Implementing the First Diverging Diamonds for DOTs

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History of Diverging Diamond Interchanges (DDI)

- 1st DDIs built in Europe
  - Versailles and Seclin, France
  - Early 1970’s

- 1st in United States
  - I-44 / State Route 13 Interchange Springfield, MO
  - Completed June 2009
  - Congestion related crashes reduced 50%

- Currently 150+ locations in 45 states
- Over 80 additional locations in development
Safety Advantages

Fewer conflict points

<table>
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<tr>
<th>Conflict Points</th>
<th>Diverging</th>
<th>Merging</th>
<th>Crossing</th>
<th>Total</th>
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<td>Crossing</td>
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<tr>
<td>Total</td>
<td>14</td>
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</tbody>
</table>

SPUI interchange

Conflict Points
- Diverging: 6
- Merging: 6
- Crossing: 8
- Total: 20

DDI interchange

Conflict Points
- Diverging: 8
- Merging: 8
- Crossing: 10
- Total: 26

Diamond interchange
Safety Advantages

Fewer crashes than a conventional Diamond

Crash Modification Factors for the countermeasure Convert Diamond Interchange in Urban and Suburban areas to a Diverging Diamond in the CMF Clearinghouse

- CMF 10761 = 0.858 (Total Crash Reduction is expected to be 14%)
- CMF 10762 = 0.558 (Fatal and Injury Crash Reduction is expected to be 44%)
- CMF 10765 = 0.448 (Angle, Left Turn Crash Reduction is expected to be 55%)

These CMFs have a 4-star rating
Operational Advantages

Simple Signal Phasing

Cross Street Progression

Left-turn Progression

PHASE 1

PHASE 2
Operational Advantages

- Provides higher LOS improvement than Diamond interchange
- Signal timing typically operates at ½ cycle length of adjacent intersections, which flush out the ramps and contraflow lanes
Design Considerations

- Retrofit on existing diamond configuration may be possible at minimum cost by repurposing structure
- Opportunities to phase construction and minimize traffic disruptions during construction
Design Considerations

- Work well with high skew interchanges
- Opposite of Single Point Urban Interchange (SPUI) designs
Design Considerations

- Lower speeds at interchange
  - Gradual reduction of speeds at approaches
  - 25-35 mph desirable through DDI
  - 15-20 mph desirable for free movements with pedestrian crossings

Exhibit 6-65. Target design speed and horizontal curve radii relationships.
Directional Crossover Intersections (DCI)

- 40 or greater angle preferred
  - Lower angles increase likelihood of wrong way movements at DCI
- Tangent length critical to determine stop bar location to prevent path overlap and discourage wrong way movements

Exhibit 6-34. DDI elements and tangent length.
Design Considerations

- Pedestrian crossing
  - Traditional outside bridge

Note: Pedestrians and Bikes can share this space via a shared use path/Sidepath
Design Considerations

- Pedestrian crossing
  - In median

Note: Pedestrians and Bikes can share this space via a shared use path/Sidepath.
Design Considerations

- Bike crossing
  - Outside of travel lanes
  - Next to median in between intersections
Design Guidance

- DDI Informational Guide (NCHRP Research Report 959)
- Free Download From National Academies Website
DDI Summary

Advantages
- Simple two phase, two signal design
- Higher LOS than Diamond design
- Can be designed to retrofit diamond interchanges at minimum cost
- Fewer crash conflict points
- Better than SPUI at skewed crossings

Disadvantages
- No through movement for ramps
- Snow storage/removal
- Driver familiarity/education
- Less potential for progression on the crossroad - One crossroad direction at a time through the interchange

Design Considerations
- Minimum 500 feet between ramp intersections
- Minimum 40-degree angle for crossover intersections
- Reduced design speeds
- Beware of choosing DDI near adjacent intersections
Questions

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