CITY OF APPLETON

Trails Master Plan

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INTRODUCTION

The Appleton Trails Master Plan explores opportunities to enhance and expand multi-modal facilities, for both recreation and transportation purposes within the City of Appleton. New trails and improvements to existing trails will lend to the creation of a network that provides connections to key destinations and recreation opportunities within the city and region. This plan builds on existing proposals and planning efforts and includes the results of a trail audit and stakeholder input to identify and prioritize projects for network expansion.

Project Vision, Goals, and Objectives

The purpose of the Trails Master Plan for Appleton is to provide a framework for future investments in a system of interconnected multimodal transportation facilities in Appleton. The Trails Master Plan focuses on improving connectivity to local destinations, linking to the trail system in the Fox Valley, increasing safety and accessibility for all trail users, supporting economic development, and enhancing quality of life for Appleton area residents.

Developing the Trails Master Plan included consideration of future land use developments, major origins and destinations within the City, and review of current and proposed on-street bike lanes and trails. To identify trail connections, the project team conducted trail condition audits of existing trails such as the Apple Creek Trail, the Highview Trail, the Newberry Trail, the North Island Trail, and the Providence Trail. To maintain concurrency with existing plans and polices, the team reviewed the City of Appleton On Street Bike Plan, Appleton (Fox Cities) TMA and Oshkosh MPO Bicycle and Pedestrian Plan, City of Appleton Parks and Recreation Department Master Plan, the Downtown Plan, the Five-Year Updates to the City's Comprehensive Plan, and relevant plans for communities adjacent to Appleton.

Additional major considerations also included ADA accessibility, connectivity to future subdivisions, connectivity to private corporations and businesses, and trail purpose in terms of recreation and/or transportation.

This plan identifies trail alignments at a high level by referencing previous planning efforts, direction from city staff, and public involvement. As trails are implemented, further study will be conducted to verify and adjust the alignments through further detailed investigation and public involvement.

Setting

The League of American Bicyclists has ranked Appleton as a Bronze Level Bicycle Friendly Community. This accolade acknowledges Appleton has a growing population of bicycle commuters with programs and events to encourage more people to ride, increasing numbers of streets with dedicated bicycle infrastructure and trails, and plans and policies to further advance cycling in the community. This trails master plan will build upon these achievements and demonstrate Appleton's continued efforts to further improve conditions for bicycling as Appleton re-applies for bicycle friendly community status in 2017.

Bicycling, walking and trail use are becoming increasingly popular in Appleton. With a current total of eight miles of trails within the city, residents and community members have expressed a growing interest in trail expansion. As the City continues to grow and becomes even more of a regional cultural and tourist destination, it will be important that future capital investments and development projects incorporate trails, on-street bikeways, and pedestrian paths as vital community assets.

The past several years have seen growth in city and regional trail development including but not limited to: new Telulah park trail connection via Newberry trail, CB trail, key on-street bike lane striping projects, such as Mason, Fremont and John streets, and regional efforts such as the Fox Cities Paper Trail. In addition to these land based trails, the Fox-Wisconsin Heritage Water Trail passes through the center of Appleton.

Along with this expansion in trail development, there has been strong support from volunteers and private interests to add additional trails to the network. Some of these groups include Fox Cities Greenways, Fox Cities Cycling Association, the Appleton Bike/Ped Advisory Committee, and large employers, such as Kimberly Clark, who increasingly view trails as a baseline requirement for retaining existing and attracting new employees.

The City of Appleton also understands that trails are a core component of quality of life investment and directly support community and economic development efforts underway, such as the River Heath development and Eagle Flats. The City has identified future funding to support new trail construction in its CIP over the next 5-year period, including the potential for adding key river trail connections including trestle trails.

This Trails Master Plan will provide clear direction to City Council to invest in future trail connections over next several years while fostering additional opportunities for public-private partnerships to extend trail network.

Benefit of Trails

HEALTH & EQUITY

The ability for all Appleton residents and visitors to safely and conveniently walk and bicycle is a fundamental equity measure and translates to numerous community health and equity related benefits. Improved community health and wellness is directly related to increased levels of physical activity. A growing body of literature has shown a strong connection between parks and trails and increased physical activity. An expanded trail network, in combination with a complete network of sidewalks bike lanes and bike routes, could dramatically increase safe and convenient opportunities for residents and visitors to walk and bike, leading to increased frequency and duration of physical activity among residents. This could in turn lead to reduced risk of obesity, diabetes, heart disease, stress related health problems, and other health concerns attributed to physical inactivity.

TRANSPORTATION & ENVIRONMENTAL BENEFITS

The Appleton trail network will result in increased access and connections to many local and regional destinations. It would provide residents and visitors with more travel options and present a safe, comfortable, efficient, and enjoyable way for people to get around. Additionally, the network would provide the City with transportation-specific benefits related to reductions in the number of vehicle miles traveled (VMT). These benefits include reductions in the estimated costs of congestion, vehicle collisions, road maintenance, and direct household vehicle expenses - as well as the estimated environmental impact associated with vehicle emissions.

ECONOMIC & PROPERTY VALUE BENEFITS

The Appleton trail network will provide residents and visitors access to local parks, regional destinations of cultural and historical significance, and all of the everyday connections that the community makes for work, school, shopping, and play.

As a growing industry and significant economic driver in the region, tourism is an increasingly important basis for developing the regional trail network. Trail networks may also lead to the creation of tourism-based jobs.

Additionally, the transportation and recreation amenities that the network provides could incentivize residents and business owners to invest in property. Property value studies of similar trail systems show that nearby property owners can expect a 3.5% increase in property values.

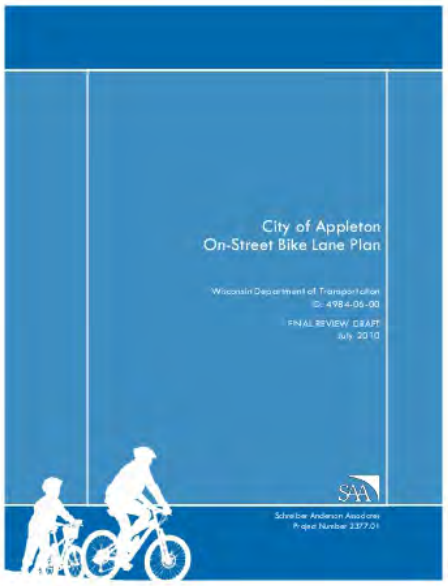
EXISTING DOCUMENTS

The development of a comprehensive trail network in the City of Appleton is addressed in numerous plans at both the local and regional levels. These plans address network extent, quality, and purpose. The following section provides a review of these existing documents, including:

- City of Appleton On-Street Bike Lane Plan (2010)
- Fox Cities Transportation Management Area and Oshkosh Metropolitan Planning Organization Bicycle & Pedestrian Plan (2014)
- City of Appleton Parks and Recreation Department Master Plan (2004)
- Comprehensive Plan: Transportation Element (2010-2030)
- Comprehensive Plan: Downtown Element (2010-2030)
- Greenville Comprehensive Open Space & Outdoor Recreation Plan (2015)
- Little Chute Comprehensive Park & Outdoor Recreation Plan, Supplement #1: Pedestrian and Bicycle Facilities Recommendations (2008)
- Village of Kimberly Open Space & Recreation Plan (2013)

In addition to these planning documents, the Trails Master Plan team coordinated with Public Works to incorporate relevant information from the Downtown Appleton Mobility Study, which was completed in August 2016.

City of Appleton On-Street Bike Lane Plan
Adopted: September 15, 2010



This plan examines opportunities for implementation of an on-street network for the city. Building on regional and state goals for increasing the viability of bicycling for transportation, the plan provides guidelines for facility selection and implementation, education and encouragement programming, funding opportunities, and project prioritization. The plan recognizes the benefits of bicycling for public health, transportation cost, environmental impact, and social cohesion. A primary goal is to increase bicycle commute mode share by capturing a portion of the reported 49% recreational cyclists in the state. Snow and other debris were identified by stakeholders as a concern and barrier to use; recommendations in the plan call for snow clearing on facilities and bike parking locations to address this concern. The plan concludes with a prioritized project list and implementation time line, specific actions related to the 5 Es for all community members, standard element costs, and a general framework for route and wayfinding signage development.

Fox Cities Transportation Management Area & Oshkosh Metropolitan Planning Organization Bicycle & Pedestrian Plan
2014

The Bicycle & Pedestrian Plan aims to ensure that regional residents can safely and conveniently walk and bike between destinations, while maintaining access to transit services. The plan recognizes the benefits of active transportation for regional connectivity, economic value (through tourism, health benefits, and increased property values), and for addressing obesity and environmental concerns. Goals include increasing biking and walking trips to school, equity among modes, and providing connections among municipalities.

City of Appleton Parks and Recreation Department Master Plan

2004

The Parks and Recreation Department identifies acquisition of greenways, especially within new residential developments, as a primary goal. Multi-use trails are considered to be a park facility, and in the public outreach process the Department found significant demand for more trails. Over two-thirds of respondents indicated current use of the trail system, and more than half favored adding new trails.

Comprehensive Plan – Transportation Element

2010-2030

Promoting bicycling as a viable means of transportation and increasing safety for all cyclists are primary goals of the Transportation Element. Similar to the other plans reviewed here, education, integration with transit, coordination with Safe Routes to School efforts are identified as primary pathways to achieve these goals. Connectivity to the regional trail system in addition to local destinations are important elements to this plan. Although the roadway network for motor vehicles is assumed to require expansion over the plan period, the plan recommends focusing this growth in a strategic manner so as to reduce congestion and lessen the environmental impact. However, several member towns do have plans in place to expand the existing width of several major corridors. This section will be updated as the Comprehensive Plan is updated in 2016.


6

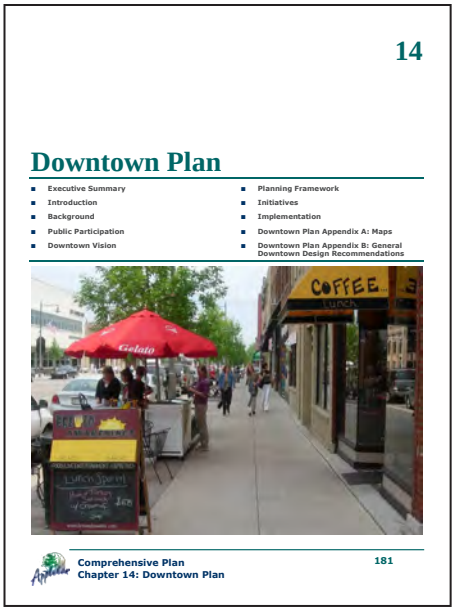
Transportation

- Streets and Highways
- Air Service
- Bicycle and Pedestrian System
- Rail Transportation
- Water Transportation
- Public Transit Services

Comprehensive Plan
Chapter 6: Transportation
57

Comprehensive Plan – Downtown Element
2010-2030

The Downtown Element focuses on the developing clear connections between adjacent multi-use trails and Downtown. By adding entry elements, wayfinding signage, and increased bicycle parking options, connectivity through downtown will be enhanced. The Plan prioritizes developing a rails-trail along the northern portion of downtown to improve connectivity to adjacent neighborhoods. Identifying safe routes and additional off-street opportunities is vital to addressing safety and connectivity concerns for bicycling in the area. This section will be updated as the Comprehensive Plan is updated in 2016.

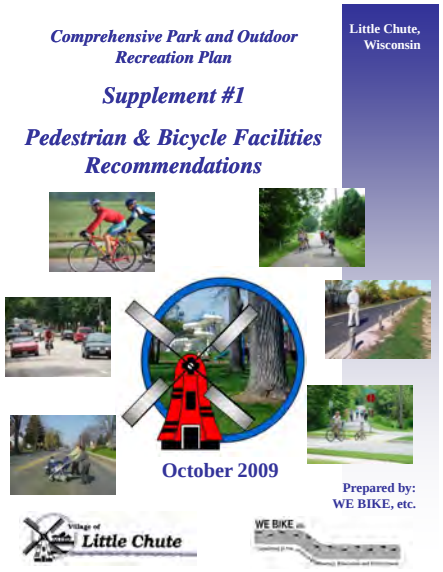


Greenville Comprehensive Open Space & Outdoor Recreation Plan
2015

Identifies a number of goals related to multi-modal facilities. Public input identifies frequent use of existing trail facilities during non-snow months, as well as support (67%) for more trail development. Plan recommends the development of a Town Bike and Pedestrian Facility Plan to establish levels of service, project prioritization, and network connectivity. Ten specific corridors are identified for improvement or development. While none of these trails provide a direct connection to Appleton, the CB Trail Extension and Design Drive Trail provide connections to proposed regional trails that have access to Appleton from 5-12 mph, and downhill bicyclist speeds can reach 20-30 mph. A design speed of 10 mph is used for bicycle signage and crossings.

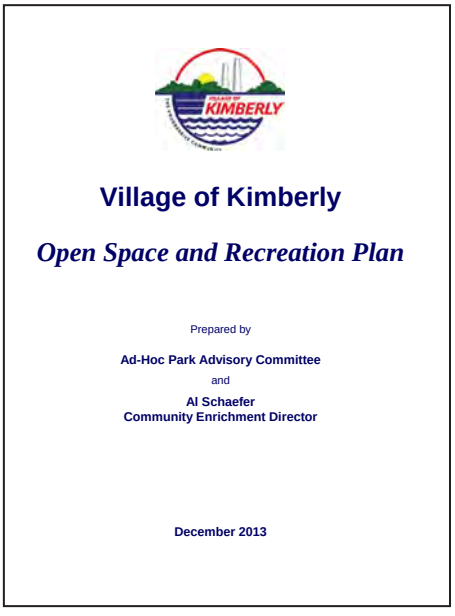
Little Chute Comprehensive Park & Outdoor Recreation Plan Supplement #1: Pedestrian & Bicycle Facilities Recommendations
2008

Accompanying element to the larger Park and Outdoor Recreation Plan that identifies specific guidelines and recommendations for the bicycle and pedestrian network. The plan identifies facility types and limitations, and encourages intersection treatments to improve safety for pedestrians and cyclists. Similar to other plans in the region, Little Chute identifies that education and enforcement are integral to a successful network. Despite minimal reported collisions from 2002-2007, the majority of those reported did involve cyclists. Utilizing this information as well as village-wide and corridor specific factor, the plan presents a recommended project list. One route in particular, bike lane along Highway 96, provides a clear connection into Appleton City Limits.



Village of Kimberly Open Space and Recreation Plan
December 2013

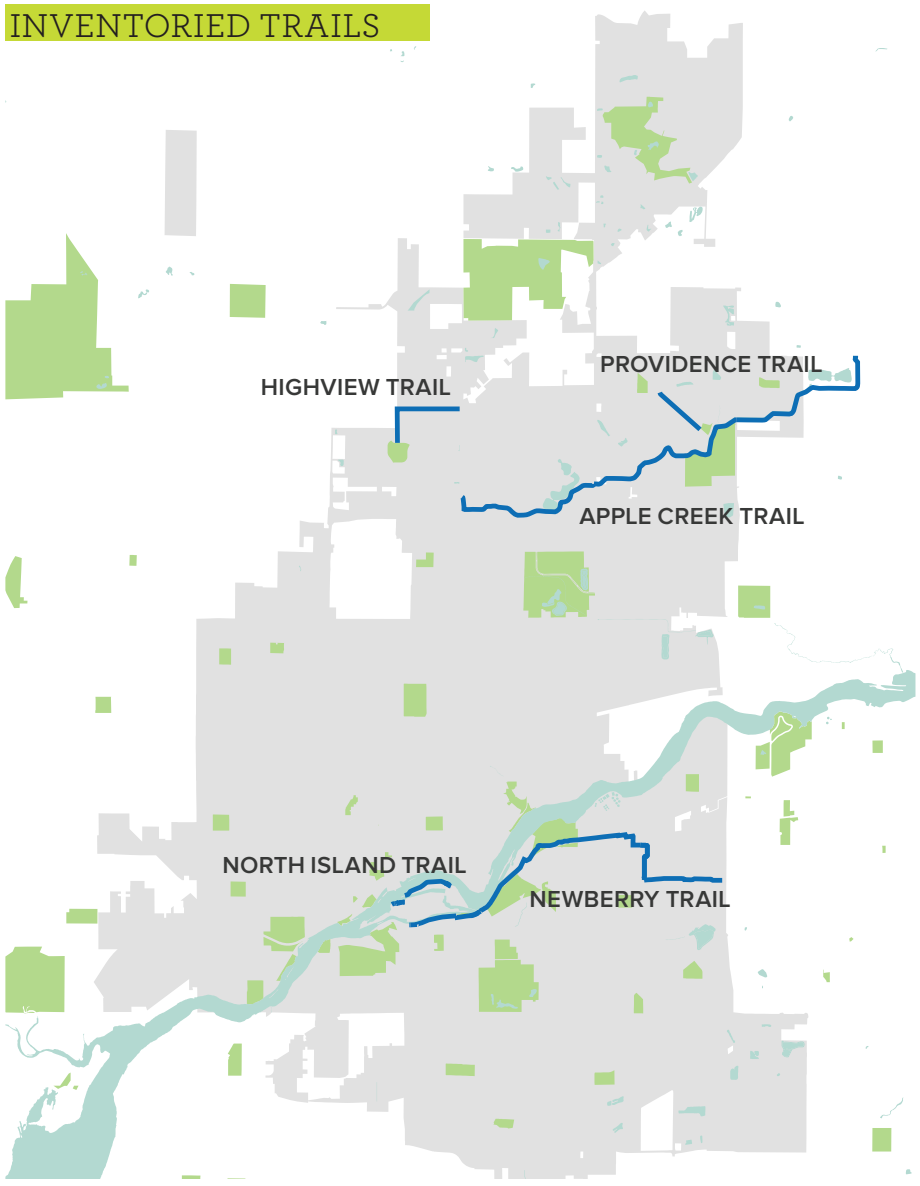
The open space plan identifies needed multi-purpose trails interconnected with the CE Trail and neighboring communities. Specific links identified include Railroad Street, Kennedy Avenue, Marcella Street, Cobblestone, and Mill Site. Addition bicycle lanes could be implemented along complete street corridors, including Kimberly Avenue, 3rd Street, and John Street. Similar to regional goals, the plan aims to provide quality recreation facilities that are accessible to all ages and abilities, provide protection to natural resources, and promote region-wide cooperation. An accompanying action plan outlines all recommended projects, associated costs, and projected timeline for completion.



TRAIL CONDITIONS AUDIT

The condition of eight miles of trails within the City of Appleton were audited in early 2016. The project team collected information on trail condition, surface quality, and amenity locations along the trail network. The data summarized here is intended to provide a high-level snapshot of existing conditions and may contribute to the development of future trail projects and maintenance plans.

INVENTORIED TRAILS



Project staff collect trail inventory data using Collector for ArcGIS.

Trail Audit Location

The trails included in the existing conditions audit included the following:

- Apple Creek Trail
- Highview Trail
- Newberry Trail
- North Island Trail
- Providence Trail

Trail Audit Methods

A team of two conducted the audit by walking along the length of each trail. Collector for ArcGIS paired with a GPS unit allowed for attributes related to trail condition and quality to be captured in their correct location along each segment. Additional images and descriptions were captured for items requiring further review.

The use of Collector allows for data captured in the field to be directly translated into a GIS database, which can be used in analysis of existing trail needs. The database is compatible with the city's existing system and can be updated by city staff as trail conditions and the extent of the system change.

Trail Audit Criteria

The following fields were entered into the Collector application. Each field is detailed with the type and definition of data entered.

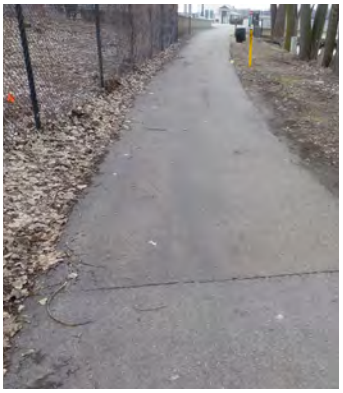
- Surface Issues
- Crossings
- Signs
- Maintenance Concerns
- Barriers/Obstacles
- Amenities
- Limited Sight-line

SURFACE ISSUE:

» **Captures location of buckling, heaving, cracking, or other issue. The following types of issues are defined below[1]:**

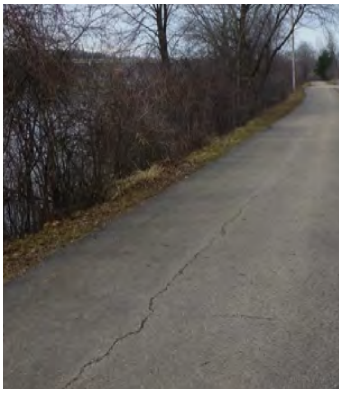
Alligator: Fatigue cracking associated with repeated traffic loading; exhibits as parallel longitudinal cracks that begin to interconnect

Patching: Area of pavement replaced with new material



Transverse: Cracks that run perpendicular to roadway centerline; can be caused by shrinkage due to low temperatures or cracks in underlying layers

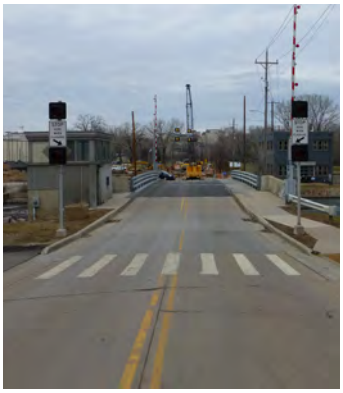
Sags: Specific depressions of pavement due to settlement or displacement due to tree roots



Longitudinal: Cracks that run parallel to trail center line and are often discontinuous. These cracks are often associated with loading on the trail surface

Edge Condition: Locations along pavement edge where pavement has broken away from pathway

1 Pavement Surface Condition Field Rating Manual for Asphalt Pavements. Northwest Pavement Management Association, 2008.



CROSSING:

» Captures location of trail crossings with roadways

SIGNS:

» Location of signs, including regulatory, wayfinding, and interpretative

MAINTENANCE CONCERN:

» Captures location of maintenance concerns, including drainage issues

BARRIERS/OBSTACLES:

» Locations of barriers to trail path, such as storm drains and utilities

AMENITY:

» Captures location of items such as trash receptacles and benches

LIMITED SIGHTLINE:

» Walls, fences, vegetation, and other barriers along the corridor that impact visibility

Seasonal pooling along trails were often associated with surface cracking.

Visible crossings improve comfort for trail users at intersections with roadways.

Edge conditions include cracking and disintegration of the trail surface.

Summary of Findings

Surface issues were the most common conditions documented during the trail audit. Cracking of the surface was severe along most of the trails; newer segments experienced less severe but still frequent cracking. Drainage issues were also frequent; pooling along the trail was common at the time of the audit.

Many of the crossings documented were considered to be insufficient, meaning that at least one curb ramp and/or crosswalk was missing. While trails provide a separated facility for all ages and abilities, crossings with roadways, rail lines, or other trail segments can decrease the safety for trail users. Adequate signage, markings, and accommodations should be made to provide for users of all ages and abilities.

Trail amenities, including benches, trash receptacles, and lighting were also inventoried. Lighting was present only along the North Island trail and the westernmost extents of the Newberry trail. Signs were distributed across all trails and primarily include regulatory signage; limited wayfinding signs was noted.

TABLE 1: TRAIL AMENITY INVENTORY

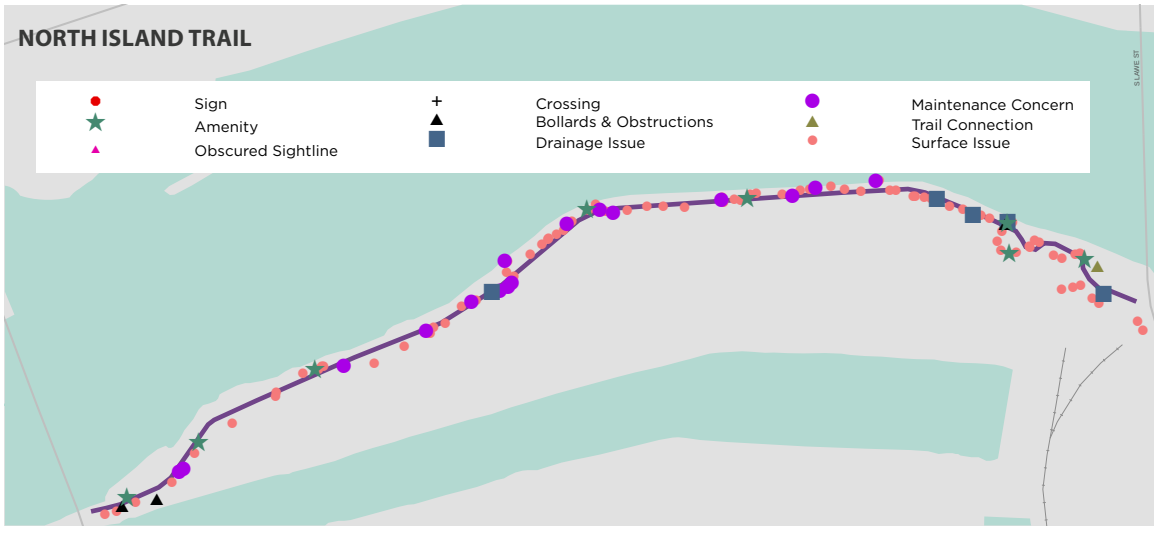
ITEM	COUNT
Signs	94
Lighting	25
Benches	22

Overall, trail widths were found to be consistently 10 feet, with only five total width changes noted. Trail surface varied between asphalt and concrete.

TABLE 2: SURFACE CONDITION SUMMARY

CONDITION	APPLE CREEK TRAIL	HIGHVIEW TRAIL	NORTH ISLAND TRAIL	PROVIDENCE TRAIL	NEWBERRY TRAIL
TRANSVERSE CRACKING	48	46*	58	16	126
LONGITUDINAL CRACKING	61	52*	5	4	53
EDGE CRACKING	56	4	9	9	19
ALLIGATOR CRACKING	17	0	0	1	11
PATCHING	19	10	9	2	6
SAGS/ SETTLEMENT	13	6	3	0	0
ROOT INTRUSIONS	1	0	16	1	4
DRAINAGE ISSUE	16	0	5	1	4

**Note that these numbers represent only a small portion of the number of transverse and longitudinal cracks on the Highview Trail. The density of cracks was often too high to document accurately.*



Example of trail audit results along the North Island Trail. Each point is maintained in a database compatible with existing city systems.

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EXISTING TRAIL NETWORK

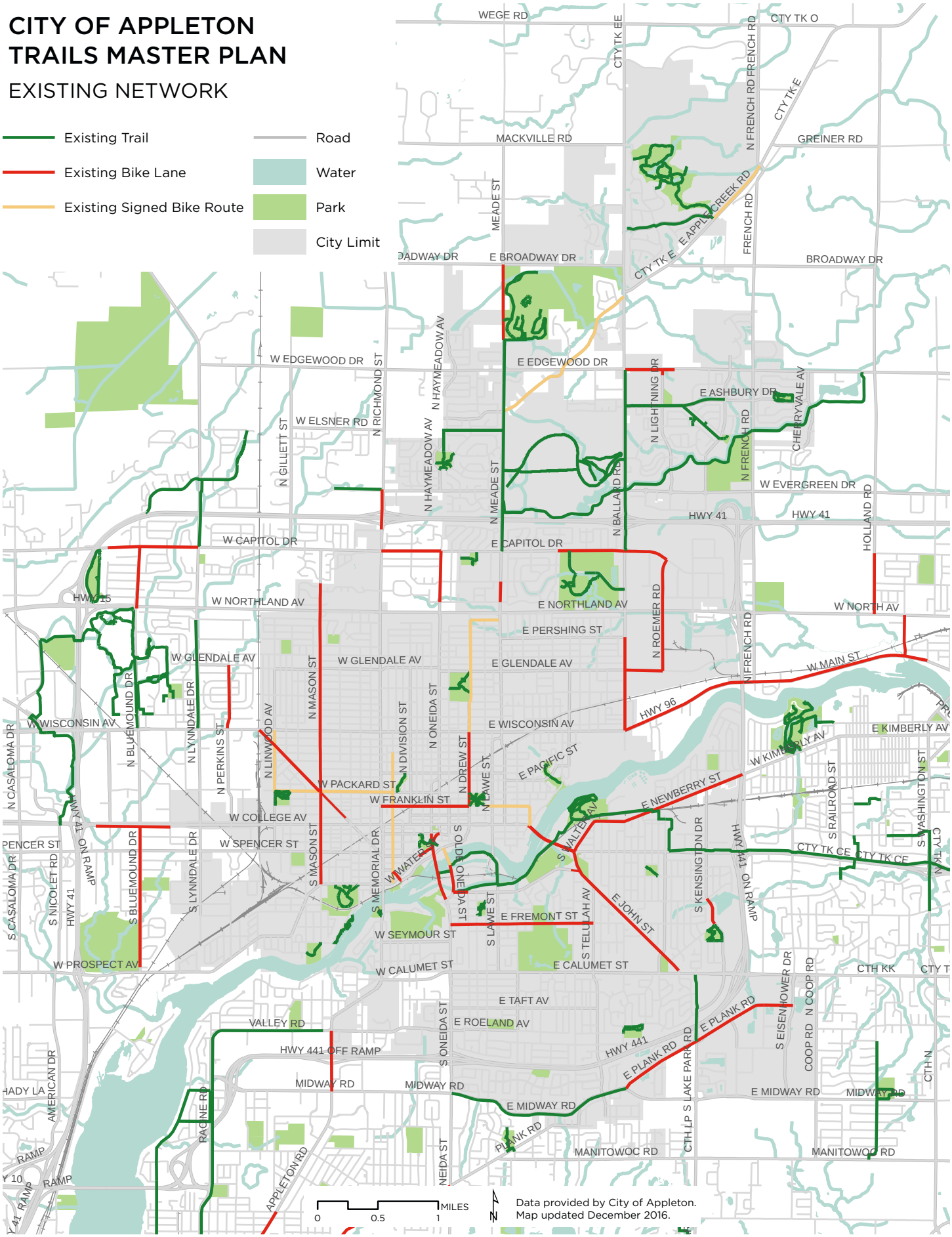
A comprehensive trail network provides recreational and transportation opportunities for bicyclists, pedestrians, and other active users. Connectivity to an on-street network of bike lanes, signed routes, and sidewalks extends the reach of the network and provide access to destinations, neighborhoods, and places of employment.

The City of Appleton currently has an active transportation network that includes off-street trails, on-street bike lanes, sidewalks, sidepaths, and on-street signed routes. The On-Street Bike Lane Plan and regional planning efforts have identified numerous corridors for network expansion, providing connections to the existing network, regional destinations, and other regional bicycle and pedestrian facilities.

The following section explores both the existing and proposed network. This network will be used in the project development phase of the Master Plan.

CITY OF APPLETON TRAILS MASTER PLAN

EXISTING NETWORK



Existing Trail Network

The existing network within city limits is comprised primarily of off-street trails (often within parks), sidepaths separated from traffic, and on-street bike lanes. The map on the preceding page depicts the existing network both within and outside of Appleton City Limits.

In general there is minimal connectivity between existing trails, with significant disconnect between trails along the river and trails north of Highway 41; opportunities to connect with the on-street network are also limited. In many cases trails do not connect directly into the on-street network, or the on-street network doesn't extend beyond the trail connection. Connections within the network are important for the overall usability of the system; safe, clear connections can promote greater trail use and increase the utility of the overall network.

As seen in the existing network map, a limited number of signed routes help connect existing facilities for bicyclists who are willing and able to travel in a mixed-traffic environment. Delineating these routes provides key wayfinding information for these cyclists. Often these signed routes end without further wayfinding to help bicyclists reach their intended destination.

Signed routes are a relatively quick approach to extending the existing network but do not accommodate users of all ages and abilities. Facilities that offer more protection, such as separated trails and cycle tracks, accommodate a wider range of users. A more comprehensive network of protected facilities can increase the utility of trails as part of Appleton's active transportation network.

It is important to note that the city is actively working to expand the current network. Current efforts assess the feasibility of adding bike lanes to road resurfacing and reconstruction projects, while sidepaths are added where possible in new development areas.

Facility Types

TRAILS:

The City of Appleton has over 20 miles of existing trails within the city limits. Trails provides a facility for bicyclists and pedestrians that is separated from motor vehicle traffic.

SIDEPATHS:

Located adjacent to roadways, sidepaths are wide (usually approximately 10 feet) pathways similar to a sidewalk. Sidepaths are more separated than on-street lanes.

BIKE LANES:

Designated lanes for bicycle use are located adjacent to motor vehicle travel lanes and may be located adjacent to on-street parking.

SIGNED ROUTES:

Existing roadways are designated as bike routes and feature signs, as see in the image to the left, that identify the route and may also provide wayfinding when route changes direction. There are no physical improvements to the roadway, and bikes ride in mixed traffic.

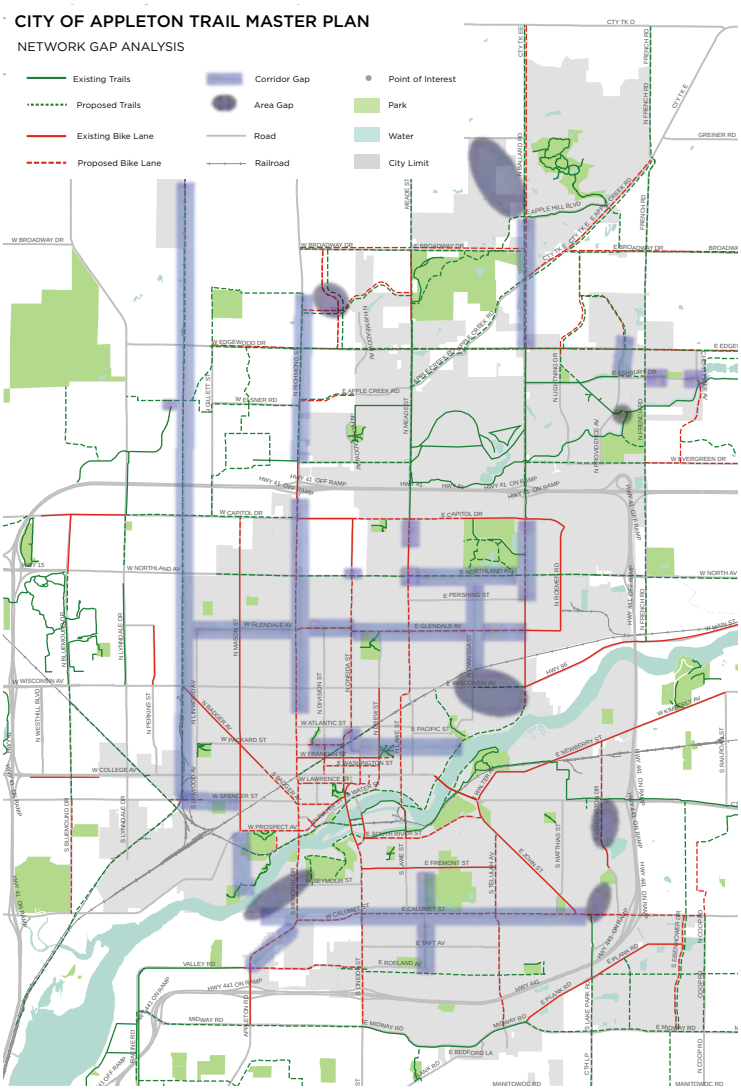
SIDEWALKS:

Appleton features a comprehensive sidewalk network, providing designated pedestrian facilities throughout the majority of the city. With the exception of some areas in downtown, bicycles are permitted on sidewalks.

A map depicting both corridor and area gaps, shown to the right, identifies potential project areas that will help increase the coverage of the existing network. Gaps may be present along an entire corridor, at a specific intersection, or for an entire area. Additional geographic features or infrastructure may create a barrier, limiting travel between two areas. Examples of these gaps are shown below. The addition of facilities in these area will provide greater connectivity across the city and with the region.

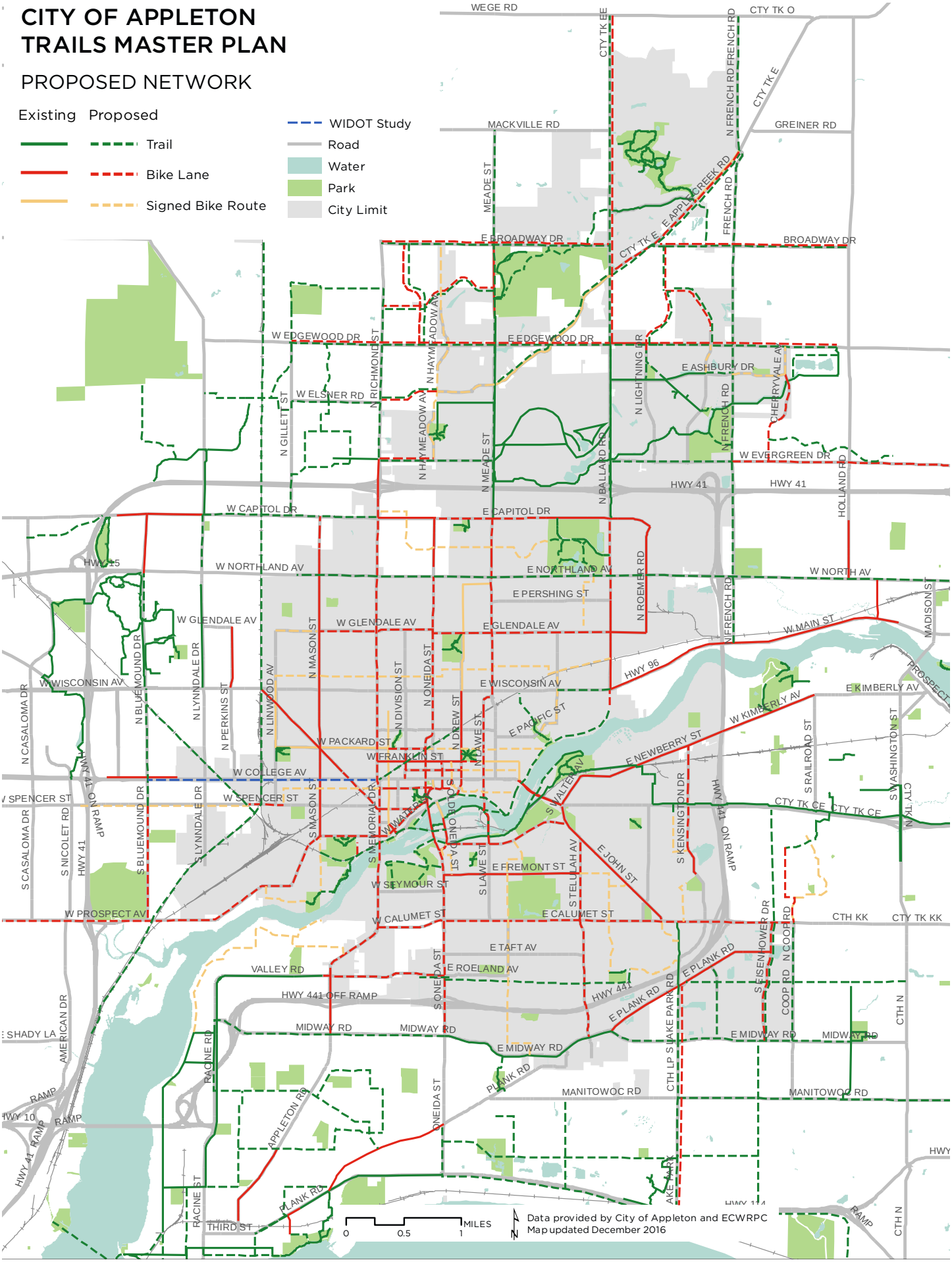
Railroad tracks represent infrastructure barriers and require specific improvements for a safe crossing along bike and pedestrian routes. They also provide opportunities for parallel routes.

Facilities ending without further information can create gaps at intersections



CITY OF APPLETON TRAILS MASTER PLAN

PROPOSED NETWORK



Proposed Network

The map on the previous page builds on the existing network within Appleton and includes facilities proposed in regional plans and the On-Street Bike Lane plan. In addition to facilities already proposed, new facilities were identified during stakeholder meetings held in May 2016, including those proposed in the ongoing Downtown Mobility Plan.

While this plan focuses on trails operated by the Parks, Recreation, and Facilities Department, project development considers connectivity with existing and proposed network segments regardless of facility type.

High visibility crossings and clear signage create continuity in the trail system at intersections with roadways.

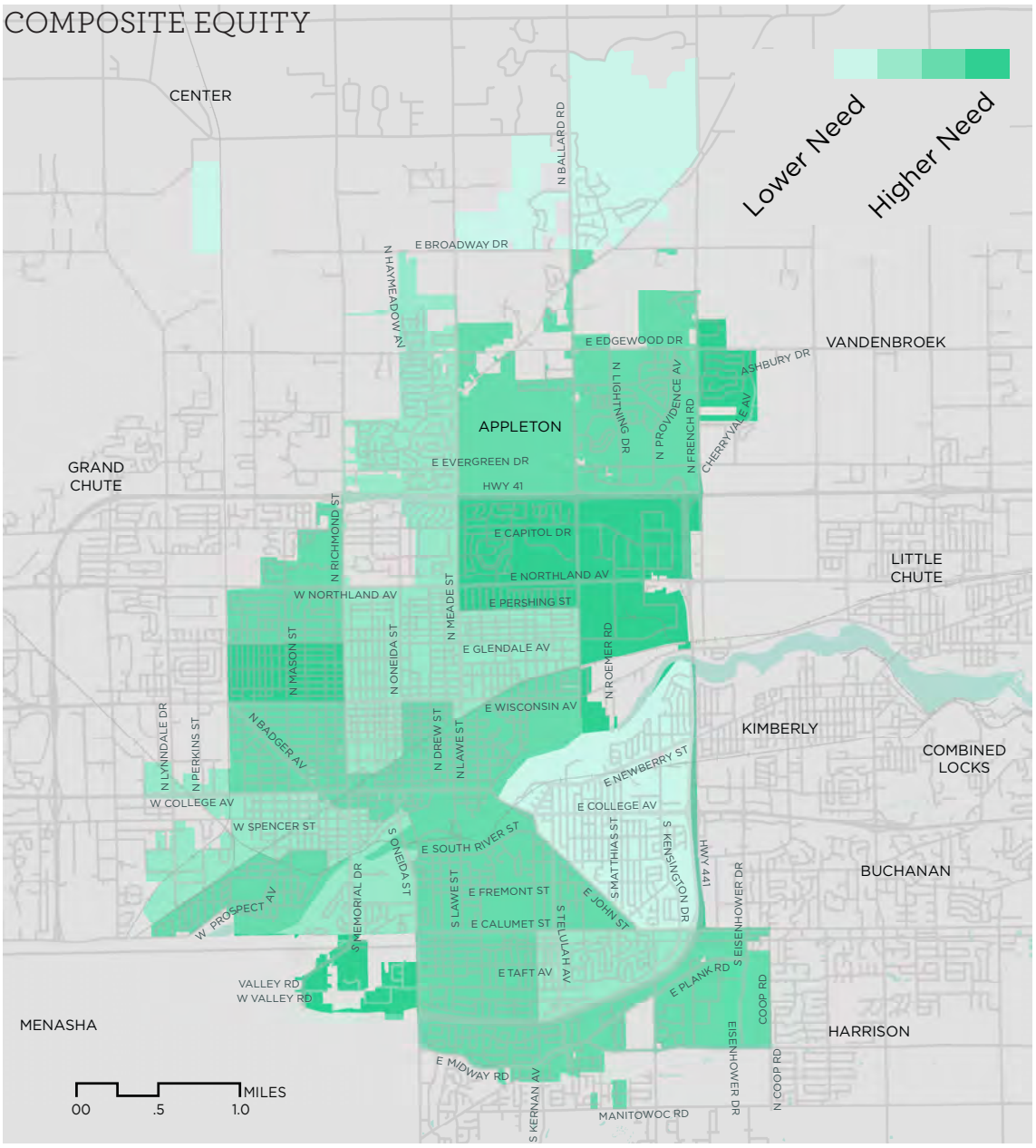
Equity Analysis

An equity analysis was conducted to better understand demographics within the City of Appleton and its relationship to facility access. The factors considered include: poverty, limited-English proficiency, non-white population, population under 18, population over 65, and population without a high school diploma. Historically these populations have been undeserved and are indicators of areas with relatively low levels of access to bicycle and pedestrian facilities.

The results are based on Census Tract boundaries as they compare with the state of Wisconsin. The five factors were then considered together to produce an overall equity score, as displayed on the next page. It is important to note that the data represent 2014 ACS data, based on a 5-year rolling average. For this reason, recent development may not be accurately accounted for. These maps provide a basis for analysis but require additional context-sensitive understanding.

The greatest areas of need are the northernmost Census Tract, north of the river along the eastern boundary of the city, and in the southwestern portion of the city near Valley Road. Individual factors varied in their distribution, however. For example, the south-western portion of the city exhibits the highest need in relation education, but scored lower for age and percent of households below poverty.

The equity analysis conducted during this planning process helps identify areas where making active transportation investments can have a large impact for children, older adults, low-income families, people of color, and people with limited English language abilities. For example, populations with limited English proficiency may be less likely to engage in the public process and may have different needs that those who do provide feedback. Therefore, additional outreach can be done in these areas to reach a wider range of the population and better understand how trail facilities can meet the needs of all residents in Appleton. These results serve as one input into project prioritization, discussed in the next chapter.


COMPOSITE EQUITY
Lower Need
Higher Need
CENTER
N BALLARD RD
E BROADWAY DR
N HAYMEADOW AV
E EDGEWOOD DR
VANDENBROEK
ASHBURY DR
N LIGHTNING DR
N PROVIDENCE AV
N FRENCH RD
CHERRY VALE AV
APPLETON
GRAND CHUTE
E EVERGREEN DR
HWY 41
N RICHMOND ST
E CAPITOL DR
LITTLE CHUTE
E NORTHLAND AV
W NORTHLAND AV
E PERSHING ST
N MEADE ST
N MASON ST
N ONEIDA ST
E GLENDALE AV
N ROEMER RD
E WISCONSIN AV
KIMBERLY
N LYNNDALE DR
N PERKINS ST
N BADGER AV
N DREW ST
N LAWE ST
COMBINED LOCKS
E NEWBERRY ST
W COLLEGE AV
E COLLEGE AV
W SPENCER ST
S ONEIDA ST
E SOUTH RIVER ST
S MATTHIAS ST
S KENSINGTON DR
HWY 441
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E JOHN ST
S TELULAH AV
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PUBLIC INVOLVEMENT

A robust public involvement process was used to help identify project priorities and refine recommendations for the Appleton Trails Master Plan. This project leverages public involvement processes happening concurrently for the Appleton Comprehensive Plan. The following is a complete list of opportunities for the public to provide input on the process:

- June 2016 Trails Master Plan Survey
- March 2016 City of Appleton Comprehensive Plan Issues and Opportunities Workshops
- May 2016 City of Appleton Comprehensive Plan Downtown Design Workshop
- City of Appleton Comprehensive Plan Survey
- City of Appleton Comprehensive Plan Interactive Website

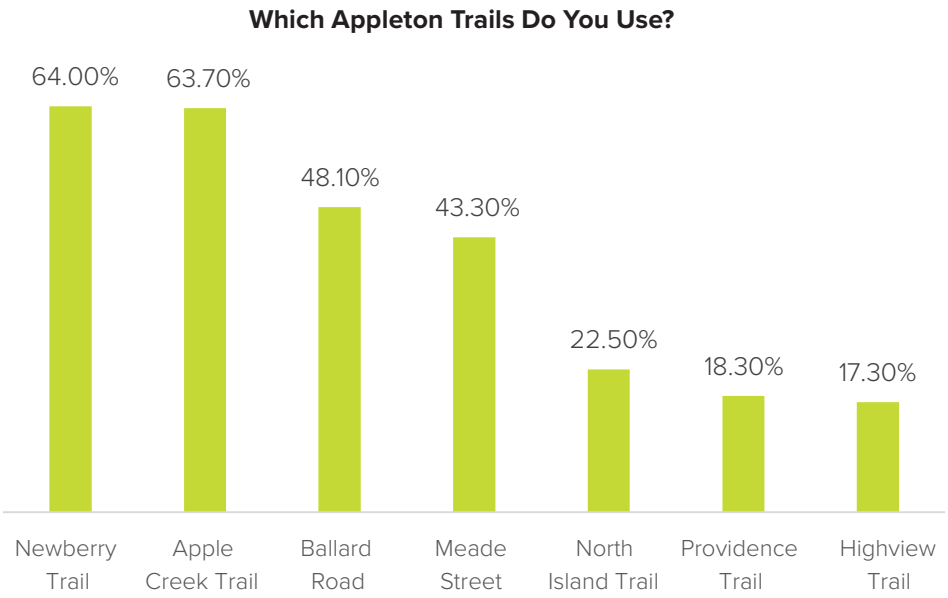
In general, respondents indicated a desire for more trails; support for the development of a dense network of trails, sidewalks, and bike lanes; and a need for more tools to better utilize the system, including wayfinding signage. A summary of comments received during the public involvement process follows.

June 2016 Trails Master Plan Survey Results

A public online survey was conducted from June 20 to July 5, 2016. The survey consisted of two parts: a four-question survey via SurveyMonkey as well as a public input map accessible through ArcGIS Online. The survey received 298 responses, and nearly 400 locations were noted on the map. The following section explores the results of this survey exercise.

EXISTING TRAIL USE

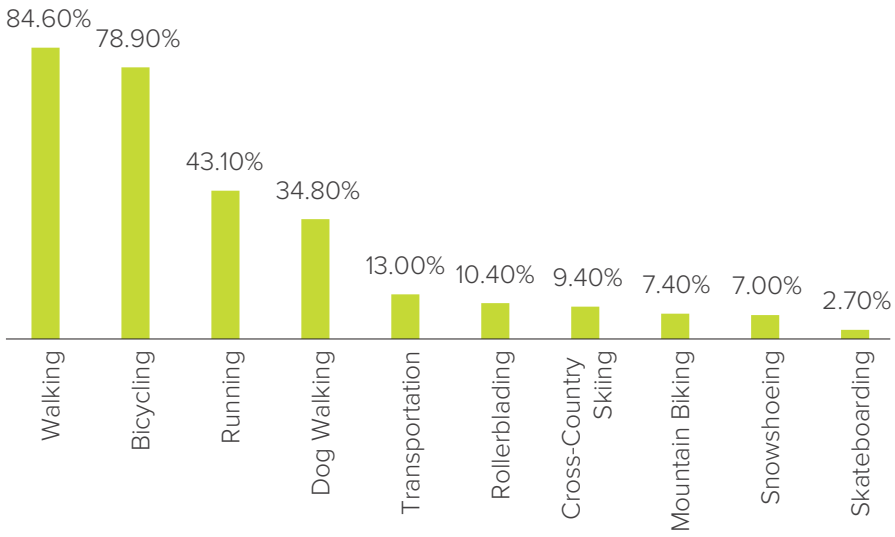
The SurveyMonkey component focused primarily on existing trail use and perceptions of existing trails. In addition to which trails, respondents were asked about how they use the trails and what features they like or dislike.



Respondents were asked to select the trails they currently use. Newberry and Apple Creek Trails received the highest response, while Ballard Road and Meade Street were also frequently indicated. Approximately 15% of participants also selected “Other.” The most frequent trails listed here included CE Trail, Paper Trail, Thrivent Trail, and the Fox Valley Tech Trail.

Several respondents indicated that they currently use trails but are not sure of the names or were unaware that trails were named.

How Do You Use Appleton Trails?
(Select all that apply)



The use of Appleton trails is diverse, ranging from expected activities--such as running, walking, and biking--to more seasonal uses of trails, including snowshoeing and cross-country skiing. Requests in the final question for plowing trails during the winter suggests a desire for year-round use of the trails, which may accommodate a wider range of activities through all seasons.

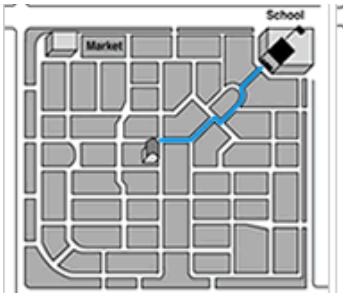
What Things Do You Like or Dislike About Appleton Trails?

	LIKE	DISLIKE	NO OPINION
TRAILS CAN BE USED FOR COMMUTING	72.3%	2.1%	25.6%
TRAILS CAN BE USED FOR SOCIALIZING AND RECREATION	92.6%	0.7%	6.7%
DOGS ALLOWED ON TRAILS	61.6%	14.7%	23.6%
PAVING CONDITION OF TRAILS	83.9%	5.5%	10.6%
SAFETY OF ROAD CROSSINGS	67.5%	17.1%	15.4%
BENCHES AND TRASH RECEPTACLES	74.1%	9.3%	16.6%
WAYFINDING SIGNS	58.8%	12.7%	28.5%

In general, respondents indicated that they like the qualities of Appleton trails. These responses, in conjunction with the following open-ended question, seem to suggest however that while there are some qualities and locations that are well-liked, this does not preclude improvement of these qualities in the overall trail network. For example, safe crossings and improved wayfinding were frequently requested, despite receiving favorable responses here. Identifying best practice locations on Appleton trails will provide further insight into the preferred features of the network.

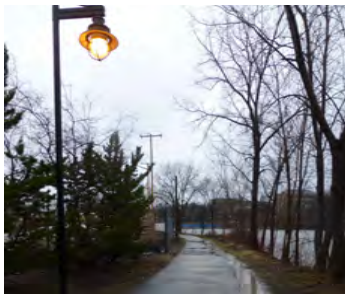
SUGGESTIONS + RECOMMENDATIONS

Respondents were encouraged to provide additional feedback regarding Appleton Trails, including any additional suggestions for improving existing trails or expanding the system. A total of 145 individual responses were received, which covered a wide range of topics.



Connectivity - 46.3%

Comments specifically requested greater connectivity among trails both in Appleton and across the region; connectivity to destinations, including parks; and connectivity among the network, including bike lanes. Many comments focused on the discontinuity of the existing trail system and asked for both greater connectivity to facilitate commuting as well as options for connecting trails into loop systems without having to drive from home. (Image: Transportation and Growth Management Oregon Guide)



Safety - 29.9%

Comments regarding safety covered three primary concerns. First was safety in terms of separation from motor vehicle traffic. Greater delineation of bike lanes and the development of more trails that provide a separation from motor vehicles are preferred. Second, safety related to crossings and interactions with other modes of travel were frequently mentioned. Finally improvements to safety on the trails were a significant concern; additional lighting, emergency call boxes, and increased patrol were often noted.

Location - 22.4%

Many respondents presented specific ideas for location of trails and areas needed for improved connections. Increased opportunities along the river as well as connections with Grand Chute were most frequently noted. Increased trail opportunities in the southern portion of Appleton were also preferred. In addition to specific locations, 3.4% of respondents included preference for more natural settings in trail siting and design.

Amenities - 14.3%

Respondents requested additional amenities for the trails, including more benches, trash receptacles, dog waste stations, restroom facilities, and drinking fountains.

Crossings - 12.2%

Crossings were most often noted in conjunction with concerns regarding safety and connectivity of trails. Interaction of trails with roadways and other points of conflict with motor vehicles discourages use of trails. Desire to use trails with family members of all ages and abilities was mentioned with requests for improved crossing conditions. Comments also included requests for improved ADA accessibility via curb ramps.

Signage - 10.2%

Several comment expressed desire for more information regarding trails. Signage was noted by 10.2% of respondents, while nearly 5% of respondents also indicated improved information via the internet or other mediums. Respondents requesting more information indicated that they would be more likely to use other trails or connect trips if they could learn more. Wayfinding and regulatory signage were specifically requested to help users navigate the existing trail system and connect more easily to nearby destinations.

Trail Uses - 7.5%

Mountain biking, dog walking, and ATV use were mentioned as desired activities for the trail system. Greater opportunities for commuting as well as loop connections were also noted.

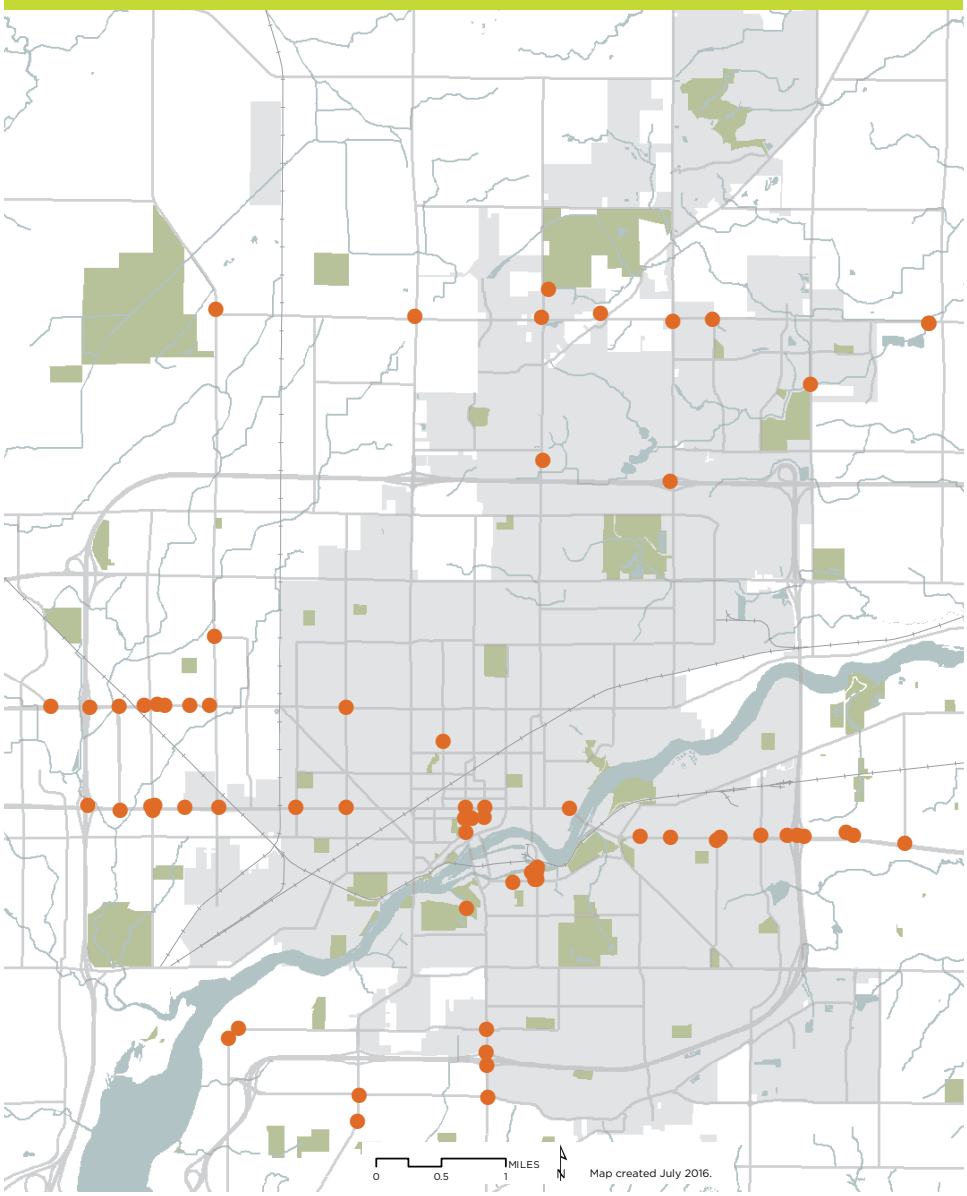
Maintenance - 6.1%

In regard to maintenance concerns, many respondents included both snow plowing in the winter and vegetation trimming as primary concerns. Similarly, some respondents requested information about repaving plans due to the surface condition along several trails.

PUBLIC INPUT MAP

An online map provided the opportunity for Appleton residents to provide feedback on the location of trails and barriers to trail use. The inclusion of the mapping component was especially useful in this exercise as many respondents indicated that they were unaware of the names of the trails they use.

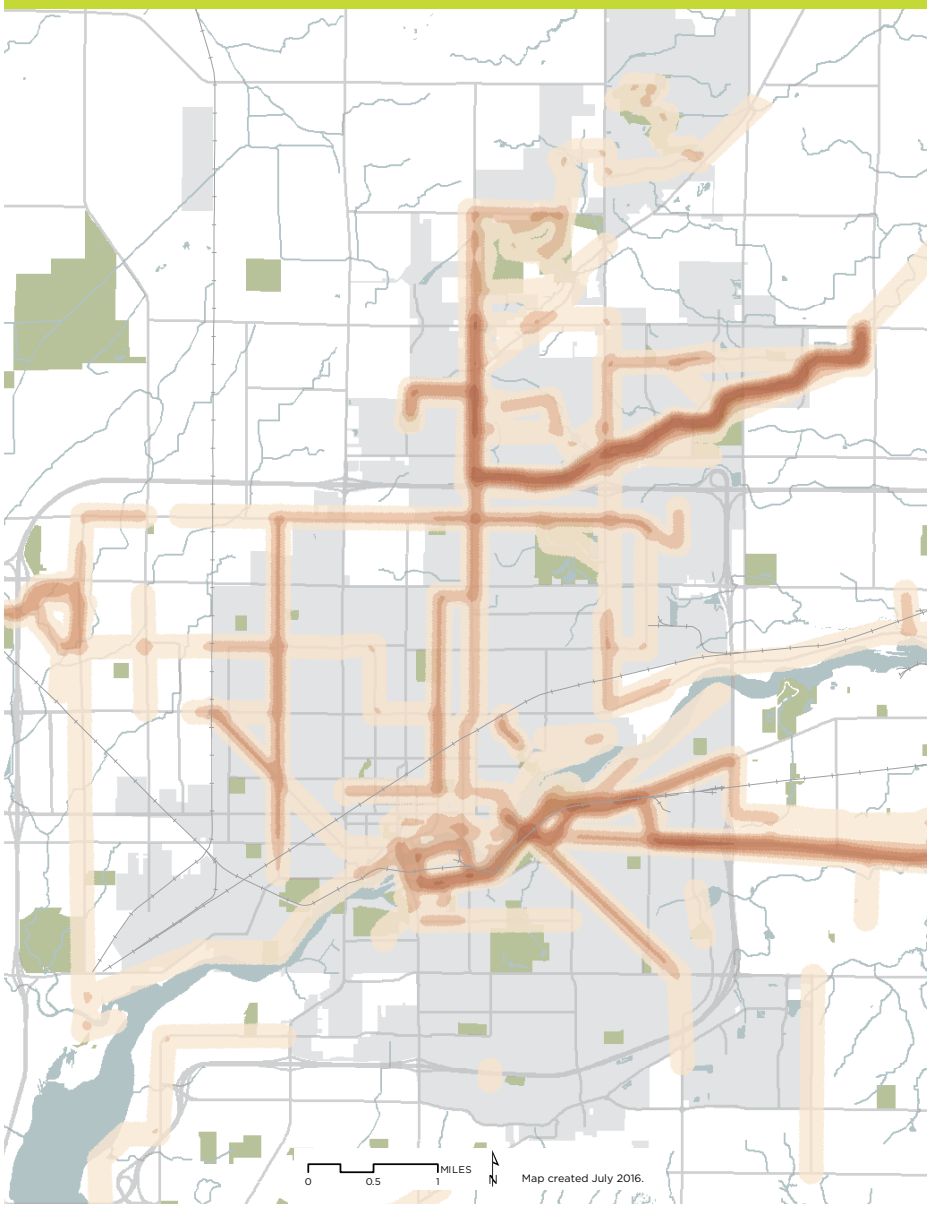
MAP 1: ANSWER TO "BARRIERS TO TRAIL USE"



A total of 68 barriers were noted, occurring primarily noted along major arterials, especially on roadways that provide regional connectivity. An additional cluster of barriers were noted in downtown.

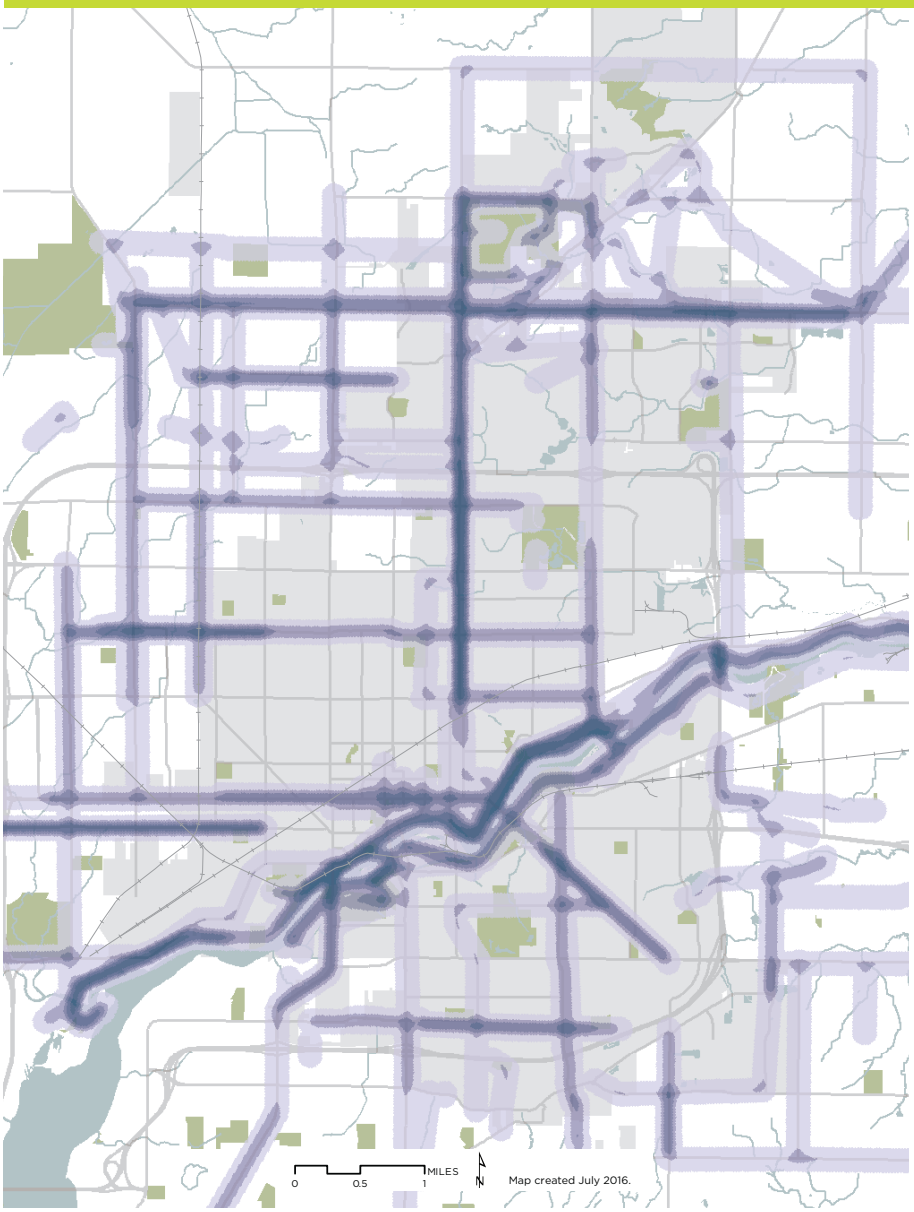
Darker areas represented a greater frequency of trail use, as indicated by 108 respondents. The most frequently noted trails include those along the river as well as trails and roadways in the northern portion of the city. These results are consistent with the survey responses indicated greatest use of the Newberry and Apple Creek Trails.

MAP 2: ANSWER TO "TRAILS I USE"



Darker areas represented a greater frequency of desired trail locations, as indicated by 210 respondents. Improved trails along the river, a north-south connection north of the river, and an east-west connection in the northern portion of the city were most commonly indicated.

MAP 3: ANSWER TO "WHERE I WANT TO SEE TRAILS"

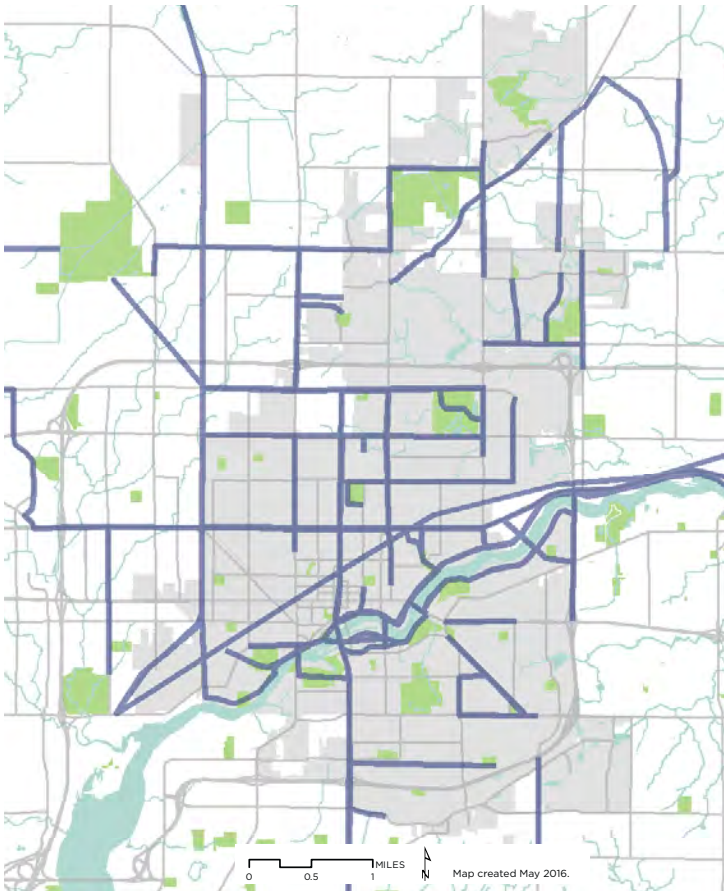


March 2016 City of Appleton Comprehensive Plan Issues and Opportunities Workshop

On March 14 and 16, public workshops were held to kick off the update to the city's Comprehensive Plan. Attendees participated in three activities. First they were asked to share their hopes and dreams for the future of Appleton as well as ideas for investing in the future. Several comments related to trail improvements, providing more trails, creating greater connectivity, and improving safety. A full list of comments can be found in Appendix 1.

Second, participants were asked what types of taxable and non-taxable development they would like to see in Appleton. Forty-six trail-related comments were generally in support of more and better-connected trails. More specific comments can be found in Appendix 1.

Finally, participants were asked to provide input specifically related to trails. A paper survey with accompanying map captured input regarding ways to improve and expand the existing trail network. This exercise was similar to the online survey described previously. The map below captures the locations identified as areas of high use or in need of improved connections during this exercise.



Map Summary
Participants indicated trails they frequently use, connections they'd like to see in the future, and areas in need of improvements. This map captures the summary of the comments provided during the March meetings described above.

May 2016 City of Appleton Comprehensive Plan Downtown & Trails Design Workshop

As part of the May 16-18 Design Workshop, the public had additional opportunities to share ideas related to the city's existing and proposed trail system. The kick-off meeting included small group exercises designed to solicit input into the downtown planning areas as well as the city's bike and pedestrian network. A summary of ideas and comments were generated during the report-out session at the end of the small group exercises; trail-related key findings are listed below.

- Public access to the river is important; more stairs and bridges are needed
- Wayfinding and beautification are needed to enhance river connectivity and downtown in general, especially for pedestrians
- Trails need to be connected beyond the river and downtown to encourage broader access via walking and biking
- Visitors need better orientation to downtown and the river
- Jones Park should be used to connect the river to downtown

On the morning of May 17th, a Community Bike Tour was conducted by Fred Young (Alta) and Rob Gusky (Fox Cities Cycling Association). The tour included several stops along the Fox River, where participants had the opportunity to share their ideas for enhancing the trail system.

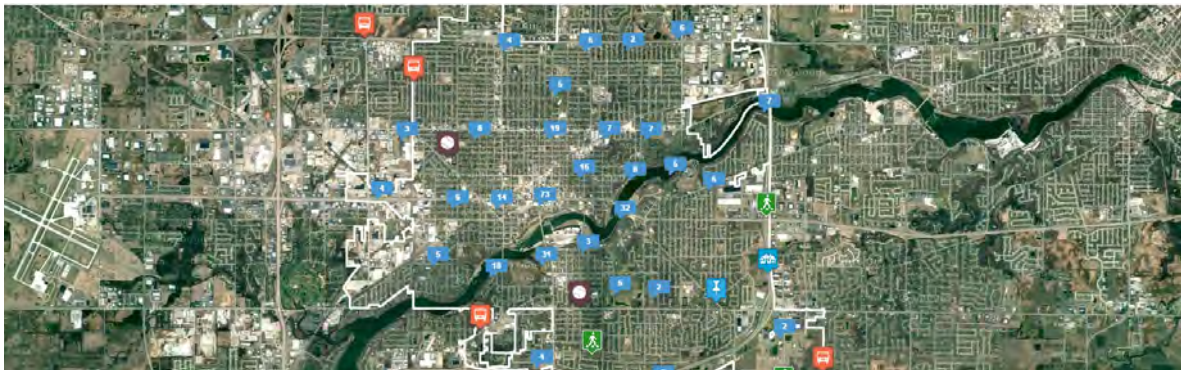
At the end of the three-day workshop, approximately 75-100 people attended the May 18th Open House, which included several display boards in the hall of the City Center Plaza. Two 30-minute presentations were provided to attendees. Written comments were solicited for key issues explored during the workshop. A summary of trail and walkability-related comments can be found in Appendix 1.

City of Appleton Comprehensive Plan Website

The ongoing Comprehensive Plan Update gathered data from over 1,000 Appleton residents in both an online survey and online web map format. The survey covered a wide range of topics, primarily related to downtown development; however, the importance of trails, a comprehensive bicycle network, and active transportation opportunities was clearly noted across many questions.

Over 50% of respondents indicated support for the development of more bicycle lanes in Appleton, while over 60% of respondents agreed that there should be more off-street dedicated facilities for bicyclists and pedestrians. Comments specific to these facility types echoed the results of the Trails Master Plan Survey: respondents want a connected low-stress network with safer crossings at railroads and intersections, more wayfinding elements, and more opportunities to connect to parks and other destinations. Many respondents called for facilities that accommodate all ages and abilities and that facilitate utilitarian trips, such as running errands, or commuting by bicycle or foot.

An online map solicited specific feedback related to a variety of issues, including 56 trails-specific comments. Comments identified critical links in the existing trail network, opportunities for enhanced trail connections, and areas in specific need of additional maintenance and repair. A full list of comments can be found in Appendix 1.



The online map allowed respondents to identify specific locations of concern for items addressed in the Comprehensive Plan.

Stakeholder Meetings

In addition to public involvement events listed above, four stakeholder committee meetings were held throughout the course of the project. The stakeholder committee was assembled from a broad range of interests to help guide the development of the plan. The consultant team also presented to the Bicycle and Pedestrian Advisory Committee and met with key stakeholders from Public Works and the Office of Economic Development.

Summary Of Public Involvement Activities

In general, Appleton residents are in favor of a well-connected active transportation network. Residents desire connections to destinations and across the region. An expanded trail network that is easy to navigate and addresses concerns of safety and accessibility is preferred, as is accommodation of all ages and abilities. Noted barriers appear to impact existing regional connectivity, while locations for new and improved trails focus on providing connections within the city. Additions of amenities or wayfinding signage may improve the utility of the trail network for residents, and improved maintenance may increase use across all seasons.

The information collected during the stakeholder meetings as well as that compiled during the public survey will help inform project development and selection as part of the Trails Master Plan.

PROJECT PRIORITIZATION

Projects to be addressed through this plan are developed from the gaps, key corridor connections, and existing trails analysis explored in the previous section. Projects identified include both new connections as well as projects derived from the trail audit findings. This section defines potential project segments then prioritizes these segments to identify which projects will have the most impact and should be implemented first.

Project Development

Three types of projects were identified based on trail audit data and proposed facilities:

- Routine Maintenance: These projects capture routine maintenance that must occur on trails. These projects are captured in the accompanying Trail Design Best Practices manual (Appendix 4)
- One-time Upgrade: Upgrade projects represent an opportunity to increase existing trail quality either through improving surface quality (addressing severe cracking, reducing drainage concerns) or addressing safety concerns through intersection and sightline improvements
- New Connections: New connections are proposed trail segments, as identified in the future network map in the previous section

Project Prioritization

Full implementation is expected to take many years, which makes it important to develop a process for selecting which projects should be implemented first. The criteria developed for project prioritization are based on best practices in the field and are consistent with the goals and themes of existing local and regional bike plans, including serving a wide range of users, providing connections to key destinations, and closing network gaps.

Separate criteria were developed for Upgrade and New Connection projects to reflect the role these projects play in enhancing the network. While the criteria aim to provide an objective assessment of network improvements, project feasibility and priority are also impacted by ongoing planning efforts within the city, including CIP development and near-term department work plans. For this reason, the initial prioritization results are then reviewed with city staff and adjusted based on this feedback.

UPGRADE PROJECTS

Upgrade projects address all possible upgrades along a project segment as identified during the trail audit. Project segments are defined as existing trail segments that occur between major roadways, railroads, and other trails.

Upgrade projects located along the river scored the highest. These projects will serve the greatest number of residents. Although not considered in the prioritization exercise, these locations also provide significant connectivity to existing and proposed network links as well as a wide range of destinations.

The projects located along these segments are primarily related to surface quality, and when combined with crossing improvements can provide an immediate benefit to trail users in terms of both quality and safety. The North Island Trail scored as a high priority upgrade; however, the trail is being resurfaced during Fall 2016 and is omitted from the results on the following page.

Project priority scores were grouped based on 4 time periods for implementation: 0-5 years, 6-10 years, 11-15 years, and 16 or more years, where highest priority projects should be considered for

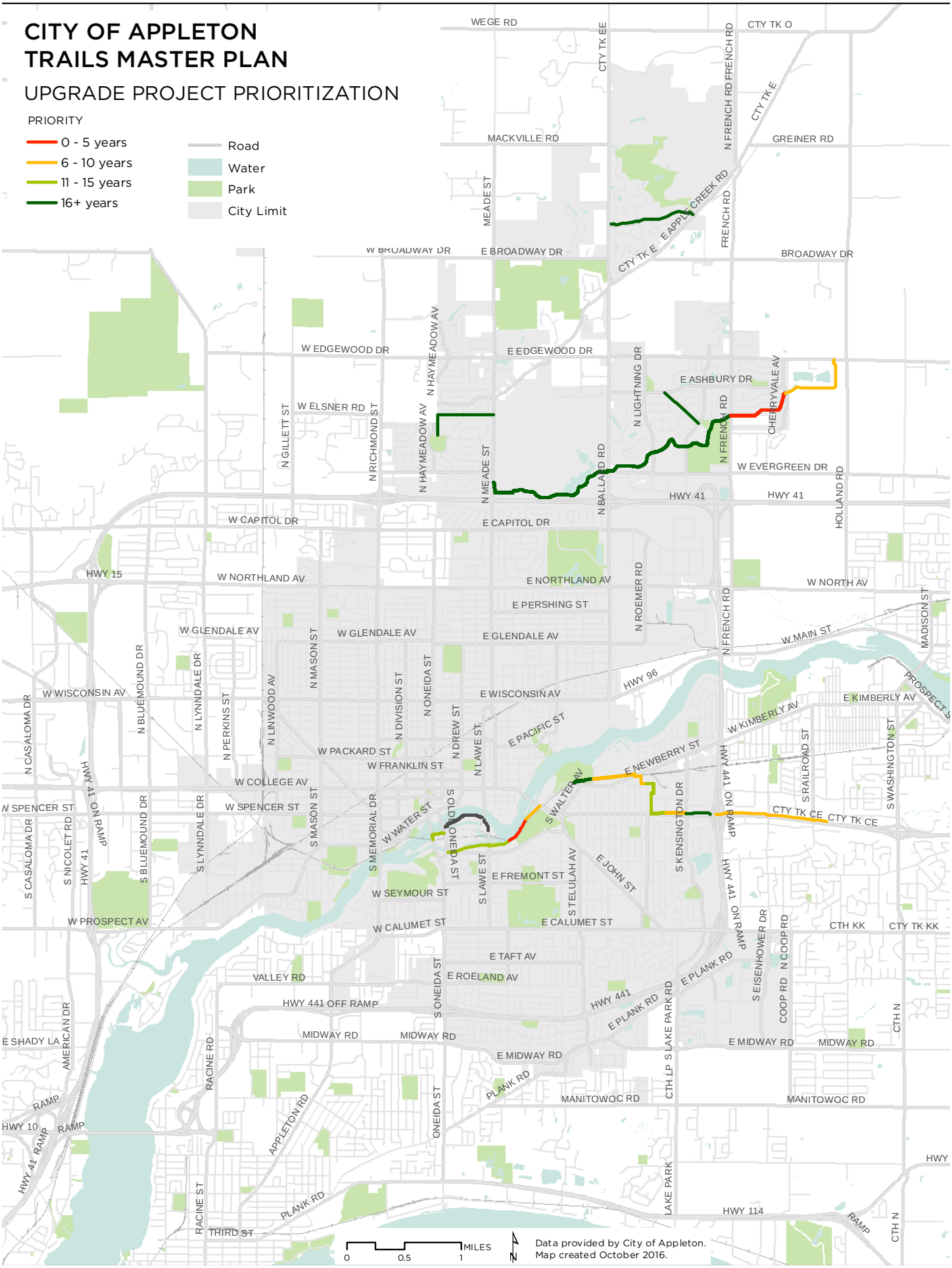
completion in the next 5 years. However, current scores are relative to the upgrade issues identified during inventory, and additional maintenance concerns may arise over subsequent years that can impact upgrade priority.

TABLE 3: UPGRADE PROJECT PRIORITIZATION CRITERIA

CRITERION	DEFINITION	OPERATIONAL DEFINITION	POINTS
Cost	What is the anticipated upgrade cost? (Low - Medium - High)	Project cost will be relatively low (surface improvements)	1
		Project cost will be relatively moderate (Drainage)	3
		Project cost will be relatively high (crossing, sightline, and obstruction improvements)	5
Safety	To What extent will the project provide an immediate safety benefit?	Project benefits safety through crossing or sightline improvements	5
		Project benefits safety by addressing pathway obstructions	3
		Project does not provide an immediate safety benefit	1
Ease of Implementation	How difficult is the project to implement?	Project implementation will be relatively difficult (crossing, sightline, and obstruction improvements)	1
		Project implementation will be relatively moderate (drainage improvements)v	3
		Project implementation will be relatively easy (surface)	5
Quality	To what extent doest the project provide an immediate benefit to the overall quality of the trail?	Project benefits quality through surface or drainage improvements	5
		Project does not provide an immediate benefit to the overall quality of the trail	1
Benefit to Residents	What portion of the population will benefit from the upgrade?	Segment is within census tract with the highest population density (top 25% of census tracts)	5
		Segment is within census tract moderate population density (Top 50% of census tracts)	3
		Segment is within census tract with lowest population density (Bottom 50% of census tracts)	1
Extent of Deficiency	What is the density of upgrades recommended along a project segment?	Upgrade projects are most dense along segment (Top 25% of segments)	5
		Upgrade projects are moderately dense along segment (Top 50% of segments)	3
		Upgrade projects are least dense along segment (Bottom 50% of census tracts)	1
Benefit to under-served populations	To what extent does the new project provide network access to Census Tracts with identified need?	Project occurs in Census Tract with greatest identified need (Top 25% of Census Tracts)	5

CITY OF APPLETON
TRAILS MASTER PLAN

UPGRADE PROJECT PRIORITIZATION



PROJECT COST ESTIMATES

The table below shows cost unit estimates for each upgrade project issue. Each project may have had none, one, or multiple issues. The following pages show the total cost to upgrade each segment. To view the type of issue associated with each segment see Appendix 4.

UPGRADE PROJECT UNIT COSTS		
ISSUE	**UNIT/COST ASSUMPTIONS**	**COST PER UNIT**
Drainage	Installation of 16 LF of 12" culvert pipe (assumes 90 feet of trail removal and replacement)	$8,500
Pavement Surface - Crackfill	Assumes crack is full trail width	$50
Pavement Replacement	LF (assumes removal and replacement as part of a larger project)	$25
Missing Crosswalk	Crosswalk (assumes a crossing width of 40 feet and ladder style markings)	$1,520
Bollard Removal	One bollard (assumes concrete base)	$375
Gate Removal	One Gate (assumes concrete base and two posts per gate)	$750

Upgrade projects, such as improved crossings with roadways and rail lines, can improve trail safety and increase comfort a wide range of trail users.

UPGRADE PROJECT LIST

UPGRADE SEGMENTS 1-5 YEARS				
LOCATION	**CROSS STREET 1**	**CROSS STREET 2**	**LENGTH (MILES)**	**PROJECT COST (WITH CONTINGENCY)***
Newberry Trail	West of E College Ave	East of S Lawe Street	0.24	$51, 600
Applecreek Trail	Cherryvale Ave	N French Rd	0.6	$74, 400
			SUBTOTAL**	**$126,000**
			TOTAL***	**$151,200**

UPGRADE SEGMENTS 6-10 YEARS				
LOCATION	**CROSS STREET 1**	**CROSS STREET 2**	**LENGTH (MILES)**	**PROJECT COST (WITH CONTINGENCY)***
Newberry Trail	E College Ave	West of E College Ave	0.17	$28,800
Newberry Trail	E Newberry St	West of E Newberry St	0.37	$66,000
Newberry Trail	E Newberry St	South of E Newberry St	0.18	$27,600
Newberry Trail	S Kensington Dr	West of S Kensington Dr	0.18	$28,800
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	0.05	$0
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	0.02	$0
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	0.05	$0
Newberry Trail	West of S Railroad St	Highway 441	0.39	$0
Newberry Trail	S Railroad St	West of S Railroad St	0.39	$0
Newberry Trail	East of S Railroad St	S Railroad St	0.12	$0
Apple Creek Trail	E Edgewood Dr	Cherryvale Ave	0.7	$34,800
			SUBTOTAL**	**$186,000**
			TOTAL***	**$223,200**

**Contingency is a 1.2 multiplier*

***Costs assume work is park of larger projects*

****Total includes engineering and construction oversight with a 1.2 multiplier.*

UPGRADE PROJECT LIST

UPGRADE SEGMENTS 11-15 YEARS				
LOCATION	**CROSS STREET 1**	**CROSS STREET 2**	**LENGTH (MILES)**	**PROJECT COST (WITH CONTINGENCY)***
Newberry Trail	S Lawe Street	S Olde Oneida Street	0.37	$1,200
Newberry Trail	East of S Lawe Street	S Lawe Street	0.21	$1,200
Newberry Trail	West of S Kensington Dr	N of E College Ave	0.47	$94,800
			SUBTOTAL**	**$97,200**
			TOTAL***	**$116,640**

UPGRADE SEGMENTS 16+ YEARS				
LOCATION	**CROSS STREET 1**	**CROSS STREET 2**	**LENGTH (MILES)**	**PROJECT COST (WITH CONTINGENCY)***
Newberry Trail	West of E Newberry St	West of E Newberry St	0.18	$30,000
Newberry Trail	Highway 441	S Kensington Dr	0.22	$33,600
Apple Creek Trail	N Ballard Rd	N Meade St	1.23	$26,400
Apple Creek Trail	N Lightning Rd	N Ballard Rd	0.46	$94,800
Applecreek Trail	N French Rd	N Lightning Rd	0.94	$33,600
Highview Trail	N Meade St	West of N Meade St	0.4	$68,400
Highview Trail	N Meade St	West of N Meade St	0.27	$44,400
Providence Trail	E Ashbury Dr	E of N Providence Ave	0.17	$32,400
Providence Trail	E Ashbury Dr	E of N Providence Ave	0.09	$14,400
Providence Trail	E Ashbury Dr	E of N Providence Ave	0.09	$0
Providence Trail	E Ashbury Dr	E of N Providence Ave	0.14	$42,000
			SUBTOTAL**	**$420,000**
			TOTAL***	**$504,000**

**Contingency is a 1.2 multiplier*

***Costs assume work is park of larger projects*

****Total includes engineering and construction oversight with a 1.2 multiplier.*

NEW CONNECTIONS

New Connections consider proposed trail segments, as identified in the proposed network map. Project segments are defined as proposed trail segments that occur between existing network segments. The existing network includes trails, bike lanes, and signed routes. Sidewalks, while relatively complete throughout the city, were not included here as more information regarding ADA compliance and sidewalk quality is needed to determine effective network connections.

Following the initial prioritization process, city staff reviewed the recommendations and provided adjustments to better reflect ongoing planning and development efforts within the city.

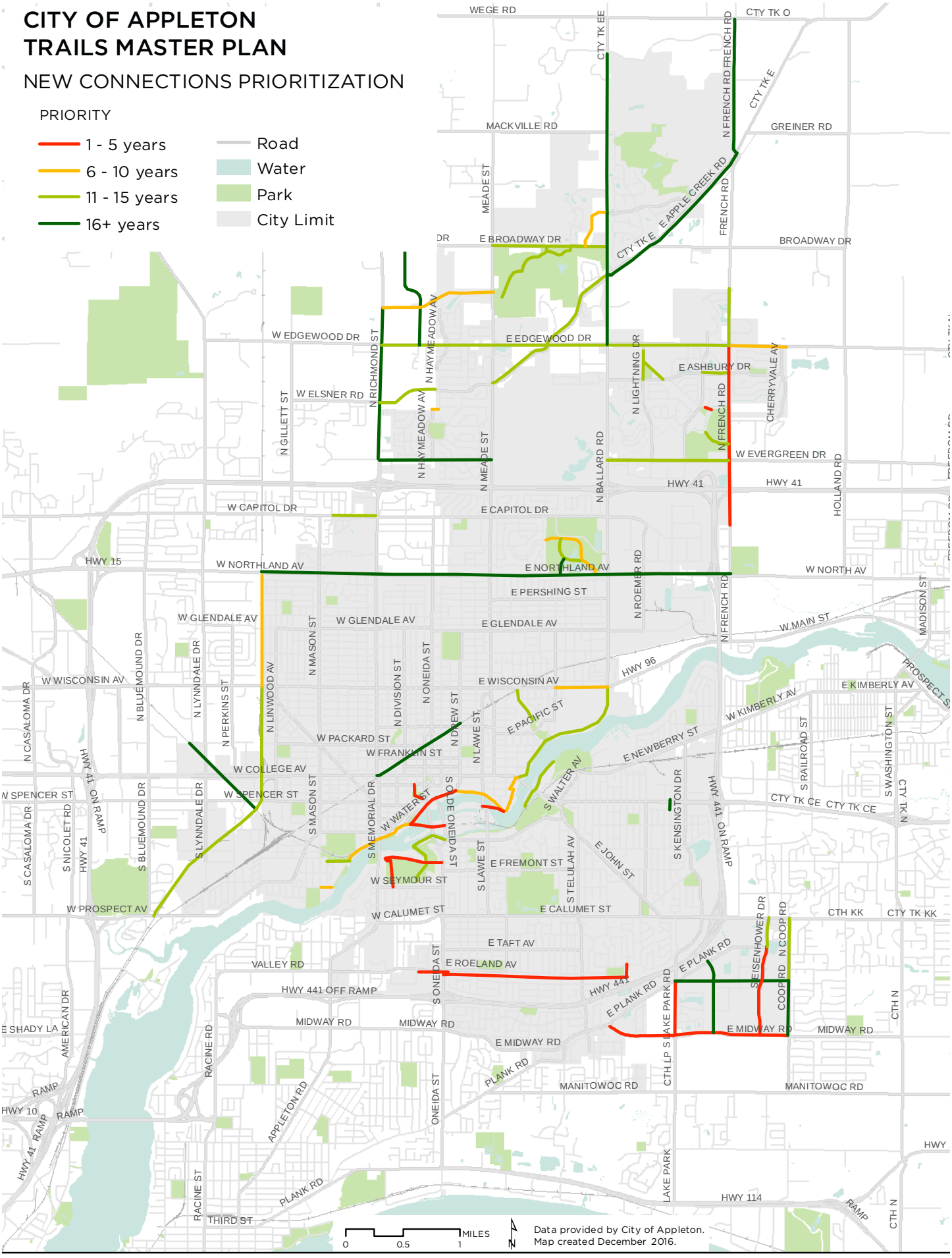
Project priority scores were categorized based on anticipated timeline for completion. Highest priority projects should be considered in the next 5 years, with subsequent projects falling into categories of 6-10 years, 11-15 years, and 16 or more years.

TABLE 4: NEW CONNECTION PRIORITIZATION CRITERIA

CRITERION	GENERAL DEFINITION	OPERATIONAL DEFINITION	POINTS
Network Connectivity	To what extent does the new project enhance connectivity between existing trails or on-street bicycle facilities?	Corridor connects two existing bicycle facilities.	5
		Corridor extends an existing facility	3
		Corridor creates a new, unconnected facility.	0
Serves Destinations	To what extent does the project provide connections to destinations including parks, schools and jobs?	The corridor provides direct access within 1/4 mile to 5 or more schools, parks and top ten employment locations in Appleton	5
		The corridor provides direct access within 1/4 mike to one to four schools, parks and top ten employment locations in Appleton	3
		The corridor does not provide direct access to a park, school or top ten employment location in Appleton	0
Geographic Equity	To what extent does the new project provide bicycle network access to residents who currently do not have access?	The corridor would provide access to residents with no connection to the bicycle or trail network within 1/4 mile	5
		The corridor would provide access to residents with no E/W or N/S connection to the bicycle or trail network within 1/4 mile	3
		The corridor provides a new connection in an area already served by the network	0
Benefit to under-served populations	To what extent does the new project provide bicycle network access to residents of Census Tracts with identified need?	Project occurs in Census Tract with greatest identified need (Top 25% of Census Tracts)	5
		Project occurs in Census Tract with moderate identified need (Top 50% of Census Tracts)	3
		Project occurs in Census Tract with lowest identified need (Bottom 50% of Census Tracts)	0

CITY OF APPLETON TRAILS MASTER PLAN

NEW CONNECTIONS PRIORITIZATION



NEW` CONNECTIONS PROJECT LIST

NEW CONNECTIONS 1-5 YEARS				
LOCATION	**CROSS STREET 1**	**CROSS STREET 2**	**LENGTH (MILES)**	**PROJECT COST (WITH CONTINGENCY)***
E Eagle Flats Pkwy	S Olde Oneida St	S Lutz Dr	0.30	$282,000
South of Fox River	S Oneida St	W Seymour St	0.79	$755,000
S of W Valley Rd	E of S Oneida St	E of W Schindler Pl	0.26	$245,000
S of E Roeland Ave	Schaefer Circle	S Oneida St	1.73	$1,642,000
E Midway Rd	Coop Rd	E Plank Rd	1.59	$1,508,000
S Lake Park Rd	Valley Lane	Manitowoc Rd	0.47	$447,000
E Water St	S Drew St	E Eagle Flats Pkwy	0.51	$483,000
E of E Fall Creek Lane	N Fallview Lane	E of N Fallview Lane	0.06	$56,000
N French Rd	E Edgewood Dr	City Boundary	1.57	$1,493,00`0
Eisenhower Dr	E Plank Rd	E Midway Rd	0.79	$748,000
S of W Lawrence St	W Lawrence St	W Prospect Ave	0.17	$162,000
E of S Lawe St	W College Avenue	S Lawe St	0.19	$182,000
			SUBTOTAL**	$8,003,000
			TOTAL***	$9,603,600

NEW CONNECTIONS 6-10 YEARS				
LOCATION	**CROSS STREET 1**	**CROSS STREET 2**	**LENGTH (MILES)**	**PROJECT COST (WITH CONTINGENCY)***
S Lutz Dr	E Eagle Flats Pkwy	W of S Pierce Ave	0.65	$617,000
S of W College Ave	W College Ave	N Drew St	0.87	$826,000
Railway	W Northland Ave	W Wisconsin Ave	0.97	$926,000
E Edgewood Dr	City Limit	N French Rd	0.51	$481,000
N of E Broadway Dr	N Ballard Rd	E Broadway Dr	0.42	$400,000
E Wisconsin Ave	N Ballard Rd	N Owaissa St	0.46	$437,000
Future Spartan Ave	Meade St	Richmond St	1.00	$952,000
S Mason St	W Prospect Ave	S Lutz Dr	0.10	$92,000
Memorial Park	E Northland Ave	N McDonald St	0.64	$611,000
E of Future Haymeadow Dr	Highview Trail	Future Haymeadow Dr	0.01	$10,000
			SUBTOTAL**	$5,352,000
			TOTAL***	$6,422,400

**Contingency is a 1.2 multiplier*
***Costs assume work is park of larger projects*
****Total includes engineering and construction oversight with a 1.2 multiplier.*

NEW CONNECTIONS PROJECT LIST

NEW CONNECTIONS 11-15 YEARS				
LOCATION	**CROSS STREET 1**	**CROSS STREET 2**	**LENGTH (MILES)**	**PROJECT COST (WITH CONTINGENCY)***
E South River St	E South River Street	N of W Seymour St	0.70	$668,000
N Coop Rd	E Calumet St	Valley Lane	0.55	$523,000
South of N Green Bay Rd	NE of E College Ave	SW of College Ave	0.47	$446,000
N Ballard Road	E Wisconsin Ave	W College Ave	1.26	$1,193,000
Railway	W College	W Prospect Ave	1.61	$1,533,000
Railway	W Wisconsin Ave	W College Ave	0.79	$747,000
W Capitol Dr	N Richmond Dr	N Gillett St	0.38	$357,000
N Lightning Dr	South of E Edgewood Dr	E Ashbury Dr	0.25	$240,000
E of N Lightning Dr	E Ashbury Dr	N Lightning Dr	0.23	$222,000
North of E Ashbury Dr	N Providence Ave	N French Rd	0.25	$236,000
E Edgewood Dr	N French Rd	N Ballard Rd	2.05	$1,948,000
E Edgewood Dr	N Meade St	N Richmond St	0.98	$933,000
Youth Sports Complex	N French Rd	Apple Creek Trail	0.24	$232,000
Planman Park	North of E Broadway Dr	West of N Meade St	1.05	$996,000
South of Railway	N Rankin St		0.29	$279,000
W College Ave	S Mason St	N Lilas Dr	0.51	$485,000
E Broadway Dr	N Ballard Rd	City Boundary	1.00	$950,000
E Evergreen Dr	N French Rd	N Ballard Rd	1.06	$1,011,000
E Applecreek Rd	N Ballard Rd	N Meade St	1.44	$1,365,000
Eisenhower Dr	E Calumet St	E Plank Rd	0.25	$241,000
French Rd	City Boundary	E Edgewood Dr	0.50	$475,000
E of Richmond St	N Haymeadow Ave	Richmond St	0.52	$495,000
S of Pierce Park	S Lutz Dr	S Lehman Ln	0.20	$191,000
Memorial Park			0.39	$375,000
			SUBTOTAL**	$16,141,000
			TOTAL***	$19,369,200.0

**Contingency is a 1.2 multiplier*
***Costs assume work is park of larger projects*
****Total includes engineering and construction oversight with a 1.2 multiplier.*

NEW CONNECTIONS PROJECT LIST

NEW CONNECTIONS 16+ YEARS				
LOCATION	**CROSS STREET 1**	**CROSS STREET 2**	**LENGTH (MILES)**	**PROJECT COST (WITH CONTINGENCY)***
Coop Rd	Valley Lane	E Midway Rd	0.48	$453,000
S Quest Dr	E Plank Rd	E Midway Rd	0.64	$607,000
W College Avenue/Railway	S Drew St	N Richmond St	0.87	$827,000
Railway	N Bluemound Dr	Proposed Trail	0.82	$779,000
N Richmond Dr	N of E Edgewood Dr	N of W Evergreen Dr	1.32	$1,255,000
W of N Richmond St	W Broadway Dr	W Edgewood Dr	0.95	$904,000
S Covenant Lane	Newberry Trail	E Henry St	0.09	$86,000
S of E Plank Rd	Coop Rd	E Plank Rd	0.99	$942,000
N French Rd	Wedge Road	E Apple Creek Rd	1.17	$1,114,000
N Ballard Rd	City Limit	E Apple Hill Blvd	1.39	$1,321,000
E Apple Creek Rd	N French Rd	N Ballard Dr	1.58	$1,506,000
W Evergreen Dr	N Meade St	N Richmond St	0.98	$934,000
N Ballard Rd	E Apple Hill Blvd	E Edgewood Dr	1.16	$1,098,000
Memorial Park	E Northland		0.13	$126,000
Northland Ave	French Rd	E Meade St	1.60	$1,521,000
Northland Ave	E Meade St	City Limit	1.70	$1,616,000
			SUBTOTAL**	$15,089,000
			TOTAL***	$18,106,800

**Contingency is a 1.2 multiplier*

***Costs assume work is park of larger projects*

****Total includes engineering and construction oversight with a 1.2 multiplier.*

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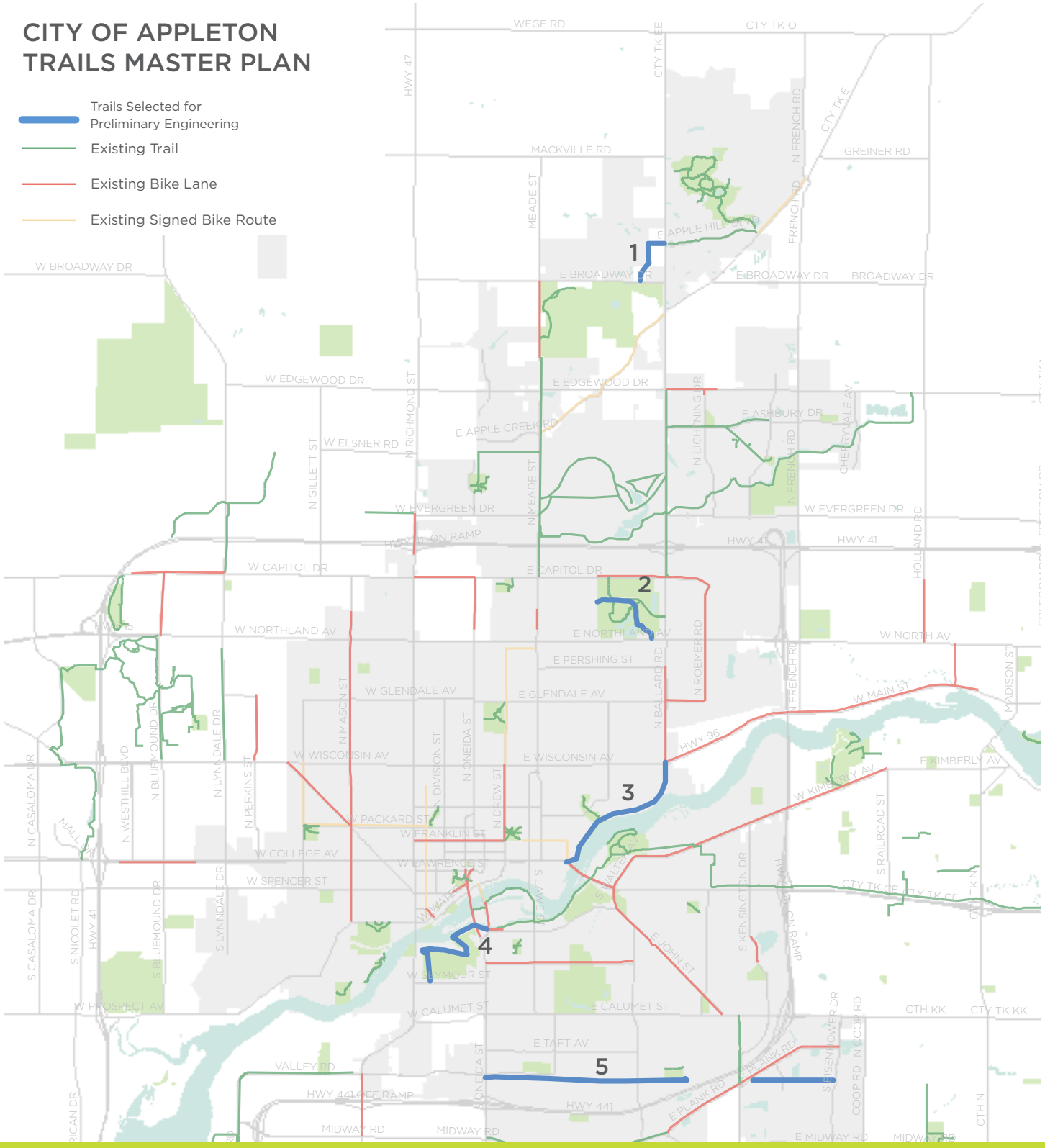


PROJECT DEVELOPMENT

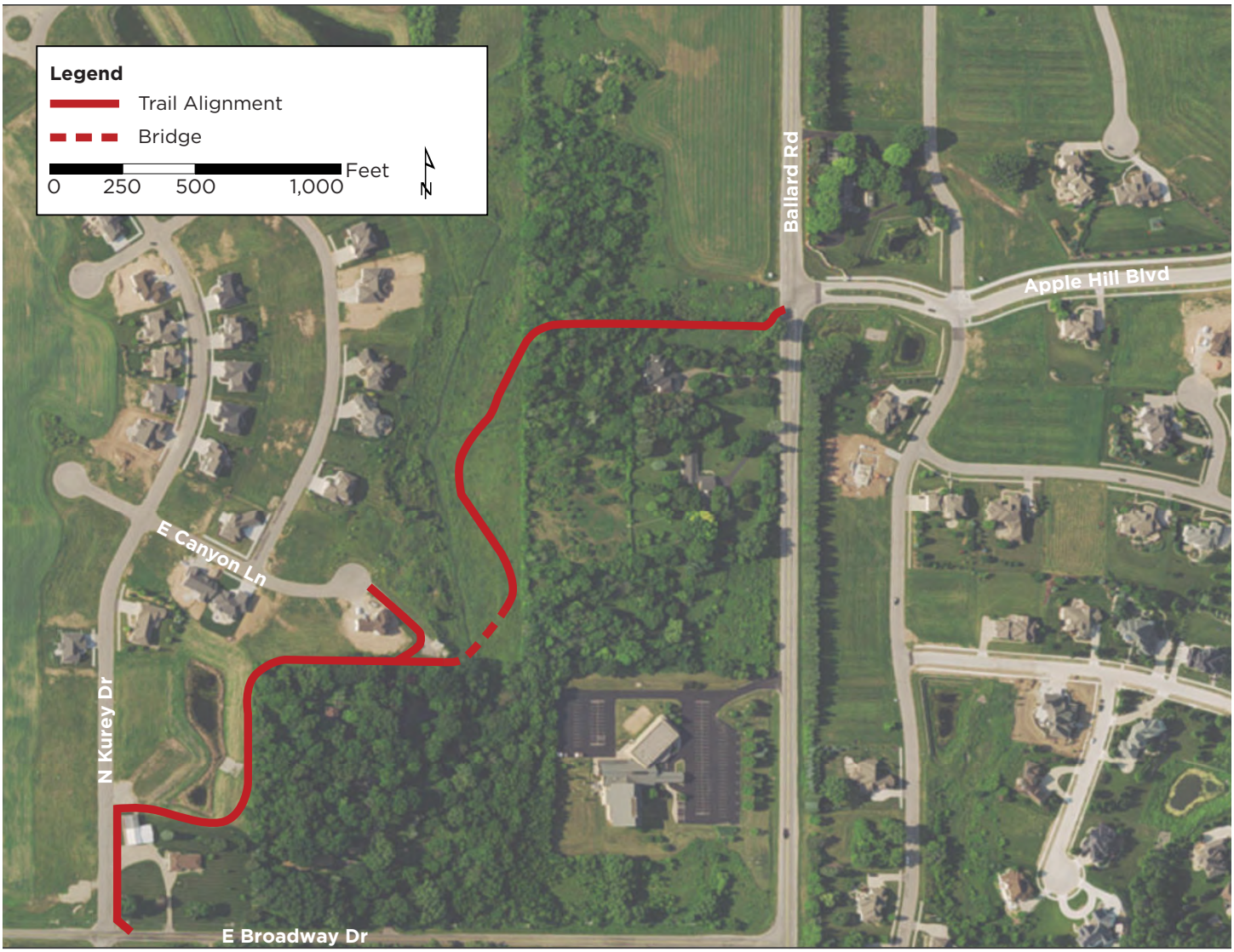
Five projects were selected for conceptual design development. The five projects--based on input from city staff, the project team, the stakeholder committee, and the Bicycle and Pedestrian Advisory Committee-- include the following:

1. Plamann Park Connection
2. Memorial Park Loop
3. Peabody Park/Fox River Trail
4. Riverview Gardens
5. WE Energies Trail

This section provides detail for the preliminary engineering completed for each of these projects, including trail descriptions, alignments, visualization, time-lines, and opinions of probably cost.

Plamann County Park

The Plamann Park access trail is a 3,000 ft bike and pedestrian path connecting the Apple Hill Farms development to Plamann Park. Primary features of this trail include a 200 ft pedestrian bridge to safely navigate slope and meet ADA regulations. The trail is routed along a navigable stream and meanders along minor terrain.



CHALLENGES

- Utilities: None identified at this time.
- Property Ownership: Easements may be required for final grading.
- Slopes: Multiple slopes within the project will require significant cuts and fills to achieve an ADA compliant path. In one instance a significant drop off occurs near a building in close proximity to navigable stream crossing and property boundary which requires construction of longer bridge to meet ADA requirements and provide passage over the water feature.
- Stormwater Management: Given the trail length and disturbance, Best Management Practices (BMPs) and stormwater facilities will need to be provided.
- Hydric soils are present – a wetland delineation will be required. The presence of hydric soils across significant portions of the project site will present challenges in siting stormwater management facilities and BMPs. The edge of trail is placed 75 feet from the navigable stream in an attempt to avoid WDNR waterway permitting but, may require permitting for shoreland zoning.
- The South connection to Broadway Drive which would ultimately enter Plamann Park is a 36-foot wide road. On-site inspection indicates that a 2-lane road (12-foot lanes) with a 7-foot separation and 10-foot trail accommodation would be a feasible alternative. This option lends itself to phased construction. The first phase could be to place chevron painting in the 7-foot separation median. The final recommendation would be to place a curb at the edge of traveled lane, as a physical barrier between vehicle traffic and trail users.
- There is a garage located 200 feet north of the intersection at Kurey Drive and Broadway Drive which may present challenges in siting the trail while allowing positive drainage. As the trail runs north and diverts from Kurey Drive along the existing detention pond, the available area for a trail is limited.
- The East connection at Ballard Road and Apple Hill Boulevard currently has the crossing placed to connect to south Apple Hill Boulevard. Apple Hill Boulevard currently has sidewalk access on both the north and south side of the road. An option to be considered is placing a pedestrian refuge at the median located on the east side of Apple Hill Boulevard. In doing so, the Plamann Park trail could connect and allow users to safely traverse to either the north or south side of Apple Hill Boulevard.

Photo simulation showing view of trail from Ballard Rd.

PERMITTING STRATEGY

The following list of agencies will need to be engaged throughout the design and permitting phases:

» U.S. Army Corps of Engineers (USACE)

» Wisconsin Department of Natural Resources (WDNR)

» Outagamie County

IMPLEMENTATION TIMELINE

YEAR	1	2	3	4	5
DESIGN	24 months				
AGENCY COORDINATION + PERMITTING*	48 months				
CONSTRUCTION					5

**Does not include time for hazmat remediation*

OPINION OF PROBABLE COSTS

Design Total	**$163,000**
Design Engineering	$163,000
Construction Total	**$1,492,000**
Construction (with Contingency)*	$1,356,000
Construction Oversight	$136,000
Project Total	**$1,655,000**

**Does not include real estate acquisition or hazardous remediation costs*

**Opinions are in 2016 dollars based upon recent trail projects in the vicinity of the project location*

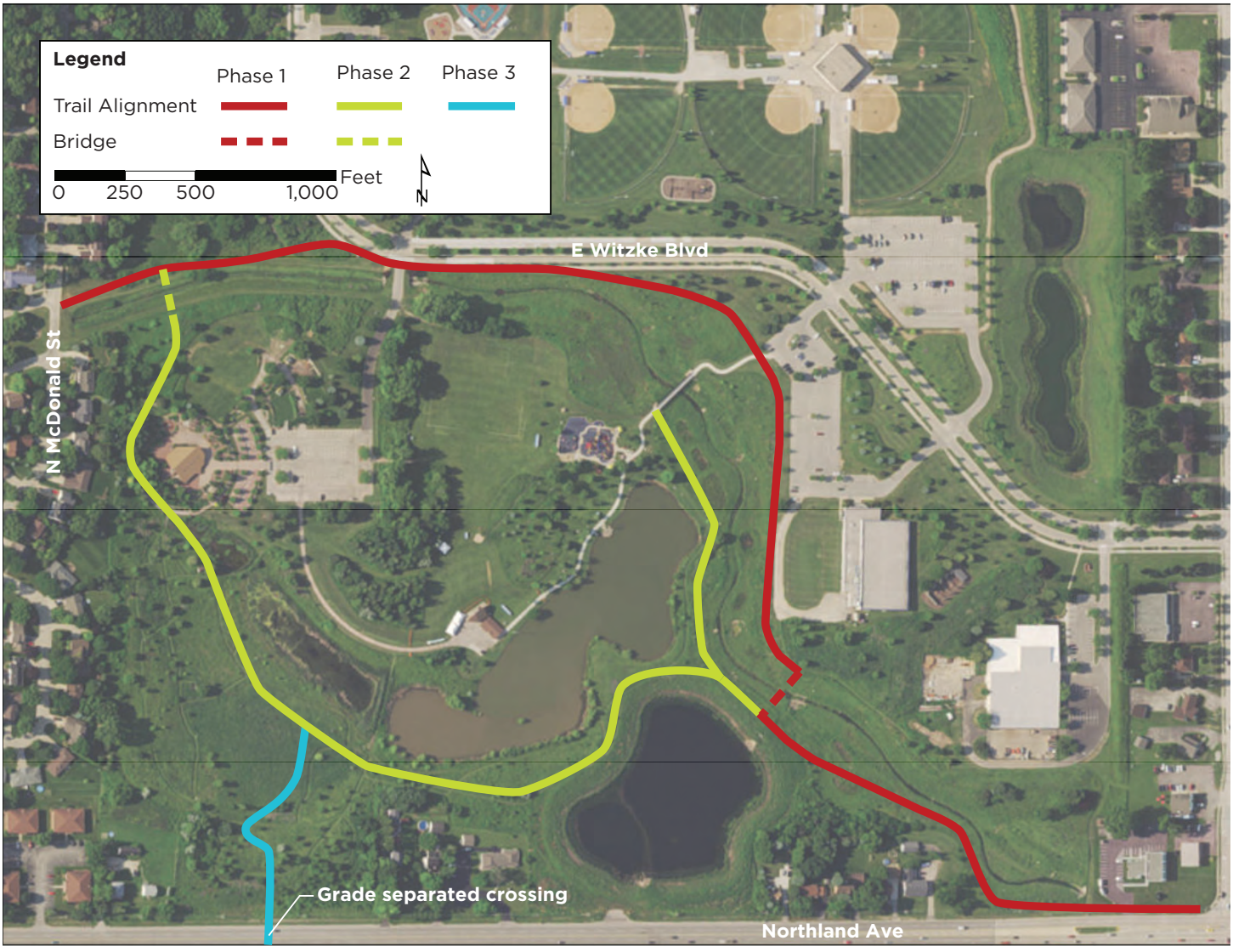
**Construction includes: Clearing & Grubbing, Common Excavation, EBS, Borrow, Base Aggregate Dense (1-1/4"), Asphaltic Surface, Concrete Sidewalk 6-inch (at take off and end points), Detectable Warning Fields, Culvert Pipe & Apron Endwalls, Pedestrian Bridge, Lighting, Signage, Restoration, Erosion Control, Mobilizaton, and Stormwater Management*

FUNDING

POTENTIAL MATCHING	MAJOR FUNDING	CRITERIA & REQUIREMENTS
Local funding	WDNR; TAP	» TAP eligible (connects park across Ballard Rd. to adjacent trail network and residential areas) » WDNR eligible (provides access to outdoor based nature recreation)

Memorial Park Loop

The Memorial Park trail is an 8,800-foot long bike and pedestrian path connecting users from Ballard Road and McDonald Street. The trail is designed to allow users to access various amenities throughout the park. The trail navigates itself around drainage features and includes two 60-foot pedestrian bridges. The trail also recommends a pedestrian bridge over Northland Avenue connecting Longview Drive and Owalssa Street to the south side of Memorial Park.



CHALLENGES

- Utilities: Utility poles and overhead facilities will need to be relocated along Northland Avenue.
- Property Ownership: Possible easements may be required for final grading and construction of trailheads.
- Stormwater Management: Given the trail length and disturbance, Best Management Practices (BMPs) and stormwater facilities will need to be provided.
- Navigable stream present on the southeast corner of the project location. Hydric soils are present – a wetland delineation will be required. The presence of hydric soils across over significant portions of the project site will present challenges in siting stormwater management facilities and BMPs.
- The City of Appleton has expressed interest in placing a pedestrian bridge from the south side of Memorial Park, over Northland Avenue, and connecting to Longview Drive and Owalssa Street. Review of this option presents immediate issues with the overhead utility and vehicle vertical clearance requirements. Complying with ADA requirements will present challenges, particularly with slopes and landings.

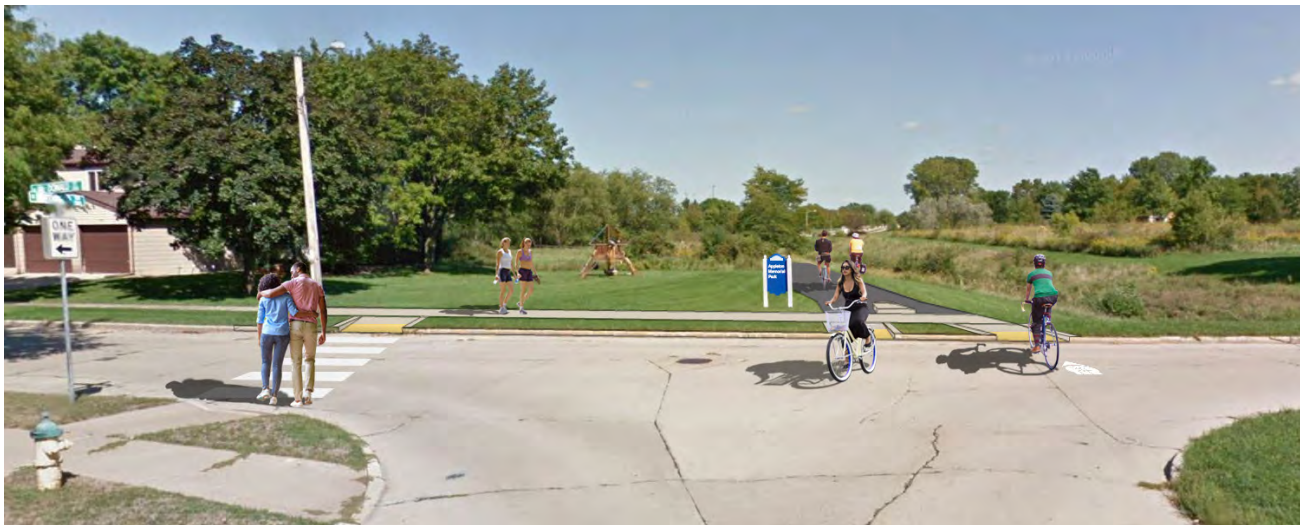


Photo simulation showing entry to Memorial Park from N McDonald Street.

PERMITTING STRATEGY

The following list of agencies will need to be engaged throughout the design and permitting process:

» Section 4(f)

» Wetlands

» Outagamie County

IMPLEMENTATION TIMELINE: PHASE I

YEAR	1	2	3	4
DESIGN	18 months			
AGENCY COORDINATION + PERMITTING*	36 months			
CONSTRUCTION				3

IMPLEMENTATION TIMELINE: PHASE II

YEAR	1	2	3
DESIGN	12 months		
AGENCY COORDINATION + PERMITTING*	24 months		
CONSTRUCTION			2

IMPLEMENTATION TIMELINE: PHASE III

YEAR	1	2	3	4
DESIGN	24 months			
AGENCY COORDINATION + PERMITTING*	42 months			
CONSTRUCTION				3

**Does not include time for hazmat remediation*

OPINION OF PROBABLE COSTS

	PHASE I	PHASE II	PHASE III
Design Total	**$128,000**	**$90,000**	**$376,000**
Design Engineering	$128,000	$90,000	$376,000
Construction Total	**$1,169,000**	**$826,000**	**$3,450,000**
Construction (with Contingency)*	$1,063,000	$751,000	$3,136,000
Construction Oversight	$106,000	$75,000	$314,000
Project Total	**$1,297,000**	**$916,000**	**$3,826,000**

**Does not include real estate acquisition or hazardous remediation costs*

**Opinions are in 2016 dollars based upon recent trail projects in the vicinity of the project location*

**Construction includes: Clearing & Grubbing, Curb Removal, Common Excavation, EBS, Borrow, Base Aggregate Dense (1-1/4"), Asphaltic Surface, Concrete Sidewalk 6-inch (at take off and end points), Detectable Warning Fields, Culvert Pipe & Apron Endwalls, Pedestrian Bridge, Lighting, Signage, Restoration, Erosion Control, Mobilizaton, and Stormwater Management*

FUNDING

PHASE	POTENTIAL MATCHING	MAJOR FUNDING	CRITERIA & REQUIREMENTS
Phase 1	Local Funding	TAP	» TAP Eligible (Connects to residential areas & Ballard bike lanes providing strong North-South connection)
Phase 2	Local funding (In addition to sources cited in funding summary seek funding from local service clubs & health care providers)	WDNR	» WDNR Eligible (Provides access to nature-based recreation) » Consider developing as part of a "healthy living" internal trail loop to leverage funding from regional health care providers
Phase 3	Local funding	TAP; WDNR	» Good TAP potential (connection to large residential areas) » Potential WDNR funding (provides access to nature-based recreation)
Other	There may be an opportunity to use other funding sources which could offset trail related costs (for example, grading). Stream is a priority navigable waterway because it is considered an area of special natural resource interest. Therefore, stormwater quality improvements may be eligible for funding through WDNR Urban Non-Point Source Stormwater Management Grant.		

Peabody Park / Fox River Trail

The Peabody Park trail is a 2,800-foot bike and pedestrian path connecting Green Bay Road to Ballard Road. This trail follows alongside the riverfront and utilizes existing trail networks through both St. Joseph's cemetery and Riverside cemetery. The walkway is ADA compliant and provides access for both transportation and recreational users.

CHALLENGES

- Utilities: Shallow stormwater outlets along the alignment will need to be considered in setting vertical profile.
- Property Ownership:
    - The first 1,900-feet of the trail alignment is placed on City of Appleton property. The latter part of the trail is connected through the Riverview and St. Joe's cemeteries which will require coordination and an easement.
    - Along this portion of the trail, St. Joe's has requested that "Stations of the Cross" structures remain untouched and undisturbed.
    - Parcel 311117712 is under private ownership and is located immediately adjacent to the west trail limit. While the trail is not infringing on this property, coordination with this property owner should be considered. Note: Property is currently for sale.
- Slopes: Upon entering the cemetery property, the lower trail route extending to the Fox River Environmental Education Alliance was field reviewed (topography and slope challenges deemed this not a viable route). However, the recommended route also presents significant grade challenges as the trail enters the cemetery. These challenges were found to be less significant and can be addressed with a boardwalk.
- Stormwater Management: Given the trail length and disturbances, Best Management Practices (BMP's) and stormwater facilities will need to be provided.
- Other: This trail alignment offers excellent access to the riverfront. Field inspection revealed that constructing this trail will require some bank stabilization and implementation of retaining walls. A boardwalk has been proposed for a portion of the trail in the cemetery property, where existing slopes and grades would require a significant amount of earthwork.

Photo simulation showing trail along the Fox River.

PERMITTING STRATEGY

The following list of agencies will need to be engaged throughout the design and permitting phases:

» Cemetary Real Estate

» Wisconsin Department of Natural Resources (WDNR)

IMPLEMENTATION TIMELINE

YEAR	1	2	3	4	5
DESIGN	36 months				
AGENCY COORDINATION + PERMITTING*	48 months				
CONSTRUCTION					5

**Does not include time for hazmat remediation*

OPINION OF PROBABLE COSTS

Design Total	**$238,000**
Design Engineering	$238,000
Construction Total	**$2,183,000**
Construction (with Contingency)*	$1,985,000
Construction Oversight	$198,000
Project Total	**$2,421,000**

**Does not include real estate acquisition or hazardous remediation costs*

**Opinions are in 2016 dollars based upon recent trail projects in the vicinity of the project location*

**Construction includes: Clearing & Grubbing, Curb Removal, Common Excavation, EBS, Borrow, Base Aggregate Dense (1-1/4"), Asphaltic Surface, Concrete Sidewalk 6-inch (at take off and end points), Detectable Warning Fields, Culvert Pipe & Apron Endwalls, Boardwalk, Lighting, Signage, Restoration, Erosion Control, Mobilizaton, and Stormwater Management*

FUNDING

POTENTIAL MATCHING	MAJOR FUNDING	CRITERIA & REQUIREMENTS
Local funding	WDNR	» Not a good fit for TAP (federally funded projects on utility ROW are challenging; presence of cemeteries. If trail phased in TAP funding may be appropriate for portion of segment)

Riverview Gardens

The Riverview Gardens access trail is a 6,900-foot bike and pedestrian path connecting Olde Oneida Street to Riverview Road and Riverview Lane. Primary features of this trail include a 1,450-foot elevated boardwalk which connects the Lock Keeper's house and Riverview Gardens. The trail will provide traversable horizontal curves and alignment to accommodate both pedestrians and bicyclists around the point at Riverview Gardens. The walkway allows more vegetation to remain providing a scenic trail with a minimal footprint. Once in Riverview Gardens, the trail follows existing golf cart paths and follows former fairways until tying into existing roadways. This trail provides access for both transportation and recreational users.

CHALLENGES

- Utilities: Existing water line from pump house appears abandoned but will need to be taken into account when setting final alignment and profile.
- Property Ownership: Easements will be required from Riverview Gardens for the majority of the trail length. Riverview Gardens is aware of the project and is supportive of the project. Easements will also be required from Fox River Navigational System Authority (FRNSA). FRNSA is also aware of the project and is supportive.
- Slopes: Slopes between the Lock Keeper's house and connection to the current cart path will present challenges in providing a trail with adequate clear zone while maintaining existing vegetation and buffer to waterway. These slopes also present challenges in providing ADA compliant grades for pedestrian use. The location of this trail adjacent to the waterway on a constant slope to the water feature will make stormwater treatment and compliance a challenge with this portion of the trail. The proposed alignment could include an elevated boardwalk to address these concerns. Benefits of an elevated boardwalk include minimized impact to existing vegetation, maintenance of current drainage, and reduced stormwater impacts. An alternate would require extensive grading of the hillslopes and construction of retaining walls and removal of significant vegetation along the slope. The slope following the existing cart path up to the existing greenhouses also presents challenges for ADA compliance and will require significant portions of fill to satisfy pedestrian guidelines for longitudinal slope.
- Stormwater Management: Given the trail length and disturbances, Best Management Practices (BMP's) and stormwater facilities will need to be provided.
- Hydric soils are present – a wetland delineation will be required. The presence of hydric soils across over significant portions of the project site will present challenges in siting stormwater management facilities and BMP's.
- Cultural Resources: Pump House and boat anchor near Lock Keeper House.

Above: Photo simulation showing boardwalk along creek leading up to Riverview Gardens. Left: Photo simulation of trail along locks.

PERMITTING STRATEGY

The following list of agencies will need to be engaged throughout the design and permitting process:

» USACE

» FRNSA

IMPLEMENTATION TIMELINE: PHASE I

YEAR	1	2	3
DESIGN	18 months		
AGENCY COORDINATION + PERMITTING*	27 months		
CONSTRUCTION			4

IMPLEMENTATION TIMELINE: PHASE II

YEAR	1	2	3	4	5	6
DESIGN	36 months					
AGENCY COORDINATION + PERMITTING*	60 months					
CONSTRUCTION						6

**Does not include time for hazmat remediation*

OPINION OF PROBABLE COSTS

	PHASE I	PHASE II
Design Total	**$118,000**	**$432,000**
Design Engineering	$118,000	$432,000
Construction Total	**$1,080,000**	**$3,961,000**
Construction (with Contingency)*	$982,000	$3,601,000
Construction Oversight	$98,000	$360,000
Project Total	**$1,198,000**	**$4,393,000**

**Does not include real estate acquisition or hazardous remediation costs *Opinions are in 2016 dollars based upon recent trail projects in the vicinity of the project location*

**Construction includes: Clearing & Grubbing, Curb Removal, Common Excavation, EBS, Borrow, Base Aggregate Dense (1-1/4"), Asphaltic Surface, Concrete Sidewalk 6-inch (at take off and end points), Detectable Warning Fields, Culvert Pipe & Apron Endwalls, Boardwalk, Lighting, Signage, Restoration, Erosion Control, Mobilizaton, and Stormwater Management*

FUNDING

PHASE	POTENTIAL MATCHING	MAJOR FUNDING	CRITERIA & REQUIREMENTS
Phase 1	Local funding (Consider making special request to Community Foundation)	TAP; TEA	» TAP eligible (connects to streets on both ends; provides safe alternative route for east-west connection) » May be TEA eligible. Consider developing trail as "job creation/retention" project to provide low-income job seekers to job training facilities
Phase 2	Local funding	WDNR; NRDA	» Consider developing trail to "provide public boating and fishing access" to Fox River.
Other	» TEA typically funds mfg.-related projects, however some ag-related projects have been funded » Water access would align with WDNR funding priorities. Several WDNR Knowles-Stewardship Programs may apply » May be good candidate for Outdoor Legacy Partnership Program by benefitting economically disadvantaged populations and providing access to outdoor recreational opportunities » May be good candidate for WE Energies Economic Health Foundation Grant		

WE Energies Trail

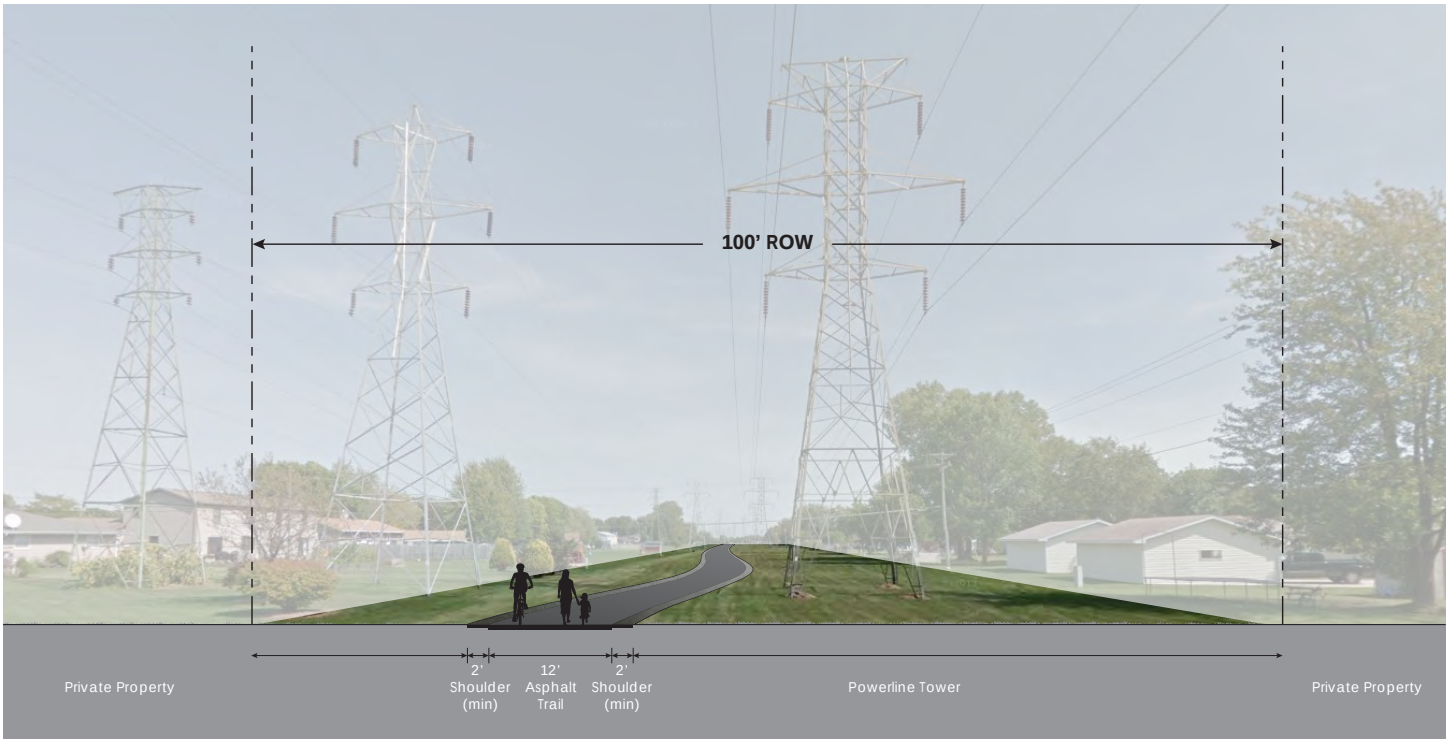
The WE Energies trail is a 10,415-foot bike and pedestrian path connecting Oneida Street to Eisenhower Drive. The trail follows an old rail corridor connecting to local bike and pedestrian accommodations around Horizons Elementary School. Bike and pedestrian upgrades will be made at the intersection of Lake Park Road and Schaefer Circle to safely transition users. The trail continues from Lake Park Road and connects at Eisenhower Drive. The walkway is ADA compliant and provides access for both transportation and recreational users.

PHASE I (WEST)

PHASE II (EAST)

CHALLENGES

- Utilities: Existing ATC and WE Energies transmission and power poles run along the corridor of this trail. Coordination with these stakeholders has been established and they are supportive of the project. Easements will be required for WE Energies West (Wheatfield Drive to Schaefer Street). Modifications to existing easements will be required for WE Energies East (Lake Park Road to Eisenhower Drive).
- Property Ownership: ATC has requested a 20' offset from their facilities. Along the corridor, there are locations at which we cannot satisfy the ATC offset and remain outside resident property lines. Ongoing communication with ATC to negotiate offset requirement.
- Slopes: No concerns at this time.
- Stormwater Management: Given the trail length and disturbances, Best Management Practices (BMP's) and stormwater facilities will need to be provided.
- This trail will not be lighted, per ATC and WE Energies request. This trail will need to be constructed to accommodate utility trucks and is currently modeled with a more robust section.
- Connection to the west at Oneida Street and Roeland Avenue will require coordination with WisDOT, who is currently designing this intersection. At the southeast corner of this intersection is an ATC substation. To the north of this substation is a 6.5 foot terrace and 5 foot sidewalk - any bike and pedestrian accommodations would have to be placed in this area.
- The connection between Schaefer Street and the Schaefer Circle connection will consist of on-street bicycle accommodations and use of existing sidewalks for pedestrians.
- A trail connection will be established at the East end of Schaefer Circle. A 10-foot curb cut will be placed and this portion of the trail will merge into the existing sidewalk. The existing sidewalk will be widened to 10-foot bike and pedestrian accommodation.
- The round-a-bout at Plank Road and Lake Park road will connect WE Energies West to WE Energies East. Bike and pedestrian accommodations will extend from the southeast leg of the roundabout to the WE Energies East trail. Trail alignment will need to be adjusted around existing utility facilities
- WE Energies West will connect at Eisenhower Drive as part of the City of Appleton 2017 design utilizing design best practice.



Above: Section showing relationship of trail to powerline towers and adjacent properties.

PERMITTING STRATEGY

The following list of agencies will need to be engaged throughout the design and permitting process:

- Utilities with facilities along corridor
- Real Estate

IMPLEMENTATION TIMELINE: PHASE I (WEST)

YEAR	1	2	3	4
DESIGN	18 months			
AGENCY COORDINATION + PERMITTING*	36 months			
CONSTRUCTION				3

IMPLEMENTATION TIMELINE: PHASE II (EAST)

YEAR	1	2	3
DESIGN	18 months		
AGENCY COORDINATION + PERMITTING*	27 months		
CONSTRUCTION			3

**Does not include time for hazmat remediation*

OPINION OF PROBABLE COSTS

	PHASE I (WEST)	PHASE II (EAST)
Design Total	**$91,000**	**$63,000**
Design Engineering	$91,000	$63,000
Construction Total	**$669,000**	**$464,000**
Construction (with Contingency)*	$608,000	$422,000
Construction Oversight	$61,000	$42,000
Project Total	**$760,000**	**$527,000**

**Does not include real estate acquisition or hazardous remediation costs*

**Opinions are in 2016 dollars based upon recent trail projects in the vicinity of the project location*

**Construction includes: Clearing & Grubbing, Curb Removal, Common Excavation, EBS, Borrow, Base Aggregate Dense (1-1/4"), Asphaltic Surface, Concrete Sidewalk 6-inch (at take off and end points), Detectable Warning Fields, Culvert Pipe & Apron Endwalls, Signage, Restoration, Erosion Control, Mobilizaton, and Stormwater Management*

FUNDING

PHASE	POTENTIAL MATCHING	MAJOR FUNDING	CRITERIA & REQUIREMENTS
Phase 1	Local funding; WE Energies Foundation Grant	WDNR	» Currently not a good fit for TAP (federally funded projects on utility ROW are challenging. Monitor for future applicability as WisDOT is working on this issue)
Phase 2	SAA	SAA	» SAA

IMPLEMENTATION

Implementation of the proposed trail network will require consideration of several factors when determining the order of projects. All proposed projects were prioritized based on a lower to higher priority scale, providing initial guidelines for project consideration.

Other factors that should be considered include overlap between trail projects and other ongoing efforts, funding opportunities, total project cost and regulatory challenges.

This section provides an overview of local, state and national funding options, a summary of cost assumptions and planning level opinions of probable cost for each project identified through the Master Planning process and a summary of cost and proposed schedule for maintenance activities.

Finally, a series of recommendations are provided that will enhance the growing trail network in Appleton and will encourage integration with the on-street network.

Funding Opportunities

Opportunities for funding the proposed network are available at the local, state, and federal levels. The opportunities noted include a range of options, from competitive technical grants to smaller awards with significant trail focus.

The City of Appleton should seek creative opportunities for funding and consider project need, type, and timeline when determining potential sources for funding. Opportunities for completing multiple projects concurrently may provide additional pathways for implementation, and partnerships with neighboring jurisdictions may create stronger applications. It is highly recommended that the City strengthen or initiate partnerships with agencies administering relevant grants in order to better understand the application requirements and specific considerations for each opportunity.

Appendix 3 provides a detailed matrix of potential funding sources, including general availability and relevance to the proposed network.

Pursuing funding opportunities will support upgrading existing Appleton trails , including developing more visible crossing, as well as implementing new trail connections.

Recommendations

The following recommendations address a variety of elements that will enhance the overall utility of Appleton's expanding active transportation network. These elements include safety improvements, network legibility, and integration with the on-street network. Drawn from best practices, public input, and the trail audit completed as part of the Trails Master Plan, these improvements can improve the overall quality of the growing trail network.

CONNECTIVITY: SEAMLESS TRANSITIONS

The utility of the existing trail network is expanded when coupled with on-street bikeways and sidewalks. Use of on-street facilities is often required for destination access. Improving connections to on-street facilities will increase the range of destinations that can be reached. Providing for seamless transitions between trails and on-street facilities encourages use of the facilities as one comprehensive network. These transitions can be enhanced through clear delineation of facilities, such as establishing clear trail entry points, reduction of barriers to trail or bike lane access, informative signing that brands the entire network and provides wayfinding, and provision of clear connections among the facilities. Greater network connectivity can also be achieved through providing bicycle and pedestrian connections at street ends.

An example of a recent project that provides a seamless transition from the trail on College Avenue Bridge to the signed route on Catherine Street.

CONNECTIVITY: NEIGHBORHOOD CONNECTIONS

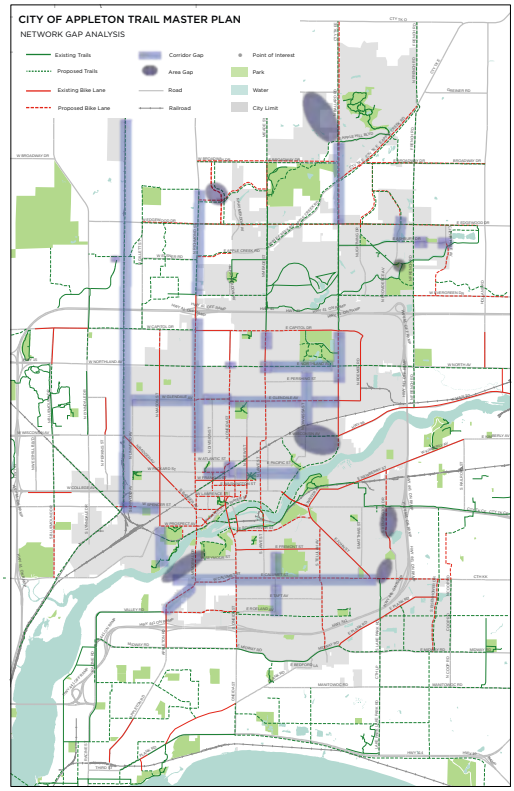
Trails and on-street facilities provide access to a variety of destinations, including homes and other neighborhood-scale points of interest, such as parks and schools. Often neighborhood streets provide low-stress facilities that can also serve as connections between other facilities. Existing routes through neighborhoods should be inventoried to better assess existing network connectivity; further analysis should be completed to identify low-stress routes that can fill network gaps in these areas. Low traffic volumes and speeds, existing traffic calming infrastructure, and connections to destinations and the larger network should all be considered.

Establishing signed routes through neighborhoods can improve the utility of existing and future connections; signage will not only identify the route but also serve as wayfinding for bicyclists and pedestrians. Further, improvements to these vital links can further enhance the city-wide network and improve overall comfort of the network. Improvements can include surface quality, signage, and methods for reducing traffic volume and speed along these routes.

Speed and volume controls, including signs, pavement markings, and speed humps are used in this neighborhood bicycle boulevard in Portland, OR.

CONNECTIVITY: MISSING LINKS

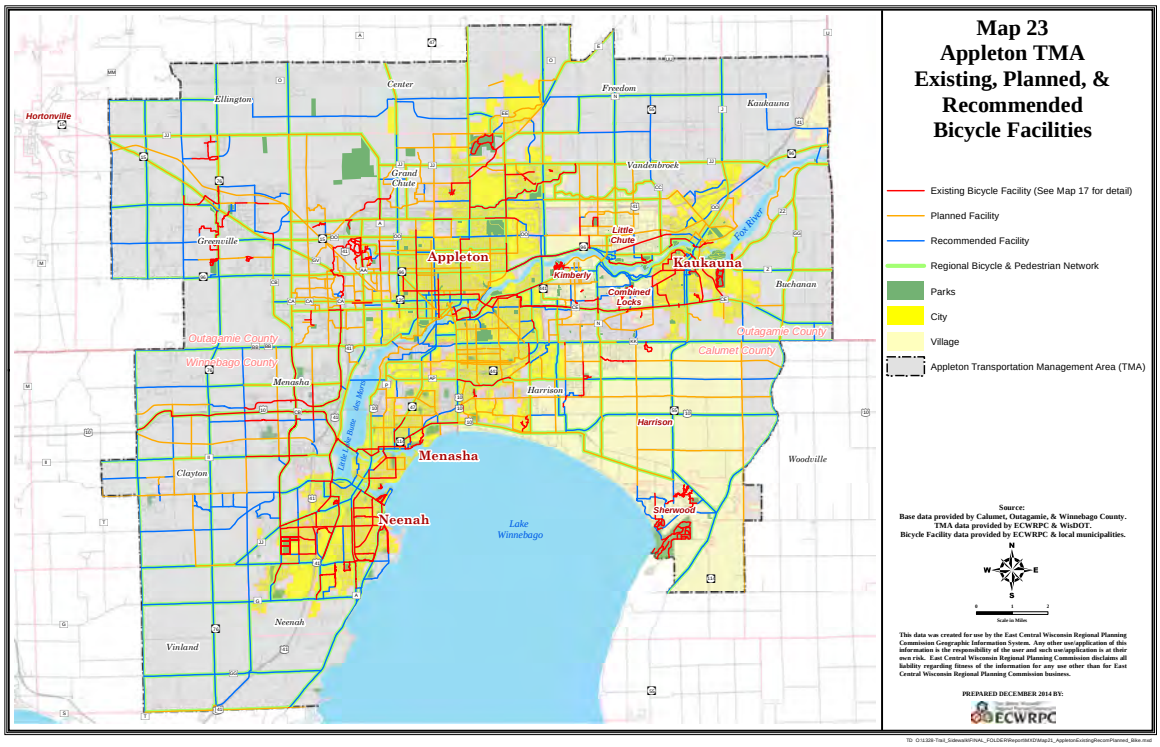
The network gap analysis map, as included in the Existing Trail Network section and below, identifies missing links in the existing network that limit the connectivity of the existing network. Gaps in the existing network result in disconnected facilities that may require bicyclists or pedestrians to travel on a high stress roadway for at least a portion of their trip. In some locations, an entire area may not have direct access to any facilities. The existing trail network provides low-stress segments that accommodate users of all ages and abilities; however, without connections across the network, the all-ages and abilities capacity is limited to small segments and result in a network accessible to only the strong and confident cyclists. The gap analysis should be used to further analyze where the most significant improvements in network connectivity can be achieved. For example, some location may require a relatively short extension of an existing facility or improved crossing to connect larger portions of the existing network. These small wins can significantly improve network utility for residents.



Existing gaps in Appleton's walking and bicycling network (explored further on page 29, represent areas of limited connectivity. Discontinuous facilities, as seen in the image on the right, force bicyclists into the roadway and can discourage walking in the area.

CONNECTIVITY: REGIONAL NETWORK

The growing network across the Fox Cities and extensive planned network outlined in the Fox Cities TMA/Oskosh MPO Bicycle and Pedestrian Plan provides residents with opportunities to connect to regional destinations, such as recreation or employment opportunities. As the network continues to grow throughout Appleton, facility development should aim to connect to trails, bike lanes, and sidewalks located in adjacent municipalities. Coordination among municipalities can better facilitate implementation in a cohesive manner that benefits residents and creates a connected network. Project coordination may also be used to leverage funding opportunities across the region.

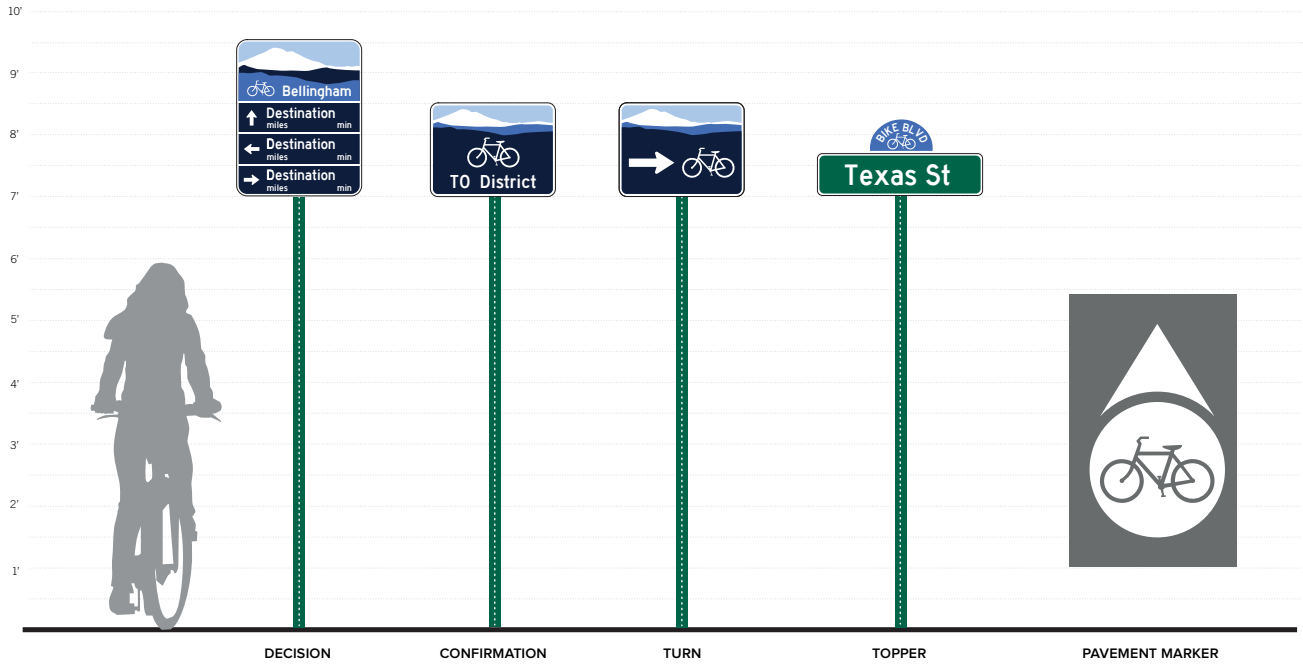


The proposed bicycle network across the Fox Cities, as outlined in the 2014 MPO Master Plan, aims to provide connections among municipalities and to major destinations. The Appleton Trails Master Plan builds on the facilities noted here, as well as developments that have occurred since, to provide a more connected trail network for Appleton residents.

SYSTEM-WIDE WAYFINDING

A comprehensive wayfinding system provides recognizable branding for the entire network while also increasing the utility of the system for all users. Current signage does not meet the needs of trail users in Appleton, as survey respondents frequently noted the need for more information regarding trails.

Clear signage helps users identify routes to their destinations while also providing information regarding bicycle-friendly facilities. Trail-specific wayfinding includes kiosks located at major entry points and trail heads provide additional information, including a system map. Similar branding, including colors, fonts, and symbols can be translated to on-street signs in order to create a city-wide system that encourages use of all facility types as one network. In order to be eligible for Federal funding options, wayfinding signage must be compliant with the Manual on Uniform Traffic Control Devices (MUTCD). MUTCD guidance defines uniform size, shape, color, and legibility of signs and messages included. However, the MUTCD also provides for inclusion of community identity and display of additional information through Community Wayfinding provisions.



The wayfinding sign family for Bellingham, Washington features Mount Baker, a distinctive feature in the area's landscape, to clearly define and brand the bicycle network. Sign toppers and pavement markers are more subtle options for defining greenways and other network links.

LIGHTING + SAFETY

Appleton's trails are important connections for pedestrians and bicyclists locally, as well as regionally for both utilitarian and recreation trips. The trail audit conducted during this project revealed that lighting is limited along some existing trails, and survey responses also indicated that residents are concerned with safety--and in particular, lighting--along new and existing trails. While the quantity of lighting is important, the provision of quality lighting is necessary to improve safety.

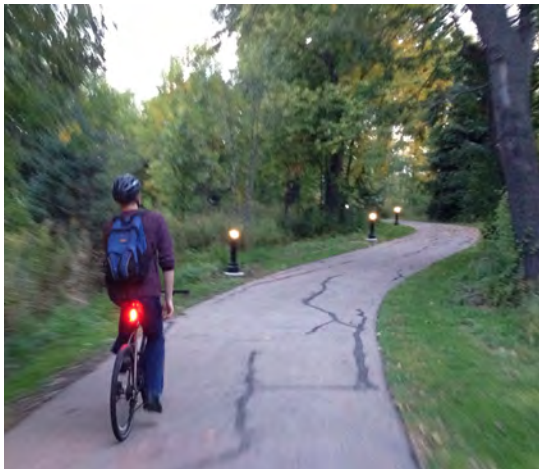
There are several benefits to including lighting to trail projects:

» help pedestrians and bicyclists to safely navigate trails

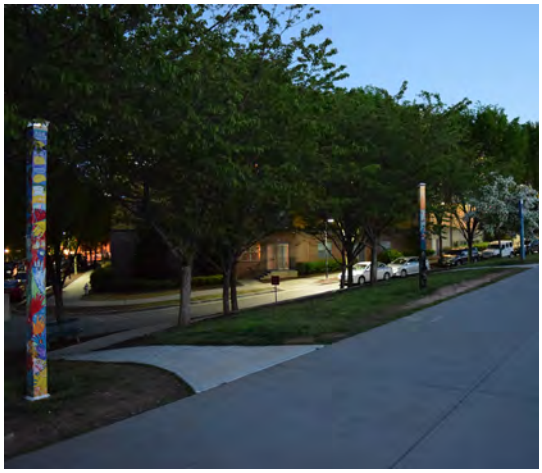
» provide visibility and security at all hours

Lighting should be of adequate brightness, providing enough visibility to identify a face up to 20 yards away. Lighting should provide uniform coverage and good color rendition. The use of metal halide or light emitting diode (LED) lamps are recommended. Average horizontal illumination levels are 0.5 to 2 foot candles or 5 to 22 lux[1]. Trail lighting should be at a pedestrian scale, but avoid light fixtures mounted at eye level that could impair visibility. Pedestrian scale lighting is typically about 15 feet tall, has lower levels of illumination, and closer spacing to avoid dark zones between lights. Fixture choice can also serve to unify the trail system.

Residents also noted that call boxes or other security devices would improve the perception of safety on trails. However, call boxes are not recommended for installation. In many communities, call boxes are removed as cell phones approach universal usage. Maintaining call boxes is no longer cost effective, and ones that do remain are often subject to vandalism or prank calls. Call boxes are only recommended in locations with limited cell reception.



Pedestrian scale lighting could include bollards with lights along the trail.



Pedestrian scale lighting along the Atlanta Beltline.

1 *AASHTO, Section 5.2.12*

PEDESTRIAN AND BICYCLE CROSSINGS

Clearly marked crossings with roadways can improve network connectivity and safety. While trails represent all ages and abilities facilities, the low-stress nature of trails can be quickly diminished at difficult, unsafe roadway crossings. The Access + Intersections chapter of the Trail Design Best Practices report (Appendix 4) provides greater detail for crossing options for both signalized and unsignalized intersections. Additional features, such as median refuge islands, can also improve the quality of crossing for wide intersections.

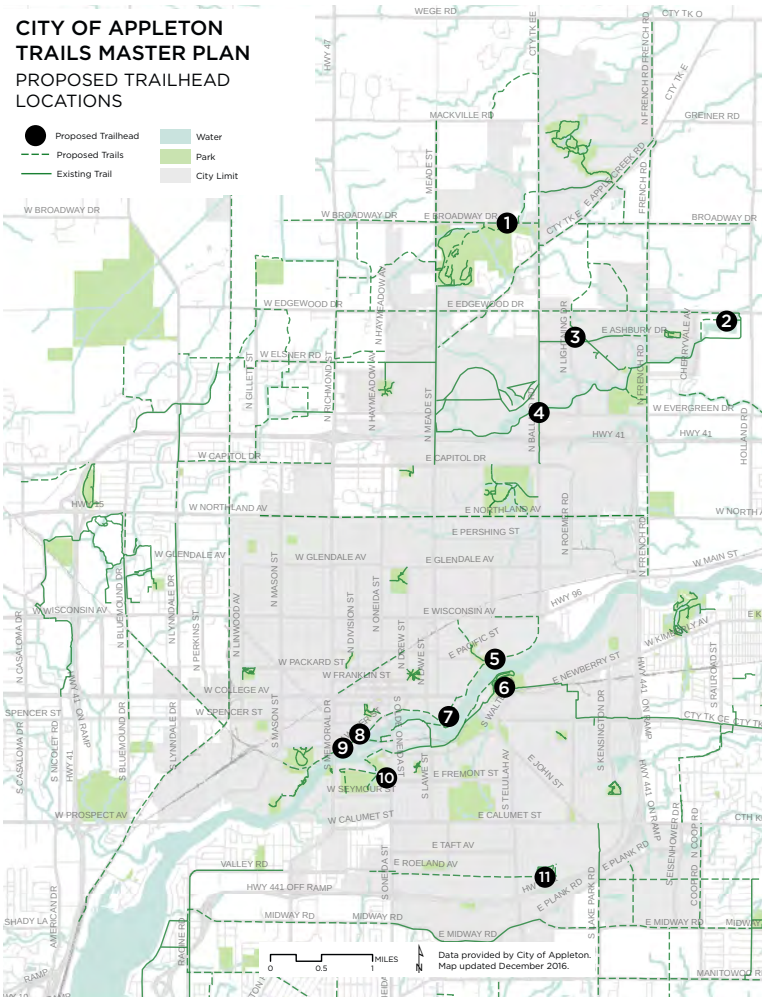
High quality crossings can employ features like clear signage, high visibility crosswalk markings, bulb outs to reduce crossing distance, rectangular rapid flashing beacons (RRFBs), or raised crosswalks to improve visibility. In addition to these items that improve safety and comfort for bicyclists and pedestrians, features such as detectable warning strips, pavement markings, and change in trail alignment can provide warnings to trail users to be mindful of the approaching intersection.

This raised crosswalk on the Burke Gilman Trail in Seattle, WA includes features such as clear signage, detectable warning strips, and pavement markings to provide warning to trail users and vehicles that they are approaching an intersection.

TRAILHEADS

Trailheads should be established at major access points along the trail network. Trailheads can include amenities such as parking (automobile and bicycle), comfort stations, drinking fountains, trash receptacles, bicycle repair stations, a location to change clothes, seating, wayfinding, and other informational signage. Information at trail heads can help orient a user to the larger network, including key connections to the on-street network and nearby destinations.

Survey responses indicated that many individuals were unaware of trail names and locations and were interested in learning more about the network. Clear designation of trails at popular access points can help increase public awareness of the growing system. Below is a map of potential trailhead locations identified during the course of this project. Further work should be done to assess the suitability and need for these and other locations.



1. Plamann Park - SW Corner of Kurey and Broadway
2. East end of Edgewood Trail Road
3. N Lightning Drive
4. At park + ride
5. Green Bay Rd at Fox River
6. Existing parking lot in Talulah Park
7. John Street at Eagle Point Development
8. North of railroad tracks, near Water Street
9. Existing parking lot at Vulcan Heritage Park
10. East of Oneida at Riverview Gardens
11. South of Woodland Park

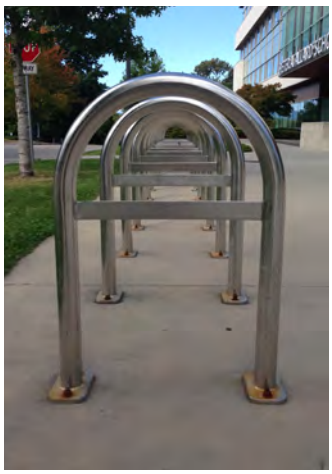
END OF TRIP FACILITIES + AMENITIES

During the public involvement sessions, participants commented that they would like to use trails and an expanded bicycle network for utilitarian trips and to access destinations such as recreational facilities. Provision of end of trip facilities at destinations throughout the trail network can help encourage these trips.

End-of-trip facilities include bicycle parking options as well as amenities like those identified in the trail heads recommendation. Benches, comfort stations, bike repair stations, a location to change clothes, and similar features can enhance the overall network. Bike parking should include options for both short-term and long-term parking, in addition to climate-sensitive considerations. Parking located under shelters or other covered facilities can accommodate riders through most seasons. In general, all parking options should support the bicycle in at least two places, preventing it from falling over. Parking should also allow for the use of a U-lock across the frame and at least one wheel. Racks should be securely installed and placed within close proximity to trail access points, ideally in conjunction with trail heads or other destinations, such as parks, recreation facilities, transit stops, or schools. APBP's *Essentials of Bike Parking* is available online and provides detail on selecting and installing bicycle parking. The Trail Design Best Practices Report (Appendix 4) addresses end-of-trip facilities in greater detail.

Covered bicycle parking provides protection from inclement weather for short term parking. A bike repair station is also located under the shelter in the example to the left.

A bike repair station in Bellingham, WA includes bike repair manuals, bicycle parking (not pictured), and bike route maps and information.



Staple racks provide secure parking options for bicycles, accommodating 2 points of contact and a U-Lock. See Appendix 6 for more detail on parking selection.

MAINTENANCE

Routine trail maintenance can prolong the life of surface materials, increase the usability of the trail, and encourage greater use of the trail across all seasons. Throughout the public engagement process, overgrown vegetation, snow clearing, and surface maintenance were frequently noted as suggestions for improvement of the trail system. Cracks and similar surface issues were the most frequently observed items during the trail audit, and several locations were observed with decreased sightlines and operating space due to overgrown vegetation. Obstructions and poor surface quality can deter use of the existing network.

It is recommended that a routine maintenance schedule is developed and tracked, building from the audit data provided as part of this report. Maintenance of trail amenities, such as lighting, should also be considered.

Inadequate drainage not only impacts the quality of the trail and reduces the lifespan of surface materials, it also creates an obstruction to trail use. Routine maintenance can help address these issues and provide for a more usable network.

TRAIL COUNTS + USER SURVEYS

Trail count programs provide a means for assessing use of existing facilities while also allowing for assessment of benefits associated with trail development. As identified in the Fox Cities MPO Master Plan, a state-wide count program and methodology does not exist at this time for Wisconsin. Various jurisdictions within the Fox Cities TMA and Oshkosh MPO have conducted bicycle and pedestrian counts on trails but without consistent methodology among locations.

It is recommended that Appleton develop a trail count program to better assess demand for trails over time and across seasons. The count program should employ methods that are repeatable across the jurisdiction and, given the nature of Appleton's network, are appropriate for both on and off-street facilities. A growing range of methods and devices provide options of varying cost, duration, and reliability. If less permanent options are selected, a strict methodology regarding location, duration, and frequency should be developed in order to provide for data that can be compared over time. See Appendix 5 for further detail about current options in counting technology.

Implementation of counting hardware may provide more reliable usage data and better capture use over time as opposed to manual count methods. However, manual count methods can provide several benefits including: a method for engaging community advocates, a method for assessing placement of automated devices, and an opportunity to gather additional feedback on existing trails.

Appleton can gather input from trail users about the network through user surveys. Surveys can cover a range of topics, including purpose of trip, frequency of use, assessment of trail quality, and travel to and from the trail. By intercepting residents on the trails, the city can capture feedback from those using the facility.

A bike counter on the Second Avenue cycle track in Seattle, WA provides real-time display of the number of bicyclists per day and year-to-date.

Conducting intercept surveys on trails and other high-use corridors provides the opportunity to gather feedback from those who use the trails and help the city better understand why people use trails and what can be improved.

EDUCATION, ENCOURAGEMENT, + ENFORCEMENT PROGRAMS

Investment in active transportation infrastructure is further enhanced through the education, encouragement, and enforcement of appropriate facility use. Programs can range from community workshops and individualized marketing campaigns to Safe Routes to School and safety marketing campaigns. Education and encouragement programs help connect residents with the tools they need to learn about the facilities available to them, to gain the skills required to safely utilize the network, and to pursue a more active, sustainable lifestyle. Programs can partner with schools, employers, and other community organizations to reach a wide audience and better understand the needs of various user groups.

The Bicycle Friendly Community (BFC) report card, issued by the League of American Bicyclists in Spring 2013, identifies that bicycling education programs are not offered in middle or high schools in Appleton and are offered in only 1-25% of elementary schools. This is one example of how the city can improve the presence and knowledge of bicycling in the city, while also improving the BFC ranking.

Further, enforcement programs reinforce appropriate behavior and improve personal safety on the trails and across the city. Few opportunities exist to provide additional education to all modes, and programs such as traffic citation diversion courses can be one method for all modes to learn the legal rights and responsibilities when walking, bicycling, and driving. Programs can target all modes, and in partnership with the police department, can aim to curb behavior specifically known to endanger bicyclists and pedestrians. Enforcement can also include programs such as a volunteer trail steward program, where groups of volunteers bicycle along the trail network to enhance safety through additional observation as well as can answer questions regarding the network.

Encouragement and safety programs, such as the program highlighted above in Pasadena, provide communities with information about the area's bicycle, pedestrian, and transit networks. Programs provide specific information about how to use the area's active transportation networks.

The Scott Get Up & Ride program encourage Kimberly Clark employees to commute by bike at 62 sites around the world. In Neenah, WI discounts at local bike shops, secure parking, education programs, and cash incentives encourage employees to bike to work[1].

1 *http://www.sustainabilityreport2010.kimberly-clark.com/people/involving-employees-in-sustainability.asp*

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CITY OF APPLETON

Appendices

Table of Contents

PUBLIC INVOLVEMENT SUPPLEMENTAL COMMENTS

March 2016: City of Appleton Comprehensive Plan Issues and Opportunities Workshops

ACTIVITY 1: A FULL LIST OF COMMENTS RELATING TO TRAILS

- Lighted safe trails
- Complete connectivity of trails and bike lanes
- Downtown bridges to the river with lovely views and trails
- More creative use of large Riverview Gardens land, designated trails…
- Need to plow our paved trails all year
- Trails that are connected using roads with high traffic
- Promote riverfront…as a neat nature area for trails (comment shortened)
- River trails
- Trails, stairs, docks, access to river at key waterfront locations
- Parks and trails with public access along the river, connecting to downtown and the neighborhoods
- More connecting trails to parks
- Pedestrian bridge over the Fox River to connect trails
- More walking/biking trails that are family friendly
- Singletrack, ski, bike, hiking trails

ACTIVITY 2: A FULL LIST OF COMMENTS RELATING TO TRAILS

- Trails, stairs, docks; river view gardens; great property with water front location; feels under utilized
- Parks and trails with public access along river (which connects to downtown and neighborhoods)
- Trail connection from old formost property along river past Peabody, Riverside Cemetery to Wisconsin Ave.
- Mountain biking trail Pierce Park
- More walking/biking trails that are family friendly where (kids) can bike safely on (not on roads) and bathrooms
- Single track, ski, bike, hike trails
- Creative mountain biking trail
- Connect Wisconsin Ave. and College Ave. with quiet, walkable and bikable trail/path

May 2016 City of Appleton Comprehensive Plan Downtown and Trails Design Workshop

ACCESS AND CONNECTIVITY TO THE RIVER

- Connect riverfront trails, better signage and connections (3)
- Love idea for boardwalks (3)
- Love the concept for Jones Park, additional ramp access and bikes (2)
- Like the concepts and ability to link Oneida Street to the river (2)
- Walking bridge connecting East John St to other side of river.
- There is no bike access to river between State and Drew.

WALKABILITY

- Lots of good ideas (3)
- Keep in mind most people will only walk ½ the time in this climate.
- Slow traffic and/or provide barrier to walkers and bicyclists on Oneida Street bridge.
- Love walkability ideas and bike lanes.
- Need to emphasize trails for both pedestrians and bikers.
- Is essential to future growth and accessibility.

STREETSCAPE

- Build bike infrastructure and bikes will come. Seeing big increases in biking every year as trail network expands.
- More plants, sidewalk cafes, bicycle parking.

City of Appleton Comprehensive Plan Survey

As part of the City's Comprehensive Plan Update, an on-line survey was launched over the period May 4th to June 6th. A total of 1,098 participants responded to the survey, including 940 completed surveys and 158 partially completed surveys. Trails related comments from the survey are summarized below:

NEIGHBORHOOD PERCEPTION

- 87.8% of respondents agreed or strongly agreed with the statement "My neighborhood is walkable"
- 69.9% of respondents agreed or strongly agreed with the statement "My neighborhood is bike friendly"

NEIGHBORHOOD – OPEN ENDED COMMENTS

The survey included several open-ended comments including "In your own words please share any additional comments related to your neighborhood." Of the 179 responses the second most frequent response had to do with bike and pedestrian improvements (44 comments). Key themes and specific comments included:

- 2 bike lanes on East Fremont deny on street parking on this street, served by city buses, as a major ambulance route to St. E's ,as a major fire truck, as a fast track east from Lawe st. Many still use sidewalks to bike..much safer.
- A stop sign on Alton Street that slowed traffic going up or down that road would make the street safer for bikes and for the growing (once again) number of young children who live there. There is a stop sign on Rankin but as there is virtually no traffic on Rankin that sign is meaningless.
- Area parks are nice. It would be nice to see less traffic. W Glendale Ave is a fairly busy street the closer you get to Mason St. I think this prevents a close knit community.
- Broadway Drive is not safe. Vehicles travel too fast and most don't slow down for pedestrians. People use this road asa short cut and drive wayyyy too fast.
- Busy street but quite neighborhood
- Drivers on the busy road don't seem to understand rules for bike riding and how the bike lanes operate. Sometimes it can be scary taking small kids biking in a trailer for this reason.
- Even with bike lanes would not feel safe riding in my neighborhood because of the high traffic volume.
- Motorcycle traffic and loud motorcycles that the police do not enforce. Pit bulls , people walking in the middle of the street cursing. Drug deals on the corners.
- My neighborhood is on a busy four lane highway. The other side of our block is a quiet residential area. We have a lot of walker's, runners, bicycles and vehicle traffic on a well maintained boulevard. Nice area.
- Road is very busy. Cars go too fast down the street.
- The city services like trash and leaf collection have always been timely and good. Midway Road traffic is increasing and may need addressing as far as safety and lighting.
- There are busy streets and no suitable places to walk to even reach a "walkable" trail. I was spoiled after living in Minneapolis for a decade where bike lanes and beautiful trails are everywhere. It would be wonderful to have a similar environment here in Appleton.
- Vehicles drive by too fast. Heavy foot traffic and bike traffic by Erb park
- We need physical barriers between motorized traffic and bicyclists and pedestrians. Texting and hurried, intolerant drivers make cycling seem so much more risky than it once did. The Dutch offer a safer approach to cycling friendly infrastructure. I live near the CE trail, but getting there feels risky.
- Bike paths for busy streets would make getting to the park easier. Prospect Ave is too busy to ride bikes with my kids, but the park is over 1 mile away.
- I have easy walkable access to the west side of downtown; however, I would love to have bike access to the

shops and establishments on the east part of College Ave

- I live in the McCarthy Creek apartment complex. It is as if we are on an island because there are no sidewalks, bike lanes, or pedestrian friendly roadways which allow for safe and easy access out of the triangle formed by Wisconsin Ave, Greenville Drive, and Mayflower Drive. I would love to be able to walk/bike to work (on Communication Dr < 1.5mi away), to the mall (also < 1.5mi away), and to the inside of the 41/441 circle.
- I walk/bike frequently, although I do not feel particularly safe doing these activities on South Oneida (the bridge updates have helped, however).
- I wish there were more sidewalks on Oneida, I live by 441, and anytime I want to walk anywhere on Oneida, I have to go on the grass, and the drivers don't pay attention to people crossing the street.
- I would like to have sidewalks in the Seminole Drive neighborhood.
- I would like to see the river public access point be more user friendly. Just a simple stepped or switchback path would make a world of difference
- I would like the city to have a campaign to educate citizens about riding bikes like vehicles rather than pedestrians and educate people about walking safely by facing traffic where there are not sidewalks.
- I would love to see a walking/biking path/trail and a playground close to my house. It would be nice to have somewhere safe to let my kids play and ride bikes. Our closest playground is Lions Park, and I'd love to have one closer!
- would really like there to be more safe biking options available.
- I wouldn't say it's bike unfriendly, but there are no designated biking lanes. There are no signs to yield for bikers, and in general biking is not well tolerated.
- I'd love a better bike/walking lane on North Ballard (north of JJ). It could bring more people to Plamann Park. I also hope that as the area around JJ and North High is developed, leaders consider beauty and walking and don't just create another Darboy/east Calumet.
- I've lived in many other states and Wisconsin has been the first one where we don't have a sidewalk for my kids to bike on or walk on
- Impossible to walk to run basic errands. There is no grocery store, pharmacy, etc. within walking distance from my house. Problem is, if I were to move closer to any of these services I wouldn't be able to walk downtown, which is 90% of the reason I choose to live where I do. Walkability is the future, and Appleton needs to provide those essential daily services.
- It would be great to have more ways to bike and/or walk safely within and between communities.
- Keep making the city more bike friendly green bay is a great example
- Lack of sidewalks, would like to have a more dog-friendly community (ex. dogs in parks, off-leash dog parks)
- Live close to downtown and Lawrence. Walkable to the post office and library and the farmers market. Wish there was a grocery store close.
- Need a sidewalk on French Road and intersection lights or another round about.

- Need more bikes intersecting the ones that currently exist!
- Neighborhood sidewalks not so great. Bus lines need to operate more frequently for people that need it (1 trip per hour is way too long)
- No sidewalks in our neighboorhood by Janet Berry Elementary.
- No sidewalks, so not very walkable.
- Our neighborhood is easily accessible for bikes, however there is not any street parking because both sides are bike lanes without parking space. Having elderly grandparents and family over means they have to walk a block or two because of restricted driveway space.
- Our neighborhood would be much safer for walking, biking, and children if we had sidewalks.
- Our street is very narrow, especially in winter with plowing, which also makes it unsafe for biking.
- Sidewalks would make our neighborhood so much safer for our kids. Especially to give them a safe route to our neighborhood park. Also it would be great to see a roundabout go in at Kennsington and Newberry.
- The Fox Valley is still very non-bike friendly outside of the CE trail.
- There are no sidewalks in our neighborhood so when walking with young children it is very hard. This is the same for bikes.
- There are no sidewalks on many of our neighborhood streets. Shoulders are gravel and traffic is too fast to feel real safe while walking and biking.
- Too many bike riders on the sidewalks in the Downtown....an accident if waiting to happen! Please at least consider signage on the pavement corners saying it is illegal and what the fine is!
- Very accessible to school, playgrounds, AMC hospital, Fire Dept. Overall good service - garbage pick-up , mail etc.
- We have always loved the easy access to the elementary school, the Y, the library, small businesses, the parks, entertainment. As someone about to retire, and thinking about aging, the walkability is critical.
- We have no sidewalks, you have to walk on the street when you do walk somewhere. I don't think my neighbors are very welcoming to anyone that looks different from the majority in this area. I don't really care about this b/c my purpose to live there is for my kids to have access to better schools.
- We live in a neighborhood without sidewalks. I think sidewalks would add to walkability and to an increased friendliness among neighbors.
- We live on N. Gillett Street and there are no sidewalks and the road is not big enough to walk or bike safely on the side of the road as people rarely move over if they are able and do not go 25 mph.
- We need more bike lanes please! A lot of us commute to work using bicycles.
- We're very near walking /biking trail, but because we have no date way to walk to it, we have to drive 1/2 mile to get to it too walk. It would be nice to connect or neighborhood to the others nearby
- While my neighborhood is safe and bike friendly, I don't consider it walkable because there are no

destinations in walking distance. It may be fine to take a stroll in the neighborhood for exercise, but I'd rather live in a neighborhood where I can walk to stores, shops, etc.

- Would like bike paths especially around popular destinations on college avenue
- Would like biking paths around the south side. I feel riding my bike on the street isn't safe.
- You can walk around in my neighborhood, but there isn't really anywhere to go. Would be nice if there were local spots to walk to where people hang out.
- West college ave. is completely unwalkable/bikeable. I would like to see bike lane/path that links from the CB trail by the airport, all the way down college to the CE trail.

TRANSPORTATION PERCEPTIONS

- 51% of respondents agreed or strongly agreed with the statement "More on-street bicycling lanes are needed"
- 76% of respondents agreed or strongly agreed with the statement "More off-street bicycling and pedestrian trails are needed"

TRANSPORTATION – OPEN ENDED COMMENTS

The survey included several open-ended comments to the statement "In your own words please share any additional comments related to your transportation needs." 338 comments were received including 30 trail specific related comments. The key themes included:

- Appleton has a nice selection of bicycle lanes and bike/pedestrian trails, and I would love to see this continue to grow.
- Appleton needs more biking lanes and scenic trails walking trails that are well marked and known.
- Better ways to get around via bike and/or walking trails would be amazing!
- Bike trails are decent but the major downfall is they are not connected
- Bike trails! We moved here from Eau Claire, WI and definitely miss the bike trails the most. We could get anywhere in EC on trails. It was very convenient and safer!
- I feel that public transportation is much easier to use with a bicycle but we lack secure bike storage near the bus station, and we have a long way to go to complete trail systems integrated with public transportation that would allow people to use them in combination safely.
- I like the concept of "complete streets" where all modes of transportation can safely transit. I love to walk on the trails along the river and wish there were more connections to get there.
- I wish that the recreational trails near my home (off French Road) were accessible by sidewalk on BOTH sides of the street.
- I would LOVE to see more dedicated bike paths and trails in Appleton. My family would definitely make frequent use of them.
- I would like to see the city continue to expand bicycle and pedestrian related or focused lanes, trails and paths

that everyone can enjoy. As a bike commuter, I very much appreciate having a “dedicated” space for riding to work or to shop. As a parent of an elementary aged child however, I wish we would be far more aggressive in installing pedestrian friendly crossings like we see on College Ave on the Lawrence campus. If grown adults can enjoy the luxury of bright flashing lights warning drivers that they are crossing the street, why are school zones only equipped with one small light to alert drivers to the presence of elementary aged children? Our son has to navigate Freemont and S. Oneida street to get to and from school and both streets are increasingly difficult to cross and dangerous. Rather than making the Freemont/Oneida intersection safer

- •I would love to see trails going around the whole fox city area I love walking and biking for fun and transportation what an awesome why to bring people together while they are out moving around town on bikes or foot
- It would be nice to get more biking and walking trails put in throughout the city.
- Keep expanding the off street bike trails! Please
- More bike trails!!

HOPES FOR THE FUTURE OF APPLETON

Respondents were asked to list their top 3 hopes for the future of Appleton. 69 trail related comments were made. Key themes included:

- More biking/walking trails
- Bike trails along the fox
- COMPLETE TRESTLE BRIDGE TRAILS
- Connect trail systems in North Appleton to rest of Fox Cities
- Connecting all sides of the city with trails
- Exercise trails throughout downtown area
- Improved Bike Trails
- More bike lanes
- More recreational trails
- More trails throughout city
- Mountain bike trails and jumps.
- Bike trail from north Appleton to downtown
- Create a riverwalk and bike trail system integrated throught the valley
- Feeling safe on trails
- Connected and expanding hiking/biking trails to neighboring citys
- Connecting parks along the river with trails.

- Continued trail connections and more access to them
- Emphasis walking trails along the river
- Maintaining parks and trails
- More fitness trails for walking, jogging, or biking.
- Trails/paths along the river (significant expansion of existing)
- Additional off street trails
- Clean up the walking trails on the Oneida St Trails-too much overgrowth prevents nice river ews. More walkable retail shops down by the river.
- I hope to see more trails integrated throughout the greenspaces.
- Improve quality of trails.
- Increase/coordination of recreation trails
- More connected trails along river
- More green space trails.
- More parks and trails on river
- Mountain bike trails
- Walking trail similar to high line in New York City make a fun trail thru flats in Appleton

NON-TAXABLE DEVELOPMENT

The survey asked respondents to list what types of non-taxable development they would like to see in Appleton. Over 400 responses referenced trails. Key themes included:

- More biking and walking trails
- Better trail connectivity
- More trails along the river
- Mountain biking trails needed

NEW ACTIVITIES, ATTRACTIONS, OR EVENTS

Participants were asked “what new activities, attractions, or events would you like to see downtown or along the river. 65 trails related comments were made. Key themes included:

- Trails along the river
- Better riverfront access including trails
- Dog friendly trails

PARK AMENITIES AND TRAILS

Participants were asked “what specific park amenities or trails do you feel are needed (and where) within the City. 215 trails related comments were made. Key themes included:

» More trails

» Better connected trails, both within the City and with surrounding communities

» Better accessibility

» Well marked trails

» Dog friendly trails

» Trails along the river

UPGRADE PROJECT TABLES

Upgrade Projects: Drainage*

Location	Cross Street 1	Cross Street 2	Length (Feet)	# of Issues	Cost per Unit	Sub-total Drainage
Newberry Trail	S Lawe Street	S Olde Oneida Street	1928	0	$8,500.00	$0.00
Newberry Trail	East of S Lawe Street	S Lawe Street	1083	0	$8,500.00	$0.00
Newberry Trail	West of E College Ave	East of S Lawe Street	1276	1	$8,500.00	$8,500.00
North Island Trail	S Lawe St	S Olde Oneida St	2005	4	$8,500.00	$34,000.00
Newberry Trail	E College Ave	West of E College Ave	890	0	$8,500.00	$0.00
Newberry Trail	West of E Newberry St	West of E Newberry St	949	0	$8,500.00	$0.00
Newberry Trail	E Newberry St	West of E Newberry St	1949	0	$8,500.00	$0.00
Newberry Trail	E Newberry St	South of E Newberry St	929	0	$8,500.00	$0.00
Newberry Trail	W of S Kensington Dr	N of E College Ave	2473	2	$8,500.00	$17,000.00
Newberry Trail	S Kensington Dr	W of S Kensington Dr	955	0	$8,500.00	$0.00
Newberry Trail	Highway 441	S Kensington Dr	1136	0	$8,500.00	$0.00
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	268	0	$8,500.00	$0.00
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	85	0	$8,500.00	$0.00
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	245	0	$8,500.00	$0.00
Newberry Trail	West of S Railroad St	Highway 441	2043	0	$8,500.00	$0.00
Newberry Trail	S Railroad St	West of S Railroad St	2078	0	$8,500.00	$0.00
Newberry Trail	East of S Railroad St	S Railroad St	652	0	$8,500.00	$0.00
Apple Creek Trail	N Ballard Rd	N Meade St	6515	2	$8,500.00	$17,000.00
Apple Creek Trail	N Lightning Rd	N Ballard Rd	2412	2	$8,500.00	$17,000.00
Applecreek Trail	N French Rd	N Lightning Rd	4961	2	$8,500.00	$17,000.00
Highview Trail	N Meade St	West of N Meade St	2104	0	$8,500.00	$0.00
Highview Trail	N Meade St	West of N Meade St	1402	0	$8,500.00	$0.00
Applecreek Trail	Cherryvale Ave	N French Rd	3147	7	$8,500.00	$59,500.00
Apple Creek Trail	E Edgewood Dr	Cherryvale Ave	3698	3	$8,500.00	$25,500.00
Providence Trail	E Ashbury Dr	E of N Providence Ave	907	0	$8,500.00	$0.00
Providence Trail	E Ashbury Dr	E of N Providence Ave	463	0	$8,500.00	$0.00
Providence Trail	E Ashbury Dr	E of N Providence Ave	471	0	$8,500.00	$0.00
Providence Trail	E Ashbury Dr	E of N Providence Ave	743	1	$8,500.00	$8,500.00
				Drainage Subtotal		**$204,000.00**

** Drainage fixes assume installation of 16 LF of 12" culvert pipe with apron endwalls, 90 foot of trail removal and replacement. Cost estimated from project 4992-00-46 Contract Mod 4 for similar work.*

Upgrade Projects: Crackfill

Location	Cross Street 1	Cross Street 2	Length (Feet)	Number of Issues	Feet/ Issue	**Crackfill	Cost Per Unit	Sub-total Crackfill
Newberry Trail	S Lawe Street	S Olde Oneida Street	1928	1	1928	Yes	$50.00	$50.00
Newberry Trail	East of S Lawe Street	S Lawe Street	1083	7	155	Yes	$50.00	$350.00
Newberry Trail	West of E College Ave	East of S Lawe Street	1276	45	28	No	$50.00	$0.00
North Island Trail	S Lawe St	S Olde Oneida St	2005	79	25	No	$50.00	$0.00
Newberry Trail	E College Ave	West of E College Ave	890	19	47	No	$50.00	$0.00
Newberry Trail	West of E Newberry St	West of E Newberry St	949	25	38	No	$50.00	$0.00
Newberry Trail	E Newberry St	West of E Newberry St	1949	134	15	No	$50.00	$0.00
Newberry Trail	E Newberry St	South of E Newberry St	929	48	19	No	$50.00	$0.00
Newberry Trail	West of S Kensington Dr	N of E College Ave	2473	113	22	No	$50.00	$0.00
Newberry Trail	S Kensington Dr	West of S Kensington Dr	955	58	16	No	$50.00	$0.00
Newberry Trail	Highway 441	S Kensington Dr	1136	43	26	No	$50.00	$0.00
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	268	0	NA	NA	$50.00	$0.00
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	85	0	NA	NA	$50.00	$0.00
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	245	0	NA	NA	$50.00	$0.00
Newberry Trail	West of S Railroad St	Highway 441	2043	0	NA	NA	$50.00	$0.00
Newberry Trail	S Railroad St	West of S Railroad St	2078	0	NA	NA	$50.00	$0.00
Newberry Trail	East of S Railroad St	S Railroad St	652	0	NA	NA	$50.00	$0.00
Apple Creek Trail	N Ballard Rd	N Meade St	6515	46	142	Yes	$50.00	$2,300.00
Apple Creek Trail	N Lightning Rd	N Ballard Rd	2412	39	62	No	$50.00	$0.00
Applecreek Trail	N French Rd	N Lightning Rd	4961	62	80	Yes	$50.00	$3,100.00
Highview Trail	N Meade St	West of N Meade St	2104	70	30	No	$50.00	$0.00
Highview Trail	N Meade St	West of N Meade St	1402	47	30	No	$50.00	$0.00
Applecreek Trail	Cherryvale Ave	N French Rd	3147	39	81	Yes	$50.00	$1,950.00
Apple Creek Trail	E Edgewood Dr	Cherryvale Ave	3698	29	128	Yes	$50.00	$1,450.00
Providence Trail	E Ashbury Dr	E of N Providence Ave	907	16	57	No	$50.00	$0.00
Providence Trail	E Ashbury Dr	E of N Providence Ave	463	0	NA	No	$50.00	$0.00
Providence Trail	E Ashbury Dr	E of N Providence Ave	471	5	94	Yes	$50.00	$250.00
Providence Trail	E Ashbury Dr	E of N Providence Ave	743	15	50	No	$50.00	$0.00
						Crackfil Subtotal		**$9,450.00**

*** Price estimate based upon web averages including labor https://howmuch.net/costs/sealing-asphalt-crack-repair. Assumes Crack is full trail width. Assumes Let as part of a larger project.*

Upgrade Projects: Pavement Replacement

Location	Cross Street 1	Cross Street 2	Length (Feet)	Pavement Replacement ***	Cost per Foot	Subtotal Pavement Replacement	Sub-Total Pavement Surface Repair Project
Newberry Trail	S Lawe Street	S Olde Oneida Street	1928	No	$25.00	$0.00	$50.00
Newberry Trail	East of S Lawe Street	S Lawe Street	1083	No	$25.00	$0.00	$350.00
Newberry Trail	West of E College Ave	East of S Lawe Street	1276	Yes	$25.00	$31,900.70	$31,900.70
North Island Trail	S Lawe St	S Olde Oneida St	2005	Yes	$25.00	$50,114.99	$50,114.99
Newberry Trail	E College Ave	West of E College Ave	890	Yes	$25.00	$22,241.34	$22,241.34
Newberry Trail	West of E Newberry St	West of E Newberry St	949	Yes	$25.00	$23,720.80	$23,720.80
Newberry Trail	E Newberry St	West of E Newberry St	1949	Yes	$25.00	$48,722.39	$48,722.39
Newberry Trail	E Newberry St	South of E Newberry St	929	Yes	$25.00	$23,221.57	$23,221.57
Newberry Trail	West of S Kensington Dr	N of E College Ave	2473	Yes	$25.00	$61,824.71	$61,824.71
Newberry Trail	S Kensington Dr	West of S Kensington Dr	955	Yes	$25.00	$23,876.16	$23,876.16
Newberry Trail	Highway 441	S Kensington Dr	1136	Yes	$25.00	$28,402.84	$28,402.84
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	268	NA	$25.00	$0.00	$0.00
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	85	NA	$25.00	$0.00	$0.00
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	245	NA	$25.00	$0.00	$0.00
Newberry Trail	West of S Railroad St	Highway 441	2043	NA	$25.00	$0.00	$0.00
Newberry Trail	S Railroad St	West of S Railroad St	2078	NA	$25.00	$0.00	$0.00
Newberry Trail	East of S Railroad St	S Railroad St	652	NA	$25.00	$0.00	$0.00
Apple Creek Trail	N Ballard Rd	N Meade St	6515	No	$25.00	$0.00	$2,300.00
Apple Creek Trail	N Lightning Rd	N Ballard Rd	2412	Yes	$25.00	$60,298.79	$60,298.79
Applecreek Trail	N French Rd	N Lightning Rd	4961	No	$25.00	$0.00	$3,100.00
Highview Trail	N Meade St	West of N Meade St	2104	Yes	$25.00	$52,607.81	$52,607.81
Highview Trail	N Meade St	West of N Meade St	1402	Yes	$25.00	$35,041.78	$35,041.78
Applecreek Trail	Cherryvale Ave	N French Rd	3147	No	$25.00	$0.00	$1,950.00
Apple Creek Trail	E Edgewood Dr	Cherryvale Ave	3698	No	$25.00	$0.00	$1,450.00
Providence Trail	E Ashbury Dr	E of N Providence Ave	907	Yes	$25.00	$22,672.72	$22,672.72
Providence Trail	E Ashbury Dr	E of N Providence Ave	463	Yes	$25.00	$11,566.63	$11,566.63
Providence Trail	E Ashbury Dr	E of N Providence Ave	471	No	$25.00	$0.00	$250.00
Providence Trail	E Ashbury Dr	E of N Providence Ave	743	Yes	$25.00	$18,572.66	$18,572.66
				Pavement Rep. Subtotal		**$514,785.88**	**$524,235.88**

******Assumes pavement removal, and replacement as part of a larger project, and 25% of the repair length requiring base replacement to typical section.***

Upgrade Projects: Crossings

Location	Cross Street 1	Cross Street 2	Length (Feet)	****Crossings	Cost per Unit4	Sub-total Crosswalks
Newberry Trail	S Lawe Street	S Olde Oneida Street	1928	0	$1,520.00	$0.00
Newberry Trail	East of S Lawe Street	S Lawe Street	1083	0	$1,520.00	$0.00
Newberry Trail	West of E College Ave	East of S Lawe Street	1276	2	$1,520.00	$3,040.00
North Island Trail	S Lawe St	S Olde Oneida St	2005	0	$1,520.00	$0.00
Newberry Trail	E College Ave	West of E College Ave	890	1	$1,520.00	$1,520.00
Newberry Trail	West of E Newberry St	West of E Newberry St	949	1	$1,520.00	$1,520.00
Newberry Trail	E Newberry St	West of E Newberry St	1949	4	$1,520.00	$6,080.00
Newberry Trail	E Newberry St	South of E Newberry St	929	0	$1,520.00	$0.00
Newberry Trail	West of S Kensington Dr	N of E College Ave	2473	0	$1,520.00	$0.00
Newberry Trail	S Kensington Dr	W of S Kensington Dr	955	0	$1,520.00	$0.00
Newberry Trail	Highway 441	S Kensington Dr	1136	0	$1,520.00	$0.00
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	268	0	$1,520.00	$0.00
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	85	0	$1,520.00	$0.00
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	245	0	$1,520.00	$0.00
Newberry Trail	West of S Railroad St	Highway 441	2043	0	$1,520.00	$0.00
Newberry Trail	S Railroad St	W of S Railroad St	2078	0	$1,520.00	$0.00
Newberry Trail	East of S Railroad St	S Railroad St	652	0	$1,520.00	$0.00
Apple Creek Trail	N Ballard Rd	N Meade St	6515	1	$1,520.00	$1,520.00
Apple Creek Trail	N Lightning Rd	N Ballard Rd	2412	1	$1,520.00	$1,520.00
Applecreek Trail	N French Rd	N Lightning Rd	4961	5	$1,520.00	$7,600.00
Highview Trail	N Meade St	West of N Meade St	2104	3	$1,520.00	$4,560.00
Highview Trail	N Meade St	West of N Meade St	1402	1	$1,520.00	$1,520.00
Applecreek Trail	Cherryvale Ave	N French Rd	3147	0	$1,520.00	$0.00
Apple Creek Trail	E Edgewood Dr	Cherryvale Ave	3698	1	$1,520.00	$1,520.00
Providence Trail	E Ashbury Dr	E of N Providence Ave	907	3	$1,520.00	$4,560.00
Providence Trail	E Ashbury Dr	E of N Providence Ave	463	0	$1,520.00	$0.00
Providence Trail	E Ashbury Dr	E of N Providence Ave	471	0	$1,520.00	$0.00
Providence Trail	E Ashbury Dr	E of N Providence Ave	743	5	$1,520.00	$7,600.00
				Crosswalks Subtotal		**$42,560.00**

*****Assumes a crossing width of 40 feet and ladder style walk epoxy with 2 foot cross bars and 1.5' longitudinal bars.*

Upgrade Projects: Gate and Bollard Removal

Location	Cross Street 1	Cross Street 2	Length (Feet)	Bollards	*****Cost per Unit	Gates	*****Cost per Unit	Sub-total Gate and Bollard Removal
Newberry Trail	S Lawe Street	S Olde Oneida Street	1928	0	$375.00	1	$750.00	$750.00
Newberry Trail	East of S Lawe Street	S Lawe Street	1083	0	$375.00	1	$750.00	$750.00
Newberry Trail	West of E College Ave	East of S Lawe Street	1276	0	$375.00	0	$750.00	$0.00
North Island Trail	S Lawe St	S Olde Oneida St	2005	1	$375.00	0	$750.00	$375.00
Newberry Trail	E College Ave	West of E College Ave	890	0	$375.00	0	$750.00	$0.00
Newberry Trail	West of E Newberry St	West of E Newberry St	949	0	$375.00	0	$750.00	$0.00
Newberry Trail	E Newberry St	West of E Newberry St	1949	0	$375.00	0	$750.00	$0.00
Newberry Trail	E Newberry St	South of E Newberry St	929	0	$375.00	0	$750.00	$0.00
Newberry Trail	West of S Kensington Dr	N of E College Ave	2473	0	$375.00	0	$750.00	$0.00
Newberry Trail	S Kensington Dr	West of S Kensington Dr	955	0	$375.00	0	$750.00	$0.00
Newberry Trail	Highway 441	S Kensington Dr	1136	0	$375.00	0	$750.00	$0.00
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	268	0	$375.00	0	$750.00	$0.00
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	85	0	$375.00	0	$750.00	$0.00
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	245	0	$375.00	0	$750.00	$0.00
Newberry Trail	West of S Railroad St	Highway 441	2043	0	$375.00	0	$750.00	$0.00
Newberry Trail	S Railroad St	West of S Railroad St	2078	0	$375.00	0	$750.00	$0.00
Newberry Trail	East of S Railroad St	S Railroad St	652	0	$375.00	0	$750.00	$0.00
Apple Creek Trail	N Ballard Rd	N Meade St	6515	0	$375.00	1	$750.00	$750.00
Apple Creek Trail	N Lightning Rd	N Ballard Rd	2412	0	$375.00	0	$750.00	$0.00
Applecreek Trail	N French Rd	N Lightning Rd	4961	0	$375.00	1	$750.00	$750.00
Highview Trail	N Meade St	West of N Meade St	2104	0	$375.00	0	$750.00	$0.00
Highview Trail	N Meade St	West of N Meade St	1402	0	$375.00	0	$750.00	$0.00
Applecreek Trail	Cherryvale Ave	N French Rd	3147	0	$375.00	1	$750.00	$750.00
Apple Creek Trail	E Edgewood Dr	Cherryvale Ave	3698	0	$375.00	1	$750.00	$750.00
Providence Trail	E Ashbury Dr	E of N Providence Ave	907	0	$375.00	0	$750.00	$0.00
Providence Trail	E Ashbury Dr	E of N Providence Ave	463	0	$375.00	0	$750.00	$0.00
Providence Trail	E Ashbury Dr	E of N Providence Ave	471	0	$375.00	0	$750.00	$0.00
Providence Trail	E Ashbury Dr	E of N Providence Ave	743	0	$375.00	0	$750.00	$0.00
					Gates and Bollard Subtotal			$4,875.00

*****Assumes gates are not significantly larger than bollards and both are in concrete bases. Two posts per gate.*

Upgrade Projects: Total Cost

Location	Cross Street 1	Cross Street 2	Length (Feet)	Total Project Cost	Total Project Cost (w Contingency)
Newberry Trail	S Lawe Street	S Olde Oneida Street	1928	$1,000	$1,200
Newberry Trail	East of S Lawe Street	S Lawe Street	1083	$1,000	$1,200
Newberry Trail	West of E College Ave	East of S Lawe Street	1276	$43,000	$51,600
North Island Trail	S Lawe St	S Olde Oneida St	2005	$84,000	$100,800
Newberry Trail	E College Ave	West of E College Ave	890	$24,000	$28,800
Newberry Trail	West of E Newberry St	West of E Newberry St	949	$25,000	$30,000
Newberry Trail	E Newberry St	West of E Newberry St	1949	$55,000	$66,000
Newberry Trail	E Newberry St	South of E Newberry St	929	$23,000	$27,600
Newberry Trail	West of S Kensington Dr	N of E College Ave	2473	$79,000	$94,800
Newberry Trail	S Kensington Dr	West of S Kensington Dr	955	$24,000	$28,800
Newberry Trail	Highway 441	S Kensington Dr	1136	$28,000	$33,600
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	268	$0	$0
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	85	$0	$0
Newberry Trail	Highway 441 Ramp	Highway 441 Ramp	245	$0	$0
Newberry Trail	West of S Railroad St	Highway 441	2043	$0	$0
Newberry Trail	S Railroad St	West of S Railroad St	2078	$0	$0
Newberry Trail	East of S Railroad St	S Railroad St	652	$0	$0
Apple Creek Trail	N Ballard Rd	N Meade St	6515	$22,000	$26,400
Apple Creek Trail	N Lightning Rd	N Ballard Rd	2412	$79,000	$94,800
Applecreek Trail	N French Rd	N Lightning Rd	4961	$28,000	$33,600
Highview Trail	N Meade St	West of N Meade St	2104	$57,000	$68,400
Highview Trail	N Meade St	West of N Meade St	1402	$37,000	$44,400
Applecreek Trail	Cherryvale Ave	N French Rd	3147	$62,000	$74,400
Apple Creek Trail	E Edgewood Dr	Cherryvale Ave	3698	$29,000	$34,800
Providence Trail	E Ashbury Dr	E of N Providence Ave	907	$27,000	$32,400
Providence Trail	E Ashbury Dr	E of N Providence Ave	463	$12,000	$14,400
Providence Trail	E Ashbury Dr	E of N Providence Ave	471	$0	$0
Providence Trail	E Ashbury Dr	E of N Providence Ave	743	$35,000	$42,000
			Total of all Projects	**$775,000**	**$930,000**

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FUNDING OPPORTUNITIES

FEDERAL				
INCENTIVE	**PROGRAM DESCRIPTION**	**AVAILABILITY**	**EFFECTIVENESS**	**RELEVANCE**
TIGER Discretionary Grants	$500 million to road, rail, transit, and port projects. Applicants must detail the benefits their project would deliver for five long-term outcomes: safety, economic competitiveness, state of good repair, quality of life, and environmental sustainability. USDOT also evaluates projects on innovation, partnerships, project readiness, benefit cost analysis, and cost share. TIGER can provide capital funding directly to any public entity. TIGER can fund projects that have a local match as low as 20 percent of the total project costs.	Highly competitive. Must demonstrate significant impact on the nation, a metropolitan area, or a region. Recognizes projects nationwide that will advance key transportation goals such as safety, innovation, and opportunity.	Since 2009, more than $210 million have gone to bicycle and pedestrian projects.	Pedestrian Projects
Transportation Alternatives Program (TAP) Funding	Combination of Safe Routes to School, Bicycle and Pedestrian, and Transportation Enhancement programs	Applications are accepted every other year, with the next round of applications being available in 2017 (likely late in year) for construction to begin in 2018/2019	Applications go through the Appleton MPO. Grants are 80% of project cost.	Trail development
Community Development Block Grant (CDBG)	Federal program which provides funds for the benefit of Low and Moderate Income Persons (LMI) and for blight elimination. Range of eligible activities include acquisition, demolition, public improvements, relocation, property rehab, housing, planning, microenterprise assistance and public service.	Appleton is a designated entitlement community. Application cycle is annual, with next deadline May 27, 2016.	Slightly more administratively burdensome but serves a different purpose and complements well with other incentives.	Infrastructure improvements, which could include trails
Surface Transportation Program (STP)	Funding to States and localities to preserve and improve the conditions and performance on any Federal-aid highway, bridge and tunnel project on any public road, pedestrian and bicycle infrastructure, and transit capital projects, including intercity bus terminals. 10% set aside can be used to build bicycle and pedestrian facilities. Applications go through the Appleton MPO.	Bi-annual, spring 2016 for 2018-2020 funding. Amount varies; 2016 has a $50 million fund. Bicycle, pedestrian, and trails		

FEDERAL				
INCENTIVE	**PROGRAM DESCRIPTION**	**AVAILABILITY**	**EFFECTIVENESS**	**RELEVANCE**
Congestion Mitigation and Air Quality Improvement Program (CMAQ)	Funding source to state and local governments for transportation projects and programs to help meet the requirements of the Clean Air Act. Funding is available to reduce congestion and improve air quality. 10% set aside can be used to build bicycle and pedestrian projects that emphasize air quality improvements. Applications go through the Appleton MPO.	Bi-annual, spring 2016 for 2018-2020 funding. Amount varies; 2016 has a $27 million fund. Bicycle and pedestrian facilities, trail bridges, and roadway intersections with trails		
Land & Water Conservation Fund (LWCF) from National Park Service	The LWCF program can be divided into the "State Side" which provides grants to State and local governments, and the "Federal Side" which is used to acquire lands, waters, and interests necessary to achieve the natural, cultural, wildlife, and recreation management objectives of federal land management agencies.	Annually, spring application for funding in following spring. $3 million biennially; $500,000 project cap.		ROW acquisition and construction
Land and Water Conservation Fund (LWCF) Outdoor Recreation Legacy Partnership Program from National Park Service	Identifies and highlights new ways of promoting opportunities for expanding outdoor play in areas with great need, as well as promoting the development of new or enhanced partnerships for outdoor recreation in urban communities across the nation. Targets projects that serve economically and/or recreationally-disadvantaged communities in areas with over 50,000 people.	Annually, spring application for funding in following spring. Up to $15 million biennially; $750,000 project cap		Acquisition and development of public outdoor recreation areas and facilities.
Federal Highway Safety Improvement Program (HSIP)	Program aims to achieve significant reduction in traffic fatalities and serious injuries on all public roads, including non-State-owned public roads and roads on tribal lands. The HSIP requires a data-driven, strategic approach to improving highway safety on all public roads that focuses on performance.	WiDOT is currently accepting completed HSIP applications. The application review process will begin after the February 15, 2017 deadline.		Engineering strategies to reduce fatal and serious injury crashes including wayfinding, pedestrian and bicycle safety infrastructure and improvements.

FEDERAL				
INCENTIVE	**PROGRAM DESCRIPTION**	**AVAILABILITY**	**EFFECTIVENESS**	**RELEVANCE**
Enhanced Mobility of Seniors and Individuals with Disabilities Program	Funds for capital and operating projects that improve the mobility of seniors and individuals with disabilities. Eligible applicants include private non-profits and local public bodies. Eligible projects include the purchase of Human Service Vehicles (see the procurement webpage for details), operating budgets, Mobility Managers, coordination and non-vehicle capital.	Funding determined by a formula based on the number of seniors and people with disabilities in each state		
Federal Lands Access Program	Funds to improve transportation facitilies that provide access to or within Federal lands, specifically high-use recreation sites and economic generators. Funding can apply to public roads, transit systems, and other facilities as a supplement to State and local resources.	Future funding dependent on Federal Transportation Funding authorization; anticipated in 2021.		
Recreational Trails Aids (RTA) Program	This is a federal program administered in all states. Municipal governments and incorporated organizations are eligible to receive reimbursement for development and maintenance of recreational trails and trail-related facilities for both motorized and non-motorized recreational trail uses. Eligible sponsors may be reimbursed for up to 50 percent of eligible project costs. Funds from this program may be used in conjunction with funds from Knowles-Nelson Stewardship development projects.	May 1st annually	Municipal governments and incorporated organizations whose primary purpose is trails or trail usage can apply for this funding.	Maintenance or restoration of existing trails; Development or rehabilitation of trailside/ trailhead facilities and trail linkages; Construction of new trails; Property acquisition for trails.

STATE				
INCENTIVE	**PROGRAM DESCRIPTION**	**AVAILABILITY**	**EFFECTIVENESS**	**RELEVANCE**
Community Development Investment Grant (CDIG)	State of WI program offered by WEDC for re/development providing financial incentives for shovel-ready projects for downtown community-driven efforts. Funds go to City.	Grants up to $250,000 are available and applications are accepted throughout the fiscal year, however WEDC staff estimates all funding for this fiscal year will be committed by December of 2016, making an early application mandatory should the City desire to access this funding source. Having a Development Agreement in place is needed for a competitive application.	Very effective depending on the project. Requires a community match so should be structured with project benefitting residents and employees downtown. Possibility for redevelopment of Soldiers Square or other public project.	Downtown redevelopment projects; including parks, trails as well as tax producing projects
Natural Resource Damage Assessment (NRDA) Program	Settlement funding from Fox River contamination lawsuits. Money can be used for environmental, recreation, and access activities in Lower Fox River	On-going grant cycle; currently approx. $42 million available. Current 5-yr plan to expend $3M/ year including up to $400K on “public use.” On-going application process.	Numerous communities along Lower Fox River have used the funding on a variety of projects	Trail development, pier. However, need to frame project as providing “fisheries access” vs. active transportation
Transportation Facilities Economic Assistance and Development Program (TEA)	WDOT funding for transportation related projects which support economic development	Year Round. Generally up to $5,000 per job created or retained for streets and stormwater improvements.	Funding is generally limited to projects supporting development of manufacturing and or distribution, however the Department has funded projects involving large scale medical center development. Should transportation improvements be needed, this program should be evaluated for use	Trail development if tied to positive economic development outcome

STATE				
INCENTIVE	**PROGRAM DESCRIPTION**	**AVAILABILITY**	**EFFECTIVENESS**	**RELEVANCE**
WDNR Recreational Boating Facilities Grant	These grants may be used by counties, towns, cities, villages, tribes, sanitary districts, public inland lake protection and rehabilitation districts and qualified lake associations for recreational boating facility project. Past projects have included ramps and service docks to gain access to the water, feasibility studies, purchase of aquatic weed harvesting equipment, navigation aids and dredging waterway channels.	A five-member Waterways Commission, appointed by the governor, reviews and recommends projects for funding. Deadlines are established quarterly.	Focus on boating facilities	Riverfront development; could fund portion of trail if used to provide access to water resource
WDNR Sports Fishing Restoration (SFR)	These grants may be used to construct fishing piers and motorboat access projects. Eligible components include boat ramp construction and renovation, along with related amenities such as parking lots, accessible paths, lighting and restroom facilities. Funding for this program comes from federal excise taxes on fishing equipment and a portion of the federal gas tax.	Grant application materials may be submitted at any time. For consideration in the federal fiscal year that begins each October, applications must be received by the regional Grants specialist no later than December 1 of the previous year.	Focus on fishing access	Riverfront development, accessible trails
WDNR Knowles-Nelson Stewardship Program	Aids for the Acquisition and Development of Local Parks (ADLP) is a regional allocation program which provides up to 50 percent matching grants to local and county units of government and nonprofit conservation organizations (NCOs) to provide assistance for the acquisition and development of local and county parks. NCOs can use these funds for the acquisition of land or easements only. County and local governments may use ADLP funds for the purchase of land and easements and the development of outdoor recreation areas for nature-based outdoor recreation purposes.	Application deadline - May 1 of each year; $4.0 million distributed annually statewide	Projects submitted for grants under the Stewardship Program must be included in a locally-adopted park plan.	Jones/Ellen Kort/YMCA Ramp Site; Trail development

STATE				
INCENTIVE	**PROGRAM DESCRIPTION**	**AVAILABILITY**	**EFFECTIVENESS**	**RELEVANCE**
WDNR Knowles-Nelson Stewardship Program	Urban Green Space (UGS) is a Statewide program which provides up to 50 percent matching grants to local and county units of government and NCOs to acquire or protect scenic, ecological, or other natural features within or near urban areas and provide land for nature-based outdoor recreation, including noncommercial gardening. These funds can be used for the acquisition of land only.	[Application deadline - May 1 of each year; $4.0 million distributed annually statewide]	Projects submitted for grants under the Stewardship Program must be included in a locally-adopted park plan.	Jones/Ellen Kort/YMCA Ramp Site
WDNR Knowles-Nelson Stewardship Program	Urban Rivers (URGP) is a Statewide program which provides up to 50 percent matching grants to local and county units of government and NCOs to purchase land or easements, or to develop shoreline enhancements on or adjacent to rivers that flow through urban or urbanizing areas. This program is intended to preserve or restore urban rivers or riverfronts for the purpose of revitalization and nature- based outdoor recreation activities. NCOs can use these funds for the acquisition of land or easements only.	[Application deadline - May 1 of each year; $1.6 million distributed annually statewide]	Projects submitted for grants under the Stewardship Program must be included in a locally-adopted park plan.	Jones/Ellen Kort Peace Park
WDNR Knowles-Nelson Stewardship Program	The Land and Water Conservation Fund (LAWCON) program was established by the U.S. Congress in 1964 to provide funding for the acquisition of land for park or open space preservation purposes and the development of outdoor recreation facilities. In Wisconsin, LAWCON funds are administered by the DNR. Up to 50 percent of project costs are eligible for funding under this program. A portion of this amount is available to local and county units of government for the acquisition of land and the development of parks and trails. The “nature-based” restriction in the Stewardship Program does not apply to LAWCON funds.	[Application deadline - May 1 of each year; $1.6 million to the State of Wisconsin allocated by Congress, 2005]	Projects submitted for grants under the Stewardship Program must be included in a locally-adopted park plan.	Jones/Ellen Kort Peace Park

CITY				
INCENTIVE	**PROGRAM DESCRIPTION**	**AVAILABILITY**	**EFFECTIVENESS**	**RELEVANCE**
Tax Increment Financing (TIF)	Property taxes generated in a defined area on new development is used by City to pay for investments in improvements or entice new improvements, and therefore increase tax base. Incentive goes to private sector project expected to generated incremental property tax revenue.	TIF should be used wherever possible, particularly if building on an underutilized site with low value. Where a district does not exist now, a new TIF district should be explored as an option. The possibility of transferring funds from a district with positive increment to a downtown TIF should be explored.	Extremely effective when development occurs and generates positive increment.	Downtown redevelopment projects

OTHER				
INCENTIVE	**PROGRAM DESCRIPTION**	**AVAILABILITY**	**EFFECTIVENESS**	**RELEVANCE**
American Greenways Kodak Awards Program	Provides small grants ($500-$2,500) to local greenways projects.	National competition – single digit number of awards annually. Applications due between March 1 and June 1 yearly.	Highly competitive and relatively low dollar awards.	
American Hiking Society – National Trails Fund	Privately supported, national grants program dedicated to building and protecting hiking trails.	Only open to American Hiking Society members (must be a 501(c)(3) or have a fiscal agent. Grants available up to $5,000. Deadline is typically February annually.	Relatively low dollar amount. Projects must be completed in one year – multi-year projects only considered in exceptional circumstances.	
People for Bikes Community Grant Program	Funding for projects that leverage federal funding, including bike paths and rail trails, mountain bike trails, bike parks, BMX facilities, and large-scale bicycle advocacy initiatives.	Local governments and non-profits may apply with requests of up to $10,000. 2017 grant cycle will be posted and available in November of 2016.	National competition – relatively low dollar grants. Does not fund planning activities.	
International Mountain Biking Association (IMBA)	Funding for maintaining and improving the sustainability of local trails, preserve the environment and enhance conservation in the mountain biking community.	Deadline is typically late summer or fall annually. Open to 501(c)(3) organizations and chapter or supporting organization status with IMBA.		

OTHER				
INCENTIVE	**PROGRAM DESCRIPTION**	**AVAILABILITY**	**EFFECTIVENESS**	**RELEVANCE**
Fox Cities Greenways	Non-Profit dedicated to fostering preservation and development of greenways and trails in the Fox Cities.	Smaller grant amounts, no deadlines. Inquire with administrative assistant with specific request. annette4greenways@gmail.com	Matching funds	Trail development; corridor preservation
Fox Cities Convention and Visitors Bureau	Funding for projects which attract visitors to greater Fox Valley.	Inquire with Director for specific request. pseidl@foxcities.org	Matching funds	Trail development
Community Foundation of the Greater Fox Cities	Partnership grant up to $25K. The partners work together for shared outcomes. Traditionally one organization is the lead and takes responsibilities for the financial liabilities for the joint effort.	Call to discuss idea. Program in the process of being combined with other grant pools, may provide opportunity for larger funding amount. https://www.cffoxvalley.org/grants/environmental-sustainability-partnership-grants/	Matching funds, likely require non-profit partnership.	Trail development
WE Energies Foundation	Relevant focus areas include economic health and environment. Grantee must be a qualified charitable, not-for-profit 501(c)(3) tax exempt organization, per Internal Revenue Service Code guidelines	Applications are reviewed on a quarterly basis. Applications for the first quarter must be received by Jan. 31, second quarter by April 30, third quarter by July 31 and fourth quarter by Oct. 31. https://www.we-energies.com/foundation/faq.htm	Requires partnering with a non-profit. WE Energies trail	WE Energies trail
Outagamie County Greenways	Designed as a partnership grant opportunity for local units of government to further develop Outagamie County's greenway system, up to 25% of a greenway project's costs can be reimbursed as part of this program. For 2016, $25,000 in funding has been allocated for greenway projects.	Spring grant deadline (2016). Check website for next year's cycle. http://www.outagamie.org/index.aspx?page=1400	Matching funds.	Bike, pedestrian, and other networks (e.g. trails, paths, and lanes), and environmental corridors (e.g. wildlife, waterways or other natural corridors).

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TRAIL DESIGN BEST PRACTICES

CITY OF APPLETON, WISCONSIN

Trail Design Best Practices

Introduction

Trails are an important part of the non-motorized transportation network in Appleton. Trails provide both recreational opportunities, and low-stress off-street connections to local destinations. Trails appeal to a variety of users with a variety of skill levels and abilities, and residents are expressing a growing interest in trail expansion. To accommodate growing user demand and ensure that future trails are appropriately designed for all types of users, this document presents trail design best practices to be used as guidelines in conjunction with existing city design guidelines. This document is part of the Trails Master Plan for Appleton which provides a framework for future investments in multi-modal facilities, improved network connectivity, improved safety and accessibility for all trail users, and improved quality of non-motorized facilities to the benefit of Appleton visitors and residents.

Table of Contents

TRAIL USER NEEDS

Trails attract a variety of users with different needs and expectations. Important design characteristics for different users are width, surface material, sight distances, clearances, and trail amenities. The following section provides the framework for incorporating standards and guidelines for trail design and planning. Trail users include:

- **Pedestrians**—joggers, walkers, baby strollers, pet walkers, nature watchers
- **Bicyclists**—commuters, recreational riders, touring riders
- In-line **skaters** and skateboarders
- **Wheelchair users** and users of other mobility devices, such as Electronic Personal Mobility Devices (EPMD)

User Behavior

The flexibility of trails draws many different users, and accommodating a safe and predictable environment for all is an important issue in trail planning, design, and development. Within a given trail width, there will be different user types traveling at different speeds, potentially large groups traveling together, and/or high volumes of people. Trail users should recognize and anticipate other user behaviors unique to user type to avoid potential conflicts. The potential user-type behavior conflicts are indicated in the table below.

***Table 1** - User Type Potential Conflicts With Other Users*

PEDESTRIANS (includes any users on foot)
Multiple pedestrians may walk more than two abreast, making it difficult for other users to pass
Children may wander unpredictably on the trail
Pet owners may not exercise on-leash etiquette, and pets may wander unpredictably on the trail
May stop or turn suddenly, before other users can react
May not keep to the right, making it difficult for other users to pass
BICYCLISTS
Have tendency to startle other users if not using voice or bell when passing
May ride more than two abreast, making it difficult for other users to pass
May not obey posted speed limits
May frighten wildlife
SKATERS
Have tendency to startle other users if not using voice or bell when passing
May use a wider portion of the trail for sweep width, making it difficult for other users to pass
May frighten wildlife
WHEELCHAIR USERS
May not keep to the right, making it difficult for other users to pass

Trail user behavior can be managed through safety programs that provide the individual user with a **Code of Conduct** for the trail, sometimes called a **Trail Ordinance**. Several communities across the U.S. have adopted progressive trail ordinances for public use. Other factors which lead to user conflicts, including the design and engineering of a trail, are discussed further in following sections of this document.

Design Needs of Pedestrians

Aside from space requirements related to pedestrian-specific activities such as pet walking or running, pedestrians have a wide variety of physical characteristics determining user needs and abilities. Age is one major factor that affects pedestrians' walking speed and environmental perception. Children have low eye height and walk at slower speeds than adults. They also perceive the environment differently at various stages of cognitive development. Older adults walk more slowly and may require assisting devices for walking stability, sight, and hearing. The table below summarizes common pedestrian characteristics for various age groups. As a rule of thumb, the MUTCD recommends a normal walking speed of three and a half feet per second for calculating the time needed for pedestrian crossings at traffic signals. Average walking speed is lowered to three feet per second in areas with older populations and persons with mobility impairments. While the type and degree of mobility impairment varies greatly across the population, the trail system should accommodate these users to the greatest reasonable extent at trail intersections, sharp turns, overpasses, and underpasses.

***Table 2** - Pedestrian Characteristics by Age*

AGE	CHARACTERISTICS
0-4	Learning to walk Require constant adult supervision Developing peripheral vision and depth perception
5-8	Increasing independence, but still require supervision Poor depth perception
9-13	Susceptible to "dart out" or intersection dash Poor judgment Sense of invulnerability
14-18	Improved awareness of traffic environment Poor judgment
19-40	Active, fully aware of traffic environment
41-65	Slowing of reflexes
65+	Difficulty crossing street in time Vision loss Difficulty hearing vehicles approach from behind

Design Needs of Dog Walkers

Dog walking is a common, anticipated use on trails. Dog sizes vary largely, as does leash length and walking style, leading to wide variation in possible design dimensions. Trails designed to accommodate wheelchair users are likely to provide the necessary dimensions for the average dog walker. Amenities such as dog waste stations at trailheads enhance conditions for dog walkers.

Design Needs of Joggers and Runners

Running is an important recreation and fitness activity commonly performed on trails. Many runners prefer softer surfaces (such as rubber, bare earth, or crushed rock) to reduce impact. Among hardened surfaces, asphalt is preferred over concrete because it is more forgiving on joints. Runners can change their speed and direction frequently. Typical running speed is 6.2 miles per hour (mph).

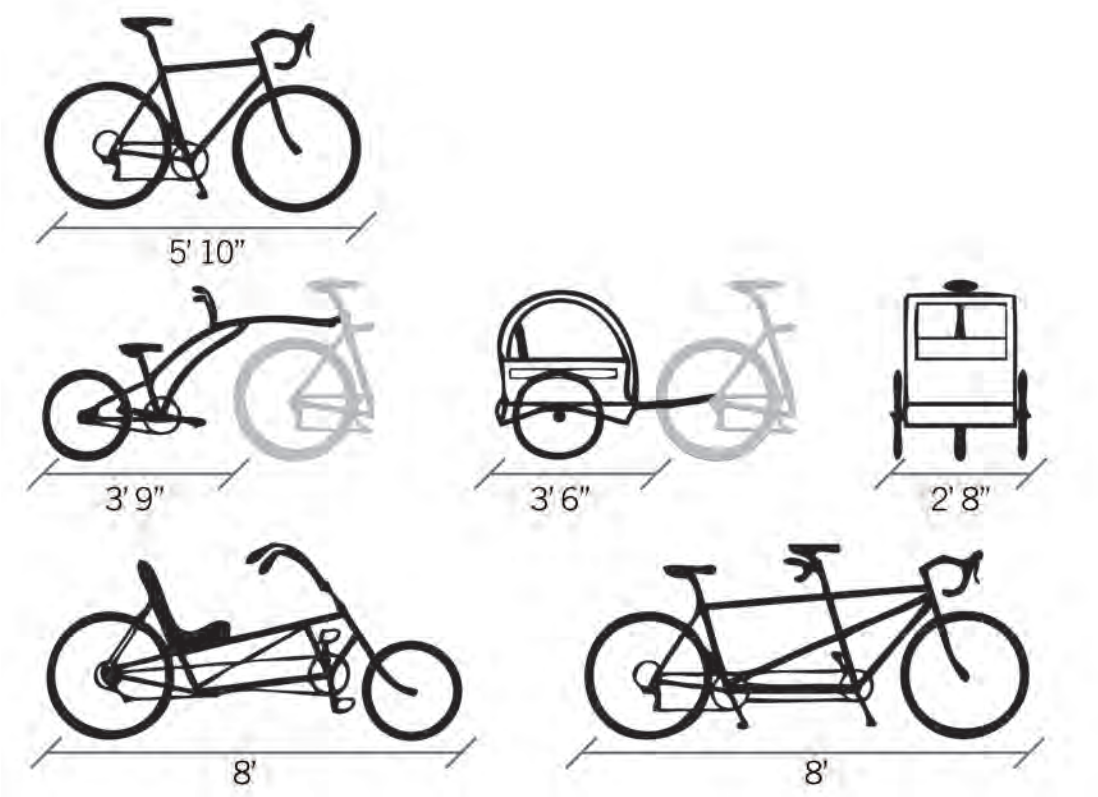
Design Needs of Strollers

Strollers are wheeled devices pushed by pedestrians to transport babies or small children. Stroller models vary greatly in their design and capacity. Some strollers are designed to accommodate a single child; others can carry three or more. Design needs of strollers depend on the wheel size, geometry, and ability of the adult who is pushing the stroller. Strollers commonly have small pivoting front wheels for easy maneuverability, but these wheels may limit their use on unpaved surfaces or rough pavement. Curb ramps are valuable to these users. Lateral overturning is one main safety concern for stroller users.

Design Needs of Bicyclists

Bicyclists and their bicycles exist in a variety of sizes and configurations. These variations occur in the types of vehicle (such as a conventional bicycle, a recumbent bicycle, or a tricycle) and behavioral characteristics (such as the comfort level of the bicyclist). The design of a trail should consider expected bicycle types on the facility and utilize the appropriate dimensions.
The figure below illustrates the varying dimensions of bicycles. Bicyclists require clear, open space with no visual obstructions to operate within a facility. The minimum operating width is greater than the physical dimensions of the bicyclist to allow the bicyclists shy distance from vertical obstacles and to allow maneuvering space around uneven pavement or other obstructions. Bicyclists prefer five feet or more operating width, although four feet may be minimally acceptable. Bicyclist speeds range from 8-15 mph on a paved level surface. Uphill speeds range from 5-12 mph, and downhill bicyclist speeds can reach 20-30 mph. A design speed of 10 mph is used for bicycle signage and crossings.

Figure 1 *- Typical Bicycle Dimensions Source: AASHTO 3.2*



Design Needs of Skaters

In-line skates are commonly used for recreational and transportation purposes. They typically have three to five wheels of three to four inches diameter, aligned in a straight line. Operational characteristics vary by skill level. Novice skaters travel more slowly and have a narrower sweep width from advanced skaters. Novice users may also have trouble making sharp turns and stopping quickly, particularly on steep grades. In-line skates are nearly impossible to use on unpaved surfaces and can be uncomfortable and difficult to operate on rough pavements, such as asphalt with large aggregate. In-line skaters have a typical speed of 10 mph.

Design Needs of Wheelchair Users

As the population ages, the number of people using mobility assistance devices increases. Manual wheelchairs are self-propelled by the user's hands and arms by pushing rims attached to the wheels. Braking is done through resisting wheel movement with the hands or arm. Alternatively, a second individual can control the wheelchair using handles attached to the back of the chair. Typical speed for manual wheelchair users is 3.6 mph. Power wheelchairs use a battery powered motor to move. The size and weight of power wheelchairs limit their ability to negotiate obstacles without a ramp. Various control units are available that enable users to control the wheelchair movement, based on user ability (e.g., joystick control, breath controlled). Typical speed for power wheelchair users is 6.8 mph. Maneuvering around turns requires additional space for both types of wheelchair devices. Providing adequate space for 180° turns at appropriate locations is an important element for accessible design.

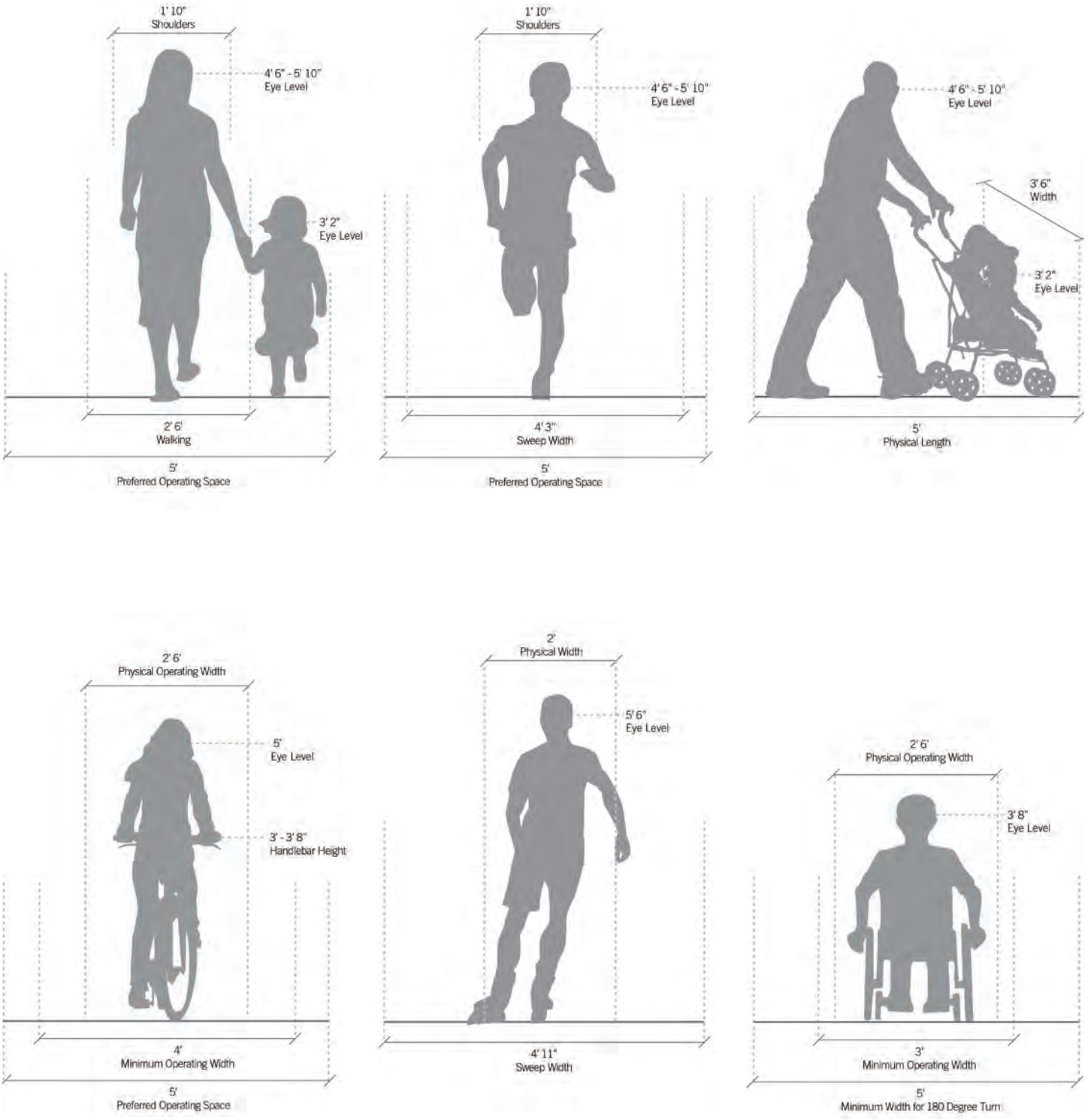
Winter Design Needs

Trails can also be used for winter recreational activities such as snowshoeing, nordic skiing, or riding fat bikes. Trails used for these activities should only be on trails or segments of trails that do not serve as key bicycle and pedestrian connections that would require snow removal. For more information, see Winter Maintenance pg 60.

Trail User Dimensions

The figure to the right illustrates the spatial needs of the trail user groups discussed. Note that the preferred operating width for all user types is approximately five feet.

Figure 2 *- Trail User Dimensions*



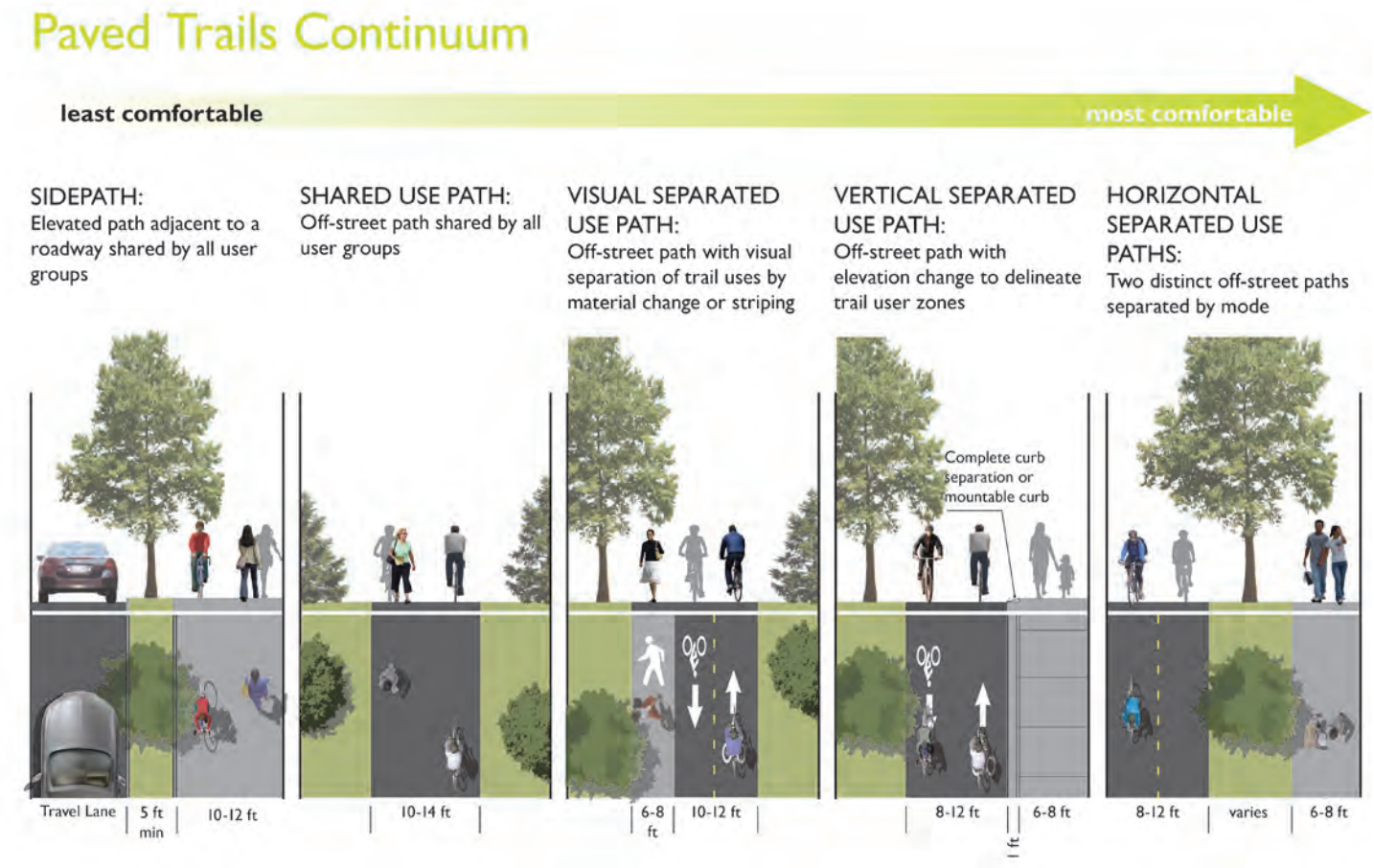
FACILITY SELECTION

Trails can vary in width, material, and degrees of user separation. Trail types are selected based on available width, anticipated user types, and user volumes. This section outlines the following trail typologies:

- **Sidepaths**—designated non-motorized facility adjacent to a roadway
- **Shared Use Paths**—off-street facility for use of all non-motorized user groups
- **Separated Use Paths**—parallel off-street facilities separated by mode, typically pedestrians and slower moving users on one path and faster moving users such as bicycles and skaters on an adjacent path
- **Soft-Surface Trails**—narrow dirt or compact gravel paths for use by runners, equestrians, or mountain bikes either adjacent to a paved trail or in parks or other natural areas

Paved Trails Continuum

For trails with anticipated use from multiple user groups, including bicyclists or other wheeled users that prefer a paved surface, there is a spectrum of trail widths from minimal comfort to complete mode separation. Moreover, there are different means of separating user groups. Figure below illustrates the spectrum of trail facilities.



Sidepath

As defined by AASHTO, a sidepath is a shared use path located immediately adjacent and parallel to a roadway. Sidepaths are for two-way movement by bicycles, pedestrians and other non-motorized users. Sidewalks are not considered sidepaths as they are not conducive to riding a bicycle and can lead to user conflicts (AASHTO, Section 3.4.2). Sidepaths are appropriate adjacent to roadways with high speed or high volumes of motor vehicles that would discourage bicyclists from using the roadway, and there are no practical alternatives to improving the roadway or redirecting cyclists to alternate routes. Sidepaths may also be used to supplement on-street bikeways. However where sidepaths are placed adjacent to roadways without on-street bike facilities, some cyclists may still opt for the roadway as a more direct route, and may suffer driver harassment. Moreover, drivers may not anticipate bicycles on the sidepath and there are potential conflict points at driveways and intersections (AASHTO, Section 5.2.2). Thus, if possible, shared use paths should be designed on a corridor distinct from the roadway, as described in the shared use path section below.

Sidepaths must have a minimum of five feet of distance between the path and the roadway. If this setback distance is not available, there must be a barrier or railing to protect the path from vehicles and to discourage path users from crossing the roadway other than designated locations (AASHTO, Section 5.2.2). Sidepaths are eight to fourteen feet wide, and accommodate low volumes of users as described in the shared use path section below.

Shared Use Path

A shared use path is an off-street dedicated facility for two-way bicycle traffic and other non-motorized users such as pedestrians, skaters, wheelchair users, and joggers. Shared use paths are a 10 to 12 feet wide single surface capable of accommodating low to moderate volumes of users. 12 feet is preferred to enable a cyclist to pass another path user going the same direction, while another path user is approaching from the opposite direction. AASHTO defines 10 feet as the minimum paved dimension for two way travel. An absolute minimum width of eight feet which should only be considered in constrained conditions for short distances (Section 5.2.1). At low volumes shared use paths are functional, pleasant, and adequate for use by users of all ages and abilities. Preferred volumes for shared use paths:

» Volumes less than 30 pphpf* (CROW, p.136)

pedestrians per hour per foot of path width

Visual Separated Use Path

Separated use paths are multi-use paths with delineated space to separate travel modes and sometimes directions. Separation generally separates fast user types (bicyclists, roller-bladers, skate boarders) from slow user types (pedestrians, or small children on bicycles). Separation may be visual, such as a four inch painted line and pavement markings, or a material change. Commonly, concrete is used for pedestrian tread area, and dark asphalt is used for bicycle tread area. Signs can also supplement pedestrian and bicycle zones. Visual separation of paths is appropriate for paths with limited widths and lower volumes. Preferred minimum width for separated use is 15 feet: a 10 foot bicycle path and five foot pedestrian path (AASHTO, Section 5.2.1).

» Volumes of 30 - 48 pphpf (CROW, p.136)

Vertical Separated Use Path

Another type of trail user separation is an elevation change, where pedestrians are at a higher elevation than cyclists. The elevation is generally achieved by a mountable or rolled curb so that users can briefly move onto the adjacent path for a passing or evasive maneuver if necessary. A minor grade separation of a three inch curb offers positive guidance for user positioning without interfering with pedals (NACTO, 2012). This type of separation is appropriate for slightly higher user volumes.

» Volumes of 48-60 pphpf (CROW, p.136)

Horizontal Separated Use Path

Finally, trail user groups can be on completely distinct paths so there is no point of conflict. This is necessary for trails of very high user volumes. However, these trails will often need to converge to one trail at intersections and driveway crossings for limited conflict points with motor vehicles. Paths can be divided by a narrow dividing strip of gravel, cobblestones, grass, or pavers. With four feet or greater space for user separation, this area may be used for path furnishings such as lighting, shrubs, or small trees. These vertical elements further enforce user separation. Trail direction can also be separated into separate paths. If bicycle treads are physically separated by direction, each path should be five feet minimum width with a preferred minimum is seven feet to allow for passing (NACTO, 2012).

» Volumes greater than 60 pphpf (CROW, p.136)

Soft Surface Trails

Soft surface trails are usually adjacent to paved trails, or travel through parks or other natural areas. Trail width will vary depending on the existing topographic and environmental conditions, but are typically three to eight feet wide with no required shoulder. Trail surface can be made of dirt, rock, soil, forest litter, or other native materials. Some trails use crushed stone (aka “crush and run”) that contains about 4% fines by weight, and compacts with use. Soft surface trails may be preferred by runners and mountain bikers, but are not preferred by road bikers or in-line skaters. There are also slope and surface material considerations for ADA accessible trails. See Accessible Trail Design on page 22 for further discussion.

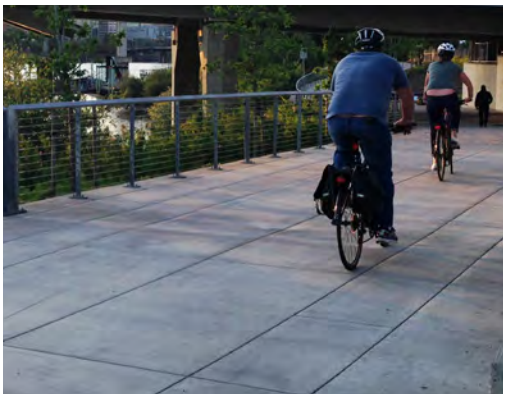
FACILITY DESIGN

Paved trails have basic parameters of best practice design discussed the following sections:

- **Materials**—paving types
- **Standards**—slopes, clearances, ADA and CPTED
- **Pavement Markings**—centerlines and edge lines
- **Edge Conditions**—defining the trail edge
- **Drainage**-ensuring proper water flow and erosion control

Trail Surface

When determining surface type for paved trails, consider topography, surrounding landscape, underlying soils, and user needs. All surfaces have advantages and disadvantages, and each must be analyzed to determine which surface is appropriate in any given location. American Disabilities Act Accessibility Guidelines (ADAAG) compliant trails require firm, stable, slip resistant surfaces, which in most instances is a paved surface for access and ease of use. In some cases, packed gravel fines can be used, where there is little to no topography. However, packed surfaces require much more maintenance effort and cost over time, and may not be desirable in the long term.



Paved Surface Materials

For paved trails, a proper foundation will increase the longevity of the trail surface. Two inches of surfacing material over six inches of base course gravel over geotextile fabric is recommended for construction.

Asphalt is a common surface for trails, offering substantial durability for the cost of installation and maintenance. Asphalt is popular with users for its smooth, continuous surface and has the benefit of lower cost, but requires more upkeep than concrete. As a flexible pavement, asphalt can also be considered for installing a paved trail on grades steeper than 3%. If constructed properly on suitable sub-grade, asphalt has a life span of about half that of concrete, or 10 to 15 years.

Concrete can last twenty five years or more when properly constructed and maintained on a regular basis,. The high cost of concrete is often the most limiting factor since it is one of the most expensive surfaces to install. It is recommended that concrete be used for its superior durability and lower maintenance requirements in areas prone to frequent flooding, and for intensive urban applications. To prevent expansion joints from jarring cyclists or in line skaters, saw cut concrete joints rather than troweled improve user experience.

Permeable paving is twice the cost of asphalt to install and is only recommended in very special trail applications. Permeable paving should only be used areas with proper drainage, and is not suitable in floodplain or areas with ponding or sedimentation. Permeable paving also requires a maintenance schedule for vacuuming debris after storm events to retain permeability.

Width

Eight feet is the absolute minimum width allowed for a shared use trail and is only recommended in constrained conditions for short distances. The AASHTO defined minimum width for a two-way trail is 10 feet. However, 12 feet (and in very heavy trail use, fourteen feet or more) is recommended for trails with moderate to high concentrations of users and/or variety of users. A separate soft surface track (five feet minimum) can be provided adjacent to a paved shared use path for pedestrian use where right-of-way permits.

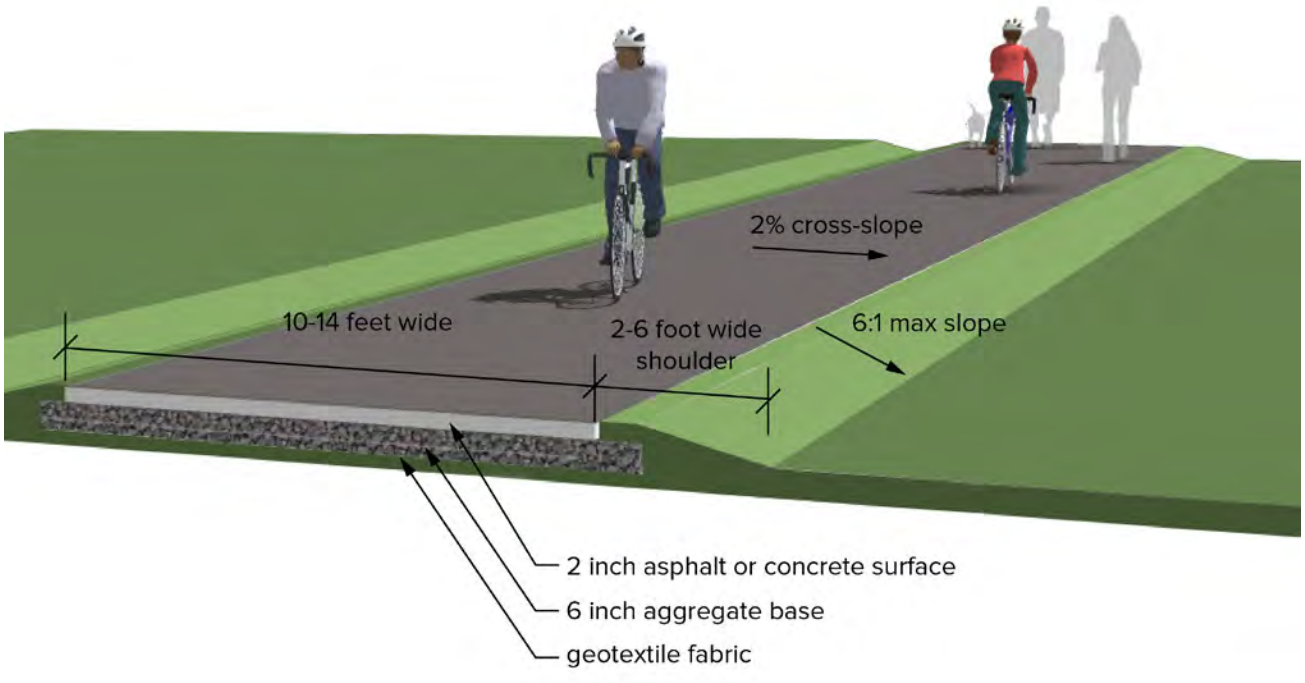
Clearances

A two foot minimum graded shoulder should be provided on both sides of the trail for clearance from lateral obstacles such as signs, vegetation, or bridge abutments. Ideally, shoulders are three to five feet wide with a maximum cross slope of 1V:6H (AASHTO, Section 5.2.1).

Clearance to overhead obstructions should be 10 feet, and an absolute minimum of eight feet only in constrained conditions. Note that higher clearances may be necessary for maintenance or emergency vehicle access.

Cross-Slope

Trails should provide a 2% cross slope from crown of trail in both directions to provide positive drainage off the trail as conditions allow. The cross slope should be no greater than 5% for accessibility requirements.



Accessible Trail Design

The United States Access Board ADA accessibility guidelines apply to trails and outdoor recreational access routes. In addition to the surface and cross-slope requirements described prior, accessible trails require the following:

Clear tread width: three feet minimum for low-volume, pedestrian-only facilities; 10 feet minimum for multi-use facilities. Where trail width is less than 60 inches, passing space must provided at least every 1,000 feet.

Low longitudinal slope: 5% or less. Steeper slopes may be used if resting intervals of no less than five feet long and equal to the width of the trail are provided at the bottom and the top of the slope in the intervals listed below. No more than a third of the total trail length may exceed a running slope of 8.33%.

» Up to 8.33% for a maximum of 200 longitudinal feet

» Up to 10% for a maximum of 30 longitudinal feet

» Up to 12.5% for a maximum of 10 longitudinal feet

Consistent smooth surface: 0.5 inches is the maximum vertical discontinuity, and any disruption greater than 0.25 inches high shall be beveled to avoid trip hazards

Detectable pavement changes: provided at curb ramps, before entering roadways, and at rail crossings

Crime Prevention Through Environmental Design (CPTED) Principles for Trails

Personal safety, both real and perceived, heavily influences a trail user's decision to use a facility and a community's decision to embrace the trail system. CPTED is a proactive approach of using design principles to deter undesired behavior.

» Principle #1: Natural Surveillance

» Principle #2: Natural Access Control

» Principle #3: Territorial Reinforcement

» Principle #4: Maintenance

These principles can be applied to trail facility design, management features, and trail amenities:

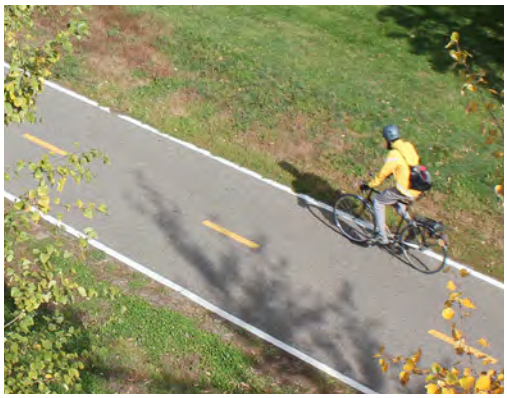
Sight lines: Where possible, trails should be located near buildings with windows facing the trail, or adjoining properties with open views to the trail. Convex mirrors should be provided at blind corners and at the approaches to underpasses with poor sight lines.

Fencing: Where feasible, fencing installed along trails should not obstruct the view of trail users. Permeable fencing of four feet tall or less can provide a barrier sufficient to denote property boundaries or deter access. Opaque fencing or walls can degrade the experience of trail users, obscure views, and create a "tunnel" effect that can cause users to feel "trapped." Where the trail is fenced for long stretches, intermittent openings should be located to allow users to enter and exit the trail. Access points to the trail should be at locations with good visibility from the surrounding neighbors.

Vegetation: All ground cover and shrubs along trails should be trimmed to a maximum height of three feet above ground level. Trees should be limbed-up to provide 10 feet of vertical clearance over the trail within the trail corridor. Tree canopies should not obstruct pathway illumination. Hostile native landscaping material (e.g. vegetation with thorns) can be used in strategic areas to discourage unauthorized use and eliminate entrapment areas.

Lighting: Light quality is as important as the quantity. Poor lighting, whether too bright or not bright enough, can diminish safety. Where lighting is installed on trails, the illumination should be adequate to identify a face up to 20 yards away. The lighting should provide uniform coverage and good color rendition. The use of metal halide or light emitting diode (LED) lamps are recommended, as they provide excellent color rendition. Color rendition is especially important when describing identifying features such as hair, clothing, and vehicle color.

Maintenance: Signage should be placed at trailheads indicating a contact number to report graffiti, suspicious behavior, and maintenance issues. Add anti-graffiti application to retaining walls or other blank surfaces where appropriate. A maintenance schedule should be established to regularly monitor trail conditions.



Striping and Pavement Markings

Striping and pavement markings are particularly beneficial in areas of limited sight distance, high traffic areas, intersection approaches, and in areas where night time use is anticipated. All markings should be non-slip or non skid material, and shall be retroreflective per the MUTCD. High visibility thermoplastic is the most durable and visible material for trail applications.

Under most conditions, trail centerline markings are not necessary. However, per AASHTO guidelines, "on pathways with heavy peak hour and/or seasonal volumes, or other operational challenges such as sight distance constraints, the use of a centerline stripe on the path can help clarify the direction of travel and organize pathway traffic." (5.2.1) Centerlines can also reinforce trail user etiquette to travel on the right and pass on the left. A four to six inch dashed yellow centerline stripe should be used where passing is allowed, and a solid stripe should be used where passing is discouraged. Solid centerlines should be provided on tight or blind corners and on the approaches to roadway crossings.

Four inch solid white edgeline striping should be provided on trails with anticipated nighttime use. White edge lines can also be used on intersection approaches to highlight changing trail conditions, or to delineate a separation of path users (AASHTO, 5.4.1).

Pavement markings are commonly used to reinforce signs along a trail, such as separation of bicycles and pedestrians. However, pavement markings should not be used to replace signs altogether. Instead, pavement markings should be used to call additional attention to a possible problem area, such as trail access points, roadway intersections or bridges, or converging trails. Possible pavement markings for trails include the pedestrian and bicycle symbols, yield lines, stop bars, and the word markings “Stop,” “Yield,” and “Slow.” Due to slower travel speeds, word pavement markings should not be elongated, should read in conventional order, and should be scaled minimally as to not overwhelm the pathway.

Trail Edge Definition

Vegetation, topography, ditches, fencing, railings, or walls may be used to clearly mark trail edges beyond the shoulder. These features can serve multiple purposes, including:

- Providing visual separation/privacy screens
- Delineating public space from private property
- Discouraging the development of unauthorized foot trails
- Separating users from hazardous drop-offs or adjacent non-compatible land use

Wildlife passage and safety for trail users are important factors in determining appropriate trail edge treatments. If separation is desired purely for privacy reasons, native vegetation buffers or the use of topography are recommended where possible. For separation to preventing trespassing or guard against hazardous slopes, consider the use of topography, ditches, semi-transparent fencing or railings, and hostile vegetation.

Drainage and Erosion Control

Drainage and erosion control are necessary to ensure a stable and low maintenance facility. Excessive soil erosion near a trail is usually the result of water collecting and flowing along the trail edge or onto the surface with enough volume and velocity to carry away soil. This impacts trail width, trail surface quality, and degrades adjacent habitat or downstream water resources. Designing the trail to follow natural land contours and planting low ground cover vegetation up to the edge of the trail help prevent and reduce erosion problems. Proper drainage for a trail can be ensured with a 2% cross slope for both the paved tread and trail shoulders. A maximum 1:6 slope is allowable for shoulders, but 2% is preferred. When managing storm water along all trails, use dispersed infiltration systems such as vegetated swales or over engineered storm water control structures such as storm drains and catch basins for reduced maintenance and improved aesthetic. For sections of trail where uphill water is collected in a ditch and directed to a catch basin, water should be directed under the trail in a drainage pipe of suitable dimensions.

Vegetative Screening

The presence or absence of vegetation and the type of vegetation present in a trail corridor impacts habitat quality, ecological sustainability, and the aesthetic experience for the trail user. Trees and shrubs on trails can serve as habitat for wildlife, stabilize erodible soils, and shelter trail users shade from the sun and rain. Vegetation is also an effective means of establishing trail boundaries while maintaining visual permeability. Strategic placement of bushes and plantings can deter users from using unauthorized foot trails, access points, or exits. When using vegetative screening, ground cover and shrub height should be a maximum of two feet above ground level to maintain an open line of sight on the trail. Similarly, trees should be trimmed to provide a minimum of eight feet of vertical clearance for trail circulation and to avoid obstructing trail lighting.

In locations where trees and shrubs are lacking and can be planted, native species are the most ecologically sustainable choice. As a group, native species require less maintenance than horticultural plantings and often provide wildlife with a food source. Topography and soil moisture regime largely determine where different plant species occur. Competing invasive vegetation should be removed regularly and replaced with mulch to conserve water. Trail vegetation should be selected and placed to provide seasonal comfort: shade in the warmer months and sunlight in colder months. Seeds and plants should be placed either right before or during the rainy season to take advantage of seasonal rainfall (spring and fall). Note that larger plants require more water to survive than seeds and smaller plants. Fertilizing native plants is only necessary in extreme cases when the condition of the soil is in need of repair.

Railings and Fences

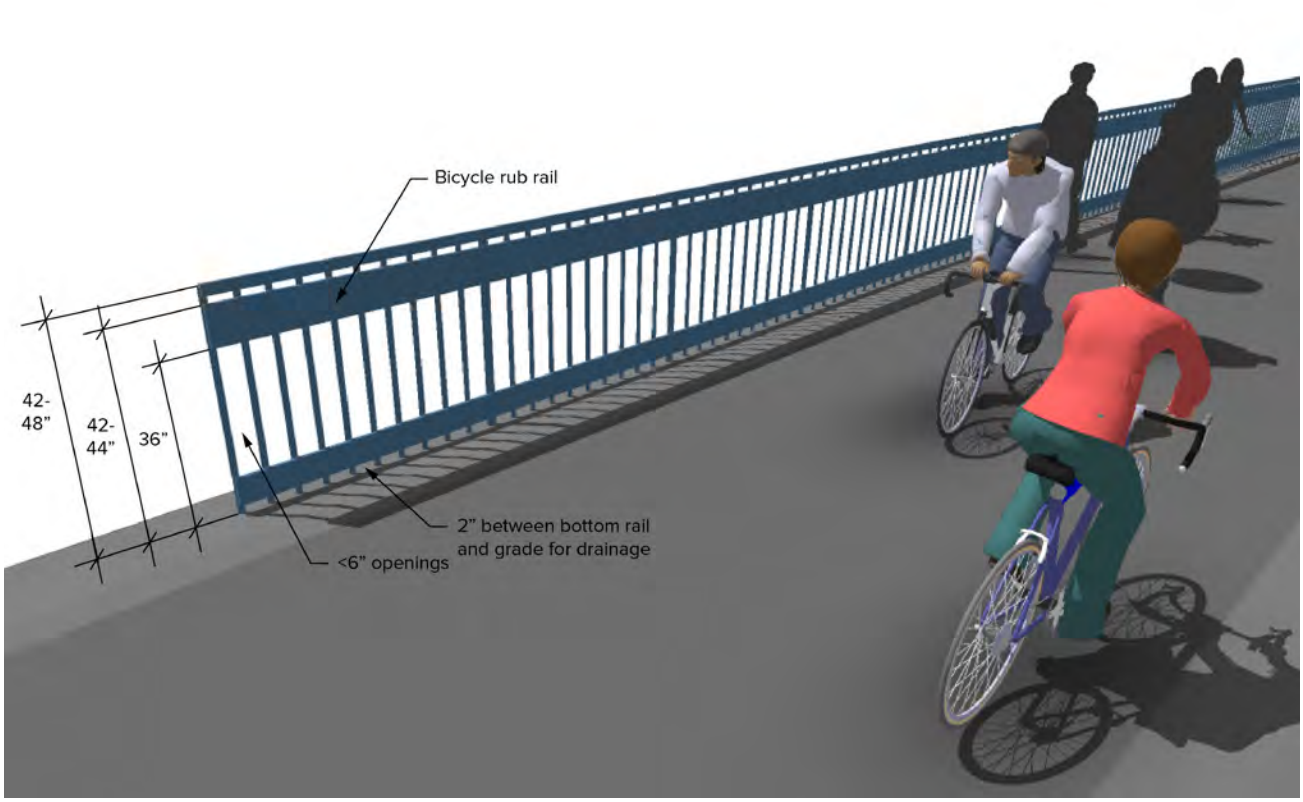
Railing and fences are important features on bridges, some boardwalks, or in areas where there may be a hazardous drop-off or incompatible adjacent land uses. By AASHTO standards, where there is a side slope or considerable vertical drop within six feet of the edge of the trail, a 42 inch safety rail is required:

» Slope is greater than or equal to 3:1 and drop of six feet

» Slope is greater than or equal to 2:1 and drop of four feet

» Slope is greater than or equal to 1:1 and drop of one foot

Railings may need to be as tall as 48 inches where more hazardous conditions exist, such as a bridge over a highway. At a minimum, railings and fences should consist of a horizontal top, bottom, and middle rail. The middle railing functions as a 'rub rail' to reduce the risk of bicycle handlebars getting caught by a railing. Middle rails should be located 36 inches to 44 inches above the finished grade. The bottom rail should be two inches above finished grade to allow for drainage. Openings between horizontal or vertical members on railings should be small enough that a six inch sphere cannot pass through in the lower 27 inches. This is to prevent children from falling through the railing openings. For the portion of railing higher than 27 inches, openings may be spaced such that an eight inch sphere cannot pass through. Local, state, and/or federal regulations and building codes should be consulted to determine when it is appropriate to install a railing and comply with current standards.



CORRIDORS

Ideal locations for trails are often found along existing corridors used for natural areas, utilities, or railroads. Each of these corridors presents additional design considerations for trails:

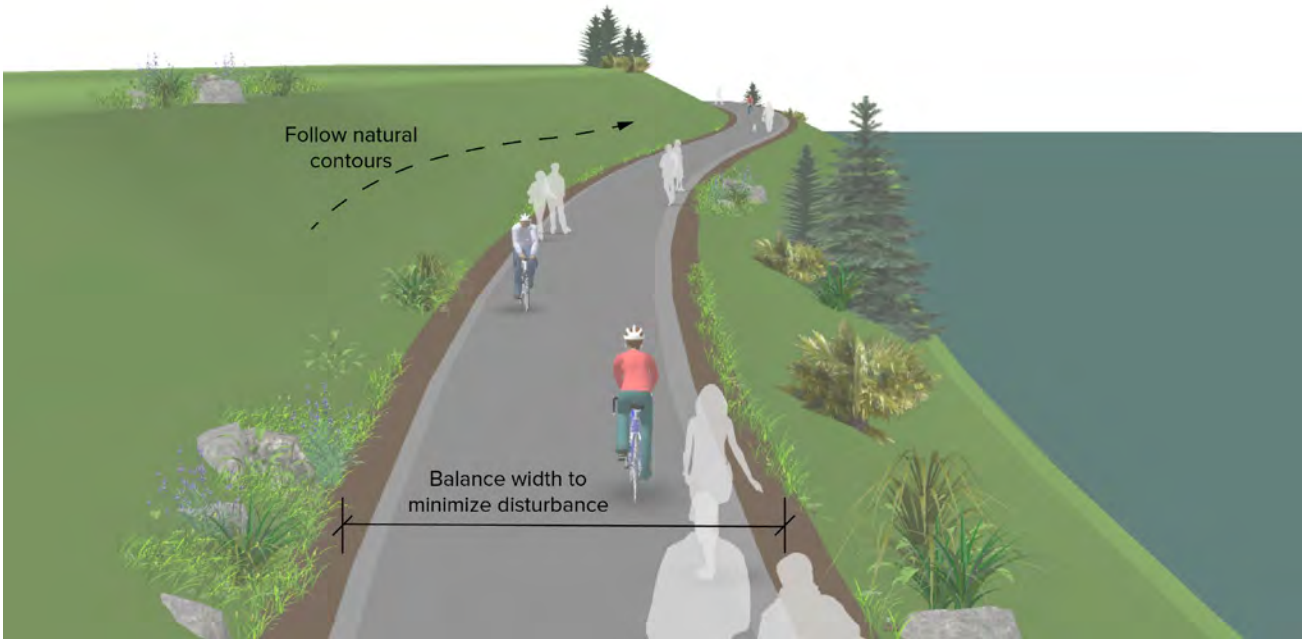
- **Riparian**—preservation of wildlife and natural habitat
- **Utility**—adequate clearances to equipment
- **Rail**—safety considerations adjacent to active rail lines

Riparian Corridors

Riparian corridors often offer substantial recreational and open space preservation opportunities. These corridors include rivers and streams, drainage facilities, and wetlands (where environmentally feasible). All trails constructed within riparian corridors should be studied for storm water impacts, wildlife habitat impacts, and floodplain development impacts. All trails within floodplain areas will require adequate environmental permits from local floodplain administrators. Local requirements for storm water and watershed buffers should be consulted to determine acceptable uses and buffer widths.

Trail Location: Trails in riparian corridors should follow the contours and avoid fall lines, which are prone to erosion and generally cannot be maintained over time. Existing native vegetation should be preserved to the extent possible to limit soil erosion and ecological impacts. Trails should be constructed at the maximum practical distance from streams, and locations immediately adjacent to or abutting stream banks should be avoided. Trails constructed near streams should include restoration projects where feasible. Restoration projects commonly involve reshaping of the floodplain to reduce bank angles and heights to allow the stream to access its floodplain. Trail locations in wetlands should be avoided. If wetlands must be crossed, choose the narrowest crossing point and use low impact elevated tread structures for trail construction, such as boardwalks and bridges to preserve these fragile ecosystems.

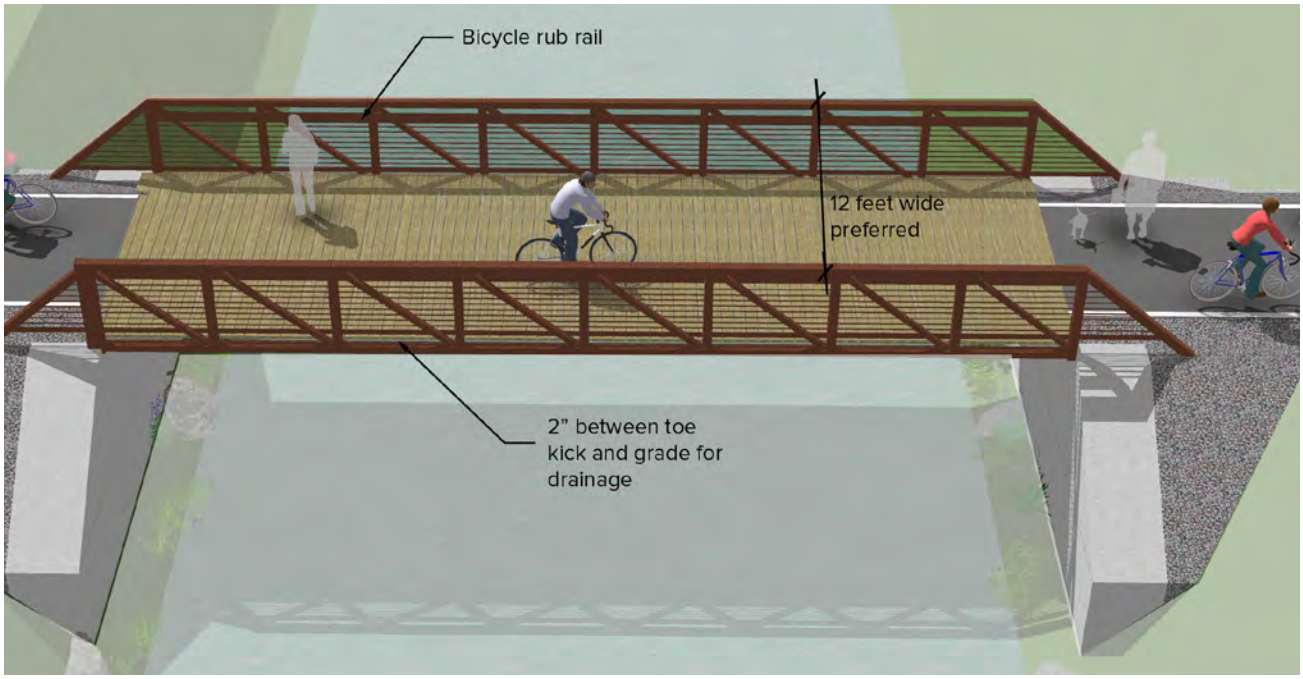
Surface Materials: Other than wetland areas, concrete is the recommended surface treatment for trails prone to flooding due to its superior durability and lower maintenance requirements. Permeable paving is not recommended in floodplain areas or areas without proper drainage. Sheet flow and sediment transport clog permeable pavement pores and will require vacuuming after all storm events. Gravel or crushed stone fines should not be used in riparian areas prone to flooding as these materials have very low cohesiveness and erode easily, contributing to increased sediment in streams.



Boardwalks and Bridges: Where trails cross over sensitive natural or inundated areas such as small creeks and wetlands, boardwalks and bridges should be used to limit the potential for environmental impact. Note that local, state, and federal permits will be likely be required for any construction in wetlands. Consult a structural engineer for member sizing and post footing design of these structures. Common boardwalk foundations consists of marine-grade timber posts or auger piers (screw anchors) which provide greater support and durability. The evaluation of boardwalk footings should include uplift as well as loading consideration for flood events.

Boardwalks range in length and can span as little as 10 feet or stretch for longer distances depending on site conditions. Boardwalk clear span width should be a minimum of 10 feet when no rail is used. 12 feet is preferred in areas with higher anticipated use and whenever railings are used. Bridges are used where greater span lengths are required and when the objective is to reduce base flood elevations. Boardwalks are usually constructed of timber, concrete, or recycled plastic decking. Recycled systems such as Trex® are popular for their material durability, however they have structural limitations. Modular concrete boardwalk systems are gaining popularity due to their low-impact installation methods and durability within wet areas. Permatrak™ is a system being used in some communities in the state and by the National Park Service. In choosing boardwalk material, careful consideration should be given to minimize slippery decking surfaces following storm events. A topcoat of non-skid paint, sandy compounds, or a light asphalt overlay can be effective on timber decking. Concrete is the most reliable non-skid surface.

On boardwalks, typically a six inch curb rail is recommended. However, a 42 inch guardrail is required at locations where there is a 30 inch or greater difference in the low water bridge elevation and the ground elevation below. Railings will also be required for bridges. Refer to the previous section for best practice design for fences and railings.

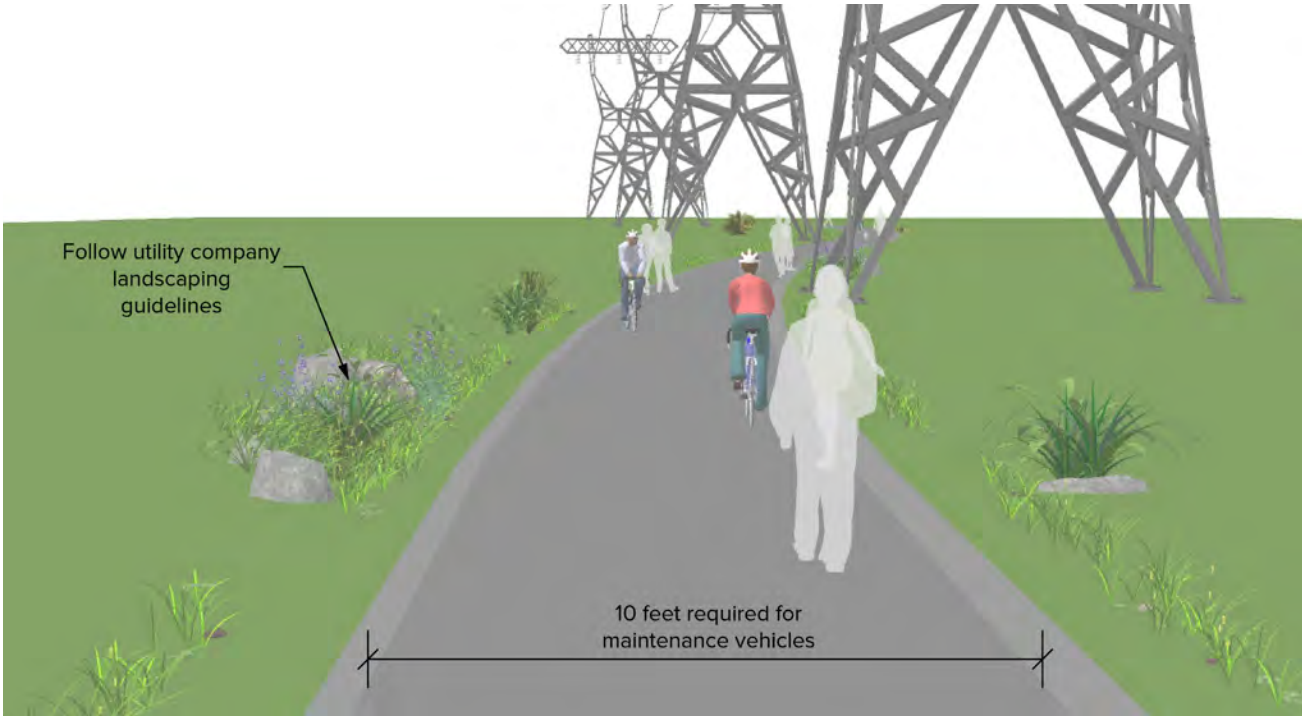


Utility Corridors

Underground and above-ground utility corridors can potentially accommodate trails. Utility companies benefit from this arrangement by having an easily accessible route to their utility service. Review each utility's policy and construction specifications for repair, access, and corridor maintenance requirements. The trail may need to be closed at certain times when utility repairs are necessary. Note that utility companies will likely require specific design guidelines, may determine trail routing and alignment, and may impose landscaping limitations. All trails in utility corridors require acquisition of an easement from the current title owner of the land.

Trail width: 10 feet of width is required for maintenance vehicle access. In sewer easements, the edge of trail should be at least 10 feet from manhole rims. For electrical utility corridors, a minimum separation of 25 feet is required between the trail and any associated electrical equipment (such as guy wires, power poles, and towers).

Trail amenities: Structures, which include signage, lighting, and benches, are typically restricted within utility easements. Review each utility's policy.

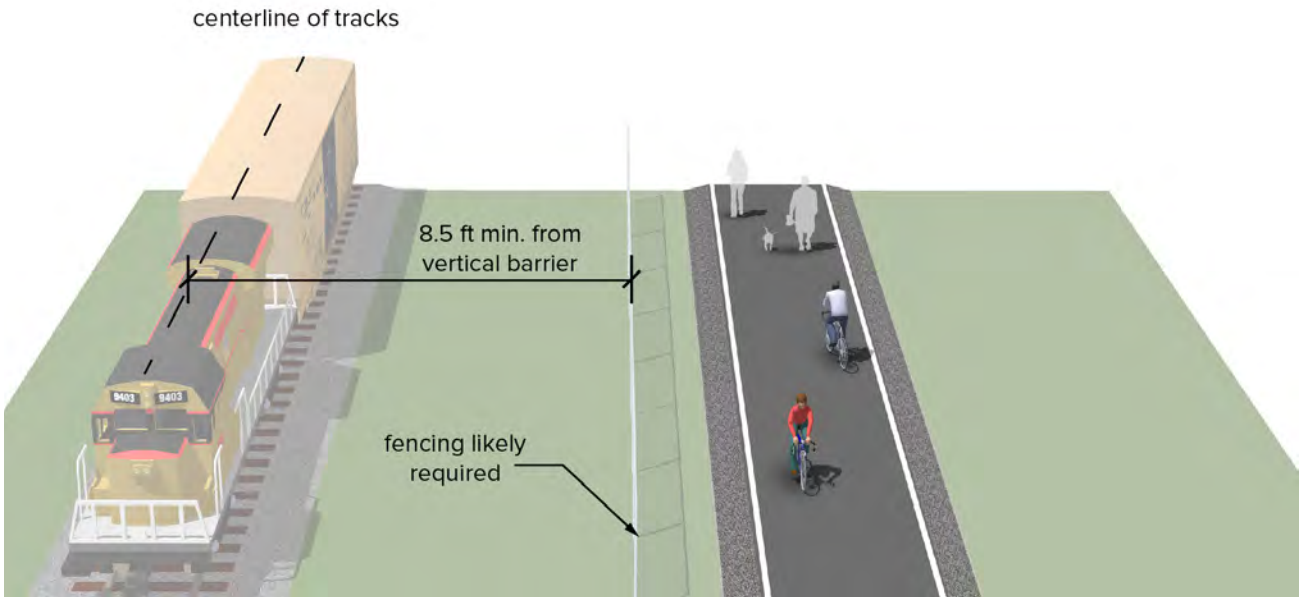


Active Rail Corridors

Rails-with-trails are multi-use paths adjacent to active railroads. It should be noted that several constraints can impact the feasibility of rail-with-trail projects. In some cases, corridor space needs to be preserved for future planned freight, transit or commuter rail service. In other cases, limited right-of-way width, inadequate setbacks, concerns about safety/trespassing, and numerous crossings may affect a project's feasibility.

Fencing: Railroads may require fencing with rail-with-trail projects due to concerns with trespassing and security. Requirements can vary based on the volume and speed of train traffic on the adjacent rail line and the setting of the shared use path, i.e. whether the section of track is in an urban or rural setting. If required, fencing should be a minimum of five feet in height with higher fencing than usual next to sensitive areas such as switching yards.

Setback: Trail setbacks from the active rail line will vary depending on the speed and frequency of trains, and available right-of-way. Separation greater than 20 feet will result in a more pleasant trail user experience and should be pursued where possible.



ACCESS + INTERSECTIONS

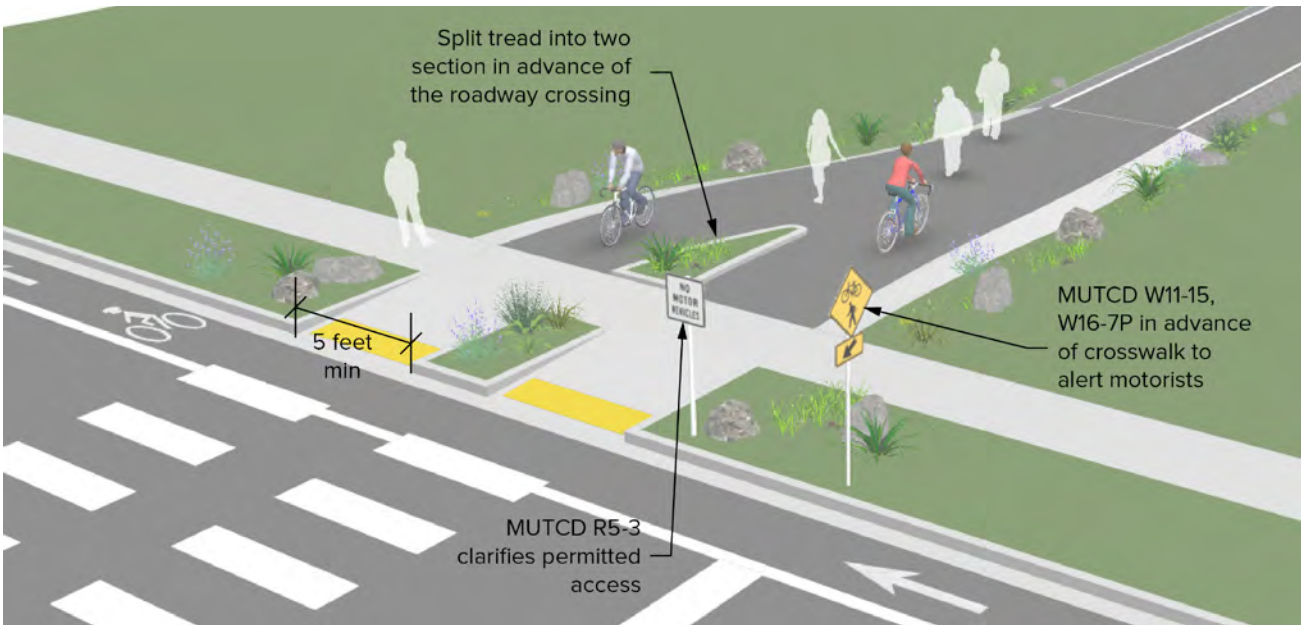
Roadway and trail crossings can create potential conflict points; however, well-designed crossings can mitigate many operational issues and provide a higher degree of safety and comfort for all users. Generally speaking, trail facilities require additional considerations due to the higher travel speed of bicyclists versus other trail users. The sign types, pavement markings, and treatments will vary based on the roadway type the trail crosses. Proper signage and pavement markings alerting trail users of at-grade crossings must also be utilized. This section details crossing treatments for the following contexts:

- Trail Entry Control
- Local or Collector Street Crossings
- Arterial Crossings
- Intersections with other Trails
- Railroad Crossings
- Underpasses and Overpasses

Trail Entry Control

A variety of physical barriers and design strategies are employed to restrict motor vehicle access to trails. A common treatment is the bollard post; however the bollard presents numerous safety hazards to trail users, and their use should be discouraged. Potential hazards include inconsistent and unpredictable placement, broken fold-down posts that often do not fold back up, removable posts lacking flush sleeves, or removable posts with theft preventing chains that dangle onto the trail surface. If bollards are used at intersections and access points, they should be adequately spaced and brightly colored and/or supplemented with permanent reflective materials to be visible at night. Removable barriers should leave a flush surface to prevent tripping hazards.

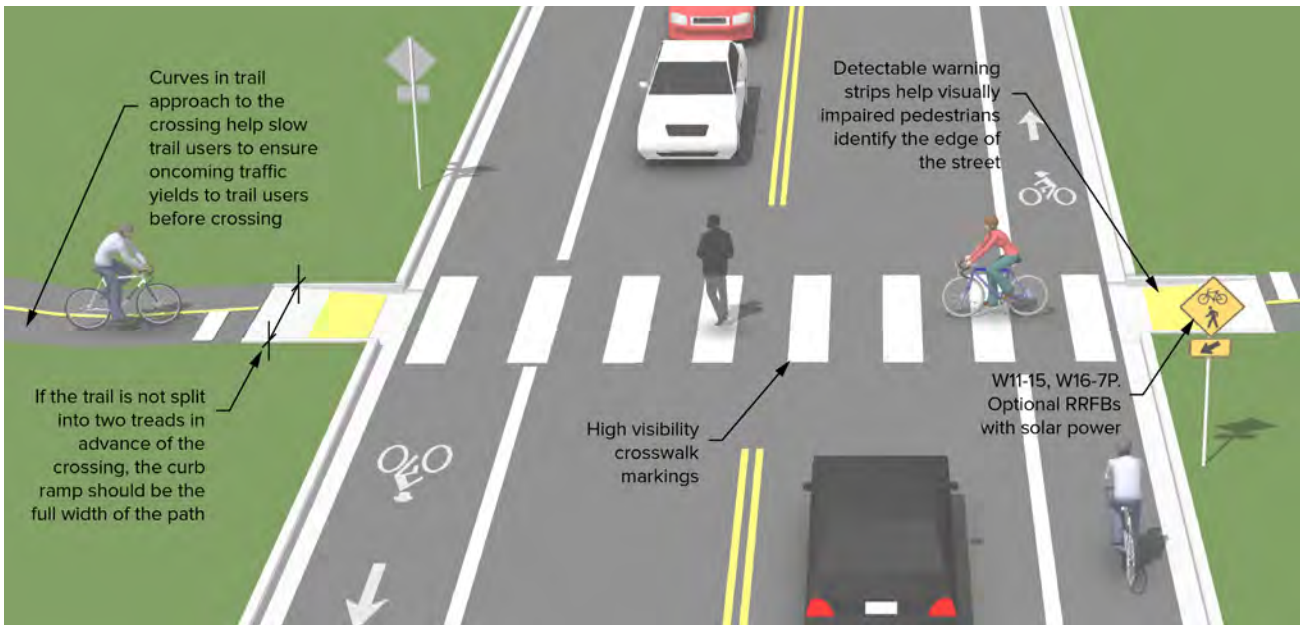
Physical barriers should only be considered when other measures do not adequately control unauthorized vehicles, or where the danger posed by unauthorized vehicles exceeds the safety risks to trail users by the barriers themselves. Alternative design strategies to control shared-use path entry include signage indicating “No Motor Vehicles” (MUTCD R5-3) placed at the trail access point, separating the trail into two treads in advance of the crossing so that the curb cuts are not conducive to motor vehicle access, and including a landscaped median to act as an access barrier. Note that there should be a minimum of five feet clearance for each tread for trail user access.



Local and Collector Street Crossings

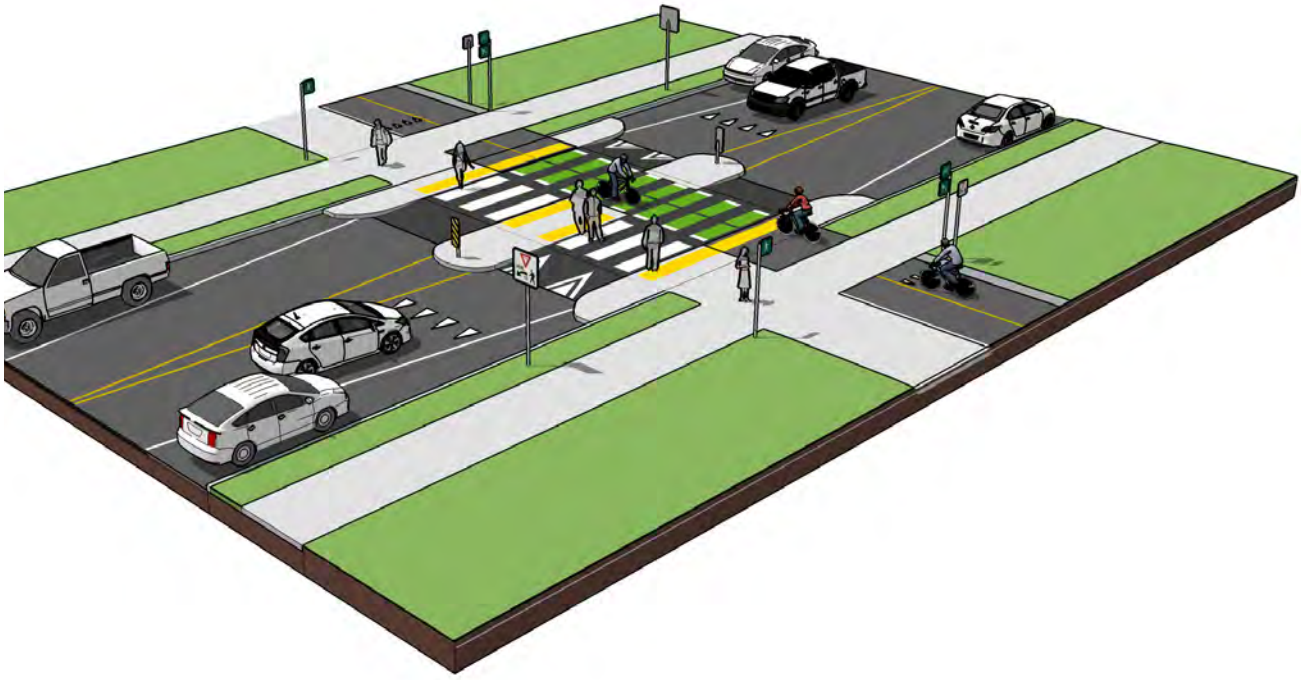
Marked Unsignalized Crossings

The design of trail crossings of local and collector streets depends on an evaluation of vehicular traffic, sight lines, trail volumes, use patterns, vehicle speed, road type, road width, and other safety issues such as proximity to major attractions. An unsignalized crossing typically consists of a marked crossing area, with signage and other markings to slow or stop traffic. Marked crosswalks statistically increase motorists yielding the right-of-way to pedestrians (Mitman). High-visibility crosswalk markings are the preferred marking type (FHWA) as transverse lines are essentially not visible when viewed from a standard approaching vehicle (McGrane). Locate crosswalk markings out of wheel tread when possible to minimize wear and maintenance costs. Stop or Yield lines may be used on the roadway 25 feet in advance of crosswalks where right-of-way priority is given to path users. A yield line must be paired with a Yield (R1-2) or Yield Here To Pedestrians (R1-5) sign. In roadway Yield to Pedestrians (R1-6) signs may be used along the centerline point of a crosswalk. On the trail, add detectable warning strips at the roadway crossing to help visually impaired pedestrians identify the edge of the roadway.



Median Refuge Islands

When space is available, using a median refuge island can improve user safety by providing pedestrians and bicyclists space to perform the safe crossing of one side of the street at a time. Refuge islands minimize user exposure by shortening crossing distance and increasing the number of available gaps for crossing. The waiting area should eight feet wide or wider to allow for a variety of bicycle types and multiple trail users. The refuge island must be accessible, preferably with an at-grade passage through the island rather than ramps and landings. To promote yielding to trail users, the median safety island should be designed to require horizontal deflection of the motor vehicle travel lanes. If a refuge island is landscaped, the landscaping should not compromise the visibility of trail users crossing in the crosswalk. Consider the use of landscaping with low-growing, minimally-spreading native shrubs and ground cover that require little maintenance and are no higher than 18 inches. Note that refuge islands may collect road debris and may require somewhat frequent maintenance. For separated use trail crossings, the crossing should maintain user separation. The pedestrian path should use crosswalk markings and the bicycle path should use green colored pavement.



Rectangular Rapid Flashing Beacons (RRFBs)

RRFBs alert drivers that path users wish to cross and promote yielding. This treatment provides similar yielding rates to that of a conventional traffic signals. Passive (loop) detection technology or active push buttons can activate warning beacons for oncoming path users. Push buttons should be no higher than four feet above the ground for ADA accessibility.

Bulb-outs

Curb extensions, or bulb-outs, shorten crossing distance and position users in a visible location. They also visually narrow the roadway to slow motor vehicles approaching the crossing.

Raised Crosswalks

Vertical deflection can slow drivers to prepare them to yield to trail users. Raised crossings should raise six inches above the roadway with a steep 1:6 (16%) ramp. Advisory speed signs may be used to indicate the required slow crossing speed.

Rectangular rapid-flashing beacon (RRFB)

Arterial Crossings

Signalized crossings provide the most protection for users through the use of a red-signal indication to stop conflicting motor vehicle traffic. Trail crossings within approximately four hundred feet of an existing signalized intersection with crosswalks are typically diverted to the signalized intersection to avoid traffic operation problems when located so close to an existing signal. If possible, route users directly to a signalized crossing. If the diversion to a signalized intersection is perceived out of the direct line of travel, trail users can be expected to cross at unmarked locations, which is hazardous for all users. If no signalized crossings are within the vicinity of the trail, use an appropriate crossing treatment as described in the previous section.

Signalized crossings are normally activated by push buttons or detection loops. The maximum delay for activation of the signal should be two minutes, with minimum crossing times determined by the width of the street.

Intersections with Other Trails

At the intersection of two trails, users should be aware that they are approaching an intersection and of the potential for encountering different user types from a variety of directions. This can be achieved through a combination of regulatory and wayfinding signage and unobstructed sight lines.

Trails should be aligned to intersect at 90° angles when possible, or consider off-setting the trail intersection and creating two three-way intersections rather than one four-way intersection. Merging paths should be avoided, and the connection should be configured as a T-intersection. Where merges are unavoidable or necessary for other reasons, an open sightline of 75 feet from the merge point should be provided between paths.

A roundabout may be a viable design option to slow speeds and clarify expected operation. If a roundabout design is used, consider the use of landscaping with low growing (no more than 24 inches high) and minimally spreading native shrubs and ground cover that require little maintenance and provide clear sight lines. Other material can be used within roundabouts such as boulders and public art to discourage shortcut paths through the central island as long as clear sight lines under three feet are maintained.

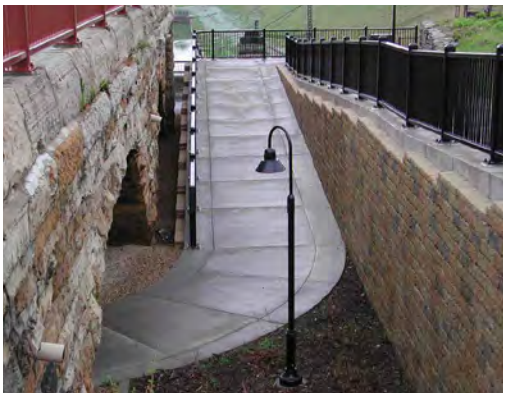
Railroad Crossings

Locations where trails must cross railroad tracks are problematic for pedestrians, particularly for those with mobility or vision impairments. Wheelchair casters and bicycle wheels can easily get caught in the flange-way gap, and slippery surfaces, degraded rough materials, or elevated track height can cause tripping hazards for all users. Angled track crossings also limit sight triangles, impacting the ability to see oncoming trains.

The crossing should be as close as practical to perpendicular with tracks. Ensure clear lines of sight and good visibility so that trail users can see approaching trains. The crossing must be level and flush with the top of the rail at the outer edge and between the rails. Flange-way gaps should not exceed two and a half inches (three inches for tracks that carry freight.) Concrete or rubber is the best material for pedestrian railroad crossings.

Bells or other audible warning devices may be included in the flashing-light signal assembly to provide additional warning for pedestrians and bicyclists. In areas with frequent train movements, pedestrian automatic gate arms or manually operated swing gates may help control trail user movements when a train is approaching.

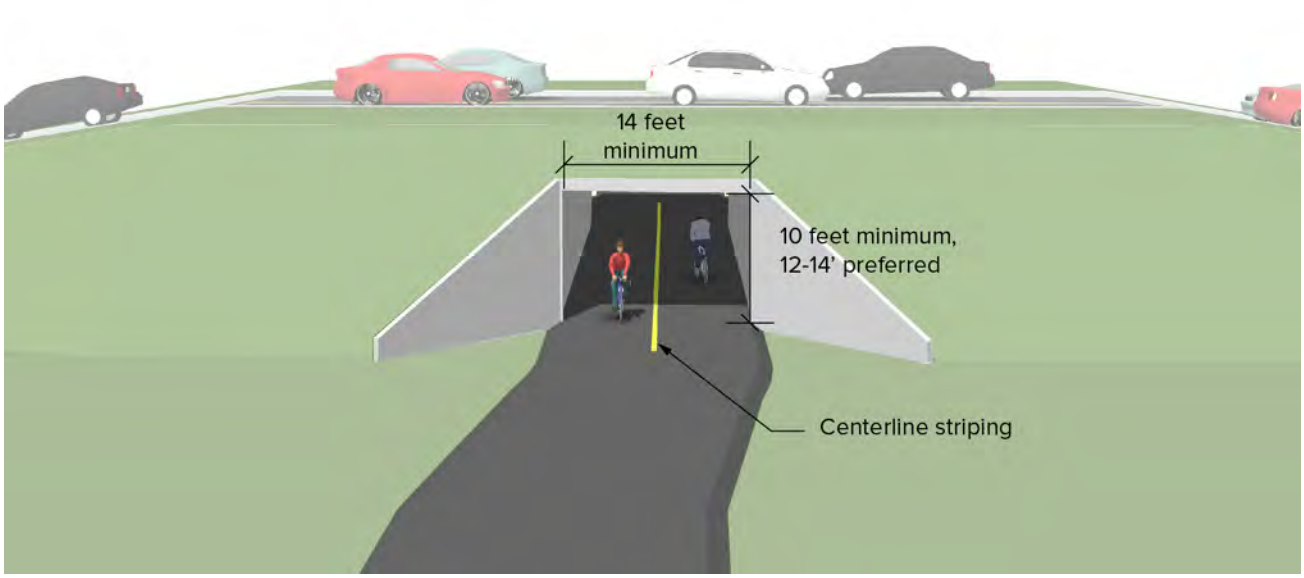
Crossing design and implementation is a collaboration between the railroad company and the highway agency. The railroad company is responsible for the cross-bucks, flashing lights and gate mechanisms, and the highway agency is responsible for advance warning markings and signs. Warning devices should be recommended for each specific situation by a qualified engineer based on various factors including train frequency and speed, path and trail usage, and sight distances.



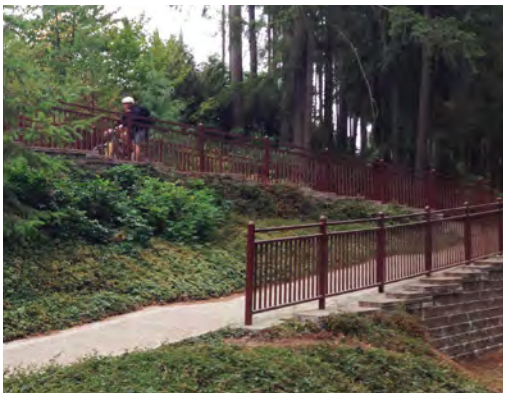
Undercrossings

Undercrossings can provide critical trail system links in areas separated by barriers such as railroads and highway corridors. In most cases, these structures are built in response to user demand for safe crossings where they previously did not exist. There are no minimum roadway characteristics for considering grade separation. Undercrossings must be a minimum of 14 feet wide, and greater widths are preferred for undercrossing lengths of over 60 feet. For maintenance vehicles, there must be a 10 foot minimum vertical clearance.

The undercrossing should have a centerline stripe, even if the rest of the path does not have one, to discourage passing movements. Safety is a major concern with undercrossings as path users may be temporarily out of sight from public view and may experience poor visibility. To mitigate safety concerns, an undercrossing should be designed to be spacious, well-lit, equipped with emergency phones at each end and completely visible for its entire length from end to end. Potential problems of undercrossings include conflicts with utilities, drainage, flood control, and vandalism.



Overcrossings



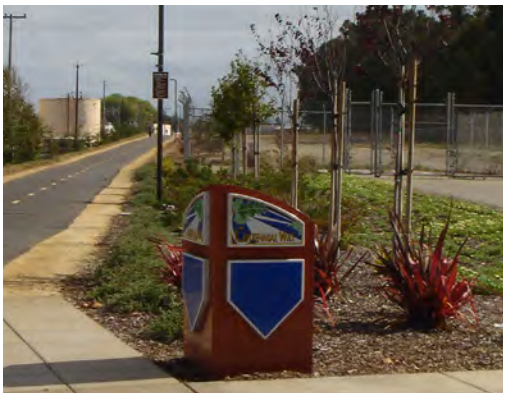
Bicycle and pedestrian overcrossings can be used to continue trails over large barriers such as deep canyons, waterways, or major roadways or rail yards. Overcrossings require a minimum of 17 feet of vertical clearance to the roadway below versus and elevation difference of 12 feet for an undercrossing. This results in greater elevation differences and much longer access ramps for bicycles and pedestrians to negotiate. Access ramps to overcrossings are limited to 5% slopes per the ADA. Level resting landings much be provided at four hundred foot intervals. Steeper grades will require more frequent landings.

Overcrossings pose potential concerns regarding visual impact and functional appeal, as well as space requirements for approach ramps. Overcrossings can be more difficult to clear of snow than undercrossings.

AMENITIES

When designing functional, attractive, and inviting trails, the small details matter. Elements such as a lighting fixtures, public art, benches, and other amenities help create a unique identity for a trail. It is important that these details work together to create a complete experience for all users. This section discusses the following amenities:

- Minor Access Points
- Major Trailheads
- Art
- Lighting
- Signage and Wayfinding



Minor Access Points

Trail access points can occur at parks, residential developments, or other logical points of interest. Any access point to the trail should be well-defined with appropriate signage designating the corridor as a shared-use trail and prohibiting motor vehicles. Well defined trail access points can prevent the development of informal "social" trails which can follow poorly executed routes and trample floodplain vegetation or sensitive areas. Typically, trail access points have very minimal infrastructure, possibly including a small parking lot, drinking fountains, benches, trash and recycling receptacles, an information kiosk, or wayfinding signage about the trail network.

Trailheads

Trailheads should be established near large residential developments, commercial areas, and transportation nodes to be highly accessible to the surrounding community and to the trail system. There is no prescription for the frequency of trailheads. Conduct user counts, vehicle counts, and surveys across the trail network at peak hours of use to determine parking and access demand. There may be opportunities to locate trailheads at existing public facilities or created through partnerships with owners of existing parking areas. Trailheads can include many amenities such as: automobile parking, bicycle parking, comfort stations, drinking fountains, trash and recycle receptacles, dog waste stations, bicycle repair stations, wayfinding and informational signage shelters, and picnic areas. Trail amenities should be placed no higher than four feet off the ground for accessibility. Trailhead signage should provide accessibility information, such as trail gradient/profile, distances, tread conditions, location of drinking fountains, and rest stops.

Parking

Major trailheads can provide parking for 10 to 40 vehicles, depending on availability of land and anticipated level of use of the trail. Minor access points can have small lots accommodating up to 10 vehicles. Typically trailhead parking lots are paved to accommodate vehicles year round. Parking lots should be located in existing disturbed areas to minimize environmental impacts, and vegetative screening can be used to reduce the visual impact of parking areas. Consider one-way vehicle circulation to reduce parking area size. Where major trailheads are located in or near neighborhoods, provide user access from local streets crossing the trail, and possibly install "No Parking" signs to minimize parking impacts on local streets.

Trailheads should provide emergency and maintenance vehicle access and turnaround. Place ADA accessible parking spaces near the site's accessible route, at a rate of one accessible space per 25 standard spaces. ADA parking spaces and access aisles should not exceed 2% slope in any direction, and the remainder of the lot surface should never exceed 5% slope in any direction.

Comfort Stations

There are a number of factors to consider before locating comfort stations, including available land, size of trailhead, existing comfort station facilities, utility availability, maintenance vehicle access, and user need. Prior to undertaking any comfort station building design, consultation with a structural and civil engineer, state building codes, health and safety codes, ADAAG and Public Rights-of-Way Accessibility Guidelines (PROWAG) standards, and local development codes is required.

The space required for each comfort station building depends on the number of toilets to be provided. Prioritize location of comfort stations at trailheads within existing parks and review gaps for placement at other trailheads or locations within the system. If other comfort station facilities are available within the park and trail system, use wayfinding signage along trails to direct users appropriately. Comfort station structures should be located adjacent to vehicular access points for security, maintenance, and access to water and sewer. Composting toilets should be considered in remote areas or where utility connections are unavailable. Always provide comfort station facilities outside of flood-prone areas.

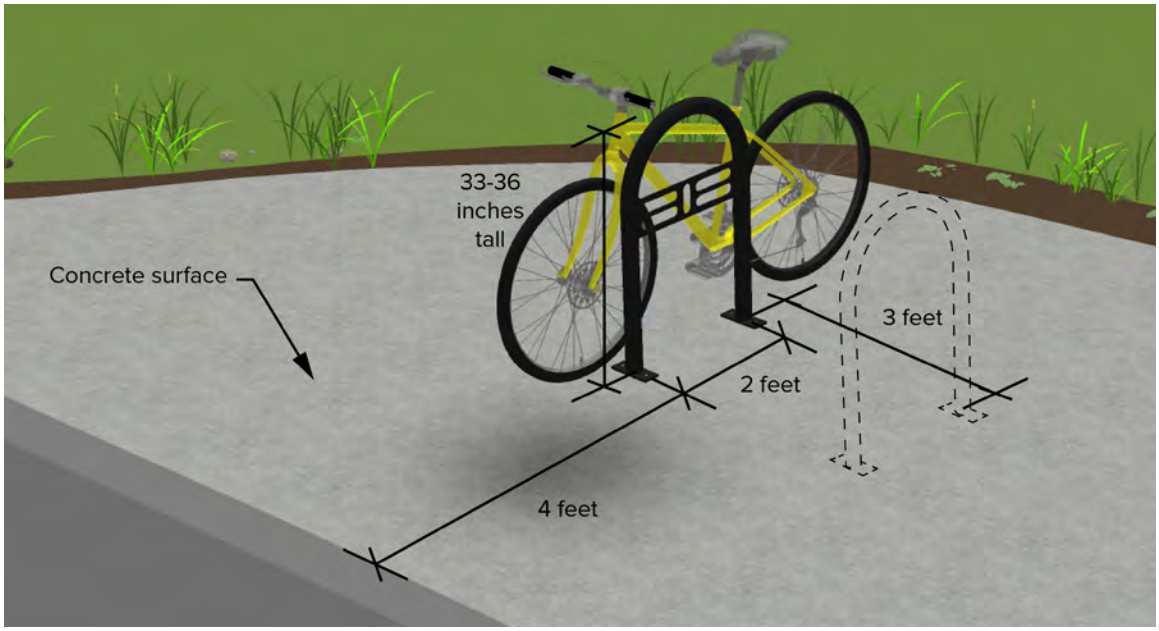
Comfort stations should also make use of natural light and ventilation to the extent possible, and should be constructed of durable materials resistant to vandalism. Bicycle parking should be provided close to comfort station structures so that bicyclists do not have to prop unsecured bicycles against comfort station buildings.

Bicycle Parking

Bicycle parking should be convenient, highly visible, and easily accessible from the trail. Bicycle parking should be located at comfort stations, select trailheads, points of interest, and rest stops. Signage may be desired to direct users to designated bicycle parking areas. Bicycle racks should be located on a hardscape surface and not be located directly in front of other trail amenities. Ideal rack location is parallel along the trail approach, no more than 25 feet from trail ingress/egress points and at least five feet from the edge of trail to avoid trail user conflict. Consideration should be given to avoid emergency ingress/egress, service access, and vehicular conflict areas.

The bicycle rack should support the bicycle in at least two places, preventing it from falling over, and the rack should allow locking of the frame and one or both wheels with a U-lock. Consider bicycle racks that resist cutting, rusting, bending, and deformation. A “staple” rack is an ideal rack type as it is easily recognizable, can accommodate bicycles of all sizes, and allows secure locking techniques.

When installing racks, ensure the rack is securely anchored to ground to prevent bicycle theft. On concrete surfaces, use .375 inch anchors to plate mount and shim as necessary to ensure vertical placement. When installing racks on pavers or other non-stable surfaces, embed the rack into the material base with core holes no less than three inches in diameter and 10 inches deep.



Bicycle Repair Stations

Bicycle repair stations are small kiosks designed to offer a complete set of tools necessary for routine bicycle maintenance and minor repairs. Popular locations for placement include major or minor trailheads and rest stops trails. Bicycle repair station tools are secured by high security cables, but will still be an attractive target for theft. Kiosks should be placed in areas of high activity to reduce potential vandalism. Consider grouping repair stations together with other amenities such as seating, bicycle parking, and drinking fountains at a rest stop.

Drinking Fountains

Drinking fountains provide opportunities for users to replenish fluids and potentially extend their trip. Locate drinking fountains near comfort stations, at trailheads, parks, and other public gathering places along the trail. Drinking fountains should be placed at least five feet from trail edge, and no higher than four feet off the ground to be ADA compliant. Drinking fountains should be placed on a well-drained surface (2% sloped concrete slab). Consider the use of durable and vandalism-resistant materials such as steel or stone.

Seating

Seating along trails provides a place for users to rest, congregate, contemplate, or enjoy art, nature, and interpretive elements throughout a trail. Benches can be designed to create identity along the trail or be strictly utilitarian. Picnic tables provide places for trail users to congregate for meals or to relax. Locate seating along the trail at one mile intervals where appropriate, or where there is a demand by users. Seating within half-mile of trailheads is recommended. Provide benches and picnic tables in areas that provide interesting views, are close to an interpretive element, and offer shade or shelter from wind. Benches and other site furniture should be located a minimum of three feet from the edge of the trail, a minimum of four feet from comfort stations and drinking fountains, or a minimum of two feet from trash and recycling receptacles, lighting poles, and sign posts. Wheelchair access should be ensured by providing compact, level surfaces at picnic tables and alongside benches. To prevent vandalism, seating should be securely anchored to hardened surfaces such as concrete or asphalt. Consider durable or native materials such as boulders that are vandalism-resistant.

Trash Receptacles

Trash and recycle receptacles are necessities for trail maintenance and appearance. Trash and recycling receptacles should be prioritized along more heavily used trail sections, at each trailhead, and each seating area (one per every one picnic table, one per every two benches). Placement of other receptacles will depend upon the location of concessions, facilities and areas of group activities. Receptacles need to be accessible to maintenance personnel and should be set back a minimum of three feet from the edge of the trail. For recycling receptacles, signage should be provided indicating which recyclables are accepted. Consider including educational signage about the importance of recycling and the environmental benefits.

Receptacles should be selected for the expected trash/recycling amount, maintenance and collection program requirements, durability, and animal-resistance. In areas with adequate sunlight, consider compacting receptacles for trash and recyclables that use smart technology.

Art

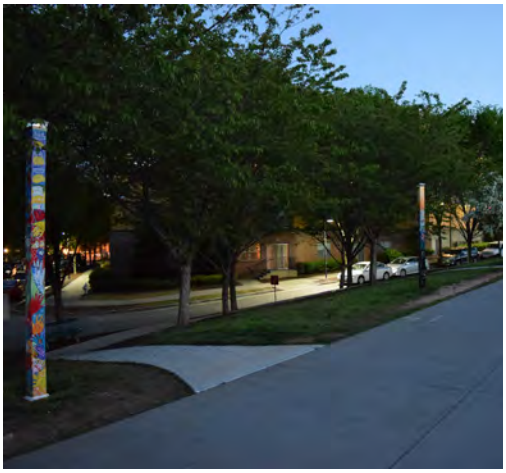
Including public art on trails can engage the local community and create an identity for the trail. Public art can be aesthetic or functional, doubling as seating or shelter, and depending on the scale and form, an activity in itself to serve as a public attraction. Memorable art installations can act as landmarks and serve as valuable wayfinding tools. Public art can also be a used as an interpretive device for telling a compelling story about the trail and area history.

Art can be placed at one or multiple locations along trails. Provide art displays on trails with anticipated high use and user exposure. Key locations such as turns or landscape changes could be areas to highlight through the inclusion of public art. When appropriate, artists can be engaged as part of the corridor planning and development process.

Artists should be encouraged to produce artwork in a variety of materials for sites along the corridor. Consider developing furnishings and amenities with artistic intent and providing continuity between elements while maintaining the unique styles of multiple artists. Community-based art and temporary installations are also effective ways of integrating public art into a trail.

Lighting

Lighting for trails should be analyzed on a case-by-case basis with full consideration of the maintenance commitment lighting requires. Lighting can improve visibility for day time use in tunnels and underpasses, and night-time use along the trail and intersection crossings. Lighting can provide extended operation hours for all trail users, which should be considered particularly during winter months when trips to and from work are often made before sunrise and after sunset. Dependent upon trail hours, consider lighting in urban and/or commercial land use areas. Recommended locations for lighting include trailheads and parking areas, comfort stations, trail intersections, entrances and exits of bridges and underpasses and in tunnels, and street crossings. Lighting spacing along trails depends on the type and intensity of lights, though thirty to fifty feet spacing is common for pedestrian scale lighting. Solar powered lighting is available where utility collection is difficult or when alternative energy sources are desired. Lighting is generally not appropriate for trails in remote areas, trails with low use, or where there is little to no development.



Lighting should respond to the conditions of the site and meet the minimum standards set forth by the Illuminating Engineering Society of North America (IESNA). Full cut-off fixtures, or luminaries with no direct uplight, should be used to reduce light pollution. These fixtures also limit direct glare or excessive illumination on to adjacent properties, streets, or sidewalks.

Trail lighting should be at pedestrian scale, but avoid light fixtures at eye level that could impair visibility. Pedestrian scale lighting is typically about 15 ft tall, has lower levels of illumination, and closer spacing to avoid dark zones between lights. Pedestrian scale light fixtures are typically high pressure sodium vapor or metal halide lamps, which produce better "white light" than sodium vapor lamps. LEDs are the preferred lighting bulb as they offer a wide range of light levels and can reduce long term utility costs. Average horizontal illumination levels are 0.5 to two foot candles or five to 22 lux (AASHTO, Section 5.2.12).

Signage and Wayfinding

A comprehensive system of signage ensures that information regarding the safe and appropriate use of all facilities, both on-road and on shared-use paths. The bicycle and trails networks should be signed seamlessly with other alternative transportation routes, such as bicycle routes from neighboring jurisdictions, trails, and local transit systems. Signage includes post- or pole-mounted signs and pavement markings. Signage is further divided into information signs, wayfinding signs, regulatory signs, and warning signs. All signage should conform to the Manual on Uniform Traffic Control Devices and the American Association of State Highway Transportation Official Guide for the Development of Bicycle Facilities.

Wayfinding Signage

The ability to navigate through a city or across a trail network is informed by landmarks, natural features, and other visual cues. Wayfinding signs indicate:

» Direction of travel

» Location of destinations

» Designated bike routes or trails

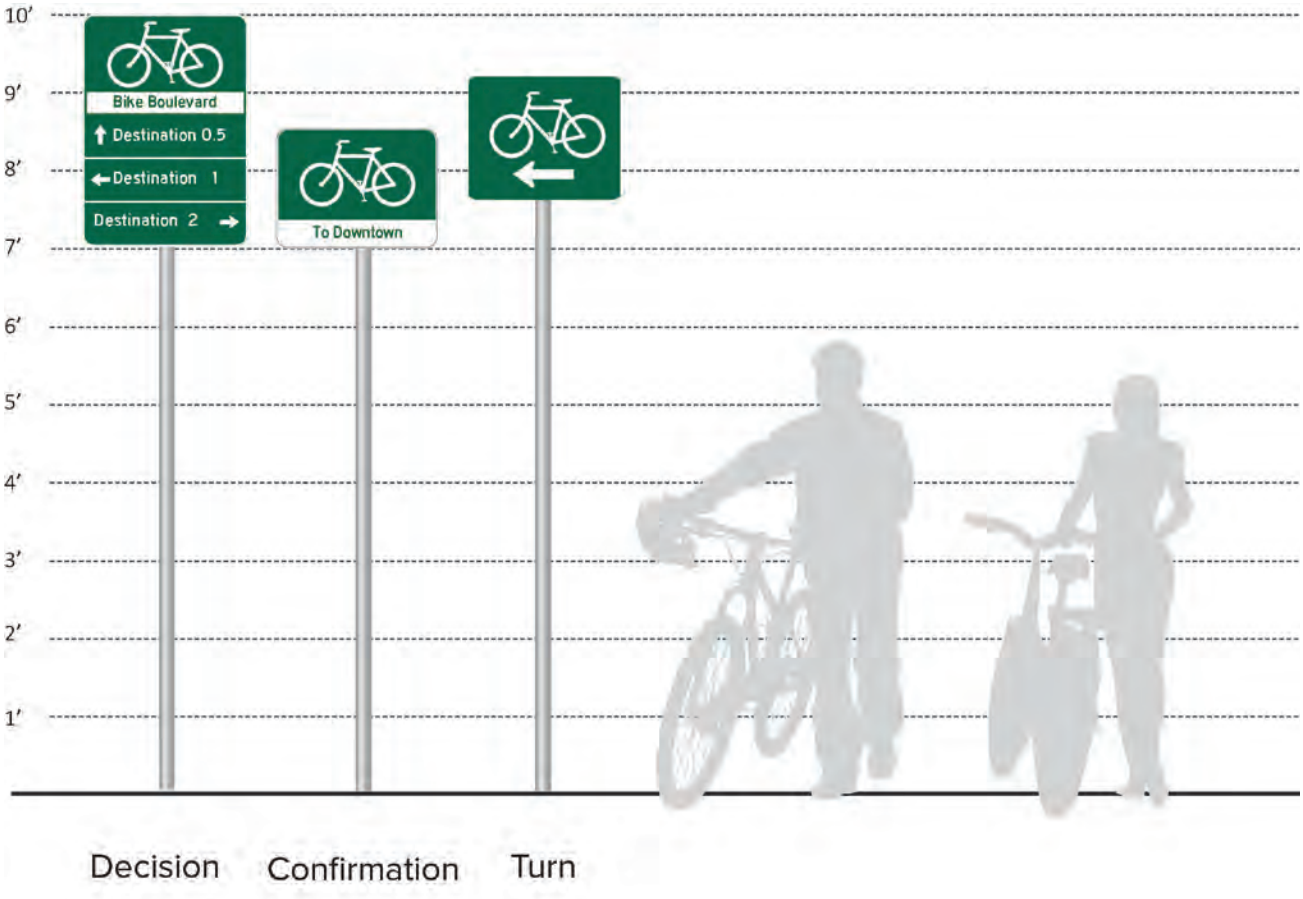
Wayfinding signage serves many purposes, including familiarizing users with a trail system, helping users and emergency responders identify locations, marking designated bike routes, and labeling trail access points. Wayfinding signs also visually cue motorists that they are driving near a trail corridor and should use caution. There are three general types of wayfinding signs:

Decision Signs mark the junction of bikeways and/or trails and inform users of the route options to access key destinations. Destinations, arrows, distances, and travel times are included on decision signs.

Confirmation Signs indicate to bicyclists that they are on a designated bikeway and make motorists aware of the bicycle route. This signage can indicate a single regional destination and distance/time, but does not include arrows or a full list of destinations.

Turn Signs indicate with arrows where a bikeway turns from one street onto another street or trail. This signage can be used in conjunction with pavement markings.

Section 1A.12 of the MUTCD establishes the general meaning for sign colors. Green is the color used for directional guidance and is the most common color of bicycle wayfinding signage in the US. Custom community wayfinding signs may use other MUTCD allowed colors, and include pedestrian-oriented travel times and designs such as local town logos or sponsorship branding.



Sign Placement

Signs are typically placed at decision points such as the intersection of two or more bikeways or trails, and at other key locations leading to and along bicycle and pedestrian routes. It can be useful to classify a list of destinations for inclusion on the signs based on their relative importance to users throughout the area. A particular destination's ranking in the hierarchy can be used to determine the physical distance from which the locations are signed. For example, primary destinations (such as the downtown area) may be included on signage up to five miles away. Secondary destinations (such as a transit station) may be included on signage up to two miles away. Tertiary destinations (such as a park) may be included on signage up to one mile away.

Decision Signs are placed on the near-side of intersections in advance of a junction with another bicycle route, and along a route to indicate a nearby destination.

Confirmation Signs are placed every quarter to half mile on off-street facilities and every two to three blocks along on-street bicycle facilities, unless another type of sign is used (e.g., within one hundred fifty feet of a turn or decision sign). Confirmation signs should be placed soon after turns to confirm destination(s). Pavement markings can also act as confirmation that a bicyclist is on a preferred route.

Turn Signs are placed on the near-side of intersections where bike routes turn (e.g., where the street ceases to be a bicycle route or does not go through). Pavement markings can also indicate the need to turn to the bicyclist.

Regulatory Signs

Regulatory signs give a direction that must be obeyed, and apply to intersection control, speed, vehicle movement, and parking. The examples below are types of regulatory signs that could be integrated into a signage program. Smaller scale signs or plaques may be used for trail applications. See the MUTCD 9B for a detailed list of regulatory sign application and guidance.

Etiquette Signage

Informing trail users of acceptable etiquette is a common issue when multiple user types are anticipated. Yielding the right-of-way is a courtesy and yet a necessary part of a safe trail experience. The message must be clear and easy to understand. The most common trail etiquette systems involve yielding of bicyclists to pedestrians. Trail etiquette information should be posted at access points and periodically along the trail.

Interpretive Signage

Interpretive displays provide trail users with information about the surrounding environment or site, wildlife, vegetation, history, and the significance of cultural elements. Interpretive displays may also be combined with public art and sculpture opportunities along the trail. Consider the character of the trail and surrounding elements when designing these signs. Work with experts specific to the information you are conveying on the signs such as historians, ecologists, or artists. Separate interpretive signage panels from the main trail circulation so that users can stop and not impede traffic Consider including interpretive signage at rest stops or areas of congregation. Panels must be ADA accessible. Consider use of technology for interpretation.

Informational Kiosks and Message Centers

Kiosks and message centers provide trails users with information to orient themselves, learn of areas of interest, read the rules and regulations of the trail system, and find the hours of operation. Kiosks should be installed at each major and minor trailhead. When locating kiosks next to parking facilities, set the units back far enough from traffic and protect the support posts or structure with appropriately sized barriers. Evaluate the use of emerging technology options for implementation of information and messages as part of the signage program.

MAINTENANCE

Regular, routine maintenance on a year-round basis will not only improve trail safety, but will also prolong the life of the trails. Maintenance activities required for continuous, safe trail operations should always receive top priority. This section discusses:

- General Trail Maintenance
- Winter Trail Maintenance
- Temporary Trail Closures

General Trail Maintenance

A high level of trail maintenance is critical to the overall success and safety of the trail system. Maintenance includes such activities as pavement stabilization, landscape maintenance, facility upkeep, sign replacement, fencing, mowing, snow removal, litter removal, painting, and pest control. However, the effects of a good maintenance program are not limited to the physical and biological features of the trails. A high standard of maintenance is an effective way of promoting use of trails, and is necessary to preserve positive public relations with adjacent land owners. Moreover, the psychological effects of good maintenance can be an effective deterrent to vandalism, litter, and encroachments. A successful maintenance program requires continuity and a high level of citizen involvement. Scheduled trail Inspections and volunteer patrols can prevent maintenance issues and ensure rapid identification of problems. In addition to scheduled inspections, the following table is a list of maintenance needs and suggested frequency of completion:

MAINTENANCE TASK	SUGGESTED FREQUENCY
Major damage response (fallen trees, washouts, flooding)	Immediately
Site furnishings; replace damaged components	As needed
Graffiti removal	Weekly; immediately as needed
Shrub/tree irrigation for introduced planting areas	Weekly during summer months until plants are established
Trash disposal	Weekly during high use; twice monthly during low use
Litter pick-up	Weekly during high use; twice monthly during low use
Fencing repair	Inspect monthly for holes and damage, repair immediately
Inspections	Daily routine inspections; seasonal detailed inspections (4 times/year); immediately after wind storms or flood events
Pavement sweeping/blowing	As needed; before high-use season
Culvert inspection	Before rainy season; after major storms
Maintaining culvert inlets	Inspect before onset of wet season
Lighting repair	Monthly; annually
Shoulder plant trimming (weeds, trees, branches)	Bi-annual (Fall or Spring)
Sign repair/replacement	1-3 years
Pavement markings replacement	1-3 years
Introduced tree and shrub plantings, trimming	1-3 years
Pavement sealing; pothole repair	5-15 years
Comfort station maintenance	Daily

Trail Surface

To maintain a smooth trail surface, cracks, ruts, potholes, and water damage will have to be repaired periodically. The trail surface should be swept regularly to keep them free of debris, especially broken glass and other sharp objects, loose gravel, leaves and stray branches. Sweeping should be scheduled based on location, for example, path segments in forested areas will tend to accumulate plant litter such as leaves and pine needles and should be swept more frequently in order to maintain safe surface conditions.

Drainage

Where drainage problems exist along the trails, ditches and drainage structures will need to be kept clear of debris and periodically cleaned or flushed to prevent trail wash outs. Checks for erosion along the trails should be conducted immediately after any storm that brings flooding to the trail area.

Vegetation Management

In general, plantings alongside a trail should allow trail users clear views of their surroundings to avoid creating the feeling of an enclosed space. Understory vegetation along trail corridors should not be allowed to grow higher than three feet, and any overhanging branches over the trail should be pruned to a minimum vertical clearance of 10 feet. Tree canopies may also need to be trimmed for light fixtures or overhead utilities. Thus vegetation management will require a regular schedule of mowing, pruning, trimming, plant replacement, and tree removal as needed. Tree and plant species along a trail should be selected to minimize vegetative litter and prevent root uplifting of the trail pavement. To maintain ideal plant selections, trails also require brush removal during installation to prevent invasion of unwanted plants, and regular weeding.

Facilities and Signs

Trailhead amenities and trail signs will require regular maintenance and visual inspections. Facilities including parking lots, picnic tables, trash receptacles, and comfort stations will need scheduled cleanings. Signs such as informational kiosks, directional signs, or distance markers should be periodically checked for graffiti or damage to the sign face or post.

Graffiti

Graffiti not only affects trail aesthetics; it can also encourage other undesired behaviors, such as littering, crime, and more graffiti. The appearance of graffiti and litter is perceived as an indicator that an area is in decline. Rapid removal of graffiti and illegally dumped materials is critical to maintaining a safe facility and conveying to the community that the trail is cared for and regularly observed. Signage should be posted at trailheads indicating a contact number to report graffiti and illegal dumping.

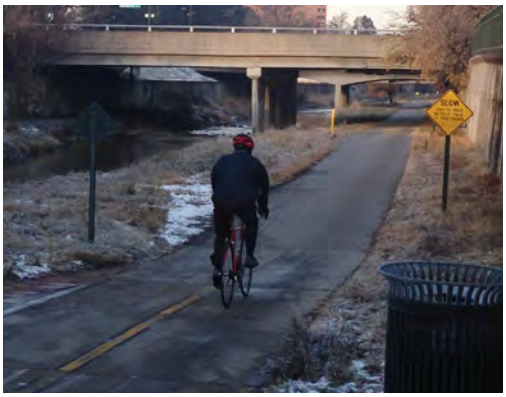
Winter Maintenance

Paved multi-use trails require significant public investment and should be used to their fullest potential year-round. Fortunately, the fleeting nature of snow allows for flexibility and creativity in dealing with it from storm to storm and season to season. The decision to clear or leave a trail unmaintained should be the result of a public decision making process involving officials, residents, and stakeholders. The decision will necessarily be based on the demand for different activities on each trail segment and the physical and budgetary constraints associated with winter pathway maintenance. Any changes to winter maintenance operations along paved paths should be made by early spring so that the appropriate changes can be made to maps and signage in time for the upcoming winter season. Appleton should produce a winter trails maintenance plan with prioritized trails that will require snow removal.

Snow Removal

Snow removal should be considered for trails that provide key connections to bicycle or pedestrian destinations. If clearing a trail or segment of trail will help to improve winter pedestrian or bicycle safety, serious consideration should be given to snow removal, unless it would place undue burden on city resources. If it is decided that a segment of trail is to be cleared in the winter, every effort should be made to ensure that the trail remains free of ice to prevent slipping injuries. This will likely require ongoing inspection between snow events to ensure that ice buildup and drifting snow is removed promptly. Salt, sand, or de-icing solution should only be used if special circumstances warrant; such as severe ice buildup or freeze thaw cycles on the trail surface. Salt or de-icing solutions will create runoff damaging to vegetation, and sand should be used in limited amounts for traction concerns and because sand can become stuck in a bicycle's gears and chain. Gravel application should be avoided as the

smaller tire width of bicycles does not adequately grip to larger aggregate and may cause cyclists to lose control and fall. Snow stakes should be used along all paths intended for clearing in order to ensure that only the paved surface is cleared and the adjacent vegetation is not damaged. Note that snow removal on some trails can also accelerate the need for major trail maintenance or reconstruction during summer months.



No Snow Maintenance

As snow removal is a significant expense, in some cases it may be preferable to not provide snow maintenance. The decision not to maintain a trail during the winter should be made as part of an open public process that clearly presents the mobility, recreational, and budgetary impacts of that decision. Snow can act as an insulating layer and help prevent pavement heaving or other damage. However, as the snow melts in the spring, paved paths can emerge from winter operations covered in dirt and debris. Because residents and visitors will begin using these facilities in the spring, every effort should be made to sweep and clear these facilities as early as practical. Lingering patches of snow should be cleared to provide a safe smooth surface for bicyclists and pedestrians. Signage along paved paths can also sustains significant damage from natural snow movement. Any signage that is missing should be replaced and any striping or stenciling that has become well worn should be repainted. This is also an opportunity to remove any irrelevant or misleading signage and add any additional signage that may be relevant to upcoming summer and winter trail activities.

Temporary Trail Closures

Partial or full sections of the trail may need to be closed for regular or emergency maintenance of the facility. Trail access for users will need to be managed during these closures. Signs should be posted at all trail entrances on the impacted segments to be closed indicating the length and duration of the closure. Notice of closure should be publicly posted forty eight hours in advance, unless in case of emergency. Trail closures should have physical barriers, and detour signs to alternate routes. The trail should not be re-opened until it has been inspected to ensure that the trail is in usable condition. Where obstructions remain, warning signs should be placed for trail users to slow down or dismount, where needed.

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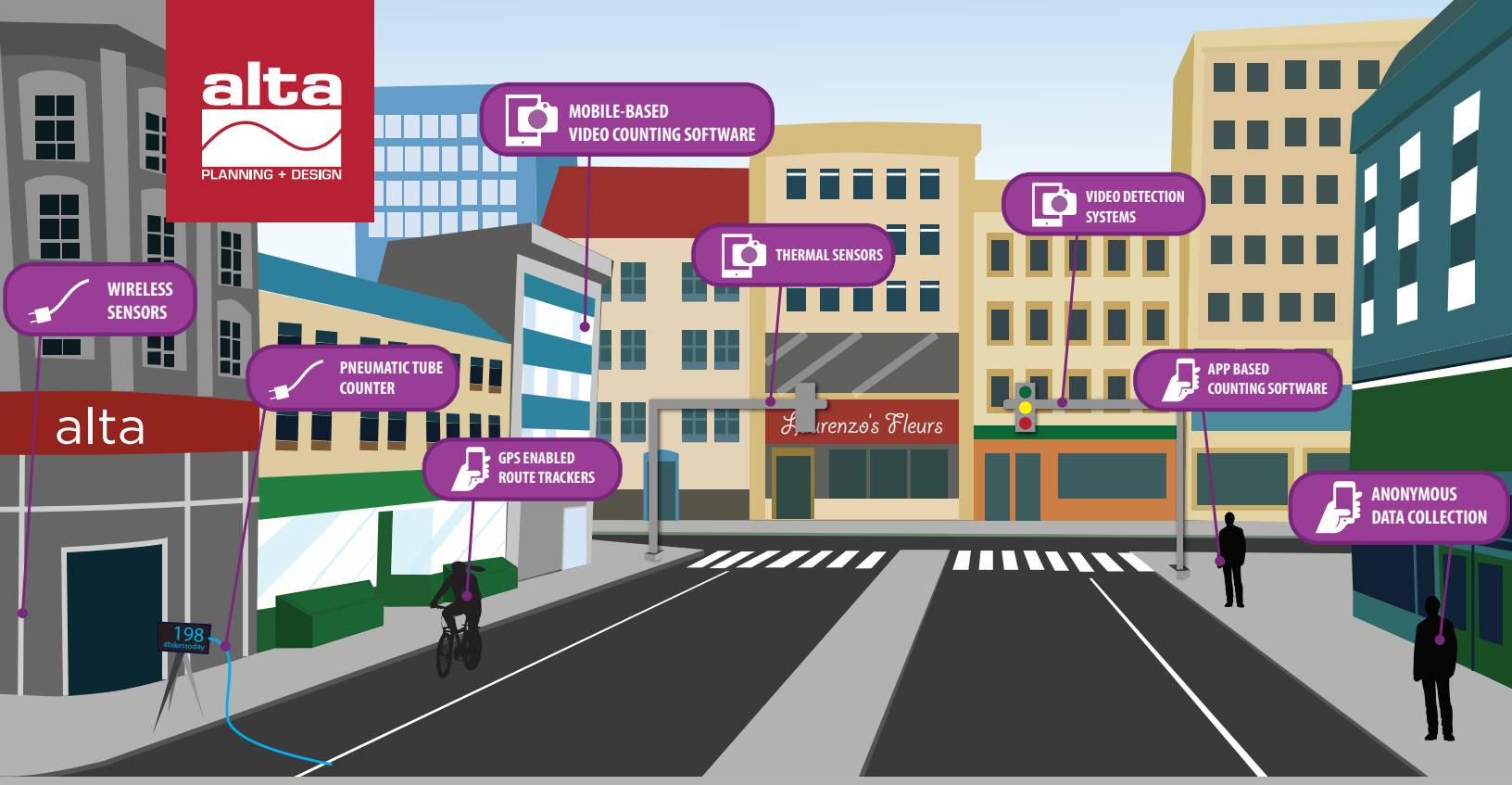
INNOVATION IN BICYCLE AND PEDESTRIAN COUNTS



Innovation in Bicycle and Pedestrian Counts

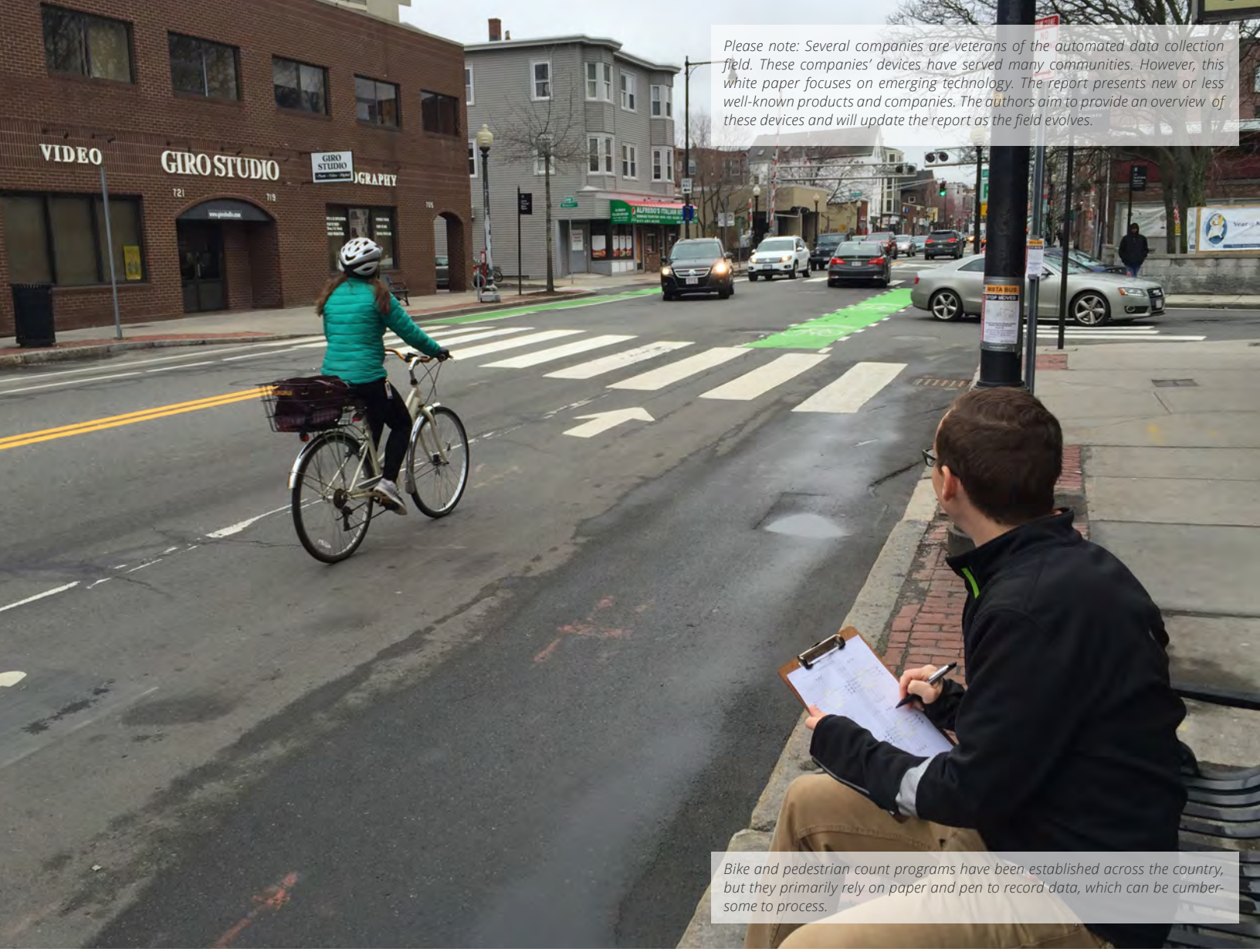
A Review of Emerging Technology

Summary

To create better facilities for people walking and biking, and to locate these facilities where demand and need is the highest, transportation professionals need reliable data to guide decision-making. Historically, collecting active transportation data has been both time and resource intensive. Although many communities have established robust count programs, there are still funding, quality control, and data management limitations. New technologies are emerging that aim to change the way active transportation data is collected, making it less expensive and easier to collect, resulting in more reliable data. This report provides a review of these technologies and their applications.

Contributors: Hugh Louch, Brad Davis, Kim Voros, Kristen O'Toole, and Sam Piper, Alta Planning + Design
This white paper is based on research leading to online publication in Spring 2016. The report is based on findings as of this date.

Please note: Several companies are veterans of the automated data collection field. These companies' devices have served many communities. However, this white paper focuses on emerging technology. The report presents new or less well-known products and companies. The authors aim to provide an overview of these devices and will update the report as the field evolves.



Bike and pedestrian count programs have been established across the country, but they primarily rely on paper and pen to record data, which can be cumbersome to process.

Introduction

Rates of active transportation have increased nationally over the past fifteen years, driven by steady growth in better walking and bicycling infrastructure. As this trend continues, transportation professionals have become frustrated by a general lack of bike and pedestrian count data. Having access to more robust data is important for several reasons:

» Data helps to determine where investments in walking and biking infrastructure are most needed

» Data makes it possible to assess changes over time, draw conclusions about the impact of new facilities, and improve the design of future facilities

» Data helps to quantify the benefits of walking and biking, which ultimately makes active transportation projects more competitive for funding

» A federal-level initiative, the US Department of Transportation's Mayor's Challenge for Safer People, Safer Streets, calls for improved walking and bicycling data collection

One of the most persistent challenges facing the bicycle and pedestrian field is the lack of usage and demand documentation. Without accurate and consistent count data, it is difficult to measure the positive benefits of investments in these forms of transportation, especially when compared to other modes, such as the private automobile. Fortunately, current and emerging technologies can capture and process non-motorized data efficiently and economically. This report provides a review of these technologies and how they can be integrated into bike and pedestrian count programs.

NATIONAL BIKE AND PEDESTRIAN DOCUMENTATION PROJECT

In 2004, Alta Planning + Design and the Institute of Transportation Engineers (ITE) Pedestrian and Bicycle Council established the National Bicycle & Pedestrian Documentation Project (NBPD).* This nationwide effort provided a consistent model of data collection for use by planners, governments, and bicycle and pedestrian professionals. Before the program, there were few systematic and coordinated efforts to include bicycle and pedestrian movements in count data.

The NBPD specifies that standardized counts should occur twice a year, in the spring and the fall. Communities record activity at key locations during two-hour morning and afternoon 'peak-commute' periods on weekdays (Tuesdays, Wednesdays, or Thursdays). A Saturday count precedes or follows the official count dates. Typically, cities and towns enlist volunteers to staff the various locations. Since its inception in 2004, hundreds of cities and towns across the country have used this methodology to count bicycle and pedestrian activity within their communities. The NBPD project has succeeded in changing the way these cities and towns collect active transportation data. However, after nearly a decade of operation, challenges to the program have become apparent:

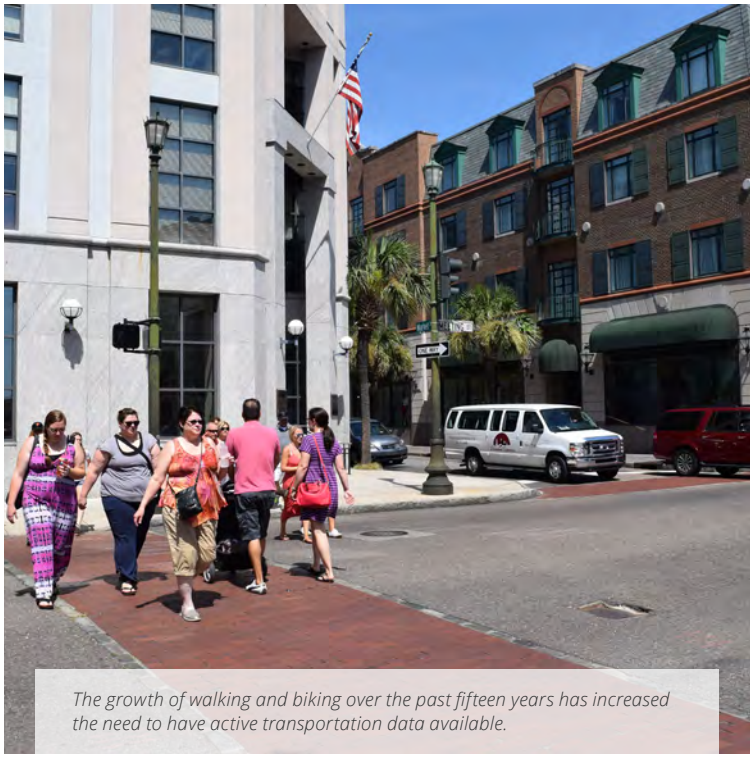
» Two-hour AM and PM count periods provide invaluable data, but planners have difficulty making annualized assumptions from this data. A single day does not represent typical travel patterns. National Cooperative Highway Research Program (NCHRP) Report 797: Guidebook on Pedestrian and Bicycle Volume Data Collection found, "the error in estimating average annual bicycle traffic from two-hour, 12-hour, or even one-week counts can be up to 40%" (TRB, 2015, http://www.trb.org/Main/Blurbs/171973.aspx). Conversely, annualized vehicle count data is readily available. Annualized data is critical because it provides the ability to understand change and forecast trends. Without comparable annualized walk and bike figures, it is more difficult to make a case for investments in these modes.

» Bicyclists and pedestrians have different travel habits than motor vehicles – trips tend to be shorter and distributed throughout the day. These factors make it more difficult to reliably capture their activity with two hour counts.

» Enlisting volunteers to staff counts is time consuming, and organizing volunteers can be a burden for municipal employees who have limited time and budget available to dedicate to this important task.

» Non-motorized counts are still primarily conducted with paper and pen. Staff digitize these records after data collection. This process can be time consuming, making data analysis a tedious task.

**Now called the ITE Pedestrian and Bicycle Standing Committee.*



The growth of walking and biking over the past fifteen years has increased the need to have active transportation data available.

Alta is not advocating for the cessation of manual count programs. Alta recognizes that integrating technology into count programs will be a gradual process that will take time. Manual programs have many benefits, including the following, which are listed in no particular order:

- They are great community building exercises that help to engage advocates and highlight the importance of walking & biking.
- Some communities may not have the resources to purchase and install automated counters, making manual count programs the most economical option. In the event that an automated program cannot be implemented, manual counts should continue to be conducted as usual.
- They can quickly produce data in locations of interest (e.g., high-crash locations, corridors that are under review for design changes).
- They can be combined with automated technology, such as mobile applications that replace clipboards with counting boards or screens.
- They are used before deploying automated devices to study a given location's suitability for automated counters. They are also used after automated devices are installed to calibrate and confirm data collected through automated means.

SHORT- AND LONG-TERM COUNT TECHNOLOGY FROM EXISTING LITERATURE AND PRACTICE

NCHRP Report 797: Guidebook on Pedestrian and Bicycle Volume Data Collection compares several types of automated equipment designed to count people walking and bicycling. The report aims to compare different solutions' accuracy, precision, and suggested uses. Due to federal funding, the NCHRP report cannot specify which brands were tested to create the report. This section discusses selected technology types discussed within the NCHRP report and similar references, such as the FHWA Traffic Monitoring Guide (TMG).

SHORT- AND LONG-TERM PEDESTRIAN COUNTERS

Pedestrian counters often use an infrared beam to count people passing a counting point. Active infrared devices are composed of a transmitter and a receiver. An infrared beam travels through the middle, undetected by the human eye. The device counts a person when they break the beam.

Similarly, passive infrared devices project an infrared beam from a fixed point. Anyone within the beam's cone shape is counted. TrailMaster, TRAFx, and EcoCounter are three commonly-used infrared count device manufacturers.

SHORT- AND LONG-TERM BICYCLE COUNTERS

Bicycle counters come in a number of shapes and sizes. Most cities with count programs use one of a handful of data collection options. Pneumatic tubes are appropriate for short-duration counts. They sit on the surface of a roadway and record bicycle traffic. Specialized filters allow the devices to "ignore" motorized traffic that passes over the tubes. EcoCounter and MetroCount are two companies that create bicycle-specific pneumatic tubes as well as other types of traffic monitoring technology. Longer duration counts are possible by using a number of technology types including inductive loops, magnetometers, piezoelectric strips, radar sensors, and thermal imaging. The NCHRP Report 797, Traffic Monitoring Guide, and NBPD outline these and other types of technology. Inductive loops, magnetometers, piezoelectric strips, and radar sensors are embedded in the pavement and detect bicycles as they pass the respective sensor. Thermal imaging cameras are affixed to existing poles within the right of way and capture bicyclists' heat signature as they ride within a counting zone. Video imaging is suitable for long- or short- duration count periods. Subsequent sections will discuss emerging thermal and video imaging solutions.

Table 1. Counter Types from Existing Literature and Practice

Technology Type	Common Manufacturers	User Type	Duration	Typical Uses
Infrared (Active and Passive)	• TRAFx • EcoCounter • TrailMaster	*Does not automatically distinguish between peds/bikes.*	Short or long	Sidewalk or shared-use path
Pneumatic Tubes	• EcoCounter • MetroCount • TRAFx • Road Sys		Short	On-road
Inductive Loop	• EcoCounter • Road Sys		Long	On-road or paved shared-use path
Magnetometer	• TRAFx		Long	Shared-use path
Piezoelectric	• MetroCount		Long	On-road
Radar Sensors	• Sensys Networks		Long	On-road
Thermal Imaging	• FLIR		Long	On-road
Video Imaging	• Miovision		Short or long	On-road

Again, the NBPD has been an extremely successful program. Countless communities have used the data to build better facilities for walking and biking. Many of the program's issues are due to it being a product of its time; in 2004, when it was launched, paper and pen was the only low-cost option for data collection (Facebook had its first birthday in 2004, the first iPhone was not released until 2007, and the first iPad not until 2010). The wireless tech-revolution that has occurred over the past 10 years has ushered in new tools to facilitate non-motorized data collection. As these products scale up, their prices fall, creating a marketplace that is changing the way we can monitor traffic.

Active Infrared

Passive Infrared
(Source: ecocounter.com)

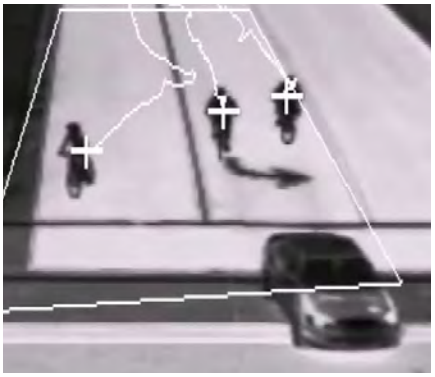
Pneumatic Tubes

Inductive Loops

Magnetometer. (Source: trafx.net)

Piezoelectric Strips/Tubes

Radar Sensors (Source: Twitter user Dongho Chang, Traffic Engineer, Seattle Department of Transportation)

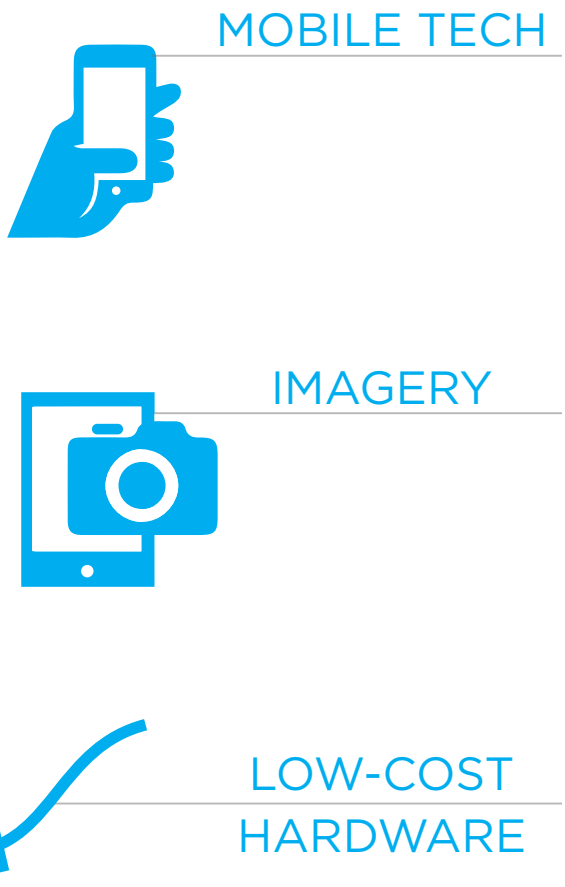


Thermal Imaging (Source: Popular Mechanics)

Video Imaging (Source: Iteris)

Innovative Counting Technologies

Several cities are leading the way in using mobile devices to measure increasing levels of bicycle traffic. Several others would like to retire their clipboards and install higher-tech, automated machines. Until very recently, such programs were cost prohibitive. New technologies can reduce the cost of non-motorized data collection, analysis, and visualization. These market disrupters have the potential to provide a variety of services, while frequently costing a fraction of traditional counting equipment. The following section outlines several services and corresponding technological solutions. The technologies that are emerging can be grouped into the categories listed below, and the graphic on page six summarizes the technologies reviewed.



Device Accuracy:

No independent authority has yet conducted a peer review of these devices' accuracy. At this time, the devices offer varying margins of error. Interested parties should contact the device suppliers to learn more about potential devices and their precision and accuracy.

Device Cost:

Device costs vary based on a number of factors. Costs are based on the price of purchasing counting units, but may also include additional charges for data processing (i.e., an hourly processing rate). Some companies allow users to utilize their own, pre-existing cameras as counting devices. In these cases, prices will differ, since they may not involve data processing but not hardware purchase costs.

INNOVATIVE COUNTING TECHNOLOGIES

Alta Planning + Design has been at the forefront of non-motorized data collection since its co-establishment of the National Bike and Pedestrian Documentation Project in 2004. New technologies are emerging that make it easier and cheaper to collect bike and ped data. Alta is assessing these technologies. The most promising are listed below, grouped by type. The relative cost of each is also identified.

$ Least Expensive $$ Moderately Expensive $$$ Most Expensive ? Prototype Stage

MOBILE TECH

APP BASED COUNTING SOFTWARE

- COUNTERPOINT $

GPS ENABLED ROUTE TRACKERS

- STRAVA METRO $$$
- RIDE REPORT $

ANONYMOUS DATA COLLECTION

- AIR SAGE $$

IMAGERY

VIDEO DETECTION SYSTEMS

- ITERIS $
- MIOVISION SCOUT $$

VIDEO COUNTING SOFTWARE

- PLACEMETER $$

THERMAL SENSORS

- VIP BIKE SENSOR $$ to $$$

LOW-COST HARDWARE

PNEUMATIC TUBE COUNTER

- WAYCOUNT $ to $$$

WIRELESS SENSOR

- NUMINA $$
- ARRAY OF THINGS ?

MOBILE TECHNOLOGY

Mobile applications and devices can harness human action to count a variety of road users, track their travel, and measure the quality of transportation infrastructure.

COUNTERPOINT (APP BASED COUNTING SOFTWARE)

Counterpoint is a mobile app designed to "make it easy to count traffic." It provides the ability to make your own counting site or add to an existing site. Tap specific buttons to record who uses the public realm during your counting session. The app also boasts robust traffic categories that are more nuanced than traditional pen and paper tallies, including user-friendly options such as "baby in stroller", "oversized bike", and "visually impaired pedestrian."

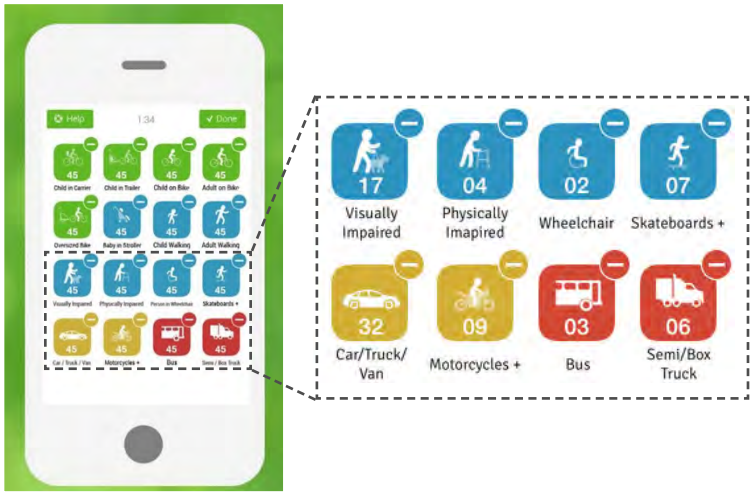
STRAVA METRO, CYCLETRACKS, AND CYCLE ATLANTA (GPS ENABLED ROUTE TRACKERS)

Many people who bike or jog use Strava or related apps to track their distance, speed, and route. Portland Bureau of Transportation (PBOT) made history a few years ago when they decided to purchase a large Strava-collected data set. Cities around the world have since purchased Strava data sets to get a sense of their cities' own trip patterns.

Although the data tends to capture recreational riders, whose gender and ethnicity do not typically represent the overall population, the data is useful to generally determine what routes people are riding. Strava is currently working with municipalities to identify the shortcomings of the data and tailor it better to cities' needs. Eighteen cities have adapted a similar app, CycleTracks, originally created for data collection in San Francisco in 2010. The application's code is open

COUNTERPOINT

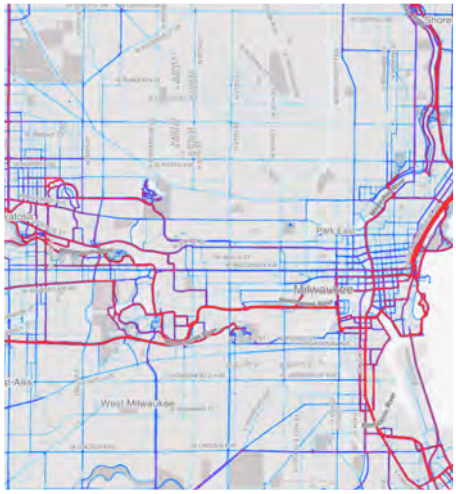
Creator Name:	Green Action Centre
User Type:	
Pros:	• Free • Easy to Use
Cons:	• Does not replace manual counting
Typical Uses:	• Crowdsourced or semi-automated volunteer-collected counts • Short-term research projects
Cost	$
Installation	Easy
Data Extraction	Mobile device



Counterpoint app screenshot (Source: http://counterpointapp.org/)

STRAVA METRO

Creator Name:	Strava, Inc.
User Type:	
Pros:	• Easily readable heat maps • Potentially high number of users per city because of crowd-sourced data
Cons:	• Potential bias towards recreational riders, especially white, older males
Typical Uses:	• Coupled with additional data sources to assist with bicycle infrastructure planning
Cost	$$$
Installation	Easy
Data Extraction	Mobile device



Heatmap of Milwaukee/Wauwatosa, WI. Red shows popular routes (Source: labs.strava.com/heatmap/)

source (http://github.com/sfcta). Cycle Atlanta (cycleatalanta.org) was created to help the City make decisions about locations for new bicycle infrastructure. App users could also submit data about their experience along a given route.

RIDE REPORT (GPS ENABLED ROUTE TRACKER + HARDWARE)

Another app, Ride Report, shares a similar mission to Strava. Once downloaded, the app automatically logs any bicycle trip. Over 20,000 people in Portland have used the app, generating a continuously updating map that displays the ease or stress of bicycling the city's streets. Ride Report's creators are developing bicycle counting hardware to augment their mobile application. The device combines a magnetometer and an infrared camera to count bicyclists. The application automatically logs other app users who pass within 20 to 30 feet of the device. The developing device uses cloud-based data storage instead of expensive physical storage. According to Bike Portland, the Portland Bureau of Transportation (PBOT) purchased 200 of the devices in 2015.

AIRSAGE (ANONYMOUS DATA COLLECTION SOFTWARE)

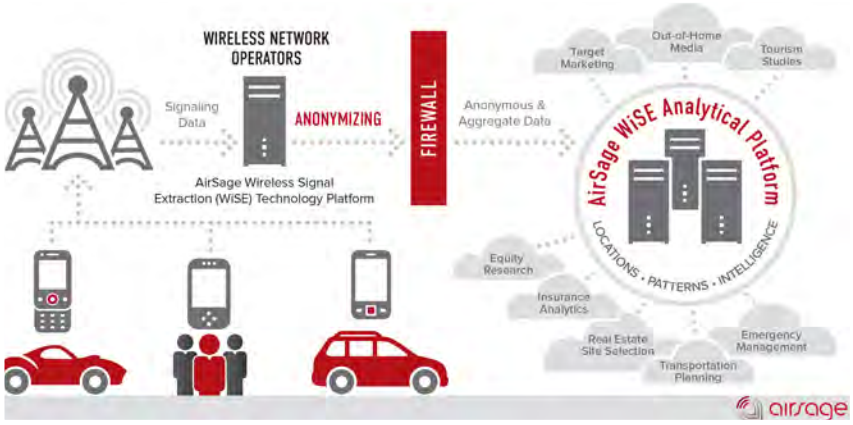
What if the data could originate from common, household devices independent of their owners' guidance? Enter, AirSage, which uses ordinary cellphone signals to generate overall traffic patterns for all roadway users. According to the company website, "AirSage generates billions of anonymous location data points, transforming terabytes of signaling data every day into valuable, relevant and accessible information." However, the current technology makes it difficult to separate the data according to form of transportation.

Ride Report stress map. The least stressful maps are shown in green (Source: ride.report/map)

RIDE REPORT

Creator Name:	Knock Software
User Type:	
Pros:	• Free • Estimates route stress
Cons:	• Only available in Portland, as of this report
Typical Uses:	• Infrastructure planning
Cost	$
Installation	Easy
Data Extraction	Mobile device

Magnetometer/ infrared sensor hardware is under development as of this report.



AirSage's process of collecting and analyzing cell phone data (Source: airsage.com)

AIRSAGE

Creator Name:	Airsage, Inc.
User Type:	
Pros:	• Large data pool • Works well when analyzing data at the macro scale
Cons:	• Difficult to accurately assess geographic travel patterns and mode used at the micro scale
Typical Uses:	• Travel volumes • Site analysis
Cost	$$
Installation	Easy
Data Extraction	Online Dashboard

IMAGERY COUNT TECHNOLOGY

Your city may already have the components necessary for bringing pedestrian and bicycle count volumes to life. Cities already use camera hardware as part of traffic signal operations. Some are beginning to install cameras to detect bicycles at traffic signals. These cameras can help give bicyclists the green light by helping them trigger traffic signals. Modifying other cameras can yield data that analyzes foot traffic, particularly traffic associated with areas of high commercial value.

VANTAGE AND AUTOSCOPE (VIDEO DETECTION HARDWARE)

Vantage video detection systems, produced by Iteris, only require a software update, called SmartCycle, to begin counting people as they bicycle through intersections.

Autoscope video detection, produced by Econolite, also has the ability to detect and count bicyclists. Video technology is useful for long-term count periods. Deploying the equipment for a one year minimum can help the city establish adjustment factors to better estimate annual ridership statistics.

MIOVISION (VIDEO DETECTION HARDWARE)

Miovision's Scout video imaging device uses a telescopic mounting device to obtain unobstructed video imagery. Scout can differentiate between motor vehicles, pedestrians, and bicyclists. The device's screen allows staff to check the unit before it is dismantled in the field. The Miovision Platform helps users understand the captured data. The Platform is also used to transmit data to Miovision staff for processing and quality assurance. Scout imagery is best for capturing data in short durations, such as week-long studies.

VANTAGE AND AUTOSCOPE

Creator Name:	Iteris; Econolite
User Type:	
Pros:	• Cities may already own hardware • Supports other functions, such as bicycle detection at intersections
Cons:	• No pedestrian features
Typical Uses:	• Bicycle traffic volumes; intersection detection; bike minimum green
Cost	$
Installation	Medium
Data Extraction	Depends on model

Iteris SmartCycle bicycle detection and counting (Source: www.iteris.com)

MIOVISION SCOUT VIDEO UNIT

Creator Name:	Miovision
User Type:	
Pros:	• Portable • Online dashboard • Large detection area
Cons:	• Presence or absence of lighting at night can affect accuracy
Typical Uses:	• Short duration studies at one or multiple intersections
Cost	$$
Installation	Medium
Data Extraction	Automatic; field collection

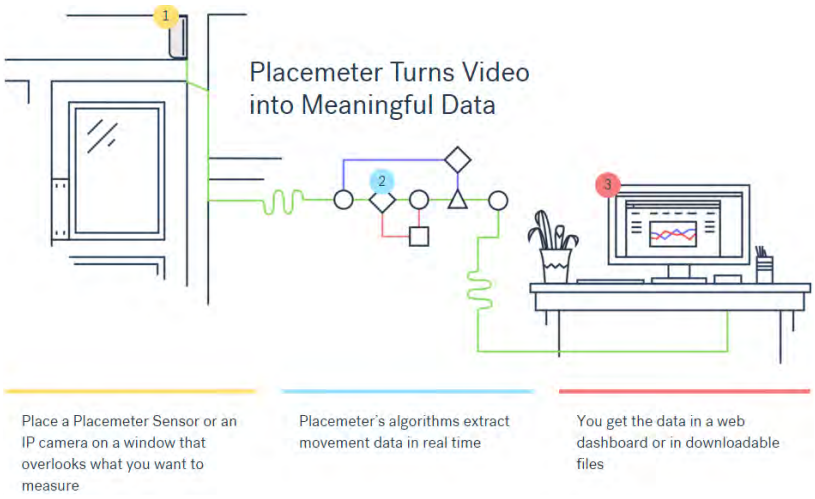
Miovision Scout video camera and LCD screen (Source: www.miovision.com)

PLACEMETER (VIDEO COUNTING SOFTWARE)

Placemeter, a company that emerged in 2012, turns video footage from any camera (including cell phones) into pedestrian, bicycle, and car movement data. First, users attach an existing security camera or a Placemeter Sensor in a window over the preferred measuring point. Placemeter defines a "Measurement Point" as a sidewalk, street, or storefront, where one wishes to measure bicycle, pedestrian, or vehicle activity. Since measurement points cannot currently distinguish between forms of transportation; users must purchase one screenline per mode of transportation. Measuring people walking, bicycling, and driving would therefore require three screenlines. After installation, the company turns measurement point video footage into data displayed on an online dashboard or emailed as a downloadable file. Placemeter can continue ongoing measurement using the Placemeter Sensor or live security cameras. In addition to travel volumes, Placemeter can measure walking direction and store visits, and it is particularly well suited for locations where continuous count data is desired. The second generation Placement Sensor is expected in 2016. One drawback of the technology is that it requires a WiFi connection.

FLIR SYSTEMS (THERMAL SENSORS)

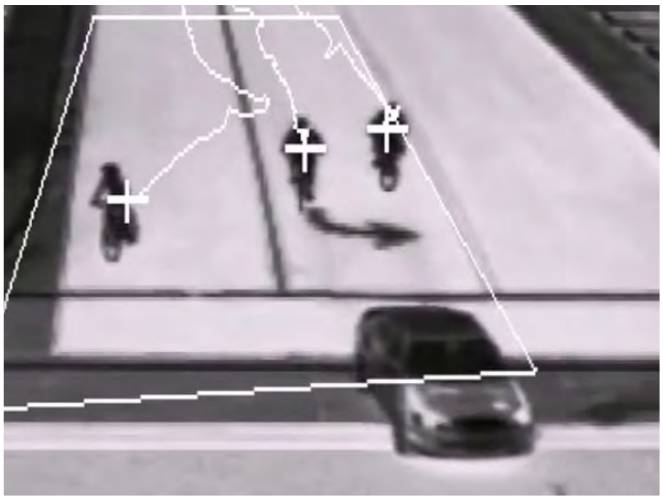
FLIR Systems, Inc. produces thermal imaging devices capable of long-term detection and counting of people walking, biking, and driving. Thermal sensors operate similarly to video sensors. While both types of devices capture imagery, thermal sensors generate images based on objects' and people's naturally-occurring infrared radiation. Thermal cameras do not need natural light to produce imagery. Therefore, they are less vulnerable to occlusion than video.



Process of collecting and analyzing data (Source: placemeter.com)

PLACEMETER

Creator Name:	Placemeter, Inc.
User Type:	
Pros:	• Use existing cameras • Dashboard to view data
Cons:	• Mode differentiation across one screenline is still in development • Need for WiFi may limit suitability in some locations
Typical Uses:	• Place sensor indoors to count in/out shop movements; traffic volumes on a sidewalk/street
Cost	$$
Installation	Easy
Data Extraction	Automatic



Bicycle detection at an intersection (Source: www.popularmechanics.com)

VIP BIKE DETECTION BOARD FOR THERMAL SENSOR

Creator Name:	FLIR Systems, Inc.
User Type:	
Pros:	• Easily installed • Bicycle detection can be used to adapt green time for people bicycling • Large detection area
Cons:	• Poor weather at night can affect accuracy
Typical Uses:	• Long duration counts at one or more intersections
Cost	$$ to $$$
Installation	Medium
Data Extraction	Automatic

INEXPENSIVE HARDWARE

WAYCOUNT (PNEUMATIC TUBE COUNTER)

WayCount, based in New York, offers three DIY-type models. Each device uses pneumatic tubes and inexpensive, easily portable components to count bikes and cars. WayCount produces three devices: Lite, Aluminum, and Hi-Viz. The Lite model is $199. The Aluminum device is $200 plus freight. WayCount Aluminum requires a minimum purchase of 250 units. WayCount Hi-Viz features a screen with 6″ tall LED letters, which makers say can be viewed 100′ away. The screen lets bicyclists, passersby, and drivers see the number of bicyclists counted in real time since the session began. Each of the WayCount devices can collect continuous data throughout a 24-hour period.

NUMINA (WIRELESS SENSOR)

Numina, an emerging product from CTY, used the Knight Foundation Prototype Fund to develop a device to track people walking, biking, and driving. The start-up aims to produce an inexpensive sensor, easily installed on existing light poles, without the need for special tools or know-how.

The 2015 Association of Pedestrian and Bicycle Professionals (APBP) conference proved the perfect testing ground for the fledgling device. Conference attendees provided feedback to improve the prototype. With time, Numina aims to measure noise pollution, air quality, and green space, in relation to traffic counts.

WAYCOUNT

Creator Name:	Tomorrow Lab
User Type:	
Pros:	• Less expensive than other pneumatic tubes • Real time count display
Cons:	• Minimum unit purchase for Aluminum counter
Typical Uses:	• Short-duration counts as part of a citywide program; one-off data collection efforts along a bike facility
Cost	$ to $$$
Installation	Easy
Data Extraction	Field collection

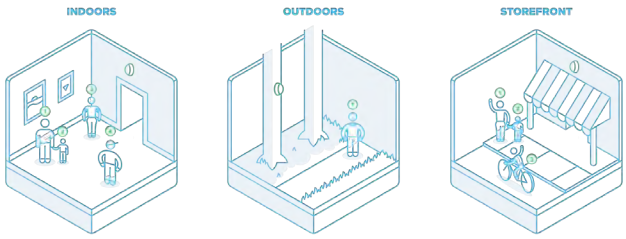
WayCount Hi-Viz in action (Source: http://waycount.com/)

NUMINA

Creator Name:	CTY
User Type:	
Pros:	• Alternative to more expensive equipment • Online dashboard
Cons:	• Not currently available for purchase- in prototyping stage
Typical Uses:	• On-street or off-street volume analysis for short- or long-term counts
Cost	$$
Installation	Easy
Data Extraction	Automatic

Potential applications for Numina sensors (Source: Numina by CTY)

Numina is **analytics for places**.



See **real-time heat maps of activity** for your neighborhood, park, institution, or business. See how *people* move, not just cars.

COUNTING AND MORE

Some devices go beyond counts data collection to investigate other characteristics of an urban space. The Array of Things (AoT) project team is developing sensors to count people in public spaces. They are also working to collect place-related data such as air quality and other indicators.

AoT, led by Argonne National Laboratory and the University of Chicago, is currently working with a $3.1 million grant from the National Science Foundation to develop an "urban-scale 'instrument'" to track a laundry list of freely-available, public data. The project team and the City of Chicago plan to install 50 sensor nodes to streetlights in early 2016. By 2017, the number will grow to 500.

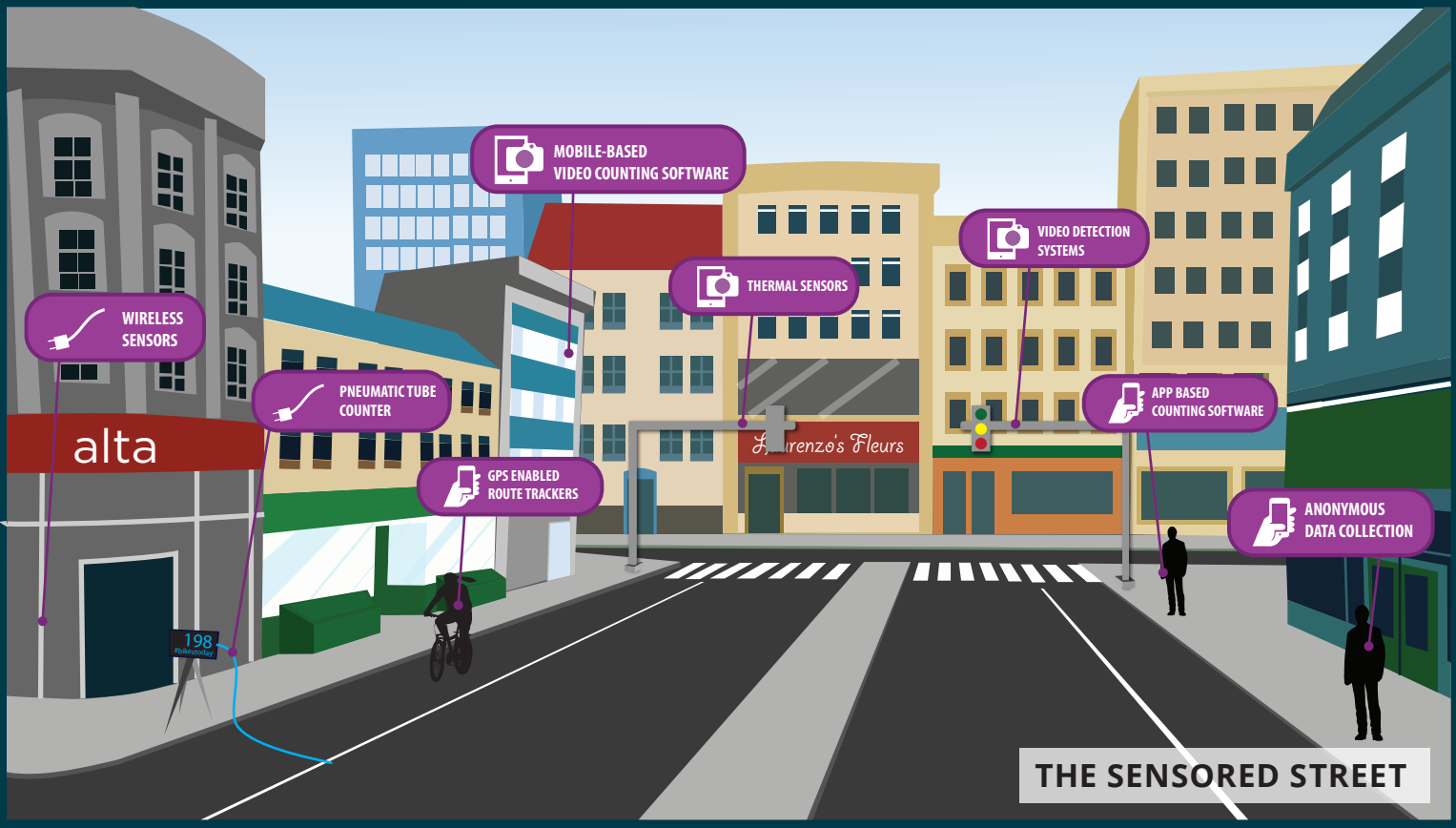
ARRAY OF THINGS PROJECT

Creator Name:	Argonne National Laboratory and the University of Chicago
User Type:	
Pros:	• Will eventually collect data related to air quality and other metrics
Cons:	• Not currently available for purchase- in prototyping stage
Typical Uses:	• Monitor citywide trends related to economic, environmental, and transportation trends
Cost	Unknown

Prototype Photo (Source: Anthony Souffle / Chicago Tribune)

Interested in Learning More?

The range of technologies shown below can help you create powerful datasets to inform transportation planning in your community. Alta Planning + Design offers comprehensive services to develop custom tailored active transportation count programs. We can help you determine which tools are the most appropriate, identify count locations, and coordinate installation. Our analytics team can also collect the data and create compelling visuals to make it useful for decision makers. Please contact us with any questions you have about instituting a tech-driven count program today.



ABOUT THE AUTHORS

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Kristen assists in managing a variety of bicycle and pedestrian projects ranging from data collection and analysis to master planning. She guides cities, regions, and states through the data collection process with the ultimate goal of deciphering data to support their current and future visions.

Sam Piper | sampiper@altaplanning.com

Sam has focused his career on developing better infrastructure for active modes of transportation. He has extensive experience leading long-term count programs and visualizing bike and pedestrian data. He enjoys using technology to make sense of our surroundings and to facilitate decision making.