ArcGIS Pipeline Referencing

Anjali Bhangay | Rahul Rakshit
ArcGIS Pipeline Referencing Overview

Information Model

- Centerline: Shape & geometry
- Network: M enabled polyline
- Calibration Points: Locks m at locations
- Events: Characteristics, incidents, assets

0 25 50
Time Aware Linear Referencing Model

Users can view and analyze how routes, events, and intersections change over time…
Industry Data Models

- Supports:
  - Esri Utility and Pipeline Data Model (UPDM)
  - Pipeline Open Data Standard (PODS) Lite
  - Or any schema that implements the location model.

...making pipeline data more inter operable
ArcGIS Pipeline Referencing Overview

**Information Model**
- **Centerline**
- **Shape & geometry**
- **Network**
  - M enabled polyline
- **Calibration Points**
  - Locks m at locations
- **Events**
  - Characteristics, incidents, assets

**ArcGIS Pro**
- Network editing
- LRS management tools
- Geoprocessing tools
- Internationalized
Geoprocessing Tools

- Configuring
- Loading
- Transformations
  - Event Measure Behaviors
  - Dynamic Segmentation
  - Measure Translation
ArcGIS Pro Ribbon Toolbar

Route, Calibration Point and Centerline editing…
ArcGIS Pipeline Referencing Overview

Information Model

- Events
  - Characteristics, incidents, assets

- Calibration
  - Points
    - Locks m at locations

- Network
  - M enabled polyline

- Centerline
  - Shape & geometry

ArcGIS Pro

- Network editing
- LRS management tools
- Geoprocessing tools
- Internationalized

ArcGIS Enterprise

- LRS web services
- Developer API samples
Pipeline Referencing for ArcGIS Enterprise

Linear Referencing capability for ArcGIS Enterprise

Pipeline Referencing Server Features

ArcGIS Enterprise

- Mapping
- Query
- Geoprocessing
- Enterprise security
- Scalability

Pipeline Referencing Server

Capabilities

- Mapping (always enabled)
- WCS
- WMS
- Feature Access
- Schematics
- Mobile Data Access
- Network Analysis
- OWS
- WFS
- Linear Referencing

LRS Web Services

Desktop

Web

Connected Mobile

Linear Referencing Service

- Apply Edits
- Create Version
- Delete Version
- Reconcile Version

Network Layer

- Geometry to Measure
- Measure to Geometry
- Translate
- Concurrencies
- Query Attribute Set
- Check Events

Event Layer

- Geometry to Station
- Station to Geometry

Redline Layer

Centerline Layer

Calibration Point Layer

Intersection Layer

Non-LRS Layer

Locks

- Query
- Acquire
- Release
Developer Samples

- REST API:
- Samples:
  http://pipelinesample.esri.com/pipeline/samples/

ArcGIS Pipeline Referencing
Sample Web Applications

- **Visualize routes**
  This sample visualizes a route network layer on a map.
- **Spatial query of routes**
  Query a route network layer using a spatial filter.
- **Attribute query of routes**
  Query a route network layer using an attribute filter (where clause).
- **Convert geometry to measure**
  Convert a geographic location into a route measure value.
- **Translate network measures**
  Translate measure values between two networks with different measures.
- **Event editing**
  Add new event records to an event layer.
- **Check Events**
  Detect common types of quality control errors - gaps, overlaps, and invalid measures - in event data.

- **Visualize events**
  This sample visualizes two types of event layers on a map — point events and linear events.
- **Spatial query of events**
  Query an event layer using a spatial filter.
- **Attribute query of events**
  Query an event layer using an attribute filter (where clause).
- **Convert measure to geometry**
  Convert route measure values into geographic points and lines.
- **Convert to station to geometry**
  Convert stationing values (e.g. 145+10) into geographic locations and route measures.
- **Query attribute set**
  Segment event layers where attributes change based on a measure or measure range for a specified route.
- **Drag-drop a CSV file of geographic locations**
  Drag-and-drop a CSV file to convert geographic locations into route measures.
ArcGIS Pipeline Referencing Overview

**Information Model**
- Events
  - Characteristics, incidents, assets
- Calibration Points
  - Locks m at locations
- Network
  - M enabled polyline
- Centerline
  - Shape & geometry

**ArcGIS Pro**
- Network editing
- LRS management tools
- Geoprocessing tools
- Internationalized

**ArcGIS Enterprise**
- LRS web services
- Developer API samples

**Event Editor**
- Line and point event editing
- Data queries
- Quality checks
- Portal security
Coming up Demo

- Configuring data for ArcGIS Pipeline Referencing
- Loading routes
- Adding events to routes in bulk
- Running quality control checks
- Editing routes
- Editing events
- Overlaying events using Web App Builder
- The road ahead
Types of LRS Network

1- LRS Network

LRS – Linear Referencing System
Types of LRS Network

2 - LRS Line Network

...with support for Engineering Stationing
Types of LRS Network

2 - LRS Line Network

…with support for Engineering Stationing
### Types of LRS Network

#### 2- LRS Line Network

<table>
<thead>
<tr>
<th>Route ID</th>
<th>Route Name</th>
<th>Line Order</th>
<th>Line ID</th>
<th>Line Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>{1838BE01-0BC9-4C58-9829-0F1D77717DCB}</td>
<td>Route 1</td>
<td>100</td>
<td>{C043CAF0-2BF7-4598-8AC8-B382647AD490}</td>
<td>Line A</td>
</tr>
<tr>
<td>{26710A05-C499-42C1-BB73-D3A8D402B109}</td>
<td>Route 2</td>
<td>200</td>
<td>{C043CAF0-2BF7-4598-8AC8-B382647AD490}</td>
<td>Line A</td>
</tr>
</tbody>
</table>

![Diagram of Routes 1 and 2 with calibration points](image-url)
Types of LRS Network

3 - Derived Network

Derived Network

LRS Line Network

Calibration Point

Routes
APR Data Loading

- Configuring data for ArcGIS Pipeline Referencing
- Loading routes
- Adding events to routes in bulk
- Running quality control checks
- Editing routes
- Editing events
- Overlaying events using Web App Builder
- The road ahead
Update Calibration Points

Calculation Method:
- M_ON_ROUTE_2D
- M_ON_ROUTE_3D
- GEOMETRY_LENGTH_2D
- GEOMETRY_LENGTH_3D
- ATTRIBUTE_FIELDS_2D
- ATTRIBUTE_FIELDS_3D
- INTERPOLATE_EXISTING
QC Checks

- Configuring data for ArcGIS Pipeline Referencing
- Loading routes
- Adding events to routes in bulk
- Running quality control checks
- Editing routes
- Editing events
- Overlaying events using Web App Builder
- The road ahead
Quality Checks

Event Checks

Gaps

Overlaps

Invalid Measures

Route Checks

Non-monotonic

0 40 20
Route Editing Workflow

- Edit route
- Update existing events on that route
- Update the derived network
Event Behaviors
After route edits, measure behavior rules can be applied to events

Before Editing
Realign Route

Stay Put
Preserves geographic location. Measures may change.

Retire
Event gets retired.

Move
Preserves measures. Geographic location may change.
Event Editing

- Configuring data for ArcGIS Pipeline Referencing
- Loading routes
- Adding events to routes in bulk
- Running quality control checks
- Editing routes
- Editing events
- Overlaying events using Web App Builder
- The road ahead
Event Editor

Browser Experience

Selection
Select By:
- Route
- Attribute
- Geometry
- Proximity

Editing
- Line & Point Events
- Event Replacement
- Event Attributes

Quality Checks
- Gaps, Overlaps & Invalid Measures
- Data Reviewer Batch Checks
Event Replacement
Add, retire and replace events in one edit operation

After event replacement

Replaced Pipe

- Valves
- Operating Pressure Range
- Class Location
- Coating
Using REST Services

- Configuring data for ArcGIS Pipeline Referencing
- Loading routes
- Adding events to routes in bulk
- Running quality control checks
- Editing routes
- Editing events
- Overlaying events using Web App Builder
- The road ahead
REST SERVICES: Example: Overlaying Events

Route

Input

Class Location

Class 1

Class 2

Coating

Corrosion

Insulation

Output

Class 1, Corrosion

Class 2, Corrosion

Class 2, Insulation
Road Map

Near term

RESTful API

- Network editing REST API

Medium Term

ArcGIS Pro

{ REST }

ArcGIS Enterprise

- ArcGIS Pro REST GP Tools
- Conflict prevention

Long Term

- Utility Network integration
Please Take Our Survey on the App

Download the Esri Events app and find your event

Select the session you attended

Scroll down to find the feedback section

Complete answers and select “Submit”