FHWA Infrastructure Health Assessment

Study Overview

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Project Objectives

- Define a consistent and reliable method to document infrastructure health
  - » Focus on pavements and bridges
  - » Initial focus on IHS, but with possible expansion to NHS
- Develop tools to provide FHWA and State DOTs ready access to key information

Project Approach

- Track #1 - Develop an approach for categorizing pavement and bridges as Good/Fair/Poor, that can be used consistently across the country
- Track #2 - Develop an approach for assessing the Overall Health of a multi-state highway corridor

Project Structure

- Phase I – Develop methodology
- Phase II – Conduct pilot
- Phase III – Present findings at national meeting

TRACK #2
HEALTH ASSESSMENT

Health Assessment

- Objective
  - » Provide FHWA with a means to examine the overall health of specific corridors and respond to requests for information
- Basic approach
  - » Present data in a way that supports professional judgment
  - » There is no single health score or number
- Data sources
  - » Draw from available data
  - » Identify future enhancements
  - » Good/fair/poor results are one input

Sample Health Report

TRACK #1
DEFINING GOOD/FAIR/POOR

Track #1 Overview

- Vision – consistent, reliable method that can be applied nationwide
- Approach
  - » Develop qualitative definitions for good/fair/poor
  - » Develop quantitative measures for placing assets into those buckets
- Benefits
  - » Approach is flexible and can evolve as the measures evolve

Defining Good/Fair/Poor

	Condition	Typical Work Activities
Good	Free of significant defects Condition does not adversely affect its performance	Activities that preserve good conditions (i.e. pavement surface treatments, deck sealing)
Fair	Isolated surface defects or functional deficiencies on pavements Minor deterioration on bridge elements	Minor rehabilitation - Pavement overlays and patching - Bridge crack sealing, patching of spalls, and corrosion mitigation
Poor	Advanced deterioration Conditions impact structural capacity	Structural repairs, major rehabilitation, reconstruction, or replacement

Potential Performance Measures
Building off Previous Work

- **Measures addressed through NCHRP 20-24(37) G**

Goal Area	Tier 1	Tier 2	Tier 3
Pavement Preservation	IRI	Structural adequacy based on HPMS distress data	
Bridge Preservation	Structural Deficiency (SD)		Structural adequacy based on NBI ratings or element-level data

Potential Performance Measures
Building off Previous Work

AASHTO Evaluation Criteria

- **Is there general consensus on the definition of the measure?**
- **Is there a common or centralized approach to data collection in place?**
- **Has the availability of consistent data across states been established through national comparative analysis or other research effort?**

Potential Performance Measures
Building off Previous Work

- **Measures addressed through FHWA Health Study**

Goal Area	Tier 1	Tier 2	Tier 3
Pavement Condition	IRI	Functional adequacy based on HPMS distress data	Structural adequacy based on HPMS distress data and deflection data
Bridge Condition	Structural Deficiency (SD)	———	Structural adequacy based on NBI ratings or element-level data

PILOT STUDY RESULTS

Outline

- Pilot study approach
- Bridge pilot study
- Pavement pilot study
- Summary of Findings

Goals of the Pilot Study

- **Bridge**
  - Validate structurally deficiency as a Tier 1 measure
  - Advance potential Tier 2 measure
- **Pavement**
  - Validate IRI as a Tier 1 measure
  - Advance potential Tier 2 and 3 measures
- **Key questions**
  - Do different data sources tell us the same thing?
  - Do different metrics help us better understand pavement and bridge conditions?

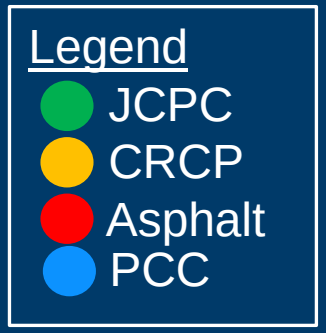
Pilot Approach

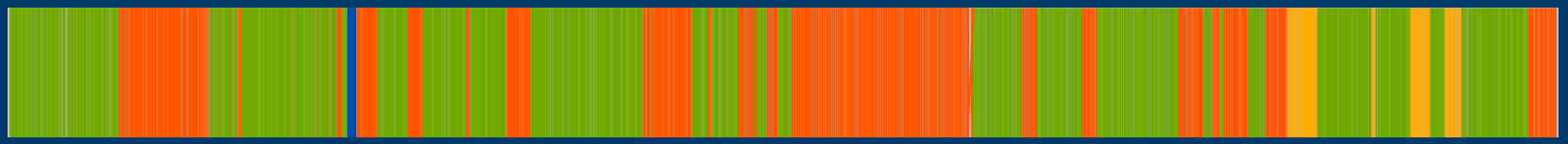
- Select a three-state pilot corridor
- Collect data sets
  - Federal data for pavements and bridges
  - State pavement data
  - Field collection for pavement data
- Compare data and measures resulting from data
- Identify issues and recommend improvements

Pilot Study Corridor

Corridor Statistics

- 874 centerline miles
  - SD = 411
  - MN = 275
  - WI = 188
- Wide range of pavement types
- AADT range = 5,000 – 90,000
- Urban and rural Interstate





Bridge Pilot Data

- Bridge analysis was performed with 2010 NBI data obtained from FHWA
- All structures along the pilot corridor were included in the analysis, culverts were pulled out for comparative analysis

	SD	MN	WI	Total
Bridges	260	109	182	551
Culverts	21	27	23	71
Total	281	136	205	622

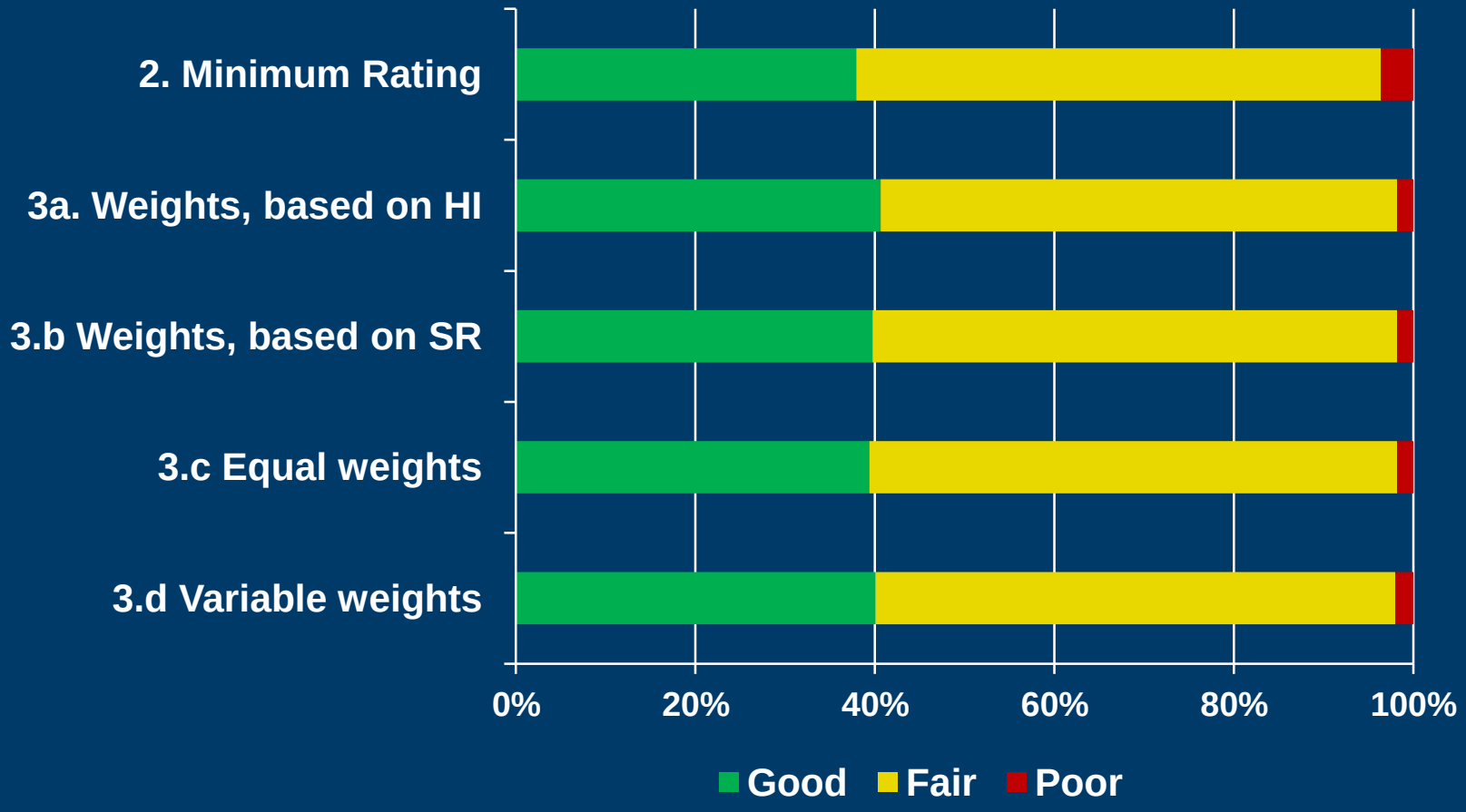
Bridge G/F/P Options

Option	G/F/P Scale	Tier 1	Tier 2	Tier 3
1. Structural deficiency		√		
2. Minimum NBI condition rating	√		√	
3. Weighted average of NBI condition ratings	√		√	

Option	Basis for Weights	Deck	Super	Sub
3.a	Bridge Health Index	5%	64%	31%
3.b	Sufficiency Rating	4%	48%	48%
3.c	Equal weights	33%	33%	33%
3.d	Variable	3a unless deck rating is much worse than super or sub rating, then 3c		

Corridors Results – Percent of Bridges

- **Structurally deficient – 3%** **CHANGE TO % OF DECK AREA**



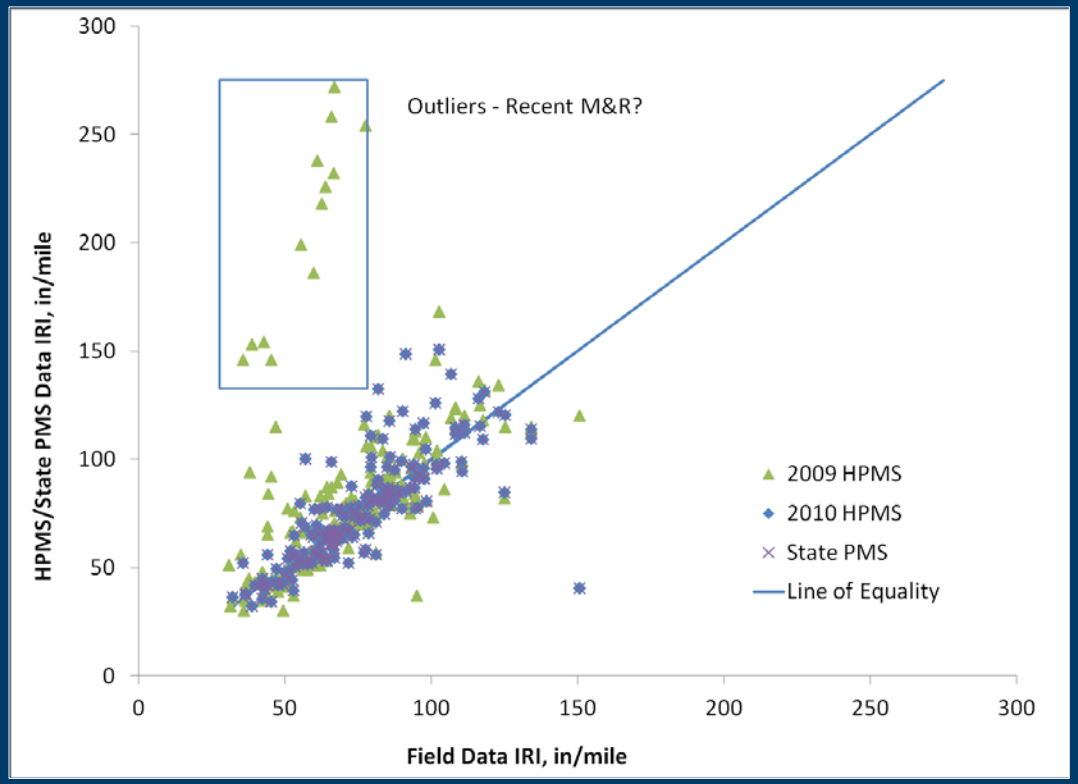
Pavement Pilot
Data items

- Roughness
  - IRI
- Additional distress data for a functional condition index
  - Cracking
  - Faulting
  - Rutting
- Structural condition index
  - Continuous deflection - Rolling wheel deflectometer (RWD)
- Also gathered documentation, visual ratings, and other information from state pavement management systems

Pavement Pilot
Data Gathering/Collection Summary

	National	State	Field	
	HPMS	PMS	Condition	RWD
MN	2009, 2010	2010	2011 (No RWD for WI)	
SD	2010	2010		
WI	2009, 2010	2010		

Comparison of HPMS, State, and Field IRI on Asphalt-Surfaced Pavements

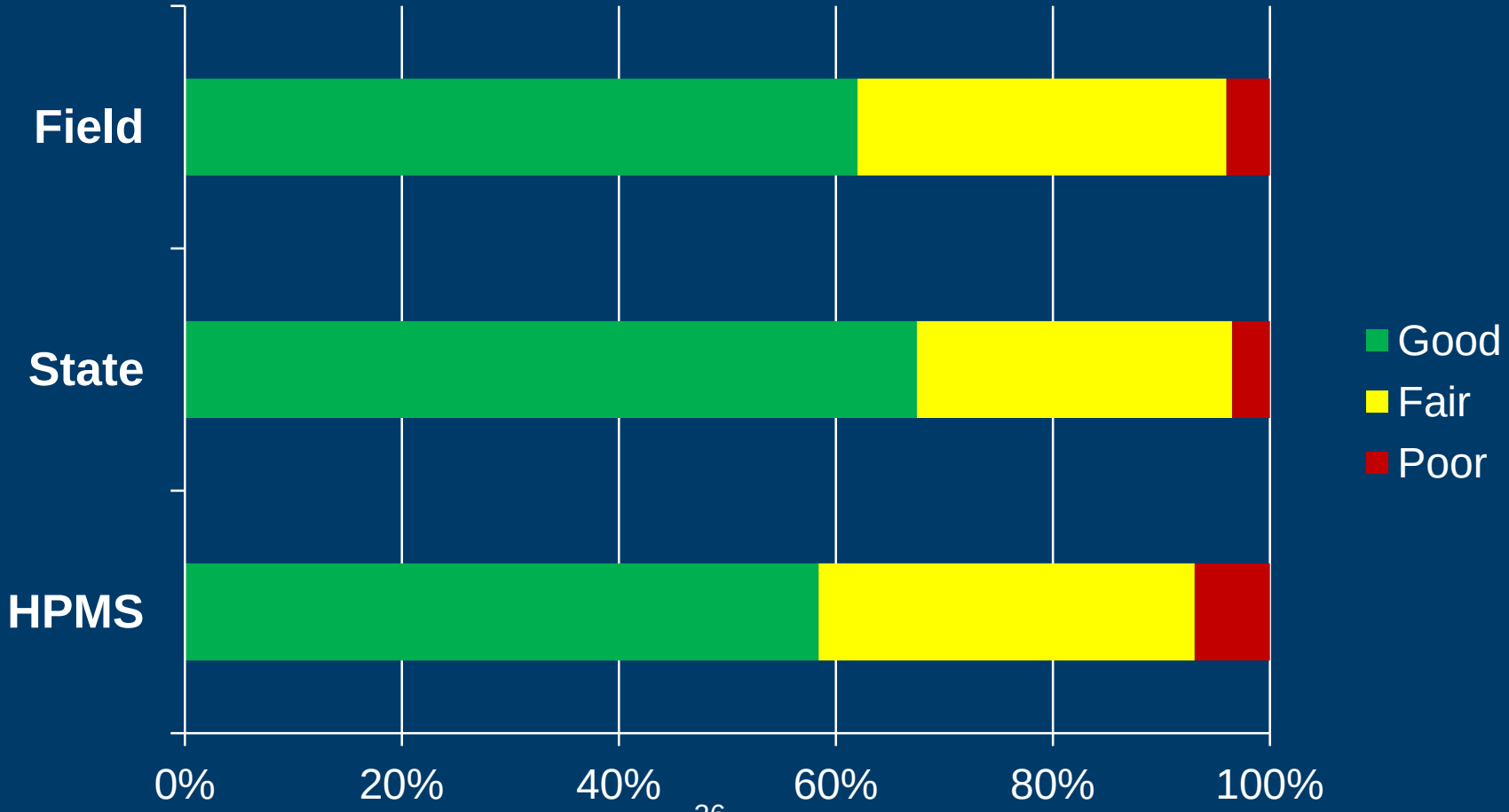


CHANGE M&R to recent work

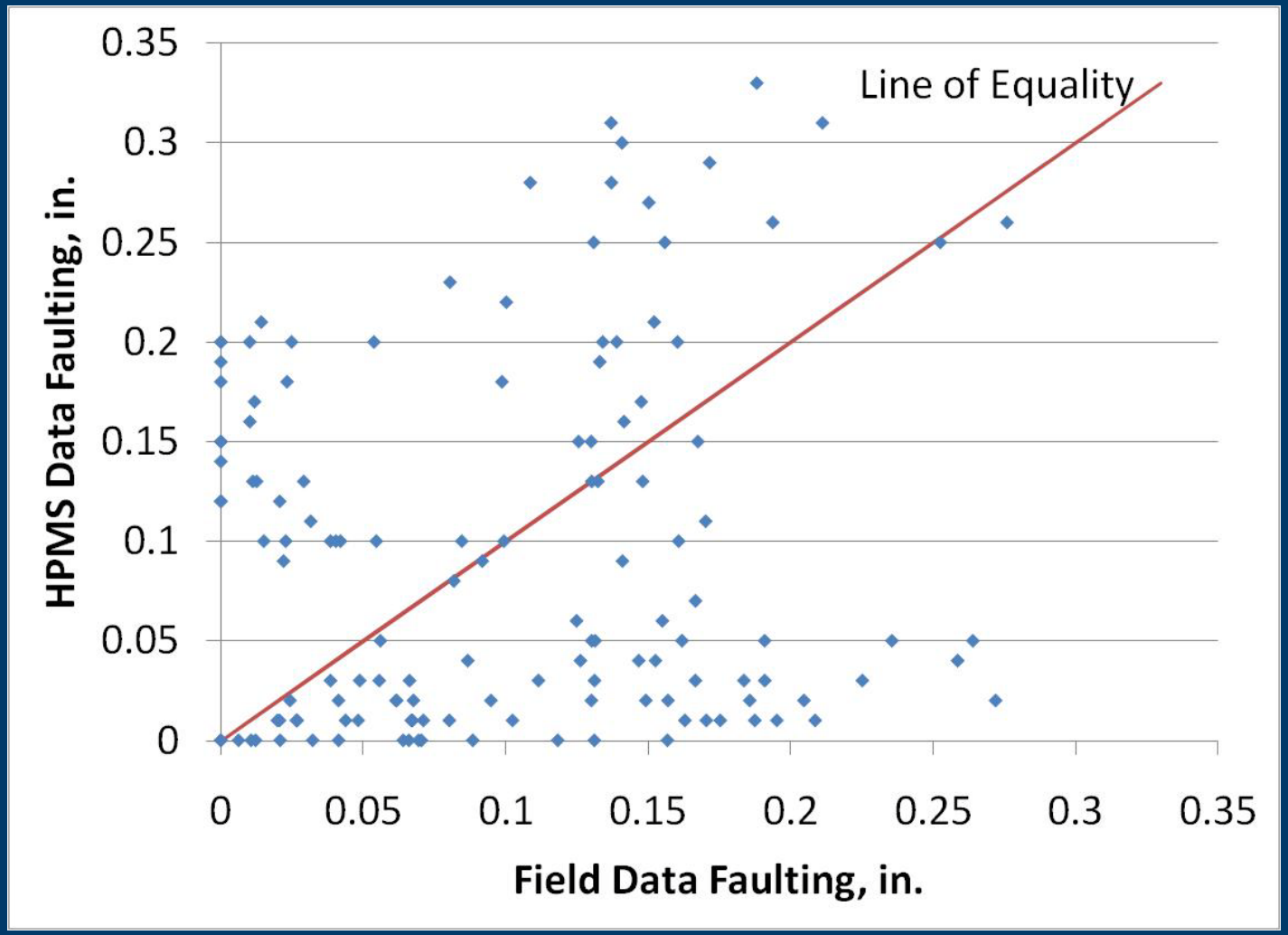
Data collected in different years

IRI Comparison – Summary

- **Do HPMS, state, and field data collection methods tell us the same thing?**



Faulting


Line of Equality
HPMS Data Faulting, in.
Field Data Faulting, in.
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35

HPMS Confidence Levels

	Confidence in HPMS Data
IRI	High
Cracking %	Low/Med
Cracking Length	Low
Rutting	Med
Faulting	Low

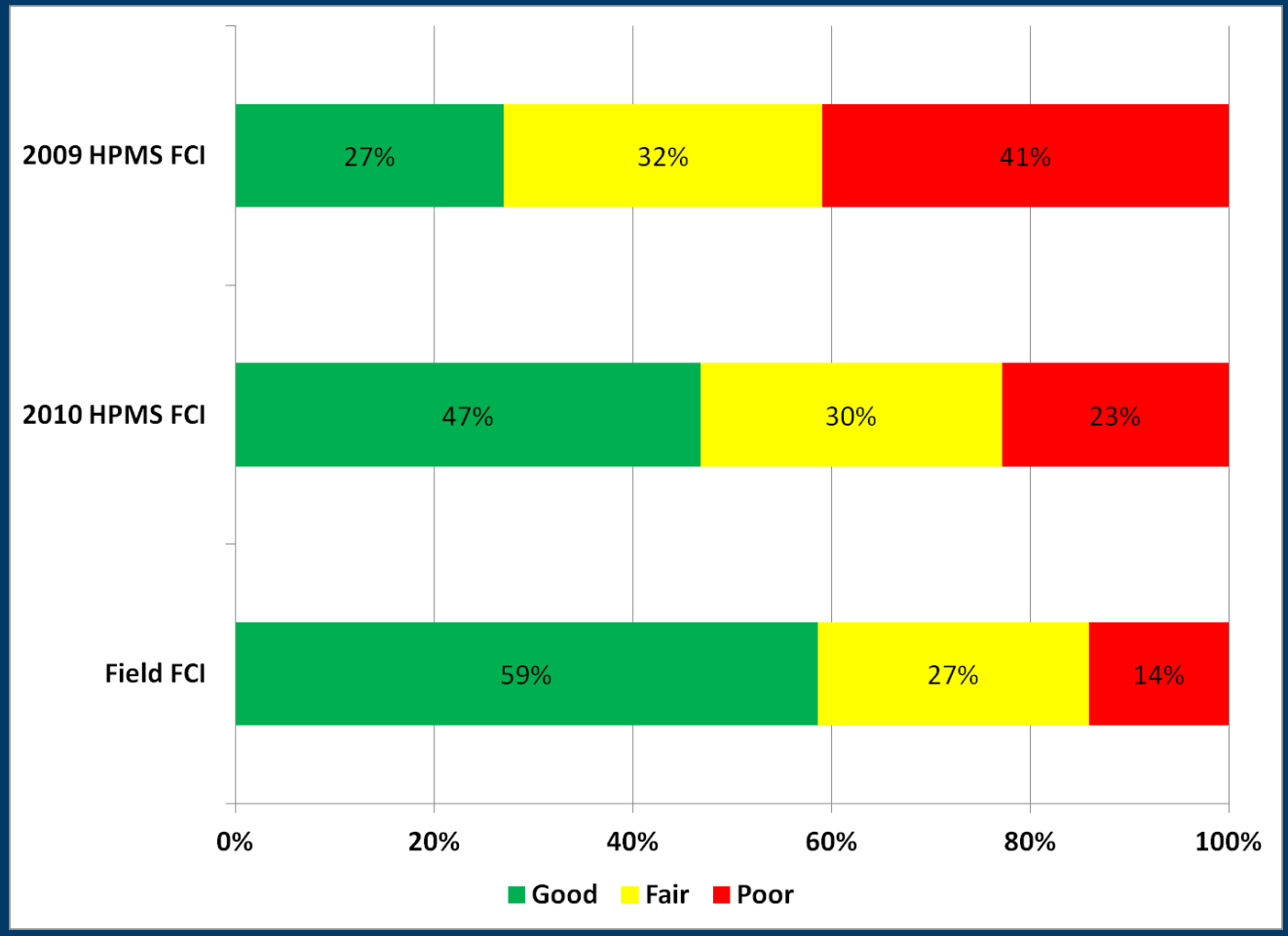
Pavement G/F/P Options

	G/F/P Scale	Tier 1	Tier 2	Tier 3
1. IRI	√	√		
2. Functional condition index based on HPMS data	√		√	
3. Structural condition based on RWD	√			√

Pavements Evaluation Options

Option	
1	Pavement roughness in terms of IRI
2	Pavement surface distresses in accordance with the Pavement Condition Index (PCI) procedure
3	Combination of pavement roughness and selected distresses (cracking, rutting and faulting)
4	Pavement structural capacity based on Rolling Wheel Deflection (RWD) measurements
5	Combination of roughness, selected distresses and RWD-based structural capacity
6	Pavement Remaining Service Life

Condition Based on FCI Computed Using HPMS and Field Data Sets



OBSERVATIONS

Observations – Data Sources

- **Bridge**
  - **NBI is viable source for national performance measurement**
- **Pavement**
  - **HPMS section lengths may create issues**
  - **Rutting data appear reasonable to use**
  - **Cracking and faulting data need closer examination**
  - **Consider developing a manual for estimating cracking, including QA/QC**
  - **Structural condition – Need RWD calibration, data collection and processing standards**

Observations – Bridge Tiers

- Structural Deficient
  - Widely reported Tier 1 measure
  - However, does not fit well into G/F/P approach since it is binary
  - Includes non-condition components (inventory rating and water adequacy)
- G/F/P based on NBI condition ratings is a viable option for a Tier 2 measure
- Final structure of a Tier 2 measure should be based on a policy discussion
  - Should minimum or weighted average be considered?
  - What is relative importance of deck compared to superstructure and substructure?

Observations – Pavement Tiers

- IRI is feasible for use as primary G/F/P indicator
  - Acceptable correlation between HPMS, state, and field sources
- While IRI does not provide a complete picture of condition, the Tier 2 and 3 measures require significant work
- Rutting and cracking data could be used as primary or “flag” G/F/P indicator
  - Flag for safety concern
  - Cracking flag only useful for concrete
- Faulting/cracking data can not be used for G/F/P – work needed

Final Report

- http://www.fhwa.dot.gov/infrastructure/asstmgmt/