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Southeast Expressway High Occupancy Vehicle Lane Evaluation Report

Final Report
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Service and Methods Demonstration Program

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16. Abstract

A non-separated concurrent-flow lane was instituted on Boston's Southeast Expressway on May 4, 1977. An eight-mile section of the left-most inbound lane was reserved for buses and carpools of three or more persons between the hours of 6:30 a.m. and 9:30 a.m. There were no official intermediate points of access or egress, removable plastic inserts were used to separate the lane from the other northbound lanes, and compliance was voluntary until October 17, 1977. Construction on a portion of the roadway began in June, 1977, reducing capacity at that point by about 25 percent.

The report describes the project development, implementation, and operations and addresses impacts in the following areas: travel times on the Expressway and alternate routes; transportation system use patterns; cost of express lane operation; violations, enforcement, and safety; and institutions and attitudes. By the end of the project the Expressway was carrying eight percent fewer people while the number of automobiles had declined 16 percent, reflecting a 71 percent increase in the number of carpools. Bus ridership increased by only 5 to 6 percent while ridership on rapid rail increased by 12 percent. Travel times were lower during the summer months for all Expressway users, but during the enforcement period an average trip in the general lanes took 7.5 minutes longer. The violation rate fell from 80 percent to 35 percent when enforcement was initiated.

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PREFACE

The author wishes to thank many persons for their help in the preparation of this paper. Daniel Brand of Charles River Associates, and John Attanucci of the Massachusetts Executive Office of Transportation and Construction, Howard Morris of the Massachusetts Department of Public Works, and Charles Kalauskas of the Central Transportation Planning Staff provided a large portion of the background information, data analysis, and insights incorporated in this paper. Harley Moore of Multisystems, Inc. and Robert Furniss of CACI, Inc. helped organize the data collection activities. David Rubin, Howard Slavin, Carla Heaton, and Donald Kendall of the Urban and Regional Research Division of the Transportation Systems Center (TSC) and Joseph Goodman of the Office of Service and Methods Demonstrations offered their insightful comments. TSC's effort was sponsored by UMTA's Office of Service and Methods Demonstration. Vera Ward was invaluable in preparing the manuscript.

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S.1 PROJECT DESCRIPTION

A non-separated concurrent-flow lane was instituted on Boston's Southeast Expressway on May 4, 1977. Reconstruction of a portion of the Expressway that would temporarily reduce its capacity by up to 25 percent had been scheduled for the summer and early fall. The motivating force behind the reserved lane was to encourage a large shift of Expressway commuters to carpools and buses, thereby preventing the serious congestion the contruction was expected to cause. The public was informed of the lane restriction through a one-month media campaign. Expressway users were told that the scheduled construction was necessary and that the only way to maintain person throughput on the facility was through the implementation of the reserved lane.

The project was divided into three distinct phases. During Phase I (May) an eight-mile section of the left-most lane in the northbound (inbound) direction on the Expressway was reserved for buses and carpools of three or more persons between the hours of 6:30 a.m. and 9:30 a.m. There were no official intermediate points of access or egress, removable plastic inserts were used to separate the lane from the other northbound lanes, and compliance was voluntary. There were no reductions made in roadway capacity during this period.

The reserved lane was instituted four weeks before construction was scheduled to begin in order to give corridor users a chance to understand and grow accustomed to the concept and to make changes in their travel patterns before the roadway capacity was reduced. During this four week period the operation of the lane was modified as needed: the entry point to the lane was blocked so that all vehicles had to begin from the normal lanes; violators were sent letters requesting that they obey the restrictions; additional plastic inserts were used where heavy weaving was occurring; and the police began to ticket motorists who continued to weave.

Phase II, the construction period, began in June and continued until mid-October. The construction at the northern end of the reserved lane resulted in a decrease in road capacity at that point of about 25 percent.

During August and September, the situation on the Expressway deteriorated and there appeared to be little difference between the reserved lane and the regular lanes in terms of congestion and vehicle occupancy. Therefore, on October 17, the police began enforcing the lane restriction by taking license plate numbers of violators and sending them $20 citations through the mail (Phase III). The

conditions actually improved compared to the March pre-implementation period. The reserved lane succeeded during the summer construction period because the public perceived a need for it, the restrictions were not enforced, the capacity limitations were imposed during a less heavily travelled period, the transportation system had sufficient excess capacity to absorb trips diverted from the Expressway, and state officials were willing to fine-tune the project as the need arose.

During Phases I and II, vehicles in the regular lanes did not experience a decrease in level of service. In fact, travel times, in general, decreased for everyone. This decrease can be attributed to several factors: auto occupancy increased from 1.30 to 1.36; many one-and two-occupant vehicles did not comply with the voluntary restrictions and used the reserved lane (the violation rate was as high as 80 percent, and considerable weaving occurred in and out of the lane even though the plastic inserts were in place); and a large number of commuters avoided the Expressway, particularly near the construction site. In June, during the peak hour, 50 percent of the persons passing the screenline near the construction site were in the reserved lane, experiencing a congestion-free ride.

The reserved lane appeared not to have led to an increase in accidents during Phases I and II. This could have been due to the use of the plastic inserts and the relatively small speed differential between users of the reserved lane and the adjoining normal lane. The seasonal decrease in total corridor traffic combined with the dense arterial network and considerable excess capacity was sufficient to absorb many of the trips diverted from the Expressway to the arterials. As a result, travel conditions on alternate roadways did not deteriorate.

During the Phase III enforcement period, the violation rate declined to 35 percent. Congestion in the regular lane became intolerable and an average trip took 7.5 minutes longer on the Expressway. There is some indication that property damage accidents may have increased during this period.

By the end of the project the Expressway was carrying eight percent fewer people while the number of automobiles had declined 16 percent. This reflects the increase in the auto occupancy rate and the substantial increase in the number of carpools, 32 percent during the first month of lane operation and an additional 39 percent during the enforcement phase. Bus ridership, on the other hand, increased by only 5 to 6 percent by the end of Phase III. This small increase can be explained, in part, by the fact that almost no new coverage was provided, headways on existing routes were not decreased, and the travel time

1. INTRODUCTION AND PROJECT OVERIVEW

1.1 PROJECT DESCRIPTION

A concurrent-flow lane reserved for high occupancy vehicles was instituted on Boston's eight-lane Southeast Expressway on May 4, 1977. The lane, the left-most lane in the northbound (inbound) direction from just north of the Routes 3 and 128 interchange in Braintree to the Southampton St. exit in Boston was eight miles long and was reserved for carpools of three or more persons and buses between the hours of 6:30 a.m. and 9:30 a.m. (see Figure 1.1). There were no official intermediate points of access or egress and removable plastic inserts were used to separate the lane from the rest of the Expressway. The lane was called the "Downtown Express Lane." Until October 17, 1977, the restrictions on the reserved lanes were voluntary. The enforcement period lasted two weeks. The project was suspended on November 2 due to citizen protest and political pressure.

The motivating force behind the reserved lane project was the reconstruction of a portion of the roadway that began on June 6 and required the four existing northbound lanes to be re-routed onto three lanes of frontage road. The institution of the reserved lane was expected to encourage people to shift from single occupancy vehicles to carpools and buses, thereby maintaining person throughput while reducing vehicle throughput. The supply of transportation through the corridor was increased and an extensive advertising and carpool matching program was instituted one month before the opening of the lane.

1.2 OBJECTIVES, INNOVATIONS, AND ISSUES

1.2.1 Objectives

The objectives of the project and the evaluation effort can be partitioned (with some overlap) into local, SMD, and TSC objectives. The local objectives were as follows:

- Minimize disruption to travel due to reconstruction of the expressway.
- Achieve Transportation System Management (TSM) objectives for more efficient use of existing transportation facilities.
- Achieve Transportation Control Plan (TCP) objectives of improved air quality and energy conservation.

There were several SMD objectives that this project addressed:

- Reduce trip times for transit travellers.
- Increase transit reliability.
- Improve transit vehicle productivity.

In addition, there were several TSC evaluation objectives that this project, when combined with the other diamond lane experiments, promoted:

- Further explore and evaluate concepts aimed at increasing vehicle occupancy on heavily travelled urban expressways by creating incentives to encourage public transit ridership and carpooling.

- Achieve a better understanding of public attitudes toward auto use, carpooling, transit ridership and preferential lanes, and to trace the effect of these attitudes on mode choice behavior.

- Acquire a better understanding of the law enforcement and traffic safety implications of the reserved lane concept.

1.2.2 Innovations - Relationship to Other Reserved Lane Projects

Non-separated concurrent-flow lanes of this type have been instituted and evaluated in Santa Monica CA, Miami FL, Marin County CA., and Honolulu HI. It is now possible to make comparisons among the various sites and make statements about the various options available to the designer of a high occupancy lane. The Southeast Expressway project differed in many respects from the other reserved lane projects. The most notable differences were the initial voluntary nature of the lane restriction, the use of plastic inserts to separate the lane from the normal lanes, the single access and egress points, and the recognized accepted need for the lane (to facilitate the movement of traffic during the construction period). A paper by Simkowitz* presents a detailed comparative analysis of the Boston, Santa Monica and Miami reserved lane projects.

1.2.3 Issues

The following issue areas are related to the objectives mentioned in Section 1.2.1 and are discussed in this report:

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*H. Simkowitz, "A Comparative Analysis of Results from Three Recent Concurrent-Flow High Occupancy Freeway Lane Projects: Boston, Santa Monica, and Miami," Department of Transportation, UMTA MA-06-0049-78-2, June 1978.

speeds, transit ridership, and accident and incident levels. While the design attempted to separate those changes attributable to the reserved lane from seasonal fluctuations and long term trends through the use of adjustment factors, satisfactory adjustment factors were found not to exist. The plan also attempted to identify those characteristics or factors such as transit availability and land use that affect the changes.

1.3.2 Overview of the Data Collection Process

During the March to November evaluation period, three major categories of data were collected: traffic, transit, and safety. Data sources included manual observations, mechanical traffic counts, police reports, and transit operating records. There were four distinct periods for analysis: Before Phase - pre-implementation (before May 4, 1977); Phase I-post-reserved lane implementation (May 4 - June 1); Phase II-construction period (June 2 - October 16); and Phase III - Post construction/enforcement period (October 17 - November 2). Due to financial constraints, the actual data collection occurred during a subset of the project period. Pre-project data was collected during 2 weeks in March. Data was collected on a regular basis between May 4 and June 29. No data was collected from July through the end of October. Phase III data was collected on October 31 and November 1 and 2.

Table 1.1 summarizes the types, quantity, and timing of the data collected during the Before Phase and during Phases I and II. Phase III data collection was limited to 3 days. Traffic data was collected between the hours of 6:30 a.m. and 9:30 a.m. Figure 1.2 maps the geographic location of the major data collection activities.

TSC, through its contractors Multisystems, Cambridge Systematics, and CACI, performed the following data collection activities: accident/incident data on the Expressway; vehicle occupancy and volume counts on feeder and parallel routes; Expressway ramp times, occupancies and volumes; and speed runs on parallel routes.

1.3.3 Interface Among Agencies

The Massachusetts Department of Public Works (MDPW) was the principle agency responsible for the Southeast Expressway reserved lane project. The Executive Office of Transportation and Construction (EOTC) had principle responsibility for the evaluation. Evaluation services, including planning, data collection and analyses, were also provided by the MDPW, the Central Transportation Planning Staff (CTPS) and the Transportation Systems Center (TSC) through the Urban Mass Transportation Administration's (UMTA) Office of Service and Methods Demonstrations (SMD). The Massachusetts Bay Transit Authority (MBTA) provided

TABLE 1.1

DATA COLLECTION ACTIVITIES

DATA	Number of check-points, routes, etc. as applicable	Number of Times Collected Before	Phases I and II (May 4-June 29 Only)
Southeast Expressway			
Volume (#of cars, buses, trucks)			
manual	2	5 days	1 day/wk
machine	2	20 days	daily
- on reserved lane			
- on general lanes			
Auto Occupancy (1, 2, 3, or more persons per vehicle)	2	5 days	1 day/wk
- on reserved lane			
- on general lanes			
Compliance Rate on reserved lane (# vehicles w. ≥ 3 occupants/total vehicles)	1	N/A	daily
Travel Time			
- on reserved lane	1	N/A	2 days/wk
- on general lanes	1	10 days	2 days/wk
Waiting Time at Ramps and ramp overflows	4	10 days	2 days/wk
Ramp Volumes	4	10 days	2 days/wk
Parallel Routes			
Volume			
Manual	3	5 days	1 day/wk
Machine	20	daily	daily
Auto Occupancy	3	5 days	1 day/wk
Travel Time	5	10 days	2 days/wk
	2	5 days	1 day/wk
Route 128			
Volume	1	5 days	1 day/wk

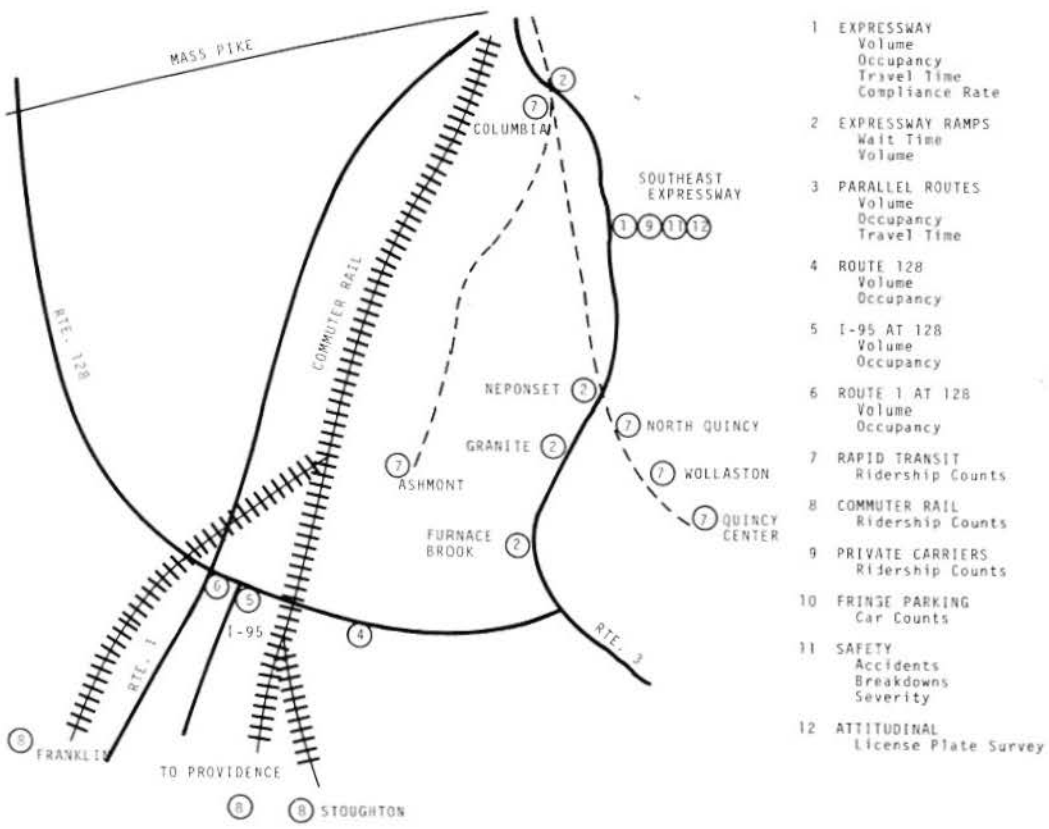

FIGURE 1.2. DATA COLLECTION MAP

2. SITE DESCRIPTION*

2.1 CORRIDOR SUMMARY

The South Shore Corridor extends along the Massachusetts Bay shore from Boston to Duxbury, as shown in Figure 2.1. This corridor has, over the last 25 years, been the fastest growing area in the region. Much of this development has been single-family homes in the middle and outer portions of the corridor, although a number of apartment developments have recently been built in Quincy and Weymouth. The inner portion of the corridor, Roxbury and Dorchester, are older urban neighborhoods of much greater residential density.

The corridor is highly oriented toward the regional core with a greater percentage of trips with core destinations than any other corridor in Boston. A higher percentage of these trips are made by transit than any corridor in Boston except the Southwest. A demographic description of the South Shore is presented in Table 2.1.

2.1.1 Population and Population Density

In 1970, the South Shore Corridor had a larger proportion of the regional population (18.8 percent) than any of the other corridors. Over the period 1950-1975, the South Shore has grown rapidly, surpassing all other parts of the metropolitan area. However, this growth rate appears to be slowing.

The corridor is composed of two distinct groups of communities. The first group contains the communities of Mattapan, Outer Dorchester, and Outer Roxbury. These communities are characterized by moderate median incomes, extremely high population densities and fairly low rates of auto ownership (almost 50 percent of all households do not own autos).

The second group contains the majority of communities in the corridor. These predominantly middle income communities are growing quite rapidly, some by as much as 58 percent in one decade. Communities closest to the core are characterized by moderate population densities (excluding Quincy) and those at a greater distance from the core are semi-rural in nature.

2.1.2 Income Levels

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*A major portion of the material in this section was taken from Program for Mass Transportation, Technical Supplement, EOTC, April 1977.

TABLE 2.1. DEMOGRAPHIC DESCRIPTION OF THE SOUTH SHORE

	1970 Pop.	1980 Est. Pop.	% Change	1970 Pop. Density (Pers/Sq. Mi.)	1970 % Elderly	1970 Median Income	1970 Automobiles Per Household (% of Households) None	One	Two or More
Braintree	35,050	41,500	+18.4	2,432	9.4	$13,030	5.8	50.9	43.4
Cohasset	6,954	9,000	+29.4	691	9.5	$14,958	4.8	40.7	54.5
Duxbury	7,636	9,500	+24.4	312	10.1	$13,523	5.1	38.1	56.8
Hanover	10,107	12,500	+23.6	647	5.1	$13,071	4.0	40.9	56.9
Hingham	18,845	21,000	+11.4	834	8.3	$14,202	6.1	43.2	50.7
Holbrook	11,775	14,000	+18.4	1,609	6.3	$11,230	4.9	55.5	39.6
Hull	9,961	11,000	+10.4	3,937	7.4	$10,677	12.2	54.1	33.7
Marshfield	15,223	24,000	+57.6	534	10.2	$11,742	15.7	52.4	31.9
Milton	27,190	30,000	+10.3	2,060	15.0	$14,728	8.0	48.8	43.2
Norwell	7,796	9,500	+21.3	365	9.5	$13,866	11.5	50.5	38.0
Pembroke	11,193	16,500	+47.4	481	5.4	$10,998	3.6	48.1	48.3
Quincy	87,966	90,000	+ 2.3	5,286	13.5	$11,094	16.8	58.6	24.6
Randolph	27,035	29,500	+ 9.1	2,620	7.0	$12,369	7.5	47.7	44.8
Rockland	15,674	17,500	+11.6	155	9.0	$10,746	10.9	56.2	32.9
Scituate	16,973	19,000	+11.9	994	7.6	$13,401	6.5	40.7	54.8
Weymouth	54,610	58,500	+ 7.1	3,082	8.3	$11,631	8.6	52.6	38.8
Roxbury, Outer Dorchester/Mattapan	154,538	N/A		18,485	13.6	$10,136	44.1	46.6	9.3
Corridor Total	518,526		+13.3*	2,003	10.9	$12,232	9.6	51.2	39.2

* Excluding Outer Dorchester/Mattapan

Although the Southeast Expressway provides a direct route from South Shore communities into downtown Boston, it becomes severely congested during peak hours. The Expressway is by far the most heavily traveled single approach to Boston from any direction. In 1976, the average daily two-way traffic volume on the Expressway at the downtown Boston cordon line was 126,000 vehicles. By comparison, the Tobin Bridge, which is the second most heavily traveled road in the region, has an average daily traffic volume of 65,000 vehicles.

The Southeast Expressway experiences heavy congestion over most of its length between Rte. 128 and Boston. South of the junction of Rtes. 3 and 128, traffic on Rte. 3 drops to 79,000 vehicles per day at South Braintree. One of the most heavily travelled roads north of Rte. 128 is Morrisey Boulevard, a six lane arterial that reaches a peak load point volume of 39,000 vehicles per day in Dorchester.

Only those portions of the South Shore Corridor closest to downtown Boston have auto travel times under 20 min. to the CBD. Outer Roxbury/Dorchester falls in this category. Mattapan and portions of Quincy and Milton have travel times of 20-30 minutes. The remainder of Quincy and Milton plus Braintree, Weymouth, and portions of Hingham and Randolph have auto travel times of 30-40 minutes to downtown Boston. For the rest of the corridor travel time exceeds 40 minutes with times up to 70 minutes occurring in the extreme outlying communities.

2.2.2 Transit

The South Shore Corridor is served by the MBTA Red Line (see Figure 2.3) and feeder bus routes connecting with the Red Line, by express buses operating to Quincy Center, by bus routes operating into Boston via the Southeast Expressway, by commuter rail (see Figure 2.2), and by commuter boat.

2.2.2.1 Rapid Transit

Rapid Transit service in the South Shore Corridor is provided by two branches of the Red Line. One branch runs from Ashmont Station in Dorchester to and through the Boston CBD. The other Red Line branch runs from Quincy Center to and through the Boston CBD, stopping at Wollaston and North Quincy. Daily ridership from 6:30 a.m. to 9:30 a.m. at three stations before the reserved lane project was 8750. Construction on an extension from Quincy Center to South Braintree is about to start. The two Red Line branches merge inside the core but have no common stations within the South Shore Corridor. Because of train merging considerations, headways on the two Red Line branches are always equal. At present, weekday service on each line is operated on 5 minute peak headways, 9 minute mid-day

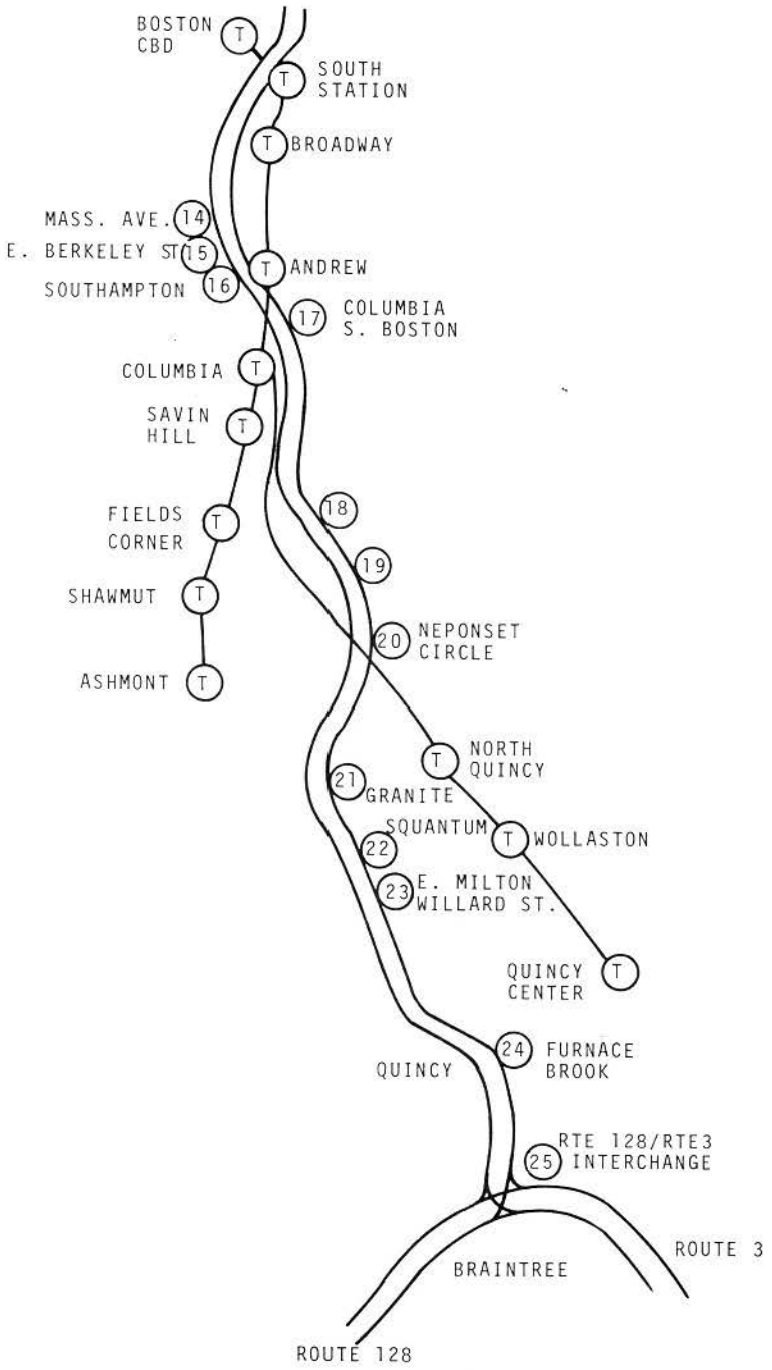


FIGURE 2.3. SOUTHEAST CORRIDOR, SOUTHEAST EXPRESSWAY AND RAPID TRANSIT-MBTA RED LINE

2.3 TRAVEL PATTERNS

During the morning peak period, an estimated 213,000 trips are made from the South Shore Corridor, of which 57,800 or 27 percent, are destined for the core. An additional 6,000 core-bound trips originate in the Brockton area with consequent impacts on the South Shore Corridor transit facilities. Of the core trips, approximately 60 percent are made by transit.

3. PROJECT DEVELOPMENT, IMPLEMENTATION, AND OPERATIONS

3.1 EVENTS LEADING TO THE RESERVED LANE PROJECT

The Southeast Expressway is the most crowded limited access roadway into Boston, and before the express lane it carried an average of 7300 vehicles in four lanes (2000 vehicles in the high speed lane) during the peak morning hour. Due to this serious overcrowding, the right hand shoulder is used as a travel lane during the peak hours in the peak direction. A contra-flow lane for buses operated on the Expressway during daylight savings months from 1971 through 1976.

In an attempt to provide an incentive for both buses and carpools, to respond to Transportation System Management (TSM) objectives for more efficient use of existing transportation facilities, and to achieve Transportation Control Plan (TCP) objectives of improved air quality and energy conservation, the Commonwealth of Massachusetts' Executive Office of Transportation and Construction developed the reserved lane concept with targeted implementation date May 5, 1976. According to the original plan, the median lane in each direction was to be reserved for buses and cars with three or more occupants. The test was to start with the northbound roadway between the hours of 6:30 a.m. and 9:30 a.m. The southbound reserved lane was to be implemented once the northbound lane was working satisfactorily. Estimates of benefits derived from the lane included a doubling or tripling of three or more occupant carpools, a thirty to forty percent increase in express bus usage, and pre-implementation volumes and congestion remaining the same on the non-reserved lanes; in summary, the EOTC estimated that it could move somewhat more people with ten percent fewer vehicles and give half the persons using the Expressway a congestion-free ride.

The implementation date came and went, and on May 28, 1976 Commissioner John J. Carroll of the Massachusetts Department of Public Works announced that the express lane would not be instituted that year. Rather, it was decided to link the reserved lane more closely in the public's eye with the Expressway reconstruction that was scheduled to begin in May 1977. This would also give the MDPW and the EOTC more time to plan and publicize the project.

As a result of heavy usage on the eighteen year old Southeast Expressway, it had become imperative to make substantial repairs to many of the bridge decks. While most bridge deck work could be deferred until 1979 when the Red Line will have been extended to Route 128, the poor condition of the southbound viaduct in the vicinity of the Massachusetts Avenue exit necessitated that it be reconstructed during the summer and fall of 1977. This reconstruction would cause serious congestion, and the

road from the Expressway. A single lane frontage road had been built parallel to the widened frontage road for access to the Boston Food Market.

During Phase II the Massachusetts Avenue exit and entrance ramps were closed, and Southampton Street was used as a detour. Vehicles heading north that normally would exit at Massachusetts Avenue could get off at Southampton and proceed west. Vehicles coming down Massachusetts Avenue to get on the Expressway and head into Boston could go up Southampton Street and take the frontage road to the Expressway. Figure 3.1 illustrates the Expressway configuration before and during construction, and Figure 3.2 illustrates the portions of the roadway that were reconstructed.

October 17, 1977 marked the beginning of Phase III. Construction had been completed and the police began enforcing the lane restriction. Due to citizen protest and political pressure, the project was suspended on November 2.

3.2.2 Transit Changes

Each of the existing private and public transit operators upgraded service levels by scheduling new routes or making additional equipment available, as needed, during peak hours. In addition, special incentives and aids were provided to help South Shore auto commuters form carpools in order to reduce the number of vehicles using the Expressway during the peak commuting hours.

The range of alternative transportation services from which commuters were able to choose included the following:

1. Increased Private Carrier Service: Plymouth and Brockton Bus Lines: provided an increase in the number of bus runs, consisting of extra sections on the high density portions of their extensive route system. Hudson Bus Lines operated a new express bus service from the Route 128 Railroad Station in Canton and the South Shore Plaza in Braintree to the Government Center District of Boston. The two smaller carriers, Almeida and Bonanza maintained existing service since they had sufficient empty seats to satisfy a substantial increase in ridership.

2. The MBTA provided maximum service levels on both branches of the Red Line by increasing the number of cars available for Red Line Operation from 88 to 104. The extra cars were placed in back-up train sets to be made available should passenger loads require them. Additional MBTA feeder bus service was provided from Weymouth Landing to Quincy Center and from Hingham to Quincy Center. Four hundred new parking spaces became available at the North Quincy Station on May 2, 1977.

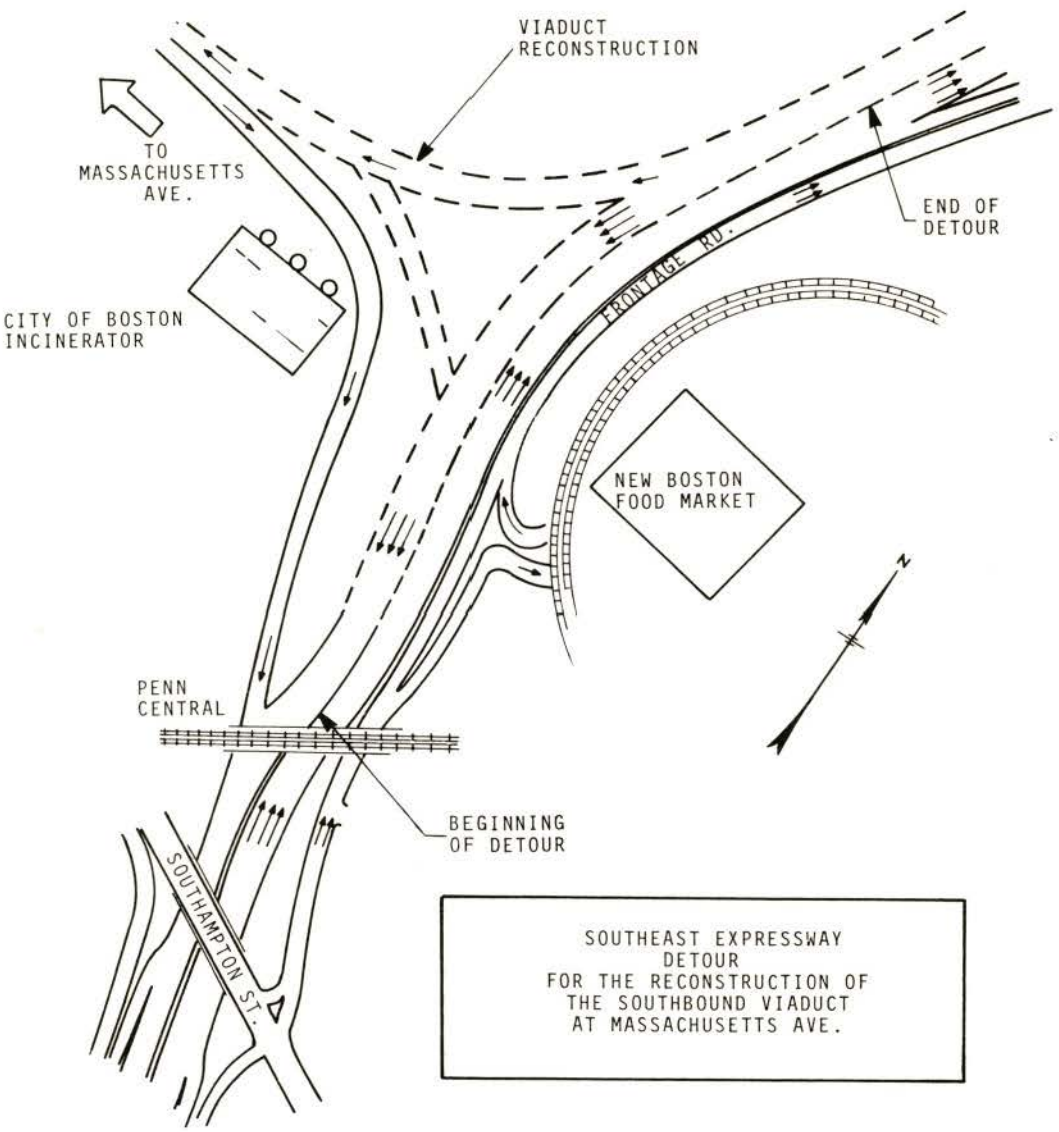


FIGURE 3.2. EXPRESSWAY RECONSTRUCTION

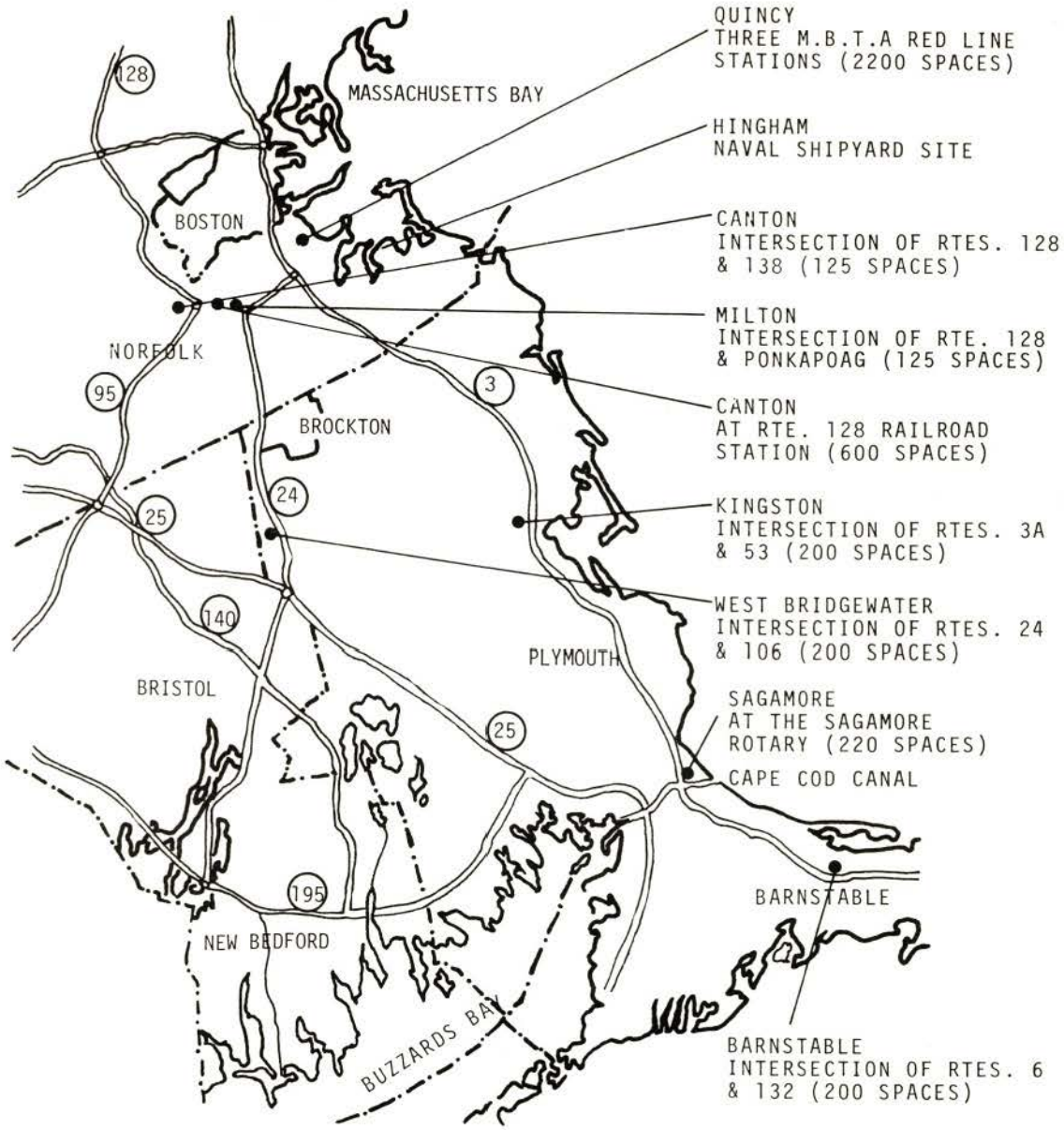


FIGURE 3.3. FRINGE PARKING SITES FOR CARPOOL AND TRANSIT USERS

It's shape-up time for the expressway!

Age, heavy traffic and a rough winter have made the Southeast Expressway a real obstacle course. If you've bumped and bounced over the Mass. Avenue Viaduct recently, then you know what we mean. On Wednesday, May 4, we'll start Phase One of our Expressway Shape-Up Plan.

Actual construction on the Mass. Avenue Viaduct will begin in June. At that time, Northbound traffic will use the new three-lane Frontage Road. Southbound traffic will be re-routed to the Northbound lanes. We'll be keeping you informed. But in order to get you in shape for the contruction now, we're offering some alternatives which may save you time later.

Downtown Express Lane

A specially-marked express lane for buses and carpools of three or more people. You can get on just North of the Junction of Routes 3 and 128 — get off in Boston. An express lane all the way.

C·A·R·P·O·O·L / 227-7665

We'll help you join a carpool so you can ride the Downtown Express Lane. Dial C·A·R·P·O·O·L / 227-7665 or stop at the Information Booth adjacent to Howard Johnson's on the Expressway near Route 128 in Quincy. Open after April 11 from 3:00 to 7:00 pm.

Express Buses

More buses to South Station, Park Square and Government Center from several locations on the South Shore. Call 227-7665 for the stop nearest your home.

Fringe Parking

We'll have extra parking for bus riders and carpoolers plus 400 new spaces at the North Quincy MBTA station on the Red Line.

Ⓣ Service

More trains with more cars on both Red Line branches. More available seats on Commuter Rail. Beefed up bus service from the South Shore to the Red Line. The T will operate at maximum capacity.

Commuter Boat

Call 227-7665 for information on commuter boat service from the South Shore.

Information

For complete, up-to-date commuter information, call 227-7665.

Maybe we can't make the expressway perfect... ...but we can make it <u>better</u>.

FIGURE 3.4. ADVERTISING FLYER

- travel times in the regular lanes increased from zero to 40 percent
- there was little apparent change in the use of alternate routes
- the number of cars using the Expressway from 6:30 a.m. to 9:30 a.m. declined by 20 percent
- the number of persons carried by the Expressway from 6:30 a.m. to 9:30 a.m. declined by 14 percent
- the number of carpools on the Expressway from 6:30 a.m. to 9:30 a.m. increased by about 33 percent
- the compliance rate, the percentage of legal users of the lane, was between 22 and 41 percent during the three hours of lane operation.

3.7 OPERATIONAL CHANGES FOLLOWING IMPLEMENTATION

The State agencies involved in running the project adopted a flexible, wait-and-see approach to the express lane. As problems developed, modifications were attempted on an ad hoc basis. Major changes and milestones were as follows:

- On May 11, the entry to the express lane was blocked, so that all vehicles had to merge into the right lanes (see Figure 3.6). Thus, it became necessary for carpools and buses (and violators) to switch back into the reserved lane. The effect of this temporary blockage was similar to metering the entry to the Expressway. A police officer was stationed at this point.
- Near the end of May, the State began recording the license plate numbers of violators and sending these persons letters requesting that they obey the lane restrictions (see Figure 3.7).
- Also, at the end of May additional plastic inserts, spaced at 20-foot intervals, were installed along portions of the roadway where serious weaving was occurring. Previous to this, all plastic inserts had been spaced 40 feet apart.
- At the beginning of June, signs were posted noting the weaving restriction, and the police began the enforcement of illegal weaving.
- On Wednesday, June 1, after the morning peak, the northbound lanes were detoured onto the newly constructed frontage road.

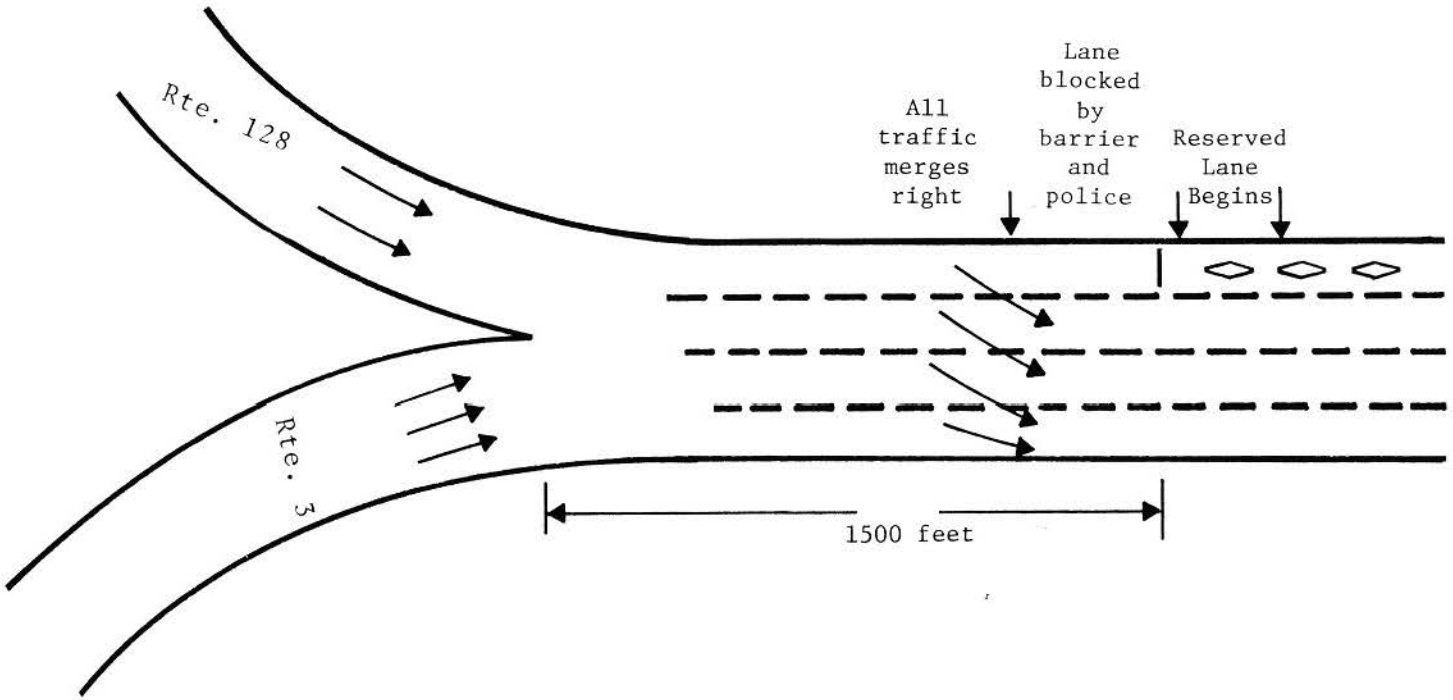


FIGURE 3.6. BLOCKED LANE ENTRY AND MERGE RIGHT

4. TRAVEL TIMES ON THE EXPRESSWAY AND ALTERNATE ROUTES

4.1 EXPRESSWAY TRAFFIC CONDITIONS

4.1.1 Vehicle Travel Times

Speed runs were performed over an 11.4 mile segment beginning at the Route 3 Union Street entry ramp in Braintree (approximately 2 miles south of the Route 128/Route 3 merge) to the Kneeland Street exit on the Expressway in Boston. Runs were conducted in both the express lane and one regular lane. Figure 4.1 presents the results. In all cases, travel time in the express lane was less than or equal to that in the regular lane. The time differential was a function of the time of day and appeared to be more pronounced during the most congested period of the morning peak. In addition, except during the early and latter part of the hours of operation, travel times in the non-reserved lane during Phases I and II were almost always less than or equal to what they were before implementation of the reserved lane. For example, in March, a trip beginning at 7:30 a.m. took about 28 minutes. In June the same trip took only 17 minutes in the express lane and 24 minutes in a regular lane.

The improvement in travel times during Phase I and II was attributed to two factors: there had been a decrease in the number of vehicles using the facility (see Section 5.1); and the "metering" of the Expressway after the Route 128/Route 3 merge point that began on May 11, one week after implementation, served to create a free-flow condition on the Expressway. The small slowdown created before the merge point was more than compensated for by the increase in vehicle speed on the facility, resulting in a net decrease in travel time. Before the reserved lane was implemented, travel times at 6:30 a.m. were very low, indicating free-flow conditions. During the project some people apparently began their trips earlier, resulting in an increase in utilization and travel time during this period.

During Phase III travel times in the express lane were very low, indicating a nearly free-flow condition. However, travel times in the regular lanes deteriorated to the point where it took non-carpoolers 40 minutes to travel the 11.4 mile segment at 7:30 a.m. An average trip in the normal lanes took 7.5 minutes longer than it had before the project began. It should be pointed out that travel times appeared to be decreasing during Phase III and, at the time of project cancellation, the corridor transportation system had not yet reached equilibrium.

4.1.2 Entry Ramp Conditions

The waiting times at the four major on-ramps were measured in March, May, and June, and both average and maximum wait-times were found to decrease in proportion to the decrease in traffic on the Expressway. The most significant improvements in wait-times occurred during the middle portion of the peak period when the facility was most congested. For example, the average wait time at the Neponset on-ramp at 7:30 a.m. decreased from 57 seconds in March to 17 seconds in June. Table 4.1 presents the average and maximum wait times at this ramp, which is the busiest one on the Expressway. Entry-ramp data was not collected during Phase III.

TABLE 4.1

WAIT TIME AT NEPONSET AVENUE ON-RAMP

Average (Maximum) in Seconds

Period	March	May	June
6:30 A.M.	21 (58)	19(34)	16(23)
7:30 A.M.	57(102)	33(58)	17(22)
8:30 A.M.	30 (47)	17(28)	16(20)

4.1.3 Total Trip Times

Except during the 6:30 a.m. to 7:00 a.m. period and after 9:30 a.m., travel times on the Southeast Expressway decreased for all users of the facility during Phases I and II. Therefore, anyone using the facility after 7:00 a.m. and before 9:30 a.m. should have experienced a decrease in travel time. A carpool traveling from the Route 3 Union Street entry-ramp to Kneeland Street in Boston at 7:30 a.m. in June could have had its time reduced from 28 to 17 minutes, a decrease in travel time of 39 percent. For a non-carpool, the decrease was less substantial, 4 minutes or 14 percent. Persons entering the Expressway closer to the Boston CBD would also experience a decrease in travel time. While persons entering after the Route 128/Route 3 merge were not legally eligible for the reserved lane, they now entered a free-flowing Expressway and did not experience the delay caused by the metering.

Persons in the outlying suburbs of Weymouth, Hingham, and Randolph experienced a travel time of 30 to 40 minutes before lane implementation. Assuming an average of 35 minutes, during Phases I and II a carpooler could have experienced a decrease in travel time of 11 minutes, a 31 percent decrease, while a non-carpooler could have

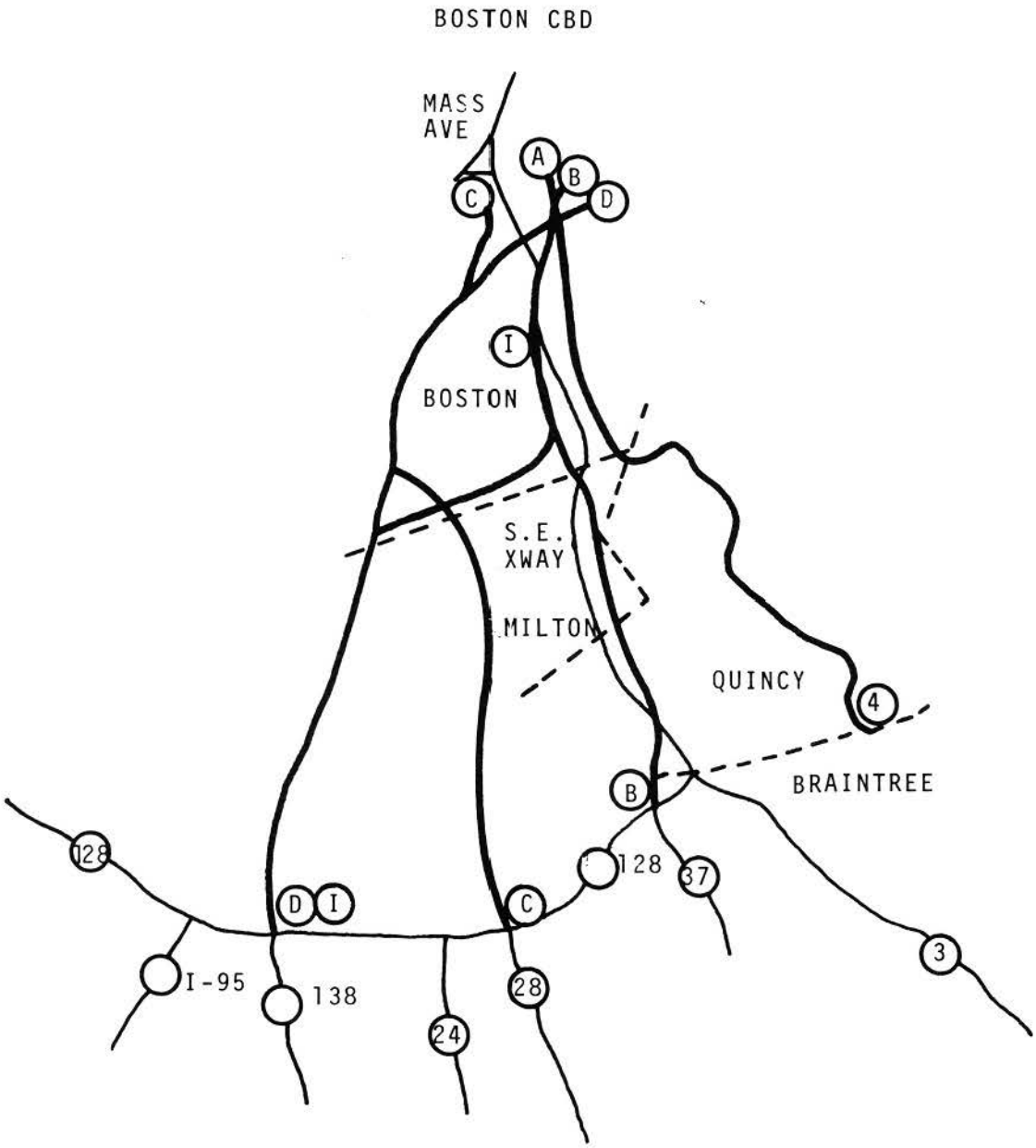


FIGURE 4.2. MAJOR ALTERNATE ROUTES

TABLE 4.2. DESCRIPTION OF SPEED RUNS ON LOCAL ROUTES (Cont.)

Route	Description		"Before" (March '77) Average Time (min)	95% Confidence Interval (min)	May 19 Average Time (min)	June 7 Average Time (min)
D	From Route 128 at Route 138 To Broadway at Dorchester Avenue Via Blue Hill Avenue--River Street-- Dorchester Avenue Distance 11.9					
		6:30	26	24-27	25	28
		7:30	36	34-38	34	33
		8:30	31	25-33	31	31
		9:30	28	27-28	28	27
E	From Route 53 at Union Street To Neponset Circle Via Quincy Avenue--Newport Avenue Distance 6.6					
		6:30	15	13-16	15	17
		7:30	18	16-20	15	18
		8:30	15	14-16	17	16
		9:30	14	13-15	14	16
F	From Hilltop Street at Granite Avenue To Neponset Circle Via Hilltop Street Distance .8 miles					
		6:30	4	3-4	3	4
		7:30	4	4-5	5	5
		8:30	4	3-4	4	5
		9:30	3	3-4	3	3
G	From Randolph Avenue at Adams Street To Southampton Street Via Morton Street--Blue Hills Parkway-- Columbia Rd.--Boston Street Distance 5.8 miles	6:30	19	17-21	19	18
		7:30	23	21-25	19	21
		8:30	24	23-25	20	24
		9:30	20	19-20	19	19

5. TRANSPORTATION SYSTEM USE PATTERNS

5.1 EXPRESSWAY USE PATTERNS

The number of cars on the Expressway during the three hours of lane operation declined immediately after implementation of the express lane and continued to remain lower than the pre-implementation level (see Figure 5.1). For example, in March 1977, the average number of cars passing the Furnace Brook screenline during the hours of 6:30 a.m. to 9:30 a.m. was 15,550. Volumes averaged 13,925 during Phase I, a decrease of 10 percent and 13,815 during Phase II, a decrease of 11 percent from the before period. During the enforcement phase, 13,020 cars passed the screenline, 16 percent fewer than in March. Magnetic loop detectors on the Expressway indicated a slight spreading of the peak period.

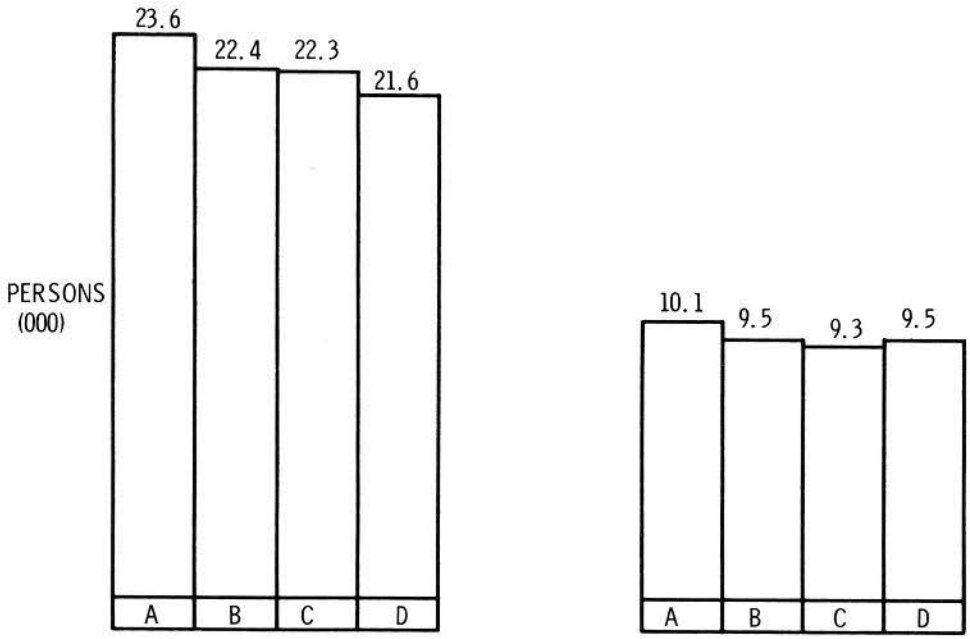
The number of cars on the facility during the peak hour of 7:00 a.m. to 8:00 a.m. changed an equivalent amount. At Furnace Brook the before figure was 5,890 while during Phase I the figure was 5,115, a decrease of 13 percent. During Phase II an average of 4,960 cars crossed the screenline during the peak hour, a decrease of 16 percent, while during Phase III 4,945 cars were counted.

The number of persons carried by the facility also decreased following implementation (see Figure 5.2). It was estimated that bus ridership changed very little. Thus, the decrease in person throughput was nearly equivalent to the decrease in auto travelers. During the March pre-implementation period, an average of 23,580 persons crossed the Furnace Brook screenline. This number fell by 5 percent to 22,380 during Phase I and average 22,310 during Phase II. During Phase III it was 21,645, 8 percent fewer than in March.

During the 7:00 a.m. to 8:00 a.m. peak hour the number of persons in cars and buses at the Furnace Brook screenline fell by 6 percent from 10,080 in March to 9,476 during Phase I. In June, this figure averaged 9,260, a decrease of 8 percent, and during Phase III it was 9,490, a decrease of 6 percent.

The express lane carried more than its "fair share" of persons on the Expressway. During the three operating hours the express lane carried 29 percent of the total persons during Phase I, 32 percent during Phase II, and 32 percent during Phase III. During the peak hour these numbers were 39 percent, 43 percent, and 42 percent respectively.

The number of carpools on the facility increased immediately upon implementation of the lane (see Figure 5.3). At Furnace Brook the number of carpools increased from 681 to 902 during Phase I, an increase of 32 percent.



A. BEFORE
B. PHASE I - PRE-CONSTRUCTION
C. PHASE II - CONSTRUCTION
D. PHASE III - ENFORCEMENT

FURNACE BROOK SCREENLINE

FIGURE 5.2. NUMBER OF PERSONS IN CARS AND BUSES ON EXPRESSWAY

In June, the average number of carpools was 899. Just before the termination of the project 1,166 carpools were recorded at the Furnace Brook screenline, an increase of 71 percent.

During the peak hour (7 a.m. - 8 a.m.) the increase in the number of carpools was even more striking. At Furnace Brook the number of carpools increased from 388 before implementation to 471 in May, an increase of 21 percent. In June, the average number of carpools was 464, an increase of 20 percent over the before period. During Phase III there were 641 carpools during the peak hour, an increase of 65 percent.

The change in carpool share (as a percent of total cars) during the 3 hours of lane operation was from 4.4 percent before implementation to 6.5 percent during Phases I and II and 9.0 percent during Phase III (see Figure 5.4). For the peak hour the corresponding numbers were 6.6 percent, 9.2 percent, and 13.0 percent.

The special carpool matching program elicited very little response. During the first two months of project operation, a maximum of 120 calls per day were received at the CARPOOL number, with average daily calls being far less than this number. At the information booth on the Expressway, 640 inquiries were made during the 8 weeks from April 11 to June 2, 1977. About 430 requests were actually made for carpool matching information, and about a third of these were matched with at least one other person and mailed a carpool matching list. It is not known how many of these persons actually formed carpools.

The percent of persons in high occupancy vehicles (3 or more person carpools and buses) increased with the inception of the lane (see Figure 5.5). In March, at Furnace Brook an average of 25 percent of the facility's users were in high occupancy vehicles during the hours of 6:30 a.m. to 9:30 a.m. This number increased to 29 percent during Phases I and II and was 35 percent during Phase III. During the peak hour, 7:00 a.m. to 8:00 a.m., the proportion of persons in high occupancy vehicles increased from 34 percent in March to an average of 39 percent during Phases I and II and 45 percent during Phase III.

Average auto occupancy on the Expressway increased when the lane was implemented (see Figure 5.6). During the three hour peak period occupancy at Furnace Brook increased from around 1.30 to about 1.36 during Phases I and II and to 1.39 during Phase III. Average auto occupancy on the express lane was considerably higher, nearly 1.8 at Southampton and 2.3 at Furnace Brook, which is further south, during Phases I and II. During Phase III occupancy was 2.0 at Southampton and 2.2 at Furnace Brook. The discrepancy in auto occupancy

railroad station and then to Government Center for a two-month period. Since ridership remained low, the service was discontinued. One reason for the failure of this service was that it was not marketed properly, and many potential riders were unaware of its existence.

Ridership at other park-and-ride lots remained the same. In all, bus ridership rose by about 100 riders, or 3 percent, during the peak period with the inception of the reserved lane. During Phase III bus ridership increased another 2 to 3 percent. This lack of increased bus patronage could be explained, in part, by the fact that, except for the Hudson Lines, no new coverage was provided and headways were not reduced. The only change was that backup sections were made available as needed.

Ridership did not increase on the commuter rail lines in May. In June, seasonally adjusted commuter rail ridership increased by approximately 100 riders during the 6:30 a.m. to 9:30 a.m. peak period. Ridership increased by 7 percent during Phase III. The two new commuter boat lines carried 170 persons daily and the original commuter boat experienced its normal summer increase of ridership from 75 to 125 passengers each way. A survey on one of the new boats indicated that approximately one-third of the passengers were former auto drivers.

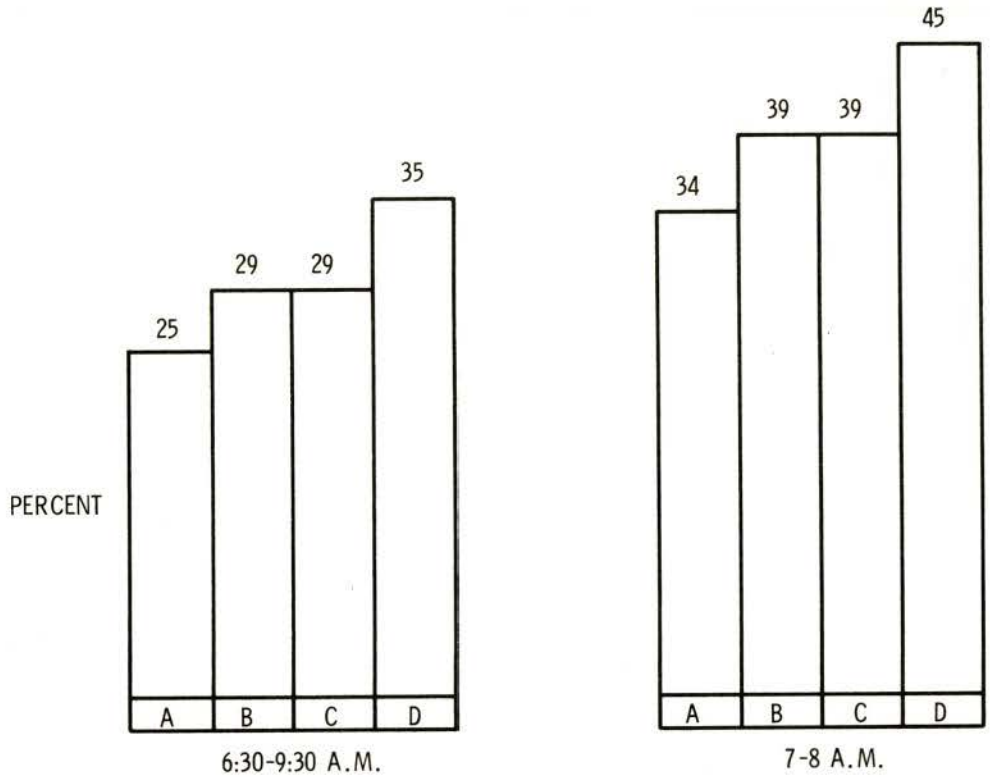


FIGURE 5.5. PERCENT OF PERSONS IN 3 OR MORE OCCUPANT CARS OR BUSES ON EXPRESSWAY

5.4 WHERE THE CARS WENT

Table 5.1, from a paper by Brand et al,* summarizes the whereabouts of the automobiles no longer travelling the Expressway in May and June. In general, the figures were obtained by dividing the observed ridership change for each mode by 1.31, the before period auto occupancy. The category "shifted to alternate route or did not make the trip" presents the primary uncertainty in the data for the reasons explained in Section 5.2.

The table indicates that the Expressway itself, through an increase in carpooling, was able to absorb half of the decrease in the number of cars in May. The parallel rapid transit route accounted for about 25 percent of the "missing" cars in May. The other modes experienced only marginal shifts, and the alternate routes were not affected.

The number of cars on the Expressway decreased by approximately 3700 from May to June, and this number was estimated to have been absorbed by the alternate routes or by seasonal decreases in corridor travel. The excess arterial capacity was sufficient to absorb this shift without a noticeable decrease in level of service. Travel by other modes remained nearly the same in June as it had been in May.

5.5 USE PATTERNS SUMMARY

- Expressway auto volumes during the three hour peak period were down 10 percent during Phase I, 11 percent during Phase II, and 16 percent during Phase III.

- Person throughput on the Expressway during the peak period declined by 5 percent during Phases I and II and 8 percent during Phase III.

- For the peak period the reserved lane carried 29 percent of total persons during Phase I, 32 percent during Phase II, and 32 percent during Phase III. During the peak hour these numbers were 39, 43 and 42 percent respectively.

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*D. Brand, J. Attanucci, H. Morris, C. Kalauskas, "Southeast Expressway Reserved Lane for Buses and Carpools," submitted for presentation at the 57th Annual Meeting of the Transportation Research Board, Washington DC, January 1978.

- During the peak period the number of carpools increased by 32 percent during Phases I and II and 71 percent during Phase III (over the March "before" number). During the peak hour the number of carpools increased by 21 percent during Phase I, 20 percent during Phase II, and 65 percent during Phase III (over the March "before" number).

- Carpool matching was relatively unsuccessful: 430 requests were made; one-third of these were matched; the number of carpools formed is unknown.

- The percent of persons in high occupancy vehicles during the peak period increased from 25 percent in March to 29 percent during Phases I and II and 35 percent during Phase III. The corresponding figures for the peak hours were 34 percent in March, 39 percent during Phases I and II and 45 percent during Phase III.

- There was a slight spreading of the peak period.

- Average auto occupancy on the Expressway increased from 1.30 to 1.36 during Phases I and II and to 1.39 during Phase III.

- During Phase I there was almost no change on alternate routes. During Phase II between 3775 and 4275 vehicles either shifted to alternate routes or did not make the trip. During Phase III, between 900 and 2,000 of the before period vehicles were travelling on alternate routes.

- During Phases I and II Red Line rapid transit ridership increased by 460 trips or 5 percent. During Phase III ridership increased by another 550 trips, a 12 percent increase over the before period.

- Express bus ridership increased by 100 trips or 3 percent during Phases I and II and by another 2 to 3 percent during Phase III.

- There was little change in commuter rail ridership during Phases I and II. During Phase III ridership increased by about 7 percent.

6. COST OF THE EXPRESS LANE OPERATION

There were no major capital costs involved in setting up the express lane. Signs, striping, drilling the holes in the roadway, and plastic inserts comprised the components for lane demarcation. The lane separation required 1500 plastic inserts costing $16,500 ($11 each) and 2000 replacements (approximately 15 to 18 posts had to be replaced daily) costing $22,000. Holes for the inserts cost $5,500 to drill. The cost of signing was approximately $7,500. The carpool matching and publicity campaign cost approximately $40,000. The existing two lane frontage road was widened to three lanes and a new frontage road constructed, but costs associated with these modifications were attributable to the reconstruction project and not to the reserved lane. Since very few additional transit vehicles were provided, equipment costs were minimal. Thus, the total fixed outlay was approximately $91,500.

The major operating cost was the daily installation and removal of the plastic inserts. The operation involved eight persons from 5:00 a.m. to 6:15 a.m. and 9:30 a.m. to 10:30 a.m. These persons were assigned to two convoys, each consisting of an open-back truck followed by a car with a flashing light. Two persons were required to install or remove the inserts, one sitting in a rear-facing jumpseat and performing the actual operation and a second providing assistance. Police protection was required for each convoy. The crew costs were $3,200 per week and the police overtime costs were $540 per week, or approximately $97,000 for the 26 weeks the reserved lane was in operation. Costs are summarized in Table 6.1

7. VIOLATIONS, ENFORCEMENT, AND SAFETY

7.1 VIOLATIONS

From its inception the express lane experienced a large number of violations. This is illustrated in Figure 7.1, which gives the violation rates, the percent of cars illegally in the lane, at Southampton and Furnace Brook. The violation rate was lower at Furnace Brook than at Southampton, averaging 64 percent at the former and 80 percent at the latter during Phases I and II. This difference was due in part to the merge-right at the beginning of the reserved lane and the presence of a State Police officer. This officer was at the merge point daily from 6:30 a.m. to 9:30 a.m., except when responding to an incident on the Expressway. Since the express lane was closed at this point, potential violators were forced into the regular lanes and had to cross through the plastic inserts to enter the lane.

The violation rate was lower during the peak hour than during the three hours of lane operation. One reason for this was the greater proportion of carpools on the facility during the peak hour.

Even though the plastic inserts separating the express lane were spaced either 20 or 40 feet apart, weaving in and out of the lane remained a serious problem. Most of the weaving occurred near the heavily used Neponset and Granite on-ramps, and this was where the 20-foot spacing was used. However, since drilling on bridge decks was not feasible, cones had to be used, and these did not function as an adequate deterrent to violators.

7.2 ENFORCEMENT

The number of police on the Expressway before the opening of the reserved lane was negligible. The policy of the State Police was to stay off busy facilities unless there was an incident. The MDC Police also preferred not to cruise. Instead, a helicopter was used to locate incidents. At the inception of the reserved lane, four cars from each force cruised the roadway. The State Police cut its number to two cruisers plus the one officer at the merge point. The MDC also cut its presence to two vehicles and these were stationed at entry ramps.

The lane restrictions were not enforced during Phase I and II. At the end of May, the State began recording license plate numbers of violators of the lane restriction. These persons were sent letters requesting them to conform to the regulations (see Figure 3.4), but they were not issued citations. In June, the police began ticketing persons for illegal weaving.

On October 17, the police began enforcing the lane restriction by taking license plate numbers of violators and sending them $20 citations through the mail. The legality of this was based on a law stating that if a police officer cannot reasonably stop a violator on the side of the road, then a summons can be sent through the mail. This has been the practice on the Massachusetts Turnpike for dealing with toll violators.

7.3 SAFETY

The reserved lane appeared not to have led to an increase in accidents on the Expressway during Phases I and II. The relevant data is presented in Table 7.1. Even with a bias in accident reporting due to the increased police presence on the facility, personal injury accidents and property damage accidents fell within the historical range recorded for these months from 1970 through 1976. Note that the 1977 figures were slightly higher than the historical averages. In addition, only two of the May 1977 accidents and two of the June 1977 accidents occurred in or could be associated with the Express lane. The reserved lane's excellent safety record could have been due to the use of the plastic inserts and the relatively small speed differential between users of the reserved lane and the adjoining normal lane during Phases I and II.

During Phase III personal injury accidents were below the average of the preceeding 7 years, but property damage accidents exceeded the average by 5. Two of these accidents were caused by violators weaving into the lane. While two and a half weeks is a short period of time over which to draw conclusions, and while the improved police presence on the roadway resulted in more acccidents being observed, some of the increase in property damage accidents might have been caused by the speed differential between the reserved and normal lanes. During the peak hour cars in the express lane averaged 38 miles per hour while those in the normal lanes averaged only 17 miles per hour.

A problem developed after 9:30 a.m. before all the inserts had been removed. Signs prohibited weaving between the hours of 6:30 a.m. and 9:30 a.m. only, and dangerous weaving, with drivers attempting to avoid the remaining inserts, occurred after the official hours of express lane operation.

7.4 VIOLATION AND SAFETY SUMMARY

- During the non-enforcement period, violations were very high, about 64 percent at the beginning of the lane and 80 percent at the end. During the enforcement phase, the violation rate declined to 35 percent.

8. INSTITUTIONS AND ATTITUDES

Unlike other reserved lane projects, implementation of the express lane on the Southeast Expressway was timed to coincide with the mandatory reconstruction of portions of the facility. The reserved lane was introduced as an action necessary to avoid total chaos on the Expressway. In addition, it was announced that the restrictions would not be enforced. Shifts in policy and operations, such as the metering, the sending of letters to violators, and the ticketing of weavers, were implemented, after careful thought, as the need arose.

For these reasons, there was no public outcry during the summer months against the reserved lane like the one experienced in Santa Monica. In fact, the relatively few articles that appeared in the Boston newspapers were merely descriptive and informative and never critical. Predictions made by state transportation officials are quoted without question (for example, the following two quotes are taken from Boston Globe articles: "Daniel Brand, an assistant transportation secretary, is convinced that if carpooling on the Expressway is tripled from its current 250 cars to 750, and the number of express bus riders increased by 30 percent, traffic conditions on the heavily-used highway may be even better than they are now" and "There is no doubt among state officials that the Transportation Department's media blitz, urging motorists to use other means of getting to work, influenced a lot of regular Expressway travelers to use the MBTA, carpools and, especially, alternate routes.") The Boston Globe described the express lane as the "brainstorm of state transportation officials."

The situation changed radically in October when the police began enforcing the lane restriction. Enforcement proved to be an unpopular change in project operations. While the violation rate went down, the number of carpools barely rose, and congestion became intolerable. Articles began appearing in the Boston Herald American calling the reserved lane a "flop" and a "war against commuters." The Boston Globe remained silent.

An irate citizenry began writing and phoning the state officials responsible for the project. Two bills were sponsored in the State House, one to prohibit the implementation of preferential treatment systems (voluntary or mandatory) for multi-passenger vehicles travelling the Southeast Expressway and the other to change the restriction to vehicles with two or more occupants. State officials decided that a change in the definition of a carpool to two or more persons would defeat the purpose of the reserved lane. No constituency appeared to support the reserved lane project.