

# Highway Performance Monitoring System (HPMS): Concepts, Data Collection & Reporting Requirements

## Module III



U.S. Department of Transportation  
Federal Highway Administration



# HPMS Data Reporting Requirements

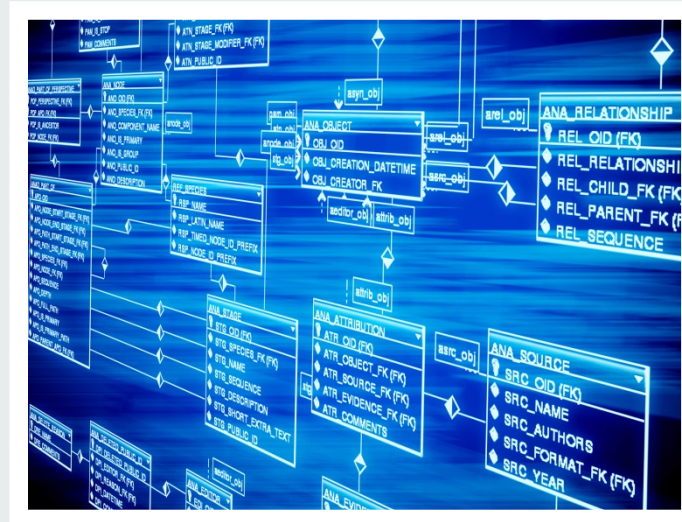
Lesson 1: Sections & Sample Panel ID File Structure

Lesson 2: Pavement Data Items & TPM PM2 Rule-related Modifications

Lesson 3: Special Networks Data Items

# Lesson One

## Sections and Sample Panel Identification File Structures



# Sections Dataset File Structure

	Field Number	Field Name
Section	1	Year_Record
	2	State_Code
	3	Route_ID
	4	Begin_Point
	5	End_Point
	6	Data_Item
	7	Section_Length
	8	<i>Value_Numeric</i>
	9	<i>Value_Text</i>
	10	<i>Value_Date</i>
	11	Comments (optional)

- Used to report the State's roadway attribute data (at most, 70 data items)
- Contains 11 data fields
  - 7 required fields
  - 3 item-dependent fields
  - 1 optional field
- Data Types
  - Numeric
  - Text
  - Date

# Inventory Data Items

- **Functional System**
- **Urban Code**
- **Facility Type**
- Structure Type
- Access Control
- **Ownership**
- **Through Lanes**
- Managed Lane Operations Type
- Managed Lanes
- Peak Lanes
- Counter-peak Lanes
- Right Turn Lanes
- Left Turn Lanes
- Speed Limit
- Toll Charged
- Toll Type
- **County Code**
- Maintenance & Operations
- **Directional Through Lanes**

*Data Items shown in **blue** are required to be reported for all public roads.*

*Data Items shown in **magenta** are required to be reported for all Federal-aid roads*

*Data Items shown in **bold** are used will be used for TPM PM2 rule analysis*

# Route & Traffic Data Items

- Route Number
- Route Signing
- Route Qualifier
- Alternative Route Name
- **Annual Average Daily Travel (AADT)**
- Single-unit Truck & Bus AADT
- Percent Peak Single-unit Trucks & Buses
- Combination Truck AADT
- Percent Peak Combination Trucks
- K-factor
- Directional Factor
- Future AADT
- Signal Type
- Percent Green Time
- No. of Signalized, Stop Sign, Type-Other Intersections
- Capacity

*Data Items shown in **magenta** are required to be reported for all Federal-aid roads*

# Geometric Data Items

- Lane Width
- Median Type
- Median Width
- Shoulder Type
- Right Shoulder Width
- Left Shoulder Width
- Peak Parking
- Widening Obstacles
- Widening Potential
- Curve Classification
- Terrain Type
- Grade Classification
- Percent Passing Sight Distance

# Pavement Data Items

- **International Roughness Index (IRI)**
- **Present Serviceability Rating (PSR)**
- **Surface Type**
- **Rutting**
- **Faulting**
- **Cracking Percent**
- Year of Last Improvement
- Year of Last Construction
- Last Overlay Thickness
- Thickness Rigid
- Thickness Flexible
- Base Type
- Base Thickness
- Climate Zone
- Soil Type

*Data Items shown in **bold** are used will be used for TPM PM2 rule analysis*



# Special Networks Data Items

- National Highway System (NHS)
- Strategic Highway Network (STRAHNET)
- National Truck Network (NN)
- Future NHS (Planned/Unbuilt NHS)

# Example Sections Dataset

Year_Record	State_Code	Route_ID	Begin_Point	End_Point	Data_Item	Section_Length	Value_Numeric	Value_Text	Value_Date	Comments
2009	41	000100200S00	0	0.75	AADT	0.75	14800	Factored '06 AADT		
2009	41	000100200S00	0.75	5.32	AADT	4.57	14700		4/2009	Est. AADT
2009	41	000100200S00	0	0.10	IRI	0.10	118		3/2009	
2009	41	000100200S00	0.10	0.20	IRI	0.10	94		5/2008	
2009	41	000100200S00	0.20	0.30	IRI	0.10	66		4/2008	
2009	41	000100200S00	0	0.75	Through_Lanes	0.75	4			
2009	41	000100200S00	0.75	5.32	Through_Lanes	4.57	4			Widened in '08

# Sample Panel Identification Dataset File Structure

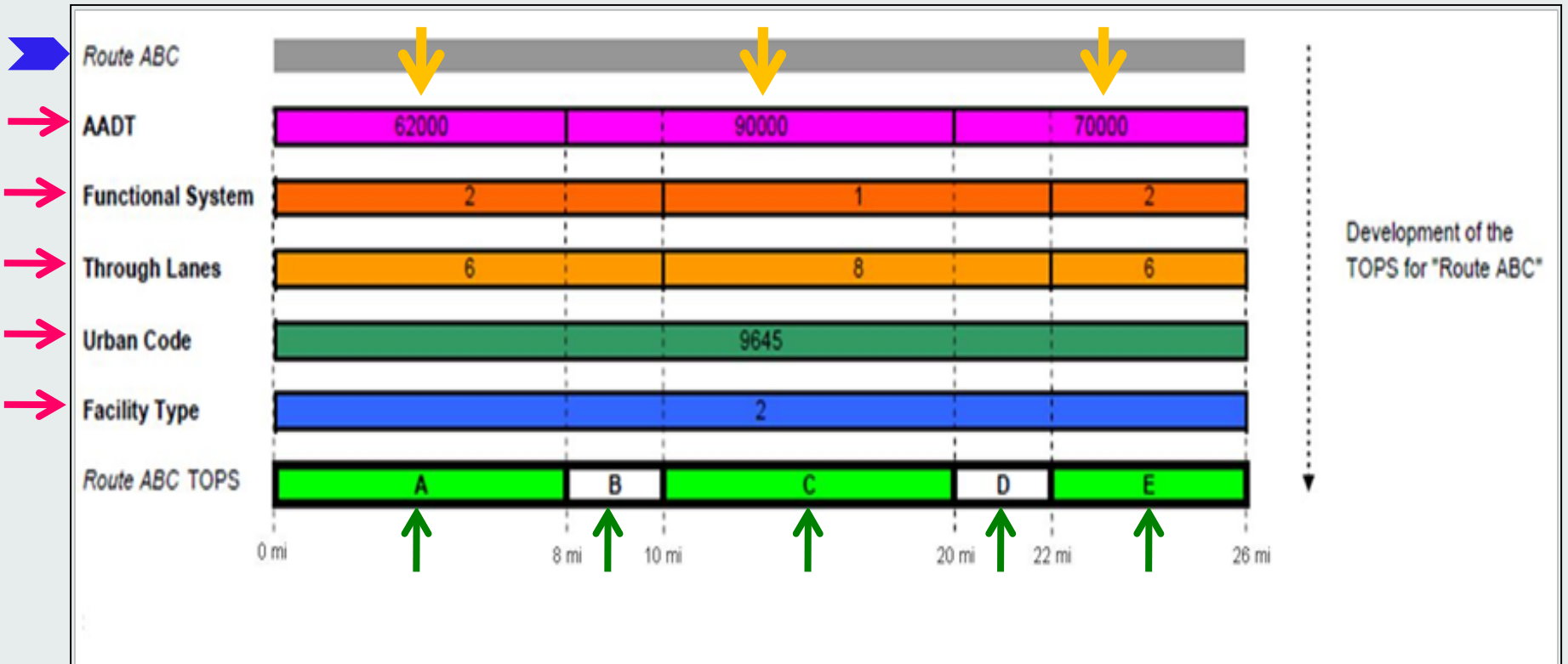
	Field Number	Field Name
Sample Panel Section	1	Year_Record
	2	State_Code
	3	Route_ID
	4	Begin_Point
	5	End_Point
	6	Section_Length
	7	Sample_ID

- Used to report the location of the State's sample sections
- Contains 7 data fields
- Data Types
  - Numeric
  - Text

# Sample Panel ID Dataset

Year_Record	State_Code	Route_ID	Begin_Point	End_Point	Section_Length	Sample_ID
2009	41	000100200S00	0	0.75	0.75	111
2009	41	000100200S00	.75	5.32	4.57	112
2009	41	000100200S00	0	0.75	0.75	113
2009	41	000100200S00	0.75	5.32	4.57	114
2009	41	000100200S00	5.32	5.69	0.37	115
2009	41	000100200S00	0	0.75	0.75	116
2009	41	000100200S00	.75	5.32	4.57	117

# TOPS Development Process

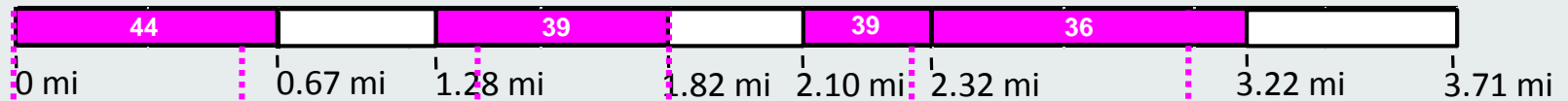


# Sections and Sample Panel ID Datasets - Relationship

- Sections Data

```

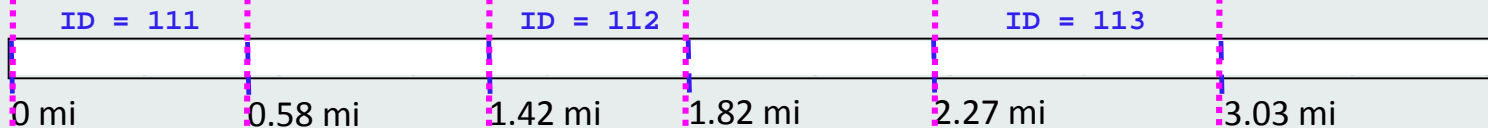
2009|41|000100200S00|0|0.67|Pct_Green_Time|0.67|44|||
2009|41|000100200S00|1.28|1.82|Pct_Green_Time|0.54|39|||
2009|41|000100200S00|2.10|2.32|Pct_Green_Time|0.22|39|||
2009|41|000100200S00|2.32|3.22|Pct_Green_Time|0.90|36|||
    
```



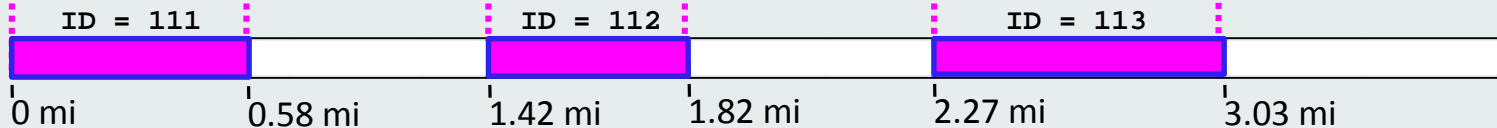
- Sample Panel ID Data

```

2009|41|000100200S00|0|0.58|0.58|111
2009|41|000100200S00|1.42|1.82|0.40|112
2009|41|000100200S00|2.27|3.03|0.76|113
    
```



- Sample Sections



# Data Aggregation/Calculation

- In most cases, Sections data can be reported for any given extent
- FHWA applies business rules to Sections data for sample data purposes
- Business rules are used to calculate roadway section-specific values for each applicable data item

# Data Aggregation Rules and Calculation Methods

Item Number	Data Item	Method
1	<b>F_System *</b>	No Calculation Required
2	<b>Urban_Code *</b>	No Calculation Required
3	<b>Facility_Type *</b>	No Calculation Required
4	Structure_Type	No Calculation Required
5	Access_Control	Predominance
6	Ownership	Predominance
7	<b>Through_Lanes *</b>	No Calculation Required
8	HOV_Type	Predominance
9	HOV_Lanes ***	Predominance
10	Peak_Lanes	Predominance
11	Counter_Peak_Lanes	Predominance
12	Turn_Lanes_R	Predominance
13	Turn_Lanes_L	Predominance
14	Speed_Limit	Predominance
15	Toll_Charged	Predominance
16	Toll_Type	Predominance
17	Route_Number	Predominance
18	Route_Signing	Predominance
19	Route_Qualifier	Predominance
20	Alternative_Route_Name	Predominance
21	<b>AADT *</b>	No Calculation Required#
22	AADT_Single_Unit	Weighted Averaging
23	Pct_Peak_Single	Weighted Averaging

- Combination
- Minimum Value
- Predominance
- Weighted Averaging

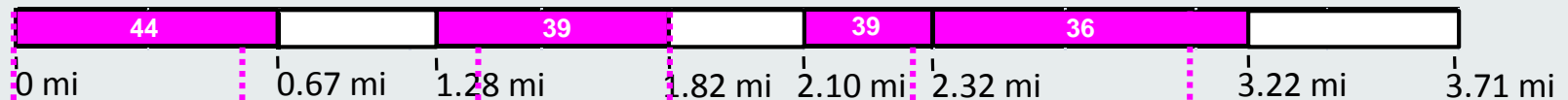


# Aggregating/Calculating Sample Section Values

- Sections Data

```

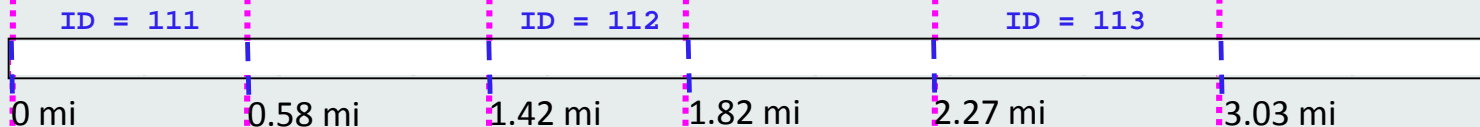
2009|41|000100200S00|0|0.67|Pct_Green_Time|0.67|44|||
2009|41|000100200S00|1.28|1.82|Pct_Green_Time|0.54|39|||
2009|41|000100200S00|2.10|2.32|Pct_Green_Time|0.22|39|||
2009|41|000100200S00|2.32|3.22|Pct_Green_Time|0.90|36|||
    
```



- Sample Panel ID Data

```

2009|41|000100200S00|0|0.58|0.58|111
2009|41|000100200S00|1.42|1.82|0.40|112
2009|41|000100200S00|2.27|3.03|0.76|113
    
```



- Sample Sections





# Lesson Two

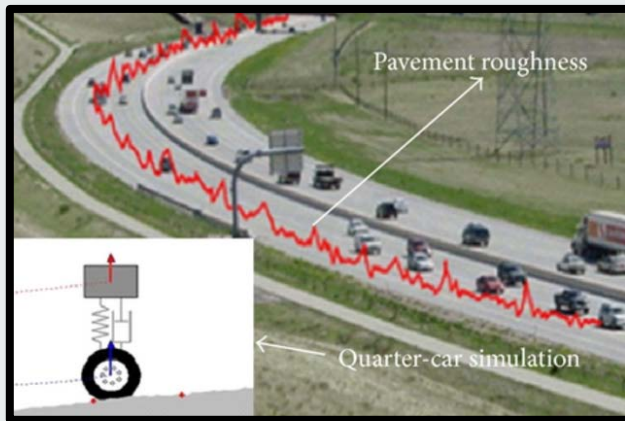
## Pavement Data Items & TPM PM2 Rule-related Modifications



# Lesson Topics

- Pavement Data & Distress Items
- PM2 Rule Modifications
- Data Collection/Reporting Guidance
- Coding Scenarios
- Directional Reporting Options

# Pavement Data & Distress Items



## IRI (International Roughness Index):

- Road roughness measurement
- Required for **all surface types**
- Reported in inches/mile



## PSR (Pavement Serviceability Rating):

- Visual inspection-based pavement condition rating
- Can be reported in lieu of IRI
- Reported/coded on scale of 0 (poor) to 5 (very good, in units of tenths (e.g., 4.2))

# Pavement Data & Distress Items (cont'd)



## Rutting :

- Longitudinal surface depressions in asphalt pavement
- Required for **asphalt** pavements
- Reported as the average depth of ruts on a section to the nearest 0.01 inch



## Faulting :

- Vertical misalignment of joints in Jointed Concrete Pavement
- Req. for **jointed-concrete** pavements
- Reported as average/mean absolute faulting to the nearest 0.01 inch



# Pavement Data & Distress Items (cont'd)



## Cracking Percent :

- Percentage of pavement surface exhibiting cracking
- Required for **all surface types**
- Reported as percent of section area or slabs to the nearest 1%



## Surface Type:

- One of 11 FHWA surface type codes determined from visual inspection or construction records
- Preservation treatments of < 0.5 in. compacted material shall be excluded surface type determination

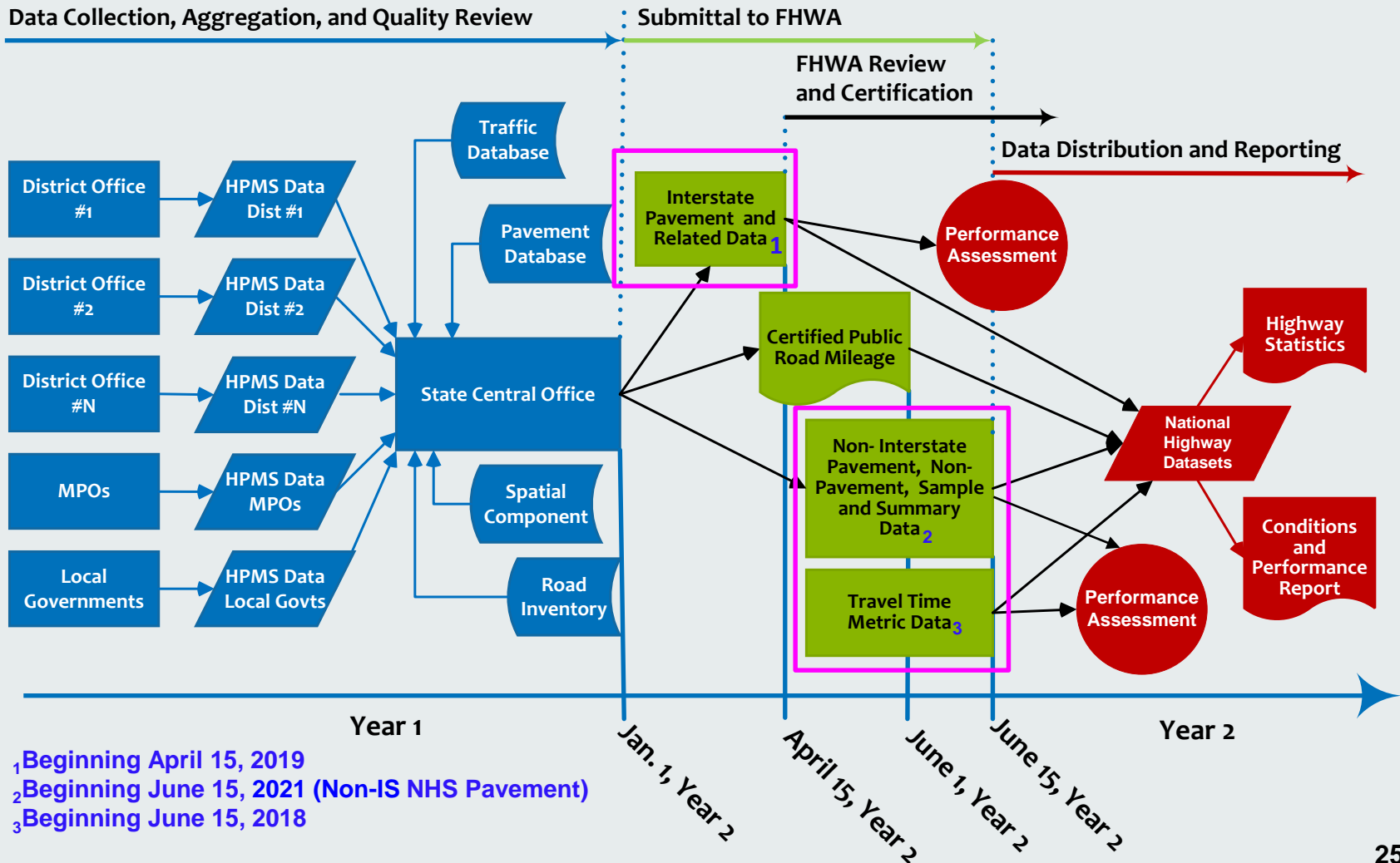
# Pavement Data Item Requirements by Surface Type

Reference: HPMS Field Manual - Table 4.5

Code	IRI	PSR	Rutting	Faulting	Cracking Percent	Thickness Rigid	Thickness Flexible
1 - Unpaved							
2 - Bituminous	in/mi	0.1-5.0	0.01"		Fatigue % area		0.5"
3 - JPCP (includes whitetopping)	in/mi	0.1-5.0		0.01"	% cracked slabs	0.5"	0.5" include for white-topping only
4 - JRCPP (includes whitetopping)	in/mi	0.1-5.0		0.01"	% cracked slabs	0.5"	0.5" include for white-topping only
5 - CRCP	in/mi	0.1-5.0			Punchout/long./patch % area	0.5"	
6 - Composite (AC / AC)	in/mi	0.1-5.0	0.01"		Fatigue % area		0.5"
7 - Composite (AC / JCP)	in/mi	0.1-5.0	0.01"		Fatigue % area	0.5"	0.5"
8 - Composite (Bituminous / CRCP)	in/mi	0.1-5.0	0.01"		Fatigue % area	0.5"	0.5"
9 - Composite (Unbonded JC / PCC)	in/mi	0.1-5.0		0.01"	% cracked slabs	0.5"	
10 - Composite (Bonded JC / PCC)	in/mi	0.1-5.0		0.01"	% cracked slabs	0.5"	
11 - Other (e.g., brick, cobblestone, etc.)	in/mi	0.1-5.0					



# HPMS Workflow / Timeline



# 2017 Pavement & Bridge Condition Rule (PM2)-related Modifications

		<u>Pre-PM2</u>			<u>Post-PM2</u>		
<u>Data Item</u>	<u>Roadway System</u>	<u>Extent</u>	<u>Collection Cycle</u>	<u>Direction</u>	<u>Extent</u>	<u>Collection Cycle</u>	<u>Direction</u>
IRI	Interstate (IS)	Full Extent	Annual	Inventory	Full Extent	Annual	Inventory*
	Non-IS NHS	Full Extent	Annual	Inventory	Full Extent	Biennial	Inventory
Surface Type	Interstate (IS)	Sample	Biennial	Inventory	Full Extent	Annual	Inventory*
	Non-IS NHS	Sample	Biennial	Inventory	Full Extent	Biennial	Inventory
Rutting	Interstate (IS)	Sample	Biennial	Inventory	Full Extent	Annual	Inventory*
	Non-IS NHS	Sample	Biennial	Inventory	Full Extent	Biennial	Inventory
Faulting	Interstate (IS)	Sample	Biennial	Inventory	Full Extent	Annual	Inventory*
	Non-IS NHS	Sample	Biennial	Inventory	Full Extent	Biennial	Inventory
Cracking Percent	Interstate (IS)	Sample	Biennial	Inventory	Full Extent	Annual	Inventory*
	Non-IS NHS	Sample	Biennial	Inventory	Full Extent	Biennial	Inventory

\*States can opt to report distress data independently for divided Interstate highway sections

# Pavement Data Collection/Reporting Guidance

- Collect in the rightmost through lane or one consistent lane
- Collect and report in uniform section lengths of 0.1 mi. (528 ft.); sections shall not exceed 0.11 mi.
- PSR, Rutting, Faulting, Cracking shall be collected for milepoint limits (i.e., sections) that are consistent with those reported for IRI



# Pavement Data Collection/Reporting Guidance (cont'd)

- The following codes must be used to specify why data could not be collected on an NHS section
  - **A:** Construction - Roadway under construction
  - **B:** Closure - Roadway closed to traffic
  - **C:** Disaster - Roadway is in area declared as a disaster zone
  - **D:** Deterioration - Roadway too deteriorated to measure and already rated “poor”
  - **E:** Other – E.g. section added to NHS post data collection

# Pavement Data Collection/Reporting Guidance (cont'd)

- Report existing values until they can be replaced by newly measured values
- Use Value Text field (Field 9) to indicate why measured value has not been reported for NHS sections
- An estimated date can be provided when exact collection date is unavailable

# Data Item 47 (IRI): Coding

## Pertinent Fields to be Coded:

- Field 6 = Data Item (“**IRI**”)
- Field 8 = Value Numeric (e.g. '**94**')
- Field 9 = Not required
- Field 10 = Value Date (e.g. “**10/2016**”)

## Example Record:

```
2017|41|123A|0|0.10|IRI|0.10|94|-----|10/2016|-----
```

# Data Item 47 (IRI): Coding (cont'd)

## Pertinent Fields to be Coded:

- Field 6 = Data Item (“**IRI**”)
- Field 8 = Value Numeric
- Field 9 = Value Text (“**A**”, for Construction)
- Field 10 = Value Date

## Example Record:

```
*2018|41|123A|0|0.10|IRI|0.10|94|A|5/2017|-----
```

\*Indicates an NHS section where IRI was not collected in 2018

# Data Item 48 (PSR): Coding

- **For NHS sections where posted speed limit is less than 40 mph, measured PSR can be reported**
- Use Value Text Field code of “**A**” to indicate that Speed Limit is below 40 if PSR is reported for NHS sections





# Data Item 48 (PSR): Coding (for NHS)

## Pertinent Fields to be Coded:

- Field 6 = Data Item (“**PSR**”)
- Field 8 = Value Numeric (e.g. '**3.5**')
- Field 9 = Value Text (“**A**”, for speed <40 mph)
- Field 10 = Value Date (e.g. “**10/2016**”)

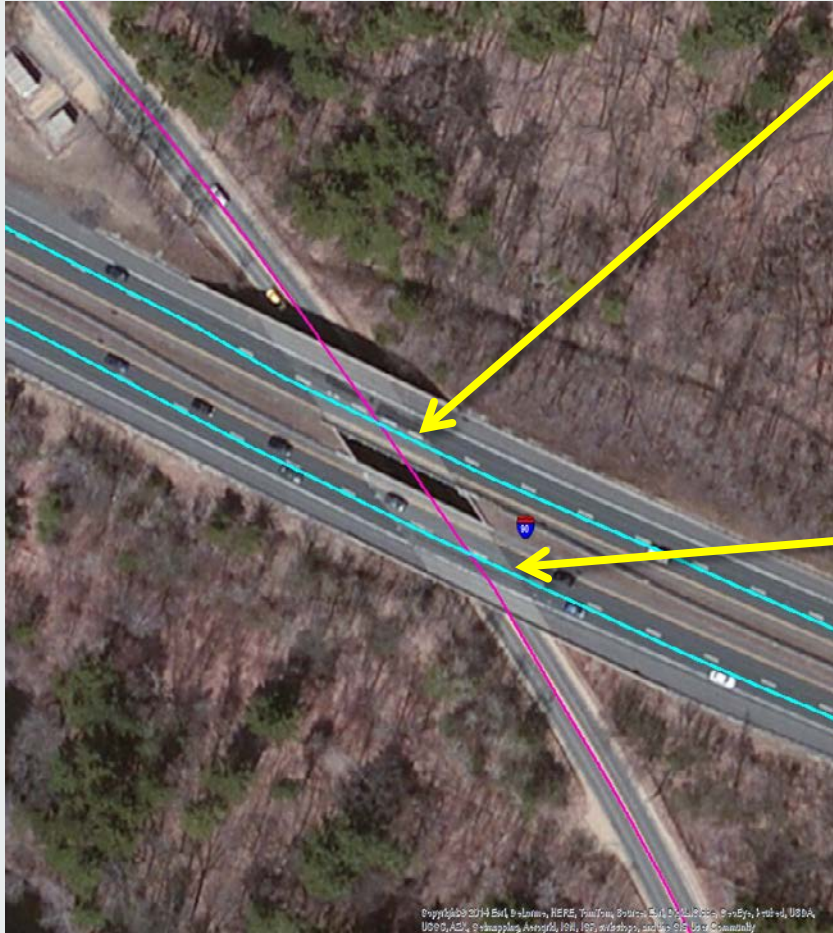
## Example Record:

```
2017|41|123A|0|0.10|PSR|0.10|3.5|A|10/2016|-----
```

# Directional Pavement Metrics Reporting Options

- If pavement data/distresses (i.e. IRI, PSR, Surface Type, Rutting, Faulting, Cracking Percent) is being reported independently for both directions of travel on **divided Interstate roadways**, then the following data items shall be reported in the same manner:
  - Urban Code
  - Structure Type
  - Route Number
  - Directional Through Lanes

# Directional Reporting Option



## Interstate 90 (I-90) West

- Functional System, Facility Type, Ownership, NHS
- IRI/PSR, Rutting, Faulting, Cracking Pct.
- Urban Code, Structure Type, Route Number, Directional Through Lanes

## Interstate 90 (I-90) East

- Functional System, Facility Type, Ownership, NHS
- IRI/PSR, Rutting, Faulting, Cracking Pct.
- Urban Code, Structure Type, Route Number, Directional Through Lanes

# Inventory Direction Reporting



## Interstate 90 (I-90) West

- Functional System, Facility Type, Ownership, NHS

## Interstate 90 (I-90) East

- Functional System, Facility Type, Ownership, NHS
- IRI/PSR, Rutting, Faulting, Cracking Pct.
- Urban Code, Structure Type, Route Number, Directional Through Lanes

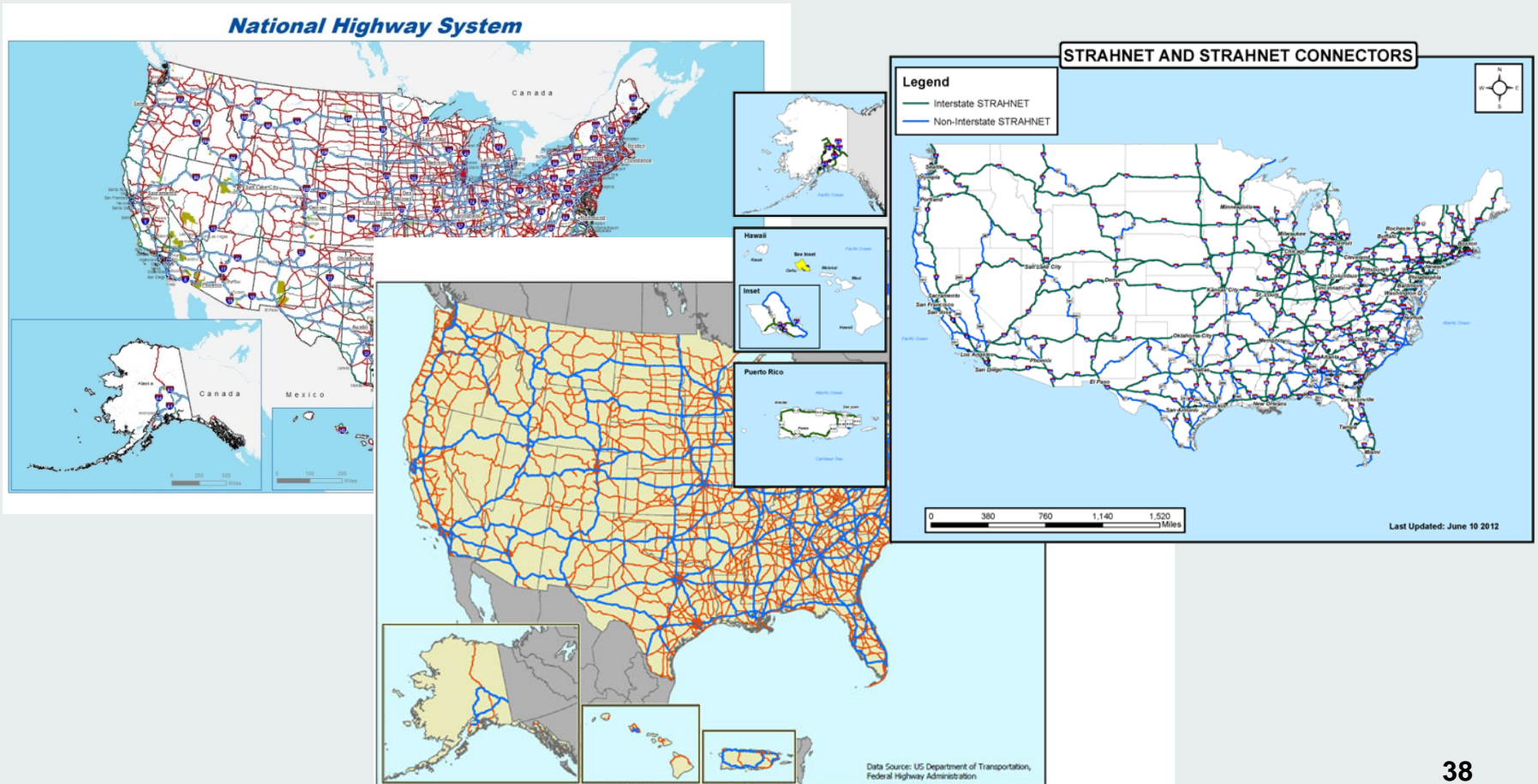
# Questions???





# Lesson Three

## Special Networks Data Items Summary



# Special Network Summary

Name	Full Name	Reporting	Data
<b>NHS</b>	National Highway System	Annual	Roadway section that is designated as a component of the NHS
<b>STRAHNET</b>	Strategic Highway Network	Annual	Roadway section that is a designated as a component of the STRAHNET
<b>TRUCK/NN</b>	National Truck Network	Annual	Roadway section that is designated as a component of the NN as defined by 23 CFR 658

# Item 67: Future Facility (Future National Highway System)

- **Definition:** Roadway section that is a component of the pending National Highway System (NHS), including intermodal connectors
- **Extent Requirement:** All roadways that are designated future NHS routes



# Guidance for Special Network Items

- States must continue to submit the data annually until directed otherwise
- FHWA may maintain this data at some point in the future
  - States will be responsible for submitting additions, deletions, etc. to FHWA for review/approval
- Datasets will be available to the States for reference and/or download purposes

# HPMS Software Module for NHS

U.S. Department of Transportation  
Federal Highway Administration

Highway Performance Monitoring System v8.0

Submittal Review National Maintenance

URBAN AREAS NHS HELP EXIT

NHS - Propose Changes

State: 4 - Arizona

Route Number 0 Lookup

Route ID Begin Point End Point NHS

To pick a section from map, click on a route  Tooltip

Add  Is this a Technical Correction

Delete  Is this part of a Realignment

Select files to upload

Zoom To	Staging ID	State Code	Data Item	Route ID	Begin Point	End Point	Value Numeric	Value Text	Value Date	Transaction Code	Code Description	Transaction Reason	Reason Description	Justification	Source
---------	------------	------------	-----------	----------	-------------	-----------	---------------	------------	------------	------------------	------------------	--------------------	--------------------	---------------	--------

- Transactional approach to NHS maintenance – In Development
- Involves State, FHWA Division Offices and FHWA Headquarters
- Data Maintained by FHWA – Available for State Download
- Other Special Networks may be added later

# Questions???



There are  
**NO STUPID QUESTIONS**  
or stupid answers.



# Data Collection/Reporting Guidance (cont'd)

## **For IRI purposes:**

- Report the average of right and left quarter-car IRI Mean Roughness Index (MRI)
- **Include structures and railroad crossings in measurement**

# Item 64: NHS (National Highway System)

## Pertinent Fields to be Coded:

- Field 6 = Data Item (“**NHS**”)
- Field 8 = Value Numeric (e.g. ‘**1**’)
- Field 9 = Not required
- Field 10 = Value Date (e.g. “**10/2008**”)

## Example Record:

```
2017|41|123A|0|5.62|NHS|5.62|1|-----|10/2008|-----
```