Designing for Bicyclist Safety at Crossings and Intersections

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April 27, 2017

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DESIGNING FOR BICYCLIST SAFETY

MEET YOUR PANELISTS

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KEY SAFETY FACTORS

Important Message

- Speed
- Number of lanes
- Visibility
- Traffic volume & composition
- Conflict points
- Proximity
- Bike control
- Connectivity

NOTE OF CAUTION

The knowledge and practice of designing for bicyclists is rapidly changing. Images in these materials and other guidelines may be outdated. Always check for the latest MUTCD interim and experimental TCD's.

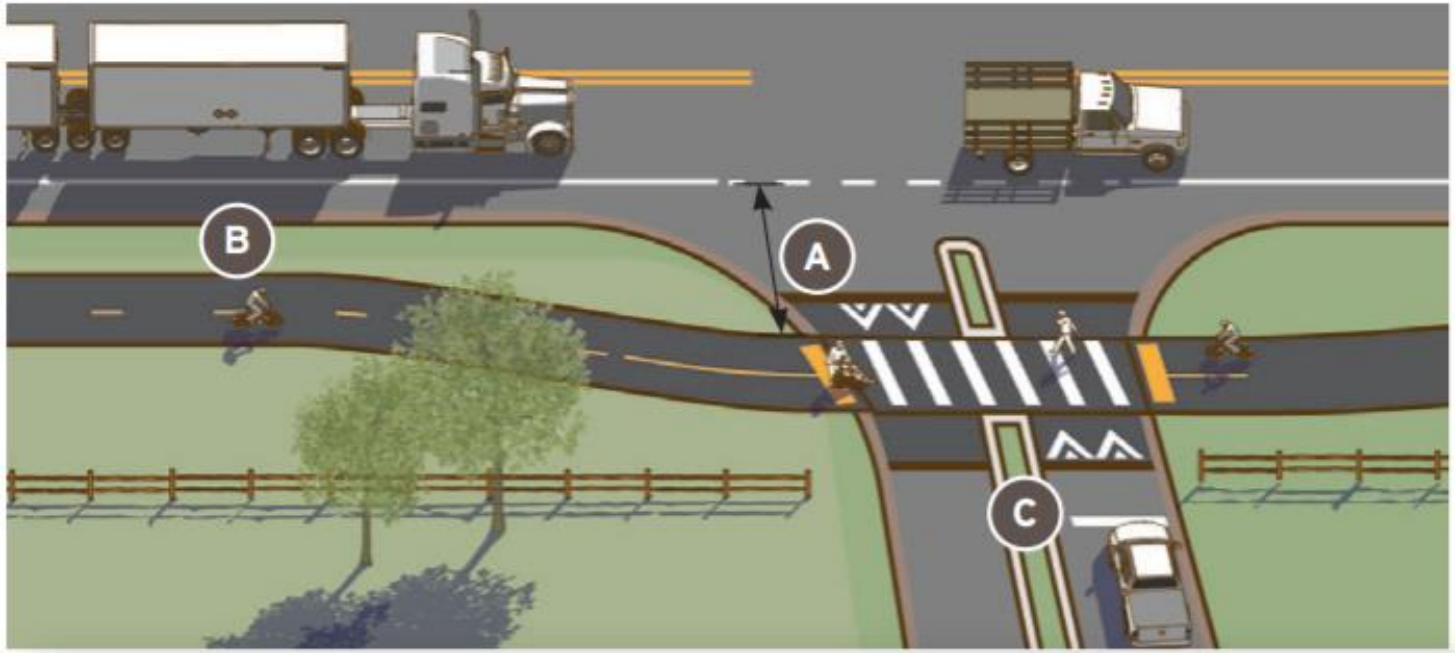
INTERSECTION DESIGN PRINCIPLES

- Reduce speed
- Minimize exposure to conflicts
- Communicate right-of-way priority
- Provide adequate sight distance

Designing for Bicyclist Safety

SHARED-USE PATH CROSSINGS

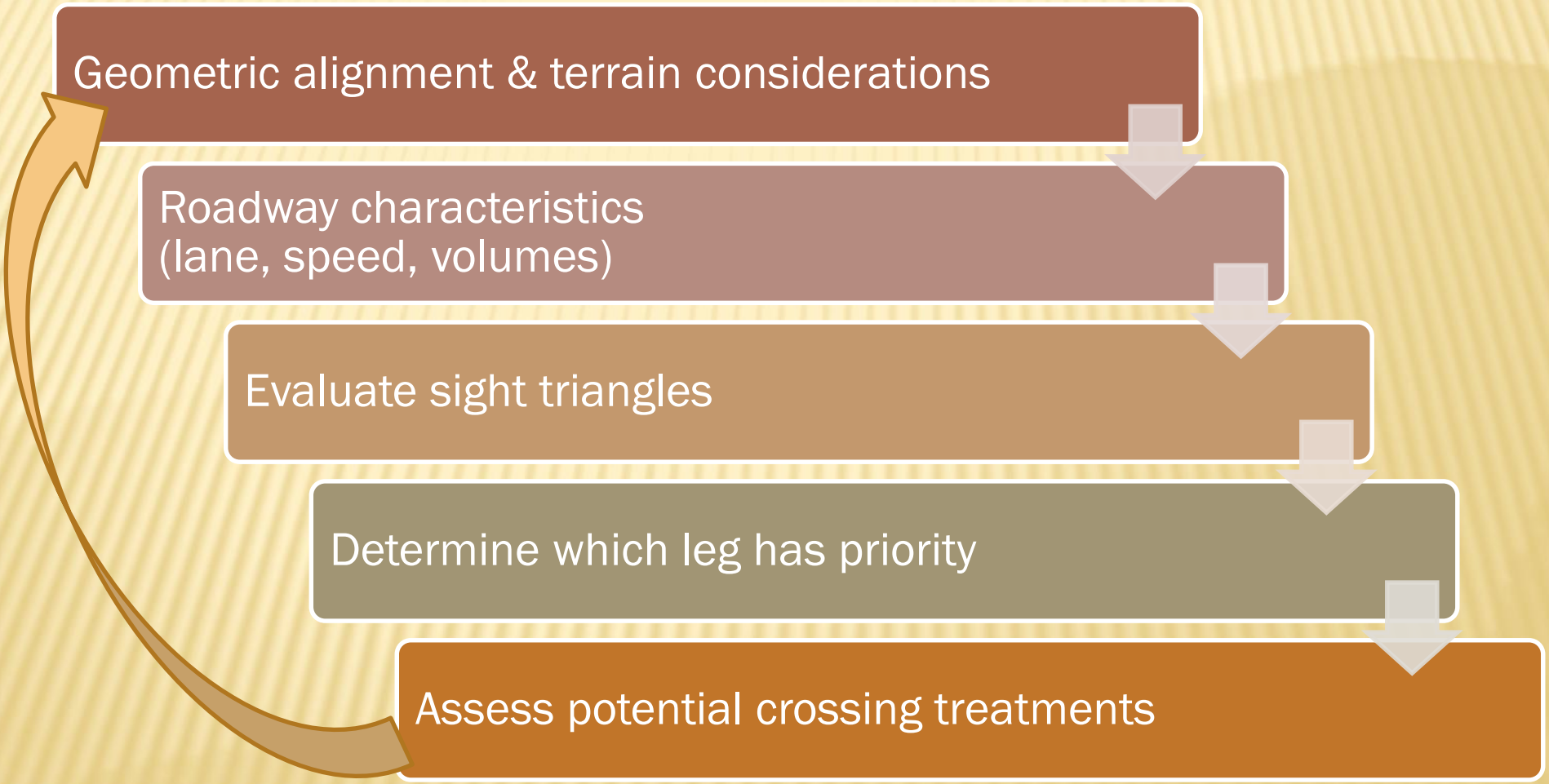
SIDE-STREET CROSSINGS



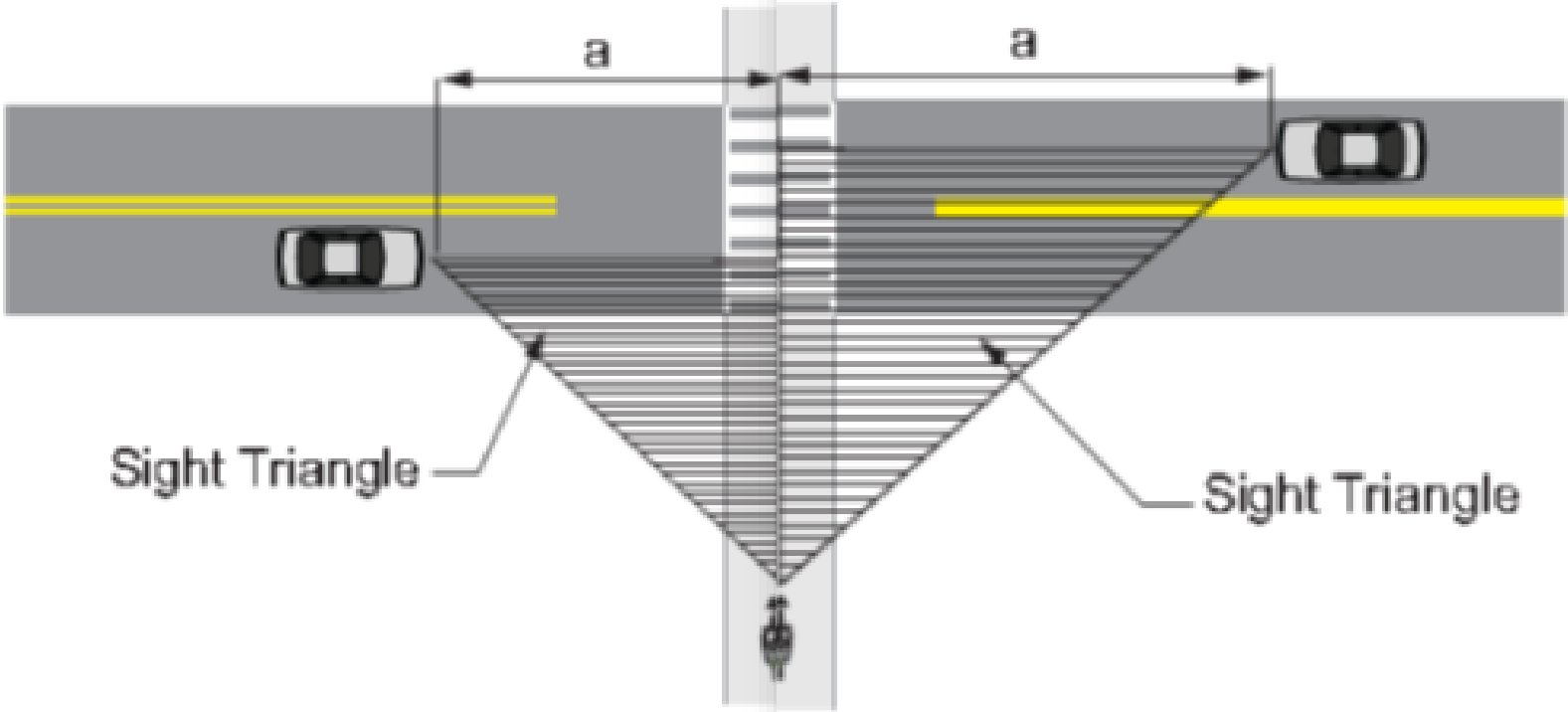
Adjacent Road Speed Limit (Mi/h)	Recommended Sidepath Separation Distance at Crossings
< 25 mi/h	6.5 ft (2.0 m)
35–45 mi/h	6.5–16.5 ft (2.0–5.0 m)
≥ 55 mi/h	16.5–24 ft (5.0–7.0 m)

**Separation distance may vary in response to available right of way, visibility constraints and the provision of a right turn deceleration lane.*

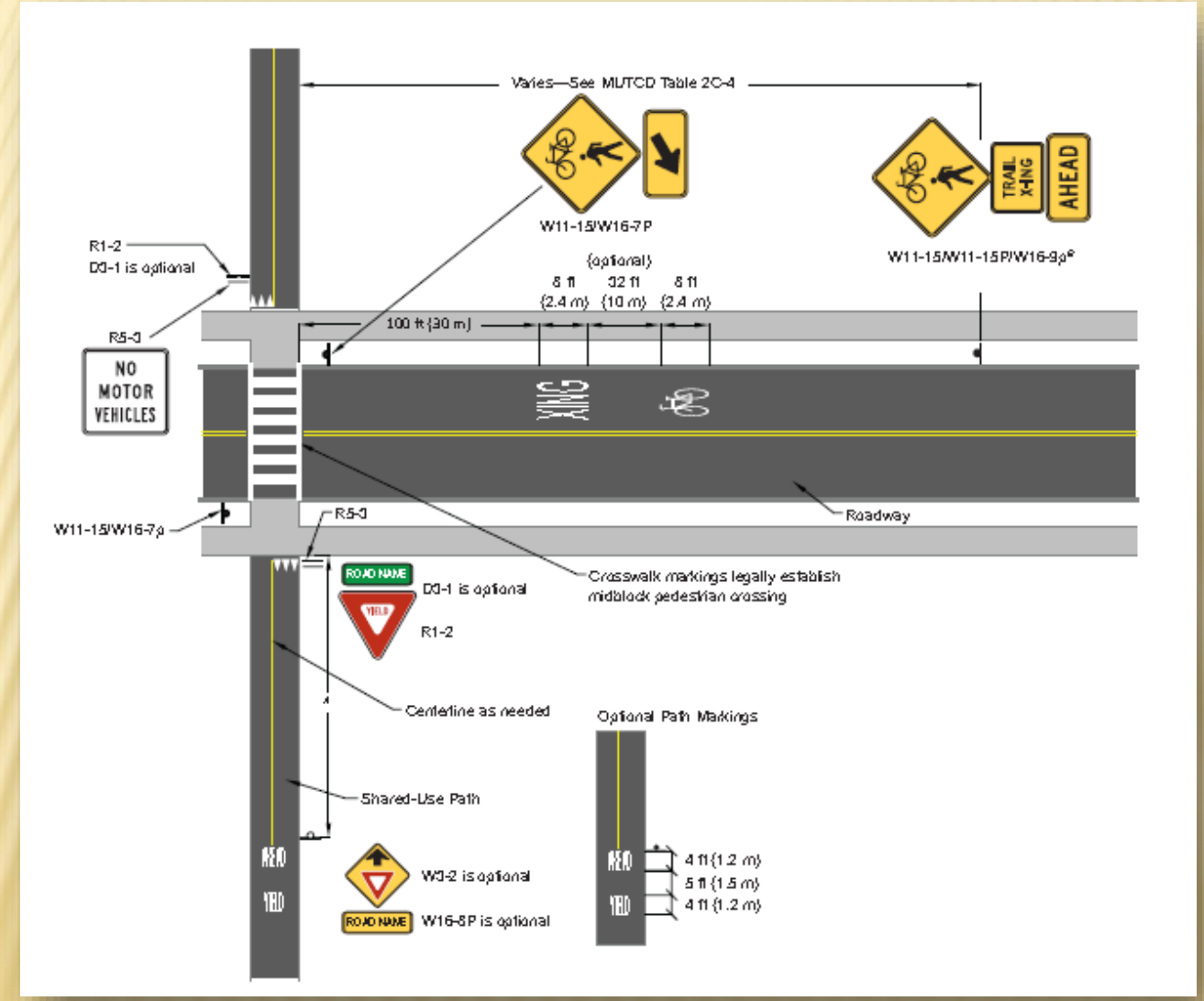
MID-BLOCK CROSSING DESIGN PROCESS



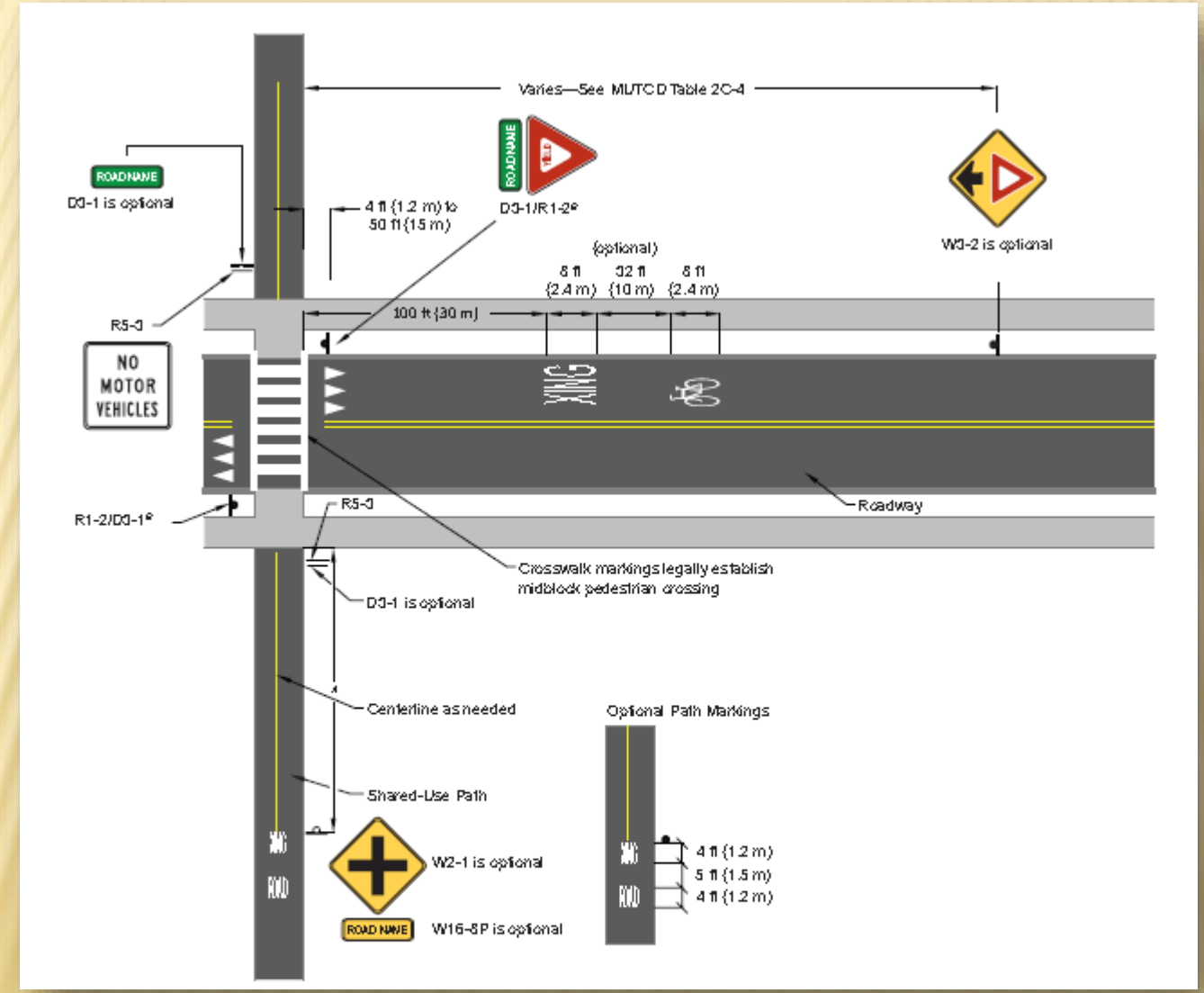
SIGHT TRIANGLES



PATH YIELDS TO ROADWAY



ROAD YIELDS TO PATHWAY



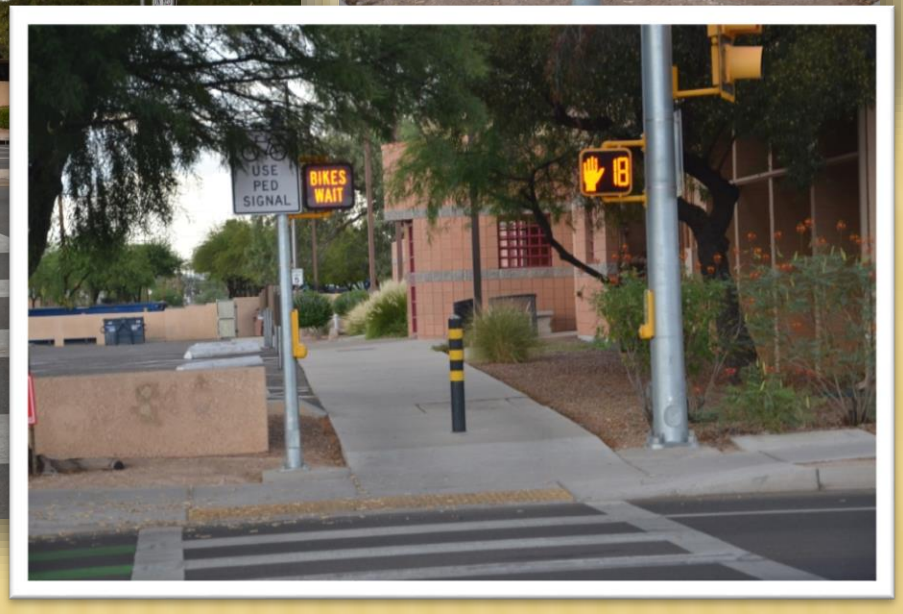
Crossing Countermeasures

- Advance warning signs
- Advance yield/stop line
- Raised island/crossing
- RRFB/PHB


TRAIL X-ING
Burke-Gilman Trail
BUMP
BIKE SALE

BIKE “HAWK” PHB

- First installation Tucson, AZ
- “BIKES WAIT”/”BIKES OK”

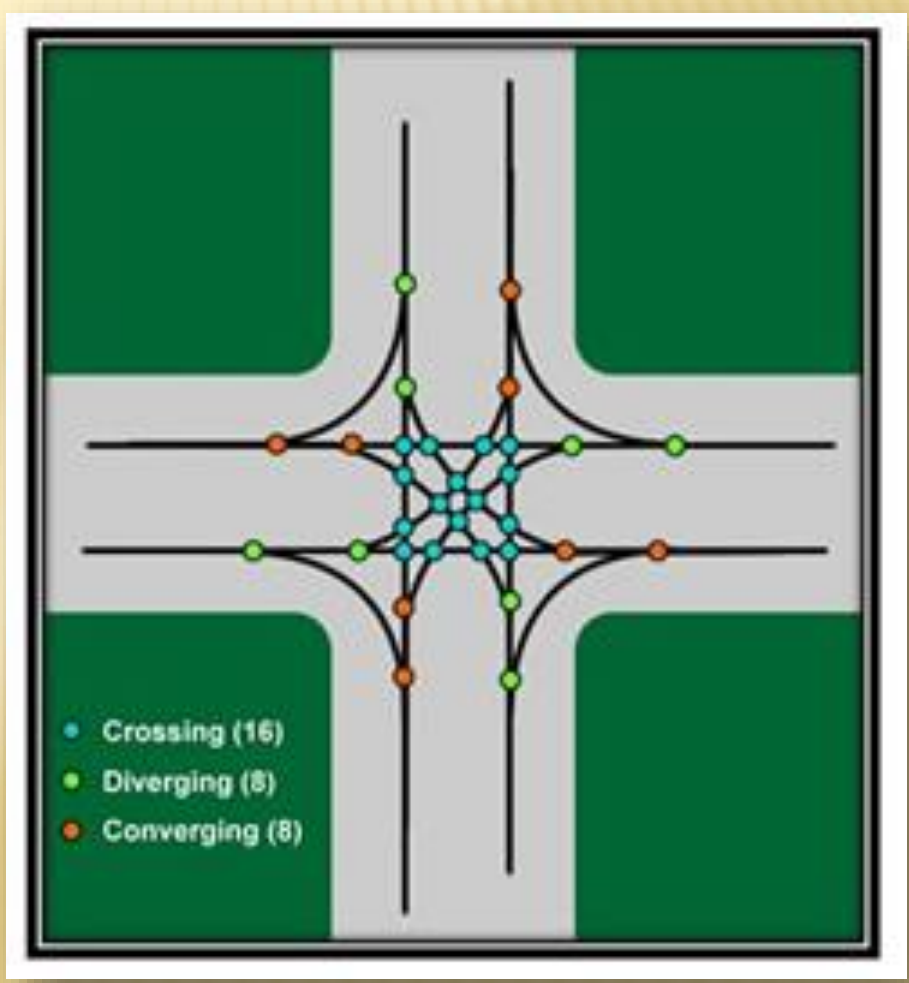


Designing for Bicyclist Safety

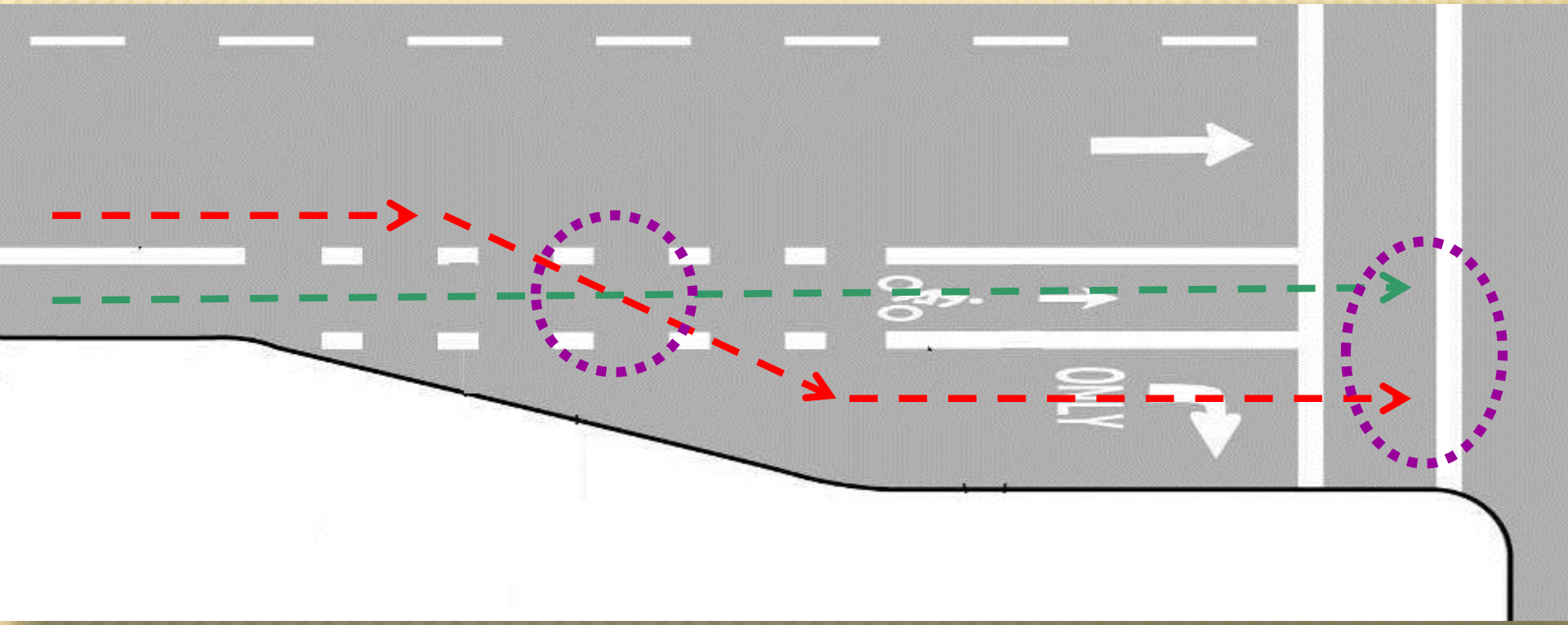
INTERSECTION DESIGN

INTERSECTION CONFLICTS

- Typical conflicts for both pedestrians and motorists, plus:
  - Right-turn/thru movement
  - Weaving to left turn



RIGHT-TURN/THRU CONFLICT



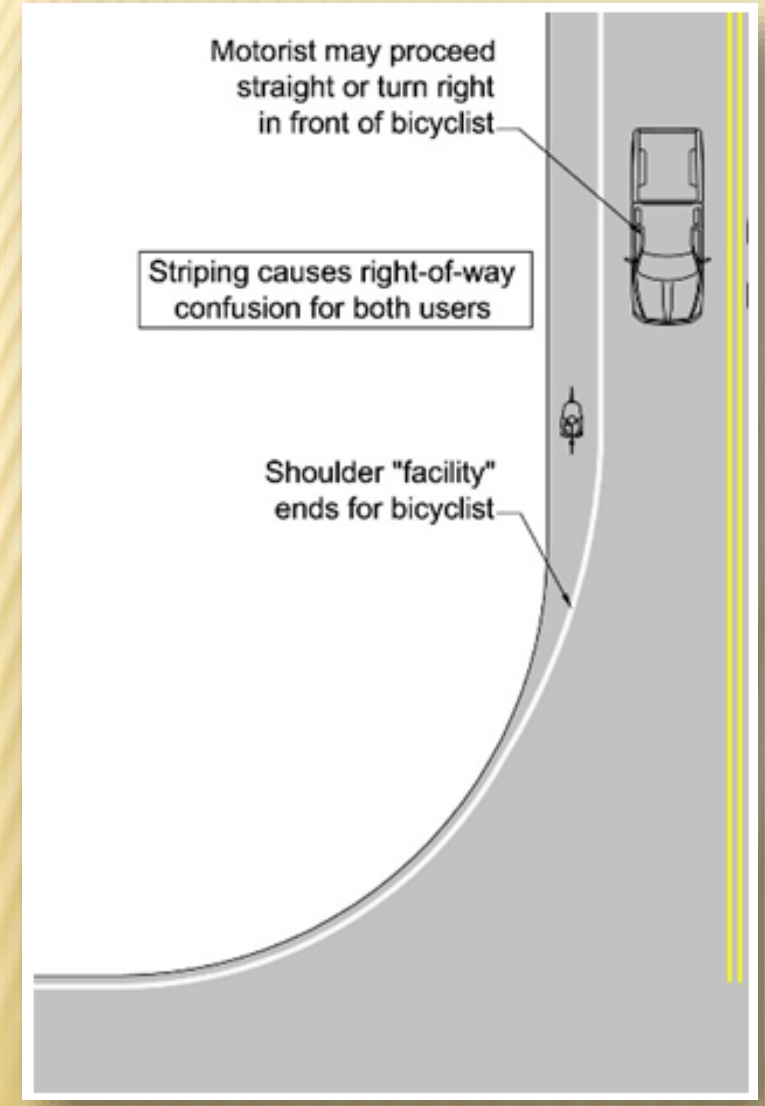
LEFT-TURN CONFLICT

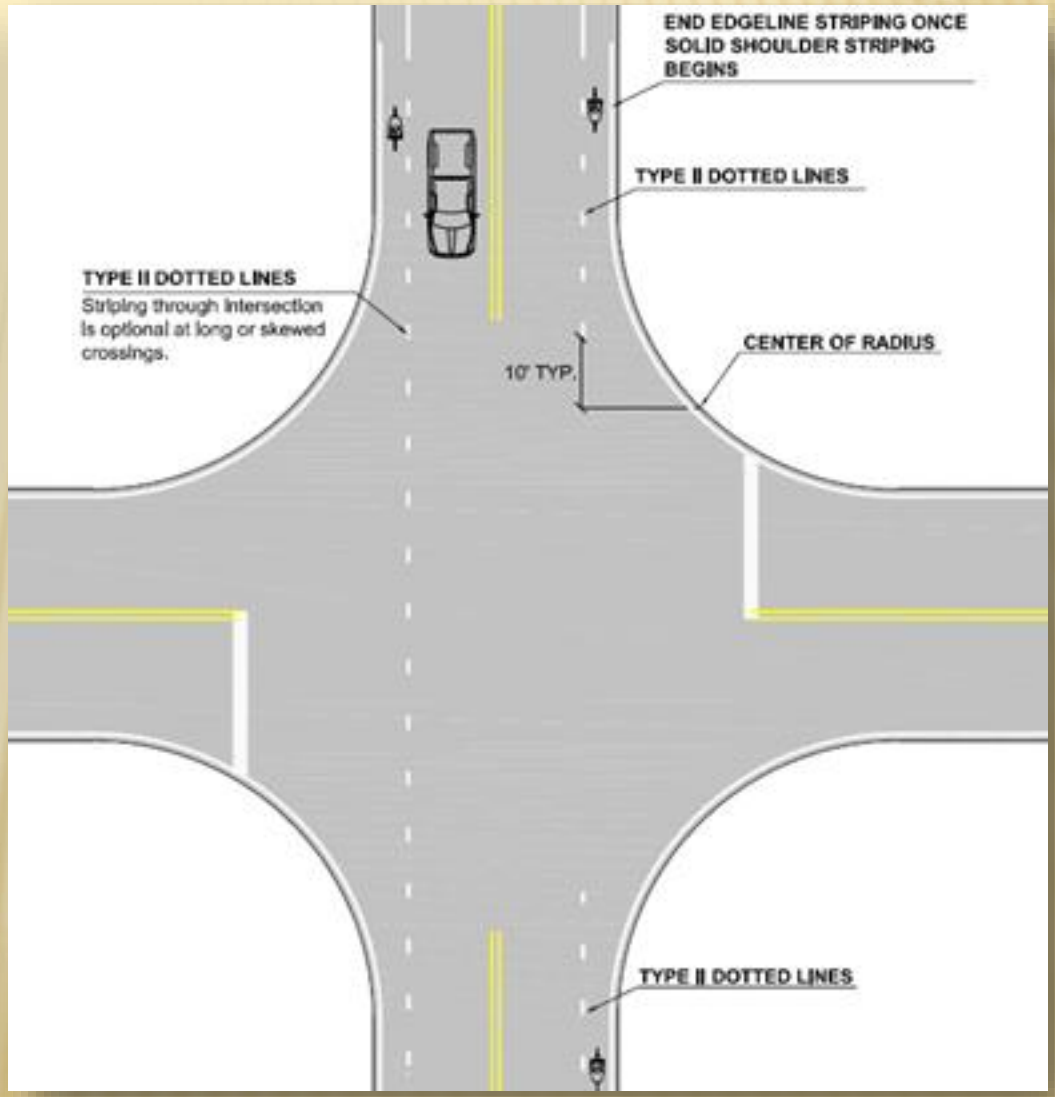
INTERSECTION COUNTERMEASURES

SHOULDER RIDING AT INTERSECTION

- Shoulder not a travel lane
- Modify shoulder striping
- Opportunity to switch to shared lanes **OR**
- Add bike lane thru intersection

SHOULDER STRIPING

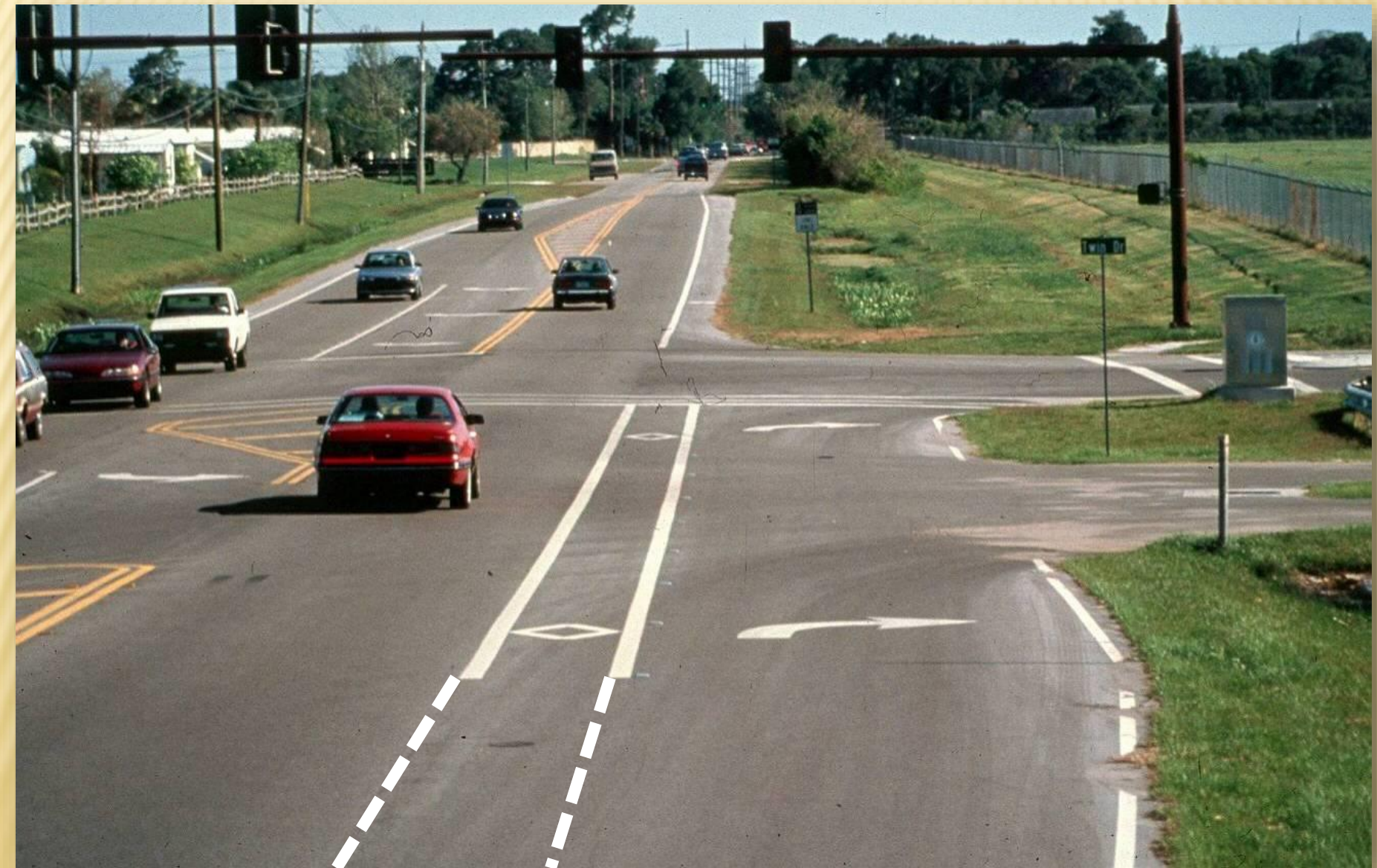




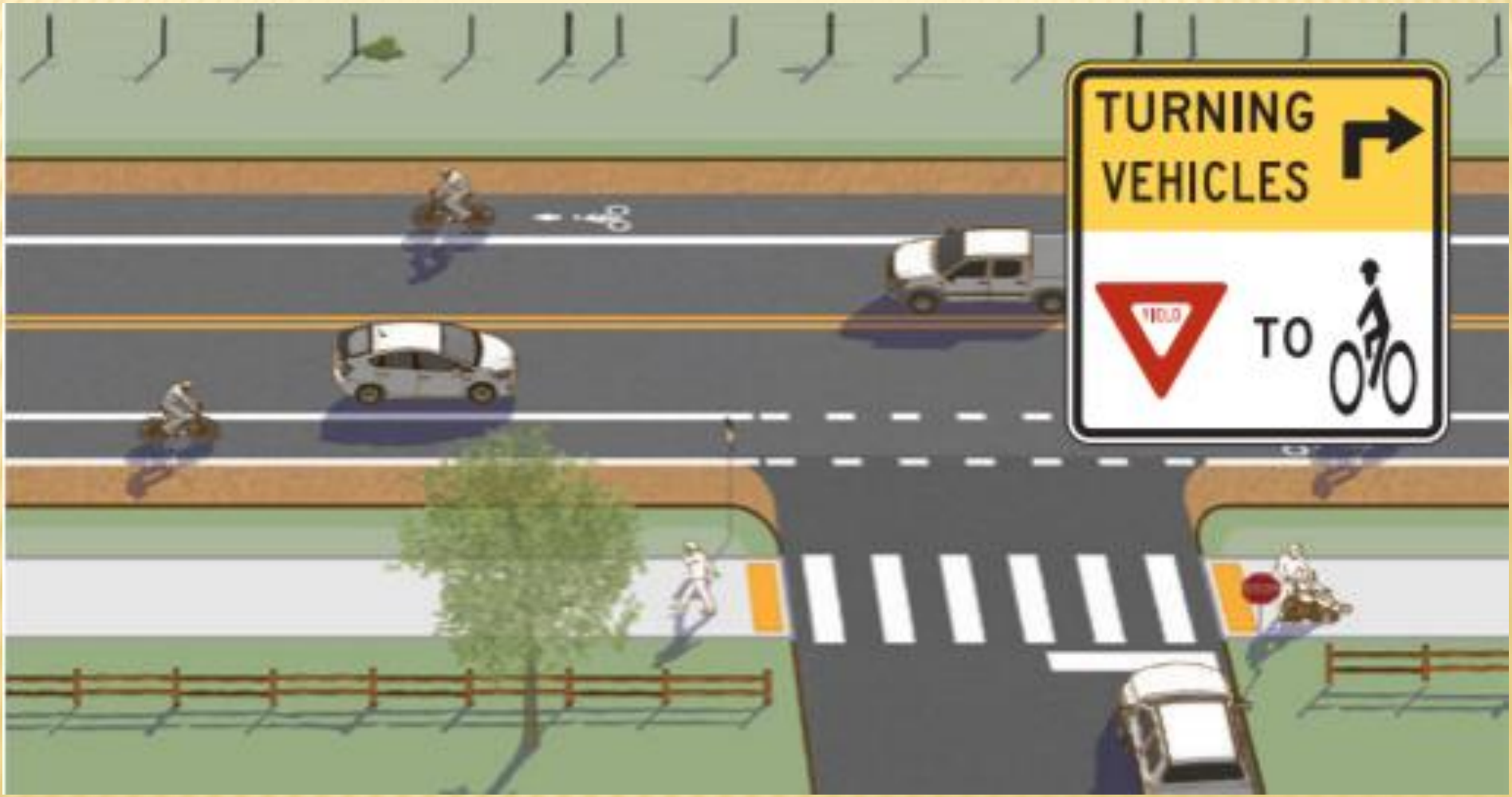
INTERSECTION WITH SHARED LANES

- Additional/all lanes are shared at intersection

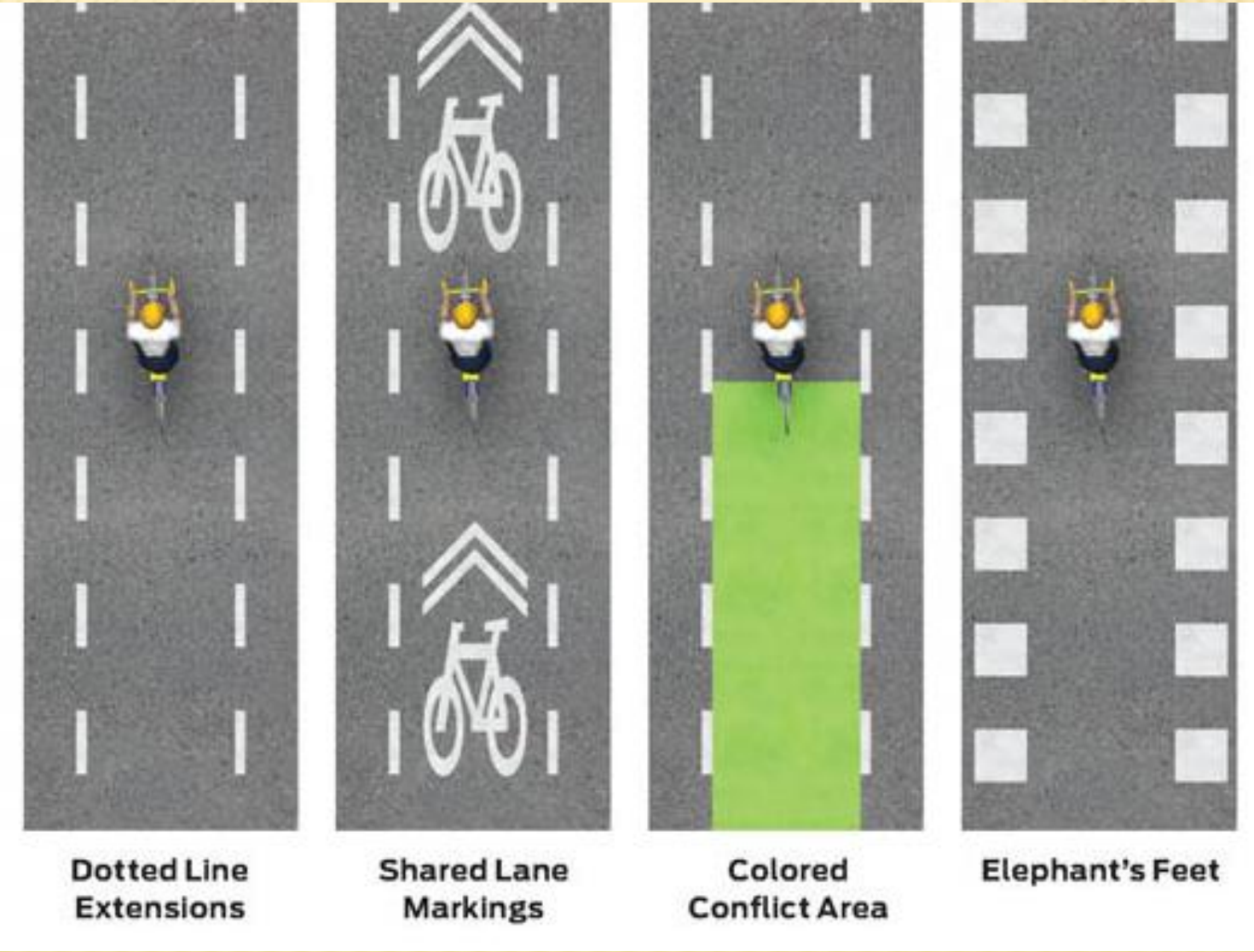
BIKE LANE THRU INTERSECTION



BIKE LANE THRU INTERSECTION



HIGHLIGHT CONFLICT ZONE



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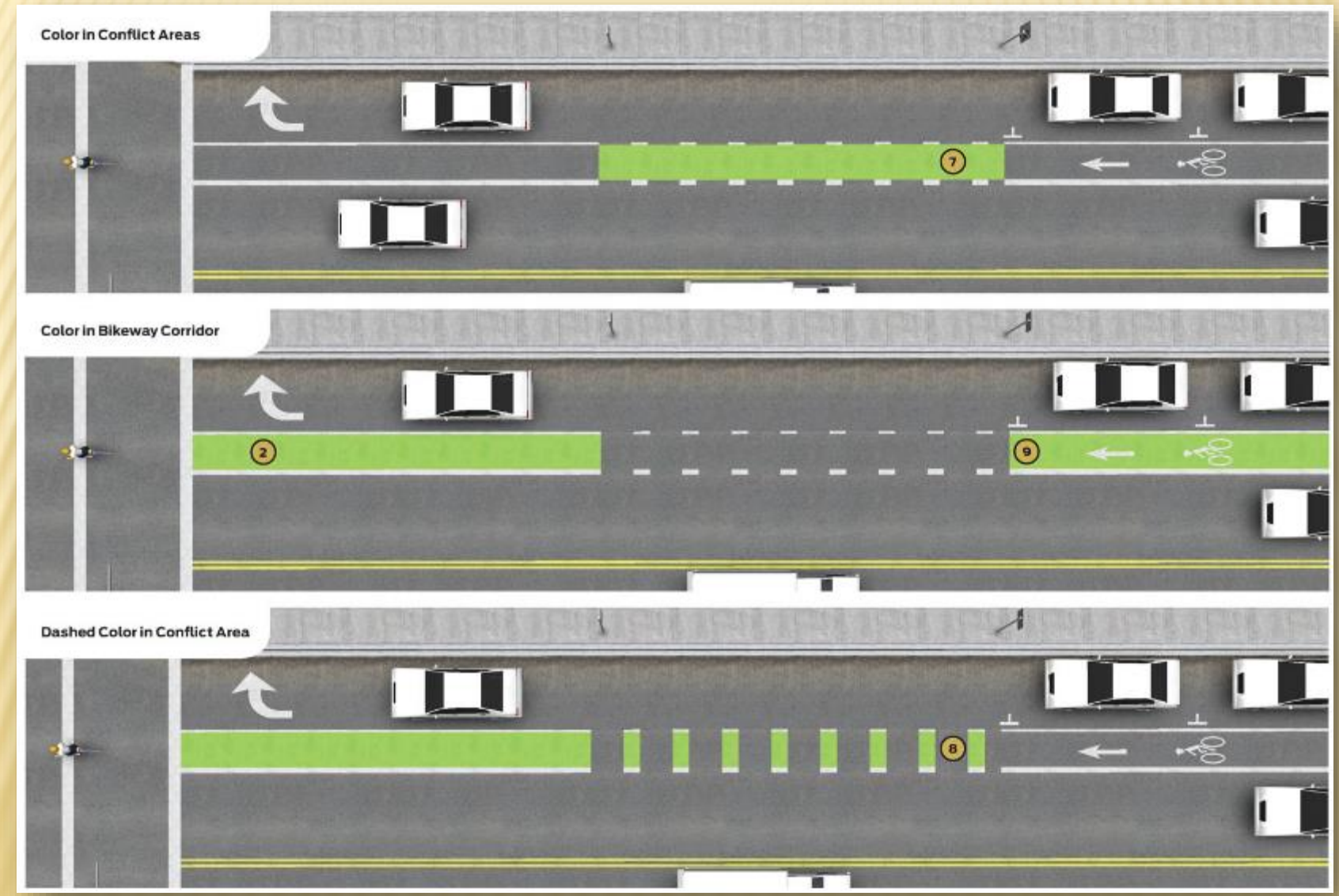
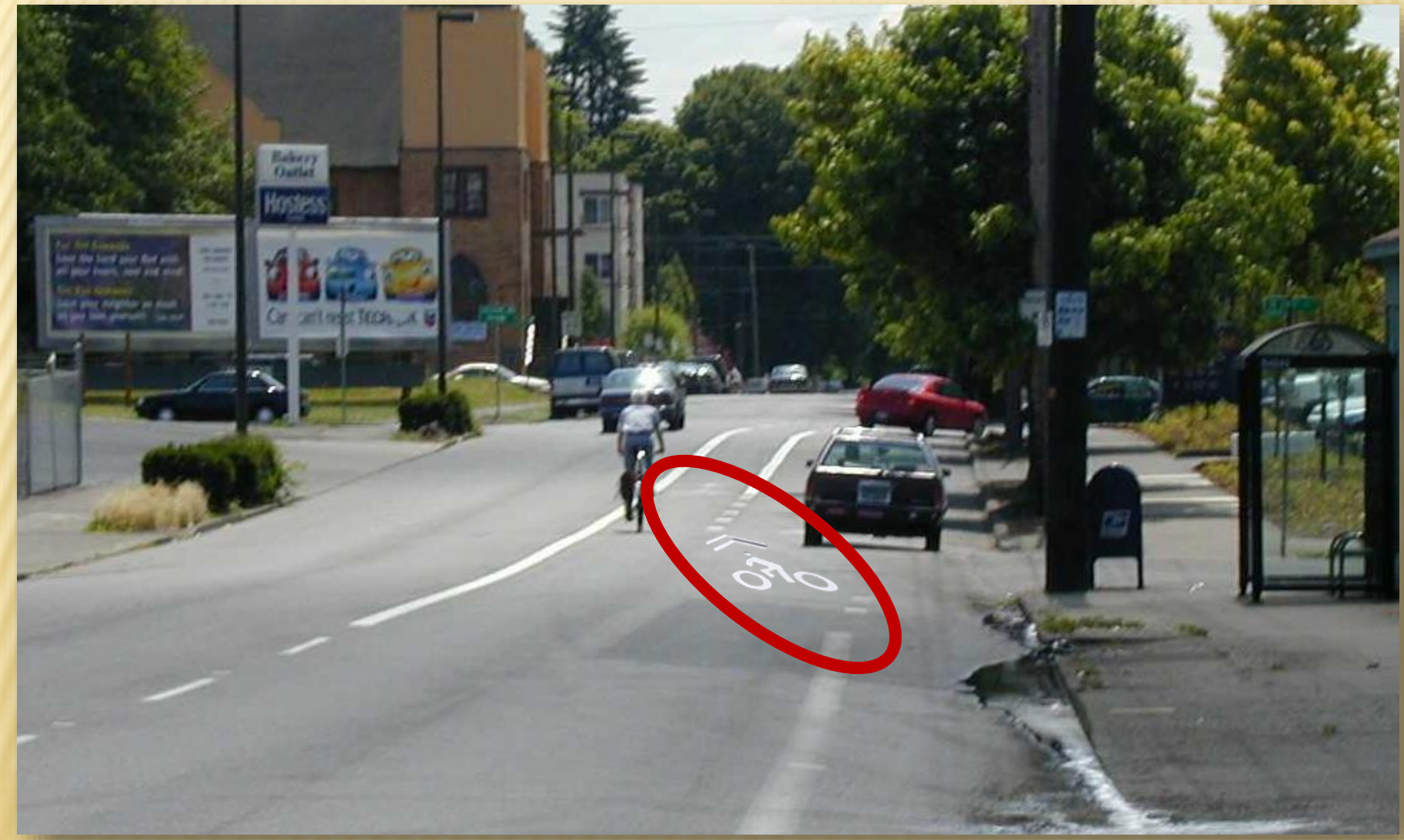
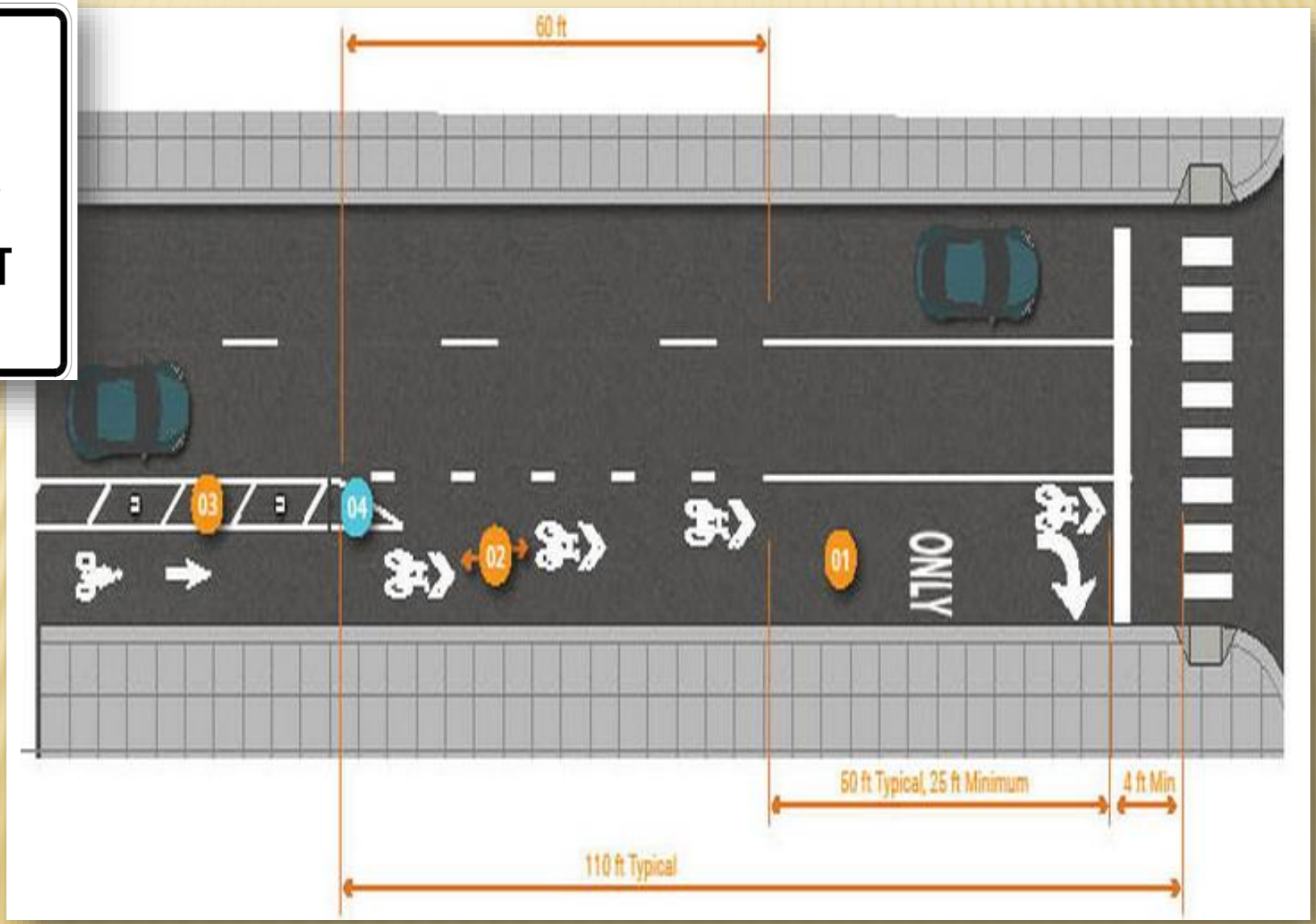


BIKE LANE THRU INTERSECTION



SHARROW W/ GREEN BACKGROUND

RIGHT TURN SHARED LANE



TWO-STAGE LEFT TURN BOX

TWO-STAGE LEFT-TURN QUEUE BOX

- Required design elements include:
  - Bicycle symbol
  - Turn or through arrow
  - Turn on red prohibition
  - Passive detection of bicycles
- Size to prevent conflicts

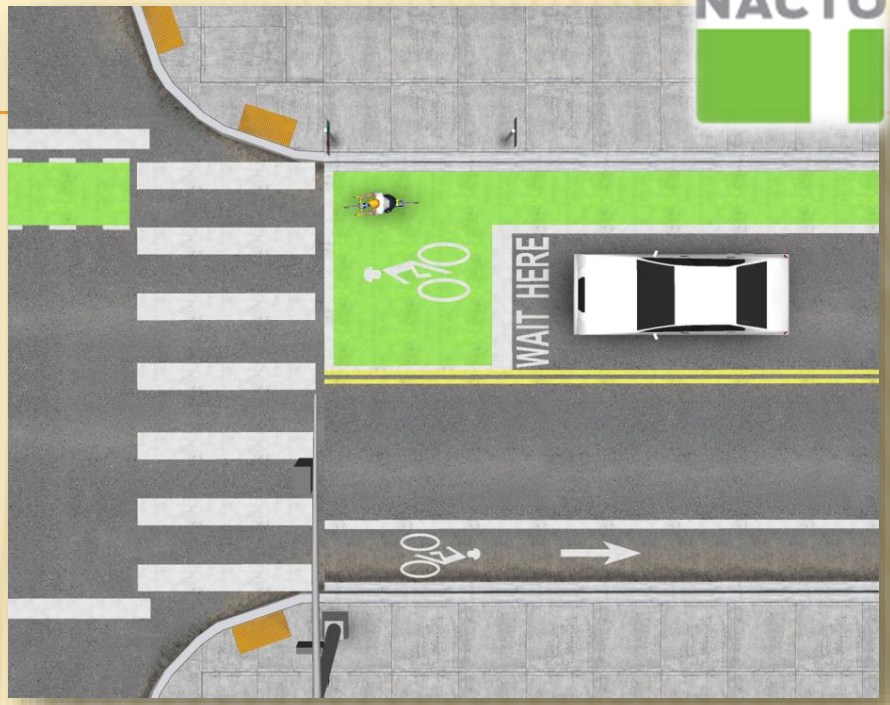
SALT LAKE CITY, UT (PHOTO: SALT LAKE CITY PUBLIC WORKS)

BIKE BOX

BIKE BOX

- Increase visibility
- Reduce signal delay for bikes
- Positioning for left-turn
- Prevent “right-hook” (except at onset of green)
- Groups bikes

BIKE BOX



- Required elements:
  - Advance stop bar
  - Bike symbol
  - RTOR prohibited
  - Setback from crosswalk
  - Countdown ped signal
  - Yellow change & red clearance

BICYCLE SIGNAL FACE

Application for:

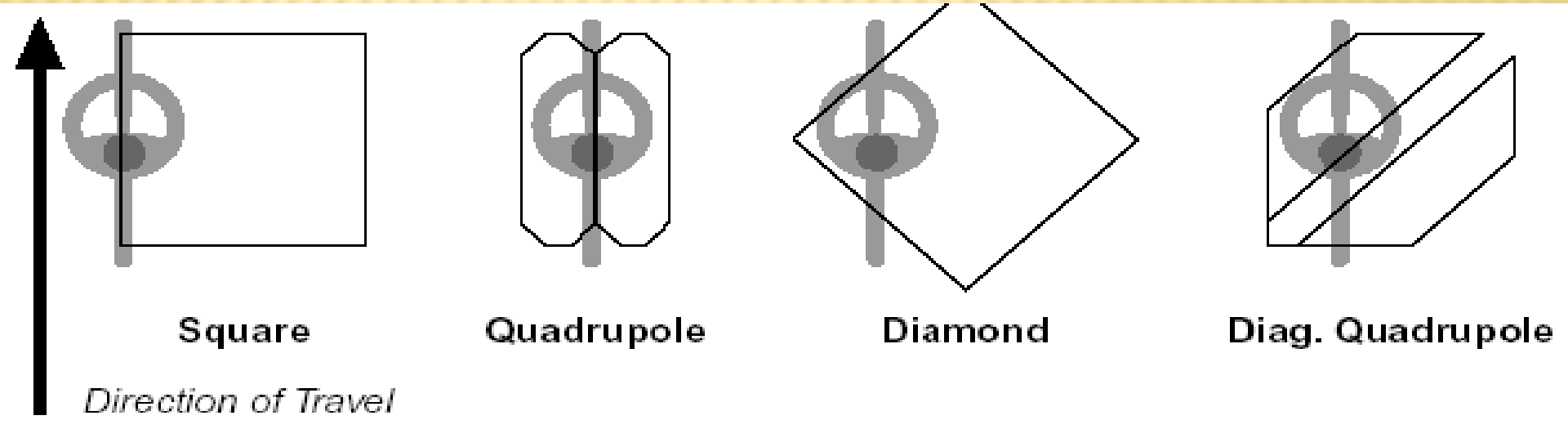
- Bicyclist non-compliance
- Provide a leading or lagging bicycle interval
- Continue the bicycle lane on the right-hand side of an exclusive turn lane
- Augment the design of a segregated counter-flow
- Unusual or unexpected arrangements of the bicycle movement through complex intersections, conflict areas, or signal control.

SAFER SIGNALS FOR BICYCLISTS

- Bikes start-up and travel slower than cars
  - Differentiating bike detection to optimize signals
  - Set initial and gap times to accommodate bikes
- Leading Bike Interval
- Segregate Conflicting Movements

BICYCLE DETECTION

- Loops
- Video
- Microwave
- Buttons



BICYCLE DETECTION

PUSH BUTTONS

Not good:
Requires dismounting

Better:
Push button close to curb

BICYCLISTS AT ROUNDABOUTS

WHAT DOES IT TAKE TO MAKE ROUNDABOUTS WORK FOR BICYCLISTS?

- Slow speeds – lots of deflection; truck apron
- Simple, single lane, throughout
- Splitter islands
- “Escape ramps” for multi-lane roundabouts

End bike lane to encourage cyclist to enter roadway

Bend OR

End bike lane to encourage cyclist to enter roadway

Bend OR

Slow speed allows cyclists to share roadway

Bend OR

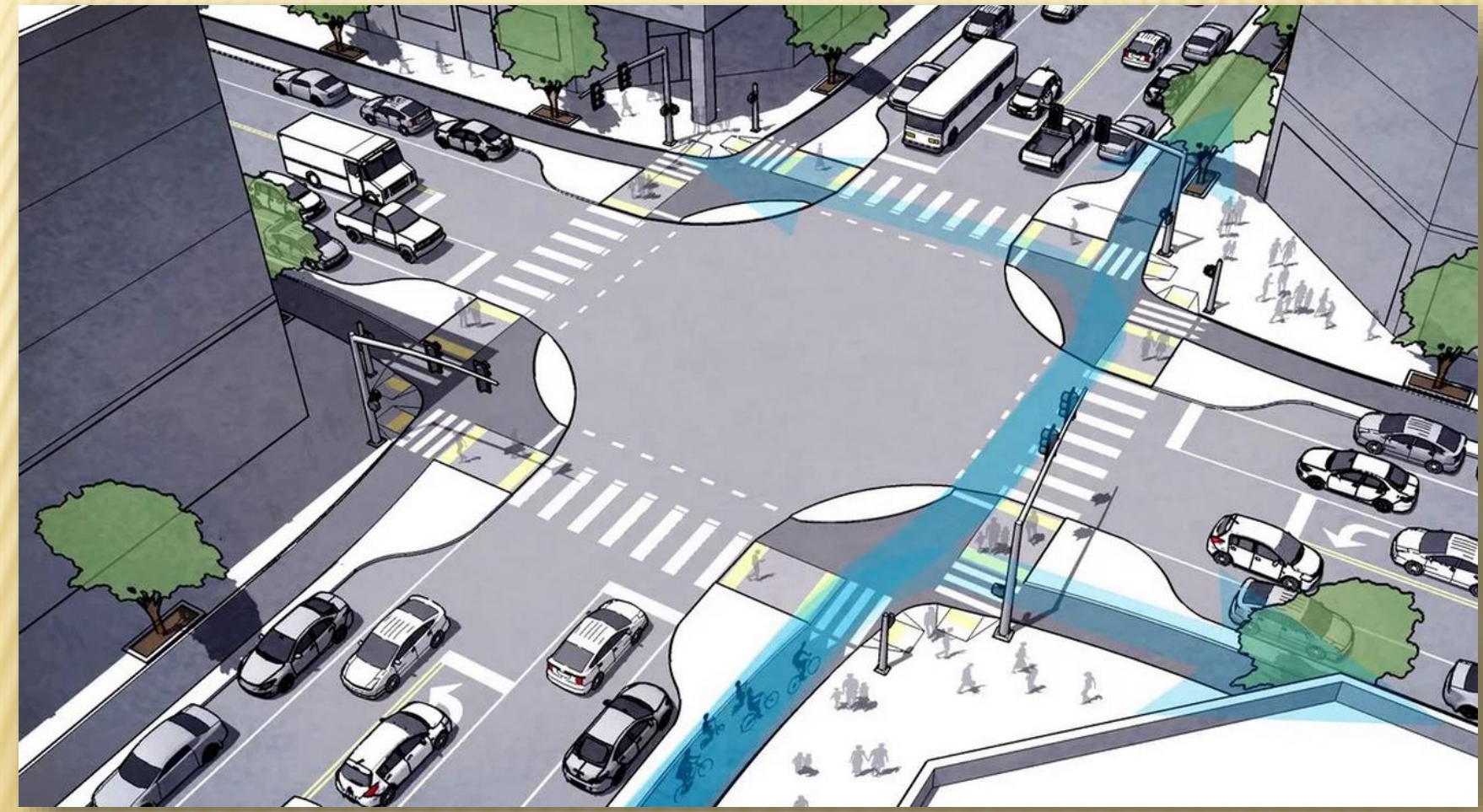
Bend OR

Bend OR

What if a cyclist doesn't want to enter the roundabout?

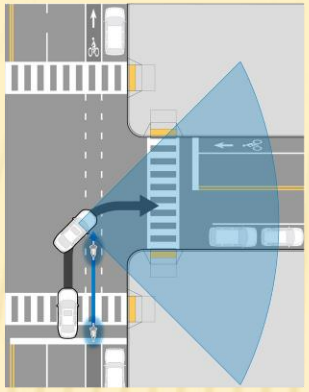
Bend OR

“PROTECTED” INTERSECTION

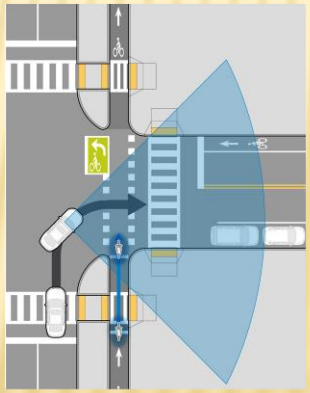


VISIBILITY AT CONFLICT POINTS

motorist's view at conventional bike lane



motorist's view at **separated bike lane**



massDOT

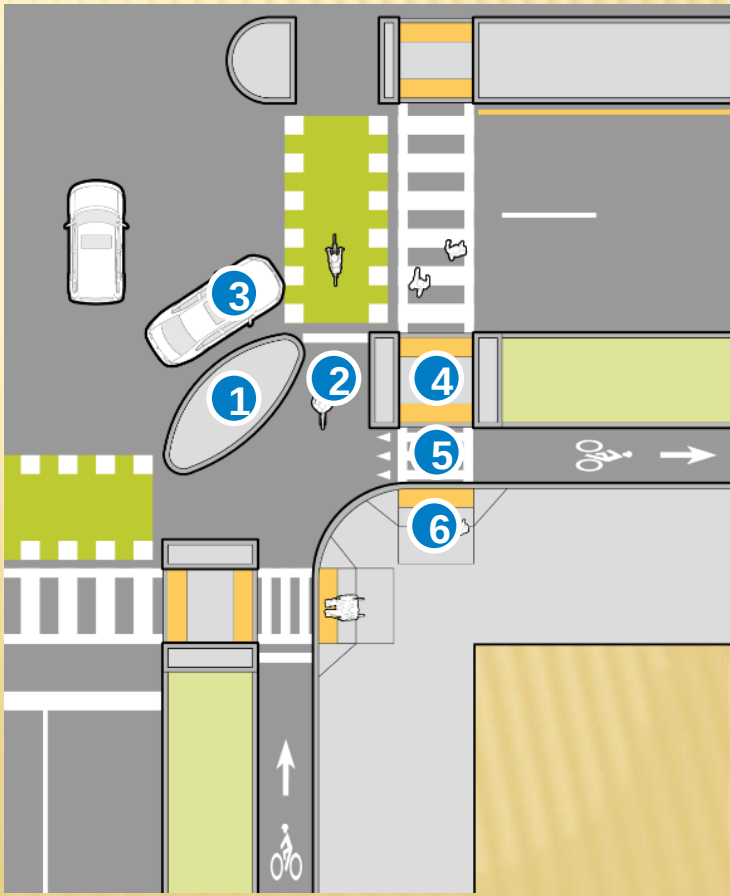
VISIBILITY AT CONFLICT POINTS

protected intersection

conventional bike lane

PROTECTED INTERSECTIONS

1. Corner refuge island
2. Forward bicycle queuing area
3. Motorist yield zone
4. Pedestrian crossing island
5. Pedestrian crossing of separated bike lane
6. Pedestrian curb ramp



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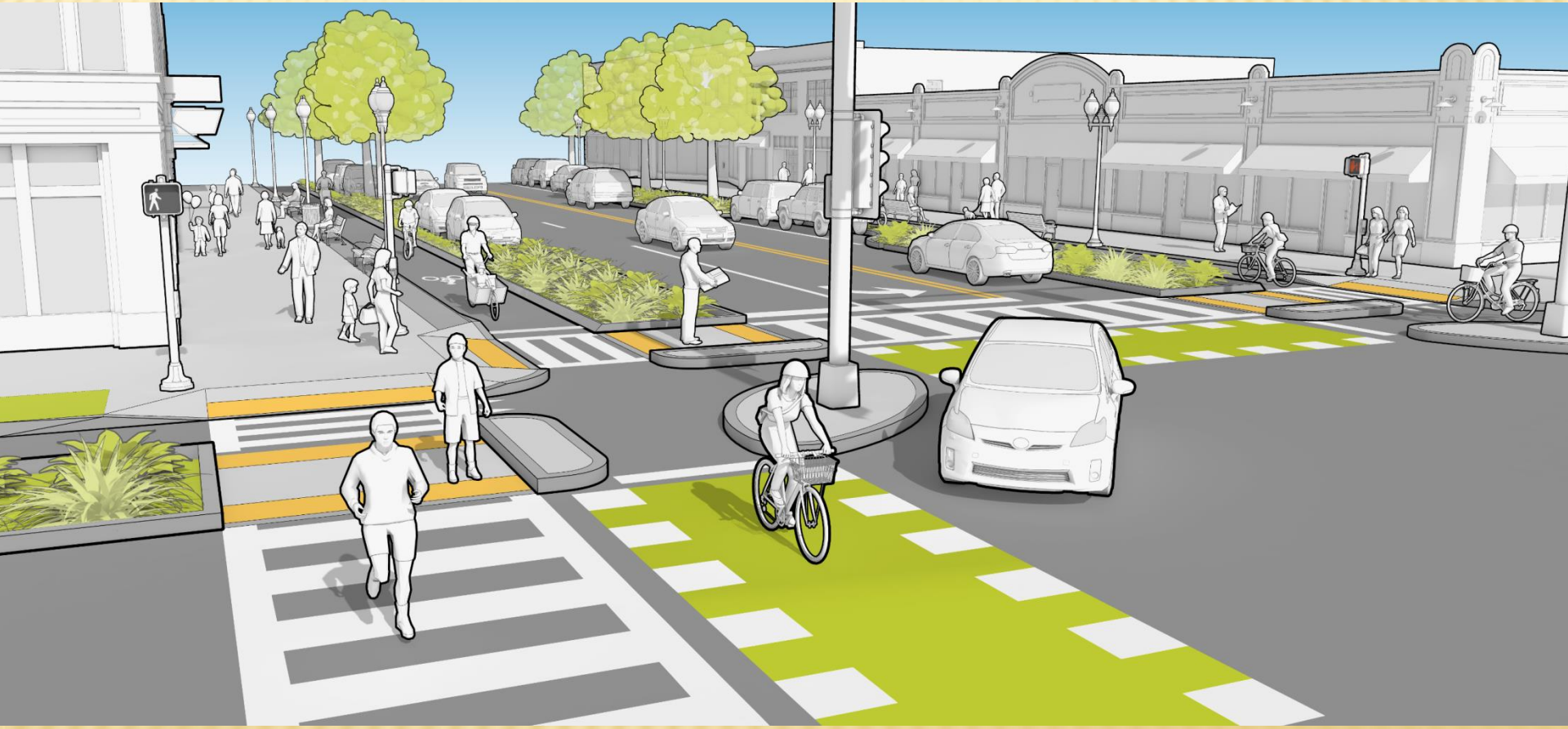
PROTECTED INTERSECTIONS



massDOT

CHICAGO, IL

CHICAGO, IL

Designing for Bicyclist Safety

SUMMARY THOUGHTS

IMPERATIVE FOR CHANGE

- 1-5 mile trip typical for casual rider
- 50% of all trips are less than 3 miles
- Most U.S. facilities are LTS 3
- Most adult bicyclists comfortable on LTS 2

KEY SAFETY FACTORS

Important Message

- Speed
- Number of lanes
- Visibility
- Traffic volume & composition
- Conflict points
- Proximity
- Bike control
- Connectivity

Designing for Bicyclist Safety

QUESTIONS

Discussion

- Send us your questions 
- Follow up with us:
  - Brooke Struve brooke.struve@dot.gov
  - Greg Bakos gbakos@vhb.com
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