NEW YORK STATE OF OPPORTUNITY. | NYSERDA | Department of Transportation

Mayor Byron W. Brown

Buffalo Bicycle Master Plan Update

Final Report

January 2016

Report Number 15-34

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ACKNOWLEDGEMENTS

This report was funded in part through a New York State Department of Transportation grant managed by the New York State Energy Research and Development Authority, and through a matching grant provided by the City of Buffalo. The grant was administered by GObike Buffalo.

The concepts presented in this report (or in an illustration) will need to be investigated in more detail before any funding commitments are made. Undertaking additional engineering, public engagement or other follow up work will be based upon funding availability.

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Thank you to the over 250 public participants who engaged with this planning process through public comment forms, interviews and three public meetings held July 30 and Dec 4, 2014 and May 21, 2015.

Technical Report Documentation Page

1. Report No. C-13-51	**2. Government Accession No.**	**3. Recipient's Catalog No.**	
4. Title and Subtitle Buffalo's Bicycle Master Plan		**5. Report Date** January 2016	
		6. Performing Organization Report Code	
7. Author(s) Jeff Olson, RA; Phil Goff, LEED AP; Sam Piper; Lindsay Zeftling, PE		**8. Performing Organization Report No. 15-34**	
9. Performing Organization Name and Address GObike Buffalo, 640 Ellicott Street, Buffalo, NY 14203		**10. Work Unit No. (TRAIS)**	
		11. Contractor or Grant No. 30906	
12. Sponsoring Agency Name and Address New York State Energy Research and Development Authority (NYSERDA) 17 Columbia Circle Albany, NY 12203 New York State Department of Transportation (NYSDOT), 50 Wolf Road Albany, NY 12232		**13. Type of Report and Period Covered** Final Report (2015)	
		14. Sponsoring Agency Code	
15. Supplementary Notes Joseph D. Tario from NYSERDA and Korie McAllister from NYSDOT served as project managers. Project funded in part with funds from the Federal Highway Administration.			
16. Abstract The Vision for the Buffalo Bicycle Master Plan Update is to make Buffalo a world-class bicycling community. Bicyclists' needs will be integrated into the City's projects, policies, and programs. Planning, implementation, and maintenance of roadway, public works, and transit projects will include improvements to accommodate bicyclists of all abilities. A well-connected bicycle infrastructure network will improve safety, the environment, public health, and quality of life for residents, visitors, and businesses. A bicycle friendly Buffalo will be a more affordable, economically competitive, and sustainable city.			
17. Key Words Bicycling, Buffalo, projects, policies, programs, planning, implementation, maintenance, network, safety, environment, public health, quality of life		**18. Distribution Statement** No Restrictions	
19. Security Classif. (of this report) Unclassified	**20. Security Classif. (of this page)** Unclassified	**21. No of Pages** 164	**22. Price**

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

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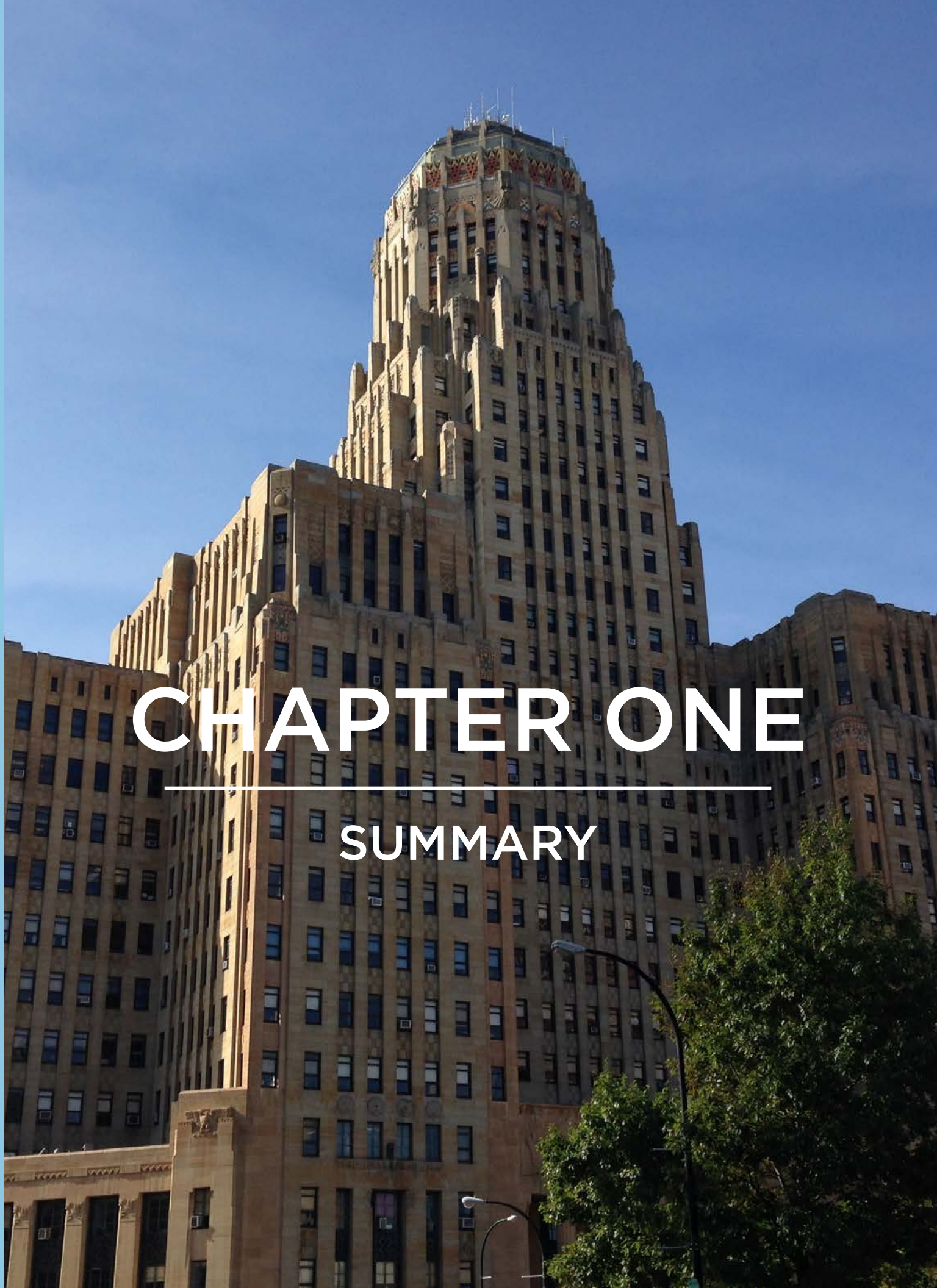


CHAPTER ONE

SUMMARY

INTRODUCTION

Across the country, cities have recognized the economic, public health and environmental benefits of becoming bicycle friendly communities. Buffalo's city leaders and its leadership have taken steps in recent years to raise the profile of bicycling while Mayor Byron Brown's vision for the City has created "one of the most bikeable, walkable and livable cities in the country."[1] The Bicycle Master Plan provides a blueprint for the expansion of Buffalo's existing bicycle network, and outlines steps to implement it in a phased approach.

Buffalo has a long history of planning for bicycle facilities. Despite national trends in transportation that focused exclusively on accommodating motor vehicles, Buffalo's commitment to improving bicycling conditions dates back to 1977, when the City's first bike Master Plan was adopted. In recent years, the City has implemented recommendations included in these plans, inspired by a national shift away from constructing bigger, wider roads to developing complete streets designed for all roadway users.

Buffalo's commitment to a more balanced, multi-modal philosophy is evidenced through the adoption of its Complete Streets Policy; the Buffalo Green Code planning efforts; and multiple park, greenway, and urban revitalization projects throughout the City. The recommended Bicycle Network introduced in this plan will serve to further Buffalo's focus on improving the City's livability by making bicycling a safe, viable and attractive mode of transportation. The plan leverages Buffalo's radial grid street pattern to propose a complete and connected network of on-street bikeways to complement the existing greenway trails. This network will connect the many destinations within the City to places where people live, learn, work, and play.

BICYCLE MASTER PLAN VISION

The Vision for the Buffalo Bicycle Master Plan Update is to make Buffalo a world-class bicycling community. Bicyclists' needs will be integrated into the City's projects, policies, and programs. Planning, implementation, and maintenance of roadway, public works, and transit projects will include improvements to accommodate bicyclists of all abilities. A well-connected bicycle infrastructure network will improve safety, the environment, public health, and quality of life for residents, visitors, and businesses. A bicycle friendly Buffalo will be a more affordable, economically competitive, and sustainable city.

[1] Mayor Brown's introduction at the Dec 4th, 2014 public meeting.

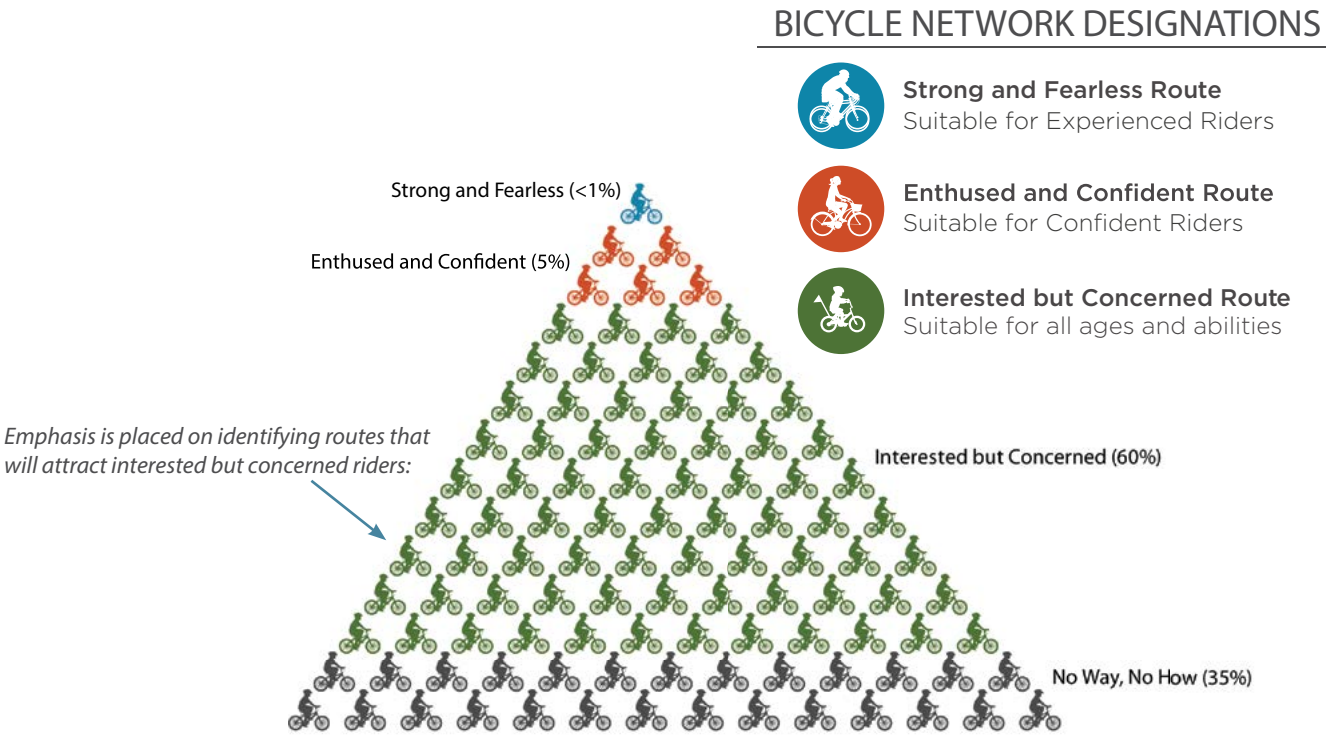
A bicycle facility "typology" was assigned for all of the streets that were included in the Master Plan's designated bicycle network. The typologies are based upon the presumed "types of bicyclists" that would be comfortable riding upon the street after the plan's recommended improvements had been implemented. The types of bicyclists were derived from empirical research that has shown that people typically fall into one of four categories related to bicycling: 1) Strong and Fearless, 2) Enthused and Confident, 3) Interested but Concerned, or 4) 'No Way, No How'. These categories served as the guiding principle for the plan, and emphasis was placed on identifying routes that catered to the majority of people that would bicycle if dedicated facilities were provided, known as the 'Interested but Concerned' group of riders. Descriptions of these categories are provided in the plan, and the distribution of the four-types of bicyclists is illustrated in the graphic below.

PLANNING PROCESS

The planning process included initial plan development by the steering committee, study consultants Alta Planning + Design (in collaboration with Wendel and Mustard Seed), GObike Buffalo, and the City of Buffalo, combined with extensive and diverse public outreach campaign. Outreach efforts included the following communications strategies:

- Public Survey (see Appendix C for summary)
- Public meeting input (July 30 and Dec 4, 2014 and May 21, 2015)
- Stakeholder meetings (six throughout process)
- GObike text message survey (see Appendix C for survey results)
- Online comments and e-mails
- Regional and local governmental input
- Outreach to Block Clubs

Public feedback informed the plan recommendations and the selection of 11 catalytic projects, which were determined to be critical to the overall bicycle network. The planning team's efforts were guided by project goals established collectively at the beginning of the planning process.

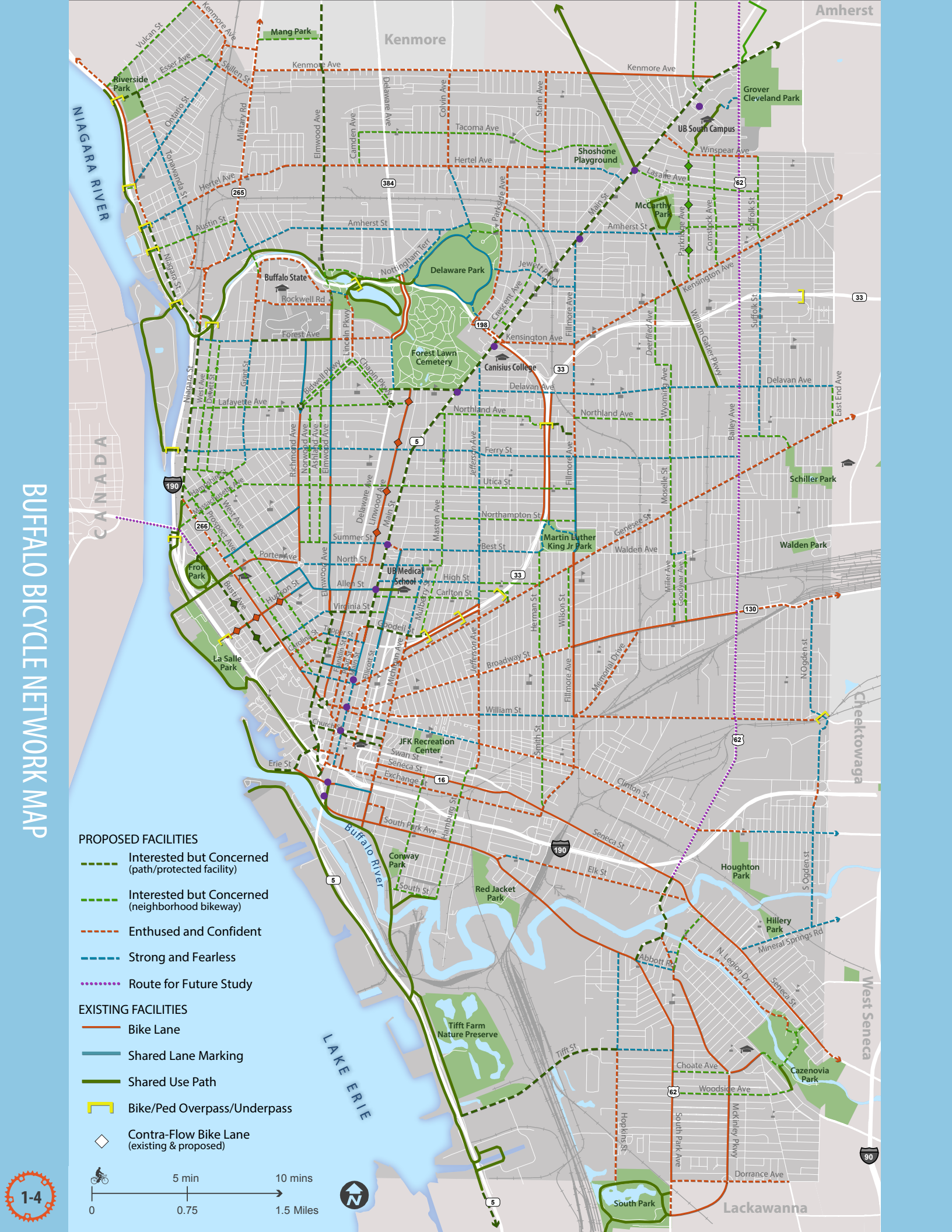


GOALS

The stakeholder committee, comprised of representatives from various public agencies, community/advocacy groups and private-sector representatives, identified prioritization factors for the Bicycle Master Plan Update. Based on the identified factors, the team outlined the following 10 project goals, ranked in order of importance as determined by the stakeholder committee:

1. **Safety**: Improve the comfort and safety of a wide range of bicyclists, ranging from children to the elderly (8-to-80 bicyclists). Aspire to reach zero pedestrian and bicyclist deaths on an annual basis.
2. **Create Complete Streets**: Help to improve accessibility for all modes of transportation, not just bicyclists.
3. **Revitalization/Economic Development:** Enhance the ongoing revitalization of Buffalo, and creates new economic development opportunities.
4. **Connectivity to Existing Bicycle Facilities:** Add to Buffalo's bicycle network by connecting directly to existing shared use paths or other bicycle facilities.
5. **Accessibility to Underserved Communities:** Provide a viable means of transportation to traditionally underserved communities by connecting residents to Live, Learn, Work, and Play destinations.
6. **Create Linkages to Destinations:** Provide linkage to transit stations and/or key commercial, night-life, cultural, or open space destinations.
7. **Improve Safe Routes to School:** Create safer off-road and on-street bicycle connections to schools for students of all ages.
8. **Complement the City's Reconstruction or Repaving List:** Incorporate dedicated bicycle improvements into the City's current list of reconstruction, repaving, or restriping projects.
9. **Political + Community Support:** Recommend improvements that have wide support among 1) elected officials, 2) City staff, 3) bike advocates, and 4) community groups to ensure that recommendations are politically viable and endorsed by the community.
10. **Cost + Engineering Challenges:** Identify projects that offer few engineering challenges and are of relatively low cost so that the network can be expanded rapidly (e.g., a street wide enough to accommodate bicycle facilities within the existing right-of-way).

Photo rendering of the Main Street Catalyst Project, which would include a cycle track, a facility designed to be comfortable for bicycle riders of all ages and abilities


BUFFALO BICYCLE NETWORK MAP
Kenmore
Amherst
Lackawanna
Cheektowaga
West Seneca
CANADA
NIAGARA RIVER
LAKE ERIE
Buffalo River
Mang Park
Riverside Park
Grover Cleveland Park
UB South Campus
Shoshone Playground
McCarthy Park
Delaware Park
Buffalo State
Forest Lawn Cemetery
Canisius College
Schiller Park
Walden Park
Martin Luther King Jr Park
UB Medical School
Front Park
La Salle Park
JFK Recreation Center
Conway Park
Red Jacket Park
Houghton Park
Hillery Park
Tifft Farm Nature Preserve
Cazenovia Park
South Park
PROPOSED FACILITIES
Interested but Concerned (path/protected facility)
Interested but Concerned (neighborhood bikeway)
Enthused and Confident
Strong and Fearless
Route for Future Study
EXISTING FACILITIES
Bike Lane
Shared Lane Marking
Shared Use Path
Bike/Ped Overpass/Underpass
Contra-Flow Bike Lane (existing & proposed)
5 min
10 mins
0
0.75
1.5 Miles
1-4

RECOMMENDATIONS

This plan recommends the addition of 300 miles of bikeways to be implemented over ten years. If plan recommendations are constructed according to this schedule, Buffalo will become one of the most bikeable cities in the United States. In order to support the general network recommendations, the plan also includes key design details and cost estimates for 11 catalyst projects that will jump-start the functionality of Buffalo's bicycle network. These projects are shown at right, and are detailed in the Catalyst Projects chapter. Through stakeholder collaboration and continued commitment by the City, the plan's vision and recommendations can become reality.

11. Catalyst Projects

- A: Elmwood Ave Cycle Track
- B: Parkridge Ave Neighborhood Bikeway
- C: Kensignton & Fillmore Intersection
- D: Delavan Ave Cycle Track
- E: Main St Cycle Track
- F: Virginia St Bike Lanes
- G: Utica St Neighborhood Bikeway
- H: Niagara St Cycle Track
- I: Jefferson Ave Shared Lane Markings
- J: Broadway 5-Point Intersection
- K: Church St Cycle Track

Lane miles of facilities in the proposed network by type

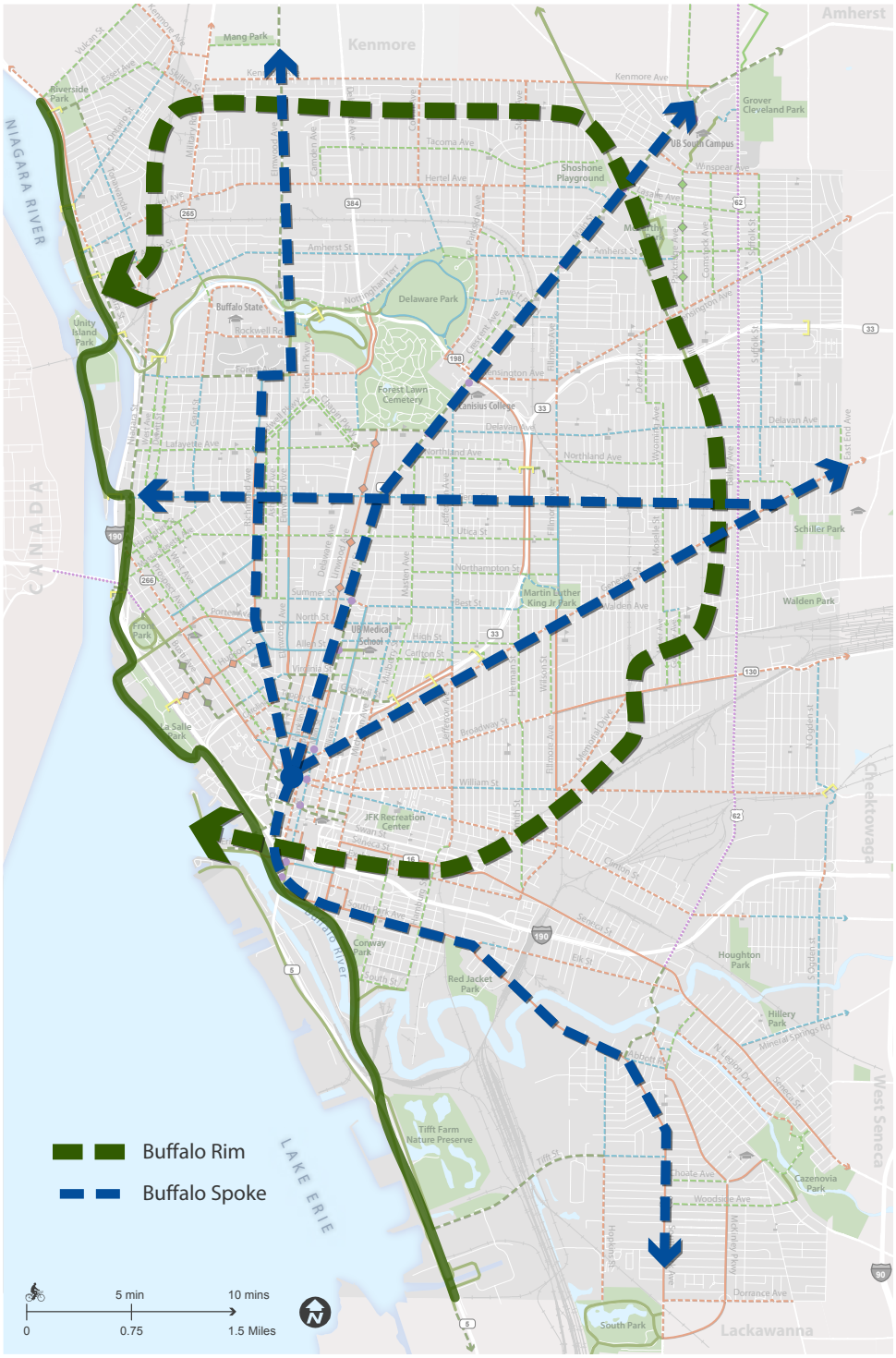
A variety of bike facilities are proposed that would be comfortable for the majority of bicyclists

CONCLUSION

The completion of the Bicycle Master Plan Update is the first of many key steps that need to occur to realize the plan's objectives. As the network is implemented, studies should also be undertaken to identify opportunities to convert Buffalo's many rail corridors into multi-use trails. A long-range vision for the city is to create a "rim-and-spoke"'network here a connected system of multi-use trails would serve as the rim of the network, and key bikeway corridors would serve as the spokes connecting the rim to the downtown hub. The visionary diagram below, if implemented, would place Buffalo's on-street bikeway and greenway trail network on par with other world class systems.

With collaboration, foresight, and strong community participation, every mile of the proposed network can be built. Implementing the bicycle network will benefit those who already bike in Buffalo, as well as those who will choose to bicycle once comfortable, connected facilities are available. The network will also make bicycling a more-accessible and safe mode of transportation for those who do not have access to a vehicle.

Cities throughout North America are in competition with each other for talent and employers, and increasingly people are choosing to live in places that are walkable, bikeable and offer many amenities. The completion of this network will complement other initiatives aimed at increasing Buffalo's population, and help to retain and attract valuable workers by making Buffalo a more desirable city in which to live, work, and recreate. Overall, a more bike-friendly Buffalo will be a harbinger to a more sustainable, liveable, and prosperous Buffalo.



Rim-and-Spoke vision for the Buffalo Bicycle Network

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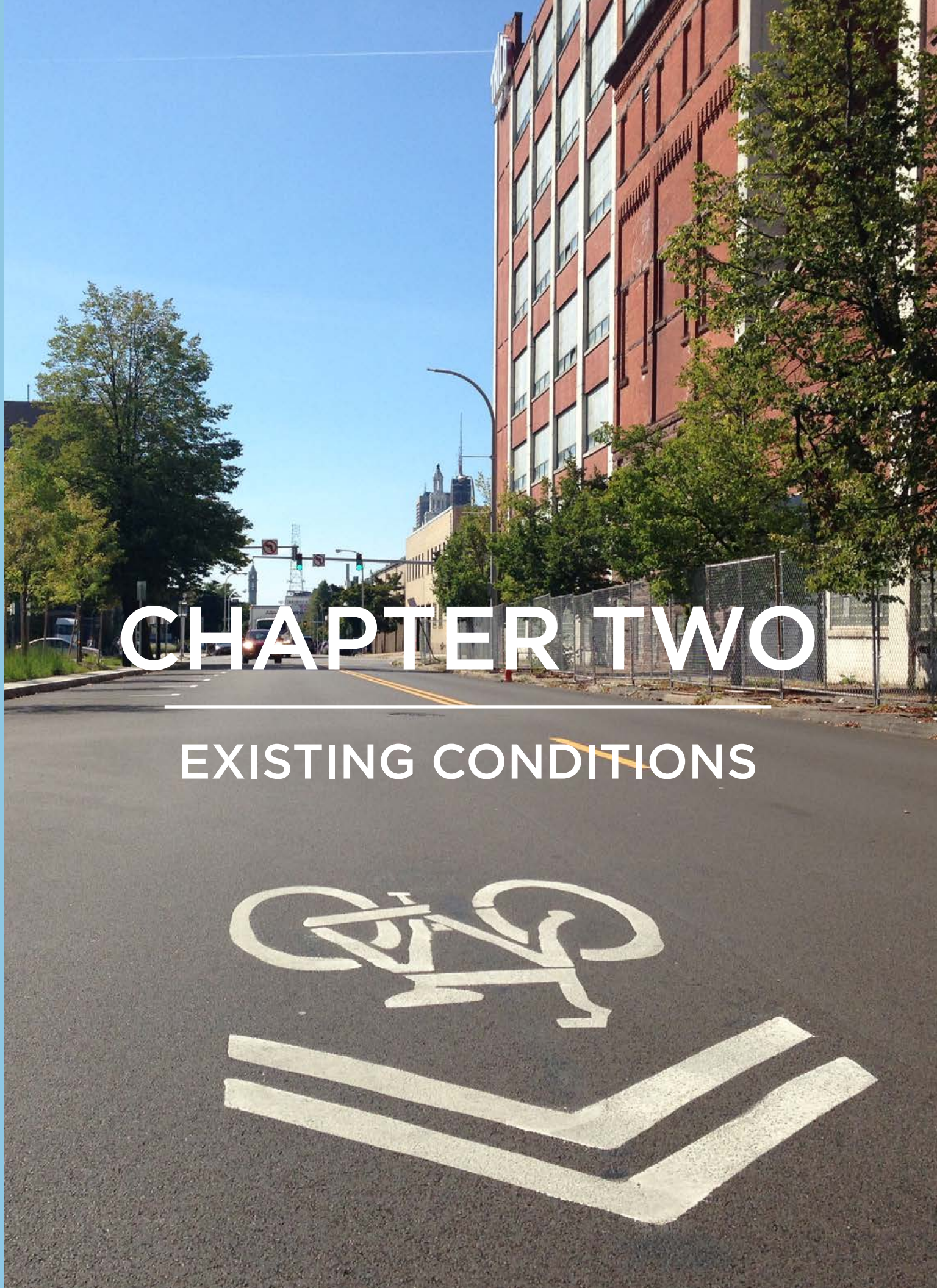


CHAPTER TWO

EXISTING CONDITIONS

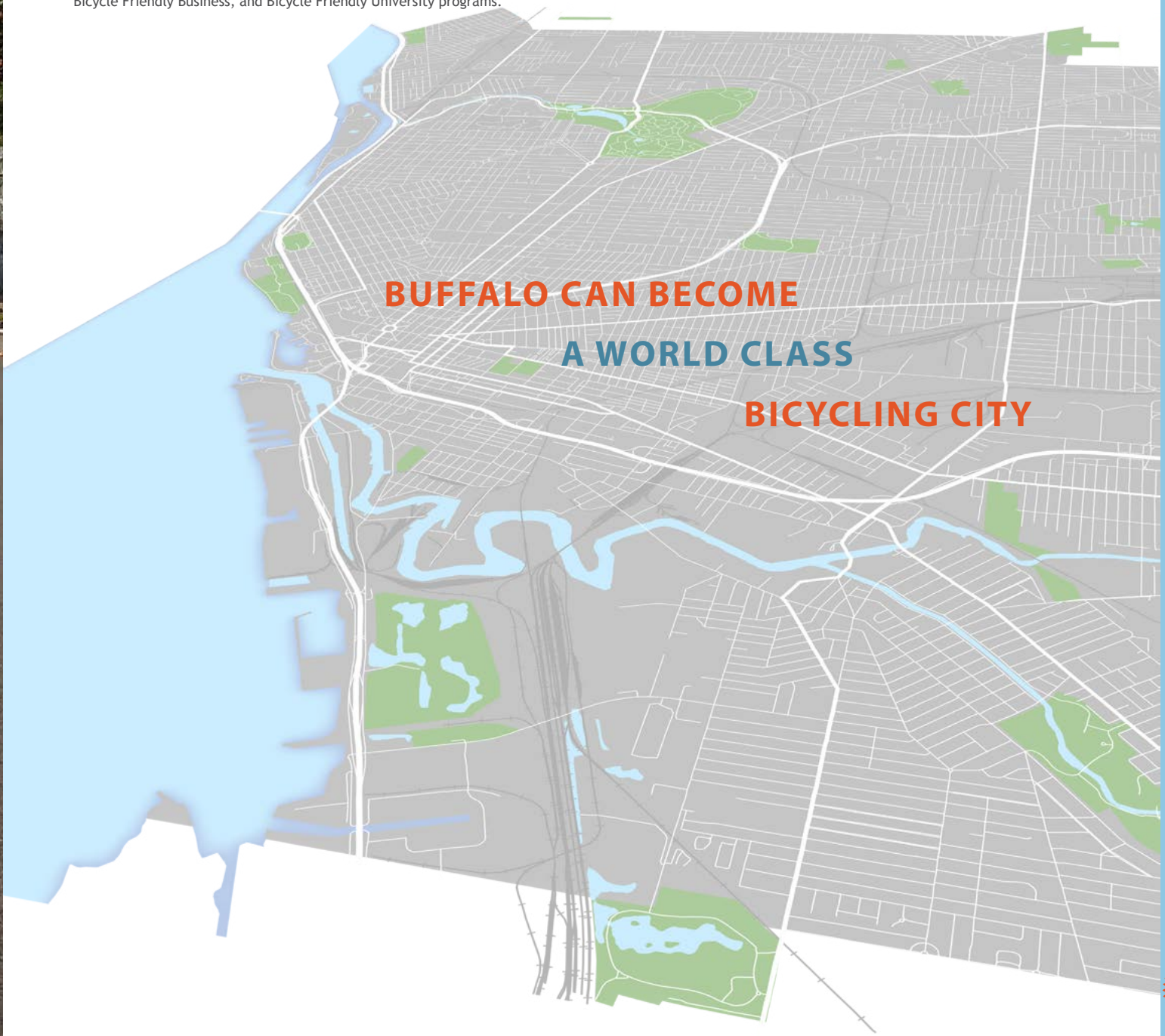
INTRODUCTION TO ANALYSIS

This chapter identifies the vision and goals for the Bicycle Master Plan Update. It includes summaries of pertinent existing plans and policies and a review of the City's Bike-Friendly Community application to the League of American Bicyclists[1] (LAB). In addition, this section of the plan contains a review of existing bicycling conditions in the city.

To increase Buffalo's bronze level Bicycle Friendly Community (BFC) rating, it is important to understand how Buffalo has achieved this accomplishment and the challenges in the network that currently keep the City from a higher ranking. Also, to propose a comprehensive "Five E's" approach–Engineering, Education, Encouragement, Evaluation, and Enforcement–it is critical to examine the existing environment, demographics, and ongoing programs for bicyclists. The area's geographic and demographic characteristics significantly affect the everyday transportation decisions made by bicyclists, pedestrians, transit riders, and motorists.

A comprehensive approach was implemented consisting of research, fieldwork, Geographic Information Systems (GIS) analysis, existing plan review, and Stakeholder Committee meetings. A BikeSpace analysis was used to determine which streets could accommodate dedicated bicycle facilities, and a bicycle network gap analysis is also included in this technical memorandum. The existing conditions identified in this report will ultimately serve to inform the recommendations in the final Bicycle Master Plan Update.

1 The League of American Bicyclists is a national bicycling advocacy organization that promotes and administers the Bicycle Friendly Community, Bicycle Friendly Business, and Bicycle Friendly University programs.



EXISTING BICYCLE FACILITIES

In recent years, Buffalo has implemented a range of bicycle facilities throughout the city including:

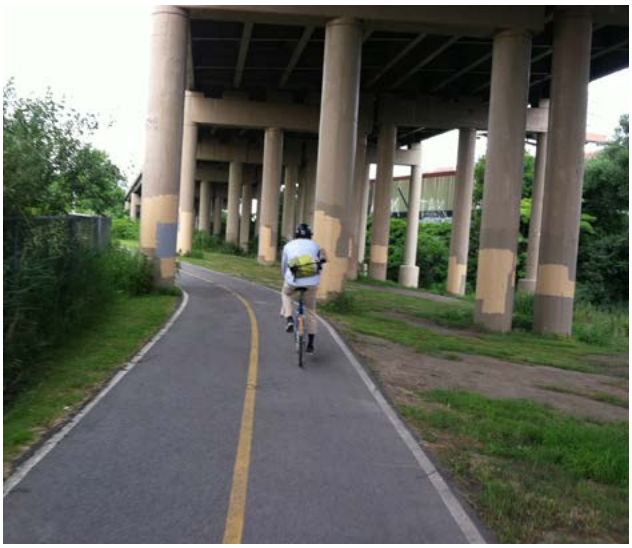
Elmwood Ave Cycle Track

Bike Lanes on Main St

Bike Lane on FIllmore Ave

Sharrows on Ellicott St

Contra-Flow Bike Lane on Hudson St



Shared Use Path along Scajaquada Creek

SUMMARY OF EXISTING PLANS & POLICIES

The City of Buffalo, like many cities in the 1950s-60s, became part of the national trend of highway building in an effort to increase the economic vitality of their downtowns. In Buffalo, motorists benefited from this improved access, but neighborhoods became disconnected and some historically significant buildings were replaced with surface parking lots. The city's transportation system became oriented toward moving motor vehicles more efficiently and fast. To advance this policy, some streets were widened. Investments in infrastructure specific to bicycling, walking, and public transit was reduced as well.

After decades of planning for motor vehicle traffic, the national urban planning objectives have shifted to local, community driven projects that improve livability, walkability, and make cities more bike friendly. "Complete streets" that accommodate all modes of travel are being constructed around the country in order to improve the economic vitality of cities. Buffalo has embraced this concept through the adoption of its Complete Streets policy and other recent efforts that will make Buffalo a better place to live, learn, work, and play.

A summary of relevant plans pertaining to the bike master planning effort are provided below.

QUEEN CITY HUB: A REGIONAL ACTION PLAN FOR DOWNTOWN BUFFALO

This planning effort led by the City began in 1994 as a visioning process to outline the future of Downtown Buffalo. Over the next 10 years, five summits were held to refine the vision and determine actionable strategies to implement the vision. The planning processes incorporated an extensive public involvement process, including: interviews, public hearings, and public meetings. Committees were established through the planning process to implement priority projects. **Of the 15 projects, 12 have been completed.** One emphasis of the plan was improving access to downtown so that everyone could, "drive and park, ride the train or bus, cycle, and especially walk in order for everyone to take advantage of everything Downtown has to offer."

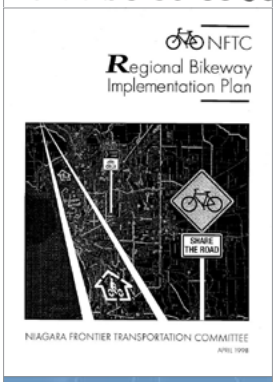
REGIONAL BIKEWAY IMPLEMENTATION PROGRAM (1998)

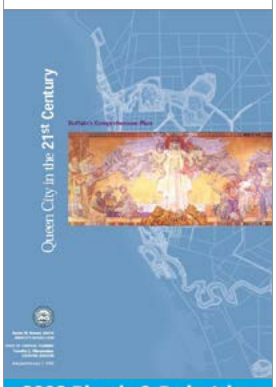
The goal of this plan developed by the Niagara Frontier Transportation Committee (now GBNRTC) was to create a range of strategies and cost estimates to create a network of dedicated bicycle routes throughout the Niagara Frontier region. The report produced a Bicycle Network Master Plan for Buffalo, which was adopted

BUFFALO'S HISTORY OF RECENT PLANNING EFFORTS

1977
The first City of Buffalo Bikeway Plan is released

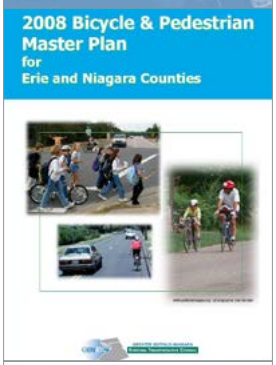
1998
First update of the region's Bicycle Master Plan since 1981

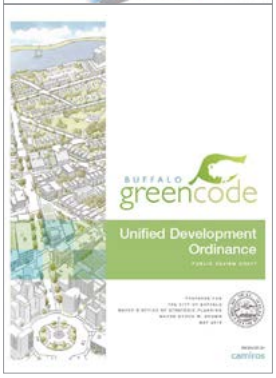




2006
Buffalo Comprehensive Plan Adopted

2008
Bicycle + Pedestrian Master Plan for Erie and Niagara Counties adopted. Updated BLOS and facility maps for Buffalo are included





2014
Buffalo's Green Code efforts culminate in the form-based Unified Development Ordinance

by the City's Common Council in 1998. The plan recommended facilities so that, when the network was built-out, most of the city's residents would living within one half-mile of an on-road bicycle facility.

The first section of the plan showcases the Bicycle Master Plan for the City of Buffalo. To develop the network, the plan developed Bicycle Level of Service (BLOS) scores based on roadway comfort levels (using grades "A," most comfortable, to "F," least comfortable) for many the city's major roadways. The BLOS maps were to be used by planners to help identify areas in high need of improvements, and prioritize projects. Of important note was that **75% of all road segments within the city of Buffalo received a score of "D" or worse, mainly due to high traffic volumes and constrained rights-of-way.** The report also recommended treatments to improve the BLOS scores for the city's routes, including the installation of bike lanes, wide curb lanes, and paved shoulders.

GREENWAY SYSTEM IMPLEMENTATION PLAN (1998)

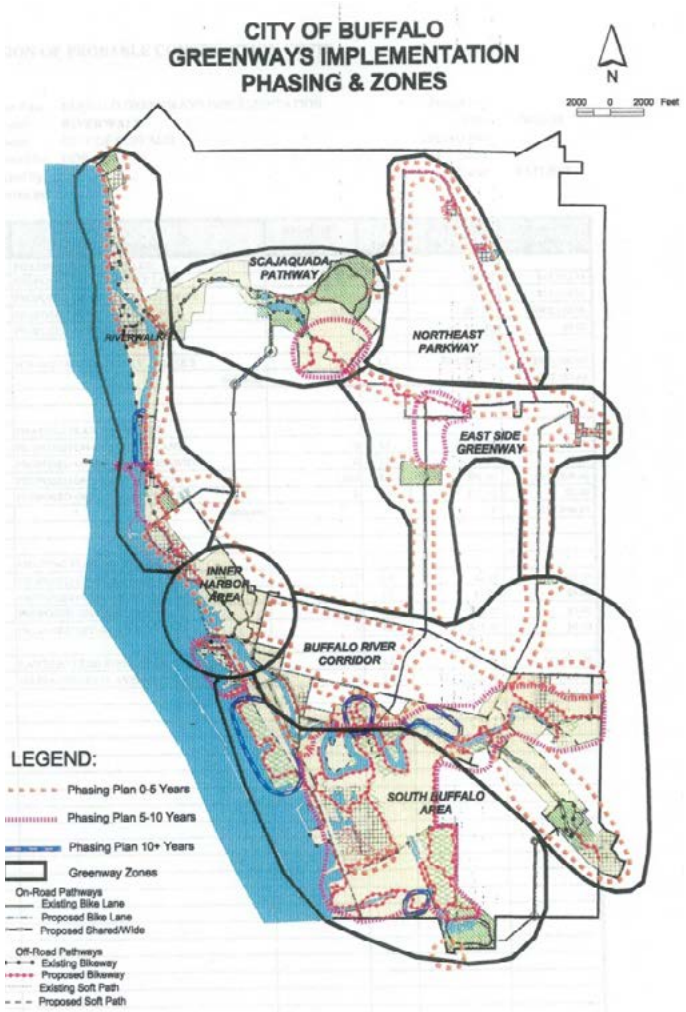
This plan developed by the City created a compelling vision for expanding the three main "spokes" of Buffalo's greenway system, including the Riverwalk, the Buffalo River Greenway, and the Outer Harbor Greenway. **The vision of the plan was to create a series of pathways that would connect activity centers throughout the city to downtown and encourage people to stay in the area.** A central feature of the improved Greenway network would be a plaza, called the "Common" or "Village Green", which would be located in the Inner Harbor, creating a strong connection between the links that comprised the greenway system. Nine goals for the greenway system were identified in the plan, and are:

1. Increase access to the waterfront.
2. Reduce traffic congestion.
3. Increase recreational opportunities.
4. Increase economic development.
5. Connect to local destinations.
6. Connect and improve Olmsted park network.
7. Increase educational opportunities.
8. Enhanced quality of life and health for human and wildlife communities.
9. Enhance environmental sustainability of area.

The plan identified physical barriers in creating a connected network of greenways, as well as property acquisitions that would need to be made to route the trails. Detailed cost estimates for the full build out of the greenway system were also provided.

BUFFALO COMPREHENSIVE PLAN - QUEEN CITY IN THE 21ST CENTURY (2006)

The City of Buffalo's comprehensive plan, adopted in 2006, serves to guide development of the city over the next 20 years. **Smart Growth principles are the foundation of the plan**, and through the implementation of strategic planning efforts Buffalo can "fix the basics, build on assets." Broadly the plan has several focus areas, including the economy, the community, the environment, infrastructure, financial capacity and control, and planning and zoning. The plan is to be reviewed and revised every five years to ensure its continuing relevance. These focus areas are organized according the following themes:



The Greenway System Implementation Plan identified several zones within Buffalo's Greenway System and created phased stratagies to create connections.

1. Delivering quality public services.
2. Maintaining public infrastructure.
3. Transforming Buffalo's economy.
4. Reconstructing the schools.
5. Rebuilding neighborhoods.
6. Restoring the Olmsted, Ellicott, and waterfront systems.
7. Protecting and restoring the urban fabric.

In terms of transportation, the plan notes that of the 675 miles of roads within the city's limits, 210 are eligible for federal aid. The remaining **465 miles of road are maintained with city funds** and the lack of municipal funds available to upkeep the roads has led to some deterioration of the network. **Vehicle miles traveled increased city wide from 16 million in 1984 to 19 million in 1999.** The Niagara Frontier Transportation Authority provides transit service for the city through its subsidiary NFTA Metro, and the system carries 94,000 passengers daily. There has been an increase in ridership in recent years. Key transportation goals for the master plan include:

- Improve regional mobility and accessibility.
- Support existing and future economic development activities.
- Improve transportation and land use coordination.
- Preserve existing infrastructure.
- Improve quality of life for all residents.

There is not much of an emphasis in the plan on improving non-motorized transportation access. Some long term transportation priorities identified in the plan include: neighborhood traffic calming measures, pedestrian and bicycle amenities, and streetscape improvements. The plan notes that bicycling is increasing in popularity as a mode of transportation, and more dedicated bicycle facilities should be constructed. Specifically, the Regional and Urban Design Guide Principle #8 states that "Buffalo supports the continuing development of public transit and expanded bicycle facilities on the waterfront, through the Olmsted parks and elsewhere" and that children should be able to walk and bike to school.

BICYCLE AND PEDESTRIAN MASTER PLAN FOR ERIE AND NIAGARA COUNTIES (2008)

The Greater Buffalo-Niagara Regional Transportation Council developed this master plan in November of 2008. The plan's primary goal was to "make walking and bicycling integral parts of daily life in the region" by recommending projects, programs, and policies for a 10-year period. It **includes over 100 actions and recommendations with a time table of expected completion.** Sections of the report included chapters on enhanced street design for walking and bicycling, bike parking, transit connections, education and marketing programs, enforcement efforts, crash analysis and an implementation plan.

The plan is the third in a series of other bicycle and pedestrian planning efforts, the first of which was produced in 1981 and helped to create a unified vision for bicycling and walking in Buffalo-Niagara. This plan was updated in 1998 with the introduction of a Bicycle Level of Service (BLOS) score for the region's road network, and a Regional Bikeway Implementation Program, that resulted in a network of routes that would best serve cyclists and connect them to activity generators.

The BLOS scores for the city were updated in the 2008 plan, and existing and proposed bicycle routes in Buffalo were mapped as well. The 2008 Bicycle and Pedestrian Master Plan serves as the foundation for the Buffalo Bicycle Master Plan Update, and provides goals and performance measures to create improved walking and biking connections in the city and throughout the region.

THE BUFFALO OLMSTED PARK SYSTEM: PLAN FOR THE 21ST CENTURY (2008)

This plan, produced by the Buffalo Olmsted Parks Conservancy, provides a comprehensive summary of the existing conditions of the Olmsted Parks System, which includes six major parks, multiple parkways, circles, and small spaces, and was placed on the National Register of Historic Places in 1982 as a cultural landscape. The plan then makes recommendations for each individual component of the system to restore the parks and parkways to their original grandeur. The restoration projects are planned over a 20-year horizon and are estimated to cost $252.5 million. The improvement of the parks should not be seen as an expenditure of capital funds with little return, but rather an investment in community assets that provide a place to recreate, improve air and water quality, and moderate temperatures.

Several **urban development projects aimed at improving automobile access in the City have drastically affected the appeal of the park system and interrupted non-motorized circulation.** These projects include:

- The Humboldt Parkway was demolished to make room for the Kensington Expressway.

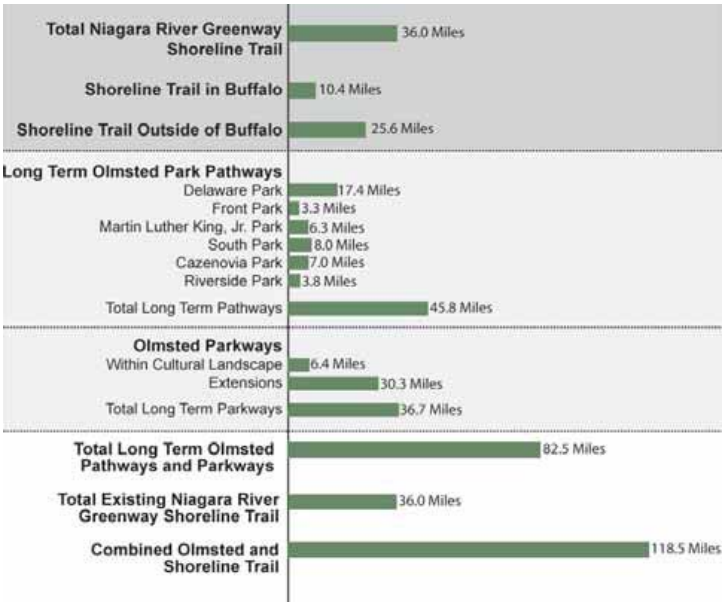
- Martin Luther King, Jr. Park lost valuable parkland with the construction of the Kensington Expressway.
- Delaware Park was split in two with the construction of the Scajaquada Expressway.
- A large portion of Gala Water (now called Hoyt Lake) in Delaware Park was lost with the construction of access roads to the Scajaquada Expressway.
- Both Riverside and Front Parks were separated from the water—their raison d'être—with the construction of the New York State Thruway.
- Front Park lost parkland and the "borrowed" green space from Fort Porter, and was cut off from the city with the construction of the Peace Bridge and its access roads.
- Cazenovia Park lake was abandoned and eventually eliminated.
- All of the six major parks have been altered from "natural landscapes" with the profusion of single-use facilities such as baseball diamonds, tennis courts, and golf courses.

The plan incorporated a thorough public involvement process, and **polled over 28,000 park users** to determine why they like to use the Olmsted Parks. "Walking, strolling, or running" were the most popular activity, and "relaxing, socializing, and picnicking" were a second favorite. In total, 71% of park goers activities were unstructured, including activities such as biking, roller blading, special events, programming, and the activities highlighted above.

Fixing the basics of the park is the short-term priority, including rehabilitating landscape and vegetation, operations and management, paths and trails, recreational opportunities, branding, and providing amenities such as water, rest rooms, and benches.

COMPLETE STREETS POLICY AND POLICY BRIEF (2008)

The City of Buffalo adopted a Complete Streets Policy in 2008. The policy states that in all new construction, reconstruction, street maintenance, public works, and park projects shall include bicycle and pedestrian facilities. The intent of the provision of these facilities is to provide safe access for all roadway users, including persons with disabilities, pedestrians, bicyclists, motorists, and transit riders. The Policy also requires that the City of Buffalo Bicycle and Pedestrian Advisory Board shall review street construction projects. In only the following circumstances should bicycle and pedestrian facilities not be provided during the aforementioned street projects:



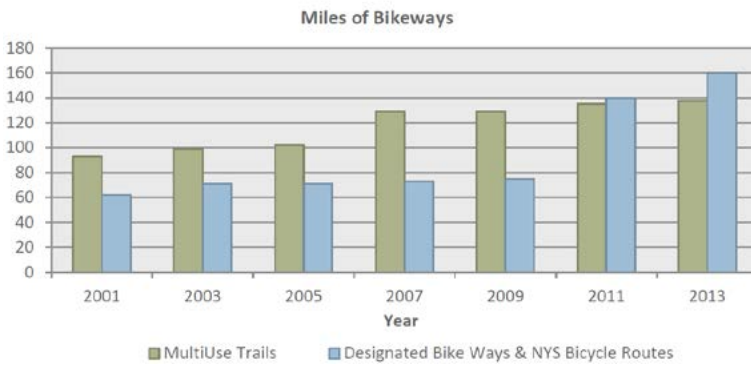
The six restored Olmsted parks are shown at the same scale in this image to demonstrate their comparative size.

8. Delaware Park - 368 Acres
9. South Park - 168 Acres
10. Cazenovia Park – 196 Acres
11. Martin Luther King Jr. Park – 51 Acres
12. Riverside Park – 37 Acres
13. Front Park – 26 Acres

Source: Buffalo Olmsted Parks Conservancy

- Bicyclists are prohibited by law. If this is the case, alternate accommodations shall be made in the same transportation corridor.
- If anticipated use is low, and the cost of the bicycle and pedestrian accommodations exceeds 20% of the larger project.
- If the existing right-of-way does not provide space for bike facilities or sidewalks, the Commissioner shall explore alternatives to providing accommodations, including lane reconfiguration, paved shoulders, signage, traffic calming, education and enforcement.
- Or, if the provision of bicycle and pedestrian facilities constitutes a threat to the health, safety and/or welfare of pedestrians, bicyclists and/or motorists.
- The policy also notes that Bicycle and Pedestrian facilities shall be planned, developed and maintained in accordance with guidelines adopted by USDOT, NYSDOT and AASHTO, or other guidelines approved by the City of Buffalo.

Justification for the adoption of the Complete Streets Policy is provided in the Complete Streets Policy Brief. The brief notes that historically, walking and biking maintained a much higher percentage of overall transportation mode choices that they do today. One of the primary reasons for the decline in choosing these two modes has been a decline in safety. **In NYS, the leading cause of injury, hospitalization, and death among five-to-nine year olds is being struck, as pedestrians, by motor vehicles.** Youth (ages 5 to 17) also represent a disproportionate amount of bicycle/motor vehicle injuries and fatalities (61.6%) and pedestrian/motor vehicle injuries and fatalities (25.7%) when compared to this age groups percent composition (only 25%) of the total NYS population.



The miles of bikeways in the Buffalo-Niagara Region have steadily increased over the past decade (source: GBNRTC)

In 2003, New York State spent $6.1 billion in medical expenditures related to obesity, and complete streets can counter this staggering figure by making active transportation more appealing. The brief also notes that non-motorized transportation will contribute to a reduction in greenhouse gasses and fuel consumption if, as a result of the construction of complete streets, motor vehicle trips are replaced with bicycle and pedestrian trips. Complete streets will enhance the economic vitality of the community; by promoting walkable, bikeable shopping experiences. Lastly, as the general NYS population ages and baby-boomers reach retirement age in large numbers, complete streets will provide older people with the opportunity to age in place.

2040 METROPOLITAN TRANSPORTATION PLAN (MAY 2014)

GBNRTC's The Long-Range Transportation Plan serves as the guiding document for the Buffalo/Niagara metropolitan region, and ensures that the region is in compliance with federal transportation planning regulations. The plan covers all modes of transportation, including roads, bicycles and pedestrians, transit, freight, air, and water. The report notes that **the number of bikeways and multiuse trails has increased over the past decade, from 60mi to 75mi for bikeways and 90mi to 135mi for trails.**

GBNRTC also collects BLOS data biannually, and **over the same period average BLOS scores in the region have improved.** The report notes that NFTA has shown a commitment to intermodal transportation, allowing bicycles on all of their rail cars at all times and equipping over 50% of their busses with bike-on-bus racks. Often, cities with successful bike mode shares have good transit systems, as the two modes are complements to each other. In Buffalo, transit ridership has risen since 2000, but dropped slightly in the past two years.

One of the goals of the plan is to increase mobility and accessibility by offering a more balanced transportation system that provides modal choices. Transportation options should be specially enhanced for the transportation disadvantaged in the community. Non-motorized modes, which by their nature are affordable, should be expanded. Generally, the LRTP emphasizes the importance of planning for all modes, and notes the economic, environmental, and social benefits that will be gained by providing diverse transportation options.

BUFFALO GREEN CODE: LAND USE PLAN (2011)

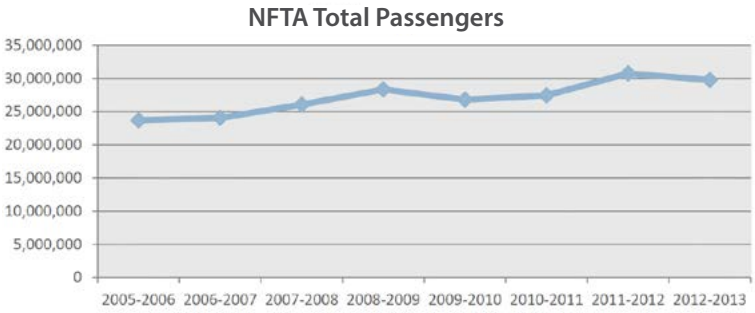
Buffalo's Land Use Plan was the first component of the on-going Buffalo Green Code planning process. The land-use plan set the stage for the subsequent Buffalo

Unified Development Ordinance, a form based code that was oriented at regulating the appearance of buildings to ensure consistency and attractiveness of the built environment, rather than the building's use. The overall intent of this zoning overhaul being to create more desirable places in Buffalo to live, learn, work and play.

Buffalo's existing land use pattern positions the city well to become a bicycle-friendly community. Many neighborhoods–especially in the central core of Buffalo–are compact, dense and full of a mix of uses. **Buffalo has a person per square mile density of 6,436 making it more dense than Milwaukee, Denver and Portland, OR.** Also, due to the density, walking, cycling and public transportation are all viable modes of transportation.

The report notes that in 2009, **"13% took transit to work, 6% walked, and 1% biked. These are among the highest rates of non-car commuting in the nation."** Additionally, 30% of Buffalo's residents do not have a personal vehicle. Though this may not be due to choice, it represents a significant portion of the population that would benefit from increase bicycle access for transportation. The plan highlights several goals related to land use, the economy, environment, and demographics. Goals and objectives related to bicycling are highlighted below:

- Embrace Mayor Brown's Mobility Project by continuing to install bicycle facilities as part of routine roadway construction projects.
- Continue installation of bicycle racks in neighborhood centers through ongoing implementation of Mayor Brown's Commercial District Bicycle Rack Program.
- Protect rail-to-trail opportunities and incorporate vacant rail corridors into greenway plans where appropriate.
- Revisit policies that give undue preference to automobile use at the expense of transit, such as minimum parking requirements.
- Support a robust transit system by focusing compact neighborhood development and employment density in areas with high transit accessibility.
- Support the Complete Streets Policy.
- Support plans for the Safe Routes to Schools and Safe Routes for the Elderly.
- Support planning initiates for the Niagara River Greenway, Buffalo River Greenway, Black Rock Channel Greenway, the DL&W (The Del) Greenway and Outer Harbor Greenway.



Transit Ridership, a mode that supports bicycle transportation, has increased in recent years, but dropped off in 2013

CHILDREN'S HEALTH: A GROWING NEED TO INCORPORATE PHYSICAL ACTIVITY INTO THE DAILY LIVES OF YOUTH (2012)

This report produced by the University at Buffalo's Food Systems Planning and Healthy Communities Lab highlights many statistics that are relevant to the Bicycle Master Plan. The report notes that about 30% of households in Buffalo do not have access to a vehicle, and students who live within these houses need to walk, bike, or ride a bus to get around. **Almost all elementary school students (90%) are bussed to school;** the remaining 10% walk or bike to school. High school students are bussed on NFTA buses, and are provided with passes to ride along the routes to and from school.

BUFFALO greencode

The Buffalo Greencode is a plan that holistically serves to guide all planning and development decisions in the city, emphasizing sustainable solutions to the city's growth

Overall, physical activity levels among students are low: **71% of students do not get the recommended minimum 60 minutes of physical activity a day.** 21% of middle school students and 18% of high school students reported not being physically active any day of the week. 40% of 6-12 graders did not belong to any sports team in their school or community during the past 12 months. As a result of this inactivity, **25% of Buffalo City School District students are overweight or obese.** The report discusses the barriers to active living for children, including the risk of being struck by a vehicle while walking and biking, and high crime rates. **Youth were involved in a disproportionate amount of pedestrian and bicyclist accidents with motor vehicles from 2010-11** as 26.5% of accidents involve youth, while only 22% of city residents are youth.

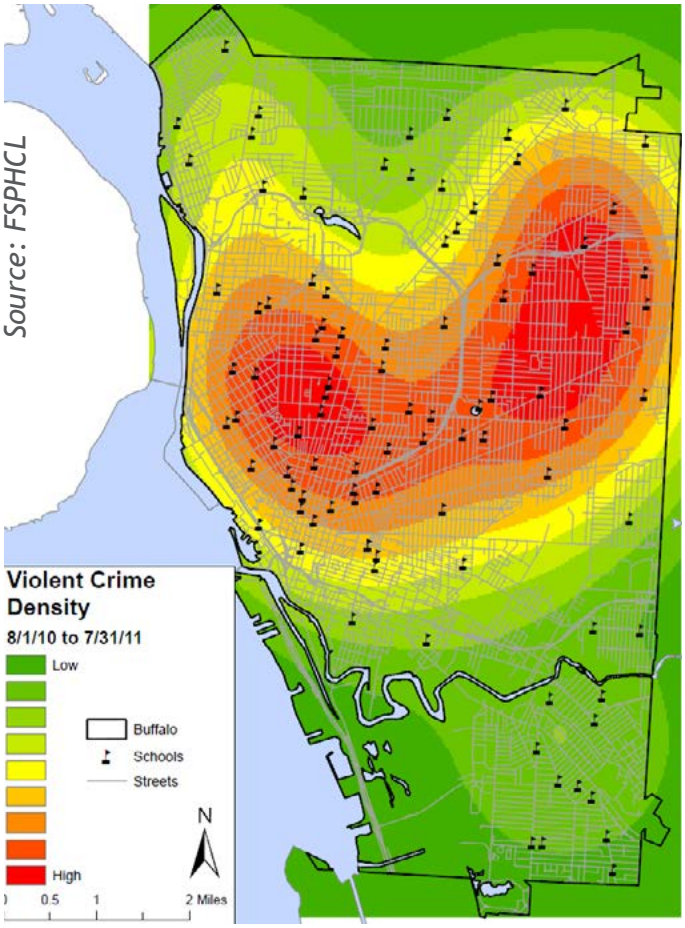
According to the report, Buffalo's youth bear a disproportionately high burden of poverty, which impacts their ability to be physically active. Poor families may not have enough money to pay for children's community sports league fees and to purchase transit passes for children to travel to games or practices. Compared to wealthier families, poor families more often live in high-crime areas with unsafe traffic conditions, impacting the safety of outdoor physical activity.

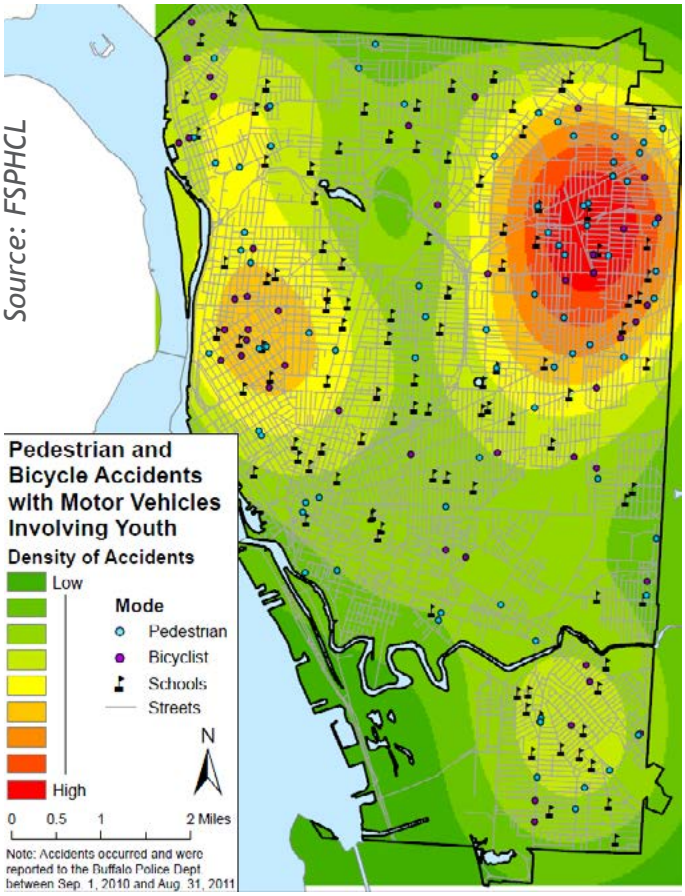
LOCAL WATERFRONT REVITALIZATION PROGRAM (2014 DRAFT)

The local waterfront revitalization program includes several strategies for improving Buffalonians' access to their waterfront. The transportation components of the priority projects are outlined below.

Niagara Street/Great Lakes Seaway Trail Streetscape Project

Niagara St, a designated segment of the Great Lakes Seaway Trail National Scenic Byway, links many destinations along Buffalo's waterfront and is envisioned to become the primary waterfront transportation corridor for the city. Currently, conditions of the roadway





Children in Buffalo should be able to walk and bike to school, but barriers exist, such as high-crime areas and the risk of getting struck by a vehicle.

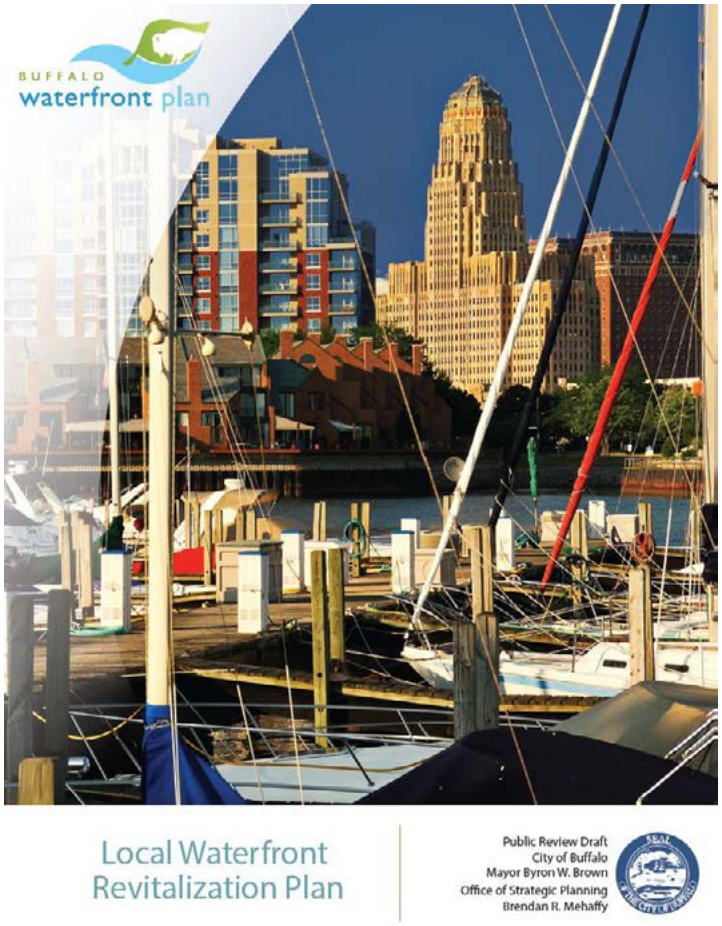
are not conducive to non-motorized transportation; the right-of-way is wide and there are few traffic calming measures. Vehicle speeds along the roadway "regularly exceed the posted speed limit by 15 mph or more".[1] The plan for this roadway calls for streetscape improvements, dedicated bicycle and pedestrian facilities, and improved transit access and beautification. All these efforts are aimed at sparking redevelopment along the corridor and improving non-motorized access. Construction on the street began in fall 2014.

Scajaquada Expressway Boulevard Project
The project goal is to convert the Scajaquada Expressway into an at-grade, landscaped boulevard. Other project objectives include making the expressway a complete-street through the installation of bike and pedestrian accommodations, and overhauling the streetscape of the corridor to traffic calm the roadway. The expressway, which currently divides Delaware Park and rich cultural resources north and south of the road, would become a multi-modal corridor that enhances, rather than detracts from, the surrounding areas.

Niagara St./ Virginia/Carolina I-190 Interchange Gateway Project
The interchange would be reconstructed to minimize its visual impact on the surrounding neighborhood. Improved connections would be made to the waterfront via Virginia and Carolina Streets. The project also recommends the removal of the on-ramp from Virginia Street. The on-ramp area then could be adaptively re-used as a development parcel. Pedestrian crossing enhancements would be included as well.

Erie Street Waterfront Connection
Project involves the realignment of Erie Street to provide direct access between Main Street and the waterfront. The reconstruction would provide new development sites close to the waterfront, and provides a key opportunity to convert underpass barriers into gateways. Pedestrian access and safety through the corridor would also be enhanced.

Cars on Main Waterfront Connection
Auto traffic has not been permitted on Main Street since 1982, and like most downtown pedestrian malls around the country, the lack of auto traffic has negatively impacted local businesses along the street. The proposed plan seeks to reopen Main St to two-way vehicular traffic to spur retail activity and economic development. (The 500 and 600 blocks were completed in 2015.)



Perry Street/Cobblestone Connector
Make streetscape improvements to enhance the impression visitors to Buffalo have of the city, as this corridor is the primary gateway to Canalside and the First Niagara Center.

Ohio Street Reconstruction
Reconstruction project will fill a gap in the walking/ bicycling network with a multi-use path between Michigan Ave and Fuhrmann Boulevard. (Completed in 2015.)

Main Street was recently reopened to vehicles.

1 Buffalo Local Waterfront Revitalization Program, Transportation Project, TI. Niagara Street/Great Lakes Seaway Trail Streetscapes Project, pg 41

The Scajaquada Expressway will be reconstructed in the future, although funds have yet to be dedicated to the project. The rendering above shows one proposal to make the limited access highway a boulevard.

ONGOING STREET CONSTRUCTION PROJECTS:

Three street construction projects are planned or under construction in Buffalo, including:

Kenmore Avenue Reconstruction

The City of Buffalo and Erie County are progressing on the reconstruction of Kenmore Avenue between Main Street and Fairfield Avenue. Kenmore Avenue (CR 307) travels from Grand Island Boulevard (NYS Route 324) at its western terminus to Main Street (NYS Route 5) at its eastern terminus and is 5.5 miles long. The portion between Main Street and Starin Avenue is the first phase of the reconstruction project, and is 1.3 miles long. Enhancements will be made to improve safe travel for vehicles and pedestrians, and traffic signals and geometric improvements to the roadway is being made to make the traffic flow more efficient. Improvements will include new five foot bike lanes on each side for the project corridor. Construction is now underway.

Mayor Brown announces the Kenmore Avenue Reconstruction project in the summer of 2013

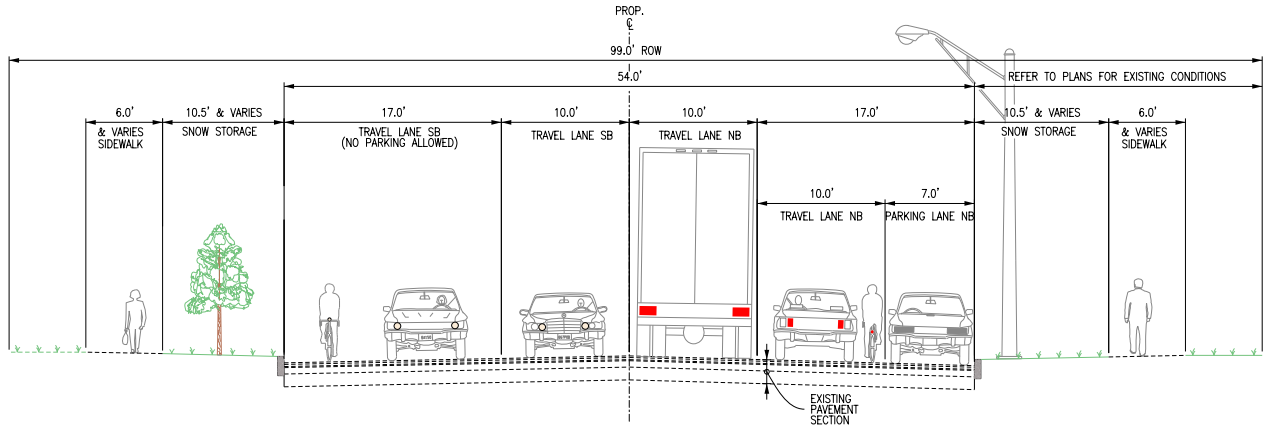
North Buffalo Rails to Trails Project

A shared-use path is being built along the former rail corridor from Main St to the city line at Kenmore Ave. From there, the path will connect to the City of Tonawanda's rail-trail project, set for 2015 as well.

The shared used path will connect LaSalle Station to the proposed Townawanda/Erie County Path

Niagara Street Gateway

The Niagara Street Gateway project is a rehabilitation of Niagara Street, between S. Elmwood and Porter. Minor pavement widening, milling/asphalt overlay, street lighting, traffic signal replacements (Carolina, Georgia, and I-190 and Virginia Street), as well as pedestrian and bicycle facility improvements will improve this important gateway to the downtown business district. There will also be a landscape feature and other amenities (signage, etc.) to highlight this corridor as a gateway. Construction is underway.



The graphic above shows the existing cross-section of Niagara St, which does not currently have dedicated space for bicyclists. The proposed street reconfiguration will provide bike lanes and improved street-scaping treatments.

OTHER PLANNING EFFORTS:

Recent Neighborhood Urban Renewal Plans (URP):

- 2002 Michigan Ave Preservation Area URP
- 2003 Union Ship Canal Redevelopment Area URP
- 2005 Genesee Village URP 2016
- 2005 Seneca Babcock Redevelopment Project URP
- 2005 Union Ship Canal Redevelopment Area URP Amendment
- 2005 Urban Homestead Program
- 2006 Downtown Urban Renewal Project Phase IV URP
- 2007 Pratt Willert Revitalization Area URP Amendment

ONGOING PLANNING EFFORTS + INITIATIVES:

Elmwood Ave Wayfinding Pilot Project Proposal
This 2014 effort has been led by the City's Bicycle and Pedestrian Advisory Board, with help from the Elmwood Village Association, GObike Buffalo, and the City of Buffalo. The pilot project aims to improve bike accessibility to Elmwood Village's many businesses and destinations through bicycle wayfinding signage. After a one-year period, the program will be assessed to determine if there is an increased use in dedicated bike routes, increased awareness among bicyclists, and if any safety improvements were registered.

Buffalo Green Code: Unified Development Ordinance
Buffalo's Unified Development Ordinance is the city's first comprehensive zoning rewrite since 1953, and codifies the land use policies of the Comprehensive Plan and Buffalo Green Code planning documents. The intent of the code is to ensure that development is consistent, and that buildings complement rather than detract from one another. It is a form based code, emphasizing the importance of regulating the form of the building and allowing multiple uses within districts. This helps to create a more varied and diverse built environment, which in turn lends itself to walkability and bikeability. There are specific provisions identified in the code that relate to bicycle infrastructure. These provisions are highlighted below:

- Multi-use paths must be provided when new development is constructed alongside the shore to provide linear access for bicyclists and pedestrians (5.3.3, Section B).
- Minimum bicycle parking spaces must be provided at all new development sites that meet certain requirements. The code also specifies the percentage of long and short term parking that must be provided (8.2.1).
- Descriptions and standards are provided for short and long term bicycle parking.
- Bicycle Parking must conform to the standards in the Bicycle Parking Design Guide produced by the Association for Bicycle and Pedestrian Professionals.
- Any development over 50,000 square feet, except within the D-S, D-C, D-IL, and D-IH zones, must submit and make good faith efforts to implement a transportation demand management (TDM) plan aimed at reducing single occupancy vehicle trips; strategies must be identified to reduce vehicle miles traveled by site users, and promote alternate modes of transportation, including walking, bicycling, ridesharing and transit; modal share objectives should be stated to gauge performance of the TDM program.
- All public and private vehicular rights-of-way must be complete streets, designed for safe, comfortable, and convenient movement both along and across rights-of-way by people of all ages and abilities, using multiple modes, and consistent with the City's complete streets policy.

Buffalo BikeShare
Currently, there is a bike share pilot program that includes 40 bikes scattered throughout the University Buffalo south campus, in Elmwood Village, Allentown and in downtown Buffalo. The fleet of "Smart Lock" bikes are owned and maintained by the Shared Mobility Inc. nonprofit. The program has experienced only modest levels of use, but there is interest in expanding the system to include more bicycles and potentially bike share stations in strategic locations throughout the city.

Buffalo BikeShare program incorporate "Smart Lock" bikes that can be locked at bike racks throughout the city.

BUFFALO'S BICYCLE FRIENDLY COMMUNITY APPLICATION

The League of American Bicyclists' (LAB) Bicycle Friendly Community Application identifies strengths in the City of Buffalo's bicycling program and reveals some areas for improvement. Within the City's Office of Strategic Planning or Public Works, Parks and Streets, there is no dedicated Bicycle and Pedestrian Coordinator. Buffalo has a Bicycle and Pedestrian Advisory Board that meets one or more times a month, and is comprised of 12 board members. GObike Buffalo's director acts as the chair for the Bike/Ped Advisory Committee. GObike Buffalo is a very active advocacy group, that acts as a contractor to the City for services and programs.

Based on the application, the City's most significant achievement was the Mayor's commitment to adding 10 miles of on-street bicycle facilities per year. To develop the network, the City in collaboration with GObike Buffalo funded this bicycle master planning effort.

The city adopted a Complete Streets Policy in 2008. This policy included many positive statements that required that bicycle and pedestrian facilities be incorporated into construction projects. The policy also required that the Pedestrian and Bicycle Advisory Board review all plans before implementation. In addition to this Policy, Buffalo also has streetscape design guidelines that outline specific treatments appropriate for streets based upon their context.

BIKE PARKING

A City-wide ordinance requires that bicycle parking be provided at all new building developments. The amount and location of the parking (indoor/secure vs. short term) depends on the type and size of the building. The bicycle parking rack selection and installation process must conform with APBP standards.

- At the time of application, there were 2,000 bike parking spaces in Buffalo
- 75% conformed to APBP standards
- 30% were on street bicycle corrals
- 1-5% were Bike Lockers

BIKES ON TRANSIT

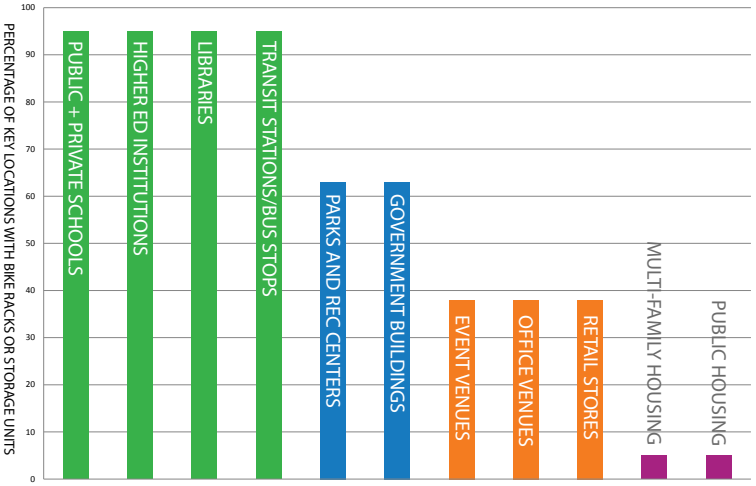
At the time of the application, 51-75% of NFTA busses were equipped with bike-on-bus racks. According to NFTA, in 2013 up to 88% of all buses are equipped with front-mounted racks with the capacity to carry up to two bicycles. The NFTA's goal is to increase that to 100% as older buses without racks are retired and all new models include them.

BICYCLE FACILITIES

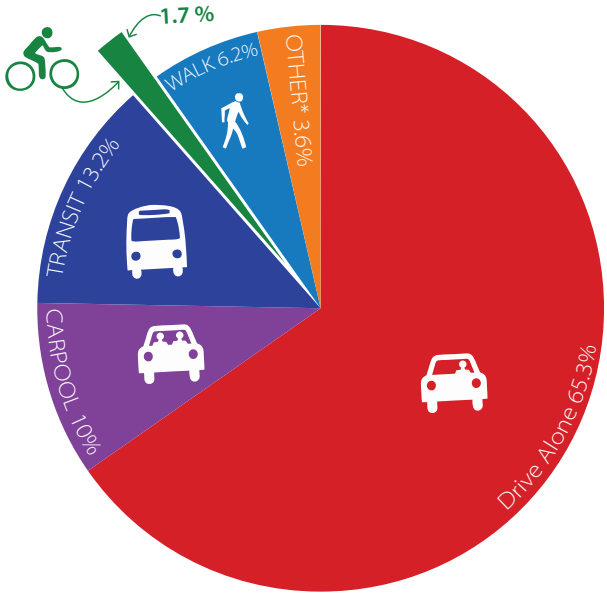
At the time of the application, the shared-use path network totaled 14 miles within city limits. Bike lanes totaled 13.5 miles, with two miles of contra-flow bike lanes and an additional 10 miles planned. Shared lane markings totaled 5.8 miles with 31 miles planned. There are no bike boulevards, no signed bike route. 1-25% of arterial streets had bike lanes or paved shoulders and 100% of shared-use paths were open to bicyclists.

MAINTENANCE

The maintenance policies include street sweeping, snow clearance, and pothole maintenance. Complaints are submitted online, through a city hotline, and shared are monthly BPAB meetings. Shared-use paths are swept annually, vegetation maintenance is done quarterly, but paths are frequently not cleared of snow during the winter and routine maintenance of the trails' surface is inconsistent.



The chart above shows the percentages of bike racks in Buffalo by location type. These numbers are averages for the location type. (Source: BFC Application)



Above is the City of Buffalo's 2014 mode split. From 2000-2010 the City's bike mode share increased from 0.4 to 1.7% (source: CTPP 2000; 2006-2010 ACS)

SAFETY

According to the LAB application, there are no special accommodations for bicyclists at intersections, such as bicycle signals or bike boxes (bike signal has been added at the intersection of Linwood and North St.) There is no formal Safe Routes to School program in place in the City. Children are being taught safe bicycling skills through youth bike clinics or rodeos.

GObike Buffalo has spearheaded several efforts to educate motorists and bicyclists to share the road safely. These efforts include Share the Road educational videos aired on community website and local TV channels, distributing a community newsletter/magazine article, updating a newspaper column/blog on bicycling, and dedicating a bikepage on community website. When Shared Lane Markings (sharrows) were first installed in the city, GObike Buffalo procured extensive local media coverage on the purpose of sharrows.

Separate courses on traffic skills, cycling skills, and commuter classes are each offered biannually for bicyclists. At the time of the application, there was one League Cycling Instructor in the City, and there had been at least one League Cycling Instructor seminar in the past two years. Bicycle maintenance classes and workshops are offered frequently all year round.

The City and GObike Buffalo have led efforts to ensure that the education programs reach traditionally underserved populations. They have partnered with various refuge organizations and parole assistance groups for bicycle giveaways that include safety instructions. They have also partnered with public schools on Safe Routes to School and Recycle-A-Bicycle programs. GObike Buffalo created the GO Buffalo campaign, which consisted of a large marketing push to encourage safe commuting by bicycle, as well as walking and public transit. The program included the use of radio, television and public transit ads, as well as outreach during various public events and an extensive canvassing effort to alternative modes. This effort was funded by a Jobs Access Reverse Commute grant.

ENCOURAGEMENT

To promote National Bike Month, the City has publicly supported the event, organized community rides and a Mayor-led and Council-led ride, aired videos promoting bicycling on community websites and television channels, published a guide to Bike Month events, created a Bike Month website, organized commuter breakfasts, organized a summer street closure event, provide bike valet at events, and organize a bike to school day, promote bicycle-themed festivals, and lead public education campaign related to cycling. Promotions for these events have reached an estimated 9% to 10% of the community. Bike to Work day is another actively promoted encouragement campaign, reaching 26% to 50% of the community. There are also Bicycle Benefits promotions which are granted by local businesses for commuters.

Bicycling is promoted year round through community and charity rides, videos aired on TV and posted online, summer streets events, bike races, commuter events, guides to commuter events, bike valet parking, bike to school days, bike-themed festivals, public education campaigns, and host community celebrations and rides each time a bicycle project is completed.

In 2009, Mayor Byron W. Brown announced that the Buffalo Police Department would enhance police bicycle patrols city-wide.

Signature cycling events in Buffalo have included: SkyRide, Ride for Roswell, Wheel to Reel, Tour de Farms, Bike Pageant, Biketoberfest, Bike to School Day, Play Streets, Cyclists, Larkinville Criterion, Bike to the Bisons, Ride for Missing Children, Campus Wheelworks Collective rides, Midnight Bikeride, Slow Ride Buffalo, and Tour de Cure.

Several cycling organizations have been created in the area, including Recreational Bike Clubs, Mountain Bike Clubs, Friends of the Trail Groups, Racing Clubs/Teams, – and Bicycle Co-ops. At the time of the application, there were seven specialty bike retailers in the City; facilities in the area include a velodrome, cyclocross course, and pump tracks as well as a skatepark that allows bikes. The City supports these events through the provision of in-kind funding (police presence and road closures). Visit Buffalo Niagara, a local tourism board, offers bicycles during events for out of town participants and organizes bicycle tour of local gardens. There are several bike clubs in the city, including: The Angry Bees, The Niagara Bicycle Club, UB Bicycle Club, The Lazy Randonneur Club, Cogragation, Campus Wheelworks Collective, and Buffalo Bicycling Club. There are five bike shops in the City, and 10 in the Buffalo Metro area.

There are other bicycling ammentiies in the community, including themed loop rides around the community, a skate park that bicyclists always have access to, and a small bike-sharing program. This system has 75 publically available bicycles available at 25 locations around the City.

The City has one LAB Bicycle Friendly Business, GObike Buffalo, and one LAB Bicycle Friendly University, University at Buffalo. It is worth noting that SUNY Buffalo State is in the process of developing a Bicycle Master Plan for its campus.

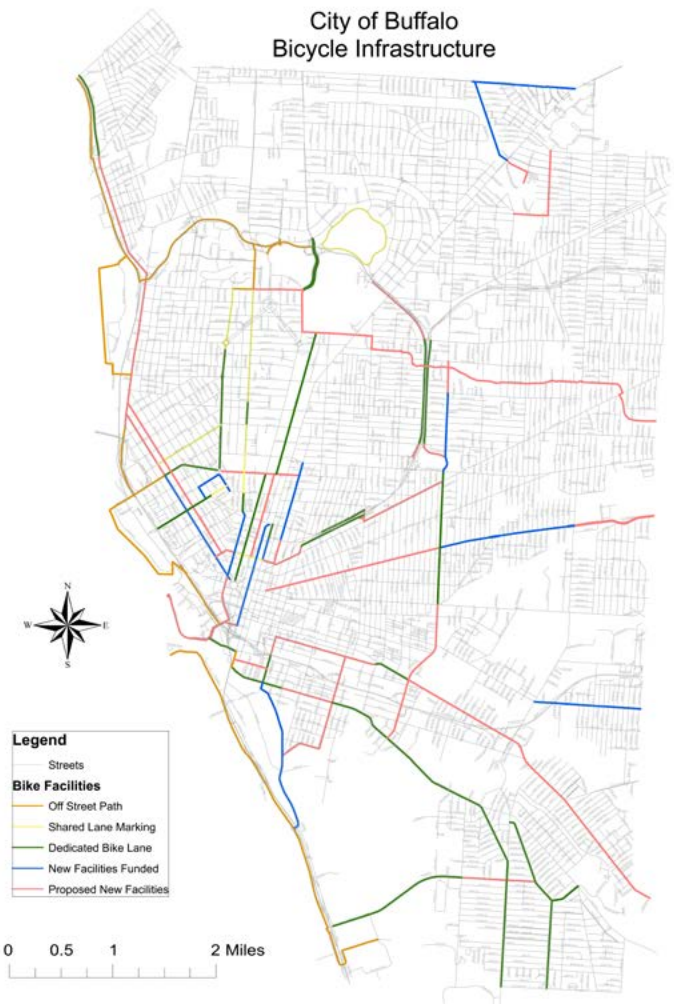
Youth recreation programs have included Recycle a Bicycle, community Cycling Center, and a program called Teen Treks.

MAPS

There is an online bicycle map available that details existing bicycle infrastructure by type, public restrooms and other amenities, as well as a printed version of this map. There is also a printed greenways and trails map.

ENFORCEMENT

According to the LAB application, the City has not identified a law-enforcement point person to interact with bicyclists, and no specific education is provided to police officers regarding bicycling traffic law. Enforcement campaigns targeted at improving cyclist safety include helmet, bicycle light, and bicycle lock giveaways, and share-the-road campaigns. Police do report crash data and potential traffic hazards to the city.



The City of Buffalo has a map which displays existing bicycle facilities.

EVALUATION AND PLANNING

At the time of the application, approximately 1% of residents were commuting by bike.

The latest Bicycle Plan was developed in 1998 and very few of the recommendations identified in the plan were implemented. The ongoing Bicycle Master Planning effort's goal is to implement a minimum of 10 on-street miles of bicycle facilities per year.

As part of the Buffalo Green Code, a system of metrics is going to established to evaluate the performance of bicycle and pedestrian programs and infrastructure improvement starting in January 2014.

FINAL OVERVIEW

According to the application, the three primary reasons the City should be designated as a Bicycle Friendly Community include:

- "With a strong advocate push and a rapidly growing cycling community, Buffalo has grown leaps and bounds over the last several years becoming a regional leader in bicycle friendly communities and home to a very strong bicycle community"
- "Through a partnership between advocates and the City, a progressive Bicycle Master Plan and Green Code are being developed and on-street facilities are being added at a minimum of 10 miles per year with a focus on connectivity"
- "Flying Bison Brewing Company's most popular line of beer, Rusty Chain, is a benefit for GObike Buffalo and works to educate the community about the benefits of bicycling"

The three aspects most in need of improvement include:

- A complete network of connected on-street bicycle facilities, under the guidance of a bicycle master plan (in progress).
- Increased buy-in and commitment from the City of Buffalo, including increased staff focus on bicycling, increased enforcement and education of law enforcement, etc.
- More advanced bicycle facilities, such as bicycle boxes, and protected bicycle lanes.

In 2013 Buffalo was designated a Bronze Level Bicycle Friendly Community by the League of American Bicyclists. The City's long term goal is to achieve platinum level designation.

LEAGUE OF AMERICAN BICYCLISTS' (LAB) FEEDBACK ON BUFFALO'S APPLICATION

The following list describes the feedback Buffalo received when it submitted the application to be designated a Bike Friendly Community in the Summer of 2013.

- Create a new bicycle master plan; set target for trips made by bike.
- Extend the amount of time the Bicycle & Pedestrian Coordinator spends on BFC efforts.
- Although it is commendable that this position is currently held by an advocacy organization, a formal Bike and Ped Coordinator position should be established within city government.
- Provide bicycle facilities on collectors and arterials.
- Develop a system of Bicycle Boulevards.
- Ensure that there is dedicated funding for Bicycle Master Plan recommendations.
- Expand public education and safety campaigns for motorists.
- Improve bicycling education for bicyclists of all ages.

Additional recommendations to promote cycling:

ENGINEERING

- Training for city staff (engineers, planners, law enforcement) on accommodating bicyclists.
- Consider passing an ordinance that would require larger employers to provide end-of-trip amenities (i.e., bike parking and showers).
- Implement traffic calming measures and reduce neighborhood street speeds to 25mph.
- Conduct road diets where appropriate, and use street width gained to install bicycle facilities.
- Install a bicycle wayfinding system.
- Improve the maintenance of on and off-road infrastructure. Increase frequency of sweeping, address potholes, and conduct routine snow removal after storms.
- Develop a connected network.
- Improve accommodations for bicyclists at intersections.
- New and improved facilities should conform to best practices and guidelines (AASHTO, NACTO etc.)

EDUCATION

- Expand bicycle education for children and youth.
- Consider creating a Bicycle Ambassador program.
- Offer cycling skills classes, Traffic Skills 101 classes and bike commuter classes more frequently.
- Host a League Cycling Instructor (LCI) seminar to increase the number of certified LCIs in Buffalo.
- Start a share-the-road motorist education program.

ENCOURAGEMENT

- Continue to expand encouragement efforts during Bike Month, and during Bike to Work day and Bike to School day.
- Continue to encourage a variety of social and family-friendly bicycle-themed community events year round.
- Encourage businesses to promote cycling in the workplace by becoming members of the Bicycle Friendly Business Program.

ENFORCEMENT

- Invite a police officer to become an active member of the bicycling advisory committee .
- Educate officers on the "Share the Road" message and traffic law as it related to cyclists and motorists, and ask police officers to implement their education in the community by citing bicyclist and motor vehicle infractions.
- Pass more laws which protect cyclists, including a penalty for failing to yield to turning cyclists, penalties for motor vehicles that door cyclists, and make it illegal to park or drive in the bike lane.

EVALUATION/PLANNING

- Monitor bicycle usage by analyzing U.S. Census' Journey to Work data.
- Conduct yearly bicycle and pedestrian counts at key locations in the city to gauge demand and use of existing facilities.
- Adopt of bicycle level of use to be achieved by a specific time frame (i.e., 5% of residents by 2020; 10% by 2030).
- Implement a community-wide motor vehicle trip reduction program or ordinance.

EXISTING CONDITIONS ANALYSIS

The analysis of existing conditions has been divided into two sections: current conditions and system gap analysis. Current conditions includes a description of existing and proposed bicycle facilities, while the system gap analysis inventories missing links in the on- and off-street bicycle pedestrian network and/or challenges to creating a complete bicycle network.

CURRENT CONDITIONS

Alta conducted an analysis of current conditions based on field work, online resources, and through the examination of GIS data, aerial imagery, and online mapping websites.

Buffalo's bicycle facilities include an extensive shared-use path system along the eastern bank of the Niagara River and the shores of Lake Erie. The trail system totals 14 miles as of summer 2013. This trail system is optimally positioned within a larger regional network. Buffalo is the western terminus of the Erie Canalway Trail, a multi-use trail consisting of over 260 miles of built trail, and 100 more miles of planned trail, that connects Buffalo in the west to Albany in the east following the historic Erie Canal route.

In addition to the trail network, the City of Buffalo contains a small but growing network of on-street bike lanes (approximately 20 center line miles and growing). Bike lanes have been striped along Richmond Ave, Porter Ave, Hudson St, Delaware Ave, Red Jacket Pkwy, McKinley Pkwy, South Park Ave, Tifft St, Seneca St, Fillmore Ave, Cherry St, BFNC Dr, Humboldt Pkwy, Linwood Ave and portions of Elmwood Ave. Shared Lane Markings (5.8 miles total) have also been applied on some of the city's streets, including Connecticut St, Richmond Ave, Elmwood Ave and W Chippewa St. The City also has two miles of contra-flow bike lanes.

SYSTEM GAP ANALYSIS

Alta conducted a qualitative system gap analysis based on field observations, existing planning documents, and through the examination of GIS data and aerial imagery. The analysis includes existing trail and on-street networks and includes corridor gaps, spot gaps, challenging intersections, infrastructural barriers, and land use gaps that are particularly challenging for bicyclists and pedestrians. This analysis provides an understanding of which areas have the greatest need for improvements, which areas can benefit most from strategic investment, and which areas pose the greatest challenges to further developing a bicycling network.

While the riverfront trail network in Buffalo is fairly comprehensive, and there is a growing on-street bicycle network, critical gaps remain.

EXISTING CONDITIONS MAP

EXISTING FACILITIES

- Bike Lane(s)
- Shared Lane Marking
- Shared Use Path
- Bike/Pedestrian Overpass

EXISTING CONDITIONS

- Pre-K & Primary Schools
- Primary/Secondary & Secondary Schools
- College/University
- NFTA Metro Station

5 min 10 mins

0 0.75 1.5 Miles

CORRIDOR GAPS

These gaps are missing links of significant length where bicycle facilities are desired but do not exist, or are not adequate based on existing or future demand. They may correspond to a street corridor or a desirable route connecting popular destinations.

According to the preliminary existing conditions analysis, significant east/west Corridor Gaps occur along Hinman Ave to Amherst St, Forest Ave to Delavan Ave, and along Best St and Seneca St among others. North/south gaps exist along Ontario St, Elmwood Ave, Niagara St, Bailey Ave, and Delaware Ave.

SPOT GAPS

Intersections that function well for bicyclists are critical in creating a comfortable cycling network, and poorly designed intersections represent significant gaps.

Spot gaps are scattered throughout the city. The spot gaps identified on the map are those gaps located along corridors where there is current or latent bicycling demand. These gaps are point-specific locations lacking facilities or other treatments to accommodate safe and comfortable travel for bicyclists. Major spot gaps include Niagara Square, the intersections of Niagara St and Forest Ave, Kenmore Ave and Main St, Seneca St and Bailey Ave. There are also gaps along corridors that currently interupt the flow of cyclists. These include where Main St crosses the Scajaquada Expressway, Delaware Ave at Chapin Parkway and Elmwood Ave through Delaware Park.

INFRASTRUCTURAL BARRIERS

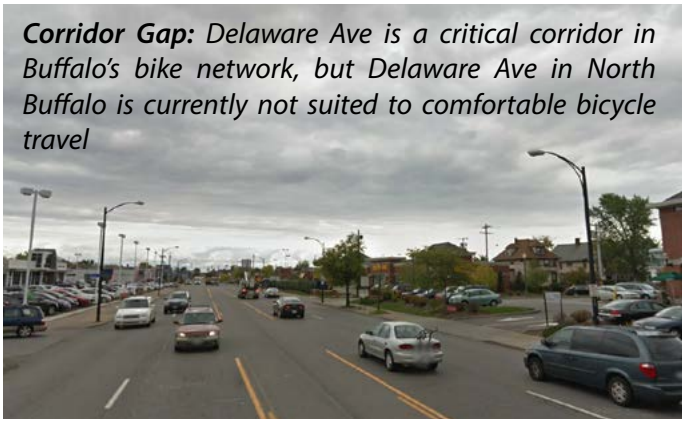
These barriers include highways, some arterial streets and rail lines that hinder movement by pedestrians and bicyclists either physically or psychologically.

Major road barriers include the Scajaquada Expressway, I-190, and Route 33. Rail corridors that pose barriers are located in North West Buffalo, East Buffalo between Delavan and Seneca, and South Buffalo east of Tifft Farm Nature Preserve.

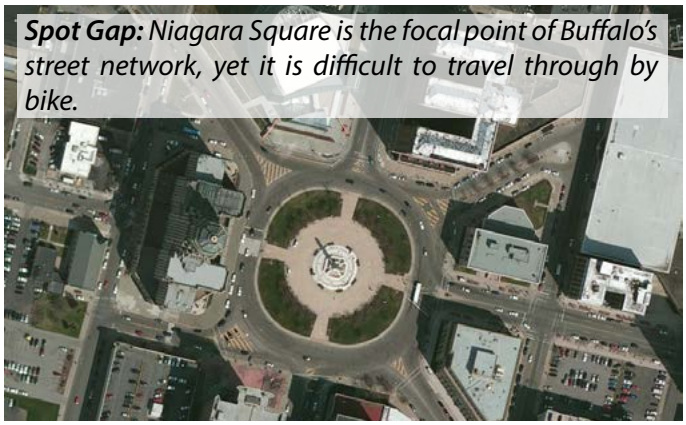
LAND USE BARRIERS

Parking lots, vacant/abandoned properties, and other post-industrial land-uses can be unattractive, cause security concerns, and create an unfriendly environment for bicycling.

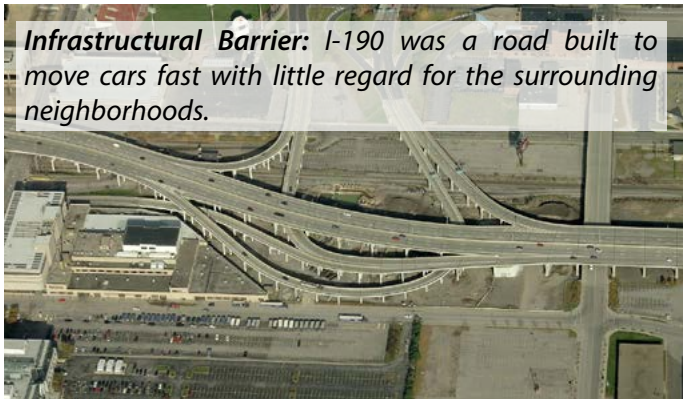
The land use barriers in Buffalo include rail yards in south Buffalo and East Buffalo and surface level parking lots downtown.



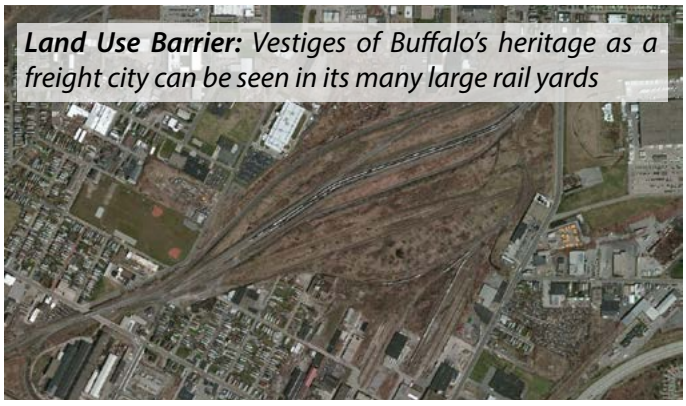
Corridor Gap: *Delaware Ave is a critical corridor in Buffalo's bike network, but Delaware Ave in North Buffalo is currently not suited to comfortable bicycle travel*



Spot Gap: *Niagara Square is the focal point of Buffalo's street network, yet it is difficult to travel through by bike.*



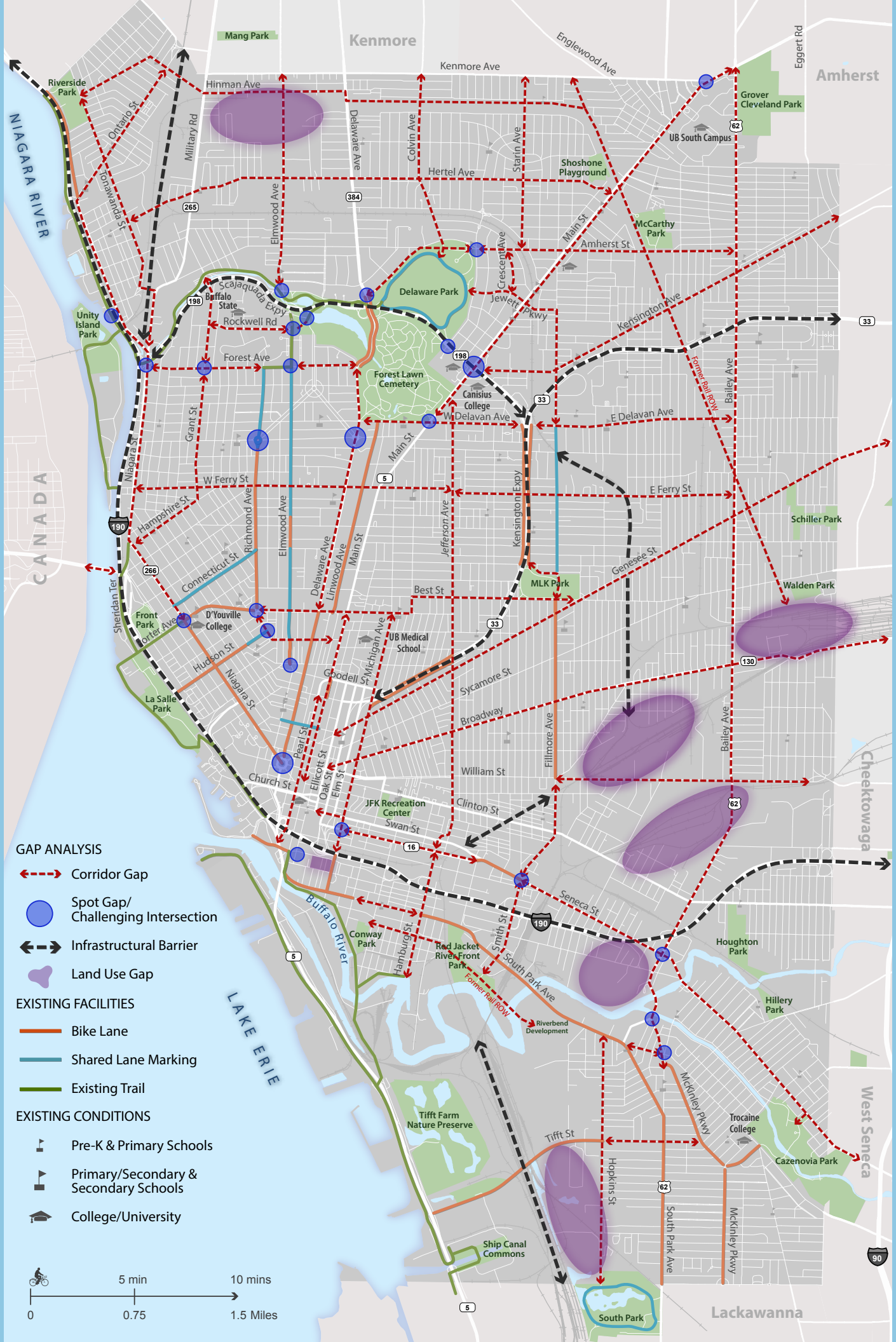
Infrastructural Barrier: *I-190 was a road built to move cars fast with little regard for the surrounding neighborhoods.*



Land Use Barrier: *Vestiges of Buffalo's heritage as a freight city can be seen in its many large rail yards*

Photo Sources: Bing Maps

GAP ANALYSIS MAP



BIKESPACE ANALYSIS MAP

Using GIS data provided by the City and GBNRTC, Alta developed the BikeSpace analysis map. The purpose of the map and analysis process was two-fold. The first objective was to identify the streets within the City that could accommodate bicycle facilities within the existing right-of-way without altering the current lane configuration. The second objective was to identify four-lane roads in the City that would be good candidates for conversion from a four-lane road to a two-lane road with a center turning lane. This lane reduction is known as a "road-diet." This analysis provides a snapshot of lower-cost enhancements that could be made to Buffalo's bicycle network with little interruption to current traffic patterns. A summary of this analysis is provided below.

LANE WIDTH AVAILABILITY

The BikeSpace analysis mapped the roads in the City of Buffalo that had excess road-width (beyond the standard 11 foot wide travel lane) available that could potentially be converted into dedicated bicycle facilities. Streets that were too narrow (less than five feet total excess width available) to accommodate bicycle facilities were omitted from the analysis. The remaining road sections were categorized into one of four groups depending on the amount of excess pavement width available. The four groups were: 6-9 feet, 10-14 feet, 15-18 feet, 18+ feet. Generally, a more protected bicycle facility could be installed on streets with more excess street-width available. For example, with 10 feet excess width, two standard bike lanes could be striped along the street; with 15 feet excess width, a two-way cycle track could be installed or a buffered bike lanes. This exercise is helpful in identifying the "low-hanging-fruit" in the City's street network, or those roadways that could accommodate a bicycle facility without lane narrowing, street reconstruction or removal of parking.

18+ Feet Available

Streets with 18+ feet available could accommodate a generous protected bicycle facility, such as a cycle-track or buffered bike lanes. Protected facilities encourage less experienced cyclists to bike, and therefore are the ideal treatment when conditions are present to accommodate them. There are 5.9 miles of road with 18+ feet excess street-width available, including sections of William St between Fillmore Ave and the City line to the east, and along Bidwell Parkway and Chapin Parkway south of Delaware Park.

15-18 Feet Available

Streets with 15-18 feet available could accommodate a standard protected bicycle facility, such as a cycle-track or buffered bike lanes. There are 3.4 miles of road with 15-18 feet excess street-width available, including portions of Main St, Delaware Ave, and Franklin St downtown.

10-14 Feet Available

Streets with 10-14 feet available could accommodate a standard bike lane and a more protected buffered bicycle lane. There are 11.8 miles of road with 10-14 feet excess street-width available, including a portions of Kenmore Ave, Niagara St, Amherst St, Lincoln Pkwy, Ganson St and Seneca St.

6-9 Feet Available

Streets with six-to-nine feet excess width available cannot accommodate bicycle facilities as they are now, but are considered "threshold streets." The threshold of 10feet of excess street-width that needs to be reached to install bicycle facilities could be achieved through the creative reallocation of the street's cross-section. Reallocation options include narrowing travel lanes to the 10 foot minimum, and/or reducing the parking lane width to the 7- foot minimum, and/or removing parking. There are 16 miles of road with 6-9 feet excess street-width available, including portions of Abbott Rd, Seneca St, Clinton St, William St, Ellicott St and Washington St downtown, Kensington Ave, Olympic Ave, Elmwood Ave, Forest Ave, Nottingham Terr, and Kenmore Ave.

ROAD DIETS

Many roads in the Buffalo were built to accommodate higher traffic volumes than actually travel on these streets today. The number of lanes along these streets can therefore be reduced while still maintaining acceptable levels of traffic flow. In recent years, "road diets" or conversions of four-lane roads to two-lane roads with a center turn median and bike lanes, have become commonplace. This lane reconfiguration tends to traffic calm corridors and increases the amount of excess street width available that can be converted to dedicated bicycle facilities. The traffic volumes along four-lane roads are the primary criteria used to determine if a road-diet is appropriate, along with signal density.[2]

- Streets with less than 15,000 annual average daily traffic (AADT) are very good candidates for road-diets. Congestion will likely not increase if the number of lanes is reduced.
- 15,000 – 18,000 AADT are good candidates, in that the number of lanes can be reduced without increasing congestion significantly. Trade-offs need to be analyzed.
- 18,000 – 20,000 ADT could be candidates, but individual traffic studies need to be conducted to determine if congestion will increase, and if the increase in congestion is acceptable.
- More than 20,000 ADT may be candidates, but congestion and vehicle delay will increase so trade-offs need to be considered.

[2] *Going on a Road Diet. Tan, Carol. Federal Highway Administration. 2011*

When determining the appropriateness of a road diet, trade-offs need to be weighed. Fewer lanes may increase congestion, but this may be offset by improved non-motorized access. In addition to traffic volumes, other factors need to be weighed as well, including: signal density, number of collisions, vehicle speeds, freight usage, bus stops and routing, and access. Project goals should be identified and engineering judgment should be exercised prior to the implementation of a road diet. The traffic volumes for the four-lane roads in Buffalo were mapped, and the results of this analysis are displayed on the BikeSpace map. Final determination requires engineering analysis that takes into account multiple factors in addition to Annual Average Dialy Traffic (AADT).[3]

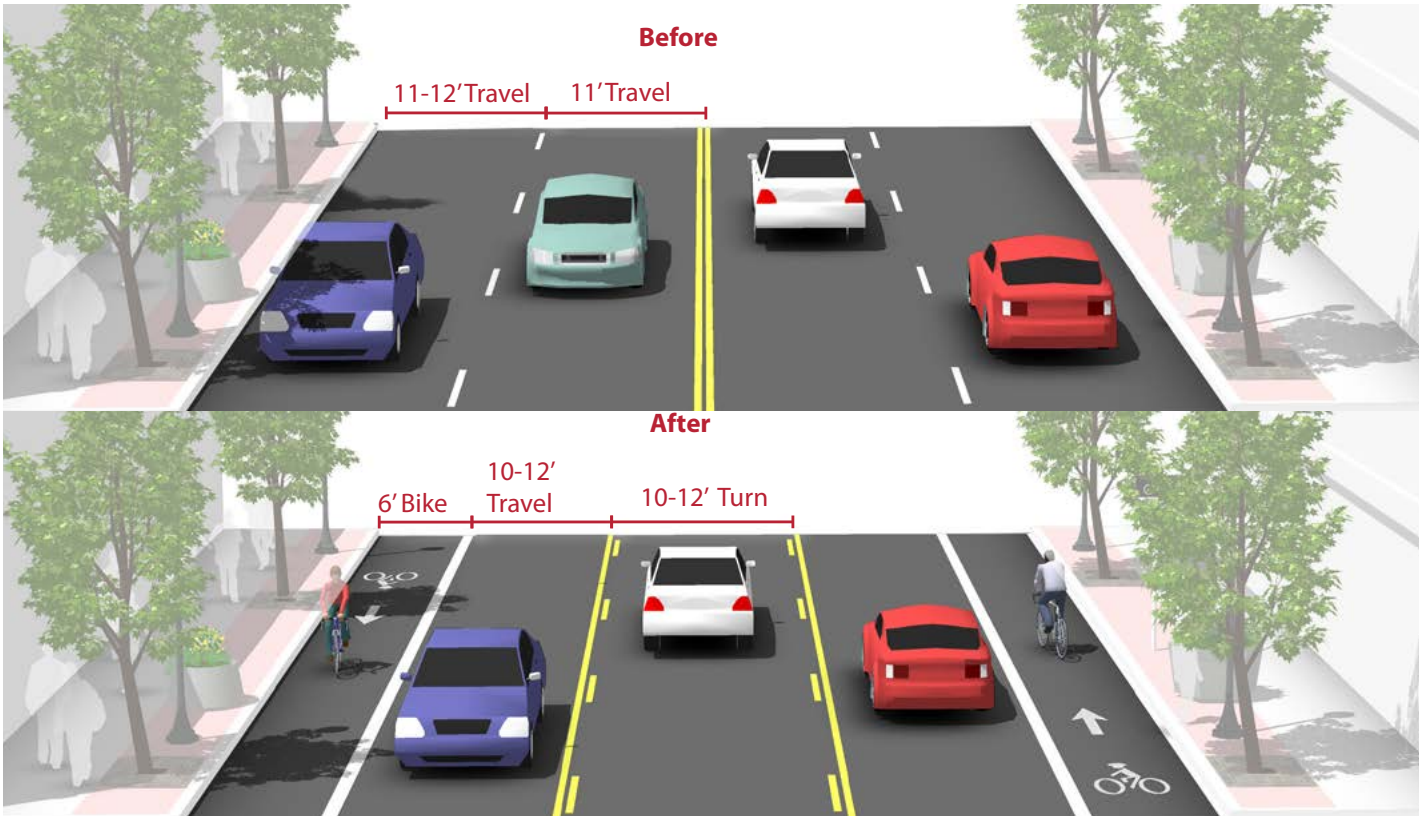
Less than 15,000 AADT
Roads with volumes less than 15,000 AADT include portions of South Park Ave, Seneca St, Perry St, North and South Division St, Broadway, Elmwood Ave, Niagara St, Jefferson Ave, Genesee St, Kensington Ave, E Amherst St, Parkside Ave, Hertel Ave, and Kenmore Ave.

15,000 - 18,000 ADT
Roads with volume between 15,000 - 18,000 include lower portions of Bailey Ave only.

18,000 – 20,000 ADT
Roads with volumes between 18,000 – 20,000 AADT include portions of Main St, Hertel Ave, Bailey Ave, Elmwood Ave, lower Delaware Ave, Tonawanda St, and Seneca St.

More than 20,000 ADT
Roads with volumes greater than 20,000 AADT include portions of Delaware Ave, Elmwood Ave and Main St.

Road Diet: The graphic below shows a typical four-lane to two-lane with center turn lane "road diet" lane reconfiguration. The reduction of one travel lane creates excess lane width that can be converted into dedicated lane space for bicyclists.



[3] Data for the analysis was provided by NYS DOT via the NYS GIS Clearinghouse. This data file includes traffic volume data for the 35,000+ traffic count stations throughout New York State for the year 2012. These traffic count stations cover the entire length of New York's Interstate Highways, United States Highways, and State Highways, as well as most significant local routes. Traffic counts are taken at short-count stations for 2-7 days, once every 3-6 years, to collect data that allows for extrapolation to annual traffic estimates.


BIKESPACE ANALYSIS MAP
BUFFALO BICYCLE MASTER PLAN
2-24
TOTAL CURB-TO-CURB WIDTH AVAILABLE FOR BICYCLE FACILITY
6 - 9 feet
10 - 14 feet
15 - 18 feet
18 + feet
AADT VOLUMES ON 4-LANE, ROAD DIET CANDIDATES
< 15,000
15,000 - 18,000
18,000 - 20,000
>20,000
Feasible
Not Feasible
EXISTING FACILITIES
Bike Lane
Trail
0
5 min
0.75
10 mins
1.5 Miles
Kenmore
Amherst
Cheektowaga
West Seneca
Lackawanna
CANADA
NIAGARA RIVER
LAKE ERIE
Buffalo River
Mang Park
Riverside Park
Unity Island Park
Delaware Park
Shoshone Playground
McCarthy Park
Grover Cleveland Park
Schiller Park
Walden Park
Martin Luther King Jr Park
La Salle Park
Front Park
JFK Recreation Center
Conway Park
Houghton Park
Hillery Park
Cazenovia Park
Tifft Farm Nature Preserve
South Park
Kenmore Ave
Englewood Ave
Eggert Rd
Hertel Ave
Amherst St
E Amherst St
Delaware Ave
Elmwood Ave
Military Rd
Niagara St
Jonawanda St
Lincoln Pkwy
Bidwell Pkwy
Chapin Pkwy
Parkside Ave
Main St
Kensington Ave
Olympic Ave
Bailey Ave
E Delavan Ave
Fillmore Ave
Humboldt Pkwy
Jefferson Ave
E Ferry St
W Ferry St
Richmond Ave
Linwood Ave
Connecticut St
Busti Ave
Porter Ave
Sheridan Ter
Hudson St
Goodell St
Sycamore St
Broadway
Genesee St
Walden Ave
William St
Clinton St
Swan St
Seneca St
Church St
Perry St
Louisiana St
Ganson St
South Park Ave
McKinley Pkwy
Tifft St
Abbot Rd
Franklin St
Pearl St
Oak St
Elm St
Washington St
Erie St
N Division St
S Division St
W Seneca St
190
33
62
5
16
130
90
265
384
198
266

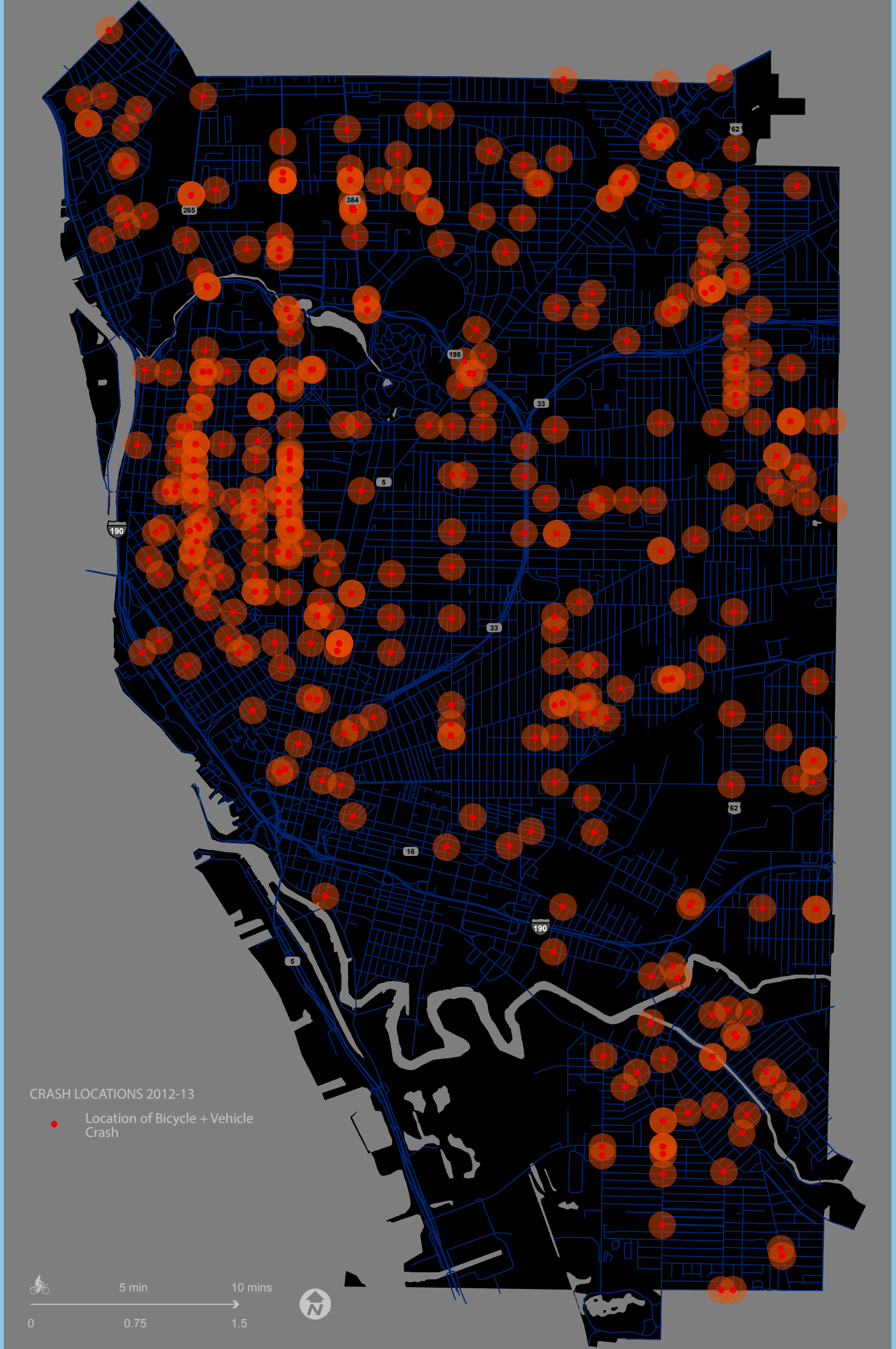
CRASH ANALYSIS MAP

To help understand where improvements to bicyclist safety are needed, bicyclist and motorist crash data were mapped. The data was gathered through NYSDOT's Accident Location Information Service (ALIS) Database. The crashes analyzed occurred between February 2011 and December 2013, representing about three years of crash data.

On the following page, two visuals are provided that display crashes involving motor vehicles and bicyclists in the City of Buffalo. The first map displays the location where the crashes occurred. This is a cluster map, and is helpful in communicating where there are clusters of crashes in the City. Clearly, there are some areas and corridors that have a higher frequency of bicycle/motor vehicle crashes. These include East Buffalo, between Delaware Park and Downtown, Bailey Ave, Genesee St, Broadway, Main St, Hertel Ave, Kensington Ave, and South Buffalo. This map shows that crashes tend to occur at intersections, and emphasize the fact that within bicycle networks, intersection enhancements need to be prioritized.

The second map displays those roads that were located within 0.1 mile of a bicycle and motor vehicle crash. This graphic is helpful in identifying the streets that crashes tend to occur on and near. This map will inform network-planning recommendations so that streets with a high crash risk are addressed.

Reporting bicycle/motor vehicle crashes is imperative to documenting where crashes occur, and provides invaluable information that can be used to inform corridor and intersection design. Many cities now issue wallet sized cards to help cyclists correctly report accidents (source: bostonbikes)


CRASH LOCATIONS 2012-13
Location of Bicycle + Vehicle Crash
5 min
10 mins
0
0.75
1.5
265
384
198
33
5
190
62
16

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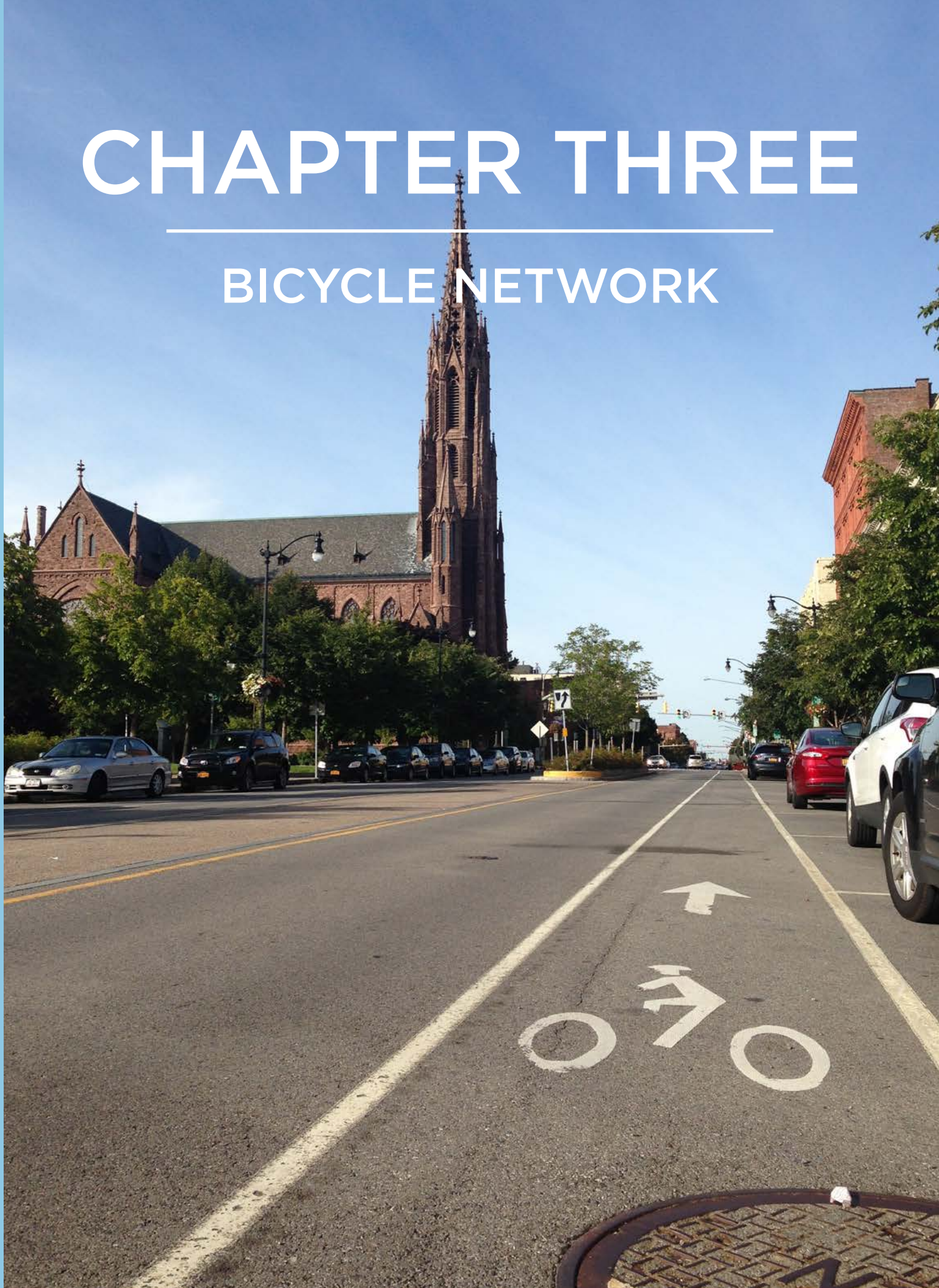
CHAPTER THREE

BICYCLE NETWORK



PLANNING THE BICYCLE NETWORK

The proposed city-wide bicycle facility network is the result of a collaborative planning process that involved a combination of technical analysis and extensive public input. The overarching objective in developing the network was to identify desirable bikeway corridors and recommend a facility type for these routes, creating a feasible bicycle network that fulfilled the vision of this Bicycle Master Plan: *to provide a safe and connected bicycle network throughout the city, thereby increasing the livability of Buffalo's neighborhoods as more people ride their bicycles for all trip purposes*. A parallel objective was to provide facilities in the network for all types of bicyclists. This process is described in more detail in the blue box below.

The proposed bicycle network was updated iteratively throughout the development of the plan. As draft networks were prepared, they were shared with the public and stakeholders, and the network was refined until it reflected the community's vision for a bikeable Buffalo. The following list indicates the several channels of communication that informed the final network recommendations:

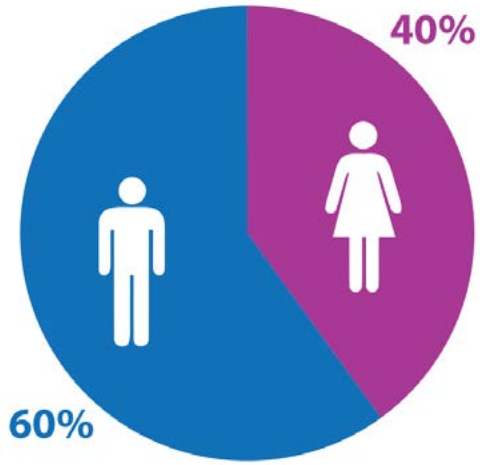
- Public Survey (see Appendix C for summary).
- Public meeting input (July 30 and Dec 4, 2014 and May 21, 2015).
- Stakeholder meetings (6 throughout process).
- GObike Text Message Survey (see Appendix D for survey results).
- Online Comments and Emails.
- Regional and Local Governmental Input.
- Neighborhood Groups Outreach.
- Six stakeholder meetings .

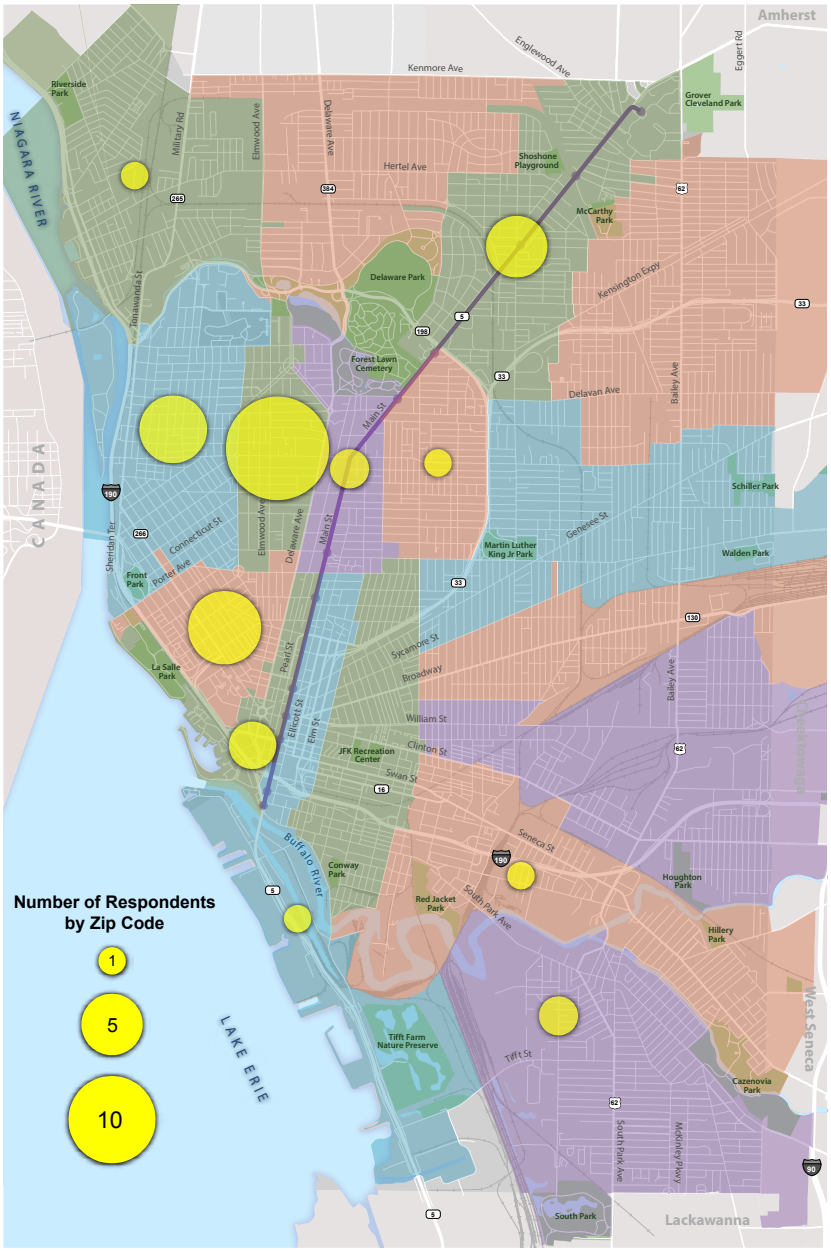
Throughout the remainder of this plan, icons are used to represent one of three 'types of bicyclists'. The types of bicyclists are described in detail in this chapter. These categories served as the basis for the development of the bicycle network recommendations, in that the categories define the facility reccomnedations. Each facility type serves one or more of the types of bicyclists. The icons are shown at right for reference.

PUBLIC INPUT

The recommended Bicycle Network is a reflection of the community's desire for a more bike friendly Buffalo. Through communications with residents, business owners, stakeholders and other interest groups, the planning team was encouraged to develop a feasible network that would elevate the status of bicycling in Buffalo. Every effort was taken to engage a wide range of stakeholders to ensure that the plan recommendations were a reflection of the community's vision for a more bikable Buffalo. The graphics on this page summarize the "what/where/who" feedback collected via a survey distributed early in the project.

At the first public meeting on July 30, 2014, over 50 attendees completed a survey. The gender breakdown of respondents was:

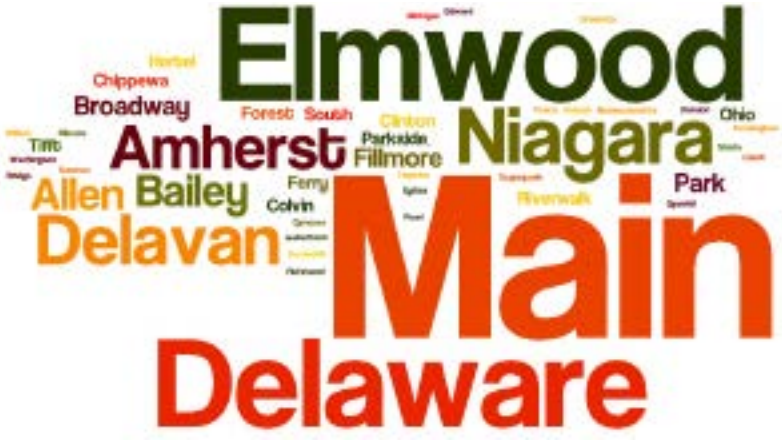




Number of survey respondents by Zip Code. Colored shapes represent different zipcodes.

Survey respondents were also asked to record their zip code so the planning team could understand where feedback was coming from. The **map above, at right,** displays the different zip codes in the Buffalo (colored shapes), and the proportion of respondents by zip code (yellow circles). In total, 21 zip codes were recorded, nine of which were located outside of the city limits.

Respondents were also asked to identify the three streets that needed the most improvement for bicyclists. As shown in graphic at right, Main, Delaware, and Elmwood were the top three streets listed. Cumulatively, a total of 150 roads and intersections were recorded.[1]



1 Duplicates are included in the count of 150 roads

TYPES OF BICYCLISTS

The guiding principle for this plan was to develop a bicycle network that provided facilities for all types of bicyclists. Rather than designate facilities in the network by facility type, proposed facilities were coded according the type of bicyclist that would be comfortable biking upon them. Bicycle infrastructure should accommodate as many user types as possible, and the proposed Buffalo Bike Network includes separate or parallel facilities where practicable to provide a comfortable bicycling experience for the greatest number of people.

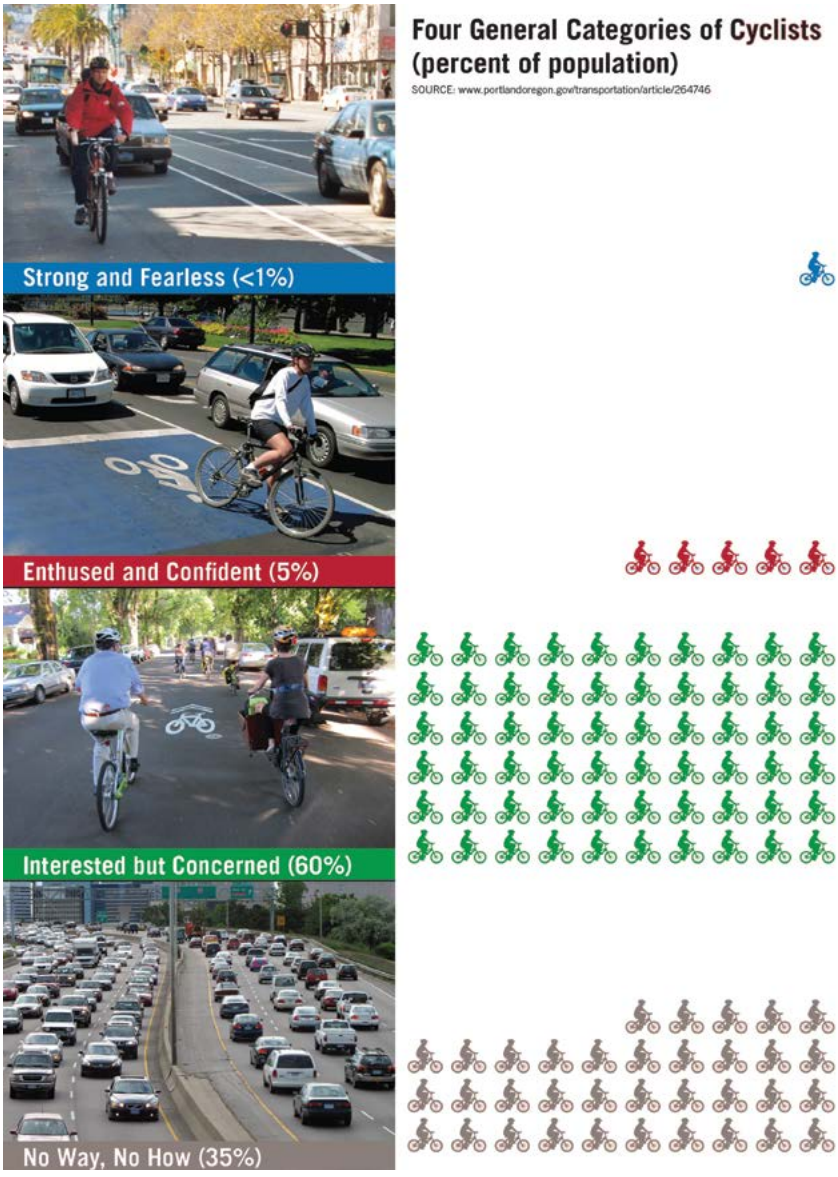
The bicycle planning and engineering professions currently use several systems to classify the population, which can assist in understanding the characteristics and infrastructure preferences of different bicyclists. The most conventional framework classifies the "design cyclist" as *Advanced*, *Basic*, or *Child*.[2] A more nuanced understanding of the US population as a whole is illustrated in the figure below. Developed by planners in Portland, OR,[3] and supported by data collected nationally since 2005, this classification provides the following alternative categories to address varying attitudes towards bicycling in the US. Although a scientific poll has not been conducted to categorize comfort levels of bicyclists or potential bicyclists in Buffalo, the demographic profile of the community and anecdotal evidence suggests that this categorization is also applicable to the city.

- **Strong and Fearless** (less than 1% of population) – Characterized by bicyclists that will typically ride anywhere regardless of roadway conditions or weather. These bicyclists can ride faster than other user types, prefer direct routes and will typically choose roadway connections — even if shared with vehicles — over separate bicycle facilities such as shared use paths.

- **Enthused and Confident** (5% of population) - This user group encompasses bicyclists who are fairly comfortable riding on all types of bikeways but usually choose low traffic streets or shared use paths when available. These bicyclists may deviate from a more direct route in favor of a preferred facility type. This group includes all kinds of bicyclists such as commuters, recreationalists, racers and utilitarian bicyclists.

- **Interested but Concerned** (approximately 60% of population) – This user type comprises the bulk of the population and represents bicyclists who typically only ride a bicycle on low traffic streets or multi-use trails under favorable weather conditions. These bicyclists perceive significant barriers to their increased use of cycling, specifically traffic and other safety issues. These people may become "Enthused & Confident" with encouragement, education and experience.

- **No Way, No How** (approximately 35% of population) – People in this category do not ride bicycles for a variety or reasons: they may lack the physical ability to do so or simply do not enjoy riding a bicycle. Some do not because of extreme concern about personal safety. Its unlikely that those within this group will ever ride.



2 Roger Geller, City of Portland Bureau ofTransportation,Four Types of Cyclists. 2009
3 FHWA, Selecting Roadway Design Treatments to Accommodate Bicycles, Publication No. FHWA-RD-92-073. 1994

DEVELOPING THE NETWORK

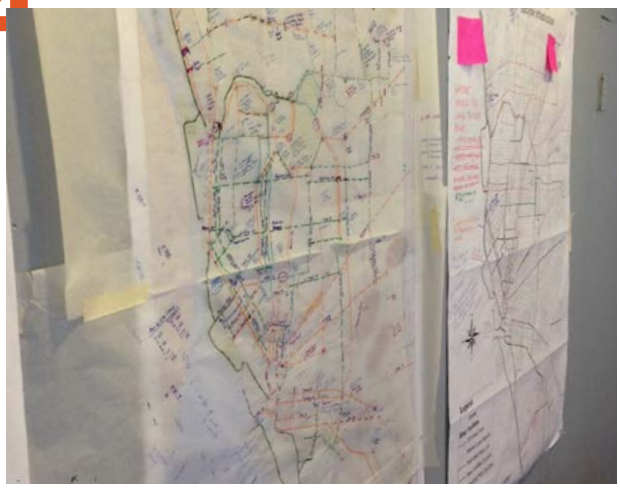
The bicycle network was developed through an iterative process. Public input recorded at the July 30th public meeting was combined with information collected through several stakeholder committee meetings in the fall of 2014. This feedback was combined with data collected through site visits and GIS mapping, Buffalo's existing Bicycle Network Map, and recommendations included in other plans. All of this information was synthesized to develop the **Gap** and **BikeSpace Analysis** maps, which served as the foundation for the network recommendations. After these maps were presented publicly, work began on developing the bicycle network recommendations.

1 FIRST PUBLIC MEETING

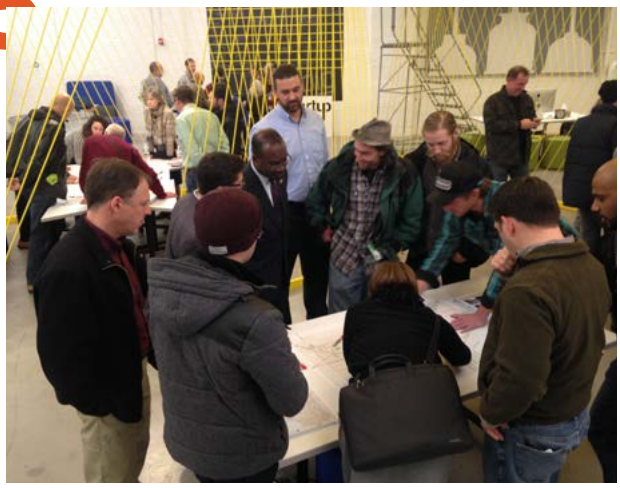
2 STAKEHOLDER ENGAGEMENT ROUNDS

3 GAP + BIKESPACE ANALYSIS

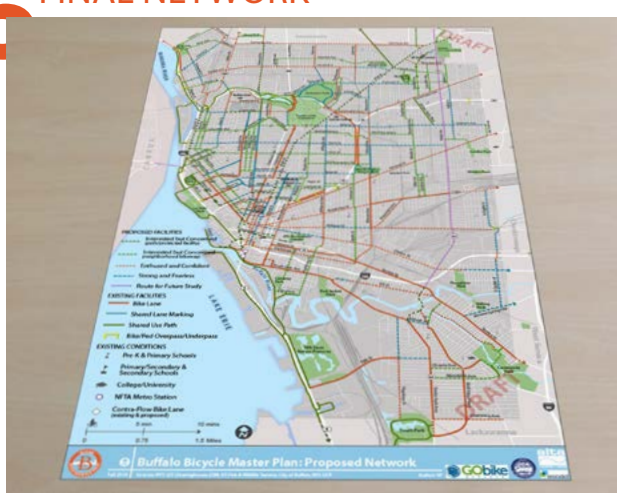
4 NETWORK DEVELOPMENT



5 PUBLIC WORKSHOP



6 FINAL NETWORK



To develop the network, desire lines between activity generators were identified. Streets that provided access between the generators were studied to determine if they could be dedicated as a bikeway connection. Key streets were designated as bikeway links, and the most appropriate facility type was identified based upon the street's width, traffic volume and roadway context. An initial network map was presented publicly at the Dec 4, 2014 workshop. Afterwards, the network was again revised to include important connections identified by the public.

Consistent with the guiding principle of this planning effort proposed facilities were coded according to the type of bicyclist that would be comfortable biking upon them. Overall, the network was developed so that it would provide access for all types of bicyclists. The graphic below displays the tiers of facilities that comprise the network, each of which accommodates one or more of the types of bicyclists. The network map is displayed on the subsequent page.

TIER 1 Interested but Concerned PROTECTED FACILITY

TIER 1 Interested but Concerned NEIGHBORHOOD BIKEWAY

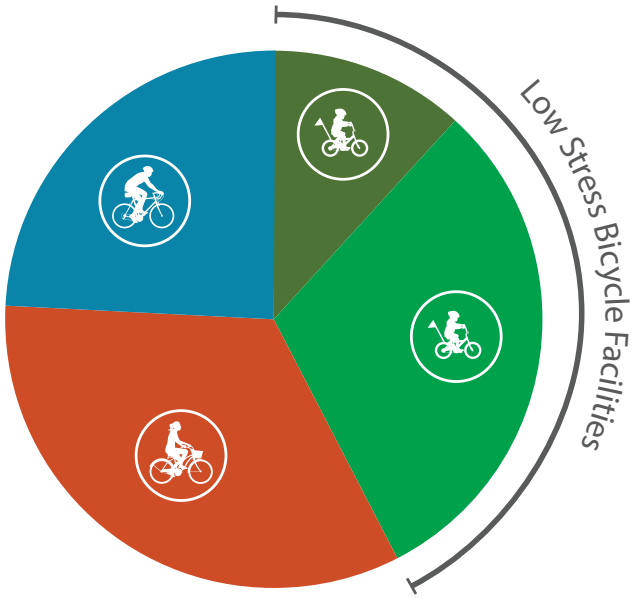
TIER 2 Enthused and Confident

TIER 3 Strong and Fearless

BUFFALO BICYCLE NETWORK MAP

VISUALIZING THE NETWORK

One of the primary goals of the Buffalo Bicycle Master Plan Update was to create a range of facilities that would serve all different types of bicyclists. The team carefully analyzed desire lines in the city, and identified streets that could accommodate bicycle facility improvements. Where a desire line existed, and if a street could not accommodate a higher order facility (e.g. protected facility or bike lane), a shared lane marking treatment was recommended. Although this type of facility is designed primarily for the strong and fearless type of bicyclist, shared lane markings help to identify streets as links in the overall bike network, and communicate to drivers to be cognisant of the presence of bicyclists. The graphics below help to visualize the proportion of facilities recommended in this plan by tier, and the types of bicyclists that will be served by the improvements. The lane mileage totals include the Mayor's annual commitment of 10 lane miles per year of bicycle facilities.



Composition of the proposed network by facility type

Lane miles of facilities in the proposed network by type

RIM-AND-SPOKE VISION

The emphasis for this Buffalo Bicycle Master Plan Update is the development of a long-range plan for a city-wide, on-street bicycle network. Trails are critical links in any city's bicycle network, and existing and proposed trails were an important consideration in the creation of this plan. Through conversations with the public and stakeholders, it became apparent that the near-term focus for trail infrastructure should be placed on improving conditions along the city's existing trails, rather than proposing the construction of new ones.

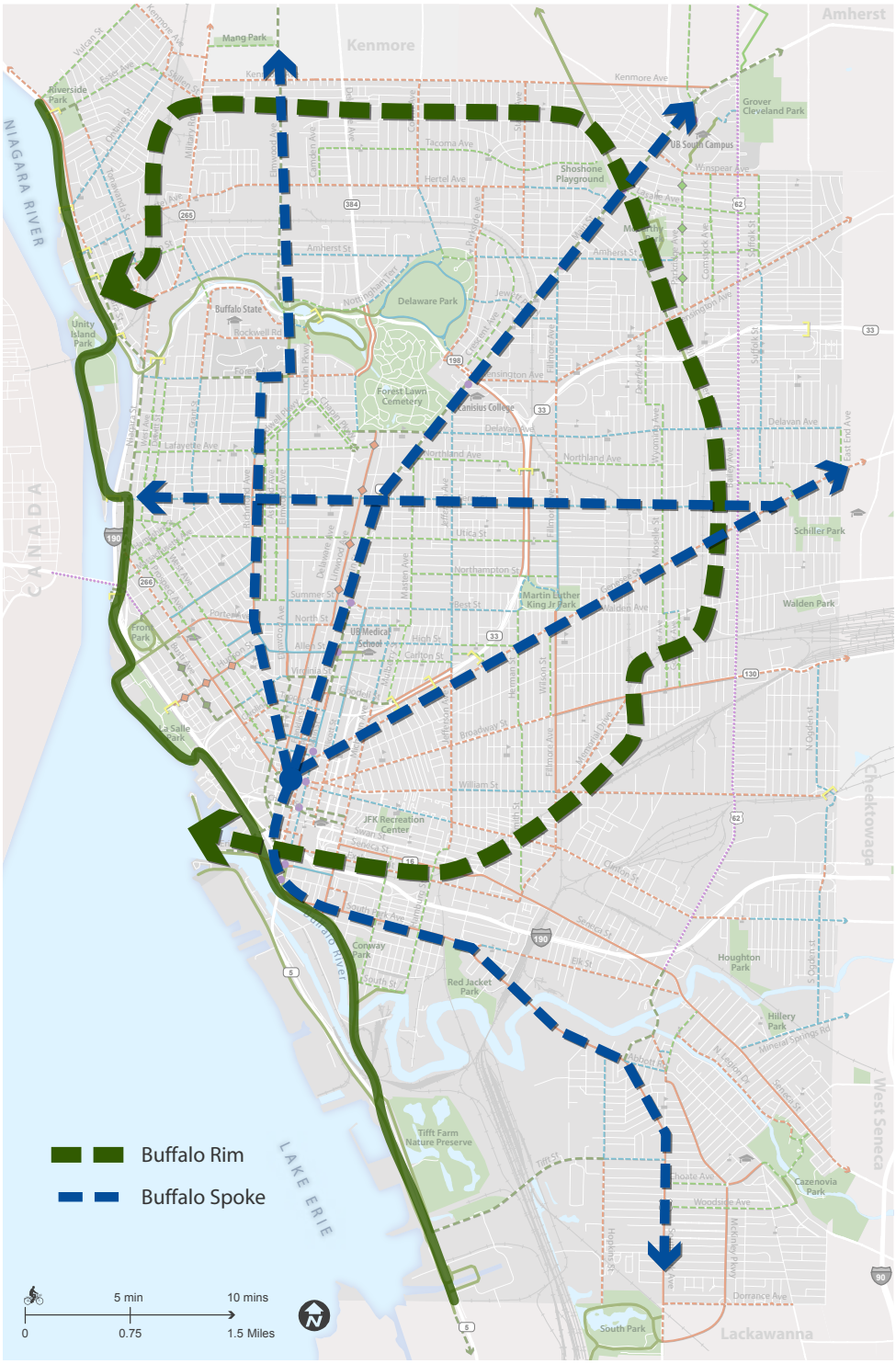
It is important to recognize that Buffalo does have many rail corridors that could be adaptively repurposed into rail trails. A long term vision for the city is presented at-right to create a rim-and-spoke network --where a connected system of multi-use trails would serve as the rim of the network--and key bikeway corridors would serve as the spokes connecting the rim to downtown. The visionary diagram at right, if implemented, would place Buffalo's on-street bikeway and greenway trail network on par with other world class systems.

It is important to present this vision in this plan as a desirable future option, and to emphasize that future studies should consider the feasibility of implementing the rim-and-spoke vision.

PRIORITY NETWORK

It is recognized that Buffalo's bike network will be implemented in phases, with some routes identified as higher priorities than others. The planning team combined multiple input sources, including public and stakeholder feedback, to identify the routes that comprise the **Priority Network**. These routes were selected because they fill critical gaps in the existing network, and would provide connectivity to and from Buffalo's major activity generators, including Downtown, neighborhoods, academic institutions and Buffalo's cultural centers. Due to their importance, the implementation of the Priority Network (displayed on pg 2-9) should be prioritized.

In the following chapter, several smaller links within the Priority Network are identified as Catalyst Projects. These projects were selected because they present particularly challenging design issues that would need to be overcome in order to create a connected Priority Network for the City of Buffalo.




DRAFT
DRAFT
NIAGARA RIVER
CANADA
LAKE ERIE
Tonawanda
Amherst
Cheektowaga
West Seneca
Lackawanna
A
B
C
D
E/F
G
H
I
J
K
PRIORITY PROJECT
Priority Project
PRIORITY NETWORK (in bold)
Interested but Concerned (path/protected facility)
Interested but Concerned (neighborhood bikeway)
Enthused and Confident
Strong and Fearless
Route for Future Study
EXISTING FACILITIES
Bike Lane
Shared Lane Marking
Shared Use Path
Bike/Ped Overpass/Underpass
Contra-Flow Bike Lane (existing & proposed)
5 min
10 mins
0
0.75
1.5 Miles

BICYCLE INFRASTRUCTURE WINTER MAINTENANCE

All of the facilities recommended in the Bicycle Network Map will require year-round maintenance. Buffalo experiences long winters with heavy snow falls. For bicycling to become a viable mode of transportation in Buffalo, accommodating bicycles during the winter months needs to become a City priority. Winter biking maintenance best practices are elaborated upon in Appendix E, where specific details are provided for maintaining bicycle facilities during winter months. General recommendations are included in this section.

The winter maintenance of bikeways and infrastructure (ie: bike racks) should be a planned, regular activity within the city. Bicycles have different winter needs than motor vehicles—for example, less weight and tire surface area means they are more sensitive to snow and ice—and winter roadway maintenance programs should have specialized practices to respond to these needs.

Given Buffalo's winters, the City should prioritize safe conditions for bicyclists year round. There are different strategies and equipment; however, thoughtful roadway design and a strategic bikeway snow removal and de-icing program that includes snow removal prioritization are key to the safe and comfortable accommodation of bicyclists in the winter. Many separated bicycle facilities are recommended in this plan, and Buffalo should adopt policies which ensure the these facilities are made safe for bicyclists year round. Cities around the country that have extensive bicycle networks and also contend with harsh winters have established best practices for the maintenance of separated bicycle facilities that Buffalo can draw from.

Chicago, IL: Small plows/bob-cats clear cycle tracks that are separated from the roadway by bollards. Alternatively, delineator posts can be removed during winter and larger plows clear cycle track and painted buffer areas to the curb

Cambridge, MA: Despite historic volumes of snow in 2015, Cambridge prioritized snow removal on City cycle-tracks using a small bob-cat style plow

Hamilton, ON: Two-way cycle tracks in Hamilton are routinely cleared of snow using plows (source: Norma Moore)

In winter, bicyclists require accessible bike parking. Covered bike parking should be provided at key locations, and property owners and the City should collaborate to ensure clearing of snow

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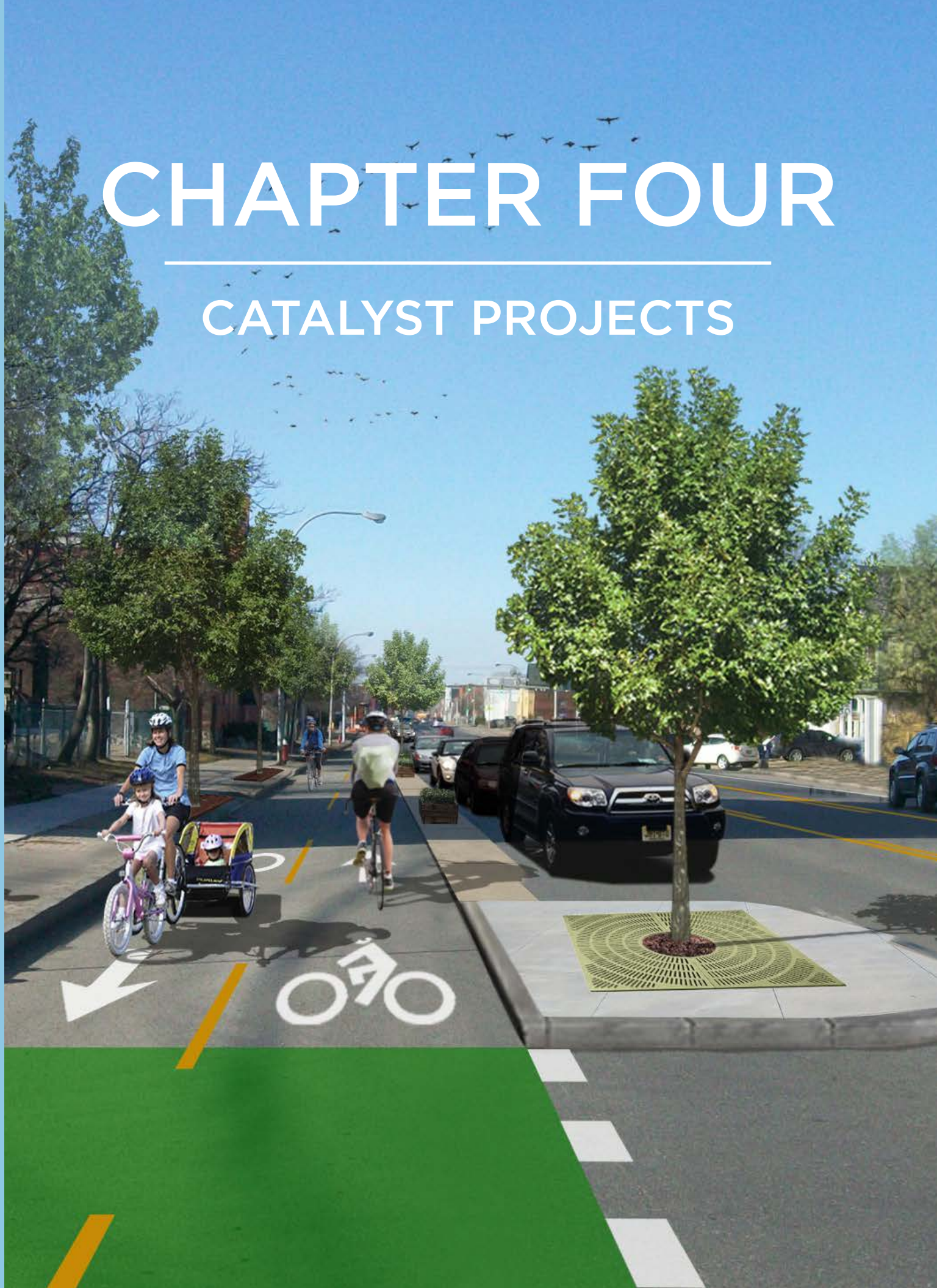
CHAPTER FOUR

CATALYST PROJECTS



CATALYST PROJECTS

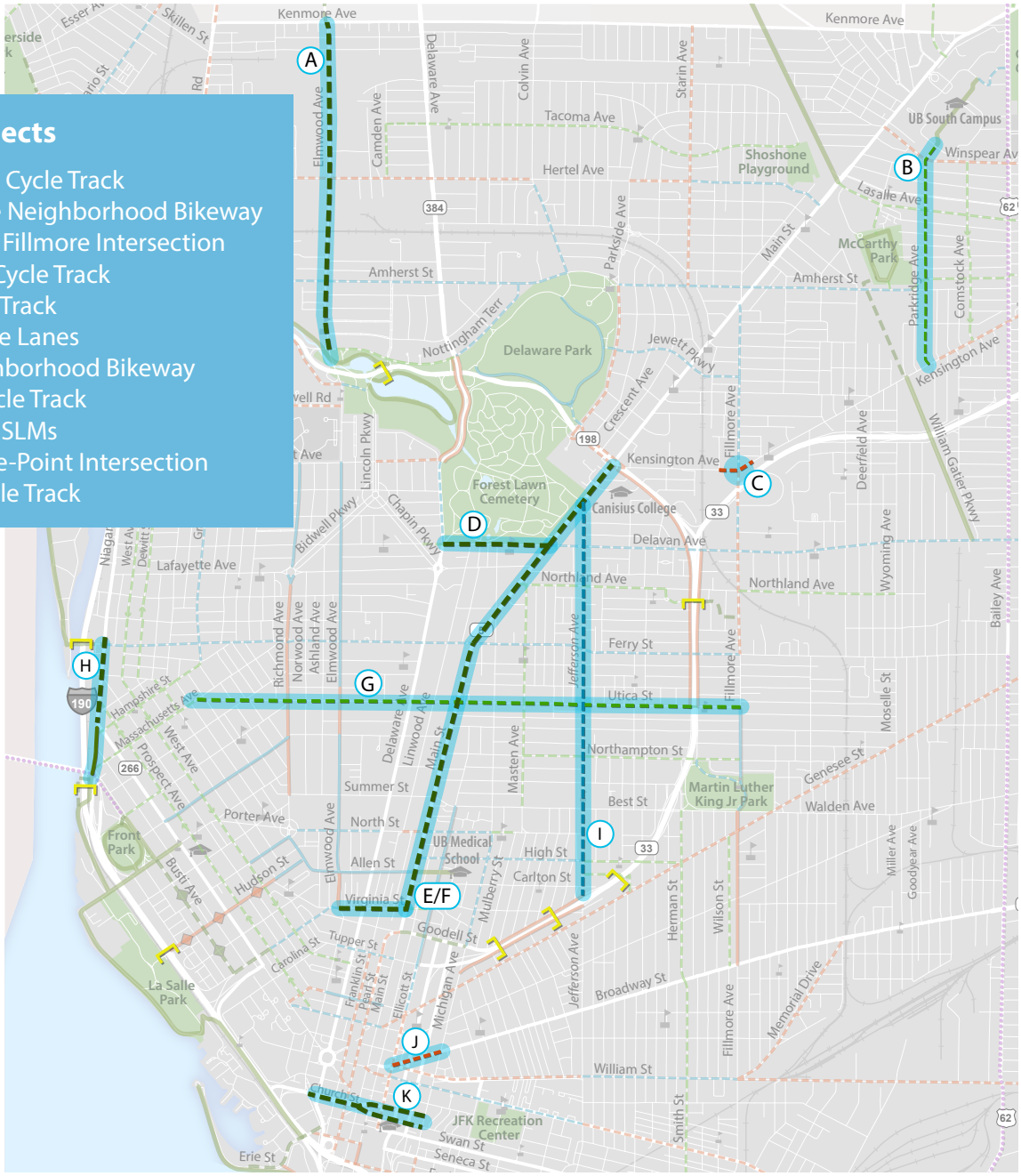
Eleven high priority catalyst projects that will provide critical bikeway connections were identified. This chapter provides design details and cost estimates for the 11projects. Criteria used to select them include:

- Connections to existing bike facilities.
- Opportunity to induce new riders immediately.
- Linkage to key destinations.
- Equal distribution between east and west side neighborhoods.
- Clear support from stakeholders and community members.

To determine the appropriate solutions to improve bicycle access for the 11 projects, the combined field investigation, traffic and GIS research, and innovative bicycle facility design methodologies were used to produce feasible solutions to the project challenges. The proposed designs will ensure improved comfort and safety for bicyclists along these key connections. The proposed designs included in this chapter present detailed information about the proposed facility designs. Each project includes a summary, street cross sections, detailed drawings of key intersections, and in some instances, 3-D photo renderings to help imagine how the future facility would appear. Planning level cost estimates for the projects are provided as well.

11 Catalyst Projects

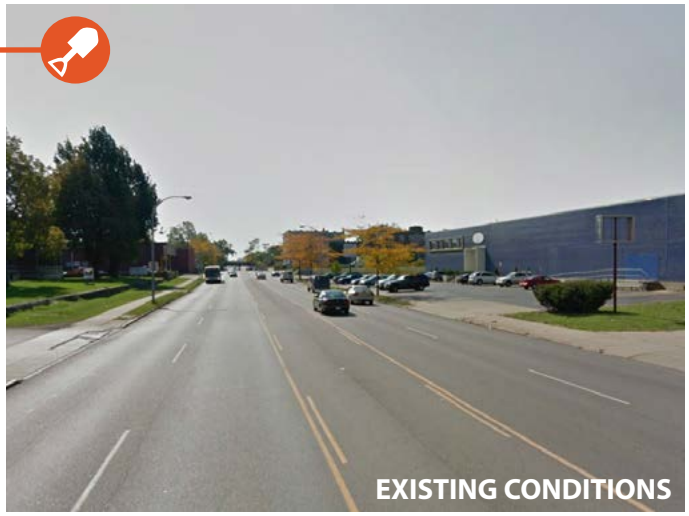
- A: Elmwood Ave Cycle Track
- B: Parkridge Ave Neighborhood Bikeway
- C: Kensington & Fillmore Intersection
- D: Delavan Ave Cycle Track
- E: Main St Cycle Track
- F: Virginia St Bike Lanes
- G: Utica St Neighborhood Bikeway
- H: Niagara St Cycle Track
- I: Jefferson Ave SLMs
- J: Broadway Five-Point Intersection
- K: Church St Cycle Track



The map at right shows the distribution of the 11 Catalyst Projects.

A: ELMWOOD AVE

This project will create a critical north/south bikeway connection between Delaware Park /SUNY Buffalo State and the proposed bicycle facility enhancements along Elmwood north of Buffalo in Tonawanda. Currently, the five-lane street is an auto-oriented corridor with no bicycle accommodations. Traffic volumes along the length of the project range from 18,000 vpd to more than 20,000 vehicles per day (vpd). Within this range, most four or five lane roadways are able to accommodate a reallocation down to three lanes, one in each direction with a center turn lane and right turn lanes at signalized intersections. This lane designation provides the spaces for one-way cycle tracks on both sides of the street, and various enhancements at intersections.



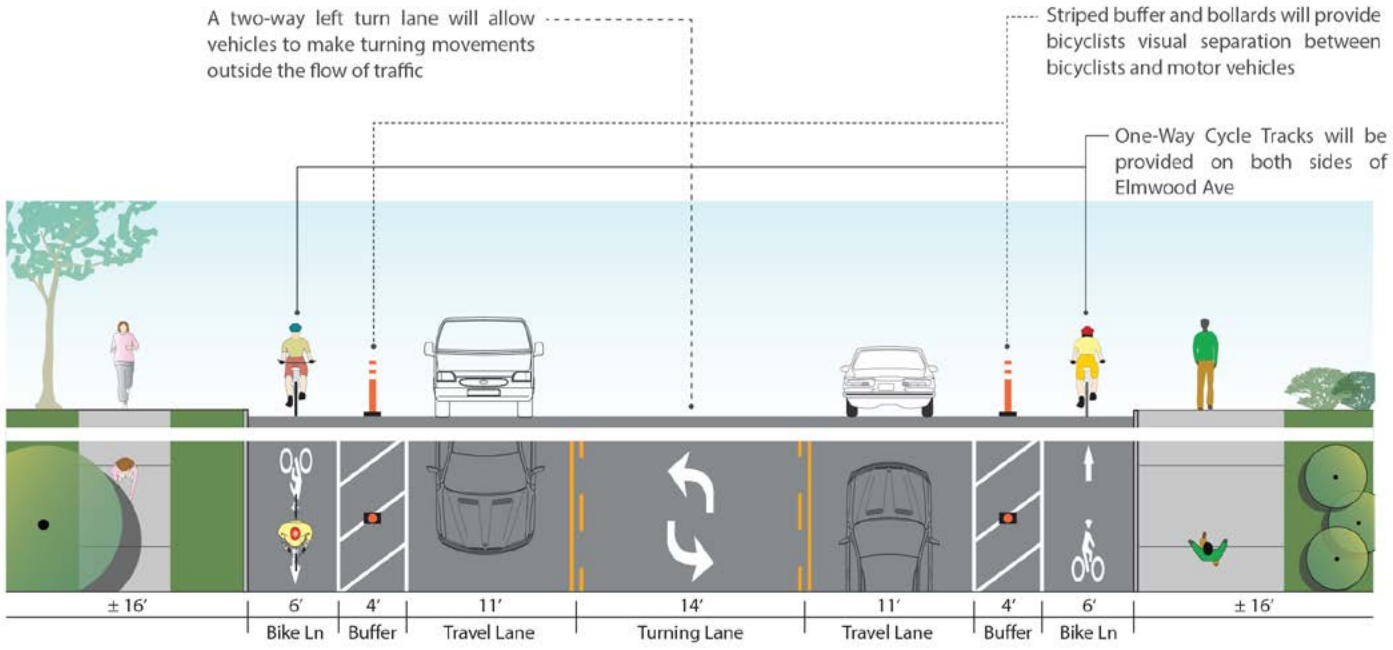
EXISTING ISSUES

- High traffic volumes and lack of dedicated facilities create an uncomfortable bicycling environment.
- No convenient north/south bikeway connection exists between SUNY Buffalo State/ Delaware Park to Tonawanda.
- The lane-reduction concept for Elmwood maintains Delaware Avenue as the primary motor vehicle route from Amherst Street and the Delaware Park area of Buffalo to Tonawanda.

WHY THE PROJECT IS IMPORTANT

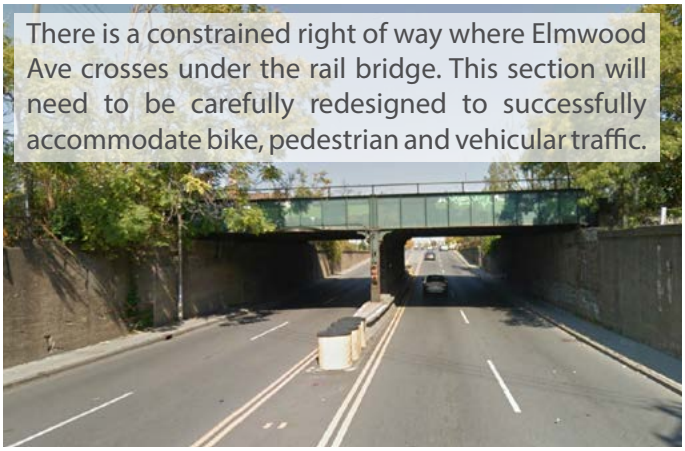
- Will provide safe and convenient bikeway connection between Tonawanda and points north of Buffalo to SUNY Buffalo State/ Delaware Park and points south.
- Connection will not only improve biking experience, but can also serve to remake Elmwood Ave into a complete street, which could spur economic development along the corridor.

PROPOSED CROSS SECTION - AT MIDBLOCK



Existing ROW Width: 88 feet | Existing Curb-to-Curb Width: 56 feet

CONSTRAINED RIGHT-OF-WAY

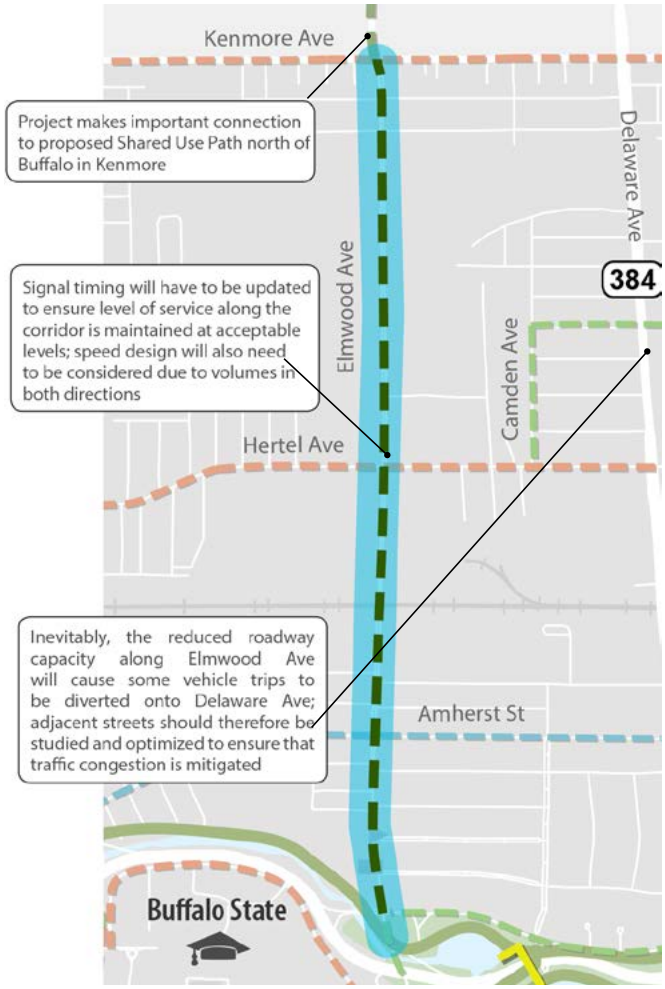


There is a constrained right of way where Elmwood Ave crosses under the rail bridge. This section will need to be carefully redesigned to successfully accommodate bike, pedestrian and vehicular traffic.

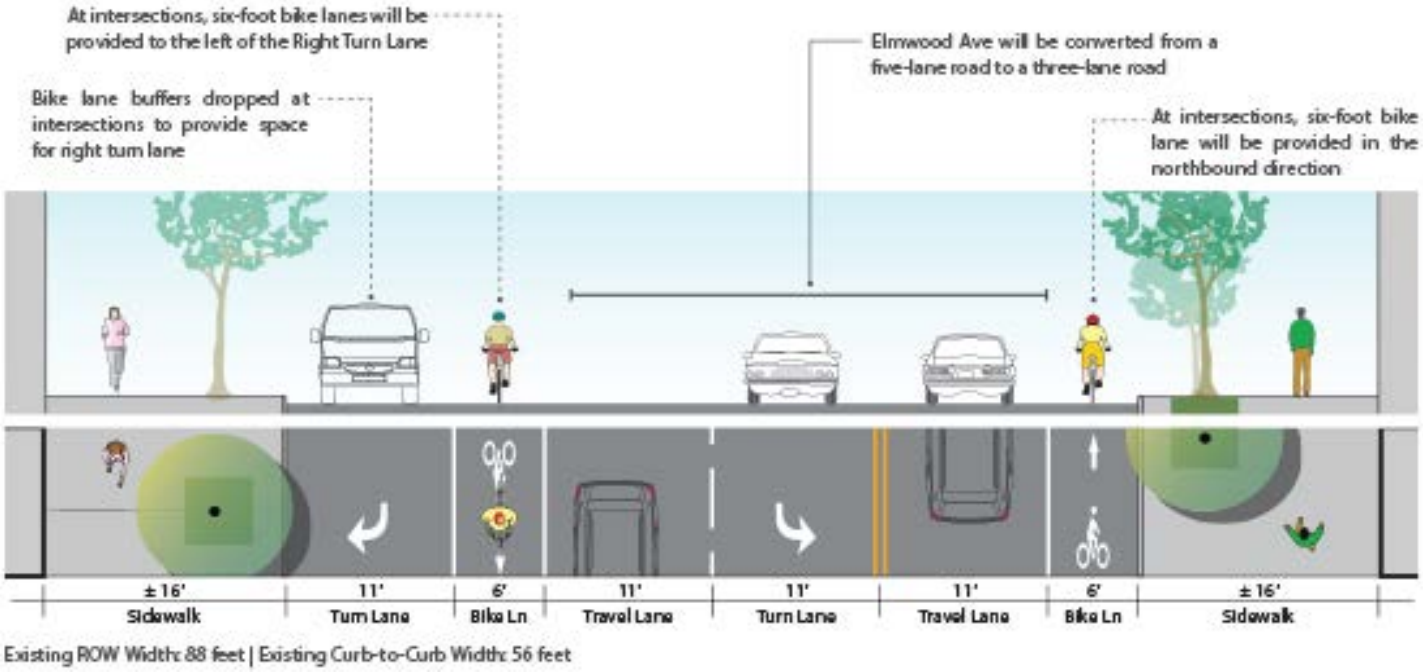
COST ESTIMATE

1. Roadway Striping, Markings and Signage	$122,000
2. Delineator Posts/Bollards	$62,250
Subtotal	**$184,200**
3. Additional Costs	+33%
Total	**$245,018**

PROJECT AREA



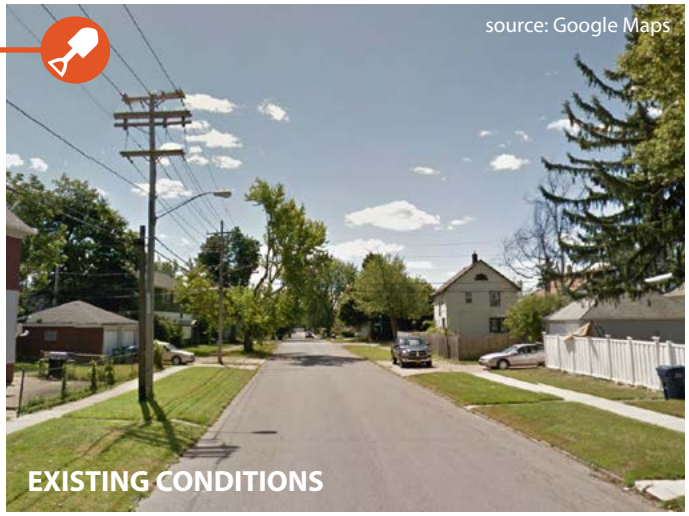
PROPOSED CROSS SECTION - AT SIGNALIZED INTERSECTION



Existing ROW Width: 88 feet | Existing Curb-to-Curb Width: 56 feet

B: PARKRIDGE AVE

This project would provide a key connection from the UB South Campus to the proposed bicycle facilities along Kensington Ave. The low vehicle volumes (<3,000-5,000 Average Daily Traffic[ADT]) and restricted parking along on the west side of Parkridge present an opportunity to create a safe and comfortable bicycle facility. The proposed design includes a contra-flow bike lane in the south bound direction, and shared lane markings (or "sharrows") north bound. "Bike may use full lane" and other wayfinding signs would be installed to help guide users along the corridor toward the proposed facility on Kensington. The installation of traffic calming treatments would further improve the bicycling experience along Parkridge.



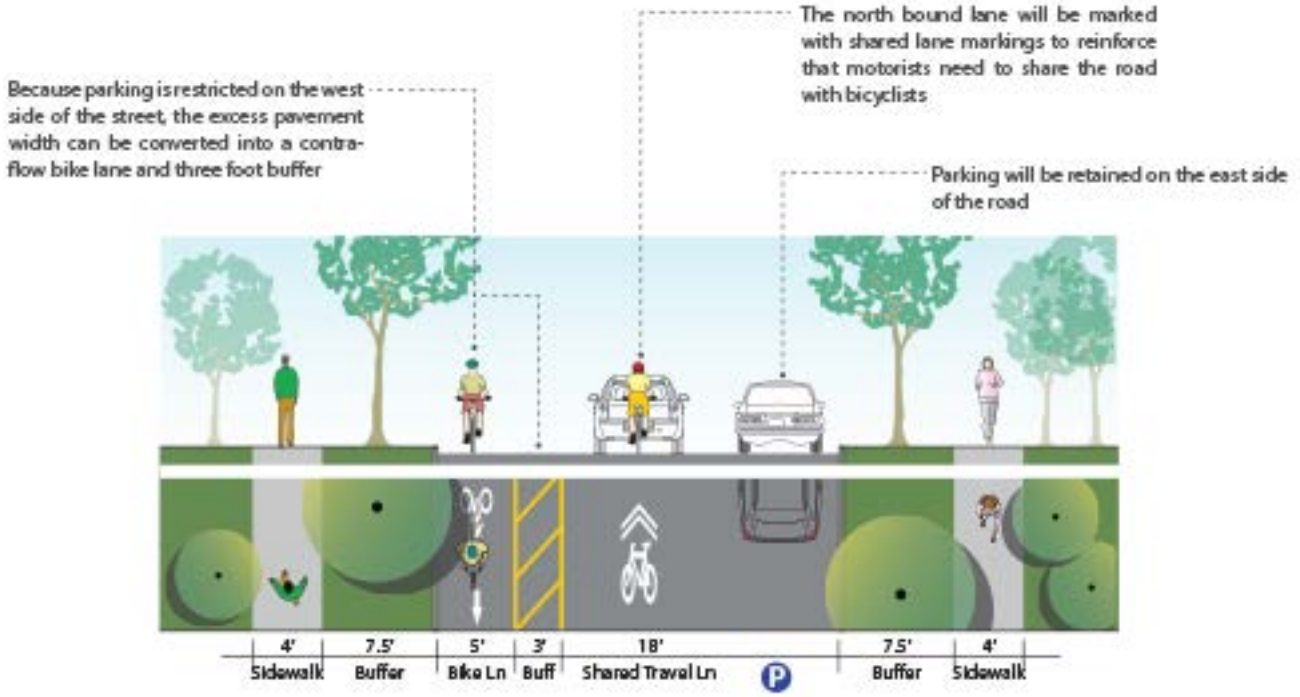
EXISTING ISSUES

- There is no existing bikeway connection from the UB South Campus to downtown.
- Lack of parking on the west side of the street creates effectively wide travel lanes. Wide travel lanes have been cited as contributing to higher overall speeds when compared to narrow travel lanes.

WHY IT'S IMPORTANT

- Would create a strong connection between UB South Campus and the proposed facility on Kensignton Ave.
- Would delineate travel lanes along the street, reducing the width of the vehicular lanes. This would likely have the effect of moderating overall travel speeds along the street, creating a more comfortable environment for bicyclists, pedestrians and neighborhood residents.

TYPICAL PROPOSED CROSS SECTION



NEIGHBORHOOD BIKEWAY DESIGN STRATEGY

Although no federal guidelines exist, several best practices have emerged for the development of neighborhood bikeways. At a minimum, neighborhood bikeways should include distinctive pavement markings and wayfinding signs. They can also use combinations of traffic calming, traffic diversion, and intersection treatments to improve the bicycling environment. The appropriate level of treatment to apply is dependent on roadway conditions, particularly motor vehicle speeds and volumes. Traffic conditions on neighborhood bikeways should be monitored to provide guidance on when and where treatments should be implemented. When motor vehicle speeds and volumes or bicyclist delay exceed the preferred limits, additional treatments should be considered for the neighborhood bikeway.

The neighborhood bikeway "toolbox" includes:

- Effective wayfinding through signs + pavement Markings.
- Speed and volume management.
- Intersection design + management.

Signage

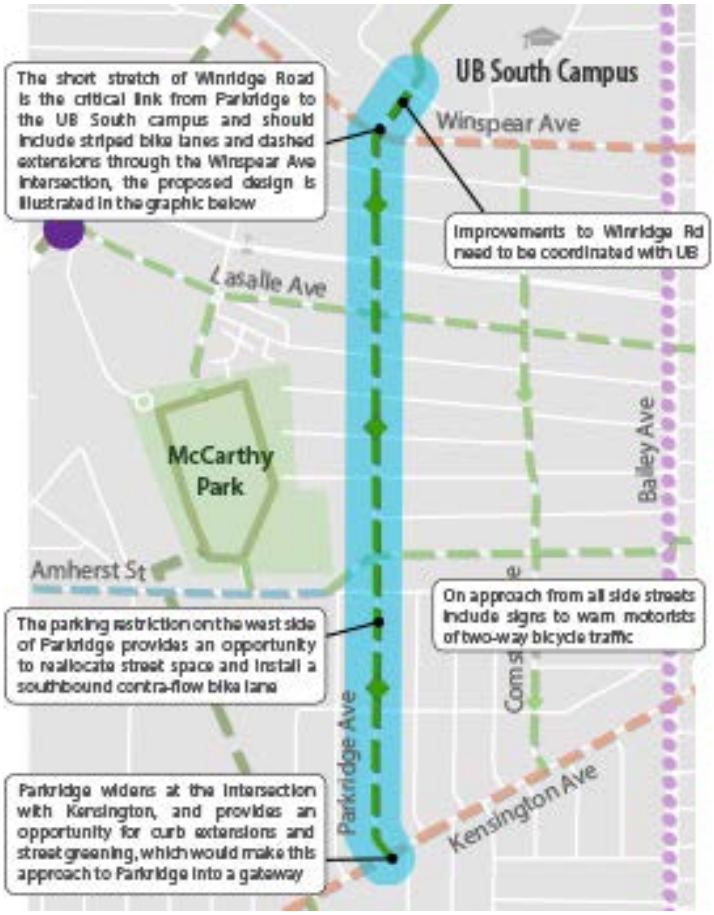
Pavement Markings

Traffic Diversion

COST ESTIMATE

1. Roadway Grinding, Restriping & Signage	$39,500
2. Bicycle Signalization	$14,000
Subtotal	**$53,500**
3. Additional Costs	+33%
Total	**$72,500**

PROJECT AREA



KEY INTERSECTION

C: KENSINGTON/FILLMORE INTERSECTION

The intersection of Kensington Ave and Fillmore Ave is a critical link along the future bikeway corridor, but is difficult to navigate for all travel modes. In the west bound direction, there are six travel lanes on the approach to Fillmore, plus an additional four in the east bound direction. This designation creates a large expanse of pavement and a long exposure time for bikes and pedestrians crossing Kensington. Longer crossing exposure times increase bike/pedestrian/motor vehicle conflicts, and can increase the probability of crashes. With approximate AADT between 5,000 - 10,000 vpd, Kensington has excess capacity, and a road diet is recommended for the corridor. This plan will provide additional street space that can be converted into bicycle facilities.

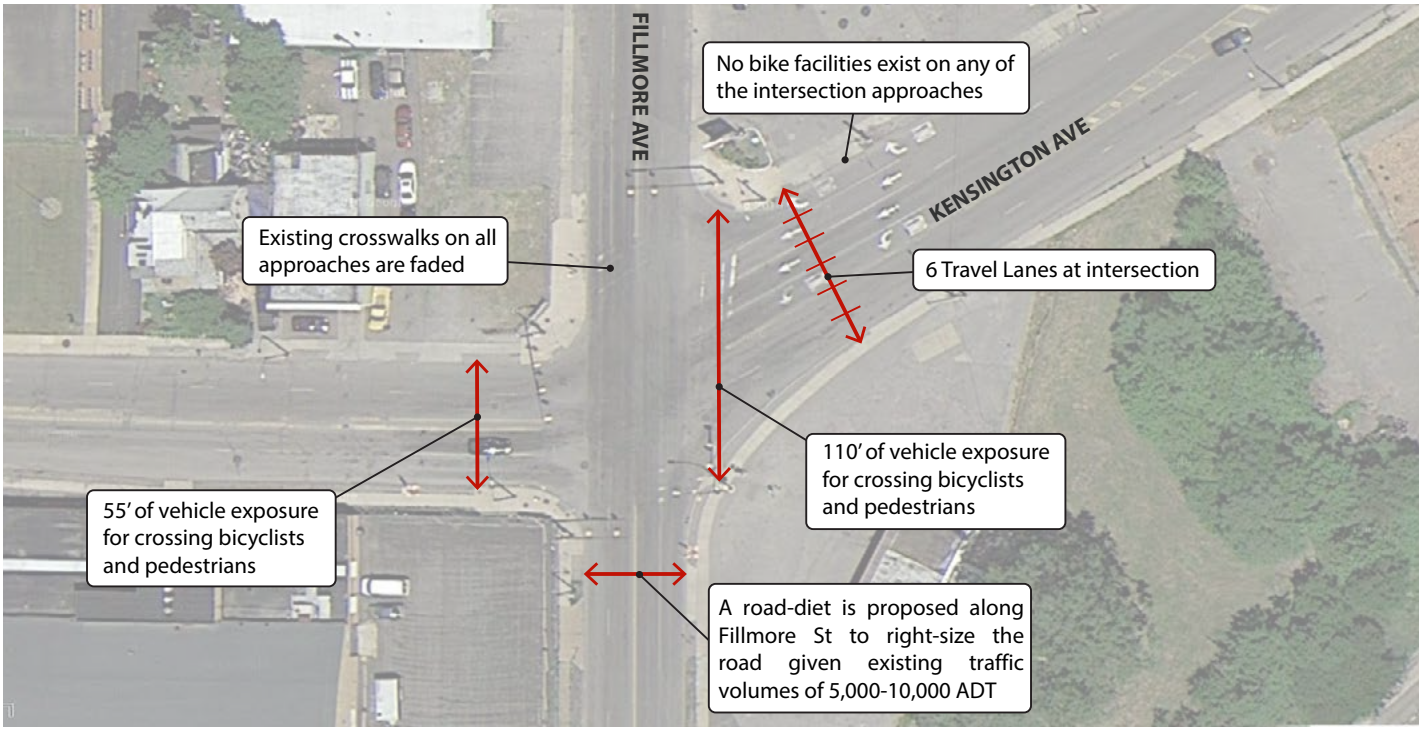
EXISTING PROJECT ISSUES

- Long crossing distances are correlated with higher likelihood of bike and pedestrian injuries.
- Roads that are constructed to carry more vehicles than travel upon them (i.e., roads that are over-built or have excess capacity) are correlated with elevated overall travel speeds.
- The intersection is confusing and difficult to navigate for all modes of travel.

WHY IT'S IMPORTANT

- Intersection improvements will reduce bicycle and pedestrian exposure times, improving safety.
- Intersection improvements will make the crossing more logical.
- The road will be "right-sized" for existing traffic volumes, improving the flow of traffic along Kensington Ave.
- Future bike lane along Kensington Ave will be provided, improving safety and comfort.

EXISTING INTERSECTION CHALLENGES



PROJECT AREA

Green pavement markings help to identify conflict areas between bicyclists and motor vehicles. This treatment in Seattle, WA is especially effective where vehicles cross a bike lane to make right-hand turns, as shown in the image above.

COST ESTIMATE

1. Roadway Grinding, Restriping & Signage	$20,500
2. Intersection Refuge Islands	$26,000
Subtotal	**$46,500**
3. Additional Costs	+33%
Total	**$63,000**

PROPOSED INTERSECTION DESIGN

D: DELAVAN AVE CYCLE TRACK

Delavan Ave presents a key east-west bikeway connection south of Forest Lawn Cemetery. Currently, this section of the street consists of a wide (50ft) two-lane road, with an unmarked parking lane on the south side. The proposed design includes a two-way cycle track on the north side of the road, which would effectively narrow the vehicle travel lanes. This designation would help to calm traffic along the corridor and improve traffic flow along this section of Delavan Ave.

On the west edge of the project area, nonmotorized access to the cemetery is complicated by the long north-south crossing of Delavan at Delaware Ave. The proposed design would improve this crossing.

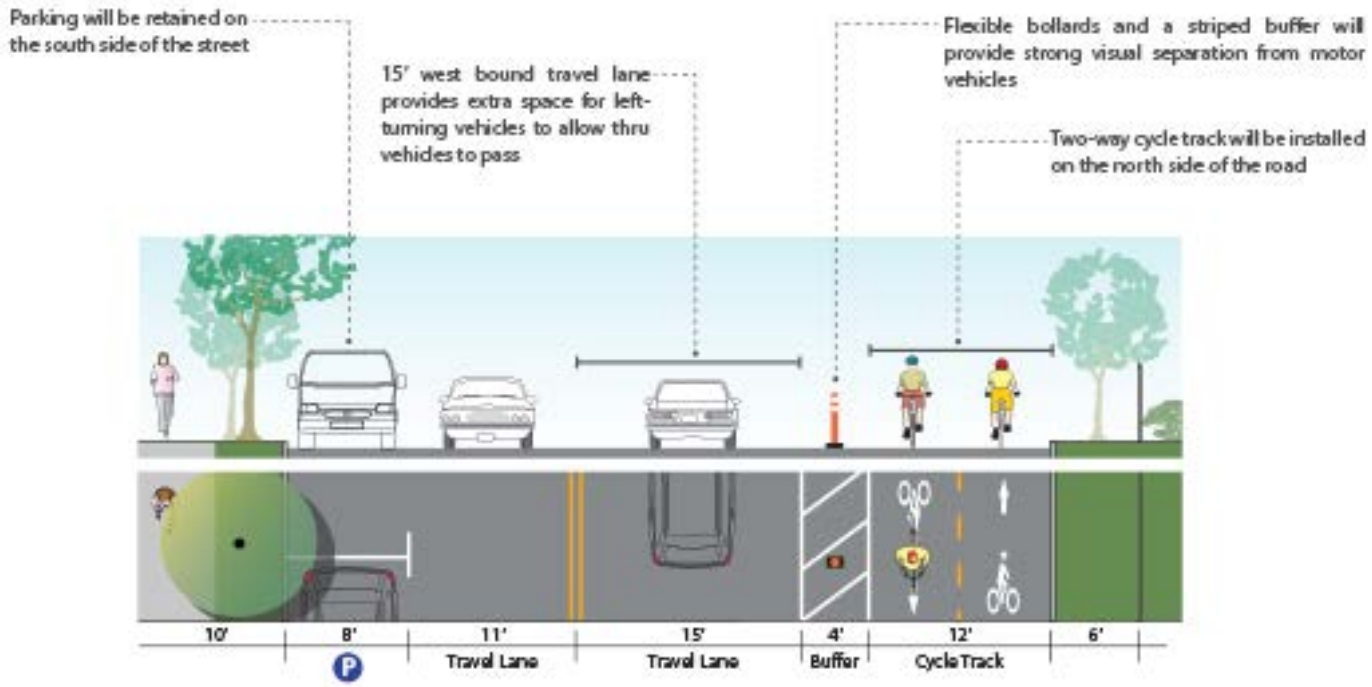
EXISTING ISSUES

- This section of Delavan Ave consists of a wide street, with wide travel lanes that contribute to higher overall travel speeds.
- Crossing Delavan to Forest Lawn Cemetery is challenging for bicyclists and pedestrians.

WHY IT'S IMPORTANT

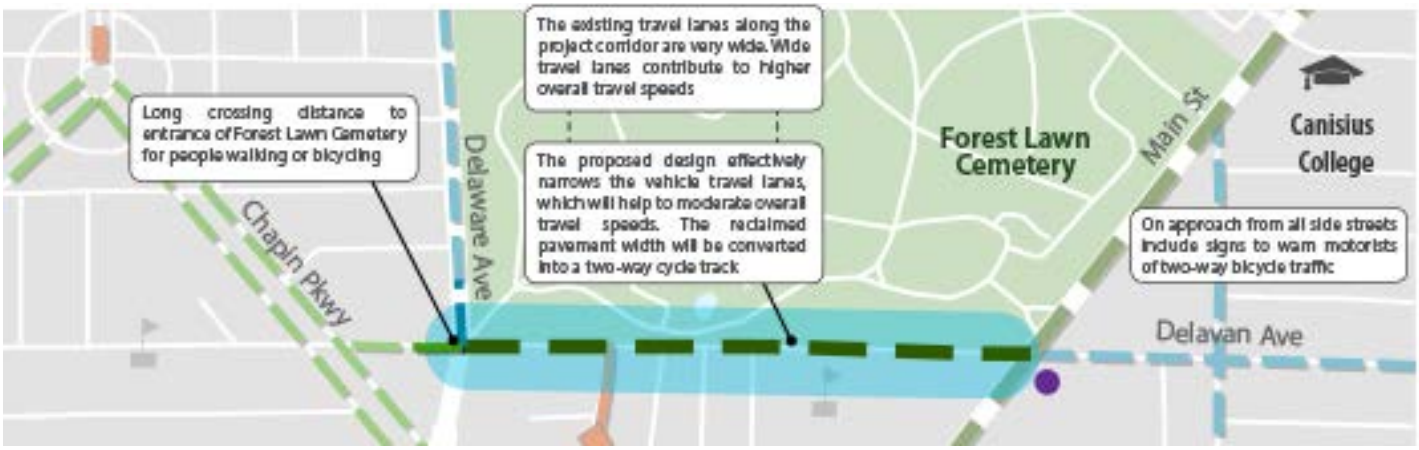
- Narrower travel lanes will help to traffic calm on the street and improve traffic flow.
- The project will include improvements to the intersection of Delavan and Delaware Ave, which will improve nonmotorized crossings in all directions.
- The proposed cycle track will provide a key east/west bikeway connection between Main Street and Elmwood Village.

TYPICAL PROPOSED CROSS SECTION



Existing ROW Width: 66 feet | Existing Curb-to-Curb Width: 50 feet

PROJECT AREA



Two-stage turn queue boxes provide a holding area for bicyclists to queue, allowing them to cross an intersection in two stages in the San Francisco area. This crossing pattern is more comfortable, especially for less experienced bicyclists.

COST ESTIMATE

1. Roadway Grinding, Restriping, Signage & Bollards	$46,800
2. Bicycle Signalization	$14,000
3. Delevan/Delaware Bike and Ped Intersection Improvements	**$43,600**
Subtotal	**$104,300**
4. Additional Costs	+33%
Total	**$141,600**

PROPOSED INTERSECTION DESIGN

E: MAIN ST CYCLE TRACK

Main Street is the most direct at-grade route for people travelling from many areas of Buffalo to Downtown. It also serves as the cross-road between East and West Buffalo. The significance of this road and the role that it plays in Buffalo's transportation network makes it a critical bikeway link. The current design of the corridor makes it an auto-dominated thoroughfare, and the proposed design would reshape the character of the road, making it a Complete Street that better serves all modes of travel. The road would be converted from a five/six lane road to a three/four lane road. A two-way cycle track is proposed for the west side of the road, which would serve as the primary north/south protected facility for Buffalo. Intersection improvements along the corridor are proposed as well.

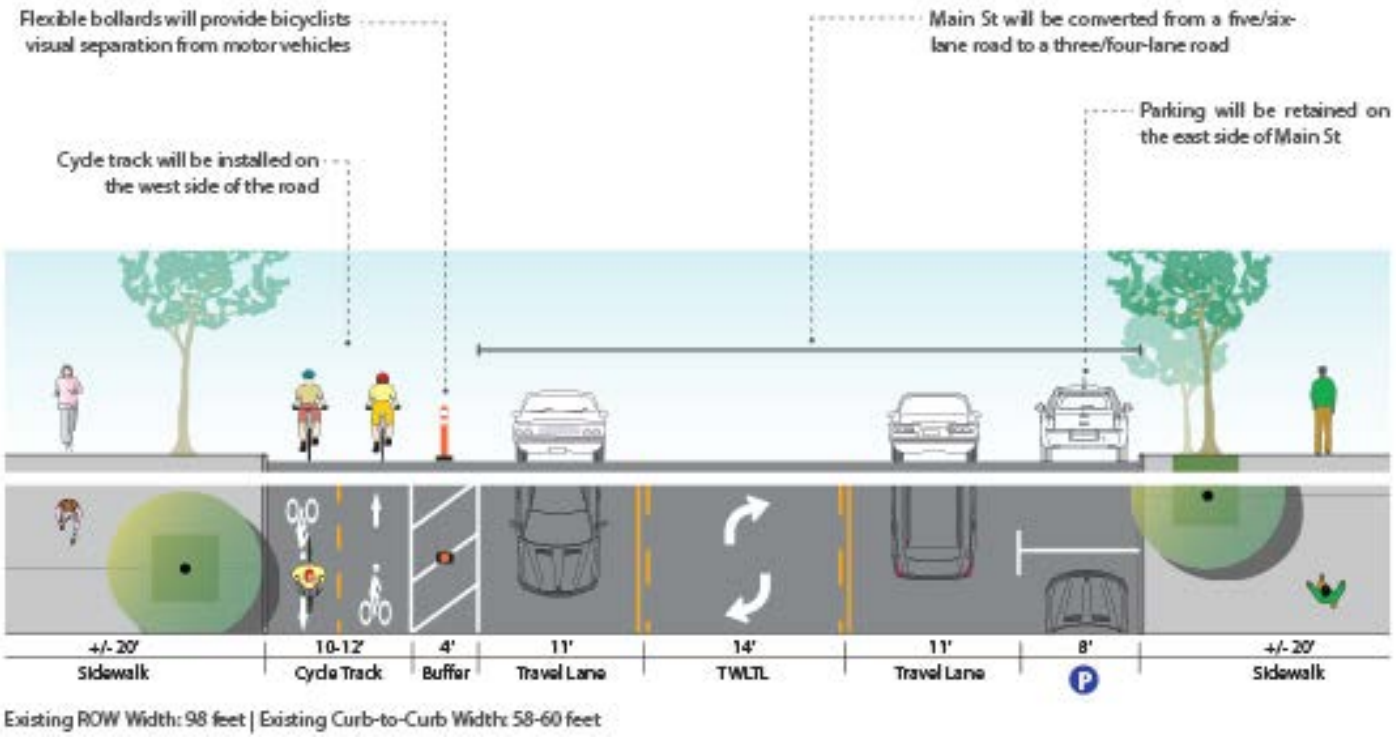
EXISTING ISSUES

- Main St is an auto-dominated thoroughfare but the most direct route to downtown.
- The five/six lane roadway is far below capacity for the current traffic volumes that range from 15,000 to more than 18,000 AADT.
- The high traffic volumes and absence of dedicated bicycle facilities makes biking along Main St uncomfortable, even for experienced bicyclists.
- The pavement is distressed and mill-and-overlay pavement rehabilitation is highly desirable within the cycle-track zone and buffer.

WHY IT'S IMPORTANT

- Would provide critical north/south bikeway connection for the City and connect to Metro stations.
- Repeatedly cited as the most important project by the public.
- Would provide North/South access for neighborhoods in East and West Buffalo.
- Would change the character of Main St, converting it into a complete street that encouraged walking and biking.

TYPICAL PROPOSED CROSS SECTION



REPRESENTATIVE PROJECTS

Two-way cycle tracks have been successfully implemented across the United States; this image shows the 10th St cycle track in Atlanta, GA, which is similar in dimension to the proposed cycle track on Main St

Green pavement markings help to identify conflict areas between bicyclists and motorists; this type of treatment has been widely adopted, as shown in the Broadway cycle track in Seattle, WA.

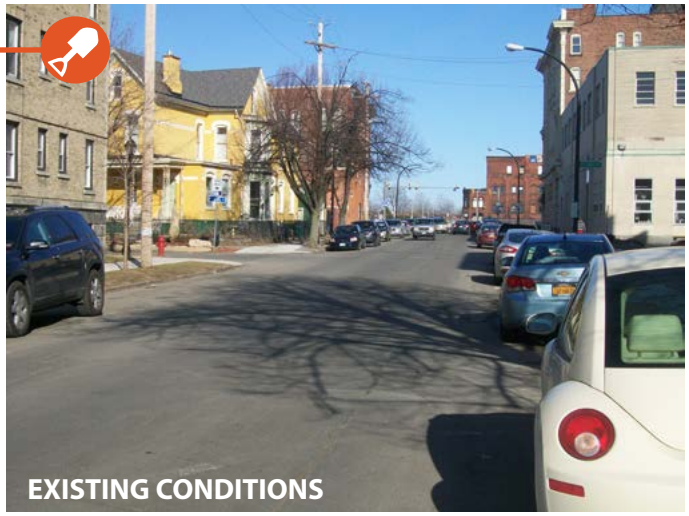
COST ESTIMATE

1. Roadway Grinding, Restriping, Signage & Bollards	$280,000
2. Bicycle Signalization	$112,000
3. Mill and Overlay Cycle Track	$336,700
Subtotal	**$728,800**
4. Additional Costs	+33%
Total	**$989,000**

PROJECT AREA

F: VIRGINIA ST BIKE LANES

Virginia St provides connectivity between two interested but concerned corridors in the city, Main St and Elmwood Ave. The important link that Virginia serves entails that the proposed bicycle facility along it be designed to accommodate a wide range of bicyclists. If the street cross-section was to remain as is, with on-street parking and two travel lanes in both directions, there would not be enough roadway space for the installation of bike lanes. The proposed design converts Virginia St into a one-way street eastbound. This configuration provides additional street space that can fit a conventional bike lane east bound, and a contra-flow bike lane west-bound, permitting two-way bicycle travel. When Virginia St is converted into a one-way, east bound street, it will form a couplet with west-bound Edward Street, a block to the south. Before this change is made, however, additional community outreach will be required to ensure the new traffic flow functions well for the neighbors and businesses in the immediate area.


EXISTING CONDITIONS

EXISTING PROJECT ISSUES

- No bikeway connection exists.
- Posses a barrier to bicycling.

WHY IT'S IMPORTANT

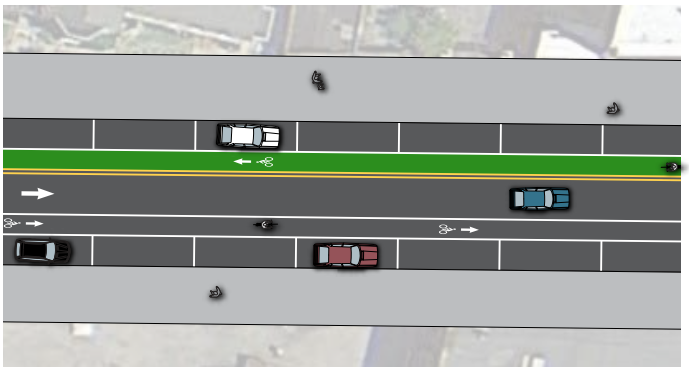
- Represents an important bikeway connection.
- Would provide comfortable, two-way bicycle travel.
- Would provide critical link between two interested but concerned facilities along Main St and Elmwood Ave.

PHOTO SIMULATION


Virginia Street looking east to the Main Street intersection

PROJECT AREA

MIDBLOCK DESIGN

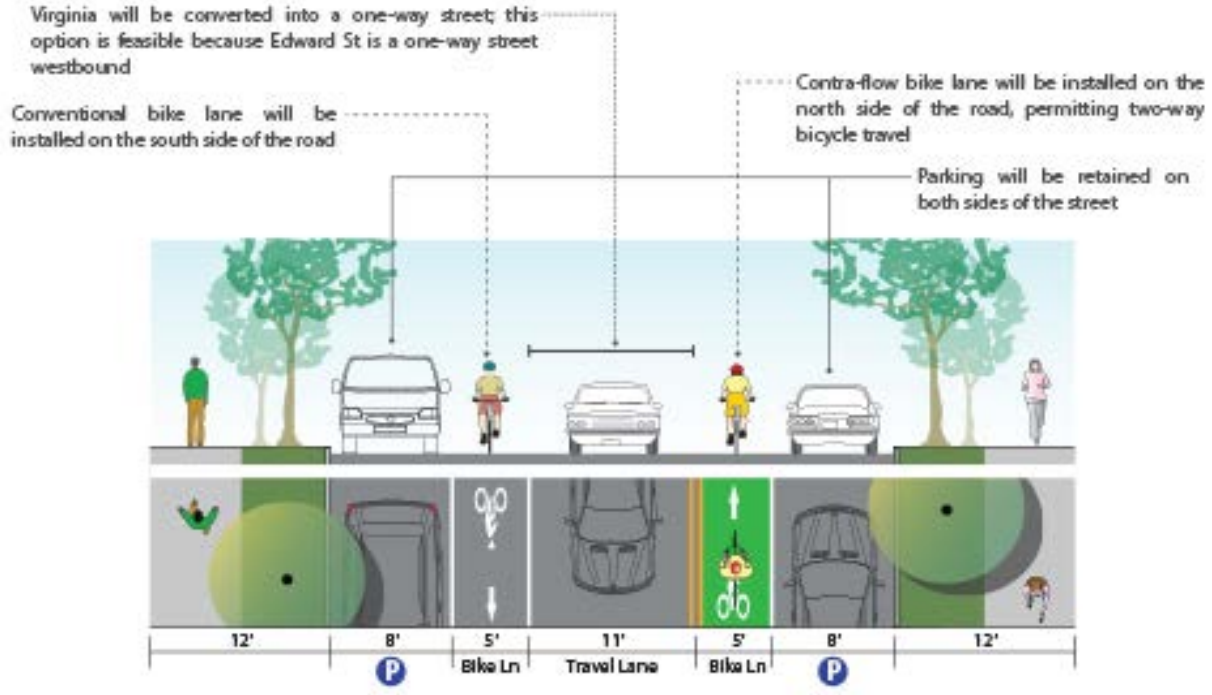


The proposed design converts Virginia into a one-way street eastbound; the reclaimed pavement width will be converted into a bike lane eastbound and a contra-flow bike lane west bound, while retaining parking.

COST ESTIMATE

1. Roadway Striping & Signage	$62,100
2. Bicycle Signalization	$21,000
Subtotal	**$83,100**
3. Additional Costs	+33%
Total	**$112,800**

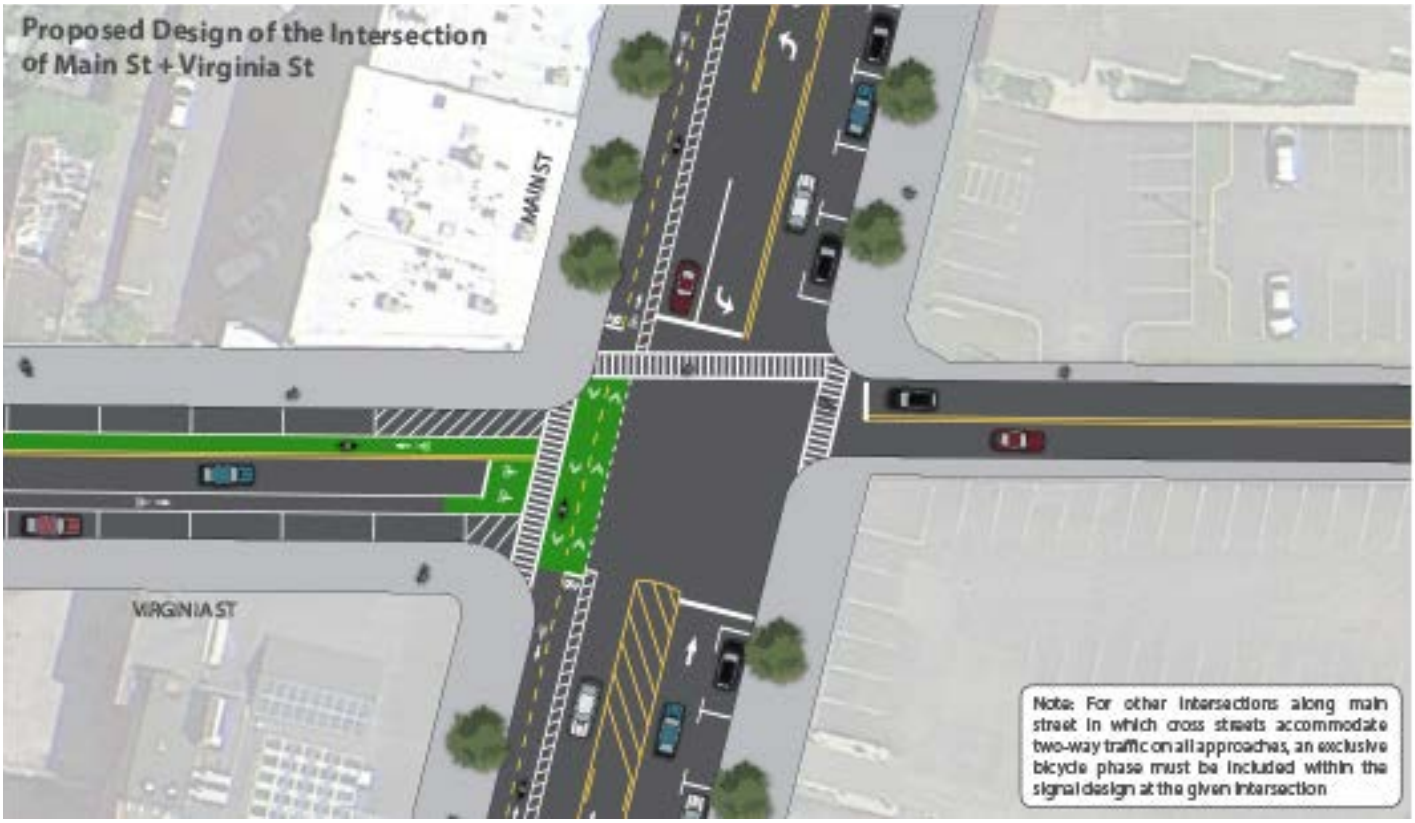
TYPICAL PROPOSED CROSS SECTION



Existing ROW Width: 61 feet | Existing Curb-to-Curb Width: 37 feet

E/F: MAIN ST + VIRGINIA ST INTERSECTION

INTERSECTION DESIGN - MAIN ST SOUTH



G: UTICA ST

Utica St represents a key east/west bikeway corridor. The directness of Utica St, combined with low traffic volumes ranging from <3,000-5,000 ADT, makes it an appealing candidate for conversion into a neighborhood bikeway.

Ideally, neighborhood bikeways should carry less than 3,000 vpd. Given that Utica St currently carries up to 5,000 vpd, it is proposed that traffic calming and potential traffic diversion treatments be implemented along the corridor to slow traffic down and potentially to divert traffic to parallel routes, such as Ferry St, decreasing traffic volumes. Options for converting Utica St into a neighborhood bikeway are presented on the following pages.


EXISTING CONDITIONS

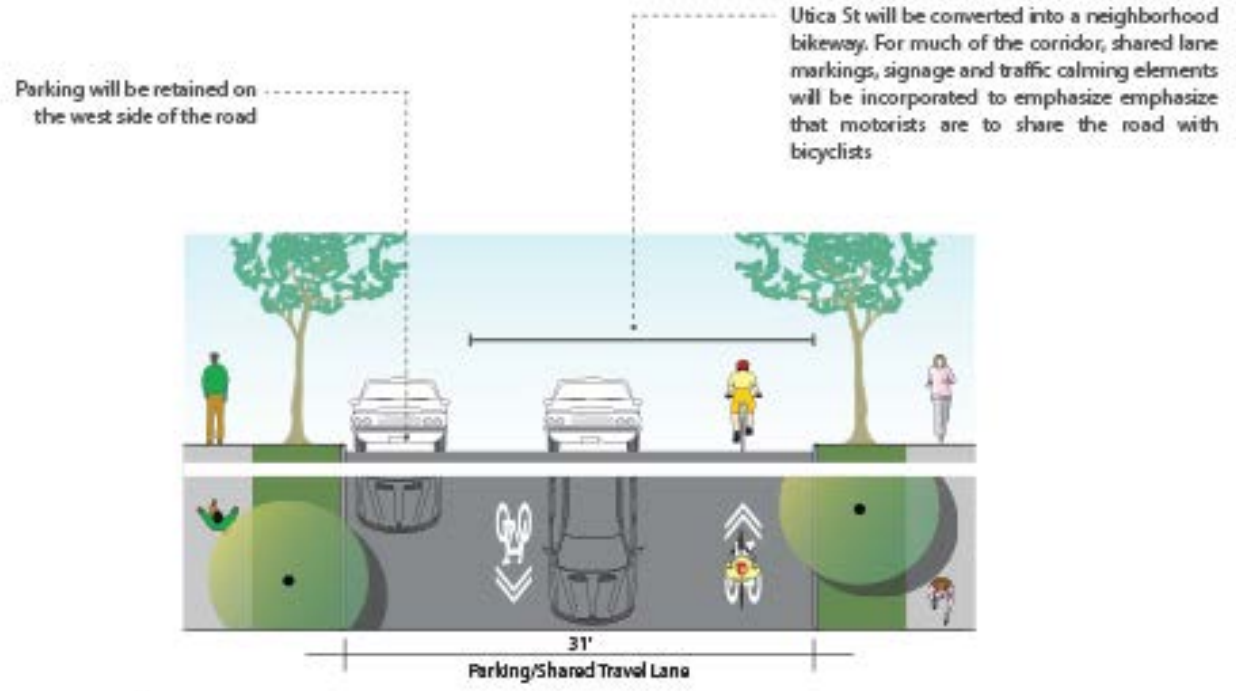
EXISTING ISSUES

- There is no convenient and direct east/west bikeway.
- Traffic volumes along Utica St are higher than the 3000 vpd threshold that is ideal for shared-street bicycling environments.
- The higher than ideal traffic volumes can be mitigated by reducing the posted speed limit, ideally to 20 mph.

WHY IT'S IMPORTANT

- Will provide a key all ages and abilities east/west bikeway connection.
- Will traffic calm the corridor, moderate vehicle speeds and improve the bicycling experience along Utica St.
- The effects of traffic calming will benefit neighborhood residents, making the street safer for all modes.

TYPICAL PROPOSED CROSS SECTION



Existing ROW Width: 66 feet | Existing Curb-to-Curb Width: 31 feet

PROJECT AREA

OTHER COMPONENTS OF NEIGHBORHOOD BIKEWAYS

Signage

Source: Portland, ME

Neighborhood Bikeways should be branded with unique stencils, "Neighborhood Bikeway" signs or custom street-sign toppers

Pavement Markings

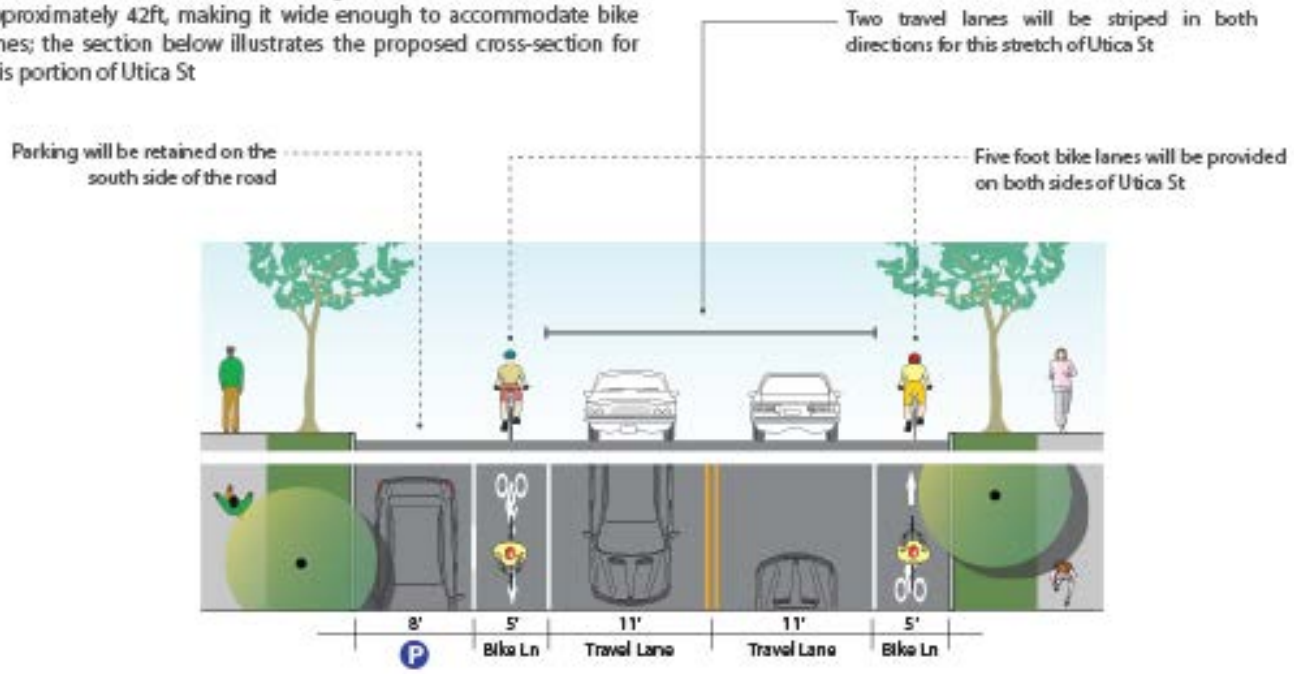
Shared Lane Markings encourage motorists to share the road

COST ESTIMATE

1. Pavement Markings, Signage & Traffic Calming Elements	$131,900
2. Section of Bike Lane	$9,300
Subtotal	**$141,200**
3. Additional Costs	+33%
Total	**$191,700**

PROPOSED CROSS SECTION - LINWOOD TO MICHIGAN

Between Linwood Ave and Michigan Ave, Utica St widens to approximately 42ft, making it wide enough to accommodate bike lanes; the section below illustrates the proposed cross-section for this portion of Utica St



Existing ROW Width: 49 feet | Existing Curb-to-Curb Width: 42 feet

TRAFFIC CALMING FOR NEIGHBORHOOD BIKEWAYS

HORIZONTAL DEFLECTION

Horizontal traffic calming devices cause drivers to slow down by constricting the roadway space or by requiring careful maneuvering.

Traffic circles reduce speeds through intersections

Curb extensions increase turn radii and reduce turning speed

Chicanes deflect vehicles and reduce mid-block speeds

Chokers create pinch-points that reduce speeds mid-block

Traffic Circle

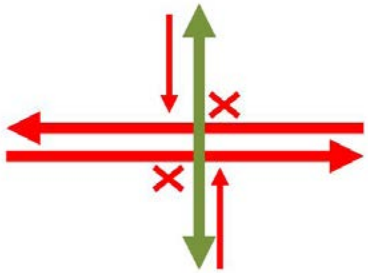
Curb Extension

Chicane

Choker

STRATEGIES FOR REDUCING VOLUME

Maintaining motor vehicle volumes below 3,000 AADT (annual average daily traffic), where 1,000 - 1,500 AADT is preferred, significantly improves bicyclists' comfort. To manage volume, physical or operational measures can be taken on routes that have been identified as a bicycle boulevard. These volume management elements also provide an opportunity for landscaping, stormwater management, and other pedestrian and bicycle supportive amenities.



Volume management tactics help to divert traffic away from neighborhood bikeways, reducing volumes along the bikeway

Traffic Restriction Signage:
The most straightforward traffic volume reduction strategy is signage restricting motor vehicle through movement

Choker Entrances:
These entrances are used to reduce motor vehicle volumes by restricting/constraining vehicle passage while allowing full bicycle passage to a boulevard

Stop Sign Placement:
At minor intersections, stop signs on bicycle boulevards should be placed on side street approaches in a way that favors through traffic on the bicycle boulevard

Median Traffic Diverters:
These diverters restrict through motor vehicle movements while providing a refuge for bicyclists to cross in two stages

H: NIAGARA ST

Niagara St is slated for reconstruction in the near future, and the bikeway improvements proposed in this plan will help to convert the street into a multi-modal corridor. The Niagara River Greenway runs north/south on the banks of the Niagara River, but due to right-of-way constraints, it is routed along Niagara St from Broderick Park for several blocks before returning to the river's bank south of the Peace Bridge. This segment of the greenway is the weak link in an otherwise uninterrupted trail. The proposed bikeway improvements along Niagara St will improve the on-street experience for greenway users, as well as provide a critical bikeway connection. Niagara St will be enhanced with street trees, creating a green visual corridor that will serve to emphasize that the street is a key segment in the Niagara River Greenway.


EXISTING CONDITIONS

EXISTING PROJECT ISSUES

- Lack of adequate space to accommodate greenway users.
- Weak link in the Niagara River Greenway.
- No bicycle accommodation exists.
- Does not provide a welcoming/memorable user experience; rather the street is an auto-dominated thoroughfare.

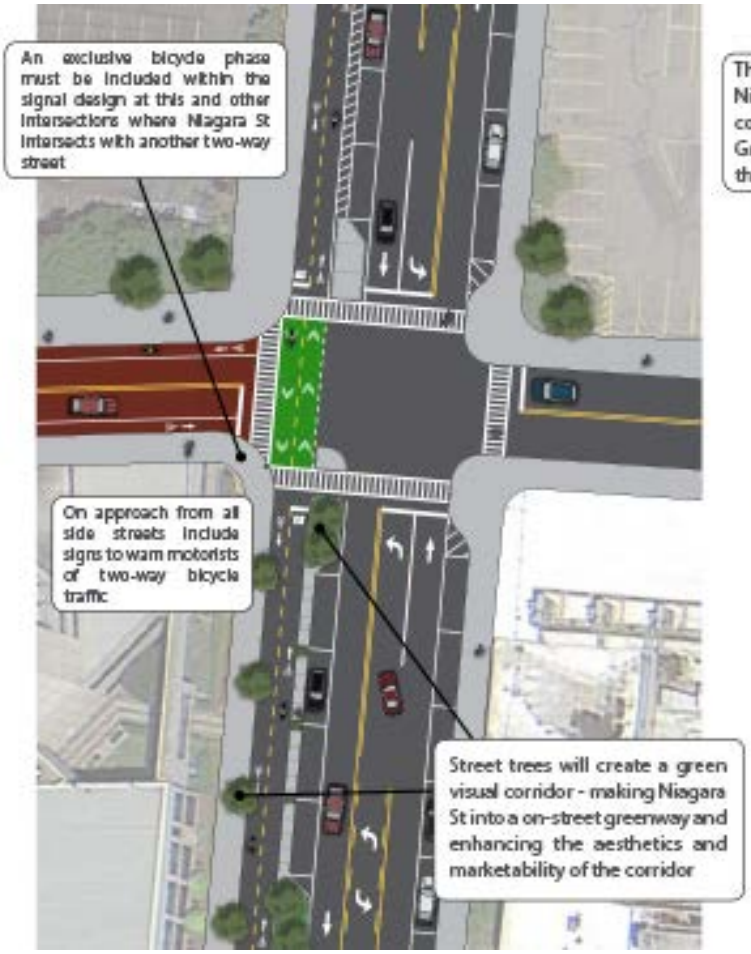
WHY IT'S IMPORTANT

- Would create a seamless connection to the off-street portions of the Niagara River Greenway.
- Provides critical bikeway connection.
- Ensures the reconstructed street accommodates all modes of travel.
- Streetscape improvements would enhance the aesthetics and marketability of the corridor.

PHOTO SIMULATION OF PROPOSED PLAN

PROJECT AREA

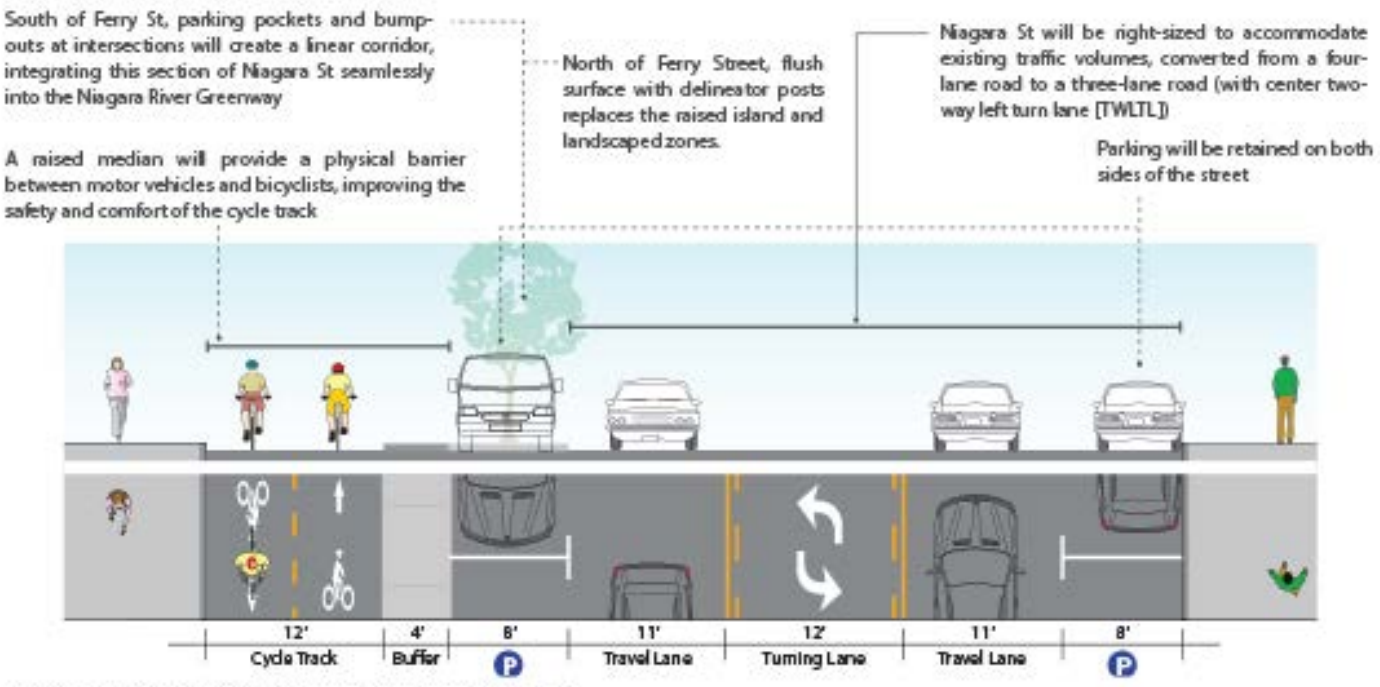
GREENWAY CONNECTION



COST ESTIMATE

1. Roadway Destriping, Striping & Signage	$34,200
2. Bicycle Signalization	$21,000
3. Rasied Median Buffer	**$385,800**
Subtotal	**$441,000**
4. Additional Costs	+33%
Total	**$598,400**

TYPICAL PROPOSED CROSS SECTION

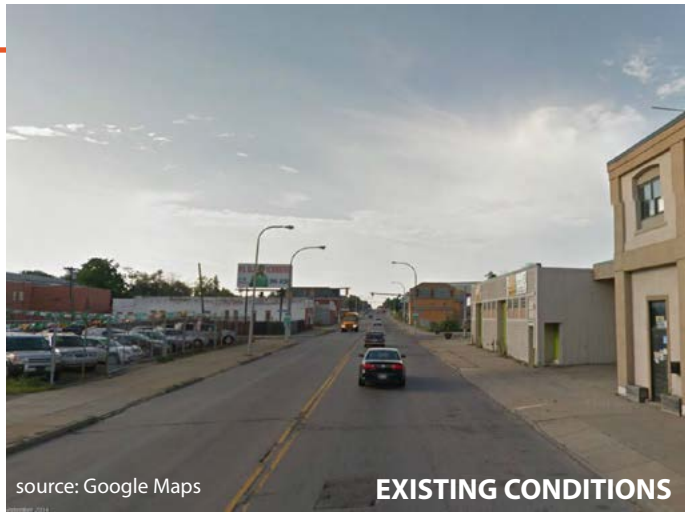


Existing ROW Width: 99 feet | Existing Curb-to-Curb Width: 66 feet

I: JEFFERSON AVE

Jefferson Ave was identified several times in the various rounds of public input and stakeholder engagement as a very desirable north/south bikeway connection. Currently, the curb-to-curb width precludes the installation of bike lanes if parking is retained on both sides of the street. In the near-term, this existing street cross section will be maintained, and shared lane markings are proposed. Because traffic volumes are higher than ideal (5,000-8,000 vpd) for the application of SLMs, it is recommended that enhanced shared lane markings (SLMs) be used.

It was identified that in some areas, demand for on street parking is low. In the long-term, parking on one side of the street could be removed to provide street space for the installation of bike lanes. This option will provide a higher level of comfort for a greater range of bicyclists.



EXISTING PROJECT ISSUES

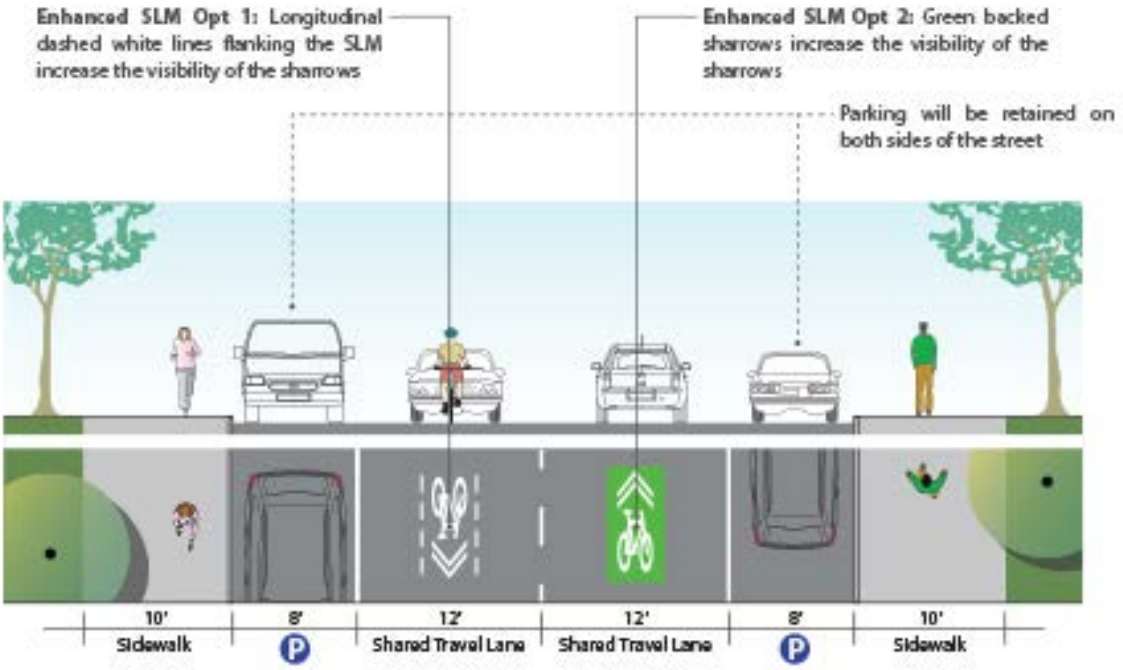
- Desirable north/south route for bicyclists, but there is no indication to motorists that they should expect bicyclists along the street.
- No existing accommodation for bicyclists .

WHY IT'S IMPORTANT

- In the short term, will designate the street as a bikeway through the application of SLMs.
- In the long term, parking on one side of the street could be removed to provide adequate street space for the installation of bike lanes .
- If bike lanes were installed, Jefferson would become a desirable bikeway route for a wide range of bicyclists.

TYPICAL PROPOSED CROSS SECTION - NEAR TERM OPTION

Given existing traffic volumes along Jefferson (5,000- 8,000 vpd) the near term option would provide a facility primarily for strong and fearless riders. To increase motorists' awareness of bicyclists along the corridor, enhanced shared lane markings are recommended. Two types of enhanced SLMs are illustrated below.



Existing ROW Width: 60 feet | Existing Curb-to-Curb Width: 40 feet

ENHANCED SHARED LANE MARKINGS

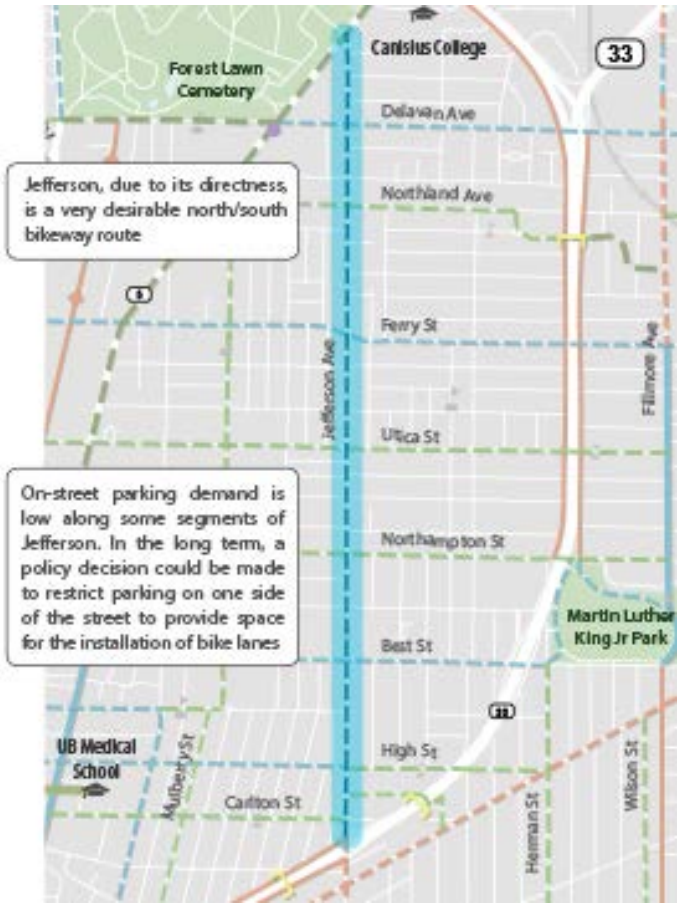
OPT 1: Longitudinal white lines flanking a standard SLM helps to emphasize to motorists the presence of bicyclists, and for bicyclists, communicates proper lane positioning

OPT 2: Green back sharrows are another option for an enhanced shared lane marking; the green treatment (typically thermoplastic) makes the SLM much more visible, and accentuates the presence of bicyclists along the corridor

COST ESTIMATE

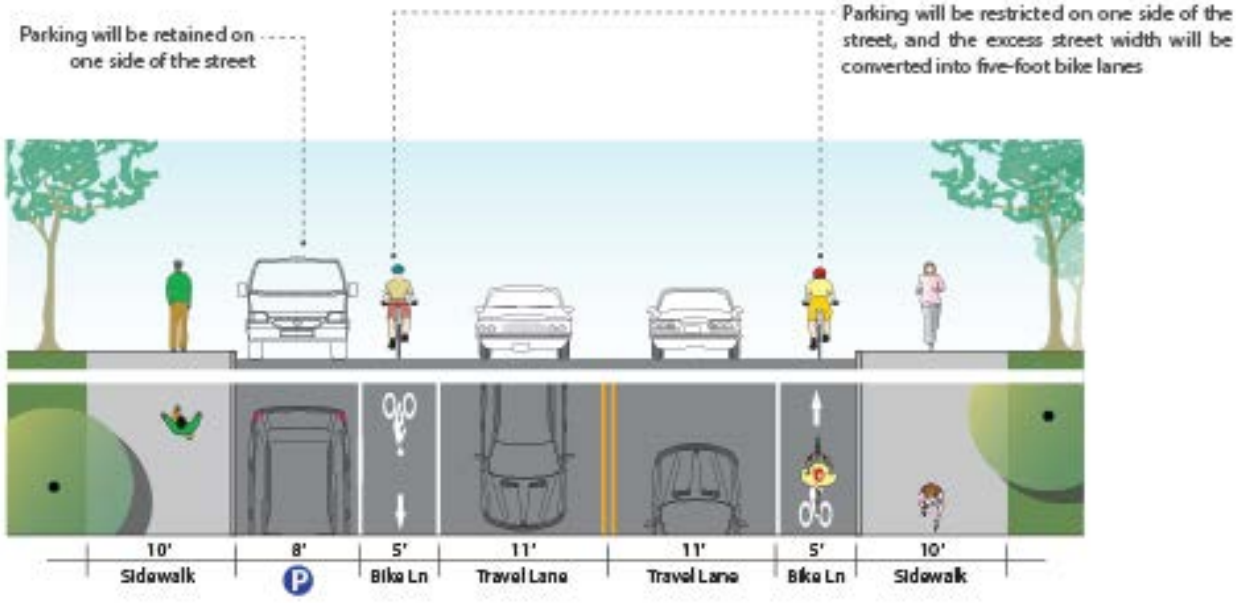
Short Term Option #1 Enhanced SLM:	$30,000
• dashed longitudinal line flanking sharrow	
Option #2 Enhanced SLM	**$50,000**
• Green Back Sharrow	
Short Term Long Term Option #3	**$92,000**
• Destriping, Striping & Signage	
Subtotal of Options	**$172,000**
4. Additional Costs	+33%
Total Of Options	**$228,760**

PROJECT AREA



PROPOSED CROSS SECTION - LONG TERM OPTION

Jefferson Ave represents a desirable north/south bikeway corridor, but given the existing right-of-way and parking on both sides of the street, only shared lane markings are a feasible treatment in the near term. This treatment is not ideal given the traffic volumes along the corridor (5,000-8,000 vpd), and the proposed long-term option would remove parking from one side of the street, converting the excess street space into bike lanes. This facility is more appropriate given the volumes along Jefferson, and would provide a much more comfortable bikeway connection for a larger range of bicyclists.



Existing ROW Width: 60 feet | Existing Curb-to-Curb Width: 40 feet

J: BROADWAY INTERSECTION

This portion of Broadway was selected as a catalyst project because it presents a design challenge to successfully move bicyclists through the intersection. With five major streets converging at a single point, bicycling through the intersection is very difficult, and likely only the most brazen bicyclists are currently choosing this route to access downtown. The proposed improvement to Broadway and the surrounding streets would delineate bicyclist lane positioning through the intersection, and make traffic circulation more logical. To decrease crossing distances and exposure time for bicyclists and pedestrians, a triangular "pork chop" island is proposed at the intersection between Broadway and William St. The enhancements will improve crossing conditions for all modes of travel.


EXISTING CONDITIONS

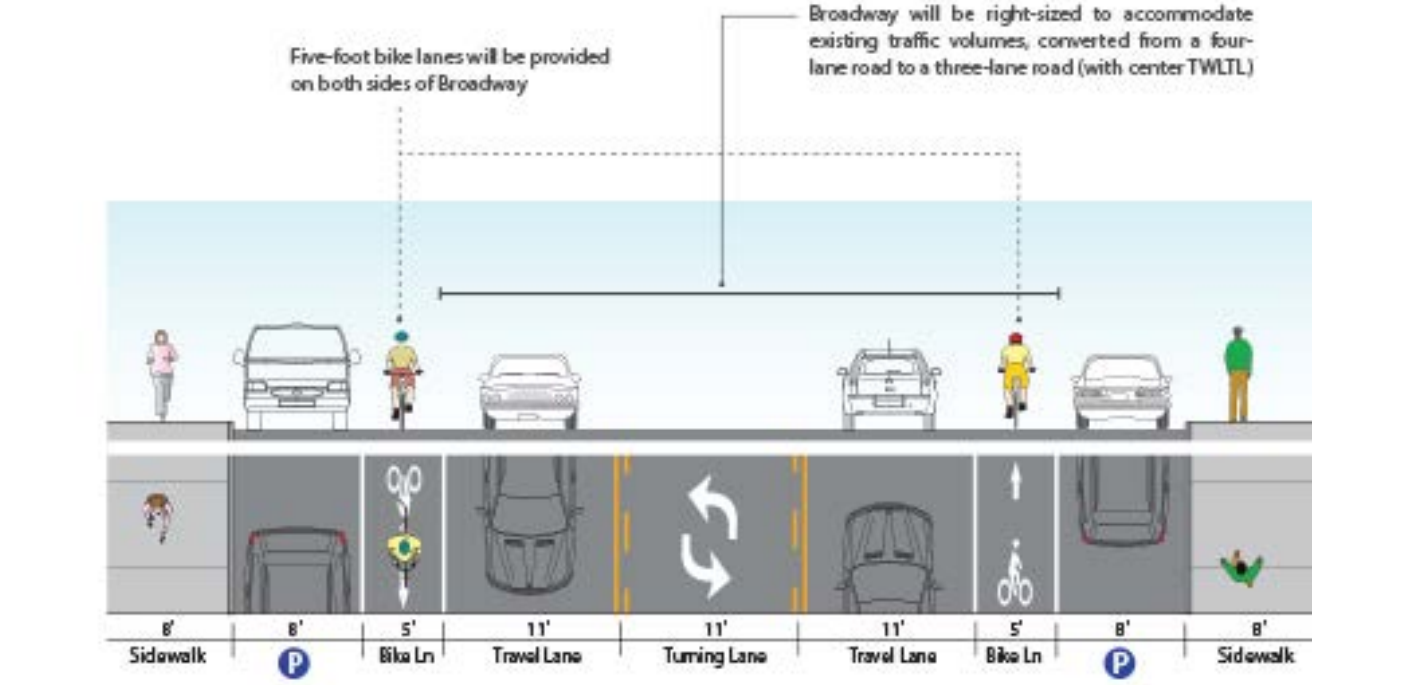
EXISTING PROJECT ISSUES

- Crossing the intersection for all modes of travel is difficult.
- Likely only the most brazen bicyclists are choosing to use this intersection to access downtown.
- Pedestrian crossing distances are long.

WHY IT'S IMPORTANT

- Broadway represents an important east/west bikeway connection.
- The intersection of Broadway/William/Ellicott would be made more logical.
- Lane position on the approaches and through the intersection would be delineated for bicyclists, improving the crossing experience.

TYPICAL PROPOSED CROSS SECTION

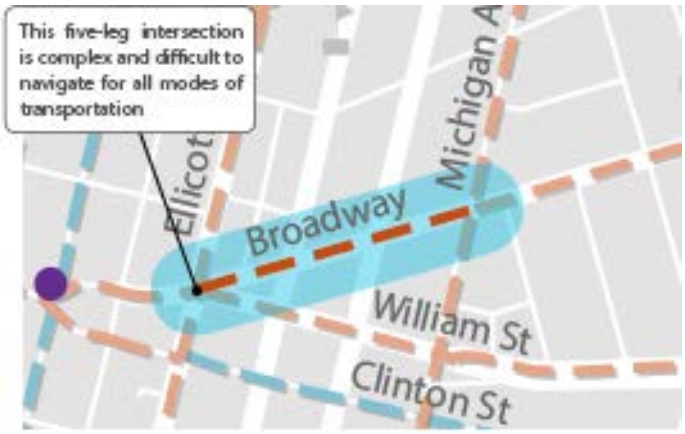


Existing ROW Width: 75 feet | Existing Curb-to-Curb Width: 59 feet

THROUGH TRAVEL LANE TRANSITIONS

When bicyclists need to cross a turn lane to make a through movement, a conflict is created. Through travel lane transition zones can be enhanced by dropping the bike lane in advance of the intersection so that bicyclists can merge across the turn lane as gaps in traffic permit. Shared lane markings can also be applied to provide additional guidance.

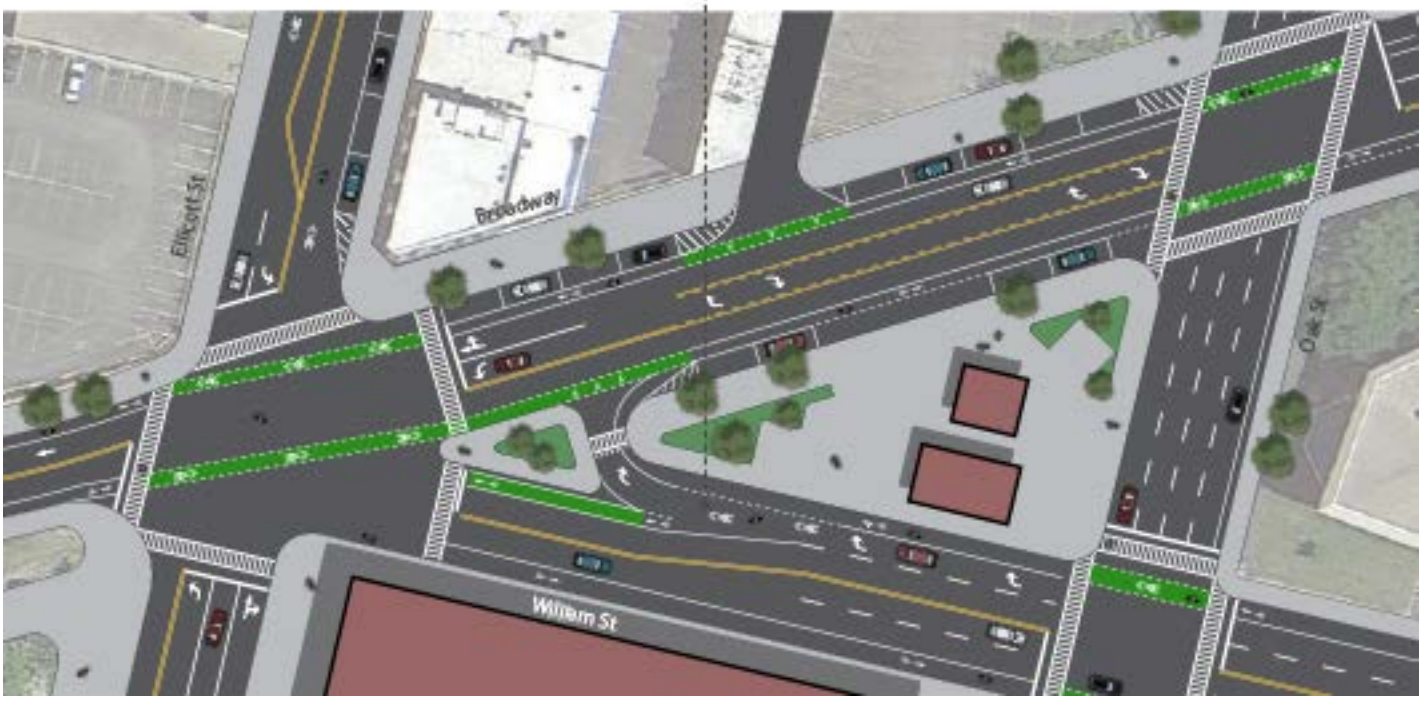
PROJECT AREA



COST ESTIMATE

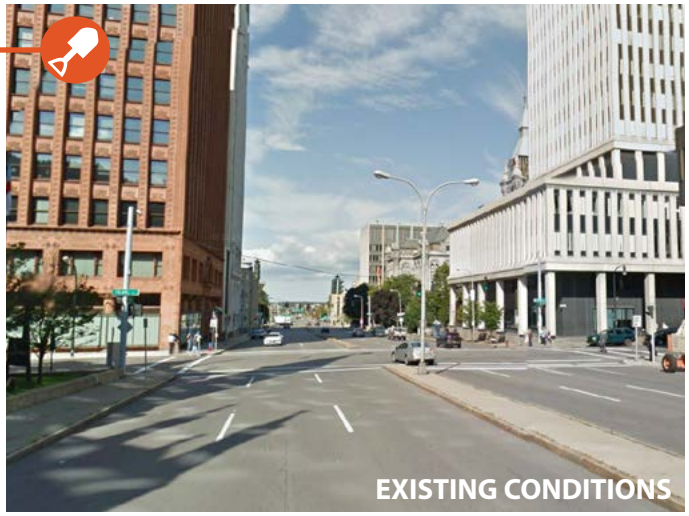
1. Roadway Destriping, Striping & Signage	$38,300
2. Bicycle Signalization	$103,400
Subtotal	**$141,700**
3. Additional Costs	+33%
Total	**$192,300**

PROPOSED INTERSECTION DESIGN



K: CHURCH ST CYCLE TRACK

Currently, Church St is not an inviting street for bicyclists, but could provide a critical east-west connection through the heart of downtown. Due to the design of the street, very few bicyclists likely choose to ride on-street along Church coming to and from downtown. Church St serves as an example of a street, that when improved, would become a desirable bikeway connection due to its proximity to Downtown. One-way cycle tracks are proposed on both sides of Church St and Division St, which will provide an all-ages-and-abilities separated facility for bicyclists.



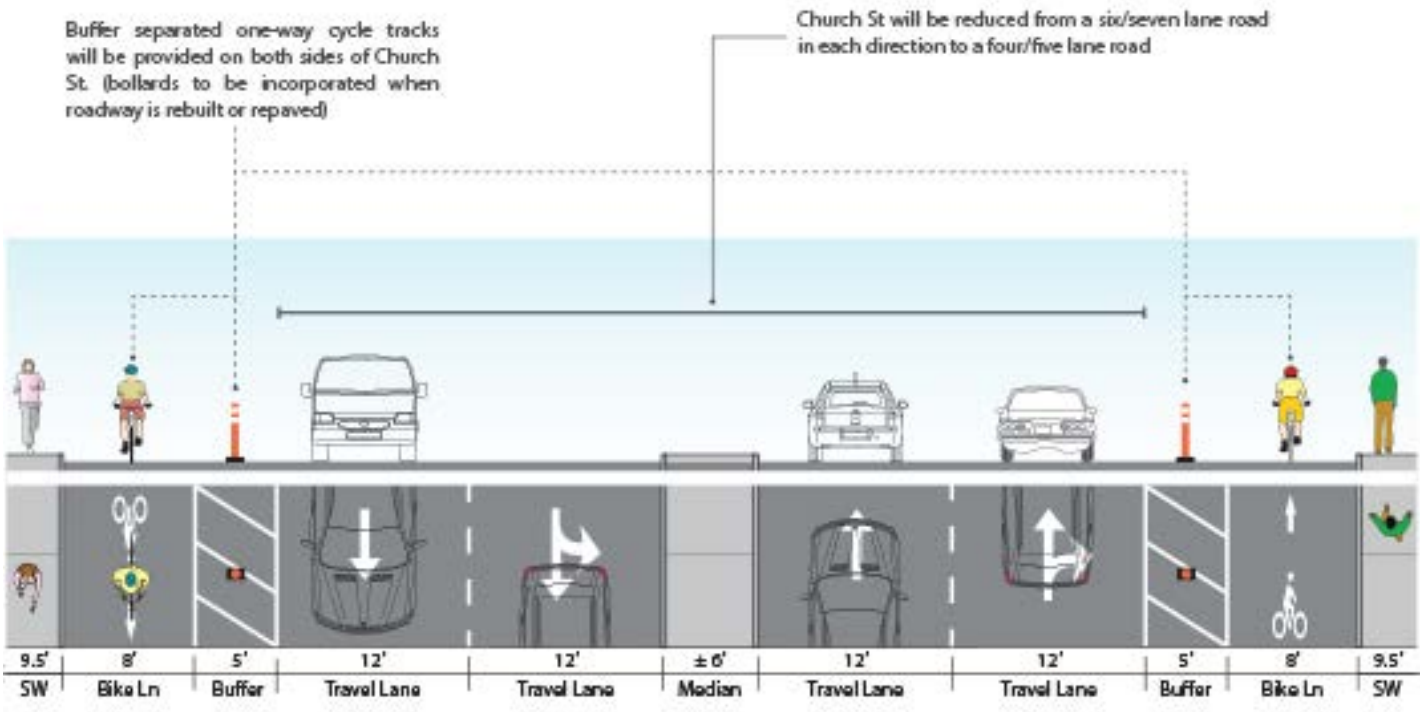
EXISTING PROJECT ISSUES

- Church St is an intimidating street to bicycle upon.
- No convenient east/west connection into Downtown Buffalo exists.
- The street is an auto-dominated thoroughfare.

WHY IT'S IMPORTANT

- Would provide an all-ages-and-abilities facility.
- Would provide convenient and direct access to downtown.

CHURCH ST PROPOSED CROSS SECTIONS



Existing ROW Width: 99 feet | Existing Curb-to-Curb Width: 80 feet

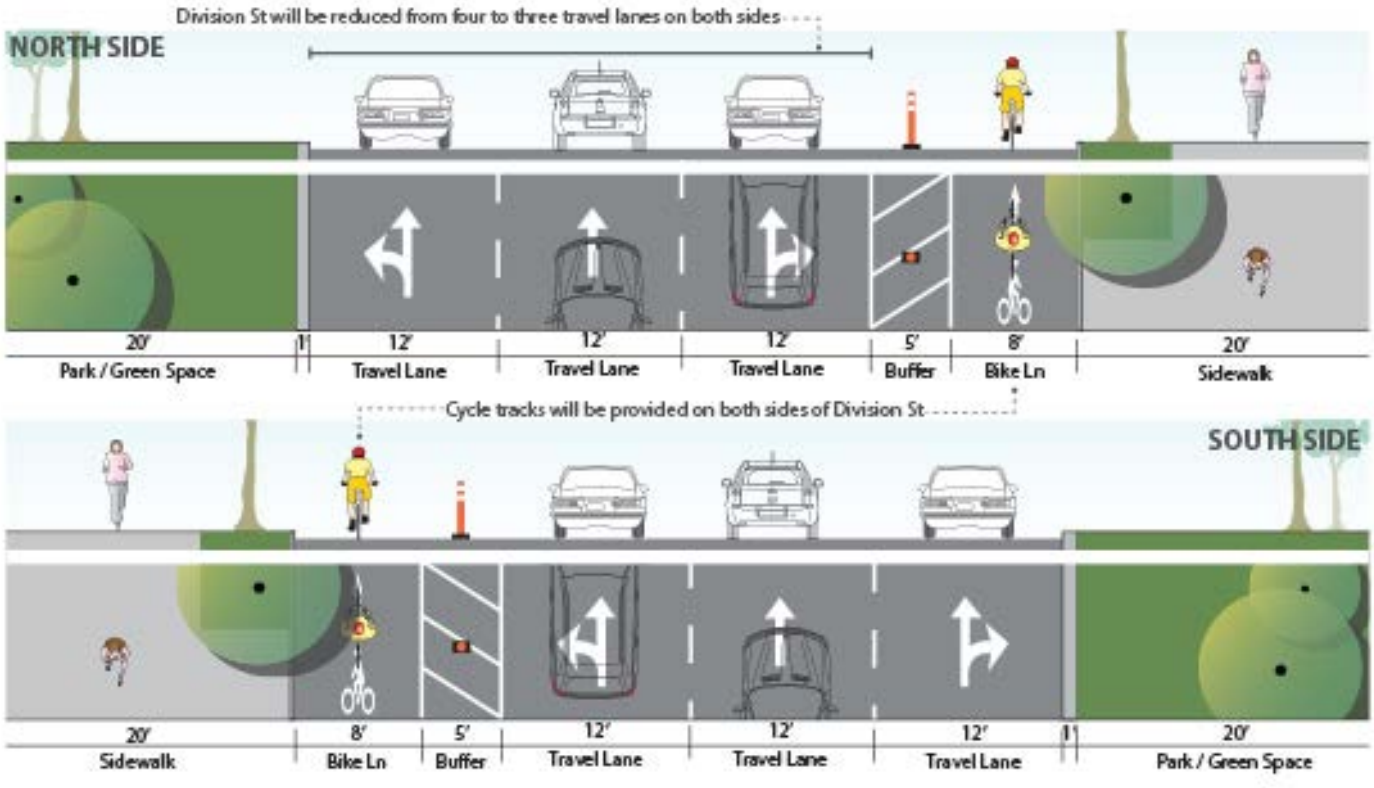
PROJECT AREA

COST ESTIMATE

Church St Four-Lane w/ One-Way Cycle Track • destriping, striping, signage & bollards	$37,800
Division St Four-Lane w/ One-Way Cycle Track • destriping, striping, signage & bollards	$40,900
Subtotal	**$72,700**
Additional Costs	+33%
Total	**$98,700**

The Church St cycle track will resemble those found in downtown Chicago

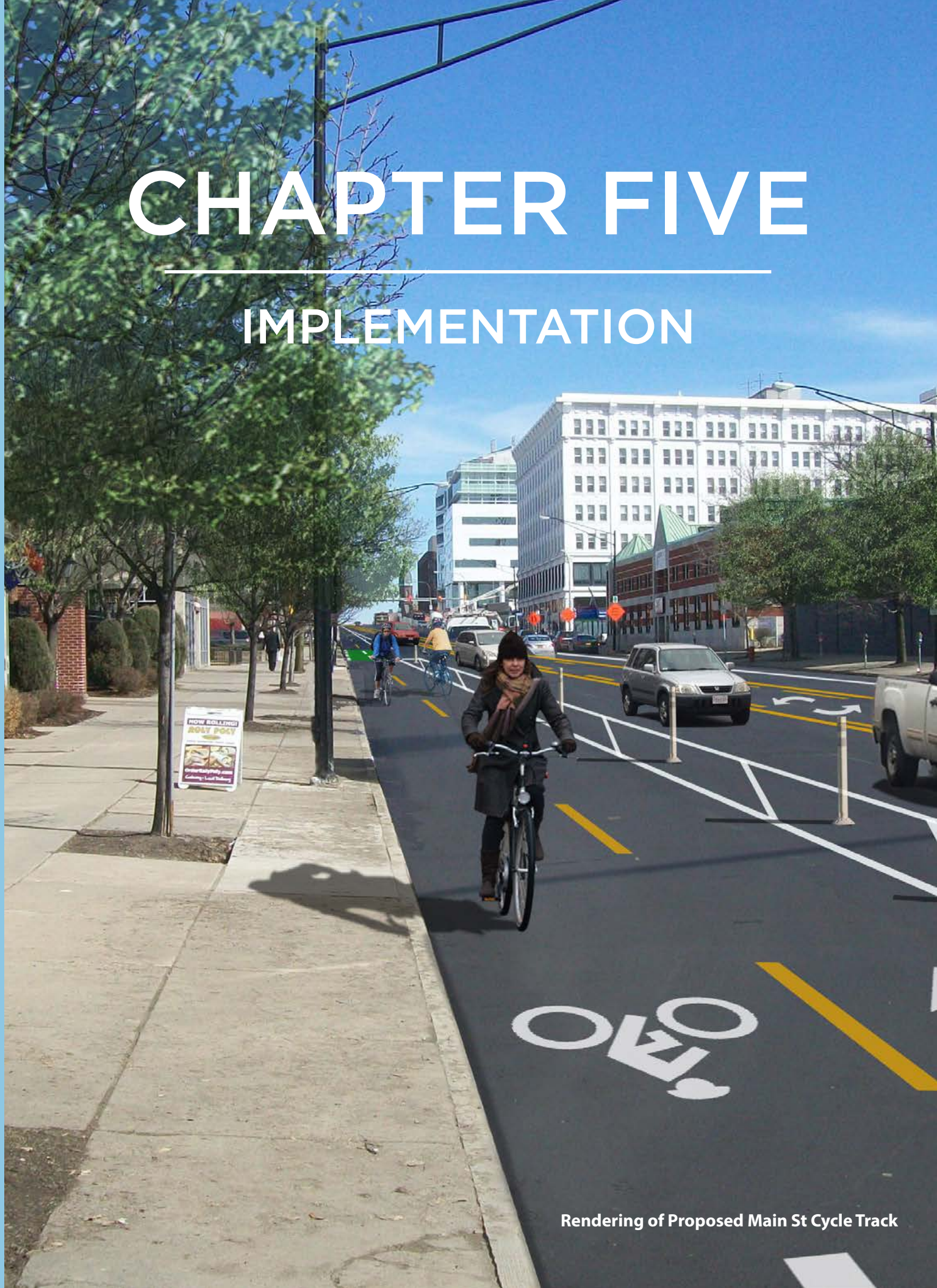
DIVISION ST PROPOSED CROSS SECTIONS



Existing ROW Width: 90 feet | Existing Curb-to-Curb Width: 50 feet

CHAPTER FIVE

IMPLEMENTATION



Rendering of Proposed Main St Cycle Track

INTRODUCTION

The Implementation Recommendation section outlines a strategy for the development of the city-wide bicycle network. Comprised of facilities for those considered "interested, but concerned", "enthused and confident" and "strong and fearless" bicyclists, the implementation of the network is intended to elevate Buffalo's League of American Bicyclists (L.A.B.) Bike Friendly Community status from its current bronze level to silver, gold and, ultimately, platinum. The long-term implementation of the network will feature a three-step process that includes:

1. Maintaining Mayor Brown's commitment to create 10 lane miles of new bike facilities per year, which includes new bike lanes and "sharrows" within currently funded mill-and-overlay and federal aid projects.
2. Securing funding and staff resources to develop the Master Plan's 11 catalyst projects, with high-level emphasis on the Main Street Cycle Track[1] (shown left) and other projects needed to facilitate Main Street's connection to nearby bike facilities on Linwood or Delaware.
3. Developing a long-term strategy for funding and maintaining the recommended approximately 300 lane mile, city-wide network, utilizing state community home improvement programs (CHIPs), Consolidated Funding Application (CFA) or other key funding sources.

Concurrent with the three primary actions above, other key city-wide implementation actions include:

- Buffalo Common Council's adoption of the City of Buffalo Bicycle Master Plan Update's recommendations.
- Buffalo Common Council and the City Department of Public Works adoption of the NACTO Urban Bikeway Design Guide, and incorporation of recommendations from FHWA's recent Separated Bike Lane Planning and Design Guide.
- Ensure that the City DPW's repaving list is coordinated with recommended bikeways in the Master Plan.
- Pursue area-wide recommendations for traffic-calming (especially around schools) in a long-term pursuit to slow traffic and create a more amenable environment for bicycling.
- Develop a public outreach strategy for the eleven catalyst projects illustrated in this report.
- Work with nonprofits such as GObike Buffalo and the Buffalo Niagara Partnership to develop public-private partnerships to fund catalyst projects in the short term and all city-wide bicycle projects in the long term.

The Elmwood Ave Cycle Track is the product of Mayor Brown's commitment to implement more bicycle facilities in Buffalo

1 The Main Street Cycle Track, in particular, is intended to be a "game changer" for the city. It contains many of the ingredients for a successful project that changes how people think of bicycling in Buffalo and induces new riders. It's a flat "protected" facility that links major destinations—the north end of downtown, the Medical Campus, Canisius College and ultimately, the UB South campus. It also provides connections to many Metro stations and is relatively-easily accessible from both the East-side and West-side neighborhoods.

PERFORMANCE MEASURES

Critical to the success of the master plan is to gauge its progress using a series of Performance Measures. Performance Measures (PMs) are tools to monitor progress related to building new facilities, expanding ridership, improving safety, and ensuring a diverse bicycling population over time. Because PMs are typically quantitative in nature, they must also be trackable through data collection such as bicycle counts, surveys, and crash statistics over specific time intervals.

It should be recognized that no one performance measure by itself will determine the success of the Master Plan. The PMs must be examined together to fully assess progress. For instance, if the total mileage of bicycle facilities were to increase significantly, but the number of people bicycling remained static, that would signify that there is an issue somewhere in the system that needs to be addressed.

The table below provides a list of the performance measures set against an approximately 10-year time frame that is intended to move Buffalo into the upper echelon of mid-size bicycle-friendly cities, such as Madison, Wisconsin, and Salt Lake City, Utah.

#	Performance Measure	Current Status	Annual Goal for Year		
			2017	2021	2025
1	L.A.B. Bike Friendly Community Status	Bronze	Silver	Gold	Platinum
2	Lane miles of bike facilities	72 miles	150*	200*	300*
3	Bicycle Commuter Mode Share (city-wide, during warm-weather months)	1.6%	3.2%	6%	10%
4	Bicycle racks	~400	600	800	1,000
5	On-street bike parking corrals (seasonal)	0	3	15	30
6	Reported motor vehicle-bicycle crashes w/ injuries	1.0X	0.9X	0.75X	0.5X
7	Percentage of schools connected by bicycle facilities and/or traffic-calmed roadways	unknown	25%	50%	90%

* Mileage numbers include Mayor Brown's commitment to stripe ten lane miles of bike facilities per year

Properly tracked with regular counts and data-gathering efforts, the Performance Measures will complement the Goals established for this master planning effort, and leverage bicycle-infrastructure improvements to enhance the City's livability and economic vitality. Combined with on-going downtown/BNMC redevelopment efforts, revitalization of economically distressed neighborhoods, and an expanding arts and culture scene, bicycle improvements will place Buffalo on a trajectory to gain jobs and population in the future and become a more green and sustainable community.

Lane miles of bike facilities such as striped bike lanes are a key indicator of a more bicycle friendly Buffalo

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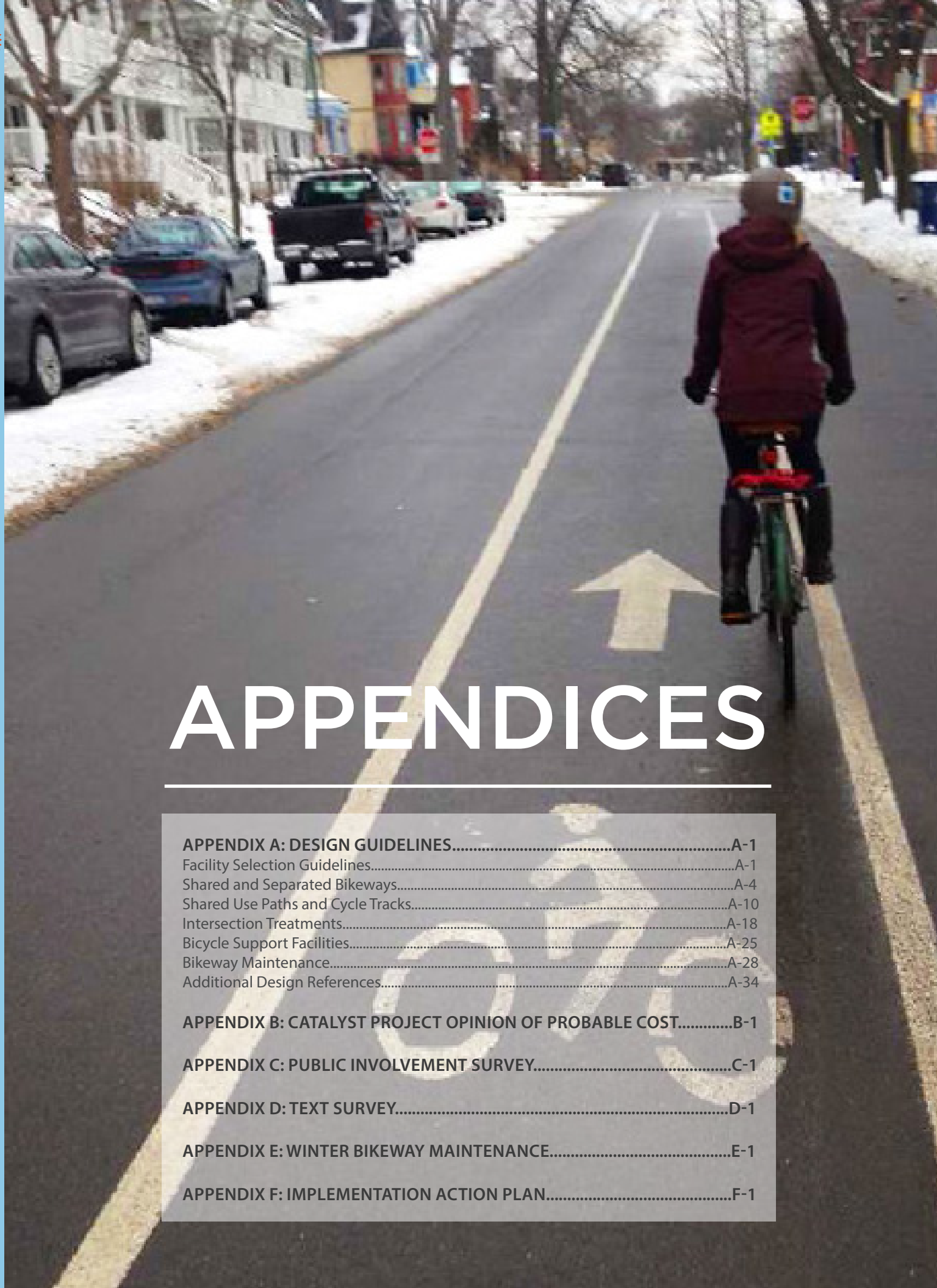
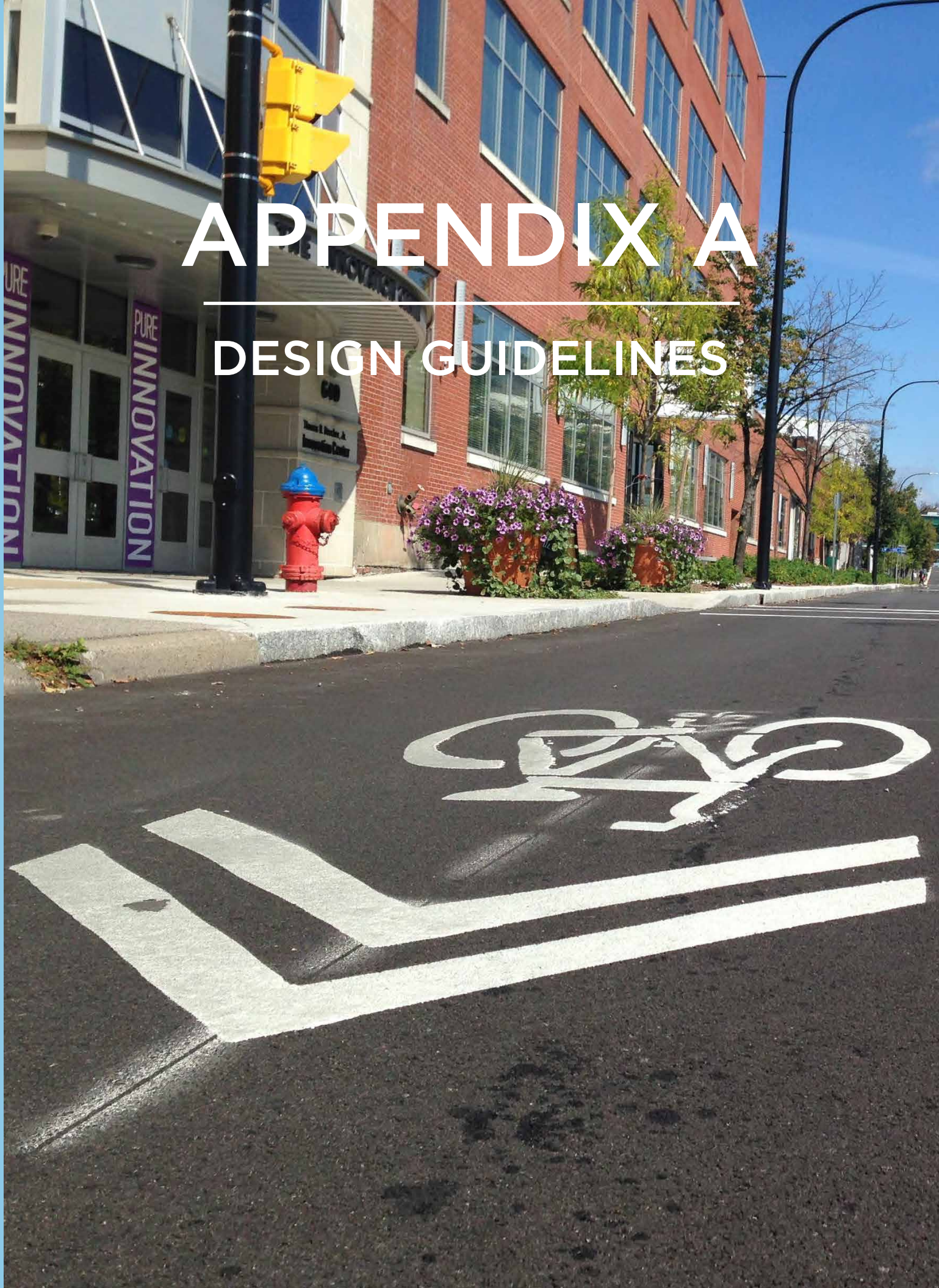


APPENDICES



APPENDIX A

DESIGN GUIDELINES

BICYCLE FACILITY SELECTION GUIDELINES

This section summarizes the bicycle facility selection typology developed for the City of Buffalo. The design guidelines in this chapter will help make Buffalo's streets safer for all modes of travel, creating streets that fulfill objectives outlined in the City's **Complete Streets** legislation/**Green Code Plan**, and which compliment the on-going efforts to improve the **Olmsted Parkways** for non-motorized travel. The specific facility type that should be provided depends on the surrounding environment (e.g. auto speed and volume, and adjacent land use) and expected bicyclist needs. For instance, the ideal facility for a main thoroughfare that attracts seasoned bike commuters will be different than a facility for a neighborhood street used by children to bike to school.

FACILITY SELECTION GUIDELINES

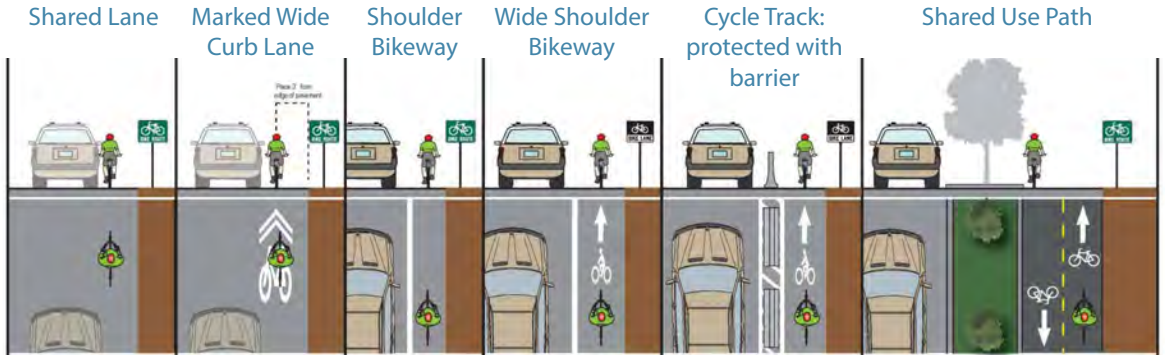
There are no 'hard and fast' rules for determining the most appropriate type of bicycle facility for a particular location — roadway speeds, volumes, right-of-way width, presence of parking, adjacent land uses, and expected bicycle user types are all critical elements of this decision. Additionally, many surveys and studies have shown that most most bicyclists prefer facilities separated from motor vehicle traffic or located on local roads with low motor vehicle traffic speeds and volumes. Because off-street pathways are physically separated from the roadway, they are perceived as safe and attractive routes for bicyclists who prefer to avoid motor vehicle traffic.

The graphic below illustrates the range of bicycle facilities applicable to various roadway environments, based on the roadway type and desired degree of separation. Engineering judgment, traffic studies, previous municipal planning efforts, community input and local context should be used to refine criteria when developing bicycle facility recommendations for a particular street.

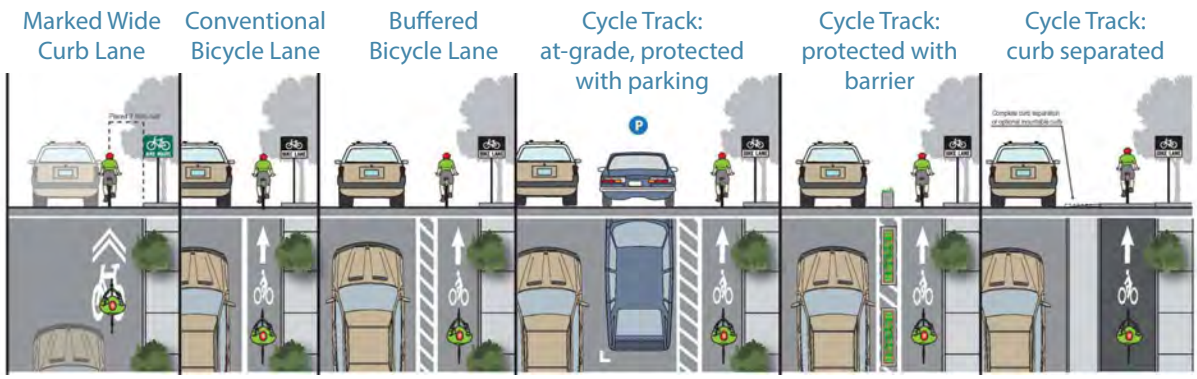
In some corridors, it may be desirable to construct facilities to a higher level of treatment than those recommended in relevant planning documents in order to enhance user safety and comfort. In other cases, existing and/or future motor vehicle speeds and volumes may not justify the recommended level of separation, and a less intensive treatment may be acceptable.

Least Protected → Most Protected

Range of collector/arterial bikeway treatments (without curb and gutter)



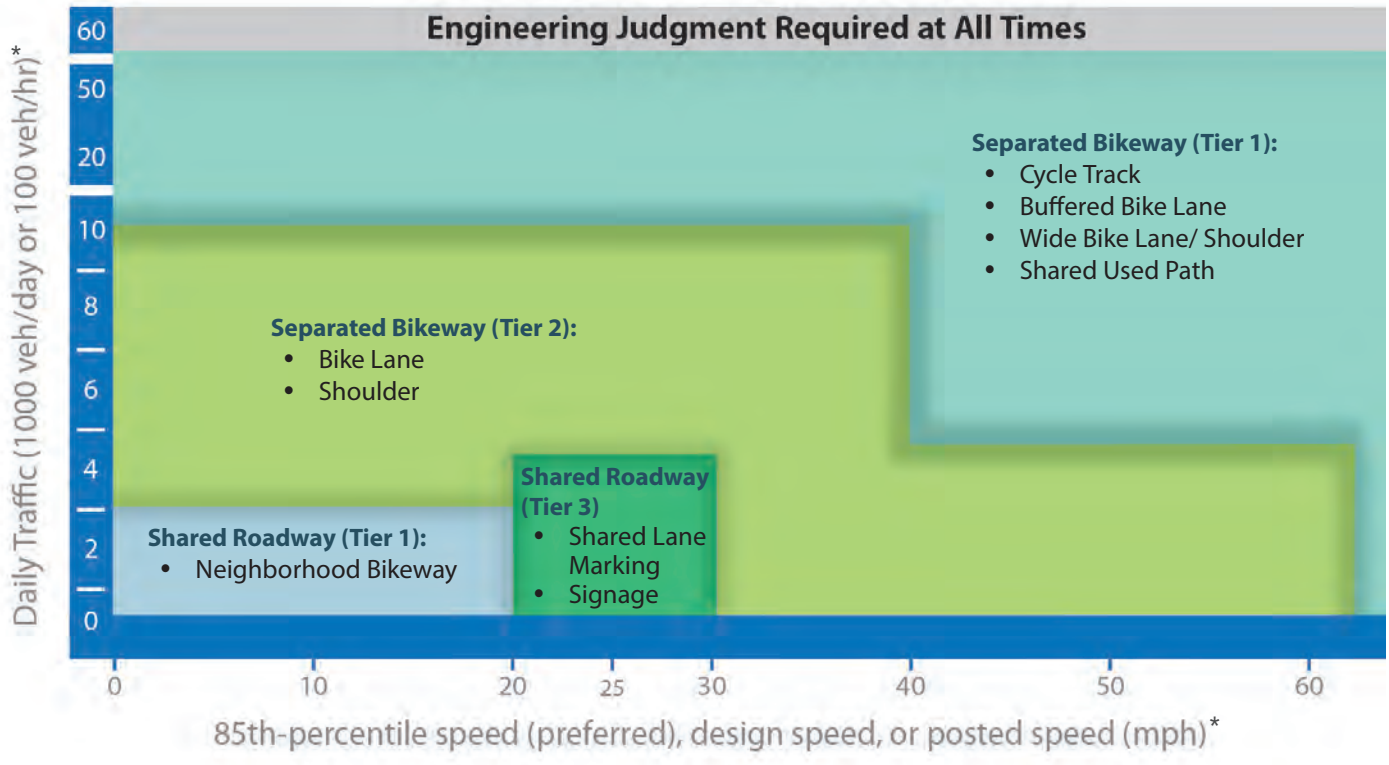
Range of collector/arterial bikeway treatments (with curb and gutter)



FACILITY SELECTION CHART

Selecting the best bikeway facility type for a given roadway can be challenging, due to the range of factors that influence bicycle users' comfort and safety. There is a significant impact on cycling comfort when the speed differential between bicyclists and motor vehicle traffic is high and motor vehicle traffic volumes are high. As a starting point to identify a preferred facility, the chart below can be used to determine the recommended type of bikeway to be provided in particular roadway speed and volume situations. To use this chart, identify the daily traffic volume on the y -axis and travel speed on the x -axis for the existing or proposed roadway, and locate the facility types indicated by those key variables.

This chart by itself cannot fully represent the range of roadway complexities that can contribute to the optimal bikeway facility selection. Rather, this chart should be used as a starting point for the selection of bicycle facilities. Some of the other factors (beyond speed and volume) that could affect facility selection include the percent-age of heavy vehicles, transit service and frequency, the presence of on-street parking, intersection density, sur-rounding land use, and roadway sight distance. The transportation planner or designer's judgment should be applied to select the facility that will provide the greatest amount of protection within the existing roadway context for the expected user group.



FACILITY TIERS

Surveys completed in Portland OR and elsewhere have shown that there are three "types" of bicyclists that make up roughly 2/3 of the population (the other 1/3 is not interested in bicycling at all). Approximately 1% of the adult population is considered "strong and fearless" and are comfortable riding on almost any road with or without bike facilities. Five to eight percent of adults consider themselves "enthused and confident" and frequently ride for commuting, errands and recreation. They have a strong preference for some level of infrastructure such as striped bike lanes where possible. The largest segment--up to 60%--are considered "interested but concerned". This group may occasionally ride on local streets or off-street paths but does not feel comfortable riding adjacent to traffic. Developing coherent bikeways that are separated and protected from traffic are thought to be the best way to change "interested-but-concerned" riders into more-regular riders. The facilities illustrated in the following sections have a varying impact on perceived and physical comfort levels. Generally, as the separation between the bicycle facility and motor vehicle traffic increases, safety levels increase as well.

*The engineering profession acknowledges that generally, peak hour traffic volumes represent 10% of the total daily volumes along a roadway segment (www.fhwa.dot.gov)

The Buffalo Bicycle Network Plan recommends facilities for all types of cyclists, and groups the recommend facilities into 3 tiers. These tiers are illustrated in the graphic below. Throughout the design guidelines section, icons are displayed indicating the type of bicyclist that the facility accommodates. The icons that represent each of the tiers are shown below.

TIER 1 Interested but Concerned PROTECTED FACILITY


Buffered Bike Lane


Source: People for Bikes

Street-level Cycle Track


Sidewalk-level Cycle Track/Shared Use Path

TIER 1 Interested but Concerned NEIGHBORHOOD BIKEWAY


Traffic Calming

Traffic Diversion

Intersection Treatment

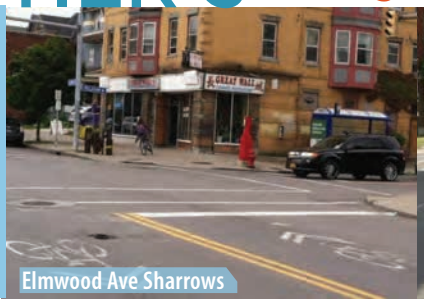
TIER 2 Enthused and Confident


Linwood Ave Bike Lane and Contra-flow


Delaware Ave "road diet" with bike lanes

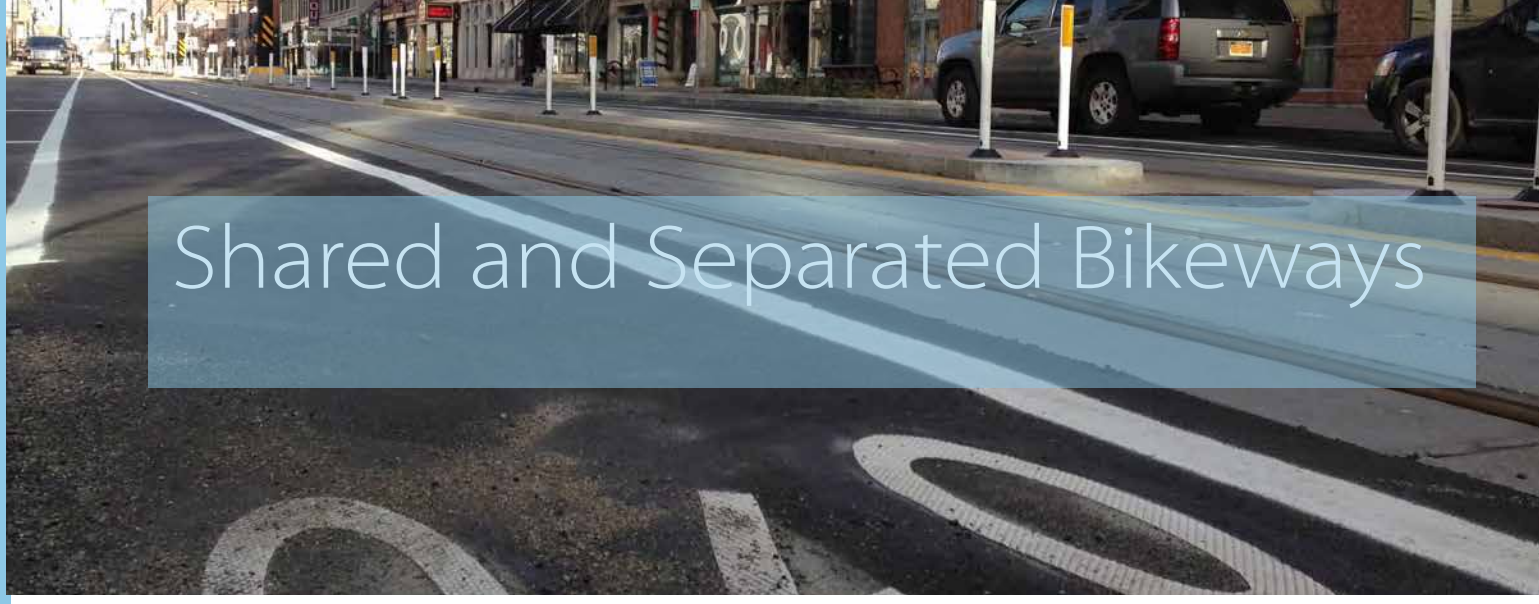

Enhanced Sharrows

TIER 3 Strong and Fearless


Elmwood Ave Sharrows


Elmwood Ave Transitions


Signal Loop Detector



Shared and Separated Bikeways


Marked Shared Roadway


Neighborhood Bikeway


Contra-Flow Bike Lanes


Conventional Bicycle Lanes

SHARED ROADWAYS

On shared roadways, bicyclists and motor vehicles use the same roadway space. These facilities are typically used on roads with low speeds and traffic volumes, however they can be used on higher volume roads with wide outside lanes or shoulders. A motor vehicle driver will usually have to cross over into the adjacent travel lane to pass a bicyclist, unless a wide outside lane or shoulder is provided.

Shared roadways employ a large variety of treatments from simple signage and shared lane markings to more complex treatments including directional signage, traffic diverters, chicanes, chokers, and/or other traffic calming devices to reduce vehicle speeds or volumes.

NEIGHBORHOOD BIKEWAYS

Neighborhood Bikeways are a special class of shared roadways designed for a broad spectrum of bicyclists. They are low-volume local streets where motorists and bicyclists share the same travel lane. Treatments for neigborhood bikeways are selected as necessary to create appropriate automobile volumes and speeds, and to provide safe crossing opportunities of busy streets.

SEPARATED BIKEWAYS

Designated exclusively for bicycle travel, separated bikeways are segregated from vehicle travel lanes by striping, and can include pavement stencils and other treatments. Separated bikeways are most appropriate on arterial and collector streets where higher traffic volumes and speeds warrant greater separation.

Marked Shared Roadway

Description

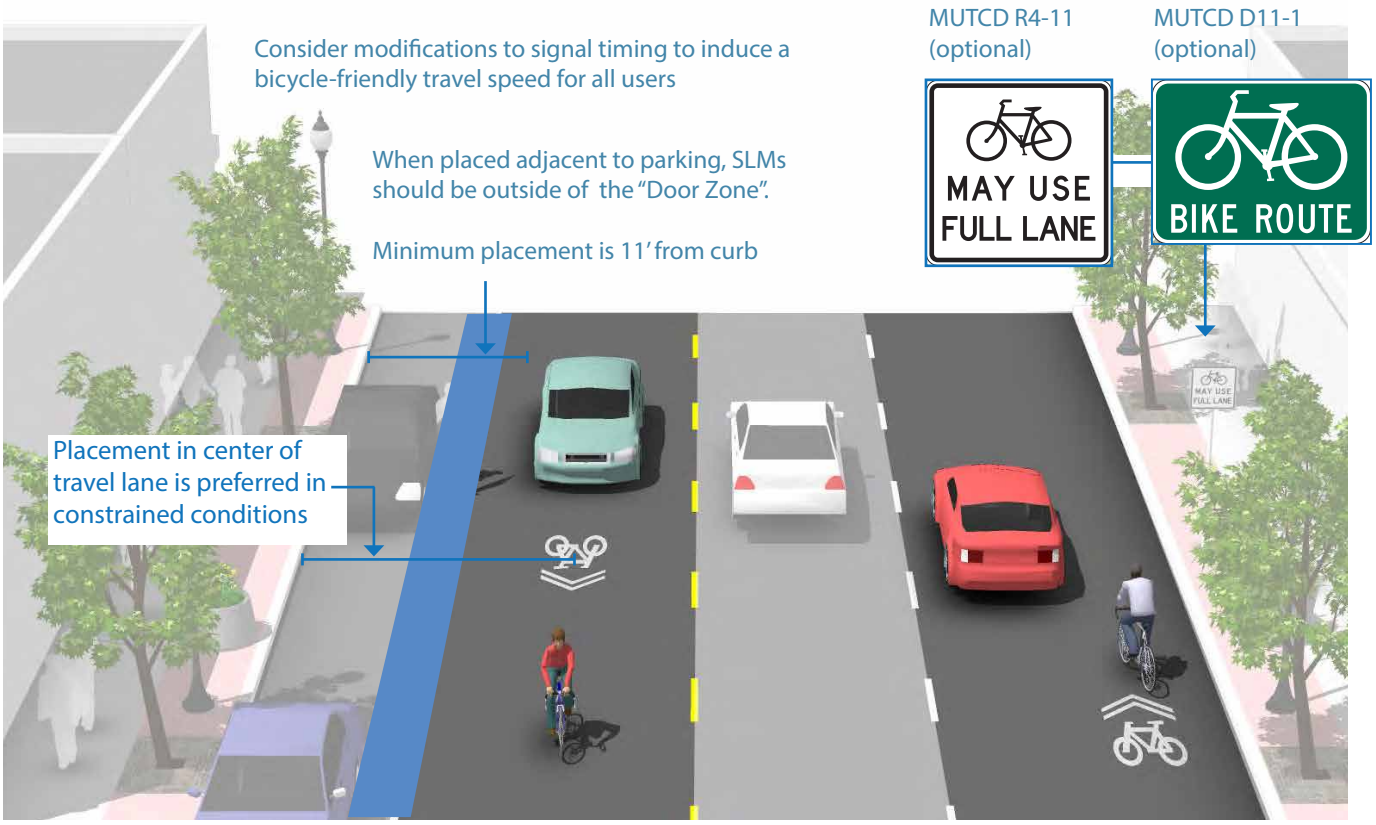
A marked shared roadway is a general purpose travel lane marked with shared lane markings (SLM) used to encourage bicycle travel and proper positioning within the lane.

In constrained conditions, the SLMs are placed in the middle of the lane to discourage unsafe passing by motor vehicles. On a wide outside lane, the SLMs can be used to promote bicycle travel to the right of motor vehicles.

In all conditions, SLMs should be placed outside of the door zone of parked cars.

Guidance

- In constrained conditions, preferred placement is in the center of the travel lane to minimize wear and promote single file travel.
- Minimum placement of SLM marking centerline is 11 feet from edge of curb where on-street parking is present, 4 feet from edge of curb with no parking. If parking lane is wider than 7.5 feet, the SLM should be moved further out accordingly.



Discussion

Bike Lanes should be considered on roadways with outside travel lanes wider than 15 feet, or where other lane narrowing or removal strategies may provide adequate road space. SLMs shall not be used on **shoulders**, in designated **Bike Lanes**, or to designate **Bicycle Detection** at signalized intersections. (MUTCD 9C.07)

This configuration differs from a **Neighborhood Greenway** due to a lack of traffic calming, wayfinding, and other enhancements designed to provide a higher level of comfort for a broad spectrum of users.

Additional References and Guidelines

AASHTO, *Guide for the Development of Bicycle Facilities.* 2012

FHWA, *Manual on Uniform Traffic Control Devices.* 2009

NACTO, *Urban Bikeway Design Guide.* 2012

Materials and Maintenance

Placing SLMs between vehicle tire tracks will increase the life of the markings and minimize the long-term cost of the treatment.

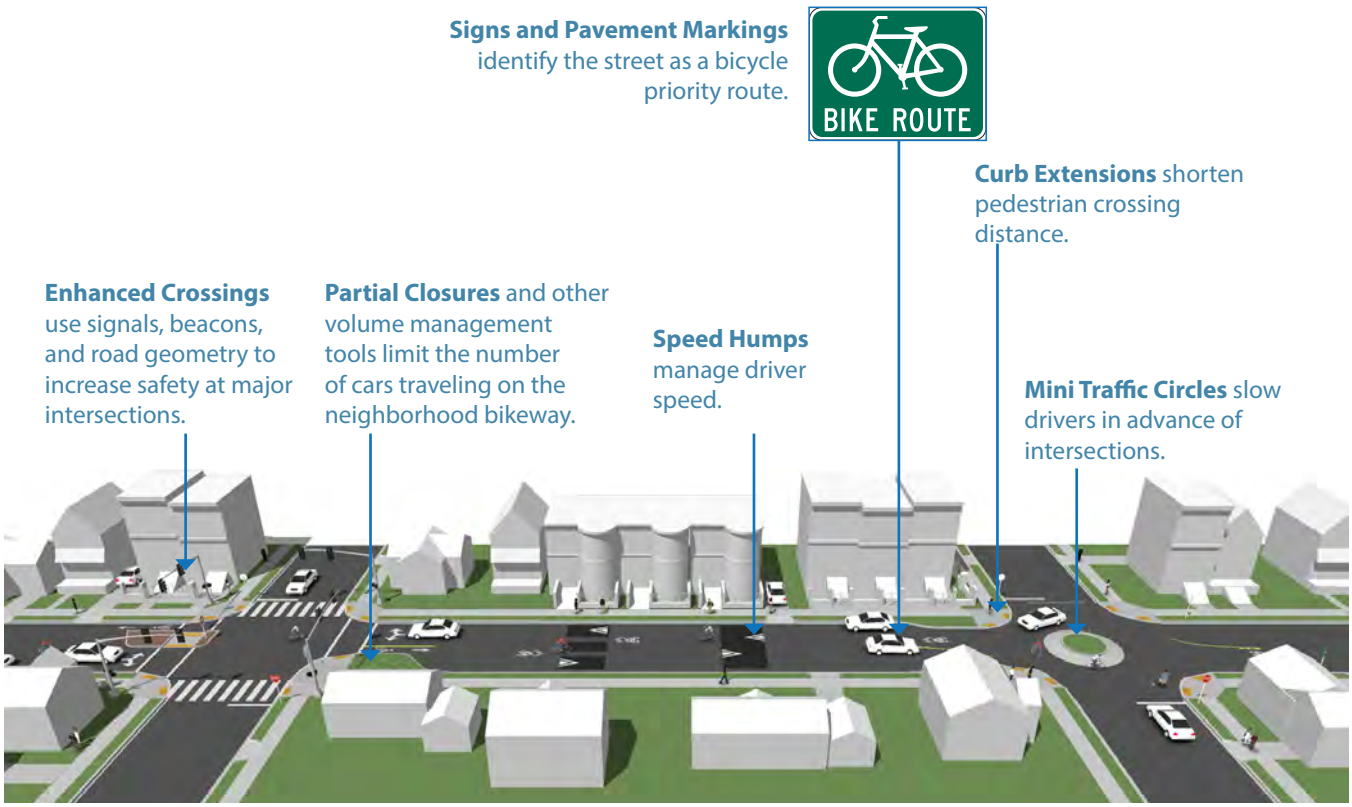
Neighborhood Bikeway

Description

Neighborhood Bikeways are low–volume, low–speed streets modified to enhance bicyclist comfort by using treatments such as signage, pavement markings, traffic calming and/or traffic reduction, and intersection modifications. These treatments allow through movements of bicyclists while discouraging similar through–trips by non-local motorized traffic.

Guidance

- Signs and pavement markings are the minimum treatments necessary to designate a street as a neighborhood bikeway.
- Neighborhood Bikeways should have a maximum posted speed of 25 mph. Use traffic calming to maintain an 85th percentile speed below 22 mph.
- Implement volume control treatments based on the context of the neighborhood Bikeway, using engineering judgment. Target motor vehicle volumes range from 1,000 to 3,000 vehicles per day.
- Intersection crossings should be designed to enhance safety and minimize delay for bicyclists.



Discussion

Neighborhood Bikeway retrofits to local streets are typically located on streets without existing signalized accommodation at crossings of collector and arterial roadways. Without treatments for bicyclists, these intersections can become major barriers along the neighborhood bikeway and compromise safety.

Traffic calming can deter motorists from driving on a street. Anticipate and monitor vehicle volumes on adjacent streets to determine whether traffic calming results in inappropriate volumes. Traffic calming can be implemented on a trial basis.

Additional References and Guidelines

Alta Planning + Design and IBPI, *Bicycle Boulevard Planning and Design Handbook*. 2009

FHWA. *BikeSafe, Bicycle Countermeasure Selection System*. 2005

Ewing, Reid, *Traffic Calming: State of the Practice*. 1999

Ewing, Reid and Brown, Steven, *U.S. Traffic Calming Manual*. 2009

Materials and Maintenance

Vegetation should be regularly trimmed to maintain visibility and attractiveness.

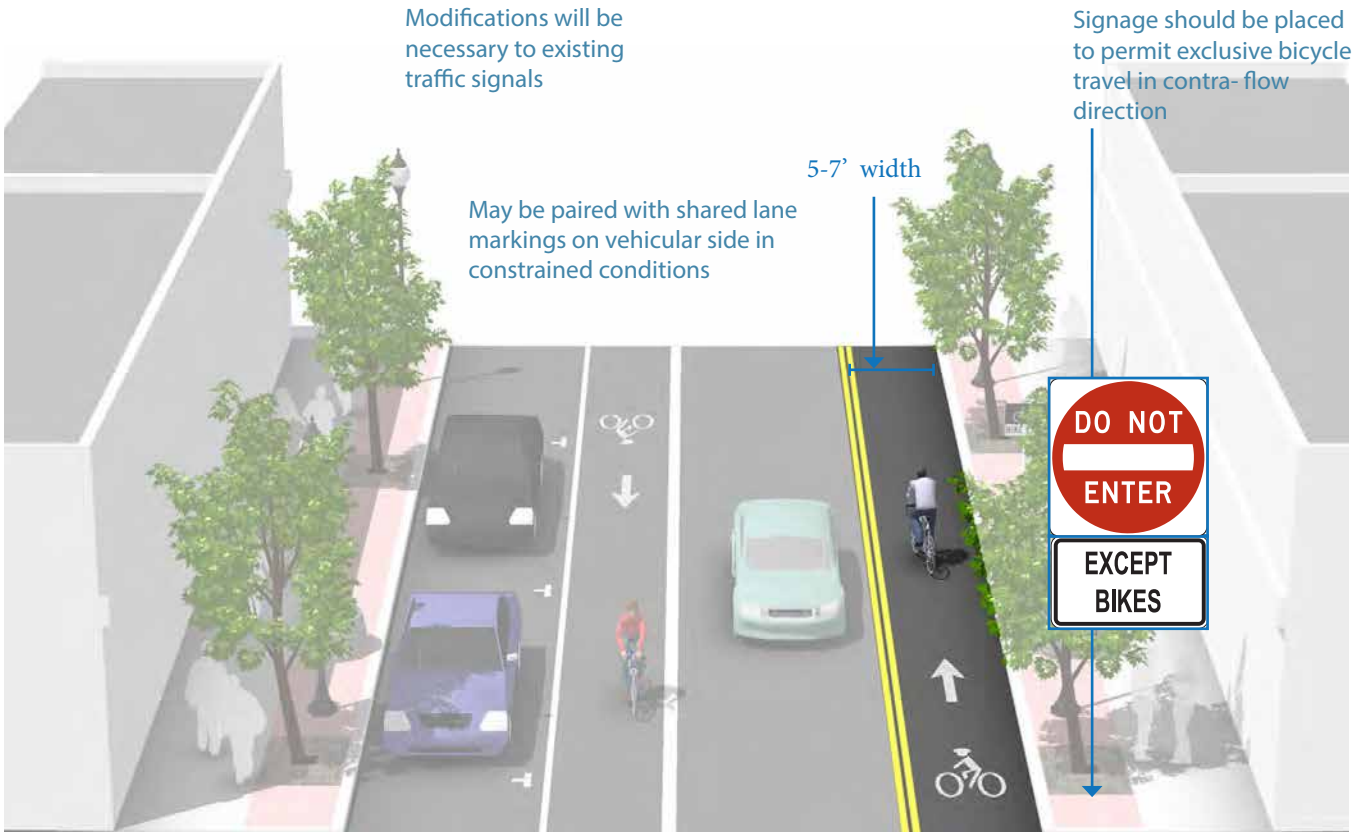
Contra-flow Bike Lane on One-way Street

Description

Contra–flow bike lanes provide bidirectional bicycle access on a roadway that is one–way for motor vehicle traffic. This treatment can provide direct access and connectivity for bicyclists and reducing travel distances. Contra–flow bike lanes can also be used to convert two–way motor vehicle traffic to one-way to reduce traffic volumes where desired.

Guidance

- The contra–flow bike lane should be 5-7 feet wide and marked with a solid double yellow line and appropriate signage. Bike lane markings should be clearly visible to ensure that the contra–flow lane is exclusively for bicycles. Coloration should be considered in the bike lane.
- Signage specifically allowing bicycles at the entrance of the contra flow lane is recommended.



Discussion

Because of the opposing direction of travel, **Contra–Flow Bike Lanes** increase the speed differential between bicyclists and motor vehicles in the adjacent travel lane. If space permits consider a buffered bike lane or cycle track configuration to provide additional separation. Special attention should be paid to intersections, where the contra-flow bike lane will create an additional conflicting movement. These intersections can be stop controlled or signalized.

Additional References and Guidelines

AASHTO, *Guide for the Development of Bicycle Facilities.* 2012
FHWA, *Manual on Uniform Traffic Control Devices.* 2009
NACTO, *Urban Bikeway Design Guide.* 2012

Materials and Maintenance

Paint can wear more quickly in high traffic areas.

Bike Lane

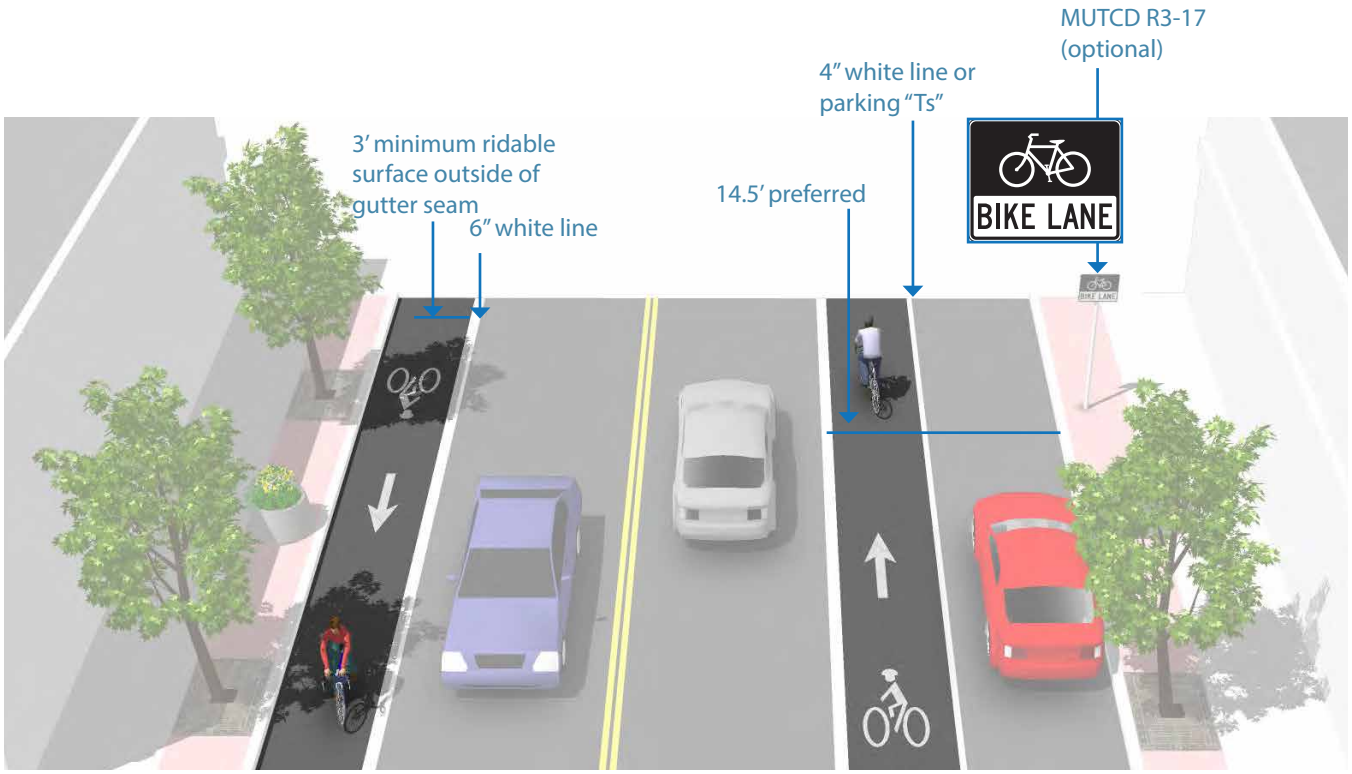
Description

Bike lanes designate an exclusive space for bicyclists through the use of pavement markings and signage. The bike lane is located adjacent to motor vehicle travel lanes and is used in the same direction as motor vehicle traffic. Bike lanes are typically on the right side of the street, between the adjacent travel lane and curb, road edge or parking lane.

Many bicyclists, particularly less experienced riders, are more comfortable riding on a busy street if it has a striped and signed bikeway than if they are expected to share a lane with vehicles.

Guidance

- 4 foot minimum when no curb and gutter is present.
- 5 foot minimum when adjacent to curb and gutter or 3 feet more than the gutter pan width if the gutter pan is wider than 2 feet.
- 14.5 foot preferred from curb face to edge of bike lane. (12 foot minimum).
- 7 foot maximum width for use adjacent to arterials with high travel speeds. Greater widths may encourage motor vehicle use of bike lane.



Discussion

Wider bicycle lanes are desirable in certain situations such as on higher speed arterials (45 mph+) where use of a wider bicycle lane would increase separation between passing vehicles and bicyclists. Appropriate signing and stenciling is important with wide bicycle lanes to ensure motorists do not mistake the lane for a vehicle lane or parking lane. Consider **Buffered Bicycle Lanes** when further separation is desired.

Additional References and Guidelines

AASHTO, *Guide for the Development of Bicycle Facilities.* 2012
FHWA, *Manual on Uniform Traffic Control Devices.* 2009
NACTO, *Urban Bikeway Design Guide.* 2012

Materials and Maintenance

Paint can wear more quickly in high traffic areas.

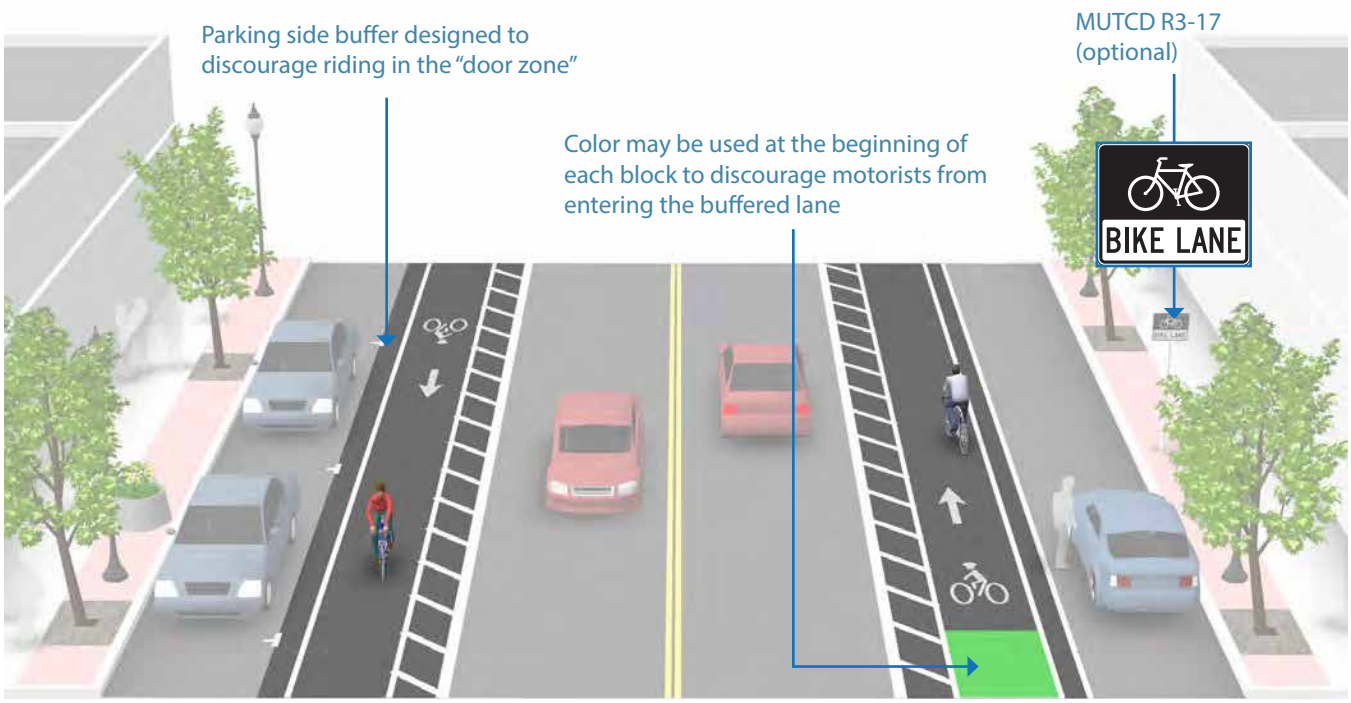
Buffered Bike Lane

Description

Buffered bike lanes are conventional bicycle lanes paired with a designated buffer space, separating the bicycle lane from the adjacent motor vehicle travel lane and/or parking lane. Buffered bike lanes are allowed as per MUTCD guidelines for buffered preferential lanes (section 3D-01). Buffered bike lanes are designed to increase the space between the bike lane and the travel lane or parked cars. This treatment is appropriate for bike lanes on roadways with high motor vehicle traffic volumes and speed, adjacent to parking lanes, or a high volume of truck or oversized vehicle traffic.

Guidance

- Where bicyclist volumes are high or where bicyclist speed differentials are significant, the desired bicycle travel area width is 7 feet.
- Buffers should be at least 2 feet wide. If 3 feet or wider, mark with diagonal or chevron hatching. For clarity at driveways or minor street crossings, consider a dotted line for the inside buffer boundary where cars are expected to cross.



Discussion

Frequency of right turns by motor vehicles at major intersections should determine whether continuous or truncated buffer striping should be used approaching the intersection. Commonly configured as a buffer between the bicycle lane and motor vehicle travel lane, a parking side buffer may also be provided to help bicyclists avoid the 'door zone' of parked cars.

Additional References and Guidelines

AASHTO, *Guide for the Development of Bicycle Facilities.* 2012
FHWA, *Manual on Uniform Traffic Control Devices (3D-01).* 2009
NACTO, *Urban Bikeway Design Guide.* 2012

Materials and Maintenance

Paint can wear more quickly in high traffic areas.

Shared Use Paths + Cycle Tracks

A cycle track is an exclusive bike facility that combines the user experience of a separated path with the on–street infrastructure of a conventional bike lane. A cycle track is physically separated from motor traffic and distinct from the sidewalk. Cycle tracks have different forms but all share common elements–they provide space that is intended to be exclusively or primarily used by bicycles, and are separated from motor vehicle travel lanes, parking lanes, and sidewalks. In situations where on-street parking is allowed, cycle tracks are located to the curb–side of the parking (in contrast to bike lanes).

Cycle tracks may be one–way or two–way, and may be at street level, sidewalk level or at an intermediate level. If at sidewalk level, a curb or median separates them from motor traffic, while different pavement color/ texture separates the cycle track from the sidewalk. If at street level, they can be separated from motor traffic by raised medians, on–street parking or bollards.

A two–way cycle track is desirable when more destinations are on one side of a street (therefore preventing additional crossings), if the facility connects to a path or other bicycle facility on one side of the street, or if there is not enough room for a cycle track on both sides of the road.

By separating bicyclists from motor traffic, cycle tracks can offer a higher level of comfort than bike lanes and are attractive to a wider spectrum of the public.

Shared Use Paths are facilities separated from roadways for use by bicyclists and pedestrians.
Intersections and approaches must be carefully designed to promote safety and facilitate left–turns from the right side of the street. See **separated bikeways at intersections** on page 43 of this report for more information.


Shared Use Paths


One Way Cycle Tracks


Two-Way Cycle Tracks

Shared Use Paths

Description

Shared use paths can provide a desirable facility, particularly for recreation, and users of all skill levels preferring separation from traffic. Bicycle paths should generally provide directional travel opportunities not provided by existing roadways.

Guidance

Width

- 8 feet is the minimum allowed for a two–way bicycle path and is only recommended for low traffic situations.
- 10 feet is recommended in most situations and will be adequate for moderate to heavy use.
- 12 feet or more is recommended for heavy use situations with high concentrations of multiple users. A separate track (5' minimum) can be provided for pedestrian use.

Lateral Clearance

- A 2 foot or greater shoulder on both sides of the path should be provided. An additional foot of lateral clearance (total of 3') is required by the MUTCD for the installation of signage or other furnishings.
- If bollards are used at intersections and access points, they should be colored brightly and/or supplemented with reflective materials to be visible at night.

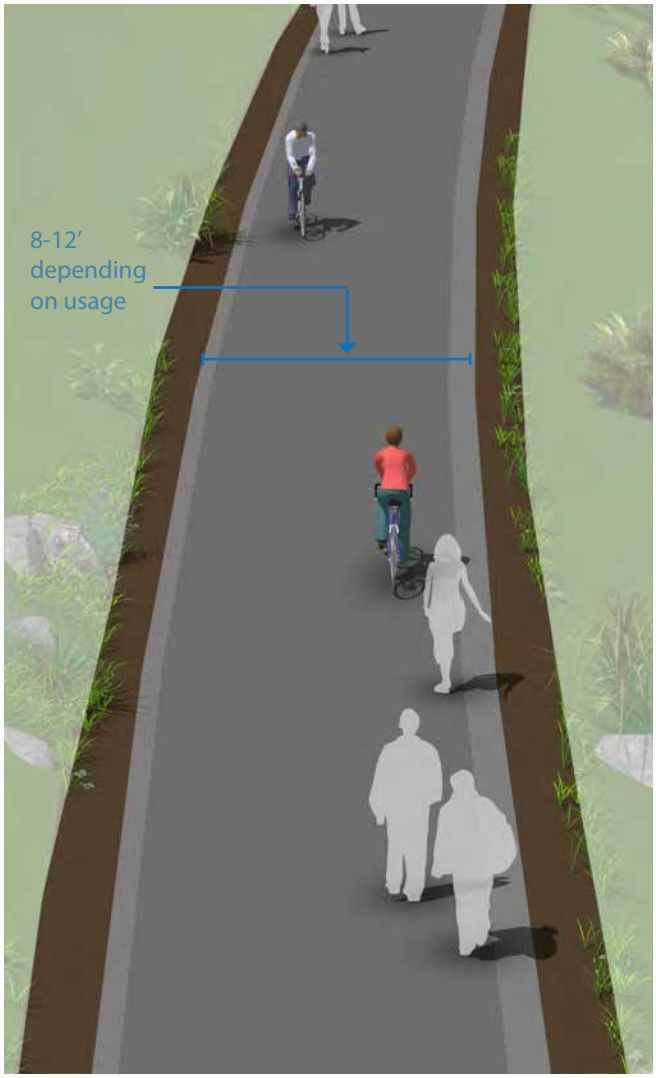
Overhead Clearance

- Clearance to overhead obstructions should be 8 feet minimum, with 10 feet recommended.

Striping

- When striping is required, use a 4 inch dashed yellow centerline stripe with 4 inch solid white edge lines.
- Solid centerlines can be provided on tight or blind corners, and on the approaches to roadway crossings.

Terminate the path where it is easily accessible to and from the street system, preferably at a controlled intersection or at the beginning of a dead-end street.



Discussion

The AASHTO Guide for the Development of Bicycle Facilities generally recommends against the development of **shared use paths along roadways**. Also known as "sidepaths", these facilities create a situation where a portion of the bicycle traffic rides against the normal flow of motor vehicle traffic and can result in wrong–way riding when either entering or exiting the path.

Additional References and Guidelines

AASHTO, *Guide for the Development of Bicycle Facilities.* 2012

FHWA, *Manual on Uniform Traffic Control Devices.* 2009

Flink, Chuck, *Greenways: A Guide To Planning Design And Development.* 1993

Flink, Chuck, *Trails for the Twenty-First Century.* 2001

Materials and Maintenance

Asphalt is the most common surface for bicycle paths. The use of concrete for paths has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of path users.

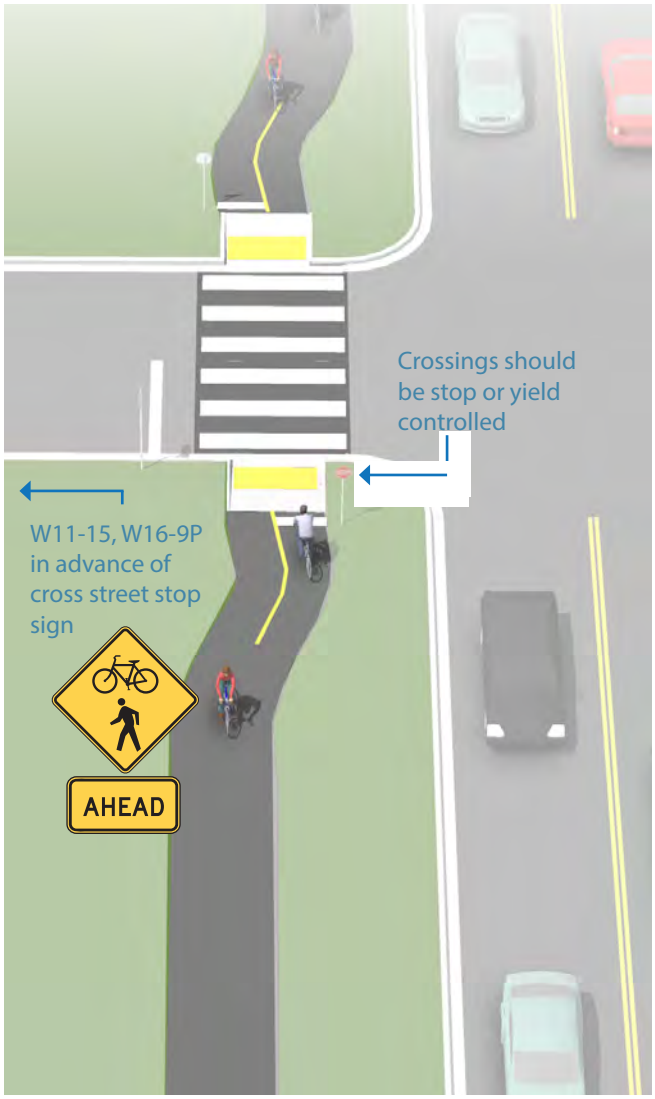
Shared Use Paths Along Roadways

Description

A shared used path adjacent to a roadway provides for two way travel separated from motor vehicle traffic. A shared use path allows for two–way, off–street bicycle use and also may be used by pedestrians, skaters, wheelchair users, runners and other non–motorized users. These facilities are frequently found in parks, along rivers, beaches, and in greenbelts or utility corridors where there are few conflicts with motorized vehicles.

Along roadways, these facilities create a situation where a portion of the bicycle traffic rides against the normal flow of motor vehicle traffic and can result in wrong-way riding where bicyclists enter or leave the path.
The AASHTO *Guide for the Development of Bicycle Facilities* provides guidance on the development of shared-use paths directly adjacent to roadways.

Pay special attention to the entrance/exit of the path as bicyclists may continue to travel on the wrong side of the street.



Guidance

- 8 feet is the minimum allowed for a two–way bicycle path and is only recommended in low traffic situations.
- 10 feet is recommended in most situations and is adequate for moderate to heavy use.
- 12 feet is recommended for heavy use situations with high concentrations of multiple users such as runners, bicyclists, rollerbladers and pedestrians. A separate track (5' minimum) can be provided for pedestrian use.

Bicycle lanes should be provided as an alternate facility whenever possible.

Discussion

When designing a bikeway network, the presence of a nearby or parallel path should not be used as a reason to not provide adequate shoulder or bicycle lane width on the roadway, as the on–street bicycle facility is preferred over the "sidepath" by experienced bicyclists and those who are cycling for transportation purposes.

Additional References and Guidelines

AASHTO, *Guide for the Development of Bicycle Facilities.* 2012
NACTO, *Urban Bikeway Design Guide.* 2012 (See entry on Raised Cycle Tracks.)

Materials and Maintenance

Asphalt is the most common surface for bicycle paths. The use of concrete for paths has proven to be more durable over the long term. Saw–cut concrete joints (rather than troweled) improve the experience of path users.

Cycle Track Separation and Placement

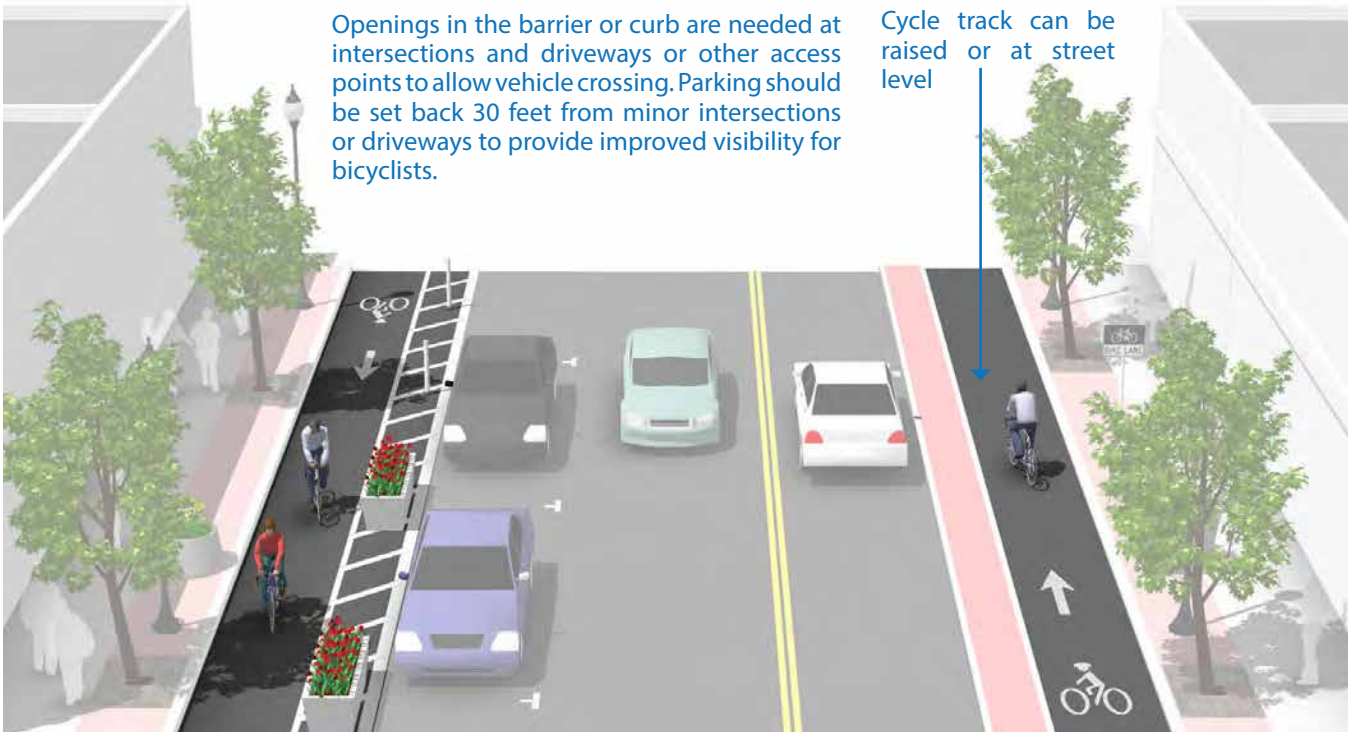
Description

Protection is provided through physical barriers and can include bollards, parking, a planter strip, an extruded curb, or on-street parking. Cycle tracks using these protection elements typically share the same elevation as adjacent travel lanes.

Raised cycle tracks may be at the level of the adjacent sidewalk or set at an intermediate level between the roadway and sidewalk to separate the cycle track from the pedestrian area.

Guidance

- Cycle tracks should ideally be placed along streets with long blocks and few driveways or mid–block access points for motor vehicles. Cycle tracks located on one–way streets have fewer potential conflict areas than those on two-way streets.
- In situations where on–street parking is allowed, cycle tracks shall be located between the parking lane and the sidewalk (in contrast to bike lanes).



Discussion

Sidewalks or other pedestrian facilities should not be narrowed to accommodate the cycle track as pedestrians will likely walk on the cycle track if sidewalk capacity is reduced. Visual and physical cues (e.g., pavement markings & signage) should be used to make it clear where bicyclists and pedestrians should be travelling. If possible, separate the cycle track and pedestrian zone with a furnishing zone.

Additional References and Guidelines

NACTO, *Urban Bikeway Design Guide*. 2012

Materials and Maintenance

Barrier separated and raised cycle tracks may require special equipment for street cleaning operations.

Two-Way Cycle Tracks

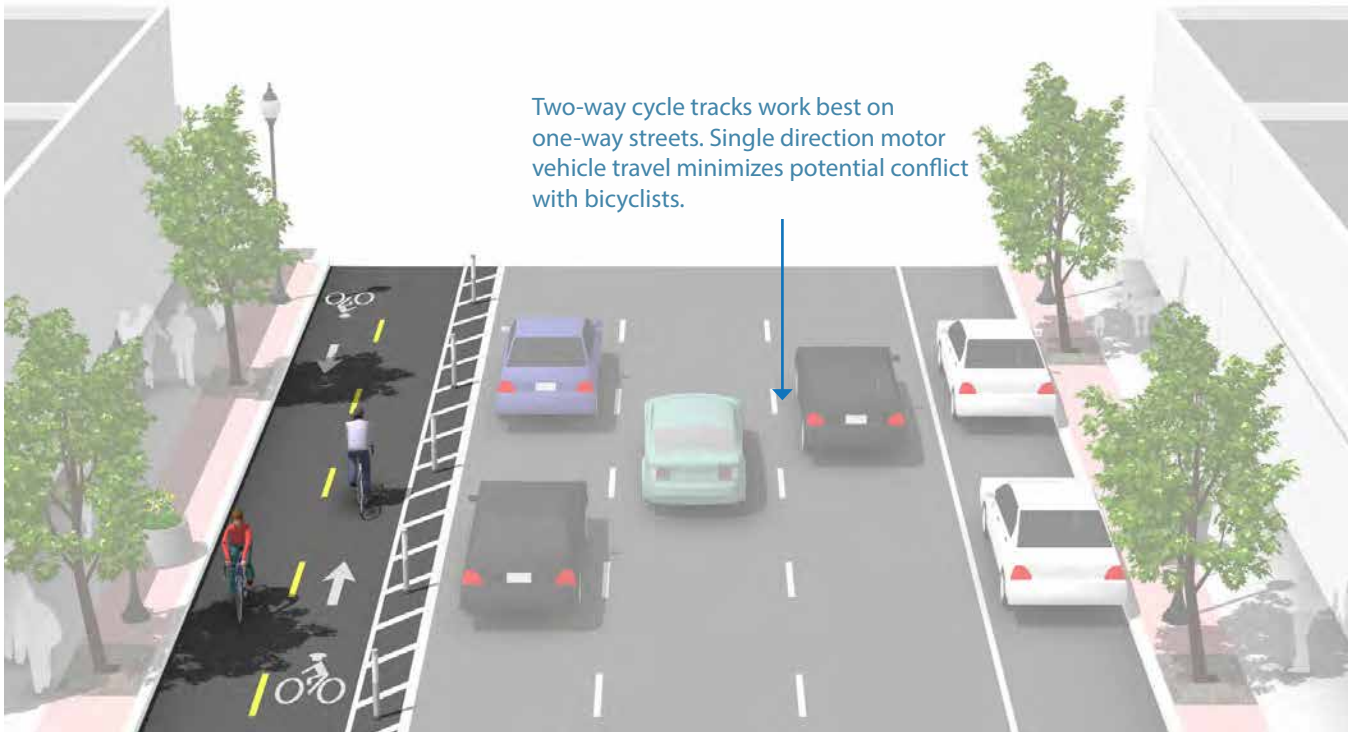
Description

Two-way cycle tracks are physically separated cycle tracks that allow bicycle movement in both directions on one side of the road. Two-way cycle tracks share some of the same design characteristics as **one-way cycle tracks**, but may require additional considerations at driveway and side-street crossings.

A two-way cycle track may be configured as a protected cycle track at street level with a parking lane or other barrier between the cycle track and the motor vehicle travel lane and/or as a raised cycle track to provide vertical separation from the adjacent motor vehicle lane.

Guidance

- 12 foot recommended minimum for two-way facility
- 8 foot minimum in constrained locations
- When placed adjacent to parking, the parking buffer should be three feet wide to allow for passenger loading and to prevent door collisions.



Discussion

Two–way cycle tracks require a higher level of control at intersections to allow for a variety of turning movements. These movements should be guided by separated signals for bicycles and motor vehicles. Transitions into and out of two–way cycle tracks should be simple and easy to use to deter bicyclists from continuing to ride against the flow of traffic.

At driveways and minor intersections, bicyclists riding against roadway traffic in two-way cycle tracks may surprise pedestrians and drivers not expecting bidirectional travel. Appropriate signage is recommended. **This is especially important when two-way cycle track are installed on two-way streets.**

Additional References and Guidelines

NACTO, *Urban Bikeway Design Guide*. 2012

Materials and Maintenance

Barrier separated and raised cycle tracks may require special equipment for street cleaning operations.

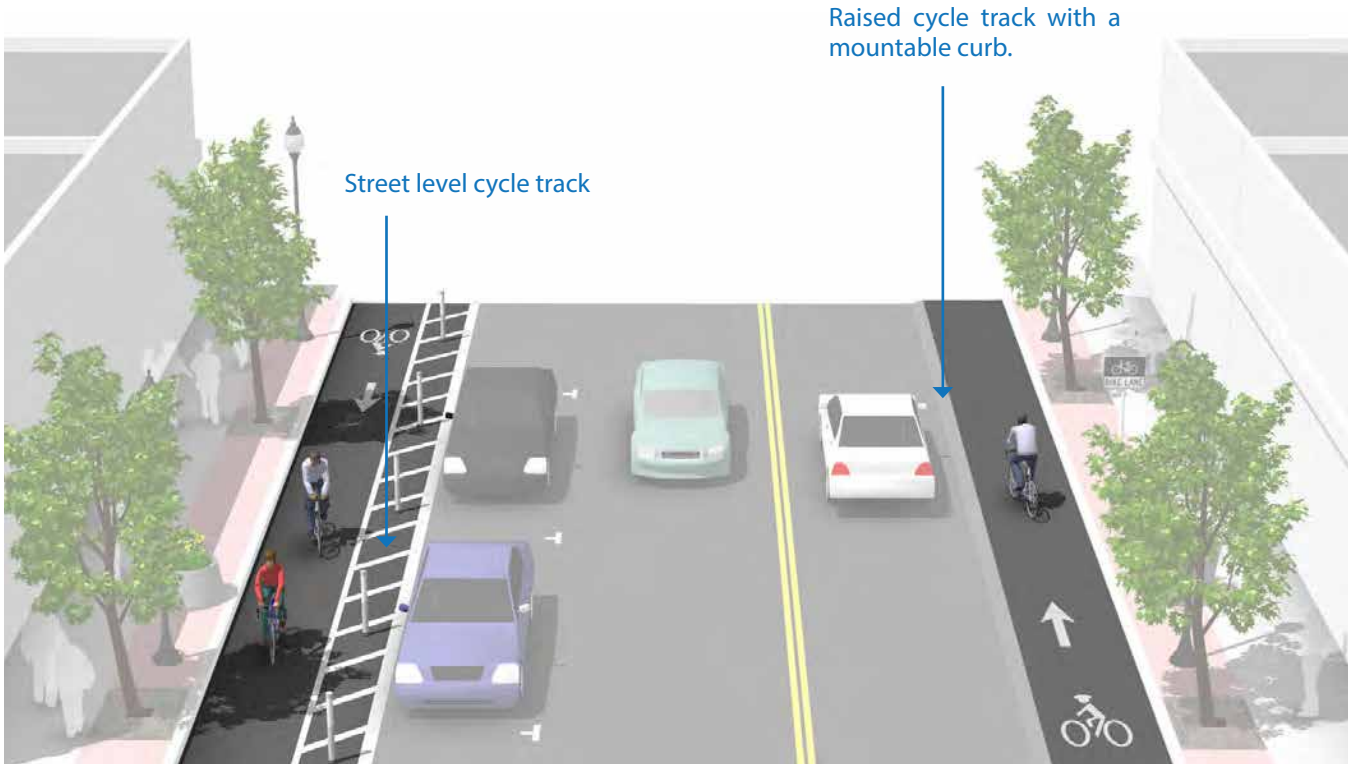
One-Way Cycle Tracks

Description

One-way cycle tracks are physically separated from motor traffic and distinct from the sidewalk. Cycle tracks are either raised or at street level and use a variety of elements for physical protection from passing traffic.

Guidance

- 7 foot recommended minimum to allow passing.
- 5 foot minimum width in constrained locations.
- When placed adjacent to parking, the parking buffer should be three feet wide to allow for passenger loading and to prevent door collisions.
- When placed adjacent to a travel lane, one-way raised cycle tracks may be configured with a mountable curb to allow entry and exit from the bicycle lane for passing other bicyclists or to access vehicular turn lanes.



Discussion

Special consideration should be given at transit stops to manage bicycle and pedestrian interactions. Driveways and minor street crossings are unique challenges to cycle track design. Parking should be prohibited within 30 feet of the intersection to improve visibility. Color, yield markings and "Yield to Bikes" signage should be used to identify the conflict area and make it clear that the cycle track has priority over entering and exiting traffic. If configured as a raised cycle track, the crossing should be raised so that the sidewalk and cycle track maintain their elevation through the crossing.

Additional References and Guidelines

NACTO, *Urban Bikeway Design Guide.* 2012

Materials and Maintenance

Barrier separated and raised cycle tracks may require special equipment for street cleaning operations.

Driveways and Minor Street Crossings

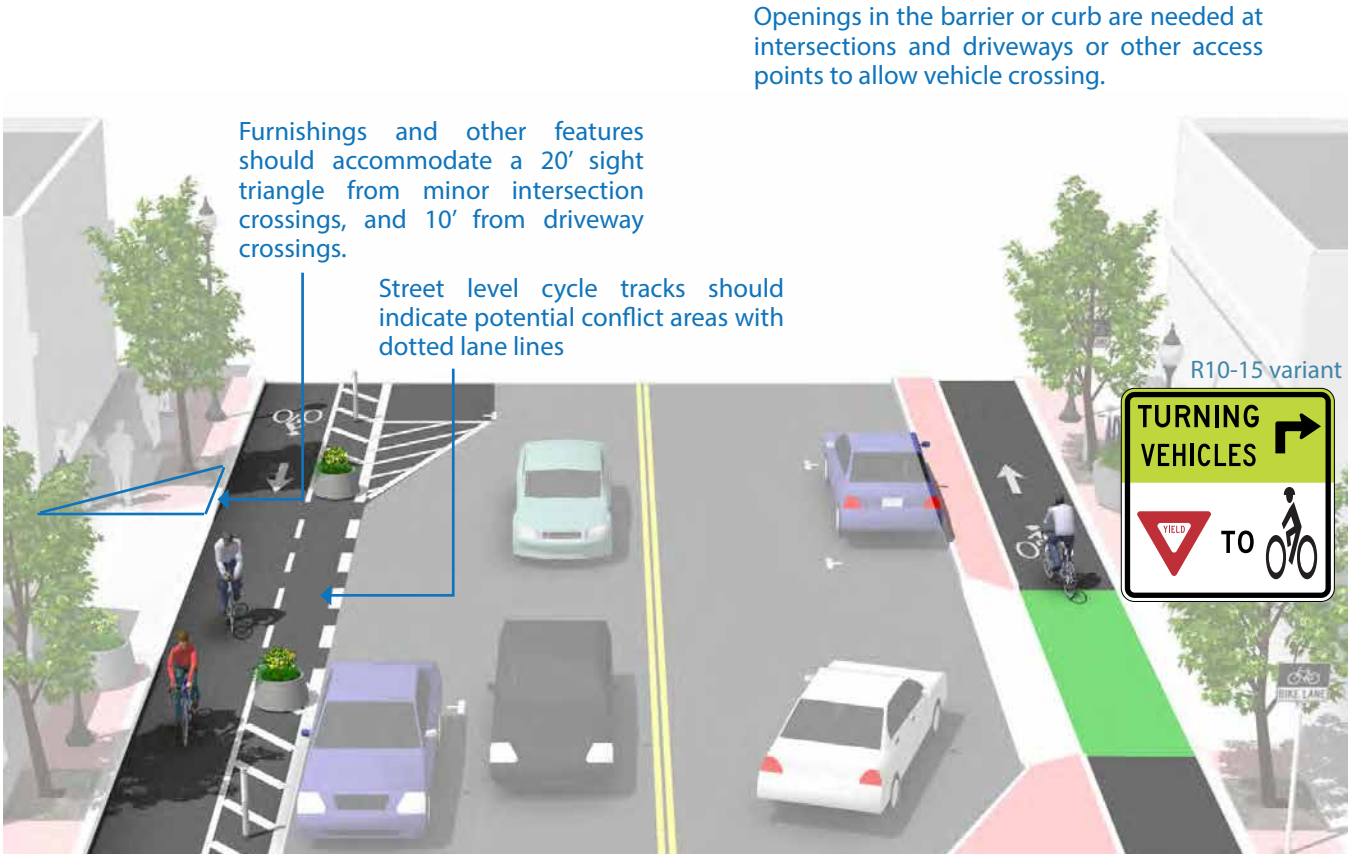
Description

The added separation provided by cycle tracks creates additional considerations at intersections that should be addressed.

At driveways and crossings of minor streets a smaller fraction of automobiles will cross the cycle track. Bicyclists should not be expected to stop at these minor intersections if the major street does not stop.

Guidance

- If raised, maintain the height of the cycle track through the crossing, requiring automobiles to cross over.
- Remove parking 30 feet prior the intersection.
- Use colored pavement markings and/or shared lane markings through the conflict area.
- Place warning signage to identify the crossing.



Discussion

At these locations, bicyclist visibility is important, as a buffer of parked cars or vegetation can reduce the visibility of a bicyclist traveling in the cycle track. Markings and signage should be present that make it easy to understand where bicyclists and pedestrians should be travelling. Access management should be used to reduce the number of crossings of driveways on a cycle track. Driveway consolidations and restrictions on motorized traffic movements reduce the potential for conflict.

Additional References and Guidelines

NACTO, *Urban Bikeway Design Guide*. 2012

Materials and Maintenance

In cities with winter climates, barrier separated and raised cycle tracks may require special equipment for snow removal.

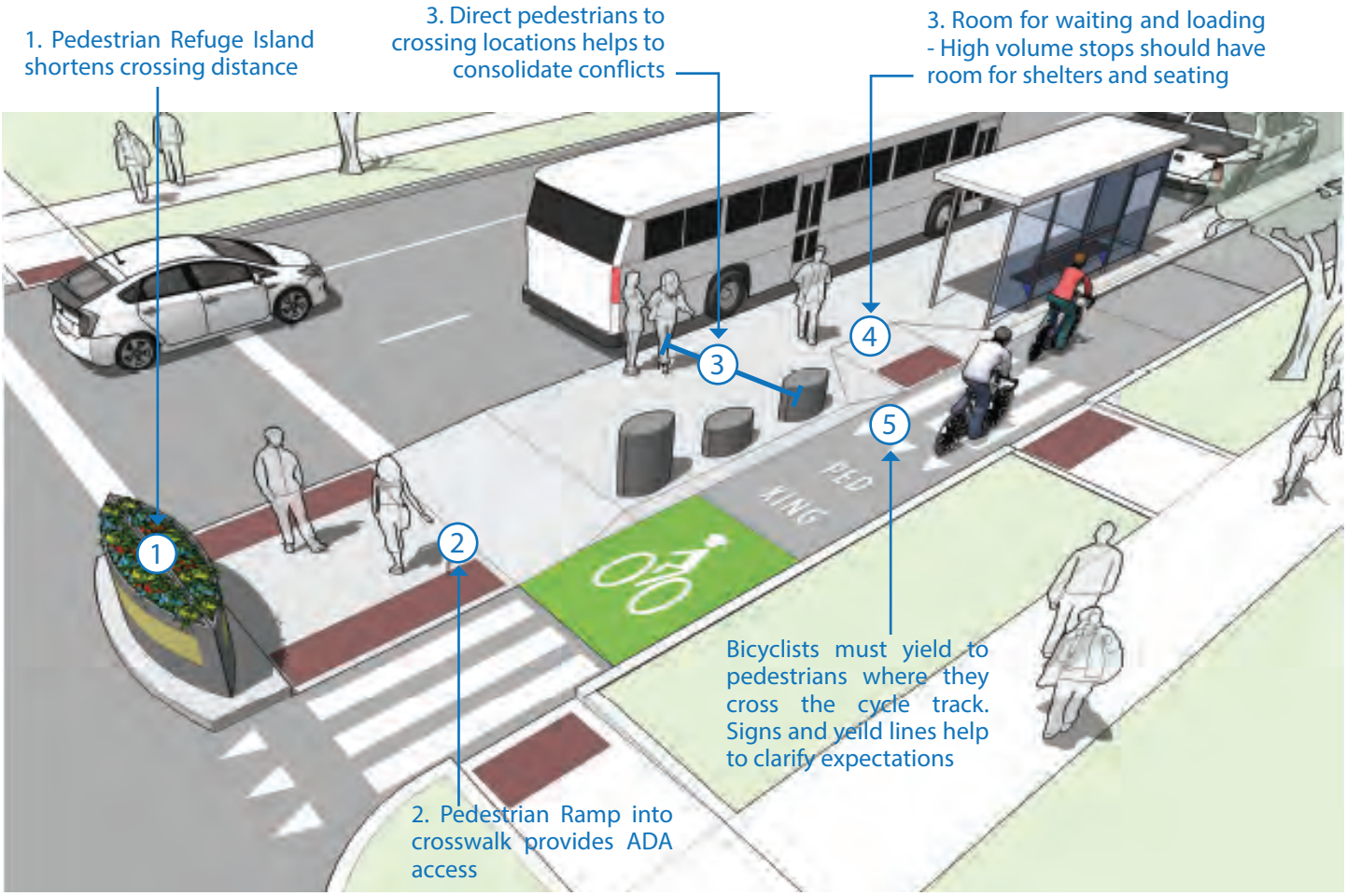
Cycle Track Transit Bypass

Description

A bicycle transit bypass is a channelized lane for bicyclists designed to provide a path for bicyclists to pass stopped transit vehicles, and clarify interactions between passengers and bicyclists. This is particularly helpful on corridors with high volumes of transit vehicles and bicyclists, where "leapfroging" may occur, and on protected bike lane corridors where maintaining physical separation is important to maintain user comfort.

Guidance

- Use along routes where bike lanes or protected bike lanes and transit operations overlap.
- Transit island should be wide enough to accommodate mobility devices.
- Transit island stops to maximize usable space for transit riders, bicyclists and pedestrians.



Discussion

The construction of a bicycle transit bypass minimizes conflict between bicyclists and transit vehicles/transit riders. When installed, bypasses help to clarify user expectations for bicyclist path and pedestrian crossing locations. They also help to make transit boarding more efficent by reducing delay for transit when transit vehicles stop in-lane. Overall, bypass platforms prioritize transit, bicyclists and pedestrian movements - improving the experience of these modes.

Additional References and Guidelines

NACTO, *Urban Street Design Guide*. 2013

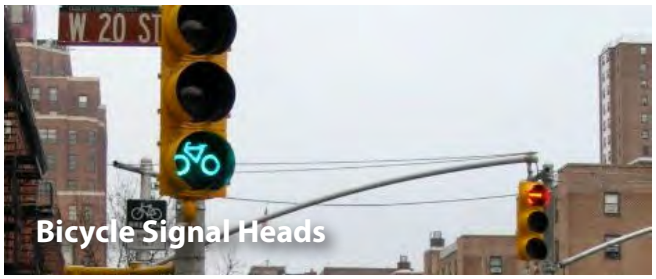
Materials and Maintenance

In cities with winter climates, maintenance of bicycle transit bypass structures may require special equipment for snow removal.

Intersection Treatments

Colored Bike Lanes in Conflict Areas

Intersection Crossing Markings



Bicycle Signal Heads

Bicycle Queuing Treatments

Intersections are junctions at which different modes of transportation meet and facilities overlap. An intersection facilitates the interchange between bicyclists, motorists, pedestrians and other modes in order to advance traffic flow in a safe and efficient manner. Designs for intersections with bicycle facilities should reduce conflict between bicyclists (and other vulnerable road users) and vehicles by heightening the level of visibility, denoting clear right-of-way and facilitating eye contact and awareness with other modes. Intersection treatments can improve both queuing and merging maneuvers for bicyclists, and are often coordinated with timed or specialized signals.

Bicycle signals and beacons facilitate bicyclist crossings of roadways. Bicycle signals make crossing intersections safer for bicyclists by clarifying when to enter an intersection and by restricting conflicting vehicle movements. Bicycle signals are traditional three lens signal heads with green, yellow and red bicycle stenciled lenses that can be employed at standard signalized intersections and hybrid beacon crossings.

The configuration of a safe intersection for bicyclists may include elements such as color, signage, medians, signal detection and pavement markings. Intersection design should take into consideration existing and anticipated bicyclist, pedestrian and motorist movements. In all cases, the degree of mixing or separation between bicyclists and other modes is intended to reduce the risk of crashes and increase bicyclist comfort.

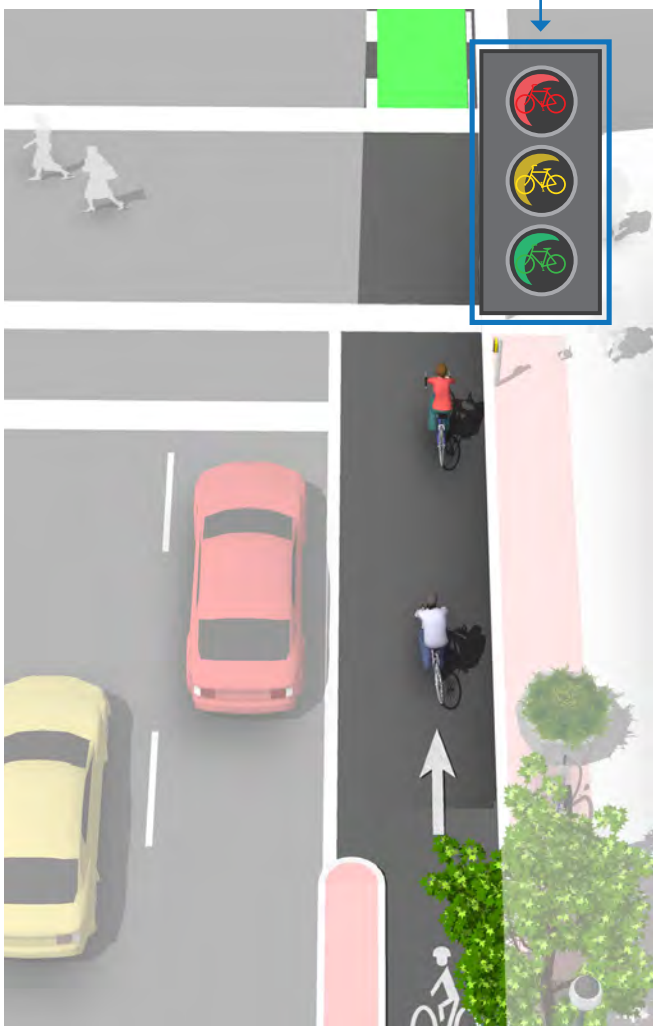
Cycle Track Major Street Crossings

Description

Cycle tracks approaching major intersections must minimize and mitigate potential conflicts and provide connections to intersecting facility types.

Cycle track crossings of signalized intersections can also be accomplished through the use of a bicycle signal phase which reduces conflicts with motor vehicles by separating bicycle movements from any conflicting motor vehicle movements. This is especially the case with two-way cycle tracks on two-way streets, where an exclusive bicycle phase will mitigate conflicts between turning vehicles and bicycle traffic.

Demand–only bicycle signals can be implemented to reduce vehicle delay and to prevent an empty signal phase from regularly occurring.



Guidance

- Drop cycle track buffer and transition to bike lane 16' in advance of the intersection.
- Remove parking 16' -50' in advance of the buffer termination.
- Use a **bike box** or advanced stop line treatment to place bicyclists in front of traffic.
- Use **colored pavement** markings through the conflict area.
- Provide for left-turning movements with **two–stage turn** boxes.
- Consider using a protected phase **bicycle signal** to isolate conflicts between bicyclists and motor vehicle traffic.
- In constrained conditions with right turn only lanes, consider transitioning to a **shared bike lane/turn lane.**

Discussion

Signalization utilizing a bicycle signal head can also be set to provide cycle track users a green phase in advance of vehicle phases. The length of the signal phase will depend on the width of the intersection.
The same conflicts exist at non-signalized intersections. Warning signs, special markings and the removal of on-street parking in advance of the intersection can raise visibility and awareness of bicyclists.

Additional References and Guidelines

AASHTO, *Guide for the Development of Bicycle Facilities.* 2012
FHWA, *Manual on Uniform Traffic Control Devices.* 2009
NACTO, *Urban Bikeway Design Guide.* 2012

Materials and Maintenance

Paint can wear more quickly in high traffic areas.

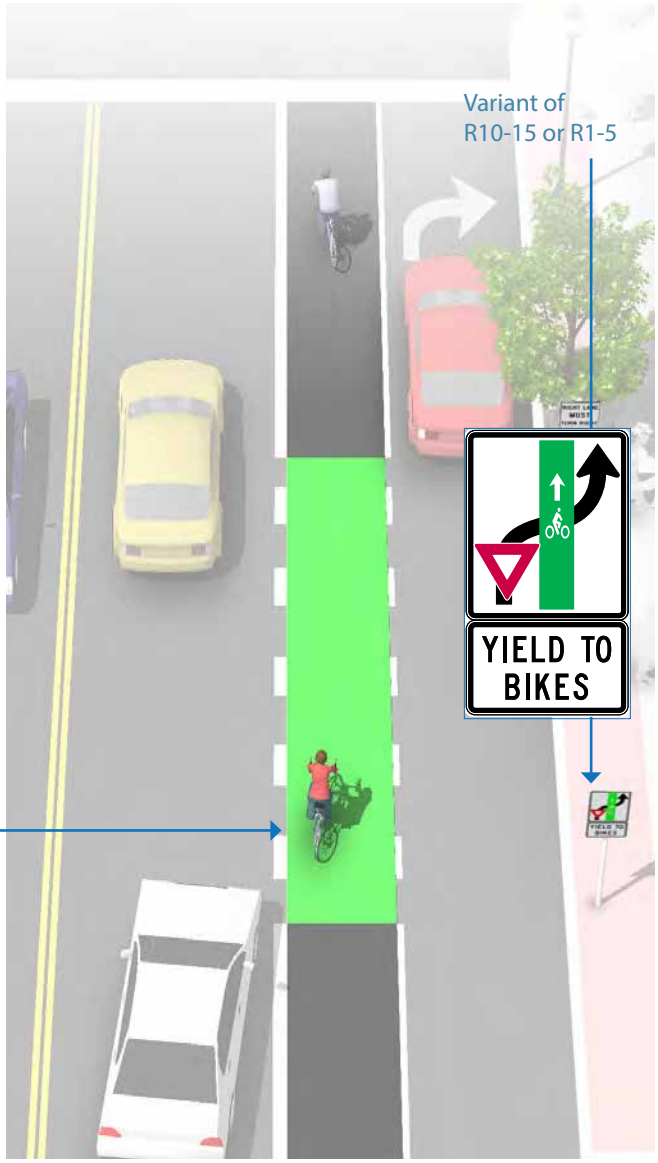
Colored Bike Lanes in Conflict Areas

Description

Colored pavement within a bicycle lane increases the visibility of the facility and reinforces priority of bicyclists in conflict areas.

Guidance

- Green colored pavement was given interim approval by the Federal Highways Administration in March 2011. See interim approval for specific color standards.
- The colored surface should be skid resistant and retro-reflective.
- A "Yield to Bikes" sign should be used at intersections or driveway crossings to reinforce that bicyclists have the right-of-way in colored bike lane areas.



Discussion

Evaluations performed in Portland, OR, St. Petersburg, FL and Austin, TX found that significantly more motorists yielded to bicyclists and slowed or stopped before entering the conflict area after the application of the colored pavement when compared with an uncolored treatment.

Additional References and Guidelines

FHWA, Interim Approval (IA-14) has been granted. Requests to use green colored pavement need to comply with the provisions of Paragraphs 14 through 22 of Section 1A.10. 2011

NACTO, *Urban Bikeway Design Guide*. 2012

Materials and Maintenance

Because the effectiveness of markings depends entirely on their visibility, maintaining markings should be a high priority.

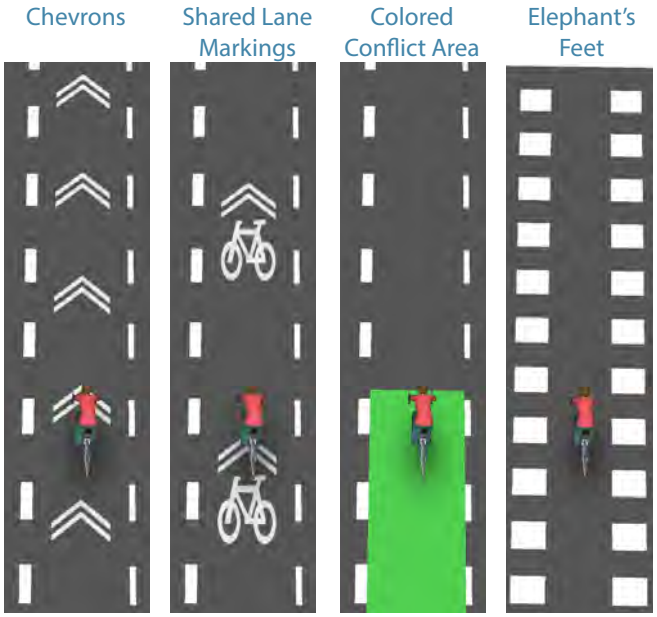
Intersection Crossing Markings

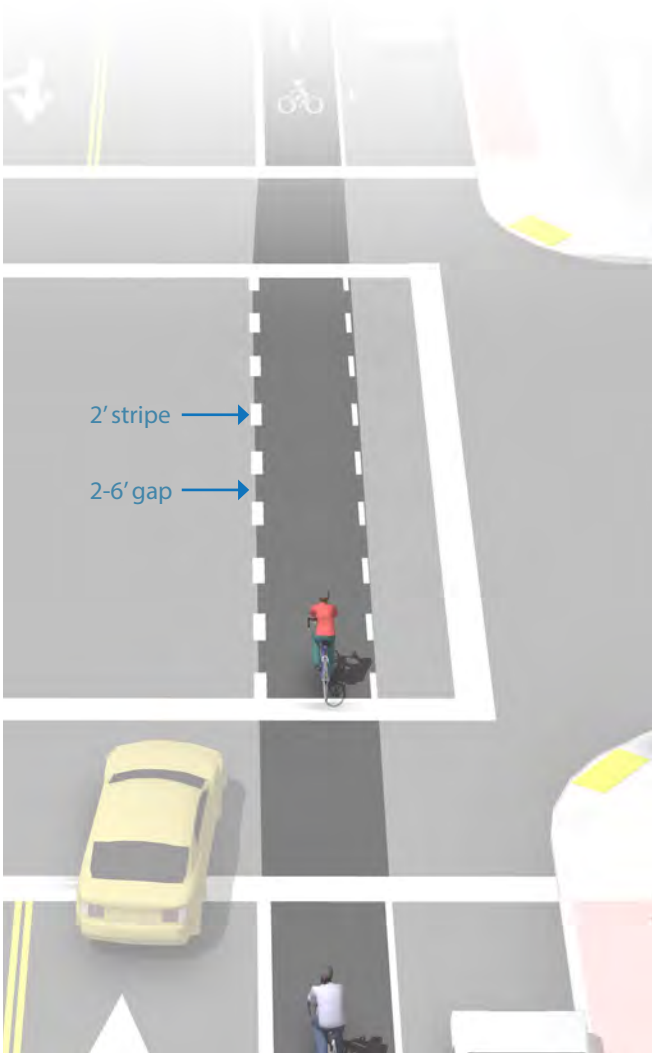
Description

Bicycle pavement markings through intersections indicate the intended path of bicyclists through an intersection or across a driveway or ramp. They guide bicyclists on a safe and direct path through the intersection and provide a clear boundary between the paths of through bicyclists and either through or crossing motor vehicles in the adjacent lane.

Guidance

- See MUTCD Section 3B.08: "dotted line extensions"
- Crossing striping shall be at least six inches wide when adjacent to motor vehicle travel lanes. Dotted lines should be two-foot lines spaced two to six feet apart.
- Chevrons, shared lane markings, or **colored bike lanes in conflict areas** may be used to increase visibility within conflict areas or across entire intersections. Elephant's Feet markings are common in Europe and Canada.





Discussion

Additional markings such as chevrons, shared lane markings, or **colored bike lanes in conflict areas** are strategies currently in use in the United States and Canada. Cities considering the implementation of markings through intersections should standardize future designs to avoid confusion.

Additional References and Guidelines

AASHTO, *Guide for the Development of Bicycle Facilities.* 2012
FHWA, *Manual on Uniform Traffic Control Devices, 3A.06.* 2009
NACTO, *Urban Bikeway Design Guide.* 2012

Materials and Maintenance

Because the effectiveness of marked crossings depends entirely on their visibility, maintaining marked crossings should be a high priority.

Bicycle Signal Heads

Description

A bicycle signal is an electrically powered traffic control device that should only be used in combination with an existing conventional or hybrid signal. Bicycle signals are typically used to improve identified safety or operational problems involving bicycle facilities. Bicycle signal heads may be installed at signalized intersections to indicate bicycle signal phases and other bicycle-specific timing strategies. Bicycle signals can be actuated with bicycle sensitive loop detectors, video detection, or push buttons. In the United States, bicycle signal heads typically use standard three-lens signal heads in green, yellow, and red. Bicycle signals are typically used to provide guidance for bicyclists at intersections where they may have different needs from other road users (e.g., bicycle–only movements, or leading bicycle intervals).

Guidance

Specific locations where bicycle signals have had a demonstrated positive effect include:

- Those with high volume of bicyclists at peak hours
- Those with high numbers of bicycle/motor vehicle crashes, especially those caused by turning vehicle movements
- At T–intersections with major bicycle movement along the top of the "T."
- At the confluence of an off-street bike path and a roadway intersection
- Where separated bike paths run parallel to arterial streets

Discussion

Per *EDSM No: IV.7.1.5*, new signal installations shall be performed by, or under the direction of traffic operations as requested from the District Traffic Operations Engineer and/or Traffic Engineering Management. Local municipal code should be checked or modified to clarify that at intersections with bicycle signals, bicyclists should only obey the bicycle signal heads. For improved visibility, smaller (4 inch lens) near-sided bicycle signals should be considered to supplement far-side signals.

Additional References and Guidelines

NACTO, *Urban Bikeway Design Guide.* 2012

The National Committee on Uniform Traffic Control Devices has formed a Task Force that is considering adding guidance to the MUTCD on the use of bicycle signals.

DOTD, *EDSM No: IV.7.1.5. Engineering Directives And Standards, DOTD Traffic Signal Manual.* 2012

Materials and Maintenance

Bicycle signal heads require the same maintenance as standard traffic signal heads, such as replacing bulbs and responding to power outages.

Two Stage Turn Boxes

Description

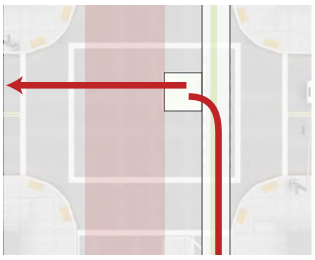
Two–stage turn queue boxes offer bicyclists a safe way to make left turns at multi-lane signalized intersections from a right side cycle track or bike lane.

On right side cycle tracks, bicyclists are often unable to merge into traffic to turn left due to physical separation, making the provision of two–stage left turn boxes critical. Design guidance for two-stage turns apply to both bike lanes and cycle tracks.

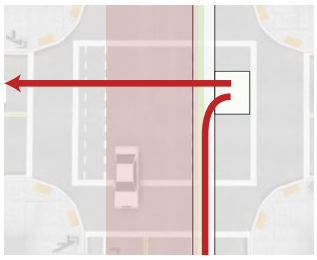
Guidance

- The queue box shall be placed in a protected area. Typically this is within an on–street parking lane or cycle track buffer area.
- 6' minimum depth of bicycle storage area
- Bicycle stencil and turn arrow pavement markings shall be used to indicate proper bicycle direction and positioning.
- A "No Turn on Red" (MUTCD R10-11) sign shall be installed on the cross street to prevent vehicles from entering the turn box.

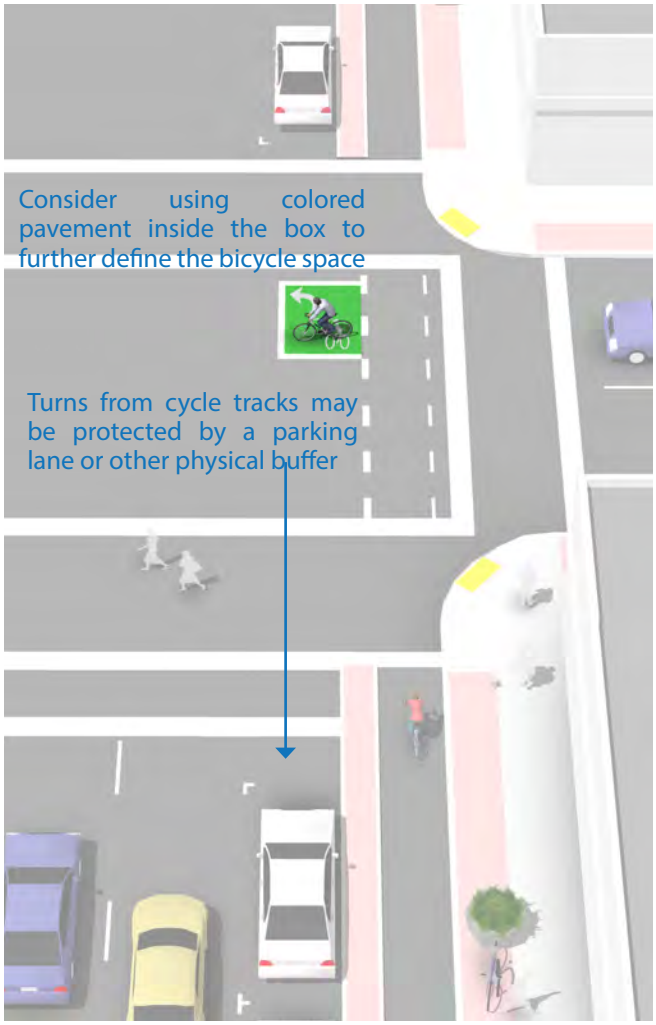
Cycle track turn box protected by physical buffer:



Bike lane turn box protected by parking lane:



Turns from a bicycle lane may be protected by an adjacent parking lane or crosswalk setback space



Discussion

While two stage turns may increase bicyclist comfort in many locations, this configuration will typically result in higher average signal delay for bicyclists due to the need to receive two separate green signal indications (one for the through street, followed by one for the cross street) before proceeding.

Additional References and Guidelines

NACTO, *Urban Bikeway Design Guide*. 2012

Materials and Maintenance

Paint can wear more quickly in high traffic areas.

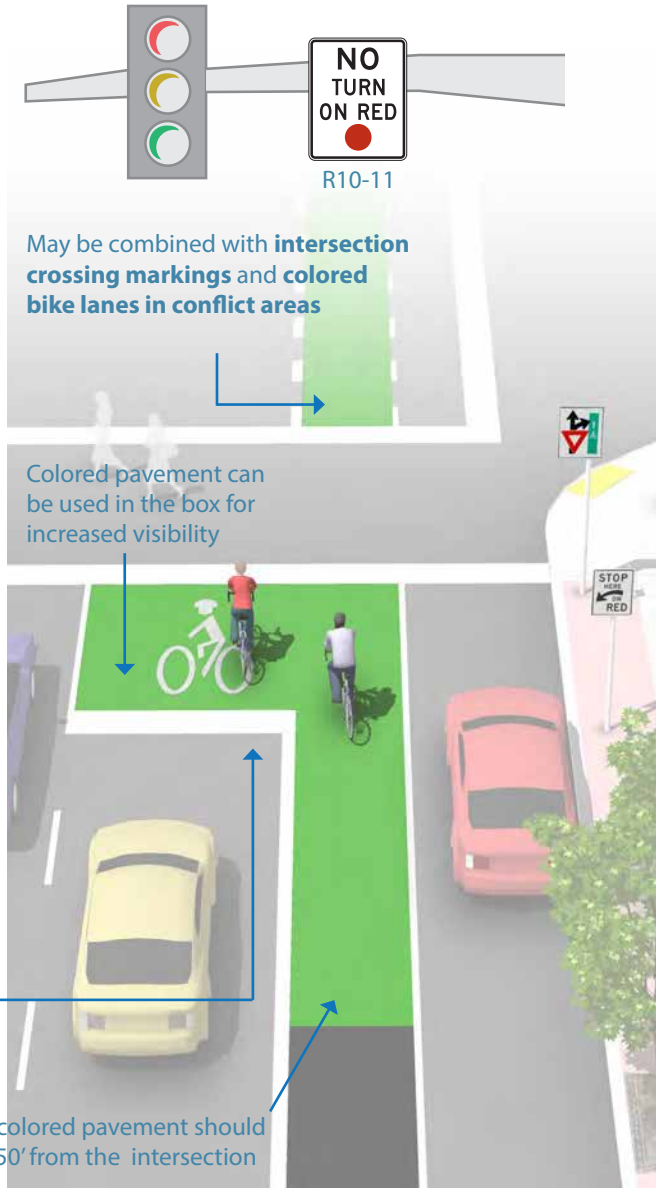
Bike Box

Description

A bike box is a designated area located at the head of a traffic lane at a signalized intersection that provides bicyclists with a safe and visible space to get in front of queuing motorized traffic during the red signal phase. Motor vehicles must queue behind the white stop line at the rear of the bike box.

Guidance

- 14' minimum depth
- A "No Turn on Red" (MUTCD R10-11) sign shall be installed overhead to prevent vehicles from entering the Bike Box.
- A "Stop Here on Red" sign should be post-mounted at the stop line to reinforce observance of the stop line.
- A "Yield to Bikes" sign should be post-mounted in advance of and in conjunction with an egress lane to reinforce that bicyclists have the right-of-way going through the intersection.
- An ingress lane should be used to provide access to the box.
- A supplemental "Wait Here" legend can be provided in advance of the stop bar to increase clarity to motorists.



Discussion

Bike boxes should be placed only at signalized intersections, and right turns on red shall be prohibited for motor vehicles when placed in front of a shared through-right lane. Prohibiting right turns on red improves safety for bicyclists, yet does not significantly impede motor vehicle travel. Bike boxes should be used in locations that have a large volume of bicyclists and are best utilized in central areas where traffic is usually moving more slowly. Installing bike boxes on downhill grades should be considered more carefully.

Additional References and Guidelines

NACTO, *Urban Bikeway Design Guide.* 2012

FHWA, Interim Approval (IA-14) has been granted. Requests to use green colored pavement need to comply with the provisions of Paragraphs 14 through 22 of Section 1A.10. 2011

Materials and Maintenance

Because the effectiveness of markings depends entirely on their visibility, maintaining markings should be a high priority.

Bicycle Support Facilities

BIKE PARKING

Bicyclists expect a safe, convenient place to secure their bicycle when they reach their destination. This may be short-term parking of 2 hours or less, or long-term parking for employees, students, residents, and commuters. Bicycle maintenance stands provide support for bicyclists to make quick fixes to their bicycles.

Bike Maintenance Stand

Guidance

- Stands should be located periodically along key bike commute routes, proximate to locations with concentrations bike parking (ie. next to a bike corral)
- Stations should be placed at key destinations in the city, such as sports venues, universities, city/town hall, libraries and grocery stores.
- Stations should be inspected once every two weeks in the winter months to ensure that the air pump is still functional.
- The rear of the stations must be offset 12" from any fixed object; the front and right side of the station must be offset 60" from any fixed object; and the left side must be offset 45" from any fixed object.
- Place station under building/structure roofs where possible to minimze winter impacts to the station and it's tools/pump

Description

Bike maintenance stands are durable, all-weather outdoor units that provide the necessary tools for bicyclists to make quick fixes to their bikes and pump-up their tires. These stands are a critical bicycle support facilities, giving bicyclists confidence that they can repair their bikes in the event of mid-trip low tire pressure or mishap. Stations also provide bicyclists that do not own tools the opportunity to fix their own bike, free of cost.

Bike Racks

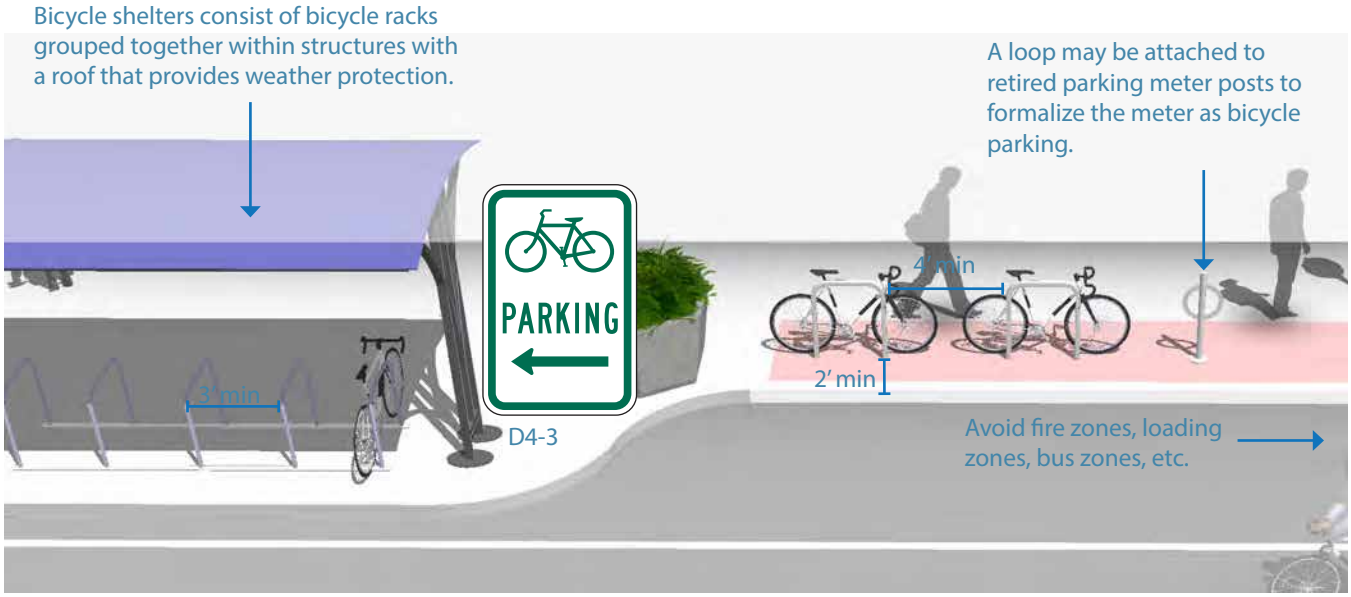
Description

Short–term bicycle parking is meant to accommodate visitors, customers, and others expected to depart within two hours. It should have an approved standard rack, appropriate location and placement, and weather protection. The Association for Pedestrian and Bicycle Professionals (APBP) recommends selecting a bicycle track that:

- Supports the bicycle in at least two places, preventing it from falling over.
- Allows locking of the frame and one or both wheels with a U-lock.
- Is securely anchored to ground.
- Resists cutting, rusting and bending or deformation.

Guidance

- 2' minimum from the curb face to avoid 'dooring.'
- Close to destinations; 50' maximum distance from main building entrance.
- Minimum clear distance of 6' should be provided between the bicycle rack and the property line.
- Should be highly visible from adjacent bicycle routes and pedestrian traffic.
- Locate racks in areas that cyclists are most likely to travel.



Discussion

Where the placement of racks on sidewalks is not possible (due to narrow sidewalk width, sidewalk obstructions, street trees, etc.), **bicycle parking** can be provided in the street where on–street vehicle parking is allowed in the form of **on–street bicycle corrals**. Some types of bicycle racks may meet design criteria, but are discouraged except in limited situations. This includes undulating "wave" racks, schoolyard "wheel bender" racks, and spiral racks.

Additional References and Guidelines

AASHTO, *Guide for the Development of Bicycle Facilities.* 2012
APBP, *Bicycle Parking Guide, 2nd Edition.* 2010

Materials and Maintenance

Use of proper anchors will prevent vandalism and theft. Racks and anchors should be regularly inspected for damage.

On-Street Bike Corral

Description

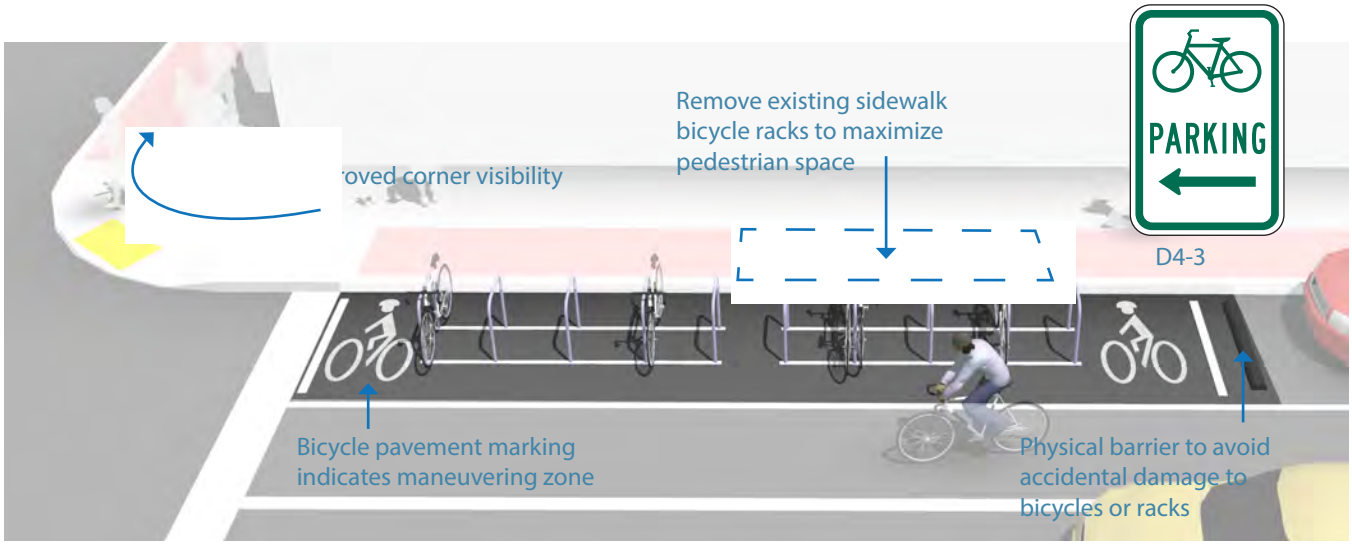
Bicycle corrals (also known as on-street bicycle parking) consist of bicycle racks grouped together in a common area within the street traditionally used for automobile parking. Bicycle corrals are reserved exclusively for bicycle parking and provide a relatively inexpensive solution to providing high-volume bicycle parking. Bicycle corrals can be implemented by converting one or two on-street motor vehicle parking spaces into on-street bicycle parking. Each motor vehicle parking space can be replaced with approximately 6-10 bicycle parking spaces.

Bicycle corrals move bicycles off the sidewalks, leaving more space for pedestrians, sidewalk café tables, etc. Because bicycle parking does not block sightlines (as large motor vehicles would do), it may be possible to locate bicycle parking in 'no-parking' zones near intersections and crosswalks.

Guidance

See guidelines for sidewalk **Bicycle Rack** placement and clear zones.

- Bicyclists should have an entrance width from the roadway of 5' – 6'.
- Can be used with parallel or angled parking.
- Parking stalls adjacent to curb extensions are good candidates for bicycle corrals since the concrete extension serves as delimitation on one side.



Discussion

In many communities, the installation of bicycle corrals is driven by requests from adjacent businesses, and is not a city-driven initiative. In such cases, the city does not remove motor vehicle parking unless it is explicitly requested. In other areas, the city provides the facility and business associations take responsibility for the maintenance of the facility. Communities can establish maintenance agreements with the requesting business. Bicycle corrals can be especially effective in areas with high bicycle parking demand or along street frontages with narrow sidewalks where parked bicycles would be detrimental to the pedestrian environment.

Additional References and Guidelines

APBP, *Bicycle Parking Guide, 2nd Edition.* 2010

Materials and Maintenance

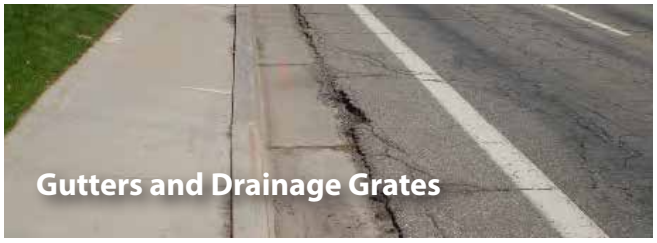
Physical barriers may obstruct drainage and collect debris. Establish a maintenance agreement with neighboring businesses.

Bikeway Maintenance

Regular bicycle facility maintenance includes sweeping, maintaining a smooth roadway, ensuring that the gutter-to-pavement transition remains relatively flat, and installing bicycle-friendly drainage grates. Pavement overlays are a good opportunity to improve bicycle facilities. The following recommendations provide a menu of options to consider to enhance a maintenance regimen.

RECOMMENDED WALKWAY AND BIKEWAY MAINTENANCE ACTIVITIES

Maintenance Activity	Frequency
Inspections	Seasonal – at beginning and end of Summer
Pavement sweeping/ blowing	As needed, with higher frequency in the early Spring and Fall
Pavement sealing	5 - 15 years
Pothole repair	1 week – 1 month after report
Culvert and drainage grate inspection	Before Winter and after major storms
Pavement markings replacement	As needed
Signage replacement	As needed
Shoulder plant trimming (weeds, trees, brambles)	Twice a year; middle of growing season and early Fall
Tree and shrub plantings, trimming	1 – 3 years
Major damage response (washouts, fallen trees, flooding)	As soon as possible
Snow/Ice Removal	See Snow Ice Removal Section (pg 2-31)



Sweeping

Guidance

- Establish a seasonal sweeping schedule that prioritizes roadways with major bicycle routes.
- Sweep walkways and bikeways whenever there is an accumulation of debris on the facility.
- In curbed sections, sweepers should pick up debris; on open shoulders, debris can be swept onto gravel shoulders.
- Pave gravel driveway approaches to minimize loose gravel on paved roadway shoulders.
- Perform additional sweeping in the Spring to remove debris from the Winter.
- Perform additional sweeping in the Fall in areas where leaves accumulate .

Description

Bicyclists often avoid shoulders and bike lanes filled with gravel, broken glass and other debris; they will ride in the roadway to avoid these hazards, potentially causing conflicts with motorists. Debris from the roadway should not be swept onto sidewalks (pedestrians need a clean walking surface), nor should debris be swept from the sidewalk onto the roadway. A regularly scheduled inspection and maintenance program helps ensure that roadway debris is regularly picked up or swept.

Signage

Guidance

- Check regulatory and wayfinding signage along bikeways for signs of vandalism, graffiti, or normal wear.
- Replace signage along the bikeway network as-needed.
- Perform a regularly-scheduled check on the status of signage with follow-up as necessary.
- Create a Maintenance Management Plan.

Description

Bike lanes, shared shoulders, Neighborhood Bikeways and paths all have different signage types for wayfinding and regulations. Such signage is vulnerable to vandalism or wear, and requires periodic maintenance and replacement as needed.

Roadway Surface

Guidance

- Maintain a smooth pothole-free surface.
- Ensure that on new roadway construction, the finished surface on bikeways does not vary more than ¼".
- Maintain pavement so ridge buildup does not occur at the gutter-to-pavement transition or adjacent to railway crossings.
- Inspect the pavement 2 to 4 months after trenching construction activities are completed to ensure that excessive settlement has not occurred.
- If chip sealing is to be performed, use the smallest possible chip on bike lanes and shoulders. Sweep loose chips regularly following application.
- During chip seal maintenance projects, if the pavement condition of the bike lane is satisfactory, it may be appropriate to chip seal the travel lanes only. However, use caution when doing this so as not to create an unacceptable ridge between the bike lane and travel lane.

Description

Bicycles are much more sensitive to subtle changes in roadway surface than are motor vehicles. Various materials are used to pave roadways, and some are smoother than others. Compaction is also an important issue after trenches and other construction holes are filled. Uneven settlement after trenching can affect the roadway surface nearest the curb where bicycles travel. Sometimes compaction is not achieved to a satisfactory level, and an uneven pavement surface can result due to settling over the course of days or weeks. When resurfacing streets, use the smallest chip size and ensure that the surface is as smooth as possible to improve safety and comfort for bicyclists.

Pavement Overlays

Guidance

- Extend the overlay over the entire roadway surface to avoid leaving an abrupt edge.
- If the shoulder or bike lane pavement is of good quality, it may be appropriate to end the overlay at the shoulder or bike lane stripe provided no abrupt ridge remains.
- Ensure that inlet grates, manhole and valve covers are within ¼ inch of the finished pavement surface and are made or treated with slip resistant materials.
- Pave gravel driveways to property lines to prevent gravel from being tracked onto shoulders or bike lanes.

Description

Pavement overlays represent good opportunities to improve conditions for bicyclists if done carefully. A ridge should not be left in the area where bicyclists ride (this occurs where an overlay extends part-way into a shoulder bikeway or bike lane). Overlay projects also offer opportunities to widen a roadway, or to re-stripe a roadway with bike lanes.

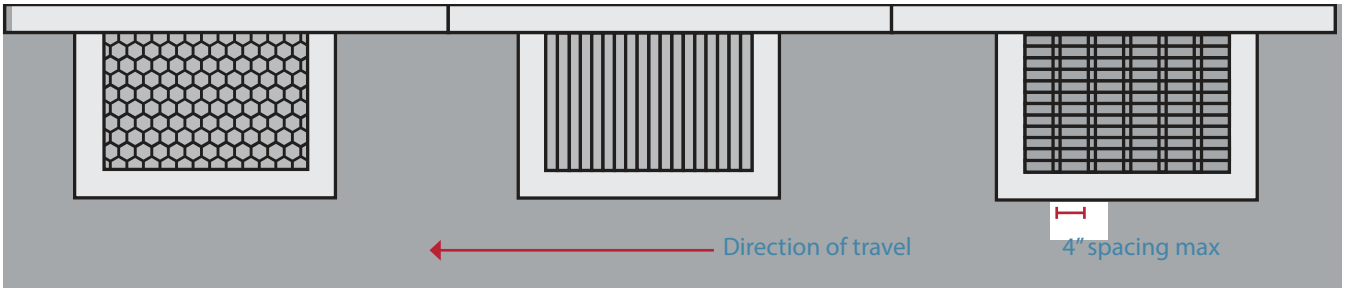
Drainage Grates

Guidance

- Require all new drainage grates be bicycle-friendly, including grates that have horizontal slats on them so that bicycle tires and assistive devices do not fall through the vertical slats.
- Create a program to inventory all existing drainage grates, and replace hazardous grates as necessary – temporary modifications such as installing rebar horizontally across the grate should not be an acceptable alternative to replacement.

Description

Drainage grates are typically located in the gutter area near the curb of a roadway. Drainage grates typically have slots through which water drains into the municipal storm sewer system. Many older grates were designed with linear parallel bars spread wide enough for a tire to become caught so that if a bicyclist were to ride on them, the front tire could become caught in the slot. This would cause the bicyclist to tumble over the handlebars and sustain potentially serious injuries.



Gutter to Pavement Transition

Guidance

- Ensure that gutter-to-pavement transitions have no more than a ¼" vertical transition.
- Examine pavement transitions during every roadway project for new construction, maintenance activities, and construction project activities that occur in streets.
- Inspect the pavement 2 to 4 months after trenching construction activities are completed to ensure that excessive settlement has not occurred.
- Provide at least 3 feet of pavement outside of the gutter seam.

Description

On streets with concrete curbs and gutters, 1 to 2 feet of the curbside area is typically devoted to the gutter pan, where water collects and drains into catch basins. On many streets, the bikeway is situated near the transition between the gutter pan and the pavement edge. This transition can be susceptible to erosion, creating potholes and a rough surface for travel.

The pavement on many streets is not flush with the gutter, creating a vertical transition between these segments. This area can buckle over time, creating a hazardous condition for bicyclists.

Landscaping

Guidance

- Ensure that shoulder plants do not hang into or impede passage along bikeways
- After major damage incidents, remove fallen trees or other debris from bikeways as quickly as possible

Description

Bikeways can become inaccessible due to overgrown vegetation. All landscaping needs to be designed and maintained to ensure compatibility with the use of the bikeways. After a flood or major storm, bikeways should be checked along with other roads, and fallen trees or other debris should be removed promptly.

Maintenance Management Plan

Guidance

- Provide fire and police departments with map of system, along with access points to gates/bollards
- Enforce speed limits and other rules of the road
- Enforce all trespassing laws for people attempting to enter adjacent private properties

Description

Bikeway users need accommodation during construction and maintenance activities when bikeways may be closed or unavailable. Users must be warned of bikeway closures and given adequate detour information to bypass the closed section. Users should be warned through the use of standard signing approaching each affected section (e.g., "Bike Lane Closed," "Trail Closed"), including information on alternate routes and dates of closure. Alternate routes should provide reasonable directness, equivalent traffic characteristics, and be signed.

Snow + Ice Removal

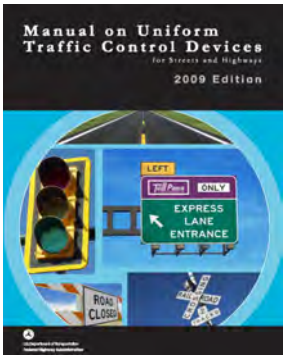
Guidance

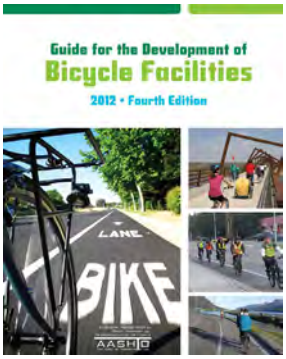
- Plan bike facilities with sufficient right-of-way to accommodate unimpeded travel, snow removal vehicles, and storage space for snow. Buffered bike lanes and cycle tracks have the advantage of allowing for additional vehicle access and storage space.
- Where roadways are plowed, the pedestrian through zone of sidewalks should be kept free and clear of snow debris to the extent possible. Curb ramps and landings, crosswalks and refuge islands must be kept clear so as not to impede safe pedestrian crossings.
- Parking restrictions offer additional space for maintenance of bike facilities between a parking lane and vehicle travel lane during snow events.
- Alternative off-street or parallel facilities are necessary when the clearing of bikeways on major routes is not possible. They should be clearly marked, well-maintained and facilitate at least the same level of access and connectivity.
- Municipalities should invest in smaller, more specialized snow removal vehicles to allow for better access to narrower bike facilities. Due to their smaller size the vehicles have better maneuverability, and may also be used for clearing sidewalks. ATV-mounted snow plows are one example of a specialized vehicle.
- Recessed thermoplastic pavement markings, protected flexible bollards, tapered curb edges, and vertical delineators are among some of the additional measures employed to further protect bike facilities, and maintenance equipment from wear or damage.
- Jurisdictions that experience significant snow events and have a de-icing program should employ a proactive or anti-icing strategy, and have a plan for the removal of de-icing surface material debris that accumulates in and around bike facilities and sidewalks.
- A prioritization schedule for snow removal is necessary and should focus on primary routes and destinations that impact the highest volume of bicyclists immediately following snow events. These include routes to and from commercial centers and schools, and key connections such as bridges.

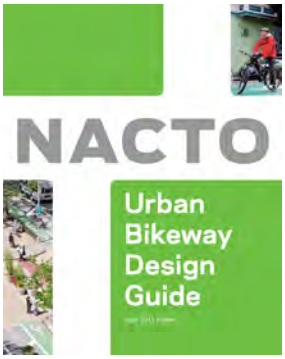
Description

Winter maintenance of sidewalks and bicycle facilities is an important consideration for cities and towns that receive significant amounts of snowfall. Cities should expect pedestrian and bicycle activity year round, even in inclement conditions and providing safe conditions for pedestrians and bicyclists year round should be a top priority. Safe and comfortable accommodation of pedestrians and bicyclists during the winter months depends on thoughtful roadway design, and a strategic snow removal and de-icing program that includes appropriate snow removal equipment and a snow removal prioritization schedule. See Appendix E for more information on maintenance of bike facilities during winter months. This winter bike maintenance white paper can also be viewed on Alta Planning + Designs website under the resources tab.

ADDITIONAL DESIGN REFERENCES







The Federal Highway Administration's ***Manual on Uniform Traffic Control Devices*** (*MUTCD*) defines the standards used by road managers nationwide to install and maintain traffic control devices on all streets, highways, bikeways, and private roads open to public traffic. The *MUTCD* is the primary source for guidance on lane striping requirements, signal warrants, and recommended signage and pavement markings.

To further clarify the *MUTCD*, the FHWA created a table of contemporary bicycle facilities that lists various bicycle-related signs, markings, signals, and other treatments and identifies their official status (e.g., can be implemented, currently experimental). See ***Bicycle Facilities and the Manual on Uniform Traffic Control Devices.***[16]

Bikeway treatments not explicitly covered by the *MUTCD* are often subject to experiments, interpretations and official rulings by the FHWA. The ***MUTCD Official Rulings*** is a resource that allows website visitors to obtain information about these supplementary materials. Copies of various documents (such as incoming request letters, response letters from the FHWA, progress reports, and final reports) are available on this website.[17]

American Association of State Highway and Transportation Officials (AASHTO) ***Guide for the Development of Bicycle Facilities***, updated in June 2012 provides guidance on dimensions, use, and layout of specific bicycle facilities. The standards and guidelines presented by AASHTO provide basic information, such as minimum sidewalk widths, bicycle lane dimensions, detailed striping requirements and recommended signage and pavement markings.

The National Association of City Transportation Officials' (NACTO) 2012 ***Urban Bikeway Design Guide***[18] is the newest publication of nationally recognized bikeway design standards, and offers guidance on the current state of the practice designs. The NACTO *Urban Bikeway Design Guide* is based on current practices in the best cycling cities in the world. The intent of the guide is to offer substantive guidance for cities seeking to improve bicycle transportation in places where competing demands for the use of the right of way present unique challenges. All of the NACTO *Urban Bikeway Design Guide* treatments are in use internationally and in many cities around the US.

Meeting the requirements of the Americans with Disabilities Act (ADA) is an important part of any bicycle and pedestrian facility project. The United States Access Board's proposed ***Public Rights-of-Way Accessibility Guidelines***[19] (PROWAG) and the ***2010 ADA Standards for Accessible Design***[20] (2010 Standards) contain standards and guidance for the construction of accessible facilities. This includes requirements for development of accessible shared use pathways.
Some of the treatments that follow are not directly referenced in the current versions of the AASHTO Guide or the MUTCD, although many of the elements of these treatments are found within these documents. In all cases, engineering judgment is recommended to ensure that the application makes sense for the context of each treatment, given the many complexities of urban streets.

16 FHWA, *Bicycle Facilities and the Manual on Uniform Traffic Control Devices*. 2011 *http://www.fhwa.dot.gov/environment/bikeped/mutcd_bike.htm*
17 FHWA, *MUTCD Official Rulings. http://mutcd.fhwa.dot.gov/orsearch.asp*
18 NACTO, *Urban Bikeway Design Guide*. 2012
19 United States Access Board, *Public Rights-of-Way Accessibility Guidelines*. 1999
20 United States Department of Justice, *2010 ADA Standards for Accessible Design*. 2010

ADDITIONAL LITERATURE

In addition to the previously described national standards, the basic bicycle and pedestrian design principals outlined in this chapter are derived from the documents listed below. Many of these documents are available online and provide a wealth of public information and resources.

ADDITIONAL US FEDERAL GUIDELINES

- FHWA Separated Bike Lane Planning and Design Guide. 2015 http://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/separated_bikelane_pdg/
- AASHTO, *AASHTO Policy on Geometric Design of Streets and Highways*. 2001 www.transportation.org
- United States Access Board, *Public Rights-of-Way Accessibility Guidelines (PROWAG)*. 2007 http://www.access-board.gov/PROWAC/alterations/guide.htm
- United States Department of Justice, *2010 ADA Standards for Accessible Design*. 2010 http://www.ada.gov/2010ADAstandards_index.htm

BEST PRACTICE DOCUMENTS

- Alta Planning + Design and the Initiative for Bicycle & Pedestrian Innovation (IBPI), *Fundamentals of Bicycle Boulevard Planning & Design*. 2009 *http://www.ibpi.usp.pdx.edu/media/BicycleBoulevardGuidebook.pdf*
- Alta Planning + Design, *Cycle Tracks: Lessons Learned*. 2009 *http://www.altaplanning.com/App_Content/files/pres_stud_docs/Cycle%20Track%20lessons%20learned.pdf*
- Association of Pedestrian and Bicycle Professionals (APBP), *Bicycle Parking Design Guidelines, 2nd Edition*. 2010
- City of Portland Bureau of Transportation, *Portland Bicycle Master Plan for 2030*. 2010 h*ttp://www.portlandonline.com/transportation/index.cfm?c=44597*
- FHWA, *BIKESAFE: Bicycle Countermeasure Selection System*. 2005 *http://www.bicyclinginfo.org/bikesafe/index.cfm*
- FHWA, *Report HRT-04-100, Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations*. 2005 *http://www.fhwa.dot.gov/publications/research/safety/04100/*
- FHWA, *Designing Sidewalks and Trails for Access*. 2001 *http://www.fhwa.dot.gov/environment/sidewalk2/contents.htm*
- King, Michael, for the Pedestrian and Bicycle Information Center, *Bicycle Facility Selection: A Comparison of Approaches*. 2002 *http://www.hsrc.unc.edu/pdf/2002/BicycleFacilitySelectionMKingetal2002.pdf*
- Oregon Department of Transportation, *Oregon Bicycle and Pedestrian Design Guide*. 2012 *http://www.oregon.gov/ODOT/HWY/BIKEPED/planproc.shtml*

APPENDIX B

CATALYST PROJECTS

OPINION OF PROBABLE COST

OPINION OF PROBABLE CONSTRUCTION COST

Project Title:	**Catalyst Project A**	Project No.:	**4687-02**
Location:	**Elmwood Ave Cycle Track**	Original Date:	**04/13/15**
Owner:	**City of Buffalo**	Revised Date:	**06/12/15**
Estimated by:	**rjf**	Page:	1 of 11
Checked/Approved By:	**MVM**		

BID ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE (M & L) incl. O&P	ESTIMATED AMOUNT
	8,300 ft				
1.0	**3 Lane w/ one-way Cycletracks on each side**				
1.1	Roadway De-Striping (5 lane, 2 solid, 4 dashed)	33,200	lf	$ 0.50	$ 16,600.00
1.2	Roadway Striping (6 solid, 2 dashed)	58,100	lf	$ 0.80	$ 46,480.00
1.3	Roadway Cross-Hatching (2.67-4"cross hatch/lf)	22,166	lf	$ 1.30	$ 28,815.80
1.4	Roadway Symbols (Bike Lane, Sharrows, Turn Arrows, Etc.)	64	ea.	$ 170.00	$ 10,880.00
1.5	Signage	48	ea.	$ 400.00	$ 19,200.00
	Subtotal:				**$ 121,975.80**
1.6	Bollards (to be incorporated when roadway is re-built)	415	ea.	$ 150.00	$ 62,250.00
				SUBTOTAL	**$ 121,975.80**
				10% Contingency	**$ 12,197.58**
				8% Bonds, Gen.Reqrmnts	**$ 9,758.06**
				15% Design Fees	**$ 21,589.72**
				TOTAL	**$ 165,530.00**

OPINION OF PROBABLE CONSTRUCTION COST

Project Title: **Catalyst Project B**
Location: **Parkridge Ave Neighborhood Bikeway**
Owner: **City of Buffalo**
Estimated by: **rjf**
Checked/Approved By: **MVM**

Project No.: **4687-02**
Original Date: **04/13/15**
Revised Date: **06/12/15**
Page: 2 of 11

BID ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE (M & L) incl. O&P	ESTIMATED AMOUNT
	5,670 ft				
1.0	**1 Lane one-way w/ parking on East side**				
1.1	Roadway De-Striping (not striped)		lf	$ 0.50	$ -
1.2	Roadway Striping (2 solid)	11,340	lf	$ 0.80	$ 9,072.00
1.3	Roadway Cross-Hatching (1.02 - 3' cross hatch/lf)	570	lf	$ 1.30	$ 741.00
1.4	Roadway Symbols (Bike Lane, Sharrows, Turn Arrows, Etc.)	52	ea.	$ 170.00	$ 8,840.00
1.5	Signage	52	ea.	$ 400.00	$ 20,800.00
1.6	* Add Bicycle Signalization on existing controller	2	ea.	$ 7,000.00	$ 14,000.00
	Subtotal:				**$ 53,453.00**
	Assumption:				
*	Existing cabinet, equipment, and controller can accommodate new additional bicycle displays				
			SUBTOTAL		**$ 53,453.00**
			10% Contingency		**$ 5,345.30**
			8% Bonds, Gen.Reqrmnts		**$ 4,276.24**
			15% Design Fees		**$ 9,461.18**
			TOTAL		**$ 72,540.00**

OPINION OF PROBABLE CONSTRUCTION COST

Project Title: **Catalyst Project C**
Location: **Kensington & Fillmore Intersection**
Owner: **City of Buffalo**
Estimated by: **rjf**
Checked/Approved By: **MVM**

Project No.: **4687-02**
Original Date: **04/13/15**
Revised Date: **06/12/15**

BID ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE (M & L) incl. O&P	ESTIMATED AMOUNT
	300 ft				
1.0	**Intersection Improvements**				
1.1	Roadway De-Striping (14 solid, 5 dashed)	2,475	lf	$ 0.50	$ 1,237.50
1.2	Roadway Striping (15 solid, 3 dashed)	2,475	lf	$ 0.80	$ 1,980.00
1.3	Roadway Cross-Hatching (1.34-4"cross hatch/lf)	100	lf	$ 1.30	$ 130.00
1.4	Roadway Symbols (Bike Lane, Sharrows, Turn Arrows, Etc.)	24	ea.	$ 170.00	$ 4,080.00
1.5	Signage	12	ea.	$ 400.00	$ 4,800.00
1.6	Crosswalk Striping	3,600	lf	$ 1.30	$ 4,680.00
1.7	Surface Treatment for Pavements, Type 2 Traffic Grade (Green)	900	sf	$ 4.00	$ 3,600.00
1.8					
	Subtotal:				**$ 20,507.50**
2.0	**Pedestrian Safe Zones**				
2.1	**Curbed Islands**				
	General Demolition	528	sf	$ 5.00	$ 2,640.00
	New Curbline - Granite	144	lf	$ 40.00	$ 5,760.00
	Concrete Sidewalk - 6" depth	456	sf	$ 38.50	$ 17,556.00
	Subtotal:				**$ 25,956.00**
			SUBTOTAL		**$ 46,463.50**
			10% Contingency		**$ 4,646.35**
			8% Bonds, Gen.Reqrmnts		**$ 3,717.08**
			15% Design Fees		**$ 8,224.04**
			TOTAL		**$ 63,060.00**

OPINION OF PROBABLE CONSTRUCTION COST

Project Title:	**Catalyst Project D**	Project No.:	**4687-02**
Location:	**Delevan Ave Cycle Track**	Original Date:	**04/13/15**
Owner:	**City of Buffalo**	Revised Date:	**06/12/15**
Estimated by:	**rjf**	Page:	4 of 11
Checked/Approved By:	**MVM**		

BID ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE (M & L) incl. O&P	ESTIMATED AMOUNT
	2,700 ft				
1.0	**2 Lane w/ two-way Cycletrack on one side**				
1.1	Roadway De-Striping (2 lane, 2 solid)	5,400	lf	$ 0.50	$ 2,700.00
1.2	Roadway Striping (4 solid, 1 dashed)	12,150	lf	$ 0.80	$ 9,720.00
1.3	Roadway Cross-Hatching (1.34-4"cross hatch/lf)	3,618	lf	$ 1.30	$ 4,703.40
1.4	Roadway Symbols (Bike Lane, Sharrows, Turn Arrows, Etc.)	20	ea.	$ 170.00	$ 3,400.00
1.5	Signage	15	ea.	$ 400.00	$ 6,000.00
1.6	Bollards (20' O.C.)	135	ea.	$ 150.00	$ 20,250.00
1.7	* Add Bicycle Signalization on existing controller	2	ea.	$ 7,000.00	$ 14,000.00
	Subtotal:				**$ 60,773.40**
2.0	**Delevan -Delaware Intersection Improvements**				
2.1	**Curbline extension to intersection**				
	General Demolition	1,200	sf	$ 5.00	$ 6,000.00
	New Curbline	180	lf	$ 40.00	$ 7,200.00
	Topsoil, Seed and Mulch	900	sf	$ 22.95	$ 20,655.00
2.2	Striping 150' beyond intersection (6 solid, 8 dashed)	1,500	lf	$ 0.80	$ 1,200.00
2.3	Roadway Symbols (Bike Lane, Sharrows, Turn Arrows, Etc.)	13	ea	$ 300.00	$ 3,900.00
2.4	Crosswalk Striping	782	lf	$ 1.30	$ 1,016.60
2.5	Green Epoxy paint for directional location of cyclist	900	sf	$ 4.00	$ 3,600.00
	Subtotal:				**$ 43,571.60**
	Assumption:				
*	Existing cabinet, equipment, and controller can accommodate new additional bicycle displays				
			SUBTOTAL		**$ 104,345.00**
			10% Contingency		**$ 10,434.50**
			8% Bonds, Gen.Reqrmnts		**$ 8,347.60**
			15% Design Fees		**$ 18,469.07**
			TOTAL		**$ 141,600.00**

OPINION OF PROBABLE CONSTRUCTION COST

Project Title: **Catalyst Project E**
Location: **Main St Cycle Track**
Owner: **City of Buffalo**
Estimated by: **rjf**
Checked/Approved By: **MVM**

Project No.: **4687-02**
Original Date: **04/13/15**
Revised Date: **06/12/15**
Page: 5 of 11

BID ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE (M & L) incl. O&P	ESTIMATED AMOUNT
	12,730 ft				
1.0	**3 Lane w/ two-way Cycletrack on West side**				
1.1	Roadway De-Striping (4 solid, 2 dashed)	63,650	lf	$ 0.50	$ 31,825.00
1.2	Roadway Striping (5 solid, 3 dashed)	82,745	lf	$ 0.80	$ 66,196.00
1.3	Roadway Cross-Hatching (2.67-4"cross hatch/lf)	17,058	lf	$ 1.30	$ 22,175.40
1.4	Roadway Symbols (Bike Lane, Sharrows, Turn Arrows, Etc.)	112	ea.	$ 170.00	$ 19,040.00
1.5	Signage	112	ea.	$ 400.00	$ 44,800.00
1.6	Bollards (20' O.C.)	640	ea.	$ 150.00	$ 96,000.00
1.7	* Add Bicycle Signalization on existing controller	16	ea.	$ 7,000.00	$ 112,000.00
	Subtotal:				**$ 392,036.40**
2.0	**Mill and Overlay Cycle Track**				
2.1	**12' wide Cycle Track + 4' Wide Buffer**				
	Mill 1.5" depth	22,631	sy	$ 4.00	$ 90,524.00
	Overlay 1.5" Top Course	1,952	ton	$ 92.50	$ 180,560.00
	38 Cross Street painted w/ Green Epoxy (36' avg length)	16,416	sf	$ 4.00	$ 65,664.00
	Subtotal:				**$ 336,748.00**
	Assumption:				
*	Existing cabinet, equipment, and controller can accommodate new additional bicycle displays				
			SUBTOTAL		$ 728,784.40
			10% Contingency		$ 72,878.44
			8% Bonds, Gen.Reqrmnts		$ 58,302.75
			15% Design Fees		$ 128,994.84
			TOTAL		$ 988,970.00

OPINION OF PROBABLE CONSTRUCTION COST

Project Title:	**Catalyst Project F**	Project No.:	**4687-02**
Location:	**Virginia St One-Way Conversion**	Original Date:	**04/13/15**
Owner:	**City of Buffalo**	Revised Date:	**06/12/15**
Estimated by:	**rjf**	Page:	6 of 11
Checked/Approved By:	**MVM**		

BID ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE (M & L) incl. O&P	ESTIMATED AMOUNT
	1,700 ft				
1.0	**1 Lane w/ Parking both sides**				
1.1	Roadway Striping (5 solid)	8,500	lf	$ 0.80	$ 6,800.00
1.2	Parking Striping (60spaces)	600	lf	$ 1.30	$ 780.00
1.3	Contra-flow Green Epoxy Paint	8,500	sf	$ 4.00	$ 34,000.00
1.4	Roadway Symbols (Bike Lane, Sharrows, Turn Arrows, Etc.)	36	ea.	$ 170.00	$ 6,120.00
1.5	Signage	36	ea.	$ 400.00	$ 14,400.00
1.6	* Add Bicycle Signalization on existing controller	3	ea.	$ 7,000.00	$ 21,000.00
	Subtotal:				**$ 83,100.00**
	Assumption:				
	No existing striping				
	Additional signage to convert 2-way street to 1-way street				
*	Existing cabinet, equipment, and controller can accommodate new additional bicycle displays				
			SUBTOTAL		$ 83,100.00
			10% Contingency		$ 8,310.00
			8% Bonds, Gen.Reqrmnts		$ 6,648.00
			15% Design Fees		$ 14,708.70
			TOTAL		$ 112,770.00

OPINION OF PROBABLE CONSTRUCTION COST

Project Title: **Catalyst Project G**
Location: **Utica St Neighborhood Bikeway**
Owner: **City of Buffalo**
Estimated by: **rjf**
Checked/Approved By: **MVM**

Project No.: **4687-02**
Original Date: **04/13/15**
Revised Date: **06/12/15**

BID ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE (M & L) incl. O&P	ESTIMATED AMOUNT
	13,810 ft total (Linwood -Michigan = 1,535 lf)				
1.0	**2 Lane share the road w/ parking on North side**				
1.1	Roadway Symbols (Bike Lane, Sharrows, Turn Arrows, Etc.)	56	ea.	$ 170.00	$ 9,520.00
1.2	Signage	56	ea.	$ 400.00	$ 22,400.00
1.3	Traffic Calming Element	5	ea.	$ 20,000.00	$ 100,000.00
1.4					
1.5					
	Subtotal:				**$ 131,920.00**
	Linwood -Michigan = 1,535 lf				
2.0	**2 Lane w/ dedicated Bike Lane and parking on North side**				
2.1	Roadway Striping (3 solid)	4,605	lf	$ 0.80	$ 3,684.00
2.2	Roadway Symbols (Bike Lane, Turn Arrows, Etc.)	12	ea.	$ 170.00	$ 2,040.00
2.3	Signage	9	ea.	$ 400.00	$ 3,600.00
2.4					
2.5					
	Subtotal:				**$ 9,324.00**
			SUBTOTAL		**$ 141,244.00**
			10% Contingency		**$ 14,124.40**
			8% Bonds, Gen.Reqrmnts		**$ 11,299.52**
			15% Design Fees		**$ 25,000.19**
			TOTAL		**$ 191,670.00**

OPINION OF PROBABLE CONSTRUCTION COST

Project Title: **Catalyst Project H**
Location: **Niagara St Cycle Track**
Owner: **City of Buffalo**
Estimated by: **rjf**
Checked/Approved By: **MVM**

Project No.: **4687-02**
Original Date: **04/13/15**
Revised Date: **06/12/15**

BID ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE (M & L) incl. O&P	ESTIMATED AMOUNT
	3,410 ft				
1.0	**3 Lane w/ two-way Cycletrack on one side**				
1.1	Roadway De-Striping (4 lane, 2 solid 2 dashed)	10,230	lf	$ 0.50	$ 5,115.00
1.2	Roadway Striping (4 solid, 3 dashed)	18,755	lf	$ 0.80	$ 15,004.00
1.3	Parking Striping (70spaces)	680	lf	$ 1.30	$ 884.00
1.4	Roadway Symbols (Bike Lane, Sharrows, Turn Arrows, Etc.)	28	ea.	$ 170.00	$ 4,760.00
1.5	Signage	21	ea.	$ 400.00	$ 8,400.00
1.6	* Add Bicycle Signalization on existing controller	3	ea.	$ 7,000.00	$ 21,000.00
	Subtotal:				**$ 55,163.00**
2.0	**Raised Median Buffer**				
2.1	**4' wide raised curb buffer area**				
	Sawcut existing roadway	6,850	lf	$ 4.00	$ 27,400.00
	General Demolition	1,550	sf	$ 5.00	$ 7,750.00
	New Curbline	6,850	lf	$ 40.00	$ 274,000.00
	Sidewalk Concrete (4" thick)	43	cy	$ 38.50	$ 1,655.50
	Pocket Green Space (trees & shrubs, Topsoil, seed and mulch)	100	ea	$ 750.00	$ 75,000.00
	Subtotal:				**$ 385,805.50**
	Assumption:				
*	Existing cabinet, equipment, and controller can accommodate new additional bicycle displays				
			SUBTOTAL		**$ 440,968.50**
			10% Contingency		**$ 44,096.85**
			8% Bonds, Gen.Reqrmnts		**$ 35,277.48**
			15% Design Fees		**$ 78,051.42**
			TOTAL		**$ 598,400.00**

OPINION OF PROBABLE CONSTRUCTION COST

Project Title: **Catalyst Project I**
Location: **Jefferson Ave SLM's**
Owner: **City of Buffalo**
Estimated by: **rjf**
Checked/Approved By: **MVM**

Project No.: **4687-02**
Original Date: **04/13/15**
Revised Date: **06/12/15**
Page: 9 of 11

BID ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE (M & L) incl. O&P	ESTIMATED AMOUNT
	10,000 ft				
1.0	**Option #1 - Enhanced SLM (white w/ dashed)**				
1.1	100' O.C.	100	ea	$ 300.00	$ 30,000.00
2.0	**Option #2 - Enhanced SLM (Green Back Sharrows)**				
2.1	100' O.C.	100	ea	$ 500.00	$ 50,000.00
3.0	**Long Term Option - 2 Lane w/ parking on one side**				
3.1	Roadway De-Striping (2 solid, 2 dashed)	30,000	lf	$ 0.50	$ 15,000.00
3.2	Roadway Striping (5 solid)	50,000	lf	$ 0.80	$ 40,000.00
3.3	Roadway Symbols (Bike Lane, Sharrows, Turn Arrows, Etc.)	100	ea.	$ 170.00	$ 17,000.00
3.4	Signage	50	ea.	$ 400.00	$ 20,000.00
3.5					
	Subtotal:				**$ 92,000.00**
			SUBTOTAL		**$ 92,000.00**
			10% Contingency		**$ 9,200.00**
			8% Bonds, Gen.Reqrmnts		**$ 7,360.00**
			15% Design Fees		**$ 16,284.00**
			TOTAL		**$ 124,850.00**

OPINION OF PROBABLE CONSTRUCTION COST

Project Title: **Catalyst Project J**
Location: **Broadway 5-Point Intersection**
Owner: **City of Buffalo**
Estimated by: **rjf**
Checked/Approved By: **MVM**

Project No.: **4687-02**
Original Date: **04/13/15**
Revised Date: **06/12/15**
Page: 10 of 11

BID ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE (M & L) incl. O&P	ESTIMATED AMOUNT
	430 ft				
1.0	**Intersection Improvements**				
1.1	Roadway De-Striping (4 solid, 4 dashed)	2,580	lf	$ 0.50	$ 1,290.00
1.2	Roadway Striping (9 solid, 4 dashed)	4,730	lf	$ 0.80	$ 3,784.00
1.3	Parking Striping (8spaces)	100	lf	$ 1.30	$ 130.00
1.4	Roadway Symbols (Bike Lane, Sharrows, Turn Arrows, Etc.)	33	ea.	$ 170.00	$ 5,610.00
1.5	Signage	21	ea.	$ 400.00	$ 8,400.00
1.6	Crosswalk Striping	3,000	lf	$ 1.30	$ 3,900.00
1.7	Green Epoxy Paint for Bike Crossways	3,800	sf	$ 4.00	$ 15,200.00
	Subtotal:				**$ 38,314.00**
2.0	**Pedestrian Safe Zones**				
2.1	**Curbed Islands**				
	General Demolition	1,625	sf	$ 5.00	$ 8,125.00
	New Curbline	165	lf	$ 40.00	$ 6,600.00
	Concrete Sidewalk	1,100	sf	$ 38.50	$ 42,350.00
	Topsoil, Seed and Mulch	350	sf	$ 22.95	$ 8,032.50
	Subtotal:				**$ 103,421.50**
	Assumptions:				
	Improvements on Broadway and William				
			SUBTOTAL		**$ 141,735.50**
			10% Contingency		**$ 14,173.55**
			8% Bonds, Gen.Reqrmnts		**$ 11,338.84**
			15% Design Fees		**$ 25,087.18**
			TOTAL		**$ 192,340.00**

OPINION OF PROBABLE CONSTRUCTION COST

Project Title: **Catalyst Project K**
Location: **Church St Cycle Track**
Owner: **City of Buffalo**
Estimated by: **rjf**
Checked/Approved By: **MVM**

Project No.: **4687-02**
Original Date: **04/13/15**
Revised Date: **06/12/15**

BID ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE (M & L) incl. O&P	ESTIMATED AMOUNT
	1,300 ft + N/S Division St 1,730 ft				
1.0	**Church Street - 4 lane w/ one-way Cycletrack on each side**				
1.1	Roadway De-Striping (5 dashed)	3,250	lf	$ 0.50	$ 1,625.00
1.2	Roadway Striping (4 solid, 2 dashed)	6,500	lf	$ 0.80	$ 5,200.00
1.3	Roadway Cross-Hatching (3.6-5'cross hatch/lf)	4,680	lf	$ 1.30	$ 6,084.00
1.4	Roadway Symbols (Bike Lane, Sharrows, Turn Arrows, Etc.)	16	ea.	$ 170.00	$ 2,720.00
1.5	Signage	16	ea.	$ 400.00	$ 6,400.00
1.6	Bollards (20' O.C.)	65	ea.	$ 150.00	$ 9,750.00
	Subtotal:				
					$ 31,779.00
2.0	**North and South Division Street - 3 lane w/ one-way Cycletrack on each side**				
2.1	Roadway De-Striping (6 dashed)	5,190	lf	$ 0.50	$ 2,595.00
2.2	Roadway Striping (4 solid, 4 dashed)	10,380	lf	$ 0.80	$ 8,304.00
2.3	Roadway Cross-Hatching (3.6-5' cross hatch/lf)	6,230	lf	$ 1.30	$ 8,099.00
2.4	Roadway Symbols (Bike Lane, Sharrows, Turn Arrows, Etc.)	24	ea.	$ 170.00	$ 4,080.00
2.5	Signage	12	ea.	$ 400.00	$ 4,800.00
2.6	Bollards (20' O.C.)	87	ea.	$ 150.00	$ 13,050.00
	Subtotal:				**$ 40,928.00**
			SUBTOTAL		**$ 72,707.00**
			10% Contingency		**$ 7,270.70**
			8% Bonds, Gen.Reqrmnts		**$ 5,816.56**
			15% Design Fees		**$ 12,869.14**
			TOTAL		**$ 98,670.00**

APPENDIX C

PUBLIC INVOLVEMENT SURVEY

Buffalo Bike Path
Planning Comment Form
July 29, 2014

Data prepared by Insight International USA, LLC

Q1: Name and contact info

Adrienne Boudreau, 907-0504

Al, 716-316-4049

Allen Burger Venture (ABV)

Angela Keppel

austinrossanders@gmail.com

Bernice Radle, berniceradle@gmail.com

Bob Drajem, 854-8170

Brenda Fischer, brendafischer99@yahoo.com

Chip Grieco, cgrieco@jaeckle.com, 843-3844

Chris Hawley, chrishawley716@gmail.com

Chris Miller

Dan Cadzow, cadzow@buffalo.edu

Dave Henning, davehenning81@gmail.com

David Wahl, davidwahl@verizon.net

Dwight King, dwight.king@roadrunner.com

Elizabeth Giles

Erik Eggleston, erik.b.eggleston@gmail.com

Gala Bistulfi, 716-361-1653

Gary Witulski, 851-4272

Geoff Schutte, geoffschutte@gmail.com

Holly Hutchinson, hhutchinson2@gmail.com

Jamie Hamann-Burney

Jane Peterson

Jane Zaremski

John Michael Mulderig

Joseph Greco Trapp, jgrecotrapp@gmail.com

Kathy Burmarker

Katie O'Sullivan, katosulliv@gmail.com

Ken Rogers

Krista Hanypsiak

Leslie Duggleby, today_goodlife@hotmail.com

Lynn Magdol

Lynn Marinelli

Lynn Meslinsky, Lynn.Meslinksy@gmail.com

MaryAnne Connell

Mike Galliban

Nate Attard

Philip L. Haberstard

Ray Reichcut

Rob Leteste, rleteste@buffalo.edu

Ryan Kucinski, 716-908-3099,

ryan.e.kucinski@gmail.com

Seth Amman

Timothy Staszak

Travis Norton

Q2: Which zip code do you live in?

Zip Code Occurrence:

1 - 14004
1 - 14051
1 - 14075
1 - 14086
7 - 14201
3 - 14202
1 - 14203
1 - 14207
1 - 14208
2 - 14209
1 - 14210
6 - 14213
5 - 14214
2 - 14217
2 - 14220
1 - 14221
14 - 14222
1 - 14223
1 - 14226
1 - 14228
1 - No Answer

Q3: What is your gender and your age?

Male:

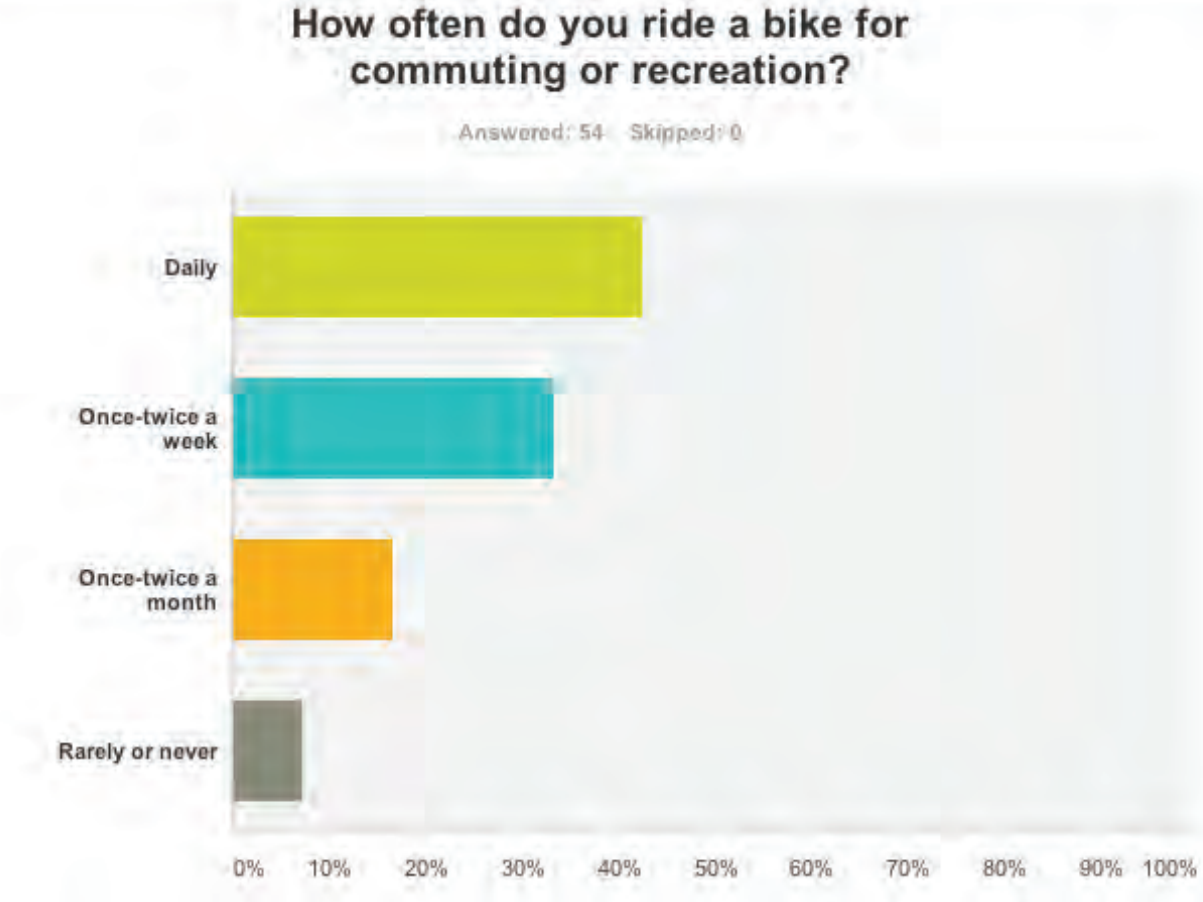
Male, N/A
Male, 23
Male, 24
Male, 24
Male, 25
Male, 25
Male, 26
Male, 27
Male, 27
Male, 27
Male, 27
Male, 27
Male, 29
Male, 30
Male, 31
Male, 32
Male, 32
Male, 33
Male, 36
Male, 39
Male, 40
Male, 40
Male, 46
Male, 47
Male, 48
Male, 50
Male, 52
Male, 61
Male, 62
Male, 64
Male, 69
Male, 72

Female:

Female, 23
Female, 25
Female, 27
Female, 28
Female, 29
Female, 31
Female, 36
Female, 36
Female, 44
Female, 49
Female, 50
Female, 51
Female, 52
Female, 53
Female, 55
Female, 56
Female, 57
Female, 59
Female, 60
Female, 68

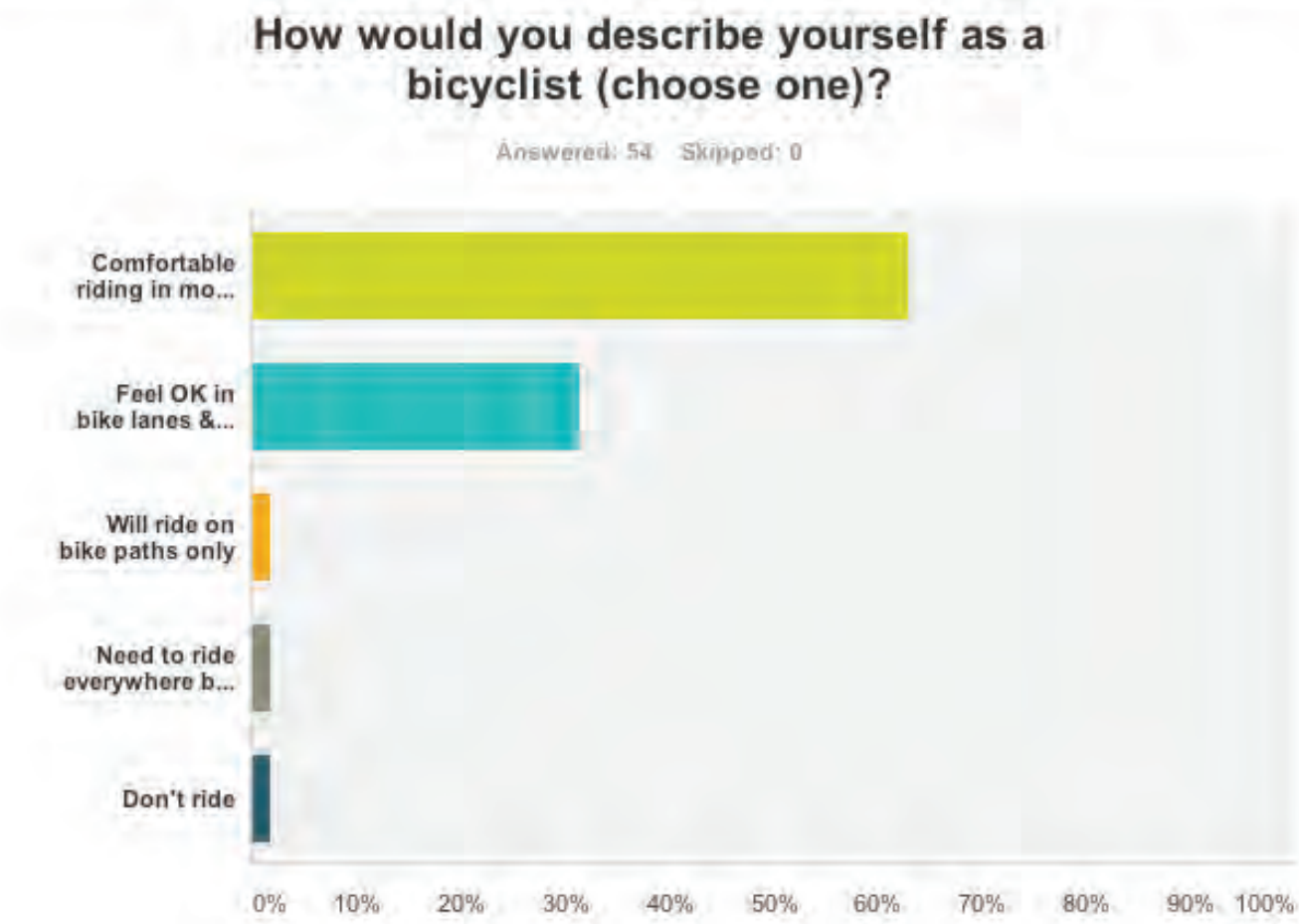
2 Did not answer

Q4: How often do you ride a bike for commuting or recreation?



Answer Choices	Responses	
Daily	42.59%	23
Once-twice a week	33.33%	18
Once-twice a month	16.67%	9
Rarely or never	7.41%	4
Total		54

Q5: How would you describe yourself as a bicyclist (choose one)?

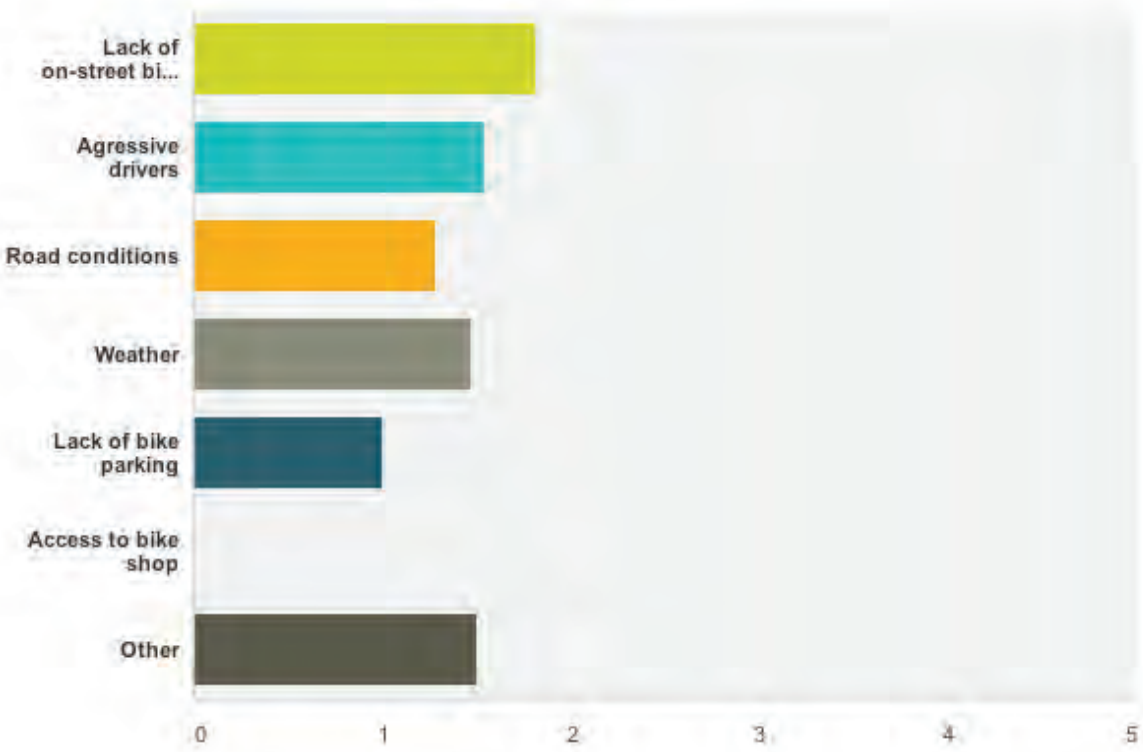


Answer Choices	Responses	
Comfortable riding in most traffic conditions	62.96%	34
Feel OK in bike lanes & quieter streets	31.48%	17
Will ride on bike paths only	1.85%	1
Need to ride everywhere but don't like it	1.85%	1
Don't ride	1.85%	1
Total		54

Q6: In your opinion, what are the #1 and #2 most significant barriers to bicycling in Buffalo?

In your opinion, what are the #1 and #2 most significant barriers to bicycling in Buffalo?

Answered: 54 Skipped: 0



	1	2	Total	Average Ranking
Lack of on-street bike facilities	82.14% 23	17.86% 5	28	1.82
Agressive drivers	53.57% 15	46.43% 13	28	1.54
Road conditions	28.00% 7	72.00% 18	25	1.28
Weather	46.67% 7	53.33% 8	15	1.47
Lack of bike parking	0.00% 0	100.00% 8	8	1.00
Access to bike shop	0.00% 0	0.00% 0	0	0.00
Other	50.00% 2	50.00% 2	4	1.50

What are the three most important streets or intersections in need of improvement for bicyclists?

198 and Scajaquada
Access to Outer Harbor
All major spoke streets (Niagara, Clinton, Genesee, etc)
Allen
Allen & Elmwood
Allen St
Allen St
Allen Street
Amherst
Amherst & Elmwood
Amherst St and Colvin
Amherst St/Parkside Ave
Amherst Street
Anything east end
Anything on east side - Broadway, Clinton, William
Areas around poorer communities
Around Niagara Sq. and other traffic circles
Bailey
Bailey
Bailey Ave
Bike lane on Elmwood
Broadway
Broadway, Court Street
Chippewa St
Colvin Blvd
Connecting rowing club/boat house path to Broderick Park
Delaware (east west conenction) very wide road, train stop at end
Delaware (north of North St)
Delaware & Summer
Delaware and other cross streets
Delaware Ave
Delaware Ave
Delaware Ave
Delaware Ave (198 to Kenmore)
Delaware Ave (north of existing lanes)
Delaware Ave especially that intersection with Forest near the park
Delaware Ave near 198
Delaware Ave.
Delaware Ave. and Amherst St
Delaware x Delevan
Delevan
Delevan Ave
Delevan Ave
Delevan Ave
Delevan Ave between Main and Linwood
Delevan Ave. and everywhere
Division Streets
Ellicott or Washington
Elmwood (North of Iroquois)
Elmwood & lots of streets (Summer, Bryant, North, etc)
Elmwood Ave
Elmwood Ave
Elmwood Ave - past 198 heading north
Elmwood Ave (most of it)
Elmwood Ave and Forest
Elmwood Ave at 198 Bridge
Elmwood Ave.
Elmwood near Allen
Elmwood/Chippewa
Entire waterfront
Entrances and connections to park bike paths via streets
Ferry Ave corridor - all east to west with sharrows
Filmore Ave
Filmore/Main -> Amherst/Main
Fireman's Park area
Gates Circle
Hertel
Hertel Ave
Hopkins St
Humboldt Pkwy
Inner to Outer Harbor connection
Intersection of South Park & Bailey & Abbott Rd
Kensington

What are the three most important streets or intersections in need of improvement for bicyclists?

Lasalle Park Ring especially near soccer fields
Main & Delevan
Main & Ferry
Main & Filmore
Main St
Main St
Main St
Main St
Main St north of Goodell
Main St north to south
Main St.
Main St. and North St. (Access to Medical Campus)
Main Street
Main Street
Main Street
Main Street
Main Street
Main Street
Main Street
Main Street (so much potential)
Main Street Amherst street to city line
Main Street and most cross streets
Main Street between downtown and UB South
Main Street from Downtown
Main Street is critical north-south corridor (from UB South to downtown) that needs to be accessible/safe for cyclists, not just for cars
Main Street, Bailey Ave
Massachusetts Ave - connect West side to water/Lake Erie
Michigan
Neighborhood bike corridors - Niagara St to Elmwood to East
Niagara Circle
Niagara Square
Niagara St
Niagara St
Niagara Street
Ohio
Ohio
Ongoing maintenance at Riverwalk Bike Path
Park to park to park
Parkside & Linden
Peace Bridge
Pearl/Goodell/ Edward
Portions of Starin Ave, etc
Richmond between Forest and Lafayette
Riverwalk
Route 5 attach further bike bridge
South Elmwood & Niagara - Lanes don't line up -> free for all
South Park
Tifft St.
Tifft St. Bridge to McKinley Parkway
West downtown/Allentown/Elmwood
While Ohio Street is under construction-have contractor sweep up stones and gravel as much as possible so people can connect inner and outer harbor

Do you have any other general comments for the planning team?

Bicycle rental, bike share with station hubs

Build on existing work of city planning staff, including identification of potential class II and class III bicycle facilities (see attached). Seattle bicycle master plan is the gold standard--beautiful and useful document. Help us take it to the next level -- Buffalo is ready for cycle tracks. Review the green code/bike paring/thoroughfare design standards. Nacto urban bikeway design guide will be incorporated by reference. -Identify bike corral potential locations, including on street -Attached map shows (solid line) and potential (dotted line) bicycle facilities, as determined by city office of strategic planning -YES! to the "Minimum Grid" -Sharrows are nice but only barely better than useless -- they aren't really bicycle facilities and do not improve the safety and comfort of cyclists. At best they raise "awareness"

One major barrier to many potential riders is that we live in a relatively violent city. Traffic is bad enough - but it's a shame to hear about the recent assaults in and around the Elmwood village. If the city can't protect it's flagship neighborhood, what hope does the rest of the city have. A friend of mine was lunged at by an individual attempting to punch him off of his bike while he was riding on Richmond Ave. He reported the incident to a Buffalo police officer a couple blocks away, but the office did not act on the information since my friend wasn't sure if he wanted to officially press charges. Bike safety is mostly about road design, traffic flow, etc. but our streets need to also be with far less crime. Bikes are also stolen constantly. A decoy bike program would be nice.

1. Connect to Southtowns - maybe through Old Steel Plant 2. Signage on South of the City 3. Bike rentals downtown and on waterfront 4. Comprehensive bike lane/path map 5. Protest use of retread in paving material which leaves wires in pavement causing many flat tires. My bike repair shop alone has a bucket full of wire removed from flat tires

Need more bicycle racks, especially in parks and cultural attractions/events to encourage individuals, friends or family to attend by bike and stop to recreate, shop, eat, visit and enjoy. Build a Veloway! Austin TX has a 3.1 mile one - only for bicycles and inline skaters!

Cycling education, signage on Linwood about against traffic

When looking at bike paths, we need to take a broader perspective, as greenways

Keeping roads cleared from debris in winter is a big issue and post-winter stone and debris is bad as well, blocks bike lanes and road edges are slippery on a bike due to grit

Do you have any other general comments for the planning team?

Lived for 30+ years in Pacific Northwest (Seattle and Port Townsend, WA) now in Buffalo for 3 years. Enjoying it here. Have to say that when I moved here I was AMAZED at how many people run red lights! It sure would be nice if the Outer (car) lane on Grand Island (River Rd. W?) was open to bicyclists! I think the speed limit is higher in this lane, than the inside lane. Was pulled over by a cop up there this spring. It would be great to ride from downtown - alomg water front and on down - bike lane along Rt 5? Would love to keep going safely LOVE Linwood ContraLane Thank you! As a city, why not have daily or weekly features of a biker or walking commuter? Think I've seen a bicyclist featured on Go-Bike site, maybe in the Buffalo News or on the Blur Cross Billboards. Maybe feature rides for failures (or others) destination rides. Another feature, those that live without a car and how they do it (car share, bicycling, other) I love the idea of going on a long loop ride around the greater Buffalo area- heading north from Downtown up and over to the NE Amherst etc then down and back to town. Safely and on bike friendly lanes/roads. I was nervous when I first started riding in Buffalo. Realize that cyclists need to be hyper-aware of all around them. But Buffalo drivers were like none I'd ever seen! It's not will someone run a red light but how many people. Before moving here, I read about bicycling in Buffalo. I learned about the Go Bike FARMTOUR. Went on my first farmtour in 9/2011 and really enjoyed it. Rode back to town from Ole's Farm with Justin B and a hand full of others. It was a wonderful ride, and it opened my eyes to city riding in Buffalo and greatly contributed to my comfort level of riding here (William St etc) Might not have done that without that introduction by GO Bike.

More bike racks

Really need to look at separated cycle tracks. Many existing bike paths are in need of repair (Riverwalk, Kregal) More bike racks at schools Avoid contra-flow, non-separated lanes (especially on long straight roads like Linwood

Need sheltered racks, need more bike lanes

Improvements to existing bike paths in Buffalo. Protected bikeways!

Bike lane separated from vehicular traffic by parking lane for cars.

Have a pay as you go system like in NYC.

Very much like to see a bike beltway that would be good for commuters & tourists. Utilise rail trails. Need major bike highway on the Eastside. Need a connector between Richmond and Linwood.

There is a controversy between the City and the County about who is responsible for area of the Riverwalk. I have spent two years contacting many politicians only to keep getting the run around.

Do you have any other general comments for the planning team?

-Connect the paths from S. Buffalo to downtown - Major city streets like Main, North, William, Clinton, East Ferry, Bailey -I'm not convinced Delaware is safe -I would love to ride my bike to work from S. Buffalo (east of Seneca St.) to downtown Buffalo, if they were , at minimum, protected bike lanes. I prefer safe bike paths, but would settle for lanes. I would also prefer riding in areas that have trees and cleaner air rather than riding through industrial wastelands with dust and toxic stuff. Maybe a master plan can include partnering with Retree WNY.

Need wider streets for increasing number of motor vehicles as populations are growing and there are more drivers. This is a bad idea because: -Bad weather/poor visibility/potholes! -Aggressive Drivers including biers who run stop signs and red lights -Slick conditions and heavy winds could lead to more accidents -This program deters form Buffalo. I don't like it.

-Make the "beer" way Bicycle/Pedestrian friendly -Use all other rails to trails in Buffalo -Connect to rural suburbs, trails/bike lanes -Set up more incentives -Through employee witness programs for walking, biking and transit to walk

-Need crosstown East/West routes (Clinton, Exchange, Broadway, Ferry) -Need separated/ buffered facilities -Need winter maintenance and plowing -Need all season maintenance (trail and lane sweeping)

-Can we tap into the beltline RR ROW? -Bike paths or bridal paths -Bike paths over lanes where ever possible (pollution and safety) -Encourage everyone (cars, bikes, and pedestrians) to shoe the public infrastructure in a mutually respectful manner -Outdoor maps around the city that depict bike paths/ lanes. Possible a Buffalo bike map app. -Prioritize E-W routes like Ferry St. -Protect bikeways! Allow kids to develop a bike culture.

Any street to provide bike access from North Buffalo through Downtown needs improvement. More bike police. Increases driver awareness of bikes, develops a sense of safety for bikers at night, connects citizens with police in a way that could facilitate better communication of issues and concerns.

Will purchase a bike and ride when more bicycle facilities are implemented. I haven't road a bike in 30 years, but recent bike improvements may encourage me.

Consider putting bike lanes right of parked cars and adding further separation with a median where space is available.

Getting a trail from the outer harbor to woodlawn beach would open up Hamburg and Southtowns.

Do you have any other general comments for the planning team?

As both a cyclist and a pedestrian I have almost been hit by a car 3 times at Delaware and Nottingham. In order to make alternative modes of transportation, a viable lifestyle choice, bikeways must be augmented by public transportation (bus and rail, cable car) connections. The 2 should be planned together to work as a system seeing as most people cannot cycle distances over 3-4 miles.

I would like to see more division (either physically or visually) between cars and bikes (cones or painted bike lanes).

Let me know what I can do!

1. Ongoing maintenance needs to be part of the plan/transition before consultants leave 2. Would like to see the existing infrastructure of the skyway used to house a bike path and walking path over the river, the lower level concrete could be used to develop a double decker bridge 3. Get us involved, tell us how we can help and what we can do now

Keep Corp Engineer bridge open, Develop way for cyclists to easily report road hazard, potholes

-More sharrows -Driver education, I'm tired of being told to get on the sidewalk -Army Corp of Engineer Bridge closed during best biking hours -More signs on bike paths -Biker education- helmets and lights, stay off sidewalks -Lift bridge schedule parted -Encourage businesses to offer free bikes to employee for lunch time errands -Reach out to immigrant community -Incorporate faith communities in encouraging bike use, especially with young and immigrant population

-Share the road campaign -Clear responsibilities for maintenance, upkeep - sweeping of paths and bikeways -Bike only grid -Commuter routes

We need some of the simpler things in Buffalo - like bike racks at rail stations, bike lanes along the sidewalk between parking lanes, etc. Don't overlook the simple stuff - as we're missing a lot of it and it could make life better for a lot of people quick

there are plenty of streets with too many car lanes that could easily accomodate dedicated bike lanes and perhaps have a traffic calming effect. Broadway/Genessee/Sycamore are examples (corridors to the Eastside), Main St, Delaware, Niagara Street, Parkside Ave. It is important that bicycle infrastructure be continuous/consistent not Switch between sharrows, dedicated bike lanes, and nothing, like on Elmwood

Bike paths should be connected to transit and the park systems throughout the city and the city's waterfront and waterways should all be connected and integrated with bike paths. Protected bike lanes should be the norm.

Do you have any other general comments for the planning team?

Bike paths should be connected to transit and the park systems throughout the city and the city's waterfront and waterways should all be connected and integrated with bike paths. Protected bike lanes should be the norm.

Intern at the LADOT Bicycle Program in Spring of 2014, graduated from USC with Masters of Urban Planning and interested in helping/contributing to creation of the Master Plan in any way possible through volunteering/traffic counts/design/etc. -Protected bike lanes (advocate for 8-80 cities) -On street bike facilities to accommodate weather (ie. protected bike lanes for winter) -Buffalo's take on Gil's minimum grid -> also a way to integrate with all the first ring suburbs and create an easy-to-understand way finding system for all users Initial ideas to consider: -radial street network is great opportunity to implement protected bicycle lanes, making them the most important arterials in the bicycle network hierarchy -parklets& bicycle corrals -more events like CicLAvia in Los Angeles -Bike racks on metro trains -Planning/Designing bike lanes (any type) so the bike lane will not be used as snow removal storage -Need bicycle path/trail that connects Niagara Falls past the outer harbor along the water -Policies that will compliment bicycling (ie. LA passed law saying any new development over 10k sq. ft. needs to include shower facilities) -Recommendations for policies like LA's bicycle harassment law -Recommendations for maintenance of bicycle infrastructure costs based on Donald Shoup's ideas about investing parking revenue (can be expanded to other similar forms of revenue) into the streets/ neighborhoods it is collected from

1. Main Street- goes so many great places, connects so many neighborhoods- moderately dangerous between Main & Jefferson and Main & Bailey 2. Off topic- roundabouts/traffic circles - good for traffic (autos) bad for pedestrians 3. Adventure cycling established an across the country route that goes through Buffalo, it would be great to connect Rt 5 to Furman Blvd (from Hamburg) 4. Add sheltered/ secured bike parking at ends of Transit

-It is very important to educate everyone that bikes belong on the roads. I have been "buzzed" and told to get off the road many times by angry aggressive drivers. -Improving waterfront recreational bicycling will help bring people into the city, or to suburbs north & south. -Grand Island Bridges need to work to be bike friendly -Once bike lanes& paths are created they must be maintained (cleaned and patched) -Do we have old railroad tracks from the city out that could be converted to bike paths to encourage cycling mobility? -Nice bike paths along the Niagara River - Niagara Falls area need to be smoothed out where tree roots have caused heaving. Vegetation growth weeds trimming periodically. Could Greenway money be used here? -I have heard that plans exist to make a bike path close to the Lake Erie waterfront from Buffalo to Erie PA, connecting many communities along the way. It would be wonderful to see that done.

Very much like to see a bike beltway that would be good for commuters & tourists. Utilise rail trails. Need major bike highway on the Eastside. Need a connector between Richmond and Linwood.

APPENDIX D

TEXT SURVEY

GObike Buffalo partnered with Grow 716 (a program of the Western New York Environmental Alliance) to engage citizens in identifying streets in the City of Buffalo they think could use bike lanes. To participate, folks simply had to text in and list as many streets as they would like to see be considered. Below are the results.

The most frequently identified streets:
Main St.
Delaware Ave.
Elmwood Ave.
Niagara St.
Hertel Ave.
Allen St.
Summer/Best/Walden
Forest Ave.

Repeated requests:

- Install protected multiuse pathway on Main St
- Install protected bike lanes on Richmond Ave.
- Install infrastructure to connect UB North & South to downtown

Intersections of concern:

- Linwood and North
- Elmwood and Auburn

Street Name Requested	Percentage of Responses
Main St.	17.40%
Delaware Ave	9.70%
Elmwood Ave	5.80%
Niagara St	4.50%
Delavan Ave	4.50%
Hertel Ave	4%
Allen St.	4%
Summer St	4%
Best St.	3.20%
Forest Ave.	3.20%
Clinton St.	3%
Connecticut St.	3%
Colvin Ave.	2%
Walden Ave.	2%
North St.	2%
Ferry St	2%
Bailey Ave	1.30%
Utica St.	1.30%
Michigan Ave	1.30%
Grant St.	1.30%
Wherle Dr	1.30%
William St.	1.30%
Porter Ave	1.30%
Millersport	1.30%
Richmond (Protected Bike Lanes)	1.30%
Huron St	0.70%
Virginia St	0.70%
Pearl St	0.70%
Abbott Rd	0.70%
South Park Ave	0.70%
Electric Ave	0.70%
Lake Ave	0.70%
Goodell St	0.70%
Edward St	0.70%
Church St.	0.70%
South Division	0.70%
Exchange St	0.70%
Starin Ave	0.70%
Harlem Rd	0.70%
LaSalle Ave	0.70%
Sheridan Dr.	0.70%
Kenmoe Ave	0.70%
Tonawanda St.	0.70%
Lafayette Ave.	0.70%

Parkside Ave	0.70%
Nottingham Terrace	0.70%
Jersey St	0.70%
West St	0.70%
Jefferson St	0.70%
Broadway St.	0.70%

Total responses: 155

APPENDIX E

WINTER BIKEWAY MAINTENANCE

PERSPECTIVES IN PLANNING Volume 2, Number 1

Winter Bike Lane Maintenance:

A Review of National and International Best Practices (Updated 2/14)

SUMMARY

This white paper provides collected best practices on winter bikeway maintenance as seen in US cities and around the world. The paper covers snow removal from bikeways, different types of de-icing surface applications and their advantages/disadvantages, and best practices for winter maintenance prioritization and scheduling. The paper also includes a brief discussion on innovative winter maintenance techniques either in use or in development.

Introduction

As bike infrastructure continues to grow in the US, so does the need to maintain these facilities year-round. The regular maintenance of bike infrastructure is especially important in towns and cities with established bicycling networks and significant bicycling populations – if jurisdictions provide bicycle facilities, they can expect that people will use them year round[1].

The winter maintenance of bikeways should be a planned, regular activity in cities and towns that receive significant amounts of snowfall. Bicycles have different winter needs than motor vehicles—for example, less weight and tire surface area means they are more sensitive to snow and ice—and winter roadway maintenance programs should have specialized practices to respond to these needs. However, many cities fail to adequately maintain their bicycling networks in the winter months. This is typically due to inexperience with winter bikeway maintenance, constrained roadway maintenance budgets, and/or inadequate equipment.

Bicyclists on Kinzie Street protected cycle track in Chicago, Illinois, after snow clearing.

This white paper provides collected best practices on winter bikeway maintenance as seen in North American cities and around the world. The paper covers snow removal from bikeways, different types of de-icing surface applications and their advantages/disadvantages, and best practices for winter maintenance prioritization and scheduling. The paper also includes a brief discussion on innovative winter maintenance techniques either in use or in development.

Snow Removal Best Practices

A heavy snowfall will typically require the initial removal of snow from the bikeway to restore the functionality of the facility. A proactive and reactive de-icing program (discussed in the following section) in conjunction with scheduled snow removal is necessary to help maintain good riding conditions along bikeways in the winter. There are many considerations that factor into how to best remove snow from bikeways in the winter.

1. Gin Kilgore, Alta Planning + Design, Co-founder of Chicago Bike Winter

These factors are the bikeway type, the storage of snow on or off the roadway and the presence and type of vertical protection or separation along a bikeway.

Snow Storage and Roadway Design

One of the best ways to facilitate the removal of snow from bikeways is thoughtful roadway design. While in some cases, snow is removed from the roadway and relocated to a storage site (such as a nearby commercial parking lot), most roadway maintenance programs plow snow off the main portion of the road to the shoulder if one exists, as close to the roadway edge as possible or along a sidewalk buffer if one exists. Unfortunately, with roadways that include typical, unprotected bike lanes at the edge of the roadway, the bike lane often becomes the area for snow storage on the roadway. This practice leaves bicyclists either trying to share the vehicular lane or riding to the edge of the roadway while trying to avoid piled-up snow and stay clear of the vehicular path – both are unsafe and uncomfortable conditions for bicyclists on roadways with designated bike lanes. There are several roadway planning and design considerations that can be taken to avoid this situation.

Plan Roadways with sufficient right-of-way

On new roadways or in roadway re-engineering projects that include bike lanes (or may include them in the future), provide enough right-of-way for preferably a six foot bike lane and a six foot storage space on the side of the road or in the buffer space between the road and the sidewalk (cities that typically receive heavier snowfall such as Montreal prefer an eight foot minimum storage space). This will allow typical truck-mounted snow plows to plow snow into the designated storage space rather than the bike lane. The six foot width of the bike lane will also allow for some narrowing of the bike lane due to snow while still maintaining its functionality.

Small snow removal vehicle clearing a buffered bike lane in Vienna, Austria. Photo Credit: http://www.ibikeoulu.com/presentations/presentation_oulu_szeiler_130213.pdf

Provide a Wide Bike Lane Buffer

Where it is possible to provide one, such as in some "road diet" projects, a wide protected or unprotected bike lane buffer can provide ample storage space for snow. A minimum five-foot-wide buffer is preferable to accommodate moderate snowfall with minimum encroachment upon the bike lane. This design will require the use of a smaller bike lane snow plow to clear this portion of the roadway.

Above: Protected cycletrack in Salt Lake City, UT after small truck plow snow removal. Photo Credit: Travis Jensen

Below: Vertical delineators help inform snow plow drivers of obstacles such as cycletracks, raised medians and bulb-outs in Salt Lake City, UT

Salt Lake City, UT has designed their protected cycletracks specifically to accommodate snowplows. Protective, flexible bollards are located at a far enough distance from the curb to allow a small truck mounted snowplow to clear the bikeway. Also, cycletracks, medians and bulb-outs in Salt Lake City are designed with tapered front ends and vertical delineators at obstacles to help prevent snowplow blade collisions along these facilities.

Restrict On-street Parking During Snow Events

Where a bike lane is located between on-street parking and the vehicular lane, parking along the roadway can be restricted during snow events to allow this space to become snow storage space. While this isn't an option for all roadways, it could be utilized along priority bicycle routes in the winter.

Provide Off-Street or Parallel Facilities

Where off-street facilities or bicycle boulevards are provided parallel to major routes, the clearing of bikeways on the main route may be unnecessary so long as these alternate snow routes are clearly marked, well-maintained, and bikeway network connectivity isn't affected.

Provide Enough Width for Small Truck Snow Plows

There are small, specialized snow removal vehicles that are used to remove snow where typical snow removal vehicles are too wide to pass. Many large cities with harsh winter climates such as Chicago have a fleet of these specialized vehicles and ATV-mounted snow plows primarily for the purpose of clearing sidewalks. While most cycle tracks in Chicago can be cleared with typical pickup truck-mounted snow plows, ATV-mounted snow plows and bombardier snow plows are used along the few protected cycle tracks (such as Kinzie Street) that are too narrow for pickup trucks[2].

In many towns and cities, sidewalk snow removal is contracted out, meaning that the city does not own these specialized vehicles. Utilizing existing maintenance vehicles such as pickup trucks with mounted snow blades can prove to be much more cost-effective and time-efficient than purchasing or using smaller vehicles which operate at slower speeds and have smaller plow blades. Access for snow removal vehicles should also be a consideration when designing shared-use paths and greenways.

Recessed thermoplastic bike lane marker in Minneapolis, MN. Photo Credit: http://bikewalkmove.org/tag/minneapolis-bike-infrastructure

Recessed Thermoplastic Pavement Markings

Milling the area of pavement three millimeters deep where thermoplastic pavement markings are applied has shown to be effective in reducing damage as a result of snowplows in a 2010 study[3]. Minneapolis mills the area of pavement where thermoplastic bike lane indicators are placed to help reduce damage as a result of snowplows. While this method results in more expensive installation costs, if the bike lane is located on a street that receives heavy plowing, it may save in long-term maintenance costs (and help preserve safety conditions along the roadway).

Snow Removal Vehicle Type

Along protected, on-street bikeways one major design consideration that influences snow removal is the design and provision of vertical separation. Many cities such as Chicago, Salt Lake City, and New York City are installing protected cycle tracks that include a parking lane, striped buffers and physical barriers between the cycle track and the motor vehicle travel lanes. In Chicago, as in most US cities with protected cycle tracks, flexible-post bollards are installed along the cycle track buffer. These bollards are bolted into the pavement and left up year-round meaning that conventional large truck-mounted snow plows cannot fit down these paths.

Facilities such as protected cycle tracks, shared use paths, and in some cases bike lanes will require smaller snow plow vehicles. Common vehicle types are listed on the following page:

2. Sources: Interview with Mike Amsden, Chicago DOT Bikeways Planner and http://www.suntimes.com/photos/galleries/index.html?story=18655473

3.http://www.easts.info/publications/journal_proceedings/journal2010/100292.pdf

Truck Mounted Plow Blade

Large trucks are the typical roadway clearing vehicle in most cities with harsh winter climates. These vehicles are also typically used for applying de-icing materials to the roadway. These vehicles can be used to clear and de-ice most roadways with conventional bike lanes.

Pickup Truck-Mounted Plow Blade

Pickup truck-mounted snow plows are typical in many cities with snow removal programs. These are commonly utilized on smaller roadways and in parking lots that are difficult for larger trucks to access. Pickup trucks can be equipped with de-icing equipment as well. Pickup trucks can be utilized on many protected cycle tracks and multi-use paths and it is important to consider pickup truck snow plow access in the design of these facilities.

Small Snow Removal Vehicles

Small snow removal vehicles are available from a number of different manufactures. Many small utility vehicles such as tractors, ATVs, bombardiers, and "skid steers" can be equipped with snow removal devices. Typically small vehicles are either equipped with snow plows, snow brushes (effective for removing light snow) or snow blowers (effective for relocating heavy snow). Many small snow removal vehicles can also be equipped with de-icing applicators as well. Small snow removal vehicles can be utilized in areas too constrained for a pickup truck-mounted snow plow such as narrow, protected cycle tracks.

De-icing Surface Applications Best Practices

There are two primary strategies for roadway de-icing that are used by winter maintenance programs. A reactive approach applies de-icing material to the roadway surface after the storm event. The snow or ice is plowed off the surface and the material is applied to the roadway to break the bond between the ice and the roadway.

A proactive or anti-icing approach applies the de-icing material to the roadway approximately two hours before the snow event. This is the most effective de-icing strategy. Following the snow, the roadway is cleared and additional de-icing material is added as necessary. The advantages of a proactive approach are that less de-icing material and plowing is needed. North Dakota

Example of a bombardier mounted with a snow plow. Vehicles like this and ATVs are used in Chicago along cycletracks that are too narrow for larger snow plow vehicles such as pickup trucks. Image credit: http://www.publiquip.com

DOT reports that in the department's experience, one-third of the de-icing material is needed with proactive strategies compared to reactive ones[4]. More information on de-icing can be found through FHWA: http://www.fhwa.dot.gov/reports/mopeap/eapcov.htm

The removal of roadway grit resulting from winter roadway de-icing and traction improvement applications is an especially important consideration for bike lanes. Salt and sand tend to accumulate in bike lanes due to motor vehicle traffic, water and wind. Accumulation of this debris can cause discomfort and pose a safety threat to bicyclists along the roadway if not addressed. It is recommended that cities devise a maintenance plan to remove this debris from the roadway, prioritizing primary bicycling routes, once the threat of winter precipitation has passed. In in Järvenpää, Sweden for example, sand and road grit is cleared from all bikeways every year before the 1st of May.

Winter maintenance programs should consider all the advantages and disadvantages of salting and sanding bicycle facilities before determining salting procedures. For example, the Minneapolis Parks and Recreation board typically does not salt and sand entire trails due to cost, ineffectiveness at low temperatures, and environmental consequences, but will apply spot applications after freeze and thaw periods where slick spots occur[5].

The following section provides an overview of common types of de-icing materials used on roadways and bikeways and their advantages and disadvantages.

4. http://www.dot.nd.gov/divisions/maintenance/docs/anti-icingfacts.pdf

5 Phone interview with Simon Blenski - Bicycle Planner with Minneapolis Public Works Department. January 2014

Salt

Rock salt is a readily available and commonly used de-icing material. After salt is applied to the roadway, it needs to be crushed by tires to dissolve most effectively[6]. The dissolution of the salt creates a brine that prevents ice from bonding to the roadway. The disadvantages of roadway salt are that it is a highly corrosive material and salt-infused stormwater runoff can cause environmental damage. Also, salt loses its effectiveness at temperatures lower than 15 degrees Fahrenheit. At these temperatures, other chemicals such as calcium chloride or magnesium chloride may be used, but these types of mixtures lose most of their effectiveness at temperatures below zero degrees Fahrenheit[7]. Bicycles with exposed gears are especially susceptible to corrosion caused by roadway salt. Also, because of their narrow tires and reduced weight, bicycles may not crush salt as effectively as motor vehicles (however, no studies have been conducted that examine this).

Pre-wetted Salt

Pre-wetted salt is roadway salt that is sprayed down with a brine solution either upon application or in storage prior to being loaded in trucks. Pre-wetting facilitates the dissolution of the salt, allowing for quicker reaction times than dry salt, less material than dry salt and improved application accuracy (dry salt tends to bounce off the travel path).[8]

De-icing Alternatives

Some roadway maintenance departments combine a beet juice solution with roadway salt or salt brine. Beet juice is an inexpensive additive to a de-icing solution that improves the adherence of salt and sand to the roadway and also lowers the freezing temperature of the ice. The advantages of beet juice are that it is inexpensive, it adheres well to the roadway, and it is much more environmentally friendly than using plain road salt[9]. A combination of beet juice and roadway salt or brine can reduce the number of de-icing applications required and save costs.

Some cities are also utilizing cheese brine, a by product of cheese production, as an additive to rock salt applications. Many cities have reported success with this method in recent years. Like beet juice, cheese brine helps rock salt adhere to the roadway, has a lower freezing temperature than regular brine, and is more environmentally friendly. It provides cost savings for both cheese manufacturers, in terms of waste removal costs, and cities, with reduced expenditures on rock salt[10].

Sand and Gravel

Sand and gravel are abrasives and are used primarily for providing roadway traction – these materials have little ability to melt ice. The application of sand is usually done in conjunction with salt or other deicing treatments. While sand is good for providing traction, too much sand can pose a hazard for bicyclists. Sand can get trapped in the bicycle's drivetrain and wet sand can get on a bicyclist's clothes. If sand is applied to a roadway with a bikeway it should be cleared as soon as possible when the threat of winter precipitation has subsided. The use of sand can also have negative environmental impacts, especially when mixed with salt[11].

Larger particulate sand or gravel applied to the roadway can be hazardous to skinny bicycle tires due to the larger size of the aggregate. Gravel is not recommended along roadways with on-street bikeways

Innovative and Experimental Snow Removal

Several European cities with harsh winter climates and high bicycling mode share are experimenting with innovative treatments to remove snow from bikeways more quickly and effectively than traditional methods. These cities justify utilizing these more effective, but more costly techniques since bicycling is such an essential piece of their transportation system and economies.

6. http://www.semcog.org/uploadedFiles/Programs_and_Projects/Water/Stormwater/Municipal_Training/Streets_and_Parking_Lots/Road%20Salt%20Application.pdf

7 http://www.cargill.com/wcm/groups/internal/documents/image/na3036958.pdf

8. http://www.ctre.iastate.edu/pubs/semisesq/session1/donahey/index.htm

9. http://www.dvice.com/2012-12-29/beet-juice-answer-safer-roads-icy-weather

10 http://www.nytimes.com/2013/12/24/us/wisconsin-finds-another-role-for-cheese-de-icing-roads.html

11. http://epdfiles.engr.wisc.edu/pdf_web_files/tic/bulletins/Bltn_006_SaltNSand.pdf

Photo Credit: http://www.ibikeoulu.com/presentations/oulu_2013_warm_wetted_sand_aniska.pdf

Heated Bicycle Paths

The City of Amsterdam recently began testing heated bicycle paths along the city's bikeways. The system works by using geothermal assisted 'asphalt collectors' which collect heat from the bike paths in the summer and store it underground for use in the winter. The move is intended to increase winter safety and ridership – every four weeks that Dutch bikeways remain frozen over in the winter results in approximately 7,000 additional bicycling accidents. The heated lanes are estimated to cost slightly over $90,000 per mile which may seem costly, but the city will also be saving costs on plowing and de-icing[12].

The town of Umea, Sweden already has approximately 33,000 square meters of heated pathways. These are installed for improved safety on segments of pathways that would be difficult to otherwise maintain[13].

Warm Wetted Sand

The town of Umea, Sweden is experimenting with the application of warm, wetted sand as an alternative de-icing and traction improvement technique along on-street and off-street bikeways. The material is applied via a specialized truck which contains a water tank, water heater and separate storage for sand. The sand and hot water are mixed upon application and applied via a spreader on the rear of the truck. Initial results have shown that the technique has been effective in both improving traction and reducing surface ice. The benefits of the sand over roadway salt are that it is more environmentally friendly and the sand won't cause corrosion of bike parts. The benefits over dry sand are that the wet sand provides better traction over ice and significantly reduces the amount of sand that sprays on riders and their bicycles[14].

Prioritization

Prioritization and scheduling is a key component of a successful winter bikeway program. For most jurisdictions, keeping all bikeways completely clear during or immediately after a heavy snow event is infeasible. Primary bikeways should be cleared first, providing the best access to the greatest number of people possible following a heavy storm event. Destinations should be taken into consideration as well. If roadway clearing and de-icing begins first thing in the morning, primary routes leading to schools and business districts should be cleared first[15].

In Järvenpää, Finland, Class A routes, the main bikeway routes from residential areas to the city center and through the city center, are cleared first. These are followed by Class B routes, bikeways along other major roads, and Class C routes, those along residential streets and through parks.

- Class A routes are plowed within four hours of 3 centimeters of snow accumulation and de-icing treatments are applied before 7 am. Plowing is done before 7 am when snowing at night.
- Class B routes are plowed within four hours of 5 centimeters of snow accumulation and de-icing treatments are applied as needed. Plowing is done before 7 am when snowing at night.
- Class C routes are plowed after class B routes and plowing is done before 10 am.

Sand and road grit is cleared from Class A, B and C bikeways in Järvenpää every year before the 1st of May.

The Twin Cities area has one of the most extensive greenway networks in the US. Because of the high-level of use the greenways receive for both transportation and recreation year-round, keeping them clear is a high-priority. Typically the greenway network is cleared within 24 hours of a snow event. Trails are cleared to the pavement surface utilizing pickup trucks and/or skid steers[16].

12. http://www.ecf.com/news/dutch-to-heat-cycle-lanes-ecf-newswatch/

13. http://www.ibikeoulu.com/presentations/marie_frosvinge_umea_winter_cycling_conference.pdf

14. http://www.ibikeoulu.com/presentations/oulu_2013_warm_wetted_sand_aniska.pdf

15. http://www.ibikeoulu.com/presentations/winter_maintenance_jarvenpaa_mari_paatalo_13_02_13.pdf

16 Phone interview with Simon Blenski - Bicycle Planner with Minneapolis Public Works Department. January 2014

In 2012, the City of Calgary, Canada upgraded all of their roadways with bike lanes to "Priority I" for snow clearing. Priority I roadways are cleared first following a snow event and receive continuous plowing and de-icing until bare pavement is achieved. All other marked bike routes are considered "Priority II" for snow removal, meaning that they will be cleared 48 hours after the snow stops until bare pavement is achieved. Residential streets are plowed last in Calgary, maintaining a packed surface[17].

The Wisconsin Department of Transportation also offers guidance on the prioritization of snow removal from shared-use paths (Wisconsin Bicycle Facility Design Handbook, 2009 p. A-4, A-5):

> *Winter use varies according to local conditions. In some communities (e.g. Eau Claire, Madison), paths are plowed regularly and are used frequently by bicyclists and pedestrians. Heavily-used paths that serve key destinations should be considered first for plowing. Even paths that serve only occasional use should be considered for snow removal if the path is the only means of making a key connection (e.g., crossing a bridge). Lower priority may be given to isolated paths that serve recreational users who must travel long distances to use them. In these cases, managers may allow want to allow use by cross country skiers or snowmobile operators as long as all applicable laws are followed.*
>
> *To ensure that winter use is properly accommodated, agencies must clearly understand who will maintain what path. For paths along state highways, a municipality will have the responsibility for maintenance. Winter use and snow removal frequency will be determined by the municipality after considering the following factors:*
>
> - *Expected use by bicyclists and pedestrians;*
> - *Parallel options for bicyclists and pedestrians if the path is not passable; and*
> - *State statute 81.15 regarding the liability for accumulation of snow.*

View of Rachel Street cycletrack in Montreal, summer (above) and winter (below). Photos courtesy of Barktek Komorowski and Vélo Québec.

Case Study: Montreal[18]

Montreal has been a North American leader in bicycle network development and bicycling culture for many years. Montreal's bicycle network consists of over 350 kilometers (approximately 220 miles) of bikeways and was ranked the best bicycle-friendly city in North America by Copenhagenize Design Co. in 2013.

The 2008 Transportation Plan established a "White Network" of priority bikeways across the City that established around 60 kilometers (40 miles) as priority bikeways for snow clearing in the winter. However, now the strategy is shifting to trying to keep as much of the network cleared and open as possible in the winter.

Protected bikeways, some receiving as many as 800 people per day throughout winter months, remain a priority for the City. Typically, curb-separated cycle tracks are cleared with a smaller plow vehicle immediately following street clearing. Montreal receives an average of 80 to 90 inches of snowfall annually, so snow removal must often be implemented as well.

Montreal typically marks their bikeways with standard roadway paint, not thermoplastic. Since thermoplastic is much more expensive than paint, this reduces maintenance costs of bikeway re-striping from plow blade damage.

17 http://www.calgary.ca/Transportation/Roads/Pages/Road-Maintenance/Snow-and-ice-control/SNIC-policy-FAQs.aspx

18 Based on January 21, 2014 interview with Bartek Komorowski, Research and Consulting Project Leader with Vélo Québec.

One of the biggest critiques of Montreal's bicycle network is that cycle tracks which are bollard-separated are considered seasonal. Bollards are removed from November 15th to April 1st annually and parking moves into the cycle tracks, eliminating the bikeways throughout these months. However, a new report on Winter Bicycling in Montreal commissioned by the City and developed by Vélo Québec recommends ways for keeping these bikeways operational in the winter such as removing bollards but maintaining the parking restrictions and bikeways.

Conclusion

Cities can expect bicyclists to use the road network year round, even in inclement conditions. It is a city's responsibility to provide safe conditions for bicyclists year round. Strategies and equipment may vary among cities; however, thoughtful roadway design and a strategic bikeway snow removal and de-icing program that includes snow removal prioritization are key to the safe and comfortable accommodation of bicyclists in the winter.

Keeping pathways and bike racks clear of snow for bicyclists is an important mobility consideration. This is especially true in campus settings like the University of Chicago, where the vast majority of students don't own a vehicle.

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APPENDIX F

IMPLEMENTATION ACTION PLAN

BUFFALO BIKE FACILITY MASTER PLAN

IMPLEMENTATION ACTION PLAN

As part of the bicycle master plan development process an implementation roundtable was held at City Hall on May 22, 2105. This meeting was covered in the current Scope of Work for the Buffalo Bike Facility Master Plan Update. The three hour meeting was intended to bring together representatives from the Mayor's office, Public Works, Planning, Economic Development and other city departments as well as key stakeholders from the private sector The goal was to identify opportunities for both the short-term implementation of bicycle-related roadway restriping projects and funding strategies for longer-term projects that may require more significant City investments, federal funding and/or partnerships with the private sector. The conversation centered on the development of a protected bike facility (or "cycle track") on Main Street between Humboldt Parkway and Goodell Street, the number one catalyst project in the draft plan and also outlines a strategy for the development of the city-wide bike-facility network. Comprised of facilities for those considered "strong and fearless", "enthused and confident" and "interested, but concerned", the evolution of the network is intended to elevate the Bike Friendly Community status of Buffalo from its current bronze to silver, gold and, ultimately, platinum level. The long-term implementation of the network will feature a three-step process that includes:

1. Maintaining Mayor Brown's commitment to create 10 lane miles of new bike facilities per year, which includes new bike lanes and sharrows within currently-funded mill-and-overlay and Federal Aid projects.
2. Secure funding and staff resources to develop the Master Plan's eleven catalyst projects, with high-level emphasis on the Main Street Cycle Track and other projects needed to facilitate Main Street's connection to nearby bike facilities on Linwood or Delaware.
3. Develop a long-term strategy for funding and maintaining the recommended 150 mile city-wide network, utilizing state CHIPs, CFA or other key funding sources.

The tables below provide additional detail for step #2 above, with an emphasis on the tasks and sub-tasks required in the coming months that will lead to the implementation of the Main Street Cycle Track in 2016.

A: SECURE MAIN STREET DESIGN FEES (GOAL: $135k-150k)

#	Task	Task Lead	Date
A1	Timeline for fundraising: $50,000 by June 1st, $50,000 by September 1st and minimum of $35,000 by December 1st	All	June 1, Sept 1, and Dec 1
A2	Buffalo-Niagara Partnership (BNP) to oversee project management duties (up to 25 hours/week) for the design process	BNP/Dan Leonard	End of year
A3	Draft Main Street RFP	City/Mike Finn	May 29
A4	Raise Minimum of $135,000 for Main Street design and engineering fees	All	See A1
A5	Raise $70,000 through CHIP funding source	City/Mike Finn	Sept 1 ($50,000), Dec 1 ($20,000)
A6	Raise $35,000 through BNP members UB, Canisius and BNMC	BNP/Dan Leonard	June 1
A7	Raise $15,000 through private-sector commitment	Justin/GObike Board	June 1

A8	Raise $15,000 min. through crowdsourcing campaign co-lead by GOike Buffalo and Flying Bison Brewery	Justin/ Tim Herzog	Dec 1

B: LOCATE MAIN STREET CAPITAL FUNDS (GOAL: $1.1m)

#	Task	Task Lead	Date
B1	Establish a grant writing "SWAT Team" comprised of: GBNRTC rep, GObike rep (Justin), BNP rep and BNMC rep; mix of volunteer and profession effort; BNP to raise $$ for professional grant writer	Mike Finn	??
B2	City to develop Capital Funding package	City/Mike Finn	Jan 1, 2016
B3	Determine availability of shifting money and securing an amendment to the TIP; amendment will need support from TPS (shouldn't be a big problem with strong support from City)	GBNRTC/Amy Weymouth with help from NYS DOT	May 29
B4	Outside of TIP process, other options for capital funding include: • CHIPs • DASNY grant funding • Buffalo Sewer Authority (would need to be justified due to CSO issues) • New York State CFA funding • Better Buffalo Billion (funding stream for TOD projects) • Leverage redevelopment $$ for bike-related streetscape	City/Mike Finn OSP	Post May 29
B5	Repaving: City may want to consider combining Main Street protected bikeway project with repaving of full roadway (adds an extra $1m, minimum, but needs to be done in next few years)	Eric Schmarder	
B6	Phasing: will need to be coordinated with ongoing work at BNMC, not complete until 2017 (bikeway may need to come in two stages)	Mike Finn	

C: ESTABLISH MAIN STREET IMPLEMENTATION TEAM

#	Task	Task Lead	Date
C1	Establish core team: Mike Finn (chair), Eric Schmarder, Justin Booth and Jim Cuozzo (NYSDOT)	Mike Finn	May 22 (done)
C2	Incorporate Director of Office of Strategic Planning onto team	Mayor Brown	May 29
C3	Finalize Implementation Team's mission (draft: oversee Main Street design contract, fundraising for capital costs and coordination with other catalyst projects within the Master Plan)	Mike Finn	May 29

D. DEVELOP A MEDIA STRATEGY

#	Task	Task Lead	Date
D1	Draft press release for Main Street initiative (coordinate with Mayor's Press Secretary)	Justin Booth	May 27 (draft); May 29 (final)

D2	Announce Main Street implementation effort at SkyRide event	Mayor Brown/Justin	May 30
D3	Coordinate social media and web-based outreach related to Flying Bison fundraising campaign and other efforts	Justin Booth and Tim Herzog	May 30

IMPLEMENTATION PLAN SCOPE

To accomplish the tasks, additional strategies will be considered to ensure the plan's recommendations become a reality. These include:

"BEST PRACTICES FOR FUNDING BICYCLE FACILITIES

An implementation team will research ways in which other bike-friendly cities and Metropolitan Planning Organization's (MPO's) fund bike facilities and synthesize the research into a 'Best Practices' guide for the City of Buffalo and GBNRTC. This information will provide direction on strategies to implement the Buffalo Bike Facility Master Plan Update that may not have been considered. The guide will include examples of private sector involvement and investment in active transportation infrastructure from cities and regions that have similar challenges to the City of Buffalo.

GRANT APPLICATIONS

The implementation team will work with the City and GBNRTC to draft applicable grant applications for key bike facility project recommendations outlined in the Master Plan Update report. Preparing complete, compelling applications may increase the chances of federal or state funding for projects. The team will also identify grant opportunities and funding strategies that may not otherwise have been considered.

NACTO URBAN BIKEWAY DESIGN GUIDE WORKSHOP

The implementation team will hire a consultant to deliver a full-day workshop highlighting the NACTO Urban Bikeway Design Guide. The workshop will be designed for up to 20 public officials, engineers, agency planners and advocates to learn the benefits of innovative bikeway designs, engineering standards that support them, and design strategies intended to promote more bicycling by a wider cross-section of the community. The day-long event will include lunch and a bike-facility design exercise for the assembled group.

COORDINATION OF BICYCLE FACILITY IMPLEMENTATION

The implementation team will work closely with the city of Buffalo's Department of Public Works to facilitate coordination of city-funded repaving projects and federal aid reconstruction efforts. The implementation team will analyze the current repaving schedule and advise the City on roadways in which bike lanes, sharrows and other facilities could be easily implemented with paint and signage. We will create a matrix of roadways scheduled for future repaving or reconstruction to ensure the Master Plan's recommendations are considered in their implementation.

ANNUAL REPORT CARD OF BICYCLE FACILITIY IMPLEMEMTATION PROGRESS

The implementation team will prepare information for the inclusion in the annual report card of bike facility implementation. Information will be provided that tracks where new bike facilities have been created, and status of mid-term and longer-term projects. The Report Card will also identify the key challenges to implementing the Bike Facility Master Plan and provide direction on how they can be addressed. The Report Card will include a running total of key performance measures such as overall miles of bike facilities in the City (by type), number and type of reported crashes and bike counts at key locations (per availability).

We will benchmark our success based upon the performance measures and milestones identified in the Bicycle Master Plan as shown below.

#	Performance Measure	Current Status	Annual Goal for Year		
			2017	2021	2025
1	L.A.B. Bike Friendly Community Status	Bronze	Silver	Gold	Platinum
2	Lane miles of bike facilities	72 miles	150*	200*	300*
3	Bicycle Commuter Mode Share (city-wide, during warm-weather months)	1.6%	3.2%	6%	10%
4	Approximate % of women riders**	25% (est.)	33%	40%	50%
5	Bicycle racks	~400	600	800	1,000
6	On-street bike parking corrals (seasonal)	0	3	15	30
7	Reported motor vehicle-bicycle crashes w/ injuries	1.0X	0.9X	0.75X	0.5X
8	Percentage of schools connected by bicycle facilities and/or traffic-calmed roadways	unknown	25%	50%	90%

* Mileage numbers include Mayor Brown's commitment to stripe ten lane miles of bike facilities per year

** The percentage of women riders within a given city is considered a good indicator of how bicycle friendly a city is, as women tend to be less tolerant of mixing with motor vehicle traffic and more likely to ride when low-stress bikeways are available.

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