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

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

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April 30, 2020

Meet the Panelists

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How Blind People Travel - 2

April 30, 2020

Janet M. Barlow

Accessible Design for the Blind

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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

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

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

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

NCHRP 3-78b - Orientation and Alignment Cues

- NCHRP 3-78b *Guidelines for the Application of Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Vision Disabilities*
- Research on wayfinding at roundabouts and channelized turn lanes
- NCHRP Report 834 published 2017
  - Wayfinding assessment
  - Can be applied to other types of intersections

Example from Guidelines

Figure 3-5: Detectable landscape separation at roundabouts

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

The Travel Experience for People with Vision Disabilities

Donna Smith
Manager Accessible Services
Sound Transit

Different People Travel Differently

- Onset of blindness
- Training received
- Opportunity/willingness to explore
- Level of risk
- Personality – bold vs timid

SoundTransit

Nonvisual Cues for Travel

- Auditory cues: traffic, pedestrians, echo location
- Tactile cues: surface underfoot, information from cane tip or motion of dog guide, things touched
- Scents that are reliably in the same place

Street Crossing – T Intersection

Judging when to cross without an accessible pedestrian signal

Tactile Wayfinding in Rail Stations

Tactile Wayfinding for Bike/Ped Space

Tactile feature for Transit Island

Mitigating Stress

- Consider the travel needs of everyone
- Install accessible pedestrian signals
- Include tactile features in the design
- Use braille signs and audio messaging
- What benefits people with disabilities will benefit everyone!

Thank You!

- Donna Smith
- Sound Transit
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Tactile Walking Surface Indicators to Aid Wayfinding

April 30, 2020

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Tactile Walking Surface Indicators (TWSIs)

- Developed in Japan in 1960’s
- A guidance and warning system
  - Raised domes or truncated domes to indicate caution, a transition, or point of interest
  - Raised bars oriented in direction of travel, to indicate a path of travel
- Used with variations, to some extent, in most developed urban areas of the world
- Broadly standardized in ISO 23599 *Assistive products for persons with vision impairments and persons with vision and hearing impairments—Tactile walking surface indicators*

TWSIs in the US

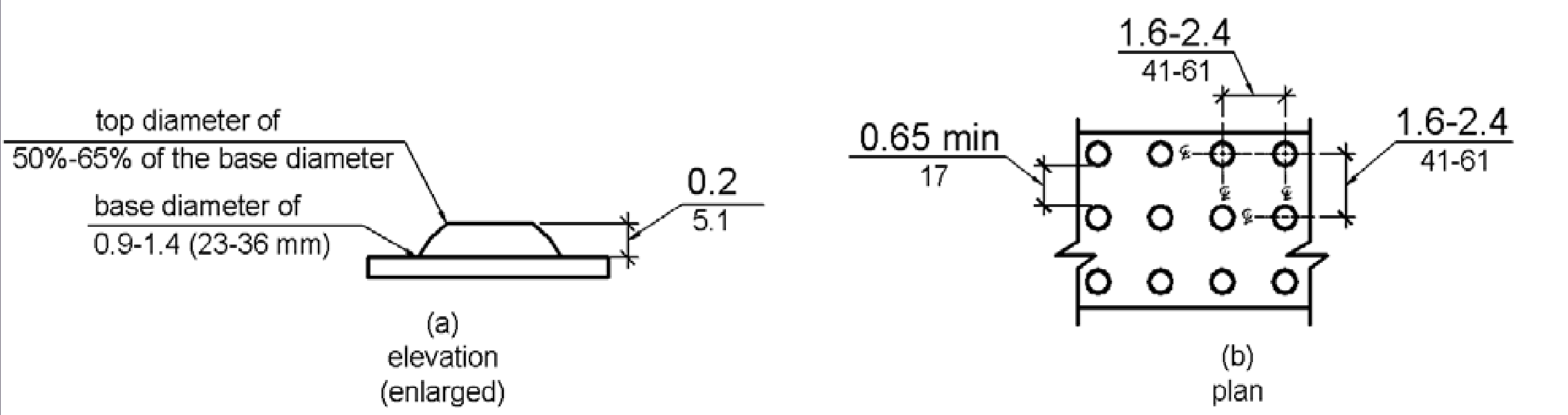
- Truncated domes used in US as “detectable warning surfaces” (DWS)
  - Primarily used to mark the limit of a safe path of travel, such as at a platform edge, or blended transition between sidewalk and street, such as the bottom of a curb ramp
  - Standardized in 2006 DOT Standards and 2010 ADA Standards, based on research
- Guidance surfaces little used in US to date
  - Most surfaces are raised bars, but they vary in dimensions and in the way they are used

DWS Research in US

- Many projects, beginning in 1980
  - No surface comprised of grooves in concrete was found to be detectable
  - Surfaces comprised of raised domes or truncated domes, or raised bars, .2 in high, were highly detectable
  - 24 in width in the direction of travel was necessary for most travelers with vision disabilities to detect them and come to a stop without going beyond them
- 24 in of truncated domes increased safety at platform edges and curb ramps <u>for all riders</u>

2006 DOT Standards

- Section 705 specifies DWS dome size, spacing, and visual contrast--Range of spacing and dome size permitted
- Required at transit platform boarding edges
  - 24 inches (610 mm) wide
  - Full length of the public use areas of the platform.



2006 DOT Standards

- Detectable Warnings required at curb ramps
  - Full width of the curb ramp (exclusive of flared sides)
  - Extend either the full depth of the curb ramp, or 24 inches (610 mm) deep minimum measured from the back of the curb on the ramp surface.

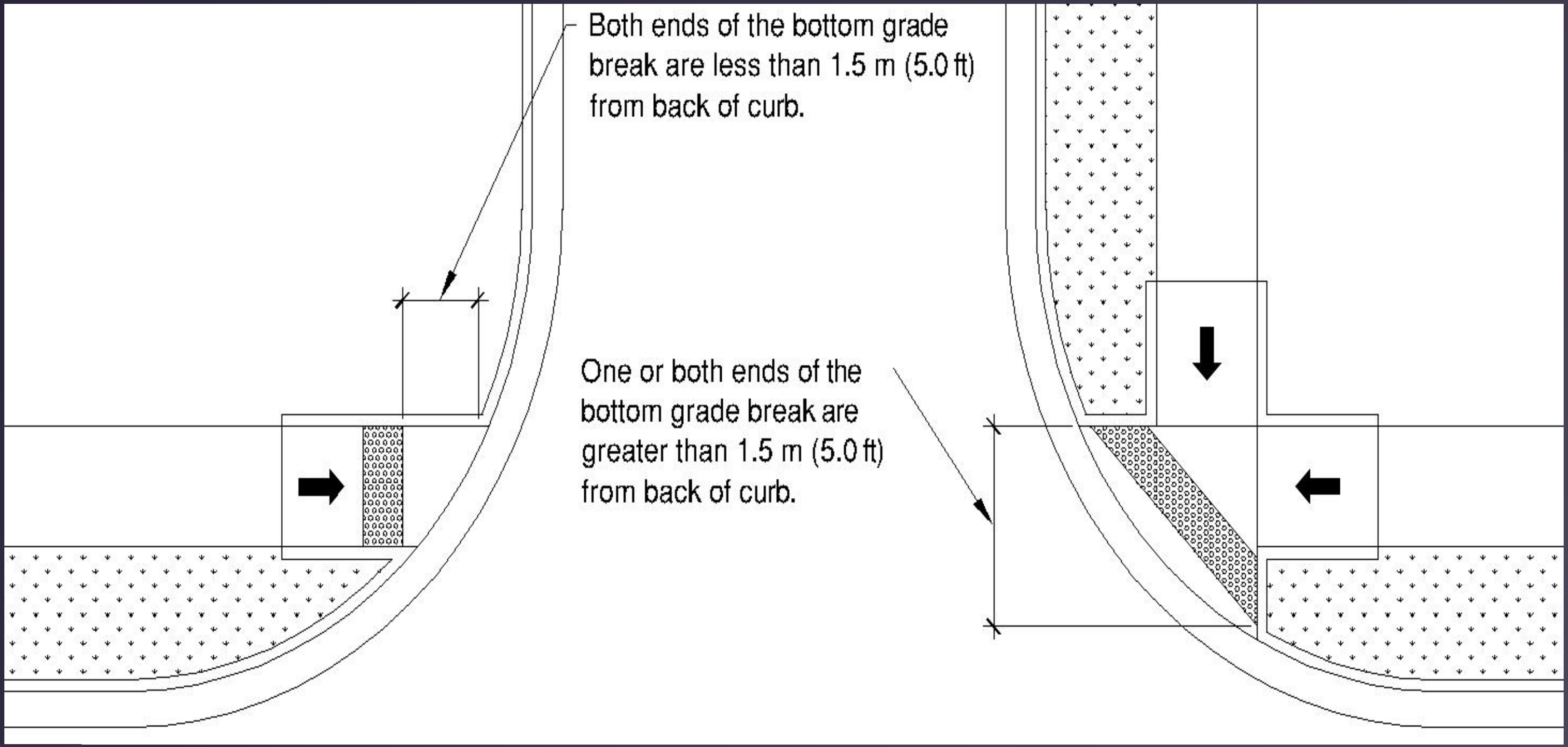
2010 ADA Standards

- Specifications for Detectable warnings the same as in the 2006 DOT Standards
- Only required at transit platforms

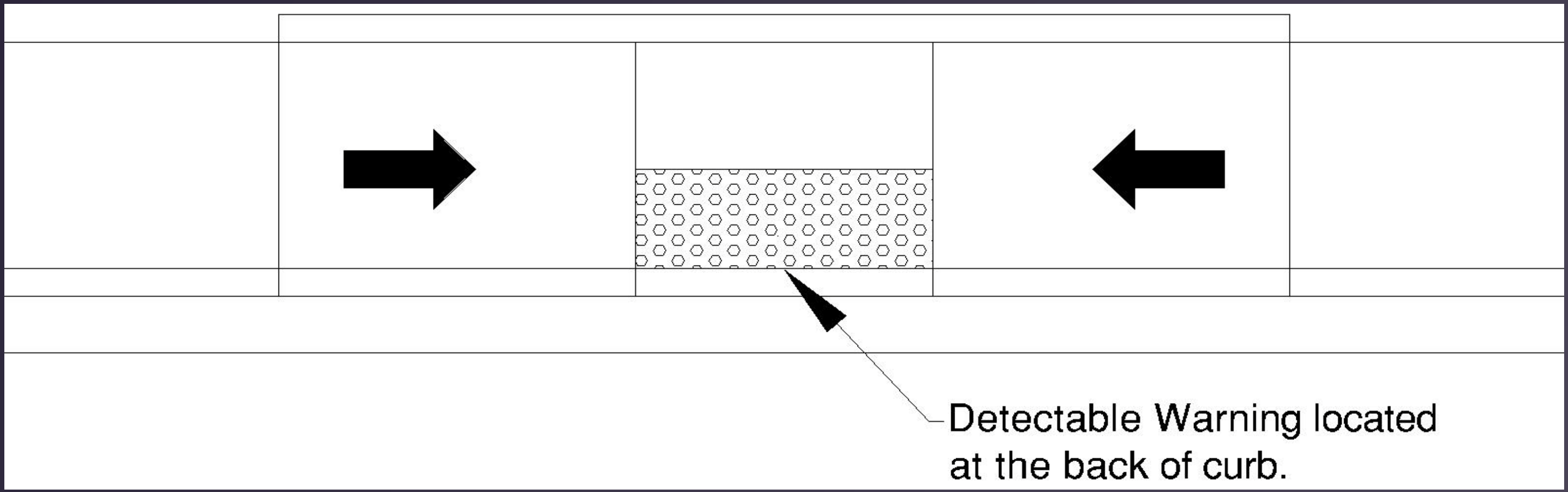
2011 PROPOSED PROWAG

- Same standards for dome size, spacing and visual contrast as DOT/ADA Standards
- Added much more specific language regarding DWS placement on curb ramps and medians/islands
- Three types of ramps described/shown
  - Perpendicular
  - Parallel
  - Blended transition

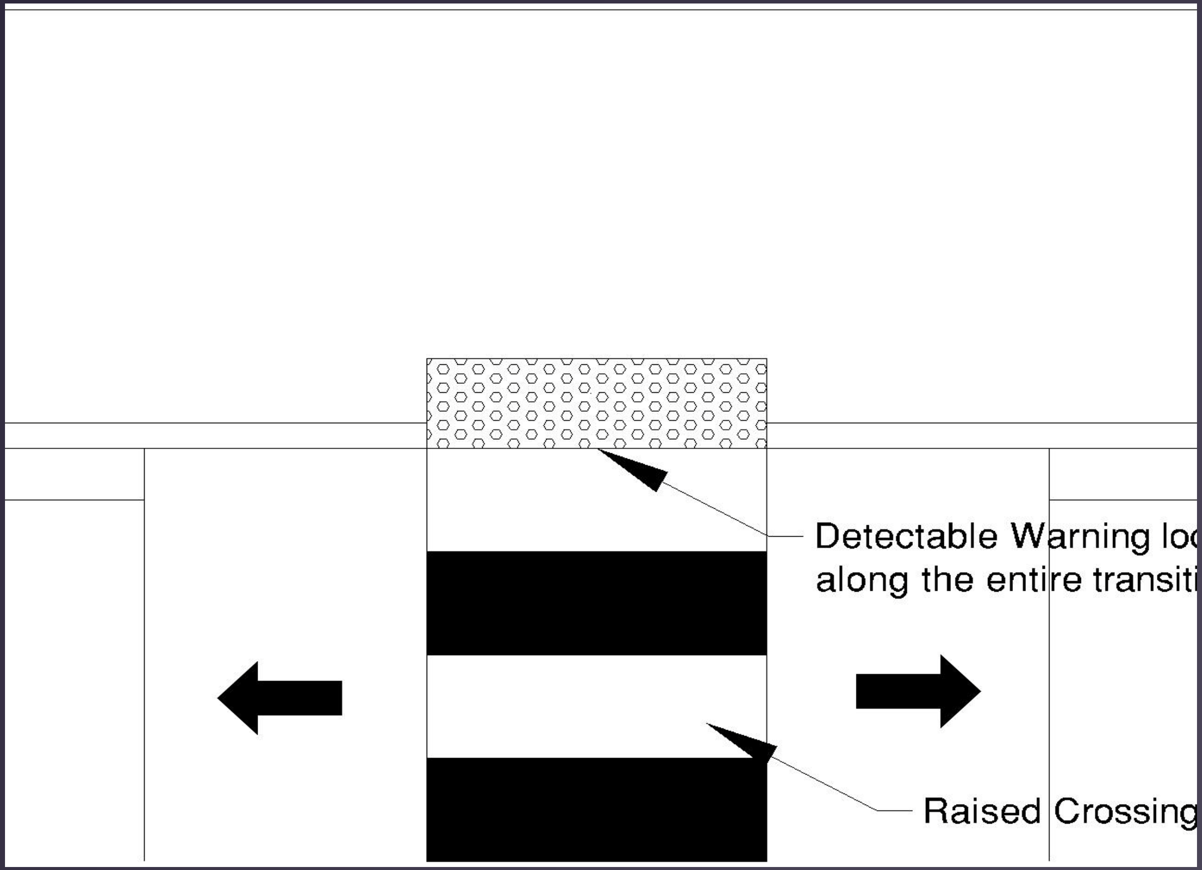
2011 PROPOSED PROWAG
Perpendicular curb ramps



2011 PROPOSED PROWAG
Parallel Curb Ramps



2011 PROPOSED PROWAG
Blended Transitions



Example Installation--DWS

Photo credit: Lee Rodegerdts

Example installations

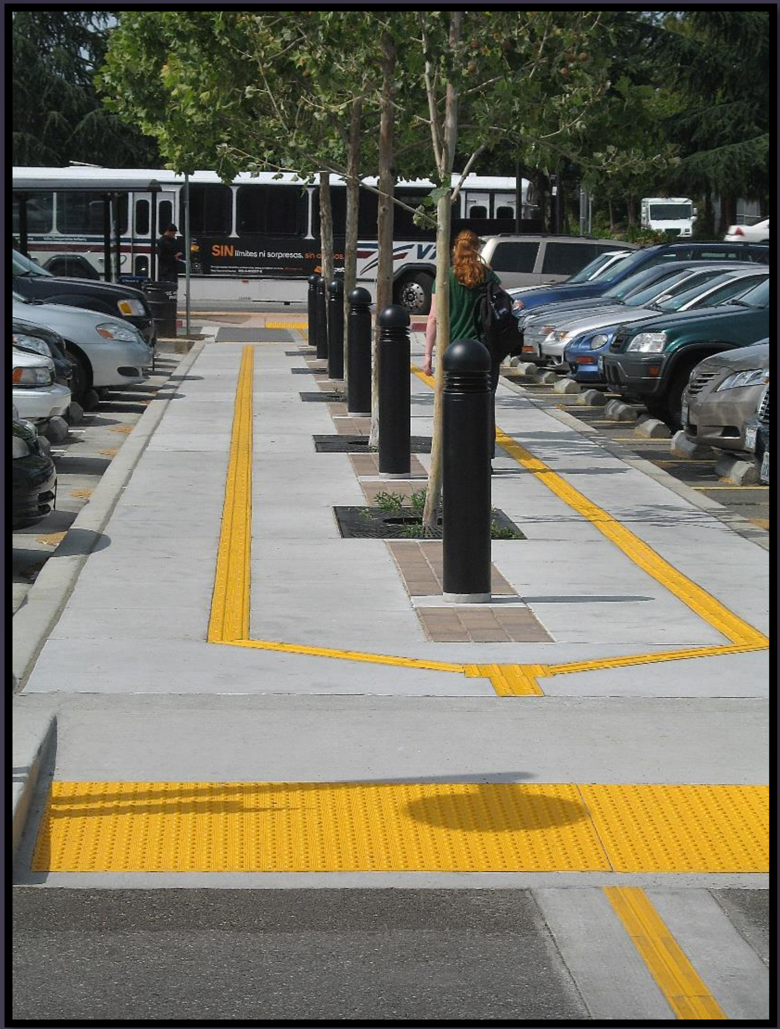
Guidance surfaces (GS)

- Not standardized in US
- Typical surface is raised parallel bars less than ¼ inch high

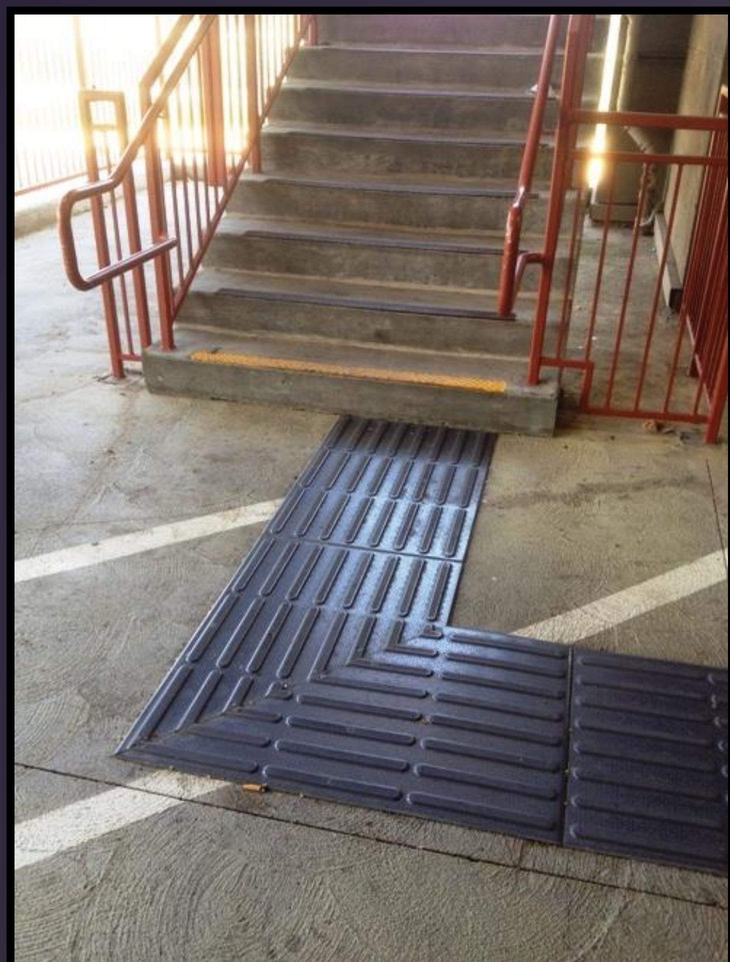
Guidance surfaces (GS)

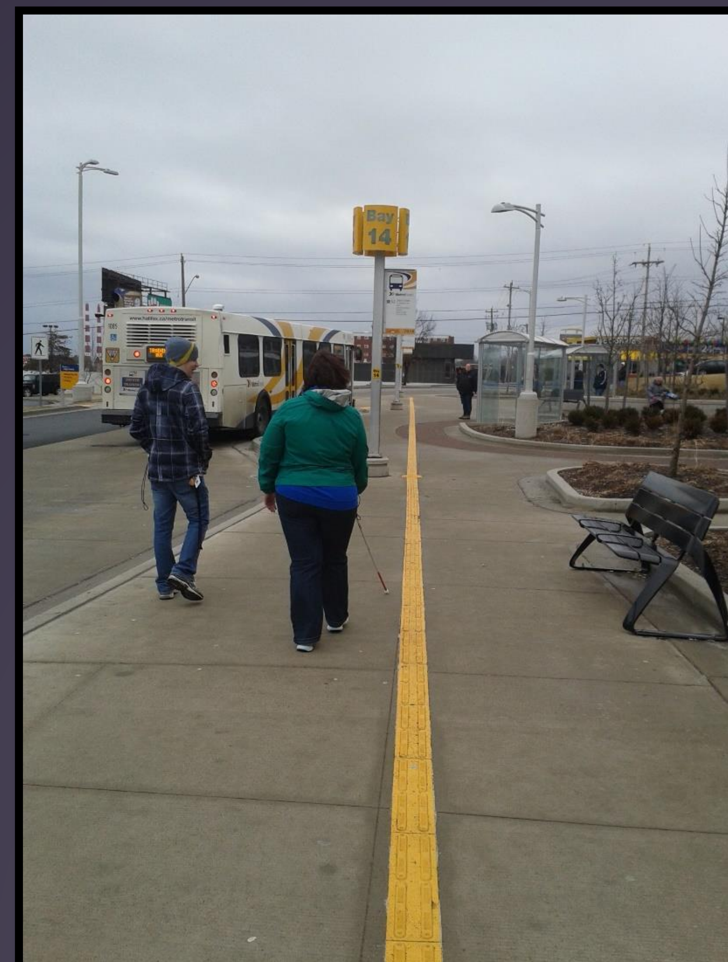
- Installed at a number of transit properties, including in and around some bus and rail stations
- Most use a raised bar surface
- Surface geometry, surface width, and installation locations vary

Example installations – GS varying widths



Example installations – GS varying widths





Transit platform usage

- DWS at edge of platform
- Guidance surface to indicate location of door

GS between bike lane and sidewalk

- 6-inch (150-mm) wide guidance surface is used to delineate between the pedestrian and cycle areas in a sidewalk-level separated bikeway.
- 24-inch (600-mm) deep area of a DWS indicates where pedestrians are intended to cross the bikeway

Detectable surfaces - grooved surface intended as guidance surface at shared street was not detectable

- Need
  - Underfoot detectability
  - Cane detectability
  - Not impediment to wheelchair users

"Surfaces that are reliably detectable and identifiable should be used to define a linear, obstacle-free pedestrian access route through the comfort zone."

ACCESSIBLE SHARED STREETS

NOTABLE PRACTICES AND CONSIDERATIONS FOR ACCOMMODATING PEDESTRIANS WITH VISION DISABILITIES

U.S. Department of Transportation
Federal Highway Administration

OCTOBER 2017

Publication Number: FHWA-HEP-17-096

Recently Completed Research

- To identify a delineator for separated bike lanes at sidewalk level
  - Highly detectable to pedestrians with vision disabilities
  - Crossable by people with mobility disabilitie
- An activity of the Better Market Street Project, San Francisco
- Recommendation: A raised trapezoidal strip .75 inch high, 6.25 inches wide at the top, with sloping sides at a 22 degree angle

On-Going Research on TWSIs

- Effect of guidance surfaces on travelers with vision and mobility impairments
  - Administration for Community Living, National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR) grant #90IF0127
  - Research on a novel use of GS to aid in locating crosswalks and aligning to cross in challenging locations

On-Going Research on TWSIs

- Tactile Wayfinding in Transportation Settings for Travelers Who Are Blind or Visually Impaired
  - TCRP B-46—Highway Safety Research Center, UNC
  - Laboratory research
    - Identify geometry of guidance surface that is highly detectable and discriminable from DWS
    - Determine whether special indicator surface is needed at choice points and identify a recommended surface if needed
  - Field research in transit and public rights-of-way settings in at least two cities
  - Preparation of comprehensive guidance for use of TWSIs in transit and public-rights-of-way, including DWS, guidance surfaces, and delineators for use between pedestrians and bikes on separated bike lanes at sidewalk level

For additional information contact bbentzen@accessforblind.org

Effect of guidance surfaces on travelers with vision impairments

Funded by NIDILRR
Project # 90IF0127

The original problem

Once wheelchair ramps became prevalent, it was easy for pedestrians who are blind to walk out into the street without realizing it

The solution

TWSIs (truncated domes, detectable warnings)

https://commons.wikimedia.org/wiki/File:Detectable_Warnings.jpg

TWSIs (DWS)

Indicate change from walking surface to road surface when there is no level change

Secondary problem: TWSIs often misunderstood to indicate where to stand to cross or to provide alignment for crossing

Photo by Robert Wall Emerson

Photo from http://www.transcanadatraffic.ca/TekWay.html

Photo from https://armor-tile.com/projects/

When used judiciously, bar surfaces may provide alignment information*

*Scott, A. C.. Barlow, J. M., Guth, D. A., Bentzen, B. L., Cunningham, C. M., & Long, R. (2011). Nonvisual cues for aligning to cross streets. *Journal of Visual Impairment & Blindness, 105*(10) 648-661.

This project

Used tactile bar tiles (guidance surfaces) to

- indicate where a pedestrian should stand to cross and
- to provide alignment information

Intended for use at crossings places that may be confusing or difficult to find (e.g., roundabout crosswalks, mid block crossings, very rounded corners, angled or skewed crosswalks)

Intended to be used in conjunction with detectable warnings

Phase 2 – Visual Impairments

- Types of placements: midblock crossing, roundabout, 4 leg regular intersection (2 corners), crossing top of a T, skewed crossings, large radius corners, apex ramps
- Collected data in Sarasota, FL, and Alexandria, VA (extended placements at corner and non-corner crossings), then Seattle, WA and again in Alexandria (smaller 2 by 2 foot segments).

Photo by Robert Wall Emerson

Phase 1 – Mobility Impairments

- Participants used: manual wheelchairs, power chairs, mobility canes, forearm crutches, and rolling walkers

- Moved over raised bar surfaces in different orientations

- The surfaces did not create major problems but there was a general preference for moving across them parallel to the pedestrian line of travel, when traveling along the sidewalk

Photo by Beezy Bentzen

Peds found the surfaces well

	Sarasota	Alexandria 1	Seattle	Alexandria 2
% of trials peds contacted GS	78.6	92.2	96.1	94.2

Alignment was faster

	Sarasota	Alexandria 1	Seattle	Alexandria 2
Without surface	95.6	78.2	61.2	85.6
With surface	73.0	73.4	48.2	74.0

Aligned was better

	Sarasota	Alexandria 1	Seattle	Alexandria 2
Without surface	39.0	30.0	22.8	16.8
With surface	73.2	73.2	79.1	75.7

Pedestrians aligned on ramp, DWS, or guidance surface

	Sarasota	Alexandria 1	Seattle	Alexandria 2
Without surface	81.2	57.8	34.3	40.0
With surface	97.6	85.3	91.2	93.3

Pedestrians aligned within crosswalk

	Sarasota	Alexandria 1	Seattle	Alexandria 2
Without surface	83.3	84.7	77.5	80.0
With surface	92.9	87.1	95.1	97.5

General findings

- Pedestrians who are blind were generally able to use surfaces to align to crossings and be more correctly aligned than without them

BUT

- Finding the surfaces, if they were there, was not always a sure thing
- If a person has particularly poor orientation or is unfamiliar with the surfaces, they may further confuse the pedestrian or not be of use

- Consistency of use will be key in useful implementation

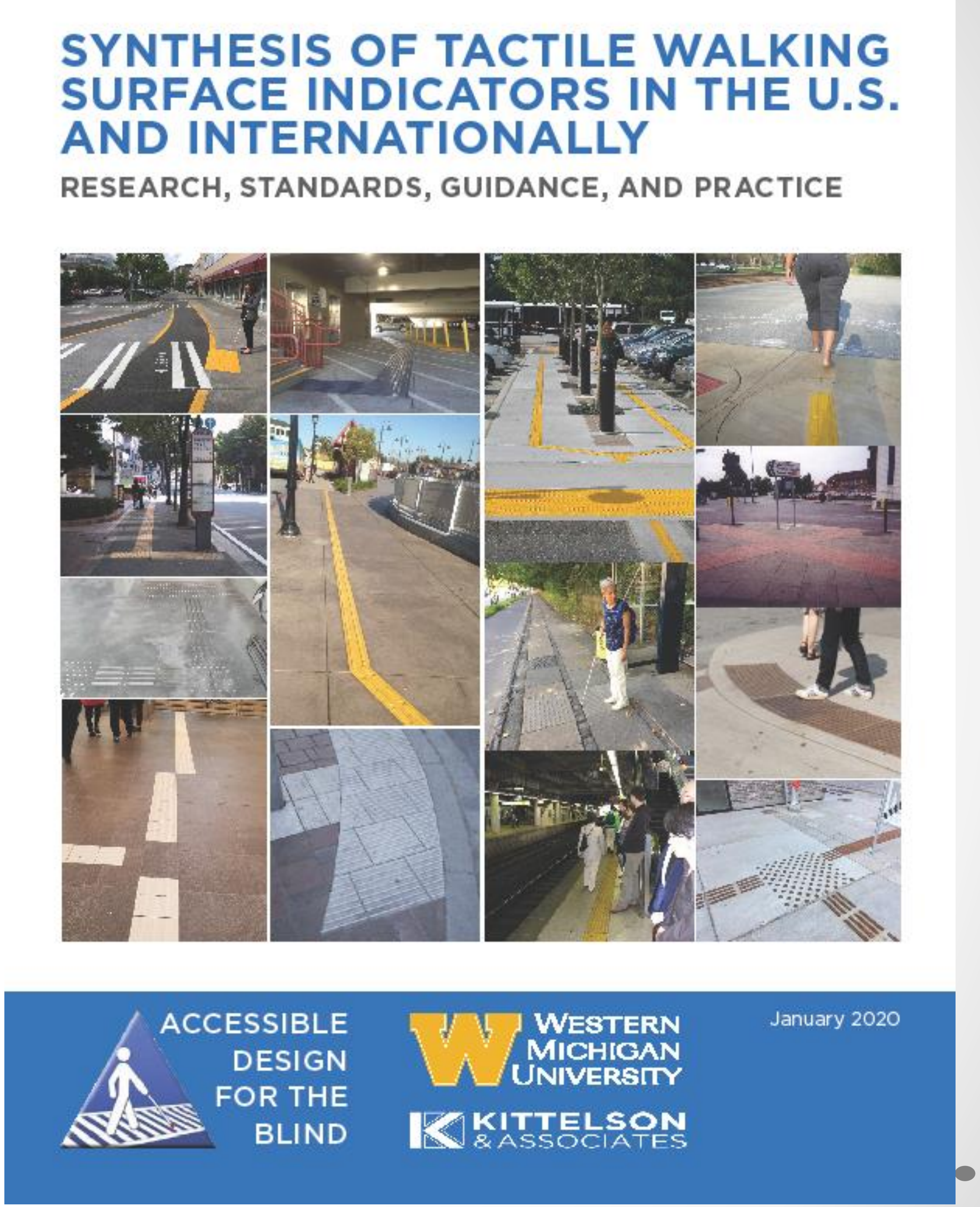
Installation notes

- Placement for non-corner crossings might need to extend across the sidewalk to the building line
- Corner placements would likely be smaller segments placed next to DW
- With very skewed crossings, it was sometimes problematic figuring out where to place the surfaces to minimize impact on ramps

Thanks !

Guidance document in preparation

"A guidance surface to help vision disabled pedestrians locate crosswalks and align to cross"



Identifying a Delineator for Separated Bike Lanes at Sidewalk Level

April 30, 2020

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Part of redevelopment project

Goal--Improve travel for pedestrians, cyclists, and transit riders along a 2.2 mile stretch of Market Street, San Francisco

- Limit access to vehicles other than transit
- Increase sidewalk width
- Provide a sidewalk-level bikeway to increase safety of cyclists
- Provide a detectable tactile delineator between pedestrians and cyclists

Approach to identifying a delineator

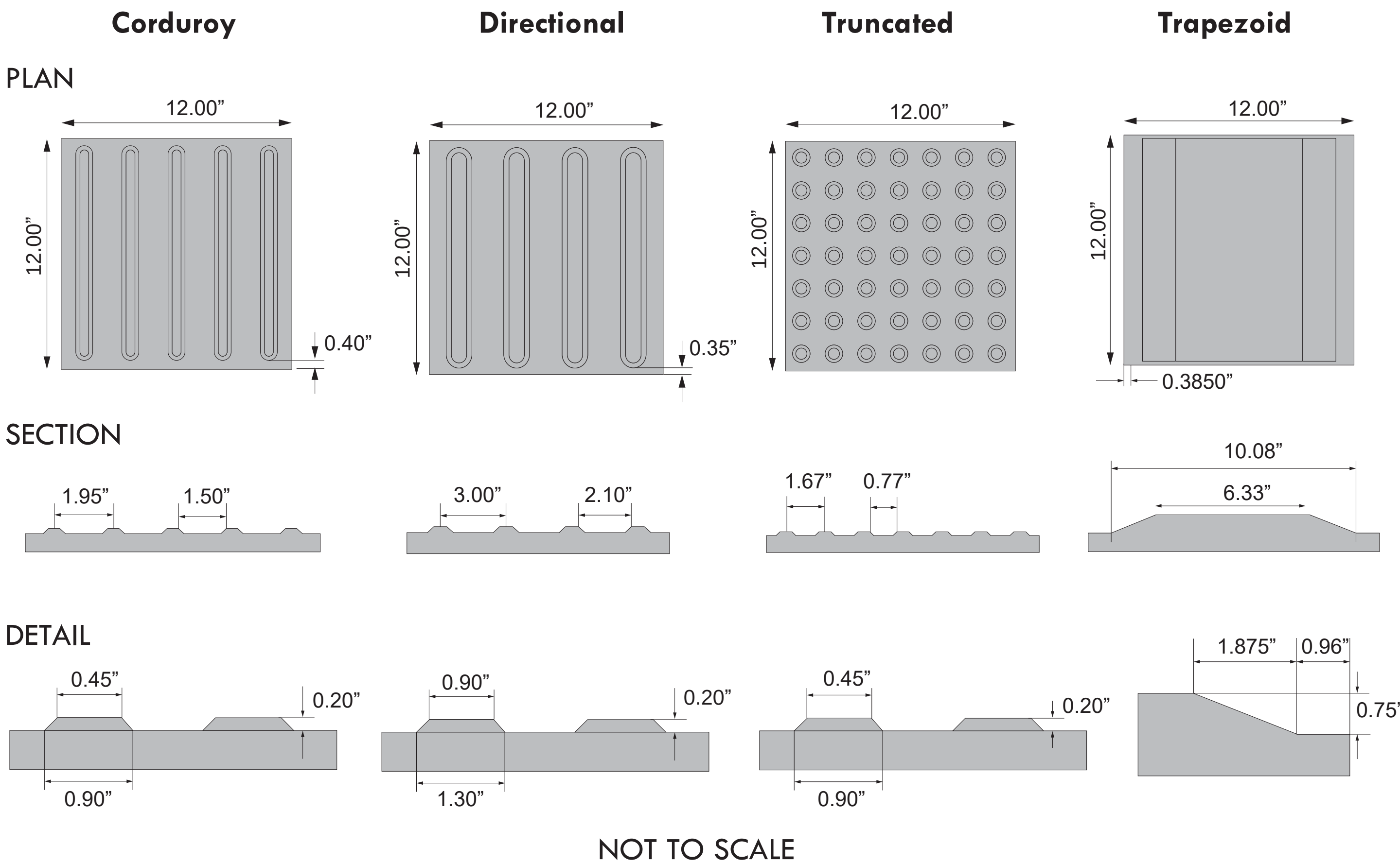
- No US standard or guidance
- Human factors research was conducted to identify a delineator that was
  - At least as reliably detected by pedestrians who are vision disabled as truncated domes
  - Accurately identified by by pedestrians who are vision disabled
  - Not a barrier to crossing by people having mobility disabilities

Choosing surfaces to test

Human factors considerations

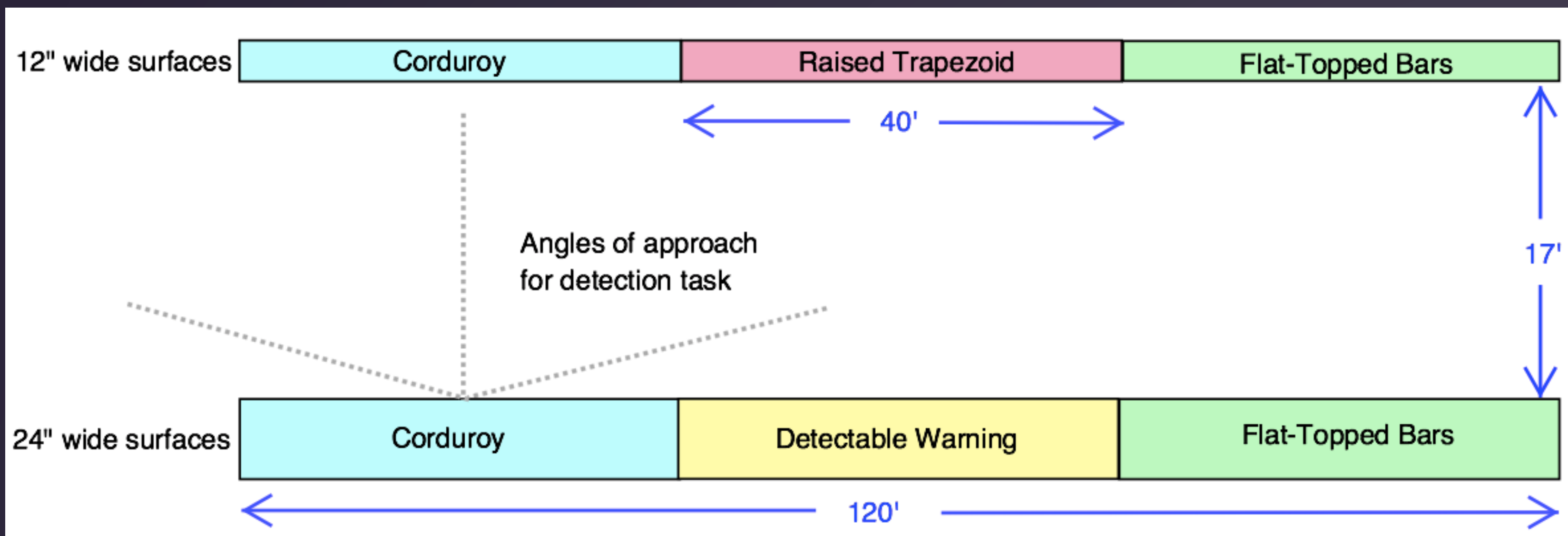
- Research shows that they are likely to be highly detectable to pedestrians with vision disabilities, uniquely identifiable, and easy to follow
- Research or experience shows that they are likely to be crossable by people with mobility impairments
- Experience shows that they are likely to cause no adverse effects for cyclists or other pedestrians

All surfaces tested



The Corduroy and Directional surfaces were tested at 12” wide and 24” wide.

Layout of surfaces for testing



Surfaces were embedded in concrete,
which was level with the base of each surface

Research participants

- 26 vision disabled--using a long cane
- 30 mobility disabled—using manual or power wheelchairs, cane/s, crutch/es, various walkers, and no aid, but had difficulty walking

Vision disabled participants--Procedures

- Detection
  - Approach each surface 6 times—2 approaches from 90°; 2 approaches each from approximately 25° angles to the left and to the right
- Identification
  - With guide, step onto surfaces 8 times from various angles. Step off after 3 sec. and identify surface as “domes,” “bars,” (any kind), or “trapezoid”
- Following
  - Follow each surface for 40’, with surface on left and on right

Detection

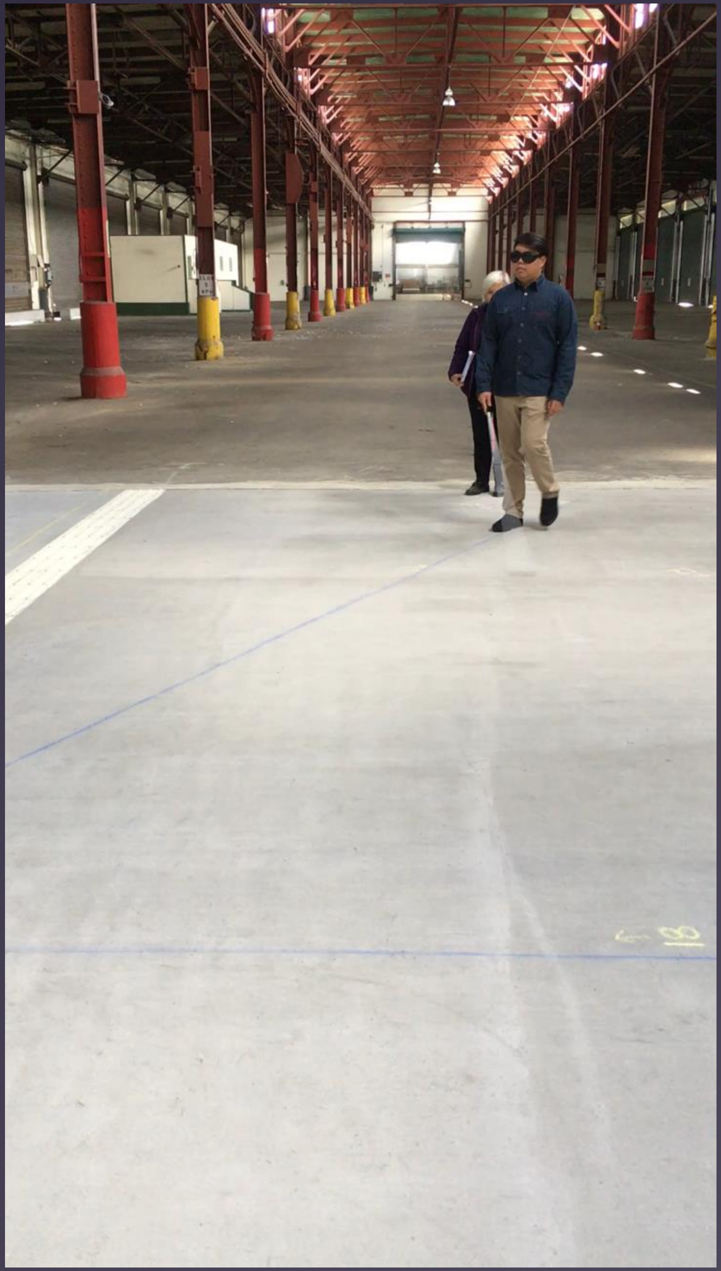
Vision disabled participant approaching 12” wide corduroy from 90º.

Detects surface with cane and stops without stepping on it. Cane intrudes more than 6” into bikeway.

Detection

Vision disabled participant approaching 12″ wide directional surface from 25º.

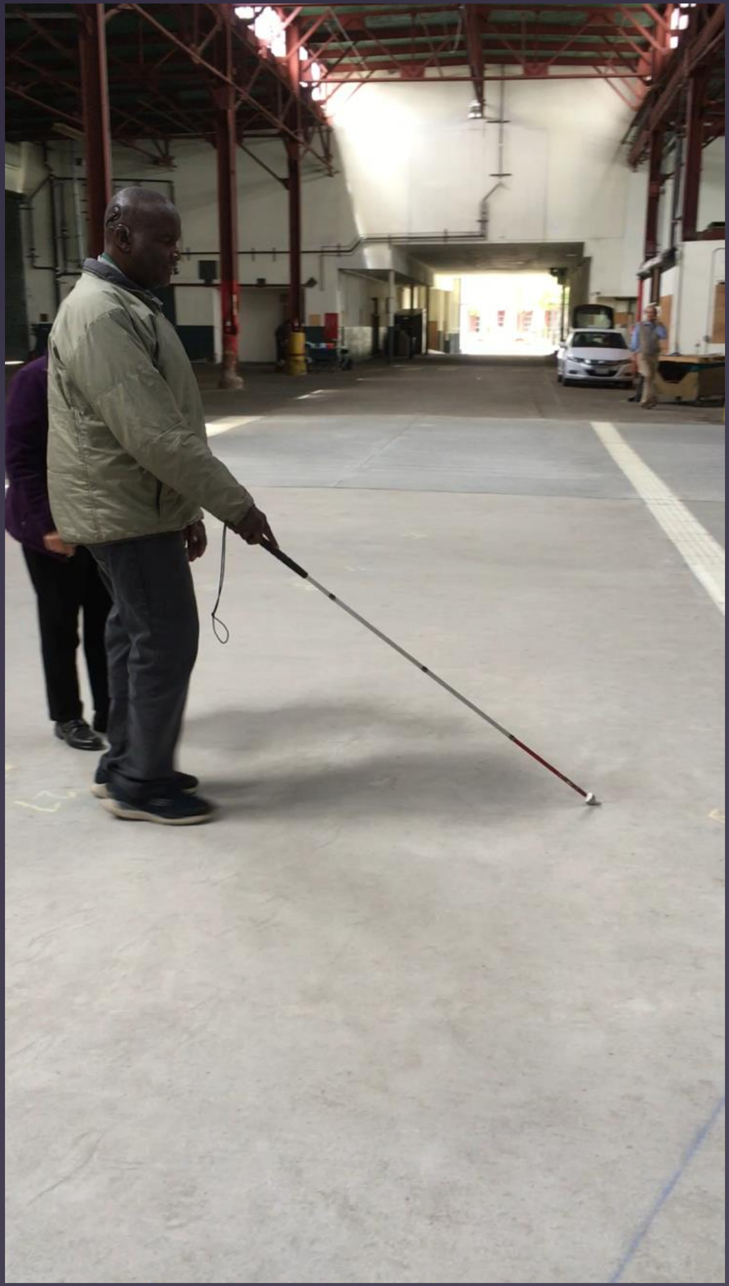
Detects surface with cane and stops without stepping on it. Cane does not intrude more than 6″ into bikeway.



Detection

Vision disabled participant approaching 12″ wide trapezoidal surface from 90º.

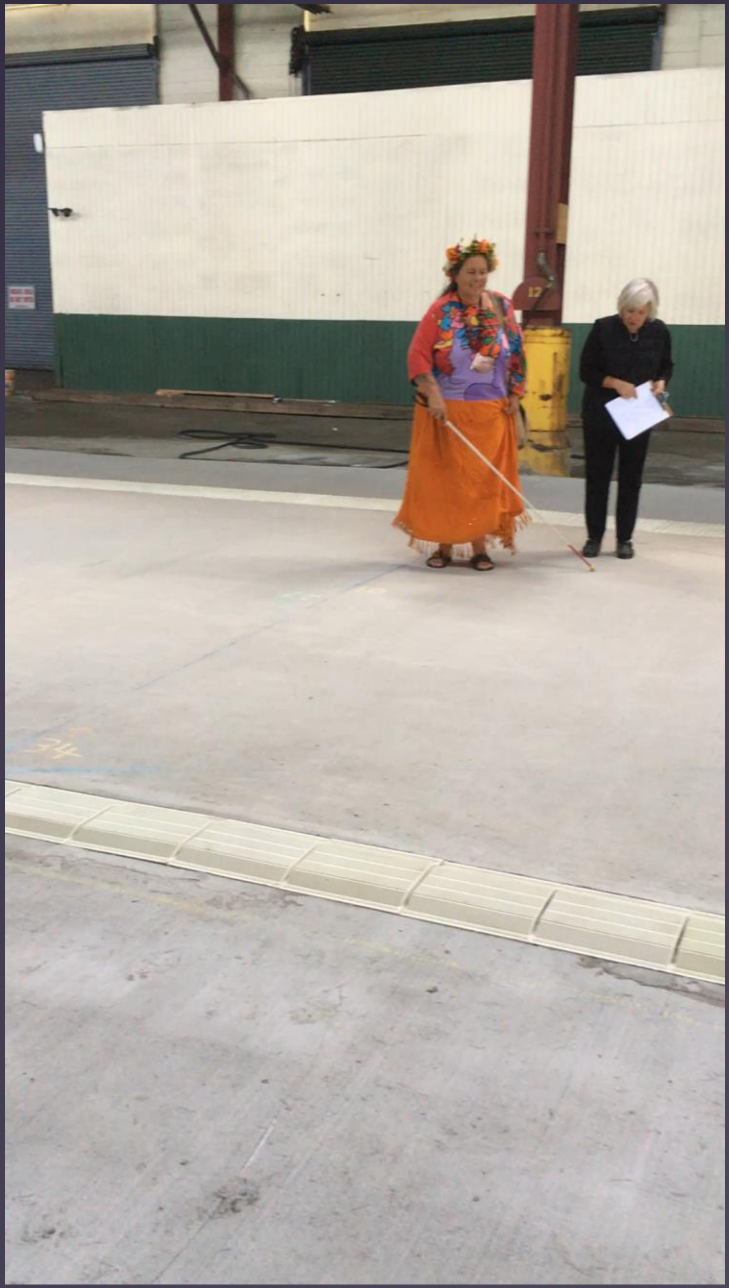
Contacts surface with cane but stops only after stepping on it. Cane intrudes more than 6″ into bikeway.



Detection

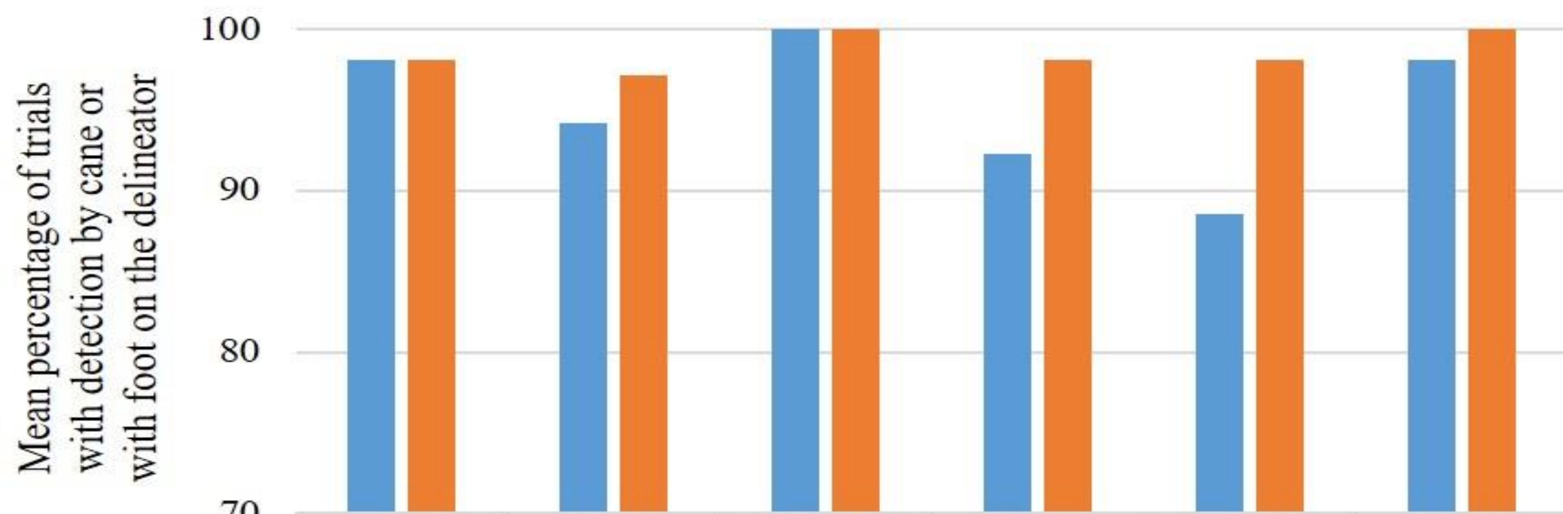
Vision disabled participant approaching 12” wide trapezoidal surface from 25º.

Detects surface with cane and stops without stepping on it. Cane intrudes more than 6” into bikeway.



Detection--Long cane users

% of trials on which surface was detected by cane or foot. No significant differences between surface geometry or width, or perpendicular vs. angled approach



Approach	DWS	24" Corduroy	24" Flat-Top Bars	12" Corduroy	12" Flat-Top Bars	Trapezoid
Perpendicular	98.1	94.2	100.0	92.3	88.5	98.1
Angled	98.1	97.1	100.0	98.1	98.1	100.0

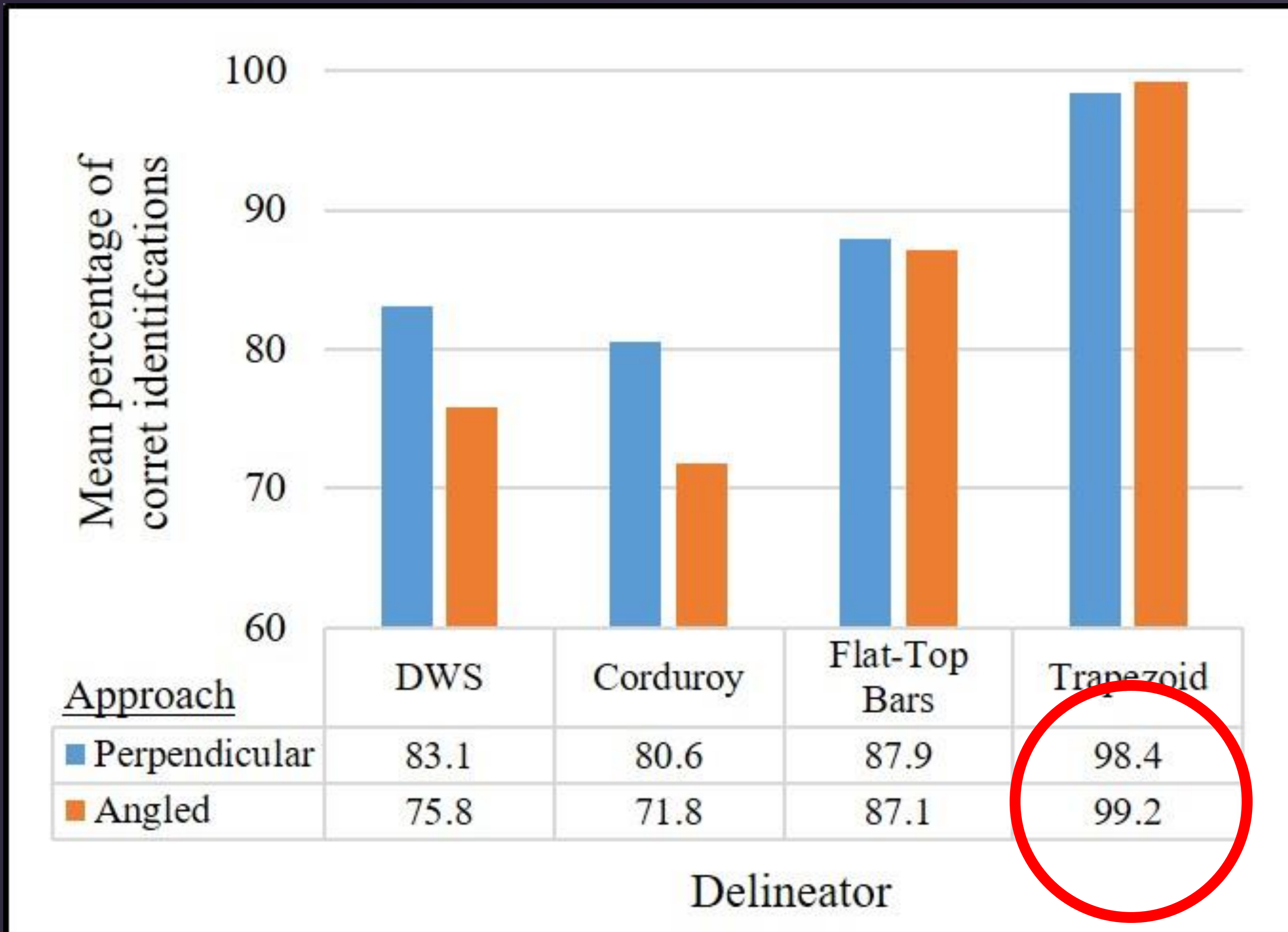
Delineator

Identification

Vision disabled participant is guided onto trapezoid and then off. He identifies it as "trapezoid."

Identification

% of trials on which surface was identified under foot.



Trapezoid identified significantly better than all other surfaces

Following

Vision disabled participant following 12” wide trapezoidal surface.

Cane does not intrude into bikeway.

Results—Following the surfaces

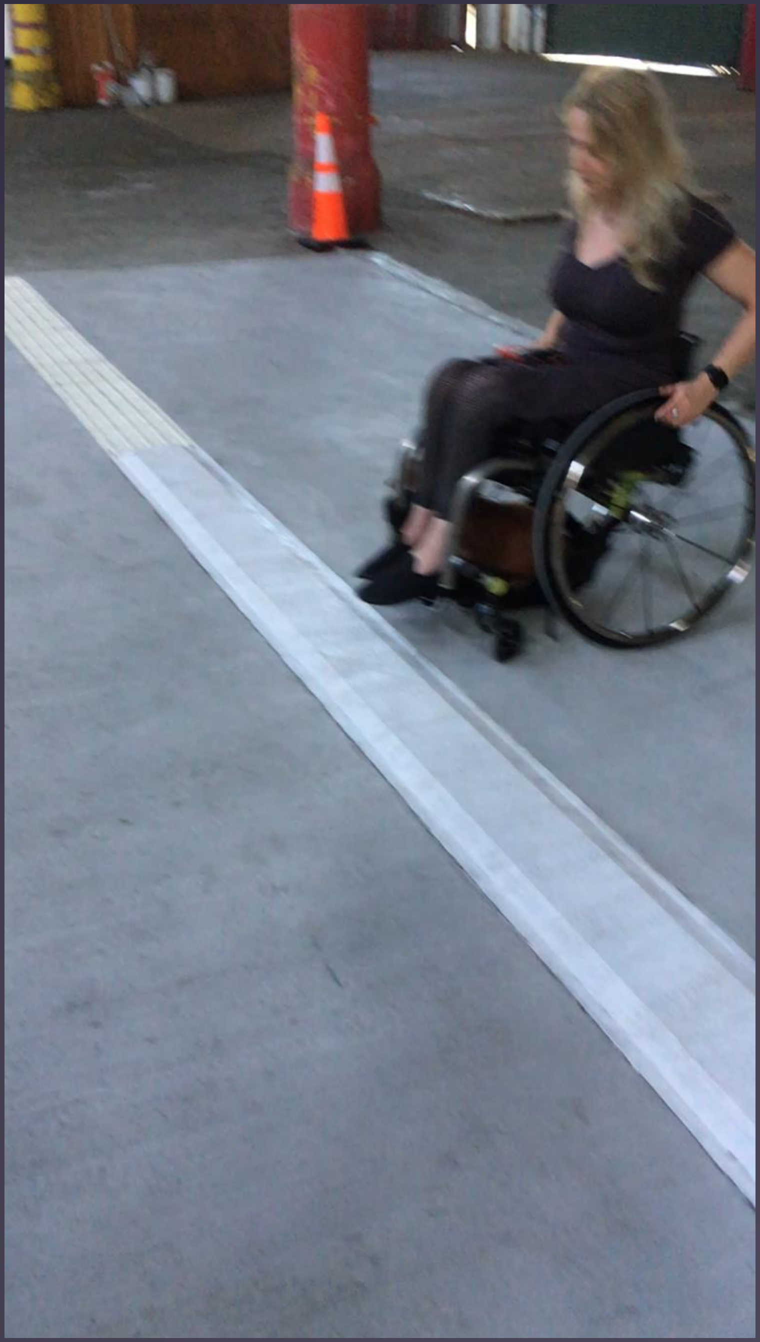
- Participants successfully followed the surfaces without losing them on 302 of 312 total trials
- No significant difference in following, by surface type or width
- Significantly higher rates of cane intrusion for 12” surfaces than for 24” surfaces

Mobility disabled participants--Procedures

- Cross each surface 4 times
  - Participants were told “You don’t have to cross any surface that you think would not be safe for you to cross. Or if you make one crossing and it is particularly difficult or uncomfortable for you, you can say that you’d rather not cross it again.”
- Rate each crossing of each surface for effort, stability and comfort in relation to crossing the detectable warning
- State preference for use of “wide bars,” “corduroy,” and ”trapezoid” as a delineator

Crossing and rating

Mobility disabled participant using a manual wheelchair crosses the trapezoid and rates it in relation to crossing the truncated dome detectable warning.



Crossing

Mobility disabled participant using a power wheelchair crosses the wide raised bars

Crossing

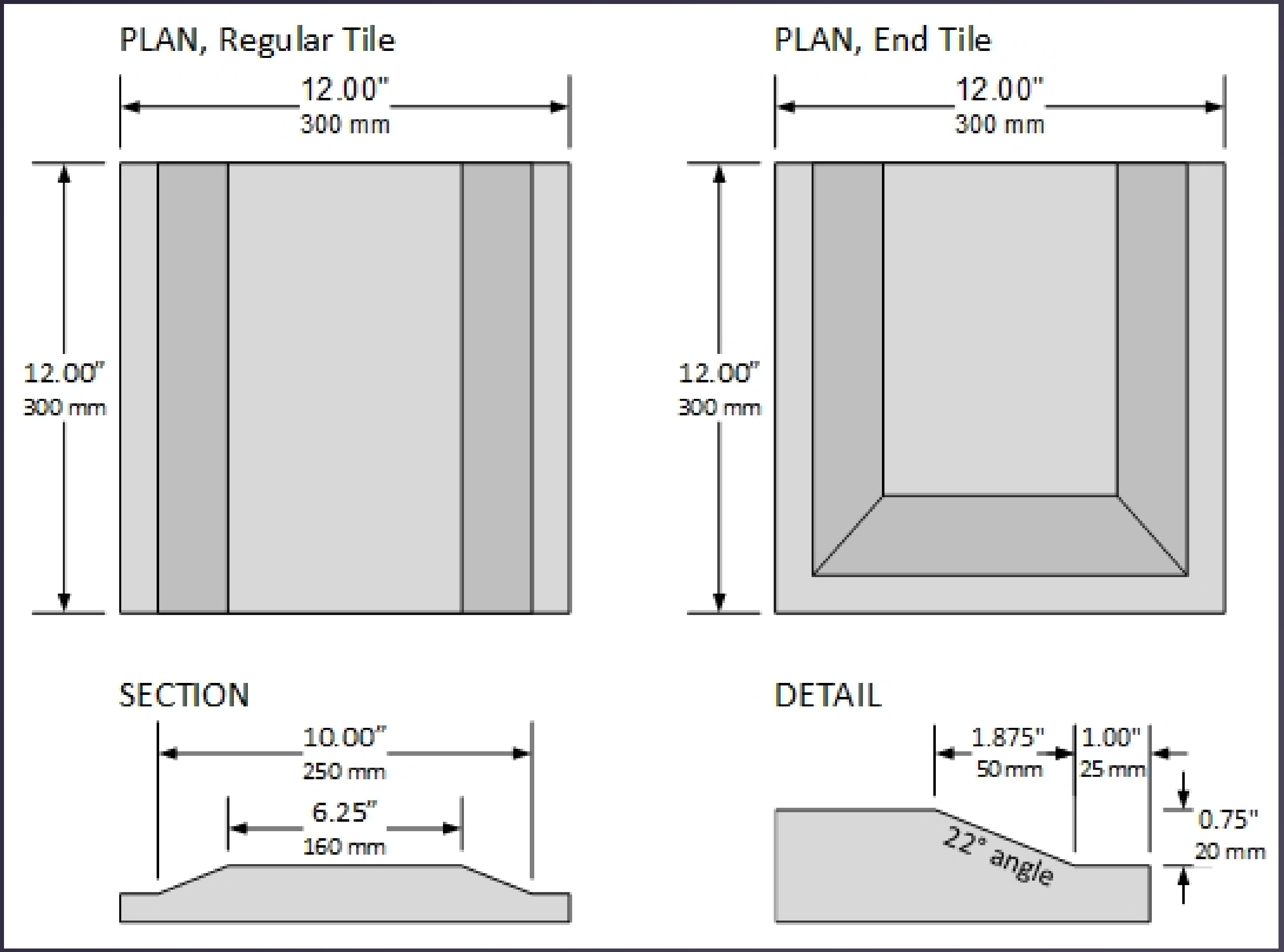
Mobility disabled participant using a crutches crosses the corduroy

Results

- All surfaces readily crossed 4 times; no surface was a barrier to crossing
- Little significant difference from detectable warning surface in effort, instability or discomfort
- Trapezoid was least preferred as a delineator
- Some participants said they cared more about having a delineator that discouraged crossing by bikes than one that was easy to cross

Recommendation

Use a trapezoidal indicator between bicycle and pedestrian sides of a separated bikeway at sidewalk level



Rendering of Better Market Street with trapezoidal delineator between pedestrians and bicycles

Source:
San Francisco
Pubic Works
Better Market
Street Project

Trapezoidal
delineator

ACKNOWLEDGMENTS

I would like to acknowledge the City and County of San Francisco and in particular San Francisco Public Works, the San Francisco Municipal Transportation Agency, the Mayor's Office on Disability and the Port of San Francisco, as well as the individuals with disabilities that made this research possible.

Prototype surfaces were produced by StrongGo.

Additional researchers were Alan Scott and Linda Myers.

For additional information:

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Discussion

- ⇨ Send us your questions
- ⇨ Follow up with us:
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  - ⇨ General Inquiries pbic@pedbikeinfo.org
- ⇨ Archive at www.pedbikeinfo.org/webinars