



Diverging Diamond Interchanges

Implementation Lessons Learned

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Agenda

- ***DDI 101***
- ***DDI Design***
- ***Signal Head Placement***
- ***Traffic Operations***
- ***Constructability***

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DDI 101



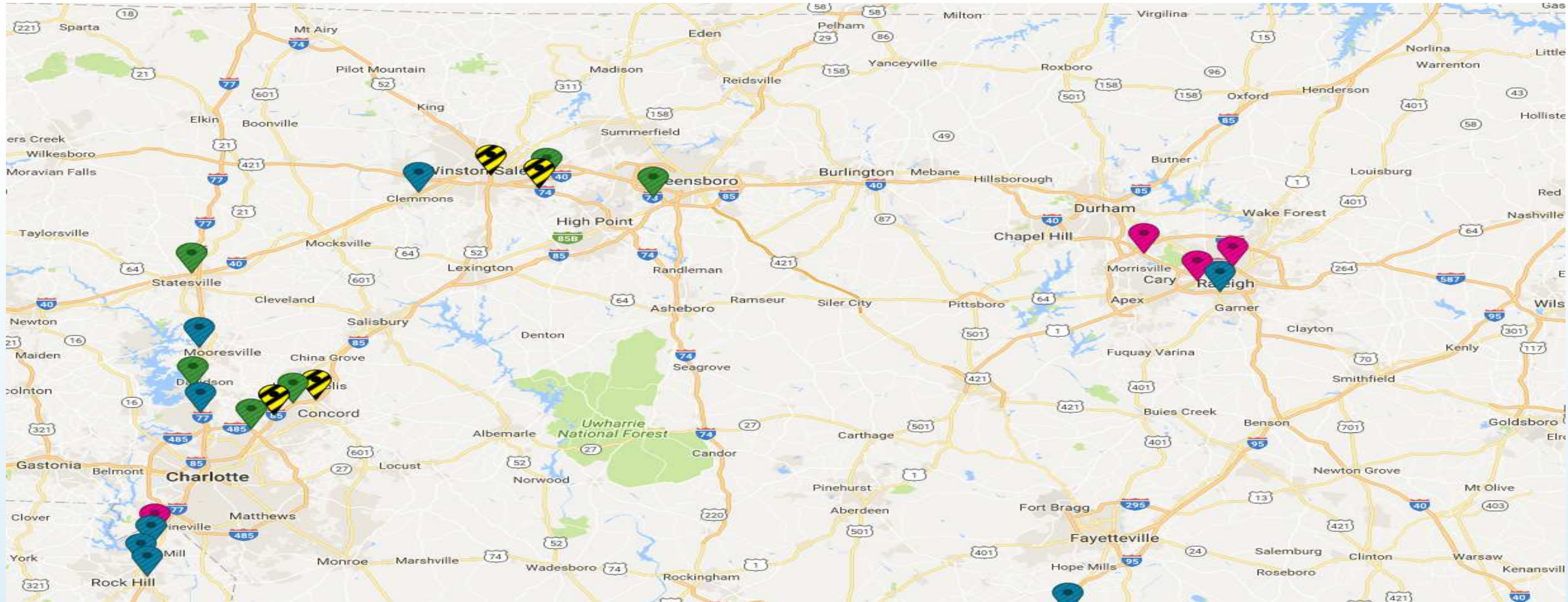
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Where are the DDIs?



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Where are the DDIs?



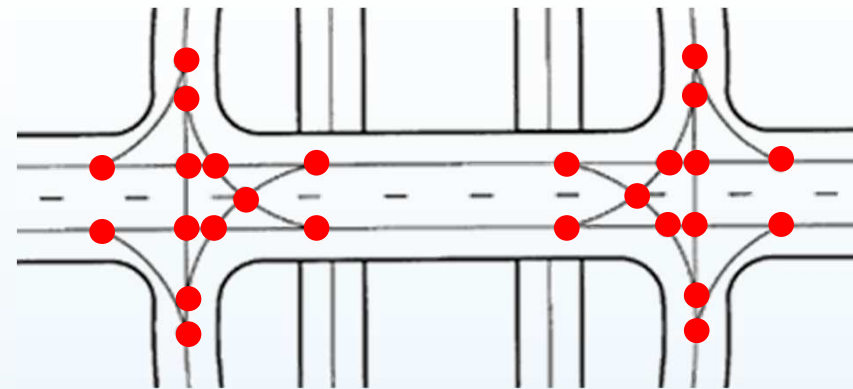
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What is a DDI?

- It's an innovative interchange designed to accommodate left-turning movements at signalized, grade-separated interchanges while **eliminating the need for left-turn phasing**.
- Traffic crosses over to the left side of the roadway between the ramp nodes of the interchange.
- **No opposing traffic for left-turning movements** made at the interchange.

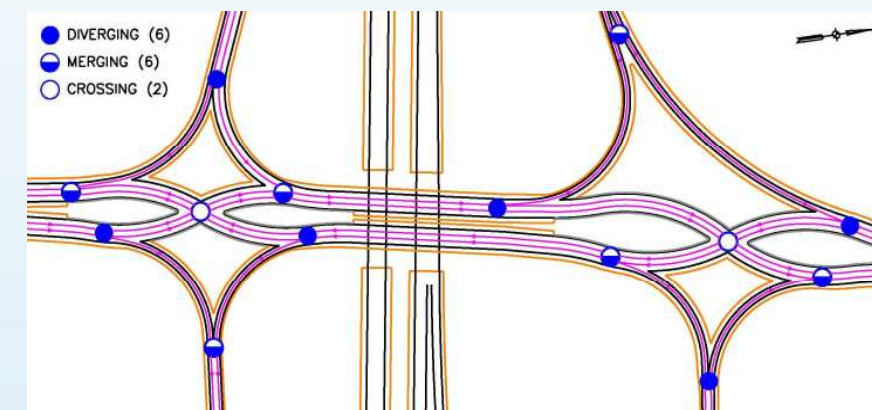
Benefits of a DDI

- Reduced Number and **Severity** of Conflict Points – fewer conflict points generally results in fewer crashes.



Traditional Diamond has 26 Conflict Points; 10 are crossings

DDI has 14 Conflict Points; only 2 are crossings



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Benefits of a DDI

- **FHWA Completed Research – DDI Safety Audits ***

- Evaluated 7 DDI Locations Nationwide

- 4 in Missouri
 - 1 in Kentucky
 - 1 in Tennessee
 - 1 in New York

- **Results:**

- 32% Reduction in Total Number of Crashes
 - **39% Reduction in Serious Injury/Fatal Crashes**

* FHWA Publication: FHWA-DTFH61-10-C-00029, August 2015

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DDI Concerns

- **Challenges**

- Users can't easily travel from off-ramp to on-ramp in a DDI
- DDIs don't accommodate equally heavy through volumes along the arterial well
- DDIs must be evaluated within the corridor rather than as an isolated solution
- DDIs violate driver expectation by placing traffic on the "wrong side" of the road

- **Public Myths**

- DDIs are confusing to navigate
- DDIs allow for easy wrong-way movements
- DDIs are not pedestrian friendly



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DDI Concerns



MAKE IT INTUITIVE TO DRIVERS!

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DDI Design



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Crossover Design

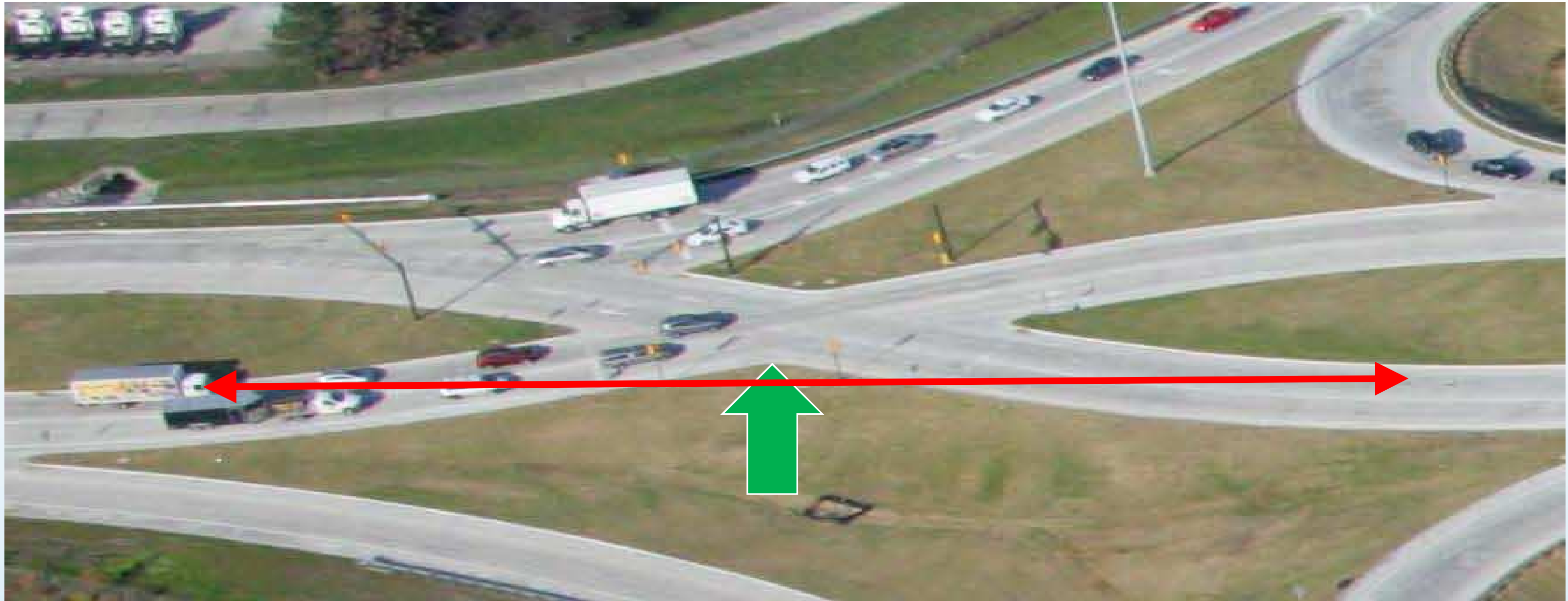
Crossover Design

State DOTs recommend crossover angles of no less than 45 degrees between opposing approaches. Research findings indicate a higher correlation between lower crossover angles and

Source: FHWA DDI
Informational Guide – 2014

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Crossover Design



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Crossover Design

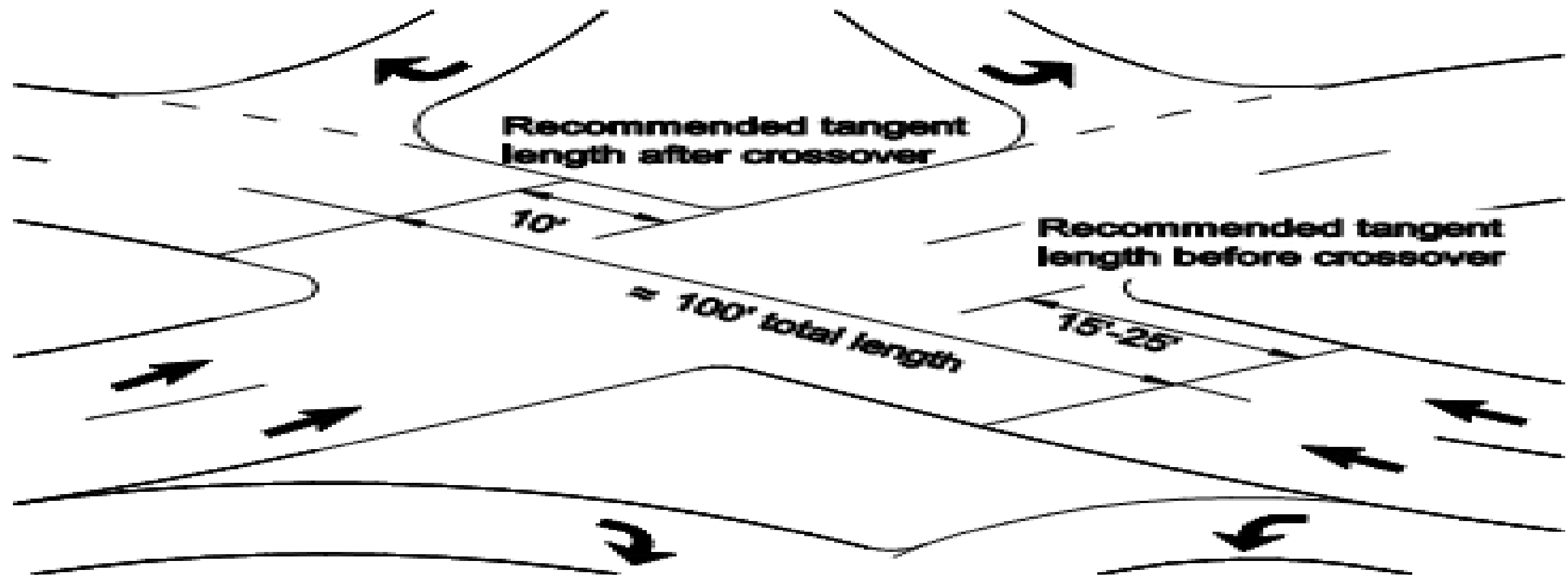


Exhibit 7-16. Tangent length approaching and departing the crossover.

Source: FHWA DDI
Informational Guide – 2014

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Design Vehicles



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Design Vehicles



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Signal Head Placement



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Signal Head Placement



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Signal Head Placement



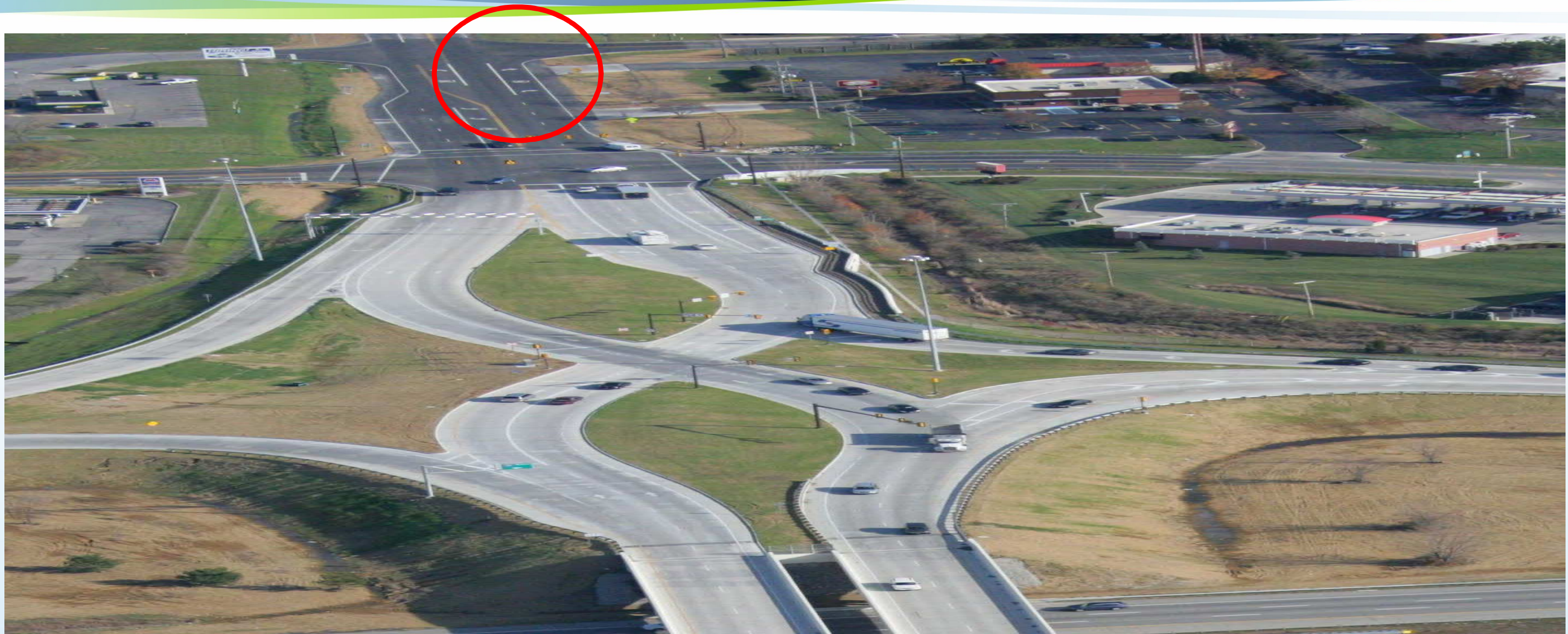
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Traffic Operations



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Lane Utilization



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Adjacent Traffic Signals



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Adjacent Traffic Signals



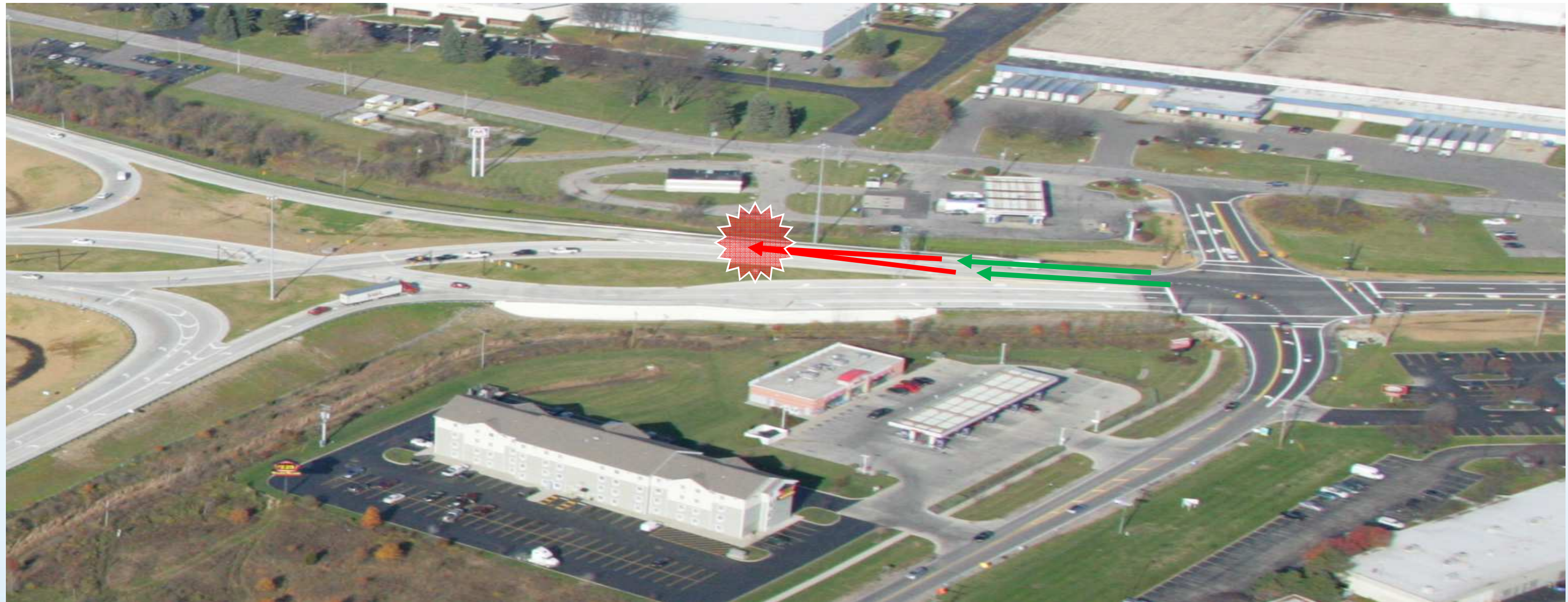
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Adjacent Traffic Signals



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Adjacent Traffic Signals



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Adjacent Traffic Signals



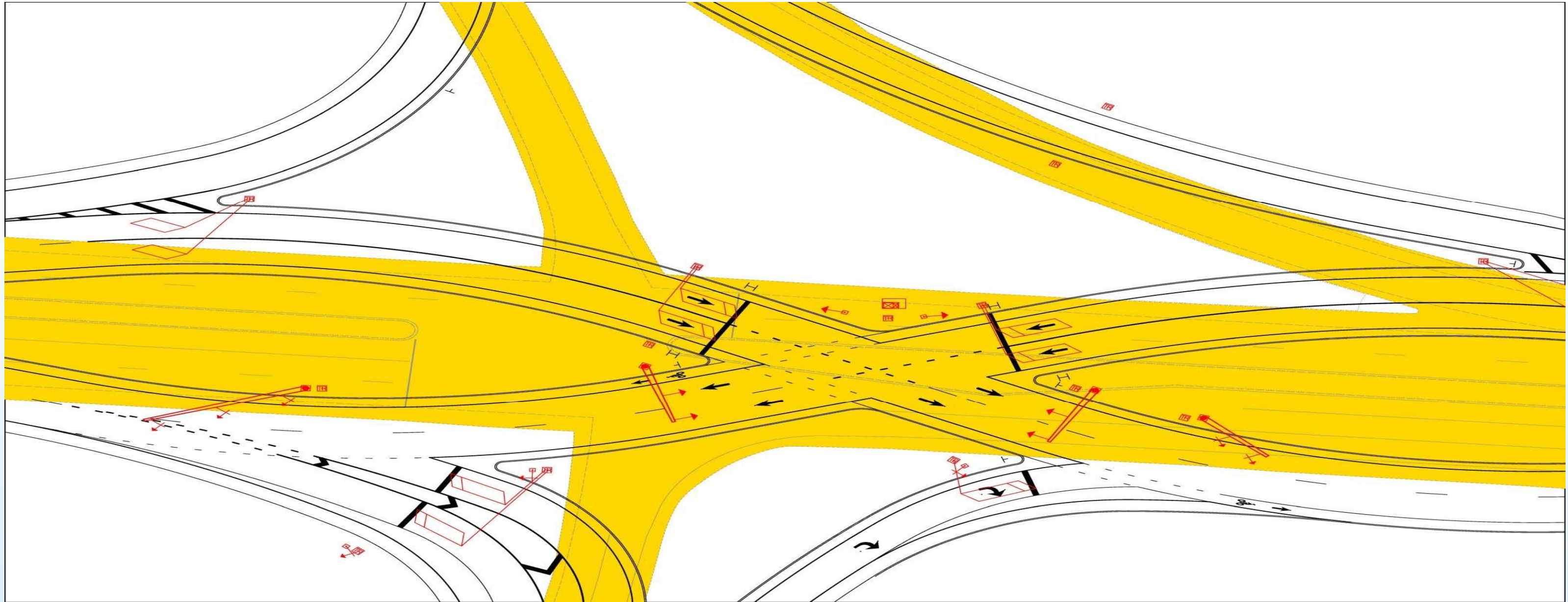
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Constructability



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Constructability



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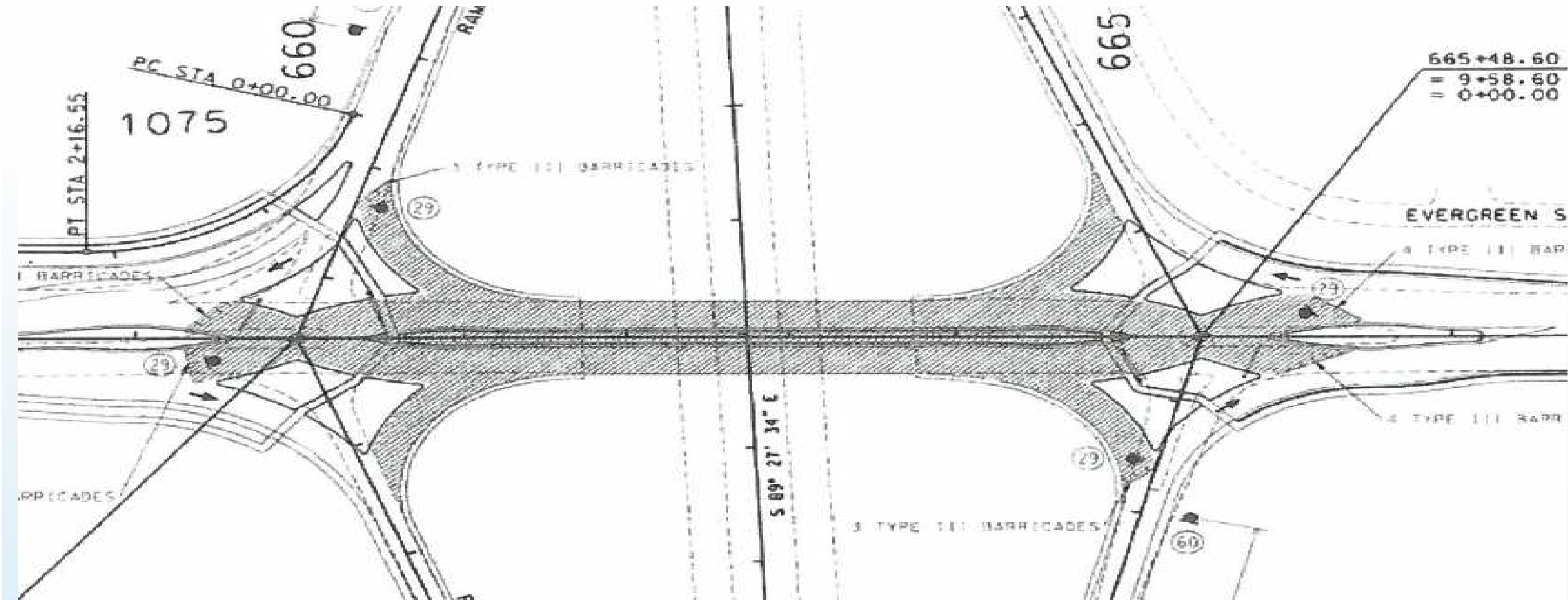
Constructability



Options for how to maintain traffic

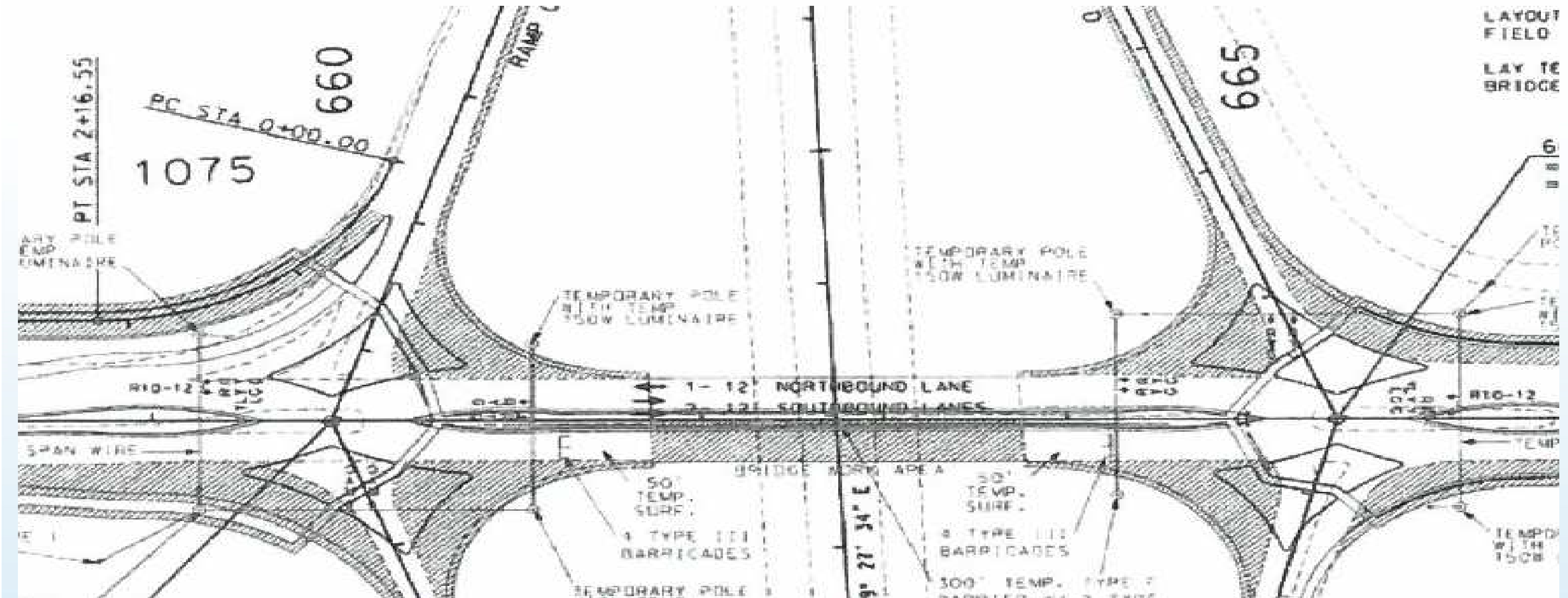
- Bridge Closure
- Part-width Construction
- Off-line Construction

Constructability – Bridge Closure



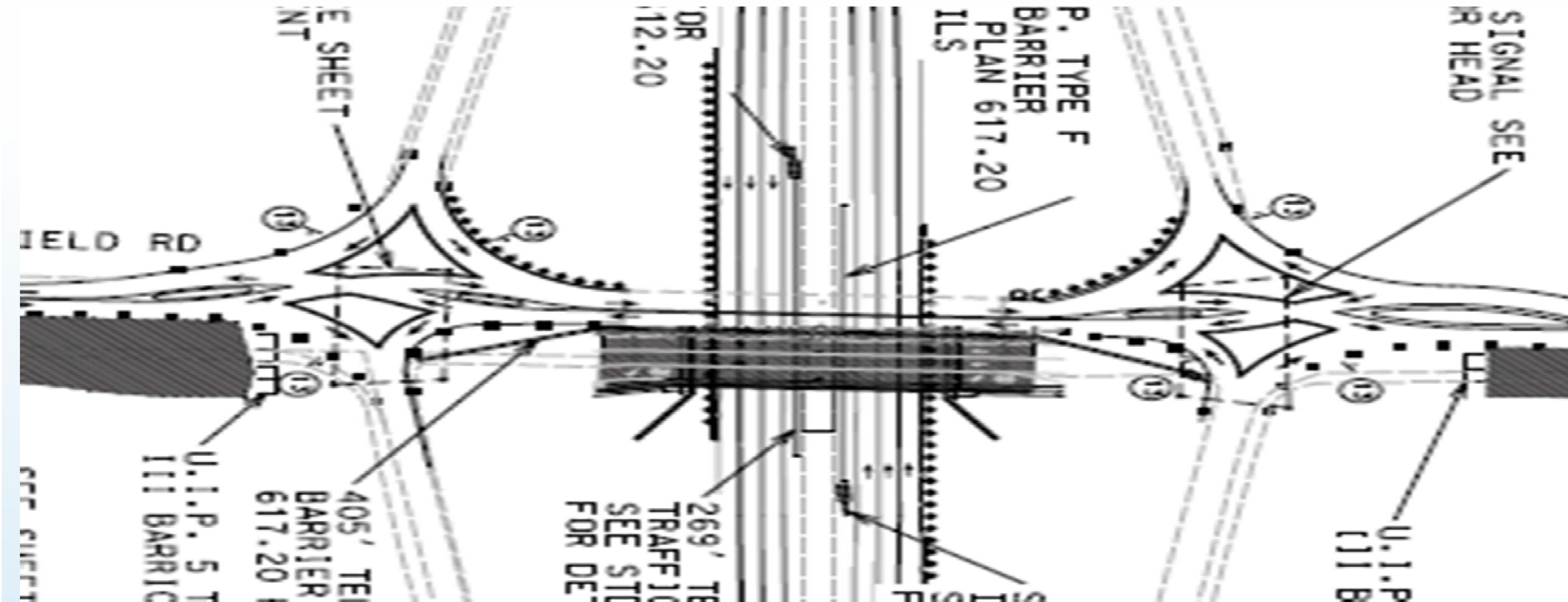
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Constructability – Part-Width



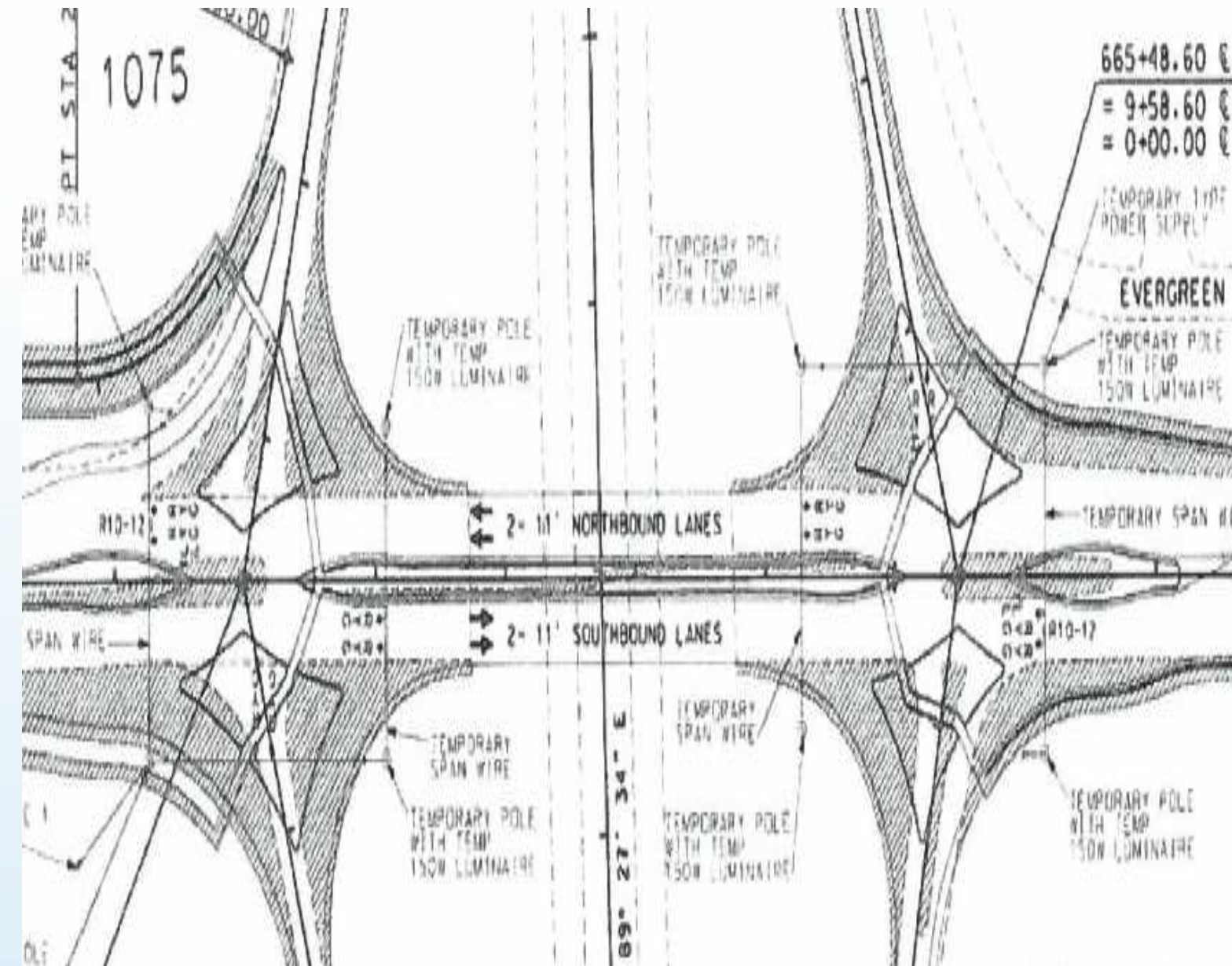
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Constructability – Part-Width



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Constructability

Weekend Closure

- Signal Testing
- Final Pavement Markings

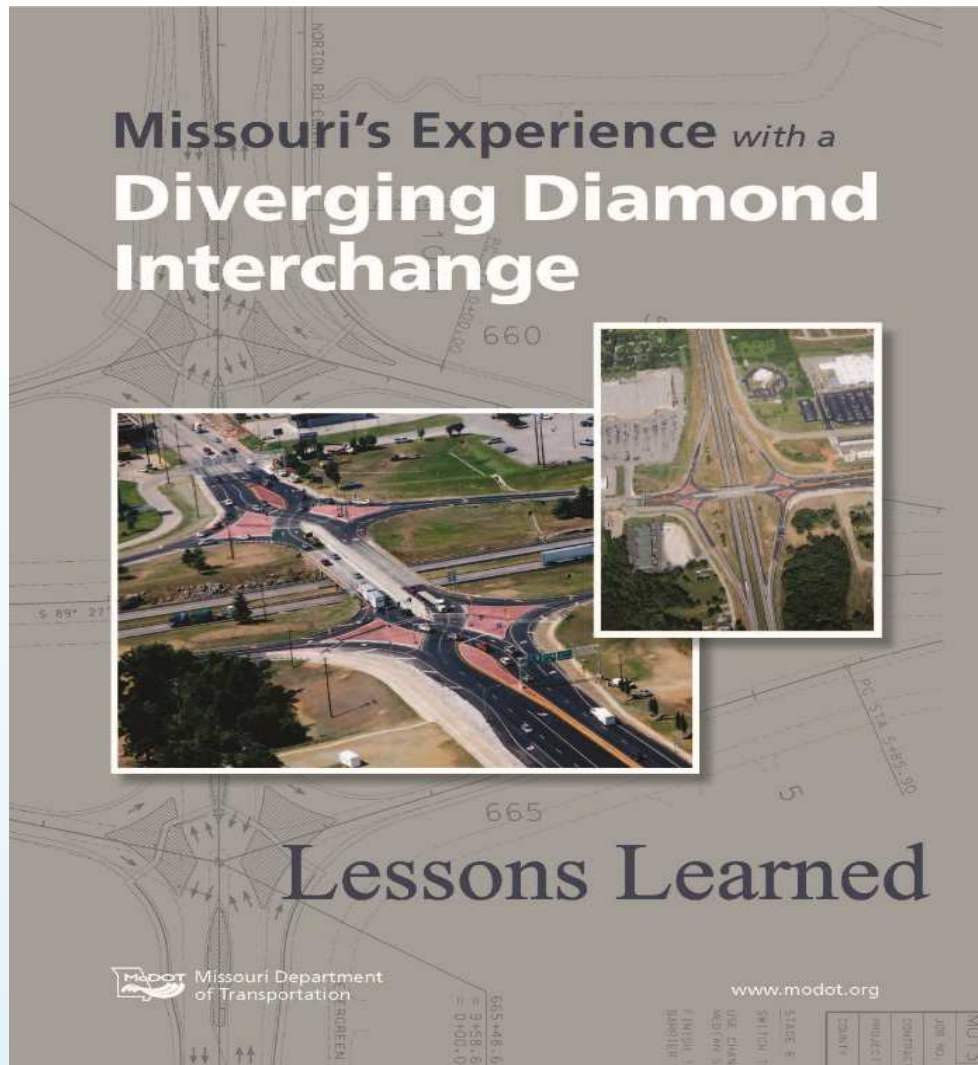
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Other DDI Lessons Learned

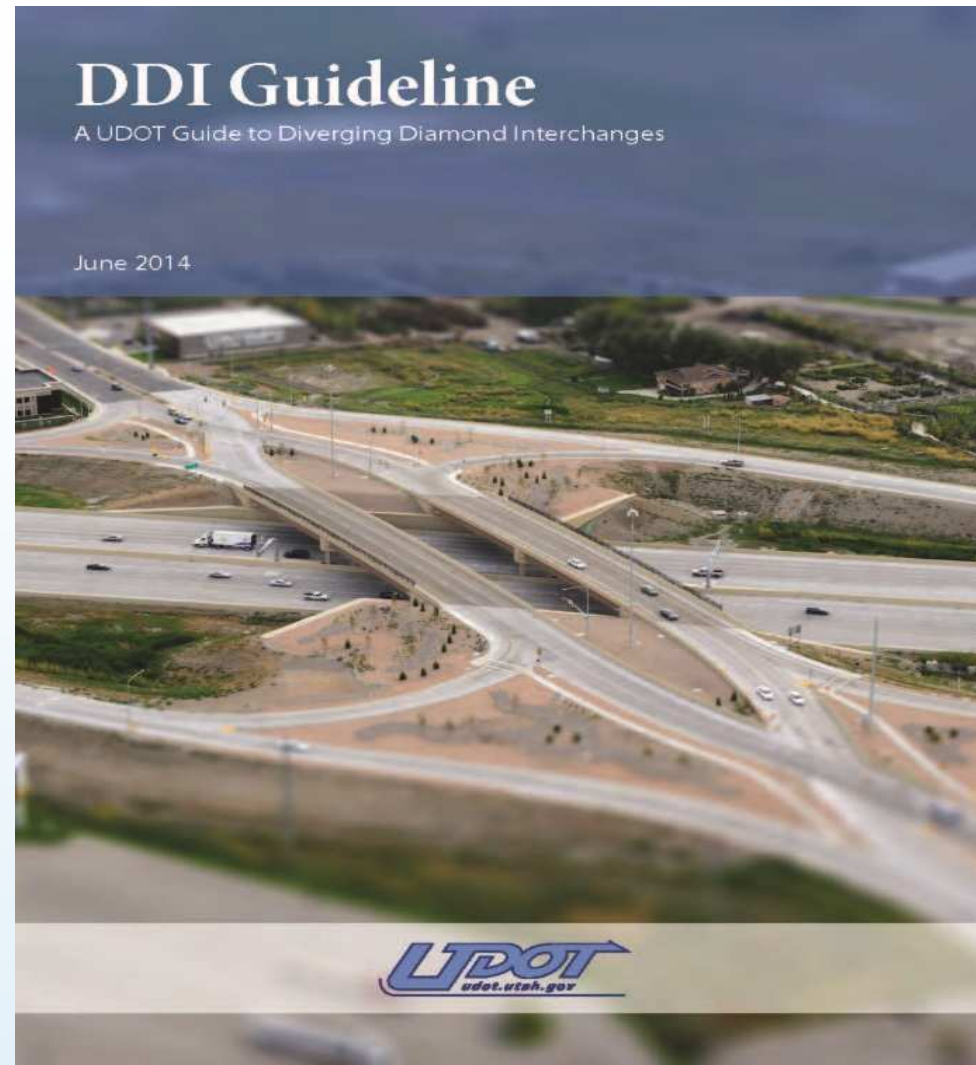
- *Traffic Analysis – Synchro vs. Vissim*
- *DDI Selection As An Alternative*
- *Multimodal Accommodations*
- *Pavement Markings & Signs*
- *Signalized Right Turns*
- *Superelevation Design*
- *Drainage Design*
- *Pavement Joints*
- *Public Outreach & Education*
- *Plan Development*

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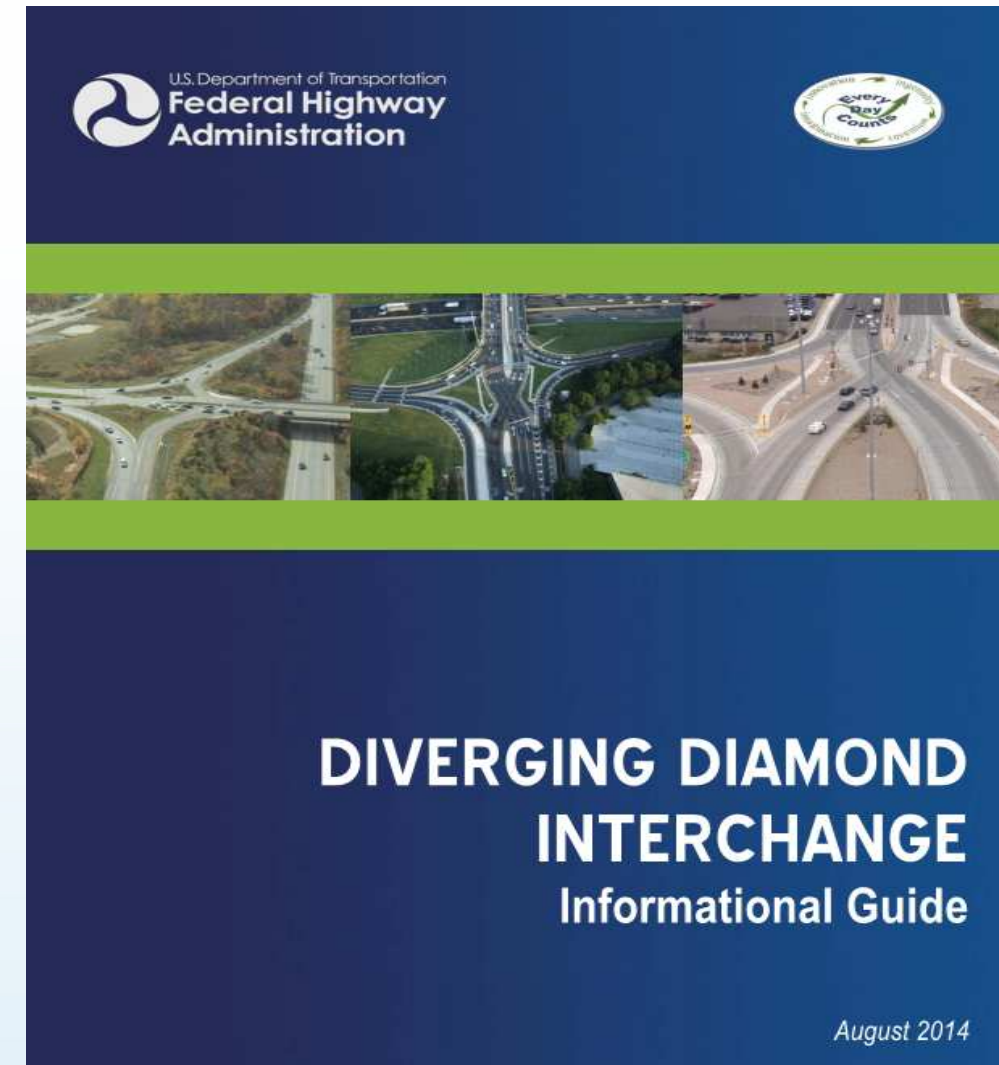
DDI Guidance



Missouri DOT - 2010



Utah DOT - 2014



FHWA - 2014

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Questions?

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