

DESIGN GUIDANCE FOR DIVERGING DIAMOND INTERCHANGES (DDIS)

INTRODUCTION

A Diverging Diamond Interchange (DDI) is an innovative interchange design where traffic on the crossroad briefly shifts to the opposite side of the roadway at each end of the bridge.

The DDI accommodates high volumes of left turns at signalized interchanges by eliminating the need for a left-turn phase at the signals. After crossing over, vehicles travel on the left side of the road, enabling free-flowing left turns onto ramps without stopping or conflicting with through traffic. The design significantly reduces crash potential and improves traffic operations because all ramp terminal movements are signal controlled or free flow and no left turn must cross opposing traffic.

General Design Considerations

- **Design Vehicle:** Use an IDV-WB-67 as the minimum design vehicle for all geometric layouts.
- **Vehicle Separation:** Maintain a minimum 4-foot separation between parallel vehicle paths throughout the interchange. Verify by vehicle path schematics.
- **Crossroad Lane Widths:** Provide 15-foot lane widths on the crossroad in curves. Lanes may be narrowed in tangent section across bridge.
- **Buffer Markings:** If needed, add buffer markings to maintain minimum separation between parallel vehicles. Ideally, place the buffer area along the **inside edge line** of the lane.
- **Signal Cabinet Placement:** Utilize a single signal cabinet to control both terminal intersections. Position the cabinet so that a technician standing at the cabinet can see both terminal intersections and the diverge point on the interstate for the busiest exit ramp. Pull-off space should be provided near the cabinet, so vehicles do not block travel lanes when maintenance is being performed on the cabinet.

Ramp Considerations

- **Multilane Ramp Design**
 - For ramps with multiple lanes, ensure the design accommodates the design vehicle (WB-67) traveling from either lane without encroachment.
 - Standard lane width should be 12 feet, with buffer areas added as needed for trucks path.
- **Ramp-Crossroad Approach Angle (See Figure 1)**
 - Exit-ramp lanes approaching the crossroad should intersect at 75-80.
 - **Signal Visibility:** Angle signal heads so that vehicles on the exit-ramp have a clear view of signal indications.
 - If this is not possible, install a supplemental signal head.

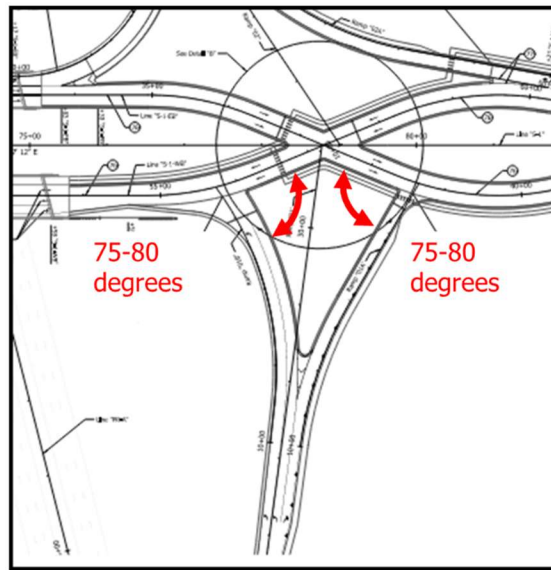


Figure 1. Ramp-crossroad approach angle geometry.

- **Option Lane Split Design**
 - Evaluate the 95th percentile queue length to ensure the option lane is not blocked by stopped vehicles.
 - Provide a minimum taper length of 150 feet for the option lane split.

- Merge Point Design
 - Merge points between left- and right-turning traffic on the entrance ramps should:
 - Be yield controlled and aligned at a 75-80 degree angle to promote visibility (as shown in Figure 2), or
 - Be designed as free flowing, with a gore area and possibly a raised curb between movements (as shown in Figure 3).
 - The decision to use yield-control or free-flow should be based on traffic analysis results.

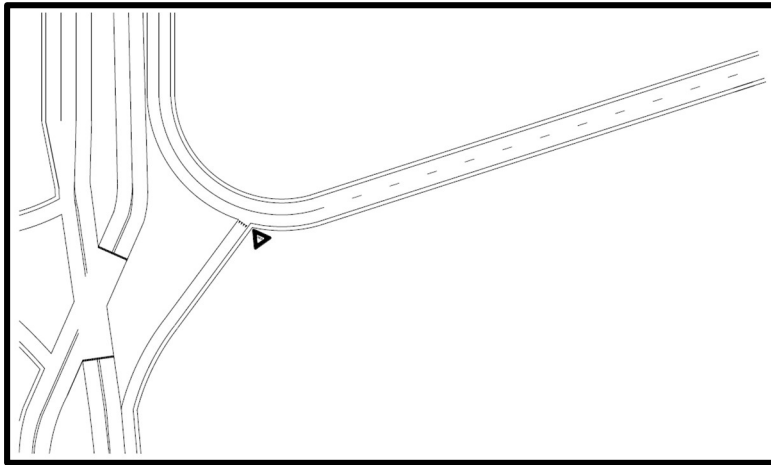


Figure 2. Yield controlled merge on entrance ramp.

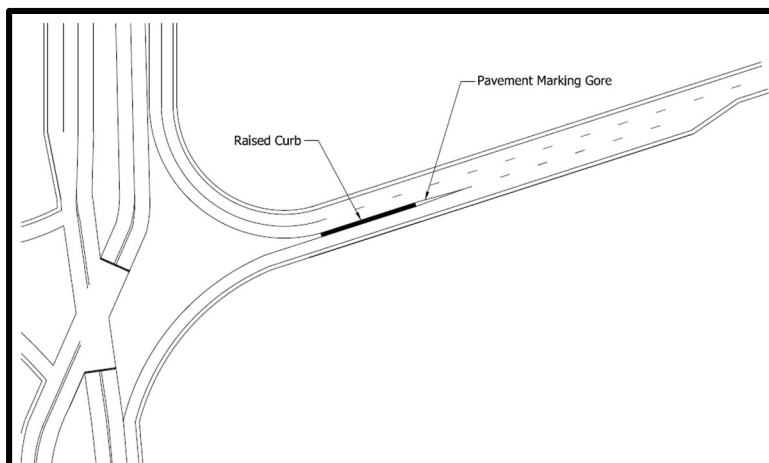


Figure 3. Free-flowing merge on entrance ramp.

Crossover Intersection Geometrics and Considerations

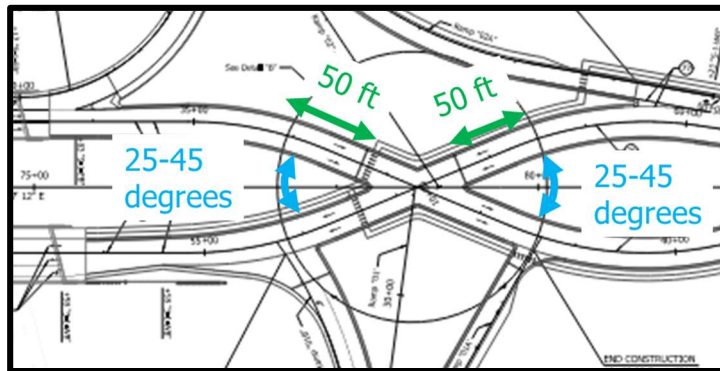


Figure 4. Ideal crossover intersection geometrics.

- **Crossover Angle**
 - The smaller angle at the crossover intersection should be between 25° and 45° (See Figure 4 for ideal intersection layout).
- **Curve Geometry**
 - Distance between the PC and the PT should be 150-200 feet.
 - Minimum crossover radius:
 - 300 feet for 25 mph design speed
 - 350 feet for 30 mph design speed.
- Minimum tangent between curves and the crossover intersection: 50 feet.
- Minimum tangent between reverse curves (excluding the crossover intersection): 75 feet.
 - Do not include a Point of Reverse Curve.
- **Right Turn Geometrics**
 - Refer to IDM Chapter 46 for detailed guidance
 - Avoid large radius turns that create poor visibility or inadequate lookback angle for drivers at the stop bar.
- **Signage Requirements**
 - Install “No U-turn” signs at crossover intersections.
 - Use “No Turn” signage where appropriate
 - Include arrow pavement markings in each lane and vertical arrow signs over each lane to reinforce correct lane usage.

Bridge Considerations

- **Clear Roadway Width**
 - Provide a minimum 30 feet clear roadway width on the bridge.
 - Position beam lines to allow for single lane closure during bridge maintenance without disrupting traffic flow.
- **Bridge Configuration**
 - Where possible, use two separate bridges (one per direction) rather than a single combined structure.
- **Pedestrian Path Placement**
 - Preferred location: center of the interchange along one of the two bridges, minimizing pedestrian-vehicle conflict points.
 - Exception: If exit-ramp right turn volumes are high, consider an alternate path to reduce conflicts.
 - Avoid crossing pedestrians across free-flowing movements where possible.
 - Utilize appropriate warning devices, such as rectangular rapid flashing beacons (RRFBs), to ensure visibility and safety for pedestrians.
 - Avoid placing pedestrians between two barrier walls as this discourages use and may lead to unsafe behavior.
- **Tangent Length**
 - Provide a minimum tangent length of 75 feet beyond each end of the bridge deck.

CONTACT INFORMATION

If you have any questions regarding the content of this Highway Design Aid, please contact lularacuente@indot.in.gov.