Super-2 Highways

Design Manual
Chapter 6
Geometric Design
Originally Issued: 04-29-19
Revised: 10-31-23

Background

The Mobility and Safety (Super-2) section of Chapter 5 in the State Transportation Plan (STP) states:

> "As part of the 2017 plan, analysis was conducted to provide a data-driven recommendation for mobility and safety improvements to Primary Highway System corridors. The aim was for these improvements to enhance the operation of the network in particular corridors where capacity expansion needs were not identified, but improvements would help the corridors compliment the state's multilane highway network.
>
> The mobility and safety improvements are realized through the Super-2 concept. As part of the 1997 State Transportation Plan, the Iowa DOT introduced Super-2 style roadways with the basic goals of maximizing the benefits of two-lane roadways through improved roadway safety, capacity, and mobility, while reinforcing the growing importance of lowering right-of-way needs and construction and maintenance costs. Super-2 improvements serve as alternatives to four-lane capacity expansion projects and can aid in uninterrupted flow of traffic and the accommodation for slower traffic when necessary. A defining feature of Super-2 improvements is the addition of passing lanes, which improve roadway operation by providing opportunities to pass slower-moving vehicles. Other examples of Super-2 design elements include wider paved shoulders, left and right turn lanes, acceleration lanes, limited access, and geometric improvements."

Chapter 5 of the STP also lists routes targeted for Super-2 enhancements, see Table 1 and Figure 1 below. Super-2 enhancements may be applied to other two lane corridors not identified in the STP.

Table 1: Targeted Super-2 corridors.

route	from	to
US 18	South Dakota border	I-35
	US 218	IA 76
US 30	Nebraska border	US 169
	5.2 miles east of IA 1	US 61
US 34	0.8 miles west of US 275	west corporate line of Ottumwa
US 63	Missouri border	US 34
	IA 92	US 20
	US 18	Minnesota border
US 71	Missouri border	US 18
	IA 86	Minnesota border

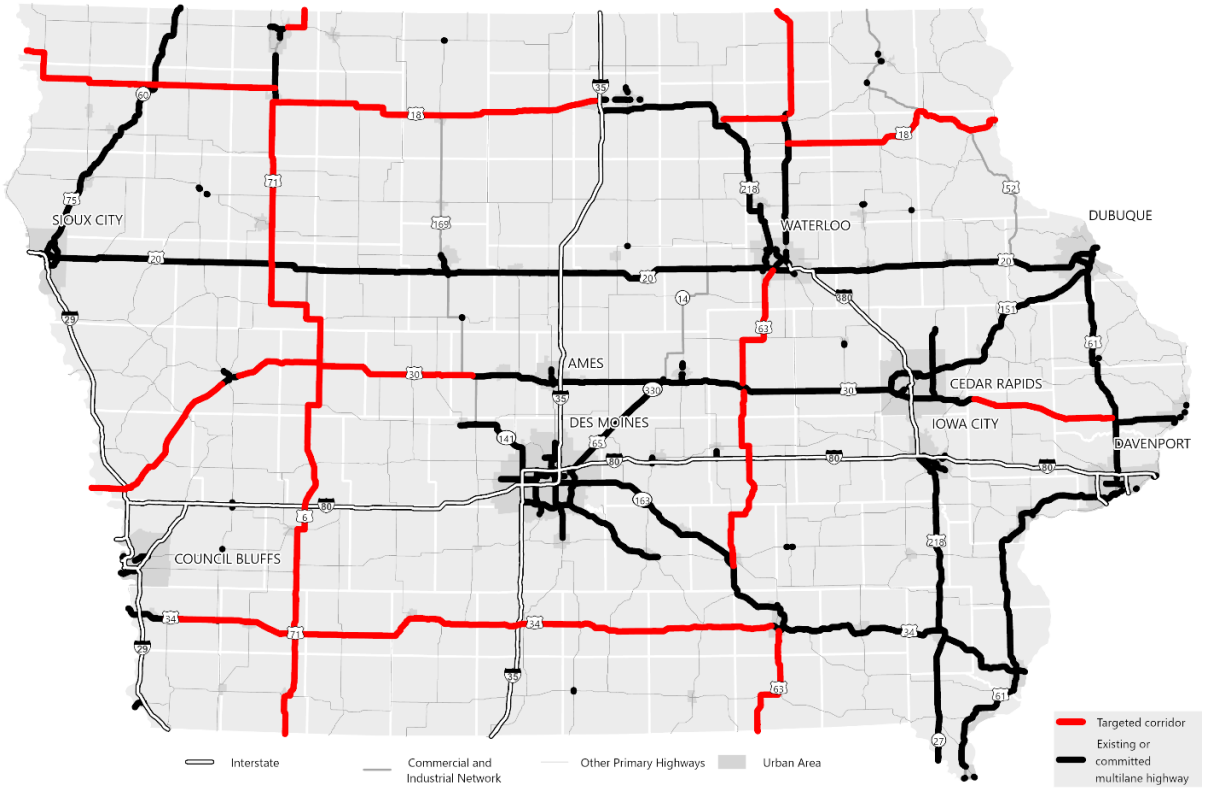

Figure 1: Targeted Super-2 corridors.

This section provides design guidance related to passing lanes, turning lanes, access management, shoulder design, signs and pavement markings, and rumble strips for Super-2 Highways.

Passing Lanes

Super-2 highways provide improved safety and mobility on two lane roadways by providing passing opportunities for faster moving vehicles, thus reducing the potential for a head on crash with oncoming traffic. Passing opportunities are created by providing passing lanes at regular intervals. The length of passing lanes is adjusted depending on traffic volumes on the route. Since traffic volumes can vary within a corridor, passing lane spacings and lengths must be applied to individual segments of the corridor, rather than the whole corridor, to ensure proper operation of a Super-2 facility.

Passing Lane Location

When reviewing a corridor for passing lane locations, avoid the following locations if possible:

- Areas of reduced speed adjacent to incorporated areas of municipalities.
- Areas with six or more accesses per mile in one direction of travel.
- Bridges or multiple barrel reinforced concrete box culverts to avoid the added expense of widening or lengthening existing structures.
- At-grade railroad crossings.
- Areas where the right-of-way (ROW) line is shared with a railroad, unless there is sufficient room within the existing ROW to accommodate the passing lane and not impact drainage.
- Four legged intersections with paved approaches on all four legs. Placing passing lanes through intersections with unpaved sideroads is acceptable, and in some instances will be necessary due to the passing lane length. If placing a passing lane through a paved intersection is unavoidable, contact the Geometrics Engineer.
- Horizontal curves with advisory speeds less than the posted speed limit of the roadway.
- Curves with limited horizontal sight distance.
- Environmentally sensitive areas.
- Within one mile of the ramps at interchanges.

When determining passing lane locations, consideration needs to be given to passing lane locations for the opposing direction of traffic. Figure 2 shows different passing lane location configurations for opposing traffic lanes.

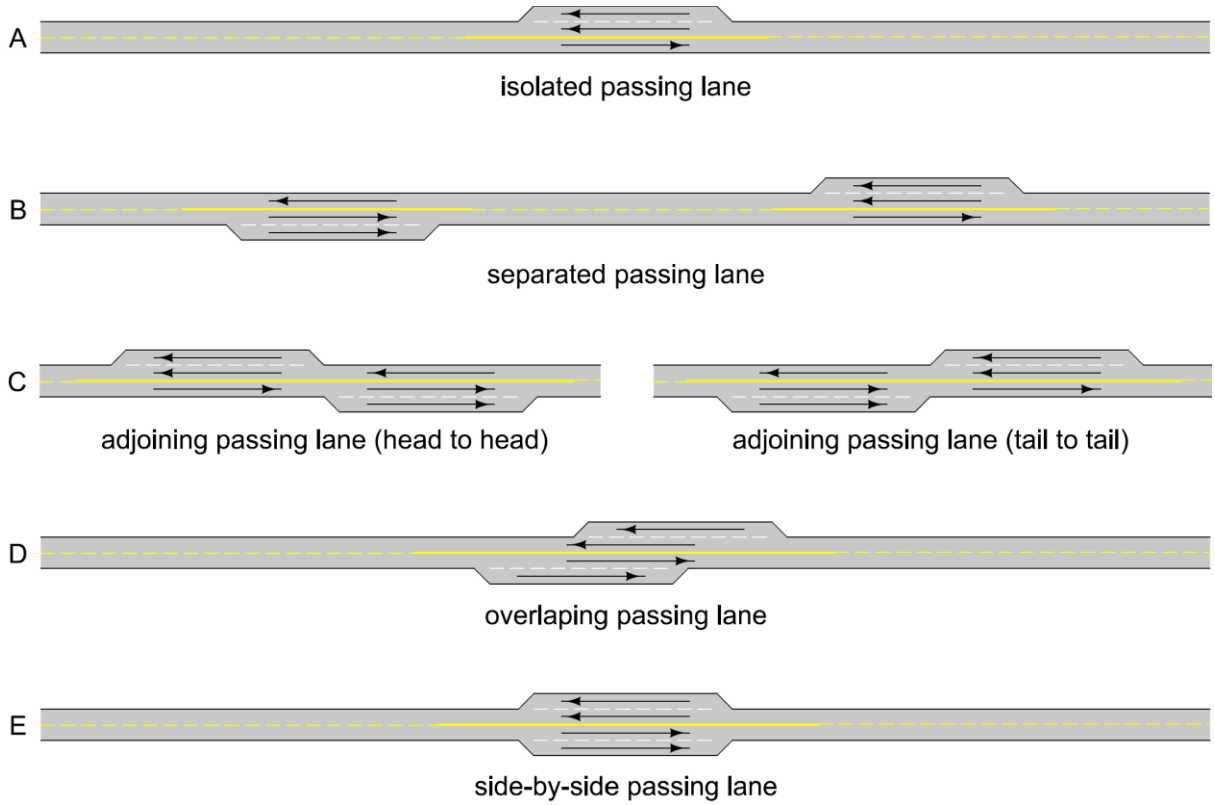

Figure 2: Passing lane location configurations for opposing traffic lanes.

Configuration A is intended to be used where a passing opportunity is only needed in one location. Configuration B is the preferred pattern for the locations of the passing lanes. If adjustments for the passing lane locations are necessary, configuration C (either head to head or tail to tail) may be used. Of the two, tail to tail is preferred. Configuration D is typically the result of the passing lanes functioning as a combination passing/climbing lane or in areas where other constraints prevent offsetting the passing lanes. The use of Configuration E gives the appearance that the roadway in the area of the passing lane is a four lane undivided section, so it should only be used when constraints on the project prevent offsetting the passing lanes as shown on the other configurations.

In areas where hilly terrain exists, passing lanes should be placed on ascending grades to allow the passing lane to function as a combination passing lane/climbing lane.

Passing Lane Design

Typical Passing Lane Section

Twelve foot wide lanes are preferred. Eleven foot wide lanes are acceptable.

Passing Lane Spacing

Preferred spacing between passing lanes is 4 to 5 miles. This spacing is based on the desire to provide passing opportunities with uniform spacing between each passing opportunity in one direction. The length between passing lanes may adjusted up to 0.50 miles to avoid items in the list of features to avoid, or to avoid impacts to other features in the corridor (utilities, accesses, etc.). The absolute minimum distance between passing lanes is 3.5 miles.

Passing Lane Lengths

As Figure 3 shows, passing lanes are introduced using a diverge taper and are dropped using a merge taper. Figure 3 also shows reference locations for the distance between passing lanes.

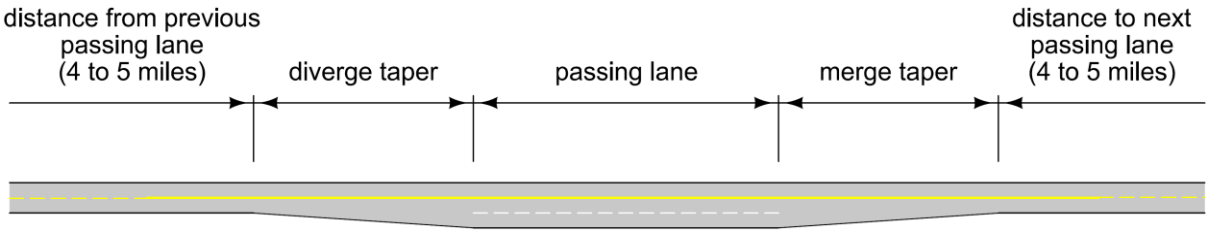

Figure 3: Passing lane components.

The diverge taper should be developed using a 15:1 taper rate. The length of the merge taper depends on the design speed of the roadway and should be based on the length of taper and taper rates for dropping lanes found in Section 6C-1.

The length of the passing lane is based on the current Average Annual Daily Traffic (AADT) or the current Vehicles Per Hour (VPH) volumes for the roadway and are shown in Table 2.

Table 2: Passing lane lengths*.

AADT	VPH	length min. (miles)	length max. (miles)
1000	100	0.50	0.50
2000	200	0.50	0.60
3000	300	0.60	0.80
4000	400	0.80	1.50
5000	500	1.00	1.75

* The lengths in this table do not include the length of the diverge taper or the merge taper.

When a passing lane will also function as a climbing lane, the lengths shown in Table 2 should be extended to aid trucks in climbing the grade.

Turning Lanes

Left turn Lanes

Warrants for left turn lanes will be based on safety and volume. If either warrant is met, include left turn lanes.

Safety Warrants for Left Turn Lanes

The Potential for Crash Reduction (PCR) dashboard can be used to search for patterns of correctable crashes at intersections, e.g. rear-end, angle oncoming left turn, or sight distance related, that could be addressed with left turn lanes. Use the KAB filter to review High/Medium intersections.

Volume Warrants for Left Turn Lanes

Figure 4 (based on NCHRP Report 745 Figure 2) is used to determine left turn warrants. Warrants are based on design year volumes.

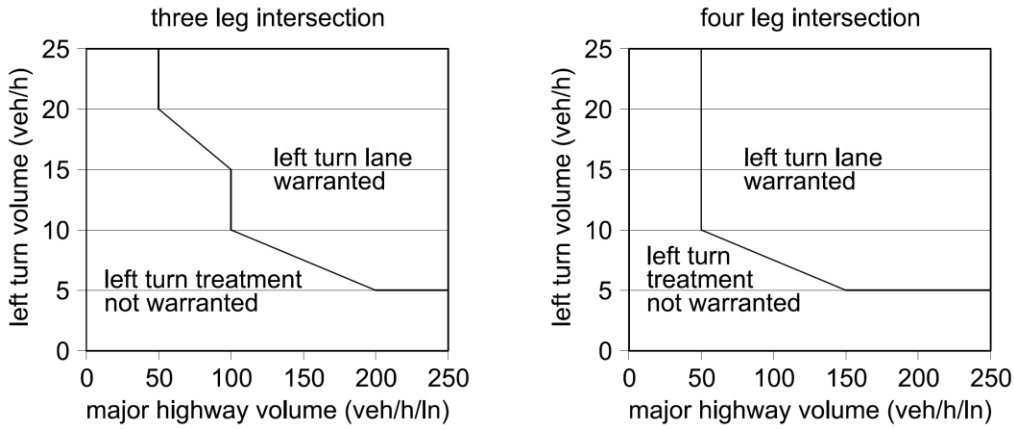

Figure 4: Left turn lane treatments.

Right Turn Lanes

Right turn lanes should be placed at all paved intersections and should be considered at unpaved intersections. Offset right turn lanes are preferred. Section 6C-5 provides guidance for offset right turn lanes. If a 20 foot offset is not possible due to ROW constraints, the maximum amount of offset should be provided given sight distance and available ROW. Refer to Section 6D-1 for information related to intersection sight distance.

Access Management

Chapter 2 of the Access Management Manual provides information regarding classification of accesses and roadways (types and categories, respectively), which are used to determine required spacing. Chapter 3 of the Access Management Manual provides information regarding location and design of accesses.

Contained within Chapter 3 of the Access Management Manual is a discussion of functional area for an intersection. The functional area of an intersection is where movements such as slowing, stopping, turning, queuing, and complex traffic maneuvers may result in the potential for conflicts and crashes.

Passing lanes also have a functional area (though not defined in the Access Management Manual). It is the length of the passing lane plus the diverge and merge tapers (see Figure 2 above for passing lane components).

New accesses should not be located within the functional area of an intersection or passing lane. Existing accesses may remain if approved by the District Engineer. Relocation is preferred if it can be done at a reasonable cost. Frontage roads are not desired, but may be considered for extreme cases.

Outside of functional areas, accesses should be located at ¼ mile spacing.

Shoulder Design

Shoulders at passing lanes shall be paved. Refer to Table 3 for shoulder widths. These widths apply throughout the Super-2 corridor.

Table 3: Shoulder widths*.

existing shoulder widths	paved width
10 feet or more	10 feet
8 to 10 feet	pave full existing width
less than 8 feet	widen to 10 feet and pave full width

*At parallel right turn lanes, shoulders may be reduced to 2 feet and safety edge is not required.

Designers are encouraged to use design flexibility to minimize the impact on right-of-way and construction when evaluating widening shoulders. Refer to Section 1C-8 for documenting design decisions.

Signs and Pavement Markings

Standard Road Plan PM-222 shows layouts for the necessary signing and pavement markings for passing lanes and intersections with passing lanes.

Rumble Strips

Shoulder and centerline rumble strips should be carried through passing lanes. Refer to Section 3C-5 and PV-12 and PV-13 for more information regarding rumble strips.

Chronology of Changes to Design Manual Section:

006C-002 Super Two Highways

10/31/2023	Revised Clarified left turn lanes are included if either volume warrants or safety warrants are met. Changed volume warrants from current year to design year. Added information into Table 3 regarding shoulder widths at right turn lanes.
6/26/2023	Revised Rewrote to reflect current guidance.
7/27/2021	Revised Included more considerations when adding improvements to portions of the corridor.
4/29/2019	NEW New.