I-93/Southeast Expressway/Route 3 (Braintree Split)

Operational Assessment and Potential Improvements

A report produced by the Central Transportation Planning Staff for the Boston Region Metropolitan Planning Organization

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ORIGIN OF STUDY

State legislators, South Shore Coalition members, and officials from South Shore area communities requested that this study be included in the fiscal year 2002 Unified Planning Work Program produced by the Boston Region Metropolitan Planning Organization (MPO). In their letter to the MPO, proponents of this study expressed concern about safety, congestion, and delays at the Braintree split, especially their effects on Route 3 in that vicinity.

THE BRAINTREE SPLIT

The "Braintree split" is essentially the network of ramps and highway segments that comprise the interchange of I-93, the Southeast Expressway, and Route 3 South. The split is located partially in the town of Braintree and partially in the city of Quincy. All ramps into and out of the interchanges are directional. A directional connection is defined "as a one-way roadway that does not deviate greatly from the intended direction of travel. Interchanges that use direct connections for the major turn movements are termed directional interchanges."[1]

To the southeast of the split are Route 3 interchanges 18 (Washington Street) and 19 (Burgin Parkway) with their associated lane drops and weaving, merging, and diverging maneuvers that add to the complexity of the main interchange. Immediately to the southwest of the split is I-93 interchange 6 (Route 37, Granite Street). Just north of the split is the southern terminus of the Southeast Expressway HOV lane and less than one-half mile north of that is interchange 8 (Furnace Brook Parkway).

During an average weekday, the Braintree split carries between 250,000 and 275,000 vehicles on six two-lane directional ramps that connect the three major highways: I-93/Southeast Expressway, I-93/ Route 128, and Route 3 South. In short, the Braintree split is an interchange that was designed for high-level connections (flyovers). It carries more than a quarter of a million vehicles a day, whose drivers encounter a complex driving environment, including the unpredictability of traffic incidents. Therefore congestion, delays, and queues are common, especially in the northbound direction in the morning and, to a lesser degree, in the southbound direction in the evening.

[1] American Association of State and Highway and Transportation Officials, *A Policy on Geometric Design of Highways and Streets,* Fourth Edition, Washington, D.C., 2001.

TRANSPORTATION PROBLEMS

Studies and field reconnaissance indicate that many of the delays at the Braintree split interchange are due to bottlenecks outside of the split itself. One example is the northbound AM peak period traffic congestion on the Southeast Expressway resulting from downstream turbulence of merging traffic from the Granite Avenue on-ramp, the Route 3A on-ramp, the HOV lane merge, and the Columbia Road on-ramp. In addition, ramp merge difficulties at the entrance to Route 24 create PM peak-period traffic congestion on the I-93 segment beginning at Route 24 that spills back into the split. Also, on Route 3 South the AM peak period merging traffic from the northbound on-ramps at Union Street, Route 18, Derby Street, and other routes creates traffic turbulence on Route 3 South, resulting in extensive traffic queuing.

The internal problems are the weaving, merging, diverging, short sight distance, insufficient intersection capacity, and lane drops. Many internal problems of the AM peak travel period also show up during the PM peak travel period. Field reconnaissance indicates that some of the merging and weaving traffic operations at the Braintree split create safety problems, for example, the short weave sections for Route 37 northbound on-ramp traffic proceeding to the Southeast Expressway and for Washington Street northbound on-ramp traffic proceeding to the HOV lane. Another example is the southbound PM peak-period traffic congestion on the Southeast Expressway that result from the downstream turbulence of merging traffic from the Furnace Brook Parkway on-ramp, the HOV lane, and traffic diverging to Route 3 South and I-93 southbound. This causes traffic queues on the Expressway that extend into the Granite Avenue area.

Transportation problems in the study area include, but are not limited to, traffic congestion, highway safety issues, and mobility. The Central Transportation Planning Staff (CTPS) applied a regional approach to address the problems identified in and around the split, as its traffic is regional in character, in other words, it is not confined to the adjacent communities. Also, as most of the congestion at the split occurs during the peak travel periods, the study focused on commuter trips between communities in southeastern Massachusetts and the Boston urban core. In this study, highway, transit, and parking solutions were considered for improving safety and traffic flow through the split. All of the planned transit and highway projects currently under construction or in planning stages that would affect traffic through the split were reviewed and accounted for.

OBJECTIVES

The primary objectives of the study were to:

- Assess traffic operations on ramps and roadways within the Braintree split and leading to and from the split.
- Develop, evaluate, and recommend operational improvements to improve traffic safety and operations.

The purpose of this study is to focus on operational improvements that can be implemented in the short term. In developing plans for the improvements, the following criteria were considered: that the improvements would not require land takings, would have no adverse environmental impacts, would not adversely affect residential neighborhoods, could be constructed within the right-of-way, would be cost-effective, and would buy time to look at long-range improvements. Particular attention was paid to the impacts of the split on Route 3 South operations.

CTPS conducted the study in conjunction with an advisory task force composed of representatives from Braintree, Quincy, Milton, the Massachusetts Highway Department (MassHighway), the Massachusetts Bay Transportation Authority (MBTA), the Metropolitan Area Planning Council (MAPC), the South Shore Coalition, the South Shore Chamber of Commerce, and elected officials. The advisory task force met three times during the course of the study, at the Braintree Town Hall. At these meetings, the work program for the study and task products were presented for comments and feedback. Appendix A contains information on the public participation efforts, including comments on this study, the CTPS response, and attendance at task force meetings.

STUDY AREA

The primary study area extends between Route 3 South interchange 17 (Union Street, Braintree), I-93 interchange 6 (Route 37, Braintree), and I-93/Southeast Expressway interchange 8 (Furnace Brook Parkway, Quincy). Operational improvements were developed and tested for this study area. During the testing, the study area was expanded beyond I-93 interchange 6, I-93 interchange 8, and Route 3 South interchange 17 in order to determine the benefits and impacts of the additional improvements that are recommended for further consideration.

The study area supports a variety of land uses, including residential, industrial, commercial, and recreational. Specific uses include office

and industrial parks and shopping centers. It has a well-established land use pattern; therefore, future developments can be expected to consist of mostly redevelopment at existing sites. The area under study is served by public transportation, including bus transit, rapid transit, and commuter rail transit. However, about 70 percent of the commuting trips to the Boston urban core are by automobile; they occur during peak travel periods and pass through the split.

PREVIOUSLY PLANNED AND PROPOSED IMPROVEMENTS

Presently, there are highway and transit improvement projects that have already been planned for the area to increase traffic flow, improve safety and mobility, and facilitate redevelopment in the area. Of these projects, the Greenbush and the New Bedford/Fall River commuter rail lines, the Burgin Parkway Viaduct Project, and the Naval Air Station Access Improvements are the most significant. Other significant projects are the proposed Route 3 South Transportation Improvements Project and the extension of the I-93/ Granite Street (Route 37) Northbound Off-Ramp.

ADDITIONAL IMPROVEMENTS RECOMMENDED IN THIS STUDY

The recommended improvements that were developed with the participation of MassHighway, the MBTA, and the study's advisory task force were assembled into two packages—a safety package and a traffic flow package. They include upgrading short acceleration and deceleration lanes, improving HOV access, adding advanced queue detection and warning systems, and other improvements that would remove bottlenecks and facilitate traffic flow. The planned highway and transit projects and the additional improvements, if implemented, are expected to increase safety and improve traffic flow at the split.

The improvements that were recommended by CTPS in this study for further consideration are described in detail in Chapter 7 and are summarized below. Their locations are indicated in white on the accompanying maps, which also give location numbers. The numbers are consistent with the numbers used to designate these locations throughout this report. The traffic problems at each location are detailed in Chapter 2.

CTPS, MAPC, MassHighway, and the advisory task force suggested several improvements for evaluation. All of the improvements were discussed with safety, design, and environmental experts from MassHighway. The improvements that were suggested but were not recommended are documented in Appendix C of this report, along with the reasons for not recommending them.

Safety Improvement Package

Overview Map

Improvements at Location #1 Upgrade short deceleration lane to improve safety and provide more space for exiting traffic. The proposal calls for:

- Lengthening the existing deceleration lane on southbound I-93 onto Route 37 as far back as possible to provide more storage room and sufficient length for exiting vehicles to change lanes.
- Installing signs on the Route 3 South connector informing motorists exiting onto Route 37 that they should be in the rightmost lane.

These modifications would improve safety and make it easier for northbound Route 3 South traffic to exit onto Route 37.

Improvements at Location #2 Reconfigure existing ramp to eliminate the short weave distance and improve safety for Route 37 traffic heading north to the Expressway. The proposal calls for:

- Restricting the existing on-ramp to serve only the traffic that is heading to Route 3 South. A median barrier or some form of separation would be required to prevent the ramp traffic from violating this restriction.
- Constructing a double left-turn bay at the signalized ramp-arterial junction for use by traffic proceeding to the Expressway to access the south-side on-ramp.
- Installing new signs or modifying existing signs on Route 37 to guide motorists to the appropriate ramps.

These modifications would increase safety at the split by providing the south-side on-ramp to the Expressway with a longer weaving section.

Improvements at Location #3 Install advanced warning and detection systems to improve safety on the Route 3 South connector from the Expressway during the PM peak period. The proposal calls for:

- Installing real-time sensors for queue detection and overhead variable message signs to inform and warn motorists to reduce speed in advance of the downstream traffic queue that is obscured from view by the horizontal curvature of the roadway.

Improvements at Location #4 Enhance access to the HOV lane for Washington Street on-ramp traffic during the AM peak period of travel. The proposal calls for:

- Moving the connector between Burgin Parkway and Washington Street northbound on-ramp and the Expressway further south and creating a new ramp connector with a right full auxiliary lane.
- Installing new signs to direct traffic to the HOV lane.

The proposed ramp connector upgrade would, in effect, lengthen the weaving distance over which traffic on this ramp can change lanes to access the HOV lane.

Traffic Flow Improvement Package

Improvement at Location #5 Lengthen the acceleration lane for the southbound on-ramp from the Furnace Brook Parkway to the Expressway. The upgrade is expected to reduce merging and weaving in the area and to help on-ramp traffic from the Furnace Brook Parkway enter the Expressway.

In addition, the feasibility of a long-term solution should be examined: extending the HOV lane on the Southeast Expressway to Route 3 South and to I-93 toward Route 24. These extensions would remove the weave and merge of southbound HOV traffic heading to Route 3 South and to I-93 toward Route 24.

Overview Map

Improvements at Location #6 Improve traffic safety and flow at the Burgin Parkway/Centre Street intersection. The Burgin Parkway Viaduct Project in Quincy, already in the design stages, will address this problem. That project is described in detail in Chapter 6.

Improvement at Location #7 Make design configuration improvements for the southbound section of Route 3 South between the split and Union Street. This proposal was designed to address the PM peak-period southbound congestion on Route 3 South between the split and Union Street. This segment of Route 3 South, with three southbound travel lanes, is a bottleneck, as it receives high traffic volumes from five lanes—two from the Expressway southbound, two from I-93 northbound from (Route 128), and one from the Burgin Parkway southbound on-ramp to Route 3 South. The proposal calls for:

- Adding a fourth southbound travel lane on this segment of Route 3 South. The fourth lane would be an auxiliary lane, beginning at the Burgin Parkway on-ramp and possibly ending after the exit ramp at the Union Street interchange. This lane would facilitate the maneuvering of entering and exiting traffic, which would increase the capacity of this section of the roadway.

This proposal would also benefit the Burgin Parkway Viaduct project by reducing the southbound on-ramp traffic queues to Route 3 South.

Improvement at Location #8 Upgrade ramp acceleration lane to improve traffic flow from the Burgin Parkway and Washington Street to southbound I-93/Route 128. This proposal was designed to address traffic safety and congestion at the merge point of the connector ramp from the Burgin Parkway and Washington Street to southbound I-93. The proposal calls for:

- Lengthening the acceleration lane for the on-ramp from Burgin Parkway and Washington Street to the connector between Route 3 South and I-93 southbound.

This improvement is expected to increase safety at this location. In addition, when it is combined with improvements #1 and #10, it would help reduce congestion at this location, as traffic congestion at locations #1 and #10 often impacts traffic flow at location #8.

Improvements at Location #9 Make design configuration improvements at interchange 17 (Union Street in Braintree). This proposal was designed to specifically address on-ramp traffic to and from the Union Street rotary interchange that impacts traffic flow on Route 3 South and the Braintree split during the AM and PM peak travel periods. The proposal calls for:

- Upgrading the northbound acceleration lane into an auxiliary lane, possibly ending after the exit ramp at exit 19 (MBTA's Quincy Adams Station), to provide more room for the on-ramp traffic to merge with northbound traffic on Route 3 South during the AM peak period.
- In the southbound direction, upgrading the deceleration lane into an auxiliary lane, possibly extending just past the exit ramp, as an exit-only lane to provide more storage room for the southbound traffic exiting onto Union Street and to improve traffic flow on southbound Route 3 during the PM peak period.
- Implementing intersection improvements at the Union Street rotary interchange, including slip lanes for right turns.

These modifications would improve traffic flow and safety on Route 3 South and would reduce congestion at the Union Street rotary.

Improvements at Location #10 Make design configuration improvements on the I-93 segment between Routes 24 and 37 and related interchange improvements at interchange 4 (Route 24). This proposal was designed to address PM peak-period traffic congestion that impacts traffic operations at the split; specifically, congestion on I-93 near Routes 24 and 128 that spills back into the split. The proposal calls for:

- Adding a travel lane on I-93 southbound beginning south of the Route 37 interchange and ending at the area where traffic diverges to Route 24.
- Reconfiguring the lane assignment at the diverge point of I-93 and Route 24 to dedicate two travel lanes to the two-lane connector ramps for about one-half mile on I-93 southbound.
- Widening the merge point of Route 24 southbound to receive the four travel lanes from the connecting ramps. This improvement would have significant congestion-reduction benefits.
- Installing new signs or modifying existing signs to guide motorists to Route 24.

The proposed improvements are expected to facilitate traffic flow on southbound I-93 approaching Routes 24 as well as through the split.

Improvements at Location #11 Make traffic improvements at the I-93/Route 37 ramp-arterial junction. The I-93/Route 37 traffic improvements for addressing the problems at this location are already in the planning/design stages. That project is described in detail in Chapter 6.

BENEFITS OF THE IMPROVEMENTS

In 2025, increased traffic volumes are expected to increase delays that will be worse than 2003 conditions and to increase the extent and duration of congestion if the no-build option is implemented. The proposed improvements (all together) would improve travel conditions in 2025 at the Braintree split and its connecting highways. Travel speeds and travel-time savings using the build and no-build options for 2025 are shown are shown in Figures 28 and 29. The proposed improvements would reduce the impacts of bottlenecks in and around the split and are expected to increase traffic safety in the study area.

Both highway and transit solutions are needed to address 2025 traffic demand. The transit projects described in Chapter 6 (commuter rail to Greenbush, New Bedford/Fall River, and Wareham; suburban commuter rail feeder bus service; parking enhancements, etc.), if implemented, would attract new transit riders diverted from non-transit trip modes such as "drive alone." As a result, these transit projects have congestion reduction benefits and would improve regional transit system capacity, mode choice, and connectivity.

The proposed improvements described in this report are conceptual in nature. They primarily address safety problems and bottlenecks in the highway system. Although preliminary analysis of the improvements

indicates that they have significant safety and operational benefits, they would have to undergo further review and analysis before final recommendations are made. Such review and analysis would include, but not be limited to, environmental and right-of-way issues, public support and participation, benefit and cost analysis, design, and prioritization of the improvements. In all cases, MassHighway would be the implementing agency.

NEXT STEPS

The next steps after this study are as follows:

- Perform further review and analysis including, but not limited to, environmental and right-of-way issues, public support and participation, benefit and cost analysis, design, and prioritization of the improvements before final recommendations are made.
- Develop long-term solutions to address mobility, safety, and congestion issues, including additions and redesigns, transit solutions, and travel demand management strategies.
- Evaluate the feasibility of another long-term solution: extending the HOV lane on the Southeast Expressway to Route 3 South and to I-93 toward Route 24. These extensions would remove the weave and merge of southbound HOV traffic heading to Route 3 South and to I-93 toward Route 24.

1 INTRODUCTION

State legislators, South Shore Coalition members, and officials from South Shore communities requested that this study be included in the Boston Region MPO's fiscal year 2002 Unified Planning Work Program. In their letter to the Boston Region MPO, proponents of this study expressed concern about safety, congestion, and delays in the Braintree split, especially their effects on Route 3 South in that vicinity.

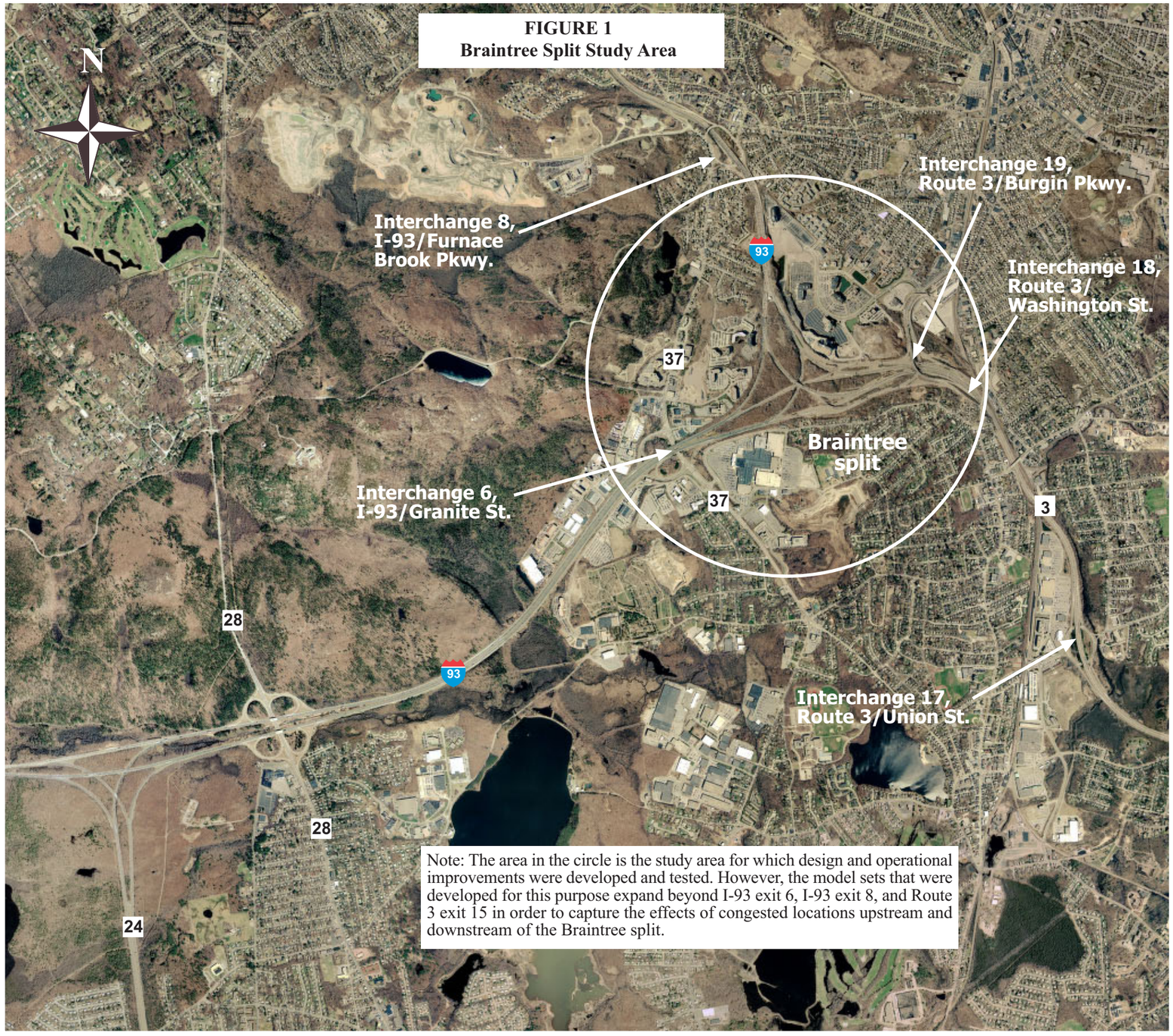
As shown in Figure 1, the Braintree split is essentially the network of ramps and highway segments that comprise I-93, the Southeast Expressway, and Route 3 South. To the southeast of the split, interchanges 18 (Washington Street) and 19 (Burgin Parkway) with their associated lane drops and weaving, merging, and diverging maneuvers add to the complexity of the main interchange. Immediately to the southwest of the split is I-93 interchange 6 (Route 37). Just north of the split is the southern terminus of the Southeast Expressway HOV lane and less than one-half mile north of that is I-93 interchange 8 (Furnace Brook Parkway).

During an average weekday, the Braintree split carries between 250,000 and 275,000 vehicles on six two-lane direct connections that connect the three major highways: I-93, the Southeast Expressway, and Route 3 South. In short, the Braintree split is an interchange that was designed for high-level connections (flyovers). It carries more than a quarter of a million vehicles a day, whose drivers encounter a complex driving environment. Therefore, congestion and incidents are common, especially in the northbound direction in the morning and, to a lesser degree, in the southbound direction in the afternoon.

Field reconnaissance indicates that there are safety problems created by some of the merging and weaving traffic operations at the Braintree split. Field reconnaissance also indicates that some of the delays encountered at the split are due to bottlenecks located outside of the split.

The report is organized into nine sections: an executive summary and eight chapters. Chapter 1 gives the background of the study. Chapter 2 documents the study area's traffic concerns. Chapter 3 describes the existing highway and transit conditions. Chapter 4 presents the socioeconomic trends and growth impacts in the study area. Chapter 5 explains the travel patterns of commuting trips to the Boston urban core. Chapter 6 presents the planned and proposed projects in the study area. Chapter 7 describes the improvements that are recommended in this study. Chapter 8 gives the process by which proposed transportation improvements may be implemented.

FIGURE 1
Braintree Split Study Area



Note: The area in the circle is the study area for which design and operational improvements were developed and tested. However, the model sets that were developed for this purpose expand beyond I-93 exit 6, I-93 exit 8, and Route 3 exit 15 in order to capture the effects of congested locations upstream and downstream of the Braintree split.

2 INVENTORY OF TRAFFIC PROBLEMS

Through meetings with the Advisory Task Force and field reconnaissance, CTPS developed an inventory of traffic problems in the study area and its vicinity. They include, but are not limited to, the following safety and operational problems listed below and shown in detail in Figures 2 and 3.

- Traffic congestion
- Downstream traffic bottlenecks
- High traffic demands
- Weaving and merging
- Short sight distance
- Traffic signal capacity issues
- Access to transit service

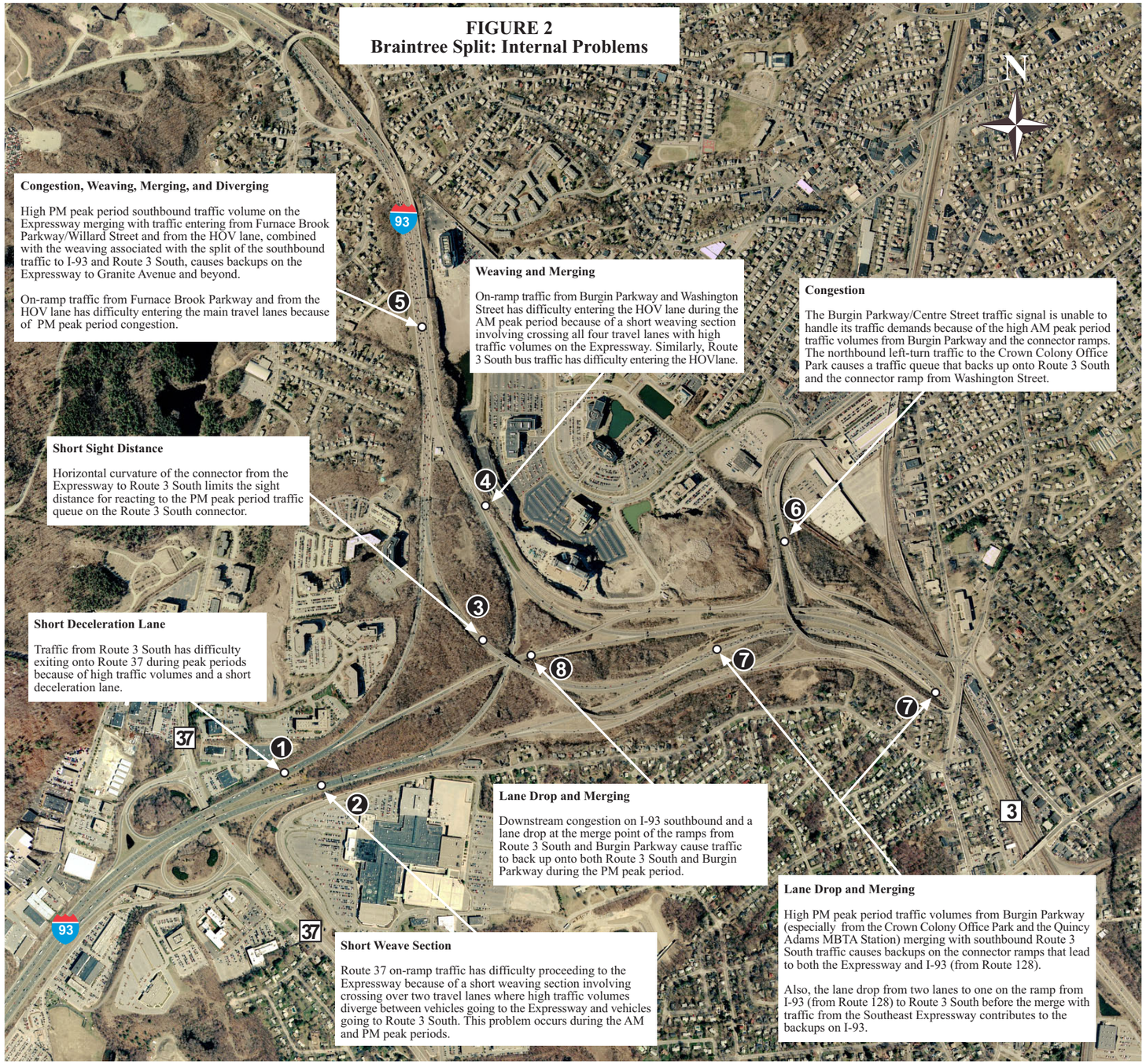
These problems were grouped into two categories: external and internal. The internal problems are those that exist within the split and affect its traffic and safety operations. The external problems are those that exist outside of the Braintree split but have a major impact on its traffic and safety operations. The numbers in the circles and the text in the boxes in Figures 2 and 3 represent specific locations and identify the particular problem at each location.

2.1 INTERNAL PROBLEMS

The internal problems are the weaving, merging, diverging, short sight distance, insufficient intersection capacity, and lane drops. Many of the AM peak-travel period internal problems show up during the PM peak travel period too, such as problems at locations #1, #2, #8, and #9. On the other hand, there are internal concerns that are confined either to the AM or PM peak period, for example, the problems at locations #3, #4, #5, #6, and #7.

Field reconnaissance indicates that some of the merging and weaving traffic operations at the Braintree split create safety problems such as short weave sections for Route 37 northbound on-ramp traffic proceeding to the Southeast Expressway and for Washington Street northbound on-ramp traffic proceeding to the HOV lane. Also, the PM peak-period southbound merging traffic from the Furnace Brook Parkway on-ramp and the HOV exit, and diverging traffic from the Southeast Expressway onto Route 3 South create traffic congestion on the Expressway that extends into the Granite Avenue and Neponset River areas.

FIGURE 2
Braintree Split: Internal Problems



2.2 EXTERNAL PROBLEMS

Downstream traffic bottlenecks are the external problems that have major impacts on the Braintree split traffic operations in both peak travel periods (Figure 3). All three major highways of the split have bottlenecks. In the morning, downstream bottlenecks on the Expressway created by the northbound on-ramp traffic from Granite Avenue, Route 3A, Columbia Road, and the HOV merge restrict northbound traffic flow on the Expressway. On some occasions, this causes the traffic queue to back up into the Braintree split, restricting traffic flow from Route 3 South and I-93.

Another external problem is traffic operations at the Union Street rotary interchange on Route 3 South in Braintree. The high traffic volume on the ramp heading northbound disrupts traffic flow on Route 3 South in the AM peak travel period, which, in conjunction with similar activities at the Route 18 and Derby Street interchanges, causes recurring traffic backups on Route 3 South that are unrelated to traffic operations in the Braintree split. Similarly, the high southbound traffic volumes exiting Route 3 South at Union Street in the PM peak travel period cause traffic to spill back onto Route 3 South, restricting traffic flow from the split and from I-93 northbound onto Route 3 South.

Also, the PM peak-period congestion on I-93 southbound toward Route 24 spills back into the split. On many occasions, this backup restricts traffic from the Expressway and Route 3 South entering I-93 southbound toward Route 24. The main causes of this congestion are the bottleneck at the entrance to Route 24 where two congested two-lane ramps feed into three lanes on Route 24, and traffic diverging from I-93 onto Route 24.

The direct impact of the I-93 southbound PM peak-period congestion is reduced traffic flow through the split. In 1994, the Expressway was servicing 7,900 southbound vehicles per hour at the split during the PM peak hour, of which 4,100 continued on I-93 and 3,800 continued on Route 3 South. In 2003, this number decreased to 6,600 southbound vehicles per hour during the PM peak hour, of which 3,200 continued on I-93 and 3,400 continued on Route 3 South. As explained above, these traffic patterns were due to the increasing congestion on I-93 southbound traveling toward Route 24 in the PM peak period.