

## **Philadelphia, Schuylkill Expressway**

WERNER EICHORN and LOIS M. MORASCO  
PENNSYLVANIA DEPARTMENT OF TRANSPORTATION

Designed as one of a network of expressways ringing the metropolitan Philadelphia area, Interstate 76,—or the Schuylkill Expressway, as it is more commonly known—was fully opened to traffic in 1961, 10 years after construction began. In the ensuing 25 years, I-76 came to stand virtually alone, as community opposition halted construction of almost all of the remaining proposed highways.

For most of its 21-mile length from the Pennsylvania Turnpike in Montgomery County to the Walt Whitman Bridge in Philadelphia, I-76 is a four-lane, limited access highway, with some short stretches of six or eight lanes. The highway carries between 80,000 to 143,000 vehicles daily. Much of the highway passes through difficult terrain composed of steep rock cuts, high embankments, and wide, deep gullies. These restrictions, along with other constraints imposed by an adjacent railroad, parkland, and residential properties, are responsible for the variation in width and lack of progress by the Pennsylvania Department of Transportation to widen the highway to provide additional expressway capacity.

In about the mid 1970s, it became obvious that both the expressway pavement and the bridges in the 17.7-mile section between the Turnpike and University Avenue in Philadelphia were rapidly deteriorating, making any further interim remedial action ineffective. Of the 50 bridges within these limits, 38 required redecking, including the 1500-foot Pencoyd Viaduct, which crosses a Conrail freight line and the Schuylkill River.

Because of the highway's importance and urgent need for rehabilitation, Secretary of Transportation Larson committed the department to reconstructing the expressway as quickly as possible with the least amount of disruption to motorists.

### **KEEPING TRAFFIC MOVING**

Planning complex traffic strategies for major rehabilitation projects is not a new role for PennDOT. Responsibility for 44,000 miles of roadway and more than 25,000 bridges has provided ample opportunity to use construction and traffic management techniques over the last 12 years.

The challenge of the Schuylkill Expressway project was to provide sufficient off-

expressway capacity on the local road system to handle the traffic expected to divert when construction started, as well as to maintain an acceptable level of on-expressway movement while the work was underway.

The department realized that the projected work would disrupt not only the more than half a million daily users of the expressway, but also the communities adjacent to I-76 and the local transportation system. The local system faced a two-fold dilemma: it would need to find additional capacity on trains and buses to carry the expected increase in passengers, and it would have to revise its schedules to reflect delays of those buses that used both the expressway and the local street system.

A project liaison engineer was named to coordinate the various aspects of the improvement project, from planning and design to trouble shooting during construction. The department also contracted with the traffic engineering firm of Orth-Rodgers & Associates, Inc. of Philadelphia, to plan the off-expressway strategies required to handle the diverted traffic. To gain insight into the problems likely to be experienced by the affected communities and get support from businesses, agencies, and other organizations and groups with an interest in the project, the project manager also put together a task force to help plan the traffic management for the necessary off-expressway improvements. The task force was composed of 14 municipal governments (including the city of Philadelphia), the local transit authority (SEPTA), the Delaware Valley Regional Planning Commission, the Keystone/Triple A Club, the Pennsylvania State Police, four local chambers of commerce, a paratransit association, and two traffic reporting services.

To begin the planning process, Orth-Rodgers set up a five-task work program that called for:

1. establishing and analyzing the existing transportation situation;
2. developing expressway reconstruction strategies;
3. evaluating the impact of the recommended reconstruction strategies on the region's transportation network;
4. developing and designing the traffic management plan;
5. monitoring the effectiveness of the traffic management plan.

## ORIGIN AND DESTINATION SURVEY

Under the first task of the work program, planners made a detailed inspection of the expressway ramps and the mainline structure, and conducted an origin-and-destination (O & D) survey of peak period expressway users. They also studied travel time on 15 corridors running parallel to the expressway; automatic traffic recorder and manual-turning movement counts; intersection saturation flow; vehicle classification counts; on-street parking; intersection/corridor capacities; delays and level of service; and conducted a physical inventory of 250 traffic signals.

The O & D survey consisted of a pre-addressed, postage-paid postcard questionnaire. Respondents were asked six questions to determine their entrance and exit use, where they were coming from and going to, and the vehicle occupancy and type. The final question asked what the respondent would do, given certain choices, if expressway driving became too inconvenient during construction.

Of the 37,000 cards distributed, 14,000—or 38 percent—were returned, a response rate indicative of the keen public interest in the rehabilitation project. Among the survey findings were that the average vehicle occupancy was 1.45 persons, three out of four vehicles contained only a driver, and 17.5 percent had only one passenger.

Although 80 percent of the respondents indicated they would change their travel habits, 60.3 percent said they would change routes but continue to drive, 10.8 percent said they would use public transportation, and 2.2 percent said they would join a carpool.

The survey also indicated that the expressway trips were relatively short, averaging 5.5 miles. Also of particular interest was that only 18 percent of all users had a trip destination in center city Philadelphia, indicating that there were no concentrated travel patterns and that the resultant desire lines involved the entire region. These findings were especially important to developing the second task, the reconstruction strategies.

## THE STRATEGIES

The construction staging and duration of the work were dictated by the 50 structures and the complexities of two of them: the Pencoyd Viaduct and the Vine Street Interchange, both of which required longer phasing.

The task force, using the survey results and the construction phasing requirements, decided on a three-year construction schedule that would involve a total of five sections. Most of the work would be done in the second construction season. They also defined three traffic-related goals to be followed as the strategies for the on-expressway portion of the traffic management plan were developed. They were:

- Maintain at least one lane of traffic in each direction at all times in the construction areas.
- Encourage trucks, tourists, and other long-distance travelers to remain on the expressway during construction.
- Reopen all lanes of traffic from approximately November through February. This third goal was later modified when planners determined that the redecking of the Pencoyd Viaduct could be done in one season if started several months earlier than the planned March 1 start date.

The probable key to achieving the desired 50 percent reduction of expressway traffic during the morning and afternoon peak periods was the decision to limit local drivers' access to the highway by closing certain ramps. Ramps were closed based on the following criteria:

1. On-ramps leading into a construction zone where only one lane was open;
2. Ramps with a bridge that needed rehabilitation;
3. Ramps blocked by a construction operation; and
4. Ramps that, if open, encouraged more than the optimum number of drivers to use the expressway.

The final decision was to close a total of 46 ramps, most of them on-ramps, over the three-year construction project. With this important decision made, the traffic consulting firm approached the third task, the problem of reassigning the traffic that would be diverted from the expressway onto the local street system.

## MITIGATION MEASURES

The department's ability to make improvements on detour routes is the most recent development in the area of traffic control for construction projects. These mitigation

measures can be used to: correct existing restraints on capacity; widen to increase capacity for the anticipated traffic movements; modify phasing, timing, and coordination of traffic signals; or improve public transportation facilities and service. In the case of the Schuylkill Expressway, all of these measures were used.

Because of the presence of the expressway, improvements had been negligible to many alternate routes, either because of other priorities or an insufficient benefit-cost ratio. As a result, the adjacent road system was not prepared to take on the added burden of diverted expressway traffic.

The task force was instructed to develop a list of potential improvements for the diversion routes and the public transportation system. This process was carried out during some 30 meetings of the task force members, with an evaluation of the proposals provided by Orth-Rodgers under task three of its five-point program.

The traffic management plan developed was based on the list and budgeted at \$12 million. It contained the following general categories of improvements:

1. Traffic signals (coordination, timing or phasing changes, new or modernized signals and temporary signals);
2. Roadway construction (minor widening, turning lanes, on-street parking replacement);
3. Emergency restoration (immediate repairs to key diversion routes);
4. Transit (parking lot expansion, additional buses to maintain headways in increased traffic, additional rail cars to increase ridership, extension of rail service beyond the exiting terminus);
5. Ridesharing (increase regional ridesharing efforts in Schuylkill Expressway corridor);
6. Traffic control (assign traffic control officers to key intersection and school bus stops).

To carry out the improvements, two contracts totaling \$1.3 million for roadway and signal work were let in 1984 in anticipation of the 1985 expressway construction. A combined roadway and signal project for \$2.6 million was let in 1985 for off-expressway improvements required for the 1986-1987 expressway construction.

Except for the installation of 29 temporary signals, all of the improvements made under these three contracts were permanent.

In evaluating proposals of this type, it is important to favor acceptance of even marginal improvements to have a system flexible enough to adjust to traffic demand. This rationale is based on anticipated diversions and certain assumptions that may or may not prove valid.

Also of considerable benefit was the department's extensive file of existing traffic volumes on its nonprimary routes. This file provided the basis for the evaluations during construction to see if complaints were, in fact, the result of expressway diversions or if problems predated construction.

In addition to the contractual work, department maintenance workers performed emergency restoration consisting of mechanized patching on four corridors. This was done by accelerating the maintenance schedule for those roads tagged as possible diversion routes.

Transit improvements included parking lot expansions at three locations, an extension during peak travel hours of the Paoli local train service to Downingtown, and supplemental service for expressway bus routes. The result of the added train service was 1,300 more passenger trips per day on the Paoli to Downingtown extension. The supplemental bus service enabled SEPTA to provide service as frequently as before construction, despite delays of up to 35 minutes caused by the

required detour routings. This minimized the impact of construction on some 6,000 bus users each weekday.

The Delaware Valley Regional Planning Commission contacted close to 1,000 companies as part of its corporate outreach program to promote vanpools and ridesharing during reconstruction. This effort was supplemented by speeches at business meetings, direct mail, public service announcements, news releases, and interviews.

Of the 5,016 commuter requests for matches in 1985, 3,206 were attributed to the expressway reconstruction, and more than half of those calls were received in the first four months of the year. Similar results were achieved in 1986. The increased workload was handled by adding telephone lines to the CAR POOL toll-free hot line and hiring one part-time employee during the first quarter of each of the two years.

Funds to pay for manual police control were allocated in the expressway construction project budget. Agreements were entered into with the various municipalities on hourly police compensatory rates when this service was required. Certain key intersections and school crossings were selected for police protection before the start of construction. Because the department could immediately place a police officer at specific locations when needed, it could quickly respond to problems until it could take other action, such as installing temporary traffic signals or changing the timing of a traffic light.

Three contracts totaling \$13 million also were awarded in 1984 and 1985 to prepare the expressway to handle two-way traffic during reconstruction.

The first was a \$2.5-million contract to improve the shoulder and concrete safety barrier along a six-mile section of the expressway. The contract also provided for correcting slope erosion and improving drainage.

During the 1985 construction season, while the eastbound lanes were being rebuilt, the upgraded shoulder and the westbound left lane handled the two-way directional traffic, with a safety lane in between.

The second contract was for \$7.4 million and covered work on a five-mile area; in addition to the shoulder upgrading, it included building a concrete box culvert to replace an existing steel bridge over a railroad.

The final contract was for \$3.2 million for a three-mile section of expressway and included improved lighting in the Philadelphia section of the City Avenue interchange.

While this preliminary construction work was going on, traffic on the expressway was maintained, except for certain exceptions made in the off-peak hours.

## TRAFFIC MONITORING

Before start of the expressway project, the Orth-Rodgers consultant team took counts both on I-76 and on the alternate route system that provided the basis for determining where the traffic had gone. During construction, the team did a series of manual and automatic traffic counts as part of its on-going monitoring analysis of the on- and off-expressway traffic patterns.

The counts were taken in the peak commuting periods, 6 a.m. to 9 a.m. and 3 p.m. to 6 p.m., at key locations on the expressway and along the diversion routes. The team used speed and delay runs on the expressway to identify problem areas.

The consultants' quick identification of the problems, and an equally rapid review and decision process in the department's traffic unit, were important to the success of the traffic management plan. In the first several months of construction, adjustments for left-turn phasing, retiming of signals, and the addition or removal of a temporary signal were frequently made to improve traffic flow.

Surprisingly, auxiliary police were not needed as often or as extensively as anticipated for the off-expressway diversion routes. This was attributed largely to the wide dispersal of the traffic and the effectiveness of the revamped system of signals.

The department kept construction interference with the traffic movement on the expressway at a tolerable level by making the contractors responsible for warning motorists in advance of any added restrictions. The traffic unit approved the type of restriction and the times it could be in effect. Peak hour restrictions were kept to an absolute minimum and approved only under unusual circumstances.

To help the department control the on-expressway traffic disruptions required by the contractor, all contracts included a clause entitled, "Advance Notice of Traffic Restrictions." The clause stated:

Notify the engineer at least four calendar days in advance of the start of any operation which will affect the flow of traffic and provide the engineer with details of the work to be done. After notification, the District Office will advise the public of these traffic restrictions and possible delays.

Motorists were then given sufficient warning through the various mechanisms set up under the public information program and could choose an alternative to avoid the added delay. As a result, unusually long and enduring backups rarely materialized.

Lastly, breakdowns and accidents on the expressway in the construction zone were handled by towing services that were hired by the general contractors for each zone. The service was provided free, 24 hours a day, seven days a week, for the duration of each contract. It helped immeasurably in maintaining the flow of traffic through the construction.

## INFORMING THE PUBLIC

The data derived from the O & D survey were valuable not only in planning how to maintain traffic during construction, but proved very useful in putting together the public information program, which was the responsibility of the press office. Among the most significant findings in the survey was that 80 percent of the expressway users indicated they would change their travel habits during the construction. One of the public information goals was to give this group information that would help at least half of them make this change.

In the early planning stages of the project, it became apparent that hardly anyone but PennDOT wanted the reconstruction to take place at the time. Both business and government viewed the proposal with considerable misgiving, convinced the reconstruction would totally disrupt the only major east-west traffic movement between city and suburb and so play havoc with the area's economy.

The suggested alternatives ranged from the impractical—such as waiting to complete several new expressways still on the drawing board—to the impossible, which included the suggestion to build an expressway on top of the existing one.

To address these concerns, the press office, in putting together the public information program, also listed among its goals the need to allay fears that the reconstruction would shut down the city of Philadelphia, make it impossible to get anywhere, and frighten tourists away.

Using the O & D findings press officers divided the audiences into two major groups when putting together information that would help motorists either cope with the construction or avoid it. The first group included visitors, tourists and truckers; the second consisted of commuters and occasional local drivers.

Because of the lack of a good parallel route or another expressway, it was not practical to try to divert tourists, truckers, and other long-distance users from I-76, so they were encouraged to stay on the expressway. Conversely, commuters and occasional local drivers had numerous options, and they were encouraged to choose an alternative to I-76 during the reconstruction.

To accomplish this, the 1985 and 1986 public information program provided for:

1. A *Visitors' Guide* (Figure 1) for each of the first two construction seasons. The guide was directed at truckers, tourists and other long-distance travelers, and was designed to encourage them to stay on I-76.

2. A *Commuters' Guide* (Figure 1) for each of the first two construction seasons. A more comprehensive brochure, this guide described in detail ramp closures and detours, alternate routes, and other ways to ease commuting.

In 1987, when over 90 percent of the work will be completed, the two guides will be combined.

3. A special mailing list composed of tourist bureaus, travel agencies, trucking associations, convention centers, hotels, automobile clubs, chambers of commerce, corporations, service organizations, cultural and sports institutions, medical centers,

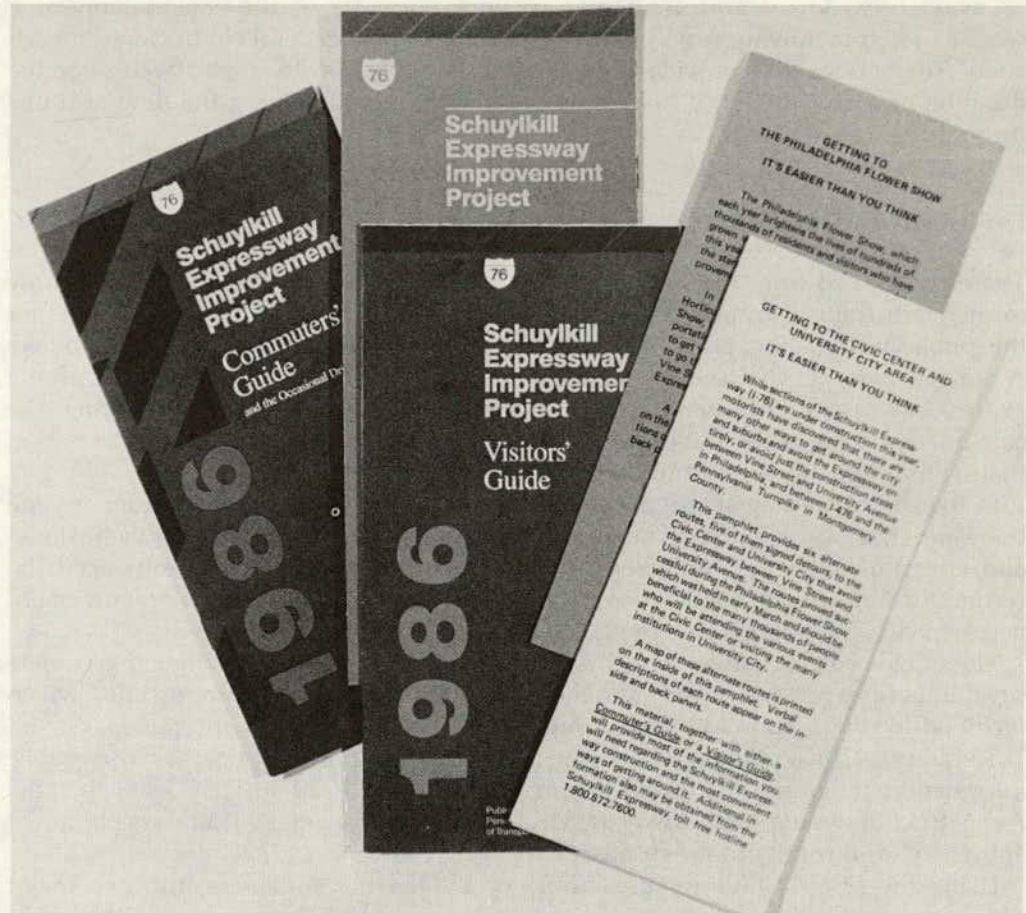


FIGURE 1 Brochures prepared by Public Information Program for Schuylkill Expressway Improvement Project.

and hospitals, colleges and universities, and government and elected officials. Those on the list received the brochures and other special mailings.

4. Stationery to give the project its own identification.

5. Three PSAs initially, and funds for two more if required. The first two PSAs were completed in time for the initial press conference on January 17, 1985.

6. A Toll Free Hotline set up at the department's district office in St. Davids (a suburb) for the press office to use to oversee the operation. Operators described alternate routings to callers, and also answered questions about the construction, took complaints for forwarding to the press office, and sent out information.

7. Other public relations tools, including press conferences, news releases, radio and television interviews, and special media events.

Planning the public information program took approximately a year, although publicity on the project had been continuous since 1982. The major thrust of the publicity was the distribution of the guides, which took place during the 12 weeks preceding the permanent traffic restrictions.

The long-range planning for the expressway rehabilitation, the mitigating traffic measures—including the monitoring during construction—and the largest public information program ever undertaken by the department for a construction project, combined to make the expressway project a success.

No massive traffic jams materialized; life went on in the city of Philadelphia; the tourists came as usual; and the region's drivers proved that, given choices and information, they could be quite resourceful and cope successfully with a major reconstruction project.