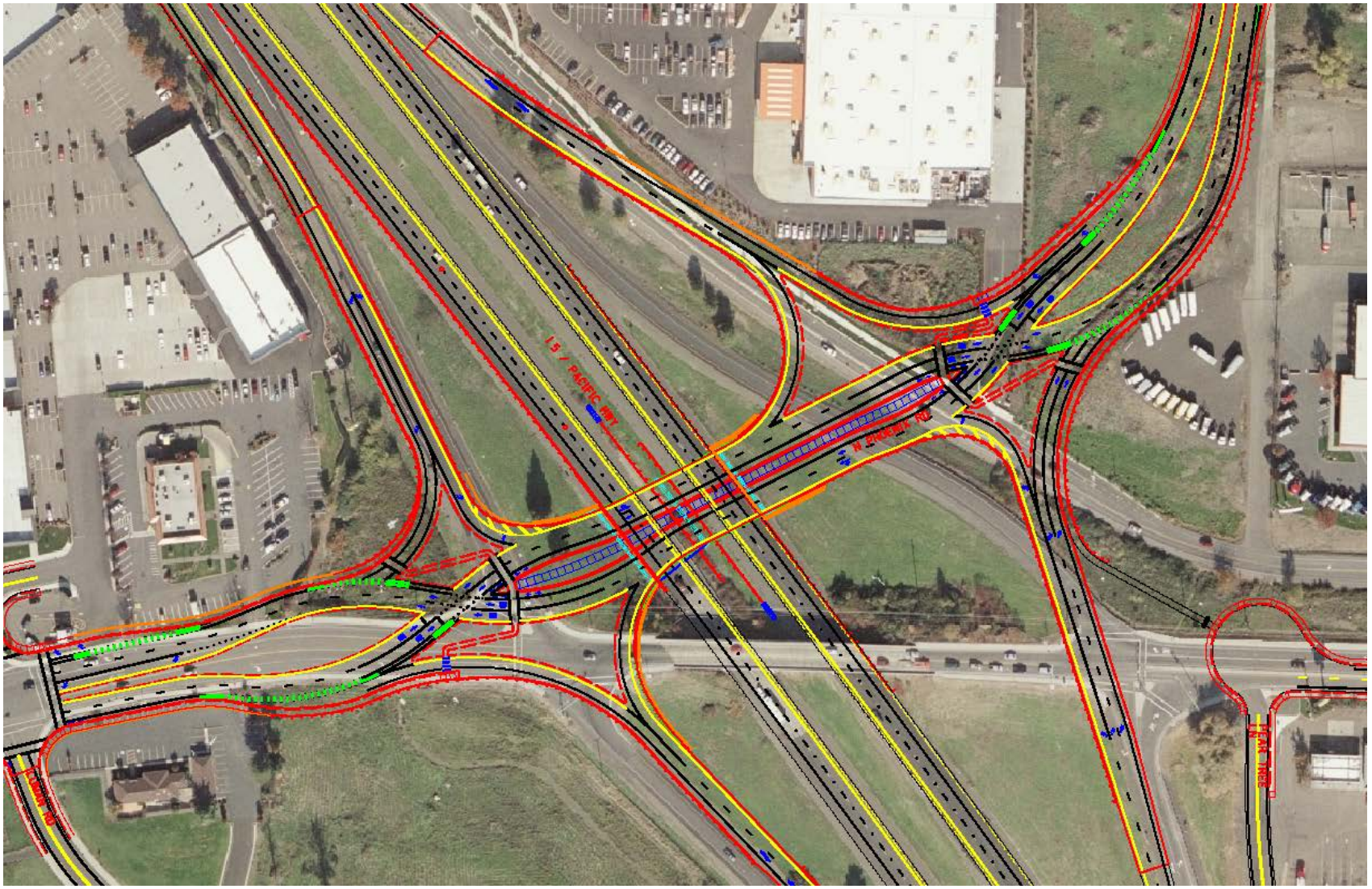
Fern Valley Interchange – I-5, exit 24 Diverging Diamond Interchange

Fern Valley Interchange – I-5, exit 24

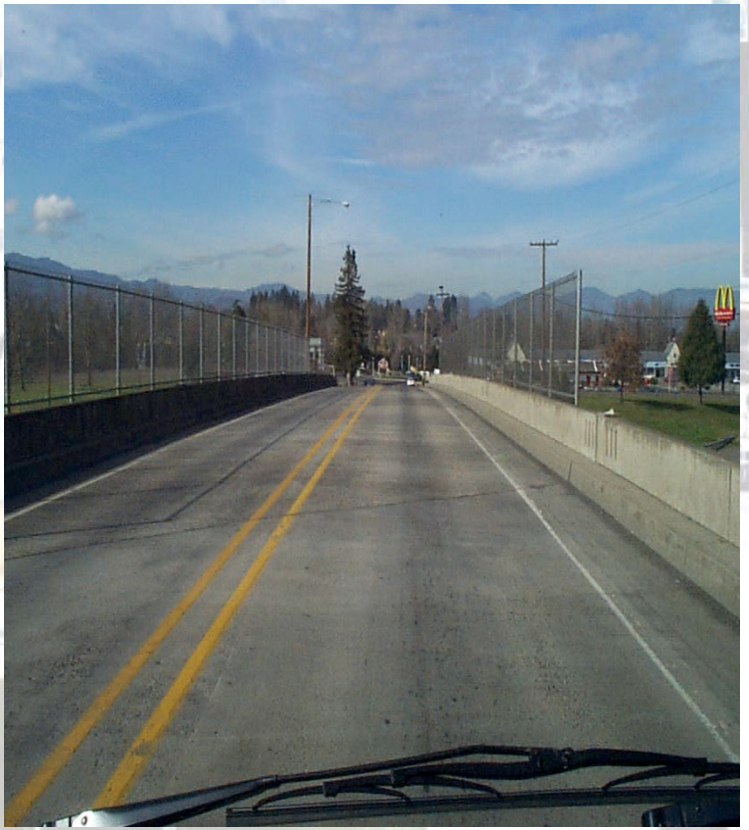
2013 Transportation Engineering Conference

Fern Valley Interchange (exit 24) DDI



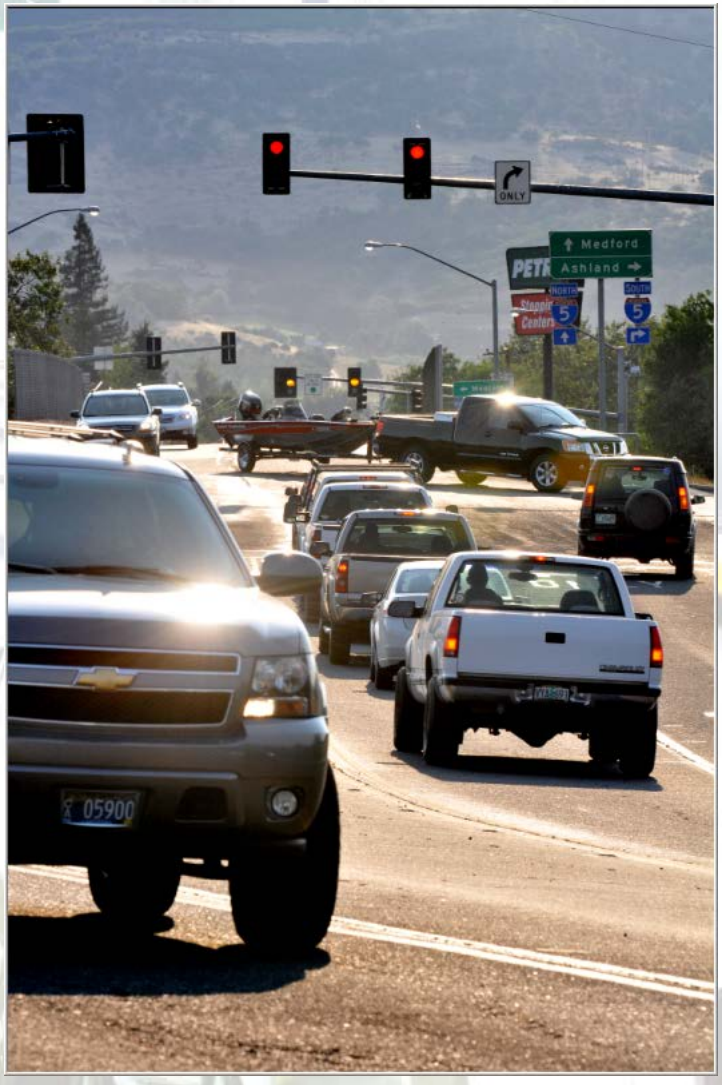
Existing Conditions - Fern Valley Interchange

- The southbound ramp is at capacity and the northbound ramp is exceeding capacity
- *Peak hour traffic queuing up on the off-ramps backs up onto I-5*
- Making left turns onto Fern Valley Road from I-5 ramps is extremely difficult, causing motorists to pick unsafe gaps in the traffic when merging
- Existing bridge is too narrow to add left turn lanes
- The vertical curve of the existing I-5 overcrossing results in unsafe sight distance.



Existing Conditions - Fern Valley Interchange

- **Both Luman Road and Pear Tree Road are located too close to the ramp terminals to allow for safe traffic movements. 750’ to first R-in/R-out 1320’ to first full movement intersection.**
- ***These conditions combine to create a safety and operational problem for the interchange***
- **Existing Bear Creek Bridge is load rated and narrow limiting freight and creating unsafe conditions for bikes and pedestrians.**
- **Existing Hwy 99 has shared 14’ outside travel lanes (bicycles) and only has sidewalks on the west side.**



Fern Valley Interchange – I-5, exit 24 Diverging Diamond Interchange

Brainstorming with MoDOT

Advantages of the Diverging Diamond Interchange

- Improved efficiency & capacity by eliminating protected left turn signal phase (Free Left)
- Reduced number of conflict points. (MoDOT saw 50% reduction in crashes)
- Improved signal operation by using two-phase signal with short cycle lengths
- DDI style interchange may reduce right of way costs due to smaller bridge structure
- DDI provides for easy U-turns for those interstate drivers who miss an exit

Advantages of the Diverging Diamond Interchange

DDI is safer than traditional diamond style interchanges as It effectively reduces the conflict points from 30 to 18

Table 1 Conflict Points

Type	Diamond	SPUI	DDI
Diverging	10	8	8
Merging	10	8	8
Crossing	10	8	2
Total	30	24	18

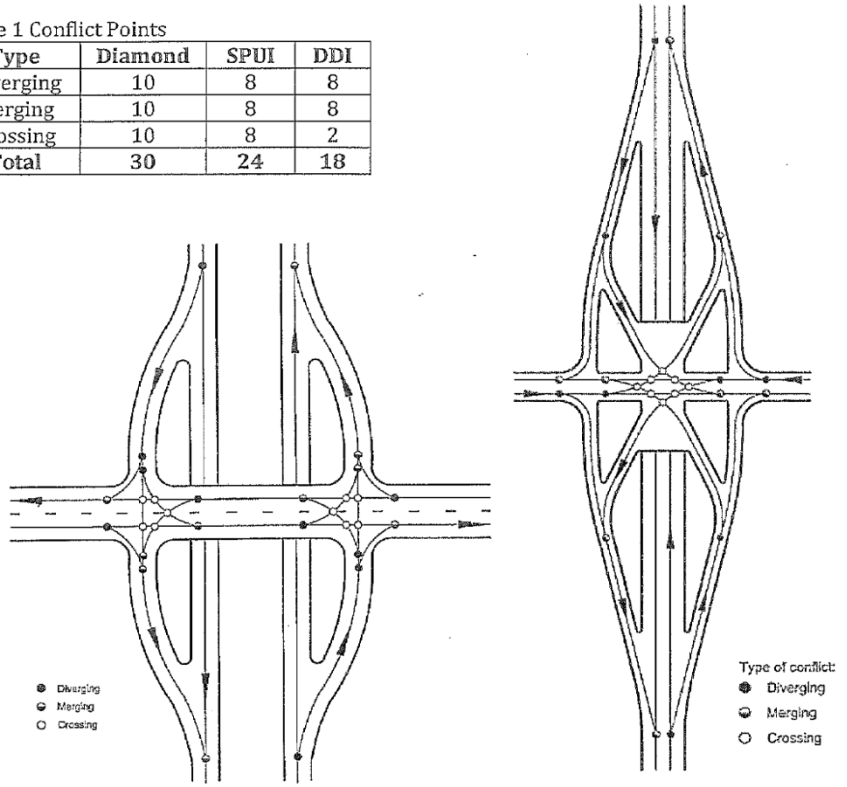
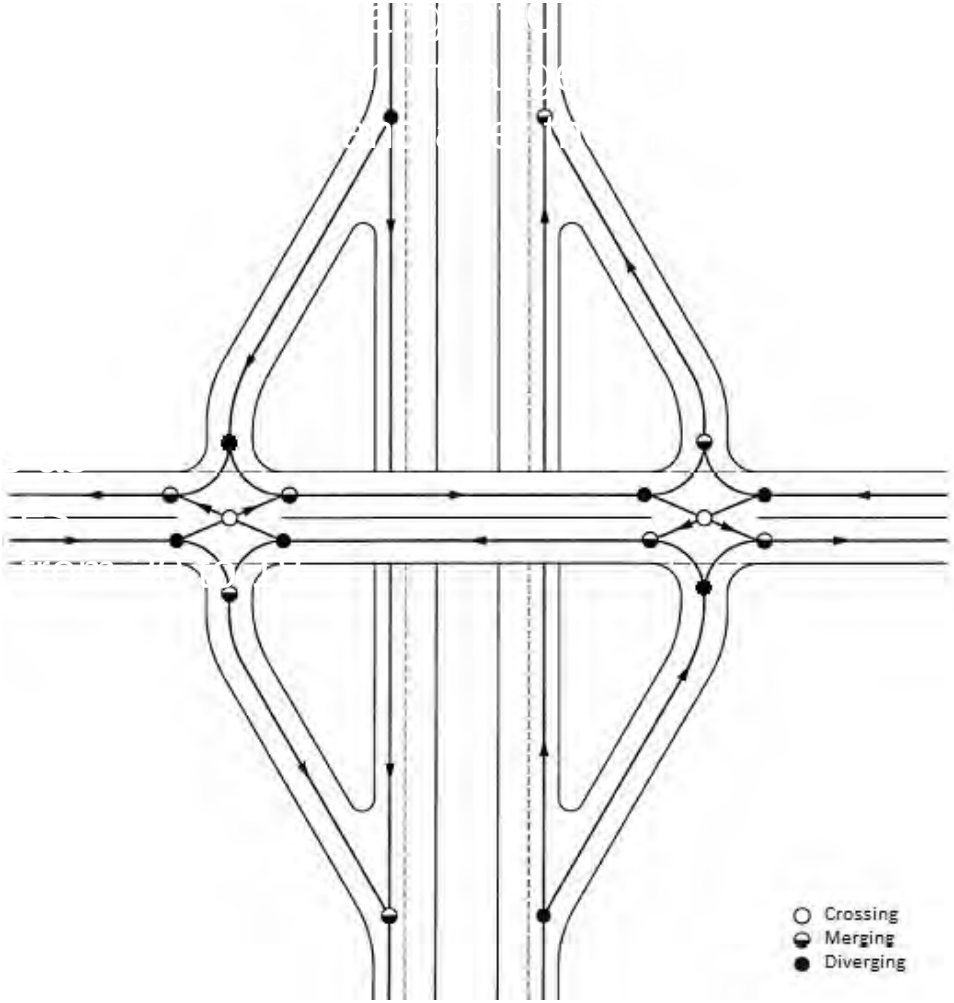


Figure 1.1 Points of conflict on traditional interchanges

Diverging Diamond Conflict Points

DDI reduces the most critical conflict point 'crossing' from 10, for a traditional diamond, to 2



Disadvantages of the Diverging Diamond Interchange

- If through traffic is heavy and balanced (50%/50%) the DDI may not perform as efficiently since opposing movements cannot run simultaneously.
- Does not work for system interchanges
- May be initially confusing to some drivers
- Traffic exiting the interstate may not re-enter in the same direction. No up and overs. Left or right turn only.
- Pedestrians may be confused at some crossings where traffic approaches from an unfamiliar direction.

Elements of Design:

Horizontal Geometry of Cross-Overs; they are the physically defining characteristic of a DDI.

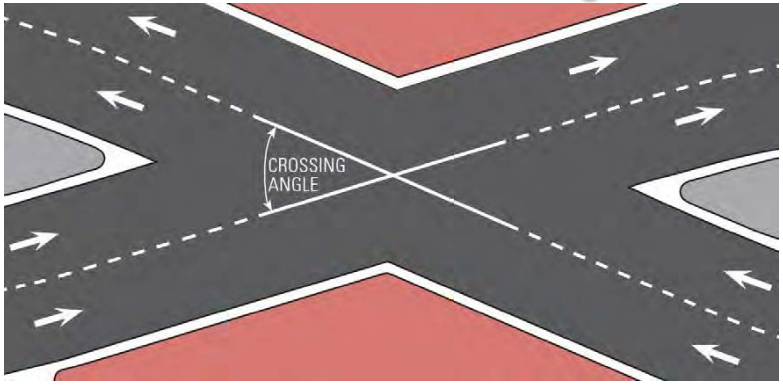
Could be viewed as ‘Non-traditional intersections of two one-way roads where only through movements occur’

- Crossing Angle
- Tangent Length
- Curve Radii (reversing curves) - define design speed of the interchange (25 mph)
- Lane Width

Elements of Design

Crossing Angle:

Is the acute angle between lanes of opposing traffic within the crossover, Missouri has used 40-50 degrees; Utah suggests 30 degrees



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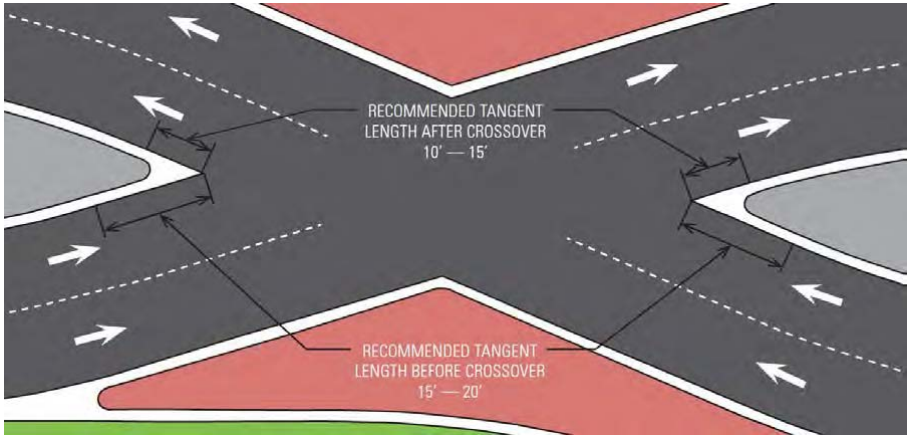
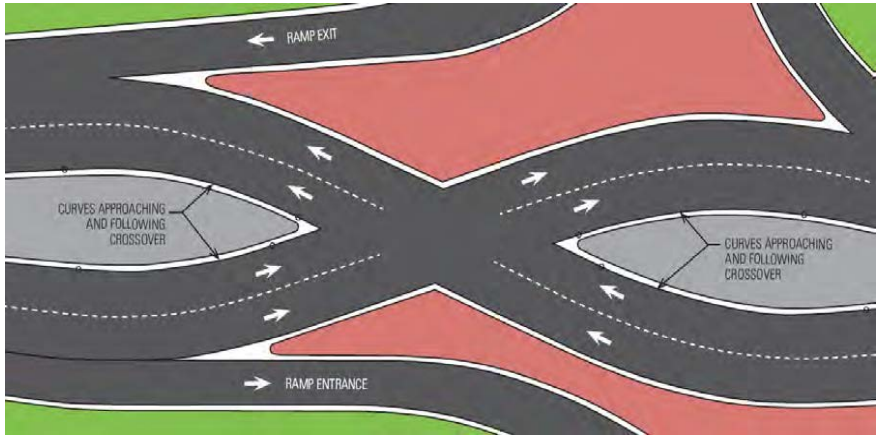
Tangent Length

Aligns vehicles with receiving lane

Curve Radii

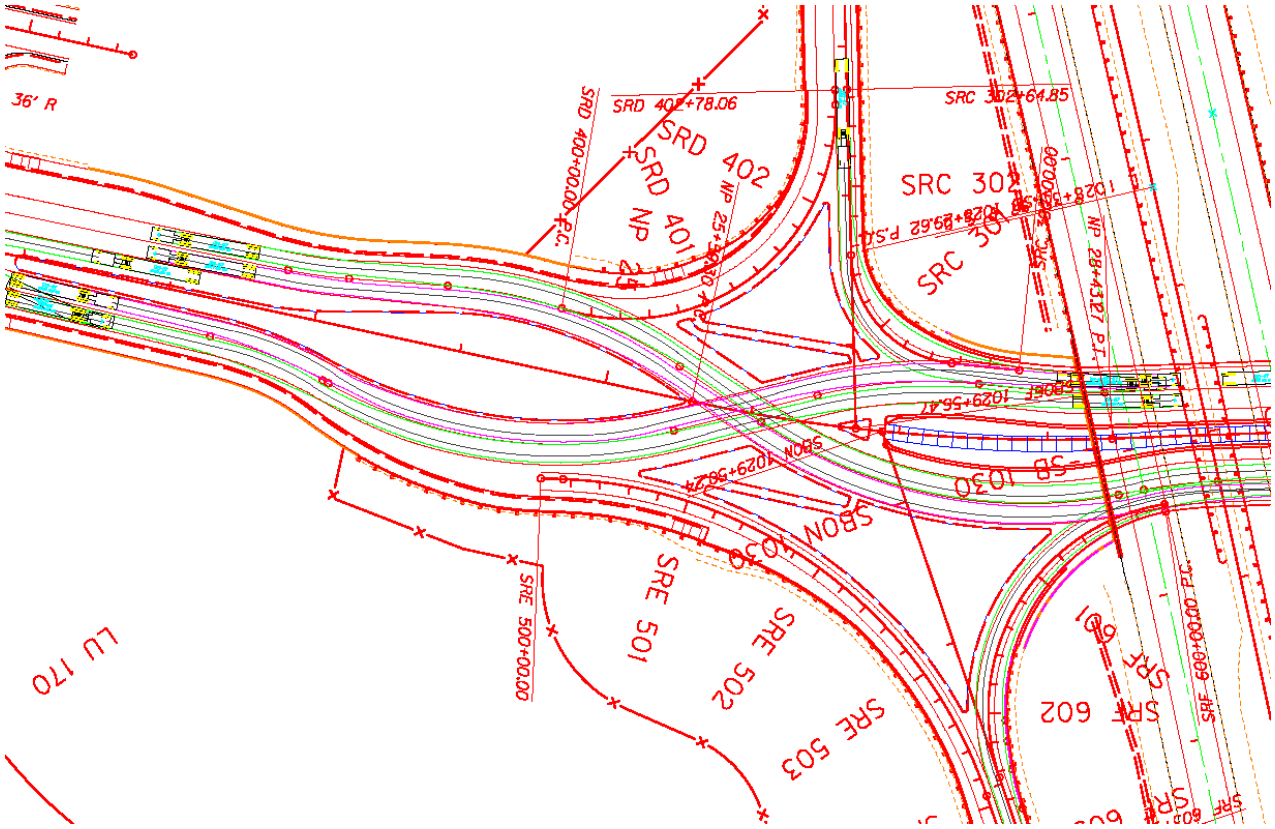
Typically 150’ to 350’





Lane Width

Cross-over lane width is a function of the interchange layout, horizontal and cross-over geometry, design vehicle off-tracking; WB-67 for most interchanges. In most cases the cross-over lane width will be greater than the normal cross road.




ONLY
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MACK

Pedestrians

All interchanges due to ramp terminals and structures are challenging to provide safe crossings for pedestrians, on foot or in a wheelchair.

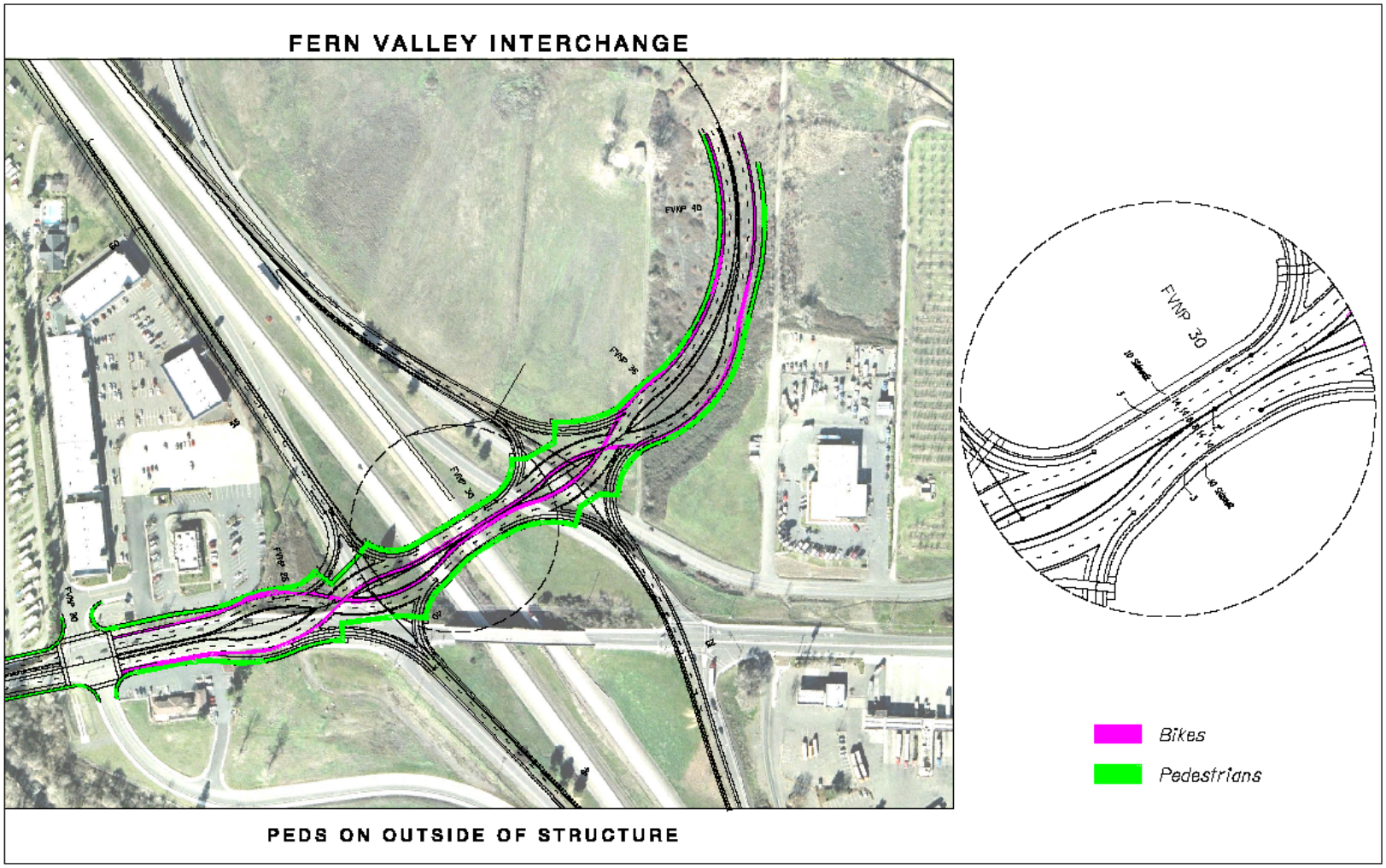
Anytime sidewalks approach the interchange they should continue through it.

Pedestrian behavior can be unpredictable and they may choose to cross where convenient to avoid out of direction travel.

The DDI provides two configurations to accommodate pedestrians

1. Outside Perimeter Pedestrian Crossing
2. Inside (middle of the cross-route) Pedestrian Crossing

Pedestrians



Pedestrian – Outside Crossing

Advantages -

Pedestrians may feel more comfortable as this is a more common and predicable crossing.

Less conflict if Interstate is carried over top as sidewalk is adjacent to abutment.

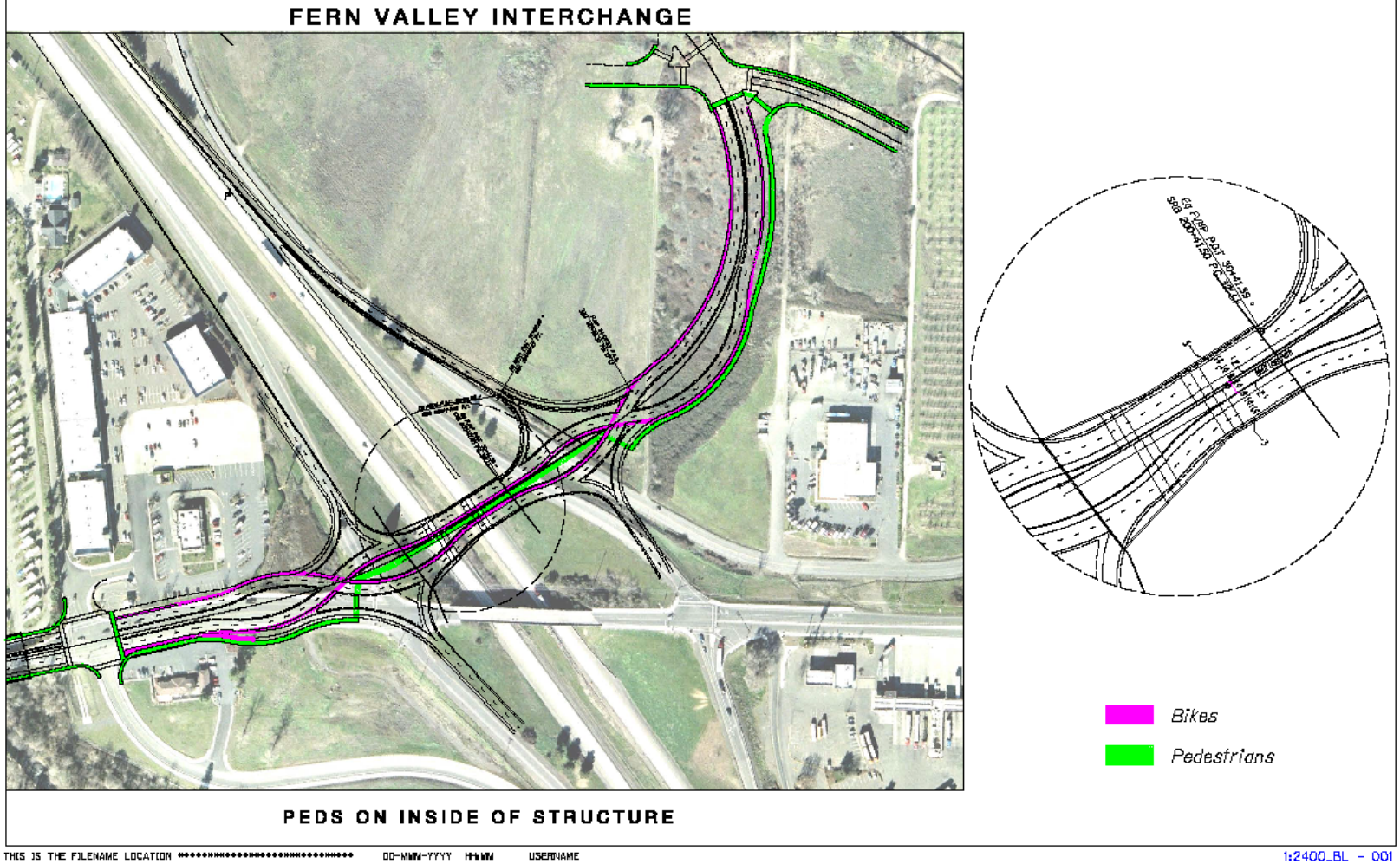
Disadvantages –

Pedestrians cross free-right and free-left movement at ramps.

Free-left movement may be inconsistent with pedestrian expectation as it approaches from an unfamiliar direction.

If mainline is carried over the cross-route bridge components may restrict sight distance for pedestrians crossing the free-left movement at slip ramps.

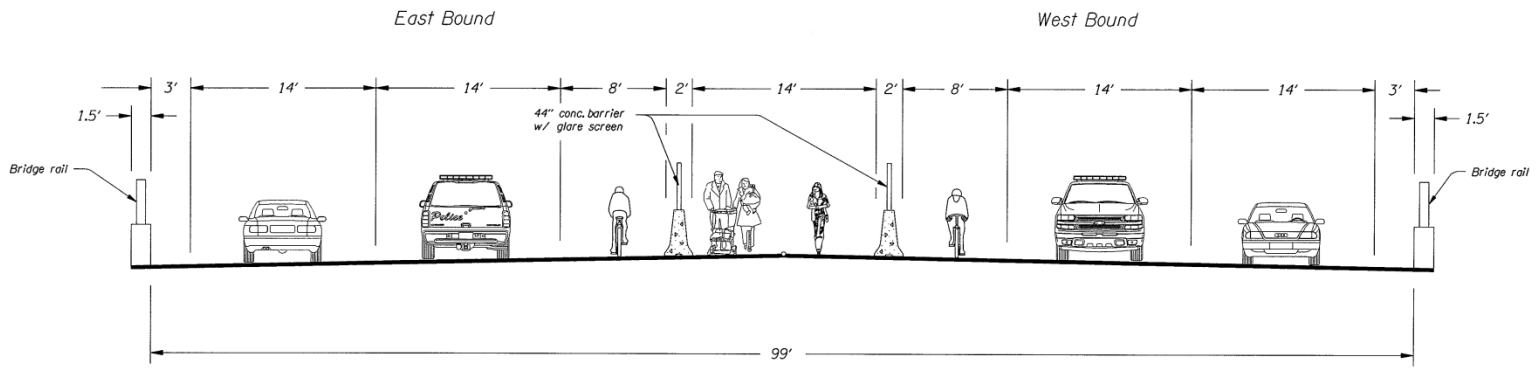
Pedestrians



Pedestrians

FERN VALLEY INTERCHANGE

POSTED SPEED: 25 MPH



PEDS IN MIDDLE OF STRUCTURE

Pedestrians - Inside Crossing

Advantages –

Reduction in number of times pedestrian crosses unprotected (future RRFB at free rights-conduit installed with project)

Only one walkway needed in median; less structure width = cost savings

Other Benefits of DDI –

Pedestrian can cross to other side of cross-route at cross-over intersection. Two phased signal provides opportunity for pedestrian to cross from inside island to inside median when opposing traffic is stopped at signal

Pedestrians - Inside Pedestrian Crossing

Disadvantages –

If interstate is carried over the cross-route interior bridge bents and columns may conflict with median sidewalk and complicate the design.

Pedestrians may feel uncomfortable if median crossing is narrow with vehicles traveling on both sides.

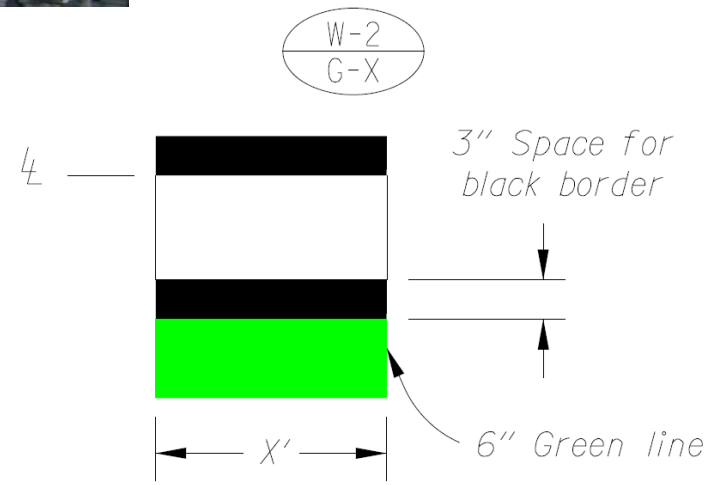
Traffic Separations Between Cross-overs

Bicycles

- Bike and Pedestrian sub-committee
- Siskiyou Velo – Bicycling Club
  - Provide bike lanes on Hwy 99
  - Clearly define/delineate bike lanes
  - Green pavement markings for bike lanes
  - Improve sight distance on Greenway horizontal curve under Bear Creek Bridge

Green Bicycle Pavement Markings

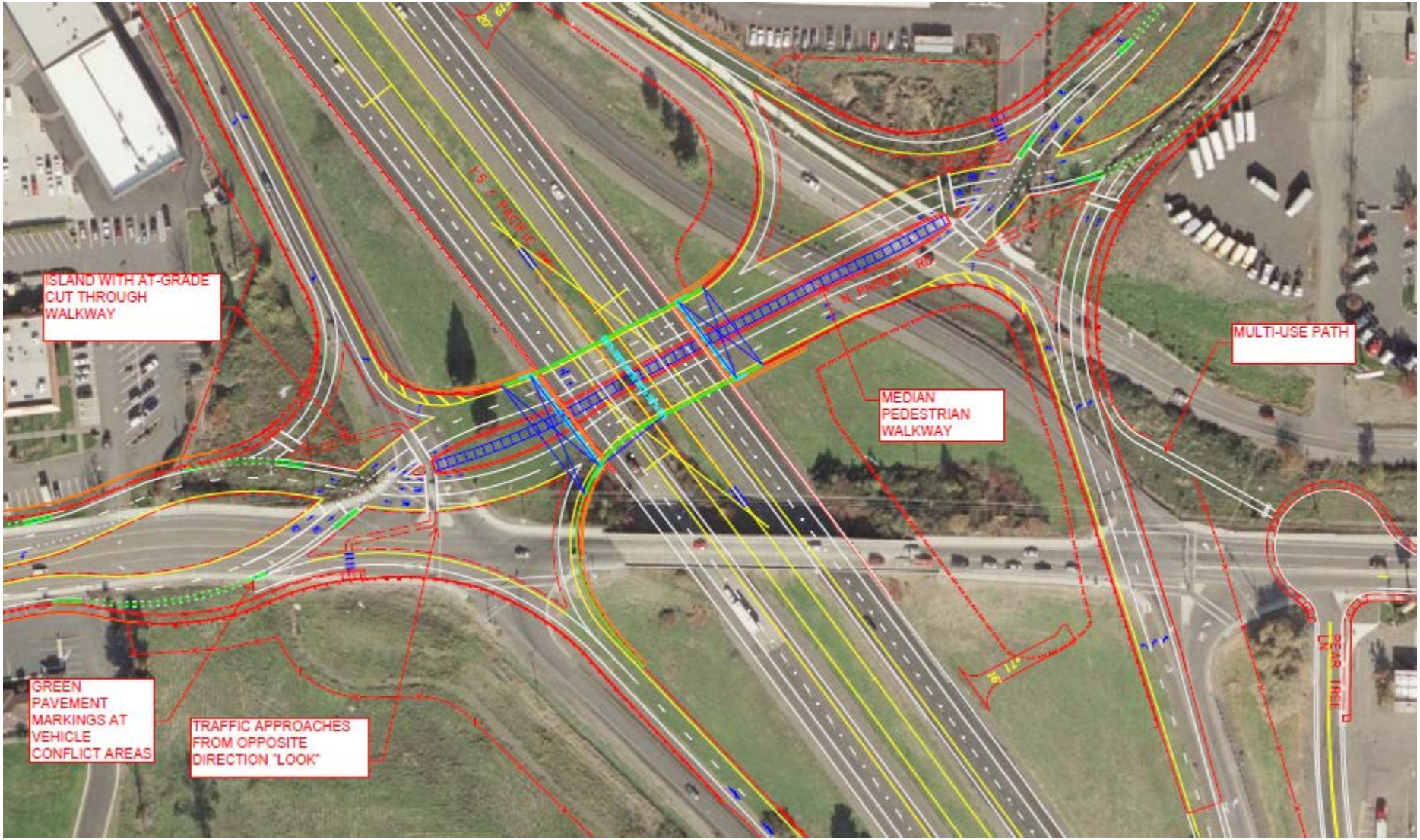
- Define space in which to ride
- Cyclists feel more comfortable
- Increase cyclist visibility
- Help motorists predict where to expect cyclists.

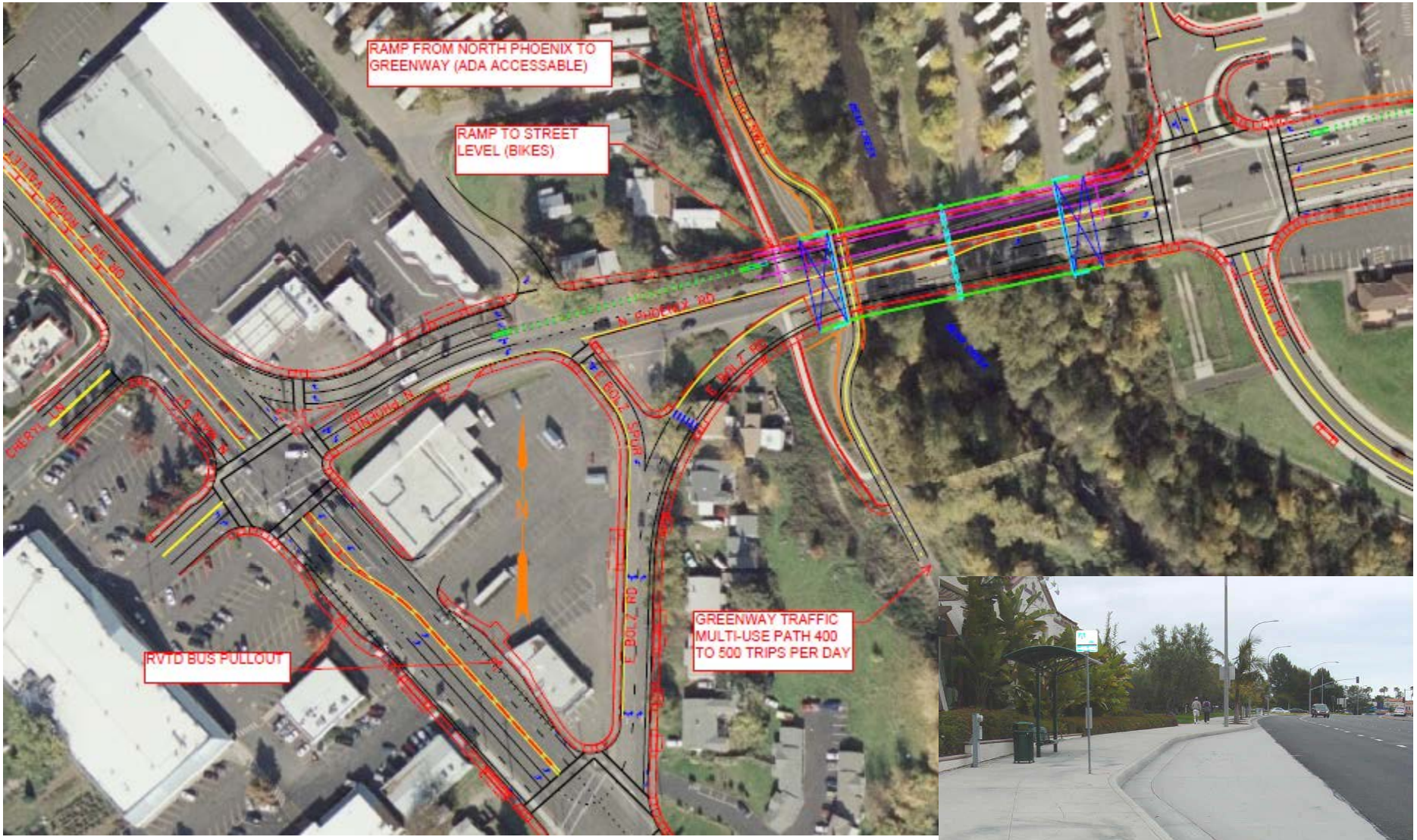


Bicycle traffic side

CHANNELIZING LINE SUPPLEMENTATION
6″ GREEN LINE WITH 8″ CONTRASTED WHITE LINE

For bike lane


ISLAND WITH AT-GRADE CUT THROUGH WALKWAY
MULTI-USE PATH
MEDIAN PEDESTRIAN WALKWAY
GREEN PAVEMENT MARKINGS AT VEHICLE CONFLICT AREAS
TRAFFIC APPROACHES FROM OPPOSITE DIRECTION "LOOK"


RAMP FROM NORTH PHOENIX TO GREENWAY (ADA ACCESSABLE)
RAMP TO STREET LEVEL (BIKES)
RVTD BUS PULLOUT
GREENWAY TRAFFIC MULTI-USE PATH 400 TO 500 TRIPS PER DAY

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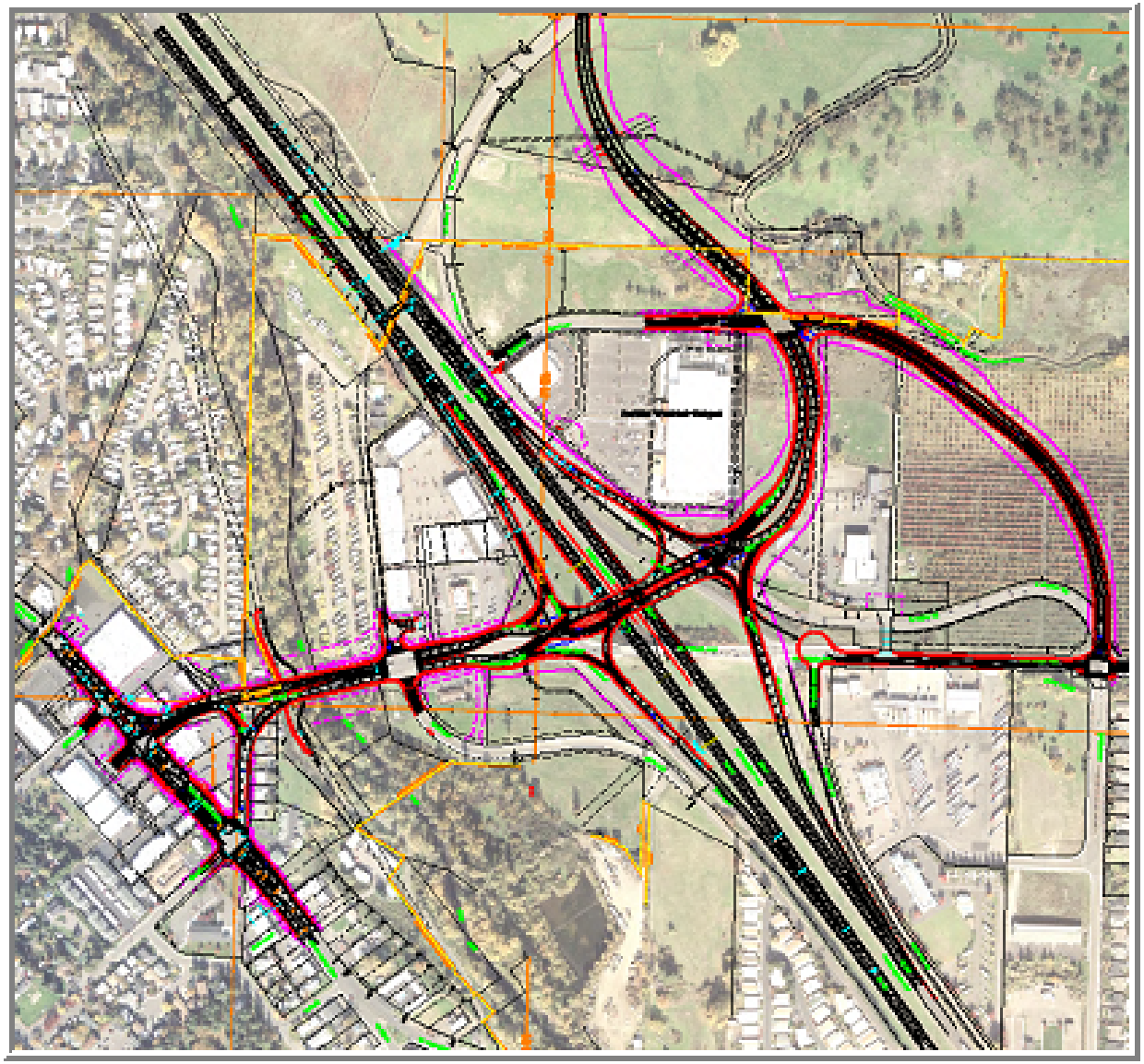

Conclusions

•The DDI is a good tool – not a one size fits all.

• It's a comparable alternative to using a Single Point (SPUI), a Tight Diamond (TDI), or a Partial Cloverleaf design.

• It's not an appropriate alternative for a "System" type interchange (Freeway to Freeway, e.g.).

• The DDI should be considered where there is heavy turning movements in multiple directions and there's need to move a lot of ADT in a relatively small space.

First DDI in the World ~ Versailles, France ~ built in the 1970's

Diverging Diamond Interchanges open in the U.S.A.

I-44 @ SR 13 Kansas Expressway - Springfield, MO.
US 60 James River Freeway @ National Avenue - Springfield, MO
I-15 @ American Fork Main Street - American Fork, UT
I-270 & Dorsett Road - Maryland Heights, MO
US 129 Bypass / SR 115 @ Middlesettlements Road / Bessemer Street - Alcoa, TN
I-15 @ SR 92 Timpanogos Highway - Highland, UT
KY Route 4 (New Circle Road) @ US 68 (Harrodsburg Road) - Lexington, KT
Bangerter Highway @ SR 201 - West Valley City, UT
I-15 @ 500 East - American Fork, UT
I-435 @ Front Street - Kansas City, MO
US 65 @ SR 248 - Branson, MO
I-285 @ Ashford-Dunwoody Road - Dunwoody, Georgia
MD 295 @ Arundel Mills Boulevard - Hanover, MY
US 67 @ SR 221 - Farmington, MO
I-590 @ South Winton Road - Brighton, NY
NEW!!! US 65 @ Chestnut Expressway - Springfield, MO
NEW!!! I-580 @ Moana Lane - Reno, NV
NEW!!! MO 150 @ Botts Road - Kansas City, MO

End of the Highway…