Low-Cost Approach to Reducing Crashes on Multilane Undivided Highways in Louisiana

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Undivided highways consistently perform at low levels of safety, particularly in urban and suburban areas with relatively high densities of driveways. Federal Highway Administration (FHWA) statistics show that rural two-lane highways have the highest traffic fatality rate but undivided highways have the highest crash rate and highest crash injury rate in the United States. A large proportion of the crashes on undivided roadways involve rear-end collisions.

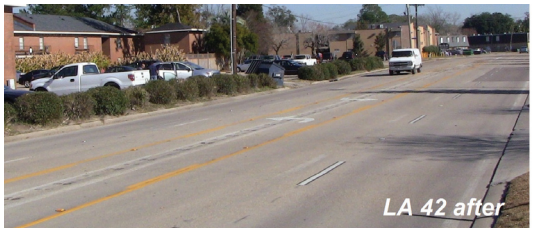
Problem

Louisiana has approximately 1,200 miles of undivided multilane roadways; most of these are four-lane highways in the state's Department of Transportation and Development (DOTD) system. Ninety-three percent of these roadways are in urban and suburban areas.

Installing a physical separation—either a barrier or a green space—is the crash countermeasure most often recommended. If the roadway width is sufficient, however, a four-lane undivided highway can be changed easily into a five-lane roadway with the center lane available for left-turns; this configuration reduces rear-end collisions.

Nevertheless, this conversion option introduces access control problems and therefore is not considered a good design alternative, although it may be the least expensive. Louisiana already had policies that discouraged the use of five-lane roadway designs in the construction of new roads; the state seldom had considered this option for reducing crashes on undivided roadways. Tight budgets, however, precluded expensive solutions.

(a)



(b)

LA-42 (*a*) before and (*b*) after conversion from four to five lanes.

Solution

Between 1999 and 2007, several Louisiana DOTD district offices identified the reduction of rear-end crashes on four-lane undivided highways as an urgent need. To meet this need within the available budgets, the district offices received permission to convert several segments of undivided four-lane roadways into five-lane roadways; the center lane served as a two-way left turn lane. The conversion required restriping the pavement markings without increasing the pavement width.

Researchers from the University of Louisiana at Lafayette evaluated the effectiveness of this approach as part of a study funded by the DOTD's Louisiana Transportation Research Center (*1*). The main objective of the study was to identify and develop crash modification factors (CMFs) unique to Louisiana.

CMFs are a tool for evaluating benefit–cost relationships through estimates of the effectiveness of roadway improvements in reducing crashes or reducing crash severity. The study developed a Louisiana-specific CMF for converting a four-lane urban undivided roadway to a five-lane roadway. The researchers examined the sites converted by the Louisiana DOTD districts between 1999 and 2007.

The statistical analysis included six years of crash data—three years before the restriping projects and three years after, excluding the project implementation year. The CMFs for all roadways were estimated at less than 0.6, with a standard deviation of less than 0.07. This finding indicated that the implementation of the conversion strategy would reduce the expected number of crashes by 40 percent. Table 1 (page 44) summarizes the crash reductions for each segment.

A major concern was whether the conversion had increased other types of crashes despite reducing the number of rear-end collisions. An analysis of the data by crash type on all four segments showed decreases

TABLE 1 Crash Reduction Summary

Route	Before		After		Change	
	Crashes	*Average Crash Rate (per million VMT)*	*Crashes*	*Average Crash Rate (per million VMT)*	*Crashes*	*Average Crash Rate (per million VMT)*
LA-3025	358	10.05	147	4.59	-59	-54.3
LA-182	178	8.12	85	3.53	-52	-56.5
LA-28	206	7.38	99	4.09	-52	-44.6
LA-1138	260	16.01	167	10.63	-36	-33.6

Note: VMT = vehicle miles traveled.

of 44 percent to 82 percent in rear-end collisions.

On LA-3025, reductions in all major types of crashes also were evident, particularly in sideswipe crashes in both directions and in right-angle crashes. LA-1138 registered a significant decrease of 89 percent in head-on collisions and a 75 percent decrease in same-direction sideswipe crashes.

On LA-28, however, head-on crashes and same-direction sideswipe crashes increased, although other types of crashes showed a decreasing trend. On LA-182, right-angle, left-turn, and same-direction-sideswipe crashes increased slightly—but a lack of information on the type of collision for several crashes from the time before the conversion affected the comparison.

Application

Although Louisiana no longer allows five-lane roadway designs for new construction, the crash reductions associated with the lane conversion approach were impressive and clearly demonstrated that this solution was feasible under financial constraints. The benefit–cost ratio of lane conversion by restriping is huge—more than 160. Louisiana DOTD therefore plans to continue using this crash countermeasure on a case-by-case basis on urban and suburban undivided roadways.

In one case, the Louisiana DOTD Traffic Section identified LA-42, Burbank Drive, as a candidate for conversion in 2013. The four-lane undivided highway with two travel lanes in each direction is near the Louisiana State University campus in Baton Rouge. This section of LA-42 has a high traffic volume—an average daily traffic of approximately 17,400 vehicles—with heavy congestion during peak periods.

TABLE 2 Estimated Benefit–Cost Ratios for Lane Conversions

Segment	Total Benefits ($)	Total Cost ($)	Benefit–Cost Ratio
LA-3025	2,754,000	14,100	195
LA-182	1,914,000	11,500	166
LA-28	2,110,000	10,600	199
LA-1138	2,317,000	12,300	188

During the peaks, a large number of vehicles attempt left turns into the many businesses, apartment complexes, and side roads. No turn lanes support these movements, however; as a result, left-turning vehicles have to wait within the travel lane for an opening, delaying traffic and increasing the risk of rear-end collisions on a busy road.

The conversion project removed the four-lane striping and the raised pavement markers (RPMs) in November 2013 and installed new striping and RPMs for five lanes. The new pavement marking added a two-way left-turn lane through the length of the project, with dedicated left-turn lanes at the traffic signals. Removing the turning vehicles from the through lanes is expected to ease congestion and to reduce some types of crashes within the project area. Figure 1 (below) presents a typical section of the conversion, showing the lane widths.

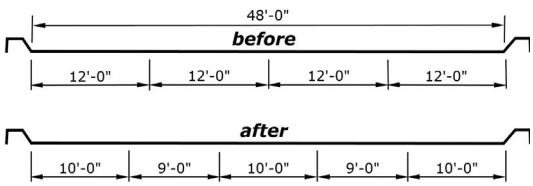


FIGURE 1 LA-42 lane width and configuration, before and after conversion from four to five lanes.

Benefits

The benefit–cost ratio for each segment was determined by comparing FHWA's average costs for injury crashes and property-damage-only crashes with Louisiana DOTD's average costs for the restriping. Table 2 (below left) shows the estimated benefit–cost ratios.

The LA-42 project expects a reduction in congestion, along with a reduction in certain types of crashes, such as rear-end collisions. Researchers will continue to monitor the crash data from this site and will analyze the effectiveness of the conversion after three years of crash data are collected.

Reference

1. Sun, X., and S. Das. *Developing Louisiana Crash Reduction Factors*. Project No 08-3SS, Louisiana Transportation Research Center, Baton Rouge, 2013.

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Suggestions for Research Pays Off topics are welcome. Contact G. P. Jayaprakash, Transportation Research Board, Keck 488, 500 Fifth Street, NW, Washington, DC 20001 (202-334-2956; gjayaprakash@nas.edu).