

Abridgment

Countermeasures for Truck Accidents on Urban Freeways: A Review of Experiences

KAY FITZPATRICK, DAN MIDDLETON, AND DEBBIE JASEK

Because of the rise in truck volume, the interaction of these large vehicles with other traffic, and the publicity given to major truck accidents, public awareness of the consequences of truck accidents and incidents is heightened. A literature review, telephone interviews, and visits to selected sites provided information on several truck accident countermeasures implemented on high-volume urban freeways. An FHWA survey found that 15 states have restricted trucks to certain lanes to improve highway operations. The New Jersey Turnpike and I-5 north of Los Angeles have sections on which trucks are restricted to a separated facility. Ramp treatments include reconstruction to remove outside curbs, installation of tall barriers, evaluation of the appropriateness of posted ramp speeds, and active and passive warning signs. Truck diversions or bans exist in Minneapolis-St. Paul, south of Cincinnati, San Diego, Los Angeles, and Atlanta. Allowing trucks to park in a park-and-ride lot during nighttime hours and increasing enforcement to restrict the length of stay in inappropriate locations (e.g., mainlane shoulders or along entrance and exit ramps) are measures used to reduce shoulder parking. Maryland, Virginia, and California have urban truck inspection stations, and Chicago, Tampa, and Seattle have elements of their incident management program directed toward trucks.

The issue of truck accidents and incidents on urban freeways is a vital concern for both traffic managers and the general public. Public awareness is now heightened because of the rise in truck volume, the interaction of these large vehicles with other traffic, and the publicity given to major truck accidents. Besides the fatalities and injuries resulting from truck-involved accidents, the excessive costs and delays caused by these accidents and by incidents have prompted several operating agencies to consider strategies to reduce the problem.

A literature review, telephone interviews, and visits to selected sites identified countermeasures used to reduce truck accidents on urban freeways. The countermeasures include lane restrictions, separate truck facilities, ramp treatments, truck diversions, truck bans, reduction of shoulder parking, urban truck inspection stations, and incident management. This paper contains a summary of identified experiences and issues associated with these countermeasures.

LANE RESTRICTIONS

Several states are restricting the lanes in which trucks can operate. The objective in restricting trucks to the right lane or lanes is typically to improve highway operations and reduce accidents. To assess the effect of lane restrictions for trucks,

FHWA in 1986 asked its division offices to report experiences with lane restrictions (1). The FHWA survey indicated that 15 states implemented restrictions to improve highway operations. While the benefit of improved highway operations is reduced accidents, only eight states reported that their truck restrictions were directed toward reducing accidents. The field survey also indicated that, in most cases, restrictions were applied without detailed evaluation plans including before and after studies.

Information on accident experience with lane restrictions in Florida was included in the FHWA survey (1). In 1988 Florida conducted a 6-month experiment to determine the effect of prohibiting large trucks from using the left lane on I-95. With signs posted about every mile—and good media coverage and strict police enforcement—98 percent compliance was achieved. The accident rate for all vehicles decreased 2.5 percent for an all-day (24-hr) period but increased 6.3 percent during the prohibition period (7:00 a.m. to 7:00 p.m.). The proportion of accidents involving trucks with three or more axles decreased 3.3 percent during the hours of the restriction.

The Virginia Department of Transportation (DOT) instituted a lane restriction for trucks on its I-95 section of the Washington, D.C., Capital Beltway between I-395 and the Woodrow Wilson Bridge (near the Virginia state line) on December 1, 1984. A lane restriction was similarly imposed by Maryland on its portion of the Beltway in an attempt to reduce accidents. Several studies of the Virginia I-95 data evaluated accidents, speeds, and volumes to determine the effects of the countermeasure. Initial studies recommended the retention of the countermeasure primarily because of favorable public perception and the decrease (or no change) in accident severity, even though accident rates had risen (reasons were not provided to explain the increase in accident rates) (2,3). Later studies revealed increased accident rates (4; unpublished data, Virginia DOT, 1989), so the removal of the truck lane restriction was recommended.

SEPARATE TRUCK FACILITIES

The New Jersey Turnpike, which is approximately 120 mi long, has a 33-mi segment that consists of interior (automobile) lanes and exterior (truck/bus/car) lanes within the same right-of-way. For 23 mi, the interior and exterior roadways in each direction have three lanes. On the 10-mi section that opened in November 1990, the exterior roadway has two lanes and the interior roadway has three lanes per direction. Each roadway has 12-ft lanes and 12-ft shoulders. Directional flows

are separated by a concrete median barrier, and the inner and outer flows are separated by a metal beam guardrail. Trucks and buses are restricted to the outer roadway, but smaller vehicles can use either the inner lanes or outer lanes. The current mix of automobile traffic is approximately 60 percent on the inner roadways and 40 percent on the outer roadways.

In California the reconstruction of a section of I-5 north of Los Angeles resulted in two parallel roadways. After completion of the new interstate roadway, the old roadway was maintained to carry truck traffic. The three major interchanges of I-5 with I-405, Route 210, and Route 14 span about 4 mi and are designed to accommodate heavy traffic demands. For example, I-5 at Route 14 carries an average daily traffic of 122,000; 13.5 percent of this volume is trucks. The truck bypass lanes at I-405 are relatively short, but the truck facility is continuous between Routes 210 and 14, using the old roadway.

Truck facilities have been considered for the corridor connecting the San Pedro ports and downtown Los Angeles, the I-10 Houston-Beaumont (Texas) corridor, and the Houston North Freeway (I-45). For the facility in Los Angeles, proposals include using the paved Los Angeles River channel as an exclusive truck facility (5), and using the Alameda Street corridor to carry trucks and trains within a right-of-way also shared by automobiles. Studies on potential sites in Texas concluded that the construction of exclusive truck facilities was not warranted because of limited truck volumes along certain sections of the corridor and the estimated cost of the facility (6,7).

RAMP TREATMENTS

Restrictive geometry on freeway ramps, resulting in a compromise of safety for large-truck operations, has become a concern for many agencies. Ramps can be especially difficult for large trucks to negotiate when inadequate design elements such as insufficient superelevation, tight curvature, unanticipated changes in compound curves, and short acceleration and deceleration lanes are combined with inappropriate posted advisory speeds.

Two ramps in Detroit, Michigan, were improved to reduce truck accidents by adding a tall (72-in.) reinforced concrete barrier intended to contain overturning trucks and their loads. One ramp connects westbound I-94 to southbound I-75, and the other ramp serves I-75 northeastbound traffic desiring to stay on I-75 northbound at the I-375 interchange. The I-75 two-lane ramp, originally constructed with an outside curb, was also reconstructed by adding a "wedge" of pavement to cover the outside curb, and the superelevation was increased to 0.074 ft/ft across both lanes and the shoulder.

Maryland and Virginia reevaluated ramp speeds on the Capital Beltway to determine whether the posted speeds were appropriate for trucks. Virginia reduced speeds on 44 ramps (4) and Maryland also reduced speeds on several ramps. California is evaluating turning roadways to determine the adequacy of speed signing for trucks.

Passive signs are sometimes used to describe the ramp alignment and to warn of the potential for truck rollover. For example, a truck-tipping sign is used on southbound I-95 ap-

proaching the Capital Beltway in Maryland. In some cases, flashing wigwags are added to signs to increase conspicuity. Active signs are used on ramps in Atlanta, Georgia, to inform drivers that their speeds are excessive. Any vehicle exiting the freeway that exceeds the design speed of the ramp will cause yellow warning lights to flash in a wigwag fashion. Because these devices do not discriminate between cars and trucks, they flash almost continuously.

Ongoing research sponsored by the Insurance Institute for Highway Safety and FHWA will evaluate the effectiveness of flashing warning lights (wigwags) in reducing truck speeds on ramps. In these studies, the devices are activated only by trucks, in contrast to signs used in Atlanta, which respond to both cars and trucks traveling faster than the preset speed.

TRUCK DIVERSIONS

In Minneapolis-St. Paul, traffic signs encourage truck traffic to divert to the bypass rather than travel straight through the central business district area on more congested freeways. This action seeks voluntary compliance and is not a regulatory ban. Although the effects of this countermeasure have not been studied, local officials do not believe that any significant diversion has resulted.

A fiery truck accident on the I-71/75 segment in Covington, Ky. (south of Cincinnati), resulted in the imposition of a truck diversion order by the Kentucky governor on July 8, 1986. Trucks were diverted from northbound I-71/75 to I-275, a freeway bypass around Cincinnati. The diversion order was expected to shift accidents from the interior interstate highways to I-275 with no net change in accidents for the entire region. However, for the I-71/75 segment, the diversion was expected to reduce truck-involved accidents by approximately 9 percent (8).

TRUCK BANS

In an effort to reduce congestion, San Diego has restricted trucks from Route 163 through scenic Balboa Park. The merging of traffic from five to two lanes, a 6 percent grade, and a lack of acceleration and deceleration lanes for interchanges all contribute to heavy congestion on the freeway. Public opinion prohibits construction of additional lanes because of the extensive landscaping and scenic location of the freeway (9).

A truck ban currently exists on the Ventura Freeway in Los Angeles primarily because the facility, which opened in 1940, has a pavement that is too weak to support trucks. Officials from the California Department of Transportation (Caltrans) report that with no trucks, this 7-in. pavement is still in good condition. The only large vehicles allowed on the freeway are transit buses. There is also a truck avoidance policy currently in effect for the Harbor Freeway (I-710) in Los Angeles during major reconstruction. It is only a voluntary ban, and Caltrans reports that the reduction in trucks is negligible.

Beginning in December 1978, a new truck restriction required that through trucks approaching Atlanta use the I-285 bypass instead of the freeways that run through the center of

the city. To evaluate compliance with this ban, a survey conducted by the Georgia Department of Transportation on March 25, 1980, showed a violation rate of 5.4 percent.

REDUCTION OF SHOULDER PARKING

The reduction of nonemergency shoulder parking assumes that if shoulders are used by motorists for emergency stopping only, a reduction of certain types of accidents could result. Agent and Pigman found that although the number of all accidents on Kentucky limited-access highways involving vehicles on shoulders was small (1.8 percent), the number of fatal accidents involving vehicles on shoulders was significant (11.1 percent) (10). Tractor trailers were overrepresented in shoulder accidents when compared with their involvement in all accidents.

Maryland has given truck drivers an alternative to shoulder parking by allowing trucks to park in a park-and-ride lot during the nighttime hours. Michigan DOT observed an increasing trend on I-94 of trucks parking during nighttime hours on mainline shoulders and along entrance and exit ramps of rest areas. Recommendations from a task force included (a) stricter enforcement to keep trucks off shoulders and ramps, (b) 2-hr restrictions on the length of stay of trucks at rest areas, and (c) provision of information on appropriate overnight truck parking facilities at rest areas and through press releases (11).

As a result of 10 fatalities occurring over a 5-year period involving vehicles parked on shoulders, Columbus, Ohio, has reduced the time period allowed for any vehicle to be parked on the right shoulder of a freeway. Effective in November 1989, the time period that a vehicle could remain on the shoulder, away from an interchange, was reduced from 12 to 3 hr. Near an interchange or at specified "hazardous" locations, a vehicle is now cited and towed immediately.

URBAN TRUCK INSPECTION STATIONS

Another strategy for reducing truck accidents is increased commercial vehicle roadside safety inspections within large urban areas. This sometimes requires the construction of urban inspection stations. Because the park-and-ride lot at the I-95/I-495 north interchange met with limited success, Maryland DOT converted the remaining unused portion into an inspection facility for trucks. Approximately 3,500 vehicles a year are inspected at the facility.

Virginia opened an urban inspection station on I-95 (Capital Beltway) at Van Dorn Street in October 1989. The construction cost of the Van Dorn Street inspection station in 1987 was \$962,000. The estimated cost of building another inspection station on the Capital Beltway near I-66 is \$3.5 million plus the cost of sound barriers. Reasons for the lower cost of the Van Dorn Street inspection station include available right-of-way and the use of an existing exit ramp.

Caltrans has an urban inspection station in Los Angeles on Interstate 405. This station, located on both sides of the urban freeway, was initially built as a weigh station. The northbound side was later modified to add six inspection bays on a paved asphalt surface. According to Caltrans officials, the estimated

cost of building a complete truck inspection station with pits and building in urban areas is at least \$8 million.

INCIDENT MANAGEMENT

Publicly owned heavy-duty tow trucks and large cranes are used in Chicago. Illinois DOT maintains the heavy-duty tow truck fleet that currently patrols 100 centerline-mi of the Chicago freeways continuously. These "minutemen" respond to more than 100,000 incidents a year. Los Angeles maintains a traffic control team whose function is to reduce the number of secondary accidents by controlling traffic at the end of the queue caused by an incident. They respond to major incidents, which are defined as two or more lanes blocked for 2 hr or more. After each incident, a report is filed that includes the estimated delay to motorists and incident costs.

Tampa, Florida, has a contractual agreement with a private firm for the services of two heavy-duty wreckers on the Howard Frankland Bridge. These trucks are stationed at each end of the bridge and move to the opposite end every 30 min unless they are responding to an incident. Maryland, which is using a rotation list to contact private tow truck operators, has incident management teams in operation on all Interstate highways. Seattle is using an incident response van that houses four communication systems, an illumination system for nighttime incidents, a means of placing flares on the roadway for immediate traffic control, and means to seal or pump from ruptured truck fuel tanks.

SUMMARY OF FINDINGS

Because of the significant delays in addition to the injuries and fatalities resulting from truck accidents and incidents on urban freeways, several operating agencies have investigated and implemented countermeasures to reduce truck accidents on urban freeways. Some of the countermeasures, such as increased enforcement, are designed primarily for trucks. Others apply to all traffic with specific elements for trucks, as when heavy-duty tow trucks are used to retrieve overturned trucks as part of an incident management program.

FUTURE RESEARCH EFFORTS

The information in this paper comes from a literature review, telephone interviews with representatives of selected agencies, and site visits conducted in an FHWA project (12,13). In most cases, implemented truck accident countermeasures were not thoroughly evaluated by responsible agencies to determine their effectiveness. Frequently, agencies do not have the resources to conduct an analysis, or limited funding hinders agencies in evaluating the countermeasures.

Information on the actual rather than perceived effectiveness of the countermeasure, cost of the countermeasure, and transferability of the measure to different circumstances should be developed. Future research efforts should be channeled into analyzing promising countermeasures identified in this research such as incident response management, tall reinforced concrete barriers, and ramp improvements.

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