

Proposed Bruce Freeman Rail Trail/MBTA Commuter Rail Crossing Alternatives Analysis



Submitted to:

Town of Concord

Department of Planning and Land Management

141 Keyes Road

Concord, MA 01742

February 2010

Submitted by:

GPI Greenman-Pedersen, Inc.

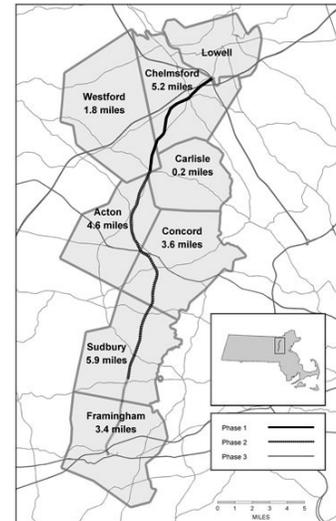
Engineers, Architects, Planners, Construction Engineers and Inspectors

105 Central Street, Suite 4100, Stoneham, Massachusetts 02180

A. INTRODUCTION

West Concord center is a small “suburban town center”. West Concord has established its identity as a separate village and has a unique architectural character defined by styles popular in the late 19th and early 20th centuries. Its structures are defined by similarities in materials, scale and orientation. The residents of West Concord value this character and want to ensure that it remains. Several studies have been done in Concord which include goals for West Concord. These studies include the “Long Range Plan for Land Use to the Year 2000” of 1987, the “West Concord Study of 1993,” the “Comprehensive Long Range Plan of 2005”, and the “Concord Villages Study of 2007”. The goal in each is to maintain the character of West Concord. A West Concord Task Force was established in 2008 to develop recommendations for West Concord.

The Bruce Freeman Rail Trail (BFRT) corridor extends approximately 25 miles along the Framingham and Lowell Railroad Corridor. The Town of Concord is currently designing the section of the BFRT from Commonwealth Avenue south to the Sudbury Town Line. The portion north of Commonwealth Avenue is being designed by the Massachusetts Department of Transportation Highway Division (MassDOT) as part of the Concord Rotary Project. The Concord section will meet the trail in Acton to the north and Sudbury to the south. Concord's 25% Preliminary Design of the trail includes a section of the trail that passes through the West Concord Village Center and crosses the active Massachusetts Bay Transit Authority (MBTA) Fitchburg Commuter Rail Line. This crossing presents a concern for both residents and the MBTA.



Greenman-Pedersen, Inc. (GPI) was retained by the Town of Concord to develop and evaluate several alternatives (see illustration on the next page) for the BFRT to cross the active MBTA Rail Line including the following:

1. Follow an existing abandoned railroad spur in the northern portion of the West Concord commuter railroad station to Commonwealth Avenue and instruct bicyclists to dismount and walk their bicycles on the sidewalk on the north side of Main Street to the existing traffic light in front of the 99 Restaurant, cross at the existing traffic signal and then re-mount south of Main Street at the existing Massachusetts Executive Office of Transportation and Construction (EOTC) owned right-of-way. Another option would be to allow bicyclists to ride on Commonwealth Avenue on a specially marked "sharrow" lane to the traffic light in front of the 99 Restaurant.
2. Follow the existing railroad right-of-way with a gap in the trail at the existing MBTA commuter railroad right-of-way.
3. Re-route the BFRT to the Assabet River east of the Concord Park assisted living facility, crossing under the active rail road and Main Street at the Assabet River.
4. Construct a tunnel under the active MBTA railroad right-of-way in the vicinity of the existing crossing.
5. Construct a ramp/bridge/elevator facility over the existing MBTA railroad right-of-way in the vicinity of the existing crossing.

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6. Follow an existing abandoned railroad spur in the northern portion of the West Concord commuter railroad station to and across Commonwealth Avenue to the driveway between Concord Teacakes and Twin Seafood, over a town right-of-way through the parking lot. From there, the trail would go behind Concord Teacakes and up the slope to the Harvey Wheeler Community Parking lot, across the parking lot and down the slope to Main Street. The trail would turn left on Main Street to the intersection with Commonwealth Avenue and then back to the BFRT right-of-way.
7. Cut through the MBTA parking lot then head easterly toward the Assabet River parallel to the MBTA Commuter Rail Line crossing the Assabet River over a pedestrian-type bridge to the property associated with Baker Avenue. The trail would then turn right to Baker Avenue crossing over the MBTA Commuter Rail proceeding toward Main Street. At this point, two options were considered. The first option proposes that the trail continue westerly on Main Street back to the Commonwealth Avenue intersection and the BFRT right-of-way. The second proposes that the trail crosses Main Street and continues up Cottage Street to Old Marlboro Road, turns right onto Old Marlboro Road which intersects with the BFRT right-of-way.

STUDY AREA AND ALTERNATIVES



Alternatives 7A and 7B are continued on the following page.



Each alternative was then evaluated based on the following criteria:

1. Effectiveness (will the users of the trail use the recommended alternative)
2. Short-term and long-term reliability
3. Short-term and long-term maintenance costs
4. Difficulty in implementing, including property ownership and permitting issues
5. Cost to design and implement
6. Risk to public safety
7. Vehicular impacts
8. Benefits to the community
9. Timeliness to implement
10. Context-sensitive aesthetics

After the presentation of each Alternative, a summary is included with each Alternative and a ranking for each of the above criteria.

Aerial mapping, Concord GIS data and some field survey were used to evaluate each alternative. Field survey data was not available for Alternatives 7A and 7B. Some of the right-of-way information is approximate only and the sketches are conceptual. More detailed field survey information and CADD drafting are required to accurately determine the true impacts of the proposed alternatives on ROW, utilities and resource areas. Construction costs are preliminary in nature and are based on current MassDOT costs.

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In order to complete the evaluation, GPI researched available data from the Town's GIS database, the Chappell Engineering Survey along the railroad spur and the Vanasse Hangen Brustlin, Inc. (VHB) Survey for the Preliminary Engineering Design and became familiar with the original Feasibility Study for the BFRT, the Engineering Assessment completed by Fay, Spofford & Thorndike (FST) in 2004, the 25% Design Report completed by VHB in 2008 and the Concord Greenways Alliance Report completed in 2008.



GPI attended an orientation meeting and site walk on May 21, 2009 with the BFRT Advisory Committee. A meeting was held on July 13, 2009 with Mr. Paul Hadley of the MBTA, Mr. Frank Frey and Mr. Tim Davis of the Department of Public Utilities (DPU), Mr. Dave Shedd of MassDOT, Ms. Marcia Rasmussen of the Town of Concord and GPI. At that meeting Mr. Paul Hadley stated that regardless of which alternative was selected, no parking spaces can be lost within the commuter rail lots and that train service could not be interrupted at any time for construction. They also stated that they could not maintain any type of elevator system on their property. Representatives from both the MBTA and DPU felt that the abandoned rail spur and crossing at Commonwealth Avenue would be the most practical solution. In addition, they felt that leaving a gap in the trail would not have an impact on their facilities but agreed it would not be practical for a bike path solution. However, Mr. Paul Hadley did state that if the "spur" or a "gap" were chosen as alternatives that fencing would be required around the MBTA property to prevent cut through use of the existing at-grade crossing. Mr. Paul Hadley raised concerns with the length of ramps required for a bridge structure and stated that although the required clearance is 22.5 feet over the tracks, they have allowed an exception with only 18 feet required over the tracks. In addition, if a bridge structure was proposed and not closed in, it would need to be plowed/salted in the winter if the remainder of the path was going to be maintained all winter. If the structure was to be closed in, ventilation would be necessary and anything over 800 feet in length must have mechanical ventilation. Representatives from both the DPU and MBTA raised concerns over the tunnel option in terms of water table, construction under the rail line and public safety. A tunnel would be extremely costly, would require very long ramps and, with the proximity to the Assabet River, the water table may be very high making flooding a concern and a pumping system necessary.

The concept of utilizing the existing at-grade pedestrian crossing was discussed at this meeting. Representatives from both the MBTA and DPU agreed that these types of at-grade pedestrian crossings are hazardous. The MBTA is actually attempting to eliminate at-grade crossings at stations by installing high level platforms, so various stations are going through rehabilitation. In addition, Mr. Paul Hadley stated that at some point the platforms at this station may be changed to high level ADA accessible platforms and the crossing could be eliminated.

Therefore representatives from both the MBTA and DPU felt that it would not be practical or desirable to add additional activity, particularly faster moving bicyclists to this crossing. Representatives from both the DPU and MBTA stated that no new crossings would be allowed.



Trail Design Criteria

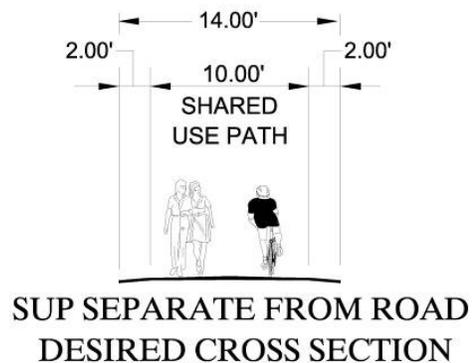


Technically called Shared Use Paths (SUPs), the terms bike trails and SUPs will be used interchangeably to refer to off-road paths accommodating bicycles as well as other non-motorized transportation including pedestrians, rollerbladers, wheelchair users and pedestrians with baby carriages. Bike trails provide a safe environment for pedestrian and leisurely bicycle traffic separated from motorized traffic. The 1999 American Association of State Highway and Transportation Officials (AASHTO) *Guide for the Development of Bicycle Facilities* presents guidelines

for the creation of shared use paths. The MassDOT *Project Development and Design Guide* follows these guidelines but also allow for context sensitive design features as long as safety is not compromised.

1. Width

Because these paths are designed to provide two-way travel of bikes and are also assumed to accommodate pedestrians, the width of the paths must be sufficient to safely and comfortably accommodate all users. The AASHTO guideline is that such paths should have a minimum width of 10 feet with 2-foot graded shoulders adjacent to the path. In addition 3 feet clearances from the edge of path should be provided to any obstruction (i.e. sign, fence, building, etc.) A path width of 8 feet may be considered where the following conditions prevail:



- Bicycle traffic is expected to be low, even on peak days or during peak hours
- Pedestrian use of the facility is not expected to be more than occasional
- There will be good horizontal and vertical alignment providing safe and frequent passing opportunities
- Vehicle loading conditions that would not cause pavement edge damage during normal maintenance

MassDOT’s 2006 *Project Development & Design Guide (Guide)* further states that an 8-foot path may be considered where severe environmental, historical and/or structural constraints exist. It should be noted, however, that an 8 foot trail was not supported by the majority voting at the Concord Town Meeting.

In order to accommodate bicycles on roadways, a minimum of four feet is necessary when the bicycle lane is adjacent to the edge of pavement, however, five foot bicycles lanes are preferred for most conditions, especially when the lane is adjacent to curbside parking, vertical curb or guardrail. Where on street parking is allowed, five foot shoulders are recommended.

2. Alignment

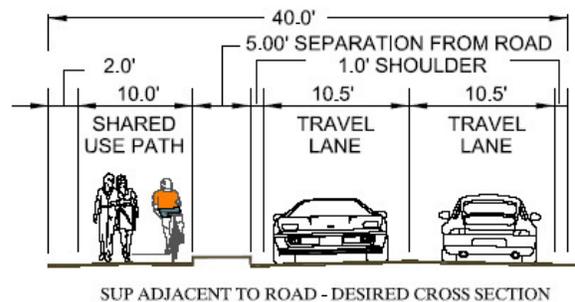


The horizontal alignment or curvature of a path is dependent on the desired design speed, anticipated lean angle and the cross-slope of the path. For most paths a lean angle of 15 degrees is appropriate and a typical design speed would be 20 mph. Based on a 20 mph design speed the minimum radius for a horizontal curve would be 100 feet. Smaller radii of as little as 36 feet can be used in areas with design speeds as low as 12 mph. Appropriate warning signs should be installed along the path in these instances. While it is always desirable to provide a smooth alignment and horizontal curvature, due to physical constraints or limited right-of-way, areas of sharper corners may be necessary. In these areas of sharper, almost 90 degree curves, appropriate warning signs should be posted along the bike path advising users of the alignment.

In areas where paths start or end, particularly at streets or intersections, additional right-of-way is typically required to provide appropriate trail definition, provide some form of physical vehicle barrier and maintain appropriate clearances for two-way bike travel.

3. Buffer

Where the path is adjacent to roadways, AASHTO and MassDOT both recommend a minimum separation of 5 feet between the path and the roadway surface. When a 5 foot separation cannot be provided, suitable physical barriers such as fences, walls, cushioning vegetation or concrete/guardrail barriers are recommended. These barriers should be a minimum height of 3.5 feet to prevent bicyclists from toppling over it and should be designed to not be a hazard to motorists or bicyclists.



The criteria recommend that 17-18 feet be available for establishing a 10 foot SUP adjacent to the roadway. If an 8 foot SUP is utilized the required Right-of-Way (ROW) associated with the SUP would be 15-16 feet. However, it should be noted that these are guidelines and the cross section for each proposed Rail segment should be carefully reviewed and designed to maximize the width of the path and separation from the roadway.

4. Vertical Grades

Vertical grades are a major concern in the design of SUPs. Generally grades in excess of 5% are not desirable for SUPs because ascents are difficult for many cyclists and descents may cause some cyclists to exceed a comfortable speed. Steeper grades also do not meet pedestrian accessibility requirements.

While grades in excess of 5% may be considered for bicycle facilities for shorter distances, grades for pedestrians cannot exceed 5% unless treated as a ramp (switchback), with a maximum slope of 8.33% in the built condition. This restriction would apply to any shared use path unless a variance from 521 CMR from the Massachusetts Architectural Access Board has been granted.

5. Intersections

Intersections along SUP routes are a critical issue, particularly roadway intersections. It is imperative that the design of a crossing provide a clear indication to users of the path where and how they should cross the intersection as well as who has the right-of-way. Generally, the following basic design principles should be followed:

- Unusual conflicts should be avoided
- Intersection design should create a path for bicyclists that is direct, logical and as close to the path of the motor vehicle traffic as possible
- Bicyclists following the intended trajectory should be visible and their movements should be predictable
- Potential safety problems associated with the difference between auto and bicycle speeds should be minimized

Trail Maintenance

Short-term and Long-term Maintenance Costs

Maintenance should include keeping the trail safe and in usable condition. It includes tasks ranging from mowing, tree trimming and clearing, trail sweeping, graffiti removal, seasonal planting, drainage structure cleanout, trash removal to replacing damaged materials and reconstructing the trail. The level of maintenance required may vary by section along the corridor depending upon the number of trail users.

According to *Rail Trail Maintenance and Operations* published by the Rails-to-Trails Conservancy Northeast Regional Office, the average annual reported cost per mile for maintenance is just under \$1,500.00. This figure does not include long-term maintenance costs such as repaving the trail or replacing a structure.

Vegetation management is both a short-term and long-term cost with a grass strip along both sides of a trail and trees growing along the trail. This includes litter clean-up, mowing, leaf removal, pruning, invasive species removal, tree removal (fallen, health/safety/aesthetics), tree and shrub planting, flower planting and chemical herbicides. Drainage maintenance is also a short-term and long-term cost ensuring that the trail remains crowned or sloped to drain and ditches, culverts and drainage structures are cleaned. If the drainage is not maintained, it creates an erosion problem which leads to more costly maintenance.

Signs, fences, gates, bollards and pavement markings must be maintained. Surveys of existing trails show that two-thirds of trails report vandalism to their signs including graffiti, damage and theft.



Trail resurfacing is a major component of long term costs. The average surface life of asphalt trails is seventeen (17) years. Resurfacing costs can be estimated at approximately \$80,000.00/mile. Resurfacing the second time will also require cold planing which would increase the cost to approximately \$130,000.00/mile. Although transportation enhancement funds can be used for maintenance, there are limited dollars and competition for these dollars can be fierce. The Town should establish a long-term maintenance fund and add funds to it each year for the occasion when it is needed.

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Police patrols should be considered in both the short-term and long-term. Regular police patrols should be conducted along the length of the trail. This sends a message that the community has developed a high quality, safe resource and encourages trail users to follow the trail rules. Insurance is both a short-term and long-term cost with an average coverage amount of \$3,000,000 and an average annual cost of \$2,100.00.

Volunteers can be very helpful with trail maintenance. In fact, studies published by the Rails to Trails Conservancy have shown that volunteers are often at the heart of every trail maintenance effort. Enlisting the help of volunteers will stretch the Town's maintenance dollars. Often times, Trail Committees enlist the help of boy and girl scouts, school and church groups and even adult organizations.

In 2004, Rails to Trails Conservancy surveyed managers of more than 100 open rail trails in the northeast region of the United States regarding trail maintenance and operations issues. Twenty-five trail managers responded with detailed information regarding the maintenance tasks they are performing and the frequency these tasks are being completed. Most responses in this survey indicated that maintenance tasks are being completed "as needed" due to a lack of funds and manpower. The numbers in the columns of the tables represent the number of survey respondents that perform the activity at that frequency. For example, the activity 'Surface cleaning of asphalt trail' is done weekly by one survey respondent, monthly by two survey respondents, etc.

Table 16: Frequency of Common Maintenance Tasks

Maintenance Activity	How often is it done?						
	Day	Week	Month	Quarter	Year	As Needed	Other
Repaving of asphalt trail						5	
Coating or sealing of asphalt trail						5	5 years
Pothole repair on asphalt trail						5	
Snow removal from asphalt trail						6	
Surface cleaning of asphalt trail		1	2	1		4	
Pavement markings maintenance and replacement					2	3	
Resurface non-asphalt trail						12	
Grade non-asphalt trail					2	8	
Pothole repair and other patches on non-asphalt trail				1		13	
Snow removal from non-asphalt trail						2	
Surface cleaning of non-asphalt trail				1		5	
Keep trail-side land clear of trash and debris	1	4	5		3	9	
Mowing		7	5	1	2	6	
Leaf removal			2		3	8	
Tree pruning		1	1		3	17	
Tree removal			1		1	17	
Invasive species removal			1			12	
Planting new vegetation					1	7	
Application of herbicides or pesticides					5	6	
Clearing of drainage channels and culverts					4	18	
Surface maintenance of parking areas		2		1	3	12	
General maintenance of trailheads (litter clean-up, etc.)	1	6	1		1	9	

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Frequency of Common Maintenance Tasks (Continued)

Maintenance Activity	How often is it done?						
	Day	Week	Month	Quarter	Year	As Needed	Other
Landscaping/gardening at trailheads		4	2	1	2	4	
Empty trash cans at trailheads		2	3	1			2
Maintenance of stationary toilets at trailheads (clean, empty, etc.)	4	2				1	
Maintenance of portable toilets at trailheads (clean, empty, etc.)		6				2	
Empty trash cans along trail		4				1	
Maintenance of stationary toilets along trail (clean, empty, etc.)	1	2					
Maintenance of portable toilets along trail (clean, empty, etc.)		2					
Maintenance of informational kiosks (repairs, etc.)		1	3		1	8	
Maintenance of picnic tables, benches, etc.				1		10	
Updating information in informational kiosks		2	1	2	1	8	
Installation of signs					1	19	
Repair/maintenance of signs					3	17	
Installation of pavement markings						4	1
Maintenance of pavement markings						3	
Patrols by police agency	7	1				5	random
Patrols by non-police agency (e.g. trail watch)	5	3				1	ongoing
Recovery from illegal acts such as dumping and vandalism	3		1		1	11	
Installation of lighting						1	
Maintenance of lighting						2	
Installation of emergency call boxes							-
Maintenance of emergency call boxes							-
Installation of gates, bollards and fencing						11	
Maintenance of gates, bollards and fencing			1			16	
Bridge, tunnel, underpass and crossing inspection	1	1		1	3	6	2-3 years
Bridge redecking						14	
Paint/stain/treat bridge deck or structure					1	6	
General bridge maintenance					2	14	
Tunnel lighting maintenance							-
Tunnel open/closed status							-
Paint tunnel/underpass walls and ceiling						2	
General tunnel/underpass maintenance						4	
Railroad grade crossing maintenance					1	4	
Road grade crossing maintenance		1			1	11	

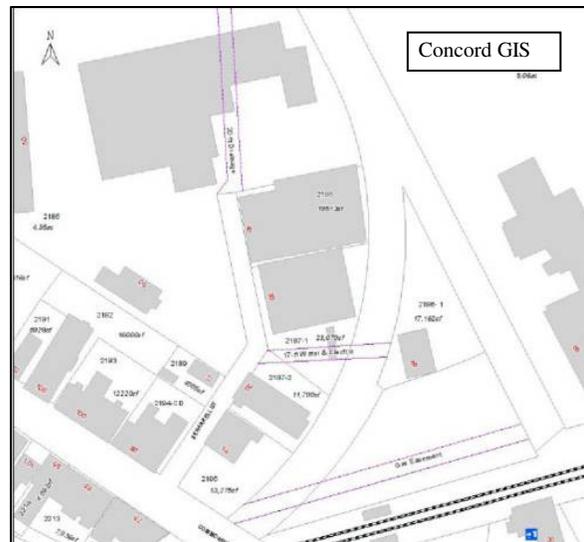
B. CROSSING ALTERNATIVES

The following section will focus on the five alternatives listed. Following the description of the alternatives is a Score Card for all five alternatives. Various conceptual level alternatives will be discussed and evaluated to assess the feasibility and impacts of construction and how they will help achieve the goals of the study.

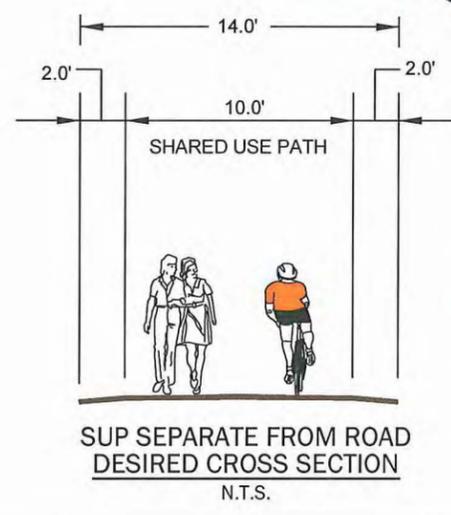
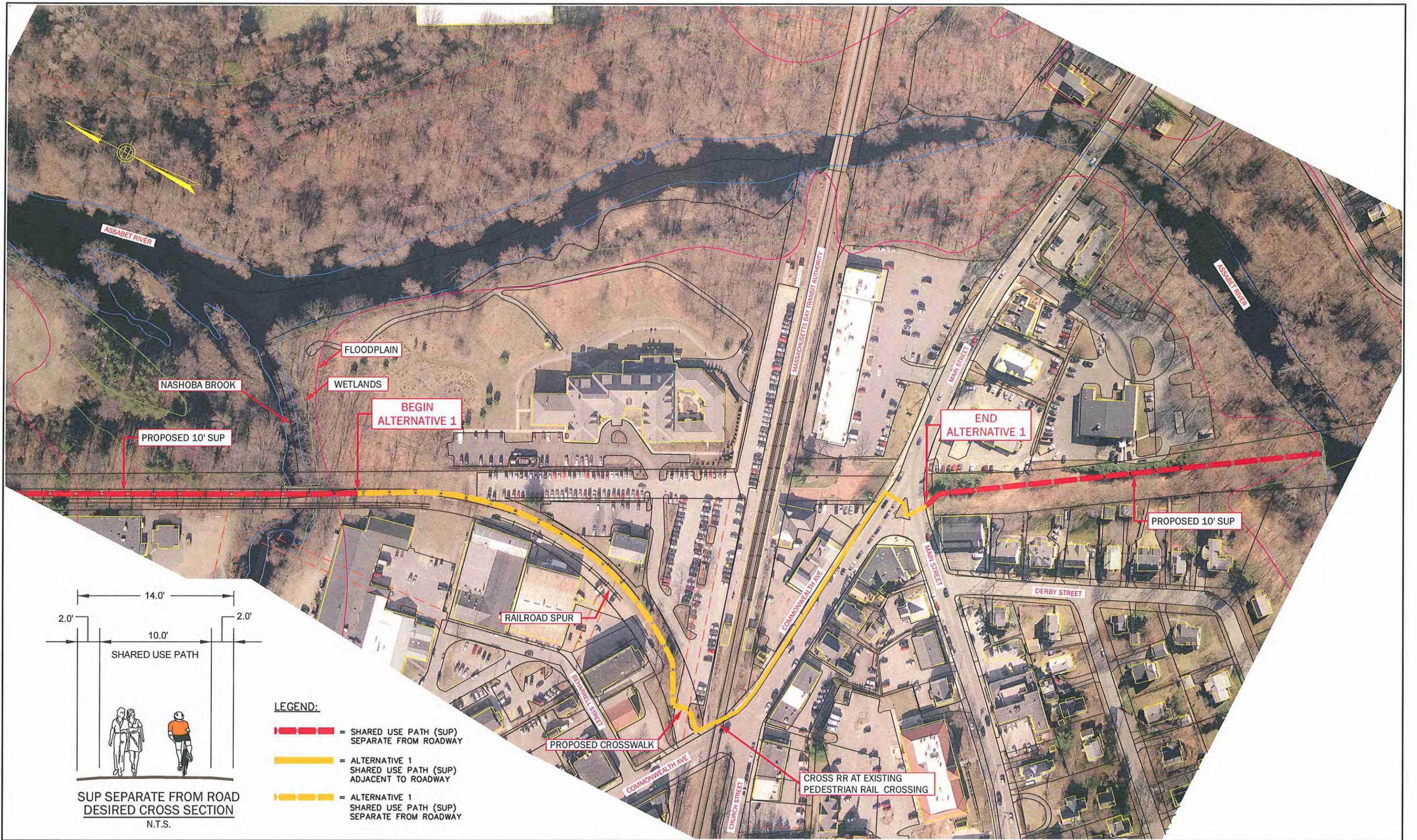
Alternative 1 - Railroad Spur to Commonwealth Avenue

This alternative proposes that the BFRT follow the abandoned railroad spur owned by the EOTC in the northern portion of the West Concord commuter railroad station to Commonwealth Avenue. See Figure 1 on the following page. There is an existing vehicle/pedestrian crossing of the active rail line with both vehicular and pedestrian gates on Commonwealth Avenue. Once trail users reach Commonwealth Avenue, there are four options. Alternative 1A would be to instruct trail users to dismount their bikes and walk them along the north side of the street on the existing sidewalk to the existing crossing in front of the 99 Restaurant. After crossing, they could remount their bikes south of Main Street at the existing EOTC owned right-of-way. Alternative 1B would be to allow bicyclists to ride on a specially marked "sharrow" lane to the traffic signal in front of the 99 Restaurant. Alternative 1C would be to provide a wider sidewalk on the north side of Commonwealth Avenue to be shared between pedestrians and trail users. Alternative 1D would be to turn in an easterly direction after crossing the tracks, run parallel to the tracks behind the West Concord Supermarket and meet Main Street in the vicinity of the existing crossing in front of the 99 Restaurant. Both Alternatives 1B and 1C would require elimination of parking on one side of Commonwealth Avenue.

The existing right-of-way along the spur varies between fifty and sixty feet and would accommodate a ten (10) foot shared use path with two (2) foot graded shoulders on either side. Heading south along the right-of-way, there are five abutting property owners along the west side of right-of-way. They include: 50 Beharrell LLC, 40 Beharrell Street LLC, 30 Beharrell Street LLC, Steinmann Realty LLC and Hollis R. and Caroline V. Holden. There are two abutting property owners along the east side of the right-of-way. They include Russell S. Beede and the Town of Concord. There are two existing utility easements along the spur. One is a seventeen (17) foot wide water and electric easement and the second is a gas easement crossing the spur right-of-way.



Site walks through the area indicate that many of the abutting properties are currently utilizing the right-of-way for storage and parking. There is also a dumpster, an A/C unit and a concrete loading dock within the existing right-of-way. This unauthorized use would no longer be allowed. With the abutting buildings very close to the right-of-way, screening mechanisms such as stockade fence, timber rail fence or plantings could be provided for separation.



- LEGEND:**
- - - - = SHARED USE PATH (SUP) SEPARATE FROM ROADWAY
 - = ALTERNATIVE 1 SHARED USE PATH (SUP) ADJACENT TO ROADWAY
 - - - - = ALTERNATIVE 1 SHARED USE PATH (SUP) SEPARATE FROM ROADWAY

ALTERNATIVE 1 - CONCEPTUAL PLAN
RR SPUR TO COMMONWEALTH AVENUE
CONCORD, MA

FIGURE 1

SCALE: 1" = 80'

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The existing spur right of way meets the existing entrance to the commuter parking area prior to intersecting Commonwealth Avenue. Therefore, in order to remain within the right-of-way, trail users would need to cross the parking lot to reach Commonwealth Avenue. It would be GPI's recommendation to cross at a 90° angle set back from the entrance a short distance and follow the curb line to Commonwealth Avenue (see illustration on the following page). With a short setback from the entrance, vehicles entering the parking area from the street will have more time to react to trail users crossing the driveway. A 90° crossing provides the shortest crossing distance for trail users thereby minimizing the potential for vehicle/trail user conflict.



Although a standard painted crosswalk could be used to channel trail users at this location, it would be our recommendation to use a raised crosswalk, a textured crosswalk, a colored crosswalk or a combination to provide a safer crossing for trail users. Raised crosswalks are crosswalks that are raised to act simultaneously as a speed hump to slow motor vehicles and increase driver awareness of a crossing. Textured and colored crosswalks provide a different material emphasizing the crossing to oncoming vehicles and textured crosswalks also provide an uneven surface for vehicles to traverse slowing their speed. Textured crosswalks can be brick, stamped pavement or even cobble stones among other materials. There are several different options as illustrated below.



Utilization of a raised crosswalk could potentially make snow removal more difficult if the snow plow driver was unaware of the crosswalk or was unable to see it. In areas with a considerable amount of snow, bollards are often placed on either side of the crosswalk to alert snow plow drivers to the presence of the cross walk.



Once trail users cross the driveway, they would follow the curb line to the existing rail gates on Commonwealth Avenue. At this point users would be instructed to walk their bikes. The sidewalk begins on the southern side of the tracks. There would be a short stretch approaching the tracks where striping could be proposed on Commonwealth Avenue to separate trail users from motor vehicles. It appears that the existing pavement width and right-of-way is sufficient for the proposed markings. Once users cross the tracks, the sidewalk begins.



Alternative 1A - Dismount Bicycles at Commonwealth Avenue

This alternative proposes that trail users utilize the existing sidewalk on Commonwealth Avenue and walk their bicycles. See Figure 2 on the following page. The sidewalk on Commonwealth Avenue begins on the southern corner of the track crossing. Signs would be proposed on Commonwealth Avenue instructing trail users to dismount their bikes and walk them along the sidewalk. While some riders may comply with the signing, it is likely that many more experienced riders will ignore the signing and ride with vehicle traffic on Commonwealth Avenue or try and ride along the sidewalk.

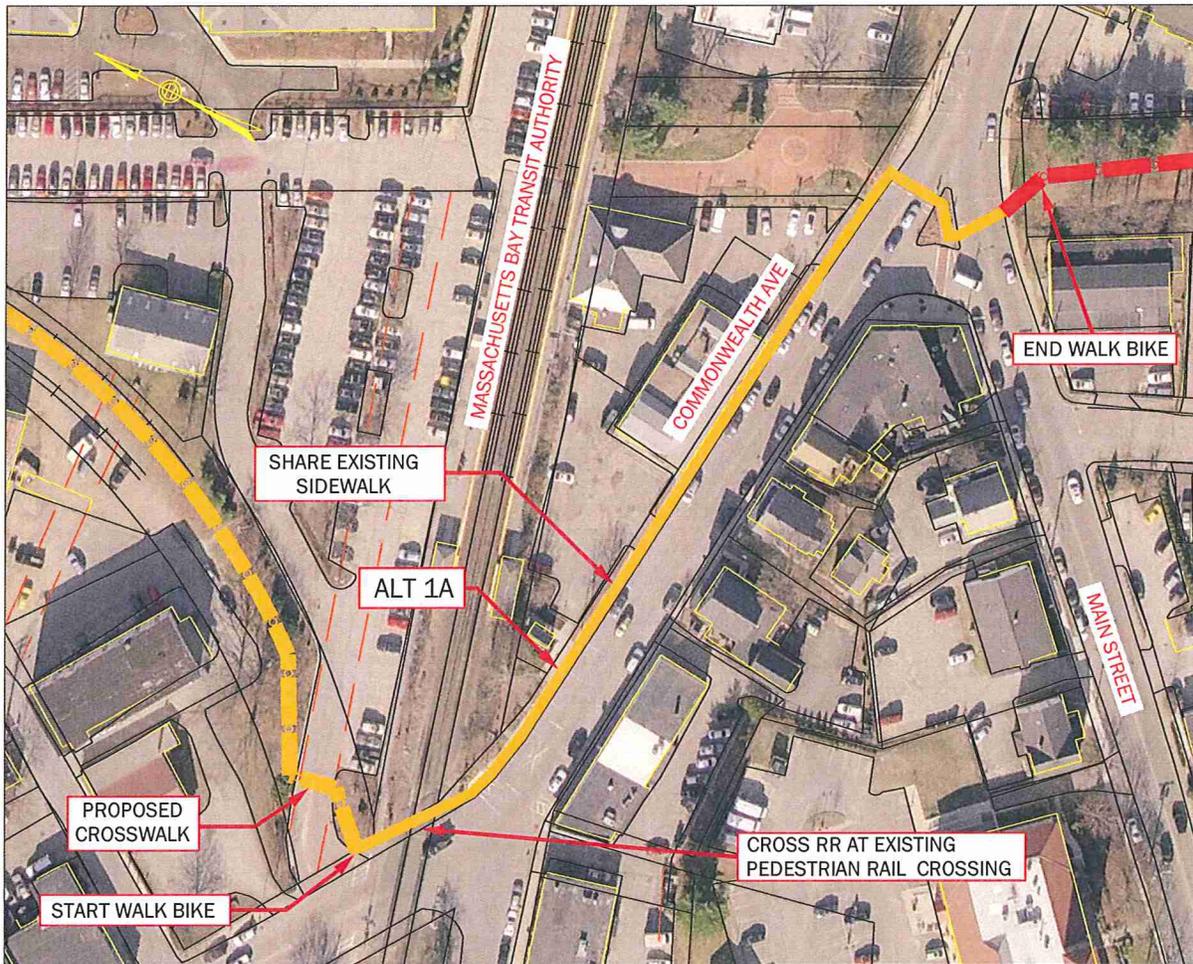
Although the existing sidewalk is between seven (7) and eight (8) feet, the parking meters and light poles decrease the usable width. The West Concord Supermarket is located on Commonwealth Avenue and anyone visiting the Supermarket utilizes the sidewalk. There are two entrance drives for the West Concord Supermarket parking area along the sidewalk, one on either side of the store. A parking lane also abuts the sidewalk along Commonwealth Avenue.



It is anticipated that the trail will draw a large volume of users including bicycles, joggers, walkers, roller bladers and skateboarders particularly on weekends. Although this option does minimize the potential for trail user/motor vehicle conflict, it will increase the potential for trail user/pedestrian conflicts since people are entering and exiting the Supermarket while it is open. During times of very high trail usage, this simple function could be delayed and if people are not paying full attention to trail users traveling along the sidewalk, this option increases the potential for pedestrian/trail user conflict.

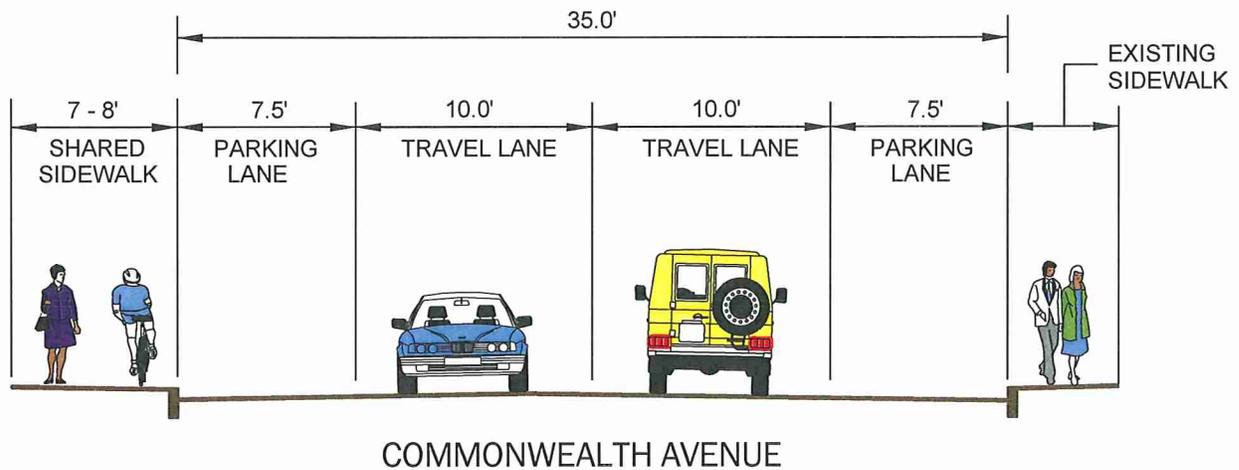


Motor vehicle passenger doors open up into the usable sidewalk area as well as into the travel lane of Commonwealth Avenue. With limited right-of-way, this option does not allow for the inclusion of a door zone buffer. A door zone is the space spanning approximately four (4) feet on either side of a parked car. It is hazardous to ride a bicycle in a door zone because if the door opens suddenly, the cyclist must either crash into it or swerve to avoid it which could cause serious injury or death. Although most areas do have laws that require car users to check for bicyclists and pedestrians before opening the door of their vehicle, there have still been countless injuries and



LEGEND:

- = SHARED USE PATH (SUP) - SEPARATE FROM ROADWAY
- = ALTERNATIVE 1A - ADJACENT TO ROADWAY
- = ALTERNATIVE 1 - SHARED USE PATH (SUP) - SEPARATE FROM ROADWAY



**ALTERNATIVE 1A
DISMOUNT BICYCLES AT COMMONWEALTH AVENUE
CONCORD, MA**

FIGURE 2

NOT TO SCALE

deaths caused by cyclists riding in door zones when a car door is carelessly opened. Therefore, if people are not paying full attention to trail users traveling along the sidewalk, opening car doors could create a hazardous situation for trail users since not everyone will dismount their bikes or get off their skateboards. Roller bladers could be traveling at a faster speed also. It should also be noted that since the sidewalk does not provide a uniform surface, roller bladers may have a more difficult time trying to traverse the sidewalk and opt to travel in the roadway.

Once trail users have traversed the sidewalk, they would cross the road at the existing crosswalk in front of the 99 Restaurant to the existing island at the intersection of Main Street and Commonwealth Avenue and then cross the existing crosswalk from the island to the EOTC owned right of way and remount their bikes to continue along the BFRT. The existing island has a pedestrian path which bends to allow for perpendicular crossings of both roadways. Depending on the volume of traffic and the volume of trail users, this two crosswalk movement could cause delays. It would be GPI's recommendation to consider intersection modifications to minimize crossing distances and times. GPI would investigate reconfiguring the intersection to a more traditional "T" intersection with a single crossing of Main Street.



Alternative 1B - Sharrow Lane on Commonwealth Avenue

This alternative proposes sharrow lanes on Commonwealth Avenue. Sharrows are shared lane

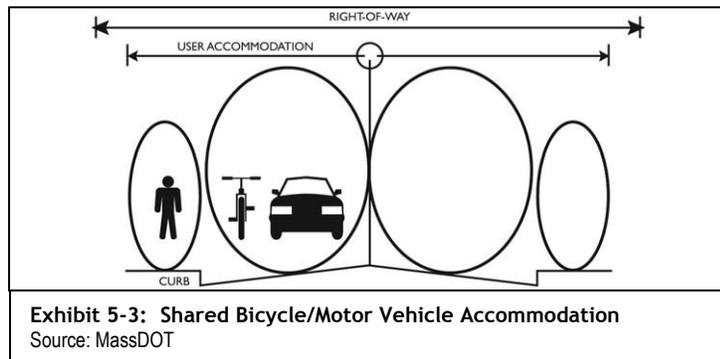


Exhibit 5-3: Shared Bicycle/Motor Vehicle Accommodation
Source: MassDOT

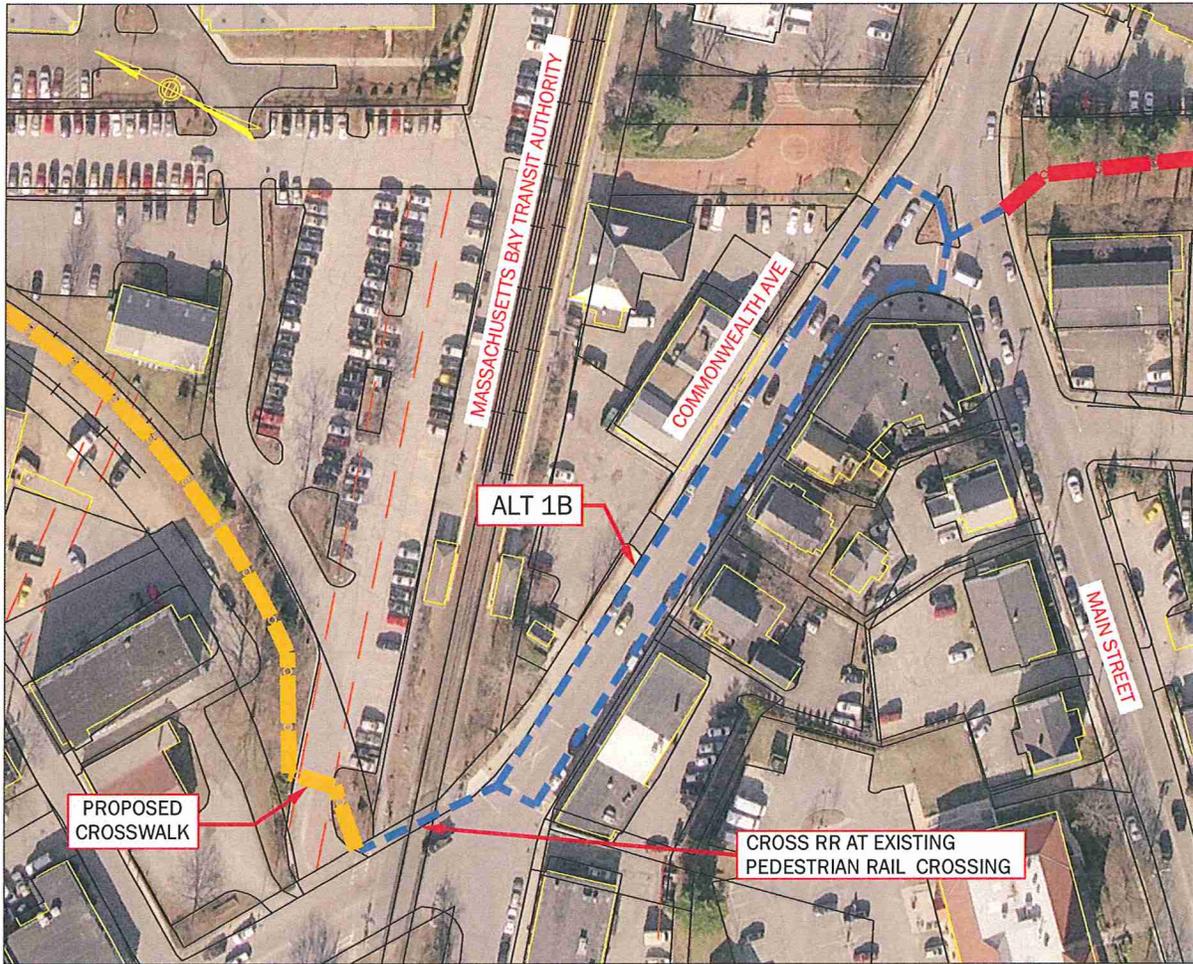
pavement markings clarifying where cyclists are expected to ride and reminding motorists to expect cyclists on the road. Sharrows are used when there is not enough room on the street for bicycle lanes. See Figure 3 on the following page. The **Guide** requires a minimum of fourteen (14) feet for shared bicycle/motor vehicle accommodation. Pedestrians would

still utilize the existing sidewalk which would remain separated from the roadway by a raised curb.

The pavement width on Commonwealth Avenue is approximately thirty-five (35) feet in width. The roadway includes one travel lane in each direction and parking on both sides against vertical curbing. The existing parking lanes are between seven (7) and eight (8) feet in width indicating that the existing travel lanes are approximately ten (10) feet in width. Commonwealth Avenue is classified as an urban collector. There is an existing crosswalk on Commonwealth Avenue just east of its intersection with Church Street.

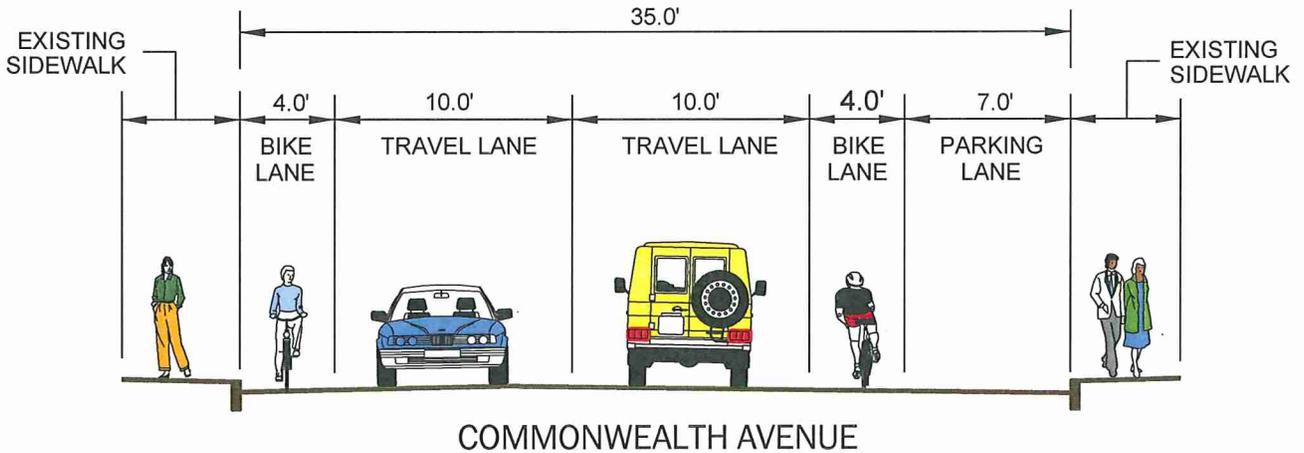


In order to accommodate two - fourteen (14) foot travel lanes, parking would need to be eliminated along one side of Commonwealth Avenue. Since only the West Concord Supermarket is on the north side of Commonwealth Avenue and they have parking facilities, GPI would recom-



LEGEND:

- - - = SHARED USE PATH (SUP) – SEPARATE FROM ROADWAY
- - - = ALTERNATIVE 1B – SHARROW LANES ON ROADWAY
- - - = ALTERNATIVE 1 – SHARED USE PATH (SUP) – SEPARATE FROM ROADWAY

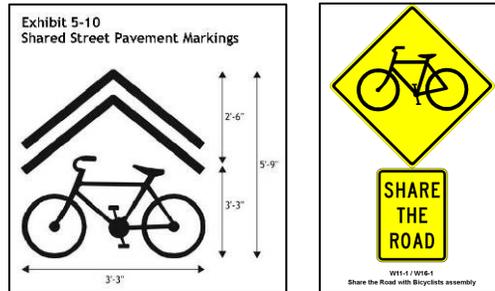


ALTERNATIVE 1B
SHARROW LANE ON COMMONWEALTH AVENUE
 CONCORD, MA

FIGURE 3

NOT TO SCALE

mend removal of the parking lane on the northern side of Commonwealth Avenue resulting in the loss of fifteen (15) parking spaces. Removal of this parking lane would improve site distance for trail users crossing Commonwealth Avenue who are heading south along the BFRT. If it was not removed, the combination of the parked cars and the slight curve in the roadway make it difficult to see oncoming traffic. The parked cars make it more difficult to see oncoming traffic. The proposed section would include one seven foot parking lane and two fourteen foot travel lanes. GPI would recommend Share the Road pavement markings and signing.



Trail users heading south along the BFRT would utilize the existing crosswalk at the Commonwealth Avenue/Church Street intersection to enter the shared roadway. They would follow the shared roadway until Commonwealth Avenue intersects with Main Street. There are two existing crosswalks at this location. One crosswalk would bring trail users to the existing island and the second would bring trail users from the existing island to the EOTC owned right-of-way. Trail users heading north along the BFRT would cross Main Street (Route 62) at the existing crosswalk from the EOTC right-of-way to the existing island and then from the existing island to the proposed shared roadway.



The existing signal at Main Street and Commonwealth Avenue currently provides exclusive pedestrian phasing resulting in all traffic stopping when the crossing phase is activated. GPI recently evaluated operations of the signal as part of a Townwide Traffic Signal Inventory. The intersection operates fairly well with delays typical of a signal in a downtown area. During peak commuting periods, queues are regularly experienced along the Main Street approaches. With the addition of trail users, the exclusive "WALK" or pedestrian phase may be called more frequently resulting in increases in delays and longer queues for motorists. Intersection modifications to minimize crossing distances and times should be examined, including reconfiguring the intersection to a more traditional "T" intersection with a single crossing of Main Street.



With one parking lane remaining on the south side of Commonwealth Avenue, the width provided for trail users headed in a southerly direction still puts them at risk from opening car doors.

Alternative 1C - Wider Sidewalk on Commonwealth Avenue



This alternative proposes a wider sidewalk on Commonwealth Avenue. See Figure 4 on the following page. The existing sidewalk on Commonwealth Avenue varies between seven (7) and eight (8) feet in width. The usable sidewalk space is reduced with the light poles, parking meters and street furniture. Therefore, in order to accommodate BFRT traffic with the existing sidewalk traffic and reduce the potential for significant congestion, this option would again eliminate the parking on the north side of Commonwealth Avenue and increase the width of the sidewalk.

As an urban collector, MassDOT requires ten (10) foot travel lanes and four (4) foot shoulders. The minimum acceptable parking lane must be seven (7) feet. In order to implement this alternative, GPI would propose to shift the curbing on the north side of Commonwealth Avenue five (5) feet in a southerly direction leaving both travel lanes and the parking lane on the south side of Commonwealth Avenue as they exist today. By shifting the curb line, approximately twelve (12) feet would be provided on the north side of Commonwealth Avenue between the center line of the roadway and the vertical curb. It should be noted though that with only twelve (12) feet, MassDOT would require the filing of a Design Exception Report for the sub-standard shoulder width.

This would provide a sidewalk in excess of twelve (12) feet to be utilized by pedestrians and trail users. GPI would still propose signing that would request trail users to dismount their bicycles and walk them. Although many riders may not dismount their bikes, the wider sidewalk should lessen the potential for pedestrian / bicycle collision.



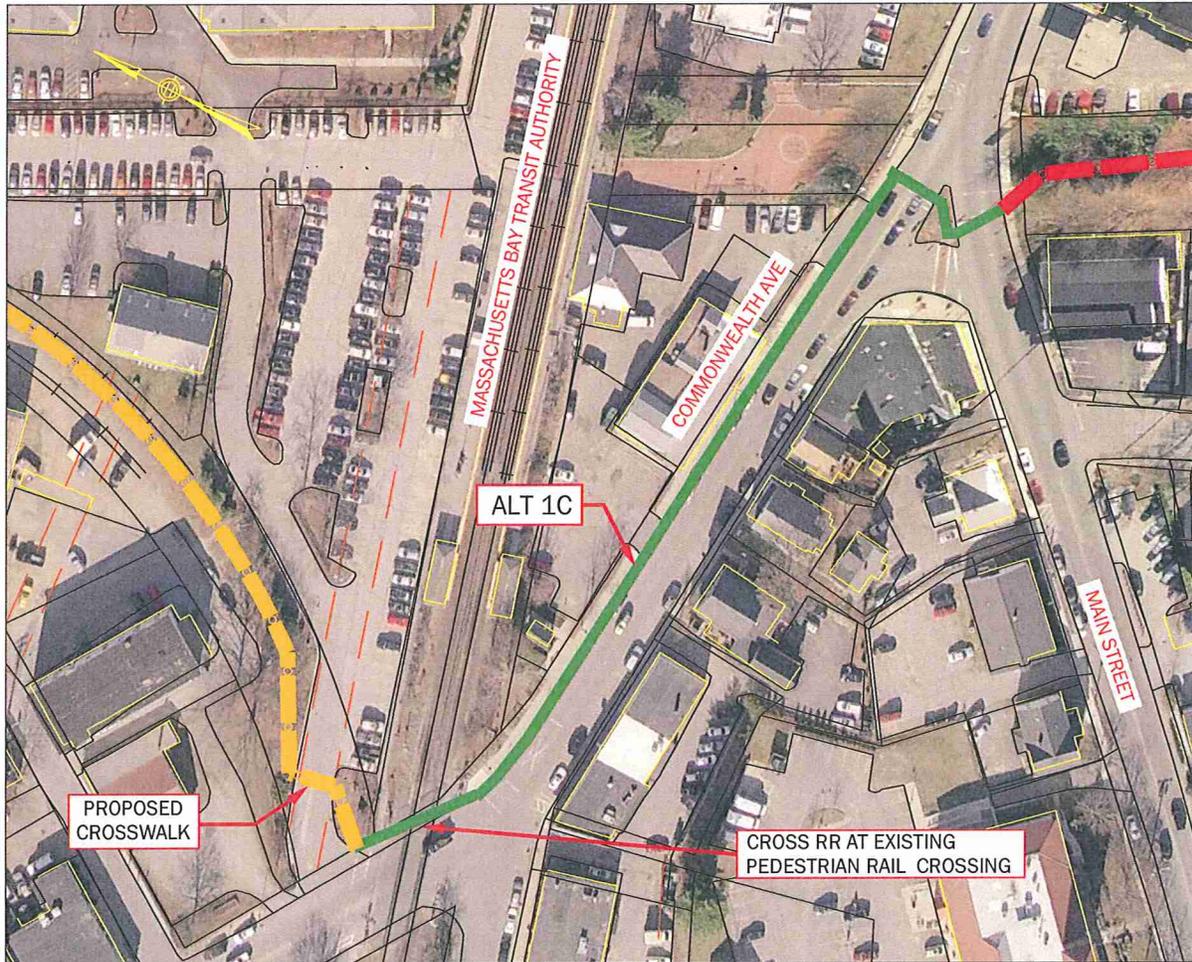
Another consideration would be to provide some separation between the required five (5) foot sidewalk for pedestrians and the portion being utilized by the trail. This separation could be as simple as a paint stripe or a paver stripe. The trail side of the sidewalk could also be denoted by a different color such as the Ride-A-Way coating which would define the section dedicated for trail users. This separation would provide additional guidance to keep pedestrians and trail users apart. Signing would be proposed indicating which portion of the wider sidewalk was

intended for trail users. Although it would be difficult to prevent crossover, the increased width should make it less necessary.

Alternative 1D - Trail behind the West Concord Supermarket

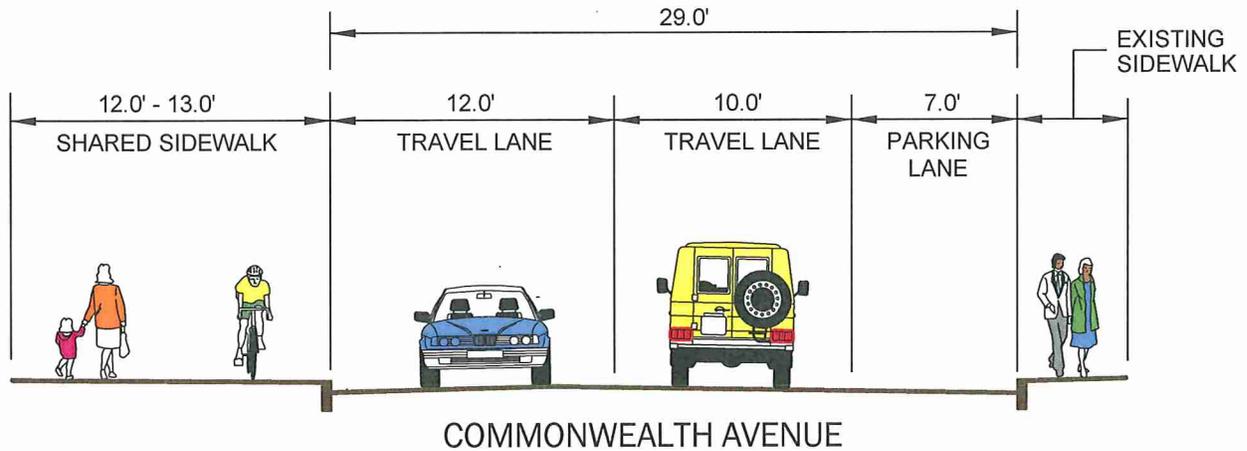
Alternative 1D proposes a trail behind the West Concord Supermarket that would cross the tracks at the existing gated crossing on Commonwealth Avenue, run parallel to and south of the tracks and then bend around Union Station to the existing Main Street crossing in front of the 99 Restaurant. See Figure 5 on page 20. The Town of Concord owns a small portion of the right of way at the westernmost portion of the area between the tracks and Commonwealth Avenue. Mandrioli Real Estate Trust and the MBTA own the remaining portion of the right-of-way in this area. In





LEGEND:

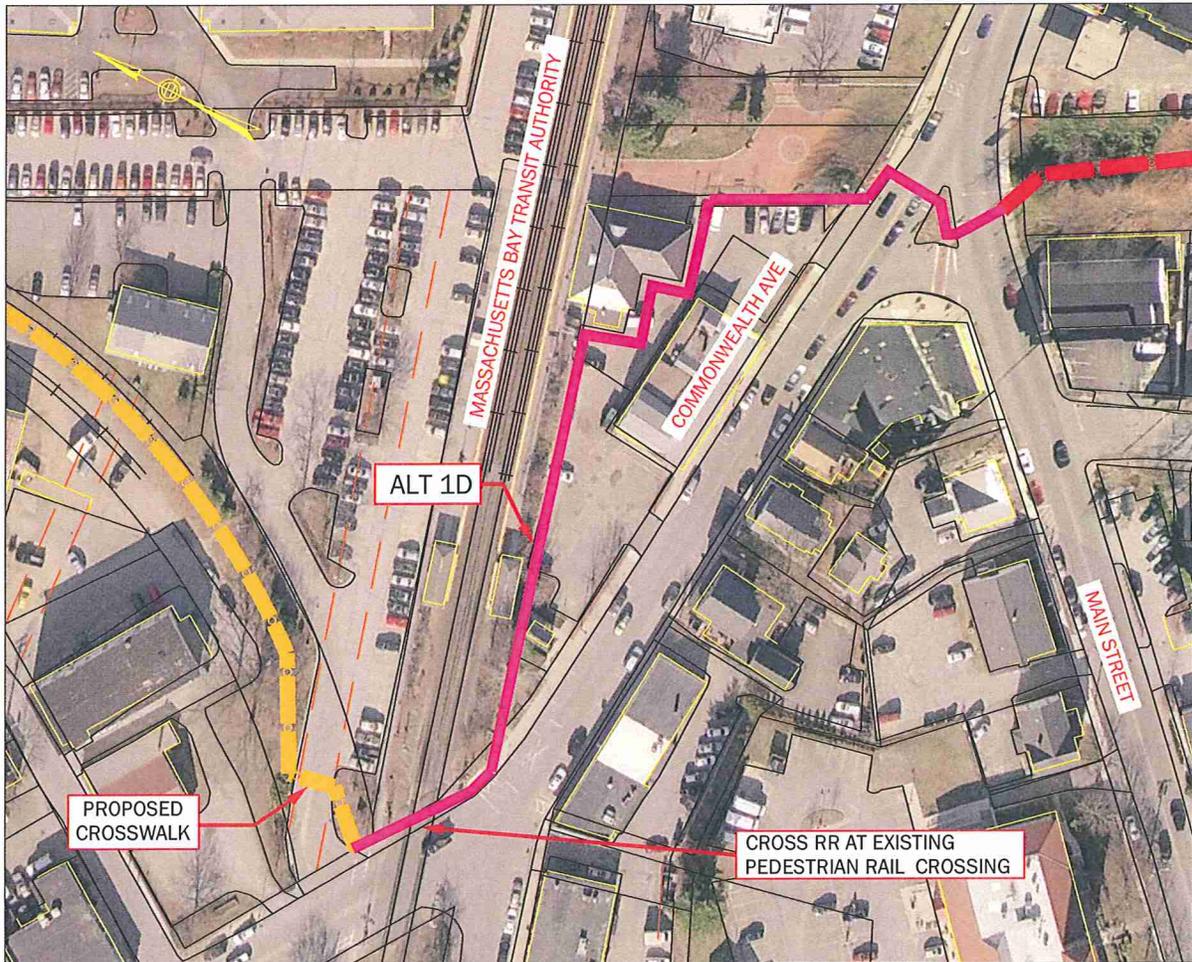
- = SHARED USE PATH (SUP) – SEPARATE FROM ROADWAY
- = ALTERNATIVE 1C – ADJACENT TO ROADWAY
- = ALTERNATIVE 1 – SHARED USE PATH (SUP) – SEPARATE FROM ROADWAY



ALTERNATIVE 1C
WIDER SIDEWALK ON COMMONWEALTH AVENUE
 CONCORD, MA

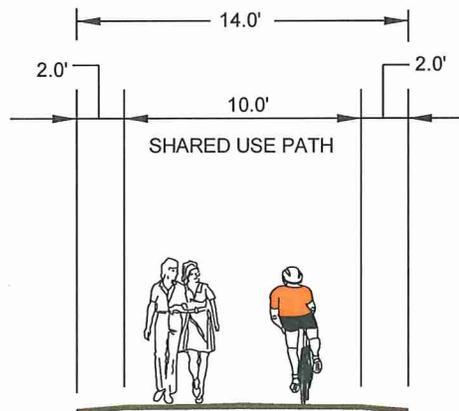
FIGURE 4

NOT TO SCALE



LEGEND:

-  = SHARED USE PATH (SUP) – SEPARATE FROM ROADWAY
-  = ALTERNATIVE 1D – TRAIL BEHIND THE WEST CONCORD SUPERMARKET
-  = ALTERNATIVE 1 – SHARED USE PATH (SUP) – SEPARATE FROM ROADWAY



SUP SEPARATE FROM ROAD DESIRED CROSS SECTION

ALTERNATIVE 1D
TRAIL BEHIND THE WEST CONCORD SUPERMARKET
 CONCORD, MA

FIGURE 5

NOT TO SCALE

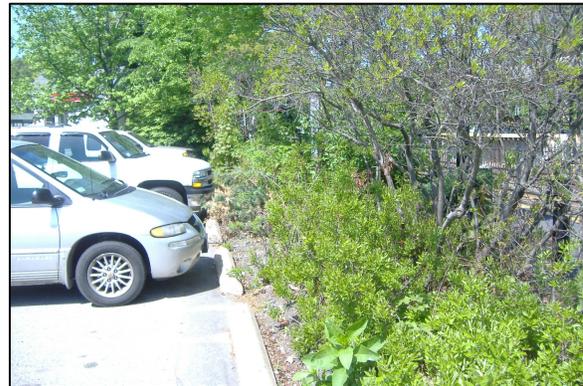
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Proposed Bruce Freeman Rail Trail/MBTA Commuter Rail Crossing Alternative Analysis

in addition to the West Concord Supermarket, Union Station is located on this property. Union Station currently functions as the MBTA Commuter Rail Station and is listed on both the State and National Register of Historic Places. It was constructed in 1893 at the former junction of the Boston-Fitchburg and Framingham-Lowell railroad lines and is the only remaining building associated with the railroad in West Concord still intact and located on its original site. This area is currently utilized as a parking lot and as a loading zone.



The edge of the existing parking lot parallel to the tracks is lined with wheel stops and is the approximate location of the MBTA Fitchburg Line property line. Currently there is a fence set approximately ten feet from the MBTA Fitchburg Line property line and edge of the existing parking lot. This area is landscaped with trees, bushes and various plantings.



There are also some wheel stops and granite bollards at the rear of Union Station. These are proposed to protect those entering or exiting the rear door of Union Station. There is reserved parking along the easternmost portion of the parking lot abutting Concord Junction Depot Park.



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The existing landscaped area between the MBTA fence and the parking lot is approximately ten feet in width which is insufficient to provide a trail meeting MassDOT and AASHTO Standards. At a minimum an eight foot trail with two foot shoulders on either side would be required. Therefore, in order to accommodate the trail, right-of-way would be necessary from both Mandrioli Real Estate Trust and the MBTA impacting the existing parking and flow of traffic through the area. An effort would be made to rearrange the existing parking lot to accommodate the trail through this area. However, parking spaces would likely be lost. It would also be GPI's recommendation to provide fencing or a suitable barrier between the parking lot and the proposed trail. If fencing was proposed, the wheel stops should remain.

It is our understanding that previous discussions with West Concord Supermarket indicated that they did not want to lose any parking spaces. In order to minimize the potential loss of parking, a sidewalk rather than a trail could be provided in the landscaped area. Trail users would be required to dismount their bikes and walk them.

Once the trail reached Union Station, it would need to follow the outline of Union Station and stay as close to the building as possible since the area is also utilized as a loading zone and



people utilize this area to enter and exit the parking area. In order to accomplish this, the trail would not meet the minimum radius requirements as defined in the *Guide* and would essentially serve as a sidewalk since space is limited. There is a distance of approximately fifteen feet between Union Station and West Concord Supermarket where they are closest to each other. With a distance of only fifteen feet, trail users would need to share this space with vehicles. Trail users would be required to dismount their bikes through this area due to the width of the sidewalk and the

turns necessary to get around Union Station. This presents an issue with people entering and exiting the rear doors of the Union Station building also.

In order for the sidewalk/trail to reach Main Street, it would follow the curbline along Concord Junction Depot Park. As a result, the parking spaces along the easternmost portion of the MBTA property in this area would be lost and with the limited space most likely could not be replaced.

Incorporating the trail in front of the MBTA platforms was discussed in the field but not investigated further. With only ten feet between the front of Union Station and the tracks, there is insufficient space in front of the platforms and Union Station to safely incorporate a trail enabling bikers, walkers, skateboarders, roller bladers and runners to traverse the area while people are entering and exiting the train.



Alternative 1 Summary**EVALUATION CRITERIA****Effectiveness**

Routing the trail along the abandoned railroad spur has both pros and cons. Since human nature is to find the most direct route from Point A to Point B, users may try and find a more direct route, i.e. through the MBTA parking lot and across the tracks. It would be GPI's recommendation to install fencing at the existing MBTA parking lot and along the spur to prevent trail users from taking that route.

Although signing can be proposed requiring bicyclists to dismount their bikes and walk them, it will be extremely difficult to enforce without constant monitoring, warnings and possibly enforcement such as police warnings, tickets and fines. If Alternative 1A or 1C were chosen and there is a lot of pedestrian traffic on the sidewalk, trail users may opt to travel on the street. Avid trail users may opt to travel on the street regardless of the sidewalk traffic. Conversely, if Alternative 1B is chosen, families with small children may opt to have the children travel on the sidewalk and avoid the street. If Alternative 1D were chosen, trail users may avoid the proposed path on the outskirts of the parking lot and cut through the parking lot or they may continue along Commonwealth Avenue to Main Street.

From the *AASHTO Guide for the Development of Bicycle Facilities*, "In general, the designated use of sidewalks (as a signed shared facility) for bicycle travel is unsatisfactory". Sidewalks are typically designed for pedestrian speeds and maneuverability and are not safe for higher speed bicycle use. This option presents conflicts between pedestrians and bicyclists as well as bicyclists and parking meters, light poles, sign posts and parked cars. Walkers, joggers, skateboarders and roller skaters can and often change their speed and direction almost instantaneously leaving bicyclists insufficient reaction time to avoid collisions. Pedestrians have a difficult time predicting the direction of oncoming bicyclists. Although a wider sidewalk does provide more space, it does not necessarily add to the safety of sidewalk bicycle travel since wider sidewalks might encourage higher speed bicycle use. AASHTO however does note that sidewalk bikeways should only be considered under certain limited circumstances such as to provide bikeway continuity along heavily traveled roadways having inadequate space for bicyclists.

Short-term and Long-term Reliability

Although not direct, Alternative 1 does provide a continuous path for the BFRT. However, it will not be reliable as far as compliance. It will be extremely difficult to force trail users to dismount and walk their bikes. It may also not be reliable as far as use. Trail users may opt to travel on a more direct or less congested route.

Short-term and Long-term Maintenance Costs

The maintenance costs described earlier in this report apply. The annual maintenance cost for a trail is approximately \$1,500/mile. The long-term paving cost would be approximately \$80,000/mile the first time and \$130,000/mile the second time.

Difficulty in Implementing

Alternatives 1A, 1B and 1C only require an easement from EOTC. No additional right-of-way would be required. The Town would need to work with the abutters along the spur as far as their unauthorized use of the right-of-way and screening mechanisms.

Alternative 1D would require an easement from the EOTC, Mandrioli Real Estate Trust and the MBTA. This alternative would likely result in the loss of parking, make loading and unloading more difficult and inconvenience people using the rear entrances of Union Station.

The Town should also work with the business owners along Commonwealth Avenue to ensure that they are in support of the selected alternative. The political ramifications of removing a lane of parking or parking spaces could present a major road block for the project.

Alternatives 1A (substandard width for bicycle accommodations), 1C (substandard shoulder width) and 1D (substandard width for bicycle accommodations, sight distance and minimum radius requirements) would likely require design exceptions since they do not meet the design standards required. This would entail the preparation of a design exception report and approval by the Design Exceptions Committee. These alternatives would require discussion and/or meetings with both the AAB/ADA Coordinator and the Bicycle/Pedestrian Accommodation Engineer at Mass DOT. At this time, it is unknown whether or not any of the options would be approved by MassDOT. In discussions with MassDOT regarding this report, they had indicated that they would need a formal submission in order to evaluate any alternative and make any decisions.

It should be noted however, that the MBTA would approve of Alternatives 1A, 1B and 1C. Alternative 1D would require further review by the MBTA.

With federal funds being allocated towards the construction of the BFRT, a Categorical Exclusion (CE) Checklist would be required. Since work will be proposed within the Riverfront Area of Nashoba Brook, a Notice of Intent must be filed with the Concord Natural Resources Commission. It is possible that an Environmental Notification Form (ENF) would also be required assuming that this would be constructed as part of the Concord BFRT and not independently. It should be noted that these permits will be required regardless of this alternative. None of these alternatives trigger additional permitting.

Cost to Design and Implement

The projected design costs assume that the design is being completed as part of the design of the Concord BFRT and not just the section that this report is evaluating. The costs will increase if the design of this alternative is removed from the design of the Concord BFRT and done independently. All costs in this report assume that the project is being designed and constructed as part of the BFRT Phase 2C.

The construction of one (1) mile of bikepath without any structures is approximately \$1.5 million/mile.

The design cost for incorporating Alternative 1 into the BFRT Phase 2C would be approximately \$70,000.00. Construction of this alternative would be approximately \$500,000.00.

Risk to Public Safety

Alternatives 1A and 1C eliminate potential trail user/moving motor vehicle conflict except at the MBTA parking lot entrance on Commonwealth Avenue and the crossing at the existing crosswalk in front of the 99 Restaurant which are concerns for all alternatives. They do however increase the potential for trail user/pedestrian conflict as trail users try and make their way along the sidewalk. If the volume of trail users is high, it could potentially have an impact on business at the West Concord Supermarket. It will make it more difficult for vehicles to enter the parking lot and for patrons to enter and exit the store. Alternative 1B does place trail users closer to

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moving motor vehicles since they will be sharing a lane with them. Alternative 1D also places trail users closer to moving vehicles in the area between Union Station and West Concord Supermarket. This alternative also increases the potential for trail user/pedestrian conflict as people try and enter or exit the rear of the Union Station Building and also increases the potential for collision for trail users since sight distance will be limited in areas.

All variations of this alternative except Alternative 1D create a potential conflict with trail users and opening car doors since right-of-way does not allow for a door zone.

Bicycle crash statistics from the Pedestrian and Bicycling Information Center's website (<http://www.bicyclinginfo.org/> and <http://www.walkinginfo.org/>) at intersections indicate that bicyclists are not safer on the sidewalk because they become almost invisible to the motorist. When a driver turns, either left or right, or into a driveway or alley, they are simply not looking for, or expecting to encounter, a bicyclist. If they do look and see a bicyclist they may still underestimate the speed a rider is traveling on the sidewalk - because it will likely be much faster than a pedestrian. Although there is not a specific crash statistic attributed to bicyclists riding on sidewalks, the fact that the bicyclist was riding on the sidewalk contributed to the crash as can be seen below.

Motorist turns left in front of cyclist	42% of bicyclists are on the sidewalk
Motorist turns left into oncoming cyclist	15% of bicyclists are on the sidewalk
Motorist turns right into bicyclist	31% of bicyclists are on the sidewalk
Motorist drives out of alley/driveway	48% of bicyclists are on the sidewalk
Motorist drives through intersection	15% of bicyclists are on the sidewalk
Bicyclist rode out intersection with signal	24% of bicyclists are on the sidewalk

Furthermore, the quality of the riding surface on most sidewalks is far inferior to the parallel roadway. The vast majority of bicycle crashes that end up with the bicyclist seeking medical attention do not involve a motor vehicle and happen because a rider either falls after hitting an obstacle, slides on gravel or leaves, or loses control. Riding on the sidewalk is fraught with the kind of dangers and obstacles that may increase the chances of that happening.

The 1992 report, *Risk Factors for Bicycle-Motor Vehicle Collisions at Intersections* authored by Alan Wachtel and Diana Lewiston concludes that *"Bicyclists on a sidewalk or bicycle path incur greater risk than those on the roadway (on average 1.8 times as great), most likely because of blind conflicts at intersections. Wrong-way sidewalk bicyclists are at even greater risk, and sidewalk bicycling appears to increase the incidence of wrong-way travel"*

Vehicular Impacts

Alternatives 1B and 1C eliminate one lane of parking along Commonwealth Avenue. Alternative 1B does propose that trail users and vehicles will be sharing the roadway. Alternative 1D will likely result in the loss of parking and could potentially make loading/unloading activities more difficult. Alternatives 1A, 1B and 1C propose potential conflict with trail users and opening car doors. With the trail routed along Commonwealth Avenue, turning into and out of the West Concord Supermarket parking lot may be more difficult. Alternative 1D may make loading, unloading, entering and exiting the parking area behind the West Concord Supermarket.

Benefits to the Community

This alternative provides a continuous route along the BFRT. This also directs trail users to the businesses along Commonwealth Avenue and the MBTA Commuter Rail Station.

Timeliness to Implement

This option requires the elimination of one lane of parking or parking spaces in addition to eliminating unauthorized use of the right-of-way along the spur so the public process may delay the design process. Each alternative requires right-of-way. If the Main Street/Commonwealth Avenue intersection is reconfigured and reconstructed, the design will take between one (1) and two (2) years.

If a design exception is determined necessary and approved and the abutters are amenable, none of the options presented under Alternative 1 propose any special or time consuming design features so assuming this would be incorporated into the BFRT Phase 2C design and construction, the design could be completed in approximately 24 months and the construction could be completed in an additional 24 months.

Context-sensitive Aesthetics

A solid fence to prevent trail users from entering the MBTA Commuter Rail parking area could negatively impact the visual character and aesthetics of the area.

Inclusion of context-sensitive aesthetics such as pavers, colors and plantings could be included in the design of any option under Alternative 1. Alternative 1A does not propose any changes to Commonwealth Avenue other than some signing. Alternatives 1B and 1C do propose changes to Commonwealth Avenue but these changes could be implemented with minimal disruption to the historic context of the area. Alternative 1D does not propose changes along Commonwealth Avenue however does propose changes in the vicinity of Union Station which is listed on the National and State Registers of Historic Places.

Alternative 1 does have both positive and negative impacts on the businesses, particularly the West Concord Supermarket. Although trail users will be directed to the businesses, one lane of parking and/or parking spaces will be lost and sidewalk congestion and trail traffic could negatively affect the business.

Alternative 2 - Gap in the BFRT

This alternative proposes to leave a gap in the Bruce Freeman Rail Trail from the northern end of the MBTA Commuter Rail parking area and the EOTC Owned right of way on the south side of Main Street. See Figure 6 on the following page.

Signing would be proposed indicating that the trail ends. It would be GPI's recommendation to propose additional signing and possibly a diagram indicating that the trail begins again south of Main Street to assist users not familiar with the area and the trail with continuing south when they reach the end of the trail.

Trail users who wish to continue will seek to find the most direct route through this area which would be to travel through the MBTA parking lot to the existing crossing forcing trail users to share use of the parking lot with motorists. In the July 13th meeting with the MBTA and DPU it was suggested that fencing be provided to prevent this movement. It would be GPI's recommendation to provide stockade fencing or chain link fencing blocking access to the Concord Park parking facility and the MBTA commuter rail parking lot to prevent trail users from utilizing this route. Chain link fencing could be hidden with landscaping. Even with fencing, trail users may find a way around the fencing and back into the parking lot whether it is from the railroad spur or the Concord Assisted Living Facility property unless the entire lot is fenced in. Installation of the fence would require easements and approval from Concord Park and EOTC.



Alternative 2 Summary

EVALUATION CRITERIA

Effectiveness

This will not be an effective alternative. Trail users will be left on their own to figure out how to get from the end of the trail to south of Main Street or vice versa.

Short-term and Long-term Reliability

This alternative does not propose a continuous route for the BFRT. The *Massachusetts Bicycle Facilities Inventory Project* was completed in 1995 by Mass Bike under contract to MassDOT to inventory proposed and existing bicycle facilities. Part of this process was to prioritize the proposed facilities. One of the criteria for prioritization was connectivity with other routes and directness. If the connectivity was provided, the proposed facility received the most points. The *Massachusetts Bicycle Transportation Plan* emphasizes creating a network of trails. Leaving a gap does not meet the goals established by the State. With a gap in the trail, trail users who are not familiar with the trail and the area may reach the end of the proposed trail and turn around and go back to where they came from.

Short-term and Long-term Maintenance Costs

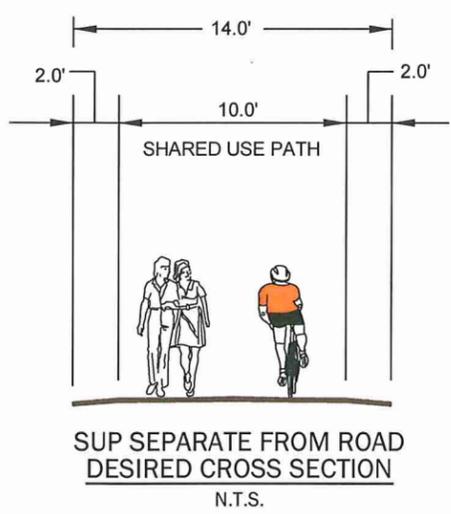
Aside from maintaining fencing and signing the short-term and long-term costs for this alternative would be minimal.

Difficulty in Implementing

No right-of-way would be required for this alternative. Easements would be required from Concord Park and EOTC for the installation of fence on their property.



LEGEND:
 = SHARED USE PATH (SUP) SEPARATE FROM ROADWAY
 = PROPOSED FENCE



ALTERNATIVE 2 - CONCEPTUAL PLAN
 GAP IN THE BFRT
 CONCORD, MA

FIGURE 6

SCALE: 1" = 80'

The MBTA has no objections to this alternative but did note that funding may be an issue without a continuous path. MassDOT would likely not approve this alternative for state and/or federal funding since it does not present a continuous route.

With federal funds being allocated towards the construction of the BFRT, a Categorical Exclusion (CE) Checklist would be required. Since work will be proposed within the Riverfront Area of Nashoba Brook, a Notice of Intent must be filed with the Concord Natural Resources Commission. It is possible that an Environmental Notification Form (ENF) would also be required assuming that this would be constructed as part of the Concord BFRT and not independently. It should be noted that these permits would be required even if this alternative was not selected. This alternative does not trigger additional permitting.

Cost to Design and Implement

The design efforts for including signing and fencing on the plans would be minimal. Installation of fencing and signing would cost approximately \$40,000.00.

This option could also jeopardize funding for the project. The Federal Highway Administration and MassDOT do not fund portions of trails. All trails constructed with state and federal dollars must have logical starting and stopping points. Although West Concord Center is a logical terminus with the Commuter Rail Station and the businesses, it does not provide connectivity to the south for trail users headed south or to the north for trail users headed north. If funding is lost, the Town of Concord would need to fund construction of the BFRT through the community. Currently the construction cost is estimated at approximately \$7,000,000.00.

Risk to Public Safety

This option strands trail users where the trail ends. Without a proposed design, this option presents a concern getting trail users across Main Street to the EOTC owned right-of-way. With a gap in the trail, user safety could be jeopardized without the proper signing, striping and guidance.

Vehicular Impacts

Although this alternative does not propose any direct vehicular impacts, with a gap in the trail, trail users will be forced to find their way to where the BFRT begins again and they could go in any direction. This could present the potential for trail user/vehicular impacts, especially for trail users not familiar with the area.

Benefits to the Community

This alternative does not propose a continuous route for the BFRT. It could certainly discourage users unfamiliar with the area from visiting the trail. Leaving a gap may also prevent those unfamiliar users from entering the village of West Concord and visiting the local businesses. A solid fence could negatively impact the visual character and aesthetics of the area.

Timeliness to Implement

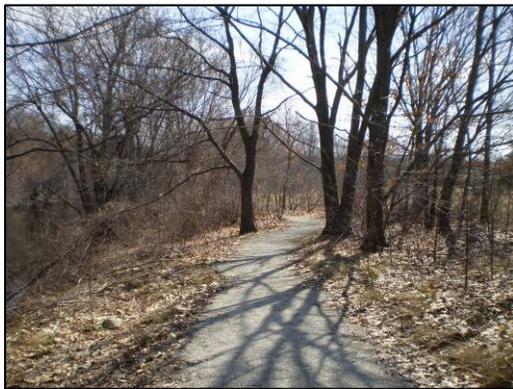
Alternative 2 does not propose any special or time consuming design features so assuming this would be incorporated into the BFRT Phase 2C design and construction, the design could be completed in approximately 24 months and the construction could be completed in an additional 24 months.

Context Sensitive Aesthetics

A solid fence to prevent trail users from entering the MBTA Commuter Rail parking area could negatively impact the visual character and aesthetics of the area.

Alternative 3 - Reroute the BFRT to behind Concord Park Assisted Living Facility

The Assabet River flows at the eastern limits of the Concord Park Assisted Living Facility. After the BFRT crosses the Nashoba Brook structure, the trail could bend easterly and follow the Assabet River behind the facility. There is an existing stone dust path at the rear of the facility property and a small slightly wooded area separating the property from the river. There is a sitting area with some benches at the northern end of the stone dust path. It is our understanding that Concord Park has concerns about incorporating the bike trail with the stone dust trail on the property and the desire is to keep them separate. Concord Park is an assisted and independent living senior community so the concern lies with possible conflict between high speed cyclists and elderly residents.



The right of way behind Concord Park is owned by VOA Concord Assisted Living Inc. The right-of-way between the MBTA Bridge and Main Street is owned by A&D Real Estate LLC. The MBTA right-of-way is approximately sixty-six (66) feet in width. The rail track bed is approximately twenty-five (25) feet in width.

Consideration was given to incorporating the bike trail into the existing rail bridge over the Assabet River. A letter was sent by the Town of Concord to the MBTA on April 13, 2009 requesting that the MBTA include a walkway along the MBTA's track east of West Concord station and the crossing of the Assabet River adjacent to the Fitchburg Mine Line tracks. The MBTA's response indicated that the right of way width in this area was insufficient to provide the safe separation necessary for the MBTA's trains and a path. Therefore, incorporating the bike trail into the existing rail bed would not be acceptable to the MBTA. MBTA's response letter dated May 13, 2009 has been included on the following page.

The Assabet River was designated a Wild and Scenic River in 1999 with ecology, archaeology and history, scenic, recreation and literary resources being identified as the “outstandingly remarkable values”. The Wild and Scenic Rivers Act prohibits any department or agency of the United States from assisting in the construction of any water resources project that would have a “direct and adverse” effect on the values for which the river was established and it precludes federal assistance to projects below/above a designated river that have been determined to “invade the area or unreasonably diminish the scenic, recreational, and fish and wildlife values present...as of the date of designation”. The River Stewardship Council (RSC) was established to coordinate conservation of the river. They function as an advisory committee to the National



Massachusetts Bay Transportation Authority

Deval L. Patrick
Governor

Timothy P. Murray
Lt. Governor

James A. Aloisi, Jr.
Secretary and MBTA Chairman

Daniel A. Grabauskas
General Manager

May 13, 2009

Mr. Gregory P. Howes
Chair
Town of Concord
Board of Selectman
22 Monument Square
PO Box 535
Concord, MA 01742



Dear Mr. Howes:

I am writing in response to your letter of April 13, 2009 requesting the MBTA include a walkway along the MBTA's track east of the West Concord station and the crossing of the Assabet River adjacent to our Fitchburg Main Line tracks. The MBTA firmly believes in the benefits of transit oriented development and we are always looking for ways to make such proposals successful.

Your request is compelling but our review of the available right of way width in this specific area is insufficient to provide the safe separation necessary for the MBTA's trains and a path. This type of access/usage over an active MBTA railroad bridge is not allowed anywhere on our system. Your proposal would place the public extremely close to trains passing in excess of 60 MPH. Debris and ice can be kicked up by a passing train, causing a dangerous situation. The movement of the bridge during train passage would also be startling to bikers or walkers.

The cost to protect pathway users from these occurrences could not be justified when the alternative existing path of travel is relatively close in travel time. By our rough calculation, the distance of the existing route between the West Concord station and the Baker Avenue grade crossing is 1814 feet with the route along the tracks being just 258 feet shorter.

Should you wish to reconsider the separate pedestrian/bike bridge away from the railroad bridge the MBTA would gladly work with the Board of Selectmen to provide a proper connection to the MBTA's station platforms, just as we have with the Bruce Freeman Rail Trail routing through the parking lot and across the tracks at the protected Commonwealth Avenue grade crossing.

After careful consideration, I regret that the MBTA cannot concur with your request.

Sincerely,

Daniel A. Grabauskas
General Manager

Driven by Customer Service

Massachusetts Bay Transportation Authority, Ten Park Plaza, Boston, MA 02116-3974

Park Service (NPS) on federal permits affecting the rivers' outstanding resources. Any work would need to be reviewed by the RSC. Since they are not a permitting agency, they review projects through the Army Corps of Engineers PGP II application to determine if any project within a quarter mile of the designated river has a direct and adverse impact. They review plans and offer comments.

Alternative 3A - Tunnel under the MBTA Rail Line

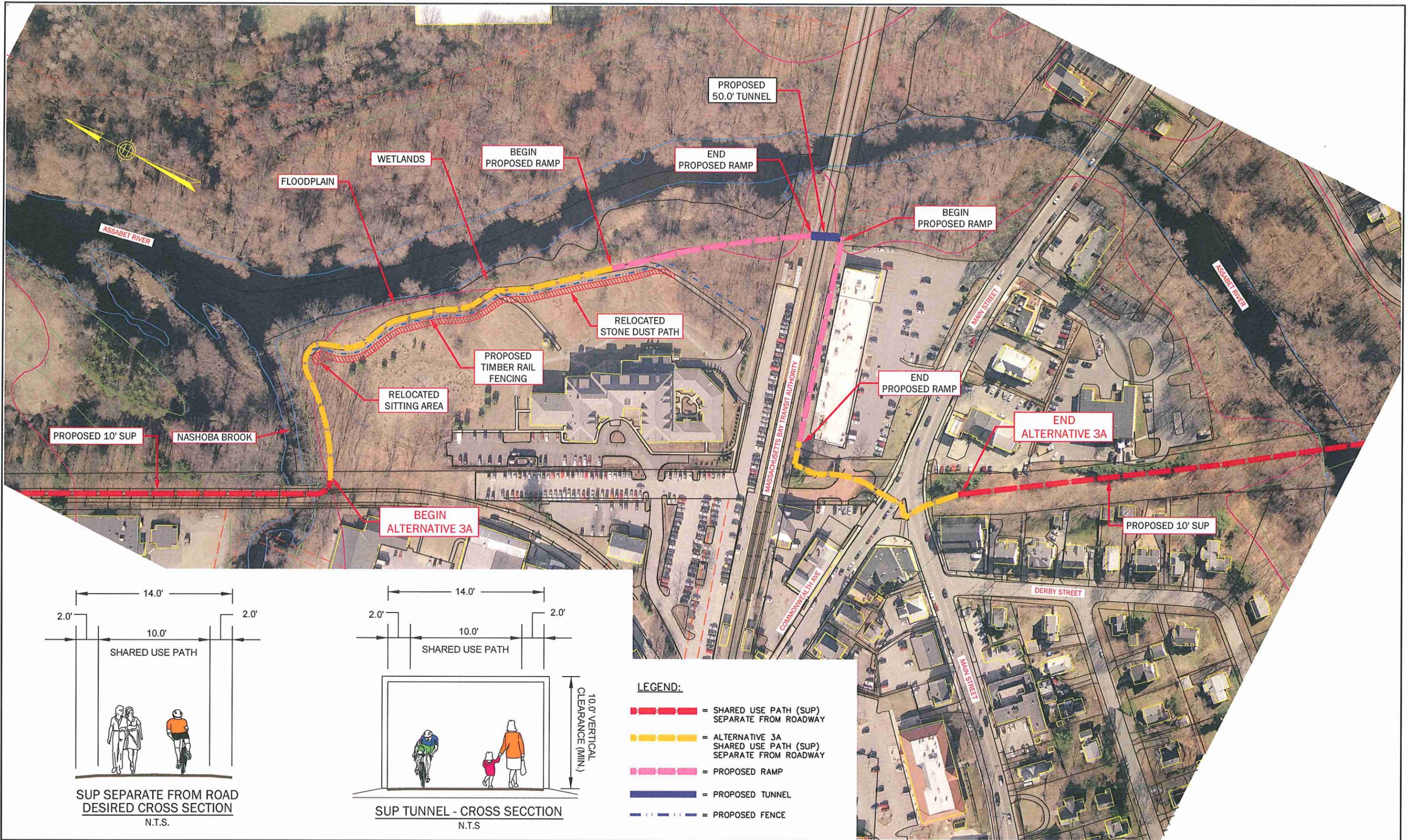


This alternative would require tunneling under the active rail line. A meeting with the MBTA and DPU on July 13, 2009 indicated that they did not have an issue with a tunnel under the tracks if it could be completed without interrupting rail service. With the proximity of the Assabet River, it is assumed that the water table is very high. A tunnel would require an extensive pumping system both during and after construction. Prior to furthering this design, borings must be performed to determine the exact location of the water table, the subsurface soil and whether or not there is ledge.

The MassDOT *Guide* requires a ten foot vertical clearance for underpasses and tunnels. The *Guide* also requires a two (2) foot wide clear shoulder on either side of the trail through the tunnel which would require a fourteen (14) foot wide tunnel. GPI would propose a reinforced concrete box tunnel. With a fourteen (14) foot width, the required wall thicknesses would be between twelve (12) inches and eighteen (18) inches. In order to install the tunnel without suspending train service, the tunnel would need to be between six (6) and eight (8) feet under the bottom of the tracks making the trail elevation in the tunnel between seventeen (17) and nineteen (19) feet under the bottom of the tracks. At a depth of six (6) to eight (8) feet under the tracks, the tunnel could be jacked straight through with no additional support required for the tracks. If the tunnel was shallower than six (6) to eight (8) feet under the tracks, train service would need to be suspended in order to place a temporary frame and brace the tracks. However, jacking the tunnel is only a feasible solution if there is no ledge removal required.

For ADA compliance, the maximum slope for the proposed trail is 5%. The grade can be increased to 8.33%; however, level landings would be required every thirty (30) feet. Therefore, in order to install a tunnel between seventeen (17) and nineteen (19) feet under the active rail line, the ramps down to reach that elevation would be between three hundred and forty (340) and three hundred and eighty (380) feet in length at a 5% grade. The actual tunnel would be approximately fifty (50) feet in length. Railing and retaining walls would be necessary on the ramps descending and ascending from the tunnel.

The distance between the MBTA Bridge and Main Street varies between three hundred (300) and four hundred (400) feet and does not provide sufficient distance for the tunnel to surface before Main Street. The elevation difference from the existing ground in that location to the parking area of the West Concord Shopping Plaza is in excess of ten (10) feet. If a tunnel system were proposed, after crossing under the tracks the tunnel would need to take a 90° turn to begin climbing back up to existing ground requiring trail users to dismount their bicycles. See Figure 7 on the following page. This provides a sight distance issue and does not meet the minimum radius requirements in the *Guide*. With a sharp turn, a blind corner is created and the potential for trail user collision is greatly increased. This would require the posting of warning signs alerting trail users to the sharp turn and requiring that they dismount and walk their bikes. Although a switch



ALTERNATIVE 3A - CONCEPTUAL PLAN
 REROUTE BFRt BEHIND CONCORD PARK
 CONCORD, MA

FIGURE 7

SCALE: 1" = 80'

back ramp system could fit in this location between the MBTA tracks and Main Street, the option was not investigated further due to the presence of floodplain and the difference in elevation from the land abutting the Assabet River where the tunnel would surface and the parking area at West Concord Shopping Plaza.

This ramp system would run parallel to the track behind the businesses in a westerly direction and reach ground level at the westerly end of the West Concord Shopping Plaza. The paved area behind the buildings varies between fifteen (15) and twenty (20) feet and the businesses currently use that area to load/unload and as a back entrance to their buildings. At the edge of the paved area the ground begins to climb to the tracks. In order to daylight the tunnel, an easement would be required from A&D Real Estate LLC and would make use of the property behind the businesses for loading and unloading impossible.



Tunnels also provide safety and security issues. Providing long sight lines is a crucial aspect of tunnel design to ensure both perceived and actual safety. People should be able to see the far end of the tunnel when they enter it. A tunnel would isolate trail users and although studies have shown that crime does not increase in tunnels, it is a possibility. (*Rail-Trails and Safe Communities: The Experience on 372 Trails - Rails-to-Trails Conservancy 1998 and Evaluation of the Burke-Gilman Trail's Effect on Property Values and Crime* - Seattle Engineering Department, 1987.) In order to remove some of the safety and security concerns, lighting and possibly security cameras would be necessary.

If this option were selected, after the trail surfaced from the tunnel, it would need to be routed through the Concord Station area to the existing crosswalk and traffic signal at Main Street in front of the 99 Restaurant. As mentioned earlier, it would be GPI's recommendation to make intersection modifications to minimize crossing distances and times. The reconfiguration of the intersection to a more traditional "T" intersection with a single crossing of Main Street would

accomplish this goal. This would require right-of-way from the Boston Gas Company who owns a strip of land abutting and east of the EOTC right-of-way between the tracks and Main Street, and from EOTC.

Alternative 3B - Bridge over the MBTA Rail Line

This option would bridge over the active rail line. The MBTA requires twenty-two and a half (22.5) feet over the rails, however, with appropriate waivers from the MBTA the clearance can be as low as eighteen (18) feet. The tracks are elevated in this area. They are approximately ten (10) feet higher than the ground just north of the tracks and five (5) feet higher than the ground south of the tracks.

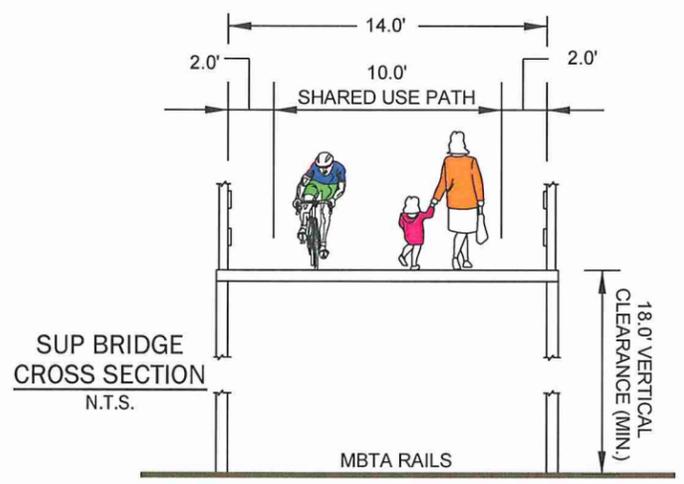
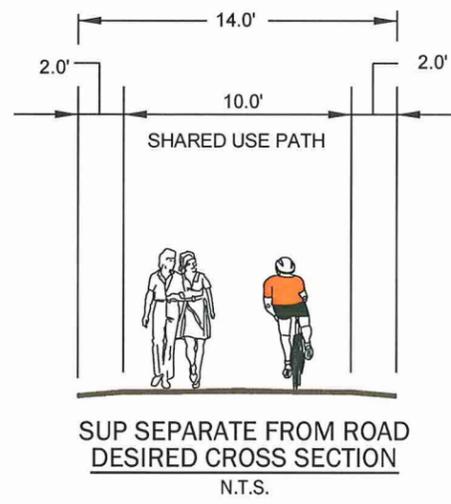
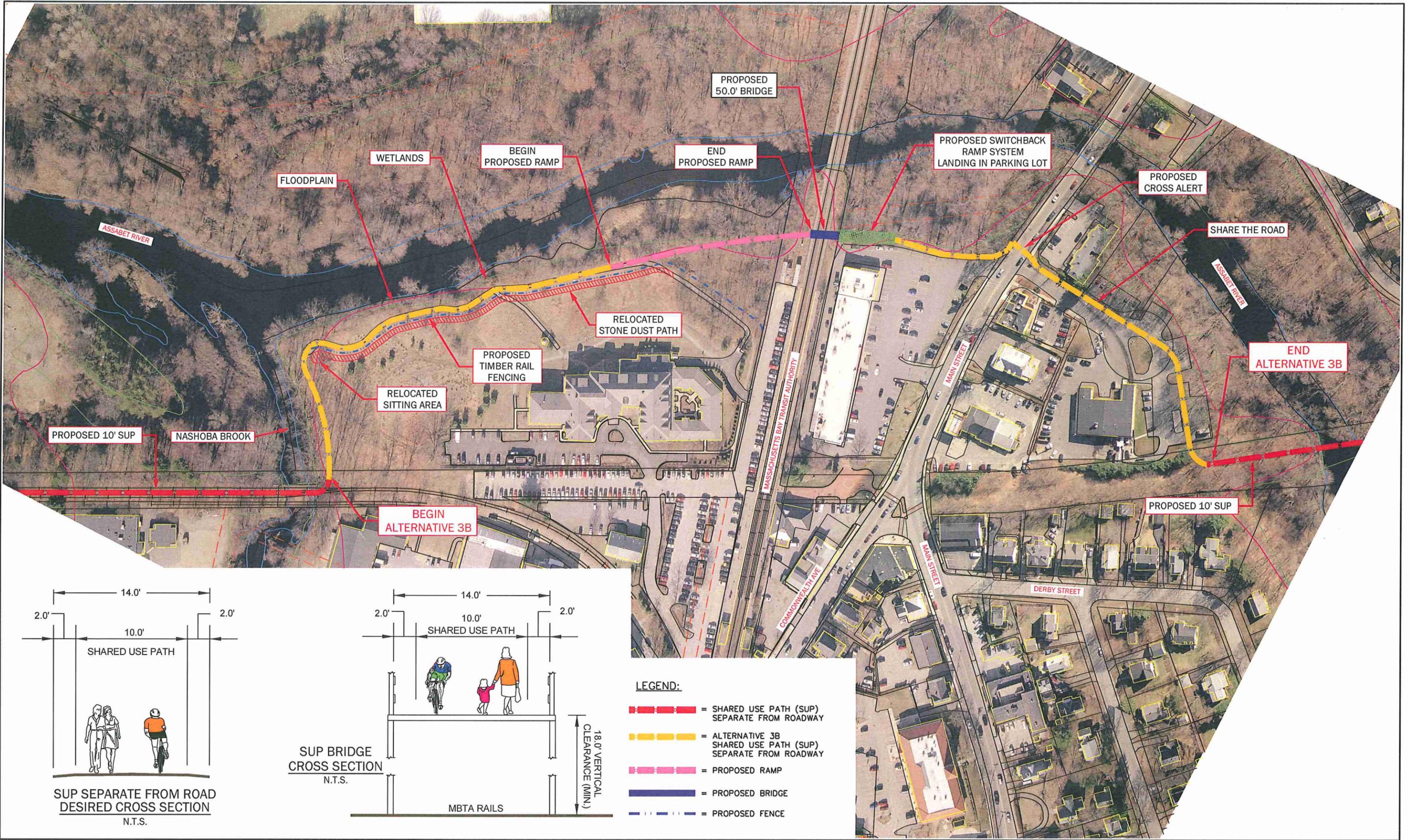


In order to reach eighteen (18) feet above the tracks at a 5% grade, the ramp up headed in a southerly direction would need to be approximately five hundred sixty (560) feet in length and would begin at approximately the center of the Concord Park Facility building. The ramp down would need to be approximately four hundred sixty (460) feet in length to reach existing grade at the parking lot level. There is insufficient distance between the MBTA tracks and Main Street for the ramp to reach existing ground.

Additionally, the parking lot and Main Street are in excess of ten (10) feet above existing ground. Therefore, in order to reach the ground, a switchback ramp system would be necessary requiring users to dismount their bicycles. The structure would be approximately thirty-five (35) feet in height if it was covered with four (4) - one hundred (100) foot ramps with switch backs and a final sixty (60) foot ramp to the existing parking lot. See Figure 8 on the following page. This would require right-of-way from A&D Real Estate LLC and would prohibit use of the parking lot at the eastern side of the West Concord Shopping Plaza. The base of the switch back ramp system would be in the floodplain requiring special design features for support and minimization of impacts.



If this option were selected, the trail would be directed along the eastern limits of the West Concord Shopping Plaza parking area to the existing cross walk on Main Street across from Dunkin Donuts. The existing crosswalk at that location crosses people to the sidewalk in front of Dunkin Donuts. In order to utilize this for the BFRT, the crosswalk must be shifted closer to



- LEGEND:**
- — — — — = SHARED USE PATH (SUP) SEPARATE FROM ROADWAY
 - — — — — = ALTERNATIVE 3B SHARED USE PATH (SUP) SEPARATE FROM ROADWAY
 - — — — — = PROPOSED RAMP
 - — — — — = PROPOSED BRIDGE
 - - - - - = PROPOSED FENCE

ALTERNATIVE 3B - CONCEPTUAL PLAN
REROUTE BFRt BEHIND CONCORD PARK
CONCORD, MA

FIGURE 8

SCALE: 1" = 80'

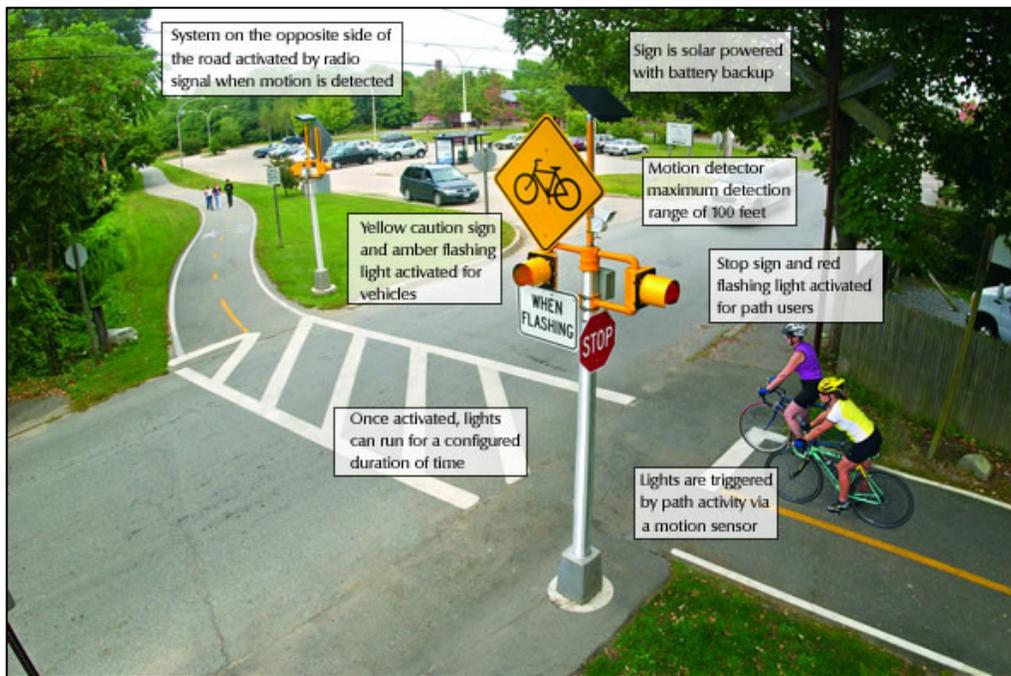
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Proposed Bruce Freeman Rail Trail/MBTA Commuter Rail Crossing Alternative Analysis

Westgate Road or to the other corner of the intersection of Main Street with Westgate Road. Typically in situations like this, a Cross Alert system could be proposed to help trail users cross Main Street. However, with the proximity of the Fire Department Emergency Signal, the addition of another signal may be confusing for drivers in which case other design alternatives for this crossing may be necessary including combining the trail crossing/emergency fire signal.



The Cross Alert system provides an advance, active alert to approaching vehicles that path users are at or near the intersection. The Cross Alert system consists of a red LED light and stop sign which are presented to path users and an amber LED light and warning sign which are presented to vehicular traffic. The sign is powered by a solar panel, which is backed up by a battery. The system is activated by path activity via an infrared motion sensor. The companion sign on the other side of the road is activated via radio signal when the first sign detects motion on the path. This system includes an integrated trail counter to provide a count of trail users who cross the intersection.



Once trail users have crossed Main Street they would share Westgate Road which leads to the Concord Car Wash with vehicles. It appears that the area at the end of Westgate Road is also used for parking. There is one driveway entrance to a parking lot at the rear of the Dunkin Donuts. The existing pavement width on Westgate Road appears sufficient to allow for two travel lanes and bicycle accommodations. With the car wash and the parking area provided at the end of Westgate Road it would be our recommendation to keep the trail along the outside edge of the lot. Two crosswalks would be necessary to

accomplish this. One crosswalk would be required at the intersection with Main Street and one crosswalk would be required just south of the Dunkin Donuts parking entrance. Trail users headed south could then cross to the outside edge of the property. Once through the car wash property, the trail would cut through the woods back to the EOTC owned right-of-way before the proposed bridge structure over the Assabet River. From Concord GIS, this property is owned by Mr. Jerome L. Robertson.



Alternative 3 Summary

EVALUATION CRITERIA

Effectiveness

A trail abutting the Assabet River would provide a very scenic location for a trail and most trail users would utilize the trail. However, as with Alternative 1 since human nature is to find the most direct route from Point A to Point B, users may try and find a more direct route, i.e. through the MBTA parking lot and the existing crossing. Fencing may be necessary to prevent this.

Although signing can be proposed requiring bicyclists to dismount their bikes and walk them where sight distance is limited, it will be extremely difficult to enforce without constant monitoring, warnings and possibly enforcement such as police warnings, tickets and fines.

There is also the possibility that public opinion of the tunnel (Alternative 3A) may act as a deterrent for some trail users. The switch back ramp system (Alternative 3B) for the bridge however may force avid trail users to find a more direct route.

Short-term and Long-term Reliability

Alternative 3 provides a continuous, reliable trail both in the short-term and the long-term if it is maintained. Studies have shown that tunnels are generally only closed if there are flooding issues and bridges are only closed for maintenance.

A switch back ramp system will require trail users to dismount and walk their bikes. Although signs would be posted, trail users may not dismount their bikes creating a potentially dangerous situation. Compliance may be low.

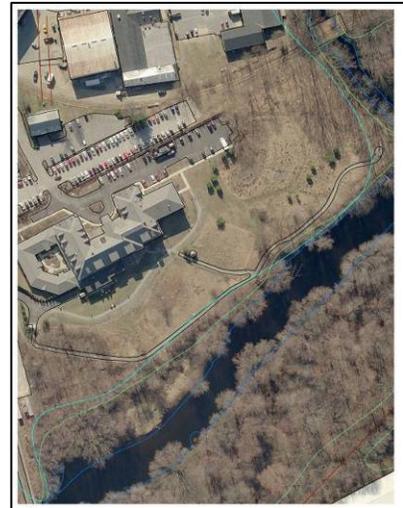
Short-term and Long-term Maintenance Costs

The maintenance costs mentioned earlier in this report apply to this alternative also. The annual maintenance cost for a trail is approximately \$1,500/mile. The long-term paving cost would be approximately \$80,000/mile the first time and \$130,000/mile the second time.

In addition, it should be emphasized that structures must be inspected on a recurring basis. Although this inspection should occur yearly, studies have shown the average inspection interval is four years. Bridges could be constructed with galvanized steel to eliminate the need for periodic painting. However, bridge structures would require periodic maintenance to repair galvanized coating failures, leaking joints, and miscellaneous repairs to chipped walking surfaces or damaged protective screens. Additionally, any lighting or security cameras within the bridge/ramps would require periodic replacement. Boardwalk structures are typically constructed of timber and would require miscellaneous repairs on regular intervals for member replacements and repairs.

Difficulty in Implementing

According to Concord GIS, in addition to the riverfront resource area, the Assabet River has floodplain and wetlands. The extent of the floodplain of the Assabet River varies along its length. Any area within the floodplain would be subject to periodic flooding, therefore if the BFRT was routed through floodplain, it would need to be via a boardwalk structure. Between the Nashoba Brook crossing and the MBTA bridge structure, there would be enough room outside the floodplain limits to shift the stone dust trail closer to the facility and construct the BFRT. This however, would require a substantial amount of right-of-way from the facility. Although two separate paths could be provided, unless fencing was installed there would be no means of insuring that trail users stayed on the trail and off the Concord Park property. Providing fencing would make it much more difficult for facility residents to enjoy the river.



The floodplain and wetlands between the MBTA Rail Bridge and Main Street are extensive and cover most of the area west of the Assabet River. Any structure built through that area would need to be a boardwalk type structure. Compensatory flood storage would need to be provided for all floodplain filled by constructing within the floodplain. There is a thirty foot sewer easement that runs through that area also.

Borings would need to be conducted to determine the subsurface soil information, the location of the water table and the presence of ledge prior to initiating the design of this alternative. In order to reach the required elevations both under and over the active rail line, extensive ramp systems and right-of-way would be required. An easement would be required from the MBTA to cross over or under their facility. Right-of-way would be required from Concord Park for both Alternative 3A and 3B and they would lose access to and views of the Assabet River. Right-of-Way would be required from A&D Real Estate LLC for both alternatives and with the tunnel option they would lose use of all property at the rear of the businesses.

With the proximity of the Assabet River and the floodplain, a high water table and flooding would be a concern. A pumping system would most likely be necessary in a tunnel. A mechanical ventilation system and lighting would be required.

Ventilation would also need to be considered for a bridge structure over the rail line if it were to be enclosed. If the structure was not covered and the BFRT remained open for trail use year round, the bridge would need to be plowed and salted. If a bridge structure was chosen, the preferred option would be an open air structure, with fencing on the sides to prevent objects from falling onto the railroad, and a roof structure to provide snow and rain shelter.

The bridge option would introduce the potential for trail user/motor vehicle contact as users cross Main Street and share the road with vehicles along Westgate Road, vehicles entering the parking lots and the car wash.

Right-of-way would be required, parking would be lost at West Concord Shopping Plaza and the businesses would lose use of the alleyway behind them.

These alternatives may require Design Exceptions since they do not meet the design standards required with respect to sight distance. This would entail the preparation of a Design Exception Report and approval by the Design Exceptions Committee. They would require discussion and/or meetings with both the AAB/ADA Coordinator and the Bicycle/Pedestrian Accommodation Engineer at Mass DOT. At this time, it is unknown whether or not either of these options would be approved by MassDOT. In discussions with MassDOT regarding this report, they had indicated that they would need a formal submission in order to evaluate any alternative and make any decisions. The cost of these alternatives would also weigh in heavily on MassDOT's decision.

It should be noted that the MBTA would support the tunnel option providing MBTA service would not require suspension. This however does make construction more difficult. The MBTA did voice concerns with a bridge structure but have allowed them in the past.

With federal funds being allocated towards the construction of the BFRT, a Categorical Exclusion (CE) Checklist would be required. Since work will be proposed within the Riverfront Area of Nashoba Brook and the Assabet River, a Notice of Intent must be filed with the Concord Natural Resources Commission. It is possible that an Environmental Notification Form (ENF) would also be required assuming that this would be constructed as part of the Concord BFRT and not independently. It should be noted that these permits will be required regardless of this alternative; however, work in the floodplain makes the permitting process much more extensive. An Army Corps of Engineers PGP II Application and coordination with the RSC would be required due to the Wild and Scenic River designation of the Assabet River.

Any work within the floodplain would require contacting the Federal Emergency Management Agency (FEMA). Projects proposed in floodplains are reviewed in conjunction with Massachusetts Environmental Policy Act (MEPA), Massachusetts Wetlands Protection Act, and Massachusetts Office of Coastal Zone Management reviews.

Cost to Design and Implement

The design cost for Alternative 3A would be between \$500,000.00 and \$750,000.00. The design cost for Alternative 3B would be approximately \$500,000.00 to \$600,000.00.

Assuming a concrete tunnel under the MBTA tracks and associated transition to above grade, the construction cost would be between \$5 and \$7 million making the total construction cost of Alternative 3A between \$7 and \$9 million. If rock is encountered, the construction cost could increase by 100% or more depending on the amount of rock removal.

Assuming a steel ramp/bridge structure similar to other MBTA commuter rail locations, the construction cost would also be between \$5 and \$7 million making the total construction cost of Alternative 3B between \$7 and \$9. If additional architectural features were included to improve the structure aesthetics, the total cost could increase by 25% or more depending on the architectural features.

In addition to design and construction costs, construction in a floodplain may make it necessary to get flood insurance in order to obtain construction financing.

Risk to Public Safety

Rail-Trail Maintenance & Operation published by the Rails to Trails Conservancy Northeast Regional Office states that approximately a quarter of constructed trails of the 100 trails surveyed reported illegal activities unique to bridges and tunnels including climbing and jumping from bridges, graffiti and vandalism. A tunnel would isolate trail users potentially jeopardizing their safety. The blind corner in the tunnel could present an unsafe condition for trail users who do not dismount their bikes and remain in their travel lane. Switch back ramps do create a potentially hazardous situation for trail users if they do not dismount their bikes due to limited sight distance.



Trail users will be put in potential contact with motor vehicles at the Main Street crossing if Alternative 3A is selected and in the West Concord Shopping Plaza, at the Main Street crossing, along Westgate Road and through the car wash if Alternative 3B is selected.

If fencing was not provided separating Concord Park from the trail, there is potential for bike/pedestrian conflicts.

Vehicular Impacts

Alternative 3A prevents business owners from utilizing the paved area behind their businesses in the West Concord Shopping Plaza for loading and unloading. This alternative also puts trail users in contact with vehicles at the Main Street crossing in front of the 99 Restaurant.

Alternative 3B has vehicular impacts in the parking lot of West Concord Shopping Plaza. It also puts trail users in contact with vehicles at the Main Street crossing, along Westgate Drive and in the car wash/parking area at the end of Westgate Drive.

Benefits to the Community

Routing the trail along the Assabet River would provide a continuous, very scenic route for the BFRT. Both Alternative 3A and Alternative 3B would bring trail users to the businesses in West Concord. Alternative 3B directs trail users to the MBTA Commuter Rail Station.

Timeliness to Implement

Design of a bridge or tunnel requires extensive MassDOT and MBTA review. Right-of-way would be required with both Alternatives 3A and 3B. Depending on the extent of work in the floodplain and wetlands, the permitting process could be extensive.

Assuming the design and construction is completed as part of the BFRT Phase 2C and the abutters are amenable, the design could be completed within 24 to 30 months. The environmental

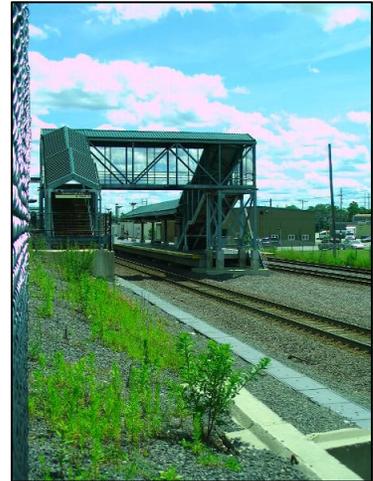
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permitting could be completed within that time frame. The construction would take approximately 30 to 36 months.

Context Sensitive Aesthetics

Although the tunnel option presents an underground alternative, the ramps descending to and ascending from the tunnel create a very large hole in the ground. This hole would detract from the view the Concord Park residents currently have of the Assabet River. A bridge would destroy the residents' view of the Assabet River. The bridge option would also place a very large structure in the village of West Concord.



Alternative 4 - Tunnel under the MBTA Rail Line

This option proposes a tunnel under the existing rail line near West Concord Station. Borings would be necessary to determine the subsurface soil and the presence of ledge and/or groundwater prior to proceeding with this alternative. At West Concord Station, the tracks are at ground elevation. The tunnel would still need to be between seventeen (17) and nineteen (19) feet under the existing tracks requiring a ramp between three hundred forty (340) and three hundred eighty (380) feet in length with a 5% grade. The grade could be increased to 8.33% with level landings provided every thirty (30) feet. However, this grade is quite steep for many riders and walkers. As with option 3A, there is insufficient distance between the rail line and Main Street for the tunnel to reach existing ground. The tunnel would therefore need to cross under both the active rail line and Main Street before climbing up to existing ground unless the Town opted for a switchback ramp system allowing the tunnel to ascend to existing ground.

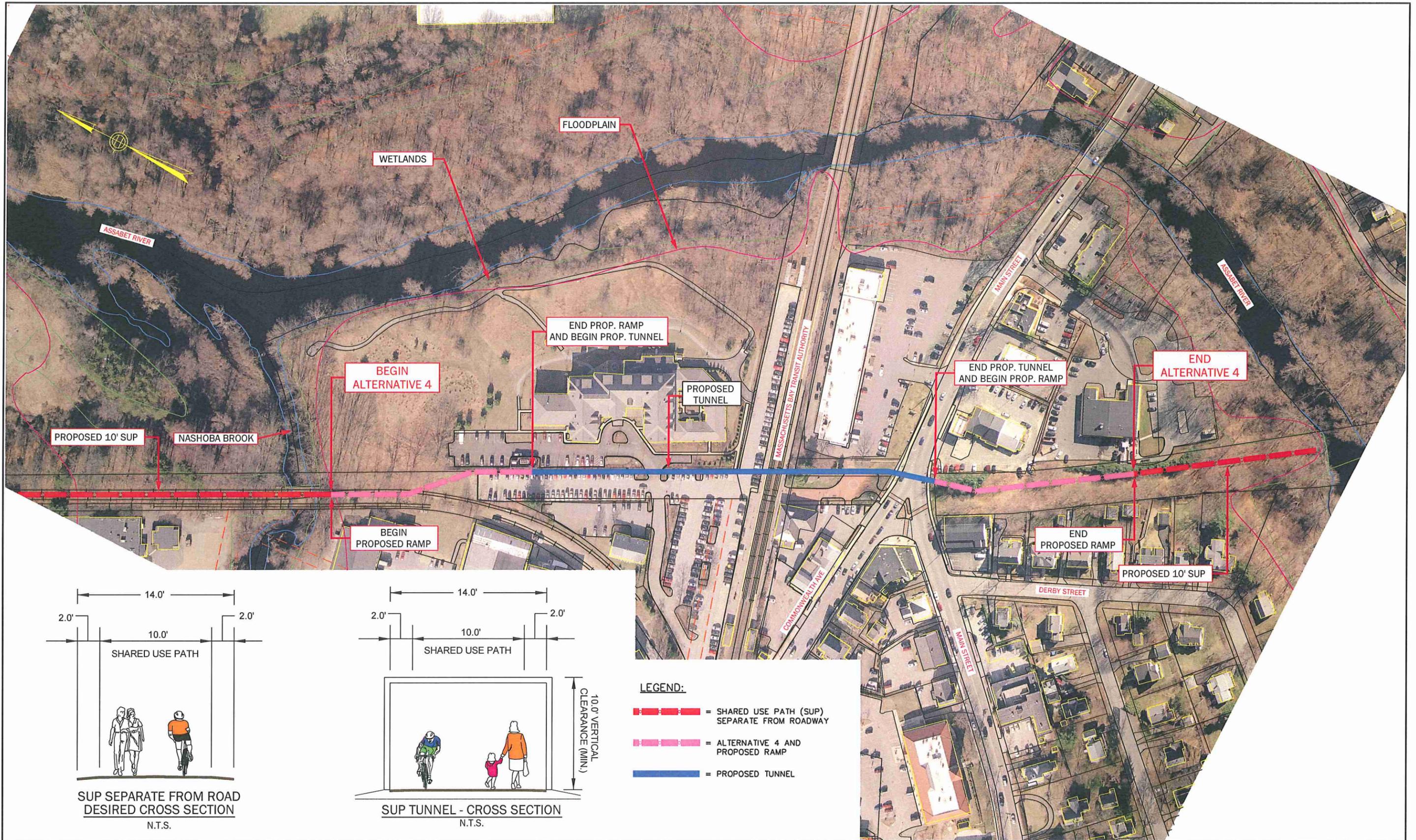
The MBTA did indicate at a meeting held on July 13th that they would not allow for the loss of any parking or allow bikes to ride through the parking lot. Concord Zoning Bylaw requires full size parking spaces to be 9'x18' with a 24' aisle width to accommodate two-way traffic. The existing parking lot is approximately fifty (50) to fifty-one (51) feet in width at the northern limits and allows for two rows of 90° parking. With a required width of 60 feet the existing parking lot does not meet the Zoning Bylaws. A tunnel could not be incorporated in the existing lot without taking parking.



The MBTA parking between the tracks and Concord Park is approximately thirty-nine (39) feet in width. The area allows for one row of 90° parking. Concord Zoning Bylaw requires forty-two (42) feet to accommodate this parking. The existing parking area does not meet the Zoning Bylaws and a tunnel could not be incorporated in this area without taking parking. It should be noted however that the State is exempt from local zoning bylaws.

There is an eight (8) to nine (9) foot gap between the edge of the MBTA lot and the Concord Park parking lot. Since this is insufficient width for the tunnel, the tunnel would need to begin just after crossing the Nashoba Brook Bridge. Beginning the descent here would allow for the tunnel to be underground prior to reaching the existing parking facilities and prevent loss of any parking. The tunnel would continue descending to reach the required depth under the active rail line. After the tunnel crosses under the tracks, it could slowly begin climbing to reach existing ground south of Main Street. The ramp and tunnel system would be between 1,000 and 1,500 feet in length.

There is insufficient distance, only one hundred seventy (170) feet, between the MBTA Tracks and Main Street. However, if the Town desired, a switchback ramp system could be utilized between the MBTA tracks and Main Street to have the tunnel surface before Main Street. This option produces blind corners and forces trail users to dismount and walk their bikes. See Figure 9 on the following page.



ALTERNATIVE 4 - CONCEPTUAL PLAN
 TUNNEL UNDER THE MBTA RAIL LINE
 CONCORD, MA

FIGURE 9

SCALE: 1" = 80'

Lighting and ventilation would be required in either tunnel option. Railing and retaining walls would also be required. A pumping system would likely be necessary depending on the water table

The Concord Park right-of-way is owned by VOA Concord Assisted Living Inc. The MBTA Commuter Rail parking lot is owned by EOTC. The Boston Gas Company owns a strip of land parallel to and abutting the EOTC right-of-way on the east between the tracks and Main Street which conveys a gas main under the surface.

Alternative 4 Summary

EVALUATION CRITERIA

Effectiveness

This alternative does provide a straight and direct route for the BFRT under the rail line. With a direct route, the trail through the tunnel would be followed by most trail users. However, the idea of traveling through the tunnel and being isolated underground may be problematic for some trail users depending on the time of day and if they were traveling alone. These users may avoid the tunnel and travel above ground through the existing MBTA parking lot and across the existing crossing. A fence may be necessary to prevent this movement.

Short-term and Long-term Reliability

If maintained this alternative does present a reliable alternative for crossing the MBTA rail line. Studies have shown that tunnels are generally only closed if there are flooding issues.

If the switchback ramp system was selected, trail users may not dismount and walk their bikes through the ramp system ascending from the tunnel. Enforcement of this requirement may be difficult.

Short-term and Long-term Maintenance Costs

The maintenance costs mentioned earlier in this report apply to this alternative also. The annual maintenance cost for a trail is approximately \$1,500/mile. The long-term paving cost would be approximately \$80,000/mile the first time and \$130,000/mile the second time.

It should also be emphasized that structures must be inspected on a recurring basis. Although this inspection should occur yearly, studies have shown the average inspection interval is four years. The maintenance associated with a 1,000 to 1,500 foot long tunnel could be very substantial. A continually operating ventilation system would be required, as would extensive lighting. These systems would require frequent maintenance and periodic replacement. The tunnel will be below the water table and require pumping and drainage to keep the tunnel dry and reduce water infiltration. Generally tunnels that are below the water table will develop leaks and require periodic repairs at construction and expansion joints.

Difficulty in Implementing

It should be noted that the MBTA would support the tunnel option providing MBTA service would not require suspension. This however does make construction more difficult.

If the switchback ramp system were selected, this alternative may require a Design Exception for sight distance requiring the preparation of a Design Exception Report and approval by the Design Exception Committee. This alternative would require discussion and/or meetings with both the AAB/ADA Coordinator and the Bicycle/Pedestrian Accommodation Engineer at Mass DOT. At

this time, it is unknown whether or not this option would be approved by MassDOT. In discussions with MassDOT regarding this report, they had indicated that they would need a formal submission in order to evaluate any alternative and make any decisions. The cost of this alternative would also weigh in heavily on MassDOT's decision and it is likely that this alternative would not be approved by MassDOT due to its cost.

Depending on the location of the tunnel, this option may require right-of-way from Concord Park after crossing the Nashoba Brook Bridge and would require an easement from the MBTA to cross under their rail line. It would also require an easement from EOTC.

Although the tunnel will be located under the parking lots, construction of the tunnel will cause disruption to the parking lots.

With federal funds being allocated towards the construction of the BFRT, a Categorical Exclusion (CE) Checklist would be required. Since work will be proposed within the Riverfront Area of Nashoba Brook, a Notice of Intent must be filed with the Concord Natural Resources Commission. It is possible that an Environmental Notification Form (ENF) would also be required assuming that this would be constructed as part of the Concord BFRT and not independently. It should be noted that these permits will be required regardless of this alternative.

Since this option proposes a very long tunnel, the public process may prolong the design. A tunnel may not be accepted by the public.

Cost to Design and Implement

The design cost for Alternative 4 would be approximately \$1.25 to \$1.5 million.

The construction cost of this tunnel would be in the vicinity of \$20 million making the total construction cost for Alternative 4 in excess of \$25 million. The presence of rock, or a high water table could increase the construction cost tremendously.

Risk to Public Safety

Rail-Trail Maintenance & Operation published by the Rails to Trails Conservancy Northeast Regional Office states that approximately a quarter of constructed trails of the 100 trails surveyed reported illegal activities unique to bridges and tunnels including climbing and jumping from bridges, graffiti and vandalism. Although this alternative does remove the potential for trail user/motor vehicle conflict, with the length of the tunnel being in the vicinity of a quarter of a mile, trail users would be isolated underground. This provides safety concerns. Providing long sight lines is a crucial aspect of tunnel design. To ensure both perceived and actual safety, a user should be able to see the far end of the tunnel when they enter it. This design would not allow that.

If the switchback ramp system was selected, trail users may not dismount and walk their bikes through the tunnel creating a potentially dangerous situation.

If the switch back ramp system is selected, trail users will be put in contact with motor vehicles at the Main Street crossing.

Vehicular Impacts

If the switch back ramp system is selected, trail users will be put in contact with motor vehicles at the Main Street crossing. During construction, vehicles will be impacted in the MBTA Commuter Rail parking lot and Concord Park’s parking lot.

Benefits to the Community

This alternative would provide a continuous, direct route for the BFRT. However, it would not bring trail users directly to the West Concord businesses or MBTA Commuter Rail Station unless the switchback ramp system was selected.

Timeliness to Implement

Design of a tunnel would require extensive MassDOT and MBTA review.

Assuming the design and construction is completed as part of the BFRT Phase 2C and the abutters are amenable, the design could be completed within 24 to 30 months. The construction would take approximately 30 to 36 months.

Context Sensitive Aesthetics

Aesthetic features could be added to the tunnel. Since the tunnel would be underground it would not detract from the existing West Concord community setting. The ramp system descending and ascending from the tunnel however would create a very large hole in West Concord Village.



Alternative 5 - Bridge/Elevator over the MBTA Rail Line

This option proposes a bridge over the existing rail line near West Concord Station. The elevator



option was eliminated from further evaluation following the July 13th meeting where the MBTA representative stated they would not accept or approve the elevator option. The MBTA will not accept the responsibility for maintaining an elevator system and voiced concerns over trail users being trapped if there was a power outage. Since no parking in the MBTA lot can be lost, the Town would need to work with the Concord Park facility in order to accommodate the trail. There is an eight (8) foot to nine (9) foot gap between the edge of the MBTA lot and the edge of the

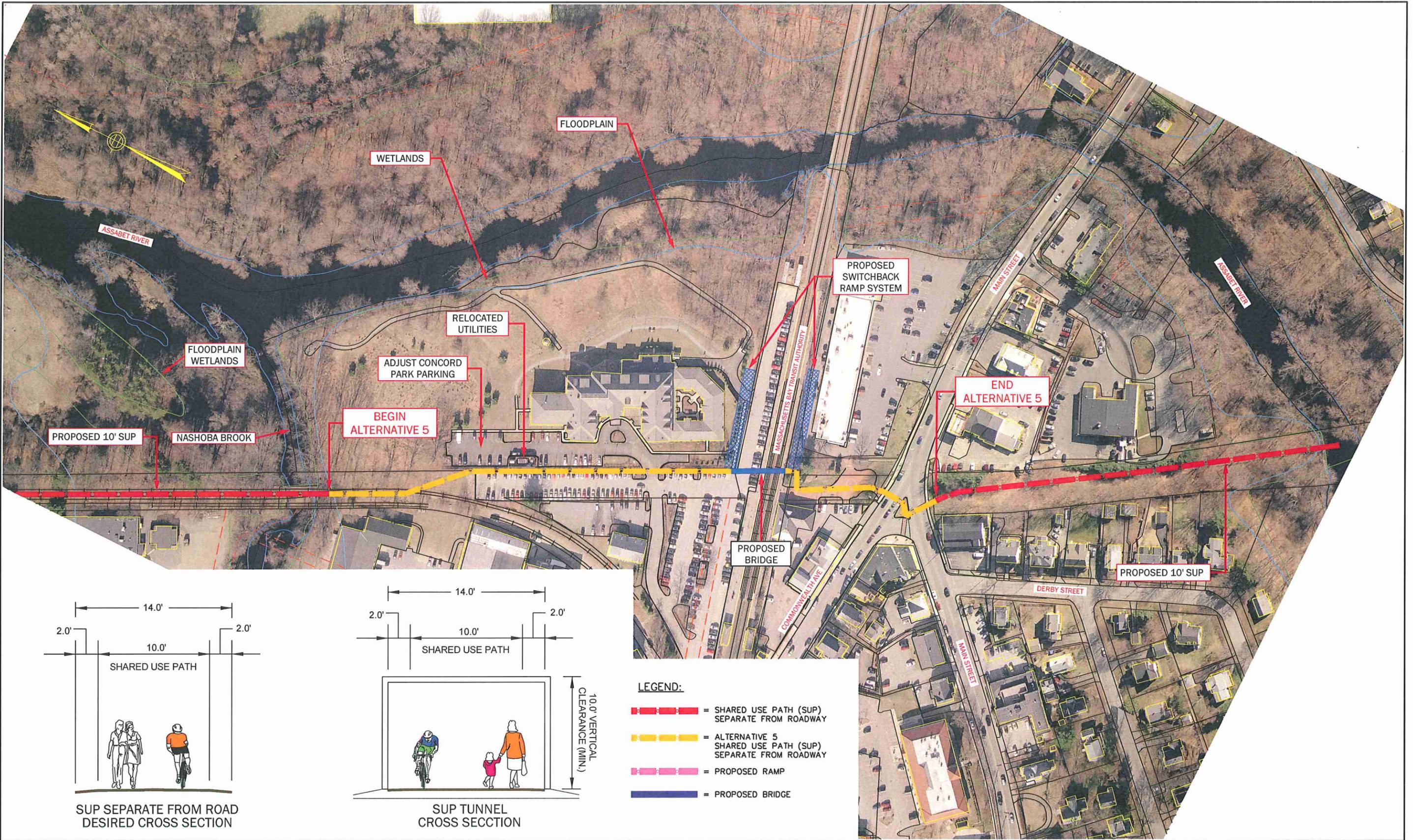
Concord Park. The MBTA parking lot and Concord Park are separated by a fence. Concord Park has four "utility boxes" enclosed by stockade fencing. The fencing is approximately eight (8) feet away from the edge of commuter parking lot.

As stated earlier, the *Guide* and AASHTO require a ten (10) foot trail with two (2) foot graded shoulders and a three (3) foot clearance to any obstruction. Ideally, the trail section through this area should be twenty (20) feet in width. MassDOT may permit some exceptions to this design with explanation and communication. Since the gap between the parking lots is not sufficient for the trail, one or both of the parking lots will require adjustment and parking spaces may be lost. If this area were utilized for a portion of the trail, it is likely that the removal and resetting of the "utility boxes" would be required. This alternative may also result in increasing impervious area on the VOA Concord Assisted Living, Inc. property. It would be GPI's recommendation to propose fencing or an alternate barrier to separate the trail from the MBTA parking lot to prevent trail users from utilizing the existing rail crossing in the parking lot at Union Station and possibly the Concord Park parking lot to keep trail users off the property

Once the trail approaches the tracks, it would take a 90° turn prior to reaching the MBTA Commuter Parking area. In order to reach the required minimum 18 foot clearance over the tracks and meet the 5% maximum grade requirements, the ramps would need to be approximately 360 feet in length. In order to accommodate 360 feet, a switchback ramp system would be required between the Concord Park facility and the MBTA Commuter Parking Lot requiring trail users to dismount their



bicycles. At the narrowest point, there is just over 34 feet between the Concord Park facility and the parking lot. There are also several plantings, some fencing and a rear access drive to Concord Park. This would require additional right-of-way from VOA Concord Assisted Living, Inc. and result in the loss of the ability to use their rear access drive. The ramp system would be laid out parallel to the parking lot, head easterly for approximately 180 feet before taking a 180° turn and traveling 180 feet in a westerly direction to reach the required 18 foot clearance. A bridge structure would then carry the trail users over the tracks and the parking area requiring right-of-way from both EOTC and the MBTA. See Figure 10 on the following page.



ALTERNATIVE 5 - CONCEPTUAL PLAN
 BRIDGE OVER THE MBTA RAIL LINE
 CONCORD, MA

FIGURE 10

SCALE: 1" = 80'

Once across the tracks, there is insufficient space between the rail line and Main Street for the ramp to reach existing ground without a switchback ramp system. This ramp system would need to be placed behind the West Concord Shopping Plaza Buildings and would require right-of-way from A&D Real Estate LLC. There is approximately 25 feet between the back of the buildings and the fence line. This would no longer allow use of this paved area behind the buildings for loading or unloading by the business owners.

Once the ramp reached existing ground, the trail would be routed through Concord Station to the existing crosswalk and traffic light in front of the 99 Restaurant. As mentioned earlier, it would be GPI's recommendation to make intersection modifications to minimize crossing distances and times. The reconfiguration of the intersection to a more traditional "T" intersection with a single crossing of Main Street would accomplish this goal. This would require right-of-way from Boston Gas Company and EOTC.



Alternative 5 Summary

EVALUATION CRITERIA

Effectiveness

Although this option does get trail users safely across the rail line, avid trail users may avoid following this route. With an extensive switch back ramp system, trail users may seek a more direct route. This route would be through the MBTA parking lot and the existing crossing. If this were fenced off preventing this movement, they may still travel along the fencing until they are permitted back into the lot at the driveway.

Although signing can be proposed requiring bicyclists to dismount their bikes and walk them, it will be extremely difficult to enforce without constant monitoring, warnings and possibly enforcement such as police warnings, tickets and fines.

Short-term and Long-term Reliability

If maintained this alternative does present a reliable alternative for crossing the MBTA rail line.

This alternative may not be reliable as far as compliance. As stated, a switch back ramp system will require trail users to dismount and walk their bikes. Although signs would be posted, trail users may not dismount their bikes.

Short-term and Long-term Maintenance Costs

The maintenance costs mentioned earlier in this report apply to this alternative also. The annual maintenance cost for a trail is approximately \$1,500/mile. The long-term paving cost would be approximately \$80,000/mile the first time and \$130,000/mile the second time.

It should also be emphasized that structures must be inspected on a recurring basis. Although this inspection should occur yearly, studies have shown the average inspection interval is four years. Bridges could be constructed with galvanized steel to eliminate the need for periodic painting. However, bridge structures would require periodic maintenance to repair galvanized coating failures, leaking joints, and miscellaneous repairs to chipped walking surfaces or

damaged protective screens. Additionally, any lighting or security cameras within the bridge would require periodic replacement.

Difficulty in Implementing

This alternative may require a Design Exception since it does not meet the design standards required with respect to sight distance. This would entail the preparation of a Design Exception Report and approval by the Design Exceptions Committee. It would require discussion and/or meetings with both the AAB/ADA Coordinator and the Bicycle/Pedestrian Accommodation Engineer at Mass DOT. At this time, it is unknown whether or not this option would be approved by MassDOT. In discussions with MassDOT regarding this report, they had indicated that they would need a formal submission in order to evaluate any alternative and make any decisions. The cost of this alternative would also weigh in heavily on MassDOT's decision

Although the MBTA did voice concerns with a bridge option, they have allowed it. MBTA service cannot be suspended making construction more difficult.

This option would require right-of-way from Concord Park, right-of-way from the MBTA to cross over their rail line, right-of-way from Boston Gas Company and right-of-way from EOTC.

With federal funds being allocated towards the construction of the BFRT, a Categorical Exclusion (CE) Checklist would be required. Since work will be proposed within the Riverfront Area of Nashoba Brook, a Notice of Intent must be filed with the Concord Natural Resources Commission. It is possible that an Environmental Notification Form (ENF) would also be required assuming that this would be constructed as part of the Concord BFRT and not independently. It should be noted that these permits will be required regardless of this alternative

Cost to Design and Implement

The design cost for Alternative 5 would be between \$500,000.00 and \$600,000.00.

The construction cost of this ramp and bridge option could range from \$5 to \$7 million making the total construction cost for this Alternative between \$6 and \$8 million.

Risk to Public Safety

Rail-Trail Maintenance & Operation published by the Rails to Trails Conservancy Northeast Regional Office states that approximately a quarter of constructed trails of the 100 trails surveyed reported illegal activities unique to bridges and tunnels including climbing and jumping from bridges, graffiti and vandalism. This alternative does remove the potential for trail user/motor vehicle impact except at the existing traffic signal and crosswalk on Main Street in front of the 99 Restaurant. Switch back ramps do create a potentially hazardous situation for trail users if they do not dismount their bikes.

Vehicular Impacts

This alternative would put trail users in contact with motor vehicles at the existing traffic signal and crosswalk on Main Street. The parking lot at Concord Park would require adjusting in order to accommodate the trail.

Benefits to the Community

This alternative would provide a continuous, direct route for the BFRT and direct trail users to the West Concord businesses and the MBTA Commuter Rail Station.

Timeliness to Implement

Design of a bridge would require extensive MassDOT and MBTA review.

The "utility boxes" at Concord Park would require relocation and the parking lot would need to be re-laid out to accommodate the same number of parking spaces that exist today. Working with Concord Park to come to an agreement may prolong the design process.

This alternative would require right-of-way from VOA Concord Assisted Living, Inc., A&D Real Estate LLC, Boston Gas Company and EOTC.

Assuming the design and construction is completed as part of the BFRT Phase 2C and the abutters are amenable, the design could be completed within 24 to 30 months. The construction would take approximately 30 to 36 months.

Context Sensitive Aesthetics

The ramp on the northern side of the tracks would block the side of the facility and the facility would not longer have use of the access drive. The view from the facility would essentially be destroyed.

This alternative would also place a very large structure with switch back ramps in the center of West Concord detracting from the setting the Town wishes to maintain. Below are some renderings showing an MBTA structure in West Concord. Although they depict an elevator system, they are useful in demonstrating the scale and look of a structure over the tracks.



Alternative 6 – Railroad Spur to Main Street via Harvey Wheeler Community Center

As with Alternative 1, this Alternative proposes that the BFRT follow the abandoned railroad spur owned by the EOTC in the northern portion of the West Concord commuter railroad station to Commonwealth Avenue. There is an existing vehicle/pedestrian crossing of the active rail line with both vehicular and pedestrian gates on Commonwealth Avenue. The same considerations from Alternative 1 apply to this alternative until the trail reaches Commonwealth Avenue. Please note that the remainder of this alternative is being evaluated without mapping and survey elevations. Once that information becomes available further investigation into this alternative will be necessary to draw concrete conclusions.

Once trail users reach Commonwealth Avenue, they would cross Commonwealth Avenue to the driveway between Concord Teacakes and Twin Seafood. See Figure 11 on the following page.



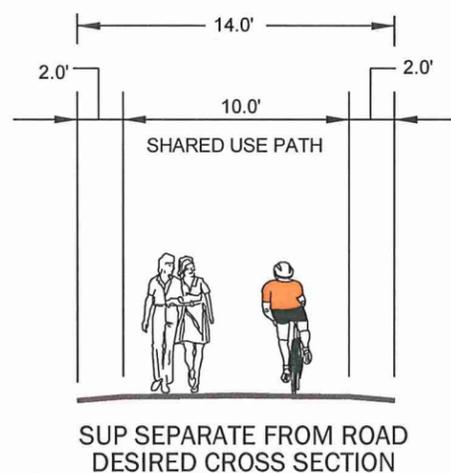
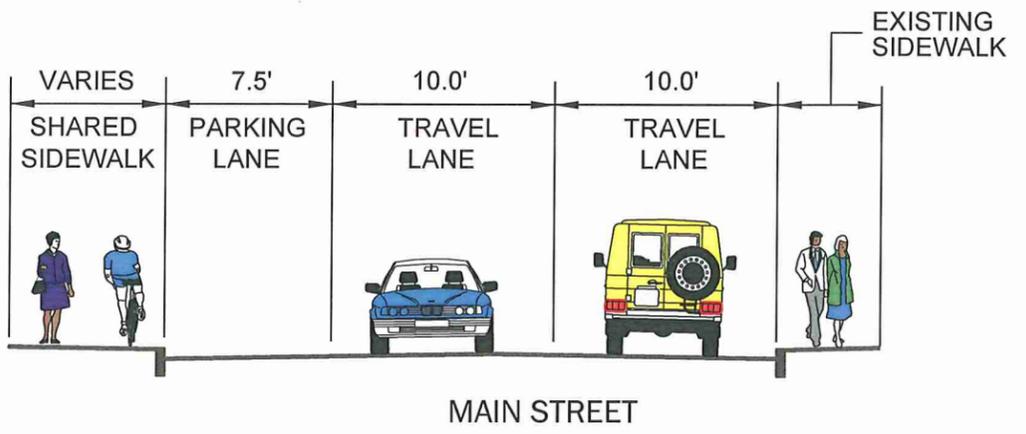
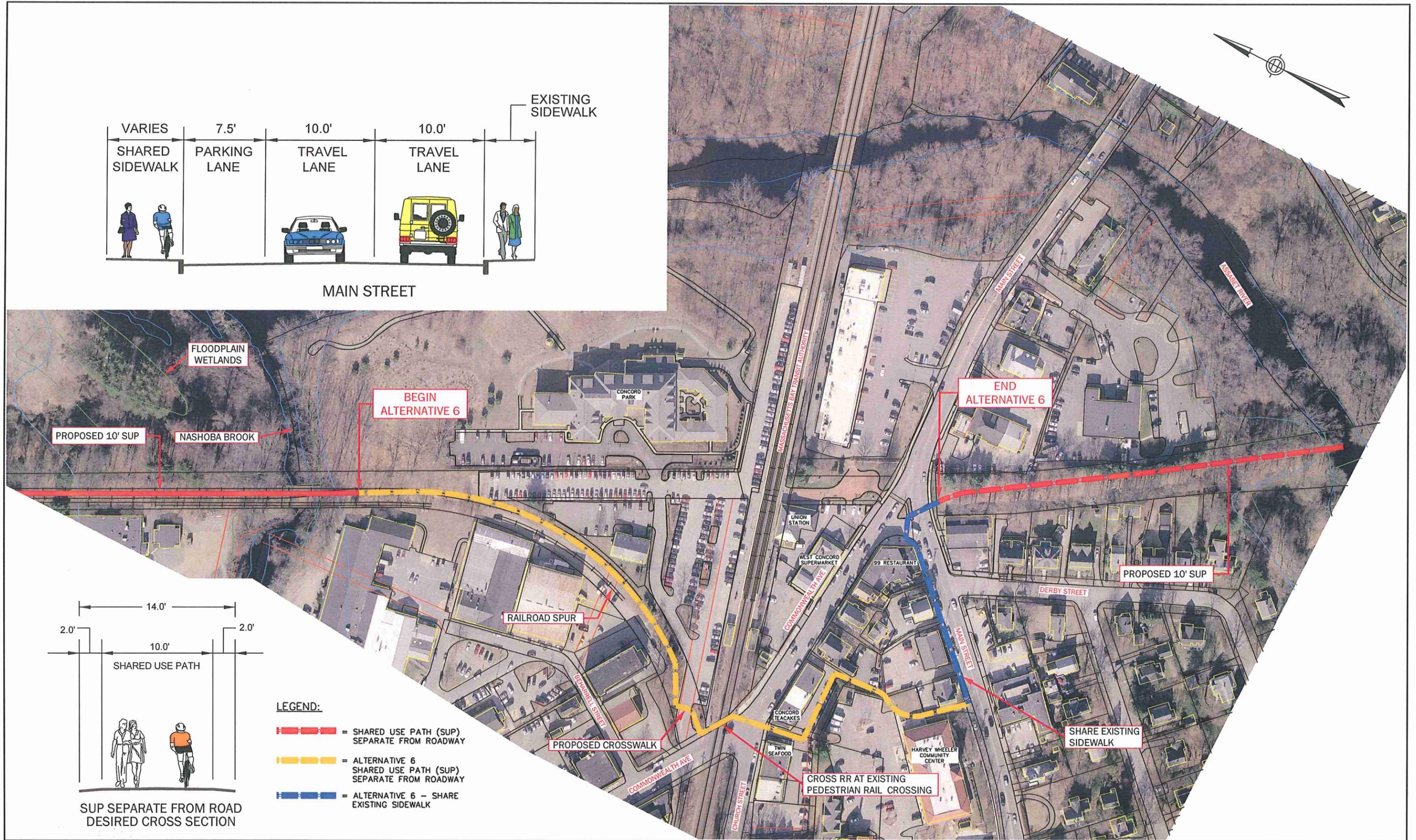
Concord Teacakes has an entrance into the building from the driveway. The driveway continues to the back of the buildings where it turns right to parking spaces behind Twin Seafood and left to angled parking behind Concord Teacakes. According to Concord GIS mapping, this driveway is partially owned by the Town of Concord and partially owned by Vernco Concord LLC. It appears that the Town owns approximately 1/3 of it, and the Concord Teacakes entrance encroaches into this right-of-way. From available mapping, it appears that the driveway is between twenty and

twenty five feet in width. If this driveway was made one-way out, the width should be sufficient to incorporate a twelve foot vehicle travel lane and an eight to ten foot bike path.



At the end of the driveway, the trail would turn left and run parallel to and behind Concord Teacakes on the Town of Concord property. From Concord GIS mapping, it appears that the paved area behind Concord Teacakes is owned by Vernco Concord LLC and the area south of that parking (the slope) is owned by the Town of Concord. This turn would not meet the minimum radius requirements in the *Guide*. It would be GPI's recommendation to provide curbing and possibly fencing between the parking area and the trail. There are dumpsters and possibly an electrical box that would possibly need relocation in this area.





- LEGEND:**
- — — — = SHARED USE PATH (SUP) SEPARATE FROM ROADWAY
 - — — — = ALTERNATIVE 6 SHARED USE PATH (SUP) SEPARATE FROM ROADWAY
 - — — — = ALTERNATIVE 6 - SHARE EXISTING SIDEWALK

ALTERNATIVE 6 - CONCEPTUAL PLAN
RR SPUR TO MAIN STREET VIA HARVEY WHEELER COMMUNITY CENTER
 CONCORD, MA

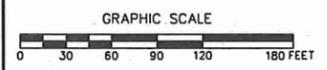


FIGURE 11
 SCALE: 1" = 80'

The available pavement width between the Concord Teacakes building and the slope climbing up to the Harvey Wheeler Community Center property varies, narrowing as it approaches the far eastern end of the building. If 45° degree parking were proposed in this area, the stalls would require sixteen and one half (16 ½) feet with an aisle width of fifteen (15) feet. Although, there may be sufficient pavement width through this area to accommodate the parking and aisle, survey would be required to verify this. Depending on where the actual property line fell, some additional width may be required on property currently belonging to the Town of Concord to accommodate the parking area.



At the eastern edge of the parking lot, the trail would turn in a southerly direction on the Town of Concord property and follow along the edge of the Harvey Wheeler Community Center parking lot. The radius required to make this turn would also not meet the requirements in the *Guide*. Since the elevation difference between the Concord Teacakes parking area and the Harvey Wheeler Community Center parking area appears to be in excess of ten feet, GPI would not recommend climbing the slope to the parking lot. It should be noted however that even though the elevation in the Concord Teacakes parking lot is close to the elevation of Main Street, the trail would still need to slope up to meet the paved walkway at the community center before sloping down to Main Street. This would be

necessary in order to stay on town property and minimize impacts to abutting properties. The slope necessary to do this would be less than 5% and in compliance with ADA regulations. Since the trail would be cutting into the slope, a retaining wall would be necessary. For a portion of the trail, retaining walls would be necessary on both sides of the trail. This could potentially require temporary and/or permanent easements from the property owners at 41/43/45/47 Commonwealth Avenue in order to construct the retaining wall.



The community center parking along the eastern edge of the lot would be lost. However, the existing configuration of the lot could be examined and modified in an attempt to minimize the loss of any parking spaces. The chain link fence and lighting would need to be removed and reset. It would be our recommendation to propose curbing or curb stops along the parking lot edge in the vicinity of the trail. Alternate barrier between the parking lot and the trail could be considered instead of the chain link fencing.

Without survey it is difficult to determine the elevation difference from the top of stairs at the Community Center to Main Street. The stairs would need to be maintained since there is another set of stairs which enters the building at the landing of these stairs and replacing the stairs with a

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ramp would result in slopes in excess of what is allowable by ADA without a level landing. It would be our recommendation to propose the trail adjacent to the stairs. The trail could meet the existing paved walkway at the base of the stairs. There is a light pole and a fence that may require relocation; however, it appears that there is sufficient width within the Town right-of-way to accommodate a ten foot wide paved path. The proposed trail would be in close vicinity to the abutting property owned by First Concord Realty Corp. It would be our recommendation to propose fencing between the trail and the abutting property.



Once the trail reached Main Street, it would turn left. It is our understanding that the Town



would like to widen the sidewalk along Main Street and propose that the trail users share the sidewalk for this short stretch. From available mapping it appears that the pavement width on Main Street varies between thirty-four (34) and thirty-six (36) feet, consisting of two travel lanes and one parking lane. Sidewalks exist along both sides of the roadway. The sidewalk along the western side of the roadway varies from four (4) feet at the Harvey Wheeler Community Center to eight (8) feet at the 99 Restaurant. The existing paved roadway width is not sufficient to provide a cross

section meeting the requirements of the *Guide*. The *Guide* would require two eleven (11) foot travel lanes, two four (4) foot shoulders and a seven (7) foot parking lane or, thirty-seven (37) feet. The four foot shoulders are required because a bike cannot be precluded from utilizing the roadway. Ten (10) foot travel lanes or narrower shoulders may be considered; however, a design exception must be submitted and approved. There are also utility poles along the western side of the roadway.

The Main Street right-of-way appears to be approximately fifty (50) feet in width according to Concord GIS mapping. If the entire right-of-way were utilized, it may be possible to widen the sidewalk along the western side of Main Street slightly while providing four (4) foot sharrow lanes along the roadway. The right-of-way would permit two eleven (11) foot travel lanes, two four (4) foot shoulders, one seven (7) foot parking lane, one five and a half (5.5) foot sidewalk and one seven and a half (7.5) foot sidewalk. This would of course require the relocation of the utility poles. It is assumed for the purposes of this report that the utilities will be put underground as part of a different town project. Although, trail users would be instructed to dismount their bikes along the sidewalk, they would also be able to ride along the roadway if they chose to.

At the intersection with Commonwealth Avenue, there are existing crosswalks which could be utilized to route the trail users to and from the existing railroad right-of-way.

EVALUATION CRITERIA

Effectiveness

As with Alternative 1, routing the trail along the abandoned railroad spur has both pros and cons. Since human nature is to find the most direct route from Point A to Point B, users may try and

find a more direct route, i.e. through the MBTA parking lot and across the tracks. It would be GPI's recommendation to install fencing at the existing MBTA parking lot and along the spur to prevent trail users from taking that route.

This alternative itself may encourage trail users to find a more direct route to the railroad right of way since it is a fairly long and circuitous route. On the shared sidewalk portion of the trail, trail users will be instructed to dismount and walk their bikes. Although signing can be proposed requiring this, it would be extremely difficult to enforce without constant monitoring, warning and possibly enforcement. If there is a lot of pedestrian traffic on the sidewalk, trail users may opt to travel on the street. Avid trail users may opt to travel on the street regardless of the sidewalk traffic.

From the *AASHTO Guide for the Development of Bicycle Facilities*, "In general, the designated use of sidewalks (as a signed shared facility) for bicycle travel is unsatisfactory". Sidewalks are typically designed for pedestrian speeds and maneuverability and are not safe for higher speed bicycle use. This option presents conflicts between pedestrians and bicyclists as well as bicyclists and parking meters, light poles, sign posts and parked cars. Walkers, joggers, skateboarders and roller skaters can and often change their speed and direction almost instantaneously leaving bicyclists insufficient reaction time to avoid collisions. Pedestrians have a difficult time predicting the direction of oncoming bicyclists. Although a wider sidewalk does provide more space, it does not necessarily add to the safety of sidewalk bicycle travel since wider sidewalks might encourage higher speed bicycle use. AASHTO does note however that sidewalk bikeways should only be considered under certain limited circumstances such as to provide bikeway continuity along heavily traveled roadways having inadequate space for bicyclists.

Short-term and Long-term Reliability

Although not direct, this Alternative does provide a continuous path for the BFRT. However it may not be reliable as far as compliance and use since this alternative would require trail users to dismount and walk their bikes along the sidewalk on Main Street. Although signs would be posted, trail users may not dismount their bikes, thus creating a potentially dangerous situation. As mentioned, trail users may also opt to find a more direct route.

Short-term and Long-term Maintenance Costs

The maintenance costs discussed earlier in this report also apply to this alternative. The annual maintenance cost for a trail is approximately \$1,500/mile. The long-term paving cost would be approximately \$80,000/mile the first time and \$130,000/mile the second time.

It should also be emphasized that the retaining wall structures must be inspected on a recurring basis. Although this inspection should occur yearly, studies have shown the average inspection interval is four years.

Difficulty in Implementing

This alternative would require an easement from EOTC for use of the abandoned railroad spur. The Town would need to work with the abutters along the spur as far as their unauthorized use of the right-of-way and screening mechanisms.

This alternative would likely require an easement from Vernco Concord LLC. The Town would need to work with Concord Teacakes as far as their unauthorized use of Town right-of-way but would also need their cooperation as far as incorporating the proposed trail into the driveway. They would also need to work with Verno Concord LLC and Concord Teacakes as far as the

proposed parking behind the facility. If the existing drive between Concord Teacakes and Twin Seafood is not one-way, making it one way could trigger some opposition.

The Town may need to work with the owners of 41/43/45/47 Commonwealth Avenue (Jack Reader, J. Tyler Spring, Nicholas C. Boynton and Evelyn K. Bennett) regarding an easement for construction of the trail.

Potential loss of parking at the Community Center could also present a problem.

This alternative was not previously discussed with the MBTA or MassDOT. However, it is likely that the MBTA would approve of it.

This alternative may require a Design Exception with MassDOT since it does not meet the design standards required with respect to sight distance and cross section along the Main Street section. This would entail the preparation of a Design Exception Report and approval by the Design Exceptions Committee. It would require discussion and/or meetings with both the AAB/ADA Coordinator and the Bicycle/Pedestrian Accommodation Engineer at MassDOT. At this time, it is unknown whether this option would be approved by MassDOT. In discussions with MassDOT regarding this report, they had indicated that they would need a formal submission in order to evaluate any alternative and make any decisions.

With federal funds being allocated towards the construction of the BFRT, a Categorical Exclusion (CE) Checklist would be required. Since work will be proposed within the Riverfront Area of Nashoba Brook, a Notice of Intent must be filed with the Concord Natural Resources Commission. It is possible that an Environmental Notification Form (ENF) would also be required assuming that this would be constructed as part of the Concord BFRT and not independently. It should be noted that these permits will be required regardless of this alternative.

Cost to Design and Implement

The design cost for Alternative 6 would be between \$150,000.00 and \$200,000.00.

The construction cost of this option could range from \$1 to \$1.5 million.

As noted previously, these costs assume that the utilities along Main Street will be placed underground as part of a different town project.

Risk to Public Safety

This Alternative does provide a dedicated trail for users. It does however place trail users closer to moving vehicles since they will be sharing a lane with them along the driveway between Concord Teacakes and Twin Seafood, potentially along Main Street and at the existing crosswalks at the intersection of Main Street and Commonwealth Avenue. It also increases the potential for trail user/pedestrian conflict since Concord Teacakes has an entrance along the driveway and trail users could potentially be sharing the sidewalk along Main Street.

Since it does propose a very circuitous route to get users to the railroad right-of-way, trail users may not follow the trail and opt to find their own route.

If the volume of trail users is high and trail users are sharing the sidewalk, it could potentially have an impact on the businesses along Main Street. It will make it more difficult for vehicles to enter the parking lots and for patrons to enter and exit the businesses.

This alternative also poses a potential conflict with trail users and opening car doors since right-of-way does not allow for a door zone.

Bicycle crash statistics from the Pedestrian and Bicycling Information Center's website (<http://www.bicyclinginfo.org/> and <http://www.walkinginfo.org/>) at intersections indicate that bicyclists are not safer on the sidewalk because they become almost invisible to the motorist. When a driver turns, either left or right, or into a driveway or alley, they are simply not looking for, or expecting to encounter, a bicyclist. If they do look and see a bicyclist they may still underestimate the speed a rider is traveling on the sidewalk - because it will likely be much faster than a pedestrian. Although there is not a specific crash statistic attributed to bicyclists riding on sidewalks, the fact that the bicyclist was riding on the sidewalk contributed to the crash as can be seen below.

Motorist turns left in front of cyclist	42% of bicyclists are on the sidewalk
Motorist turns left into oncoming cyclist	15% of bicyclists are on the sidewalk
Motorist turns right into bicyclist	31% of bicyclists are on the sidewalk
Motorist drives out of alley/driveway	48% of bicyclists are on the sidewalk
Motorist drives through intersection	15% of bicyclists are on the sidewalk
Bicyclist rode out intersection with signal	24% of bicyclists are on the sidewalk

Furthermore, the quality of the riding surface on most sidewalks is far inferior to the parallel roadway. The vast majority of bicycle crashes that end up with the bicyclist seeking medical attention do not involve a motor vehicle and happen because a rider either falls after hitting an obstacle, slides on gravel or leaves, or loses control. Riding on the sidewalk is fraught with the kind of dangers and obstacles that may increase the chances of that happening.

The 1992 report, *Risk Factors for Bicycle-Motor Vehicle Collisions at Intersections* authored by Alan Wachtel and Diana Lewiston concludes that *"Bicyclists on a sidewalk or bicycle path incur greater risk than those on the roadway (on average 1.8 times as great), most likely because of blind conflicts at intersections. Wrong-way sidewalk bicyclists are at even greater risk, and sidewalk bicycling appears to increase the incidence of wrong-way travel"*

Benefits to the Community

This alternative would provide a continuous dedicated route for the BFRT. The trail will direct users to the businesses in the downtown area and to the MBTA Commuter Rail Line. It will also provide a direct connection to the Harvey Wheeler Community Center.

Timeliness to Implement

This option requires modifications to the existing Main Street cross section, the potential loss of parking spaces at the Harvey Wheeler Community Center and eliminating unauthorized use of the right-of-way along the spur so the public process may delay the design process.

This alternative does not propose any special or time consuming design features, so assuming this would be incorporated into the BFRT Phase 2C design and construction and the abutters are amenable, the design could be completed in approximately 24 to 30 months and the construction could be completed in an additional 30 to 36 months.

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As noted, this assumes that the utilities along Main Street will be placed underground as part of a different town project.

Context Sensitive Aesthetics

This alternative does not propose changes along Commonwealth Avenue detracting from the historic setting.

Inclusion of context-sensitive aesthetics such as pavers, colors and planting could be included along sections of the trail.

The retaining walls wall could utilize a block wall retaining system with some form of safety railing.

A solid fence to prevent trail users from entering the MBTA Commuter Rail parking area could negatively impact the visual character and aesthetics of the area.

Alternative 7 – Baker Avenue Route

This Alternative would direct trail users through the MBTA parking lot to the rail line where it would turn and head easterly along the Assabet River running parallel to the rail line on the north side of the tracks. A new pedestrian bridge would be proposed over the Assabet River and the trail would continue easterly to Baker Avenue. At Baker Avenue, the trail would turn right crossing over the MBTA commuter rail line proceeding toward Main Street. Once the trail reaches Main Street, there are two options. Please note this alternative is being evaluated without mapping and survey elevations. Once that information becomes available further investigation into this alternative will be necessary to draw concrete conclusions.

In order to accommodate the trail in the existing MBTA parking lot, parking spaces would be lost. As stated previously, the MBTA did indicate at a meeting held on July 13th, 2009 that they would not allow for the loss of any parking or allow bikes to ride through the parking lot. Therefore this alternative is being evaluated assuming that no parking spaces can be lost and the trail cannot go through the MBTA parking lot. It should also be noted as stated in previous alternative that Concord Zoning Bylaw requires full size parking spaces to be 9'x18' with a 24' aisle width to accommodate two-way traffic. The existing parking lot is approximately fifty (50) to fifty-one (51) feet in width at the northern limits and allows for two rows of 90° parking. With a required width of 60 feet the existing parking lot does not meet the Zoning Bylaws and does not provide sufficient space to accommodate a trail.



As stated previously, there is an eight (8) to nine (9) foot gap between the edge of the MBTA lot and the Concord Park parking lot. They are separated by a fence. Concord Park has four “utility boxes” in this area enclosed by stockade fencing. The fencing is approximately eight (8) feet away from the edge of the commuter parking lot. The *Guide* and AASHTO require a ten (10) foot trail with two (2) foot graded shoulders and a three (3) foot clearance to any obstruction. Ideally, the trail section through this area should be twenty (20) feet in width. MassDOT may permit some exceptions to this design with explanation and communication.

Since the gap between the parking lots is also not sufficient for the trail, one or both of the parking lots will require adjustment. Since the MBTA will not allow for the loss of parking spaces, Concord Park may lose parking spaces. If this area were utilized for a portion of the trail, it is likely that the removal and resetting of the "utility boxes" would be required. This alternative may also result in increasing impervious area on the VOA Concord Assisted Living, Inc. property. It would be GPI’s recommendation to propose fencing or an alternate barrier to separate the trail from the MBTA parking lot to prevent trail users from utilizing the existing rail

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crossing in the parking lot at Union Station and possibly to separate the trail from Concord Park to keep trail users off the property.

Once the trail approaches the tracks, it would take a 90° turn prior to and just north of reaching the tracks. A 90° turn would be required to minimize impacts to abutting property and would require signing instructing trail users to dismount their bikes and walk them. This would not meet the minimum radius requirements in the *Guide*. As stated previously, the MBTA parking between the tracks and Concord Park is approximately thirty-nine (39) feet in width. It is partially owned by the MBTA and partially owned by the EOTC. The area allows for one row of 90° parking. Concord Zoning Bylaw requires forty-two (42) feet to accommodate this parking. The existing parking area does not meet the Zoning Bylaws and a trail could not be incorporated in this area without taking parking. Although the State is exempt from local zoning bylaws, it would be GPI's recommendation to place the trail north of the parking area on the Concord Park property.



As stated earlier, at the narrowest point, there is just over 34 feet between the Concord Park facility and the commuter rail parking lot. There are also several plantings, some fencing and a rear access drive to Concord Park. This would require additional right-of-way from VOA Concord Assisted Living, Inc. The proposed trail would cross the rear access drive to Concord Park. It would be GPI's recommendation to place fencing between the Concord Park facility and the proposed trail to keep trail users off the property.

The trail would continue easterly and require a bridge to cross the Assabet River which is designated a Wild and Scenic River. A prefabricated structure could be utilized. It is likely that the abutments would be located in the 100 year floodplain and could potentially impact the existing wetlands. Borings would be required to determine the subsurface material in this area in order to design the substructure.

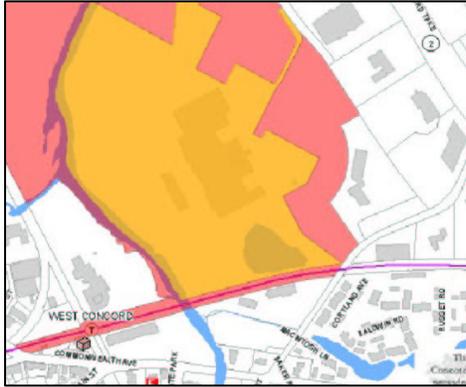


As mentioned previously, the Assabet River was designated a Wild and Scenic River in 1999 with ecology, archaeology and history, scenic, recreation and literary resources being identified as the “outstandingly remarkable values”. The Wild and Scenic Rivers Act prohibits any department or agency of the United States from assisting in the construction of any water resources project that would have a “direct and adverse” effect on the values for which the river was established and it precludes federal assistance to projects below/above a designated river that have been determined to “invade the area or unreasonably diminish the scenic, recreational, and

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fish and wildlife values present...as of the date of designation”. The River Stewardship Council (RSC) was established to coordinate conservation of the river. They function as an advisory committee to the National Park Service (NPS) on federal permits affecting the rivers’ outstanding resources. Any work would need to be reviewed by the RSC. Since they are not a permitting agency, they review projects through the Army Corps of Engineers PGP II application to determine if any project within a quarter mile of the designated river has a direct and adverse impact. They review plans and offer comments.



The MBTA right-of-way between the Assabet River and Baker Avenue appears to be approximately 65 feet in width. The trail would need to be outside and north of the MBTA right-of-way with fencing separating the trail from the rail line since the MBTA has previously voiced concerns with the possibility of the high speed trains throwing ice or debris as they pass. The fencing would also prevent trail users from approaching the tracks. This property is the 300 Baker Avenue property and is owned by Normandy Concord Acquisition LLC.

There is a body of water on this property just outside the MBTA right-of-way. In order to route the trail through the 300 Baker Avenue property, some form of a boardwalk would be necessary. The boardwalk would need to be approximately 400 feet in length. It would require permitting through the Concord Natural Resources Commission.



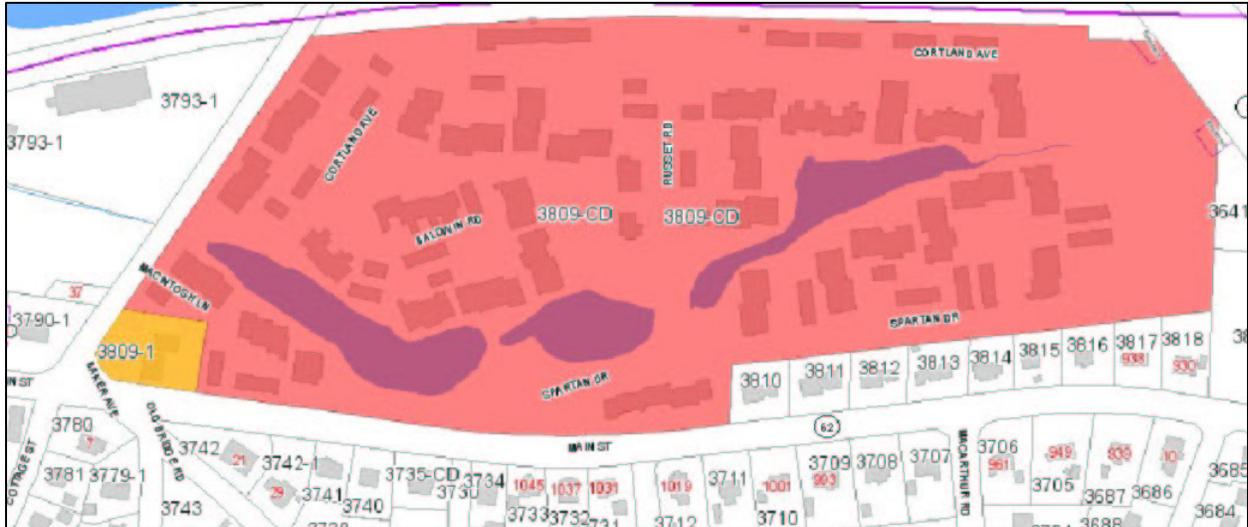
Utility poles are located along the railroad right-of-way along the northern side of the tracks. These would likely need to be relocated in order to accommodate the trail. Once the trail reached Baker Avenue, it would turn right onto Baker Avenue and cross the tracks at the existing gates. The radius of this turn would not meet the minimum radius requirements in the *Guide*.



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The Baker Avenue right-of-way appears to be forty (40) feet while the pavement width varies between twenty-five (25) and thirty (30) feet. Thirty feet of available pavement would allow two eleven (11) foot travel lanes with two four (4) foot “sharrow” lanes. Where thirty feet of pavement was not available, right-of-way would be required. The utility poles are located along the eastern side of Baker Avenue although there is one utility pole just south of the tracks on the western side of Baker Avenue. The buildings are also much closer to the roadway along the eastern side of the roadway. All of the property along the eastern side of Baker Avenue between the tracks and Main Street is owned by 112 Main Street LLC.



To avoid relocation of the utility poles and potential property impacts, right-of-way would potentially be necessary from the property owners along the western side of Baker Avenue. These owners include John W. Boynton and A. E. Winemiller (Baker Avenue Appreciation LLC) of 336 Baker Avenue, Irene R. Smith of 36A Baker Avenue and Nikoel LLC of 1134 Main Street. There are however several large trees and a sidewalk along the western side of Baker Avenue. The sidewalk runs from the tracks to Main Street.

There is a small waterway which is carried under Baker Avenue through a large culvert outletting on the western side of the roadway. There is also a small culvert emptying through the wingwall. There is guard rail at the edge of the sidewalk. Depending on available pavement width in this area, the culverts may need to be extended and the guard rail may need to be removed and reset. Mass GIS mapping indicates that this waterway has 100 year floodplain associated with it and there are likely wetlands.





The trail would cross two commercial driveways along the western side of Baker Avenue. The second is the drive to Citizen’s Bank which is at the intersection of Baker Avenue and Main Street. The pavement width does increase as Baker Avenue approaches Main Street since there are four travel lanes. There is a median island with an electric utility pole separating the northbound and southbound travel lanes. There is an existing traffic signal at this intersection with a signal pole at the northwest corner of the intersection at the back of the sidewalk.

Alternative 7A – Main Street to the Rail Right-of-Way

This alternative proposes the trail turn right onto Main Street. See Figures 12 and 13 on the following pages. The radius of this turn would not meet the minimum radius requirements in the **Guide**. The right-of-way on Main Street appears to be between forty-five (45) and fifty (50) feet while the existing pavement width appears to be between twenty five (25) and thirty (30) feet. There is a sidewalk along both sides of Main Street. If thirty-feet of pavement width were available, two eleven (11) foot travel lanes could be provided with four (4) foot “sharrow” lanes. It should be noted that with the heavy volume of traffic on Main Street, five (5) foot dedicated bike lanes would be preferred.



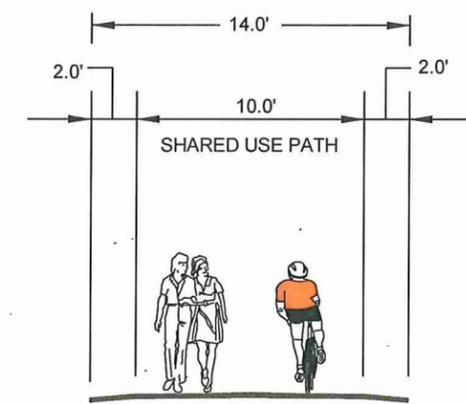
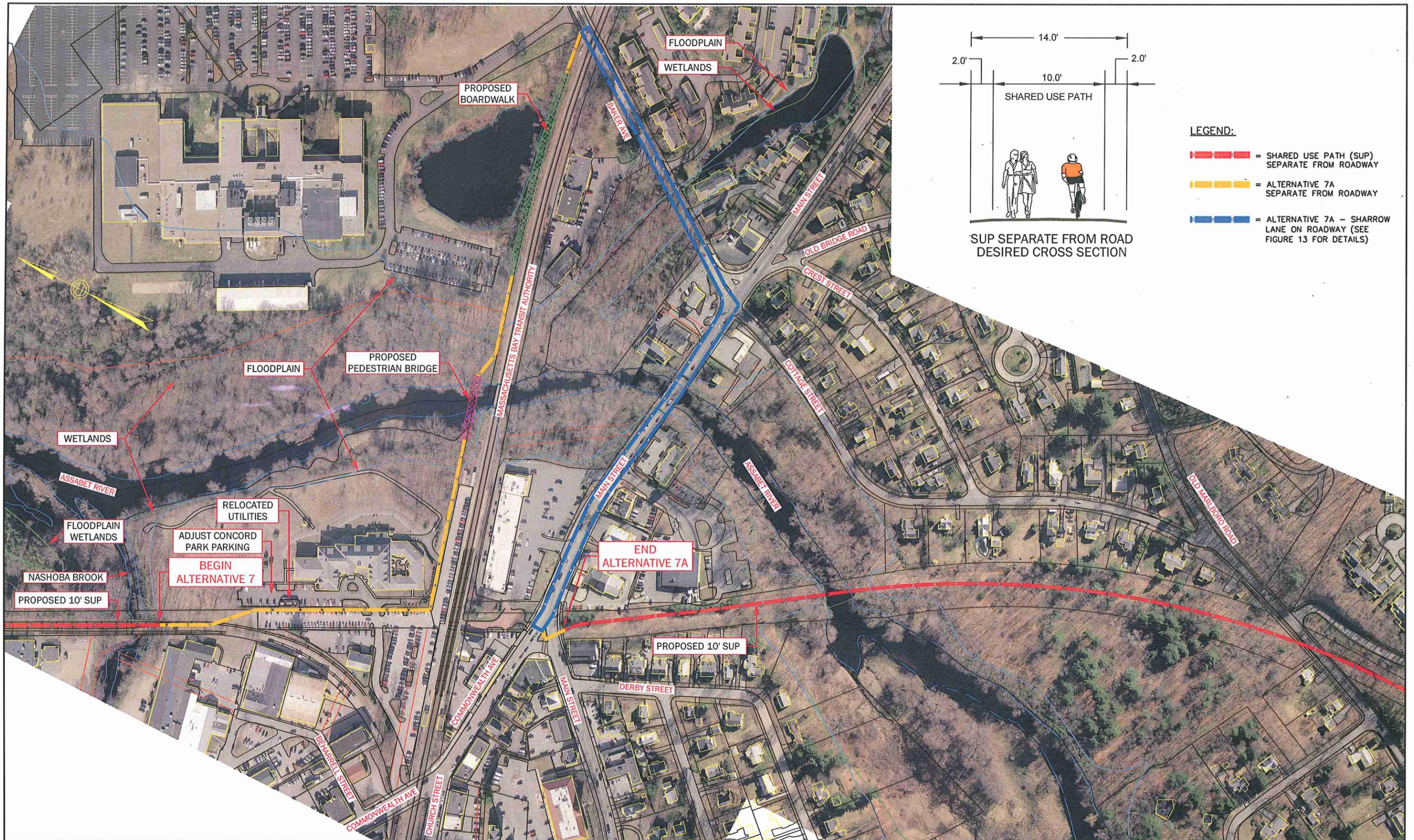
If thirty feet of pavement were not available, this alternative would likely not be an option since Main Street crosses over the Assabet River via a bridge. If it were not available, the bridge would need replacement to achieve the necessary width. The cost of the bridge replacement would likely remove this alternative from consideration unless the town opted to pay for the replacement.

The trail would continue along Main Street to the existing rail right-of-way. It does appear that thirty feet of pavement may be available along the remainder of Main Street allowing for two eleven (11) foot travel lanes and two (4) foot “sharrow” lanes, however as mentioned with the heavy volume of traffic five (5) foot dedicated bike lanes would be preferred. If the width was not available, right-of-way would be required from the several abutting commercial property owners. Main Street can be very busy at times and is abutted on both sides by commercial properties. This could potentially create a dangerous situation for trail users and would likely discourage parents with small children from utilizing the trail.

Alternative 7B – Cottage Street to Old Marlboro Road

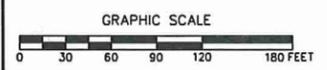
This alternative proposes that the trail cross Main Street from Baker Avenue to Cottage Street. See Figures 13 and 14 on page 65 and 66. Cottage Street appears to have a right-of-way width of approximately forty (40) feet and a pavement width of approximately twenty-four (24) feet. Cottage Street is a residential street with many large trees, mailboxes, fencing and utilities including fire hydrants and poles. There is one commercial property at the southwest corner of the intersection of Cottage Street with Main Street. It does not appear that the existing pavement width will accommodate bike travel and right-of-way would be necessary.





SUP SEPARATE FROM ROAD
DESIRED CROSS SECTION

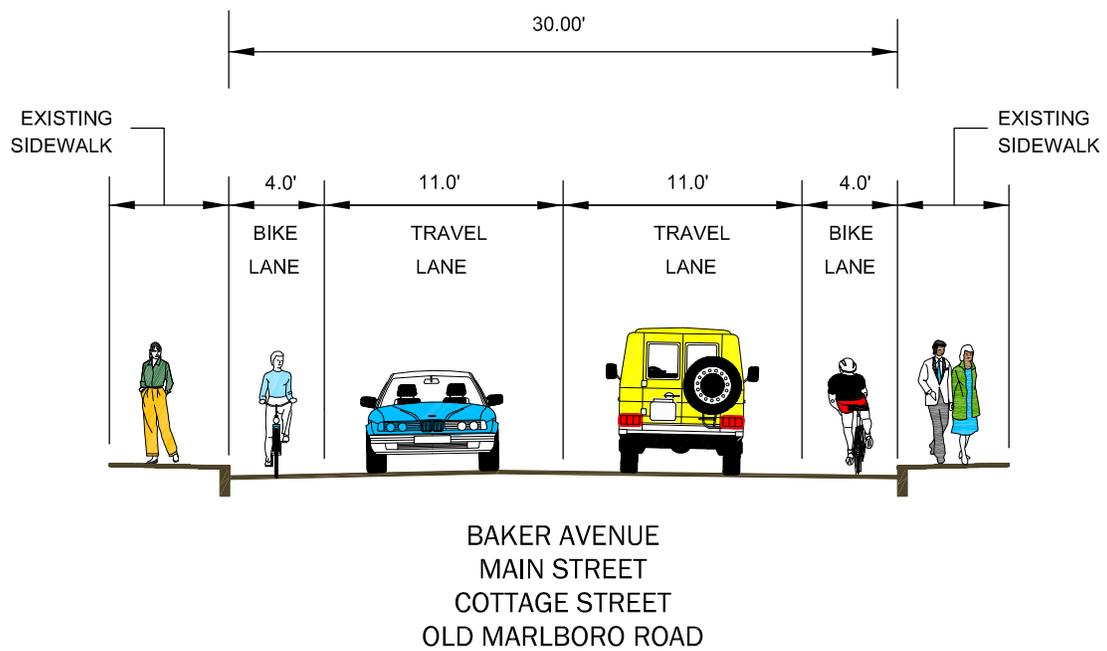
- LEGEND:**
- = SHARED USE PATH (SUP) SEPARATE FROM ROADWAY
 - = ALTERNATIVE 7A SEPARATE FROM ROADWAY
 - = ALTERNATIVE 7A - SHARROW LANE ON ROADWAY (SEE FIGURE 13 FOR DETAILS)



ALTERNATIVE 7A - CONCEPTUAL PLAN
BAKER AVENUE TO MAIN STREET
CONCORD, MA

FIGURE 12

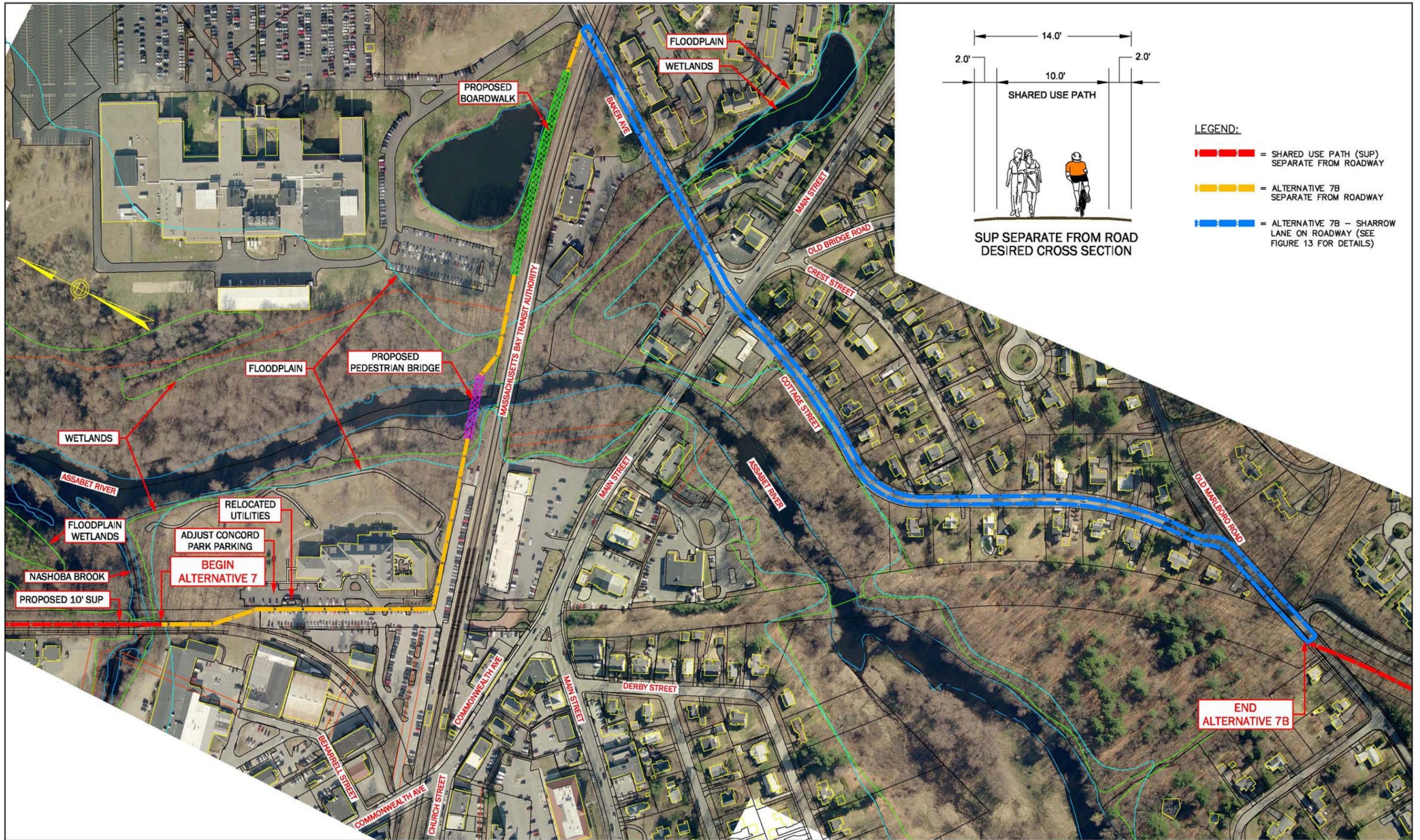
SCALE: 1" = 120'



ALTERNATIVE 7
SHARROW LANE ON ROADWAY
CONCORD, MA

FIGURE 13

NOT TO SCALE



ALTERNATIVE 7B - CONCEPTUAL PLAN
 BAKER AVENUE TO COTTAGE STREET
 CONCORD, MA

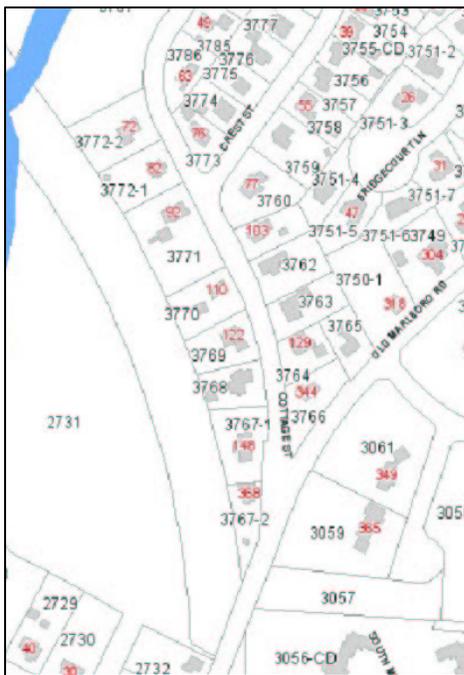
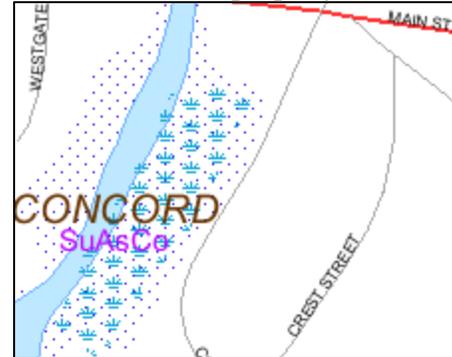
FIGURE 14

SCALE: 1" = 120'



The eastern side of Cottage Street has several abutting residential properties. There are six homes on Cottage Street between Main Street and the first curve heading southward along the roadway. Although there are no homes or buildings along the western side of Cottage Street until the first curve in the roadway, there is a large area of wetlands and 100 year floodplain associated with the Assabet River. The utility poles are located along the western side of Cottage Street. This presents two options, one would be to take property from the six residential property owners

including William B. and Natalie C. McCarthy, Concord Housing Authority, Ellen B. Garber, Stephen T. Irza and Anne E. Leggat, George and Carolyn Gould and Stephen and Claudette Cavalier in order to widen the roadway and avoid relocating the utility poles and an extensive environmental permitting process. The second would be to take property from two property owners including George F. and Shirley R. Rohan and George R. and Cuma V. Dee along the western side of Cottage Street, relocate the utility poles and either fill the wetlands and floodplain or construct a boardwalk over this area. The boardwalk would minimize resource area impacts but still require permitting. Both options are costly, time consuming and may create a road block for the project depending on the square footage of wetlands being filled.



After the curve in Cottage Street, there are residential properties on both sides of the roadway south to Old Marlboro Road. The pavement width also seems too narrow. Right-of-way would be necessary from numerous residential property owners to widen the roadway to accommodate bicycle travel. It appears that there are eight residential properties along the western side of Cottage Street including Thomas F. And Pamela J. Gardner, Wagner Realty Trust, Richard A. and Jane H. Montague, Michael A. and Caroline R. Partridge, Christine Parks, Lorne Cooper and Nancy Birchard, Peter M. and Anne O. Standish and Eric Holm and Donna L. Deangelis. The property along the eastern side is owned by Lelie R. Senderlund, Thomas R. and Carey B. Sands, Rose Mary Gordon, Imants K. and Aina S. Skaubitis, Scott M. and Colleen N. Van Houten, Yvonne E. and Mary P. Theriault and Olof C. and Jane A. Johnson. Without survey information it is impossible to determine how much property would be needed and the best location to take this property to minimize impacts.

In addition, the elevation of the Cottage Street roadway increases considerably as it continues south. Review of available mapping indicates that the elevation increases over thirty feet between Main Street and Old Marlboro Road. In the vicinity of the curve in the road depicted in the adjacent photo, the roadway climbs over 21 feet in approximately 350 feet. This slope would present issues with ADA compliance since it is in excess of 5%.





The trail would then turn right onto Old Marlboro Road until it meets the existing rail right-of-way. The right-of-way along Old Marlboro Road appears to be approximately forty (40) feet wide while the pavement width only appears to be approximately twenty-four (24) feet. This would not be sufficient to accommodate bicycle travel so right-of-way would be necessary. There are three properties on the southern side of Old Marlboro Road owned by Raouf A. and Sarah T. Ismail, Jeffrey M. and Susan J. Patterson and 1112 Main Street LLC before the railroad right-of-way is reached.

If Alternative 7B were selected, the Town would need to decide whether the portion of right-of-way between the town center and Old Marlboro Road would be designed and paved. Paving this portion of the right-of-way would provide a spur to the businesses in West Concord and the MBTA Commuter Rail. It will also however encourage trail users to avoid the long circuitous route of this Alternative and cut through West Concord. Not including this portion of the right-of-way would eliminate a bridge over the Assabet River.



Another option to consider is to make Cottage Street one-way from Old Marlboro Road to Main Street. If this were done, there appears to be sufficient pavement width to accommodate dedicated bike lanes along Cottage Street. This option still does present issues with grades and ADA compliance.

EVALUATION CRITERIA

Effectiveness

Since human nature is to find the most direct route from Point A to Point B, users may try and find a more direct route since it is a fairly long and circuitous route. Sharing the road with motor vehicles may discourage families with young children from utilizing the trail.

Short-term and Long-term Reliability

Although not direct, this Alternative does provide a continuous path for the BFRT.

Short-term and Long-term Maintenance Costs

The maintenance costs discussed earlier in this report also apply to this alternative. The annual maintenance cost for a trail is approximately \$1,500/mile. The long-term paving cost would be approximately \$80,000/mile the first time and \$130,000/mile the second time.

In addition, it should be emphasized that structures must be inspected on a recurring basis. Although this inspection should occur yearly, studies have shown the average inspection interval is four years. Bridges could be constructed with galvanized steel to eliminate the need for periodic painting. However, bridge structures would require periodic maintenance to repair galvanized coating failures, leaking joints, and miscellaneous repairs to chipped walking surfaces or damaged protective screens. Additionally, any lighting or security cameras within the bridge/ramps would require periodic replacement. Boardwalk structures are typically constructed

of timber and would require miscellaneous repairs on regular intervals for member replacements and repairs.

Difficulty in Implementing

According to Concord GIS, in addition to the riverfront resource area, the Assabet River has floodplain and wetlands. The extent of the floodplain of the Assabet River varies along its length. Floodplain and wetlands are also associated with the wetland area along Cottage Street. Any area within the floodplain would be subject to periodic flooding. Compensatory flood storage must be provided for any floodplain filled. If wetlands are filled, replication must be provided. If more than 5,000 square feet of wetlands is filled, more extensive permitting will be required including a Category II Army Corps of Engineers Programmatic General Permit.

Borings would need to be conducted to determine the subsurface soil information, the location of the water table and the presence of ledge prior to initiating the design of this alternative for the pedestrian bridge and boardwalk(s).

Substantial right-of-way would be required from both residential and commercial properties in order to meet the guidelines.

Trail users would be sharing the road with motor vehicles with both options 7A and 7B.

It should be noted that this option has not been presented to the MBTA or MassDOT. Since both Alternatives 7A and 7B could potentially require right-of-way from the MBTA or potential adjustments to their parking facilities, it is likely that they will require further review of this alternative.

These alternatives may require Design Exceptions since they may not meet the design standards. This cannot be determined until survey has been completed. If required, this would entail the preparation of a Design Exception Report and approval by the Design Exceptions Committee. They would require discussion and/or meetings with both the AAB/ADA Coordinator and the Bicycle/Pedestrian Accommodation Engineer at Mass DOT. At this time, it is unknown whether or not either of these options would be approved by MassDOT. In discussions with MassDOT regarding this report, they had indicated that they would need a formal submission in order to evaluate any alternative and make any decisions.

With federal funds being allocated towards the construction of the BFRT, a Categorical Exclusion (CE) Checklist would be required. Since work will be proposed within the Riverfront Area of Nashoba Brook and the Assabet River, a Notice of Intent must be filed with the Concord Natural Resources Commission. It is also possible that an Environmental Notification Form (ENF) would be required assuming that this would be constructed as part of the Concord BFRT and not independently. With the proposed bridge crossing over the Assabet River, a Chapter 91 Waterways License will be required. It should be noted that some of these permits will be required regardless of this alternative; however, work in the floodplain makes the permitting process much more extensive. An Army Corps of Engineers PGP II Application and coordination with the RSC would be required due to the Wild and Scenic River designation of the Assabet River.

Any work within the floodplain would require contacting the Federal Emergency Management Agency (FEMA). Projects proposed in floodplains are reviewed in conjunction with Massachusetts Environmental Policy Act (MEPA), Massachusetts Wetlands Protection Act, and Massachusetts Office of Coastal Zone Management reviews.

Cost to Design and Implement

The design cost for Alternative 7A would be between \$750,000.00 and \$1 million. The design cost for Alternative 7B would be approximately \$1 million to \$1.5 million.

The construction cost for Alternative 7A would be between \$6 and \$8 million. If additional architectural features were included to improve the structure aesthetics, the total cost could increase by 25% or more depending on the architectural features.

The construction cost for Alternative 7B would be between \$7 and \$9 million. If additional architectural features were included to improve the structure aesthetics, the total cost could increase by 25% or more depending on the architectural features.

In addition to design and construction costs, construction in a floodplain may make it necessary to get flood insurance in order to obtain construction financing.

Risk to Public Safety

Rail-Trail Maintenance & Operation published by the Rails to Trails Conservancy Northeast Regional Office states that approximately a quarter of constructed trails of the 100 trails surveyed reported illegal activities unique to bridges and tunnels including climbing and jumping from bridges, graffiti and vandalism. Trail users will be put in potential contact with motor vehicles at the access drive to Concord Park (Alternatives 7A and 7B), along Baker Avenue (Alternatives 7A and 7B), Main Street (Alternative 7A), Cottage Street (Alternative 7B) and Old Marlboro Road (Alternative 7B).

Vehicular Impacts

This alternative results in potential impacts to the MBTA Commuter Rail parking lot and the Concord Park parking lot. Although no parking spaces can be lost in the MBTA Commuter Rail parking lot and it will be the goal to avoid losing parking spaces from Concord Park, there would be potential impacts during construction. Vehicles will also be sharing the road with bicycles and pedestrians along Baker Avenue (Alternatives 7A and 7B), Main Street (Alternative 7A), Cottage Street (Alternative 7B) and Old Marlboro Road (Alternative 7B).

Benefits to the Community

Routing the trail over the Assabet River would provide a very scenic route for the BFRT. Both alternatives 7A and 7B do provide a continuous route for the trail. Both alternatives will provide the residential neighborhoods along Baker Avenue and Cottage Street easy access to the trail.

Timeliness to Implement

Design of a bridge requires extensive MassDOT review. Substantial right-of-way would be required with both Alternatives 7A and 7B. Depending on the extent of work in the floodplain and wetlands, the permitting process could be extensive.

Assuming the design and construction is completed as part of the BFRT Phase 2C and the abutters are amenable, the design could be completed within 24 to 30 months. The construction would take approximately 30 to 36 months.

Context Sensitive Aesthetics

Architectural features could be added to the pedestrian bridge and boardwalk structure. Pavers and plantings could be included.

Fencing could negatively impact the visual character and aesthetics of the area.

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C. CONCLUSION

Evaluation Criteria	DESIGN OPTIONS											
	Option 1 - Railroad Spur to Commonwealth Ave				Option 2	Option 3 - Access Behind Concord Park		Option 4	Option 5	Option 6	Option 7 - Baker Avenue Route	
	1A-Dismount Bikes at Commonwealth Ave	1B-Sharrow Lane on Commonwealth Ave	1C-Wide Sidewalk on Commonwealth Ave	1D-Behind West Concord Supermarket	Gap in BFRT	3A-Tunnel Under MBTA	3B-Bridge Over MBTA	Tunnel Under MBTA	Bridge Over MBTA	Spur to Main St. via Community Center	7A-Baker Avenue to Main Street	7B-Baker Avenue to Old Marlboro Road
Effectiveness	2	4	4	1	1	4	4	3	3	3	2	2
Short Term and Long Term Reliability	4	5	4	4	1	2	4	3	3	3	3	3
Short Term and Long Term Maintenance	3	3	3	3	5	1	1	1	1	3	2	2
Difficulty in Implementation (Ownership and Permitting Issues)	4	3	3	2	5	1	1	1	2	2	1	1
Cost to Design and Implement	4	4	4	4	5	1	1	1	1	3	1	1
Risk to Public Safety	4	2	4	3	2	3	4	3	4	3	1	1
Vehicular Impacts	5	2	4	2	5	5	5	5	4	2	2	1
Benefits to the Community	4	4	4	3	1	2	1	2	1	4	2	1
Timeliness to Implement	4	4	4	4	5	1	1	1	1	3	1	1
Context Sensitive Aesthetics	4	4	4	4	5	1	1	1	1	4	3	3
Score	38	35	38	30	35	21	23	21	21	30	18	16

Design Cost	\$70,000	\$70,000	\$70,000	\$70,000	-	\$500,000 - \$750,000	\$500,000 - \$600,000	\$1.25 - \$1.5 million	\$500,000 - \$600,000	\$150,000 - \$200,000	\$750,000 - \$1 million	\$1 - \$1.5 million
Construction Cost	\$500,000	\$500,000	\$500,000	\$500,000	\$40,000	\$7 - \$9 million	\$7 - \$9 million	> \$25 million	\$6 - \$8 million	\$1 - \$1.5 million	\$6 - \$8 million	\$7 - \$9 million
Design Duration	24 months	24 - 30 months	24 - 30 months	24 - 30 months	24 - 30 months	24 - 30 months	24 - 30 months	24 - 30 months				
Construction Duration	24 months	30 - 36 months	30 - 36 months	30 - 36 months	30 - 36 months	30 - 36 months	30 - 36 months	30 - 36 months				

Ranking System	
1	Highly Negative Impact
2	Slightly Negative Impact
3	Little or No Impact
4	Slightly Positive Impact
5	Highly Positive Impact

SUMMARY

Prior to the addition of Alternatives 6 and 7, the alternatives were discussed with both the MBTA and MassDOT. The report was reviewed by MassDOT.

The MBTA does not have any objections to directing the trail to the existing track crossing on Commonwealth Avenue. They do not have any objections to a gap in the trail but have noted that this could cause potential issues with funding. Although they are accepting of a tunnel under the tracks providing it does not require the suspension of service, they also noted concerns with the water table in the vicinity of the Assabet River and public safety within the tunnel. They are also accepting of a bridge over the tracks, although they have voiced concerns with the length of the ramps needed to reach the required elevation, lighting, ventilation and maintenance. An elevator system would not be allowed. Parking cannot be lost and the trail cannot utilize the parking lot or the existing crossing.

In conversations with MassDOT, they have stated that without a formal submission they are not in a position to choose a preferred alternative or state whether or not an alternative would or would not be approved. Many of the alternatives presented in this report will require design exceptions. All of the alternatives presented in this report will require discussion with and review by the AAB/ADA Coordinator and Bicycle/Pedestrian Accommodation Engineer at MassDOT. Based on past experience, it is likely that the very costly alternatives will not be considered as viable options by MassDOT unless the community is willing to absorb the cost.

Cost is a major concern in the selection of alternatives. Alternative 2 has the lowest design and construction cost, however, based on past experience GPI does not believe that this alternative would be funded since it does not provide a continuous path. Alternatives 3, 4, 5 and 7 have a bridge, tunnel and/or a boardwalk type structure. Bridges, tunnels and boardwalk structures are more costly to design and more costly to construct. Alternative 6 includes a switchback ramp system. Alternative 1 does not include any special design features so the cost appears commensurate with the cost of constructing a bike trail. Right-of-way will also affect the cost of the Alternatives however this cost cannot be determined without coordination with the effected abutters.

Safety is also a major concern in the selection of alternatives. In an ideal world, a separate path would be provided for both bicycle and pedestrian use. Since this is not always possible, bicycle lanes can be provided along roadways. For commuters and avid bike riders, this is acceptable. For recreational trail use, this is not ideal and adds a factor of risk for trail users, especially those with young children. Alternatives 1A and 1B are safe with respect to motor vehicles since they remove the potential for pedestrian/motor vehicle contact. Alternative 1B is the safer of the two alternatives since it provides a separate path along the sidewalk for trail users since it is likely that many may not dismount their bikes as instructed by signing. Alternative 1C does place trail users in closer contact with vehicles, however, it is not for a very long distance. Alternative 1D presents safety and sight distance issues as trail users try and traverse the parking area especially for those who do not dismount their bikes as instructed by signing.

Alternative 2 strands trail users and leaves them on their own to find the trail. This will most likely present safety issues, especially for those not familiar with the area.

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Alternative 3A places trail users in a tunnel underground with sight distance issues. In an ideal situation, trail users should be able to see the other end of a tunnel when they enter it. This is not possible with this tunnel. Alternative 3B introduces a switch back ramp system and then has trail users sharing the roadway with vehicles on Westgate Road. Alternative 4 introduces a very long tunnel and potentially a switchback ramp system. Alternative 5 introduces a bridge with switchback ramps. If trail users do not dismount their bikes as instructed by signing, there is potential for collision with other trail users on the blind corners.

Alternative 6 introduces a switch back ramp section and proposes that trail users share the road with motor vehicles along Main Street. Alternative 7A proposes that trail users share the road along Baker Avenue and Main Street. Alternative 7B proposes that trail users share the road along Baker Avenue, Cottage Street and Old Marlboro Road.

Alternatives 3 and 7 would require a more extensive environmental permitting process than the other alternatives since they will most likely involve work in floodplain and in wetlands. They both propose work in the vicinity of the Assabet River which would require review by the RSC. The remaining alternatives all involve the same amount of permitting.

Therefore, based on cost, safety and environmental factors, GPI recommends Alternative 1C – a wider sidewalk on Commonwealth Avenue as the Preferred Alternative. There are of course other factors to take into consideration including the effectiveness of the route and project abutters. The hope is that through discussions with the various stakeholders, the desired Alternative can be identified and a consensus Preferred Alternative can be presented to MassDOT.



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