



INTERCHANGES

Module 7

Learning Outcomes

7-2

- At the end of this module, you will be able to:
- Identify how land uses around freeway interchanges create pedestrian trips
- Explain how and why pedestrian crashes occur at interchanges (driver expectation of pedestrians is very low; high-speed, free-flow movements)
- Select slow-speed, right-angle urban designs

Land Use, Vehicles and Pedestrians

7-3

Medford OR

- ❑ Large commercial tracts generate traffic
- ❑ Employees walk to jobs at retailers, restaurants, service stations, & hotels
- ❑ Visitors walk to and from restaurants and hotels
- ❑ Pedestrians must cope with vehicles entering and exiting the freeway

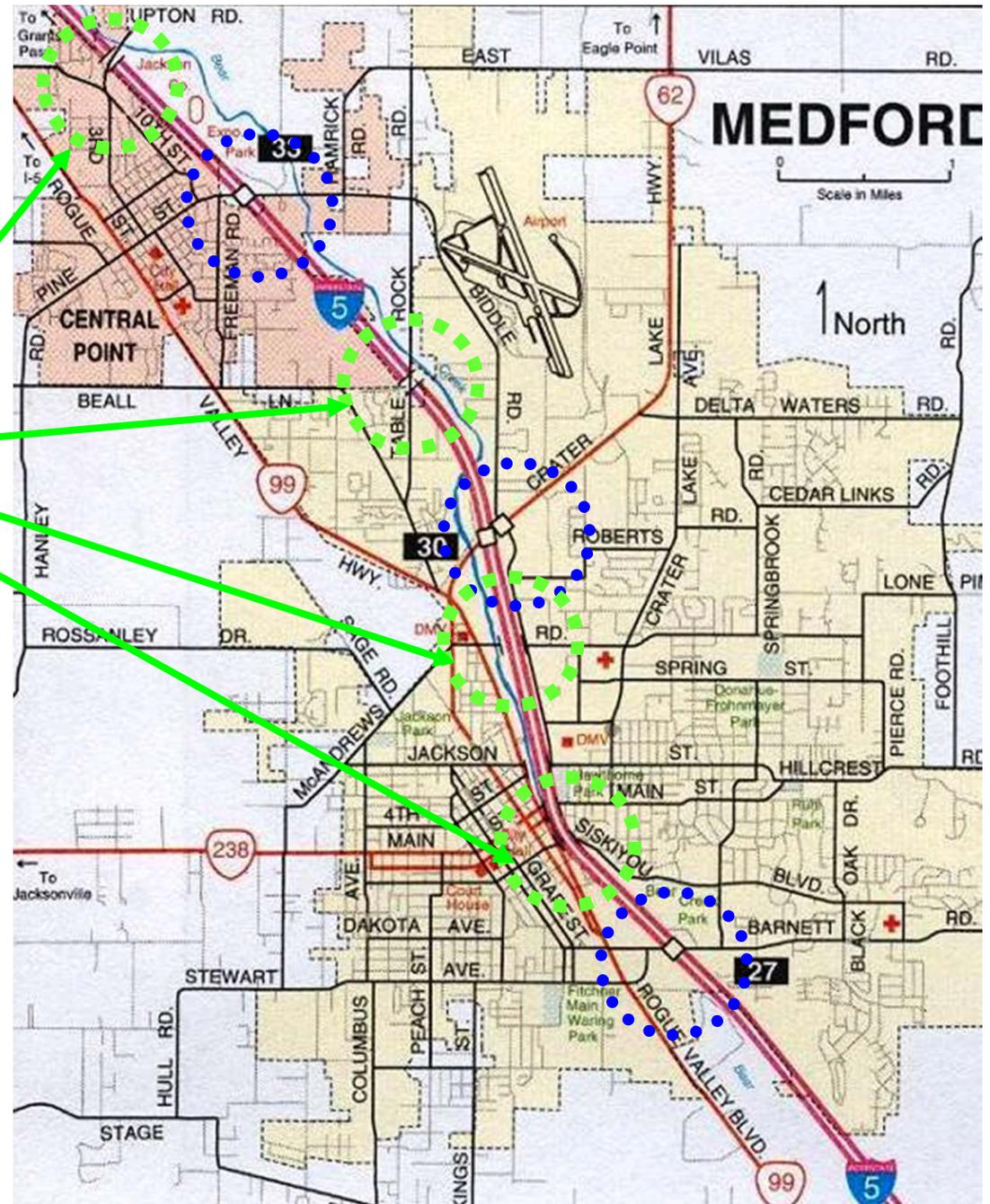


Typical city has a few freeway interchanges

And some non-interchange crossings

Non-interchange crossings are easier for pedestrians

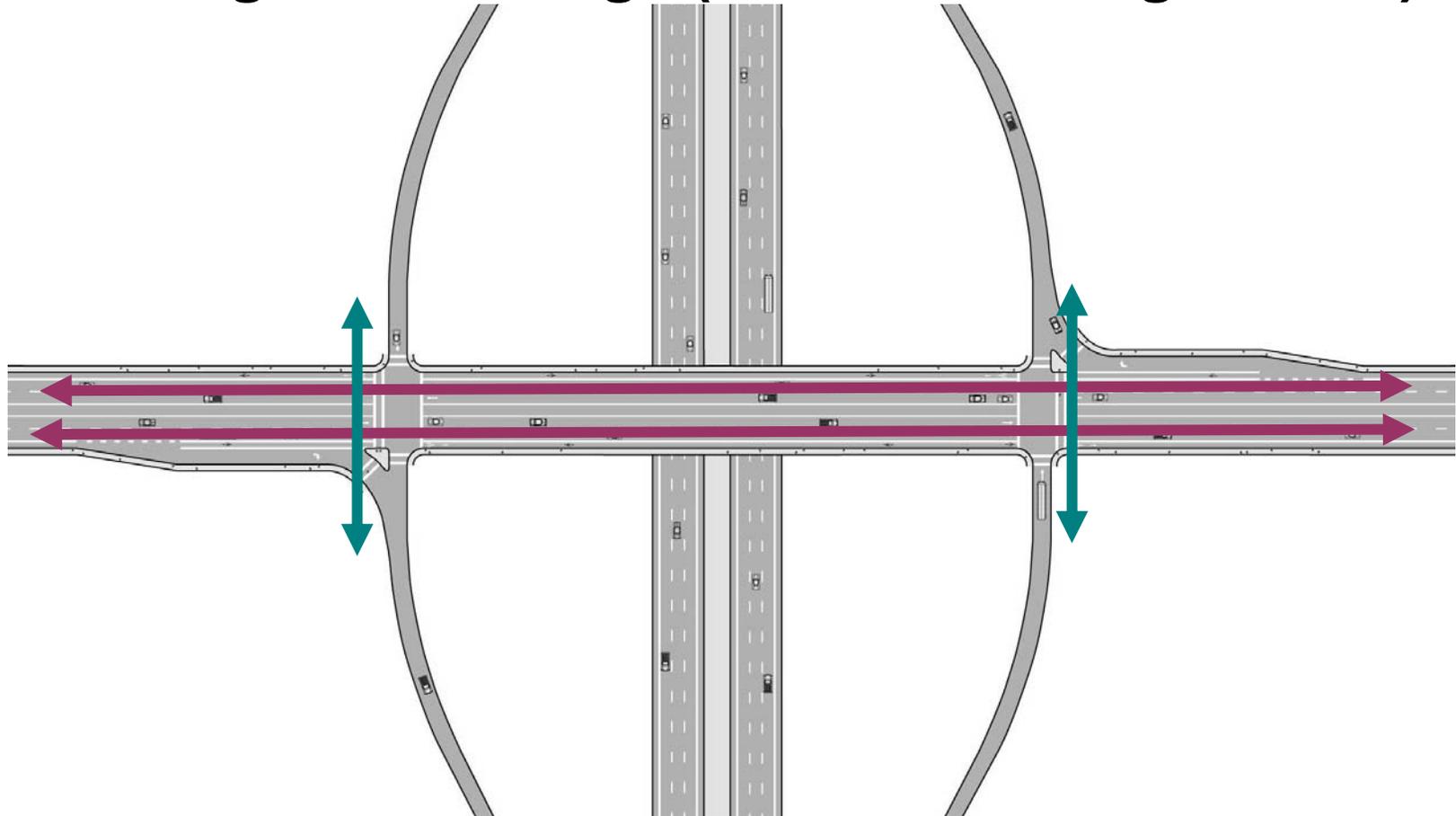
Interchanges have many conflicts



Accommodate all pedestrian movements

7-5

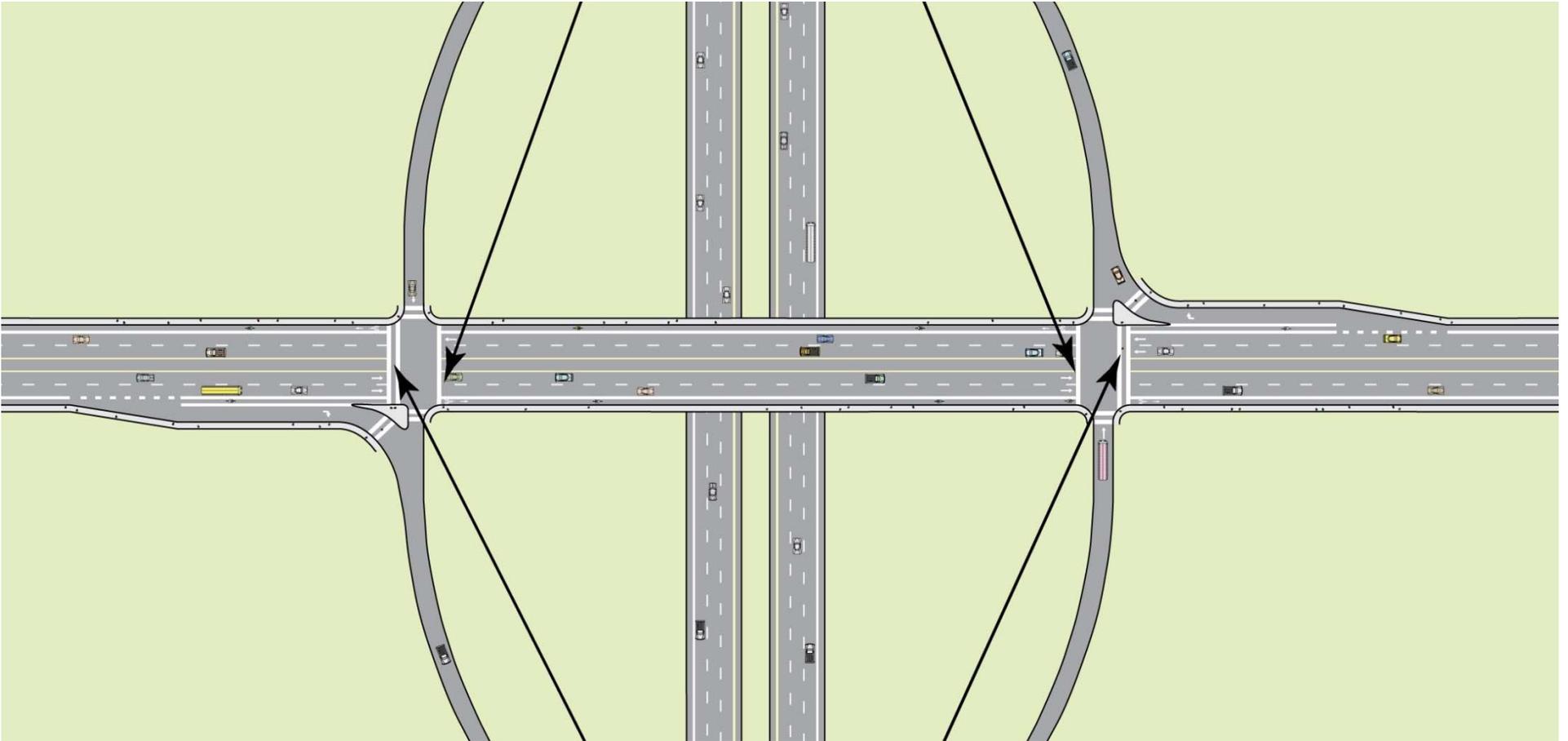
1. Through interchange (east-west along arterial)



2. Across the arterial (north-south)

Designing for Pedestrian Safety – Interchanges

These inside crosswalks may be closed

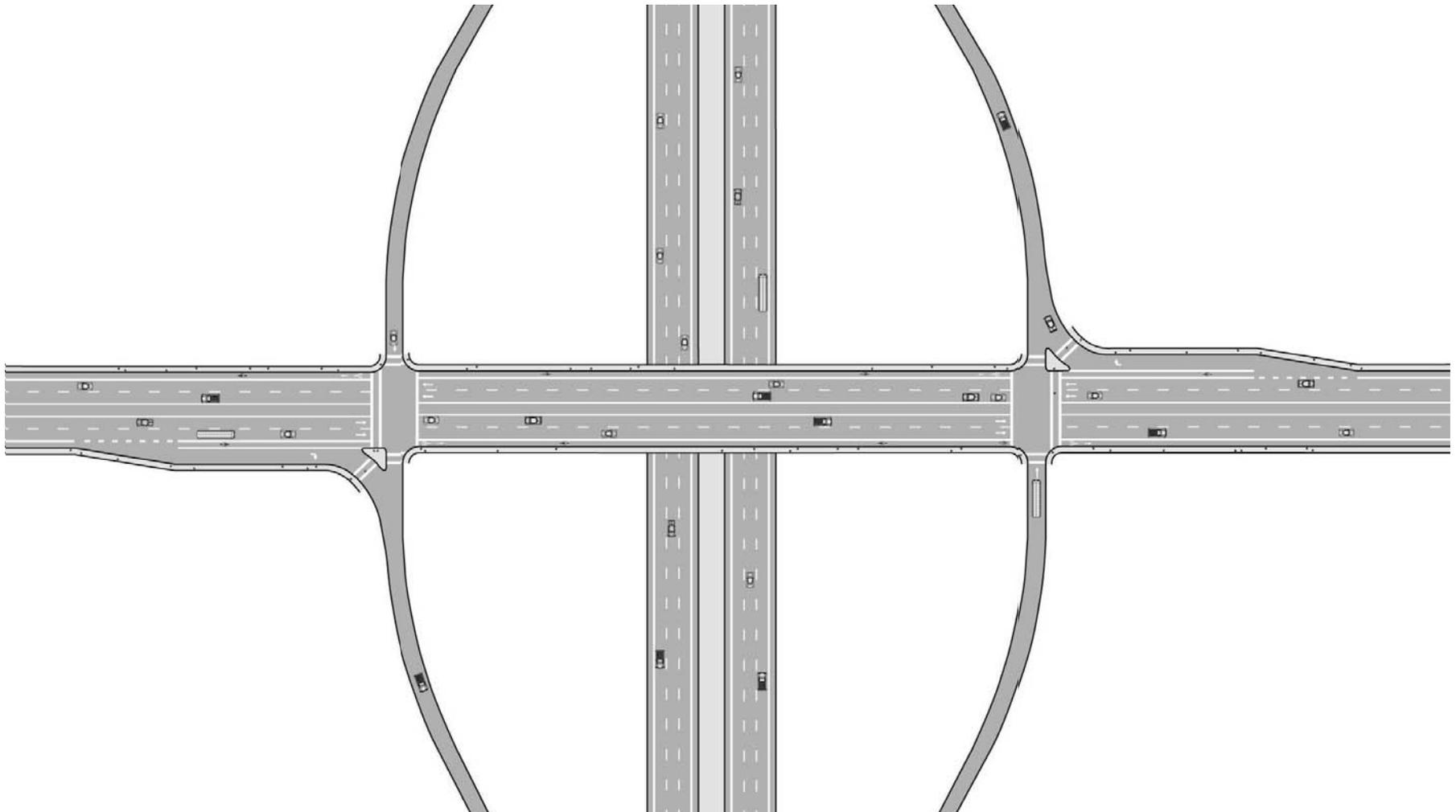


These crosswalks must be open

7-6

Designing for Pedestrian Safety – Interchanges

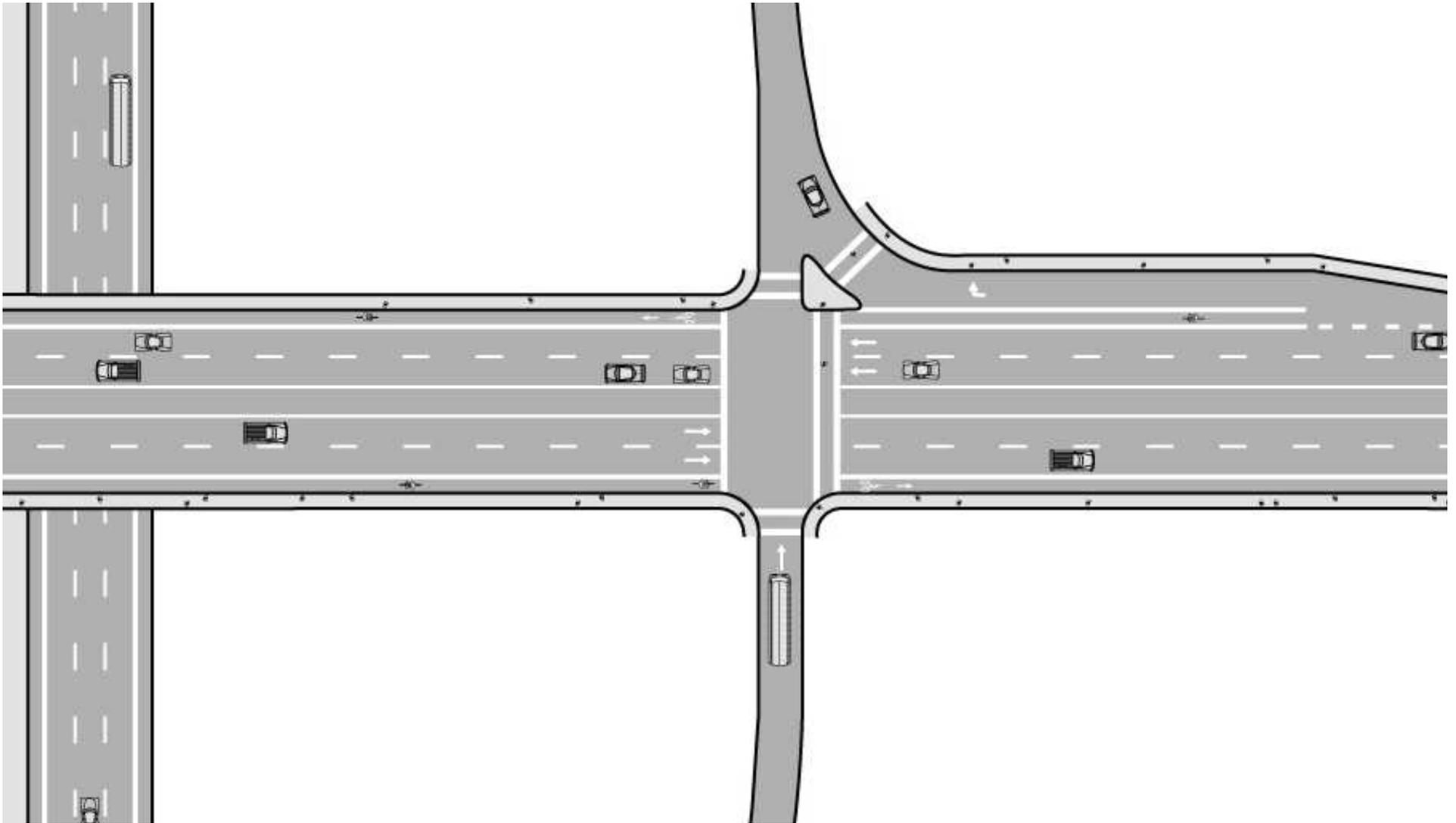
Interchange then becomes a Large Intersections





7-8 Baker City OR

- Design interchanges to look like an intersection, then drivers are more likely to expect pedestrians



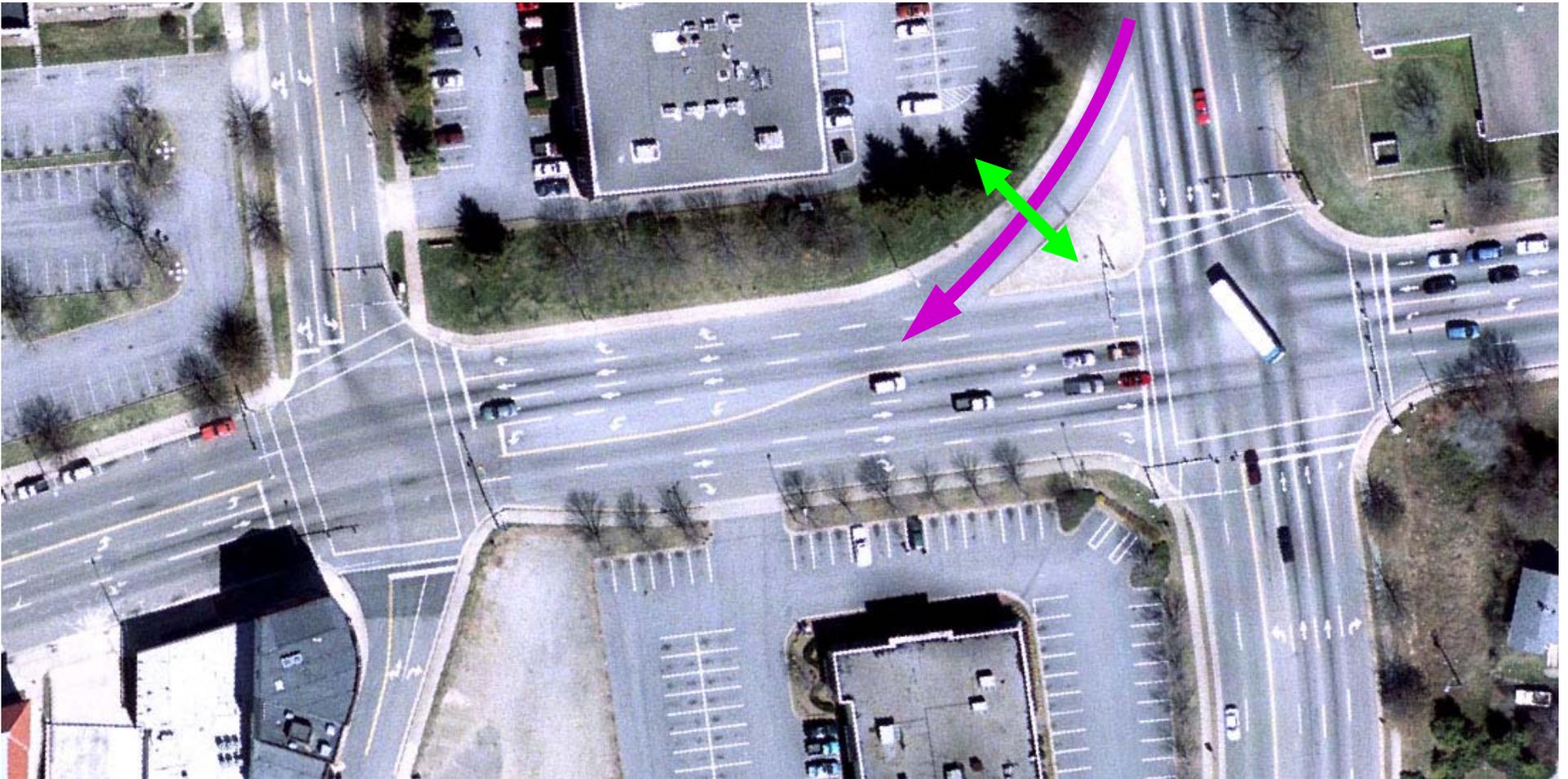
7-9

Consider each terminus as $\frac{1}{2}$ an urban intersection

Avoid free-flow movements...

7-10

Asheville NC



... they are difficult for pedestrians to cross

Designing for Pedestrian Safety – Interchanges

Positive Example: Reconfigured Ramp Terminus

7-11

Springfield OR



- Flat angle = wide crossing & high-speed turns
- Tight angle = short crossing & slow speed turns

Positive Example: Reconfigured Ramp Terminus

7-12

Springfield OR



- Red line = old crosswalk
- Green line = new crosswalk

Where free-flow ramps exist, good crosswalk placement is critical

7-13

- Reminder from geometry module – crosswalk placement requires balancing goals:
- Shortest crosswalk length
- Minimal crosswalk setback to:
 - ▣ Reduce out-of-direction travel
 - ▣ Provide good sight lines between peds and motorists
- Proper ramp placement



7-14 Salem OR

- Where free-flow ramps are used (least desirable)
Crosswalk should be placed where it's visible



7-15

Salem OR

Barrier should not obscure crosswalk

Designing for Pedestrian Safety – Interchanges

Crosswalk Placement

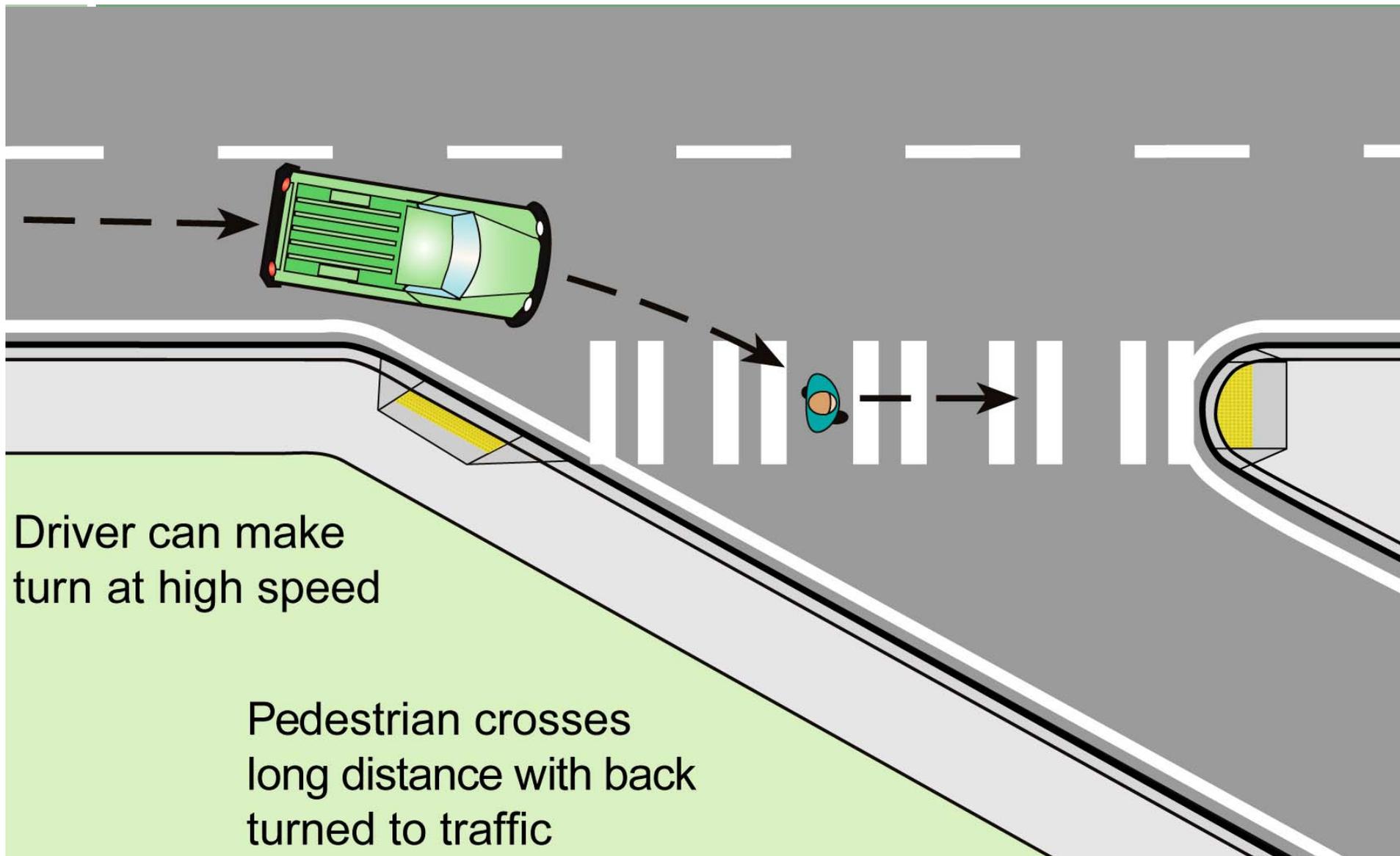
7-16

Choosing the best crosswalk placement where it's not clear what's most logical for the driver or the pedestrian:

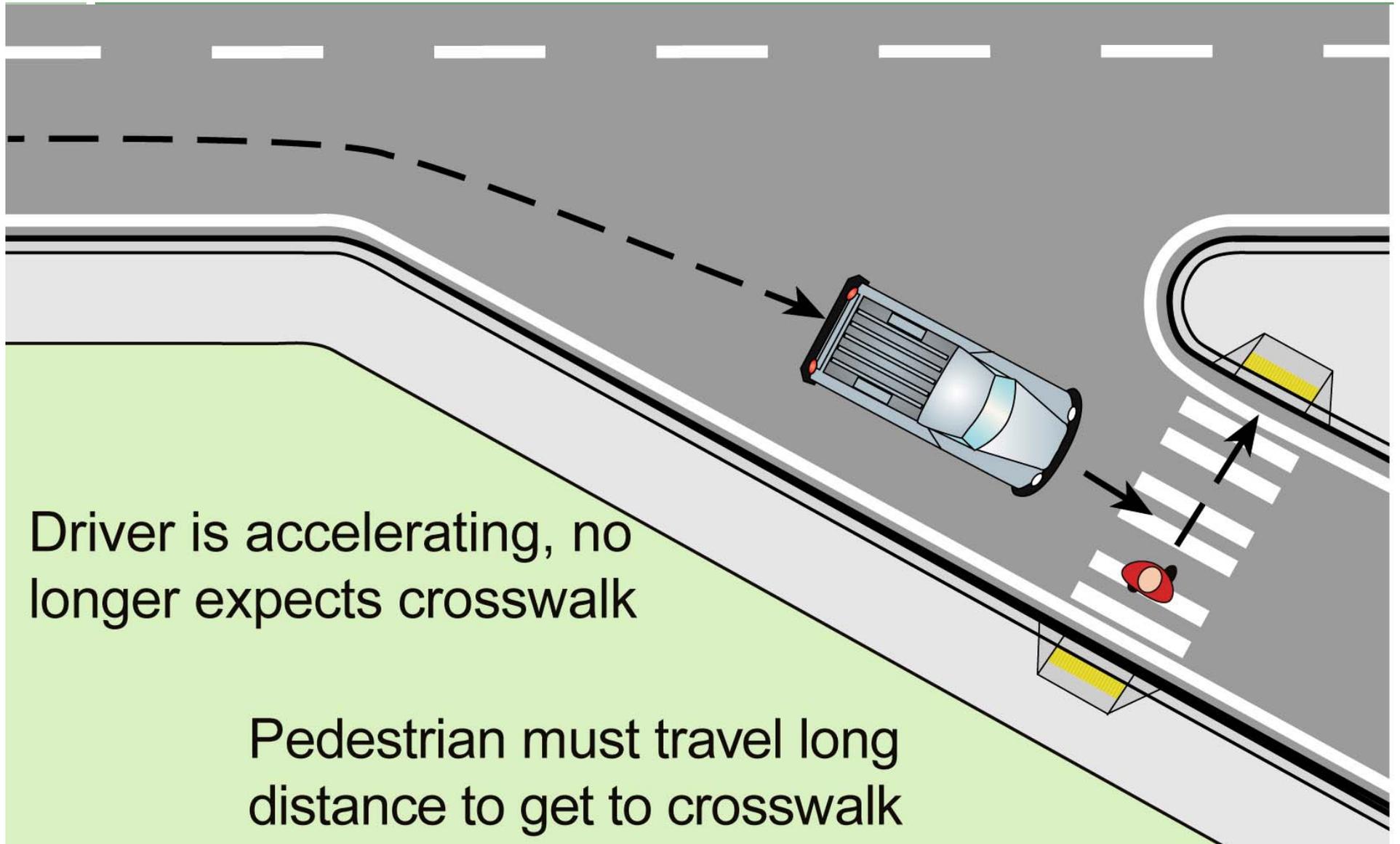
3 choices:

- Most direct route
- Shortest crosswalk
- “Compromise” - midway solution

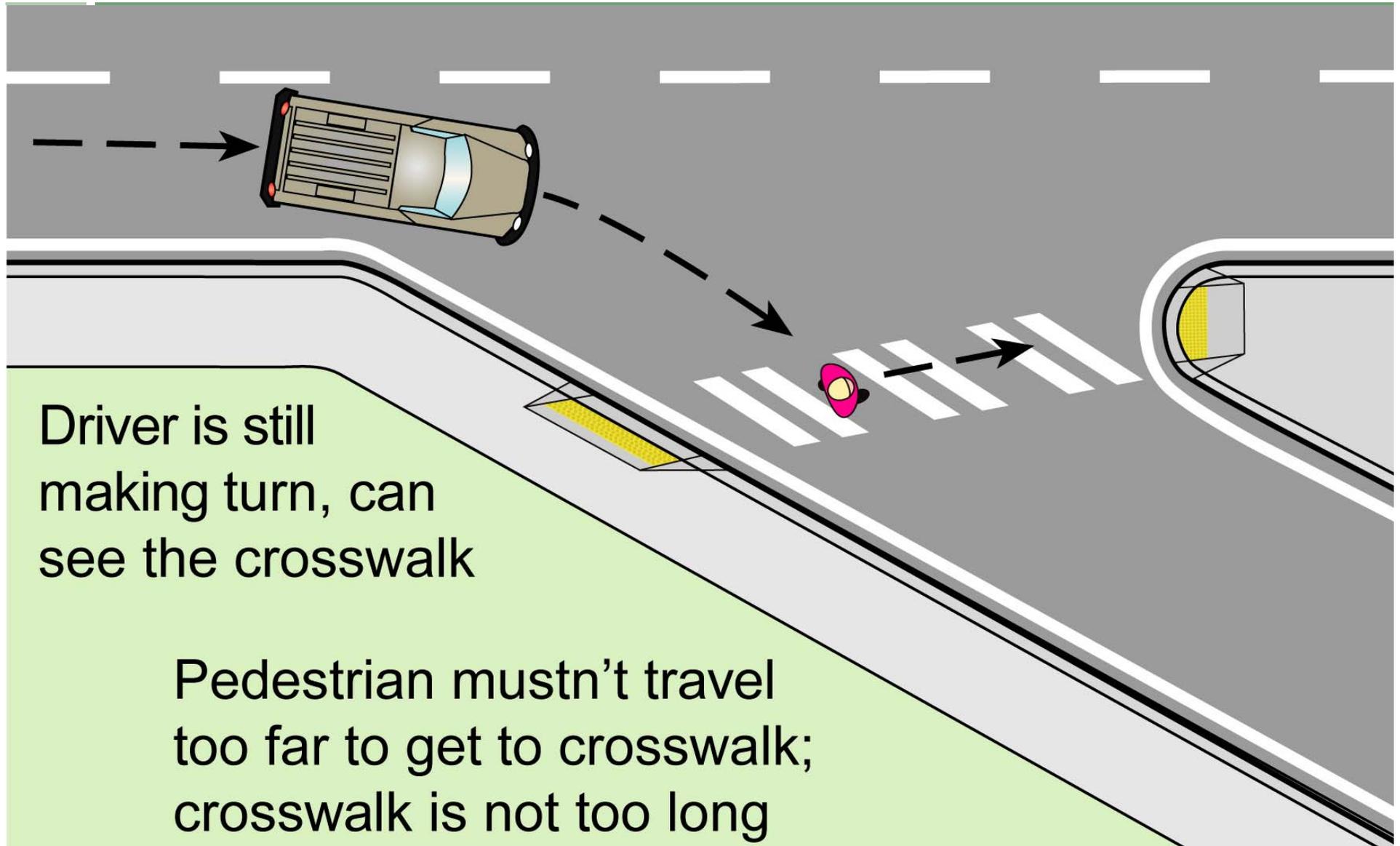
Most Direct Route



Shortest Crosswalk



Midway Solution – Balances Goals





Where to place crosswalk?

Observe pedestrians

7-20 Washington DC

- Younger woman takes direct route (*looks over shoulder*)
- Older man seeks crosswalk
- Midway would be used by both
- YIELD TO PED signs indicate a problem

Single Point Urban Interchange (SPUI)

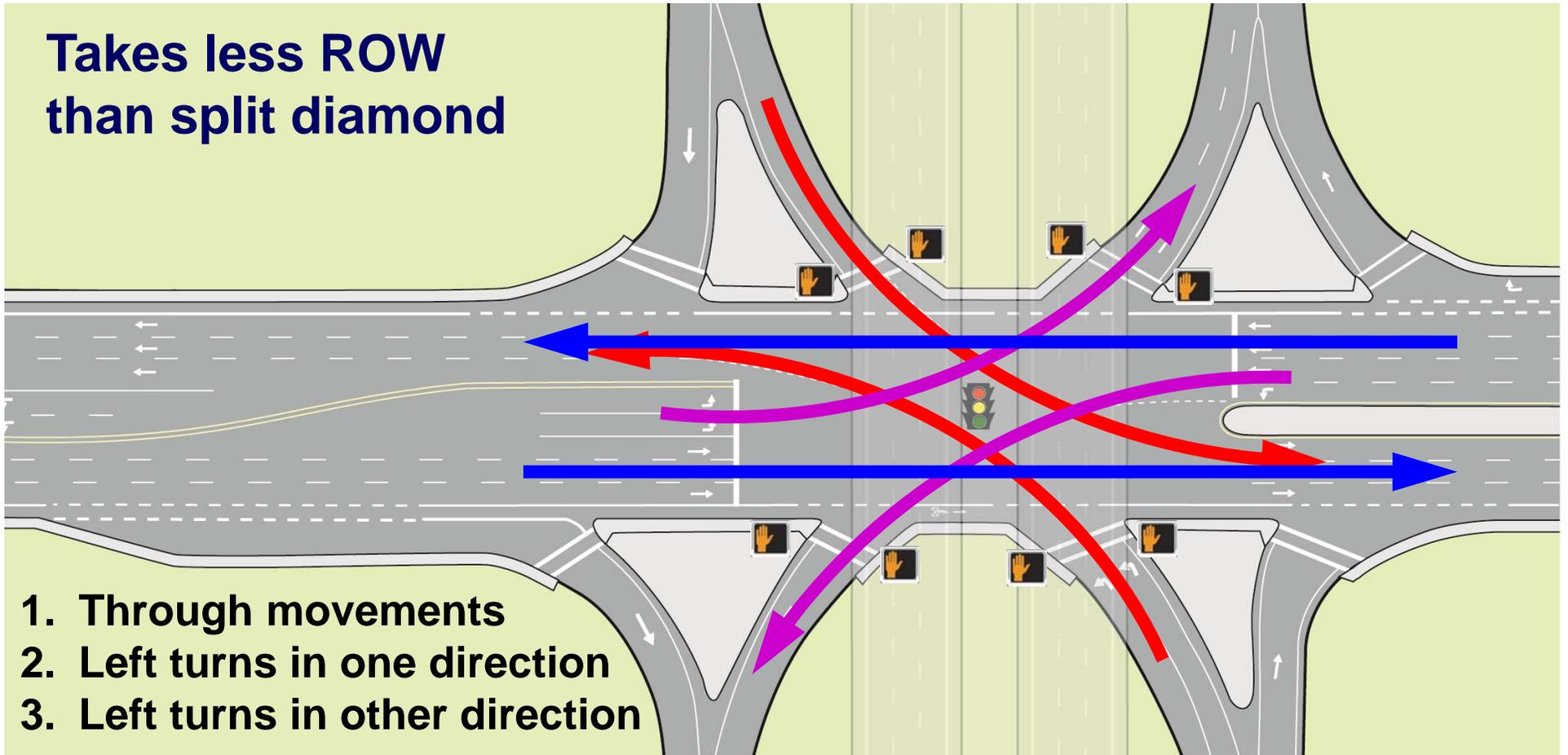
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Single Point Urban Interchange

7-22

**Takes less ROW
than split diamond**



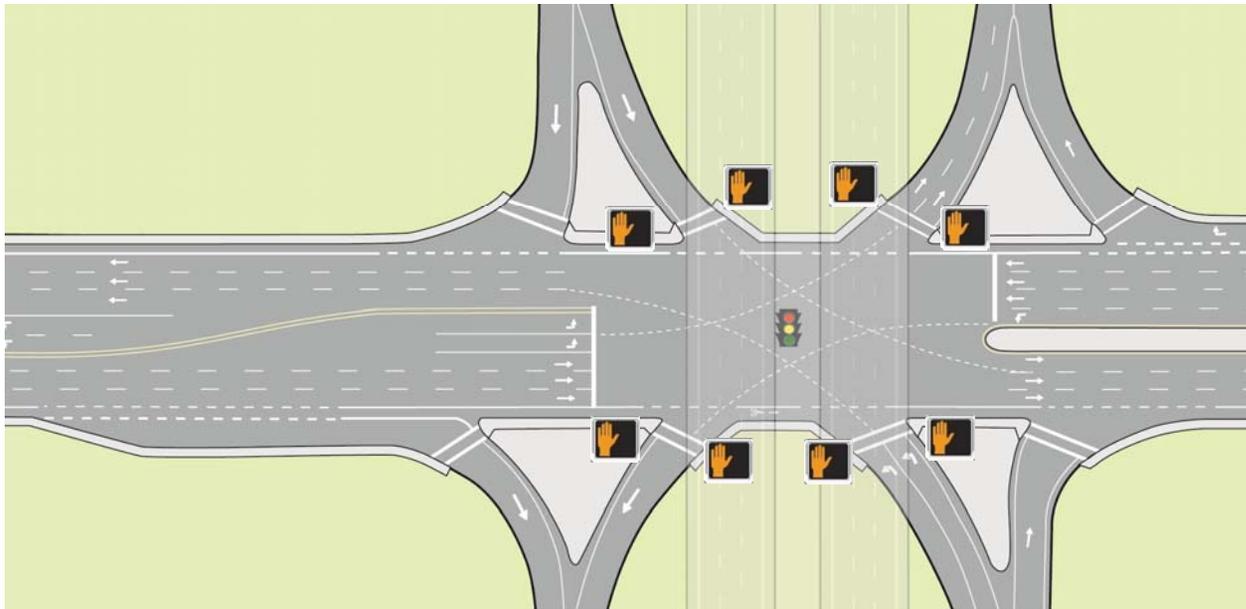
1. Through movements
2. Left turns in one direction
3. Left turns in other direction

Signal timing; 3 movements are run through one signal

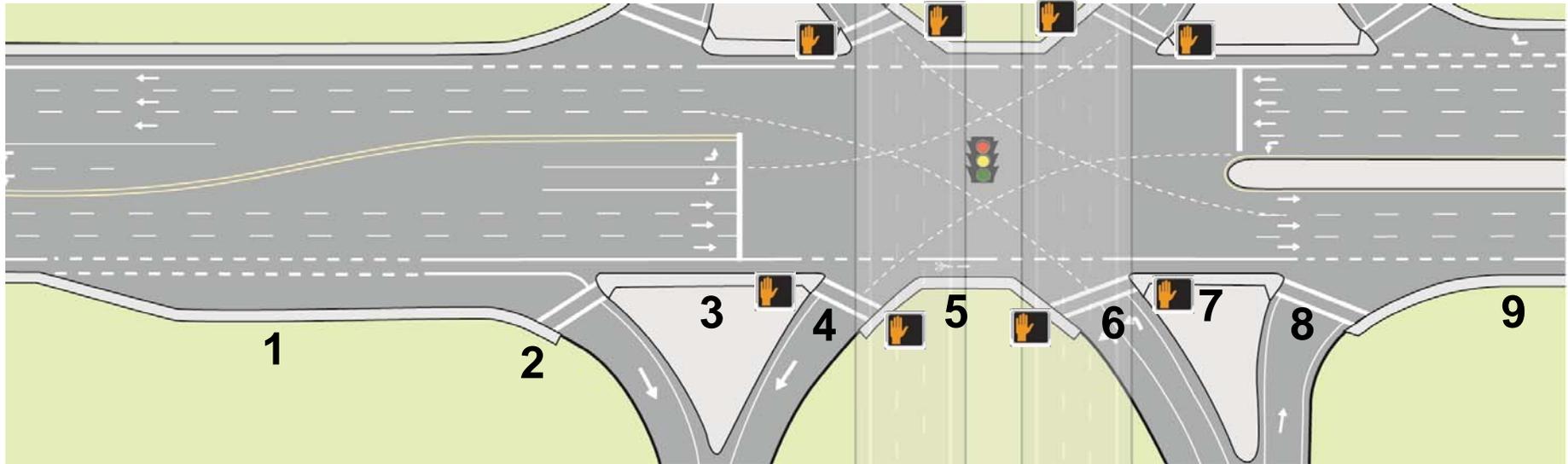
How to make SPUI work for pedestrians:

7-23

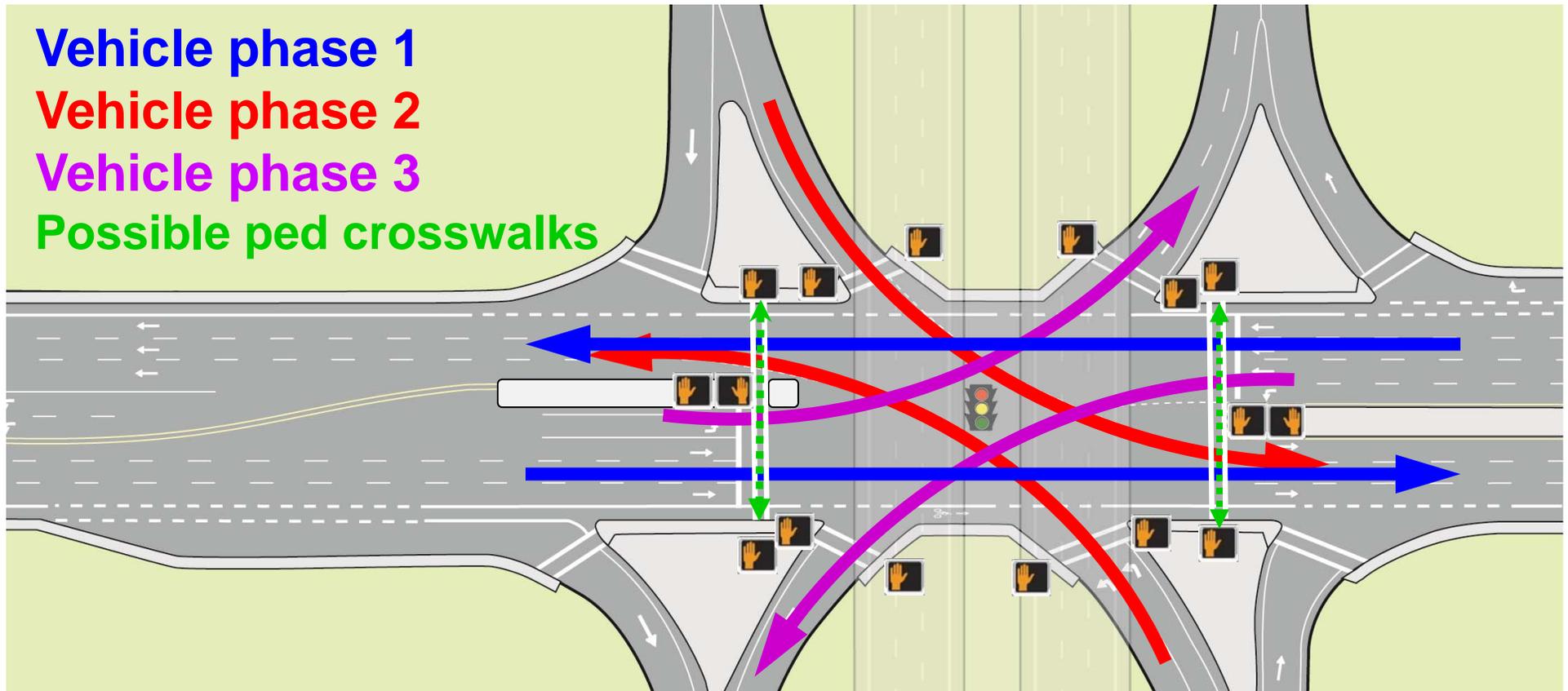
- Provide continuous sidewalks
- Break up crossings into several small steps
- Use good geometry; create tight, right-angle crossings;
- Make it clear to drivers where to expect pedestrians



SPUI Pedestrian crossing sequence:



- 1. Ped walks next to well defined right-turn lane (RTL)**
- 2. Ped crosses RTL at a point with good visibility; drivers yield to peds**
- 3. Ped proceeds on island**
- 4. Ped crosses entry lane; signal controlled**
- 5. Ped proceeds on sidewalk on or under bridge**
- 6. Ped crosses exit lane; signal controlled**
- 7. Ped proceeds on island**
- 8. Ped crosses exit lane; stop controlled; drivers yield to peds**
- 9. Ped continues on his merry way**



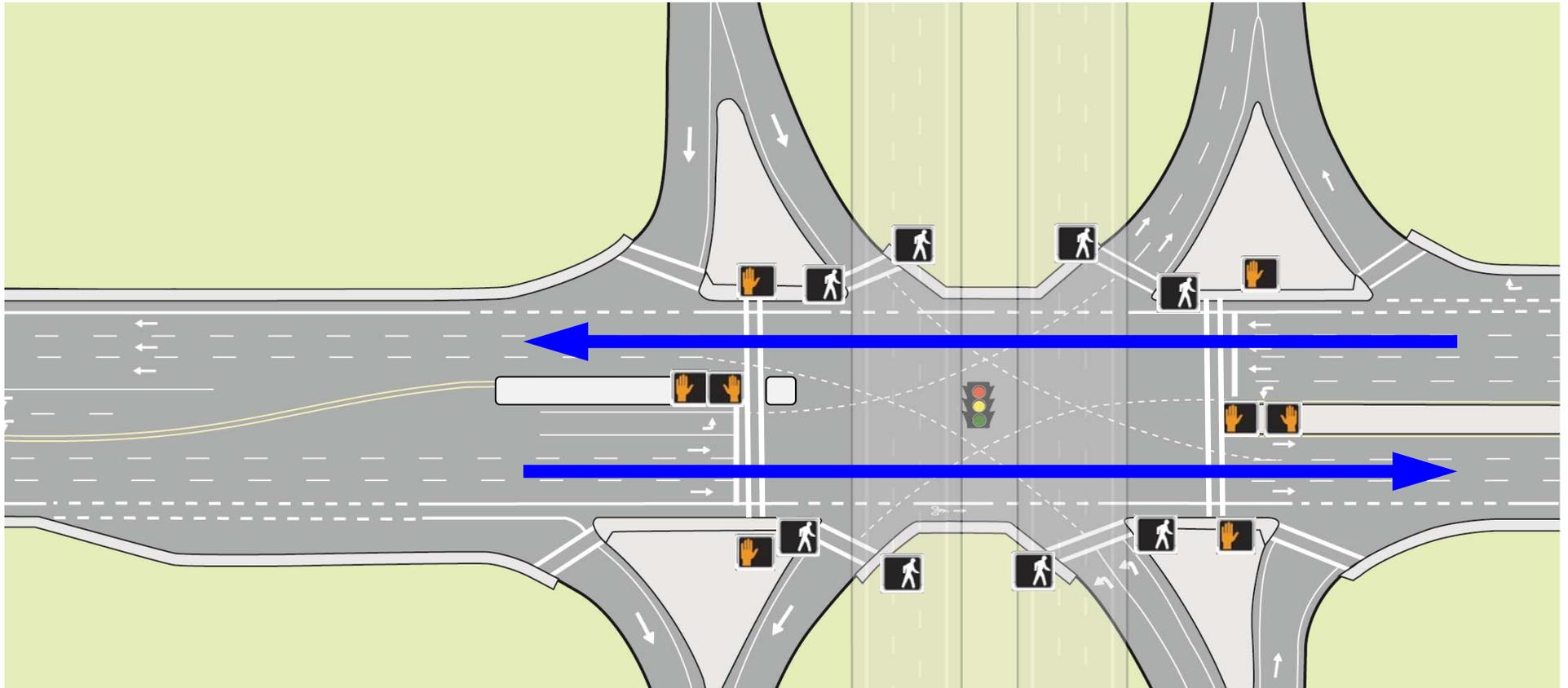
With most SPUIs there is never a phase when pedestrians can cross the urban arterial without conflict

Solution 1: Two-step crossing (one step during vehicle phase 2 and the other during vehicle phase 3) NOTE: requires median refuge & Ped Signals

Solution 2: Nearby midblock signalized ped crossing, or nearby signalized intersection with crosswalks

Getting Pedestrians Across a SPUI

7-26

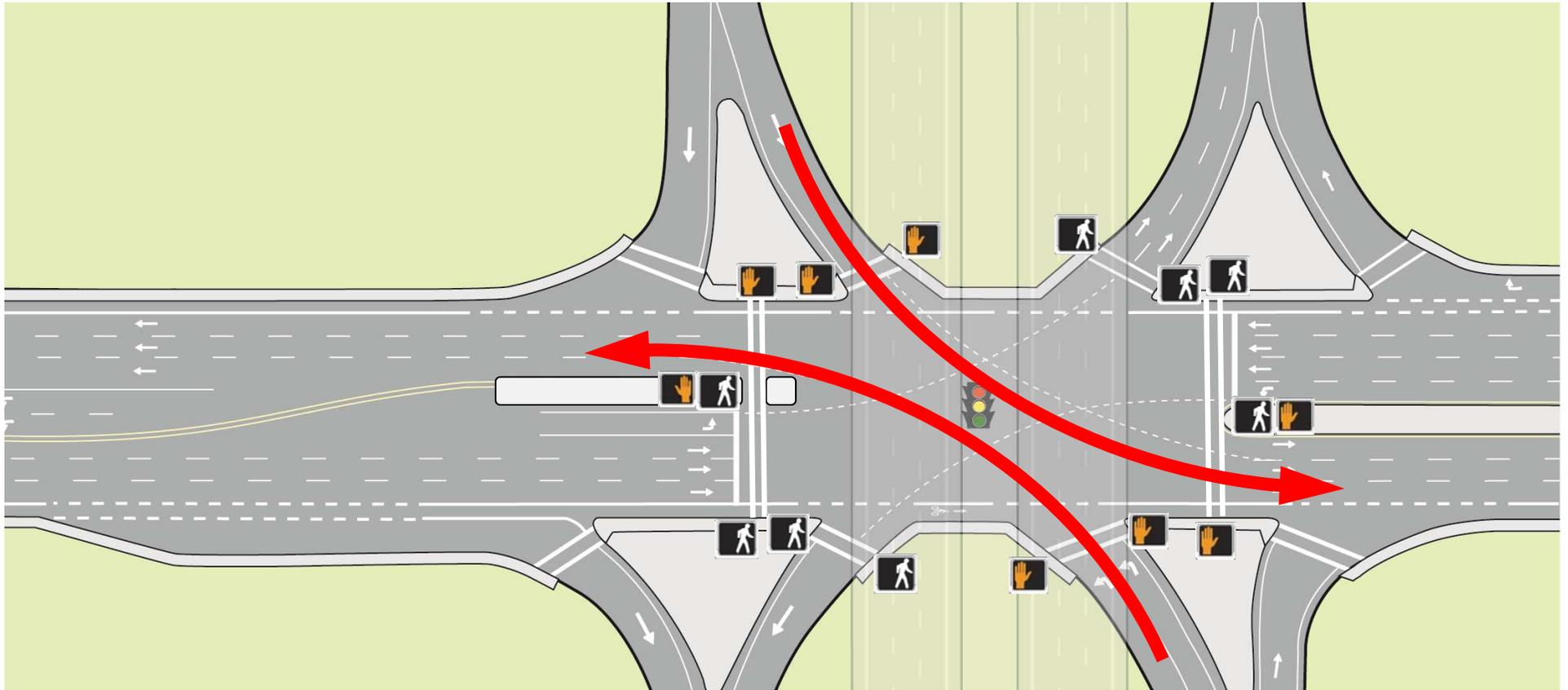


Vehicle phase 1

Designing for Pedestrian Safety – Interchanges

Getting Pedestrians Across a SPUI

7-27

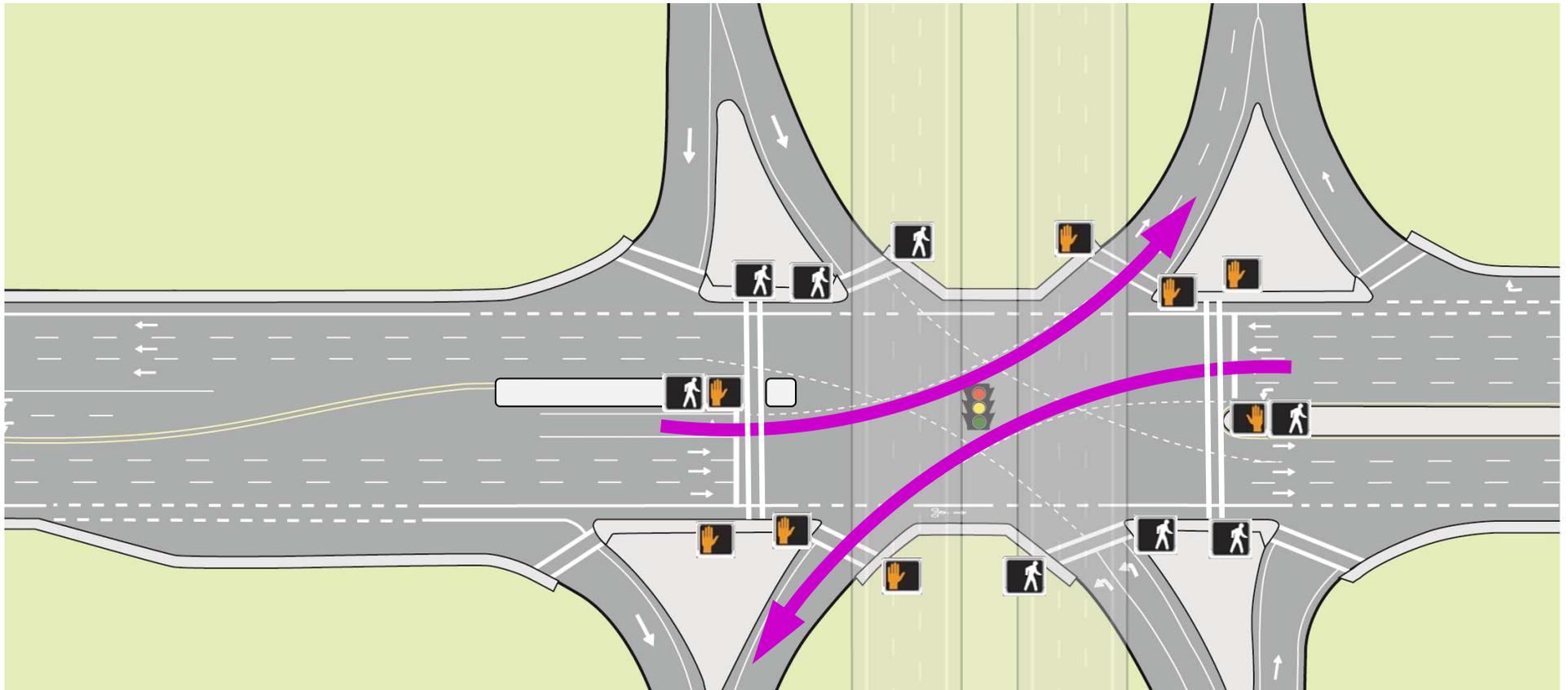


Vehicle phase 2

Designing for Pedestrian Safety – Interchanges

Getting Pedestrians Across a SPUI

7-28



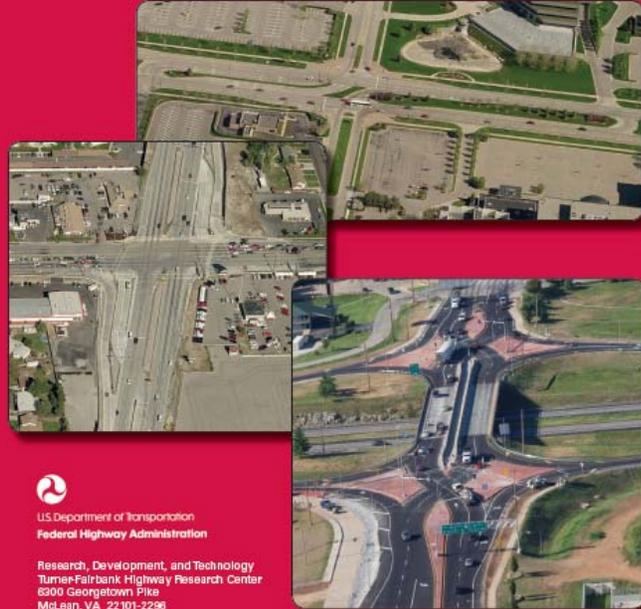
Vehicle phase 3

Designing for Pedestrian Safety – Interchanges

Alternative Intersections/Interchanges: Informational Report (AIR)

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U.S. Department of Transportation
Federal Highway Administration

Research, Development, and Technology
Turner-Fairbank Highway Research Center
6300 Georgetown Pike
McLean, VA 22101-2296

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Alternative Intersections/Interchanges

Designing for Pedestrian Safety – Interchanges

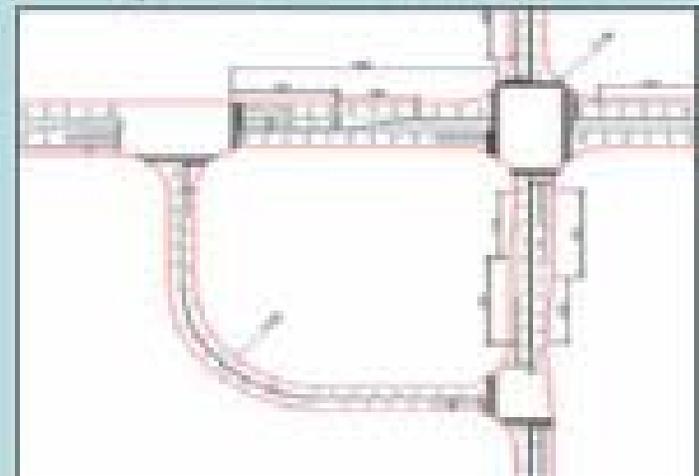
DISPLACED LEFT-TURN



MEDIAN U-TURN



QUADRANT ROADWAY



RESTRICTED CROSSING U-TURN

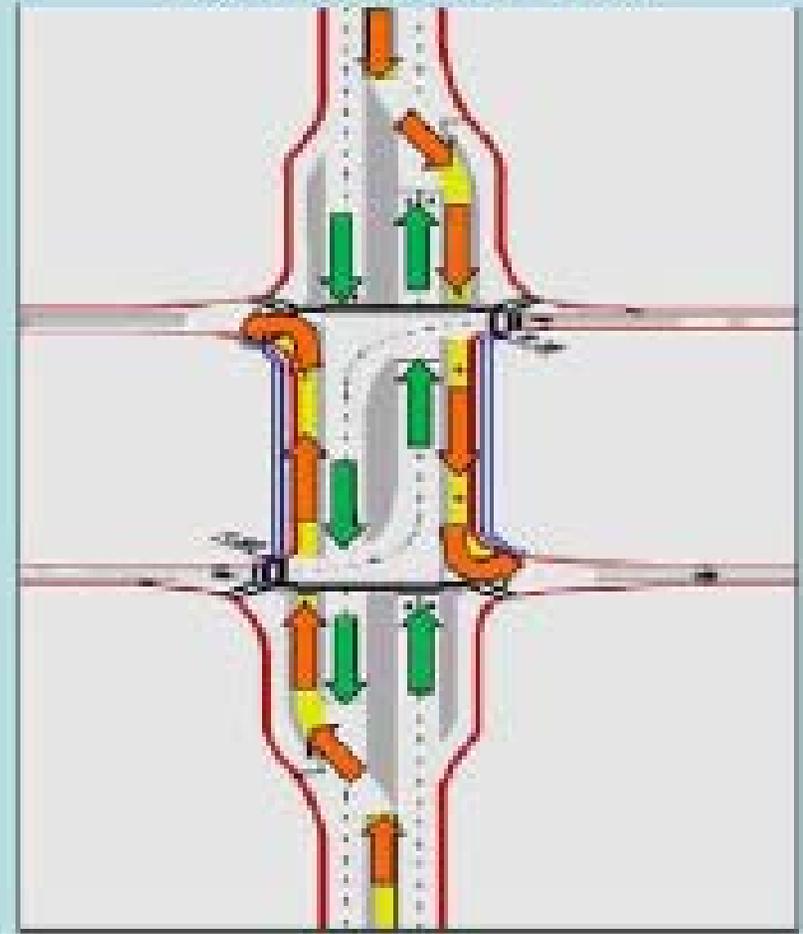


Four Intersection Concepts

DOUBLE CROSSOVER DIAMOND



DISPLACED LEFT-TURN



7-31

Two Interchange Concepts

Designing for Pedestrian Safety – Interchanges

Double Crossover Diamond

7-32

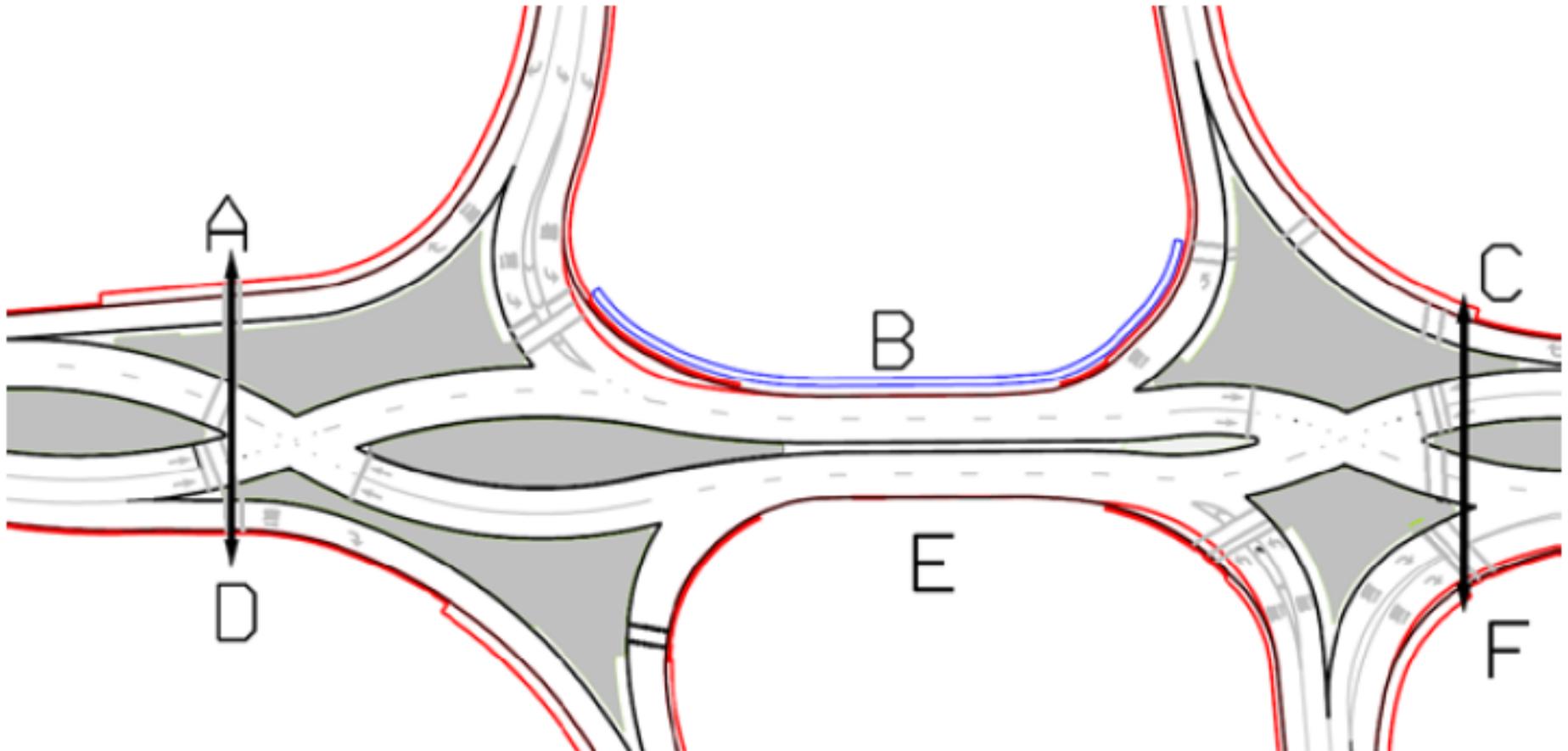


Figure 177. Illustration. Pedestrian movements in a DCD interchange.

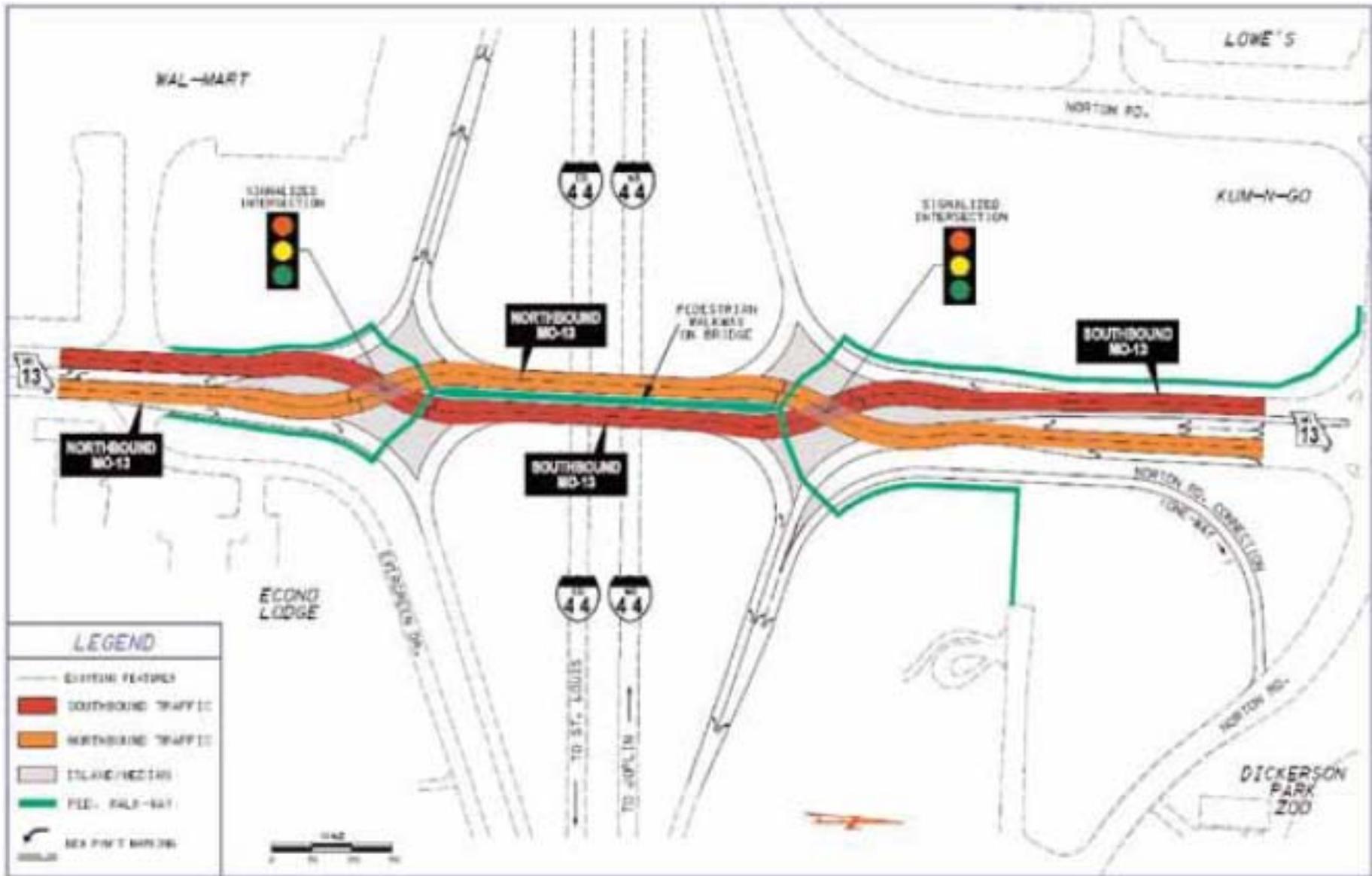


Figure 178. Illustration. Proposed pedestrian accommodation in the median of the DCD interchange in Springfield, MO.

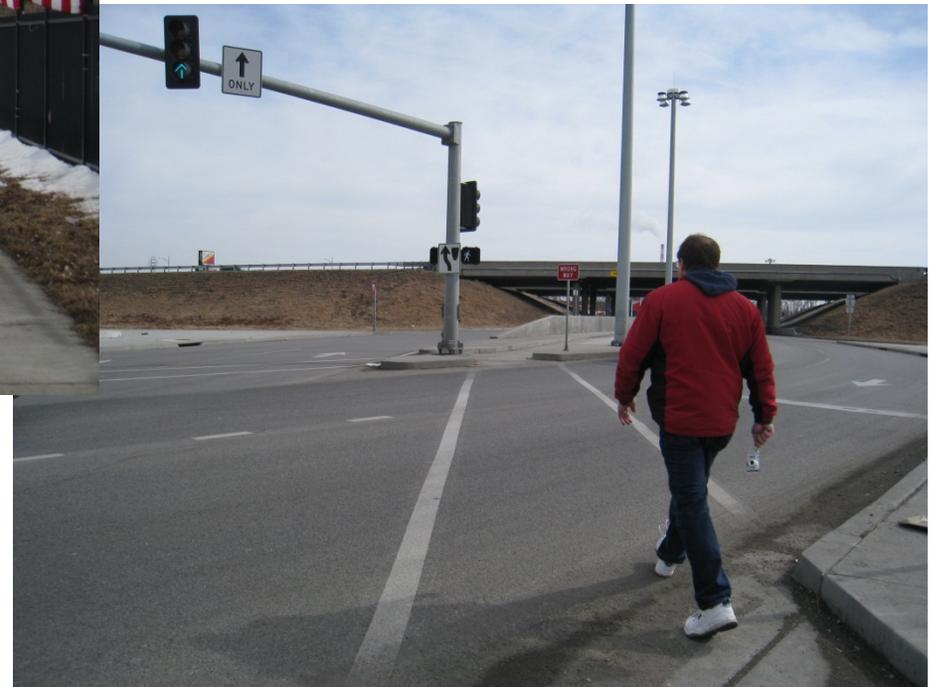
Double Crossover Diamond

7-34

Kansas City MO

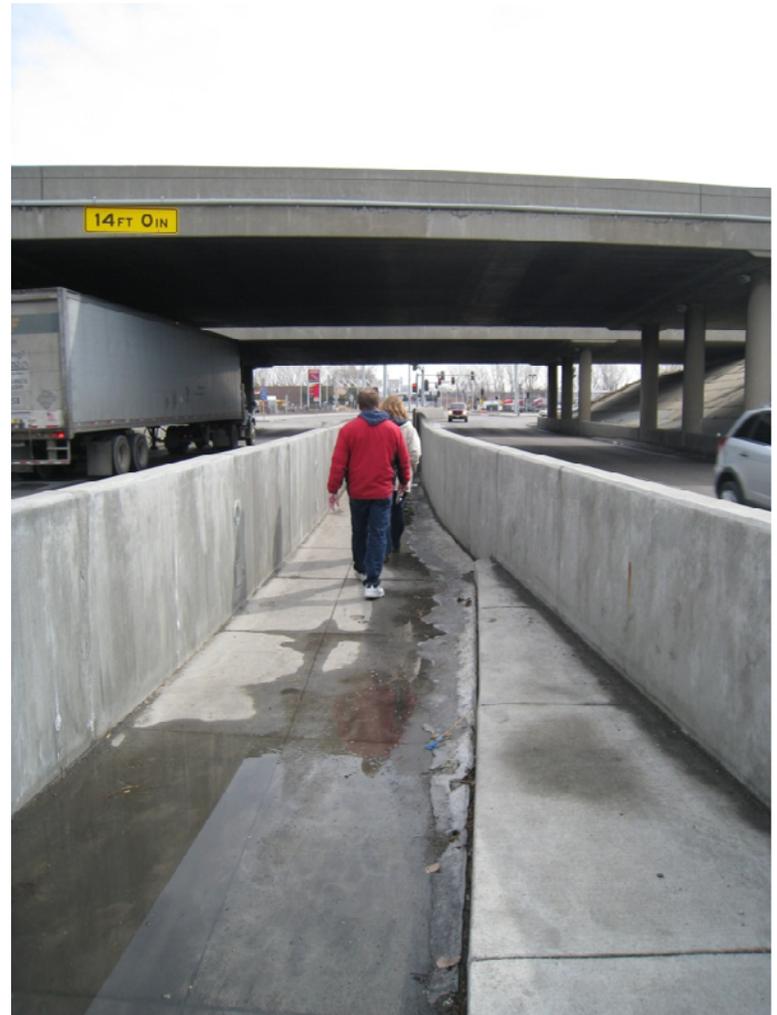


Leading up to the
protected Center
Crossing



Double Crossover Diamond Walking down the Protected Center

7-35 Kansas City MO



Designing for Pedestrian Safety – Interchanges

Double Crossover Diamond

7-36

Kansas City MO



Multiple LED Lighting fixtures embedded in the wall



Displaced Left Turn Interchange

7-37

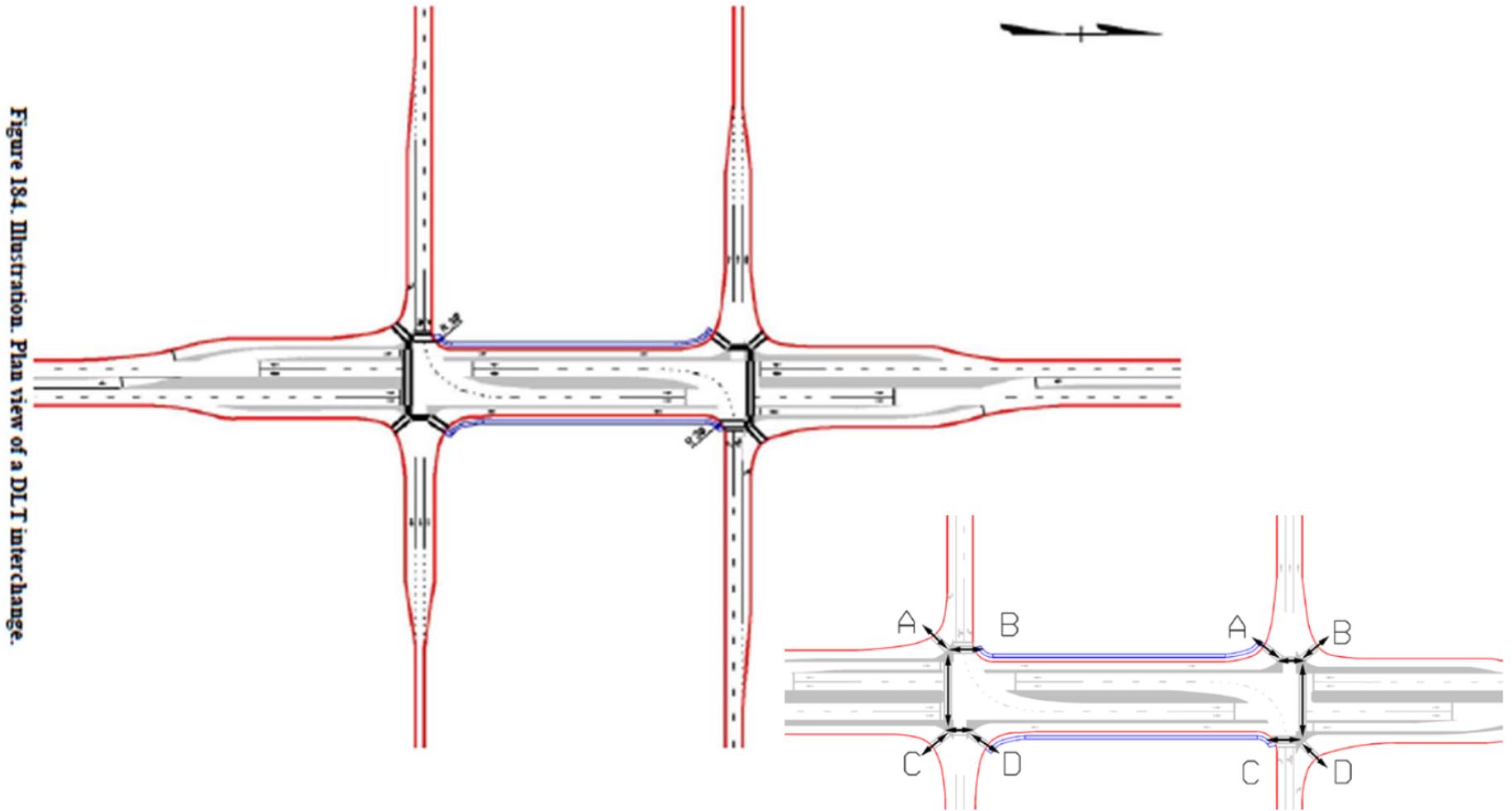


Figure 184. Illustration. Plan view of a DLT interchange.

Figure 193. Illustration. Pedestrian movements in a DLT interchange.

Let's Recap

7-38

- Why is controlling land uses important?
 - Attractors create pedestrian demand
- Why do ped crashes occur at freeway interchanges?
 - Driver expectation of pedestrians is very low
 - They're driving fast
- What kind of movements should be avoided?
 - High-speed, free-flow
- How can one mitigate for these problems?
 - With slow-speed, right-angle urban design
 - With improved crosswalk placement

Learning Outcomes

7-39

- You should now be able to:
- Identify how land uses around freeway interchanges create pedestrian trips
- Explain how and why pedestrian crashes occur at interchanges (driver expectation of pedestrians is very low; high-speed, free-flow movements)
- Select slow-speed, right-angle urban designs

7-40

Questions?