

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

ESRI UC 2010, San Diego, CA
Cody Cohn – Sr. GIS Analyst
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.

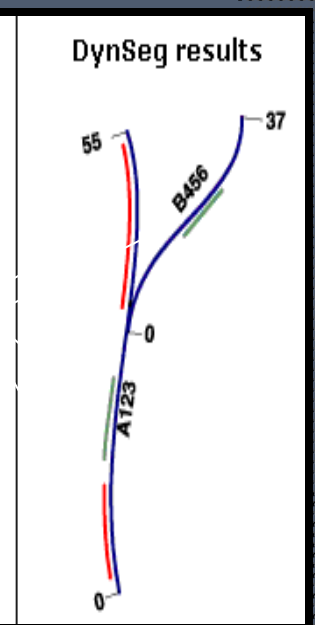
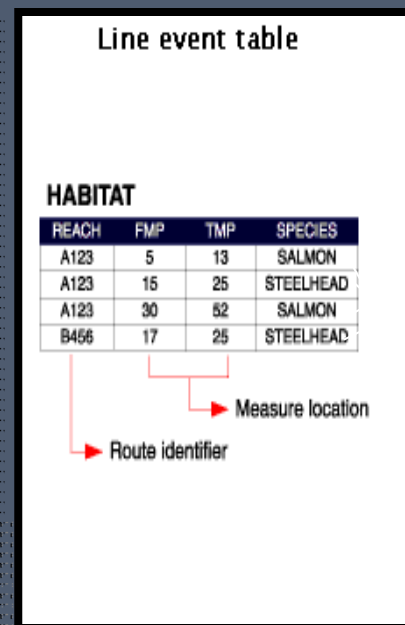
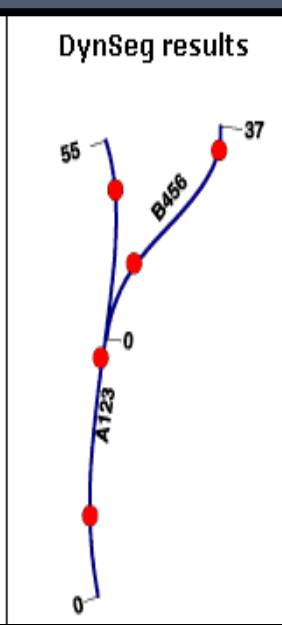
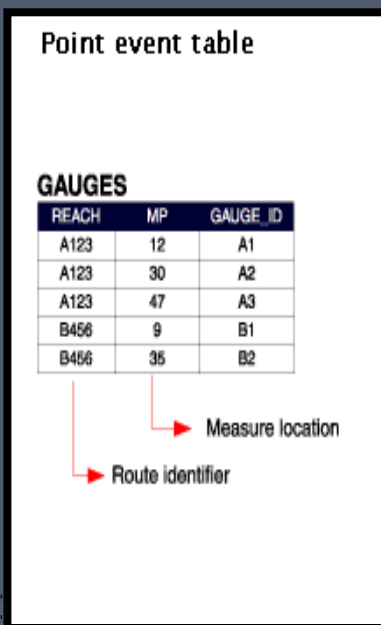
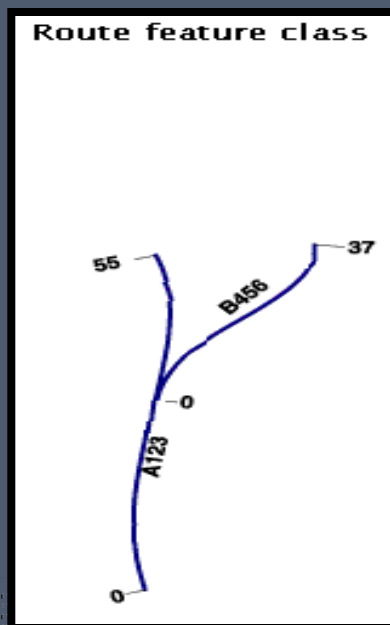
● Dynamic Segmentation (DynSeg)

- 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



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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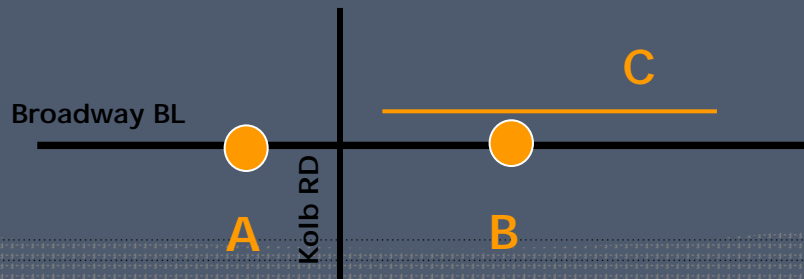
Pima County's LRS/DynSeg

- 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 :

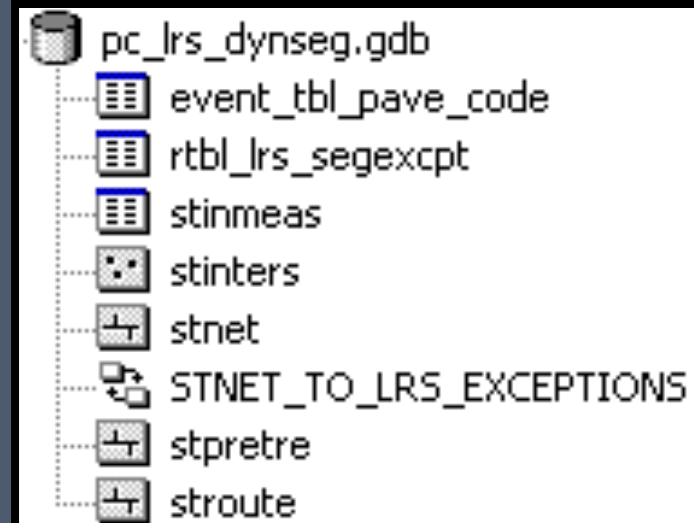
- STNET
- RTBL_LRS_SEGEXCPT
- STPRERTE

● Intersections or Cross Streets

- STINTERS
- STINTMEAS

● Events

- Event table

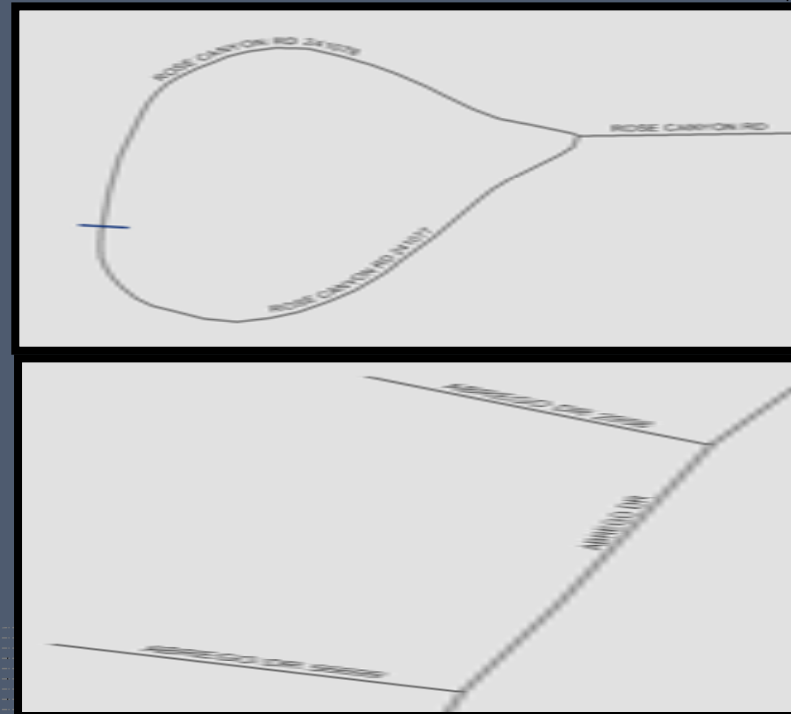


ROUTE

- 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

ROADID *	EXCEPTION_TYPE
241077	LOOP
241078	LOOP
2958	KNUCKLE
56699	KNUCKLE

Segment Exceptions Related 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 STROUTE
 - CRSTR_LINK is the FK Join
- Necessary Attributes :
 - CROSSTREET – Simple cross street ID
 - The STINTERID is appended when referencing Dup Intersection

RID	CROSSTREET	MEAS	COUNTER	STINTERID	CRSTR_LINK	X_COORD	Y_COORD
VAIL VIEW RD 54080	VAIL VIEW RD	0.00000000	1	7404	VAIL VIEW RD	1073335.6...	354462.1...
BROADVIEW DR	VAIL VIEW RD	2764.18600000	2	41411	VAIL VIEW RD 41411	1073244.4...	355000.9...
VAIL VIEW RD	BROADVIEW DR	2598.95100000	2	41411	BROADVIEW DR 41411	1073244.4...	355000.9...
SAHUARITA RD	VAIL VIEW RD	88008.48600000	1	20228	VAIL VIEW RD	1073199.4...	352418.0...
VAIL VIEW RD	SAHUARITA RD	0.00000000	1	20228	SAHUARITA RD	1073199.4...	352418.0...
IRIS PL	VAIL VIEW RD	0.00000000	2	14063	VAIL VIEW RD 14063	1073251.3...	352955.1...

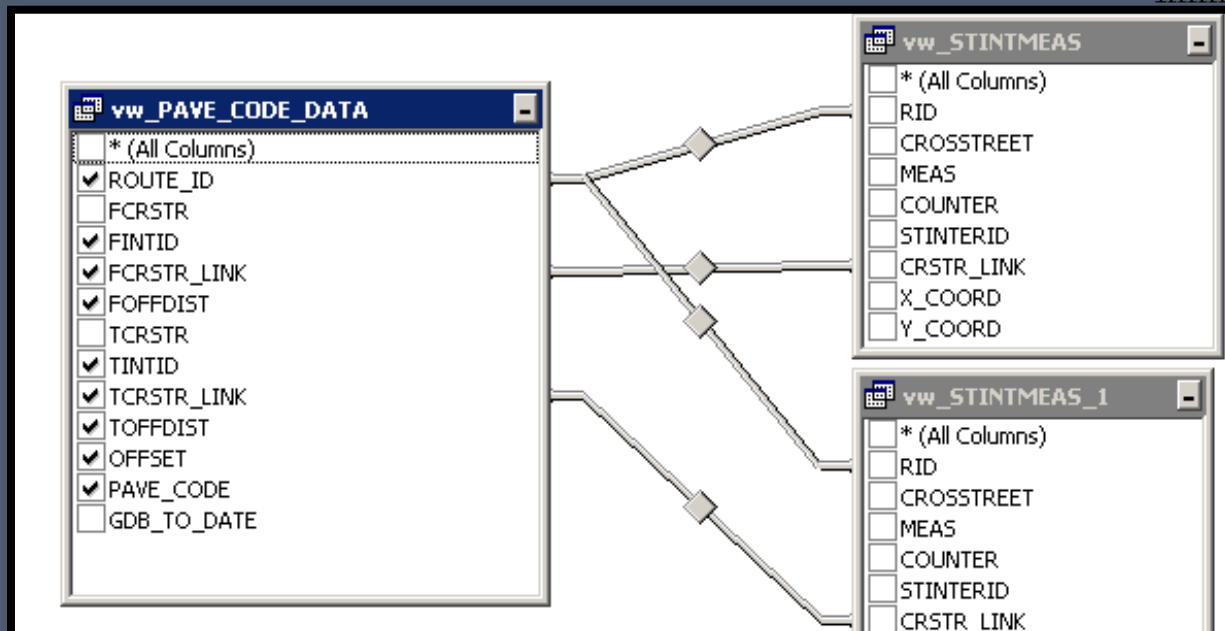
Event Data Table Fields

(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



ROUTE_ID	FCRSTR	FINTID	FCRSTR_LINK	FOFFDIST	TCRSTR	TINTID	TCRSTR_LINK	TOFFDIST	OFFSET	PAVE_CODE	GDB_TO_DATE
3RD ST	MCKINLEY AV	90477	MCKINLEY AV 90477	0.00000000	2ND AV	113592	2ND AV 113592	0.00000...	NULL	1	12/31/9999 12:...
40TH ST	ALVERNON WY	0	ALVERNON WY	-630.521...	ALVERNON WY	0	ALVERNON WY	0.00000...	NULL	1	12/31/9999 12:...
43RD PL	DODGE BL	0	DODGE BL	0.00000000	DODGE BL	0	DODGE BL	691.439...	NULL	1	12/31/9999 12:...
44TH ST	DODGE BL	59442	DODGE BL 59442	0.00000000	DODGE BL	59442	DODGE BL 59442	938.504...	NULL	1	12/31/9999 12:...
44TH ST	PALO VERDE RD	0	PALO VERDE RD	0.00000000	DODGE BL	59441	DODGE BL 59441	0.00000...	NULL	1	12/31/9999 12:...

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

The screenshot shows a GIS software interface with a query builder window and a data table. The query builder window displays a join of two tables: 'GISData.vw_STINTMEAS' and 'GISData.vw_PAVE_CODE_DATA'. The data table below shows the resulting query results.

ROUTE_ID	POCKET	POCKET_ID	POCKET_NAME	POCKET_CODE	POCKET_LENGTH	POCKET_WIDTH	POCKET_DEPTH	POCKET_VOLUME	POCKET_AREA	POCKET_PERIMETER	POCKET_SHAPE	POCKET_TYPE	POCKET_STATUS	POCKET_COMMENT
1	POCKET_1	1	POCKET_1	1	100	100	100	1000000	10000	10000	10000	1	1	POCKET_1
2	POCKET_2	2	POCKET_2	2	200	200	200	4000000	40000	40000	40000	2	2	POCKET_2
3	POCKET_3	3	POCKET_3	3	300	300	300	9000000	90000	90000	90000	3	3	POCKET_3
4	POCKET_4	4	POCKET_4	4	400	400	400	16000000	160000	160000	160000	4	4	POCKET_4
5	POCKET_5	5	POCKET_5	5	500	500	500	25000000	250000	250000	250000	5	5	POCKET_5
6	POCKET_6	6	POCKET_6	6	600	600	600	36000000	360000	360000	360000	6	6	POCKET_6
7	POCKET_7	7	POCKET_7	7	700	700	700	49000000	490000	490000	490000	7	7	POCKET_7
8	POCKET_8	8	POCKET_8	8	800	800	800	64000000	640000	640000	640000	8	8	POCKET_8
9	POCKET_9	9	POCKET_9	9	900	900	900	81000000	810000	810000	810000	9	9	POCKET_9
10	POCKET_10	10	POCKET_10	10	1000	1000	1000	100000000	1000000	1000000	1000000	10	10	POCKET_10

Display Route Event Table ArcMAP

The screenshot shows the ArcMap interface with the 'Display Route Events' dialog box open. The dialog box is configured to display route events from the 'vector.GISData.vw_Cartograph_Events' layer. The 'Route Reference' is set to 'vector.GISData.stroute' and the 'Route Identifier' is 'ROUTE_ID'. The 'Event Table' is 'vector.GISData.vw_Cartograph_Events' and the 'Route Identifier' is 'ROUTE_ID'. The 'Type of events' is 'Line Events: Define a discontinuous portion of a route'. The 'Measure fields' are 'From-Measure: FMEAS' and 'To-Measure: TMEAS'. The 'Offset' is 'None'. The 'Advanced Options' checkbox is checked.

Attributes of vector.GISData.stroute

OBJECTID *	ROUTE_ID *	Shape *	Shape_Len
127	46TH ST	Polyline M	2065.874616
128	47TH ST	Polyline M	2691.273793
129	48TH ST	Polyline M	1169.946793
130	49ER FAIRWAY LN	Polyline M	2176.198747
131	4TH AV	Polyline M	33479.239346
132	4TH PL	Polyline M	660.085521

Attributes of vector.GISData.vw_Cartograph_Events

ROUTE_ID	FCRSTR	FOFFDIST	FINTID	FMEAS	TCRSTR	TOFFDIST	TINTID	TMEAS
Cloud Rd	Webster Rd	0	<Null>	11361.05	Elena Maria	30	<Null>	13391.1
Alwood Pl	Knollwood Ct 5568	0	5568	1029.875	Knollwood Ct 63	0	8950	0
Camino Miramonte	Catalina Hy	0	<Null>	59536.10	Melgome WY	0	<Null>	61378.8
Georgia Dr	Yvon Dr	0	<Null>	0	Yvon Dr	310	<Null>	310
Calle Del Suerte	Camino De Oeste	0	<Null>	1607.444	Trails End Rd	0	<Null>	0
Calle Exelso	Circulo Del Sur 2552	0	2552	0	Camino Holgado	0	<Null>	1006.94
Calle Fortunado	Bullinger Av	0	<Null>	0	Bullinger Av	410	<Null>	410
Cibola Av	Pentator Rd	0	<Null>	1427.906	Catalina Av	0	<Null>	0
El Camino Del Cerro 18	El Camino Del Cerro	0	<Null>	333.836	El Camino Del C	-305	<Null>	28.836
Root Ln	Romero Rd 4261	0	4261	1624.579	Romero Rd 4261	730	4261	2354.57
Jamie Av	Nasmi Rd	0	<Null>	9990.559	Bepp Rd	0	<Null>	5384.99
Camino Esquina	Placita Esquina	65	<Null>	416.139	Camino Alisa	0	<Null>	0
Pendot St	Eaglestone Lp	0	<Null>	0	Onyx St	0	<Null>	1113.61
Camino Francisco Soza	Graycroft Rd	-2470	<Null>	16.976	Graycroft Rd	0	<Null>	2488.97
Dover Dr	Iving Dr	0	<Null>	4289.903	Drexel Rd	0	<Null>	8893.85
Bula Primera	Calle Bupa	-755	<Null>	-10.769	Calle Bupa	0	<Null>	744.231
Calle Del Suerte 56759	Calle Del Suerte	0	<Null>	0	Calle Del Suerte	295	<Null>	295
Montebella Rd	Sesame Ln	0	<Null>	8043.469	Los Altos Rd	0	<Null>	5502.26
Sonnet Ln	Billy Rd	1320	<Null>	14936.22	Billy Rd	0	<Null>	13616.2
Sonnet Ln	Billy Rd	1320	<Null>	14936.22	Billy Rd	0	<Null>	13616.2
Placita Del Rincon	Calle Del Rincon	0	<Null>	0	Calle Del Rincon	390	<Null>	390
Measingale Rd	Camino De Oeste	0	<Null>	47594.79	Camino De West	-3127	<Null>	44467.7

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
● lewis.cohn@pima.gov