Designing Pedestrian Facilities for Accessibility

Module 3

Curb Ramps & Blended Transitions

U.S. Department of Transportation
Federal Highway Administration

Federal Highway Administration
RESOURCE CENTER

Curb Ramps & Other Transitions

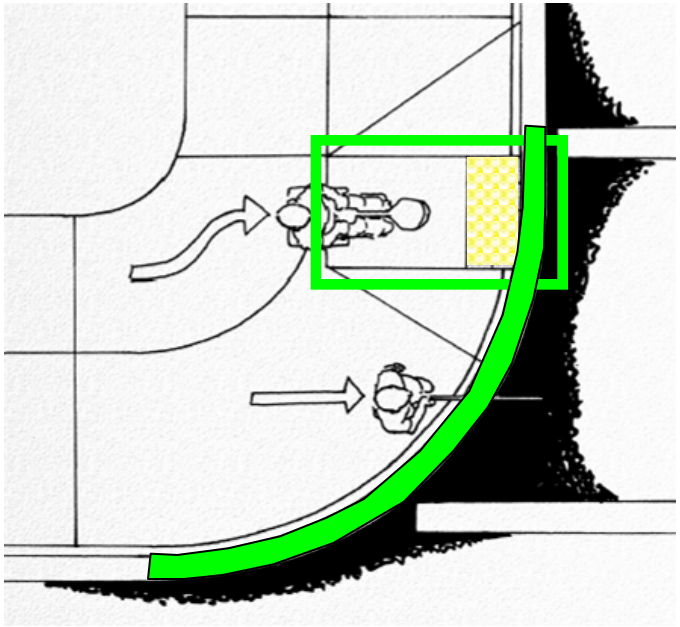
- Purpose:
  - Allow pedestrians to transition between the street and sidewalks, islands, etc.
- Typically installed at:
  - Intersections (1 ramp at each end of each crosswalk)
  - Mid-block crossings (including trail crossings)
  - Accessible on-street parking spaces
  - Passenger loading zones & bus stops

R 304 Curb Ramps (R303)

- First required by the Rehabilitation Act of 1973, Section 504
- The implementing regulations under Title II of the ADA require curb ramps for existing facilities, as well as for all new construction

Curb Ramp Conundrum

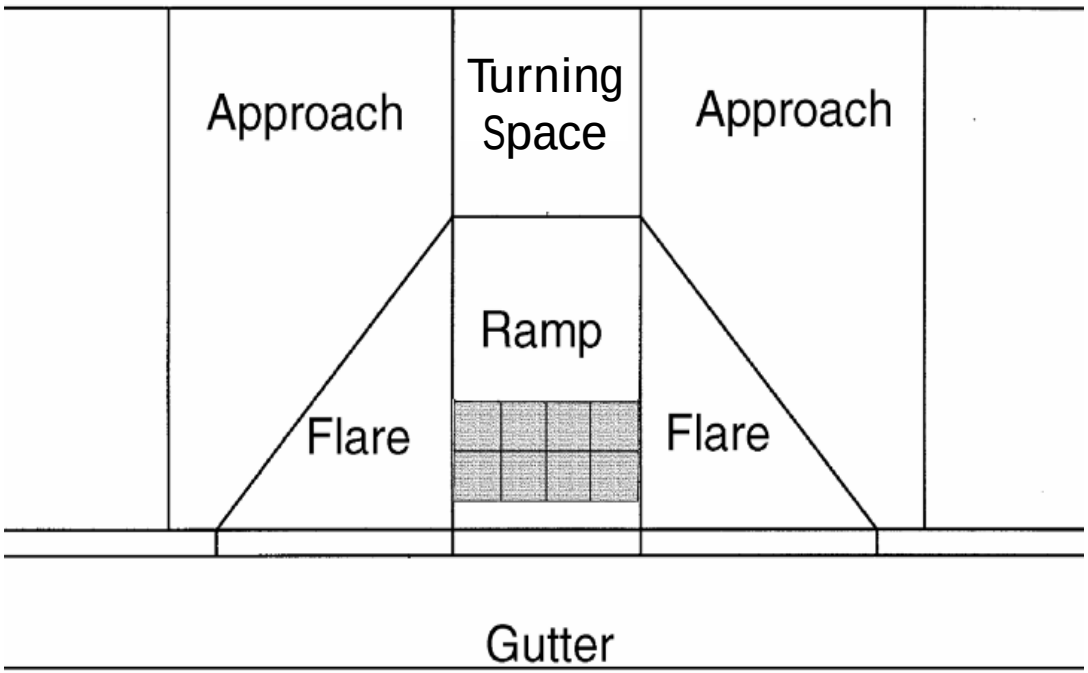
- Curbs: cue for pedestrians who are blind or with low vision
- Curbs are a barrier for persons in wheelchairs
- Curb ramps remove the barrier for wheelchairs
- Detectable warnings are a "replacement" cue to indicate location of the street



Design Issues for Pedestrians Who use a Wheelchair

US Access Board Video
Persons Who Use Wheelchairs (10 mins)

R304 Curb Ramp Components (R303)



Curb Ramp Components - Visual and Tactile Contrast

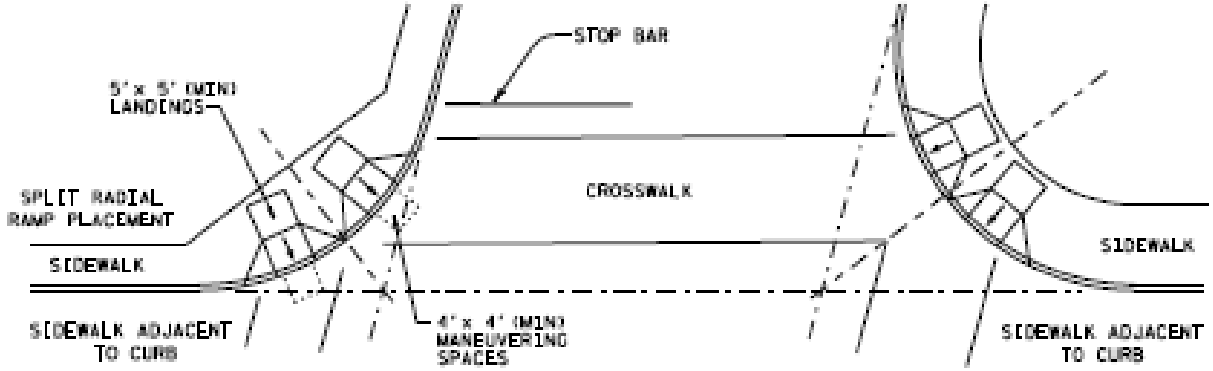
- Detectable warnings (truncated domes)
  - Visual
  - Tactile
- Covered in Module 4

Curb Ramp Alignment

- Curb ramps aligned with crosswalks help wheelchair users orient themselves to cross the street
- On small radius corner, curb ramp can be aligned with crosswalk and be perpendicular to curb

Curb Ramp Alignment

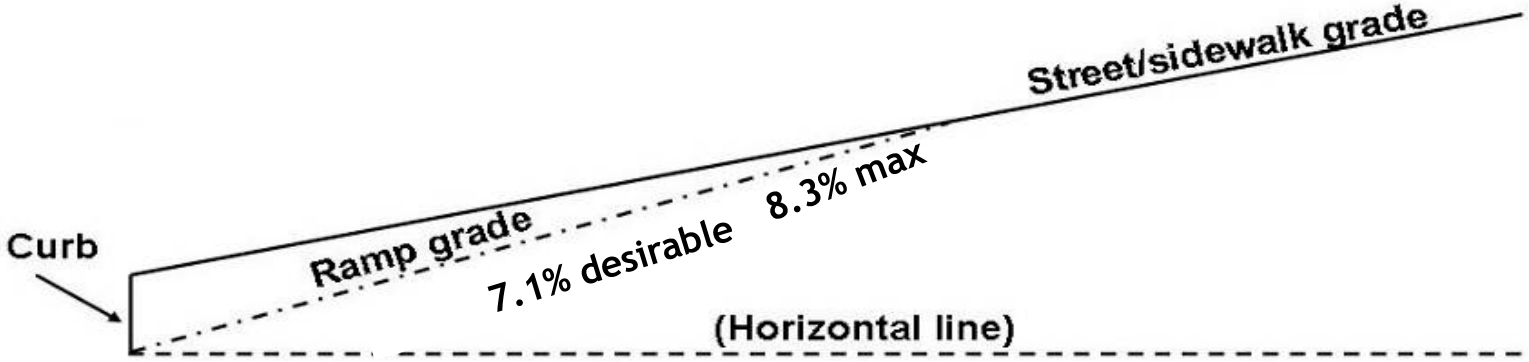
- Large Radius placement



SKEWED INTERSECTION WITH "LARGE" RADIUS

R304 R303.2 Curb Ramp Grade (Running Slope)

- Recommended maximum grade to allow for construction tolerance – 7.1%
- Maximum grade – 8.3%
- Least slope possible is preferred
- When "chasing grade," running slope length need not exceed 15', but slope must be uniform (R304.2.2 and R304.3.2)



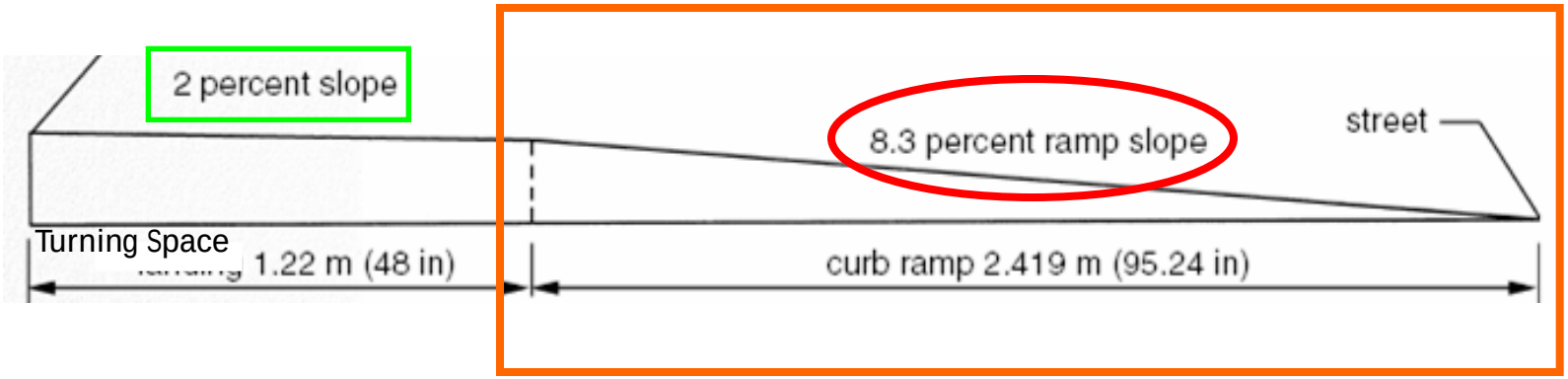
R304.2.2 Curb Ramp Length (R303)

$$\text{Ramp Length} = \frac{\text{curb height}}{(\text{ramp slope}) - (\text{sidewalk cross slope})}$$

(ramp slope) = 8.3%

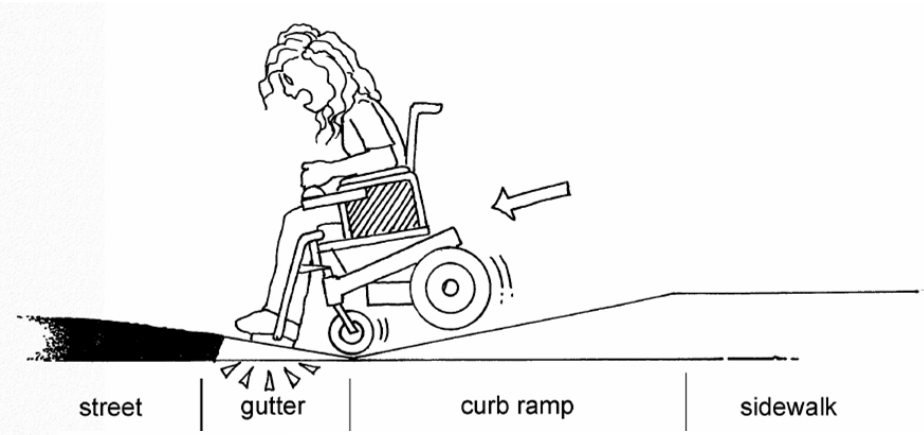
(sidewalk cross slope) = 2%

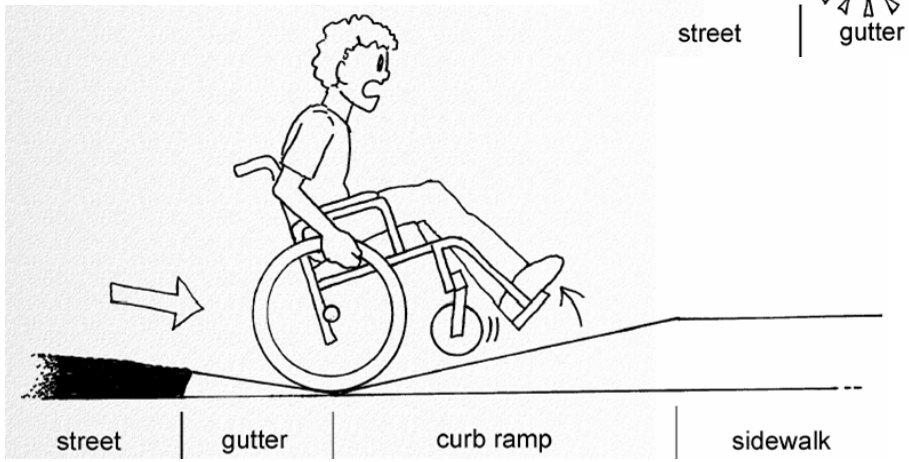
- Sample curb ramp length calculation
  - Curb height / (8.3%-2%) = Ramp Length
  - Higher curb or flatter ramp grade = longer curb ramp



R304.5.4 Change of Grade (Counter Slopes) (R303.3.5)

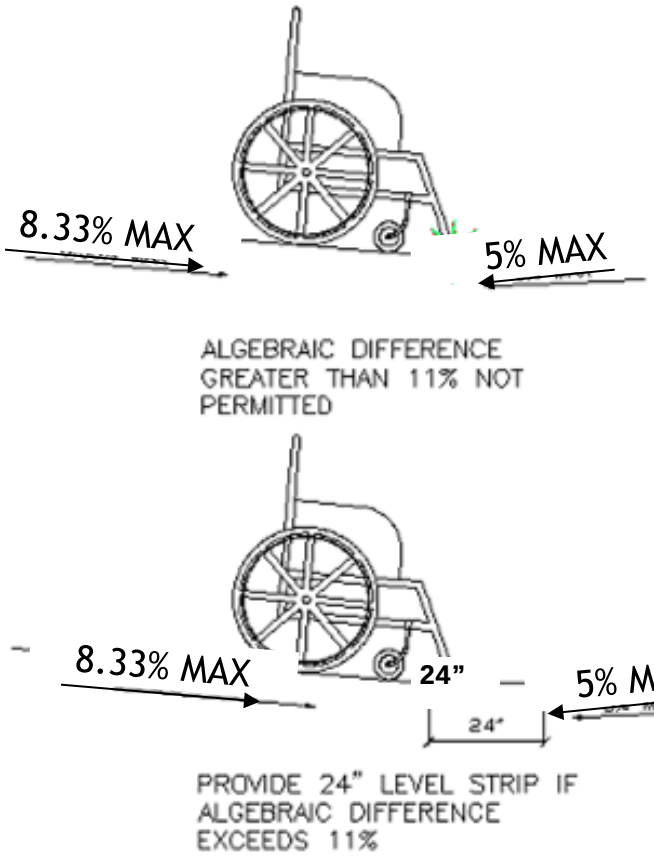
Abrupt changes of grade are difficult to use and can cause wheelchairs to flip over backward or forward





Change of Grade (Counter Slopes) (R303.3.5)

- PROWAG allows 8.3% ramp plus 5% grade at the adjacent street = 13.3%
- Best Practice:
  - If algebraic difference exceeds 11%, provide a 2 foot level area at base of curb ramp



Change of Grade (Counter Slopes)

Without the flat area, a wheelchair can get stuck at the bottom of the ramp or flip forward or backward

R 304.5.1 Curb Ramp Width

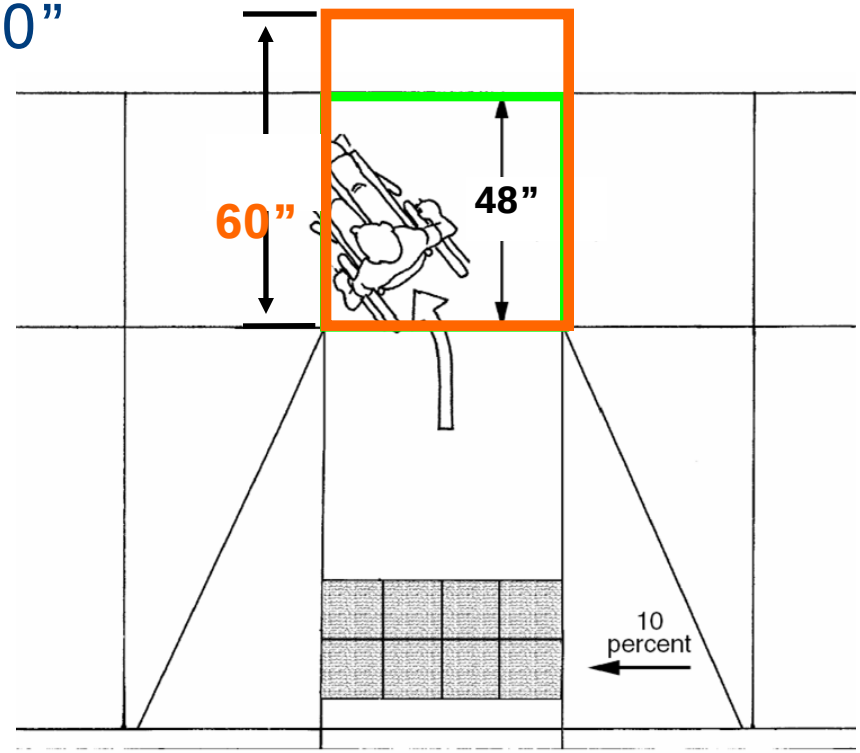
- PROWAG min: 4’
- Wider ramps are better: full crosswalk or sidewalk width

R304.2.1 & R304.3.1 Turning Space (R303)

- Min. 4.0 ft. by 4.0 ft. turning space shall be provided at the top of the curb ramp and shall be permitted to overlap other landings and clear space.
- Cross Slope (R304.5.3 as published)
  - If Stop/Yield control: 2% max.
  - If Signal/uncontrolled/midblock: match street grade
- Cross Slope (expected revision)
  - If Stop/Yield control: 2% max.
  - If Signal/uncontrolled: **5% max**.
  - Midblock: match street grade

Turning Space Dimension
R304.2.1 & R304.3.1

- Turning space should be 4 feet x 4 feet minimum
- Turning area may overlap or serve multiple ramps
- 60” min. in direction of pedestrian crossing when constrained
- Best practice: 60” x 60”



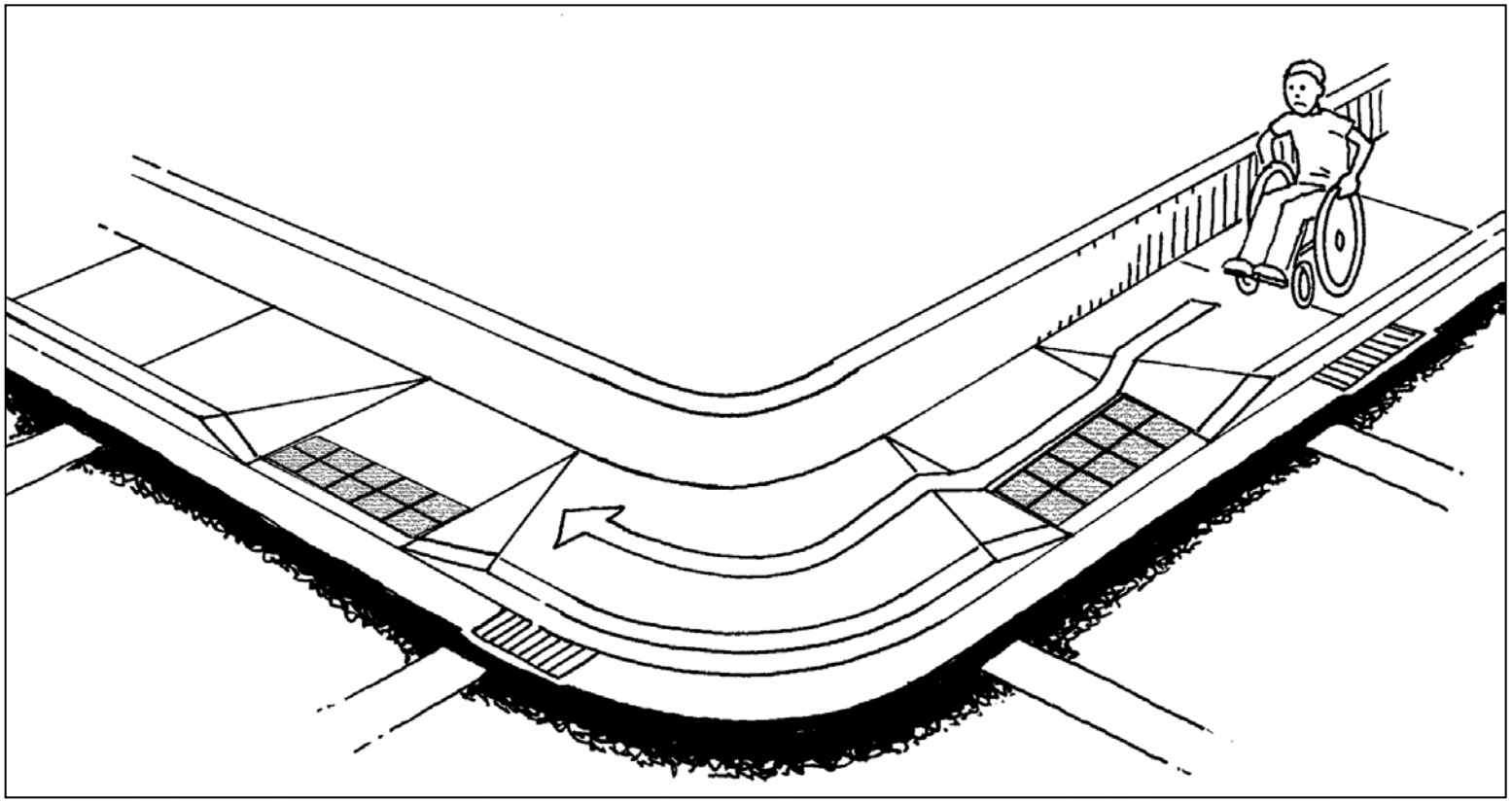
Turning Space

Planter strip & small radius make it easy to place 2 curb ramps per corner lined up with sidewalks, obstacle-free, and with turning space

Turning Space

Without a turning space, user must turn while climbing, which is difficult for many users, and not compliant with the ADA.

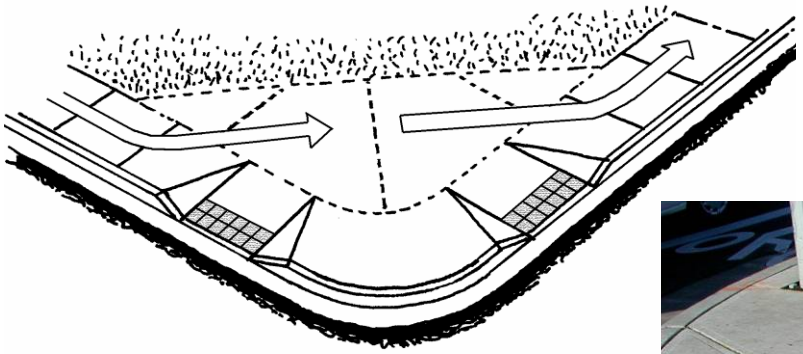
Without a turning space, pedestrians continuing along the sidewalk experience severe cross-slope

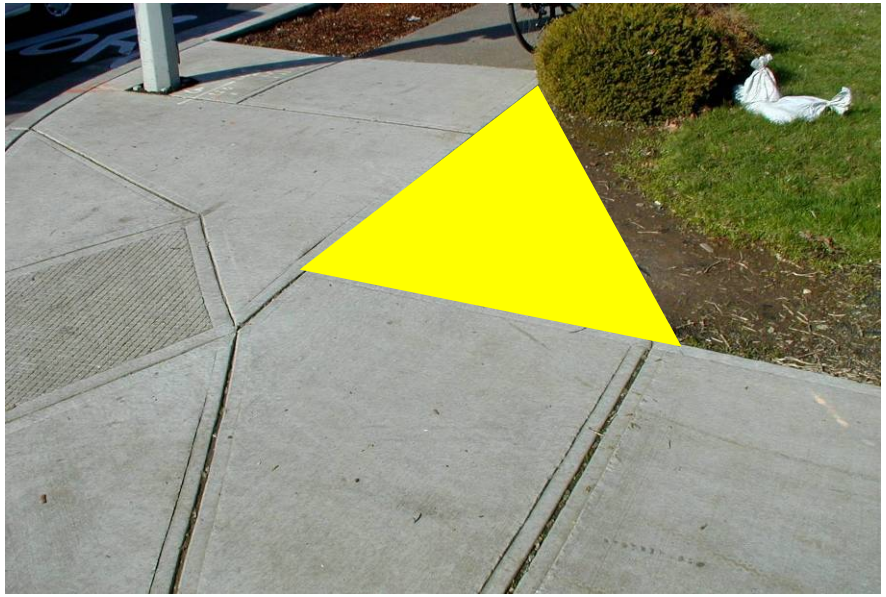


Turning Space

Turning Space

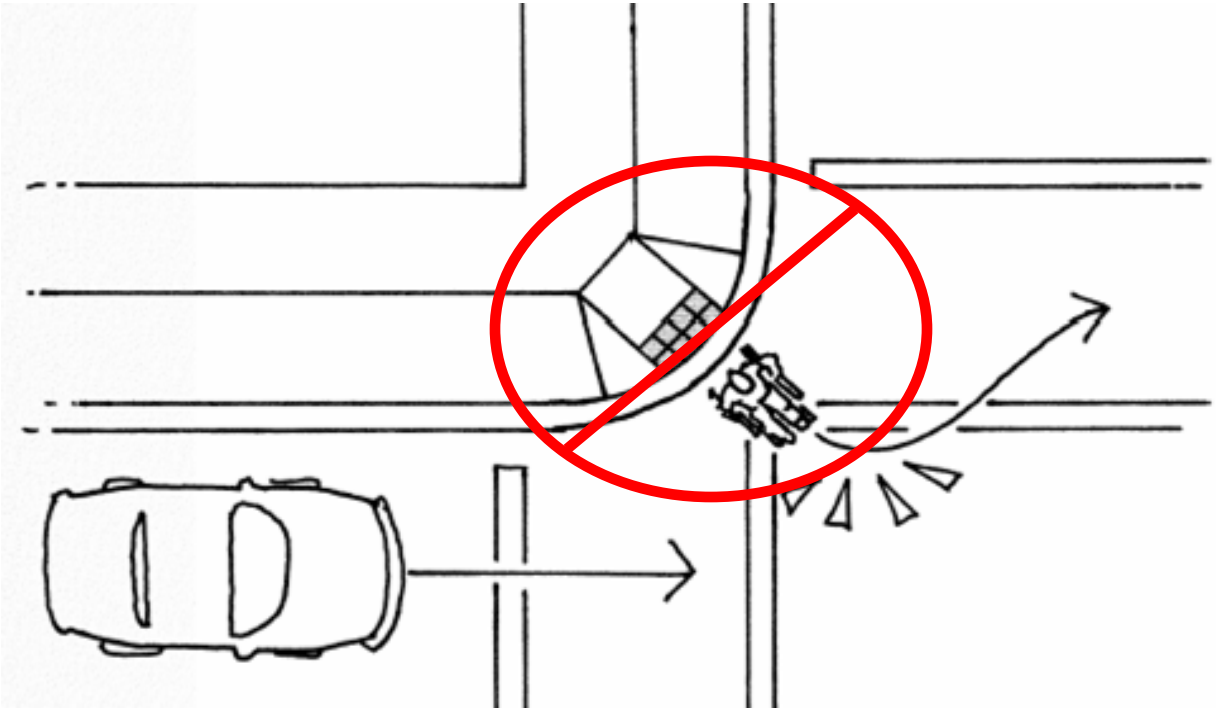
Non-compliant curb ramps without a turning space may be retrofitted by adding a turning space behind the curb ramps





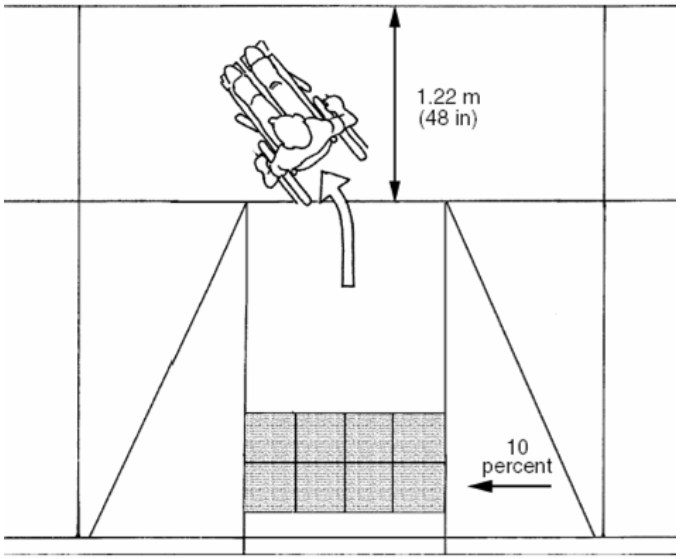
R304.5.5 Clear Space (R303.3.6)

Bottom of curb ramp must have 48 x 48 inch clear space wholly outside the parallel vehicle travel lane and within the crosswalk.



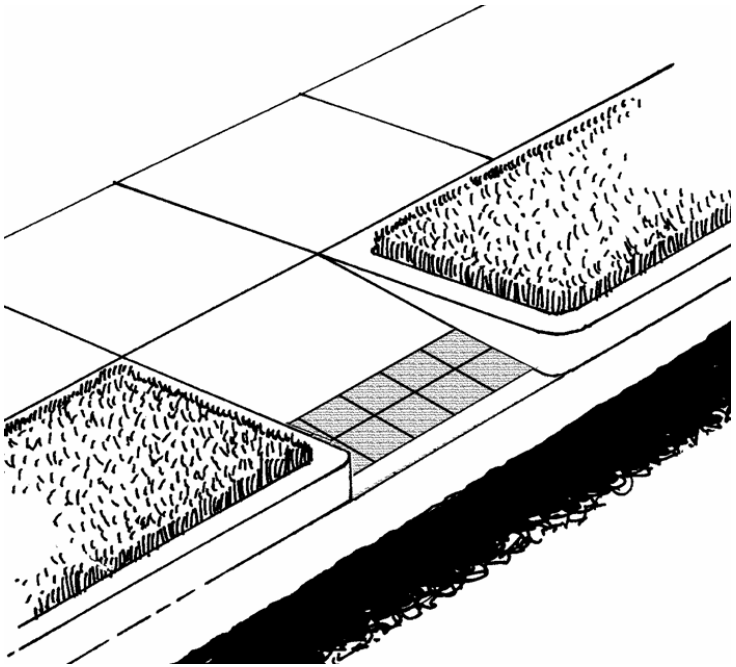
R304.2.3 Perpendicular Curb Ramp Flared Sides (R303)

- Flared sides with a slope of 10 percent maximum, measured parallel to the curb line, shall be provided where a pedestrian circulation path crosses the curb ramp
- Flares are not part of the pedestrian access route.



Advisory R304.2.3 No Flare Sides (R303.2.1.4)

- Returned curbs provide useful directional cues when aligned with the pedestrian street crossing
- Flares are not needed if the sides of the curb ramp are protected from cross travel by landscaping, street furniture, chains, fences or railings

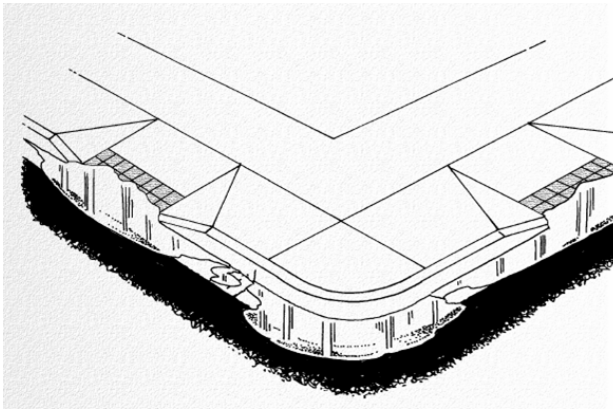


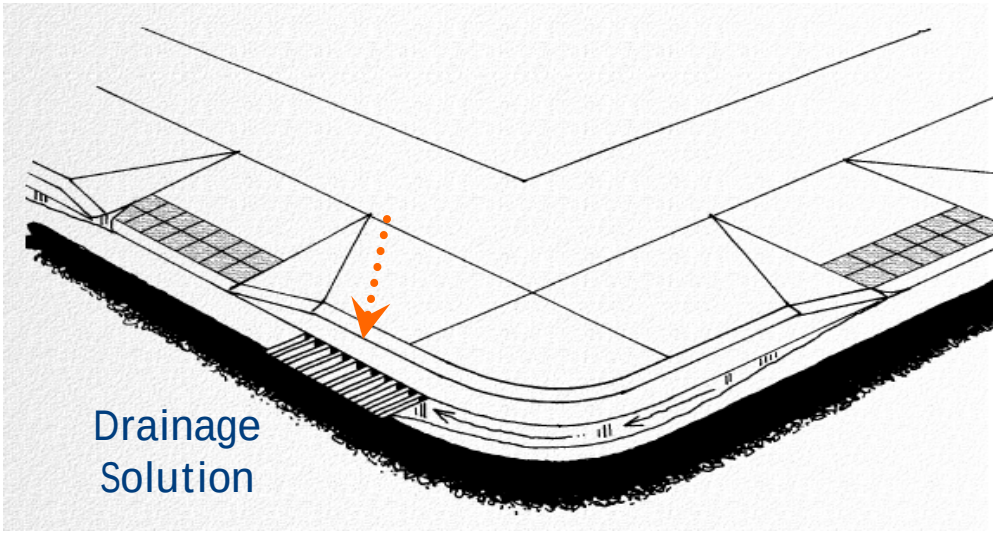
Flared sides not needed in landscaped areas

Best Practice - Drainage at Curb Ramps

- To prevent standing water at the base of curb ramps:
  - Place inlets upstream of ramps
  - Widen the gutter pan and flatten at the curb ramp
  - The gutter pan counter slope must be flatter than the running slope of the curb ramp; a steeper gutter cross slope can resume outside the curb ramp

Add inlets upstream of ramps

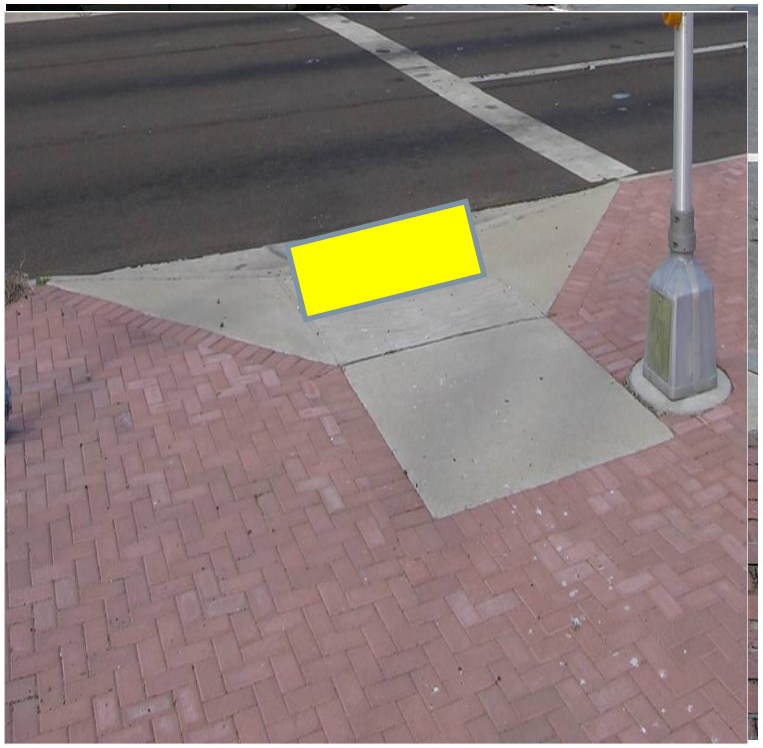




R302.7 Surfaces (R303.3.3)

Curb ramp surface should be smooth, texture makes them hard to climb

Poor design



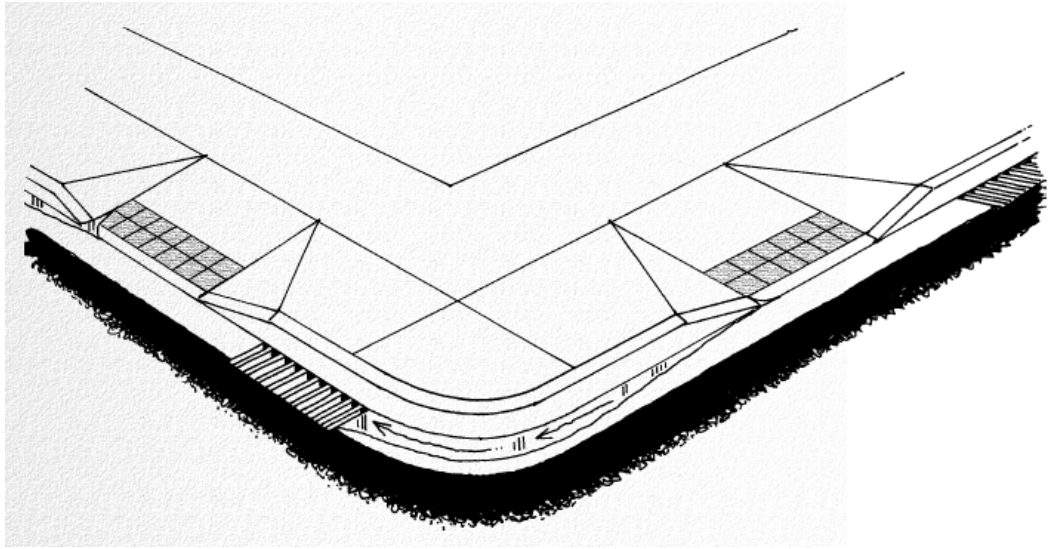
Better design

Types of Sidewalk/Street Connections

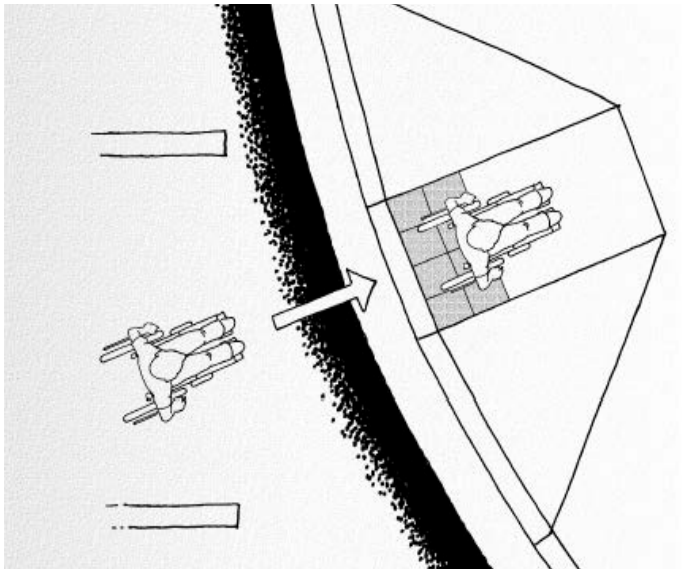
- Curb Ramps (running slope 5 - 8.3%)
  - R304.2 - Perpendicular curb ramps (R303.2.1)
  - R304.3 - Parallel curb ramps (R303.2.2)
- Blended Transitions (R304.4) - Blended transitions (running slope < 5%) (R303.2.3)

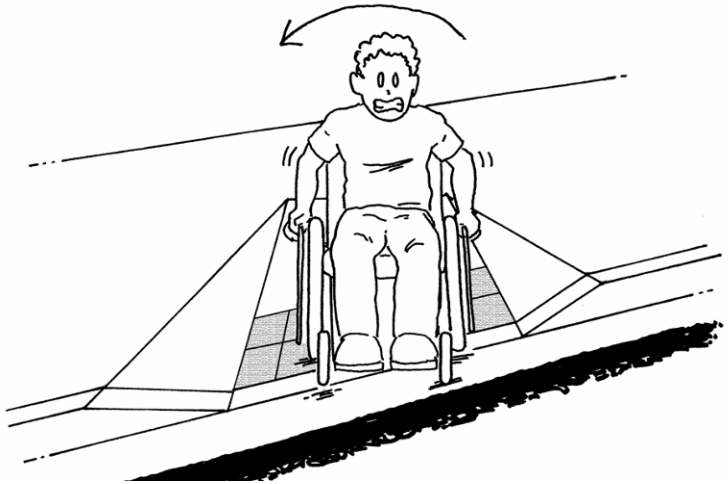
R304.2 Perpendicular Curb Ramps (R303.2.1)

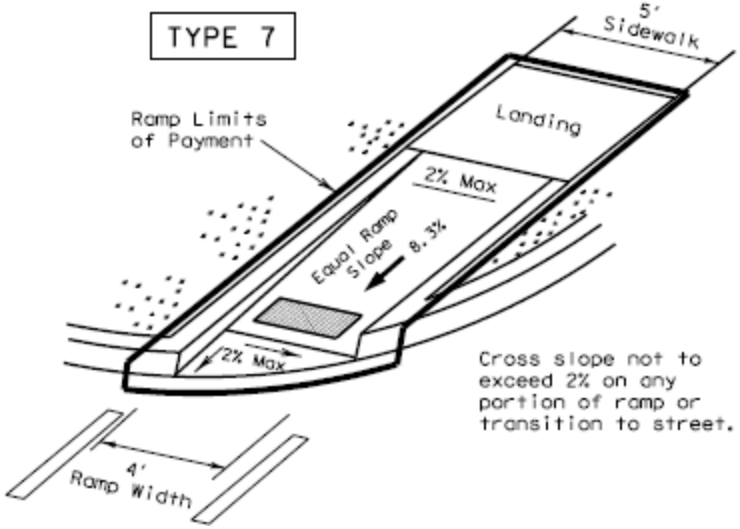
- Perpendicular curb ramps shall have a running slope that cuts through or is built up to the curb at right angles or meets the gutter grade break at right angles.
- Grade: 5-8.3%
- Min. 4’x4’ turning space at top of ramp
- Flared sides if cross travel permitted



Perpendicular Curb Ramp Alignment



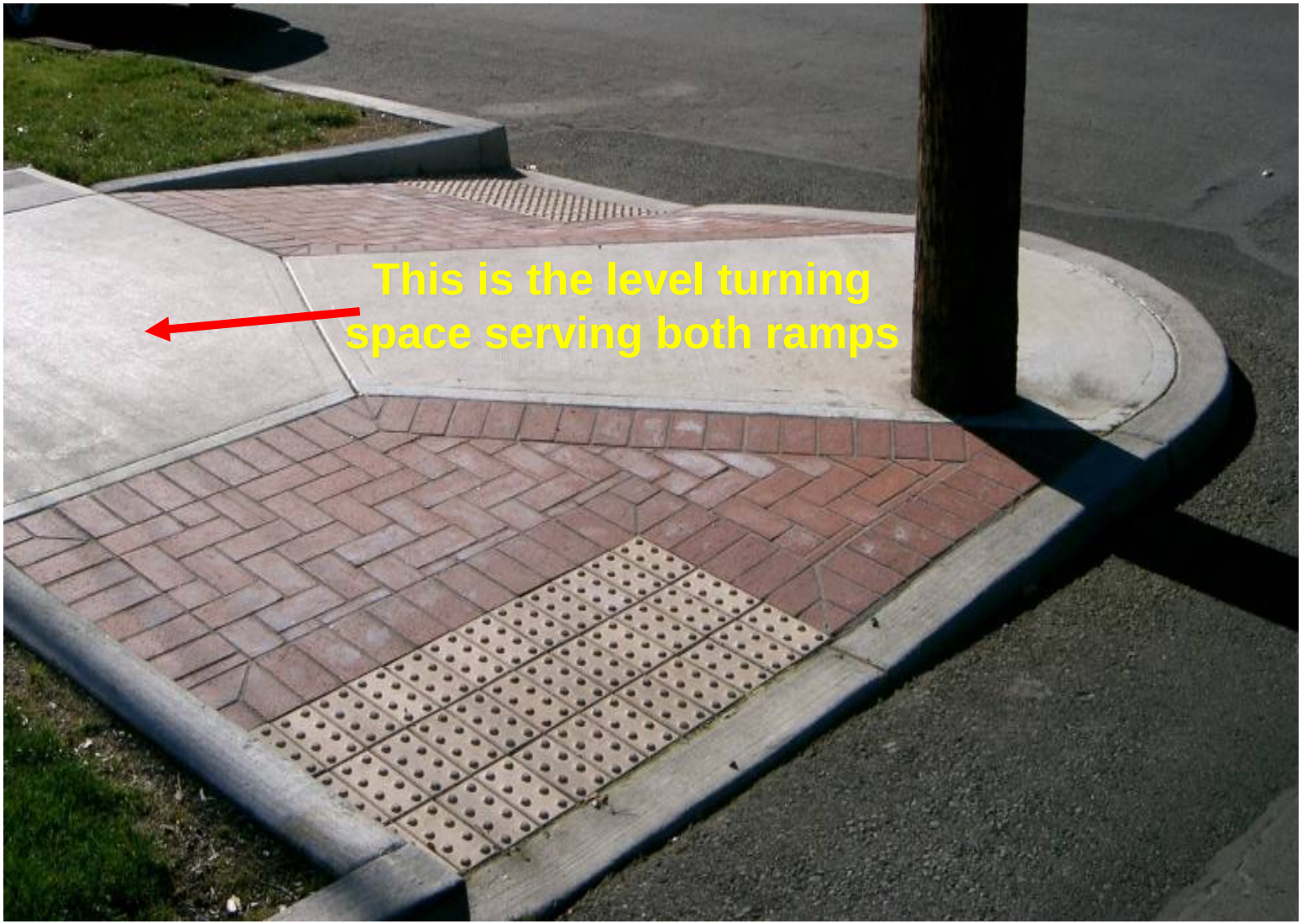




R304.5.3 Perpendicular Curb Ramp Cross Slope (R303)

- Cross Slope (R304.5.3 as published)
  - If Stop/Yield control: 2% max.
  - If Signal/uncontrolled/midblock: match street grade
- Cross Slope (expected revision)
  - If Stop/Yield control: 2% max.
  - If Signal/uncontrolled: **5% max**.
  - Midblock: match street grade

Perpendicular Curb Ramp



Perpendicular Curb Ramps

- Advantages
  - Least likely to pond and trap sediment
  - User has setback from traffic while waiting to cross
- Disadvantages
  - Difficult to provide a good path of travel on large radius corners
  - Require a lot of space – a wide sidewalk, a curb extension, or a planter strip may be needed to accommodate the curb ramp and the level landing

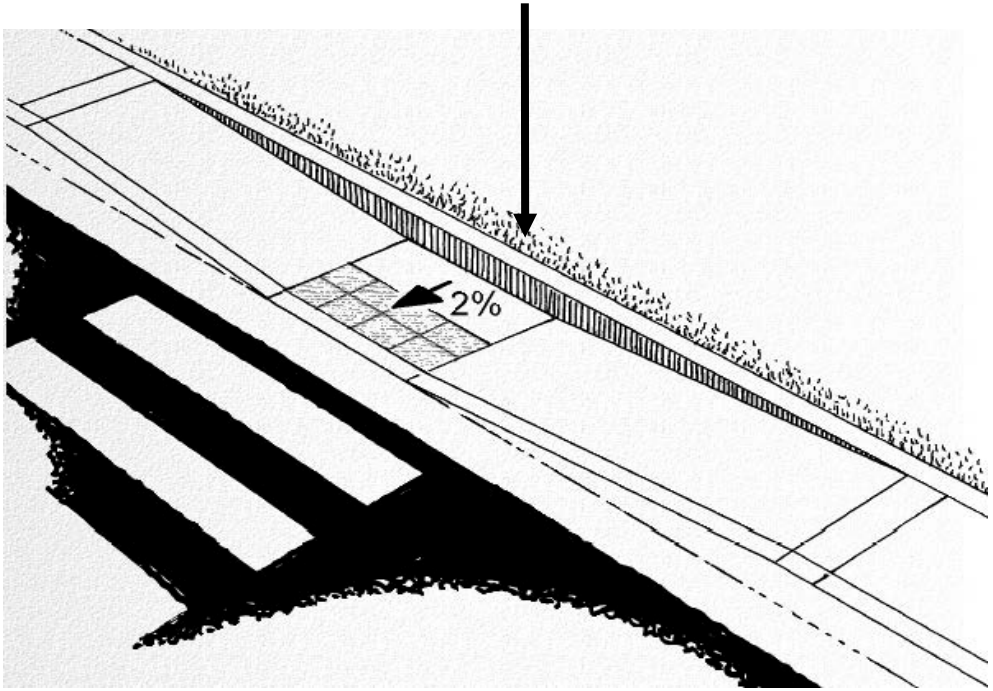
R304.3 Parallel Curb Ramps (R303.2.2)

- Parallel curb ramps shall have a running slope that is in-line with the direction of sidewalk travel.
- Grade: 5-8.3%
- Min. 4’x4’ turning space at bottom of ramp

Parallel Curb Ramps

- The ramp is parallel to the curb and the pedestrian's direction of travel on the sidewalk

Curb at rear not required, but retains soil and provides edge for pedestrians with visual impairments



R304.5.3 Parallel Curb Ramp Cross Slope (R303)

- Cross Slope (R304.5.3 as published)
  - If Stop/Yield control: 2% max.
  - If Signal/uncontrolled/midblock: match street grade
- Cross Slope (expected revision)
  - If Stop/Yield control: 2% max.
  - If Signal/uncontrolled: **5% max**.
  - Midblock: match street grade

Parallel Curb Ramps

- Advantages
  - Fits within narrow ROW
- Disadvantages
  - Users continuing along the sidewalk must negotiate ramp grades
  - Careful attention must be given to the construction of the bottom turning space to limit accumulation of water and/or debris

R304.4 Blended Transitions (R303.2.3)

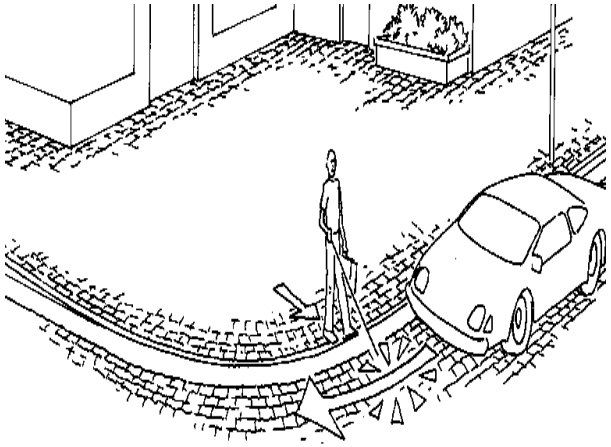
- Running slope - 5 percent maximum
- Cross Slope as published (same revisions expected)
  - If Stop/Yield control: 2% max.
  - Otherwise: 5% max.
- No turning space is required

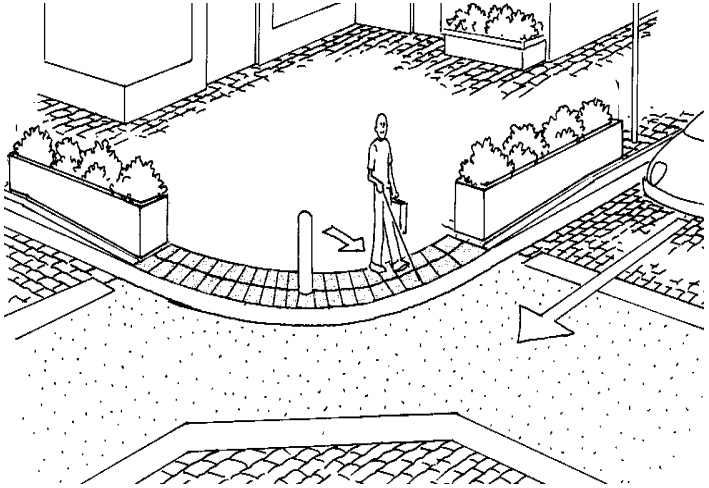
Blended Transitions

- Sidewalk elevation lowers to street with gradual change in slope

Blended Transitions

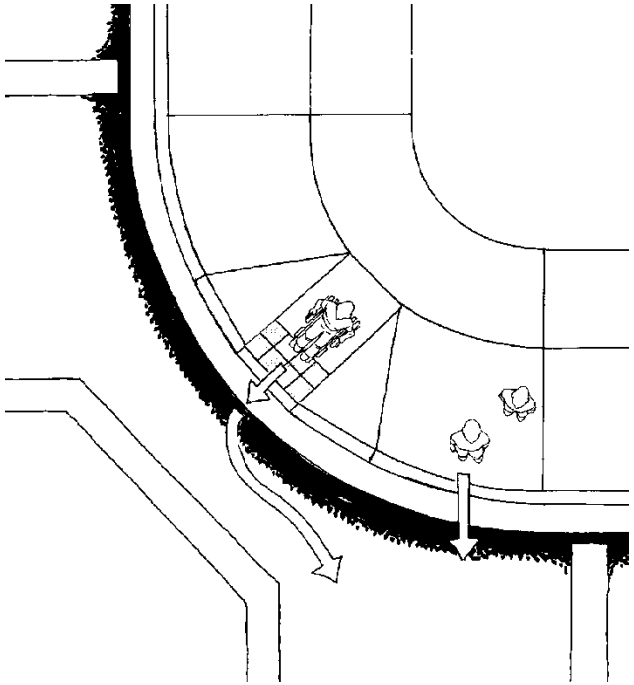
- Advantages
  - No turning space required
- Disadvantages
  - Children, persons with cognitive impairments, guide dogs may not distinguish street edge
  - May allow turning vehicles to encroach onto sidewalk





Diagonal (single) Curb Ramp

- Diagonal curb ramp is a single ramp located at the apex of the corner that serves both crosswalks
- Unacceptable in new construction
- Curb ramp must land within the crosswalk that it serves; diagonal curb ramps don't and are not permitted under 2011 NPRM

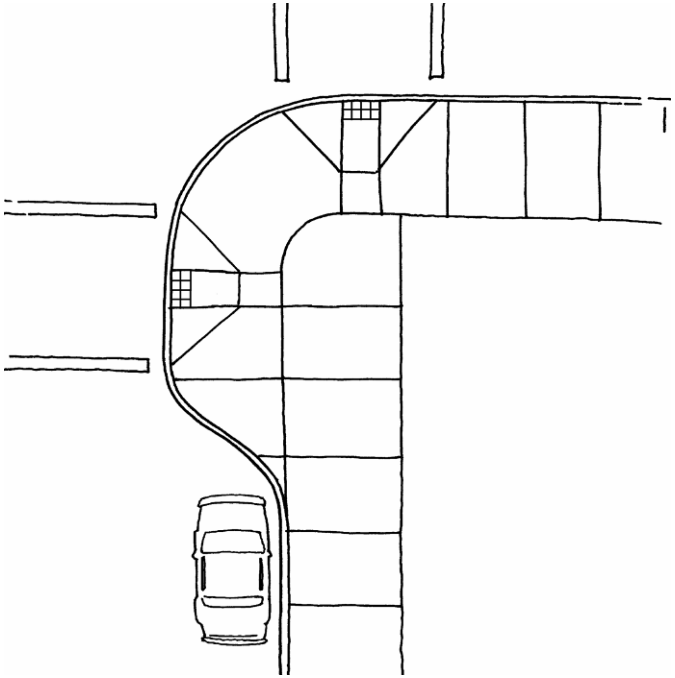


Diagonal Curb Ramp

- Disadvantages
  - Forces wheelchair users out of crosswalk
  - Causes persons who are blind or with low vision to cross diagonally – projecting pedestrians into the center of an intersection
  - Do not serve either crosswalk well

Curb Extensions

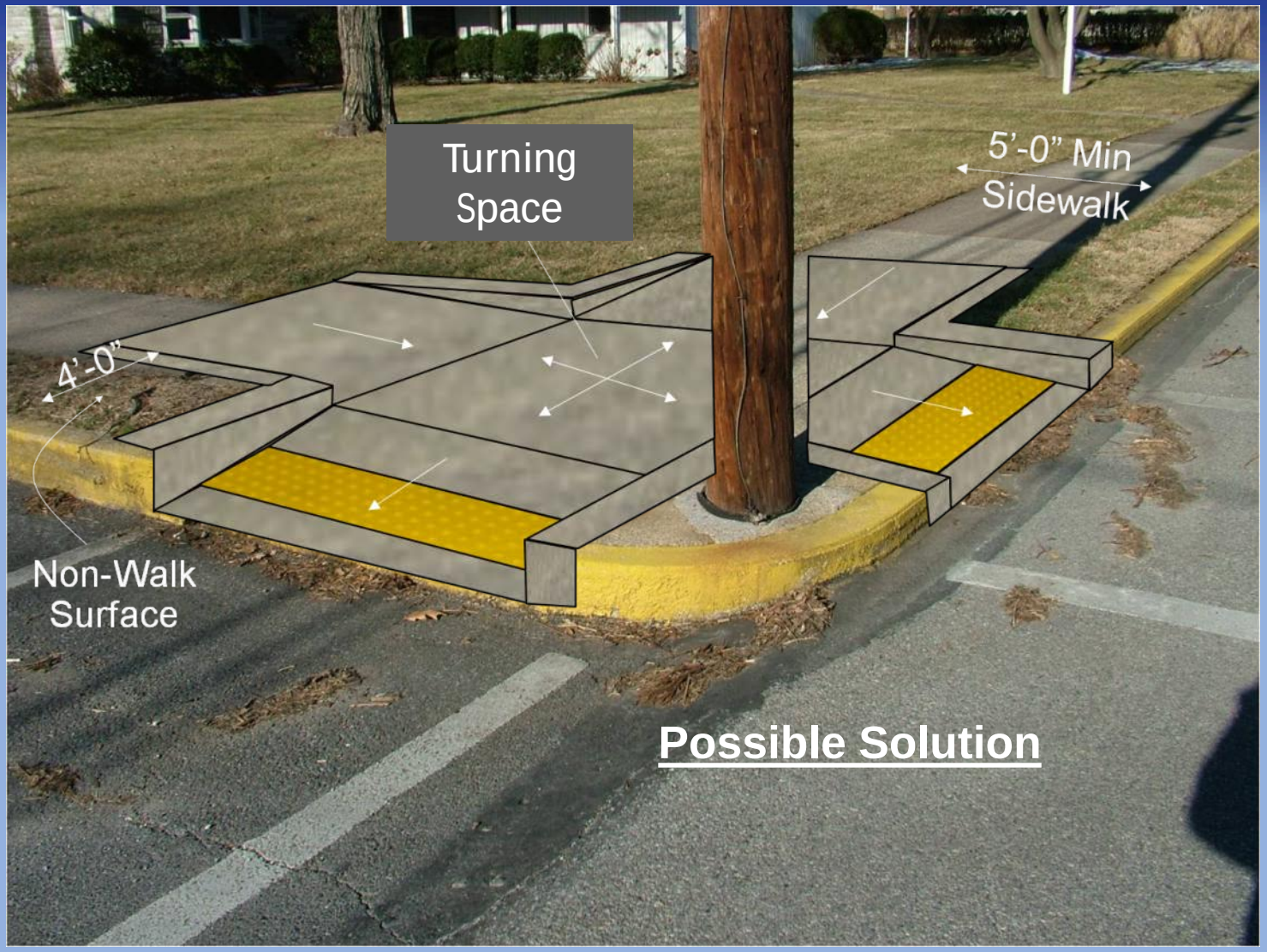
- Instead of built-up ramps, use curb extensions (bulb outs) with perpendicular ramps at locations with on street parking



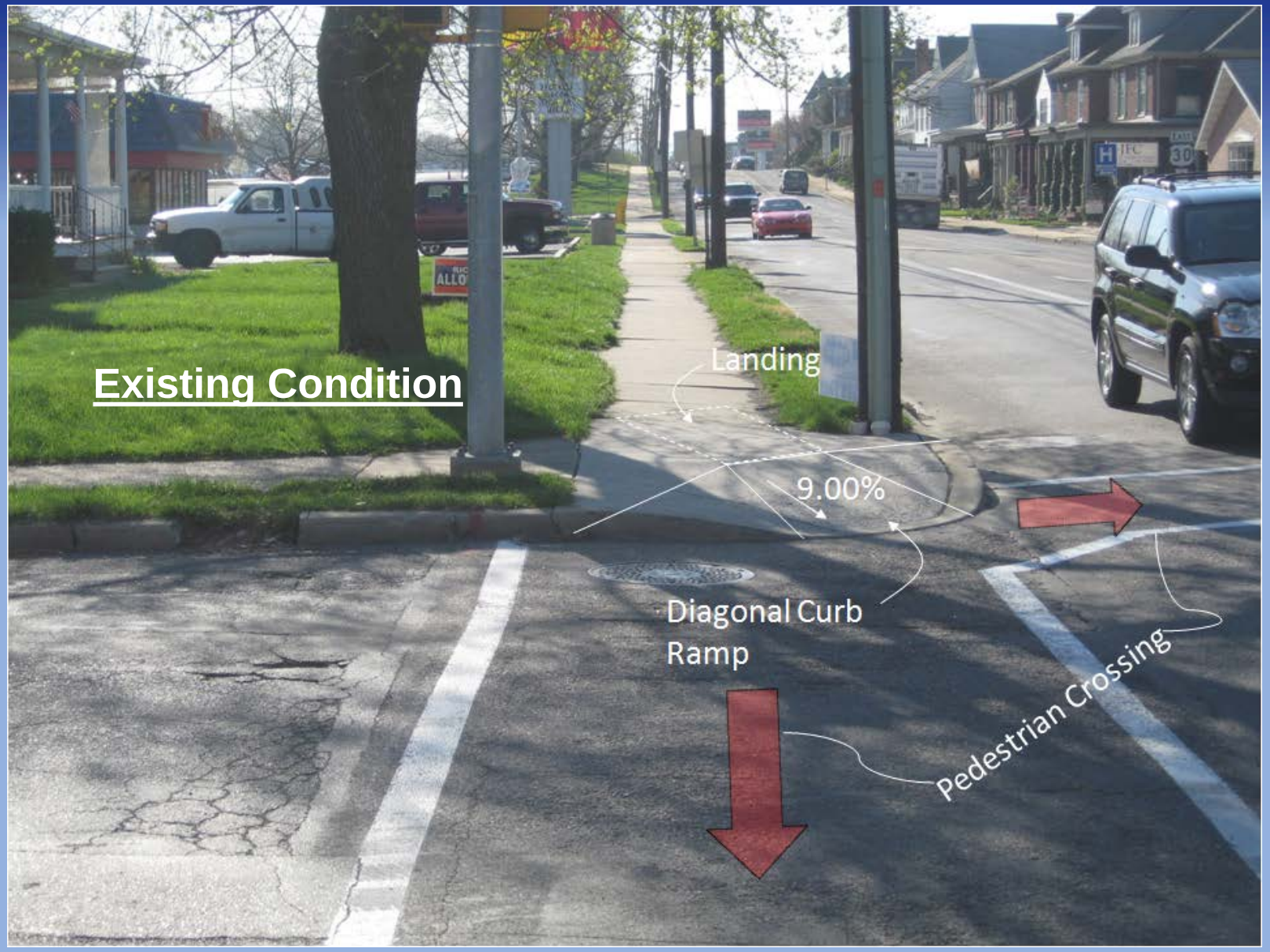
Combination Ramp

Example #1

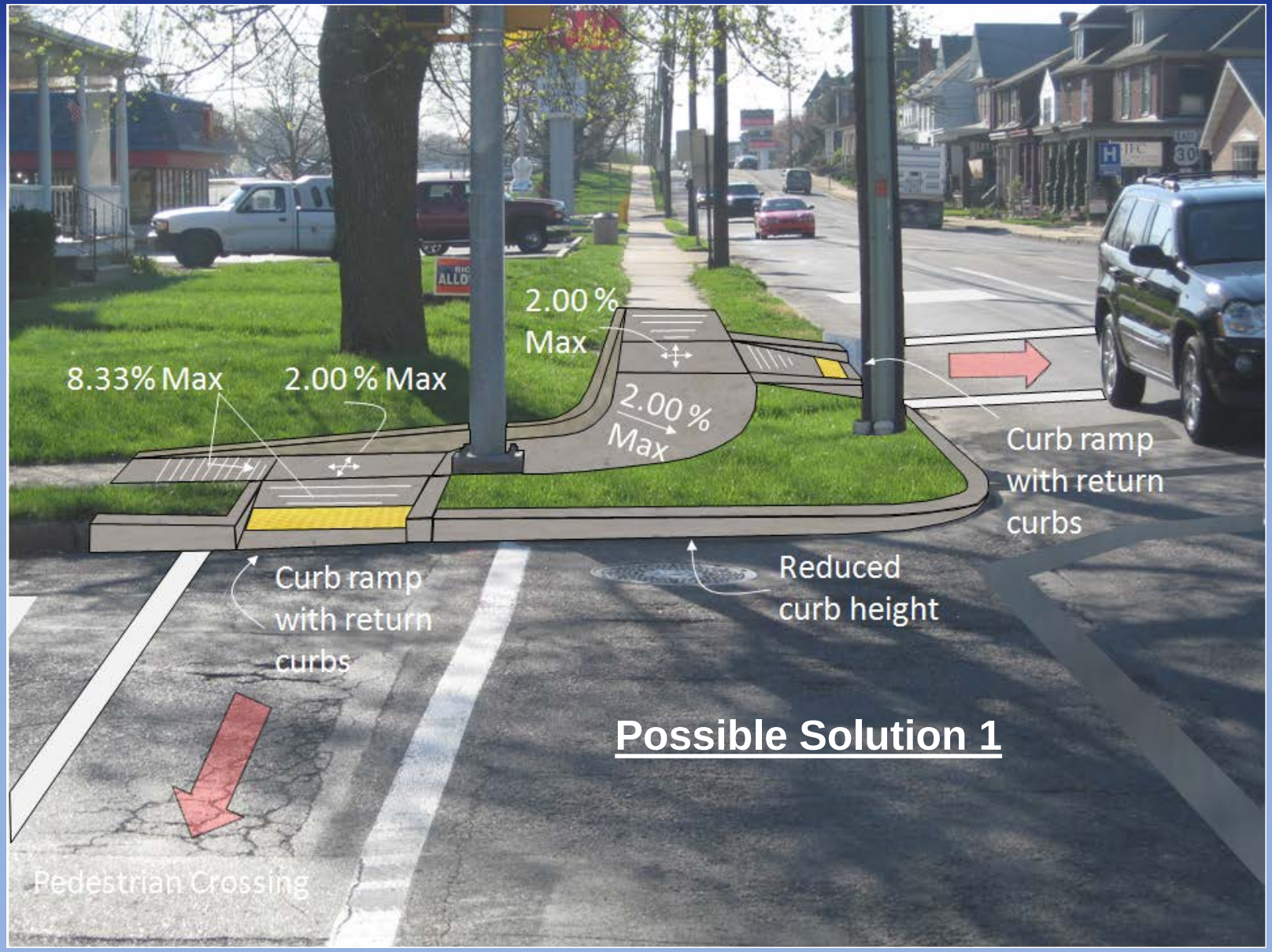
Example #1


Turning Space
5’-0” Min Sidewalk
4’-0”
Non-Walk Surface
Possible Solution

Example #2

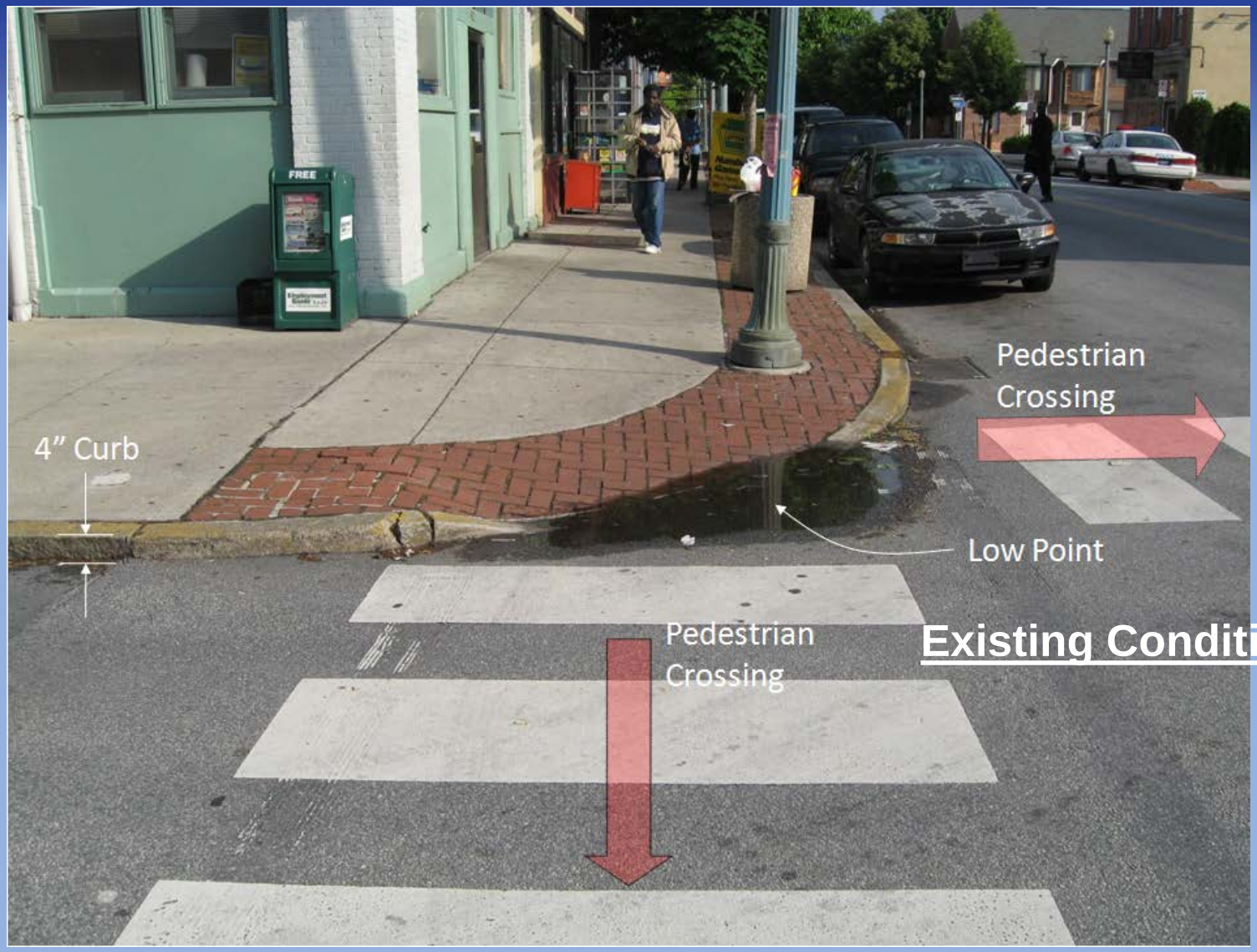

Existing Condition
Landing
9.00%
Diagonal Curb Ramp
Pedestrian Crossing

Example #2

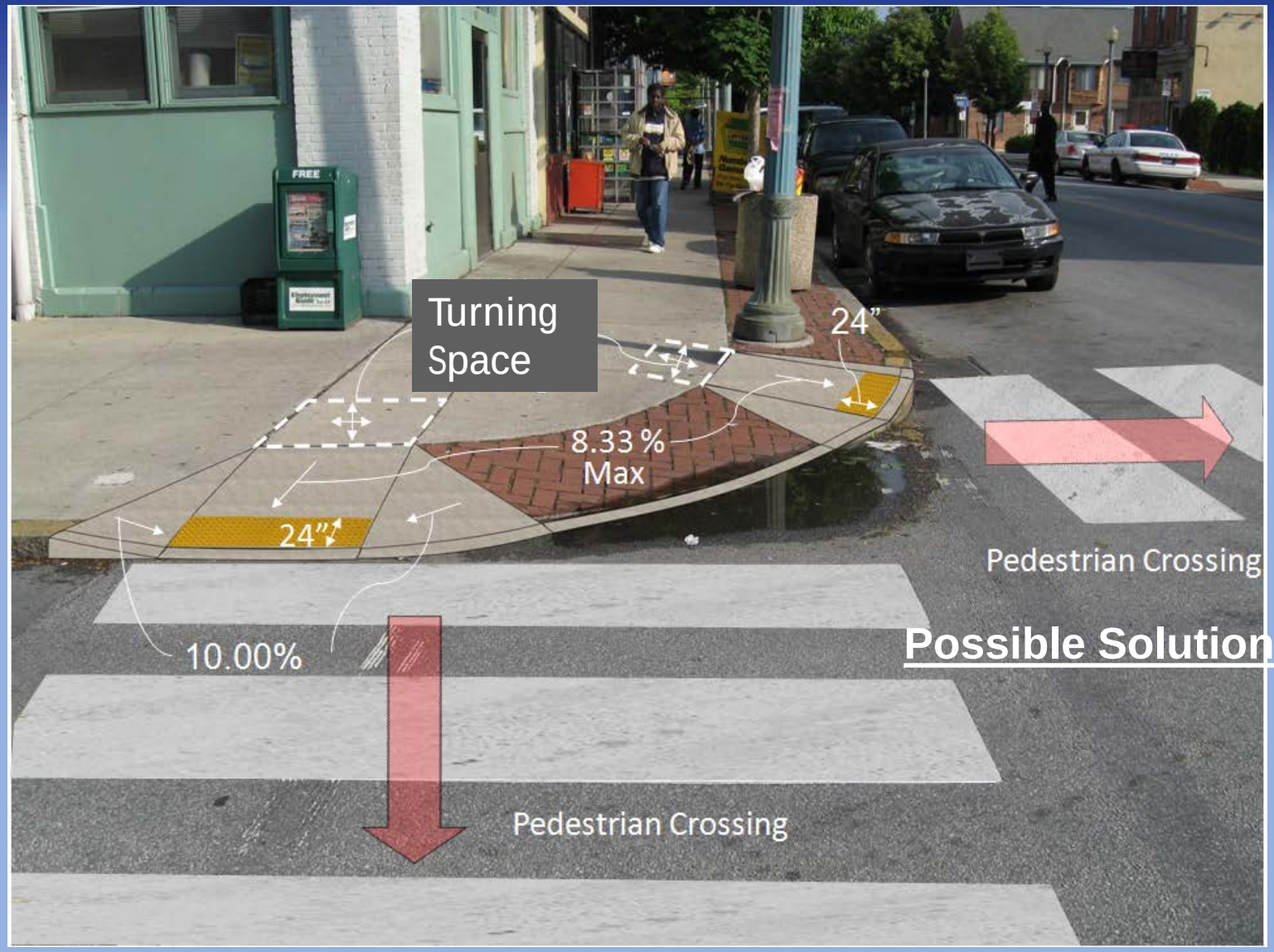

8.33% Max
2.00 % Max
2.00 % Max
2.00 % Max
Curb ramp with return curbs
Curb ramp with return curbs
Reduced curb height
Possible Solution 1
Pedestrian Crossing

Example #2

Example #3


FREE
Pedestrian Crossing
4” Curb
Low Point
Pedestrian Crossing
Existing Condition

Example #3


Turning Space
24”
8.33 % Max
24”
Pedestrian Crossing
Possible Solution
10.00%
Pedestrian Crossing

Questions