



# TECHSUMMARY *October 2019*

State Project No. DOTLT1000087 / LTRC Project No. 15-3SA

## Investigating Safety Impact of Centerline Rumble Strips, Lane Conversion, Roundabout, and J-Turn Features on Louisiana Highways

### INTRODUCTION

To reach the "Destination Zero Deaths" goal, DOTD has been constantly implementing crash countermeasures. Over the past several years, a few relatively new crash countermeasures were implemented on state highways, such as centerline rumble strips (CLRS) on rural two-lane highways, restriping four-lane undivided roadways (4U) in urban and suburban areas to create three-lane (3T) or five-lane (5T) roadways with center turn lane, J-turn or restricted crossing U-turn (RCUT) on high-speed corridors, and roundabouts. This project was aimed to evaluate the effectiveness of these crash countermeasures.

### OBJECTIVE

The specific objectives were to:

- Perform a before-after crash characteristics analysis,
- Develop the crash modification factors (CMFs), and
- Perform the benefit-cost analyses.

### SCOPE

- The study on CLRS effectiveness was limited to the 1,865 miles of rural two-lane highway segments where CLRS were implemented by DOTD excluding the roadway segments that experienced other changes beside the CLRS installation over the study period of six years (three years before and after).
- The lane conversion study was limited to urban four-lane roadway conversions to five lanes (six sites) and three lanes (four sites). Considering the added left turn lane at some intersections within the analysis segments, the safety evaluations were conducted in both cases (with and without intersection).
- The RCUT study was limited on the 10 RCUTs on four divided multiple-lane highways with speed limit higher than or equal to 55 mph. Due to the difference in design, three types of RCUT are evaluated—complete RCUT, partial RCUT with two minor streets, and partial RCUT with one minor street. The analyses were conducted on two settings: RCUT section (including U-turn locations) and intersection only (only main intersection).
- A total of 18 roundabouts were studied, which were further divided into four groups mainly by traffic control type.

### LTRC Report 597

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## METHODOLOGY

The study basically consisted of four major steps:

1. Google Maps were used to verify the locations and construction years of each countermeasures.
2. The crash analysis was done by crash severity, manner of collision, user type, time of the day, alcohol involvement, and distracted driver condition. To capture all intersection-related crashes, the research team investigated all crashes within at least 150-ft. radius of the intersection. For a few intersections with high AADT, crashes that occurred a half mile away from the intersections were also investigated considering potential traffic queues at the intersections.
3. Original crash reports were used to further validate and verify the crash characteristics in lane conversion, RCUT, and roundabout analysis.
4. Empirical Bayes (EB) method (while Safety Performance Function is available) and Improved Prediction method were used to estimate the CMFs.

## CONCLUSIONS

CLRS is an effective measure for rural two-lane highways. The observed reduction is 15.1%, 31.2%, and 22.1% for total, fatal, and injury crashes, respectively. Targeted crashes (head-on and opposite direction sideswipe crashes) was reduced by 36.7%. The lane conversions again approve to be a very effective and low-cost crash countermeasure for undivided urban and suburban multiple-lane roadways. For 4U to 3T, the observed reductions are 35.6% for total and 46.2% for injury crashes including intersections, i.e., roadway segment plus intersection because of added turning lane at some intersections; excluding intersections, the reductions are 33.3% for total and 55% for injury crashes. For 4U to 5T, the observed reductions are 23.9% for total and 38.5% for injury crashes with intersections; excluding intersections, the reductions are 24.7% for total and 32.9% for injury crashes. Based on the small sample size evaluated in this study, the results indicate that RCUTs can significantly improve high-speed roadway safety. The observed total crash reductions are 13.1%, fatal crashes 100% and injury crashes 11.5% for the RCUT section. For intersection only, the observed reductions in total, fatal, and injury crashes are 31.1%, 100%, and 41.8%, respectively. The targeted right-angle and left-turn crashes reduced by 58.8% and 37% for RCUT section, and for intersection only, they are 68.1% and 61.5%. Roundabouts can serve two purposes: reducing congestion and crash severity. The observed injury crash reduced by 57% based on the aggregated crash statistics for all 18 roundabouts. Based on the limited sample size for each group in this study, the intersections with stop control on the minor street (without layout change) harvest the highest safety benefits from roundabouts because of the biggest reduction in number of conflicting points. The observed reductions in this group are 70%, 78%, and 65% for total, injury and PDO crashes, respectively.

## RECOMMENDATIONS

Based on the results, the project recommends that the state may consider implementing CLRS, lane conversion, RCUT, and roundabout at locations where the targeted crash rate is higher than the state average.