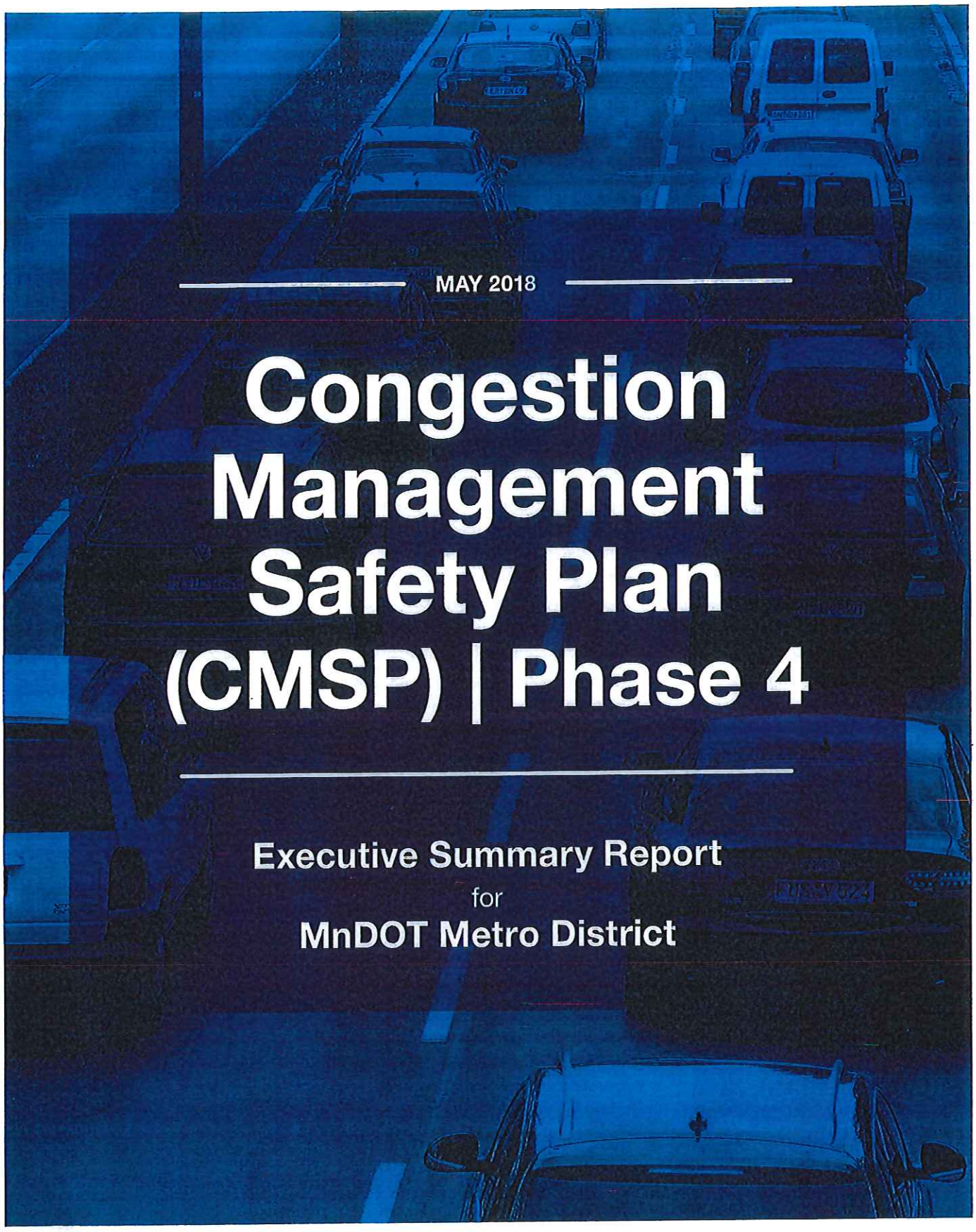


MAY 2018

Congestion Management Safety Plan (CMSP) | Phase 4

Executive Summary Report
for
MnDOT Metro District

SRF Consulting Group, Inc.

DEPARTMENT OF TRANSPORTATION

Sambatek

BACKGROUND

The Congestion Management Safety Plan (CMSP) is a funding program that seeks to implement lower-cost/high-benefit improvements to address congestion and safety problems on Minnesota Department of Transportation's (MnDOT) Metro District trunk highway system. Identification of problem locations and selection of solutions is completed using a data driven process to maximize the return on investment in terms of 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 are also typically lower-cost and smaller in scope than traditional highway investments, which is intended to allow them to be delivered more quickly and simply.

Several previous phases of CMSP have been undertaken over the past decade. The first phase, titled Congestion Management Planning Study, was completed in 2007 and identified 186 potential highway improvements on Metro District roadways. From these, 19 of the most promising solutions were recommended as demonstration projects, and 13 of these have been implemented since that time.

Phase 2 of the Congestion Management Safety Plan, undertaken in 2009-2010, addressed several policy considerations for adoption of the lower-cost/high-benefit investment approach for the region. Workshops were conducted to facilitate instruction and dialogue on flexible design and managed corridors, and to better define the range of solutions for the lower-cost, high-benefit approach. In addition, the System Problem Statement was developed as part of this study to identify and characterize congestion and safety issues on the Metro highway system. The System Problem Statement utilized the annual Congestion Report produced by MnDOT's Regional Transportation Management Center (RTMC) to identify locations with recurring congestion on the freeway system. Each location was then characterized by a description of the problem's underlying causes such as entering traffic, lane drop, or weaving.

CMSP Phase 3 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. Lower-cost/high-benefit improvement concepts were developed for these locations in design charrettes, and their costs, benefits, and effectiveness were estimated. These factors were used 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 have also been constructed. In addition, 25 of these project opportunities are in the process of further design and study, and 11 are programmed for construction over the next four years.

Phase 4, the 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 over recent years. Travel time reliability has also 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.

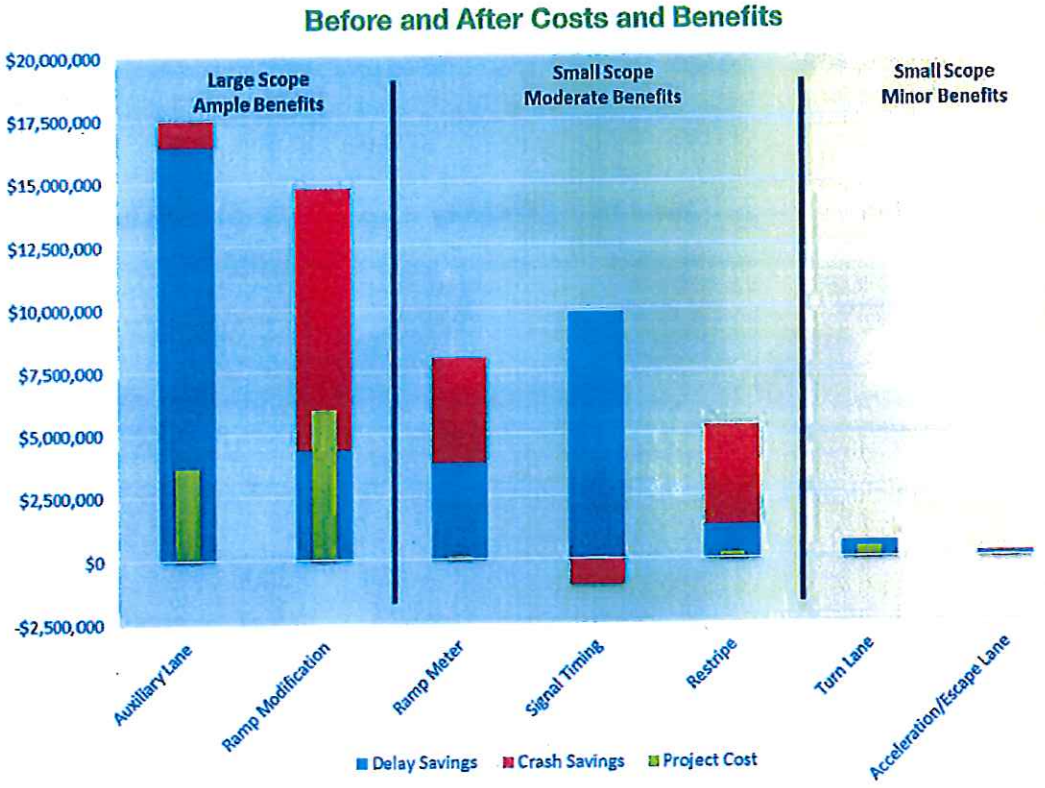
BEFORE AND AFTER STUDIES

With more than a decade since the CMSP program was introduced and two iterations of project opportunities 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. With the intent of improving upon previous CMSP studies, before and after studies were conducted. The purpose of the before and after studies is threefold:

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

To conduct before and after studies, the team reviewed project opportunity lists from previous phases and categorized them as completed, programmed, under study, low priority, or dropped. Projects that had been completed were evaluated with before and after studies to capture the projects' impacts to congestion, reliability, and safety performance on the affected highway segments.

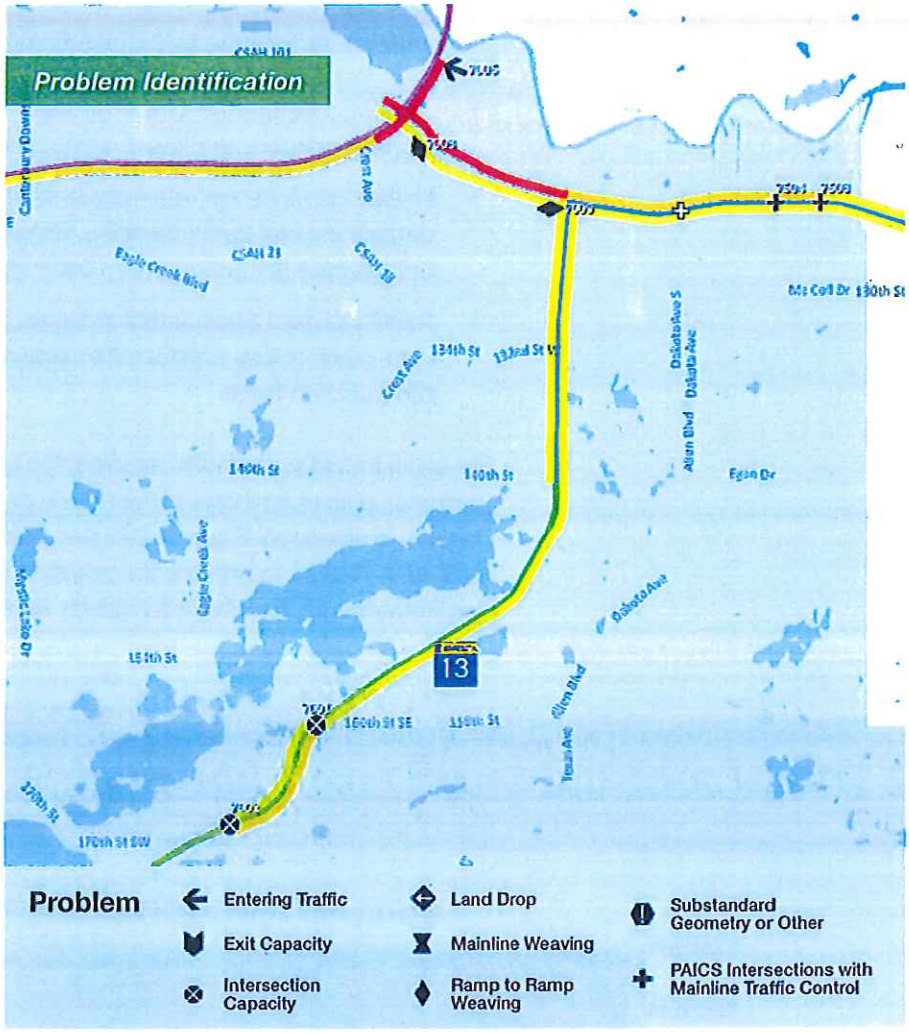
SOLUTION EFFECTIVENESS FINDINGS



SYSTEM PROBLEM STATEMENT

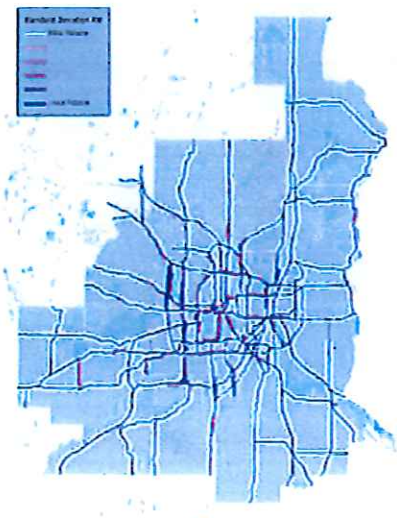
The System Problem Statement has been developed to provide an overview of the mobility and safety issues observed on MnDOT's Metro District trunk highway system. The study area considered in the CMSP system problem statement includes all MnDOT-owned trunk highways within the eight-county Metro District.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

Congestion, reliability, and safety problem statement data were combined using GIS software, which allows it to be illustrated on maps and also facilitates technical analysis in subsequent steps. Finally, all of the observed safety and mobility problem locations were characterized using a variety of problem descriptions, and were considered as candidates for CMSP solutions.

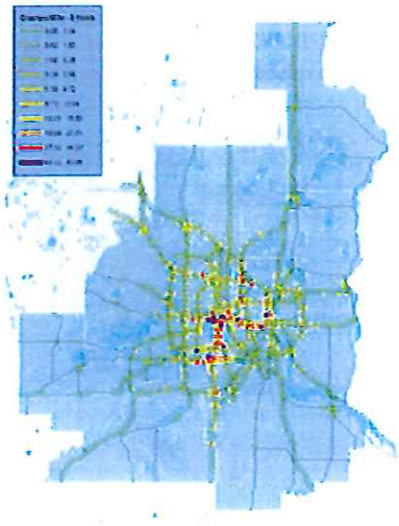


Recurring Congestion

Travel Time Reliability



Crash Density



PRIMARY SCREENING

The primary screening process was performed to identify the highest cost problem locations for prioritization of solution development. For primary screening, user costs for congestion, reliability, and safety were monetized for each problem location in the study area. The problem locations with the highest user costs for each roadway type were screened through this process to prioritize the locations for solution development in the Eight-County Metro District.

Problem locations in Sherburne County and Wright County considered in the system problem statement were also monetized and compared to overall primary screening results. However, these locations will not be carried forward for solution development since they are outside of the MnDOT metro system. As noted, CMSP is a funding program within MnDOT's Metro District; since these trunk 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

In the problem statement process, 465 problem locations were identified among the study area. 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 problem magnitude of each location. User costs for these three factors were assigned 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 lower-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 roadway types that make up the Metropolitan trunk highway system. The roadway types consist of 2 Lane Rural, 2 Lane Urban, 4+ Lane Urban, 4+ Lane Expressway, 4 Lane Freeway, and 6+ Freeway. The screening method to identify the priority problem locations used roadway type as one of the screening factors to ensure that solutions would be developed throughout the system. As a result, the study didn't necessarily recommended solutions for all the largest problems system-wide, but rather prioritized the largest problems located on each roadway type across the system.

Summary of Screening Results

The System Problem Statement inventory was screened to 68 priority problem locations for development of lower-cost/high-benefit solutions at design charrettes. 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 (TPP)* opportunity list.

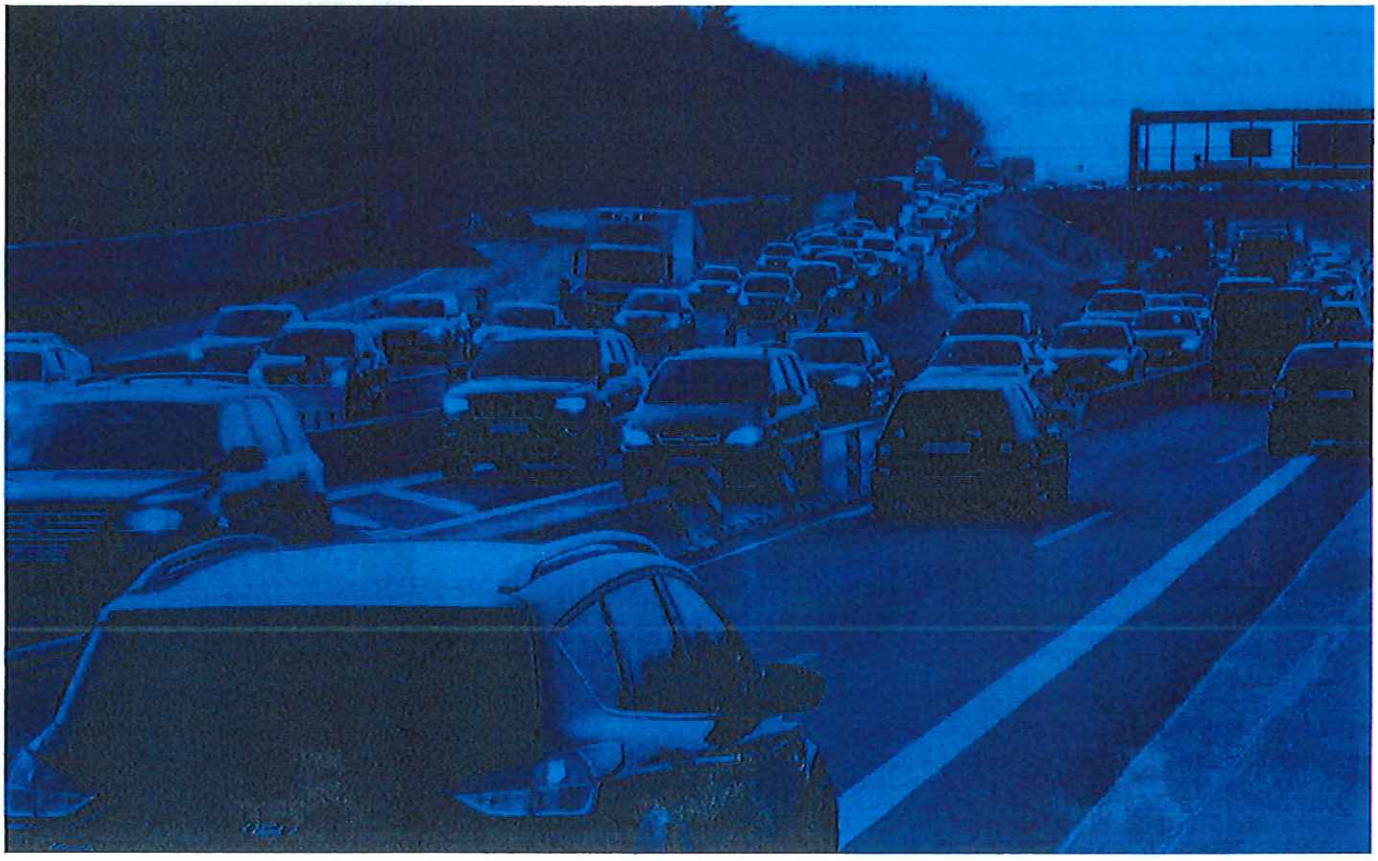
Summary of Screening Results	
6+ Lane Freeway	7
4 Lane Freeway	10
4+ Lane Expressway	15
4+ Lane Urban	15
2 Lane Urban	3
2 Lane Rural	18
	68 Locations
I-494/TH 62	15
TH 169	9
TH 10	3
CMSP 3 Opportunities	6
I-94	5
	38 Locations
Wright & Sherburne Counties	3
	3 Locations

GEOGRAPHIC/PROBLEM TYPE DISTRIBUTION

Primary Screening Results

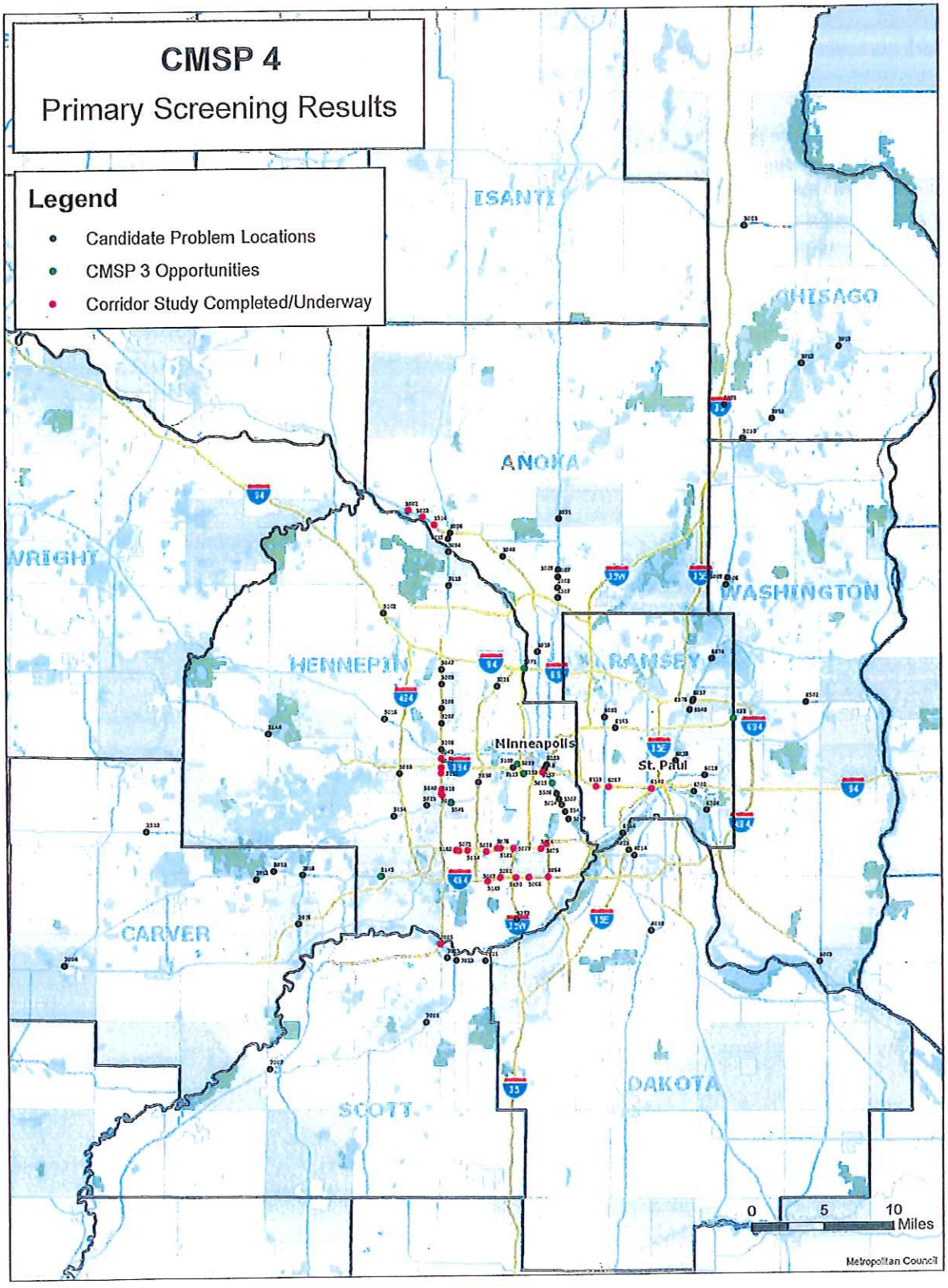
- Total problem magnitude: $128,178,500 (68 locations)
- Total problem magnitude by county:

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 CHARRETTES

A series of intensive Design Charrettes were held in December of 2016 to develop potential solutions to alleviate the traffic issues identified through the problem statement.

Through collaboration amongst the panel of technical experts, one or more solutions were developed at each problem location to undergo a cost-effectiveness evaluation.

By The Numbers

4 DESIGN CHARRETTE EVENTS

33 PARTICIPANTS

15 HOURS OF DESIGN, ESTIMATING AND EVALUATION

101 SOLUTIONS DEVELOPED

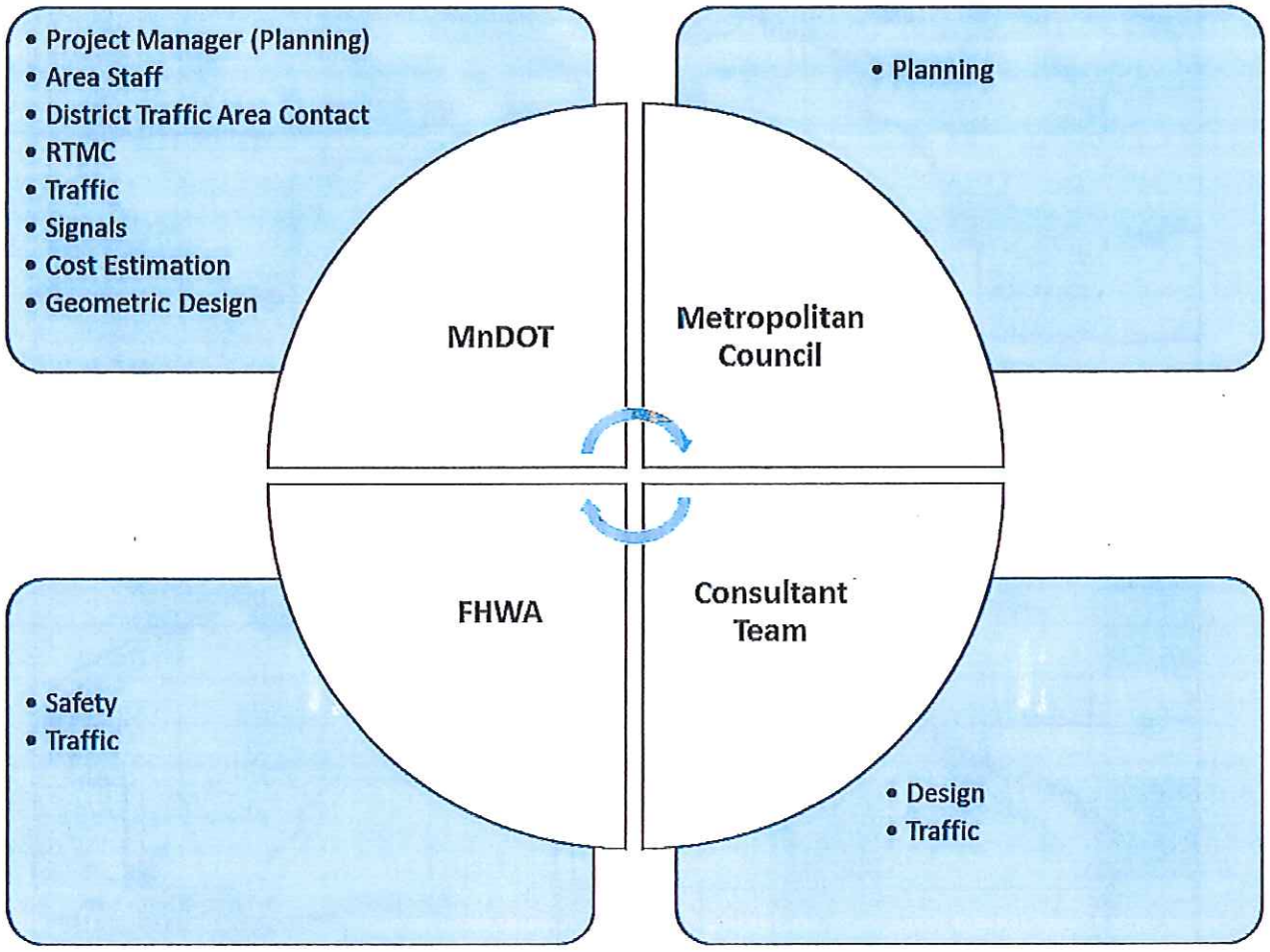
68 LOCATIONS WERE REVIEWED

Cost of Solutions

$17,610,000
MOST EXPENSIVE SOLUTION

$10,000
LEAST EXPENSIVE SOLUTION

Design Charrettes Functional Groups



Concept Sketch

After solutions were proposed at each location by the technical panel, the concepts were sketched 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 Park (North Side)

Green T

↳ Close North Side, provide access to another leg

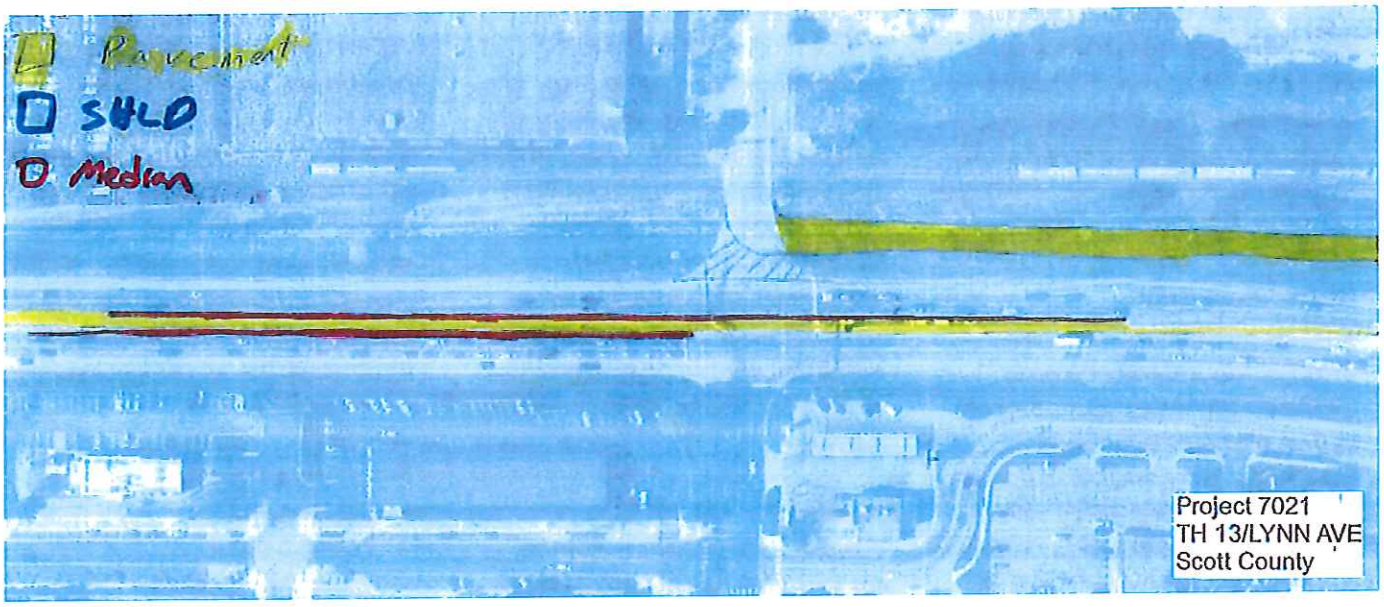
Long Term Vision → Maybe a Freeway?

↳ Interchange at 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 secondary screening process was completed to generate a planning-level cost effectiveness evaluation of solutions developed during the design charrettes. The primary elements that were used to determine project benefits were highway user savings associated with vehicle delay, travel time reliability, and crash costs. Solution cost estimates were developed to provide an understanding of the capital costs required to implement the solutions. Together these were used to estimate each solution's return on investment.

Traffic Evaluation

A primary objective of the cost effectiveness evaluation was to determine the impact each solution had on the existing problem magnitude. Individual analyses were performed for travel delay, safety, and travel time reliability to determine the expected user benefit of each project. The following information summarizes the effort that was completed to determine each element of project benefit.

Delay

Existing annual delay costs at each problem location were derived using MnDOT loop detector information and INRIX data. To assess the vehicle delay reduction of each solution, existing traffic conditions were compared to traffic conditions under the assumed build configuration. The methods involved in performing the traffic analysis were selected based on the problem and facility types.

The resulting delay reduction from the traffic analysis was factored into the existing delay cost to produce expected user benefit associated with travel delay.

Safety

The existing safety problem magnitude was computed from crash data for the three-year period from July 2012 to June 2015. Crashes were monetized in accordance with their severity based on recommended values from the MnDOT Office of Transportation System Management. Crash frequencies were modified based on an aggregation of the geometric modifications and delay reduction of each solution to determine safety benefit.

Reliability

Travel time reliability savings was the final component in determining overall project benefit. 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, results from the delay and safety evaluations were factored into the reliability analysis. The reliability module from SHRP2's C11: *Tools for Assessing Wider Economic Benefits of Transportation* incorporated crash frequency and capacity elements and was used for the reliability savings assessment. Scenarios were assessed for existing and proposed build conditions to determine the reduction in nonrecurring delay. The observed reduction was applied to the existing reliability user cost to determine travel time reliability savings.

Cost Estimate Development

Along with project benefits, cost estimates were also 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 mark-up

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

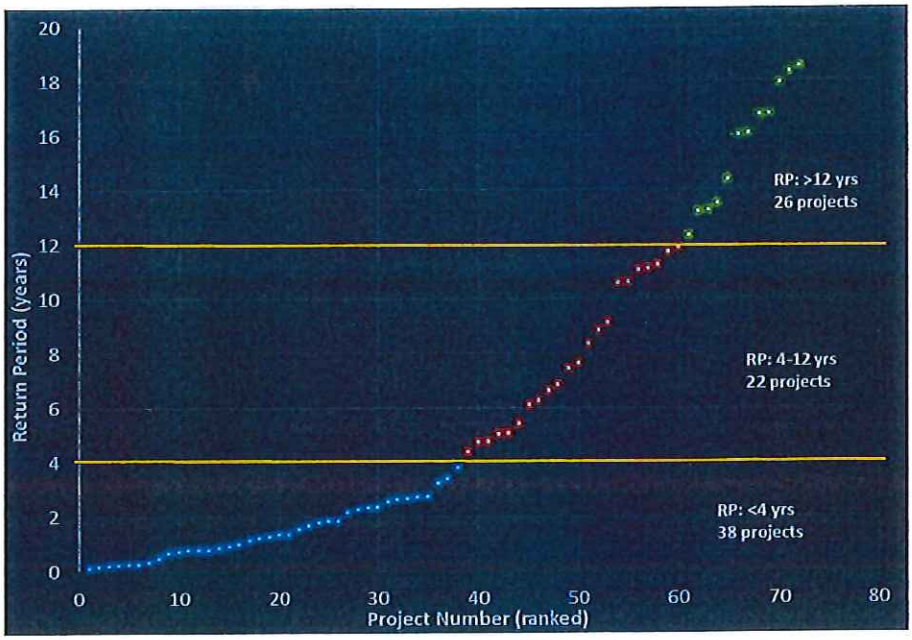
These elements included, but were not limited to:

- Subsurface assessment (soil conditions)
- Noise walls
- Construction duration
- Design delivery
- Overhead signage
- Impacts to drainage

RETURN PERIOD

Recommended Spot Mobility Location List

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

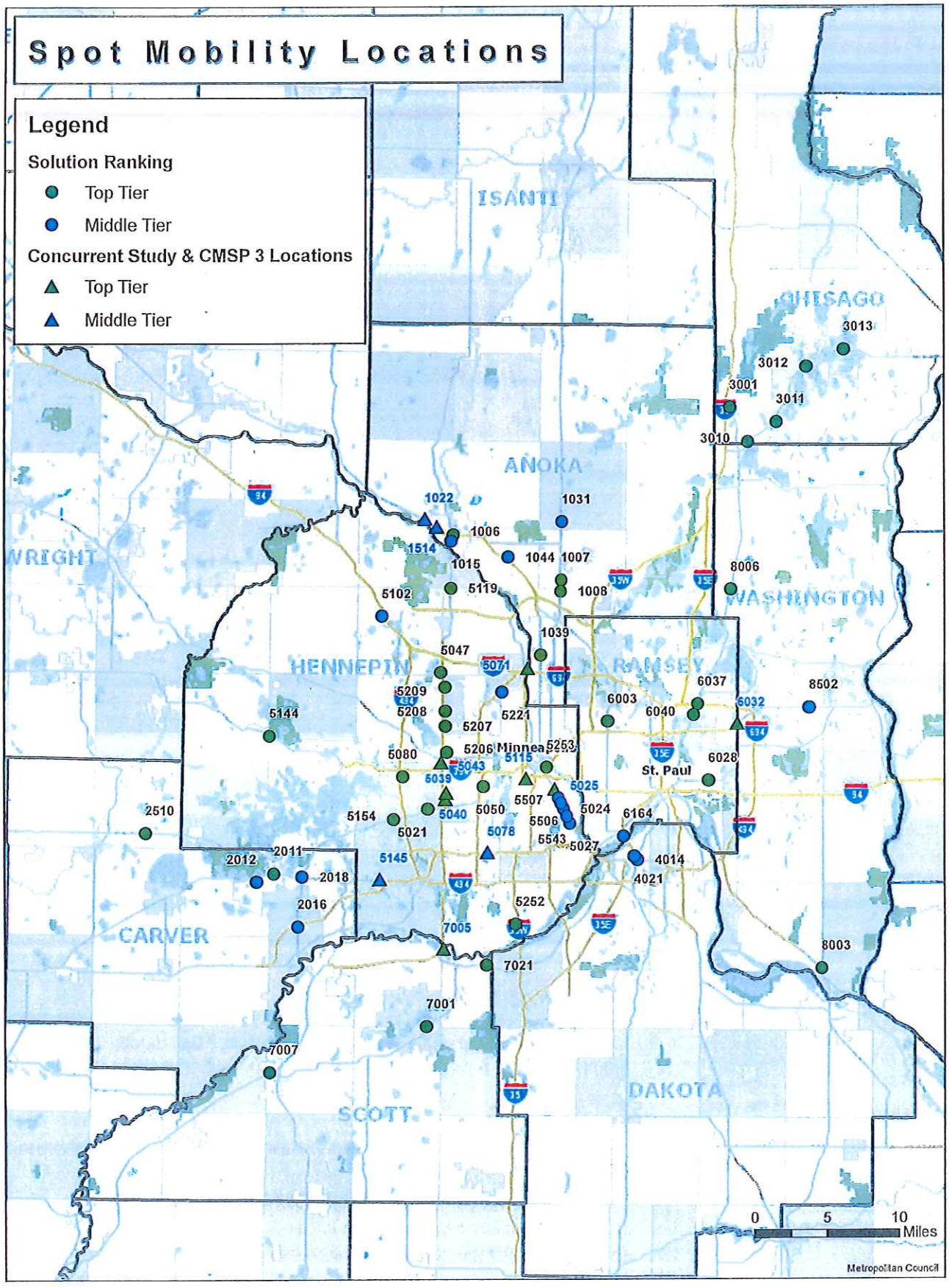


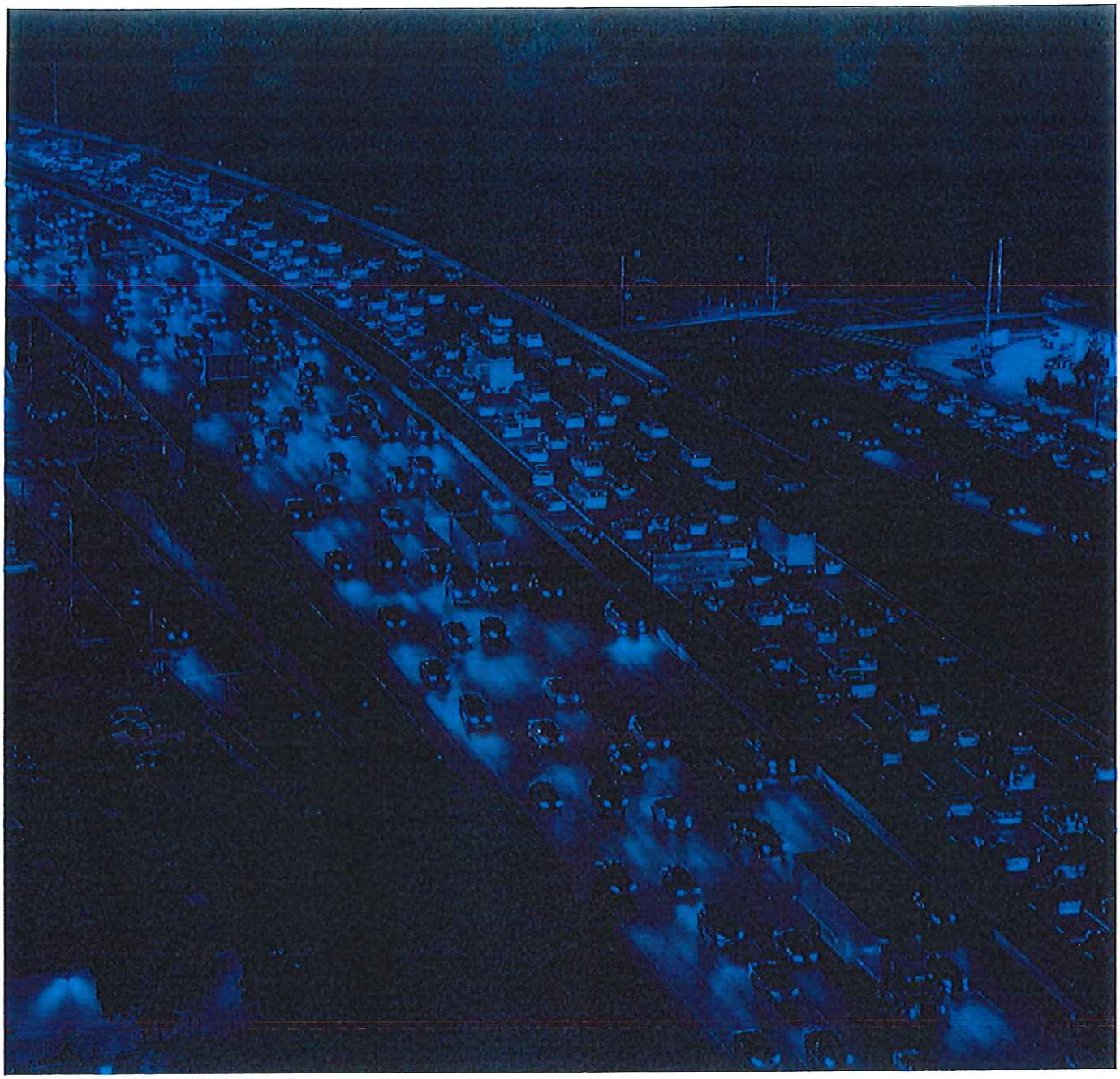
CONCLUSION

The Congestion Management Safety Plan used a data-driven process to develop lower-cost/high-benefit solution opportunities for the Metro highway system. Recommended spot mobility solutions from this study (return periods less than ten years) and other project development sources were formalized 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 (TIP)*.

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





For More Information Contact:

Michael Corbett
MnDOT Metro Division – Planning

Direct Phone
651-234-7793

Email
Michael.J.Corbett@state.mn.us