INTERSECTION GEOMETRY
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
Small, tight intersections best for pedestrians...

Simple, few conflicts, slow speeds

Designing for Pedestrian Safety – Intersection Geometry
Large intersections can work for pedestrians with mitigation
Skewed intersections

Skew increases crossing distance & speed of turning cars
Cars can turn at high speed
Skew increases crosswalk length, decreases visibility
Right angle decreases crosswalk length, increases visibility
Skewed intersection reduces visibility

Driver looks left, doesn’t see pedestrian on right
Adjust skew by bringing out curb

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Result: driver behavior change
Curb radius – small radii are safer for pedestrians

- Large radii:
- Increase crossing distance and
- Make crosswalk & ramp placement more difficult
Effect of large radius on crosswalk:

It adds to crossing distance...

Additional area to cross
+ Higher speed turns
Effect of large radius on crosswalk:

... and makes it hard to figure out where to cross

Note right-turning vehicle

... and makes it hard to figure out where to cross
Effect of large radius on drivers

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

3. Don’t choose larger design vehicle than necessary

Bus makes turn several times an hour
Minimize curb radius

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

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
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

- Curb ext. increases likelihood drivers will yield to peds
Pedestrians wait where they can see, in front of parked cars

Curb ext. places pedestrian where he can see and be seen
Before: high speed right-turns
Curb extension and new corner radius must be designed together – see earlier radius discussion

After: slow speed right-turns

- Curb extension and new corner radius must be designed together – see earlier radius discussion
• Curb extensions allow room for street furniture
• But use care not to block sight lines
Curb extensions enable signs to be moved in

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Drainage solutions 1. Additional inlet

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Drainage solutions 2. Slotted drain

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Drainage solutions 3. Leave original curb + islands
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
Before: road looks and feels wide
After: curb extension integral to sidewalk
Street looks narrow even with no parked cars
More examples: curb extension integral to sidewalk

Designing for Pedestrian Safety – Intersection Geometry
Reminder – crosswalks are provided:
1. To indicate to pedestrians where to cross
2. To indicate to drivers where to expect pedestrians
Crosswalks should normally be placed on all legs of an intersection.
Large intersection is capacity driven, pedestrian unfriendly…

Should there be a crosswalk here?

Of course!

Closing a crosswalk is not the answer
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

Right & left-turning drivers don’t see crosswalk
Single ramp reduces crosswalk setback but lengthens crosswalk
Balancing the goals works best

Note: 3” curb exposure between ramps allows them to be close together

Note: Crosswalk length and setback are greater with large radii than with small radii
Crosswalk placement: Observe pedestrians
“When in doubt, paint it out!”

Crosswalks can have odd shapes to take pedestrians where they want to go.
What are your policies & practices regarding crosswalk placement?
Pedestrian Islands

Benefits:
- Separate conflicts & decision points
- Reduce crossing distance
- Improve signal timing
- Reduce crashes
Right-Turn Slip Lane: Design for Pedestrians

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High speed, head turner = low visibility of pedestrians

Old Way

Wide Angle

40°

Tighter angle

55 to 60 degree angle between vehicle flows.

New way

Slow speed, good angle = good visibility of pedestrians
Cut through medians and islands for pedestrians

2:1 length/width ratio

Bicycle lane

55° to 70° between vehicular flows.

25’ to 40’ radius depending on design vehicle

Crosswalk one car length back

Long radius followed by short

150 to 275’ radius

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Drivers naturally trace the right island shape
Peds could start crossing here...

... instead of here

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Should we mark this crosswalk?

Yes: It’s a yield-controlled approach, and it may not be clear where peds cross.
Cut-through preferred over ramps

Truncated domes at cut-throughs

8’ or more preferred width – 6’ minimum
With ramps, provide at least 48” level area
NOT Okay

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Best:

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

St Paul  MN
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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?