

ArcGIS as a Reporting Tool

Automating Corridor Safety and Operational Assessments

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TRANSPORTATION ENGINEERING/PLANNING

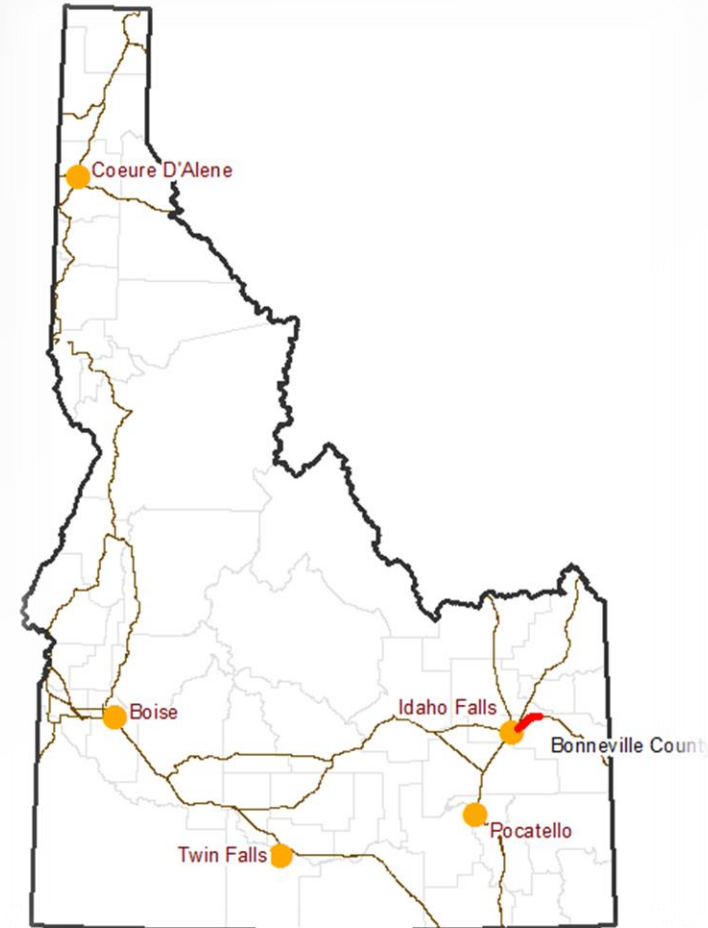
Presentation topics

- Project background
- Data sources
- Building a template
- Report production
- Lessons learned
- Next steps



Project background

- US 26 Safety and Operational Study
- Largely rural corridor
- Pilot study for report automation
- ITD wants to reduce resources needed to conduct corridor studies



Project background

- 5 – Lane to 2 – Lane Cross-section
- Non-orthogonal stop controlled intersections
- Looking for proactive identification of safety issues
- Wanted review of unused operational capacity



Data sources

Safety Records



Traffic Counts



Field Observations

Pavement Management System



Planned Project Database



Infrastructure / CAD / GIS Data

Data sources

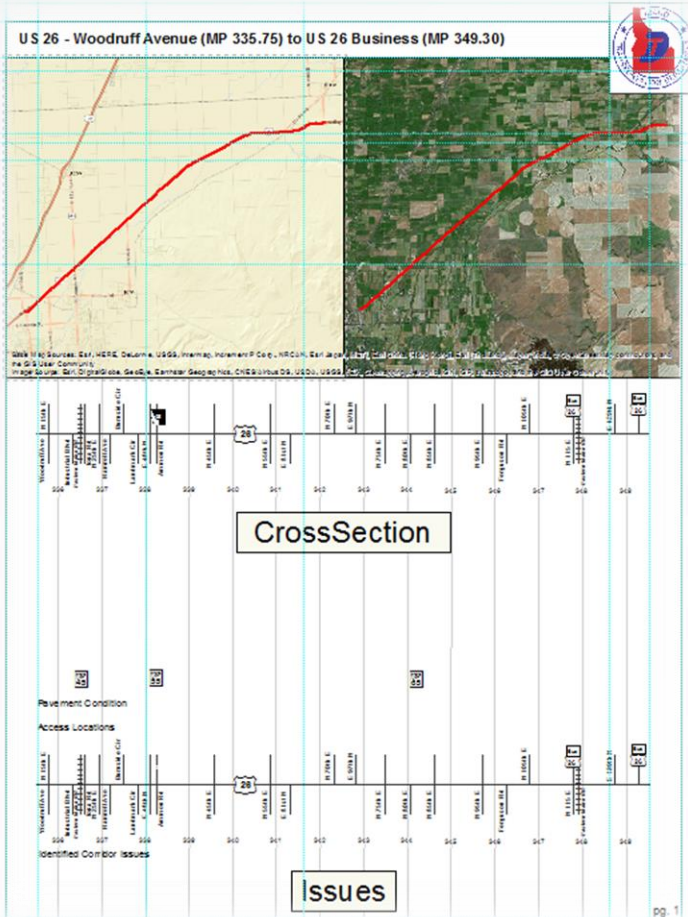
- Data compiled into segment and intersection tables
- Pre-built formulae for traffic and safety operations

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG		
		Import Safety Data																																	
1		Approach Names																																	
2	Node #	MilePost	Left	Right	Latitude	Longitude	ExFromLaneT	ExFromLaneL	ExFromLaneF	ExFromLaneR	ExFromLane	ExFromLane	040	b_2040	c_2040	N_SPF2040	k_2040	CMF_1i_2i	CMF_2i_2i	CMF_3i_2i	CMF_4i_2i	Cal_2040	N_Pred_2												
3	1	335.751	St Leons Rd	Woodruff Ave	43.51824	-112.00243	2	1	1	0	0		-7.182	0.722	0.337	24.42472	0.277	1	1	1	1	1	24.42472												
4	2	336.481	RR	RR	43.52473	-111.99038							#VALUE!					1	1	1	1	0.89626	1	#VALUE!											
5	3	336.597	Iona Rd	Iona Rd	43.52577	-111.98866	1	1	0	0	1		0.008	0.848	0.448	8.788296	0.494	1.64951	0.52	1	1	1	7.538118												
6	4	336.938	25th E	Hitt Rd	43.52872	-111.98386	1	1	0	0	1		-7.182	0.722	0.337	20.12498	0.277	1	1	1	1	1	20.12498												
7	5	337.21		Romrell Ave	43.53094	-111.98027							#VALUE!					1	1	1	1	0.89626	1	#VALUE!											
8	6	338.064	Telford Rd	E 49th N	43.53958	-111.96625	1	1	0	0	1		0.008	0.848	0.448	6.424492	0.494	1.64951	0.52	1	1	1	5.510577												
9	7	338.24	SH 43	Ammon Rd	43.54104	-111.96377	1	1	0	0	1		-7.182	0.722	0.337	11.68868	0.277	1	1	1	1	1	11.68868												
10	8	339.552	Crowley Rd	N 45th E	43.55305	-111.94406	2	1	1	0	0		0.008	0.848	0.448	3.502076	0.494	1.597183	0.52	0.74	1	1	2.152362												
11	9	340.856	Iona North Rd	N 55th E	43.56532	-111.92412	2	1	1	0	0		0.008	0.848	0.448	3.51752	0.494	1.597183	0.52	0.74	1	1	2.161854												
12	10	341.256		E 81st N	43.56929	-111.91753	2	0	1	0	0		2.526	1.204	0.236	0.95451	0.46	1	1	0.86	1	1	0.820879												
13	11	342.239	70th E		43.57853	-111.90263							#VALUE!					1	1	1	1	0.89626	1	#VALUE!											
14	12	342.813	E 97th N		43.58379	-111.89397	1	0	0	0	0		2.526	1.204	0.236	0.766948	0.46	1.289855	1	0.86	1	1	0.850757												
15	13	343.455	N 75th E		43.58965	-111.88434	2	0	0	0	0		2.526	1.204	0.236	1.124076	0.46	1.350133	1	0.86	1	1	1.30518												
16	14	344.054		80th E Rd	43.59434	-111.87423							#VALUE!					1	1	1	1	0.89626	1	#VALUE!											
17	15	344.607	Milo Rd	N 85th E	43.59805	-111.86415	2	1	1	0	0		0.008	0.848	0.448	1.224203	0.494	1.449153	0.52	0.86	1	1	0.793358												
18	16	345.716	Buck Rd	N 95th E	43.60544	-111.84417	2	1	1	0	0		0.008	0.848	0.448	1.651654	0.494	1.480944	0.52	0.86	1	1	1.093854												
19	17	346.276		Ferguson Rd	43.60888	-111.83436							#VALUE!					1	1	1	1	0.89626	1	#VALUE!											
20	18	346.785	Shelton Rd	N 105 E	43.60903	-111.82452							#VALUE!					1	1	1	1	0.89626	1	#VALUE!											
21	19	347.787	Ririe Hwy	N 115 E	43.60895	-111.80442	1	1	0	0	1		0.008	0.848	0.448	3.42244	0.494	1	0.52	1	1	1	1.779669												
22	20	347.907	RR	RR	43.60897	-111.80170							#VALUE!					1	1	1	1	0.89626	1	#VALUE!											
23	21	348.729	129th N Rd		43.61219	-111.78757							#VALUE!					1	1	1	1	0.89626	1	#VALUE!											
24	22	349.294	N 130th E		43.61235	-111.77572	1	1	0	0	0		2.526	1.204	0.236	0.946757	0.46	1	0.56	0.86	1	1	0.455958												

Building a template

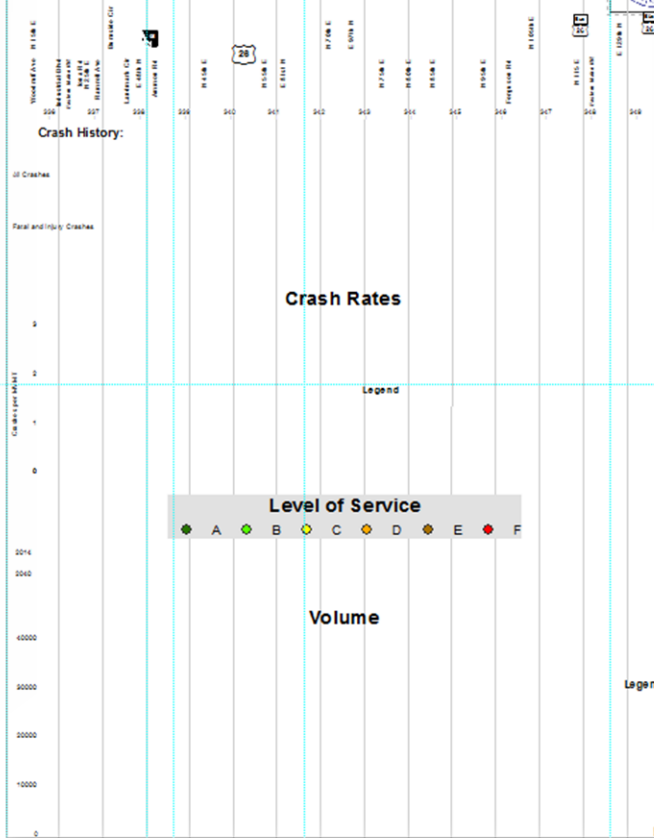
- Proof of concept
- Template built to be project specific
- Template needed to include all of the objects that would form the report
- Further automation of report components is recommended

Building a template



Roadway Crash and Operations Summary

US 26 - Woodruff Avenue (MP 335.75) to US 26 Business (MP 349.30)



Report production

- Reporting tool was developed using ArcPy
- Report was based on a 4 page structure
 - Roadway Summary
 - Roadway Crash and Operations Summary
 - Intersection Summary (1 for each intersection)
 - Potential Mitigation Measures (1 for each intersection)

Roadway Summary

US 26 - Woodruff Avenue (MP 335.75) to US 26 Business (MP 349.30)

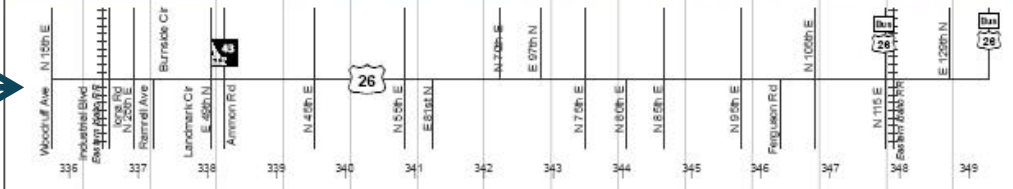


Report production

Project Location Map



Corridor Linear Profile



Corridor Travel Lanes



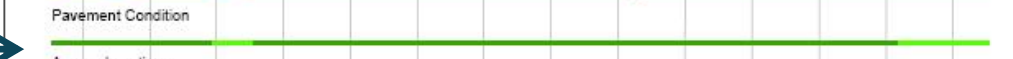
Intersection Control



Speed Limit



Pavement Condition



Driveways / Access



Potential Issues / Deficiencies





US 26 - Woodruff Avenue (MP 335.75) to US 26 Business (MP 349.30)

Report production

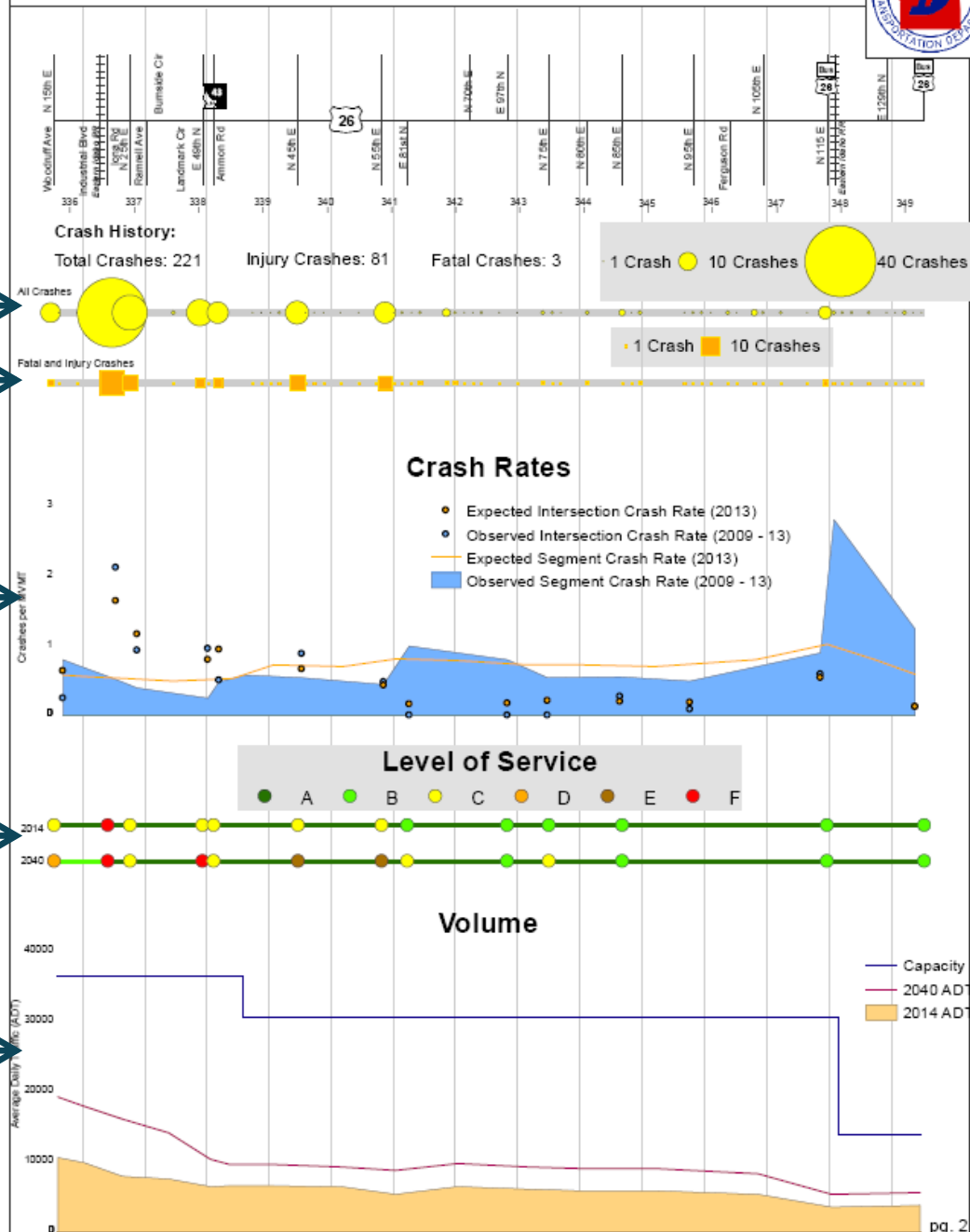
Crash Clusters

Injuries/Fatalities

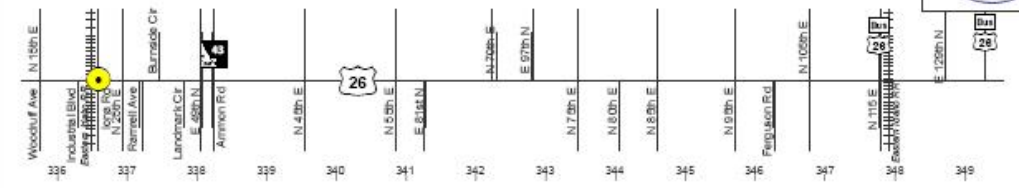
Crash Rates vs. Expected

Existing and Future LOS

Volume and Capacity



US 26 at Iona Rd



Safety

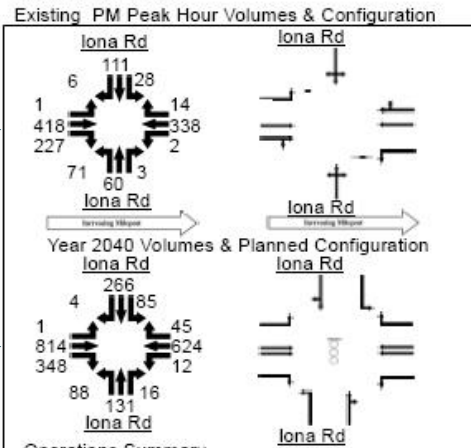
Existing (2009-13) Crash Conditions

Crash Type				
Rear-End	Angle	Turning	Side Swipe	Other
2	32	9	1	1

Crash Severity			Total	Rate
PDO	Injury	Fatal		
31	14	0	45	2.16

Crash Frequency (Crashes/Year)		
Observed	Expected	Difference
9.0	6.94	2.06

Traffic Operations



Operations Summary

	Existing	2040 No Build	2040 Build
LOS	F	F	C
Delay (s)	>50	>50	27.4
V/C	0.78	>1.0	0.51

Issues, Needs, Planned Projects

- Safety improvements needed (District Traffic Engineer)
- High side street delay (US 26 Plan (2015))
- Meets crash signal warrant (US 26 Plan (2015))
- Turning & angle crashes (US 26 Plan (2015))
- Irregular driving behavior observed (US 26 Plan (2015))

Identified operational or safety issues

Report production

Intersection Aerial

Crash Summary

Crash Statistics

Existing Volume and Configuration

Future Volume and Configuration

Operational Characteristics



US 26 at Iona Rd - Potential Mitigation Measures

Safety Countermeasures to Consider

Countermeasure	CMF	Expected Crash Reduction (per Year)			
		Fatal/Injury	PDO	Total	Benefit
Provide Right-Turn Lane (2 Approaches)	0.74	0.73	1.61	2.34	\$182,381.68
Correct Skew	0.61	1.09	2.42	3.51	\$273,572.52
Lighting	0.90	0.28	0.62	0.90	\$70,146.80
Signalize Intersection	0.56	1.23	2.73	3.96	\$308,645.92
Flashing Beacons	0.95	0.14	0.31	0.45	\$35,073.40
Convert 4-leg Intersection to two T-Intersections	0.86	0.39	0.87	1.26	\$98,205.52
Roundabout	N/A	N/A	N/A	N/A	N/A
Restrict Turning Movements with signing	N/A	N/A	N/A	N/A	N/A
Right-Turn Acceleration Lanes	N/A	N/A	N/A	N/A	N/A

Report production

Potential Safety Mitigations →

Operational Countermeasures Considered

Countermeasures	No-Build Operations				Build Operations			
	Year 2015		Year 2040		Year 2015		Year 2040	
	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C
Traffic Signal (w/ LT lanes on Iona Rod)					B	0.3	C	0.51
Roundabout	F	0.78	F	>1.0	A	0.38	C	0.87
Movement Restrictions (RI/RO)					B	0.22	D	0.6

Potential Operations Mitigations →

Recommended Improvements

- Install a traffic signal with lighting or evaluate options for restricting movements (0-5 Years)
- Reduce intersection skew (0-5 Years)
- Install right-turn lanes on US 26 approaches (0-5 Years)
- Install left-turn lanes on Iona Road approaches (0-5 Years)
- Upgrade adjacent railroad intersection in conjunction with above improvements (0-5 Years)

Recommendations →

Lessons learned

- ArcPy has limitations that increased the challenge of developing this system
- Setting up dynamic graphics through code is more work than it would be with a traditional graphics program
 - The ability to represent data spatially and consistently makes up for a lot!
- Corridor segmentation for data aggregation can leave room for subjective conclusions

Lesson learned

- We could not automate everything
 - Engineering judgement and review was needed to identify mitigations
- Some manual data collection and entry could not be avoided where the existing sources were incomplete or not consistent with the other data being used
- Linear referencing tools are a powerful ally and can easily translate between schematic and geographical representations

Next steps

- Move to a web-based implementation
- Improve ability to handle longer corridors
- Reduce technical emphasis to make reports more understandable to the public



Questions?

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