AEGIST: Applications of Enterprise GIS in Transportation

RDIP Workshop – West Virginia

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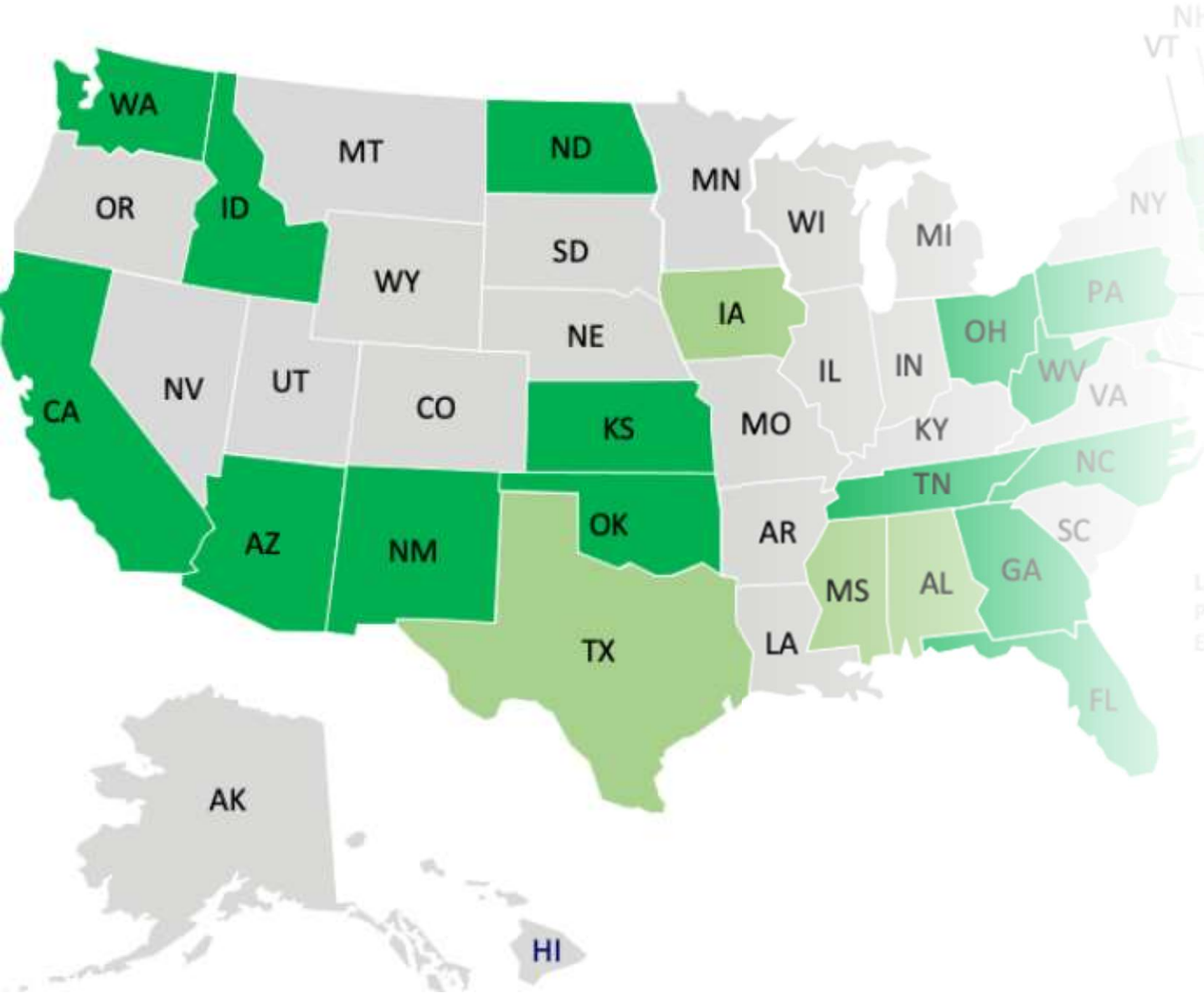
Disclaimer: Information in this deck is subject to change during the AEGIST Project (2019 – 2024)



Who is a part of AEGIST?

- FHWA Offices of Planning & Safety
- 18 States; 5 more engaged
- Local Agencies
- Federal Lands Management Agency
- National and International Standard Development Organizations
- Software vendors, Data vendors and agency consultants

All of the above engaged to deploy best practices and standards using AEGIST pilots at each agency

Why AEGIST?

Enabling Data Offices/Councils & Geospatial Information System Units at State DOTs to meet Agency Performance Goals and Objectives of Business Units at their Agencies

Project Planning & Programming

- Project Selection & Evaluation
- Highway Economic Requirements Analysis
- Statewide Transportation Improvement Program

Asset Management

(Operations and Maintenance)

- Pavement Life Cycle Plan
- Bridge Life Cycle Plan
- Maintenance Work Management
- Emergency Response
- Asset Inventory & Routine Inspection Operations

Data Office, Data Governance Council, Data Analytics Unit
Information Technology (IT) Unit,
Geospatial Information Systems (GIS) Unit

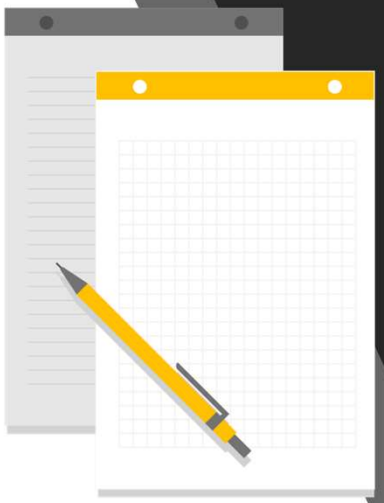
Design & Construction: Digital Delivery

- Survey (Ground Survey, Mobile Lidar, Aerial Imagery & Lidar)
- Environmental Planning, Design and Fabrication
- Construction Management

Traffic and Safety

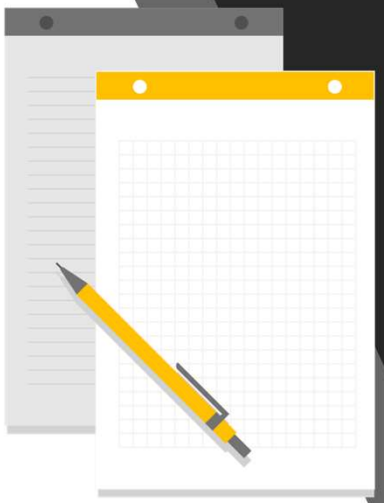
- Travel Demand Modeling
- Highway Safety Analysis
- Freight / Truck Routing
- Congestion Management
- Traffic Systems Operations and Management

AEGIST Beneficiaries



- Planners (AEGIST modeled data + traditional census data)
  - Land use and transport modeling, impact assessments (resilience, environmental justice), complete streets design, investment analysis
  - Travel demand modeling and vehicle routing
- Roadway Inventory & Geospatial Information Systems Unit
  - Federal reporting: HPMS, ARNOLD, MIRE
  - Data quality automation, GIS products teams
- Safety engineers
  - Roadway Improvement Data Program Deployment
  - Roadway safety analysis, Intersection safety analysis,
  - Pedestrian, Bike network for safety analysis
- Asset Managers
  - Asset Information Management, Data governance (roads/bridges/safety), digital twins, better lifecycle data integration
- Digital Delivery: Design, Construction Management
  - Hand-off As-Built Asset and Roadway Characteristics data to Asset Managers, thereby improving quality of data reported to FHWA

AEGIST Beneficiaries



- Federal agencies
  - Better data reporting from States for HPMS 9, MIRE, ARNOLD, Federal-Aid projects data submission
  - Decentralized national road network data creation
  - Development of National standards for road data modeling
- Local agencies
  - Roadway Mileage Reporting
  - Pavement condition information tracking
  - Safety analysis using comprehensive roadway inventory data
  - Transportation improvement programs data standards
- Emergency management agencies
  - NG911 and ARNOLD Road Centerline data integration methodology, approach and proof-of-concept pilots
- Federal Lands Management Agency: Roads data integration
- Private Sector: Governance of Emerging Data Technologies
  - Integrate Connected Vehicle Environment (CVE), Unmanned Aerial Systems and Mobile Survey data in enterprise asset systems

State DOT Technical Activities - Highlights

1. Pennsylvania Speed Limit Data Extraction Automation from PDFs; Integrating NG911 & DOT Roads
2. California Roads Sharing (CaRS) Data and Application Architecture - Integrating NG911 & DOT Roads
3. Idaho Data Governance Portal, Federal Lands Roads Data Conflation with DOT and Local Roads
4. Connecticut: FME for Roads Data Quality Reporting
5. Ohio: Strategic Plan for Road Network Data Management
6. Kansas, North Carolina, New Mexico & Florida: Road Segments and Intersections Model for Model Inventory of Roadway Elements (MIRE), Safety Analysis, Freight Analysis, Travel Demand Modeling
7. Tennessee: Design to GIS/Asset Management Data Migration
8. Washington: Building the Linear Referencing System with State and Local Roads in Roads & Highways

State DOT Technical Services Activities Summary

Base Period States (Oct 2019 – May 2023)		Coordination Efforts
Connecticut DOT	(1) Road Network Data Quality Report Generation using FME (including HPMS Data) (2) CTDOT LRS-GIS Data Migration to AEGIST Data Model (formerly NRBM) for Publication & APIs	
Idaho Transportation Department	(1) Spatial **Data Governance** Platform (Data Portfolio/Catalog; Data Engineering and Data Analytics) (2) DOT LRS Routes, FLMA Routes and Local Agency Routes Conflation Tool (Python-Based)	**FHWA BIM Projects:** BIM National Strategic Roadmap; Data Governance
Tennessee DOT	(1) Strategic Roadmap for Spatial Data Management and Governance at Enterprise Level (2) BIM-GIS Integration – Roadway Characteristics Data from Design/CAD to Geospatial Information Systems using Digital Twins and Building Information Modeling Tools-Techniques	**FHWA BIM Projects:** BIM National Strategic Roadmap; Data Governance
Caltrans	**(1) California Roads Sharing (CaRS):** Caltrans, CalOES, Local Agencies (NG-911, ARNOLD-HPMS Data) (2) CTDOT LRS-GIS Data Migration to AEGIST Data Model (formerly NRBM) for Publication & APIs	**e911/NG-911, HPMS 9.0 MIRE, National Roads Pilot**
Pennsylvania	(1) Traffic Count Site Selection Using GIS (2) Geocoding Data Workflow Automation using Python-Based Geoprocessing Tool (3) Speed Limit Data Quality Review using Routes, Signs, Vertical-Horizontal Curves GIS Data **(4) Local Agency and DOT Roads Integration:** NG911 NENA Discussion and Data Exchange with DOT **(5) Data Governance** for PennDOT Assets: Traffic & Safety, Projects, (6) Building Information Modeling: Building Spatial Digital Twins with Data from Multiple Systems	**e911/NG-911, HPMS 9.0 MIRE, National Roads Pilot**
Ohio DOT	(1) Strategic Roadmap for Roads Data Administration using LRS: 10 Areas Identified, such as: • Road Network Data Model for Travel Demand Modeling & Safety using DOT & Local Data • **Complete Streets:** Bike Routes and Pedestrian Network • HPMS 9.0-ARNOLD Rules Compliance, LRS-GIS Database Administration, Data Quality • Open Standards Compliant, Machine Readable, Topological Road Network Data Model	**e911/NG-911, HPMS 9.0 MIRE, National Roads Pilot**

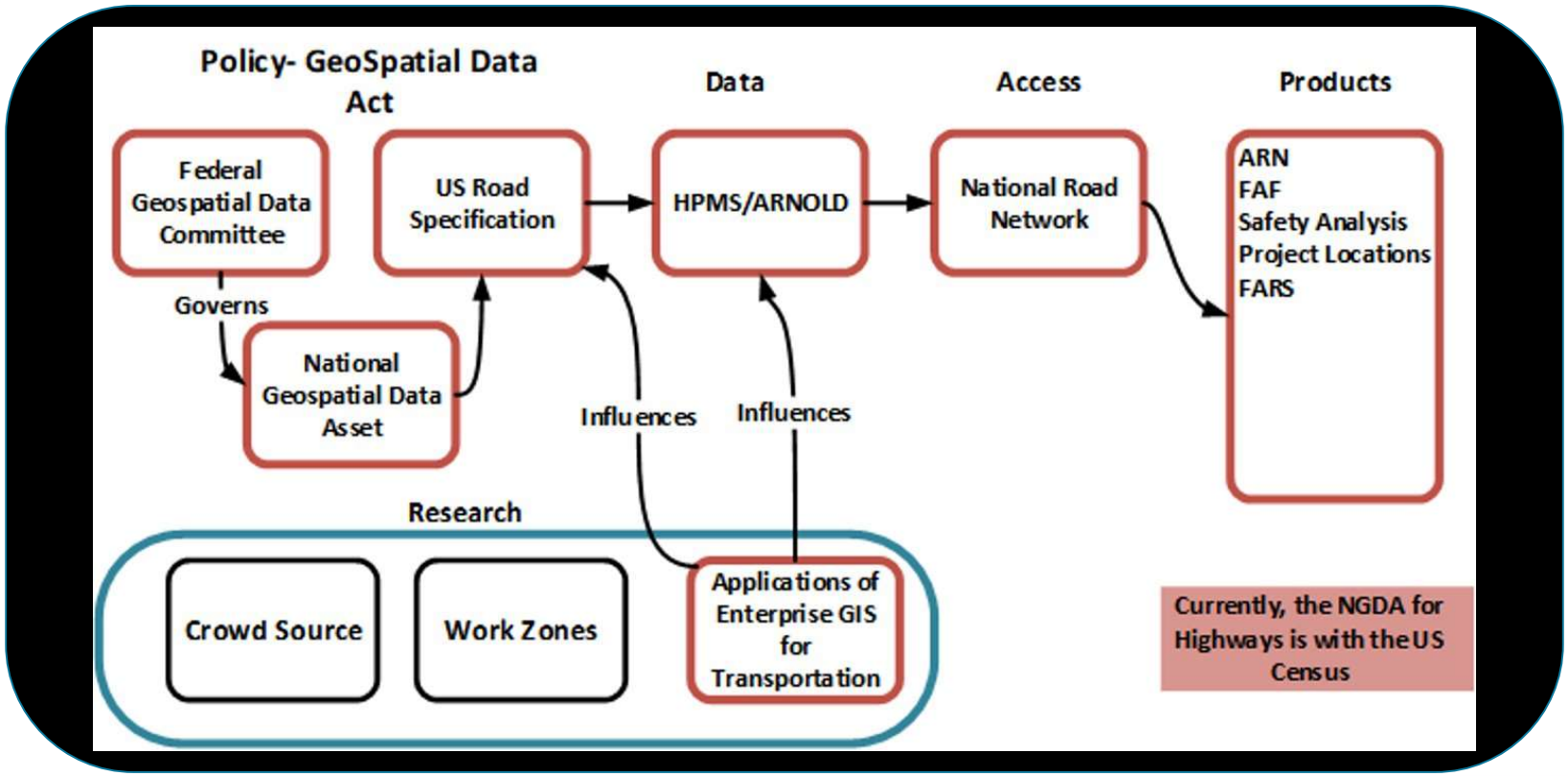
State DOT Technical Services Activities Summary

Period of Performance 1 States (July 2021 – May 2023)		Coordination Efforts
New Mexico DOT	(1) ALRS Review and Comparison with AEGIST Data Model (National Road Network- NRN Data Model) (2) Generating Routes with Z-values using Lidar data (3) Intersection Features Data Engineering and Modeling with Topology and Connectivity using Lidar and Open Street Maps (OSM) data. Pilot Implementation: Limited Study Area. (Semi-Automated Data Engineering/Modeling). Statewide Implementation (Investigating Automation with Lidar Data)	**e911/NG-911, HPMS 9.0 MIRE, National Roads Pilot**
Washington State DOT	(1) Building All Roads LRS – State and County Roads (2) All/State Roads Data Modeling in LRS Systems: Frontage Roads, Ramps, Local Crossings, Roundabouts (LRS DB Modernization) (3) Best Practices for Managing Road Geometry in the LRS: All/State Roads (4) Roads Inventory data modeling (e.g. speed limit) & data management (DB modernization) (5) Provisioning Roads data to Stakeholders: Projects	**HPMS 9.0, MIRE, National Roads Pilot**
Florida DOT	(1) Intersection Features Data Engineering and Modeling with Topology and Connectivity: Open Standards Compliant, Machine Readable, Topological Road Network Data Model (2) Dual-Carriageways Data Modeling	**HPMS 9.0, MIRE, National Roads Pilot**
North Carolina DOT	(1) Intersection Features Data Engineering and Modeling with Topology and Connectivity: Integrating data from NCDOT LRS, Open Street Maps, Traffic Signals Data for Enterprise Users (e.g. Safety)	**HPMS 9.0 National Roads Pilot**
Kansas DOT	(1) Intersection Features Data Engineering and Modeling with Topology and Connectivity (2) Lidar Data Integration into LRS-GIS System and Publication for use by Enterprise Systems. *Mobile Lidar Project Tasks: Routes with Z-values from Lidar Data, Creating HSM Road Segments & Calibrating Safety Performance Functions*	**e911/NG-911, HPMS 9.0 MIRE, National Roads Pilot**

AEGIST Implementation Activities at PFS States

	CA	CT	FL	ID	TN	PA	OH	KS	NM	NC
Spatial Data Governance, Management *Strategy, Roadmap, Metadata, Data Portfolio & Library, Workshops*				✓	✓	✓	✓			✓
Spatial Data Modeling										
Roads Data Modeling & Business Rules *DOT, Federal, Local: HPMS, ARNOLD, NG911, MIRE, Intersection*	✓		✓			✓	✓	✓	✓	✓
Intersections Data Model *HPMS 9.0, MIRE, GDF, IFC Roads Based*			✓				✓	✓	✓	✓
Data Quality Automation *HPMS, MIRE & Assets*	✓	✓		✓						
Spatial Data Integration and Engineering										
Roads Data Integration, Authoritative Data Mgmt. *DOT, Federal, Local Roads Data Sharing & Federation*	✓		✓					✓	✓	
Road Network and Events Data Publication/Sharing *Data Model for Data Warehouses. Data Models & Engineering in Data Hubs*		✓		✓		✓	✓			
Spatial Data Analytics										
Spatial Statistics, Econometrics, AI/ML, Optimization *Descriptive, Diagnostics, Predictive and Prescriptive Analytics; Image Analysis*		✓	✓			✓		✓		✓

AEGIST Publication Data Model Influencing HPMS/ARNOLD and NRN; PFS States to Review & Comment on the AEGIST Model



State DOT Technical Services Examples

- Pennsylvania Speed Limit Data Extraction Automation from PDFs; Integrating NG911 & DOT Roads
- Idaho Data Governance Portal
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U.S. Department of Transportation
Federal Highway Administration

Road Centerlines Modeling

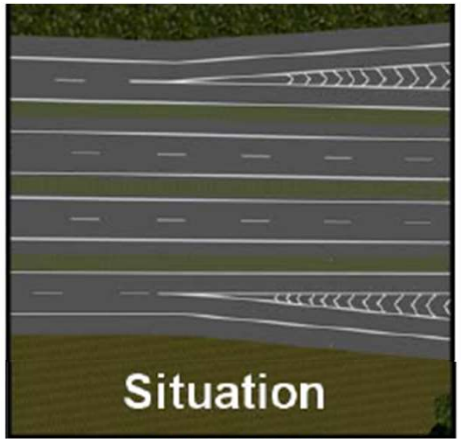
Road Network Data Modeling (Creation) Rules, Standards, Policies and Processes

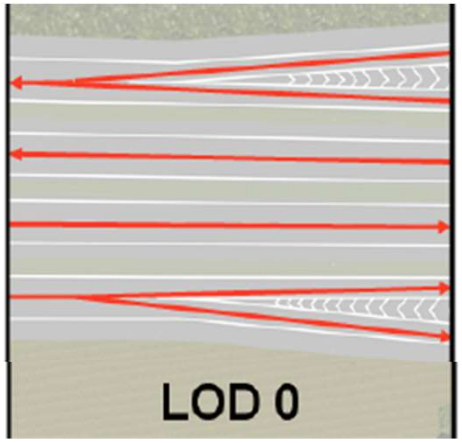
Roads Data Modeling Administration Levels and Standards in the US

1. LRS Route Naming and Identification
2. LRS Route Concurrency
3. LRS Centerline Modeling Detail (LOD)
4. LRS Centerline Accuracy (2D) (LOA)
5. LRS Centerline Authoritative Source
6. Mileage Accumulation Direction
7. Divided-Undivided Highways Modeling
8. Linear Referencing Methods (LRM) Maintenance

[3] LRS Centerline Modeling Detail (LOD)

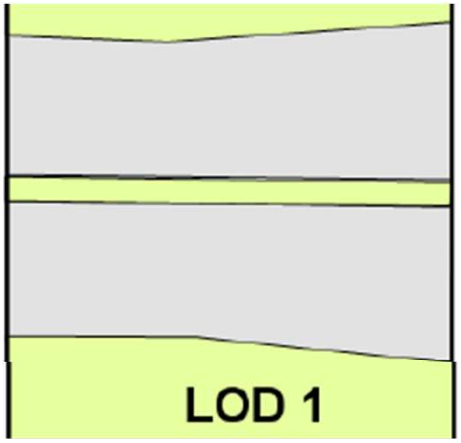
- **Administration Level 1:**
  - **Vertices**: No established rules for vertex density when editor digitizes centerlines
  - **Breaking centerlines**: Centerline length and break points not formally managed. No policy or procedure for defining centerline geometries
  - **Z-values**: Z-values are not modeled in the LRS
- **Administration Level 2:**
  - **Vertices**: Formal "internal" procedural document exists, that is used to determine vertex density when digitizing centerlines
  - **Breaking centerlines:** Formal "internal" procedural document exists to determine centerline geometry length and break points
  - **Z-values**: Z-values are not modeled in the LRS, but Z-values extracted from other data sources (e.g.: LiDAR) are integrated with LRS Routes to engineer a 3D linear routes data model. The engineered data model is published for use in specific business processes.
- **Administration Level 3:**
  - **Vertices:** Formal procedural document to (a) determine vertex density (b) bring external linework into LRS (c) Perform QA/QC checks on external linework to ensure it meets vertex density rules, and (d) perform geometry conflation, correction for external data in accordance with procedural document. *(Note: External data source could be NG911, DOT CADD, etc.)*
  - **Breaking centerlines:** Formal procedural document to (a) determine centerline geometry length and break points (b) ensure that external linework meets centerline geometry and break points related rules
  - **Z-values:** Z-values modeled in the LRS, and vertical curve is considered in determining centerline vertex density.





TransportationComplex provides linear network with line objects

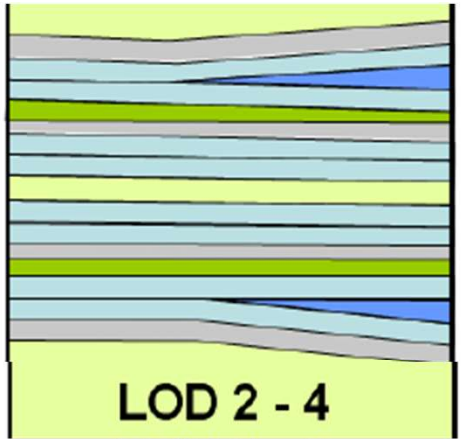
line objects



TransportationComplex provides surface geometry describing the actual shape of the object

TransportationComplex (Surface geometry)

Terrain surface



Surface geometry is devided thematically into TrafficAreas, like:

Traffic – cars

Traffic – emergency lane

Traffic – restricted area

Auxiliary - grass

[3] Level-of-Detail (LOD) (Geometry)

Source Standard: CityGML

Use Case	Project Planning	Project Delivery	Operations & Maintenance
Project Information Modeling in FMIS & DOT PPMS	LOD 0, LOD 1	LOD 0, LOD 1	
Complete Streets for Highway Safety Analysis	LOD-0, 1, 2-4		LOD 0, LOD 1, LOD 2-4
Asset Inventory & Performance, ARNOLD Reporting			LOD 0
Travel Demand Modeling, Freight OD-Routes Analysis			LOD 0
Traffic Design Model Simulation		LOD 2-4	
Roadway Geometry (Alignment, Pavement Cross-section, Profile)		LOD 1, LOD 2-4	
Point Cloud Classification and Asset Data Extraction from Lidar			LOD 2-4

[4] Route Concurrency

- **Administration Level 1: …**
  - » LRS ignores route concurrency and concurrency is not modeled, or concurrency is modeled in events
  - » LRS is incapable of storing route concurrencies or route dominance rules

  For example: Colorado, Indiana
- **Administration Level 2: …**
  - » Concurrency is stored in the LRS Route Tables, i.e., routes are created for both dominant and subordinate route(s), centerline is associated with these routes (in centerline sequence), and, an event table is created to flag dominant/subordinate route.
  - » Because of the way concurrency is setup in the LRS, all business data has to be referenced to the dominant route manually, unless the dominant/subordinate events table is used in the Dominance Rules setup. (due to lack of consistent business rules to automate the identification of dominant route)
  - » Event and roadway characteristics data can only be extracted on the dominant route, thus leaving attribute gaps on the subordinate route(s)

  For example: ?
- **Administration Level 3: …**
  - » Concurrency is stored in the LRS and the system has automated rules to assign business data to the proper dominant route
  - » Event and characteristics data can be extracted easily on the dominant route and on the subordinate route(s).

  For example: Most States?

AEGIST Guidebook v2.0 Data Modeling Standards

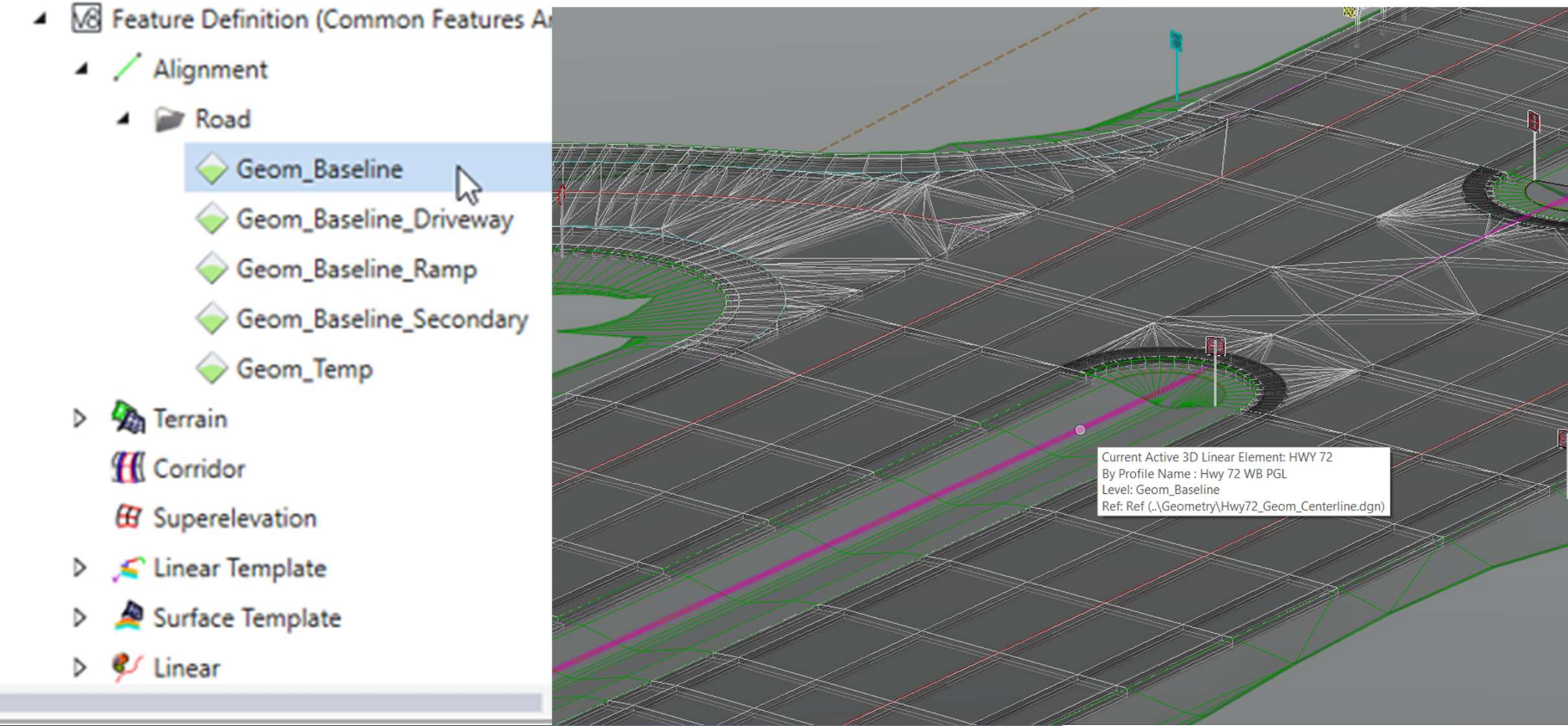
Content Standards

1. Highway Performance Monitoring System (HPMS 9), especially HPMS 9.0 Reassessment
2. National Bridge Inventory (NBI); Bridge Management Elements (BME); National Bridge Elements (NBE)
3. United States Road Specifications (USRS) and US Army Corp of Engineers (USACE) Road Lines
4. United States Census Bureau's Road TIGER/Line files
5. Model Inventory of Roadway Elements (MIRE)

Geometry Standards

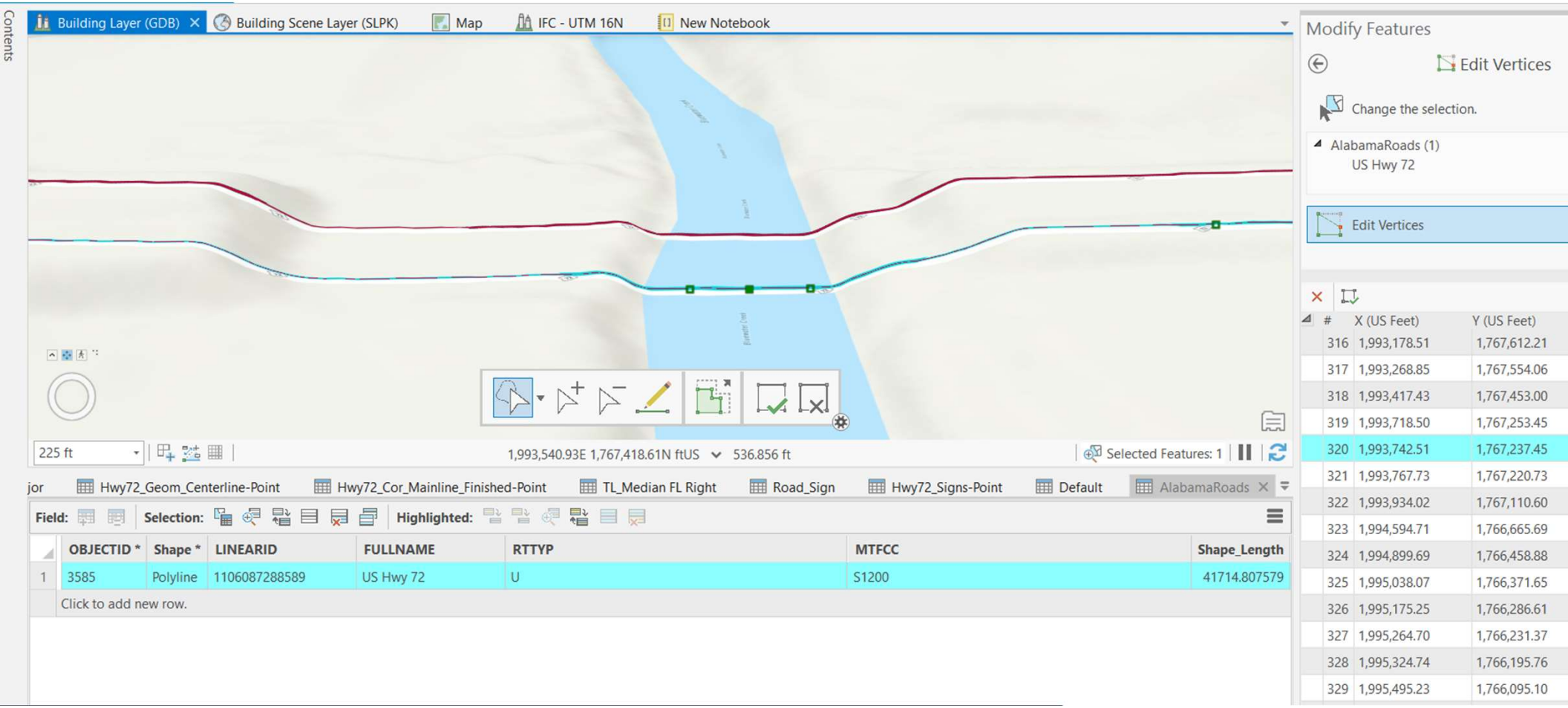
1. All Roads Network of Linearly Referenced Roads (ARNOLD)
2. Geographic Data Format (GDF) from Open Geospatial Consortium (OGC)
3. CityGML from Open Geospatial Consortium (OGC)
4. General Modeling Network Specification (GMNS)
5. Industry Foundation Classes (IFC) from buildingSMART
6. Open Street Maps (OSM) and Shared Streets
7. Proprietary standards: Esri Roads & Highways ALRS, Bentley AssetWise LRS (AWLRS), GeoMedia, Rizing Intersection Manager, TransCAD, Cube, Emme, HERE, INRIX etc.

Tennessee DOT: Design Data to GIS and Asset Management

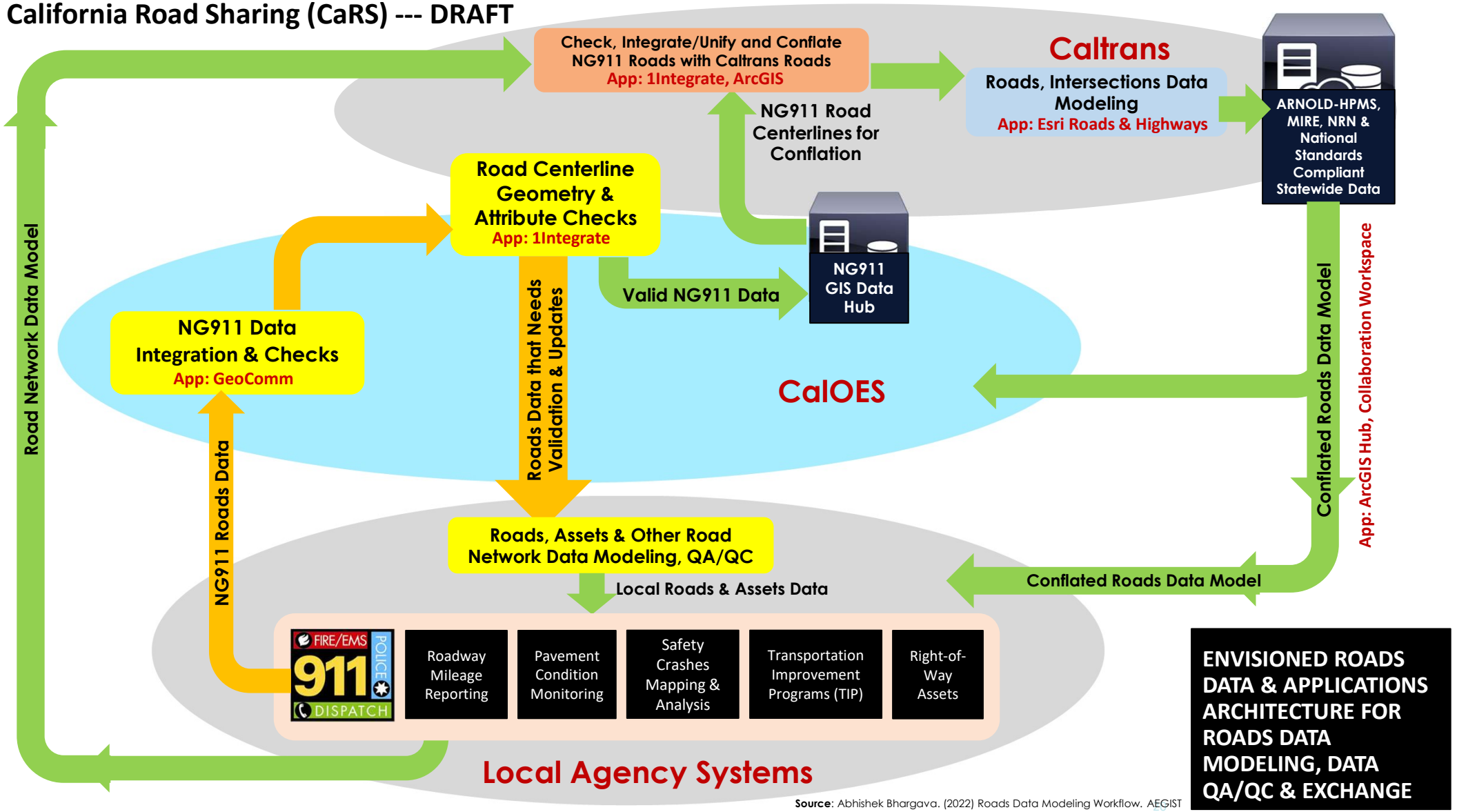


Tennessee DOT: Design Data to GIS and Asset Management

R&Hs Linear Referencing System – Route Redlines and Events



California Road Sharing (CaRS) --- DRAFT



ENVISIONED ROADS DATA & APPLICATIONS ARCHITECTURE FOR ROADS DATA MODELING, DATA QA/QC & EXCHANGE

Source: Abhishek Bhargava. (2022) Roads Data Modeling Workflow. AEGIST

California Road Sharing (CaRS)

California Road Sharing (CaRS)

Road to Governed California Centerlines

California's road system is managed by various authoritative roads data management government agencies. These include the Caltrans State Department of Transportation (DOT), 58 counties and 482 municipalities using multiple data systems.

Vision: The **California Road Sharing (CaRS) Program** will establish the **Road to Governed California Centerlines.** Road data modeling, management and exchange practices will be coordinated across Caltrans, Cal OES and Local agencies. A Statewide Roads Data, Applications and Technology Architecture will be created for management of road centerline geometry and road information. Pilot projects will be done with stakeholders in California and workshops will be held as part of the ongoing FHWA-led AEGIST program involving 18 States, in the U.S. to gather information for successful deployment of an integrated and federated data management system with data modeling, governance, sharing and QA/QC rules..

Benefits to Stakeholders

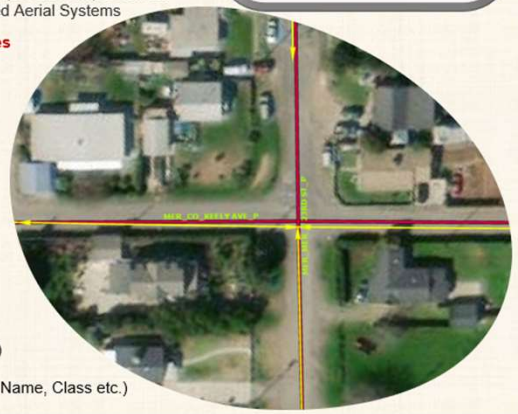
- Public safety enhancement through data-driven emergency management, preparedness and incident response
- Transportation planning, traffic studies, safety assessments and geo-locating address information (geocoding)
- Linear referencing of infrastructure asset inventory and condition assessment data in Asset Management Systems
- Capital and Maintenance project work data management (linear/spatial referencing)
- Topologically connected routable network development for map-based vehicle routing and analysis of driving directions, distances, roadway mileage reporting, freight routing.
- Deployment of Statewide Roads Data Governance Framework through establishment of National standards-based roads data modeling and QA/QC rules across government agencies
- Development of Digital Twins for Right-of-way Asset Management, Safety Analysis, Transportation Improvement Programs (TIP), CV/AV & Unmanned Aerial Systems

PROGRAM GOALS

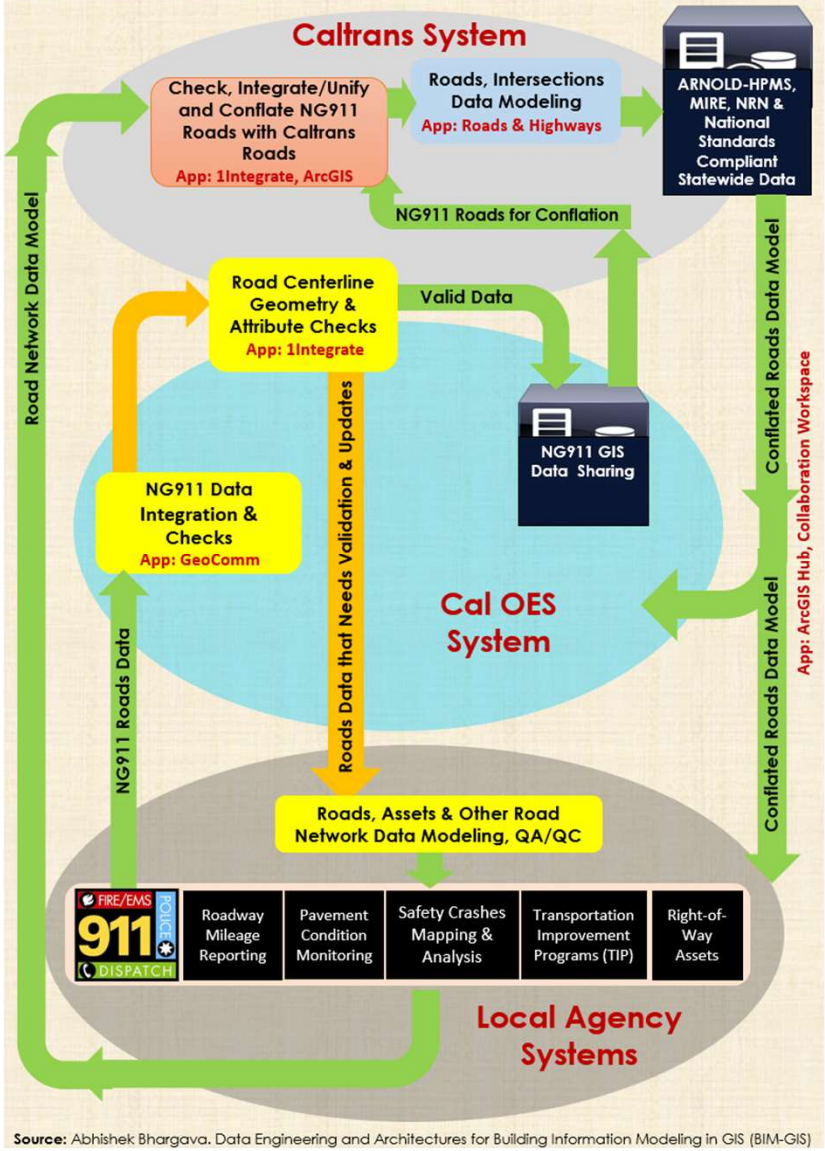
- ✓ Create a governed state-wide road centerline dataset to meet ARNOLD and NG911 roads data requirements
- ✓ Provide mutual benefits to State and Local jurisdictions, especially the business users involved in highway project planning, survey, design, construction, safety, traffic and asset management operations
- ✓ Coordinate roadway cartographic and data model recommendations
- ✓ Support Transportation for the Nation (TFTN), which promotes a publically available, high quality road centerline that is coordinated across all levels of government
- ✓ Building Information Modeling (BIM) for Roads and Assets using Standards for supporting AI/ML Applications, CV/AV and UAS.

Roads Data Modeling & QA/QC Rules

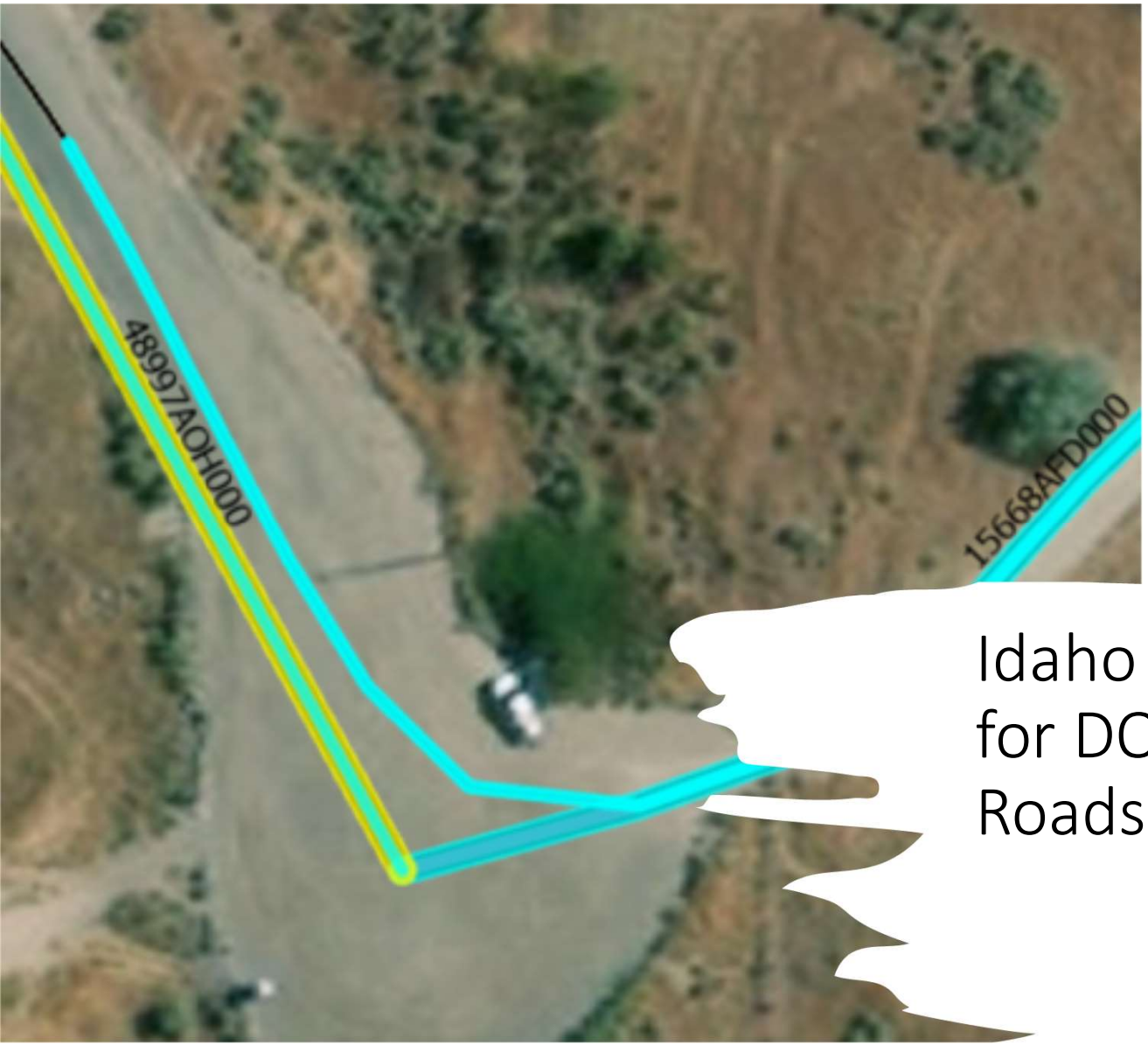
- Null and Multi-Part Geometry
- Duplicate Vertices
- Centerline Alignment
- Digitization Direction
- Centerline Accuracy, Source
- Self-Intersecting Geometry
- Start/End Nodes Alignment
- Overshoots/Undershoots
- Kickbacks
- Bifurcations
- Turn Lanes & Ramps Centerlines
- Emergency Crossovers
- Railroad Crossings
- Administrative Boundary Junctions
- Overlap/Concurrent Roads
- Dual-Geometry (Divided/Undivided)
- Roundabouts & Traffic Circles
- Road Identification Information (ID, Name, Class etc.)

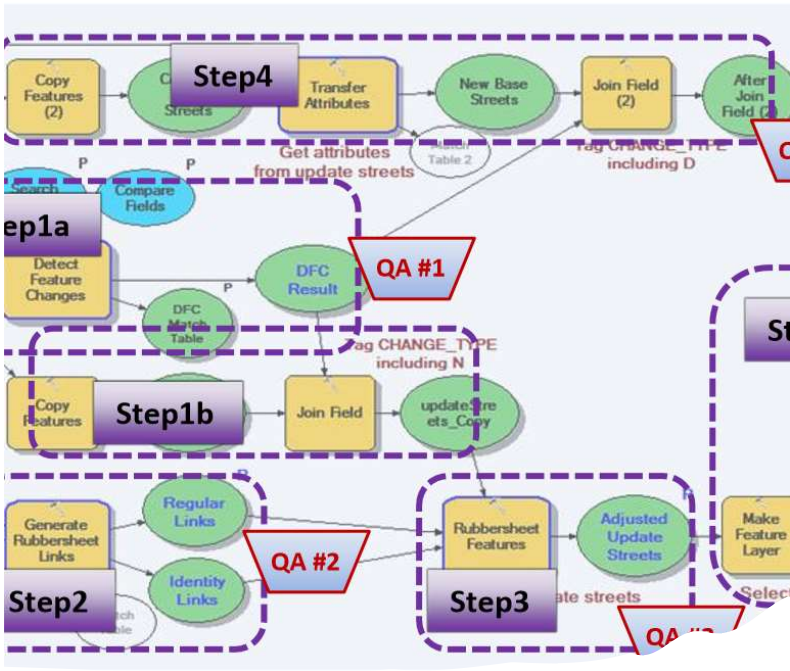


Envisioned Data & Application Architecture



Source: Abhishek Bhargava. Data Engineering and Architectures for Building Information Modeling in GIS (BIM-GIS)





Idaho Geoprocessing Tool for DOT and Federal Lands Roads Data Conflation

Pennsylvania

Speed Limit Data Extraction from Permits PDF using Python

Speed Limit Permits
(Authoritative Source)

TC -31
12/86

ORIGINAL

Department of Transportation

Engineering District 8-0

County: Lancaster
SR: 0741 (Entire SR)
Speed Limit

As a result of an engineering and traffic study, a speed limit(s) on the following section(s) of the subject State-designated highway is hereby established:

From Segment	Offset	To Segment	Offset	MPH	Side	Posting Responsibility
0010	0000	0040	0000	Turnback		
0040	0000	0050	1247	35	Both	PennDOT
0050	1247	0090	0977	45	Both	PennDOT
0090	0977	0130	1938	35	Both	East Hempfield
0130	1938	0190	0000	35	Both	Manor Twp.
0190	0000	0210	0306	40	Both	PennDOT
0210	0306	0250	0150	45	Both	PennDOT
0250	0150	0250	2912	40	Both	PennDOT
0250	2912	0260	0000	Null With SR 0324		
0260	0000	0284	0000	45	Both	PennDOT
0285	0000	0285	1265	45	Descending	PennDOT
0284	0000	0284	1265	45	Ascending	PennDOT
0284	1265	0290	0000	Null With SR 0222		
0290	0000	0300	0345	40	Both	PEnnDOT
0300	0345	0320	0804	35	Both	West Lampeter Twp.
0320	0804	0350	2003	40	Both	PennDOT
0350	2003	0390	0000	25	Both	Strasburg Boro.
0390	0000	0400	2233	25	Both	Strasburg Twp.
0400	2233	0530	0870	50	Both	PennDOT
0530	0870	0540	3008	35	Both	PennDOT
			(End SR)			

Scripts and/or models to automate analysis

Process to extract data from PDF, Excel or other static documents

Create tools or processes to sync data among sources or notify when changes occur

```
def MCRegDF(Page1DataSplit, year):
    DF = pd.DataFrame()
    for LineNo in range(3,len(Page1DataSplit)):
        #Regular expression being used to extract a list of tuples by including multiple () extraction brackets
        #Look for A-Z 0 or more times
        #IF you encounter one space, keep looking for A-Z 0 or more times
        #Stop extracting if you encounter space one or more times - But this should only happen after you have ignored
        #space one time. Extract all of these spaces as second value in the tuple
        #Third value in the tuple should include 0-9, encountered 0 or more times AFTER having encountered a series of spaces
        LineContentList = re.findall('([A-Z]*\s[A-Z]*)(\s+)([0-9,]*)',Page1DataSplit[LineNo])
        for item in LineContentList:
            if item[0] != ' ':
                s1 = item[0].strip()
                s2 = item[2].strip()
                s3 = ''
                for i in s2.split(","):
                    s3 = s3 + i
                DF = DF.append({'COUNTY':s1, 'MCReg_'+str(year):s3}, ignore_index=True)
    DF = DF.set_index(['COUNTY'])
    return DF

MCReg2013DF = MCRegDF(MCReg2013Page1DataSplit, 2013)
MCReg2014DF = MCRegDF(MCReg2014Page1DataSplit, 2014)
```


U.S. Department of Transportation
Federal Highway Administration
Intersection Modeling

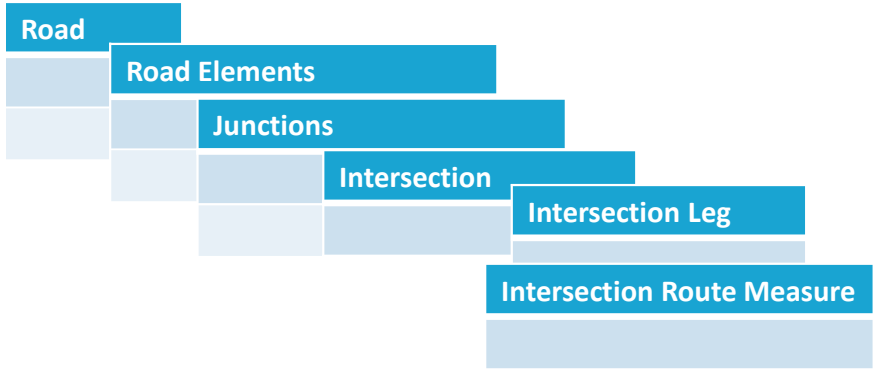
AEGIST Intersection Model

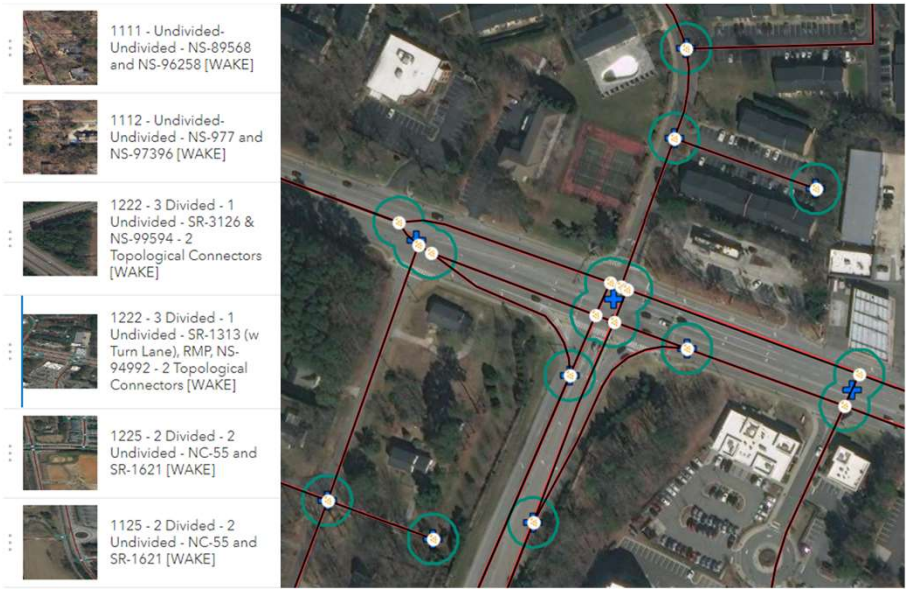
OGC Geographic Data Format (GDF), CityGML, buildingSMART IFC, Generalized Modeling Network Specification (GMNS) and MIRE Standards Compliant

- LRS Route, Centerline (Datum), Route-Centerline (M:N)
  Intersection Features
  - **Junctions (Nodes):** At Intersections, TAZ Centroid*, Bridge, Access Points, Median Cuts, Intersection Median Ends, Intersection Leg Begin/End, State/County/Town/Parish Boundaries (Snap Points). Setup as LRS Event.
  - **Intersection Point** at Centroid, at a perpendicular offset from LRS Route *(e.g.: Median Cut Intersection, MIRE-126).* Setup as GIS Feature.
  - **Road Segment:** Junction to Junction. Setup as LRS Event. Ideally aligned with NG911 Road Centerlines, with MIRE and NG911 attribution.
  - **Intersection Leg:** MIRE compliant road approaches.
- Topological Segments (GIS features)
  - Intersection Connectors
  - Turn Segments/Lanes (HPMS 12, 13)
  - Median Crossovers (MIRE-62)

Connectivity, Topology:

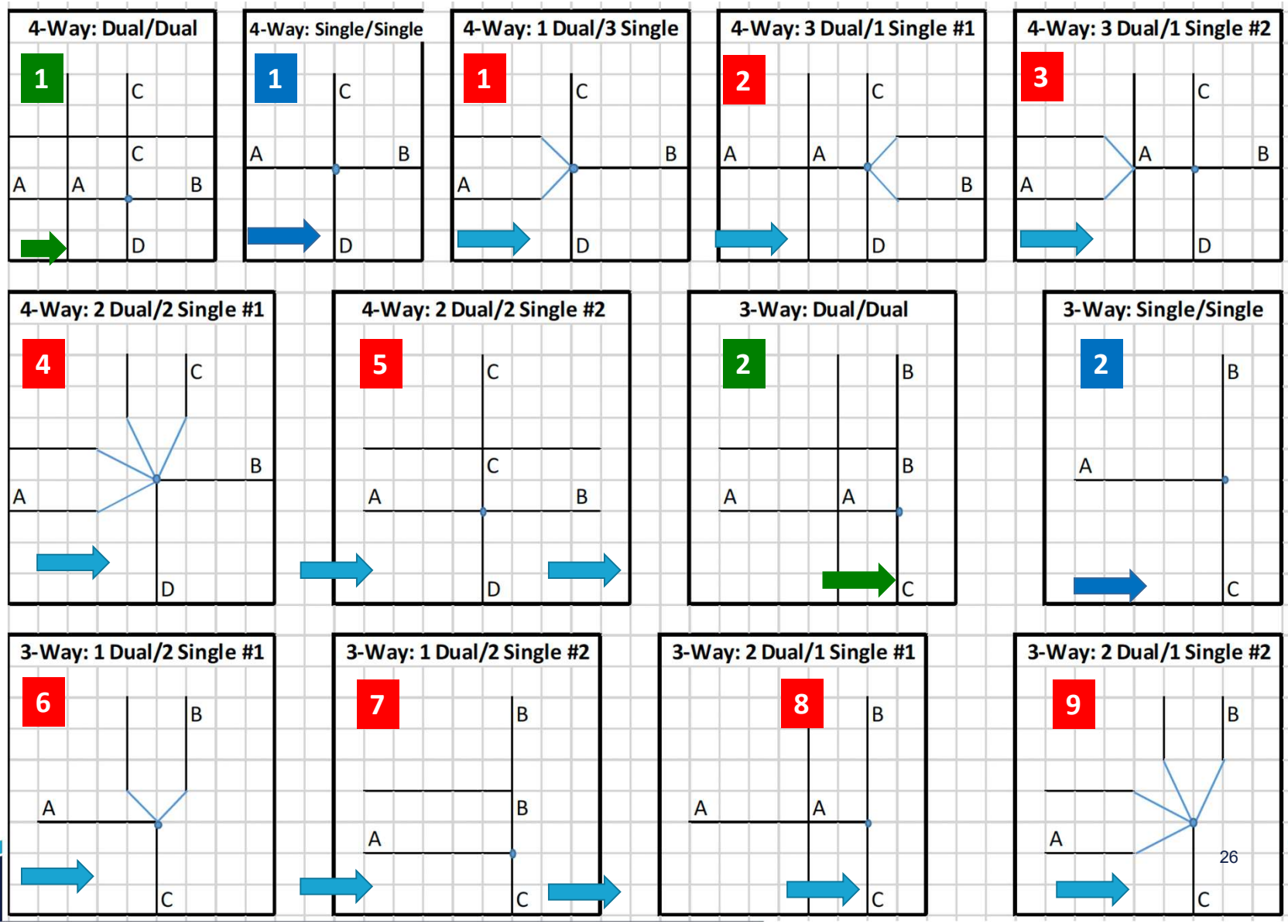
- Road Segments and Intersection Parent-Child Data Relationship
  Junctions (Nodes) with Road Segments, Connectors, Turn Segments/Lanes, Median Crossovers, Reverse Route Segments, Inventory Routes, Continuity Intersection Points





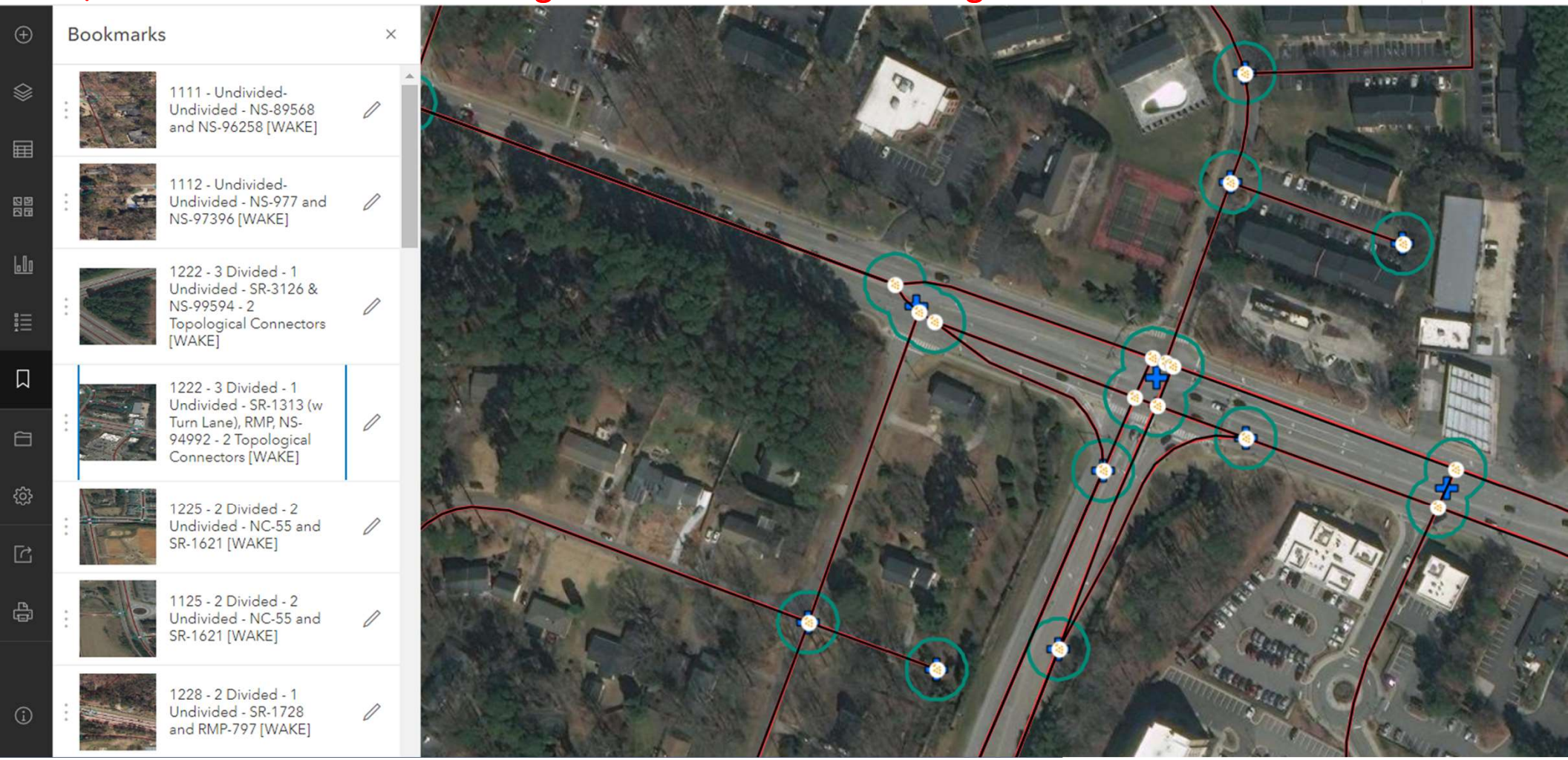
Scenario 1.1: Intersections with Non-State Highway System Route(s)

- Undivided Highways (3/4 Way) — 1.1.1
- Divided-Undivided Highways (3/4 Way) — 1.1.2
- Divided Highways (3/4 Way) — 1.1.3



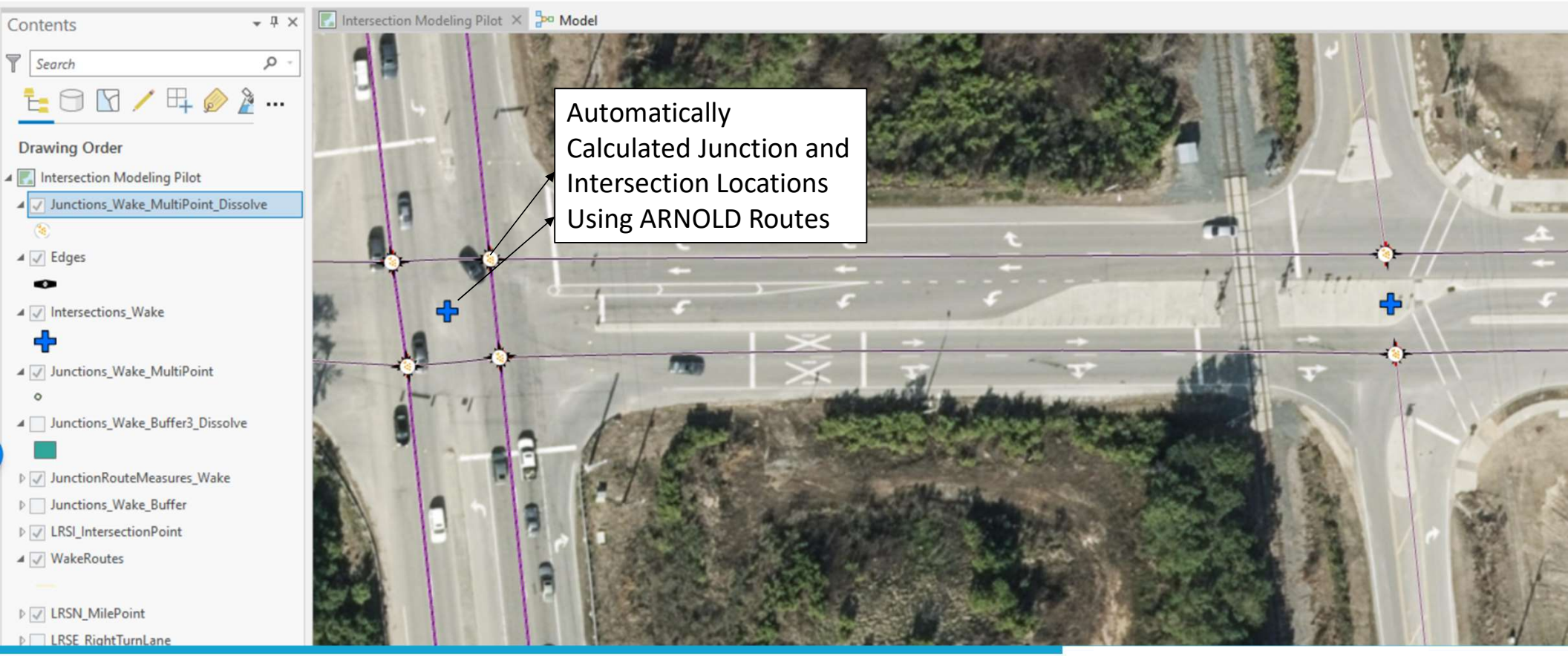
Road Network Data Model

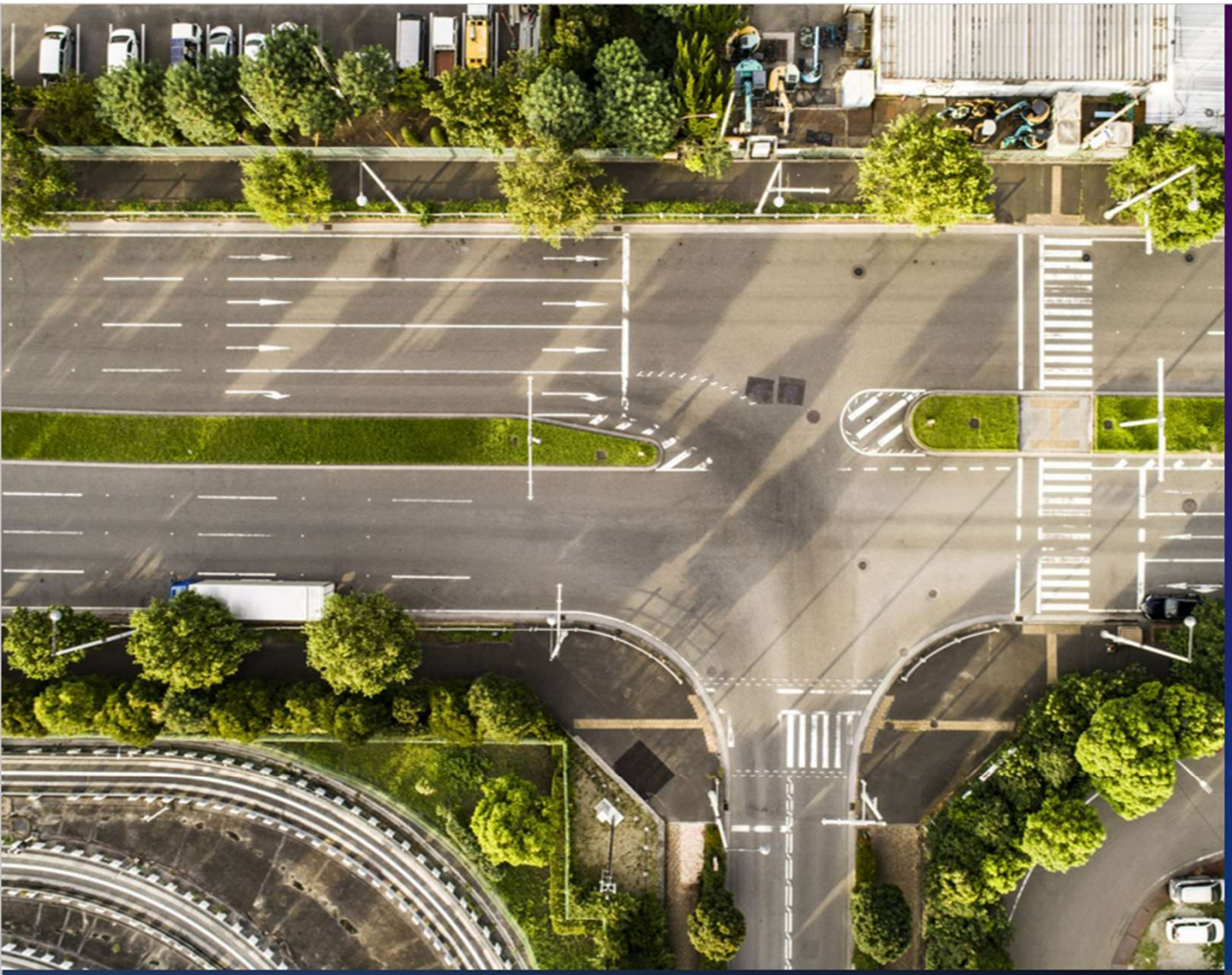
LRS/ARNOLD Routes for Creating Junctions and “Associating” them with Intersections



Road Network Data Model

LRS/ARNOLD Routes for Creating Junctions and Intersections



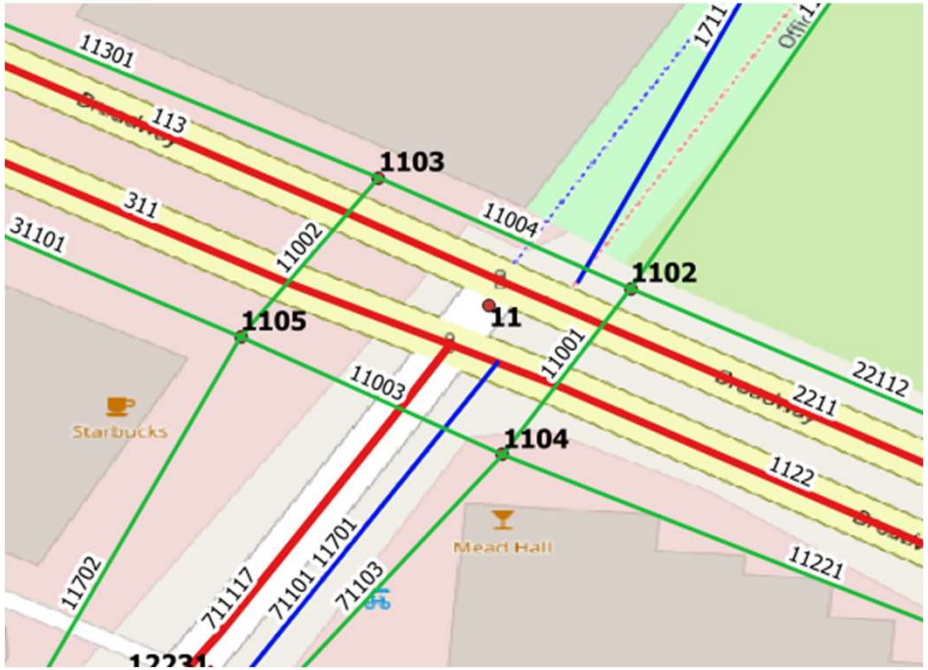


DIGITAL TWIN FOR COMPLETE STREETS

- Routes: Motorists, Pedestrians, Trails, Transit (Bus, Rail), Managed Lanes
- Sidewalks
- Bike lanes (or wide paved shoulders)
- Special bus lanes
- Comfortable and accessible Public transportation stops
- Frequent and safe crossing opportunities
- Median islands
- Accessible pedestrian signals
- Curb extensions
- Narrower Travel Lanes
- Roundabouts

and more Transportation Right-of-Way Assets

AEGIST Incorporating GMNS Standard for Modeling Multimodal, MIRE-Compliant Signalized Intersection from ARNOLD and NG911 Roads

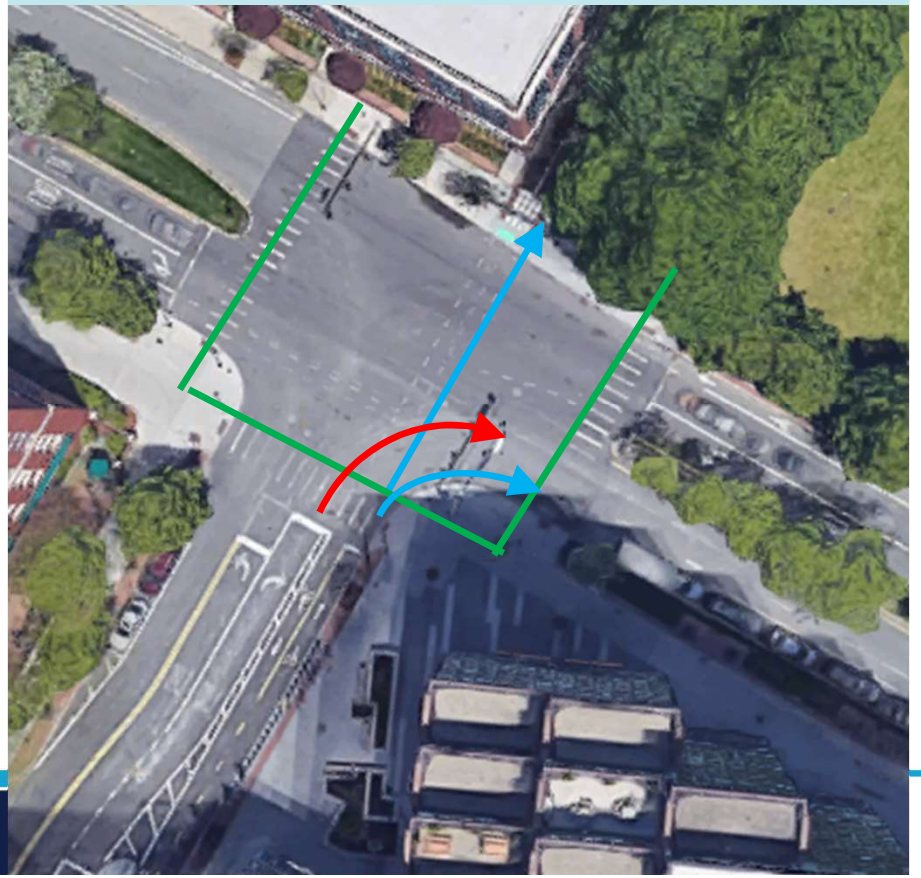


Red: Vehicle links and movements

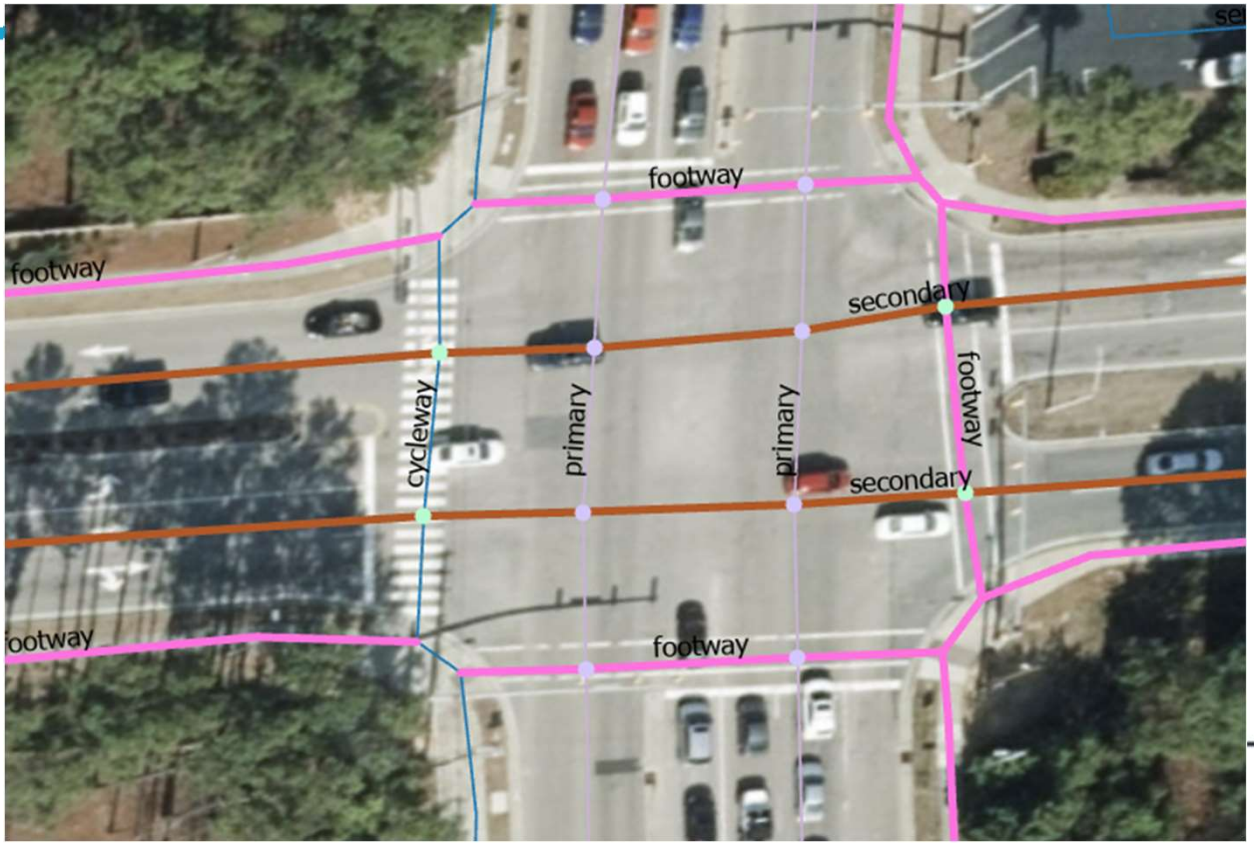
Blue: Cycle track links and movements

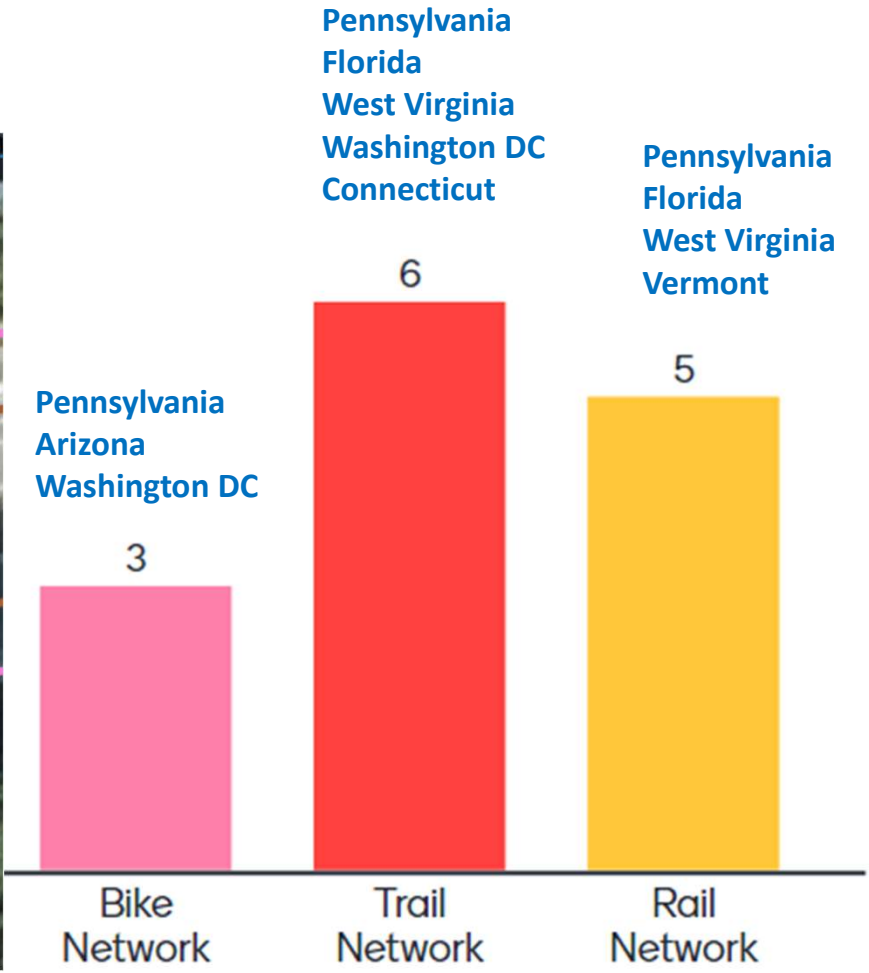
Green: Pedestrian links and crosswalks

Selected Movements from Ames St.



States with Routes for Bike, Ped/Trail, Rail Networks





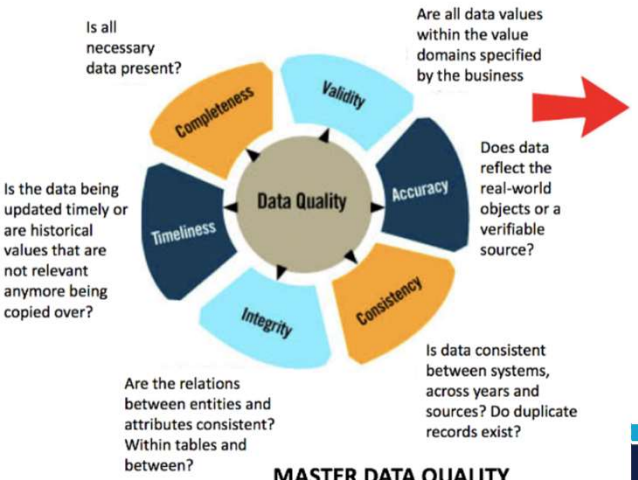
Number of Responses: 9

U.S. Department of Transportation
Federal Highway Administration

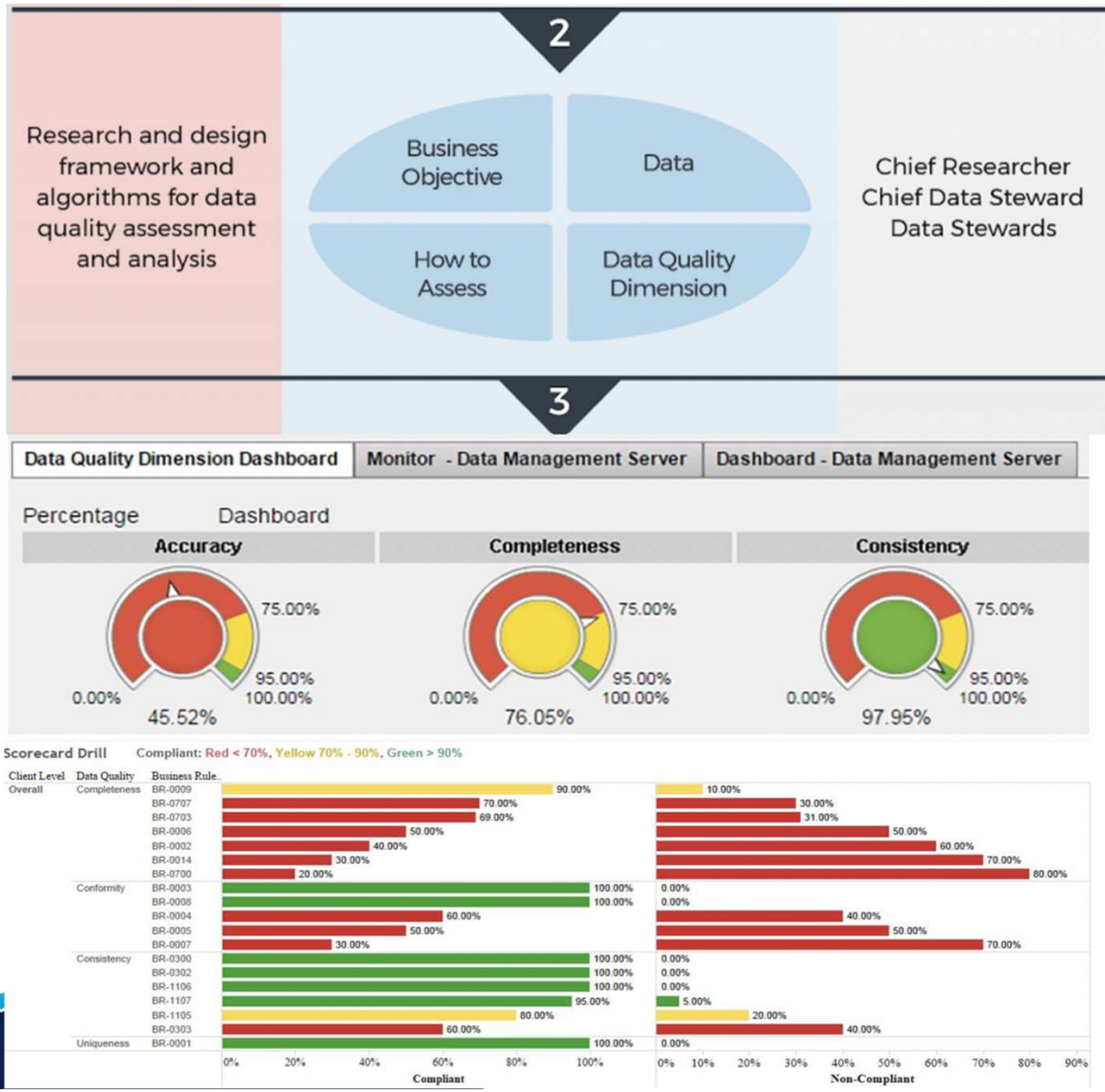
Data Quality

Connecticut and Idaho Data Quality Rules Automation & Dashboards

1. Portfolio: Inventoried “data assets”
2. Data Models & their objective. Enterprise Data Dictionary, Data Quality Dimensions and rules
3. Automating data processing, integration & quality using Data Science Workbench
4. Data Governance Dashboards

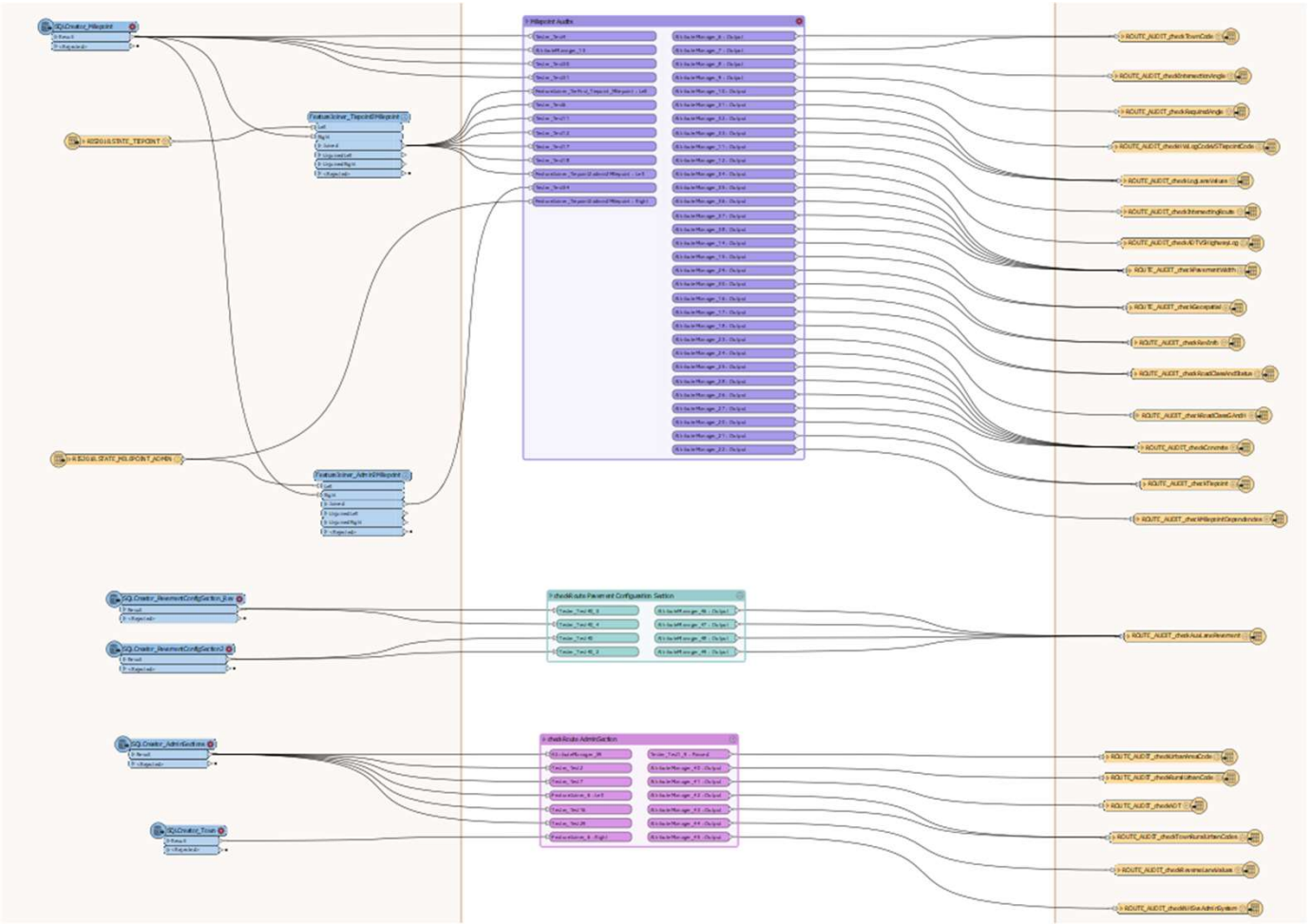


MASTER DATA QUALITY MANAGEMENT (DQM) FRAMEWORK



Connecticut DOT

Data Quality Rules Implementation using Feature Manipulation Engine (FME)




U.S. Department of Transportation
Federal Highway Administration
Data Governance

Deploying Data Governance System

For On-Premise, Cloud and Edge Computing Data Systems

Open-Standards Compliant

Data Catalog	Object Type Library	Data Dictionary (Properties & Property Sets)
Data Models Catalog	Applications Catalog	Applications Communication Diagram
Application Integrations Catalog	Authoritative Data Management Models	Data Quality Governance
Data Integration & Engineering Governance	Data Publication Governance	Data Analytics Governance

FHWA, Applications of Enterprise GIS in Transportation

- Idaho Department of Transportation
- Pennsylvania Department of Transportation
- Ohio Department of Transportation
- Tennessee Department of Transportation

FHWA, Identifying Data Frameworks and Governance for Establishing Building Information Modeling (BIM) Standards

IDAHO TRANSPORTATION DEPARTMENT

Idaho Data Portfolio

Data Assets Inventory and Applications

TOGAF 9.2 Standard Compliant

Data Assets | Object Type Library (OTL) | Data Dictionary | Data Applications

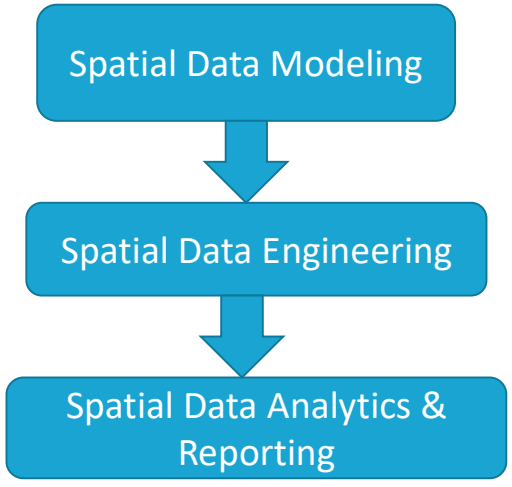
Grid view | 1 hidden field | Filter | Grouped by 1 field | Sort | Color | Share view

	Asset ID	Description	Owners	Stewards	Performance Goal	Business Domain	Priority
PERFORMANCE GOAL: Infrastructure Health	Count 11						
28	1 Bridge	As part of national requirements for our bridge inve...	DOT Bridge Department	Program Info Coordinato...	Infrastructure Health	Asset Management	High
29	Culvert		DOT Asset Management	ITD Districts	Infrastructure Health		
30	Horizontal Curve (Alignment)		HPMS Coordinator Doro...	HPMS Coordinator Doro...	Infrastructure Health		
31	HPMS 0.1 Mile Segments		HPMS Coordinator Doro...	HPMS Coordinator Doro...	Infrastructure Health		
32	HPMS Sample Sections		HPMS Coordinator Doro...	HPMS Coordinator Doro...	Infrastructure Health		
33	Maintenance Work Orders		DOT Asset Management	Maintenance Manager S...	Infrastructure Health	Asset Management	Medium
34	Pavement (Road) Surface	Road Surface is maintained on state routes by ITD a...	DOT Asset Management	HPMS Coordinator Doro...	Infrastructure Health	Asset Management	High
35	Pavement Distress				Infrastructure Health	Asset Management	High
36	Pavement Roughness (IRI)	Pavement ratings gathered from longitudinal road p...	DOT Roadway	Pavement Data Manager...	Infrastructure Health	Asset Management	High
37	Pavement Structure				Infrastructure Health	Asset Management	High
38	Snow Plow Data	Data generated from snowplow pings process as pa...	DOT Maintenance Supp...	Maintenance Manager S...	Infrastructure Health	Fleet & Equipment	High
+							
PERFORMANCE GOAL: Infrastructure Health, Traffic Safety, Mobility	Count 3						
PERFORMANCE GOAL: Infrastructure Health, Mobility	Count 3						
PERFORMANCE GOAL: Traffic Safety	Count 4						
45	Crash Data	Records of crashes with vehicle and severity inform...	Office of Highway Safet...	Office of Highway Safet...	Traffic Safety	Management	High
46	Intersection Influence Area	A spatial polygon feature that represents the shape ...	DOT Asset Management	Not Currently Managed	Traffic Safety	Management	Low
47	Intersection Routes		Not Currently Managed	Not Currently Managed	Traffic Safety	Management	Low
48	Traffic Counts	Raw Traffic data from counters	DOT Traffic Data	Traffic Data Manager Ma...	Traffic Safety	Travel Demand Modeling	High

Governing Data Using Spatial & Linear Referencing Systems

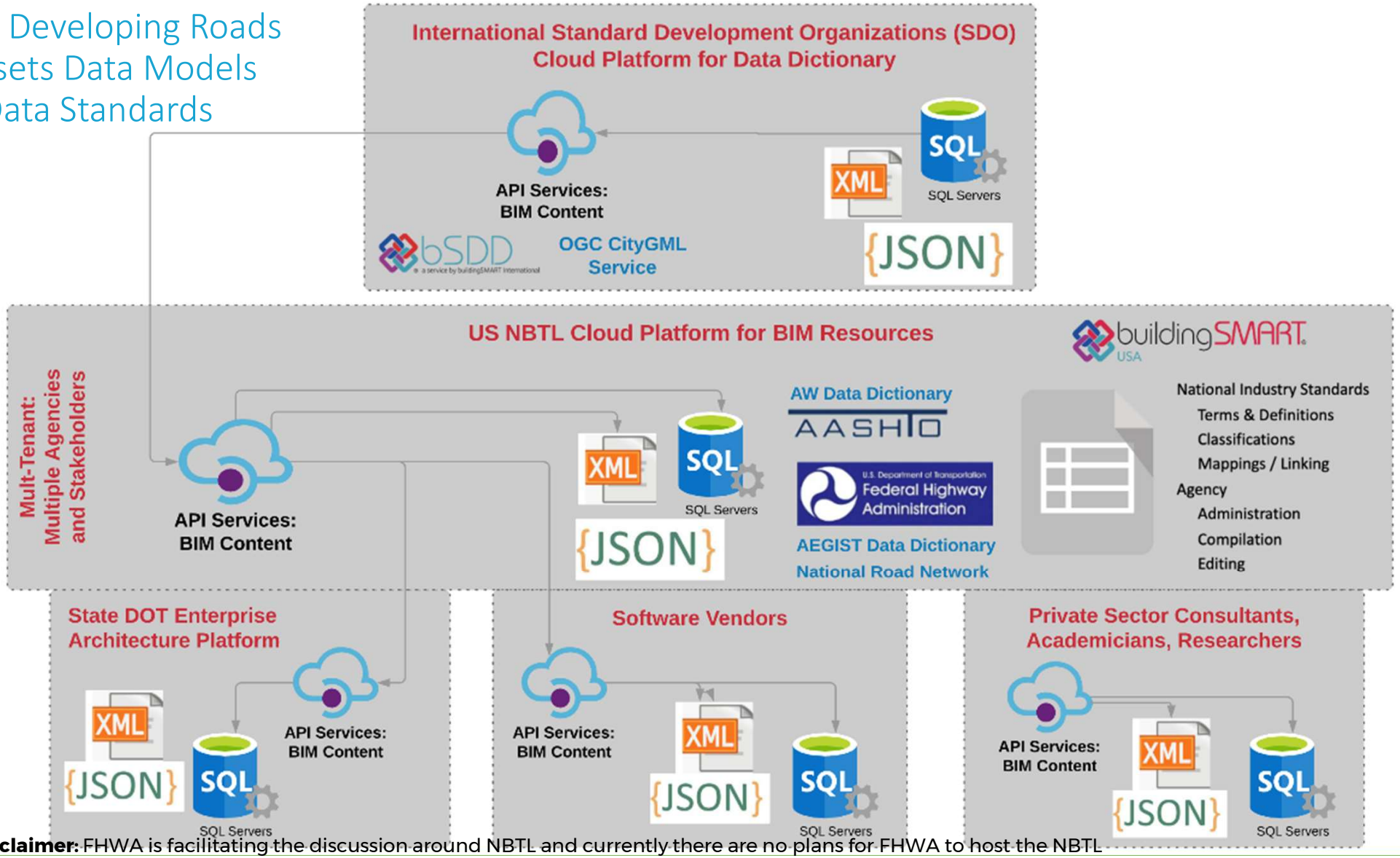
Spatial Data Modeling in
Transactional Systems of Records (SoRs)
and **Spatial Data Engineering** for Publication to
Enterprise Data Warehouses, Databases to support
Spatial Data Analytics and Reporting
Via the Systems of Engagement (SoE)

Ensuring Transportation Equity by Preparing Spatial Transportation Data for Decision Makers across All Asset Life Cycle Phases & Processes



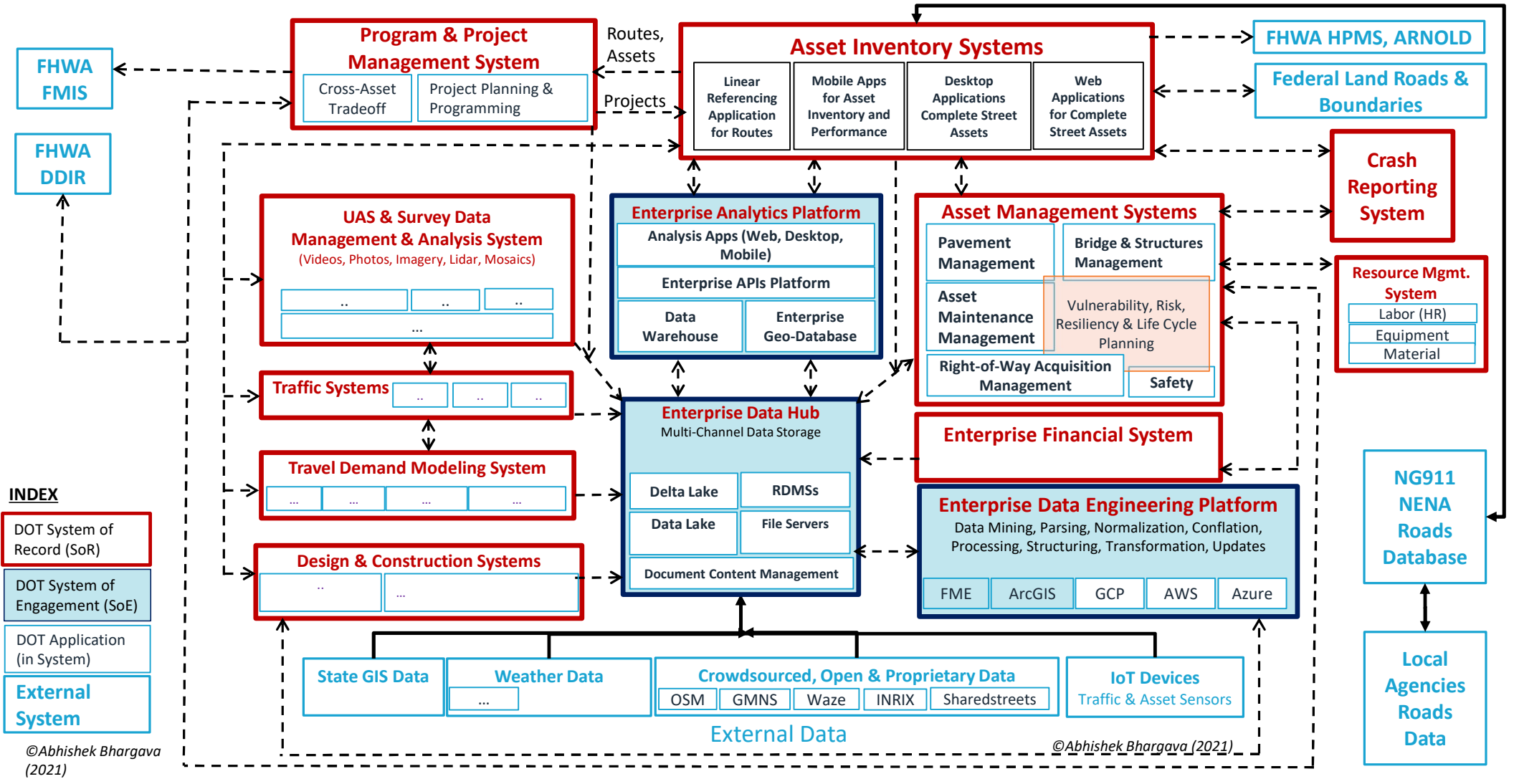
© Source: Bhargava et.al. (2021). Identifying Data Frameworks and Governance for Civil Integrated Management. FHWA Research. WSP

AEGIST Developing Roads and Assets Data Models using Data Standards



Disclaimer: FHWA is facilitating the discussion around NBTL and currently there are no plans for FHWA to host the NBTL

AEGIST Building Information Modeling (BIM) for Road Network Data Integration



Questions & Open Discussion

Contact: joseph.hausman@dot.gov
FHWA, Office of Planning