

Colorado Dept. of Transportation (CDOT)'s Geodatabase Migration Project

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Three Portions of Today's Presentation

✦ The Migration Project – Goals & Stages

✦ The Data Model – Logical and Physical Design

✦ **Broader Applicability,
Evaluation, and Future**

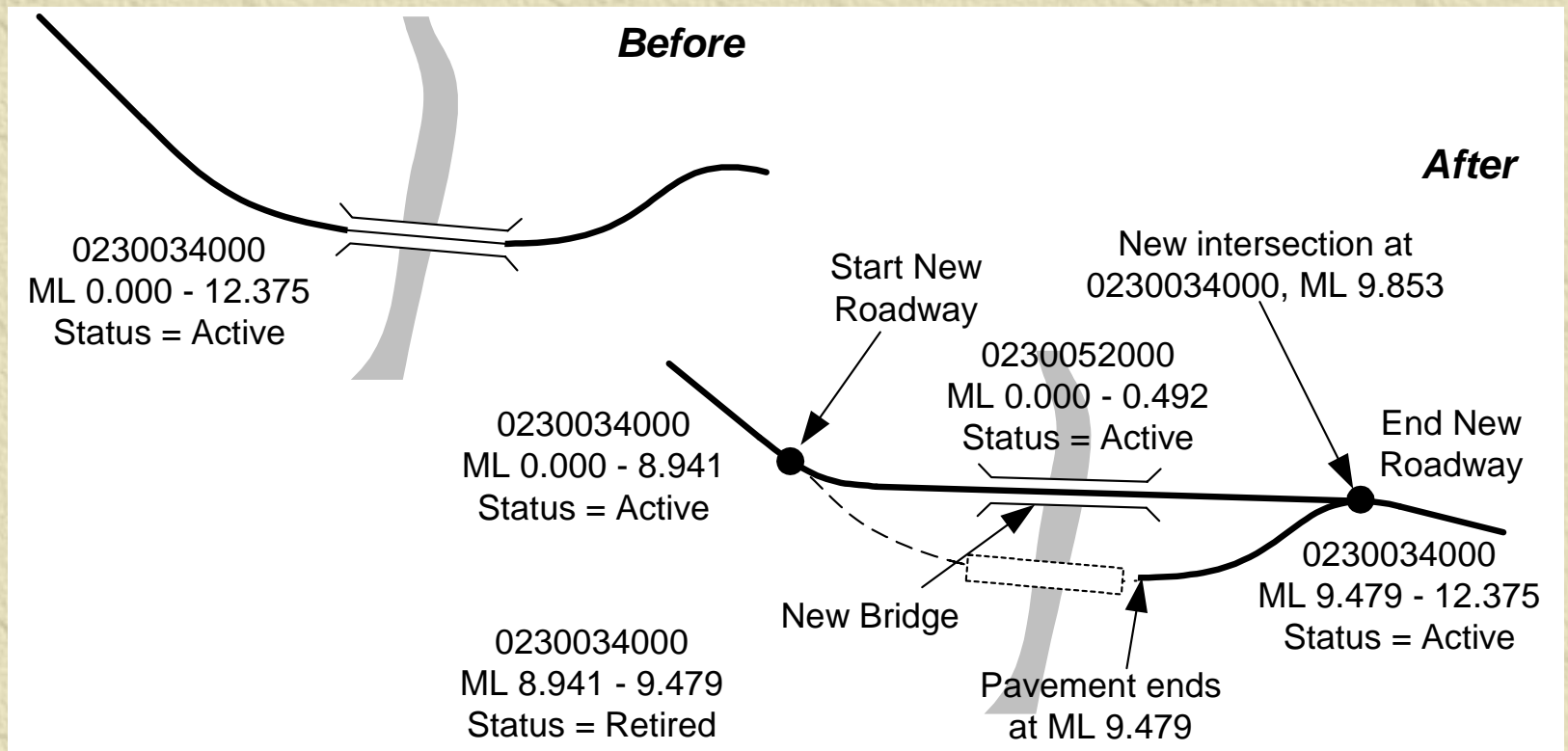
Business Rules 1

- ✦ History is never deleted
- ✦ Strong control over entered values
- ✦ Real world facility “owns” object class
- ✦ Object class “owns” feature classes
- ✦ Multiple geometric representations
- ✦ Multiple segmentation schemes

Business Rules 2

- ✦ Multiple measurement resolutions
- ✦ Multiple atomicity
- ✦ Multimodal support
- ✦ Linear datum support
- ✦ Distinction between development (editing) and production (publication) databases and hardware

Evolving Facilities



History Preserved

- ✦ Date record was written (PK)
- ✦ Who entered the record
- ✦ Date information was collected
- ✦ Date values became valid
- ✦ Date values stopped being valid (status changes to retired)
- ✦ Current value has status = Active

LinearEvent
<u>roadwayID</u>
<u>linearEventID</u>
<u>linearEventDate</u>
enteredBy
collectionDate
fromDate
toDate
fromMeasure
toMeasure
side
length
offsetReferent
lateralOffset
offsetDirection
directionOfTravel
eventType
primaryValue
secondaryValue
status

Multiple Attributes

- ✦ Stores two attribute values
- ✦ Permits related and alternative entries
 - ◆ Pavement type and width
 - ◆ Shoulder type and width
 - ◆ Old coded value and new coded value
- ✦ String fields sized to accept longest possible value

LinearEvent

roadwayID

linearEventID

linearEventDate

enteredBy

collectionDate

fromDate

toDate

fromMeasure

toMeasure

side

length

offsetReferent

lateralOffset

offsetDirection

directionOfTravel

eventType

primaryValue

secondaryValue

status

Event Types

Use if coded value domain

ValueDomain
<u>eventTypeID</u>
<u>valueDomainID</u>
<u>valueDomainDate</u>
enteredBy
fromDate
toDate
domainValue
displayValue
equivalentDomainValue
equivalentDisplayValue
meaning
listOrder
status

0..*

EventType
<u>eventTypeID</u>
<u>eventTypeDate</u>
enteredBy
fromDate
toDate
eventType
displayValue
meaning
compilationMethod
listOrder
primaryDomainType
primaryDefaultValue
primaryUnitOfMeasure
primaryNumberOfCharacters
primaryNumberOfDecimals
primaryMinValue
primaryMaxValue
primaryDomainSource
secondaryDomainType
secondaryDefaultValue
secondaryUnitOfMeasure
secondaryNumberOfCharacters
secondaryNumberOfDecimals
secondaryMinValue
secondaryMaxValue
secondaryDomainSource
status

Location Detail

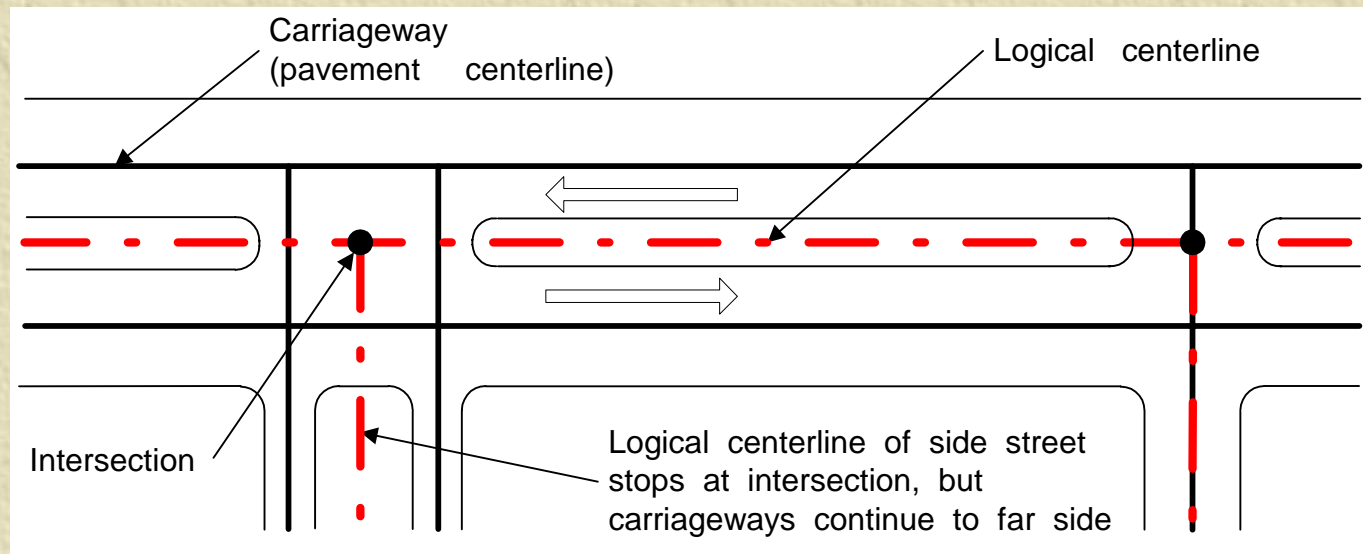
- ✦ Which roadway
- ✦ Location along roadway
- ✦ Location across roadway
- ✦ Applicable direction
- ✦ Precise length of event

LinearEvent
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<u>linearEventID</u>
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toMeasure
side
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lateralOffset
offsetDirection
directionOfTravel
length
eventType
primaryValue
secondaryValue
status

Roadway Representations

✦ Centerline (logical)

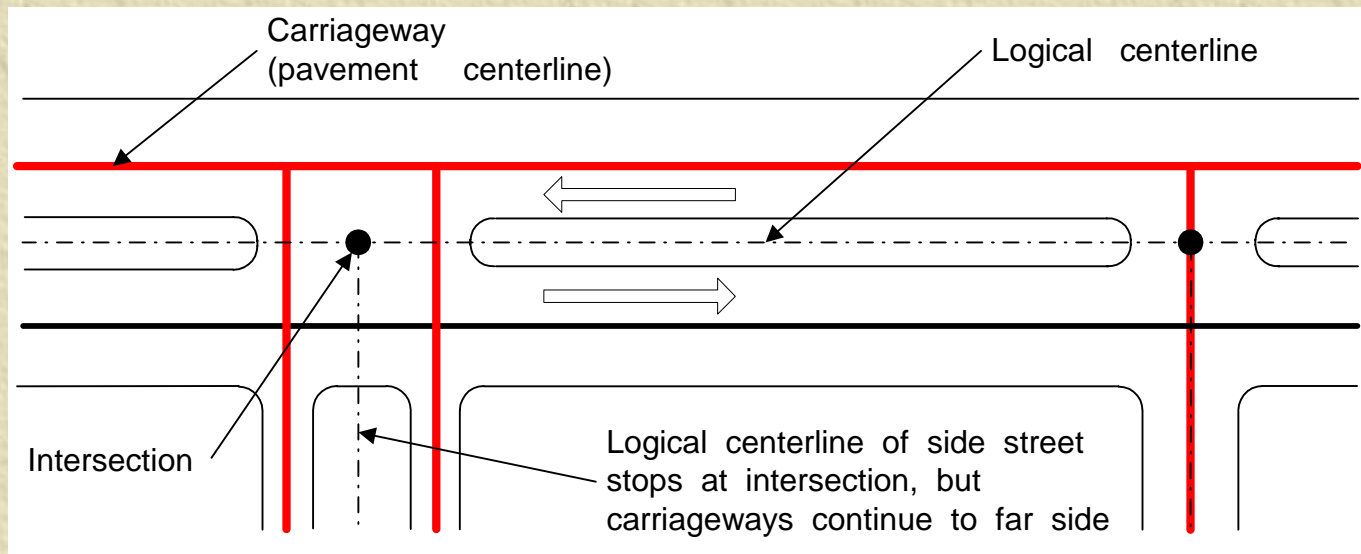
✦ Supports dynamic segmentation



Roadway Representations

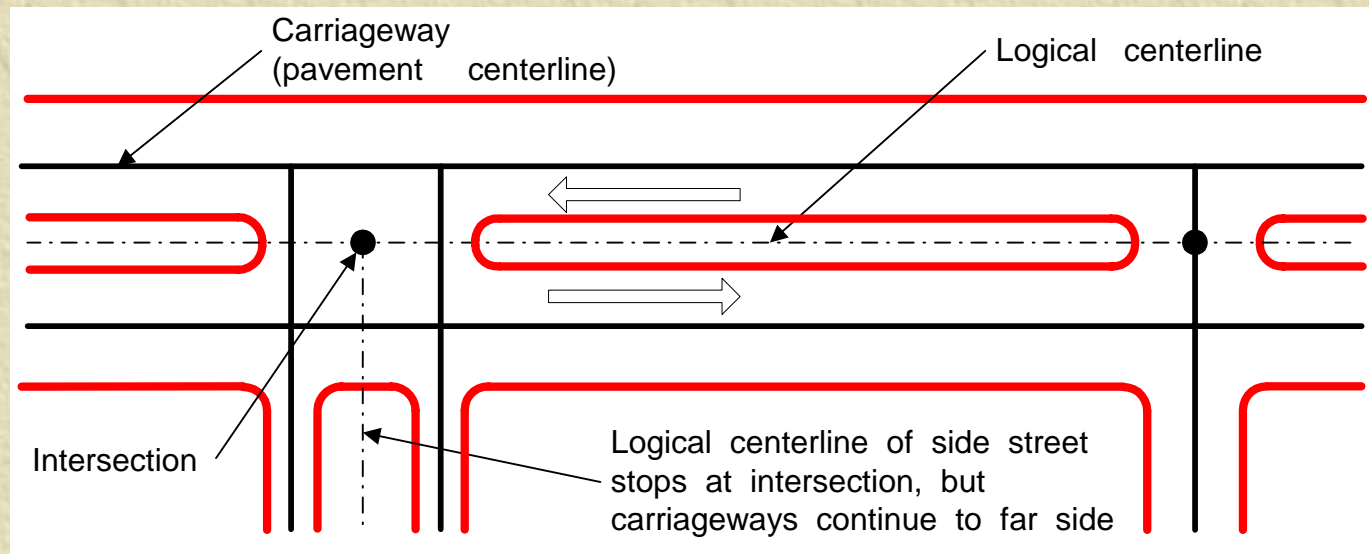
✦ Carriageway (physical)

✦ Supports dynamic segmentation

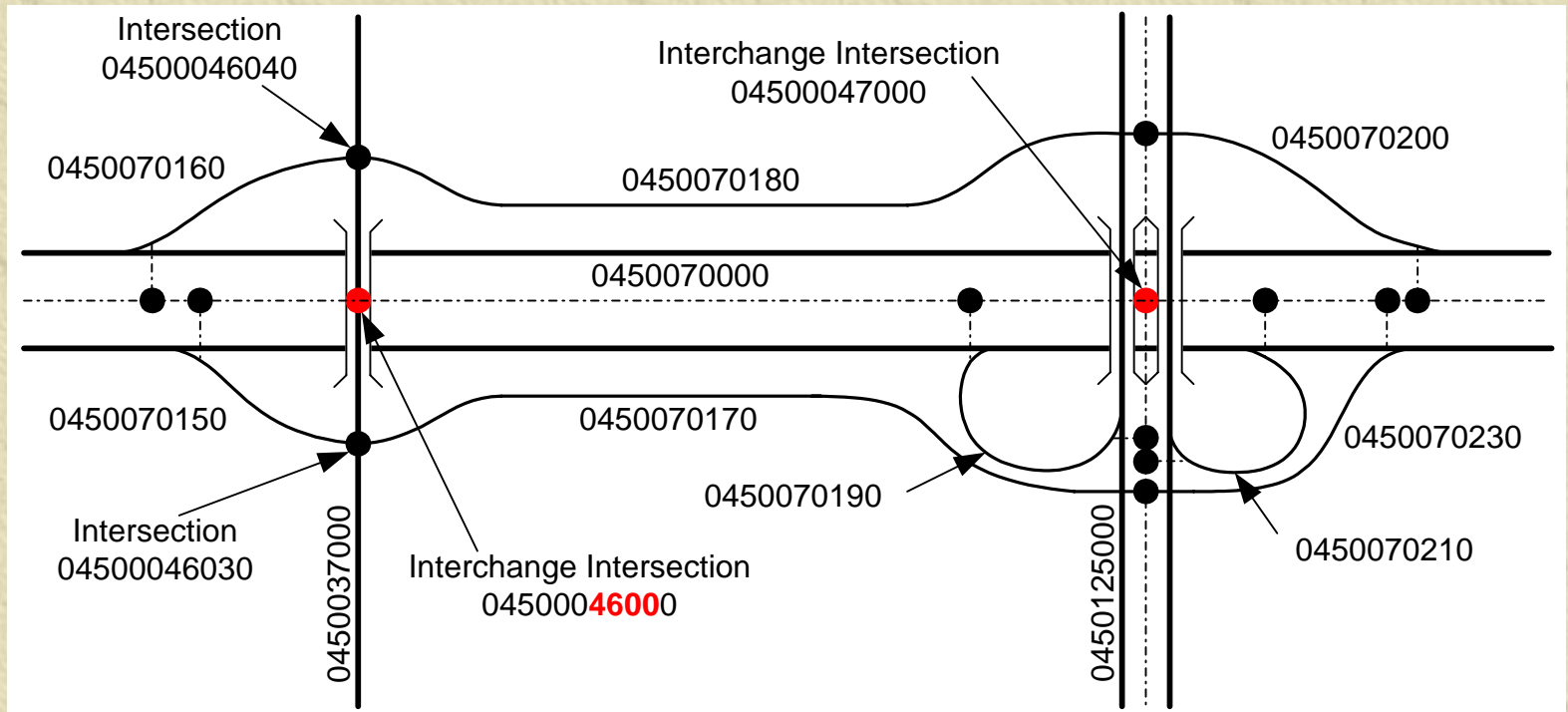


Roadway Representations

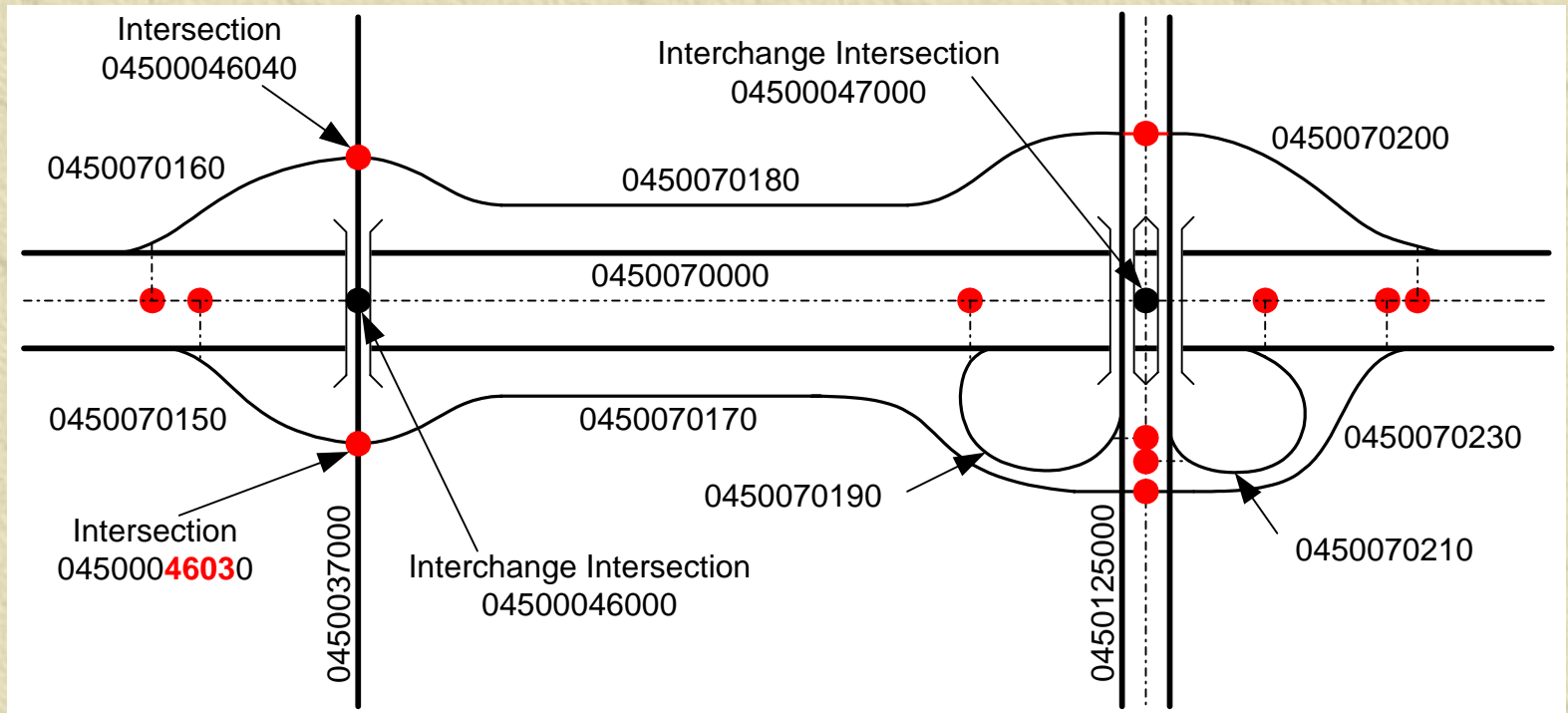
- ✦ Edge line (local physical)
- ✦ Does not support dynamic segmentation
- ✦ Distinct “ancillary” roadways



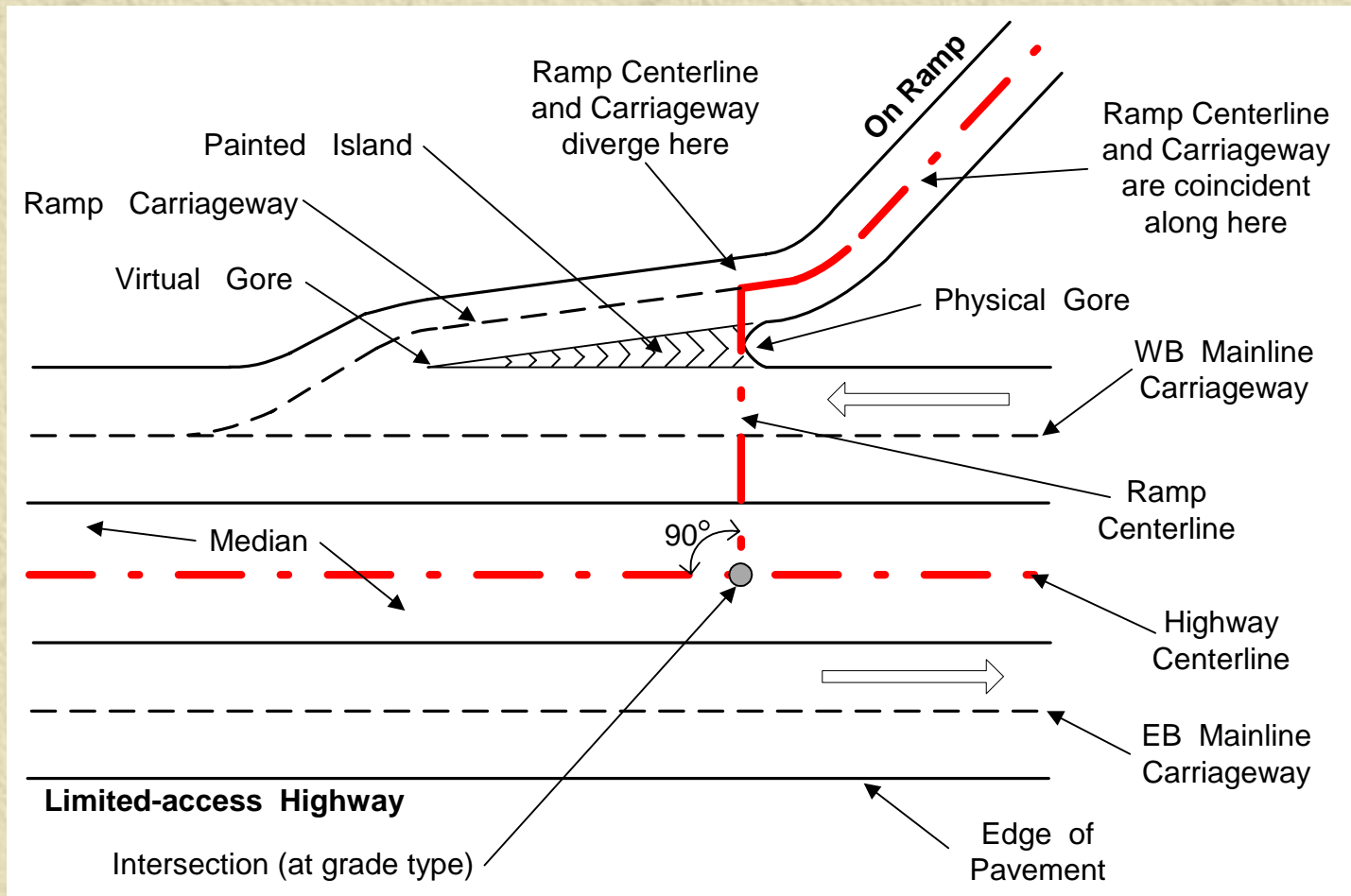
Interchange Representations



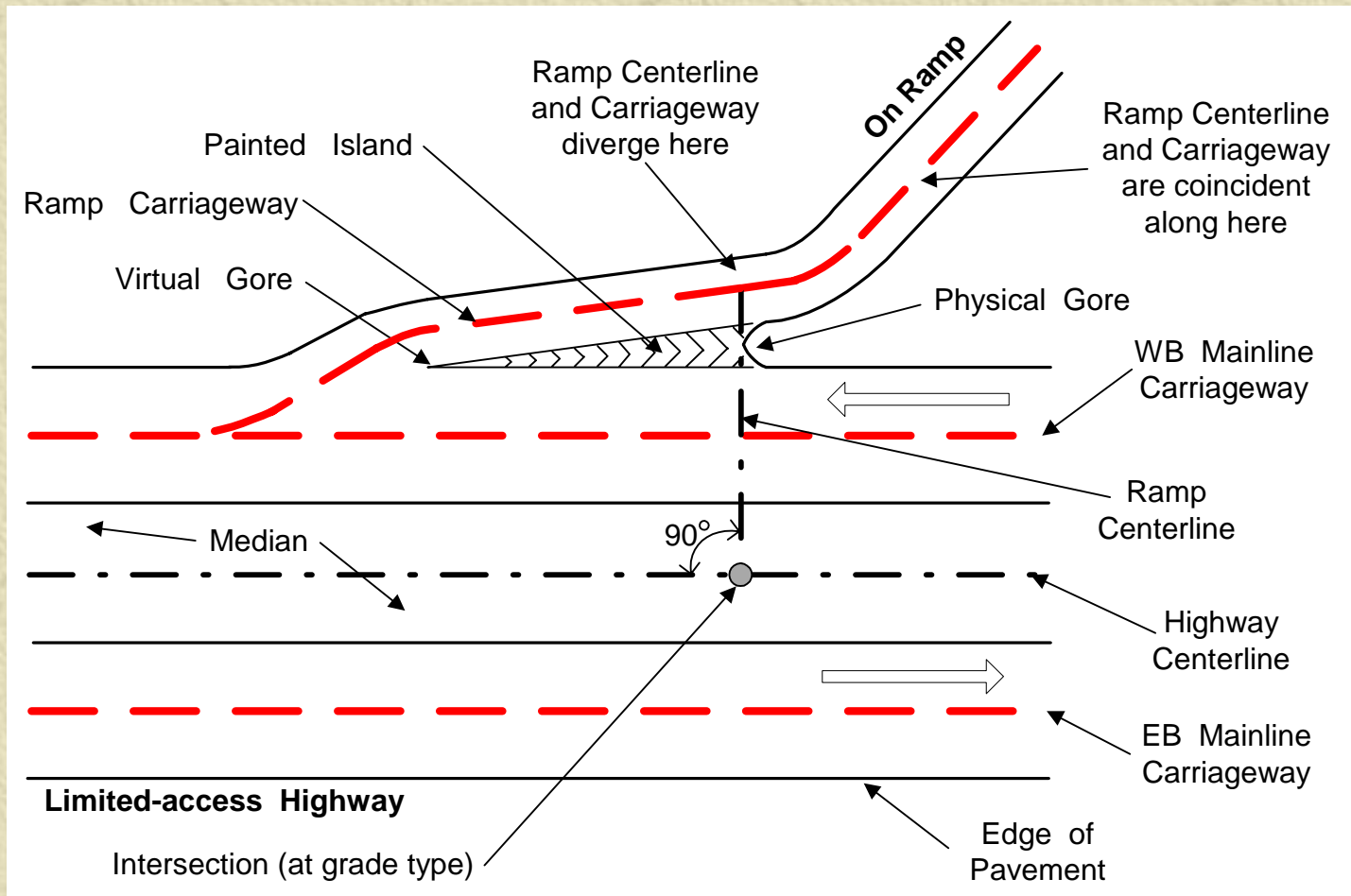
Interchange Representations



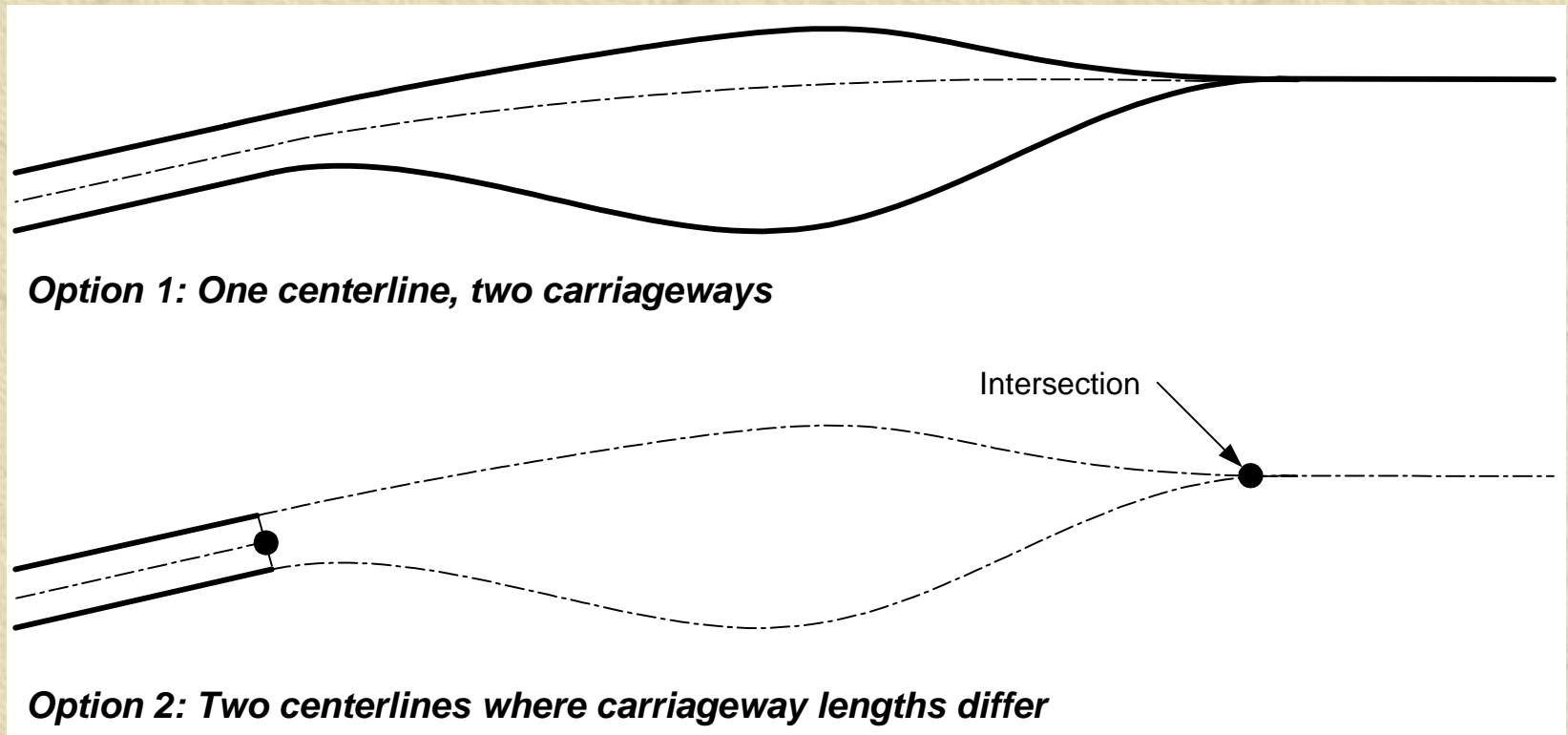
Centerlines & Carriageways



Centerlines & Carriageways



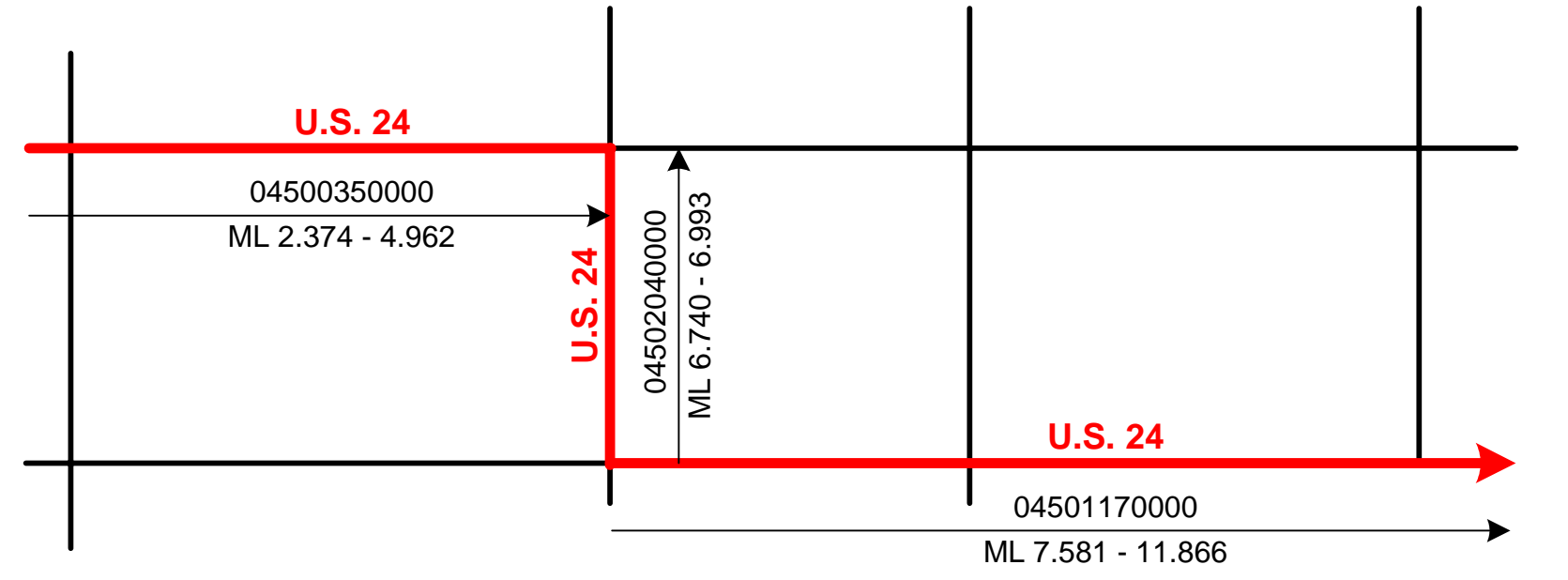
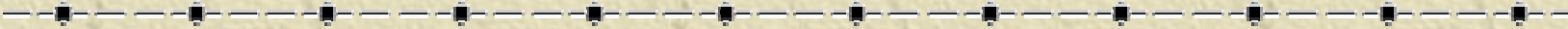
Two Roadways or One?



Multiple Segmentation Schemes

- ✦ Roadway – physical continuous travelway in a single county
- ✦ Local Segment – portion of a roadway with generally homogeneous attributes
- ✦ Selected linear event – e.g., signed route traversal across all roadway sections with the same designation

Traversal Example



Multiple Atomicity

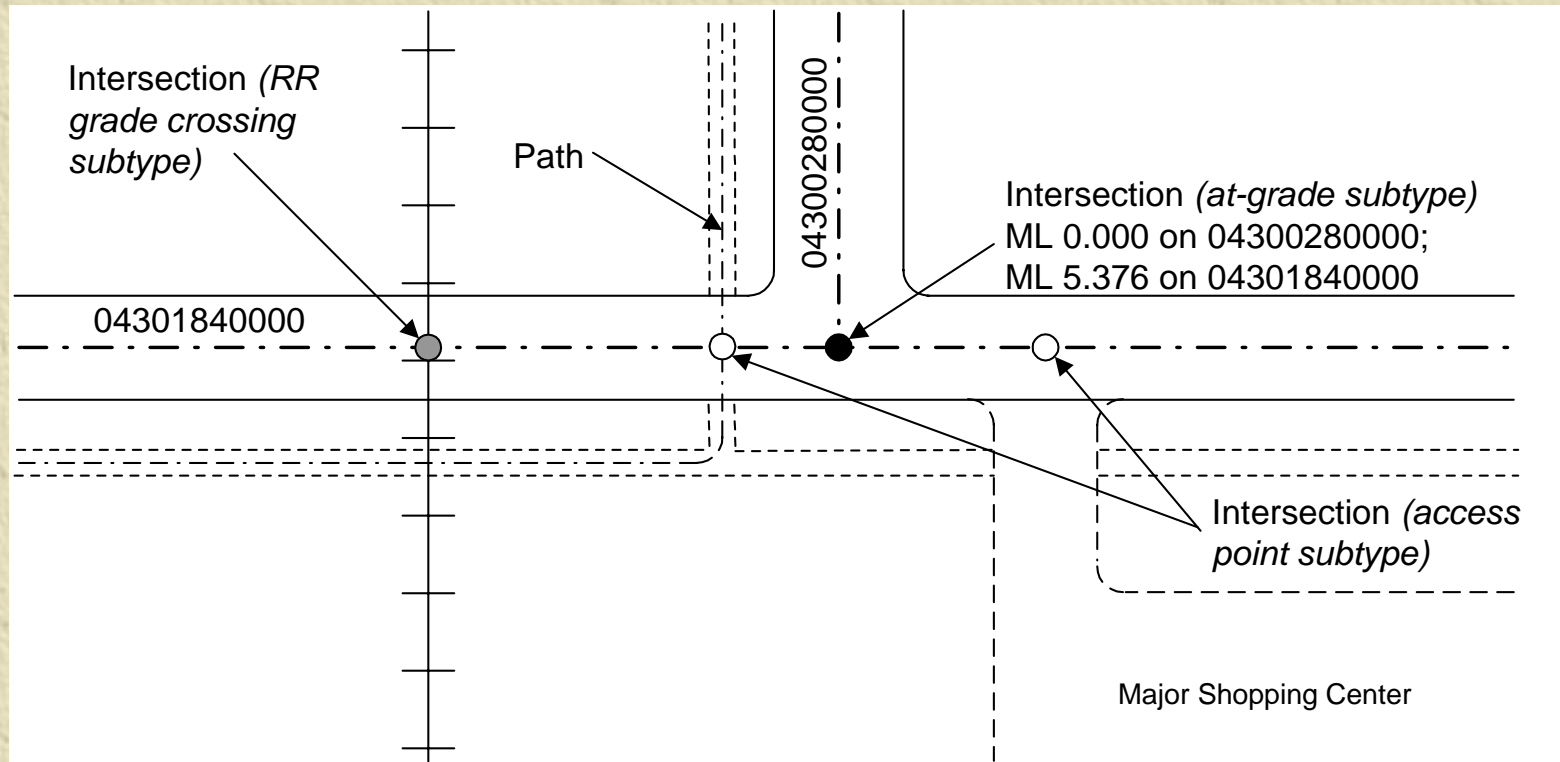
✦ Roadway atomicity – point and linear events

- ✦ State where a roadway element exists
- ✦ Can point to external table(s) with additional information

✦ Element atomicity

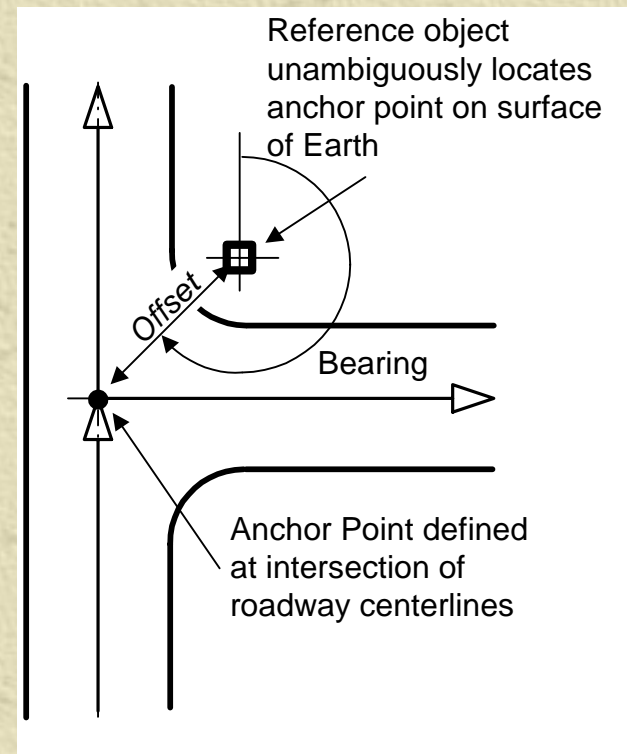
- ✦ Non-linear location/identification
- ✦ Detailed information about the element

Multimodal Support



Linear Datum

- ✦ Consists of
 - Anchor points
 - Anchor sections
 - Reference objects
- ✦ Reduces linear measure errors
- ✦ Uses field recoverable objects
- ✦ Can offer points of registration between data sets



Development (Editing) Database

- ✦ Fully normalized (except Local Segments)
 - ◆ No redundancies
 - ◆ No traversals or other derived elements
- ✦ Continuous versioning through date stamps
- ✦ Single format (geodatabase)
- ✦ Server located in editing staff's office
- ✦ Transactional updates

Production (Publication) Database

- ✦ Denormalized subsets of development database
- ✦ Discrete versioning
- ✦ Derived and calculated fields
- ✦ Multiple formats
- ✦ Server(s) located in central IT shop

Editing Web Site Home Page

The screenshot shows the TranSys Editor web application interface. At the top left is the CDOT logo, a stylized mountain with a red and yellow sun, and the text "DOT". To its right is the text "TranSys Editor". In the top right corner, there are links for "Contact CDOT", "Help", and "Sign In" (in red), followed by a search box with a "Search" button. Below this is a blue navigation bar with four tabs: "CDOT USER", "LOCAL USER", "ADMINISTRATOR", and "ABOUT TranSys EDITOR". The main content area is divided into two columns. The left column contains several sections: "Online Editing" (with a green header), "New User? [Learn More](#)", "Online ID" and "Password" input fields, a "Sign In" button, and a "Remember my ID" checkbox. Below this is the "Geographic Zoom" section with three dropdown menus for "County", "Urban Area", and "CDOT Region", each with a "Go" button. At the bottom of the left column is the "Tools & Help" section with a "Download Data" dropdown and a "Go" button. The right column is a large white area containing the text "ArcIMS Map Display Frame".

Local User



TranSys Editor

Contact CDOT ♦ Help ♦ **Sign Out**

Local User [User Name] is signed in

CDOT USER ▶ **LOCAL USER** ▼ **ADMINISTRATOR** ▶ **ABOUT TranSys EDITOR** ▶

Geographic Zoom

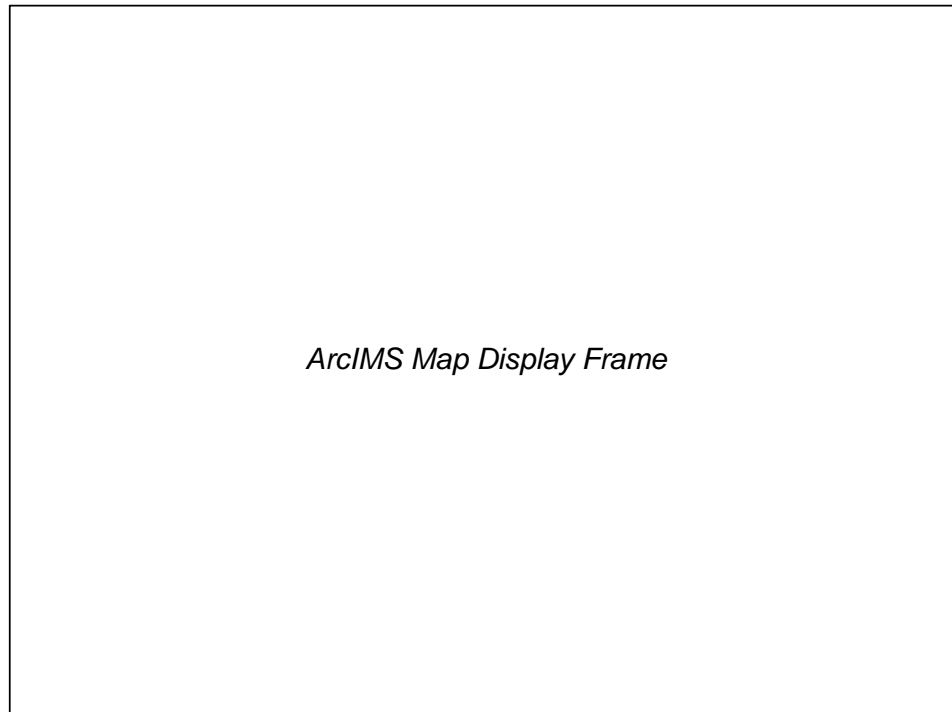
Add

Edit

Tools & Help

Have You...

- Updated all local segments?
- Saved your work session?
- Passed consistency checks?
- Reviewed changes by others?
- Committed your changes?



ArcIMS Map Display Frame

State Roadway Editing

Event Data
x

Events for Roadway 04300020000 (Fremont County)

Select Event Types to Display

Default group

Functional Class group

Jurisdiction group

Cross-section group

HUTF group

HPMS group

Route Signing group

Custom

Forest Route Name
Functional Class
Government Level
Hazardous Material Route Flag
HOV Lane
HPMS Sample Section ID
HPMS Universe Section
Inside Shoulder

SLD Scale

1:

Cursor Milelog

	0.000	1.000	2.000	3.000	4.000	5.000
Roadway	City of Florence Fremont County					
Maint Jurisdiction	25		●	45		55
Speed Limit	Asphalt					
Surface Type	16		●	6		
Functional Class						
Local Segments	100	●	200	●	200	300

4/5/2004

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Comparison to Other Efforts

- ✠ Includes concepts from NSDI draft standard
 - ◆ Public key
 - ◆ Granular equivalencies
- ✠ Consistent with NCHRP 20-27(2) & (3)
 - ◆ Supports four spatial functions
 - ◆ Includes linear datum
 - ◆ Includes temporal aspects of object classes
- ✠ Not based on ESRI's UNETRANS model because
 - ◆ Geometry is optional
 - ◆ Topology is optional

Project Lessons Learned

- ✦ Scope creep is a continuing struggle
- ✦ Added goals to support
 - ◆ Integration with data from local jurisdictions
 - ◆ Denormalized portions of the data model
- ✦ Balancing resources is a challenge
- ✦ Staff time for participation more limited than anticipated

Pilot Migration Goals

- ✦ Test definitions of physical data model
- ✦ Test software and hardware that comprise the editing environment
- ✦ Develop and test processes used to migrate the data (2 way)

Results of Pilot To Date

- ✦ Completed a master roadway centerline layer
- ✦ Established a GIS-ID foreign key for ALL of the Sybase data
- ✦ Calibrated an LRS for the major and local roads
- ✦ Completed 80% of all of the linear events

Next Steps – Near Term

- ✦ Use pilot results to migrate data (multi-step) to new editing environment
 - ◆ All at once
 - ◆ Highways first then local roadways
- ✦ Design production (publication) data model
- ✦ Design annotation data model; establish accurate feature-linked annotation

Next Steps – Longer Term

- ✦ Build the Web-based editing application
- ✦ Build key data usage applications
- ✦ Schedule cutover steps from old to new databases
- ✦ Build production database

Contact Us

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Your business card gets more information.