



**2015**



# **Bedford**

## **Pedestrian + Bicycle Plan**

## Bedford Pedestrian and Bicycle Plan

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**December 2015**



# **Bedford**

## **Pedestrian + Bicycle Plan**

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# Introduction

## About the Plan

The Bedford Pedestrian and Bicycle Plan provides a tremendous opportunity to improve bicycling and walking in the Town and its implementation will contribute to a healthier, safer, more vibrant community. In 2014, the Healthy Bedford Task Force and Bicycle Advisory Committee, along with other departments and committees, initiated the development of a Pedestrian and Bicycle Plan (the Plan) to improve walking and bicycling capacity and connectivity throughout Town and to increase the transportation options available to residents of all ages. This plan was a key recommendation set forth in the Town of Bedford Comprehensive Plan (December, 2013). The plan indicated a goal to “Develop a pedestrian/bicycle connectivity master plan, covering sidewalks, crossings, off-road pedestrian and multipurpose trails, and identifying relatively safe on-road bicycle routes and lanes.

This project included an analysis of existing conditions and extensive community input. The resulting Plan, presented here, includes prioritized recommendations which will improve and expand the Town’s pedestrian and bicycle network as well as non-infrastructure strategies designed to encourage safe walking and bicycling. These investments will build upon the existing sidewalk, trail and bicycle route network and provide additional transportation and recreation opportunities for residents and visitors.

## Why Walking and Bicycling?

Walking and bicycling are forms of active transportation that can be enjoyed by people of all ages. These forms of transportation help maintain one’s health and contribute to the livability of communities. Increasingly, residents want and expect their communities to provide good walking and bicycling facilities. In a recent survey by Healthy Bedford, residents cited “Community” and

“Trails and Nature” as the factors that most impact their quality of life in a positive way. When asked what they find to be the biggest challenge to quality of life, “Traffic” and “Lack of Sidewalks” were among the top issues cited.

Among the many reasons walking and bicycling are important include:

- In 2012, less than half of adults living in the U.S. reported meeting the recommended physical activity requirements and a third reported being physically inactive.
- Approximately 13 percent of people in the U.S. who are 16 years of age or older do not drive. This figure includes persons with temporary or permanent disabilities, those who cannot afford to drive, seniors, or those who have chosen to travel by other modes.
- Walking is an essential form of transportation for people who do not drive. In addition, everyone is a pedestrian at some point in their journey—even if it is just walking to a parked car or to public transportation.
- Walking is the most frequently reported activity among adults who meet physical activity guidelines, as well as for those who do not.
- Bicycling is becoming increasingly popular as a healthy and inexpensive mode of transportation. Bicycling is a good option for trips that may be too far for walking but don’t require a vehicle.

## Planning Process

To gain an understanding of the walking and bicycling needs in Bedford and the potential for increasing trips by these modes, the planning process for this project incorporated several elements, including:

- Existing conditions analysis
- Data collection in the field
- Identification of a vision and goals through discussions with the plan’s steering committee and public input

- Development of infrastructure and non-infrastructure recommendations and a guide for implementation
- Review with the steering committee and public

## Existing Conditions

As a first step to determining the walking and bicycling needs in Bedford, the planning team analyzed existing conditions through research on demographics, transportation trends, and field observations. This section of the Plan summarizes the information related to existing pedestrian and bicycle safety and access, facilities planning, and community health in the Town of Bedford.

### Community Profile

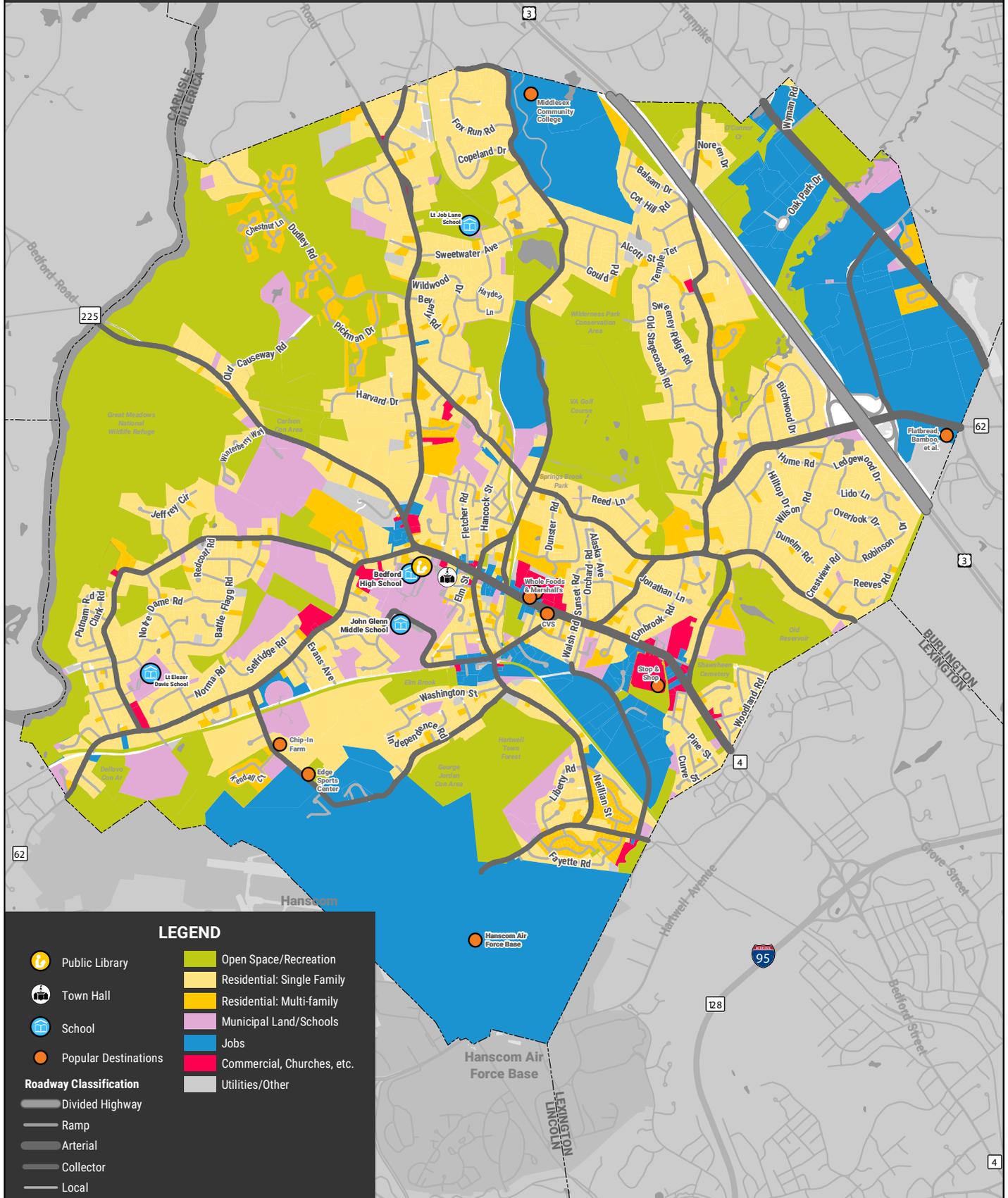
Bedford is located in Middlesex County, about fifteen miles northwest of Boston immediately outside of the I-95/Route 128 belt and west of Route 3. Bedford is a regional employment center with more jobs, mostly professional and educational, than residents. The southern part of Bedford is largely occupied by Hanscom Air Force Base, and the regional retail and employment center in Burlington is to the east. The Town center is located off The Great Road/Routes 62/4/225. There are retail developments in this area, as well as municipal services such as the town hall and library, schools, and single family residential neighborhoods. Steeped in colonial area history, visitors are drawn to Bedford’s historic sites including homes, the Old Burying Ground, The Wilson Mill, the Job Lane House and the original Bedford Flag. Figure 1 illustrates the land use designations in Bedford.

The population of Bedford is approximately 14,500. According to 2013 U.S. Census data, 35% of households are families with children under the age of 18. Demographic data provided by the Boston Region Metropolitan Planning Organization (MPO) indicate that Bedford’s senior population makes up a slightly larger portion of its population (13.5%) than the regional average



# Bedford

## Pedestrian + Bicycle Master Plan



**LEGEND**

	Public Library		Open Space/Recreation
	Town Hall		Residential: Single Family
	School		Residential: Multi-family
	Popular Destinations		Municipal Land/Schools
	Divided Highway		Jobs
	Ramp		Commercial, Churches, etc.
	Arterial		Utilities/Other
	Collector		
	Local		

Figure 1: Land Use and Street Types

(9.6%). With a number of children and seniors, many of whom may be unable to drive, there is a need to improve residents' access to non-motorized forms of transportation.

Existing development patterns in centers along and near the Great Road are typically very car oriented as part of a post-World War II development pattern. The Town Comprehensive Plan sets forth goals of reinforcing slightly denser, mixed use, and multi-modal development in these existing developed area.

With improvements to local infrastructure and increased awareness of walking and bicycling options, many destinations in Bedford could be accessible by walking or bicycling. Major destinations include elementary schools, central retail areas, the Veterans Administration Hospital, and Hanscom Air Force Base, among others. Figure 2 illustrates potential bicycling and walking demand based on major destinations.

### Bicycling and Walking Network

According to the 2013 American Community Survey, 1.9% of Bedford's population commuted by walking and 0.3% commuted by bicycle. Nationally, 2.8% of the population walked to work and 0.6% commuted by bicycle.

As shown in Figure 3, Bedford is a nexus of regional bike paths, both paved and unpaved. The paths are popular for both recreational and commuting purposes. The popularity of the trail in this area suggests that connecting the three could provide an economic development opportunity. In addition, the weekday and weekend trends show that the facility serves both commuter trips as well as recreation trips. On-road bicycle facilities include bike lanes on Burlington Road and shared-lane markings on Hancock Road, Hillside Road, and Springs Road.

While many neighborhoods have sidewalks, a number of neighborhoods do not. These include:

- The Great Road (between South Road and Shawsheen Road, in particular)
- North Road

- South Road
- Carlisle Road
- Concord Road
- Davis Road
- Hartwell Road
- Page Road and
- Wiggins Avenue

Davis Road is in particular need of a sidewalk since Davis School is located there. The Bedford Bicycle Advisory Committee has proposed a trail easement plan to improve connectivity in and around the town center, to improve access by walking and biking, and to reduce car dependence.

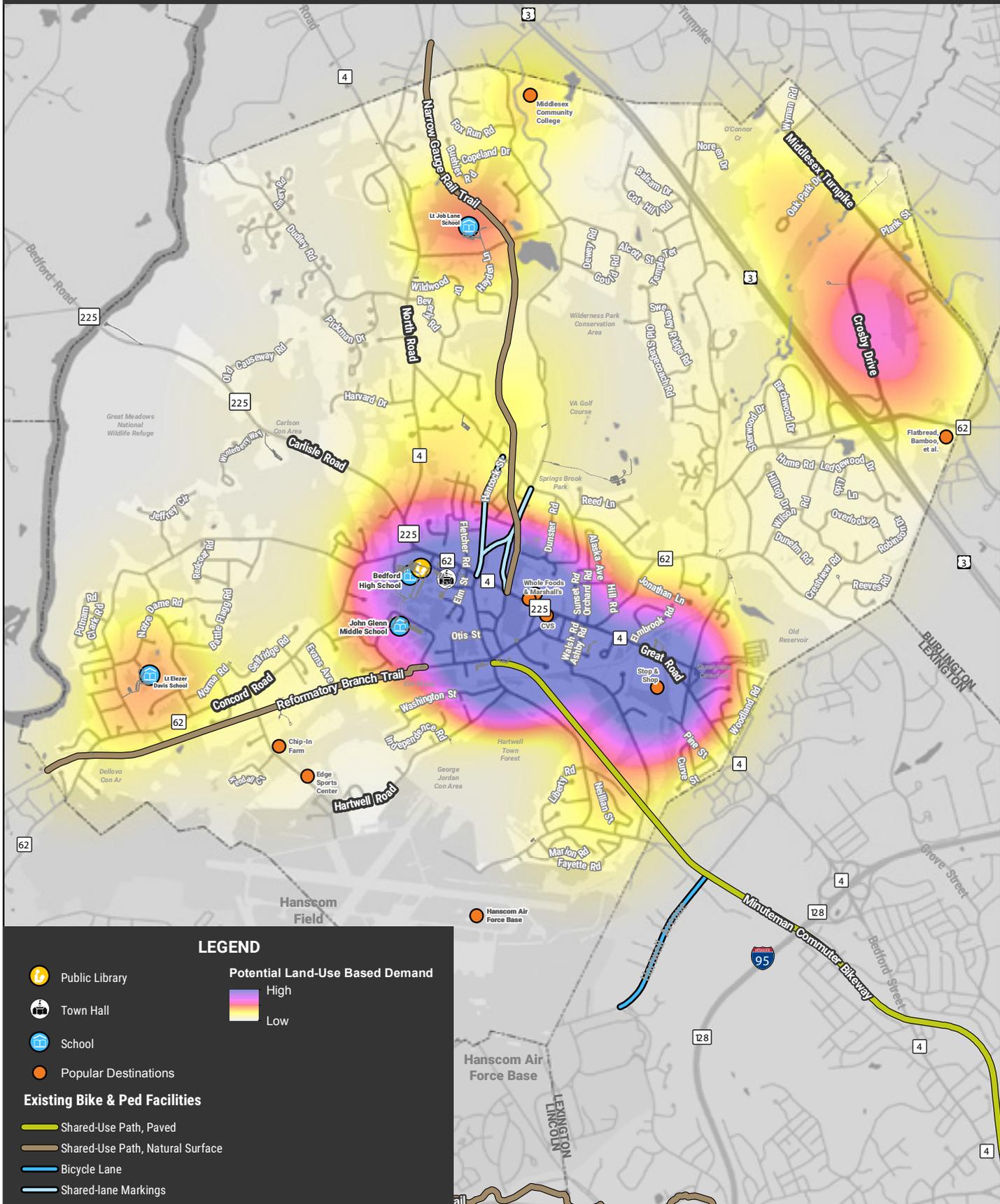
Spot counts conducted along the Minuteman Bikeway in Bedford indicate the popularity of the trail for both commuting and recreation purposes. Counts taken on a Wednesday in June of 2014 show 253 pedestrians and bicyclists between 10:30 AM and 11:30 AM. Counts taken on a Saturday in July of 2013 show 452 pedestrians and bicyclists between 9:00 AM and 10:00 AM. On both days, bicyclists represented over 80% of users on the trail.



*Minuteman Bikeway in Bedford*

# Bedford

Pedestrian + Bicycle Master Plan



## LEGEND

- Public Library
- Town Hall
- School
- Popular Destinations

### Existing Bike & Ped Facilities

- Shared-Use Path, Paved
- Shared-Use Path, Natural Surface
- Bicycle Lane
- Shared-lane Markings

Potential Land-Use Based Demand

High

Low

Figure 2: Potential Bicycle and Pedestrian Demand

# Bedford

Pedestrian + Bicycle Master Plan

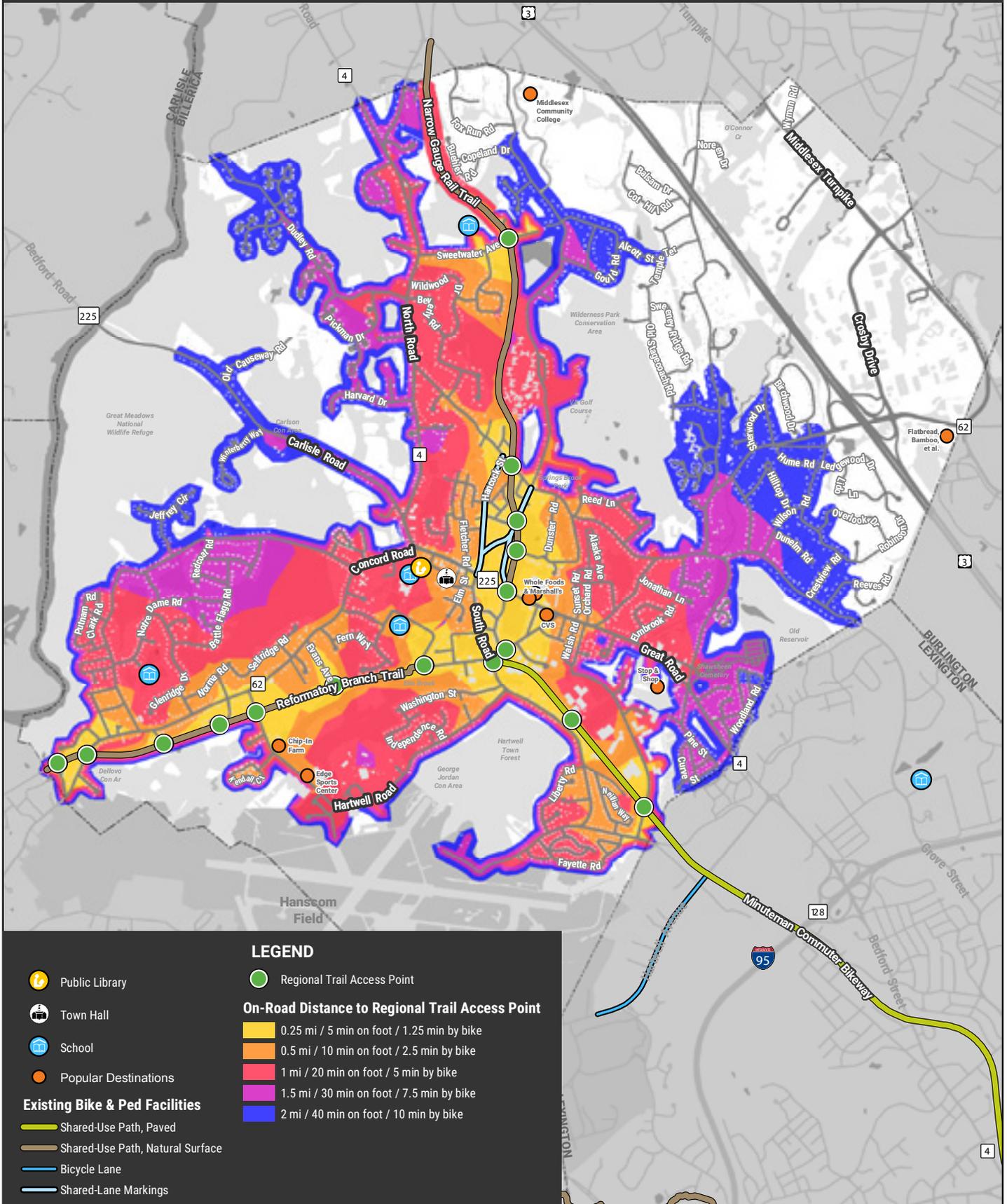


Figure 3: Regional Trail Access



*The Great Road*

## Roadway Network

Bedford's roadway network includes a number of major arterials and highways including Routes 3, 4, 62 and 225. I-95/Route 128 and Route 3 are the most traveled roads in Bedford, followed by The Great Road. The only designated on-street parking in Bedford, aside from private roads or business parks, is on The Great Road through the town center. The roads in Bedford are often historic and typically have two lanes and narrow rights of way. Speed limits are 25 or 30 MPH throughout Bedford, except west of Town center. Figure 4 shows the average daily traffic (ADT) of major roads in Bedford. The traffic volumes on the majority of the collector and arterial roads through Bedford are typically very high and result in significant congestion during peak commuter hours.

## Transit

Improving pedestrian and bicycling access to transit can increase transit ridership as well as broaden the number of destinations a pedestrian or bicyclist that can reach by incorporating transit as part of their trip. There are three providers of transit service in Bedford:

1. **Bedford Local Transit (BLT):** Provides in-town service to locations along The Great Road. BLT offers scheduled transport to shopping malls and other stops in Bedford,

Billerica, and Burlington, as well as on-demand door-to-door service within Bedford.

2. **Massachusetts Bay Transit Authority (MBTA):** Route 62, with service from Alewife Station to Bedford V.A. Hospital, runs along Route 225 in Bedford and offers connections with BLT at Stop & Shop, CVS and Old Town Hall. The 76 bus provides service from Alewife to Hanscom Air Force Base. Route 62 buses have front-mounted racks that for bicycles. Route 351 provides service from Alewife to Wiggins Avenue businesses.
3. **Lowell Regional Transit Authority:** The Route 14 bus runs through Bedford for service to the Burlington Mall and Lahey Clinic with stops at Bedford Springs Apartments and the Mitre Facility. Route 14 vehicles can accommodate up to two bicycles on exterior bike racks.

Bedford Local Transit provides door-to-door service and there are sidewalks on at least one side of the road along the MBTA route. The Bicycle Advisory Committee's easement plan describes additional connections in the retail areas and town center which would support transit access.

## Safety

Crash data reported from 2002 to 2012 reveals that the majority of crashes occurred on The Great Road. One quarter of crashes reported involved an injury. Of the 3,289 reported crashes, 22 involved a bicyclist and 16 involved a pedestrian.

## Related Plans and Studies

The Town of Bedford has developed a number of plans and studies that point to the need to improve conditions for walking and bicycling and this Plan builds on these previous efforts.

The 2013 Bedford Comprehensive Plan clearly notes the importance of developing and maintaining bicycle and pedestrian facilities for both transportation and recreational purposes.

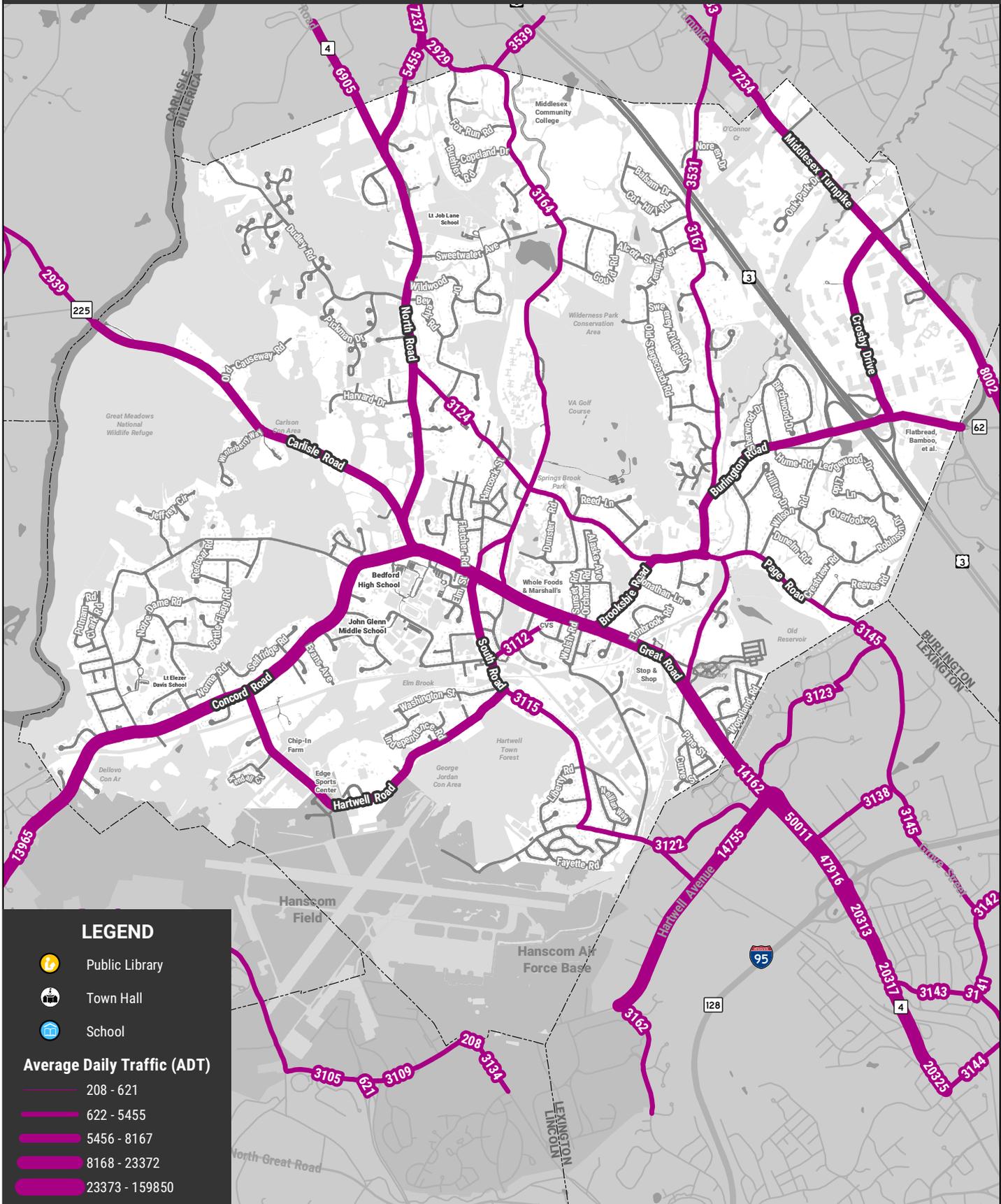


Figure 4: Average Daily Traffic

While the plan does not outline specific areas of improvement, it does call out several strategies, such as zoning policies requiring bicycle and pedestrian facilities, streetscaping to attract walkers and bicyclists and calm traffic, and lane width reductions as part of repaving programs.

The plan's vision calls for an increase in walking and biking, as noted in the following excerpt:

*“Multi-modal transportation alternatives, transportation demand management efforts, and land use changes encourage use of alternative modes of travel... Connected sidewalks, paths, and bicycle trails and lanes enable residents to walk or ride their bicycles to shopping and employment destinations, as well as for recreation or health... The corridors safely accommodate drivers, transit riders, walkers and bicyclists. New development projects in the village centers and other locations incorporate a blend of housing, jobs, and amenities such as retail and recreation, with less reliance on motorized vehicle trips.”*

Additionally, Goal 3 of the plan's six goals calls to “Increase the connectivity of the pedestrian and bicycle network.”

The Town of Bedford, along with the Towns of Arlington and Lexington, worked with the Massachusetts Department of Conservation and Recreation (DCR) to develop Navigating the Minuteman Commuter Bikeway, a plan to improve the popular bikeway running through each town. The report includes suggestions for wayfinding, trail amenities, crossing improvements and trail extensions.

The Safe Routes to School program conducted assessments of two of the Town's schools, listing recommended improvements in proximity to the John Glen Middle School and Job Lane School.

In 2011, the Bedford Planning Board endorsed The Great Road Master Plan, which included improved sidewalks, landscaping, upgrading existing traffic signals, and signaling the intersection of The Great Road, North Road, and Concord Road. The plan covers The Great Road from Bacon Road to North Road and continuing up North Road to Carlisle Road. The plan also called for updates to ramps and crossings for ADA compliance.

## Community Input

In the fall of 2014 and spring of 2015, Bedford held an Open House, Community Meeting, and hosted an online WikiMap to solicit public comments on the state of walking and biking in Bedford.

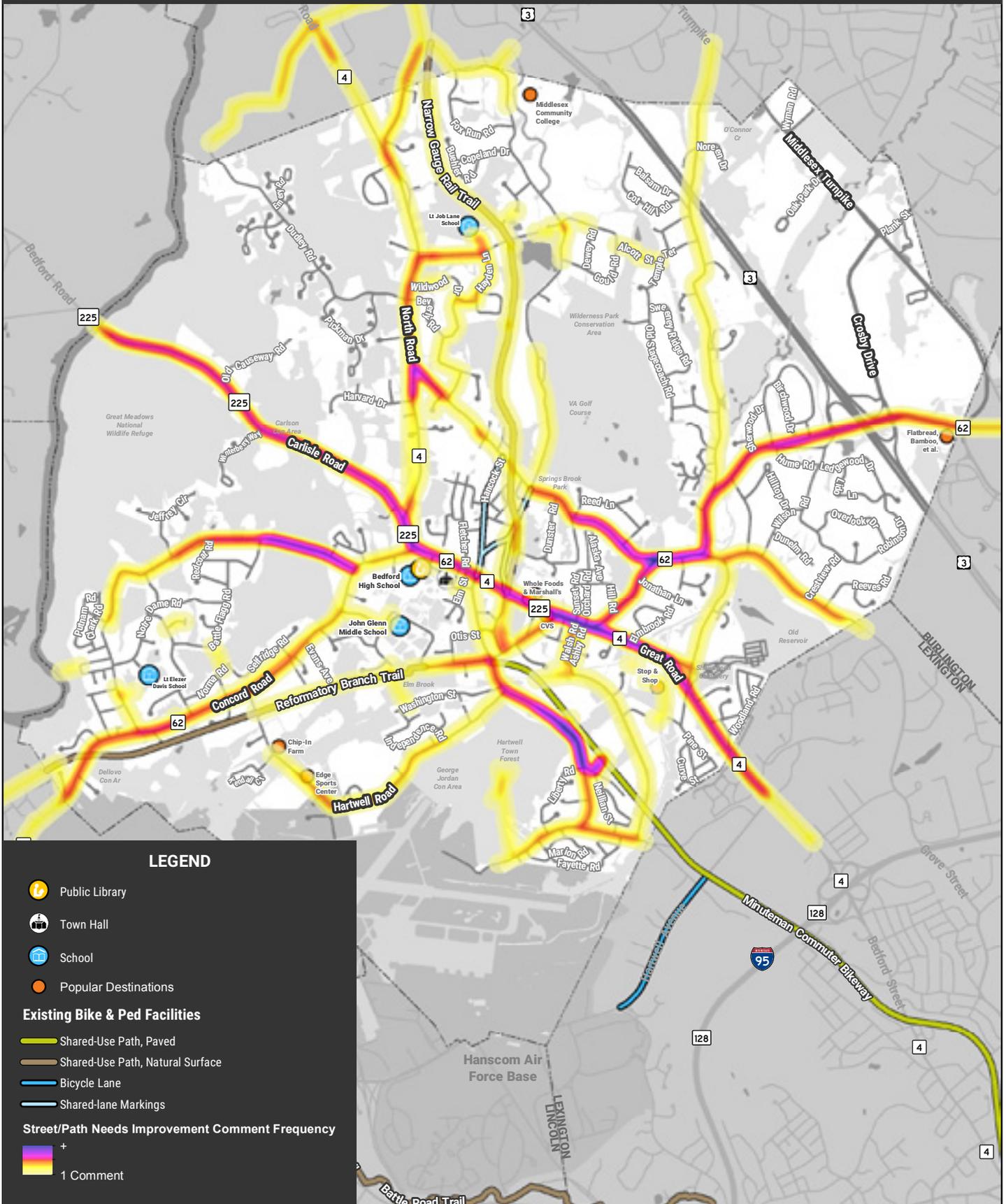
There were a total of 301 comments and 662 unique users on the WikiMap (some users looked at the map but did not comment). Participants identified routes they currently use for walking or biking and identified streets and specific locations in need of improvement. See Figures 5 through 7.

Based on public input and a field analysis, the following types of improvements were identified as the primary steps to encourage safe walking and bicycling in the Town:

1. Completing gaps in the existing network
2. Improving safety at crosswalks
3. Providing on- and off-road bicycle facilities



*Bedford Pedestrian and Bicycle Plan Open House*



**LEGEND**

- Public Library
- Town Hall
- School
- Popular Destinations

**Existing Bike & Ped Facilities**

- Shared-Use Path, Paved
- Shared-Use Path, Natural Surface
- Bicycle Lane
- Shared-lane Markings

**Street/Path Needs Improvement Comment Frequency**

- +
- 1 Comment

Figure 5: WikiMap Comments/Frequency of Street or Path Needs Improvement”

# Bedford

Pedestrian + Bicycle Master Plan

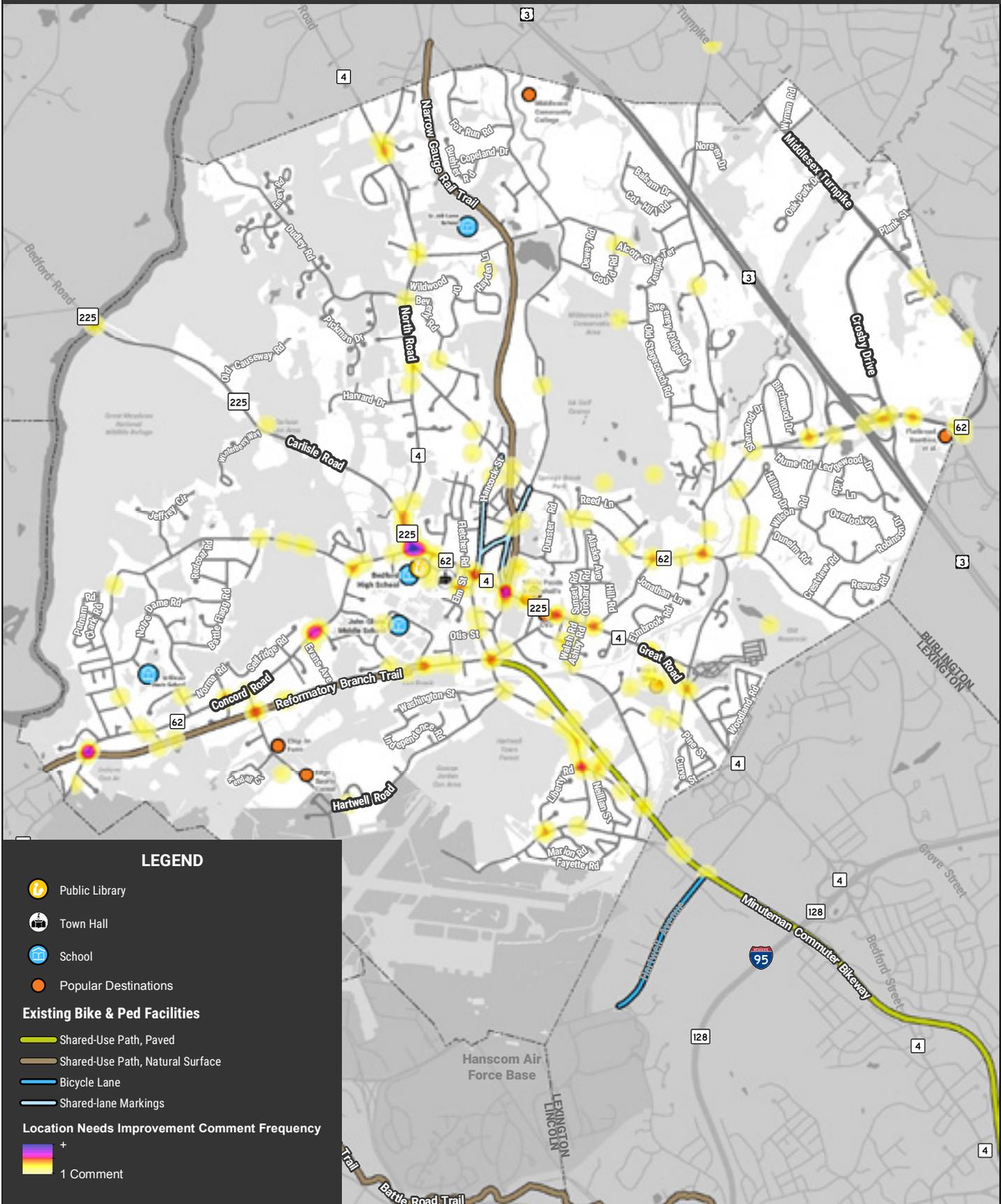


Figure 6: WikiMap Comments/Frequency of “Location Needs Improvement”

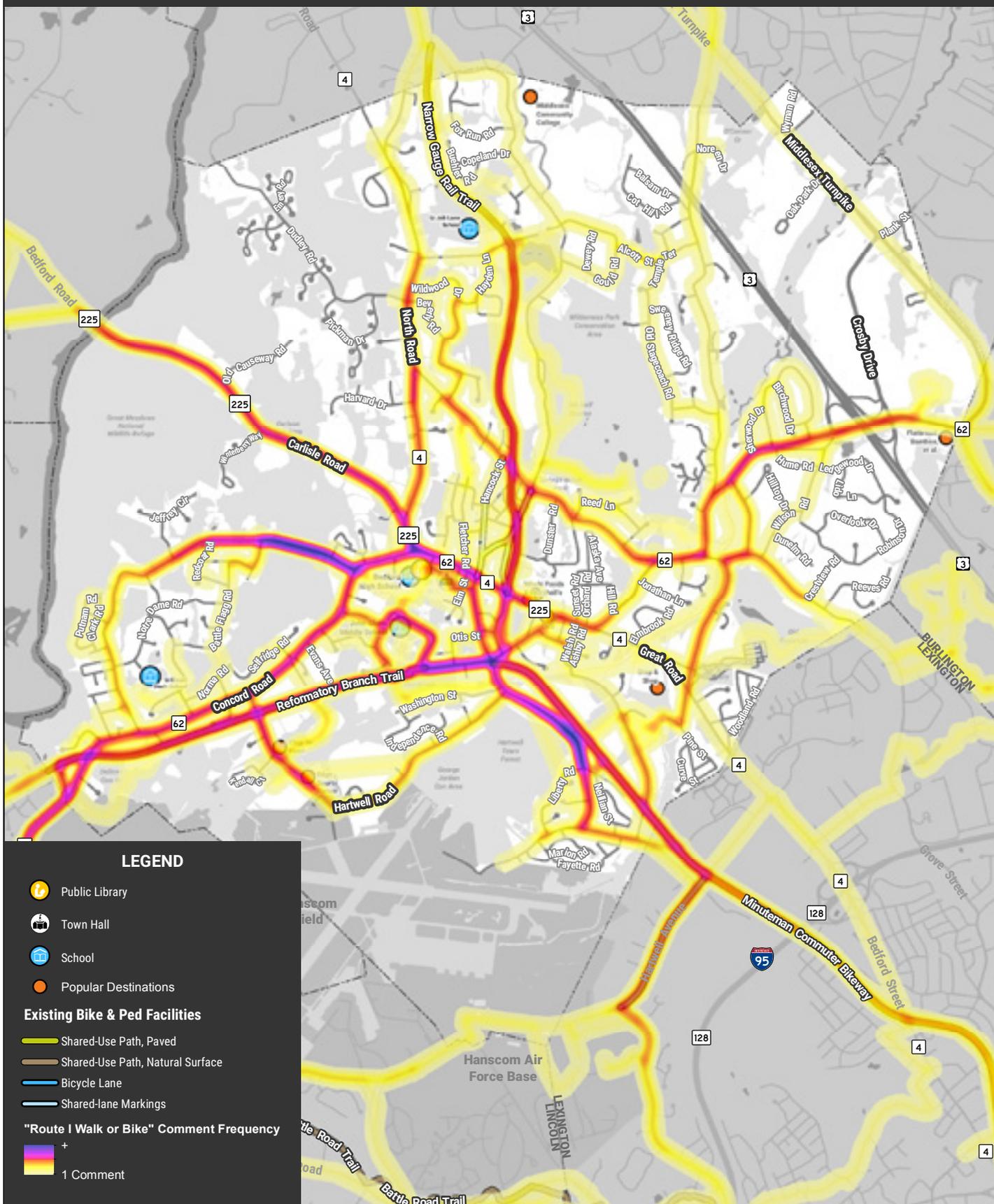


Figure 7: WikiMap Comments/Responses to "Routes I Walk or Bike"

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# Vision and Goals

Understanding Bedford's vision for bicycling and walking was essential to the development of this Plan. The vision and goals were developed using input provided by the public at an open house in fall 2014, a community meeting in spring 2015, an online interactive WikiMap regarding bicycling and walking needs, and ongoing guidance from the Plan's steering committee. Throughout this process, the community cited the need to fill gaps in the existing bicycling and sidewalk networks and to improve the safety of walking and bicycling in Bedford. An analysis of existing conditions and a review of previous planning efforts further informed the development of the Plan's vision and goals.

The Vision, resulting from this process, sets the bar high. It describes what residents would like Bedford to look like in the future and their aspirations for walking and bicycling. The Goals provide more specific activities required to realize this Vision. In the following sections, a series of recommendations outline the steps that will be necessary to achieve the Vision and Goals of the Plan.



# Vision

*Bedford will be a well-connected community where walking and bicycling are convenient and attractive to residents and visitors alike. Pedestrians and bicyclists will feel safe and respected on Bedford's streets and trails, which will connect residential neighborhoods, shopping, employment centers, public services, and recreational areas.*

*The well-being and health of Bedford residents will improve from more walking and bicycling. These facilities and the active transportation they inspire will contribute to a vibrant Bedford with healthier residents, safer streets and less congestion. Through active transportation, residents will have more opportunities to engage in their community. The local economy will gain from the benefits associated with public investments in walking and bicycling.*

# Goals

1

**Connectivity:** *Create a safe and attractive network of pedestrian and bicycle facilities.*

- *Provide sidewalks, paths, and crossings that allow pedestrians of all ages and abilities to safely and comfortably reach local and area destinations.*
- *Develop safe and welcoming bicycling facilities that encourage positive interactions between drivers, bicyclists, and pedestrians.*

2

**Comfort and Design:** *Develop design standards for bicycle and pedestrian facilities and integrate maintenance plans into existing programs to ensure high-quality facilities that are usable year-round.*

3

**Culture:** *Promote a culture of bicycling and walking.*

- *Obtain Gold Level Bicycle Friendly Community designation from the League of American Bicyclists.*
- *Obtain Walk Friendly Community status from the Pedestrian and Bicycle Information Center.*

4

**Safe School Routes:** *Prioritize school routes as locations for bicycle and pedestrian improvements as part of a Bedford Safe Routes to School program.*



# Facility Toolkit

The following section, Infrastructure Improvements, identifies the locations and types of recommended infrastructure improvements. The accompanying facility toolkit includes a description of each type of facility, its purpose, the advantages and disadvantages of installing it, and the typical methods and cost of installing it.

All designs should adhere to the guidelines from the latest edition of the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), the Public Rights of Way Access Guide (PROWAG), as well as any other standards such as AASHTO's "A Policy on Geometric Design of Highways and Streets," the Massachusetts Department of Transportation's design guidelines, and the National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide, as appropriate.

### Shared-Use Path, Paved



#### Description

- Two-way path on a dedicated right-of-way (ROW) open to bicycles, pedestrians, and most other non-motorized uses
- Provides low-stress bicycle and pedestrian connection
- **Typical Dimensions:** 10-14 ft. wide depending on expected user volume plus 2 ft. wide clearance on either side

#### Application

- Often installed along active or abandoned rail corridors, utility easements, or along streams, rivers, or other linear features
- Provides long-distance connections as well as short-cuts between areas without bicycle or pedestrian infrastructure

#### Considerations

- ROW easement or acquisition may be required
- Separate maintenance program may be required
- Path should be ADA-compliant

#### Action Required

- Construction
- Estimated cost: \$1.2M per mile

### Shared Use Path, Natural Surface



#### Description

- Two-way unpaved path open to bicycles, pedestrians, and most other non-motorized uses
- May use stone dust or other soft surfacing
- **Typical Dimensions:** 8-12 ft. wide depending on expected user volume

#### Application

- Provides long-distance connections as well as short-cuts between areas without bicycle or pedestrian infrastructure
- Often functions primarily as a recreational facility

#### Considerations

- Typically not ADA-compliant due to surface
- Provides low-stress bicycle and pedestrian connection
- ROW easement or acquisition may be required
- Separate maintenance program may be required
- Typically not preferred by people riding road bikes

#### Action Required

- Construction
- Estimated cost: \$1.2M per mile

## Sidepath



### Description

- Two-way path, adjacent to a roadway, open to bicycles, pedestrians, and most other non-motorized uses
- Provides low-stress bicycle and pedestrian connection
- **Typical Dimensions:** 10-14 ft. wide depending on expected user volume plus 5 ft. wide buffer from roadway

### Application

- Roads with available ROW on one or both sides
- Roads in areas where pedestrian activity is lower in volume

### Considerations

- ROW easement or acquisition may be required
- Path may be easier to maintain and clear snow than a standard sidewalk
- Path should be ADA-compliant

### Action Required

- Construction
- Estimated cost: \$640K-1.2M per mile

## Sidewalk



### Description

- Typically concrete pathway adjacent to roadways for pedestrian travel
- Must meet minimum dimensions and smoothness for ADA-compliance
- May have decorative paving or plantings
- Should be wider where high pedestrian volumes are present or desired
- **Typical Dimensions:** Min. 4 ft. wide, 5-10+ ft. in high user volume areas; min. 2 ft. wide buffer from roadway preferred

### Application

- Roads where pedestrians may be present
- Routes that connect to public destinations including transit

### Considerations

- Separates pedestrians from vehicular travel
- Facilitates pedestrian travel, particularly for persons with disabilities
- Right-of-way easement or acquisition may be required
- Maintenance required to ensure year-round accessibility

### Action Required

- Construction
- Estimated cost: \$410K-\$1.1M per mile to add, widen, or construct concrete sidewalk; \$670K-1.9M to add, widen, or construct brick sidewalk

## Shared Street



### Description

- A shared space for motorists, pedestrians, and bicyclists
- Typically, the road surface is at the same level as the sidewalk surface to create a continuous pedestrian space
- Motorists and bicyclists welcomed as ‘guests’ in a pedestrian-dominated space

### Application

- Streets with high pedestrian volumes
- Narrow streets where sidewalks do not accommodate pedestrians sufficiently or where ADA-compliance is not otherwise possible
- Streets where slow vehicular speeds and low vehicular volumes are preferred

### Considerations

- Provides flexible pedestrian space
- Enlivens street-life, enhances retail environments
- Consideration of commercial loading activity for adjacent buildings may be required

### Action Required

- Construction or street closure for temporary installation
- Estimated cost: \$2M per mile of construction, \$140K per mile of temporary closure

## Traffic Signal or Beacon



### Description

- Traffic signals may include full signalization of an intersection or the addition of pedestrian indications
- Pedestrian hybrid beacons, are activated on demand by pedestrians or bicyclists in order to warn and control motor vehicle traffic
- Signal or beacon type varies depending on location, intended user, traffic volume, and speed

### Application

- At uncontrolled crossings with high volumes of bicyclists and/or pedestrians
- Roadways with traffic volumes sufficient to make crossing at an unsignalized intersection difficult
- Mid-block shared-use path crossings

### Considerations

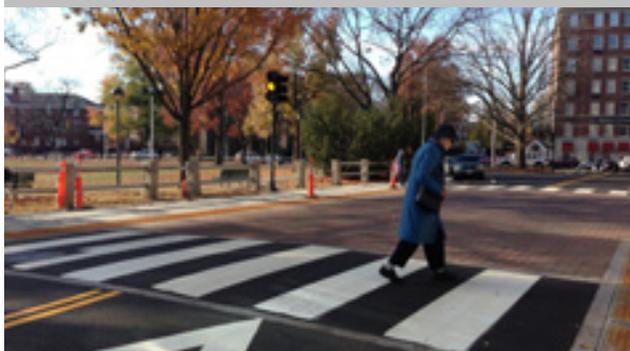
- Must meet Manual on Uniform Traffic Control Devices (MUTCD) traffic control device warrants
- Helps pedestrians and bicyclists cross busy streets
- Requires activation or detection

### Action Required

- Traffic engineering study
- Signal purchase and installation
- May require installation of ADA-compliant crossings
- Estimated cost: \$75K for a pedestrian hybrid beacon; \$150K for a full traffic signal

## Crossing Improvement

### Raised Intersection



#### Description

- A crosswalk or entire intersection raised from street level to sidewalk level to increase pedestrian visibility and calm traffic

#### Considerations

- May require bollards to prevent motorists from driving on sidewalk
- Estimated Cost: \$95K

### Pedestrian Refuge Island



#### Description

- Raised median or island that provides in-street refuge at a pedestrian crossing

#### Considerations

- Opportunity for plantings, rain gardens, or other green infrastructure
- Estimated Cost: \$8K

### Curb Extension



#### Description

- An extension of the sidewalk at crossings to reduce pedestrian crossing distances and provide greater visibility for pedestrians

#### Considerations

- May require parking reductions or utility modifications
- Estimated Cost: \$20K

### Rapid Flash Beacon



#### Description

- Rectangular rapid flash beacons are activated on demand by pedestrians or bicyclists in order to warn and control motor vehicle traffic

#### Considerations

- Requires activation or detection
- Estimated Cost: \$15K

## Bike Lane



### Description

- An exclusive lane for bicyclists designated with pavement markings and signage
- Located adjacent to motor vehicle travel lanes and flows in the same direction as motor vehicle traffic
- **Typical Dimensions:** Min. 5 feet. 6 foot min. preferred adjacent to parked vehicles; 4 ft. acceptable adjacent to curb in low speed environments

### Application

- Used on medium to low volume streets with traffic speeds of 40 mph or less

### Considerations

- Provides separate travel lane for bicyclists
- Mixing zones may be required at intersections or bus stops
- Enforcement often required to keep motorists from parking or stopping in bike lanes

### Action Required

- Signs and markings, construction
- Estimated cost: \$20-\$46K per mile retrofit (type varies); \$590K per mile to reconstruct and widen roadway to accommodate bike lanes

## Separated Bike Lane



### Description

- One- or two-way bicycle facility with vertical separation from motor vehicle traffic
- Vertical separation may be provided by parked motor vehicles, flexible bollards, plantings, or curbs
- May be located on a roadway or raised to, or just below, sidewalk level
- **Typical Dimensions:** 4-5 ft. wide travel lane plus minimum 3 ft. buffer from roadway

### Application

- Along roadways with high vehicular volumes, speeds, or complex traffic patterns
- Along primary roadway corridors providing access to high-demand destinations where high bicycle volumes are present or desired

### Considerations

- Provides comfort for bicyclists and motorists
- Specialized intersection treatments may be required to accommodate bicyclists
- Separation of bicyclists and pedestrians may require specialized design treatments
- Potential parking restrictions due to sight lines

### Action Required

- Construction or signs, markings, and signals depending on level of implementation
- Estimated cost: \$127K-153K per mile for retrofit; \$710K per mile for construction

### Shared-lane Markings



#### Description

- Street markings used to indicate a shared lane for bicyclists and motorists
- Indicates where bicyclists should position themselves in the travel lane to avoid open car doors where on-street parking is present
- Provides visual cue of where to expect bicyclists
- **Typical Dimensions:** Min. 11 ft. from curb with on-street parking, min. 4 ft. from curb without on-street parking

#### Application

- Low-speed (less than 35 mph) roadways lacking space for dedicated bike lanes
- Travel lanes typically range from 10-14' wide

#### Considerations

- Require motorists to change lanes to pass
- Low level of comfort for novice bicyclists

#### Action Required

- Signs and markings
- Estimated cost: \$11K per mile for one lane; \$22K per mile for two lanes

### Bike Lane Intersection Striping



#### Description

- Roadway striping used to indicate the intended bicycle path of travel through an intersection
- May include green pavement, bicycle markings, or dashed bicycle lane lines
- **Typical Dimensions:** Min. 4 ft. wide, should match connecting bike lane

#### Application

- Signalized, unsignalized, or complex intersections

#### Considerations

- Provides greater visibility and comfort for bicyclists
- Highlights potential conflict areas between bicyclists and motorists
- Green high friction surface adds additional cost to bike facility

#### Action Required

- Signs and markings
- Estimated cost: \$9K per typical intersection

## Intersection Geometry



### Description

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- Modifications to curb lines or edges of pavement at an intersection, typically related to decreasing intersection width or turning radii at the intersection corners

### Application

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- Slip lanes (pictured above), forked intersections, or wide turning radii that create multiple or long crossings for pedestrians or that allow motorists to turn at high rates of speed
- Where intersection design exceeds traffic volume and vehicle types

### Considerations

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- Reclaims unused roadway space for pedestrians
- Decreases crossing distances
- Provides opportunity for plantings, rain gardens, pocket parks, or street furniture

### Action Required

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- Construction
- Retrofit with paint, planters, or flexible posts may be desired for temporary, experimental, or low-cost applications
- Estimated cost: Varies depending on materials used and degree of construction

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# Prioritization Process

The recommendations of this plan were prioritized based on the following criteria. Each recommendation was given a score for each of the categories below and then sorted into high, medium, and low priorities, based on an overall score. Connectivity, Safety, and Vulnerable Users scores are weighted in the overall score. Note that a high overall score may not reflect a high score for each criteria. Detailed scoring tables are included in the appendices of this report.

# Prioritization Criteria

The recommendations in this plan were scored according to the following criteria.

## Connectivity

Scores in this category rate each recommendation's impact on completing gaps and improving the connectivity of the streets and paths throughout the Town. High ranking scores address high demand connections or connections with few alternative routes. Medium-ranked recommendations improve minor connections within the bicycle or pedestrian network. Low scoring recommendations do not significantly improve the Town's non-motorized network.

## Safety

Scores in this category rate each recommendation's impact on the overall safety of walking and biking conditions. Separated bicycle facilities or high visibility crosswalks on high volume streets received a high rating. Adding signed routes for bicycling on appropriate streets received medium ratings. Recommendations with a minor impact on safety received a low score.

## Vulnerable Users

Scores in this category reflect each recommendation's impact on vulnerable or choice-limited users. Vulnerable users include children, seniors, and people with disabilities who may be slower and/or have mobility or sensory limitations. Choice-limited users include people who have limited transportation options due to financial, geographic, or physical constraints. Recommendations for facilities near schools or neighborhoods with high populations of low-income or elderly residents received high scores. Recommendations that indirectly

address vulnerable or choice-limited users, such as improving visibility for pedestrians at crosswalks or improvements near transit stops, received medium scores. Recommendations with little direct impact on vulnerable or choice-limited users received a low score.

## Right-of-Way

Right-of-way scores reflect the level of difficulty obtaining right-of-way for implementation. A high scoring recommendation would be given to a project planned within land already owned by the Town of Bedford. A medium score requires some land acquisition, however, parties owning the land are believed to be amenable to a sale or easement. A low score indicates that a project is planned in an area largely owned by private parties or partially owned by private parties who are not likely to be amenable to a sale or easement.

## Lifecycle Cost

Lifecycle costs include the recommendation's implementation and maintenance costs. Implementation includes design, review, and construction activities.

	High	Medium	Low
Connectivity	Critical connection in Town and/or regional bicycle or pedestrian network	Minor connection in Town and/or regional bicycle or pedestrian network	Not a significant component of the Town or regional bicycle and pedestrian network
Safety	Addresses serious safety issue	Addresses moderate safety issue	Addresses minor safety issue or does not address safety
Vulnerable Users	Primary focus is vulnerable or choice-limited users	Indirect impact for vulnerable or choice-limited users	Little impact for vulnerable or choice-limited users
Right-of-Way	Land wholly owned by the Town of Bedford.	Land mostly owned by the Town of Bedford, additional right-of-way procurement believed to be feasible.	Land primarily owned by private parties, or partially owned by private parties believed not to be amenable to sale or easement.
Lifecycle Cost	Low cost to implement and maintain	Medium cost to implement and maintain	High cost to implement and maintain

Prioritization criteria were assigned the following weights: Right-of-way and Lifecycle Cost were weighted 1.0; Connectivity was weight 1.5; and Safety and Vulnerable Users were weighted 2.0.



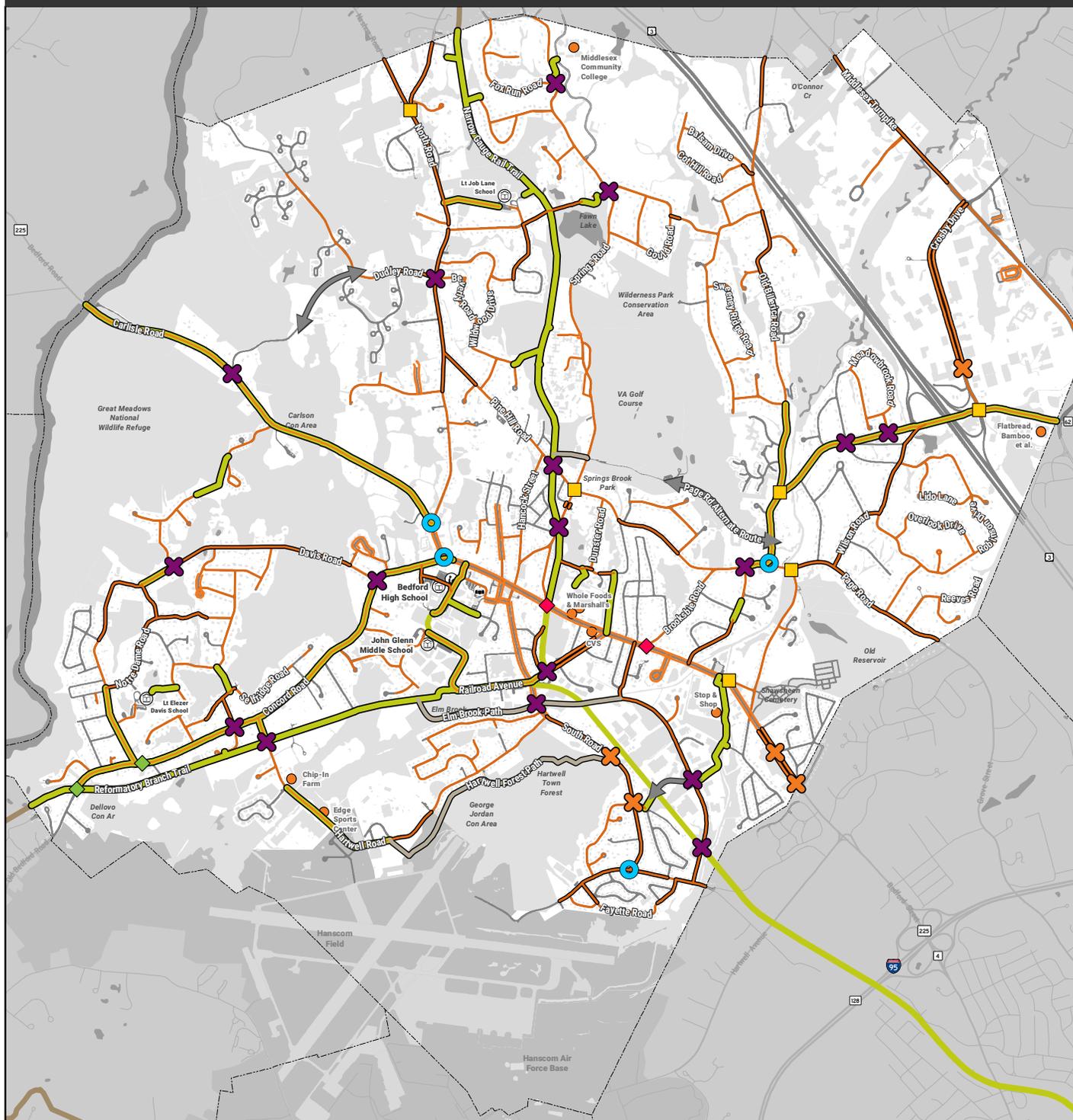
# Infrastructure Recommendations

The following maps show the type and location of infrastructure recommendations in Bedford.

Figures 8 through 12 show the overall recommended pedestrian network and detailed area maps. Figures 13 through 17 show the overall recommended bicycle network and detailed area maps. The maps show both existing and proposed facilities in order to illustrate the complete network.

Detailed descriptions for each infrastructure improvement are included in a table following the maps. Note that in some locations, recommendations are specific in nature (e.g. “sidepath”) while others are more general (e.g. “improved crossing”). General recommendations require additional research and public feedback to determine specific designs for those locations.

All recommendations will need to go through a public involvement process during design and implementation, as noted in the Implementation chapter.



### LEGEND

- Public Library
- Town Hall
- School
- Popular Destination

- #### Existing Pedestrian Facilities
- Shared-Use Path, Paved
  - Shared-Use Path, Natural Surface
  - Sidewalk, 1-side
  - Sidewalk, 2-sides

- #### Proposed Spot Improvements
- Crosswalk
  - Add Traffic Signal
  - Bike/Ped Signal

- #### Proposed Pedestrian Facilities
- Modern Roundabout
  - Geometric Improvement
  - Crossing Improvement

- #### Proposed Pedestrian Facilities
- Shared-Use Path, Paved
  - Sidepath
  - Improved Shared-Use Path
  - Sidewalk, One-side
  - Sidewalk, Two-sides
  - Desired Connection

Figure 8: Pedestrian Network Plan

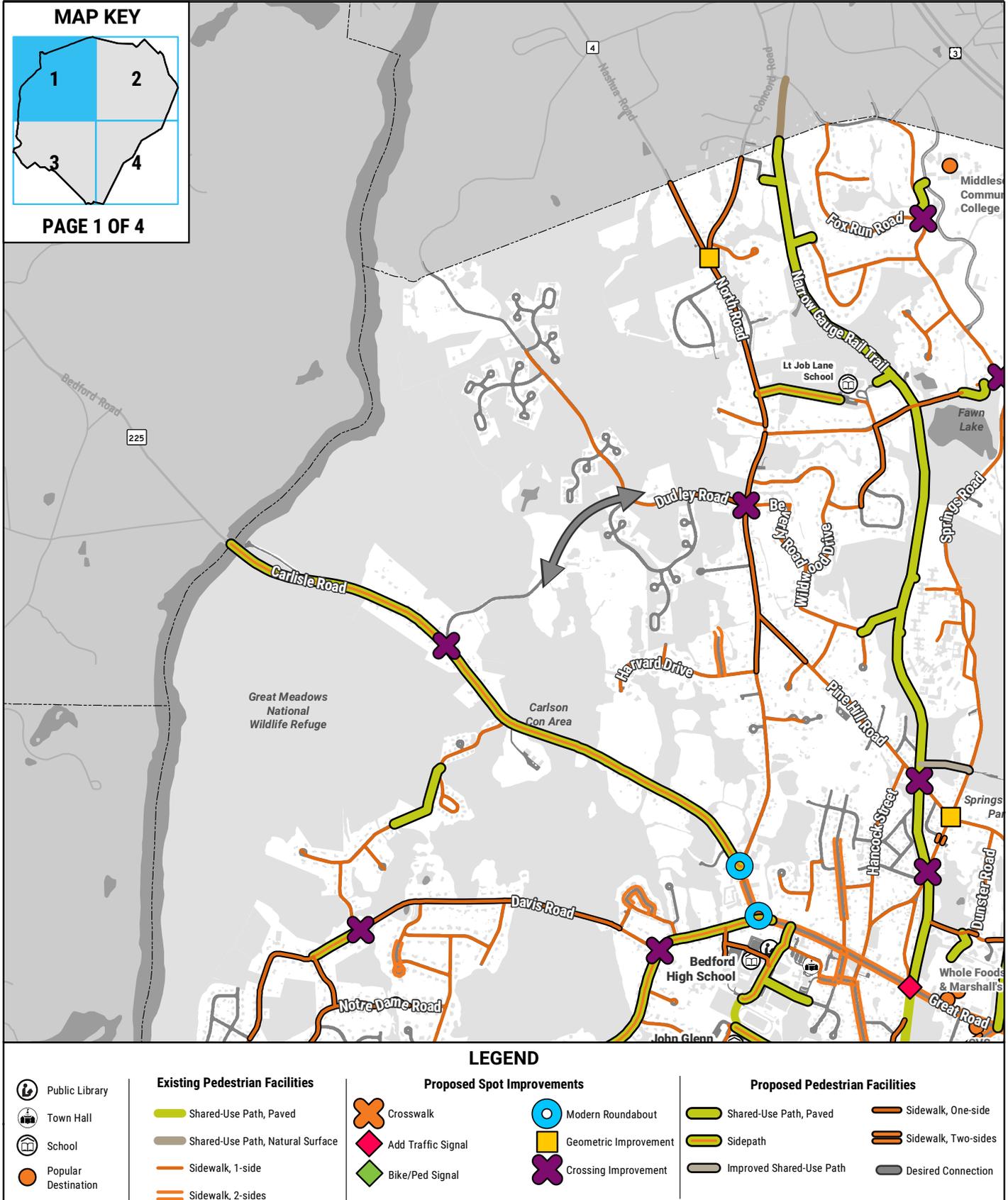
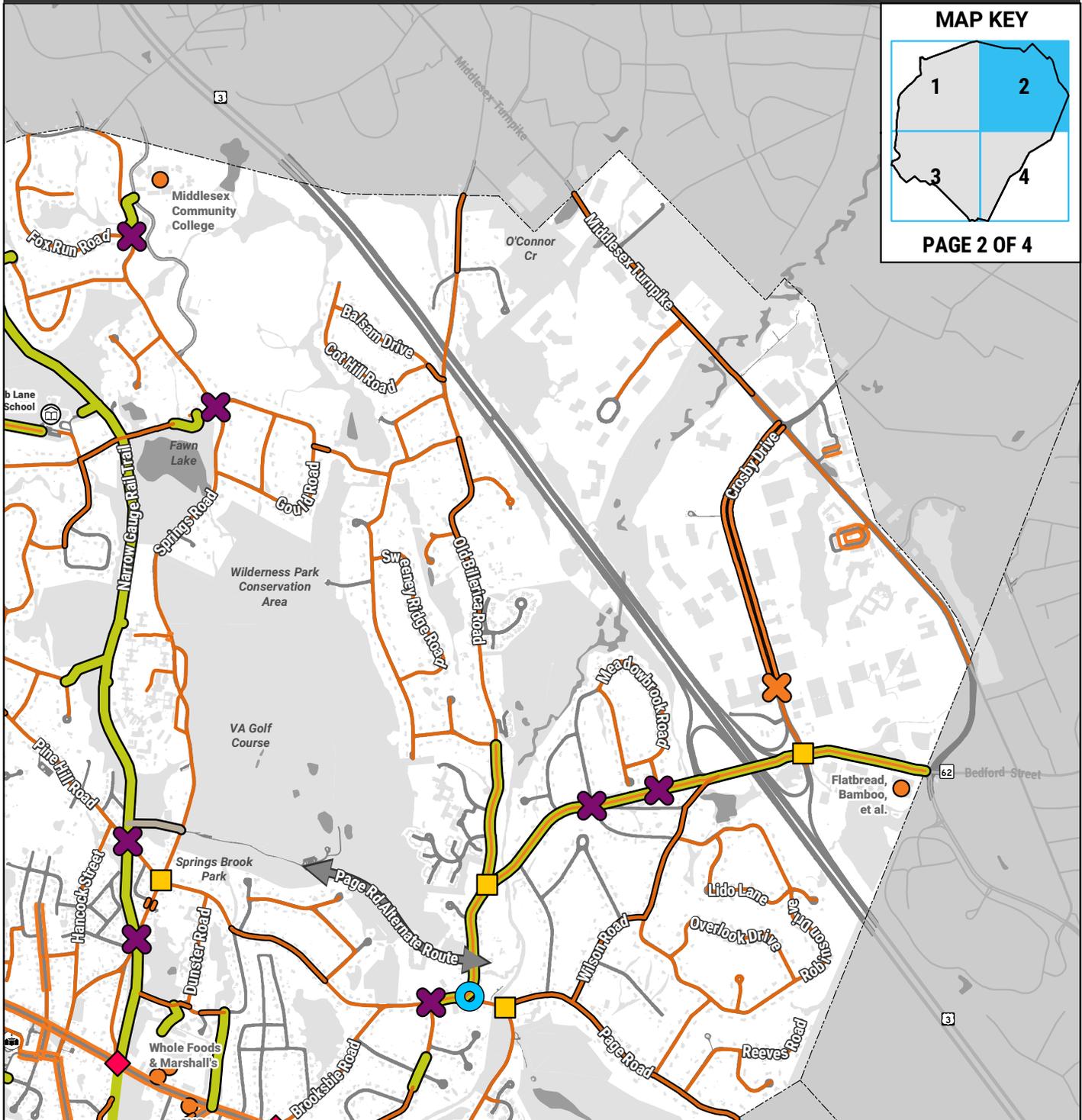


Figure 9: Pedestrian Network Plan / Area 1



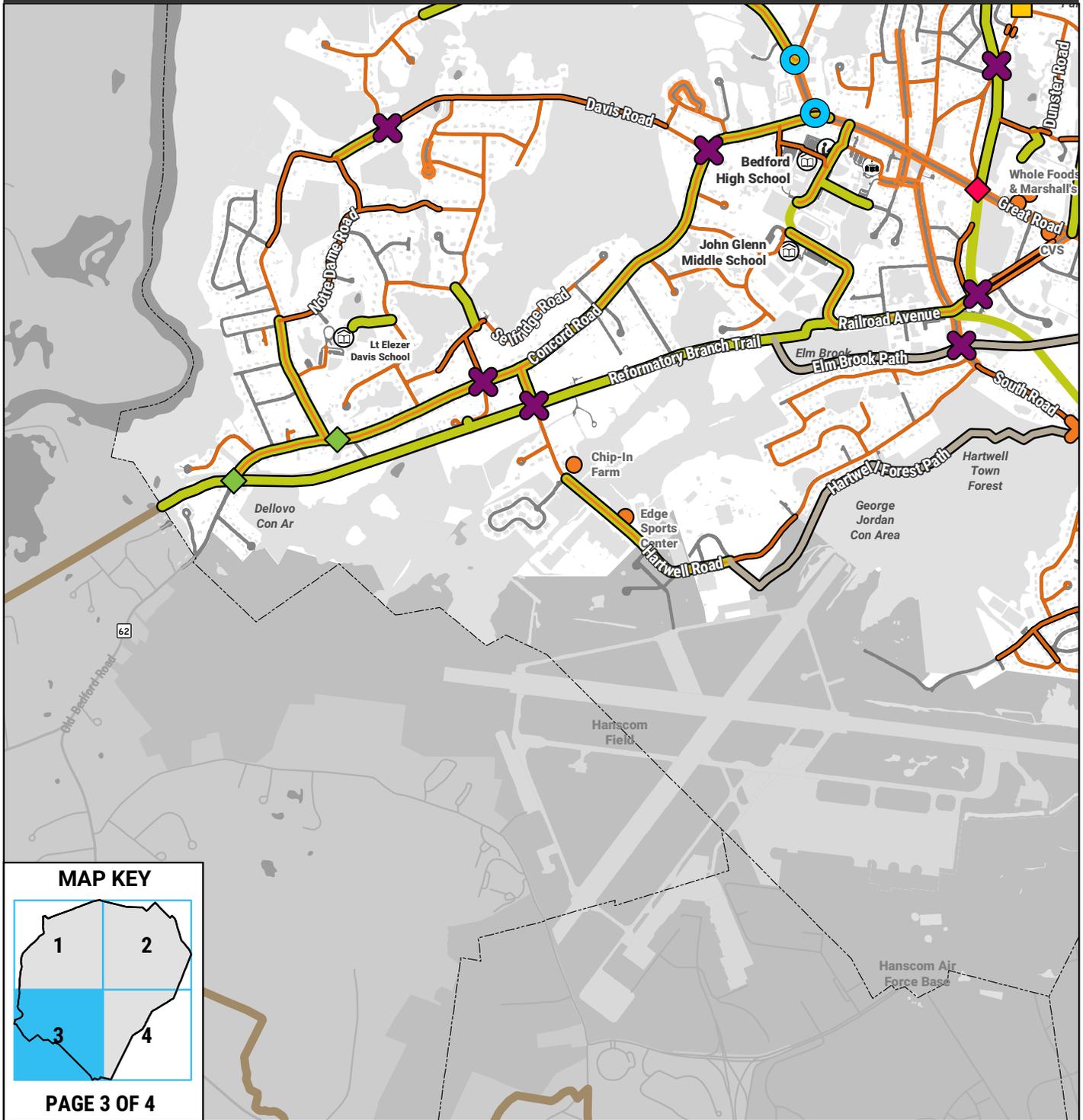
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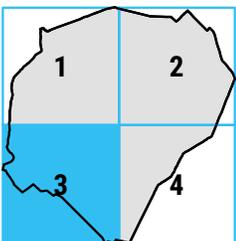
**LEGEND**

<ul style="list-style-type: none"> <li>Public Library</li> <li>Town Hall</li> <li>School</li> <li>Popular Destination</li> </ul>	<p><b>Existing Pedestrian Facilities</b></p> <ul style="list-style-type: none"> <li>Shared-Use Path, Paved</li> <li>Shared-Use Path, Natural Surface</li> <li>Sidewalk, 1-side</li> <li>Sidewalk, 2-sides</li> </ul>	<p><b>Proposed Spot Improvements</b></p> <ul style="list-style-type: none"> <li>Crosswalk</li> <li>Add Traffic Signal</li> <li>Bike/Ped Signal</li> </ul>	<p><b>Proposed Pedestrian Facilities</b></p> <ul style="list-style-type: none"> <li>Modern Roundabout</li> <li>Geometric Improvement</li> <li>Crossing Improvement</li> </ul>	<ul style="list-style-type: none"> <li>Shared-Use Path, Paved</li> <li>Sidewalk, One-side</li> <li>Sidewalk, Two-sides</li> <li>Improved Shared-Use Path</li> <li>Desired Connection</li> </ul>
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Figure 10: Pedestrian Network Plan / Area 2



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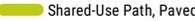
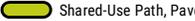
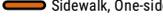
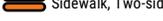
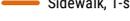
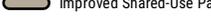
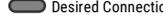
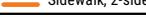
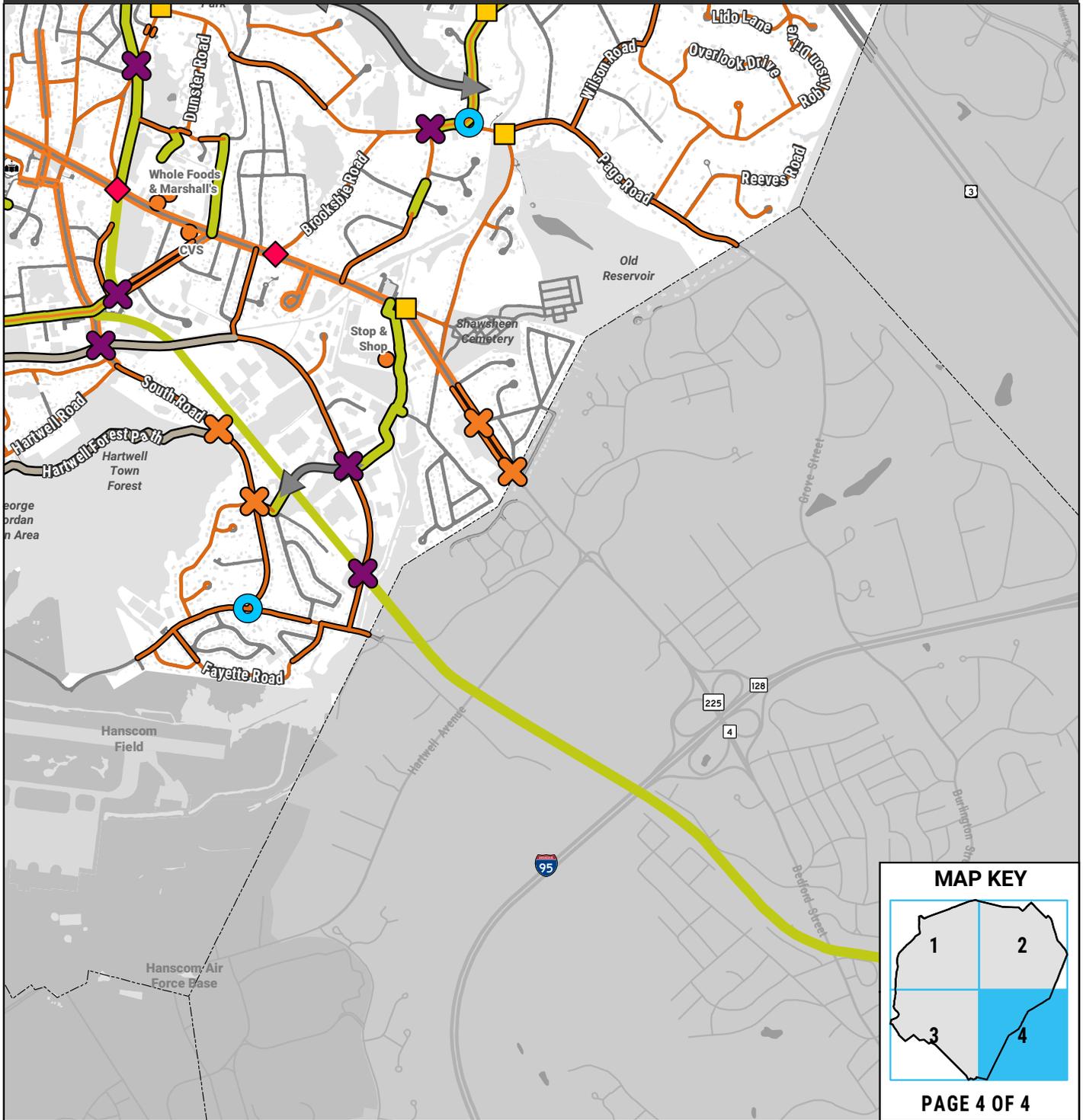
Existing Pedestrian Facilities		Proposed Spot Improvements		Proposed Pedestrian Facilities	
 Public Library	 Shared-Use Path, Paved	 Crosswalk	 Modern Roundabout	 Shared-Use Path, Paved	 Sidewalk, One-side
 Town Hall	 Shared-Use Path, Natural Surface	 Add Traffic Signal	 Geometric Improvement	 Sidepath	 Sidewalk, Two-sides
 School	 Sidewalk, 1-side	 Bike/Ped Signal	 Crossing Improvement	 Improved Shared-Use Path	 Desired Connection
 Popular Destination	 Sidewalk, 2-sides				

Figure 11: Pedestrian Network Plan / Area 3



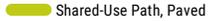
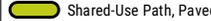
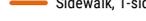
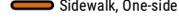
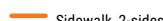
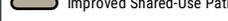
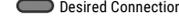
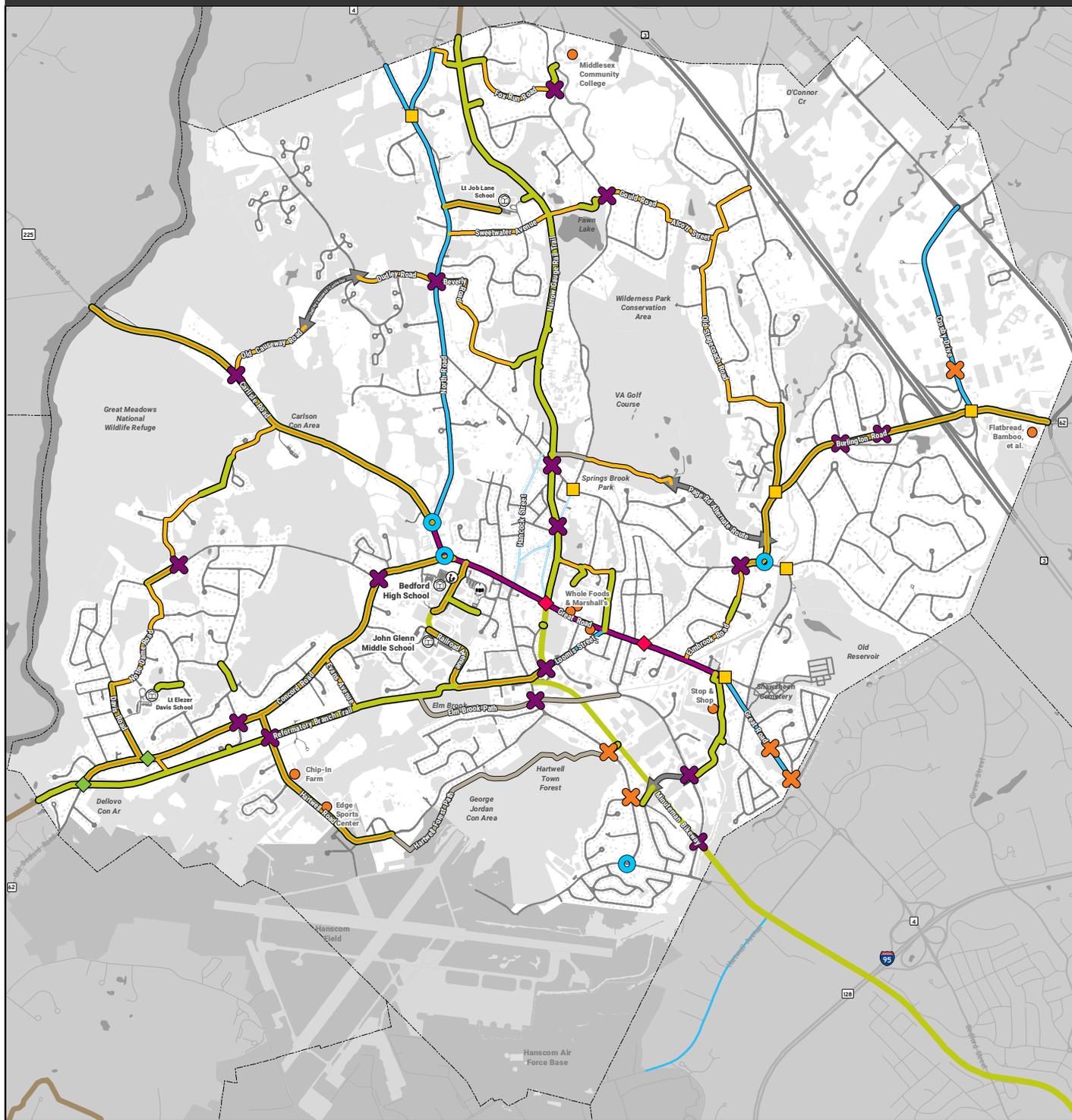
LEGEND			
 Public Library	<b>Existing Pedestrian Facilities</b>	 Crosswalk	<b>Proposed Pedestrian Facilities</b>
 Town Hall	 Shared-Use Path, Paved	 Add Traffic Signal	 Shared-Use Path, Paved
 School	 Shared-Use Path, Natural Surface	 Bike/Ped Signal	 Sidepath
 Popular Destination	 Sidewalk, 1-side	 Modern Roundabout	 Sidewalk, Two-sides
	 Sidewalk, 2-sides	 Geometric Improvement	 Improved Shared-Use Path
		 Crossing Improvement	 Desired Connection

Figure 12: Pedestrian Network Plan / Area 4



### LEGEND

- Public Library
- Town Hall
- School
- Popular Destination

#### Existing Bike Facilities

- Shared-Use Path, Paved
- Natural Surface Shared-Use Path
- Bike Lane
- Shared-Lane Markings

#### Proposed Spot Improvements

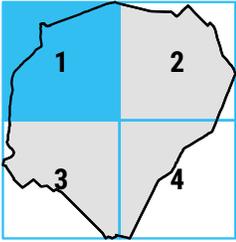
- Crosswalk
- Add Traffic Signal
- Bike/Ped Signal

#### Proposed Bike Facilities

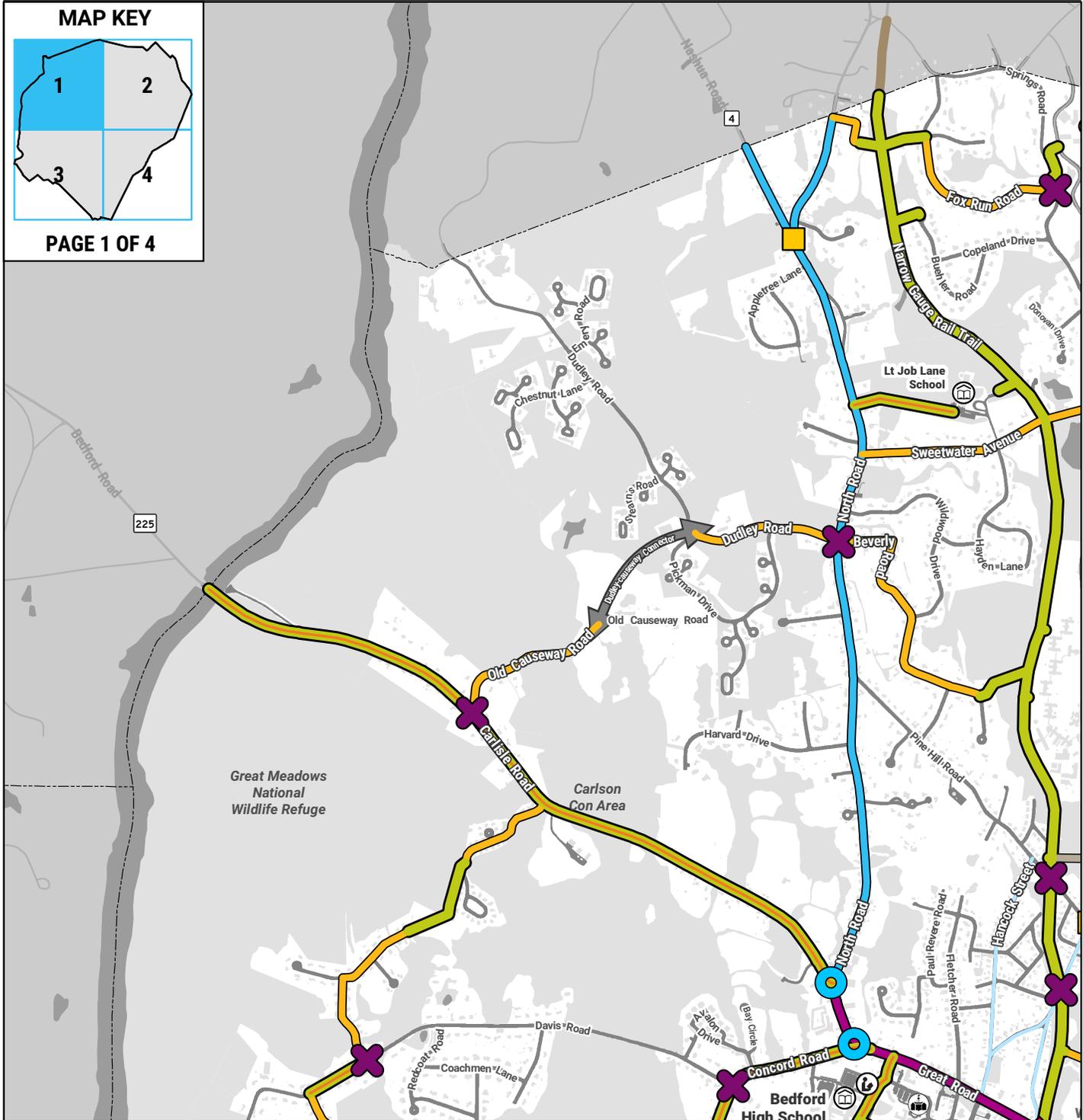
- Modern Roundabout
- Geometric Improvement
- Crossing Improvement
- Shared-Use Path, Paved
- Sidepath
- Natural Surface Shared-Use Path
- Separated Bike Lane
- Shared Street
- Bike Lane
- Shared-Lane Markings
- Desired Connection

Figure 13: Bicycle Network Plan

**MAP KEY**



PAGE 1 OF 4



**LEGEND**

- Public Library
- Town Hall
- School
- Popular Destination

**Existing Bike Facilities**

- Shared-Use Path, Paved
- Natural Surface Shared-Use Path
- Bike Lane
- Shared-Lane Markings

- Crosswalk
- Add Traffic Signal
- Bike/Ped Signal

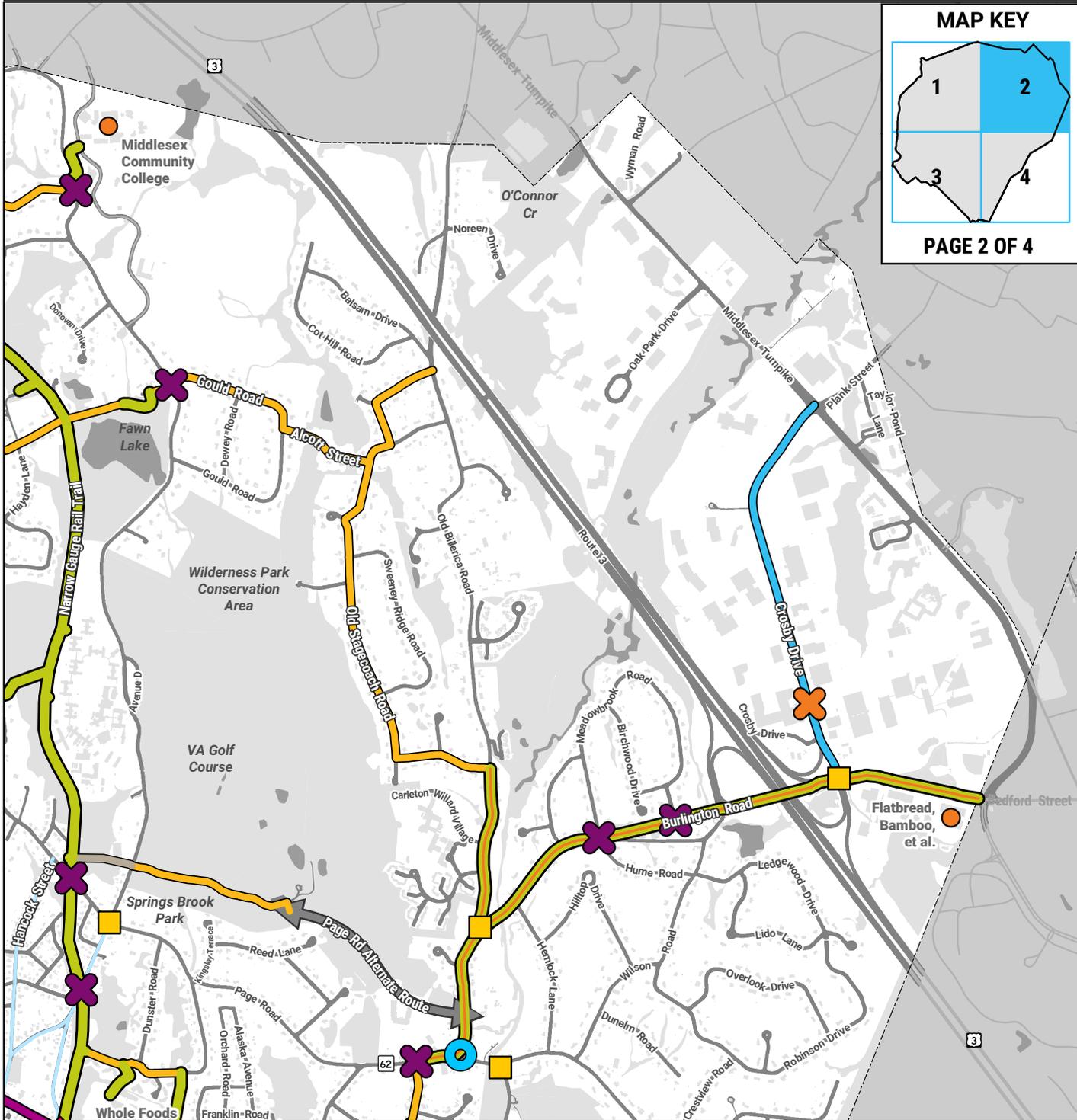
**Proposed Spot Improvements**

- Modern Roundabout
- Geometric Improvement
- Crossing Improvement

**Proposed Bike Facilities**

- Shared-Use Path, Paved
- Shared Street
- Sidepath
- Natural Surface Shared-Use Path
- Separated Bike Lane
- Bike Lane
- Shared-Lane Markings
- Desired Connection

Figure 14: Bicycle Network Plan / Area 1

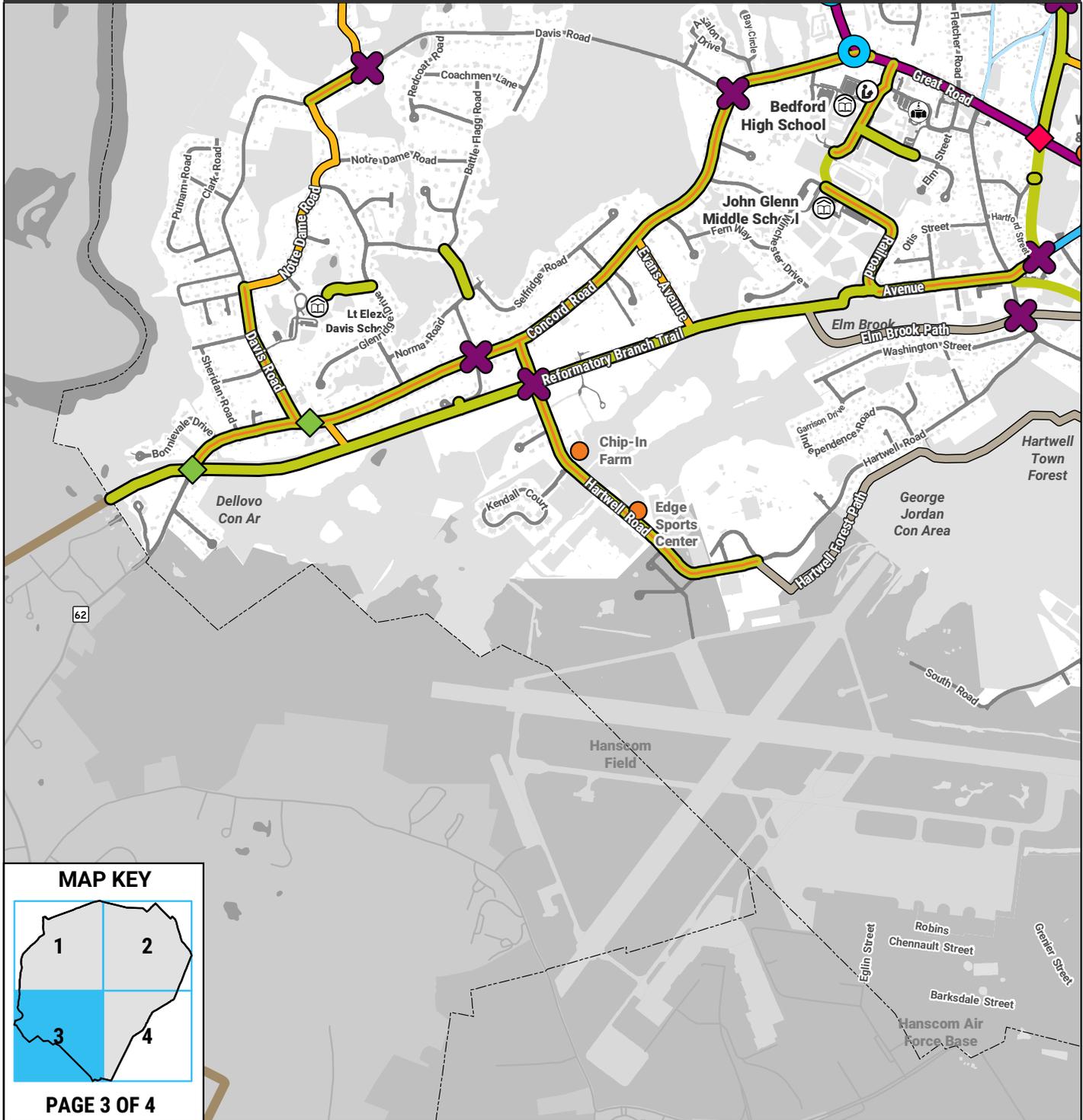


**MAP KEY**

**PAGE 2 OF 4**

Existing Bike Facilities		Proposed Spot Improvements		Proposed Bike Facilities	
	Public Library		Crosswalk		Shared-Use Path, Paved
	Town Hall		Add Traffic Signal		Sidepath
	School		Bike/Ped Signal		Natural Surface Shared-Use Path
	Popular Destination		Modern Roundabout		Bike Lane
			Geometric Improvement		Shared-Lane Markings
			Crossing Improvement		Separated Bike Lane
					Shared Street
					Desired Connection

Figure 15: Bicycle Network Plan / Area 2



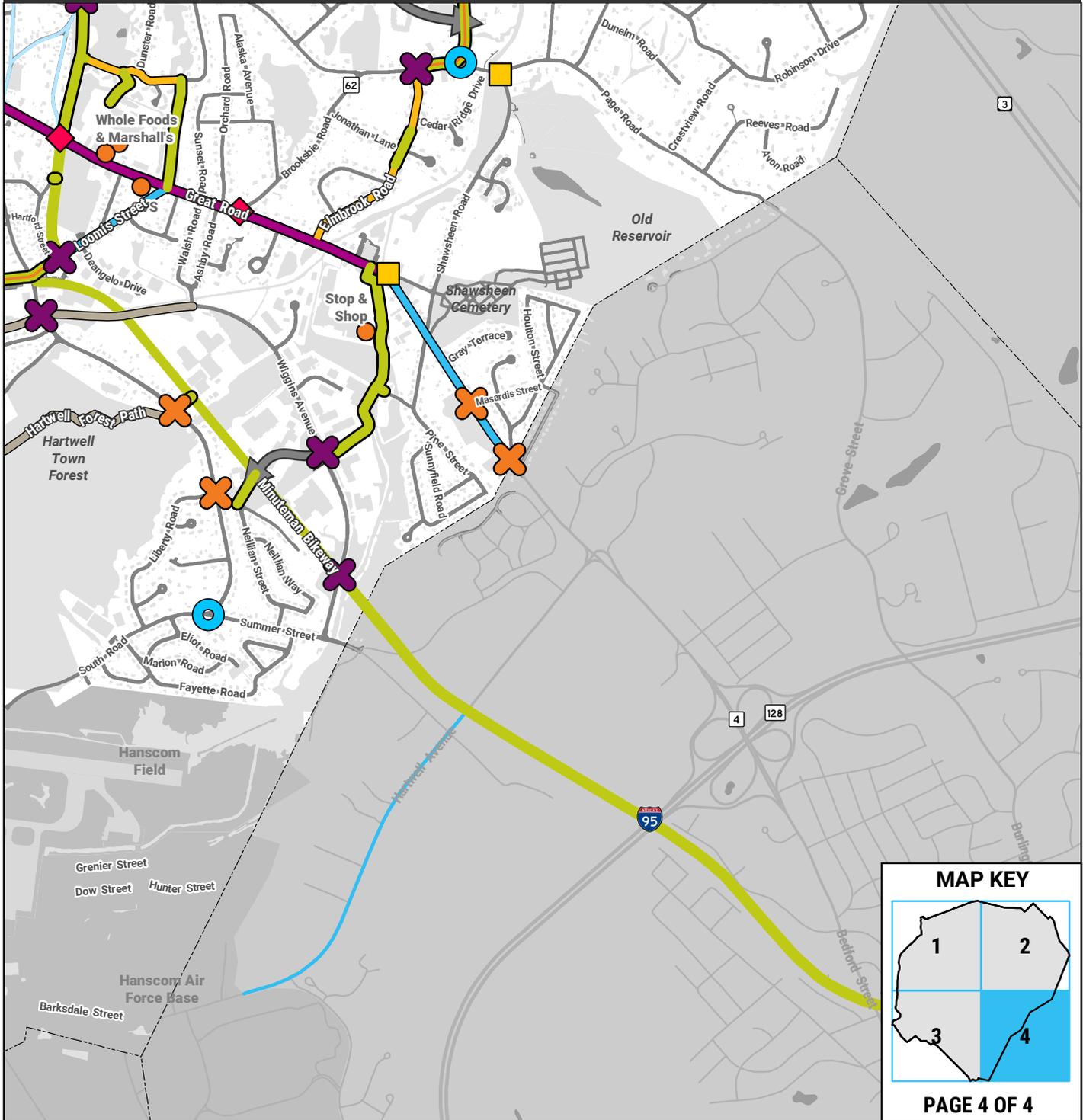
**MAP KEY**

**PAGE 3 OF 4**

**LEGEND**

Public Library	<b>Existing Bike Facilities</b>	Crosswalk	Modern Roundabout	<b>Proposed Bike Facilities</b>	Shared Street
Town Hall	Shared-Use Path, Paved	Add Traffic Signal	Geometric Improvement	Sidepath	Bike Lane
School	Natural Surface Shared-Use Path	Bike/Ped Signal	Crossing Improvement	Natural Surface Shared-Use Path	Shared-Lane Markings
Popular Destination	Bike Lane			Separated Bike Lane	Desired Connection
	Shared-Lane Markings				

Figure 16: Bicycle Network Plan / Area 3



**MAP KEY**

**PAGE 4 OF 4**

LEGEND			
Public Library	<b>Existing Bike Facilities</b>	Crosswalk	Modern Roundabout
Town Hall	Shared-Use Path, Paved	Add Traffic Signal	Geometric Improvement
School	Natural Surface Shared-Use Path	Bike/Ped Signal	Crossing Improvement
Popular Destination	Bike Lane		Shared-Use Path, Paved
	Shared-Lane Markings		Sidepath
			Natural Surface Shared-Use Path
			Separated Bike Lane
			Shared Street
			Bike Lane
			Shared-Lane Markings
			Desired Connection

Figure 17: Bicycle Network Plan / Area 4

## Infrastructure Recommendations Table

ID	Street	From	To	Description	Priority	Score
17	Bedford Village Connector, Bedford Village Rd, Dunster Rd, Great Rd-Dunster Rd Connector	Narrow Gauge Trail	Great Rd	Shared Street/ Shared-use path, Paved	High	2.87
17	Bedford Village Connector, Bedford Village Rd, Dunster Rd, Great Rd-Dunster Rd Connector	Narrow Gauge Trail	Great Rd	Sidewalk 1-Side, Shared-use path, Paved	High	2.87
30	Davis Rd	William St	-	Crossing Improvement	High	2.87
34	South Rd, Evergreen Ave	Summer St	Hartwell Rd	Sidewalk 1 Side	High	2.87
34	South Rd	Hartwell Forest Path	-	Crosswalk	High	2.87
34	South Rd	Evergreen Ave	-	Crosswalk	High	2.87
35	Summer Street, South Rd	Tilden St	Lexington Town Line	Sidewalk 1 Side	High	2.87
2	Great Rd	Bacon Rd	Lexington Town Line	Separated Bike Lane from Bacon Rd to Shawsheen Ave . Bike lanes from Shawsheen to Lexington Line	High	2.73
2	Great Rd	Grey Terr	Lexington Town Line	Sidewalks 2 sides	High	2.73
2	Great Rd	Perham St	-	Crosswalk	High	2.73
2	Great Rd	Masardis St	-	Crosswalk	High	2.73
2	Great Rd	Shawsheen Ave	-	Geometric improvement	High	2.73

<i>ID</i>	<i>Street</i>	<i>From</i>	<i>To</i>	<i>Description</i>	<i>Priority</i>	<i>Score</i>
2	Great Rd	Brooksbie Rd	-	Traffic signal	High	2.73
26	Fox Run-Community College Connector, Fox Run Rd	Middlesex Community College	Narrow Gauge Rail Trail	Shared Street, Shared-use path, Paved	High	2.73
30	Davis Rd, Notre Dame Rd, Hillcrest Rd	Davis Rd	Concord Rd	Sidepath, Shared Street	High	2.67
49	Hayden Ln	Dutton Ln	Sweetwater Ave	Sidewalk 1-Side	High	2.67
6	Concord Rd	Great Rd	Reformatory Branch Trail	Sidepath	High	2.60
8	Hartwell Rd	Kendall ct	Bagley Ave	Sidewalk 1 Side / Sidepath	High	2.60
10	Minuteman-South Rd Connector	Minuteman Commuter Bikeway	South Rd	Shared-use path, Paved	High	2.60
12	Stop & Shop Path	Minuteman Commuter Bikeway	Great Rd	Shared-use path, Paved	High	2.60
18	Old Billerica Rd/Page Rd	Elmbrook Rd	Burlington Town Line	Sidepath	High	2.60
18	Burlington Rd	Rte 3 Ramps	-	Geometric improvement	High	2.60
18	Burlington Rd	Earl Rd	-	Crossing Improvement	High	2.60
18	Burlington Rd	Meadowbrook Rd	-	Crossing Improvement	High	2.60
18	Old Billerica Rd/Page Rd	Page Rd	-	Modern Roundabout	High	2.60
18	Page Rd	Elmbrook Rd	-	Crossing Improvement	High	2.60

<i>ID</i>	<i>Street</i>	<i>From</i>	<i>To</i>	<i>Description</i>	<i>Priority</i>	<i>Score</i>
19	Old Billerica Rd, Wagon Wheel Dr, Old Stagecoach Rd, Temple Terr, Bandera Dr.	Burlington Rd	Old Billerica Rd	Sidepath, Shared Street	High	2.60
19	Old Billerica Rd	Burlington Rd	-	Geometric improvement	High	2.60
20	Alcott St, Gould Rd, Sweetwater Ave, Sweetwater-Fawn Connector Path. Fawn Circle	Temple Terr	North Rd	Shared Street/ Shared-use path, Paved	High	2.60
20	Alcott St, Sweetwater Ave, Sweetwater-Fawn Connector Path	Temple Terr	North Rd	Shared Street/ Shared-use path, Paved	Med	2.60
20	Gould Rd	Springs Rd	-	Crossing Improvement	Med	2.60
29	Winterberry Way, Jeffrey-Winterberry Connector, Jeffrey Circle, William St	Carlisle Rd	Davis Rd	Shared Street, Shared-use path, Paved	High	2.60
11	Minuteman-Evergreen Connector	Minuteman Commuter Bikeway	Evergreen Ave	Shared-use path, Paved	Med	2.47
41	Springs Rd	Spring Lane	Nickerson Rd	Sidewalk 2 Sides	Med	2.47
4	Railroad Ave	Reformatory Branch Trail	High School	Shared-use path	Med	2.40
15	Loomis St	South Rd	Great Rd	Bike Lanes, Sidepath	Med	2.40
15	Loomis St	South Rd	Great Rd	Sidewalk 2 Sides, Sidepath	Med	2.40
15	Loomis St	Narrow Gauge Trail	-	Crossing Improve- ment	Med	2.40

<i>ID</i>	<i>Street</i>	<i>From</i>	<i>To</i>	<i>Description</i>	<i>Priority</i>	<i>Score</i>
16	Narrow Gauge Rail Trail	Great Rd	Billerica Town Line	Shared-use path, Paved	Med	2.40
16	Narrow Gauge Rail Trail	Hillside Ave	-	Crossing Improvement	Med	2.40
16	Narrow Gauge Rail Trail	Pine Hill Rd	-	Crossing Improvement	Med	2.40
16	Narrow Gauge Rail Trail	Billerica Town Line	-	Trail Amenity	Med	2.40
28	Carlisle Rd	North Rd	Carlisle Town Line	Sidepath	Med	2.40
40	Liljegren Way	High School	Concord Rd	Sidewalk 1 Side	Med	2.40
45	Old Billerica Rd	Temple Terr	Mitchell Grant Way	Sidewalk, 1 Side	Med	2.40
48	Middlesex Tpke	Billerica Town Line	Crosby Dr	Sidewalk 1 Side	Med	2.40
50	Pine Hill Rd	Heritage Dr	North Rd	Sidewalk, 1 Side	Med	2.40
1	Great Rd/North Rd	Carlisle Rd	Bacon Rd	Separated Bike Lane from Bacon Rd to Carlisle Road	Med	2.33
1	Great Rd/North Rd	Bacon Rd	-	Traffic signal	Med	2.33
1	Great Rd/North Rd	North Rd	-	Modern roundabout; alternatives to 2 lane roundabouts	Med	2.33
1	Great Rd/North Rd	Carlisle Rd	-	Modern roundabout; alternatives to 2 lane roundabouts	Med	2.33
13	Wiggins Ave	Minuteman Commuter Bikeway	Ashby Rd	Shared-Lane Markings	Med	2.33
13	Wiggins Ave	Summer St	Ashby Rd	Sidewalk, 1 Side	Med	2.33

<i>ID</i>	<i>Street</i>	<i>From</i>	<i>To</i>	<i>Description</i>	<i>Priority</i>	<i>Score</i>
13	Wiggins Ave	Minuteman Commuter Bikeway	-	Crossing Improvement	Med	2.33
22	Crosby Dr	Burlington Rd	Middlesex Tpke	Bike Lanes, Side-path	Med	2.33
22	Crosby Dr	Mitre Driveway	Middlesex Tpke	Sidewalk 2-sides	Med	2.33
22	Crosby Dr	Mitre Driveway		Crosswalk	Med	2.33
42	Page Rd	Francis Kelley Rd	Dunster Rd	Sidewalk 1 Side	Med	2.33
43	Page Rd	Shawsheen Rd	Lexington Town Line	Sidewalk 1 Side	Med	2.33
47	Old Billerica Rd	Noreen Dr	Billerica Town Line	Sidewalk, 1 Side	Med	2.27
56	North Rd, Chelmsford Rd	Billerica Town Line	Carlisle Rd	Bike Lanes	Med	2.27
3	Railroad Ave	Reformatory Branch Trail	South Rd	Shared-use path	Med	2.20
12	Stop & Shop Path	Wiggins Ave	-	Crossing Improvement	Med	2.20
55	Davis Road	Concord Rd	William Street	Shared-Lane Markings	Med	2.20
14	Elm Brook Path	Wiggins Ave	Reformatory Branch Trail	Shared-use path, Natural Surface	Med	2.13
14	Elm Brook Path	South Rd	Elm Brook Path	Crossing Improvement	Med	2.13
21	Narrow Gauge-Springs Brook Park Connector	Old Billerica Rd	Narrow Gauge Rail Trail	Shared-use path, Natural Surface, Shared Street, Desired Connection	Med	2.13

<i>ID</i>	<i>Street</i>	<i>From</i>	<i>To</i>	<i>Description</i>	<i>Priority</i>	<i>Score</i>
27	North Rd, Chelmsford Rd	Billerica Town Line	Harvard Dr	Sidewalk 1-Side	Med	2.13
27	North Rd	Chelmsford Rd	-	Geometric improvement	Med	2.13
32	Battle Flagg-Selfridge Connector	Battle Flagg Rd	Selfridge Rd	Shared-use path, Paved	Med	2.13
38	Ashby Rd, Wiggins Ave	Great Rd	Wiggins Ave	Sidewalk 1 Side	Med	2.13
5	Reformatory Branch Trail	Railroad Ave	Concord Town Line	Shared-Use path, Paved	Med	2.07
5	Reformatory Branch Trail	Concord Rd	-	Bike/Ped Signal	Med	2.07
5	Reformatory Branch Trail	Hartwell Rd	-	Crossing Improvement	Med	2.07
25	Job Lane School Path	North Rd	Job Lane School	Sidepath	Med	2.07
7	High School Path / Mudge Way	Great Rd	Existing Path near Football Field	Sidepath	Low	1.93
31	Davis School Path	Glenridge Dr	Davis School	Shared-use path, Paved	Med	1.93
36	Fayette Rd	South Rd	Lynnfield St	Sidewalk 1 Side	Low	1.93
37	Fayette Rd	Genetti Circle	Summer St	Sidewalk 1 Side	Low	1.93
51	Norma Rd, Ten Acres Dr	Concord Rd	Selfridge Rd	Sidewalk, 1 Side	Low	1.93
9	Hartwell Forest Path	Shaw Circle	South Rd	Shared-use path, Natural Surface	Low	1.87
23	Narrow Gauge-Wildwood Drive Connector, Wildwood Dr, Beverly Rd	Narrow Gauge Rail Trail	North Rd	Shared-use path, Paved, Shared Street	Low	1.87

<i>ID</i>	<i>Street</i>	<i>From</i>	<i>To</i>	<i>Description</i>	<i>Priority</i>	<i>Score</i>
23	Beverly Rd	North Rd	-	Crossing Improvement	Low	1.87
54	Springs Rd	Page Rd/ Pine Hill		Geometric Improvement	Low	1.87
44	Old Burlington Rd, Wilson Rd	Burlington Rd	Page Rd	Sidewalk 1 Side	Low	1.67
52	Minuteman Com- muter Bikeway	Lexington Town Line	-	Trail Amenity	Low	1.53
53	Minuteman Com- muter Bikeway	Evergreen Ave Connec- tor		Trail Amenity	Low	1.53
24	Old Causeway Rd	Carlisle Rd	-	Crossing Improvement	Low	1.40
24	Dudley Rd, Old Cause- way Rd, Desired Con- nection	North Rd	Carlisle Rd	Shared Street, Sidewalk 1 Side, Desired Path Con- nection	Low	1.40
39	Bacon Rd, Hartford St	Loomis St	Great Rd	Sidewalk 1 Side	Low	1.40
46	Balsam Dr	Cot Hill Rd	Old Bil- lerica Rd	Sidewalk, 1 Side	Low	1.40

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# Priority Corridor and Node Recommendations

The following design concepts provide a template for bicycle and pedestrian improvements throughout the Town. While these concepts were developed for a specific street or intersection, the general design features are applicable to other streets in the area.

Members of the steering committee selected five corridors and nodes to be analyzed in detail for pedestrian and bicycle improvements. The corridors were selected based on input received at the Open House and on the WikiMap. The selected represent locations where existing pedestrian and bicycle infrastructure is poor or missing and while detailed concepts may be reapplied at other locations throughout Bedford.

Figure 18 shows the locations of the priority corridors described in this chapter. The corridors were chosen based on need for bicycling and walking improvements and represent a diversity of street types in the area. These corridors will be models for improvements throughout the Town.

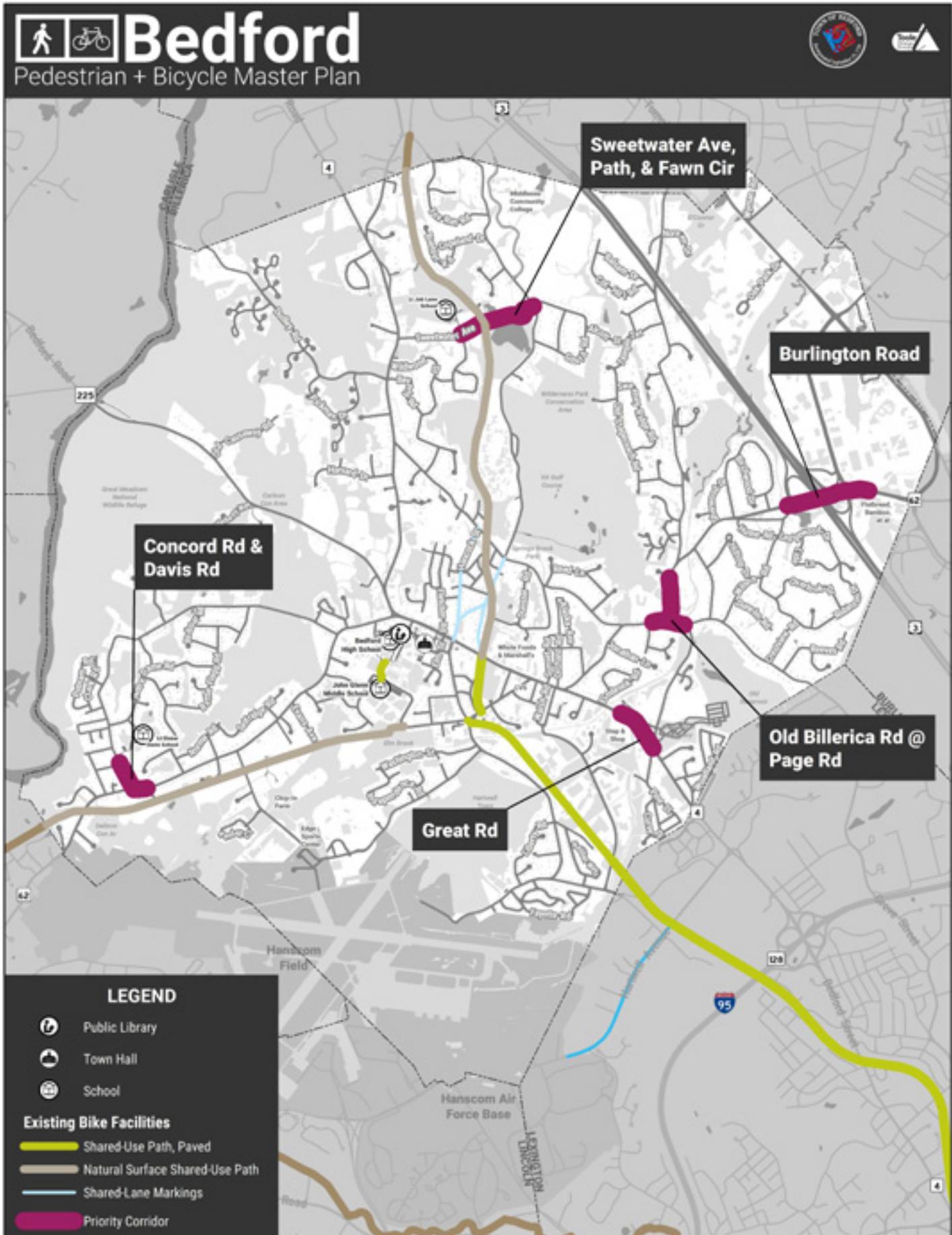


Figure 18: Priority Corridor Locations

# Priority Corridor

## Burlington Road

Burlington Road from Meadowbrook Road to the Burlington Town Line in its current state does not accommodate bicyclists and pedestrians due to high volumes and street width, as well as highway ramp crossings and complex signalized intersections. This is a critical corridor for people who want to walk or bike to several major employers in the area.

### Recommended Improvements

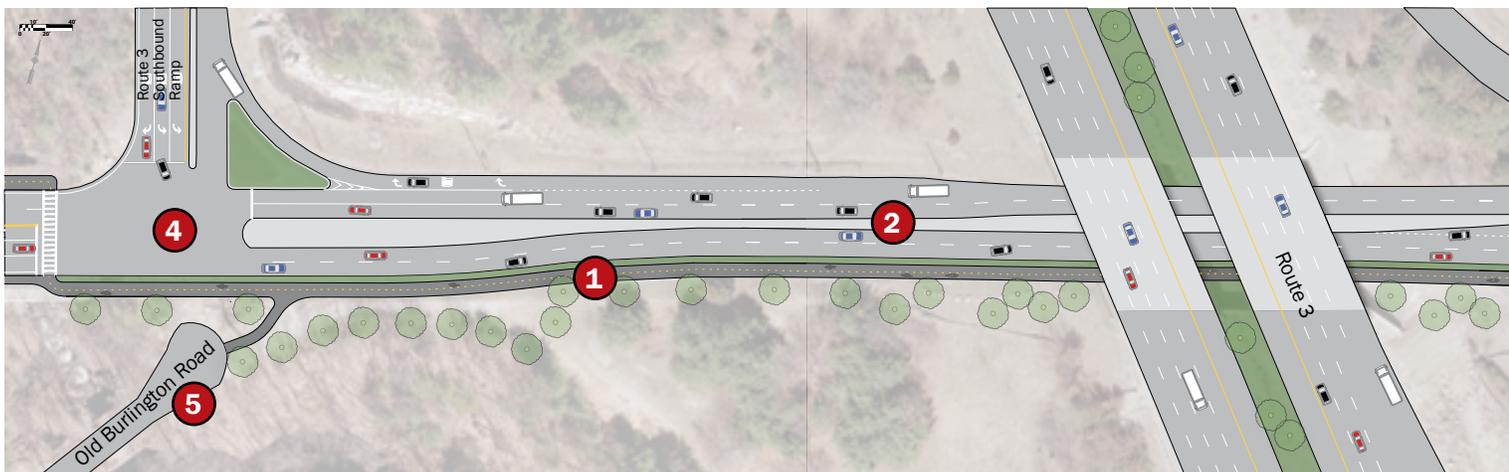
1. Sidepath on the south side of the road for bicyclists and pedestrians.
2. Narrowed travel lanes reduce speeds and provide sufficient width for a path.
3. Offset crossings at side street intersections provide improved visibility between vehicles and path users.
4. Signalization Improvements at both ramp intersections allow for safe crossing.
5. Connection to Old Burlington Road to provide additional biking and walking connectivity.

### Next Steps for Implementation

Narrow the existing median and travel lanes to allow for widening of the sidewalk to create the sidepath.

### Applicable Corridors

- Carlisle Road
- Concord Road
- Davis Road
- Hartwell Road
- Old Billerica Road
- Railroad Avenue



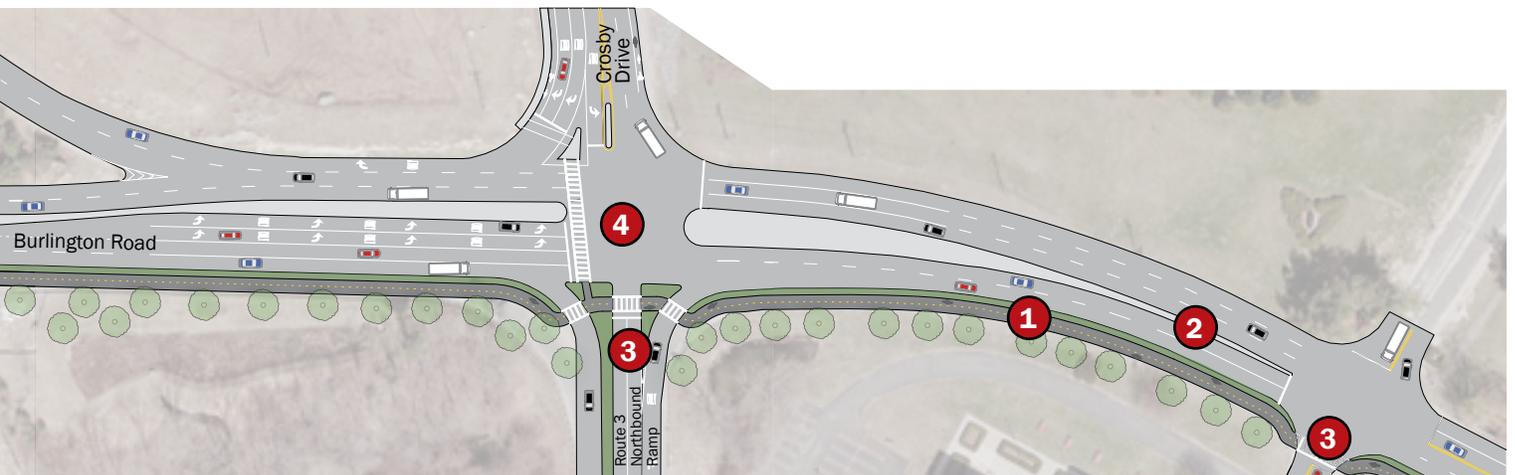
*Proposed improvements for Burlington Road*



Existing condition: Lack of bicycle and pedestrian facilities on Burlington Road



Sample treatment: Side path



# Priority Corridor

## Concord Road

Concord Road in its current condition provides inconsistent sidewalk coverage and no accommodation for bicycles. The low density suburban context and lack of signals encourages higher vehicular speeds.

### Recommended Improvements

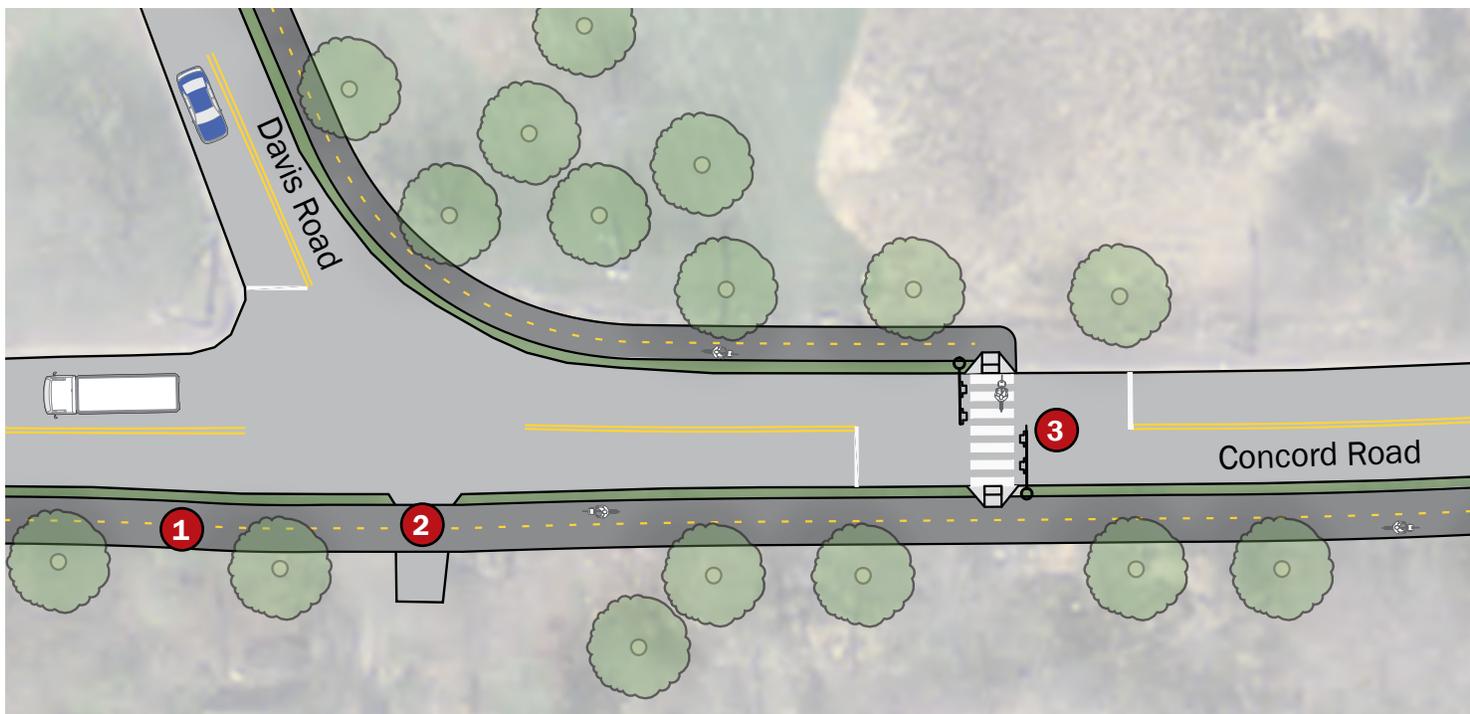
1. Sidepath on the south side of the road for bicyclists and pedestrians.
2. Raised crossings and/or offset geometry at side street intersections reduce turning speeds and provide improved visibility between vehicles and path users. High visibility midblock crossing.
3. High visibility crosswalk with a pedestrian hybrid beacon provides safe access between the Concord Road sidepath and Davis Road.
4. Level driveway crossings limit the up and down path profile for cyclists.

### Next Steps for Implementation

In segments where an existing sidewalk is provided, widening of the sidewalk within the right-of-way combined with narrowing the existing roadway cross-section will provide sufficient width for a path. It may be necessary to shift the centerline of the roadway in order to accommodate these recommendations.

### Applicable Corridors

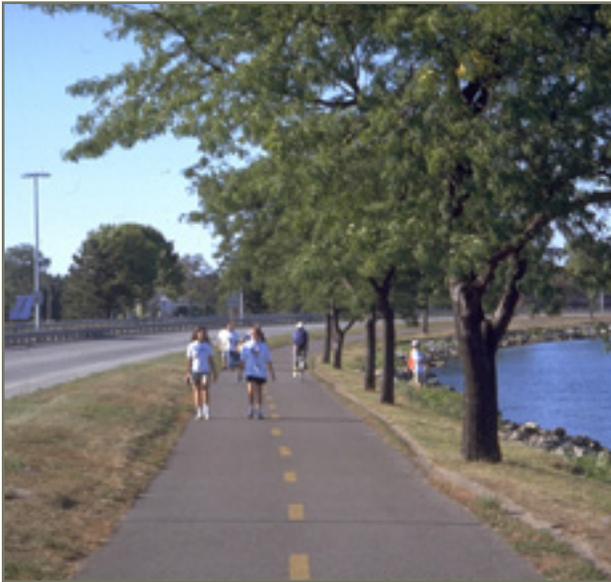
- Burlington Road
- Carlisle Road
- Davis Road
- Hartwell Road
- Old Billerica Road
- Railroad Avenue



*Proposed improvements for Concord Road*



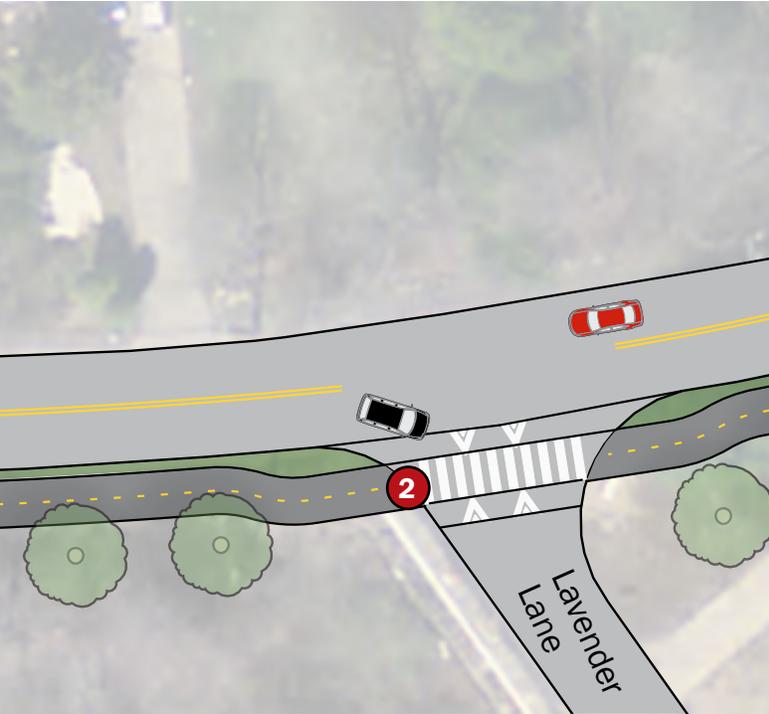
Existing condition: Lack of bicycle and pedestrian facilities on Concord Road



Sample treatment: Side path



Sample treatment: Pedestrian hybrid beacon



# Priority Corridor

## The Great Road

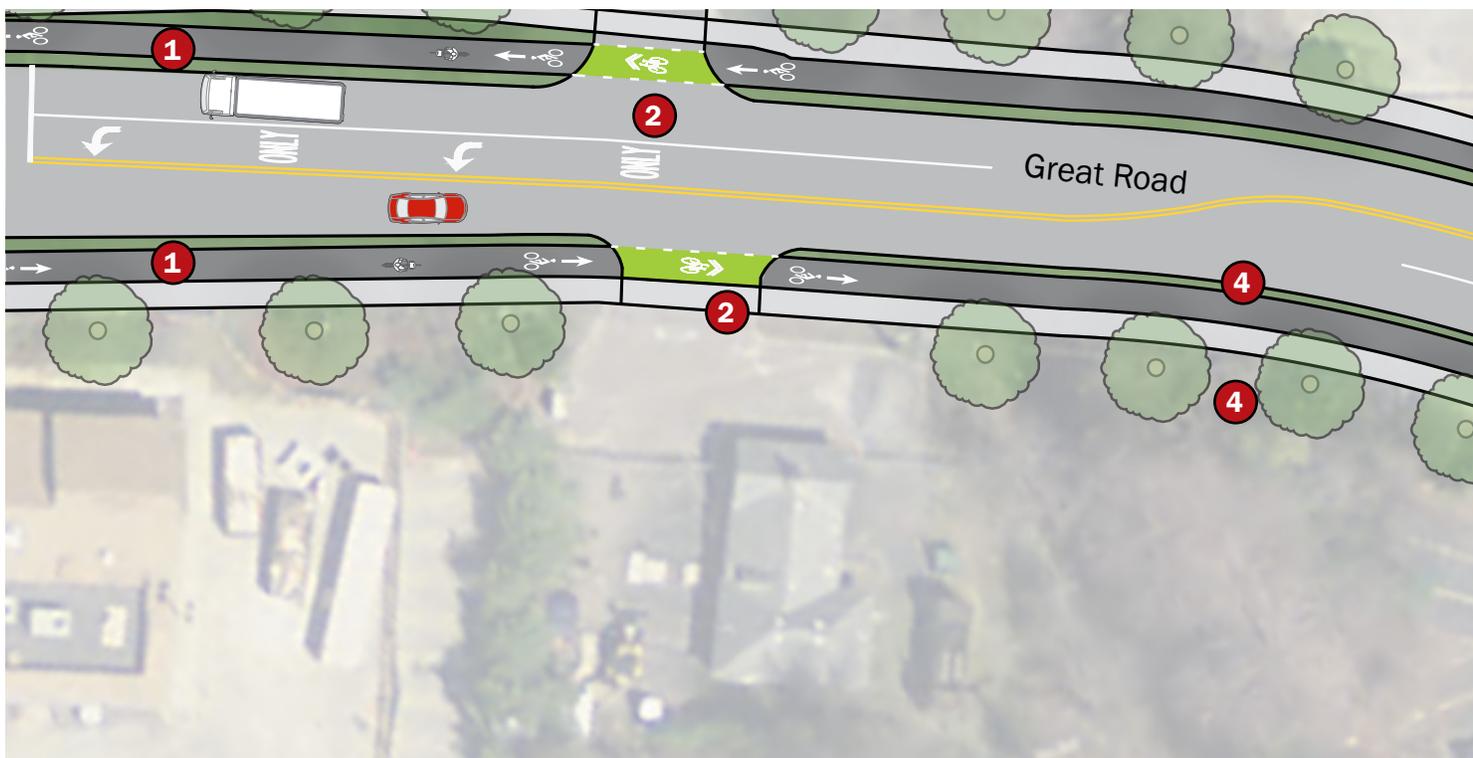
The Great Road from Bacon Road to Shawsheen Road is a major commercial corridor with high vehicular volumes, high vehicular speeds, and several access points to retail and commercial areas with potential for turning conflicts. This roadway is a primary transportation corridor, linking residential, commercial, and retail areas. It is a critical component of the transportation network for all modes.

## Next Steps for Implementation

As an interim project, restripe Great Road to retrofit bike lanes within the existing roadway cross-section. Future roadway reconstruction will allow for shifting the curb to provide separated bike lanes and improved sidewalks.

## Recommended Improvements

1. Separated bike lane
2. Green markings at intersections and driveways
3. Realign Shawsheen Road intersection to reduce turning speeds and conflicts.
4. Landscaping for comfort and traffic calming
5. Provide protected intersection treatments at major side streets and driveways, including corner islands or raised approaches.



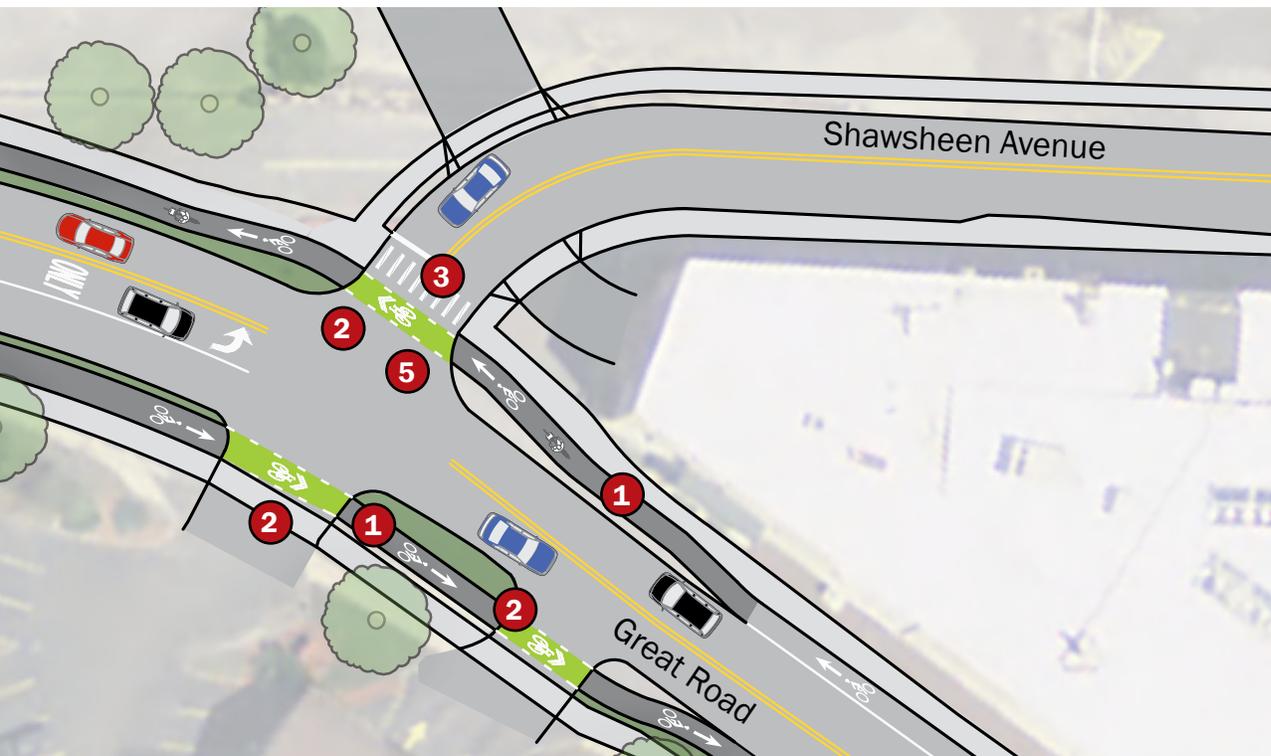
Proposed improvements for Great Road



Existing condition: Lack of bicycle facilities on The Great Road



Sample treatment: One-way separated bike lane



# Priority Corridor

## Lane School Corridor

Sweetwater Avenue, the primary connection between the Job Lane Elementary School and the residential neighborhoods to the east, lacks consistent accommodations for bicyclists and pedestrians. Providing shared streets, improved crossings, and paved path connections will allow more students to walk and bike to school.

### Recommended Improvements

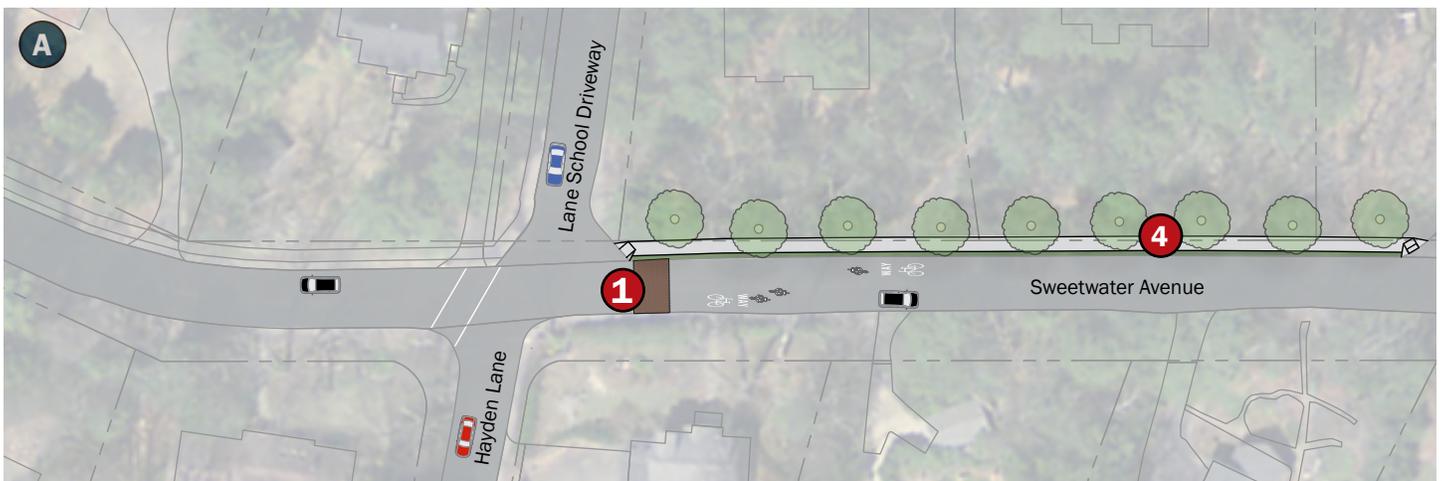
1. Gateway treatment including unique surface materials and signage east of Hayden Lane.
2. Raised Intersection for Springs Road at Fawn Circle to promote safe access between Fawn Circle and Gould Road.
3. Paved trail connection between Sweetwater Avenue and Fawn Circle.
4. New sidewalk between the Lane School Driveway and the eastern terminus of Sweetwater Avenue.
5. Improved crossing at the intersection with the Narrow Gauge Trail
6. Shared Street treatment for Sweetwater Avenue and Fawn Circle.

### Next Steps for Implementation

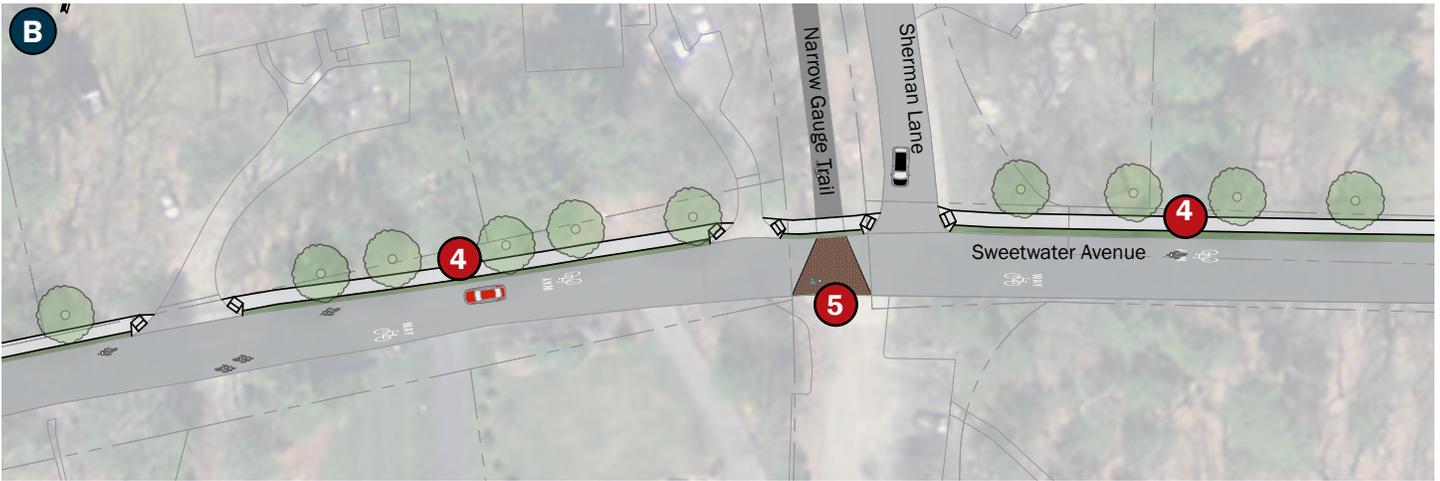
Coordinate with adjacent property owners to identify any potential impacts to grading and landscaping. Construction of the proposed path within the available right-of-way may require regrading and relocation of an existing stone wall.

### Applicable Corridors

- Dunster Road & Bedford Village
- Elm Brook Road
- Fox Run Road & Green Street
- Old Causeway Road & Dudley Road
- Wildwood Drive & Narrow Gauge Trail
- Williams Street & Winterbury Way



Proposed Improvements for Sweetwater Avenue near the Lane School Driveway



Continues to Map C

Proposed Improvements for Sweetwater Avenue near the Narrow Gauge Trail



Continues to Map D

Proposed Improvements for Sweetwater Avenue near the existing path



Proposed Improvements for Sweetwater Avenue near Fawn Circle

# Priority Node

## Page Road & Old Billerica Road

The intersection of Page Road and Old Billerica Road is a typical Y-style intersection with challenges for bicycle and pedestrian travel and crossing. Sight distance is poor for drivers and cyclists turning to and from Old Billerica Road. Traffic speeds are high through the intersection.

### Recommended Improvements

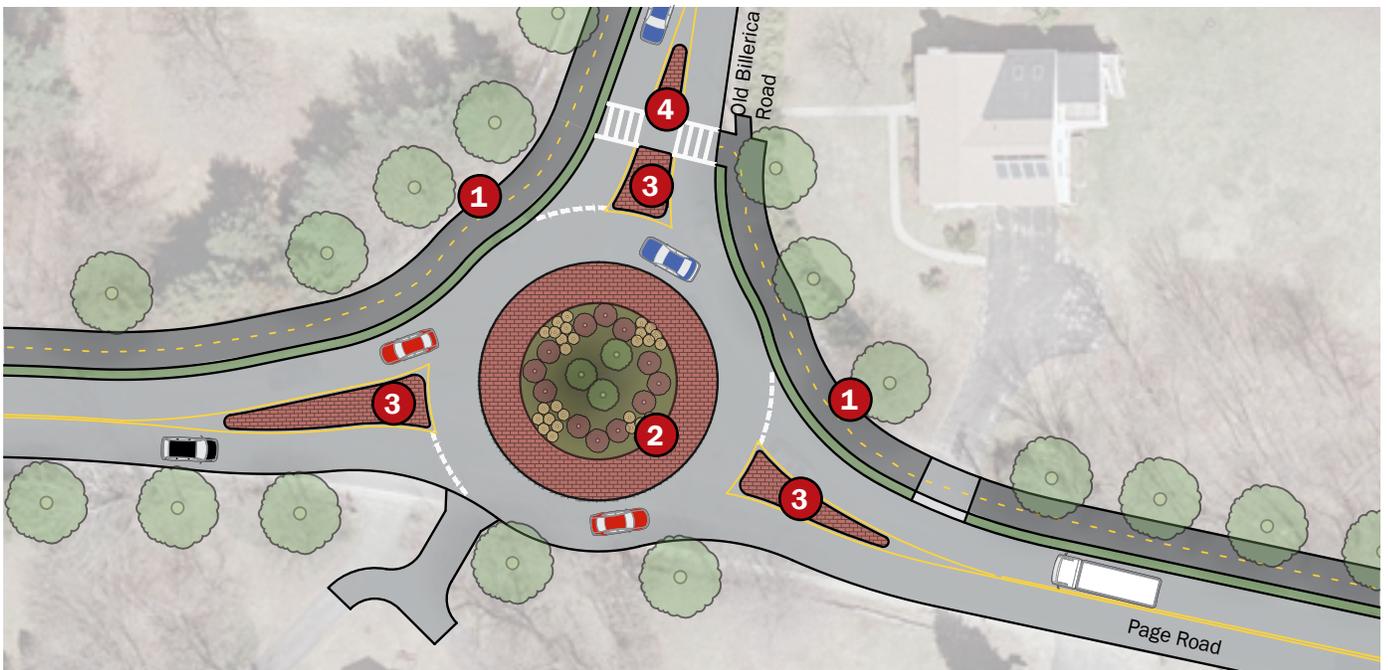
1. Sidepaths on the north side of Page Road and the west side of Old Billerica Road provide critical connections.
2. A modern roundabout reduces conflicts, improves safety, and provides increased capacity.
3. Splitter islands on the approaches reduce vehicle speeds and allow for a two-stage pedestrian crossing on Old Billerica Road.
4. Crosswalks at the splitter island allows pedestrians and bicyclists to cross one travel lane at a time.

### Next Steps for Implementation

Coordinate with adjacent property owners to identify any potential impacts to grading and landscaping and begin design implementation process (outlined in the implementation chapter). Note that the sidepath and roundabout may be implemented in separate phases. If they are implemented in two phases, the first phase must include accommodations for the second phase.

### Applicable Corridors

- Great Road & Concord Road
- North Road & Carlisle Road
- South Road & Summer Street



*Proposed roundabout at Page Road and Old Billerica Road*



*Existing condition: Limited visibility and lack of bicycle facilities*



*Sample treatment: Single-lane modern roundabout*



*Existing condition: Limited visibility and lack of safe pedestrian crossings*



*Sample treatment: Crossing island*



# Non-Infrastructure Recommendations

The following table lists the non-infrastructure recommendations for the Town of Bedford. These recommendations are organized by 5 E's of transportation planning and include the priority level and organization or department responsible for implementation. It is critical to apply strategies from all 5 E's to ensure a holistic approach to supporting walking and bicycling.

## The 5 E's

- 1. Education**
- 2. Encouragement**
- 3. Enforcement**
- 4. Engineering**
- 5. Evaluation**

## Responsible Parties

The following lists the boards, committees, departments and organizations responsible for implementing the various non-infrastructure recommendations, and the acronyms by which they are referred to throughout this chapter:

BAC = Bicycle Advisory Committee

BFC = Bedford Family Connection

BPD = Bedford Police Department

BPS = Bedford Public Schools

CEC = Capital Expenditures Committee

COA = Council on Aging

COC = Chamber of Commerce

DPW = Department of Public Works

ED = Economic Development

FMM = Friends of Minuteman Bikeway

HB = Healthy Bedford

PB = Planning Board

REC = Recreation Department

TAC = Transportation Advisory Committee

TC = Trails Committee

# 1. EDUCATION

<i>Recommendation</i>	<i>Priority</i>	<i>Responsible</i>
<p><b>Continue to provide bicycle and pedestrian safety classes for children.</b> Schools should offer bicycle safety courses as part of the Safe Routes to School program or through other programming. Courses should instruct children how to ride a bicycle, complete a bicycle safety check, use safe riding skills, and follow the rules of the road. Schools are encouraged to work with the Police Department to provide training. (To qualify as a Gold Bicycle Friendly Community, at least 50% of primary and secondary schools must offer bicycling education.)</p>	High	BPS
<p><b>Continue promoting bicycle safety classes for adults and seniors.</b> Classes should include education on safe riding skills, bicycle safety checks, rules of the road for bicyclists, and bicycle facilities and infrastructure. (At least two classes should be offered each year in order to qualify as a Gold Bicycle Friendly Community.)</p>	High	HB + COA
<p><b>Provide education and training to staff on bicycle and pedestrian planning and engineering.</b> These may include online or in person training from National Association of City Transportation Officials (NACTO), Association of Pedestrian and Bicycle Professionals (APBP), Pedestrian and Bicycle Information Center (PBIC), American Planning Association (APA), Institute of Transportation Engineers (ITE), or other organizations. Bedford has already offered education to staff on Complete Streets.</p>	Med	PB, BAC + DPW
<p><b>Provide education and ongoing training to law enforcement personnel on bicycle and pedestrian rights and responsibilities.</b> These may include online or in person training from NACTO, APBP, PBIC, APA, ITE, or other organizations. Last year, MassBike developed an enforcement video with the Boston Police Department entitled “Shifting Gears: Bicyclists &amp; Public Safety” which has been very well received by law enforcement.</p>	Med	BPD
<p><b>Continue to provide bike maintenance classes for kids, adults, and seniors.</b> Bicycle maintenance classes provide basic skills to casual riders to maintain bicycles for transportation and recreation, making bicycling accessible to more people. Local businesses offer these classes and the Town may consider offering classes as well, or promoting existing classes.</p>	Med	FMM
<p><b>Develop informational brochure on bicycling rules and responsibilities.</b> These brochures can be distributed to realtors, businesses, schools, and town departments to provide information and education about bicycle facilities, laws, and safe riding.</p>	Med	BPD
<p><b>Update etiquette signs along sidepaths and shared use paths, especially in transition areas from the Minuteman Bikeway.</b> Etiquette and education are critical to safety as well as smooth operations.</p>	Med	DPW

## 2. ENCOURAGEMENT

<i>Recommendation</i>	<i>Priority</i>	<i>Responsible</i>
<p><b>Promote Safe Routes to School.</b> Participation in Safe Routes to School (SRTS) programs can take the form of organizing annual walk events (such as International Walk to School Day), data collection, walking school buses, bike trains, walking and biking curricula, free or discounted helmet distribution, and monthly walk to school events. SRTS is a MassDOT program. Information on is available at <a href="http://www.commute.com/safe-routes-to-school">http://www.commute.com/safe-routes-to-school</a>.</p>		<b>BPS</b>
<p><b>Adopt a Complete Streets Policy</b> A robust Complete Streets policy will reinforce the town's commitment to bicycling and walking by requiring bicycle and pedestrian infrastructure on some or all streets in the town, with some special exceptions.</p>		<b>BAC, TAC, HB + PB</b>
<p><b>Apply for Walk-Friendly Community designation.</b> Walk-Friendly Community designations can be earned from the Pedestrian and Bicyclist Information Center. The recommendations in this document include specific targets for a successful application.</p>		<b>HB</b>
<p><b>Re-apply for Bicycle-Friendly Community designation.</b> Bicycle-Friendly Community designation can be earned from the League of American Bicyclists. The recommendations in this document include specific targets for a successful application.</p>		<b>BAC</b>
<p><b>Continue to organize regular walking groups.</b> The Town and other organizations should expand walking groups around other demographics, geographic location, or interests (e.g. mom &amp; baby, seniors, intergenerational walk to school day).</p>		<b>COA, BFC, Comm Orgs, + Churches</b>
<p><b>Continue to organize special biking events.</b> These may include a cyclovia event (where streets are closed to vehicular traffic), midnight bicycle rides, Bike to Work day, or other events that celebrate biking, encourage participation, and enhance the visibility of bicycling.</p>		<b>BAC + Econ Dev</b>
<p><b>Continue to promote regular biking groups.</b> Local bike shops already host regular recreational biking groups. These should be publicized and expanded as a way to introduce new people to bicycling and increase the visibility of bicycling in Bedford.</p>		<b>BAC + FMM</b>
<p><b>Include walking, biking, and transit directions on business websites and brochures.</b> These directions will help people, especially those not familiar with Bedford, know their transportation options and will increase the visibility of walking and biking in Bedford.</p>		<b>ED</b>

## 2. ENCOURAGEMENT

<i>Recommendation</i>	<i>Priority</i>	<i>Responsible</i>
<p><b>Add a funding program in the Town budget for bicycle and pedestrian facilities.</b></p> <p>A dedicated funding program makes it easier to conduct small scale bicycle and pedestrian projects on a regular basis.</p>		<b>DPW</b>
<p><b>Continue to organize special walking events.</b></p> <p>Special walking events may include holiday or seasonal themed walks with businesses, walking challenges (distance over time), Walk to Work Days, International Walk to School Day, or other events that encourage people of all ages and abilities to walk.</p>		<b>HB, TC + ED</b>
<p><b>Continue to organize Open Street events.</b></p> <p>During such events, streets are closed to traffic and open to the community for exercise, recreation, shopping, and general enjoyment. These events are an opportunity to include walking and biking education and build visibility for walking and biking programs. Events may be organized by community members and work with the Planning Department to server as a liaison to other town departments.</p>		<b>BPD, HB, COC + ED</b>
<p><b>Encourage businesses to create bicycle and pedestrian friendly entrances and access through parking lots.</b></p> <p>Encourage developers and land owners to include paths/easements between properties to build out an off-road bicycling and walking network. (This is also noted as a design review element below in “Enforcement.”)</p>		<b>PB + ED</b>
<p><b>Maintain bike parking zoning bylaws for new developments.</b></p> <p>New developments are required to provide bicycle parking onsite per Section 7.4.4 of Town of Bedford Zoning Bylaws. Refer to the APBP guide to bike parking.</p>		<b>PB</b>
<p><b>Develop bike benefit program for shoppers.</b></p> <p>This program would provide stickers for bike helmets that entitle bicycle riders to discounts from local retailers. Bike benefit programs may also include special hours on bike event days or special events promoting biking to retail.</p>		<b>ED + COC</b>
<p><b>Encourage businesses to install covered, secure, and well-lit bike parking for both customers and employees.</b></p> <p>The availability of bike parking is often a major factor in encouraging bicycling and can also be significant to attracting customers.</p>		<b>PB + ED</b>
<p><b>Hold a 2-mile challenge.</b></p> <p>Encourage/challenge residents/employees to bike or walk for trips under 2 miles.</p>		<b>HB</b>

### 3. ENFORCEMENT

<i>Recommendation</i>	<i>Priority</i>	<i>Responsible</i>
<p><b>Continue the community law enforcement/bicycling liaison relationship.</b></p> <p>This may be either a volunteer position who works with police and the Bedford Bicycle Advisory Committee to connect, communicate, and cooperate, or joint meetings of law enforcement officials and the bicycle advisory committee to work together on issues.</p>		<b>BPD</b>
<p><b>Review town ordinances related to bicycle use, registration and parking.</b></p> <p>Ordinances should encourage bicycling and protect bicyclists rather than discourage use.</p>		<b>PB, DPW + BPD</b>
<p><b>Use the Pedestrian and Bicycle Plan for project and development review.</b></p> <p>Compare all proposed capital projects and development reviews to the infrastructure recommendations in the Pedestrian and Bicycle Plan for opportunities to implement recommendations. Include easements across and between parcels to create walking and bicycling connections and develop an off-road network.</p>		<b>PB, TC + CEC</b>
<p><b>Continue police presence on bike paths.</b></p> <p>Police or volunteer presence on bike paths can increase safety and the perception of safety in these areas.</p>		<b>BPD</b>
<p><b>Increase police presence/ticketing at crosswalks.</b></p> <p>Other communities have had great success in improving their walk-friendliness by increasing enforcement at crosswalks and ticketing drivers who don't yield to pedestrians in the crosswalk.</p>		<b>BPD</b>
<p><b>Continue progressive ticketing program aimed at drivers and bicyclists and "bad driver" reporting program.</b></p> <p>Progressive ticketing programs employ warnings and education before ticketing as a means to educate road users about traffic laws, new facilities, and safe habits. "Bad driver" reporting program allows bicyclists or pedestrians to report unsafe vehicular driving to police without having to confront the driver.</p>		<b>BPD</b>

## 4. ENGINEERING

<i>Recommendation</i>	<i>Priority</i>	<i>Responsible</i>
<p><b>Require traffic management plans during construction to provide for pedestrian and bicycle travel.</b></p> <p>The town should review traffic management plans for signs and detours that maintain pedestrian and bicyclist access around construction zones.</p>	 High	<b>DPW</b>
<p><b>Organize volunteer snow clearance program.</b></p> <p>A volunteer snow clearance program recruits community groups, schools groups, sports teams, or community service minded individuals to assist with snow clearance activities. These groups can supplement the town's snow clearance program, focus on routes to transit, or on off-street paths.</p>	 High	<b>HB</b>
<p><b>Update pedestrian and bicycle design standards for crossings.</b></p> <p>Consider countdown signals for crossings, which increase pedestrian safety by informing pedestrians of remaining crossing time and reducing the number of pedestrians still in the crosswalk when opposing traffic receives a green light.</p>	 High	<b>DPW</b>
<p><b>Audit bus stops to ensure that bicycle and pedestrian access is clear and convenient.</b></p> <p>Transit stops should be accessible to disabled persons and connect to sidewalks. Stop locations should be audited for crosswalks and warning signage to improve the visibility and safety of pedestrians using the transit stop. Bicycle access should be supported with bicycle parking and maintenance stations.</p>	 High	<b>TAC</b>
<p><b>Include shared use paths in snow clearance activities.</b></p> <p>Ensuring year-round access to walking and bicycling facilities allows citizens to rely on these facilities for daily uses.</p>	 High	<b>DPW</b>
<p><b>Install bicycle lanes or paths on at least 78% of arterial streets and include at least 45% of the town's total road mileage in the local bike network.</b> This is a requirement to qualify as a Gold Level Bicycle Friendly Community.</p>	 Med	<b>BAC, TAC + DPW</b>
<p><b>Inspect condition of sidewalks, side paths, and pedestrian ramps as part of Pavement Condition review.</b></p> <p>Incorporate pedestrian and bicycle infrastructure data points into regular maintenance assessments. Data collected in GIS compatible formats can be cross-checked with the Pedestrian and Bicycle Plan.</p>	 Med	<b>DPW</b>
<p><b>Inspect and restripe bicycle and pedestrian facilities annually.</b></p> <p>Pavement markings generally require restriping every 3-5 years to maintain visibility. Pedestrian and bicycle markings should be incorporated into existing inspection programs.</p>	 Med	<b>DPW</b>

## 4. ENGINEERING

<i>Recommendation</i>	<i>Priority</i>	<i>Responsible</i>
<p><b>Require installation of wheel guards on Town owned heavy vehicles.</b></p> <p>Wheel guards prevent bicyclists from being pulled under the wheels of heavy vehicles in a crash. The Town should retrofit vehicles operated by the Town, such as waste removal, construction or maintenance vehicles. Contracted vehicles should also include wheel guards.</p>		<b>DPW</b>
<p><b>Update pedestrian and bicycle signage and markings to current standards.</b></p> <p>The Manual on Uniform Traffic Control Devices (MUTCD) provides guidance on retroreflectivity, messaging, location, and color for pedestrian and bicycle signage and markings. Current edition is 2009.</p>		<b>DPW</b>
<p><b>Include on- and off-road bicycle facilities in maintenance programs.</b></p> <p>Bike lanes and off road paths should be cleared of debris and snow, year-round. Bicycle facilities should be added to street sweeping and snow clearance programs.</p>		<b>TC, BAC, DPW + FMM</b>
<p><b>Continue to use and promote SeeClickFix or other mobile or online application to report issues to the Town.</b></p> <p>A mobile app allows citizens to report maintenance needs that impact walking and biking.</p>		<b>DPW + BPD</b>
<p><b>Install bicycle and pedestrian wayfinding.</b></p> <p>Bicycle and pedestrian wayfinding should include navigation to popular destinations, time and/or distance to destination. This should be integrated with any town-wide wayfinding plan for all transportation modes.</p>		<b>ED, BAC + FMM</b>
<p><b>Install public bike maintenance stations.</b></p> <p>Public maintenance stations allow bicyclists to fill tires with air and complete minor repairs. These stations offer convenience to bicyclists and increase the visibility of bicycling in the community.</p>		<b>BAC + DPW</b>
<p><b>Create a shared parking ordinance.</b></p> <p>Shared parking allowances would optimize parking supply in existing surface lots and improve the pedestrian environment by fostering more pedestrian friendly land-use and scale.</p>		<b>PB + DPW</b>
<p><b>Create a bicycle parking program.</b></p> <p>The Town should create a bike parking request system and install new bike racks and bike parking corrals in areas of high demand.</p>		<b>BAC + DPW</b>

## 5. EVALUATION

<i>Recommendation</i>	<i>Priority</i>	<i>Responsible</i>
<p><b>Review and update the Pedestrian and Bicycle Plan every two years.</b> The plan will require updates as conditions change over time.</p>	 High	<b>TAC, BAC + DPW</b>
<p><b>Conduct walking audits annually.</b> A walking audit is a method to determine if neighborhoods or specific routes meet walkability criteria, such as safety, connectivity, accessibility, comfort, cleanliness, and maintenance. Walk audits should be completed near schools or other high demand locations. WalkBoston and PBIC have helpful information on how to conduct a walking audit.</p>	 High	<b>TAC</b>
<p><b>Collect bicycle and pedestrian crash data annually.</b> The Town should collect data bicycle and pedestrian crashes. Crash reports should be modified to include information specific to pedestrian and bicycle crashes (see recommendation regarding crash reports.) Law enforcement may need training on new procedures.</p>	 Med	<b>BAC + BPD</b>
<p><b>Collect and analyze walk counts.</b> Data collection is typically led by the Boston Region MPO/CTPS, and relies on volunteers for counts. Participate in the data collection at key locations throughout Bedford to track walking.</p>	 Med	<b>TAC</b>
<p><b>Collect and analyze bike counts and crash data.</b> Data collection is typically led by the Boston Region MPO/CTPS, and relies on volunteers for counts. Participate in the data collection at key locations throughout Bedford to track bicycling.</p>	 Med	<b>BAC</b>
<p><b>Review recommended spot and segment improvements for potential demonstration projects.</b> Some recommendations may be candidates for temporary or low-cost interim improvements. This will allow the Town to try out recommendations before construction funding is available.</p>	 Med	<b>DPW</b>
<p><b>Establish a vehicle miles travelled (VMT) reduction target.</b> Bedford should set a target VMT reduction percentage by a specific date. This will provide a benchmark for a Complete Streets policy. VMT reduction efforts may initially include specific populations, such as increased mode shifts at schools, neighborhood car-free days or weeks, or “walk to lunch” programs at local businesses.</p>	 Med	<b>BAC + TAC</b>
<p><b>Establish bicycle/pedestrian mode share goals.</b> Mode share is the percent of trips taken among all travel modes. Bedford should set target mode shares for walking and biking. Mode share can be tracked through census data, traffic counts, and/or local surveys. The Town may look to similar towns who have reached Gold level Bicycle Friendly designation to set a target or work with the Bike Committee to determine a reasonable number.</p>	 Med	<b>BAC + TAC</b>

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# Implementation

This chapter describes the process for implementing the recommendations of this Plan. Activities involve coordination among the Town, state, and non-governmental organizations, determining early-action projects to help gain momentum, maintaining facilities, and measuring progress over time.

## Applying the Vision to Town Projects

The vision statement of the Pedestrian and Bicycle Plan should be referred to for all Town infrastructure projects regardless of whether they are included within this plan. The vision should be discussed during the design and review process, as part of all public outreach efforts, and when determining construction phasing and staging. Consideration should be given to the construction phasing and staging to reduce bicycle and pedestrian impacts.

## Infrastructure Implementation

The Plan recommends that bicycle and pedestrian infrastructure improvements should be considered and incorporated into all roadway work, construction, and maintenance activities. Some infrastructure recommendations in the plan will not overlap with individual roadway projects and should be scheduled through annual investment budgets or pursued as standalone bicycle or pedestrian improvement projects.

Coordinating bicycle and pedestrian improvements with general infrastructure projects early in the design process is the most cost effective approach for implementation, resulting in cost savings for the Town. In most cases, the cost of the pedestrian or bicycle treatments are minimal relative to other roadway costs and may be able to be incorporated without adding significant cost burdens to the project. Projects funded and/or constructed by MassDOT should include the recommendations of the Plan during the project scoping phase for potential to incorporate recommendations.

Another cost effective method to implement the bicycle and pedestrian improvements is to incorporate them into existing Town maintenance programs. For example, a bicycle lane may be added to an existing road when the road is resurfaced or when pavement markings are restriped. This may require additional design work to determine if eradication, shifting, or new parking

lines, travel lines, or centerlines are necessary. In addition, existing or future vendor contracts and/or Town department budgets should be modified if needed to include items such as green high friction surface, bicycle pavement markings symbols, or sign materials.

The Town's Budget and Capital Improvements Plan has a general capital investment program for resurfacing, which may be used to include bike lanes or improve crosswalks as a part of resurfacing, however, there are no general programs for bicycle and pedestrian facilities in the budget. Specific bicycle and pedestrian projects should be included in the list of capital projects.

This Plan recommends creating a dedicated funding program within the Town budget for bicycle and pedestrian improvements. The projects implemented through these programs would generally be small and located at various, discrete locations in the town. Using the cost calculator, GIS database, and prioritization tables included in the Plan, Town staff can estimate budgets and track this type of annual program. The Town may also consider creating new budget lines for annual investment such as signal upgrades, signage installation, or pedestrian ramp improvements.

Projects that are primarily focused on bicycle or pedestrian improvements may be eligible for state or federal funding within the federal transportation act, such as the Transportation Alternatives Program under Moving Ahead for Progress in the 21st Century (MAP-21) and future transportation acts. Similarly, some bicycle or pedestrian recommendations may also be good candidates for non-profits, public private partnerships, or public fundraising.

The infrastructure recommendations of this plan are categorized as high, medium, or low based upon the methodology outlined in Chapter 4.

The implementation of bicycle and pedestrian infrastructure should follow the process and protocols in place for all types of infrastructure projects. A typical infrastructure process includes a phase of community outreach, design and review, and construction.

## Public Outreach

Concurrently with the design and review aspect of the implementation process, the project should include a public outreach component. The public outreach component may include public meetings, online forums, direct outreach to individuals, organizations, or schools, or other appropriate methods to obtain feedback from the public. Consideration should be given to be sure all infrastructure recommendations address issues that are particularly relevant for all, especially vulnerable populations including children, seniors, and persons with disabilities.

## Design and Review

All infrastructure projects will require engineering design and review. The design and review process for each project will vary depending on designer, such as a private consultant or Town department, and funder, such as the Town or MassDOT.

The design and review section of the process will include development of engineering plans, specifications, and estimates for construction and should follow federal, state, and local standards and guidelines. Projects may require an initial conceptual design study as part of the design process and may require further analysis. Consideration should be given to conducting a walking and/or bicycling audit at the beginning of the project to identify existing bicycle and pedestrian issues that should be addressed during the design process. Projects with state or federal funding may require additional scoping for environmental or other permitting requirements.

According to the MassDOT Healthy Transportation Policy Directive, all MassDOT funded and/or designed projects should seek to increase and encourage more pedestrian, bicycle and transit trips.

All prepared construction documents should be reviewed by the necessary Town departments including, but not limited to, the Planning Department, Public Works Department, and the Police and Fire Departments if necessary.

If the project lead is outside of the Town administration, namely a private entity or the State, the Planning or Public Works Departments may require peer review to ensure that the project is designed and implemented according to the town's standards and the intent of the Pedestrian and Bicycle Plan.

## Construction

After the completion of the community outreach and design and review process, the project may be implemented through construction. Construction of the recommendations may be completed by selecting a contractor through a public bid process or using Town staff through the Public Works Department.

During construction, bicycle and pedestrian impacts should be limited by maintaining access for these modes. If using alternative routes or detours, consideration should be used to provide the most direct route with appropriate signage. In some instances, transit stops may need to be temporarily relocated and appropriate signage should be used.

At the completion of construction, informational signage or increased enforcement may be necessary for some of the recommendations being installed for the first time. This may include where bike signals or bike boxes are installed, where street operations are being modified, or where new traffic controls are installed.

## Maintenance

Maintenance is critical for the function, performance, and longevity of bicycle and pedestrian infrastructure. Bicycle and pedestrian facilities should be added to inspection schedules and the maintenance and repair of facilities should be accounted for in maintenance budgets.

Off-road paths should be plowed, swept and otherwise maintained year-round to allow for consistent commuting or traveling by walking or

bicycling. For walking and bicycling facilities to truly be useful as a transportation network, they must be maintained at the same level as other transportation facilities in the Town.

## Early Action Projects

A key step in building momentum for a network of bicycle infrastructure is identifying a series of low cost measures which the Town can implement within the next 12 months. These items are low cost measures, have minimal impact to existing land and roadway usage, and may be designed and implemented within a single construction season.

Short-term projects include three primary categories:

### 1. High priority sidewalks

Where short gaps exist in areas of high pedestrian demand and right-of-way is available, the Town should move forward as soon as possible to close gaps using the provided sidewalk prioritization. See Figure 8 in the Infrastructure chapter for details.

### 2. Bike lanes

Bike lanes are recommended along select corridors where existing roadway width permits. As these projects do not typically require physical roadway construction, implementation can happen relatively quickly and at low cost. This plan recommends that all bike lane recommendations be implemented within the next 12 months. Additionally, consider implementing bike lanes on Great Road along the segments where existing roadway geometry permits as an interim improvement until such a time as a separated bike lanes may be constructed as part of a larger project.

### 3. Shared-lane markings and signage

The Town should implement recommended shared-lane markings and signage as an interim measure until a future network of separated bike facilities is developed. See Figure 19 for a map of proposed locations for shared-lane markings in the Town.

Shared-lane markings should be implemented on selected corridors throughout Bedford where traffic conditions permit. Town staff should work with the Bicycle Advisory Committee to determine priority locations for implementation. Appropriate locations include roadways where 85th percentile vehicle speeds are below 35 miles per hour and bike lanes or other bicycle facilities are not feasible in the immediate future. Shared-lane markings provide positive guidance for bicyclists indicating proper positioning within the roadway and reinforce the fact that bicyclists must take the full lane when necessary. The markings and associated signage serve to remind drivers that bicyclists use the corridor and that it is necessary to change lanes to pass. It is important to understand that while shared-lane markings increase driver awareness of bicyclists, they have not been found to increase bicycle mode share.

Shared-lane markings should be implemented with care in Bedford to avoid diluting their message through overuse. On corridors identified for shared-lane markings, the markings should be placed upon entry to the road from major intersections, at corners and vertical curves with limited sight distance, and otherwise at roughly ¼ mile intervals. The first shared-lane marking in each direction on the roadway should be installed with an adjacent MUTCD compliant R4-11 sign including the optional CHANGE LANES TO PASS placard to remind all users of the rules of the road.



R4-11

See Figure 19 for a map of proposed locations for shared-lane markings in the Town.

# Bedford

Pedestrian + Bicycle Master Plan

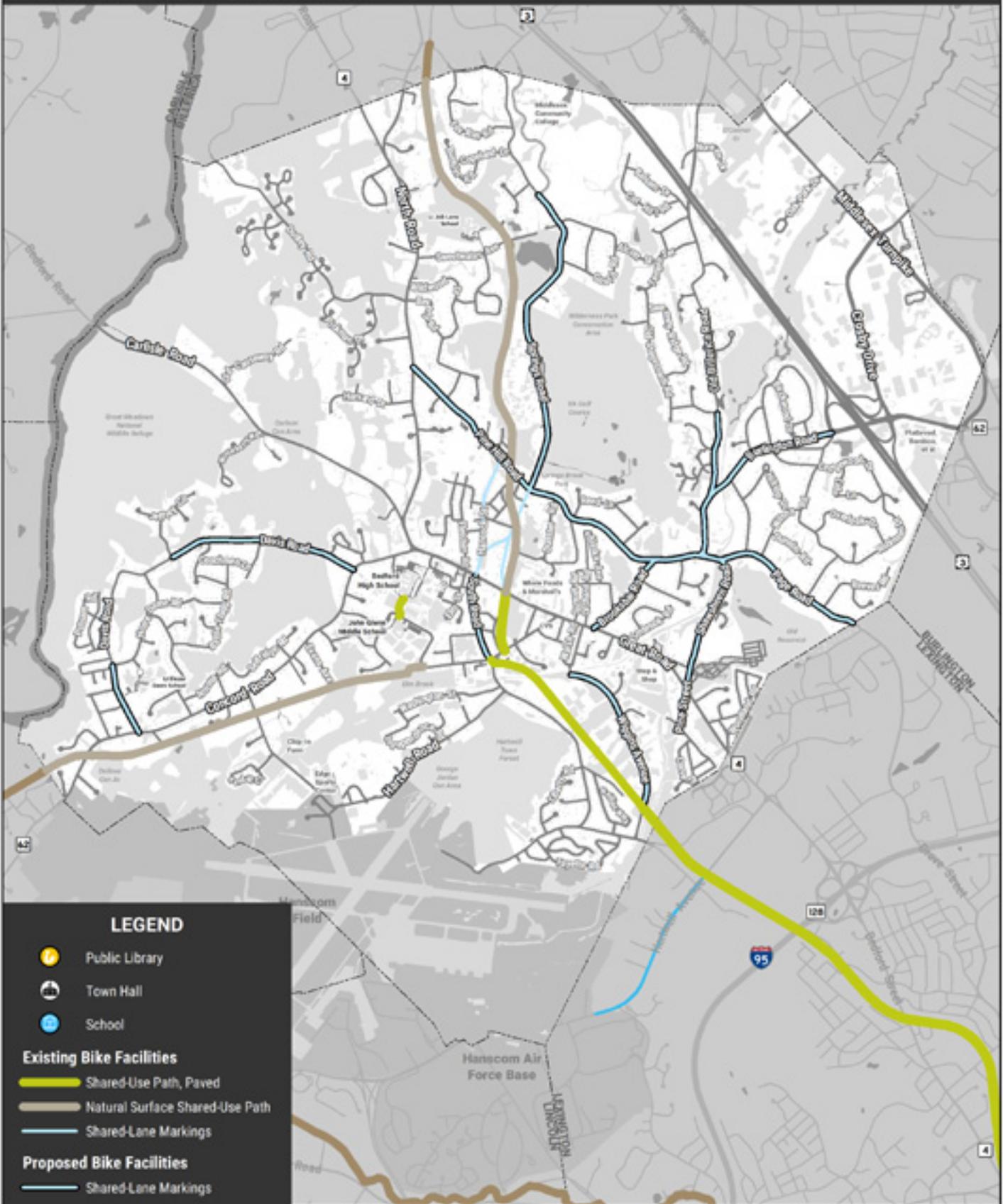


Figure 19: Proposed Shared-lane markings

## Non-Infrastructure Implementation

The Town of Bedford has already established many successful policies and practices for encouraging and promoting walking and bicycling. Maintaining or expanding these existing assets and programs and developing additional policies and programs will help achieve the vision of the Pedestrian and Bicycle Plan.

In order to have a well-balanced and effective set of programs it is important to pursue recommendations in all of the Five E's. Education, enforcement, and evaluation, in particular, take sustained effort to implement. Fortunately, policy and programming recommendations can be spearheaded by a broad array of actors and funded in numerous ways—or may require no funding at all.

Many Town departments, boards, and committees are responsible for implementing the Pedestrian and Bicycle Plan. The non-infrastructure recommendations table indicates the lead department for each. In practice, this department will often be a collaborator or liaison with a partner in the business community or a community organization.

## Prioritization

Many infrastructure recommendations involve completing gaps in the network, especially within the trail network. Completing these gaps will create new options for walking and bicycling trips and will have an impact on the popularity of certain routes. As the gaps are filled in, new demands or travel patterns will evolve and these new patterns may impact the prioritization of other improvements. The town may need to shift the prioritization of infrastructure recommendations as projects are implemented.

Non-infrastructure recommendations will be implemented by both the public and private sector. Although the recommendations have been prioritized, agencies responsible for

implementation should consider, but not be constrained by, this prioritization. Private and nonprofit organizations implementing certain recommendations may accelerate the implementation process if those recommendations are closely aligned with their organizational missions or if they find opportunities to move recommendations forward.

Funding for policy and programming is based to a large extent on affinity and opportunity. Recruiting more entities and departments to take up these recommendations opens more avenues for funding and organizing the initiatives. Some of the recommendations for programming are volunteer efforts and require more labor and organization than funding.

## Measuring Progress

The Town of Bedford should monitor the infrastructure and non-infrastructure recommendations implemented each year using the recommendation tables and GIS database from the plan. Regular updates to the status of the recommendations may be appropriate.

Measuring the scale and impact of investments is essential to build momentum towards achieving the vision of the Plan. Some projects and initiatives may not seem successful initially but should be evaluated and analyzed to understand long term impacts. Based on the outcome, the recommendations of the Plan may be modified to help refine future recommendations, policies, or programming and may reduce costs.

Bicycle and pedestrian counts should be conducted in a consistent manner (same time of year, time of day, location). The Town should continue work with the advisory groups or volunteers to conduct these counts.

Crash rates are another important statistic that should be tracked. Crash rates should be analyzed in the context of “exposure,” or walking and bicycling rates in relation to number of incidents. Small data samples can produce misleading statistics. Another way of measuring safety is through surveys tracking the perception

of safety. Intercept surveys at a specific location and/or community surveys that track perception changes over time are a useful supplement to maintaining crash records.

Achievements such as obtaining Gold level Bicycle Friendly Community designation and Walk Friendly Community status are also key measurements of progress.

