METROPOLITAN COUNCIL

REGIONAL BICYCLE BARRIERS STUDY

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Background and Purpose

In 2015, the Regional Bicycle Transportation Network (RBTN) was adopted into the Metropolitan Council's 2040 Transportation Policy Plan (TPP). The RBTN established the bicycle transportation corridor and alignment priorities for regional planning and investment in the Twin Cities. The RBTN's goal is to establish an integrated network of on-street bikeways and off-road trails to improve conditions for bicycle transportation at the regional level. The TPP will be updated to include results from this Regional Bicycle Barriers Study.

The Metropolitan Council conducted the Regional Bicycle Barriers Study (Study) to examine the major *physical* barriers to bicycling in the seven-county Twin Cities region; these barriers include the region's freeways and expressways, rivers and streams, and rail corridors. From there, the Metropolitan Council prioritized points along these barriers where the potential need for new crossings (i.e., bridges and underpasses) or improved at-grade intersection crossings on planned bikeways is the greatest.

In addition to the regional bikeway corridors and alignments identified in the RBTN, the Study considered local bikeway networks and their barrier crossing needs. These areas included locations where a barrier intersected with a local planned bikeway, a RBTN corridor or alignment, and/or a collector roadway. A series of potential barrier crossing points were identified and analyzed; the final point locations were determined with assistance from a technical advisory work group of bicycle transportation professionals and advocates, from input received from two focus group sessions with area cyclists representing a variety of backgrounds, and from results of an interactive, online map survey.

This identification and prioritization process happened thanks to a robust, data-driven approach and coordination with city, county, state, and parks agency planning and engineering staff. The Study will be documented in the forthcoming *2040 Transportation Policy Plan Update,* which sets policies for the region's transportation system used for planning and investment direction.

The purpose of this final study report is to summarize the methodology used to prioritize barrier crossing improvement opportunities, and to explain and document the results of the prioritization process. The study analysis was informed by a methodology developed through the National Cooperative Highways Research Project 803 (NCHRP 803). The methodology uses weighted factors (e.g., bicycling demand and network connectivity) to determine overall priority score rankings of individual barrier crossing opportunity locations. Individual factors were assigned unique variables to quantify and tabulate overall factor scores, which were then compiled to produce overall priority scores for each analysis point.

Stakeholders

Project stakeholders included a Technical Advisory Work Group (TAWG), a Project Management Team (PMT), participants in two bicyclist focus groups, and members of the general public who weighed in via an online WikiMap survey.

TECHNICAL ADVISORY WORKING GROUP

The TAWG met six times during the Study's duration, providing invaluable discussion and feedback on the prioritization factors, measures and barrier crossing improvement points included for analysis. Table 1 lists the TAWG meeting dates and topics.

Table 1: Technical Advisory Working Group Meeting Dates and Topics

Date	Topic
November 2016	Study approach, analysis parameters, factors, and measures
December 2016	Preferred spacing, intro. to evaluation factors and measures
April 2017	Focus group results, factors, measures, and factor weights
May 2017	Analysis point development, factor measures, and calculations
July 2017	Draft barrier crossing points analysis results
October 2017	Final barrier crossing points analysis results, final review process

The TAWG included representation from:

Counties

- Anoka County
- Carver County
- Dakota County
- Hennepin County
- Ramsey County
- Scott County
- Washington County

Cities

- City of Chaska
- City of Maplewood
- City of Minneapolis
- City of New Brighton
- City of Richfield
- City of Saint Paul

State and Regional Agencies

- Metropolitan Council
- Minnesota Department of Transportation

Park Agencies

- Anoka County Parks
- Ramsey County Parks
- Three Rivers Park District

Advocacy Organizations

- Transit for Livable Communities
- Bloomington Bicycle Alliance

PROJECT MANAGEMENT TEAM

The PMT consisted of Metropolitan Council and Minnesota Department of Transportation Metro District staff. This team provided ongoing direction to the consultant team throughout the project.

FOCUS GROUPS

To gain detailed and meaningful input from people who bicycle in the region, the Metropolitan Council hosted two focus groups with stakeholders from various demographic, racial, and ethnic groups. One focus group identified potential participants from the core cities and suburbs that self-identified as avid bicyclists who regularly used bicycling as a form of transportation. A second focus group recruited people from disadvantaged communities or underrepresented racial and ethnic groups with some bicycling experience. Both focus groups were slightly more than half female, and each helped review ways to measure each prioritization factor and weight its relative importance.

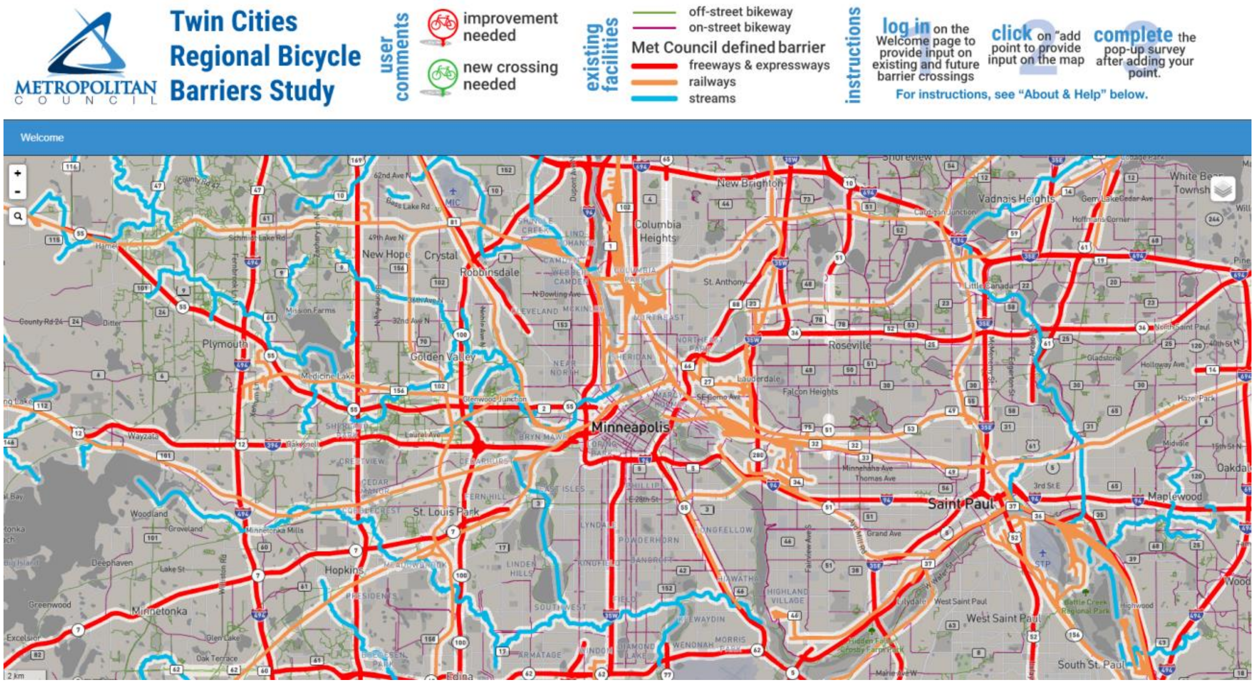
The focus groups had many suggestions (additional details are included in Appendix A: Focus Groups Summary), but two notable ideas were about the significance of direct routing and the large impact of rail operations where roadways crossed with railways. One participant who commutes from Burnsville to Bloomington shared stories of coworkers who had to bicycle to work at 5:30 a.m. because they had no other options. For these commuters, the most direct route over the Minnesota River was on the I-35W bridge, a reality that emphasized the need for direct access over barriers.

Another participant shared stories from their neighborhood about stopped/idling trains blocking three perpendicular roadway/rail crossings for long periods of time; this not only caused crossing delays, but sometimes resulted in unsafe behavior such as people carrying their bicycles between train cars to get through the crossing. In response to this observation, several existing roadway/rail crossings with known volumes of long and/or slow-moving trains were added to the analysis. Other feedback from focus group participants included an exercise to prioritize among four general analysis factors: network connectivity, safety/existing conditions, bicycling demand, and social equity.

GENERAL PUBLIC

Input from the general public and bicycling stakeholders, which came via an online interactive WikiMap (Figure 1, Regional Bicycle Barriers Study WikiMap), was used as a variable under the social equity and bicycling demand factors. Participants in the mapping exercise helped identify existing problem crossings of major barriers to identify potential sites where new crossings (bridges or underpasses) would be most beneficial. The more people that identified the same location as needing improvement, the higher its demand score. The online WikiMap survey produced 2,007 comments from 431 participants. The Metropolitan Council distributed the WikiMap survey through email lists as well as through cycling-specific and neighborhood groups on Facebook.

Figure 1: Regional Bicycle Barriers Study WikiMap

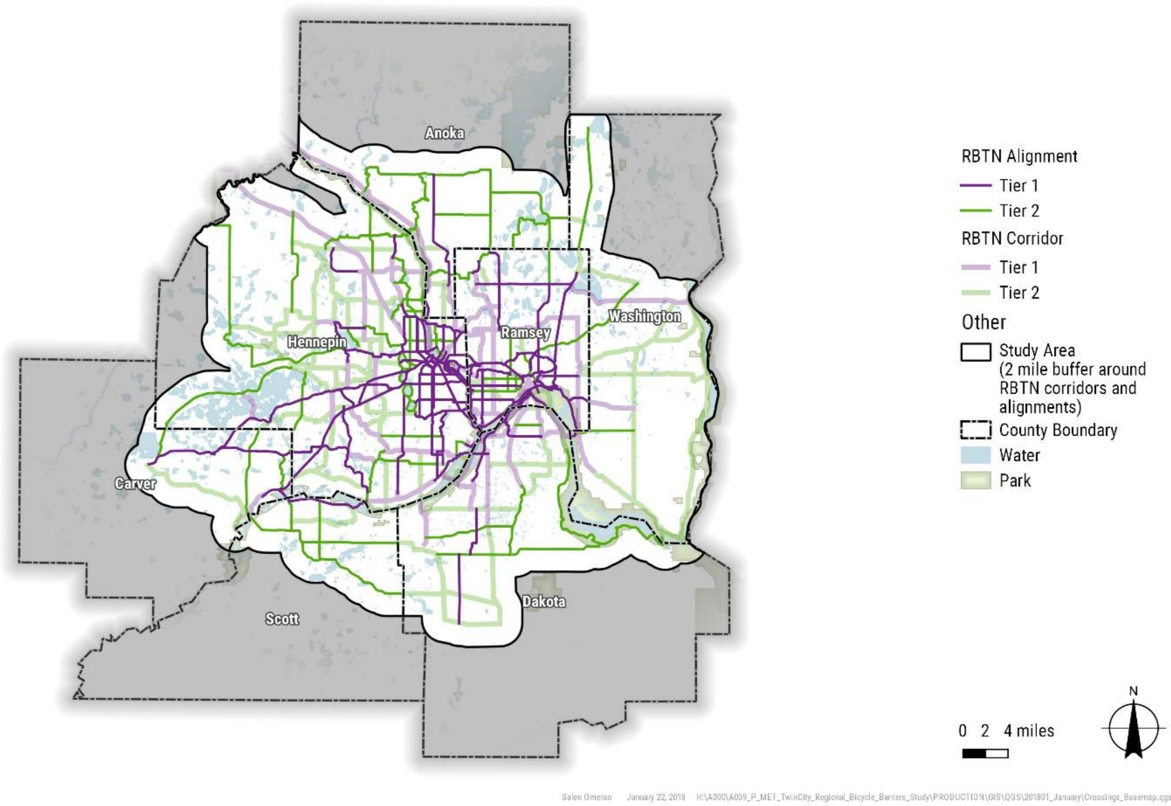


Participants in the WikiMap survey were also asked to complete a short, optional demographic survey. This information was used to track participation, and later in the project some of the information was used to weight some of the analysis measures. This is detailed in the *Identifying Variables* section later in this report.

Definition of Regional Barriers

The first step of the analysis was to define the Study area and the segments of physical bicycle barriers to be analyzed. The Study area focuses on the Regional Bicycle Transportation Network (RBTN) coverage area, which includes parts of all seven counties . The Study area was defined to include locations within and between existing RBTN corridors and alignments, plus one mile added to the outer periphery of the network. The RBTN corridors and alignments are routes that the Metropolitan Council's earlier Regional Bicycle System Study found to have higher levels of existing and potential bicycling demand. The defined Study area is shown in Figure 2.

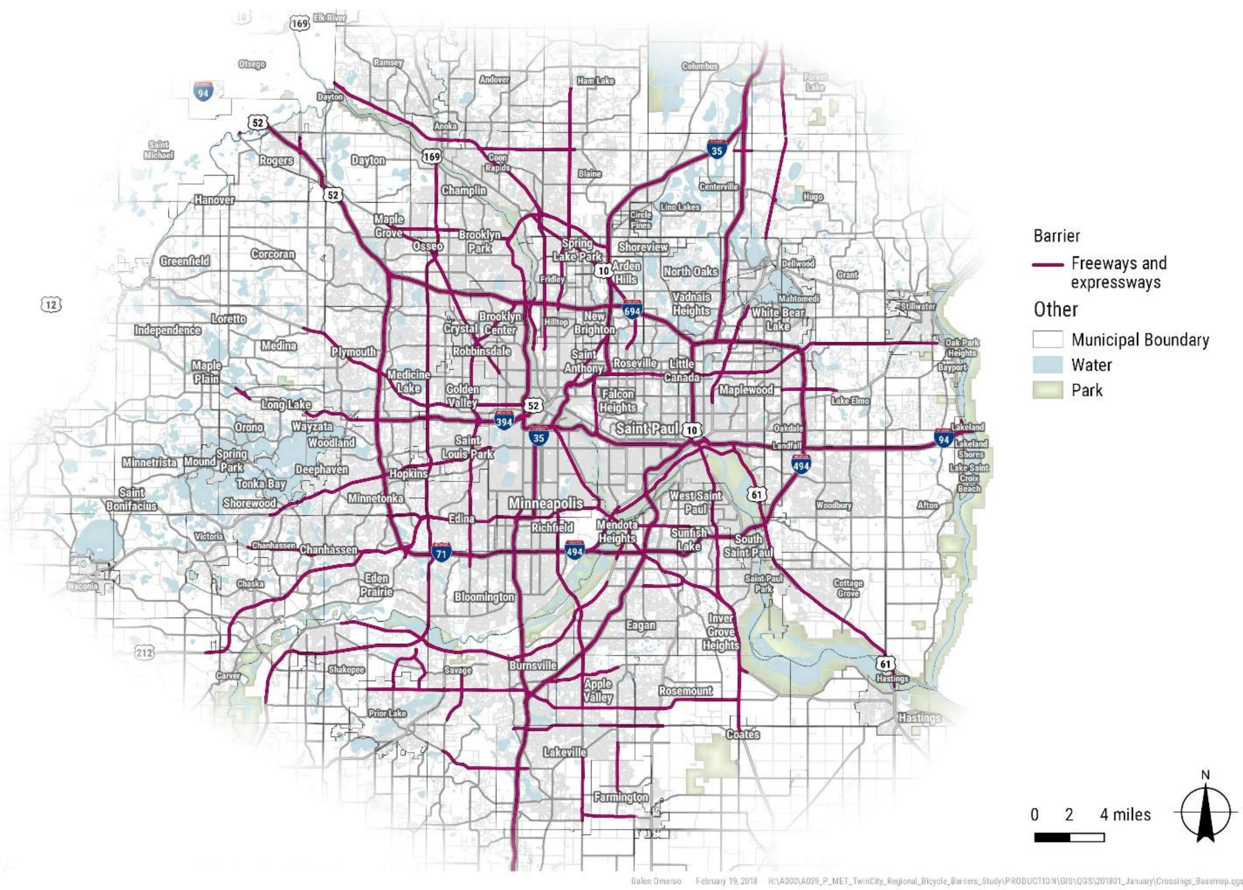
Figure 2: Regional Bicycle Barriers Study Area



The Study defined physical bicycle barriers to include second- and third-order rivers and streams, rail line corridors, and freeways and expressways.

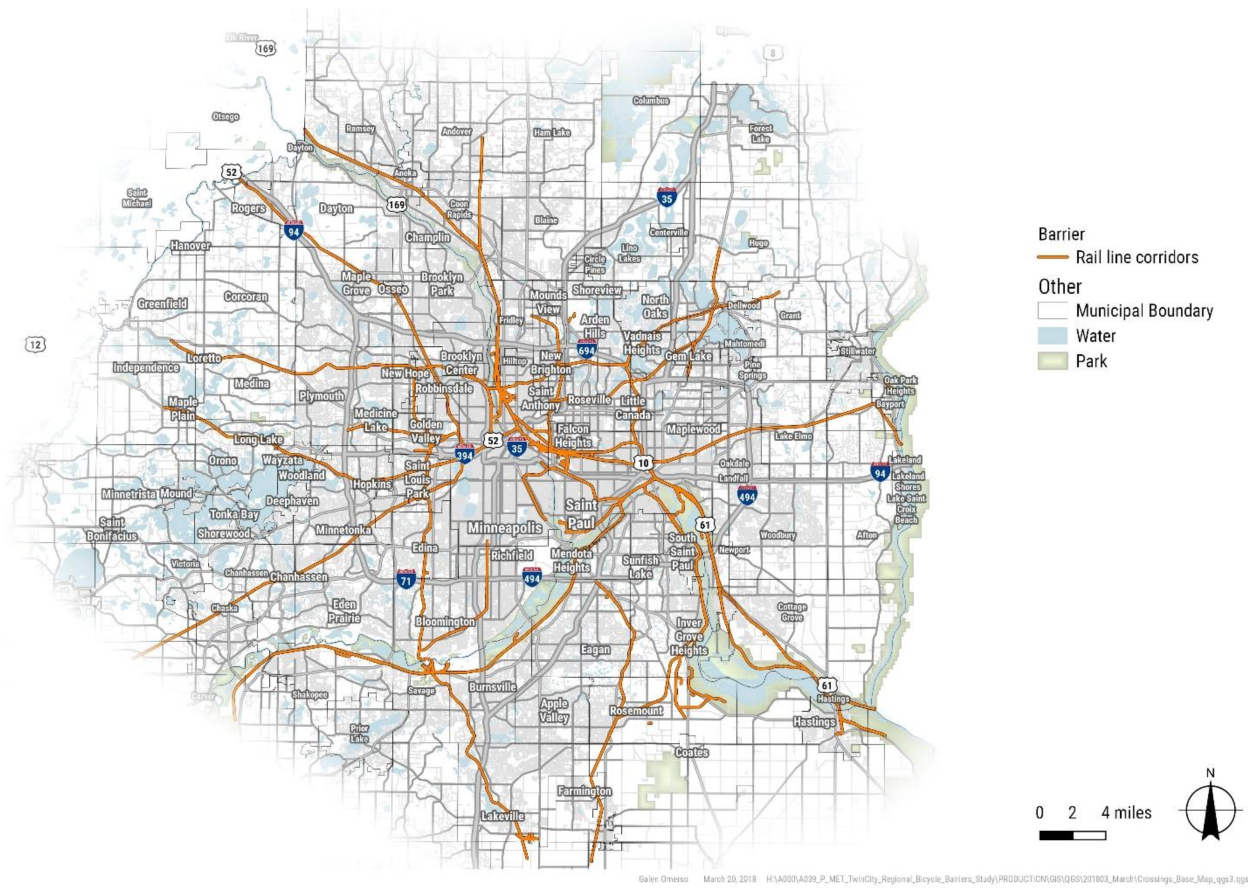
Freeways are highways with full access control, meaning motorists do not encounter any cross-road intersections. For the purpose of this study, expressways were defined to include the region's non-freeway principal arterials consisting of at least four lanes and divided by a median. In addition, minor arterial highway segments that shared these characteristics and were recommended for inclusion in the study by TAWG members were added to the expressways data layer. Expressways differ from freeways in that they have cross-road intersections with traffic signals and some partial stop sign-controlled intersections with right-turn-in/out-only access. Freeways and expressways included in the Study are shown in Figure 3.

Figure 3: Freeways and Expressways



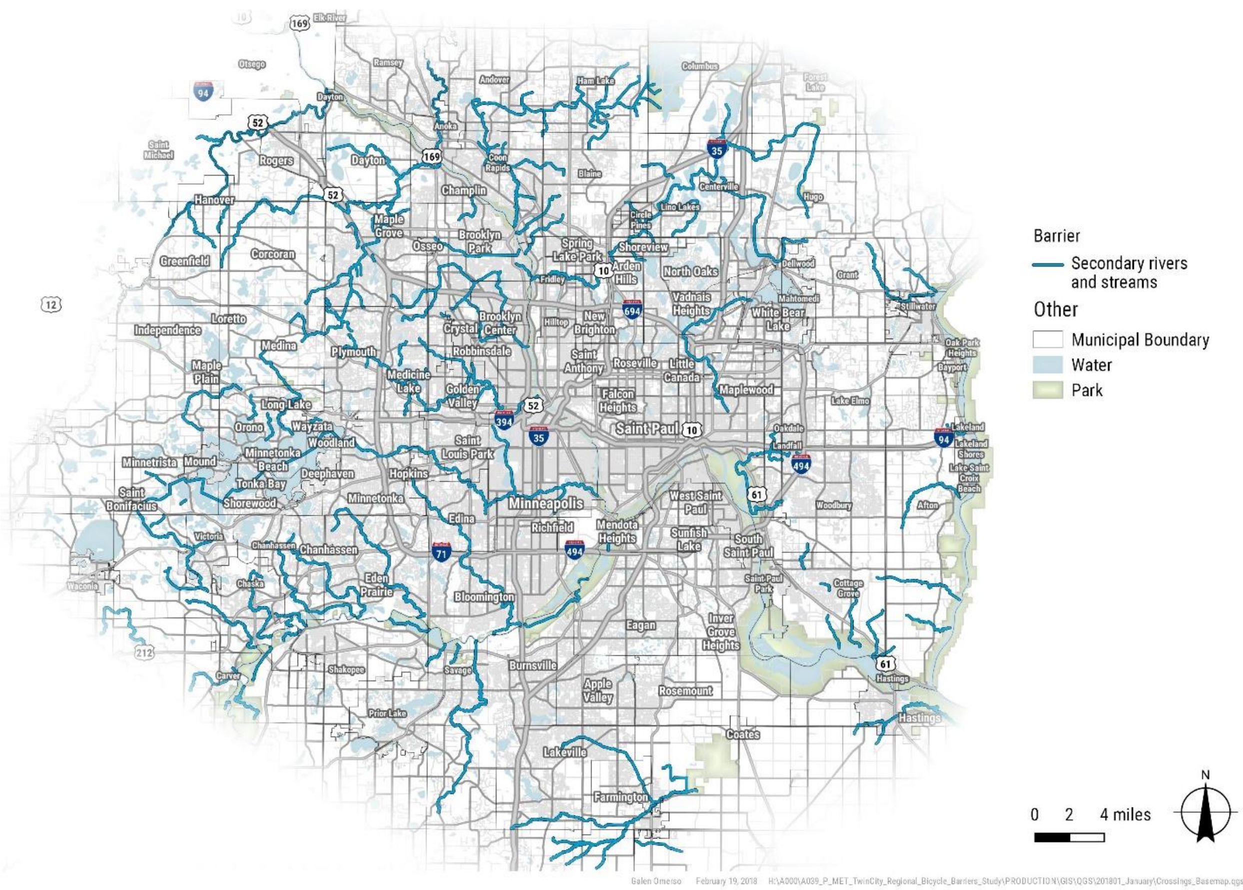
The region’s rail corridors are also included as barriers in this study. Rail corridors include Class I railroad mainlines, short line railroad corridors, rail yards, and rail lines with at-grade road crossings that experience long delays near rail yards due to switching operations (Figure 4).

Figure 4: Rail Corridors



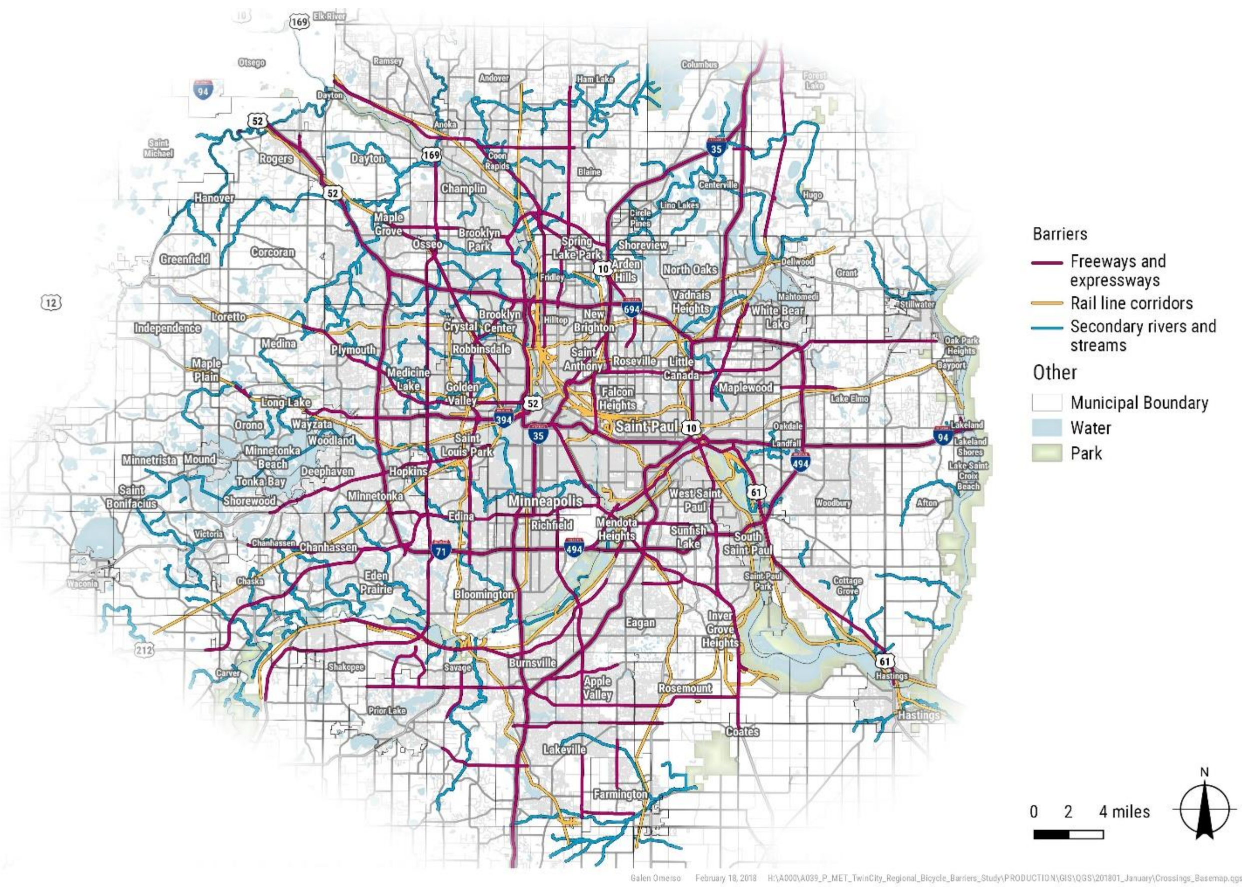
Rivers and streams included the main tributaries of the region's primary rivers, which are categorized as second- and third-order rivers and streams (Figure 5). The region's primary rivers (the Mississippi, Minnesota, and Saint Croix) were not analyzed in this Study because of the large differences in approach and scale that would be required for these major rivers compared to the other barriers. However, this Study (based on discussions with the TAWG) recognizes these major rivers as highly significant, and possibly the most challenging physical barriers to bicycling in the Twin Cities region. As such, they will be addressed in the Metropolitan Council's forthcoming *Transportation Policy Plan Update*.

Figure 5: Streams



The composite of all regional bicycle barriers included in the Study is shown in Figure 6.

Figure 6: Regional Bicycle Barriers



Identification of Barrier Crossing Analysis Points

PLAN-BASED POINT IDENTIFICATION

The second step of the analysis was to identify points along barrier segments that represented barrier crossing opportunities. These points were identified as locations where a barrier intersected with a local planned bikeway, a Regional Bicycle Transportation Network (RBTN) corridor or alignment, and/or a collector roadway. Locations with existing bikeways (as identified in the Metropolitan Council's regional bicycle system inventory compiled from city and county data throughout the region) were excluded. Minor or principal arterials that intersect a barrier at-grade were only analyzed if on a local or regional *planned* bikeway. Because this Study primarily focused on identifying opportunities to bike across *physical* barriers, bicyclist comfort levels at roadway or road/rail intersections (and thus bicycle facility type) were not evaluated. In addition, the lack of detail in available data and the extraordinary resources that would be required to analyze facility types across the region were prohibitive to that level of analysis. As a result, existing bikeways or existing local roads that intersected with a bicycle barrier were assumed to provide an adequate bike crossing.

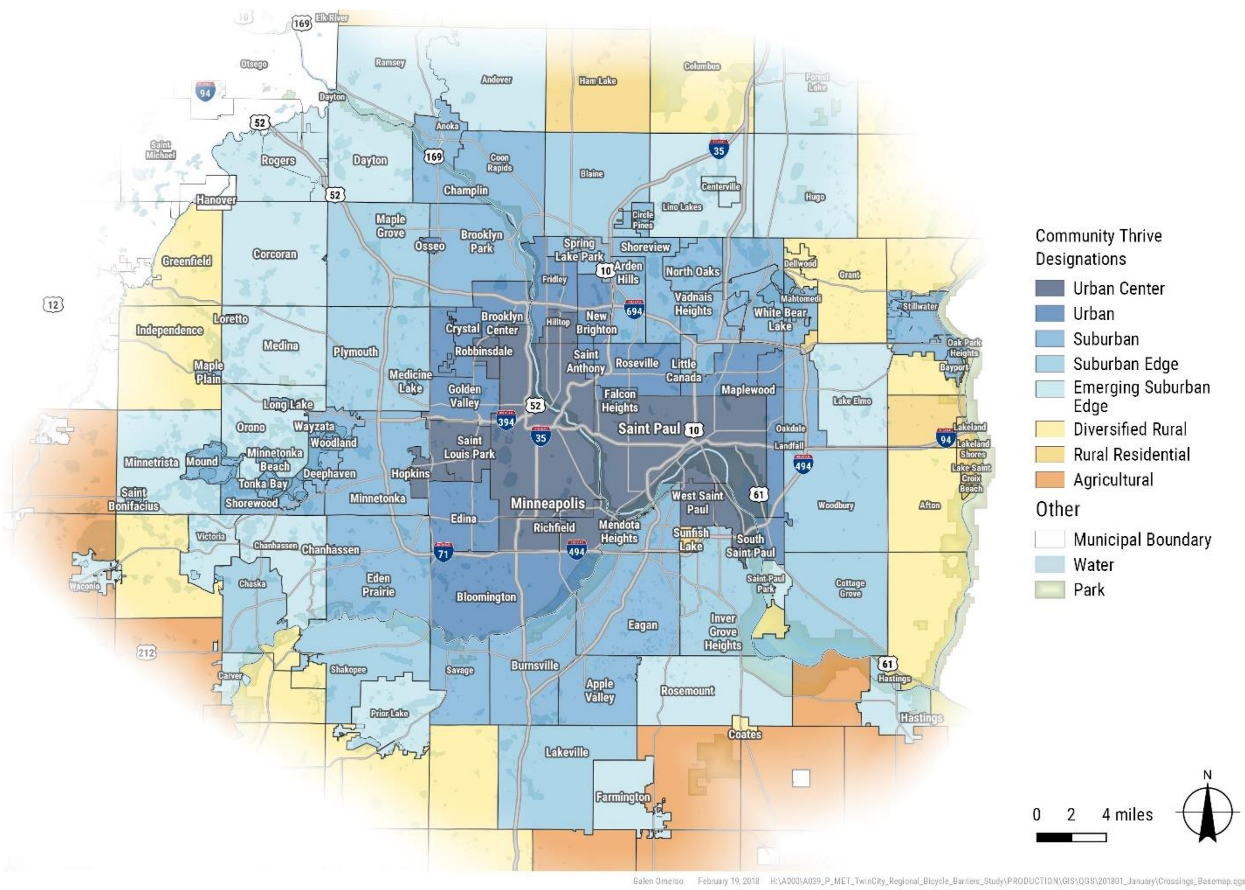
In the third step of the analysis, additional barrier crossing opportunity locations were identified based on input from the public and the iterative TAWG reviews. To offer an opportunity for the cycling public to provide direct input to the study, an online, interactive WikiMap survey was developed, displaying all streets and highways in relation to the identified regional barriers.

WikiMap survey respondents were invited to mark points where they desired new barrier crossings. All locations having at least two "votes" for a new barrier crossing were added to the potential barrier crossing points for analysis.

BARRIER CROSSING SPACING CRITERIA

The Metropolitan Council, with support from the PMT and TAWG, determined that there were areas where barrier crossing opportunities identified in the previous steps were spaced too far apart to achieve well-connected bicycle networks with regularly spaced barrier crossing locations. Through several discussions at TAWG meetings, criteria were developed to define preferred crossing spacing criteria; these were later used to add or adjust barrier crossing improvement points in the analysis. Bicyclist expectations and transportation networks vary with land use and density; therefore, preferred crossing frequencies should differ according to sub-regional context just as spacing of minor arterials and roadway bridges vary across the region.

Figure 7: Thrive MSP 2040 Community Designations, Aggregated to Four Groups



The eight community designations defined in the Metropolitan Council's *Thrive MSP 2040* regional plan (Figure 7) were aggregated into four groups (as shown in Table 2) to allow for the varying levels of expectation and need in the region's subareas. Draft spacing criteria were reviewed and revised by the PMT and TAWG. Table 2 summarizes the final preferred maximum spacing criteria as developed by the TAWG and applied in the Study.

Table 2: Preferred Maximum Spacing of Barrier Crossing Opportunities by Thrive MSP 2040 Community Designation

Thrive Community Designations	Preferred Maximum Spacing	Example Cities
Urban Center	½-mile	Minneapolis, Saint Paul, Richfield, Hopkins, South St. Paul
Urban	¾-mile	Golden Valley, Roseville, Maplewood, Crystal, Edina
Suburban, Suburban Edge, Emerging Suburban Edge	1 mile	Blaine, Woodbury, Maple Grove, Eagan, Lakeville
Diversified Rural, Rural Residential, Agricultural	2 miles	Grant, Afton, Ham Lake, Lake Elmo, Independence

Spacing Criteria Application

The preferred maximum barrier crossing spacing criteria were used to identify additional points for analysis as potential connections across physical barriers. The frequency of barrier crossing opportunities identified in steps one through three did not always meet the preferred spacing criteria, which left significant crossing gaps along some of the barriers. These spacing-generated points were advanced along with the other potential crossing improvement locations to the evaluation and prioritization stages of the analysis. This section details how the spacing criteria were applied to generate these additional analysis points.

A routing process was used to identify spacing-generated points by applying specific origin and destination points on either side of the barrier. Origin and destination pairs were placed at equal intervals along barrier segments based on the spacing criteria set for each Thrive community group. Each pair was then evaluated for how far a bicyclist would need to travel to get from one side of the barrier to the other. If there was an existing or potential crossing nearby, the resulting travel distance would be relatively small, and the spacing-generated point was removed from consideration because the nearby crossing opportunity already provided an adequately spaced connection. The distance used to search for crossings near a spacing-generated point origin/destination pair was dependent on the spacing criteria. The analysis was then repeated for additional locations along the barrier.

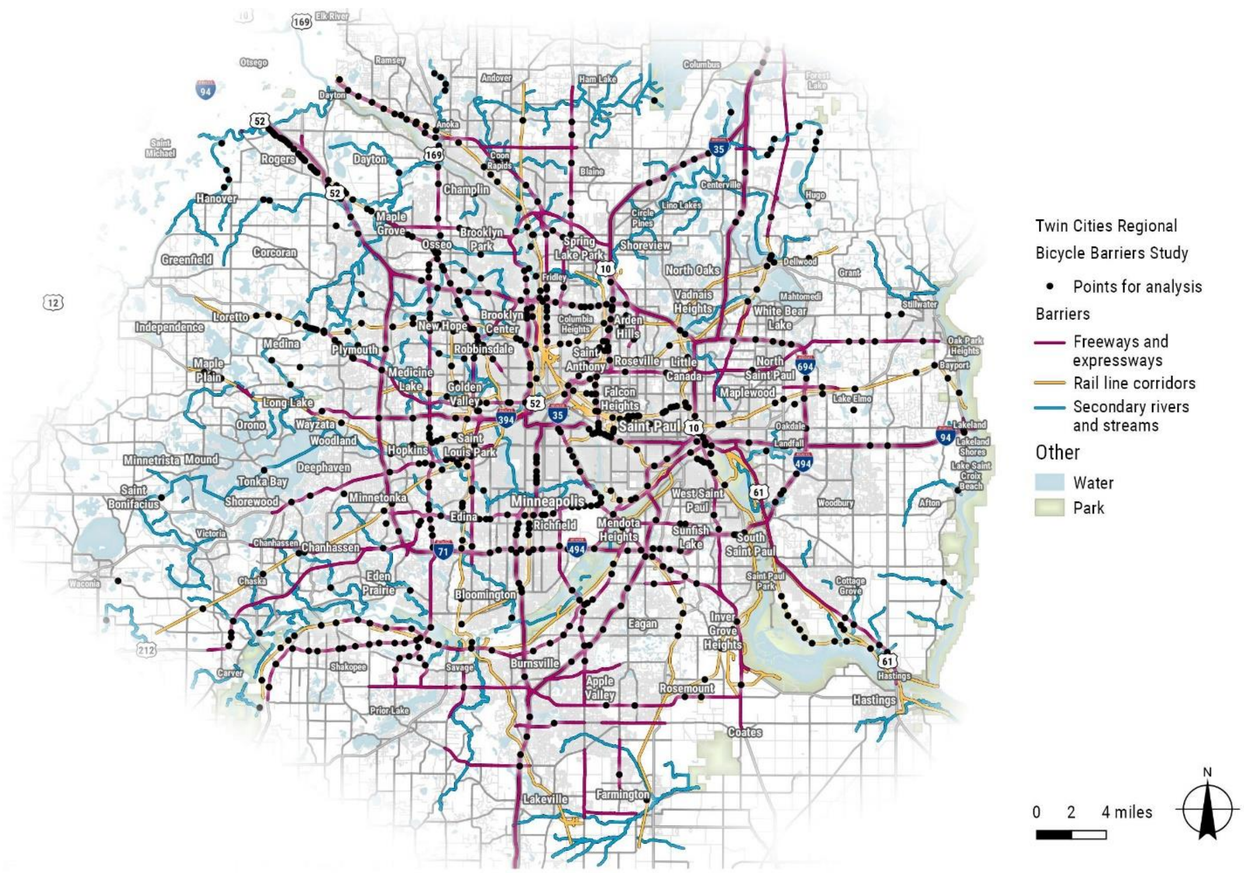
The TAWG and Metropolitan Council staff reviewed the spacing-generated points identified through this analysis to determine if any were extraneous or in a non-intuitive location.

A point was considered extraneous for any of several reasons, including:

- There was an existing or recently constructed barrier crossing, or one that was fully funded and scheduled for construction
- A grade-separated crossing was already in place at the barrier with a useable roadway (bike shoulder or local road included) crossing the barrier (these points were re-coded as an existing crossing)
- The point was over a stream that flows naturally underground or through a culvert
- Two points in very close proximity along the same barrier were to be considered one point for analysis
- Two points on two tightly spaced barriers where it would not be possible to develop separate crossings (e.g. an expressway parallel and adjacent to a rail line) such that only a single crossing of both barriers would be necessary
- Any other point that seemed to be non-intuitive (especially those points that were generated as conceptual points based on the spacing criteria)

Based on this extensive process, many points were found to be extraneous and removed from consideration as potential barrier crossings. The remaining spacing-generated points and other potential crossing locations from steps one through three are shown in Figure 8.

Figure 8: Barrier Crossing Points for Final Analysis



Evaluation of Barrier Crossing Points

SELECTION OF ANALYSIS FACTORS

The Metropolitan Council involved the PMT and the TAWG in identifying the evaluation factors to be applied in the Study analysis. As a starting point, the National Cooperative Highways Research Project 803 (NCHRP 803) was referenced, which examined national best practices in prioritization.

Based on input from the two cyclist focus groups and the TAWG, four evaluation factors were selected for application in the study analysis. These included:

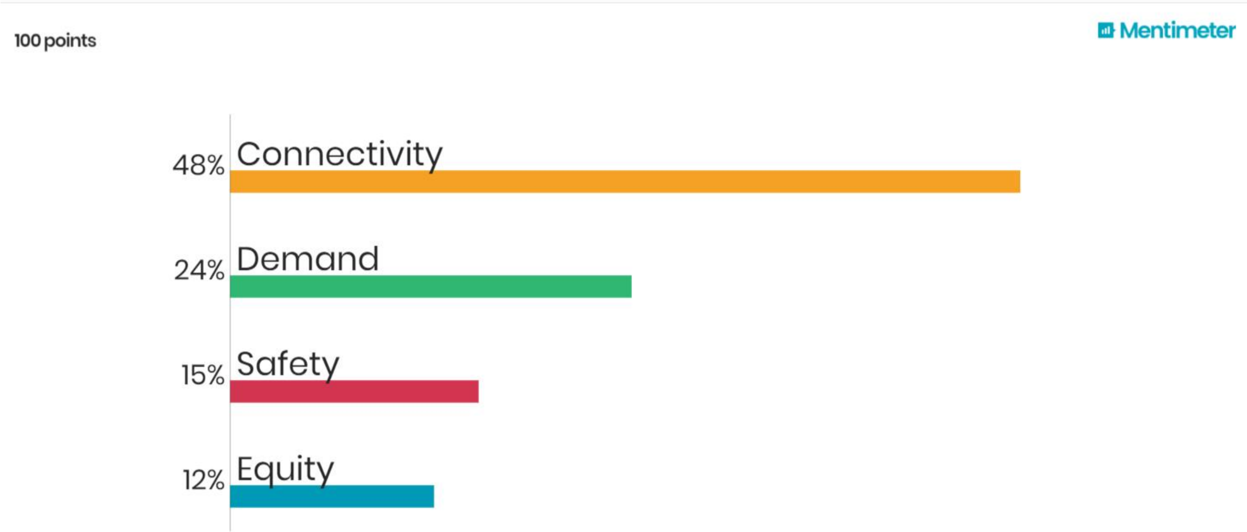
- Social equity
- Network connectivity
- Bicycling demand
- Safety/existing conditions

In the NCHRP 803 methodology, safety and existing conditions are discussed as two separate factors. The TAWG and Metropolitan Council staff collectively determined that available data inputs for safety and existing conditions were somewhat limited and recommended combining the two factors into a single category. Input from the focus groups and WikiMap survey respondents (described in *Stakeholder Groups* section) was also used to determine the weights for the scoring factors.

ESTABLISHING FACTOR WEIGHTS

Based on the methodology from the NCHRP 803 report, factor weights were applied on a scale of 0 to 10. Factor weights for the Study were determined through input generated at the two cyclist focus groups and during subsequent discussions with the TAWG and PMT. After the factors had been selected, the TAWG voted on priorities via a live poll to establish the factor preferences. As shown in Figure 9, the results of the poll identified network connectivity as the highest priority factor, followed by bicycling demand, safety/existing conditions, and social equity.

Figure 9: TAWG poll on Factor Weights



The results of the live poll, as summarized in Table 3, were then converted to the 10-point weighting scale to be compatible with the Active Transportation Prioritization Tool (APT) spreadsheet from the NCHRP 803 report used in the Study.

Table 3: Factor Weights

Factor	Weight (0 to 10 scale)
Network Connectivity	4.825
Bicycling Demand	2.425
Safety/Existing Conditions	1.525
Social Equity	1.225

IDENTIFYING FACTOR MEASURES

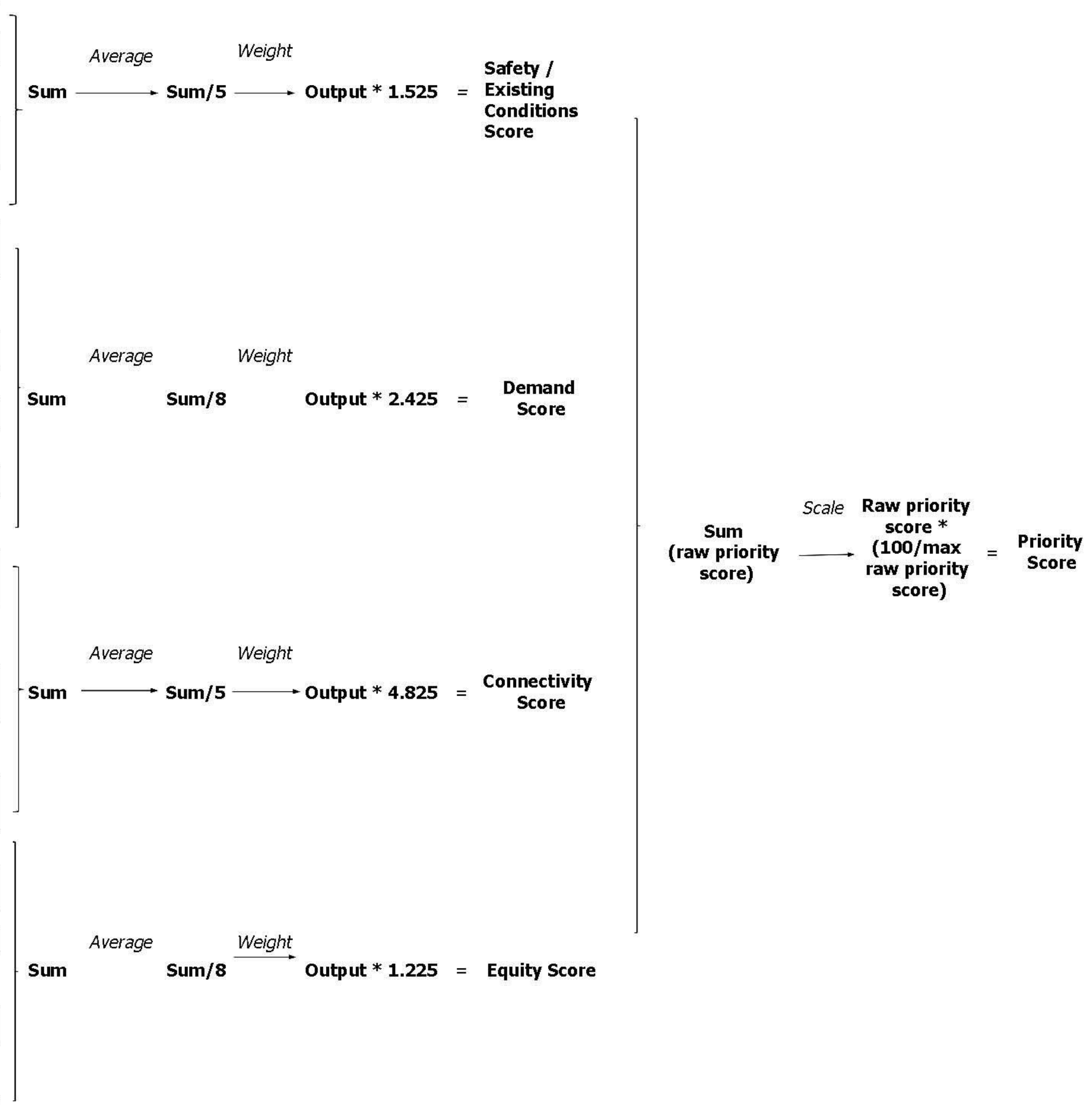
Multiple measures were chosen for each evaluation factor. The outputs of these measures, or variables, were averaged to determine an overall priority factor score. For example, the safety/existing conditions factor included bicycle- and pedestrian-involved crashes, bicycling and walking mode share, existing population density, existing employment density, and WikiMap-identified problem areas. Raw scores for these items were calculated using a Geographic Information Systems (GIS) linked spreadsheet. Raw scores were normalized to account for the differences in units and disparities in value ranges. To address this, each variable was proportionately scaled to a range of 0 to 10.

All variables within a factor were weighted equally by calculating an average; averages were then multiplied by the factor weights.

The analysis point factor scores for each of the four factors (safety/existing conditions, bicycling demand, network connectivity, and social equity) were then summed and again normalized to a 0 to 10 scale to determine the analysis point overall priority score as shown in Figure 10.

Figure 10: Analysis Point Scoring Scheme

Factor	Variable	Scaled Score
Safety / Existing Conditions	Bike/Ped Crashes	0-10
	Bike/Walk Modeshare	0-10
	Existing Population Density (2014)	0-10
	Existing Employment Density	0-10
	WikiMap-Identified Problem Area	0-10
Demand	Population density (2040 estimate by TAZ)	0-10
	Employment density (2040 estimate by TAZ)	0-10
	Transit ridership	0-10
	Schools	0-10
	Colleges / Universities	0-10
	Regional Parks	0-10
	Point Type	0-10
	WikiMap - Suggested new crossing	0-10
Connectivity	Local Trails - planned mileage	0-10
	Local Trails - existing mileage	0-10
	Regional Trails - existing and planned mileage	0-10
	RBTN Corridor and Alignment mileage	0-10
	Route distance to nearest existing crossing	0-10
Equity	Areas of Concentrated Poverty	0-10
	Areas of Concentrated Povertywith More Than 50% People of Color	0-10
	Population under 15 yrs old	0-10
	Population 65 yrs old and over	0-10
	Zero-car households	0-10
	People of color	0-10
	WikiMap comments from females	0-10
	WikiMap comments from people of color	0-10



Network Connectivity

The factor score for network connectivity is an average of the following five variable scores:

1. *Proximity to Existing Local Bikeways*

   Proximity to existing local bikeways was selected as a variable to measure connectivity because it indicates how much impact a barrier crossing improvement might have on the broader bicycle network's connectivity.

   Scores were calculated by taking the sum length in miles of existing local bikeways within .25 miles of the barrier crossing opportunity, then scaled to fit the 0 to 10 score range. Existing bikeways were determined from Metropolitan Council's regional bicycle system inventory data layer, compiled from data provided by each county in 2016.

2. *Proximity to Planned Local Bikeways*

   Proximity to planned local bikeways was selected as a variable to measure connectivity because it indicates how much impact a barrier crossing improvement might have on the broader planned local bicycle network's connectivity.

   Scores were calculated by taking the sum length in miles of planned local bikeways within .25 miles of the potential barrier crossing, then scaled to fit the 0 to 10 score range. Existing bikeways were determined from the Metropolitan Council's regional bicycle system inventory.

3. *Proximity to Regional Bicycle Transportation Network (RBTN) Corridor Centerline or Alignment*

   Whether a barrier crossing improvement opportunity is located near an RBTN alignment or corridor centerline was selected as a variable to measure connectivity because it indicates the degree to which an improvement will serve a regional bicycle transportation connection.

   Scores were calculated by taking the sum length in miles within .5 miles of a potential barrier crossing improvement analysis point, then scaled to fit the 0 to 10 score range.

4. *Proximity to Existing or Planned Regional Trail*

   Whether a barrier crossing opportunity is aligned with an existing or planned Regional Trail was selected as a variable to measure connectivity because it indicates whether it will fill a gap in or make an improvement to a regional trail (as identified in the *2040 Regional Parks Policy Plan*).

   Scores were calculated by taking the sum length in miles of existing or planned regional trail within a .5 miles of a potential barrier crossing, then scaled to fit the 0 to 10 score range.

5. *Route Distance to Nearest Barrier Crossing*

   Distance to the nearest existing barrier crossing was selected as a variable to measure connectivity because it indicates the degree to which a bicyclist must go out of their way to cross a barrier without an improvement.

   Scores were calculated by measuring the trail or on-street route distance (in meters) to the nearest existing crossing, then scaled to fit the 0 to 10 score range. Existing crossings were defined as an existing bikeway (defined in a local or regional plan) or a local road crossing of a regional bicycle barrier.

Bicycling Demand

The factor score for demand is an average of the following eight variable scores:

1. *Point-type Score*

   Point-type refers to how the analysis point was identified to be included in the Study. Point-types included planned barrier crossings (bikeway is in a local/regional plan and intersects with the barrier), TAWG or Metropolitan Council-added barrier crossing points, and spacing-generated points (based on spacing criteria from Table 2).

   Based on TAWG member input, project staff determined that potential barrier crossings generated by local and regional bicycle plans should be given a higher priority. As such, the prioritization analysis was amended to include a new variable for point-type. This new variable was scored on a 0 to 10 scale as follows:

   - Planned barrier crossings 10 points
   - TAWG/Metropolitan Council-added crossings 6 points
   - Spacing-generated crossing locations 4 points

   Planned crossings were derived from planned bikeways identified in a local or regional plan.

2. *Population Density (2040)*

   Population density was selected as a variable to measure existing conditions because it indicates where a barrier crossing improvement would serve the most people near their homes.

   Scores were calculated as average 2040 population density (estimated by TAZ) within a .5 miles of a barrier crossing opportunity, then scaled to fit the 0 to 10 score range.

3. *Employment Density (2040)*

   Employment density projections for 2040 were selected as a variable to measure demand because these projections indicate where a barrier crossing improvement would serve the most people near their place of employment.

   Scores were calculated by using the average 2040 employment density (estimated by TAZ) within .5 miles of a potential barrier crossing, then scaled to fit the 0 to 10 score range.

4. *Transit Ridership*

   Transit ridership was selected as a variable to measure demand because it indicates where there may be bicycling demand for "last mile" connections to a transit stop.

   Scores were calculated by taking the sum of boardings and alightings within a .5 miles of a potential barrier crossing, then scaled to fit the 0 to 10 score range.

5. *Proximity to Schools*

   Proximity to schools was selected as a variable to measure demand because it indicates potential usage by students, guardians, and/or staff where a barrier crossing improvement could allow for better bicycle access.

   Scores were calculated by counting the number of schools within .5 miles of a potential barrier crossing, then scaled to fit the 0 to 10 score range.

6. *Proximity to Colleges and Universities*

   Proximity to colleges and universities was selected as a variable to measure demand because it indicates potential usage by students, faculty, and/or staff where a barrier crossing improvement could allow for better bicycle access.

   Scores were calculated by counting the number of colleges within .5 miles of a potential barrier crossing, then scaled to fit the 0 to 10 score range.

7. *Proximity to Regional Parks*

   Proximity to existing regional parks (as identified in the 2040 Regional Parks Policy Plan) was selected as a variable to measure demand because it indicates potential usage at a regional resource where a barrier crossing project could facilitate improved bicycle access to a regional park.

   Scores were calculated by counting the number of regional parks within .5 miles of a potential barrier crossing, then scaled to fit the 0 to 10 score range.

8. *Suggested New Crossings from WikiMap*

   The project WikiMap online interactive tool provided participants the opportunity to suggest locations for new barrier crossings. The new crossing suggestions were selected as a measure of demand because they indicate public desire for a new barrier crossing.

   Scores were calculated by taking the sum of "suggested new crossing" responses on the WikiMap within .25 miles of a suggested barrier crossing, then scaled to fit the 0 to 10 score range. When these locations were scored for their point-type, they were categorized and scored as TAWG/Council-added points (in *Demand* section).

Safety/Existing Conditions

The factor score for safety/existing conditions is an average of the following five variable scores:

1. *Proximity to Bicycle or Pedestrian Crashes*

   Proximity to bicycle or pedestrian crashes was selected as a variable to measure safety/existing conditions because it indicates where there may be an opportunity to improve area conditions for non-motorized transportation. It may also indicate areas where people are walking or bicycling regardless of conditions.

   Scores were calculated by counting the number of crashes within 500 feet of a barrier crossing opportunity, then scaled to fit the 0 to 10 score range. Crash data were applied from MnDOT's non-motorized collisions database.

2. *Bicycle or Pedestrian Mode Share*

   Bicycle or pedestrian mode share was selected as a variable to measure safety/existing conditions because it indicates where people bike or walk to commute to work.

   Scores were calculated as average mode percent share within .5 miles of a barrier crossing point, then scaled to fit the 0 to 10 score range. Biking and walking mode shares were derived from the U.S. Census American Community Survey database.

3. *Existing Population Density (2014)*

   Population density was selected as a variable to measure existing conditions because it indicates where a barrier crossing improvement would serve the most people near their homes in existing conditions. Scores were calculated as average 2014 population density within .5 miles of a barrier crossing opportunity, then scaled to fit the 0 to 10 score range.

4. *Existing Employment Density*

   Employment density was selected as a variable to measure existing conditions because it indicates where a barrier crossing improvement would serve the most people near their place of employment in existing conditions.

   Scores were calculated as average 2014 employment density within .5 miles of a barrier crossing opportunity, then scaled to fit the 0 to 10 score range.

5. *Problem Locations Identified through WikiMap Input*

   Problem locations identified on the WikiMap were selected as a variable to measure existing conditions because they indicate public desire for an existing barrier crossing improvement based on where participants identified an "improvement needed".

   Scores were calculated as a sum of "improvement needed" responses on the WikiMap survey within .25 miles of a barrier crossing opportunity, then scaled to fit the 0 to 10 score range.

Social Equity

The Metropolitan Council has adopted equity as one of the outcomes of Thrive MSP 2040, which defines equity as the following:

> *"Equity connects all residents to opportunity and creates viable housing, transportation, and recreation options for people of all races, ethnicities, incomes, and abilities so that all communities share the opportunities and challenges of growth and change. For our region to reach its full economic potential, all of our residents must be able to access opportunity. Our region is stronger when all people live in communities that provide them access to opportunities for success, prosperity, and quality of life."*
>
> *-Thrive MSP 2040*

Each variable that contributes to the overall priority score for equity relates to the Metropolitan Council's equity goals and is described in this section.

The factor score for equity is an average of the following eight variable scores:

1. *Areas of Concentrated Poverty*

   Areas of concentrated poverty (ACPs) were selected as a variable to measure equity because they provide a geographic-based metric for the degree to which people with lower incomes may be served by a barrier crossing opportunity.

   Scores were calculated by awarding 10 points to barrier crossing opportunities inside an ACP.

2. *Areas of Concentrated Poverty with More Than 50% People of Color*

   Areas of concentrated poverty with more than 50% people of color (ACP50s) were selected as a variable to measure equity because they provide a geographic-based metric for the degree to which people with lower incomes who are also people of color may be served by a potential barrier crossing improvement.

Scores were calculated by awarding 10 points to barrier crossing opportunities inside an ACP50.

3. *Population Under 15 Years Old*

   Percentage of population under 15 years old was selected as a variable to measure equity because this age group is not old enough to drive, but includes many people generally old enough to make some trips by bicycle.

   Scores were calculated as average percent of the population under 15 within .5 miles of a barrier crossing opportunity, then scaled to fit the 0 to 10 score range. Specific age group population data were derived from the U.S. Census American Community Survey database.

4. *Population 65 Years and Older*

   Percentage of population 65 years and older was selected as a variable to measure equity because this age group is less likely to drive than younger adults, and typically does not feel comfortable riding a bicycle without a designated facility.

   Scores were calculated as average percent of the population 65 and over within .5 miles of the barrier crossing opportunity, then scaled to fit the 0 to 10 score range. Specific age group data were derived from the U.S. Census American Community Survey database.

5. *Zero-Car Households*

   Percentage of households with zero-cars was selected as a variable to measure equity because people that do not own or have access to a car are more likely to rely on transit, walking, and/or bicycling to make transportation trips.

   Scores were calculated as average percent of households with no vehicle available within .5 miles of a barrier crossing opportunity, then scaled to fit the 0 to 10 score range. Specific household data were derived from the U.S. Census American Community Survey database.

6. *People of Color*

   Percentage of population people of color was selected as a variable to measure equity because it provides a geographic-based metric for the degree to which people of color may be served by a barrier crossing opportunity. It should be noted that this measure is different from ACP50 variable, but there may be some overlap. Metropolitan Council staff and the TAWG determined the overlap to be acceptable, since those areas indicate higher need.

   Sources were calculated as average percent of the population that is non-white (including Hispanic and Latino) within .5 miles of a barrier crossing opportunity, then scaled to fit the 0 to 10 score range. Specific population by race data were derived from the U.S. Census American Community Survey database.

7. *WikiMap Input from Females*

   WikiMap input from people who self-identified as female was selected as a variable to measure equity because the participation rates in bicycling for women are less than those for men. In addition, there is a higher proportion of men than women in the field of bicycle planning. Adding input from women to the equity score emphasizes the input from those typically underrepresented.

Scores were calculated by counting the number of comments from WikiMap users self-identifying as women within .25 miles of a barrier crossing opportunity, then scaled to fit the 0 to 10 score range.

8. *WikiMap Input from Participants Self-Identifying as Any Race Other Than White*

   WikiMap input from people who identified themselves non-white was selected as a variable to measure equity because typical participation rates in bicycle planning are higher for Caucasians than they are for many people self-identifying as non-white. Adding input from people of color to the equity score emphasizes the input from those typically underrepresented.

   Scores were calculated by counting the number of comments from WikiMap users self-identifying as any race other than white within .25 miles of a barrier crossing opportunity, then scaled to fit the 0 to 10 score range.

Final Analysis Results

FINAL SCORE CALCULATIONS

The raw factor scores were calculated as an average of each factor-specific variable score. Overall factor scores were then weighted, according to the factor weights previously described, and overall priority scores normalized to a 0 to 100 scale to arrive at a final score for each barrier crossing point analyzed (Figure 10: Analysis point scoring scheme).

BARRIER CROSSING POINTS ANALYSIS RESULTS

As described in this study report, and with the help of agency stakeholders represented by the TAWG and PMT, the initial set of nearly 1200 barrier crossing analysis points were refined through the Study process and winnowed down to 675 crossing points for the final analysis. The results of the barrier crossing points analysis are summarized in Appendix B with weighted factor scores, overall priority scores, and final normalized (scale of 1 to 100) scores displayed.

Ultimately, the study converted the top 450 ranked points to a series of crossing improvement areas along regional bicycle barriers. These areas are displayed as circles and grouped into three equally distributed priority tiers in Figures 11 and 12 for freeways/expressways and railroad corridors/second-order streams, respectively. The area circle diameters shown in these figures vary by aggregated Thrive community designation and correspond to the preferred maximum spacing criteria previously described in Table 2. The circle diameters represent the actual barrier segments where a future crossing improvement project may be desired.

Figure 21: Regional Barrier Crossing Improvement Areas: Freeways and Expressways

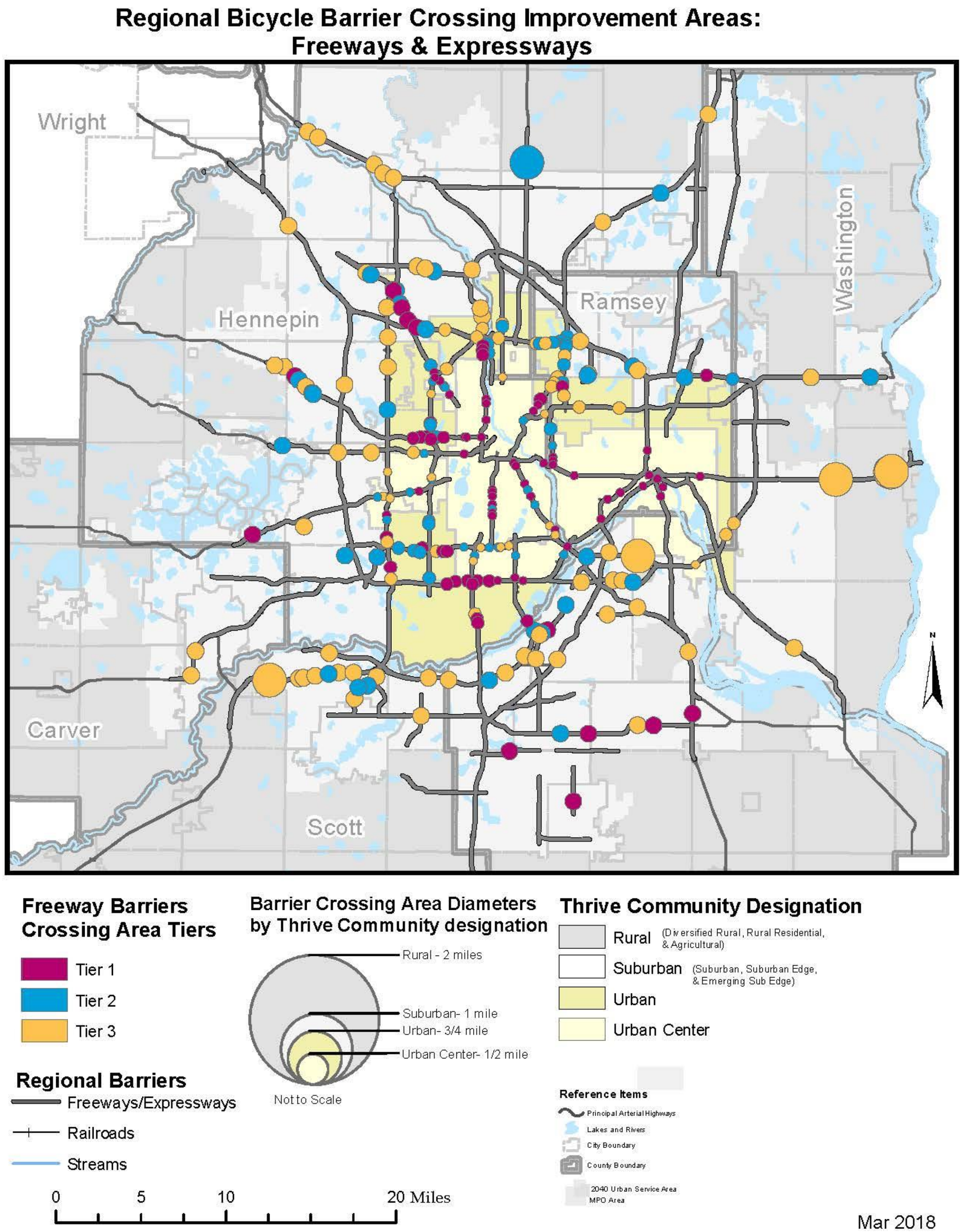
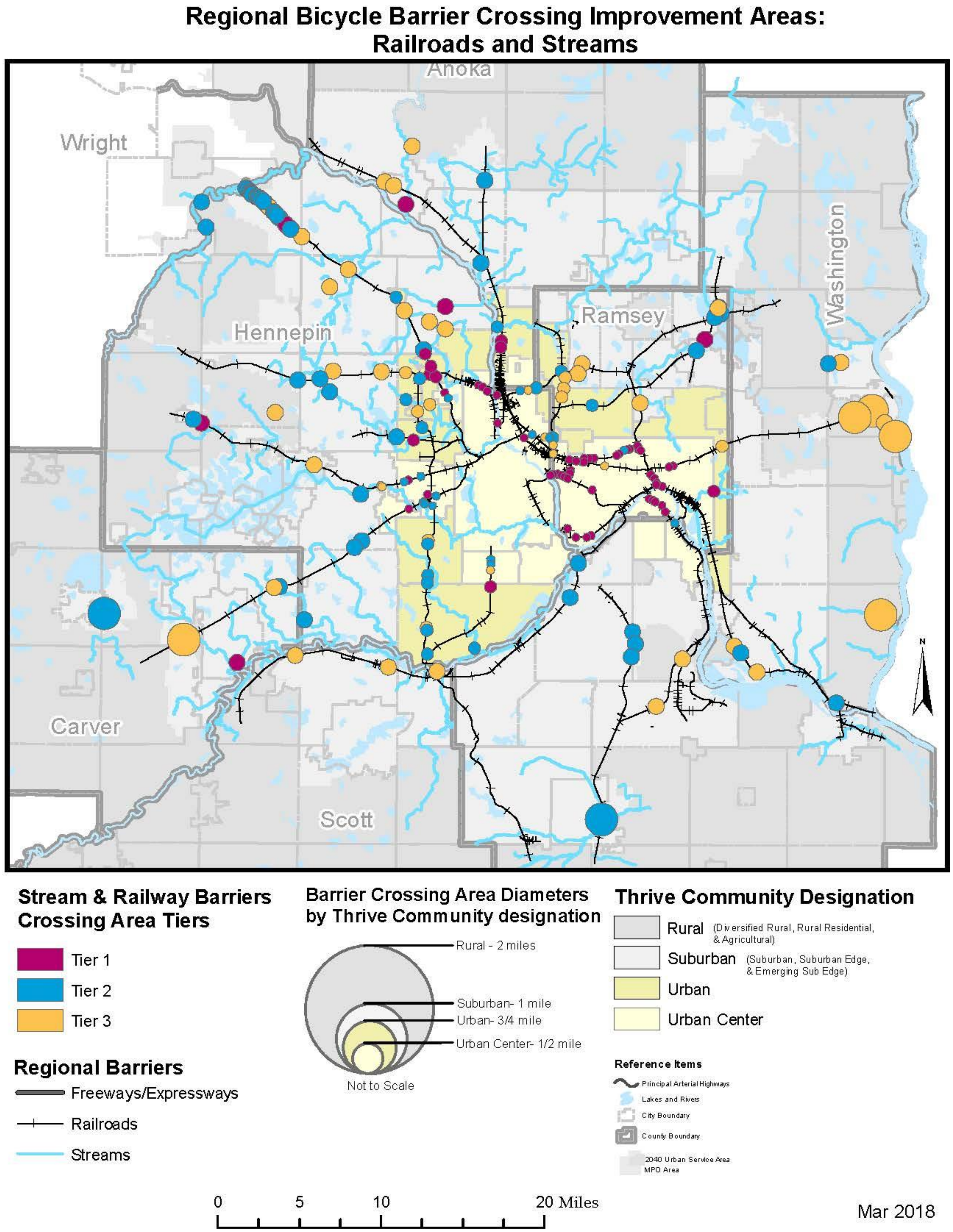


Figure 32: Regional Barrier Crossing Improvement Areas: Railroads and Streams



As there tend to be fewer roadways and planned bikeways in the region's suburban and rural areas, there are fewer opportunities to incorporate improved bikeway crossings in existing roadway projects compared to cities closer to the urban core. This can be a challenge when determining the ideal location for a crossing improvement. To help mitigate this reality, the mapping scheme presented in Figures 11 and 12 affords these outer region cities and counties more flexibility in siting specific barrier crossing projects by applying larger circles (consistent with the spacing criteria defined by aggregated Thrive community designation) to represent barrier crossing improvement areas. In more densely developed urban areas where there are a higher number of planned barrier crossings a and dense road network with many opportunities to develop barrier crossing improvement projects, the mapping scheme applies smaller improvement area circles. These smaller-diameter circles also correspond to the preferred maximum spacing between barrier crossings in these areas, as previously described.

Each of the seven counties have multiple barrier crossing opportunities in the top 450 ranked locations. Hennepin County had the most crossing opportunity locations, followed by Ramsey County. The most common barriers with high scoring barrier crossing improvement locations were rail corridor and freeway and expressway barriers. Potential crossing points along the river and stream barriers did not rise to the top as priority locations for crossing improvements.

The following appendices contain additional data and details about the Study. Note that the ID numbers in the crossing point scores table included in Appendix B directly correspond to a digitized dataset of points available via the following link:

https://metrocouncil.org/Transportation/Planning-2/Transit-Plans,-Studies-Reports/Bike-Pedestrian-Planning/Regional-Bikeway-Barriers-Study.aspx

The complete final Active Transportation Prioritization Tool spreadsheet used to analyze potential crossing points in this study can be found via this link:

https://metrocouncil.org/Transportation/Planning-2/Transit-Plans,-Studies-Reports/Bike-Pedestrian-Planning/Regional-Bikeway-Barriers-Study.aspx

Appendices

APPENDIX A: BICYCLING FOCUS GROUPS SUMMARY

APPENDIX B: CROSSING POINT SCORES SUMMARY TABLE