

# Survey of Efforts To Evaluate Freeway Service Patrols

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Some program administrators believe that there is no need to evaluate their service patrol programs unless funding is threatened. However, all programs should be evaluated to some extent to ensure that resources are used optimally. Before conducting an evaluation, program administrators should ask specific policy questions and clearly link the study to these questions. Therefore, it is recommended that larger programs perform comprehensive evaluations in which appropriate measures of effectiveness directly correspond with policy questions. Appropriate measures of effectiveness include the following: public perception, safety benefits, operating statistics, congestion delay, air quality and energy consumption benefits, and benefit-cost ratios. Approximately 32 service patrol programs in the United States and Canada were surveyed and the nature of the programs and the means by which their administrators are evaluating them were analyzed. All programs are very popular with motorists. Most programs keep some form of operating statistics, and several have conducted comprehensive evaluations, with benefit-cost ratios ranging from 2:1 to 36:1. Several upcoming studies also are discussed. If studies to date are any indication, service patrols are cost-effective programs to reduce incident-related congestion. If additional evaluations in large areas produce positive results, it is recommended that FHWA initiate programs and provide guidelines and training for large metropolitan areas with extreme congestion. Finally, it is recommended that states or regions coordinate similar programs and include them as part of a larger incident management program.

Transportation engineers have attributed over 50 percent of all urban freeway congestion to traffic incidents (1). In recent years, transportation policy makers have placed greater emphasis on more innovative and low-cost transportation alternatives. With the emphasis of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) on making existing facilities more efficient, freeway service patrols, or roving tow truck programs, have become an increasingly popular approach. These vehicles are dedicated to quickly clearing incidents such as accidents and stalls to reduce congestion delays and keep traffic moving. Whereas Chicago's program has been operating since 1960, many new programs have been launched in the 1990s.

These programs are very popular with the motoring public. One motorist phoned the Metropolitan Transportation Commission (personal communication) to talk about the Freeway Service Patrol in the San Francisco Bay Area:

I had blown a tire and was waiting on the phone about 15 seconds when one of your drivers. . . Bob, rolled up and changed my tire—he could not have been more professional or courteous. It was raining out there. He was working real close to the slow lane where the trucks are going by, and just did an outstanding job. (He) spoke to me about tires and safety, and had me back on the road in no time. . . . Again, excellent program; it's the best utilization of my tax dollars. . . and it keeps the freeways clear.

Metropolitan Transportation Commission, 101 Eighth Street, Oakland, Calif. 94607.

Public response is certainly one way to measure the effectiveness of service patrols. What other measures of effectiveness are transportation officials using to evaluate freeway service patrols? A survey of program administrators yielded varying answers: from counting the number of assists to conducting comprehensive studies calculating a benefit-cost ratio.

In the following section, measures of effectiveness used to evaluate freeway service patrols are discussed. Next, the results are presented of a telephone survey of most U.S. service patrols and one from Canada, which show the measures of effectiveness they use. Also reviewed are existing comprehensive evaluations of freeway service patrols and forthcoming studies. Finally, evaluation efforts to date are assessed and recommendations are made.

## MEASURES OF EFFECTIVENESS

There are a variety of ways to measure the effectiveness of service patrols, both quantitatively and qualitatively. Possible categories include public perception, safety benefits, selected operating statistics, congestion delay, air quality and energy consumption benefits, and benefit-cost ratios. The use of these measures was investigated in a survey and literature search of evaluation efforts. Motorists who are helped by service patrols often provide feedback to program managers in the form of phone calls, letters, or questionnaires, which are all indications of public perception. Many people support the service and its funding because they value the help they received or the security of knowing the service exists.

Motorists feel safer because trained tow truck drivers help them with car trouble and consequently save them from having to walk along the freeway to get help. Furthermore, when stalled vehicles are removed from the freeway quickly, other motorists may avoid secondary accidents. Many programs collect data, such as number and type of assists, and calculate statistics to evaluate their services. Location of service areas or hours of operation may be evaluated if other factors, such as time of assist, also are recorded.

Some programs use more sophisticated means of evaluating their services. For instance, a benefit-cost ratio may be calculated to determine whether a program is cost-effective. Benefits generally are calculated by determining the vehicle-hours of delay reduced by a service patrol multiplied by a particular dollar value of time. In his report, Finnegan (2) suggests other units of measure, as shown in Table 1.

## NATIONWIDE SURVEY OF SERVICE PATROL PROGRAMS

In June and July 1993, a telephone survey of service patrol administrators around the United States and Canada was conducted

TABLE 1 Products and Units of Measure

Product	Unit of Measure
1) Reduced peak period congestion	Hours of reduced delay Dollar value of reduced delay Increase peak period freeway speeds Increase traffic volume
2) Improved air quality and reduced fuel consumption	Pounds of reduced vehicle emissions Gallons of reduced fuel consumption Dollar value of reduced fuel consumption
3) Reduced secondary accidents	Number of accidents avoided Dollar value of avoided accidents
4) Excellent service (i.e. reduced motorist anxiety, stress, and discomfort)	Distribution of responses to motorist survey questions Motorist survey comments, letters, and phone calls

to determine the nature of their programs and find out what they are doing to evaluate their programs. The operations portion of the survey was modeled after a survey by *The Urban Transportation Monitor* (3). A total of 32 service patrol programs in the United States and Canada were identified. In addition to the 26 service patrol programs surveyed, California's six Freeway Service Patrol (FSP) programs were included.

The programs surveyed varied from a small, one-truck operation in Haywood County, North Carolina, to large operations such as the 51-vehicle "Minutemen" program in Chicago and the 138-tow truck FSP in Los Angeles. The survey was broken down into five sections. Operations information was requested first, such as the number of vehicles, hours of operation, and sponsorship. The second section asked about the cost of each program and its funding sources. The third section examined various operating statistics collected and how they were utilized, and the fourth section asked questions about public perception. Finally, evaluation efforts that had been completed or were in progress were surveyed. Specific information about service patrol programs with six or more vehicles is summarized in Table 2. Although all four programs in North Carolina are counted separately in the 32 total patrols, they are combined in Table 2. Surveyed programs with five or fewer vehicles include

- Golden Gate Bridge, San Francisco, California—four heavy tows;
- Howard Franklin Bridge Courtesy Patrol, Tampa/St. Petersburg, Florida—two heavy tows;
- Hoosier Helper, northeast Indiana—two pickups and three vans;
- Motorist Assist, St. Louis, Missouri—five pickups;
- Motorist Assist, Kansas City, Missouri—four pickups;
- Courtesy Patrol, New Jersey Turnpike, New Jersey—three vans;
- Pittsburgh, Pennsylvania—three regular tows;
- Courtesy Patrol, Fort Worth, Texas—two pickups and one sander/utility truck;
- Highway Helper, Seattle, Washington—1 van;
- Road Ranger, Seattle, Washington—three vans; and
- Emergency Patrol, Toronto, Ontario, Canada—three pickups.

The following sections describe some interesting key findings from the survey.

## Operations

In this survey it was discovered that there is a variety of ways to operate freeway service patrols. The sponsors and centerline kilometers patrolled are shown in Figure 1. With the exception of a few bridge patrols and units that respond only to major incidents, most vehicles patrol continuously. Communications systems, hours of operation, and type of vehicles vary by program. Some programs, such as the Chicago Minutemen, are able to handle almost any type of incident with their equipment; however, because of the expense of big rig tows, most programs operate regular tow trucks, pickup trucks, or vans. Since pickup trucks are less expensive to purchase and operate, over 50 percent of the programs have them in their vehicle fleet.

Communications systems were an important component of operations for all service patrols. All programs reported having a two-way radio communications system, and 19 programs also reported having cellular phones. The San Francisco Bay Area and Los Angeles FSPs also have automatic vehicle location (AVL) systems and mobile data terminals (MDTs)—small on-board computers—to assist with dispatch and data collection. Minneapolis and Houston are planning AVL systems. Indiana's Hoosier Helper also uses MDTs.

## Program Funding and Costs

The 32 service patrols vary greatly in the types of funding they receive, as shown in Table 2. Fifteen receive only state department of transportation (DOT) funds, and nine additional programs receive funding from their state DOTs as well as other sources, which may include federal ISTEA funds. For three patrols that operate on bridges and turnpikes, money comes from toll receipts. Three patrols are privately sponsored. Samaritania funds its patrols through corporate sponsors, and two radio stations in Seattle sponsor patrols. These sponsors advertise on the tow trucks. Finally, two programs are funded by other sources, including federal ISTEA funds. Most patrols do not charge motorists for the service; however, three programs charge for gasoline, and Washington State's Incident Response program bills the party at fault in major incidents.

TABLE 2 Selected Service Patrol Survey Results

STATE	California	California	California	California	California	California	California	Colorado	Illinois
LOCATION	San Francisco Bay Area	Los Angeles	Riverside	San Diego	Orange County	Sacramento	Bay Bridges except Golden Gate Bridge	Denver	Chicago
PATROL NAME (Year Initiated)	Freeway Service Patrol (1992)	Freeway Service Patrol (1991)	Freeway Service Patrol (1993)	Freeway Service Patrol (1993)	Freeway Service Patrol (1992)	Freeway Service Patrol (1992)	none (1936)	Mile-High Courtesy Patrol (1992)	Emergency Traffic Patrol "Minutemen" (1960)
SPONSOR(S)	Caltrans, CHP, Metropolitan Transportation Commission SAFE	Caltrans, CHP, L.A. Co. Metro. Trans. Authority	Caltrans, CHP, Riverside Co. Transportation Commission	Caltrans, CHP, SANDAG	Caltrans, CHP, Orange Co. Trans. Authority	Caltrans, CHP, Sacramento Trans. Authority	Caltrans	Colorado DOT	Illinois DOT
PATROL PROVIDER	outside contractor	outside contractor	outside contractor	outside contractor	outside contractor	outside contractor	in-house	outside contr. & state patrol	in-house
CENTERLINE KILOMETERS PATROLLED	177	568	34	39	77	43	not available (n/a)	43	127
NO. OF VEHICLES	36 tow trucks	138 tow trucks	8 tow trucks	8 tow trucks	12 tow trucks	6 tow trucks	13 heavy tows	4 reg. tows, 2 pickups	3 heavy tows, 36 reg. tow, 11 pickups, 1 car
TYPE OF PATROL	peak commute	peak commute	peak commute	peak commute	peak commute	peak commute	day & night	peak commute	day & night
ESTIMATED ANNUAL ASSISTS	70,000	250,000	18,000	18,000	45,000	10,000	45,900 in 1992	12,000	100,000
FUNDING SOURCE(S)	State FSP, MTC SAFE, ISTEA, Federal Construction Funds	State FSP, Local Sales Tax	State FSP, Local Match	State FSP, Local Match	State FSP, Local Match	State FSP, ISTEA, Local Match	Maintenance Budget and Tolls	Maintenance Budget and Federal Monies	Gasoline Taxes and DMV Fees

### Data Collection

A total of 29 of the 32 programs surveyed collect operating statistics on the number of assists performed. Although it covers the entire state of Washington, the Incident Response program performed only 292 assists in 1992 because the team is on call to handle large incidents only. On the other hand, Chicago and Los Angeles handle over 100,000 incidents a year. Almost all patrol administrators collect data on the date, time, location, and vehicle problem. In addition, they usually collect data on the vehicle type, miles patrolled, and additional tows required. Because managers do not have common definitions for the data collected, it is difficult to compare data across programs. All patrols keep records in the form of daily drivers' logs; 16 patrols survey motorists with comment cards given after each assist.

The programs differ greatly in the intervals between reports, from weekly to annually. Although most programs collected data on a regular basis, they did not necessarily make reports on a regular basis. Nine of the patrols made reports as needed, and two programs had never prepared a status report.

### Public Perception

Program administrators gauge the public's perception through surveys, letters, and phone calls. Almost all programs receive feedback from the public, and an overwhelming majority of the responses have been positive and supportive. Many agencies believe that the service patrols are the best public relations activity they

have. A comment from a pleased motorist said it all: "He came. He saw. He help[ed]." A total of 16 of the 32 programs survey motorists at the time of assist, and all programs have received numerous letters and phone calls. So far, no survey has been administered to obtain feedback from nonusers. Such a survey could be used to rally additional political support for programs.

### Other Evaluation Criteria

Several questions on the survey addressed other evaluation criteria for freeway service patrols. Of the 32 programs, only a few had calculated a benefit-cost ratio as shown in Table 3 (4-8). However, these ratios cannot be directly compared because the survey showed that administrators calculate program costs differently. For example, although all programs included operating costs, some did not include administrative costs. All benefits included a dollar value for reduced delay, but researchers valued time at different rates. Although other benefits may have been included in the ratios, reduced delay was always the most significant.

Many program administrators apparently see no need to have more comprehensive evaluation efforts. One administrator even said that the program does not need to justify its existence. "It would be like saying that you have to justify the need for snow plows during the winter." Another said, "We know we're doing a good job, no doubt about it." For other programs, the only stated purpose of evaluation was to justify funding for existing service or to examine the possibilities of expansion.

TABLE 2 Continued

STATE	Minnesota	New Jersey	New York	North Carolina	Texas	Washington	Washington D.C.	Washington D.C.	10 States
LOCATION	Minneapolis	New Jersey	New York City	Charlotte, Winston-Salem, Greensboro, Haywood County	Houston	Statewide	Washington D.C. & Baltimore	Washington D.C.	11 Metropolitan Regions
PATROL NAME (Year Initiated)	Highway Helper (1987)	Emergency Service Patrol (1993)	Commuter Assistance Teams (1990)	Motorist Assistance Patrol (1992)	Motorist Assistance Program (1986)	Incident Response (1990)	Emergency Traffic Patrol (1989)	Safety Service Patrol (n/a)	Good Samaritan (1978)
SPONSOR(S) * Managing Organization	Minnesota DOT	New Jersey DOT	New York State DOT	North Carolina DOT	*TexDOT, Sheriff Dept., METRO, Car Dealers, Cell. Phone	Washington DOT	Maryland DOT	Virginia DOT	*Samaritania and Corporate Sponsors
PATROL PROVIDER	in-house	in-house	in-house	in-house	in-house & outside cont.	in-house	in-house	in-house	Samaritania, Inc.
CENTERLINE KILOMETERS PATROLLED	113	39	97	293	225	entire state	644	1448 (includes highways and streets)	varies
NO. OF VEHICLES	6 pickups	8 vans & trucks	6 pickups	8 pickups	9 vans	9 pickups	8 reg. tow, 6 vans on-call	2 heavy tow, 2 regular tow, 14 pickups, 3 vans, 2 other	Number of vans varies by region
TYPE OF PATROL	all day	all day	peak commute	all day	all day	on-call	peak commute	all day	peak commute
ESTIMATED ANNUAL ASSISTS	13,000	not available	4,200	not available	22,800	292 in 1992	17,000	40,000	not available
FUNDING SOURCE(S)	Traffic Manage. Budget	ISTEA	Maint. Budget	Maintenance Budget, Federal construction funds, Gasoline tax	TexDOT, Sheriff Dept., METRO, Car Dealers, Cell. Phone	Maintenance Budget	Maint. Budget	Maintenance Budget (Gas Taxes)	Corporate Sponsors

### Statewide Efforts To Evaluate FSPs

California and North Carolina have made an effort to coordinate their service patrol programs statewide, including evaluations. North Carolina coordinates four service areas and has plans for a statewide evaluation. California FSPs have formed a partnership that consists of the California Highway Patrol (CHP), the California Department of Transportation (Caltrans), and a local agency in each region to sponsor the service patrol. In the San Francisco Bay Area, the private tow contractors who provide the service are considered a fourth partner, with two tow representatives participating on the FSP technical advisory committee. In all six California FSP programs, the agencies sign a memorandum of understanding that outlines the duties of each agency, drawing on the strengths of each. Although each FSP is controlled and operated locally, all programs share information and ideas through a formal statewide committee and an informal network. In addition to the larger statewide committee, an evaluation committee and a funding allocation committee have been formed to address specific areas of the statewide program. Smaller programs benefit from evaluation studies conducted by the larger programs. The public benefits from this coordination by being able to access similar services throughout the state.

The California FSP Evaluation Committee was established in response to state legislation to prepare a comprehensive evaluation of the FSP program statewide. The committee coordinates the evaluation efforts of different areas, standardizes data collection statewide, and plans to extrapolate the results of local studies to the entire state.

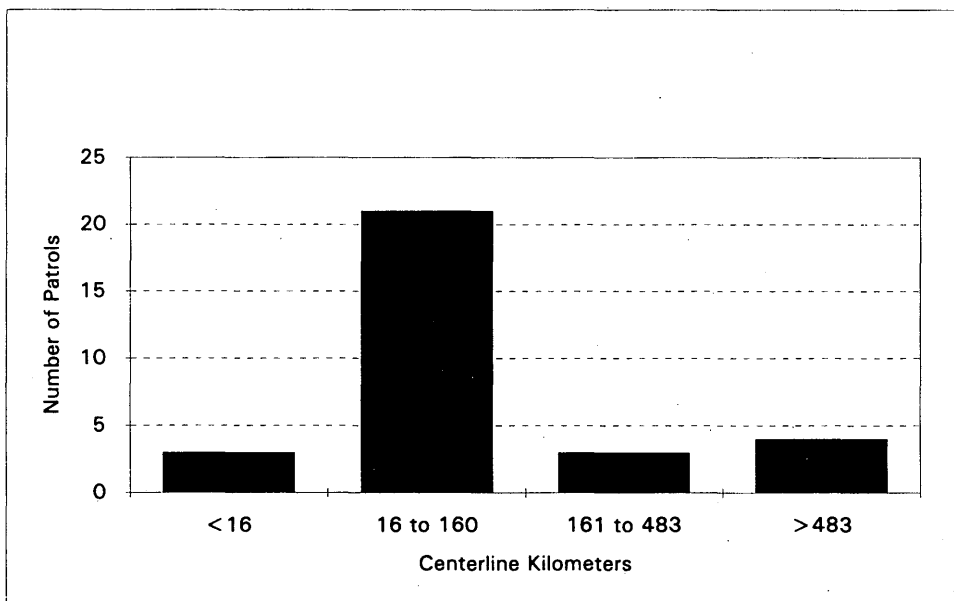
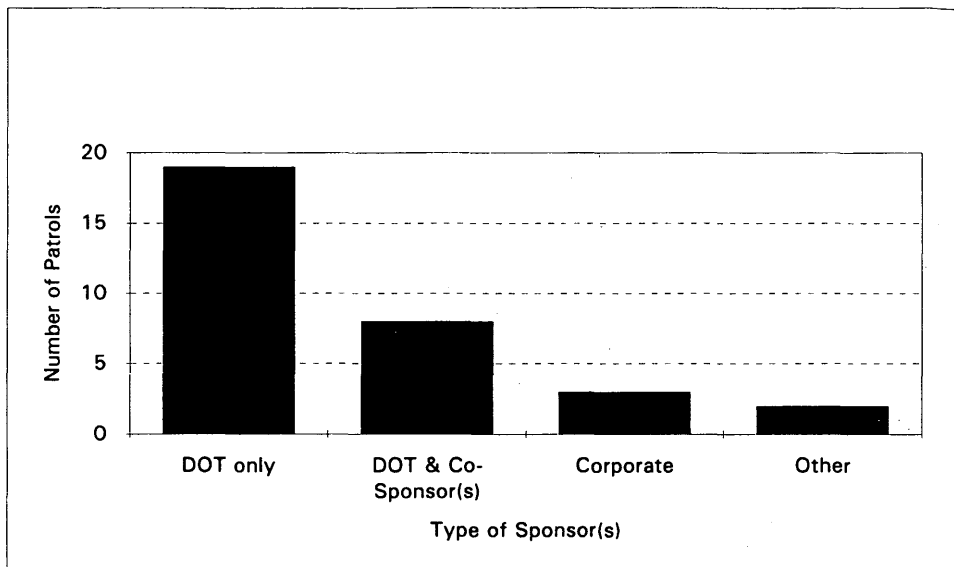
### COMPREHENSIVE EVALUATION STUDIES

Several programs already have completed comprehensive evaluation studies: the Emergency Traffic Patrol in Chicago, FSP in Los Angeles, the service patrols in Seattle during the 1990 Goodwill Games, the Mile-High Courtesy Patrol in Denver, various patrols in Houston, and the Motorist Assistance Patrol in Charlotte, North Carolina. These studies are summarized below.

#### Emergency Traffic Patrol in Chicago

Begun in April 1960, Chicago's Emergency Traffic Patrol—better known as the Minutemen—has grown to a fleet of 51 vehicles, including 39 heavy and light tow trucks, 11 pickups, and a supervisor's car. In addition to the Emergency Traffic Patrol's major incident response team and roving patrol, Chicago has established a freeway traffic management program that includes the Traffic Information Program, with 1,800 loop detectors on over 160 km (100 mi) of highway, and the Traffic Systems Center, which feeds traffic and incident information to the media (5).

In October 1990, Cambridge Systematics completed a study for the Trucking Research Institute on the incident management programs (5). This evaluation determined that the entire Chicago Freeway Traffic Management Program, including the Emergency Traffic Patrol, had a benefit-cost ratio of 17:1. The program costs were composed of capital, operations, maintenance, labor, and overhead totaling \$5,549,290 (1990 dollars) annually. Benefits were estimated using models developed by FHWA (9) to calculate



**FIGURE 1** Service patrol operations: (top) service patrol sponsors; (bottom) centerline miles patrolled.

**TABLE 3** Benefit-Cost Ratios

Location	Program	Benefit-Cost Ratio	Year
Charlotte, NC (4)	Motorist Assistance Patrol	7.6:1	1993
Chicago (5)	Emergency Traffic Patrol	17:1	1990
Denver (6)	Mile-High Courtesy Patrol	13.5:1 to 18.4:1	1993
Houston	Motorist Assistance Program	19:1	1993
Houston (7)	Motorist Assistance Program	7:1 to 36:1	1991
Houston (8)	Freeway Courtesy Patrols	2:1	1973

vehicle-hours of delay before and after implementing the program. This delay was translated to travel time savings with time valued at \$10/person-hr. A second benefit-cost ratio of 11:1 was calculated for an alternative "partial incident management" program (i.e., a major incident response team only, on-call for large incidents and hazardous materials). Inputs to the model included type and duration of incidents with and without the program. The Cambridge Systematics study stated that the effectiveness of Chicago's program is based on years of personal relationships within agencies involved in incident management and recommended establishing institutional agreements through an "integrated regional incident management program" (5).

### Freeway Service Patrol Evaluation in Los Angeles

In June 1992, Finnegan of the Los Angeles County Metropolitan Transportation Authority (MTA) completed a study of freeway service patrol assists in Los Angeles (2). At the time of the study, MTA contracted with private tow operators for 88 tow trucks to patrol 346 km (215 mi) of freeway in Los Angeles during the peak periods. This program, a joint project of MTA, CHP, and Caltrans, began operating in July 1991 (2).

Finnegan evaluated the program's economic impact (137 new jobs), compiled the results of motorist surveys (92 percent rate the service as excellent; 7 percent, good), and calculated statistics on operations. By May 1992, over 130,000 motorists had been assisted, and FSP was performing over 700 assists per day at a cost of \$43 each.

In addition, he developed the FSP Assist Model to help public officials make optimum use of the resources available. This model uses miles of freeway, accident rates, and average annual daily traffic to estimate FSP assists. The model accounts for 54 percent of the variance in total daily assists between different freeway segments. On the basis of the concepts of a deterministic queuing model used to quantify congestion for incidents, he concluded that public officials could improve cost-effectiveness by maximizing the number of assists and reducing the incident response times (2).

### Service Patrols in Seattle and Tacoma at 1990 Goodwill Games

In 1990, the Washington Tow Truck Operators Association provided six tow truck patrols for two weeks in Tacoma, Washington, during the Goodwill Games. Washington State Patrol (WSP) officers in six specially equipped jeeps also provided service in Seattle. In March 1991, Mannering and Hallenbeck of the Washington State Transportation Center published a report for the Washington State Department of Transportation (WSDOT) describing the impacts of these 12 service patrol vehicles (10).

Data were collected from the WSP computer-aided dispatch system that consisted of incident report forms completed for each assist and a survey of motorists who returned a prepaid postage card to WSDOT. Researchers compared data before and during the Goodwill Games to determine changes brought about by the congestion mitigation efforts. This study found a decrease in incident duration within the study area, with service patrols reaching incidents an average of over 5 minutes sooner than regular tow service. Although the study did not compute a benefit-cost ratio or decrease in vehicle delay, the researchers concluded that if the

service patrols decreased the time for incident detection, initial response, and (in many cases) incident clearance as measured in the study, they did improve traffic performance. Additionally, motorists like the service (10).

### Courtesy Patrol Pilot Program in Denver

The Mile-High Courtesy Patrol in the Denver metropolitan region was implemented on a pilot basis from September 1992 through February 1993 and remains operational. An agreement between Colorado DOT and the Colorado State Patrol was formed to provide the patrol. Local contractors of the American Automobile Association (AAA) are under contract to provide the tow service. Covering 43 centerline km (27 mi) of freeway, AAA operates four tow trucks and Colorado State Patrol officers run two 4-wheel-drive vehicles.

Cuciti and Janson of the University of Colorado at Denver performed a comprehensive evaluation in June 1993 for the Colorado DOT (6). Four objectives of the study were to (a) collect data on assists, (b) evaluate public perception of the patrols, (c) calculate a benefit-cost ratio, and (d) determine which type of patrol was more effective, AAA or state patrol (6).

To gather information on public perception, every motorist was given a comment card after being assisted. A total of 99 percent of the 550 motorists who returned comment cards said the service was a good use of their tax dollars. Many motorists acknowledged the benefits of better traffic flow, less congestion, and good public relations for law enforcement and other government agencies.

In addition, Cuciti and Janson calculated a benefit-cost ratio by examining a segment of Interstate 25 before and after the Mile-High Courtesy Patrol began service. They used a deterministic queuing model to estimate vehicle delay involving four phases (detection, response, service, and queue dissipation). By varying the reduced capacity assumed when an incident blocked traffic lanes, they found that the courtesy patrol reduced, on average, 78 to 98 vehicle-hr of delay per incident in the morning peak period and 71 to 75 vehicle-hr in the afternoon peak.

They valued travel time savings at \$10/vehicle-hr and estimated the total program costs to be between \$110,000 and \$130,000 in the 6-month evaluation period. A 6-month travel time savings was estimated to be \$1.8 million to \$2 million. Using the information above, Cuciti and Janson calculated a benefit-cost ratio of 13.5 to 18.4:1 for the range of program costs and delay per incident. Their evaluation recommended establishing a permanent program, extending the operating hours, and patrolling areas with narrow or nonexistent shoulders. They did not determine which service mode was more effective—state patrol or AAA—because there were advantages and disadvantages in each (6).

### Motorist Assistance Program in Houston, Texas

Houston's Motorist Assistance Program (MAP) began in 1986 as a joint project between the Harris County Sheriff's Department and the Houston Automobile Dealers' Association. Now the program includes three more sponsors: Texas DOT, Metropolitan Transit Authority of Harris County (METRO), and Houston Cellular Telephone. The current program has nine vans operated by Harris County sheriff deputies patrolling 225 km (140 mi) of freeway.

Texas Transportation Institute prepared an annual report for Texas DOT and METRO for Houston's MAP in 1991. From August 1, 1989, to July 31, 1991, MAP performed more than 24,000 assists (7). Researchers estimated the benefits of a reduction in vehicle-hours of delay by using methods developed by FHWA (11). They calculated delay for lane and shoulder incidents for seven routes with and without MAP. For the average duration of an incident without MAP, they used an upper-limit assumption of a 20-min reduction as a result of MAP (12). They calculated 3,102,576 vehicle-hr saved, resulting in \$38 million saved by motorists, and assumed a value of time at \$12/vehicle-hr. A conservative 5-min reduction per incident would result in a reduction of 607,392 in vehicle-hr of delay, equating \$7.4 million. Costs included labor salaries, benefits, and vehicle costs, yielding an average cost of \$85.67 per incident. The benefit-cost ratio was estimated to be between 7:1 and 36:1, depending on average response times used. In addition to the benefit-cost ratio, the study addresses the importance of public acceptance. With 12 representative examples of public appreciation letters attached to the report, it shows that the MAP program is well liked by the motoring public (7).

#### **MAP in Freeway Reconstruction Area in Houston**

Texas Transportation Institute recently completed a study for Texas DOT to evaluate MAP on the Southwest Freeway (U.S. Highway 59) in Houston, Texas. Conducted by Paul Hawkins with William McCasland as the principal investigator (unpublished data), the study evaluated the impact of using two MAP vans on the Southwest Freeway versus having no MAP service. The study was conducted from August 1991 to July 1992 during a period of heavy reconstruction on the freeway that eliminated most shoulders, with MAP vans patrolling from 6:00 a.m. to 10:00 p.m.

To evaluate the service, Hawkins used computer model FREQ10 to simulate traffic on the freeway, modeling incidents by reducing the freeway capacity. He simulated incidents with one lane blocked and incidents on shoulders and calculated the difference in delay with and without MAP. He found that depending on the location, removing some incidents actually increased delay during certain periods because the incidents acted as a meter, increasing the efficiency of the freeway. However, for the approximately three-quarters of the 17 incidents modeled, MAP reduced the delay experienced by motorists.

Taking all 17 case studies into account, the vans demonstrated a 19:1 benefit-cost ratio. A total cost of \$196,483 was calculated, including equipment, drivers, and Texas DOT administrative costs. Total benefits of \$3,700,000 included a small cost savings to assisted motorists who did not have to pay for additional help and the larger cost savings of reduced delay to other motorists on the freeway. The majority of the savings came from clearing incidents that blocked one lane of the freeway. Although this study showed significant benefits from MAP, Hawkins recommended that each candidate freeway for a service patrol be investigated separately because factors that affect the benefits, such as traffic volumes and accident rates, vary in different areas.

#### **Service Patrols in Houston in Early 1970s**

One of the earliest studies on service patrols was completed in 1974 for the Texas Highway Department by Fambro of the Texas

Transportation Institute (8). In 1973, the Texas Highway Department (now Texas DOT) provided courtesy patrols consisting of tow pickup trucks in Houston. Although Fambro calculated a benefit-cost ratio of 2:1 and recommended that the program continue, service was later discontinued until MAP began patrolling in 1986 (8).

#### **Motorist Assistance Patrol in Charlotte, North Carolina**

In 1993, Mooney of FHWA and Kirk with the North Carolina Department of Transportation (NCDOT) performed an evaluation of the Motorist Assistance Patrol in Charlotte, North Carolina, for NCDOT (4). This study evaluated the service of three pickup trucks, which performed a total of 12,600 assists a year. They calculated a benefit-cost ratio of 7.6:1 on the basis of the reduction in vehicle-hours of delay calculated using FREWAY3, a computer model developed by FHWA (4).

#### **UPCOMING STUDIES**

In addition to these existing studies, several other efforts are under way to determine the effectiveness of service patrols. These studies include one on the FSP in the San Francisco Bay Area, an FHWA study on incident detection issues, and one on the Highway Helper program in Minneapolis.

#### **FSP in the San Francisco Bay Area**

During 1993 in the San Francisco Bay Area, the FSP had 29 roving tow trucks patrolling 177 centerline km (110 mi) of freeway during peak commute hours. This program is jointly sponsored by the Metropolitan Transportation Commission Service Authority for Freeways and Expressways (MTC SAFE), CHP, and Caltrans. Private tow companies provide the service under contract with MTC SAFE. Caltrans has contracted with Partners for Advanced Transit and Highways (PATH), with Haitham Al-Deek of the University of Central Florida at Orlando and Pravin Varayia of the University of California at Berkeley as principal investigators, to conduct an evaluation of the program.

The purpose of this study is to evaluate the effectiveness of FSP in reducing incident congestion by developing a benefit-cost ratio. The benefits will be calculated as the cost savings of vehicle-hours of delay, and costs will include tow contractor and agency administrative costs. The researchers will quantify other benefits such as reduction in air pollutants and fuel use, but these factors will not be included in the benefit-cost ratio.

To collect data, students drove in five specially equipped cars on an 11.8-km (7.3-mi) stretch of Interstate 880 freeway. They collected data during the morning and afternoon commute hours for 5 weeks before and after FSP service was added in 1993. These researchers have collected one of the most comprehensive data sets, which includes the following:

1. Incident data from direct observation, the CHP computer-aided dispatch system, AAA dispatch logs, and tow companies operating on the freeway segment. Over 1,200 incidents were observed in the pre-FSP data collection.

2. Loop detector data from 340 mainline, 16 off-ramp, and 57 on-ramp loops.

3. Tach vehicle data from five tach cars, including global positioning system data.

4. Truck weigh station data. Two stations, one in each direction of I-880, provided truck counts and weights at different times of the day.

PATH researchers plan to write a computer program to calculate the cumulative recurring and nonrecurring congestion for each incident on the basis of a deterministic queuing model. They also will sort incidents into broad categories, and average characteristics will be calculated for each category for both the before and after data. If, on average, the incident duration decreases with FSP, congestion delay will most likely decrease. MTA in Los Angeles is planning a similar study. Caltrans plans to include the study results in a statewide FSP evaluation report with policy recommendations to be released in December 1994.

### **FHWA Study on Incident Detection Issues**

FHWA has contracted with Ball Systems Engineering Division, with Pete Payne as principal investigator, to conduct a study of incident detection issues (unpublished data). The team consists of researchers at California Polytechnic State University (Cal Poly) at San Luis Obispo led by Ed Sullivan; the University of Maryland, under the direction of Gang-Len Chang; and the University of California at Irvine with Stephen G. Ritchie. The study will develop and test a new generation of incident detection algorithms for use in the nation's freeway traffic management centers. An additional goal of the study is to develop a tool, supported by Cal Poly, that would allow users to analyze the impacts of incidents on freeways. The team plans to use data from federal sources (Highway Performance Monitoring System), state accident data bases, FSP in the San Francisco Bay Area, and the PATH study mentioned earlier to develop and verify the model.

This tool will be a personal computer program that will allow the user to try different scenarios at a specific site. It will predict the frequency of incidents by type and the expected duration of each type. It also might be used to model the effects of the freeway service patrols by varying the response time to incidents. Thus, planners may use results to determine where it would be cost-effective to implement service patrols. The impact analysis tool is scheduled to be available by the end of 1994, and the incident detection algorithm work will continue through 1997 (Payne, unpublished data).

### **Highway Helper in Minneapolis**

In Minneapolis, Sue Groth and Glen Carlson with the Traffic Management Center of Minnesota DOT are evaluating the Highway Helper program, which uses six pickup trucks operating all day on weekdays. They plan to assess the benefits of time savings and calculate a benefit-cost ratio. This study was to be completed by the spring of 1994 (unpublished data).

### **ASSESSMENT OF EVALUATION EFFORTS**

In assessing the evaluation efforts of service patrol program administrators throughout the country, appropriate measures of ef-

fectiveness are noted, comprehensive versus limited studies are considered, program and evaluation goals are examined, and an attempt is made to not generalize the results. On the basis of this survey and existing evaluation studies, appropriate measures of effectiveness include public perception, safety benefits, selected operating statistics, congestion delay, air quality and energy consumption benefits, and benefit-cost ratios. The survey results show the extent to which program administrators use these measures of effectiveness. Because service patrol programs are so popular, public perception is the easiest criterion to measure. Most program administrators receive letters and phone calls praising their programs. The second most common form of evaluation is selected operating statistics. Although most program administrators collect data on assists, it is not clear whether their statistics are used to evaluate existing service or merely to count the number of assists performed. Many programs do not regularly prepare reports using their statistics. Measuring safety benefits, congestion delay, fuel consumption, and air quality impacts is more difficult and requires costly data collection.

This difficulty is exhibited in the studies mentioned. In the Chicago study, which includes the entire incident management program, it is difficult to isolate the effects of the service patrols. Other methods, such as Los Angeles' regression model, are not able to account for all variables affecting FSP service. Also, this model relates only to a specific area and could not be applied to service patrols in other cities. In several studies, researchers make assumptions about critical variables such as response and clearance time at an incident because these variables are difficult to measure. Methods using models must be carefully calibrated, which often requires extensive data collection. Nevertheless, models used to calculate delay caused by incidents are evolving, as shown by the PATH study in the San Francisco Bay Area. In addition to improving methodologies, administrators should evaluate service patrols against other options to manage incidents and improve traffic performance.

The evaluation of service patrol programs ranges from limited to comprehensive. The scope of the evaluation should depend on the size and cost of the program, the goals of administrators, and policy questions administrators need to answer. Although all program administrators should evaluate their programs to some extent, more comprehensive evaluations only for larger programs are recommended; this can justify the expense of more costly evaluations as a way to ensure that resources are being allocated efficiently.

Various transportation officials have different goals and needs for evaluating service patrols. Goals include ensuring continued funding, adequate resources, and sufficient personnel. Many of the DOT programs are a part of their regular maintenance operations, and program administrators may feel no need to evaluate the service patrols unless funding is threatened. Politicians authorizing funding for the programs may be interested in quantified benefits as well as public perception. This may apply to other program administrators as well. According to McDade, evidence of the value of the service patrols to the operating and sponsoring agencies has been seen in the form of hundreds and thousands of letters, cards, and notes of appreciation from those who are served every year (14).

In California, where each FSP is run by a partnership of the state DOT, the highway patrol, and the metropolitan planning organization (MPO), individual agencies may have different evaluation needs. Needing to justify the funds spent for the project on



the basis of its goals of reducing congestion, the MPO may require a more comprehensive evaluation. However, program administrators in an MPO also must balance paying for an evaluation versus putting additional trucks on the road. The evaluation needs of all three agencies are balanced through the California statewide evaluation committee. Agencies around the state join efforts, eliminating extra costs.

Finally, program evaluators must be careful not to apply the results of evaluations to other areas or programs that are not appropriate. Some measures of effectiveness are dependent on specific factors, such as freeway geometry, traffic volume, and the effectiveness of incident detection and response, and should not be generally applied.

## CONCLUSIONS

On the basis of these assessments of evaluation efforts of service patrol programs, several conclusions are drawn and recommendations are made. Before conducting an evaluation, program administrators should ask specific policy questions and clearly link the study to these questions. To optimize current resources, existing areas of service and hours of operation should be evaluated. The policy questions also should correspond directly to the measures of effectiveness chosen. For example, if congestion relief and improvement in air quality are goals of the program, vehicle-hours of delay and air quality impacts should be studied. Traffic conditions also change over time, and evaluation plans should provide regular monitoring on some level.

There are definitely advantages to coordinating with other agencies and programs and being part of a larger incident management program. The partnership arrangement used in California's FSP programs provides the institutional structure for agencies to cooperate and draw from the strengths of each. Statewide committees in California allow similar programs to combine resources and focus on specific goals, such as evaluating the programs and maintaining adequate funding. In the case of Chicago, where service patrols are the most visible part of a larger incident management program, a positive evaluation can create a constituency for the entire program (13).

If studies to date are any indication, service patrols are cost-effective programs to better utilize existing freeways and reduce incident-related congestion. The largest service patrol programs are located in the Chicago; Washington, D.C.; San Francisco; and Los Angeles areas. If evaluation results in these large areas show that they are meeting these goals, as the Chicago program has, it

is recommended that FHWA initiate programs and provide guidelines and training for large metropolitan areas with extreme traffic congestion.

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