PRINCETON
bicycle master plan

Summary Report

2017

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Fisher Hall

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Summary Report

Princeton welcomes cycling as an essential, comfortable, convenient, and safe form of transportation for residents and visitors of all ages and abilities. Bicycling will play a critical role in Princeton's future, not only as a recreational activity, but as an everyday and viable means of transportation – as an easy way to get to school, run errands, commute to work, and see friends. Investing in bicycle infrastructure and programs will attract more people to bicycling, encourage them to ride more often and with greater confidence, and have many positive impacts on the quality of life in Princeton, including its livability, safety, affordability, health, equity, economy, and environment.

How Princeton Bicycle Master Plan Will Be Used

The Princeton Bicycle Master Plan (BMP) will inform the development, over time, of a comprehensive cycling network. The BMP provides a vision and framework for the future of cycling in Princeton that should be implemented in three ways:

- As roads are due for resurfacing or other routine maintenance, the BMP should guide the design of streets to appropriately accommodate bicyclists and further the implementation of the bicycle network
- The BMP should be used to support applications for grants and other funding, or to direct local funding towards bicycle and Complete Streets projects
- The BMP should guide the development of programs and policies that support a bicycle friendly community and encourage more people to bicycle as a means of daily transportation

The vision and framework outlined in the BMP are the result of an inclusive process that reflects a community supported vision. The BMP should help provide context and justification for future bicycle infrastructure projects and assist the community and stakeholders in understanding why a bicycle facility is being included in a project and where that particular facility fits in the overall network and vision. The BMP should be used not only by public officials, but also by the public to better understand and support the development of a safer, healthier, and more mobile Princeton.

Methodology

The development of the Princeton Bicycle Master Plan was undertaken in four primary tasks, as described below. The result is a Bicycle Master Plan that will help Princeton implement its Complete Streets policy and achieve its goal of creating streets and corridors that are safe and accessible to users of all modes, ages, and abilities.

The Princeton Bicycle Master Plan provides the Princeton community with a framework for the future of bicycling in the Municipality. It provides clarity to the purpose of bicycle improvements, as well as the strategy for implementing where and what type of bicycle facilities will be developed in the future. The BMP will guide Princeton towards realizing its vision of a town where users of all ages can safely and comfortably ride a bicycle regardless of their abilities, the purpose of their trip, or their destination.

Planning Context

- Review of existing plans, policies, programs, and previous studies
- Evaluation of geographic, transportation, and demographic context
- Summary of benefits associated with improved bicycle infrastructure

VISION STATEMENT

Princeton values cycling as an essential form of transportation for residents, workers, and visitors. Implementation of the Bicycle Master Plan over time creates a community that allows bicyclists of all ages and abilities to safely, comfortably, and conveniently access major destinations throughout Princeton. As a result, Princeton is a more livable, vibrant, equitable, healthy, and sustainable place, whose streets encourage people to bicycle for fun, recreation, and daily transportation.

Community Involvement

- Input and guidance from a local Study Advisory Committee
- Meetings with 3 Focus Groups, representing different community interests and perspectives
- Direct involvement of the Planning Board
- Online Wikimap, gathering 516 comments from 84 unique users
- Online survey (470 responses)
- Comment forms (>120 responses)

Existing Conditions Analysis

- Crash data analysis
- Bicycle level of traffic stress analysis
- Review of existing infrastructure (paths, roadways, parking)

Recommendations

- Provides references and standards related to bicycle infrastructure design
- Identifies and prioritizes bicycle network and parking improvements
- Includes programs and policies to support implementation, including education, enforcement, encouragement, and evaluation actions and initiatives
- Incorporates a variety of facility types to accommodate vulnerable users and cyclists of all abilities
- Establishes municipal-wide network that links residential areas with key travel destinations
- Includes metrics and indicators to monitor BMP implementation and alignment with its vision and goals
- Supports implementation of municipal capital improvement program

Goals, Metrics, and Indicators

The Princeton Bicycle Master Plan presents a vision for the future of cycling in the community. To support this vision, the Princeton BMP seeks to achieve the following goals:

Goals

1. **Policy** – Advance and support the Municipality's Complete Streets Policy and Master Plan.
2. **Safety** – Improve safety for all roadway users and prioritize bicycle safety for those with limited transportation options, including school-age children and other vulnerable roadway users.
3. **Accessibility and Comfort** – Create a low-stress bicycle network that is accessible to cyclists of all ages and ability levels.
4. **Connectivity and Convenience** – Develop a core bicycle network with seamless and convenient connections throughout the municipality and across the region, including schools, offices, public library, parks, local shopping, and residential neighborhoods.
5. **Mobility** – Encourage higher bicycle use for short, local trips to mitigate roadway congestion and parking demand issues in the downtown core.
6. **Health** – Encourage and promote cycling as an active and environmentally sustainable form of transportation to improve community health and wellness.
7. **Equity and Social Justice** – Recognize cycling as an essential transportation mode, especially for those who cannot afford to own cars, and as an integral part of maintaining the community's social diversity. Acknowledge that streets are public spaces, both in terms of their legal status and in terms of their appropriate use to benefit the community as a whole.
8. **Awareness and Mutual Respect** – Promote safe cycling practices and a mutual respect and better understanding of the rules of the road among all roadway users through education, enforcement, and encouragement programs.
9. **Process and Implementation** – Establish a clear framework for implementation of the Bicycle Master Plan and creation of a core bicycle network that reflects local context, recognizes the spectrum of travel needs and facility types, and acknowledges the need for balance and trade-offs in the design of specific improvements.

Metrics and Indicators

To monitor and evaluate progress towards realizing the Princeton BMP's long-term vision and goals, the following targets will help track implementation:

- Implement one new bike facility project every year
- Double the number of students who bike to school within 5 years
- All residents live within one-half mile of a low-stress bicycle facility within 5 years
- All residents live within one-quarter mile of a low-stress bicycle facility within 10 years
- Double number that bike to work by 2025
- Implement annual bike count program
- Implement bike share system by 2017
- Implement a Vision Zero safety initiative
- Double the amount of bicycle parking available in the downtown core within 5 years
- Attain Silver Level Bicycle Friendly Community status

Types of Cyclists in Princeton

(clockwise from top-left) (1-3) Commuters along Witherspoon Street, Nassau Street, and Olden Street, respectively. (4) Students walking and biking to school along Franklin Terrace. (5) Commuter along Witherspoon Street. (6) Shopper along Nassau Street.

Bicycle Network

To achieve the goals of the Princeton BMP, the Municipality should create a bicycle network that is continuous, connected, convenient, complete, and comfortable for cyclists of all ages and abilities. Improving Princeton's roadways, paths, and trails to make the community more attractive and accommodating to cyclists will enhance mobility and encourage higher rates of bicycling in Princeton. Using input from the public involvement process, existing conditions analysis, and other data and information summarized in Chapters 1-4, as well as bicycle facility design guidance outlined in Chapter 5, the BMP identifies a core bicycle network and accompanying infrastructure improvements to create an interconnected bicycle network in Princeton. The proposed network represents a long-term vision for the future of bicycling in Princeton that can be implemented incrementally over time.

Identifying the Network and Facility Types

Developing the bicycle network was an iterative process of identifying potential routes and bicycle facility types. The selection of routes and facility types was driven by the following factors.

User Needs

The bicycle network must reflect the needs of its users. To achieve the BMP's goals related to convenience, connectivity, and mobility, it must link residential areas with key destinations, including schools, the downtown core, Princeton University, the library, parks and regional trails, the Princeton train station, and the Princeton Shopping Center.

The "desire lines" identified by the public during outreach activities provided the basis for the draft network. These routes were supplemented with additional links to enhance overall network connectivity and provide some redundancy and route choice.

In order to encourage higher ridership, the bicycle facilities implemented along each part of the network must support the BMP's goals of safety, accessibility, and comfort. The focus is on developing a low-stress bicycle network that accommodates the 60% of the population who are interested in cycling, but do not bicycle regularly due to a variety of concerns often related to safety. The proposed network should enhance mobility for children. Increased bicycling rates by this age group (ages 12 to 18) is an indicator of a quality low-stress network, where both children and their parents feel the network provides a comfortable and safe bicycling environment.

In line with the BMP's goals related to equity and social justice, the network must also support the needs of residents who rely on bicycling as a form of transportation. It must make bicycling a safe, comfortable, and convenient mode of transportation for those that do not have access to a car. The network must connect residential areas of the Municipality to the downtown and areas of employment, as well as regional linkages to neighboring municipalities.

As was shown in the Princeton survey responses, as well as national data, exposure to high traffic speeds and busy streets are a significant barrier to cycling and there is a strong user preference for separated facilities. Creating a network that emphasizes low speeds and separated facilities are therefore key components of an effective low-stress bicycle network.

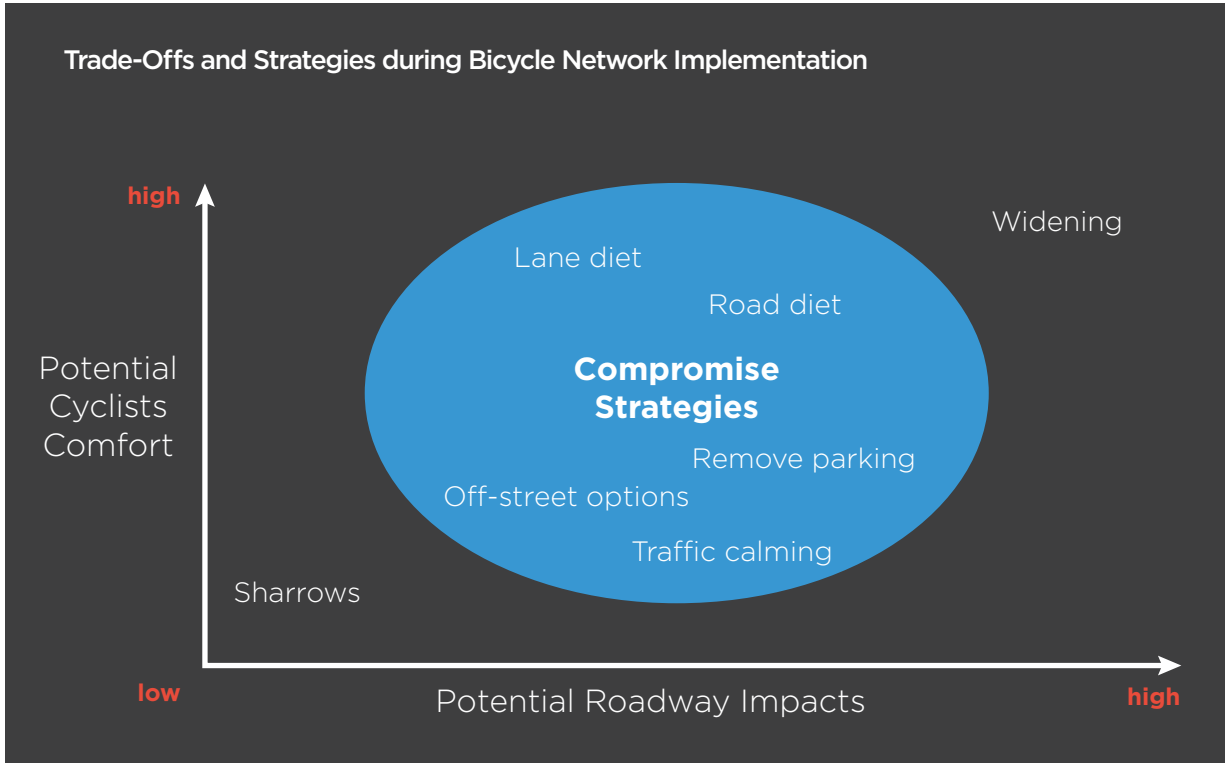
The desire lines overlaid with the existing bicycle level of traffic stress analysis combined critical information on user needs. It illustrates where users want to bicycle, and what routes would need to be improved in order to better accommodate them. This provided the starting point for identifying the network and developing targeted bicycle improvements to create a low-stress network. A design target of LTS 1 is desired to create a comfortable network for all bicyclists.

Context and Trade-Offs

The proposed facility type is driven largely by the context of each link of the network. Factors such as the surrounding land use and density, traffic volume and speed, frequency of driveways, on-street parking demand, proximity of off-street parking options, historical context, constraints such as street trees and utilities, and existing roadway widths were used to help identify appropriate bicycle facilities. The proposed network leverages Princeton's existing shared-use paths by improving conditions to bring them up to current standards. It also utilizes the Municipality's low speed, low volume local street network to provide parallel, alternative routes where feasible.

Implementation of the bicycle network will inevitably involve trade-offs as Princeton strives to implement its Complete Streets policy and create a more balanced, multimodal transportation network. For each section of the network, alternatives range from striping shared-lane markings to roadway widening and right-of-way acquisition. The shared-lane marking alternative does not impact the roadway, but essentially maintains the status quo for cyclists and provides no benefit from the perspective of traffic stress. The Municipality typically owns a minimum of 50 feet of right-of-way along each roadway. This provides an opportunity to widen or realign roadways in order to provide dedicated facilities for cyclists, but requires more significant capital costs and potential impacts to residential landscaping, street trees, utilities, driveways, etc.

Where there is limited existing curb-to-curb pavement width, the proposed facilities attempt to minimize capital costs and right-of-way impacts while still striving to create a low-stress network. This requires reconfiguring the existing roadway through signing and striping changes, while recognizing potential trade-offs may be necessary to improve overall community mobility. Examination of changes to public streets must consider not only the needs of local residents, but the needs all residents and street users. Trade-offs include narrowing travel lanes or removing on-street parking in order to provide additional space for bicycle facilities. One-way pair alternatives were also considered, but were not advanced due to potential impacts on traffic speed and overall circulation patterns and a limited area where this option is possible. Ultimately, any changes must be approved by the town council on a project-by-project basis.



Proposed Network

The full Proposed Bicycle Network Map is shown on the opposite page. This map illustrates the proposed on-road bicycle facilities, shared-use path improvements, and intersection improvements recommended as part of the Princeton BMP. A closer look at the proposed network through the center of Princeton is provided on page 11.

The proposed bicycle network includes approximately 67 miles of on-road and off-road bicycle facilities. The types of bicycle facilities are described in Chapter 5, and the total mileage of each facility type is shown in the table to the right.

In addition to corridor improvements for bicyclists, intersection improvements are also recommended at several locations throughout the network. Intersection improvements are critical to the connectivity and performance of the proposed low-stress network and overall user comfort. A high-stress intersection can create a significant barrier on an otherwise low-stress corridor, causing the network to become fragmented and discontinuous. Improvements are recommended to support the corridor recommendations and develop a network that is accessible for cyclists of all ages and abilities.

Total Mileage of Proposed Bicycle Network (by type)

Facility Type	Length (miles)	% of Network
Improved Shared-Use Path	18.7	28%
New Shared-Use Path	10.9	16%
Separated Bicycle Lane	0.4	1%
Bicycle Lane	9.0	13%
Bicycle Lane + Shared-Use Path	0.9	1%
Bicycle Lane + Shared-Lane Markings	0.4	1%
Bicycle Boulevard	12.1	18%
Shared-Lane Markings	2.2	3%
Enhanced Shared-Lane Markings	3.9	6%
Pipeline Recreational Trail	7.5	11%
Complete Street Corridor Plan	1.1	2%
TOTAL	**67.0**	**100%**

Implementation

The proposed bicycle network is intended to be conceptual in nature and based on typical roadway characteristics. Detailed design will occur during implementation on a project-by-project basis, following the design guidance outlined in Chapter 5 and supplemented with more detailed best practice design guidance from NACTO, AASHTO, and FHWA, also referenced in Chapter 5. The design of a bicycle boulevard, for example, may vary slightly from street to street. While a 20 mph speed limit and signature wayfinding signage should be consistent, the type of traffic calming elements will be determined by the unique needs and context of the street.

Each project must consider user needs, the surrounding context, and potential trade-offs required to meet the needs of all street users. The proposed network minimizes the need for trade-offs, while still meeting the goals of the BMP. Potential trade-offs are limited to:

Speed limit reduction

- All bicycle boulevards (20 mph)
- NJ Route 27
- Snowden Lane/Van Dyke Road
- Washington Road

Potential impacts to on-street parking

- Harrison Street (Prospect Avenue to Carnegie Lake)
- Hodge Road (Library Place to U.S. Route 206)

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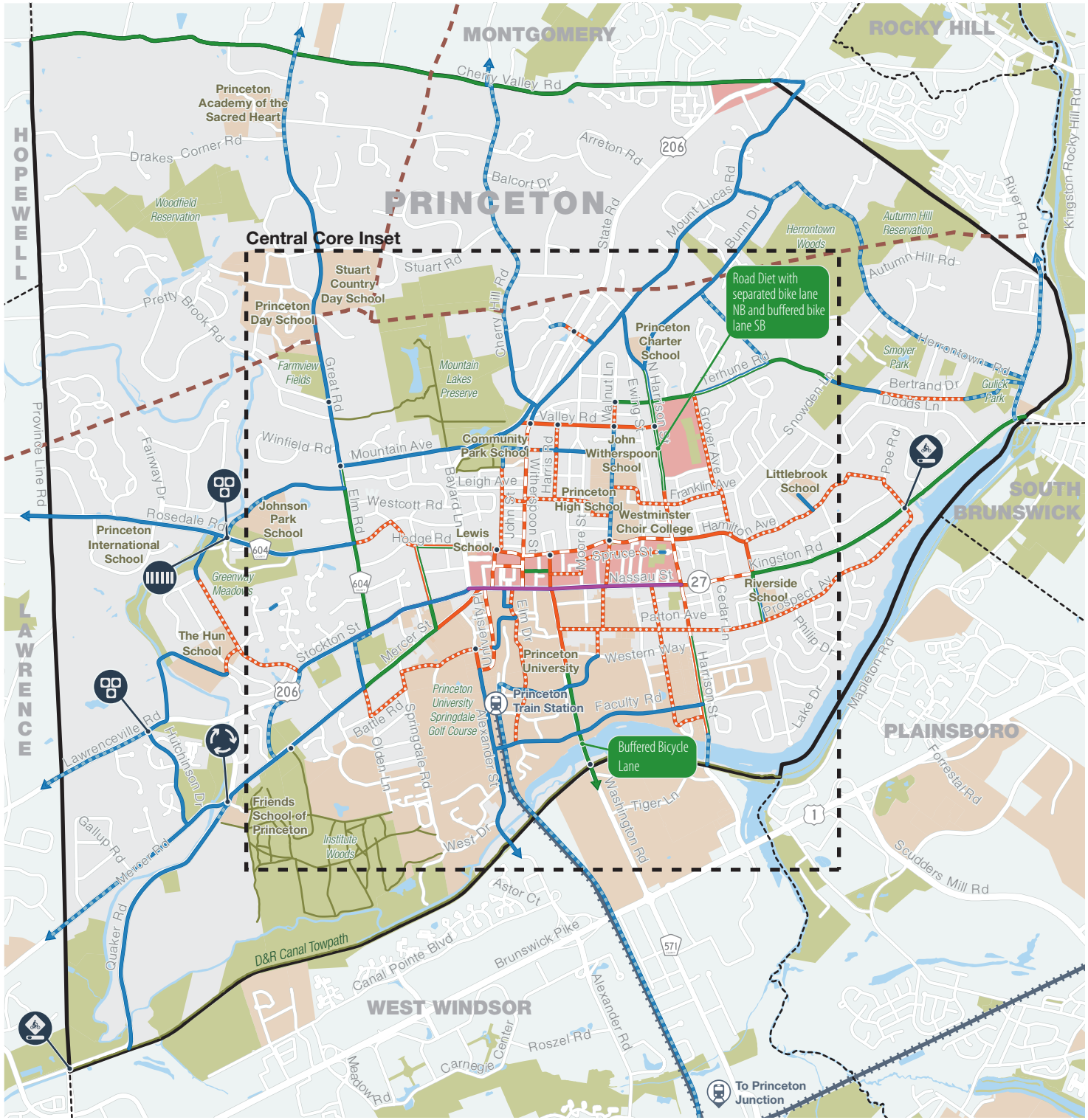
Proposed Bicycle Network

- Complete Street Corridor Plan
- Improved Shared-Use Path
- New Shared-Use Path
- Separated Bike Lanes
- Bicycle Lane
- Bicycle Lane + Path
- Bicycle Lane + Shared Lane
- Bicycle Boulevard
- Shared-Lane Markings
- Enhanced Shared Markings
- Pipeline Recreational Trail
- School
- Park
- Commercial Area
- Existing Trail

Intersection Improvement

- Roundabout
- RRFB
- HAWK
- Bike Box
- Crosswalk Enhancements
- Inset Intersection Improvement

0 0.25 0.5 1 Miles



- Library Place (Hodge Road to Mercer Street)
- Mercer Street (Library Place to Lovers Lane)
- NJ Route 27 (Washington Road to U.S. Route 206; actual impact dependent on which alternative is advanced)
- Riverside Drive (NJ Route 27 to Prospect Avenue, prohibited on southbound side only)

Potential right-of-way impacts

- Widening of existing or construction of new shared-use paths may involve minor right-of-way impacts, and will vary on a project-by-project basis.

The Princeton BMP provides a baseline core network to prioritize improvement strategies. The network is intended to be a starting point and updated periodically as needs change. The network may be expanded or additional improvements made as needs arise or opportunities are available through other roadway projects.

Project Prioritization

The proposed bicycle network can be developed incrementally, integrating improvements into routine maintenance and resurfacing projects to reduce costs and create a comprehensive network over time. Two factors should help drive project prioritization:

- Build out the network around projects already identified in the Municipality's six-year capital program
- Target projects that improve access to schools and major activity hubs (downtown, Princeton Shopping Center, train station, D&R Canal)

Through these strategies, Princeton can create an initial core that improves bicycle mobility to major destinations. Over time, additional links can be added to enhance network connectivity and create more route choices.

Priority projects include a mix of both low hanging and more transformative projects. Low hanging fruit, such as bicycle boulevard improvements, restriping, or enhancements to existing paths can be implemented relatively quickly and at lower cost. Transformative projects, such as the proposed Nassau Street Complete Street Plan and Harrison Street road diet, require more substantial investment but impact high demand areas and create highly visible bicycle infrastructure that can generate excitement and spur faster growth in bicycle ridership.

The proposed priority projects to develop an initial core network include the following corridors:

- Hodge Road/Hamilton Avenue (Elm Road to NJ Route 27)
- Prospect Avenue (NJ Route 27 to Washington Road)
- Walnut Lane/Chestnut Street/Olden Street (Terhune Road to Princeton Station)
- Terhune Road (Walnut Lane to Harrison Street)
- Harrison Street (Terhune Road to Hamilton Avenue)
- Franklin Avenue (Walnut Lane to Leavitt Lane)
- Leavitt Lane (Franklin Avenue to Hamilton Avenue)
- Guyot Avenue/Path (Walnut Lane to John Street)
- Nassau Street (US 206 to Harrison Street)
- Elm Road / Lovers Lane (Mountain Avenue to Mercer Street)
- Johnson Trolley Path (Elm Road to Rosedale Road)

These improvements are listed in Appendix D. As additional opportunities arise, other segments of the network can be added to the list and advanced more quickly.

Network Gaps and Future Initiatives

Some existing gaps in the proposed network will require a re-examination of needs and trade-offs to incorporate enhanced bicycle facilities into longer term corridor improvements. Key remaining gaps in the low-stress network include Nassau Street, Witherspoon Street, and the Hamilton Avenue corridor. Longer term strategies to address these gaps are discussed in the BMP and appendices.

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Proposed Bicycle Network:
Central Core

- Complete Street Corridor Plan
- Improved Shared-Use Path
- New Shared-Use Path
- Separated Bike Lanes
- Bicycle Lane
- Bicycle Lane + Path
- Bicycle Lane + Shared Lane
- Bicycle Boulevard
- Shared-Lane Markings
- Enhanced Shared Markings
- Pipeline Recreational Trail
- School
- Park
- Commercial Area
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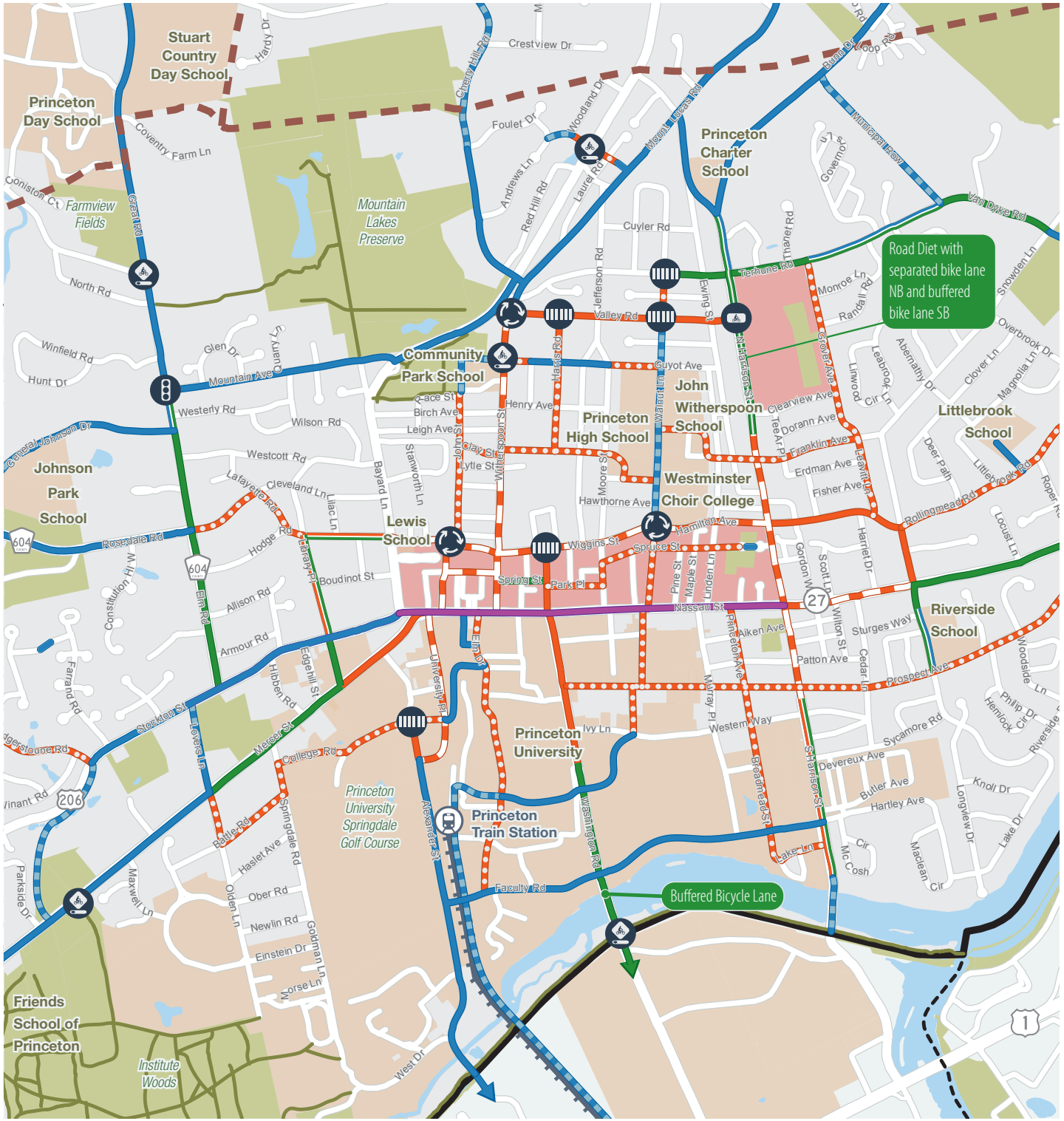
Intersection Improvement

- Roundabout
- RRFB
- HAWK
- Bike Box
- Crosswalk Enhancements
- Traffic Signal

0 0.25 0.5 1 Miles



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