



## MEMORANDUM

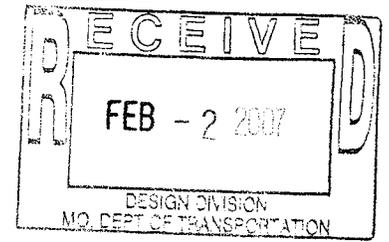
### Missouri Department of Transportation Project Development District 4

**TO:** Jay Bestgen-de

**FROM:** Susan McCubbins, P.E. SKM  
Transportation Project Manager

**DATE:** February 1, 2007

**SUBJECT:** Route I-435, Jackson County  
Front Street Interchange  
Job No. J4I1121B  
Practical Design 2007 Awards for Excellence



The purpose and need of this project is to provide safety improvements at the northbound and southbound exits from I-435 and within the interchange on Front Street. This is an industrial area, with about 30% large trucks, and during the peak travel times traffic regularly backs up the exit ramps onto I-435. Traffic also backs up on Front Street causing gridlock in the interchange. Many elements of the interchange are not standard, such as the distance between ramp intersections and the clearance under the I-435 bridges. There is also not enough horizontal clearance for a dedicated eastbound left turn lane, or additional through lanes, under the bridges.

The original STIP amount for this project, which came from a Major Investment Study of I-435, was a total of \$23 million based on total reconstruction of the existing interchange. The study recommended a single point interchange at this location. A Value Engineering (VE) study was conducted in 2002 that analyzed several interchange options:

- Single Point design was found to improve the level of service but would require extensive reconstruction of I-435, would cost about \$31 million for right-of-way and construction, and would cause problems due to the long clearance times for trucks through the intersection.
- Half-Cloverleaf design was found to improve the level of service for the exit ramps but would require large amounts of right-of-way, would cost about \$37 million, and would cause problems with trucks not being able to appropriately accelerate from the loop ramps onto the freeway.
- Roundabout design was found to cost less than the other options at about \$10 million but did not perform as well and would cause problems with operation if trucks did not use the roundabouts at the same time.
- Tight Urban Diamond design was found to require extensive reconstruction of I-435, did not function as well as the single point or half-cloverleaf and would cost about \$28 million for right-of-way and construction.

The Core Team was concerned that any substantial investment at this location could be negated by any potential future capacity improvements to I-435. It was determined that for a cost of \$11 to \$12 million, the existing tight diamond could be modified to provide capacity improvements

lasting 10 to 15 years at less cost and would not require any reconstruction of I-435. At that time, a preliminary design was developed which included:

- Adding lanes to the exit ramps with double and triple left turns onto Front Street.
- Adding lanes to Front Street for about one-half mile on each side of the interchange to handle the traffic from the exit ramps.
- Adding lanes to Front Street under the I-435 bridges requiring retaining walls behind the bridge piers in the existing sand fills.

In 2005 the Core Team discovered a Diverging Diamond Interchange (DDI) in Versailles, France. It has been in place for more than 20 years and has a low accident rate. We decided to create a traffic model and compare it to the traffic model developed for the previous preliminary design. The DDI design provides the following advantages over the previous design:

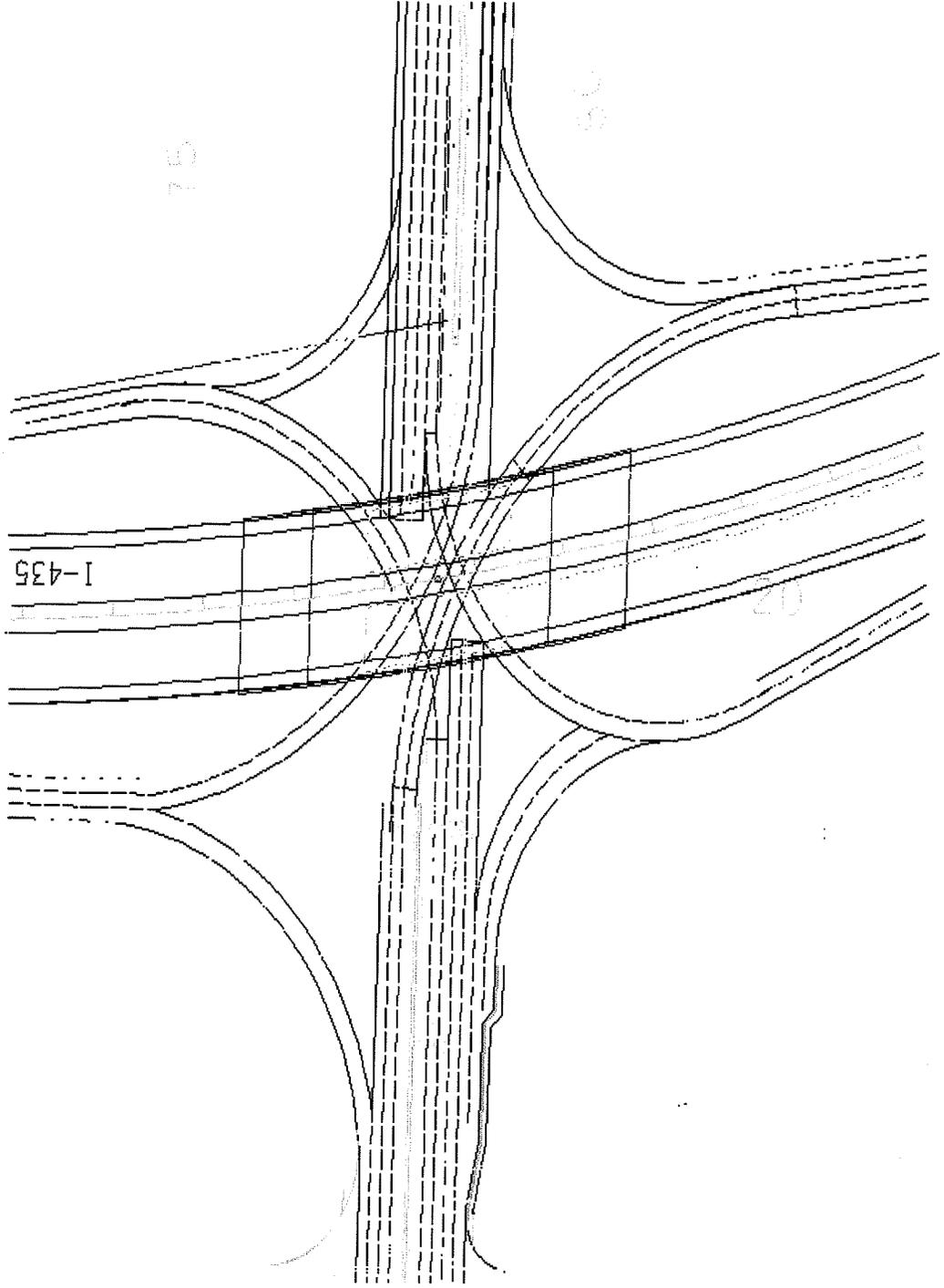
- Capacity of left turn lanes doubles, eliminating the need for the triple left turn lanes and eliminating the left turns across opposing traffic, improving safety.
- Levels of service in the interchange improve from D, E and F to A, B and C.
- Reduces the number of lanes required under I-435, eliminating the retaining walls.
- Reduces the number of lanes needed on Front Street beyond the interchange, reducing the right-of-way impacts.
- Increases the storage capacity between the ramp terminals from 350 feet to 550 feet.
- Improves sight distance at the ramp terminals.
- Allows for simpler signal timing and geometry, which accommodates U-turns if needed.
- Incorporates geometry that has traffic-calming features and reduces speeds while maintaining capacity. This should result in fewer and less severe crashes.
- Allows shorter signal cycles that should improve pedestrian compliance and safety.
- Reduces the amount of infrastructure to construct, maintain or replace in the future.
- Reduces conflict points in the interchange from 45 to 21.
- Reduces the length of time to construct the project from two construction seasons to one.
- Significantly reduces the cost of the project to about \$7 million.

The Core Team originally settled on a “practical design” after the 2002 VE study because of the many unknown factors concerning I-435. However, after studying the DDI design in 2005, the team decided it was a better design solution for this project and proceeded to present our findings to District and Central Office management, with the support of Federal Highway Administration (FHWA). FHWA has built a traffic simulator based on our design, including our proposed signing, signals and pavement markings. This model has helped us improve the safety of the design and allowed FHWA to study driver’s reaction to the DDI. We used the traffic models and drive through videos from the traffic simulator at the public hearing and the public has reacted positively, stating they understand and like the concept of the DDI.

This will be the first DDI in North America. MoDOT, FHWA and other transportation agencies in many states and other countries are anxious to see it in operation.

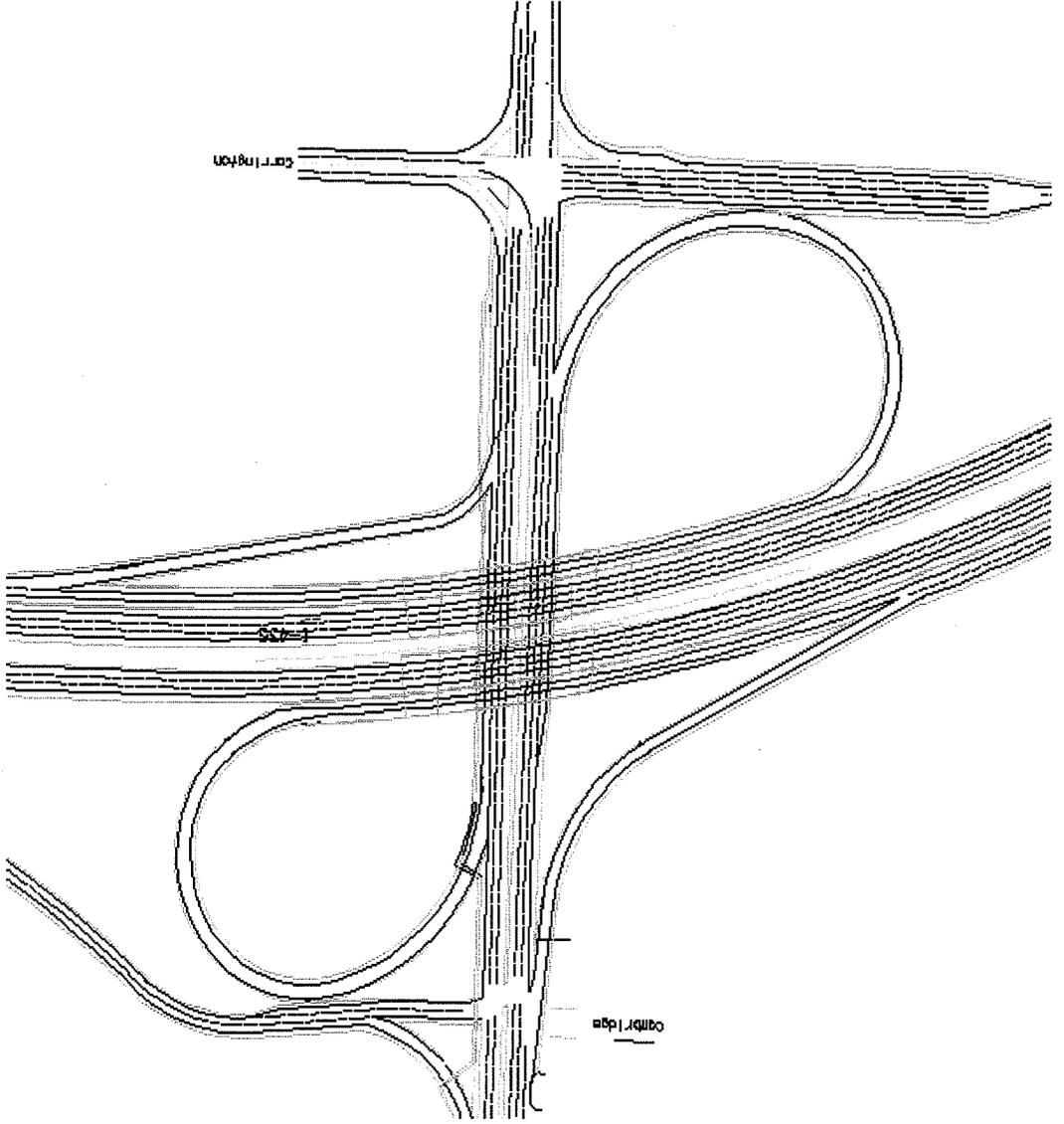
# Single Point

R/W \$2M Const. \$29M (2002)



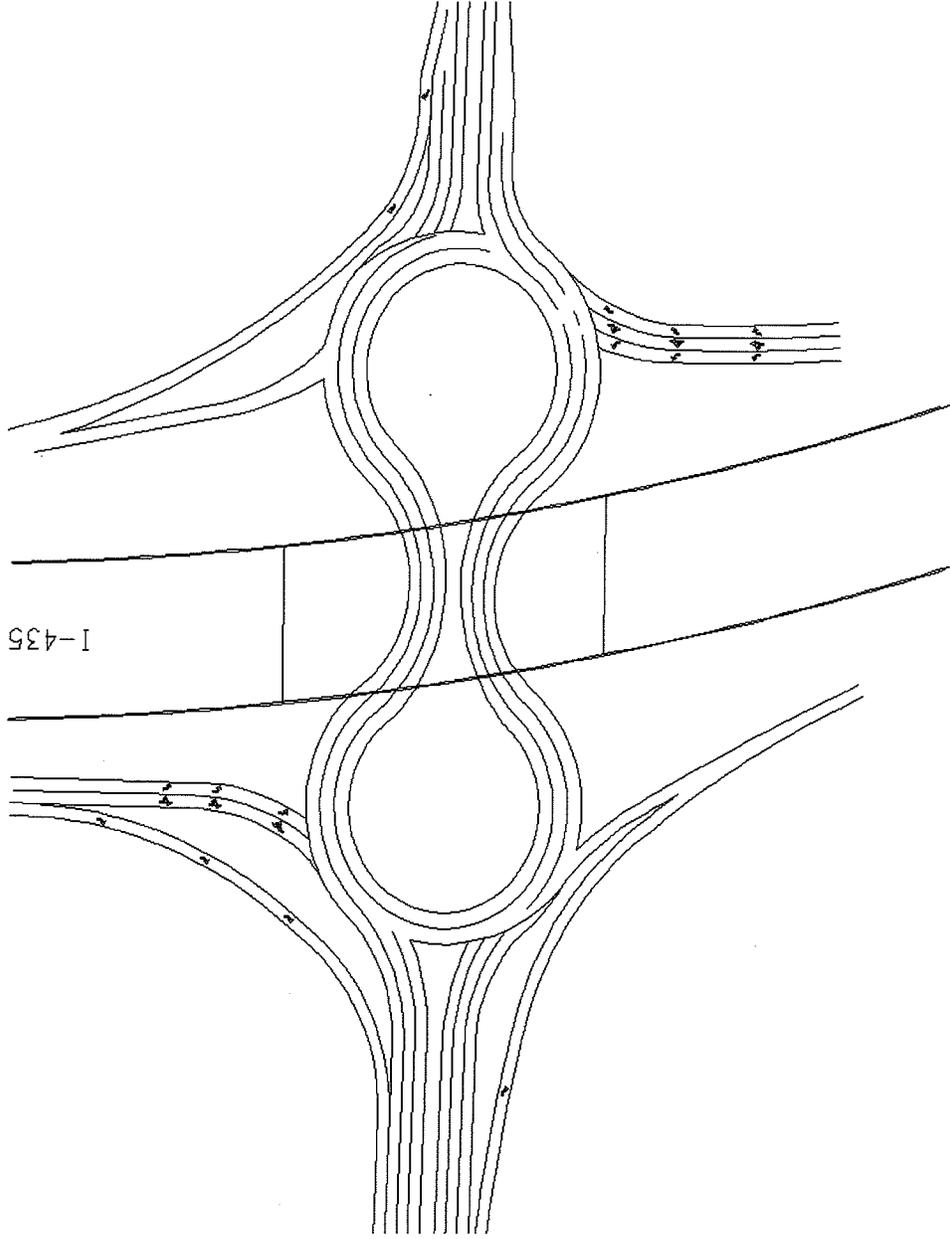
# Half-Cloverleaf

R/W \$11M Const. \$26M (2002)



# Roundabout

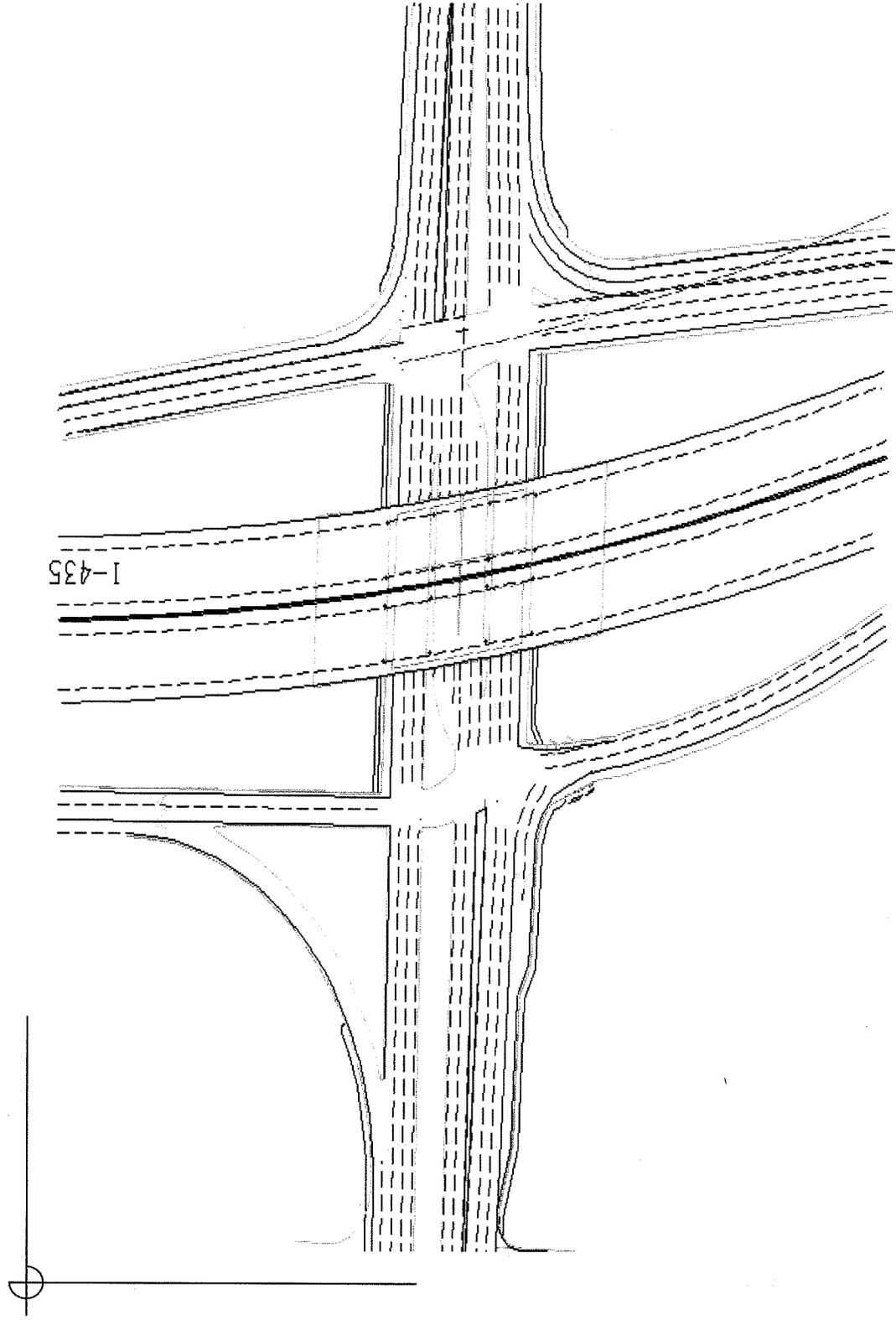
R/W \$2M Const. \$8M (2002)



# Tight Urban Diamond

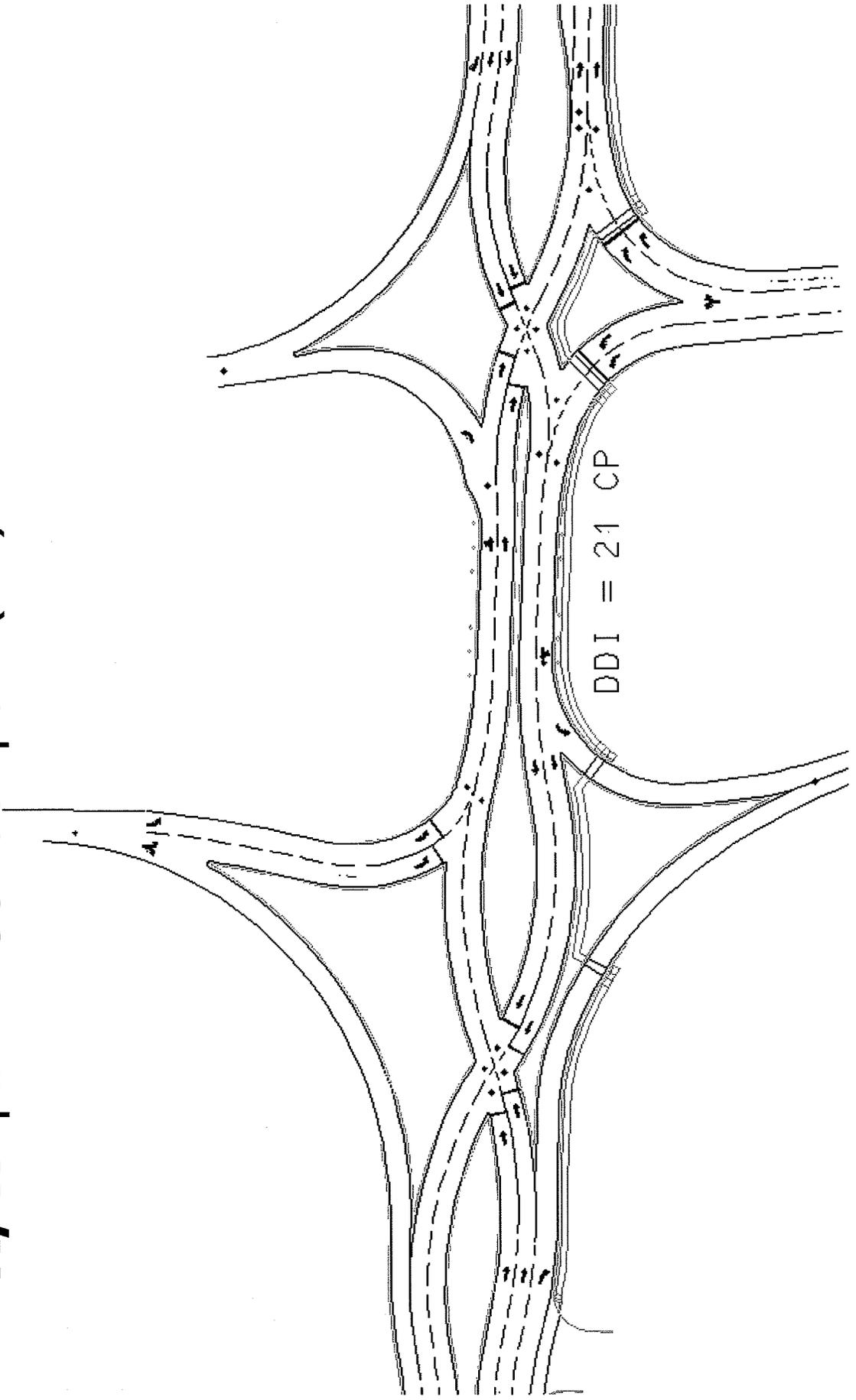
**New - R/W \$2M Const. \$26M** (2002)

**Mod. Existing - R/W \$4M Const. \$7M** (2005)



# Conflict Point Diagram – DDI

R/W \$1M Const. \$6M (2005)



# 2007 APPLICATION FORM

(required for each entry)

Job No. J41121B

Route I-435

County Jackson

STIP Description (Scoping or Construction, state which STIP)

05-09

06-10

07-11

Add lanes to ramps and Front Street from River Front Road South to Hawthorne Road.

Project Manager (could have both)

MoDOT Susan McCubbins

Consultant \_\_\_\_\_

Active core team members as approved by the MoDOT PM (may include consultants)

Josh Scott-D4 Trans. Planning

Mark Stock-D4 Area Engr.

Kevin Irving-FHWA

Dave MacDonald-D4 Traffic

Steve Porter-D4 Comm. Rela.

Laura Ruman-Design-Env.

Susan Nelson-D4 Design

Joe Donner-D4 R/W

Robert Rhodes-D4 Design-Utilities

Rob Curtin-D4 Design

Project Contacts (will have both for consultant entry)

District Susan McCubbins

Consultant \$ \_\_\_\_\_

STIP budget \$7617

or

Award cost \$ \_\_\_\_\_

Value Engineering study during design? yes  no  (if yes) Project Stage Conceptual Study

VE Contact person \_\_\_\_\_

Construction-stage VE (VECP)? yes  no  (if yes) Explain \_\_\_\_\_

Total VECP savings \$ \_\_\_\_\_

VECP Contact Person \_\_\_\_\_

Why is this entry the "poster" image for MoDOT's practical design philosophy?

(In layman's terms - 100 words or fewer – attach additional sheet if necessary) \_\_\_\_\_

After a VE study in 2002, the Core Team decided modifying the existing tight urban diamond to provide 10 to 15 years of improved capacity and safety, at a cost of \$11 million, was a better use of the available funds than spending \$28 to \$37 million on total reconstruction of the interchange. In 2005 we discovered the diverging diamond interchange (DDI) design. Comparisons with previous traffic models and estimates showed the DDI design would provide greatly increased capacity and safety at this location for 20+ years and would reduce the total project costs by \$5 million dollars. This will be the first DDI in North America.

Send entries to: MoDOT Design Division, ATTN: Jay Bestgen  
1320 Creek Trail Dr.  
Jefferson City, Missouri 65109

**All entries must be received no later than close of business on February 1, 2007**