

Enforcement as a Consideration in TSM Planning

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With the recent focus in transportation planning on obtaining more efficient use of the existing transportation system, many agencies unaccustomed to playing a major role in transportation planning and implementation are of critical importance in successful project development. This paper examines the role (and the obstacles of playing such a role) of enforcement agencies in the transportation system management planning process. Two transportation projects in Boston—a preferential lane on an expressway and a center city automobile-restricted zone—are described and used to illustrate the importance of enforcement in successful project implementation. The paper concludes that several institutional barriers hinder effective police participation in the project planning process. In general, police representation somewhere in the project development process was deemed necessary by police officials. In the case of Boston, the police agencies provided useful technical information to project planners. Strong enforcement should begin immediately at project initiation and then taper off to be reapplied when necessary. It is recommended that local transportation agencies provide opportunities for police participation in project planning, with the needed financial support if necessary. Also, the U.S. Department of Transportation should modify existing transportation programs (or seek the legislative changes needed to do so) so that enforcement activities can be funded. Technical information should be provided to both transportation planners and police officials on the role that enforcement has in transportation project development.

Urban transportation planning in the United States has changed tremendously during the past two decades. Most recently, transportation planning has experienced a pronounced shift toward planning that is service-oriented (rather than facility-oriented), that involves relatively inexpensive actions, and that seeks, through operational changes, the most efficient use of existing facilities (1). This shift in focus was first formally introduced into the transportation planning process by the joint transportation system management (TSM) planning regulations of the Urban Mass Transportation Administration (UMTA) and the Federal Highway Administration (FHWA) in September 1975 (2). One consequence of this type of planning is that it requires the participation of actors who never thought of themselves as being related to transportation planning because of the previous long-range focus and the general disregard for implementation concerns of such efforts. The purpose of this paper is to examine the role of one such group of actors—those agencies that are responsible for enforcing the TSM actions once they have been implemented.

TRANSPORTATION PLANNING AND ENFORCEMENT

Several examples in the transportation sector illustrate the enforcement component of TSM projects. In Miami, where minimal enforcement was provided for a preferential lane project on a major freeway in the region, the percentage of vehicles not in compliance with the mandated occupancy level reached 75 percent (3). Police enforcement of the Santa Monica diamond lane experiment kept the violation rate to only 10–20 percent (4). In Boston, a self-enforcing, voluntary diamond lane experienced a violation rate of greater than 80 percent (5). When police began ticketing violators through the mail, the violation rate fell to 35 percent (and the resulting congestion in the general use lanes became so unacceptable to expressway users that, through political pressure, the project was terminated). At a recent meeting of the regional TSM committee in Boston, a planner, in describing a recently implemented automobile-restricted zone (ARZ) stated that the enforcement campaign had been the biggest factor in

the ARZ's success to date. In Washington, D.C., an innovative parking enforcement program has played a major role in controlling the illegal use of parking space and in maintaining traffic flow (6).

The literature in transportation planning seldom mentions the role of enforcement in project planning. In fact, a recent review of the literature, along with interviews of TSM planners in 18 U.S. cities, found the following (7):

1. Most police agencies consider traffic enforcement measures solely as a means to reduce accidents or improve the safety conditions of a specific facility. The use of enforcement to achieve other objectives (e.g., improve traffic flow or reduce parking availability) has not been found in the literature.

2. The transportation agency most often cited as having some interaction with the police department is the traffic engineering department. This interaction was necessary for accident prevention and other safety-related issues. Little evidence was found of cases where the police participated on an ongoing basis in a transportation planning process.

3. An effective enforcement program encompasses more than just the police agency; it also includes the courts, state licensing agencies, and transportation implementing agencies.

4. Administrative adjudication has been used in some cases to relieve the heavy load of traffic cases that the courts must hear. This has provided speedier, less-expensive disposition of traffic cases.

5. The important role of enforcement in parking management strategies has received the most attention in the transportation literature. Most authors, however, have simply commented on the necessity for enforcement and do not examine reasons why it might not occur.

6. Recent attention to the success and failure of high-occupancy vehicle (HOV) lanes has pinpointed enforcement as a critical factor in the operation of the facility. A concern over the safety of the police officer, a lack of resources to undertake such an effort, and the noninvolvement of the police agency in the project design phase have contributed to a hesitancy on the part of the police to enforce HOV lanes.

7. Those TSM plans that do mention enforcement include it as a component of specific projects. Few mention enforcement as a TSM strategy in its own right.

8. Few TSM planners consider enforcement during the planning process. Most planning for specific TSM projects assumes that the project will be enforced and that the specifics of the enforcement strategy will be worked out between the police agency and the implementing agency.

All of these examples underscore one important lesson—if we are truly serious about managing the existing transportation system, we cannot ignore enforcement as a strategy that has the highest potential payoff. And yet, few TSM planners consider problems of enforcement during the planning process. Further, representatives of enforcement agencies are not actively involved in the planning of such projects. These findings lead to some interesting research questions about what role enforce-

ment agencies should have in the TSM planning process.

1. What are some of the institutional constraints that limit the participation of enforcement agencies in the transportation planning process?

2. How do police representatives view their involvement (or lack thereof) in the planning process?

3. What information or technical capabilities do enforcement agencies have that could complement existing planning approaches?

4. How can transportation agencies at all levels of government contribute to an increased role for the police? and

5. How do the characteristics of an enforcement strategy relate to project implementation?

To answer these questions, several case studies were conducted of TSM project planning in the Boston metropolitan area. Two projects--a preferential lane on a major expressway and an automobile-restricted zone in the center city--will be briefly discussed in this paper. A more detailed analysis of these and other projects and their relationship to enforcement concerns can be found elsewhere (8).

CASE STUDY A: THE SOUTHEAST EXPRESSWAY RESERVED LANE

The Southeast Expressway is the most heavily congested roadway in Massachusetts. This major highway serves the Boston metropolitan area. During the past 20 years, it has received increased attention from local transportation planners and engineers as to possible ways of decreasing the burden. The expressway has also become the focus of often heated public debate as the different attempts at solving the expressway problem have created negative impacts on several constituent groups. The Southeast Expressway reserved lane was the latest, and most controversial, effort to improve the performance of the expressway. The purpose of this case study is to examine the role of the enforcement agencies in the planning and implementation of the lane, with special attention given to the problems of such a scheme as perceived by those responsible for enforcement (9).

Enforcement Problem

The type and extent of enforcement for the Southeast Expressway reserved lane project were influenced by several factors. First, the reserved lane removed and existing lane from general use without providing for additional capacity, thus large numbers of drivers could be expected to attempt (and, in fact, did attempt) to circumvent the resulting congestion in the remaining general purpose lanes by using the reserved lane. The enforcement of the lane, therefore, given this large potential for violations, would have to be on an extensive scale. Second, the 8-mile reserved lane was to be separated from the general use lanes by 19-in plastic posts spaced 20 ft apart in heavily congested areas and 40 ft apart in the remaining areas. Given that there was no physical separation between the preferential and nonpreferential lanes, the safety risks of cars weaving in and out of the reserved lane were quite high. Third, there was no space along the length of the project where violators could be pulled over and ticketed. Enforcement control of the lane would thus have to occur at the beginning or end of the project. Finally, the project extended through two police agency jurisdictions, which required that some effort be made to coordinate the activities of both agencies.

The Planning Stages

The planning of the reserved lane began almost 2 years before it was actually implemented and involved most of the transportation agencies in the Boston region. The Massachusetts Department of Public Works (MDPW) was the key agency involved with the project in that it was responsible for the operation of the Southeast Expressway. Starting in November 1976, weekly meetings were held under its auspices with the other affected agencies to coordinate preparations for lane implementation. The other agencies included the Executive Office of Transportation and Construction (EOTC), which is the state department of transportation and whose officials were the major proponents of the lane; the Massachusetts Bay Transportation Authority (MBTA), which is responsible for operating public transportation in the Boston region; and the Metropolitan District Commission (MDC) and the state police, the agencies responsible for policing specific highways in the region.

The major proponents of the project viewed the lane as a very visible and effective means of showing the region's commitment to TSM and air quality and energy conservation objectives. Other transportation officials, however, were skeptical about the feasibility of the lane. The MDPW officials argued that the engineering considerations for implementing the project were formidable, and police officials stated that, given its design characteristics, the lane was unenforceable. Perhaps more importantly, the opportunity for cars to weave in and out of the lane created serious safety problems. It was decided early in the project planning process that driver compliance to the reserved lane would be on a voluntary basis because (10)

1. The voluntary approach simplified the legal requirements for implementation and enforcement of the express lane project.
2. Public acceptance of a voluntary lane would be greater and the concept could be proven without alienating those opposed to the project at the start. The responsibility for the success or failure of the project was, therefore, shifted to the general public (and each commuter then using the expressway) and away from a focus on the police's ability or right to enforce the three-occupant carpool requirement.

The role of the enforcement agencies was thus to be limited to assisting in accident situations and traffic control, which was the role both agencies were satisfied in playing.

Representatives from the MDC and state police agencies attended the weekly meetings at the MDPW and reported on their efforts to increase their capability to respond to any incidents on the expressway. Often at these meetings, however, police representatives expressed the concern that had worried them throughout the planning stage--the possibility of serious accidents caused by vehicles weaving in and out of the reserved lane. Police representatives repeatedly suggested that some procedure be adopted that would result in some respect for the cones. MDC representatives suggested that repeat violators be sent a letter to the effect that their action had been reported to the Registry of Motor Vehicles for disciplinary measures. They also requested that press releases about the reserved lane emphasize that, although compliance was voluntary, noncompliance was, in fact, a violation. Both of these suggestions were adopted.

In summary, both the MDC and state police agen-

cies played an active role during the planning of the reserved lane. Both agencies, however, were of the opinion that (a) the lane was unenforceable and (b) serious safety problems were associated with the weaving of automobiles in and out of the lane. But, because the decision had been made to go ahead with the project, the agencies were very cooperative in designing a strategy for effective implementation.

Implementation

When finally implemented on May 4, 1977, the reserved lane extended along an 8-mile stretch of the Southeast Expressway and was reserved for buses and carpools of three or more occupants. During the early days of operation, the results were close to those expected. Travel times in the reserved lane decreased (between 20 and 40 percent), travel times in the regular lanes increased (by 40 percent), the number of carpools on the expressway increased (by about 33 percent), and the noncompliance rate was high (the percentage of legal users of the lane ranged between 22 and 41 percent). The high noncompliance rate was of serious concern to transportation officials because it not only negatively affected the ability of the lane to handle HOVs but also encouraged automobile drivers caught in the congested regular lanes to weave into the reserved lane. Indeed, the violation rate increased steadily until, by the end of May, it was decided that some enforcement effort had to be made.

Two major changes were made at the end of May that were designed to improve the compliance rate. First, the state began recording the license plate numbers of violators and sent them letters requesting that they comply. Second, additional plastic inserts were placed in those sections that experienced the highest rate of weaving movements. Signs were posted that noted the weaving restriction and the police began to enforce it. The enforcement and compliance observation was accomplished by having police cruisers travel in the lane nearest to the reserved lane, which provided the police officer with good opportunities to observe automobile behavior in the lane. The results of these enforcement efforts, however, were discouraging.

By early October, the reconstruction work on the expressway had been completed. However, transportation officials had already decided to continue the lane past the reconstruction stage because they were convinced that the concept had been successful in increasing the productivity of the expressway and that it was now accepted by the commuters as a feasible use of road space. It was further decided that, if the lane were to have a major impact on travel in the corridor, it was essential that it be enforced and that fines be levied against those in violation.

The decision to enforce the lane created problems for the police agencies. The police agency representatives still maintained that the lane was unenforceable, except for sending citations through the mail, and they were uncertain as to the legality of this action. It was not until a local judge agreed that the mailing of citations was acceptable that the police agencies agreed to enforce the regulation. The regulation, similar to one already used by the Massachusetts Turnpike Authority in enforcing toll payment, stated that (11):

...Where a violation is observed by a police officer and the officer is unable to give the original of the citation to the violator at the time of such offense because the violator could not have been stopped or the failure is justified for some other reason...the citation shall be issued to the registered owner's last address as

appearing in the records of the Registry of Motor Vehicles.

This regulation also provided for a maximum fine of \$20 payable by the owner of the car in noncompliance.

This new phase in the lane operation began on October 17, 1977, and almost immediately there was a public outcry against the project. Several legislators introduced a bill that would have prohibited the MDPW from continuing the lane and another bill that would have decreased the occupancy requirement for the lane from three plus to two or more persons, an action that would have effectively killed the project. On November 2, 1977, the MDPW commissioner announced the immediate termination of the project. All citations that had been issued during the enforcement period were dismissed.

CASE STUDY B: THE DOWNTOWN CROSSING

The Boston downtown retail district has been the focus of many improvement programs during the past 15 years. Numerous new office buildings, the construction of a government center, and the recently completed and successful Faneuil Hall complex, all located in the downtown area, have made the Boston central business district (CBD) one of the most active and thriving in the United States. In an effort to encourage the continued physical and economic revitalization of downtown Boston, city officials proposed and implemented an ARZ centered on Washington Street, the center of the commercial district (12). The ARZ, called the Downtown Crossing, was designed to take advantage of the high level of mass transit access provided by four subway lines and several express and local bus routes and the pedestrian activity that occurs in the area. As has been stated by several Boston officials, however, the successful enforcement of restricted vehicle access and parking was the key factor in the initial acceptance and eventual success of the Downtown Crossing.

Enforcement Problem

The successful implementation of any innovative transportation project requires that the general public be informed of the new system or service and also that special efforts be made to ensure compliance with new rules or regulations, if such exist. One of the major components of plans for ARZs is a scheme for rerouting the traffic that originally traveled through the study area and a plan to direct those automobiles that were originally parked in the ARZ area to special parking locations at the periphery. The enforcement component of the strategy to implement an ARZ is thus to enforce all parking, traffic, and loading regulations in the study area and in the areas immediately adjacent to the ARZ. This enforcement is necessary not only to ensure the safety of the pedestrians who now use the street areas but also to maintain the flow of traffic that now bypasses the central area. The first objective (to ensure the safety of the pedestrian) is even more critical in those ARZ plans that do not begin with massive redesign of the street system so that it looks like a pedestrian zone but rather convert the existing street to pedestrian use as the first stage in an incremental implementation strategy.

The Downtown Crossing provided an especially difficult enforcement problem. Although the original traffic volumes on the streets that would constitute the ARZ were not large in comparison with those for other cities, the narrow streets and complex traffic circulation in the area produced high levels of con-

gestion throughout the day. On Washington Street, for example, the evening peak-hour volume was close to 1000 vehicles, a traffic volume that would now have to find alternative routing (assuming that the Downtown Crossing would not significantly affect modal choice for the work trip). Another factor that exacerbated the congestion problem was the high level of illegal parking that occurred throughout the area. For example, a traffic study completed in 1976 indicated that traffic flow in downtown Boston could be increased by 35-40 percent if illegal parking were eliminated in the area (13). A previous study in 1972 found that 27 percent of all cars parked in downtown Boston on an average day were parked illegally (14). In specific regard to the Downtown Crossing, it was estimated that its implementation would eliminate approximately 600 on-street parking spaces, 240 legal and 360 illegal (15). Thus, the implementation of the Downtown Crossing would displace a large number of vehicles that would need alternative locations to park and presumably, if given the chance, would still be parked illegally in the Downtown Crossing area.

In addition to the large number of legally and illegally parked cars in the ARZ area, the downtown was the focal point for many deliveries of urban goods. On an average day, almost 3000 deliveries were made in the area that includes the Downtown Crossing and areas adjacent to it. Again, if the Downtown Crossing was to be a safe area for pedestrians, access to the area by delivery vehicles had to be strictly controlled and would require strong enforcement of loading and unloading restrictions.

In summary, the enforcement problems associated with the Downtown Crossing were formidable. The public had for many years considered illegal parking an acceptable risk to take because of the lack of follow-up to any tickets received. The crossing was also going to displace a relatively large number of parkers whose initial reaction would most likely be to park illegally in the ARZ area. Although the volume of traffic that now had to be rerouted was not large, the narrow streets would create high levels of congestion that, if augmented by delays caused by illegally parked cars, could become unbearable. Finally, the downtown area attracted almost 3000 delivery trips daily that would now have to be consolidated or the times of delivery changed so that the deliveries could be made during specified hours. Enforcement of these loading regulations would be critical to the success of the Downtown Crossing. All of these factors created the need for a well-conceived enforcement strategy and a potentially vital role for the police department in the project planning process.

Round 1: The Early Stages

Transportation problems in Boston have, for a long time, received a great deal of attention from city officials and professional planners. The governor's decision in the early 1970s to halt plans for major highway construction in the city created a cadre of transportation professionals concerned with many of the then nontraditional approaches to TSM. Thus, during the past decade we have seen in Boston efforts to increase parking restrictions, the imposition of a freeze on the provision of new commercial parking spaces, consideration given to discouraging commuter traffic through neighborhood areas, and greater emphasis on the important role that transportation investment can have on encouraging development in the downtown area. With this as a background, it is not surprising that serious efforts would be made to implement an ARZ in downtown Boston.

The Downtown Crossing was not the first time that an automobile restriction had been tried in Boston. In the 1950s, Winter Street had been closed on an experimental basis several times. In 1971, Washington Street was closed on Saturdays to allow car-free shopping. However, the Downtown Crossing was the first attempt to create an ARZ on a permanent basis. The idea for the crossing came from officials in the mayor's office who thought that the crossing made sense not only from a transportation planning point of view but also as an illustration of the mayor's concern and interest in maintaining the Boston downtown area as the focal point of regional economic activity. In these early stages, three agencies were involved in the project development process--the Boston Redevelopment Authority (BRA), the Boston Traffic and Parking Commission, and the mayor's office. However, only after the major proponents of the crossing left the mayor's office and became key officials in the Traffic and Parking Commission did the Downtown Crossing become a priority item on the transportation agenda for the city.

The perspective on the enforcement component of the Downtown Crossing plan differed significantly between the staffs of the different agencies involved. Staff members of the BRA thought that the project had to be designed for self-enforcement (i.e., the project should incorporate as many features as possible that make the Downtown Crossing look like an area where cars should not be). Suggestions for these features included mountable curbs, brick paving, and special lighting. Staff members of the traffic and parking commission thought that, given the public attitude toward enforcement, any effort to enforce the regulations in the crossing area would be ineffective and that the best strategy would be to sign and signalize the area so as to discourage drivers from entering. The officials in the mayor's office, however, felt very strongly that, unless a major effort were made to actively enforce the crossing, it would be a failure. Their desire for an active enforcement program grew over time, especially when representatives of the downtown merchants stated that their support for the project was contingent on the provision of police enforcement.

Thus, when planning for the Downtown Crossing became a priority activity, the question of what level of enforcement would be appropriate and feasible for the project became very important. The role of the police department up to this time had been minimal. With enforcement now an issue, the police department had to be involved in the project planning process and, at the request of the traffic and parking commissioner, a representative of the police department participated in formulating the enforcement component of the project proposal. His major role, however, was to review the proposed enforcement strategies and to identify barriers to their successful implementation.

The proposal to UMTA to request federal money to support the Downtown Crossing included a request of \$134 400 in Section 6 of the Urban Mass Transportation Act of 1964, as amended, demonstration grant funds for the provision of enforcement. This figure included funds for four police officers (two from 8:00 a.m. to 4:00 p.m. and two from 4:00 to 10:00 p.m.) and two additional tow-truck operators, both groups for a period of 52 weeks. The enforcement costs were to cover (16) "immediate police towing of illegally parked cars and the assignment of officers at the two major entry points into the TTIP [Downtown Crossing] area and at the intersections which require traffic officers."

Up to the submission of this grant application,

the police department had not been actively involved in the project planning process. However, enforcement was now clearly identified as a major factor in the likely success of the Downtown Crossing. Police officials were to play a critical role in the successful implementation of the Downtown Crossing, although this role was not so much a result of police department policy as it was of personal commitment to the project.

Round 2: Implementation

With approval of the UMTA demonstration grant, more detailed plans could be made on the specific implementation steps needed to complete the project successfully. An enforcement plan, so detailed as to discuss the exact position of police officers on the streets, was developed by a planner in the traffic and parking commission and an official in the mayor's office who was familiar with the then existing towing program. The police department representative reviewed this plan and identified the problems that would be faced in its implementation (such as the personnel assignments being incompatible with the existing structure of work shifts). As before, the role of the police department throughout this stage of the project was one of reviewing the plans made by others rather than developing a plan of its own. However, individual police officers were soon beginning to influence the evolution of the plan as they became actively involved with specific components of the plan.

One of the most useful inputs from the police department came from a group of lieutenants being trained in the Boston Police Academy. They were asked as an exercise in one of their classes to examine the enforcement plan of the Downtown Crossing and to recommend changes that would make the plan more effective. The enforcement resources in the original proposal were considered by this group to be too small by half. The lieutenants recommended a three-phase program. The intensive phase 1 included five entry control officers, three of whom patrolled successive blocks of Washington Street that led to the restricted area. These officers were to siphon off traffic before it could cause a disruption at the entry point. Additional resources allocated in phase 1 included five tow trucks and four meter maids. Phase 2 was to be a program to maintain continuous enforcement surveillance in the area, and phase 3 would be an intensive program done randomly to freeze positive enforcement attitudes (17).

The plan was thus to provide heavy enforcement during the first month, remove the pressure for two weeks, and then reapply it for two more weeks. The reasoning for this strategy was that the public had to be convinced early in the project operation that city officials were serious about enforcing the restrictions. Enforcement could then be allowed to taper off but reapplied at periodic intervals or when circumstances dictated. Another element of the plan included a concentration of enforcement efforts on the main street and allowances given to illegal parking on side streets. The lieutenants thought that this differentiation between important areas and less-important areas helped create an image of enforcement in the crossing area while not tying up traffic on peripheral streets with massive towing of vehicles. The maintenance of the traffic pattern was considered by the lieutenants a crucial objective of the enforcement plan.

Another key police actor in the development of the enforcement plan was the lieutenant in charge of the police towing enforcement unit. The lieutenant and an official in the mayor's office worked closely in devising a towing program for the Downtown Cross-

ing that made available towing capability by switching the duties of existing tow operators from general scofflaw apprehension (tow and hold) to a concentrated effort on the Downtown Crossing. No additional towing resources were thus necessary, and there was also no added pressure placed on the adjudication process, which was already reaching capacity.

The initial towing program consisted of motor-cycle officers, meter maids, and police tow trucks supplemented by private-contractor tow trucks. As it turned out, the meter maids did not participate in the enforcement program because union rules required that they be consulted in any decisions to reallocate their services. This had been overlooked by the enforcement planners, and accordingly the meter maids refused to participate. Although drivers of the buses that use the Downtown Crossing were requested to call the dispatcher to report any illegally parked cars, there are few examples of any bus driver doing so. The major reason for this seems to be that many of the bus drivers were unaware of their having such a capability.

Three days before the Downtown Crossing was implemented, leaflets that informed drivers of what was about to happen were placed on the windshields of all automobiles in the study area. In anticipation of having to tow a much larger number of vehicles than under normal circumstances, the police towing unit focused on three major streets prior to the initiation of the crossing and raised its towing rate to 60 tows/day.

The Downtown Crossing opened on the Tuesday after Labor Day, and the strict enforcement started that Thursday. The police lieutenant and the transportation official from the mayor's office supervised the towing program directly by riding around the study area and giving instructions and calling in tow trucks. Both felt that consistency was the most important attribute of the towing program during the initial phase of the operation. Initially, 50-75 cars/day were towed. The reaction time of the police tow trucks was very small--as soon as a car parked in a tow area, a truck was called and the car removed. Close to 600 cars were towed in the first week and 400 in the second week.

One of the major problems with the towing program was associated with the private contractor. The initial contract stipulated that the contractor would receive payment on a per tow basis, which encouraged the truck drivers to quickly dispense of the cars they were handling and return to the streets to get more. Several cars were damaged in these high-speed runs to the impoundment lot, which resulted in claims against the city. In response, police officers in the Downtown Crossing called their own tow vehicles when the need arose. As a result of these problems, and also given an increased public understanding and acceptance of the crossing, the tow rate decreased to about 10 tows/day when the contract expired in June 1979. Currently, there is no special attention given to towing in the crossing area. The problem of illegal parking is minimal because the crossing has now been redesigned with the pedestrian totally in mind (i.e., it is obvious to the automobile driver that he or she should not be in the area).

CASE SUMMARIES AND INTERPRETATION

The reserved lane on the Southeast Expressway is perhaps the best example of the role of enforcement agencies in the planning of innovative projects. The two police agencies involved (the MDC and the state police) cooperated in the project planning process, although they often expressed severe reser-

vations about the project. Specifically, they argued that the project was unenforceable and that the possibility for high levels of weaving between the general purpose and reserved lanes created unacceptable safety hazards. It was not until the decision had been made by high-level officials in the MDPW and the EOTC that there would be a project that the police agencies turned to developing a strategy for enforcing the project. This response reflects the general behavior of the police agencies throughout the project planning process--decisions made by higher authorities will be implemented.

Because of the difficulties with geometric design, the lane operated on a voluntary basis during the reconstruction of the expressway. As was expected, the violation rates were quite high and, although notifications of violation were sent through the mail, the noncompliance rate remained high throughout the summer. Safety issues once again were the dominant concern of the police agencies and they played an important role in identifying weaving sections that were particularly dangerous and that were to be the focus of increased enforcement efforts.

When transportation officials decided to continue the project beyond the end of the reconstruction period and also decided that the only way to make the lane successful was to enforce it, police officials once again voiced concerns about the enforceability of the lane. They were particularly worried about the legality of sending citations through the mail and were not about to participate actively in the enforcement program until they had assurances that the courts would permit such a scheme. This attitude illustrates a key characteristic of police behavior in traffic enforcement--the legality of the action and the capability and willingness of the courts to follow through on citations were important points to establish before the police agencies participated willingly in the program.

The enhanced enforcement strategy of the reserved lane was indeed successful in that the violation rate decreased significantly. In one location, the violation rate was almost halved--from 74 percent to 35 percent of the vehicles in the lane in noncompliance. However, the negative impact on the general use lanes was so dramatic and significant that the resulting controversy resulted in the termination of the project. For example, the average travel time on the expressway (11.4-mile segment) in the general use lanes jumped from 24 min during the construction phase to 40 min during the enforcement phase, an increase of 67 percent (this figure is for a time period that starts at 7:30 a.m.). One could conclude, therefore, that the enforcement strategy was indeed successful in making the lane operate more effectively by discouraging violators from using the lane. One of the ironic results of this case, however, is that the success of the enforcement strategy could have been a major cause for the controversy that surrounded the project and its eventual termination.

The results of this case suggest two courses of action that could have been taken by transportation officials that might have changed the outcome of the project. First, the enhanced enforcement program (i.e., sending citations through the mail) could have begun at the beginning of the project, when the lane was more closely associated with the reconstruction. To begin enforcement after 5 months of operation, when drivers are now accustomed to the delays and congestion, and also taking away the original rationale for the project had a high potential of raising the anger and frustration of the expressway users. The second option for the authori-

ties was to continue lane operation as it had occurred during the reconstruction (i.e., low levels of enforcement and accept the high level of violations). This option was not acceptable to the transportation officials, who argued that the project would, to all intents and purposes, be worthless.

This case illustrates what seems to be the most-effective enforcement strategy for innovative TSM projects--enforce the project from the beginning of operation. This means that a great deal of effort must be made to ensure the willing cooperation of the enforcement agencies and to alleviate their concerns about public safety, legality, and judicial follow-through.

Although city officials had considered the enforcement component of the Downtown Crossing for some time, the final traffic enforcement strategy was defined by the requirements of the plan submitted by the police lieutenants. Swift, sure, and firm enforcement had to be provided in order to change the habits of Boston motorists. Instant towing and plenty of traffic direction were the cornerstones of the learning process for the Boston driver. The initial intense effort was to taper off to a lower level after the new patterns had become established. Periodic crackdowns would occur whenever violations became a problem in order to freeze positive enforcement attitudes.

Another more-passive enforcement strategy was to make the restricted area as self-enforcing as possible. This approach, led by BRA, involved designing the restricted areas to look as though automobiles did not belong there so that police needs would be kept to a minimum. Although not available in the beginning, capital improvements such as bricking, lighting, and amenities were made during 1978 and 1979. They define the regulated areas well and keep present-day entry enforcement requirements to a minimum. Long-term ability for self-enforcement is a worthwhile goal and, combined with vigorous enforcement, makes an effective campaign for the establishment of new driver behavior patterns.

Announcements about the crossing and the changes to be made were distributed through the media. Radio stations were helpful in referring to the changes positively and not as potential disasters precipitated by downtown congestion. The support of the public and motorists was deemed crucial to the success of the plan, where success was defined as improvement of the downtown environment for shoppers and businesses. The public had to know what changes were being made and how they could cope with them.

In general, the large level of effort expended in considering all facets of the implementation process was rewarded by the success the crossing now experiences. Even in this case, where police officers played an important role in the implementation of the project, some problems can still be identified. Even though the police department had some input in the planning through the lieutenants' critique of the plan, it was generally left out of the planning process itself. Some police officers felt as though the plan was handed to them as a fait accompli and were resentful of being excluded from the planning. They felt that, in projects that involved police participation, a police representative should attend meetings regularly so that at least one officer becomes familiar with the project. The meter maids' reaction is illustrative of what happens when key actors are not involved.

Other agencies, in turn, are reluctant to include police officers in project planning for fear of police intransigence. This attitude between transportation planners and police officials is long standing and well known in the limited literature of traffic enforcement planning. This attitude, com-

bined with an admitted lack of resources (and perhaps interest) in traffic enforcement on the part of the department, creates a complex and frustrating set of relationships between the images of various city agencies. In the case of the Downtown Crossing, where ties of cooperation and friendship existed, planning was well done and actions well executed. Where contacts were not so strong (meter maids, MBTA drivers), few successes were seen.

The conclusions that can be drawn from the Downtown Crossing project are straightforward and recognized by most of the actors involved. In light of previous experimental failures as a result of ineffective enforcement and management, enforcement for the crossing was judged critical. Merchants insisted on it and the new traffic pattern would demand it, at least initially. The use of federal funding to support enforcement was essential. Even though the enforcement effort was considered at least as important as any other feature of the plan, it comprised only 4 percent of the total expense of the project.

The coordination of planning and enforcement agencies was very important. Coordinated actions worked effectively, but those without coordination were not successful. This coordination could be facilitated if some formal relationship were established to overcome the lack of regular established relations between agencies. Planning groups should seek out contacts in areas in which they have little or no expertise if they want to develop effective plans. The early involvement in the process of agencies critical for successful implementation is essential.

All persons questioned considered the Downtown Crossing successful and thought that it has improved downtown Boston. Enforcement and coordination were named as key issues. Although generalization from the Boston experience might be dangerous, the favorable results in Boston help support a stated need for police agency involvement in the planning process of innovative TSM actions.

CONCLUSIONS

This paper began by listing several research questions on what role enforcement agencies should have in the TSM planning process. The case studies described in this paper have provided some insights on the answers to these questions.

1. What are some of the institutional constraints that limit the participation of enforcement agencies in the transportation planning process?

Enforcement agencies tend to be isolated from the other agencies in a metropolitan area involved with transportation efforts. They have not traditionally held close liaison with planning and implementing agencies, and, indeed, have often focused resources on other issues perceived more important than traffic law enforcement (e.g., serious crime apprehension and prevention). Further, enforcement agencies tend to be closely tied with the judicial system and do not undertake actions that will not be supported by the courts. Finally, the lack of financing of police participation in transportation planning and project implementation creates serious obstacles to effective implementation.

On the other side, transportation planners often ignore the potentially critical role that police officers have in the design of TSM projects. Police representatives are often incorporated into the project planning process, but usually late in the process and without full recognition of the contribution that such representatives could make.

2. How do police representatives view their in-

volvement (or lack thereof) in the planning process?

The Boston case studies represent a very small sample on which general conclusions can be made. Indeed, in these cases, police officers expressed two viewpoints on this particular issue. One group suggested that the current situation of law involvement was most appropriate given the other more important demands on the police force. However, another group, represented by those most actively involved in the Boston projects, felt that a more active involvement was necessary. This group could not understand why the police department was added to the planning process as a minor actor when police participation during project implementation was absolutely critical to project success. In general, most police officers felt that a strong police representation somewhere in the project development process was necessary.

3. What information or technical capabilities do enforcement agencies have that could complement existing planning approaches?

Police officers are probably the most qualified individuals to comment on driver response to changing circumstances. They work on a day-to-day basis with this type of behavior. Thus, police representatives would be able to provide insightful comments on the feasibility of project concept and design and also establish the basic characteristics of an enforcement strategy that would effectively reinforce desired project results.

These conclusions were borne out most visibly in the Downtown Crossing project where police representatives changed the enforcement plan prepared by transportation planners and devoted a lot of resources during the initial stages of project implementation. Without this input, the project might not have been quite so successful.

4. How can transportation agencies at all levels of government contribute to an increased role for the police?

Government agencies should adopt three major actions to accomplish this increased role. At the local level, transportation agencies should recognize the importance of police participation in project and plan development and provide formal opportunities for their participation. These opportunities should be supplemented with financial support where necessary to allow such participation.

At the federal level, the U.S. Department of Transportation should (a) provide for the funding of enforcement activities in the existing funding programs (and strive for legislative changes where necessary) and (b) disseminate information to transportation planners and police officers as to the important role of enforcement in project implementation. Often both groups do not understand the processes, procedures, and motivation of the other.

5. How do the characteristics of an enforcement strategy relate to project implementation?

In both Boston project cases (and in others examined in this research project), the implementation of the project depended heavily on enforcement. The lessons from these projects indicate that heavy enforcement of the project should be provided in the initial stages of implementation with a gradual tapering off, if necessary. And, as illustrated by the reserved lane, enforcement should be provided at the beginning of the project so that desired travel behavior is encouraged from the beginning. The project implementation process is as critical (if not more so) in the design of a project as the planning process, thus great care should be made in providing for early and effective police involvement.

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New Jersey Turnpike Automatic Traffic Surveillance and Control System Performance Observation

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The New Jersey Turnpike Authority's Automatic Traffic Surveillance and Control system became fully operational in January 1976. The system has proven to be an effective tool for managing traffic flow on the New Jersey Turnpike's most heavily traveled section. Motorists are provided with a diversion capability to the least-congested roadway by means of changeable message signs. The paper describes the unique roadway configuration covered by the system as well as the traffic parameters that dictate sign changes. Traffic flow affected by the system during the afternoon and evening peak hours of two high-volume traffic days was evaluated. Automatic sign changes, the magnitude of traffic parameters that caused the sign changes, and the number of vehicles diverted during these two days are described in this paper.

The New Jersey Turnpike Authority's Automatic Traffic Surveillance and Control (ATSC) system was installed and made operational in January 1976. This system was originally conceived and developed prior to and during the widening of the northern 36 miles of the New Jersey Turnpike in the latter part

of the 1960s. Its purpose is to completely automate traffic control on the 12-lane section of the New Jersey Turnpike that extends 36 miles from central New Jersey to the George Washington Bridge approaches. The ATSC system provides traffic surveillance and control based on traffic data received from the field. The traffic parameters obtained from the computer are occupancy, average running speed, volume, unused capacity, and vehicle classification. These parameters are collected by means of 850 loop detectors imbedded in the pavement of all roadway components of the 36-mile network.

The traffic data collected are transmitted via buried cable to two front-end processors that process and compress the raw data and, in turn, transmit the refined data to a main computer for further analysis and action, if necessary. This main operating computer is a Digital Equipment