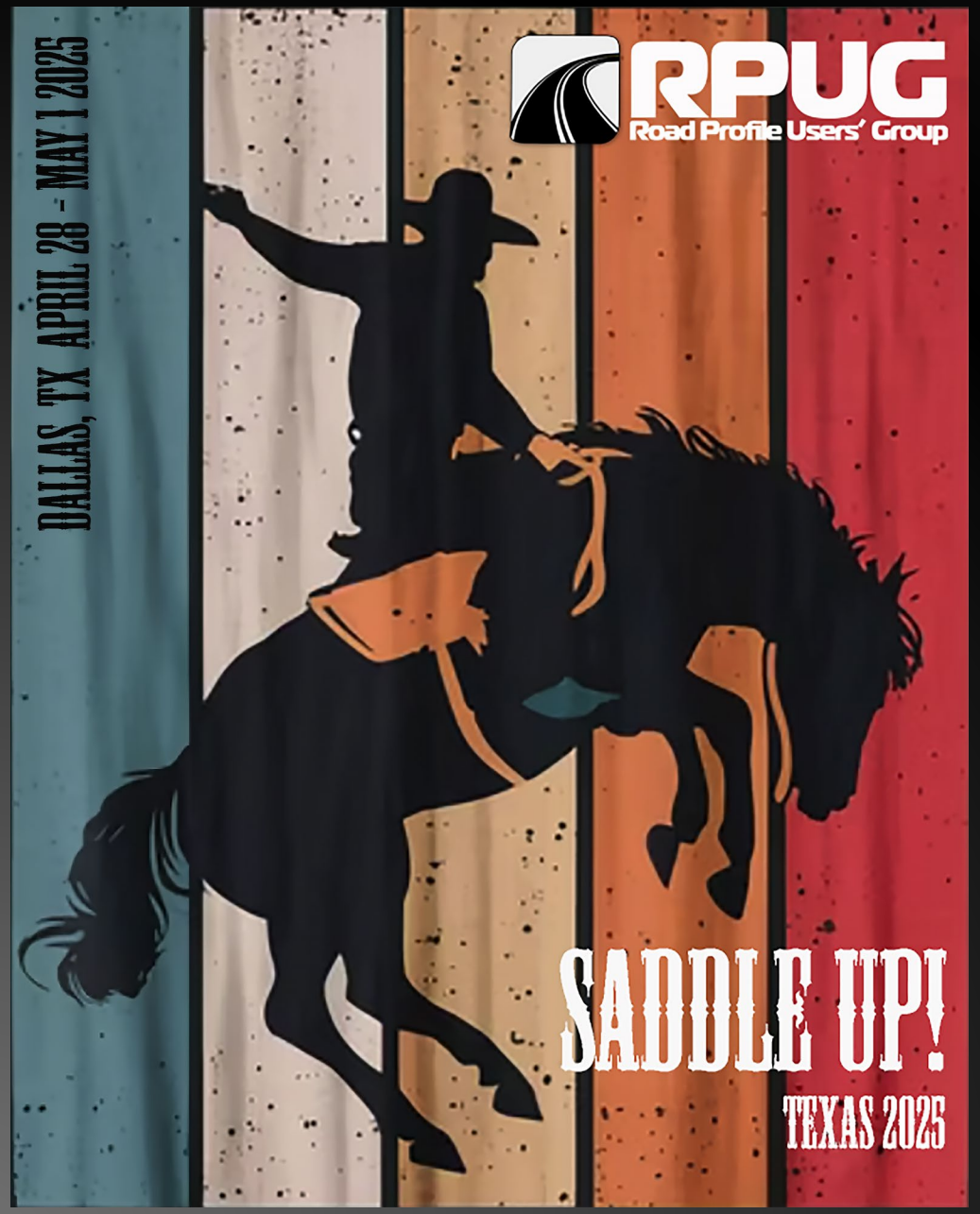

SMOOTH ROADS, STRONG PARTNERSHIPS: DEVELOPING CDOT'S LATEST SPECIFICATIONS

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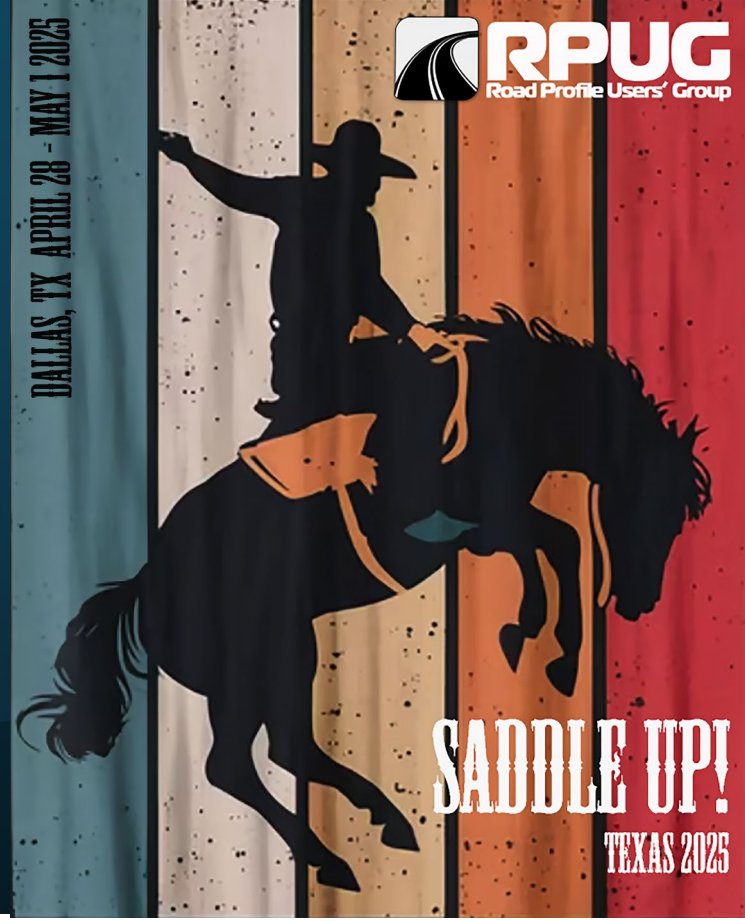
RPUG
Road Profile Users' Group

Smooth Roads, Strong Partnerships: Developing CDOT's Latest Specifications



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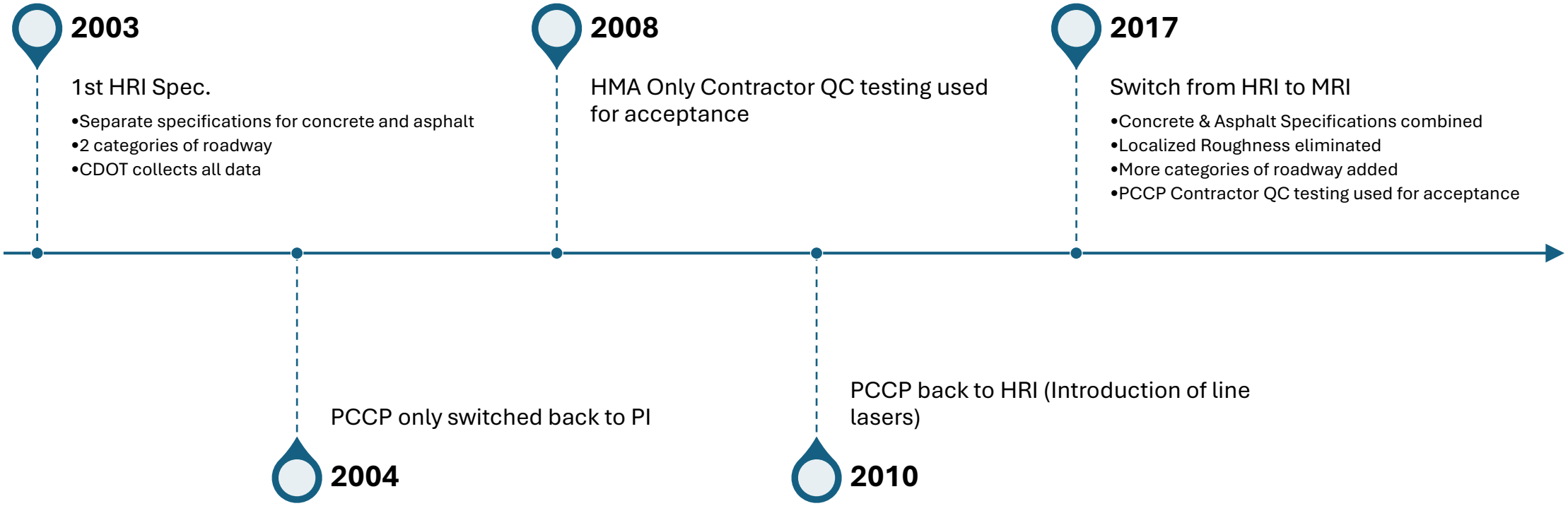
History of CDOT Smoothness Specifications



Where we started

- 2022 Formed update taskforce
  - Joint industry taskforce
  - Maximum 5 representatives from each

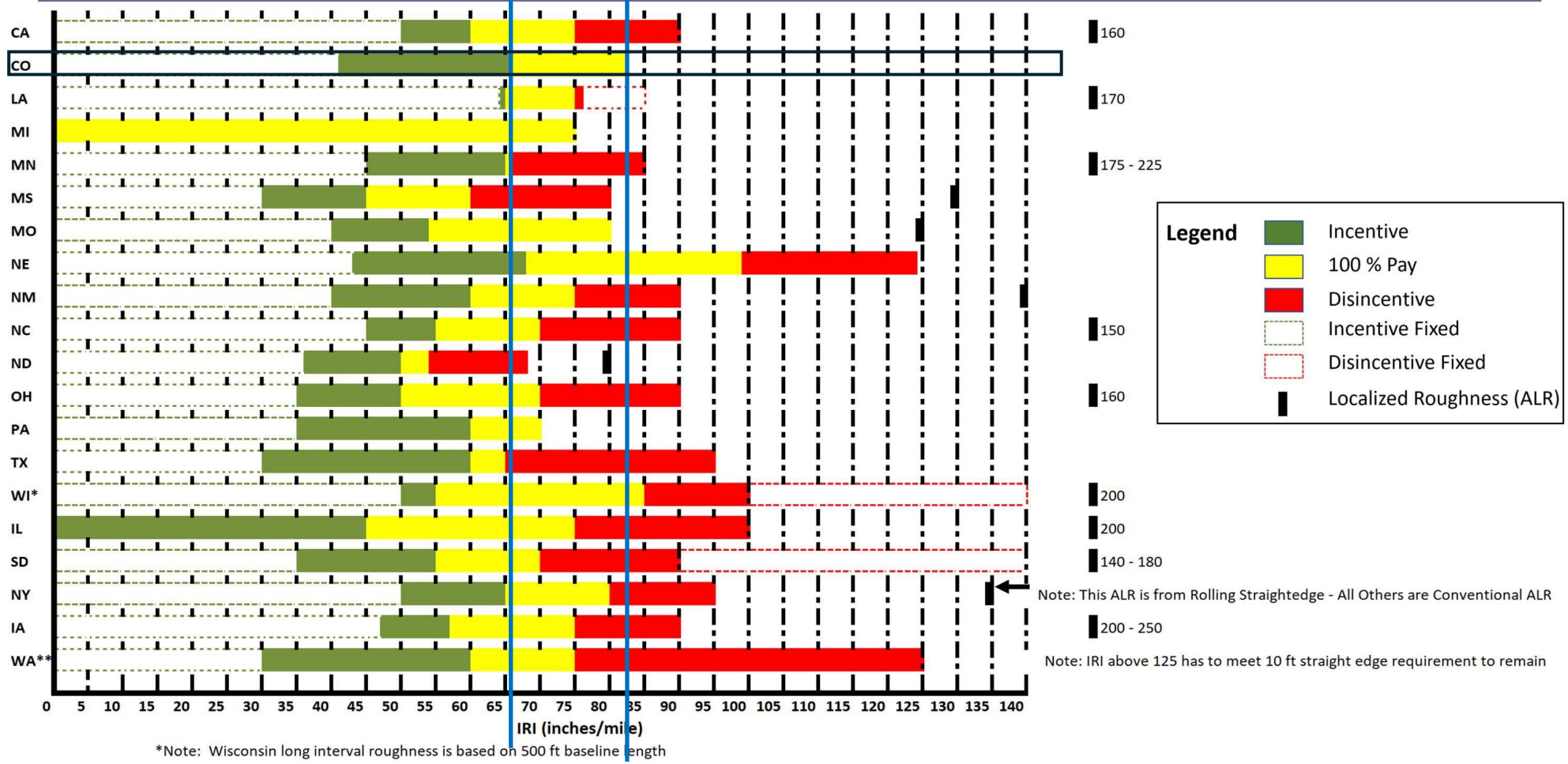
Table 105-6
HMA PAVEMENT SMOOTHNESS (INCHES/MILE)
MEAN ROUGHNESS INDEX

Pavement Smoothness Category	Maximum Incentive Payment ($/sq.yd.)	Incentive Payment ($/sq.yd.)	No Incentive	Corrective Work Required (0.10 mile sections)
I	MRI ≤ 46.0 I = $1.28	MRI > 46.0 and < 73.0 I= 3.46-0.0474 MRI	MRI ≥ 73.0 and ≤ 88.0	MRI > 88.0
II	MRI ≤ 40.0 I = $1.28	MRI > 40.0 and < 67.0 I= 3.18 – 0.0474 MRI	MRI ≥ 67.0 and ≤ 82.0	MRI > 82.0
III	MRI ≤ 52.0 I = $1.28	MRI > 52.0 and < 80.0 I= 3.66 – 0.0457 MRI	MRI ≥ 80.0 and ≤ 97.0	MRI > 97.0

Table 105-7
PCCP SMOOTHNESS (INCHES/MILE)
MEAN ROUGHNESS INDEX

Pavement Smoothness Category	Maximum Incentive Payment ($/sq.yd.)	Incentive Payment ($/sq.yd.)	No Incentive	Corrective Work Required (0.10 mile sections)
I	MRI ≤ 46.0 I = $2.80	MRI > 46.0 and < 73.0 I = 7.57 – 0.1037 MRI	MRI ≥ 73.0 and ≤ 88.0	MRI > 88.0
II	MRI ≤ 40.0 I = $2.80	MRI > 40.0 and < 67.0 I = 6.948 – 0.1037 MRI	MRI ≥ 67.0 and ≤ 82.0	MRI > 82.0
III	MRI ≤ 52.0 I = $2.80	MRI > 52.0 and < 80.0 I= 8.00 – 0.100 MRI	MRI ≥ 80.0 and ≤ 97.0	MRI > 97.0

2023 IRI State Smoothness Specifications

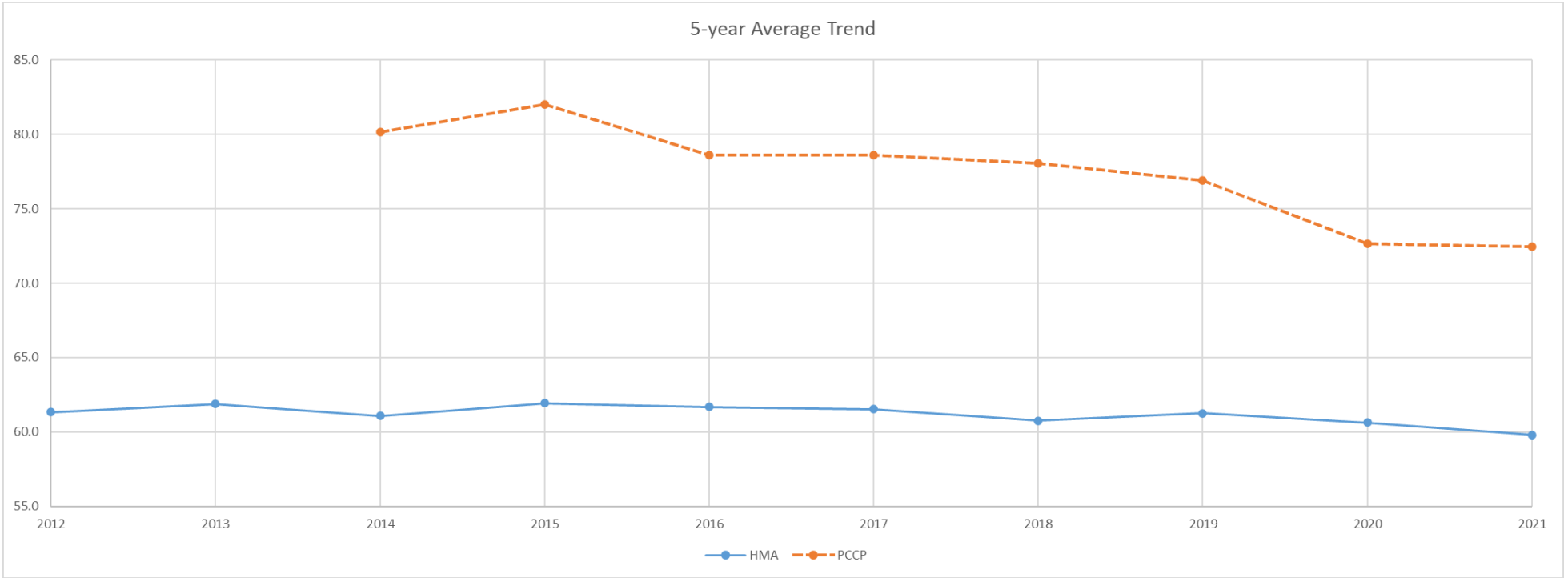


*Note: Wisconsin long interval roughness is based on 500 ft baseline length

**Note WSDOT's baseline is 52.8 ft and then averaged to 528 ft

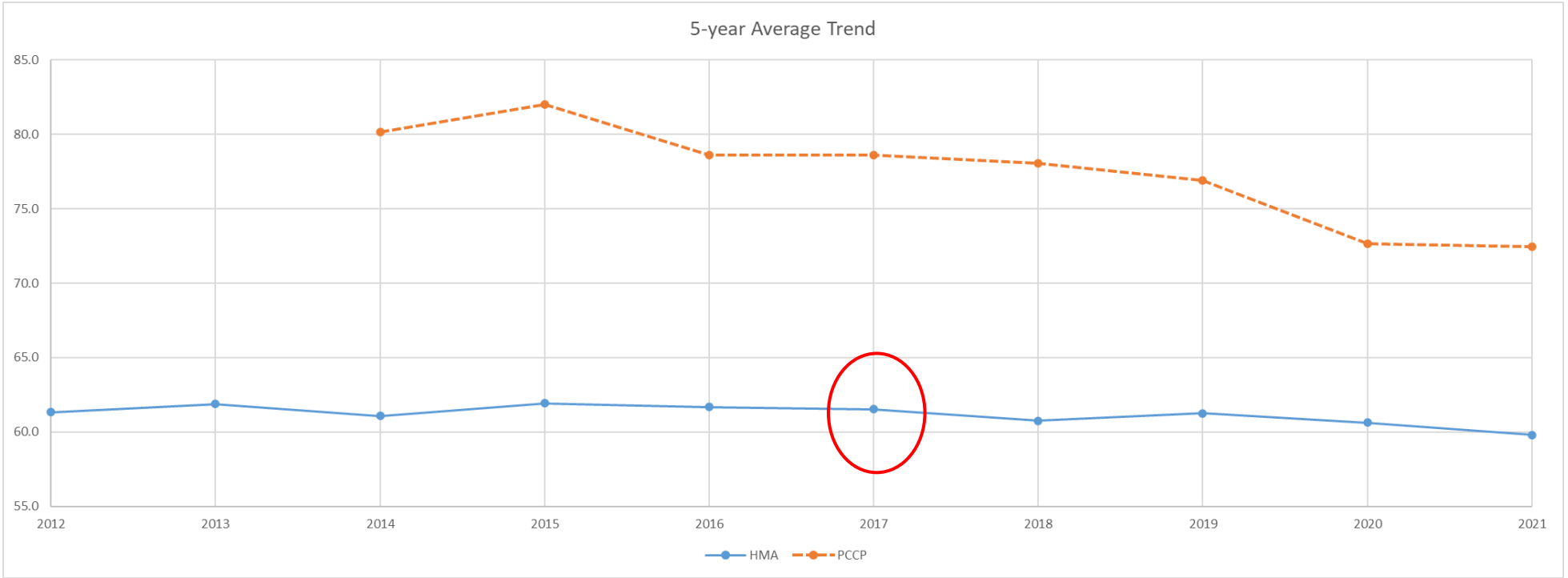
Why the need

		5-Year Running Average									
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
HMA	MRI	61.3	61.9	61.1	61.9	61.7	61.5	60.8	61.3	60.6	59.8
PCCP	MRI			80.2	82.0	78.6	78.6	78.1	76.9	72.6	72.5



What if we increase the incentive?

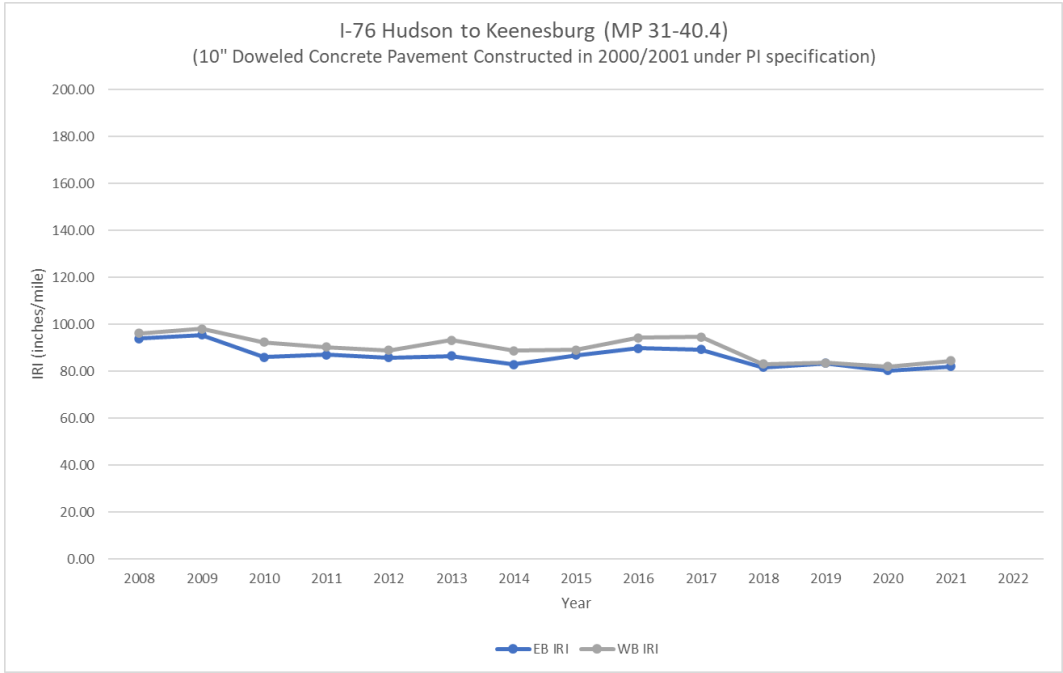
Year	HMA $/SY	PCCP $/SY
2003	$0.32	$1.40
2010	$0.64	
2011		$2.80
2017	$1.28	



Should concrete and asphalt have the same requirement?

- For MRI: YES!
  - The users don’t care
  - The federal metrics have the same requirements
  - Starting smoother helps maintain smoothness

- For Incentive: NO!
  - HMA surface is replaced more frequently
  - Concrete maintains smoothness longer
    - Must be properly designed and constructed

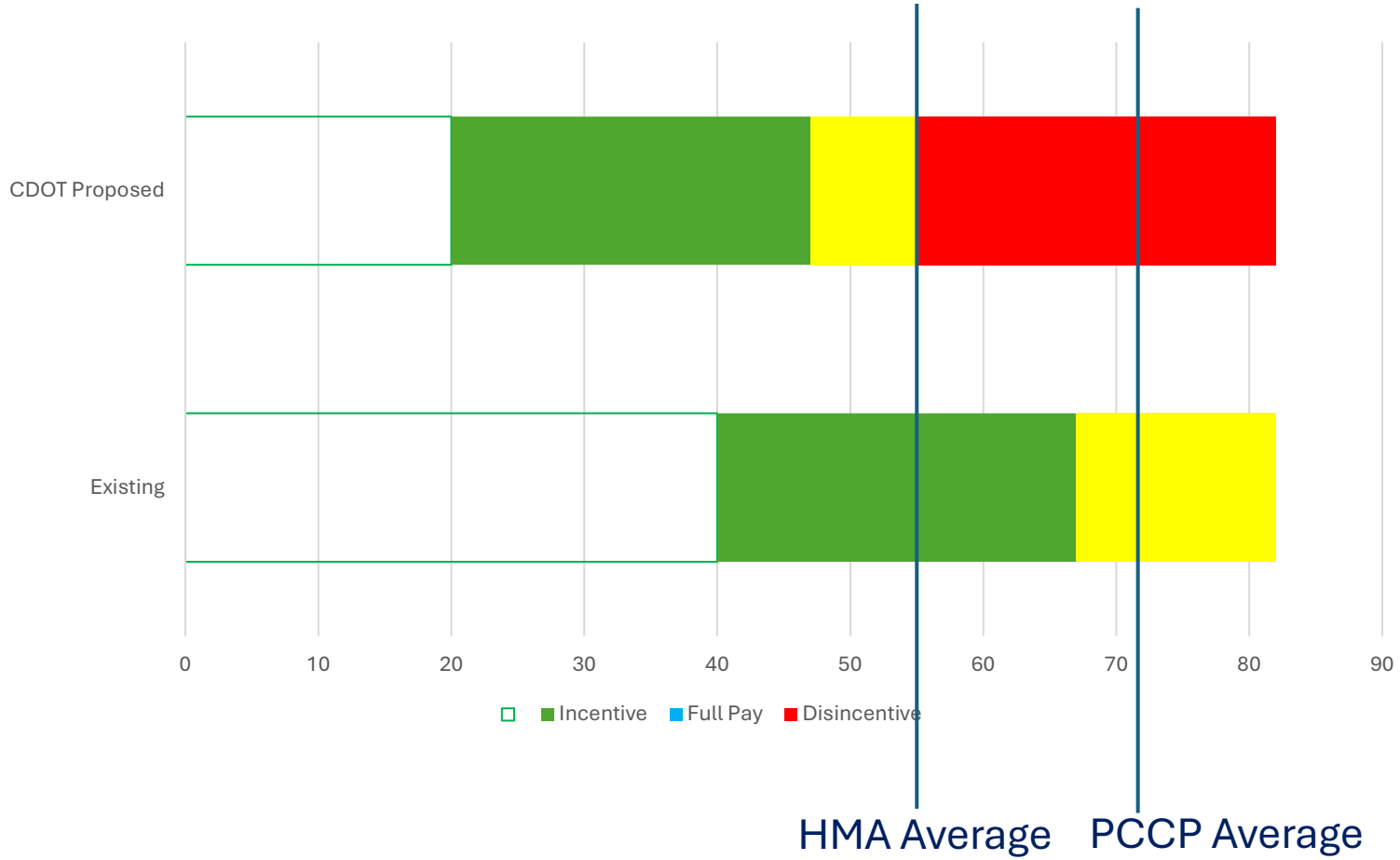


CDOT survey of surrounding states

State	Max Incentive IRI	Zero I/D band IRI	Max Disincentive IRI	Corrective work IRI
North Dakota HMA 1	39	45-60	78	>78
North Dakota HMA 2	34	48-56	75	>75
North Dakota HMA 3	32	42-50	70	>70
North Dakota Concrete Repair	N/A	N/A	N/A	>70
North Dakota Concrete Urban	36	50-54	68	>100?
North Dakota Concrete Rural	36	50-54	68	>68
Wyoming Plant Mix	40	55-65	95	>80
Wyoming Plant Wearing Coarse	30	45-55	85	>70
Wyoming Plant Concrete	Profilograph Index. No correlation			
Kansas	Profilograph Index. No correlation			
Utah	40	60-70	90	>90
South Dakota HMA 1 Opp	35	50-65	80	>80
South Dakota HMA 2 Opp	30	45-60	80	>80
South Dakota HMA 3 Opp	25	40-60	80	>80
South Dakota PCCP	35	55-70	90	>90
HMA Average (CDOT Cat 2 Equiv)	32	47-59	81	>81
PCCP Average (CDOT Cat 2 Equiv)	37	55-65	83	>83
CDOT Category 2 equivalent				
CDOT Current Cat2	40	67-82	N/A	>82

CDOT's requirements were more lenient than surrounding states

CDOT's Initial Proposal



Industry Response

January 16, 2023

To: Colorado Department of Transportation
From: The Road Building Industry of Colorado
RE: Smoothness specification updates/changes to the current specification

CAPA and ACPA share CDOT's goal for achieving smoother roads for Colorado. CDOT, CAPA, and ACPA partnering together is the best way for this mutual goal to be achieved. Each party understanding each other's concerns, challenges, and limitations is paramount to ensuring that the path forward is effective and efficient to yield the desired results. However, both industries have identified several concerns about the proposed specification update, including.

1. The contractors from both industries have stated the adjusted requirements will not generate smoother roads and will drive up the cost of construction in an already inflated market.
2. The proposed specification will eliminate incentives while providing a disincentive to roadways that are currently considered exceptional. This is confirmed by the smoothness data CDOT has provided, which shows that with concrete at the 2022 average MRI of 68.7 in/mi and asphalt at the 2022 average MRI of 64.1 in/mi, both pavement types would fall into disincentive under the proposed specification. On one project the numbers were used and found the incentive would have been reduced by 72% using the new table.
3. The proposed MRI values for incentive are difficult to achieve even with profile grinding pavement, and the current levels of incentive are not adequate to motivate contractors to further improve smoothness results past the minimum that is required.
4. The proposed specification does not address the challenges that directly affect smoothness results. While the concrete and asphalt industry are inherently different, they share common obstacles to smoothness: limited working hours, complex phasing, mix design requirements, and limited opportunities for improvement due to pavement sections.
5. The adjusted ranges for incentive / disincentive / corrective work have clearly made this a smoothness penalty specification. We do not believe much incentive money will be paid out given these ranges, and the price for both pavement types may rise to reflect this.
6. Instead of solely focusing on specification revisions, including solutions to overcome the above challenges will be more efficient both from cost and constructability.

ACPA
COLORADO/WYOMING CHAPTER

Colorado Asphalt
Pavement Association

Pavement Smoothness Category	Maximum Incentive	Incentive Range	No Incentive	Corrective Work Required (0.10 mile sections)
A	MRI ≤ 45.0	MRI > 45.0 and < 55.0	MRI ≥ 55.0 and ≤ 70.0	MRI > 70.0
B	MRI ≤ 55.0	MRI > 55.0 and < 65.0	MRI ≥ 65.0 and ≤ 80.0	MRI > 80.0
C	MRI ≤ 60.0	MRI > 60.0 and < 70.0	MRI ≥ 70.0 and ≤ 85.0	MRI > 85.0

Incentive only? Incentive and Disincentive?

- 2017 Update removed Localized roughness requirements
- Disincentive options were removed as trade-off

- Result:
  - Tighter Specification Limits
  - Smoother Roadways

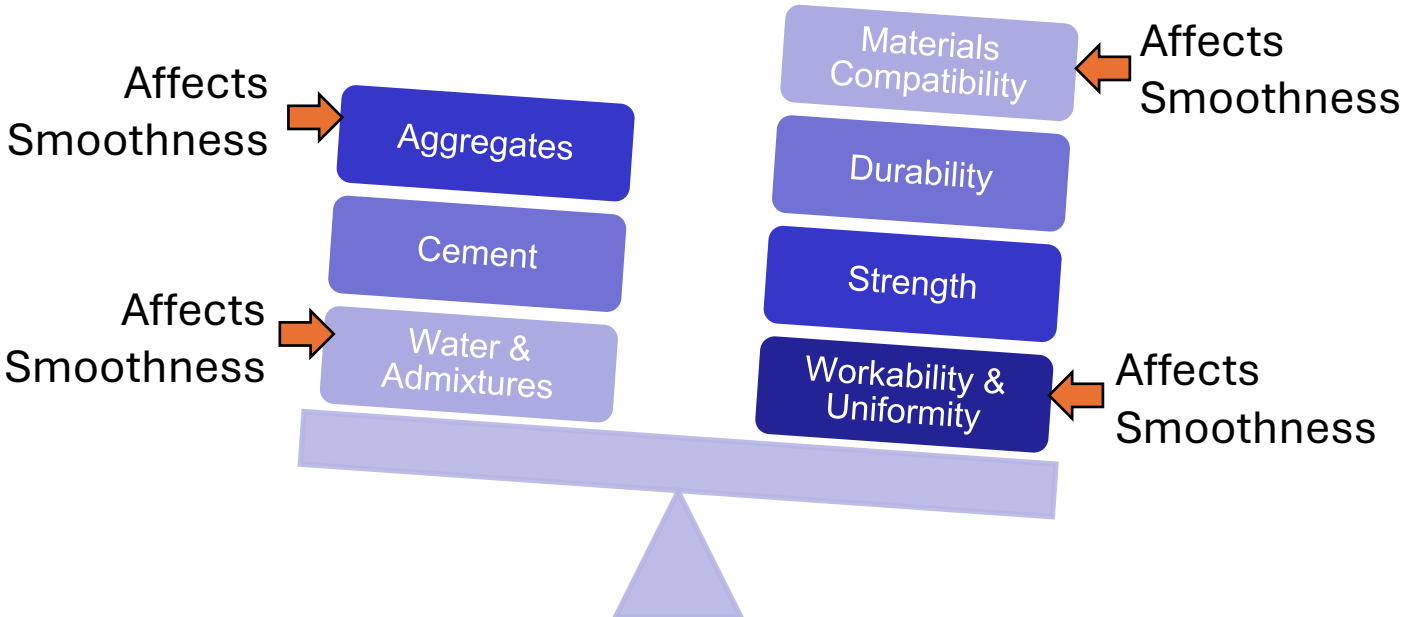
Grinding into incentive?

- The smoother a road starts, the longer it stays smooth
- Grinding is not a detriment to pavement quality or durability
- Contractors are not going to do extra grinding to earn incentive
- Paying incentive is cheaper than paying for grinding later

Smoothness Specifications are not standalone

- Phasing
- Work Hours
- Materials
- Testing

Asphalt	Concrete
• Change the requirements for milling to create a smooth platform to place any new lift of material. This might include, but not limited to, increasing, or reducing the mill depth to eliminate scabbing. • Maximize/ optimize paving window hours to ensure a minimum of 6 hours per shift of actual placement time each workday. • Utilize intermediate lifts between roto-milling and wearing course.	• Compressive Strength Acceptance instead of Flexural Strength. • Optimize phasing to maximize paving production and lengths.



Final Product

PCCP Smoothness (Inches/Mile)
Mean Roughness Index

Pavement Smoothness Category	Maximum Incentive Payment ($/sq.yd.)	Incentive Payment ($/sq.yd.)	No Incentive	Corrective Work Required (0.10 mile sections)
A	MRI ≤ 40.0 I = $2.80	MRI > 40 and < 55.0 I=10.2670 - 0.1867*MRI	MRI ≥ 55.0 and ≤ 70.0	MRI > 70.0
B	MRI ≤ 45.0 I = $2.80	MRI > 45.0 and < 60.0 I=11.2000 - 0.1867*MRI	MRI ≥ 60.0 and ≤ 75.0	MRI > 75.0
C	MRI ≤ 50.0 I = $2.80	MRI > 50.0 and < 65.0 I= 12.1330 - 0.1867*MRI	MRI ≥ 65.0 and ≤ 80.0	MRI > 80.0

*HMA must meet the same MRI, Incentive is less

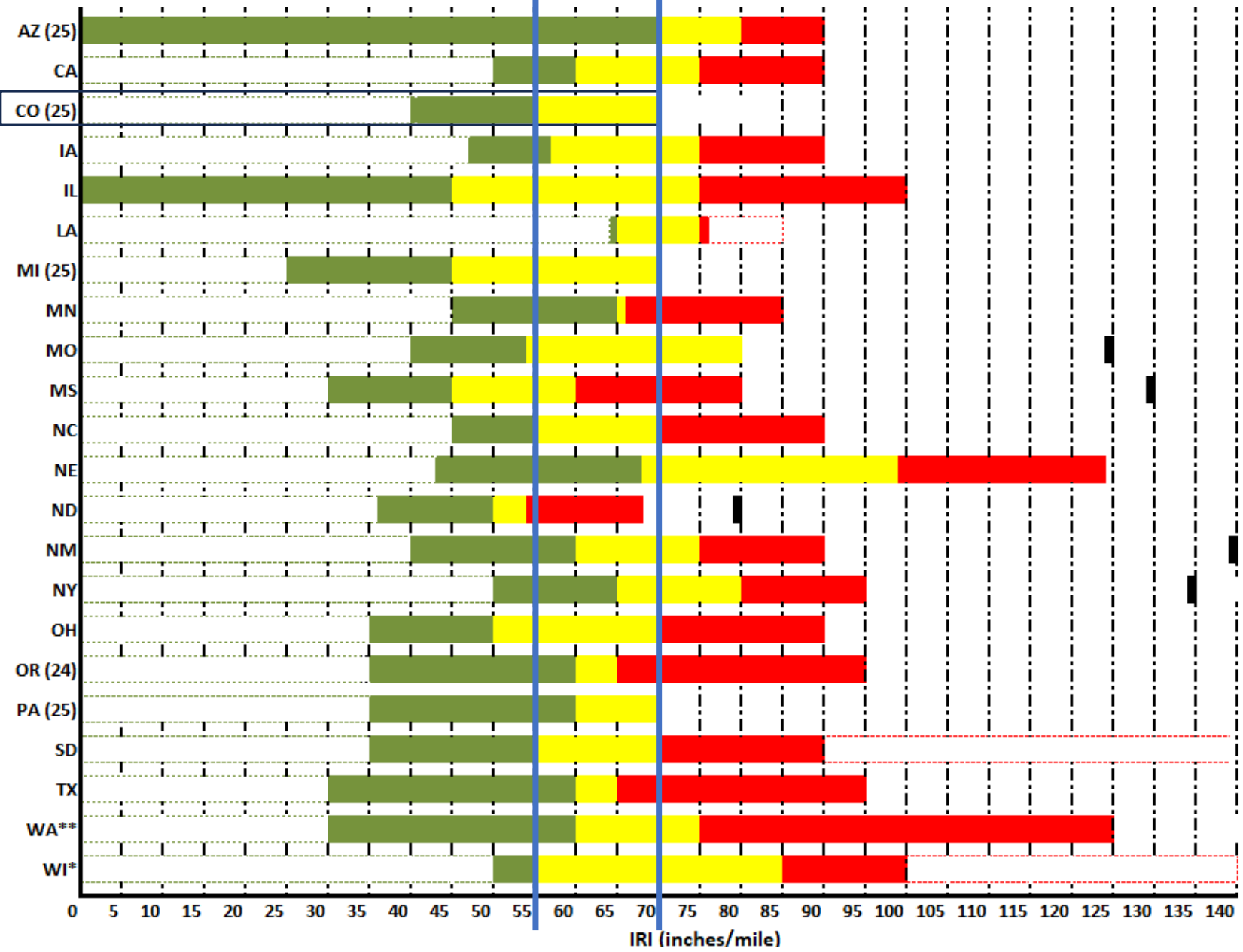
- 5 Year Averages
  - PCCP= 71.7 in/mi
  - HMA= 55.7 in/mi

- 15% reduction in incentive and corrective action limits
- HMA and PCCP must meet same target value
- PCCP Incentive rate is higher
- Grinding into incentive allowed

- Industry trends will continue to be monitored
- Limits will be reevaluated in 3-5 years

- Started conversation about changes to other specs that may be inhibiting focus on smoothness

2025 State Smoothness Specifications



0.3" bump in 25' Max incentive is $9000 per tested lane

160

200 - 250

200

170

0.3" Bump in 25'

175 - 225

150

Note: This ALR is from Rolling Straightedge

160

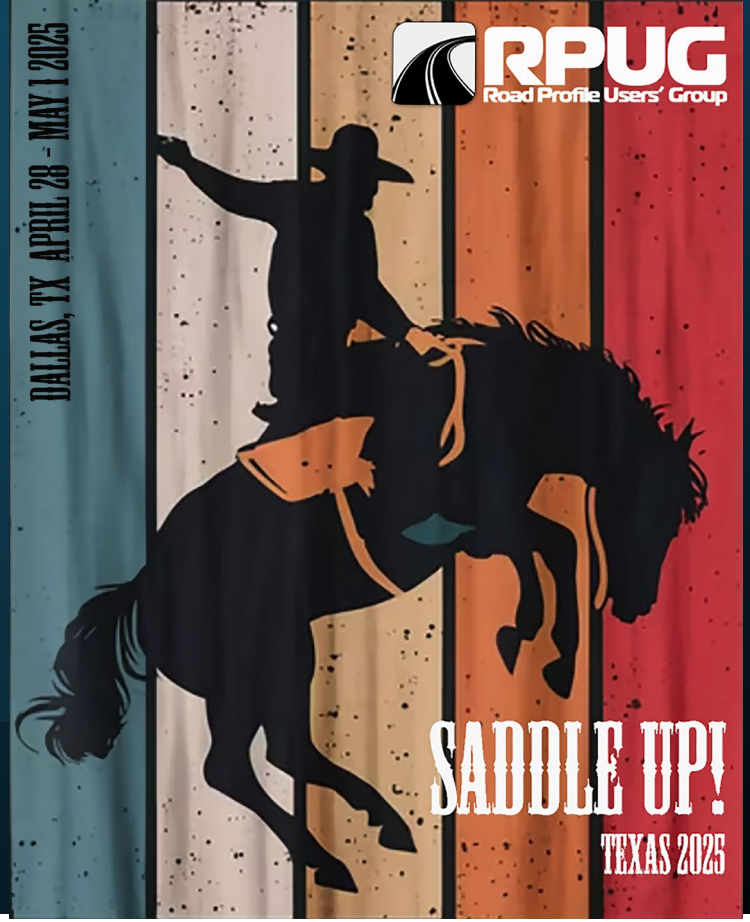
160

140 - 180

**IRI Above 125 has to meet 10 ft straight edge requirement to remain. WSDOT's baseline is 52.8 ft and then averaged to 528

200 *Long Interval Roughness Based on 500 ft Segment

Thank You!



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