

Pavement Condition Reporting and Target Setting in the TAMP

Where Are We and Where Do We Need to Go?

A Summary of the Interstate Condition Project

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Project Background





Background

- **MAP-21 requires FHWA to adopt pavement performance measures for evaluating condition of IHS and NHS**
- **Highway Performance Monitoring System (HPMS) selected as data source**
- **HPMS pavement condition data elements include:**
 - ▶ IRI
 - ▶ Cracking percent
 - ▶ Faulting
 - ▶ Rutting

AC and JCP – good if all metrics good, poor if two or more metrics poor

CRCP – good if both metrics good, poor if both metrics are poor
- **Concerns about validity and availability of HPMS pavement data**

Project Objectives

- 1. Collect statistically significant sample of data on IHS and produce report indicating IHS pavement condition nationally and in each State where data collected**
- 2. Determine if HPMS is unbiased representation of IHS pavement condition**
- 3. Recommend improvements to data collection and reporting necessary to make HPMS unbiased or improve precision**
 - ▶ Is two-way data collection necessary?
 - ▶ Does data need to be collected in more than one lane in a direction?
 - ▶ What is the optimum HPMS section length?
 - ▶ Do all distress items require full extent reporting or is sampling adequate?
 - ▶ Are protocols proposed by FHWA adequate for collecting and reporting distress or do they need improvement?



Data Collection

- **Data collection**
 - ▶ ~8,624 miles “routine”
 - ▶ ~1,500 miles QC data, opposing direction, and adjacent lane
 - ▶ ~10,000 miles total
- **Comparison with IHS (contiguous US)**
 - ▶ 46,460 vs. 8,624 miles (18.6%)
 - ▶ 66 vs. 9 Interstates (13.6%)
 - ▶ 48 vs. 39 States and D.C (81.3%)





Data Collection



Data Quality Plan

- **Data collection**
 - ▶ Data collection contractor
 - ▶ Quality Management Plan
 - ▶ AMEC quality assurance reviews
 - **Data analyses**
 - ▶ AMEC
 - ▶ Quality Plan
 - ▶ Project Review Policy
 - **Communications**
-

Data Analyses & Findings





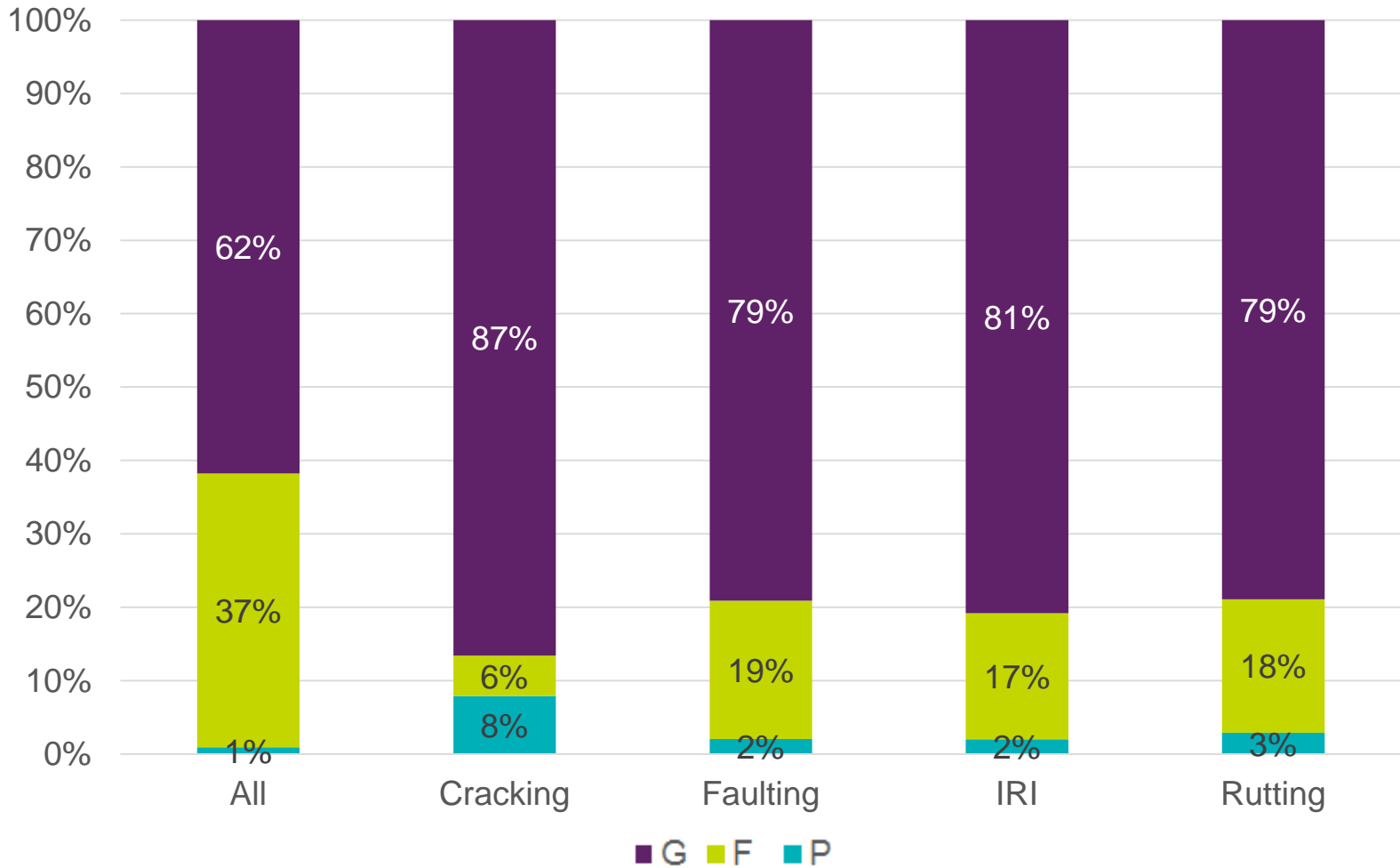
QC Data Comparison

| Element | Routine Data Avg | QC Data Avg | Statistically Significant? |
|-------------------|------------------|-------------|----------------------------|
| Average IRI | 65 in/mile | 64 in/mile | Yes |
| Average Rut Depth | 0.13 in | 0.14 in | Yes |
| AC HPMS Crack | 1.8% | 1.6% | Yes |
| AC % WP | 4.0% | 3.6% | Yes |
| PCC % Crack | 2.3% | 2.1% | No |
| LCMS Faulting | 0.03 in | 0.03 in | Yes |

Differences observed in averages are of little engineering significance



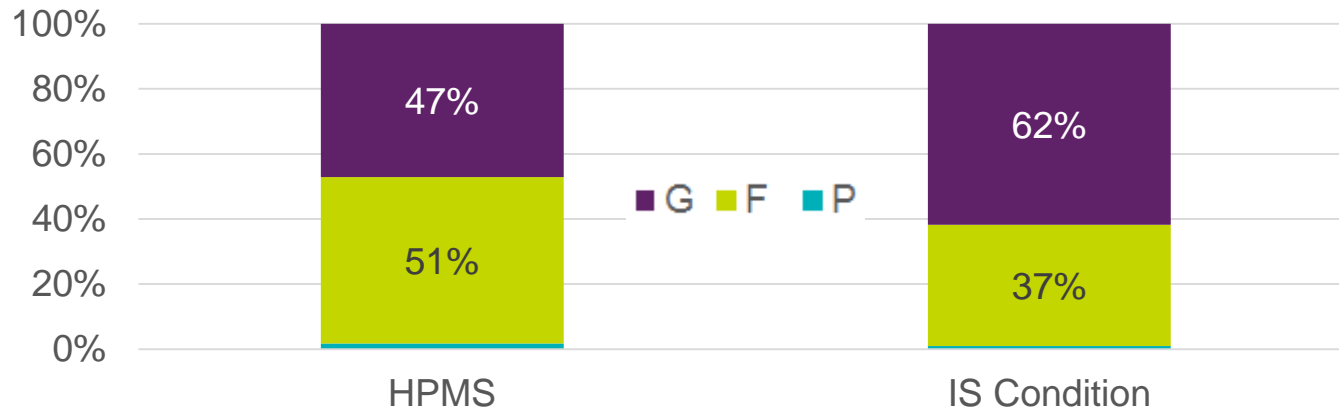
IS Condition – All Data





Comparison with 2014 HPMS

| Data Set | % Good | % Fair | % Poor |
|---|--------|--------|--------|
| HPMS (All IS) | 47 | 51 | 2 |
| HPMS (Route) | 45 | 53 | 2 |
| IS Data | 62 | 37 | 1 |
| Excluding Bridges | 63 | 36 | 1 |
| Excluding Bridges and Segments < 0.1 mile | 62 | 37 | 1 |



HPMS data variability is higher than project data



Comparison by Condition Metric

HPMS (route data only)

| Condition Metric | IS Condition Data Avg | HPMS Avg | Statistically Significant | Engineering Significant |
|------------------|-----------------------|------------|---------------------------|-------------------------|
| Cracking | 3.0% | 3.6% | Yes | No |
| Rutting | 0.15 in | 0.12 in | Yes | No |
| Faulting | 0.04 in | 0.05 | Yes | No |
| IRI | 72 in/mile | 77 in/mile | Yes | No |



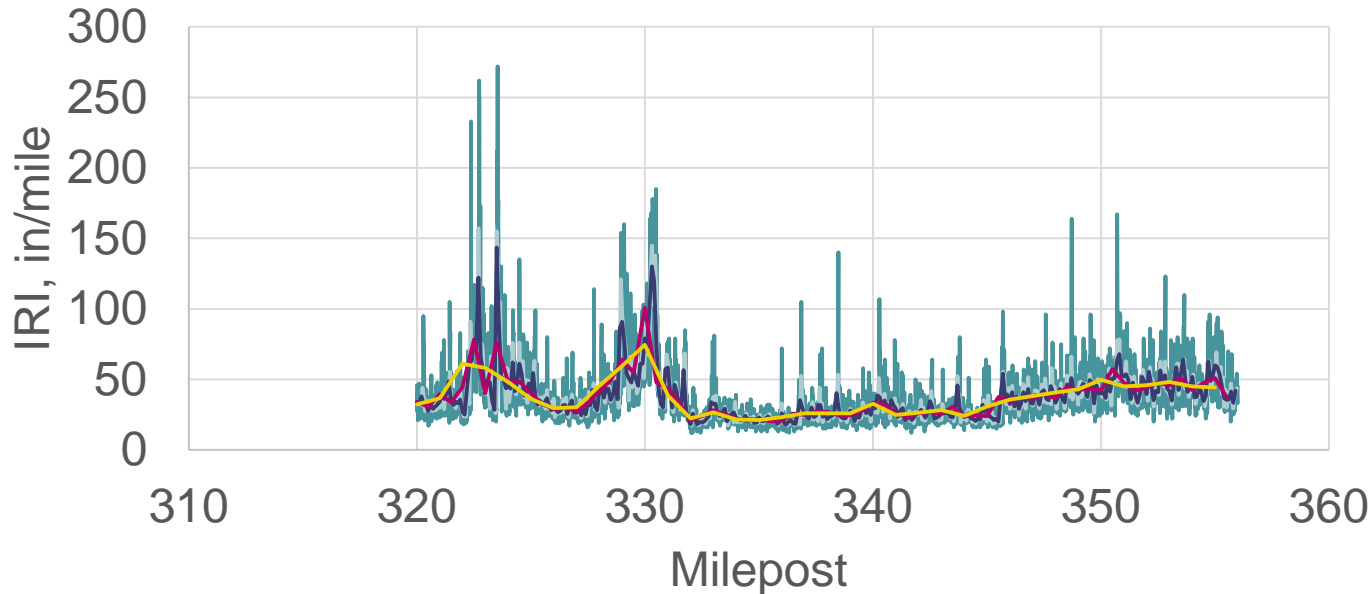
Opposite Direction & Adjacent Lane

| Condition Metric | “Routine” | Adjacent Lane | Opposing Direction | Statistically Significant |
|------------------|------------|---------------|--------------------|---------------------------|
| IRI | 68 in/mile | 66 in/mile | 66 in/mile | Yes |
| AC HPMS Cracking | 2.3% | 1.6% | 2.4% | Yes, No |
| AC % WP | 4.9% | 3.5% | 5.2% | Yes, No |
| PCC Crack | 11.7% | 7.0% | 13.6% | Yes, No |
| Rutting | 0.14 in | 0.11 in | 0.14 in | Yes |
| Faulting | 0.07 in | 0.05 in | 0.07 in | Yes |

- **Differences have little to no engineering significance**
- **Approximately 3% of the opposing lane data had a different surface type than the primary direction**



Section Length - IRI



- Reviewed section lengths from 0.01 mile to 1 mile
- With smaller section lengths, more detail is discernible but analysis and transmittal difficulty increases



Sampling Requirements

- **Started by looking at national level data**
- **Sample size associated with national data can mask some of variability**
- **Better to review in terms of individual States**
- **Requirements for sample size increase with smaller sample sizes associated with cracking data**

| IRI | | Error Level | | |
|------------------|------|-------------|-----|-----|
| Confidence Level | | 1% | 5% | 10% |
| 90% | 1.65 | 77% | 17% | 5% |
| 95% | 1.96 | 82% | 21% | 7% |
| 99% | 2.58 | 88% | 31% | 12% |

| Rut | | Error Level | | |
|------------------|------|-------------|-----|-----|
| Confidence Level | | 1% | 5% | 10% |
| 90% | 1.65 | 80% | 19% | 6% |
| 95% | 1.96 | 85% | 24% | 8% |
| 99% | 2.58 | 91% | 34% | 13% |

| Fault | | Error Level | | |
|------------------|------|-------------|-----|-----|
| Confidence Level | | 1% | 5% | 10% |
| 90% | 1.65 | 96% | 59% | 33% |
| 95% | 1.96 | 97% | 66% | 39% |
| 99% | 2.58 | 99% | 75% | 50% |

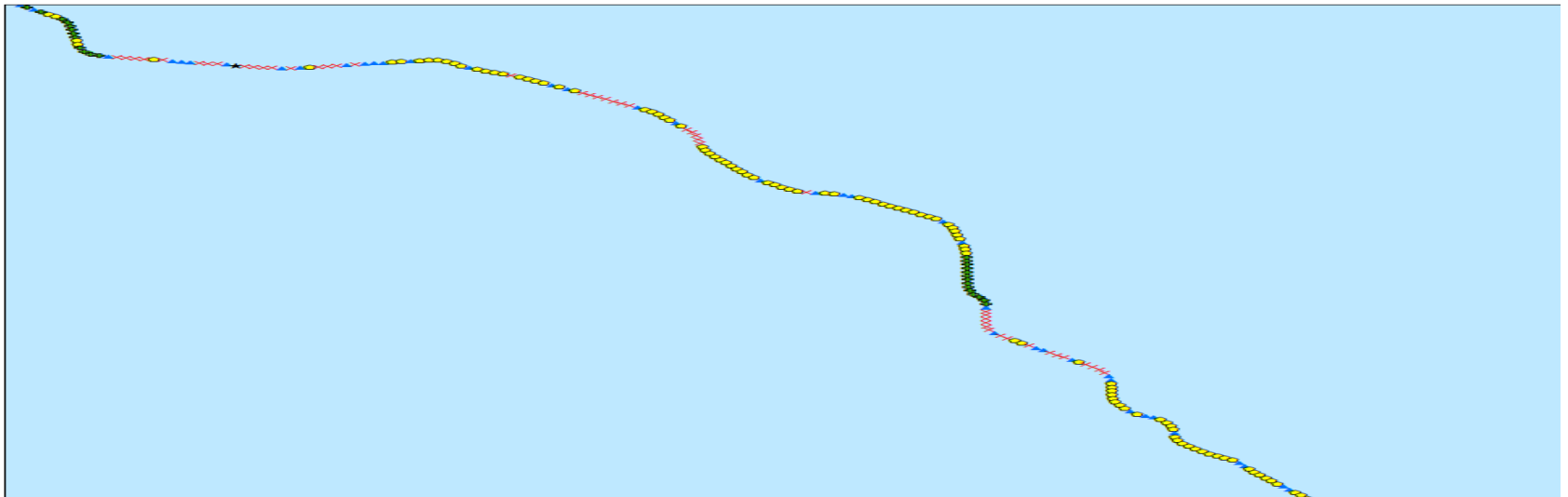
| AC Crack | | Error Level | | |
|------------------|------|-------------|-----|-----|
| Confidence Level | | 1% | 5% | 10% |
| 90% | 1.65 | 99% | 79% | 53% |
| 95% | 1.96 | 99% | 83% | 60% |
| 99% | 2.58 | 100% | 89% | 71% |

| PCC Crack | | Error Level | | |
|------------------|------|-------------|-----|-----|
| Confidence Level | | 1% | 5% | 10% |
| 90% | 1.65 | 100% | 91% | 76% |
| 95% | 1.96 | 100% | 93% | 80% |
| 99% | 2.58 | 100% | 96% | 87% |

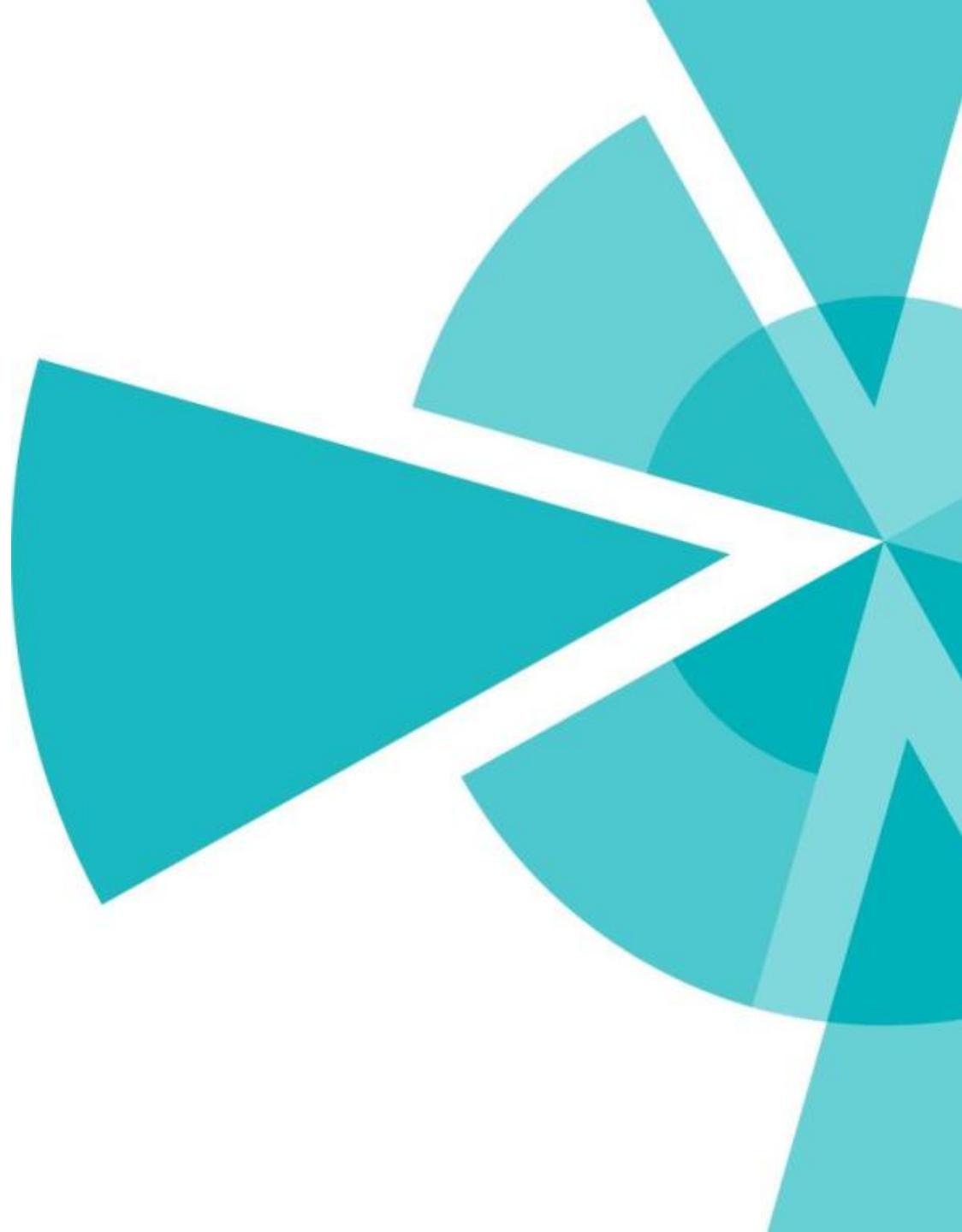


Point-by-Point Comparison

- **Within State Comparison**
- **Missing data range from 0% to 100%**
- **Similar performance from both data sets ranges from 1% to 83% (higher percentage equals more similar performance)**
- **Found significant differences in some States**



Conclusions



Summary and Conclusions

Objective 1 – Collect statistically significant sample of data on IHS and produce report indicating IHS pavement condition nationally and in each State where data collected

- **Data collected on over 9,844 miles of Interstate in 39 states**

Objective 2 - Determine if HPMS is unbiased representation of IHS pavement condition

- **HPMS data – 51% good, 2% poor performance observed**
- **“IS Condition” data – 62% good, 1% poor performance observed**
- **Found significant differences in some States**

Summary and Conclusions

Objective 3 - Recommend improvements to data collection and reporting necessary to make HPMS unbiased or improve precision

- **Collection in opposing direction not necessary**
- **Collection in adjacent lane not necessary (although adjacent lane slightly better condition)**
- **Summarizing to 0.1 mile best option**
 - ▶ Longer segment lengths yields more fair condition
 - ▶ Shorter segments lengths more variability
- **100% sample required**
- **Work needs to be done on faulting and rutting requirements**



Summary and Conclusions

Objective 3 - Recommend improvements to data collection and reporting necessary to make HPMS unbiased or improve precision

- **Include bridges within data collection – does not significantly impact performance indicator and provides additional valuable info on condition of bridge decks**
- **Standardize equipment requirement**
- **LCMS provides a better estimate of rutting (as opposed to 5 point)**
- **LCMS provides a better estimate of faulting (as opposed to RPS)**

Thank you

