



BICYCLE FACILITY IMPLEMENTATION

Quick Reference Guide

LRRB Report Number: 2020RIC03
October 2020



Technical Report Documentation Page

1. Report No. 2020RIC03		2.		3. Recipients Accession No.	
4. Title and Subtitle Bicycle Facility Implementation - Quick Reference Guide				5. Report Date October 2020	
				6.	
7. Author(s) Rena Kuehl and Mike McGarvey, SRF Consulting Group Colin Harris and Maria Wardoku, Alta Planning + Design				8. Performing Organization Report No.	
9. Performing Organization Name and Address SRF Consulting Group, Inc., 3701 Wayzata Boulevard, Suite 100, Minneapolis, MN 55416-3791 Alta Planning + Design, 2525 Franklin Ave E, Suite 110 Minneapolis, MN 55406				10. Project/Task/Work Unit No.	
				11. Contract (C) or Grant (G) No. 1033240	
12. Sponsoring Organization Name and Address Minnesota Department of Transportation Office of Research & Innovation 395 John Ireland Blvd., Mail Stop 330 St. Paul, Minnesota 55155				13. Type of Report and Period Covered Final Report	
				14. Sponsoring Agency Code	
15. Supplementary Notes http://mndot.gov/research/reports/2020/2020RIC03.pdf					
16. Abstract (Limit: 200 words) In addition to people walking, people bicycling are our most vulnerable roadway users; they are most at risk of serious injury or death when they are involved in motor vehicle-related crashes. Local, county, regional and state transportation agencies play an important role in providing and maintaining safe and comfortable bicycle facilities. Planners and engineers must consider many factors when choosing and designing an appropriate facility for the roadway and land use context. This Quick Reference Guide was informed by a survey of local agencies' bicycle facility design practices, questions and concerns. It is intended to demystify common questions about appropriate facility selection and design to help practitioners confidently implement low-stress bicycle transportation networks. The Guide provides information on the variety of bicycle facility selection and design guidance documents available and identifies which to use as primary resources in Minnesota.					
17. Document Analysis/Descriptors Bike Facility, Bike Design, Bike Planning, Bike Selection, Bicycle, Bikeway, Bike Lanes, Bike Trail Maintenance				18. Availability Statement No restrictions. Document available from: National Technical Information Services, Springfield, Virginia 22161	
19. Security Class (this report) Unclassified		20. Security Class (this page) Unclassified		21. No. of Pages 40	22. Price

TABLE OF CONTENTS

Introduction	1
Why invest in safe and comfortable bicycling?.....	2
Purpose of this Quick Reference Guide	5
Resources	7
Primary Resources.....	7
Secondary Resources.....	7
Additional Resources.....	8
Frequently Asked Questions	11
Bikeway Selection Process FlowChart	19
Survey Results.....	23

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INTRODUCTION

In addition to people walking, people bicycling are our most vulnerable roadway users; they are most at risk of serious injury or death when they are involved in motor vehicle-related crashes. Local, county, regional and state transportation agencies play an important role in providing and maintaining safe and comfortable bicycle facilities. Planners and engineers must consider many factors when choosing and designing an appropriate facility for the roadway and land use context.

This Quick Reference Guide, hereafter called the Guide, was informed by a survey of local agencies' bicycle facility design practices, questions and concerns. It is intended to demystify common questions about appropriate facility selection and design to help practitioners confidently implement low-stress bicycle transportation networks. The Guide provides information on the variety of bicycle facility selection and design guidance documents available and identifies which to use as primary resources in Minnesota.

A great bicycle facility may not be used if people can't safely and comfortably reach it; it is only through a connected network that people can get where they need and want to go. Having a bicycle network plan is critical to making good planning, scoping and design decisions related to bicycle routes and facilities. Bicycle network plans help communities envision a seamless, interconnected system of bikeways. Networks should be thoughtfully planned to provide necessary and desired connections and access. The most successful bicycle networks facilitate trips for people of all ages and abilities.

Once a community has adopted a bicycle plan and identified corridors for bike lane implementation, this Guide will provide guidance to assist in selecting the most appropriate type of bicycle facility for each location.



Why invest in safe and comfortable bicycling?

Forty percent of all trips in the U.S. are 2 miles or less, but two-thirds of those trips are taken in cars.¹ Bicycling 2 miles takes only about 12 minutes. Communities can benefit substantially from shifting short trips from driving to bicycling by providing safe, comfortable and connected bicycle networks.^{2,3} The Federal Transit Administration (FTA) states, “Walking and bicycling are important tools for making it easier and more convenient for riders to use public transportation.”⁴

Mode shift can reduce congestion and can help communities meet emissions reduction and air quality goals.⁵ Bicycling is cleaner, quieter and results in less roadway surface damage than driving. Bicycles require much less storage space and operational space than cars, freeing up more public space for other uses.

Communities with safe and comfortable bicycling attract tourism and new residents.⁶ Communities with high-quality bicycle facilities are better equipped for technological innovation as bicycle facilities increasingly serve people using e-scooters and other new mobility devices. Businesses benefit,

1 [National Household Travel Survey](#), FHWA, 2017.

2 [Influences on Mode Shift Associated with Various Classes of Bikeways](#), Caltrans, 2019.

3 [“Network Connectivity for Low-Stress Bicycling,”](#) Furth et al., 2016.

3 [Manual on Pedestrian and Bicycle Connections to Transit](#), Federal Transit Administration, 2017.

5 [“Impacts on Air Pollution and Health by Changing Commuting from Car to Bicycle,”](#) Johansson et al., 2017.

6 [Bicycling Means Business: The Economic Benefits of Bicycle Infrastructure](#), Advocacy Advance, 2012.

too—customers who arrive by car spend the most per visit, but bicyclists visit more often and spend more overall.⁷ Additionally, bicycling infrastructure creates the most jobs (design, construction and materials procurement) for a given level of spending (road-only projects create the least).⁸

Residents of communities with low-stress bicycle facility networks experience higher quality of life.⁹ Studies consistently show that people who commute via bicycle are happier and healthier than those who commute via car.¹⁰ Children who walk or bike to school are more physically active than children who are driven or bused to school; school-based physical activity is linked to improvements in academic performance, including academic achievement and behavior.¹¹

Overall, as more people choose to bicycle, the risks for everyone bicycling decrease—the likelihood that a person bicycling will be struck by a person driving decreases as the number of people bicycling increases.^{12, 13} As communities construct new bicycle infrastructure, the focus should be on providing access for people of all ages and abilities. Low-stress facilities encourage the greatest percentage of residents and visitors to ride bikes for all purposes.

7 [“Business Cycles: Catering to the Bicycling Market,”](#) Clifton et al., 2012.

8 [Pedestrian and Bicycle Infrastructure: A National Study of Employment Impacts,](#) Heidi Garrett-Peltier, 2011.

9 [Designing for All Ages & Abilities: Contextual Guidance for High-Comfort Bicycle Facilities,](#) NACTO, 2017.

10 [“Commute Well-Being Differences by Mode: Evidence from Portland, Oregon, USA,”](#) Oliver Smith, 2017.

11 [Safe Routes to School handout,](#) Bicycle Alliance of Minnesota, 2019.

12 [“Cycling Lanes Reduce Fatalities for All Road Users, Study Shows,”](#) *Science Daily*, 2019.

13 [“Report: As Cities Add Bike Lanes, More People Bike and Biking Gets Safer,”](#) *Streetsblog USA*, 2016.



PURPOSE OF THIS QUICK REFERENCE GUIDE

This Guide was developed to serve as a quick reference to the [Minnesota Department of Transportation Bicycle Facility Design Manual](#) (February 2020). Through a comprehensive assessment of pertinent existing research, the Guide offers local agencies a quick reference to key resources, frequently asked questions, a bike selection and policy flowchart, and more. With this Guide, local agencies can quickly navigate to reliable and current resources necessary to determine bicycle facility selection, design process, and operations and safety.

The MnDOT Bicycle Facility Design Manual was developed based on national standards and accepted industry practices. The Manual should be used in conjunction with current versions of the of the MnDOT Road Design Manual and the Minnesota Manual on Uniform Traffic Control Devices. It is not intended as a legal standard for MnDOT state roads. Locals may also refer to the Manual for guidance. However, all design guidance should be considered with engineering judgment. Local agencies should review local

and state aid roadway design rules, as flexibility and/or limitations may exist when compared to the MnDOT Bicycle Facility Design Manual.



The Guide is organized as follows:

RESOURCES

A list of resources for local agencies organized by relevance. A good place to begin!

FREQUENTLY ASKED QUESTIONS

A list of common questions Minnesota local agencies asked on a variety of topics, along with resources to find the recommended solution and/or best practice.

BIKEWAY SELECTION PROCESS FLOWCHART

A general process toward developing bicycle facility designs.

SURVEY RESULTS

Common themes and experiences gathered from Minnesota cities and counties.



RESOURCES

This resource list was compiled for Minnesota agencies' use. The resources are organized in three categories: primary, secondary and additional resources. Primary resources include the two main resources for facility selection and design and traffic control specifications. Secondary resources provide more in-depth information on the design of a particular type of facility. Additional resources include a deep dive into national case studies and guidelines on topics like accessibility, maintenance, independent trails and more.

Primary Resources

- Minnesota Department of Transportation (MnDOT) – [Bicycle Facility Design Manual](#), February 2020
- MnDOT – [Minnesota Manual on Uniform Traffic Control Devices](#) (MMUTCD), Part 9: Traffic Control for Bicycle Facilities ([current version](#))

Secondary Resources

- American Association of State Highway and Transportation Officials (AASHTO) – [Guide for the Development of Bicycle Facilities](#), 2012 (updated version anticipated in 2020)
- Various National Association of City Transportation Officials (NACTO) Guides:
 - [Urban Street Design Guide](#), October 2013
 - [Urban Bikeway Design Guide, Second Edition](#), March 2014
 - [Designing for All Ages and Abilities](#), December 2017
 - [Don't Give Up at the Intersection](#), May 2019
 - [Transit Street Design Guide](#), April 2016
 - [Other guides](#) (Blueprint for Autonomous Urbanism, Global Street Design Guide, Urban Street Stormwater Guide, Bike Share Station Siting Guide)

- Federal Highway Administration (FHWA) – [Small Town and Rural Multimodal Networks Guide](#), December 2016
- FHWA – [Separated Bike Lane Planning and Design Guide](#), May 2015
- FHWA – [Bikeway Selection Guide](#), February 2019

Additional Resources

Bike Lanes

- Massachusetts DOT – [Separated Bike Lane Planning & Design Guide](#), November 2015
- State Aid Rules 8820.9941 and 8820.9951: Minimum Design Standards, On-Road Bicycle Facilities
 - On-Road; Urban – [New/Reconstruction](#)
 - On-Road; Urban – [Reconditioning](#)

Multi-Use Trails

- Minnesota Department of Natural Resources (MNDNR) – [Trail Planning, Design and Development Guidelines](#), 2007
- State Aid Rules
 - Off-Road; [Minimum Off-Road and Shared Use Path Standards](#) (8820.9995)
 - On-Road; Urban – [New/Reconstruction](#) (8820.9941)
 - On-Road; Urban – [Reconditioning](#) (8820.9951)

Maintenance

- Local Road Research Board (LRRB) – [Best Practices: Corridor Management/Maintenance of Paved Recreational Trails](#), November 2019
- Minneapolis – [Pedestrian and Bicycle Winter Maintenance Study](#), April 2018
- NACTO – [Case Studies: Downsized Street Maintenance Vehicles](#), October 2019
- MnDOT – [District Bicycle Plans](#), March 2019
- FHWA – [Noteworthy Local Policies That Support Safe and Complete Pedestrian and Bicycle Networks](#), November 2016

Websites

- NACTO – [Cities for Cycling Peer Network](#)
- People for Bikes – [Statistics Library](#)
- [Better Bike Share Partnership](#)
- [Bicycle Alliance of Minnesota](#)
- [North American Bike Share Association](#) (also works with other forms of shared micromobility)
- Transportation for America – [Shared Micromobility Playbook](#)

Other Resource Documents


- MnDOT – [Minnesota’s Best Practices for Pedestrian/Bicycle Safety](#), 2013 (updated version anticipated in 2020)
- FHWA – [Bicycle and Pedestrian Program](#)
- FHWA – [Pursuing Equity in Pedestrian and Bicycle Planning](#), 2016
- U.S. Department of Justice – [Americans with Disabilities Act](#) (ADA), current version
- U.S. Access Board – [Public Rights of Way Guidelines](#) (PROWAG), current version
- Portland State University – [Economic Impacts of Bicycle and Pedestrian Street Improvements](#), 2013
- MnDOT – [Assessing the Economic Impact and Health Benefits of Bicycling in Minnesota](#), 2016
- National Cooperative Highway Research Program (NCHRP) – [Guidance to Improve Pedestrian and Bicyclist Safety at Intersections](#), 2020
- Institute for Transportation and Development Policy – [The Bike Share Planning Guide](#)














FREQUENTLY ASKED QUESTIONS

The questions in this section were compiled from the results of an LRRB survey distributed to Minnesota local agencies in September 2019. Local agencies submitted questions concerning issues they experience with bicycle operations and safety, facility selection, and design process.

For each question, the tables on the following pages indicate where to find more information in the [MnDOT Bicycle Facility Design Manual](#) and in supplemental resources. The orange wheel  indicates that the resource covers the topic addressed in the question. In the first column of supplemental resources, the year 2012 or 2020 (found below the orange wheel) indicates which version of the AASHTO Guide for the Development of Bicycle Facilities to reference. Questions are organized by topic, presented in four tables:

- **Table 1** – System Planning and Facility Selection (Dark Blue Table)
- **Table 2** – Facility Design (Teal Table)
- **Table 3** – Safe Crossings / Intersection Design (Light Blue Table)
- **Table 4** – Maintenance (Green Table)

Table 1 System Planning and Facility Selection

What is your question?	MnDOT Bicycle Facility Design Manual Section & Subsection	MnDOT Bicycle Facility Manual Page #	AASHTO – Guide for the Development of Bicycle Facilities (2012 and 2020)	FHWA – Bikeway Selection Guide	FHWA – Separated Bike Lane Planning and Design Guide	FHWA – Small Town and Rural Multimodal Networks Guide	Various NACTO Guides ¹	Portland State University – Economic Impacts of Bicycle and Pedestrian Street Improvements ²	State Aid Rules 8820.9941 and 8820.9951: Minimum Design Standards, On-Road Bicycle Facilities	People for Bikes Statistics Library ³	NACTO Cities for Cycling Peer Network ⁴	MnDOT – Assessing the Economic Impact and Health Effects of Bicycling in Minnesota ⁵	LRRB – Best Practices: Corridor Management/Maintenance of Paved Recreational Trails	NACTO – Blueprint for Autonomous Urbanism, Bike Share Station Siting Guide	Better Bike Share Partnership ⁶	ITDP – The Bike Share Planning Guide ⁷	North American Bikeshare Association ⁸	Transportation for America – Shared Micromobility Playbook ⁹
<p>Bicycle network planning: Facilities have been designed by taking advantage of street reconstruction projects, so the network is not well connected. It has created public perception issues; people feel that bike lanes do not get used.</p>	<p>Bicycle Network Planning</p> <p>Project Type: "Design Flexibility Options"</p>	<p>2-8 and 2-9</p> <p>3-16 and 3-17</p>	 2012 and 2020															
<p>Some residents have expressed safety concerns about pedestrians and bicyclists sharing facilities (shared-use paths); is there any credence to this concern?</p>	<p>Shared Use Path: "Separating Bicyclists from Pedestrians"</p>	<p>5-5</p>	 2012 and 2020															
<p>How do you manage the trade-offs of bicycle level of service (LOS) and vehicle throughput?</p>	<p>MnDOT Policy & Plans: "Complete Streets Policy"</p> <p>MnDOT Policy & Plans: "Performance Based Practical Design"</p>	<p>1-15</p> <p>1-16 and 1-17</p>	 2020															
<p>How do you determine the side of the road for a two-way facility?</p> <p>How do you determine one-way vs. two-way operation?</p>	<p>Sidepath: "Selecting a Side of the Roadway"</p> <p>Selecting a Bicycle Facility: "One-Way Versus Two-Way Operation"</p>	<p>5-25</p> <p>3-11</p>	 2020															
<p>What are the best bicycle facility design strategies for a given roadway?</p>	<p>Selecting a Bicycle Facility</p>	<p>3-8</p>	 2020															
<p>Is there consistent terminology for types of bike facilities and the wide variety of facility types?</p>	<p>Bicycle Facility Types</p>	<p>3-7</p>	 2020															
<p>Is there guidance for selecting and designing bicycle facilities for situations with limited right of way?</p>	<p>Project Type: "Design Flexibility Options"</p>	<p>3-16 and 3-17</p>	 2020															

What is your question?	MnDOT Bicycle Facility Design Manual Section & Subsection	MnDOT Bicycle Facility Manual Page #	AASHTO – Guide for the Development of Bicycle Facilities (2012 and 2020)	FHWA – Bikeway Selection Guide	FHWA – Separated Bike Lane Planning and Design Guide	FHWA – Small Town and Rural Multimodal Networks Guide	Various NACTO Guides ¹	Portland State University – Economic Impacts of Bicycle and Pedestrian Street Improvements ²	State Aid Rules 8820.9941 and 8820.9951: Minimum Design Standards, On-Road Bicycle Facilities	People for Bikes Statistics Library ³	NACTO Cities for Cycling Peer Network ⁴	MnDOT – Assessing the Economic Impact and Health Effects of Bicycling in Minnesota ⁵	LRRB – Best Practices: Corridor Management/Maintenance of Paved Recreational Trails	NACTO – Blueprint for Autonomous Urbanism, Bike Share Station Siting Guide	Better Bike Share Partnership ⁶	ITDP – The Bike Share Planning Guide ⁷	North American Bikeshare Association ⁸	Transportation for America – Shared Micromobility Playbook ⁹	
Is there evidence to show an increase in bicycle users after installation of dedicated facilities, or any subsequent effect on vehicular traffic (decreased volume, speeds, accidents, etc.)?	Not included	Not included																	
What case studies exist to help convey the benefits of installing bike facilities ?	Not included	Not included																	
Is there easily accessible data on the safety of bike lanes and bikeable shoulders , similar to a crash modification factor?	Not included	Not included	 2012 and 2020																
Are bike lanes with painted buffers (but no physical buffer) safer than conventional bike lanes?	Not included	Not included	 2020																
How do we plan for having enough funding to maintain or replace our bikeways and trails?	Appendix D: Funding for Bicycle Transportation	8-15																	
How do we design for future flexibility to respond to changing modes of travel (i.e., scooters and micromobility)?	Bicyclist Characteristics: “Electric-Assisted Devices”	4-5	 2020																

1 Various NACTO Guidelines, including Designing for All Ages and Abilities, Urban Bikeway Design Guide, Don't Give Up at the Intersection

2 Portland State University – Economic Impacts of Bicycle and Pedestrian Street Improvements: <https://wsd-pfb-sparkinfluence.s3.amazonaws.com/uploads/2020/03/Economic-Impacts-of-Street-Improvements-summary-report.pdf>

3 People for Bikes Statistics Library: <https://peopleforbikes.org/our-work/statistics/>

4 NACTO Cities for Cycling Peer Network: <https://nacto.org/program/cities-for-cycling/>

5 MnDOT – Assessing the Economic Impact and Health Effects of Bicycling in Minnesota: <http://www.dot.state.mn.us/research/TS/2016/201636.pdf>

















6 Better Bike Share Partnership: <http://betterbikeshare.org/>













7 Institute for Transportation and Development Policy – The Bike Share Planning Guide: <https://www.itdp.org/who-we-are/for-the-press/the-bike-share-planning-guide>

8 North American Bikeshare Association (also works with other forms of shared micromobility): <https://nabsa.net/>

9 Transportation for America – Shared Micromobility Playbook: <https://playbook.t4america.org/>










Table 2 Facility Design

What is your question?	MnDOT Bicycle Facility Manual Section "Sub-Section"	MnDOT Bicycle Facility Manual Page #	AASHTO – Guide for the Development of Bicycle Facilities (2012 and 2020)	FHWA – Separated Bike Lane Planning and Design Guide	Various NACTO Guides	Massachusetts DOT – Separated Bike Lane Planning and Design Guide	MNDNR – Trail Planning, Design and Development Guidelines	State Aid Rules 8820.9941 and 8820.9951: Minimum Design Standards, On-Road Bicycle Facilities	U.S. Access Board – Public Rights of Way Guidelines (PROWAG)	U.S. Department of Justice – Americans with Disabilities Act (ADA)	Minnesota Manual on Uniform Traffic Control Devices	Bicycle Alliance of Minnesota
Where can I find design guidance for addressing drainage issues?	Drainage Shared Use Path: "Cross Slope" and "Grade" Shared Use Path: "Drainage" Separated Bike Lane: "Design Overview" Separated Bike Lane: "Street Buffer" Winter Maintenance: "Design"	4-24 5-8 5-12 5-32 5-34 6-8	 <i>2012 and 2020</i>									
How do I address grade drop-offs and adequate clearance from roadways?	Shared Use Path: "Horizontal and Vertical Clearance"	5-6 and 5-7	 <i>2012 and 2020</i>									
How do you design separated bike lanes/cycle tracks adjacent to sidewalks that are ADA-accessible (specifically delineation for visually impaired users)?	Separated Bike Lane: "ADA Considerations"	5-36	 <i>2020</i>									
What construction materials are recommended for bicycle facilities and why?	Pavement Design	4-23										
What are the recommended dimensions for the different facility types?	Shared Use Path: "Path Width" Sidepath: "Managing Cross-Section Widths" Separated Bike Lane: "Lane Width" Bike Lane: "Bike Lane Dimensions" and "Buffered Bike Lanes" Paved Shoulder: "Shoulder Width and Horizontal Clearance" Shared Roadway: "Shared Travel Lane Width" Sidepath: "Selecting a Side of the Roadway"	5-4 and 5-5 5-22 and 5-23 5-33 5-40 and 5-41 5-55 5-60 5-25	 <i>2012 and 2020</i>									

What is your question?	MnDOT Bicycle Facility Manual Section "Sub-Section"	MnDOT Bicycle Facility Manual Page #	AASHTO – Guide for the Development of Bicycle Facilities (2012 and 2020)	FHWA – Separated Bike Lane Planning and Design Guide	Various NACTO Guides	Massachusetts DOT – Separated Bike Lane Planning and Design Guide	MNDNR – Trail Planning, Design and Development Guidelines	State Aid Rules 8820.9941 and 8820.9951: Minimum Design Standards, On-Road Bicycle Facilities	U.S. Access Board – Public Rights of Way Guidelines (PROWAG)	U.S. Department of Justice – Americans with Disabilities Act (ADA)	Minnesota Manual on Uniform Traffic Control Devices	Bicycle Alliance of Minnesota ¹
What are the required grades when constructing a bicycle facility adjacent to a new road project?	Shared Use Path: "Grade"	5-8	 2012									
Where can I find guidance for separating pedestrians and bicyclists ?	Shared Use Path: "Separating Bicyclists from Pedestrians" Separated Bike Lane: "Sidewalk Buffer"	5-5 5-35	 2012 and 2020									
Is there any guidance about how to design roadways for lower speeds so that on-street bike facilities would be more appropriate in more locations?	Project Type: "Roadway Reconfiguration" Shared Roadway: "Bicycle Boulevards" Speed Tables, Raised Crossings and Raised Intersections Roundabouts	3-16 5-64 7-22 7-13	 2012 and 2020									
The majority of our on-road bikeways have no signage or marking. Where do I find guidance for signing and striping of on-road facilities?	Paved Shoulder: "Signs and Markings" Pavement Markings, Signs & Signals	5-55 4-8 to 4-16	 2012 and 2020									
Where can I find guidance for wayfinding, proper usage, and general education of pedestrians and bicyclists?	Pavement Markings, Signs & Signals	4-8	 2012									

¹ Bicycle Alliance of Minnesota: <https://www.bikemn.org/education>





Table 3 Safe Crossings / Intersection Design

What is your question?	MnDOT Bicycle Facility Manual Section "Sub-Section"	MnDOT Bicycle Facility Manual Page #	AASHTO – Guide for the Development of Bicycle Facilities (2012 and 2020)	Various NACTO Guides ¹	NCHRP – Guidance to Improve Pedestrian and Bicyclist Safety at Intersections ²
How do you design to minimize conflict between bicyclists and turning vehicles at intersections ?	General Intersection Design Principles Sidepath: "Intersection Design" Separated Bike Lane: "Protected Intersections" Bike Lane: "Bike Lanes at Intersections" and "Bicyclist Left-Turn Considerations" Paved Shoulder: "Intersections" Shared Roadway: "Bicycle Boulevards" Roundabouts Median Refuge Islands: "Variations" Speed Tables, Raised Crossings and Raised Intersections Pavement Markings, Signs & Signals: "Bicycle Crossing Markings"	4-25 and 4-26 5-27 5-37 and 5-38 5-47 to 5-53 5-58 5-64 7-13 7-19 7-22 4-10 to 4-12	 2012 and 2020		
How do you provide safe crossings of higher-speed roadways?	Pedestrian and Bicycle Bridges and Underpasses	7-8 and 7-9	 2012 and 2020		
How do you design for the conflict of right-turn lanes and bikeable shoulders on rural highways ?	Intersections: "Right-Turn Lanes"	5-58	 2012 and 2020		
How do you design bike lanes with bump-outs so that we don't have to choose between bike safety and pedestrian safety in more urban areas?	Curb Extensions	7-21	 2012 and 2020		

1 Various NACTO Guidelines, including Don't Give Up at the Intersection

2 NCHRP – Guidance to Improve Pedestrian and Bicyclist Safety at Intersections, <http://www.trb.org/Main/Blurbs/180624.aspx>

Table 4 Maintenance

What is your question?	MnDOT Bicycle Facility Manual Section "Sub-Section"	MnDOT Bicycle Facility Manual Page #	LRRB – Best Practices: Corridor Management/Maintenance of Paved Recreational Trails	Minneapolis – Pedestrian and Bicycle Winter Maintenance Study
It can be difficult to keep all trails open year-round due to weather conditions . Will there be safety concerns or issues with the newly proposed on-street lanes?	Winter Maintenance: "Water Pooling and Ice" and "Snow"	6-8 and 6-9		
Where can I find guidance on keeping trails free of debris and maintaining the clear zone with mowing?	Debris and Obstructions	6-7		
Sometimes bicycle facilities in road right of way are not given the same level of maintenance attention as the road system when they are off-road trails. What are the recommended maintenance activities and frequencies ?	Introduction: "Types of Maintenance Activities"	6-4		



BIKEWAY SELECTION PROCESS FLOWCHART

“Bike facility selection primarily depends on the traffic volume and operating speed characteristics of the roadway, which are often implied by their functional classification (arterial, collector, local) within various land use contexts. The land use context will likely have a big impact on the available right-of-way, the mix of roadway users, property access, traffic operating speeds, road operations and safety performance, and community goals—all of which will inform trade-off decisions” (Bikeway Selection Guide, FHWA).

Figure 1 (modeled after the “FHWA Bikeway Selection Process and Guide Outline” in FHWA’s [Bikeway Selection Guide](#)) draws on the “use of engineering judgment, best practices, design flexibility, documentation, and experimentation,” and expands it to include Minnesota-specific information. The Bike Facility Decision Flowchart provides guidance on the process for selecting a bicycle facility by first establishing a bikeway selection policy, which leads to bikeway selection planning, bikeway selection and finally, bikeway design. It is a multi-step process potentially yielding *multiple solutions, sometimes none of which are ideal*.

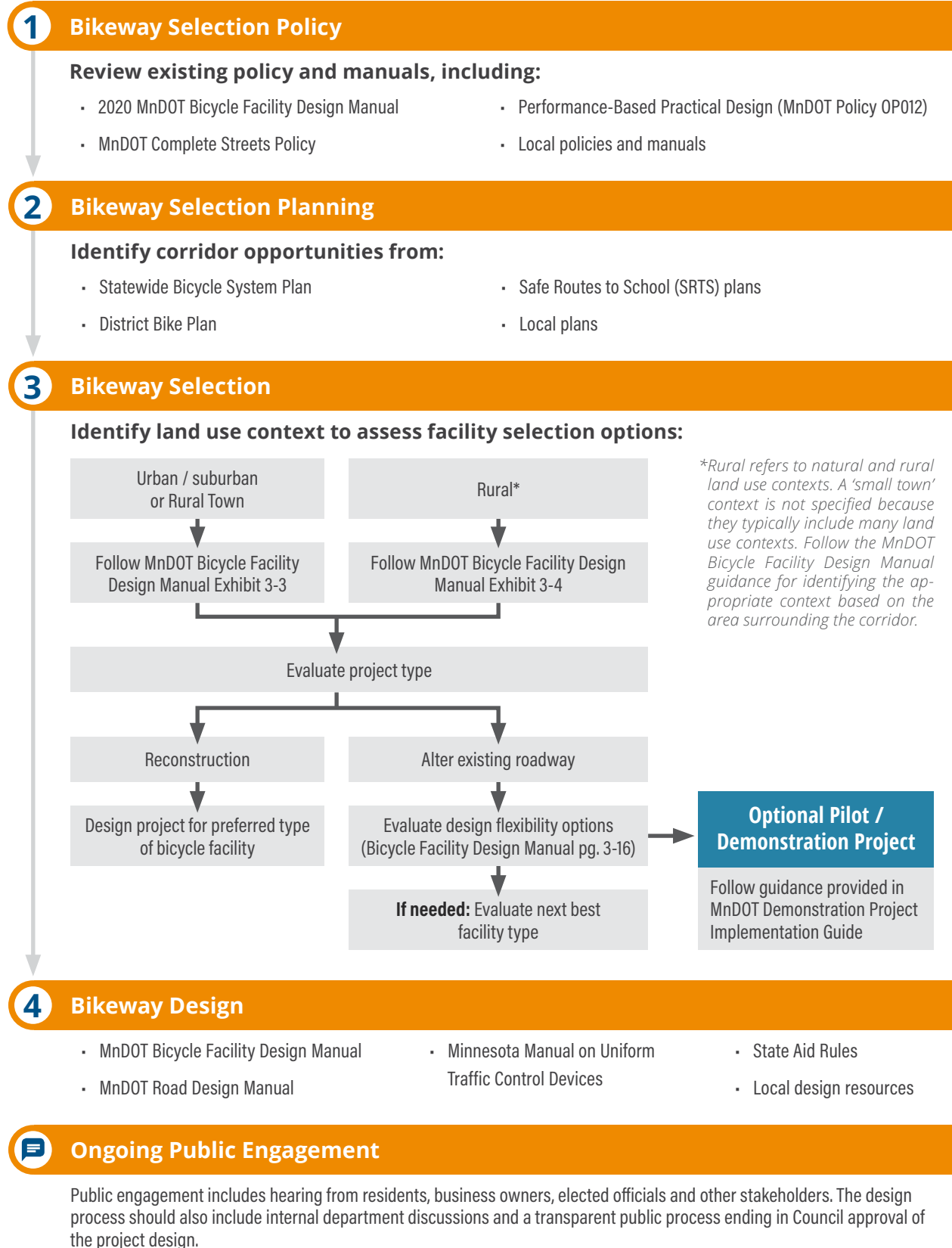
- **Step 1. Bikeway Selection Policy:** Decision-makers should review existing MnDOT and local manuals and policies that establish a framework for bicycle facility selection. These documents provide the background behind directives for constructing bikeways and the methods to do so.
- **Step 2. Bikeway Selection Planning:** Review whether the project corridor is identified within local or state plans. Analysis and recommendations from a published planning document can help streamline the bikeway selection process. Recommendations pertaining to nearby streets are helpful for considering connections between the study corridor and other parts of the bikeway network.

- **Step 3. Bikeway Selection:** The MnDOT Bicycle Facility Design Manual contains two facility selection charts that offer recommendations based on land use context, posted speed limit, and motor vehicle volumes. Identifying land use context is the first step in determining which chart to consult for facility selection recommendations. After evaluating project types, decisions are made based on the type of project (e.g., reconstruction or alterations to the existing roadway). At this stage, the draft design could be implemented as a temporary demonstration project.
- **Step 4. Bikeway Design:** After selecting a bikeway facility type, refer to local and state-level design guidance for recommended facility widths, intersection treatments and other design details.

Documents referenced in the Bike Facility Decision Flowchart are listed under Resources.



Figure 1 Bike Facility Decision Flowchart





SURVEY RESULTS

A survey on bicycle facility design and selection was distributed to Minnesota cities and counties in September 2019. The purpose of the survey was to identify agencies with bike facility selection experience, existing bike plans and policies, and questions surrounding facility selection. Forty-six responses were received; 26 respondents provided their contact information, which showed the following breakdown: 14 cities and 12 counties.¹⁴

Table 6 Survey Respondents By Agency and Years of Experience

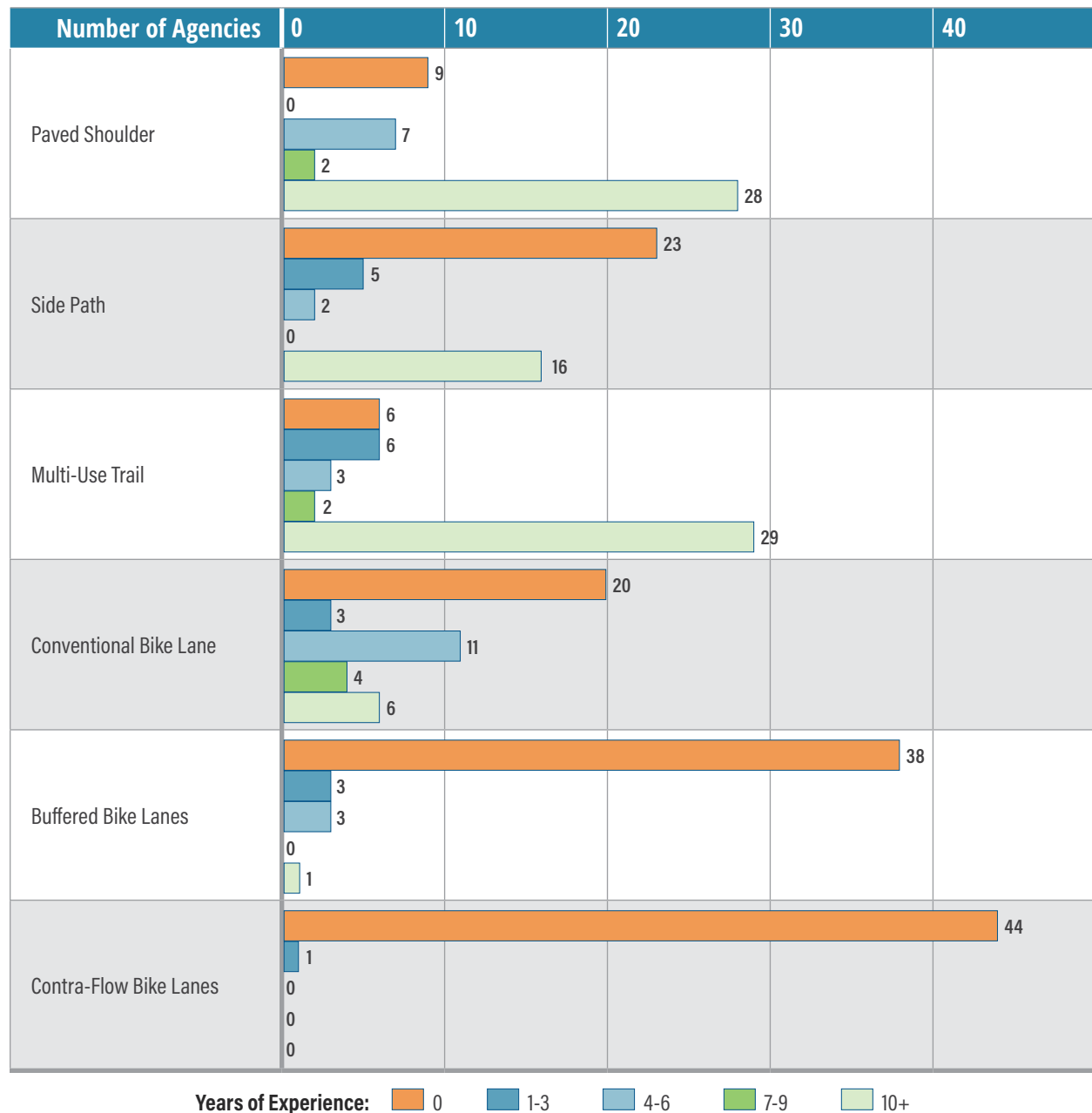
Agency	Years of Experience Installing Bicycle Facilities ¹⁵
City of Albert Lea	10+
City of Alexandria	10+
City of Andover	10+
City of Burnsville	10+
City of Duluth	10+
City of Edina	10+
City of Hutchinson	10+
City of Lino Lakes	10+
City of Marshall	7-9
City of Mendota Heights	10+
City of Plymouth	10+
City of Rochester	10+
City of Thief River Falls	4-6

Agency	Years of Experience Installing Bicycle Facilities ¹⁵
City of White Bear Lake	10+
Beltrami County	0
Blue Earth County	10+
Dodge County	10+
Hennepin County	10+
Kandiyohi County	10+
Lac qui Parle County	0
Otter Tail County	10+
Pipestone County	4-6
Pope County	10+
St. Louis County	4-6
Stearns County	10+

¹⁴ Duplicates removed from the table.

¹⁵ Years of experience was determined by taking the highest range of years an agency reported for any of the bicycle facilities in questions 1 and 2.

1. How many years of experience does your agency have installing the following bike facilities?



Key Takeaway:

Agencies are more familiar with off-road facilities. Many agencies are not familiar with on-street bike facilities (newer or more recent additions to the toolbox).

Most common levels of experience:

Paved Shoulder – 28 responded 10+ years



Photo Credit: Brandon Whyte

Side Path – 23 responded 0 years



Multi-Use Trail – 29 responded 10+ years



Conventional Bike Lanes – 20 responded 0 years



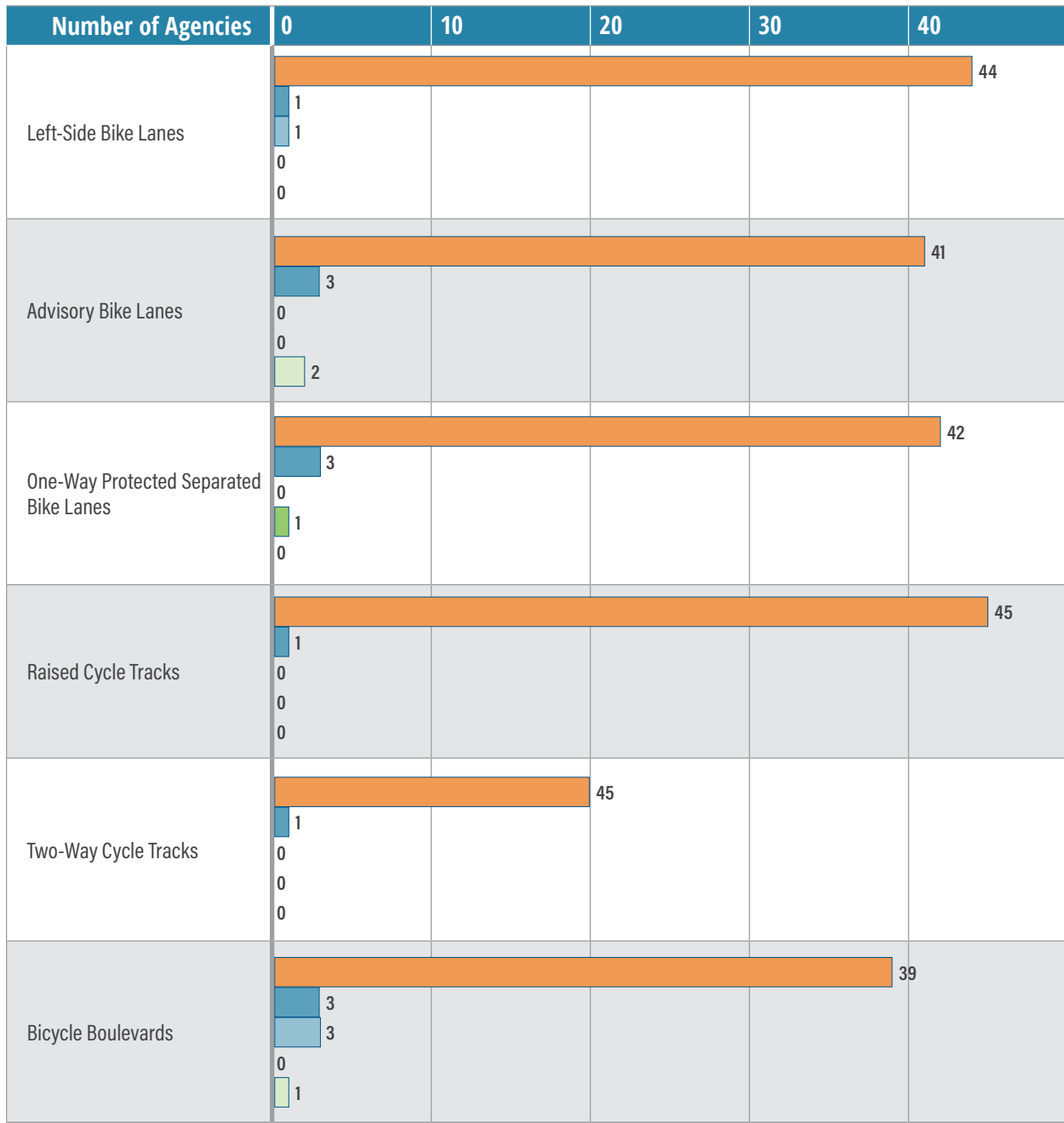
Buffered Bike Lanes – 38 responded 0 years



Contra-Flow Bike Lanes – 44 responded 0 years



2. How many years of experience does your agency have installing the following bike facilities?



Years of Experience: 0 1-3 4-6 7-9 10+

Key Takeaway:

Agencies are more familiar with off-road facilities. Many agencies are not familiar with on-street bike facilities (newer or more recent additions to the toolbox).

Most common levels of experience:

Left-Side Bike Lanes – 96% responded 0 years



Advisory Bike Lanes – 89% responded 0 years



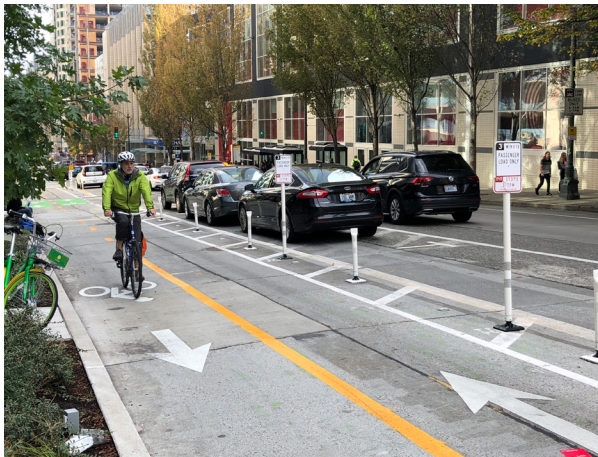
One-Way Protected Separated Bike Lanes – 91% responded 0 years



Raised Cycle Tracks – 98% responded 0 years



Two-Way Cycle Tracks – 98% responded 0 years



Bicycle Boulevards – 85% responded 0 years



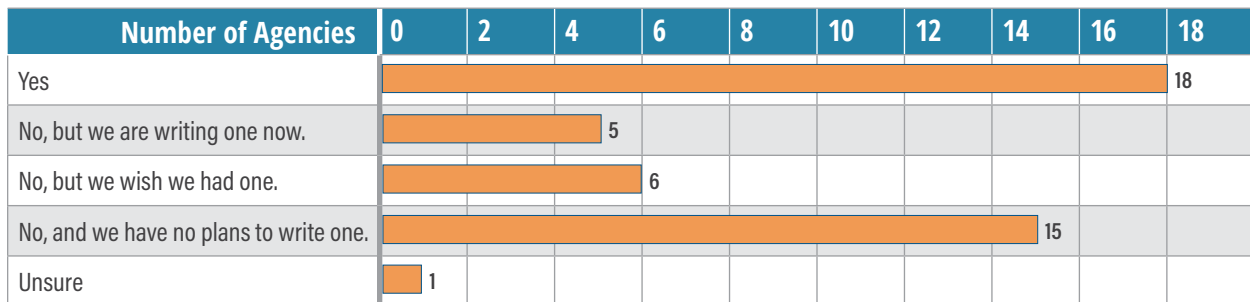
3. Has your agency completed any experimental bike lane projects?

For example: Prototype/pilot projects or demonstration/experimental (if yes, please describe).

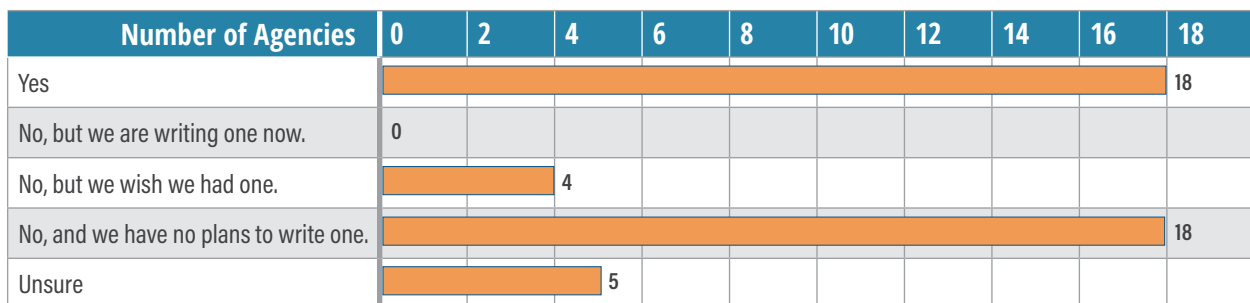
15 out of 21 responded “no.” Responses included:

- Burnsville: We will be installing our first on-street bike lane this fall and a second on-street bike lane in the spring.
- Washington Avenue Reconstruction project – cycle track included bicycle signals that required a request to experiment with FHWA.
- St. Louis County has installed what we refer to as a “Super Sidewalk.” This is a 10-foot-wide asphalt paved path, but it doesn’t meet bike path/trail design requirements.
- White Bear Lake has designated and signed several roadways as bike routes without formally striping. Also, have tried pavement markings outside of the parking lane on the edge of the travel lane.
- City of Duluth: Yes, two-way cycle track on a one-way street.
- Yes, Alexandria piloted a project in 2016 to experiment with various options for a section of street that would link Central Lakes Trail to Downtown Alexandria. See YouTube video at the link below: <https://www.youtube.com/watch?v=ZqE0yqwguy8>

4. Does your agency have a bike plan?



5. Does your agency have a complete streets policy and/or plan?



6. How does your agency select and design bicycle facilities? (Select all that apply.)

Number of Agencies	0	5	10	15	20	25	30	35	40
In-house									36
Hire a consultant.									23
Haven't designed one yet.		3							

7. Rate the priorities your agency has used in selecting a type of facility.

ADT	12.5% 5	67.5% 27	7.5% 3	5% 2	7.5% 3
Speed	10% 4	52.5% 21	25% 10	5% 2	7.5% 3
User type	17.5% 7	47.5% 19	22.5% 9	5% 2	7.5% 3
Connectivity	48.8% 20	36.6% 15	9.8% 4	4.9% 2	
Driveways	17.5% 7	50% 20	15% 6	17.5% 7	
Utilities	7.7% 3	33.3% 13	23% 9	35.9% 14	
Major barriers (bridges, intersections, rail, water)	7.5% 3	62.5% 25	17.5% 7	5% 2	7.5% 3
Public input	17.5% 7	72.5% 29	10% 4		

■ Highest Priority
 ■ High Priority
 ■ Low Priority
 ■ Lowest Priority
 ■ No Priority

Key Takeaways:

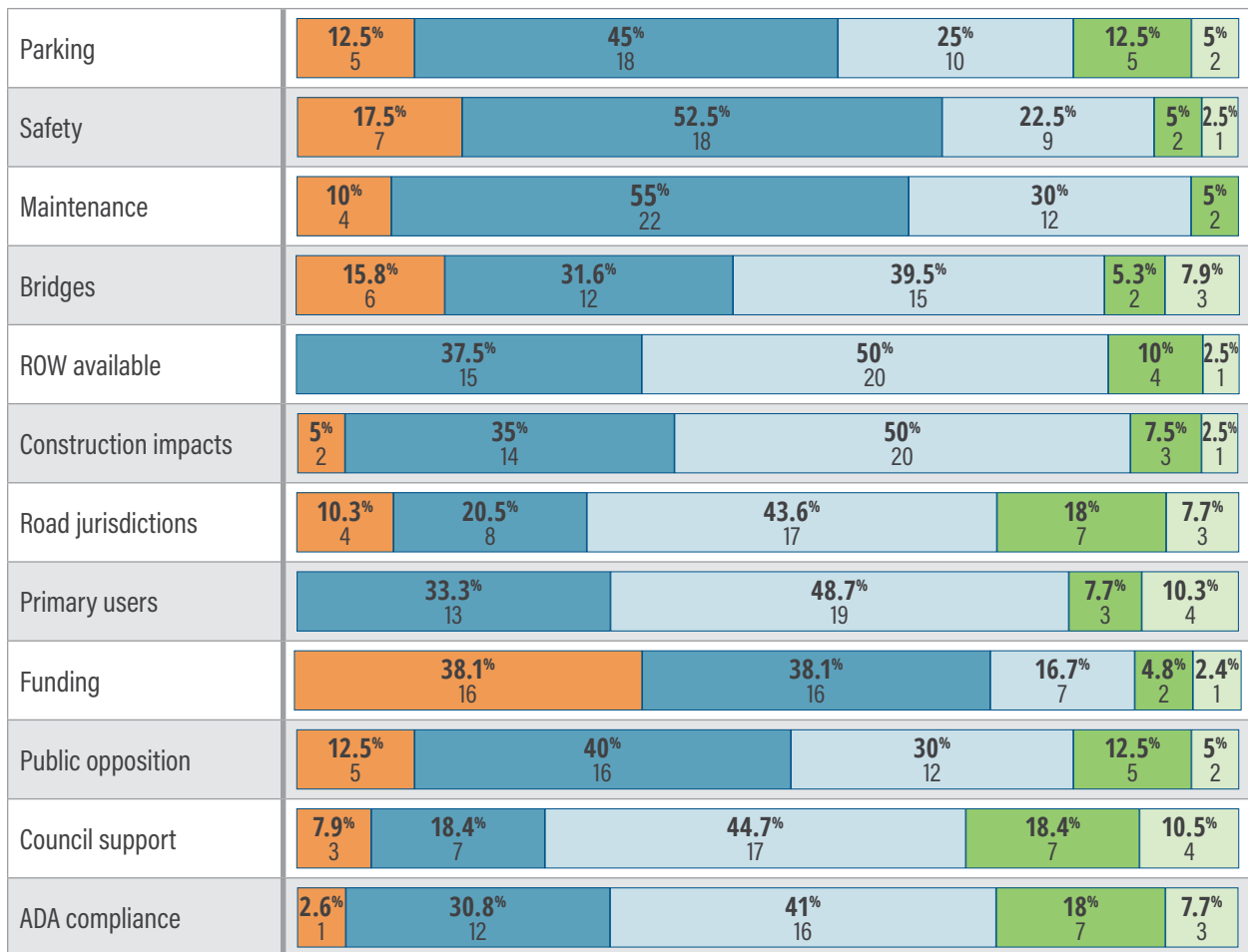
- The highest priorities are consistency with trail facilities, filling gaps, and connectivity.
- The second tier of priorities include speed, average daily traffic (ADT), mitigating major barriers, user types, and responding to public input.
- Potential for conflicts with driveways and utilities should be considered in facility selection but are generally not a high priority.

8. Other priorities used in facility selection (please specify):

- Existing shoulder is at least 4' wide
- Safety enhancements
- Lowest cost
- Available width of road
- They are usually initiated by Cities within our County. The County then sponsors the project so that Safe Routes to School or other funding may be received.
- Regarding facility selection—Dakota County has a fairly straightforward policy for facility selection that directs staff to select off side paths/multi-use trails in urban and suburban areas and wide shoulders in rural areas. This is primarily driven by the fact that most of the County Highway network is high speed (except in some of our older communities). With that in mind, many of the newer and innovative bicycle treatments don't really fit well with our network (bike boulevards, advisory bike lanes, etc.).



9. Rate the elements that have created challenges for your agency when selecting and designing bicycle facilities.



■ Highest Challenge
 ■ High Challenge
 ■ Low Challenge
 ■ Lowest Challenge
 ■ No Challenge

Key Takeaways

- Once you've selected the bike facility, the highest challenges to implementation are securing funding, availability of ROW, maintenance, safety, and the potential removal of parking. Public opposition to a project for a variety of reasons may also be a challenge.
 - The highest challenges will serve as the basis for the FAQs where additional research will be necessary to help decision-making (see pages 11-17 of this Guide).
- Secondary considerations such as temporary construction impacts, primary uses and political support can also sway the decision-making process.
- Bridges, ADA compliance, and multiple road jurisdictions may also be considered.

10. Has your agency’s experience with maintenance issues impacted how your agency may design future bicycle facilities?

Number of Agencies	0	5	10	15	20	25
Yes					18	
No					23	

11. If yes, how have maintenance issues impacted the design of future bicycle facilities?

Trail Section / Pavement / Pavement Management

- Spending the money up front to make sure you have a good base to place the bituminous surface certainly helps maintain the pavement’s condition.
- When trails were initially installed, there wasn’t necessarily a good focus on the sub-base. So, replacement has become a challenge when replacing.
- We have a lot of sand, gravel and other material getting onto trails that are built on the inslope of a rural section roadway. We usually lack ROW to move the trail further from the roadway. On future projects, we are trying to build trails on the backslope or building a swale between the trail and the roadway. The swale would be used to catch material washing off the roadway. This option will require additional ROW and may also cause drainage issues.
- Switched from 8’ to 9’ standard width for maintenance vehicles.
- Root and rodent issues, cracking.
- The maximum grade allowed for the bike path does not allow for good ditch turf establishment.
- These questions are in regard to multiuse (separated) trails. What are the best practices for mitigating tree root damage to a bituminous trail surface? Is chip sealing an effective and worthwhile maintenance activity, and if so, are there recommendations on materials? Thinking specifically about the size of the chip and the trail’s surface being friendly for rollerblades. Which is better in terms of maintenance, user-friendliness and life span, a wooden bridge deck or a bituminous surface, if concrete is not an option?

Funding for Trail and Facility Maintenance

- The funding just isn’t there to keep up with the number of miles of trail that we have.
- Causes our agency to be more judicial in making decisions so that we minimize future maintenance obligations.
- Funding to keep trails in good condition.
- Wider pavement, boulevard for snow storage, created ongoing maintenance funding source—takes away from building new. Trepidation with building new trails because of increased maintenance without a dedicated funding source. Can get outside funding for building new, but there’s no outside funding for ongoing maintenance.

Snow Removal

- We do not have winter maintenance of protected bike lanes figured out. Because of this, it has stalled, stopped and changed the facility type of various projects.
- Seeking options to protect from blowing/drifted snow, and anticipating potential pavement concerns with design (soil conditions, drainage, etc.).
- Separation of facilities from roadways for snow storage and mowing operations.
- Drainage and snow removal are always key priorities.

Managing Public Expectations

- On street or off street
- We need to manage the public's expectations, and so being consistent with maintenance will be a cost item.



12. What type of issues does your agency have with operations and safety?

Pavement Management

- Drainage issues.
- Keeping up with replacing the amount of trails we have due to funding.
- Very hard to install due to limited right of way.
- Fitting in where there is a lack of ROW.
- Tree roots pushing through the asphalt surface, creating rough trails. Making sure that we include in our RFPs that contractors must squeegee during crack filling operations. We are noticing and hearing from the public that our trails (specifically the bridge decks) are becoming extremely rough due to crack filling.
- Drop-offs, clearance from roadways.
- Regularly keeping the trails free of debris and maintaining the clear zone with mowing.

Public Expectations

- Education of pedestrians and bicyclists on the path.
- Many facilities have been designed by taking advantage of street reconstruction projects, so the network isn't well connected. It's created public perception issues that bike lanes don't get used, but the riders tell us they would use them if they're better connected. They don't feel safe because of the lack of connectivity.
- The trails fall under the umbrella of the highway department but are not given the same level of attention as the road system when they are off-road trails. Therefore, they are not checked for condition and safety as often.
- Effectively no issues. These facilities generally improve safety.

Winter Maintenance

- We need a local city agency to take responsibility for winter maintenance of protected bike lanes.
- Can be difficult to keep all trails open year-round due to weather conditions. Unsure if there will be safety concerns or issues with the newly proposed on-street lanes.
- Don't really have any. Our trails are last to be plowed in the winter as we focus on roads first.

Safe Crossings

- Separating walkers and bicyclists.
- Conflicts with turning vehicles at intersections.

- This may not be the primary purpose of the research, but our biggest safety issue is how to provide safe crossings of higher-speed roadways. Many of the crossing treatments such as rectangular rapid-flashing beacons are not appropriate on roads 45 mph and higher, which is a big part of our network.
 - Also, with crossings, the County will provide grade-separated crossings when we can, but there can sometimes be a challenge in getting people to use them, especially if they are on corridors with signals. These roads can be unsafe/uncomfortable to cross, but installing bridges/tunnels doesn't always solve the problem since they can be a longer distance for people to cross than at-grade.





LRRB Report Number: 2020RIC03
October 2020



Minnesota Local Road Research Board – Minnesota Department of
Transportation Office of Research and Innovation

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