Innovation in Interchange Design – The Diverging Diamond

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Interchange Considerations

- Traffic & Operations
- Safety
- Pedestrians
- Site Conditions – Access Management
- Maintenance of Traffic - Constructability
- Right of Way & Potential Impacts
- Costs
Traditional Interchange Designs

- Conventional Diamond Interchange
- Partial Cloverleaf Interchange
- Single Point Urban Interchange (SPUI)
- Tight Urban Diamond Interchange
The Diverging Diamond
Two Phase Signal Operation - Signal Phase 1
Two Phase Signal Operation - Signal Phase 2
Safety Benefits

- Reduction in Potential Vehicle-to-Vehicle Conflict Points
  - Traditional Diamond Interchange
    - 26 Conflict Points
  - SPUI
    - 18 Conflict Points
  - DDI Interchange
    - 14 Conflict Points
Pedestrian Accommodations

**Advantages:**
- Shorter distance for pedestrians to cross
- Outside Crossings are more familiar to pedestrians
- Four of the crossings may be protected

**Disadvantages:**
- Pedestrians cross free flowing traffic
- Potential for eight unprotected crossings
Pedestrian Accommodations

- **Advantages:**
  - At least four of the crossings will be protected.
  - Could potentially only have two unprotected crossings.

- **Disadvantages:**
  - Unfamiliarity with untraditional center crossing.
  - More lanes to cross at the center median.
  - May increase signal timing to allow for pedestrians to clear.
Access Management

Typical Requirements

Guidelines for Limitation of Access at Diamond Type Interchanges

Guidelines for Limitation of Access at Cloverleaf-Type Interchanges

Diamond Interchange Access Spacing

Cloverleaf Interchange Access Spacing

FHWA Requirements coming in the future for DDIs
Maintenance of Traffic
Constructability
Diverging Diamond Simulation

- Drive Thru Movie Diverging Diamond – Pioneer Crossing - Utah
Advantages

- Provides for two phase signals with short cycle lengths
- Substantially reduces the number of conflict points
- Geometry reduces speeds and results in less severe crashes
- Increases the capacity of turning movements to and from the ramps
- Improves pedestrian safety
- Minimizes ROW impacts
- Cost effective
Disadvantages

- Drivers may not be familiar with configuration
- Problematic for high-speed arterials
- Operational issues with closely spaced intersections
- Operational issues with high thru volumes >650 veh/hr/ln
- Exiting traffic cannot re-enter the freeway in the same direction and can impact emergency vehicles and accident bypass
DDI Locations

- **I-44/Missouri 13 – First Diverging Diamond Interchange – Springfield, Missouri**
  - Open to traffic: June 21, 2009

- **US 60 James River Freeway at National Avenue - Springfield, Missouri**
  - Open to traffic: July 12, 2010

- **I-15 at American Fork Main Street - American Fork, Utah**
  - Open to traffic: August 23, 2010

- **I-270 & Dorsett Road - Maryland Heights, Missouri**
  - Open to traffic: October 17, 2010

- **US 129 Bypass / SR 115 at Middlesettlements Road / Bessemer Street - Alcoa, Tennessee**
  - Open to traffic: December 17, 2010
DDI Locations

I-44/Missouri 13

US 60 James River Freeway at National Avenue

I-270 & Dorsett Road
DDI Summary

- **Operations**
  - Free lefts and right turns
  - 2 phase signals

- **Safety**
  - Reduced conflict points
  - Accommodates pedestrian movement

- **Flexibility & Costs**
  - Minimizes ROW impacts
  - Ease of MOT
  - Standard bridges
Questions?