Leveraging Data and GIS to Prioritize Future Interchanges in Minneapolis-St. Paul

PRINCIPAL ARTERIAL
INTERSECTION
CONVERSION STUDY

Association of Metropolitan Planning Organizations Annual Conference

October 20, 2017

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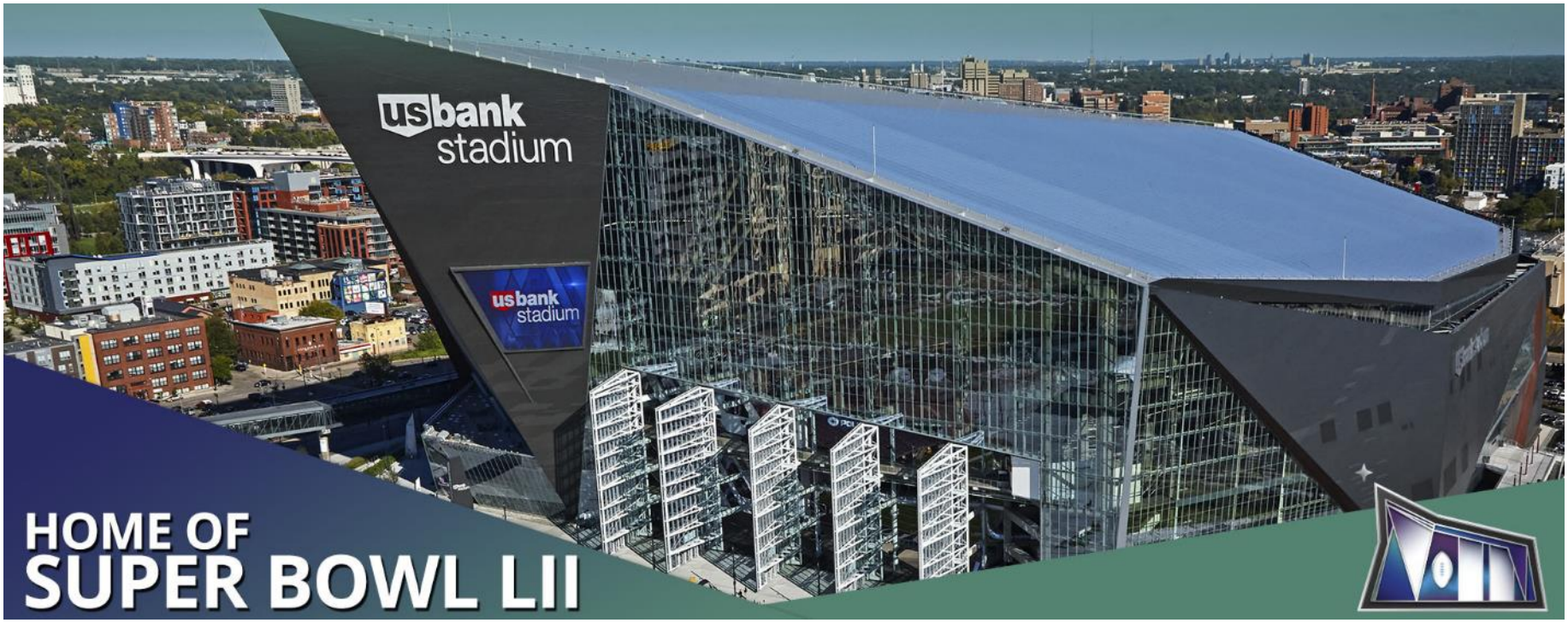
Minneapolis-St. Paul, MN



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Likely February Weather

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Congested Intersection

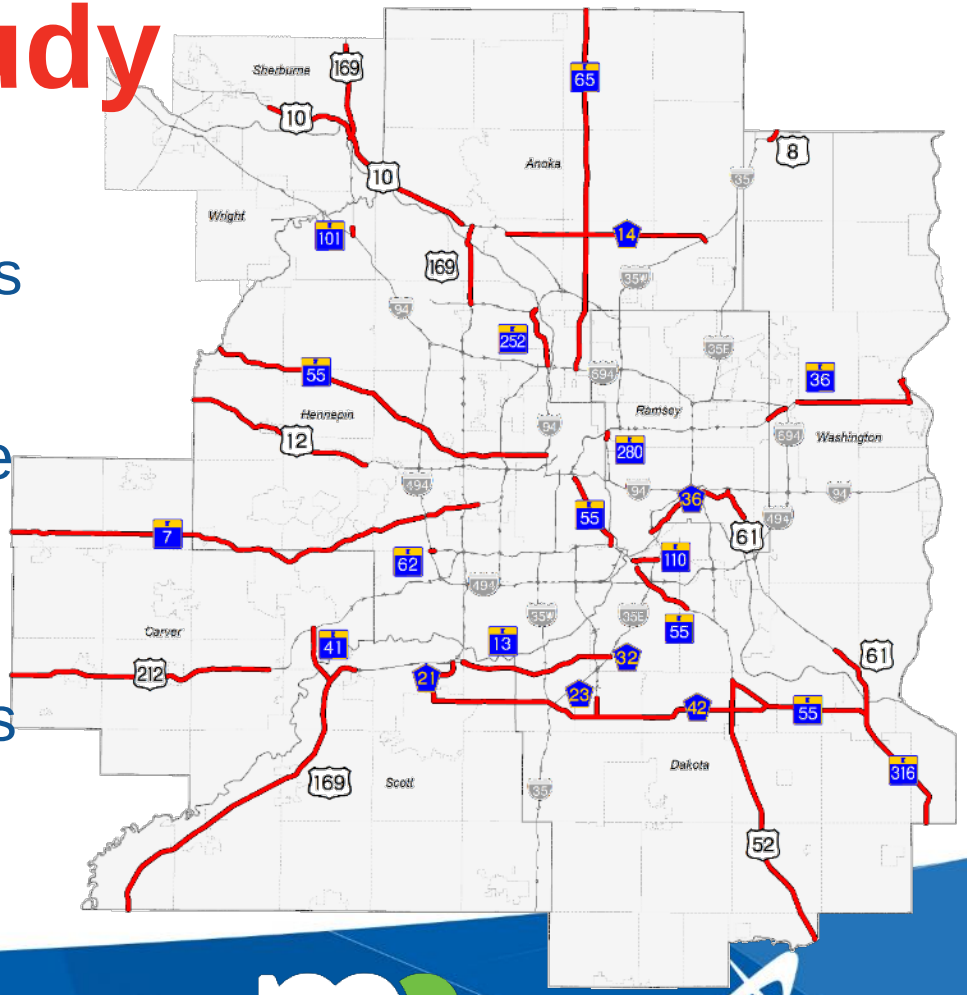
Interchange

Congested Intersection

Interchange

Principal Arterial Intersection Conversion Study

- Mobility and safety problems at many at-grade intersections
- Identify regional priorities given high demand for grade separations and limited funding
- Constructed 16 interchanges in past 10 years; avg. construction cost of $20M



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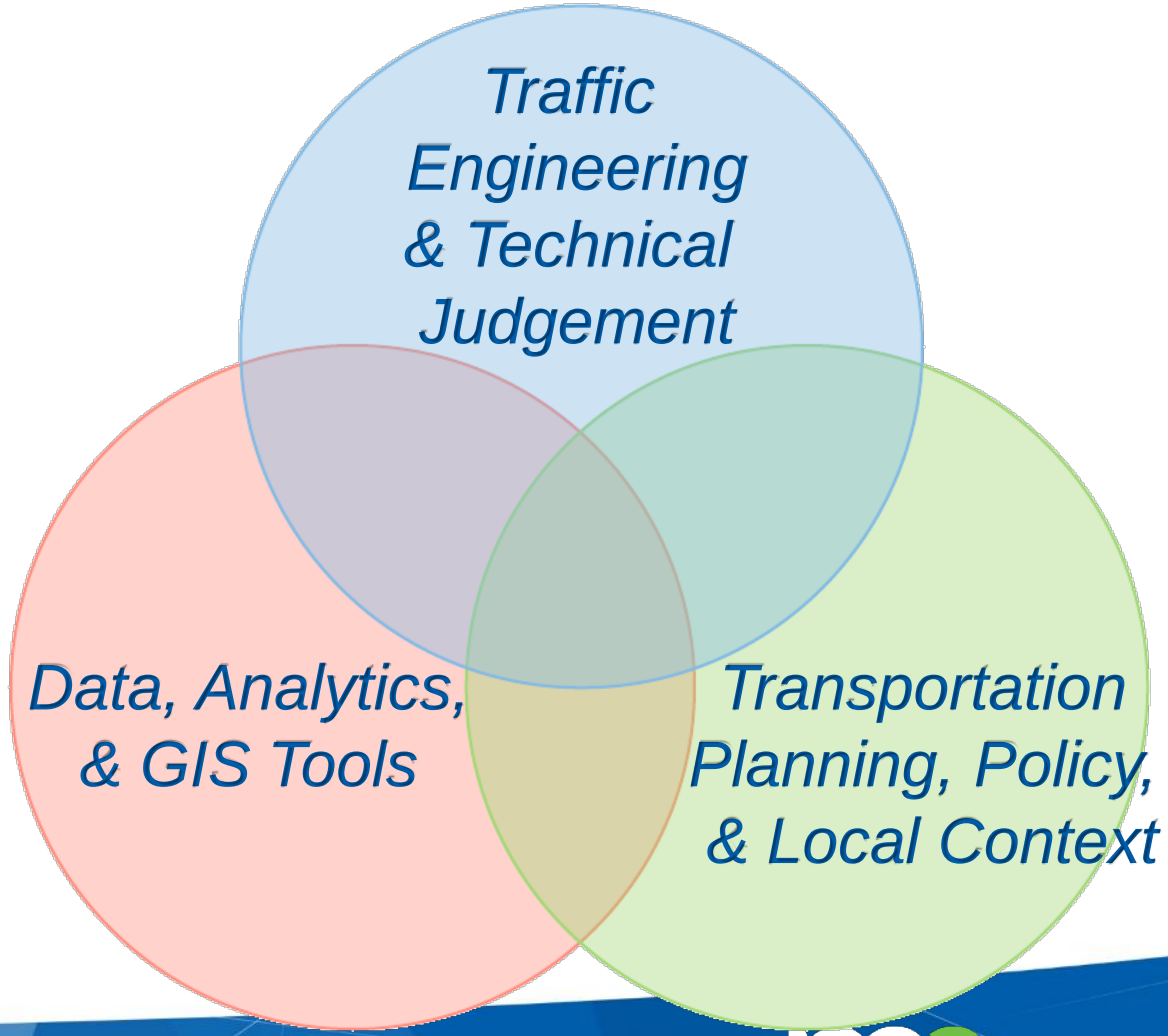
Balancing of Study Inputs



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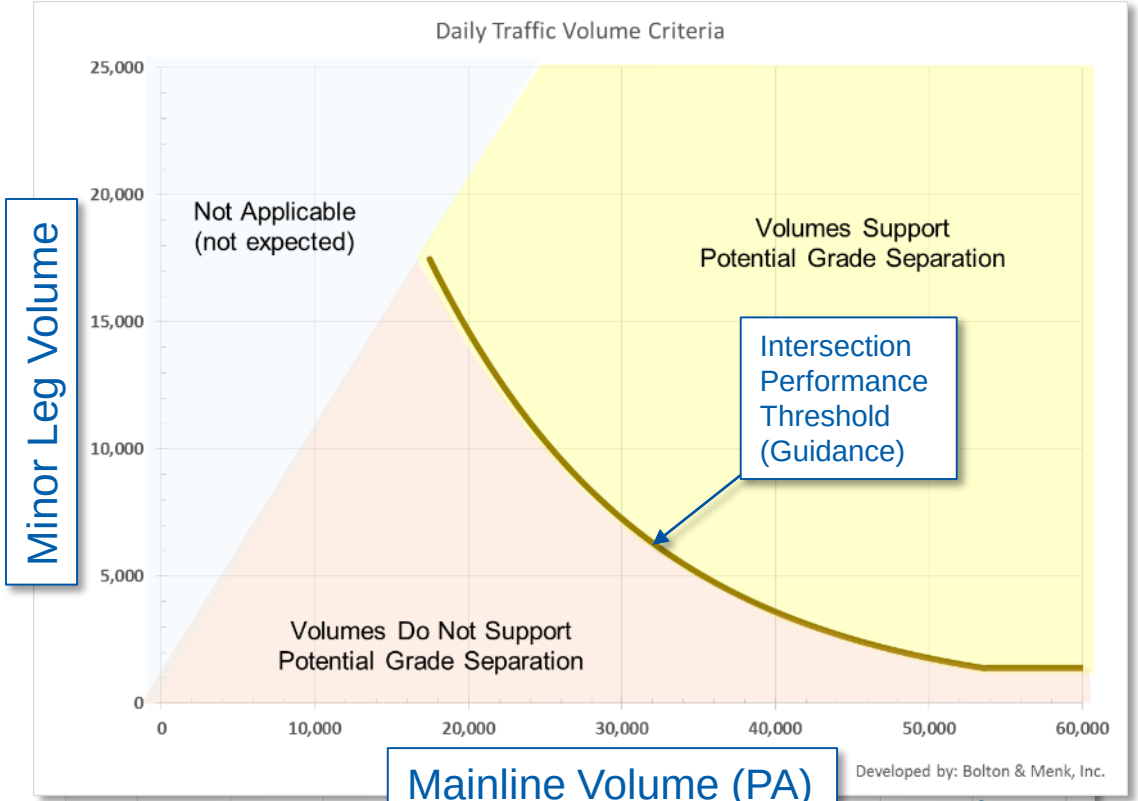
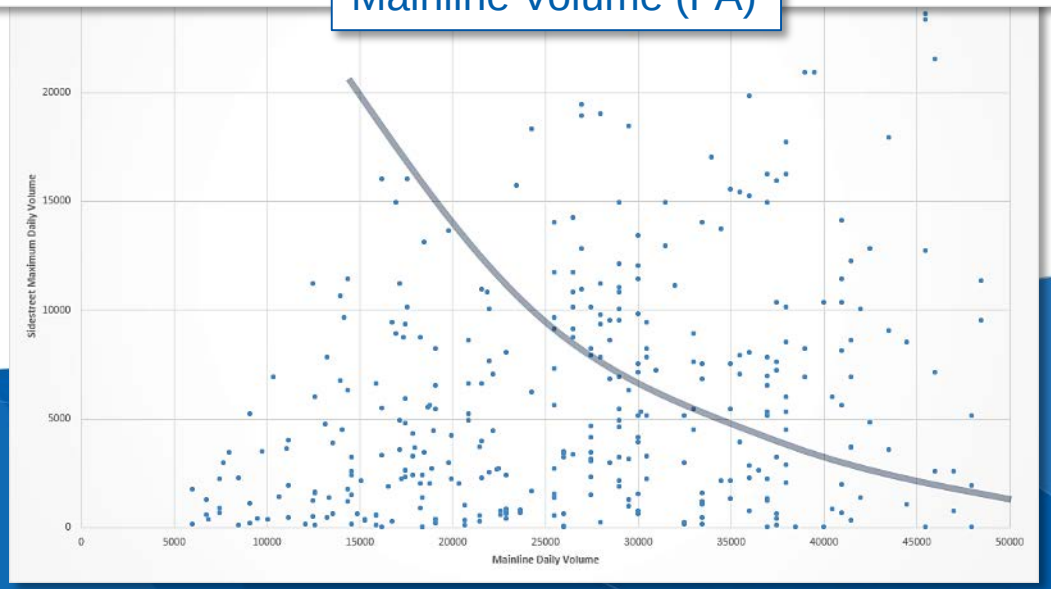
Traffic Engineering and Technical Judgement





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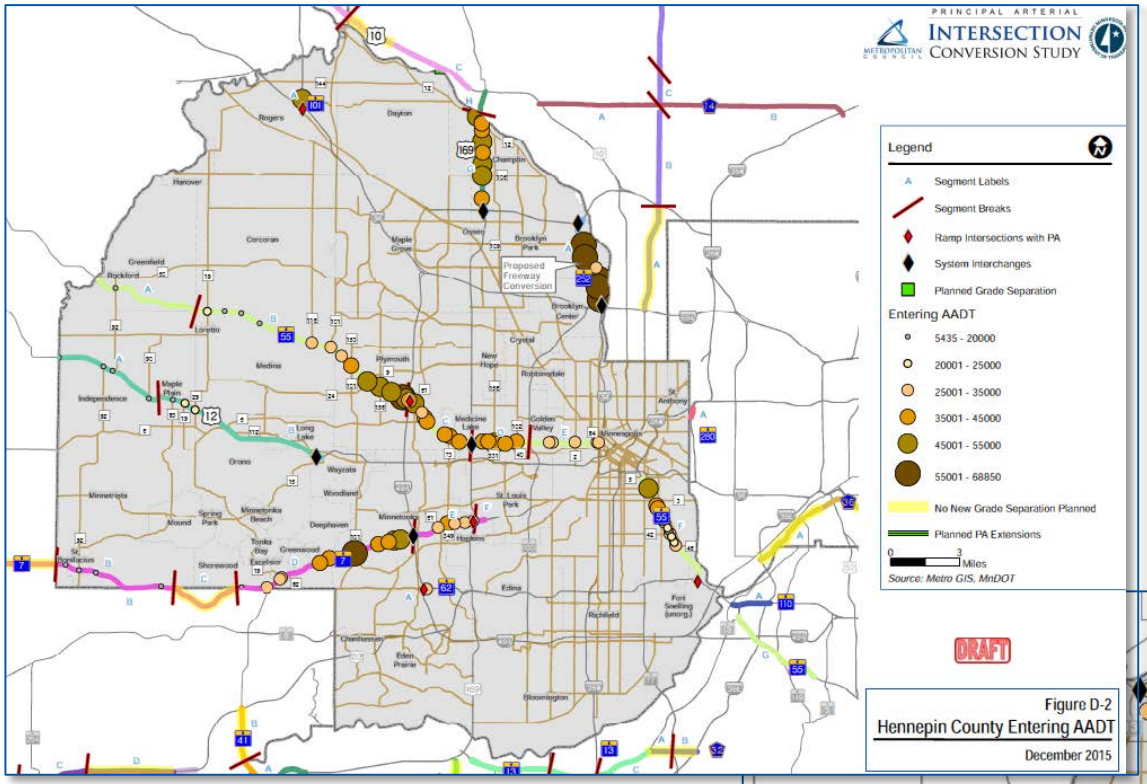
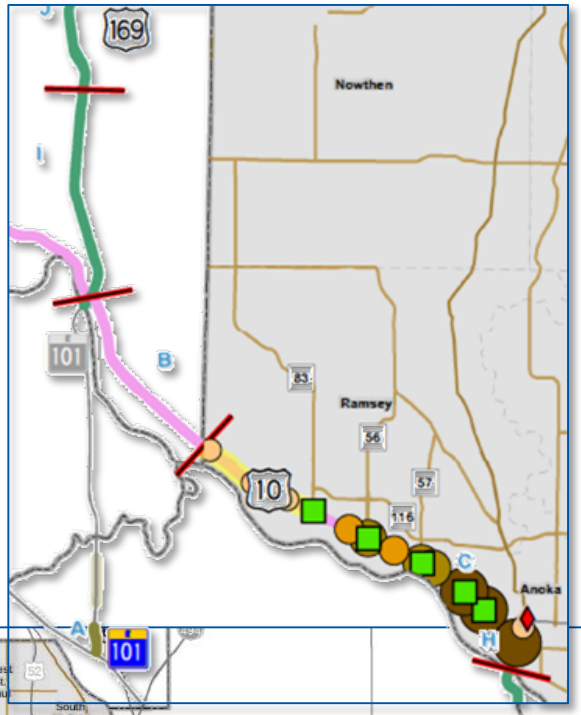
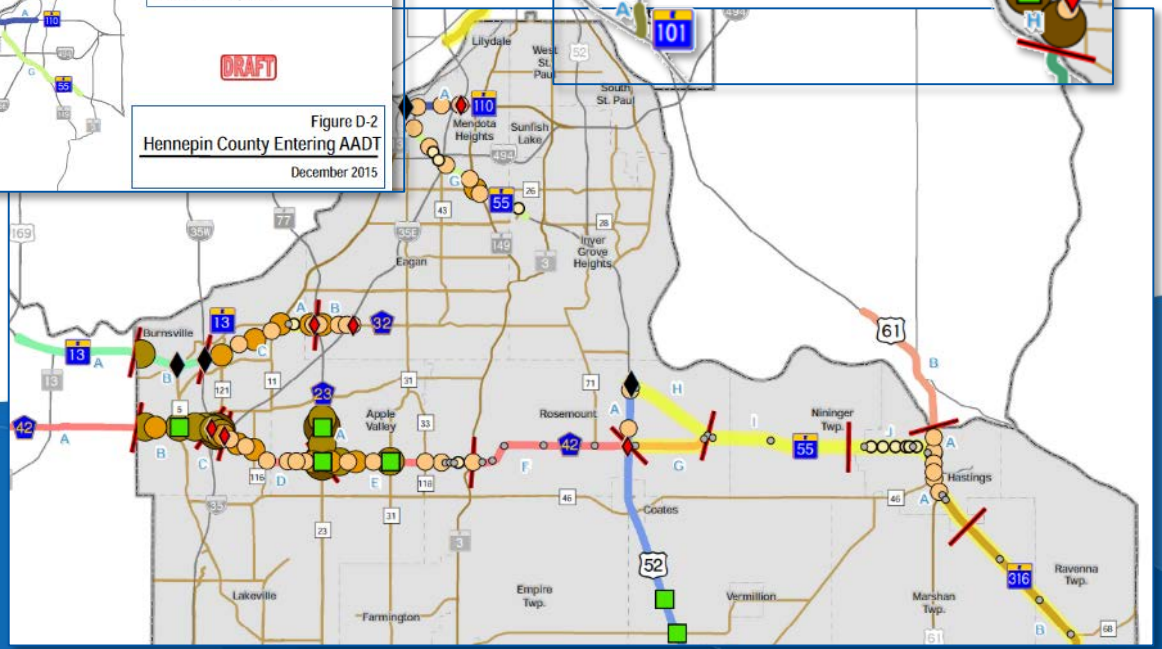
Data, Analytics, and GIS Tools







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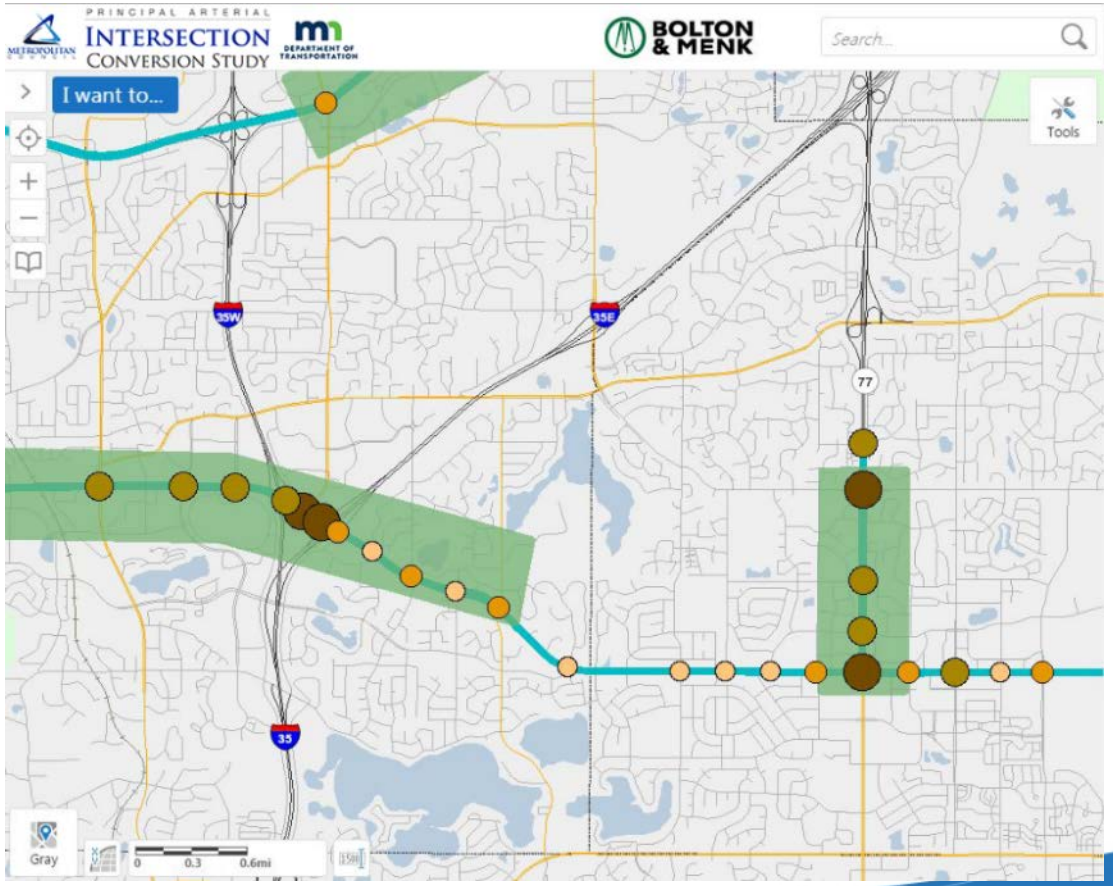
Use of GIS

- Need for Automation
- Data Analysis: Formulas/Scripts
- Web GIS Applications (https://arcg.is/1DHiXS)



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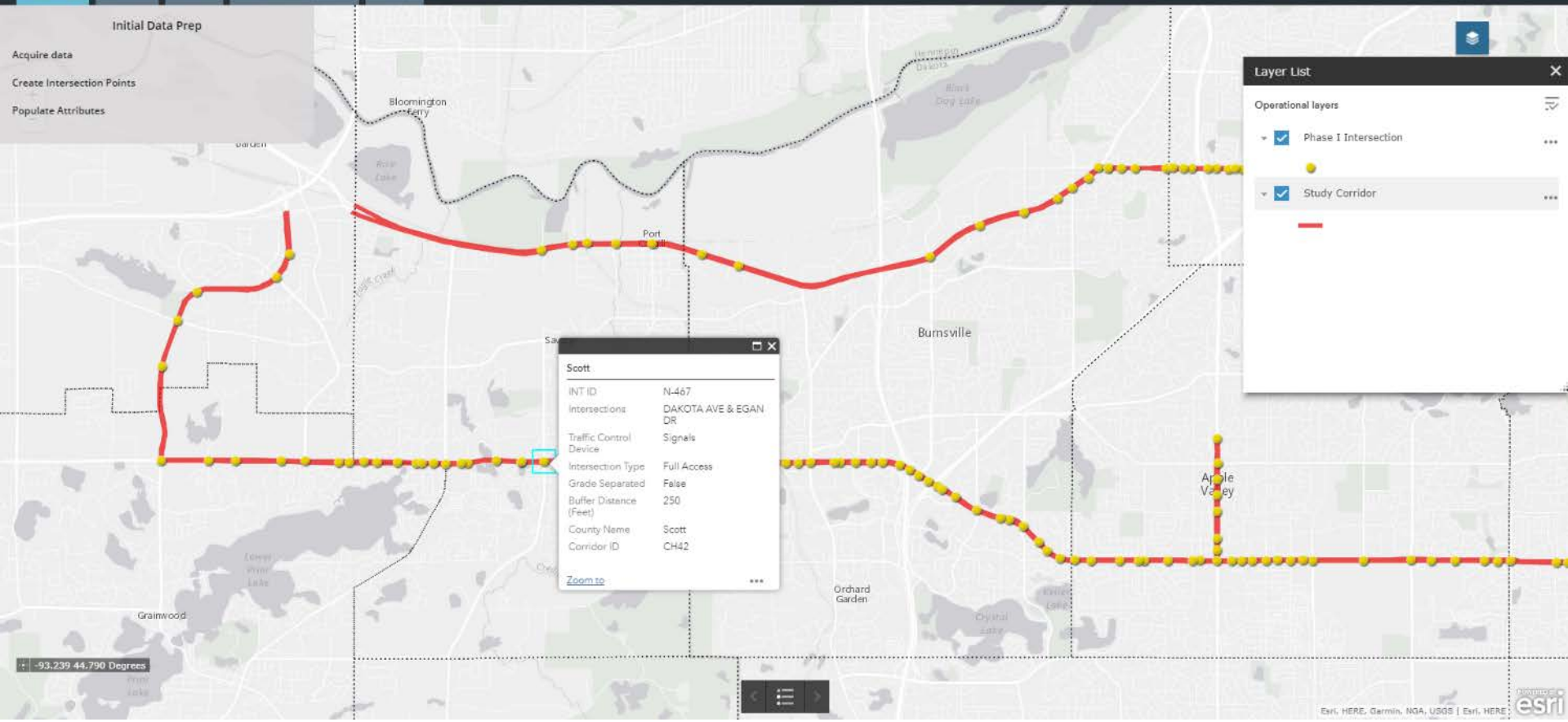
Principal Arterial Intersection Conversion Study

Data Prep | Analysis | Phase I | Phase II Priority Map | Results



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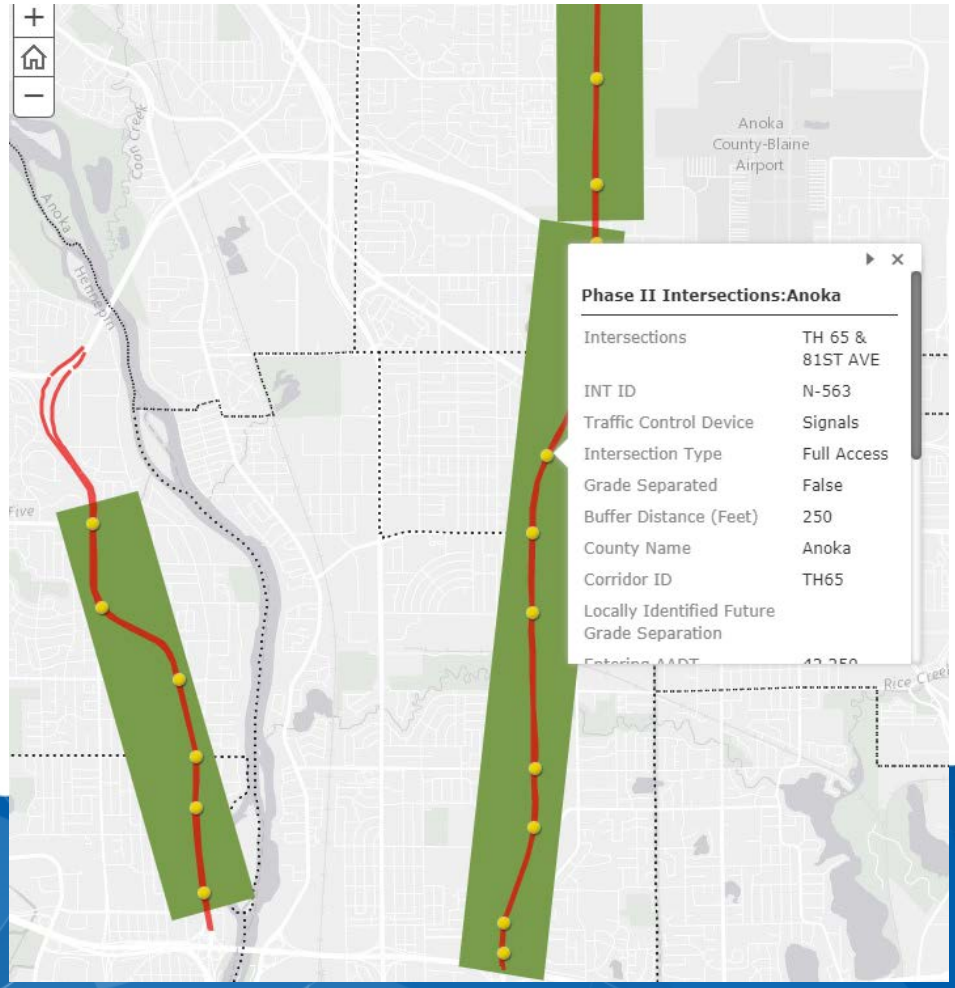
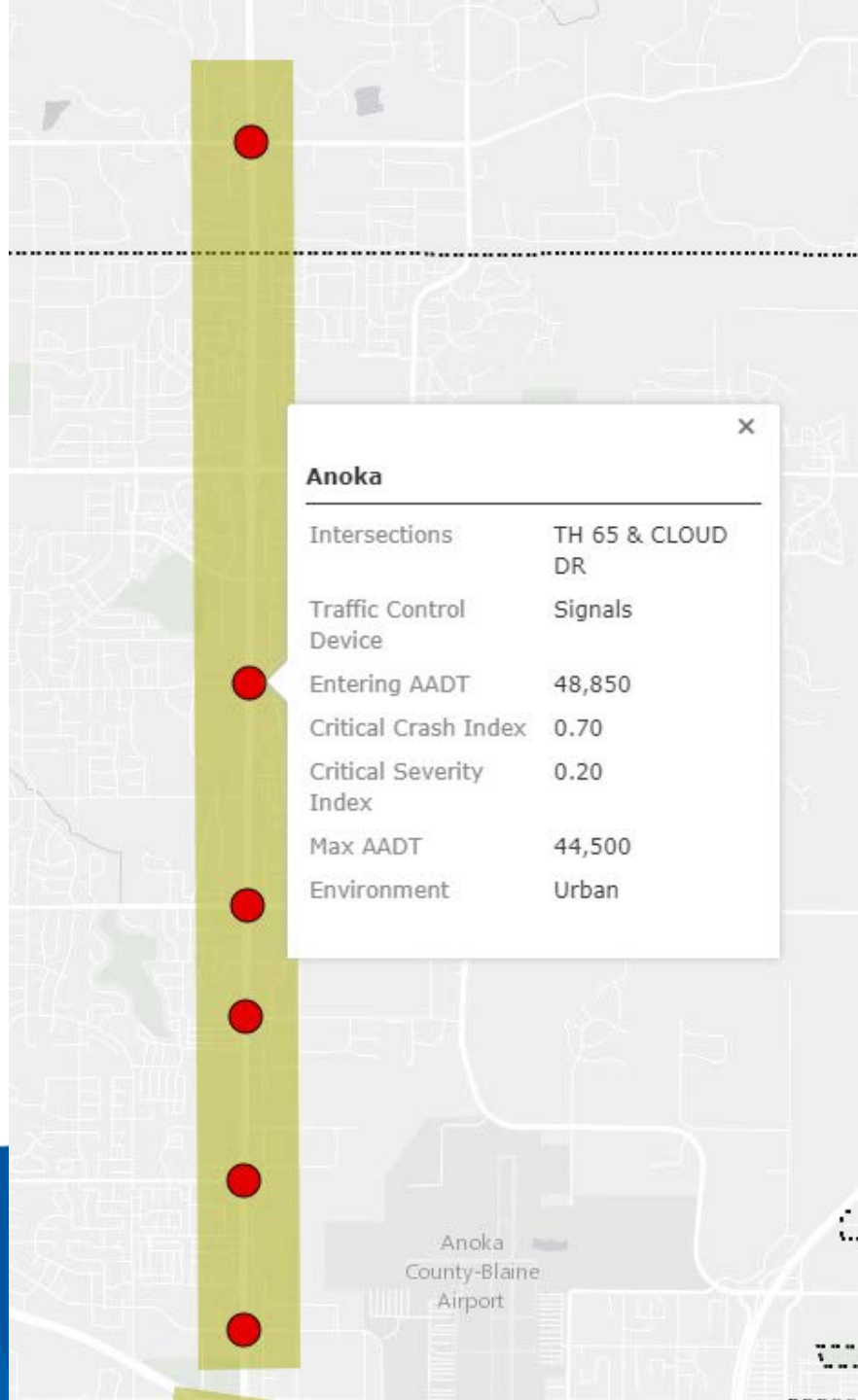
Data Layering





Capacity Analysis

- FHWA Capacity Analysis for Planning of Junctions (CAP-X) Tool
  - Test intersection data against various solutions
  - Ask: What type of investment to provide a reasonable volume/capacity (V/C) ratio?

Capacity Analysis Summary

		Existing Intersection	Expanded Intersection	Alternative At-Grade Intersection	Add PA Capacity	Hybrid Interchange	Full Interchange
TH 7-A							
1	CH 101	▧	▧	▧	☐	▧	☐
2	Woodland Rd.	☐	☐	☐	☐	☐	☐
3	Williston Rd.	▩	▩	▩	☐	▧	☐
	Key	▩ V/C ≥ 1.0		▧ V/C > 0.85 & < 1.0		☐ V/C ≤ 0.85	

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CAP-X Tool: Example Outputs

Results for Intersections

#	TYPE OF INTERSECTION	Sheet	Zone 1 (North) CLV	Zone 1 (North) V/C	Zone 2 (South) CLV	Zone 2 (South) V/C	Zone 3 (East) CLV	Zone 3 (East) V/C	Zone 4 (West) CLV	Zone 4 (West) V/C	Zone 5 (Center) CLV	Zone 5 (Center) V/C	Overall v/c Ratio	Ranking
1	Conventional	FULL									1193	0.75	0.75	6
2	Conventional Shared RT LN	CSRL									1139	0.71	0.71	3
3.1	Quadrant Roadway	S-W			2200	1.37			491	0.31	1885	1.18	1.37	12
3.2		N-E	2013	1.26			328	0.21			1916	1.20	1.26	9
3.3		S-E			2138	1.34	2138	1.34			1942	1.21	1.34	10
3.4		N-W	1988	1.24					208	0.13	2157	1.35	1.35	11
4.1	Partial Displaced Left Turn	N-S	160	0.10	988	0.62					1176	0.73	0.73	5
4.2		E-W					171	0.11	63	0.04	1065	0.67	0.67	2
5	Displaced Left Turn	FULL	160	0.10	988	0.62	171	0.11	63	0.04	1049	0.66	0.66	1
6.1	Restricted Crossing U-Turn	N-S	1290	0.81	270	0.17	549	0.34	1283	0.80			0.81	7
6.2		E-W	4316	2.70	2605	1.63	555	0.35	2292	1.43			2.70	15
7.1	Median U-Turn	N-S	1063	0.66	193	0.12					1173	0.73	0.73	4
7.2		E-W					202	0.13	299	0.19	1349	0.84	0.84	8
8.1														

Solutions Tested for One Intersection Location:

Intersection

Analysis

Results for Interchanges

#	TYPE OF INTERCHANGE	Sheet	Zone 1 (Rt Mrg) CLV	Zone 1 (Rt Mrg) V/C	Zone 2 (Lt Mrg) CLV	Zone 2 (Lt Mrg) V/C	Zone 3 (Ctr. 1) CLV	Zone 3 (Ctr. 1) V/C	Zone 4 (Ctr. 2) CLV	Zone 4 (Ctr. 2) V/C	Zone 5 (Lt Mrg) CLV	Zone 5 (Lt Mrg) V/C	Zone 6 (Rt Mrg) CLV	Zone 6 (Rt Mrg) V/C	Overall v/c Ratio	Ranking
10.1	Diamond	N-S					1006	0.63	994	0.62					0.63	7
10.2		E-W					185	0.12	193	0.12					0.12	3
11.1	Partial Cloverleaf	N-S					879	0.55	167	0.10					0.55	6
11.2		E-W					304	1.26	168	0.11					0.19	5
13.1	Displaced Left Turn	N-S	171	0.11			1092	0.68	990	0.62			1163	0.73	0.73	8
13.2		E-W	114	0.07			67	0.04	143	0.09			171	0.11	0.11	1
14.1	Double Crossover Diamond	N-S	171	0.11	990	0.62	1011	0.63	1126	0.70	173	0.11	1163	0.73	0.73	8
14.2		E-W	121	0.08	95	0.06	55	0.03	175	0.11	203	0.13	70	0.04	0.13	4
15.1	Single Point	N-S	173	0.11			1457	0.91					1186	0.74	0.91	10
15.2		E-W	121	0.08			182	0.11					70	0.04	0.11	2

Interchange

Analysis

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Planning, Policy, & Local Context

Interchange Under Construction

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Weighted Criteria

- Criteria & Weights – *Which intersections*:
  - Serve higher volumes of traffic, reduce mobility, and cause variable travel times? **(Mobility = 40%)**
  - Have a higher rate/cost of severe crashes? **(Safety = 30%)**
  - Can accommodate grade separation, serve regional routes, and leverage other modes? **(Corridor Context = 30%)**
- Technical Steering Committee (TSC) members helped to establish these weights

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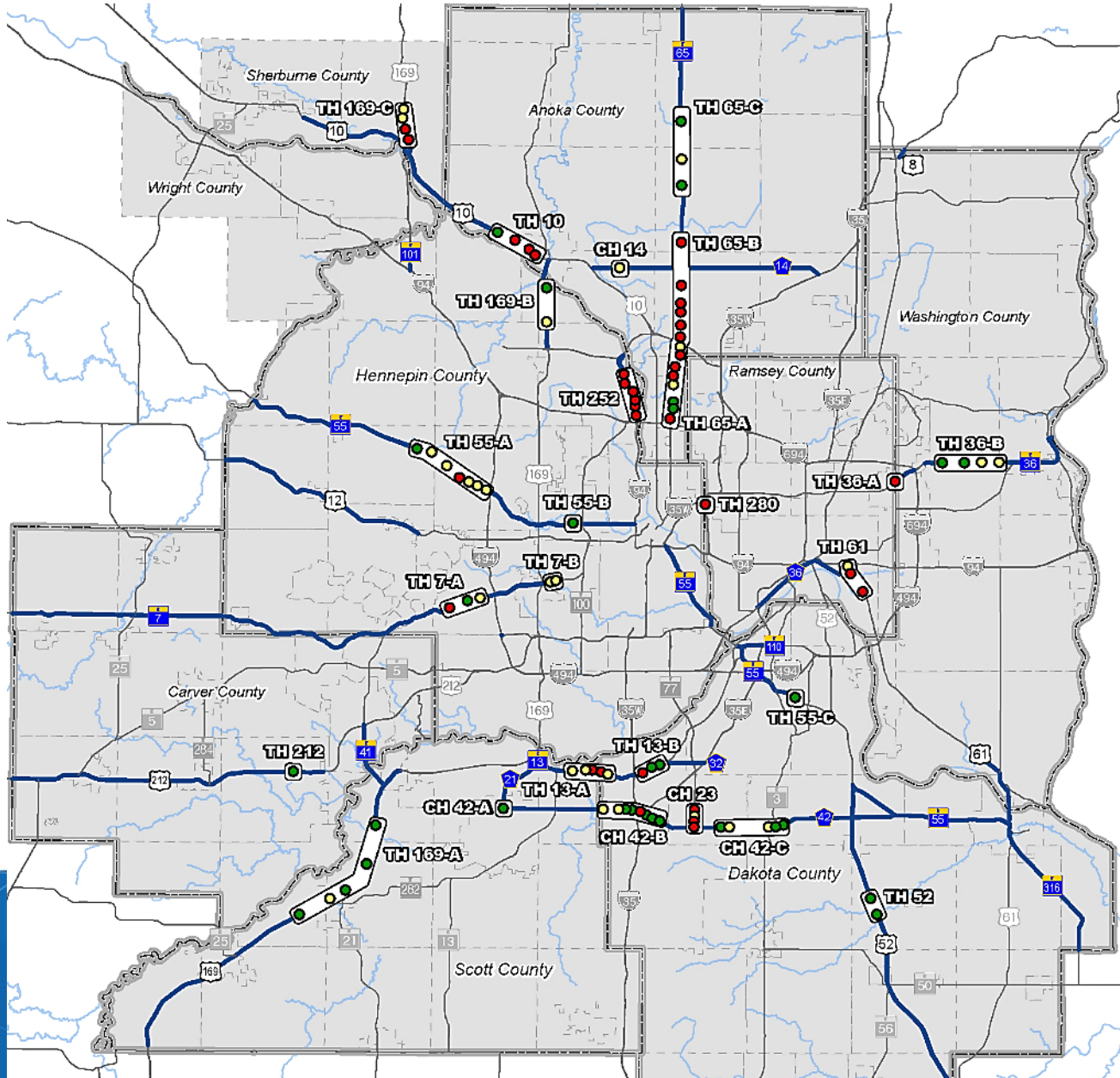
Priority Map (91 Intersections)

Grade-Separation Priorities:

- 34 High
- 27 Medium
- 30 Low

26 Focus Areas

- Intersection locations & corridors
- Likely basis for future corridor studies



Grade-Separation Priority

- High
- Medium
- Low

Role of the Study in Future Planning

- Results will:
  - Modify TPP and MnSHIP investment scenarios
  - Provide input to funding decisions for competitive state and federal awards
  - Serve as a reference for local planning and policy reviews
  - Make the case for additional funding

- Advises the right-sizing of proposed projects based on intersection priorities

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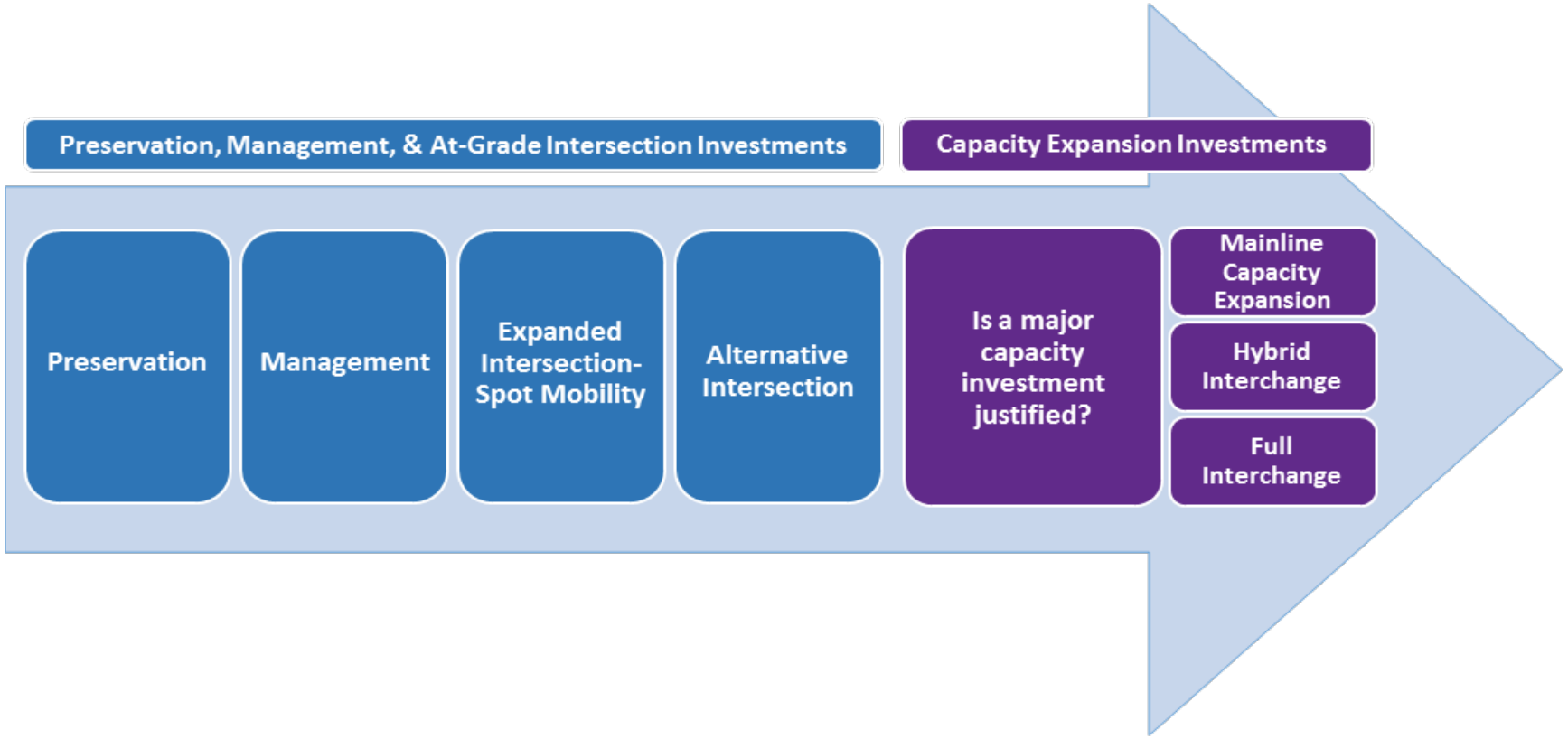
Regional Investment Philosophy



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For More Information

Steve Peterson, Metropolitan Council

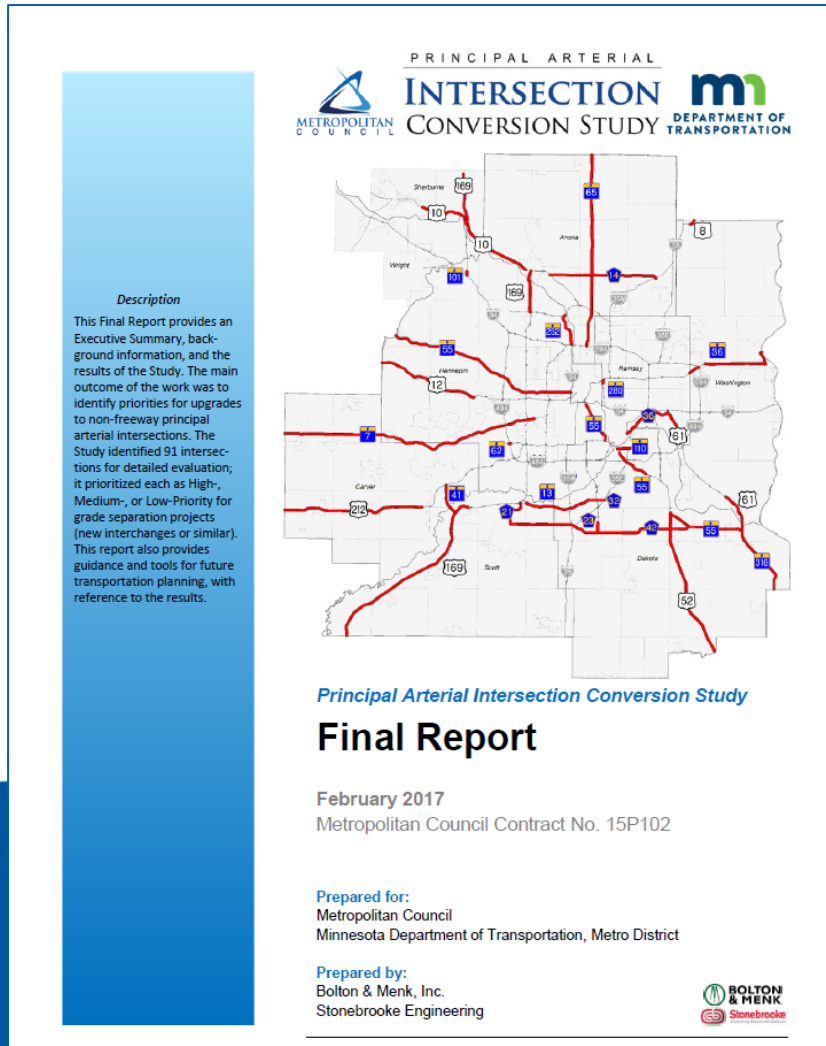
651-602-1819 or
Steven.Peterson@metc.state.mn.us

Paul Czech, MnDOT

651-234-7785 or
Paul.Czech@state.mn.us

Web GIS Applications:
https://arcg.is/1DHiXS

Project Website: metrocouncil.org/PAICS



PRINCIPAL ARTERIAL
INTERSECTION CONVERSION STUDY

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Description

This Final Report provides an Executive Summary, background information, and the results of the Study. The main outcome of the work was to identify priorities for upgrades to non-freeway principal arterial intersections. The Study identified 91 intersections for detailed evaluation; it prioritized each as High-, Medium-, or Low-Priority for grade separation projects (new interchanges or similar). This report also provides guidance and tools for future transportation planning, with reference to the results.

Principal Arterial Intersection Conversion Study

Final Report

February 2017
Metropolitan Council Contract No. 15P102

Prepared for:
Metropolitan Council
Minnesota Department of Transportation, Metro District

Prepared by:
Bolton & Menk, Inc.
Stonebrooke Engineering

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