Reconstructing Major Transportation Facilities: The Case of Boston's Southeast Expressway

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ABSTRACT

With an increased emphasis on the rehabilitation and reconstruction of existing infrastructure, transportation engineers are becoming increasingly concerned about the planning efforts needed to maintain acceptable travel conditions in urban corridors where major reconstruction efforts are occurring. Described in this paper are the reconstruction of a major expressway that serves downtown Boston and the efforts made by the state transportation agency to minimize disruption to expressway users. The actions that were implemented include improved subway and bus service, expanded park-and-ride facilities, increased ridesharing capability, improved commuter boat operations, increased capacity on major parallel routes, and extensive public information dissemination. The results of an evaluation program are used to discuss the effectiveness of each action. These results, combined with similar experiences elsewhere (e.g., Pittsburgh and Chicago), provide useful guidance to transportation officials on the overall approach that should be adopted to minimize disruption during reconstruction efforts. Because large-scale reconstruction usually affects the lives of many people, the political factors associated with such reconstruction can be significant. These factors, as found in the Boston case, are highlighted. Also outlined are the major characteristics of an overall strategy for minimizing disruption during reconstruction projects.

As the highway system ages, transportation planners and engineers are increasingly faced with the challenge of reconstructing major highway facilities in a manner that minimizes disruption to facility users. Described in this paper is a strategy that was adopted by the Massachusetts Department of Public Works (MDPW) to minimize disruption during the reconstruction of a major expressway that serves Boston. The response of expressway users to this strategy, which was determined through surveys and traffic-ridership counts, is discussed in detail. Because the reconstruction of a major urban highway facility is a complex undertaking and potentially controversial, the key characteristics of a successful strategy to minimize disruption to facility users are outlined in the final section of this paper.

PLANNING THE RECONSTRUCTION OF MAJOR TRANSPORTATION FACILITIES

The planning of the reconstruction of a major urban highway is different from the typical transportation planning effort in several ways. First, there are two major groups that will be affected by the reconstruction--the users of the facility and those individuals who live in areas that will experience increased congestion as a result of diverted traffic. The often lengthy time needed to generate public interest in the construction of new facilities is considerably reduced in reconstruction efforts where the reconstruction is viewed as an immediate and dramatic threat to existing travel behavior. The responsible agency must therefore be prepared to deal with the issues that are likely to be raised by both groups--issues that could easily conflict with each other. For example, providing alternate routes for diverted traffic (an objective of facility users) can easily conflict with minimizing traffic congestion in adjacent communities (an objective of nearby residents).

Second, the types of actions that need to be considered in reconstruction planning range from those that require physical construction (e.g., park-and-ride lots) to changes in institutional behavior (e.g., variable work hours). A wide range of skills is necessary to implement a successful strategy that includes such diverse actions. Because these skills are seldom found in one individual, reconstruction planning requires the coordinated effort of numerous agencies and transportation professionals and, most likely, a formal coordinating mechanism such as a task force.

Third, the time frame for reconstruction planning is much more limited than that for most other projects. Whereas new construction projects can sometimes be in the planning stage for 3 or more years, planners concerned with reconstruction issues usually have, at the most, 1 year before the reconstruction begins. The impact of this short time frame is greatest on the analysis methodology that is used to assess alternate courses of action. Throughout the planning effort, but especially in the latter stages when the public begins to realize that the project will soon occur, planners must have an analysis capability that produces reliable information quickly. Analysis will not only be necessary on the impacts of the reconstruction on alternate routes and modes, but important policy issues (such as the banning of trucks) will likely surface throughout the planning process. The need for a quick response to these types of issues suggests that the analysis methodology must rely mainly on existing data bases, and use relatively uncomplicated and unsophisticated modeling techniques.

A recent conference on the future of travel analysis methods concluded that gaining a better

understanding of the effects of reconstructing major facilities was one of the important issues likely to face transportation professionals in the next 5 years (1). There is little information in the literature on how temporary travel disruptions affect travel behavior and how facility reconstruction should be planned. Most technical articles have focused on construction-related activities such as safety (2,3) or on the overall economic benefits of the reconstruction project (4). More recently, attention has been given to the operations plan that was needed to divert traffic during short periods while maintenance activities were undertaken (5). The type of literature that came closest to reconstruction planning was that on contingency planning (6,7). However, these articles were mainly concerned with addressing sudden temporary transportation disruptions.

It was not until the Federal Highway Administration sponsored a demonstration project on the reconstruction of a major expressway in Pittsburgh that substantial documentation was available on the characteristics of reconstruction planning and of traveler response (8,9). The documents produced during this project were important for their contribution to understanding what happened in Pittsburgh, but left unanswered questions about how such planning should occur elsewhere and how different circumstances might influence the effectiveness of mitigating actions.

These characteristics of reconstruction planning, and the still little-researched phenomenon of traveler response to major construction disruption, will be further examined in the following case study of expressway reconstruction in Boston.

RECONSTRUCTION OF BOSTON'S SOUTHEAST EXPRESSWAY

Boston's Southeast Expressway is the only major highway facility that connects Boston with the rapidly growing southeastern part of Massachusetts. Originally designed in the late 1950s to handle an average daily traffic volume of 75,000 vehicles, the Expressway was carrying more than 160,000 vehicles daily by 1983. This substantial increase in volume was the result of rapid growth in the communities that were served by the Expressway and a highway construction ban which, in 1970, stopped most major highway construction in the metropolitan area. A major expressway 6 miles away that was intended to carry a large portion of the Boston-bound traffic was never built, thus causing most highway traffic from the south of Boston to use the Southeast Expressway. During the period that followed the highway ban, however, a rapid rail transit line was extended south parallel to the Expressway. Other means of transportation in the corridor, all of which serve the Boston commuter, include several commuter boat lines, two commuter rail lines, numerous public and private bus services, and a regional ridesharing program.

In 1982 the MDPW found that the 15 bridge decks on the Expressway were in various stages of deterioration. Within 2 years these bridge decks would have to be replaced, an effort that would cause serious disruption to the users of the Expressway. The reconstruction of the bridge decks, however, was viewed by MDPW engineers as an opportunity to make other improvements to the roadway, including resurfacing the entire length of the road in a way that would not add substantially to the level of disruption likely to be caused by the bridge construction. Thus in March 1983, the MDPW began the reconstruction of 8.5 miles of the Southeast Expressway. The reconstruction, which would last until November 1985, would not only involve replacement of the bridge decks and resurfacing of the roadway, but would also involve

1. Improvement of vehicle access and egress at selected ramps through widening and lengthening of merge areas;
2. An increase in safety measures through provision of more effective emergency turnouts, lighting the entire length of the Expressway, and encouraging more consistent road signing; and
3. Elimination of serious drainage problems that existed in several locations along the roadway.

Because such reconstruction would likely cause serious disruption to Expressway users, MDPW engineers undertook two major efforts that were designed to minimize disruption. First, given that the Expressway was such an important highway facility that served large numbers of people, the MDPW wanted to provide as much capacity on the Expressway during the reconstruction period without hindering its ability to finish the project as quickly as possible. It was decided that the 6-lane Expressway (with two breakdown lanes that are used as travel lanes during the rush hours) was to be divided into four sections of two lanes each. The reconstruction would begin on the outside two lanes on the northbound side with the remaining two lanes serving northbound traffic at all times. The southbound roadway was divided into two parts with 8.5-miles of barriers. The two lanes between the barriers and the Expressway median were reversible lanes, northbound between the hours of 5:30 a.m. and 12:00 p.m. and southbound between 1:00 p.m. and 10:00 p.m. The remaining two southbound lanes served southbound traffic at all times (Figure 1).

By designing the traffic management scheme this way, MDPW engineers were able to provide the same number of lanes in the peak hour direction during the project as there was before, although the capacity would likely decrease because of barrier constraints and the "curiosity factor" of construction that occurs so close to the roadway. When the two lanes under construction were finished, the next two northbound lanes would be closed to traffic and the finished lanes opened to traffic.

The second effort by MDPW engineers was to prepare a comprehensive plan for minimizing disruption to Expressway users. The actions in this plan were selected on the basis of several criteria that included

1. The degree to which the action will provide opportunities for Expressway users to use alternative modes, routes, or times;
2. The feasibility of implementation within the time span before reconstruction;
3. The cost effectiveness from the point of view of the action's contribution to minimizing disruption per dollar expended;

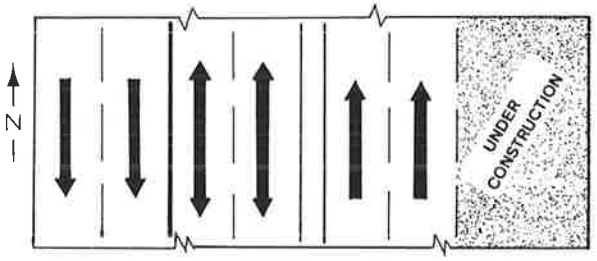

FIGURE 1 Lane configuration during construction.

4. The contribution of the action to more permanent transportation improvements after the reconstruction was completed; and
5. The flexibility of removing the action that was found to be ineffective.

ACTIONS TO MINIMIZE DISRUPTION DURING EXPRESSWAY RECONSTRUCTION

The types of actions that were implemented to minimize disruption ranged from construction projects to operational improvements. The overall cost of these actions was about $9 million.

Park-and-Ride Lots

The MDPW is responsible for the park-and-ride program in the Commonwealth of Massachusetts and, in this capacity, had constructed several parking lots (1,600 spaces) throughout southeastern Massachusetts. In anticipation of the reconstruction, the MDPW expanded two lots, built three more, and leased space for a sixth, adding a total of 1,500 spaces to the park-and-ride capacity that serves the Expressway. Each of these lots was to be served by public or private bus service. In addition, the MDPW subsidized the expansion of five parking lots (300 spaces) at commuter rail stations.

Ridesharing

A private, nonprofit corporation was established in 1978 to organize long-distance commuter vanpools as an alternative to the single-passenger automobile, and, up to 1983, it served more than 1,800 commuters in 135 vans throughout the state. Because of the reconstruction project, this corporation was asked to establish an employer-based ridesharing program and create an information brokerage program that would be the focal point for all information on transportation options in the Boston metropolitan region. For the first time, Boston commuters could call one phone number to obtain information on public and private bus services, commuter rail services, commuter boat operations, ridesharing options, and park-and-ride locations.

Alternative Routes

Experience from other cities that faced reconstruction projects indicated that one of the predominant means of commuter response was to find alternate highway routes to the destination. In anticipation of such behavior, MDPW engineers identified four major routes that would serve as likely diversion routes, and located key congestion points along these routes. Working with local officials, MDPW engineers were able to make signal and pavement marking improvements at 29 intersections.

Mass Transit

As mentioned previously, the Expressway corridor was served by several mass transit modes. Unfortunately, the subway line that serves the corridor was already at capacity during rush hours, and the major commuter rail line experienced ridership at 140 percent of seating capacity during several peak hour departures. The mass transit component of this program therefore focused on adding temporary capacity to the fixed rail system and on implementing new bus services. By doubling rail departures on the southern commuter rail lines, an additional 2,200 passenger seats would be available to commuters. The public transit agency also made agreements with eight private bus operators to provide express bus service from key communities in southeastern Massachusetts. A total of 30 buses were added to peak hour service. In addition, two new commuter boats were subsidized for operation from a town 10 miles south of Boston.

Variable Work Hours and Flextime

Another means of adapting to disruption found in other reconstruction projects was commuters changing their departure time to avoid major delays. The MDPW, in cooperation with the transit agency and the Boston Chamber of Commerce, sponsored a major conference to encourage large employers to implement a variable work hours or flextime program. It was expected that large government agencies would initiate such programs to set an example.

Police Enforcement

Officials from communities adjacent to the Expressway indicated great concern that overflow traffic would create serious congestion and safety problems in the neighborhoods through which alternate routes traveled. The MDPW, in cooperation with local police agencies, identified numerous intersections where police enforcement of traffic regulations and directing of traffic might be necessary. A multiphased strategy of placing police officers at 68 intersections during the first 2 weeks, at 31 intersections for the subsequent 3 weeks, and then at those intersections where clear problems existed, was agreed to by the state and local police authorities.

Local Community Assistance

The state devoted most of its resources to regional transportation services, that is, the provision of bus, boat, and rail services that could be used by commuters throughout the affected area. In meeting with local officials, however, it became apparent that there would be several local sites such as transit terminals where increased traffic caused by the reconstruction would likely increase congestion. The department set aside $500,000 to fund proposals from communities that would help mitigate these congestion problems. Fifteen proposals were funded, including the provision of local ridesharing assistance, additional police at terminal sites, expansion of town park-and-ride lots, newspaper advertising, and shuttle bus service to a commuter boat terminal.

Public Information and Community Liaison

A critical component of the mitigation plan was to make available as much information on alternatives as was feasible. Three staff members were hired to lead the public information effort that included radio and television advertisements, the production of public information materials, newsletters, slide shows, and the holding of more than 200 meetings. Utility companies voluntarily published 100,000 brochures on the project and enclosed them with monthly billings. One major corporation produced a videotape

on the project to be shown to its employees and loaned to any other interested corporation.

In addition to these actions, the department also required the construction contractor to provide four tow trucks that would be able to handle breakdowns and accidents, and incorporated into the contract a clause that provided a $10,000 per day bonus if the job were finished before the project deadline. To minimize congestion and to avoid a potentially dangerous accident situation, large trucks were also banned from the reversible lanes. Because of the difficulty in enforcing this ban, numerous meetings were held with trucking associations to seek their voluntary compliance.

COMMUTER AND COMMUNITY RESPONSE TO EXPRESSWAY RECONSTRUCTION

The characteristics of commuter and community response to the reconstruction during the first 3 months is discussed in the following sections. This response was determined through a comprehensive data collection effort that included screenline traffic counts, license surveys, on-board ridership questionnaires, and household mailback surveys.

Traffic Volumes

In the weeks leading up to the reconstruction, the local media reported daily on the concerns of public officials, businessmen, and Expressway users with regard to the economic, social, and political impacts of the reconstruction. As a result of this attention, in addition to numerous warnings from the MDPW's public information effort, there were 7,000 fewer cars on the Expressway during the first week of reconstruction than there were in previous weeks (Figure 2). A major consequence of this decrease in traffic was a much improved traffic flow on the Expressway itself. By the third week of reconstruction, a vastly improved Expressway flow (and extensive media attention) began to attract large numbers of vehicles back to the Expressway.

Overall, the Expressway experienced a 9-percent decrease in traffic in the northbound direction (about 5,000 vehicles) between the hours of 6:00 a.m. and 7:00 p.m. when adjusted for seasonal variation. In the southbound direction, the decrease was close to 3 percent during the same period. During the morning 3-hr peak period, the average reduction in traffic has been about 1,500 vehicles.

The average time to travel northbound between 7:00 and 9:00 a.m. on the Expressway decreased by 4 min for commuters in the reversible lane section and by 3 min for commuters in the remaining two lanes. In the southbound peak, the time saving was 1 min for the reversible lane and 1.5 min for the remaining two lanes. The average automobile occupancy did not change significantly from that before the reconstruction.

Not surprisingly, the alternate routes to Expressway travel experienced heavier travel when Expressway volumes were down. These routes showed various degrees of impact that ranged from a 20-percent increase to a 4-percent decrease from traffic volumes before the reconstruction. In addition, traffic counts showed that a larger portion of traf-

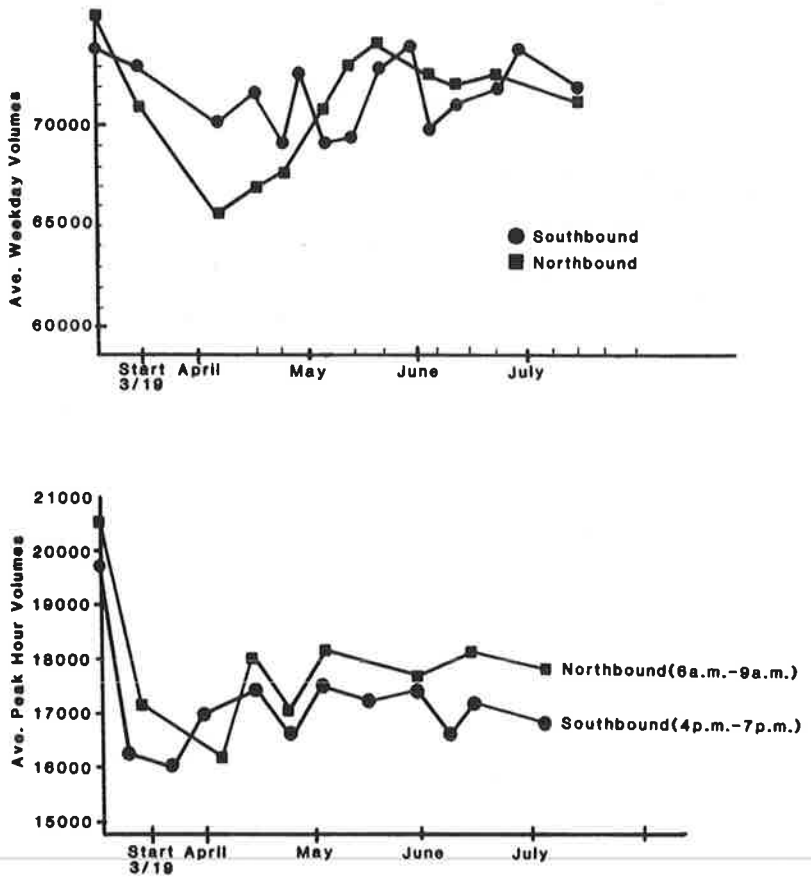

FIGURE 2 Average weekday and peak hour traffic volumes.

fic was on these routes in the first hour of peak hour travel (6:00 to 7:00 a.m.) than was the case before reconstruction. Thus, although the alternate routes did experience additional traffic, this traffic was spread over the entire 3-hr peak period and did not create any serious congestion problems. Further, the travel time needed to travel each of the five major alternate routes decreased, thus indicating that the traffic management actions implemented by the MDPW were successful.

With regard to trucks, 2 months after the reconstruction began, the overall number of heavy trucks decreased by 600. On the two alternate routes that closely paralleled the Expressway, the increase in heavy trucks was 330. On a percentage basis, the largest decrease in the number of trucks occurred during the hours of 1:00 to 3:00 p.m., that period in which only two lanes were available in the northbound direction.

Park-and-Ride

Vehicle counts were taken at 16 park-and-ride-sites 1 month after reconstruction began and showed an increase of 7 percent in parked vehicles from before the reconstruction. A user survey was conducted at each of the 16 lots, and 41 percent (700) of the surveys were returned. Close to 7 percent of those surveyed were new users of the lot who had come from Expressway vehicles, and 4 percent had come from other lots. The majority of the respondents (78 percent) were using the lot 5 days per week. Of particular interest was the mode used by the commuters after leaving their car at the lot--14 percent carpooled, 14 percent vanpooled, 13 percent used a commuter boat, 33 percent used bus service, 22 percent used commuter rail, and 4 percent indicated that they used other means.

Commuter Boat

The number of riders who used commuter boats fluctuated widely during the period following the beginning of reconstruction. During the second week of reconstruction, boat ridership had increased by 225 passengers. By the following week, this increase had declined to 130 passengers, and by the beginning of July (3.5 months after reconstruction began) ridership had increased by 350 passengers. The difficulty with interpreting this data is that several factors, including seasonal variation and the addition of new service, can explain this increase in ridership. The best indication of how many Expressway commuters were attracted to commuter boat service is obtained from a ridership survey that was conducted 1 month after reconstruction began (10). About 260 passengers (a 70-percent response) responded to this survey, which indicated that 15 percent of the respondents (40) were using the service for the first time because of the reconstruction. Of this number, 60 percent used a car as their primary means of transportation before switching to commuter boat.

Commuter Buses

The extra commuter buses that were subsidized by the department, in general did not experience a significant increase in ridership. The change in ridership on individual routes ranged from a 33-percent increase to a 34-percent decrease. The most successful express service was initiated from Brockton, a city 30 miles south of Boston, to a rapid transit terminal that provided direct service to Boston. This service showed an increase of 260 passengers per day 1 month following the beginning of reconstruction. In general, and excluding the Brockton express service, commuter bus ridership, when seasonally adjusted, increased by 4 percent.

Because it had been anticipated that some of the bus service might not be cost-effective, the department and the regional transit authority agreed to review these services every 3 months. Twenty-three bus runs were discontinued after the first 3-month evaluation that was based on the criteria that each run have at least 15 passengers and not cost more than $3.50 per passenger. Fifteen bus runs were continued.

Commuter Rail and Rapid Transit

During the first several weeks of reconstruction, the most heavily used mass transit alternative was the additional commuter rail service. Ridership increased by about 1,000 passengers after the second week of reconstruction. By the second month of reconstruction, the number of new riders who used commuter rail had reached a fairly stable level of 400 passengers per day. In addition, the number of cars parked at the commuter rail stations had increased by 200 cars.

The change in ridership on the subway line that served the affected corridor did not change significantly when adjusted for seasonal variation. During the month of April, a period that encompassed 2 to 6 weeks after the beginning of reconstruction, the overall change in ridership during the morning peak period was an increase of 600 passengers. In May the ridership declined by 500 passengers and in June there was little difference between the observed and expected ridership.

The previous discussion indicates that the commuter response to the reconstruction occurred across several modes and alternate routes. To better determine this response, a license plate survey was conducted in which close to 6,000 questionnaires were sent to Expressway-user households whose address was determined from license plate registrations. Of these, 595 valid responses were obtained. The results of this questionnaire provide some interesting information on the dynamics of commuter response. Because the questionnaire was sent to those who had used an automobile during the day of the license plate survey, one can assume that most of the respondents usually used their car for travel. Of the 595 respondents, 208 (35 percent) indicated that they had tried an alternate means of transportation during the 2 weeks before and after reconstruction began. Of these, 53 (25 percent) tried the subway, 19 (9 percent) commuter rail, 22 (11 percent) express bus, 15 (7 percent) commuter boat, 107 (51 percent) drove on an alternate route, and 11 (5 percent) rode as a passenger on an alternate route. (Note: percentages do not total 100 because of rounding.) Of particular interest is that 65 percent of the respondents did not change their behavior because of the reconstruction and stayed on the Expressway, and the most common commuter response was to try an alternate route.

In addition to this information on commuter response, the questionnaire also contained a request for respondents to list up to three sources of information that they were exposed to on alternative means of travel. The responses to this request are summarized in Table 1. It is interesting to note that the normal means of information--radio, television, newspapers, and word of mouth--were the pre-

TABLE 1 Sources of Information on Alternate Means of Transportation

Sources	Respondents
Newspaper	345
Radio/television	300
Word of mouth	158
Pamphlet	82
Poster	33
Community meetings	13
Telephone information line	7

Note: Respondents were asked to list no more than three sources.

dominant sources of information. Much of the information presented by the media was provided by the MDPW's community liaison-public relations effort for the Expressway reconstruction.

DEVELOPING A STRATEGY FOR MINIMIZING RECONSTRUCTION DISRUPTION: LESSONS FROM THE SOUTHEAST EXPRESSWAY

There is little question that the reconstruction of major transportation facilities can cause tremendous disruption to an urban area. Not only are there concerns about maintaining commuter mobility during the reconstruction period, but adjacent residential and commercial interests often become rightly concerned about significant impacts of diverted traffic. Given these concerns, the responsible agency must develop an effective strategy for approaching the likely disruption and for communicating information on the project and on the mitigating actions to affected interest groups.

On the basis of the Southeast Expressway experience, there are several important characteristics of commuter response to major reconstruction and of a successful mitigation strategy.

Understanding Likely Commuter Response

The dynamic nature of commuter response to such disruption can be observed in the fluctuation of the number of vehicles that use the Expressway throughout the reconstruction period. For example, in the 3-hr evening peak period (southbound) during the first 2 weeks of construction, the average traffic volume was 16,500 vehicles. By the fourth week of construction, and after 2 weeks of media attention on how easy the Expressway commute was, the average traffic volume for this 3-hr period was 17,500 vehicles. This change caused a perceptible increase in the level of congestion in the southbound peak direction which, along with media attention on the worsening situation, resulted in an average volume during this 3-hr period for the following 2 weeks of 16,400 vehicles. During the next 2 weeks, the average volume increased to 17,600 vehicles, where it stayed for 4 weeks. Not surprisingly, the fluctuation of traffic volumes on alternate routes and ridership on alternative modes was opposite that of the Expressway, increasing when volumes decreased on the Expressway and vice versa.

The importance of this fluctuation was that it was symptomatic of an important characteristic of commuter response to travel disruption--there appeared to be a period of adjustment in which commuters tried alternative actions to decide which was the best coping strategy. Thus, there was a pendulum effect of traffic coming back to the Expressway when travel conditions were good, and leaving when conditions worsened. This phenomenon continued until the second month of construction when some form of equilibrium was established. It is during this initial reaction period that providing information on alternative means of travel is critical.

Identifying Agency Objectives

The reconstruction of major transportation facilities is often subject to conflicting agency and community objectives. The responsible agency will most likely want to complete the project as soon as possible, which usually means restricting the use of the facility. Such restrictions, however, mean diverting traffic elsewhere--a diversion that can create significant problems in other areas unless they are anticipated and steps are taken to mitigate the impact.

The responsible agency must face this trade-off between speed of construction and traffic diversion early in the planning process. In the case of the Southeast Expressway, every attempt was made to handle as much traffic as possible on the Expressway itself (i.e., the reversible lanes), and to discourage commuters from using alternate routes. In anticipation of diverted traffic, the MDPW made traffic engineering improvements and provided traffic police at key bottleneck points, but these routes were neither advertised by the MDPW nor signed as detour routes. Instead, a comprehensive alternative mode program was developed and advertised as the major means of avoiding the disruption.

Implicit in the agency objectives for project construction is the overall philosophy toward the mitigation program. In Boston, the $9 million spent on mitigating actions was considered as much a cost of the project as the physical construction activities (Table 2). And although several analyses were conducted before construction, which indicated the likely commuter response to the disruption, MDPW officials believed that the best approach to minimizing disruption was to provide a wide range of options for commuters (even though some of these options were not considered cost-effective), and then to cut back services that were not being used after 3 months. Not only did such an approach deal with the uncertainty associated with predictions of commuter response, it also appealed to interest group pressure on the various options implemented.

TABLE 2 Budget for Mitigating Actions

Mitigating Actions	Budgeted Amount ($ thousand)
Express bus subsidy	1,230
Local bus subsidy	680
Commuter rail subsidy	3,900
Commuter rail parking	280
Commuter boat subsidy	1,010
Transit police	72
Traffic police	400
Traffic engineering improvements	200
Public information	250
Park-and-ride lots	1,000

Maintaining Program Flexibility

Because many of the mitigating actions were costly to implement, MDPW officials believed it was important to implement them in such a way that would al-

low their being discontinued if found to be ineffective. Flexibility was thus a key characteristic of program implementation and was found especially in the provision of bus services and police traffic control. Bus service was provided through 3-month contracts with private bus operators. If, at the end of the 3 months, a service had not attracted a sufficient number of riders and no actions could be taken to increase ridership, the service was to be discontinued. Of the 38 bus departures initially subsidized by the department, 23 were discontinued after the first 3-month review. Extensive police presence at key intersections was provided at the beginning of the project with a gradual reduction in force over a 5-week period. At the end of this period, department engineers and local police officials determined together where police officers would continue to direct traffic.

The flexible approach to program implementation appeared to have two important consequences. First, it permitted the department to adjust its resources in a timely fashion to provide the most cost-effective actions once it was clear how commuters were responding to the disruption. Second, it showed local communities and politicians that the department was willing to adjust its mitigating action program to meet needs as they arose. This willingness prompted numerous local officials to work closely with MDPW officials to monitor impacts and to suggest action that they deemed necessary.

Providing Public Information

Given the objective of providing as many options as possible to Expressway users, the department's second objective was to publicize these options and to provide a mechanism for dealing with public and media input. The public information program included newsletters, numerous community meetings, television and radio announcements, newspaper supplements, more than 100,000 brochures and utility bill supplements, and a telephone hotline. Two professionals were hired to act as a community liaison before and during the project, and they spent much of their time in community meetings explaining the project and providing feedback to project engineers on actions that should be considered in project design. These professionals attended all project meetings and participated in discussions at all levels on the mitigating action program.

No matter how extensive the department's public information campaign was, the day-to-day coverage by local media was considered to be one of the most important means of disseminating information to the public. Three major local newspapers published newspaper supplements that outlined alternate modes and routes to Expressway travel, and in one case, even provided schedules of all bus departures in the affected area. Special efforts were made to explain the project to editorial boards, which resulted in the publication of numerous editorials in support of the project and urged commuters to seek alternative means of travel.

Overall, the MDPW budgeted close to $250,000 for public information. On the basis of public and political response to the project, the activities associated with this effort were probably the most critical component of the success of the project.

Coordinating Organizational Action

A project of the magnitude of the Southeast Expressway reconstruction will often require the coordinated effort of numerous agencies, usually at different governmental levels. In the Boston case, the MDPW worked closely with the Massachusetts Bay Transit Authority (the regional transit authority), state and metropolitan police, a regional ridesharing agency, port authority, turnpike authority, and about 15 cities and towns that were affected by the reconstruction. To handle the extensive coordinating effort, a task force was established that met periodically to discuss progress and to identify specific actions that needed to be taken to overcome implementation barriers. This task force not only provided an opportunity for other agencies to discover what was being planned for the project, but it also provided an opportunity for different groups inside the department to coordinate their efforts. For example, the task force was used by engineers from the construction, traffic engineering, design, and planning divisions as an important mechanism for exchanging information on what each was doing for project design and construction.

The value of this task force became most apparent in a disagreement between the police agencies and the MDPW over an accident management strategy for the reconstruction project. The task force was viewed by the heads of each agency as the appropriate mechanism for resolving the basic issues, and after three meetings, a consensus was reached.

Providing Technical Information

Because of the often controversial nature of large-scale reconstruction projects, agency and political decision makers want to have up-to-date information on traveler response to the project and the likely explanation for such response in a timely manner. In the Boston case, there was a substantial demand for information on traffic volumes (both on the expressway and on parallel routes), transit ridership, vehicle occupancy, accidents, and travel time comparisons almost immediately following the beginning of construction. In anticipation of this demand, the MDPW developed an extensive travel monitoring program to obtain information before, during, and for evaluation purposes, after the Expressway project. The schedule for these data collection activities is shown in Figure 3.

Planning and Analysis for the Reconstruction

The nature of a reconstruction project is such that predicting commuter response through analytical means could be a complex undertaking. Several technical analyses were undertaken for the Expressway project, which resulted in 22 technical reports. However, the analysis methodology for these efforts was uncomplicated, relying heavily on origin-destination data from previous surveys and on highway capacity analysis procedures. No effort was made to predict, through demand estimation techniques, which alternatives would most likely be used by Expressway commuters. Instead, capacity analyses were undertaken on alternate routes and modes to determine their additional carrying capacity and to identify key bottlenecks or constraints to handling additional demand. This analysis approach fit closely the overall philosophy of the planning effort that was to provide as much additional capacity as possible.

Even with this simple analysis style, several important characteristics of the analysis process merit special attention. First, although the experiences of other urban areas are important in determining the likely effectiveness of alternate actions, each travel corridor has its own set of

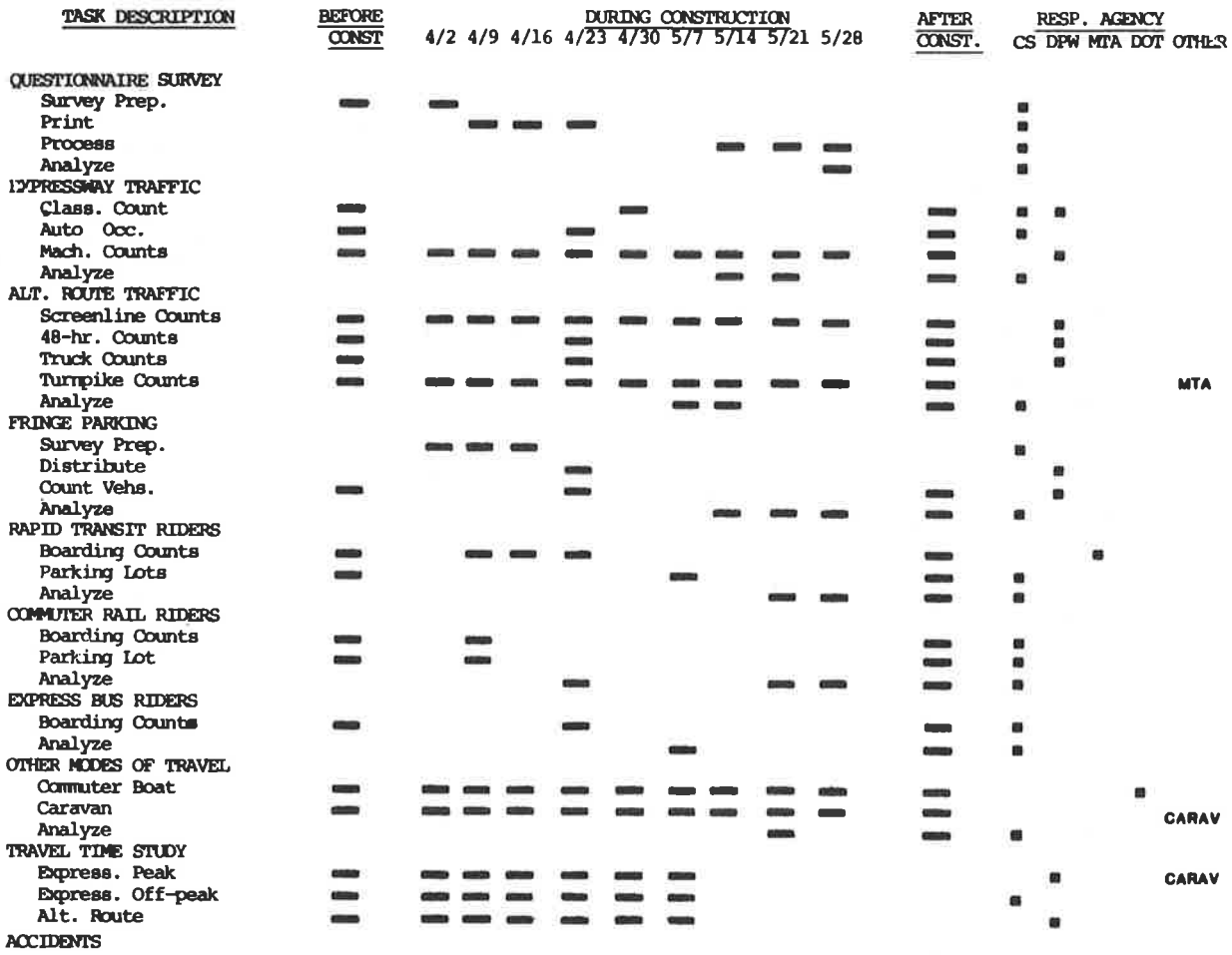

FIGURE 3 Data collection activities for expressway monitoring.

travel behavior characteristics. For example, one result of the Pittsburgh demonstration was the seeming ineffectiveness of the commuter rail service. In Boston, with a well-developed commuter rail system in the affected corridor, the commuter rail service was the most effective alternative mode.

Second, a distinction needs to be made between the immediate (first 2 or 3 weeks) response to the disruption and the equilibrium that is reached when facility users become used to alternative means and routes of travel. The analysis process needs to examine both the short- and long-term response to major disruption.

Third, once construction begins on a major facility, unexpected events can lead to pressure for changes in the strategy to minimize disruption. The analysis process must have the capability to provide quick response to requests for information on the likely impacts of implementing alternative strategies. For example, after a major truck accident on the Expressway caused substantial delays during an evening rush hour, the department received considerable pressure to ban trucks from the Expressway. Within 48 hr, an analysis of truck travel, and of the available alternate routes, convinced decision makers that such a course of action was not feasible.

Although the analysis in the Boston case was not that sophisticated, it was able to provide the information desired by decision makers in a timely and effective manner. It thus served a most important role in developing the department's strategy for handling the disruption.

CONCLUSIONS

The reconstruction of Boston's Southeast Expressway is an example of the type of major facility reconstruction that is facing several North American cities. As observed in the Boston case, the strategy adopted to minimize disruption to the commuter can often be quite comprehensive and complex. In Boston, this strategy included:

1. Added capacity to park-and-ride lots;
2. Additional bus, boat, and train services;
3. Traffic engineering improvements along alternate routes;
4. An increased emphasis on ridesharing and flexible work hours;
5. Increased enforcement along alternate routes;
6. A comprehensive and extensive public information campaign; and
7. Careful traffic management on the construction site itself.

The results of the evaluation effort showed that commuters responded quite dramatically to the media attention on the anticipated disruption of the reconstruction. The most important means of alternate travel was an alternative route, and the most-used mass transit option was commuter rail. The perceived success of the Expressway project was greatly influenced by a comprehensive public information and media effort that provided extensive information on the project and on alternative means of travel.

Although the Boston experience can be considered unique to the circumstances of the Expressway reconstruction, several observations on this experience appear applicable to other situations. The dynamic nature of commuter response to disruption indicates that the initial reaction period (likely to be from 2 to 4 weeks in duration) is an extremely important transition period in which it is paramount that information be provided on what is happening with the project and on the alternative means of travel available. In addition, the responsible agency must clearly identify the objectives of the strategy, and the overall philosophy it will follow in developing a mitigation plan. The resulting plan must be flexible in its implementation to allow the removal of ineffective actions in a timely fashion. The responsible agency must also establish an institutional mechanism for coordinating the action of numerous agencies. With regard to information, a program of data collection is needed to provide the information necessary to modify the mitigation strategy and to answer questions that will surely arise from communities that are affected and the media. Perhaps most important, a comprehensive community relations-media program is essential to the success of any program to minimize disruption.

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