Innovations in Accessibility

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DESIGNING FOR PEOPLE WITH VISION DISABILITIES

ACCESSIBLE DESIGN FOR THE BLIND, LLC

- Beezy Bentzen, Ph.D., COMS, Director of Research

PBIC Webinar- Innovations in Accessibility, June 11, 2024

Accessible Design for the Blind

Who are we talking about?

- People who are totally blind or who have low vision--"People with vision disabilities" (PVD)
- The large majority have some vision
- The large majority become vision disabled after the age of 60
- The large majority have some degree of age-related hearing loss

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How many people are we talking about?

Estimates from 2022 National Health Interview Survey

- 340,000 American Adults age 18 and older are totally blind
- 3.89 million adults have a lot of trouble seeing, even when wearing glasses
- 50.18 million reported experiencing some degree of vision loss

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People with low vision have special challenges

- Loss of visual acuity (sharpness of vision)
- Loss of visual field
  - May be able to see in the center of the field
  - May be able to see only in the periphery
  - May have patchy fields of vision loss
- Difficulty seeing at night
- Sensitive to glare
- Reduced contrast sensitivity

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Crossing a street with full vision

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Crossing the street with acuity loss—about 20/400

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Crossing a street with central field loss—Macular degeneration

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Crossing a street with patchy field loss—Diabetic retinopathy

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Crossing a street with peripheral field loss—Retinitis pigmentosa

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Tools for travel

- Many PVDs use no obvious tool—you won't recognize them as people having vision disabilities
- Long white cane—scans the environment approximately where the next foot will fall
- Dog guide—handler gives directions; dog provides safety; only 5-10% of PVD
- Low vision aids—monocular; primarily for spot checking, especially signs
- Apps—many that are helpful to some PVD, but never a substitute for providing accessible information such as accessible pedestrian signals (APS)

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Techniques for travel

Listening—most important technique

- Vehicle sounds to determine onset of walk interval at signalized crossing—surge of through traffic in near lane
- Vehicle sounds to determine direction (align to cross)—primarily traffic parallel to crosswalk
- Vehicle sounds to detect traffic gaps and yielding vehicles

Many PVDs have never been taught techniques for maximizing use of their low vision, or taught to use any special techniques

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Major problems crossing streets

- No signal—hard to hear gaps and yields
- Quiet cars and bicycles
- Complex signalization
  - Actuated—unpredictable
  - Leading pedestrian intervals
  - Exclusive pedestrian phasing
- No APS
- No (or intermittent) parallel traffic to align with
- Wide crossings with no median refuge
- Complex geometry
- Apex curb ramps

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Treatments to increase safety and wayfinding

- Install accessible pedestrian signals (APS)
- Minimize crossing distance
- Control speed
- Position curb ramps so slope is aligned with crossing direction
  - Not always possible because of need for grade break to be perpendicular to slope
  - Not always possible because of wide curb radius
- Install tactile walking surface indicators (TWSIs)

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What treatments are required?

- Legal requirements for accessible public rights-of-way (PROW) have been around for a long time
- Section 504 of the Rehabilitation act of 1973 and the ADA, passed in 1990, both required facilities receiving Federal funds to be accessible, but provided no technical specifications for PROW
- Finally, PROWAG (2023) gives technical specifications for what the legally required accessibility looks like for streets and sidewalks.

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What is PROWAG?

- The *Accessibility Guidelines for Facilities in the Public Right-of-Way* (PROWAG) are accessibility guidelines for implementing the Americans with Disabilities Act (ADA) with regard to: sidewalks, crosswalks, pedestrian signals, and other public pedestrian facilities, to ensure they are equally accessible to and usable by all pedestrians.

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When do the PROWAG guidelines become enforceable standards?

- When the guidelines are adopted as standards under the ADA by the U.S. Department of Justice and the U.S. Department of Transportation.
- DOT will do a separate rulemaking to adopt PROWAG—notice of proposed rule-making expected in 2024.
- DOJ and DOT may modify PROWAG—but can't make it less stringent

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Can we wait to provide access?

- Section 504 of the Rehabilitation act of 1973 and the ADA, passed in 1990, both required facilities receiving Federal funds to be accessible, but provided no technical specifications
- People with vision disabilities have been waiting two generations to have accessible pedestrian signal information

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It's the civil rights laws that make jurisdictions vulnerable

- Both New York City and Chicago have been found to be at fault because they have been slow to make pedestrian signal information accessible
- Judgements were based not on PROWAG, but on the Rehabilitation Act of 1973 and the ADA of 1990.

General principles for when the requirements of PROWAG apply

- New construction—envisioned as a “green field”
- Alterations—definition

“Alteration . . . . A change to or an addition of a *pedestrian facility* in an existing, *developed public right-of-way* that affects or could affect *pedestrian* access, circulation, or usability”

- No specific criteria for alterations triggering installation of accessible pedestrian signals—DOT may provide specific criteria when they adopt PROWAG.

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PROWAG requirements affecting travel by pedestrians with vision disabilities

Numerous requirements and specifications related to accessible pedestrian signals (APS) and to audible information devices

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APS required wherever there are pedestrian signal heads

- At red/yellow/green traffic signals
- At pedestrian hybrid beacons (PHBs)
- Applies whether there is a pushbutton that actuates the pedestrian phase, or passive actuation

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Technical specifications for APS

- Shall have pushbutton or passive actuation
- Require high contrast tactile arrow oriented parallel to direction of travel on crosswalk
  - Arrow enables user to know which crosswalk the pushbutton actuates
  - Not a good cue for establishing a heading across the crosswalk
- Default walk indication—percussive tone
  - Hard for many people to understand speech
  - Easier to localize percussive tone
- Speech walk indication only permitted in alterations, where pushbuttons not separated by 10’

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More technical specifications for APS

- Require vibrotactile walk indication—vibrating arrow
- Require locator tone other than in walk interval
  - Locator tone required during pedestrian clearance—not audible countdown.
  - Locator tone required during Wait
- May have pushbutton information message
- Speech walk indications and pushbutton information messages must follow model messages

  "Wait to cross Howard at Grand."

  "Howard. Walk sign is on to cross Howard."

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APS audible beaconing

- Purpose
  - To improve the ability of pedestrians who are vision disabled to cross streets without veering significantly outside the crosswalk
- How it works—in response to button press >1 sec
  - The volume of the push button locator tone during the pedestrian change interval (flashing Don't Walk or countdown) is increased, and
  - The louder locator tone comes from a loud speaker on the far end of the crossing only, that is aimed at the center of the crosswalk and that is mounted on a pedestrian signal head.

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How audible beaconing works

Drawing credit: Polara

1. Button pressed for 1 sec or more
2. Walk indication from APS at normal volume
3. Loud locator tone from speaker on the opposite end of the crosswalk during pedestrian change interval

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When is APS audible beaconing helpful?

- Very wide crossings
- Skewed crossings
- Crossings where there's no traffic parallel to the direction of the crosswalk
- Crossings where an individual is having difficulty crossing within the crosswalk

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Pedestrian actuated warning devices, including RRFBs, require audible information devices

- With push button or passive actuation
- With a locator tone if there's a push button
- With a speech message describing the status of the indication—but the message is not specified (See MUTCD 2023—"Warning lights are flashing")
- Without audible or vibrotactile walk indication

Roundabouts

- Sidewalk separated from curb by landscaping or other nonprepared surface between crosswalks, min. 24 inches wide, or
- Sidewalk not separated from curb requires a continuous and detectable vertical edge treatment along the street side of the pedestrian circulation path, from crosswalk to crosswalk

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Roundabouts and channelized turn lanes with multi-lane crossings

Multi-lane crossings require a traffic control signal with a pedhead, a PHB, an RRFB, or a raised crosswalk.

PHB—Photo credit-City of Columbus

Raised crosswalk—Photo credit-Kittelson

RRFB—Photo credit--Kittelson

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Questions?

Requests for Additional Information?

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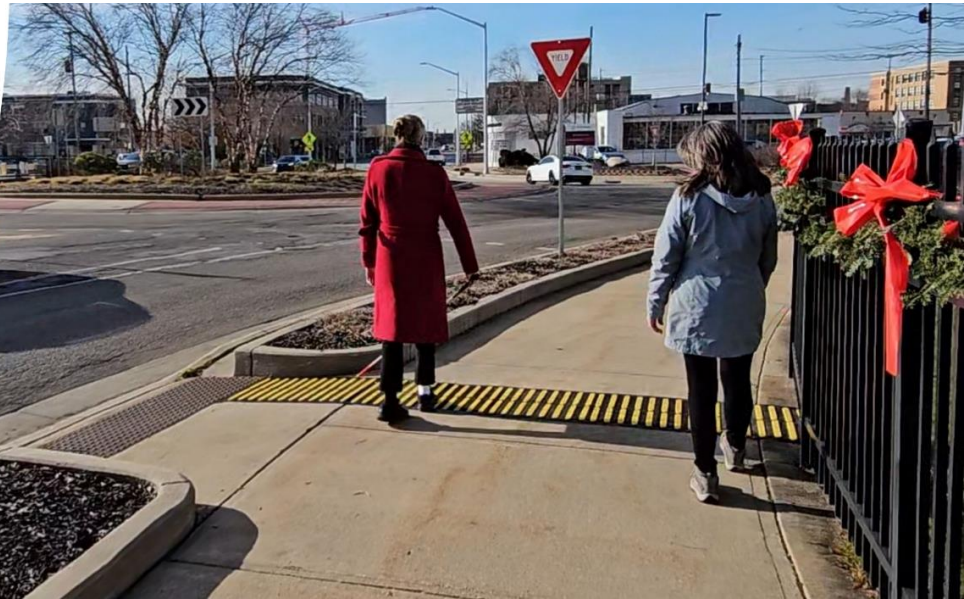

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DATE 06/11/2024

RESEARCH AND GUIDANCE ON THE USE OF TACTILE WALKING SURFACE INDICATORS FOR PEDESTRIANS WITH VISION DISABILITIES

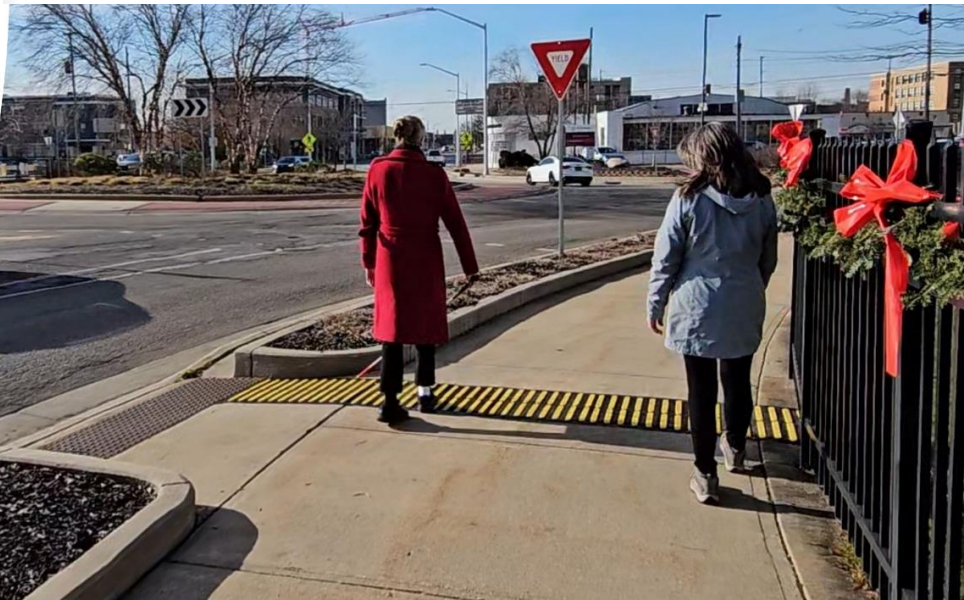
Accessible Design for the Blind

THE UNIVERSITY OF NORTH CAROLINA HIGHWAY SAFETY RESEARCH CENTER

KITTELSON & ASSOCIATES

Goals

- Provide an introduction to Tactile Walking Surface Indicators (TWSIs)
- Present evidence-based recommendations in the use of TWSI to improve the accessibility of pedestrian environments.



Tactile Walking Surface Indicator (TWSI)

Generic term for 3 types of walking surfaces to aid wayfinding for pedestrians with vision disabilities:

- Detectable warning surface (DWS)
  - aka: truncated domes, or domes
- Tactile direction indicator (TDI)
  - aka: raised bars, guiding bars, or directional bars
- Tactile warning delineator (TWD)
  - aka: trapezoidal delineator, or trapezoid

Photo Credit: Beezy Bentzen

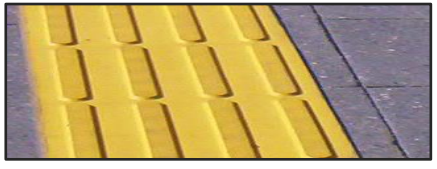
Photo Credit: John Robert McPherson, CC0, via Wikimedia Commons

Photo Credit: Linda Myers

APS and TWSIs as tools or building blocks to address safety and accessibility challenges

- Accessible Pedestrian Signals (APS)
  - Pedestrian signal timing.
  - Audible beaconing can provide heading assistance for difficult crossings.

- Detectable warning surface (DWS)
  - Warning surface with defined / required uses.

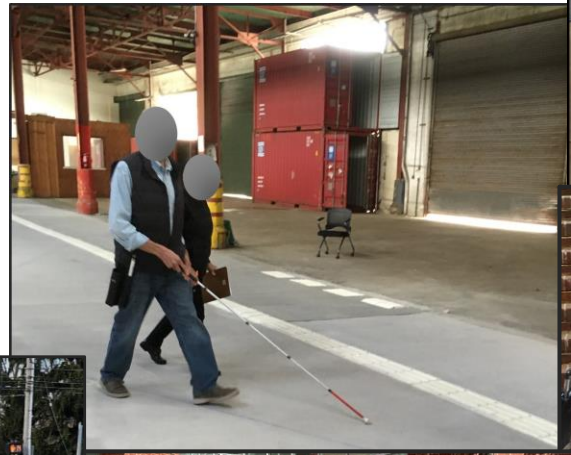


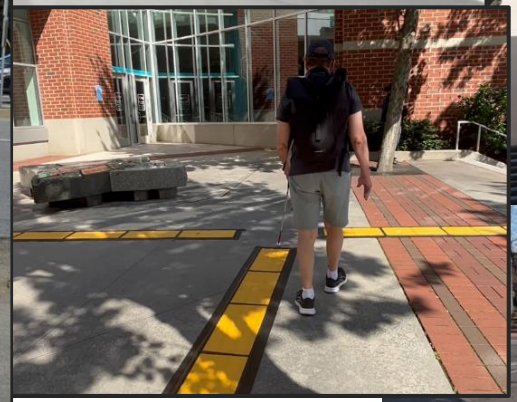
- Tactile direction indicator (TDI)
  - Directional guidance in large and/or open spaces; can be over large distances
  - Indicator of crossing or boarding locations
  - Crossing alignment cue

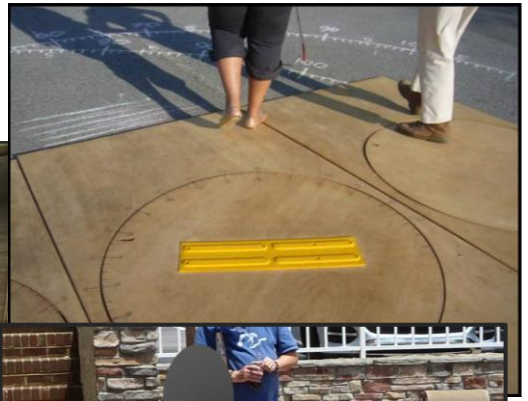
- Tactile warning delineator (TWD)
  - Delineator to define and separate spaces that exist at the same level.

Human Factors Research

The guidance provided is informed by *empirical human factors experiments* conducted with participants with disabilities.







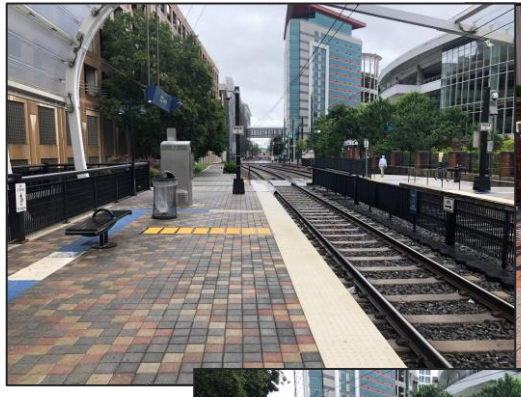
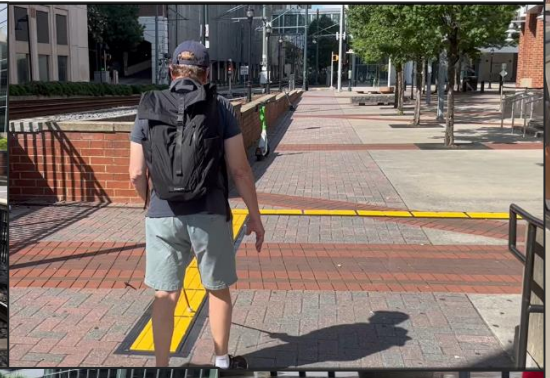
Funding for projects has come from the National Eye Institute; National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR); San Francisco Public Works; Federal Highway Administration; Transit Cooperative Research Program

Photo Credits: ADB Staff, S. Graham, & S. Worth O'Brien

TCRP B-46

Tactile Wayfinding in Transportation Settings for Travelers Who Are Blind or Visually Impaired.

PI: Sarah O’Brien, UNC HSRC

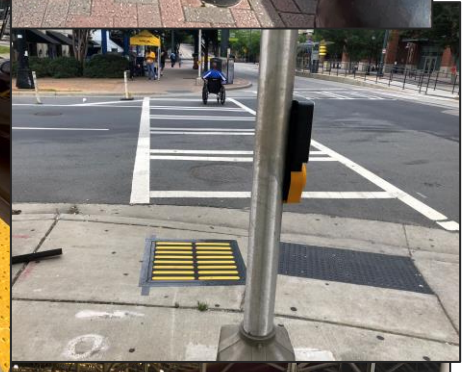
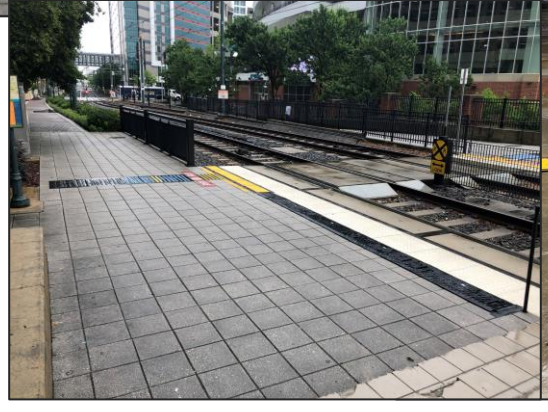
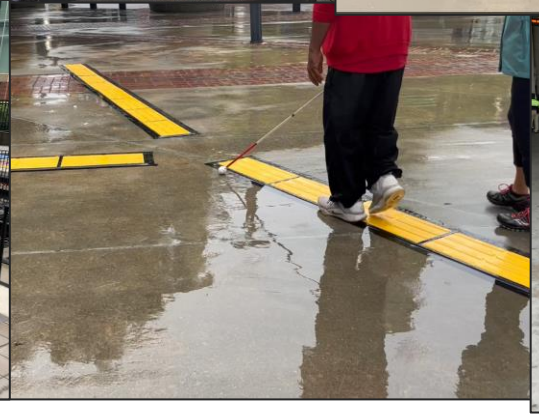




Photo Credits: A. Scott & S. Worth O’Brien

Wayfinding Challenges:

- Locating Crossing Near Roundabouts & at Midblock Locations

- Establishing Crossing Alignment

Photo Credits: ADB Staff

Locating Crossings and Aligning to Cross

Guidance for Midblock Crossings

- TDI bars extending across the width of the sidewalk at the crosswalk location.
- Raised bars oriented perpendicular to the direction of travel for the crosswalk.

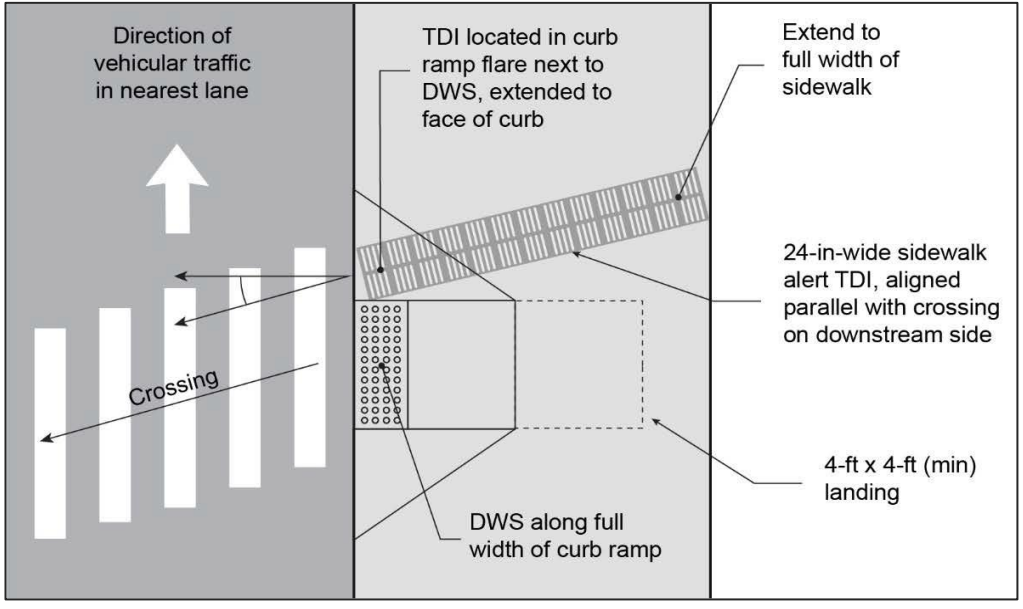


Figure 28. Example of TWSIs for a Typical Midblock or Roundabout Street Crossing for a Narrow Curb Ramps with Flares.
[O'Brien, et al. (2024). TCRP Research Report 248]

Guidance for Crossings at Intersections

- TDI bars do not extend across the width of the sidewalk at corner / intersection crossing locations.
- A 2-foot by 2-foot square of TDI bars are used, with the raised bars oriented perpendicular to the direction of travel for the crosswalk.

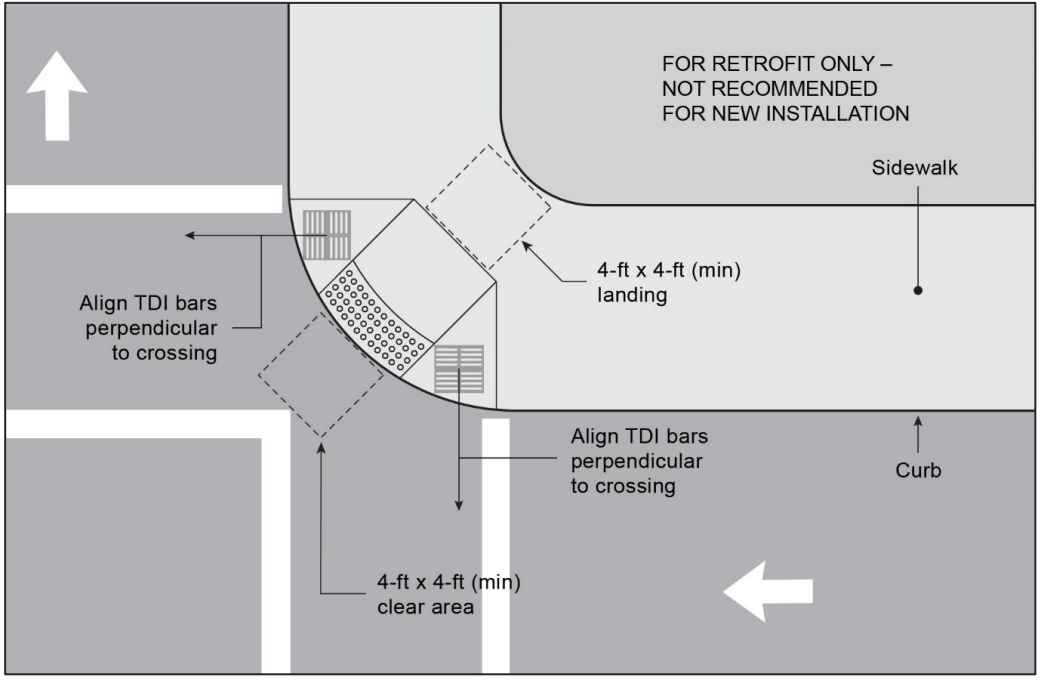


Figure 38. Example of TWSIs for Single Corner Curb Ramp Serving Two Crossings. [O'Brien, et al. (2024). TCRP Research Report 248]

Wayfinding Challenge:
Floating Transit Stops & Bike Lanes at Sidewalk Level

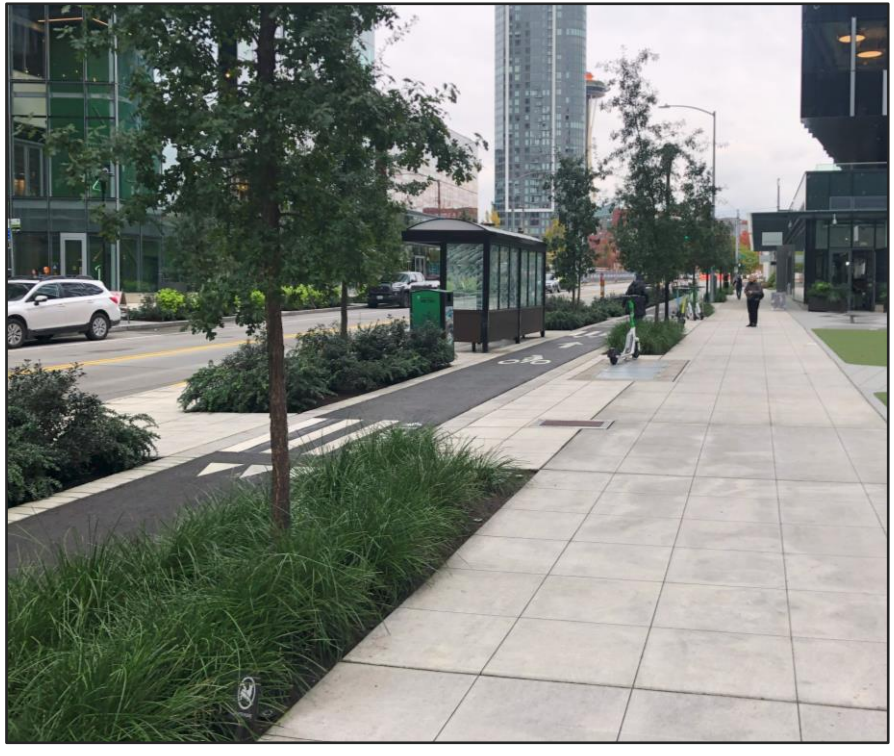
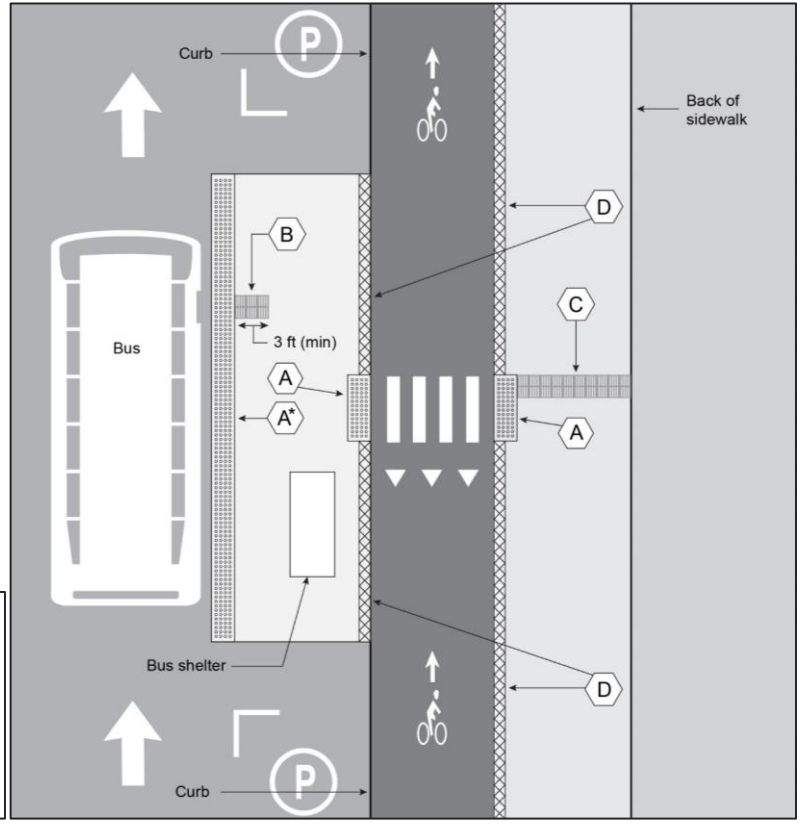


Photo Credits: Alan Scott

Guidance for Floating Transit Stops & Bike Lanes at Sidewalk Level

- TWD to create accessible boundary between the sidewalk and the bike lane, if at the same level (otherwise, this would be curb).
- TDI across the sidewalk at the marked crossing location.
- DWS adjacent to the bike lane at the marked crossing location.
- TDI on the boarding island to mark the approximate location of the front boarding door.



*DWS required if platform is raised above standard curb height — see PROWAG

A DWS

B TDI transit door location bars
(bars may be rotated to meet local regulations or needs)

C TDI sidewalk alert bars

D TWD if bicycle lane is abutting and at same grade as pedestrian facility

Figure 24. Example of TWSIs for a Bus Boarding Island.
[O'Brien, et al. (2024). TCRP Research Report 248]

Wayfinding Challenge:
Protected Intersections

Photo Credits: Alan Scott

Guidance for Protected Intersections

- TWD to create accessible boundary between the sidewalk and the sidewalk-level bike lane.
- DWS adjacent to the bike lane at the marked crossing locations.
- DWS adjacent to the street at the marked crossing locations.

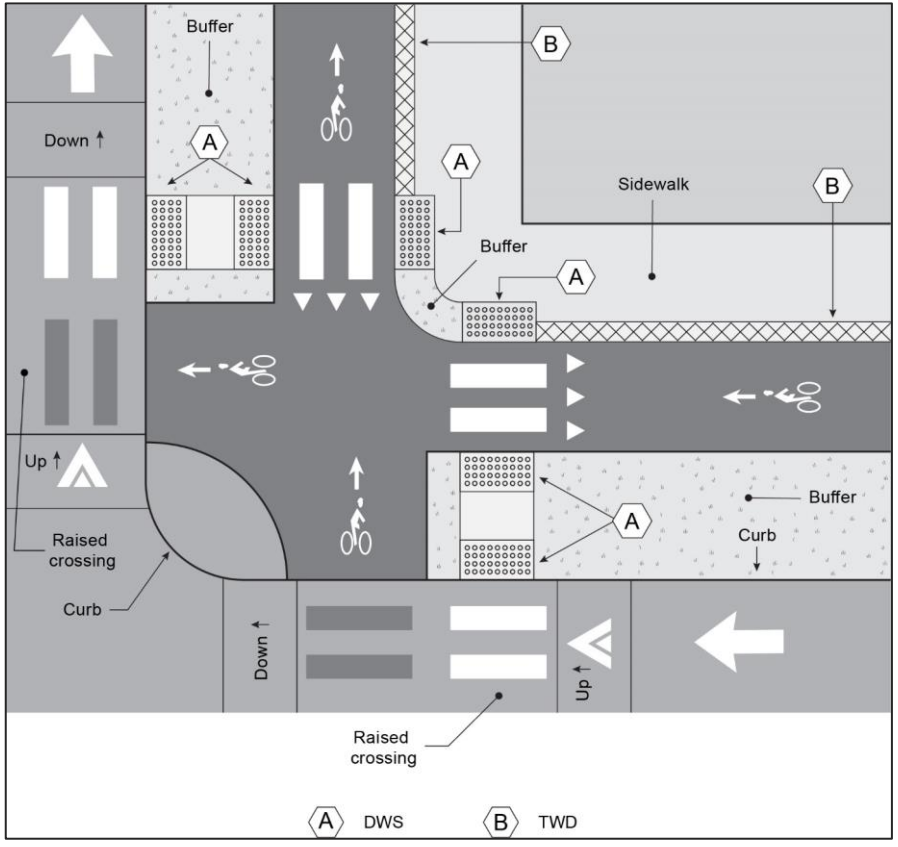
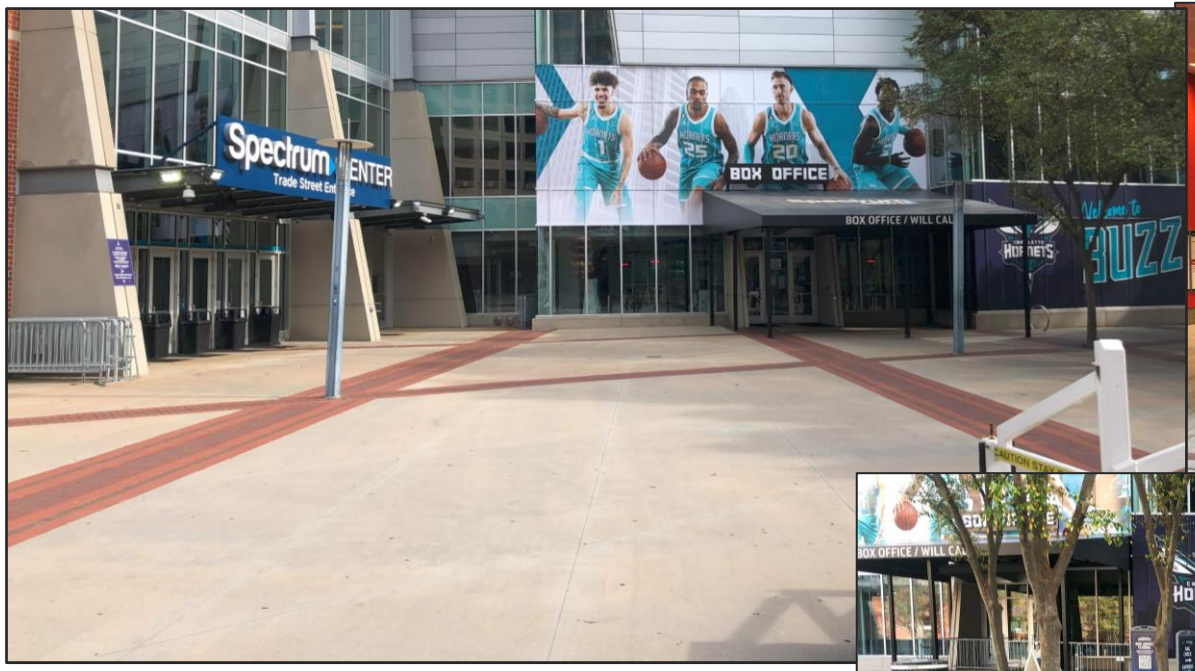


Figure 39. Example of TWSIs for Corner with Separated One-Way Bicycle and Pedestrian Facilities. [O'Brien, et al. (2024). TCRP Research Report 248]

Wayfinding Challenge – Plazas / Open Spaces



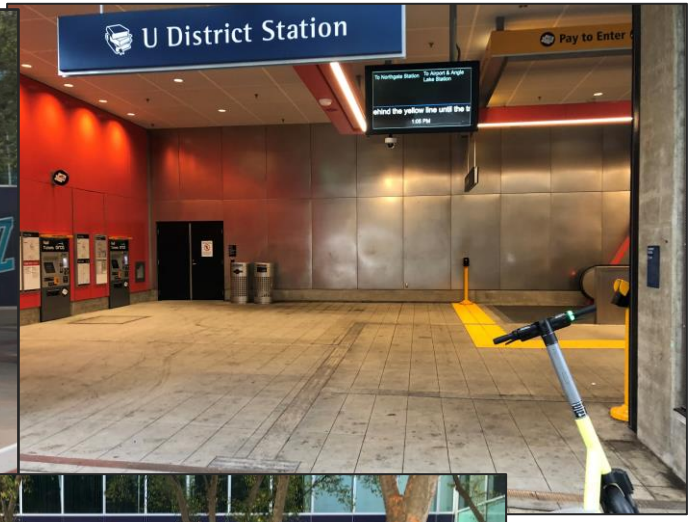
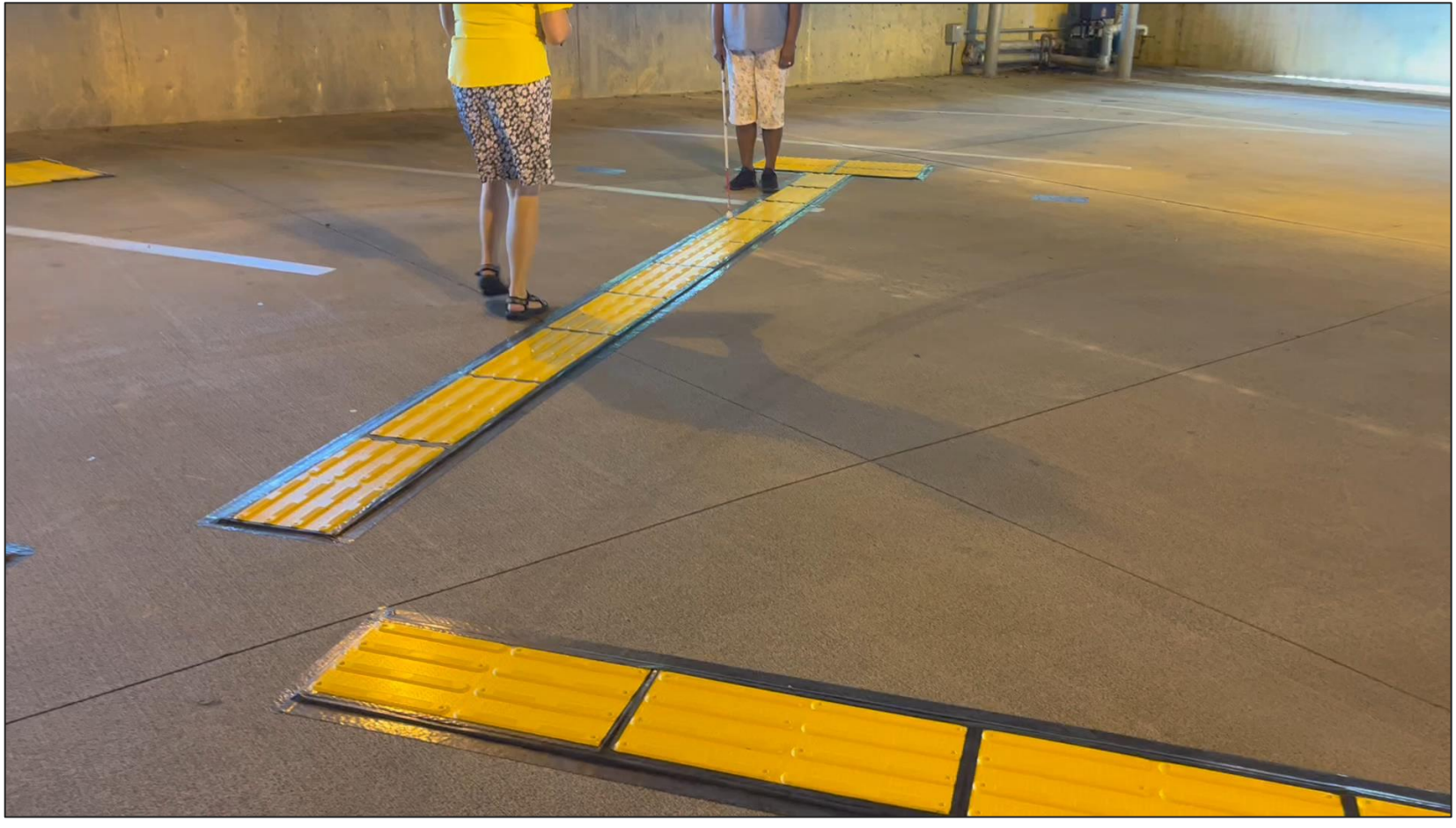
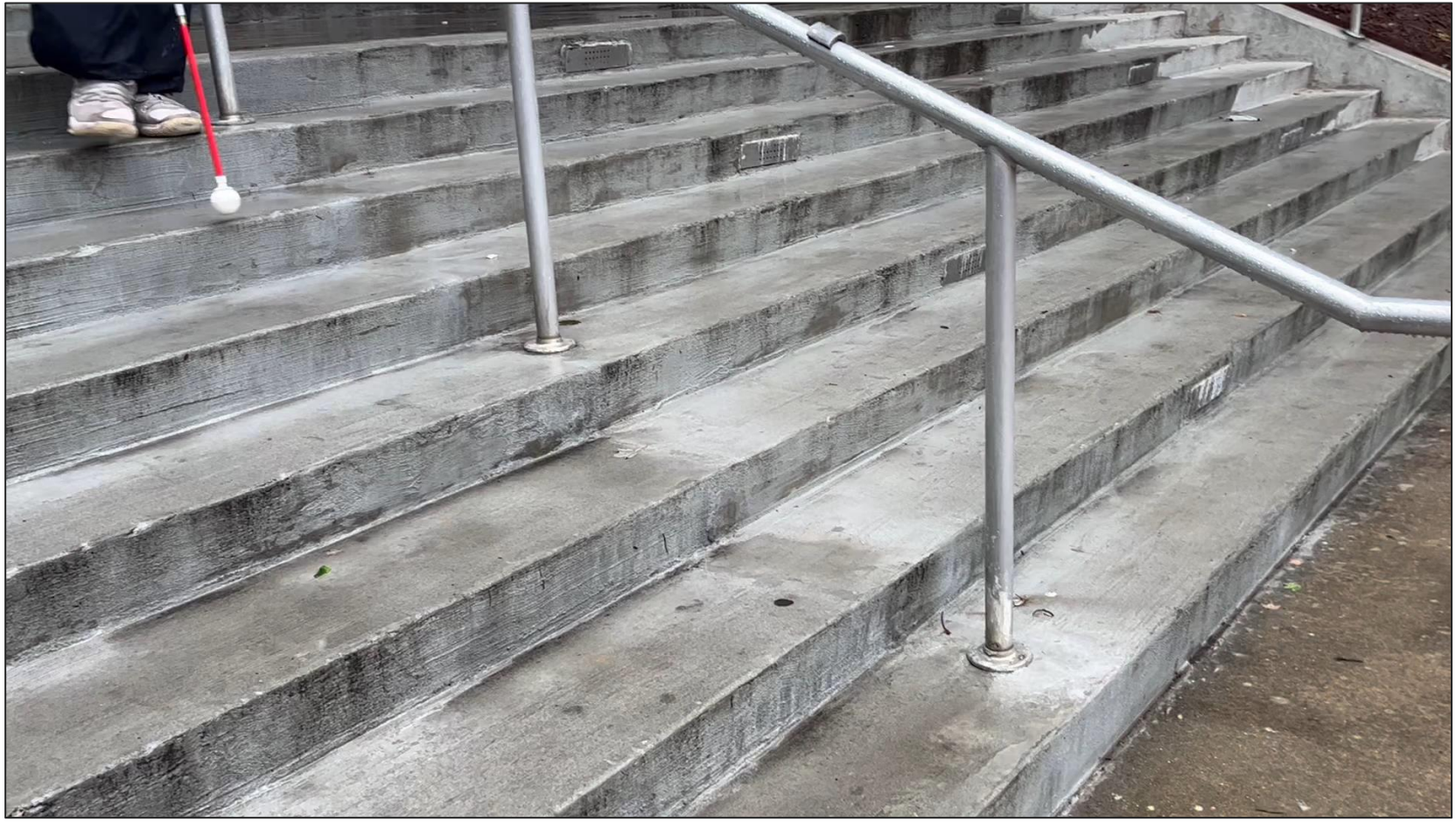


Photo Credits:
Alan Scott

Guidance on TDI Paths & Path Intersections



Guidance on TDI Paths & Path Intersections



Guidance for Plazas and other Open Spaces

- 12-inch-wide paths of TDI used to create a path network connecting locations of interest.
- Where paths would intersect (referred to as “Choice Points”), an area 3 feet by 3 feet is left empty of any TWSI.

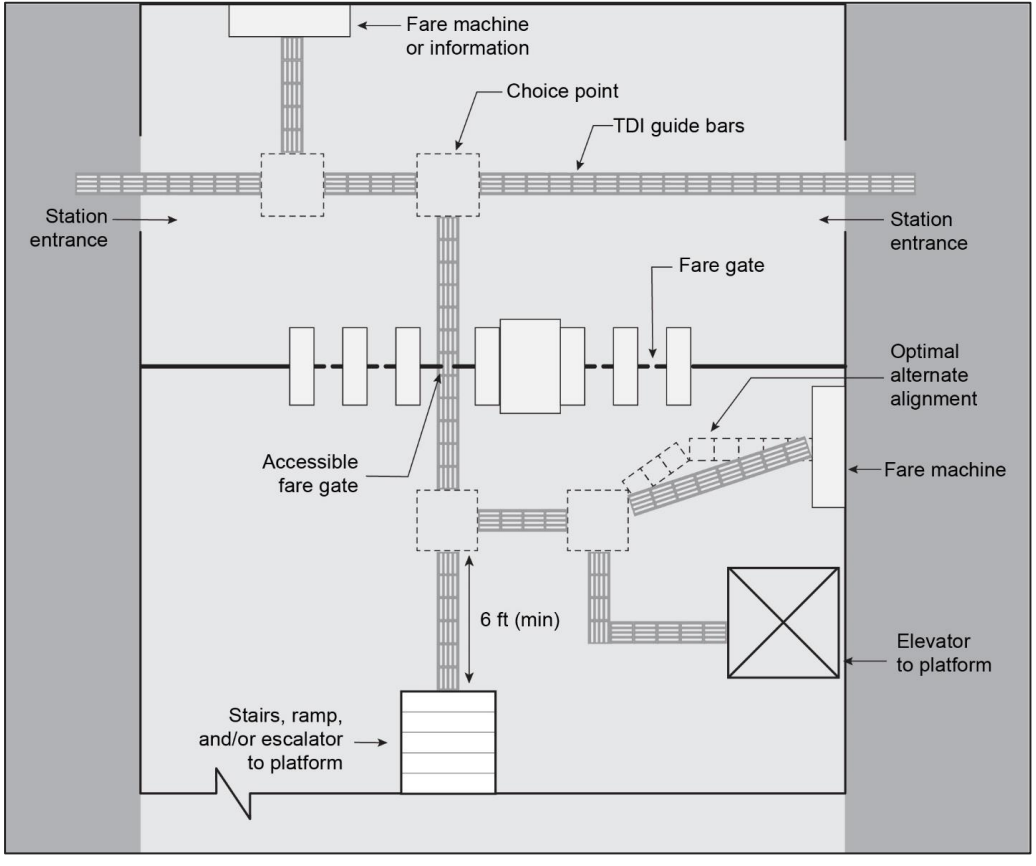


Figure 18. Example of Guide Bars in a Transit Station Mezzanine. [O’Brien, et al. (2024). TCRP Research Report 248]

Wayfinding Challenges Imposed by New Designs

Can we use what we have learned about TWSI to make many environments/facilities accessible, including innovative and quick-build facilities? Let's consider quick-build sidewalk extensions

Photo Credit: Alan Scott

Accessibility at Innovative New and Quick-Build Pedestrian and Bicycle Designs, FHWA-PROJ-21-0049. PI: Bastian Schroeder, Kittelson & Associates

Research on Quick-Build Sidewalk Extensions

The treatment(s) that most significantly improved wayfinding for pedestrians with vision disabilities at quick-build sidewalk extensions that were 17 feet deep (no bike lanes, no APS) were:

- DWS relocated from curb ramp to near the boundary of the curb extension
- TWD used within the curb extension along the transverse lines of the crosswalk
- Spacing of detectable perimeter elements should be no greater than 2 feet.

Photo Credit: Alan Scott

For more design guidance:

- TCRP Research Report 248 (free to download)
- Accessibility at Innovative New and Quick-Build Pedestrian and Bicycle Designs (forthcoming, availability TBD)

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References

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Discussion

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