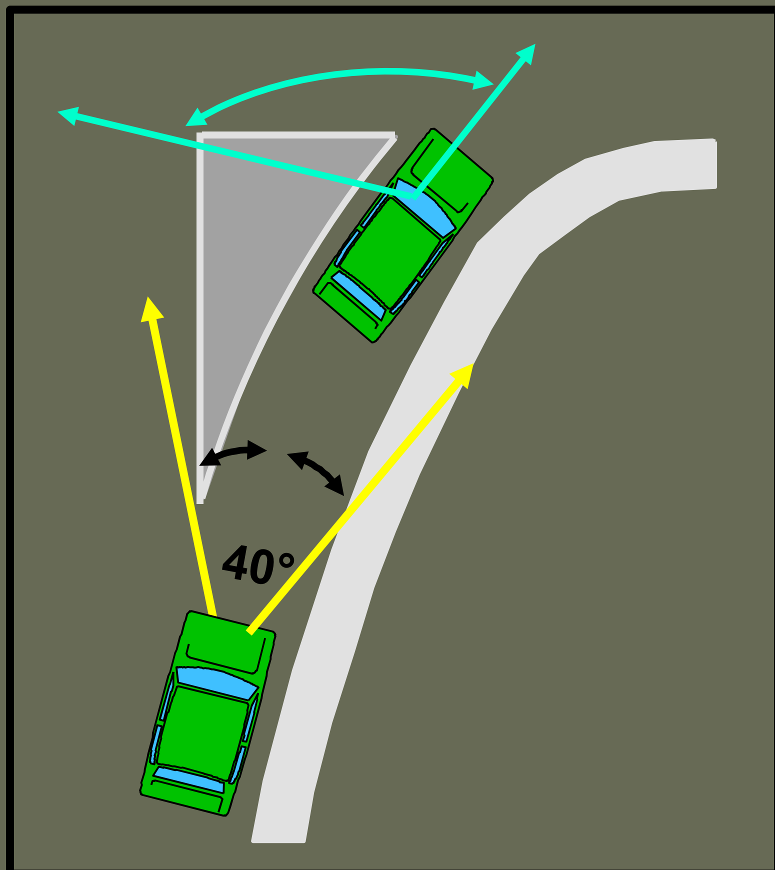


INTERSECTION GEOMETRY

Learning Outcomes

At the end of this module, you will be able to:

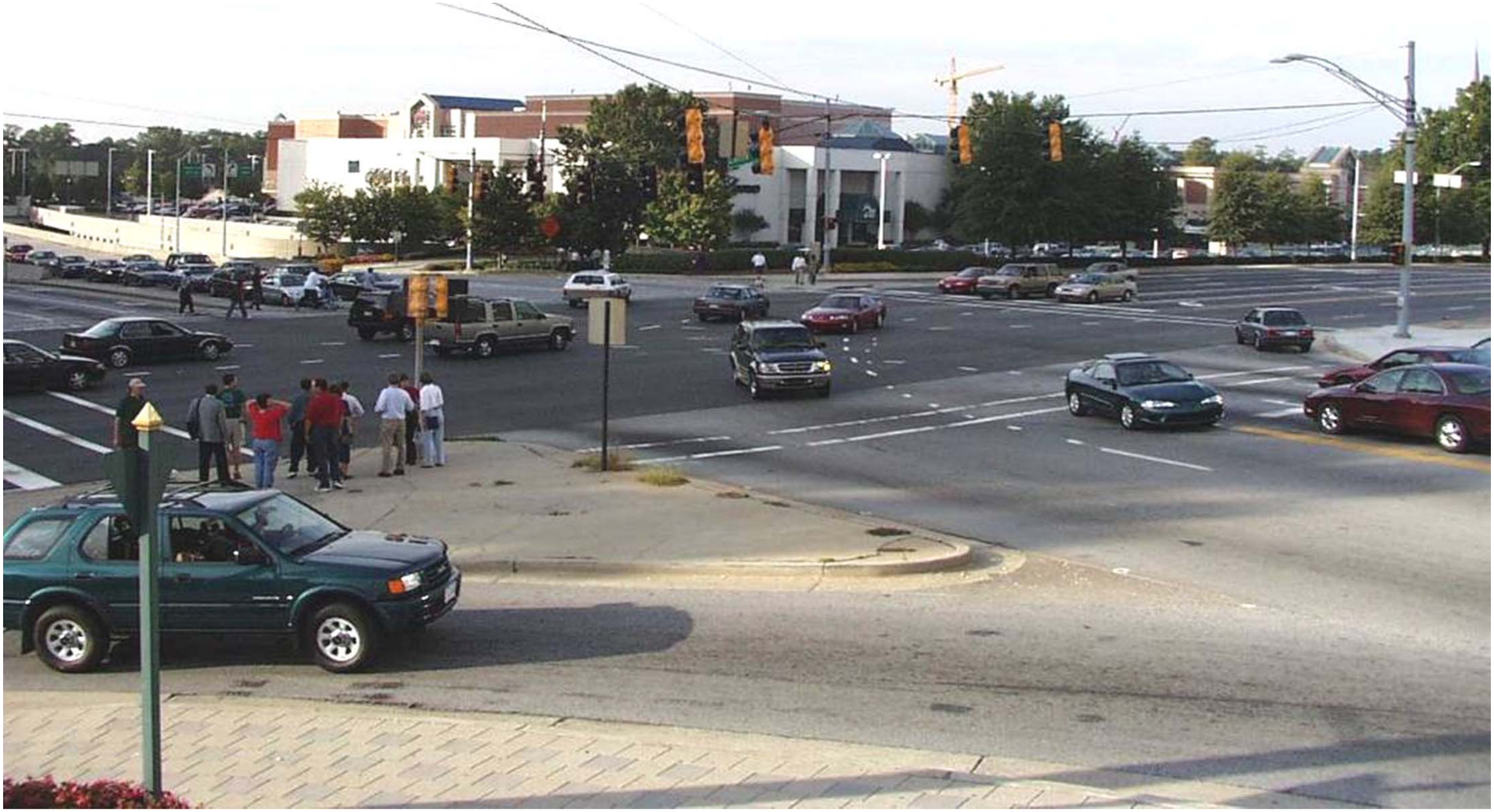
1. Explain why tight/right angle intersections are best
2. Describe why pedestrians need access to all corners
3. Assess good crosswalk placement: where peds want to cross & where drivers can see them
4. Explain how islands can break up complex intersections

Intersection Crashes
Some basic facts:

1. Most (urban) crashes occur at intersections
2. 40% occur at signalized intersections
3. Most are associated with turning movements
4. Geometry matters: keeping intersections tight, simple & slow speed make them safer for everyone

5-4 **Philadelphia PA**

- Small, tight intersections best for pedestrians…
- Simple, few conflicts, slow speeds

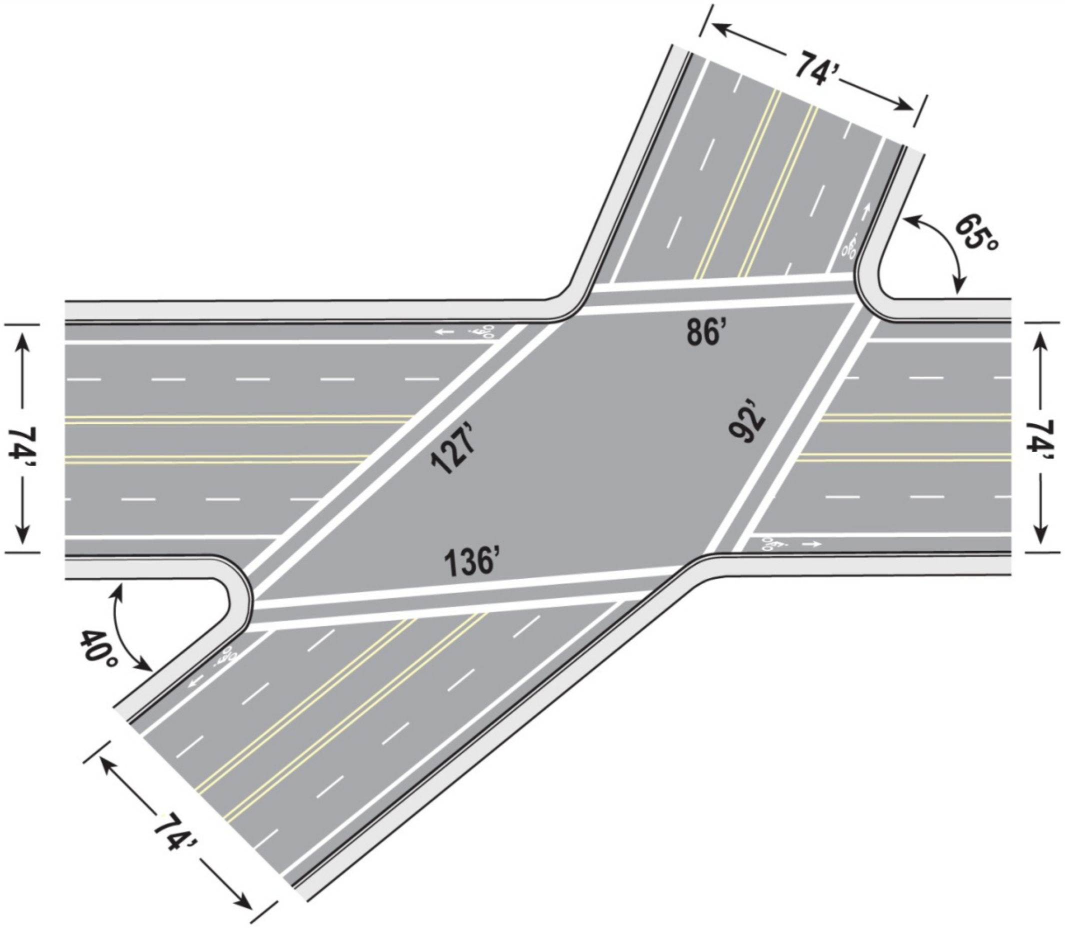


5-5

Atlanta GA

Large intersections can work for pedestrians with mitigation

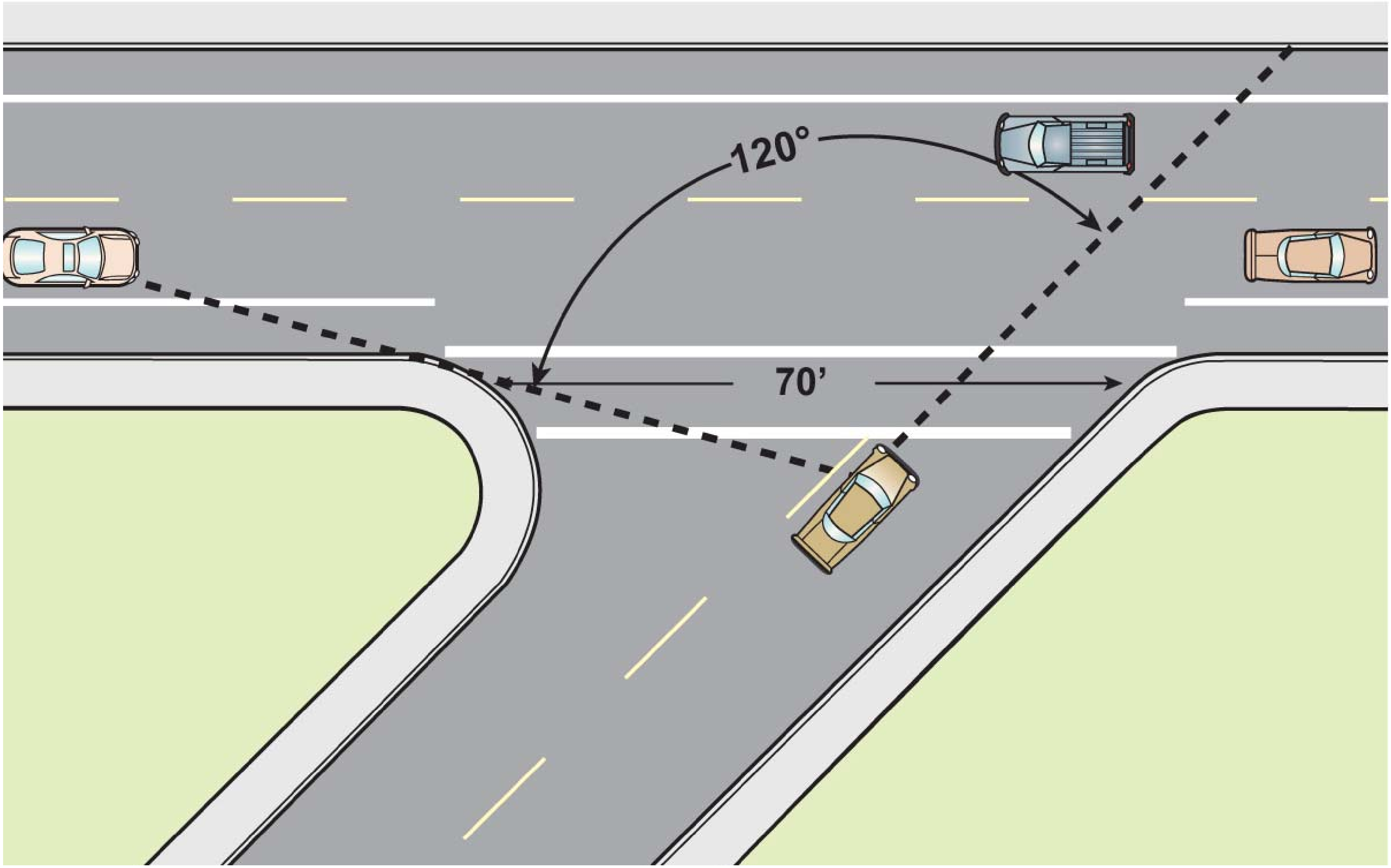
Skewed intersections



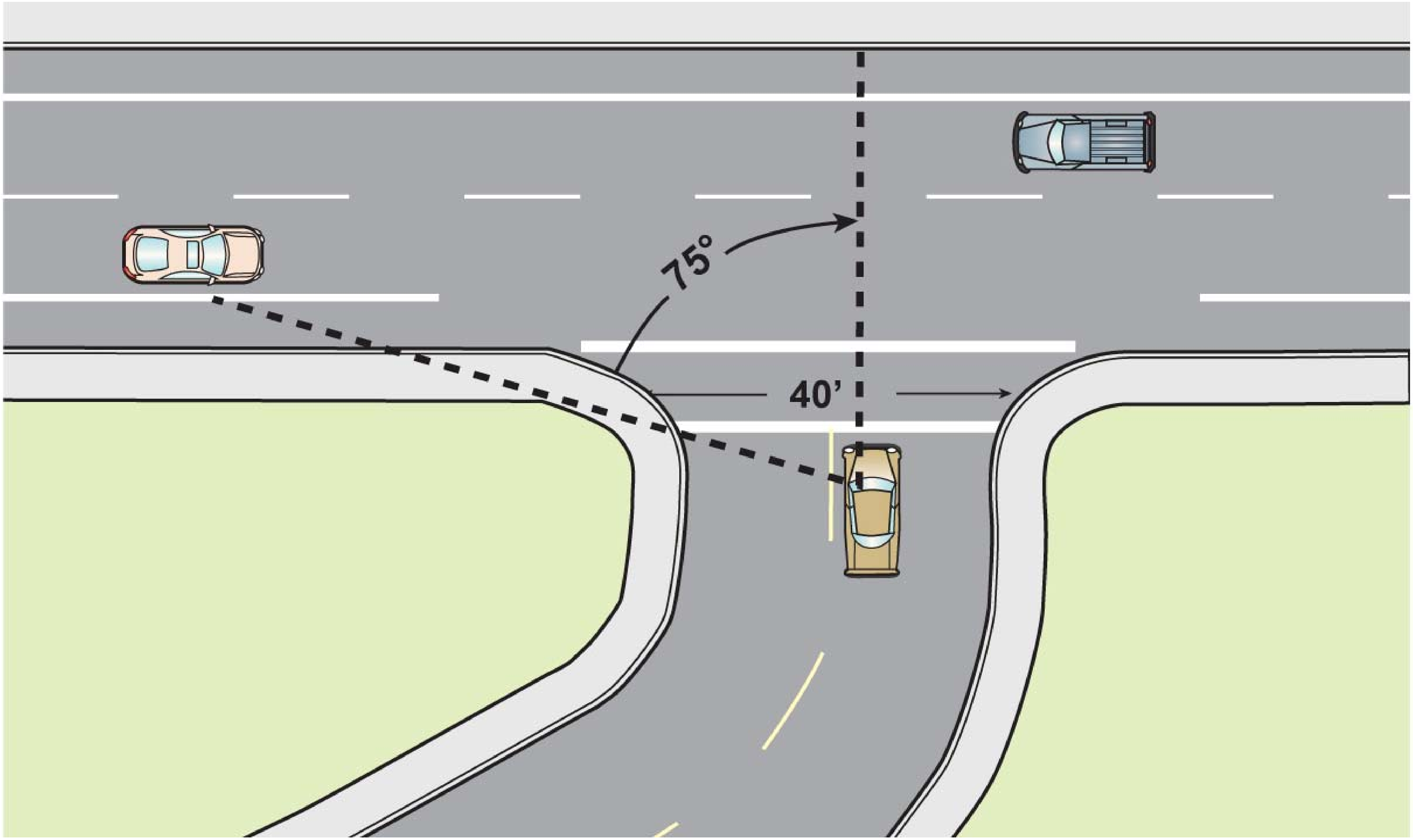
Skew increases crossing distance & speed of turning cars

5-7 **Philadelphia PA**

Cars can turn at high speed

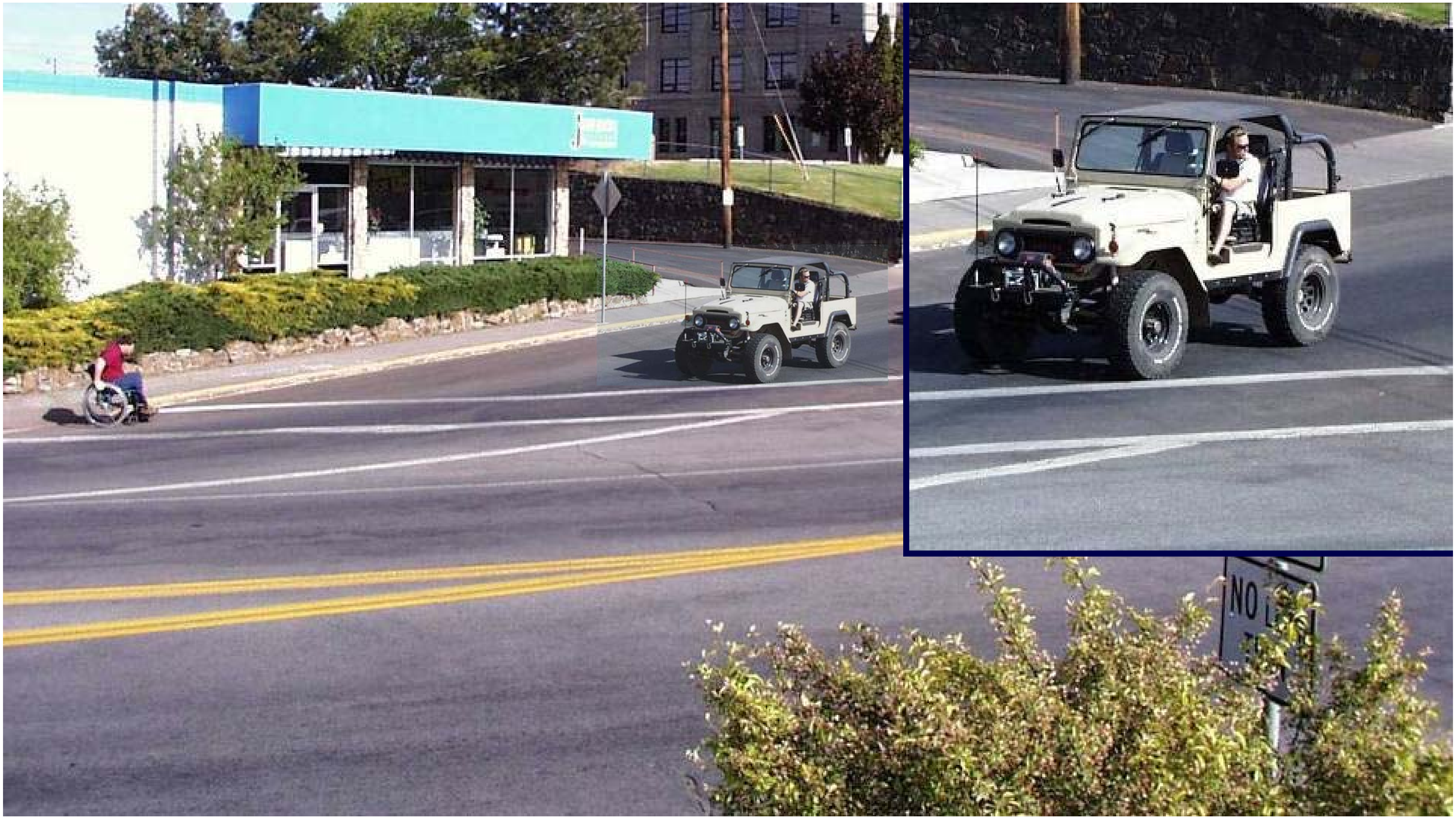


Skew increases crosswalk length, decreases visibility



5-9

Right angle decreases crosswalk length, increases visibility



5-10 **Bend OR**

- Skewed intersection reduces visibility
- Driver looks left, doesn't see pedestrian on right

5-11 **Bend OR**

Adjust skew by bringing out curb

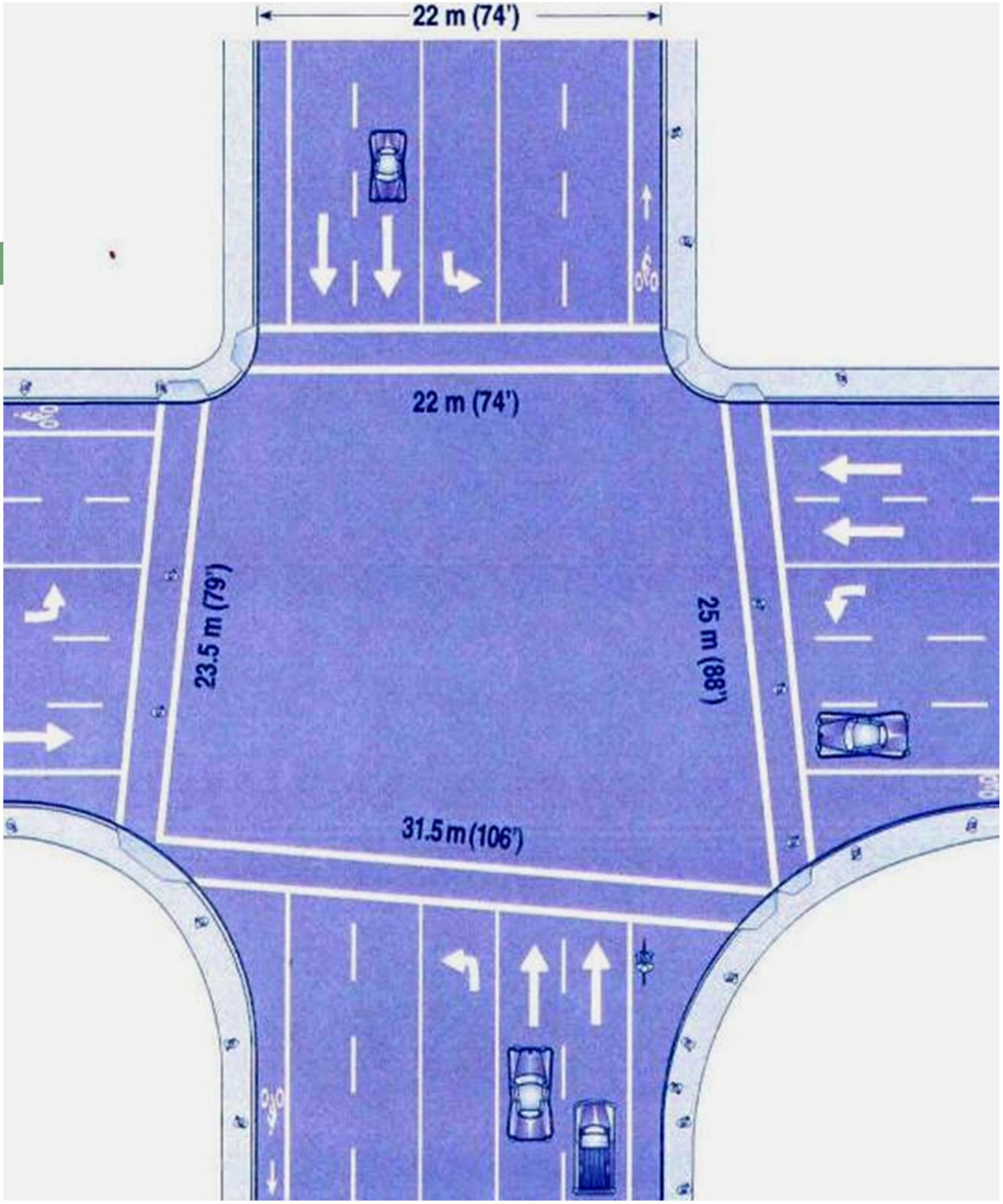
 Bend OR

Result: driver behavior change

Curb radius – small radii are safer for pedestrians

5-13

- Large radii:
- Increase crossing distance and
- Make crosswalk & ramp placement more difficult



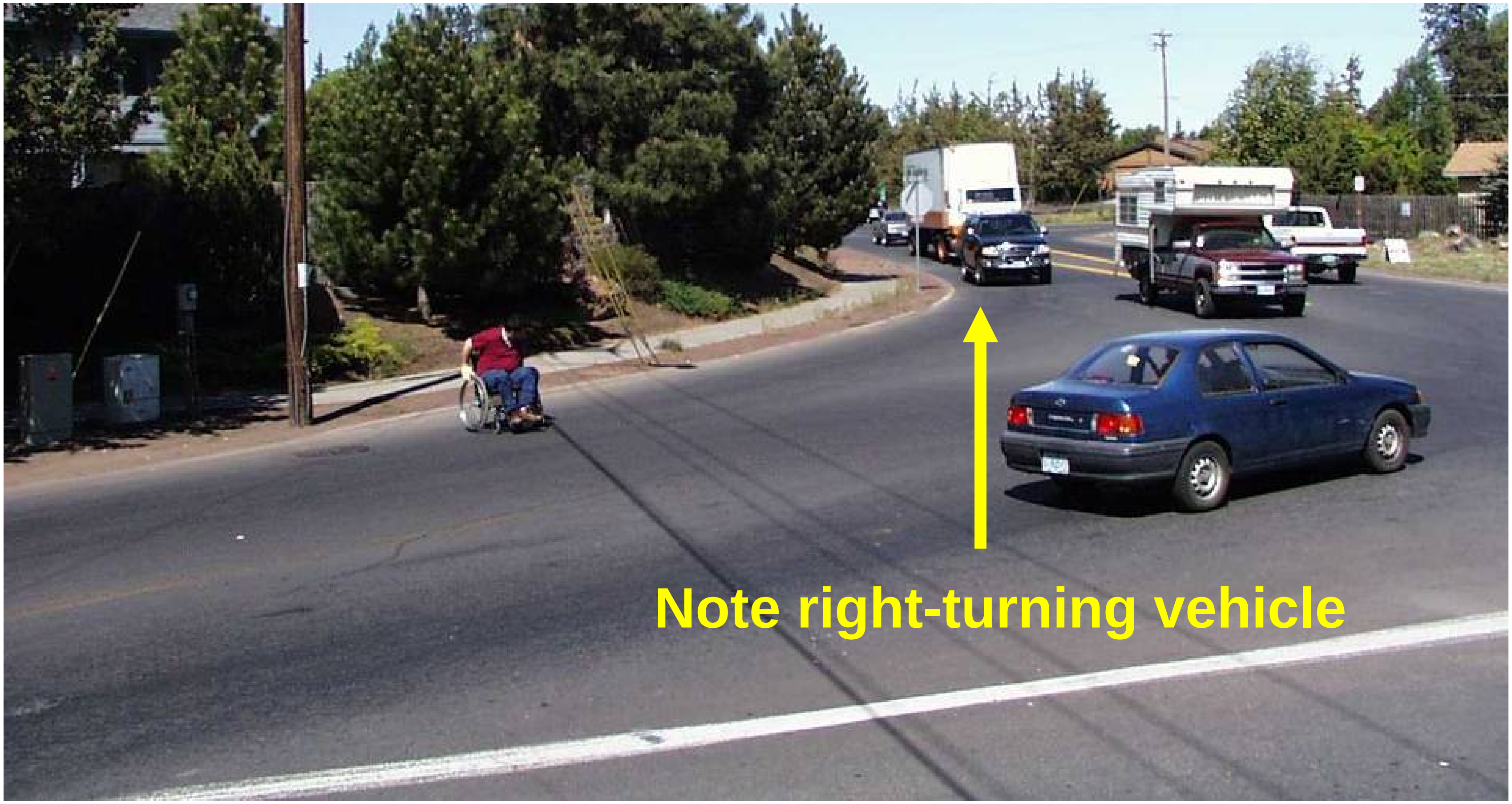
Effect of large radius on crosswalk:

5-14 **Bend OR**

It adds to crossing distance…

Effect of large radius on crosswalk:

5-15 **Bend OR**



… and makes it hard to figure out where to cross

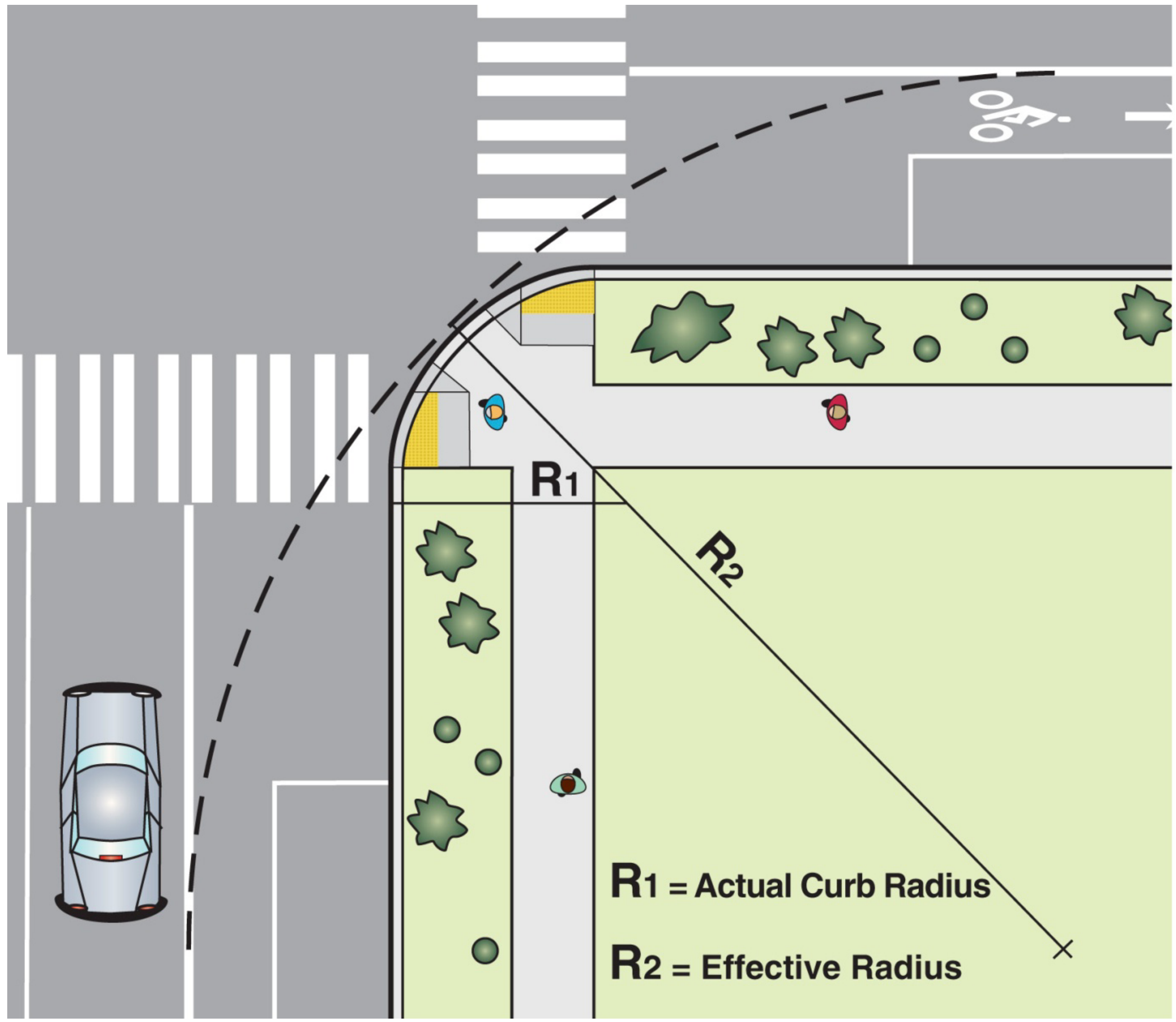
Effect of large radius on drivers

 Tigard OR

They drive fast, ignoring pedestrians

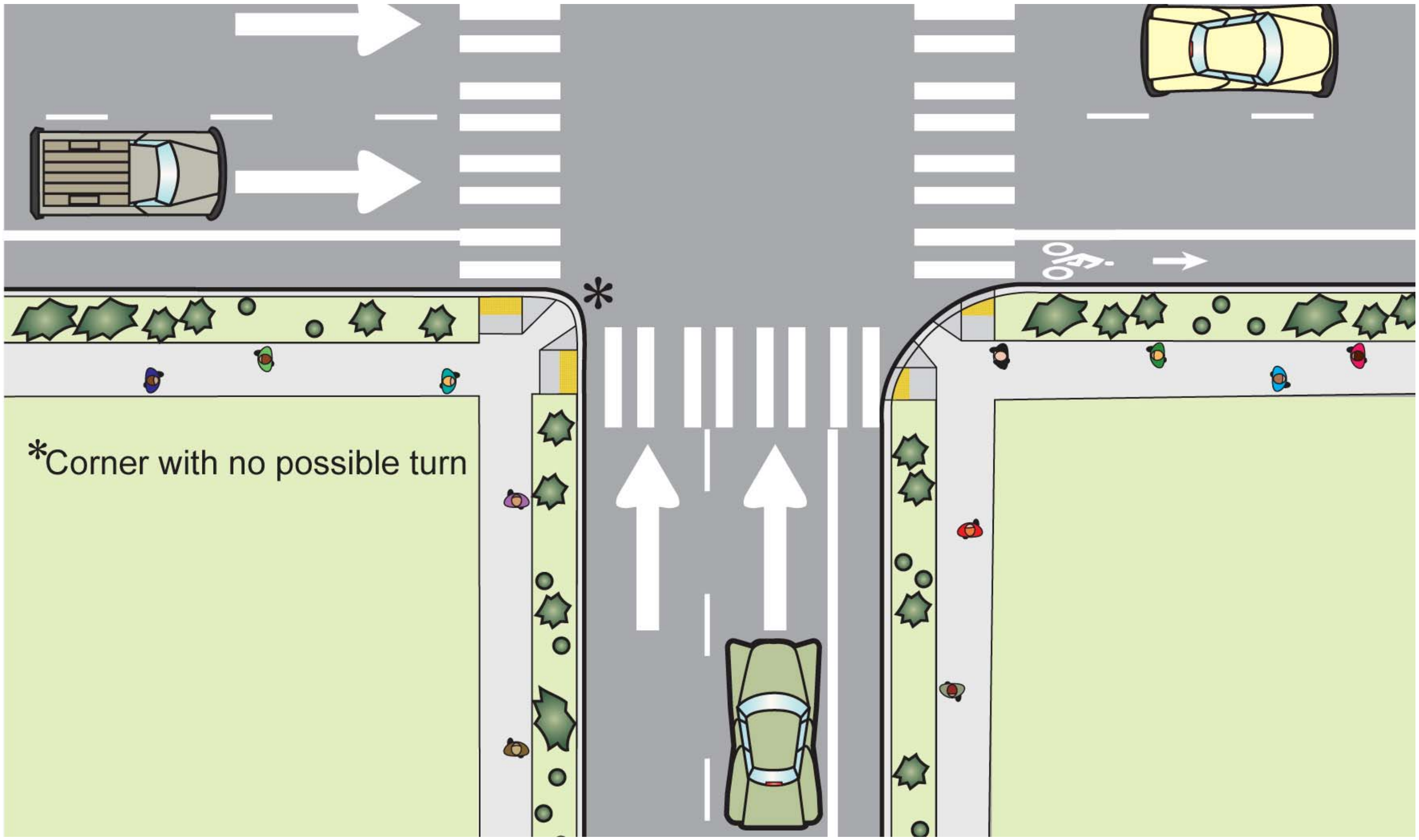
Minimize curb radius

1. Calculate effective radius: Larger than built radius if travel lanes offset from curb with parking and/or bike lane



Minimize curb radius

2. At one-way streets, corner with no turns can have tight radius



Minimize curb radius

Canyonville OR

3. Don't choose larger design vehicle than necessary

Bus makes turn several times an hour

Minimize curb radius

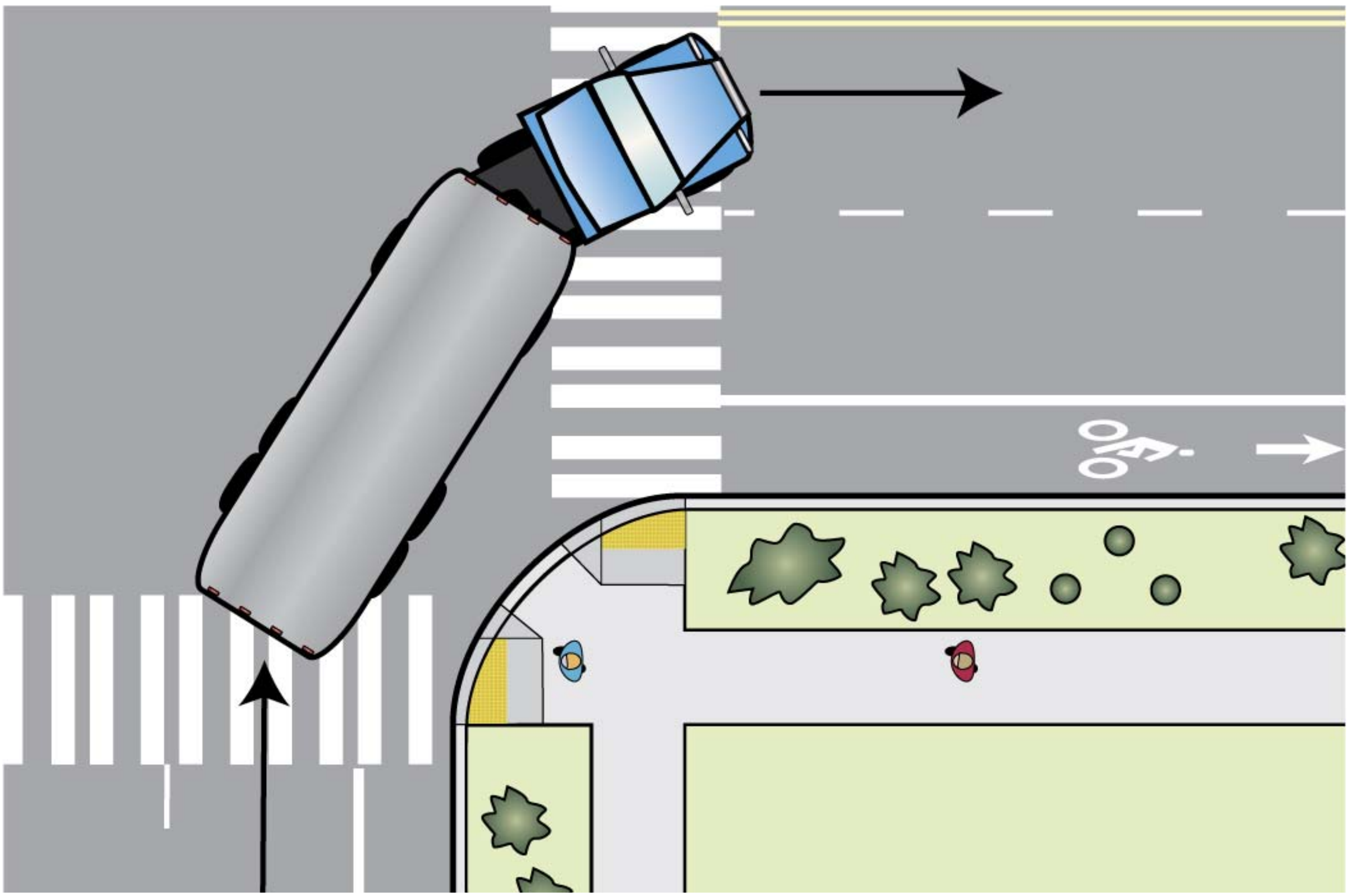
Santa Barbara CA

3. Don't choose larger design vehicle than necessary

Moving van, once or twice a year; peds cross every day

Minimize curb radius

4. Where appropriate, let trucks use 2nd lane



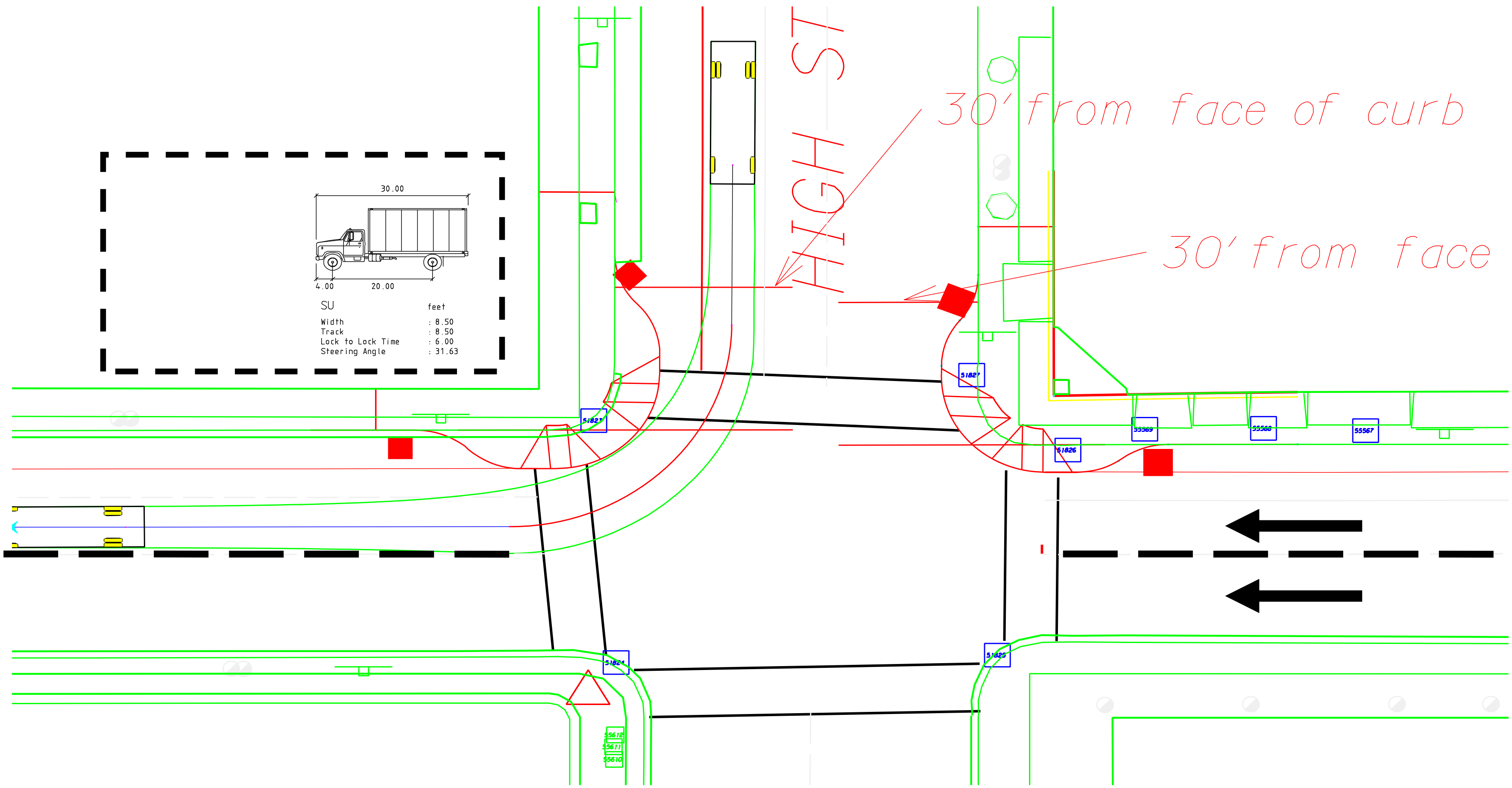
Minimize curb radius

Canyonville OR

5. Trucks can make very tight turns at slow speeds

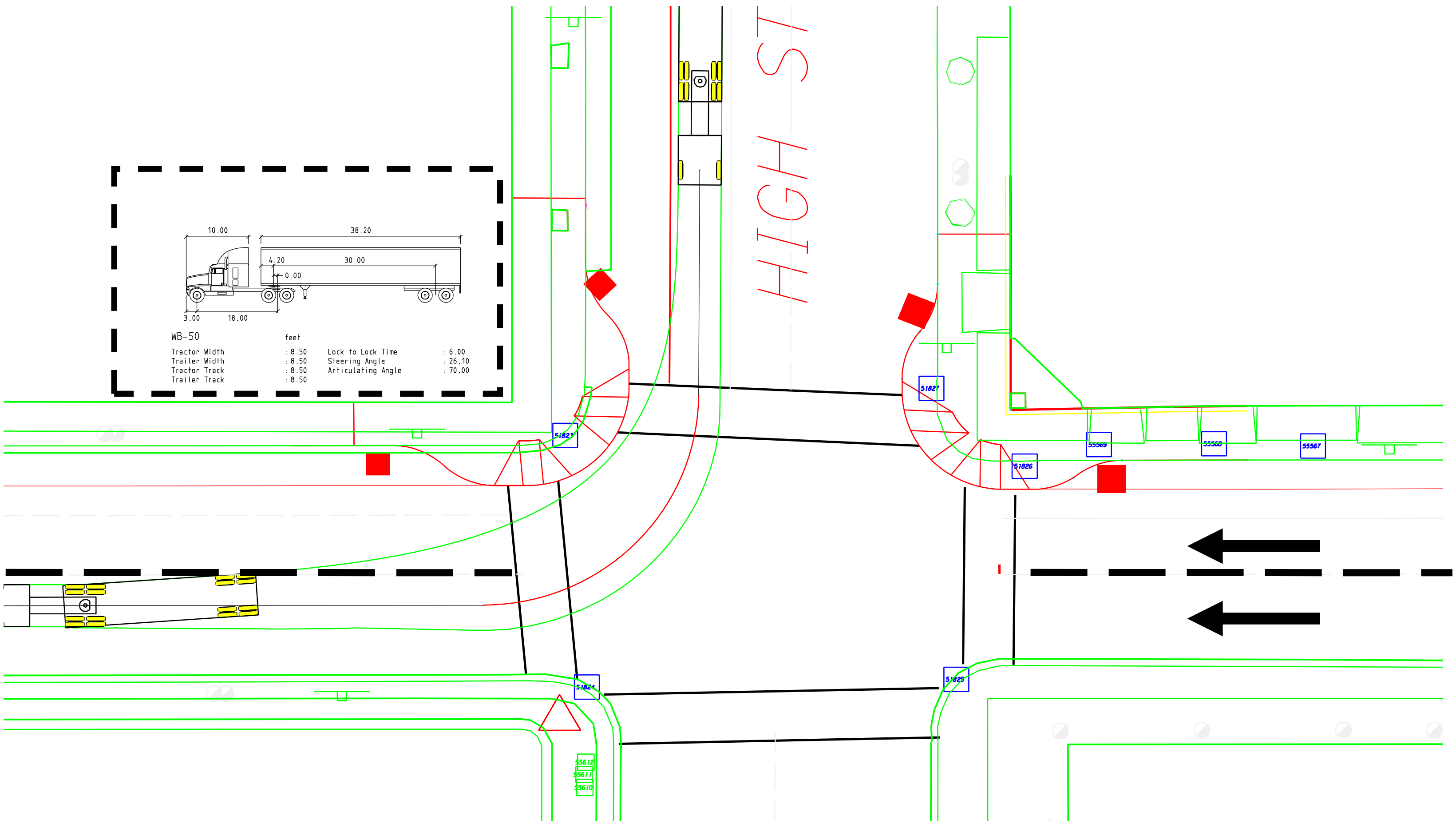
Minimize curb radius

6.a Turn common Single Unit truck (SU-30) into near lane



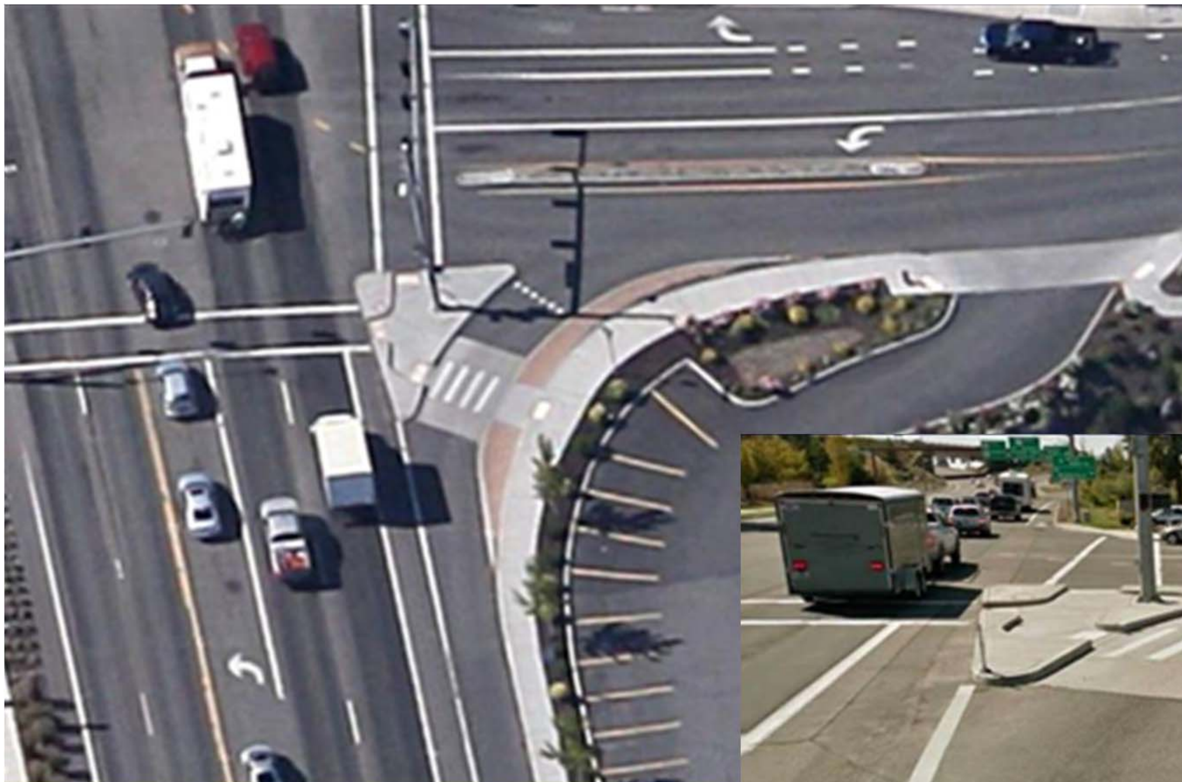
Minimize curb radius

6.b Turn less common Semi (WB-50) into 2nd lane



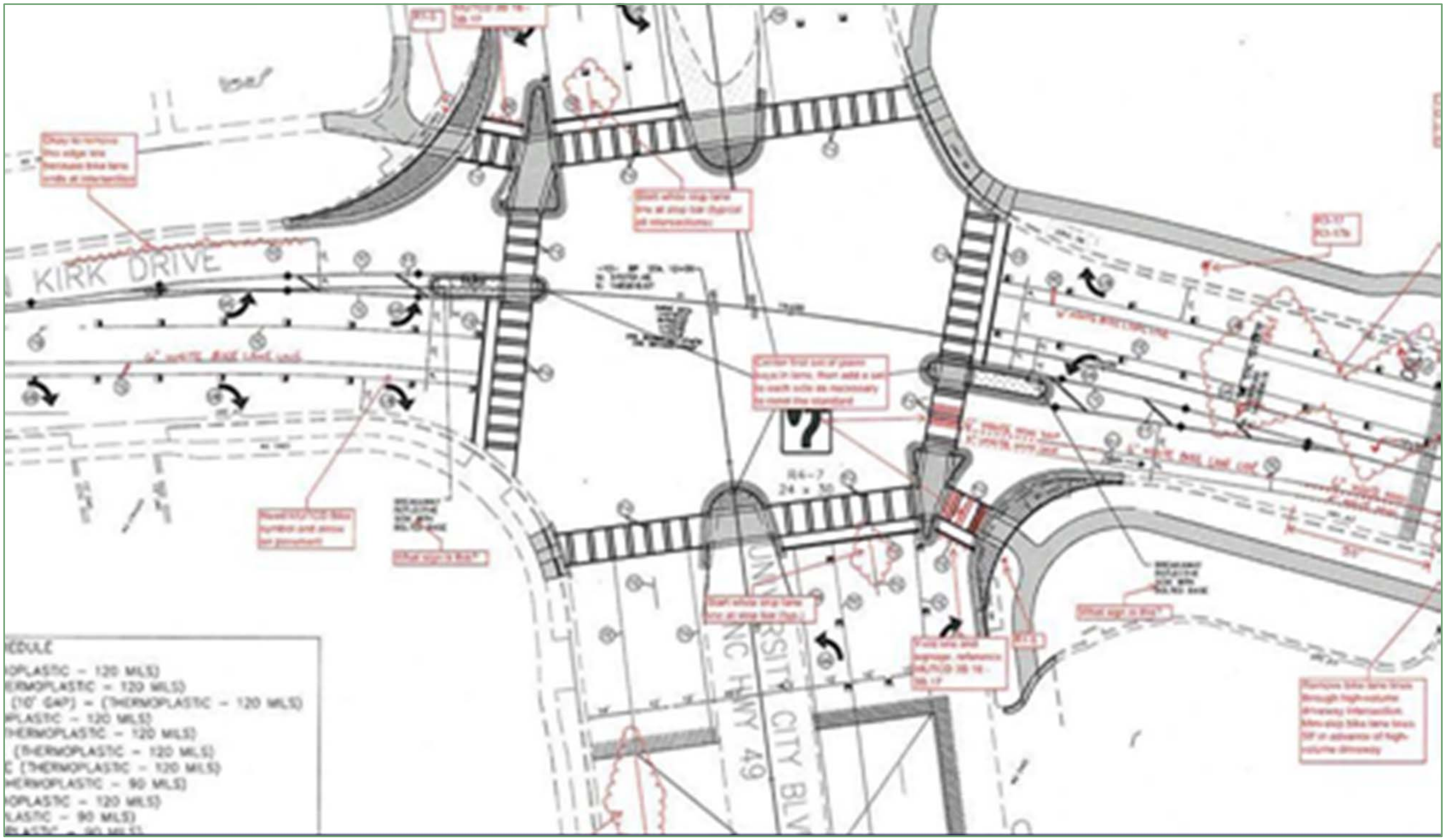
Minimize Curb Radius w/Truck Apron

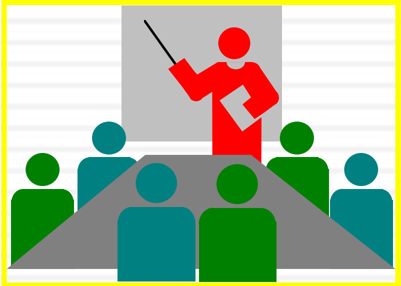
5-25 **Bend OR**



Minimize Curb Radius w/Truck Apron

Charlotte NC





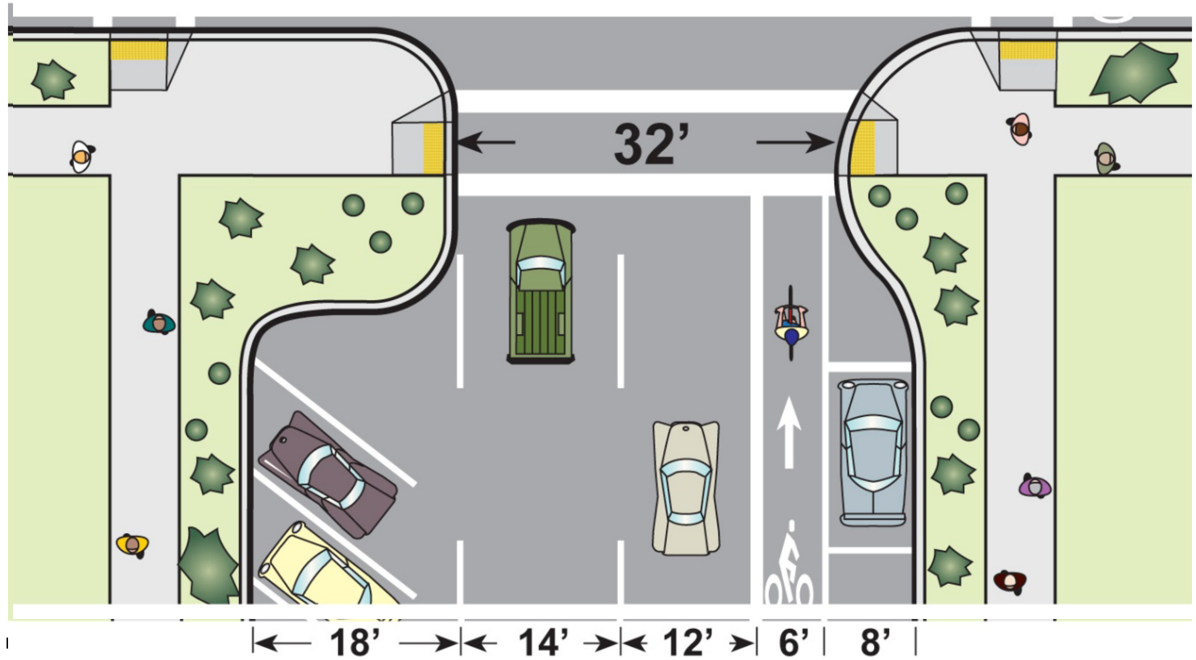
5-27

Discussion:

What are your policies & practices regarding corner radii?

Curb extensions

Most focus is on reduced crossing distance

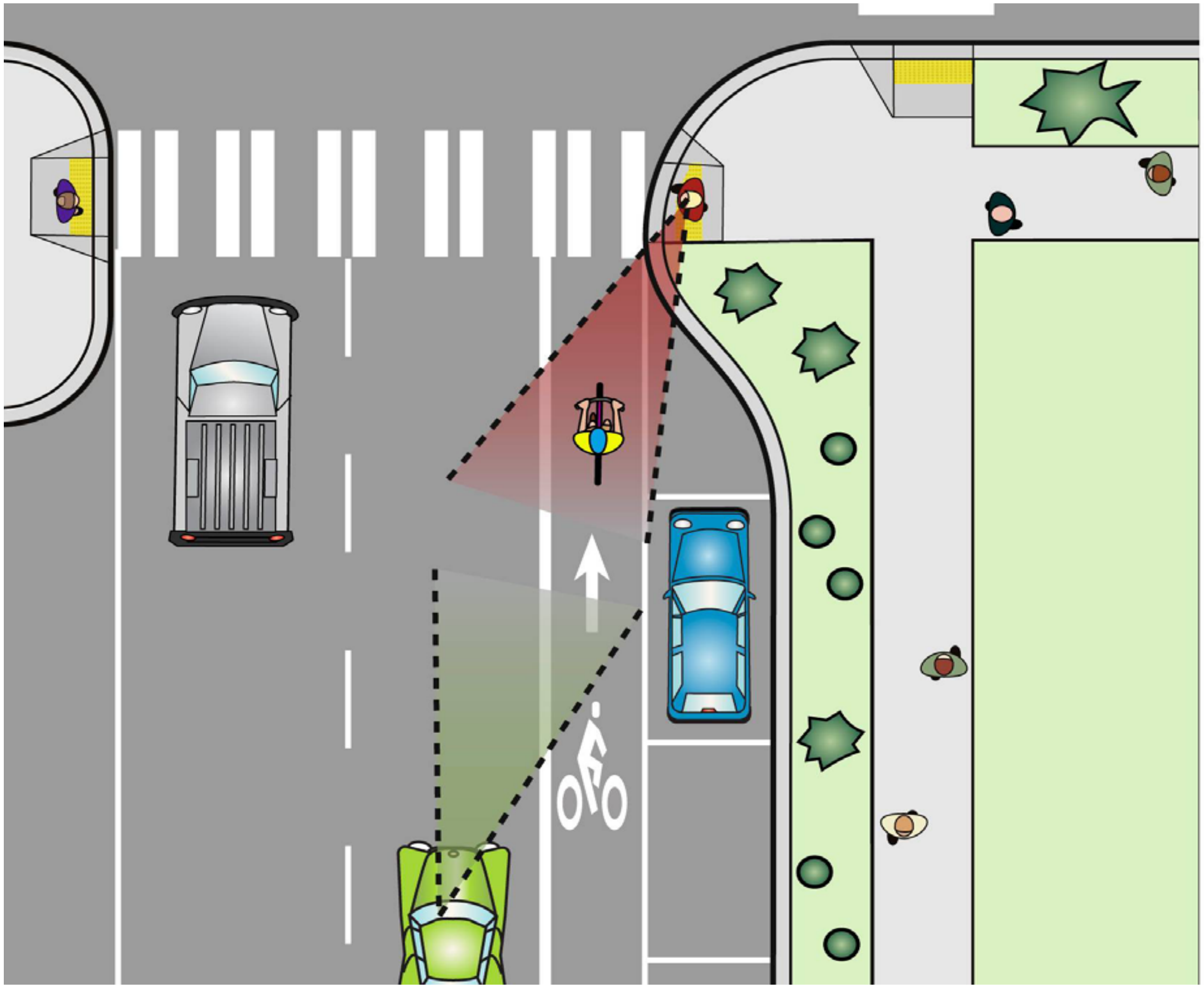


Other advantages:

- Better visibility between peds and motorists
- Traffic calming
- Room for street furniture

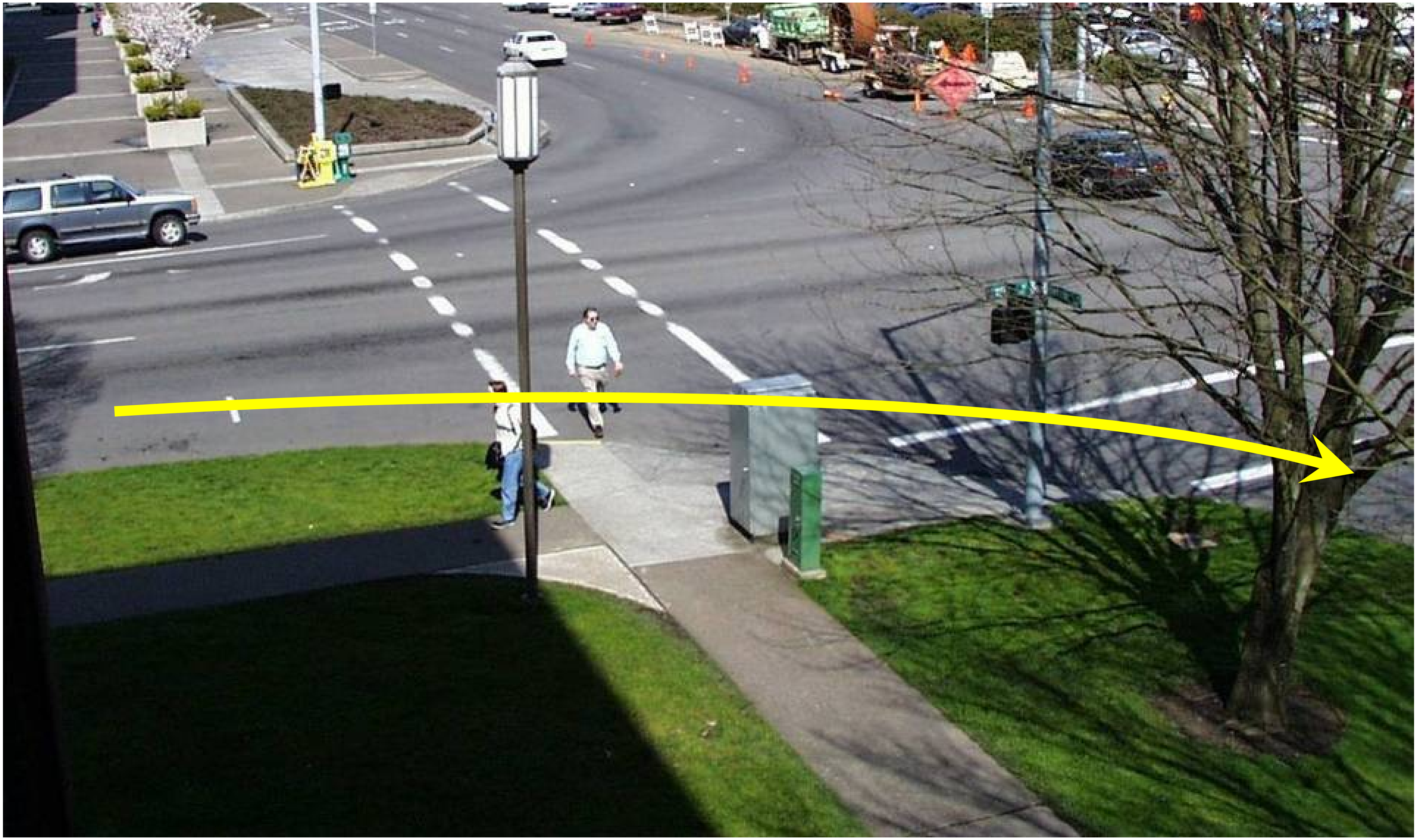
Curb extensions should be the width of the parking lane and not encroach on bike lanes or travel lanes

Better Visibility



Pedestrians wait where they can see, in front of parked cars

Curb ext. places pedestrian where he can see and be seen



5-31 Salem OR

Before: high speed right-turns

After: slow speed right-turns

5-32 Salem OR

- Curb extension and new corner radius must be designed together – see earlier radius discussion

 Joseph OR

Curb ext. increases likelihood drivers will yield to peds

- Curb extensions allow room for street furniture
- But use care not to block sight lines

5-35 **Fredericksburg VA**

Curb extensions enable signs to be moved in

5-36 **Salem OR**

Drainage solutions 1. Additional inlet

5-37 Salem OR

Drainage solutions 2. Slotted drain

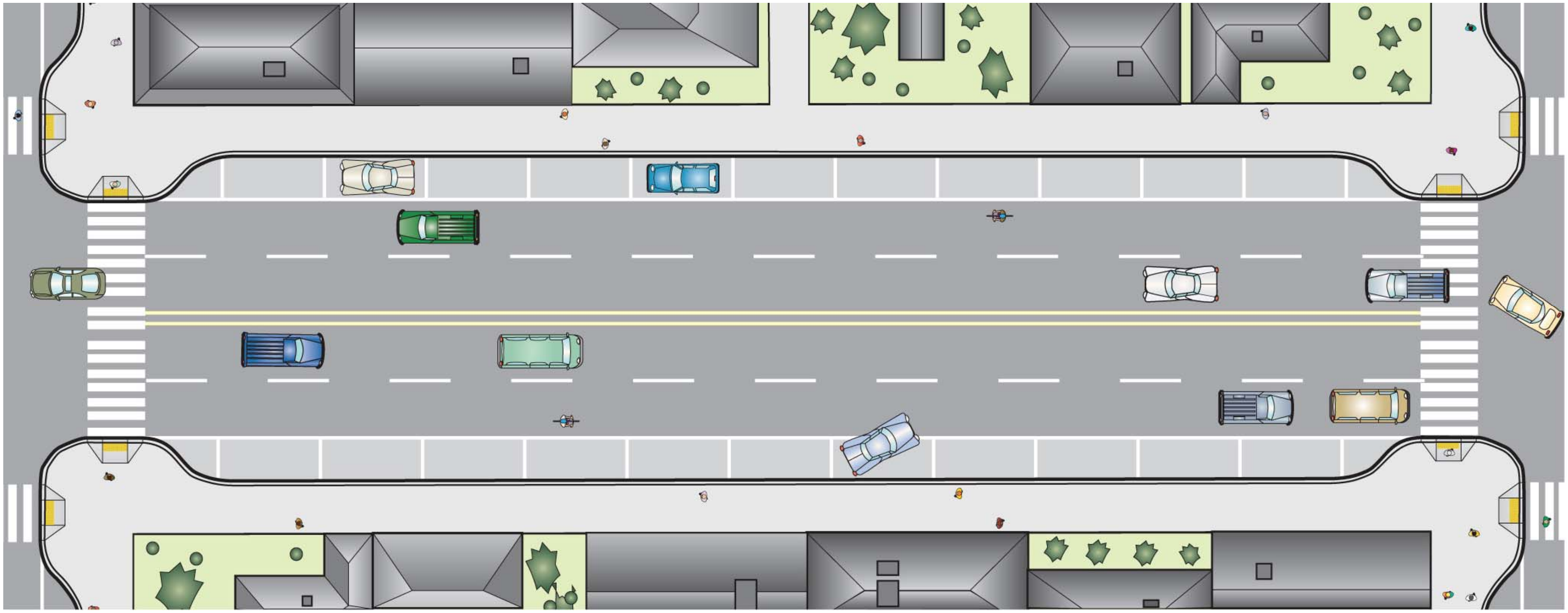
 Tucson AZ

Drainage solutions 3. Leave original curb + islands

5-39 **Tucson AZ**

Drainage solutions 4. Same as before, plus plate

Curb Extension Integrated with the Sidewalk



"Parking pockets" in furniture zone have similar surface materials as the sidewalk

5-41 Lake Oswego OR

Before: road looks and feels wide

5-42 Lake Oswego OR

After: curb extension integral to sidewalk

Street looks narrow even with no parked cars

5-43

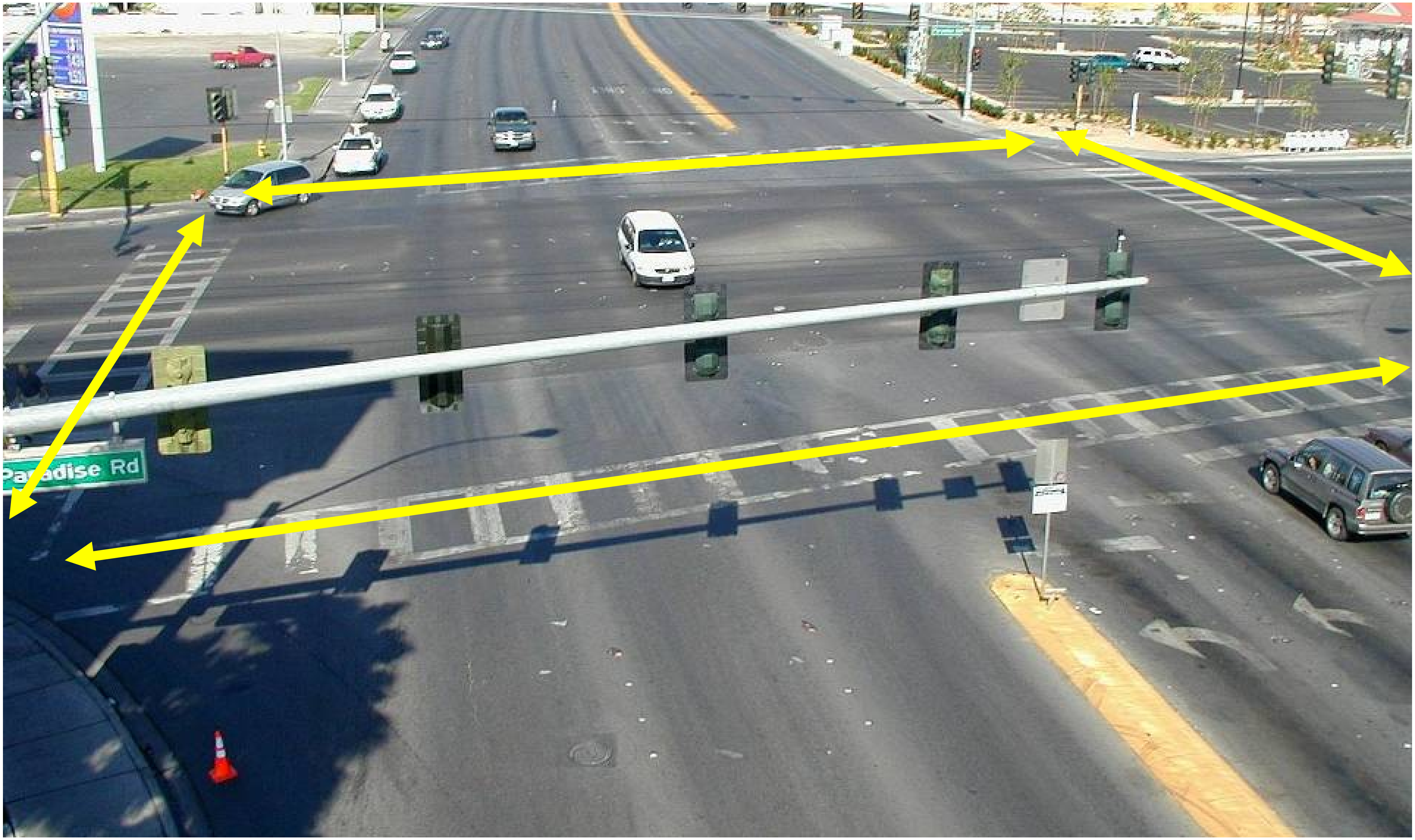
Cornelius & Charlotte NC

More examples: curb extension integral to sidewalk

Reminder – crosswalks are provided:

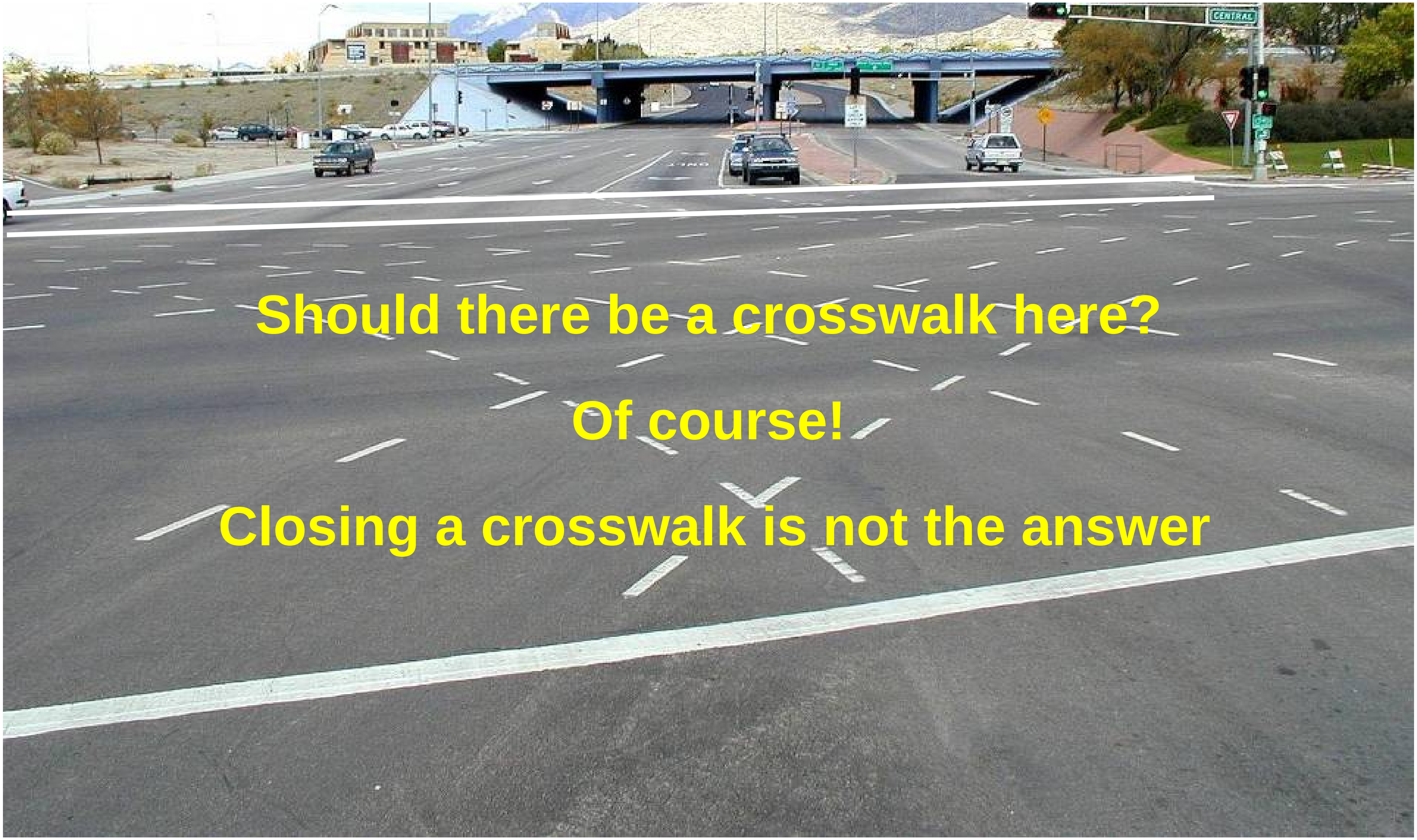
1. To indicate to pedestrians where to cross
2. To indicate to drivers where to expect pedestrians

University Place WA



5-45 **Las Vegas NV**

Crosswalks should normally be placed on all legs of an intersection



5-46 **Albuquerque NM**

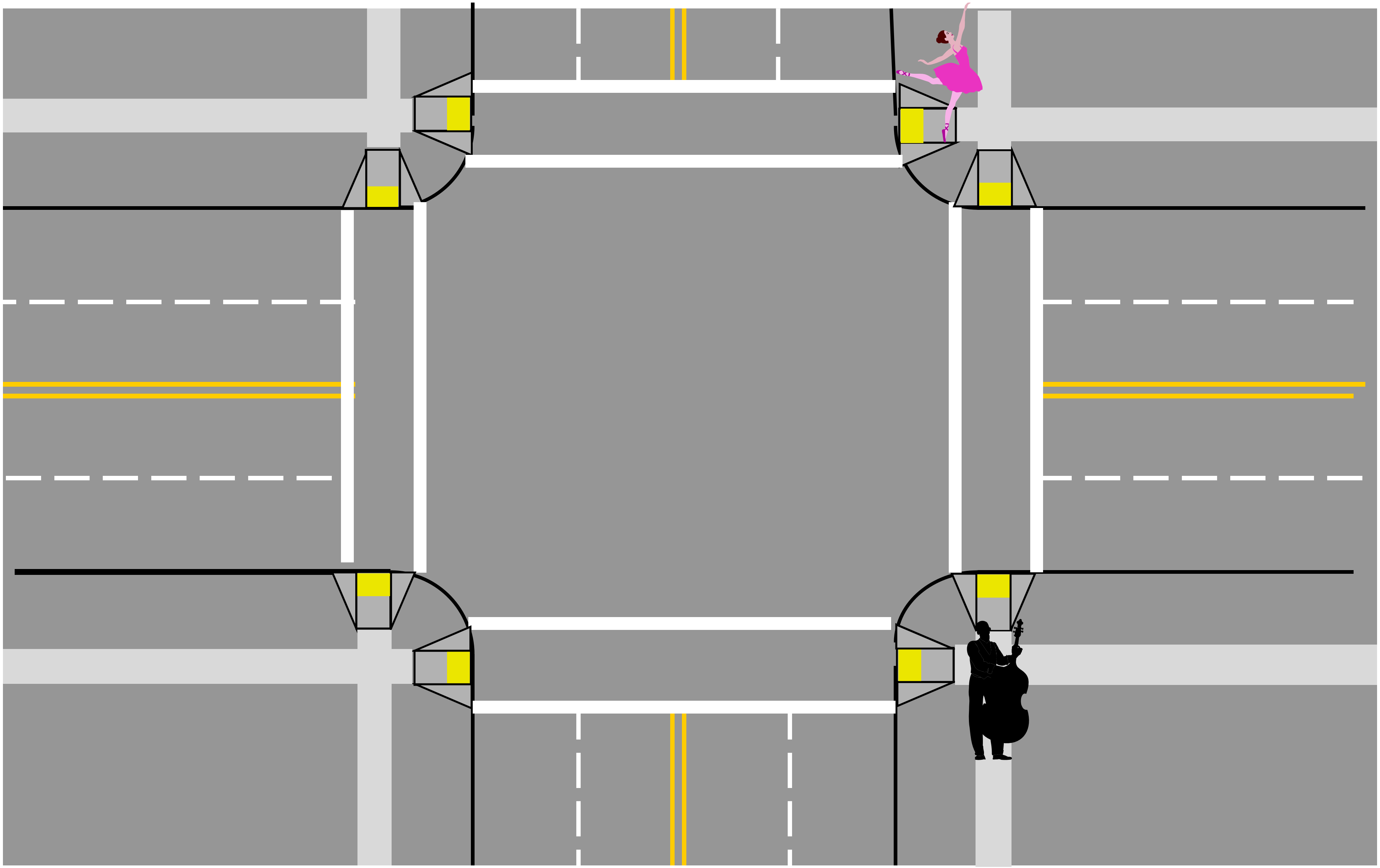
Large intersection is capacity driven, pedestrian unfriendly…


Here's what pedestrians are expected to do
Will she wait?
Is crossing 15 lanes safer
than crossing 5 lanes?

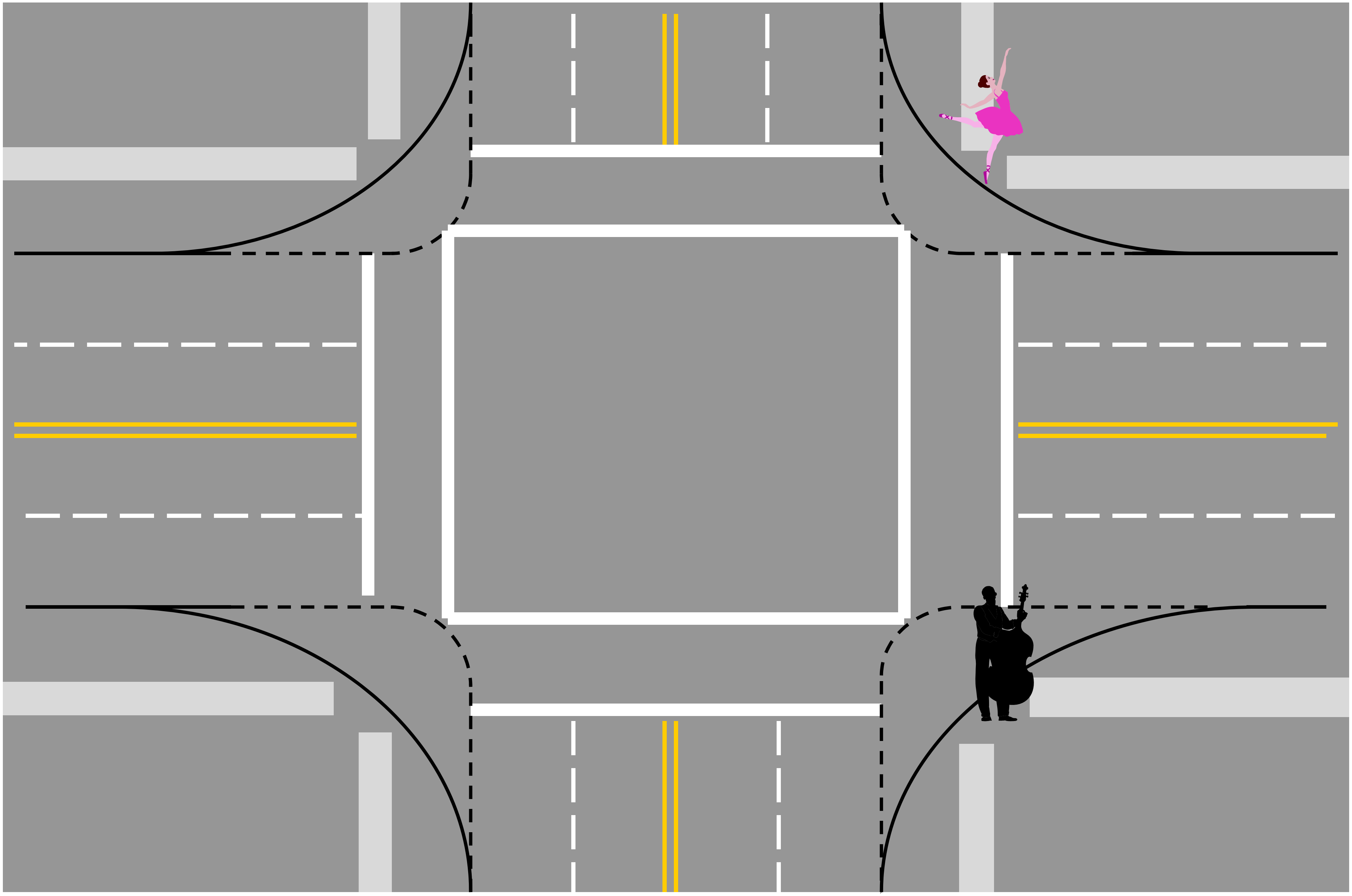
Crosswalk placement requires balancing several goals that sometimes compete:

- Shortest crosswalk length
- Minimal crosswalk setback to:
  - Reduce out-of-direction travel
  - Provide good sight lines between peds and motorists
- Proper ramp placement:
  - Ramps entirely contained in crosswalk
  - Two ramps preferred whenever possible

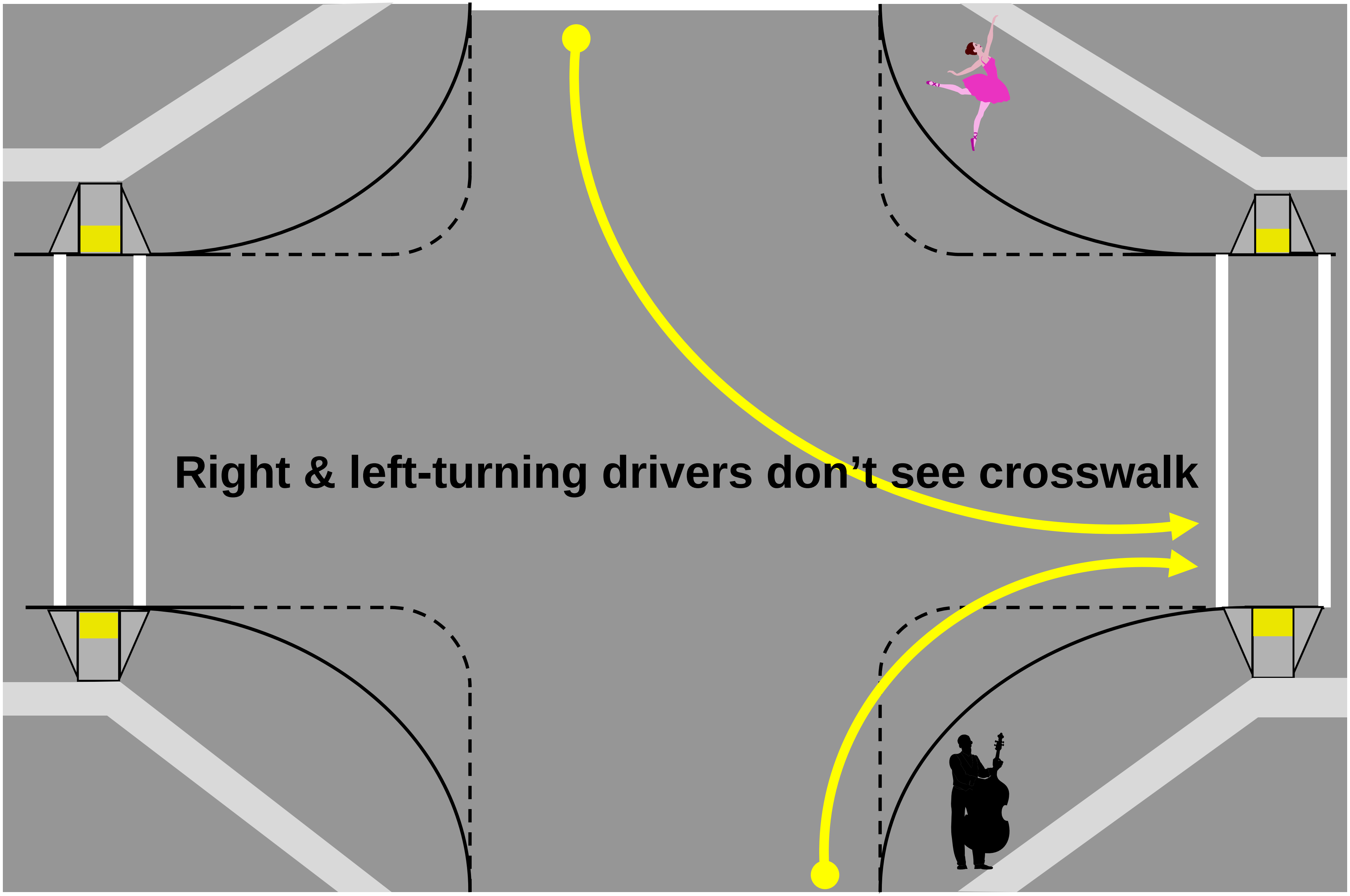
Small corner radii allow two ramps, shortest crosswalks, direct travel paths



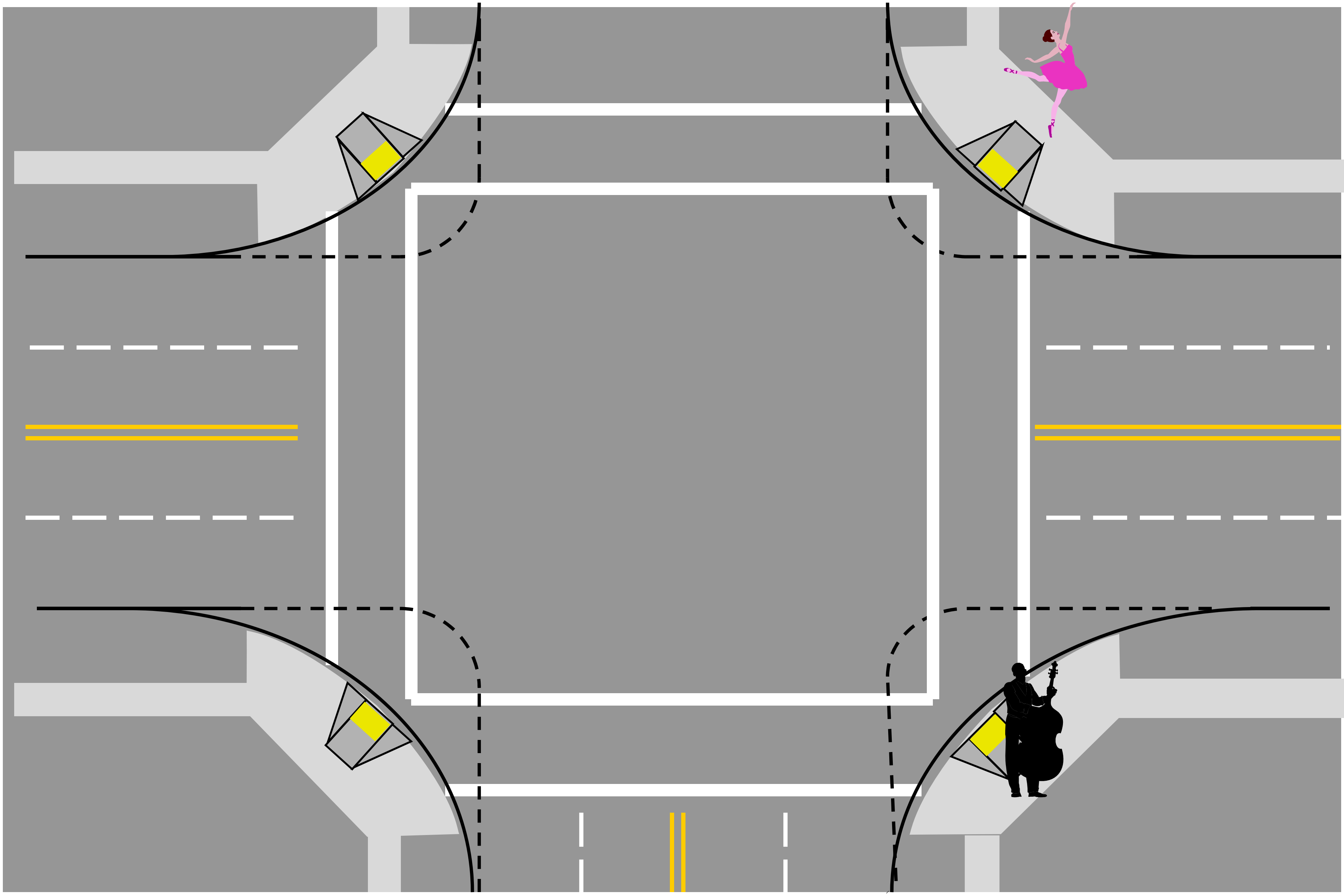
Larger radii create large undefined areas



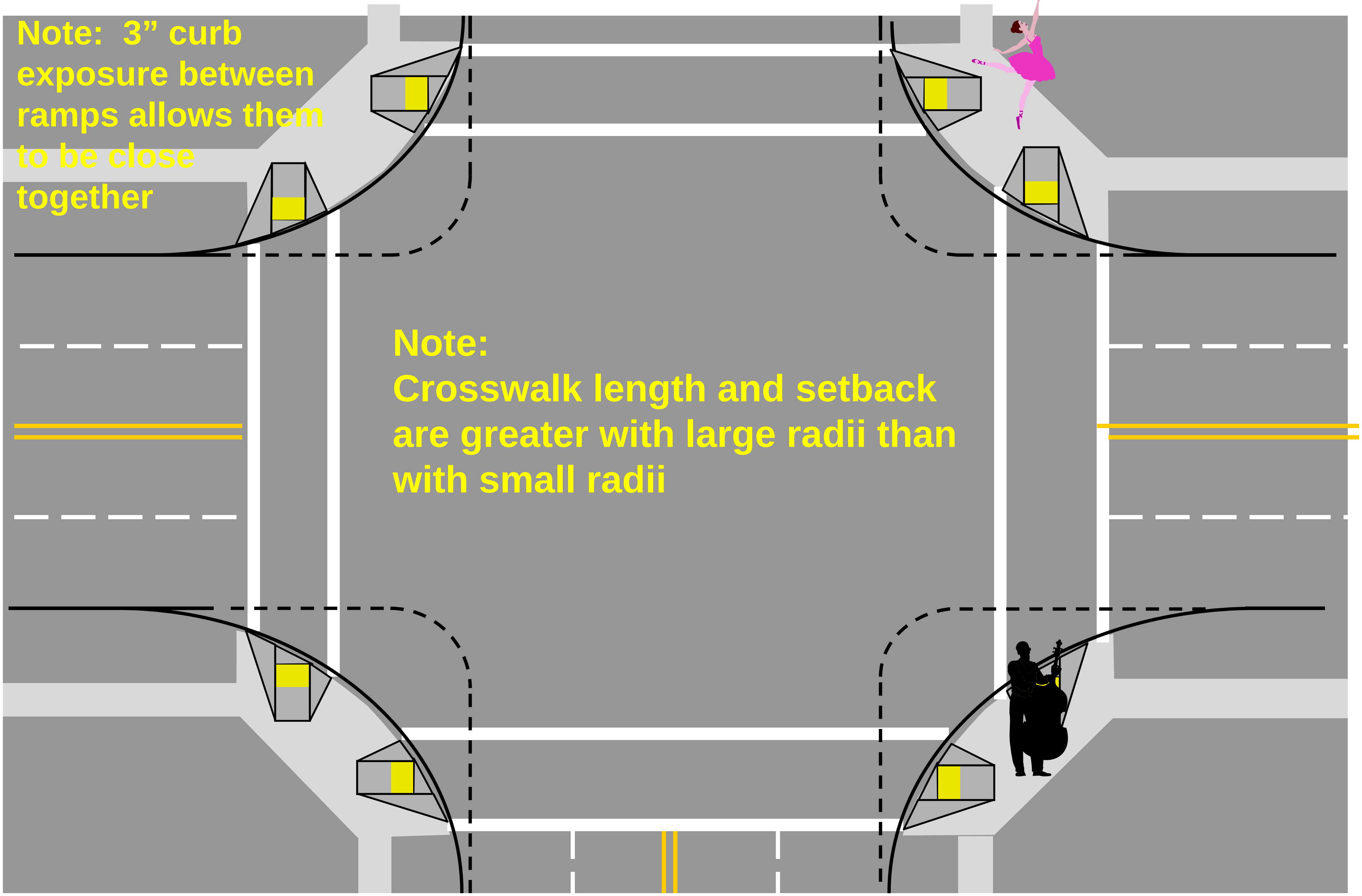
Crosswalks at shortest crossing = longer walking distance



Single ramp reduces crosswalk setback but lengthens crosswalk



Balancing the goals works best



5-54 **Corvallis OR**

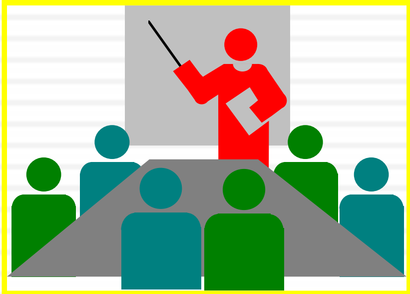
Crosswalk placement: Observe pedestrians

“When in doubt, paint it out!”

5-55

Honolulu HI

Crosswalks can have odd shapes to take pedestrians where they want to go



5-56

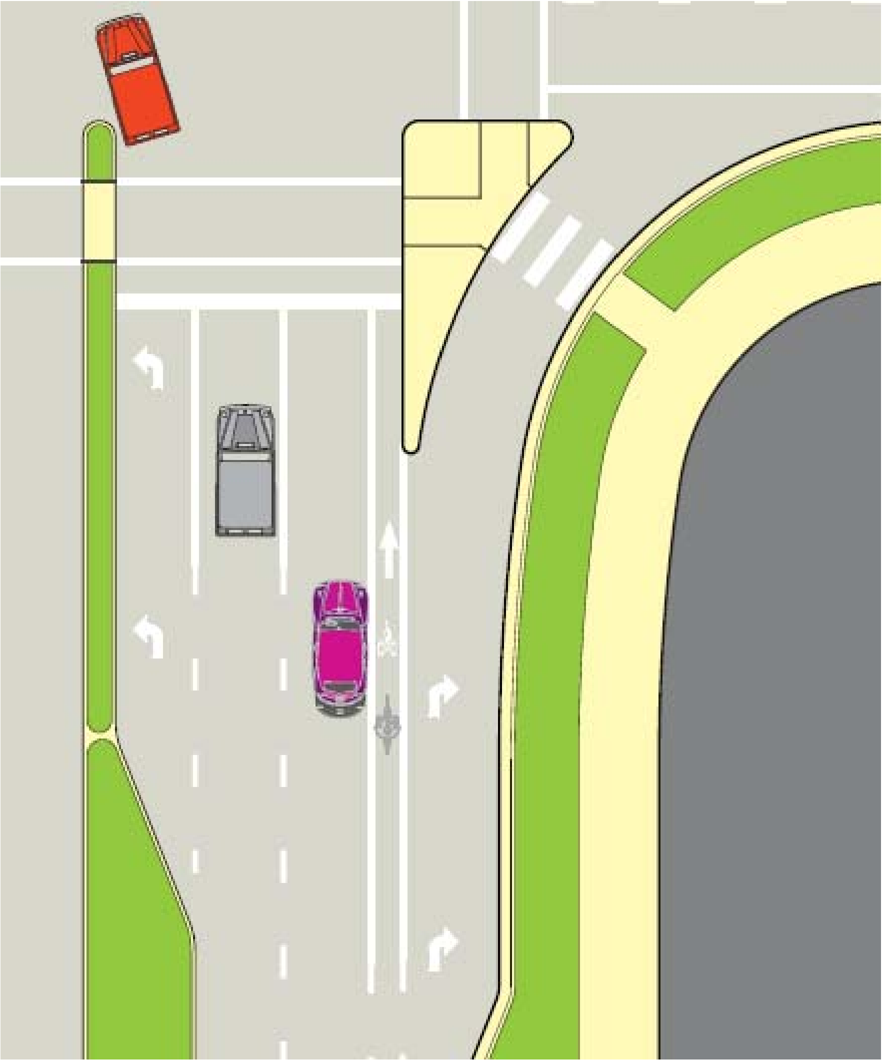
Discussion:

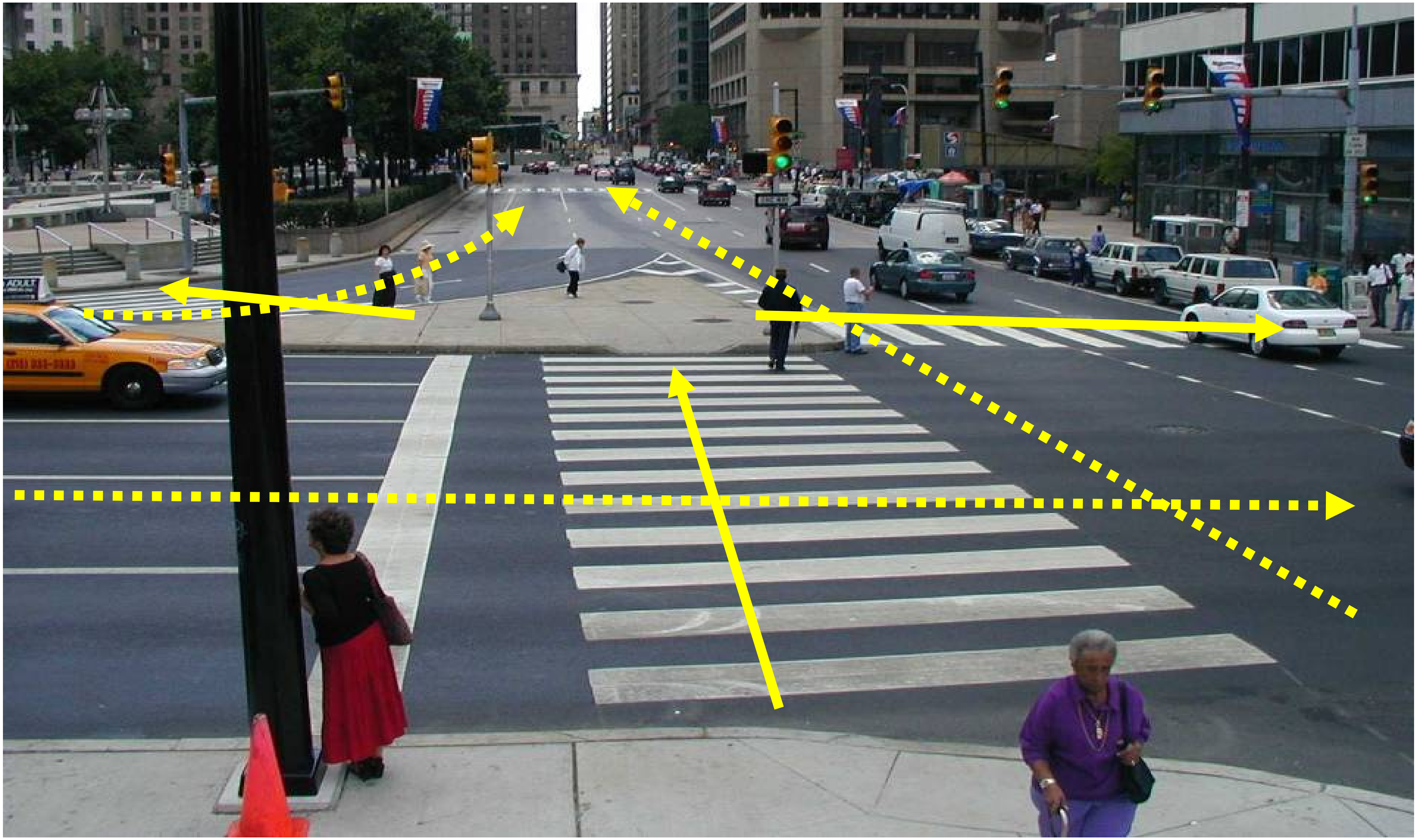
What are your policies & practices regarding crosswalk placement?

Pedestrian Islands

Benefits:

- Separate conflicts & decision points
- Reduce crossing distance
- Improve signal timing
- Reduce crashes

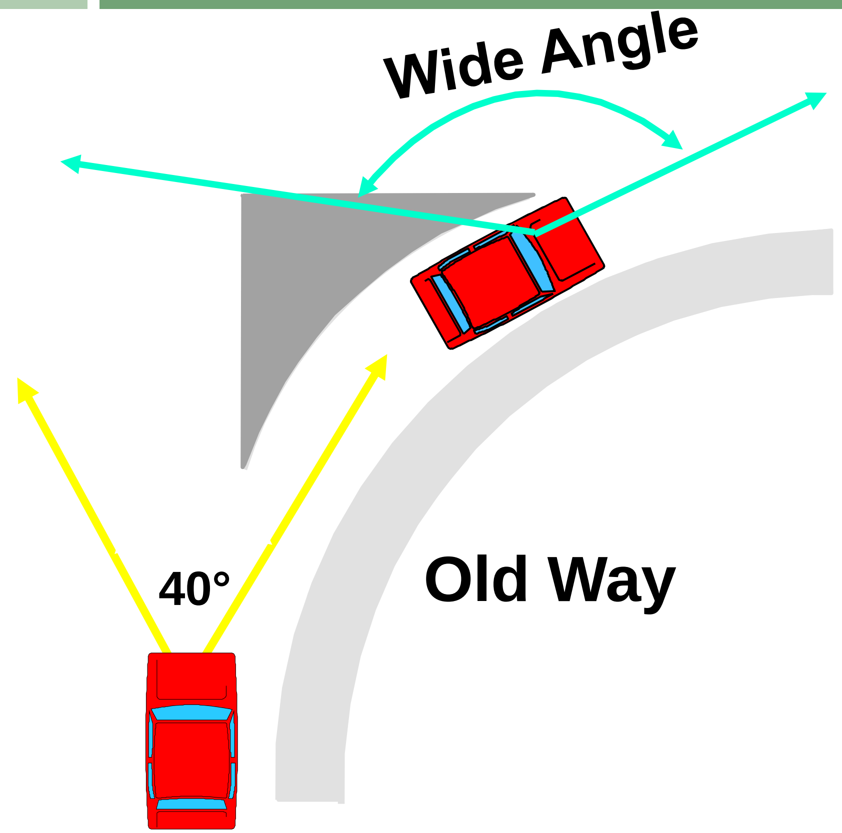




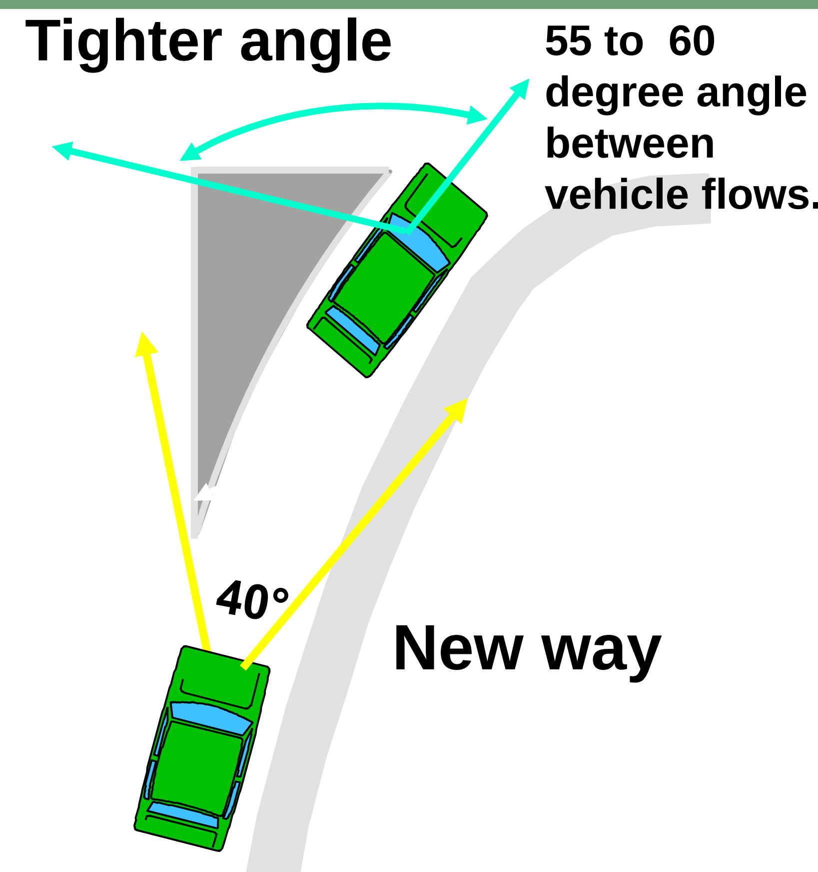
5-58 **Philadelphia PA**

Imagine the signal timing without island

Right-Turn Slip Lane: Design for Pedestrians

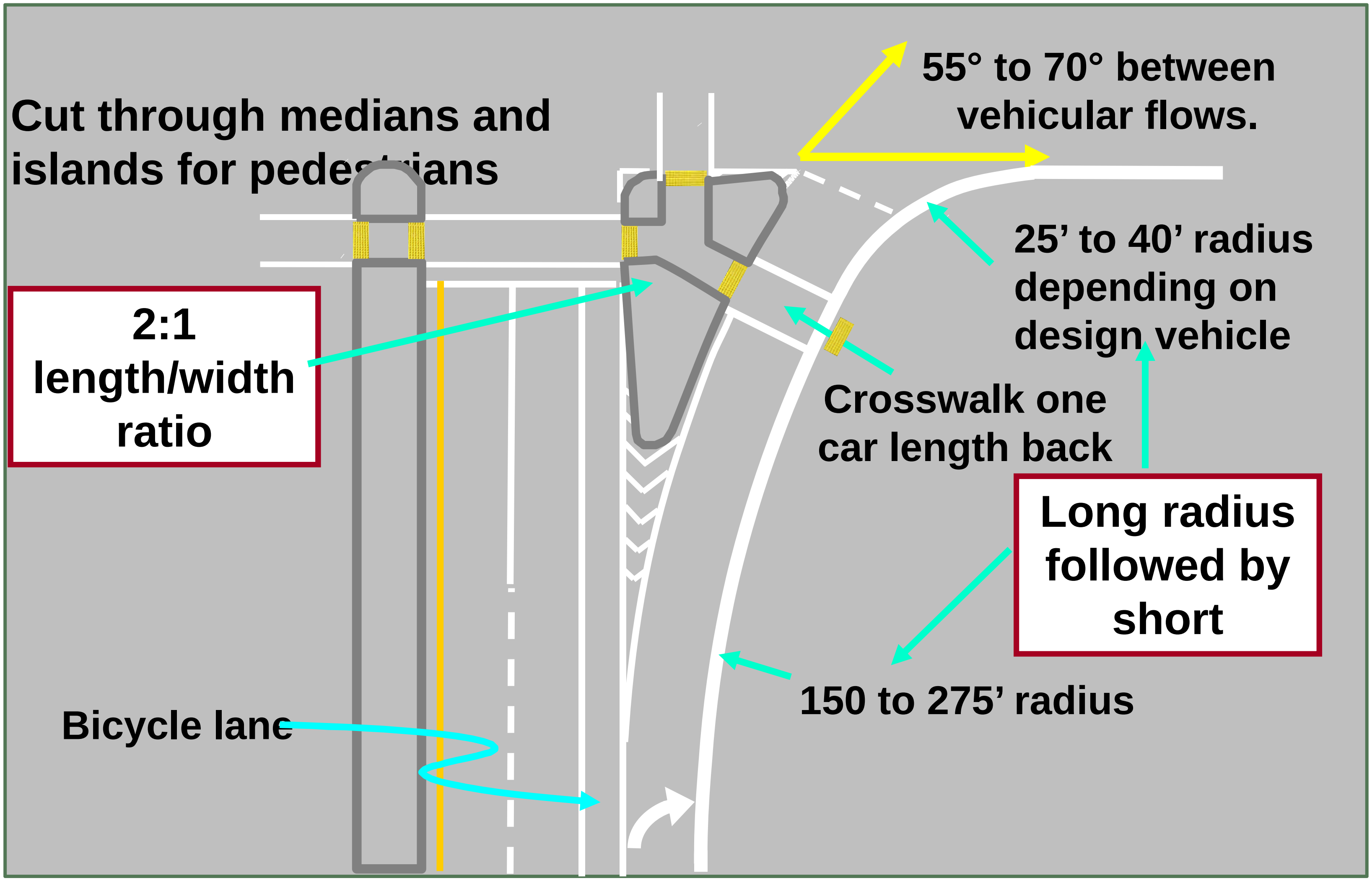


High speed, head turner = low visibility of pedestrians



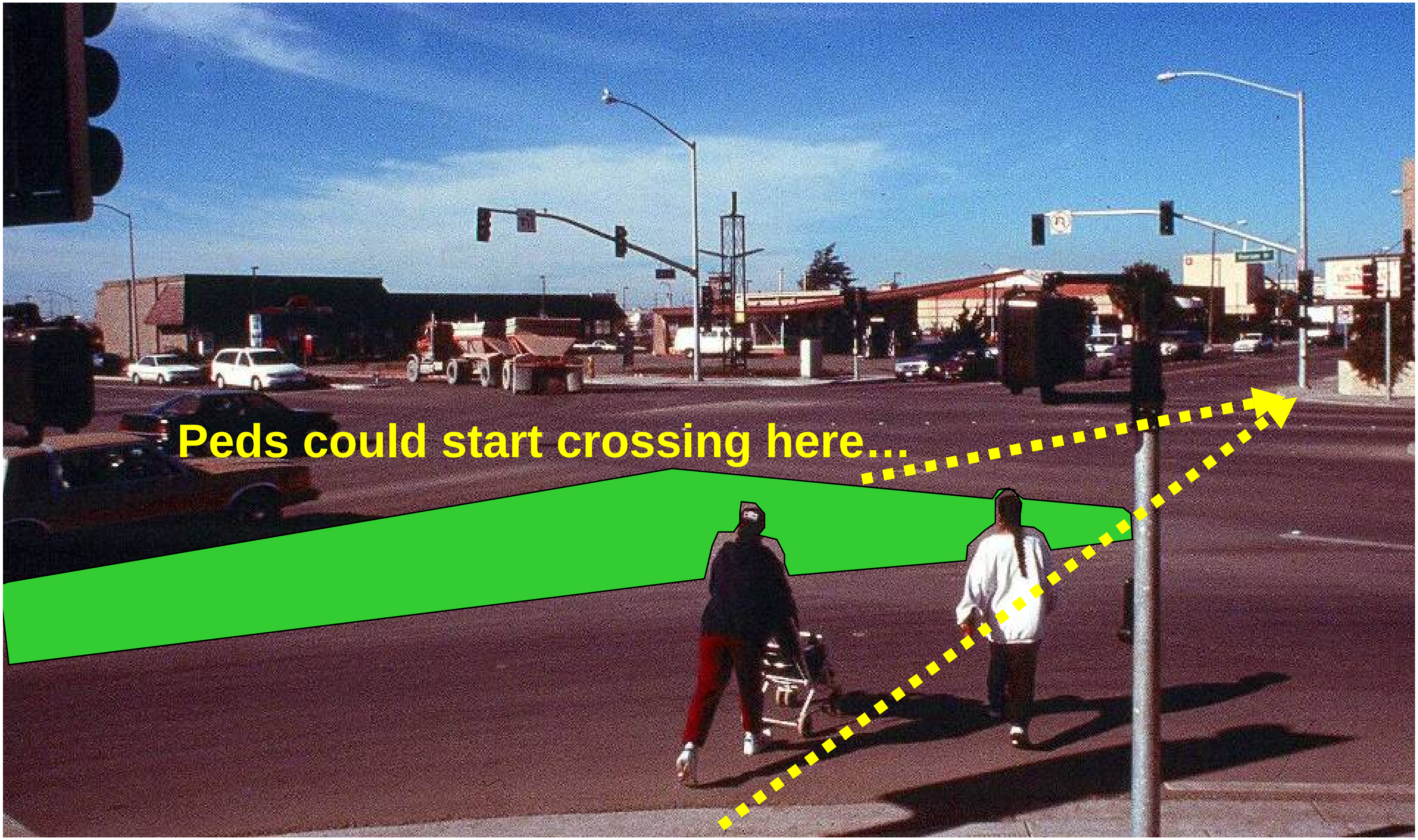
Slow speed, good angle = good visibility of pedestrians

Right-Turn Slip Lane - Details



5-61 **Fairbanks AK**

Drivers naturally trace the right island shape



5-62 **Fresno CA**

… instead of here


Should we mark this crosswalk?
Yes: It's a yield-controlled approach,
and it may not be clear where peds cross.

Atlanta GA

Raised islands can improve a large multi-lane intersection

Honolulu HI

Raised islands can improve a large multi-lane intersection

1. Build raised islands between thru & RT lanes to separate ped/driver conflicts. Consolidate two crosswalks into one.

Honolulu HI

Raised islands can improve a large multi-lane intersection

2. Move stop bar forward to improve capacity and safety for motorists

Honolulu HI

Island Design Details

5-67 Salem OR

- Cut-through preferred over ramps
- Truncated domes at cut-throughs
- 8’ or more preferred width – 6’ minimum

5-68 St Paul MN

With ramps, provide at least 48” level area

5-69 St Paul MN

NOT Okay

Not acceptable

Acceptable, not great

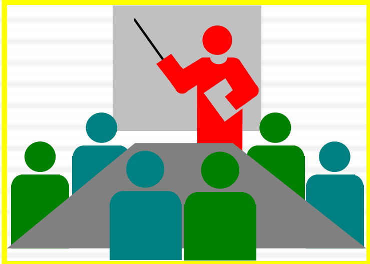
St Paul MN

Best:

5-71

- Bullet nose protects pedestrians from high-speed left-turning cars

St Paul MN



5-72

Discussion:

What are your policies & practices regarding providing pedestrian islands?

Intersection Geometry: Recap of Design Measures

- Should pedestrians have access to all corners?
  - Yes
- Why?
  - Otherwise peds will dash across anyway
- Intersection geometry should be?
  - Tight (small radii); right angles
- How do you break up complex intersections?
  - With islands
- Where should you place crosswalks?
  - Where pedestrians want to cross and where drivers can see them

Intersection Geometry Learning Outcomes

1. You should now be able to:
2. Explain why tight/right angle intersections are best
3. Describe why pedestrians need access to all corners
4. Assess good crosswalk placement: where peds want to cross & where drivers can see them
5. Explain how islands break up complex intersections

Questions?