Quality Assessment of 2017 HPMS Data

By

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RPUG Road Profile Users' Group

Outline

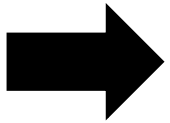
- Background
- Project Objectives
- Project Data Collection
- Project Data Analysis
  - Repeatability & Reliability Analysis
  - Comparison of Project and 2017 HPMS Datasets
- Conclusions

Background

- MAP-21 and FAST ACT legislations have required FHWA to establish pavement performance measures for IHS and NHS
- Performance measures for IHS:
  - Percentage of pavements in good condition
  - Percentage of pavements in poor condition
- Performance measures based on HPMS data

Background

- HPMS data include:
  - IRI
  - Cracking
  - Rutting
  - Faulting



ACP and JCP:

- Good, if all condition metrics good
- Poor, if two or more condition metrics poor
- Fair, all other combinations

CRCP:

- Good, if both condition metrics good
- Poor, if both condition metrics poor
- Fair, all other combinations

Condition Metric Ratings

Condition Metric	Performance Level	Threshold
IRI – All Pavements	Good	< 95
	Fair	95 -170
	Poor	> 170
Percent Cracking, AC	Good	< 5%
	Fair	5 – 20%
	Poor	> 20%
Percent Cracking, CRCP	Good	< 5%
	Fair	5 – 10%
	Poor	> 10%
Percent Cracking, JCP	Good	< 5%
	Fair	5 – 15%
	Poor	> 15%
Rutting - AC	Good	< 0.20
	Fair	0.20 – 0.40
	Poor	> 0.40
Faulting - JCP	Good	< 0.10
	Fair	0.10 – 0.15
	Poor	> 0.15

Objectives

1. Assess reliability and repeatability of automated distress data collection by comparing to LTPP data

2. Compare pavement condition ratings to HPMS 2017 at network, State, and route level

Project Data Collection

- Total mileage: 7,544 miles
- 11 interstates, 34 States

Surface Type	Mileage	Prop
AC	5,734	76.0%
JPCP	1,384	18.4%
CRCP	426	5.6%

Repeatability & Reliability Analysis

Project Repeatability Acceptance Criteria

Condition Metric	Acceptance Criteria
IRI	• Coefficient of variation of 5%
Rutting	• Values within ±0.08 inches of mean with a 90% CL
Faulting	• Standard deviation of values not to exceed 15% of mean value if mean is greater than 0.1 inches, otherwise, not to exceed 0.03 inches.
Cracking Percent	• ACP: within ±30% of mean with a 90% CL if mean is greater than 5%, otherwise, the standard deviation must be less than 1.5%. • JCP: within ±15% of mean with a 90% CL if mean is greater than 5%, otherwise, the standard deviation must be less than 1.5%.

LTPP Sections

- 20 SPS test sections on I-10
- 2 asphalt concrete sections and 18 jointed concrete sections
- 10 repeat runs on each test section

Repeatability Results

Condition Metric	Results
IRI	12 test sections met the criterion 7 test sections had a COV between 4 and 10 1 test section (with some high severity longitudinal cracking within the vicinity of the wheelpath) had a COV greater than 10.
Rutting	2 ACP test section met the criterion
Percent Cracking on ACP	2 ACP test section met the criterion
Percent Cracking on JCP	18 JCP test sections met the criterion
Faulting	3 test sections did not meet the criterion one of the sections exhibited some high severity longitudinal cracking within the vicinity of the wheelpath

Reliability Analysis

$$pm_{2018} = PM_{2018} + \varepsilon$$

$$lm_{2016} = LM_{2016} + \gamma$$

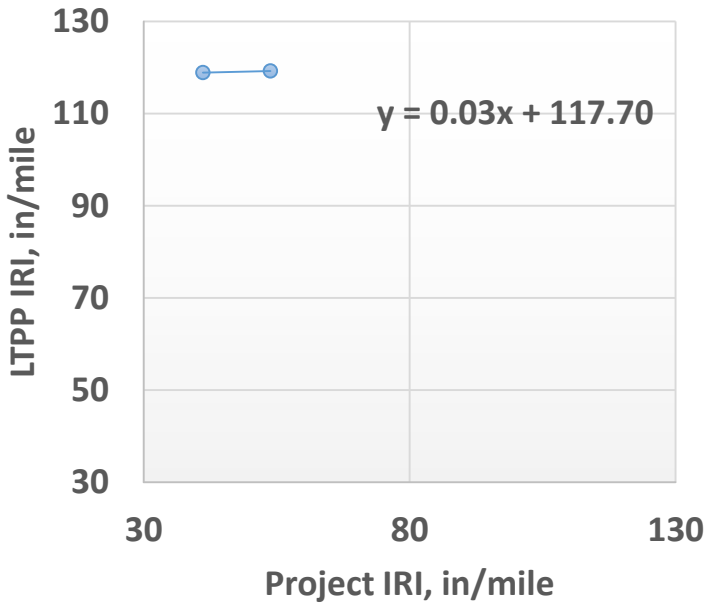
$$LM_{2018} = LM_{2016} + \Delta LM$$

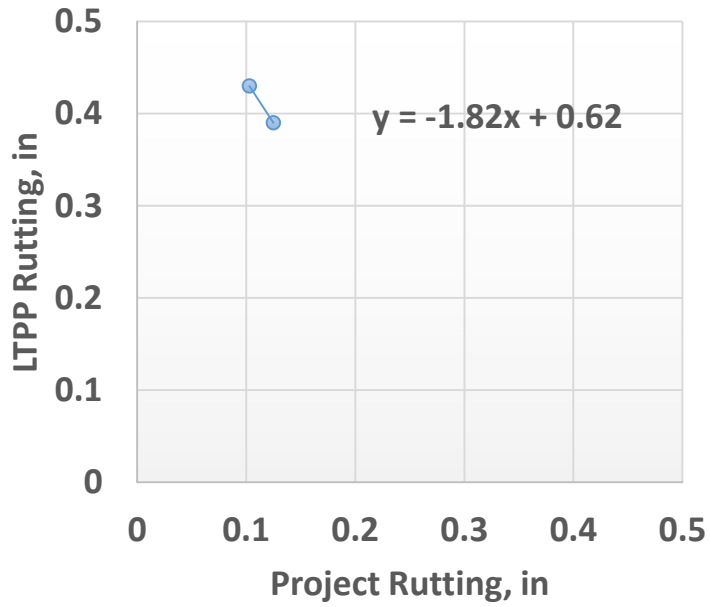
$$PM_{2018} = LM_{2018}$$

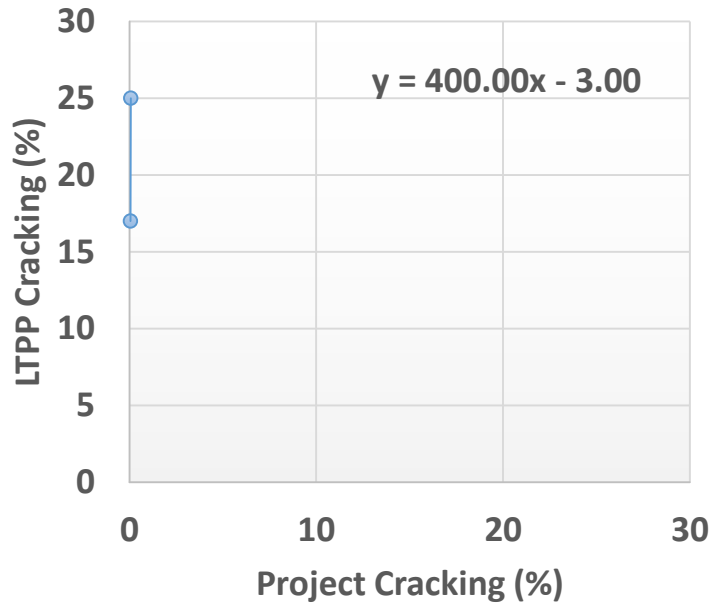
$$lm_{2016} = pm_{2018} - \varepsilon + \gamma + \Delta LM$$

- LTPP 2016 was used at the time of the project.

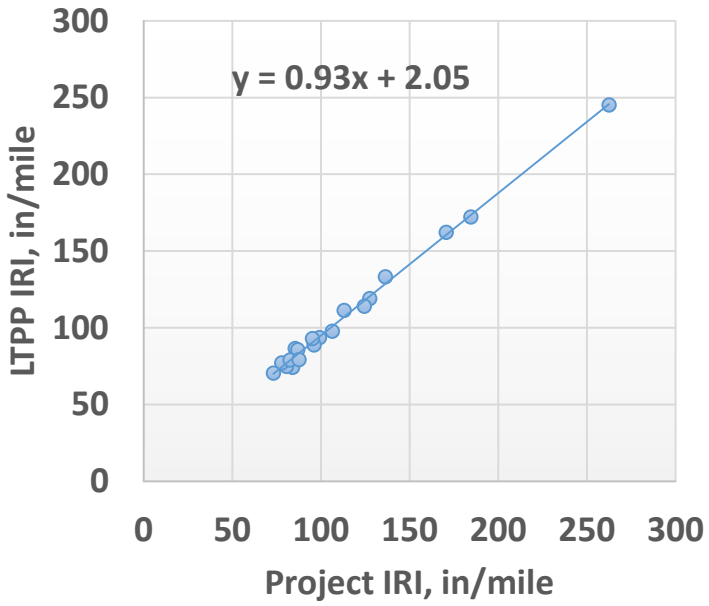
ACP Sections

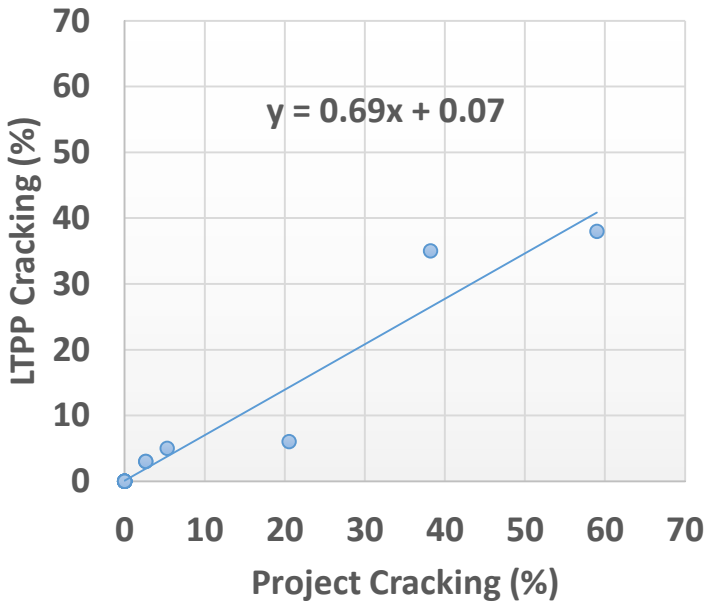


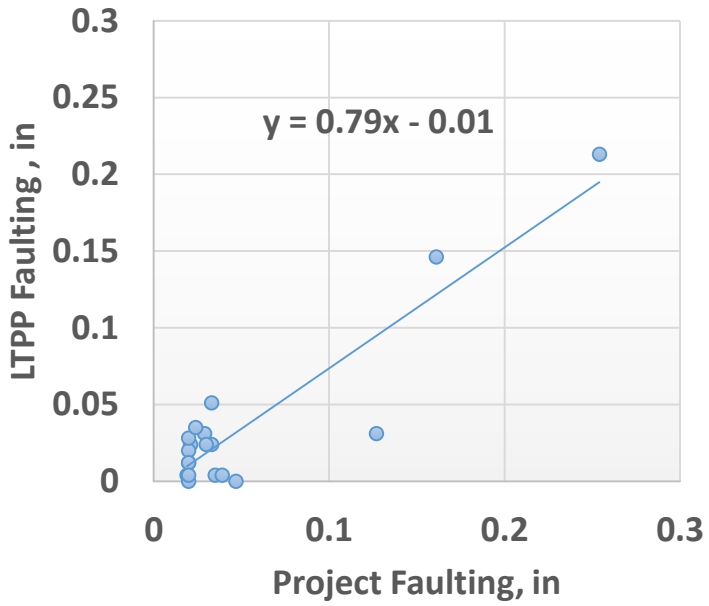




JCP Sections







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Network – Level Comparison of Project and 2017 HPMS

Condition Metrics

Element	Mean	Standard Deviation	Min/Max
Project – IRI (in/mile)	67	35	19 / > 300
2017 HPMS – IRI (in/mile)	78	44	1 / > 300
Project – Rutting (in)	0.15	0.09	0.03 / 0.89
2017 HPMS – Rutting (in)	0.14	0.08	0 / 1.50
Project – Cracking (%)	3.4	6.6	0 / 73.0
2017 HPMS – Cracking (%)	3.3	10.2	0 / 100.0
Project – Faulting (in)	0.04	0.03	0 / 0.55
2017 HPMS Faulting (in)	0.03	0.05	0 / 1.11

Condition Metric Ratings

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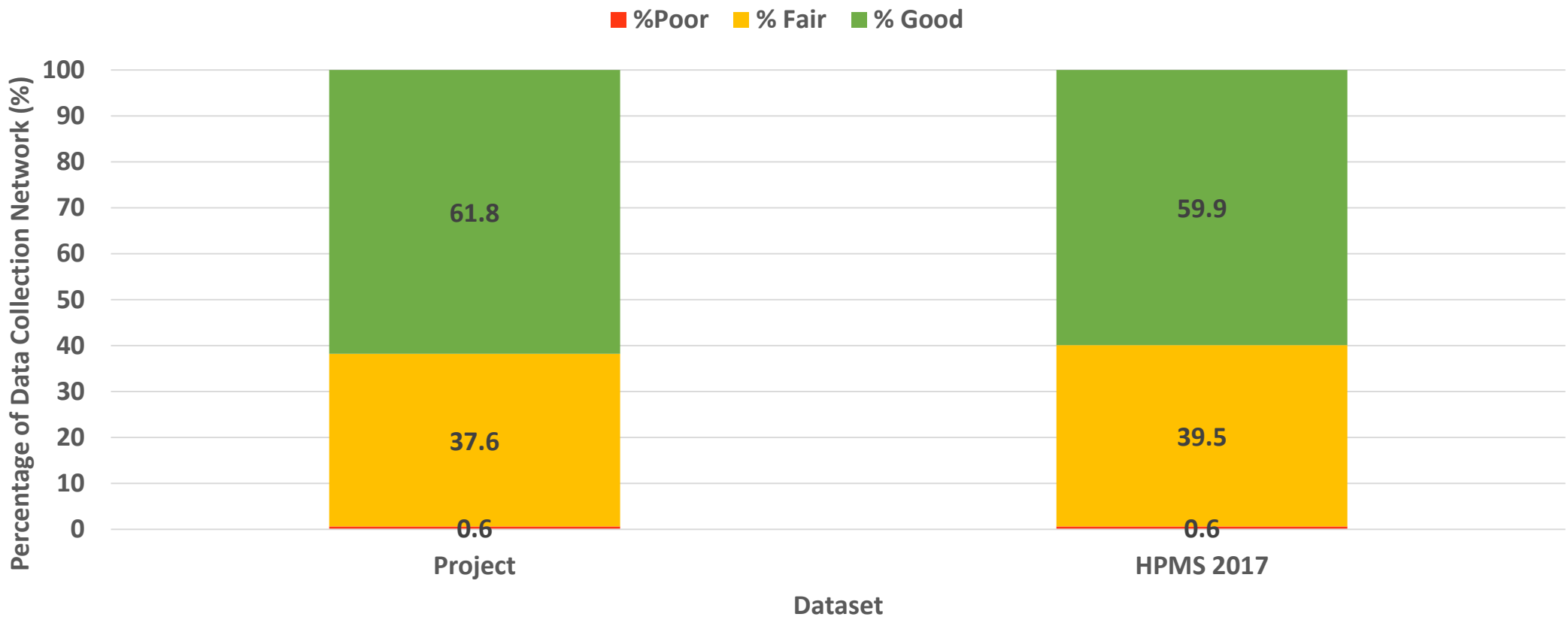
Overall Condition Ratings



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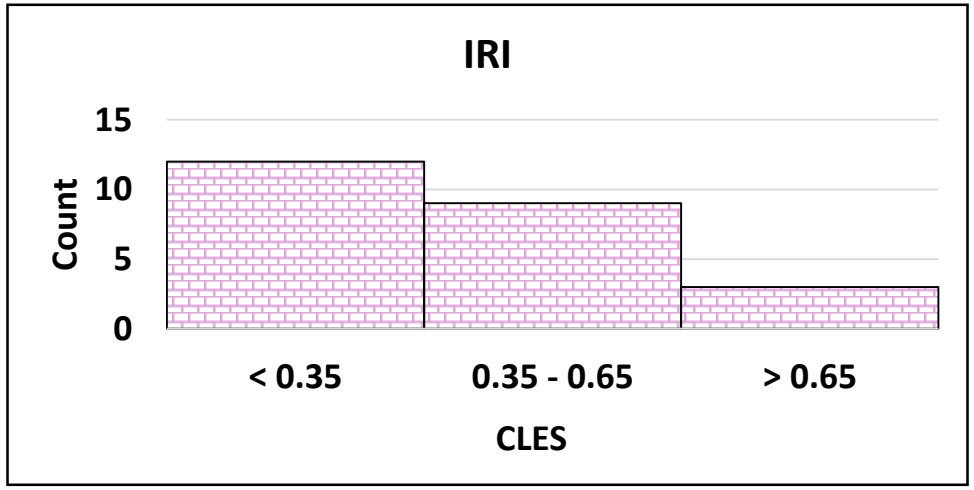
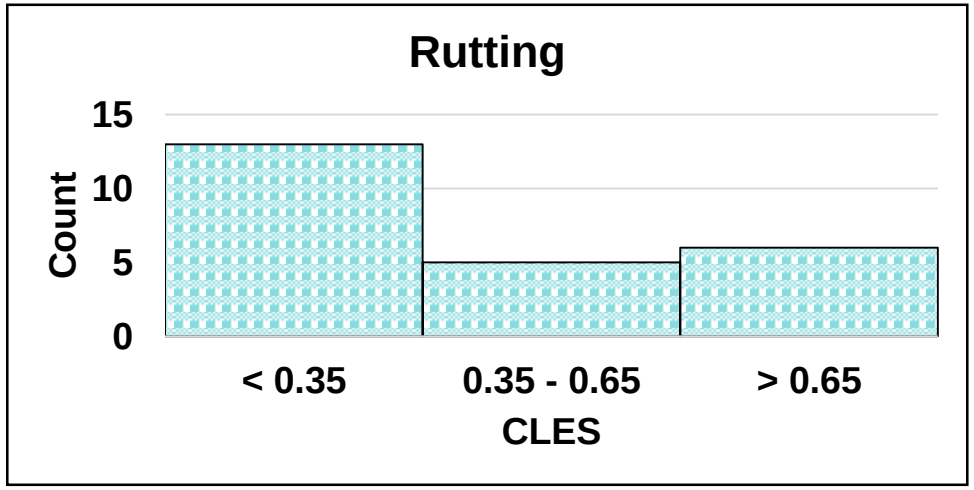
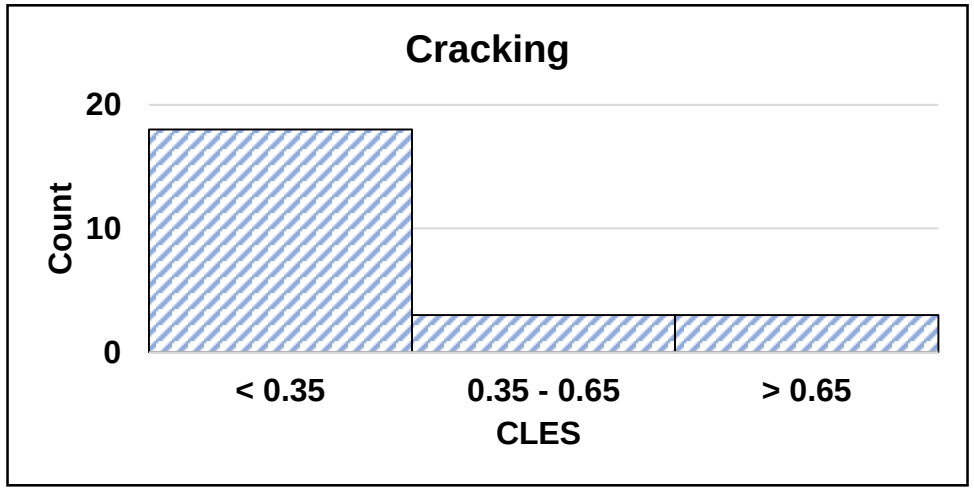
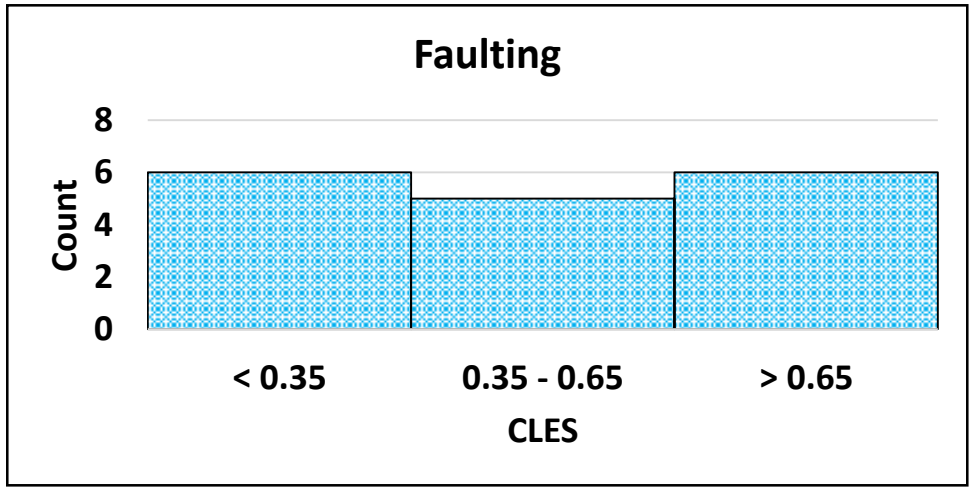
State – Level Comparison of Project and 2017 HPMS

Common Language Effect Size Results





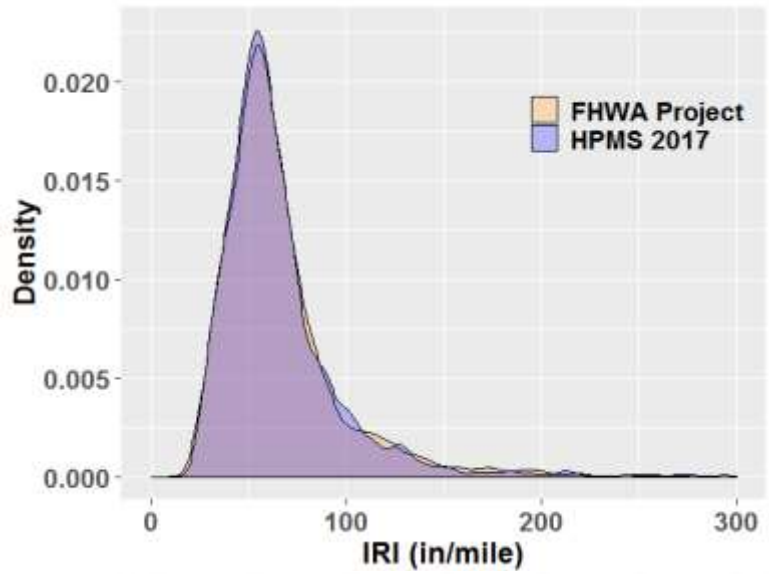


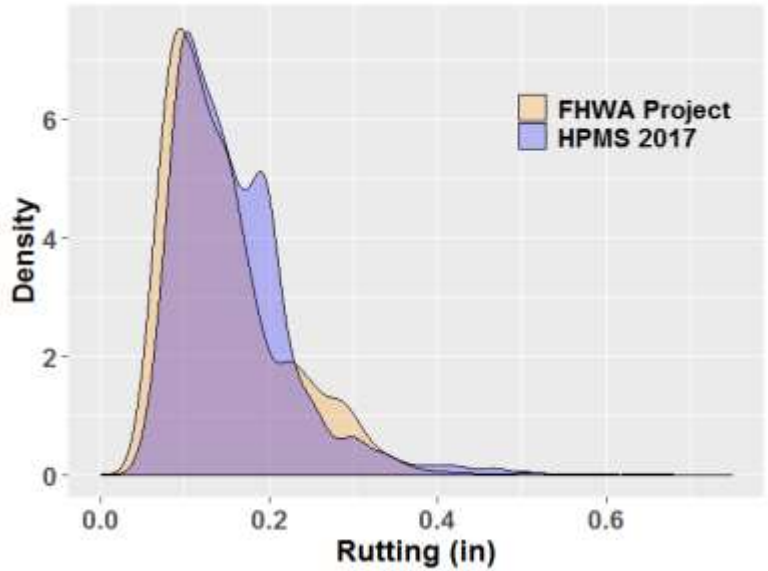


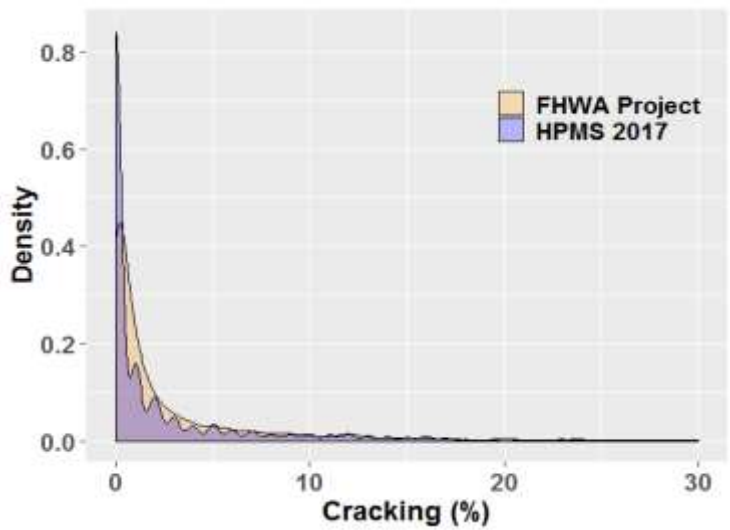
Route – Level Comparison of Project and 2017 HPMS

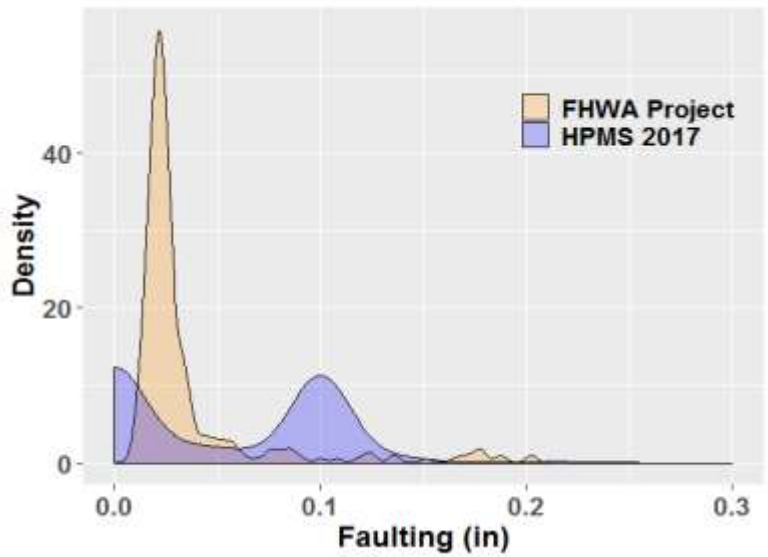
- 2,151 ACP segments,
- 308 JCP segments, and
- 34 CRCP segments

Route Level Comparison









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Conclusions

- Project acceptance criterion for IRI repeatability was met at 12 of 20 test sections, while seven of remaining test sections had a COV close to acceptance threshold
- Rutting and percent cracking criteria were met for all LTPP test sections
- Reliability analysis results showed that condition metrics measured for AC sections had a drastic improvement between 2016 and 2018, while JCP sections did not show improvements in conditions and were within generally expected changes

Conclusions

➢Network

- A comparison of performance measures resulting from FHWA project and 2017 HPMS datasets indicate that values are quite close

- Mean of IRI values were larger for 2017 HPMS than those for project, while minor differences were observed between values for rutting, percent cracking and faulting

Conclusions

➢State

- CLES was used to compare differences between condition metric distributions for 2017 HPMS and FHWA project datasets
- Comparison showed that condition metrics matched well for some States between 2017 HPMS and FHWA project datasets
- Large differences in two or more condition metrics resulted in a significant difference in performance measures for a given State while variability in only one condition metric has little to no impact on performance measures

Conclusions

➢Route

- Distributions obtained from 2017 HPMS and project datasets for IRI, rutting, and cracking are nearly identical

- For faulting, the two datasets have fairly distinct density plots, which might be due to differences in the precision of the measured data

Thank You