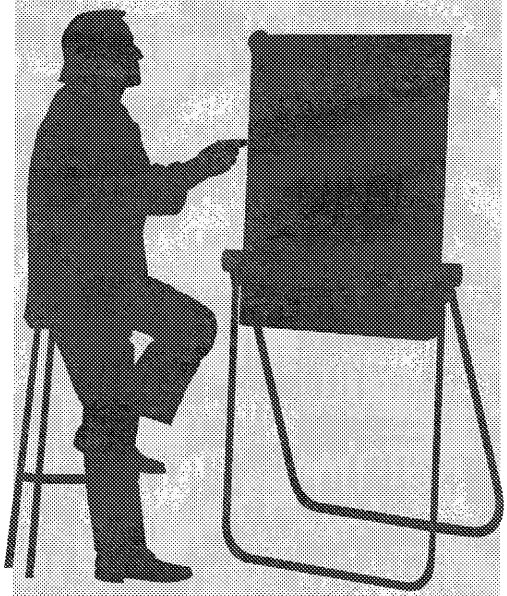
FINAL REPORT

LESSONS LEARNED FROM VIRGINIA'S PILOT CORRIDOR SAFETY IMPROVEMENT PROGRAM



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Abstract

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Corridor safety improvement programs (CSIPs) use an approach to traffic safety that emphasizes multidisciplinary cooperation as a means of identifying and targeting traffic safety problems and implementing corrective countermeasures. In 1990, the Federal Highway Administration (FHWA) began emphasizing CSIPs as a wise use of limited highway safety improvement resources and published guidelines for their implementation in 1991.

Rather than follow the FHWA guidelines explicitly, Virginia decided to try a slightly different approach to determine if the CSIP process could be enhanced. In particular, Virginia's pilots placed more responsibility for identifying problems and developing countermeasures on local multidisciplinary task forces than recommended by the FHWA guidelines. The procedures used in the rural and urban pilot projects were compared with each other and with the FHWA guidelines to determine the successes and shortcomings of the CSIP process as implemented in Virginia.

The report recommends that Virginia not continue the CSIP process unless the FHWA guidelines and other key recommendations are followed to establish a new pilot.

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A report prepared by the Virginia Transportation Research Council
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INTRODUCTION

Doing more with less is a common theme at all levels of government in the United States today. Limited budgets and staff and rising costs have forced all areas of the public sector to use their resources wisely and efficiently. Thus, transportation agencies must focus on problems that have the greatest potential benefits relative to costs.

Corridor safety improvement programs (CSIPs) use an approach to traffic safety that emphasizes multidisciplinary cooperation as a means of identifying and targeting traffic safety problems and implementing corrective countermeasures, thereby integrating improvements involving the highway, human factors, and vehicles. In 1990, the Federal Highway Administration (FHWA) began emphasizing CSIPs as a wise use of limited highway safety improvement resources, and the U.S. Department of Transportation identified corridor, pedestrian, and motor carrier safety programs as three major safety initiatives to be implemented nationwide.[1]

CSIPs are premised on the fact that crashes tend to occur along connected segments of highway, known as corridors. Some corridors have relatively high crash, fatality, and injury rates that may not be alleviated solely by spot highway improvements. In these cases, multiple factors likely contribute to the problems. CSIPs seek to identify these problems and formulate countermeasures using a multidisciplinary approach involving engineering, enforcement, education, and emergency response personnel. This approach provides a broad perspective in which problems and potential corrective measures are less likely to be overlooked. In addition, individuals or groups that participate in the CSIP may develop a sense of ownership in the process, thereby having an increased interest in seeing that the problems of the corridor are corrected.

CSIPs are the result of a concept developed in Pennsylvania for an 8.0-km (5-mi) corridor of U.S. 322, a high-volume, high-speed, two- and four-lane highway. In response to a multiple-fatality crash on the corridor, Pennsylvania's governor requested that the Pennsylvania Department of Transportation (PennDOT) develop a crash-reduction plan. To develop the plan, PennDOT assembled a multidisciplinary team, which included the department's chief safety engineer, a traffic engineer, a maintenance engineer, and local elected and police officials. The team recommended a 14-point improvement program, including enhancing signing and pavement markings, reducing speed limits, increasing local police enforcement, installing a concrete

median barrier, placing anti-skid pavement surfaces, and establishing an area for commercial vehicle inspections. The plan was fully implemented within 6 months. Because of the dramatic success of this effort, PennDOT analyzed crash data to identify other problem corridors. This innovative approach was documented and is the model with which other states have developed CSIPs.[1]

In 1991, FHWA published guidelines for developing a CSIP, which noted that rural and urban arterials have a high number and density of fatalities per kilometer.[2] Many of these arterials are free-access facilities with operating speeds of 64.4 km/h (40 mph) or greater. The guidelines suggested that corridors with particularly high crash and severity rates be selected as candidates for a CSIP. Further, the guidelines outlined a 13-step CSIP implementation process:

1. *Designate a lead agency,* preferably the state department of transportation or highways. This agency should designate a program manager to develop, coordinate, and manage the CSIP.

2. *Determine what agencies need to be involved from the outset of program conception.* The representatives of these agencies should be at a level high enough to make commitments for the agency.

3. *Determine conceptually what types of activities are needed to reduce crashes and save lives on the corridor from the highway, human factor, vehicle, and emergency response perspectives.*

4. *Determine what existing agencies are doing, what resources are required, and what resources are available to implement the CSIP.* Such resources include data, staff support, time, and funding.

5. *Conduct an initial corridor meeting.* The upper-management representatives from the agencies should be included. The objectives of the meeting include providing an understanding of the CSIP concept, developing a firm direction for the CSIP, and establishing an understanding of the multiagency involvement and contacts.

6. *Establish selection criteria, and select a corridor.* Corridors with high crash and severity rates and those identified by the public because of safety concerns should be considered. The candidate corridors should reflect logical roadway configuration boundaries, such as a highway that connects two major arterials. The candidates should be categorized by priority, taking into account whether there is no potential for major replacement in the near future, whether recent improvements may have corrected the problems, and whether recent or planned changes along the corridor may heighten safety concerns.

7. *Develop an action plan.* The highway, human factor, vehicle, and emergency response perspectives must be taken into account. Crash data should be reviewed in detail by the lead agency to identify the problems on the corridor. Police, emergency medical, school, and other officials should be interviewed to gain insight and different perspectives on the problems. The completed plan should include a list of problems on the corridor and possible safety initiatives.

8. *Establish a multidisciplinary safety team of 10 to 15 members to gain further insight into the problems and solutions to be implemented, obtain community support, and gain access to groups and individuals who can assist in implementation.* The team does not have to meet frequently but should provide advice and concurrence in problem analysis and identification of potential safety initiatives. At the first meeting, an overview of the CSIP and the corridor should be presented and existing programs discussed. Problem identification analysis should be presented, and the team asked to point out any omissions. Safety initiatives should be reviewed, and those worthy of pursuit identified. Important considerations are whether a majority of the people or organizations responsible for implementation concurs with the recommendations and whether sufficient funds are available to ensure satisfactory implementation.

9. *Revise the plan.* Based on the team's input, the plan should be revised and reviewed with the corridor safety program manager for technical and financial soundness.

10. *Present a final draft action plan at the second meeting of the team.* Any final comments should be incorporated into the plan.

11. *Schedule a media conference, and announce the plan.*

12. *Implement the initiatives.* This includes securing funds and establishing a schedule for implementation. Major changes in the plan should be taken back to the multidisciplinary team for advice and concurrence.

13. *Evaluate the effectiveness of the initiatives.* The evaluation should include activities conducted, changes in crashes, and intangibles such as improved cooperation and communication.

In early 1992, the Virginia Department of Transportation (VDOT) decided to establish a pilot CSIP. Rather than follow the FHWA guidelines explicitly, VDOT decided to try a slightly different approach to determine if the guidelines could be enhanced. In particular, VDOT decided to try to encourage more active participation by team members by giving them greater responsibility in identifying crash problems and determining appropriate countermeasures. VDOT also decided to pilot the CSIP in a rural and an urban area to determine potential differences in the ability of the process to be effective. Additionally, VDOT did not limit team

membership to 15. To obtain greater public input, VDOT replaced the media conference with a public meeting so the public could comment on the program.

PURPOSE AND SCOPE

This study evaluated Virginia's pilot CSIP by documenting the process used and the lessons learned. The focus was not the effectiveness of the countermeasures, but rather the ability of the CSIP process, as implemented, to establish countermeasures that have the potential to reduce crashes and injuries.

METHODS

This study compared the CSIP process as implemented in Virginia with that described by the FHWA guidelines. Since deviations from the guidelines were planned, they were not considered a deficit of the program. However, the study allowed for a structured comparison of Virginia's pilot program with a process that has documented success. Successes and shortcomings of Virginia's implementation were determined, and key recommendations were developed by comparing the rural and urban pilot projects with each other and with the FHWA guidelines.

The author attended all but two of the local task force meetings and conducted the analysis from notes he took at those meetings, the project manager's notes, and his and the project manager's files on the project. The measure of success or failure was the ability of the program to establish a process that resulted in implementing countermeasure programs that have the potential to reduce crashes and injuries.

DESCRIPTION OF VIRGINIA'S PILOT CSIP

Agency Involvement

From the outset, VDOT was the lead agency, and the program was endorsed by VDOT's Assistant Commissioner for Operations and the Administrator of the Traffic Engineering Division. A senior traffic engineer in the division was designated the program manager, and overseeing the CSIP was to take 50 percent of her work time.

The Office of the Governor's Highway Safety Representative, which is the Transportation Safety Administration of the Department of Motor Vehicles (DMV), expressed great interest in

the CSIP and wanted an active role in its development. Thus, DMV was made a cosponsor of the program.

Steering Committee

The Steering Committee was to be the executive committee of the CSIP. Upper management representatives from VDOT, DMV, the Department of Health's Office of Emergency Medical Services (EMS), the Virginia Department of State Police (VSP), and the Virginia Alcohol Safety Action Program (VASAP) had a preexisting relationship as members of the Transportation Safety Policy Committee. These representatives and management representatives of the Department of Education's Office of Driver Education (DOE) and Department of Alcohol Beverage Control (ABC) were selected to serve on the committee. The co-chairs were VDOT's Assistant Commissioner for Operations and DMV's Deputy Commissioner.

Corridor Selection

Selection of Locations

In July 1992, VDOT decided to establish pilot corridor projects in a rural and an urban area of the state. The Roanoke area of southwest Virginia was selected for the rural pilot because the VDOT district traffic engineer and DMV transportation safety field coordinator, who oversees DMV's community traffic safety program, had a long history of working together effectively.

The Richmond area was selected for the urban pilot. Northern Virginia is dealing with extreme traffic congestion, and many large cities in Hampton Roads maintain their own roads. The Richmond area was selected so that the unique challenges of Northern Virginia and Hampton Roads would not complicate the implementation of the pilot.

There was a lengthy consideration of whether VDOT or a local task force should choose the corridors. The decision was that VDOT would make the choice. In April 1993, VDOT developed a project work plan. In July, the Steering Committee met and members were briefed on the corridor concept and told that two corridors would soon be selected.

Corridor Selection Analysis

VDOT wanted to choose corridors with the worst crash severity problems in the two VDOT districts. For each district, primary routes under VDOT's jurisdiction were eligible for consideration. VDOT used its *Summary of Accident Data* for the years 1988 through 1990,[3] which lists crash information for primary roads by segment, as the basis for its analysis.

For each segment, vehicle miles of travel, which is based on the length of the segment and the annual average daily traffic, was used to calculate crash rates. Fatality, injury, and severity rates (the number of fatal and injury crashes divided by the total number of crashes) were calculated and converted to a z score based on the district average for each measure. A z score is the number of standard deviations a rate is from the district mean. A z score of 1.0, for example, means that a rate was 1 standard deviation above the district average.

The segments with the highest z scores were generally those less than 1.6 km (1.0 mi) long. With such a short length, one injury or fatality could result in an extremely high crash rate, particularly on segments with a low traffic volume. Thus, segments less than 1.6 km (1.0 mi) long were excluded from the analysis. The candidate corridors were drawn from segments with a z score above 2.0 for any measure for 2 of the 3 years and at least 1.0 in the third. Adjoining segments with generally positive z scores were linked to create a corridor with natural termini at major routes. VDOT's district traffic engineer for each area was asked to add corridors to the list of candidates. Candidate corridors were from 4.8 to 48.3 km (3 to 30 mi) long. The candidates were ranked for each measure, and the ranks combined to give an overall ranking for each corridor.

The project manager determined whether any candidates had recently been improved or were to receive significant improvements in the near future. This process eliminated several candidates. The urban corridor was selected by the project manager after she reviewed various candidate corridors suggested by VDOT's district traffic engineer. The rural corridor was selected based on the consensus of VDOT's district traffic engineer, DMV's transportation safety field coordinator, and the project manager. The rural corridor had been the subject of a great deal of citizen interest for many years, but the urban corridor had not.

In November 1993, the Steering Committee was informed of the corridor selections. Candidates for the multidisciplinary safety teams (task forces) in the two districts were elicited from the committee. The members were to include local and regional agency personnel, representatives of state agencies, and members of other groups deemed to have a specific interest in the project. Each task force was co-chaired by the VDOT district traffic engineer and the DMV transportation safety field coordinator.

Urban Corridor Program

Description of Corridor

The urban corridor, U.S. 144, is a two-lane minor arterial connecting U.S. 1 and U.S. 10 in southern Chesterfield County. The corridor is 8.7 km (5.4 mi) long, with an average daily traffic count of 6,780, 3 percent of which is single-unit trucks and tractor trailers. The northern end is more heavily traveled than the southern end. Subdivision development is substantial and is concentrated from the middle of the corridor to its northern end. The speed limit varies from

56.3 km/h (35 mph) for a short distance at the northern end, to 72.4 km/h (45 mph) in the middle, to 88.5 km/h (55 mph) at the southern end.

Except for its northern and southern ends, the corridor is generally straight. The road has 3.05-m (10-ft) lanes and 1.22 m (4 ft) of unimproved shoulder in both directions. In calendar years 1989-1992, 202 crashes occurred on the corridor: 3 fatal, 118 injury, and 81 property damage only. The crash rate of 375 per 100 million vehicle miles of travel (HMVMT) across the 3 years was more than double the 1990 rate of 176 for the state's primary system. The injury rate of 332 per HMVMT was almost triple the 1990 rate of 112 for the state's primary system. The fatality rate of 5.57 was more than double the 1990 rate of 2.3 for the state's primary system. The factors involved in the crashes are listed in Table 1.

TABLE 1
CRASH FACTORS FOR URBAN CORRIDOR

Factor	% of Total
Passenger vehicle	91
Driver inattention	74
Alcohol	11 (slightly below 13% state average)
Rear-end crashes	33
Angle crashes	36
Fixed object, run off road	15
Sideswipe	5

Task Force Members

The task force consisted of 21 members. The program manager and two research scientists from the Virginia Transportation Research Council (VTRC) served as ex officio members. The agencies represented were DMV, VDOT, ABC, ASAP, local fire and EMS units, elected county supervisors, state and local police, county schools, local transportation agencies, a planning commission, and a transportation safety commission.

Task Force Deliberations

Between February 1994 and March 1995, seven meetings were held. Fourteen members attended the first meeting, and between 9 and 11 attended the second through fifth meetings. Only 5

attended the sixth and seventh. Of the 16 members who did not represent either VDOT or DMV, 9 attended the first meeting, 5 or 6 the next four, and only 1 the last two.

Meeting 1. Members were briefed on the corridor concept and given descriptive information concerning the corridor, including physical and crash data, aerial photographs, and intersection crash diagrams. They were asked to take the information with them, identify and prioritize the problems, and decide how the problems should be addressed.

Meeting 2. Suggested initiatives included moving a flashing school zone sign to the other side of a hill; slowing traffic by lowering the speed limit or selective speed enforcement; resurfacing pavement; conducting a public information campaign; conducting an origin and destination (O&D) survey; cutting back the tree line; and adding turn lanes at problem intersections.

A speed sample would be taken, and police officials agreed to determine the cost of providing selective enforcement for 1 year. VDOT agreed to conduct a skid test to determine the condition of the pavement. Since a rescue station was being added near the south end of the corridor, response times would be reduced in a matter of months.

Meeting 3. The police agencies reported that about 8 weeks of selective enforcement would cost approximately $3,500. DMV reported that about $10,000 was available to help establish nonhighway countermeasures on the corridor. The members were asked to review the crash data in detail to determine where turn lanes might be beneficial.

Meeting 4. It was reported that the school zone sign could be moved easily and that a contractor had been hired to trim the trees along the corridor. The O&D survey was scheduled. VDOT agreed to investigate countermeasures for run-off-road crashes. DOE would alert driver education instructors at neighboring schools of a young driver crash problem. Prioritizing intersections for improvement was discussed.

Meeting 5. It was noted that cost estimates would be needed to determine how many intersections could be improved, given the allotted funds. The O&D survey was rescheduled.

Meeting 6. Skid test results were presented, and no problems were noted. Cost estimates for intersection improvements were too rough for establishing priorities. The O&D survey revealed that most of the traffic was local rather than cut through. A local television station and two local newspapers covered the survey, noting that the corridor was being targeted because of its crash problems. The trees had been trimmed, and the brush cut back.

Meeting 7. A slope on the northern end of the corridor had been cut back substantially to improve sight distance. Final cost estimates for intersection improvements and a paved shoulder, which addressed the run-off-road crash problem, were presented. The decision was made to add a paved shoulder to the southern end of the corridor.

Shortly after the seventh meeting, the project was canceled by the Administrator of VDOT's Traffic Engineering Division because of a lack of interest by the task force.

Rural Corridor Program

Description of Corridor

The rural corridor, U.S. 24, is a 28.0-km (17.4-mi) long minor arterial highway connecting U.S. 122 in Bedford County and the town of Vinton in Roanoke County. The western end is a 3.2-km (2 mi) long four-lane divided highway with 3.66-m (12-ft) lanes and 1.58-m (5-ft) shoulders. The remainder is a two-lane highway on rolling to mountainous terrain with 3.35-m (11-ft) lanes and 1.22- to 2.44-m (4- to 8-ft) unimproved shoulders. The corridor has substantial rural and residential development, and it provides access between Roanoke and the recreational area of Smith Mountain Lake. Traffic varies widely, with the western end having an average daily traffic volume of 17,000 and the eastern end 2,100. The corridor is characterized by numerous vertical and horizontal curves.

In calendar years 1990-1993, there were 276 crashes on the corridor: 7 fatal (1 pedestrian), 135 injury, and 134 property damage only. The crash rate for the 4 years was 269 per HMVMT, more than the 1990 rate of 176 for the state's primary highways. The injury rate was 131 per HMVMT, more than the 1990 rate of 112 for the state's primary highway. The fatality rate was 6.8 per HMVMT, almost triple the 1990 rate of 2.3 for the state's primary highways. The factors involved in the crashes are listed in Table 2.

TABLE 2
CRASH FACTORS FOR RURAL CORRIDOR

Factor	% of Total
Passenger vehicles	92
Driver inattention	57
Alcohol	9 (slightly below 13% state average)
Speeding	6
Defective vehicles	4
Rear-end crashes	23
Fixed object, run off road	25
Sideswipes	4
Crashes with deer	7

Task Force Members

The task force consisted of 25 members. The program manager and two research scientists from VTRC served as ex officio members. The members represented DMV, VDOT, ABC, ASAP, local fire and EMS units, elected county supervisors, state and local police, county schools, a planning commission, a transportation safety commission, a local community development agency, a community group, and private business.

Task Force Deliberations

Between June 1994 and April 1995, six meetings were held. The first was attended by 16 of the members. To encourage more active participation of the voluntary fire and EMS representatives, the second meeting was held in the evening. All 25 members and three interested citizens attended. The third meeting was attended by 9 members, the fourth by 14, and the fifth and sixth by 9. Of the 20 members who did not represent VDOT or DMV, 12 attended the first meeting, 20 the second, 6 the third, 11 the fourth, and 6 the fifth and sixth.

Meeting 1. Members were briefed on the corridor concept and given descriptive information on the corridor, including physical and crash data and intersection crash diagrams. Because of the introduction of the CSIP, VSP was planning to conduct a DUI checkpoint. DMV reported that $10,000 was available to fund nonhighway improvement programs. Suggested initiatives included closing down some passing lanes and conducting an O&D survey. One member complained that VDOT had previously turned down all requests for improvements to the corridor. The members were asked to take the physical and crash data with them, identify and prioritize the problems, and determine how the problems should be addressed. It was suggested that the second meeting be held in the evening so that representatives of the local volunteer fire and EMS units, who had other employment, could more easily attend.

Meeting 2. This evening meeting was attended by every member and three concerned citizens. The corridor concept was briefly reviewed for the benefit of those who had missed the first meeting, and these members were given the physical and crash information. VSP's DUI checkpoint had resulted in 17 DUI arrests.

Suggested initiatives included reducing the speed limit, installing traffic signals, targeting enforcement, installing guardrail, and adding a paved shoulder. Many fire and EMS representatives were adamant in requesting that several passing lanes be closed. The VDOT district traffic engineer said that a number of conditions needed to be met before a passing lane could be closed and that a long stretch of highway without a passing zone might result in motorists passing in areas where it was not allowed. However, he said he would study one area that was of greatest concern to the members.

It was also suggested that the percentage of out-of-town traffic involvement in crashes and the volume of alcohol sales by licensed establishments along the corridor be determined. Several members, particularly the fire and EMS representatives, expressed discontent with VDOT's denial of improvement requests that had been lodged over the years. At the end of the heated meeting, the program manager suggested that the members examine the crash data and give suggestions to the VDOT resident engineer on which problems to address and how to address them.

Meeting 3. This meeting was split into two sessions, with the evening session devoted to fire and EMS representatives. However, none of these representatives attended the evening meeting and only 1 attended the morning session.

At the morning meeting, suggested initiatives included installing guardrail; closing several passing lanes; installing turn lanes; changing the approach to an intersection; lowering the speed limit; correcting a drainage problem; installing a sign along the corridor to warn people that it was a frequent target for DUI checkpoints and selective speed enforcement; and using billboards or a variable message sign (VMS) to display public service messages. Since regulations prohibited the use of federal funds for billboards, the space would need to be donated.

Data on annual alcohol sales along the corridor were presented. VSP submitted a proposal to conduct two DUI checkpoints, 80 hours of selective speed enforcement, and a commercial motor vehicle checkpoint at a cost of $6,700. The project manager agreed to write a letter of support for the proposal to DMV. Concern was expressed about the drastic drop in the traffic count at the more urban end of the corridor. Although VDOT uses only one location on a segment for a traffic count, it was believed that the drop underrepresented the traffic. VDOT agreed to investigate the cost and appropriateness of implementing the suggested changes.

Meeting 4. Members were given articles from local newspapers on the work of the task force and the possibility that VDOT's traffic count procedures had underrepresented the traffic. Two grant applications for $3,000 each for enforcement had been sent to DMV for approval. The VSP representative noted that a commercial vehicle selective enforcement effort had resulted in three trucks being impounded. It was noted that VDOT had adopted a policy to use VMSs for specific traffic warnings and messages only in order for the public to recognize that these messages would always be of immediate importance. The speed limit would be reduced on part of the corridor; four passing zones would be closed; tape rumble strips would be installed at a major intersection; a flashing school zone sign would be moved to the other side of a hill; advance warning signs for intersections would be placed throughout the corridor; "WATCH FOR TURNING VEHICLES" and "WATCH FOR ENTERING VEHICLES" signs would be placed in front of the high school; and the drainage problem would be corrected.

A list of additional highway improvements, their costs, and the number of injuries and fatalities at the locations were also presented. This list included installing turn lanes at five

intersections; improving sight distance by replacing a grass median with a concrete median at an intersection; installing guardrail; and installing a paved shoulder.

Members were given revised crash data and asked to vote on their top three choices for highway improvement, given that there was only $500,000 in available funding. The list of the potential projects and the revised crash data were sent to the members who were not present, and they were asked to select their top three choices.

Meeting 5. The results of the balloting were presented. Installing guardrail at several locations and installing left-turn lanes at two intersections were given the highest priority. These measures were to be placed on VDOT's schedule.

DMV announced that grants were being awarded to construct two speed trailers, which used radar speed detection and a large display to inform motorists of their speed. A public meeting was scheduled. In the interim, a local newspaper ran an article on the problems of the corridor and the proposed improvements.

Meeting 6. Members made recommendations and commitments for long-range improvements. The task force agreed to support funding for the following: additional state police, the purchase of portable scales by VSP, the purchase of additional fire and EMS units, implementation of a Juvenile and Adult Driver Improvement Program, and implementation of additional highway improvements. VSP and ABC committed to continuing school presentations to warn against the hazards of drinking and driving. Members also expressed their desire that the corridor be expanded to four lanes.

COMPARISON OF VIRGINIA'S PROGRAM WITH THE FHWA GUIDELINES

Virginia's implementation of the CSIP deviated significantly from the FHWA guidelines. The following is a step-by-step comparison.

Step 1: Designate a Lead Agency

This step was followed. VDOT was the lead agency, and 50 percent of a senior traffic engineer's time was devoted to program management.

Step 2: Determine Agencies to Be Involved

This step was followed. Upper management was included in the CSIP by building a steering committee around an existing transportation safety policy committee. DMV offered to cosponsor the program.

Step 3: Determine Types of Activities Needed

This step was followed. Before the initial meeting of the steering committee, a project work plan was developed. The plan included a list of the general types of activities that might be employed from the highway, human factor, vehicle, and emergency response perspectives.

Step 4: Determine Agency Activities and Availability of Necessary Resources

This step was not followed. No information was gathered from any agency other than DMV or VDOT before the initial meetings of the task forces. Requests for agency-specific data, staff support, and funding were made only after the initial meetings. Other than the $500,000 secured for highway improvements on each corridor, $10,000 in Section 402 funds for nonhighway improvements on each corridor was the only source of funds identified.

Step 5: Conduct Initial Corridor Meeting

This step was followed. The steering committee meeting was attended by upper management representatives from all invited agencies. The CSIP concept was explained, and the target geographic regions from which the corridors would be selected were announced. The representatives agreed that their agencies would participate in the process in the target areas.

Step 6: Establish Selection Criteria and Select a Corridor

This step was followed, but the selection process took a long time. The decision to select an urban and a rural corridor was made in July 1992, but the corridors were not selected until November 1993.

Step 7: Develop an Action Plan

This step was not followed. Although the crash data were reviewed and cross tabulated to reveal the types and locations of crashes on the corridors, the identification of problems and specific countermeasures was left to the task forces.

Steps 8-10: Use Multidisciplinary Team, Revise Plan, and Present Final Draft of Plan

These steps were not followed. The teams were formed, but they had more than the 10 to 15 members suggested by the guidelines. Rather than reacting to a specific plan and making modifications, the task forces were charged with analyzing the data, proposing solutions, and

determining the top priorities. This resulted in a lengthy process. Further, because specific potential solutions had not been fully investigated before the initial meeting of the task force, the prioritization of potential countermeasures was delayed until VDOT could develop reliable cost estimates. Attendance at the first one or two task force meetings was relatively high but dwindled for subsequent meetings. Had the task force been presented with a plan that included details of the specific problems, their potential solutions, and the cost estimates for those solutions, the lengthy process could have been shortened substantially. Likewise, a shorter process would have eliminated the need for the final few meetings, which were poorly attended. Only new suggestions would have had to be investigated.

Step 11: Schedule Media Conference and Announce Plan

This step was not followed. Instead of a media conference, a public meeting was scheduled. However, no public meeting was held for the urban corridor.

Step 12: Implement Initiatives

This step was followed for the rural corridor. Countermeasures were either implemented or scheduled. Also, a number of countermeasures were implemented on both corridors during the time that the task forces were meeting.

Step 13: Evaluate Effectiveness

This step was not followed. Rather than evaluate the effectiveness of the countermeasures, VTRC decided to evaluate Virginia's CSIP process itself to determine its strengths and benefits.

DISCUSSION

Corridor Selection Process

The 16 months it took to select the corridors for the pilot substantially delayed the implementation of the CSIP. However, this delay was not a significant impediment to the success of the program. When the steering committee met 4 months before the selection of the corridors, all invited agencies attended and agreed to participate. Likewise, the first one or two meetings of the task forces were well attended. Thus, the delay created by the lengthy selection process had no effect on initial interest or willingness to participate in the program. However, delays at the beginning of a program such as this ultimately result in a delay in implementing countermeasures.

Attempts were made to identify the corridors with the worst crash problems for both target areas. Multiple measures were used, but no corridors were consistently problematic in each year analyzed. Several strong candidates were eliminated because they had or were scheduled for major improvements. Both selected corridors had worse-than-average crash problems.

The urban corridor was at the far edge of the suburban development of the county. It carried mainly local traffic and, therefore, was likely of interest primarily to those who lived along or near it.

The rural corridor, however, had received a great deal of public attention over the years. Widening the corridor to four lanes and improving its safety had already been the subject of many complaints to VDOT. Thus, the rural corridor had both a crash problem and high public interest.

Ironically, the use of selection criteria that primarily used crash data to select a corridor with the worst evidenced crash problem was flawed. The dramatic drops in traffic counts between the segments of the corridor may have influenced the estimate of the crash problem. A long segment with one traffic count may actually have much more traffic at one end of the segment than the count would indicate. If the count is taken near the end of the segment with less traffic, traffic will be underestimated. Crashes may be concentrated on the end with more traffic and may be no more than expected for that level of traffic. However, normalizing the data by a low traffic count would artificially inflate crash and severity rates. Thus, the high crash and severity rates for these corridors may, at least in part, be a function of traffic underestimation rather than crash and severity overrepresentation.

The importance of public interest was underestimated in this project. Selecting a corridor based solely on crash data may not be wise. The Pennsylvania model was begun because of the attention a single multiple-fatality crash brought to a corridor. The public attention and, particularly, the governor's concern made it imperative that the problems be addressed. The governor's involvement likely made the resolution of these crash problems a top priority of PennDOT. Although the crash problems on the corridor were real, selection of the corridor was based on public interest.

In the Virginia pilots, the rural corridor had a long history of public interest. There was no such interest in the urban corridor. Interestingly, a great deal of displeasure and even hostility were expressed toward VDOT at the early rural task force meetings for not implementing previous requests for improvements. No such displeasure or hostility was expressed in the urban task force meetings. However, the urban corridor program was canceled because of lack of interest by the task force. Although attendance waned in the latter meetings of the rural task force, the task force completed its prioritization of problems and countermeasures.

Size of Task Force

According to the FHWA guidelines, the multidisciplinary safety team should have no more than 10 to 15 members so that it does not become unwieldy. Both task forces had more than 20 members. The fully attended meeting of the rural corridor's task force had 31 participants. It was indeed unwieldy and resulted in a heated exchange. A number of members did not attend another meeting. The size of this meeting and its nature of eliciting comments from participants likely contributed to creating a hostile environment.

Identification of Problems and Countermeasures

Using the task forces to review crash data, propose countermeasures, and determine priorities significantly delayed the implementation phase of the CSIP. Part of the delay was created because of the time it took the task force to review the data and propose solutions. At least as substantial a delay was created by the time it took VDOT to develop cost estimates for proposed solutions. Unlike the delay created by the corridor selection process, the delays at this stage were noticeable and were the source of frustration for the participants. Delays at this stage were likely causes of the fatal loss of participation in the urban task force and the substantial loss of participation in the rural task force. Preparing a detailed list of crash problems and proposed countermeasures with their cost estimates before the initial meeting of the task force, which is consistent with the FHWA guidelines, would have eliminated much of this delay. Giving a high priority to developing cost estimates would eliminate even more.

Funding

Of the $1.02 million initially made available for corridor safety improvements, only $20,000 was available for nonhighway improvements. That is, initially, $1 million was allotted by VDOT for highway improvements and $20,000 by DMV for grants to other agencies for nonhighway improvements. VDOT and DMV were, however, cosponsors of the program. No other dedicated allocations were made by participating agencies, although some agencies used existing resources to contribute to improving the corridor. The relatively few dollars available for nonhighway improvements all but eliminated the possibility of implementing countermeasures related to the human factor, vehicle, and EMS perspectives. Additionally, the lack of funds for nonhighway improvements may have discouraged more active participation of nonhighway disciplines.

Although the decision making could be characterized as multidisciplinary in such a process, the implementation of countermeasures could not. Either the use of highway funds for nonhighway countermeasures or a more substantial amount of nonhighway funds would have made this program truly multidisciplinary.

RECOMMENDATIONS

The CSIP process should not be continued in Virginia unless the FHWA guidelines and the following recommendations are followed to establish a new pilot:

- *Select corridor candidates as quickly as possible.* Although the 16-month selection process did not appear to be a significant impediment to implementing the program, such a lengthy delay ultimately delays the implementation of countermeasures.

- *Base the selection of corridor candidates on both crash data and existing public interest in improving a corridor.* Although public perceptions of a problem may be incorrect, this pilot showed that data analysis is only as good as the data being used. Also, when there is a crash problem, this pilot and the initial corridor project in Pennsylvania showed that existing interest may aid in developing and implementing countermeasures.

- *Limit task force membership to 10 to 15 representatives.* The wisdom of this limit was evidenced during the fully attended meeting of the rural corridor's task force. The environment was hostile, the meeting became unwieldy, and a number of members did not attend another meeting.

- *At the first meeting of the task force, give members a detailed list of problems on the corridor and the possible countermeasures and their costs.* Although giving the task force more unrestrained initial input may be desirable, the delay created could be fatal to the project.

- *Make developing cost estimates a high priority.* The rapid development of cost estimates for suggested countermeasures is critical to the rapid implementation of the program.

- *Secure a significant amount of money to fund nonhighway countermeasures.* Such funding may come from highway monies or other sources. Having these funds available will aid in maintaining the interest of all disciplines.

The resulting process should then be evaluated.

REFERENCES

1. Zogby, J. J., Bryer, T. R., and Tenaglia, J. 1991. Pennsylvania's Corridor Highway Safety Improvement Program. *TR News 154*, May-June, pp. 11-13.

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3. Virginia Department of Transportation. *Summary of Accident Data: 1988-1990.* Richmond.