INTRODUCTION TO GEOPROCESSING CONFLATION TOOLS AND WORKFLOWS

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Agenda

- What is Conflation?
- Geoprocessing Conflation Tools
  - Demo 1 – Basic scenario
- Conflation Workflows
  - Demo 2 – Real world scenario
- Conclusions and Future Work

What is Conflation?

Translated by Esri localization

Zusammenführung

Fusione

₮⅛€

合并

Объединение

補正

Combinação

Combinación

Birleştirme

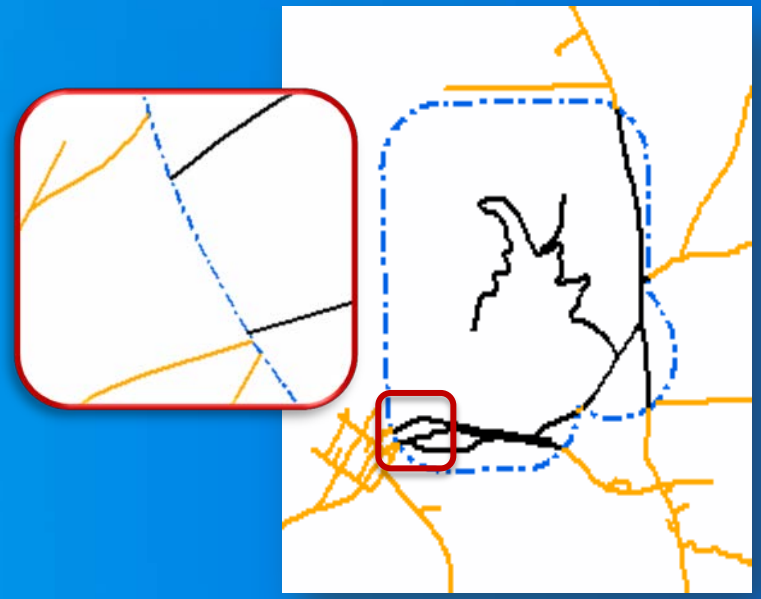
Assemblage

When using multi-source spatial data together

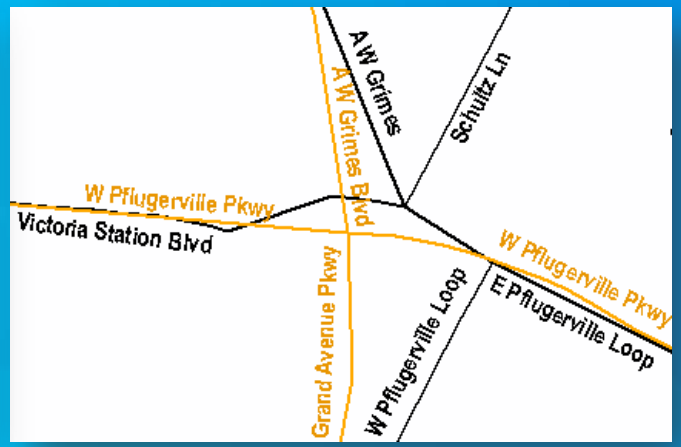
Common obstacles in analysis and mapping:

- Spatial and attribute inconsistency caused by differences in data collection and modeling
- High cost to fix the problems

Adjacent datasets



Overlapping datasets



Conflation reconciles multi-source datasets and optimizes data quality and usability

Conflation is the process of:

- Identifying corresponding features (known as feature matching)
- Making spatial adjustment and attribute transfer
- Ultimately, combining matched and unmatched features into one unified dataset with the optimal accuracy, completeness, consistency, and integrity

Long-term benefits:

- No longer living with various imperfect datasets
- More confidence in reliable analysis and high quality mapping

What's the way to get there?

Geoprocessing Conflation Tools

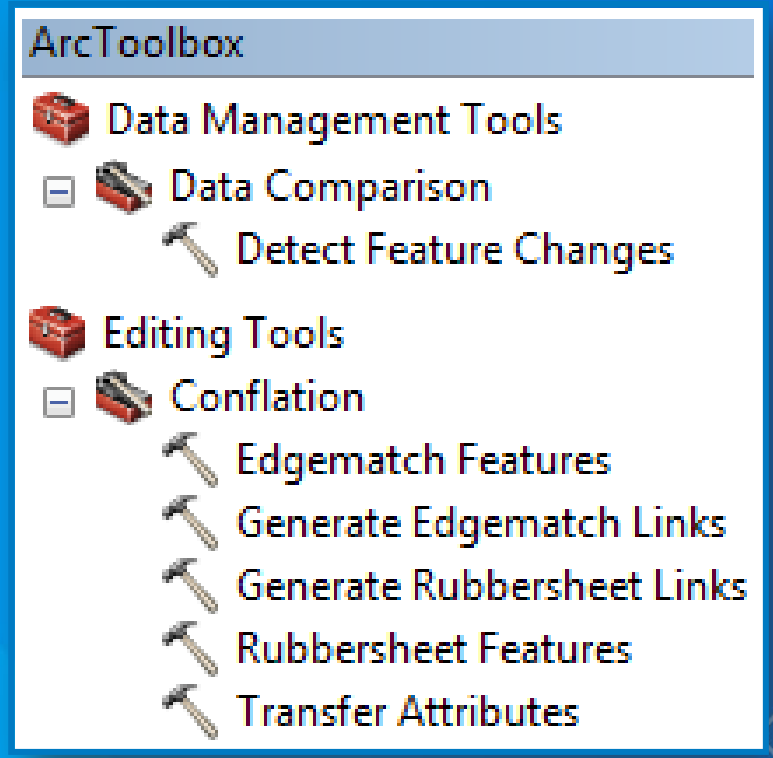
Our initial focuses

Have you used these tools?

Develop highly automated tools in Geoprocessing framework:

- Starting with linear features (roads, parcel lines, etc.)
- Aiming at high feature matching accuracy (not promising 100%)
- Providing information to facilitate post-processing

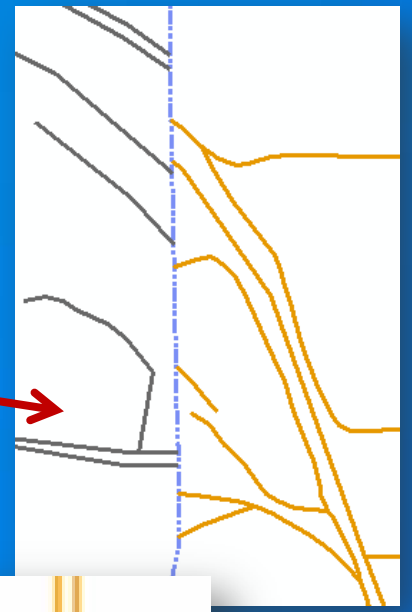
New in ArcGIS 10.2.1



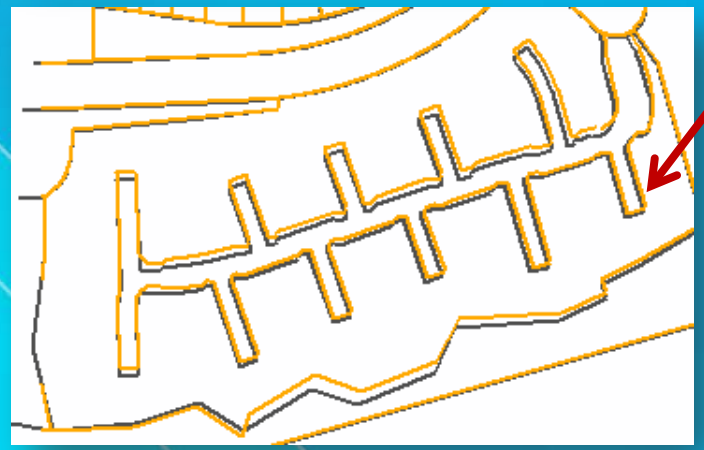
Build practical workflows

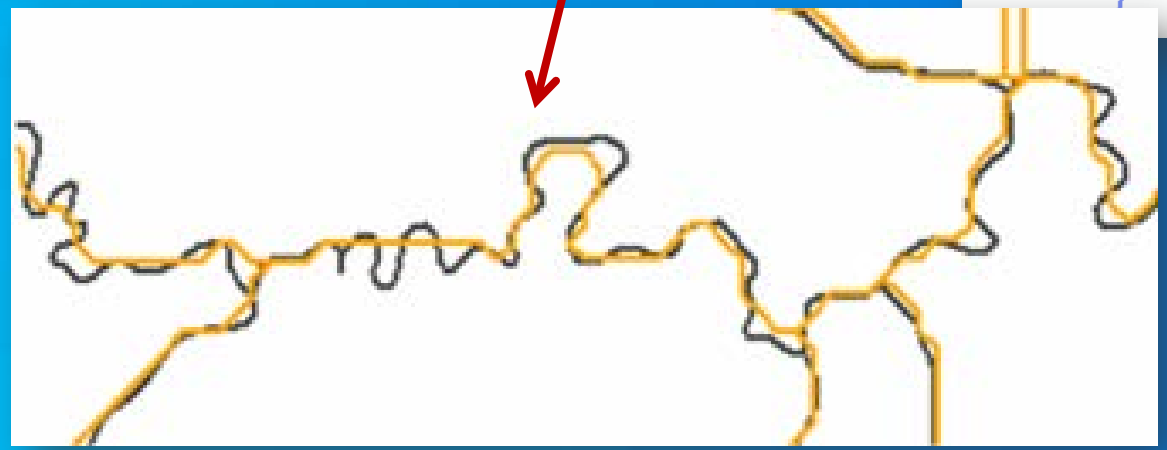
Challenges in feature matching - the key to conflation

Complexity



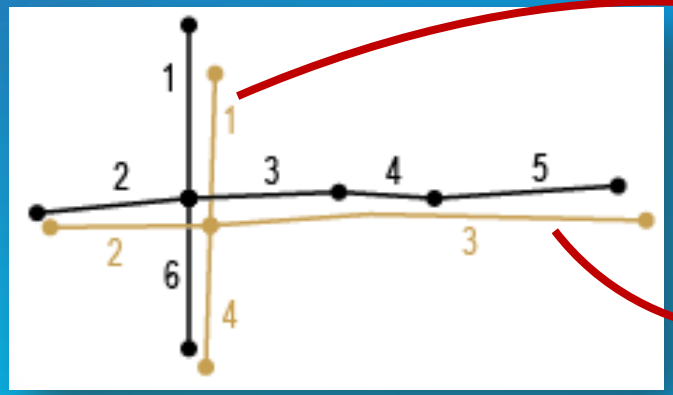
Dissimilarity





Feature matching (FM) for overlapping datasets

Based on proximity, topology, pattern, and similarity analysis, as well as attributes information

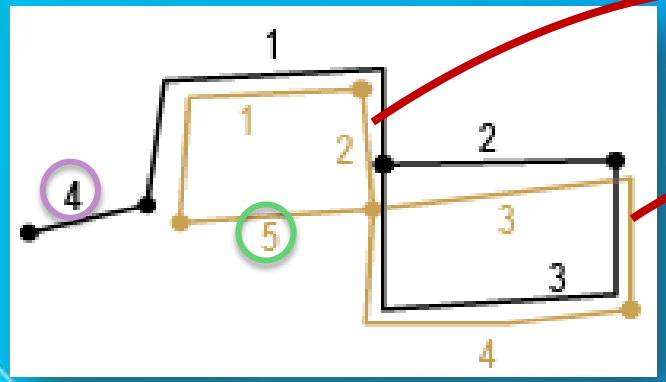


Source feature

Target feature

1:1 and 1:m matches

OBJECTID *	SRC_FID	TGT_FID	FM_GRP	FM_MN	FM_CONF
1	1	1	1	1:1	100
2	2	2	2	1:1	100
3	3	3	3	1:3	100
4	3	4	3	1:3	100
5	3	5	3	1:3	100
6	4	6	4	1:1	100



m:1 and m:n matches

OBJECTID *	SRC_FID	TGT_FID	FM_GRP	FM_MN	FM_CONF
1	1	1	1	2:1	100
2	2	1	1	2:1	100
3	3	2	2	2:2	100
4	3	3	2	2:2	100
5	4	2	2	2:2	100
6	4	3	2	2:2	100
7	5	-1	-1	N/A	0
8	-1	4	-1	N/A	0

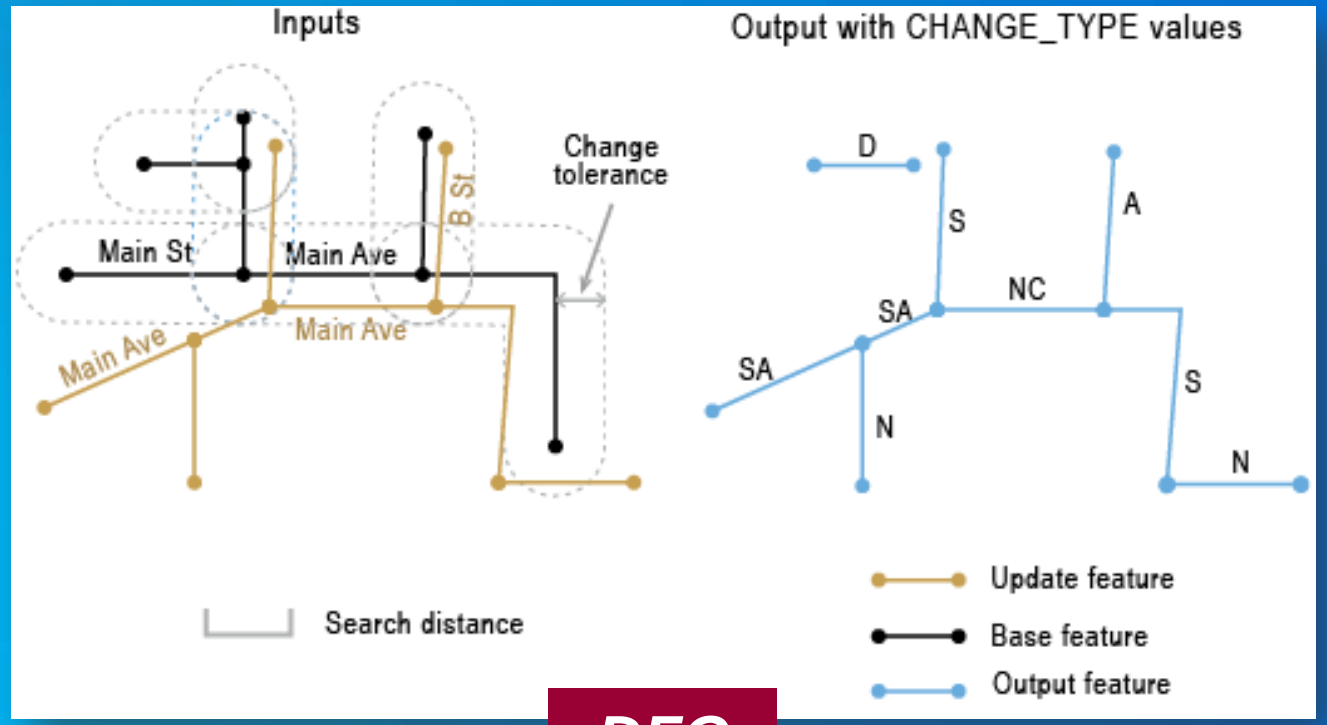
FM-based tool #1 - Detect Feature Changes (DFC)

Finding feature differences

Update features vs. base features

Output CHANGE_TYPE

- Spatial (S) change
- Attribute (A) change
- Spatial and attribute (SA) change
- No change (NC)
- New update feature (N)
- To-Delete base feature (D)

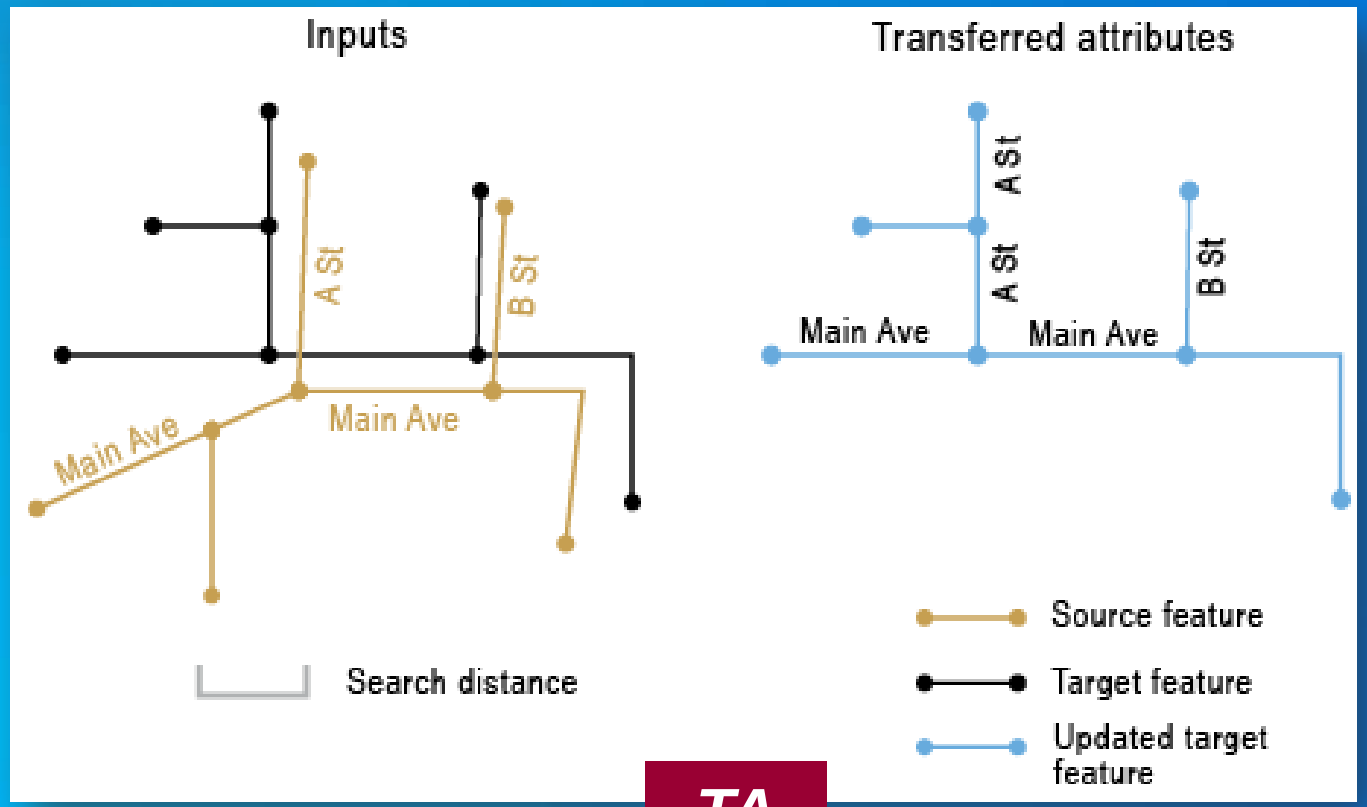


DFC

FM-based tool #2 – Transfer Attributes (TA)

From source features to target features

- Transfer fields (e.g. ROAD_NAME)
- Target features are modified



TA

FM-based tool #3 – Generate Rubbersheet Links (GRL)

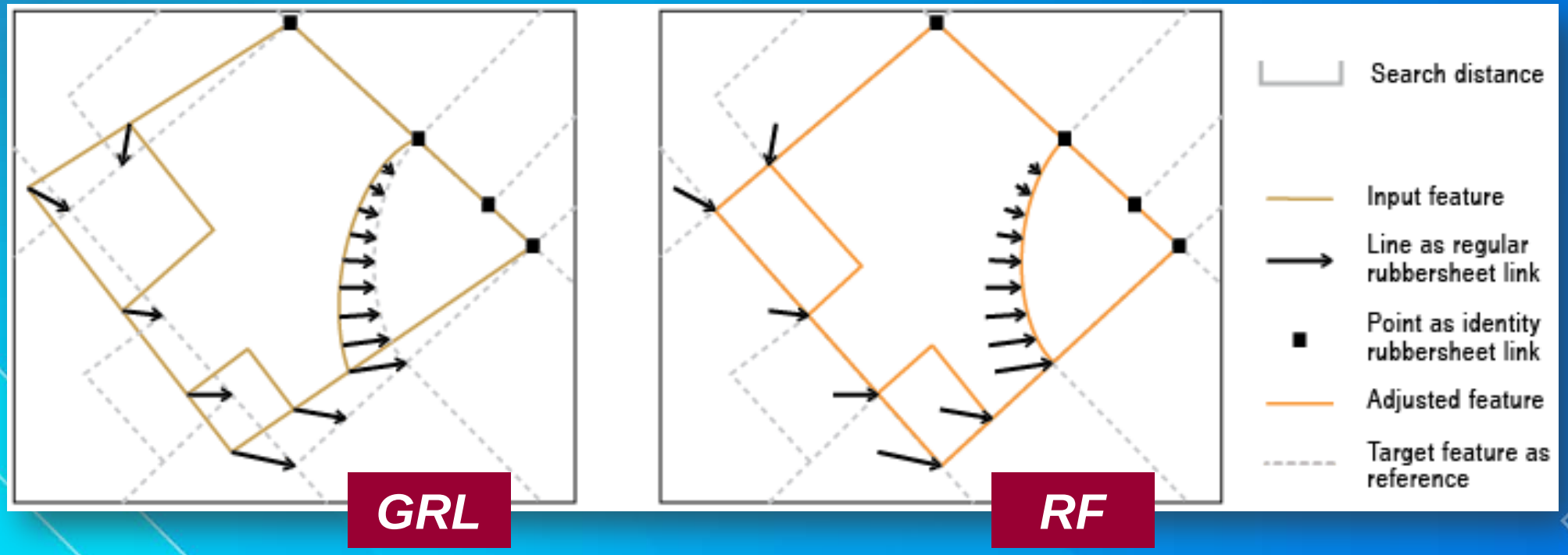
Rubbersheeting moves source locations towards target locations based on established links

Generate Rubbersheet Links (GRL)

- From source features to target features

Followed by Rubbersheet Features (RF)

- Adjusting input features



Edgematching (EM) for adjacent datasets

Based on proximity, topology, and continuity analysis, as well as attributes information

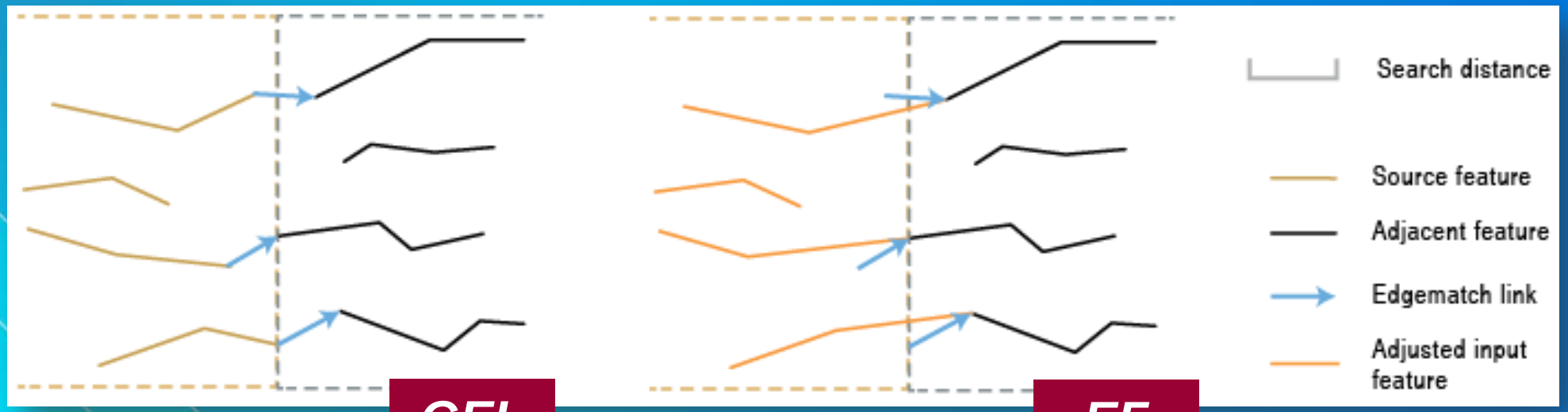
Generate Edgematch Links (GEL)

- **From source features to adjacent features**

Followed by Edgematch Features (EF)

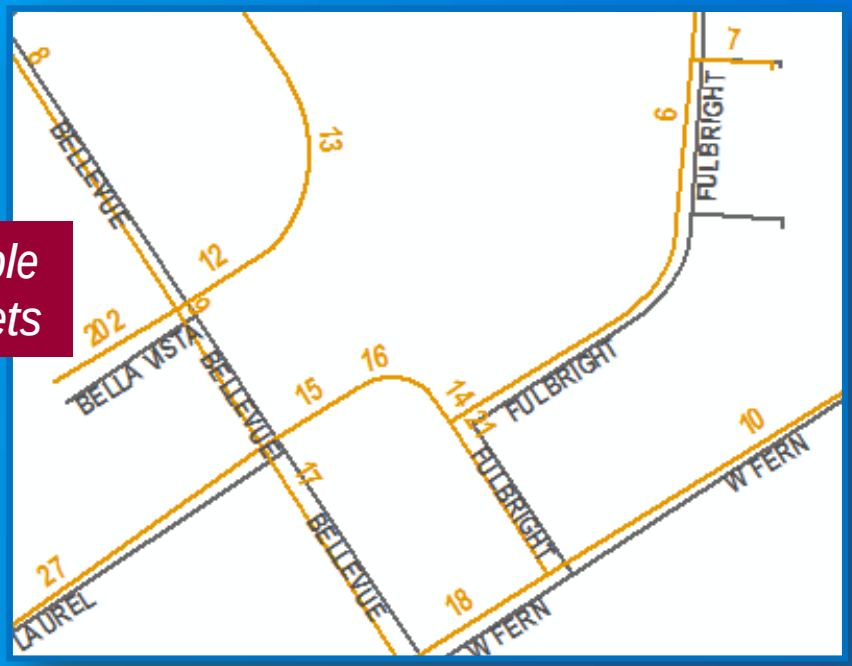
- **Connects features guided by the established links**

Recommend:
Conflation: Edgematching tools and workflows
12:30 – 1:15pm, Thur.
Demo Theater – Analysis & Geoprocessing, Hall B



Demo 1:
Basic scenario

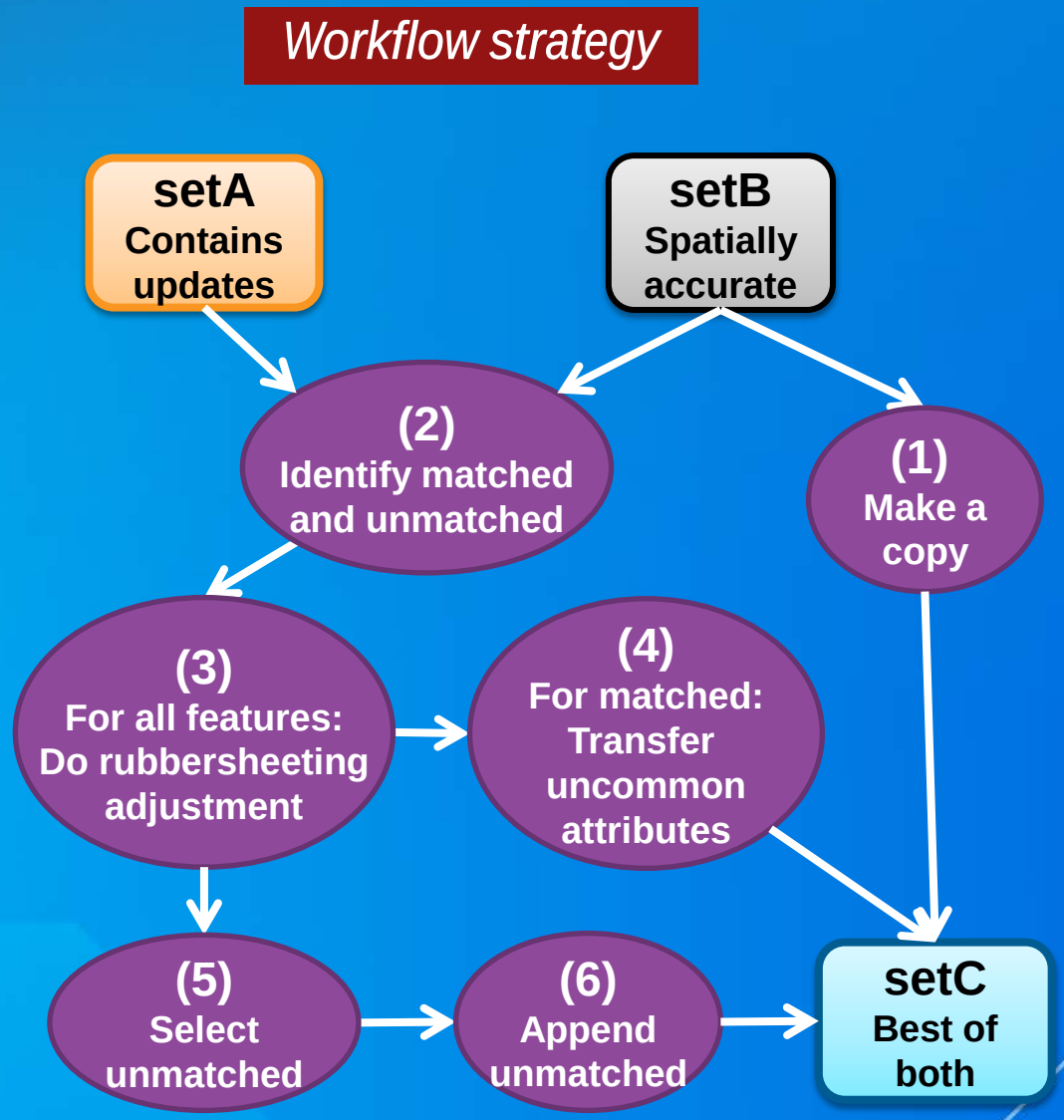
Unification of simple overlapping datasets



Unification of overlapping datasets

A popular scenario and requirements:

- To unify the two datasets into one with combined spatial and attribute information



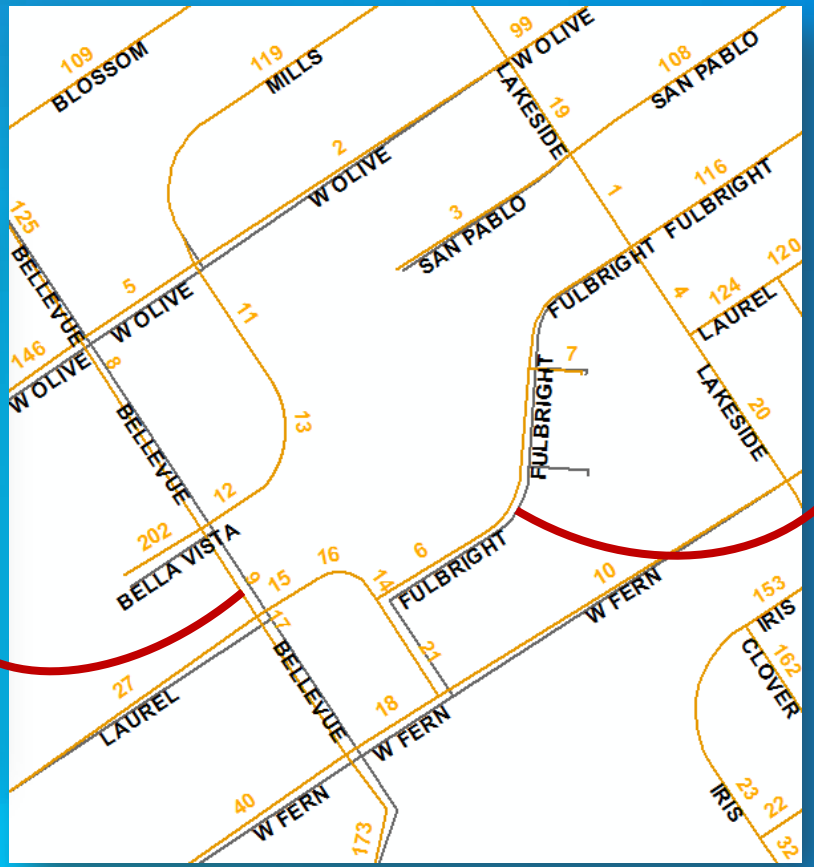
Input streets

Update features with new streets and attributes

UpdateStreets

OBJECTID *	Shape	UniqueID	Priority	Shape_Length
1	Polyline	1	<Null>	88.544127
2	Polyline	2	L	298.351168
3	Polyline	3	L	166.198499
4	Polyline	4	L	83.759794
5	Polyline	5	L	109.060742
6	Polyline	6	L	378.689485
7	Polyline	7	L	44.406315
8	Polyline	8	M	178.995089
9	Polyline	9	M	82.505747
10	Polyline	10	M	326.699698
11	Polyline	11	<Null>	113.142624
12	Polyline	12	<Null>	59.711738
13	Polyline	13	<Null>	90.582727
14	Polyline	14	<Null>	18.331248

Together

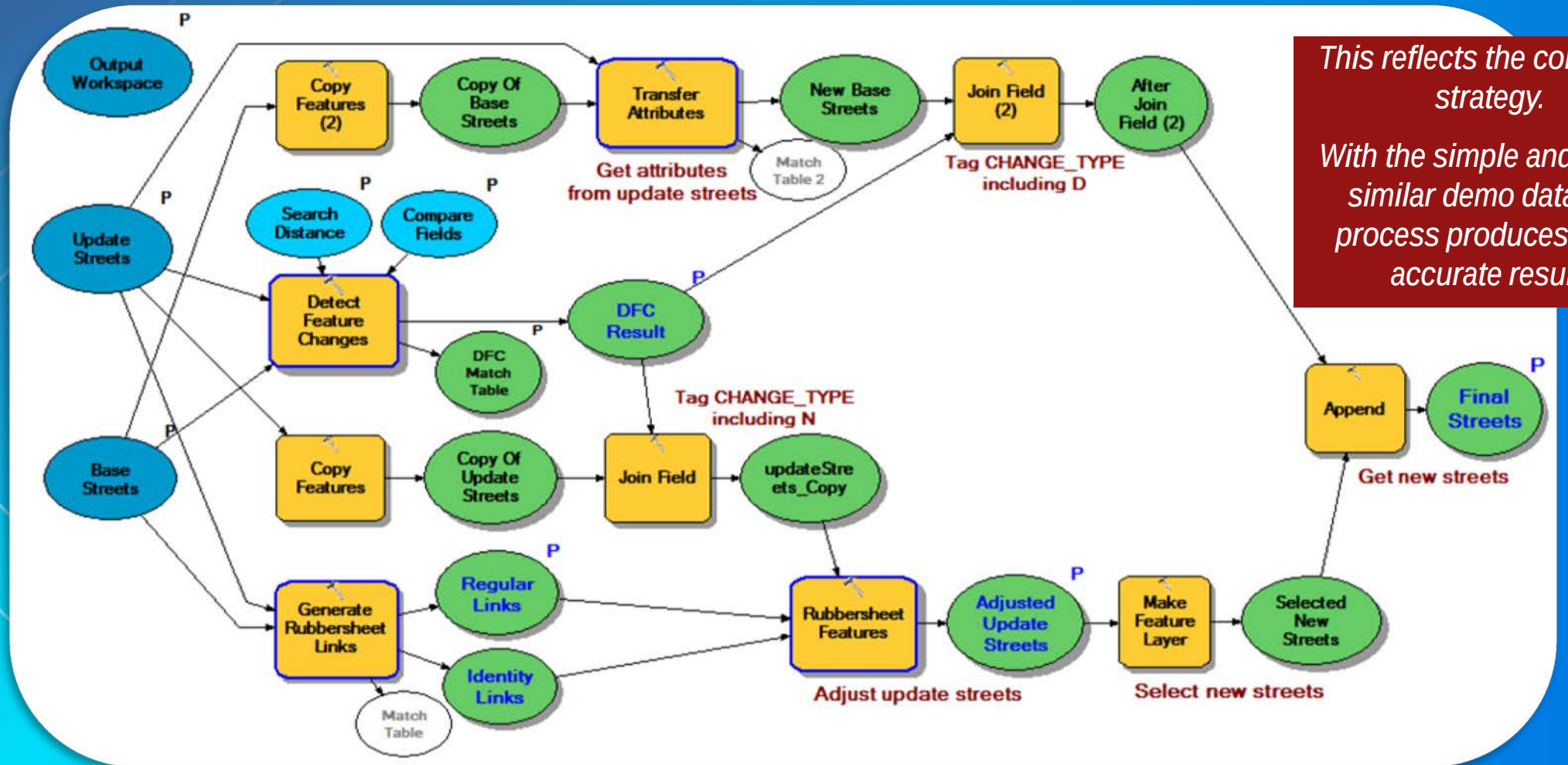


Base features with spatial accuracy and attributes

BaseStreets

OBJECTID *	Shape *	NAME	Priority	Shape_Length
130	Polyline	W FERN	M	82.64188
149	Polyline	W FERN	M	316.419224
156	Polyline	W FERN	M	87.413082
106	Polyline	SHERWOOD	L	138.32864
129	Polyline	SHERWOOD	L	154.974493
73	Polyline	SAN RAFAEL	L	94.960556
82	Polyline	SAN RAFAEL	L	86.952636
87	Polyline	SAN PABLO	L	259.025112
102	Polyline	SAN PABLO	L	162.609722
114	Polyline	NOTTINGHAM	L	138.470439
140	Polyline	NOTTINGHAM	L	217.51654
66	Polyline	MILLS	L	90.060797
69	Polyline	MILLS	L	91.095418

Part 1 - Conflate overlapping datasets

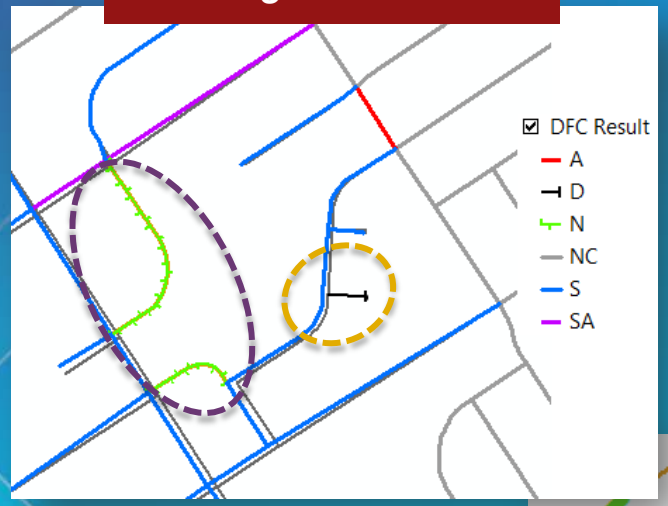


This reflects the conflation strategy.

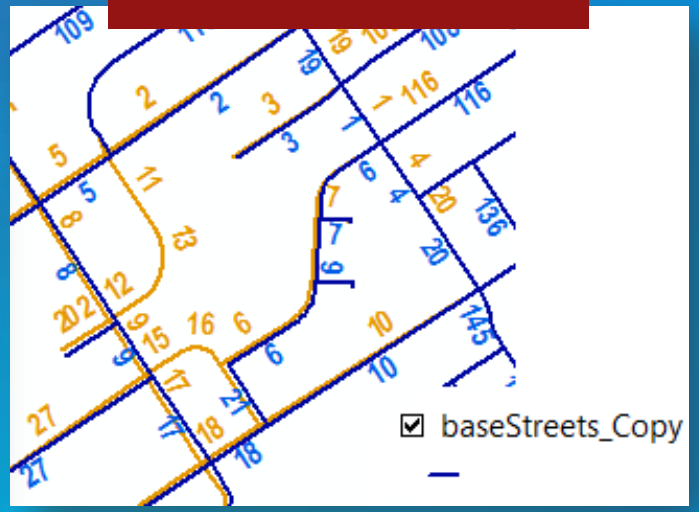
With the simple and highly similar demo data, the process produces 100% accurate result.

Results

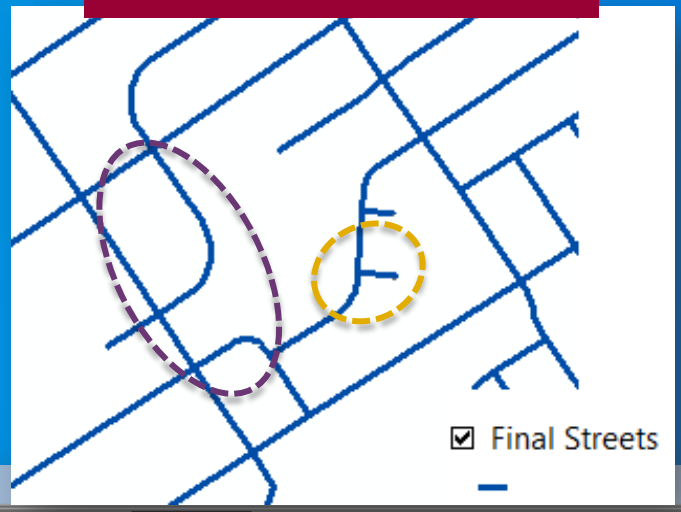
Changes detected



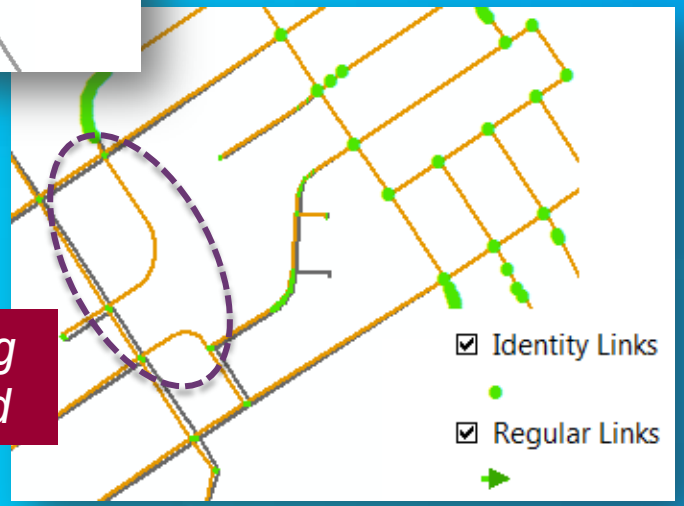
Attributes transferred



New features adjusted and added to base



Rubbersheeting links generated



Final Streets

	OBJECTID *	Shape *	NAME	Priority	Shape_Length	UniqueID	CHANGE_TYPE
	100	Polyline	W OLIVE	M	293.577825	2	A
	109	Polyline	W OLIVE	M	109.071651	5	A
	128	Polyline	<Null>	L	51.455286	<Null>	D
	200	Polyline	<Null>	M	112.706047	11	N
	201	Polyline	<Null>	M	59.242967	12	N
	202	Polyline	<Null>	M	90.29932	13	N
	203	Polyline	<Null>	M	18.383534	14	N
	204	Polyline	<Null>	M	58.252814	15	N
	205	Polyline	<Null>	M	37.23	16	N
	6	Polyline	LAUREL	L	384.916164	27	NC
	19	Polyline	W FERN	M	340.788763	40	NC
	66	Polyline	MILLS	L	90.060797	87	NC
	67	Polyline	KATHL	L	173.068809	88	NC
	69	Polyline	MILLS	L	91.095418	90	NC

Conflation Workflows

Three components in conflation workflows

- In same projection
- Data validation
- Selection of relevant features

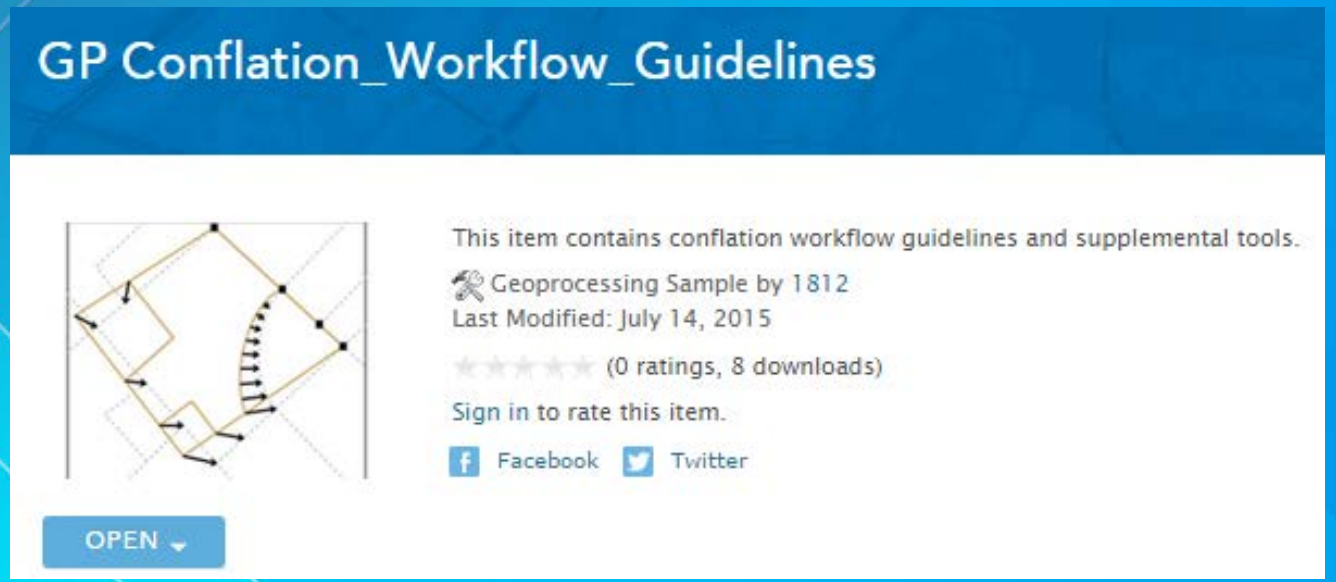
- Conflation tools
- Workflow tools

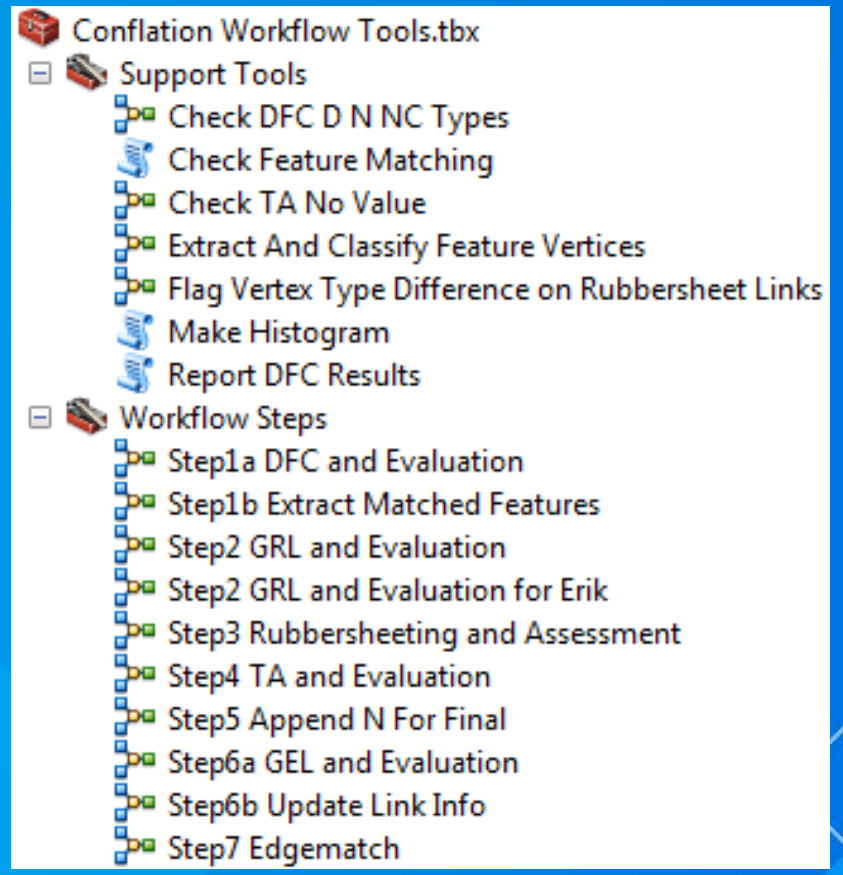
- Queued review
- Interactive editing

Supplemental tools and guidelines for download

http://angp.maps.arcgis.com/home/item.html?id=36961cde1b074f1f944758f6abec87cc

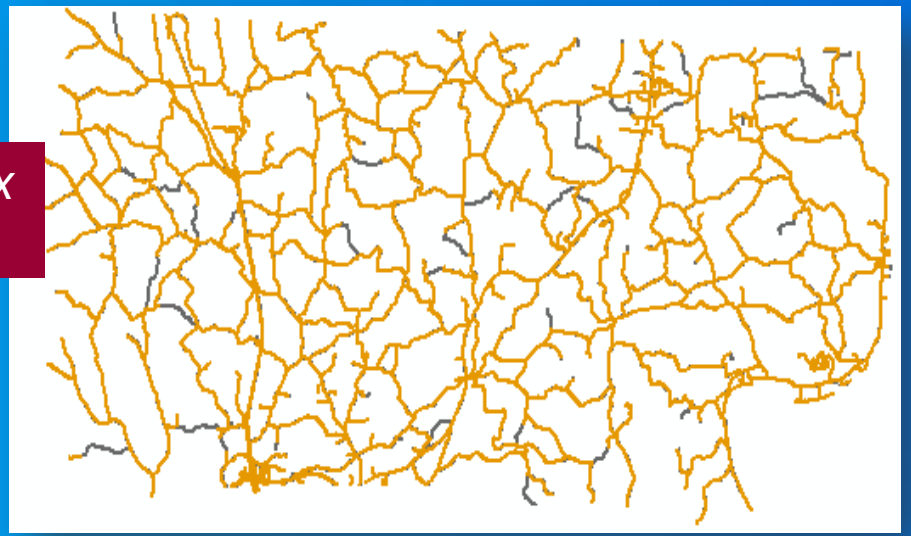
You can also search by “conflation” at arcgis.com to find the download.





Demo 2:
Real world scenario

Unification of complex overlapping datasets



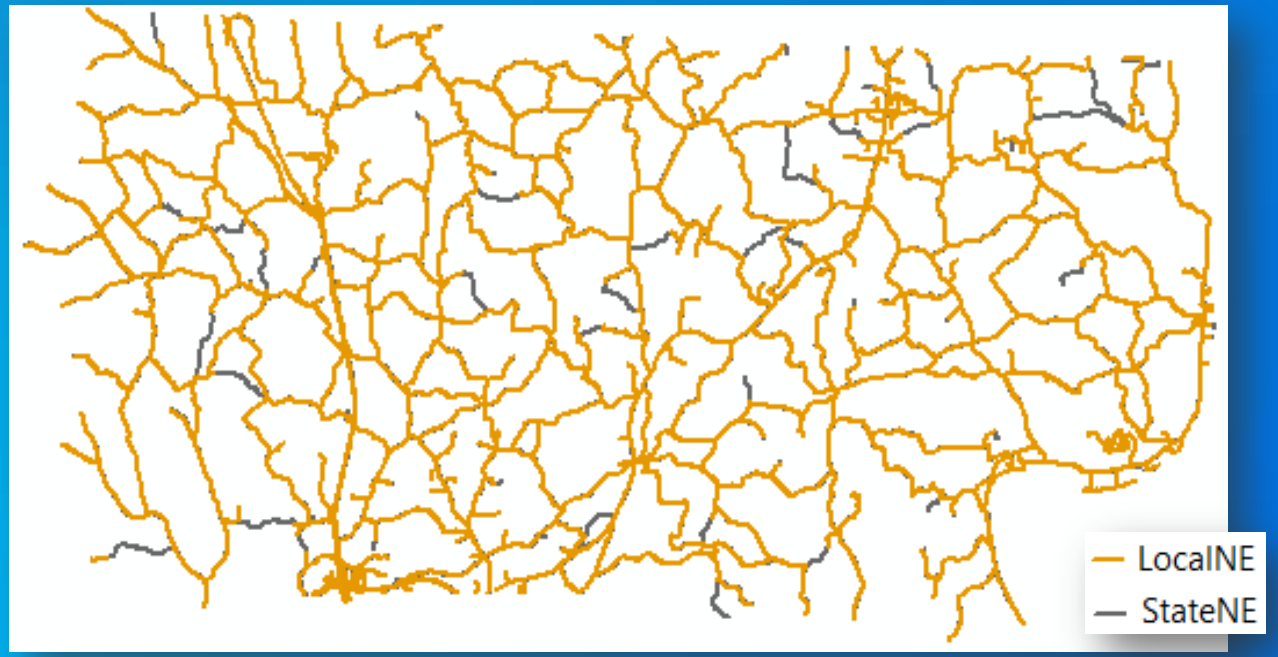
Data overview

Two road datasets (northeast of Meigs County, OH):

- **LocalNE – 1085 features**
- **StateNE – 1013 features**

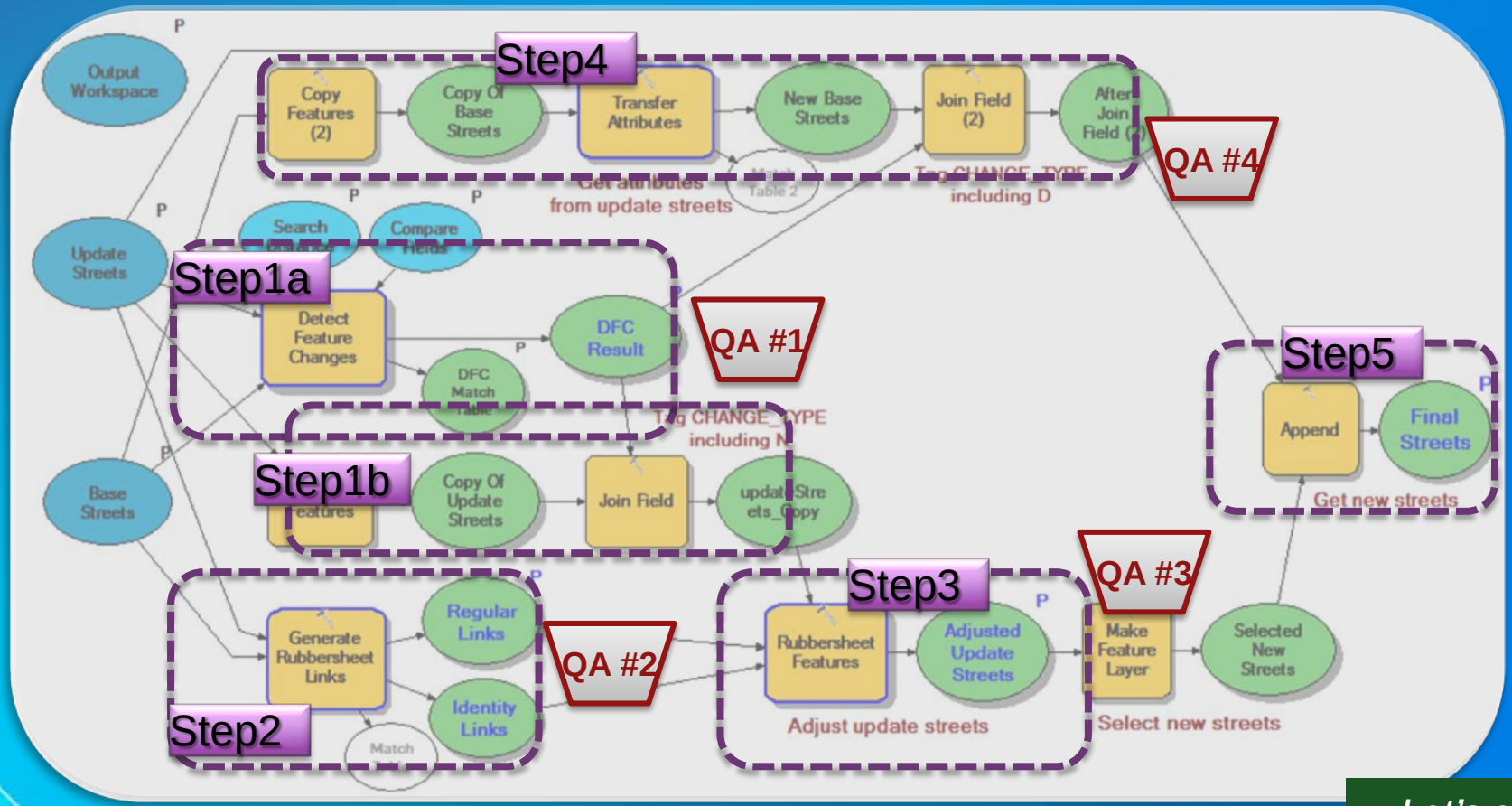
Both datasets:

- **Have common and uncommon features and attributes**
- **Are well preprocessed**



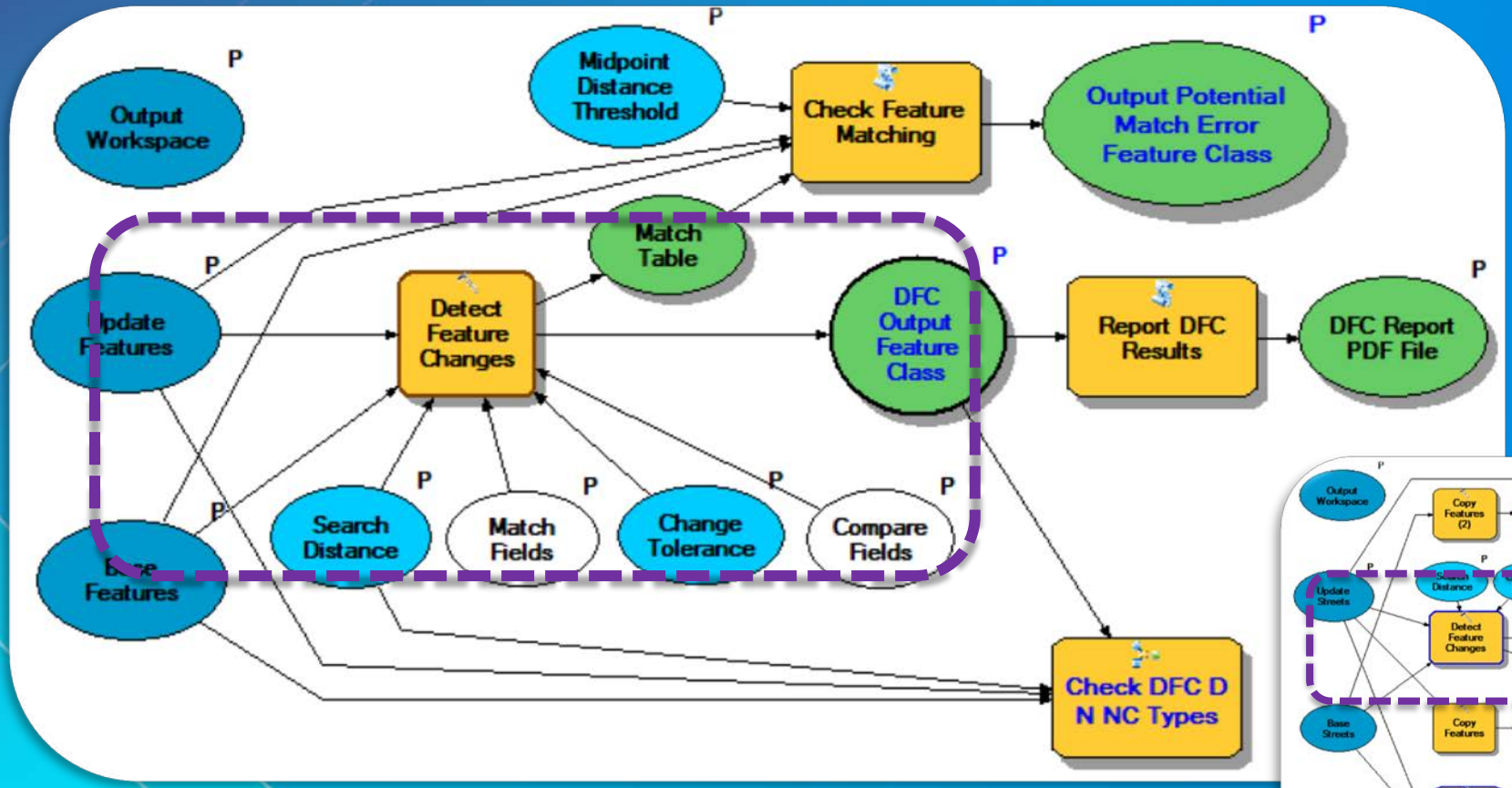
Breakdown of Demo 1 workflow into sub-workflows

Same goal and same strategy as Demo 1

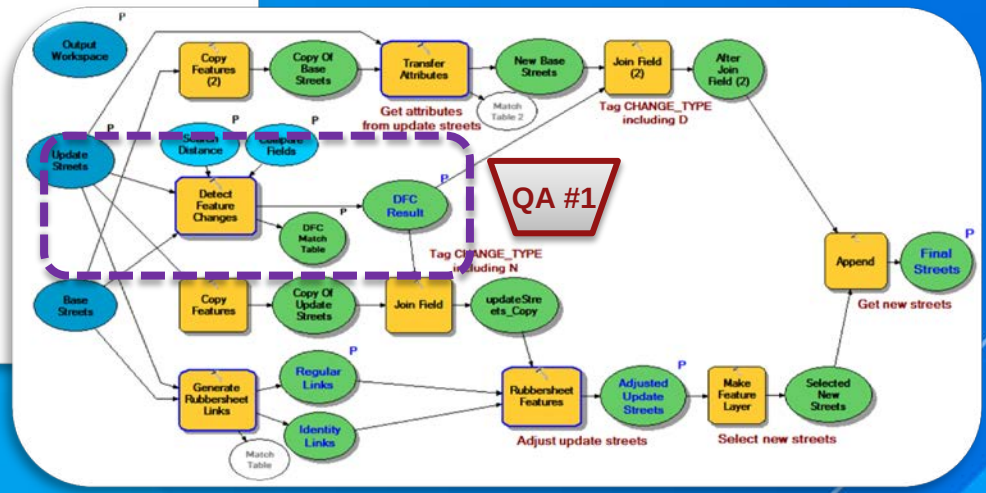


Let's get started …

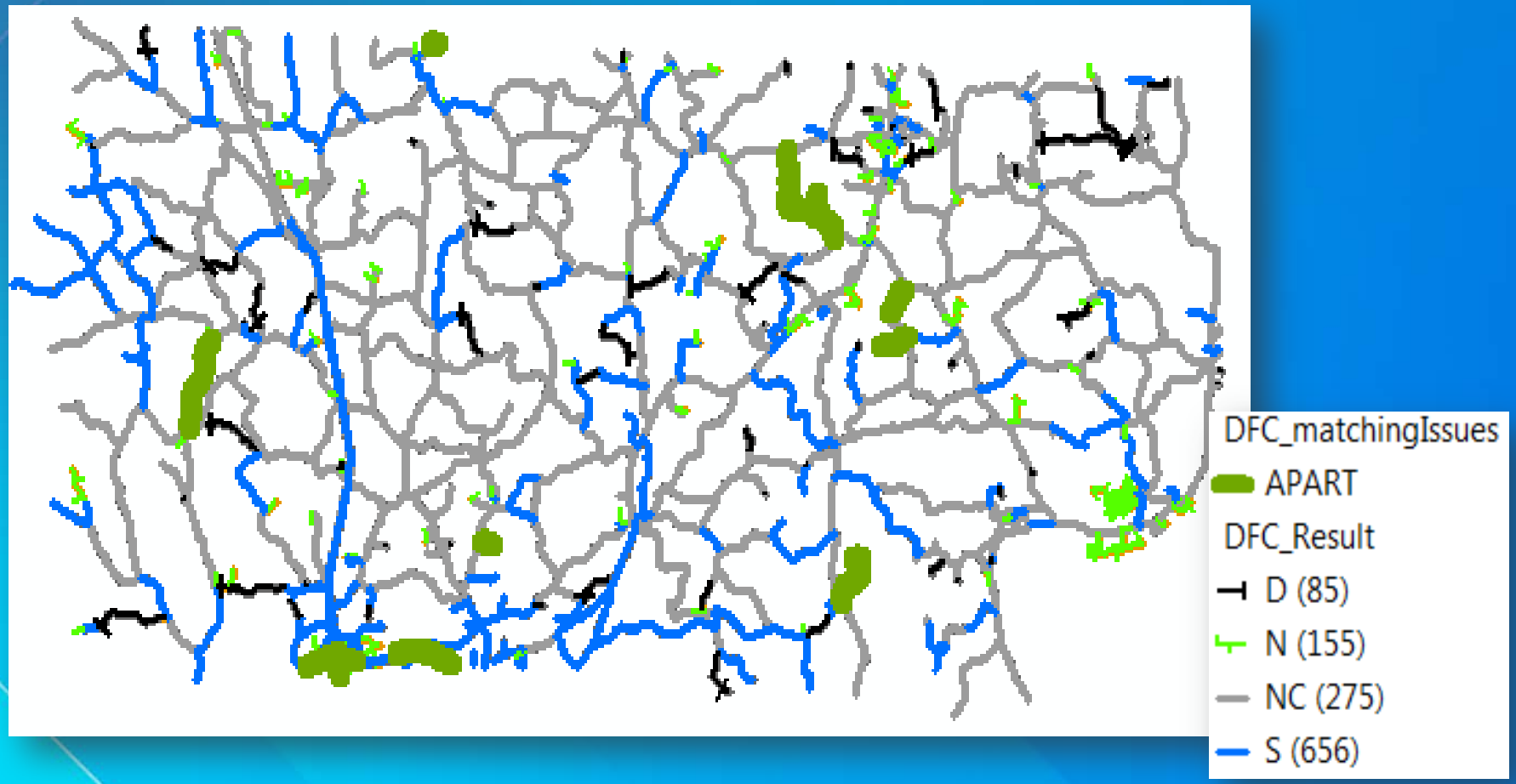
Step1a DFC and Evaluation



Step1a of the workflow with evaluation

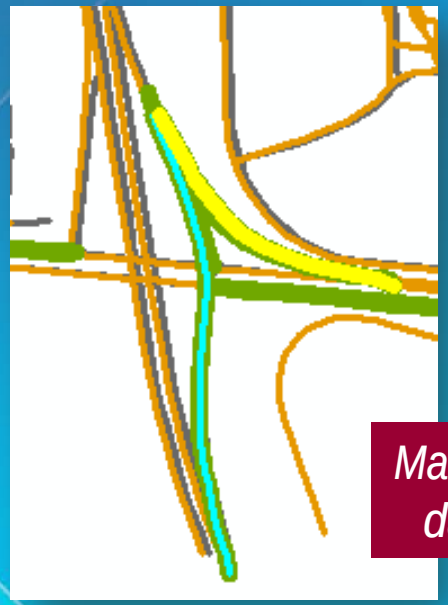


DFC result and potential match errors



QA potential match errors

Total 16 CFM_GRP were flagged; 11 had match issues due to data complexity and dissimilarity; 5 were ignorable

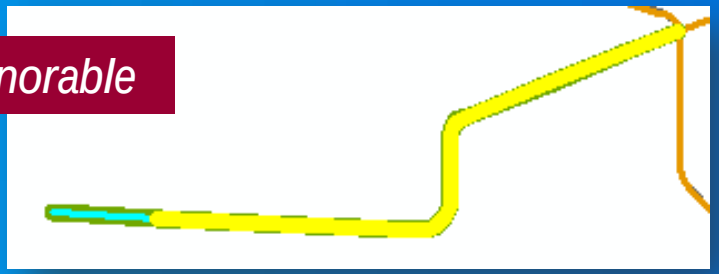


Match issue due to data complexity

DFC_matchingIssues

	OBJECTID *	Shape *	Shape_Length	SRC_FID	TGT_FID	FM_MN	FM_GRP	CFM_GRP	CFM_FLAG	CFM_DIST
▸	5	Polyline	130.569047	590	-1	2:1	25	2	APART	53.421149
	6	Polyline	742.933526	616	-1	2:1	25	2	APART	53.421149
	7	Polyline	748.586359	-1	550	2:1	25	2	APART	53.421149

Match issue ignorable



DFC_matchingIssues

	OBJECTID *	Shape *	Shape_Length	SRC_FID	TGT_FID	FM_MN	FM_GRP	CFM_GRP	CFM_FLAG	CFM_DIST
	1	Polyline	344.068097	12	-1	3:1	13	1	APART	134.185317
	2	Polyline	22.322729	20	-1	3:1	13	1	APART	134.185317
	3	Polyline	188.622333	61	-1	3:1	13	1	APART	134.185317
	4	Polyline	360.206768	-1	62	3:1	13	1	APART	134.185317

QA DFC result – CHANGE_TYPE D and N

((CHANGE_TYPE = 'N') OR (CHANGE_TYPE = 'D')) AND((NEAR_DIST > 0) AND (NEAR_DIST < 10))

Inspect records with high potential for errors:

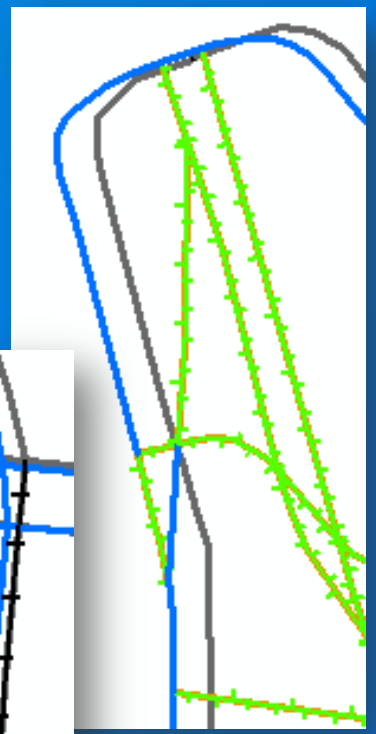
- **35 reviewed**
- **11 wrong Ns or Ds flagged**

DFC_Result_READY

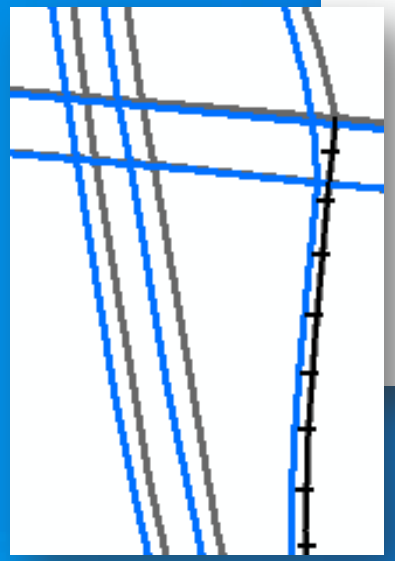
UPDATE_FID	BASE_FID	CHANGE_TYPE	LEN_PCT	LEN_ABS	Shape_Length	NEAR_FID	NEAR_DIST	REV_FLAG
106	-1	N	-1	-1	30.065054	100	9.620227	wrongN
170	-1	N	-1	-1	132.907686	142	1.690797	wrongN
661	-1	N	-1	-1	13.923188	613	0.123593	wrongN
906	-1	N	-1	-1	36.27247	823	0.268347	wrongN
-1	1	D	-1	-1	312.204053	12	5.319732	wrongD
-1	10	D	-1	-1	23.34473	20	6.295733	wrongD
-1	66	D	-1	-1	204.019635	73	1.792909	wrongD
-1	96	D	-1	-1	0.718702	124	1.4274	wrongD
-1	142	D	-1	-1	132.812766	170	2.10387	wrongD
-1	613	D	-1	-1	13.919109	661	0.070317	wrongD
-1	823	D	-1	-1	36.257103	906	0.425543	wrongD
11	-1	N	-1	-1	167.678377	12	5.040875	isN
62	-1	N	-1	-1	122.483568	3	5.081806	isN
83	-1	N	-1	-1	13.434471	69	6.240292	isN

0 (35 out of 1171 Selected)

Wrong N



Wrong D



Feature matching accuracy estimates

Matched groups:

- Total: 896 groups
- Correct: 885 groups
- Incorrect: 11 groups

Accuracy = 885 / 896 = 98.77%

Unmatched:

- Total: 240 (155 Ns + 85 Ds)
- Correct: 229 (151 Ns + 78 Ds)
- Incorrect: 11 (4 Ns + 7 Ds)

Accuracy = 229 / 240 = 95.42%

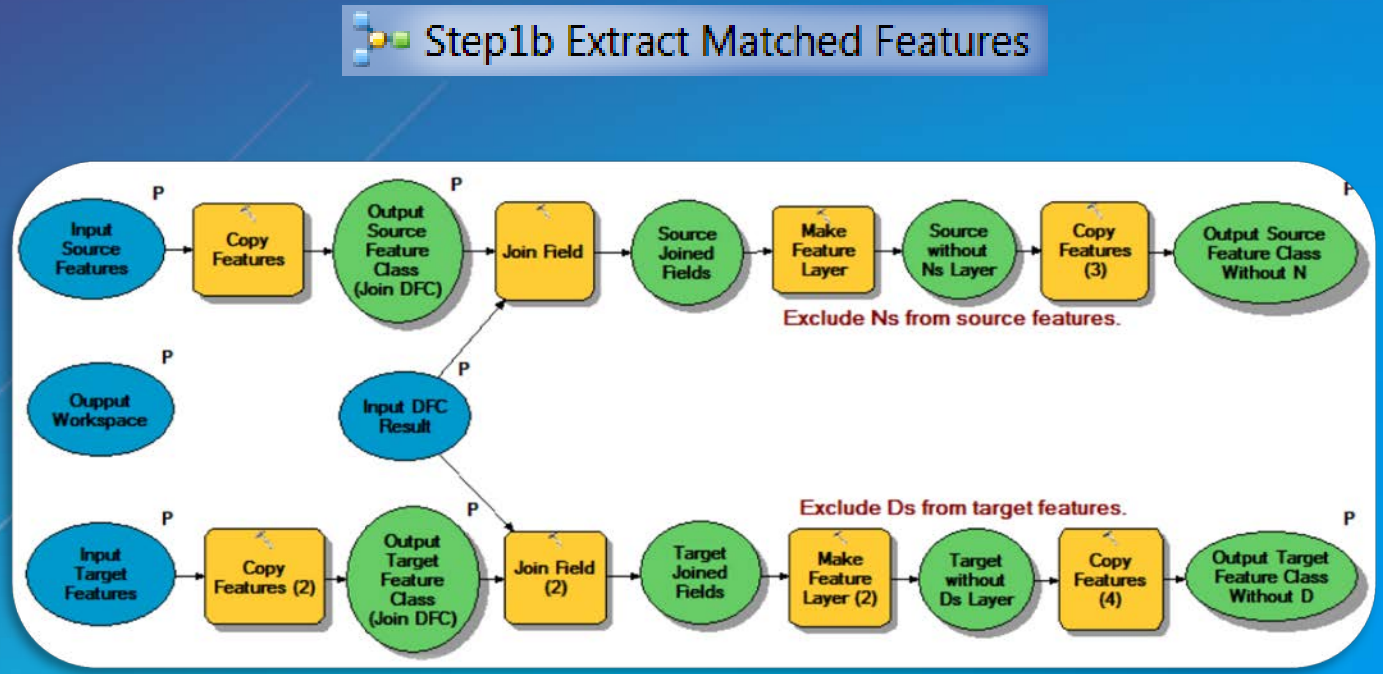
(biased by the total count)

Overall feature matching accuracy

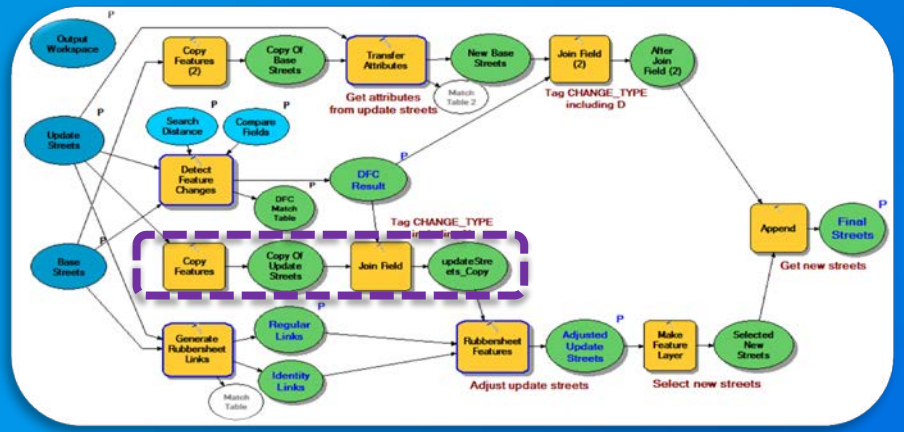
(average of matched and unmatched)

97.09%

Ready to join with inputs to tag Ns and Ds …



Step1b of the workflow



Extract matched features for GRL and TA processes

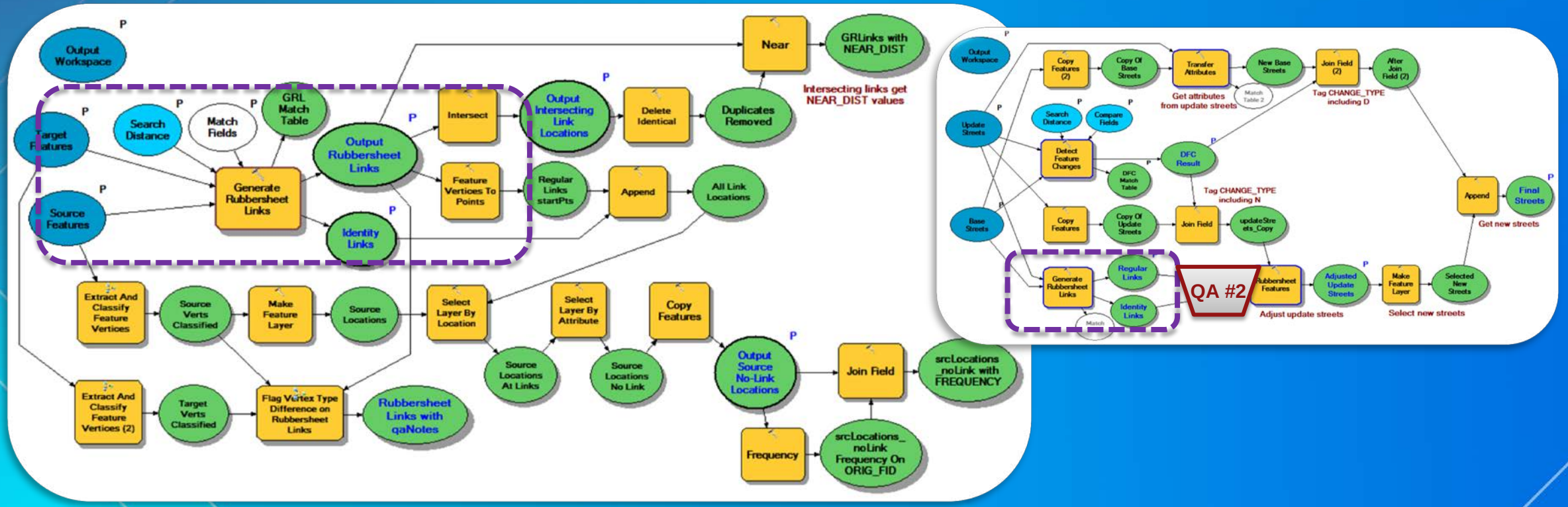
LocalNE: 934 non-N out of 1085

StateNE: 935 non-D out of 1013

Ready for GRL process …

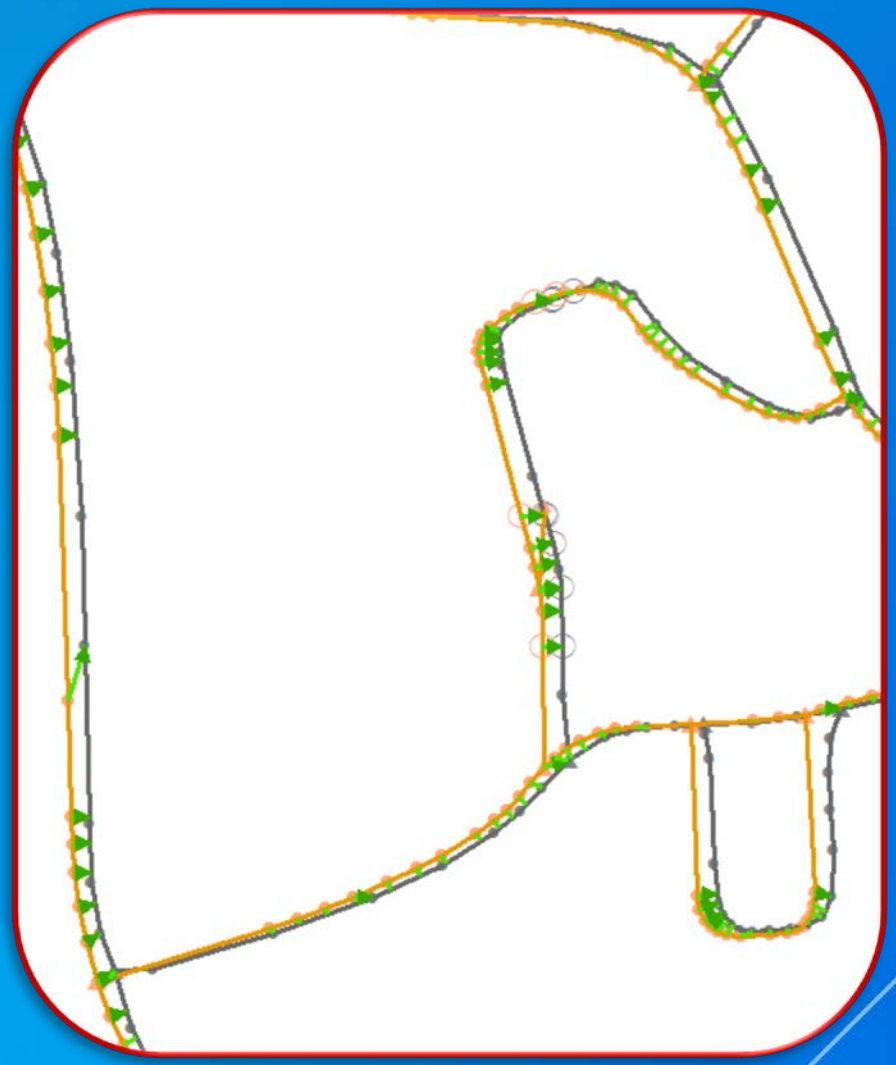
Step2 GRL and Evaluation

Step2 of the workflow with evaluation and QA



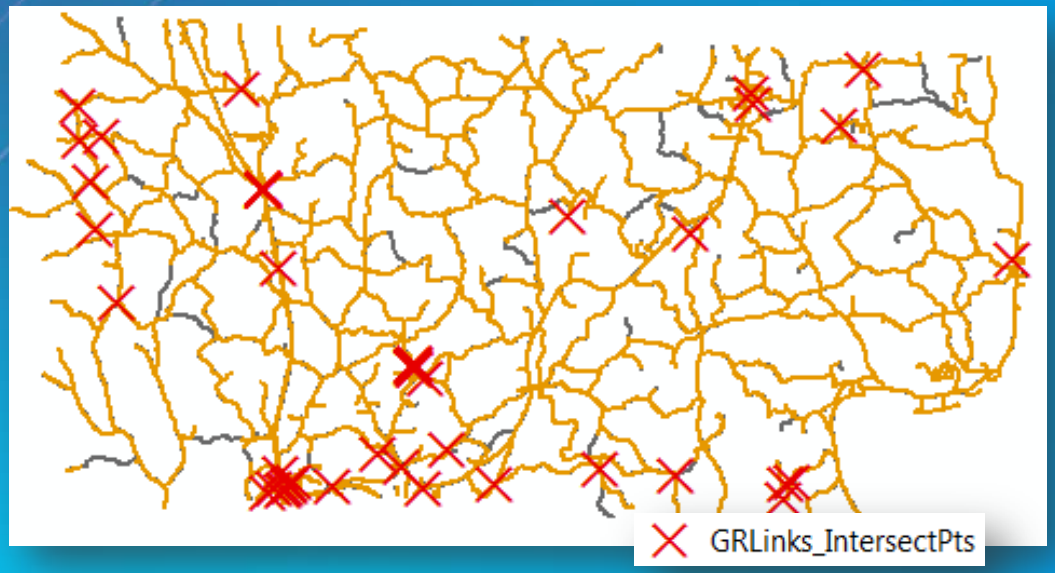
GRL result

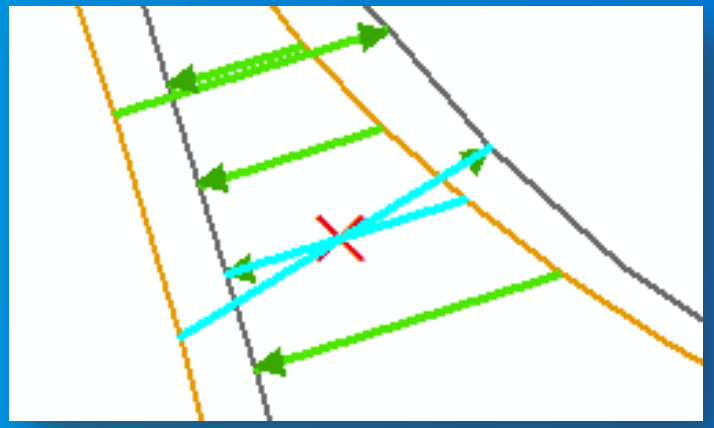
Generated total 26198 regular links and 10227 identity links

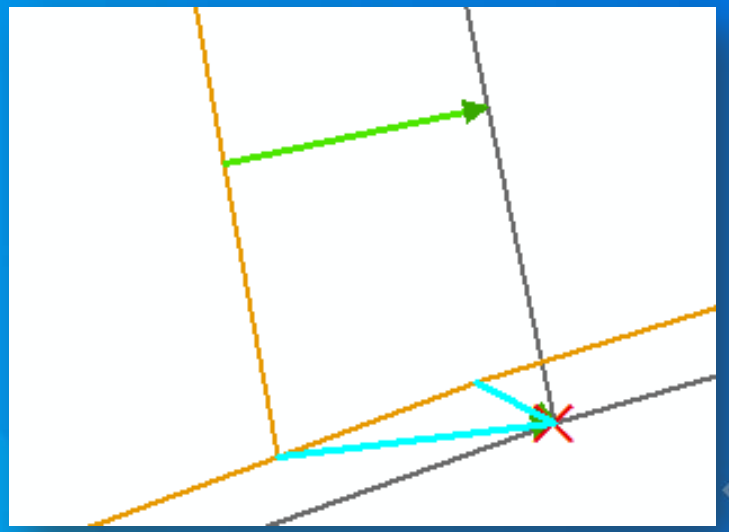


GRL evaluation results – Intersecting links

54 locations of intersecting links





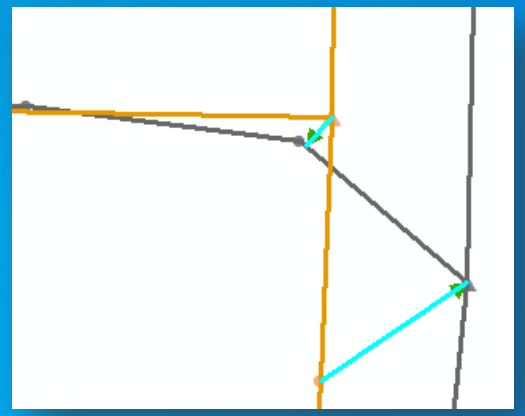


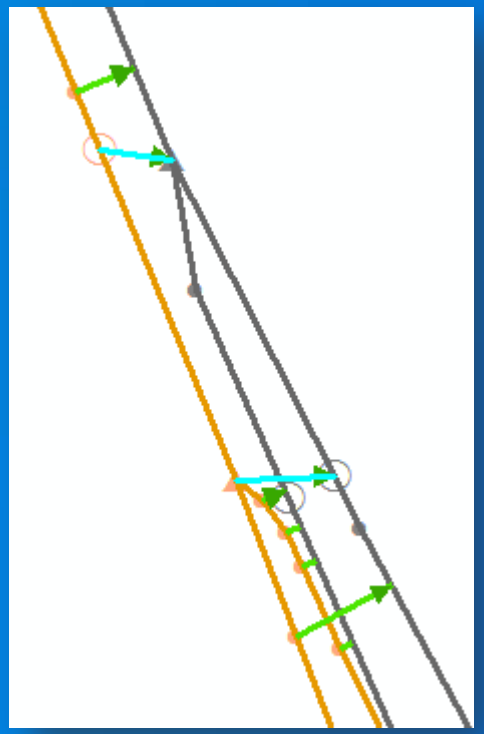
GRLinks

	OBJECTID	Shape *	SRC_FID	TGT_FID	Shape_Length	srcVxType	tgtVxType	qaNotes	NEAR_FID	NEAR_DIST
	127	Polyline	52	58	42.244837	0	0	<Null>	1	0
	1365	Polyline	53	56	29.023333	0	<Null>	src_tgt_VxType_diff	1	0
	228	Polyline	-1	-1	10.842712	3	3	<Null>	3	0
	1575	Polyline	81	-1	2.541051	0	3	src_tgt_VxType_diff	3	0
	374	Polyline	-1	-1	4.855888	3	3	<Null>	5	0
	393	Polyline	87	85	0.756891	0	3	src_tgt_VxType_diff	5	0
	392	Polyline	86	-1	4.146372	0	3	src_tgt_VxType_diff	7	0
	1534	Polyline	76	80	11.081514	3	3	<Null>	7	0
	968	Polyline	-1	-1	32.61257	3	3	<Null>	9	0
	969	Polyline	457	458	8.223584	0	3	src_tgt_VxType_diff	9	0

GRL evaluation results – linking different vertex types

(qaNotes = 'src_tgt_VxType_diff') AND((tgtVxType >=2) OR(srcVxType >=2)) AND NEAR_DIST = -1
79 of flagged links were more important





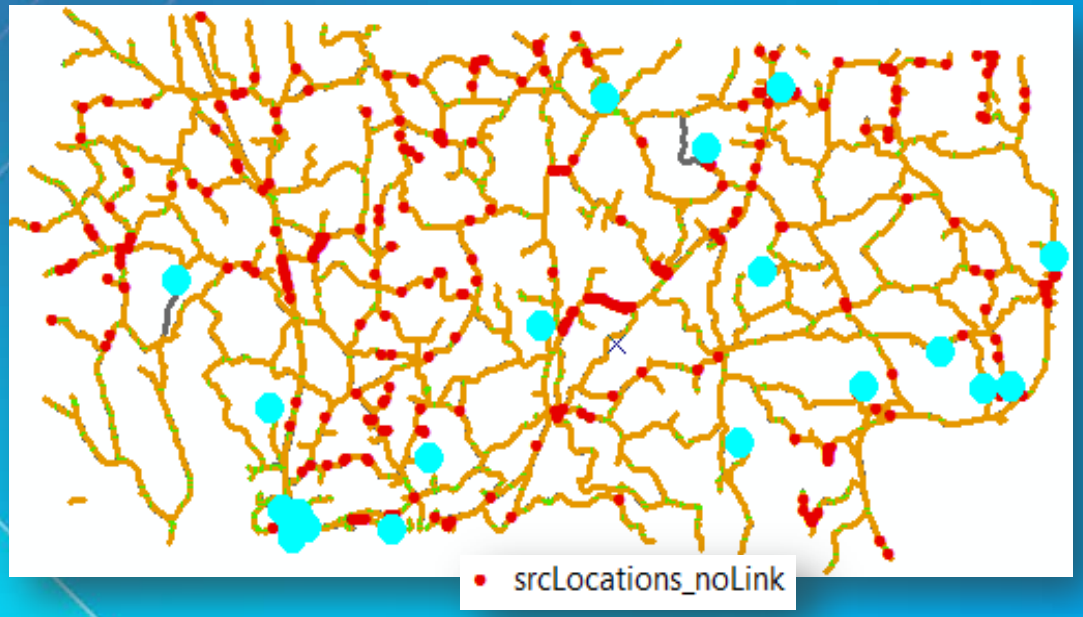
GRLinks

OBJECTID	Shape *	SRC_FID	TGT_FID	Shape_Length	srcVxType	tgtVxType	qaNotes	NEAR_FID	NEAR_DIST
1049	Polyline	-1	-1	7.254691	3	4	src_tgt_VxType_diff	-1	-1
120	Polyline	-1	-1	6.039016	2	3	src_tgt_VxType_diff	-1	-1
1039	Polyline	-1	-1	7.148172	2	3	src_tgt_VxType_diff	-1	-1
1497	Polyline	63	-1	9.38192	0	3	src_tgt_VxType_diff	-1	-1
1508	Polyline	74	75	8.318095	0	3	src_tgt_VxType_diff	-1	-1
4235	Polyline	221	-1	0.561213	0	3	src_tgt_VxType_diff	-1	-1
10712	Polyline	420	-1	4.964278	1	3	src_tgt_VxType_diff	-1	-1

0 (79 out of 26198 Selected)

GRL evaluation results – locations of missing links

22 of the 595 source locations of missing links were on nodes; all others are on in-line vertices.
20 ORIG_FID of frequency >5 locations were reviewed and confirmed non-critical.



srcLocations_noLink (595; 22 at nodes)

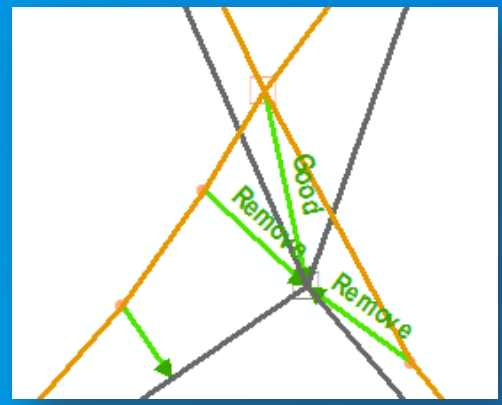
OBJECTID *	Shape *	ST_NAME	ORIG_FID	srcVxType
1	Point	SR 833 N TO US 33	3	4
20	Point	SR 833 N TO US 33	11	4
17	Point	SR 833 N TO US 33	3	2
19	Point	US 33	5	1
32	Point	US 33	53	1
57	Point	US 33	62	1
101	Point	MEIGS COUNTY FAIRGROUNDS	83	1
112	Point	FOX HILL	103	1
125	Point	RUSSELL	173	1
169	Point	LYONS DEN	184	1
207	Point	BLAKE HILL	258	1
211	Point	ODNR	292	1
217	Point	RIVERVIEW	295	1
220	Point	ANGELO	301	1
243	Point	CURTIS HOLLOW	371	1
250	Point	POOLER	385	1
303	Point	OSBORN	489	1
308	Point	MURRAY	504	1
332	Point	FIRST	524	1
482	Point	MERCER	691	1
522	Point	BOOTHE	801	1
550	Point	THIRD	855	1
2	Point	SR 833 N TO US 33	3	0
3	Point	SR 833 N TO US 33	3	0
4	Point	SR 833 N TO US 33	3	0
5	Point	SR 833 N TO US 33	3	0
6	Point	SR 833 N TO US 33	3	0
7	Point	SR 833 N TO US 33	3	0

QA regular links - summary

(qaNotes = 'src_tgt_VxType_diff') AND((tgtVxType >=2) OR(srcVxType >=2))

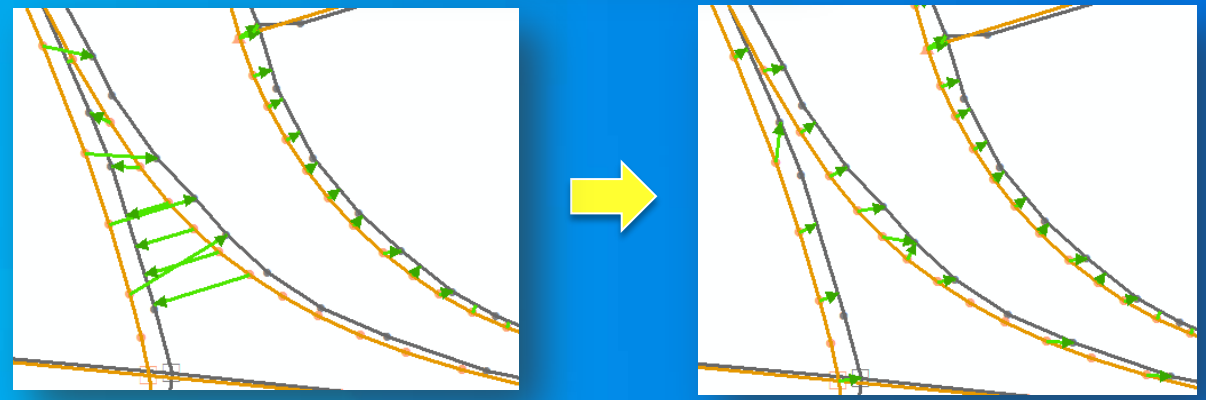
Total 241 (0.92%) of 26198 links were reviewed:

- 44 were modified
- 86 were to be removed
- 111 were ok



42 missing link locations were reviewed:

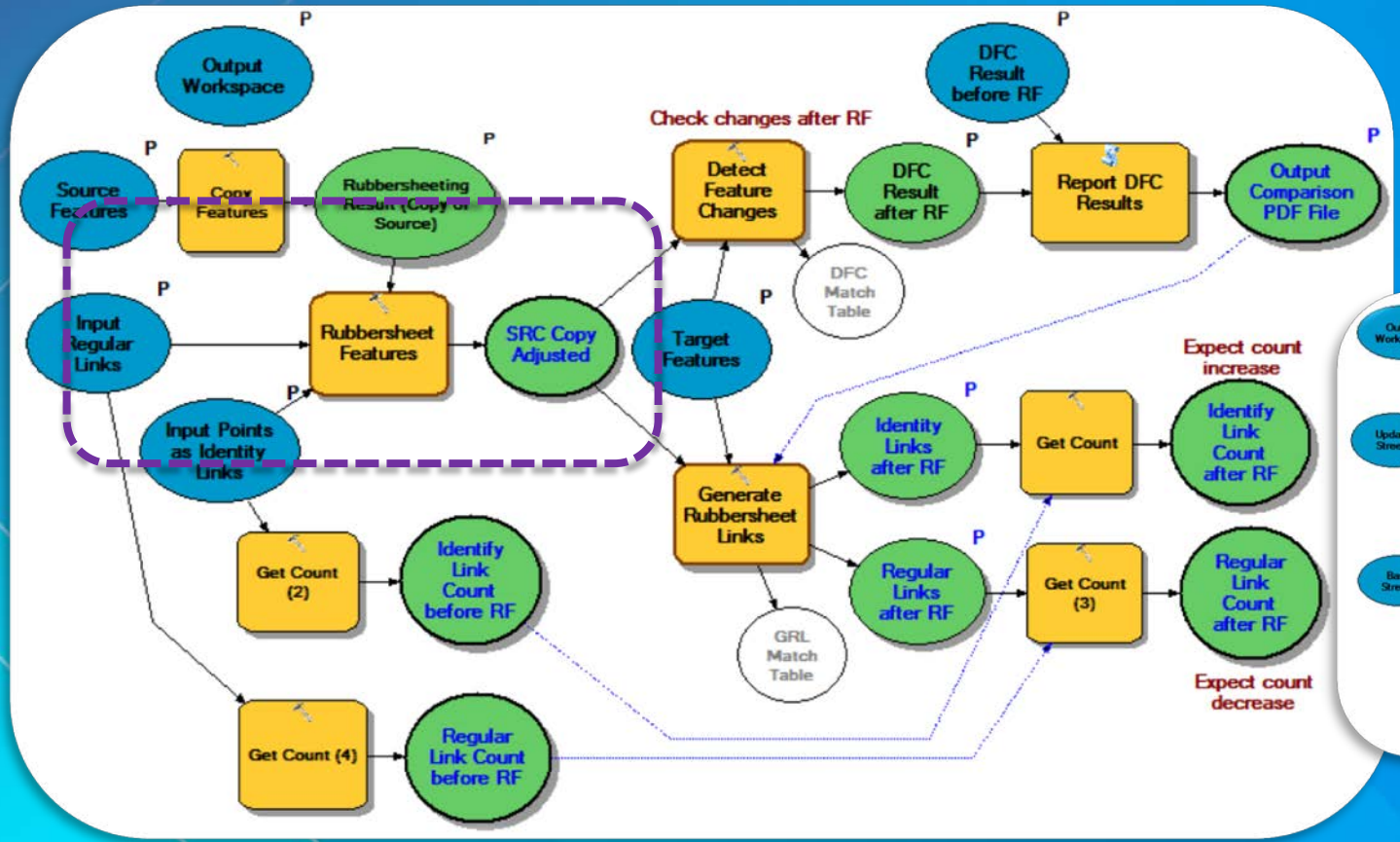
- 14 links were added
- Links at other locations were not critical



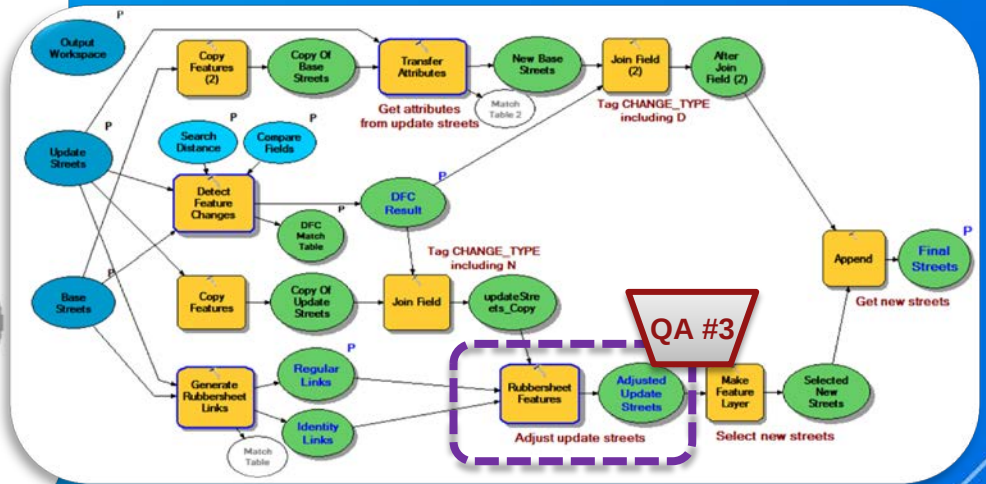
Ready for rubbersheeting …

26126 regular **links** were selected by (REV_FLAG <> 'Delete') OR(REV_FLAG IS NULL) to participate

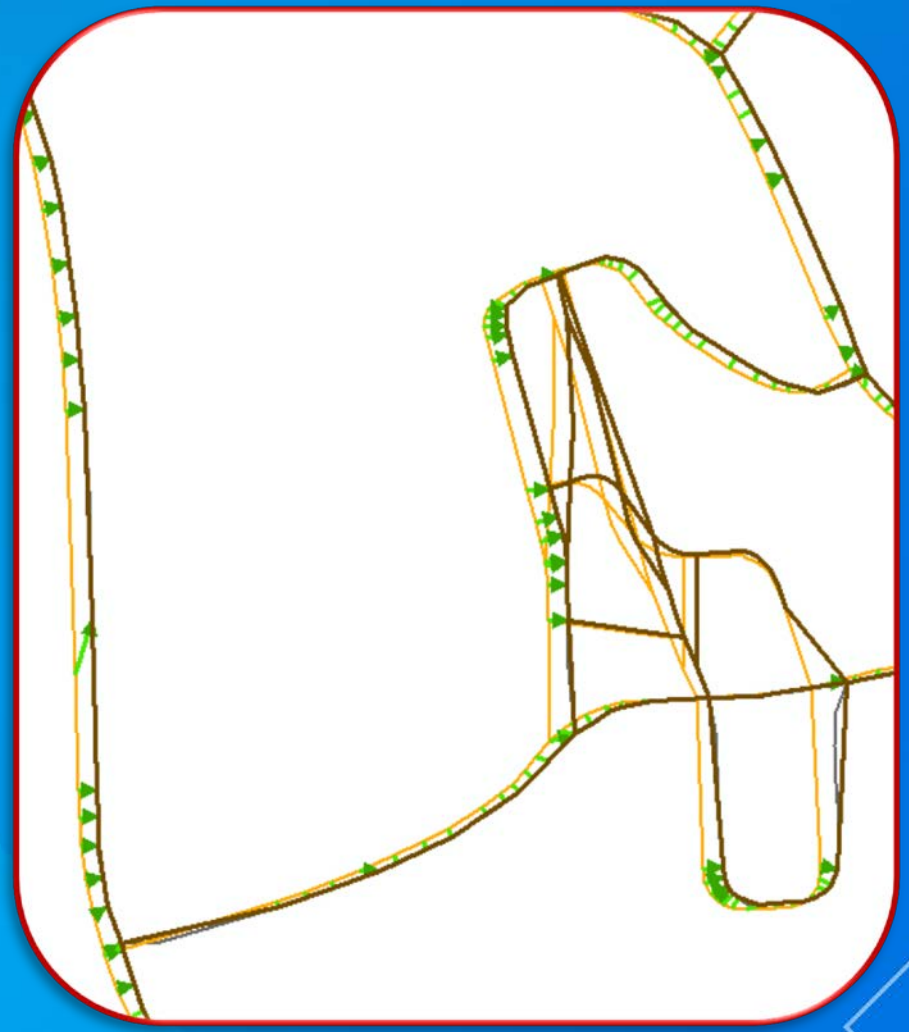
Step3 Rubbersheeting and Assessment



Step3 of the workflow with assessments

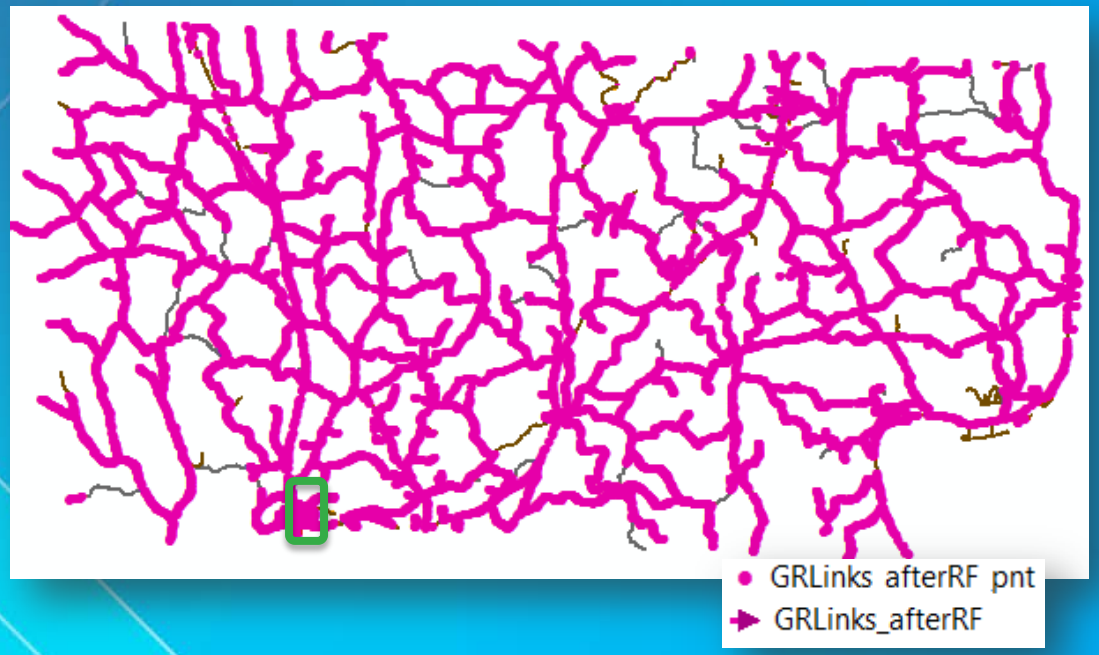


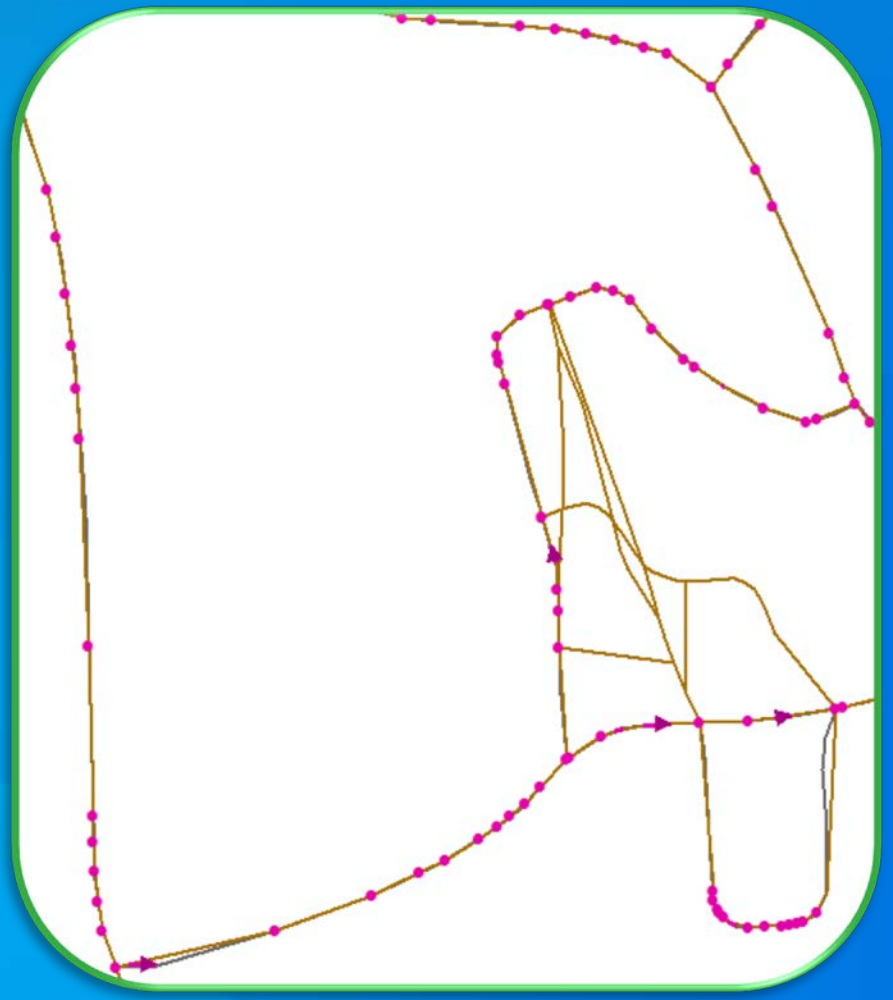
Rubbersheeting result



GRL result after rubbersheeting

Many regular links became identify links

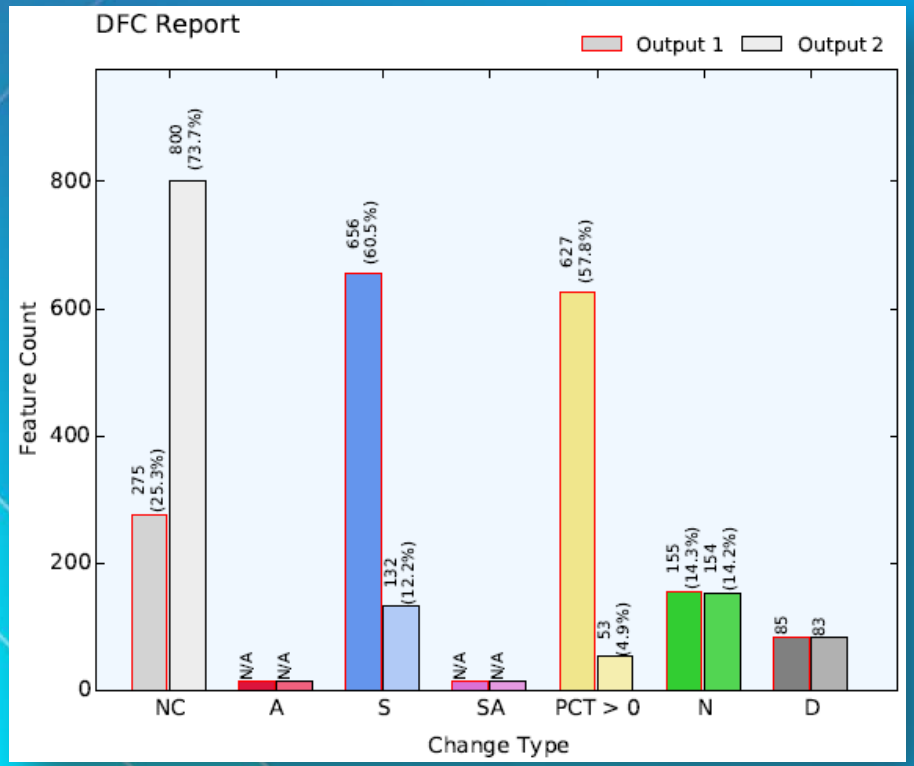




How good is the rubbersheeting result?

Three indicators showing spatial improvement

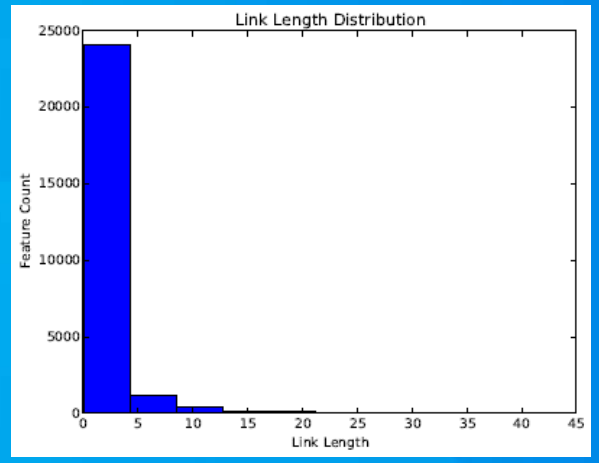
Less spatial differences

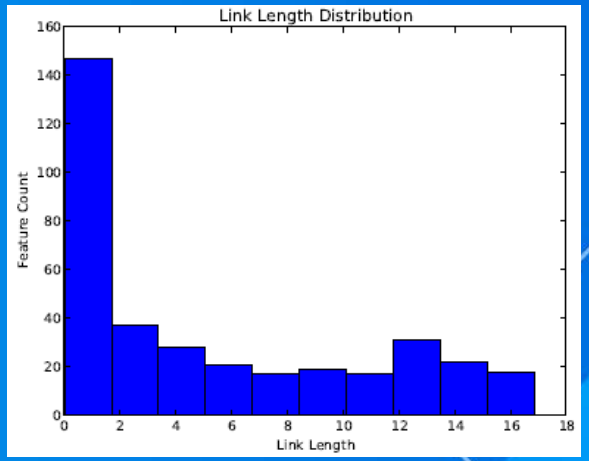


Improved location alignment

	Before RF	After RF
Regular links	26126	412
Identity links	10227	15456

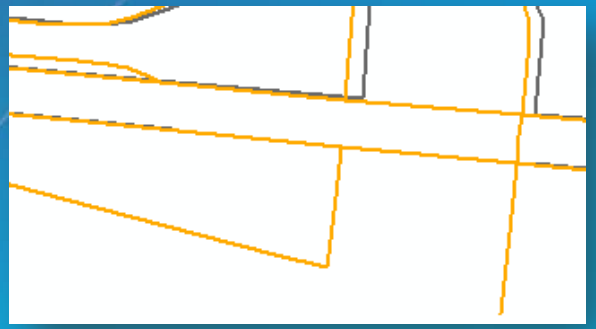
Link-length distributions before/after RF
- spatially closer to target
(Not on the same scale due to the big difference in values)

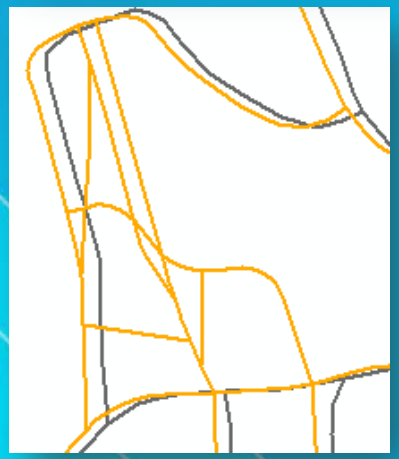




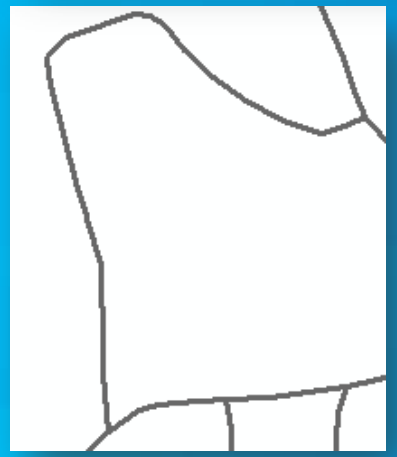
QA #3 – Check rubbersheeting result

Source (original) and target

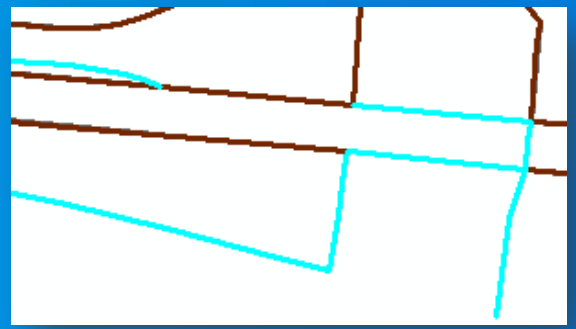


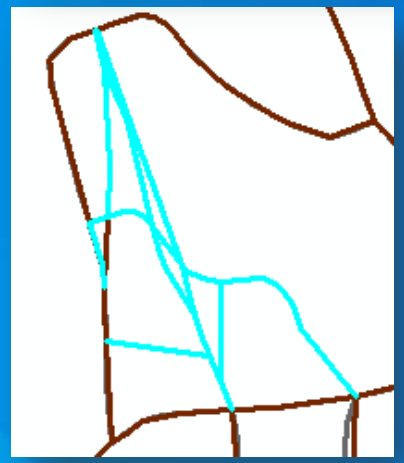


Target features



Source adjusted with N features highlighted

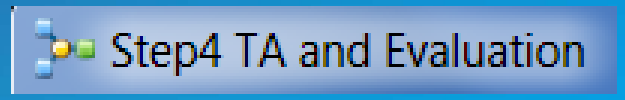


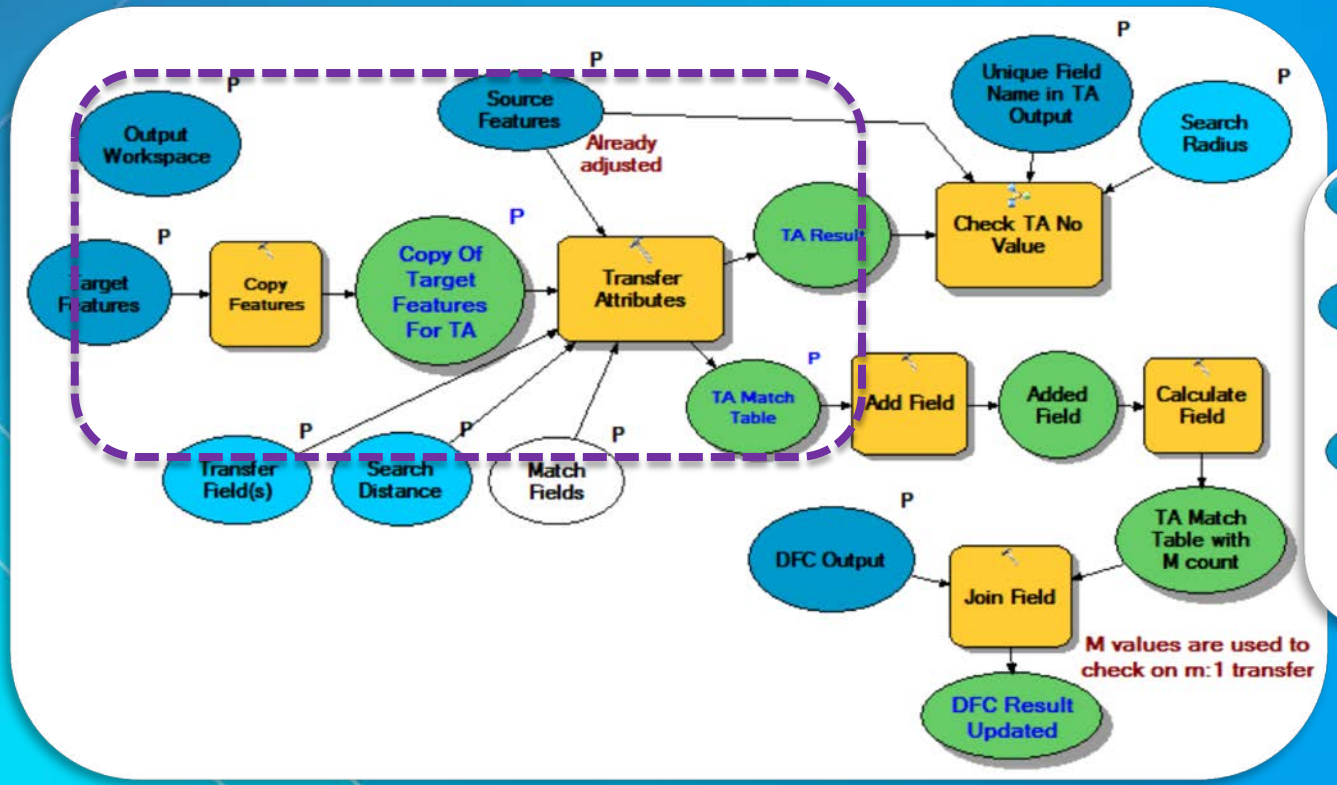


Ready to do TA …

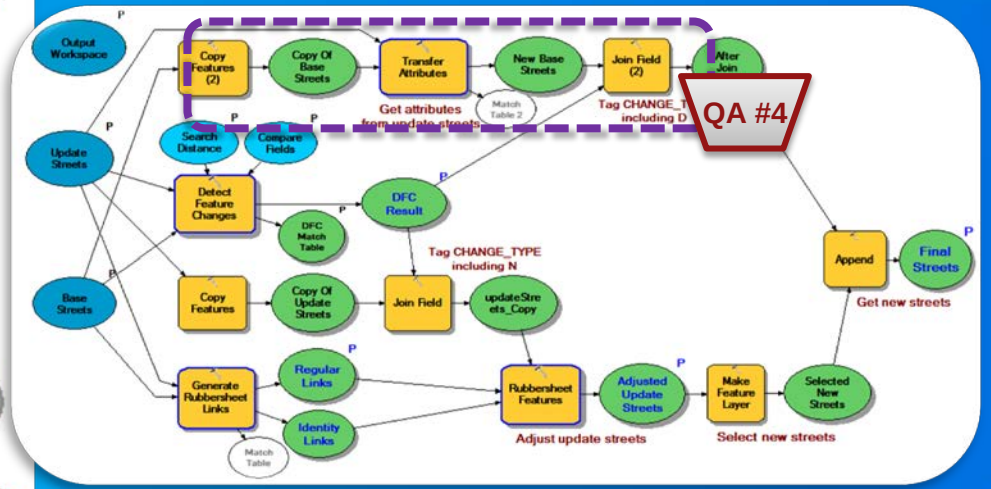
Transfer attributes from adjusted source to target

Excluding Ns from adjusted source; excluding Ds from joined target

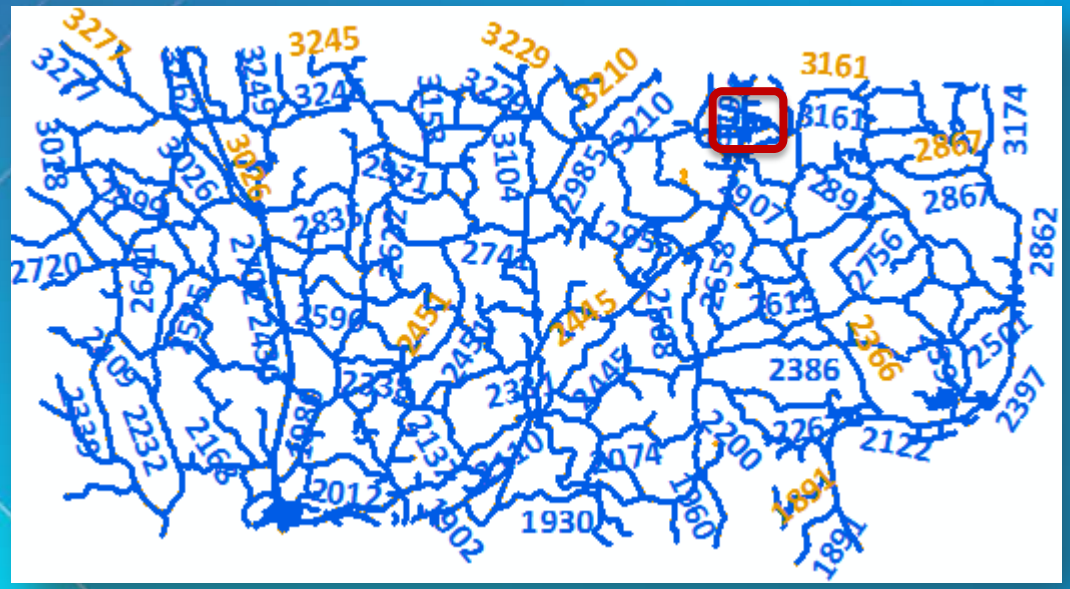


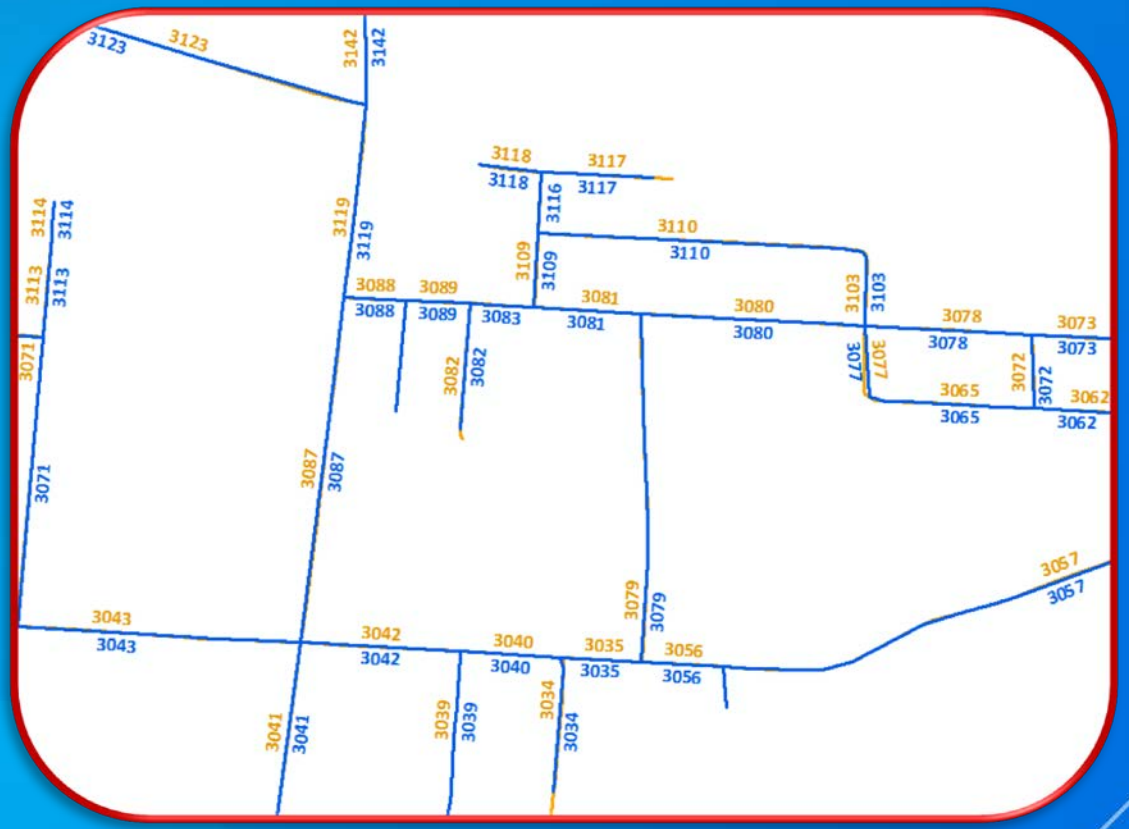


Step4 of the workflow with evaluation and QA



Attribute transfer result





QA #4 – Check attribute transfer result

NEAR_DIST >=0; no-transfer features found nearby source features for potentially missed matches

tgt_CopyForTA_FINAL

ID	CHANGE_TYPE	REV_FLAG	Shape_Lengt	RNAME	UC2014_ID	NEAR_FID	NEAR_DIST
25686	D	<Null>	59.713978	<Null>	<Null>	925	29.792733
30645	D	<Null>	56.086984	<Null>	<Null>	288	27.74351
30341	D	<Null>	55.831662	<Null>	<Null>	634	27.658837
30510	D	<Null>	95.916216	<Null>	<Null>	936	26.24684
29763	D	<Null>	37.817835	<Null>	<Null>	58	23.862568
30473	D	<Null>	44.24111	<Null>	<Null>	222	22.120555
30563	D	<Null>	432.374857	<Null>	<Null>	69	21.811976
30471	D	<Null>	74.115629	<Null>	<Null>	462	21.721167
30118	D	<Null>	42.415217	<Null>	<Null>	679	21.207608
30561	D	<Null>	49.517875	<Null>	<Null>	66	20.781753
30426	D	<Null>	40.081914	<Null>	<Null>	250	19.575952
29775	D	<Null>	39.455303	<Null>	<Null>	934	19.526662
30362	D	<Null>	38.453231	<Null>	<Null>	963	19.201207
29968	D	<Null>	40.817817	<Null>	<Null>	248	17.860293
30644	D	<Null>	83.30584	<Null>	<Null>	432	16.330416
30266	D	<Null>	41.712116	<Null>	<Null>	368	16.252561
30435	D	<Null>	30.597128	<Null>	<Null>	650	15.282429
30069	D	<Null>	30.119045	<Null>	<Null>	171	15.232608
30620	D	<Null>	30.719093	<Null>	<Null>	515	15.014051
30469	D	<Null>	318.801312	<Null>	<Null>	606	14.967127
[illegible]	D	<Null>	[illegible]	<Null>	<Null>	261	[illegible]
29744	D	wrongD	23.34473	<Null>	<Null>	20	6.295733
29743	D	wrongD	312.204053	<Null>	<Null>	12	5.319732
30772	D	isD	26.47975	<Null>	<Null>	58	4.712168
30862	D	isD	5.045483	<Null>	<Null>	262	2.519857
29875	D	isD	4.549253	<Null>	<Null>	260	2.273373
30404	D	wrongD	132.812766	<Null>	<Null>	170	2.10387
30750	D	wrongD	204.019635	<Null>	<Null>	73	1.792909
29373	D	wrongD	0.718702	<Null>	<Null>	124	1.4274
30790	D	wrongD	36.257103	<Null>	<Null>	906	0.425543
30305	D	wrongD	13.919109	<Null>	<Null>	661	0.070317
30240	D	isD	0.014701	<Null>	<Null>	363	0.002076
30234	D	<Null>	1343.361864	<Null>	<Null>	-1	-1
30404	D	<Null>	2051.673374	<Null>	<Null>	-1	-1
30462	D	<Null>	266.543937	<Null>	<Null>	-1	-1
30169	D	<Null>	860.788377	<Null>	<Null>	-1	-1
30269	D	<Null>	498.717165	<Null>	<Null>	-1	-1

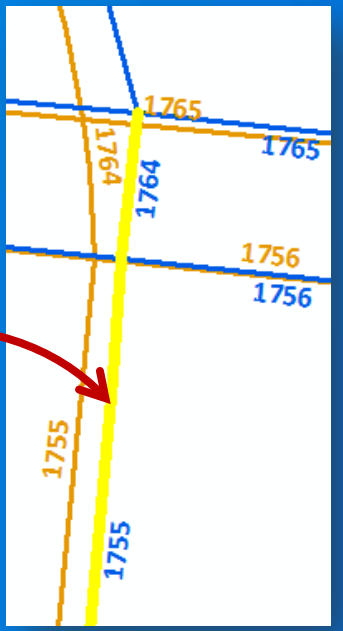
0 (32 out of 1013 Selected)

32 records were reviewed:

- 18 were edited with UC2014_ID values

tgt_CopyForTA_FINAL

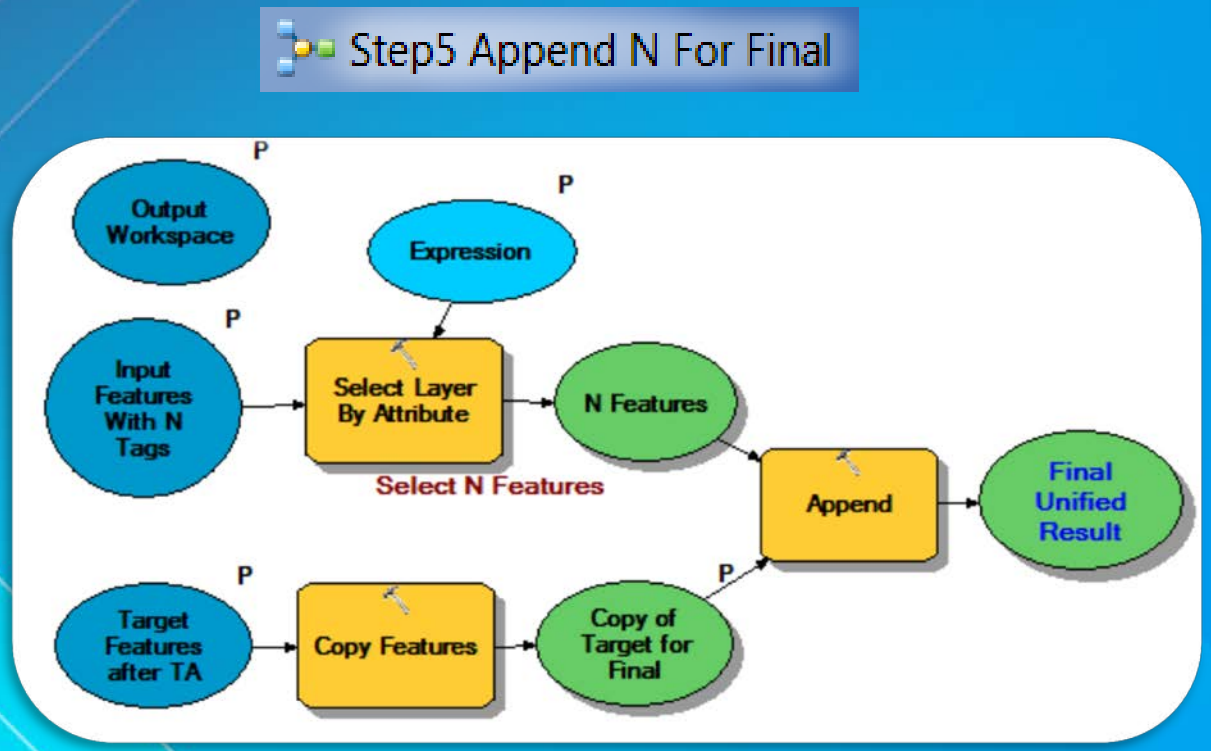
CHANGE_TYPE	REV_FLAG	Shape_Lengt	RNAME	UC2014_ID	NEAR_FID	NEAR_DIST
D	<Null>	59.713978	<Null>	3048	925	29.792733
D	wrongD	36.257103	<Null>	3027	906	0.425543
D	<Null>	42.415217	<Null>	2688	679	21.207608
D	wrongD	13.919109	<Null>	2661	661	0.070317
D	<Null>	30.597128	<Null>	2648	650	15.282429
D	<Null>	55.831662	<Null>	2627	634	27.658837
D	<Null>	30.719093	<Null>	2456	515	15.014051
D	<Null>	56.086984	<Null>	2132	288	27.74351
D	<Null>	40.081914	<Null>	2067	250	19.575952
D	<Null>	40.817817	<Null>	2064	248	17.860293
D	<Null>	44.24111	<Null>	2022	222	22.120555
D	<Null>	30.119045	<Null>	1937	171	15.232608
D	wrongD	132.812766	<Null>	1935	170	[illegible]
D	wrongD	0.718702	<Null>	1874	124	1.4274
D	wrongD	204.019635	<Null>	1820	[illegible]	1.792909
D	<Null>	49.517875	<Null>	1813	66	20.781753
D	wrongD	23.34473	<Null>	1764	20	6.295733
D	wrongD	312.204053	<Null>	1755	12	5.319732
D	isD	26.47975	<Null>	<Null>	58	4.712168
D	<Null>	432.374857	<Null>	<Null>	69	21.811976
D	<Null>	37.817835	<Null>	<Null>	58	23.862568
D	isD	5.045483	<Null>	<Null>	262	2.519857
D	<Null>	153.620314	<Null>	<Null>	261	11.071826
D	isD	4.549253	<Null>	<Null>	260	2.273373
D	<Null>	41.712116	<Null>	<Null>	368	16.252561
D	isD	0.014701	<Null>	<Null>	363	0.002076
D	<Null>	74.115629	<Null>	<Null>	462	21.721167
D	<Null>	83.30584	<Null>	<Null>	432	16.330416
D	<Null>	318.801312	<Null>	<Null>	606	14.967127
D	<Null>	38.453231	<Null>	<Null>	963	19.201207
D	<Null>	95.916216	<Null>	<Null>	936	26.24684
D	<Null>	39.455303	<Null>	<Null>	934	19.526662



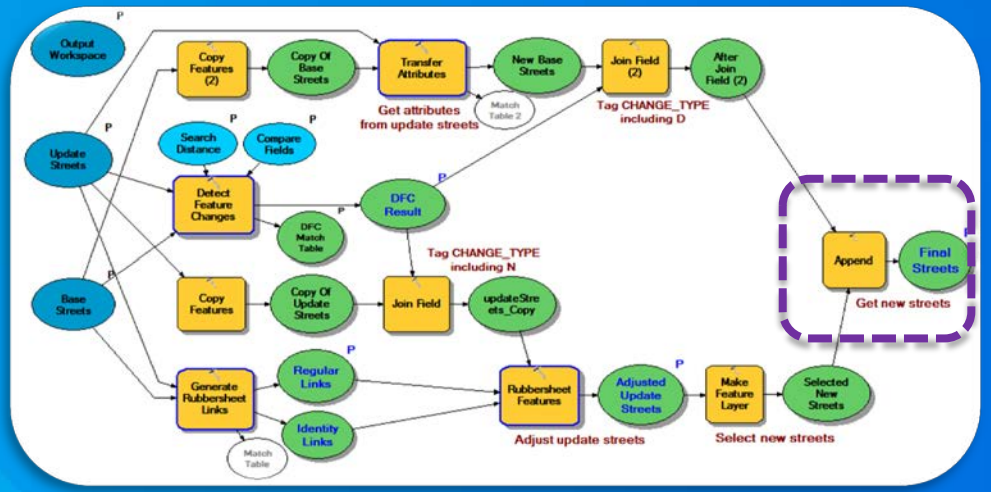
Almost there ...

Select adjusted N features; append them to target

(CHANGE_TYPE = 'N') AND((REV_FLAG <> 'wrongN') OR REV_FLAG IS NULL)



Final step of the full workflow



Appended N features in final result

tgt_CopyForTA_FINAL

	ROAD_STATU	LOG_BEG	LOC_END	ID	CHANGE_TYPE	REV_FLAG	Shape_Lengt	RNAME	UC2014_ID	NEAR_FID	NEAR_DIST
	<Null>	<Null>	<Null>	<Null>	N	<Null>	58.002288	GUTHRIE	3196	<Null>	<Null>
	<Null>	<Null>	<Null>	<Null>	N	isN	23.660369	BUCK LAKE	3200	<Null>	<Null>
	<Null>	<Null>	<Null>	<Null>	N	isN	0.39117	MUDSOCK	3207	<Null>	<Null>
	<Null>	<Null>	<Null>	<Null>	N	<Null>	45.454298	BEARWALLO	3221	<Null>	<Null>
	<Null>	<Null>	<Null>	<Null>	N	<Null>	210.402302	GRUESER	3237	<Null>	<Null>
	<Null>	<Null>	<Null>	<Null>	N	isN	0.013617	HELWIG RID	3261	<Null>	<Null>
	<Null>	<Null>	<Null>	<Null>	N	isN	6.392112	HELWIG RID	3263	<Null>	<Null>
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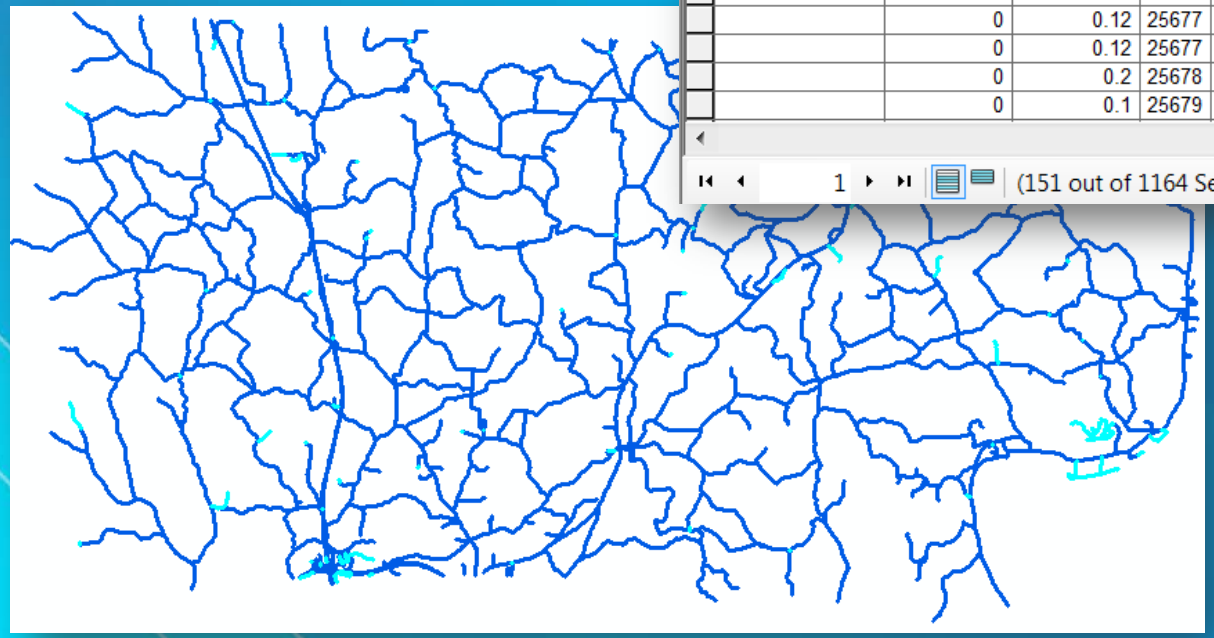
1 (151 out of 1164 Selected)



Unification of overlapping datasets completed!

Automated processing

	Processing Time
Step 1 (a, b)	1 min 3 sec
Step 2	1 min 14 sec
Step 3	1 min
Steps 4, 5	18 sec
Total	3 min 35 sec

Interactive processing (not counting final review)

	QA #1 (CFM_GRP and DN)	QA #2 (links)	QA #3	QA #4 (attribute transfer)	QA Total	Time (2-3 review counts per minute)
Review Count (locations or feature groups)	51	283	x	32	366	~ 2-3 hrs.
Edit Count (field values)	46	255	x	18	319	

Conclusions and Future Work

Thanks to:

- Department of Public Works (DPW), Los Angeles County, USA.
- Institut Cartogràfic i Geològic de Catalunya (ICGC), Barcelona, Spain.
- Ohio State Department of Transportation, USA.
- National Institute for Water and Atmospheric Research (NIWA) and Land Information New Zealand (LINZ) - Crown Copyright Reserved.
- Resource Management Service, LLC, Birmingham, AL, USA.
- All others who supported us along the way.

Conflation can be done more efficiently now

It takes a workflow:

- **Use the best practice in preprocessing.**
- **Highly accurate results and rich information are produced automatically.**
- **Small amont of interactive review and editing are necessary; time is worth-spending.**

Consider conflation a higher priority

Study the tools and workflows; understand the results

- Start with small test areas

Customize the workflows for your organizations

- Improve data quality and usability
- Bring new live and value to your data

Work with broader communities

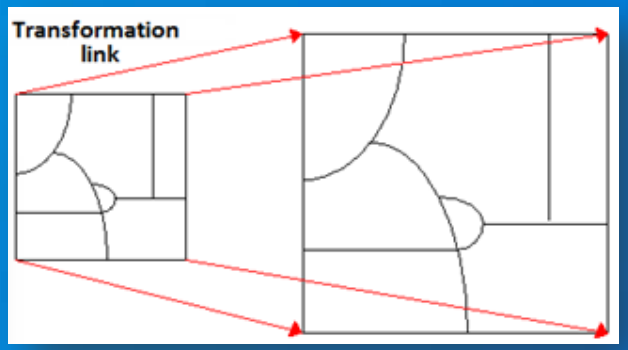
- Data sharing and collabration
- Seamless analysis and mapping

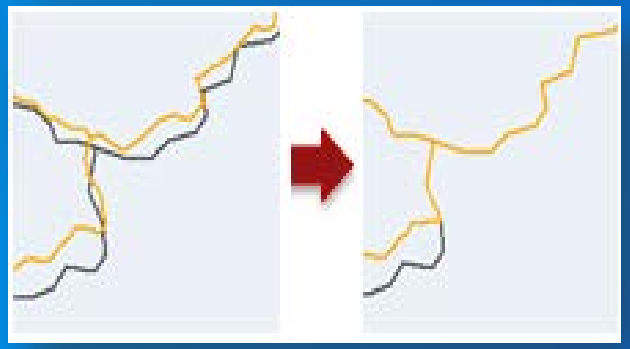
Please send us your feedbacks ☺

Our future work

New tools and enhancements

- New option in DFC tool: Compare line directions
- New Gp tools: Transform Features, Align Features
- Better feature matching





Formalization of workflows

- Common scenarios oriented
- Integrated review and editing
- Other feature types
- Contextual conflation (spatially related features)

Please send us your use cases and requirements ☺

Recent papers

- Baella B, Lee D, Lleopart A, Pla M (2014) ICGC MRDB for topographic data: first steps in the implementation, The 17th ICA Generalization Workshop, 2014, Vienna, Austria. http://generalisation.icaci.org/images/files/workshop/workshop2014/genemr2014_submission_8.pdf
- Lee D (2015) Using Conflation for Keeping Data Harmonized and Up-to-date, to be presented at the ICA-ISPRS Workshop on Generalisation and Multiple Representation, 2015, Rio de Janeiro, Brazil
- Lee D, Yang W, Ahmed N (2014) Conflation in Geoprocessing Framework - Case Studies, GEOProcessing, 2014, Barcelona, Spain. http://goo.gl/iOoSGV
- Lee D, Yang W, Ahmed N (2015) Improving Cross-border Data Reliability Through Edgematching, to be presented at The 27th International Cartographic Conference, 2015, Rio de Janeiro, Brazil
- Yang W, Lee D, and Ahmed N, “Pattern Based Feature Matching for Geospatial Data Conflation”, GEOProcessing, 2014, Barcelona, Spain. http://goo.gl/JKGJbo

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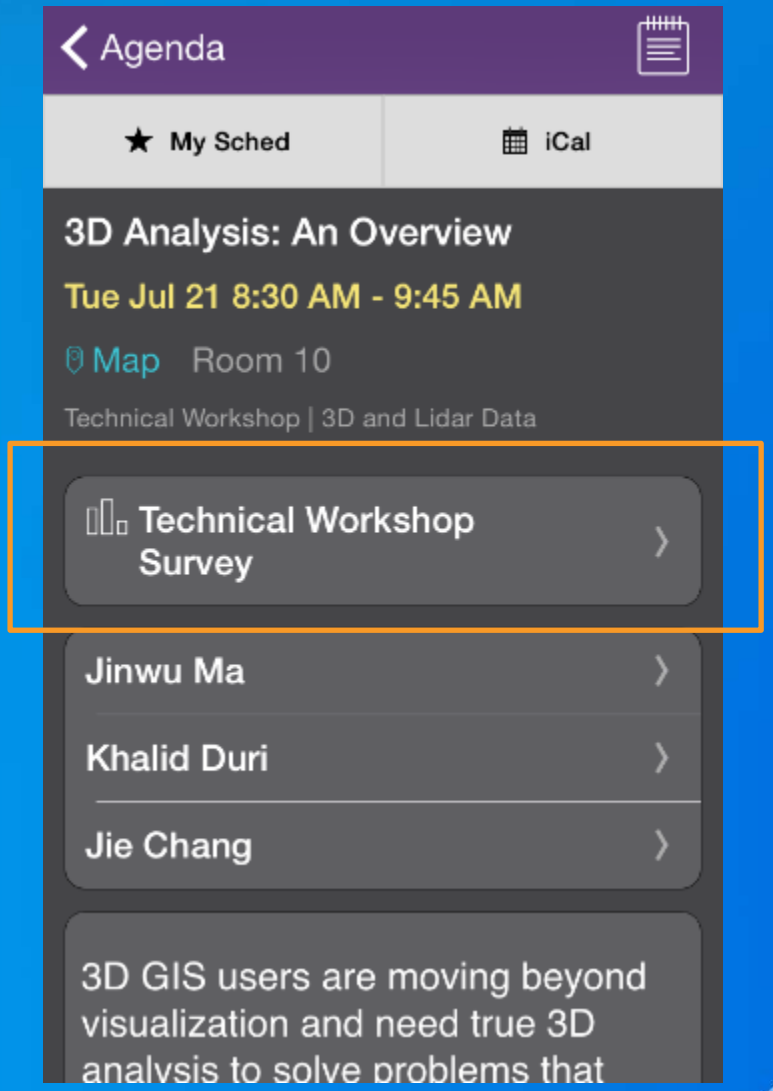
- Select Introduction to Geoprocessing Conflation tools and Workflows in the Mobile App - use Search Feature to find this title)
- Click “Technical Workshop Survey”
- Answer a few short questions and enter your comments

Thank you for attending! ☺
Any questions, comments …?



Understanding our world.