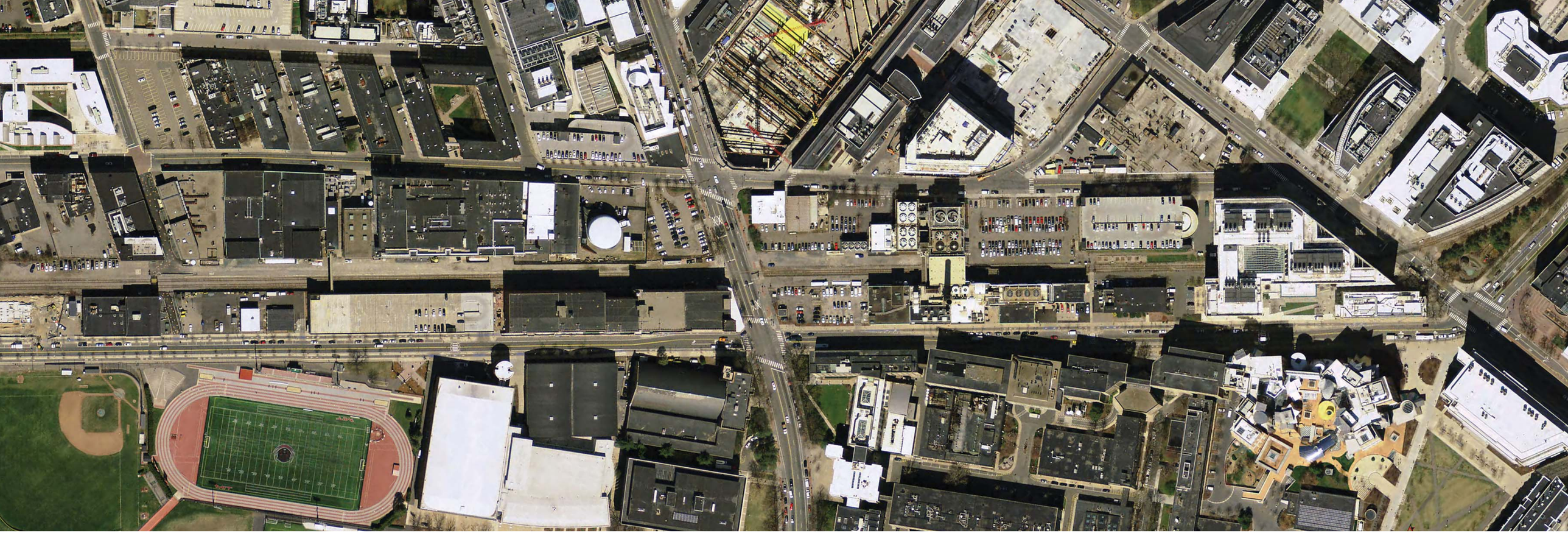
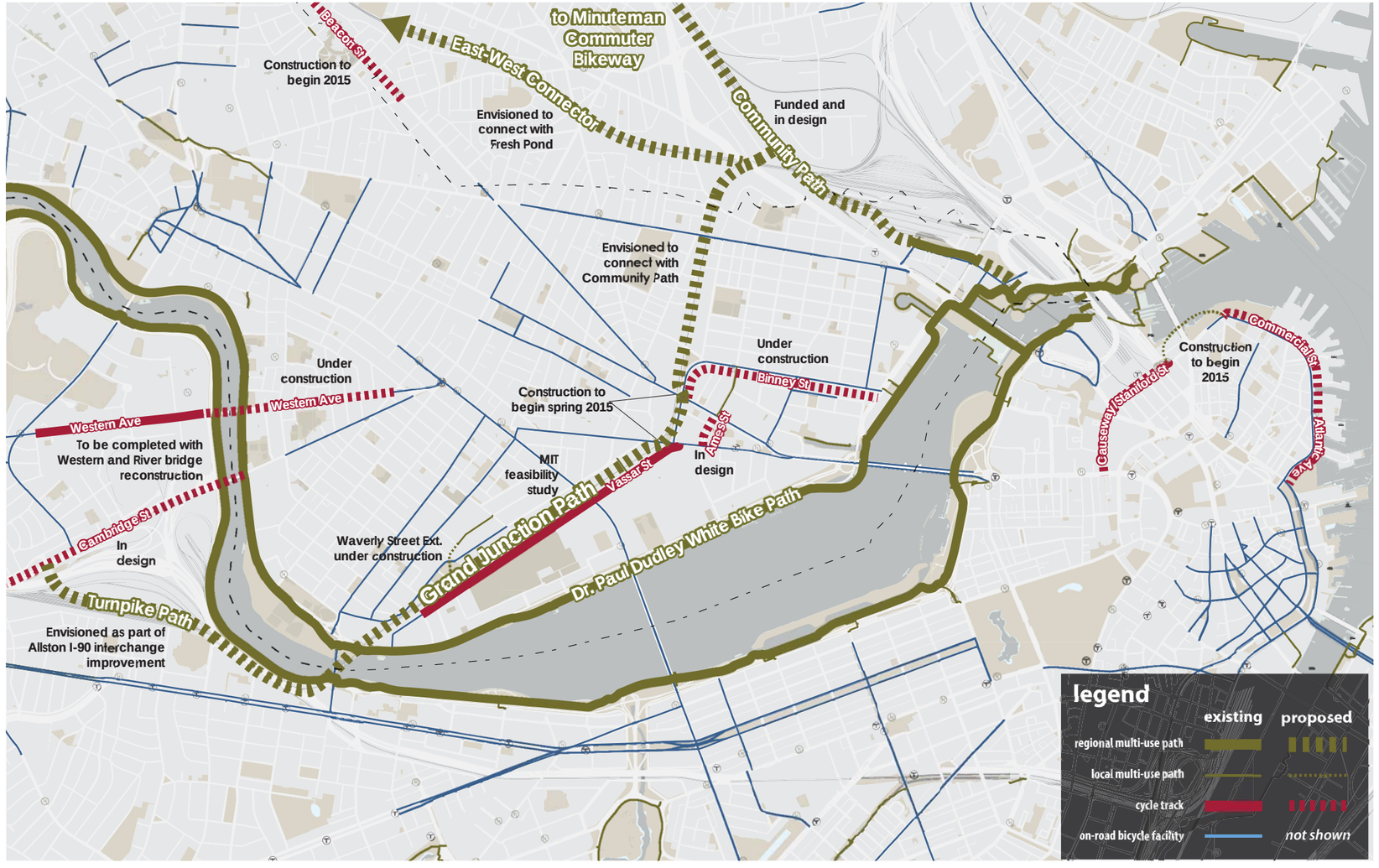


Grand Junction Community Path
and MIT Property Feasibility Study

October 2014

Existing bicycle facilities and proposed regional multi-use paths



Grand Junction Community Path and MIT Property Feasibility Study

Prepared for the
Office of Campus Planning
Massachusetts Institute of Technology

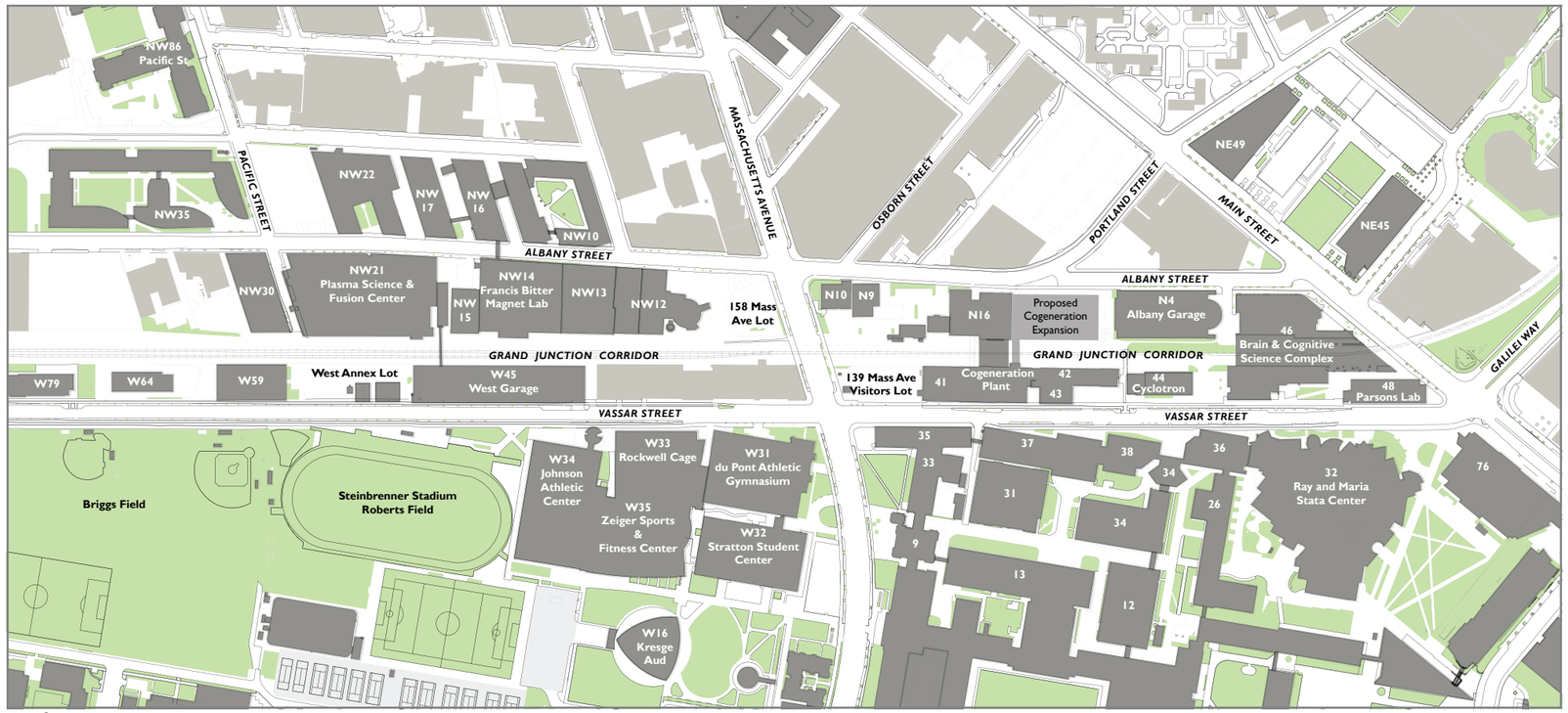
by

Kleinfelder
with
Toole Design Group
McMahon Associates
Corcoran & Associates

October 2014

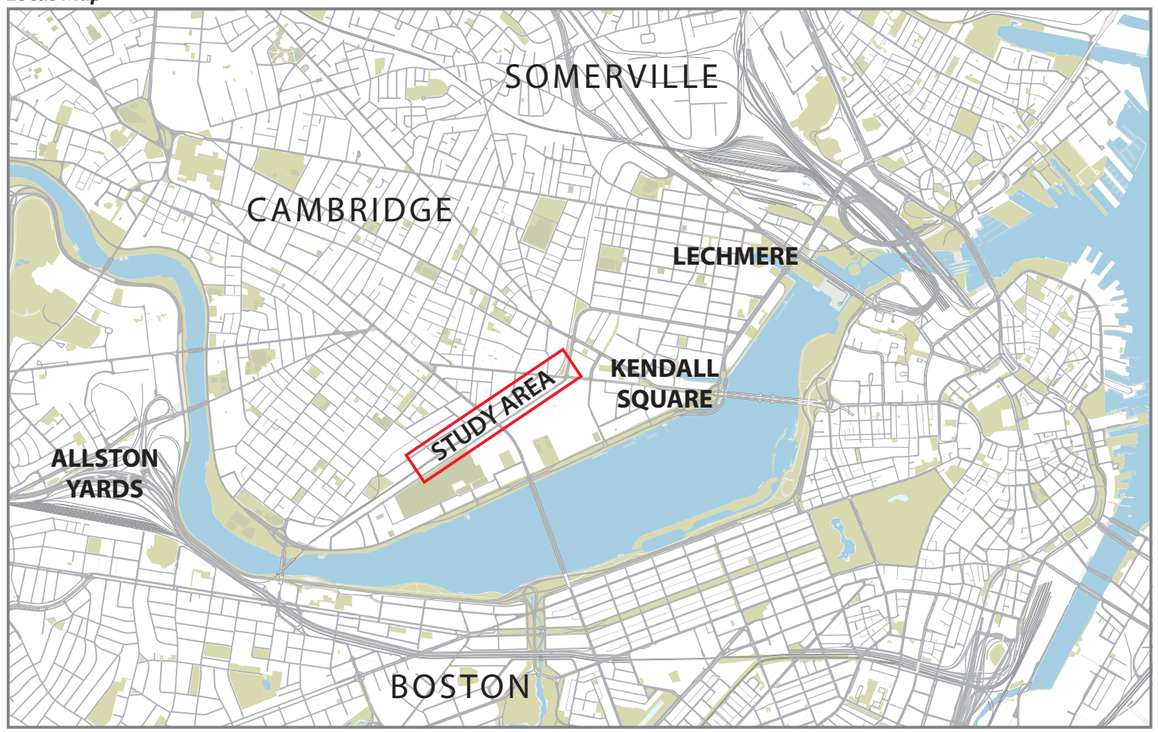
Advisory Committee

Jonathan Adams	Cambridge Bicycle Committee
Kelley Brown	MIT Office of Campus Planning
Brian DeChambeau	Cambridge Community Development Department
John Engle	MIT Facilities Department
Tom Evans	Cambridge Redevelopment Authority
Peter Fisher	MIT Physics Department
Richard Lester	MIT Nuclear Science & Engineering Department
Ari Ofsevit	Charles River TMA
Jeff Rosenblum	Cambridge Community Development Department
John Sanzone	Friends of the Grand Junction Path
Melissa Shakro	MIT Office of Campus Planning
Catherine Vanderwaart	Graduate Student Council
Ken Williams	MIT Investment Management Company



Study Area

Locus Map



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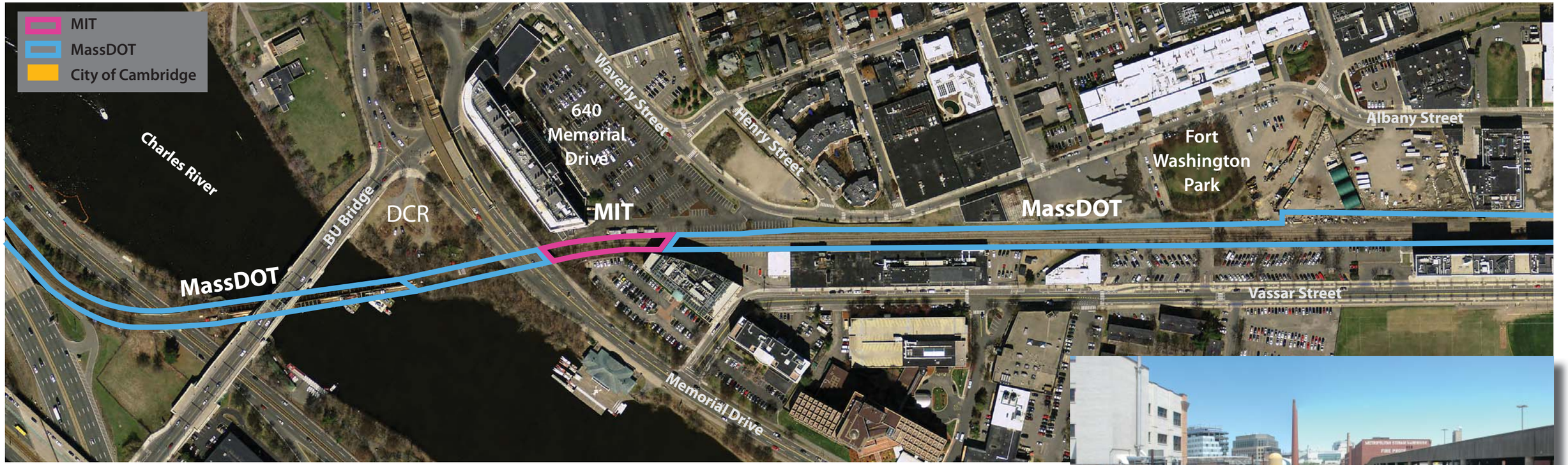
Introduction

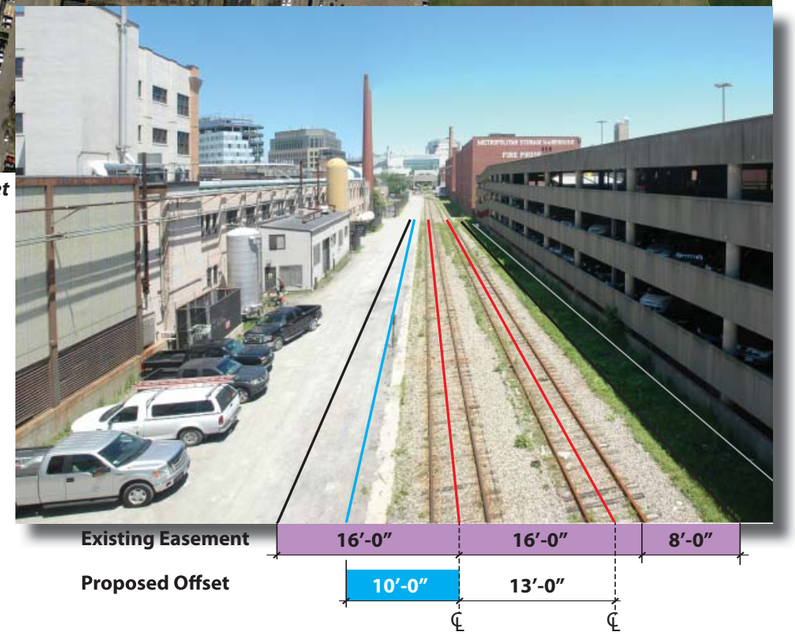
This feasibility study was undertaken to identify and understand the potential impacts of a proposed multi-use path running along the Grand Junction Corridor on the MIT campus. The purpose of the study was to explore path routes and their effect on campus operations and development. The immediate study area is a portion of the corridor owned by MIT, which runs from just west of Pacific Street to Main Street; MIT also owns a segment of the railroad corridor adjacent to 640 Memorial Drive and the segment from Main Street to Broadway. Because path users are expected to be cyclists making regional connections, a larger study area included the rail corridor and adjacent streets between the Charles River near the BU Bridge and eastward to Broadway. Ultimately the path is intended to connect to Allston on the west and to Somerville to the north. A variety of public and private entities including the Massachusetts Department of Transportation (MassDOT), the Massachusetts Department of Conservation and Recreation (DCR), MIT, the City of Cambridge, and the Cambridge Redevelopment Authority (CRA) own segments of this larger study area, or are abutters to the corridor.

The City of Cambridge was an integral part of the study effort as the largest portion of the potential path lies within its jurisdiction. Additionally, MassDOT was consulted as it has continuing rail activity on the track. An Advisory Committee representing stakeholder groups, including City of Cambridge staff, advocacy groups and MIT staff, faculty and students, reviewed and provided input to the feasibility study at key milestones. An open house was held at the MIT Stata Center to solicit input on the project and was attended by over fifty people.

A 2006 study for the City of Cambridge prepared by Alta Planning+Design established a general concept for the corridor and identified concerns or constraints in the MIT-owned section. This study, undertaken by Kleinfelder with the assistance of McMahon Associates and Toole Design Group, takes the next step and focuses on identifying and evaluating specific campus issues including delivery and service to buildings along the corridor, utility maintenance and construction, building maintenance and construction, and future development potential. An evaluation of the Vassar Street cycle track, which runs parallel to the Grand Junction Corridor, is included as part of this study along with potential improvements identified for that facility.



Right: Existing rail easement with proposed offset



Summary

The feasibility of accommodating a multi-use path in the Grand Junction Corridor is based on three primary factors:

- The amount of space available in the corridor for both path users and service vehicles--minimizing areas of conflict;
- The frequency of path user and service vehicle trips and the ability to manage potential conflict; and
- The location and length of time for construction activities that would block segments of the corridor.

To investigate these issues, the corridor was divided into a series of segments; design concepts for the various segments were developed and evaluated to measure the fit and potential impacts to MIT's research and educational operations.

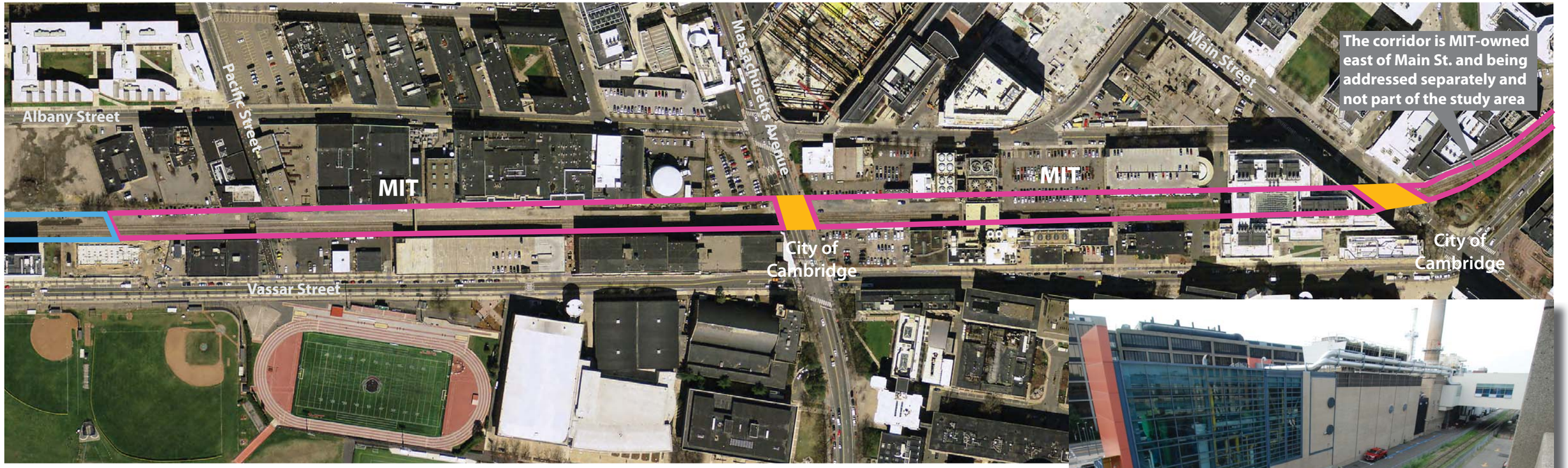
MIT's operational needs in the corridor are primarily the provision of a service drive along the back of its buildings to provide access for supplies and maintenance. The corridor currently serves vehicles accessing the buildings through a service drive system: east of Massachusetts Avenue (Mass Ave) the drive is paved, while west of Mass Ave it is largely unpaved. Maintaining the access provided by these service drives is a high priority for MIT. The western portion is plowed by MIT and used for access by the Fire Department and other emergency vehicles. *Specific existing conditions along the corridor are described on pages 4 and 5.*

Segment options on the east and west sides of Mass Ave were combined into a preferred option. This combination provides a continuous path along the north side of the track and minimizes impacts to MIT operations. This represents the best combination of the segment options, though it does not eliminate all issues, such as the use of a portion of the rail right-of-way easement for path purposes. There are several constrained locations along the route which will need to be addressed in more detail if the path concept moves ahead into the next phase of design. *The preferred option is described on pages 8 and 9.*

MIT owns the corridor between from a point roughly 250 feet west of Pacific Street and Broadway and has granted an easement to MassDOT to operate rail service. Today that operation is minimal and only consists of a few trains per day, running mostly at night with a 10 MPH speed limit. The easement east of Mass Ave is twenty feet wide, with a ten-foot offset on both the north and south sides of the centerline of the single track. West of Mass Ave the easement is forty feet wide, covering the main line plus a siding. Here the northern edge of the easement is defined by a sixteen-foot offset from the centerline of the track. The difference between the ten-foot and sixteen-foot offset is critical to the amount of space available for the path and service drive west of Mass Ave. The most viable option for the corridor is predicated on continuing the ten-foot offset from the east side over to the west side. This would require approval from MassDOT and, while there appear to be no operational constraints in applying a 10-foot offset west of Mass Ave, it is not assured. The issue has been discussed with MassDOT and they have taken it under advisement. If the existing sixteen-foot offset, rather than a ten-foot offset, remains, then the service drive and multi-use path would overlap for the entire length. This would not function as a multi-use path; it would be a shared street.

Beginning at a location roughly 250 feet west of Pacific Street and continuing to a location slightly west of the intersection of Henry Street and Waverly Street, the Grand Junction Corridor is owned by MassDOT. In this segment of the corridor there is adequate room for a multi-use path since a service drive would be unnecessary—the parcels in this segment are not accessed from the corridor. Just before the tracks pass under Memorial Drive the corridor once again reverts to MIT ownership. At this location there is not enough room for a path between the tracks and the emergency generators and other equipment along the edge of the 640 Memorial Drive parking lot, as illustrated on page 12. With that limitation, the most viable connection from the Grand Junction Corridor to the BU Bridge is along Waverly Street.

Although the path concept is viable through the MIT-owned portion of the Grand Junction Corridor between Pacific Street and Main Street under certain conditions, there remains the larger questions of connectivity, both locally



and regionally. There are significant design and feasibility issues yet to be addressed, such as crossing over the Charles River to Allston, connecting to the Somerville Community Path, and impacts of potential transit service in the corridor. The cycle track on Vassar Street can continue serving the needs of bicyclists until a path along the Grand Junction Corridor is constructed. The Vassar Street cycle track, built in 2004, was the first to be constructed in Massachusetts and one of the first in the nation. The increase in the number of cycle tracks constructed in the past ten years has provided a better understanding of their design and functionality. Drawing from this experience, potential improvements to this facility have been identified and are described on Page 15.

Assuming that the feasibility and design issues along the remainder of the corridor can be resolved and a path is constructed, corridor segments would still be subject to periodic closures for campus construction. These closures may range in duration from weeks to years. A map and description on Page 7 illustrates anticipated construction in the corridor over the next 10 years. For the periods the corridor would be closed due to construction, Vassar Street and Albany Street can serve as detour routes.

Project Cost

A conceptual level opinion of probable cost based on historical pricing data was prepared for construction of the path and related facilities, including paving for both the multi-use path and service drive, pavement markings and signage, fencing along the rail easement, lighting and police call boxes, and signal and related improvements at the Mass Ave and Main Street crossings. In the absence of detailed existing conditions and design information, allowances were included for handling of hazardous material, stormwater management, landscaping, and non-construction costs (such as design, permitting, owner's project management, etc.). Land acquisition costs are not included. All pricing was prepared in 2014 dollars. The following table breaks down the project costs by segment

Main Street to Massachusetts Avenue	$ 3,600,000
Massachusetts Avenue to Pacific Street	$ 3,300,000
Pacific Street to Henry Street	$ 6,000,000
Traffic Signal Improvements	$ 600,000
TOTAL	$13,500,000

Next Steps

The Grand Junction corridor is complex with numerous owners and abutters requiring a range of activities. While this study focuses on the MIT-owned segment of the corridor, understanding the feasibility of incorporating a multi-use path along its entire length requires a cooperative effort between MassDOT, the City of Cambridge, MIT, DCR, and affected abutters. This effort would most logically be led by the City of Cambridge, although many of the issues to resolve fall within the purview of MassDOT. A more detailed discussion of next steps can be found on page 15.

In the following pages the opportunities and constraints of the corridor and the preferred options are described more fully.

Above right: Looking westward from the top of the Albany Garage

Right: Looking eastward from the West Garage pedestrian bridge

Analysis of Existing Conditions along the Corridor

The portion of the Grand Junction Corridor that is owned by MIT principally falls between Pacific Street and Main Street. The corridor is used daily as a service drive, and portions are frequently closed for maintenance or repair to buildings that back along the corridor, for new construction, and for utility maintenance and construction. To understand the needs and operations of existing building services and future construction projects, interviews were held with building managers, department heads, campus planners and others familiar with operations along the corridor. Service vehicles use the corridor multiple times a day but are infrequent, generally averaging eight to twelve trips per day on any particular segment. In addition to day-to-day delivery and service, the corridor is used for building maintenance and construction vehicles as well as fire and emergency vehicles. Depending on the scale of the building or utility repair, the corridor may need to be closed for construction – for example, the segment on the north side of the tracks adjacent to the Albany Street Garage is currently closed to accommodate utility work. New building construction will also necessitate the closing of portions of the corridor, either for construction equipment and laydown areas or in order to safely allow construction over the corridor. The construction of the addition to the co-generation plant, which will begin in 2015 and run through 2017, is a good example of building both next to and over the corridor and will require a closure for up to two years.

The railroad tracks divide the corridor leaving a service drive on either side between Main Street and Massachusetts Avenue, where there is a single track. West of Mass Ave there is an additional siding track on the south side of the main line, and this condition precludes a path or service drive on the south side of the tracks leaving room only on the north side. Buildings line the corridor almost continuously and there are numerous gas storage tanks, fences, loading docks, access doors, dumpsters and parking spaces that take up space within the corridor. This results in the available width along the corridor changing throughout its length.

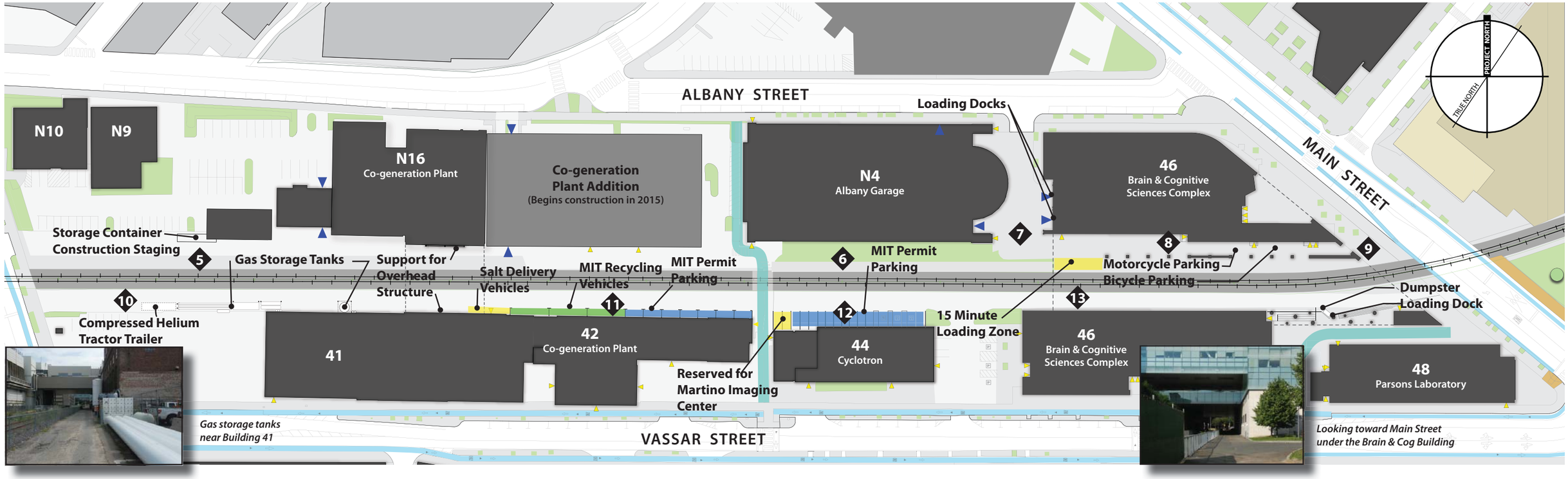
Current rail operations in the corridor are minimal and, generally, trains run at night with a ten mile-per-hour-speed limit. The corridor enables commuter rail cars to be switched between the north and south side facilities, and allows Amtrak to move Downeaster equipment from the north side to the maintenance facility in the South Bay area. Additionally, freight trains operate between the New England Produce Market in Chelsea and Beacon Park.

The feasibility of a multi-use path along this corridor is dependent on the width available. Generally, a two-way multi-use path can run side-by-side with a one-way vehicular service drive where the width is 23 feet or greater. If there is less than 23 feet available, the service drive will need to overlap onto the multi-use path. A small overlap, where the service drive encroaches onto the bicycle path while traveling in the same direction as path users, may be acceptable given the low volume of service vehicles. However, a larger overlap for a sustained length of the corridor that would cause a service vehicle to drive into the oncoming lane of the bicycle path should be avoided. If such an overlap at a pinch point is unavoidable, it should be clearly marked and bicyclists and vehicles warned of possible oncoming traffic. See Page 10 for a description of the various cross section configurations and dimensions.

Conditions could change over time as programs move from building to building or their technology needs change. For example, if the Massachusetts Avenue frontage between Vassar Street and Albany Street were developed, the site of Building 41 could be incorporated into a new development and the gas storage tanks associated with it would be removed. Future development may require service access that does not exist today.

The following locations are potential conflict points between buildings or structures in or along the corridor and the potential multi-use path; numbers refer to the points on the drawing above:

1. Near Pacific Street, the corridor is constrained at a point between the liquid nitrogen storage tank serving the Plasma Science and Fusion Center in Building NW21 and a low retaining wall supporting Pacific Street. LEVEL OF SEVERITY: HIGH
2. A tank along the back of Building NW21 causes an additional constriction. LEVEL OF SEVERITY: HIGH
3. A portion of Building NW14 protrudes into the corridor as does an adjacent gas storage tank. This feature narrows the available width, from a 10-foot offset of the rail centerline, to 23 feet, the minimum distance that a side-by-side path and service drive can fit. LEVEL OF SEVERITY: HIGH
4. Running from Building NW13 eastward to the 158 Mass Ave Parking Lot, the available width between the fence and a 10-foot rail offset narrows the corridor to 24 feet. LEVEL OF SEVERITY: MEDIUM
5. East of Massachusetts Avenue, on the north side of the tracks, there is sufficient room between Mass Ave and the co-generation plant for a standard path and service drive. Along Building N16, the co-generation plant, and the proposed addition the corridor narrows to 24 feet. LEVEL OF SEVERITY: MEDIUM



Gas storage tanks near Building 41

Looking toward Main Street under the Brain & Cog Building

6 Adjacent to the Albany Street Garage there is no service drive today and none is proposed. The community garden, which has been closed this past year because of underground utility work, can remain. LEVEL OF SEVERITY: LOW

7 Service access to the Brain & Cognitive Sciences (Brain & Cog) Building is primarily through the loading docks facing the Albany Street Garage. There is an area signed for 15-minute loading and temporary parking which would need to be relocated to accommodate a path in this location. LEVEL OF SEVERITY: MEDIUM

8 Under the Brain and Cog Building a row of building columns runs parallel to the corridor. Between the columns and the building, there is an access drive adjacent including space for permit motorcycle parking along with general bicycle parking. LEVEL OF SEVERITY: LOW

9 At the east end of the north side under Brain and Cog Building, there are two openings connecting the sidewalk area along Main Street with the area under the building. Each is roughly seven feet wide, measured perpendicular to the direction of travel. LEVEL OF SEVERITY: MEDIUM

10 On the south side of the tracks, adjacent to Building 41, a series of gas storage tanks narrow the corridor to twelve feet—the narrowest location along the corridor. A 5 MPH speed limit is posted. LEVEL OF SEVERITY: HIGH

11 Behind Building 42, the co-generation plant, there is parking for salt delivery trucks and three recycling trucks. Immediately eastward there are seven permit parking spaces. LEVEL OF SEVERITY: MEDIUM

12 Behind Building 44, the Cyclotron, there are two parking spaces reserved for the Martino Imaging Center and fourteen permit spaces. LEVEL OF SEVERITY: LOW

13 Under the Brain & Cog Building south of the tracks, there is seventeen feet of clearance along the existing service drive between the fence and the building wall. The loading dock for Building 48 is accessed from this location. LEVEL OF SEVERITY: HIGH

Mitigation Measures

The shared use of the corridor by bicyclists and pedestrians with service vehicles has the potential for conflict between users. Although the expected use of the corridor by service vehicles is low, there are measures that can be implemented to minimize friction. As MIT owns the corridor and oversees the services using the service drive, it will have the ability to implement, monitor and enforce the recommended controls, and will also bear any costs associated with those controls.

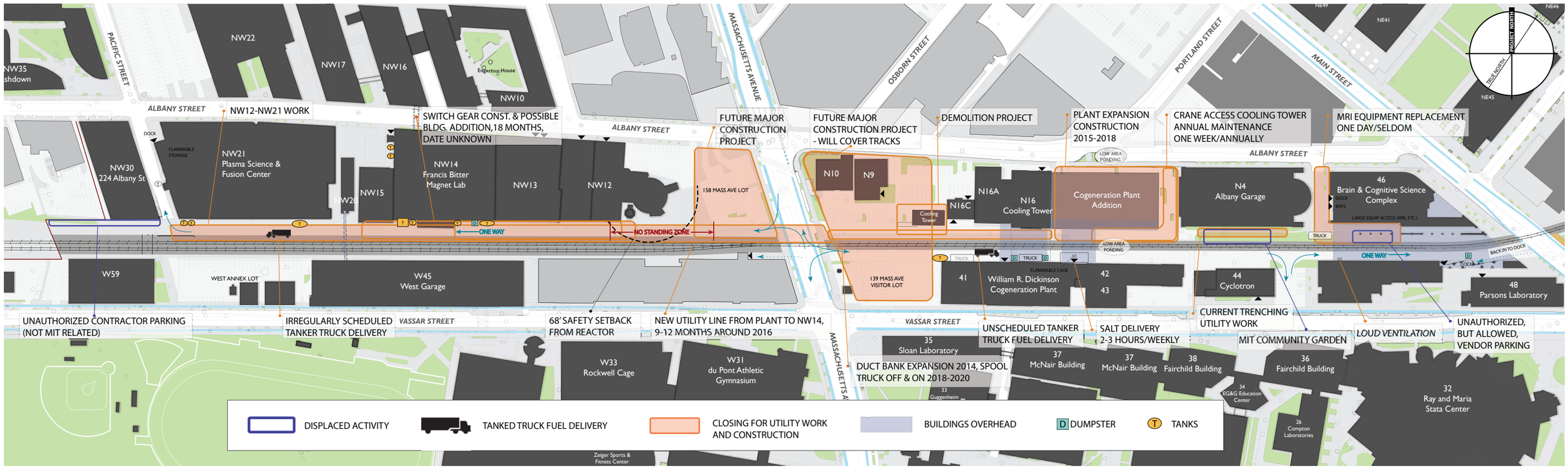
One-way movement of vehicles on service drive
The proposed service drive, running parallel to a multi-use path on the north side of the tracks, would only be wide enough to accommodate a single vehicle. Movement in one direction will not only increase predictability for bicyclists and pedestrians using the corridor but minimize conflicts between vehicles as well. In the segment of the corridor between Mass Ave and Pacific Street, vehicles would enter from Mass Ave and proceed west, exiting via Pacific Street. East of Mass Ave service vehicles would enter from Albany Street, between the garage and the co-generation plant addition, proceed westbound along the corridor and exit onto Mass Ave. See pages 8 and 9 for a diagram of service routes.

Off-peak delivery and service
If delivery and service vehicles can be prohibited from using the corridor during the morning peak period it would minimize friction with users of the path. While MIT has a certain amount of control over delivery and service vehicles, it is understood that compressed gas deliveries need to happen in coordination with facility needs. Any reduction in the number of delivery or service vehicles during this hour will be a benefit. The evening peak period for bicycles is after 5:00 PM and should not overlap with most MIT service and delivery vehicles.

Defined parking locations
While trucks delivering liquefied gas need to park next to the storage tanks, other service vehicles traveling along the corridor will need places to park that are off the service drive. Clearly defining these locations and educating drivers about their use will help to reduce the number of vehicles parking on the service drive, and therefore reduce the need for other vehicles to maneuver around them and encroach onto the multi-use path.

Warning signs and striping
Predictability is an important factor for all users of the corridor. Locations where service and emergency vehicles overlap the path, either while traveling or maneuvering, should be clearly identified and marked with striping or warnings on the path surface. Additionally, signs should be located at service drive entries to warn away unauthorized vehicles.

Low speed limit
Service and delivery vehicles should conform to a speed limit in the corridor of not more than 10 MPH.



Construction and service activities in the corridor

Future Conditions in the Grand Junction Corridor

The environment path users travel through changes dramatically as the corridor passes from the edge of the Charles River, under Memorial Drive, curving and then straightening into the long segment from Henry Street to Pacific Street, continuing in a straight line through the MIT campus, crossing Mass Ave to another section of the MIT campus, and then curving northward at Main Street toward Somerville. The frequently changing character of the corridor adds interest for the users of the path, alternating between open segments bordered by unbuilt parcels or low buildings and denser, more enclosed segments—including some with buildings overhead. The future conditions will change over time but the corridor will continue to be a mix of different types of character.

MassDOT Considerations

In addition to MIT's use of the corridor, MassDOT uses it for occasional freight rail and for shuttling commuter rail cars between the north and south rail systems. It provides the only connection to North Station from the west. MassDOT wants to maintain flexibility for various potential future transportation uses. Portions of the corridor were previously included at as part of the Urban Ring plans, and MassDOT is currently considering self-propelled diesel multiple unit train cars (DMU) for future service in the corridor that is anticipated to operate at 15-minute headways. As part of this future DMU service, a two-track configuration is preferred. This would require an extension of the second track to the east of Mass Ave and a second track through the tunnel under Memorial Drive, which would preclude a path at that location without major reconstruction. Between Mass Ave and Main Street a second track would eliminate the service drive behind the buildings fronting Vassar Street, including Building 48 and the Central Utility Plant (Building 42). A second track in this location would severely alter service to these MIT buildings, requiring substantial investment and potentially resulting in inferior service access. A multi-use path on the north side of the tracks would not be impacted by the addition of a second track on the south. Station locations for the DMU service have not been identified but, similar to the Urban Ring plans, the areas near Mass Ave and Main Street seem to be the likely candidates. A continuation of the ongoing coordination between MassDOT, the City of Cambridge and MIT is critical to address the range of issues transit service would involve.

MIT Construction Activity in the Grand Junction Corridor

MIT owns most of the land abutting the corridor from Memorial Drive eastward to Pacific Street. From Pacific Street to Main Street, MIT owns both the corridor and all abutting land. The existing service drives running adjacent to the tracks perform a vital role in campus operations, both as a service drive for delivery and maintenance vehicles and as the primary underground utility route for the campus. MIT campus planning calls for redevelopment of existing buildings and construction of new buildings along the corridor, and for maintenance of existing and installation of new utilities. Not only will this change the character of the corridor over time but it will necessitate the closing of segments for construction. The MIT campus is in a constant state of construction as buildings, and the utilities that serve them, are built or renovated. Some projects are scheduled, such as the co-generation plant addition, while others are planned but do not have an established timetable. Construction work, although not limited to the summer, predominately occurs then, driven by the weather and MIT's reduced campus activity. Several major projects will impact the corridor:

- Beginning in 2015 and running through 2017, the co-generation plant expansion will require closure of the corridor. This project will include a bridge over the corridor providing connections to Building 42.
- The corridor between Mass Ave and Building N16 will shortly become the home of construction trailers and equipment, and is the laydown space for a campus construction in that area.
- A new utility line from the cogeneration plant to Building NW14, west of Mass Ave, will close the corridor for up to twelve months in 2016.
- Scheduled to begin in the summer of 2021, Building 42 will begin a one to two year equipment replacement program.

When construction closes a segment of the corridor, Vassar Street is a natural detour

Far left: The Burke-Gilman Trail in Seattle, Washington is separated from the tracks by a low chain link fence.

Left: A shared bicycle and vehicle path along the Nebraska Furniture Mart is part of the Keystone Trail in Omaha. Trucks serving the warehouse use the trail for access. To date there have been no reports of incidents between trail users and vehicles.

Below: Warning signs along the path alert cyclists. The front sign states "Proceed slowly and in single file" and the warning sign states "Caution trucks ahead."

- The frontage on the east side of Mass Ave between Albany and Vassar streets is a prime development location and a building on this site would span over the corridor—similar to the Brain and Cog building at the other end of the block. Construction here would also require closure of the corridor.

Since a multi-use path is unlikely to be built in the next few years, some of these projects would not have an impact, but some level of construction activity in the corridor will continue into the future.

The plan shown on the opposite page illustrates known, planned, and anticipated construction activity in and around the corridor over the next ten years. The MIT campus must be responsive to the constantly changing needs of higher education and research. Activity in the next three to five years is fairly certain, however, moving further into the future, specific plans become more ambiguous and must be adaptable based on changing technology as well as grants, private donations, and annual budgets, utility infrastructure needs and maintenance requirements. In addition to major construction projects, ongoing building maintenance and operations may require periodic closures of the corridor.

The Larger Network

A multi-use path along the Grand Junction Corridor should be conceived of as part of a larger network of on- and off-street paths making both local and regional connections. Regional connections would ultimately connect with Allston to the west and Somerville to the north; and MIT and the Cambridgeport neighborhood will be both an origin and destination for many path users. Existing rail crossings at Main Street, at the west end of the Albany Street Garage, at Massachusetts Avenue, Pacific Street, and Fort Washington Park will help integrate a path along the Grand Junction Corridor with the larger neighborhood network.

In addition to network connections, these crossings will allow for path detours to Vassar Street or Albany Street when a segment of the corridor needs to be closed for construction or maintenance. Vassar Street already has a cycle track and is a good detour route. For Albany Street to be used as a bicycle detour, on-street parking in the affected area would need to be relocated for the duration of the detour.

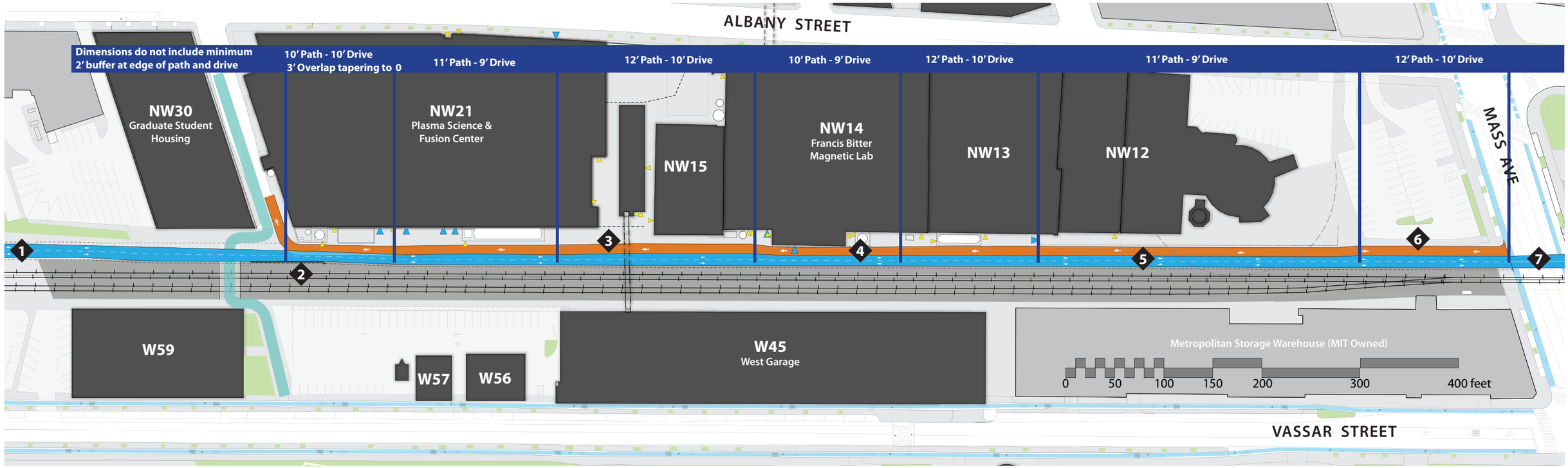
Trail Examples in Other Locations

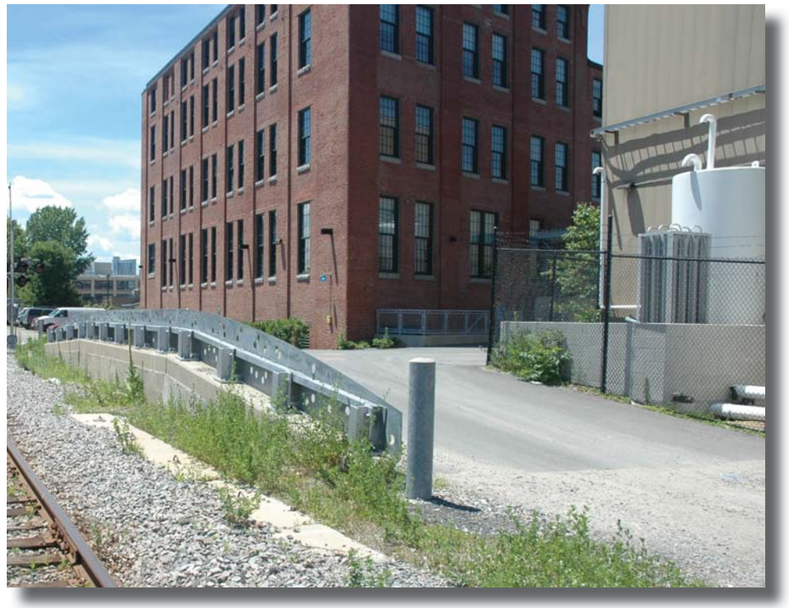
While this feasibility study does not include a detailed design of the path, there are examples from other locations that can give a sense of the character that path users would experience traveling along the corridor. Because industrial uses were frequently constructed along rail corridors to take advantage of rail delivery, paths that follow the track also go through industrial areas. The Grand Junction Corridor is a good example of an industrial corridor that is slowly transforming as industrial uses move away and the buildings that housed them are rehabilitated for other purposes. While the industrial uses are gone the architecture of the buildings is an important aspect of the corridor's character. As new buildings are constructed and existing buildings are renovated, the character of the corridor will change.

Looking at examples in other locations can help give a sense of what a path user will experience along the Grand Junction Corridor. There are several examples of bicycle paths mixed with service drives and bicycle trails along rail corridors—although the Grand Junction corridor appears to be fairly unique in its mix of uses. The Keystone Trail, in Omaha, runs adjacent to the Nebraska Furniture Mart warehouse. Trucks serving the warehouse use the trail for access to load and unload material. Unlike the proposed path for the Grand Junction Corridor, trucks and bicycles share the same pavement. The area of truck and trail interaction is approximately one-third of a mile in length. Signs along the trail warn bicyclists of trucks ahead, and also trucks that they are entering a bicycle facility. To date there have been no problems or reports of incidents between trail users and vehicles.

Most rail-with-trail facilities are located along tracks with a higher volume of trains that run at higher speeds than on the Grand Junction. The Burke-Gilman trail in Seattle is a multi-use path that runs adjacent to a rail corridor and is separated by a fence similar to the one along the Grand Junction Corridor between Mass Ave and Main Street.

A multi-use path running along the Grand Junction Corridor will share some characteristics of the examples cited above but will remain a unique combination of open and enclosed, covered and uncovered, and with and without a service drive. It will continue to change and evolve along its length providing a chronology of industrial and institutional urban form.





The retaining wall and gas storage enclosure limit the available width near Pacific Street

Description of the Preferred Options

Multiple options were developed and evaluated for the segments on either side of Mass Ave: two options between Mass Ave and Pacific Street and six options between Mass Ave and Main Street. The preferred options (Options A and C in the study) are illustrated here. They provide a continuous path on the north side of the railroad tracks, paired with a one-way, westbound service drive, and path crossings at Mass Ave and Main Street. The width of the path and service drive varies depending on the available width of the corridor. There are two exceptions to the typical condition, one at each end of the study area. In a narrow length of the corridor near Pacific Street, adjacent to Building NW21, the service drive and multi-use path overlap; and under the Brain and Cog Building near Main Street the path is split into separate eastbound and westbound lanes for approximately 150 feet. Option highlights are described below.

1. The MIT-owned segment of the corridor extends approximately 250 feet westward past Pacific Street. Beyond this point the corridor is owned by MassDOT and is wide enough to accommodate a path width of fourteen feet with three foot buffers.

2. Between the retaining wall and the gas storage tank serving Building NW21, the corridor narrows to approximately 20 feet and requires the service drive to overlap the path. The overhang of trucks making a turn onto Pacific Street would exacerbate this condition, however, the low volume of service vehicle traffic will keep the number of potential conflicts to a minimum.

3. The corridor is sufficiently wide in the area near the pedestrian bridge for the preferred 26-foot configuration for the path and service drive with additional space next to the building for service vehicle parking. See Page 10 for discussion of typical cross section configurations and dimensions.

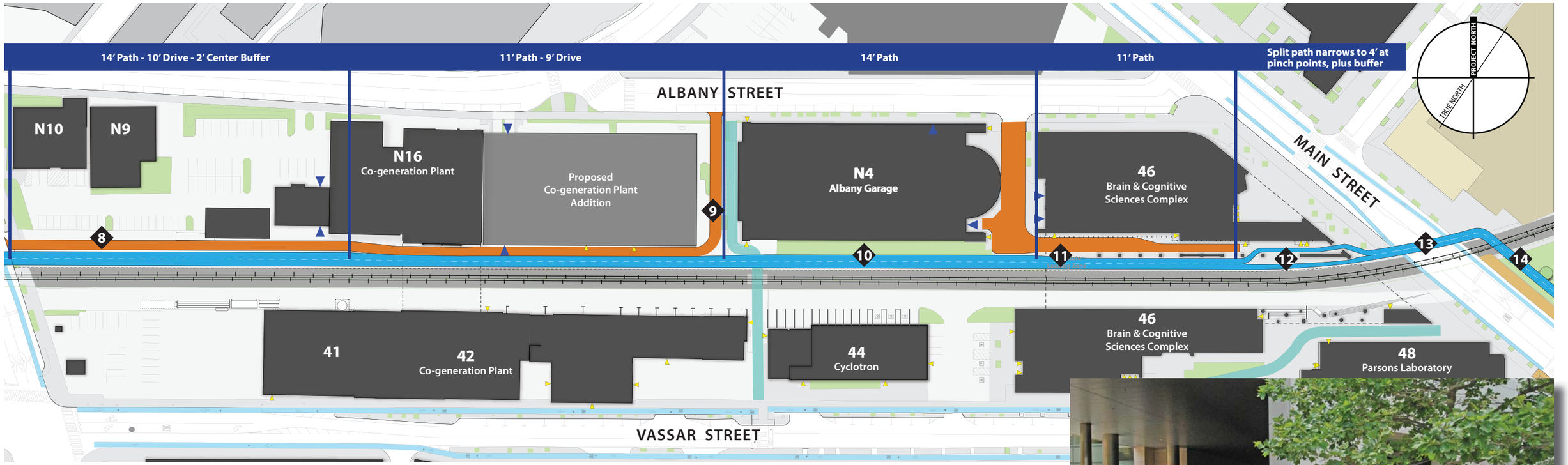
4. The one-story addition to Building NW14 constricts the corridor requiring the use of the minimal side-by-side cross section configuration of 23 feet.

5. The available width of the corridor along the fence adjacent to Buildings NW12 and NW13 is approximately 24 feet and can accommodate a side-by-side configuration.

6. Adjacent to the 158 Mass Ave lot, the path and service drive widen to fit the 26-foot configuration approaching Mass Ave. The parking use on this site permits some flexibility but a future building here would establish a hard boundary. A path would be accommodated in any building design.

7. The path crosses Mass Ave adjacent to the tracks. Traffic signals for this crossing would be coordinated with those at Albany Street and Vassar Street. See Page 11 for a more detailed discussion of the crossing.

8. Immediately east of Mass Ave there is enough width for a side-by-side drive and path with a buffer between them. Future development of this prime site is likely and the buffer area could be adjusted to accommodate a row of columns similar to the configuration under the Brain &



Cog Building at the eastern end of the block. At the co-generation plant, adjacent to Building N16, the available space narrows to approximately 23 feet and continues along the proposed plant addition at a width of approximately 24 feet.

9 The service drive would enter the corridor from Albany Street between the co-generation plant addition and the Albany Street Garage. The service drive would run parallel to a pedestrian and bicycle path that crosses the tracks at this location, connecting Albany Street and Vassar Street. This space provides an opportunity for a future plaza or open space area connecting to the path—particularly if Building 44 is redeveloped and additional space on the south side of the tracks becomes available as well.

10 Adjacent to the Albany Street Garage there is no service drive today and none is currently proposed for future conditions. Although this area is currently under construction for utility work, it was the location of a community garden and that use can be accommodated in the future with a path, as long as there is no service drive in the area.

11 At the south end of the entry drive to the garage and loading docks for the Brain and Cog Building there are spaces for 15-minute convenience parking for delivery vehicles and these will need to be relocated.

12 Under the Brain and Cog Building the path stays between the building columns and the fence running along the edge of the track easement. The path splits into separate eastbound and westbound lanes for approximately 150 feet near Main Street in order to enter and exit through the openings at the building edge. The path then comes together again before crossing Main Street.

13 The path crosses Main Street on the north side of the tracks and signalization is coordinated with the intersection at Main Street and Vassar Street. See Page 11 for a more detailed discussion of the crossing.

14 East of Main Street the path turns southward to connect with a planned off-street path along the north side of Galileo Galilei Way. The exact location of this path on the east side of Main Street needs to be studied further to avoid conflicts with the existing steam line access hatches.

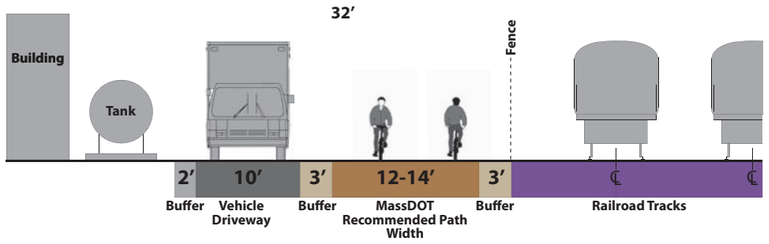
The preferred option between Mass Ave and Pacific Street is predicated on the use of a portion of the MassDOT easement. While this appears to have no impact on the rail operation—and, in fact, would be the same condition that exists east of Mass Ave—a confirmation from MassDOT would be necessary before an actual design is developed. If the use of the easement is not possible, the path and service drive would overlap continuously along the entire length of this segment and would be treated as a shared street. A fence would be constructed between the path and the rail operating envelope west of Mass Ave, similar to what already exists east of Mass Ave.

The narrow opening under the Brain & Cognitive Sciences Complex require the path to split into a one-way pair

Typical Cross Sections

To understand how space in the corridor is allocated at different locations with various widths, cross sections of typical conditions were drawn. These are described below.

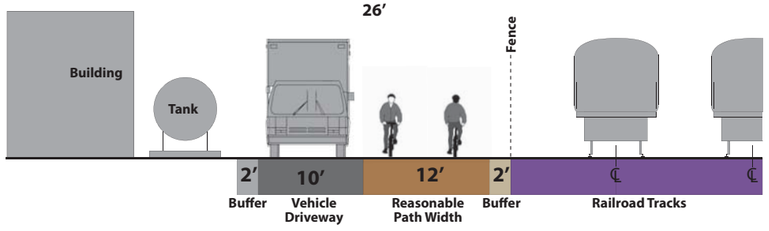
Recommended MassDOT multi-use path plus service drive



MassDOT recommends a 12 to 14-foot wide multi-use path with 3-foot buffers on either side clear of any vertical obstructions. A 12 to 14-foot width path provides enough space for two bicycles to travel in opposite directions with a third bicycle passing one or the other. This width also provides bicyclists space to pass walkers and provides room for in-line skaters who need more room for side-to-side movement. The width is not necessary because of a high volume of users but rather to accommodate users moving at different speeds.

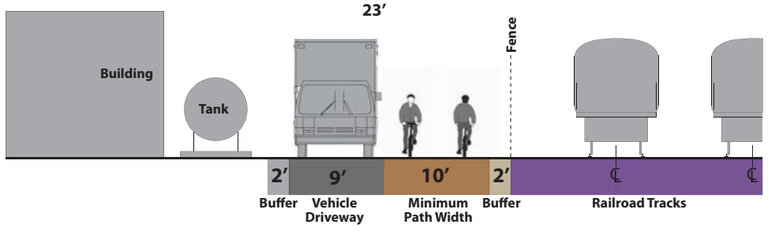
A one-way service drive would run next to the multi-use path with the drive aligned against the path going in the same direction. The service drive would be ten feet wide with a two foot buffer where it is adjacent to buildings, gas storage tanks, or other obstructions. The combined width for this cross-section is 32 feet. There are limited locations in the corridor that can accommodate this cross-section.

Typical width multi-use path plus service drive



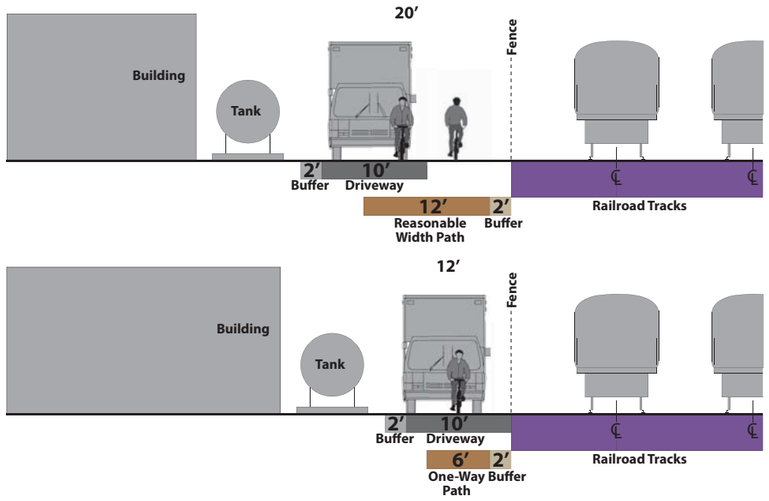
A more reasonable width for a multi-use path with a service drive that meets the constraints of this portion of the Grand Junction Corridor is 26 feet. This would be composed of a 12-foot multi-use path with a 2-foot buffer along a fence separating the rail easement. There would be no buffer between the path and the service drive and the service drive would remain at 10 feet wide with a 2-foot buffer against the buildings.

Minimal side-by-side cross section



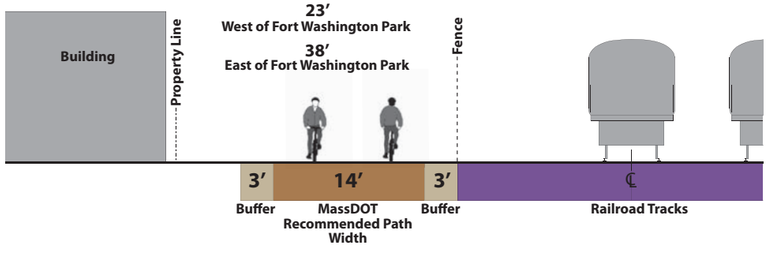
At many locations in the corridor the width falls below 26 feet to 23 or 24 feet. Rather than have the service drive overlapping the multi-use path, a narrower cross section was developed for these locations. A viable cross section can be as narrow as 23 feet and would consist of a 2-foot buffer along the rail fence, a 10-foot multi-use path, a 9-foot service drive and a 2-foot buffer.

Overlapping cross sections



Once the available width falls below 23 feet, the service drive overlaps with the multi-use path. In the preferred option this condition only occurs in one location at Pacific Street for approximately 100 feet. This pinch point can be treated as a shared street. There are precedents for mixing slow-moving vehicles with bicycles and pedestrians, although it is a less desirable condition. The Pacific Street alley, directly adjacent to this location, is currently shared by service vehicles, bicycles and pedestrians.

Cross Section at MassDOT owned segment



West of Pacific Street, the existing conditions within the corridor change, permitting a wider path section. The buildings along this segment are not serviced from the rail corridor and are not expected to be in the future, so there is no need to provide a service drive. Any access required to service the path or its components will occur on the path itself. Also, the corridor widens slightly as there used to be two or three sidings on the north side of the mainline track. While some sections of these sidings remain, most have been removed. As a result, the MassDOT recommended section of 12 to 14 feet for the path (two 6 to 7 foot lanes) plus 3 foot wide buffers on both sides can be accommodated to approximately Henry Street. Beyond that location, the current conditions of track alignment, edge uses, and property ownership narrow the available corridor so that a multi-use pathway cannot be accommodated.

Volumes for Service Vehicles, Bicycles, and Pedestrians

Space available in the corridor is one factor for the feasibility of a multi-use path in the corridor. Another is the anticipated volume of users. Based on interviews with MIT personnel, we can estimate the number of service vehicles expected on the corridor. This varies by corridor segment and is a relatively low number, averaging about one vehicle per hour during the normal work day. On weekends, the volume of service vehicles is minimal.

Pacific to Mass Ave	8 – 12 per day
Mass Ave to Main Street (on the south side)	6 – 10 per day
Mass Ave to Main Street (on the north side)	6 – 8 per day

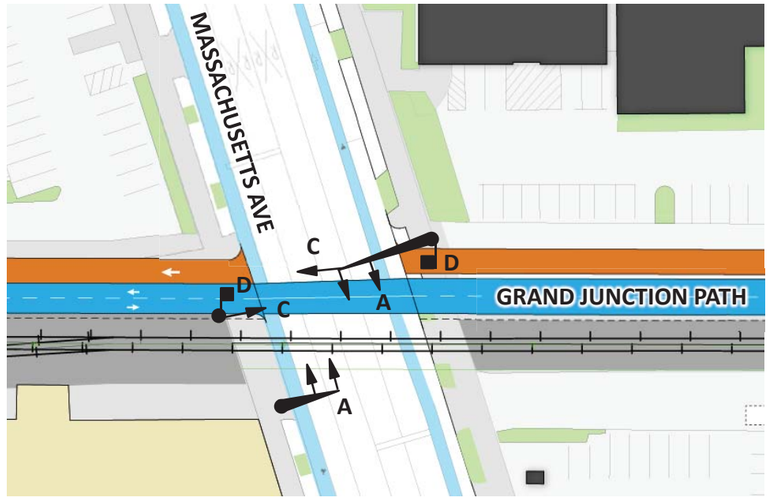
Expected bicycle volumes are difficult to assess since they would include a significant number of regional trips that are not possible along the corridor today. As a reasonable estimate, the peak hour volumes for bicycles on Vassar Street were used.

Peak Hour Trips	East Bound	West Bound	Combined Total	Bicycles per Minute
West of Mass Ave	71	33	104	1.7
East of Mass Ave	275	188	463	7.7

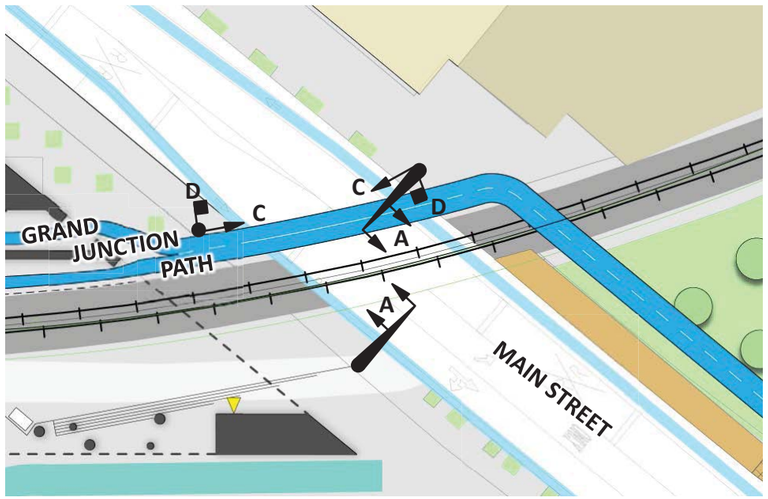
Because the Grand Junction Corridor will be a recreational route as well as a commuter route, heavy use on weekends should be expected. Based on the Boston Region MPO Bicycle/Pedestrian Count Database, sample volumes on other regional facilities are shown below.

Facility	Weekday 7-9 AM	Weekday 5-7 PM	Weekend Noon-2 PM
Southwest Corridor @ Heath Street (Weekday 09/13/2012 & Weekend 09/15/2012)	443	550	175
Minuteman @ Lexington Center (Weekday 05/07/2014 & Weekend 05/10/2014)	195	188	232

Expected pedestrian volumes are more difficult to assess. To the casual pedestrian, few destinations may be directly accessible along the Grand Junction, in which case adjacent streets may be preferred. However, the Grand Junction path may be expected to be the path of choice for runners and other recreational users because of its flow and safety from neighboring traffic. The anticipated low volumes of vehicles will minimize friction with bicyclists and pedestrians.



Proposed signal placement on Massachusetts Avenue



Proposed signal placement on Main Street

Signalized intersections in and around the study area

Crossings at Massachusetts Avenue and Main Street

The addition of the multi-use path crossings at Massachusetts Avenue and Main Street will create a complex signalization to provide a safe method of allowing pedestrians and bicyclists to cross these busy urban streets at mid-block locations while minimizing delay for all users. As part of this feasibility study, several different options were investigated to provide the crossings based on different approaches to the signal timing and coordination between the multi-use path signals and the vehicular signals for the adjacent intersections.

The following alternatives outline the different approaches that were considered related to signal timing, phasing, and overall operation; some of these may be used in combination:

1. Added signal for crossing

The simplest solution would be to insert a pre-timed signal within the existing 90-second cycle length and provide minor timing adjustments to the adjacent existing traffic signals.

Pros: Very good thru coordination and queue management for vehicles.

Cons: Delay incurred by the path users similar to that of a regular crossing without actuation.

2. Pathway Signal Detection

One way to limit the delay incurred by path users would be to provide detection for the path crossing phase. Signal detection would stop vehicular traffic on Massachusetts Avenue or Main Street when activated.

Pros: Potentially reduce waiting times for pedestrians and bicyclists to cross (depending on operational and timing strategies).

Cons: Frequent detection of the path crossing phase would more rapidly and significantly impact vehicular operations along Massachusetts Avenue or Main Street, potentially resulting in vehicle queue spillback into the adjacent intersections. The City of Cambridge has expressed that the implementation of detection on the path is not currently preferred.

3. Half-Cycle Length for Path Crossing

Providing a 45-second cycle at the proposed path crossing signals at Main Street and Massachusetts Avenue – which is half of the 90-second cycle currently in place – allows for the continued use of coordinated, pre-timed traffic signals under existing operational conditions.

Pros: Limits the delay incurred by the path users. Minimal impact to Main Street vehicular operations.

Cons: Potential for vehicular queues to exceed the storage available along Massachusetts Avenue. The City of Cambridge has expressed that the implementation of a shortened cycle is not currently preferred.

4. Shortened System Cycle Length

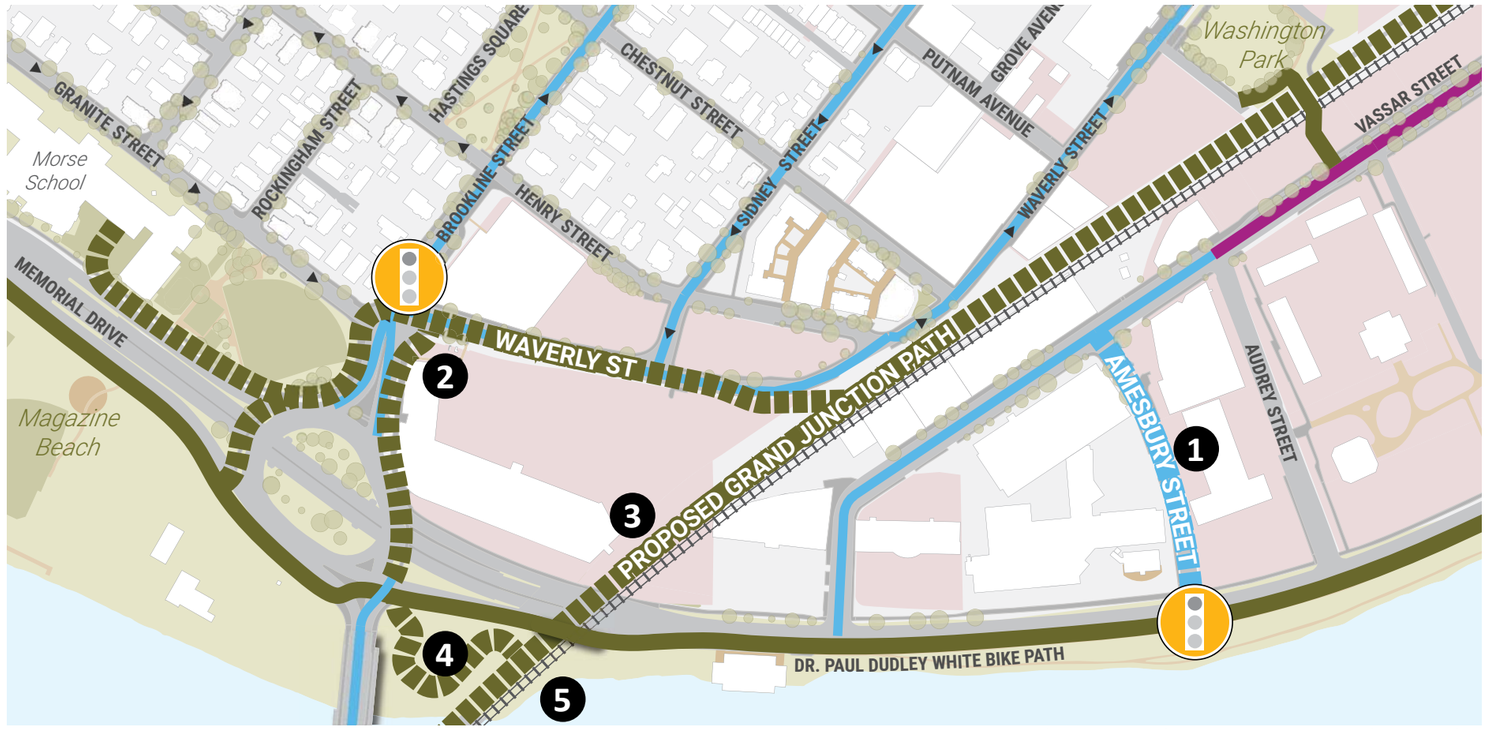
The use of a uniform, shortened cycle length allows the traffic signals at the path crossings and adjacent intersections to the path crossings to be pre-timed and placed in coordination.

Pros: Provides the most efficient operations for vehicular traffic along Main Street and Massachusetts Avenue, while minimizing delay to path users.

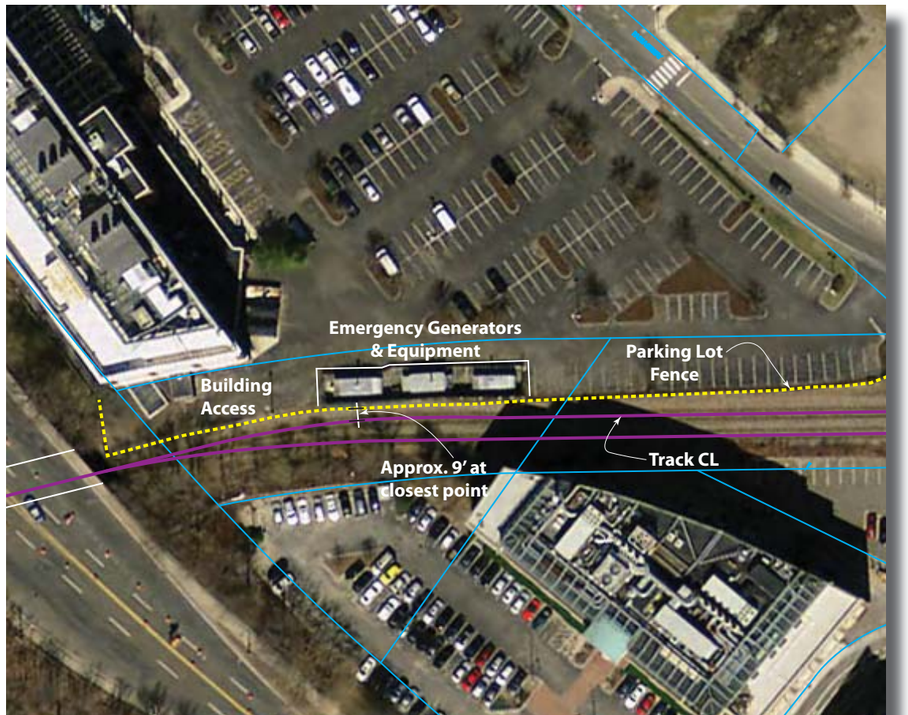
Cons: Up to twenty nearby traffic signals in the area are pre-timed and coordinated with the traffic signals adjacent to the proposed path crossing and would need to be re-timed to work with the path crossings and adjacent signals. The City of Cambridge has expressed that the implementation of a shortened cycle is not currently preferred.

The two path crossings at Massachusetts Avenue and Main Street can be signalized to allow for safe and efficient operations for all roadway and path users. Although the intersections along Massachusetts Avenue and Main Street are closely spaced, it will be possible to successfully signalize the Grand Junction path crossings. Coordination with the City of Cambridge will be necessary to allow the path crossing signals to work in conjunction with adjacent existing signals and railroad crossings. In addition to the installation of two new signals at the path crossings, signal equipment upgrades (such as signal heads, signal controllers and railroad gates), timing adjustments, and revised pavement markings may be necessary to accommodate operational changes resulting from the introduction of bicycle and pedestrian traffic along the Grand Junction path.

The signalization of the Grand Junction path crossings at Main Street and Massachusetts Avenue would be feasible with close coordination of signal phasing and timing with the adjacent signals. The proposed traffic signals should be installed to provide clear indications to vehicles at each of the signalized intersections along Massachusetts Avenue and Main Street. This is especially important within the study area due to the close proximity of the signalized intersections and the presence of the existing railroad crossings. Ensuring that traffic signal heads and warning devices are placed appropriately within the “cone of vision” described in the Manual on Uniform Traffic Control Devices (MUTCD) for each intersection approach will help provide clear and definitive direction and guidance to vehicles traveling along these roadways. Should the Grand Junction Path progress to the next level of design, items such as coordination with existing railroad pre-emption, impacts to potential future transit service, and traffic signal layout will need to be explored in greater detail prior to implementation. However, installation of traffic signal equipment for the vehicular movements at the Grand Junction path crossings is considered to be feasible and is depicted in the layout plans above.



Grand Junction path routing options near the BU Bridge



Constrained conditions adjacent to 640 Memorial Drive

Connections westward to the BU Bridge, Dr. Paul Dudley White Bike Path, and Allston/Brighton

The Grand Junction Path, when complete, has the potential to serve a large regional bicycle and pedestrian network, connecting existing and future multi-use paths. Connections to the west of the MIT-owned section of the proposed path would link the BU Bridge, the Dr. Paul Dudley White Bike Path, and the neighborhoods of Allston/Brighton.

With the proposed Grand Junction path running along the northern side of the existing railroad tracks, there are several routing opportunities for various destinations. These connections should be direct and convenient for all path users. In addition, they should maintain a low stress level and separation from vehicular traffic in order to appeal to a variety of users.

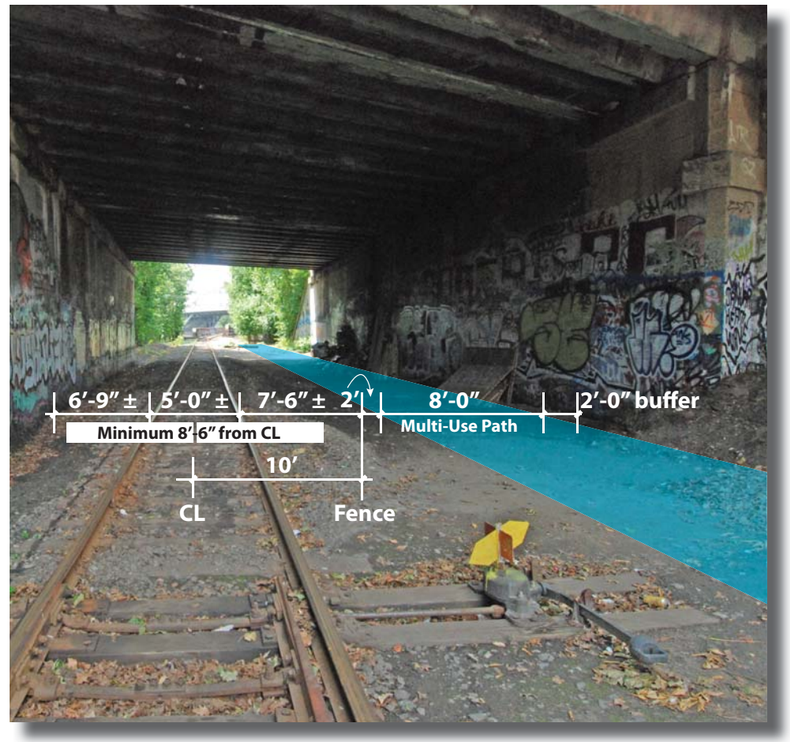
1 Amesbury Street. To connect to the Dr. Paul Dudley White Bike Path and points east, multi-use path users may utilize the existing rail crossing at Fort Washington Park to access the Vassar Street bicycle facilities and Amesbury Street. Amesbury Street offers a low-stress connection to the Dr. Paul Dudley White Bike Path (due to low traffic volumes) but will require an additional crossing on Vassar Street. Since the intersection of Amesbury Street and Memorial Drive is signalized, multi-use path users can safely cross Memorial Drive and access the Dr. Paul Dudley White Bike Path at this location.

2 Waverly Street/BU Bridge Rotary. Waverly Street and the BU Bridge Rotary provides access to the Dr. Paul Dudley White Bike Path and points west as well as to the BU Bridge. Improvements are necessary to provide a low stress connection along Waverly Street and through the BU Bridge Rotary. See the following page for details.

3 Memorial Drive Underpass. Insufficient space between the railroad tracks and the parcel line for the building at 640 Memorial Drive along with fixed generator structures present obstacles for path continuation here. Further analysis is necessary to determine if there are potential feasible solutions to this constraint. Southward, sufficient space exists to continue the path through the existing tunnel under Memorial Drive, assuming the single track configuration remains.

4 BU Bridge to Rail Bridge. For additional connectivity, a multi-use path connecting the BU Bridge approach to the rail bridge over the Charles River would provide more direct routes for path users. Due to the steep grade difference just east of the BU Bridge, further analysis is necessary to determine if a path connector is feasible.

5 Rail Bridge over the Charles River. Providing a route across the Charles River along the existing rail bridge is necessary to provide the only low stress, vehicle-separated river crossing in the vicinity. Improvements to the rail bridge would be necessary such as the use of a cantilevered path structure.



Potential location for a second track, which would not allow a path without major reconstruction.

Potential Improvements to Waverly Street and the BU Bridge Rotary

Connecting to and through the BU Bridge rotary is an important desire line for Grand Junction path users. Although outside the primary scope for the MIT-owned section of this feasibility study, the team reviewed potential improvements to provide this critical connection. Using existing City of Cambridge roadway data and aerial photos, the team prepared planning-level conceptual designs, as shown here, to continue a low-stress path connection using Waverly Street and the BU Bridge rotary. No survey, field verification, right-of-way data, or utility information were used to develop these conceptual designs. Further design is necessary including traffic analysis. The following potential improvements along Waverly Street and within the BU Bridge rotary may provide a low-stress multi-use path connection to the BU Bridge rotary, the Dr. Paul Dudley White Bike Path, the BU Bridge, and points west.

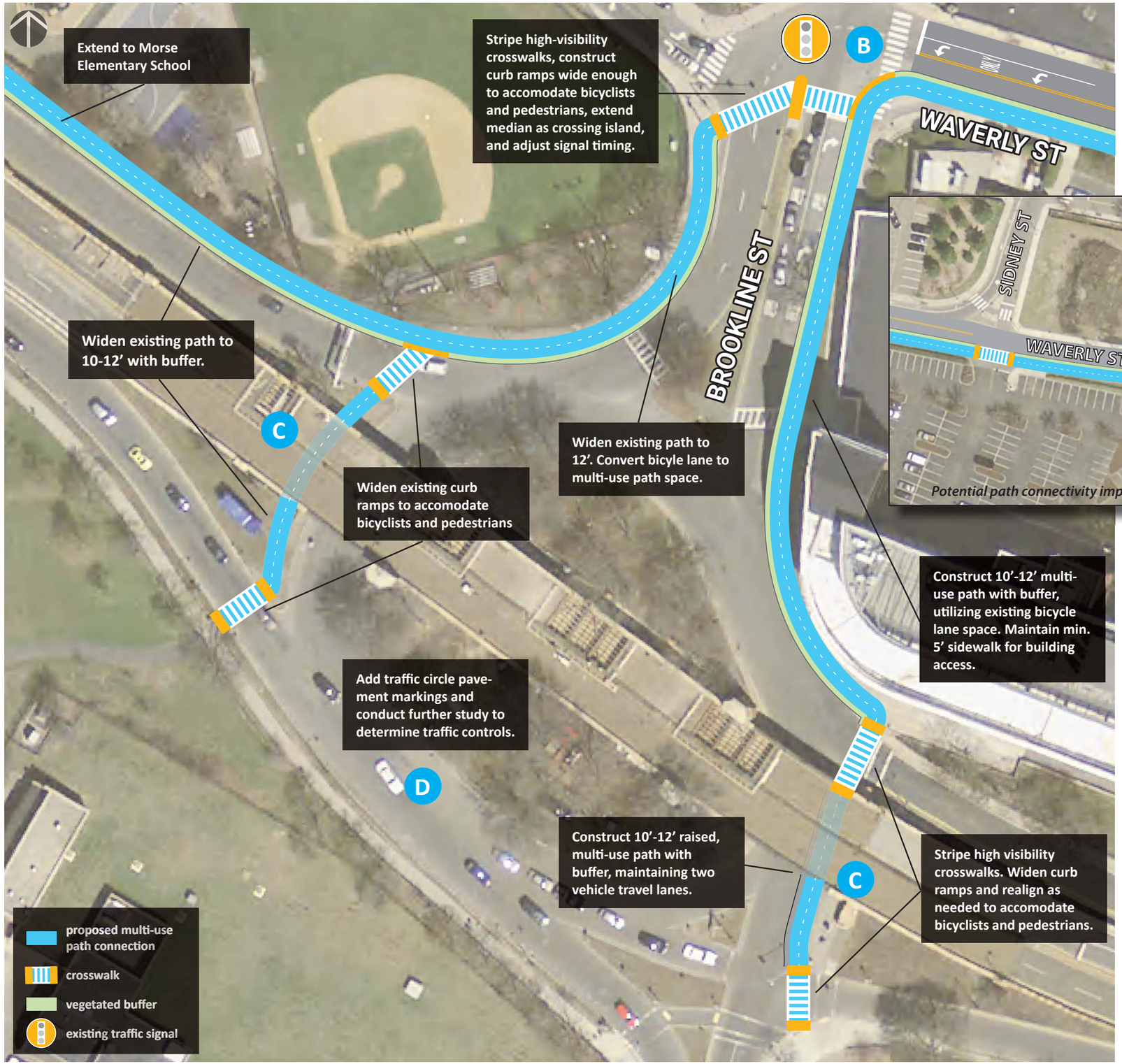
Potential path connectivity improvements on Waverly Street

A A multi-use path is proposed along the southern edge of Waverly Street connecting to the Grand Junction Path through the vegetated area between Waverly Street and the rail corridor. Space for a multi-use path on Waverly Street may be obtained from the existing bicycle lanes and roadway reconfiguration. The adjacent privately-owned parking lot may require reconfiguration and closure of one of the entrances and exits.

B At the intersection with Brookline Street, the proposed multi-use path would turn left adjacent to 640 Memorial Drive and continue south to the BU Bridge rotary. A crossing of Brookline Street with curb ramps and pavement markings may be provided to connect to the western side of the BU Bridge rotary and to the Morse Elementary School. Signal modifications and relocation of street furniture may be required.

C Multi-use paths are recommended on both the east and west sides of the BU Bridge rotary to provide connectivity from all directions. Space for a multi-use path on the east side can be obtained from the excess pavement without affecting existing traffic patterns. This raised multi-use path will improve existing sight distance issues between path users and motorists entering the rotary from the east due to the location of abutments. This may require modifications to drainage structures and relocation of street furniture including traffic signals. The existing path on the west side of the rotary should be widened to accommodate bicyclists and pedestrians. Curb ramps and crosswalks wide enough to accommodate bicyclists and pedestrians should be provided for both multi-use paths.

D Pavement markings within the rotary should be installed in order to increase predictability for all users and to decrease vehicular weaving. Further analysis should be conducted to determine the appropriate traffic controls for vehicles entering the rotary.



Proposed path connectivity improvements at the BU Bridge Rotary

Analysis of Vassar Street

As part of this feasibility study, the existing bicycle and pedestrian facilities along Vassar Street were reviewed for potential improvements and compliance with the latest standards and guidelines. The review of Vassar Street facilities was conducted as an independent task and the outcome had no impact on determining the feasibility of the Grand Junction Path.

In discussions with the Advisory Committee, it was suggested that Vassar Street continue to serve as a local bicycle connection and that the Grand Junction Path serve as a regional connection. However, Vassar Street bicycle facilities provide the potential for short term detours during future construction along the Grand Junction corridor. Temporary improvements along Vassar Street, such as crosswalks and curb ramps, would be necessary to detour bicyclists during construction projects.

Vassar Street is a two-way roadway that operates between Main Street and Memorial Drive. Typically within the right-of-way of this urban minor arterial there are two vehicular travel lanes, two one-way bicycle facilities, on-street parking on one side, and sidewalks on both sides of the roadway. The bicycle facilities provided along the corridor are either on-street bicycle lanes or a sidewalk-level one-way cycle track. The on-street bicycle lanes are typically provided at intersections and in the constrained section between Audrey Street and Memorial Drive. The remaining sections contain a sidewalk-level one-way cycle track. The sidewalk-level cycle track is an asphalt surface while the adjacent sidewalk is pavers, as shown above. Bicycle ramps are provided to transition bicyclists to and from on-street bicycle lanes and cycle tracks.

Short-term Recommendations (signs, pavement markings)

- Provide roadway crossing and curb cut at Pacific Street where railroad crossing was recently constructed
- Replace existing signage to conform to MUTCD standards
- Install warning signs at mid-block crosswalks
- Install wayfinding signage to define user separation
- Relocate signs to improve visibility
- Reinstall bicycle symbols and pavement markings
- Add yield markings at pedestrian crosswalks
- Change surface color to green
- Add yield lines and ‘Yield to Bikes” signs at driveways
- Add bicycle queue boxes at Main St. and Massachusetts Ave. intersections
- Reset utility covers within bicycle facilities where not flush with surface
- Restrict parking approximately 10-30 feet at driveways to increase visibility

Long-term Recommendations (construction necessary)

- Reconstruct bicycle lanes to cycle track at Main Street intersection
- Extend cycle track to Memorial Drive
- Revise grading to eliminate water ponding
- Install warning signs and beacons at adjacent garages

Examples of wayfinding and modal guidance treatments

South Street Seaport Cycle Track, New York, NY

Indianapolis Cultural Trail, Indianapolis, IN

Amsterdam, NL

Next Steps

The Grand Junction Corridor (GJC) is a complex area with numerous owners and abutters providing a range of activities. While this study focuses on the MIT-owned segments of the corridor, understanding the feasibility of incorporating a multi-use path along its entire length requires a cooperative effort between MassDOT, the City of Cambridge, MIT, DCR, and affected abutters. This effort would most logically be led by the City of Cambridge, although many of the issues to resolve fall within the purview of MassDOT. The varied ownership and potentially competing uses for the corridor necessitates a cooperative approach to exploring the feasibility of each of the segments which make up the corridor as well as its overall design and operation.

Decisions about the following key physical design and policy issues will affect the viability and connectivity of the Grand Junction Corridor path. Additionally, establishing a timetable for feasibility studies, design and funding for any proposed improvements to a particular segment will help to determine the best plan for overall implementation. The concept for the corridor is to build segments incrementally as funding is identified, land becomes available, and technical and policy issues are resolved, with the long term goal of connecting all segments and creating regional connections. The following issues are organized geographically, west to east, and not ordered by priority.

Connections to Allston/Turnpike Path The Allston Yards is the desired western destination for the Grand Junction Corridor path. Planning for redevelopment of that area is currently underway and includes new circulation paths for all modes; proposed connections to BU's western campus and Harvard's Allston campus near Cambridge Street; the creation of a West Station for commuter rail service; and a possible realignment of Soldiers Field Road to create more open space along the Charles River. The connection between the Allston Yards and the Grand Junction Railroad Bridge is referred to as the Turnpike Path. The design of bicycle or multi-use paths along the rail line in this area is part of the current planning effort and should be coordinated with an overall Grand Junction Corridor plan—particularly in terms of schedule.

Grand Junction Railroad Bridge Two concepts for using the bridge as part of the path are the conversion of the unused western (upstream) portion of the bridge into a multi-use path, or constructing a path against the western (upstream) side of the bridge by either cantilevering a structure off the bridge or extending the bridge foundations to support a path. The technical feasibility and cost of these, or other, concepts need to be evaluated to determine the best alternative for this segment. If a two-track transit operation was initiated in the corridor, both sides of the bridge would be needed for transit vehicles. Additionally, the railroad bridge is elevated as it crosses Soldiers Field Road and connections to the Paul Dudley White Path need to be investigated.

Improvements at BU Bridge Rotary and Waverly Street Connections between the Grand Junction Corridor, BU Bridge and the Paul Dudley White Path are critical to enhancing network connectivity but are hampered by the steep topography and the BU Bridge rotary and overpass. Suggestions for improvements to the area are included in this feasibility study and others have been proposed in the past. Depending on whether the tunnel under Memorial Drive can provide a connection along the GJC, these additional connections become critical. If a GJC path cannot connect to the river then a path along Waverly Street is the most viable alternate route. Even if a GJC path can connect to the river, the Waverly Street route adds additional connectivity to the overall network. This concept is show on page 12, but further analysis is needed to understand the impacts to MIT property and Cambridge city streets. Additionally, the Department of Conservation and Recreation (DCR) controls Memorial Drive, including the rotary, and the adjacent open space along the Charles River, and needs to be a partner in the overall corridor planning.

Tunnel Under Memorial Drive The existing rail tunnel is slightly over 31 feet wide with one rail line on the east side. An 8-foot path with 2-foot buffers can fit next to the existing track and maintain a 10-foot offset from the centerline. If a second track is required for future transit service there would not be room for a multi-use path without major reconstruction. Memorial Drive is owned by the DCR and any potential widening of the tunnel to accommodate both a second track and a multi-use path would need to be coordinated with both DCR and MassDOT.

640 Memorial Drive There is not enough space between the track and the parking lot serving 640 Memorial Drive for a multi-use path. Emergency generators and other equipment are located at the edge of the parking lot next to the tracks. These are fixed items with underground connections to the building and are critical to the building's function. Relocation of this equipment and parking spaces would be difficult and expensive. The parking lot is on MIT property and is part of a long-term building lease. A reconfiguration of the track is another possibility but that would require a detailed study in order to determine its feasibility and cost. Until space for a path at this location can be resolved, a route along Waverly Street to the BU Bridge and Paul Dudley White (PDW) Path appears to be the most viable short-term solution.

Proposed Crossing at Amesbury Street Amesbury Street provides a connection between the PDW Path and the Vassar Street cycle track and aligns with a signalized intersection on Memorial Drive. The current Vassar Street cycle track which runs parallel to the GJC will remain, providing local connections as well as providing an alternate route when segments of the corridor are closed for construction or maintenance of adjacent MIT buildings or utilities. The segment of the PDW Path between the BU Bridge and the BU Boathouse is a narrow sidewalk along Memorial Drive—a less than ideal facility for two-way bicycle and pedestrian travel. An alternative route, at least for less-experienced bicyclists, would go from the Cambridge end of the BU Bridge, under the Reid Overpass to Waverly Street, cross the tracks at Fort Washington Park, then down Amesbury Street and back to the PDW Path. While significantly longer, it may be an attractive route for casual recreational bicyclists or families riding with children.

Connections to Somerville Community Path The inclusion of the Somerville Community Path as part of the Green Line Extension (GLX) project provides an excellent opportunity for regional connectivity. How this path will connect to the Grand Junction Path is unresolved. Several options between Gore Street and the Community Path have been proposed but a technical study needs to be undertaken to access the viability.

Future Transit Service in the Corridor The largest unknown in the corridor is a physical feature as well as a planning and policy decision by MassDOT regarding future transit use. The state's goal is to maintain options and, until a decision is made, this unknown makes it difficult to understand transit needs and any potential impacts to the path. DMUs are being considered for transit service in the corridor with a goal of running at 15-minute headways. Optimally, this service would run on two tracks. However, the majority of the corridor is currently a single track and there is limited space for adding the second track. Additionally, station locations have not been determined. The feasibility of DMUs, or other transit service, in the corridor needs to be analyzed in detail to understand the requirements for service headways and if two tracks are needed throughout, the size and location of platforms, and requirements for crossings at Mass Ave and Main Street.

MassDOT Easement The proposed path configuration west of Mass Ave is dependent on the use of the outer six feet of the rail easement. While this appears to have no impact on rail operations and would mirror the conditions east of Mass Ave, a determination must be made and approval given by MassDOT.

Funding Funding for land acquisition, design, construction, and maintenance must be identified. With the cooperation of affected government agencies, land in the public realm could likely be made available for the path. However, acquisition of an easement or rights to use the MIT-owned portion of the corridor will need to be negotiated and assure MIT's ability to operate in the corridor. Although funding for design and construction would be a one-time cost, maintenance costs would be ongoing.

Operations & Maintenance Operation and maintenance for the Grand Junction Corridor will need to be a cooperative effort among owners and may be approached geographically or by task. Operation and maintenance issues to be addressed include: snow removal, police patrols, repair of pavement, maintenance of lighting and fencing, and litter collection.

Liability In light of existing physical challenges, potential limitations of statutory protections, development impediments, and risk and safety considerations posed by this multi-use rails with trails path, MIT has realistic concerns and would need to understand the apportionment of responsibility and risk associated with design, construction, maintenance, snow & ice removal, security, relocation of existing obstructions or hazards, etc., among the interested parties in considering the City's project further.

To move this project ahead, it is strongly recommended that a task force be formed that is led by the City of Cambridge and includes representatives from MIT, MassDOT, DCR, abutters, advocacy groups, and other stakeholders.

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