

Intersection Based Linear Referencing



AASHTO

GIS-T Annual Conference

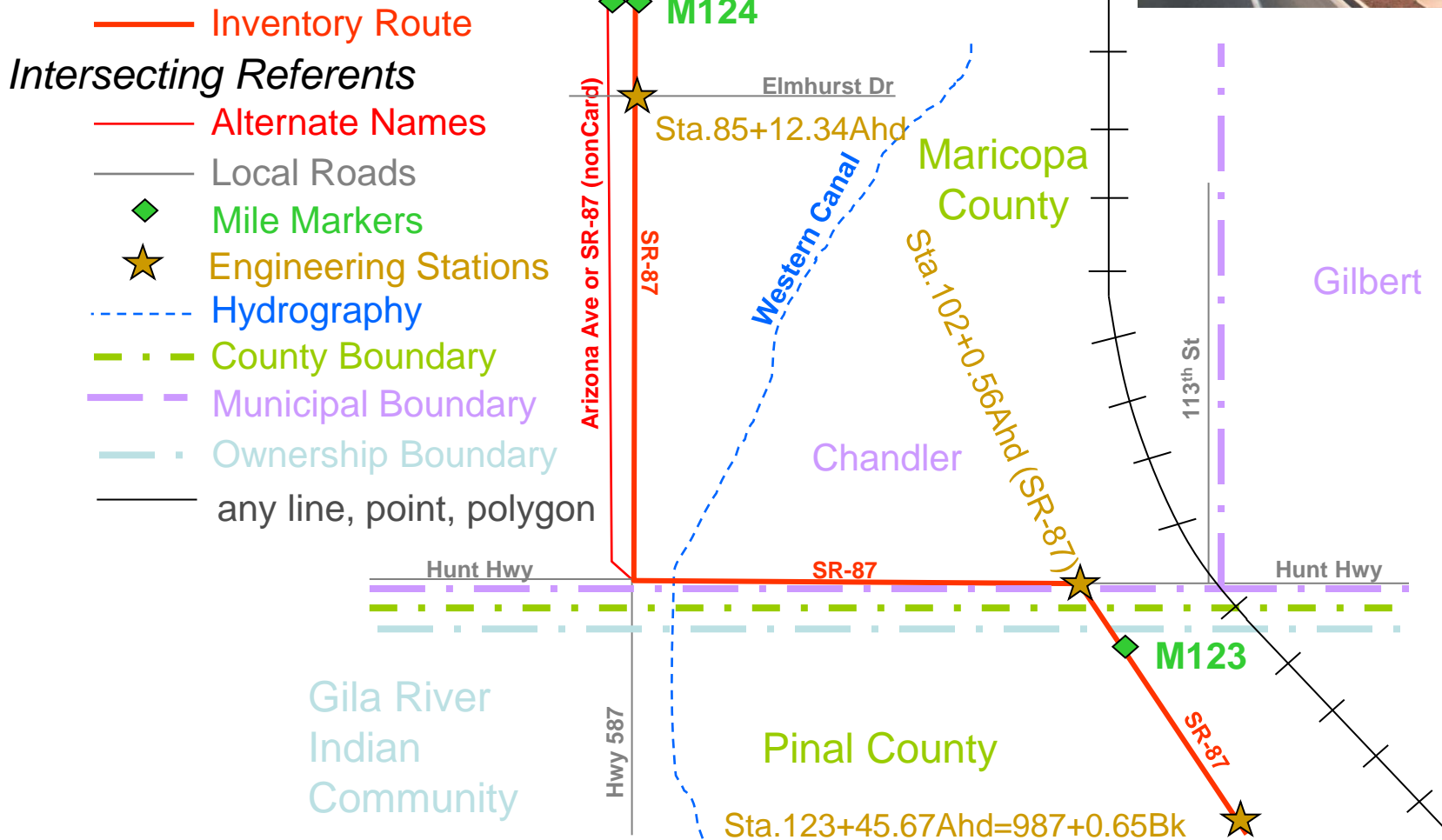
Tuesday May 7, 2013

What is Intersection Based LRS ?

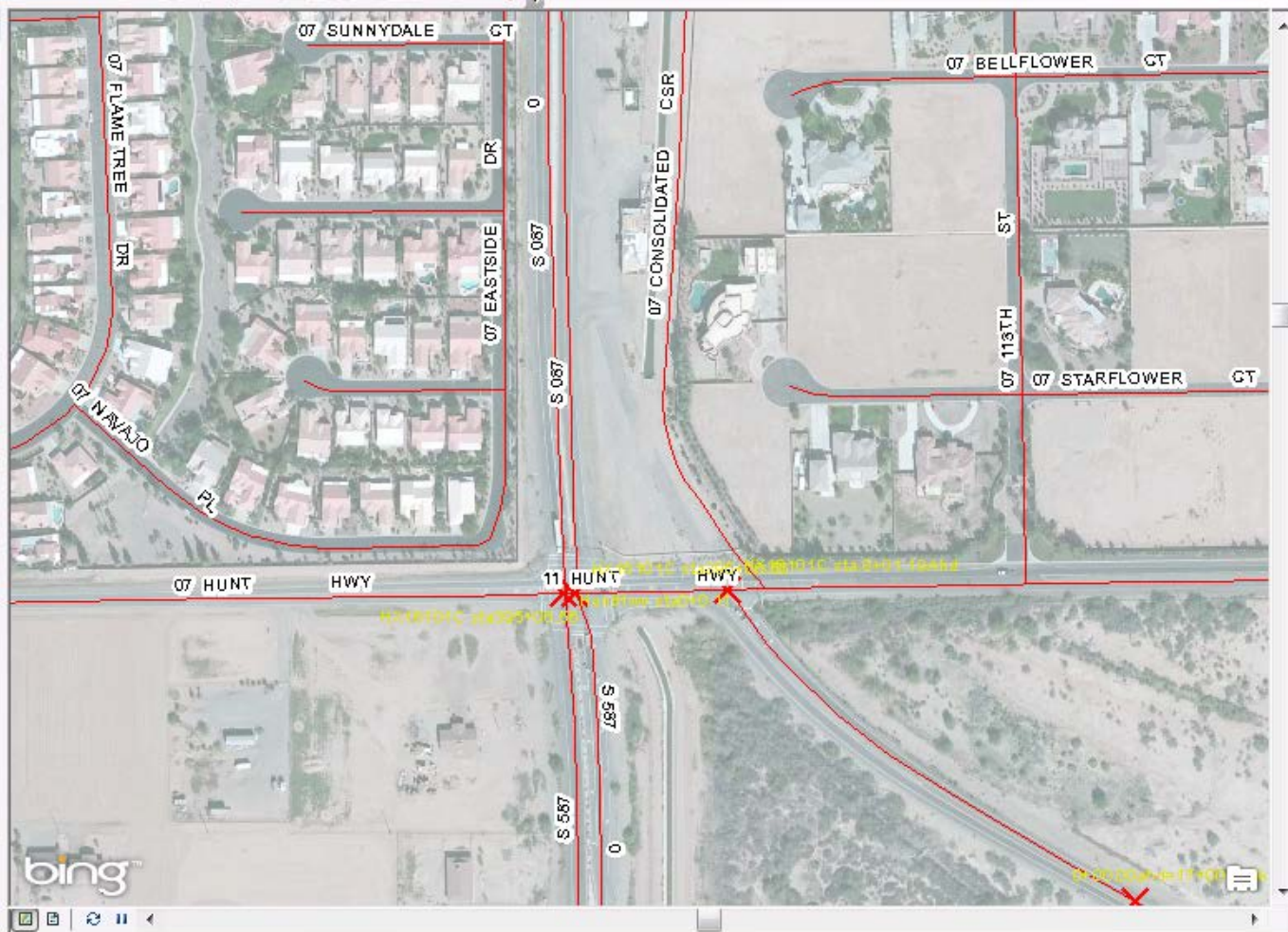


- Uses the intersection of features along routes as the LRS datum.
- The intersecting features can be any feature class that crosses routes such as engineering stationing, hydrology, and boundaries.
- These intersection events occur along every route in the network.
- Every intersecting feature then becomes one of the many methods for locating data along any route.

What is Intersection Based LRS



What is Intersection Based LRS



Advantages



- Human Understandable Descriptions
 - Events are not dependent on knowing measure(s)
- An effective LRS for **ALL PUBLIC ROADS**, which supports ARNOLD (All Roads Network of Linear referenced Data)
 - Adaptable to any topologically correct centerline
 - Uses consistent centerline naming conventions
 - Supports coincidental route names
 - Does not require calibration points
 - Elevation issues are insignificant for route measures

Challenges



- Geocoding???
- Other???

Intersection types



1. Route-Mile (Example: mile-value 300.45 on I-10)
2. Route-ReferencePost-Offset (0.45 miles ahead of M300 on I-10)
3. Route-CrossRoad-Offset (sub-categories of roads)
4. Route-Boundary-Offset (many types of boundaries)
5. Route-Engineering Stations
6. Street Address (includes StreetAddress-Offset)

Intersection Processing



LRS Table Wizard

Define Contributing Feature Classes

Include?	Name	Route?	ID Field	Prefix	Name Field	Dups OK?
<input checked="" type="checkbox"/>	ATIS.DBO.a00rte	<input checked="" type="checkbox"/>	RTE_ID		ROUTE	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ATIS.DBO.a00m	<input type="checkbox"/>	X_RTE_ID		ROUTE	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.cities20120522_polyline_1	<input type="checkbox"/>	LrsID		Lrs_Name	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.County_Line	<input type="checkbox"/>	Lrs_ID		Route	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.hydro_Dissolve	<input type="checkbox"/>	LRS_ID		Route	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.Maintenance_20110818_polyline	<input type="checkbox"/>	LrsID		Route	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.o3_com_Line	<input type="checkbox"/>	Lrs_ID		Route	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.OWNERS_20101012_polyline	<input type="checkbox"/>	LrsID		LrsName	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.Places_2009HPMS	<input type="checkbox"/>	RTE_ID		RouteName	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.PM_10_Line	<input type="checkbox"/>	Lrs_ID		Route	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.Urban_Line	<input type="checkbox"/>	Lrs_ID		Route	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ATIS.DBO.a00m_hatches_2011Jun27	<input type="checkbox"/>	LRS_ID	_	MARKER	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.Rail_Traversals	<input checked="" type="checkbox"/>	Lrs_ID		Route	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.EngineeringStations	<input type="checkbox"/>	LRM_ID		Route	<input checked="" type="checkbox"/>

Cracking/clustering tolerance:

Buttons: Import, Remove, Check Data, Add Selected Items to Map, Save, Back, Next

Intersection Processing



Assembled INT : Select Query

	Route	Meas	XRef	LrsType	X	Y	Qual	PosMsBrng
▶	S 087	44.1334	0+00.00ahd=17+00.00bk	52	724102	801226		300
	S 087	44.2731	B PHOENIX-MESA_	66	723494	801637		315
	S 087	44.2818	11 HIGHWAY 87	98	723461	801670		326
	S 087	44.3007	C MARICOPA_PINAL	60	723405	801752		321
	S 087	44.3007	Z PHX03BNDY_	65	723405	801752		321
	S 087	44.3007	Z PHXPM-10BNDY_	67	723405	801752		321
	S 087	44.3009	O GilaRiverIR_	62	723404	801753		326
	S 087	44.3021	D M7873_T8154	63	723401	801758		326
	S 087	44.3035	07 HUNT HWY	98	723396	801764		269
	S 087	44.3035	11 HUNT HWY	98	723396	801764		269
	S 087	44.3035	HX16101C sta8+01.19Ahd	52	723396	801764		269
	S 087	44.3535	M218.76 (NB S of Chandler)	50	723133	801758		358
	S 087	44.3535	S 087 0	91	723133	801758		358
	S 087	44.3535	S 587 0	91	723133	801758		358
	S 087	44.3535	07 HUNT HWY	98	723133	801758		358
	S 087	44.3535	11 HUNT HWY	98	723133	801758		358
	S 087	44.3535	HX16101C sta395+06.56	52	723133	801758		358
	S 087	44.3535	HX16101C sta395+06.56	52	723133	801758		358
	S 087	44.4916	07 ARIZONA AVE	98	723113	802487		359
	S 087	0	44.2586 0+00.00ahd=17+00.00bk	52	724102	801226		300
	S 087	0	44.3993 B PHOENIX-MESA	66	723494	801637		315

Record: 1 of 154

Road Centerline Sources



- **E911 Centerlines (Statewide Coordination)**
 - **Best source of local roads (Counties)**
- **Federal Agencies (State and Federal Coordination)**
 - **Bureau of Land Management**
 - **Bureau of Indian Affairs**
 - **Department of Defense**
- **Other**
 - **Cities, Towns**
 - **Tribal Nations**
 - **Other projects (Broadband Mapping, 9-1-1, FirstNet, etc.)**
 - **Whoever has the best data**

Benefits

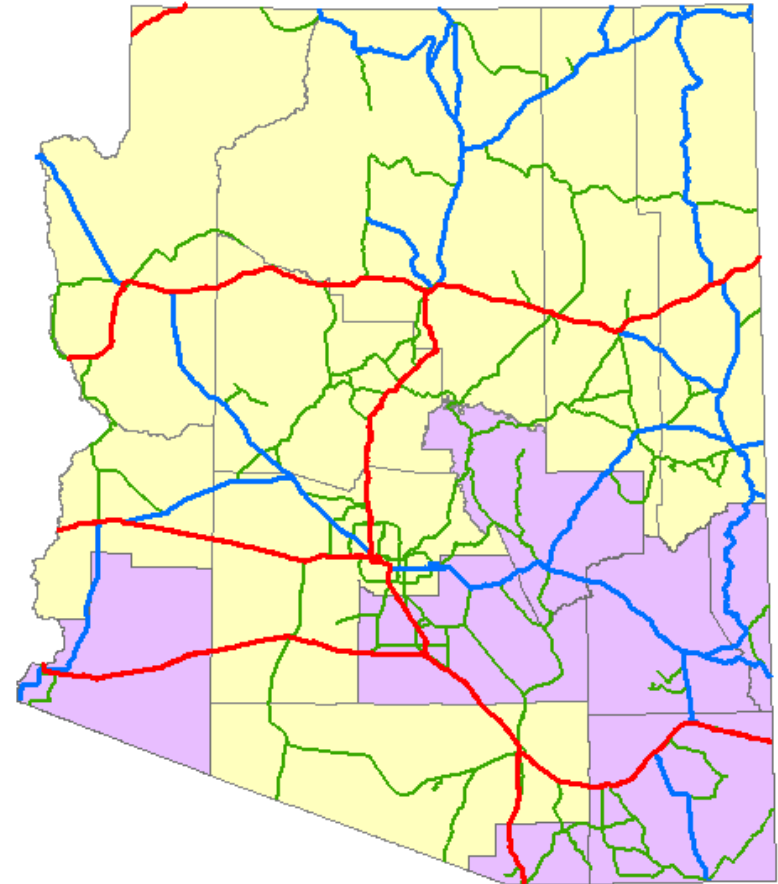


- **Any LRM that can be devised geographically can be supported**
- **Addressing is now incorporated into Transportation Linear Referencing**
- **Centerline data supplied by external sources**
- **Robust Linear Referencing for All-Public-Roads**
- **Single All Roads Network for all of Arizona**
- **Leverage resources from other projects & stakeholders**

Why is Intersection Based LRS Well Suited for ARNOLD?



- **Adaptable to multiple sources**
- **Long-term solution proven by a 38-year evolution**
- **Seven counties have already been unified**
- **Eight remaining counties will be unified by June 2014**



Questions

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Intersection Building

LRSTable Wizard

Define Spatial Limits

By Polygon Feature Layer

Use Selected

Buffer:


By One or More Routes

Use Selected

By Visible Map Extent

This wizard lets you specify the input parameters for creating new LRS tables or appending to existing LRS tables. This requires that you define the spatial extent for determining intersections between participating feature classes and the output table location.

By Visible Map Extent:
Discovers the intersections of participating features that are located within the limits of the visible map extent.



LR Methods/Types (Inputs)

LRS Table Wizard

Define Contributing Feature Classes

Include?	Name	Route?	ID Field	Prefix	Name Field	Dups OK?
<input checked="" type="checkbox"/>	ATIS.DBO.a00rte	<input checked="" type="checkbox"/>	RTE_ID		ROUTE	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ATIS.DBO.a00m	<input type="checkbox"/>	X_RTE_ID		ROUTE	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.cities20120522_polyline_1	<input type="checkbox"/>	LrsID		Lrs_Name	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.County_Line	<input type="checkbox"/>	Lrs_ID		Route	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.hydro_Dissolve	<input type="checkbox"/>	LRS_ID		Route	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.Maintenance_20110818_polyline	<input type="checkbox"/>	LrsID		Route	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.o3_com_Line	<input type="checkbox"/>	Lrs_ID		Route	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.OWNERS_20101012_polyline	<input type="checkbox"/>	LrsID		LrsName	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.Places_2009HPMS	<input type="checkbox"/>	RTE_ID		RouteName	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.PM_10_Line	<input type="checkbox"/>	Lrs_ID		Route	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.Urban_Line	<input type="checkbox"/>	Lrs_ID		Route	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ATIS.DBO.a00m_hatches_2011Jun27	<input type="checkbox"/>	LRS_ID	_	MARKER	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.Rail_Traversals	<input checked="" type="checkbox"/>	Lrs_ID		Route	<input type="checkbox"/>
<input checked="" type="checkbox"/>	ADOT.DBO.EngineeringStations	<input type="checkbox"/>	LRM_ID		Route	<input checked="" type="checkbox"/>

Cracking/clustering tolerance:

Buttons: Import, Remove, Check Data, Add Selected Items to Map, Save, Back, Next

Designate Outputs

LRS Table Wizard

Define Output Location

Output workspace:
LRS_BIN.mdb

Output spatial reference:
NAD_1983_StatePlane_Arizona_Central_FIPS_0202_Feet_Intl

Define the prefix for naming the output LRS tables

Use the values from a field in the polygon feature class

Assign a prefix

100

Overwrite Mode

Append

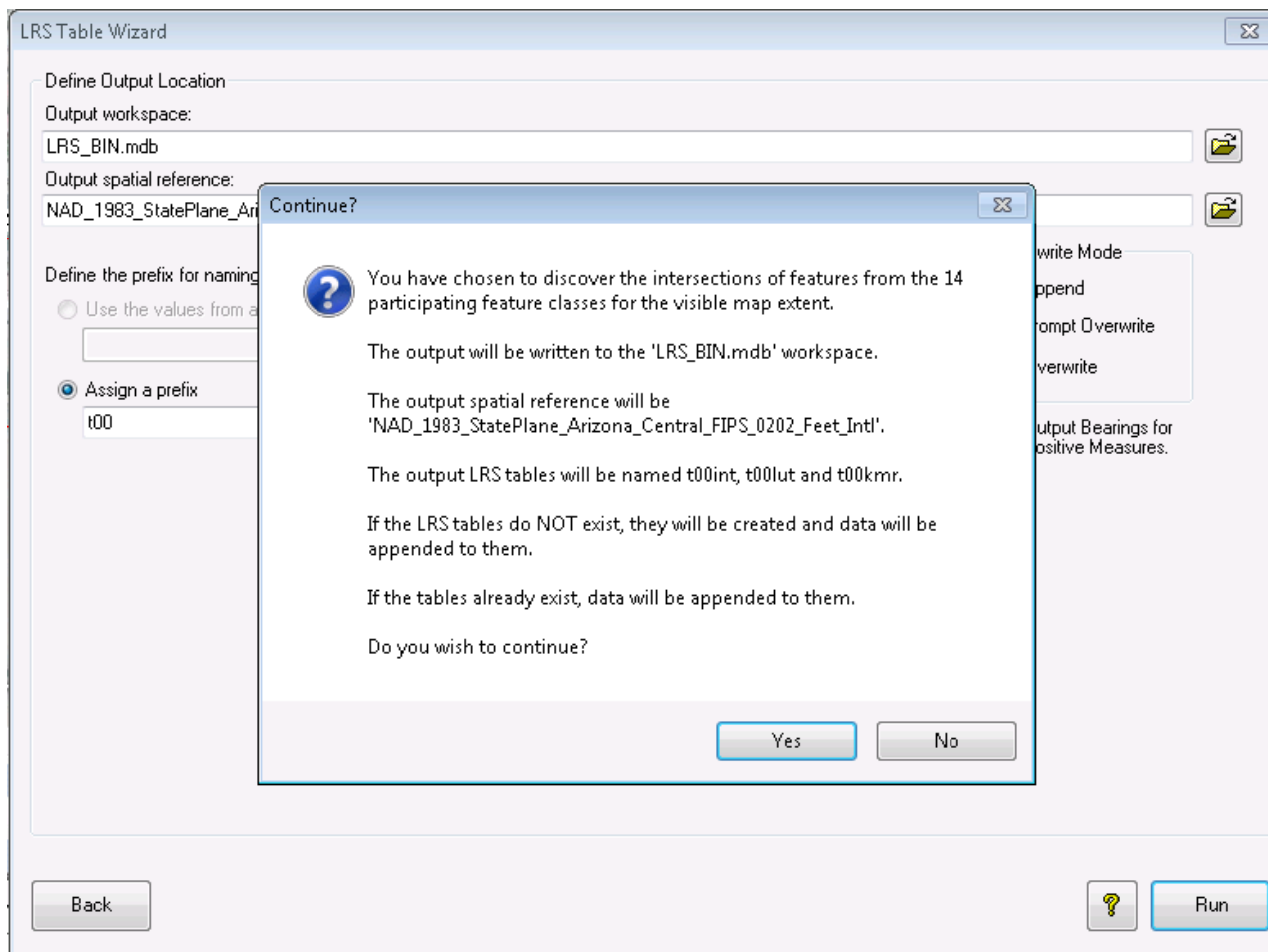
Prompt Overwrite

Overwrite

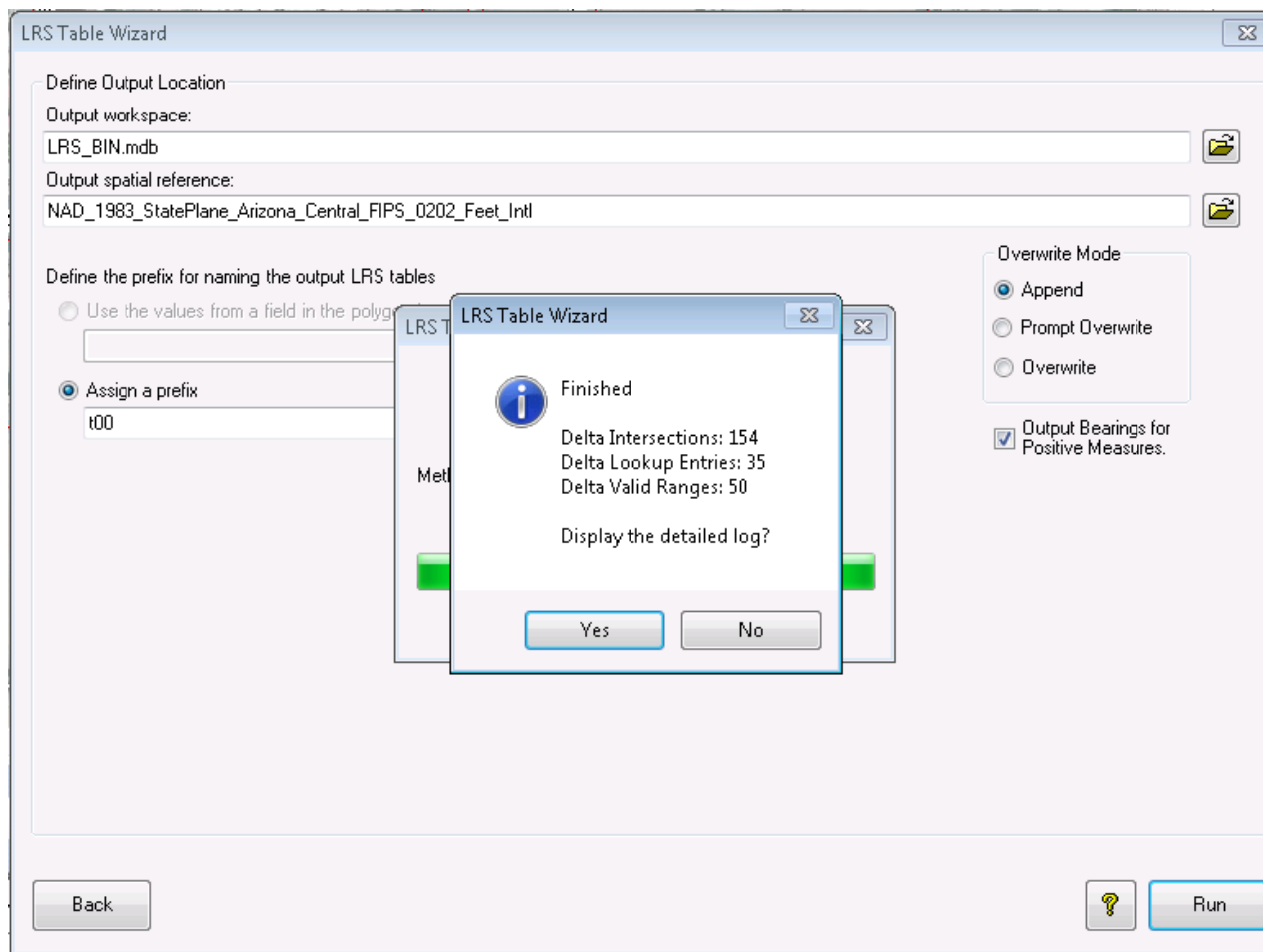
Output Bearings for Positive Measures.

Back ? Run

Confirmation....



Results



Intersections (raw)

OBJECTID	Rte_ID	X_Rte_ID	Meas	RunTime	PosMsBrng	X	Y	Qual
1	23591	114452	44.2586	4/23/2013 7:35:45 AM	300	724102	801226	
2	5970498	114452	43.8788	4/23/2013 7:35:45 AM	300	724102	801226	
3	8126990	114452	44.1334	4/23/2013 7:35:45 AM	300	724102	801226	
4	5073398	6401398	3.1625	4/23/2013 7:35:46 AM	89	723912	801775	
5	6401398	5073398	0	4/23/2013 7:35:46 AM	359	723912	801775	
6	6401398	7239298	0	4/23/2013 7:35:46 AM	359	723912	801775	
7	7239298	6401398	36.0822	4/23/2013 7:35:46 AM	89	723912	801775	
8	6401398	7261	0.0047	4/23/2013 7:35:46 AM	359	723912	801800	
9	6401398	7868398	0.0626	4/23/2013 7:35:46 AM	359	723905	802106	
10	7868398	6401398	0.2367	4/23/2013 7:35:46 AM	89	723905	802106	
11	6401398	6722198	0.1668	4/23/2013 7:35:46 AM	357	723892	802656	
12	6722198	6401398	0.262	4/23/2013 7:35:46 AM	89	723892	802656	
13	6722198	99999999	0.1881	4/23/2013 7:35:46 AM	85	723506	802624	
14	7868398	99999999	0.1601	4/23/2013 7:35:46 AM	92	723503	802120	
15	23591	2366	44.3983	4/23/2013 7:35:46 AM	315	723494	801637	
16	5970498	2366	44.0185	4/23/2013 7:35:46 AM	315	723494	801637	
17	8126990	2366	44.2731	4/23/2013 7:35:46 AM	315	723494	801637	
18	23591	5970498	44.4071	4/23/2013 7:35:46 AM	326	723461	801670	
19	5970498	23591	44.0272	4/23/2013 7:35:46 AM	323	723461	801670	
20	5970498	8126990	44.0272	4/23/2013 7:35:46 AM	323	723461	801670	
21	8126990	5970498	44.2818	4/23/2013 7:35:46 AM	326	723461	801670	
22	5073398	7261	3.077	4/23/2013 7:35:46 AM	89	723461	801767	
23	7239298	7261	35.9968	4/23/2013 7:35:46 AM	89	723461	801767	
24	5073398	6918798	3.0766	4/23/2013 7:35:46 AM	87	723459	801767	
25	6918798	5073398	0	4/23/2013 7:35:46 AM	325	723459	801767	

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Lookup Table

OBJECTID	Route	Rte_ID	LrsType	Date_O	Date_C
1	S 087 0	23591	91		
2	0+00.00ahd=17+00.00bk	114452	52		
3	11 HIGHWAY 87	5970498	98		
5	S 087	8126990	90		
7	11 HUNT HWY	5073398	98		
8	07 113TH ST	6401398	98		
12	07 HUNT HWY	7239298	98		
16	T CHANDLER_	7261	61		
18	07 STARFLOWER CT	7868398	98		
22	07 BELLFLOWER CT	6722198	98		
26	BEGIN/END/CULDESAC	99999999	99		
30	B PHOENIX-MESA_	2366	66		
48	07 CONSOLIDATED CSR	6918798	98		
56	C MARICOPA_PINAL	1560	60		
58	Z PHXPM-10BNDY_	167	67		
60	Z PHXO3BNDY_	165	65		
68	O GilaRiverIR_	6962	62		
72	D M7873_T8154	3363	63		
86	HX16101C sta.8+01.19Ahd	113952	52		
109	S 587 0	19991	91		
111	11 HIGHWAY 587	5969898	98		
136	HX16101C sta395+06.56	114152	52		
138	HX16101C sta395+06.56	114252	52		
140	M218.76 (NB S of Chandler)	1513550	50		
193	S 587	4290	90		
195	11 HIGHWAY 587 0	6337898	98		
220	HuntHwy sta0+0.11	114052	52		
222	HX16101C sta395+06.56	114352	52		
224	M218.76 (SB S of Chandler)	1513450	50		
263	07 ARIZONA AVE	6666198	98		
279	07 EASTSIDE DR	7039598	98		
288	07 SUNNYDALE CT	7895098	98		
292	07 NAVAJO PL	7508198	98		
301	07 FLAME TREE DR	7104198	98		
302	07 SUNNYDALE DR	7895198	98		

* (AutoNumber)
Record: 14 of 35

Range Table

OBJECTID	Rte_ID	BMeas	EMeas
1	23591	0	287.6387
2	5970498	0	16.0045
3	5970498	19.4023	44.0471
4	8126990	0	287.2835
5	5073398	0	7.9778
6	5073398	10.1998	35.9528
7	6401398	0	0.258
8	6401398	20.218	20.2386
9	6401398	23.8454	24.365
10	6401398	41.0745	41.307
11	6401398	41.8527	41.8998
12	6401398	50.7099	50.7872
13	6401398	50.9083	51.026
14	6401398	52.0122	52.1974
15	7239298	0	0.9837
16	7239298	0.9979	3.9155
17	7239298	32.9198	40.8975
18	7239298	42.9263	46.4488

Record: 10 of 50

Assembled...

Route	Meas	XRef	LrsType	X	Y	Qual	PosMsBmg
S 087	44.1334	0+00.00ahd=17+00.00bk	52	724102	801226		300
S 087	44.2731	B PHOENIX-MESA_	66	723494	801637		315
S 087	44.2818	11 HIGHWAY 87	98	723461	801670		326
S 087	44.3007	C MARICOPA_PINAL	60	723405	801752		321
S 087	44.3007	Z PHX03BNDY_	65	723405	801752		321
S 087	44.3007	Z PHXPM-10BNDY_	67	723405	801752		321
S 087	44.3009	O GilaRiverIR_	62	723404	801753		326
S 087	44.3021	D M7873_T8154	63	723401	801758		326
S 087	44.3035	07 HUNT HWY	98	723396	801764		269
S 087	44.3035	11 HUNT HWY	98	723396	801764		269
S 087	44.3035	HX16101C sta.8+01.19Ahd	52	723396	801764		269
S 087	44.3535	M218.76 (NB S of Chandler)	50	723133	801758		358
S 087	44.3535	S 087 0	91	723133	801758		358
S 087	44.3535	S 587 0	91	723133	801758		358
S 087	44.3535	07 HUNT HWY	98	723133	801758		358
S 087	44.3535	11 HUNT HWY	98	723133	801758		358
S 087	44.3535	HX16101C sta395+06.56	52	723133	801758		358
S 087	44.3535	HX16101C sta395+06.56	52	723133	801758		358
S 087	44.4916	07 ARIZONA AVE	98	723113	802487		359
S 087	0	44.2586 0+00.00ahd=17+00.00bk	52	724102	801226		300
S 087	0	44.3983 B PHOENIX_MESA	66	723494	801637		315

Record: 1 of 154