HPMS Reassessment: Pavements

Southeastern States Pavement Management and Design Conference

Little Rock, AR

June 3, 2008

Agenda

- HPMS reassessment
  - Why?
  - Process
  - Outcomes
  - Implementation
- HPMS 2010+ pavement data uses/needs
  - Models
  - Publications
- Reassessment impact on HPMS pavement data
  - Data items, requirements, and metadata

Why a Reassessment of the HPMS?

- Periodic HPMS reassessments
  - Contemporary issues
  - Anticipated future needs
  - SAFETEA-LU
  - Technology advances
  - Increased use of performance measures
  - Other expanded and enhanced HPMS data uses
    - » Government, academia, private sector

Reassessment Process

- Internal FHWA assessment
- Executive Resource Committee (ERC)
- Outreach effort
  - Meetings (national level users)
  - Webinars (general and topic-specific)
  - Regional workshops
  - Topic-specific issue papers
  - Draft Recommendations Report
  - Docket posting/feedback

Reassessment Outcomes

- New data model
- Data item specifications document
- Revised *HPMS Field Manual*
- Recommendations Report
- Areas for future study

Reassessment Implementation

- Continued software development
  - Enhancement tools
- New data model support/technical assistance
- HPMS training
  - Revised *HPMS Field Manual*
  - Software

Uses of HPMS Pavement Data

- National pavement needs 2010+
  - *Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance*
  - Need to update models using enhanced HPMS pavement data (HERS and NAPCOM)
  - Performance measure (enhance NHS IRI)
  - FHWA publications (*Highway Statistics, etc.)*
    - » IRI, PSR, and Pavement Type only
- Other studies (public and private)

Pavement Models

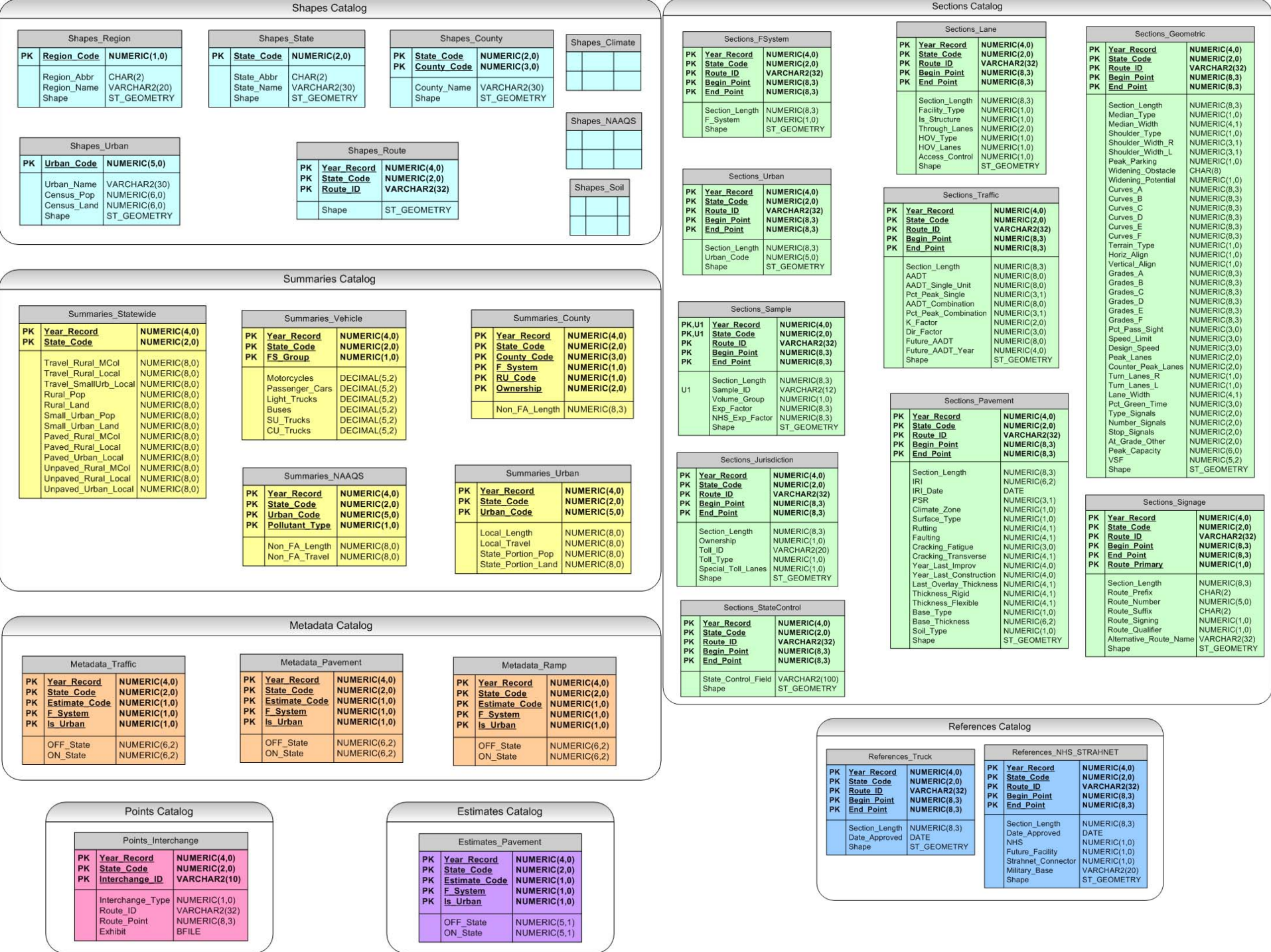
- Enhanced FHWA pavement models:
  - FHWA contractor study (Battelle, ARA)
  - Simplified version of the ME-PDG
    - » Numerous FHWA office and State participants:
      - Office of Legislative & Governmental Affairs
      - Office of Asset Management
      - Office of Infrastructure
      - Turner-Fairbank
      - Office of Transportation Policy Studies
      - Office of Highway Policy Information
      - AL, AZ, CO, KS, MA, MN, OH, WA

Pavement Models

- Enhanced FHWA pavement models:
  - Need to calculate remaining service life (RSL)
  - Need to improve HERS predictions
  - Need to improve cost estimates for the C&P Report
  - Want to capitalize and update models based on recent pavement community developments & capabilities (ME-PDG, etc.)
  - Basically need better than what FHWA has now
- Sensitivity analysis:
  - Used ME-PDG and LTPP data to identify model inputs having greatest impact on predictions
  - Identified critical State PMS data needed for National-level analysis
  - ME-PDG offers default values that can be used to minimize State data burden for HPMS reporting

Pavement Data Needs

- IRI:
  - Annual HPMS reporting on the NHS
    - » Enhanced and more timely performance indicator tracking
  - Structures included in HPMS reporting
  - IRI date added
- Other pavement data items needed for more accurate predictions
- Metadata needed to: describe, aid in interpreting, presenting, and addressing certain submitted pavement data items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HPMS Pavement Data Items

- IRI (annual for NHS, 2-year cycle otherwise)
- IRI Date (where IRI is required)
- Sampled HPMS data:
  - PSR (2-year cycle; no change)
  - Rutting (2-year cycle; consistent w/IRI reporting)
  - Faulting (2-year cycle; consistent w/IRI reporting)
  - Fatigue Cracking (2-year cycle)
  - Transverse Cracking (2-year cycle)
  - Surface Type
  - Year of Last Improvement
  - Year of Last Construction
  - Last Overlay Thickness*
  - Flexible Thickness*
  - Rigid Thickness*
  - Base Type*
  - Base Thickness*
  - Soil Type (FHWA-coded w/State override option)
  - Climate Zone (FHWA-coded w/State override option) (4 LTPP zones)

*** Default values allowed**

IRI

Extent: Required for all NHS and PAS universe sections and rural Minor Arterial sample sections. Collect and report annually for the NHS as opposed to the current 2-year reporting cycle. Note that reporting for required sections off of the NHS can remain on the 2-year maximum cycle.

Collection requirements:

Mean Roughness Index (MRI) – The average of the right and left quarter-car IRI for a given highway section. This is not to be confused with the half-car IRI, which is the summation of the average of the two wheel paths for a given section.

Direction and lane – States to consistently measure and report the MRI for the same direction and lane annually or semi-annually for NHS and non-NHS samples, respectively. Typically, this is the outermost (right) lane. The practice of measuring the "worst" lane is discouraged.

Structures and railroad grade crossings to be included.

Valid values: MRI reported as an integer to the nearest in/mi or 0.01 m/km. Code "0" for unreported data.

IRI_Date

Description: Month and year that the IRI data was collected.

Extent: Same as IRI.

Valid values: Month and year reported as MM/YYYY.

PSR

- No change

Description: Present Serviceability Rating (PSR) provides information on pavement condition on selected roadway sections.

Extent: Required for urban Minor Arterial, all Major Collector, and urban Minor Collector sample sections. If IRI is reported for a section, then PSR for that section is not required to be reported. **A sample section must have either PSR or IRI reported**.

Valid values: Code a PSR or equivalent value, to the nearest tenth (x.x), for all paved sample sections where IRI is not reported. Code "0.0" for unpaved facilities and for sections for which PSR data are not provided.

PSR (Cont'd.)

Present Serviceability Rating (Use full range of values)	
PSR	**Description**
4.0 – 5.0	Only new (or nearly new) superior pavements are likely to be smooth enough and distress free (sufficiently free of cracks and patches) to qualify for this category. Most pavements constructed or resurfaced during the data year would normally be rated in this category.
3.0 – 4.0	Pavements in this category, although not quite as smooth as those described above, give a first class ride and exhibit few, if any, visible signs of surface deterioration. Flexible pavements may be beginning to show evidence of rutting and fine random cracks. Rigid pavements may be beginning to show evidence of slight surface deterioration, such as minor cracks and spalling.
2.0 – 3.0	The riding qualities of pavements in this category are noticeably inferior to those of new pavements, and may be barely tolerable for high-speed traffic. Surface defects of flexible pavements may include rutting, map cracking, and extensive patching. Rigid pavements in this group may have a few joint failures, faulting and/or cracking, and some pumping.
1.0 – 2.0	Pavements in this category have deteriorated to such an Extent that they affect the speed of free-flow traffic. Flexible pavement may have large potholes and deep cracks. Distress includes raveling, cracking, rutting and occurs over 50 percent of the surface. Rigid pavement distress includes joint spalling, patching, cracking, scaling, and may include pumping and faulting.
0.0 – 1.0	Pavements in this category are in an extremely deteriorated condition. The facility is passable only at reduced speeds, and with considerable ride discomfort. Large potholes and deep cracks exist. Distress occurs over 75 percent or more of the surface.

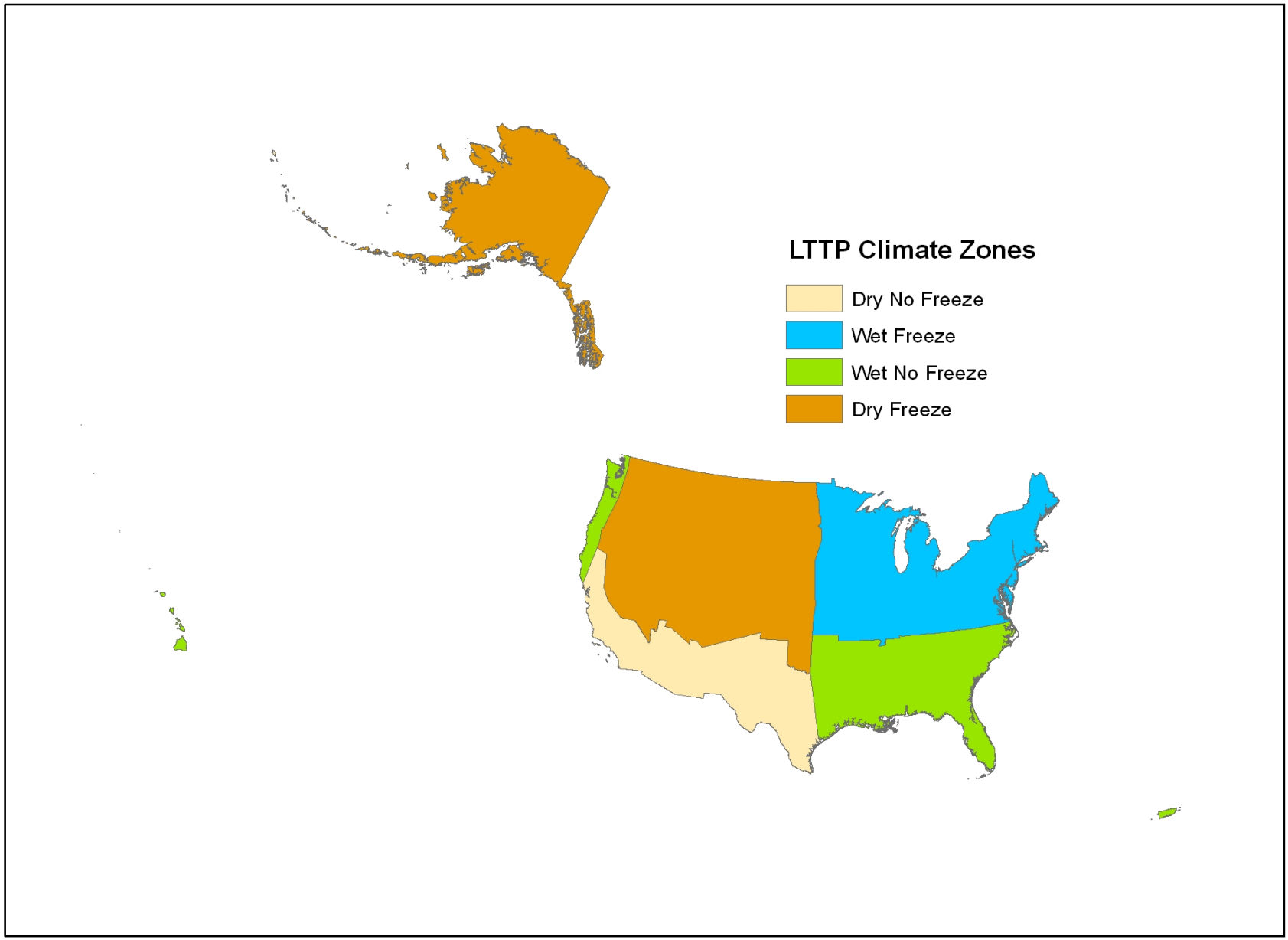
Climate_Zone

Description: FHWA-coded according to the 4 LTPP climate zone descriptions. This will be populated with identified zone via GIS map with a State override option.

Extent: All Sample sections.

Valid values:

Code	Description
1	Wet-Freeze
2	Wet-Non-Freeze
3	Dry-Freeze
4	Dry-Non-Freeze


LTTP Climate Zones
Dry No Freeze
Wet Freeze
Wet No Freeze
Dry Freeze

Soil_Type

Description: Coded in HPMS for all paved sample sections based on AASHTO soil type classes. Map-based. Default values will be determined by FHWA unless overridden by State.

Extent: All paved Sample sections.

Valid values: State may override the software coded values using the following codes:

Code	Description
0	Data not reported
1	Granular (35% or less passing the 0.075 mm sieve) (AASHTO Soil Class A0 through A-3)
2	Fine (Silt-Clay) Materials (>35% passing the 0.075 mm sieve) (AASHTO Soil Class A-4 through A-7)

Surface_Type

Extent: All sample sections: optional for other sections.

Valid values:

Code	Description
0	Not reported
1	Unpaved
2	Conventional Asphalt Concrete (Bituminous): Dense-graded asphalt concrete surface. One or more base/subbase layers may be present (including other AC (Bituminous) layers or a cement-stabilized base) but are not required.
3	Jointed Plain Concrete Pavement (JPCP): Jointed, un-reinforced Portland Cement Concrete (PCC) pavement, including a PCC overlay of this surface type placed on an existing AC (Bituminous) pavement (whitetopping). One or more base/subbase layers may be present but are not required.
4	Jointed Reinforced Concrete Pavement (JRCP): Jointed, reinforced PCC pavement including a PCC overlay of this surface type placed on an existing AC (Bituminous) pavement (whitetopping). One or more base/subbase layers may be present but are not required.
5	Continuously Reinforced Concrete Pavement (CRCP): Continuously reinforced PCC pavement, including a PCC overlay of this surface type placed over a previously existing AC (Bituminous) pavement (whitetopping). One or more base/subbase layers may be present but are not required.
6	AC (Bituminous) Overlay over Existing AC (Bituminous) Pavement: Dense-graded AC (Bituminous) surface layer with or without other HMAC layers placed over a previously existing AC (Bituminous) pavement but not existing composite pavements.

Surface_Type (cont'd.)

Code	Description
7*	AC (Bituminous) Overlay over Existing Jointed Concrete Pavement: Dense-graded AC (Bituminous) surface layer with or without other AC (Bituminous) layers placed on an intact JPCP or JRCP, including those previously overlaid with AC (Bituminous) (composite pavement).
8*	AC (Bituminous) Overlay over Existing CRCP: Dense-graded AC (Bituminous) surface layer with or without other AC (Bituminous) layers placed on an intact CRCP, including those previously overlaid with AC (Bituminous) (composite pavement).
9*	Unbonded Jointed Concrete Overlay on PCC Pavements: JPCP or JRCP overlay placed over an intact JPCP, JRCP, or CRCP with a separator layer to prevent bonding of the two PCC layers. The overlaid concrete pavement may rest on one or more base/subbase layers or directly on the subgrade.
10*	Unbonded CRCP Overlay on PCC Pavements: CRCP overlay placed over an intact JPCP, JRCP or CRCP with a separator layer to prevent bonding of the two PCC layers. The overlaid concrete pavement may rest on one or more base/subbase layers or directly on the subgrade.
11	Bonded PCC Overlays on PCC Pavements: PCC overlay bonded to an existing JPCP, JRCP or CRCP. The overlaid concrete pavement may rest on one or more base/subbase layers or directly on the subgrade.
12	Other: Surface types not covered by types 1-11 (e.g., surface treatment or chip seal).

* If the existing PCC pavement is fractured (rubblized or crack-and-seated) prior to overlaying, treat the broken PCC as a base and select the surface type that best describes the new surface. For example, AC (Bituminous) surface placed over rubblized PCC is Type 2 with fractured PCC as the base type.

Rutting

Description: Rutting is defined as an average for the entire HPMS sample section.

Extent: Required for all paved AC and composite pavement sample sections.

Collection requirements: HPMS suggests AASHTO PP38-00 or the LTPP protocol be used as a best practice.

Valid values: Reporting should be consistent with IRI inventory direction and lane. Coded in HPMS to the nearest 0.1 inch or nearest millimeter.

Faulting

Description: The average vertical displacement between adjacent jointed concrete panels.

Extent: Required for all paved jointed concrete sample sections.

Collection requirements: HPMS suggests that AASHTO R36-04 or the LTPP protocol be used as a best practice.

Valid values: Report average/mean faulting over the HPMS sample section to the nearest 0.1 inch or nearest whole millimeter. Reporting should be consistent with IRI inventory direction and lane.

Cracking_Fatigue

Description: Estimate of total area with fatigue type cracking for AC pavements and total percent of slabs with cracking for PCC pavements. HPMS suggests AASHTO PP44-01 or the LTPP distress identification manual as a best practice for use in identifying and reporting cracks at any and all severity levels (sealed and unsealed).

Extent: Required for all AC and PCC paved sample sections.

Valid values: For HPMS reporting, the percent of the total AC section area and percent of PCC slabs cracked to the nearest 5% is to be coded. Reporting should be consistent with IRI inventory direction and lane.

Cracking_Transverse

Description: Estimate of total ft/mi or m/km of transverse cracking. HPMS suggests AASHTO PP44-01 or the LTPP distress identification manual as a best practice for use in identifying and reporting cracks at any and all severity levels (sealed and unsealed).

Extent: Required for all AC (transverse cracking) and composite (reflection cracking) paved sample sections.

Valid values: For HPMS reporting, the total ft/mi (m/km) section of AC and composite pavement cracking to the nearest foot/meter is to be coded. Reporting should be consistent with IRI inventory direction and lane.

Year_Last_Improv

Description: This item is used to identify the year in which the sample section roadway surface was improved. Update as needed for all paved sample sections receiving a resurfacing treatment of at least 0.5 inches or nearest 10 millimeters of compacted pavement material.

Extent: All paved Sample sections.

Valid values: Code the year in YYYY format.

Year_Last_Construction

Description: Update as needed for all paved sample sections.

Extent: All paved Sample sections.

Valid values: Code the year the section was constructed (or reconstructed) in YYYY format.

Thickness_Rigid

Description: Coded in HPMS to the nearest 0.5 inch or nearest 10 millimeters for all concrete and composite sample sections.

Extent: All paved Sample sections.

Valid values: State to supply the actual measured value for each sample section. Default values to be provided in the Estimates_Pavement table.

Thickness_Flexible

Description: Coded in HPMS to the nearest 0.5 inch or nearest 10 millimeters for all AC and composite sample sections.

Extent: All paved Sample sections.

Valid values: State to supply the actual measured value for each sample section. Default values to be provided in the Estimates_Pavement table.

Last_Overlay_Thickness

Description: Required for all paved sample sections. Coded in HPMS to the nearest 0.5 inch or nearest 10 millimeters for all paved sample sections.

Extent: All paved Sample sections.

Valid values: State to supply the actual measured value for each sample section. Default values to be provided in the Estimates_Pavement table.

Base_Thickness

Description: Coded in HPMS for all paved sample sections to the nearest whole inch or 25 millimeters. State design default value or override with more specific value.

Extent: All paved Sample sections.

Valid values: State to supply the actual measured value for each sample section. Default values to be provided in the Estimates_Pavement table.

Base_Type

Description: Coded in HPMS for all paved sample sections based on the following.

Extent: All paved Sample sections.

Valid values:

Code	Description
0	Data not reported
1	No base
2	Aggregate
3	Asphalt or cement stabilized
4	Asphalt or cement stabilized with granular subbase
5	Hot mix AC (Bituminous)
6	Lean concrete
7	Stabilized open-graded permeable
8	Fractured PCC

State to supply the appropriate code for each sample section. Default values to be provided in the Estimates_Pavement table.

HPMS Pavement Data Default Schema

- For estimates and selected sample data items
- Used where measured values are unavailable
- State/off-State system bifurcation
- Rural/urban bifurcation
- Functional system breakout
- Mix of section level (sample) and summary data items

HPMS Pavement Estimates Data

Code	Description
1	LAST_OVERLAY_THICKNESS*
2	THICKNESS_RIGID*
3	THICKNESS_FLEXIBLE*
4	BASE_TYPE*
5	BASE_THICKNESS*
6	BINDER_TYPE**
7	DOWEL_BAR**
8	JOINT_SPACING**

*Section-level data

**Non-section level data

Binder_Type

Viscosity Graded Binders	
Code	**Description**
1	Less than AC-2.5
2	AC-2.5 to AC-4
3	AC-5 to AC-9
4	AC-10 to AC-19
5	AC-20 to AC-29
6	AC-30 to AC-39
7	AC-40 to AC-49
8	AC-50 or more

Binder_Type (Cont'd.)

Codes for Super Pave Binders									
		Low Temperature Grade							
		Less than -4	-4 to -9	-10 to -15	-16 to -21	-22 to -27	-28 to -33	-34 to -39	-40 to -45	-46 or more
High Temp Grade	Less than 40	10	20	30	40	50	60	70	80	90
	40 to 45	11	21	31	41	51	61	71	81	91
	46 to 51	12	22	32	42	52	62	72	82	92
	52 to 57	13	23	33	43	53	63	73	83	93
	58 to 63	14	24	34	44	54	64	74	84	94
	63 to 69	15	25	35	45	55	65	75	85	95
	70 to 75	16	26	36	46	56	66	76	86	96
	76 to 81	17	27	37	47	57	67	77	87	97
	82 to 87	18	28	38	48	58	68	78	88	98
	88 or more	19	29	39	49	59	69	79	89	99

Dowel_Bars

Code	Description
0	No – dowel bars not typically used
1	Yes – dowel bars are typically used

Joint_Spacing

Code the typical joint spacing to the nearest whole foot or 0.25 meter.

HPMS Pavement Metadata

- Used to describe submitted data
- State/off-State system bifurcation
- Rural/urban bifurcation
- Functional system breakout

Code	Description	Code	Description
1	IRI_EQUIP_TYPE	8	FAULTING_METHOD
2	IRI_INTERVAL	9	FAULTING_EQUIP_TYPE
3	RUTTING_METHOD	10	CRACKING_FAT_EQUIP
4	RUTTING_EQUIP_TYPE	11	CRACKING_FAT_CRACK_TYPE
5	RUTTING_NUM_SENSORS	12	CRACKING_TRAN_EQUIP
6	RUTTING_INTERVAL	13	CRACKING_TRAN_CRACK_TYPE
7	FAULTING_INTERVAL	14	CRACKING_METHOD

HPMS Pavement Metadata

IRI_EQUIP_TYPE:

Code	Description
0	Sonar
1	Combination sonar and laser
2	Laser
3	Scanning laser
4	Other

IRI_INTERVAL

Code IRI reporting interval to the nearest foot or meter.

HPMS Pavement Metadata

RUTTING_METHOD

Code	Description
0	Manual
1	Automatic

RUTTING_EQUIP_TYPE

Code	Description
0	Sonar
1	Combination sonar and laser
2	Laser
3	Scanning laser
4	Other

HPMS Pavement Metadata

RUTTING_NUM_SENSORS

Code	Description
0	Three (3) sensors
1	Five (5) sensors
2	Greater than five (>5) sensors
3	Scanning laser
4	Other

RUTTING_INTERVAL

Code rutting reporting interval to the nearest foot or meter.

HPMS Pavement Metadata

FAULTING_METHOD

Code	Description
0	Manual
1	Automatic

FAULTING_EQUIP_TYPE

Code	Description
0	Manual
1	Laser
2	Scanning laser
3	Other

HPMS Pavement Metadata

FAULTING_INTERVAL

Code faulting reporting interval to the nearest foot or meter.

CRACKING_FAT_EQUIP

Code	Description
1	Windshield survey
2	Visual distress survey (side of road)
3	Video with manual survey in office
4	Video with automated survey
5	Automated crack identification
6	Other

HPMS Pavement Metadata

CRACKING_FAT_CRACK_TYPE

Code	Description
1	Wheel path
2	Patching
3	Failures
4	All of the above
5	Other

CRACKING_TRAN_EQUIP

Code	Description
1	Windshield survey
2	Visual distress survey (side of road)
3	Video with manual survey in office
4	Video with automated survey
5	Automated crack identification
6	Other

HPMS Pavement Metadata

CRACKING_TRAN_CRACK_TYPE

Code	Description
1	Transverse
2	Reflective

CRACKING_METHOD

Code	Description
1	Long-Term Pavement Performance (LTPP)
2	American Association of State Highway and Transportation Officials (AASHTO)
3	Modified LTPP
4	Modified AASHTO
5	State developed protocol
6	Other

Conclusion

Contact: Robert Rozycki
FHWA (HPPI-20)
Phone (202) 366-5059
email: robert.rozycki@dot.gov