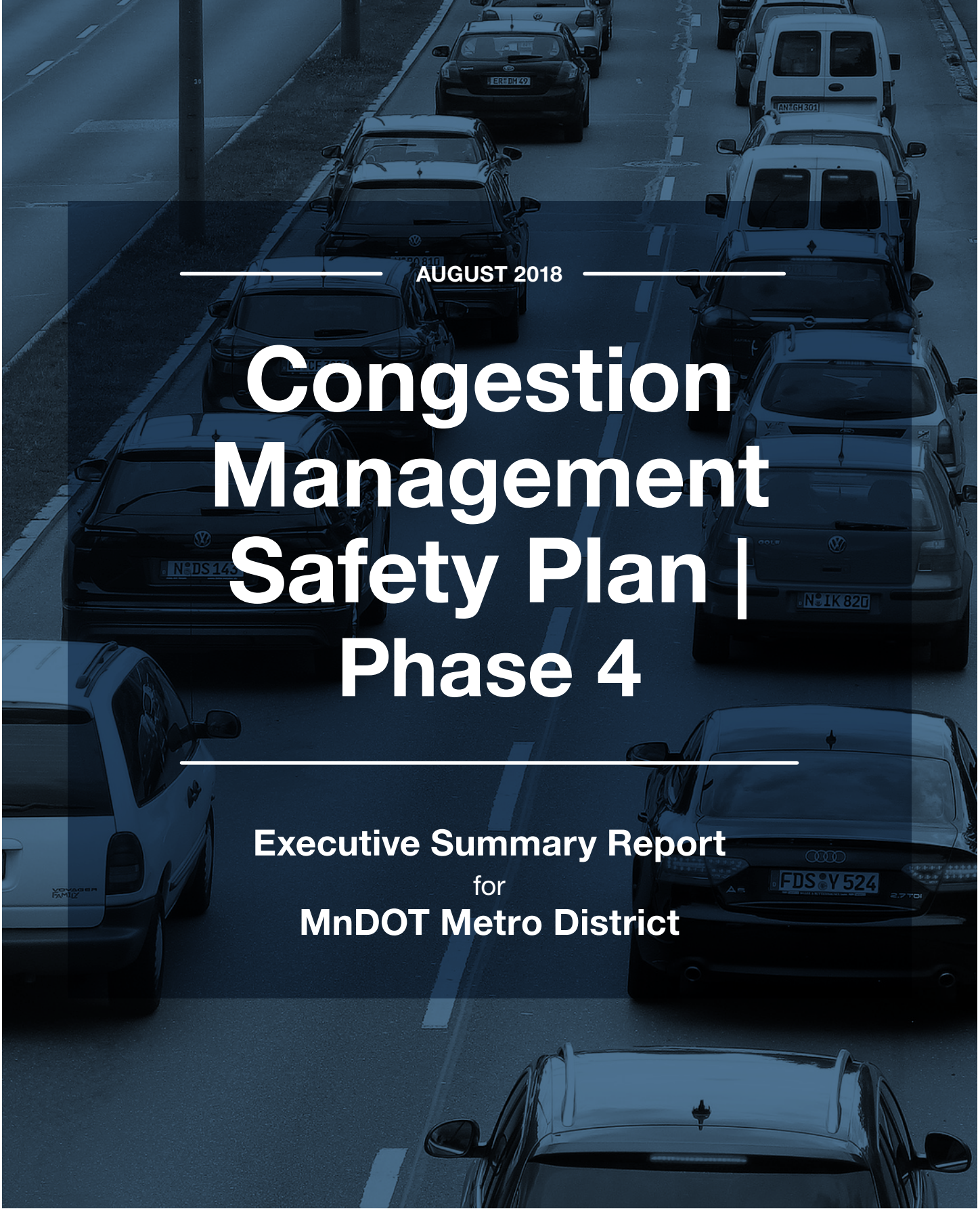

AUGUST 2018

Congestion Management Safety Plan | Phase 4

Executive Summary Report

for

MnDOT Metro District

Prepared by:
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DEPARTMENT OF TRANSPORTATION

BACKGROUND

The Congestion Management Safety Plan is a funding program that seeks to implement low-cost, high-benefit improvements to address congestion and safety problems on state highways within the Minnesota Department of Transportation's Metro District. During the multiphase CMSP process, researchers gather data to identify problem locations and potential solutions to address issues at the locations. The solutions are aimed at maximizing the return on investment — benefits for highway users. Solutions are intended to address specific problems under existing conditions, and while they are not always intended to be 100 percent effective, they should make conditions noticeably better than they are today. Solutions also are typically lower in cost and smaller in scope than traditional highway investments, which is intended to allow them to be delivered more efficiently.

The CMSP process consists of four phases.

Phase 1

The CMSP study team completed the first phase — titled Congestion Management Planning Study — in 2007. They identified 186 potential highway improvements on Metro District highways, and from those, recommended 19 of the most promising solutions as demonstration projects. Thirteen of the solutions have been implemented since that time.

Phase 2

The second phase of CMSP, which took place in 2009-10, addressed several policy considerations for adoption of the low-cost, high-benefit investment approach for the region. The study team conducted workshops to facilitate instruction and dialogue on flexible design and managed corridors, and better define the range of solutions for the investment approach. In addition, the study team developed the system problem statement as part of this study to identify and characterize congestion and safety issues on the metro highway system. The system problem statement factored in information from the MnDOT Regional Transportation Management Center's Annual Congestion Report to identify locations with recurring congestion on the freeway system. They then characterized each location by a description of the problem's underlying causes such as entering traffic, lane drop or weaving.

Phase 3

The third phase began with an extensive outreach effort in which the study team met with county and city representatives to confirm highway problem locations and gather feedback on the CMSP process. This phase then built on these results to screen the locations in the system problem statement and identify the most pressing issues. The study team developed low-cost, high-benefit improvement concepts for these locations during design workshops and estimated their costs, benefits and effectiveness. They then used those factors to develop a return period — or anticipated length of time for the benefits to equal the cost — to prioritize the strongest solutions. From a list of 53 opportunities, several Phase 3 projects also have been constructed. In addition, 25 of these project opportunities are in the process of further design and study, and 11 are programmed for construction during the next four years.

Phase 4

The fourth and current phase of CMSP repeats many of the key activities undertaken in Phases 2 and 3 by updating the system problem statement and developing a new list of opportunities that reflect changes to the Metro District highway system in recent years. Travel time reliability also has been added as an additional performance measure as part of the system problem statement. Reliability describes the variability in travel time experienced by highway users, due to factors such as weather, crashes and changes in demand.

BEFORE-AND-AFTER STUDIES

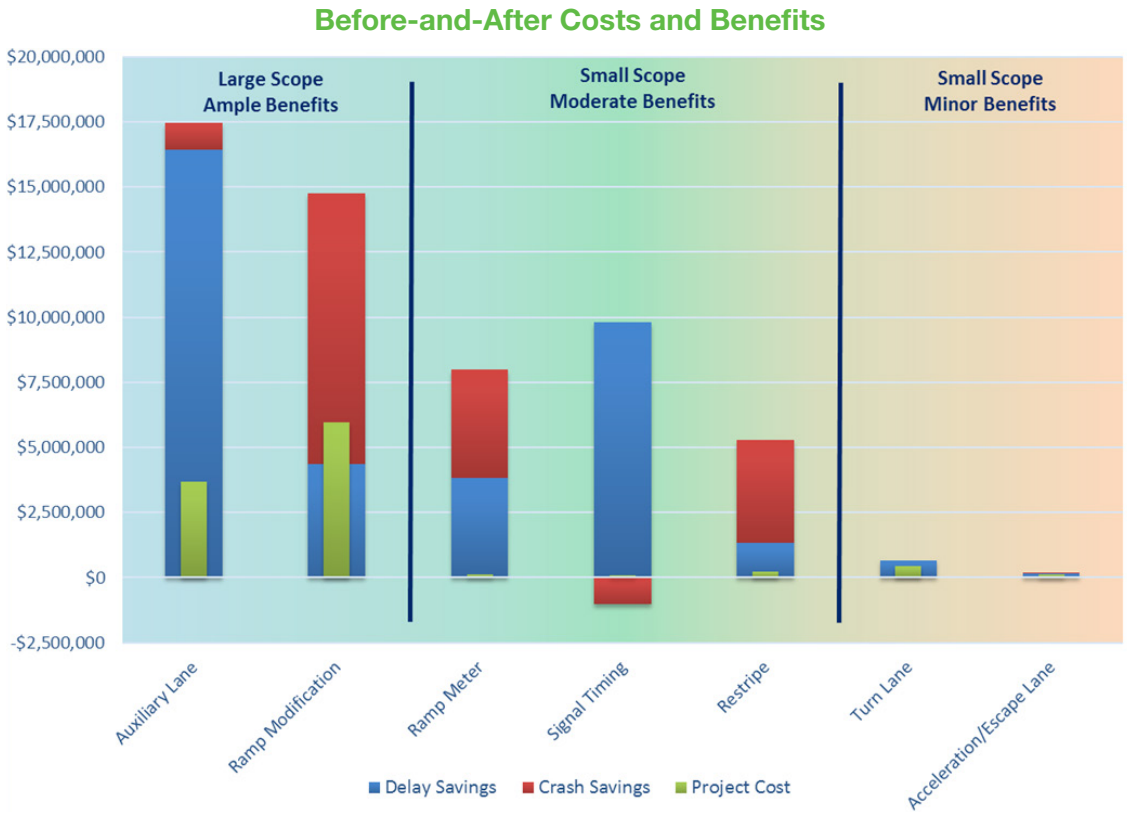
There have been two iterations of project opportunities since the CMSP was first introduced more than a decade ago. There is now a collection of solutions that have been implemented through the process. This allows practitioners to review the problem statement development process, analysis methodologies, concept development and screening criteria used in this process.

The study team conducted before-and-after studies with the intent of improving upon previous CMSP studies. The purpose of the before-and-after studies is threefold:

- Demonstrate that the CMSP process is able to identify problem locations, develop effective and low-cost solutions and implement high-benefit projects.
- Review previous methodology to identify accuracy of prediction methods for congestion and safety benefits, and project costs. The study team used findings to modify and improve the process for CMSP Phase 4 project identification and screening.
- Identify project types — auxiliary lanes, traffic management and restriping — that are more or less effective than expected and compare relative effectiveness to other project types.

The study team conducted before-and-after studies by reviewing project opportunity lists from previous phases and categorizing them as completed, programmed, under study, low priority or dropped. They then evaluated completed projects with before-and-after studies to capture the projects' impacts to congestion, reliability and safety performance on the affected highway segments.

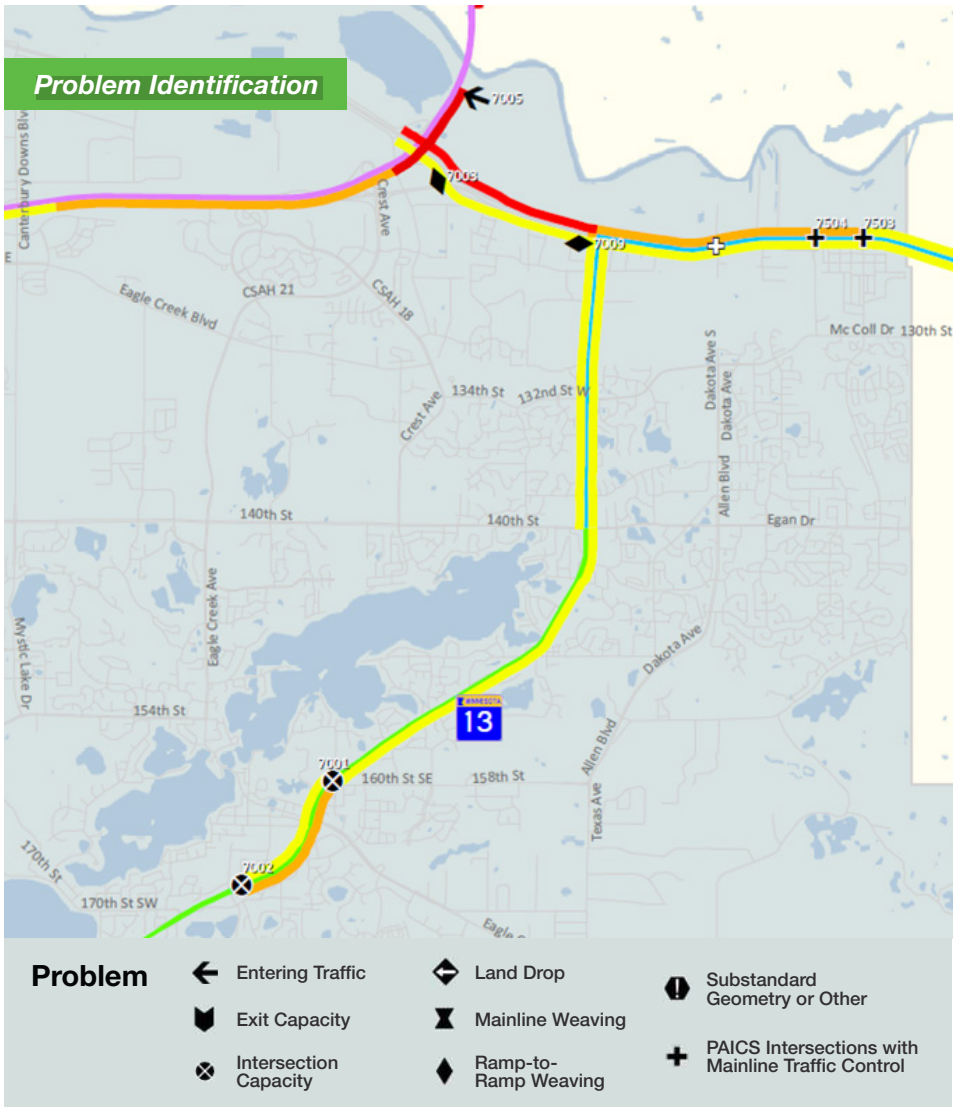
SOLUTION EFFECTIVENESS FINDINGS



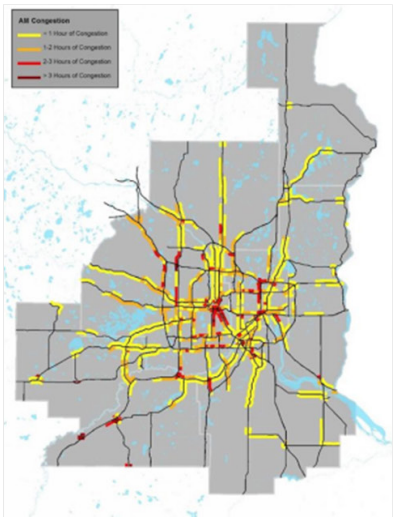
SYSTEM PROBLEM STATEMENT

The study team developed the system problem statement to provide an overview of the mobility and safety issues observed on MnDOT's Metro District highway system. The study area considered in the CMSP system problem statement includes all MnDOT-owned highways within the eight-county Metro District. In addition, segments of highways in nearby urbanized areas of Sherburne and Wright counties also have been included, as these fall within the Metropolitan Council's planning area. In all, this covers roughly 2,200 directional miles of highway in this analysis.

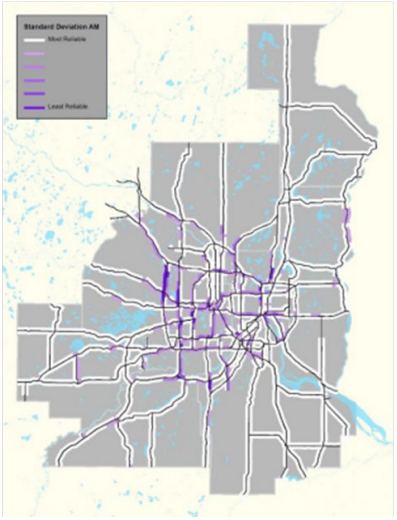
The study team combined congestion, reliability and safety problem statement data using GIS software, which allows it to be illustrated on maps and also facilitates technical analysis in subsequent steps. Finally, they characterized all of the observed safety and mobility problem locations using a variety of problem descriptions, and marked them for consideration as candidates for CMSP solutions.



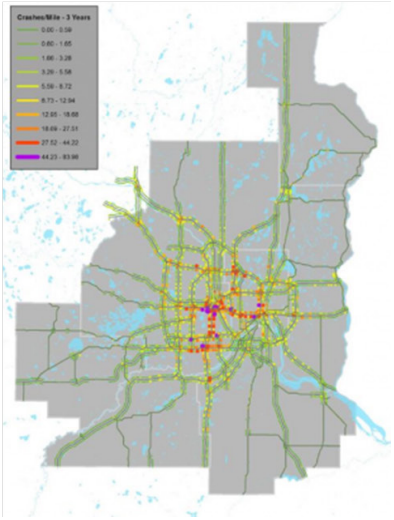
Recurring Congestion



Travel Time Reliability



Crash Density



PRIMARY SCREENING

The study team performed the primary screening process to identify the highest-cost problem locations for prioritization of solution development. They then monetized user costs for congestion, reliability and safety for each problem location in the study area. Finally, the study team screened the problem locations with the highest user costs for each road type to prioritize the locations for solution development in the eight-county Metro District.

The study team also monetized problem locations identified in the problem statement for Sherburne and Wright counties and compared them to the overall primary screening results. However, these locations will not be carried forward for solution development since they are outside of MnDOT's Metro District. As noted, CMSP is a funding program within the Metro District; since these highways are within MnDOT's District 3 area, they are ineligible for this funding. The problem statement and primary screening findings are intended to assist with District 3 planning processes.

Methods

The main objective of the primary screening process was to identify the highest priority problem locations for solution development.

Screening Components and Monetization

The study team identified 465 problem locations within the study area as part of the problem statement process. These are provided on the maps and lists in the CMSP system problem statement technical memorandum. Congestion, reliability and safety are the three components that contribute to the magnitude of each problem location. The study team assigned user costs for these three factors based on the influence area identified for the problem. Typically, the influence area is defined as the segment of highway extending upstream from the problem location to the extent of queue experiencing congestion.

Screening Procedure

The policy supporting CMSP envisions low-cost, high-benefit solutions that are diversified across the system. The CMSP 4 study implemented this vision by developing spot mobility improvements across the various road types that make up the Metro District highway system. The road types consist of *2 Lane Rural, 2 Lane Urban, 4+ Lane Urban, 4+ Lane Expressway, 4 Lane Freeway, and 6+ Lane Freeway*. The screening method to identify the priority problem locations used road type as one of the screening factors to ensure that solutions would be developed throughout the system. As a result, the study did not recommend solutions for all the largest problems system-wide, but rather prioritized the largest problems located on each road type across the system.

Summary of Screening Results

The study team screened the system problem statement inventory to 68 priority problem locations for development of low-cost, high-benefit solutions at design workshops. Furthermore, 36 problem locations located in the study area of previous and ongoing studies also passed the screening process, resulting in a total of 104 opportunities to be included (or carried) forward into the Metropolitan Council's *Transportation Policy Plan* opportunity list.

Summary of Screening Results

Road Type	Number of Locations
6+ Lane Freeway	7
4 Lane Freeway	10
4+ Lane Expressway	15
4+ Lane Urban	15
2 Lane Urban	3
2 Lane Rural	18
Total	**68**
Previous & Ongoing Studies	**Number of Locations**
I-494/Hwy 62	15
Hwy 169	6
Hwy 10	3
CMSP 3 Opportunities	7
I-94	5
Total	**36**
MnDOT District 3	**Number of Locations**
Wright & Sherburne counties	3
Total	**3**

GEOGRAPHIC/PROBLEM TYPE DISTRIBUTION

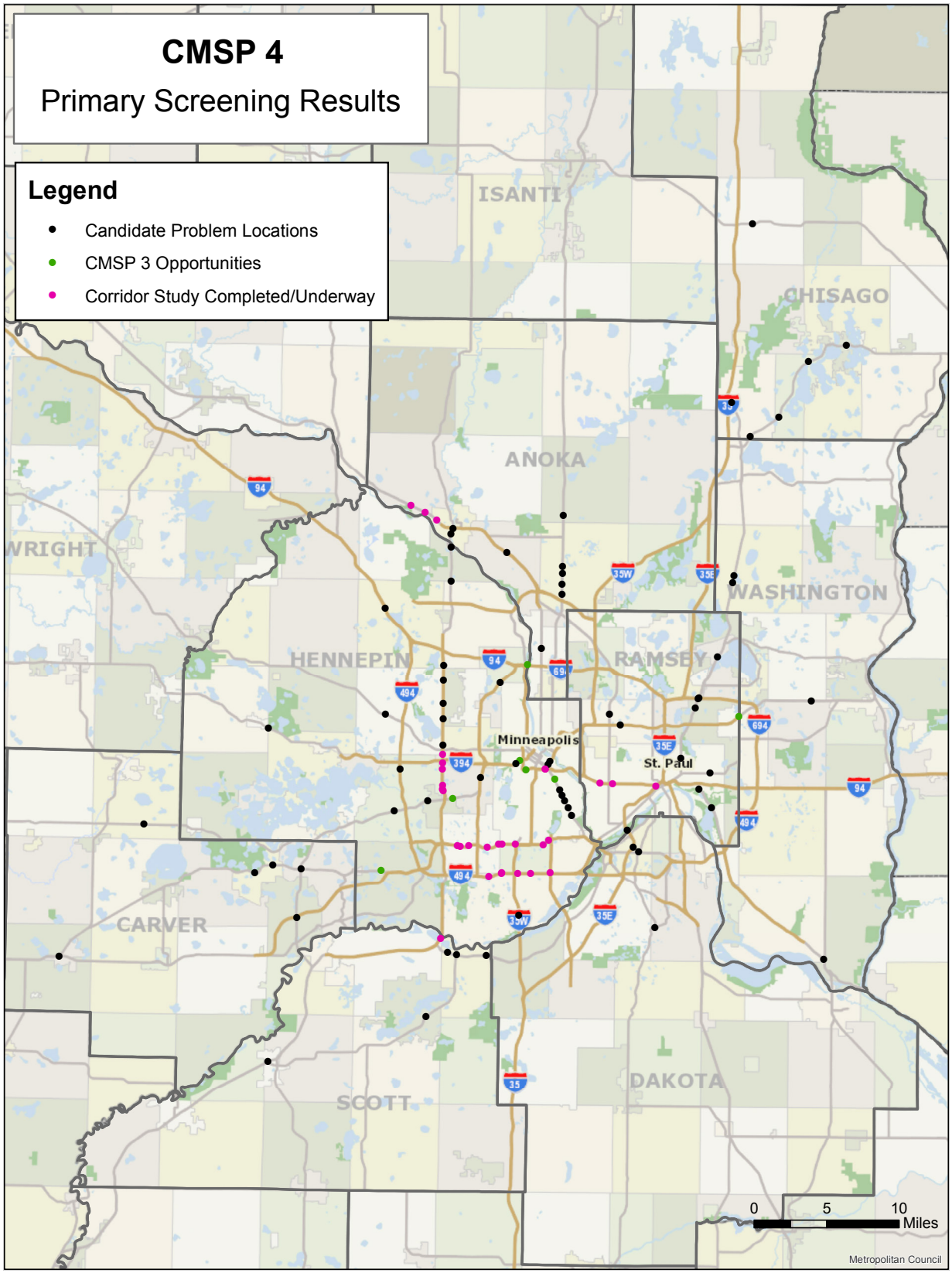
Primary Screening Results

- 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**

GEOGRAPHIC/PROBLEM TYPE DISTRIBUTION

Primary Screening Map:



DESIGN WORKSHOPS

The study team held a series of design workshops in December 2016 to develop potential solutions aimed at alleviating the traffic issues identified through the problem statement.

A collaboration of team members and a panel of technical experts conducted the workshops. The technical panel developed one or two solutions at each problem location to undergo a cost-effectiveness evaluation.

By The Numbers

4 DESIGN WORKSHOP EVENTS

33 PARTICIPANTS

15 HOURS OF DESIGN, ESTIMATING AND EVALUATION

101 SOLUTIONS DEVELOPED

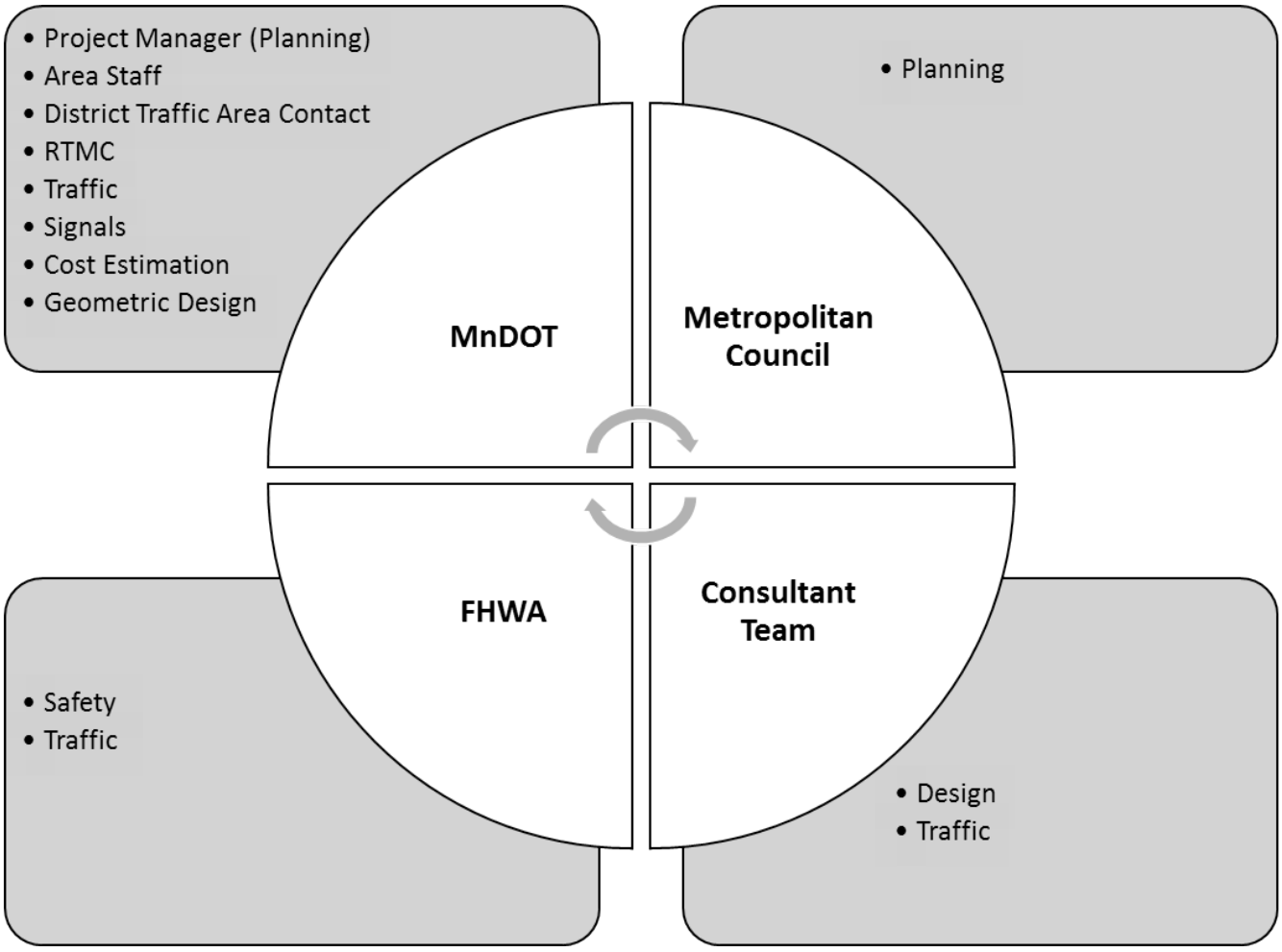
68 LOCATIONS REVIEWED

Cost of Solutions

$17,610,000
MOST EXPENSIVE SOLUTION

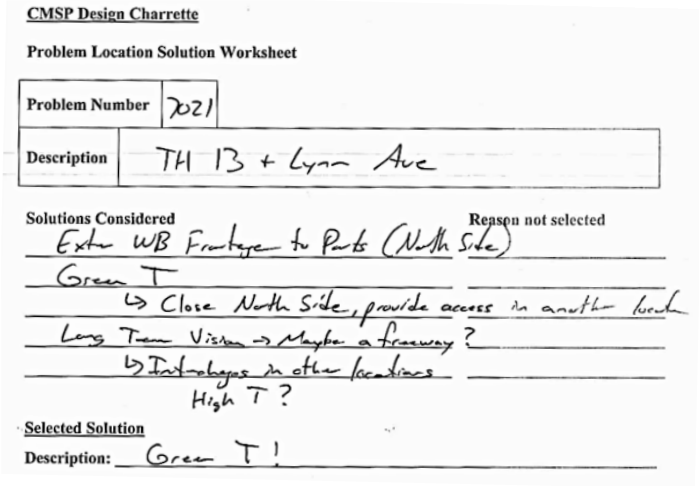
$10,000
LEAST EXPENSIVE SOLUTION

Design Workshops Functional Groups



Concept Sketch

After the technical panel proposed solutions for each location, they sketched the concepts onto an aerial image. This process provided a high-level assessment of right-of-way impacts and design needs before the solutions received a more detailed cost estimate and project impact evaluation.



CMSP Design Charrette

Problem Location Solution Worksheet

Problem Number	7021
Description	TH 13 + Lynn Ave

Solutions Considered — Reason not selected

Extra WB Frontage to Parks (North Side)

Green T

↳ Close North Side, provide access in another location

Long Term Vision → Maybe a freeway ?

↳ Interchanges in other locations

High T ?

Selected Solution

Description: Green T !

Number of Solutions by Area and Project Type

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***

**Two or more solutions were developed for several locations, so the total number of solutions is greater than the problem locations considered.*

SECONDARY SCREENING

The study team completed the secondary screening process to generate a planning-level cost effectiveness evaluation of solutions developed during the design workshops. The team primarily used highway user savings associated with vehicle delay, travel time reliability and crash costs to determine project benefits. They then developed solution-cost estimates to provide an understanding of the capital costs required to implement the solutions. The team used these together to estimate each solution's return on investment.

Traffic Evaluation

One of the team's primary objectives of the cost effectiveness evaluation was to determine the impact each solution had on the existing problem magnitude. They performed individual analyses for travel delay, safety and travel time reliability to determine the expected user benefit of each project. The following information summarizes the completed effort to determine each element of project benefit.

Delay

The study team derived existing annual delay costs at each problem location using MnDOT loop detector information and INRIX GPS speed data. To assess the vehicle delay reduction of each solution, they compared existing traffic conditions to traffic conditions under the assumed build configuration. The team then selected the methods involved in performing the traffic analysis based on the problem and facility types. Finally, they factored the resulting delay reduction from the traffic analysis into the existing delay cost to produce expected user benefits associated with travel delay.

Safety

The study team computed the existing safety problem magnitude from using crash data from July 2012 to June 2015. They monetized crashes in accordance with their severity based on recommended values from the MnDOT Office of Transportation System Management. The team then modified frequencies based on an aggregation of the geometric modifications and delay reduction of each solution to determine safety benefits.

Reliability

Travel time reliability savings was the final component in determining project benefits. The original user reliability cost derived from the deviation of average travel times during peak periods. Since both a decrease in crashes and an increase in facility capacity are expected to produce more reliable travel times, the study team factored results from the delay and safety evaluations into the reliability analysis. For the reliability savings assessment, the study team used the reliability module from SHRP2's C11: *Tools for Assessing Wider Economic Benefits of Transportation*, which incorporates crash frequency and capacity elements. They then assessed scenarios for existing and proposed build conditions to determine the reduction in nonrecurring delay. Finally, the team applied the observed reduction to the existing reliability user cost to determine travel time reliability savings.

Cost Estimate Development

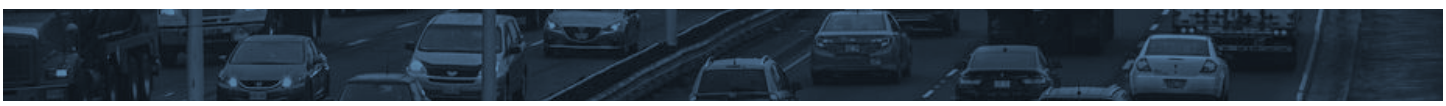
Along with project benefits, cost estimates also were necessary to estimate potential return on investment. The project cost development process was comprised of traditional estimation methods as well as an attempt to monetize several project risks and factors that are typically considered "unknowns." Primary elements that initiated the cost estimation process included:

- Project drawings
- Quantity calculations
- Unit cost factors
- Mobilization
- Traffic control
- Contractor markup

In addition to itemized unit costs and other flat-rate construction items, the study team placed detail on costs that would pivot off project type, size and location.

These elements included, but were not limited to:

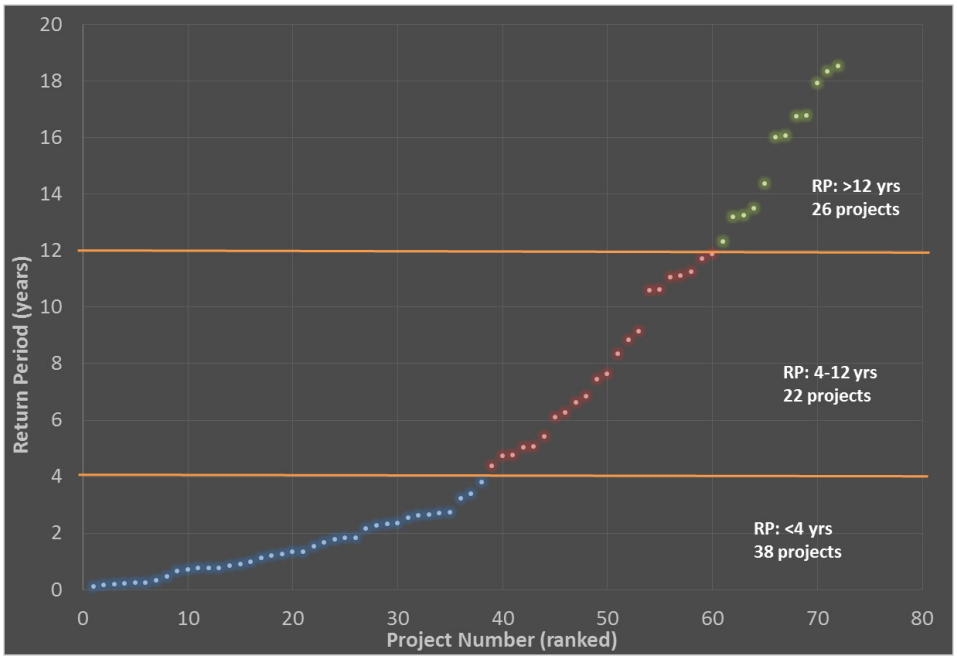
- Soil conditions
- Noise walls
- Construction duration
- Design delivery
- Overhead signage
- Impacts to drainage



RETURN PERIOD

Recommended Spot Mobility Location List

CMSP Study Locations	Priority locations identified through CMSP 4
Corridor Study Locations	I-494/Hwy 62 Hwy 169 Hwy 10 CMSP 3
Spot Mobility Locations	Combination of CMSP study locations and corridor study locations with desirable return periods

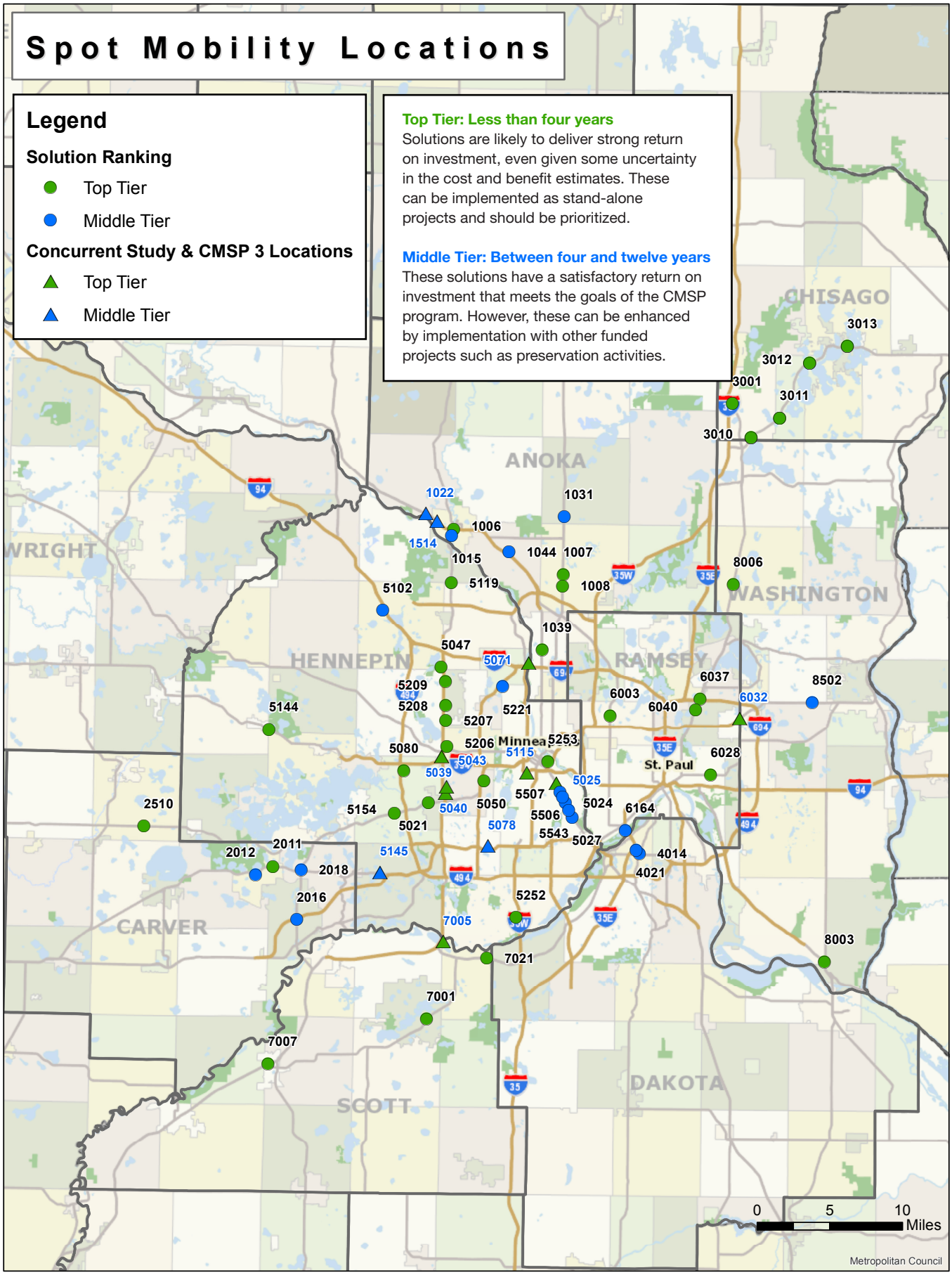


CONCLUSION

The Congestion Management Safety Plan used a data-driven process to develop low-cost, high-benefit solution opportunities for the Metro District highway system. The study team formalized recommended spot mobility solutions from this study — return periods less than ten years — and other project development sources into MnDOT's project scoping process, where projects undergo more scrutinized evaluation. This scoping process provides greater detail on the realistic effort, costs and regional impacts associated with pursuing specific projects. With these details, the Metro Program Committee will identify the strongest contenders for inclusion in the five-year *Transportation Improvement Program*.

Ultimately, the CMSP effort provides MnDOT with an important resource for planning investments that will reduce congestion and crashes, and improve travel time reliability. MnDOT planners and engineers will continuously reference the findings summarized in this report as highway improvement projects are developed and programmed.

Spot Mobility Locations Map



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