

WSDOT Preliminary Evaluation of 3-D Automated Crack Rating

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Background

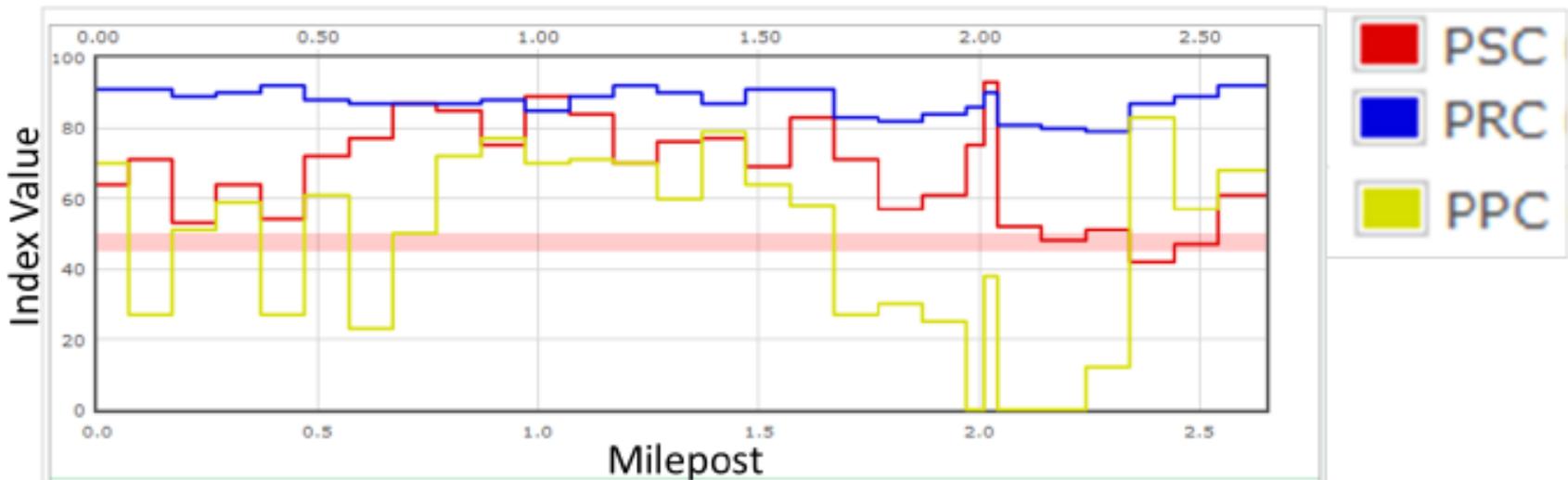
- **Data Needs at Network Level**
 - Network %Good, %Fair, %Poor (e.g., MAP-21)
 - Pooled Data for 9,000 test miles
 - Difficult for random errors to affect results
- **Data Needs at Project Level**
 - Decisions at Project Level
 - Analysis at 0.1 mile
 - Takes 3,000 staff hours to rate 9,000 test miles at computer workstation

Expectations

- **Rate cracks automatically and accurately**
 - Location
 - Crack type, severity and quantity
- **Estimate the maintenance needs**
 - Patches on alligator cracking
 - Seals on transverse and longitudinal cracking
- **Estimate the rehabilitation needs**
 - Project level in short- to long-terms
 - Estimate due year and RSL
- **Evaluation of network needs**

Pavement Indexes

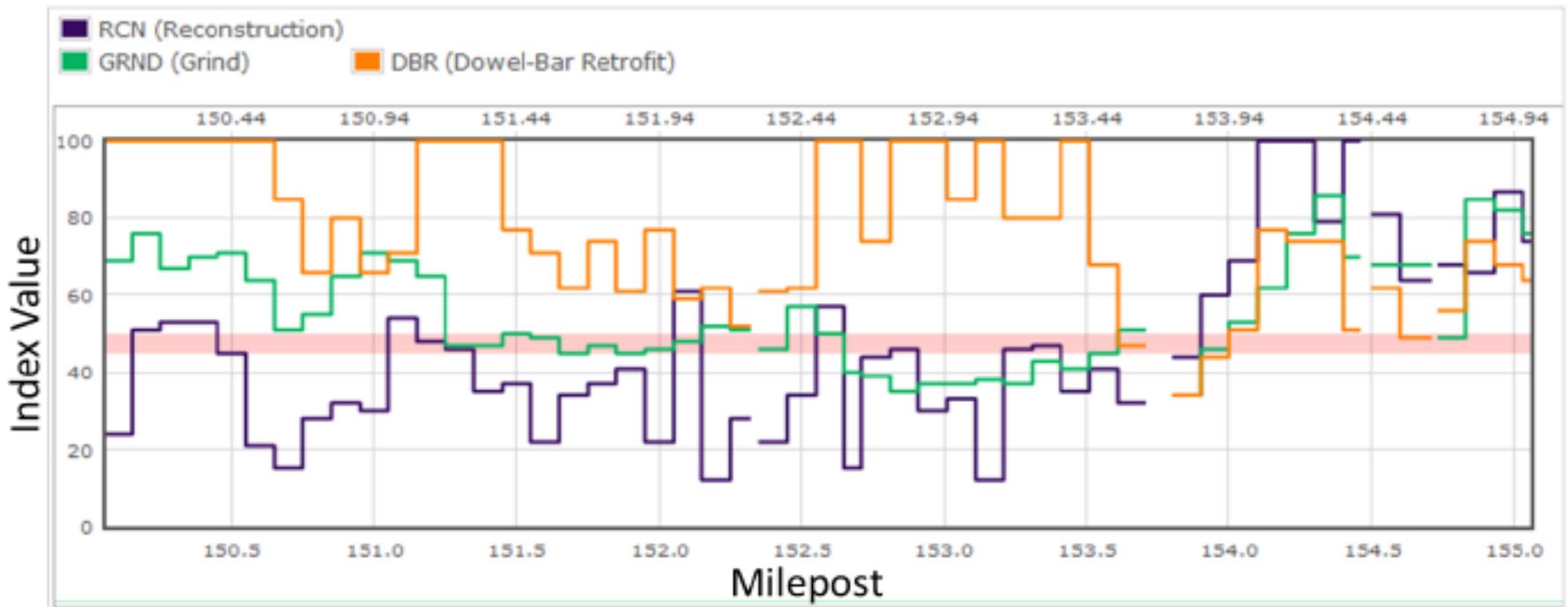
- Normalizes defects from 0 (very poor) to 100 (very good) scale
- Thresholds reported are set at a score of 50
- Rehabilitation needed at 45-50
- **PSC** (Pavement Structural Condition)
 - Input: Equivalent **Cracking**
- **PRC** (Pavement Rutting Condition)
 - Input: **Rutting**
- **PPC** (Pavement Profile Condition)
 - Input: **IRI**



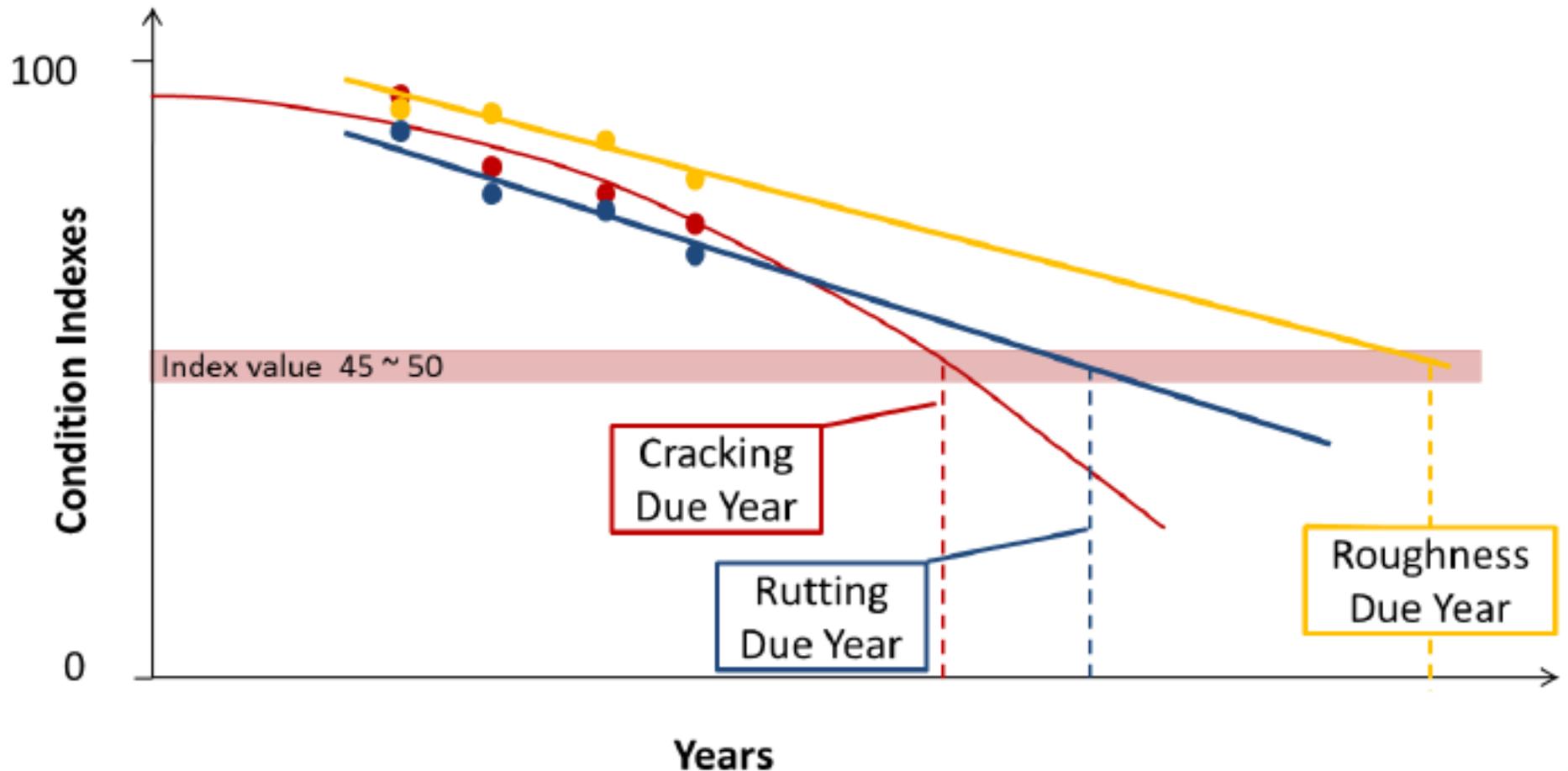
Concrete Pavement Indexes

For concrete, the previous pavement indexes are further refined to indicate the type of rehabilitation needed

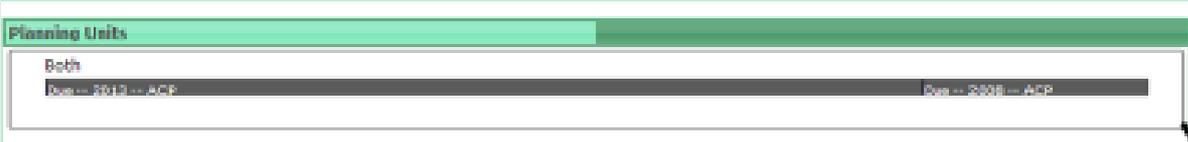
- **RCN** (Cracking) – Evaluates need for reconstruction
- **GRND** (Rutting and Roughness) – Evaluates need for diamond grinding
- **DBR** (Faulting) – Evaluates need for dowel bar retrofit



Performance Forecasting: Curve Fitting



- The Due Year is the minimum of the three condition due years.



Screenshot from WebWSPMS showing the progression from:

Survey Unit (0.1 mile)

to Preservation Unit (~1 mile)

to Planning Unit (~2 miles)

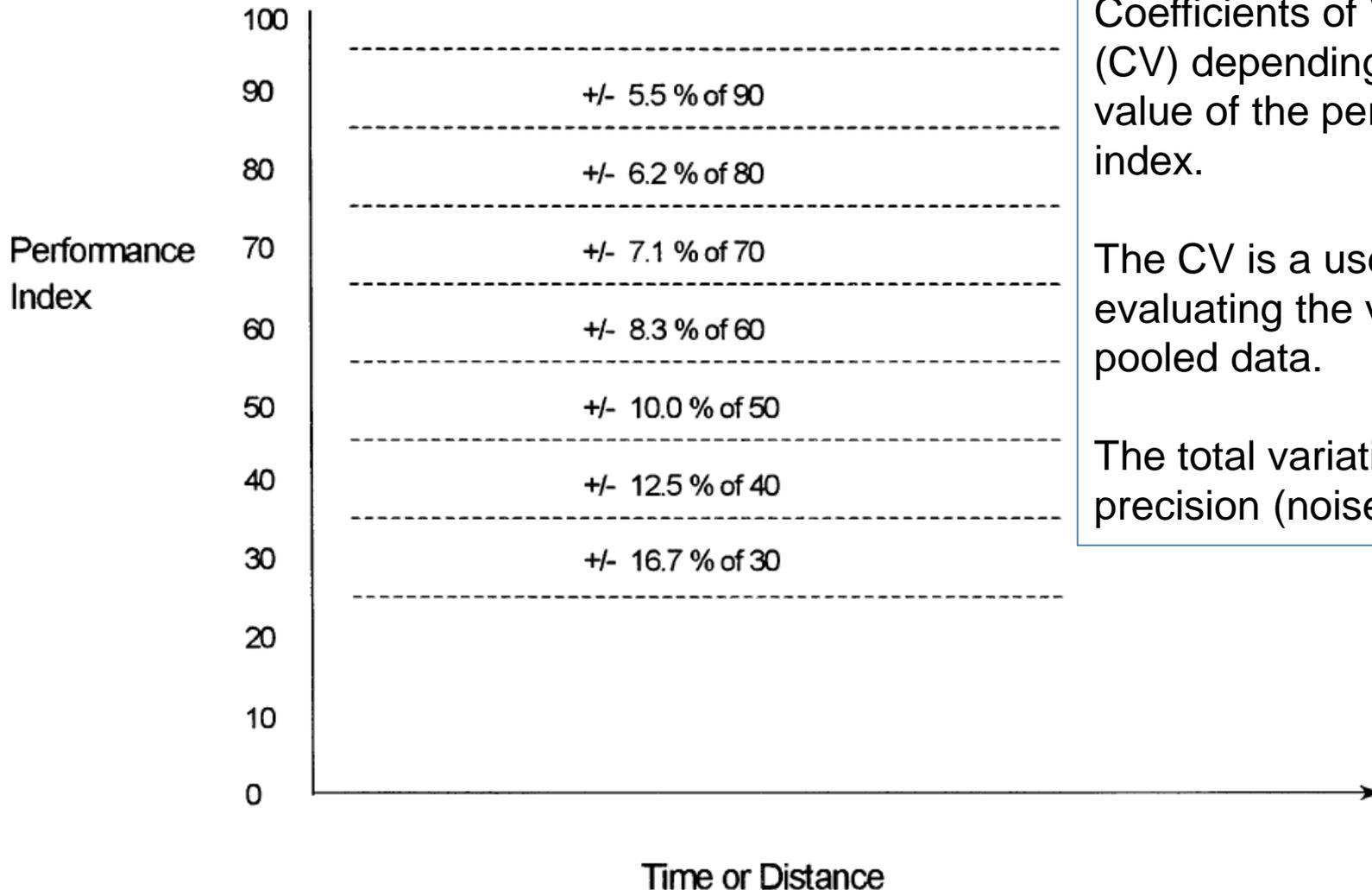
Automatically created by WSPMS

Defined by Region

to P1 Project



Desired Results



A desired level of results was set at +/- 5 points variation for the performance index.

This relates to different Coefficients of Variation (CV) depending on the value of the performance index.

The CV is a useful tool in evaluating the variation of pooled data.

The total variation includes precision (noise) plus bias.

Approach

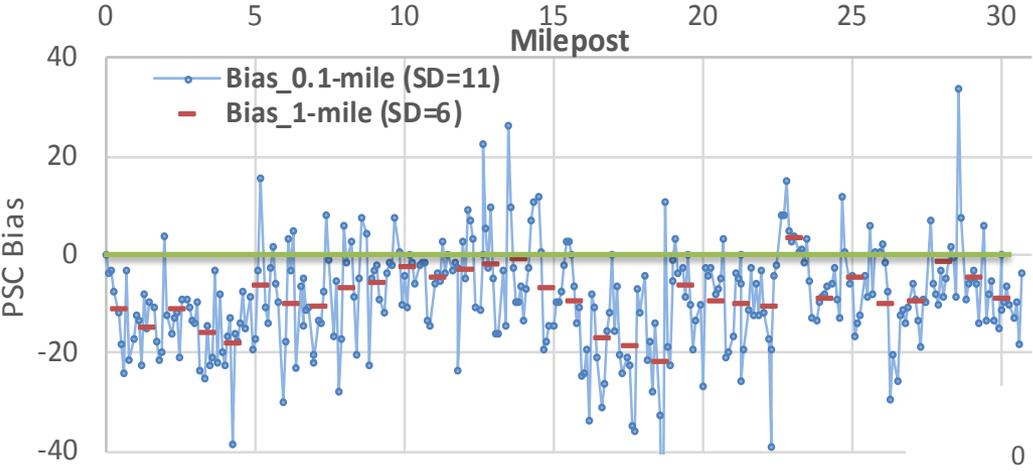
- **Use Manual Rating (after QC) as “true” value**
 - more accurately describe as “condition truthiness”
- **Project Evaluation**
 - Evaluate the data for chip seal projects
 - Characterize difference between auto rating and manual rating in terms of % bias
 - No evaluation of repeatability (noise) at this time

Test Projects

Route	MP	Test Miles	% of Due	Preferred Overlay Year	Age@2015
SR153	0-30.73	31	10%	2018	6
SR243	0-28.24	28	24%	2018	6
SR22	23.4-36.27	13	62%	2016	9

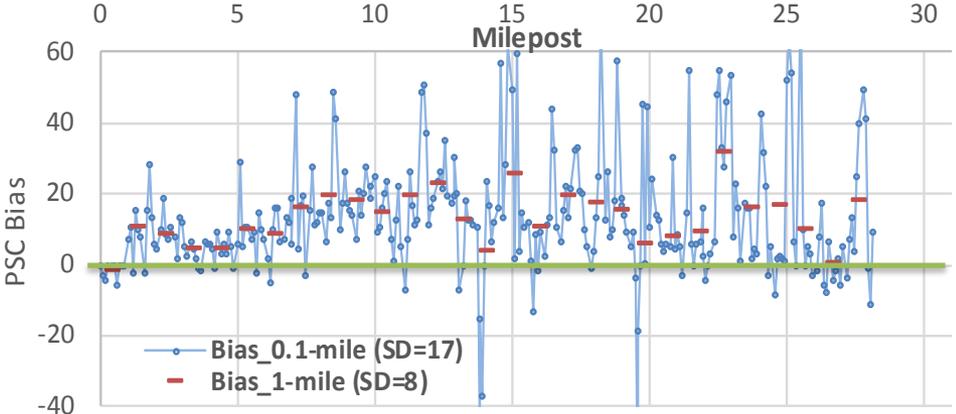
PSC = cracking index

SR153: PSC Bias (AutoRate-ManualRate)

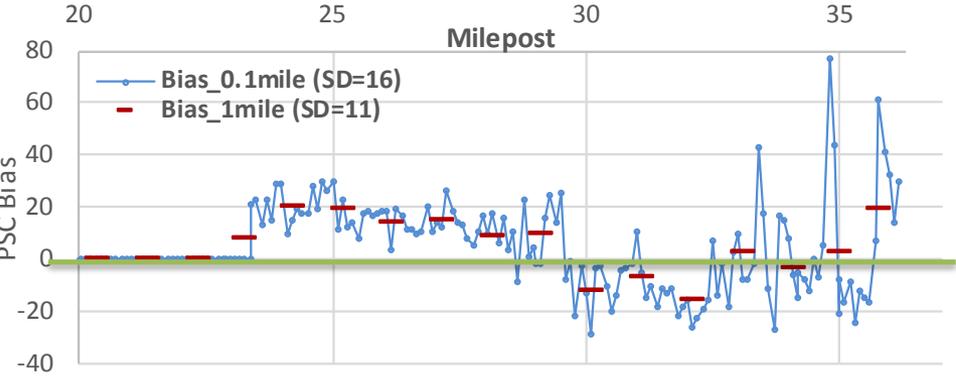


Route	PSC Bias Mean	0.1-mile PSC Bias SD	1 mile-PSC Bias SD
SR153	-9	11	6
SR243	13	17	8
SR22	6	18	12

SR243: PSC Bias (AutoRate-ManualRate)



SR22: PSC Bias (AutoRate-ManualRate)



Auto	Alligator Cracking	Longitudinal Cracking	Transverse Cracking
SR153	1,047	13,442	7,742
SR243	227	9,450	6,420
SR22	572	21,548	5,285

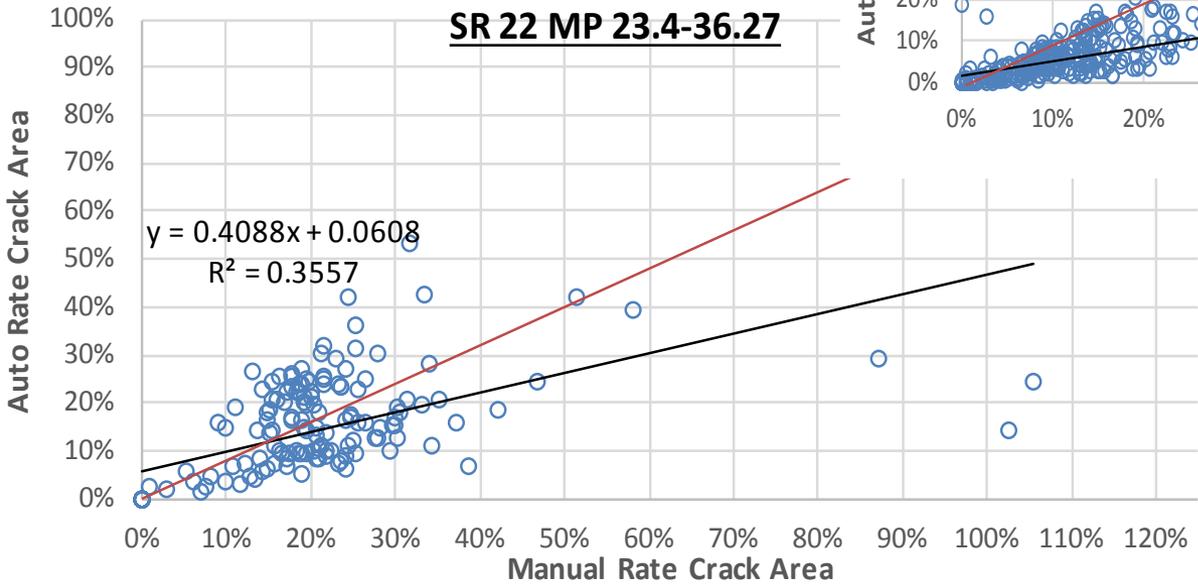
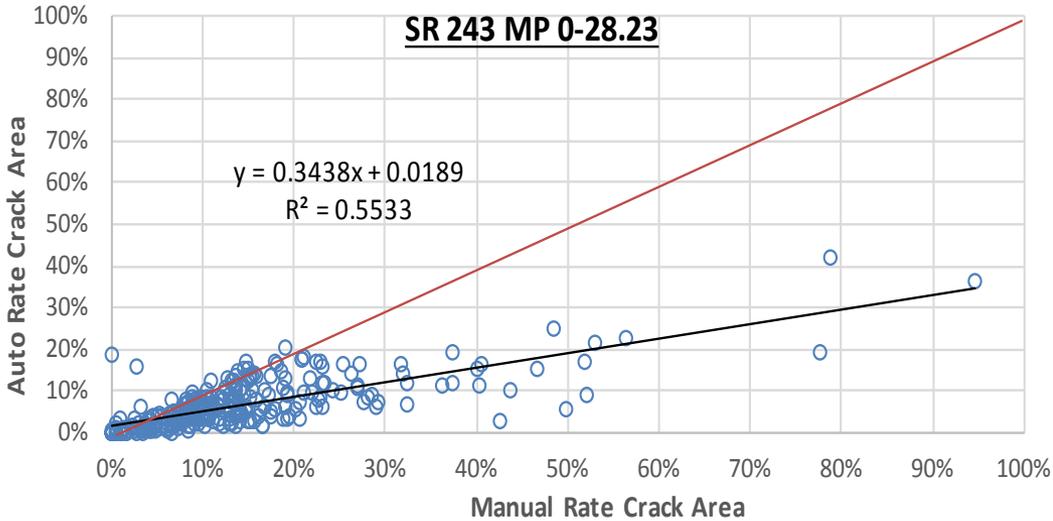
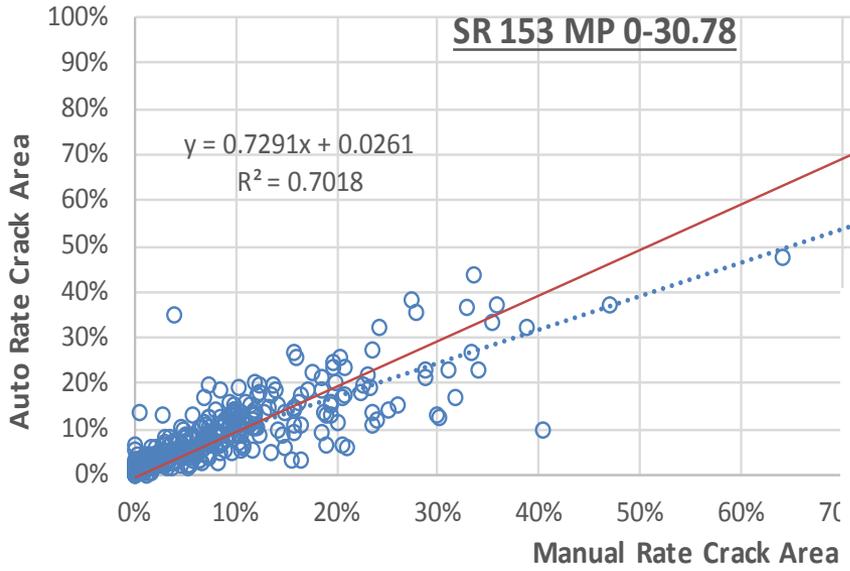
Manual	Alligator Cracking	Longitudinal Cracking	Transverse Cracking
SR153	1,204	20,517	5,353
SR243	13,204	21,386	6,886
SR22	2,357	28,508	5,204

$$\%_{Bias} = \frac{Auto - Manual}{Manual}$$

	Alligator Cracking	Longitudinal Cracking	Transverse Cracking
SR153	-13%	-34%	45%
SR243	-98%	-56%	-7%
SR22	-76%	-24%	2%

*SR22 is based on 2015 algorithm.

Total Crack Area (% of roadway area)



Comparison of Asphalt Network Condition

PSC	Condition
0 – 19	Very Poor
20 – 39	Poor
40 – 59	Fair
60 – 79	Good
80 – 100	Very Good

Condition Category Matches	
TRUE	68%
FALSE	32%

Comparison of Network Condition Assessment		
	Manual	Auto
Very Poor	1%	1%
Poor	3%	3%
Fair	13%	12%
Good	15%	28%
Very Good	68%	57%

Comparison of Asphalt Network Condition

	Manual	Auto
Very Poor	1%	1%
Poor	3%	3%
Fair	13%	12%
Good	15%	28%
Very Good	68%	57%

		Manual Rating					Auto Totals
		Very Poor	Poor	Fair	Good	Very Good	
Auto Rating	Very Poor	0.5%	0.2%	0.1%	0.0%	0.1%	1%
	Poor	0.4%	0.9%	1.1%	0.3%	0.2%	3%
	Fair	0.3%	1.3%	5%	4%	2%	12%
	Good	0.1%	0.4%	5%	9%	14%	28%
	Very Good	0.0%	0.0%	2%	2%	53%	57%
Manual Totals		1%	3%	13%	15%	68%	100%

Future Plans

- Continue working on auto-rating improvements (settings)
- Develop image library (image truth)
- Evaluate repeatability (noise) in addition to bias
- More thorough evaluation of data requirements under different conditions (network vs. project)