Enhancing Mobility, Access and Safety for Pedestrians (Part I)

Presented by FHWA Office of Safety, VHB, and UNC HSRC

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Meet the Panelists

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Perspective from the Federal Highway Administration

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How Blind People Travel

April 28, 2020

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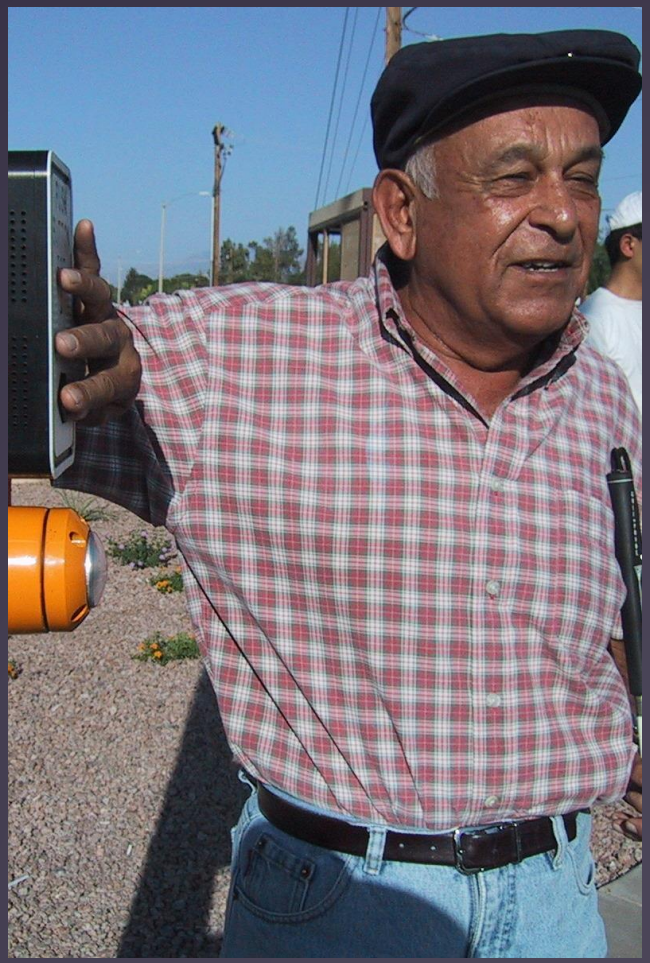
How many people are blind or have low vision in the US?

- Statistics are fuzzy; no ‘registry’ in US
- 2017 National Health Interview Survey: 26.9 million American Adults age 18 and older reported experiencing vision loss



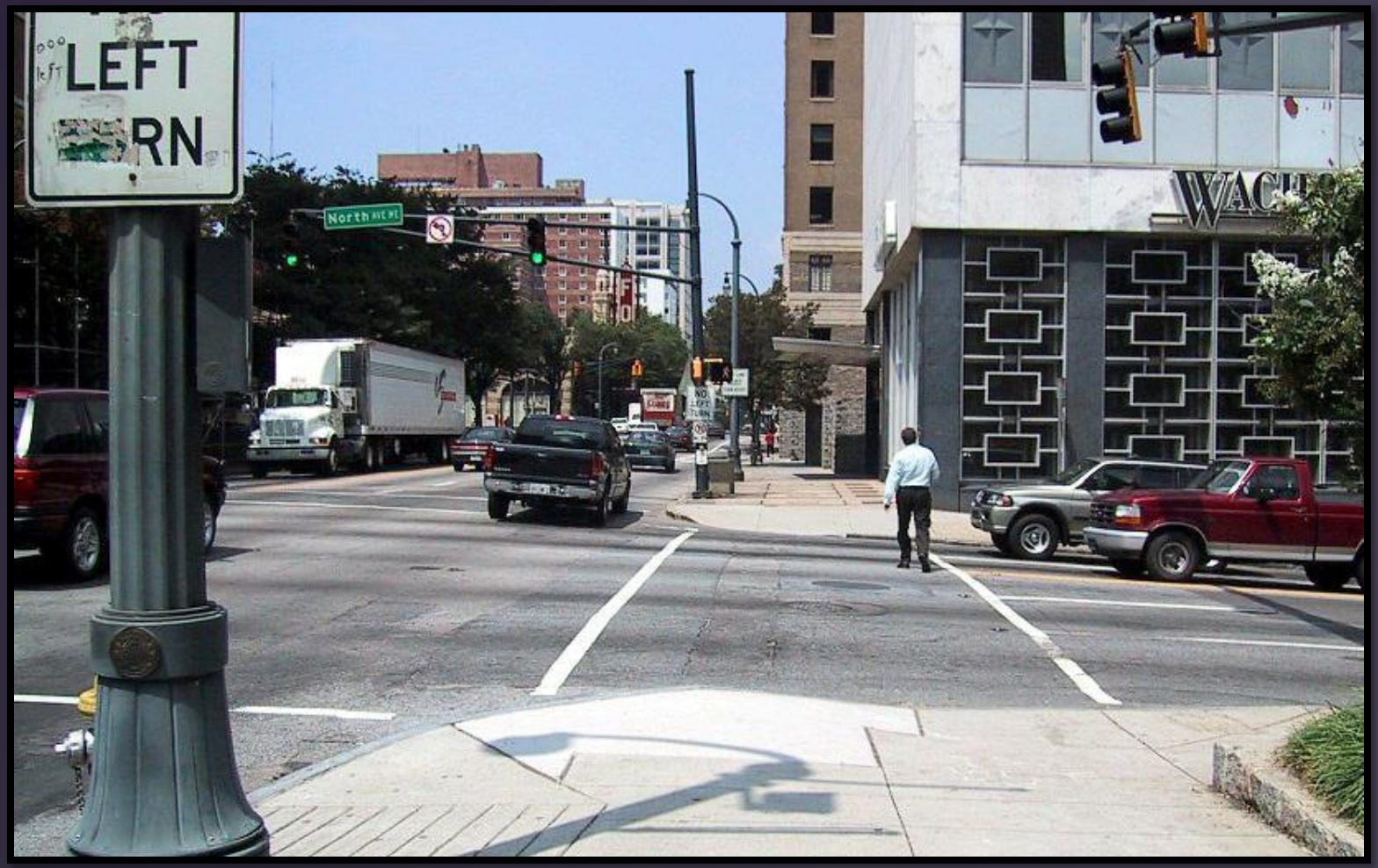
Low Vision

- Person with low vision is not totally blind
- Limitations in vision can affect
  - Ability to see signals (vehicular and pedestrian)
  - Ability to judge traffic approach speed and distance
  - Understanding drivers' intentions
  - Ability to recognize crosswalk location
  - Detection of curbs or islands, or curb ramps

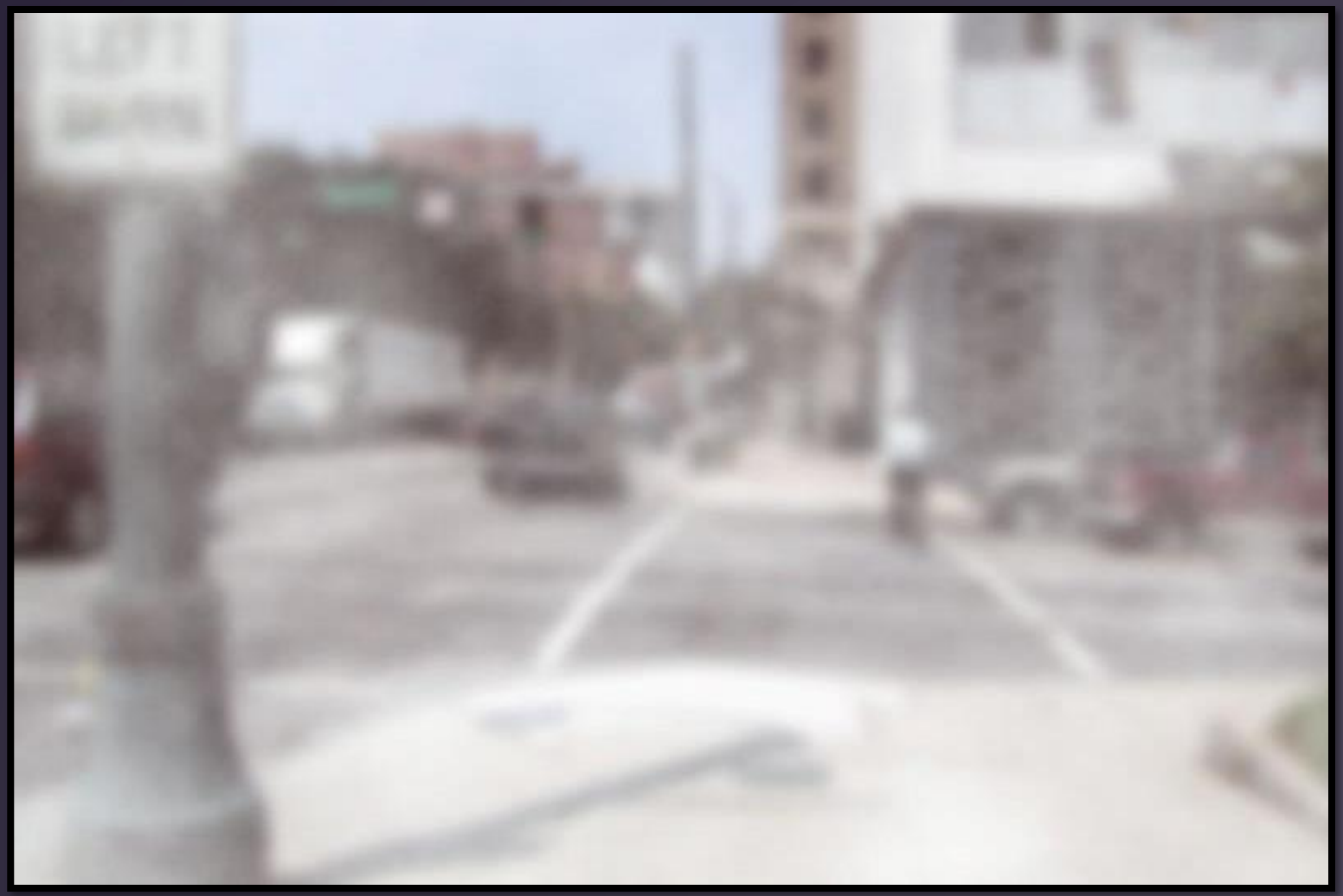
Growing older population with low vision

- Vision can vary with different lighting conditions
- May have reduced contrast sensitivity
- May react more slowly and move more slowly

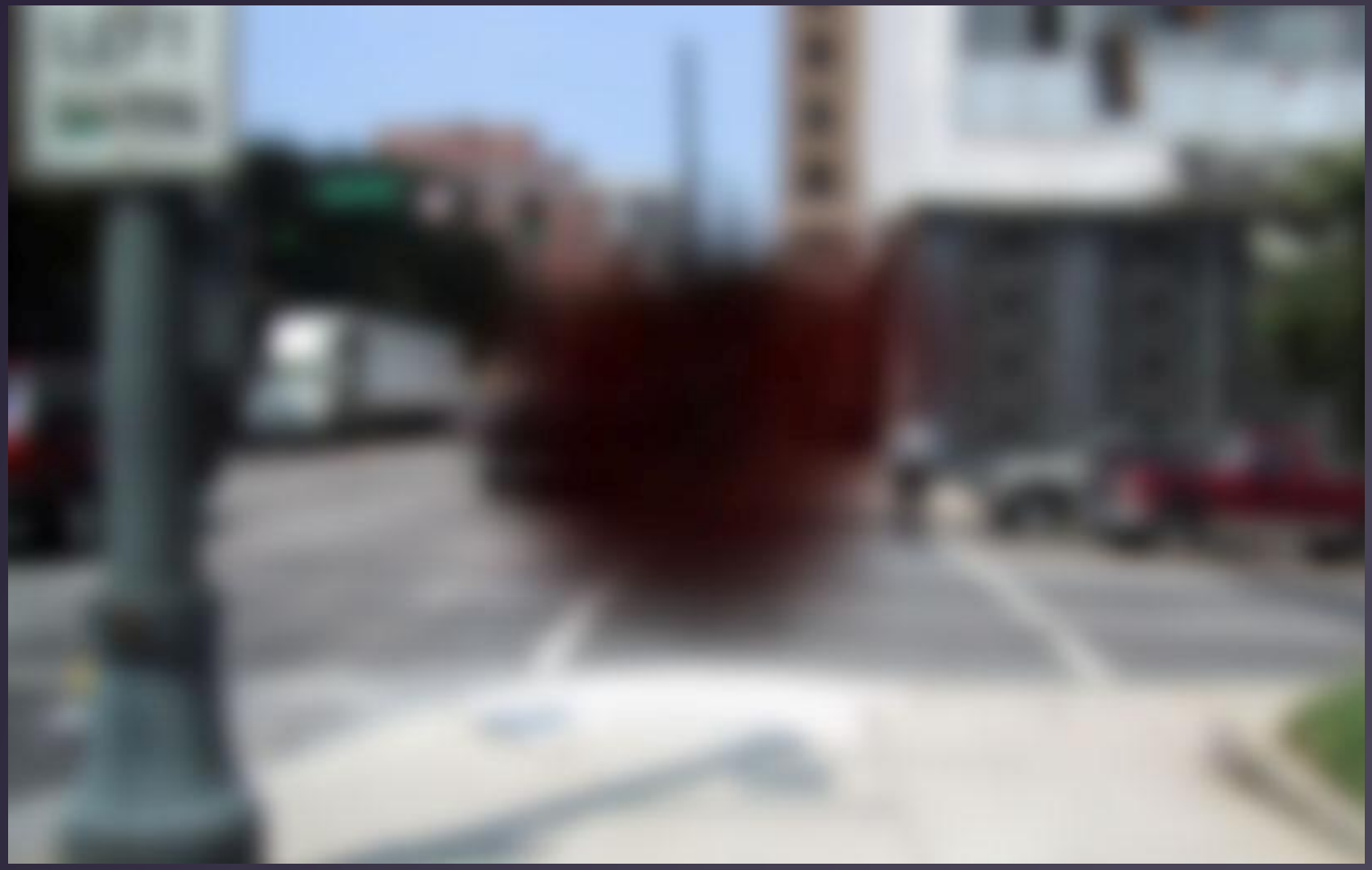
Intersection as seen by someone with "normal" vision



Overall acuity loss

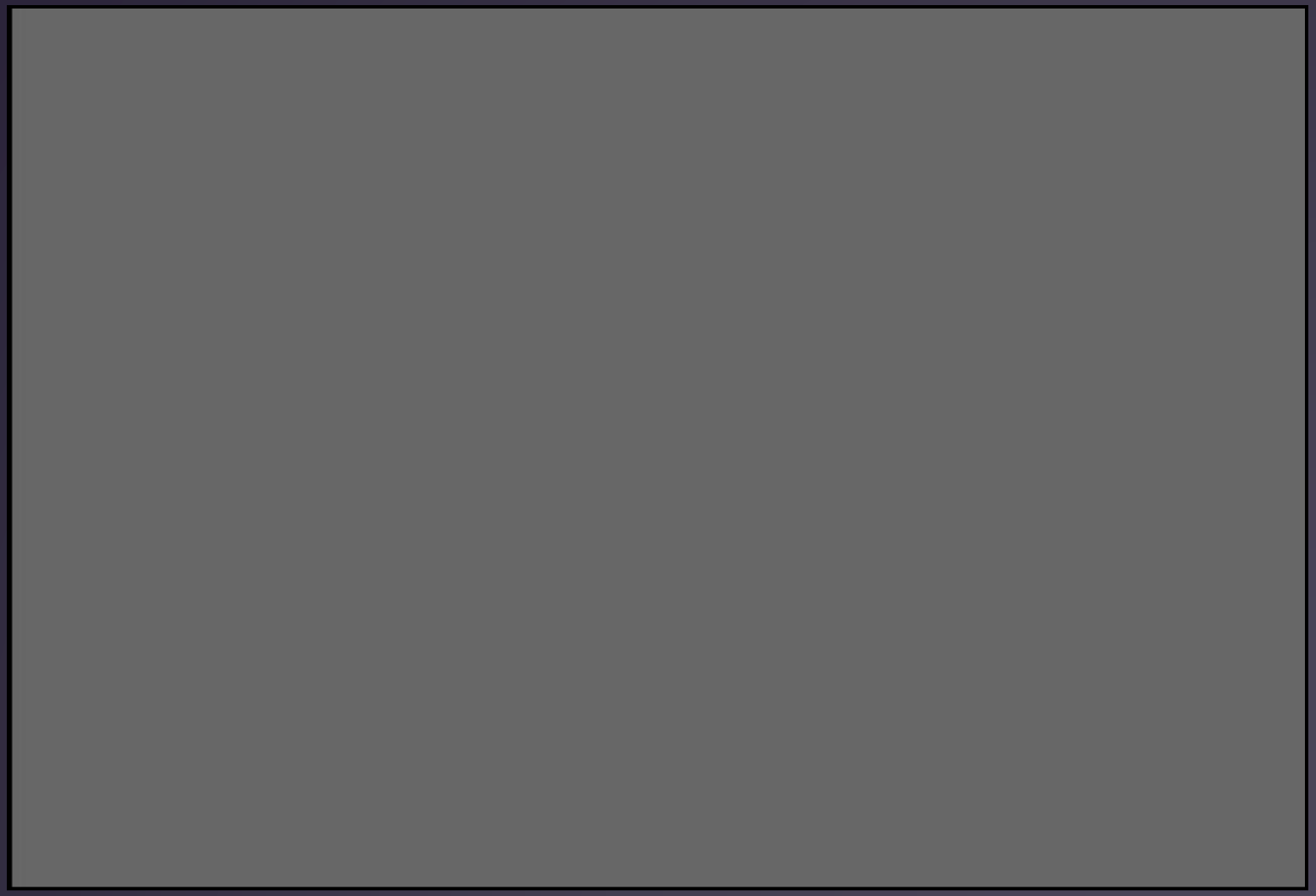


Central vision loss



Peripheral Vision Loss

Totally blind



Transportation choices for individuals who are blind or who have low vision

- Walk
- Public transit - Bus or rail
- Paratransit services
- Taxis or shuttles
- Rides from friends or relatives
- Paid drivers

Aids and techniques for obstacle and curb detection

- Long white cane
  - Used as a probe of the walking surface
  - May identify person as visually impaired

Aids and techniques for obstacle and curb detection

- Dog guide
  - Guides around obstacles
  - Stops at curbs or drop-offs
- Low vision aid, such as telescope
  - Used only for specific tasks, ie reading sign

Orientation and alignment cues

- Slight slopes and changes in surface textures
- Sidewalk and/or grass line or building line
- Traffic – both parallel to travel path and perpendicular to travel path
- Other pedestrians, sun, other cues
- Awareness of intersecting streets and general layout of area

Crossing cues

- Signalized
  - Traffic stopping on the street that the pedestrian is planning to cross
  - Vehicles starting and moving across the intersection in the closest through lane
  - Accessible pedestrian signal
- Unsignalized
  - Hearing a vehicle approaching
  - Not hearing any vehicles
  - Hearing a vehicle yielding
  - Traffic moving parallel to crosswalk

Yes! people who are blind do travel independently to new places

- Are not oriented to every place they may go
- Travel to unfamiliar destinations for shopping, errands, visiting friends, children's activities, work, or other purposes, just like those who are fully sighted
- May have to figure out streets, intersections, and intersection crossings when they arrive at them
- May be unaware of changes and may, at times, make dangerous decisions when familiar intersections have been changed

Navigating the built environment over time

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April 28, 2020

When navigating a route

- Cane used to monitor nearby information
- Hearing used to monitor traffic, distant cues and landmarks
- Crossing streets
  - Find a place to cross
    - Location specific, situational, tactual exploration
  - Align to cross
    - Main cue is traffic flow, secondary is tactual cues like return curb or grassline. Cues can lead pedestrian astray.
  - Decide when to cross
    - This is where most technology focuses (e.g. APS)
  - Cross straight
    - Far side beaconing is helpful but difficult to achieve.

Simpler intersections used to be the “norm”

Photo by Lukas Franck

More recent complex intersection
(wide, lots of lanes, islands, actuated turns)

Photo by Janet Barlow

What has changed, accessibility impacts

- Streets are wider
- Right turn on red
- Curb ramps, DWS
- New intersection designs
- Quiet cars
- Signal timing is more complex
  - Actuated intersections
  - LPI
  - Exclusive ped phases

“Fancy” Pedestrian Timing and Beacons

LPI – Leading Pedestrian Interval

- Pedestrian signal displays WALK and vehicles have red for 3 to 6 seconds
- What's the advantage?
  - Allows pedestrians to begin crossing before vehicles begin turning right
- Issues for blind pedestrians?
  - Walk signal is before surge of traffic; if you wait for surge
    - drivers aren't expecting you to cross
    - you may not have enough time to cross
  - Some drivers still turn right on red if not posted as NRTOR

LPI – Leading Pedestrian Interval

- Solution?
- Accessible Pedestrian Signal

Exclusive Pedestrian Phase (EPP)

- All vehicles have a red signal
  - May or may not be posted as No Right Turn on Red
  - Pedestrians may be allowed to cross in all directions, including diagonally
- Issues for blind pedestrians?
  - Knowing signal is an EPP
  - Deciding when to cross
  - Wayfinding – no parallel traffic

Exclusive Pedestrian Phase (EPP)

- Solution?
- Accessible Pedestrian Signal

APS

Pedestrian Hybrid Beacon (PHB)

- Sometimes called a HAWK Signal
- Different functioning than typical signals
  - Rests in dark, when activated, flashing yellow, then steady yellow, then steady red (with pedestrian phase), then flashing red wig wag

PHB

- Used at roundabouts, midblock crossings, or to provide pedestrian phase at a location where side street may just have stop signs
- Issues for blind pedestrians?
  - No parallel traffic
  - May be difficult to discern vehicles stopping
  - Vehicles are allowed to move during flashing don't walk
- Again, for pedestrians who are blind, needs an APS

- NCHRP 07-25 [Completed]
- Guide for Pedestrian and Bicycle Safety at Alternative Intersections and Interchanges (A.I.I.)

The Bottom Line

- Signals and traffic flow are not simple
- It is no longer possible to just observe an intersection and know how it will function at all times of day, or even the next cycle!
- May not be enough information available just from traffic to determine the correct time to cross

Traffic cues may not be available or usable where there are:

- Low volumes of traffic parallel to crosswalk
  - Crossing major street
  - T intersections (crossing top of T)
- Exclusive pedestrian phases
- Leading pedestrian intervals
- Heavy turning traffic volumes
- Masking sounds

Electronic devices for mobility

	User based	Environment based
Environmental info	GPS, laser cane, miniguide, Trekker breeze	Talking signs, navilens (like QR codes)
Crossing assistance	Apps linked to smart intersections	APS

Mobility technology summarized

- Most technology focuses on
  - when to cross a street
  - detecting obstacles, or
  - providing location information
- Need to figure out how to integrate functions

Accessible Pedestrian Signals: Innovation and Standards

April 28, 2020

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People who are blind or who have low vision may not be able to see the typical pedestrian signals

- Even at familiar crossings, they need to have information about the status of the pedestrian signal
- Using traffic sounds can result in delay in beginning crossing (average of 8 seconds after walk interval begins)

Standards and Guidance

- ADA regulations
- 2011 Proposed PROWAG
- 2009 MUTCD
- PROWAG proposal and MUTCD standards and guidance were based on two major research projects
  - National Eye Institute: *Blind pedestrians' access to complex intersections*
  - NCHRP Project 3-62 *Guidelines for Accessible Pedestrian Signals*

ADA Regulations - Department of Justice

- Public entities need to be certain that
  - §35.150(a) Each service, program, or activity … is readily accessible to and usable by individuals with disabilities.
  - §35.160 …communications with applicants, participants, members of the public, and companions with disabilities are as effective as communications with others
  - … shall furnish appropriate auxiliary aids and services … to afford individuals with disabilities.. an equal opportunity to participate in, and enjoy the benefits of, a service, program, or activity of a public entity

Proposed PROWAG

- Not a final rule, but provides guidance to make intersections ‘accessible to and usable by individuals with disabilities”
  - Would require APS where pedestrian signals are installed
  - Refers to MUTCD for device and location specifications

2009 MUTCD

- Guidance on pushbutton location in Part 4, section 4E.08
- Standards and guidance regarding Accessible Pedestrian Signals in Part 4, sections 4E.09 – 4E.13

MUTCD general information/standards

- The information provided by an accessible pedestrian signal shall clearly indicate which pedestrian crossing is served by each device
- Accessible pedestrian signals shall not be limited in operation by the time of day or day of week
- At accessible pedestrian signal locations where pedestrian pushbuttons are used, each pushbutton shall activate both the walk interval and the accessible pedestrian signals

Required Features of APS (2009 MUTCD)

- Pushbutton locator tone
- Audible walk indication - audible at the beginning of the associated crosswalk
- Vibrotactile walk indication - tactile arrow that vibrates
- Locator tone and walk indication volume adjusts in response to ambient noise levels
- Tactile arrow aligned parallel to direction of travel on crosswalk, high visual contrast

Pushbutton-integrated APS

- Pushbutton locator tone during Don’t WALK and Flashing DON’T WALK
- Rapid tick WALK indication

Pushbutton-integrated APS

- Pushbutton locator tone during Don't WALK and Flashing DON'T WALK
- Speech walk indication

Pushbutton Locator Tone

- Sound comes from the pushbutton
- Provides information about pushbutton presence and location
- 1 tone per second, each tone less than 0.15 seconds in duration
- Volume set to be heard within 6 – 12 feet, or at the building line, whichever is less
- Different sounds acceptable (click, beep, etc)

Audible WALK indication

- Required to be audible at the beginning of the associated crosswalk
- Rapid tick WALK indication at locations where the speakers for APS for two different crosswalks are separated by at least 10 feet
- Speech message when two APS on a corner must be mounted closer than 10 feet to each other
  - Standard language required for speech message
  - Pushbutton information message required

Vibrotactile WALK indication

- Vibrotactile WALK indication - arrow that vibrates during WALK
- Particularly useful for pedestrians who have both hearing and visual impairments
- Have to be standing with hand on pushbutton to use it

Quiet volume

- Relatively quiet unless audible beaconing is called
- Volume only 2-5dB over ambient noise level
- Audible within 6 - 12 feet of the pushbutton, or the building line, whichever is closer

Automatic volume adjustment

- Volume of pushbutton locator tone and audible walk indications adjusts in response to ambient sound
  - Louder when traffic is loud or there is other noise at the intersection
  - Quiet when traffic or other sounds are quieter (night)

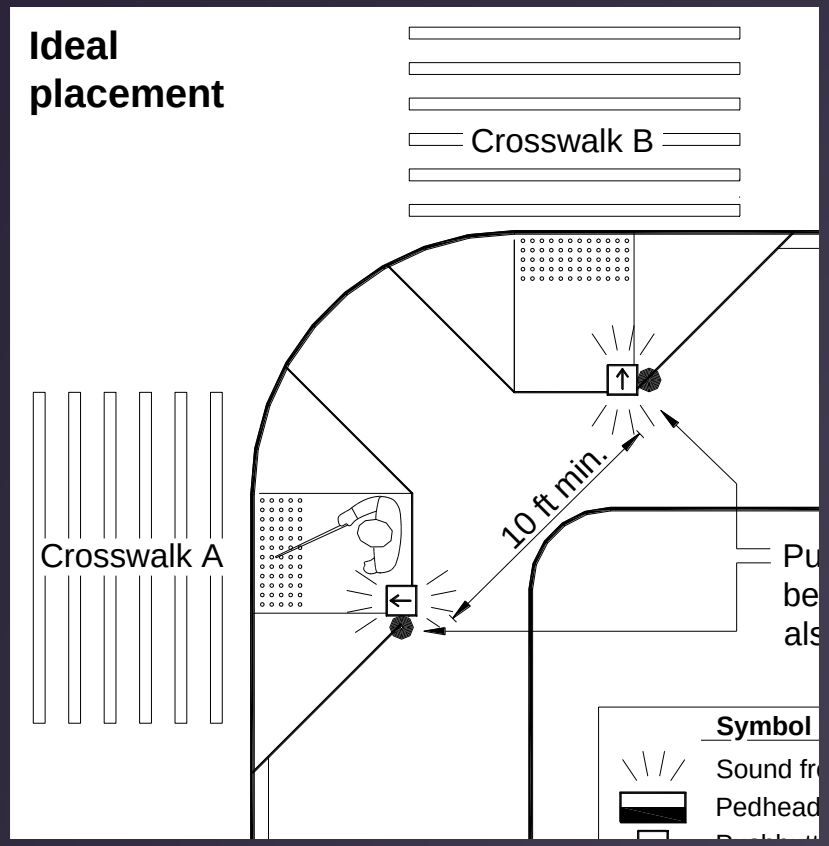
Tactile arrow

- Raised arrow aligned with direction of travel on the crosswalk controlled by the pushbutton
- Arrow may be on the pushbutton or on part of the device or sign above the pushbutton
- Arrow vibrates during WALK

Device location is critical

- Provide information to the user through proximity to the departure point
- Impose less of a cognitive load on pedestrians who are visually impaired
  - ‘I have pushed the button on my right’
  - ‘The WALK indication is coming from my right’
  - ‘That sound is for my crosswalk’
- Signal can be quieter due to proximity

Installation location recommendations



- Beside a level area
- Separated by more than 10 feet from other APS on corner
- Within 5 feet of crosswalk line furthest from the center of the intersection
- No more than 6 feet from curb with allowance for up to 10 feet

Installation Example

- Near departure point
- Poles separated by more than 10 feet
- Low sound intensities
- Vibrotactile available

Installation example

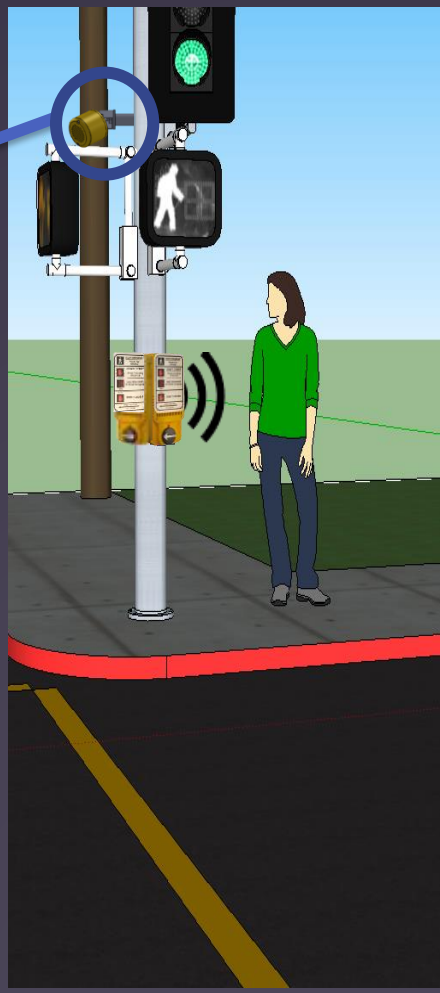
Other possible features mentioned in MUTCD

- Actuation indicator (pilot light and wait message)
- Braille street name labels
- Crosswalk maps
- Pushbutton information messages
- Audible beaconing

Pilot light or actuation indicator

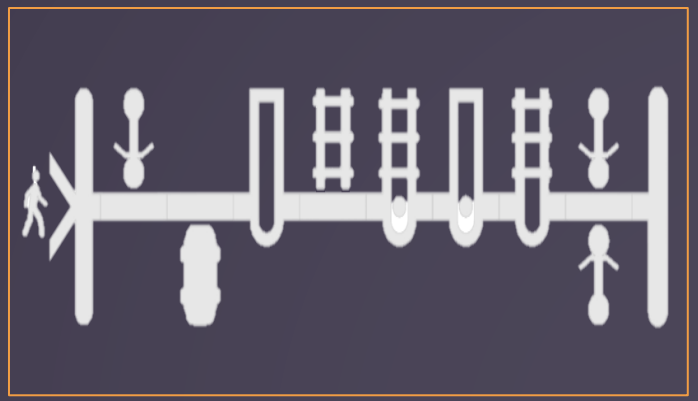
Audible beaconing

- Optimal for large busy intersections
- Additional speaker mounted on the ped head
- Sound from far end of crosswalk
- Focused on broadcasting sound on the latter two thirds of the crossing
- Audible beacons recommended when there are large and complex crossings. (MUTCD 4E.13)



Tactile crosswalk map

- Map/graphic for each crossing
- No standards for symbols at this time
- Raised symbols represent vehicle lanes, bike lanes, medians, train tracks and direction of traffic



Audible countdowns not currently allowed by MUTCD

- Speech of countdown is more constant sound than locator tone
- Can mask sound of traffic blind pedestrians need to hear
- Speech not as localizable as locator tone sound
- Blind pedestrians don't know how far it is to the end of crosswalk
- Per MUTCD 4E.12: "Following the audible walk indication, accessible pedestrian signals shall revert to the pushbutton locator tone … during the pedestrian change interval."

Recent possibilities and additions

- Bluetooth communication
- Various Apps

Bluetooth communication to APS devices

- Allow signal techs to adjust features remotely or without opening APS or pedestrian signal head
- Allow user with app to push button from phone or other ‘fob’ type device
- May provide other intersection signal information
- May increase volume of locator tone

Bluetooth communication between APS devices

- Device wired just to pedhead can communicate with APS at other end of crosswalk
  - actuation indicator
  - audible beaconing
- Other possibilities in future?

Handheld or personal devices

- Don’t replace an APS that is available on the street any more than they replace the visual pedestrian signal
- Individuals who are elderly, blind, or deafblind should not have to know about a special program or get a special device to access pedestrian signal information

Handheld or personal devices

- Even if a person knows about special program/app or device
  - May forget device
  - Battery may be dead
  - Hands can be full/occupied
  - May be unable to use it effectively
  - May be unable to afford to purchase or maintain device
- Supplemental to APS and pedestrian signal information!

Summary

- In order to know when the WALK is displayed, APS are needed by pedestrians who are blind or who have low vision, and by many elderly persons
- Particularly important at intersections with
  - Protected turns
  - Leading Pedestrian Intervals
  - Exclusive pedestrian phases
- We have standards based on research
- Need to be aware of the standards and use them in APS installation

MORE INFORMATION

www.APSGuide.org

Some research articles listed on next few slides

Thanks to Polara Enterprises, Campbell Company, and Lukas Franck for photos

Discussion

- ⇨ Send us your questions
- ⇨ Follow up with us:
  - ⇨ Elizabeth Hilton elizabeth.hilton@dot.gov
  - ⇨ Janet Barlow jmbarlow@accessforblind.org
  - ⇨ Dr. Robert Wall Emerson robert.wall@wmich.edu
  - ⇨ General Inquiries pbic@pedbikeinfo.org
- ⇨ Archive at www.pedbikeinfo.org/webinars

Resources - 1

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