Human Factors Considerations for Urban Streets

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Outline

• Vulnerable road users
• Pedestrian
  – Visually impaired pedestrians
  – Distracted pedestrians
  – Wheeled mobility devices
    • Characteristics
    • Design elements
• Non Motorized Modes
  – Bicycle
  – Equestrian
Pedestrians - Vulnerable Road Users

- Visually impaired (discussed previously)
- Distracted pedestrians
  - Lack of situational awareness (visual and audio)
- Deaf and hard of hearing (lack of audible cues)
- May use wheeled mobility devices

Pedestrian Modes is at All Trip Ends

- Intersections
  - Crossing task the most critical
    - Uncontrolled crossings
    - Roundabouts
- Reduce exposure (extended curbs)
- Reduce conflict points
- Lack of protection when there is a conflict
- Importance of low speed – new concepts of Urban Street Design
- Design for the speed you want to achieve
**Mobility Devices (types)**

- Wheeled
- Non-wheeled
  - Crutches
  - Canes

**Wheeled Mobility Aids**

- Manual Wheelchair
- Powered Wheelchairs
- 3 or 4 wheel scooters
- Powerbase wheelchair
What are main human factors considerations?

• For sensory compromised pedestrians
  – Cues and clues
  – Auditory
  – Visual
  – Tactile

What are main human factors considerations?

• For physically compromised pedestrians
  – Surface textures
  – Cross slopes
  – Ramps
  – Changes in gradient
# Pedestrian Access Route

## Physical Space | Physical | Sensory
--- | --- | ---
Curb Ramps | | |
Sidewalks | | |
Crosswalks | | |
Signal Activation | | |
Parking Lots | | |
Parking Spaces | | |
Building Access | | |
Ramps MUST be provided at every legal crosswalk (even if you think it’s “unsafe”)

Crosswalks Defined

Crosswalks Defined
Sidewalk Zone

- ODOT requires 6-ft standard sidewalk width
- Exceeds ADA minimum

Figure 4-1: The sidewalk zone system, urban context

Curb Ramps and Transitions

Devil is in the Details
Cross Slopes
Built Environment

- Construction tolerances
- Cross slopes
- Ramps
- Curb ramps
- Intersections

Cross Slope Construction

- Portland Cement Concrete tolerance is +0.2 percent
- Training of contractors and inspectors really important!!

Providing the least possible slope below the 1:12 (8.33%) maximum offers better usability for a wider range of users.

Specifying a running slope of 7.5% maximum and a cross slope of 1.5% maximum for exterior ramps will accommodate most irregularities or variances due to construction methods or materials according to a study sponsored by the Access Board.

("Dimensional Tolerances in Construction and for Surface Accessibility" by David Kent Ballast)
Cross Slope

- Running cross slope is average cross slope over a distance of about 2-ft
- Rapid changes in cross slope are hazardous
- Don’t need a cross slope on a ramp (it will drain!)
- 1.5% ODOT
- 2.0% ADAAG

1 ADA Standards for Accessible Design

Cross Slope Management
**Other Cross Slope Issues**

**Street – Building Interfaces**

**Suggested Mitigation**

**Unintended Consequences**

Parked cars may not be able to open doors

Better design
**Ramps – Slopes**

Maximum grades can make a sidewalk difficult to traverse, even if the overall running grade is moderate.


**Ramps**

- Long ramps must have LEVEL landings
  - Vertical rise must be 30 inches max
  - That would be a horizontal distance of 360 feet!
- Must provide level rest areas
  - How many? = 24
Ramp – Slopes

• ADA requires that access ramps and pathways not exceed 5%
• Maximum of 12:1 (8.33%) is only acceptable for a vertical rise of 2.5 feet

Reality - Newport, OR
**Curb Ramps**

- Landing – level
- Approach on accessible path
- Flare: sloped transition
- (Not on accessible path, but still may be hazard for low vision)
- Ramps: transition
- Gutter

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**Curb Ramps**

- Size to accommodate volume (match sidewalk width)
- ODOT: at least 48” wide (does not include flares)
  - AASHTO: 39 inches
- Ramps that are too wide or gradual – problem for low vision
- Need 2 ft. wide detectable warning (domes) near or at bottom of ramp
ODOT Standard Drawing for Sidewalk Ramp Detail

ODOT Pay Limits

Pay Limits include all ramp elements including ramp runs and turn spaces, PLUS the next adjacent sidewalk transition panels and two feet out into the street in front of the ramp (red areas).

Make grade transitions outside the pay limits
**Landing**

- Must be level
- Minimum width 48 inches
  - What might be a problem here?
  - What could be a mitigation?

**FLARES**

- Problem for distracted and low vision pedestrians - **Why?**
- NOTE: ODOT standard is 48 inches not 36 inches for landing
- Best if detectable by cane

*Figure 4-27: "Standard" ramp*
**Good Flare Design**

- Planting strip
- Detectable – cues and clues

**Curb Ramp Types**

- Perpendicular to curb face - need level landing
- Curb extension many additional benefits
- Parallel
- Diagonal
- Perpendicular - no landing
Perpendicular

• Aligned with crosswalk
• Landings
• What are the Human Factors Considerations?

ODOT Standard drawing RD 752
Parallel Curb Cuts

- May have ponding/debris problems
- Two ramp grades
- Detection

![Parallel Curb Cuts Diagram](attachment://parallel_curb_ramp.png)

Figure 4.28: Parallel curb ramp
Diagonal

**Combination Curb Ramps**

- Both perpendicular and parallel
- Reduce ramp grades on sidewalk

*Figure 4-31: Combination curb ramp*
**Diagonal Curb Ramp**

- Must have clear space
- Problematic for low vision and distracted users
- Large radius curves a problem *Why?*
- Users have to turn at transition

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**Mid-Block**
Pedestrians with Visual Impairments

• What are key Human Factors considerations?
  • Detectability
  • Tactile
  • Audible

Detectable Warnings

light-on-dark or dark-on-light contrast with adjacent walking surface (color not specified)

[ADAAG Chapter 4 Ramps and Curb Ramps]
**Gutter -Lips**

- Lips, gutters and transitions are very critical. They can catch a wheel, cane or walker tip.
- Preferred - 0” lip
- Allowable - 1/4” lip

**Gutters**

The gutter slopes counter to the slope of the curb ramp to promote drainage.
Gaps and Grates

- Openings less than ½ inch sphere
- Long dimension perpendicular or diagonal to travel - may have conflict if in bikeway

Driveways

What are the challenges with these designs? Which is the better? And why?
**Driveway Challenges**

- I am blind!
- Cues and clues?

**Intersections**

- Remain aligned with crosswalk
- Monitoring traffic during crossing
- “When is it safe to cross”
- Detecting destination sidewalk or median island
- Uncontrolled most difficult
- Quiet cars
- Lack of cues and clues
- Ambient sound levels (very difficult in roundabouts)
Characteristics of a Good Intersection

- Tight
- Simple
- Slow speed
- Good visibility
- Easy to understand
- If complex, break it up
- NO FREE-FLOW MOVES!

Intersections - Controlled

- Accessible Pedestrian Signals
- Pedestrian actuator: **audible and tactile**
- Placement (accessible)
- This is a vibro-tactile device (useful for deaf blind)
- **What is wrong in this picture?**
Crossing Times

- Examine local conditions!
- Typical walking rates 1.22 m/s (4 ft/s)
- AASHTO requires 3.5 ft/s
- Not always applicable - elderly, cognitive disabilities-start up delay
- Crossing speed may be as low as 455 mm/s (1.5 ft/s)

Analyzing the Situation

- What is wrong with this picture?
- Is the button close enough to the crosswalk that I will have time to position myself correctly at the crosswalk, facing my destination curb, before the onset of the walk interval?
- Which button controls the walk interval for the street I want to cross?
**Islands and Medians**

Why?

[ADAAG Chapter 4 Ramps and Curb Ramps]

**Islands**

- Raised islands should be cut through
  - Need Accessible Pedestrian Signal at median/island it 2 cycles required to cross street

Figure 5-19: Midblock island with high visibility crosswalks, advanced stop lines, illumination and angles cut through
Two Step Pedestrian Signal

Source: NCHRP Report 600 p. 10-10

Multilane Roundabouts-Vulnerable Population

Source: NCHRP Report 600 p. 10-10
**Traffic Control**

- Will there be a surge of parallel traffic telling me the walk interval has begun?
- Will I be able to hear it over other, concurrent traffic sounds?
- Does it stop traffic on one street, or all traffic?
- Do cars still turn during the walk interval?
- Is there a second button I must push that is on a median?

**Identifying the Crossing Interval**

- When does the WALK interval begin?
- Low volume crossings
  - No traffic noise to indicate start of WALK signal
  - Too much noise to identify signal phase or problems of split phases
Starting the Crossing

- Decision time to start crossing
- **Start up delay** and signal phase length

Ideal Placement

- Place 10 ft apart
- Rapid tick WALK indication
- Rapid tick is 8-10 repetitions per second
- What is the height range for the activator?
- Make sure that ticks are not imitated by local birds
Example of pushbutton information messages and speech WALK messages for two APS located on the same pole.
Accessible Bus Stops


Not this (sources intentionally omitted)
Or This (sources intentionally omitted)

Non Motorized Modes-Bicycles and Equestrian
New Threats

- E scooter
- E Bikes

Bike Lengths

- A. Adult typical bike
- B. Adult single recumbent bicycle
- C. Additional length for trailer bike
- D. Additional length for child trailer
- E. Width for child trailer
- F. Adult tandem bicycle

What about Protected Intersections?

- Bi-directional, separated and protected bike lane
- Try to avoid bi-directional or contra flow bike lanes unless separated and protected
- What about vulnerable pedestrians?

[Davidsuzuki.org Toronto, ON, Canada]


http://www.hobokennj.org/washingtonstreet/

Dutch Intersection- Bane or blessing?

How can this be made better for blind and low vision pedestrians?
**Class Exercise**

- How do we make this better?

**LESSONS LEARNED Evolution of the Protected Intersection December 2015**


- PREPARED BY:
  
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Shared Use Considerations

• Space

Figure 7-3: Suggested shared use path dimensions

Figure 7-4: Paved path with separate soft surface trail

Vertical Consideration

Figure 3-13–A shared-use, single-tread trail with double track (two lanes).
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Curb Ramps

- This is from US Access Board
- Oregon Standards are more conservative and many of these dimensions are unacceptable in Oregon!

[ADAAG Chapter 4 Ramps and Curb Ramps]

Built Up Curb Ramps

- Perpendicular
- Narrow sidewalks
- Low vision user challenges
- Cannot extend into vehicle or bike lanes
- Drains

Where does detectable warning belong?