Lane Conversion for Urban Roadway: An Unideal but Effective Way to Improve Roadway

Xiaoduan Sun, PhD & PE, Professor
University of Louisiana

Subasish Das, PhD Candidate
University of Louisiana

Research Question

Is inexpensive countermeasure like lane conversion for urban roadway effective?

Abstract

Undivided roadways have consistently exhibited low safety performance, particularly in urban or suburban areas where roadside development is relatively intense. This study introduces a low cost crash countermeasure successfully implemented on four different segments of undivided roadways in Louisiana. This crash countermeasure is to change an undivided four-lane roadway to a five-lane roadway with a center lane for left turns by restriping pavement markings without increasing pavement width. Based on the statistical analysis, the crash modification factors for all roadways are estimated to be less than 0.6 with a standard deviation less than 0.07. Although it is not surprising to see the biggest crash reduction comes from the rear-end collisions, the other types of collision are also reduced.

Background

In Louisiana, there are 1,530 miles of undivided multilane roadways, and most of them are four-lane highways on the Louisiana Department of Transportation and Development System (LaDOTD). With sufficient pavement width, a four-lane undivided highway can also be easily changed to a five-lane roadway with the center lane for left turns, which expectedly reduces rear-end collisions. This option, even though it is the least expensive one, is less desirable based on past experiences with five-lane roadway operations in many urban and suburban areas which is reexamined in this study.

Site Selection

	District	Control Section	Length (mi)	Installation Year	No. of Driveways	Location
LA 3025	D3	828-23	1.228	2003	30	Lafayette
LA 182	D3	032-02	1	2007	50	Opelousas
LA 1138	D7	810-06	1.07	1999	50	Lake Charles
LA 28	D8	074-01	0.92	2005	20	Alexandria

Crash Reduction Summary

	Before		After		Percentage Change	
	Crashes	Average Crash Rate	Crashes	*Average Crash Rate	Crashes	Crash Rate
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%

*calculated as total number of crashes per million VMT

Crash Characteristics

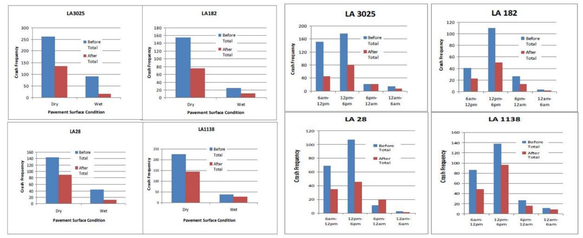
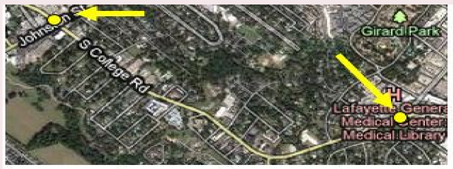


Figure 5
Crash characteristics for all four sites

Study Sites



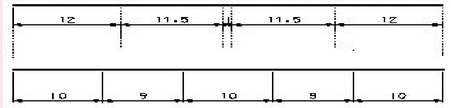


Figure 1
LA 3025 layout and lane configuration (before and after years)

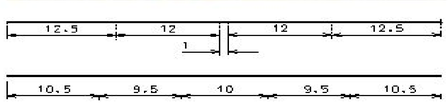


Figure 2
LA 182 layout and lane configuration (before and after years)

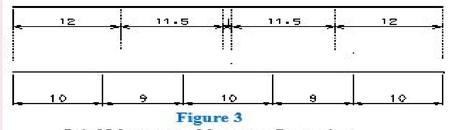


Figure 3
LA 28 layout and lane configuration (before and after years)

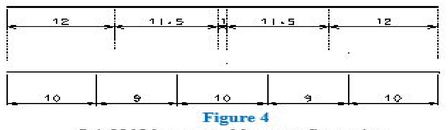


Figure 4
LA 1138 layout and lane configuration (before and after years)

Methodology

The analysis was conducted based on the principle that the true impact of a crash countermeasure should be the difference between the predicted safety after the crash countermeasure implementation and the predicted safety in the after period if the crash countermeasure were not implemented. As the models in the HSM Chapter 12 for the roadways are not calibrated with Louisiana data, **four-step** procedure introduced by Dr. Ezra Hauer was used to estimate a CMF for the re-striping projects.

Crash Modification Factor

The estimated expected CMF is 0.45, 0.43, 0.47 and 0.65 for these four roadway segments respectively. The corresponding standard deviations are 0.051, 0.062, 0.062 and 0.075.

	Safety Impact	Std. Dev.	CMF	Std. Dev.
LA 3025	175	27.62	0.45	0.051
LA 182	110	20.53	0.43	0.062
LA 1138	111	21.28	0.47	0.062
LA 28	87	25.42	0.65	0.075

Benefit-Cost Analysis

Segment	Total Benefits ($)	Total Cost ($)	B/C Ratio
LA 3025	2,753,868	14,100	195
LA 182	1,913,808	11,500	166
LA 28	2,110,212	10,600	199
LA 1138	2,317,488	12,300	188

Conclusions

Examining these two successful crash reduction cases, it is important to note that onesize-fits-all solutions do not always prevail in highway safety. Although this study shows impressive results, caution must be taken when applying this crash countermeasure in other locations. Particular attention must be made to not only the number of driveways but also the type and size of traffic generators along the roadway and existence of other travel modes.With sufficient segments (samples), it would be interesting to investigate whether the presence and size of retail business make a difference in the magnitude of the CMF. Also noted that both roadway segments are not major bus corridors and do not have noticeable bicycle and heavy truck traffic, which makes the lane conversion possible.