Texas A&M Transportation Institute

Texas Department of Transportation

PROJECT SUMMARY REPORT

0-7036: Use of Roundabouts and Innovative Intersection Designs at High-Speed Intersections in Texas

Background

Innovative intersection designs (e.g., diverging diamond interchanges [DDIs], displaced left turns [DLTs], median U-turns [MUTs], and restricted crossing U-turns [RCUTs]) and modern roundabouts have been used successfully to remove conflict points and redistribute turning traffic from traditional intersections. However, minimal guidance exists on using these intersection types at rural and high-speed locations, particularly to serve high volumes of heavy vehicles. This project investigated the operational and safety benefits of modern roundabouts and selected innovative intersection designs for high-speed locations as well as best practices for designing these intersections. Researchers compiled proven results from these designs in other states and collected and analyzed operational and safety data from intersections within and outside Texas to develop updated design guidance, which can be used to implement roundabout designs that accommodate oversize/overweight (OSOW) vehicles and innovative intersections that provide appropriate access in rural areas.

What the Researchers Did

Researchers reviewed relevant literature and existing guidance in other states to identify best practices for designing and implementing roundabouts and innovative intersections on rural and high-speed roadways. The research team compiled the results from these reviews into a preliminary set of guidance for use in Texas, along with suggestions for research needs to address in this and other projects. Researchers then conducted field studies to observe and record traffic activities at roundabouts and RCUT intersections in Texas, Kansas, and North Carolina. Researchers used a data collection plan that relied on unmanned aerial vehicles (i.e., drones) to collect video recordings, which were reduced through manual and automated processes to produce operational data (e.g., volume, speed, and turning movements). The operational data provided the basis for microsimulation models and scenarios to investigate the effects of different intersection design elements (e.g., size of the roundabout central island and distance to the neighboring RCUT U-turns) and volumes (e.g., overall, major and minor road, and heavy vehicle). Researchers also conducted an exploratory crash analysis for innovative intersections in Texas.

What They Found

Findings indicated that while roundabouts with high-speed approaches are rare in Texas, they exist and perform well in other states and can do so in Texas. Roundabouts can be designed to accommodate heavy (including OSOW) vehicles; the simulated roundabout with the largest inscribed circle diameter (ICD) (180 ft) had the best performance, but all roundabout sizes accommodated larger vehicles and outperformed two-way stop control (TWSC) for level of service (see Table 1), delay, and capacity. Larger roundabouts processed up to 15,000 vehicles per day with up to 20 percent trucks or 5 percent OSOW vehicles.

Innovative intersections are increasingly common nationwide and within Texas and can result in fewer crashes. For RCUTs, a 2,000-ft spacing between the main intersection and the U-turn intersection had the highest average speed for the overall corridor and for left-turning vehicles. Each of the four innovative intersection forms (DDIs, DLTs, MUTs, and RCUTs) in the safety review saw a lower percentage of left-turn crashes after installation. Moreover, crash severity also reduced considerably after installation, when a higher percentage of crashes were non-injury crashes.

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What This Means

Results of the project confirm that these intersection designs can be successfully used at rural and high-speed locations in Texas. Guidance provided in the research report describes recommended practices for selecting the appropriate intersection design, considerations for key design elements, appropriate traffic control devices, and guidelines for access management.

Table 1. Level of Service by Vehicle Type under Different Traffic Load Levels.

Traffic Load	ICD 180 ft				ICD 150 ft				ICD 120 ft				TWSC			
	All	Car	Truck	OSOW	All	Car	Truck	OSOW	All	Car	Truck	OSOW	All	Car	Truck	OSOW
5000 ADT_10% Truck_0% OSOW	A	A	A	N/A	A	A	A	N/A	A	A	B	N/A	B	B	B	N/A
5000 ADT_10% Truck_5% OSOW	A	A	A	B	A	A	B	B	A	A	B	B	B	B	A	B
5000 ADT_20% Truck_0% OSOW	A	A	A	N/A	A	A	A	N/A	A	A	B	N/A	B	B	B	N/A
5000 ADT_20% Truck_5% OSOW	A	A	A	B	A	A	B	B	A	A	B	B	B	B	B	B
5000 ADT_20% Truck_10% OSOW	A	A	A	B	A	A	B	B	A	A	B	C	B	B	B	B
5000 ADT_30% Truck_0% OSOW	A	A	A	N/A	A	A	A	N/A	A	A	A	N/A	B	B	B	N/A
5000 ADT_30% Truck_5% OSOW	A	A	A	B	A	A	A	B	A	A	B	C	B	B	B	B
5000 ADT_30% Truck_10% OSOW	A	A	A	B	A	A	B	B	A	A	B	C	B	B	B	B
10000 ADT_10% Truck_0% OSOW	A	A	B	N/A	A	A	C	N/A	B	A	C	N/A	F	F	F	N/A
10000 ADT_10% Truck_5% OSOW	A	A	C	C	B	A	C	D	C	B	D	D	F	F	F	F
10000 ADT_20% Truck_0% OSOW	B	A	C	N/A	B	A	C	N/A	C	C	D	N/A	F	F	F	N/A
10000 ADT_20% Truck_5% OSOW	B	B	C	D	C	B	D	D	C	C	D	E	F	F	F	F
10000 ADT_20% Truck_10% OSOW	C	B	C	D	C	C	D	D	C	C	D	E	F	F	F	F
10000 ADT_30% Truck_0% OSOW	B	B	C	N/A	C	B	D	N/A	C	C	D	N/A	F	F	F	N/A
10000 ADT_30% Truck_5% OSOW	C	B	C	D	C	C	D	D	D	C	E	E	F	F	F	F
10000 ADT_30% Truck_10% OSOW	C	C	D	D	D	C	E	E	D	D	E	E	F	F	F	F
15000 ADT_10% Truck_0% OSOW	C	C	D	N/A	C	C	E	N/A	E	E	F	N/A	F	F	F	N/A
15000 ADT_10% Truck_5% OSOW	D	D	E	E	D	D	E	F	F	E	F	F	F	F	F	F
15000 ADT_20% Truck_0% OSOW	D	D	E	N/A	E	E	F	N/A	F	F	F	N/A	F	F	F	N/A
15000 ADT_20% Truck_5% OSOW	E	E	F	F	F	F	F	F	F	F	F	F	F	F	F	F
15000 ADT_20% Truck_10% OSOW	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
15000 ADT_30% Truck_0% OSOW	F	E	F	N/A	F	F	F	N/A	F	F	F	N/A	F	F	F	N/A
15000 ADT_30% Truck_5% OSOW	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
15000 ADT_30% Truck_10% OSOW	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F

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