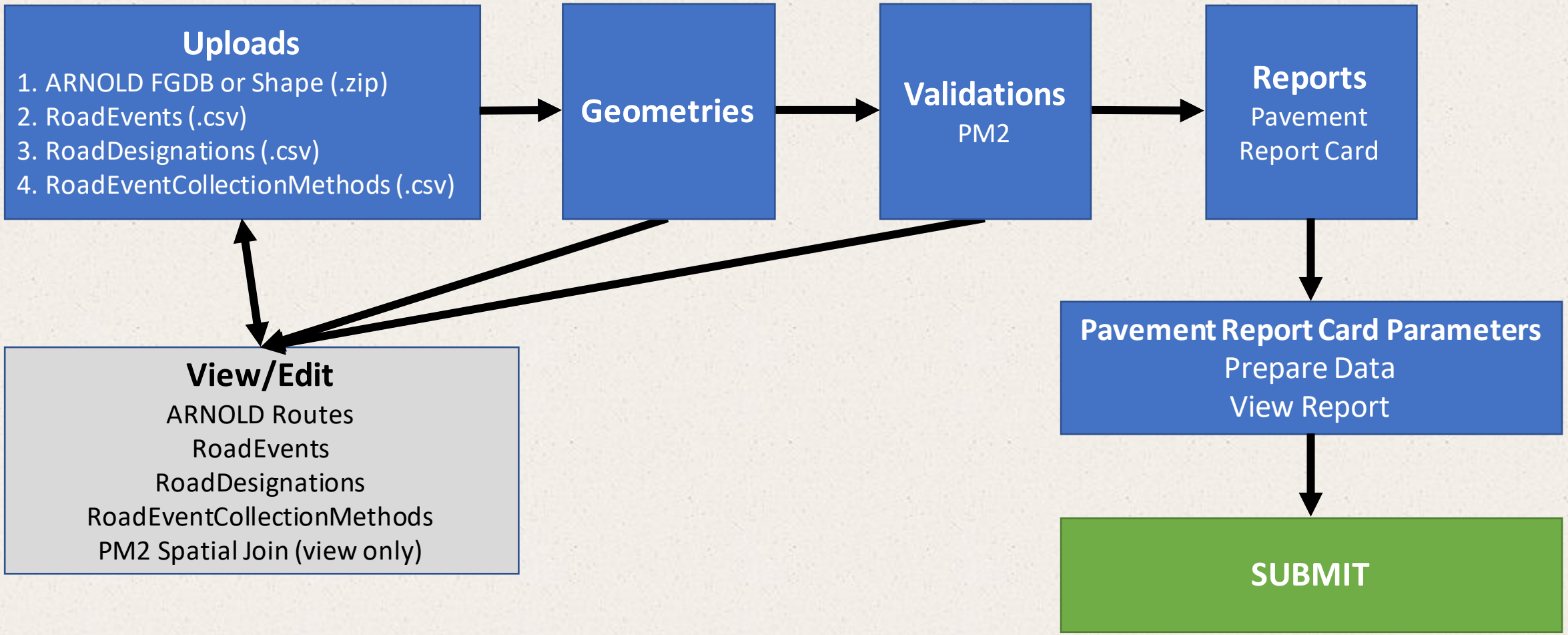
TALKING HPMS
08 MARCH 2022

What Do You Need For April 15th?

(in addition to a complete tax return)

General Workflow



ARNOLD Routes

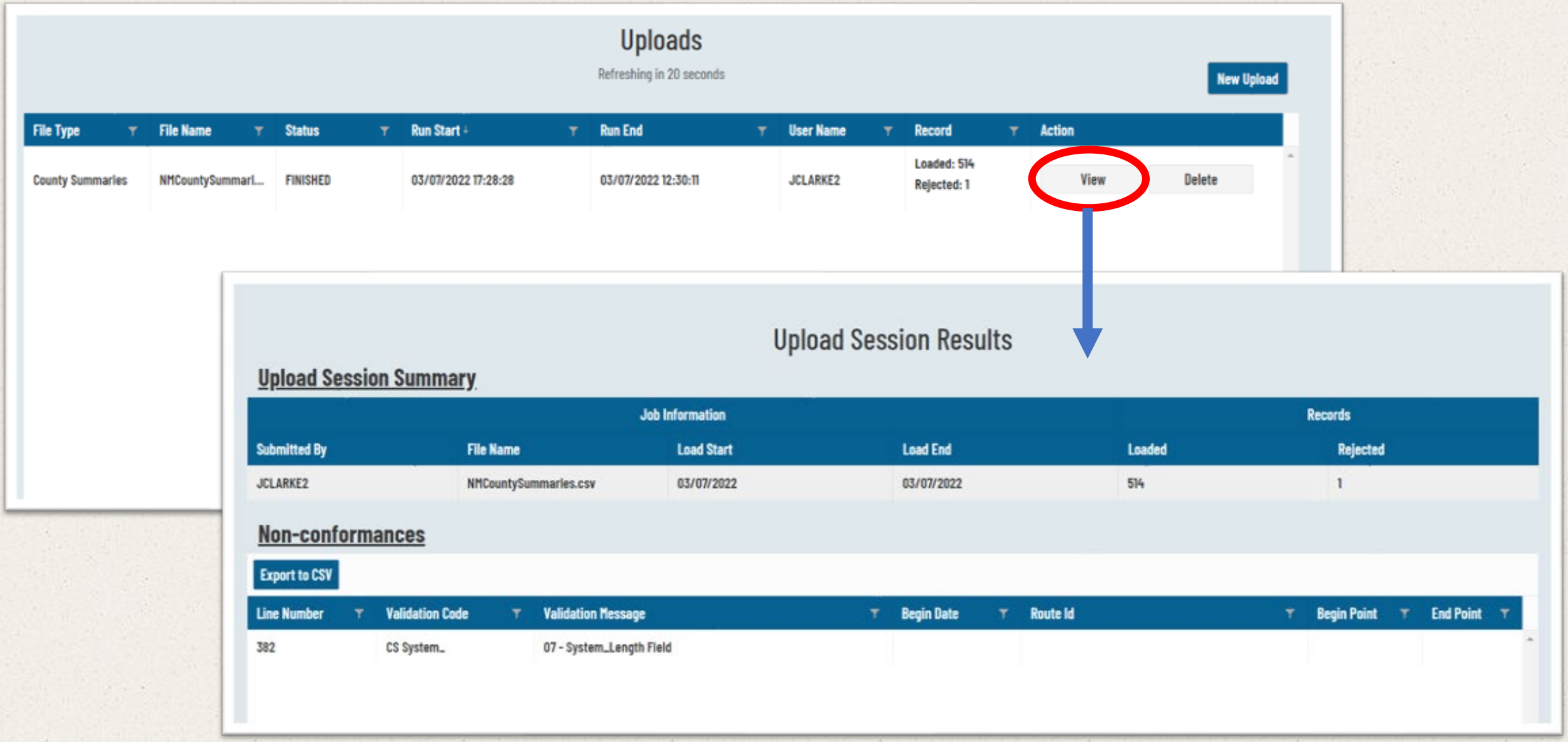
Minimum: Shape or FGDB file with the entirety of the Interstate, includes dual carriageway if using DIR_THROUGH_LANES

Reminder: Zip your Shape/FGDB file before attempting to upload it into HPMS 9.0

Tips: -FGDB loads more efficiently and is smaller in size.

-BeginDate in the FGDB and Shapefile must be Type: Date

Viewing Domain Check Results



ARNOLD Routes Domain Checks - Errors

Data Check	Message	Why is this an issue
ARNOLD has M Values	M (measure) values must exist and must not be NULL on all ARNOLD routes	Missing measures will prevent Events from linking to ARNOLD
BeginDate is not NULL	The BeginDate field must not be null	The BeginDate is used to version the data in an incremental process
Duplicate Features	ARNOLD routes must not contain two features (records) with the same geometry. One of the duplicates was deleted.	This violates a Primary Key
Overlaps	ARNOLD segments must not overlap another segment	Overlaps can cause problems during dynamic segmentation
RouteId is valid	The RouteId must not be blank, null, 0, or more than 120 characters	HPMS and Database requirement
StateId is valid	StateId must match the state code of the user, be a valid FIPS state code, and in the format Numeric (2)	HPMS Requirement

ARNOLD Routes Domain Checks - Warnings

Data Check	Message	Why is this an issue
Duplicate Vertices	ARNOLD segments must not have consecutive coincident vertices	Ugly Geometry
Kickbacks	ARNOLD segments must not have kickbacks	Ugly Geometry
Multipart Geometries	ARNOLD segments must not have multipart geometries	This is an issue if the entire Feature results in measures out of sequence. One part may reverse direction. Otherwise, this is not an issue.
Self-Intersection	ARNOLD segments must not have self-intersections	Self intersection creates ambiguity on the measures
Spikes	ARNOLD segments must not have spikes	Ugly Geometry
Increasing measures	Measure or M values on Routes must be increasing	Measures that don't increase (e.g. duplicates) interfere with the DynSeg. Some measures to appear to be on top of each other and fail this rule since they appear to be the same and not technically "Increase"
Features are Simple	Routes must not cross themselves and must have at least two vertices	
Features are Valid		

ARNOLD Geometry Check

Export to CSV | Export to Shape File | Export to FGDB | Zoom to Features on Selection | Map Selected | Clear Selections

Feature GUID	Markup Type	Route ID	Rule Name	Comment	Begin Point	End Point
082c4988-f3eb-44b6-a2d6-d659d7bf2b37	Line	100236012	Check that ARNOLD measures are increasing			
1cf9c2a2-663d-42e6-820d-bd065bf6e7c6	Line	294717011	Check for Multipart Geometries			
2d85355c-d3ea-4ab9-86de-67f763476bb5	Line	294717011	Check for Multipart Geometries			

Tom and Justin will be at GIS-T and have a discussion about these rules. Please join us if you can make it to South Carolina.

We can have other sessions for those that can't travel.

Road Designations Table

Minimum: Pipe-delimited CSV file for all Interstate routes

Date Items:

- Functional System
- National Highway System

Reminders:

- BeginDate, not Year_Record
- StateID, not State_Code
- No Section_Length
- No Value_Date
- There's a Field Mapper!

File Structure:

Field Name	Data Type (characters)	Description	Valid Values
BeginDate*	Date	Date at which the data becomes active	MM/DD/YYYY
StateID*	Numeric (2)	State FIPS code	Up to two digits for the FIPS code**
RouteID*	VarChar (120)	Location reference ID for the linear feature	Up to 120 alpha-numeric digits that identify the route; this ID must be consistent with the Route ID in the State's LRS
BeginPoint*	Decimal (8,3)	Beginning milepoint	Identifies the point of origin for a given section, using a decimal value in thousandths of a mile
EndPoint*	Decimal (8,3)	Ending milepoint	Identifies the terminus point for a given section, using a decimal value in thousandths of a mile
DataItem*	Text	HPMS Data Items	States must use the database-specific data item names
ValueNumeric	Numeric	Numeric value for data item	Must be a numeric value
ValueText	VarChar (50)	Text value for data item	Must be a text value
Comments (Optional)	VarChar (100)	Comment for State use	Variable text up to 100 characters; this field is optional

Road Designations Domain Checks - **Field**

Field	Message
BeginDate	BeginDate must be a valid date with format MM/DD/YYYY, MM/D/YYYY, M/DD/YYYY, or M/D/YYYY and must be prior to current date
StateID	StateID must match the state code of the user, be a valid FIPS state code, and in the format Numeric (2)
RouteID	RouteID field must not be blank and can not contain "|"
BeginPoint	BeginPoint must be in the format Numeric (8,3) AND must be < EndPoint
EndPoint	EndPoint must be in the format Numeric (8,3) AND must be > BeginPoint
DataItem	Data item name must be a valid RoadDesignations Data Item (F_SYSTEM, NHS, STRAHNET_TYPE, NN, NHFN)
All (Duplicates)	Where RouteID, StateID, BeginPoint, EndPoint, DataItem, ValueNumeric, ValueText, and BeginDate are all the same as another record, only the last record will be loaded to HPMS
All (Overlaps)	The BeginPoint and EndPoint of one RoadDesignations record must not overlap with another RoadDesignations record

Road Designations Domain Checks – **Data Item**

Data Item Number	Data Item	Message
1	F_SYSTEM	F_SYSTEM ValueNumeric must be a valid integer in the range (1-7)
64	NHS	NHS ValueNumeric must be an integer in the range (1-9)
65	STRAHNET_TYPE	STRAHNET_TYPE ValueNumeric must be an integer in the range (1,2)
66	NN	NN ValueNumeric must be an integer in the range (1,2)
72	NHFN	NHFN ValueNumeric must be an integer in the range (1,2,3)

Road Events Table

Minimum: Pipe-delimited CSV file for all Interstate routes

Data Items:

- Urban ID (not Urban Code)
- Facility Type
- Structure Type
- Through Lanes
- IRI
- PSR
- Surface Type
- Rutting
- Faulting
- Cracking Percent
- Directional Through Lanes (if reporting bi-directional)
- Would appreciate it if you would include RouteID (optional, not a requirement)

Reminders:

- BeginDate, not Year_Record
- StateID, not State_Code
- No Section_Length
- There's a Field Mapper!

File Structure:

Field Name	Data Type (characters)	Description	Valid Values
BeginDate*	Date	Date at which the data becomes active.	MM/DD/YYYY
StateID*	Numeric (2)	State FIPS code	Up to two digits for the FIPS code**
RouteID*	VarChar (120)	Location reference ID for the linear feature	Up to 120 alpha-numeric digits that identify the route; this ID must be consistent with the Route ID in the State's LRS
BeginPoint*	Decimal (8,3)	Beginning milepoint	Identifies the point of origin for a given section, using a decimal value in thousandths of a mile
EndPoint*	Decimal (8,3)	Ending milepoint	Identifies the terminus point for a given section, using a decimal value in thousandths of a mile
DataItem*	Text	HPMS Data Items	States must use the database-specific data item names
ValueNumeric	Numeric	Numeric value for data item	Must be a numeric value
ValueText	VarChar (50)	Text value for data item	Must be a text value
ValueDate	Date	Date value for data item	Valid values are specified by data item
Comments (Optional)	VarChar (100)	Comment for State use	Variable text up to 100 characters; this field is optional

Road Events Domain Checks (examples)

Data Item	Message
URBAN_ID	URBAN_ID ValueNumeric must be an integer and a valid US Census Urban Code for the applicable state
IRI	IRI: Where ValueNumeric is not Null, it must be an integer >0 ValueNumeric may be NULL Where ValueText = E ValueDate must = BeginDate with a format of MM/DD/YYYY, MM/YYYY, M/YYYY, or M/D/YYYY Where ValueDate <> BeginDate, ValueText must be in (A,B,C,D,E)
PSR	PSR ValueNumeric must be > 0.0 and <= 5.0 and in format Numeric (2,1) ValueText must be NULL or = A ValueDate must = BeginDate with a format of MM/DD/YYYY, MM/YYYY, M/YYYY, or M/D/YYYY
SURFACE_TYPE	SURFACE_TYPE ValueNumeric must be an integer in the range (1-11) ValueDate must = BeginDate with a format of MM/DD/YYYY, MM/YYYY, M/YYYY, or M/D/YYYY

Road Event Collection Methods

Minimum: Pavement Reporting Method

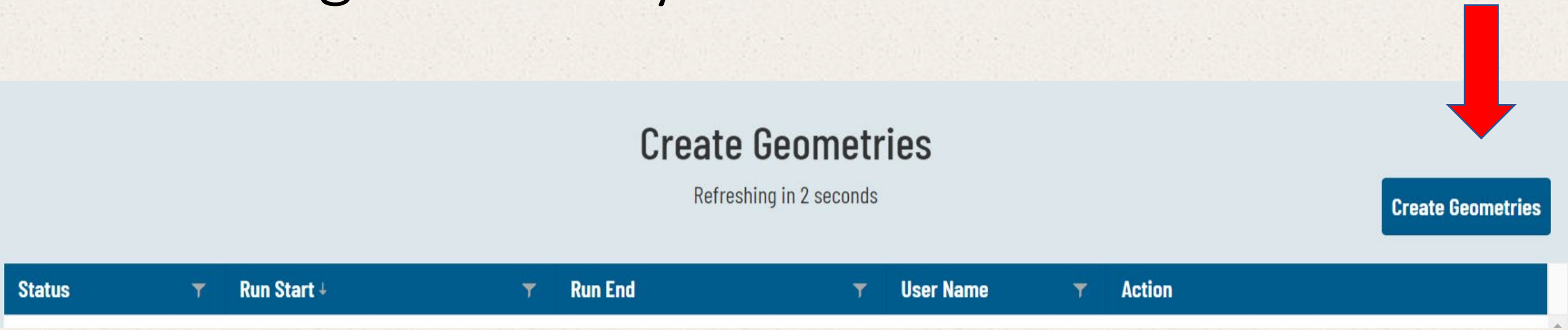
File Structure:

Field Name	Data Type (characters)	Description	Valid Values
BeginDate*	Date	Date at which the data becomes active	MM/DD/YYYY
StateID*	Numeric (2)	State FIPS code	Up to two digits for the FIPS code**
MetadataType*	Text	Road Event Collection Method Type	Must be text as described in Table 17, multiple metadata types are permitted per data item, code the predominate value when multiple values apply
FSystem*	Numeric (1)	Functional System	See Data Item 1 in Chapter 3
IsUrban*	Text	Rural or Urban	Code N for Rural, or Y for Urban (population of at least 5,000), as determined by the Census
IsStateOwned*	Text	On State / Off State System	Code N for Off-State System, or Y for On-State System, as determined by the State
ValueNumeric	Numeric (5)	Numeric Value	Must be numeric as described in Figure 17
Comments	VarChar (100)	Comment for State use	Variable text up to 100 characters; this field is optional

Road Event Collection Methods Domain Checks

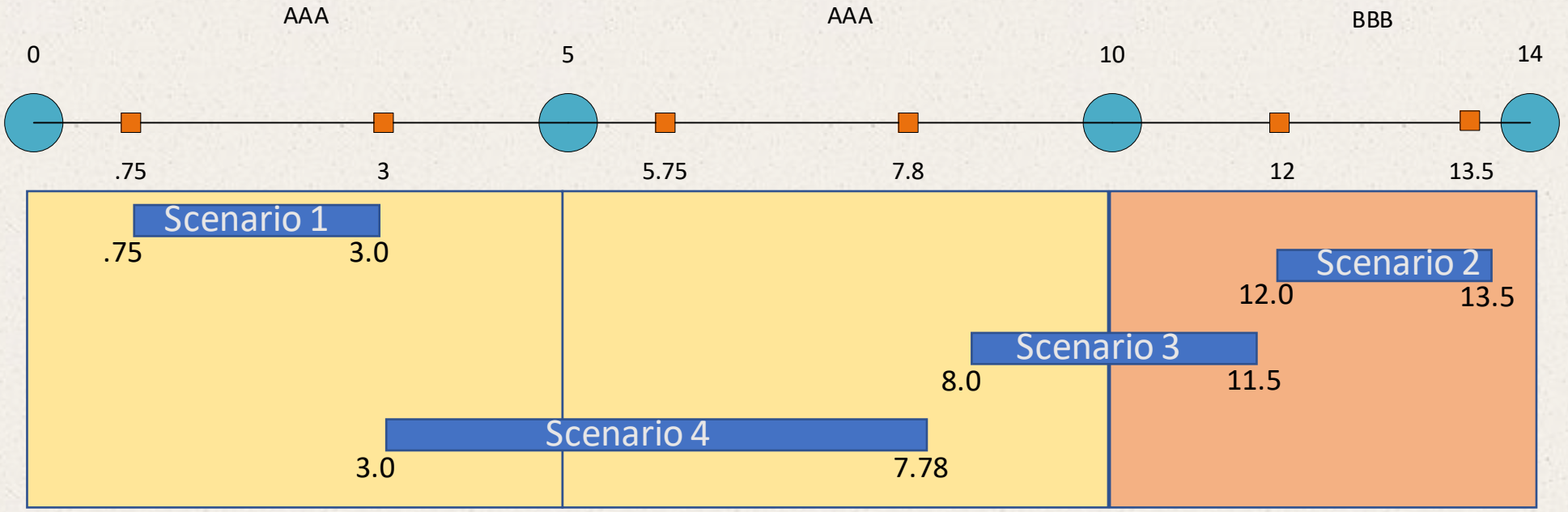
Field	Message
BeginDate	BeginDate must be a valid date with format MM/DD/YYYY, MM/D/YYYY, M/DD/YYYY, or M/D/YYYY and must be prior to current date
StateID	StateId must match the state code of the user, be a valid FIPS state code, and in the format Numeric (2)
MetadataType	MetadataType must be a valid Type per the HPMS Field Manual
FSystem	FSystem must be an integer in the range (1-7)
IsUrban	IsUrban Must be Y for Urban or N for Rural
IsStateOwned	IsStateOwned must be N for Off-State System, or Y for On-State System
ValueNumeric	Must be numeric based Field Manual definitions for each MetadataType
Comments	Comments must not be more than 100 characters and can not contain pipe "|" characters
All (Duplicates)	Where BeginDate, StateId, MetadataType, Fsystem, IsUrban, IsStateOwned and ValueNumeric are all the same as another record, then only the last record will be loaded into HPMS.

Checking Geometry



- This is a dynamic segmentation process that relates the Designations and Events data to the ARNOLD.
- If your data doesn’t link to the ARNOLD, it will be filtered out.

Test Cases—Geometry Creation

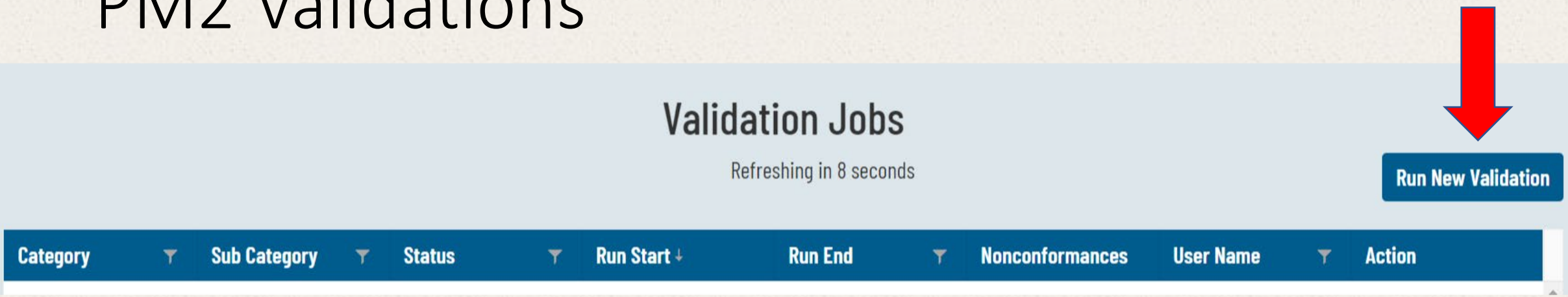


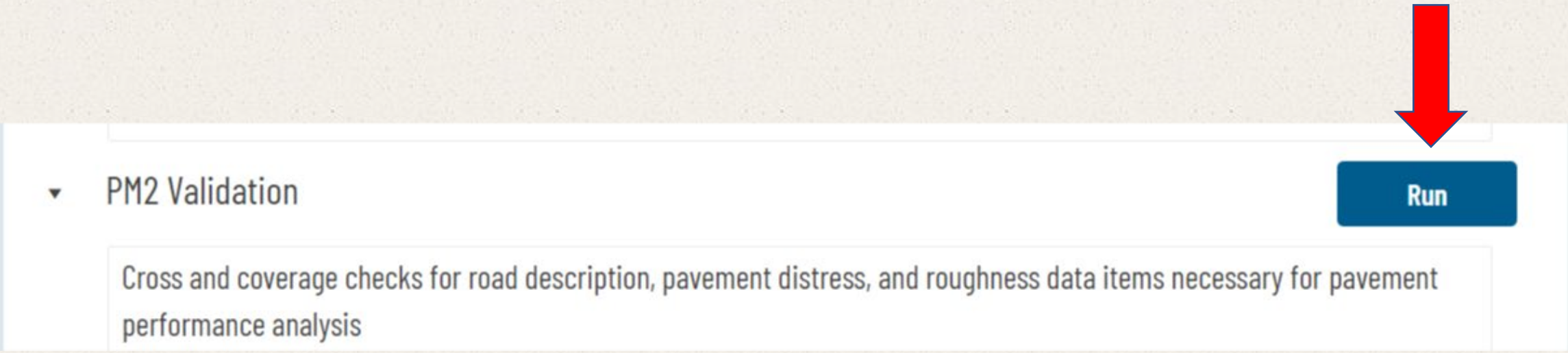
						Result		
Scenario	**Test Case**	**Action**	**RouteID**	**BP**	**EP**	**RouteID**	**BP**	**EP**
1	RoadEvents Record finds RouteID and is contained within the Measures of a single ARNOLD record	RoadEvents record creates geometry.	AAA	.75	3.0	AAA	.75	3.0
2	RoadEvents fails to find the RouteID in ARNOLD	RoadEvents record fails to create geometry	Orphan1	12.0	13.5	---	---	---
3	RoadEvents Measures partially within range of Record in ARNOLD	RoadEvents record creates geometry but only for the ARNOLD section within range, remainder gets truncated.	AAA	8.0	11.5	AAA	8.0	10.0
4	RoadEvents Measures are split between two ARNOLD Records	RoadEvents record is split between each ARNOLD section for which it is in range.	AAA	3.0	7.78	AAA	3.0	7.8

PM2 Validations

- Establishes the topology between data items
- Segment length
  - Section Length Must Not Be > 0.11 Miles
- Spatial Coincidence
  - Records of Faulting, Rutting and Cracking Percent must align with the Begin and End points for IRI records.
- Cross Check and Coverage validations for Pavement Items are in “Full” Validation, not “PM2 Validation”
  - Description of the PM2 validation in the software validation screen is more comprehensive than it should be, we’ll revise this

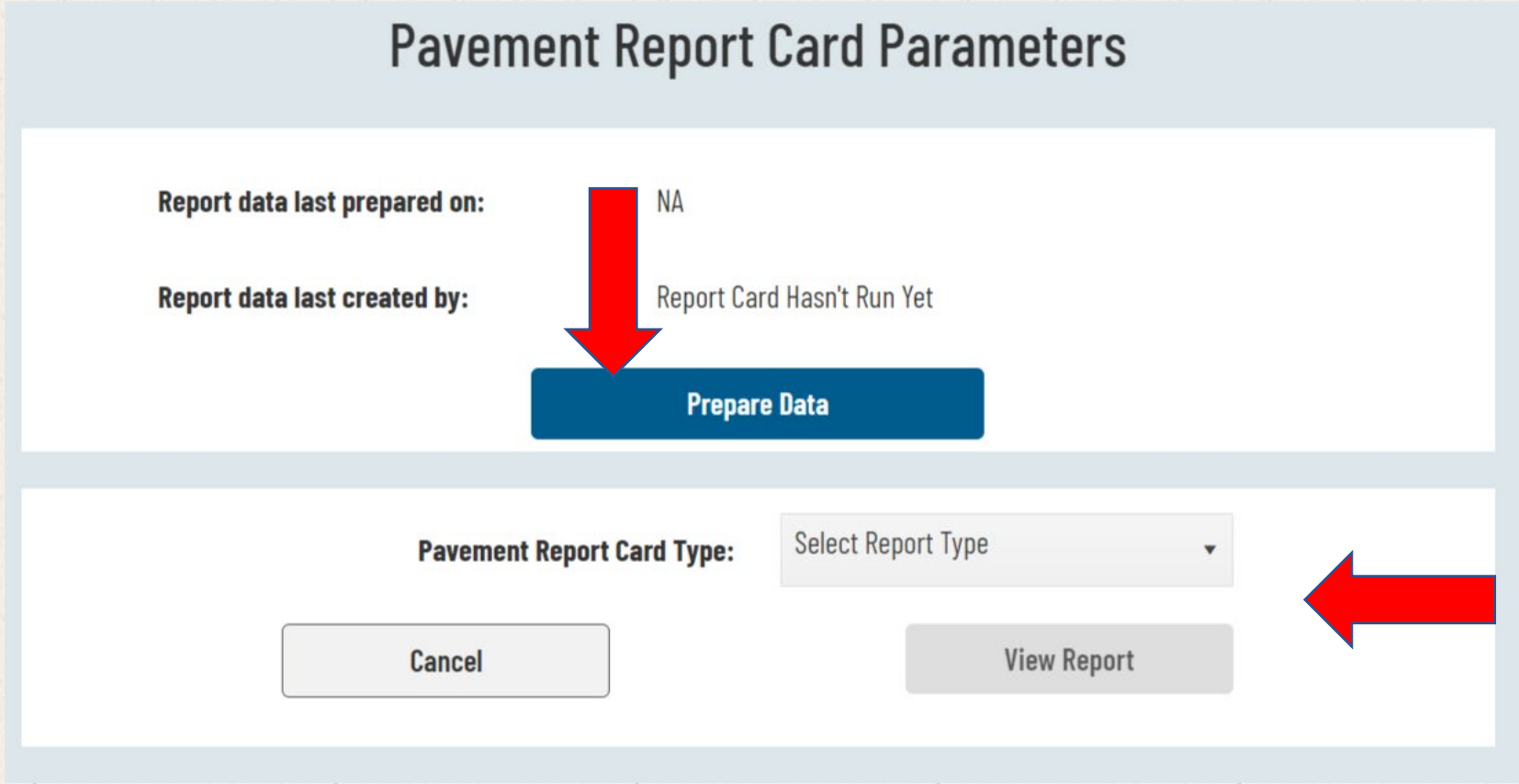
PM2 Validations





PRC Data Prep and Report Generation

- Must Prepare the Data First.
- We know it's not working yet!



Hit Submit!

Submit Data Sets

Data Set	Date of Last Submittal	Status	Status Date	Action
Interstate Pavement Data		Not Submitted		Submit
Non-Interstate Pavement Data, Samples, and Summaries		Not Submitted		Submit
Travel Time Metrics		Not Submitted		Submit