PIMA CO. AZ GIS LINEAR REFERENCING SYSTEM (LRS) DYNAMIC SEGMENTATION (DYNSEG)

ESRI UC 2010, San Diego, CA
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Pima County AZ
Topics

- LRS / DynSeg Basics & Uses
- Pima County’s LRS / DynSeg Setup & Processes
- Demo
- Lessons Learned & Challenges
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LRS / DynSeg Overview

Linear Referencing (LRS)
- Is the term used to describe the methodology for storing, transferring and displaying data using a route layer and measures.

Dynamic Segmentation (DynSeg)
- Is the process of computing and displaying the location of events in an event table.
LRS / DynSeg: The Basics

**Need:**
- Route
- Reference location
- Geographic locations (or events) stored in tabular form

![Route feature class](image1)

<table>
<thead>
<tr>
<th>GAUGES</th>
<th>REACH</th>
<th>MR</th>
<th>GAUGE_ID</th>
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<td>A1</td>
<td></td>
</tr>
<tr>
<td>A120</td>
<td>36</td>
<td>A2</td>
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<td>A123</td>
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<td>A3</td>
<td></td>
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<tr>
<td>B496</td>
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<td>B1</td>
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</tr>
<tr>
<td>B456</td>
<td>38</td>
<td>B2</td>
<td></td>
</tr>
</tbody>
</table>

![Point event table](image2)

**DynSeg results**

![Line event table](image3)

**DynSeg results**

Source: ESRI help
Why Use LRS / DynSeg?

- **Standardized data collection**
  - Between Multiple Jurisdictions

- **Simplifies storage of data**
  - Eliminates segmenting original street network
  - Reduced editing time
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Pima County’s LRS/DynSeg

- **Purpose:** Stop breaking up the street network – LOWER MAINTENANCE
- **Why?**
  - Wanted edits to street network to key all changes needed for LRS/DynSeg
- **How?**
  - ‘Intersection’ Based
  - Several different features classes used in concert to satisfy the Big 3 Needs
    - Had to account for unique configuration of street network
PC’s LRS/ DynSeg:

- Reference segment – Route from street network (and exceptions)
- Reference location – ‘Intersections’ or Cross streets
- Event features plotted ‘from’ reference location (& distance), ‘to’ reference location (& distance)

Route – Broadway BL
Cross Street – Kolb RD

A is 10 units W from Intersection (-10)
B is 30 units E from Intersection (+30)
C starts 5 units E from Intersection and goes 45 more units
Data Components

- **Route = STROUTE**:
  - STNET
  - RTBL_LRS_SEGEXCPT
  - STPRERTE

- **Intersections or Cross Streets**
  - STINTERS
  - STINTMEAS

- **Events**
  - Event table
ROUTE

- STNET = Maintained road network
- RTBL_LRS_SEGEXCPT = Exceptions table that flags funky segments
  - FK Join ROADID to STNET
- STPRERTE = Streets with exceptions accounted for
- STROUTE = routed STPRERTE

Segment Exceptions Related Table

<table>
<thead>
<tr>
<th>ROADID</th>
<th>EXCEPTION_TYPE</th>
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<td>241077</td>
<td>LOOP</td>
</tr>
<tr>
<td>241078</td>
<td>LOOP</td>
</tr>
<tr>
<td>2958</td>
<td>KNUCKLE</td>
</tr>
<tr>
<td>56699</td>
<td>KNUCKLE</td>
</tr>
</tbody>
</table>
Intersections or Cross Streets

- **STINTERS** = Polyline endpoints from STNET
- **STINTMEAS** = Table with M values along STROUTE at STINTERS (except end of road)
- Some necessary attributes in STINTMEAS to handle ‘Duplicate’ Intersections
  - Example: Loops, Different Jurisdictions (Ajo and City of Tucson), Zig Zag, etc
Intersections or Cross Streets

- STINTMEAS as a View provides the Reference Location for events
  - Measure along STRROUTE
  - CRSTR_LINK is the FK Join
- Necessary Attributes:
  - CROSSTREET – Simple cross street ID
  - The STINTERID is appended when referencing Dup Intersection

<table>
<thead>
<tr>
<th>RID</th>
<th>CROSSTREET</th>
<th>MEAS</th>
<th>COUNTER</th>
<th>STINTERID</th>
<th>CRSTR_LINK</th>
<th>XCOORD</th>
<th>YCOORD</th>
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<tbody>
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<td>7404</td>
<td>VAIL VIEW RD</td>
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<td>354462.1</td>
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<td>41411</td>
<td>VAIL VIEW RD 41411</td>
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<td>355000.9</td>
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<td>BROADVIEW DR 41411</td>
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</table>
Event Data Table Fields
(All manual entry)

- ROUTE_ID - route that the event is on
- FCRSTR - from cross street name
- FINTID – FROM STINTERID for duplicate intersections
- FOFFDIST - distance from the FROMCROSSTR
- TCRSTR - to cross street name
- TINTID – TO STINTERID for duplicate intersections
- TOFFDIST - distance from the TOCROSSTR
- OFFSET (only if applicable) - used to display event on either side of route
- EVENT_ID - unique ID in event data table
View for Event Data Table

- Created to concatenate user entered fields so it can be joined to STINTMEAS view

<table>
<thead>
<tr>
<th>ROUTE_ID</th>
<th>FCRSTR</th>
<th>FINID</th>
<th>FCRSTR_LINK</th>
<th>FOFFDIST</th>
<th>TCRSTR</th>
<th>TINTID</th>
<th>TCRSTR_LINK</th>
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<th>PAVE_CODE</th>
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<tbody>
<tr>
<td>3RD ST</td>
<td>MCKINLEY AV</td>
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<td>0</td>
<td>ALVEYON WY</td>
<td>-630.521...</td>
<td>ALVEYON WY</td>
<td>0</td>
<td>ALVEYON WY</td>
<td>0.00000...</td>
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<td>12/31/9999 12:00 AM</td>
</tr>
<tr>
<td>43RD PL</td>
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</tr>
</tbody>
</table>
Create Final Event Table

- Join event view and STINTMEAS view
- Calculate FMEAS:
  - GISData.vw_STINTMEAS.MEAS + GISData.vw_PAVE_CODE_DATA.FOFFDIST
- Calculate TMEAS:
  - GISData.vw_STINTMEAS_1.MEAS + GISData.vw_PAVE_CODE_DATA.TOFFDIST
Display Route Event Table

ArcMAP

<table>
<thead>
<tr>
<th>OBJECTID</th>
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<table>
<thead>
<tr>
<th>ROUTE_ID</th>
<th>FCSTR</th>
<th>FOOFDT</th>
<th>FINID</th>
<th>FMEAS</th>
<th>TCSTR</th>
<th>TMEAS</th>
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<td>Isla Q</td>
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</tr>
</tbody>
</table>
Nightly Processes

- STINTERS
- STROUTE
- STINTMEAS
- Unmapped events
- Flipped routes
- 3 days history - STROUTE, STINTMEAS, mapped events feature classes
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Challenges

- **Issues**
  - Unique physical aspects of the street network
  - Data Structure
  - Event mapping process

- **Challenges**
  - Rules and allowances to realize the advantage of single edits with dynamic consequences - esp. across jurisdictions
  - Converting data resources
  - Converting human resources
Lessons Learned

- LRS / DynSeg is not a plug and play environment
- Typical street network configuration is not route creation friendly
- Limited reference information on LRS / DynSeg
- Many flavors of setup
- Nightly processes play a big role
Final Thoughts

- Goal was to have an environment that would be dynamic; allowing typical day to day edits to occur once while supporting mapping for many referenced phenomena automatically ...
- We did that, and better yet, it appears to work!
- It wasn’t hard, but it was time consuming and an adventure in problem solving
Thanks!

- Cody Cohn
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