

CALIFORNIA HIGHWAY PATROL

Corridor Safety PROGRAM—A Collaborative Approach to Traffic Safety

Judge's Commentary

The focus of most problem-oriented projects is crime, but it might just as well be any other of the recurring problems dealt with by police. In fact, this year's winner of the Goldstein Award was focused on a traffic problem—a high rate of fatal accidents on a particular stretch of rural highway in California. The projects' novelty was one reason for its selection. Another was that it was focused on an important, life-threatening problem. However, judges liked many other things about the project, including the following:

- Scanning was unusually rigorous. The stretch of highway, or corridor, was selected from among 550 qualifying roadway segments on the basis of its high rate of collisions and fatalities during a three-year period. A particularly serious accident resulted in its being given high priority for treatment by the California Highway Patrol.
- Analysis consisted of a detailed review of accident data, together with input from a task force of state and local stakeholders who made a daylong visit to the roadway to see the problem first hand. The principal factors involved in the different kinds of collisions were identified.
- This analysis resulted in a comprehensive response plan with 48 specific recommendations falling under four major headings of Engineering, Emergency Response, Enforcement and Public Education. The submission included information about the cost of

the recommended actions and their status by the end of the project.



- Quantitative assessment of accident statistics clearly demonstrated the success of the project. Accidents were substantially reduced (especially when related to miles traveled) and it was estimated that in the five years after the completion of the project 21 lives were saved.
- The local community has continued to make improvements to the corridor. Encouraged by the success of the project, the California Highway Patrol has now implemented a total of 22 corridor projects and is extending the corridor concept in seeking to reduce pedestrian fatalities and those related to truck accidents.

Summary

The Problem: California State Routes (SR) 41 and 46 are rural east-west highways connecting California's Central Valley to the central coast region. After a particularly serious multiple fatality collision in 1995, the local community asked the California Highway Patrol (CHP) to assist them in reducing such tragic incidents along this corridor. A brief look at the collision picture along the corridor confirmed the need to act quickly. Between 1992 and 1995, there were a total of 976 collisions on the corridor, including 48 fatalities.

Analysis: The California Highway Patrol formed a multi-disciplinary task force to complete a comprehensive analysis of this corridor's collision problem. The main causal factor was "unsafe turning movement," which includes drifting out-of-lane

INITIAL SELECTION PROCESS FOR CORRIDOR SAFETY PROJECTS

Evaluation of the first candidate corridors began with a review of state highway data from the California Department of Transportation's (Caltrans) Traffic Accident Surveillance and Analysis System (TASAS). This database, along with information from the CHP's Statewide Integrated Traffic Records System (SWITRS), yielded 550 roadway segments for consideration. Three years of collision and victim data (1989-1991 initially) were reviewed to minimize any statistical anomalies. Segments less than eight miles in length and those with an average daily traffic count of 1,000 vehicles or less were eliminated since those rates were too variable to be reliable indicators. Also, to be included in

the selection pool, potential corridors had to pass through or be adjacent to an urban area, and fall under the jurisdiction of the CHP for at least a portion of a potential corridor. Segments with fewer than five deaths in three years were also eliminated.

Along with the statistical rankings of potential corridors, more subjective input was typically sought from a variety of sources. Personnel from the CHP and Caltrans in the localities of each segment and from members of the local public works departments requested information about the top-ranked segments. This provided a localized perspective concerning the appropriateness of applying the corridor concept to a segment,

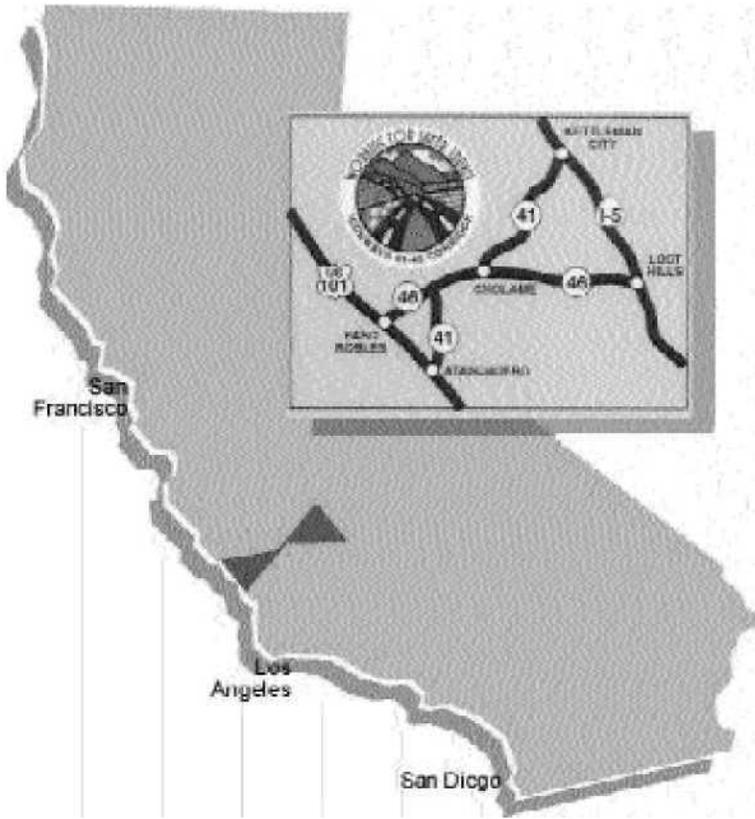
public sentiment about the proposed corridor, and other information not necessarily available at the statewide level.

Based on statistical rankings and input from local experts, recommendations for corridor selection were presented to CHP's Executive Management, who selected a portion of State Route 1 in Ventura County as the first Corridor Safety Project. A similar process resulted in selection of State Route 184 in Kern County as the second corridor project in 1995. The SR 41/46 corridor was the third corridor selected.

ⁱ U.S. Department of Health and Human Services, Public Health Reports, Vol. 110; No. 3; Pg. 233; ISSN: 0033-3549 (May, 1995).

and over-correcting off the road, and crossing over the center line into oncoming traffic. Contributory factors included inadequate shoulders, poor signage and short passing or merging lanes. A large farm worker population, comprised primarily of Spanish-speaking individuals, raised questions about motorists' knowledge of traffic signs and laws relating to use of occupant restraints, drinking and driving, and other rules-of-the-road. The remoteness of much of the corridor made access to emergency services inconvenient at best.

Response: The Corridor Safety Task Force developed a detailed action plan comprised of four main areas: enforcement, emergency services, engineering, and public education. Along the SR 41/46 corridor, CHP and local law enforcement enhanced patrol to enforce traffic laws; emergency service providers found ways to deliver services more quickly; the California Department of Transportation made engineering improvements along the corridor to enhance driver safety; and CHP mounted an extensive public education campaign to remind motorists to drive safely.



Traffic Safety Administration and the California Office of Traffic Safety (OTS) to try this safety corridor concept for the first time in California.

During the selection of an initial corridor safety project, all state highways in California were considered. The selection process incorporated a variety of quantitative measures of the safety challenges on corridors throughout the state, along with more subjective information from traffic safety officials. The inset box contains a detailed discussion of the selection process used for the initial group of possible roadway corridors.

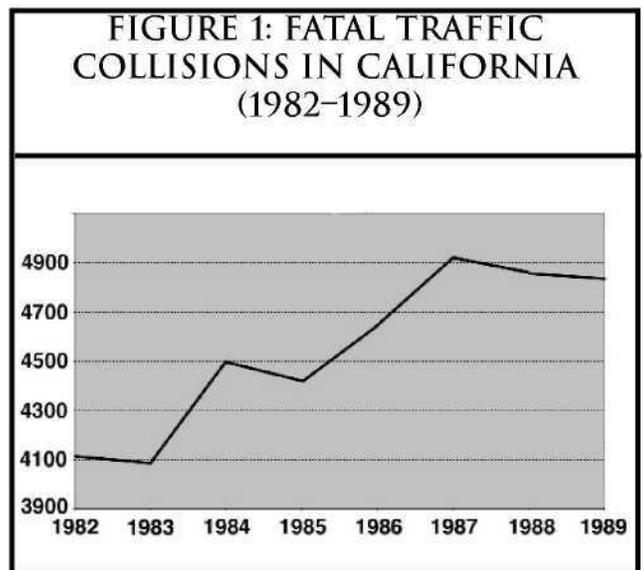
Using four years of "before" data (from 1988-1991), State Routes 41/46 were identified among the top half of the candidate routes based on collision rates (fatal, injury, and total) along with the mileage death rate (fatal victims per 100 million miles of travel). This made the corridor one of many that could be considered for the new program.

Assessment: The efforts were quite successful. Fatal collisions were reduced by 10 percent and injury collisions were reduced by 32 percent. A follow-up four-year data comparison showed continued safety benefits, especially in the more severe crashes, with a 27 percent reduction in collisions resulting in serious injuries. Over the five years of available data, it is estimated that the safety initiatives have saved 21 lives and prevented 55 injuries.

Scanning

When statewide fatalities began to increase in the mid-1980s (see Figure 1), it became evident that the CHP would have to expand its focus and seek the assistance of other traffic safety professionals in order to deal with the situation. The department developed a multi-faceted approach with input from a broad base of federal, state, and local entities to attack problems along a specific traffic corridor. Within two years, the CHP had an approved grant from the National Highway

This east-west corridor runs between two major north-south traffic arteries: Interstate 5, running through California's Central Valley, and US 101, along California's scenic central coast. SR 46,



Source: CHP Statewide Integrated Traffic Records System (SWITRS)

largely a two-lane rural route, is infamous as the roadway where actor James Dean was killed in the late 1950s. It maintained its reputation into the 1990s due to the frequency of fatal and injury collisions. Local residents dubbed the route "blood alley" and sought local, state and federal assistance to help improve safety along the SR 46 corridor. Collision data for the years 1992 through 1995 highlighted the deadly profile for both SR 41 and SR 46 (see Table 1).

Matters came to a head in an unfortunate series of fatal collisions in 1995. Traditional approaches were tried, including speed enforcement (some with aerial support) and a driving-under-the-influence (DUI) checkpoint. It became apparent that more must be done when a particularly violent crash claimed the lives of three local family members, including a young child. California State Senator Jack O'Connell and CHP officials in that part of the state were familiar with the concept of a safety corridor because CHP's first corridor program was located nearby. With a growing consensus for action, CHP Commissioner D.O. Helmick designated State Routes 41 and 46 as the third California safety corridor (currently, 22 corridor projects have been completed or are underway).

Analysis

Once a corridor has been selected, it is necessary to examine the specific collision fac-

INCIDENT	SR 41	SR 46	TOTALS
Total Collisions	622	459	981
Fatal Collisions	11	20	31
Injury Collisions	212	187	399
Fatalities	17	31	48
Injuries	348	344	692

tors associated with that particular stretch of roadway. This kind of analysis is facilitated by the CHP's Statewide Integrated Traffic Records System (SWITRS), a database of collision statistics from both CHP and local jurisdictions. All jurisdictions are required to file collision reports for fatal and injury collisions using CHP collision report forms. Information on collisions involving only property damage is submitted only if the jurisdiction investigates those incidents.

SWITRS provides data concerning the primary collision factors associated with each collision — vehicle type, time of day, weather, use of restraint systems, victim characteristics, and driver-at-fault. These statistics help develop a picture of the driving behaviors associated with traffic safety problems on each corridor and guide the development of effective solutions. SWITRS data for SR 41/46 showed the primary collision factors outlined in Table 2.

	FATAL COLLISIONS	INJURY COLLISIONS	PROPERTY DAMAGE ONLY	ALL COLLISIONS
1.	Unsafe turning	Unsafe turning	Unsafe turning	Unsafe turning
2.	Wrong side of road	Unsafe speed	Unsafe speed	Unsafe speed
3.	Improper passing	DUI	Driver not at fault	Auto right-of-way violations
4.	DUI	Auto right-of-way violations	Auto right-of-way violations	DUI
5.	Unsafe speed	Wrong side of road	DUI	Driver not at

**TABLE 3:
COLLISIONS, FATALITIES, AND INJURIES
ON THE COMBINED SR 41/46 SEGMENT (1992 - 1995)**

YEAR	TOTAL COLLISIONS	FATAL COLLISIONS	INJURY COLLISIONS	FATALITIES	INJURIES
1992	38	1	17	1	31
1993	40	3	13	4	26
1994	36	2	11	2	20
1995	43	6	18	14	34

Collisions occurred most frequently on Friday, Saturday, and Sunday between 1:00 p.m. and 6:00 p.m. The peak months for collisions varied by roadway. For SR 41, April through June had the highest number of collisions. For SR 46, it was the July through September quarter.

The merger of SR 41 and SR 46 led to an increase in traffic volumes, which rose approximately 3 percent per year from 1992 to 1995. In 1992, annual average daily traffic amounted to 12,800 vehicles. In 1996, the volume had increased to 14,400 vehicles. Collisions were particularly numerous on the combined 41/46 segment (see Table 3).

The Corridor Safety Task Force

A hallmark of the corridor approach is the inclusion of many stakeholders in the development of solutions to improve safety on a selected corridor. Corridor task forces include members from a broad base of both public and private sector entities, all of which have an interest in improving traffic safety along an identified corridor.

The focus of the task force is to determine the best courses of action for improving traffic safety based on the available collision and roadway data. In addition to driving behaviors, engineering characteristics of the roadway are studied to determine what, if any, impact they have on the safety of the corridor. The variety of viewpoints offered by the task force results in solutions tailored to a specific, community-based safety problem and provides a strong base of support

for implementing the solutions.

In March 1996, the CHP formed a task force to review the collision data and develop recommendations for safety improvements along the SR 41/46 corridor. The 31 members represented the CHP, Caltrans, local governments, fire departments, city police departments, state legislators, local public works departments, and federal transportation officials.

As in other corridor projects, the task force members traveled the length of the SR 41/46 corridor taking note of the physical characteristics that might adversely affect safety. Task force members studied:

- the adequacy of regulatory and advisory signage;
- the number of traffic or passing lanes;
- the presence of roadway shoulders and medians, and their size;
- the presence or absence of guardrails and other safety aids;
- the condition of the pavement; and
- the presence or lack of landscaping and how that might impact safety.

Based on the collision and traffic data, and the results of the task force corridor survey, a comprehensive picture of the overall safety along this corridor was developed. The primary collision factors spoke to the presence of aggressive driving and of impatient drivers behind large slow-moving vehicles who made unwise passing decisions.

Collision times and days reflected the presence of "weekend-warriors" who travel to the coast on the weekends to escape the valley heat. Analysis also suggested that many of those involved in collisions were workers employed at local farms during harvest who may have limited English skills, and who may be unfamiliar with drinking and driving laws, seatbelt laws, or other California rules-of-the-road.

Much of the corridor was quite remote. At the time of the survey, it was largely without cellular phone service and had too few call boxes, creating difficulties for motorists needing emergency services. Emergency medical services' jurisdictions further complicated the situation. Call response times were dependent on the EMS unit with jurisdiction over the area, which was sometimes not the closest unit to the scene. There was a lack of adequate roadway shoulders and medians, making it dangerous to pull over with a flat tire or other unexpected problem. Existing signage was confusing and inadequate, as were existing passing and merging lanes. Being an east-west route, glare was a problem during sunrise and sunset. The geometry of various roadway curves also contributed to poor visibility.

Response

The information collected by the task force led to the development of a comprehensive action plan designed to enhance traffic safety along the 41/46 corridor. The recommendations and proposed solutions were grouped into four basic categories: enforcement, emergency services, engineering, and education.

Enforcement

Three local CHP commands and two local police departments were involved in the plan to enhance enforcement and address the most frequent causes of collisions along the 41/46 corridor. Special overtime

enforcement operations were implemented and funded through federal traffic safety grants from the California OTS and the National Highway Traffic Safety Administration. Ultimately, officers worked 2,922 overtime hours, offered assistance and services to motorists 2,837 times, and issued 14,606 citations.

Emergency Services

Emergency response services were improved on the SR 41/46 corridor through the following actions:

- Emergency roadside call boxes were installed countywide in San Luis Obispo County.
- A CHP helicopter was permanently assigned to the CHP Coastal Division. The primary missions of this aircraft are medical evacuation of collision victims in remote areas, search and rescue, and traffic enforcement.
- The California OTS approved traffic safety grants for several county and city fire departments to fund the purchase of equipment used by emergency responders at traffic collision scenes.
- Agreements were reached with emergency service providers that the closest units may respond to traffic collision scenes, without regard to jurisdictional boundaries.

Engineering

Among the engineering improvements implemented under the direction of Caltrans, the following were particularly noteworthy:

- Delineation projects were completed where raised-profile thermoplastic striping was installed where passing was allowed in one direction. This striping is designed to get a driver's attention when the driver is fatigued, impaired, or over-correcting.

- In no-passing zones, a widened center median with rumble strips and thermoplastic striping was installed.
- Outside shoulders were treated with rumble strips and indented-profile thermoplastic striping to aid in keeping fatigued drivers alert and on the roadway.
- Several signing, striping, and maintenance projects were completed.
- Certain lane drops were reconfigured so that traffic consistently merged to the left.
- Striping at channelized intersections was refreshed to improve visibility of pavement markings.
- "Stop Ahead" warning signs were posted at certain key intersections; and, chevron signs were installed to warn motorists of impending curves.
- Several projects along SR 46 received top funding priority in the state's State Transportation Improvement Program funding plan.
- Caltrans posted signs along SR 46 declaring it a daylight headlight safety section, requiring motorists to turn on their headlights while driving because of the positive effects daytime running lights have shown in studies.
- The governor signed legislation making SR 46 a "double fine zone."
- Caltrans posted signs informing motorists that fines for violations would be doubled.

Education

A variety of educational programs and materials sought to involve the local media, businesses, government, and residents in reminding motorists to drive safely:

- Two million color flyers emphasizing safe driving habits were printed and distributed through educational institutions, newspapers, local businesses, restaurants, recreational facilities, and government agency offices.

- In-car litterbags, repeating the message of the flyers, were distributed to people who drive the corridor.
- Large and small posters were printed and posted in restaurants, at recreational destinations, and in local businesses, and emphasized the same safe driving habits.
- Local restaurants offered free cups of coffee or soft drinks to drivers who mentioned the corridor safety project. Media coverage included Spanish-language television and radio public service announcements regularly broadcast each weekend during the program's operation, intended in part to reach the area's local harvest workers.
- Three kick-off news conferences were held simultaneously just before the Memorial Day weekend in three separate locations along the corridor.

The status of the Task Force's 48 recommended actions, as taken from the project report, is provided in Table 4.

California Highway Patrol's experience with previous corridor safety projects has shown that a plan with these four action elements can considerably improve safety. Motorists are made aware of their current driving habits and provided ways to make their driving safer; enhanced enforcement is present to reinforce proper driving behaviors; the roadways on which they drive are

CATEGORY	PROPOSED	STATUS
Engineering	30	8 completed 10 initiated 12 pending
Emergency Response	4	3 completed 1 pending
Enforcement	1	1 completed
Public Education	13	13 completed

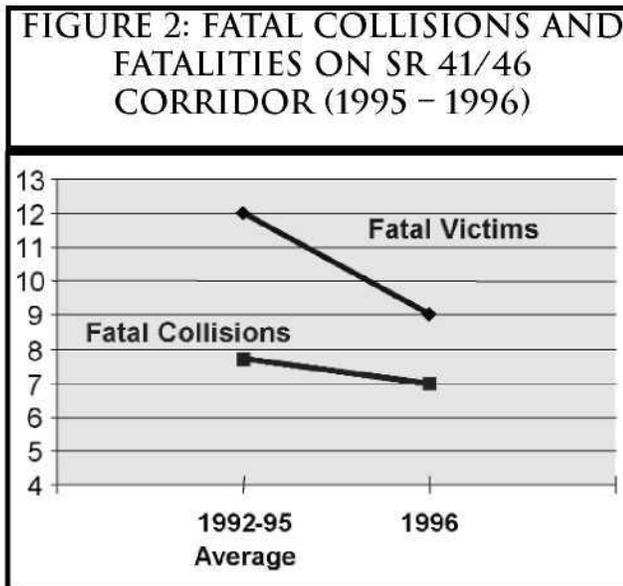
optimized for safety; emergency services are available more quickly; and, media attention involves the community as a whole and encourages everyone to be an equal partner in improving safety and saving lives.

Assessment

From a statistical point of view, the success of the corridor programs is measured by changes in collision levels. Fatal collisions are of the greatest concern, but are relatively rare events. Given the variability of these rare events from year to year, it can be difficult to measure the program's impact on fatal collisions. Injury collisions are much more common, and generally are a preferred measure of effectiveness. Fatal and injury collisions together are called reportable collisions.

A typical outcome evaluation of a corridor safety project involves a before and after study design, using exposure data (vehicle miles of travel) to adjust for the different time periods. The "before" time period is usually three years to avoid the undue influence of a recent bad year and the consequent problem of an apparent safety impact. The complete impact of the Task Force recommendations is rarely measured in full because the "after" evaluation periods are typically limited to one year for practical reasons (other corridor projects are competing for the same analytical talent). A one-year "after" time frame is often insufficient to develop, design, and implement engineering strategies, particularly if the cost or environmental impacts are substantial.

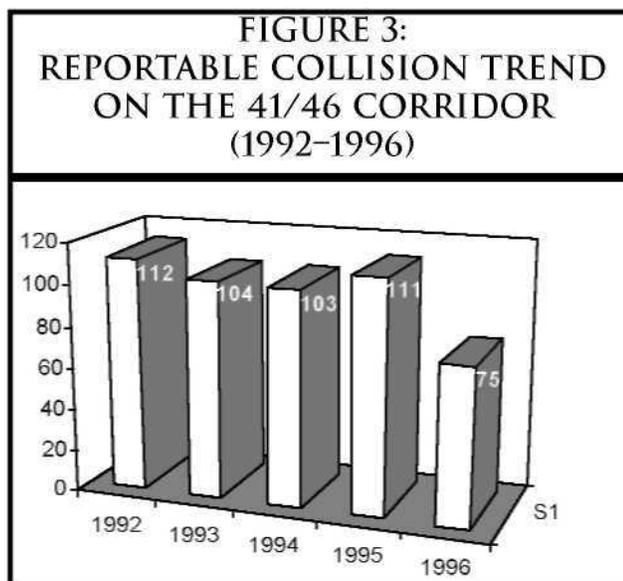
Substantial reductions in collisions occurred on the corridor since the beginning of the project. When comparing 1996 to an average of the previous four years, there was a 10 percent decrease in the number of fatal collisions (average = 7.75; 1996 = 7) and a 25 percent decrease in the number of people killed (average = 12; 1996 = 9). A comparison of 1995 to 1996 shows a 44 percent



decrease in the number of people killed in those collisions (from 16 in 1995 to 9 in 1996). Highlights of these decreases are in Figure 2.

A comparison of 1996 statistics to an average of the previous four years reveals a 32 percent decrease in injury collisions (average = 100; 1996 = 68) and an 11 percent decrease in the number of people injured (average = 173; 1996 = 154). There was a 35 percent decline in injury collisions when comparing 1995 to 1996 (from 104 to 68), and a 9 percent decrease in the number of people injured (from 170 to 154).

Figure 3 shows the decrease in "reportable" collisions (those in which a per-



TIME PERIOD	FATALITIES	SEVERE INJURY	TOTAL INJURED
1992-1995	48	68	692
1997-2000	31	50	656
Change	-17	-18	-36
Percent Change	-35.4%	-26.5%	-5.2%

son was killed or injured). There was a 30 percent decrease between 1996 and the previous four years (108 to 75) and a 32 percent decrease between 1995 and 1996 (111 to 75).

The longer-range perspective shows a continuing impact on more severe collisions, which is consistent with engineering improvements to reduce high-speed collisions involving improper passing. Comparing four pre-project years (1992-95) with four post-project years (1997-2000) shows a 35 percent reduction in fatalities, a slightly smaller reduction in severe injuries, and a 5 percent reduction in total injuries (see Table 5).

Unsafe turning was the primary cause of fatal and injury collisions on the two routes, and these collisions decreased 15 percent during the two time periods (see

FATAL AND INJURY COLLISIONS			
FACTORS	1992- 1996	1997- 2000	% CHANGE
Unsafe turning	91	77	-15.4%
Wrong side of road	36	33	-8.3%
Improper passing	20	13	-35.0%
DUI	52	45	-13.5%
Unsafe speed	73	79	8.2%

Table 6). Other primary collision factors generally decreased (note the 35 percent reduction in improper passing), with the exception of speed-related collisions (which also increased statewide).

The collision levels mentioned previously do not account for any changes in exposure, i.e., changes in the number of vehicles using the corridor. The statewide vehicle miles of travel have been increasing consistently since 1991, and available data indicates a similar trend on the corridor (+8 percent from 1993 to 1998). Other factors being equal, an 8 percent increase in traffic would result in an 8 percent increase in collisions, so the measured reductions are a conservative indicator of the actual safety benefits.

Other Evaluation Issues

A cost-benefit analysis was not conducted on this corridor because of the many different funding sources and agencies, and the extended time frame for potential collision reductions. The CHP spent just under \$90,000 in grant funds on this project, primarily for enforcement-related costs. Since 1996, approximately \$8 million has been spent on engineering improvements along the SR 41/46 corridor. These costs are easily outweighed by the societal benefits of fatal and injury collision reductions (estimated to be 21 lives and 77 injuries over the 1996 - 2000 time period).

Unintended benefits included community and political support for emergency response equipment in particular, and highway safety improvements generally. With this support and higher visibility, the local communities are more likely to be successful in the competition for state and federal highway funds.

Conclusion

The CHP's Corridor Safety concept has been extremely successful in improving safety along identified dangerous corridors. One

of the more positive effects of this concept is the continuing benefit once a "project" has ended its formal operational phases. For example, although the formal grant program along the SR 41/46 corridor has ended, the local CHP offices are still heavily involved in local safety efforts initiated with the task force action plan. Local residents also continue to keep public attention focused on the corridor with the "Fix 46" safety committee. Once the state establishes a corridor operation, the process allows the state to step back and let local communities continue efforts to maximize safety. For state fiscal years 2004 through 2008, approximately \$213 million has been "programmed" for further safety improvements along this stretch of roadway.

Corridor Safety Projects have also helped California make dramatic improvements in the number of fatal collisions occurring in the state. Since 1987, when fatal collisions peaked at 4,920, the number has dropped by 36 percent to 3,144 in 1999. Likewise, the state's mileage death rate (MDR), the number of persons killed for every 100 million miles of travel, has seen similar declines. In 1987, the MDR stood at 2.4, but has since dropped to 1.19 in 1999 — a decline of over 50 percent. A concentrated focus on traffic safety through projects such as the Corridor Safety program, occupant restraint enforcement, and drunk or impaired driver enforcement has led to these dramatic results.

The success of the CHP's corridor safety concept also has resulted in the development and implementation of 22 Corridor Safety Projects. Most have resulted in successes similar to the 41/46 corridor project. In addition, the concept has been further expanded to address two other prominent traffic safety issues: pedestrian fatalities and commercial vehicle safety.

In 1997/98, two pedestrian corridor safety projects were introduced in Modesto,

California and in south Los Angeles to reduce fatality collisions involving pedestrians. Other pedestrian corridor programs are currently in operation in Hayward, east Los Angeles, and Santa Fe Springs.

In August 2001, the first commercial vehicle safety corridor began operations along the Interstate 710 corridor in southern California. A second corridor program is scheduled to begin operations along Interstate 5 in Sacramento County in the fall of 2001, and a San Francisco Bay Area corridor will be selected and begin operations sometime in early 2002.

The corridor safety concept works well within the Problem-Oriented Policing analytical model of Scanning, Analysis, Response, and Assessment. The program is easily replicated and can be applied to a variety of traffic safety and other issues facing law enforcement. It maximizes participation by local communities and encourages a continuing local commitment to this goal. The corridor concept truly makes traffic safety a collaborative effort!

A d d i t i o n a l i n f o r m a t i o n

The formal evaluation report for the SR 41/46 Corridor Safety Project is available from the CHP's Office of Special Projects (see address below), or from the California State Library (www.library.ca.gov). It is titled: California Highway Patrol. Highways 41-46 Safety Corridor Task Force. Task force final report, SR 41-46 traffic safety corridor: Dept. of California Highway Patrol, Office of Special Projects, [1997], Call No. H325.H56 R4, Government Publications.