Minnesota Department of Transportation

SRF Consulting Group, Inc.

Congestion Management Safety Plan Phase 4

NCITE Geometric Design Committee – June 21, 2018

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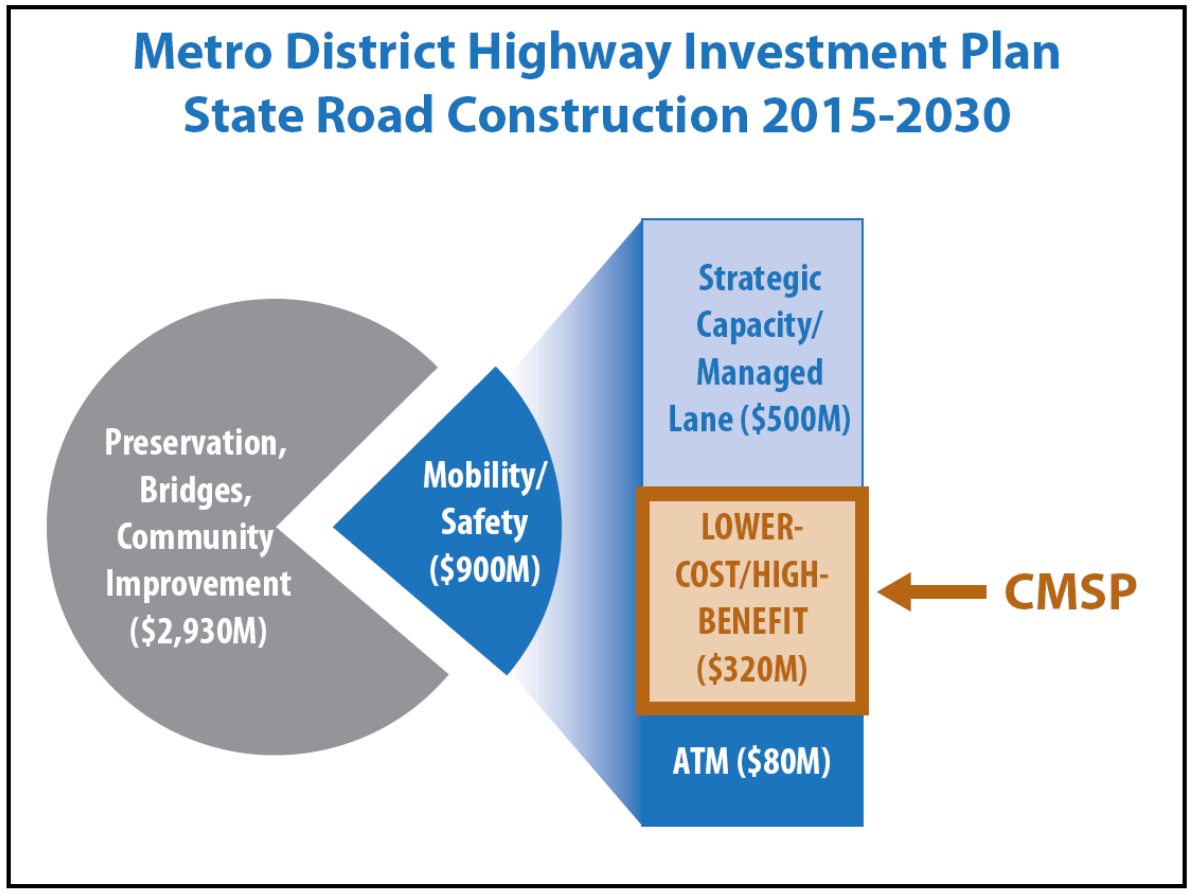
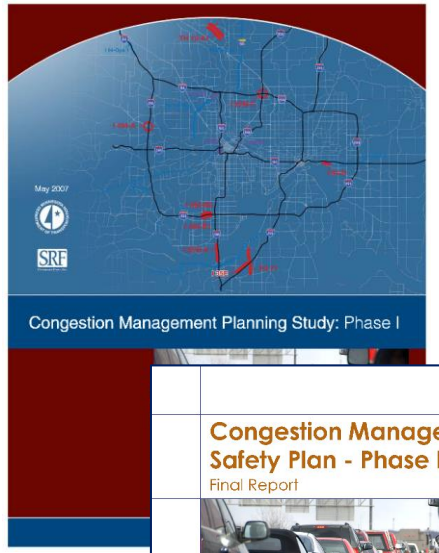
CMSP Purpose

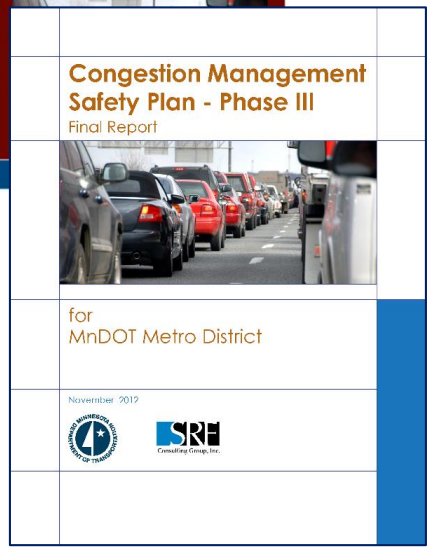


- Exclusive capital funding allocated to CMSP projects
- Program objective is to strategically develop lower-cost/high-benefit solutions targeting high-priority problem locations
- Program funds are eligible for the Twin Cities Metro trunk highway system

CMSP Background

- Congestion Management Planning Study (Phase 1 – 2007)
  - Identified 186 projects
  - 19 recommended as demonstration projects
- Congestion Management Safety Plan (Phase 2 – 2009)
  - System Problem Statement
  - Managed Corridor and Flexible Design Workshops
- Congestion Management Safety Plan (Phase 3 – 2011)
  - Local Agency Work Sessions
  - Collaborative Design Charrettes
  - Recommended 53 lower-cost/high-benefit opportunities





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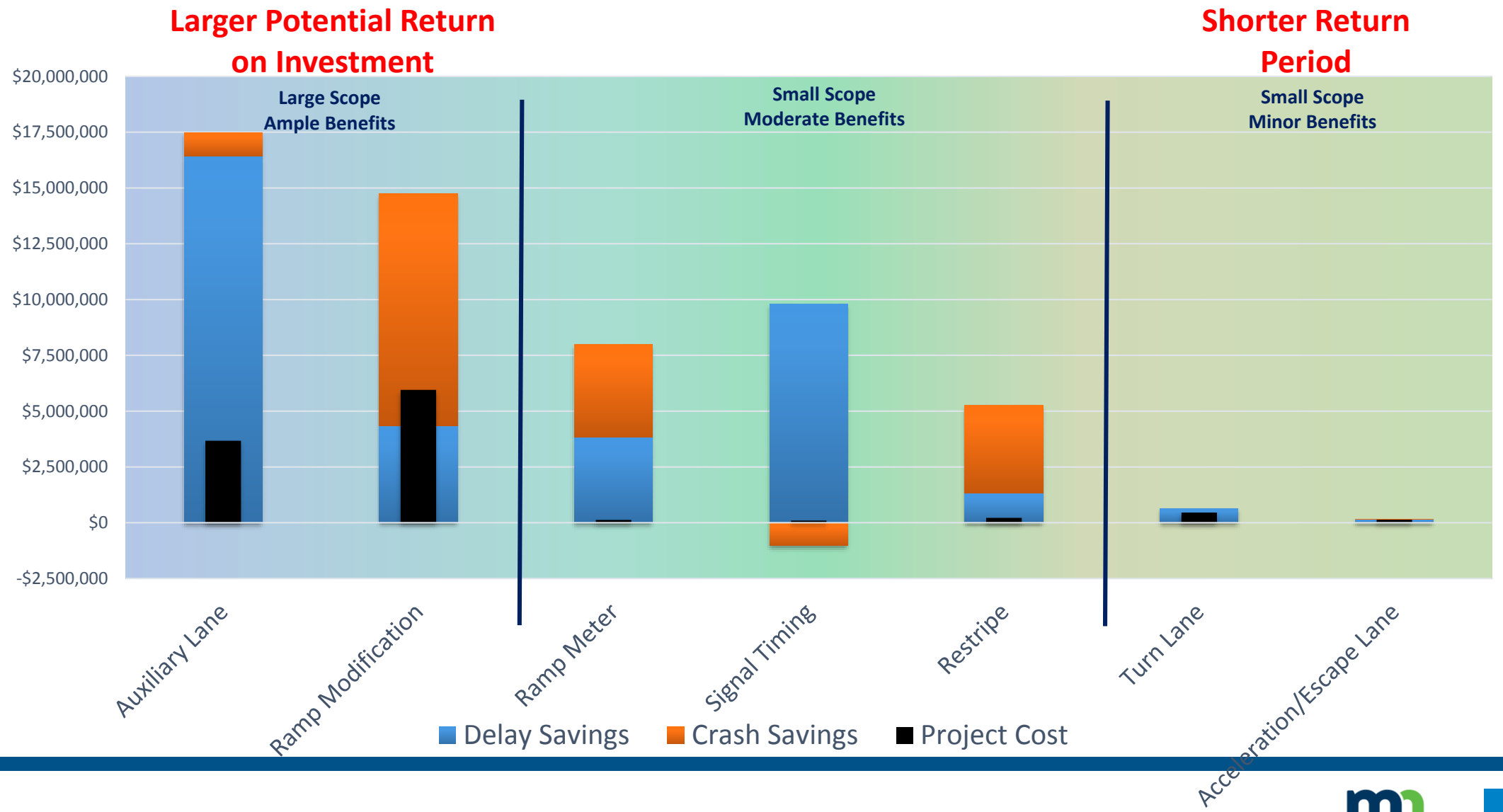
CMSP Phase 4 – New and Notable Features

- Review Previous CMSP Outcomes
  - Review Previous Opportunity Lists
  - Before and After Studies
  - Project One-Pagers
- Update CMSP Opportunity List
  - Expand data coverage beyond instrumented system
- Project Pre-Scoping
  - Additional detail for traffic impacts, geometric design, and cost estimates

Costs vs. Benefits by Project Type



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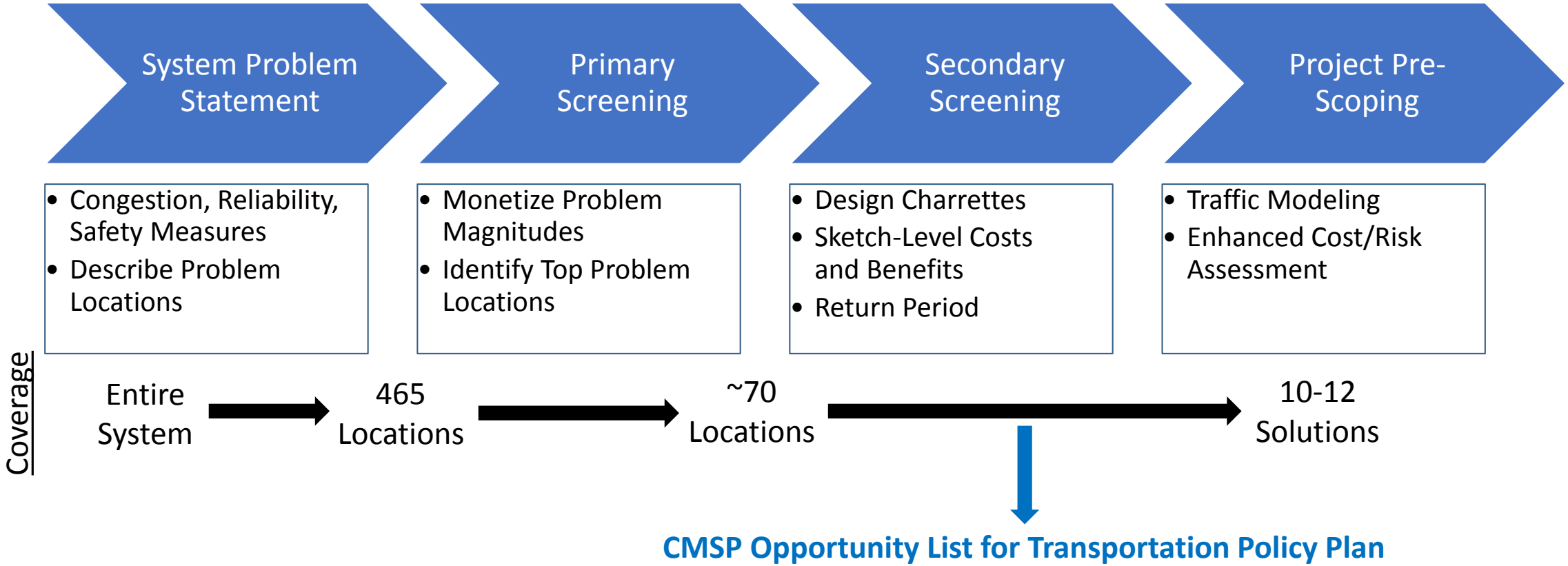
CMSP Process

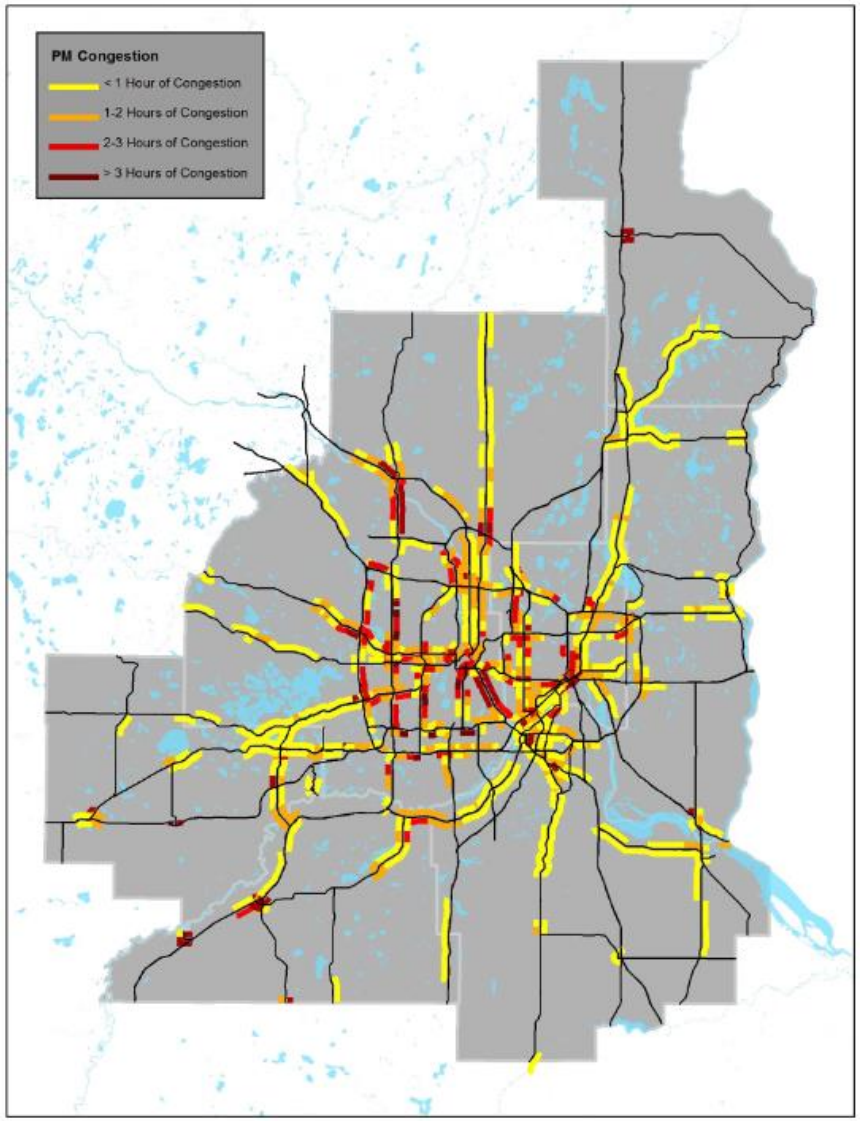


System Problem Statement

System Performance Measures

Recurring Congestion

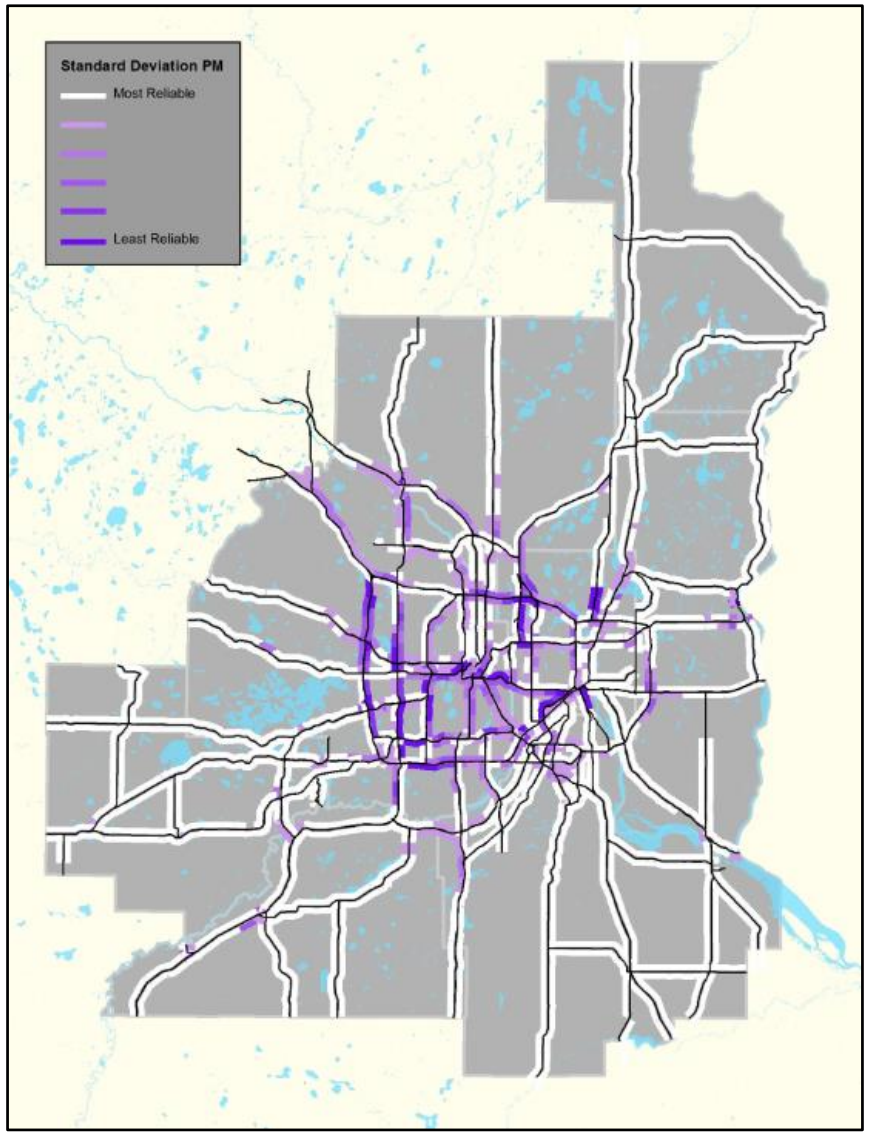
- Loop detector and INRIX speed data
- Data obtained from MnDOT *2015 Congestion Report*
- Segments mapped to MnDOT highway line layer
- Analyze data in coordination with other measures



System Performance Measures

Travel Time Reliability

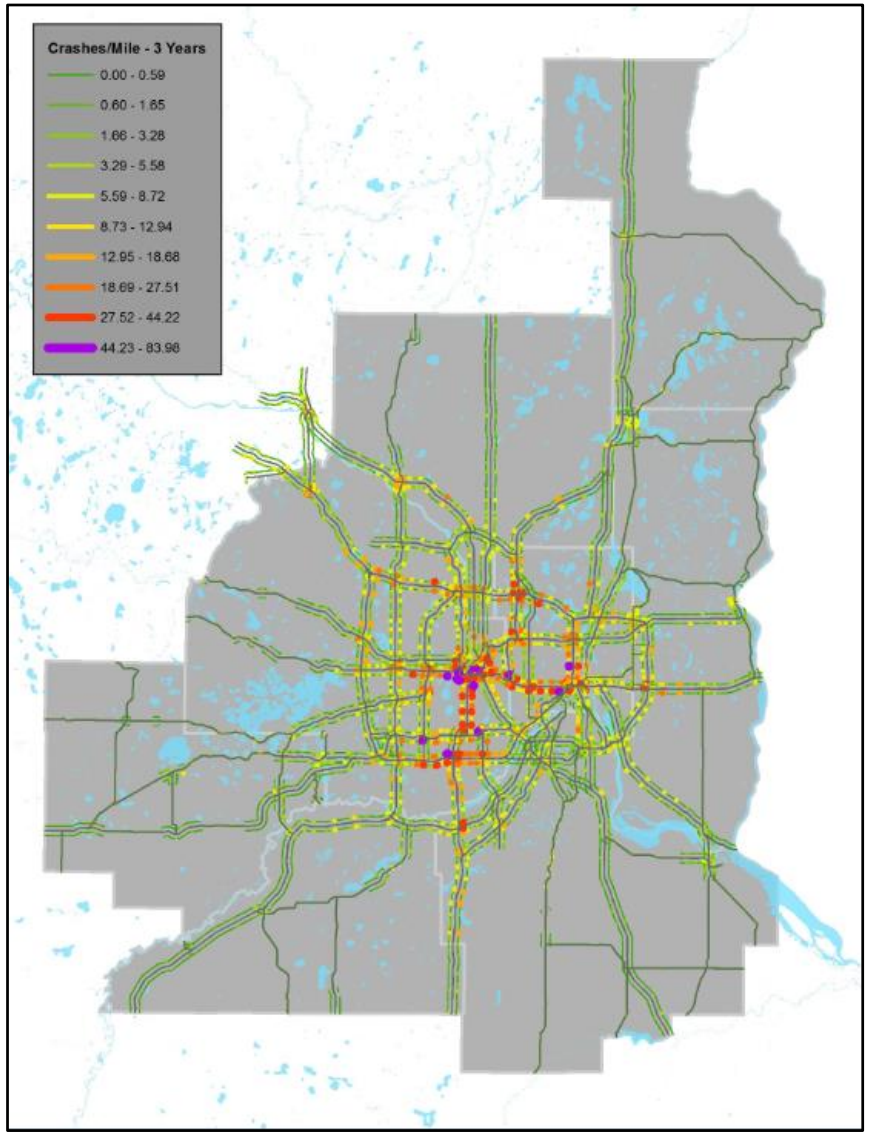
- One year of travel time data (full year 2015)
- Includes all conditions
  - Weather
  - Crashes
  - Road Work
- Standard deviation of travel time distribution



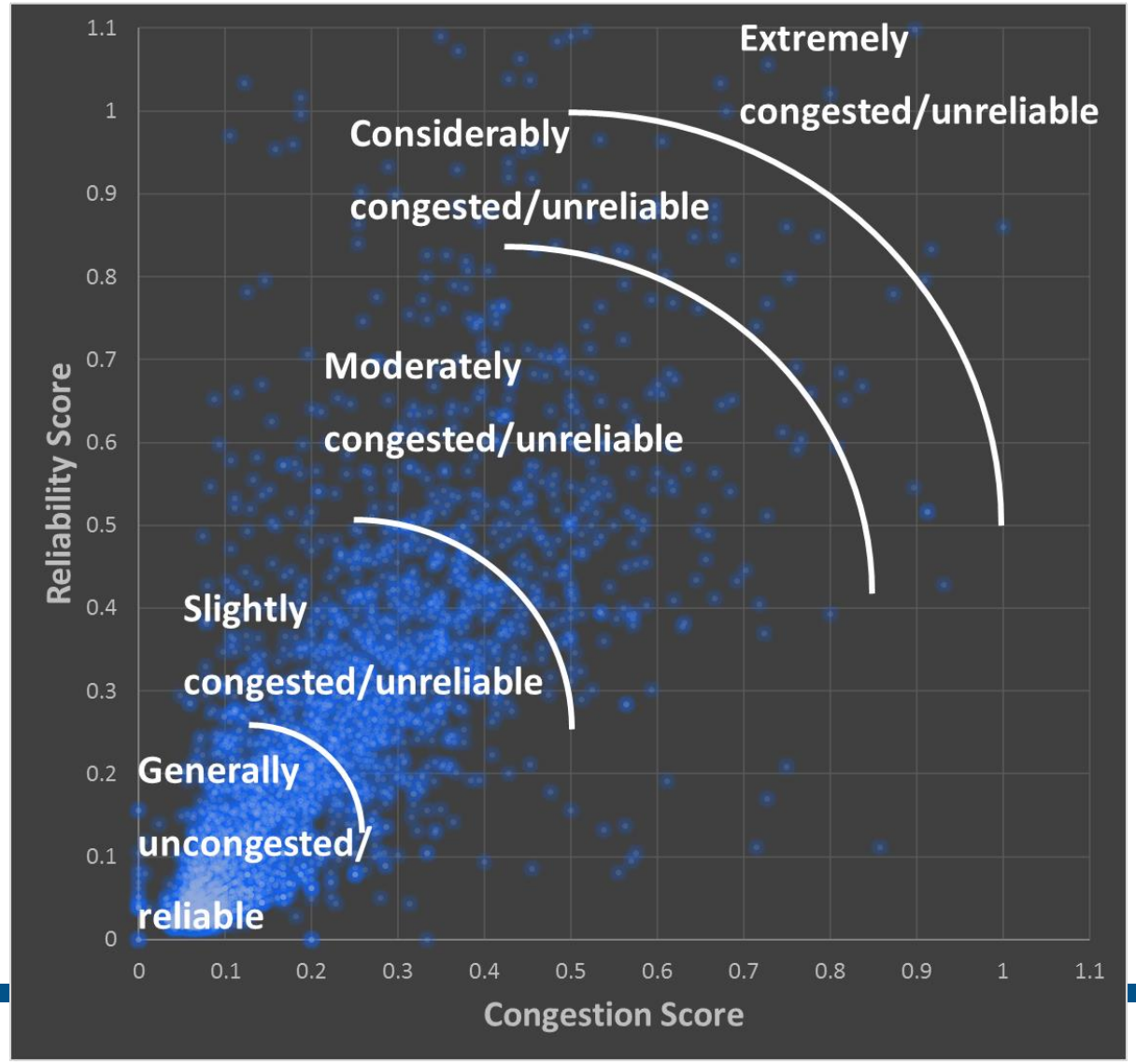
System Performance Measures

Crash Density

- 3 years of crash records (Jul 2012-Jun 2015)
- Individual crashes assigned by highway milepost and direction
- Densities show high crash concentrations



Congestion vs. Reliability



- Travel time reliability and delay assessed for each problem location
- Reliability typically correlates with congestion
- Several instances with low/moderate recurring congestion but poor reliability
  - E.g. upstream of queue locations that occasionally experience backups, high-crash locations, etc.

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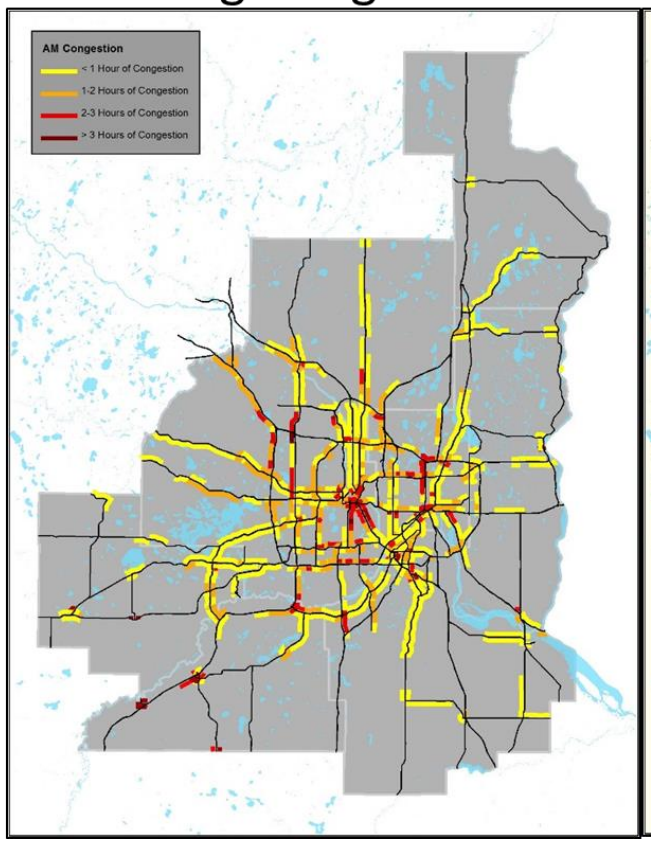
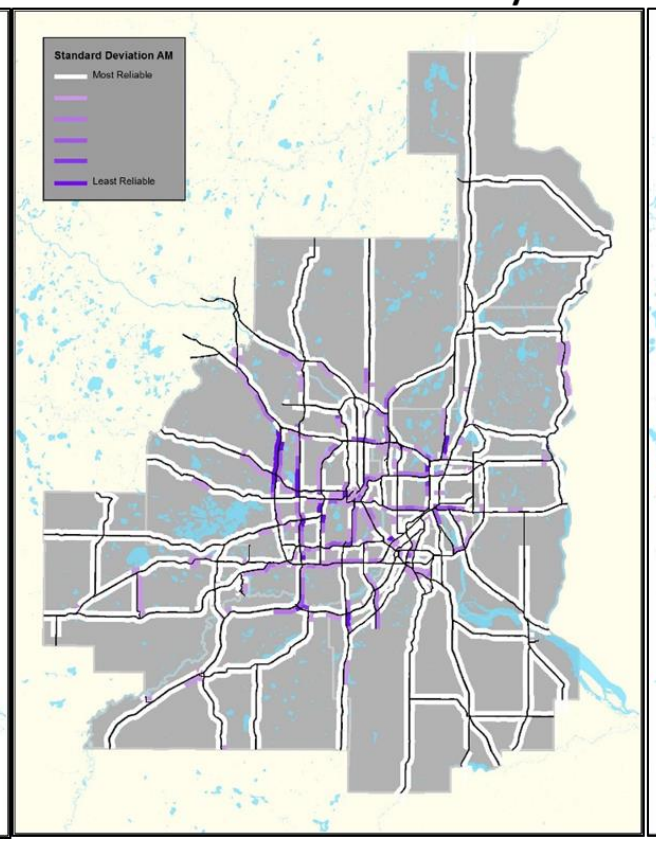
Primary Screening

Performance Measures Mapped to Highway Network

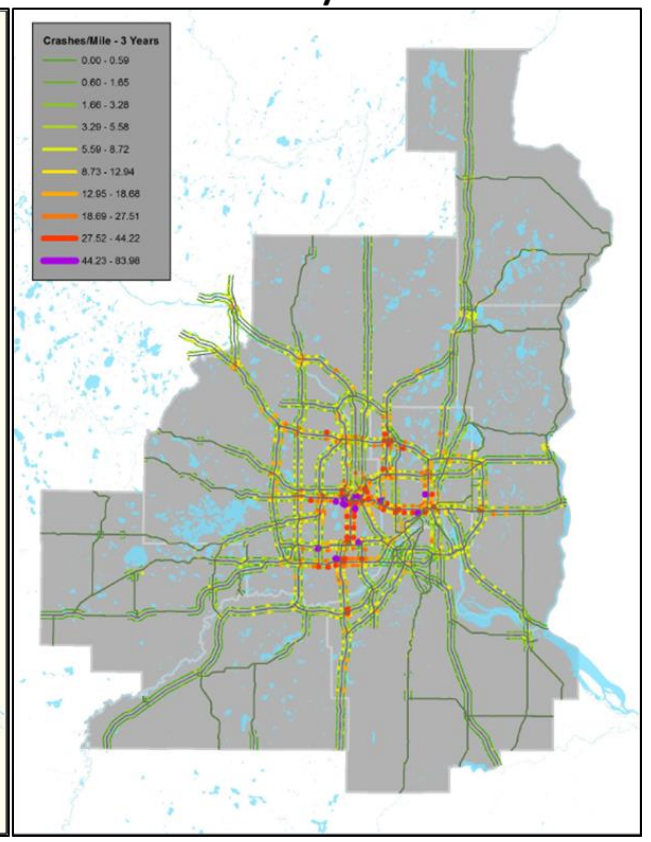
Recurring Congestion



Travel Time Reliability



Crash Density



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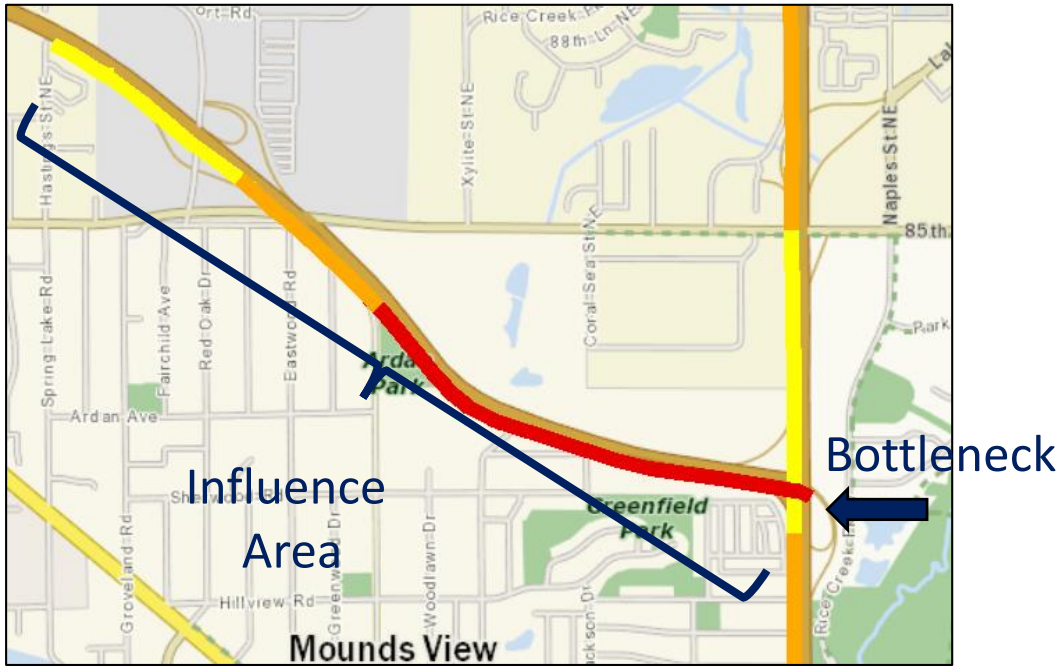
Problem Location Identification

- Single congestion problem that propagates upstream
- Congestion severity lessens without other problem factors
- Problem location at start of congestion segment
- Influence area covers extent of congestion segment(s) associated with problem

AM Peak Congestion Map



Problem Monetization
Key Elements

Congestion Cost

- Vehicle speeds
- Traffic volume
- Influence distance
- Congestion duration
- Value of time

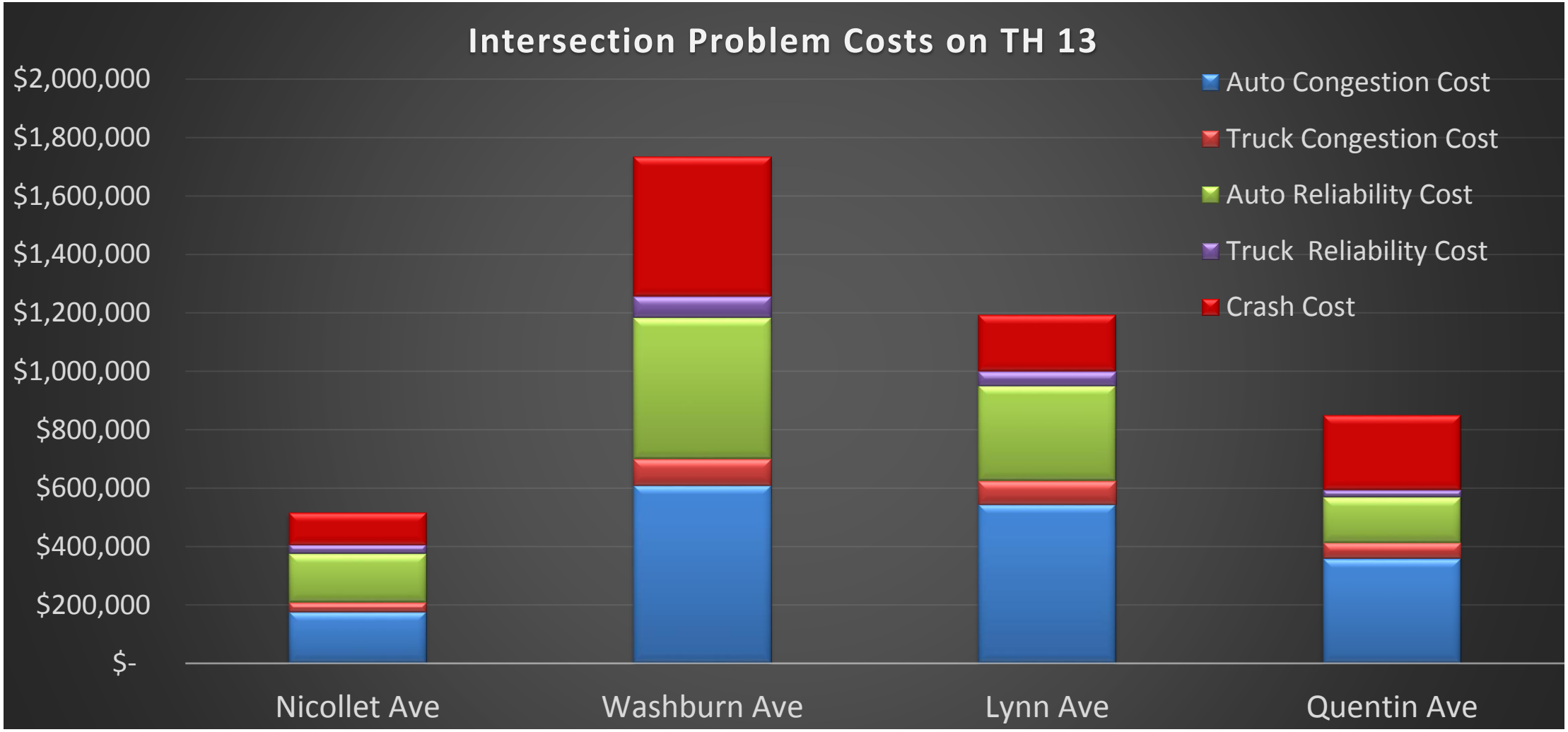
Reliability Cost

- Travel time standard deviation
- Traffic volume
- Influence distance
- Value of reliability

Crash Cost

- Number of crashes by severity
- Crash cost by severity

Example Problem Cost by Category



Total Problem Magnitude by County

- Total problem magnitude: $913,785,000 (465 locations)
- Total problem magnitude by county:

County	Total Problem Cost	#Problems	Average Cost/Problem
Anoka	$47,928,000	45	$1,065,000
Carver	$5,096,000	24	$212,000
Chisago	$513,000	8	$64,000
Dakota	$35,553,000	50	$711,000
Hennepin	$634,803,000	221	$2,872,000
Ramsey	$156,598,000	85	$1,842,000
Scott	$18,551,000	14	$1,325,000
Washington	$14,743,000	18	$819,000

Primary Screening Results
Prioritized Locations

- Total problem magnitude: $128,178,500 (68 locations)
- Total problem magnitude by county:

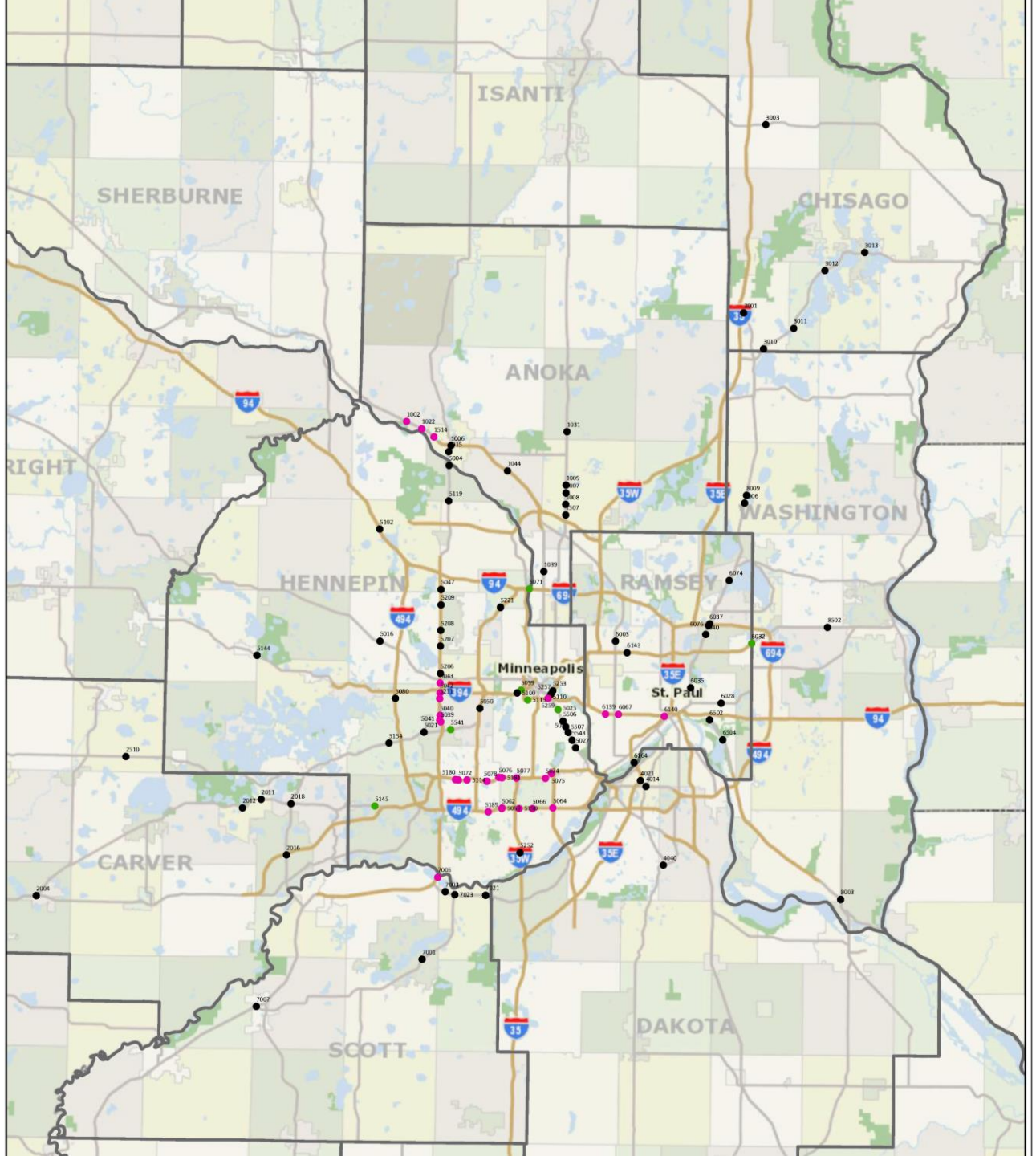
County	Total Problem Cost	# of Problems	Average Cost/Problem
Anoka	$19,402,900	9	$2,155,878
Carver	$2,586,100	6	$431,017
Chisago	$1,503,200	6	$250,533
Dakota	$3,777,200	3	$1,259,067
Hennepin	$80,869,700	24	$3,369,571
Ramsey	$12,744,200	11	$1,158,564
Scott	$5,688,300	5	$1,137,660
Washington	$1,606,900	4	$401,725
Total	**$128,178,500**	**68**	**$1,884,978**

Prioritized locations for Secondary Screening

- **Recent/Planned projects**
  - 59 problem locations
  - $239M of problem magnitude (25%)
- **Corridor Studies Completed/ Underway**
  - 62 problem locations
  - $241M of problem magnitude (25%)

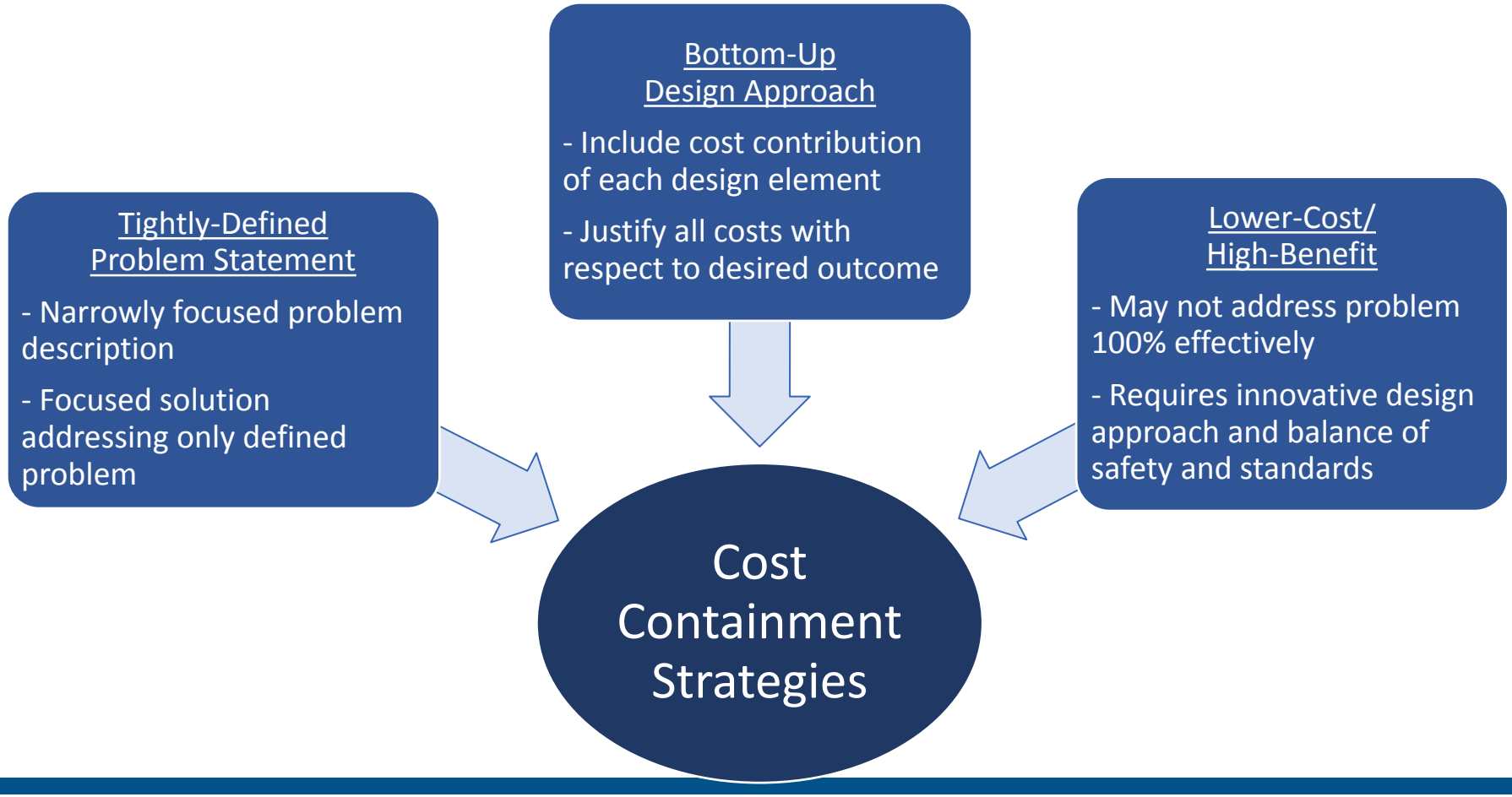
Primary Screening Results

Roadway Type	Locations
2 Lane Rural	18
2 Lane Urban	3
4+ Lane Urban	15
4+ Lane Expressway	15
4 Lane Freeway	10
6+ Lane Freeway	7
Total	**68**



Secondary Screening

CMSP Design Charrette
Concept Development Strategies

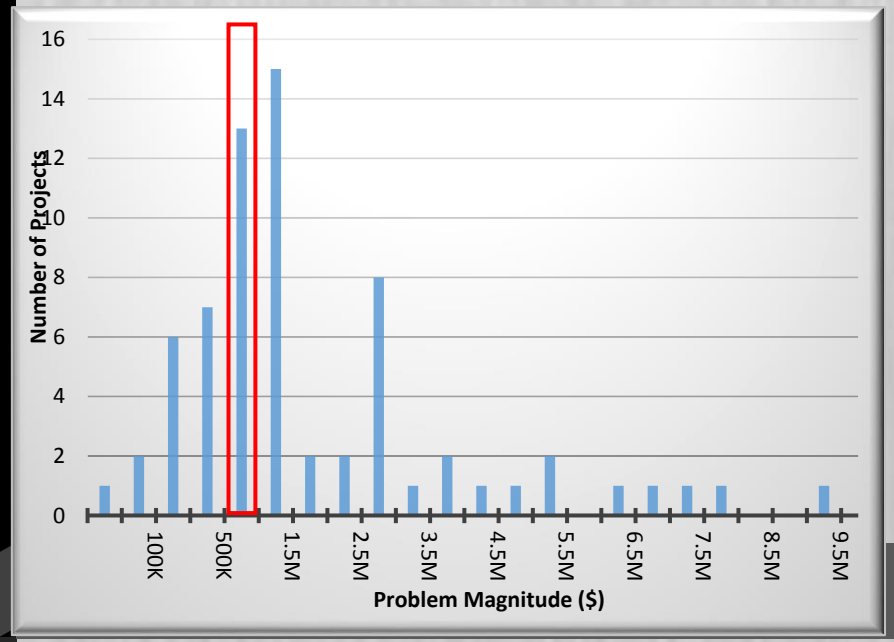


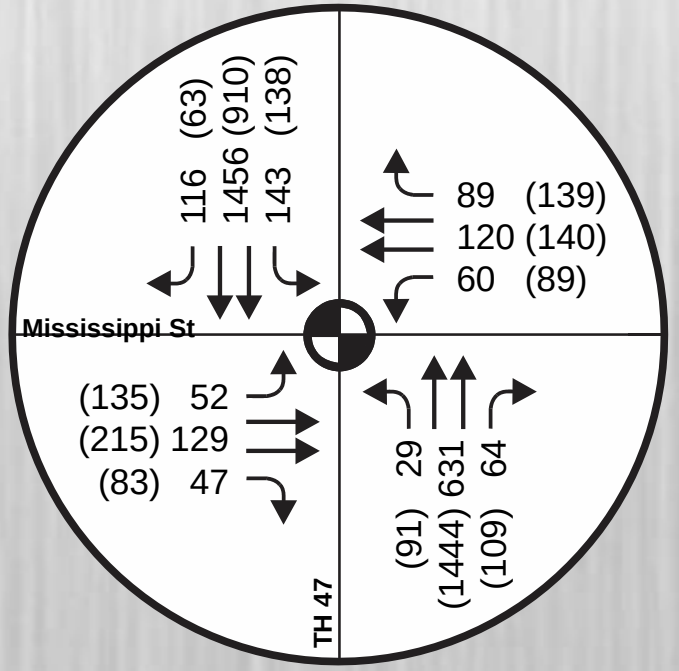
Design Charrette Activity

Project 1039
TH 47 (University Ave) and Mississippi St

Problem Magnitude

	AM	PM	Total
Delay Cost	$34,500	$217,000	$251,500
Reliability Cost	$62,400	$88,100	$150,500
Crash Cost			$315,700
	Total Annual		**$717,700**





Volumes Collected: 2013

Project 1039
TH 47 (University Ave) and Mississippi St

CMSP Crash Cost Calculator

Project #	**1039**	**Crash Cost Rank:**	**42**
Location	**MN47 at Mississippi St**	**County:**	**Anoka**
Comments	**78% crashes are injuries; 78% of crashes are intersection-related**		

Existing Conditions (July 2012 - June 2015 Data)	Rear End	Sideswipe Passing	Left Turn Into Traffic	Ran Off Road - Left Side	Right Angle	Right Turn Into Traffic	Ran Off Road - Right Side	Head On	Sideswipe Opposing	Other / N/A / Unknown / Not Coded	Total	Severity Cost	Total Cost
	1	2	3	4	5	6	7	8	9				
K	0	0	0	0	0	0	0	0	0	0	**0**	**$1,140,000**	**$0**
A	0	0	0	0	0	0	0	0	0	0	**0**	**$570,000**	**$0**
B	2	0	1	0	0	0	0	0	0	1	**4**	**$170,000**	**$680,000**
C	1	1	0	0	0	0	1	0	0	0	**3**	**$84,000**	**$252,000**
N	1	0	1	0	0	0	0	0	0	0	**2**	**$7,600**	**$15,200**
Total	4	1	2	0	0	0	1	0	0	1	**3-Year Total**		**$947,200**
	$ 431,600	$ 84,000	$ 177,600	$ -	$ -	$ -	$ 84,000	$ -	$ -	$ 170,000	**Annual Crash Cost**		**$315,700**

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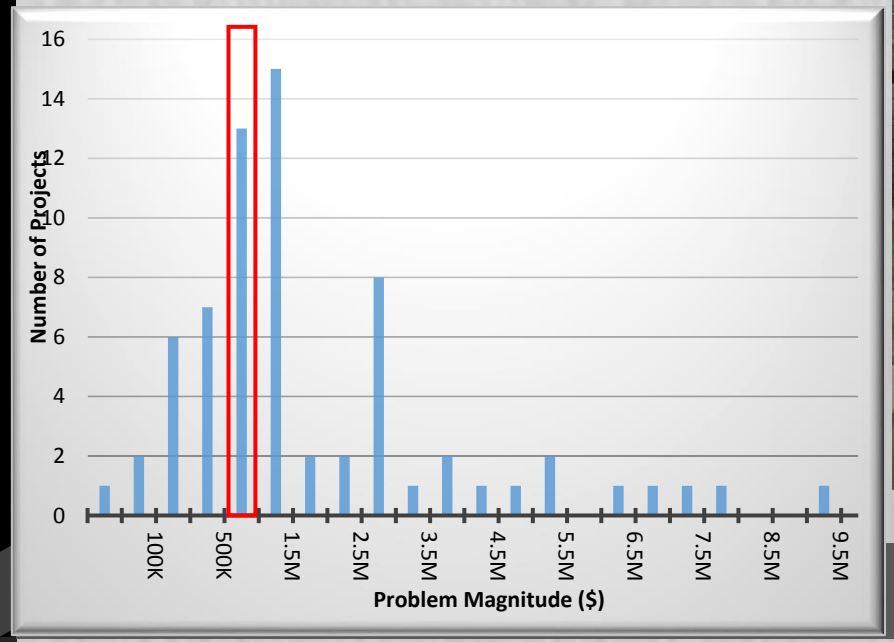
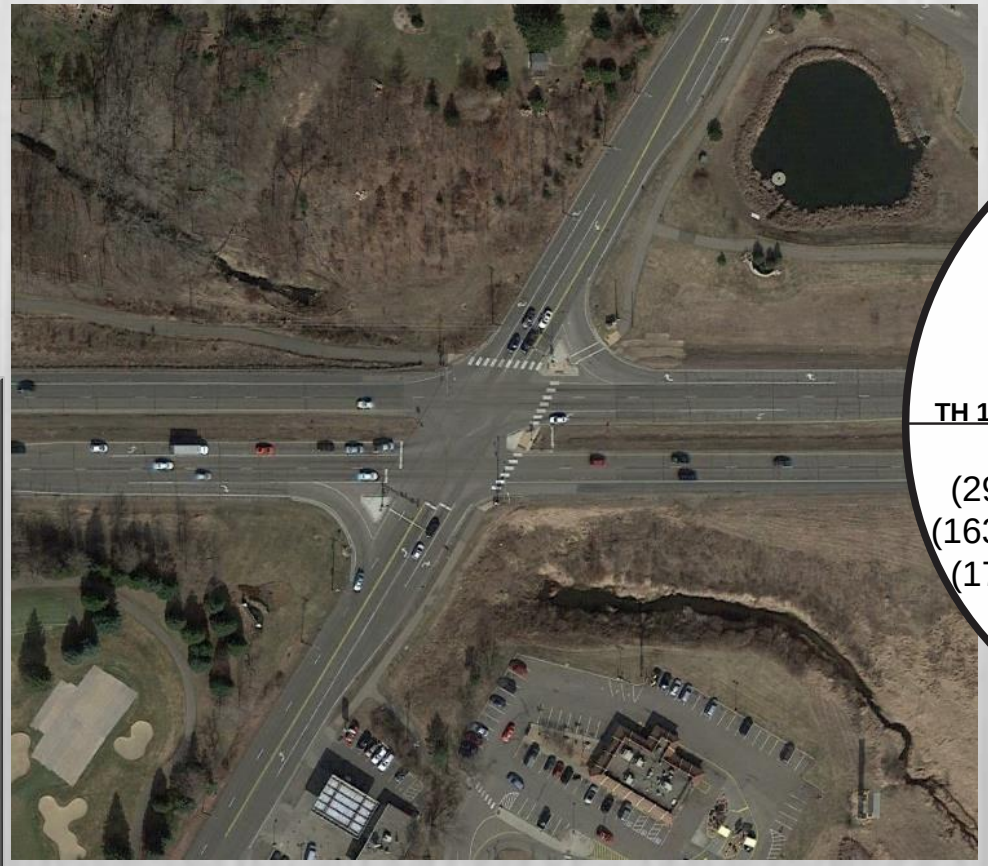
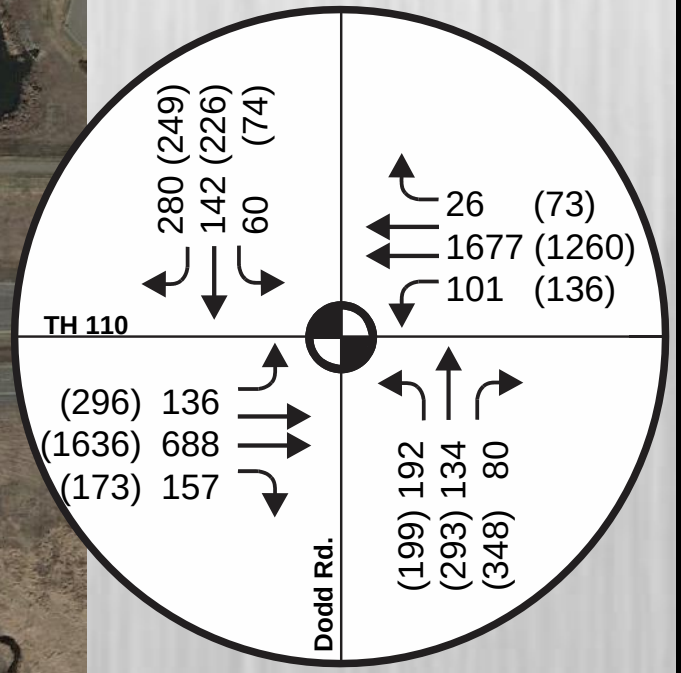
Project 4014
TH 110 and TH 149 (Dodd Rd)

Problem Magnitude

	AM	PM	Total
Delay Cost	$98,800	$271,500	$370,300
Reliability Cost	$64,300	$85,400	$149,700
Crash Cost			$349,100
		Total Annual	**$869,100**







Volumes Collected: 2016

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Project 4014
TH 110 and TH 149 (Dodd Rd)

CMSP Crash Cost Calculator

Project #	**4014**	**Crash Cost Rank:**	**39**
Location	**MN149 at MN 110**	**County:**	**Dakota**
Comments	**(27%) Crashes 4:15pm-5:45pm all EB; (36%) EB; (28%)WB; (22%) NB; (14%) SB; (71%) of Injury crashes were EB; (3) NB Crashes were at Gas Station access**		

Existing Conditions (July 2012 - June 2015 Data)	Rear End	Sideswipe Passing	Left Turn Into Traffic	Ran Off Road - Left Side	Right Angle	Right Turn Into Traffic	Ran Off Road - Right Side	Head On	Sideswipe Opposing	Other / N/A / Unknown / Not Coded	**Total**	**Severity Cost**	**Total Cost**
	1	2	3	4	5	6	7	8	9				
K	0	0	0	0	0	0	0	0	0	0	**0**	**$1,140,000**	**$0**
A	0	0	0	0	0	0	0	0	0	0	**0**	**$570,000**	**$0**
B	0	0	0	0	1	0	0	0	0	0	**1**	**$170,000**	**$170,000**
C	3	1	1	1	2	0	0	0	0	0	**8**	**$84,000**	**$672,000**
N	19	4	1	0	2	0	1	0	0	0	**27**	**$7,600**	**$205,200**
Total	22	5	2	1	5	0	1	0	0	0	**3-Year Total**		**$1,047,200**
	$ 396,400	$ 114,400	$ 91,600	$ 84,000	$ 353,200	$ -	$ 7,600	$ -	$ -	$ -	**Annual Crash Cost**		**$349,100**

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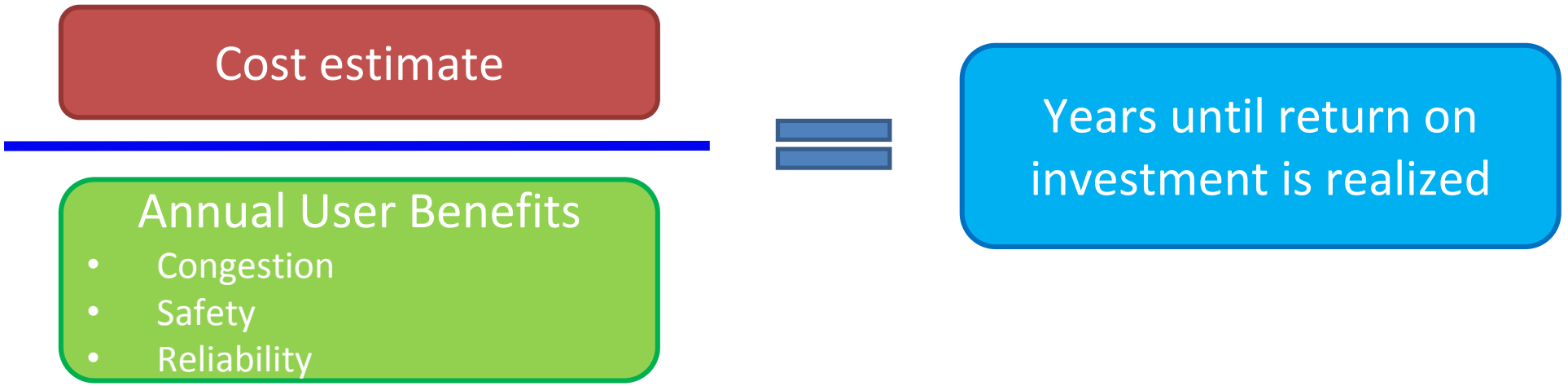
CMSP Design Charrette
Solution Type Summary

Metro Area	Auxiliary Lane	Ramp Modification	Acceleration Lane	Capacity Expansion	Grade Seperation	Alternative Intersection	Turn Lane	Signal Improvements	Ped Improvements	Restripe	Upgrade/Update Signing	Total
East	0	0	0	0	0	2	3	5	1	0	1	**12**
North	2	0	0	6	4	7	3	1	2	3	1	**29**
South	2	0	0	6	1	7	6	2	1	1	2	**28**
West	7	5	3	5	0	6	4	0	2	0	0	**32**
Total	**11**	**5**	**3**	**17**	**5**	**22**	**16**	**8**	**6**	**4**	**4**	**101***

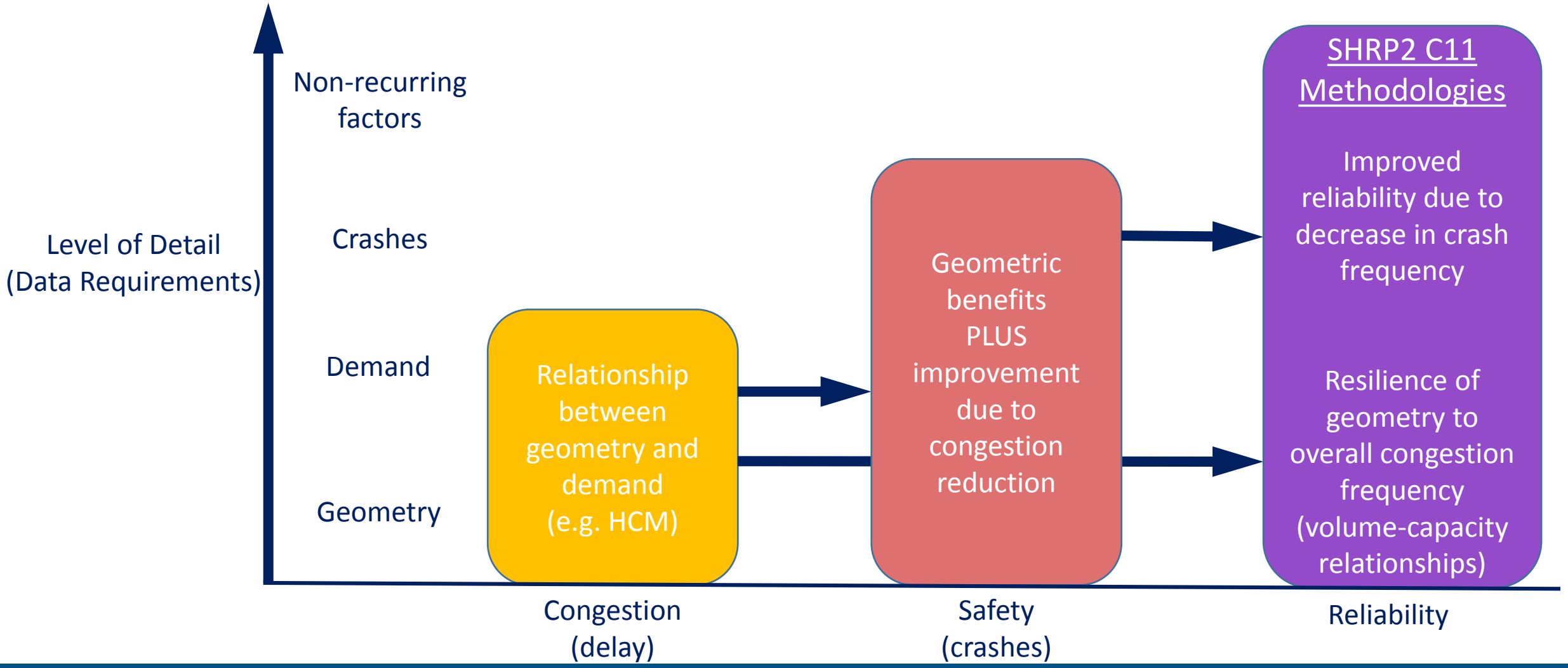
*Several locations either have more than one solution option or multiple design elements to address issues, so more solutions than locations are shown here.

Secondary Screening Methodology

Objective: Project return period



Benefit Evaluation Overview



Project Cost Estimates

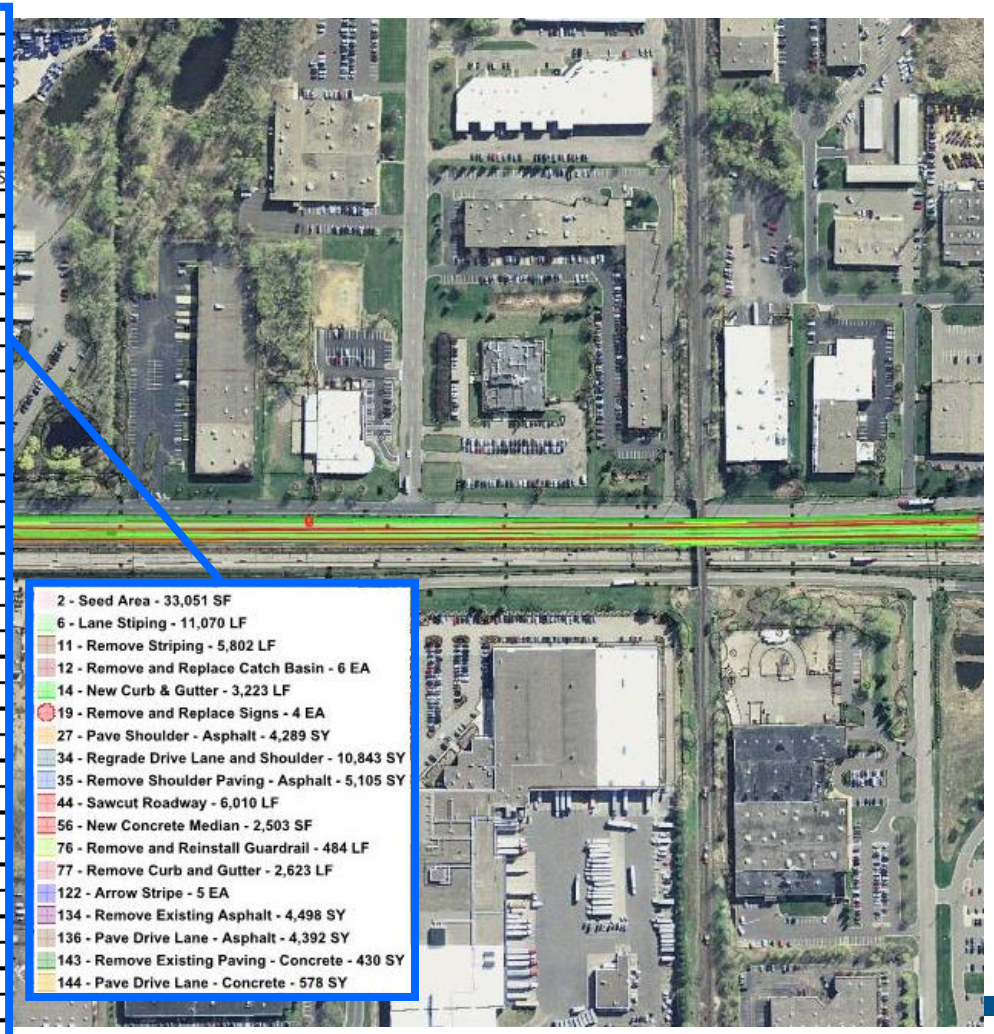
Project Cost Estimates

Scope	Construction Cost	Delivery Cost
General/Standard	Itemized costs • Paving • Sidewalk • Ped bridge • Etc.	
Site Specific	- Maintenance of traffic - Subsurface • Soil condition • Foundation-pile • Dewatering	Percentage of construction cost (varies by project type and location)
Total Project Cost = Construction Cost + Delivery Cost		

Cost	Risk
• Quantities • Delivery • Additional work based on subsurface	• Duration of construction • Maintenance of traffic impacts

Project Cost Estimates

5209 CMSP						
NB Hwy 169 & Bass Lake Road						
Item Description	**QTY**	**UOM**	**Unit Cost**	**Total Cost**	**Comments**	
NB auxiliary lane from Schmidt Lake Rd						
Mobilization	1	LS	$ 56,000.00	$ 56,000.00		
Traffic Control	1	LS	$114,000.00	$ 114,000.00	120	DAYS
Barrel						
Barriers						
Signs						
Erosion Control	1	LS	$ 36,559.96	$ 37,000.00		
Silt Fence						
Seeding						
Wood Fabric						
Lane Striping	11,070	LF	$ 0.42	$ 5,000.00		
Remove Striping	5,802	LF	$ 0.37	$ 3,000.00		
Pave - Asphalt	1875	TN	$ 76.80	$ 144,000.00		
Remove and Replace Catch Basin	6	EA	$ 12,389.15	$ 75,000.00		
Curb and Gutter	3223	LF	$ 36.50	$ 118,000.00		
Remove and Reinstall Guardrail	484	LF	$ 27.97	$ 14,000.00		
Regrade Drive Lane and Shoulder	10,843	SY	$ 40.86	$ 443,000.00		
Grading						
Aggregate Base 8" CV						
Common Borrow CV						
Concrete Median	2,503	SF	15.27	$ 39,000.00		
Remove Curb and Gutter	2,623	LF	3.79	$ 10,000.00		
Remove - Asphalt	9,603	SY	$ 6.39	$ 62,000.00		
Saw Cut	6010	LF	$ 3.92	$ 24,000.00		
Signs	6	EA	$ 405.47	$ 3,000.00		
Remove Concrete Paving	3870	SF	$ 1.34	$ 6,000.00		
Arrow Stripe	5	EA	$ 123.85	$ 1,000.00		
Pave - Concrete	578	SY	$ 31.39	$ 19,000.00		
	Subtotal			$ 1,173,000.00		
	Contractor Mark-Up		15%	$ 175,950.00		
	Total Construction Costs			$ 1,348,950.00		
	Delivery Costs		20%	$ 235,000.00		
	Total Project Costs			$ 1,590,000.00		



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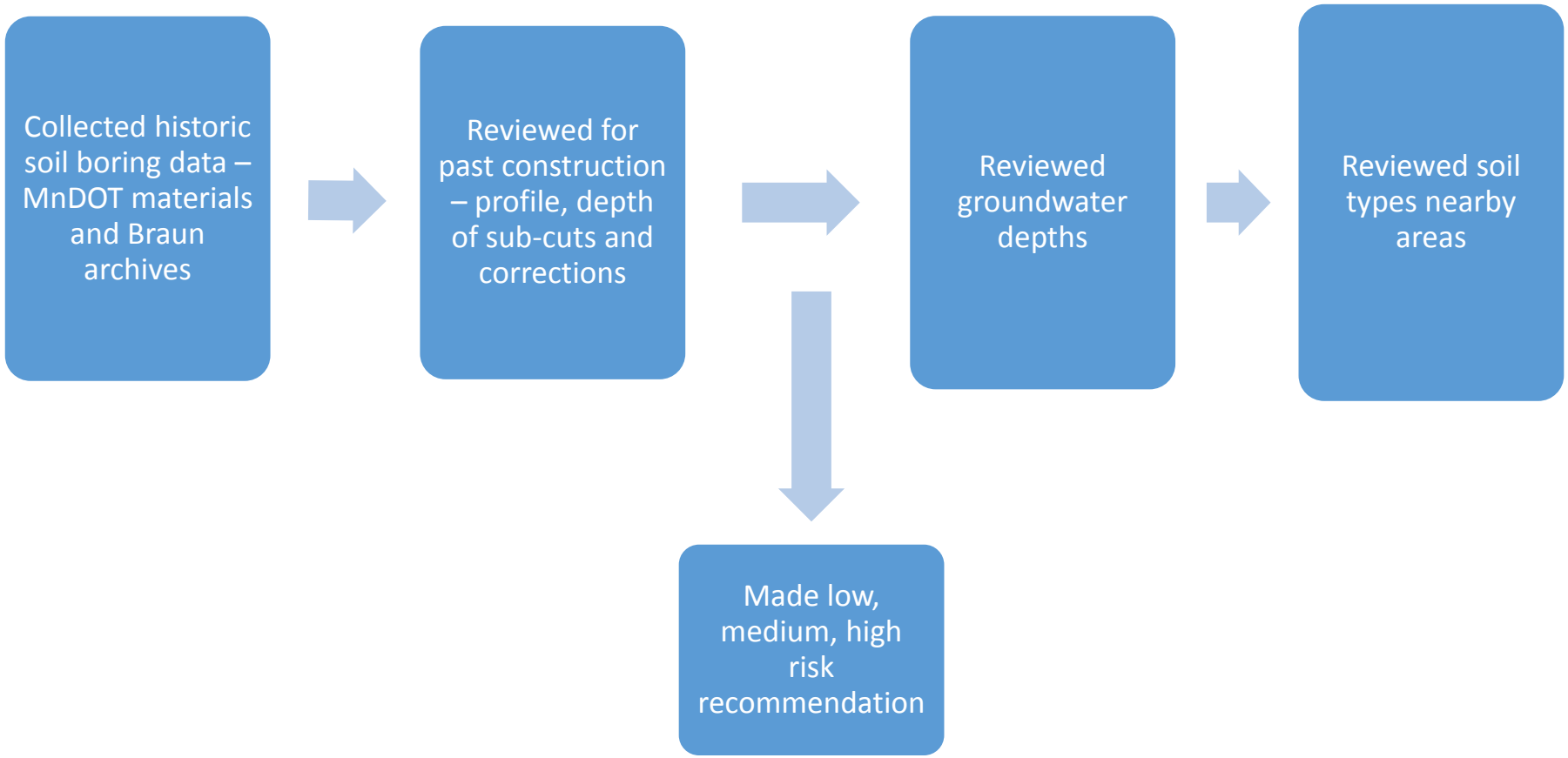
Project Cost Estimates

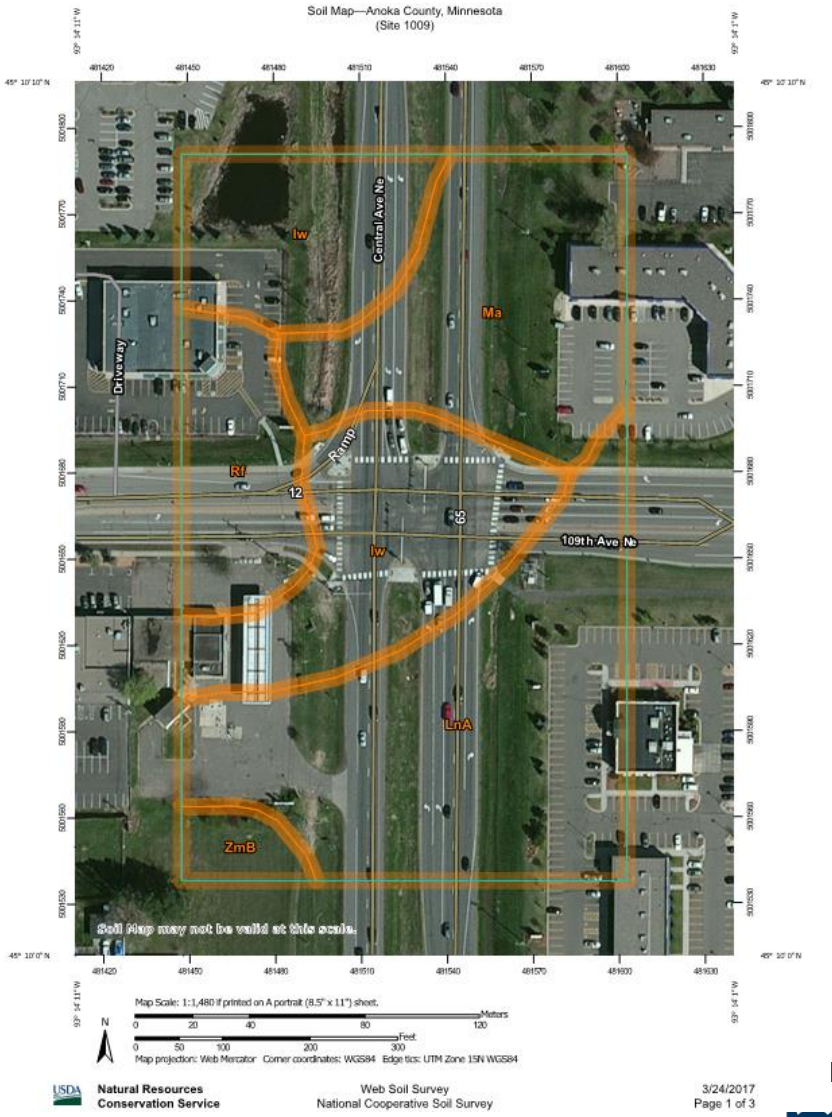
- Updates to cost estimates
  - Overhead signage
  - Noise walls
  - Subsurface information
  - Impacts to drainage
- Qualitative
  - Construction duration (inconvenience to public)
  - Potential detours (vehicle and ped traffic)

Subsurface Assessment

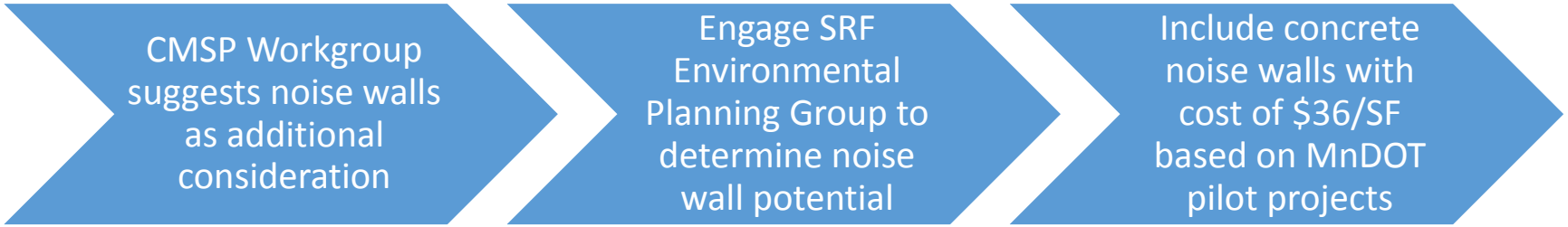


Subsurface Assessment

- Summary of 50 Braun Soil Risk Assessments
  - 42 LOW
  - 1 LOW/MED
  - 5 MED
  - 1 HIGH/LOW
  - 1 HIGH



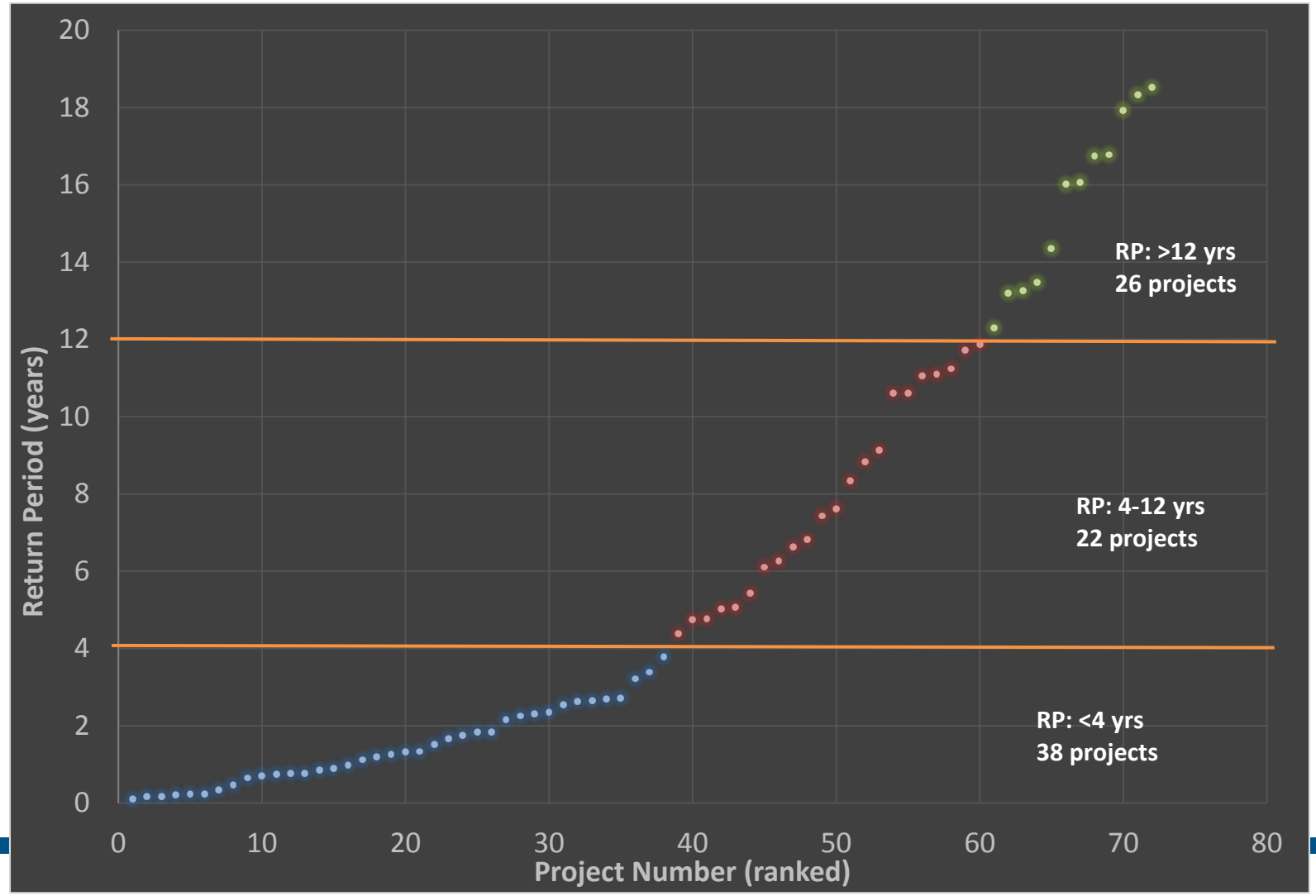
Noise Wall Assessment



Summary

- 26 solutions with potential for noise wall construction
- Average cost addition of $2.4M

Project Return Period Rankings



- Return period – years until return in investment is realized (user cost savings equates to project cost)

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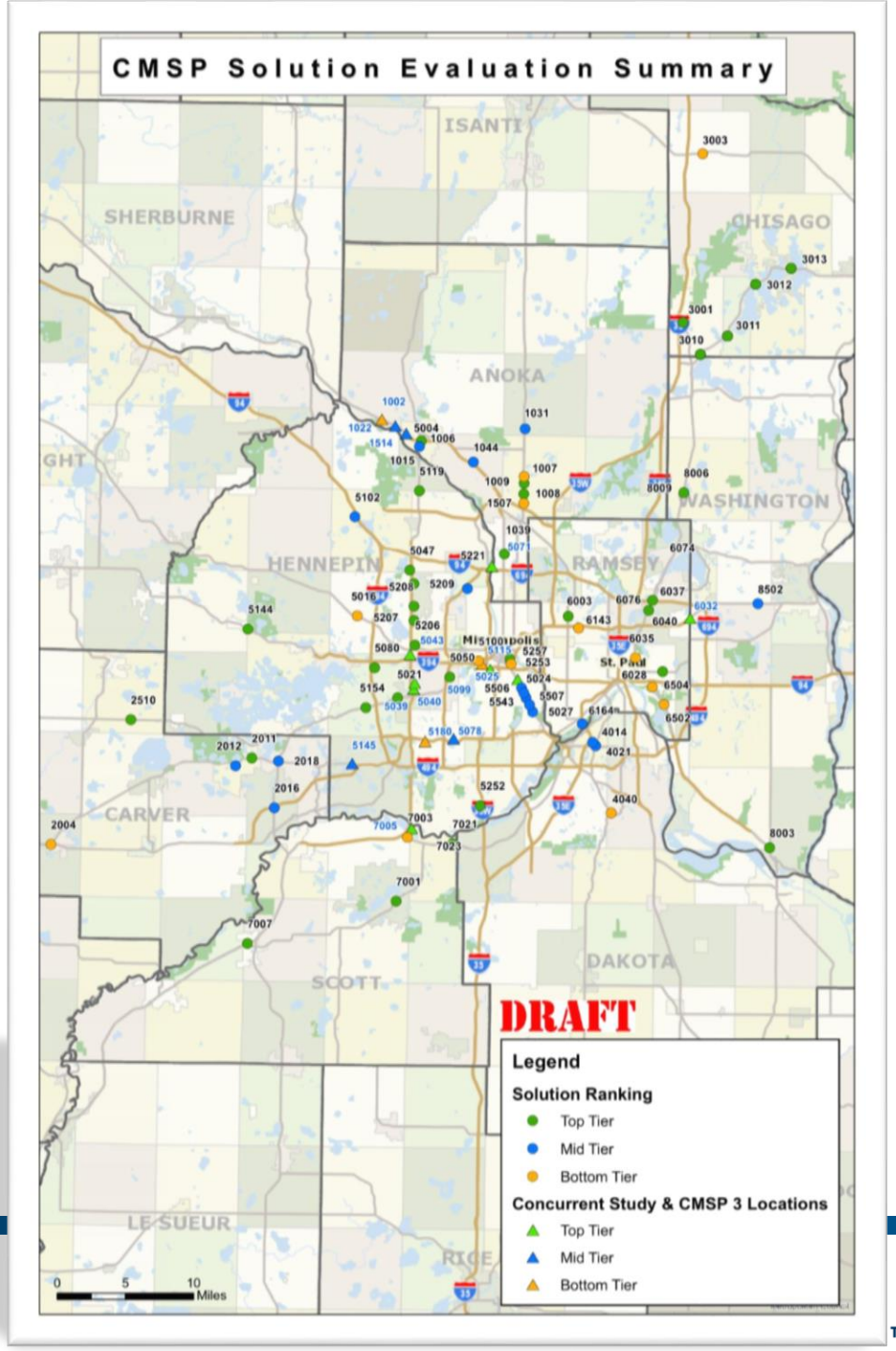
CMSP Opportunities

- Additional efforts:
  - Coordination with recently completed and ongoing corridor studies
  - Coordination with other MnDOT funding programs
- Recommended spot mobility locations:
  - Locations with desirable return period
  - Carried forward to Transportation Policy Plan



Example Outcomes

Project 1039
TH 47 (University Ave) and Mississippi St

CMSP Design Charrette

Problem Location Solution Worksheet

Problem Number	1039
Description	TH 47 (University) + Mississippi St

Solutions Considered	Reason not selected
Extend SBL	
FYA on Cross St	
Pedestrian Enhancements (Shoulder Beef Up)	→ Snow Plow issues
SE Quad, maybe reconfigure NB Right	
Reconfigure Frontage in SE Quad	
↳ Cul-de-sac	
Peds are mostly from buses	

Selected Solution

Description:

Key Design Elements:

① Extend SBL + R

② FYA on Cross St

③ Reconfigure Frontage in SE Quad if Land Use Changes

Expected Traffic / Safety Improvements:

↳ Pedestrian Fatal Crash (2 years ago?)

" Serious within past four months

Cost Considerations:

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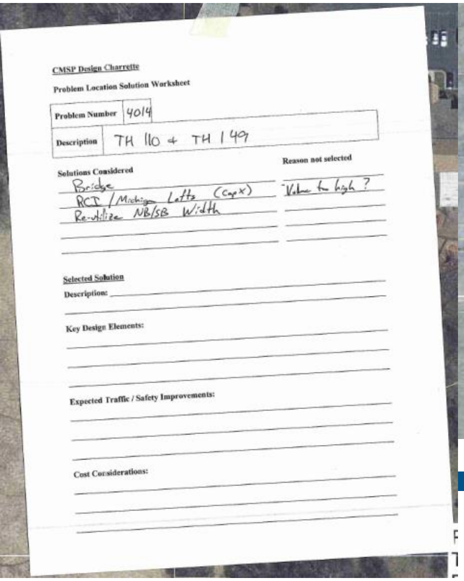
Project 4014
TH 110 and TH 149 (Dodd Rd)



CMSP Design Charrette

Problem Location Solution Worksheet

Problem Number	4014
Description	TH 110 + TH 149

Solutions Considered / **Reason not selected**

- Bridge
- RCI / Michigan Lefts (CapX) — Value too high ?
- Re-utilize NB/SB Width

Selected Solution

Description:

Key Design Elements:

Expected Traffic / Safety Improvements:

Cost Considerations:

DEPARTMENT OF TRANSPORTATION

SRF

Secondary Screening Summary

					Delay			Safety			Reliability			Total			
Solution ID	HWY	Location	Solution Description	Project Cost	Problem Magnitude	Effectiveness	Annual Cost Reduction (Benefit)	Problem Magnitude	Effectiveness	Annual Cost Reduction (Benefit)	Problem Magnitude	Effectiveness	Annual Cost Reduction (Benefit)	Problem Magnitude	Effectiveness	Annual Cost Reduction (Benefit)	Return Period (Years)
1039	TH47	Mississippi St	Extend SBL and SBR turn bays, FYA on minor approaches, consider removing frontage road in SE quadrant once City Hall moves	$220,000	$251,500	8%	$21,000	$315,700	10%	$31,000	$150,500	11%	$16,000	$717,700	9%	$68,000	3.2
4014A	TH110	TH 149	Partial Median U-Turn with three EBTs and WBTs at signal (use existing left-turn bays as decel lanes)	$1,010,000	$370,300	18%	$65,000	$349,100	10%	$36,000	$149,700	23%	$35,000	$869,100	16%	$136,000	7.4
4014B			Displaced left-turns on minor approaches	$2,100,000	$370,300	28%	$105,000	$349,100	16%	$57,000	$149,700	17%	$26,000	$869,100	22%	$188,000	11.2

Thank you!