QUESTION 5:

What are the potential safety impacts of parking areas along a roadway?

One of the primary purposes of a roadway is the movement of road users. However, this space is also sometimes used to supply parking for those visiting adjacent land uses. In addition, on-street parking is considered to be a component of Complete Streets design. It can provide a buffer between moving vehicles and pedestrians, which can often help pedestrians feel safer.

The addition of parking, however, can also lead to safety-related conflicts between those using it and others (e.g., through vehicles, pedestrian, bicyclists). This summary explores the safety impacts of parking within a roadway cross section.

PARKING LANES

Parking lanes adjacent to roadway lanes are typically included on urban cross sections to serve the needs of adjacent business or residential land uses. When on-street parking is included as part of a four-lane undivided to three-lane (four- to three-lane) cross section conversion, there are several characteristics of parking lanes that should be considered (e.g., width, location).

In Iowa, one source for parking lane information is the Statewide Urban Design and Specifications (SUDAS) program (SUDAS 2024). The SUDAS *Design Manual* includes discussions of geometric design elements related to parking lanes and presents geometric design tables with preferred (e.g., 8 to 10 feet) and acceptable parking lane widths for various functional classes of roadway (SUDAS 2024). In addition, the Complete Streets section of that document, which includes additional information about parking lane applications and widths, may also be applicable in the context of a four- to three-lane conversion (SUDAS 2024). For example, parking lanes should be placed so that they do not interfere with intersection or midblock crossing sight distances, and streets with higher traffic volumes and higher speeds should have wider parking spaces or use buffer zones (e.g., a 3 foot painted width between the parking stalls and a bicycle or traffic lane) (SUDAS 2024).

The Iowa DOT *Design Manual* also provides information about roadway design criteria, including design criteria worksheets with preferred and acceptable geometrics and typical roadway cross sections (Iowa DOT 2019). The typical cross sections in that document, which include parking lanes, have widths of 9.5 and 10 feet. However, additional information is provided in the sections and worksheets mentioned above and in a section on parking along urban primary highways (Iowa DOT 2019). For example, the continuity of traffic lanes should be maintained and should not be reduced to add parking (Iowa DOT 2019).

Iowa LTAP

Angled on-street parking

Much of this guidance, however, is focused on the mobility of through vehicles, which, in the case of four- to three lane conversion locations, should be understood in the context of the objectives and goals for the segment. (See the first summary in this series.) Similarly, the general guidance for on-street parking from the American Association of State Highway and Transportation Officials (AASHTO) *A Policy on Geometric Design of Highways and Streets* (i.e., the Green Book) is that it should be considered very carefully along arterial roadways, as these roadways are focused on through-vehicle mobility (AASHTO 2018). In addition, parking along at least one side of local or collector roadways is typical.

Some of the characteristics to consider when adding or changing parking along a roadway segment as part of a four- to three-lane conversion include the following:

- Type of parking (e.g., angled, parallel)
- Width of parking and/or buffer spaces
- Location of parking lane (e.g., adjacent to the curb)
- Need for car door buffers for bicycle lanes next to parking areas
- Sight restrictions that parking may introduce between drivers and between drivers and other road users (with the possibility that pedestrian crossings may need to be relocated or redesigned to account for parking activities)
- Snow plowing and snow storage needs

These and other characteristics can impact the safety or feeling of safety along roadway segments. The interface and interactions between vehicles engaged in parking, bicycles, and pedestrians are important. A summary of what is known with regard to the safety impacts of parking is below.

PARKING-RELATED CRASH STUDY RESULTS

Several studies have evaluated the effects of parking lanes on total vehicle crashes, specifically in urban areas. It should be noted that two documented studies were also found that focused specifically on the presence of parking lanes and crashes that involved bicycles or pedestrians. Please note, however, that studies focused on the safety impacts of parking lanes (new or existing) along roadway segments that had undergone four- to three-lane conversion were not found. The following summarizes key findings from documentation that focused on more general parking-related crash impacts:

- The AASHTO *Highway Safety Manual* provides Equation 12-32 to calculate the parking-related crash modification factor (CMF) for two-lane, three-lane (center two-way left-turn lane), and four-lane undivided urban arterials based on site characteristics (AASHTO 2014). The equation also considers the difference in safety between angled and parallel parking. This equation is based on work by Bonneson et al. (2005).
- The *Highway Safety Manual* also provides Equation 13-6 to calculate the CMF for the conversion of angled to parallel parking on urban arterials, with the manual noting that in recent years agencies have been replacing angled with parallel parking for safety and operational reasons (AASHTO 2014). This equation is based on the work of Bonneson et al. (2005), which showed that in commercial and residential areas in Texas, streets with angled parking had crash rates 1.5 to 3.0 times higher than those with parallel parking.
- Providing on-street parking increases vehicle crashes, but when parking must be provided, a parallel orientation has been found to result in fewer crashes than an angled orientation (Box 2002).
- A meta-analysis (Elvik and Vaa 2004) estimated that converting angled parking to parallel parking would reduce all crashes by 35 percent and parking-related crashes by 63 percent.
- Prohibiting on-street parking reduces incapacitating, non-incapacitating, and possible injury crashes by 20 percent and non-injury crashes by 27 percent (Elvik and Vaa 2004).
- A 2017 study (Alluri et al. 2017) to develop CMFs for bicycle crashes in Florida and found that allowing parking on both sides of the street along two-lane roadways increased the probability of bicycle crashes with vehicles by 165 percent compared to locations where parking was not allowed.
- Schimek (2018), determined that dooring crashes are one of the most common types of urban bicycle-vehicle crash, accounting for 12.0 to 27.0 percent of crashes between bicycles and vehicles.

SUMMARY

On-street parking is a typical use of roadway space in urban areas. It is also often included as part of existing or planned four- to three-lane conversions. The research to date appears to show that parallel parking does not produce as many crashes as angled parking. No research was found, however, for the particular safety impacts of parking in the context of four- to three-lane conversions. If bicycle lanes are also added in these situations, it is important to recognize the potential safety impacts of the interface and interaction between bicycles, through vehicles, and vehicles entering and exiting parking spaces.

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.