



Improving the
Southeast Expressway:
A Conceptual Plan

About the Cover Photo

The photo on the cover of this report was taken on December 17, 2010, around 8:00 AM. The view is from the Savin Hill Avenue overpass and looks almost directly south. This overpass is shown in Figure 3-3 of the report, and the field of view includes land shown in Figure 3-2.

At the right is the recently completed headhouse of the Savin Hill Red Line station. Stopped at the station platform is an inbound Red Line train that started at Ashmont and will travel to Alewife. The station is fully ADA-compliant, and the plan presented in this report requires no modification to this station.

Next to the Red Line train is an inbound train from one of the three Old Colony commuter rail branches. There is only one track at this location, as is the case throughout most of the Old Colony system. This train has a mixed consist of single-level and bi-level coaches, and is being pushed by a diesel locomotive, which is mostly hidden from view by the bi-level coaches.

Between the two trains is an underpass beneath the Ashmont branch of the Red Line. This had been a freight spur serving an industrial area on the west side of the Ashmont branch tracks. Sections A-2.3 and A-2.4 of this report present an approach to staging railroad reconstruction that utilizes the abandoned freight spur and underpass.

The two tracks to the left of the Old Colony tracks serve the Braintree Red Line branch. These tracks have their own platform at JFK/UMass Station, and then go non-stop to North Quincy. Because the Red Line uses an electrified third rail, the tracks are separated from the Old Colony tracks by a fence for the safety of commuter rail track workers. The fence at this point has a “zigzag” configuration, requiring a track worker to walk a few steps to find refuge from a passing train. This narrow track spacing does not conform to modern rail construction standards.

In the middle of the Southeast Expressway is the garage that houses the zipper machine that repositions the movable barrier in the southbound expressway lanes. At the time this photo was taken, the machine was resting in Braintree, having set up a fifth northbound lane leading to this point, which reduced the number of southbound lanes to only three. The heavy southbound congestion seen here is not the result of this morning peak-period southbound lane reduction. The message board sitting atop the zipper machine garage announces that there was an incident at Exit 8, Furnace Brook Parkway, in Quincy. Normally, three lanes are adequate in the southbound direction during the morning peak period.

At the far left of this photo is the merge area at the northern end of the zipper lane during the morning peak period. At this location, five lanes of traffic are trying to merge into four lanes, as shown in Figure 1-2. The plan in this report envisions moving this garage about 12 feet to the west, allowing five continuous lanes, and eliminating this forced merge. The proposed new garage location is shown in Figure 3-2.

Serenely presiding over the morning commute are the harbingers of 21st-century technology: a modern windmill and a cellphone tower. Yet tucked into the background is our durable 19th-century housing stock: the urban three-decker house.

Improving the Southeast Expressway

A CONCEPTUAL PLAN

Project Manager

Bill Kuttner

Project Principal

Karl Quackenbush

Engineering Support

Mark Abbott

Cartography

Ken Dumas

Mark Scannell

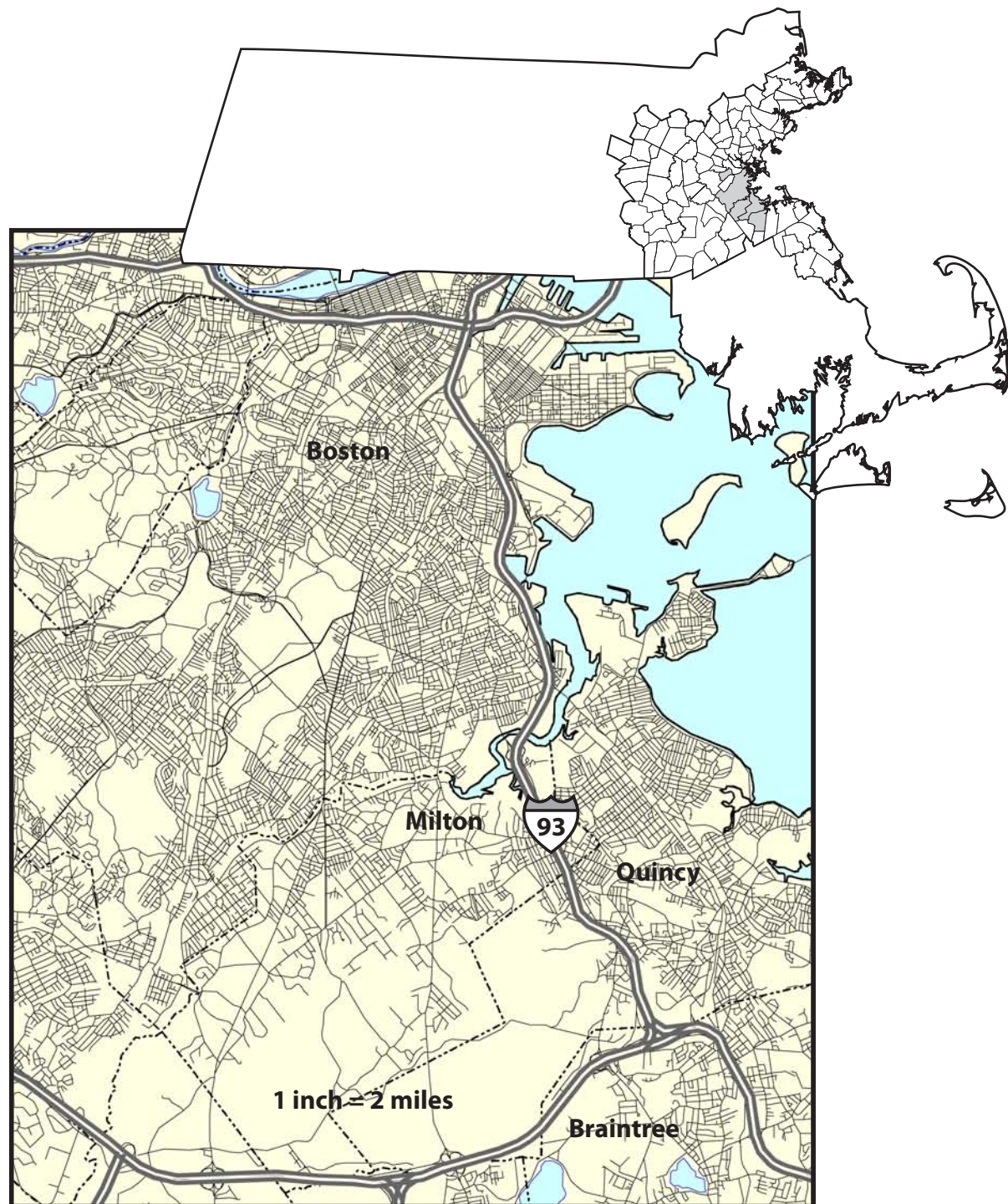
Graphics

Kim Noonan

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Central Transportation Planning Staff of the **Boston Region Metropolitan Planning Organization**. The MPO is composed of state and regional agencies and authorities, and local governments.

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To request additional copies of this document or copies in an accessible format, contact:

Central Transportation Planning Staff
State Transportation Building
Ten Park Plaza, Suite 2150
Boston, Massachusetts 02116

(617) 973-7100
(617) 973-8855 (fax)
(617) 973-7089 (TTY)

ctps@ctps.org
www.bostonmpo.org

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EXECUTIVE SUMMARY



S.1 BACKGROUND

The Southeast Expressway, a part of Interstate 93 (I-93), is the only limited-access highway entering Boston from the south. It was constructed in the 1950s as a six-lane highway, and in the 1980s the breakdown lanes were converted into travel lanes. In the 1990s, a movable barrier was implemented, allowing peak-period five-lane/three-lane configurations, with the fifth lane, referred to as the “zipper lane,” being reserved for vehicles with three or more occupants. This eight-lane highway was one of several regional expressways converging on and connecting with the severely congested Central Artery.

The Central Artery/Third Harbor Tunnel Project (CA/T project), constructed over a 10-year period starting in the mid-1990s, significantly increased north-south capacity on I-93. The CA/T project also added important new east-west connection options from the Massachusetts Turnpike Extension and Storrow Drive to the new Ted Williams Tunnel and the existing Sumner and Callahan tunnels.

Long-term increases in regional population and economic activity have increased traffic and congestion on regional highways. Furthermore, the CA/T project improvements have made I-93 a comparatively more attractive route than I-95 in the eyes of many drivers. For these reasons, between 2006, after the completion of the CA/T project, and 2010, a slowing of travel speeds and a lengthening of peak-period queues have been observed on the Southeast Expressway.

S.2 COMPLETING THE PREFERENTIAL LANE SYSTEM

The zipper lane began operations prior to major CA/T construction on the section of the Southeast Expressway between Braintree and just south of the Savin Hill

neighborhood in Boston, a distance of six miles. Given the constraints at that time, this was the maximum practicable extent over which the zipper lane could be implemented. The zipper lane has always been intended as a low-congestion express lane for preferred vehicles. Today’s use of the lane is limited to vehicles with two or more occupants.

As part of the CA/T project, a pair of dedicated lanes for high-occupancy vehicles (HOVs) was built in the median of the aboveground portion of the CA/T project south of the Turnpike Extension. These two lanes, one northbound and one southbound, extend as far south as the Massachusetts Avenue interchange, near southern limit of the CA/T project, about one mile.

This study describes how the two-mile gap between these two preferential lane systems, the zipper lane and the CA/T HOV lanes, might be connected to allow eligible vehicles to travel seamlessly the entire distance from the Braintree Split to downtown Boston. The study focuses on traffic, design, and construction issues, but leaves out a detailed discussion of eligibility. Referring to an envisioned future system as comprising “preferential lanes,” this report acknowledges the various eligibility options that a future operating agency would have: vehicle occupancy, ultra-low-emissions, payment of a toll, or other criteria.

S.3 DESIGN AND CONSTRUCTION ISSUES

This study describes in detail how a single, reversible lane could be built in a widened median of the Southeast Expressway between the Savin Hill area where the zipper lane ends to the South Bay area where the CA/T HOV lanes begin. Construction of this lane would require widening the highway right-of-way. Most required land could be obtained from other government agencies, but some would need to be taken from private landowners. Takings of any homes could be completely avoided, and takings of nonresidential structures could also, for the most part, be avoided.

The proposal in this study also includes addition of a fifth, auxiliary lane between the southbound Southampton Street on-ramp and the Columbia Road off-ramp, about one-half mile to the south. This lane would significantly reduce queues on a number of city streets waiting to enter the Southeast Expressway at Southampton Street. Traffic flows and system benefits of the reversible and auxiliary lanes are discussed in detail in this study.

Two alternatives to the proposed reversible lane are also briefly described. These are the extension of the zipper lane, and construction of the reversible lane on a viaduct.

Extension of the zipper lane could be a practical option. It would require building an operations area somewhere in the vicinity of South Bay, probably requiring some widening of the right-of-way. Another consideration is that the current zipper lane has no breakdown lane. This has been deemed acceptable in the current implementation, but the proposal in this study assumes that the reversible lane is wide enough to accommodate disabled vehicles, as well as any enforcement activities.

Constructing the reversible lane on a viaduct has also been considered as an option. The drawbacks are considered to be primarily aesthetic, but some construction economies could be possible. Issues of visual impact, and the design and construction of the viaduct, are briefly discussed in this report.

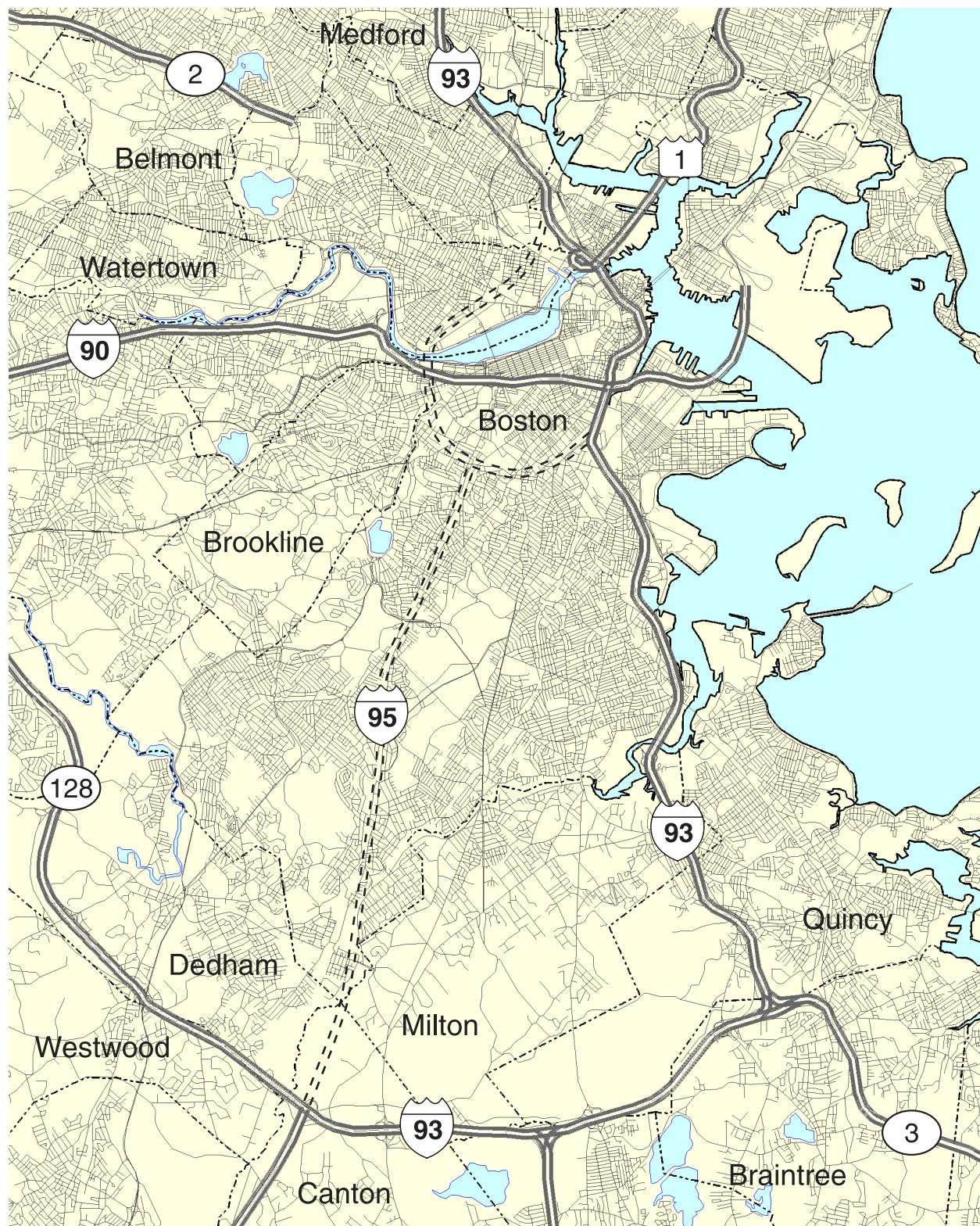
S.4 POTENTIAL TRANSIT IMPROVEMENTS

The proposal in this study would require placing three of the MBTA transit tracks at Savin Hill underground. These are the two tracks of the Braintree Red Line branch, and the one track on which all three of the Old Colony commuter rail lines are required to operate. The two tracks of the Ashmont Red Line branch would not require relocation at Savin Hill.

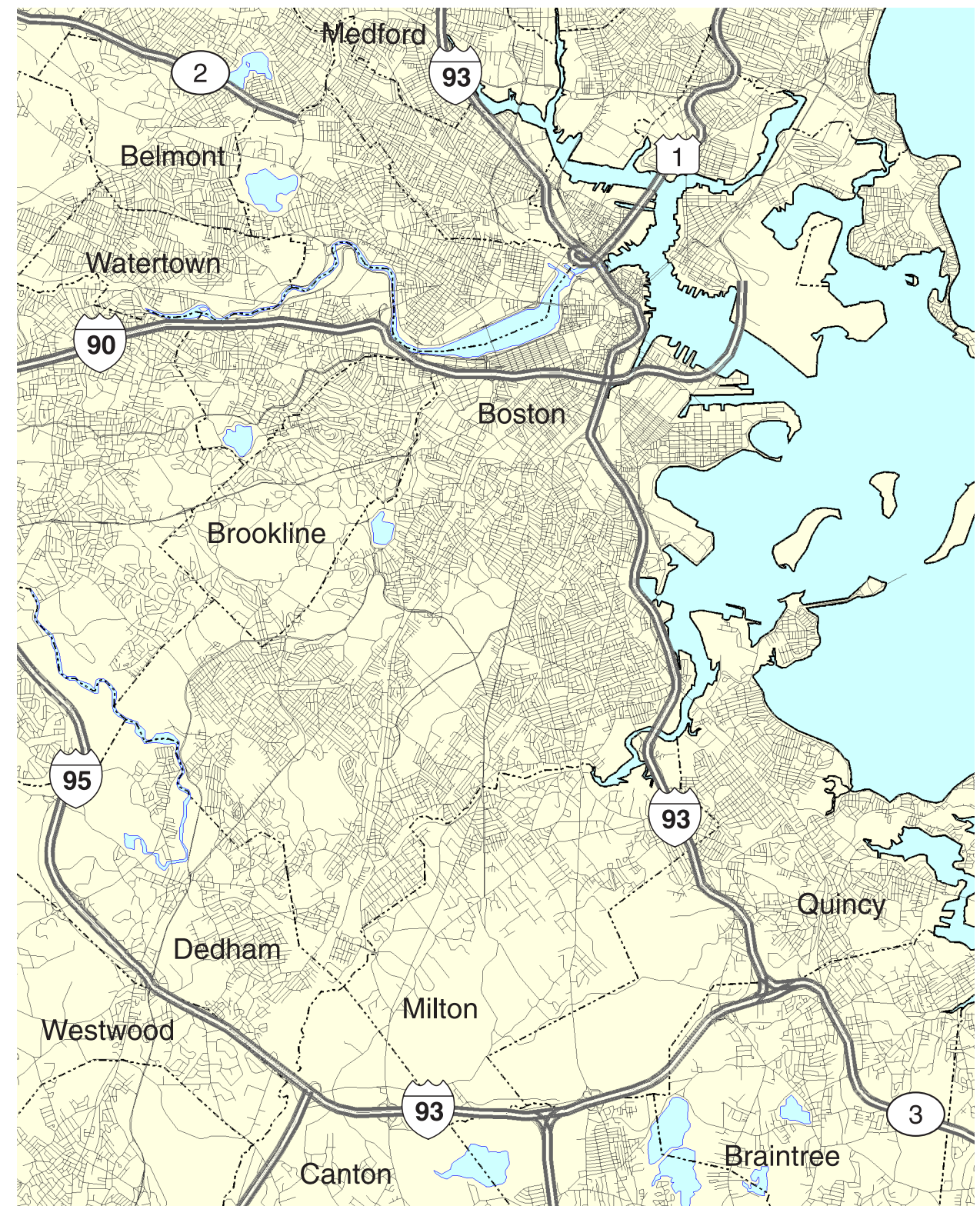
The need to build a tunnel for trains on the three Old Colony branches would present an opportunity to add a second track. Operating the three Old Colony Lines—Greenbush, Kingston/Plymouth, and Middleborough/Lakeville—over a single track hurts system reliability, and this study describes how an expanded double-track section of this line could be built in conjunction with the construction of the reversible lane.

The Red Line tracks approaching the JFK/UMass Station would also need to be rebuilt. The elimination of a noisy and unsightly flyover that was built in the 1960s for the Braintree branch is assumed.

There would also be an opportunity to reconstruct JFK/UMass Station so that all inbound service would use the same platform. The JFK/UMass Station area is considered a prime location for transit-oriented development, and construction of an optimally designed station could be considered in conjunction with redevelopment in the area around the station.



Cancelled Southwest Expressway and Inner Belt



Expressway System Today



CHAPTER 1



Background and Existing Conditions

1.1 THE SOUTHEAST EXPRESSWAY AND THE REGIONAL TRANSPORTATION SYSTEM

The Southeast Expressway was the first major limited-access highway built in Boston. It was completed in the 1950s and later connected with the mostly elevated John Fitzgerald Expressway, better known as the Central Artery. By the time the Central Artery was completed in the early 1960s, the Artery and Southeast Expressway had been incorporated into the federally sponsored Interstate highway system and designated Interstate 93 (I-93), a regional interstate connecting component.

It was envisioned that the completed Interstate system would include a second expressway entering Boston from the south. Interstate I-95 begins in Florida, passes through Providence, and by 1970 met Route 128, the metropolitan Boston beltway, near the meeting point of Westwood, Canton, and Dedham, west of the Blue Hills (see Figure 1-1).

As originally planned, I-95 would have continued directly into Boston utilizing what is still referred to as the Southwest Corridor. Near today's Ruggles Orange Line station, I-95 was to meet an inner beltway designated as I-695. I-95 would have followed today's Melnea Cass Boulevard and joined the Southeast Expressway at today's Massachusetts Avenue interchange.

Interstate I-695, known as the "Inner Belt," would have passed Back Bay to the west, crossed the Charles River near the BU (Boston University) Bridge, and joined I-93 in the Somerville industrial district still known as "Inner Belt." Indeed, ramp stubs that had been incorporated into the elevated I-93 structure in this area were later utilized to join I-93 with the Leverett Connector as part of the Central Artery/Tunnel (CA/T) project.

Opposition to construction of I-95 in the Southwest Corridor, the Inner Belt, as well as several other envisioned urban highways resulted in a wide-ranging transportation policy review in the early 1970s. Acceptance of most recommendations of the Boston Transportation Planning Review (BTPR) by the Sargent and the Dukakis administrations resulted in cancellation of both the Inner Belt and I-95 in the Southwest Corridor.

In the almost 40 years since the BTPR, the transportation system has adapted and been reshaped in a number of ways. Route 128 north of Canton was redesignated as I-95. The CA/T project added critical capacity in the system's core area, partly necessitated by the cancellation of the Inner Belt.

The Southwest Expressway was destined after the BTPR to be the only limited-access highway for traveling into Boston from the south. In light of this circumstance, a number of major transit improvements were envisioned by the BTPR, as well as by later planning efforts. The completion of the Red Line extension to Braintree, rebuilding of the Orange Line in the Southwest Corridor, lengthening of rapid transit trains to six cars, and an aggressive commuter rail improvement program made transit a viable alternative for a substantial number of trips from the south.

1.2 TRAFFIC GROWTH AND CAPACITY EXPANSION

In 1970, the earliest year for which traffic volumes on individual segments of the Southeast Expressway can be reliably estimated, there were a total of 870,000 vehicle-miles traveled (VMT) on an average weekday between the Braintree Split and the Massachusetts Avenue interchange. By 2005, weekday VMT on this stretch of I-93 had grown to 1,573,000; this represents an increase of 81%. On a percent basis, this was 1.7% compound annual growth. A related calculation shows weekday VMT increasing each year by an average of more than 20,000 vehicle-miles between 1970 and 2005. In 1970, the Southeast Expressway was the most congested expressway in Eastern Massachusetts. By 2005, congestion in the regional expressway system was widespread, but was especially severe on the Southeast Expressway, which at its heaviest point carries 250,000 vehicles per day, more than any highway segment in Massachusetts.

By any measure, this traffic growth since 1970 has been substantial and reflects demographic and economic growth, as well as evolving land use and commuting patterns. In addition, the completion of I-93 in Somerville in 1973 and of the CA/T project improved connections between the Southeast Expressway and key regional destinations, thus contributing to traffic growth on the Southeast Expressway.

The Southeast Expressway did not offer many options for accommodating this growth. Originally built within a 110-foot-wide corridor, its configuration included three travel lanes in each direction and breakdown lanes along its entire length, broadly conforming to the interstate highway standards of the time.

A major reconstruction of the Southeast Expressway in the 1980s made the breakdown lanes suitable for travel, and turnouts were added at several points outside the original 110-foot corridor, but still on state land. The improved breakdown lanes were designated as "traffic management lanes," or TMLs, which could be used by general traffic during the peak periods, but would presumably be free of traffic during off-peak periods. By the early 1990s, the Southeast Expressway was functioning like an eight-lane expressway without shoulders.

1.3 IMPLEMENTING THE CONTRAFLOW "ZIPPER" LANE

In 1993 the expanded Central Artery was undergoing its final design, and the Ted Williams Tunnel was under construction. The Massachusetts Highway Department (MassHighway), now called the Highway Division of the Massachusetts Department of Transportation, commissioned a consultant to study ways to add capacity to the Southeast Expressway by adding an HOV facility in some manner. Completed in December 1993, the *High-Occupancy Vehicle Feasibility Study for the Southeast Expressway (I-93) and Route 3* presented a number of options and made both short-term and long-term recommendations. A key short-term recommendation, the so-called zipper lane, was implemented. The 1993 *Feasibility Study* serves as the starting point for this analysis.

The *Feasibility Study* offered several short-range options but only one long-range option. The long-range plan required the widening of the Southeast Expressway corridor to allow a fully separated, reversible lane including a full breakdown lane. This proposed facility was to be restricted to high-occupancy vehicles (HOVs) and would ultimately extend

from a pair of HOV lanes being built north of Massachusetts Avenue as part of the CA/T project, south through the Braintree Split to Union Street on Route 3 in Braintree. The reversible nature of this facility in the long-range plan was based upon the fact that traffic on the Southeast Expressway is strongly directional based upon time of day. One additional lane used for HOVs going inbound in the morning and then for HOVs going outbound in the afternoon was considered an achievable improvement.

Given its commitment to the CA/T project, the Commonwealth elected to implement one of the short-range recommendations of the *Feasibility Study*. Critically, the proposed peak-period contraflow lane system between the Braintree Split and Savin Hill was implemented within the existing 110-foot corridor. Movable barriers that rest near the central median could be moved one lane away from the median as required, and thereby set up a distinct contraflow lane within one of the four-lane barrels. A lane is borrowed from the off-peak direction for four hours each peak period and made available to HOVs traveling in the peak direction (see Figure 1-2).

The movable barriers that channel the contraflow lanes are placed in position by a pair of machines, one operating on each side of the central median. The operation of these machines in moving the barriers resembles the operation of a zipper, giving the contraflow lanes their commonly used name.

The lane opening and closing procedures, as well as enforcement and equipment storage associated with safe operation of the zipper lane, required that a section of the Southeast Expressway be widened outside of the original 110-foot corridor. This requirement for a wider corridor determined that the northernmost extent of the zipper lane would have to be just south of Savin Hill.

Building the operations area closer to the planned CA/T HOV lanes would have presented several problems. The first is the lack of undeveloped right-of-way adjacent to the main expressway lanes in the Massachusetts Avenue area. Second, older, closely spaced ramps south of Massachusetts Avenue would not be compatible with safe zipper lane entry and exit operations. Reconstruction of the Massachusetts Avenue interchange and Fairmount rail line overpass would also have been complicating factors. South of Savin Hill, the MassHighway was able to use a 3,300-foot ramp-free section of the Southeast Expressway and adjacent state-

owned land to construct the northern operations area.

The zipper lane was designed in 1994 and opened in November 1995. At the time, it was anticipated that the CA/T project would be nearing completion in 2000, and that the Commonwealth would then turn its attention to the Southeast Expressway and begin implementing the long-range proposal, with 2005 as a target year. The CA/T project took somewhat longer than expected, and by 2005 a number of other interstate highway locations were being evaluated for capital-intensive improvements. Because of that delay, no further improvements have taken place in the Southeast Expressway corridor.

1.4 RECENT TRENDS IN TRAFFIC VOLUMES, TRAVEL SPEEDS, AND QUEUE LENGTHS

1.4.1 TRAFFIC VOLUMES

Traffic on the Southeast Expressway has gradually increased since 1995. Ramp counts were performed in 2010 on all of the Southeast Expressway on- and off-ramps. This has allowed the calculation of how heavily each segment of the expressway is utilized through calculation of VMT for each segment. These ramp-count-based analyses are performed every several years on major expressways.

The 2010 VMT estimate for the Southeast Expressway is 9% greater than a comparable calculation for 1995. This increase was calculated over the distance from the Braintree Split to Southampton Street, a section of the expressway where the ramp configuration was stable over the entire 15-year period.

Several factors contributed to this 9% increase. There has long been an underlying trend of regional traffic growth. Even with the recent economic downturn, an uptrend is still clearly observed in almost all corridors over the 15-year period. In addition, the increased capacity in the Central Artery to the north and the zipper lane in the south have improved the ability of the Southeast Expressway to accommodate the underlying growth trend.

1.4.2 TRAVEL SPEEDS

For the purposes of this study, a more directly relevant measurement than traffic volume is peak-period travel times and associated travel speeds both within the study corridor and on the expressway segments approaching the

corridor. Between May 20 and June 30 of 2010, CTPS undertook so-called “travel time runs.” Vehicles with on-board observers drove between the Braintree Split in the south and Route 60 in Medford, marking times at 27 key locations in each direction. The 49 southbound and 57 northbound travel time runs provided a diverse sample of recent peak-period travel speeds on I-93

These travel time runs were planned to cover an extensive portion of I-93 when preliminary fieldwork indicated that queues in 2010 were quite long, especially during the southbound PM peak period. By comparing the results of the 2010 travel time runs with similar efforts undertaken in 2006, it is possible to observe trends in both travel speeds and the extent of queues. Also, the length of the 2010 runs allowed for the measurement of speeds and queues in off-peak directions as well, giving a more complete picture of traffic on I-93.

Table 1-1 shows the average end-to-end speeds and travel times for the approximately 15 miles between the Mystic River in Medford and the Braintree Split experienced in the two sets of travel time runs. Each end-to-end measure has shown a pronounced slowing of travel speeds in the last four years. This overall slowing indicates that I-93 is carrying more traffic in this area than it did in 2006 despite the overall decline in regional traffic in the last four years due to the economic slowdown. A possible explanation for this continued traffic growth is that travel patterns are gradually adjusting to use I-93 rather than other travel paths. Even with growing congestion, the CA/T and the Southeast Expressway are seen as preferable to the I-95/Route 128 corridor and to various surface roadways.

TABLE 1-1
Average Speeds and Travel Times on
I-93 between Medford and Braintree

	<u>Southbound</u>		<u>Northbound</u>	
	2006	2010	2006	2010
AM				
Travel Time (minutes)	25	30	30	37
Average Speed (mph)	35	29	29	24
PM				
Travel Time (minutes)	38	50	33	39
Average Speed (mph)	24	18	27	23

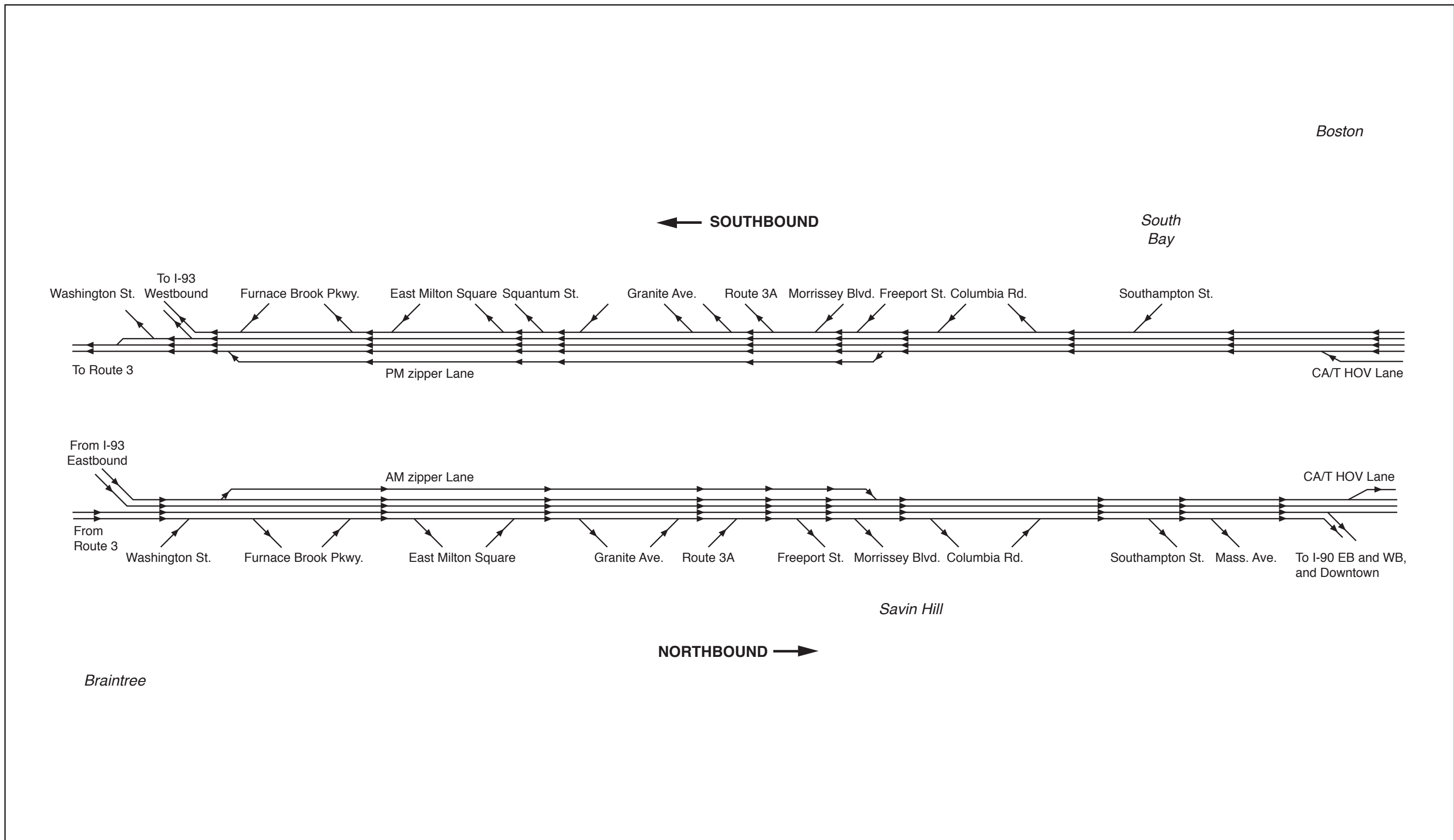


Figure 1-2
Southeast Expressway: Existing Lanes and Ramps

1.4.3 QUEUE LENGTHS

The slowdowns from 2006 to 2010 shown in Table 1-1 did not occur uniformly along this 15-mile stretch of I-93. The major effect of increased traffic between 2006 and 2010 was the lengthening of queues approaching known pinch points in the system.

Queues move at a characteristic speed that is determined by the relationship between the capacity of the roads leading into a pinch point and the capacity of the road within the constricted segment. Traffic approaching the back of a queue travels at a speed reflecting the general congestion level of the road. When a vehicle reaches the back of the queue, it slows down and makes progress at the characteristic speed of the queue. Traffic growth will not slow down the queue; it will lengthen the queue. Traffic will reach the back of the queue further and further from the pinch point, and move at the characteristic queue speed for greater and greater distances.

The 2010 travel time runs identified eight distinct points behind which queues were observed to form during the peak periods. Table 1-2 shows the locations, directions, and time periods of these eight pinch points. While the fronts of these daily queues are well defined based on the expressway design and prevailing travel patterns, the lengths of the queues vary day-to-day and season-to-season. The lengthening of these eight queues between 2006 and 2010 was the primary reason for the slowdown in traffic shown in Table 1-1.

**TABLE 1-2
Points on I-93 Behind Which Queues
Were Recently Measured**

Location	Network Situation
Southbound	
AM Somerville	Route 28 joins I-93
PM South Bay	Massachusetts Ave. traffic joins at Southampton St.
AM Savin Hill	I-93 narrows to three lanes adjacent to zipper lane
PM Braintree	Traffic backs up approaching Braintree Split
Northbound	
PM Neponset	Route 3A joins I-93 in three-lane zipper section
AM Savin Hill	Zipper lane ends; merges with general traffic
AM S. Station	I-90 traffic joins I-93 after tunnel entrance
PM Woburn	The I-95/I-93 interchange backs up traffic from Boston

1.4.4 SOUTH BAY AND SAVIN HILL

The improvement proposed by this study for I-93 is intended to shorten the northbound morning queue at Savin Hill and the southbound afternoon queue at South Bay. The major benefits of adding capacity between South Bay and Savin Hill would be realized outside of the South Bay-Savin Hill segment (see Figure 1-3). This segment handles all the traffic it can now, while a substantial and growing amount of traffic has to wait in lengthening queues north or south of this segment.

The AM queue in the northbound direction has lengthened since 2006. In both 2006 and 2010, the characteristic speed of this queue has been about 15 mph. In 2006 the queue usually reached East Milton Square, but by 2010 this queue, at its typical greatest extent, reaches the Braintree Split.

The PM southbound queue on I-93 as it approaches the Southampton Street on-ramp moves at about 10 mph. This speed was observed in both 2006 and in 2010. On a typical weekday afternoon in 2006, this queue would, at its longest, have extended back from Southampton Street into the Thomas P. “Tip” O’Neill Jr. Tunnel. By 2010, the back of the queue would typically reach the vicinity of Sullivan Square at some time during the PM peak period. Progress towards Southampton Street would average about 10 mph, but the maximum length of the queue might vary from day to day.

The northbound AM queue moves slightly faster than the southbound PM queue to Southampton Street. Also, in 2006, northbound traffic approached the back of the queue at about 20 mph. The northbound slowdown since 2006 now costs drivers in the general traffic lanes about an extra five minutes as they drive through Quincy and Milton. Since the Southeast Expressway is now completely full in this area during the morning peak period, any additional traffic growth would extend the queue southward into Route 3 from the south shore and I-93 from the southwest.

1.4.5 SOUTHBOUND ON-RAMPS AT SOUTH BAY

During the CA/T project, there was a temporary southbound on-ramp directly under the Massachusetts Avenue interchange. This on-ramp served traffic going south on Albany Street prior to the opening of the Herald Street/Albany Street on-ramp was constructed, toward the

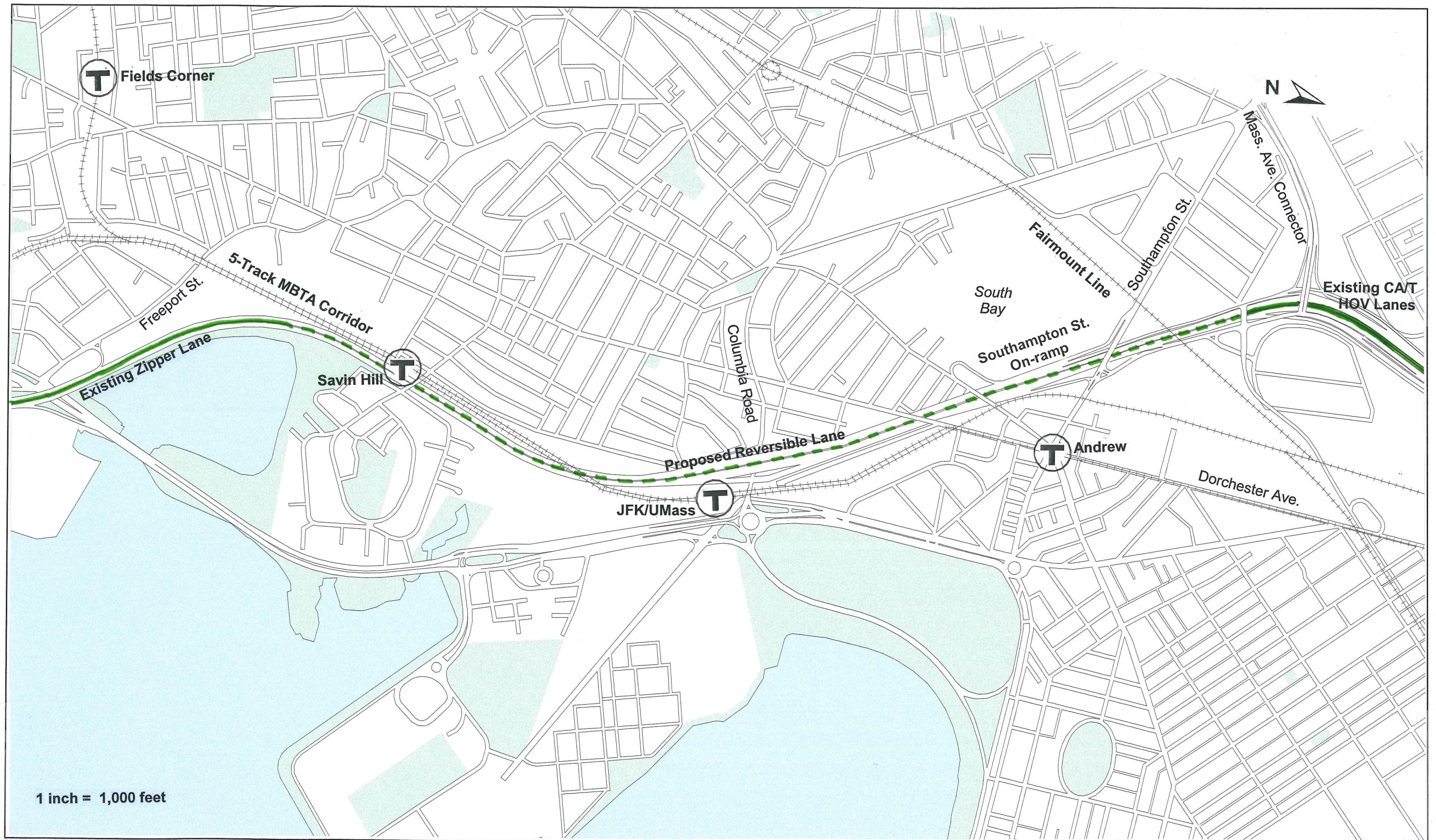
end of CA/T construction. It also supplemented the on-ramp at Southampton Street. While traffic from Melnea Cass Boulevard was directed to the Southampton Street on-ramp, traffic from the South End had the option of entering at the temporary ramp under the Massachusetts Avenue interchange.

This ramp was removed after the Herald Street/Albany Street entrance opened. The main barrel lanes were re-stripped to allow for a planned merging area for vehicles in the southbound CA/T HOV lane to join the general-purpose traffic. With the opening of this southbound HOV lane, the pavement that had provided a minimal acceleration lane for the temporary on-ramp was no longer available. The original CA/T plan had included an off-ramp exactly at the location of the temporary on-ramp, but this off-ramp was removed from the final configuration.

Forcing most South End traffic to use the Southampton Street on-ramp has resulted in long PM queues waiting to merge onto southbound I-93. Several flows of traffic come together to use this entrance: the Massachusetts Avenue connector extending from Melnea Cass Boulevard, the frontage road from Albany Street, authorized vehicles using the bypass road from South Boston, traffic from Southampton Street, and vehicles leaving the South Bay Center shopping mall parking lot. The longest branch of this queue system was recently observed extending 0.8 miles back onto the Massachusetts Avenue connector, and requiring 24 minutes to reach the Southeast Expressway entrance, for an average speed of 2 mph.

Traffic queued up to enter at Southampton Street must pass through one or more traffic signals to reach the ramp. At South Bay, a signal allocates entrance time for traffic from the shopping mall, Southampton Street, and the frontage road. Behind this signal on the frontage road is a signal at the South Boston bypass road and one where the frontage road is joined by traffic from Massachusetts Avenue and Melnea Cass Boulevard. If traffic were significantly heavier than on the day observed, the queue could have extended to the Massachusetts Avenue/Melnea Cass Boulevard intersection and into the Boston Medical Center area.

Slightly fewer than 1,500 vehicles per hour are able to merge from this ramp onto the Southeast Expressway during the PM peak as the entrance is currently configured. The only way to shorten the queue system leading to this entrance would be to increase the number of vehicles per hour that can merge onto



1 inch = 1,000 feet

FIGURE 1-3
South Bay - Savin Hill Corridor

the Southeast Expressway. With a single-lane entrance ramp, 2,000 vehicles per hour is a practical maximum. Lengthening the acceleration lane beyond its current 300 feet would allow more vehicles to merge than can do so today. With a longer acceleration lane, a two-lane entrance could also be considered, which would allow more than 2,000 vehicles to enter per hour.

An important consideration, since the capacity of the Southeast Expressway between South Bay and Savin Hill is fixed, is that any increase in vehicles entering at Southampton Street would result in a corresponding decrease in the number of vehicles that could be accepted from the main I-93 lanes. Absent an overall increase in Southeast Expressway capacity at this point, merely increasing the volume entering at Southampton Street would inevitably lengthen the southbound PM queue on I-93.

For that reason, this study begins with a conceptual plan to increase capacity on I-93 between South Bay and Savin Hill. This proposal entails the expansion of the Southeast Expressway beyond its current 110-foot-wide corridor. It would not require the taking of buildings, but would require that some portions of adjacent transit lines be rebuilt, including some tunneling.

Increasing the capacity of I-93 would shorten the southbound mainline queue and enable improvements to the Southampton Street on-ramp. The envisioned implementation would see both the mainline queues and the queue system approaching the Southampton Street entrance appreciably shortened.

CHAPTER 2



Envisioning an Improved Southeast Expressway

2.1 GOALS OF THIS PROPOSED IMPROVEMENT

This study proposes widening the Southeast Expressway between South Bay and Savin Hill by adding a reversible, preferential lane (see Figures 1-3 and 2-1). This section of the Southeast Expressway operates at its capacity during peak periods, and any traffic growth results in longer queues both in distance and duration on I-93 both north and south of this area. Both the AM and PM peak queues now routinely extend over four miles. These queues cost users considerable time and adversely impact the overall system functioning.

As implied by the magnitude of the daily queues, the implications of this improvement would be far reaching. Adding a preferential lane between South Bay and Savin Hill that could be utilized in the peak direction should significantly shorten both AM and PM peak-period queues on I-93. Relieving this regional bottleneck would also make it possible to improve southbound access in the South Bay area without exacerbating the southbound PM queue on the I-93 mainline.

Adding a preferential lane on the Southeast Expressway between South Bay and Savin Hill would require incorporating portions of the state-owned rail corridor into an expanded highway corridor. The required reconstruction of the study area's Red Line subway and Old Colony commuter rail facilities can be seen as an opportunity to add capacity, rebuild, and modernize these vital services in this congested corridor.

2.2 KEEPING TODAY'S ZIPPER LANE FACILITY

Adding a preferential lane to the Southeast Expressway is not a new proposal. The 1993 *Feasibility Study* envisioned the zipper lane as perhaps a 10-year interim improvement, after which I-93 would be widened from 110 feet to 144 feet

between Massachusetts Avenue and the Braintree Split. The additional 34 feet would embrace two 3-foot wide barriers, a 12-foot travel lane, a 2-foot shoulder, and a 14-foot breakdown lane, all delineated by appropriate pavement markings. Any operations or enforcement activities would be staged from the 14-foot breakdown lane.

The desire to replace the zipper lane with a permanent reversible lane was based on several factors. It was correctly assumed that traffic on I-93 would continue to grow and that CA/T completion would increase the use of the Southeast Expressway as a prime north-south roadway. Also, by ending at Savin Hill, the zipper lane did not provide a full complement of extra peak-direction capacity. While users would enjoy some advantage, the potential benefit would be limited by the queues experienced leaving the zipper lane in the morning or before entering it in the afternoon.

Another drawback, since the facility utilized the existing 110-foot corridor, was that there was no room within the zipper lane for a breakdown lane. As a result, tow trucks are strategically positioned every day to respond quickly to any breakdown. The costs of these tow trucks, moving the barriers, and a police presence result in an operating cost of approximately \$2,000,000 each year. A permanent facility would incur much lower costs, depending on enforcement and direction reversal protocols.

The zipper lane does, however, offer some attractive features, and it serves as the basis for the improvements proposed in this study. First of all, the incident experience has been less than feared. Initially, the viability of the zipper lane with respect to breakdowns had been called into question. After 15 years of operations, the zipper lane can now be considered viable for long-term use rather than merely a short-range expedient.

A crucial planning consideration when designing a preferential lane is selecting points where vehicles can enter or leave the facility. The current northern terminus of the zipper lane was chosen because of the availability of state-owned land where the corridor could be widened to accommodate a vehicle garage and entry/exit area. Based upon regional travel patterns, this location also happens to be an appropriate point at which to allow vehicles to enter or exit the envisioned I-93 preferential lane system.

Finally, there are ever-present considerations of construction costs and constructability. Ironically, while the zipper lane

now serves the part of the Southeast Expressway where its implementation was simplest, widening its part of the corridor would present unique difficulties over and above construction expense. The Southeast Expressway section incorporating the zipper lane abuts wetlands, parks, and neighborhood urban fabric.

Any widening of the Southeast Expressway anywhere would entail substantial expense. By continuing to utilize the current zipper lane, the proposed widening will yield infrastructure improvement with minimal neighborhood disruption.

2.3 USING THE IMPROVED SOUTHEAST EXPRESSWAY NORTHBOUND: AM PEAK PERIOD

2.3.1 THE ZIPPER LANE

The Southeast Expressway in Braintree begins with the joining of two lanes of northbound traffic approaching on I-93 from the west with two lanes of traffic approaching on Route 3 from the southeast. This four-lane section is quickly joined by an on-ramp bringing traffic from Washington Street in Braintree, from the Burgin Parkway, and from the Quincy Adams Red Line station in Quincy. This four-lane northbound configuration is utilized for about 14 hours a day: 10 hours at night, between 8 PM and 6 AM, and four hours in the midday, between 10 AM and 2 PM.

Between 6 AM and 10 AM, northbound vehicles with two or more occupants are allowed to use the zipper lane. Zipper lane users overtake traffic in the general-purpose lanes for much of the distance, depending on the level of congestion at a particular time. Just before Savin Hill the zipper lane ends and all traffic has to merge into the four general-purpose lanes. This merge, which is the front of the northbound AM queue in the general-purpose lanes, also results in queuing within the zipper lane.

In the proposed configuration, zipper lane traffic would not need to merge at Savin Hill. The end-point of the zipper lane would be at approximately the same point, but the corridor would have been widened to allow five lanes to pass the operations area in each direction, rather than the current four lanes. This five-lane northbound section would continue for 2,900 feet to the start of the new reversible lane.

This five-lane section would allow zipper lane users destined for Columbia Road, Southampton Street, Massachusetts

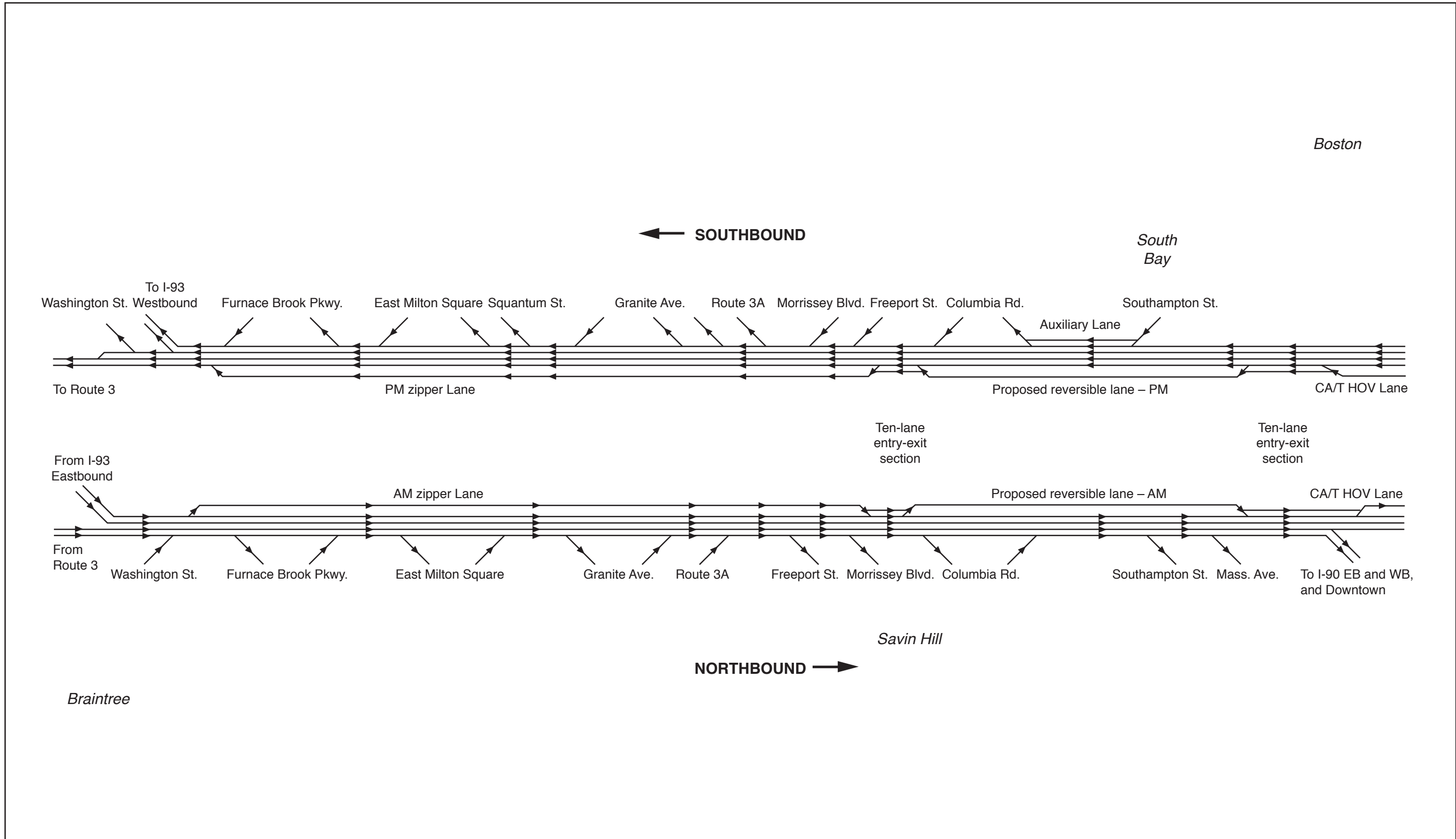


Figure 2-1
Southeast Expressway: Lanes, Ramps, and Proposed Reversible Preferential Lane

Avenue, and the Seaport District to weave into the general-purpose lanes in order to reach their desired destinations. Vehicles that enter the general-purpose lanes at Furnace Brook Parkway, East Milton Square, Granite Avenue, and Route 3A would have an opportunity to enter the reversible lane if their destination were beyond the Tip O'Neill Tunnel, in downtown Boston, or at Logan International Airport.

Zipper lane eligibility has always been based on vehicle occupancy. The occupancy criterion was both practical and enforceable. It furthered public policy by maximizing the throughput of persons, encouraging carpooling, and improving the level of service for bus operators. Given its design, the zipper lane should be used by no more than about 1,500 vehicles an hour. The current eligibility criterion allows a good level of service in the zipper lane with the exception of the exit queue at the northern end.

At the time the zipper lane opened, electronic tolling and ultra-low-emission vehicles (ULEVs) only existed in concept. Today, preferential lanes throughout the world have been implemented using various eligibility criteria, including occupancy, payment, or emissions. Nothing proposed in this study precludes implementing different eligibility criteria in any section of the proposed system of preferential lanes.

Eliminating the merge at the northern end of the zipper lane would eliminate the queue in the zipper lane and shorten the queue in the general-purpose lanes. This poses the question as to whether there would be any advantage to using the zipper lane rather than the general-purpose lanes in the improved configuration, or if the zipper lane would function merely as a fifth general-purpose northbound lane. Only if there were an advantage to using the zipper lane would anyone consider forming a carpool or making an electronic payment to use it.

Even with the addition of the proposed reversible lane, there would be significant northbound AM congestion in the general-purpose lanes adjacent to the zipper lane. This is because of two major bottleneck points along its length: the Granite Avenue on-ramp and the Route 3A on-ramp. The proposed preferential lane system should appreciably reduce this queuing. But with the elimination of the exit queue at the end of the zipper lane, a meaningful travel time savings would still accrue to eligible vehicles using the zipper lane.

The zipper lane is closed at 10 AM, and between 10 AM and 2 PM the only available northbound lanes are the four lanes of the main northbound barrel. Between 2 PM and 8 PM

northbound traffic in this section is reduced to only three lanes. Between 2 PM and 3 PM, while the southbound zipper lane is being set up, northbound vehicles are deprived of using the fourth lane over a portion of the distance. Between 3 PM and 7 PM the southbound zipper lane is open and there are only three available northbound lanes throughout the zipper lane section. Between 7 PM and 8 PM the southbound zipper lane is closed, and the Southeast Expressway gradually returns to its off-peak condition of four lanes in each direction. The hours of zipper lane operation could be modified in the future, especially in conjunction with implementation of the reversible lane.

2.3.2 THE REVERSIBLE LANE

The proposed 2,900-foot five-lane entry/exit section would extend to the Savin Hill Avenue overpass. Creating this five-lane entry/exit section, the southernmost feature of this plan, would necessitate widening the corridor to as much as 144 feet. During northbound zipper lane operating hours, the zipper lane would become the leftmost of five northbound lanes. This leftmost lane would then enter the reversible lane in the northbound direction.

When the northbound zipper lane closes, the reversible lane's entrance at Savin Hill could be blocked. Merging would not be an issue because the Southeast Expressway would deliver its four lanes of main barrel northbound traffic into the four northbound lanes adjacent the reversible lane. The fifth, leftmost weaving lane, a necessity during northbound zipper lane operations, would be redundant unless it were decided to keep the reversible lane available to northbound vehicles outside of zipper lane hours.

The proposed reversible lane would be a full 12-foot lane flanked by a 2-foot shoulder and a 14-foot breakdown lane. Ideally, the eligibility rule for the reversible lane would attract a maximum of 1,500 vehicles per hour, similar to the desired maximum within the narrower zipper lane. This volume of traffic in a preferential lane of this standard would be able to move at 55 mph, enjoying a high level of service for an urban freeway.

Achieving the optimal 1,500 vehicles per hour would depend upon the interplay of the eligibility rule with the origin-destination flows in this section of the Southeast Expressway. The reversible lane would represent an especially attractive path for vehicles destined to the Tip O'Neill Tunnel, downtown Boston, or Logan Airport. Vehicles destined to

Columbia Road, Southampton Street, Melnea Cass Boulevard, or the Seaport District would need to travel in the general-purpose lanes.

During the AM peak period, the northbound Southeast Expressway adds traffic at Columbia Road, and carries as many as 8,500 vehicles per hour in today's four-lane segment, or more than 2,100 per lane. Adding 1,500 vehicles per hour in the preferential lane would give this segment a total capacity of 10,000 vehicles per hour. With this amount of total capacity available, the northbound AM queues at Savin Hill would be eliminated, both in the general-purpose lanes and in the zipper lane. The remaining AM northbound queues would be farther south and would be associated with other expressway entrances.

The question remains as to what degree travel in the reversible lane would offer an advantage over travel in the adjacent general-purpose lanes. This would define any incentive for users to meet the eligibility criteria for preferential lane use.

While a maximum capacity of 10,000 vehicles per hour is assumed for the segment north of Columbia Road, the actual number of vehicles could be less, depending on how traffic responds to the removal of the Savin Hill bottleneck. If the maximum of 10,000 vehicles per hour were to use this segment, the four general-purpose lanes could have an average of 2,125 vehicles per hour each, which would be 42% higher than the 1,500 vehicles per hour that would be eligible to use the new reversible preferential lane. With this level of traffic, the general-purpose lanes would clearly experience congestion, which would provide slower speeds than those of the preferential lane, with its use limited to 1,500 vehicles per hour. Even in the extremely unlikely case in which traffic in this segment remained constant, there would still be 1,750 vehicles per hour in the general-purpose lanes, 17% more than in the reversible lane.

2.3.3 THE CA/T PROJECT

The Southeast Expressway was completely rebuilt as part of the CA/T project starting at the Fairmount Line railroad overpass, about 700 feet north of the Southampton Street overpass. From this point north, the corridor gradually widens to meet northbound and southbound HOV lanes that were built as components of the reconstructed roadway in this area, shown schematically at the right side of Figure 2-1.

These two HOV facilities include full breakdown lanes. The northbound lanes offer a high level of service for vehicles destined to downtown Boston or Logan Airport. Vehicles going to downtown Boston enter the surface road system at the intersection of Kneeland and Lincoln streets, while traffic to Logan Airport takes a connecting ramp to the Ted Williams Tunnel. Intercity buses also use these lanes to access the South Station Transportation Center, for which there is a dedicated bus-only ramp connected with the pair of HOV lanes.

Since the northbound HOV lane serves principally downtown Boston and Logan Airport, a second five-lane entry/exit system is proposed for the area between the end of the proposed reversible lane and the existing CA/T HOV lane system. This would allow users of the reversible lane to shift into the general-purpose lanes and enter the Tip O’Neill tunnel. It is also possible that under certain traffic circumstances, eligible vehicles in the general-purpose lanes might enter the northbound CA/T preferential lane to expedite movement toward downtown or to Logan Airport.

There are a number of closely spaced overpasses and ramps in this area that complicate placement of a transition section. The analysis undertaken here suggests that the best place to transition between the reversible lane and the five-lane entry/exit section is between the Fairmount Line overpass and the overpass aligned with the South Boston Bypass Road, a component of the Massachusetts Avenue interchange. Northbound vehicles leaving the reversible lane would enter their own lane, which after 1,600 feet would become the northbound CA/T preferential lane. Any of these vehicles destined for the Tip O’Neill Tunnel would change to one of the other general-purpose lanes in this section.

The CA/T HOV lanes are less than a mile in length, and given the ample capacity of adjacent general-purpose lanes to common destinations, they cannot be expected to provide significant travel time savings in and of themselves. Indeed, it was always envisioned that they would anchor the north end of a long-range Southeast Expressway preferential lane system.

The key northbound CA/T HOV lane destinations, downtown Boston and Logan Airport, are reached from the general-purpose lanes via Exit 20, an off-ramp close to the north end of the proposed reversible lane. Traffic on the Exit 20 ramp moves freely, so using the CA/T HOV lanes parallel to the Exit 20 ramp provides users with no travel time benefit.

In the proposed configuration, traffic on the reversible lane

would not be able to use Exit 20. Using Exit 20 would require traffic to use the general-purpose lanes from Savin Hill, forgoing any benefit of using the reversible lane. The CA/T preferential lane, however, allows vehicles destined to downtown Boston or Logan Airport to take advantage of the higher level of service available on the reversible lane, and then complete their trip on a directly accessible CA/T preferential lane.

The number of vehicles moving from the reversible lane to the general-purpose lanes in order to use the Tip O’Neill Tunnel will in almost all instances exceed the number of vehicles moving from the general-purpose lanes into the northbound CA/T preferential lane. This is because Exit 20 provides a perfectly acceptable level of service to I-90 as well as to downtown destinations. If the reversible lane is carrying its desired maximum of 1,500 vehicles per hour, the CA/T preferential lane will always be carrying fewer, hence offering an acceptably high level of service.

2.3.4 THE NEW NORTHBOUND I-93 WITH ITS PREFERENTIAL LANE SYSTEM

The improved Southeast Expressway would offer five northbound lanes of capacity along its entire length during AM peak operations. The leftmost of these five lanes would be a preferential lane system consisting of two existing components—the zipper lane and the northbound CA/T HOV lane and one new component: the proposed reversible lane. Points to enter and leave this preferential lane system have been identified which maximize origin-destination connectivity for preferential lane users.

Between the three preferential lane components would be entry/exit areas consisting of five general-purpose lanes. There would be no forced merge at the end of any preferential lane component. Eligible vehicles could weave into or out of this leftmost lane depending on the origin and destination of their trip.

Without forced merges and resulting queues in the preferential lane sections, the preferential lane would be able to operate at full capacity. However, eligibility criteria could be set to allow up to 1,500 vehicles an hour, thereby assuring a high level of service in the preferential lane system. Over much of the Southeast Expressway during most of the peak period, traffic flow in the preferential lane system would be better than traffic flow in the general-purpose lanes.

Completing the preferential lane system would eliminate the forced merge at the north end of the AM zipper lane, which makes possible free-flow travel in the preferential lane from Braintree to downtown Boston. It would also relieve the bottleneck in the general-purpose lanes at Savin Hill, and traffic flow in the general-purpose lanes would improve appreciably. The general-purpose lanes are severely overburdened today, and eliminating the forced merge at Savin Hill would lessen but not eliminate congestion. Congestion from heavy through traffic, as well as major northbound entry flows at Granite Avenue, Route 3A, and Columbia Road, would slow down traffic in the general-purpose lanes.

Eligibility criteria, now based upon vehicle occupancy, may be modified in the future. Use of electronic monitoring to verify eligibility or receive a payment is becoming a standard feature of new preferential lanes systems, both in the United States and other countries

Regardless of the eligibility criteria of the envisioned preferential lane system, a major beneficiary of this improved corridor would be buses. These include scheduled intercity buses to the South Station Transportation Center, Logan Express and other direct services to Logan Airport, and other bus operations, notably in the tourism industry. Independent of the time savings buses would experience in the completed preferential system, bus service operators would also realize a high level of travel time predictability in this corridor, which would help in designing attractive schedules and utilizing personnel. Also, customers are known to be disproportionately averse to creeping along in congested traffic, and a smooth run to downtown Boston would be a very positive feature of Southeast Expressway bus travel.

2.4 USING THE IMPROVED SOUTHEAST EXPRESSWAY SOUTHBOUND: PM PEAK PERIOD

2.4.1 THE CA/T PROJECT

The southbound lanes of the Southeast Expressway share the same corridor with the northbound lanes, but function much like a separate roadway. Many of the design and operational conventions used in the northbound system are also applied in the southbound system. But these corridor circumstances and conventions need to be formed into an effectively functioning southbound roadway system, the use of which is described in this section.

The new southbound preferential system would begin at the existing CA/T HOV lanes. These lanes have been designed to gather eligible vehicles from I-90, including Logan Airport, the Seaport District, and the Turnpike Extension, and Kneeland Street including buses from the South Station Transportation Center. Eligible vehicles in the several approach lanes would combine into one southbound HOV lane about 500 feet south of the I-90 main barrels. Non-eligible traffic would also enter the southbound general-purpose lanes near this point. Vehicles wishing to exit at Massachusetts Avenue would need to use the general-purpose lanes.

After 3,800 feet, the HOV lane would end beneath one of the Massachusetts Avenue interchange overpasses, and begin a gradual merge into the four-lane southbound main barrel. About 3,200 feet after the HOV lane ends on the left side of the main barrel, the Southampton Street on-ramp comes in from the right. This is the southern end of a major component of the southbound PM queue. This queue routinely stretches back four miles to around Sullivan Square, north of downtown Boston. Eligible vehicles using the southbound CA/T HOV lane avoid 3,800 feet of this four-mile queue, but then join the queue for the last 3,200 feet.

The proposed improvement would keep the CA/T preferential lane as it currently exists, but instead of gradually merging into the four southbound lanes, there would be a five-lane entry/exit section of about 1,200 feet in length. Vehicles in the CA/T preferential lane wishing to exit at Columbia Road would join the general-purpose lanes in this section. Eligible vehicles coming from the Tip O'Neill Tunnel would be able to weave into this lane in order to use the reversible lane.

2.4.2 THE REVERSIBLE LANE

The reversible lane is proposed to begin at or shortly before the Fairmount Line railroad overpass. During the PM peak period, the reversible lane would be set up to accept eligible southbound vehicles at this point. Eligible vehicles emerging from the CA/T preferential lanes would have a clear path in the fifth, leftmost lane for the 1,200 feet leading to the reversible lane entrance. Eligible vehicles from the Tip O'Neill Tunnel would also join the preferential lane at this point.

The reversible lane would end, after about 1.6 miles, at a five-lane entry/exit section beginning at the Savin Hill Avenue overpass. Vehicles destined to points in Dorchester, Milton,

or Quincy could join the general-purpose lanes at this point. Traffic that entered at Southampton Street or Columbia Road could also merge into the leftmost lane here in order to use the southbound zipper lane during the PM peak period. With preferential lane eligibility set to allow no more than 1,500 vehicles per hour, users of the reversible lane should experience free-flow driving conditions.

With no more than 1,500 vehicles per hour using the reversible lane during the PM peak period, there would be an incentive to meet the eligibility criteria in order to avoid the general-purpose lanes. South of the Columbia Road on-ramp, there would be 2,000 vehicles per hour in the four general-purpose lanes. Also, turbulence from the heavy flow of merging traffic at the Southampton Street entrance would ensure that the reversible lane is perceived as a superior travel option.

2.4.3 THE AUXILIARY LANE FROM THE SOUTHAMPTON STREET ON-RAMP TO COLUMBIA ROAD

During the PM peak period, about 1,500 vehicles per hour are able to enter the Southeast Expressway southbound using the Southampton Street on-ramp. These 1,500 vehicles join 6,000 or more vehicles in the four general-purpose lanes. This southbound traffic from Southampton Street is further augmented by traffic entering at Columbia Road, achieving a daily maximum of about 8,000 vehicles per hour. Since far more than 8,000 vehicles per hour want to use this roadway during the PM peak period, queues accumulate on both I-93 through the Tip O'Neill Tunnel, and on the network of surface streets leading to the Southampton Street on-ramp.

Depending on traffic conditions in Braintree, the reversible lane has the potential of accommodating up to an additional 1,500 vehicles per hour in the Savin Hill area. Increasing the total number of vehicles that can travel through this area from 8,000 to 9,500 has the potential of significantly decreasing the queues that form behind the Southampton Street on-ramp.

The plan presented here, however, has the reversible lane beginning north of the Southampton Street on-ramp. This means that all of the eligible southbound vehicles using this new lane would have already been on I-93 by the time they reached the Southampton Street entrance. Because of the size of the queue waiting to enter this segment of the Southeast Expressway, traffic from the mainline queue would fill much of the newly available capacity in the general-purpose lanes at the Southampton Street entrance. Absent any other

improvements, the increase in the number of vehicles per hour that could merge into the general-purpose lanes at Southampton Street would be limited.

In order to shorten the local street queue system that forms behind the Southampton Street on-ramp, it would be necessary to increase the number of vehicles per hour that can merge onto the Southeast Expressway at this point. To achieve this increase, the plan presented here includes a fifth "auxiliary" lane extending from the Southampton Street on-ramp to the Columbia Road off-ramp.

Presently, there is a 300-foot acceleration lane that cannot be lengthened unless the Boston Street bridge abutment is rebuilt. Rebuilding this, as well as the immediately following Dorchester Avenue bridge abutment, would allow state-owned land in the corridor to be configured into a fifth southbound lane extending one-half mile. Allowing entering traffic at Southampton Street a half-mile to merge into the four through lanes should allow about 2,000 vehicles per hour to merge onto the Southeast Expressway, the practical maximum for a single-lane on-ramp. If the on-ramp were increased to two lanes, one lane merging immediately and a second lane flowing directly into the auxiliary lane, this number could increase further, perhaps to 2,500 vehicles per hour.

The reversible lane could increase the total southbound capacity of the corridor from 8,000 to 9,500 vehicles per hour. With the auxiliary lane, traffic from Southampton Street with a one-lane ramp would increase from 1,500 to 2,000 vehicles per hour. Traffic flow from the awaiting southbound queue would increase from 6,500 to 7,500 vehicles per hour. This would result in both queues being shorter and moving faster. If modeling or field experience shows that the increase in I-93 southbound flow from 6,500 to 7,500 vehicles per hour significantly would reduce or eliminate the mainline queue, it might be possible to re-stripe the Southampton Street on-ramp as a two-lane on-ramp in conjunction with the auxiliary lane.

2.4.4 THE ZIPPER LANE AND THE BRAINTREE SPLIT

The design and operation of the southbound zipper lane during the weekday PM peak period, between 3 PM and 7 PM, mirrors the northbound AM peak operations. At about 2 PM, the southbound zipper lane setup begins, and the northbound mainline is narrowed to three lanes. At 3 PM, vehicles with two or more passengers are allowed to use the zipper lane, providing a total of five southbound lanes. At 7

PM, the zipper lane is closed and the Southeast Expressway is returned to its off-peak configuration of four lanes in each direction.

In the proposed preferential lane system, there would be a five-lane entry/exit section extending from the southern end of the reversible lane to the PM zipper lane entrance. Eligible vehicles emerging from the reversible lane would have a clear path in the fifth, leftmost lane for the 2,400 feet leading to the zipper lane entrance. Eligible vehicles from Southampton Street and Columbia Road could join this flow and enter the zipper lane. Vehicles using the reversible lane could move to the general-purpose lanes from the five-lane entry/exit section to reach off-ramps in Dorchester, Milton, and Quincy.

Adding the capacity of the reversible lane between the CA/T preferential lanes and the zipper lane would improve, but not solve, PM queue conditions on the Southeast Expressway. As observed in recent travel time runs, there is a PM queue on the Southeast Expressway as it approaches the Braintree Split (Table 1-2). This queue moves at about 15 mph and has lengthened since 2006, now extending over two miles.

Allowing the three southbound traffic flows—the preferential lane, the four general-purpose lanes, and traffic entering from Southampton Street—to move freely through South Bay would fill the downstream sections of the Southeast Expressway, ultimately lengthening the queue at the Braintree Split. Only by increasing the amount of traffic that can exit the Southeast Expressway either in the direction of Route 3 to the South Shore, or to the west continuing on I-93, can this pinch point be relieved and the queue shortened. Extending the preferential lane system through this interchange could address this problem, but is outside the scope of this study.

Even without resolving congestion issues at the Braintree Split, the proposed reversible lane would improve southbound I-93 traffic in several respects. Because the southbound PM queue from Southampton Street now routinely extends all the way through the Tip O'Neill Tunnel and reaches Sullivan Square, increased traffic flow through South Bay would relocate much of this congested traffic towards the southern end of the Southeast Expressway, closer to its final destination. Taking congested Southeast Expressway traffic out of the Central Artery would improve flow from I-93 to Logan Airport, the Turnpike Extension, and downtown Boston destinations.

With construction of the proposed reversible lane, the

completed preferential lane system could offer a consistently high level of service during the PM peak period from all set of the northern origins of I-93 southbound traffic all the way to the Braintree Split. At its southern end in Quincy, the zipper lane merges into southbound I-93 about a half mile before the Braintree Split. Frequently, there is now southbound PM queuing on the zipper lane just to the north of this merge.

The merge section could be designed to allow a certain number of vehicles per hour to emerge from the zipper lane to join the general-purpose lanes without queuing in the zipper lane if the design of the merge were matched with the eligibility criteria. Eligible users of the completed preferential system would bypass any of the congestion or queue lengthening at the southern end of the Southeast Expressway that would result from relieving the Southampton Street bottleneck.

In addition to the benefits described above, other benefits of implementing the reversible lane include reducing congestion for the traffic on I-93 north of Boston destined for Dorchester and Milton. While improved traffic flow through the South Bay would result in a longer queue backed up north of the Braintree Split, there would be a net improvement for vehicles from north of Boston going to Columbia Road, Route 3A, and Granite Avenue. Eligible vehicles going to Route 3A and Granite Avenue would have an added advantage afforded by the reversible lane. While these particular traffic flows may not be especially large, allowing these vehicles to move freely to their destination would slow the formation of the PM queue at Braintree.

2.4.5 THE NEW SOUTHBOUND I-93 WITH ITS PREFERENTIAL LANE SYSTEM

Several key aspects of the improved southbound Southeast Expressway are the functional equivalent of the improved northbound system. There would be five southbound lanes of capacity along its entire length during PM peak-period operations. The leftmost of these five lanes would be a preferential lane system consisting of two existing components and one new component, the proposed reversible lane. Between the preferential lane components would be entry/exit areas consisting of five general-purpose lanes. These entry/exit sections would be located at South Bay and Savin Hill, which would maximize origin-destination connectivity for preferential lane users.

Whereas the northbound Southeast Expressway connects with

the comparatively new CA/T preferential lane system, which has available capacity for accepting increased AM traffic, traffic flow during the PM peak period in the southbound direction is constrained by the capacity of the Braintree Split. In the proposed configuration, the existing southbound CA/T preferential lane and the proposed reversible preferential lane would end at their respective entry/exit sections without a forced merge. Eligible vehicles using the zipper lane, however, would still be required to merge into a queue in the general-purpose lanes approaching the Braintree Split.

If there were no forced merge at any point in the preferential lane system, the eligibility criteria could be set to allow up to 1,500 vehicles an hour to use the preferential lane, ensuring a high level of service throughout for eligible vehicles. If fewer than 1,500 vehicles were able to merge into the general-purpose lanes approaching the Braintree Split, as is currently the case, a queue would continue to form in the preferential lane near its southbound exit. Modifying the roadway geometry and adjusting the eligibility criteria are two tools that could be used to ensure that an exit queue does not form in the preferential lane. A complete traffic engineering analysis might determine that the optimal volume in the southbound preferential lane is less than 1,500 vehicles per hour.







Ironically, the lengthening of the queue in the general lanes approaching Braintree that would result from relieving the Southampton Street bottleneck would ensure that eligible vehicles in the zipper lane achieve increased time savings on their way to the Braintree Split. This high level of service and resulting travel time predictability would be especially important to the various bus services using the preferential lane system.

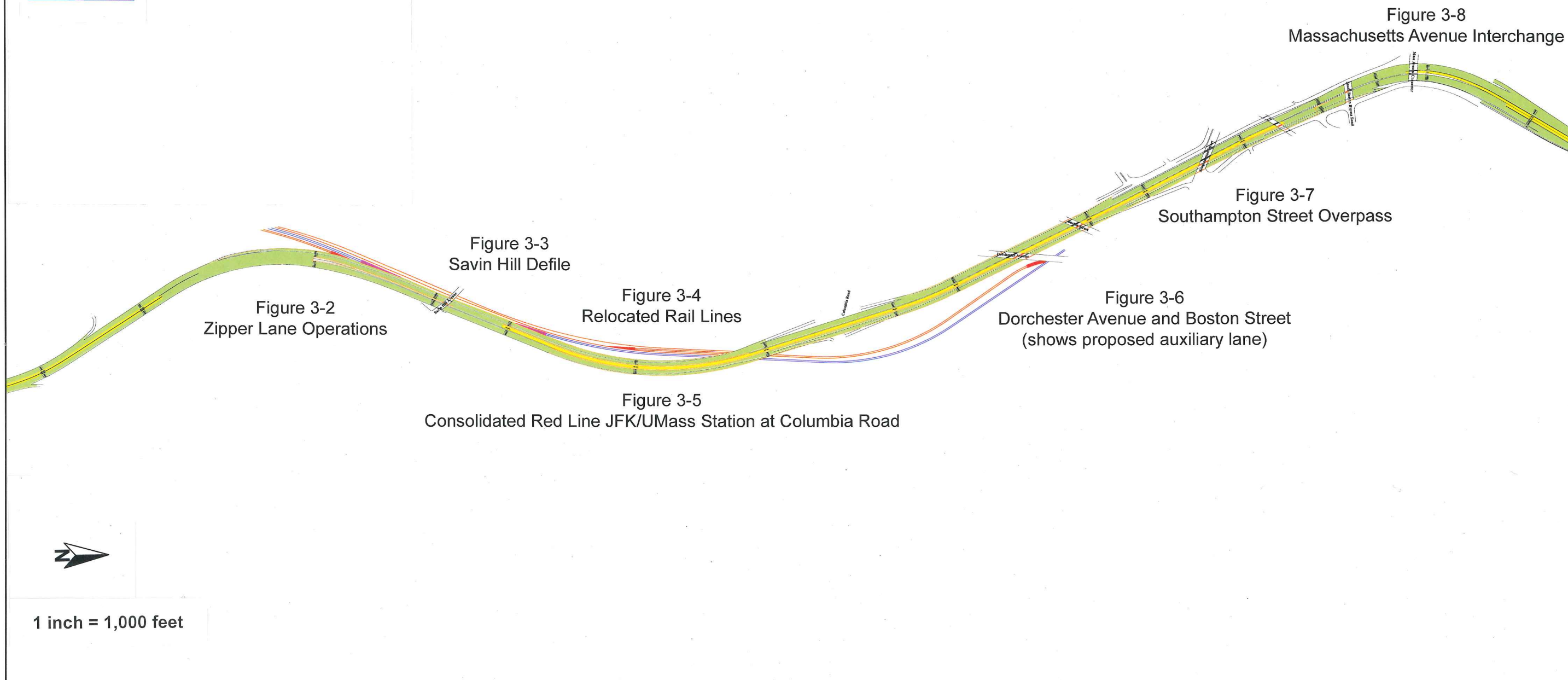
Adding a fifth general-purpose auxiliary lane southbound between the Southampton Street on-ramp and the Columbia Road off-ramp would allow 500 more vehicles per hour to enter at Southampton Street. Allowing this on-ramp to serve a practical maximum of at least 2,000 vehicles per hour would significantly shrink the queue system on local streets leading to this expressway entrance.

Moving southbound traffic expeditiously through South Bay on its way to Dorchester, Milton, Quincy, and the Braintree Split would relieve congestion within and approaching the Tip O'Neill Tunnel. Queues would form farther south, would not extend as far north, would move faster, and would end earlier in the afternoon. Given the severity of PM-peak-period

congestion today, the southbound capacity added by the reversible lane and auxiliary lane might be required to allow the CA/T to function during the PM peak period as was originally envisioned.

LEGEND:

-  Proposed general purpose roadway
-  Existing/proposed preferential lanes
-  Proposed commuter rail tracks
-  Proposed Red Line tracks
-  Proposed commuter rail tunnel portal
-  Proposed Red Line tunnel portal



CHAPTER 3

Constructing the Reversible Lane



3.1 ESSENTIALLY THE SAME ZIPPER LANE

The plan presented in this study assumes that the zipper lane would continue to operate in substantially the same manner as it does today. Some modification would be required, however, to provide the 10-lane entry/exit section at Savin Hill that is crucial to the success of the completed preferential lane system.

In the current configuration, the machine that repositions the zipper barrier for the AM peak period is housed in a garage located in a widened section of the median at the north end of the zipper lane operations area, south of Savin Hill. This garage is flanked by four travel lanes in each direction. In order to provide the 10-lane entry/exit section, a fifth lane must be added in each direction at the garage, widening the expressway by 24 feet. The garage would still be in the median, and would need to be relocated approximately 12 feet to the west of where it is now.

The improvements described in this report have been rendered in a set of eight planning-level (conceptual) graphics. Figure 3-1 shows the entire corridor and indicates which areas are shown in greater detail by the other seven graphics. Figure 3-2 shows the zipper lane operations area and the repositioned garage, an area that also appears on the left in Figure 3-1.

The physical modifications of the Southeast Expressway required to implement this plan begin 1,000 feet south of the garage. The west side of the expressway corridor would begin to gradually widen at this point, adding the required additional 24 feet of width upon reaching the garage.

Widening the Southeast Expressway corridor would require reconstruction of several on-ramps and off-ramps north of Savin Hill. Since the Southeast Expressway now operates without a breakdown lane, there are also several emergency

pullouts, one of which is just to the south of Savin Hill on the southbound side. Figure 3-2 shows the southbound emergency pullout at the point where the corridor widening in this plan begins.

The corridor plan illustrated in Figure 3-2 shows only the alignment of the travel lanes required to implement the reversible lane and its required entry/exit sections. Impacted on-ramps and off-ramps, as well as the emergency pullout, would need to be rethought, redesigned, and rebuilt. Figure 3-2 and other figures in this chapter indicate ramps that would require reconstruction, but do not show plans for the repositioning of these expressway features.

As shown in Figure 3-2, the widened Southeast Expressway travel corridor would occupy most of the southbound emergency pullout area. The pullout area could be rebuilt close to its present location without impacting any structures.

The widened corridor would reach its greatest width—approximately 160 feet—at the repositioned garage for the zipper lane equipment. At this point, the corridor would need to occupy land now used by the MBTA for the Braintree branch of the Red Line and a track used by the Old Colony Lines commuter rail service. In the plan presented in this report, both of these rail transit alignments would be reconstructed in tunnels under the Southeast Expressway. Only the tracks of the Red Line’s Ashmont branch and Savin Hill Station would remain in their present location. Required reconstruction of these rail lines is discussed fully in the Appendix.

This chapter describes in greater detail the single-level reversible lane option, built throughout at the same level as the adjacent general-purpose lanes. The intent is to show the greatest extent of corridor widening that would be required to implement the reversible lane. Toward that end, a full 144-foot-wide corridor is described, including a 28-foot preferential lane that would allow ample space for incidents, operations, and enforcement. Selective narrowing of the corridor to achieve construction economies is feasible, but any variants of this nature are not explored in this study.

3.2 KEEPING THE EXISTING ZIPPER LANE: IMPLICATIONS FOR ALTERNATIVES

3.2.1 THREE ALTERNATIVES

This study is intended to show at a planning level of detail one particular option for improving the Southeast

Expressway: a single-level reversible preferential lane requiring some widening of the corridor but no modification of the function of the current zipper lane. The discussion thus far has been concerned with how such a facility would operate and how it would provide user benefits. The balance of this study concerns itself mostly with details on how the facility might be constructed.

While this study does not include an analysis of the proposed alternatives, it does include a description of some alternatives that would most likely be evaluated as part of a formal alternatives analysis were a major Southeast Expressway investment to be considered. The two alternatives described here are extending the zipper lane at grade and without MBTA changes, and constructing a viaduct for the reversible preferential lane. While these two alternatives have distinct cost, design, and operations implications, a key basis for evaluation is whether and how they would incorporate the existing zipper lane into any possible implementation.

3.2.2 EXTENDING THE ZIPPER LANE

Today’s zipper lane works sufficiently well to be the basis for considering whether and how it might be extended northwards, preferably to form a seamless connection with the CA/T HOV lanes. The contraflow lane, as it is currently set up in the 110-foot corridor through Quincy, Milton, and Dorchester, could be extended further north within the existing 110-foot corridor. This extension would require resolving three issues: the location of the garage for the zipper machine, the location of the operations area, and whether to provide an intermediate entry/exit section.

While the two movable zipper barriers could be accommodated within the 110-foot corridor, placement of the garage south of Savin Hill would require widening the corridor to 134 feet at that point to allow construction of the garage. The current configuration results in the forced merge at this location. Adding lanes beside the garage would require 12 feet per additional lane. Placing the garage in the South Bay section on the Southeast Expressway could require extensive expressway reconstruction, including land takings. An alternative might be to place the garage within the CA/T two-way HOV facility, eliminating the breakdown lanes adjacent to the garage.

Extending south from the zipper machine garage at Savin Hill is a 1,500-foot operations area, a complex of variously positioned permanent and movable barriers at which lane

access is opened and closed in alternating directions, first in the morning and then in the afternoon. The southernmost end of this operations area is 800 feet north of the Freeport Street on-ramp, the nearest ramp to the operations area. A new, northern operations area, in the vicinity of South Bay and the existing CA/T HOV lanes, would be adjacent to a number of closely spaced ramps, which might require the resolution of operations and safety issues.

Finally, there is the issue of an intermediate entry/exit section. If the zipper lane were to be simply extended north from its current terminus, eligible vehicles would not be able to exit at Columbia Road, and it might be difficult for them to exit at Southampton Street. Depending on the location of the operations area at the northern end of the zipper lane, exiting at Massachusetts Avenue to travel to the Longwood Medical Area might also be precluded.

Origin-destination connectivity comparable to that described in this study could be maintained by establishing an entry/exit area where the Savin Hill operations area is today. This would require a section of the expressway at least 1,000 feet in length to rely solely on traffic cones for access control.

Because the zipper lane in its current configuration works well, it is reasonable to consider whether this technology might be extended. These and other issues need to be considered in any future alternatives analysis.

3.2.3 VIADUCT OPTIONS

The 1993 *Feasibility Study* envisioned in its most ambitious variant adding a permanent, reversible lane all the way from the Massachusetts Avenue interchange to the southern end of the Southeast Expressway, and continuing through the Braintree Split onto Route 3, eventually joining the location of anticipated Route 3 improvements. This ambitious plan would also have addressed congestion at the Braintree Split.

The difficulty of widening the highway was a factor in the conceptual planning presented in the *Feasibility Study*. As an alternative to widening the I-93 corridor, it was suggested that an elevated lane might be built above stretches of the Southeast Expressway. It was assumed that an elevated lane could eliminate the need for major land takings, and perhaps reduce costs.

The *Feasibility Study* addressed the issue of the visual impact of an elevated lane. Where local streets cross over the Southeast Expressway, the elevated lane would have to cross

above those overpasses. Even with the goal of economy, this high-elevation visual impact was considered especially problematic through the congested Savin Hill defile (see Figure 3-3). It was suggested at that time that the elevated HOV lane would descend to ground level from the north to pass under the Savin Hill Avenue overpass at the point now occupied by the Braintree Red Line tracks. These two Red Line tracks were to have been buried to accommodate this at-grade portion of the then proposed HOV lane. In that proposal, the HOV lane would have immediately ascended to a viaduct, and continued to an elevated entry/exit system near Neponset Circle.

In considering a viaduct option at this time, various factors, such as construction cost, land takings, maintenance cost, and visual impact, are important. Another consideration is the design assumption of this study that the existing zipper lane would continue to be used in substantially its same configuration.

The Southeast Expressway passes beneath seven overpasses between Savin Hill Avenue and the CA/T project area (see Figure 1-3). Given vertical clearance standards and the depth of typical bridge decks, a viaduct would be about 50 feet above the Southeast Expressway as the viaduct crossed over any roadways crossing over the Expressway. The Southeast Expressway crosses above Columbia Road. In this instance, a viaduct might be only 25 feet above the expressway, but it would still be about 50 feet above Columbia Road and the nearby urban fabric.

If a viaduct option were to be considered, it would require at the outset a resolution of the placement question at Savin Hill. If a viaduct through the Savin Hill area were to be built, it would require at least 1,000 feet to descend from above the Savin Hill Avenue overpass to the level of the general-purpose lanes. This would in turn require building a new zipper lane operations area further south. This could place the operations area at the point of the Freeport Avenue entrance and Morrissey Boulevard exit and underpass, located at the far left in Figure 3-1.

One of the reasons a viaduct was considered in 1993 was to avoid widening the expressway. Even with the reversible lane on a viaduct, however, some widening of the 110-foot corridor might be required. If viaduct supports comparable to those constructed as part of the CA/T project were to be constructed, they would not fit within the median profile of the current 110-foot corridor. The needed corridor widening

would be substantially less than that required for a single-level 144-foot corridor, but it would still entail substantial highway reconstruction, possible including bridge abutments.

Any repositioning of the southbound general-purpose lanes at Savin Hill westward into the immediately adjacent rail corridor would require some rail line reconstruction. If these lanes only need to be moved enough to safely accommodate viaduct support pillars, it would only be necessary to place the Braintree tracks underground. If the preferential lane were to be at the same level as the general-purpose lanes, the Old Colony track would also need to be placed underground.

The *Feasibility Study* assumed that only the Braintree tracks would need to be buried, but upon closer analysis that now appears to be optimistic. This study assumes that a proposed 10-lane entry/exit section at Savin Hill Avenue would require both the Braintree Red Line and Old Colony track to be buried. Only the Ashmont branch of the Red Line and Savin Hill Station would not have to be modified (see Figure 3-3).

An approach to utilizing a viaduct is to implement the highway and railroad reconstruction at Savin Hill exactly as presented in this study, and then construct the viaduct to the extent possible above where the proposed reversible lane is shown in this study. The proposed entrance to the reversible lane is shown at the lower right in Figure 3-3. This entrance is about 500 feet north of the Savin Hill Avenue overpass, and its direction of use would be controlled by traffic cones during daily operations.

A viaduct could be constructed using this entry point north of Savin Hill. The northbound lane would immediately begin to climb from this entrance. The widened corridor would 144 feet wide at this point, but could narrow as the reversible lane achieved the necessary vertical clearance to allow expressway traffic under the viaduct's cantilevered lanes. The corridor would still need to be widened from its current 110 feet in order to safely accommodate the viaduct support pillars in a widened median.

The viaduct would be about 25 feet above the general-purpose lanes until it approached, in the northbound direction, the Dorchester Avenue overpass, at which point it would rise to about 50 feet above the expressway. It would continue at this elevation as it crosses Dorchester Avenue, Boston Street, Southampton Street, the Fairmount commuter rail line, and the two Massachusetts Avenue interchange overpasses.

After the reversible lane viaduct has passed the Massachusetts

Avenue Connector, it would immediately descend and meet the CA/T HOV lanes as they rise approaching Albany Street (see Figure 1-3) It would be necessary to modify the CA/T HOV lanes in order to allow vehicles to use the Tip O'Neill Tunnel, access that is critical to the usefulness of a completed preferential lane system.

Some of the appeal of a viaduct alternative has been assumed economy and avoidance of land takings. While the highway corridor would most likely require some widening through much of this area, the widening required to implement a viaduct would certainly be less than to implement the single-level plan described in this study.

As for economy, the comparison is less clear. If a viaduct is accepted through the Savin Hill defile, it would still be necessary to bury the Braintree Red Line tracks and widen the expressway in the Morrissey Boulevard area to accommodate a repositioned zipper lane operations area. The cost of constructing a viaduct between Savin Hill and the CA/T HOV lanes, together with any required expressway widening, would be substantial.

If the viaduct were to start north of Savin Hill, the costs of rail line reconstruction at Savin Hill would be identical with those of the single-level option. There might still be a cost advantage, however, for building this shorter viaduct. It would be appropriate, however, to also consider the long-term costs involved with maintaining an extensive viaduct structure.

3.3 COLUMBIA ROAD AND THE AUXILIARY LANE

North of the Savin Hill Avenue overpass, the Southeast Expressway would need to be widened by 10 feet, from the 134 feet of the 10-lane entry/exit section to a width of 144 feet. This width would accommodate the full reversible lane and its two protective barriers. As Figure 3-3 illustrates, north of the Savin Hill Station platform the rail tunnel system frees up enough space in the corridor for this full widening. The added width at Savin Hill is exclusively on the west side of the Southeast Expressway into the rail corridor.

As can be seen in Figure 3-4, just north of the proposed Old Colony line tunnel portal (discussed in the Appendix), the 144-foot highway corridor would gradually begin to take land on the east side of the current 110-foot corridor. At the point where the Southeast Expressway crosses the rebuilt rail corridor at the JFK/UMass Station (Figure 3-5), the roadway expansion would be entirely on the east side of the

expressway corridor. The west side of the expressway would have returned to its existing curbs, but the ramps to and from Columbia Road on the east side of the highway would need to be reconstructed.

Another important design feature in Figure 3-5 is that the existing median barrier would be retained starting from just south of Columbia Road and continuing north into the South Bay area. The existing median becomes one of the protective barriers of the reversible lane. A new, second barrier would be built to the east in the widened roadway, allowing a 28-foot-wide reversible lane.

As shown in Figure 3-6, however, this plan would require widening the Southeast Expressway corridor on both sides of the existing median between Columbia Road and the Southampton Street on-ramp, shown in the upper right-hand corner of Figure 3-6. In addition to the new 28-foot reversible lane and its attendant widening into the rail corridor, Figure 3-6 also shows the fifth, auxiliary lane extending south from the Southampton Street entrance that would allow this on-ramp to achieve its full capacity during the PM peak period.

Adding the auxiliary lane, the reversible lane, and the second Old Colony track would require rebuilding virtually all deck and abutment components of the Dorchester Avenue and Boston Street bridges. The overpasses over the Southeast Expressway date from between 1957 and 1988. Most bridge abutments next to the rail corridor are older. The two roads rise steeply as they approach the overpasses, and constructing new abutments to allow a wider expressway would present urban design issues for the local streetscape. Fortunately, there is available land along most of this stretch of the Southeast Expressway corridor, and land takings could probably be avoided.

Boston Street presents an exception. The Polish American Citizens Club building in the wedge of land east of Boston Street but west of the Southeast Expressway might need to have the supports of one corner of the building underpinned or the building might need to be demolished. The opposite end of the Boston Street overpass would also need to be reconstructed to accommodate the expressway widening and envisioned rail corridor improvements. The modifications to the rail corridor might entail some nonresidential land takings.

3.4 THE NORTHERN END OF THE REVERSIBLE LANE

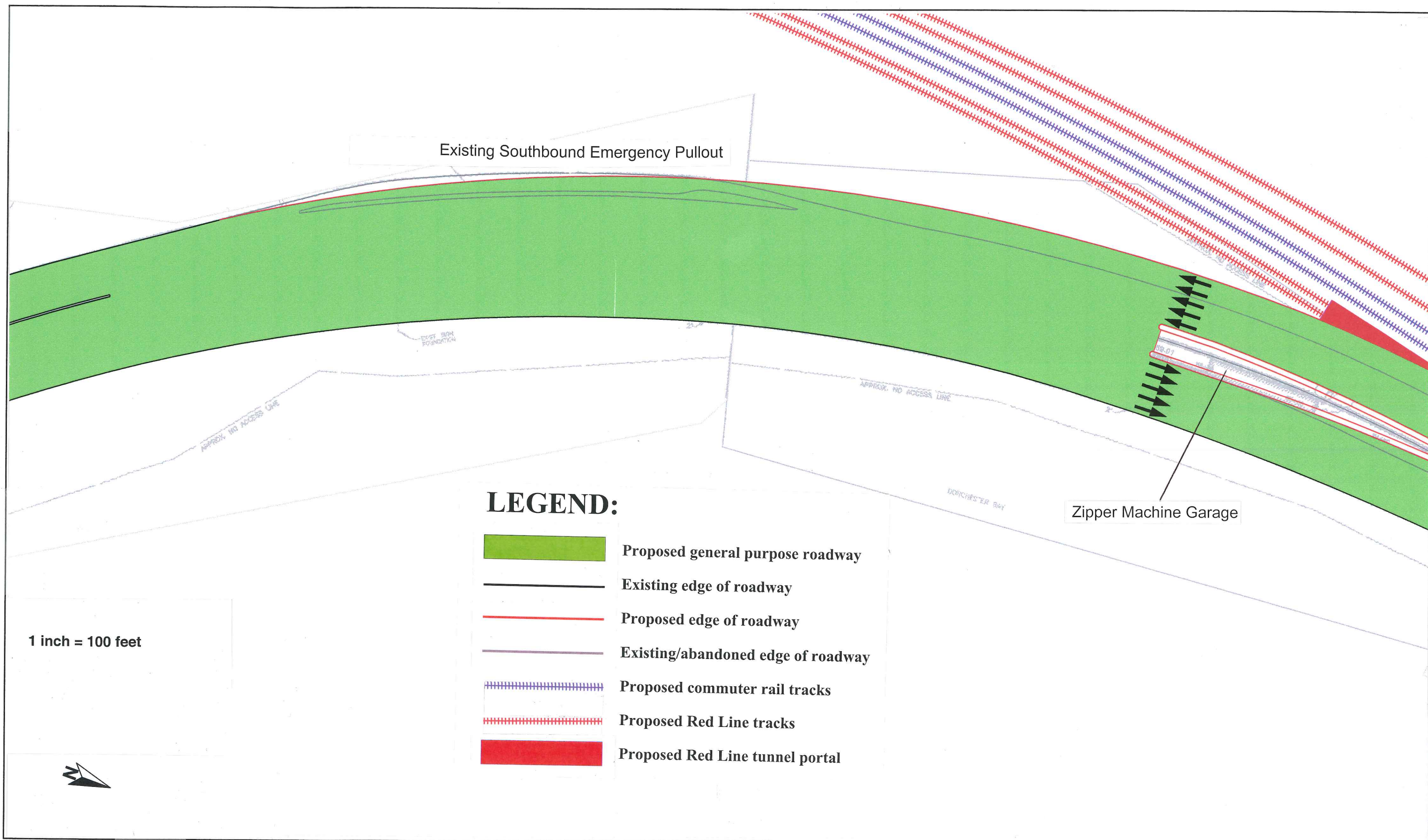
The northbound off-ramp from I-93 to Southampton Street and southbound on-ramp to I-93 from Southampton Street differ little from their original 1950s geometry. North of these ramps, the Southeast Expressway was completely rebuilt as part of the CA/T project. This area of transition is shown in Figure 3-7, with the Southampton Street ramps to and from I-93 southbound shown at the far left of the graphic.

The existing southbound lanes and median barrier would remain unchanged in this proposal. The main expressway corridor would be widened, reconstructing the northbound lanes to the east of their current position, and a second barrier would be built between the reversible lane and the northbound general-purpose lanes. The Southampton Street bridge decks over the southbound lanes and frontage road could be retained. The bridge decks over the reversible lane and the northbound lanes would need to be rebuilt. The northbound off-ramp to Southampton Street and the frontage road from Southampton Street to the Massachusetts Avenue interchange would also need to be rebuilt. Fortunately, the adjacent parcels contain parking and open industrial land, both used by Amtrak.

The final overpass that the reversible lane would go under is the Fairmount commuter rail line (see figure 3-8). Like the Southampton Street overpass, the section over the southbound general-purpose lanes and frontage road could be retained. The section crossing the reversible lanes, northbound general-purpose lanes, and frontage road would need to be rebuilt. The CA/T project employed an innovative construction method to build the southbound frontage road. This technique allowed uninterrupted rail service during construction and might be applied in the northbound direction as well.

Immediately north of the Fairmount Line tracks the reversible lane ends and a 10-lane entry/exit section starts. About 700 feet north of the Fairmount Line overpass is the first of two overpasses built as part of the CA/T project that comprise the Massachusetts Avenue interchange. The southernmost of the two overpasses, which connects with the South Boston Bypass Road, was built with sufficient width that it would not require reconstruction.

At the Bypass Road overpass there are now five southbound lanes. These include the southbound CA/T HOV lane, which is striped at this point to merge with the four general-purpose lanes. Figure 3-8 shows that the existing median would need



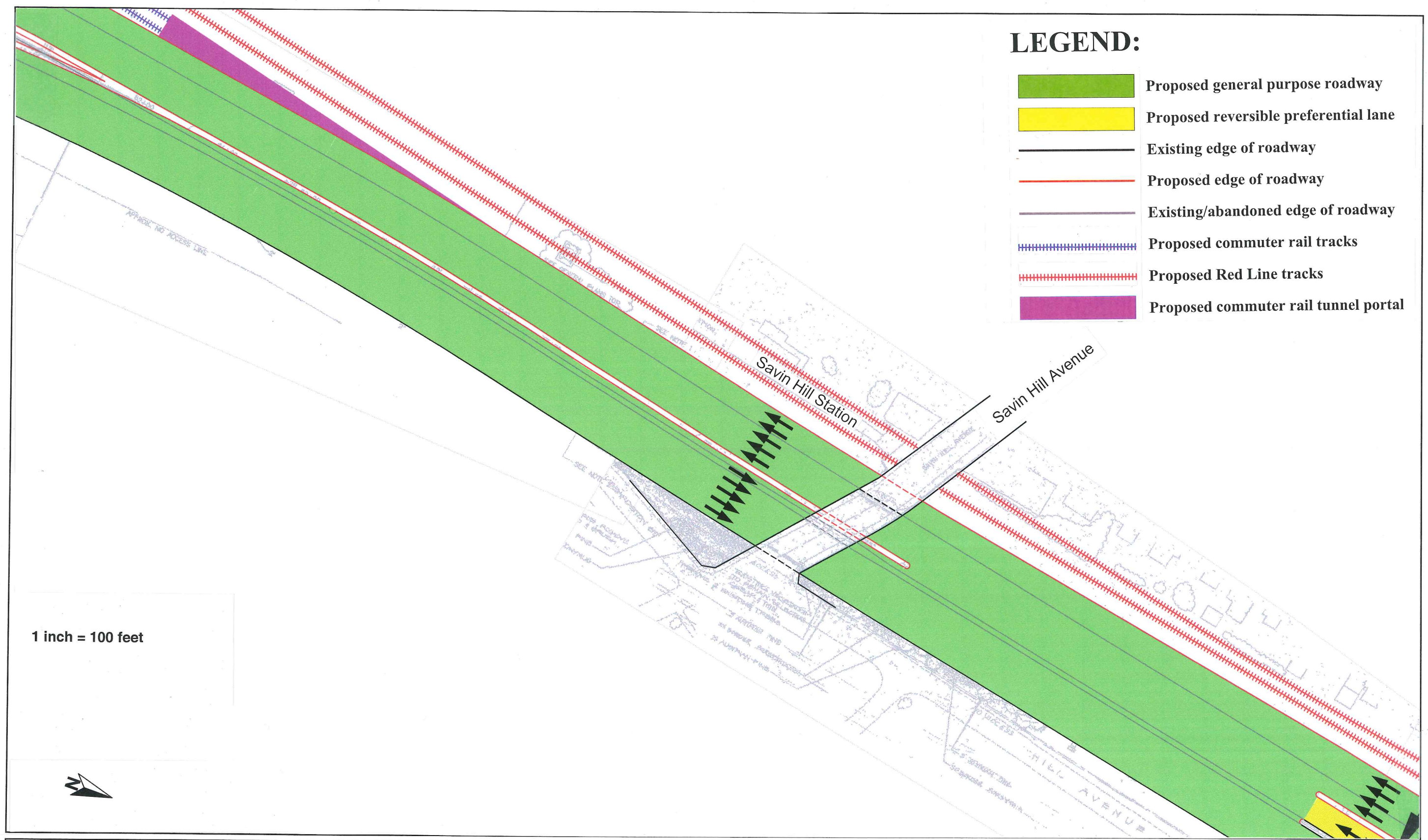
LEGEND:

- Proposed general purpose roadway
- Existing edge of roadway
- Proposed edge of roadway
- Existing/abandoned edge of roadway
- Proposed commuter rail tracks
- Proposed Red Line tracks
- Proposed Red Line tunnel portal

1 inch = 100 feet



FIGURE 3-2
Zipper Lane Operations Area



LEGEND:










- Proposed general purpose roadway
- Proposed reversible preferential lane
- Existing edge of roadway
- Proposed edge of roadway
- Existing/abandoned edge of roadway
- Proposed commuter rail tracks
- Proposed Red Line tracks
- Proposed commuter rail tunnel portal

1 inch = 100 feet

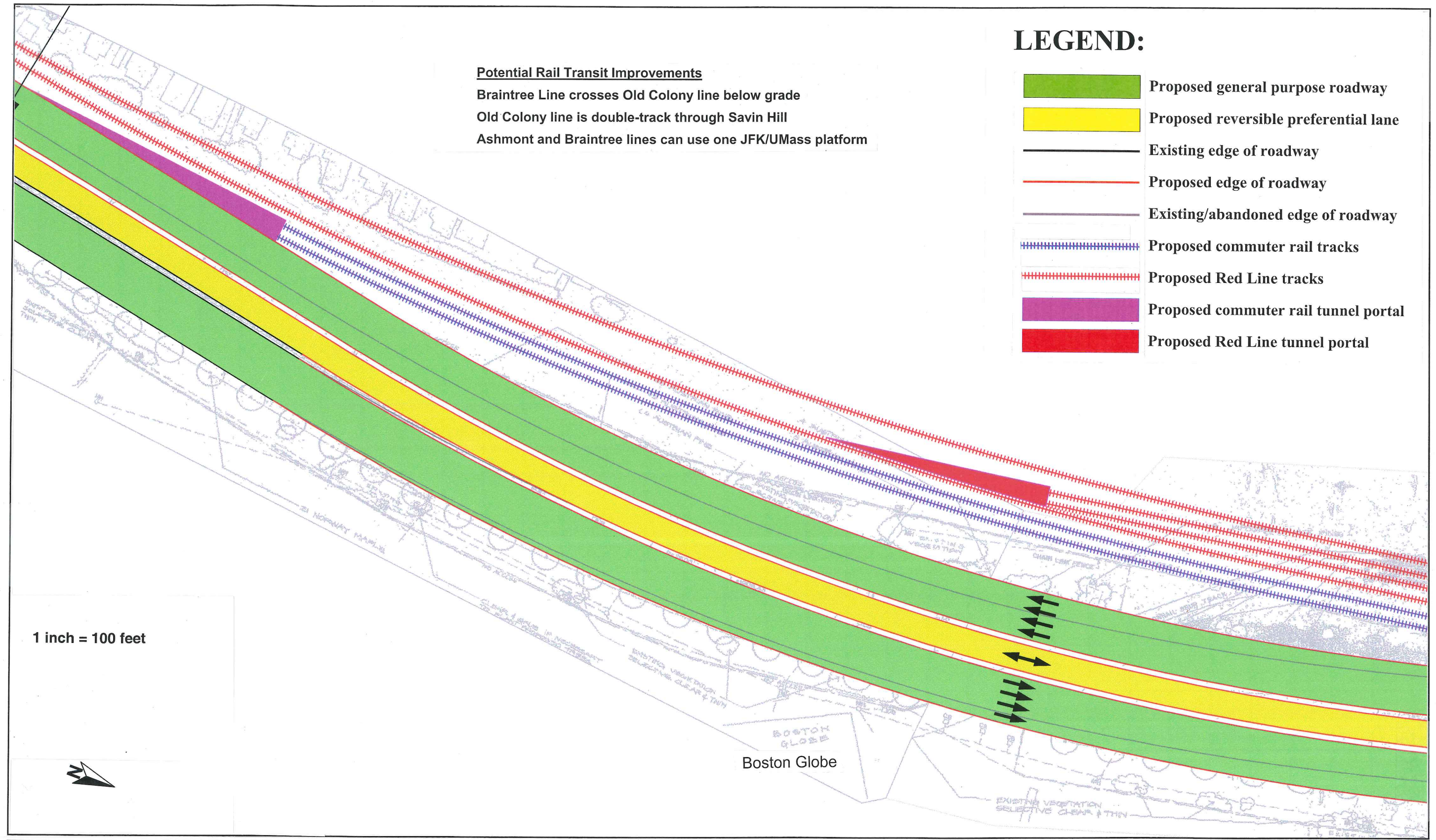


FIGURE 3-3
Savin Hill Defile

LEGEND:

-  Proposed general purpose roadway
-  Proposed reversible preferential lane
-  Existing edge of roadway
-  Proposed edge of roadway
-  Existing/abandoned edge of roadway
-  Proposed commuter rail tracks
-  Proposed Red Line tracks
-  Proposed commuter rail tunnel portal
-  Proposed Red Line tunnel portal

Potential Rail Transit Improvements
 Braintree Line crosses Old Colony line below grade
 Old Colony line is double-track through Savin Hill
 Ashmont and Braintree lines can use one JFK/UMass platform



1 inch = 100 feet



FIGURE 3-4
 Relocated Rail Lines

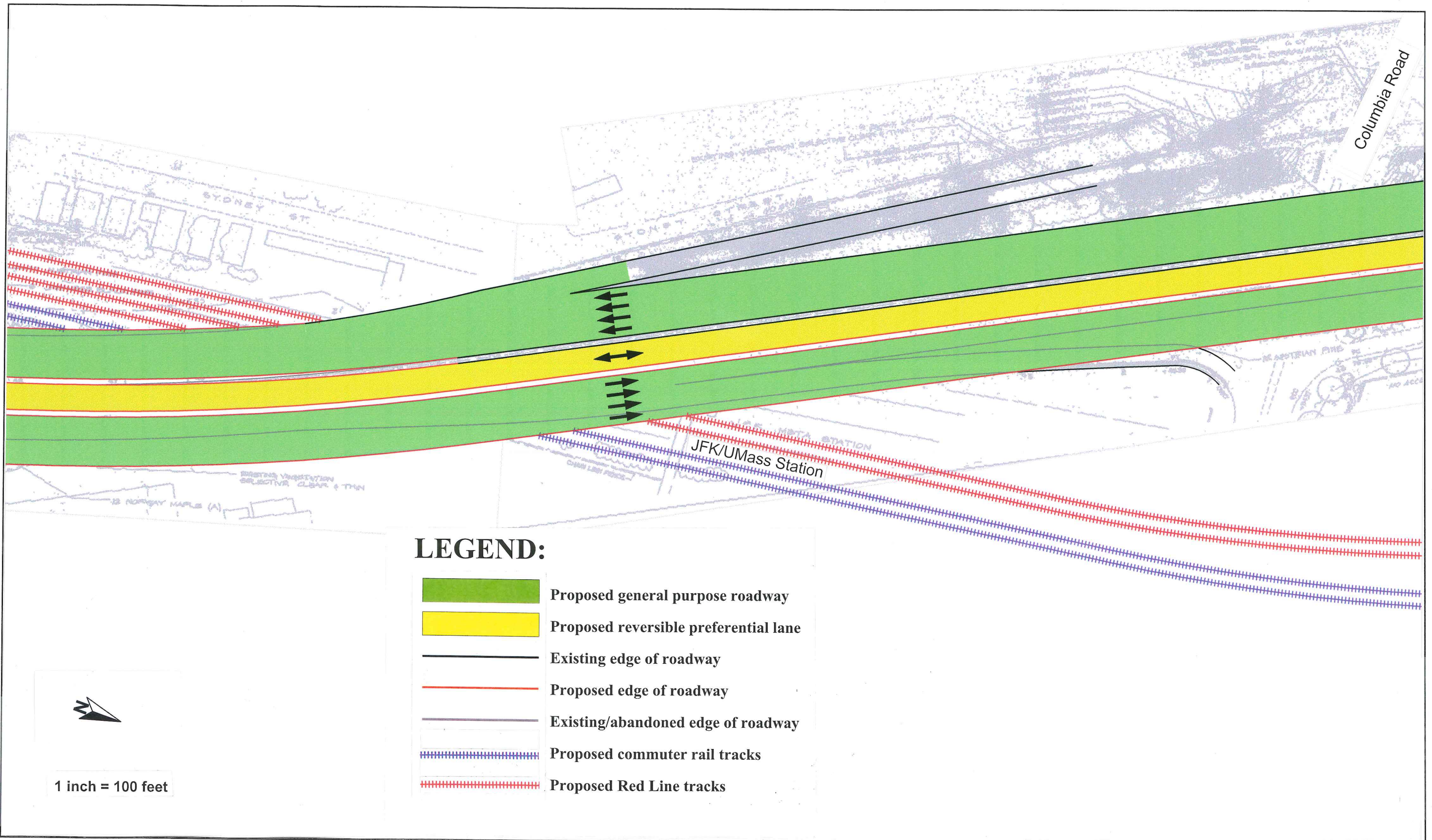


FIGURE 3-5
Consolidated Red Line JFK/UMass Station at Columbia Road

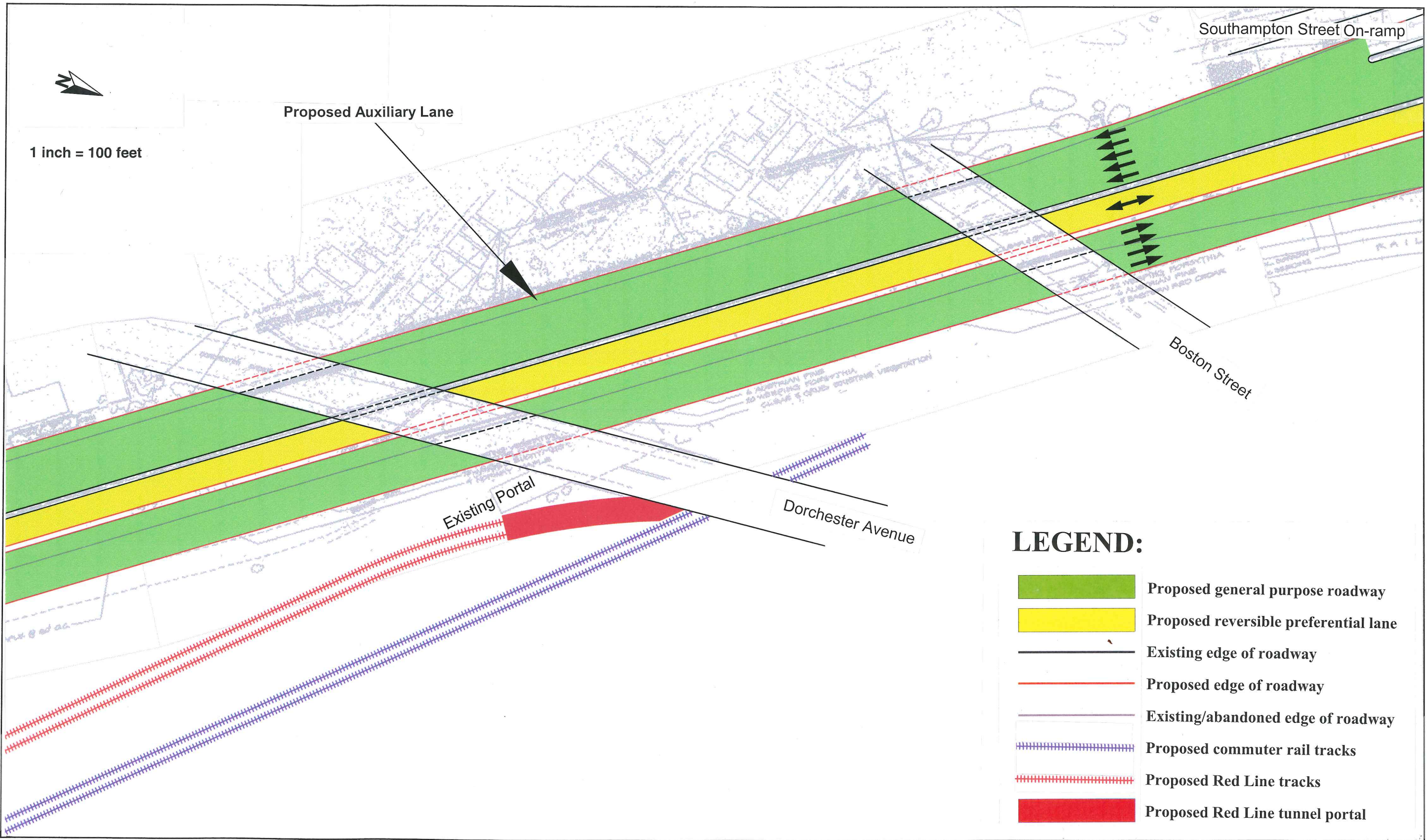


FIGURE 3-6
Dorchester Avenue and Boston Street

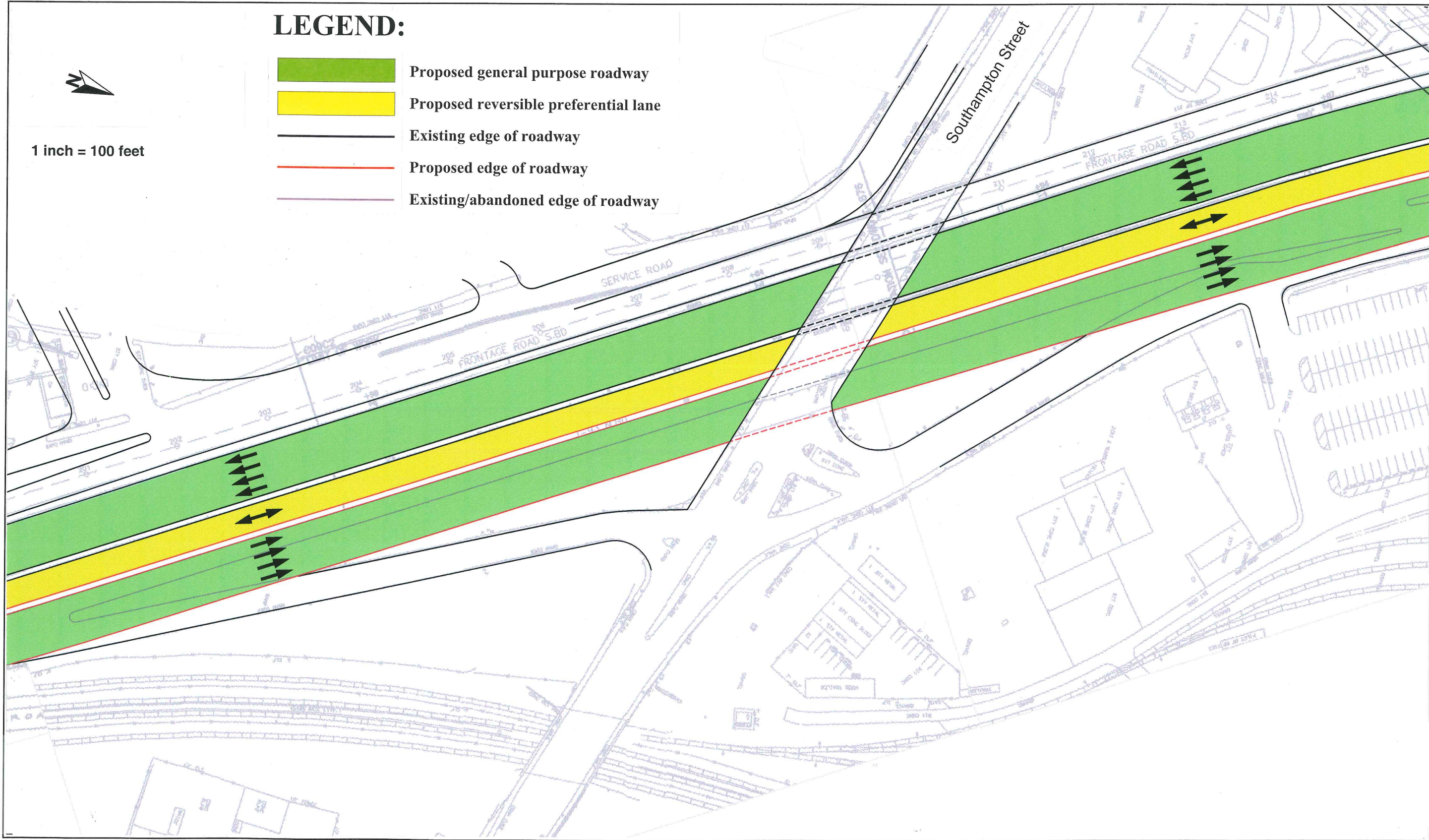
to be rebuilt towards the east, south of this overpass. This would allow a continuous stretch with five lanes of southbound traffic up to the reversible lane. During the off-peak periods, the narrowing from five to four lanes at this point would require the use of traffic cones.

The northbound five-lane entry/exit section would begin north of the Fairmount Line overpass and would require the expressway to be widened at this point, also shown in Figure 3-8. A reconstructed northbound frontage road would use a new underpass under the Fairmount Line and the Widett Circle Access Road before the Bypass Road overpass would need to be reconfigured slightly. However, a fifth northbound lane could be built under the Bypass Road overpass by simply grading and paving.

Immediately north of the Bypass Road overpass is Exit 20, a two-lane off-ramp leading to the Turnpike Extension westbound, the Seaport District and Logan Airport to the east, and a local exit to Kneeland Street. The right lane goes directly into Exit 20, and the second lane from the right would divide as it does today, resulting in a two-lane exit ramp and a four-lane main northbound barrel. The leftmost of these four lanes would enter the CA/T northbound HOV lane directly.

Adding a fifth northbound lane to create the entry/exit section would require tightening the radius of curvature of Exit 20. Preliminary analysis suggests that this modified exit from the widened expressway could be configured with a radius of 1,500 feet without requiring significant reconstruction of CA/T overpass components. This curve is similar to the curvature of this ramp immediately to the north.

There is insufficient distance for vehicles exiting the reversible lane to safely weave over three lanes in order to use Exit 20. Eligible vehicles continuing directly into the CA/T northbound HOV lane would be able to travel to all destinations reachable via Exit 20 with the exception of the Seaport District. Signage and pavement treatments could be used to dissuade traffic in the reversible lane from using Exit 20. In addition, signage at the Savin Hill entry/exit section should indicate that the Seaport District would be a destination requiring use of the general-purpose lanes.



LEGEND:

- Proposed general purpose roadway
- Proposed reversible preferential lane
- Existing edge of roadway
- Proposed edge of roadway
- Existing/abandoned edge of roadway

1 inch = 100 feet

FIGURE 3-7
Southampton Street Overpass



1 inch = 100 feet

LEGEND:

- Proposed general purpose roadway
- Existing/proposed preferential lanes
- Existing edge of roadway
- Proposed edge of roadway
- Existing/abandoned edge of roadway

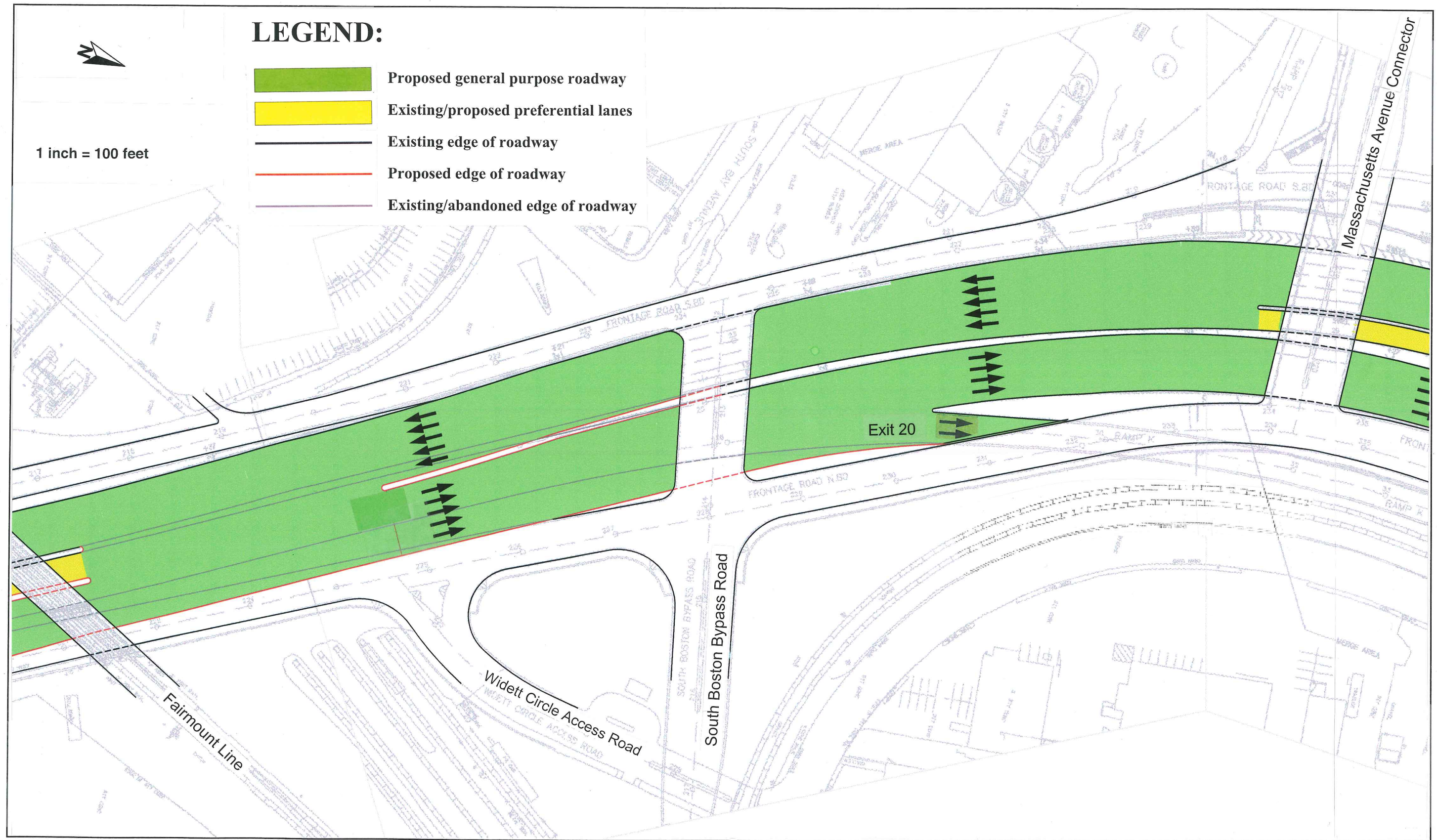


FIGURE 3-8
Massachusetts Avenue Interchange

CHAPTER 4



Summary and Next Steps

4.1 THE CHALLENGE OF IMPLEMENTATION

The Southeast Expressway is one of the most congested sections of the Boston metropolitan expressway system. Within the Southeast Expressway congestion caused by heavy traffic, and slow-moving queues caused by bottlenecks are experienced in both directions on a daily basis. Several-mile-long queues on the expressway itself are routinely observed, as well as queues on local roads approaching an on-ramp to a fully congested roadway. Some of the expressway queues extend beyond the Southeast Expressway and impede the flow of traffic to and from the Tobin Bridge, Storrow Drive, the Turnpike, and Route 3 serving the South Shore.

Since the completion of the CA/T and Old Colony projects, traffic has gradually increased on the Southeast Expressway, lengthening queues and increasing travel times significantly over the last five years. Regional traffic patterns have evolved to bring more traffic to I-93, even as the recent economic climate has thinned traffic in other parts of the expressway system. Long-range projections for regional demographic and economic growth, however, imply that the demands on the transportation system will continue to increase. This includes auto, transit, and nonmotorized travel modes.

Unless these projections are wrong, the need for additional capacity at key points in the transportation system will continually increase. As all recent experience indicates, adding capacity to a fully utilized urban transportation system is a difficult, lengthy, and expensive process.

Actions of this variety almost always require that most precious of urban resources: land. Comparisons with the celebrated Central Artery are apt. While I-93 and many of its local ramps were placed underground through Boston's

central core, the complex roadway systems approaching from the north, south, and east had to be rebuilt and expanded. This complete reconfiguration of the vital approach corridors was possible because of the availability of underutilized industrial land.

The plan described here uses tunneling at the one point in the corridor where there is absolutely no land available to incorporate into the transportation corridor: the Savin Hill defile. Unlike the Central Artery, which was buried through the downtown core, this plan envisions only tunneling at Savin Hill to the extent required to increase roadway and transit capacity. The surface at that point would remain entirely devoted to the various transportation systems.

North and south of Savin Hill, however, roadway and rail improvements could be created by widening the corridors. Available transportation and industrial land uses adjacent to the approaches to Savin Hill make it possible to add the envisioned reversible preferential lane and second Old Colony track without taking residential urban land. The costs and challenges of rebuilding or reconfiguring in this adjacent land would be substantial, however, even if the need for tunneling were minimized.

With the completion of this plan, 1,500 additional vehicles per hour would be able to travel through the South Bay–Savin Hill bottleneck using the preferential lane. This lane would offer extra capacity in the peak direction, but it could also be used during non-peak time periods. The eligibility criteria would be set to allow no more than 1,500 vehicles per hour in order to maintain a high level of service. A high level of service would be especially important if eligibility were set using a toll.

Transit capacity and service would be improved in two distinct ways. First, the reversible lane itself would be used for existing and potential bus services. Bus operators serving downtown Boston and Logan Airport, including the vital tourist industry, would be able both to offer their customers faster and more reliable travel times and to utilize their vehicles and drivers more efficiently.

Second, the expansion to two-track capacity for Old Colony service, discussed in the Appendix, would improve operational flexibility. The Old Colony Lines currently have the greatest challenge of all the local commuter lines: accommodating peak-period frequencies using a mostly single-track system. All rail operations require some system

and schedule flexibility to respond to unforeseen operations circumstances. The double-track expansion proposed here would improve the reliability of current peak-period operations and would facilitate potential schedule improvements in the future. It would also provide increased flexibility to deal with unforeseen circumstances.

A further element of transportation improvement would be the southbound auxiliary lane proposed as a fifth, rightmost lane between the Southampton Street on-ramp and the Columbia Road off-ramp. This lane has the potential to increase the number of vehicles that can enter the Southeast Expressway at Southampton Street from a current maximum of 1,500 per hour to approximately 2,000 per hour. If striped as a two-lane entrance, this increase could be greater, which would shorten the system of surface street queues that slowly approach this congested on-ramp each afternoon. While increasing overall system capacity would require additional capacity through Savin Hill, this auxiliary lane would address a critical local situation, and would be a valuable complement to improved transportation operations.

4.2 FURTHER PLANNING-LEVEL INVESTIGATIONS

A goal of this study was to show how the several intended improvements might be achieved. A system design has been presented that appears to be feasible, and all major or minor challenges that were identified have been noted. Possible design and construction approaches to overcome or work around these problems have been described.

At an MPO planning level, there are a number of valuable analyses that could be undertaken to better understand and evaluate this or related proposals. Extensive and severe queues were observed and measured at the outset of this project. To understand how queues form and collapse under various scenarios of traffic growth and roadway improvement, it is necessary to develop a computer simulation model.

At a minimum, the highway modeled should extend from the southern part of the Central Artery to the Braintree Split, in both directions, including traffic flow throughout the Braintree Split interchange. The inability of sufficient southbound traffic in the PM peak to pass through the Braintree Split is a problem that cannot be resolved solely within the Southeast Expressway. Extending preferential

lane capability through this interchange was outside the scope of this study, but should definitely be part of a follow-on investigation.

As shown in Table 1-2, queues were observed within and north of the Central Artery during both the AM and PM peak periods. Some of these queues are of considerable length, and extending the simulation model of the expressway farther north and south might be considered. Were the model to extend all the way north to beyond Montvale Avenue, the I-93 simulation model could interface with simulation work being undertaken in support of improvements to the I-93/I-95 interchange in Woburn.

The CTPS regional model set would also need to be used in the next phase of study. These models estimate regionwide traffic flows based upon assumptions of future demographic growth and land use that undergird the MPO planning process. Projections of future-year traffic on I-93 and its tributary ramps would be used as inputs to the simulation model. This would both place in stark relief the magnitude of future congestion problems on I-93 between the Braintree Split and the I-95 interchange in Woburn, and serve as a practical design tool in crafting an optimal preferential lane system.

The simulation model would need to be used in conjunction with the regional transportation model set for any alternatives analysis. This study most fully developed one, presumably feasible, alternative. If construction of the auxiliary lane by itself is considered an alternative, then there are already three alternatives to evaluate: No Build, the Auxiliary Lane, and Full Build. Other alternatives, including extending the current zipper lane, will surely present themselves as the severity of Southeast Expressway congestion continues to be apparent.

Another area for further planning-level analysis is possible reconfiguration of Columbia Junction, the Red Line track interlocking system between JFK/UMass and Andrew Station. The single Old Colony track is adjacent Columbia Junction, and adding a second track would entail significant reconstruction of Columbia Junction. This aspect of a follow-on study would probably build upon past MBTA studies, and would be done in conjunction with the MBTA to present options relevant to the MPO planning process.

Many of the figures in this report are windowed from an AutoCAD plan of the Southeast Expressway that was

developed by CTPS staff. This software rendering includes the Southeast Expressway from the northbound Morrissey Boulevard exit all the way to Albany Street in the South End. The AutoCAD plans in this report are all depicted at a scale of 1 inch=100 feet, allowing about a quarter mile of roadway to appear on each page. At an appropriate point in the planning process, it would become necessary to develop a full set of annotated plans scaled at 1 inch = 40 feet, which is the scale most often employed in roadway design.

Urban transportation systems have very long time horizons from visioning to ribbon cutting. Fixing this bottleneck of the Southeast Expressway is not a new idea, and neither is the concept of providing a second track for the Old Colony Lines. This study presents a very specific approach to improving these two systems, and defines an extent of work that could be implemented as a single, unified project. Alternative concepts to address Southeast Expressway congestion may be developed and considered, but the approach of completing the preferential lane system can now move to the next phase.

APPENDIX



Reconstructing and Improving the Rail Corridor

A-1 IMPROVING THE RAIL CORRIDOR

A-1.1 TUNNELING AS AN OPPORTUNITY FOR IMPROVEMENT

Relocating functioning rail transit lines into newly constructed tunnels is not something to be undertaken lightly, and any consideration of line reconstruction should explore any opportunities to improve as well as modernize the facility being rebuilt. Since various transit components in this corridor have been assembled piecemeal over the last century, some system design elements that conformed to specific needs at the time of implementation were later viewed as presenting drawbacks. The envisioned improvements to the Southeast Expressway present three opportunities that could improve rail transit in this corridor. Figure 3-4 shows a section of the study corridor contiguous with the corridor section in Figure 3-3, and includes key elements of the three potential rail improvements.

A-1.2 ELIMINATING THE BRAINTREE RED LINE FLYOVER

When the Braintree branch of the Red Line was constructed in the 1960s, it needed to cross a lightly used single-track railroad line, which at that time served only freight customers. A viaduct was the option chosen as the most cost-effective alternative to make this crossing. Since then, the visual and noise impacts of this transit viaduct have come to be viewed as detriments to the adjoining neighborhood.

The *High-Occupancy Vehicle Feasibility Study for the Southeast Expressway (I-93) and Route 3* (MassHighway, 1993) asserted that placing the Braintree branch of the Red Line in a tunnel through Savin Hill should be considered a benefit of completing the long-range HOV system proposed at that time. In the plan presented here, it is still necessary for the Braintree branch

to cross the Old Colony track, but the crossing is constructed underground as the Braintree Red Line branch and Old Colony track approach their respective tunnels under the Southeast Expressway.

A-1.3 ADDING A SECOND OLD COLONY TRACK

In the 1990s, the single-track freight line was upgraded and incorporated into the three-branch Old Colony commuter rail project. By the 1990s, the available remnants of freight lines upon which the new commuter rail lines were built were almost entirely single-track. Double-track passing sections had to be built on available land at strategic locations in order to allow acceptable peak-period schedules. The three Old Colony Lines operate with a bare minimum of double-track mileage, and schedule recovery from any operational delays is extremely difficult.

The *Feasibility Study* assumed that an HOV lane could be accommodated at grade through the Savin Hill area by placing just the two Braintree Red Line tracks in a tunnel. A review of MassDOT plans for this area indicates that the standard 28-foot lane envisioned by the *Feasibility Study* would require more rail right-of-way than would be freed up if only the Braintree tracks were placed in a tunnel. The *Feasibility Study* proposal might require narrowing the HOV lane at Savin Hill, an option that study does not discuss.

This study differs from the *Feasibility Study* in that it proposes a 10-lane entry/exit section at Savin Hill, entailing a 24-foot widening of the highway corridor, which would also consume more space than would be allowed by merely burying the Braintree branch of the Red Line. These 10 lanes, however, cannot be narrowed at this point, and this plan proposes that the Old Colony commuter rail line also be reconstructed in a tunnel.

If it becomes necessary to place the Old Colony track in a tunnel at Savin Hill, that would present an opportunity to take advantage of construction economies and build two underground tracks. Currently, the Old Colony commuter rail is double-tracked south of South Station until just north of Southampton Street (see Figure 1-3). It then becomes single-track until it reaches the Neponset embankment south of where the Ashmont Red Line tracks turn away from the Braintree branch corridor (see Figure A-1). On the Neponset embankment, the Old Colony commuter rail line widens into one of its two-track sections. This two-track

section continues until it crosses the Neponset River and enters Quincy. In the vicinity of the North Quincy Red Line station, the two Old Colony tracks rejoin and continue south in a single-track configuration.

Even though implementation of the reversible lane would only require reconstruction of the Old Colony line at Savin Hill, this plan proposes that expanded double-tracking be implemented the entire distance from the two-track section north of Southampton Street south to the two-track section on the Neponset embankment. Given a need to place the Old Colony tracks in a tunnel at Savin Hill, this would represent a logical extent of construction that would be associated with the tunneling activity.

If Old Colony service had use of two tracks the entire distance from South Station to North Quincy, the MBTA could achieve improved schedule adherence for the three Old Colony routes utilizing this corridor. The extended double-tracking would also facilitate any future schedule or operational improvements.

A-1.4 CONSOLIDATING RED LINE SERVICE AT JFK/UMASS STATION

The third opportunity relates to the configuration and operations of JFK/UMass Station. The Braintree branch of the Red Line was designed in the 1960s, prior to the decision to build the University of Massachusetts Boston campus at Columbia Point. Not anticipating the strong ridership growth from the new campus and other nearby developments, the Braintree branch of the Red Line was built to run express, on a separate pair of tracks, past what today is called JFK/UMass Station.

In the 1980s, the need for additional service at JFK/UMass was understood. As a result, the MBTA constructed a new platform on the Braintree Red Line branch in the early 1990s and made JFK/UMass a regular stop for all Red Line trains. Since inbound Red Line trains can stop at the platform of either the Ashmont or Braintree branch, inbound passengers wait in a large waiting area above the boarding platforms until alerted by an announcement and a variable-message sign that tell which track the next inbound train will be using. Then there begins a rush to the staircases. (With the proliferation of smartphones having transit-related applications, correctly anticipating the platform for the next inbound train could become routine.)

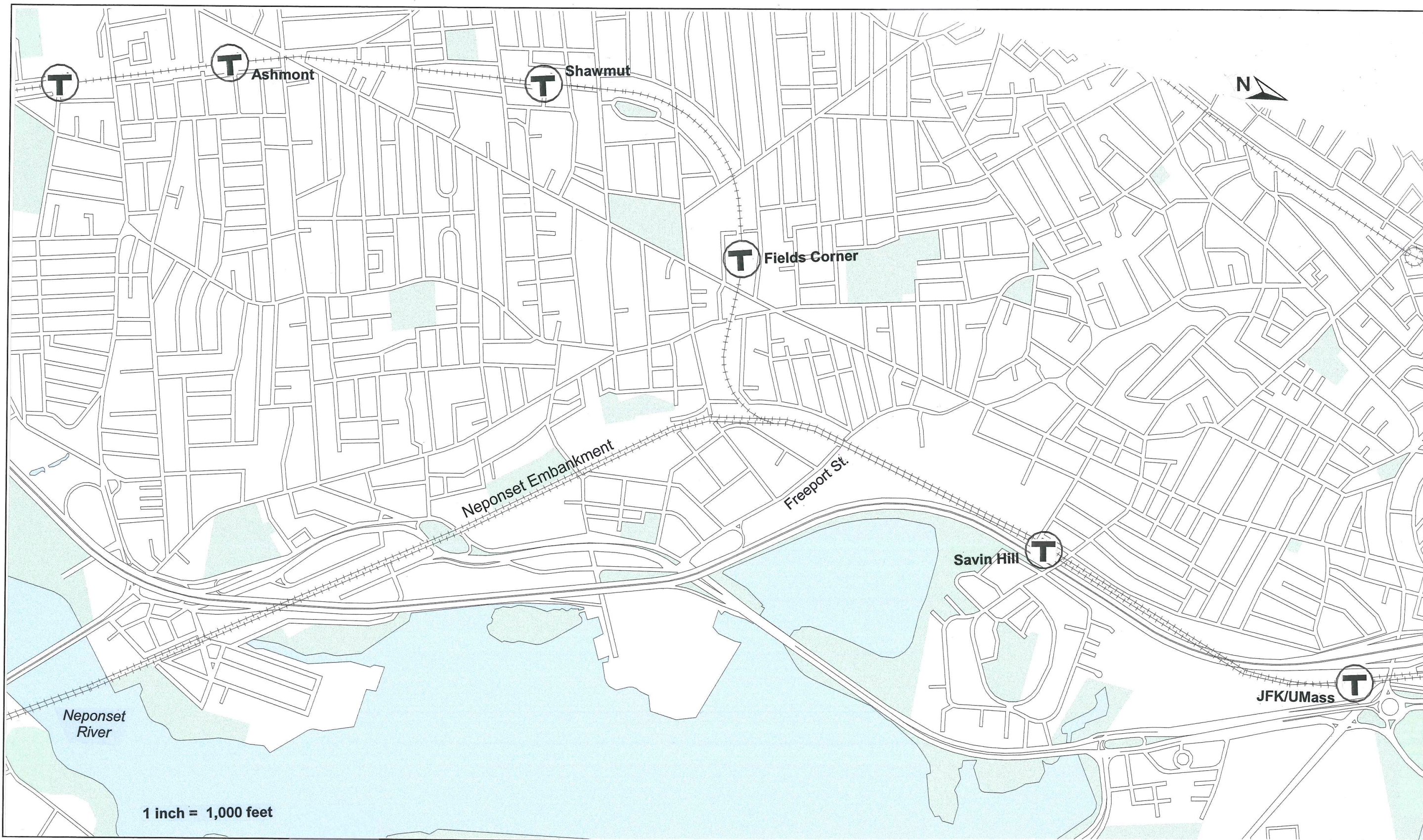


FIGURE A-1
Rail Corridors in Dorchester

Replacing the Braintree Red Line flyover with a new alignment crossing the Old Colony track below grade presents an opportunity to connect the Braintree Red Line tracks with the Ashmont tracks south of JFK/UMass Station. This would allow all Red Line service at that station to be provided on one pair of tracks (see Figure 3-5).

The required rail line relocation at Savin Hill could be accomplished with a track configuration that would keep the existing separate platforms for the Ashmont and Braintree branches of the Red Line. Indeed, in the future, keeping separate Red Line platforms may be a better option for operational reasons. The reconstruction, however, does open the possibility of Red Line consolidation at JFK/UMass, and the potential drawbacks and benefits of this approach are summarized below.

While the drawback of having separate platforms was originally the awkwardness of trying to catch the next inbound train, the benefits of consolidating Red Line service would best be realized in the context of any major “transit-oriented” development that takes place at this station. Red Line service currently requires four tracks and a large above-track waiting area. Freeing up the space used for two of the tracks would simplify the design and construction of any air-rights construction above the station. Platform access would also be simplified, since it would no longer require an above-track waiting area. As part of the reversible-lane project, a relocated Columbia Road off-ramp would also have to be built over part of the station. This would also benefit from the removal of redundant tracks.

Any developer at JFK/UMass Station must also create a design that allows for a second Old Colony track. In 2001, four years after service began on two of the Old Colony Lines (Kingston/Plymouth and Middleborough/Lakeville), a platform was built at JFK/UMass Station to allow Old Colony trains to stop there. The difficulty of scheduling trains on a single-track line is that the number of trains that can stop there is limited. A second track at the station is envisioned to allow more trains to stop when future demand warrants, possibly in conjunction with a major transit-oriented development at the site.

Implementing the rail relocation concepts described in this report would support a major development at JFK/UMass

Station in three ways. It would offer users a simple, high level of Red Line service at a consolidated platform. It would free up space, both on the ground and above the tracks, for the overall development plan. Finally, allowing Old Colony service to use two tracks all the way from South Station to North Quincy would support the scheduling of commuter rail service at JFK/UMass more than merely adding a second track at the station itself.

A-2 RECONSTRUCTING THE RAIL CORRIDOR

A-2.1 TRACK GRADES NORTH OF SAVIN HILL

As it was depicted in Figure 3-4, the system of relocated rail lines looks straightforward. The Red Line track to Ashmont would stay in its current location. The Braintree Red Line tracks would be located between the two Ashmont tracks. They would descend and pass under the track from Ashmont, as well as under the two Old Colony tracks. The Braintree branch would then pass under the Southeast Expressway, as would the two Old Colony tracks a bit farther to the south. South of Savin Hill these four tracks would emerge from under the Southeast Expressway in their correct relative positions. There would be a four-track right-of-way through Dorchester’s Neponset neighborhood to which these four tracks would connect: the Braintree Red Line tracks to the east and the Old Colony tracks to the west (see Figure A-1).

The proposed Old Colony tunnel’s northern portal would be located about 2,000 feet south of the JFK/UMass Station platform. If the Old Colony tracks were to descend at a 1.5% grade, they would be 30 feet lower at the tunnel entrance than at the station platform. Relying only on this calculation and without checking area terrain, commuter rail ruling grades (the steepest grade currently existing on a section of track), or tunnel box design specifications, it appears that there would be a feasible alignment for bringing the Old Colony tracks under the Southeast Expressway without resorting to extreme construction solutions such as lowering the platforms at JFK/UMass Station.

The Braintree Red Line tracks would pass under the Old Colony tracks about 800 feet north of the Old Colony tunnel portal. The Red Line trains would be able to start their descent at about the same point as the Old Colony tracks. The Red Line platforms at JFK/UMass Station are

shorter than the Old Colony platform, but some level track would be required for a junction of the Braintree and Ashmont Red Line branches.

The electrically powered, multiple-unit Red Line trains are designed for steeper grades than the commuter rail trains, and a 3% grade is assumed for this calculation, the same grade that Braintree trains currently experience as they cross the Neponset River between Dorchester and Quincy. Descending at a 3% grade, the Braintree branch tracks would have dropped 36 feet by the time they reached their proposed tunnel entrance 1,200 feet after the beginning of their descent and 800 feet before the Old Colony tunnel entrance. At point, the Old Colony tracks, descending at a 1.5% grade, would have descended only 18 feet, which would allow a full 18-foot clearance above the Braintree tracks within which to construct a tunnel box under the descending Old Colony tracks.

Reconfiguring the rail alignments in this area at or below grade is possible because the design standards for the construction of the Southeast Expressway in the 1950s left an elongated parcel of underutilized rail corridor in this area. This extra rail corridor space could be utilized to bring tracks below grade as they approach the Savin Hill defile, which has no land to spare at all. The ultimate design for the relocated rail lines would probably need to accommodate a freight spur that branches from the Old Colony track to serve the *Boston Globe* printing plant in South Boston, shown in Figure 3-4.

A-2.2 TRACK GRADES SOUTH OF SAVIN HILL

The Old Colony tunnel would be about 1,900 feet long, and would emerge from under the widened Southeast Expressway about 900 feet south of the Savin Hill Avenue overpass. The Braintree Line tunnel would be longer, and would end about 300 feet south of the Old Colony tunnel portal (see Figures 3-2 and 3-3). About a half mile south of Savin Hill Avenue, the rail corridor would cross over Freeport Street.

The expanded six-track rail corridor needs to be designed to cross above Freeport Street, as it does now. This would maintain the existing connection to the Ashmont Red Line branch, which turns west from the rail corridor about 800 feet south of Freeport Street. It would also provide a simple connection to the Neponset embankment for the Old Colony tracks and the Braintree branch of the Red Line.

Today the Neponset embankment is four-track along much of its length. The single Old Colony track divides to form a two-track section about a half mile south of Freeport Street, which continues south parallel to the Braintree branch Red Line tracks, crosses the Neponset River, and resumes a single-track configuration just south of the North Quincy Red Line station. The Neponset embankment would need to be widened at the northern end to lengthen the Old Colony double-track section. This could be achieved by constructing retaining walls within the rail right-of-way, and would be a necessary initial step in the construction process.

From their southern portal, the Braintree tracks would have about 1,500 feet to climb before reaching Freeport Street, and the Old Colony tracks would have about 1,800 feet. With an allowable grade of 3%, the Braintree tracks would be able to rise 45 feet, which would allow this track alignment to easily cross Freeport Street.

Bringing the Old Colony tracks over Freeport Street would pose a greater challenge. With a 1.5% grade, these tracks would rise only 27 feet over the 1,800 feet between the portal and Freeport Street, and it should be assumed that an alignment going over Freeport Street would require a grade steeper than 1.5%. To reduce the required grade, Freeport Street could be lowered and the Old Colony span over Freeport Street could be reconstructed at a lower level.

A-2.3 FINDING SPACE TO WORK IN A NARROW CORRIDOR

The overriding challenge of constructing the two rail tunnels is to maintain the capacities of the Southeast Expressway, the Old Colony Lines, and the Ashmont and Braintree branches of the Red Line throughout the construction project. Each of these four systems operates at full capacity for significant portions of the day, and any construction-phase service degradation could be seen as a fatal flaw. By utilizing a combination of tunneling techniques and careful construction staging, it might be possible to construct the two tunnels without significant disruption to current rail and highway operations.

From JFK/UMass Station to Freeport Street, almost all available land in or near the rail corridor would need to be utilized to support construction. The work area within the rail corridor itself would be obtained by combining Ashmont and Braintree Red Line services on the Ashmont tracks from JFK/UMass through Savin Hill. South of Savin Hill, the two Red Line branches would separate, using a

temporary flyover. A flyover junction would be necessary because normal safety standards used in operating so-called “flat” junctions would seriously degrade service during the extended morning and evening peak periods. The need to cross the Old Colony track also dictates the need for a temporary Braintree Red Line flyover.

Even building the temporary flyover without impacting service poses a challenge. Figure A-2 illustrates a track configuration that would allow construction of the two tunnel portals south of the Savin Hill Red Line station. To construct this system without disrupting Red Line service, it would first be necessary to widen the Neponset embankment. Old Colony service would continue to use the track that would be the southbound track in the ultimate configuration.

A temporary southbound Braintree Red Line track could then be built branching from the Ashmont Red Line tracks just south of Savin Hill Station. Fortunately, there is a large amount of open industrial land west of the rail corridor through which a temporary viaduct could be constructed. This adjacent land would also allow for any widening of the rail corridor required to accommodate six tracks.

The temporary southbound Braintree Red Line track would cross the Ashmont and Old Colony tracks and descend to grade in the newly constructed northbound Old Colony railbed. Connecting the temporary track to the southbound track to Braintree could be done over a weekend.

Rerouting the southbound Braintree trains over the temporary viaduct would allow the unused southbound Braintree track to be pulled up. A northbound temporary track could then be built in the vacant southbound railbed. The northbound temporary track would ascend roughly parallel with the southbound temporary track and share a common temporary viaduct for crossing the Old Colony track and the Red Line’s Ashmont branch, as well as crossing over Freeport Street.

The northbound temporary Braintree track would cross the Ashmont branch again, and would then return to grade in an abandoned freight spur railbed and connect with the Ashmont branch immediately south of Savin Hill Station. There is an abandoned freight spur underpass beneath the Ashmont branch that would need to be maintained during construction of the temporary viaduct for construction access in later phases of construction.

With the Braintree service relocated to the temporary viaduct, only three of the five tracks using the existing bridges over Freeport Street today would remain in use. This would allow staging of any reconstruction required for allowing six tracks to cross Freeport Street at the desired alignments and elevations. Also, the work area shown in Figure A-2 could be accessed through a Massachusetts Water Resources Authority (MWRA) parking lot.

The temporary consolidation of Braintree and Ashmont services through Savin Hill would allow the Braintree branch flyover south of JFK/UMass Station to be removed. Construction vehicles could enter this area by crossing under the Southeast Expressway through the *Boston Globe* freight spur underpass.

Construction vehicles would need to cross the Old Colony track at grade while the abandoned Braintree flyover was being removed. After flyover removal, the Old Colony track could be temporarily relocated adjacent to the Ashmont tracks, creating the maximum possible unobstructed work area. This construction-phase track configuration is shown in Figure 3-4. The track at the top of the figure is the southbound Ashmont track, which would remain at its current location throughout construction. The northbound Ashmont track could remain adjacent to the southbound track during the initial construction stages, and the single Old Colony track could be positioned next to the northbound Ashmont track. After confining the three active tracks to one side of the worksite, a second truck entrance could be set up under the Southeast Expressway just south of JFK/UMass Station, an area visible on the left in Figure 3-5.

A-2.4 BUILDING THE TWO TUNNELS

After rerouting the Braintree Red Line service to the Ashmont branch through Savin Hill Station and establishing work areas north and south of the proposed tunnels, the Red Line and Old Colony tunnels could be built. This study proposes that the Old Colony tunnel be built in the former Braintree Red Line corridor using cut-and-cover techniques. This tunnel must accommodate larger commuter rail equipment and be close to the surface to be able to more easily rise to cross over Freeport Street to the south. Both of these factors favor the cut-and-cover approach.

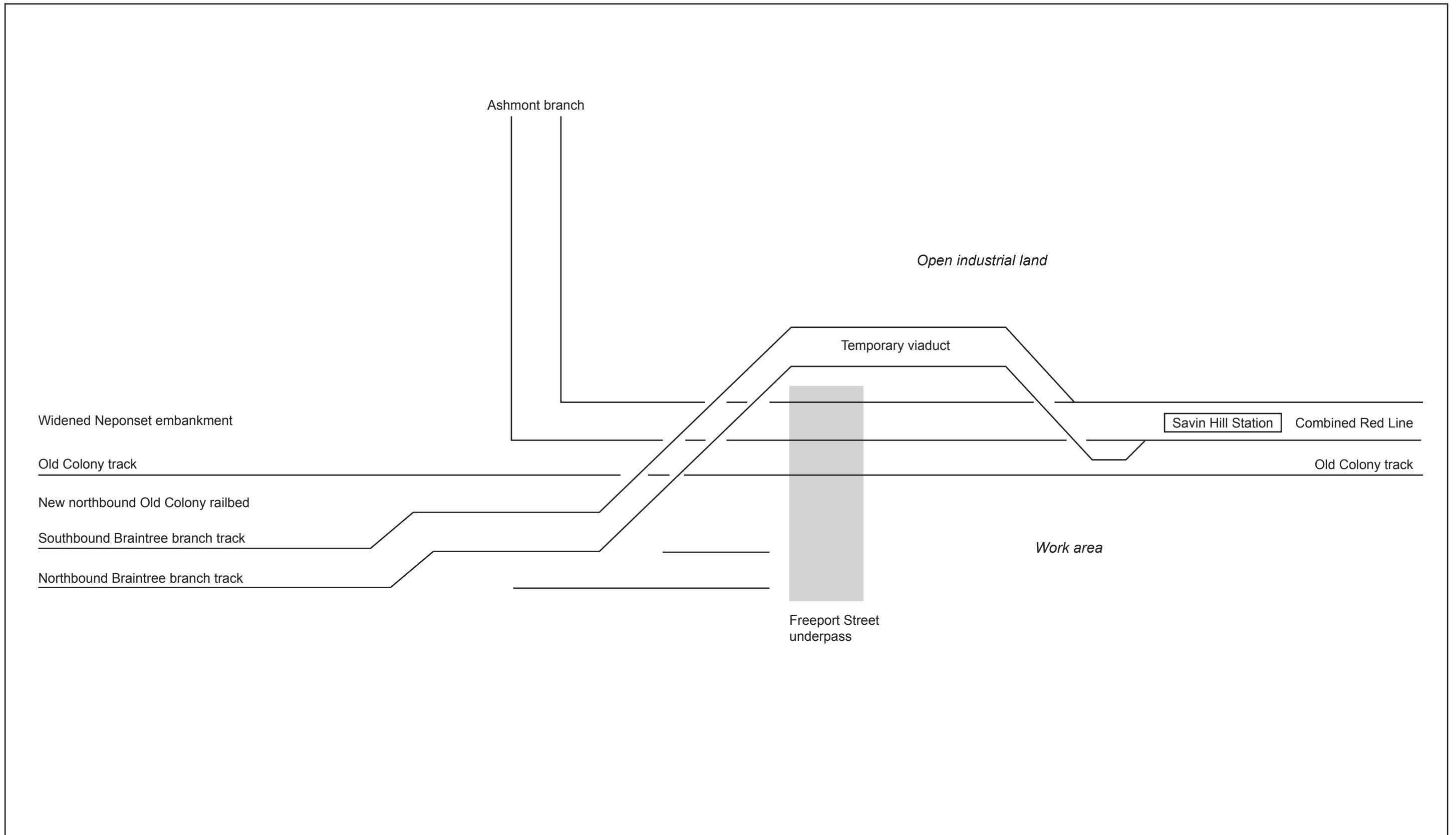


Figure A-2
Temporary Rail Operations

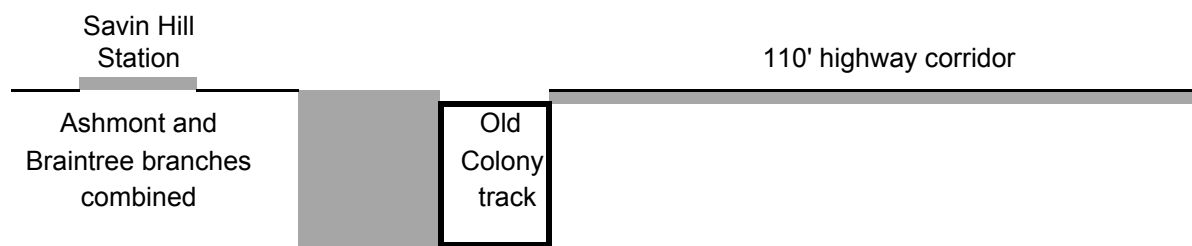
Existing conditions



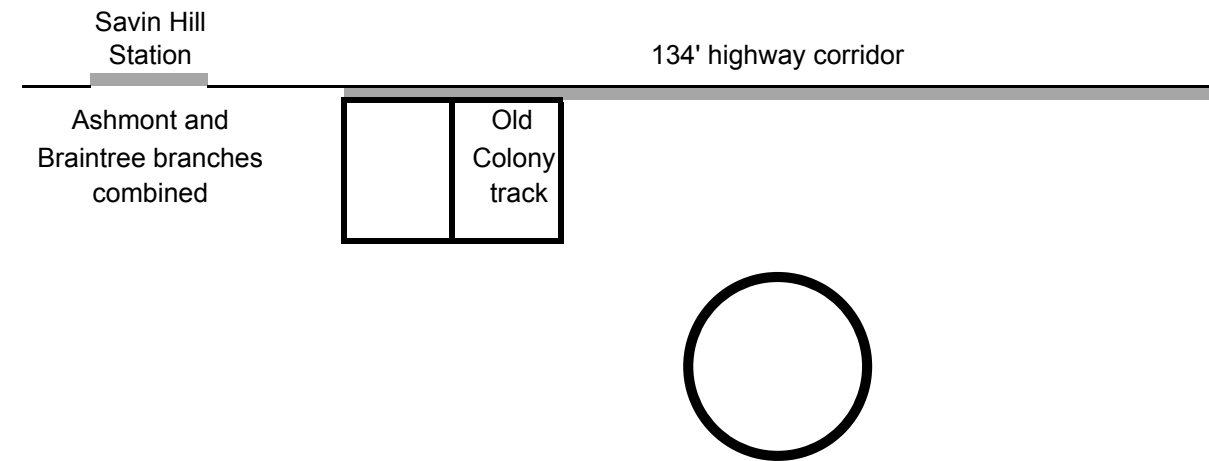
Consolidate Ashmont and Braintree service; build northbound Old Colony tunnel box



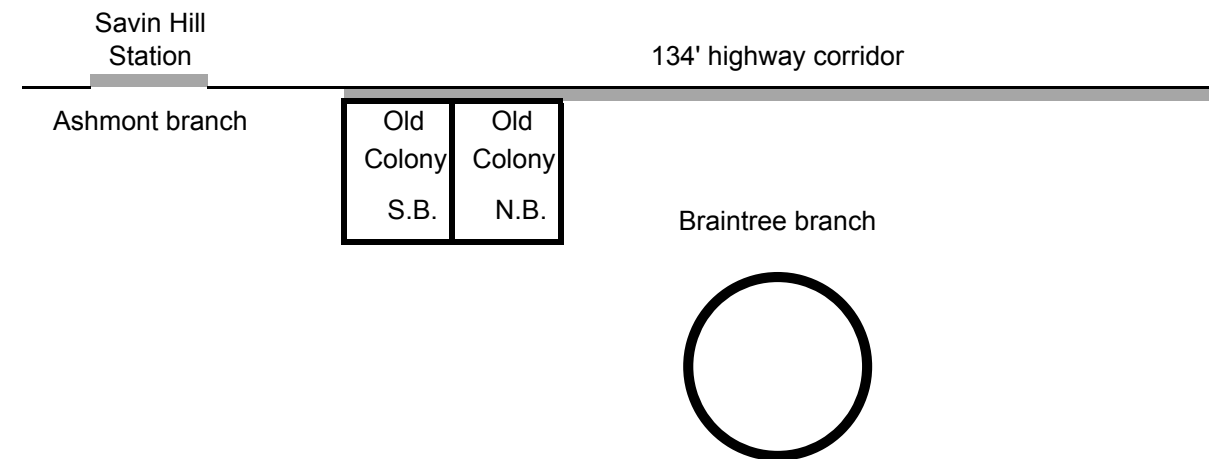
Operate Old Colony service in northbound tunnel box; build southbound Old Colony tunnel box



Bore Braintree branch tunnel; widen Southeast Expressway



Operate Braintree Line through new bored tunnel; operate Old Colony Lines on two tracks



Not to scale

The Red Line tunnel could be built under the Southeast Expressway using a tunnel boring machine, or “TBM.” Rapid transit vehicles are smaller than commuter rail cars, and boring two-track rapid transit tunnels is commonplace. Boring under the Southeast Expressway would eliminate traffic disruption during construction, a critical consideration.

The TBM would not drill the entire length of tunnel. As can be seen in Figure 3-4, the Braintree branch would go under the Southeast Expressway about 800 feet south of its tunnel portal, beyond the point where it would cross the Old Colony tracks underground. The TBM could be assembled in a trench at this point, which is also the deepest point of this tunnel. The other rail features in this area could be built using open excavation.

After TBM assembly and with boring operations underway, the Old Colony tunnel could be built. Figure A-3 illustrates how the Old Colony two-track tunnel could be built in the former Braintree Red Line corridor. The current configuration is at the top left of the figure. After the Braintree service has been moved to the Ashmont branch, a trench wide enough to construct one commuter rail track could be excavated.

Given the size of commuter rail equipment, current rail standards, and the width of concrete tunnel walls, the two-track Old Colony tunnel would occupy much of the space now used by the two Braintree tracks and the one Old Colony track. In the plan shown in Figure A-3, the Old Colony track closest to the Southeast Expressway would be built first. At the same time, most of the new track alignments shown in Figure 3-4 could be built, as well as a second Old Colony bridge over the lowered Freeport Street.

After completion of the half of the tunnel for northbound Old Colony trains and their approaches, single-track Old Colony service could be moved to the new tunnel. This would widen the work area at Savin Hill to include the now-abandoned Old Colony railbed. The half of the tunnel with the southbound Old Colony track would be constructed in this area. After relocation of Old Colony service to the new tunnel, construction access to this work area would be by way of the abandoned freight spur south of Savin Hill Station.

The Braintree TBM would come to grade in the work area shown in Figure A-2, and the TBM could be disassembled and removed via the MWRA parking lot. The Braintree Red

Line tracks could be built over Freeport Street in roughly their current alignment, and reconnected to the existing tracks on the Neponset embankment. The temporary Braintree branch viaduct could then be removed, and the original Old Colony track could be reconstructed to connect with the completed Old Colony tunnel as a second track.

After completion of the Old Colony tunnel box and the end of construction activity at the two portal areas, the Southeast Expressway could be widened from 110 feet to 134 feet in this area. This would be the vital 10-lane entry/exit section that would allow eligible vehicles to enter or leave the zipper lane or the reversible lane as required to complete their respective trips.

A-2.5 COLUMBIA JUNCTION

North of JFK/UMass Station there is a track interlocking system known as Columbia Junction. Columbia Junction organizes the tracks of the Ashmont and Braintree Red Line branches and connects these tracks with both the Red Line tunnel to Andrew Station and with a pair of access tracks connecting with the Red Line’s Cabot Yard (maintenance facility) in South Boston. A single Old Colony track parallels the aboveground Red Line and Cabot Yard access tracks.

At Dorchester Avenue, the Red Line tracks, at this location used by both Ashmont and Braintree trains, currently enter the tunnel leading to Andrew Station. This plan assumes that it would be necessary to reconstruct the Red Line tunnel between this portal and Andrew Station.

Figure 3-6 shows a proposed new tunnel entrance for the Red Line allowing an approach to Andrew Station under Dorchester Avenue. Currently, the Red Line diverts from its Dorchester Avenue alignment south of Andrew Station, goes under Boston Street, and then turns sharply to enter the aboveground rail corridor. The roof of the existing tunnel box, partially shown in Figure 3-6, protrudes several feet above ground level for several hundred feet, where it would interfere with the widening of the Southeast Expressway.

The new tunnel entrance would be built in conjunction with reconstructing the Dorchester Avenue overpass. The tunnel would extend approximately 1,000 feet beneath Dorchester Avenue to Andrew Station and might be built using mining techniques.

Constructing the new Red Line tunnel portal and the Dorchester Avenue overpass would make space available for the widening of the Southeast Expressway and the addition of a second Old Colony track, while allowing continued two-track access to the Red Line’s Cabot Yard. The new tunnel to Andrew Station would also shorten Red Line travel times.

The Boston Street overpass would also need to be rebuilt to accommodate expressway widening, the addition of a second Old Colony track, and continued two-track access to Cabot Yard. Nonresidential land takings might be required to create a four-track rail corridor.

Figures 3-5 and 3-6 do not depict the complexity of Columbia Junction, showing only the four tracks envisioned for Red Line and commuter rail service in the modified rail corridor. Adding a second Old Colony track would require some reconfiguration of Columbia Junction. The space required to add a second Old Colony track might become available as part of the consolidation of Red Line service to one pair of tracks at JFK/UMass Station.

Specific modifications to Columbia Junction are not proposed in this study, but are assumed to be feasible because of the simplification offered by consolidation of the Red Line branches at JFK/UMass Station. Also of critical importance is the availability of land adjacent to Columbia Junction that could be utilized for construction staging.