



August Meeting

8/14/2019

AGENDA

1. Announcements
2. Esri Update
3. Applications of Enterprise GIS-T – Joe Hausman, FHWA
4. Open Discussion

**** Please mute phones!! ****

ANNOUNCEMENTS

- Roads and Highways Holistic Testing
 - November 5-6th in Redlands, CA
 - Contact Nathan to get a seat
- Functionality Priorities
- 10.8 Migration
- GeoNet

Esri Updates

Nathan Easley

Applications of Enterprise GIS-T (AEGIST)

Joe Hausman, FHWA

Open Discussion

RHUG Community

Upcoming Meetings / Contacts

Wednesday, September 11, 2019

Contact Info:

Erin Lesh ealesh@ncdot.gov

Patrick Whiteford pwhiteford@azdot.gov



Product Team Update (RHUG meeting 8/14/19)

Nathan Easley

Capabilities currently under development

- **Gapped route support**
 - **Event Behaviors**

Support Incidents/Defects

- **BUG-000122847** – Certain decimals change after manual inputting certain numbers in attributes within Event Editor (fixed in 10.8)
- **BUG-000123422** – When Registering an Event from the ALRS Properties window, Event behaviors will reset to defaults (fixed in 10.8)

Support Incidents/Defects

- **BUG-000122121** – In Roads and Highways for Desktop 10.5.1, when running the interface between AgileAssets and Roads and Highways, there are approximately 17,000 issues with events returned from the Relocate Events web service (fixed in 10.8)
- Combination of the following configurations could result in this issue appearing
 - Cartographic realignments set to change the measures when the length of the centerline changes (LRS Network configuration option)
 - Business rules allow cartographic realignments
 - A cartographic realignment is completed where the change in measure is very small (less than 0.001 meters typically)
- Tool to determine impacted users
- Hotfix being built for versions with impacted users

Hotfixes

- Request from RHUG steering committee to provide hotfixes for data integrity bugs found over the past 12-18 months
 - What versions?
 - Which issues?
 - Email neasley@esri.com in the next week
- For a list of bugs fixed in each release see <http://esriurl.com/15651>
- 10.8 upgrade plans

Other Announcements

- **Holistic Testing November 5-6 in Redlands**
- **Signup link will arrive later this month**



esri

THE
SCIENCE
OF
WHERE

Applications of Enterprise GIS for Transportation (AEGIST)

The Next Step in Developing a National Transportation Dataset
Esri Roads and Highways User Group (RHUG) Meeting
August 14, 2019



The National Map Concept

- ❖ Transportation established in 1994 Executive Order 12906 as a Framework data layer/theme in the National Spatial Data Infrastructure (NSDI)
- ❖ OMB Circular A-16 revised in 2002 to establish U.S. DOT as lead agency for the NSDI's transportation theme.
- ❖ National States Geographic Information Council (NSGIC) propose Transportation for the Nation:
 - 2008 NSGIC Advocacy Agenda Issues Brief;
 - “The federal government will coordinate development of a seamless nationwide dataset of addressable roads built in a collaborative and shared environment.”



Facility Extent

- ⚙️ All public and private roads.
- ⚙️ August 7, 2012 FHWA Memo required support of these uses:
 - Bridge inspection and reporting;
 - Safety analysis;
 - Certified public road mileage;
 - Traffic records data collection;
 - Transportation for the Nation;
 - Emergency response.



Modified Transportation Components

⚙️ Topological Network for Routing –

- Commercial marketplace provides routing capability; States can't meet market requirements.
- Decision: Provide topology components, but do not seek to produce a complete routing product.

⚙️ Addressing for Everyone –

- State data is not authoritative and there is no uniformity on address format; E911 platforms require proprietary map formats.
- Decision: Support address data as optional attribute (address ranges) or elements (address points).



Modified Transportation Workflow

- ❖ U.S. DOT to catalyze and standardize the methodology for creating, editing, and publishing TFTN data.
- ❖ States, working with private partners and lower levels of government, are to produce the data and transmit it to users.
- ❖ Transportation agencies use the map and business data for project-level analysis.



Project Objectives

- ❖ Implement the U.S. DOT *Transportation for the Nation Strategic Plan*, which is the foundation for ARNOLD, MIRE 2.0 FDE, HPMS, and AASHTO Core Data Principles.
- ❖ Establish a peer-reviewed standard method for creating a national transportation base map.
- ❖ Define LRM business rules for all States to apply.
- ❖ Show how those business rules can be applied.



Project Objectives (cont.)

- ⚙ Describe best practices for data governance and data management.
- ⚙ Support all business units (e.g., planning, design, safety, maintenance, etc.) with shared definitions, documentation, and communication mechanisms.
- ⚙ Develop an implementable standard for State DOTs to deploy.



What Are the Use Cases?

⚙️ LRM data mapping:

- State scale;
- County/urban area scale;
- Corridor scale.

⚙️ Intersection mapping:

- MIRE;
- Asset management.

⚙️ HPMS.

⚙️ National Bridge Inventory.

⚙️ TIP/STIP.



Solution Requirements

- ⚙️ There must be a clearly stated and reasonable business case for each requirement.
- ⚙️ There must be a complete specification for each requirement.
- ⚙️ The individual specifications must be internally consistent.
- ⚙️ Data provider and recipient user must both use the data set for internal needs.



Solution Requirements (cont.)

- ⚙️ Any data to be mapped at a national extent must have a uniform definition, collection method, maintenance process, and delivery mechanism.
- ⚙️ Must be authoritative.
- ⚙️ All users should get the same result when asking the same question.



Outline

1. An Introduction to AEGIST
2. Enterprise GIS-T Data Governance and Capability Maturity Model Guidance
3. Fundamental Rules and Concepts
4. Fundamentals of the NRBM Standard
5. The NRBM Standard



1. An Introduction to AEGIST

- Guidebook Development
- A Brief History of GIS-T
- CIM Sets the New Context



Guidebook Development

- ❖ 50 States plus District of Columbia and Puerto Rico have 75 approaches to highway data storage and publication.
- ❖ Vendors cannot provide 52 custom solutions.
- ❖ A national map cannot be constructed without uniformity in structure and content.
- ❖ States do not have a comprehensive guide for GIS-T.



Guidebook Objectives

- ⚙ Describe the foundation of linear referencing.
- ⚙ List the core business rules.
- ⚙ Show how the States can create the National Roadway Base Map:
 - Technical design and workflow process
 - Data governance and management
- ⚙ Establish uniformity for creating, maintaining, and extending linear referencing systems and methods.

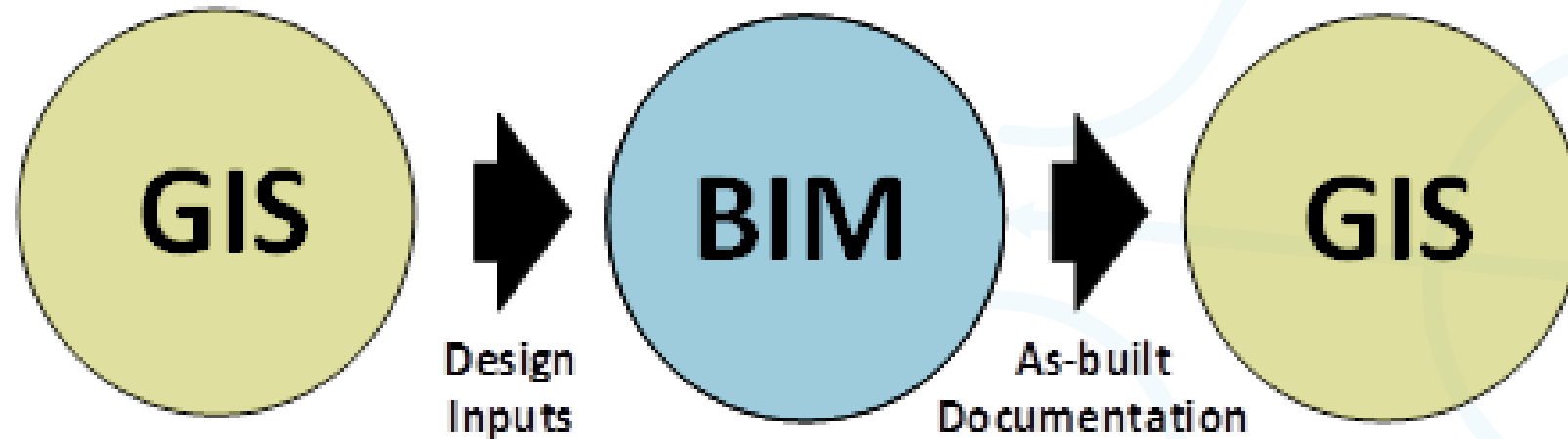


Guidebook Objectives (cont.)

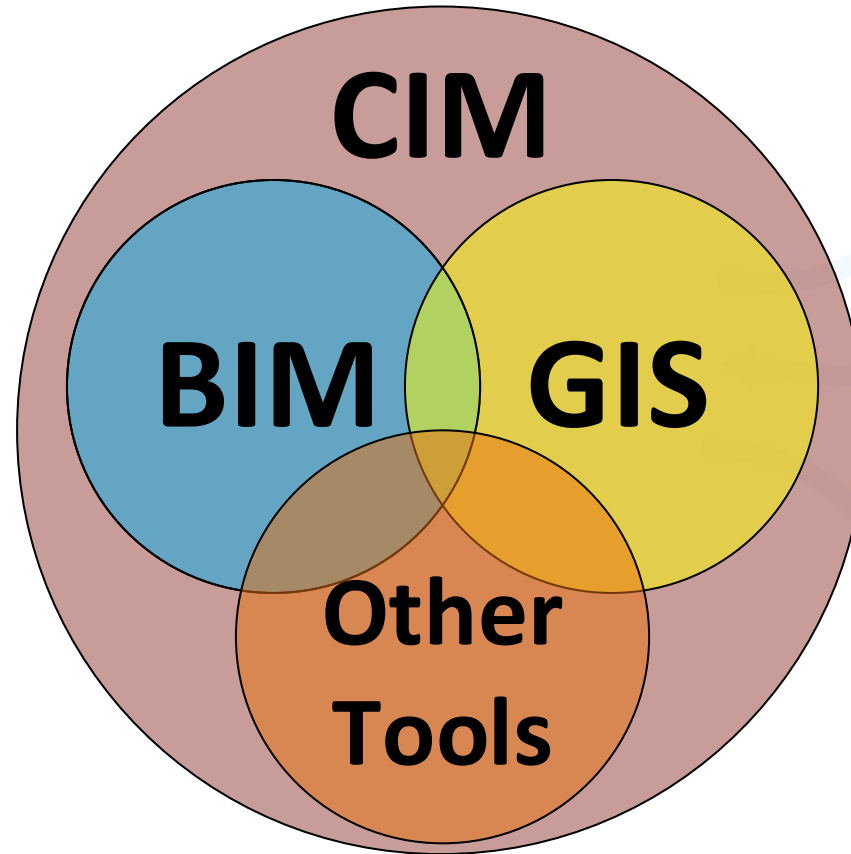
- ❖ Demonstrate ways in which traditional GIS can work with BIM/CIM/SIM systems to leverage business data usage.
- ❖ Demonstrate how the proposed standard may be implemented in relational and object-oriented data structures.
- ❖ Define best practices for spatial data governance, including how to apply self-assessment tools.



CIM Sets the New Context



CIM Sets the New Context

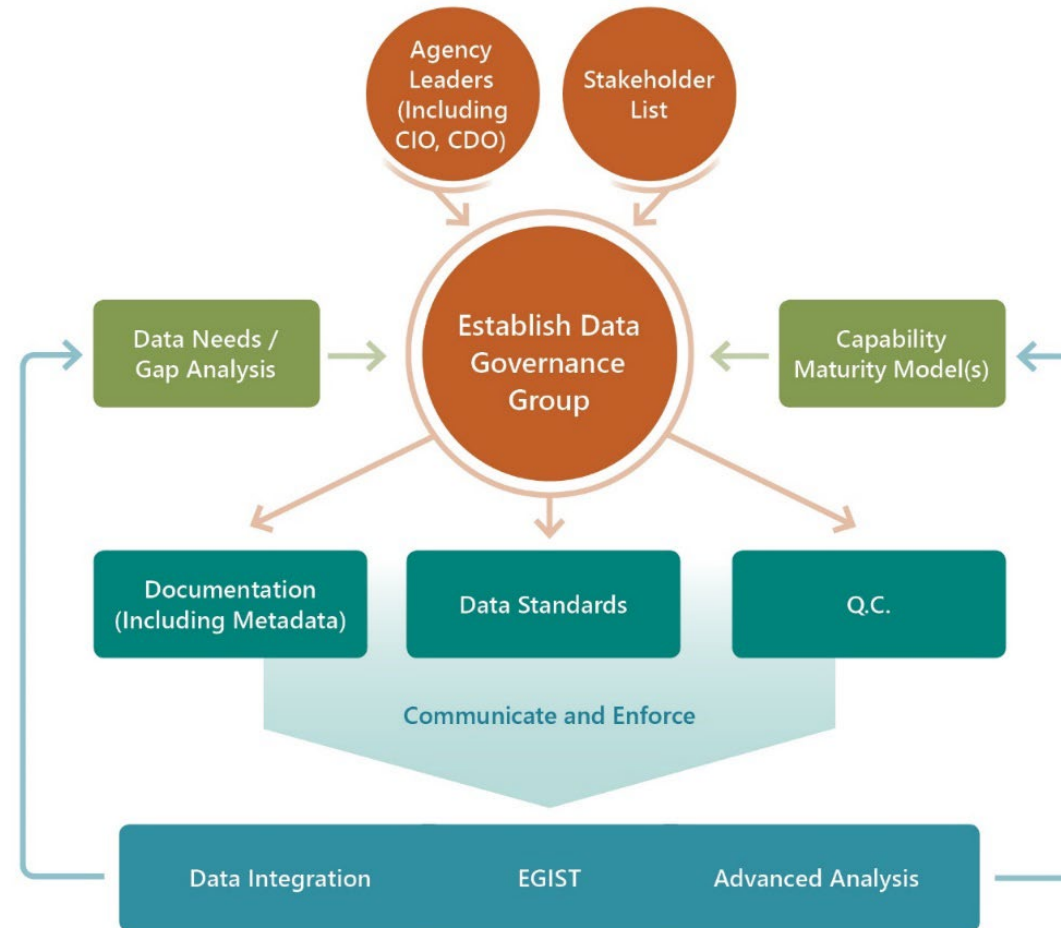


2. Enterprise GIS-T Data Governance and CMM

- What is Data Governance?
- Using Capability Maturity Models and Self-Assessment
- Final Considerations on Data Governance



What is Data Governance?



General Finding

- ⚙️ There are really two user groups that need to be satisfied:
 - Editors who maintain and publish the data (transactional workflow focus);
 - Users who utilize the data in business units (reporting and analysis focus).
- ⚙️ These groups need different data structures and software tools.
- ⚙️ This project targets editors.



What Do Editors Need?

- ⚙️ Transactional data structure.
- ⚙️ Editing software tools.
- ⚙️ Clear definitions and business rules.
- ⚙️ Understanding of data user requirements:
 - Content;
 - Format;
 - Publication schedule.
- ⚙️ Data publication tools.



Our Strategy: Collective Action

- ⚙️ Get editors to agree on:
 - Common business rules;
 - Editing workflows;
 - Data structure;
 - Data publication mechanism.
- ⚙️ Demonstrate best practices for:
 - Data governance;
 - Data management.



Decisions Made to Date

- ⚙️ Functional requirements.
- ⚙️ Common business rules.
- ⚙️ Basic data structure.
- ⚙️ Centerline production methods.
- ⚙️ Temporal support mechanism.
- ⚙️ Managing transportation system evolution.



3. Fundamental Rules and Concepts

- Linear Referencing Fundamentals
- Defined Terms
- Business Rules

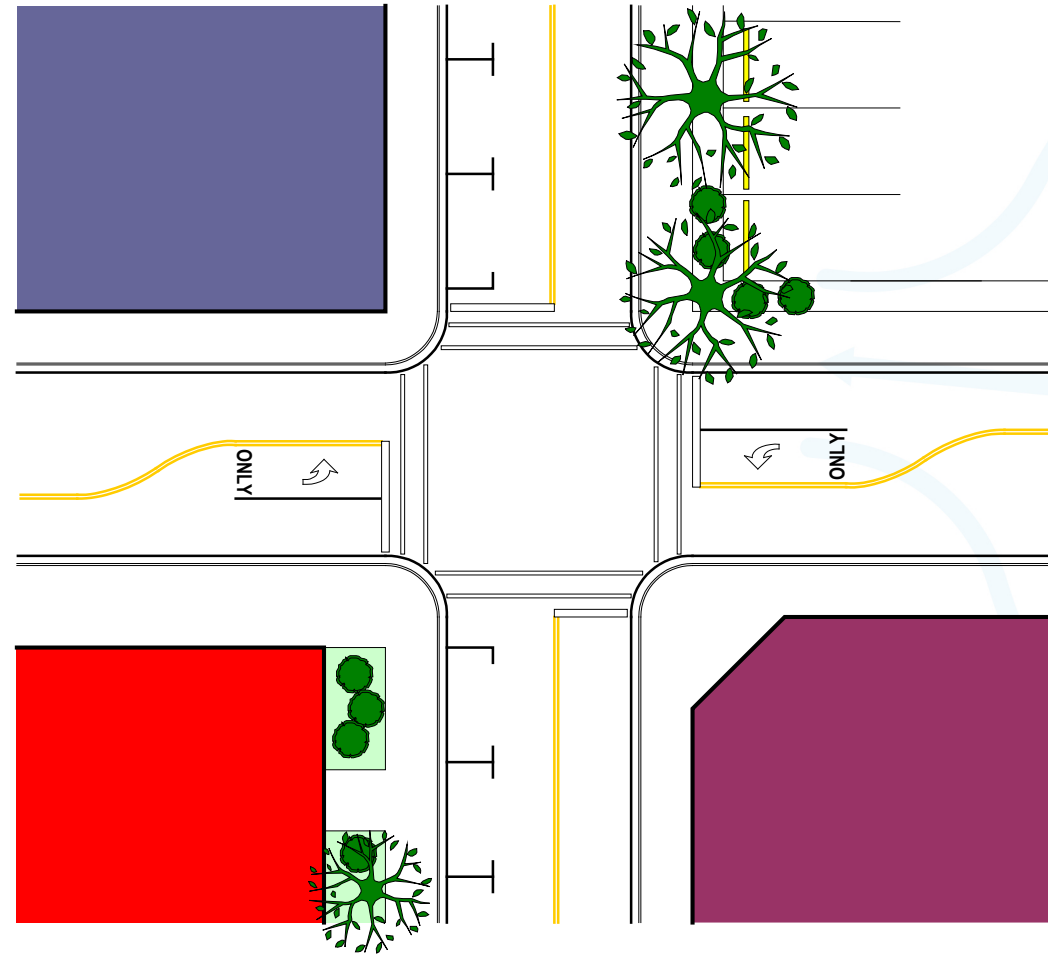


Linear Referencing Fundamentals

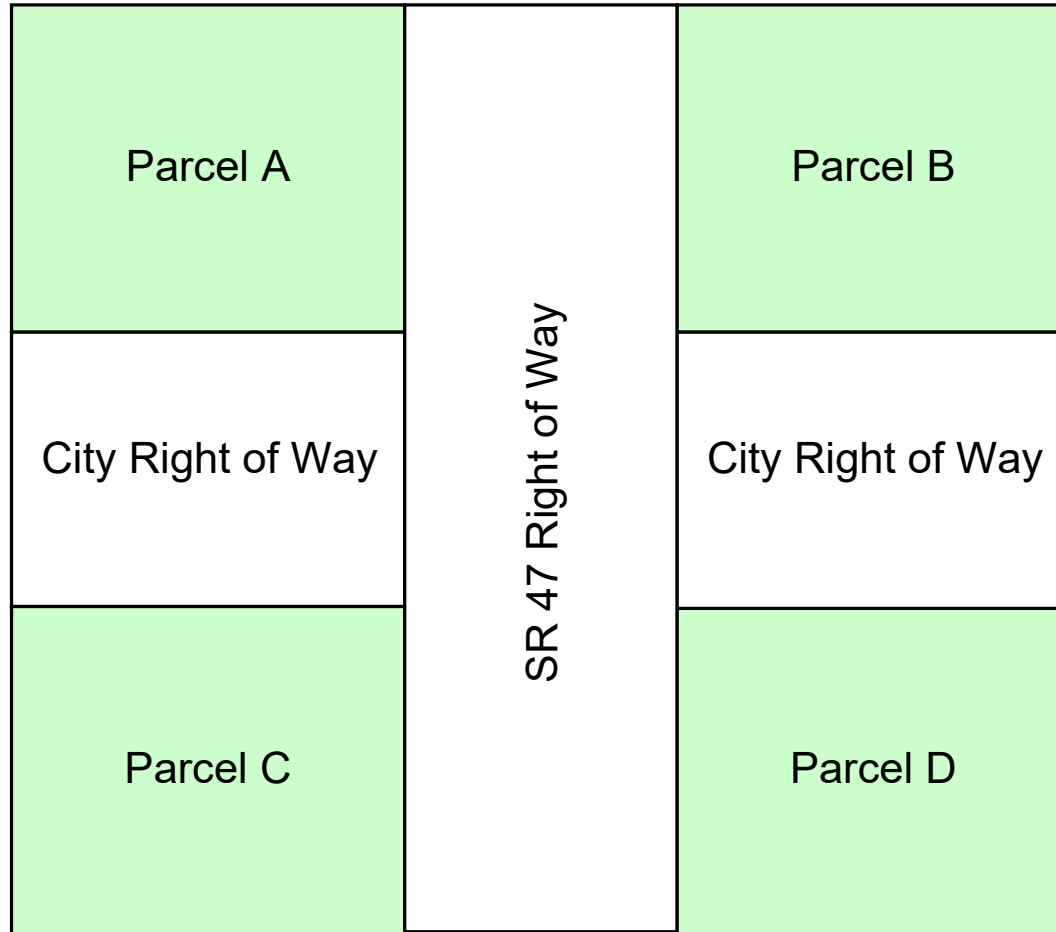
Maps are abstractions of reality intended to express a central idea of set of facts.



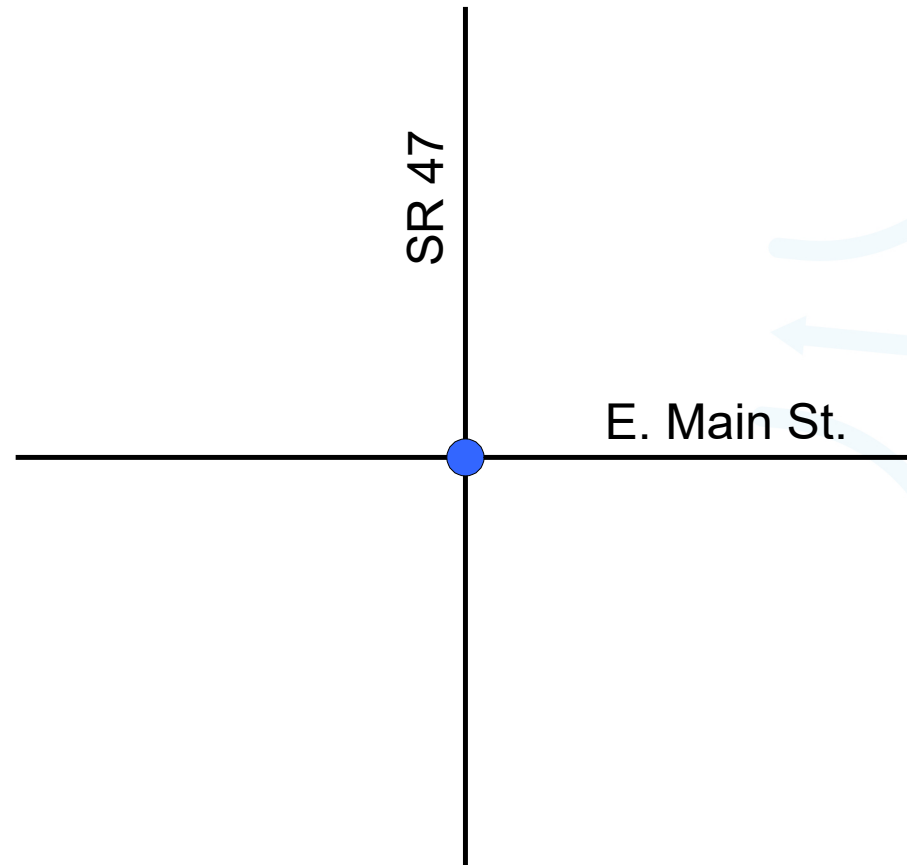
Linear Referencing Fundamentals



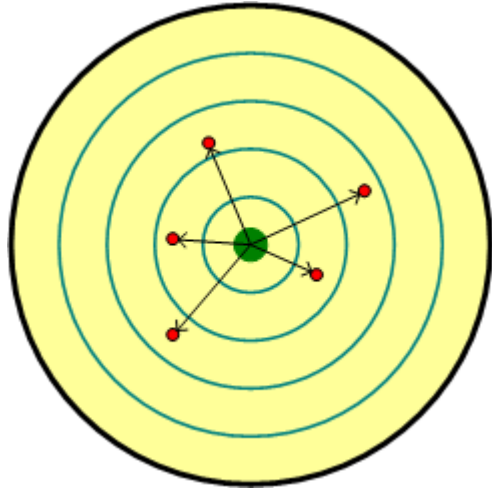
Linear Referencing Fundamentals



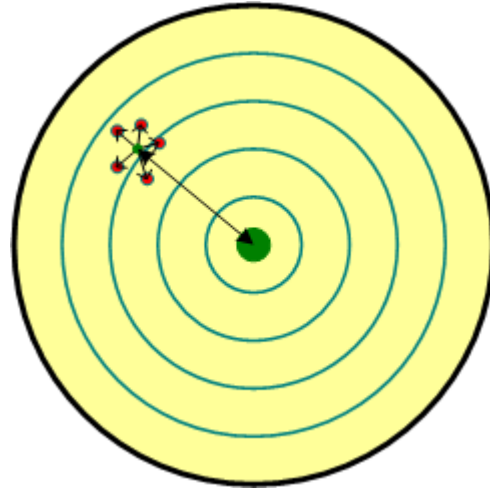
Linear Referencing Fundamentals



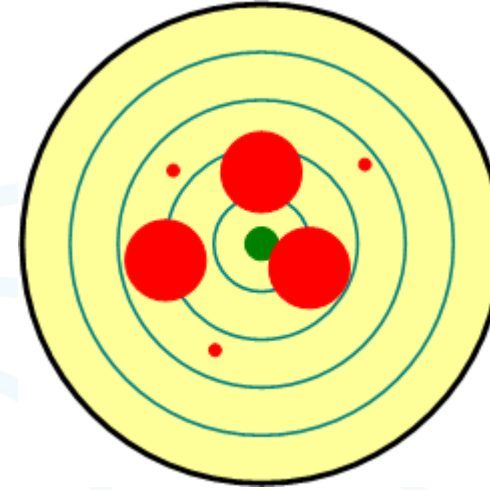
Defined Terms



Accuracy



Precision



Resolution

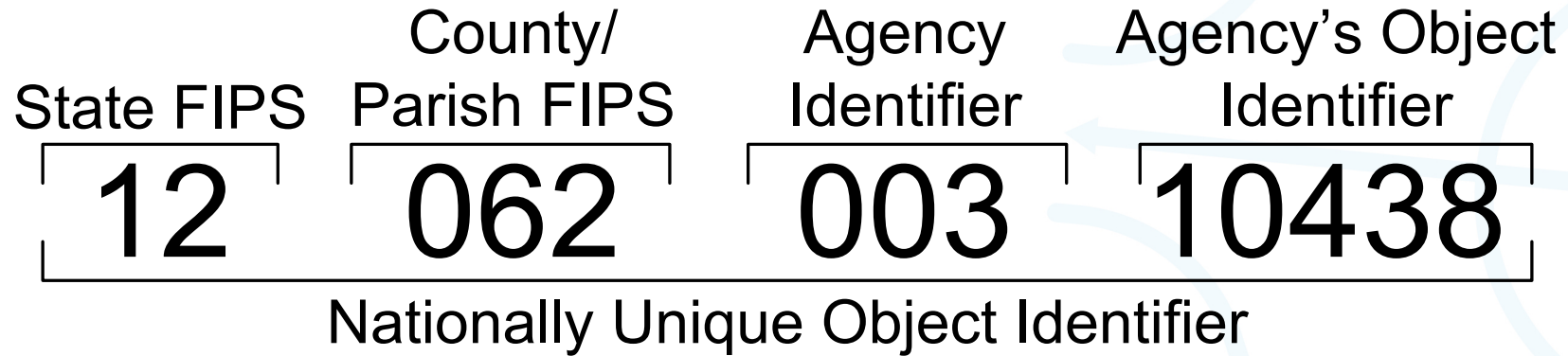


Business Rules

- ❁ LRM foundation.
- ❁ Record-level metadata to support edit history and provide temporal management of transportation system.
- ❁ Intersections are singularities in the LRS but complex objects in the map.
- ❁ Data is to be edited using inventory routes and published using named routes.



Business Rules



4. Fundamentals of NRBM Standard

- Base Concepts of Temporal Databases
- Route Segment, Intersection, and Terminus
- Inventory Routes and Linear Referencing
- Elements



Concepts of Temporal Databases

⚙️ Space:

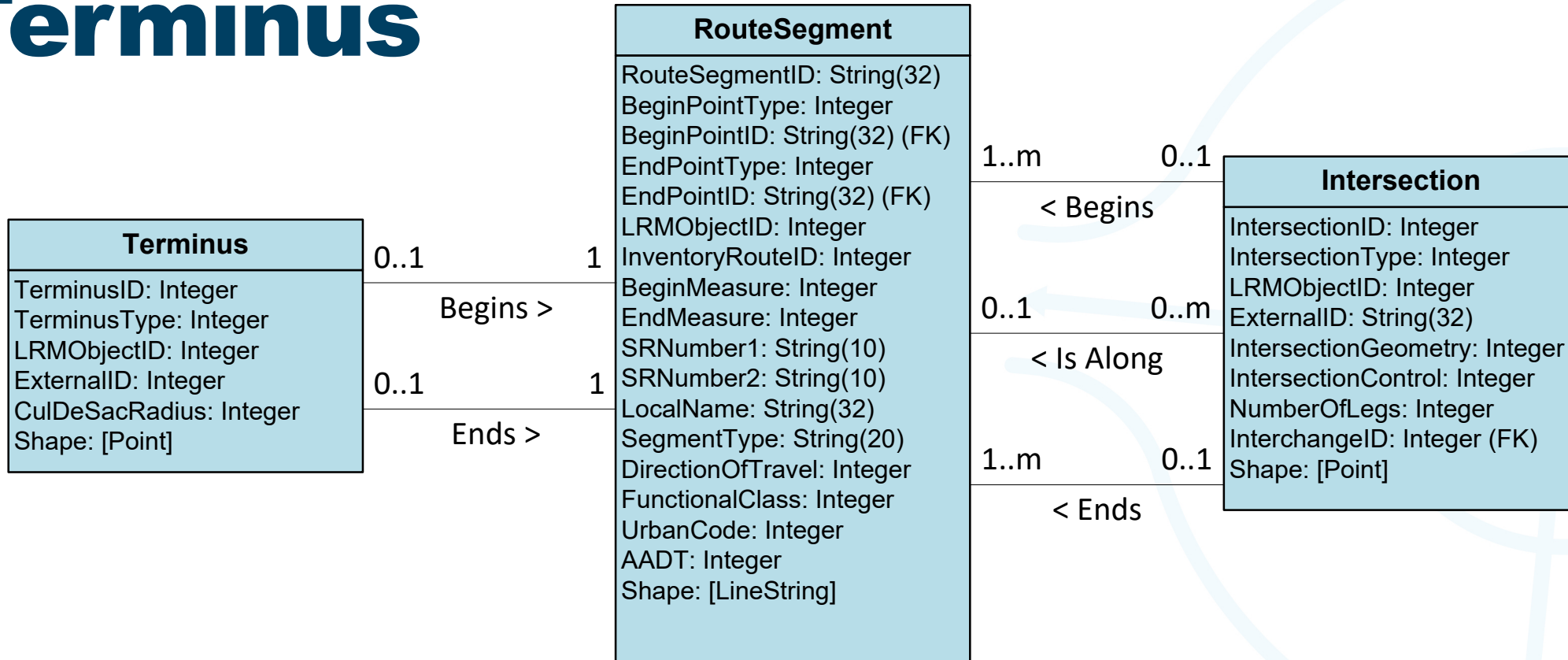
- Where along a linear facility;
- Where on the Earth;
- Relationships of elements to facilities.

⚙️ Time:

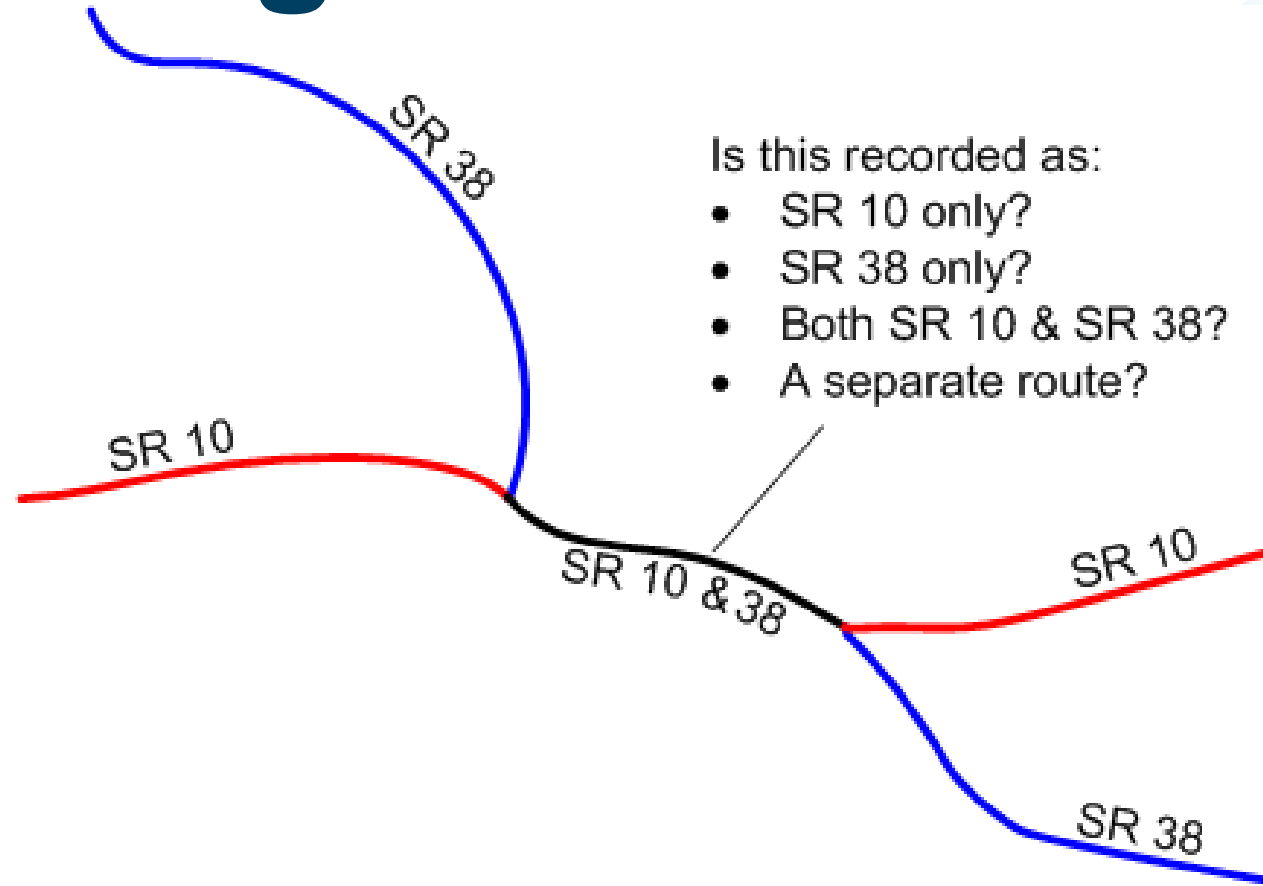
- When it was like that;
- When the data were compiled;
- Who did it and why.



Route Segment, Intersection, and Terminus



Inventory Routes and Linear Referencing

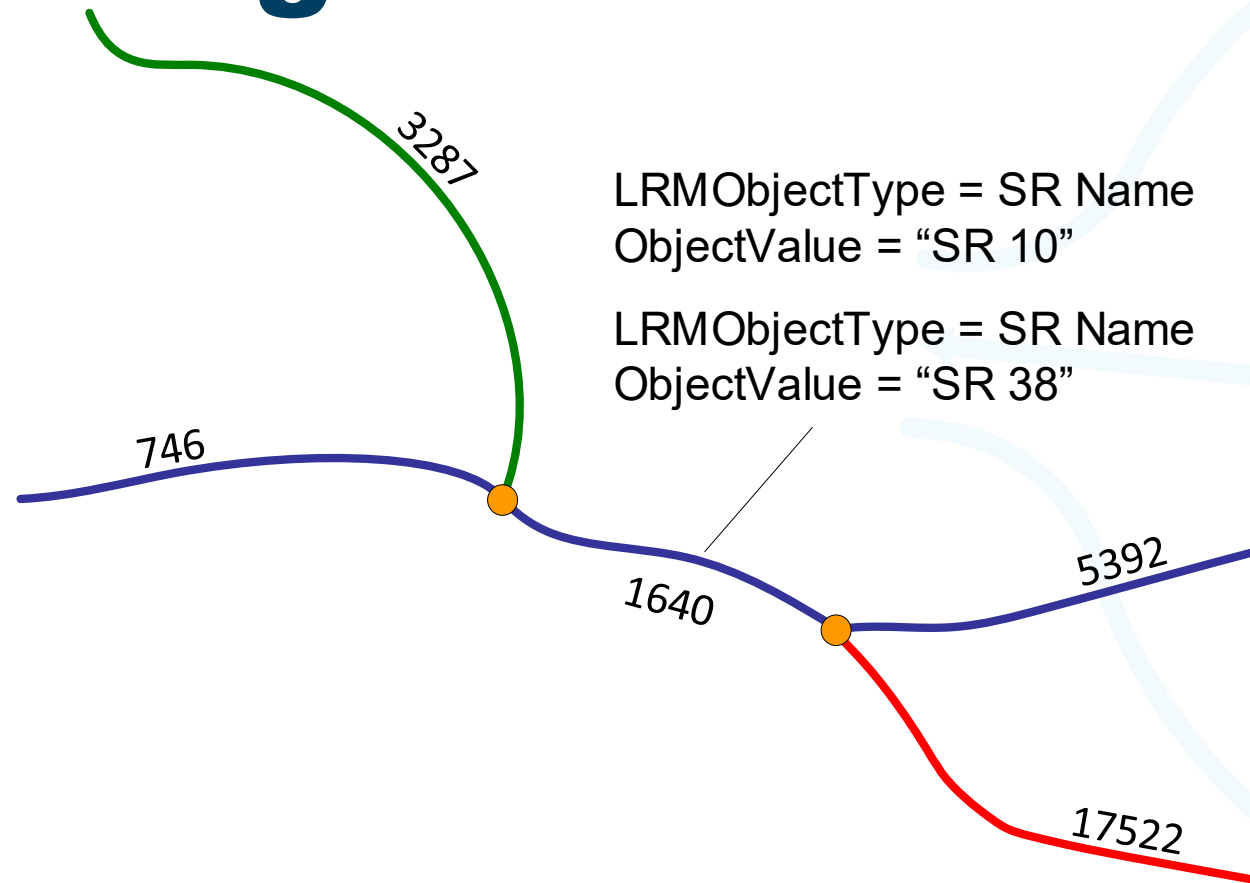


Is this recorded as:

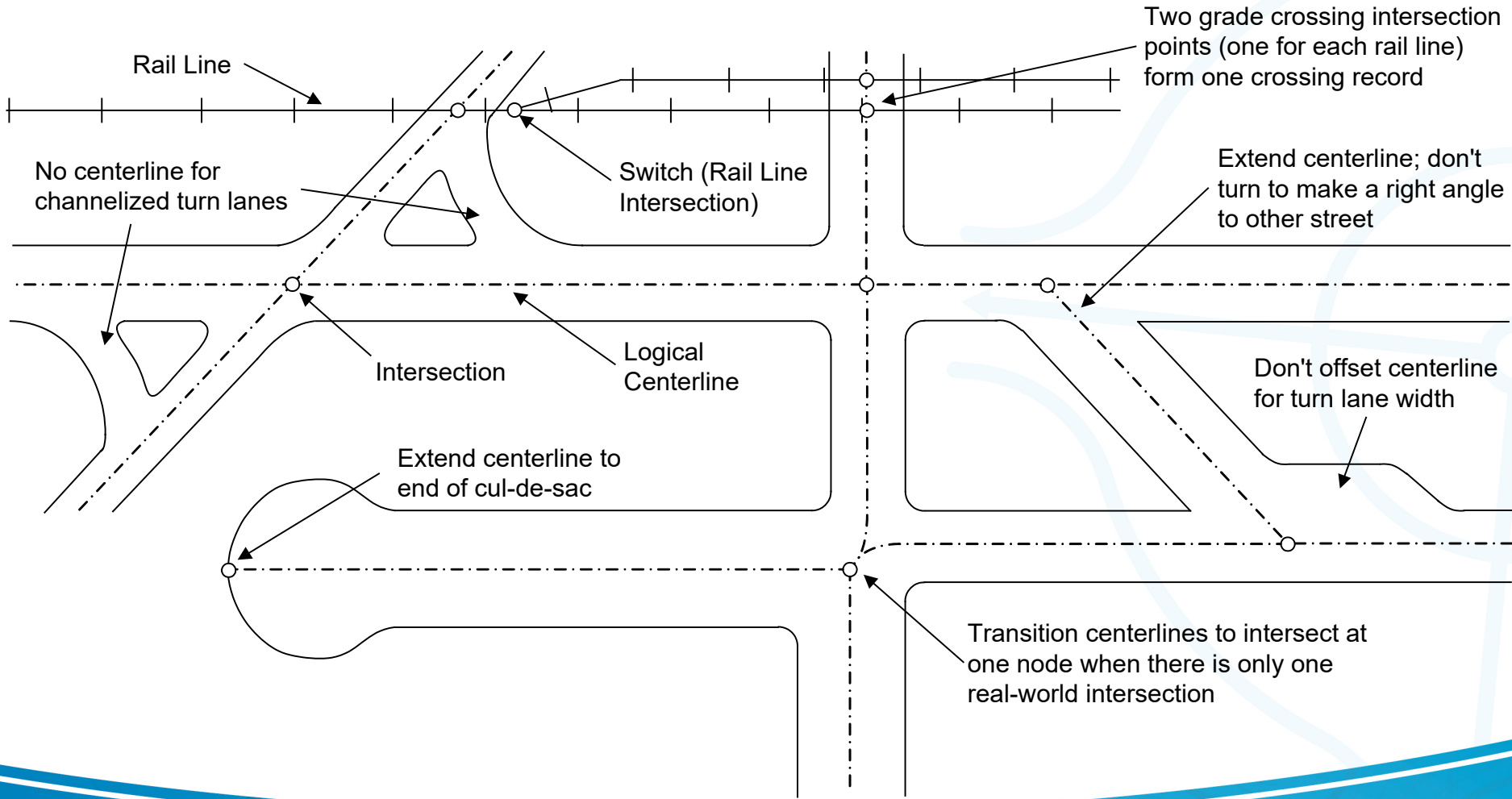
- SR 10 only?
- SR 38 only?
- Both SR 10 & SR 38?
- A separate route?



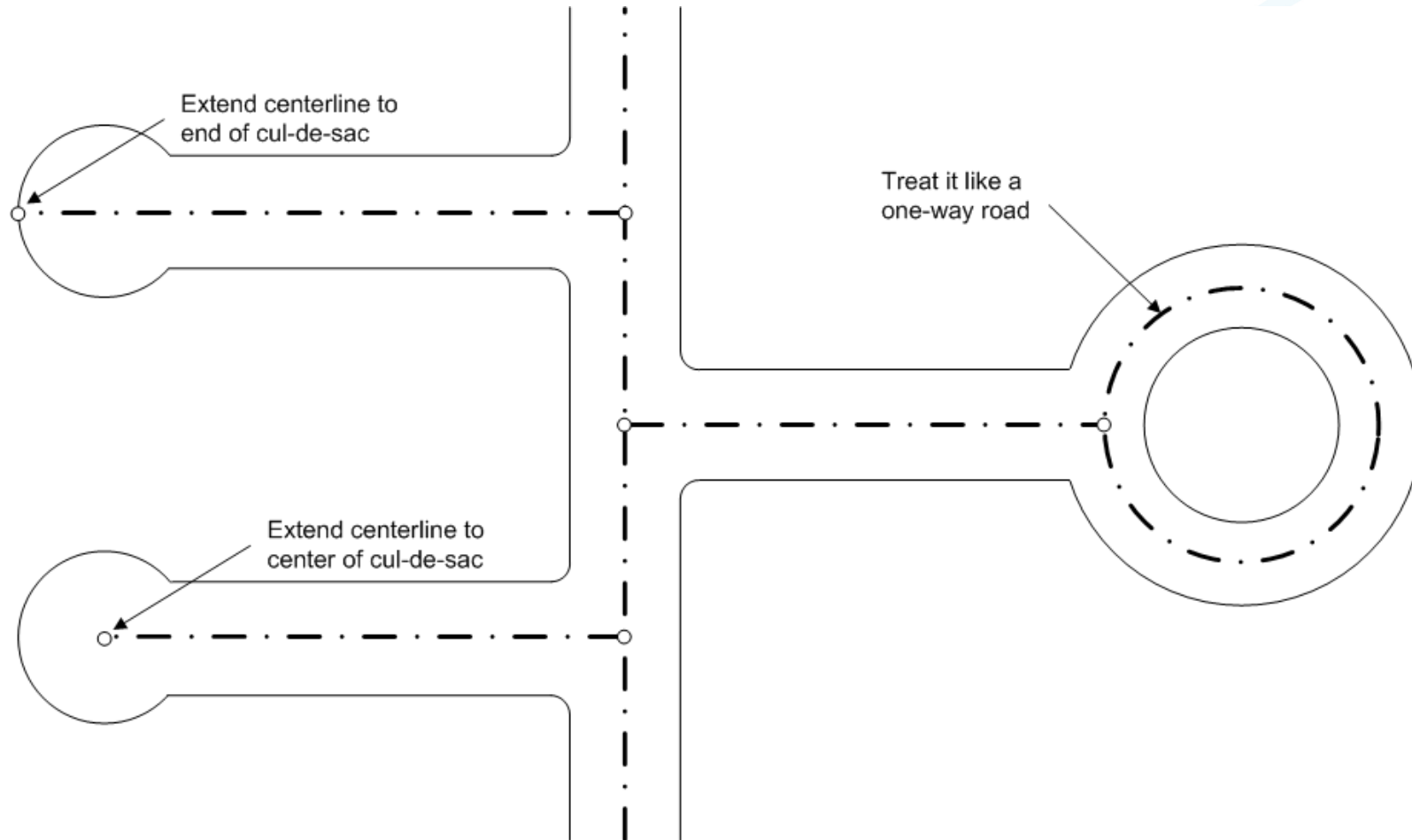
Inventory Routes and Linear Referencing



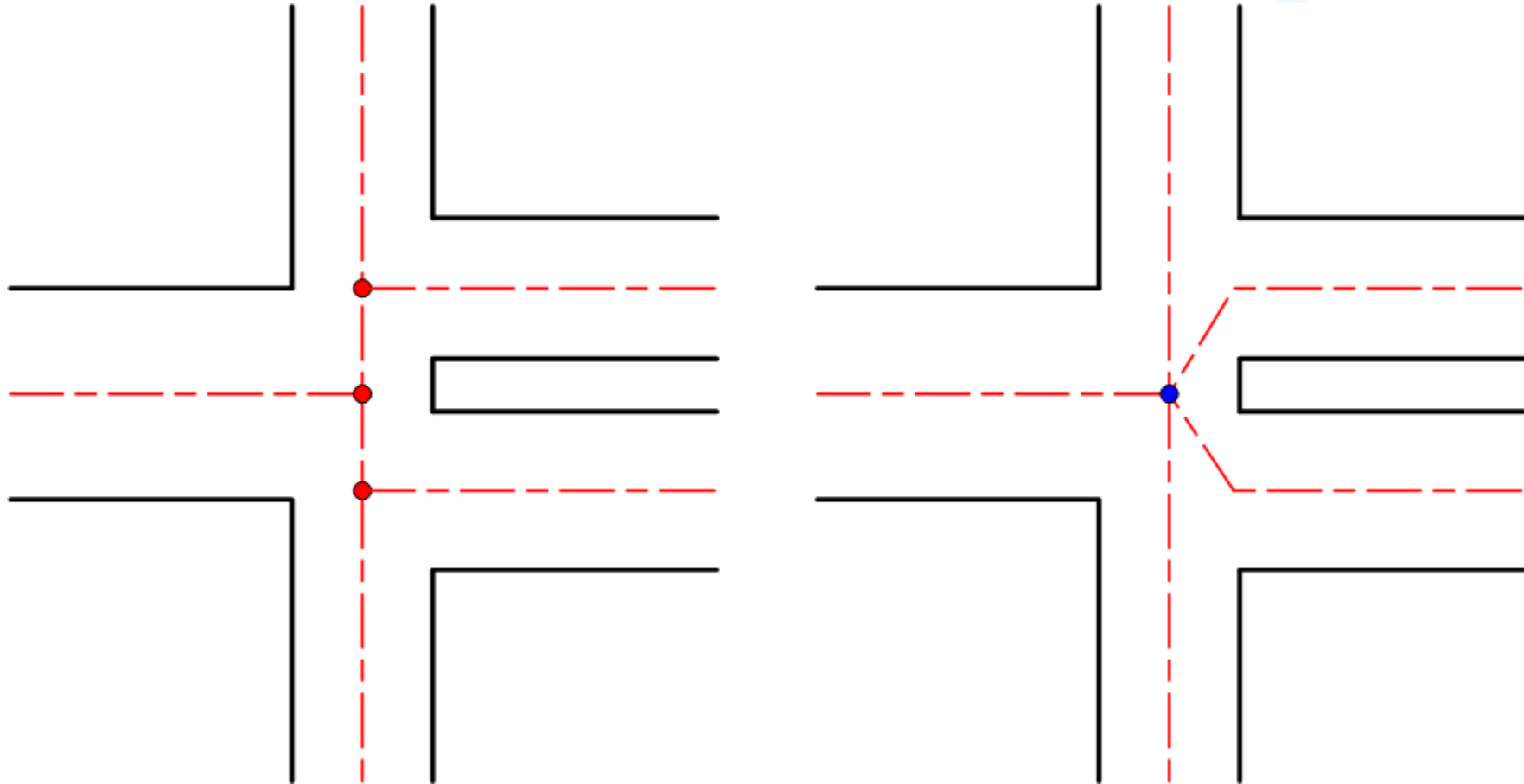
Elements



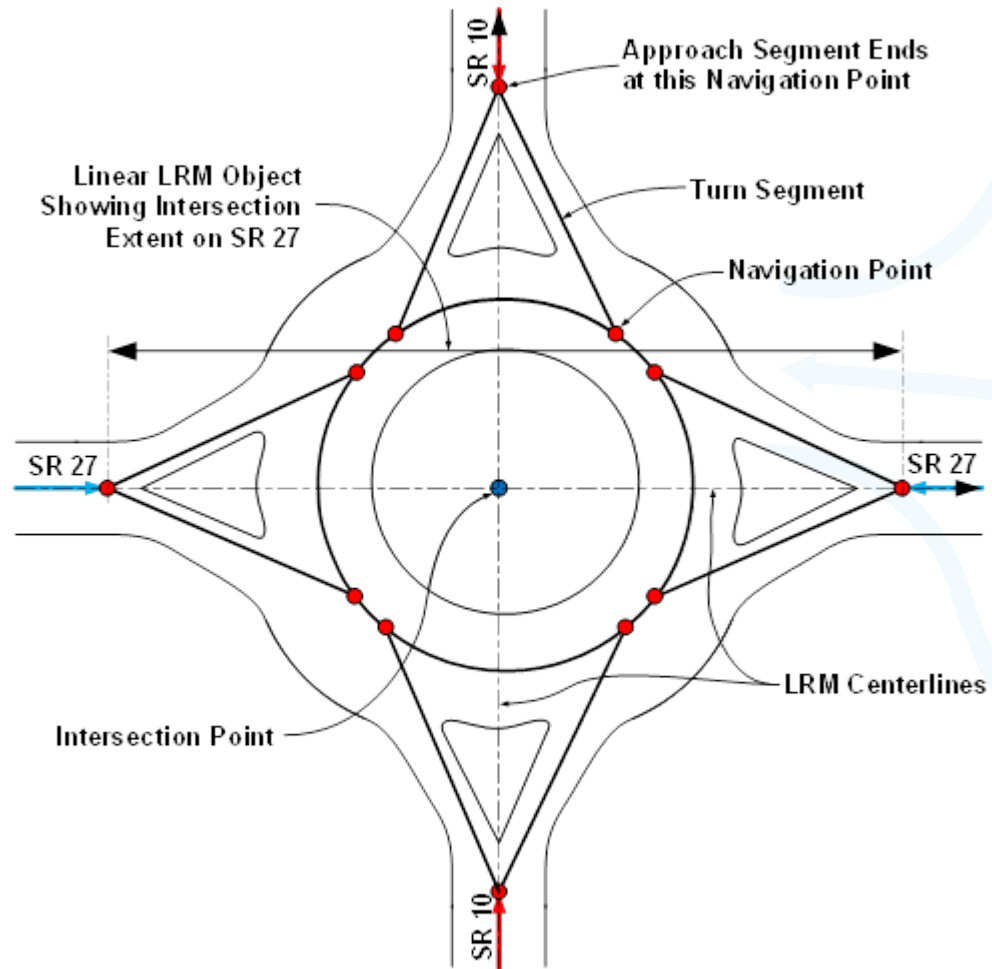
How Do You *Cul de Sac*?



How Many Intersections?



1 Roundabout = m Intersections?



The Transportation Map World

- ⚙️ Two core features exist:
 - Nodes = Intersections;
 - Edges = Segments (connections) between intersections.
- ⚙️ LRM route consists of an ordered set of edges.
- ⚙️ Midblock route changes will require insertion of a continuity intersection node.



5. The NRBM Standard

- Basic Requirements
- Data Dictionary
- LRS Database Standard
- Remaining Work



Basic Requirements

- ⚙️ Characteristic (attribute):
 - “Office” types, such as functional classification, speed limit, jurisdiction;
 - “Field” or “Observable” types, such as pavement type, shoulder width, number of lanes.
- ⚙️ Element (component); e.g., signs, bridges, guardrail.
- ⚙️ Elements are likely to be included in separate business tables and need their own geometry:
 - LRM instance record says where and what it is;
 - Element record has more descriptive information.
- ⚙️ “Real” events (things that happen); e.g., projects, crashes, traffic counting locations.



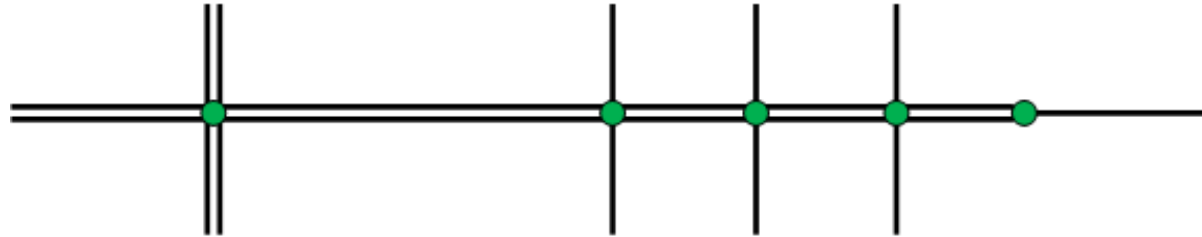
Mapping Scale

- ❖ 1:5,000 is too small for carriageways and intersection mapping.
- ❖ 1:1,200 should be the TFTN minimum scale to allow detail and intersection “space.”
- ❖ Intersections should be scale-independent.
- ❖ TFTN is a national map for detailed local analysis:
 - *National* is the geographic extent;
 - *Project-level* is the application.
- ❖ All States are doing large-scale mapping.



Scale Issues

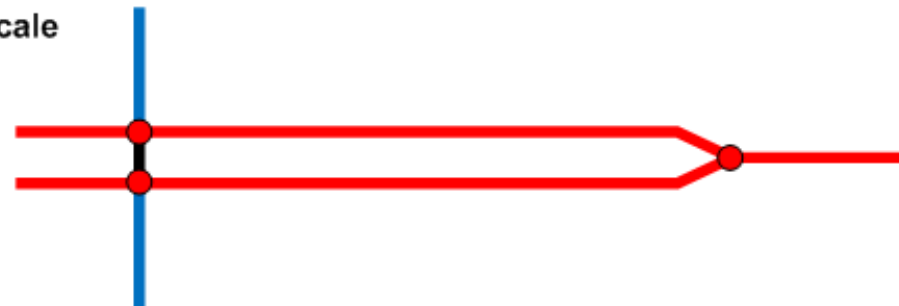
1:5,000 Scale



1:10,000 Scale



1:1,200 Scale

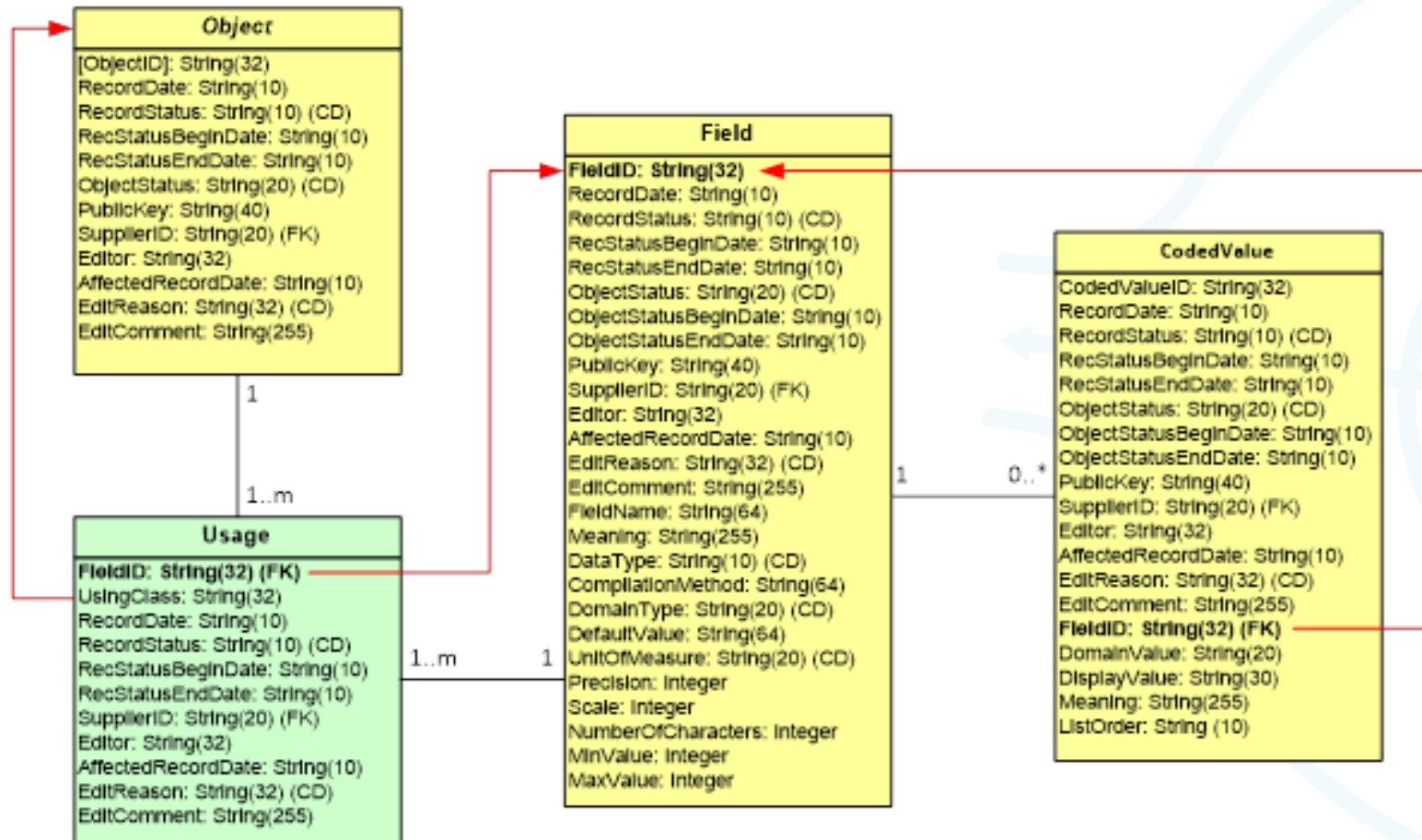


Proposed Standards

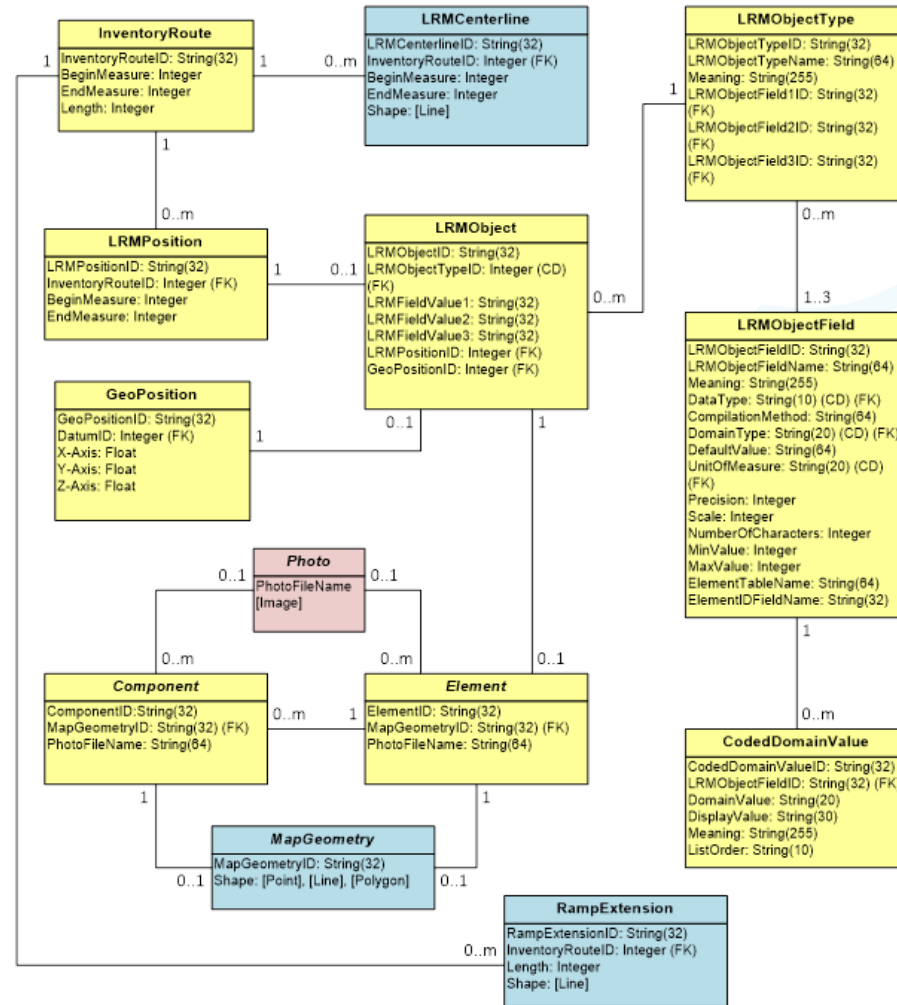
- ⚙️ Measure Resolution = 0.001 mile.
- ⚙️ Measures to be stated in integer M units:
 - 1 M = 0.001 mile.
- ⚙️ Accuracy =
 - ± 158 feet (30 M) in urban areas;
 - ± 264 feet (50 M) in rural areas.
- ⚙️ Precision = 95% of LRM positions meet accuracy standard.



Data Dictionary



LRS Database Standard



Current Status

ARNOLD Refinements

Common Business Rules Adopted

Map and Data Structures Emerge



Transportation Pooled Fund 1464

- ⚙ Applications of Enterprise GIS for Transportation, Guidance for a National Transportation Framework (AEGIST)
- ⚙ Partners: CA, CT, FHWA, GDOT, ID, TN



Questions

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Systems Planning & Analysis Team

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📧:: Joseph.Hausman@dot.gov

✉:: 1200 New Jersey Avenue SE, Washington, DC 20590



Patrick Whiteford (ADOT)12:57

please unmute

Alex Carter12:58

Yes

FDOT12:58

Yes

Patrick Whiteford (ADOT)12:58

we can hear you

Patrick12:59

We can hear you , but it sounds like you are outside in the wind

Patrick Whiteford (ADOT)13:00

I think I was muted from the meeting lead

Patrick Whiteford (ADOT)13:00

no

Patrick Whiteford (ADOT)13:01

is Kevin control the meeting?

Kyle G13:06

FRA Crossing Inventory too

Kyle G13:08

what did NRBM stand for?

Patrick13:09

Is draft of the AEGIST guidebook available?

Al Butler13:11

NRBM is the national roadway base map

Al Butler13:12

draft is going through final editing now

Kyle G13:14

Is NRBM similar to or the same as NTAD as in the BTS National Transportation Atlas Database

Kyle G13:15

?

Joseph Hausman13:15

part of it

Kyle G13:34

I'm interested in how others apply functional classification to roundabouts involving two funcclass codes

Patrick13:36

FDOT13:46

Accuracy standards between urban and rural areas is one of the legacy policy guidances utilized for FDOT's data and we are trying to get away from. We have found issues coordinating those levels of details in the data with those data standards because it leads to inconsistent statewide data collection business analysis functions. Florida has a wide mix of urban and rural areas and is seeing

almost 300K people move to the state so we have seen a lot of change and growth and as we provide more transportation assets in the state to manage that, we may be more complex than the recommended standards.

Kyle G13:49

same here as in FDOT

Kyle G13:49

basically our accuracy, precision, resolution, and operational standards minimums are all getting more detailed

NCDOT 13:50

NC agrees, it's better to collect a finer detail so you don't play catch up when urban areas expand

Kyle G13:51

highest level would go all around is what we should probably do

Kyle G13:52

for fun class

Kyle G13:53

an example of what I mean regarding operational standards would have to do with minimum lengths for thru lanes and median channels for urban vs rural

FDOT13:55

The guidelines may want to look at meeting the accuracy standards BIM and CIM may require. It's expected there would be a fine level of detail required.

Kyle G13:57

clearly