QUESTION 8:

What are the potential safety impacts of implementing turn lanes and two-way left-turn lanes?

Changes to the type of lanes used along a roadway, such as the addition of a channelized right- or left-turn lane or a two-way left-turn lane (TWLTL), can lead to a reduction in some types of crashes (e.g., rear-end) by removing turning vehicles from the traffic stream. It is possible, however, that there may be an increase in other types of crashes (e.g., broadsides). These types of improvements and almost all of the research completed about them are not specific to four- to three-lane conversion projects.

One of the objectives of adding a dedicated lane to serve left or right-turning traffic is to remove slowing or stopped vehicles from the through traffic stream. This can result in improved traffic operations and a reduction in conflicts between through and turning vehicles. A reduction in conflicts often leads to a reduction in crashes. Reductions in rear-end collisions, for example, have been found in the research and can be expected when dedicated turn lanes are added to a roadway. Some factors an agency should consider when adding turn lanes include the following:

- Conversion from four to three lanes can provide ample width for the addition of a TWLTL.
- The addition of a dedicated channelized left- or right-turn lane to an existing roadway may require additional right-of-way or affect existing features, such as sidewalks.
- Reductions in total crashes and rear-end crashes have been observed with the addition of a TWLTL, left-turn lane, and/or right-turn lane.

CHANGES IN CRASHES – TWLTLS

A significant amount of research has focused on the safety benefits of adding TWLTLs as medians within a roadway cross section. Key studies that focused specifically on the addition of TWLTLs are summarized below. (The results indicated below are specific to sites considered in those studies. Please refer to the respective source documents for more information.)

- Haleem and Abdel-Aty (2012) found that the addition of a TWLTL to the major approaches of unsignalized intersections in Florida reduced crashes by 31 percent at three-legged intersections and 34 percent at four-legged intersections.
- Das et al. (2018) considered eight sites where a four-lane roadway was converted to a five-lane cross section (i.e., four lanes and a TWLTL) and found crash reductions that ranged from 16 to 65 percent.
- In a study to develop crash reduction factors for safety improvements in Ohio, Hovey and Chowdhury (2005) determined that adding a TWLTL would reduce total crashes by 8.3 percent and injury and fatal crashes by 19.9 percent.

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Two-way left-turn lane on a three-lane roadway

(The number of through lanes was not specified in the documentation.)

- A multi-state evaluation of TWLTLs installed on two-lane roadways using the empirical Bayes method found statistically significant reductions between 12.5 and 31.4 percent for total crashes and between 21.7 and 49.9 percent for rear-end crashes (Persaud et al. 2007).

CHANGES IN CRASHES – TURN LANES

Left- and right-turn lanes can be added both through projects of their own and as part of roadway cross section conversions. Research studies that have evaluated the safety impacts of turn lanes have focused on the former type of project. For example, in an evaluation of data from 10 states and Washington, DC, Harwood et al. (2002) assessed the general safety effectiveness of adding left- or right-turn lanes to intersections. The study found that providing a left-turn lane on both major intersection approaches reduced total crashes between 19 and 47 percent, but providing a left-turn lane on one major intersection approach reduced total crashes between 10 and 33 percent. Providing a right-turn lane on both major intersection approaches, on the other hand, reduced total crashes between 8 percent and 26 percent, but providing a right-turn lane on one major intersection approach only reduced total crashes between 4 percent and 14 percent. The results of this study are used in the current American Association of State Highway Transportation Officials (AASHTO) *Highway Safety Manual* (AASHTO 2014).

Newer studies have yielded comparable results. For example, in North Carolina the addition of a left-turn lane in conjunction with signalization was found to reduce crashes by 25.2 percent at three-legged intersections and 7.8 percent at four-legged intersections (Srinivasan et al. 2014). The addition of right-turn lanes along state-owned two-lane trunk highways in Minnesota was found to reduce rear-end and other crashes related to right turns by an average of 30 percent (Ale et al. 2014).

In Illinois, a modified right-turn lane designed to increase the sight distance of approaching cross traffic for right-turning traffic was also found to reduce total crashes by 44.2 percent and fatal and injury crashes by 43.6 percent (Schattler et al. 2016).

SUMMARY

Overall, the positive safety impacts of left-turn lanes, right-turn lanes, and/or TWLTLs have been proven through research and widespread application.

These safety impacts vary widely according to the situation evaluated and analyzed but are always positive. The results discussed in this response are summarized below and are based primarily on work unrelated to four- to three-lane conversion projects. The types of turn lanes listed in the table, however, may be components of this type of conversion.

Though not discussed in this summary, the operational impacts of the addition of turn lanes to roadway segments should also be considered.

Summary of the crash reduction effects of turn lanes

TWLTL	Left-Turn Lanes	Right-Turn Lanes
8.3%–65.0% total crashes	19.0%–47.0% total crashes (when installed on both major approaches)	8.0%–26.0% total crashes (when installed on both major approaches)
21.7%–49.9% rear-end crashes	10.0%–33.0% total crashes (when installed on one major approach)	4.0%–14.0% total crashes (when installed on one major approach)
NA	25.2% total crashes (three-legged intersections)	44.0% total crashes
NA	7.8% total crashes (four-legged intersections)	43.6% fatal and injury crashes
NA	NA	33.0% right-turn related crashes

Information summarized from Haleem and Abdel-Aty 2012, Das et al. 2018, Hovey and Chowdhury 2005, Persaud et al. 2007, Harwood et al. 2002, Srinivasan et al. 2014, Ale et al. 2014, and Schattler et al. 2016.

NA = Research on this impact was not found.

References available in: Knapp, K., and D. Veneziano. 2024. *Roadway Cross Section Reconfiguration: Responses to 14 Commonly Asked Questions.* Iowa Local Technical Assistance Program, Institute for Transportation, Ames, IA. https://intrans.iastate.edu/uploads/2024/10/roadway_cross_section_reconfiguration_w_cvr.pdf.