Intersection Mobility and Safety Study Report

May 2024

METROPOLITAN COUNCIL

DEPARTMENT OF TRANSPORTATION

Project Team

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Executive Summary

Principal arterial roadways in the Twin Cities Metro serve millions of drivers, transit users, and freight haulers every day. The Intersection Mobility and Safety Study identifies and prioritizes principal arterial intersection opportunities across the Twin Cities region in order to focus and best use transportation funds. This study built on the success of the initial iteration of the study, called the Principal Arterial Conversation Study, that Metropolitan Council and MnDOT conducted in 2017.

Key goals of the study are to identify principal arterial intersections that have regionally high needs and to provide local agency partners with project implementation strategies. Rather than determining solutions for each priority intersection identified, the study intends to provide agencies with details on intersection needs so that they can work with agency partners to develop projects that address those needs and coincide with their vision of the corridor or area.

To identify and prioritize at-grade intersections on principal arterials, the Metropolitan Council and MnDOT developed 'tiers' of high, medium, and low-need intersections. Regional tiers are based on mobility, safety, multimodal, and equity-based performance measures.

The factors for potential intersection prioritization and investment considered the degree of intersection needs as determined in the regional tiering analysis, an analysis of project readiness, and confirmation from local agency staff on their priorities and long-term visions.

Before and After Analysis

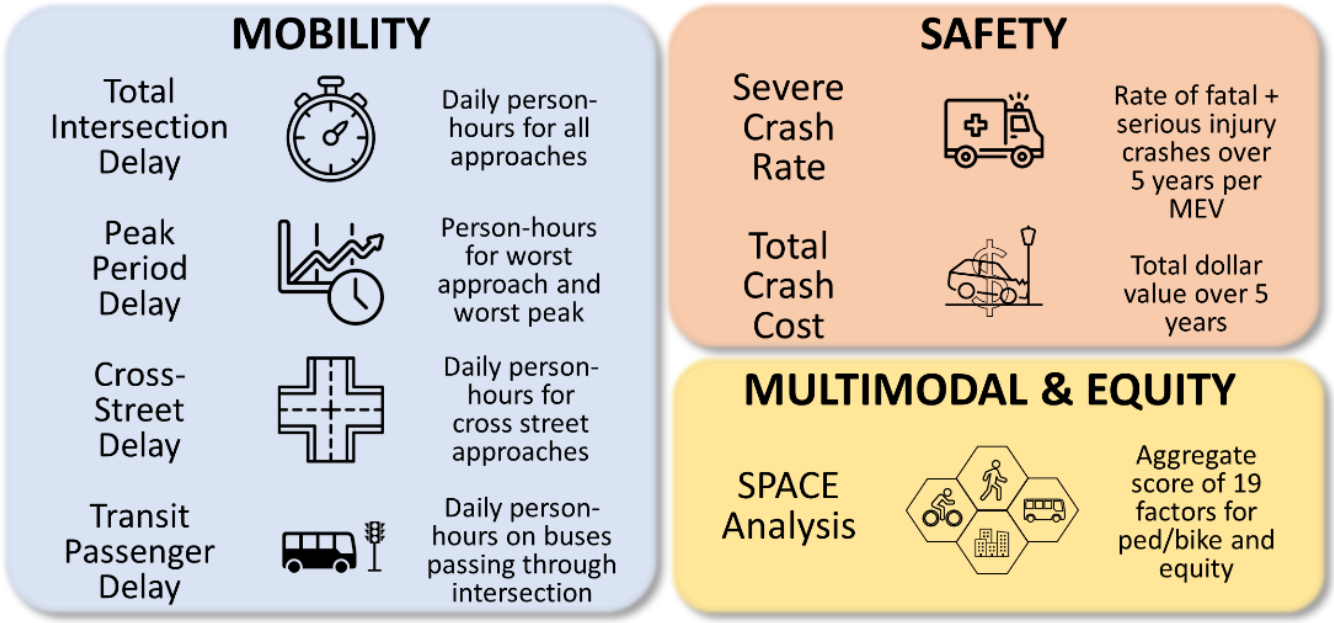
A before and after analysis was conducted to assess the impacts of four intersection improvement projects completed in the Twin Cities region over the last decade. Through review of project documentation and interviews with local agencies, the study identified lessons learned and valuable planning and implementation practices that can be applied to future projects.

Additionally, a quantitative review of the projects found that existing delay and safety issues were greatly improved with the at-grade intersection improvements and grade separated improvements resulting in annual delay and safety benefits of $1 million and $7 million, respectively. Findings observed at the study intersections demonstrate the effectiveness and return on investment that grade separation and strategic at-grade projects can have, particularly when targeted at high-need intersections.

Intersection Needs Assessment

The main goal of the needs assessment was to evaluate the performance of at-grade intersections in the Minneapolis-Saint Paul metro region (which includes the seven-county metro, plus the urbanized portions of Wright County and Sherburne County) with respect to their existing mobility, safety, multimodal, and equity needs. Figure 1 shows the seven performance measures within each of the mobility (vehicles and transit), safety, and multimodal/equity categories.

Figure 1. Intersection performance measure categories.



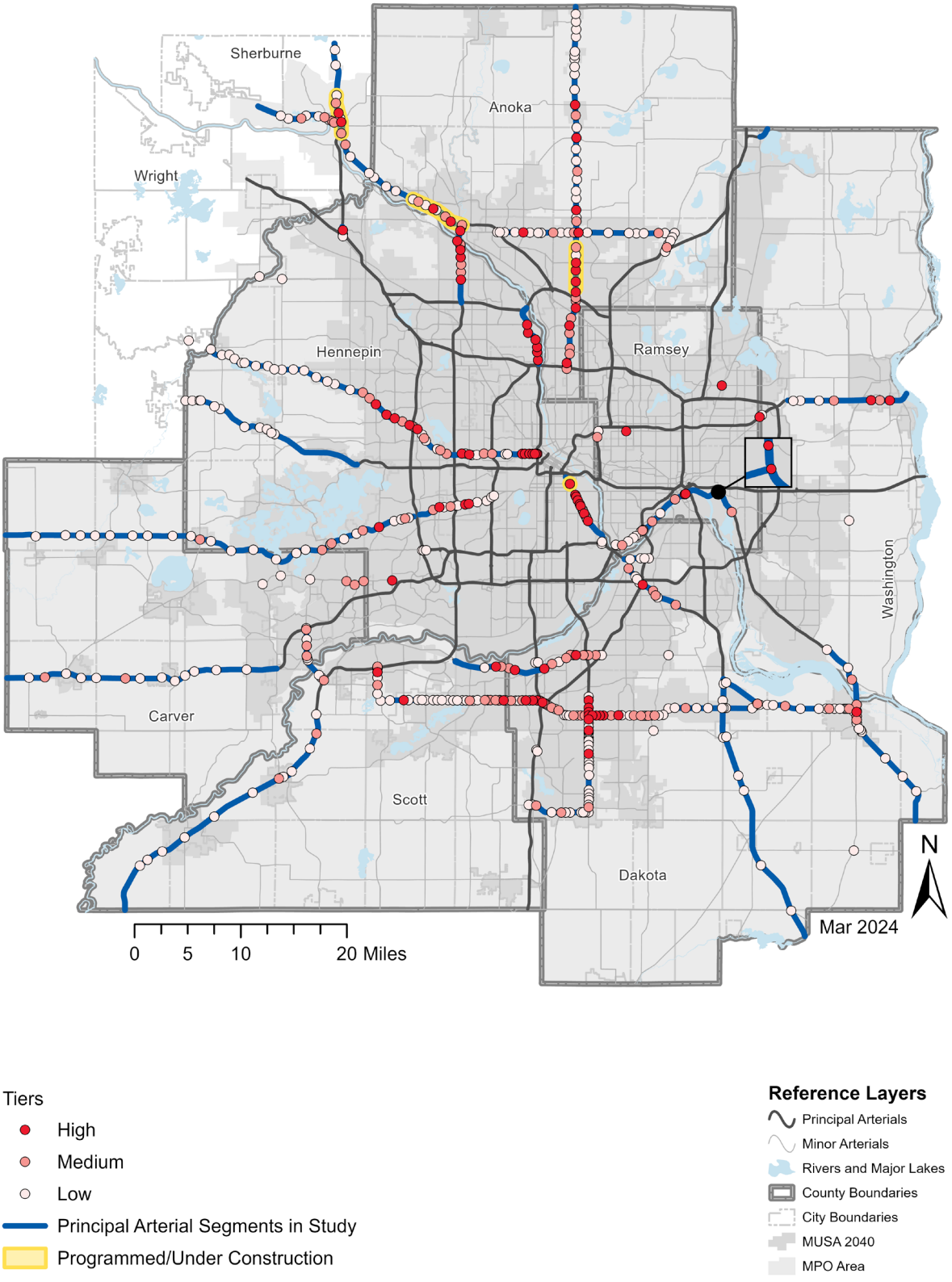
Tiering Analysis

The evaluation included 518 intersections, which incorporated existing principal arterial intersections and a small number of minor arterial intersections identified by counties and cities as local priorities. The main objective of the intersection tiering analysis was to sort intersections into high, medium, and low need tiers reflecting locations with the greatest regional needs across the performance categories.

The tiering analysis resulted in 89 intersections out of the 518 evaluated in the study to be designated in the high needs tier, followed by 117 intersections in the medium tier, and 312 intersections in the low tier. Figure 2 shows a map of intersections included in the study and the tier identified for each location.

After identifying intersection tiers, 16 corridor sections that have concentrations of high tier intersections were identified. Corridor sections are groups of intersections that are either adjacent or in close proximity to each other and include multiple high-need locations. Clusters of high need intersections suggest that some locations may be more suited for corridor-level improvements, while remaining, isolated high need locations are candidates for standalone projects.

Figure 2. Intersection tiering results.



Regional Priorities

The tiering analysis identified 89 intersections demonstrating high needs. At the time of this study, nine of these intersections had recently implemented projects, projects under construction, or fully funded projects. The remaining 80 intersections were considered high regional priorities for future investment.

The regional priority intersections were grouped based on their potential to be addressed in a single or interconnected project effort. Considerations in the groupings included the current study status of intersections and the need types and severities identified in the needs assessment and tiering analysis.

Finally, implementation plans were developed for regional priority locations. The implementation plans were intended to provide local agencies with a summary of study outcomes to assist with future project planning and decision-making. More specifically, the key objectives of the implementation plans were to outline the status and next steps in the project development process, identify the primary needs to be addressed by potential projects, compare the local visions with key needs, and determine potential funding opportunities. Study results have already been utilized by MnDOT to include in a successful Reconnection Communities federal planning grant for Highway 55 from Minneapolis to Medina.

Findings and Conclusions

- Findings from before-and-after studies demonstrate that these projects yield significant benefits and show high effectiveness in improving mobility and safety performance, as well as building out missing multimodal elements in the project areas and increasing ADA compliance.
- There are 89 intersections across the region that exhibit needs in the high tier, indicating that investments on the scale of grade separation may be justified ($22 million and over). Nine of these locations already have projects that are under construction or fully funded.
- There are an additional 117 locations in the medium tier where needs suggest substantial investment ($11 million to $22 million) could be cost effective.
- The remaining 312 locations in the low tier are candidates for at-grade projects, several warranting considerable attention and potential investment based on their degree of needs ($1 million to $11 million).
- The majority of high-need intersections are within corridors made up of several high-need locations.
    - Many of these have been studied or are advancing through project development.
    - Corridor-level solutions may be more effective than isolated improvements.
    - Remaining stand-alone locations are also critical to fill gaps in the freeway system.
- Many of the high need corridors are currently undergoing of have recently undergone corridor studies to better understand project area needs and potential solutions. For high priority corridors that have not completed a corridor study within the last decade, these corridors should be prioritized for future planning studies/corridor studies given their high regional needs.

Introduction

The Intersection Mobility and Safety Study aims to further the success of the first iteration of the study that the Metropolitan Council and the Minnesota Department of Transportation (MnDOT) conducted in 2017, the Principal Arterial Intersection Conversion Study, by identifying and prioritizing principal arterial intersection projects in the Twin Cities region. Led by Metropolitan Council and MnDOT, the purpose of identifying and prioritizing principal arterial intersections is to improve the performance and safety of non-freeway regional roads for all users. Performance and safety enhancements could include several types of either at-grade or grade separated solutions. Data and experience have shown that grade separated facilities are safer and carry traffic with less delay than non-freeway roadways with signalized intersections. However, grade separation is often not the “right size” solution for the meeting of two roadways, as it can require a larger building footprint and cost more to implement.

Key Terms:

1. Principal arterial road: A regional roadway that typically moves large numbers of people over long distances at faster travel speeds.
2. At-grade intersection: An intersection of two or more roadways at the same level, often featuring traffic control such as a stop sign or traffic signal (Figure 3).
3. Grade separated intersection: Separated roadways that cross at different levels using a bridge (Figure 4).
4. Trunk Highway (TH): Interstate, US, and MN highway routes.

Figure 3. Highway 169 and Highway 41 at-grade intersection in 2019 (courtesy of Google).

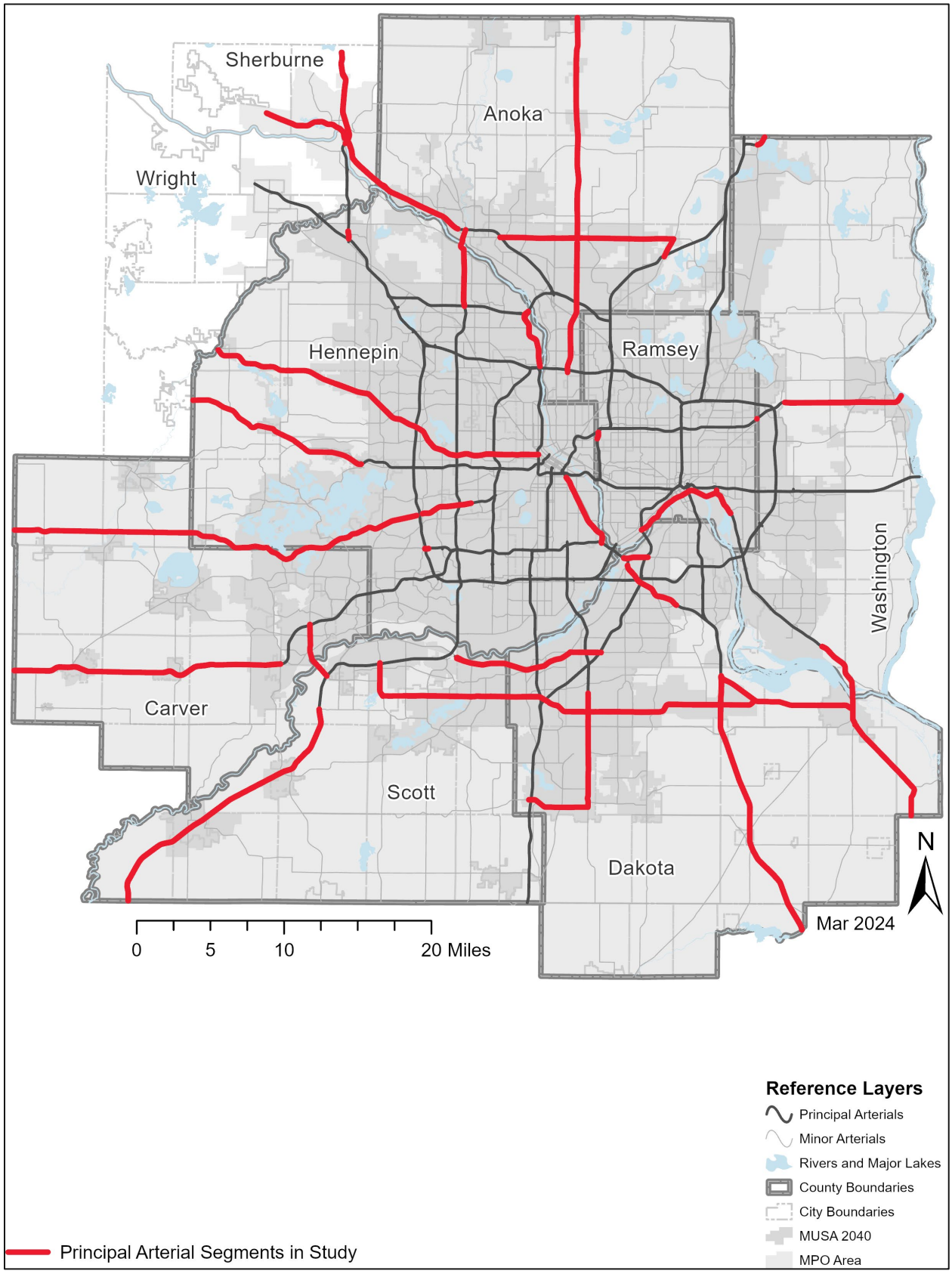
Figure 4. Highway 169 and Highway 41 grade separation in 2021 (courtesy of Google).

Principal arterial roadways in the Twin Cities Metro serve millions of drivers, transit users, and freight haulers every day. Additionally, on all roadways in the Metropolitan Council planning area, there were 2,387 crashes involving an intersection or interchange resulting in a fatality or serious injury between 2018 and 2022. This is an average of 477 crashes per year, accounting for 58% of all fatal and serious injury crashes on roads in the Metropolitan Council planning area in this period. On a statewide scale, intersection-related crashes accounted for 47% of all fatal and serious injury crashes. Given these high percentages, MnDOT's Strategic Highway Safety Plan identified intersections as a Core Focus Area that was trending in the wrong direction.

The analysis in this study will help Metropolitan Council, MnDOT, and local agencies and transportation stakeholders identify and prioritize relevant funding opportunities (e.g., the Regional Solicitation), update regional transportation policy, and better plan for long-term costs associated with transportation projects. Non-freeway principal arterial roadways in the Twin Cities region were the focus corridors of this study, as shown in Figure 5.

To identify and prioritize at-grade intersections on principal arterials, the Metropolitan Council and MnDOT developed 'tiers' of high, medium, and low-need intersections. Tiers are based on mobility, safety, multimodal, and equity-based performance measures.

Figure 5. Non-freeway principal arterial roads in the Twin Cities region.



A smaller set of locations for the study were identified as potential grade separation opportunities based on factors recommended by the Congestion Management Process (CMP) Advisory Committee, which served as the Technical Steering Committee for the study. The CMP is a joint effort comprised of Metropolitan Council, MnDOT, county, and city staff throughout the region. The CMP identifies and shapes corridors by exploring cost-effective mobility solutions.

The factors for potential intersection prioritization and investment considered the degree of intersection needs as determined in the tiering analysis, an assessment of project readiness, and confirmation from local agency staff on their priorities and long-term visions.

Stage 1: Where Have We Come From?

The relevant background for this study begins with understanding the first iteration of the study that Metropolitan Council and MnDOT conducted in 2017, called the Principal Arterial Intersection Conversion Study. The initial study identified high-priority intersections for potential grade separated conversion, prioritized and identified projects for federal funding, and gained a better understanding of project costs to prioritize longer-term transportation investments. Ninety-one non-freeway principal arterial intersections were identified and classified as either low, medium, or high priority based on their existing mobility and safety issues.

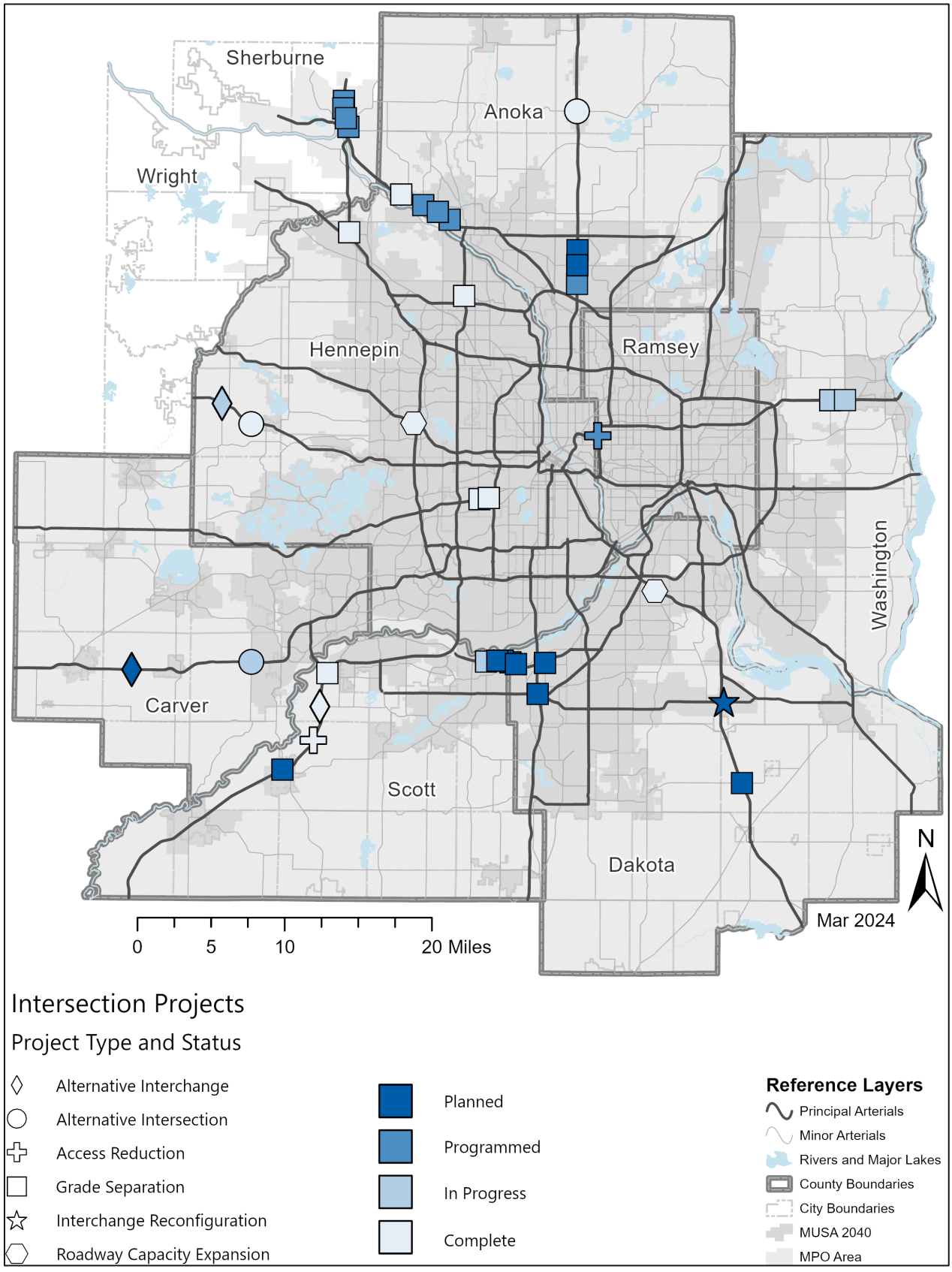
Completed and Future Projects

Figure 6 shows a map of 42 projects identified in the Principal Arterial Intersection Conversion Study, listed by project type and project status as of June 2022. The various levels of project status include already completed, in progress or under construction, programmed for construction, and locations with projects in the planning process. Figure 6 does not include corridor projects on Highway 252 and Highway 8, or past interchange projects on Highway 7, even though those locations were evaluated for funding sources or included in the before and after analysis as part of this study. Table 1 shows the number of each project type planned or programmed since the completion of the Principal Arterial Intersection Conversion Study by intersection type.

Table 1.Number of projects planned or programmed since the completion of the Principal Arterial Intersection Conversion Study (as of June 2022).

Project Type	Number of Projects
Grade separated interchange	28
Roadway capacity expansion	3
Alternative intersection (at-grade)	3
Alternative interchange designs	3
Interchange reconfiguration	2
Access reduction	2
Project type not yet defined	1
Total	**42**

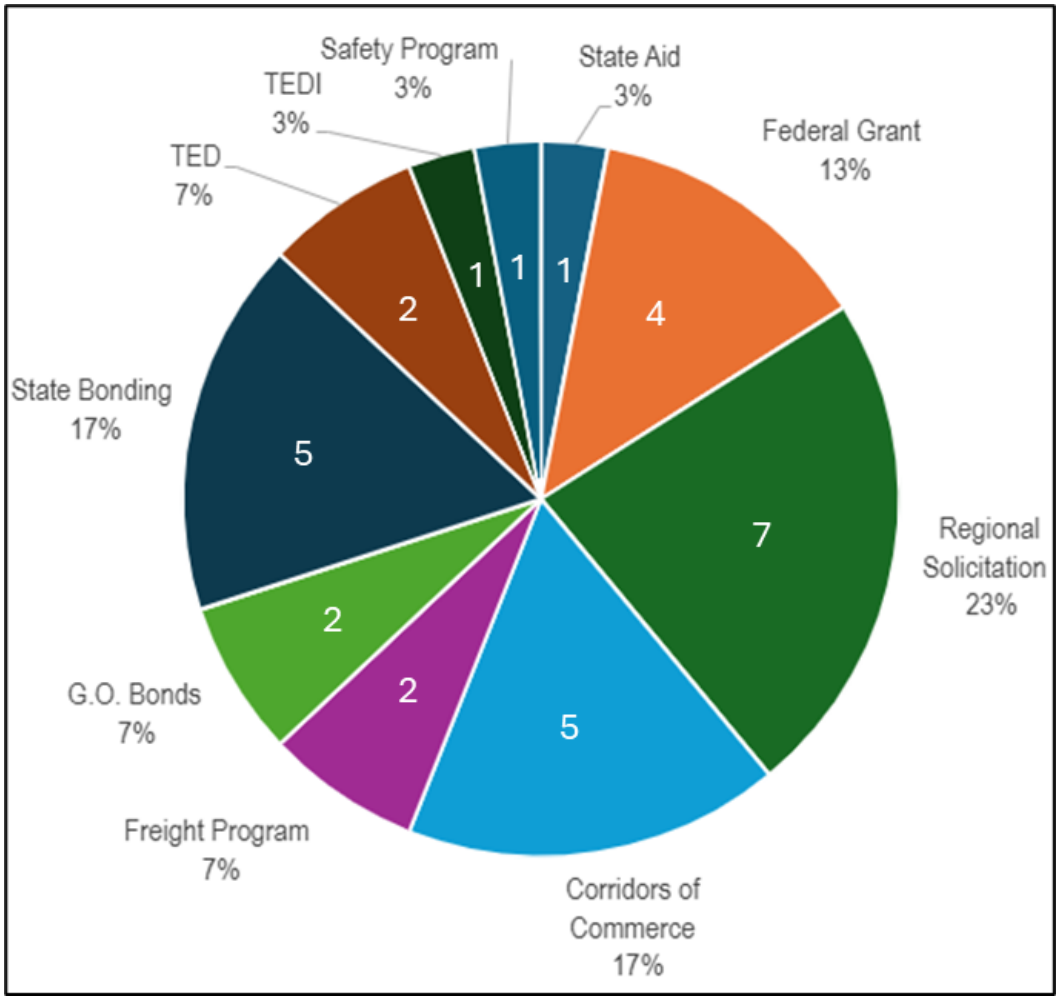
Figure 6. Principal Arterial Intersection Conversion Study projects by intersection type and status.



Funding Sources

Most grade separation projects on principal arterials are locally led with support from MnDOT. Funding for intersection and interchange improvements on principal arterials often comes from multiple sources that must be combined to complete a project. Funding sources could include federal funds, State Aid, MnDOT funds, or State Bonding. Additionally, funding could also come through federal and state grants. Figure 7 shows potential funding sources, types, and distribution examples for regional roadway projects.

Figure 7. Distribution of funding sources for intersection projects.



Before and After Analysis

A before and after analysis was conducted to assess the impacts of four arterial projects completed in the Twin Cities region over the last decade. The project aimed to gain insights into the impacts of completed intersection improvements on mobility, safety, and the general public by examining four case studies described in Table 2. By analyzing these case studies, the project hoped to identify best practices that can be applied to future projects.

Table 2. Before and after projects.

Year completed	Intersection	Project Synopsis
2014	Highway 7 and Louisiana Avenue	In 2014, MnDOT and the City of St. Louis Park collaborated on a project to improve safety and mobility at the intersection of Highway 7 and Louisiana Avenue in St. Louis Park. The project was initiated by St. Louis Park, as the community had grown significantly, and safety issues, travel delays, and capacity concerns were prevalent on Highway 7. The original project included the removal of three signal systems along Highway 7 and two right-in/right-out intersections. Following public and stakeholder engagement, a grade separated interchange was constructed, which significantly improved mobility and safety. Additionally, pedestrian and bicycle facilities were enhanced in the area to improve multimodal mobility and connectivity.
2015	Highway 10 and Armstrong Boulevard	In 2015, Anoka County led the upgrade of Highway 10 and Armstrong Boulevard (CSAH 83) in the City of Ramsey to a grade separated interchange. The goal of the project was to improve safety and mobility and eliminate an at-grade railroad crossing. A previous corridor study on Highway 10 demonstrated the need for improvements at this intersection.
2019	Highway 65 and Viking Boulevard	In 2019, MnDOT constructed Minnesota's first signalized reduced conflict intersections (RCI) at the intersection of Highway 65 and Viking Boulevard in East Bethel to improve safety and operations. The RCI prohibits drivers from making left turns from Viking Boulevard to Highway 65. The RCI initially confused some drivers regarding which movements have the right-of-way, particularly for vehicles turning off Viking Boulevard. A "No Turn on Red" for westbound Viking Boulevard users was implemented in 2020 to mitigate the confusion.
2020	Highway 169 and Highway 41	In 2020, Scott County and MnDOT constructed an interchange and an overpass and extended the frontage road at the intersection of Highway 169 and Highway 41 in Scott County. The project also included the construction of pedestrian/bicycle accommodations and the installation of new stormwater treatment. The goal of the project was to improve safety and mobility in this area by removing at-grade access to US Highway 169.

Case study projects were examined for mobility and safety performance as well as impacts on overburdened and underserved groups using both quantitative and qualitative data. Vehicle mobility and safety data, project documentation, and interviews with agency project managers were used as the primary forms of analysis.

Quantitative Analysis

The quantitative analysis focused on the impacts on traffic performance of the Highway 65 and Viking Boulevard and Highway 169 and Highway 41 projects, the two most recently completed projects and the ones where before and after data was available. Measures of traffic safety and mobility were used to quantify changes before and after the projects were implemented. Crash data was obtained from MnDOT for specified years before and after the implementation of each project. Travel time data was collected from ClearGuide for full years before and after project implementation. Data was collected for each approach leg at the study intersections.

Highway 65 and Viking Boulevard

Figure 8 displays the annual crash costs and crashes per year from 2012 through 2021 (excluding months when the project was being constructed as shown with the red line) at the Highway 65 and Viking Boulevard intersection. In addition to a 15 percent reduction in annual number of crashes, there

was a 75 percent reduction in annual crash cost, indicating a reduction in both total and severe crashes at the intersection. It should be noted that there were two fatal crashes during and shortly after construction of the RCI. Operational adjustments, including a no turn on red on the Viking Boulevard signal approaches, were implemented to further address safety issues at the intersection. The post-construction crashes in Figure 8 reflect conditions in which these operational changes were made.

Figure 8. Annual crashes and crash costs at Highway 65 and Viking Boulevard.

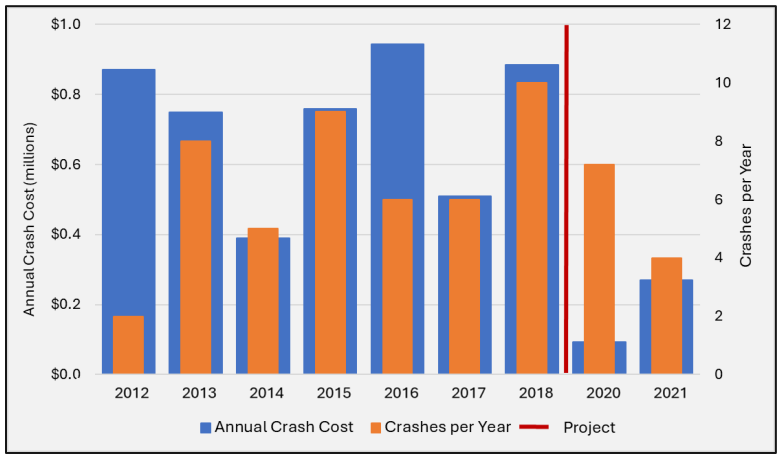
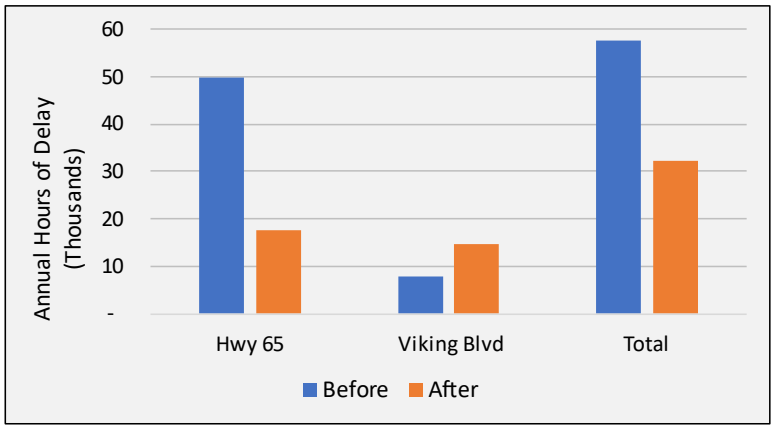


Figure 9 displays the reduction in total annual hours of delay at Highway 65 and Viking Boulevard. Delay on mainline Highway 65 was reduced after the project, which can be attributed to the reduction in signal phases required to facilitate the cross street turning movements. Delay for users coming from Viking Boulevard slightly increased, which can be attributed to additional U-turn movements associated with the RCI design and increased wait times from the No Turn on Red restriction on westbound Viking Boulevard. Total annual intersection delay was reduced by roughly 25,000 hours after the Highway 65 and Viking Boulevard project, which amounts to about $600,000 (2023 dollars) in savings per year resulting from lower travel times.

Figure 9. Annual intersection delay at Highway 65 and Viking Boulevard.



Highway 169 and Highway 41

Figure 10 displays crash reductions and the associated savings from the construction of the interchange at Highway 169 and Highway 41. For the before condition, crash data was collected for the years 2016 to 2018. For the after condition, crash data from Fall 2020 to Spring 2022 was used (limited by the data available after project completion at the time of the analysis). The average annual crash costs of about $5.5 million before construction decreased to approximately $126,000 after construction.

This resulted in an annual crash cost savings of roughly $5.4 million from the project. The average number of crashes per year was reduced from 16 to five, which reflects a 70 percent reduction in the overall number of crashes. Four of the observed crashes after project completion were property damage only crashes and there were no serious injury or fatal crashes, which connects directly to Metropolitan Council and MnDOT safety performance targets.

Figure 10. Annual crashes and crash costs at Highway 169 and Highway 41.

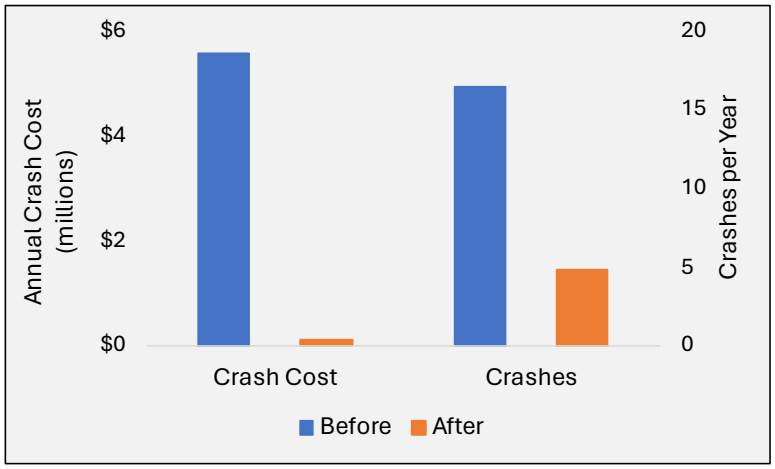
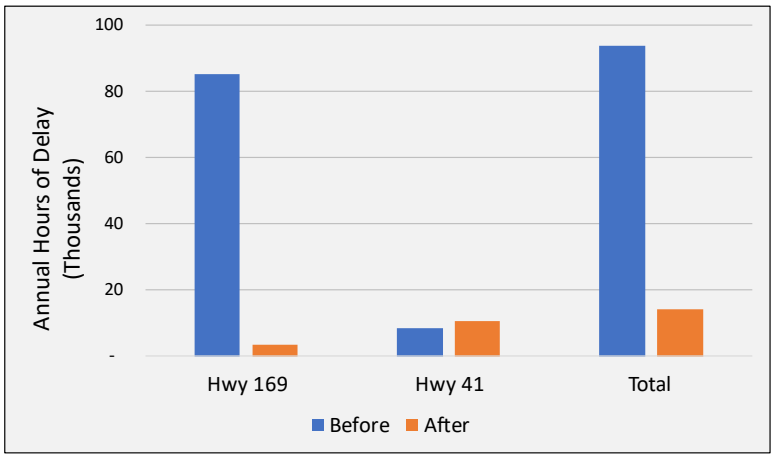


Figure 11 shows the annual hours of delay at Highway 169 and Highway 41 before and after the grade separation. After the project, mainline delay was essentially eliminated due to the free-flow characteristics of the design along Highway 169. Cross street delay was observed to be similar between the before and after project conditions; however, the total annual delay was reduced from 93,000 hours to 14,000 hours, resulting in over $2 million (2023 dollars) of travel time savings per year due to the project.

Figure 11. Annual intersection delay at Highway 169 and Highway 41.



In addition to overall time savings, travel time reliability also improved at the intersection. One measure of reliability is the buffer time index (BTI). BTI estimates how much extra time travelers need to plan for to be on time 95 percent of the time compared to an average trip. This is calculated from the difference between the 95th percentile travel time and the average travel time, divided by the average travel time. The BTI is used to measure the variability, or predictability, in travel time. A lower BTI score indicates less day-to-day variability or greater predictability of the time it takes to complete a trip.

Table 3. Peak hour buffer time index before and after project.

Year	Hwy 169: AM	Hwy 169: PM	Hwy 41: AM	Hwy 41: PM
2018	7.6%	14.3%	15.7%	25.1%
2023	1.1%	0.6%	17.1%	14.0%

Table 3 displays the BTI for the morning and afternoon peak hours in 2018 and 2023 for the Highway 169 mainline as well as Highway 41 for users approaching and traveling through the project area. Highway 169 shows about a six and 14 percentage point improvement in the BTI during the morning and afternoon peak hours, respectively, resulting in very minimal extra planning time required to complete an on-time trip compared to trip times users typically experience during both rush hours. In the morning peak hour, BTI values along Highway 41 showed a slight increase in 2023 but remained largely unchanged. The BTI improved by eleven percentage points in the afternoon peak hour, however, suggesting greater overall travel time reliability through the study area after the project was completed.

Summary

Findings observed at the Highway 169 and Highway 41 intersection and the Highway 65 and Viking Boulevard intersection demonstrate the effectiveness of improving safety and mobility that grade separation and at-grade projects can have. Both projects were also successful in providing a quick return on investment.

Qualitative Analysis

A qualitative analysis was conducted on the four case study projects to learn how each project conducted outreach, especially to historically underserved populations such as lower income communities, people living with disabilities, Black people, Indigenous people, and people of color. Each of the case studies spans a wide range of communities and land use contexts, and best practices for equity and engagement have evolved over the years. Table 4 shows historically underserved populations within three miles of each project as of 2021.

Table 4. Historically underrepresented populations within three miles of case study projects.

Description	Topic	Highway 7 and Louisiana Avenue	Highway 10 and Armstrong Boulevard	Highway 65 and Viking Boulevard	Highway 169 and Highway 41	Mpls-St. Paul Metro
American Indian and Alaskan Native	Race	0.3%	0.8%	0.7%	0.4%	0.4%
Black or African American	Race	8.5%	3.8%	0.5%	2.8%	9.9%
Hispanic and Latino (of any race)	Race	4.6%	4.9%	4.0%	15.0%	6.5%
Two or more races	Race	4.0%	3.7%	1.9%	7.9%	3.7%
Some other race	Race	0.6%	3.3%	2.7%	4.5%	0.4%

Description	Topic	Highway 7 and Louisiana Avenue	Highway 10 and Armstrong Boulevard	Highway 65 and Viking Boulevard	Highway 169 and Highway 41	Mpls-St. Paul Metro
65+	Age	17.1%	14.0%	11.0%	12.7%	14.0%
Renter occupied	Housing	43.1%	12.4%	4.6%	31.6%	31.2%
Low income (Income below 200% of the poverty level)	Income	15.6%	14.7%	10.7%	21.4%	20.6%
Population with a disability	Disability	10.0%	7.5%	6.8%	10.9%	9.9%
Walked, biked, worked at home, or other	Transportation to Work	19.4%	15.4%	8.9%	10.1%	13.6%

**Note: Data comes from the 2021 American Community Survey 5-year Estimates. Highlighted numbers are numbers above the Minneapolis-St. Paul metro region overall percentages.*

Qualitative Findings by Project

Below are findings that describe the processes by which projects were completed. The information came from interviews with project managers on each project as well as existing documentation for projects posted online. Table 5 shows a summary of engagement and equity strategies used across the four case studies.

Table 5. Equity and engagement strategies used during case study projects.

Equity or Engagement Strategy	Description	Highway 7 and Louisiana Avenue	Highway 10 and Armstrong Boulevard	Highway 65 and Viking Boulevard	Highway 169 and Highway 41
Environmental Justice Analysis	The analysis included required environmental documentation that identifies communities of color and lower-income people near the project	■	■	■	■
Public Meetings	Meeting or open house held in a community location to receive information and provide feedback	■	■	■	■
Pop-up Events	Table during a busy time or event that works best for target audiences to receive information and provide feedback			■	
Mailings	Mailing to people near the project to provide information or notify them of upcoming events	■	■		■
Community Partnerships	Partnership with key leaders/organizations to help spread information about the project	■		■	
Webpage	Webpage to provide a place for key project information	■	■	■	■

Equity or Engagement Strategy	Description	Highway 7 and Louisiana Avenue	Highway 10 and Armstrong Boulevard	Highway 65 and Viking Boulevard	Highway 169 and Highway 41
Translations and Interpretations	Project materials created in multiple languages and/or interpreters used during project events		■		■
Social Media	Posts on agency social media accounts providing information and promoting project events	■	■	■	■
Advisory Group	Group with a common interest in the project that provides guidance and advice to the project	■			

Highway 7 and Louisiana Avenue (2014)

The Highway 7 and Louisiana Avenue project used a mix of outreach strategies to get feedback and communicate with local neighborhoods and businesses.

- The project identified a population living near the intersection that did not have access to the internet. For that reason, the project survey was available both online and in paper format. The survey asked questions about people's challenges with the intersection.
- The project hosted an open house in June 2011 at the St. Louis Park City Hall to share project information and get feedback on preliminary design concepts. The open house was promoted through postcards to nearby properties, social media, and press releases.
- Nearby business owners were invited to attend weekly construction progress meetings.
- The public was invited to comment on the design concepts and the Environmental Assessment.
- A letter was also sent to tribal representatives soliciting their input on archaeological impacts.
- The project maintained communication channels with the public through construction to ensure people impacted by construction had a channel to ask questions and relay their comments.
- Crews created detour signs for businesses during construction so that customers were able to find their way to businesses during construction.
- In an interview with the project manager, they acknowledged that, if they were to do outreach over, they would have collected demographic data of respondents to understand who they were reaching. Information would have been used to identify gaps in their outreach approach.

Highway 10 and Armstrong Boulevard (2015)

The Highway 10 and Armstrong Boulevard project relied on previous studies and local knowledge to guide outreach efforts on the project. Based on previous years of engagement, they were able to build consensus to move forward with the intersection redesign.

- The project conducted three public meetings to provide project information and solicit feedback on challenges and draft designs for the intersection. The open houses were promoted through press releases and mailings to adjacent property owners.
- Spanish interpreters attended public meetings to help communicate with Spanish-speaking participants.
- The project created a website that included overview information, design concepts, and contact information.
- Social media was used to promote the project and its associated events.

- Due to the importance and notoriety of the safety concerns at this intersection, politicians were closely involved and helped champion the project, which led to greater public trust in the project.

Highway 65 and Viking Boulevard (2019)

The Highway 65 and Viking Boulevard project used a mix of strategies to deliver information and receive feedback from stakeholders. By using a variety of methods, different target audiences were able to learn about the project in ways that work best for them.

- A demographic analysis helped identify target audiences and shape the overall outreach approach. Demographic information such as race and income helped the project understand who they should be talking to and how to reach them.
- A project website included project overview information, visualizations like a drone flythrough video of a project rendering, and contact information.
- The project included two open houses and nine community presentations. The open houses were advertised through social media and direct mailing to nearby residents and businesses.
- The project set up tables at existing community events such as East Bethel Booster Days. They brought project information, had the drone flythrough video available, and had a model that demonstrated how the new intersection design would work using toy cars.
- Trusted public figures such as the City Administrator, Community Development Manager, and MnDOT Area Manager supported the project and were key in garnering positive public opinion.
- After construction was complete, the project continued to take public feedback and adjusted sight distances and signal timings to improve safety.

Highway 169 and Highway 41 (2020)

The Highway 169 and Highway 41 project conducted outreach for the project from 2015 through 2020 using a mix of outreach strategies. Some of the outreach efforts shifted in 2020 and were moved online to account for the COVID-19 pandemic.

- The project identified a high portion of Spanish-speaking, Latino residents near the project early on through local knowledge. Many of the Latino residents lived in the Jackson Township manufactured homes near Highway 169 and Highway 41. For that reason, the team provided project information in Spanish.
- The project conducted four open houses in the manufactured home community where many Spanish speakers lived. They also held two public hearings.
- Social media and newsletters helped promote the open houses and public hearings in English and Spanish.
- Scott County hosted a project website that included a video to educate the public on how to navigate the new intersection design as well as drone footage of construction progress. The education video helped improve public support of the project.
- A business liaison represented the interests of the community throughout the project. They were regularly involved with the project to ask questions and stay informed.
- A letter was sent to tribal representatives from Sioux and Sisseton-Wahpeton Oyate communities soliciting their input about potential archaeological impacts in the area.

Qualitative Analysis Key Takeaways

Each case study was analyzed based on their stated goals, their ability to consider public feedback, and how well they were able to implement equitable outcomes, especially for historically underrepresented groups. Below are the key observations based on the analyses organized by topic.

Partnering with communities

Working with community leaders to spread messages and gather feedback leads to better projects that serve their communities.

- The Highway 65 and Viking Boulevard project involved emergency management services, particularly the fire department, to ensure that their vehicles could safely navigate the new intersection design. They also held meetings at fire stations. The City Administrator of East Bethel, a recognized leader in the community, promoted the project and managed a phone hotline, which helped to build greater trust within the community.
- Community leaders in the City of Ramsey frequently received project updates for the Highway 10 and Armstrong Boulevard project. The community leaders, in turn, shared project information with their constituents, as they are key stakeholders who already have their trust.
- The project at Louisiana Avenue and Highway 7 collaborated with local artists to design and install artwork on the bridge.

Engaging early and often

Projects that initiate community dialogue early in the development process tend to result in intersection improvements that are better received by the community.

- The Highway 7 and Louisiana Avenue project began engagement efforts five years prior to the start of construction, a timeline that allowed communities to heavily influence the project from design through construction.
- Years before the project, potential support and public concerns for the proposed changes to the intersection at Highway 10 and Armstrong Boulevard were identified through conversations with the community.
- The Highway 169 and Highway 41 project identified a need for Spanish-language outreach early in project scoping thanks to a large number Spanish speaking residents nearby. The project hosted open houses at the manufactured home park and provided project information in Spanish.

Meeting on their terms

Projects that know where and how their communities like to engage can efficiently gather feedback in ways that work best for residents.

- Staff from Highway 65 and Viking Boulevard attended popular community events and provided presentations to communities throughout the long project corridor to gauge project interest, share information, and answer questions.
- The projects at Highway 7 and Louisiana Avenue, Highway 169 and Highway 41, as well as Highway 65 and Viking Boulevard, directly engaged business owners in their respective project areas to ensure their involvement in project development.

Engaging diverse audiences

Collecting feedback from all affected communities, with an emphasis on the most vulnerable, can result in better outcomes for everyone.

- The project at Highway 7 and Louisiana Ave used various methods to reach a diverse group of stakeholders. These methods included a website, in-person meetings, online surveys, paper surveys, and mailings. These different formats allowed stakeholders to provide feedback in ways that were most convenient for them. For instance, those who did not wish to attend a meeting in person could submit a survey, while those who preferred a face-to-face interaction

could attend a public meeting. The project aimed to ensure that all voices were heard and accounted for.
- The Highway 7 and Louisiana Avenue, Highway 10 and Armstrong Boulevard, and Highway 169 and Highway 41 projects sent out mail notifications to inform nearby residents about upcoming work plans and provide them with opportunities to give their feedback.

Information accessibility

Successful projects are those that have identified their target audiences and communicated information to them in the most effective manner. It is important to note that not everyone affected by the project will receive information in the same manner, so the use of multiple communication strategies is necessary. These strategies may include online and in-person communication, the use of multiple languages, and transparent processes that allow for adjustments as new information is obtained.

- All four case study projects hosted a website where project information was posted.
- The Highway 169 and Highway 41 project created an educational video demonstrating how to navigate a diverging diamond interchange. The video helped alleviate anxieties about the new interchange design and increase positive reception among residents.
- The Highway 169 and Highway 41 project translated materials into Spanish. The Highway 10 and Armstrong project had Spanish interpreters available at open houses.
- Highway 7 and Louisiana Avenue made surveys available in paper format after identifying a large population near the intersection that did not have access to internet.
- The Highway 65 and Viking Boulevard project design was adjusted after initial construction based on safety needs and stakeholder complaints identified through post-construction engagement.
- For the Highway 7 and Louisiana Avenue and Highway 169 and Highway 41 projects, business owners received information about planned construction impacting their businesses. This proactive communication with businesses helped build trust between staff and stakeholders.

Stage 2: Where Are We Now?

Local Agency Interviews

Interviews with counties, cities, and state agencies from the Twin Cities Metropolitan Area were conducted between September 2022 and June 2023 to understand agency priorities and project planning initiatives for principal arterial locations in their jurisdictions. These interviews helped weigh local perspectives with data to solidify priority intersections and ensure nothing was left out of consideration from a local perspective. The meetings involved a brief project overview followed by a discussion of each corridor in their area. Questions included:

- What is the vision for each of the highway corridors in your community?
- How closely do your priorities for highway investments align with local and regional plans and priorities?
- Which factors are most important in identifying highway intersection projects?
- How have you funded highway intersection projects in the past and how do you plan to fund them in the future?

Many counties talked about principal arterials that work for all road users, including pedestrians, transit users, bicyclists, and drivers. Ensuring the safety of all modes of travel and minimizing the likelihood of crashes that result in injuries or fatalities is of utmost importance. Reducing pedestrian-vehicle collisions on principal arterials is a high priority for agencies.

Table 6 shows an overview of which agencies participated and of the corridor locations.

Table 6. Summary of corridors discussed during local agency interviews.

Area	Date	Local Agencies Represented	Corridors	Participants
Anoka County	September 28, 2022	– Anoka County – Blaine – Centerville – Columbia Heights – Coon Rapids – Fridley – Lino Lakes	– Highway 65 – Highway 10 – Highway 169 – County Road 14	17
Hennepin County	September 28, 2022	– Hennepin County – MnDOT	– Highway 5 – Highway 7 – Highway 12 – Highway 55 – Highway 62 – Highway 101 – Highway 169 – Highway 252	4
Carver County	September 29, 2022	– Carver County – MnDOT – Chanhassen – Chaska – Victoria	– Highway 5 – Highway 7 – Highway 41 – Highway 212	9
Dakota County	October 4, 2022	– Dakota County – MnDOT – Apple Valley – Burnsville	– Highway 3 – Highway 13 – Highway 52 – Highway 55 – Highway 62 – Highway 61 – County Rd. 42	6

Area	Date	Local Agencies Represented	Corridors	Participants
Ramsey County	October 13, 2022	– Ramsey County – MnDOT – Gem Lake – Lauderdale – Maplewood – Mounds View – North Oaks – Roseville – Vadnais Heights	– Highway 36 – Highway 51 – Highway 61 – Highway 120 – Highway 280	15
Washington County	October 18, 2022	– Washington County – MnDOT – Woodbury	– Highway 8 – Highway 36 – Highway 61	6
Scott County	October 24, 2022	– Scott County – MnDOT – Savage	– Highway 13 – Highway 41 – Highway 169 – County Rd. 42 – County Rd. 78 – County Hwy. 17	8
Sherburne County	November 2, 2022	– Sherburne County – MnDOT – Elk River	– Highway 10 – Highway 169	4
City of Greenfield	December 13, 2022	– Greenfield	– Highway 55	2
Cities of Maple Plain, Mayer, and Minnetrista	December 14, 2022	– Maple Plain and Mayer – Minnetrista	– Highway 7 – Highway 12 – Highway 62	2
City of Plymouth	December 15, 2022	– Plymouth	– Highway 55	1
City of Eden Prairie	December 15, 2022	– Eden Prairie	– Highway 5 – Highway 62	2
Cities of Brooklyn Park and Brooklyn Center	December 16, 2022	– Brooklyn Center – Brooklyn Park	– Highway 169 – Highway 252	3
Cities of Excelsior, Minnetonka, and St. Louis Park	December 22, 2022	– Excelsior – Minnetonka – St. Louis Park	– Highway 7 – Highway 62	3
Wright County	January 5, 2023	– Wright County – Albertville – Hanover – Otsego – St. Michael	– Highway 10 – Highway 55 – County Rd. 19	7
City of Minneapolis	January 6, 2023	– Minneapolis	– Highway 55	3
City of Saint Paul	January 11, 2023	– Saint Paul	– Highway 61 – Warner Rd – Shepard Rd	3

Local Agency Interview Key Takeaways

Agencies were asked to discuss their priorities for principal arterials based on safety, land use, existing users, public feedback, condition, crash history, funding availability, and specific transportation policy. Below is a summary of the key takeaways that were common across meetings with local agencies. For a summary table of discussion by corridor, see Appendix A.

Priorities

- Agencies are continuing to pursue improvements at intersections on principal arterials.

- Many agencies are pursuing lower-cost improvements at intersections on non-principal arterials as well.
    - Agencies were allowed to submit priority intersections on non-principal arterials for evaluation in the needs assessment of the study. These intersections were tiered with respect to their needs similar to other principal arterial intersections. Based on the results of the tiering analysis, these intersections were considered for regional prioritization of future funding opportunities.
- Populations that have historically been overburdened by impacts of regional transportation decisions, such as Black and Indigenous populations, people of color, lower income populations, and people living with disabilities, need to be considered when planning for future regional improvements.
- Reducing pedestrian-vehicle collisions on principal arterials is a high priority for most agencies.

Barriers and challenges

- Developing, funding, and constructing interchanges is a complex process for local agencies and requires a lot of coordination to navigate the approval process, assemble funding from multiple sources, and facilitate project delivery.
- Agencies are concerned with the future principal arterial system as well as the current system. Plans for systems reviews are in place, but it is difficult to fund improvements until the facilities are re-classified.
- When MnDOT requires agencies to deliver an interchange project, it places enormous strain on staff resources for the local agency.
- Staffing changes at agencies can result in differing opinions regarding priorities, leading to additional hurdles in implementing previous or new project priorities.

Implementation barriers

- There is a double bind when pursuing federal funding: the application requires a layout to be selected for funding, but once funded, the NEPA environmental process requires starting with a blank slate of alternatives.
- Some counties noted that MnDOT does not always provide additional funding when they collaborate on a project, which can be a burden on the cities and counties.
- Projects tend to get funded using multiple sources, including Regional Solicitation, Corridors of Commerce, State Aid, State/General Obligation Bonding, Freight Funds, Sales Tax Revenue, Highway Safety Improvement Plan, Transportation Economic/Infrastructure Development, and Local Partnership Program.
- Combined funding between agencies can be difficult to navigate if agencies have different project priorities. This is further complicated when considering funding from MnDOT as well as federal funding.

Best practices and strengths

- Strong agency partnerships and aligned goals are key to getting projects done.
- In the metro area, there are strong partnerships between cities, their counties, and MnDOT.
- Local agencies valued the outreach completed for this study to discuss priorities for principal arterials with other local agencies and with MnDOT and Metropolitan Council.

Intersection Needs Assessment

The main goal of the needs assessment was to evaluate the performance of at-grade intersections in the Minneapolis-Saint Paul metro region with respect to their existing mobility, safety, multimodal, and equity needs. The evaluation included 518 intersections, which incorporated existing principal arterial intersections and intersections identified as local priorities by Metro counties and cities.

Performance Measures

Table 7 shows the seven performance measures for the mobility (vehicles and transit), safety, and multimodal/equity categories. Mobility and Safety performance measures were scaled to an index of 0 to 10. Index values were proportional to observed performance measure values. The purpose was to allow for aggregating measures in a uniform and unitless scale with the opportunity to control for outliers having an outsized influence on the overall scoring results. An explanation of each measure, the units, and the rationale for inclusion from the user perspective is also included in Table 7.

Table 7. Intersection Needs Analysis performance measures.

Measure	Category	What is measured?	Units	Rationale
Total Intersection Delay	Mobility	Annual delay summed for all approaches	Person-hours	Total travel time delay experienced
Peak Period Delay	Mobility	Annual four-hour peak period (morning or afternoon) delay on weekdays for the highest mainline approach	Person-hours	Travel time delay experienced during peak conditions
Cross Street Delay	Mobility	Annual delay for cross street approaches	Person-hours	Travel time delay experienced by travelers attempting to cross or access the main highway
Transit Passenger Delay	Mobility	Total annual passenger hours of delay. Based on Fall 2021 ridership data and the traffic delay at affected intersections	Person-hours	Travel time delay experienced by bus passengers
Severe Crash Rate	Safety	Number of fatal and severe injury crashes observed over five years divided by total entering traffic	Crashes per 100 million entering users	Frequency of severe crashes relative to traffic exposure risk
Total Crash Cost	Safety	The monetized value of all crashes by severity over five years; fatal crashes were assigned a value of two times the serious injury crash cost	Dollars ($)	The overall cost of crashes experienced
Suitability of the Pedestrian and Cyclist Environment (SPACE) Score	Multimodal and Equity	Nineteen factors are aggregated to an overall SPACE score of 0-100.	SPACE index values (0 to 100)	Multimodal and equity measures

Data Collection and Scoring

The data collection and scoring methods for each of the seven performance measures are outlined below. Detailed maps of the top scoring intersections in each category are included in Appendix C.

Mobility

Mobility data for vehicle travel was provided by the Texas A&M Transportation Institute (TTI) from the 2019 Urban Mobility Report. The mobility data was based on speed data from INRIX and the HPMS

roadway inventory. Travel time delay for each intersection approach was captured using a 200-meter buffer around the intersections. Total annual delay, peak period delay, and cross street delay were measured at each intersection.

> ***Total Annual Delay*** *was measured in person-hours and represents the total annual delay experienced by users in year 2019 on all intersection approaches. The duration of delay and the number of users impacted are both captured by the person-hours of delay statistic. This aggregated result (annual person-hours of delay) allows for direct comparison between the study intersections.*
>
> ***Peak Period Delay*** *reflects the morning and afternoon peak traffic hours (6:00 AM to 10:00 AM and 3:00 PM to 7:00 PM) and measures the annual delay during each peak period. For this measure, the highest of these two delay values was chosen to represent peak delay at that intersection. The maximum delay was used, instead of an average, so that intersections with asymmetric daily delay (one peak has more delay than the other) were not misrepresented by aggregating the delay data. Additionally, the peak period delay measure focused on the mainline approaches at each intersection.*
>
> ***Cross Street Delay*** *is the total annual delay for the cross-street users at each intersection. This captures delays that can occur when crossing or turning onto principal arterials. Some cross streets are collectors or local roads, and these intersections did not always have available cross street delay data. In situations where there was no data, but a cross street did exist, the delay was interpolated based on relationships between intersection approach AADT and measured delay data from the remainder of the study intersections.*

Transit

Transit performance was analyzed by calculating transit passenger delay at each of the study intersection approaches.

> ***Transit Passenger Delay*** *was estimated using data provided by the Metro Transit Data Science Team and the Minnesota Valley Transit Authority. Data from Metro Transit included passenger delay for bus routes associated with Metro Transit, Southwest Transit, Plymouth Metrolink, and Maple Grove Transit. Minnesota Valley Transit Authority provided ridership data, which was applied to intersection approach delay data to estimate the passenger delay at corresponding study intersections. These datasets were combined to represent the total annual passenger delay in hours at the study intersections.*

Safety

Existing safety issues at the study intersections were evaluated by assessing the total crash cost (Table 8) and severe crash rate. Five years (2017 through 2021) of existing crash data were provided from MnDOT for use in the analysis. Crashes were tied to study intersections using GIS analysis selecting crashes within a 500-foot radius of each intersection. If crashes fell within a 500-foot radius of multiple intersections, crashes were tied to the closest intersection only. Additionally, crashes along freeways were filtered out when joining crashes to study intersections to avoid crashes on the freeway mainline being quantified at freeway ramp terminal study intersections.

> ***Crash Cost*** *measures both the magnitude and severity of crashes using standardized monetary values associated with different severity of crashes. Table 8 displays the per severity crash values used in this analysis to estimate crash costs at intersections. Recommended values from the MnDOT Office of Transportation System Management (July 2022) were used to monetize crashes by severity level. A value of two times the "Serious Injury Crash" cost was used to value*

fatal crash costs. This approach was taken to limit the weight that fatal crashes would have on the intersection scoring and to reduce the impacts of randomness associated with vehicle crashes.

***Severe Crash Rate** was calculated as the number of severe crashes (fatal crashes or serious injury crashes) per 100 million entering vehicles at each intersection over the crash data collection period. Focusing on severe crashes helps clarify the urgency of the need associated with the crash issues at the intersection.*

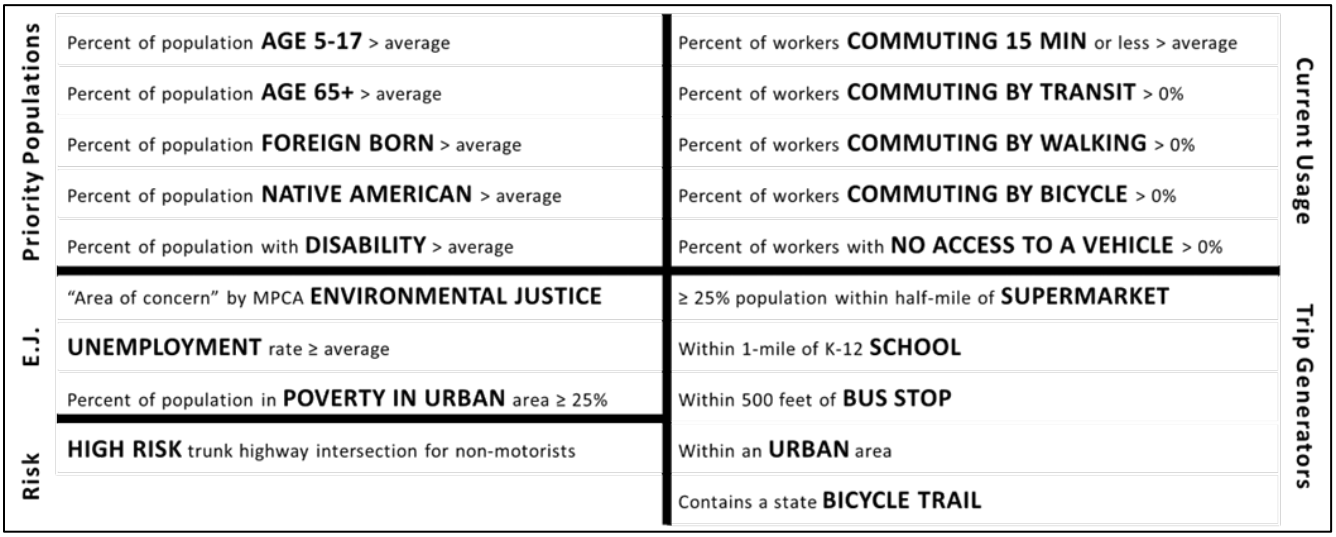
Table 8. Crash values by severity.

Crash Type	Cost
Fatal Crash	$1,500,000
Serious Injury Crash	$750,000
Minor Injury Crash	$230,000
Possible Injury Crash	$120,000
Property Damage Only Crash	$13,000

Multimodal/Equity

The Suitability of the Pedestrian and Cyclist Environment (SPACE) tool is an index of 19 social and demographic factors that are publicly available through the U.S. Census Bureau, the Metropolitan Council, and the Economic Research Service in the U.S. Department of Agriculture. Figure 12 shows the 19 factors included in the SPACE score.

Figure 12. SPACE score factors



***SPACE** input variables are used to calculate a score (out of 100 points) for half-mile hexagons across Minnesota. Higher scores indicate latent demand and a potential need for bicycle and pedestrian facilities, proportionally higher populations of disadvantaged and underserved communities, and areas of higher unemployment and poverty.*

Results of the needs assessment are summarized in Table 9 and show the range of intersection needs by performance measure. Key takeaways of the results are as follows:

- Several intersections had minimal delay and minimal or no recorded crash history during the data collection period. These intersections commonly included side-street stop control, a rural environment, and/or low traffic volumes.
- Average values were greater than median values for all six of the mobility and safety performance measures. This is reflective of intersections that scored highly in individual performance measure categories tending to be much higher than median values, which would skew average scores upward. The median and average scores for the SPACE measure were similar.
- Passenger delay was measured at 181 of the 518 study intersections. The remaining intersections did not have transit routes that were included in the Metro Transit Data Science Team and Minnesota Valley Transit Authority datasets operating through them.

Table 9: Needs assessment summary statistics.

Statistic	Total Annual Delay (hours)	Annual Peak Period Delay (hours)	Annual Cross Street Delay (hours)	Annual Crash Cost	Severe Crash Rate (per 100 million users)	SPACE Score	Annual Passenger Delay (hours)
Minimum	Minimal	Minimal	Minimal	$0	0	16	Minimal
Median	23,935	3,296	1,828	$1,645,000	0	47	8
Average	38,294	6,661	11,566	$2,249,414	1.7	46	1,480
Maximum	392,857	98,618	129,678	$15,335,000	18.9	85	30,079
Count	518	518	518	518	518	518	181

Note: Passenger Delay includes 181 observations because some intersections had no intersecting bus routes.

Tiering Analysis

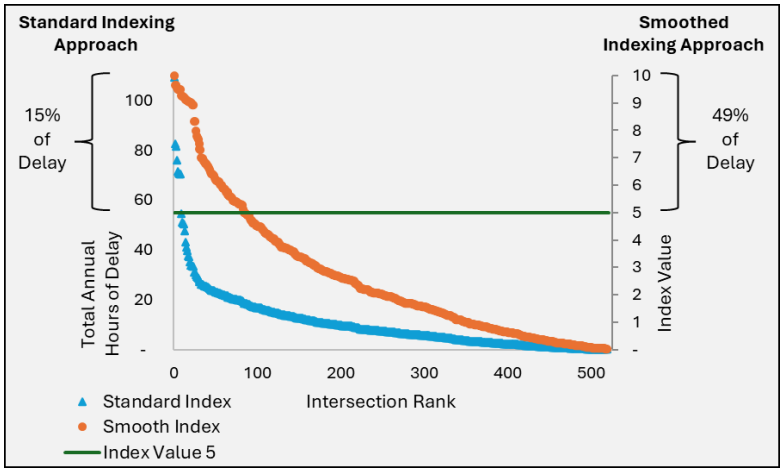
The main objective of the intersection tiering analysis was to sort intersections into high, medium, and low need tiers based on the needs assessment. Before intersection tiering could be completed, a few interim steps had to occur to develop overall intersection needs scores.

Indexing

The seven performance measures were combined into a single composite index or score as a method to tier intersections based on one score that reflects comprehensive needs. Since the raw scores for each performance measure category have different units, scores for individual measures were converted to unitless indices on a scale from zero to 10 in proportion to their raw values.

Before combining the indices into an aggregate value, the data was screened for outliers, particularly in the upper ranges of the data where locations with relatively high raw scores could severely impact the ranges established for the indices. For instance, many of the performance measures had observations that were several times higher than those reflected by most of the distribution. Using the maximum scores to proportionally set indices for the remainder of the distribution resulted in many of the locations having relatively small and similar indices (Figure 13).

Figure 13. Indexing example – total annual delay.

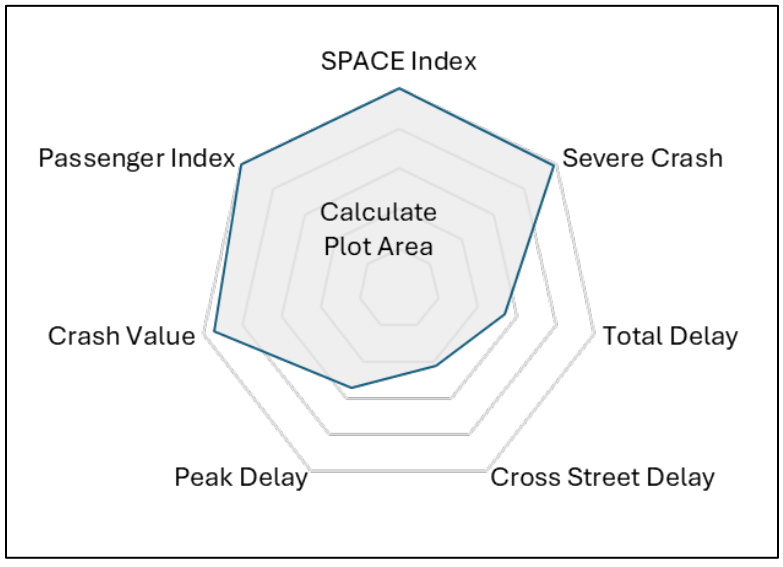


To preserve differentiation when converting from raw scores to indices, a logical breakpoint in the upper range of the scoring distribution was set to an index of nine out of the maximum index of 10. All locations above that threshold were proportionally scaled to an index between nine and 10 based on the minimum and maximum scores within that sample. The remaining locations were proportionally assigned an index between zero and nine based on the minimum possible raw score of zero and the logical breakpoint used to distinguish the upper range of scores.

Aggregation

Radial charts were used to aggregate the seven total performance measure indices. Figure 14 shows how the performance measure scores were used to illustrate individual needs and the overall magnitude of needs for each intersection. The plot area of the chart is used to represent the overall score of each intersection. The order of the variables in the area chart were optimized to maximize the calculated score for each location.

Figure 14. Example of radial aggregation method.



The area-based radial method is more sensitive to intersections with two or more higher performance measures when compared to summing, averaging, or other common aggregation techniques. This

approach allowed for locations with specific needs that are regionally significant to be reflected as a higher need in the study. Once aggregated scores to reflect overall intersection needs were established, high, medium, and low tiers were assigned based on logical breakpoints in the scoring results. Note that the intersection tiers were based on the aggregated performance measure scores. Indices showing the level of individual needs for each intersection and maps showing the top 20 intersections for each of the seven performance measures can be found in Appendix B and Appendix C, respectively.

Solution Budget Breakpoint Validation

Solution budgets are estimates of the maximum level of investment that is warranted for an intersection project for it to meet a return on investment. The solution budgets are based on existing delay and crash costs accruing at each intersection. Intersections with high solution budgets have a higher number of crashes, potentially more severe crashes, and more delay than those with lower solution budgets. These higher user costs are indicative of more potential benefits that projects can produce. Thus, locations with higher solution budgets are more appropriate for higher levels of investment.

Figure 15. Solution budgets by tier.

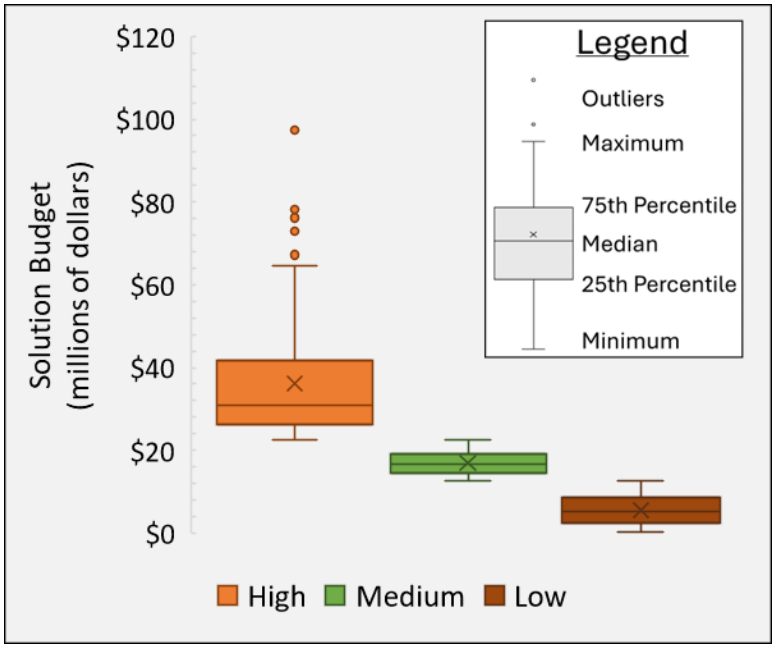


Figure 15 shows the distributions of intersection solution budgets grouped by intersection tier. Generally, intersections with larger solution budgets were in the high tier and those with smaller solution budgets were in the low tier. Approximate ranges for solution budgets that are representative of most intersections in each tier are listed below:

- High: $22 million and over
- Medium: $11 million – $22 million
- Low: <$1 million – $11 million

A key finding showed that the top 75 percent of intersections in the high tier had a solution budget of at least $26 million, which suggests that a larger level of investment, akin to that of grade separation, is warranted for those locations. The medium tier also had a notable number of locations that could justify more significant levels of investment, with the top 25 percent of locations having a solution budget of at

least $19 million, signifying that many of the medium tier intersections have solution budgets near the top of the medium tier solution budget range.

Sensitivity Tests

Sensitivity tests were performed on the scoring results to test the volatility of intersection tiers from weighting certain performance measures more than others. Generally, intersections that scored highly by weighting each performance measure equally also did so across the various scoring methods applied in the sensitivity testing. A primary reason for high need intersections scoring consistently across the scoring methods is that intersections in the high tier required moderate-to-high scores for several performance measures, rather than only needing one high score and having minimal scores for the other measures. The findings from the sensitivity testing supported that high need intersections are likely to be identified as such regardless of common scoring approaches. Examples of sensitivity tests include:

- Reducing Total Delay Impact by one-half
- Doubling the impact of the SPACE score
- Doubling the impact of crash costs

Under these and other sensitivity test conditions the results of the intersection tiering results remain largely unchanged, and any changes that do occur only change tiers of intersections that were already "cusping" between medium and low.

Intersection Tiering Results

The tiering analysis resulted in 89 intersections out of the 518 evaluated in the study to be designated in the high needs tier, followed by 117 intersections in the medium tier and 312 intersections in the low tier. Figure 16 shows a map of intersections included in the study and their overall tier. A table consisting of tiers for each study intersection is available in Appendix B.

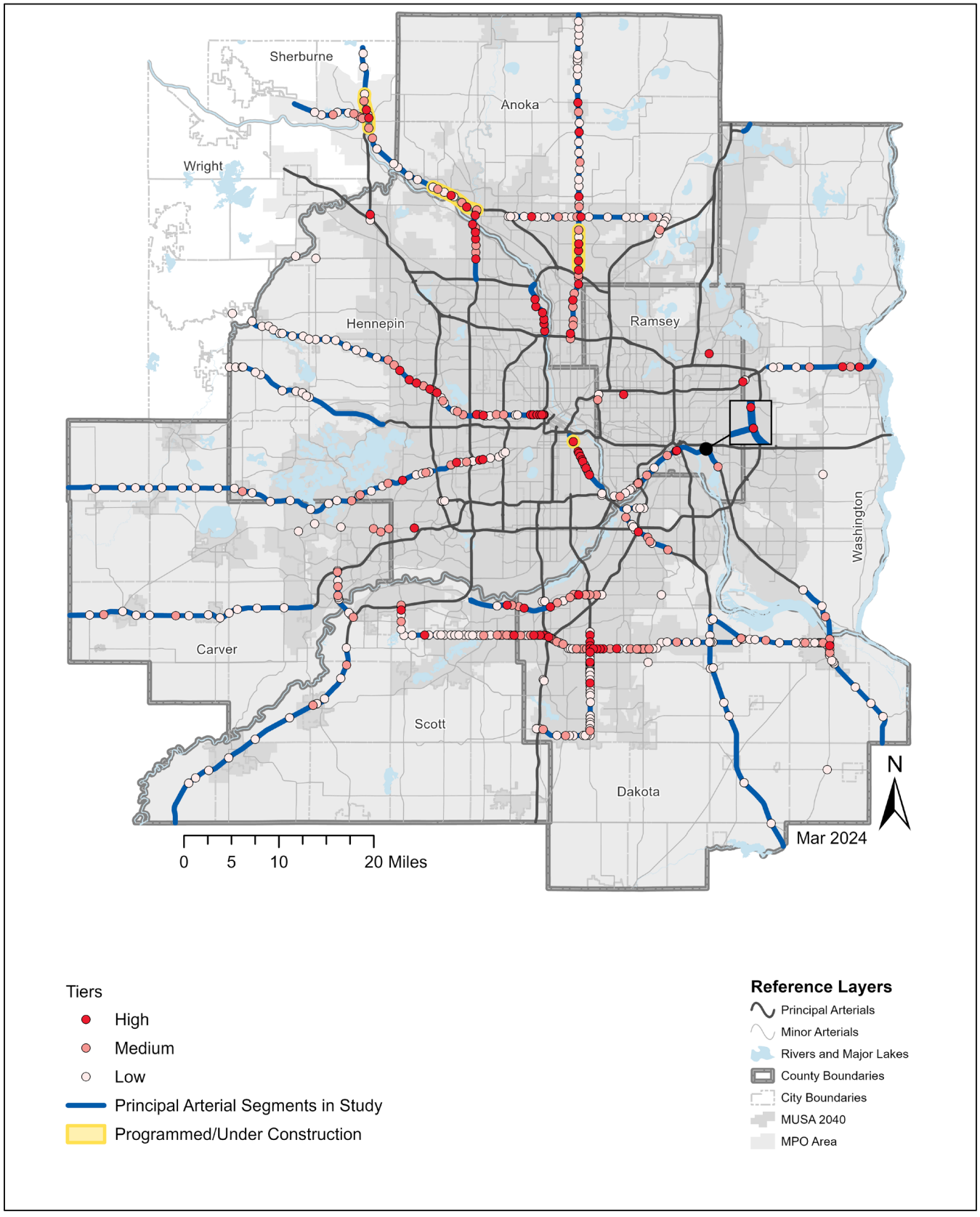
Table 10 displays the number of intersections in each tier by county. Most of the counties have intersections in each of the tiers. The distribution of tiers among counties correlates with the number of intersections studied. Some participating counties also submitted lists of intersections on non-principal arterial highways to be included in the analysis.

Table 10. Intersection tiers by county.

Tier	Anoka	Carver	Dakota	Hennepin	Ramsey	Scott	Sherburne	Washington	Wright	Total
High	15	15	0	21	38	7	4	2	0	**89**
Medium	20	20	8	41	20	7	11	7	0	**117**
Low	47	47	28	105	67	8	36	11	3	**312**
Total	**82**	82	36	167	125	22	51	20	**3**	**518**

Note that the tiering results reflect aggregated needs across the seven mobility, safety, multimodal, and equity performance measures. Understanding specific needs at intersections, regardless of their needs tier, could also be helpful for project decision-makers. For example, intersections that have a concentration of severe crashes could be prime candidates for investments into safety improvements. Identifying the types and severity of needs at each intersection, even if intersections don't have regionally high overall needs, can lead to enhanced prioritization of investments across the transportation system and rightsizing and refined scoping of solutions. A table that includes performance measure indices for each intersection and maps that show the top 20 intersections for each performance measure are provided in Appendix B and Appendix C, respectively.

Figure 16. Map of intersections by tier.



Corridor Sections

After identifying intersection tiers, 16 corridor sections that have concentrations of high tier intersections were identified (Table 11 and Figure 17).

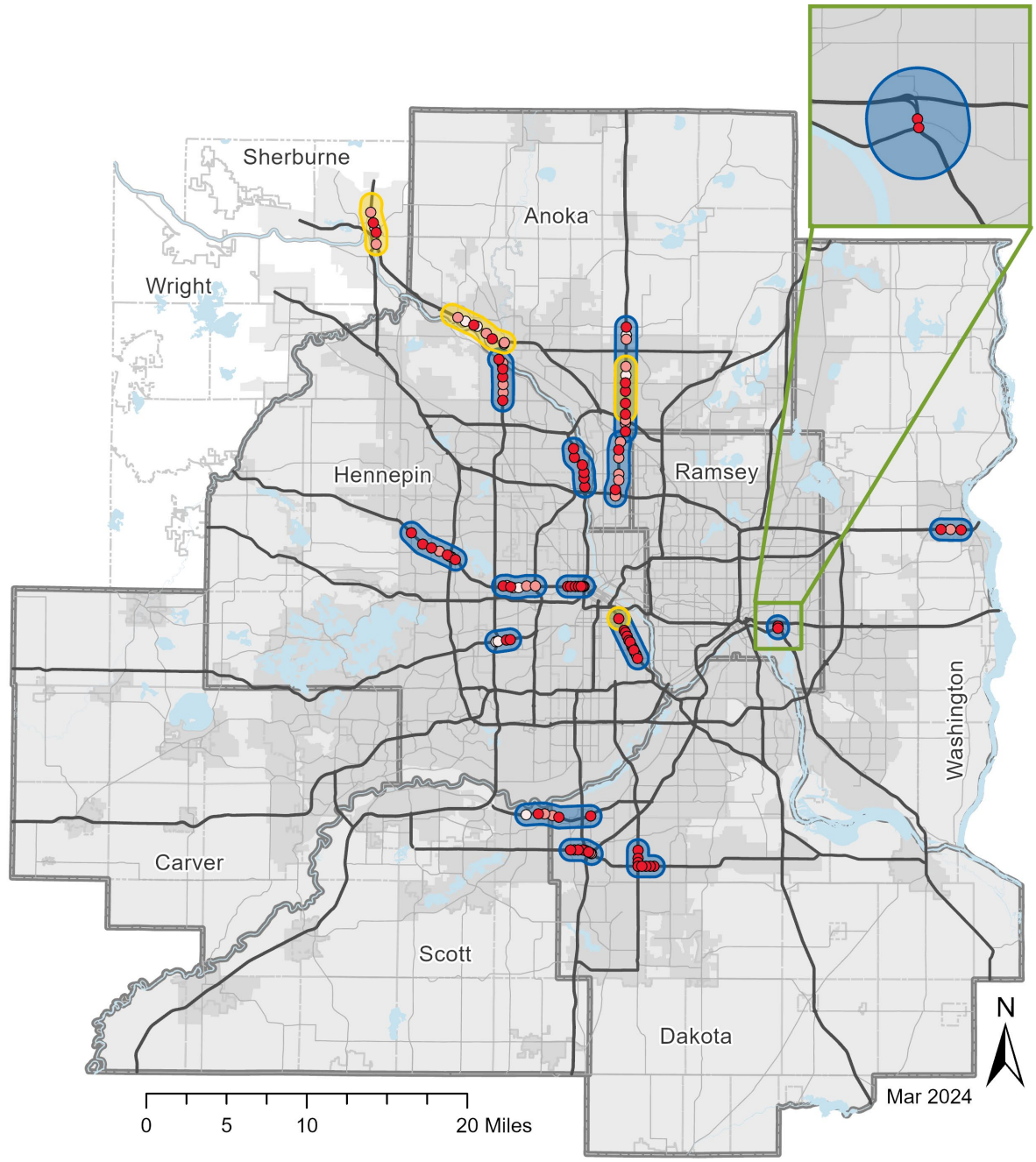
Table 11. Intersection counts for corridor sections.

Corridor	Number of Intersections
Trunk Highway (TH) 13: Quentin Ave to Washburn Ave	4
TH 252: 66th Ave to 85th Ave	6
TH 65: I-694 to CR 10	2
TH 65: 131st Ave to Bunker Lake Blvd	3
TH 55: CSAH 61 to CR 101 (Plymouth)	6
Cedar Ave: CSAH 42 to 138th St	3
CSAH 42: Cedar Ave to Flagstaff Ave	4
CSAH 42: CR 5 to I-35E (Burnsville)	4
TH 55: I-94 to Penn Ave (Olson Memorial Hwy, Minneapolis)	7
TH 55: TH 100 to General Mills Blvd (Golden Valley)	2
TH 61: Burns Ave to Warner Rd	2
TH 7: Blake Rd to Texas Ave	2
Shepard Rd (CH 36): Jackson St to Sibley St	2
TH 36 (Oak Park Heights): Washington Ave; Osgood Ave	2
TH 55: 46th St E to 26th St E (Hiawatha Ave, Minneapolis)	8
TH 169: 109th Ave to Dayton Rd (Champlin)	8

Corridor sections are groups of intersections that are in proximity to each other and have regionally significant and similar types of needs. The sections also contain medium and low tier intersections that are located within the concentrations of high need intersections, considering potential projects to address a concentration of high need intersections along a corridor may incorporate the needs of other adjacent intersections.

The tiering analysis identified 89 intersections with regionally significant needs. The analysis also helped shed light on the specific needs of all study intersections, which can assist project decision-makers in future planning and programming efforts. The high tier intersections were carried forward in the study for further evaluation, including how intersection needs compared to local project visions and potential steps and strategies for project implementation.

Figure 17. High tier corridors.



Tier
- High
- Medium
- Low
- Programmed/Under Construction
- Corridors

Reference Layers
- Principal Arterials
- Minor Arterials
- Rivers and Major Lakes
- County Boundaries
- City Boundaries
- MUSA 2040
- MPO Area

Stage 3: Where Are We Going Next?

Study Outcomes

The project identified 89 high need intersections throughout the Twin Cities region based on local agency input, the tiering results, and suggestions from regional highway partners and the CMP. At the time of this study, nine of these intersections had recently implemented projects, projects under construction, or fully funded projects. These projects are intended to address key intersection needs and be compatible with the local visions for each corridor. The list of the nine high need intersections with ongoing project work is provided below:

Highway 10 in the Cities of Anoka and Ramsey

- Fairoak Avenue
- Sunfish Lake Boulevard

Highway 55 (Hiawatha Avenue)

- 26th Street

Highway 65 in the City of Blaine

- 99th Street
- 105th Street
- 109th Street
- Viking Boulevard (data used in the needs assessment and tiering analysis reflects pre-project conditions)

Highway 169 in the City of Elk River

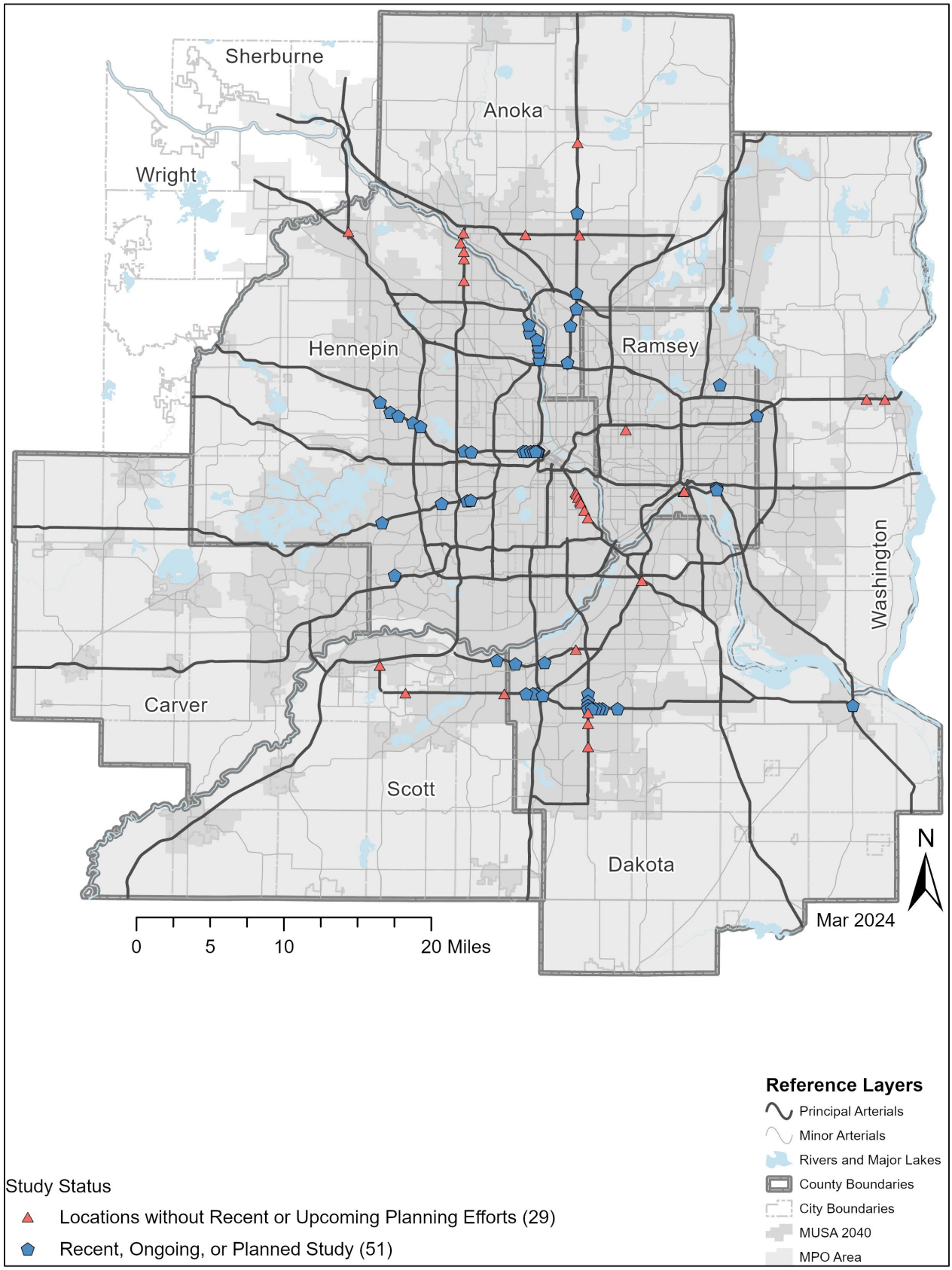
- Main Street
- School Street

The remaining 80 intersections were considered regional priorities for future investment. The section below provides a general outline for implementation and potential funding of projects for these locations.

Regional Priorities

The regional priority intersections make up locations with the largest needs for users of the at-grade transportation system in the Twin Cities Metro. The identified intersections were initially categorized based on the status of study efforts at those locations, as shown in Figure 18. Most of the intersections identified, 51 of 80, are part of a previous, active, or planned study process. The remaining 29 intersections justify additional investigation, either through local agency efforts or upcoming regional studies, considering the overall scores reflect regionally significant needs at those locations.

Figure 18. Status of regional priority intersections.



Implementation Plans

The regional priority intersections were grouped based on their potential to be addressed in a single or interconnected project effort. Considerations in the groupings included the current study status of intersections and the need types and severities identified in the needs assessment and tiering analysis. Generally, these groupings aligned closely with the corridor sections identified in the tiering analysis.

The implementation plans were intended to provide local agencies with a summary of study outcomes to assist with future project planning and decision-making. More specifically, the key objectives of the implementation plan were to outline the status and next steps in the project development process, identify the primary needs to be addressed by potential projects, compare the local visions with key needs, and determine potential funding opportunities.

Information pertaining to the project development process status, location needs, and local vision were assembled using outcomes from earlier parts of the study. Existing funding opportunities were summarized for size requirements, merit criteria (transportation problems or solutions that are the focal points of specific grant programs) and typical project types awarded and were compared to the grouped regional priority intersections.

Funding Sources

Transportation projects have many potential funding sources, but regional and federal grants can be one of the primary sources if the projects meet the qualifications for those programs. The number and size of grant programs increased considerably after the Bipartisan Infrastructure Law passed in 2021. Available funding has increased, but grant programs are becoming increasingly selective as the number of applications increases. Study results have already been utilized by MnDOT to include in a successful Reconnection Communities federal planning grant for Highway 55 from Minneapolis to Medina.

Projects can be eligible for a grant program but may not address selection criteria to the extent to be competitive in the application pool. Although each grant program is different and continually changing, projects that reduce severe and fatal crashes, implement solutions that significantly reduce travel time and emissions, or provide benefits to historically disadvantaged communities are usually the most competitive. Viable projects will also likely demonstrate significant need in multiple needs categories (e.g., mobility, safety, emissions, etc.).

Figure 19 displays the grouped regional priority intersections and their potential competitiveness in different grant programs. Some of these projects have local visions that could include multimodal or transit investments. There are additional state and grant opportunities other than those that are listed for those project types. The program ratings are based on a high-level assessment of locations' needs and relevance to grant program selection criteria. However, local agencies may have more intimate knowledge of funding programs and respective project qualifications. Thus, the list in Figure 19 should only serve as a general guide for funding opportunities.

Potential funding sources were identified for the 52 intersections that have either completed or initiated a study process. Projects addressing the needs of the other 29 identified regional priority intersections have yet to begin a formal planning process, but many of these projects may begin that process soon. It is recommended that regional priority intersections not yet involved in a planning process should be considered for further study and potential project development.

Figure 19. Regional priority location funding opportunities.

Corridors/Locations	Federal Grants			Regional Solicitation	
	RAISE	INFRA	Small INFRA	Strategic Capacity	Spot Safety & Mobility
TH 13: Quentin Ave to Washburn Ave	◑	●		●	
TH 13 & Nicollet Ave	●		●		●
TH 252: 66th Ave to 85th Ave	◕				●
TH 65 & 93rd	◑		●		●
TH 65: CR 10 to TH 10	◕	●		●	
TH 65: I 694 to CR 10	◕				●
TH 65: 131st to Bunker Lake Blvd	◑		◕	●	
TH 55: CSAH 61 to CR 101 (Plymouth)	◑				●
Cedar Ave: CSAH 42 to 138th St	◑				●
CSAH 42: Cedar Ave to Flagstaff Ave	◑				●
CSAH 42: CR 5 to I-35E (Burnsville)	◑		◕		●
TH 36 & TH 120 (Century Ave)	◕		◕	●	
TH 5 & CSAH 4	●		◑		◕
TH 61: Burns Ave to Warner Rd	◑		◑		◕
TH 7 & CSAH 101	◑		◑		◕
TH 7 & Hopkins Crossroad	◑				◑
Shepard Rd (CH 36): Jackson St to Sibley St	●				◑
TH 10: TH 169 to Jarvis St	◔		◔		
TH 36 (Oak Park Heights): Washington Ave; Osgood Ave	◑				◔
TH 169: Ferry St & Main St	◑		◕		◕

Additional detail on various funding sources for intersection projects in the Twin Cities region are provided below.

- **Highway Safety Improvement Program (HSIP)** – A core federal aid program focused on intersections and corridors with safety needs that are high for the region. It is a competitive program.
- **Multi Project Discretionary Grant Program (MPDG)-Mega** – MPDG-Mega is a federal grant program designed for large projects that have regional impacts. Mega grants are competitive and the criteria for selection focus more on overall project value than a specific project element or type. The minimum cost is $100 million and the ask maximum is 60% of the cost with a projected max of 80% of total cost.
- **Rebuilding American Infrastructure with Sustainability and Equity (RAISE)** - RAISE discretionary grants help project sponsors like local municipalities, state and Tribal governments, etc., complete critical infrastructure projects. RAISE allows project sponsors to obtain funding for projects that may be harder to support through other U.S. DOT grant programs.
- **Reconnecting Communities and Neighborhoods (RCN) Program** - Reconnecting Communities and Neighborhoods is a combination of two major discretionary grant opportunities. The Reconnecting Communities Pilot (RCP) and Neighborhood Access and Equity (NAE) Programs.

- **Regional Solicitation** – Roadway Reconstruction/Modernization, Transit Expansion, and Transit Modernization application programs.
- **Safe Streets for All (SS4A)** – Planning and construction grants that supply funds for safety improvements. It varies from $200,000 to $10 million.
- **Strengthening Mobility and Revolutionizing Transportation (SMART)** - Projects that employ high-tech solutions that affect safety, mobility, or transit would qualify for this grant program, and, depending on the project, could be competitive. $2 million is the award size, but that could increase.
- **Transportation Economic Development Program (TED)** – Provides competitive grants to state highway construction projects that produce observable economic benefits.
- **Transportation Economic Development Infrastructure (TEDI)** – Projects need to connect improvements to specific job creation or other specific economic changes. Funding is usually less than $1,000,000.

By identifying funding opportunities, this study aims to support local agencies in finding funding and more readily address corridor needs. Individual implementation plans for grouped regional priorities were created to serve as a summary of relevant findings for local agency partners. The implementation plans are provided in Appendix D.

The outcomes of this study are intended to support the goals of the TPP by identifying the region's highest priority intersections based on mobility, safety, multimodal, and equity needs. Furthermore, broader recommendations on next steps for project implementation and potential funding opportunities should allow local agency partners to progress towards bettering the transportation system for users across the region.

Appendix

Appendix A: Local Agency Priorities

Table 12 shows a summary of comments from interviewees regarding the corridors in their jurisdiction, organized by county.

Table 12. Local agency priorities by county.

County	Corridor	Location	Local Vision	Discussion
Anoka	Highway 10	Ferry St to Ramsey Blvd	Reclassification and possible grade separation	Grade separations between Fairoak Ave and Ramsey Blvd are fully funded. TH 10 is under construction between Ferry St and Thurston Ave in 2023. TH 10 will be grade separated above Thurston Ave and the signal on Thurston Ave will be replaced with a roundabout. TH 10 will also be grade separated above Fairoak Ave, eliminating access. The Main St intersection ramps will receive roundabouts for on/off access. Verndale Ave access will be eliminated. The TH 10/Ferry St interchange will become a Single Point Urban interchange.
Anoka	Highway 65	Highway 10 to Bunker Lake Blvd	Grade separation	The county prioritizes grade separation between 99th Ave and 117th Ave (awarded Corridors of Commerce funding), and between 129th Ave and Bunker Lake Blvd. Recently, MnDOT conducted a study on this stretch of TH 65.
Anoka	Highway 65	I-694 to Highway 10	Multimodal and at-grade improvements	Pedestrian crossings on TH 65 are important to elected officials.
Carver	Highway 5	Highway 5 and Victoria Dr	Reclassify/safety audit	This intersection is a low priority on TH 5 for Carver County. They have a medium-term vision for safety improvements and anticipate development near this intersection.
Carver	Highway 5	Highway 5 and Rolling Acres Rd	Reclassify/safety audit	This is a low priority for Carver County. They received a $10 million grant via the Regional Solicitation to reconstruct this intersection and expand its 4-lane capacity to the east. This project would include expansion at Minnewashta Pkwy and the Arboretum.
Carver	Highway 5	Highway 5 and Highway 41	Reclassify/safety audit	This is Carver County's highest priority on TH 5. This intersection is not a candidate for grade separation due to commercial use density, protected land restrictions from the Arboretum, and the need for access to the east.
Carver	Highway 212	County Rd 51	Grade separation	This intersection has received funding from MnDOT Highway Freight Program funds. The county is looking to grade separate this intersection due to a recent fatal crash. The project is proposed to begin in 2024.
Carver	Highway 212	Highway 5 to County Rd 53 (Norwood Young America to Cologne)	4-lane roadway	This roadway is presently undergoing capacity expansion, driven by development and system planning. On TH 212, this is Carver County's main priority.
Dakota	Cedar Ave (Apple Valley)	Cedar Ave: County Rd 42 to 138th	At-grade improvements	The city of Apple Valley does not envision grade separation at 147th St.
Dakota	County Rd 42 (Apple Valley)	County Rd 42: Cedar to Flagstaff	At-grade improvements	New developments are driving the need for at-grade improvements in this area.
Dakota	County Rd 42 and Cedar Ave (Apple Valley)	County Rd 42 and Cedar Ave	Grade separation	There was a recent fatal pedestrian crash at this intersection. Multiple serious injury crashes at this intersection recently have involved cyclists and/or pedestrians. A CSAH 42 corridor study identified significant improvements needed at this intersection.
Dakota	County Rd 42	County Rd 5 to I-35E (Burnsville)	Grade separation/ reconfiguration	There is a 2040 Management Plan published in 2022 for this roadway between Burnsville, Apple Valley, and Rosemount.
Dakota	Highway 13 (Savage to Burnsville)	Chowen Ave to Washburn Ave	Grade separation	Freeway conversion and grade separation is Dakota County's ideal vision between these intersections, which was awarded Corridors of Commerce funding.
Dakota	Highway 13 (Burnsville)	Nicollet Ave	Grade separation	This is one of Dakota County's transportation improvement priorities and has received Regional Solicitation funding.
Dakota	Highway 52	190th St	Possible access reduction	This intersection has multimodal needs. Dakota County is assessing the need for access as it is difficult for agricultural vehicles to move along TH 52.
Dakota	Highway 52	200th St	Possible access reduction	This intersection has multimodal needs. Dakota County is assessing the need for access as it is difficult for agricultural vehicles to move along TH 52.
Dakota	Highway 52	250th St	Possible access reduction	This intersection has multimodal needs. Dakota County is assessing the need for access as it is difficult for agricultural vehicles to move along TH 52.
Dakota	Highway 55	Highway 55 and Argenta Trl	Grade separation	Dakota County is interested in pursuing grade separation at this intersection.
Hennepin	Highway 5	Highway 5 and County Rd 4	Reclassification and possible grade separation	Hennepin County supports Carver County's vision to reclassify TH 5 as a principal arterial, particularly considering this intersection in Eden Prairie.
Hennepin	Highway 55	County Rd 61 to County Rd. 101 (Plymouth)	Expansion / Intersection Improvements	There is a BRT feasibility study underway in Plymouth as of Summer 2023. Plymouth City Council wants to pursue grade separation at CR 61, Vicksburg Ln, and Fernbrook Ln.
Hennepin	Highway 55	46th St E to 26th St E (Hiawatha)	N/A	There is funding for constructing expanded curbs/pedestrian areas at 46th St. Hennepin County is concerned with safety on the pedestrian/bike trail running parallel to TH 55 and the SWLRT track.
Hennepin	Highway 55	County Rd. 73	N/A	The city of Plymouth is planning improvements at this intersection in 2025, including updates for a bus stop, realignment with TH 55, and raising TH 55 by 11 feet to be in line with the station.

County	Corridor	Location	Local Vision	Discussion
Hennepin	Highway 55	Greenfield Rd	N/A	The city of Greenfield reports a high crash rate at this intersection. They would need State Aid sponsorship from Hennepin County to apply for funding since they have fewer than 5,000 residents.
Hennepin	Highway 7	Highway 7 and County Rd. 101	Possible grade separation	The city of Minnetonka is considering grade separation at this intersection if this option is not pursued at Vine Hill Rd. The main impetus is moving students to and from Minnetonka High School near this intersection.
Hennepin	Highway 7	Highway 7 and Hopkins Crossroad (CR 73)	Pedestrian grade separation	This intersection has received funding for improvements, including grade separation for bikes and pedestrians and transit stop realignment.
Hennepin	Highway 7	Woodland Rd	N/A	The city of Minnetonka recently purchased land near this intersection in preparation for a potential interchange project.
Hennepin	Highway 7	Oakridge Rd to Texas Ave (St Louis Park)	N/A	Many vehicles and pedestrians cross TH 7 to access the Knollwood Mall. There was a recent pedestrian fatality on Texas Ave. The city of St. Louis Park notes poor visibility and a high westbound rear-end crash rate at Texas Ave.
Hennepin	Highway 252	66th Ave to Brookdale Dr	Multimodal	This stretch of TH 252 is a high priority for the city of Brooklyn Center. An EIS is being conducted for the corridor to determine solutions.
Hennepin	Highway 12	Country Rd. 83 to Baker Park Rd (Maple Plain)	Redevelopment opportunities	Budd Ave shows a moderate safety need. The city of Maple Plain is considering shifting traffic to Maple Ave instead of Budd Ave, which would require reconstruction. They recently redeveloped the TH 12/Budd Ave/Main St intersection area to improve pedestrian facilities.
Ramsey	Highway 61	Highway 61 and County Rd E	N/A	This signalized intersection was recently under construction.
Ramsey	Highway 61	Burns to Warner	Grade separation	This is a high traffic stretch of TH 61. Burns Ave connects two neighborhoods across the highway, at grade. TH 61 is a barrier for cars, bikes, and pedestrians on Burns Ave.
Ramsey	Highway 61	Lower Afton Rd (County Rd 39)	Intersection improvement	This is an unsignalized intersection. A Metro Transit Park and Ride is located near this intersection.
Ramsey	Highway 36	Highway 36 and Highway 120 (Century Ave)	Grade separation	This is an at-grade signalized intersection. MnDOT recently completed a PEL study recommending grade separation.
Ramsey	County Rd 36 (Shepard Rd)	Jackson St & Sibley St	Intersection improvements	This is a primary pedestrian connection to the river. This intersection floods often in the spring.
Ramsey	Highway 280	County Rd B to Broadway	Access reduction	Pedestrian access across TH 280 is important, though the county prioritizes removing vehicle access points.
Scott	Highway 13 (Savage to Burnsville)	Quentin Ave to Lynn Ave	Grade separation	Lynn Ave is a medium-tier intersection on TH 13, which will be improved as part of the Corridors of Commerce project. There is an ongoing multimodal project at Dakota Ave. to the west.
Scott	Highway 169 (Jordan to Belle Plaine)	County Rd 282 to Meridian St	Grade separation and at-grade improvements	The county plans to grade separate Creek Dr in Jordan in 2024. They want an overpass at Red Rock Dr/CR 14. Their long-term plan is to connect Bluff Dr to 173rd Ave via an overpass. Other construction plans include CR 3, CR 8 realignment, CR 9/CSAH 282, CR 59, and Delaware Rd.
Scott	County Rd. 42	Highway 13	Grade separation and access reduction	The county purchased some properties surrounding this intersection to prepare for access removal. The volume of traffic necessitates grade separation over an alternative interchange design.
Sherburne	Highway 169	Main St to 193rd (Elk River)	Grade separation and access reduction	Access reduction at 5th St is scheduled for 2023. Interchange projects at School St and 193rd Ave are scheduled for 2023. Grade separation at Main St is scheduled for 2024.
Sherburne	Highway 10	Highway 169 to Jarvis St	Grade separation	Multiple access closures are proposed on TH 10 between 173rd Ave and Jarvis St. The city of Elk River proposes 2 interchanges, near 167th Ave and Adam St. They also want to grade separate a pedestrian trail from TH 10 downtown.
Washington	Highway 36	Highway 36 and Highway 120 (Century Ave)	Grade separation	This is an at-grade signalized intersection. MnDOT recently completed a PEL study recommending grade separation.
Washington	Highway 36	Oak Park Heights	At-grade and multimodal	Washington County is negotiating with Oak Park Heights to create a roadway extension of 59th St to form better connections around the TH 36/TH 95 interchange.
Washington	Highway 36	Grant/Lake Elmo	Grade separation	CR 17/Lake Elmo Ave is the county's top priority and has received Regional Solicitation funds. They envision grade separation at Demontreville Trl. MnDOT wants to close access to Keats Ave.
Washington	Highway 61	Kimbro to Point Douglas Dr	Multimodal at-grade improvements	The county wants to either close or convert to right-in right-out at Kimbro Ave. There are many small neighborhood connections in this area driving the need for multimodal at-grade improvements.