BATF Meeting

DATE 7/24/2025

Tactile Wayfinding – Improving Access for People with Vision Disabilities

THE UNIVERSITY OF NORTH CAROLINA HIGHWAY SAFETY RESEARCH CENTER

Accessible Design for the Blind

KITTELSON & ASSOCIATES

Wayfinding Challenges

Recognizing when a street has been reached

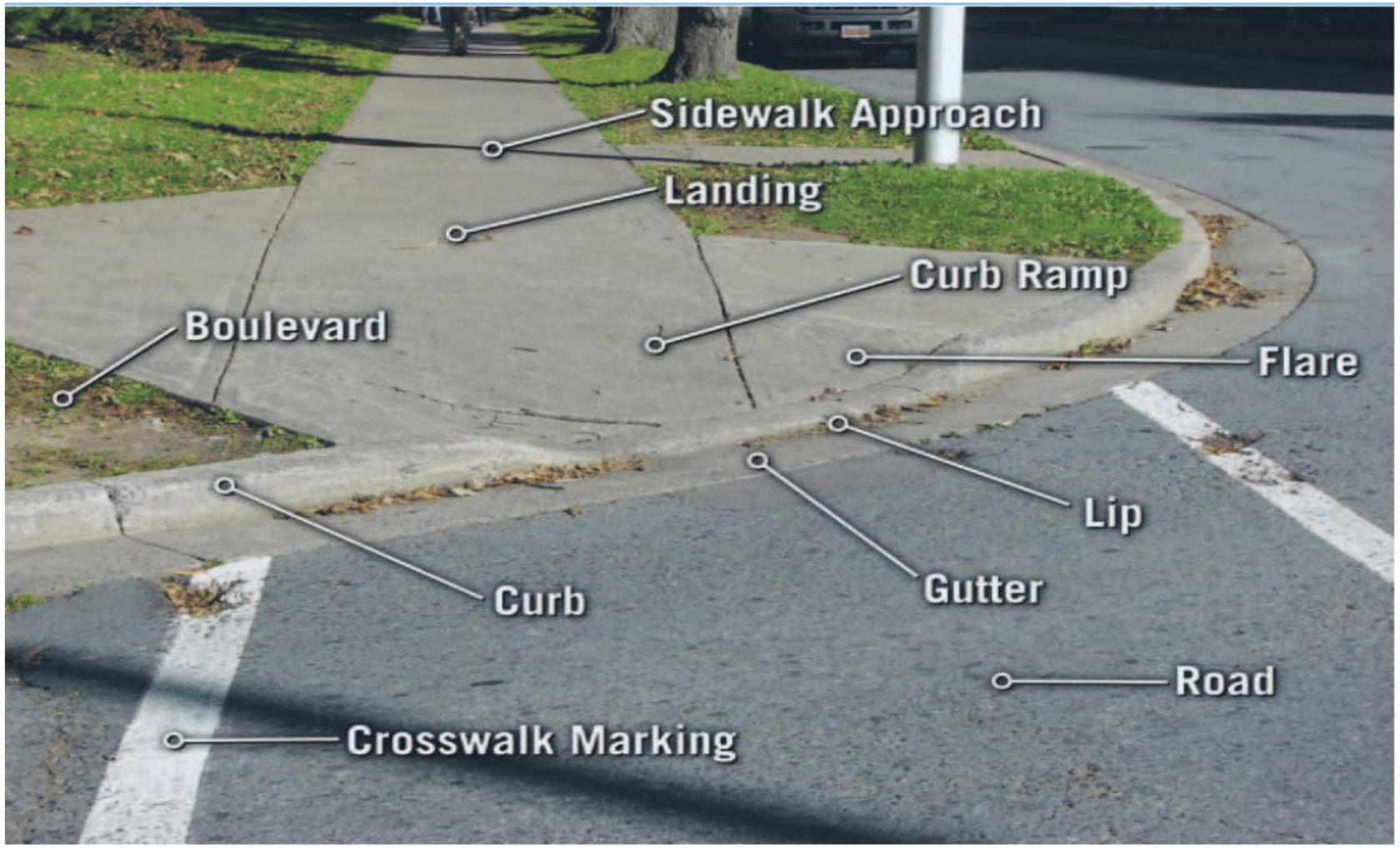


Photo Credit: Sean Bennett, Fig. 1. Representative intersection of sidewalk and road, including a diagonal curb ramp Download Scientific Figure on ResearchGate (researchgate.net)

Finding non-corner crossings

Photo credit: www.pedbikeimages.org / Toole Design Group

Aligning to cross where cues are absent or misleading

Photo credit: ADB Staff

Avoiding separated bike lanes at sidewalk level

Photo credit: Toole Design

Finding Transit Facilities

- Guidance to faregates, ticket machines, platforms, elevators/escalators
- Bus transfer areas
- Locating bus stops, floating transit islands

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

Detectable Warning Surface

What should pedestrians who are vision disabled think when they encounter truncated dome DWS?

I should stop and figure out whether I'm at a street or transit platform and prepare to either cross the street or board the vehicle.

If I'm at a street, I should explore for cues to help me align in the direction of the crosswalk.

The domes should NOT be used as a cue for aligning to cross.

Tactile Direction Indicator (TDI) – Bars

What should pedestrians who are vision disabled think when they encounter TDI bars?

- It depends on environmental context and width of the surface!
  - If 12 in. (4 bars): follow the bars parallel
  - If 24 in.: follow the bars perpendicular

If the bars are running in parallel and extending some distance, then this is a surface I can follow. I can follow it on either side if there is room. I should not encounter obstacles if I am following along while walking beside it.

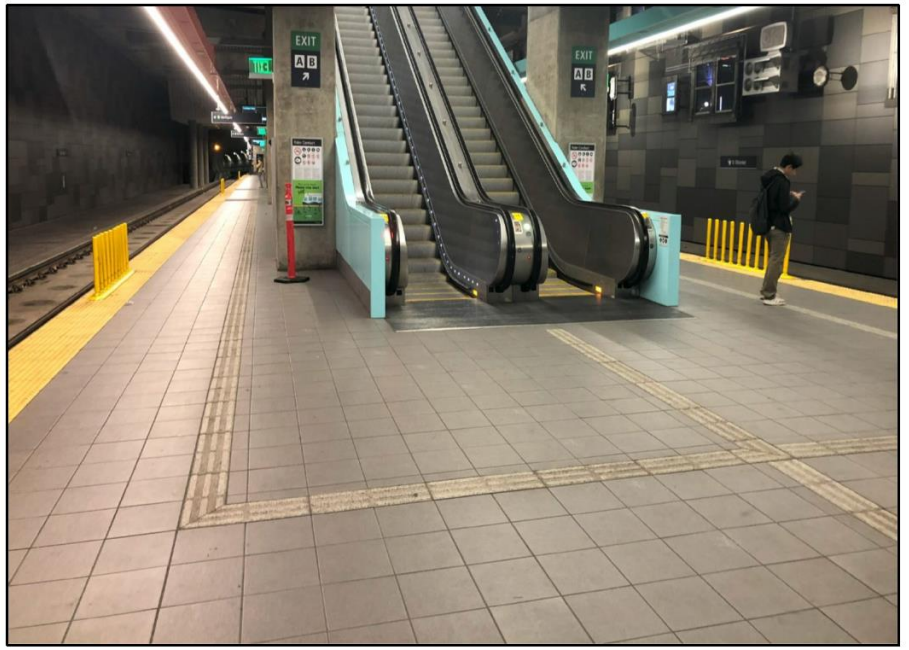


Photo Credit: ADB Staff

TDI – Sidewalk Alert Bars & Transit Door Location Bars

- Bars oriented perpendicular to direction of travel to cross street or board
- Extend at least 3 ft from DWS or curb at platform edge
- 24 in. wide surface

TDI bars running across a sidewalk, or across a transit platform indicate the location of a crossing or a transit stop. I can turn to use the bars running perpendicular under my feet to align to cross or board.

Photo Credit: ADB Staff

Photo Credit: Sarah O'Brien

Tactile Direction Indicators – Alignment Bars

- 2 ft. x 2 ft. square of bars
- Orient bars perpendicular to the direction of travel across crosswalk

If a "patch" of raised bars is located near a street crossing, and near the end of or just behind a DWS, I can use it to establish an accurate alignment with the crosswalk.

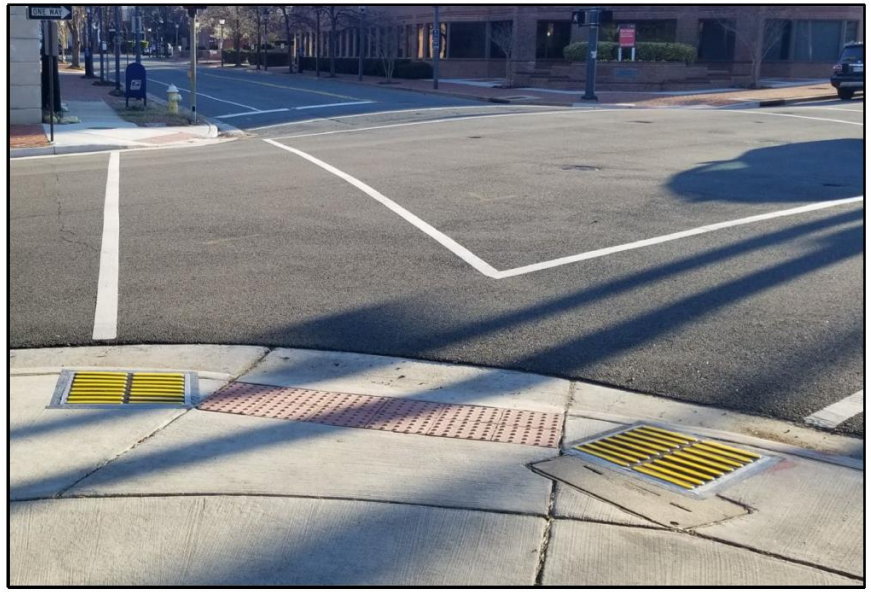


Photo Credit: ADB Staff

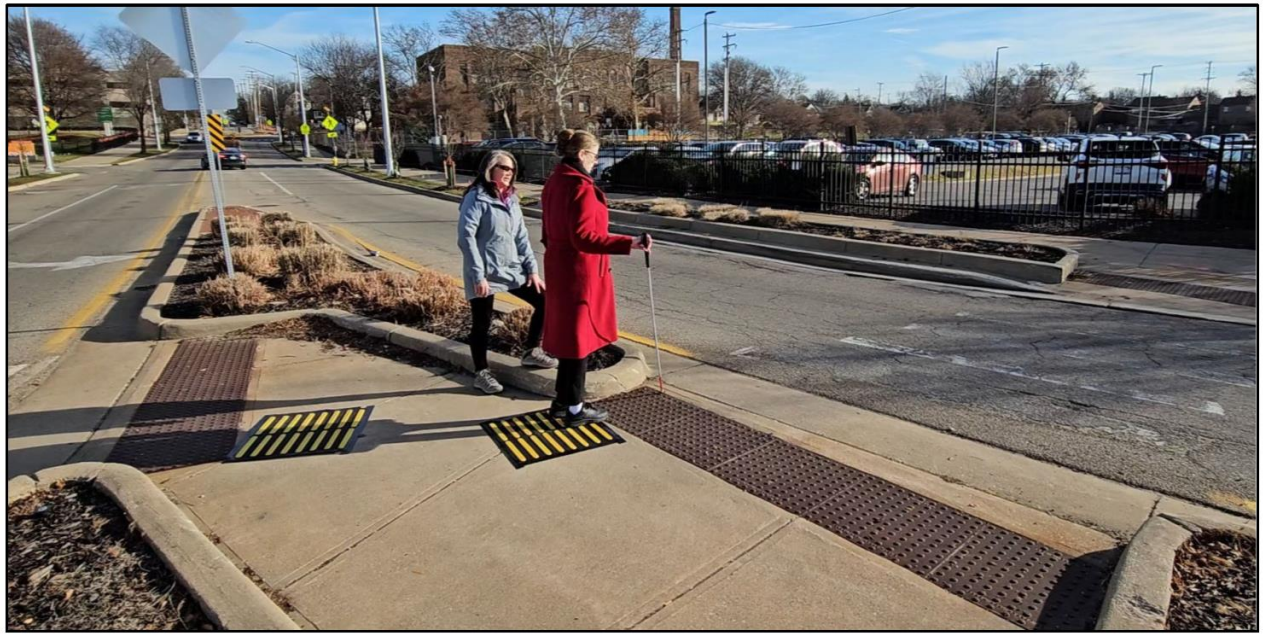


Photo Credit: Steve Graham

Tactile Warning Delineator (TWD)

What should pedestrians who are vision disabled think when they encounter a trapezoidal TWD?

I should not cross this surface because there is danger of a crash with a bicycle or other hazard on the other side.

Photo credits: Linda Myers

Evaluating TWSIs: TCRP B-46 Research

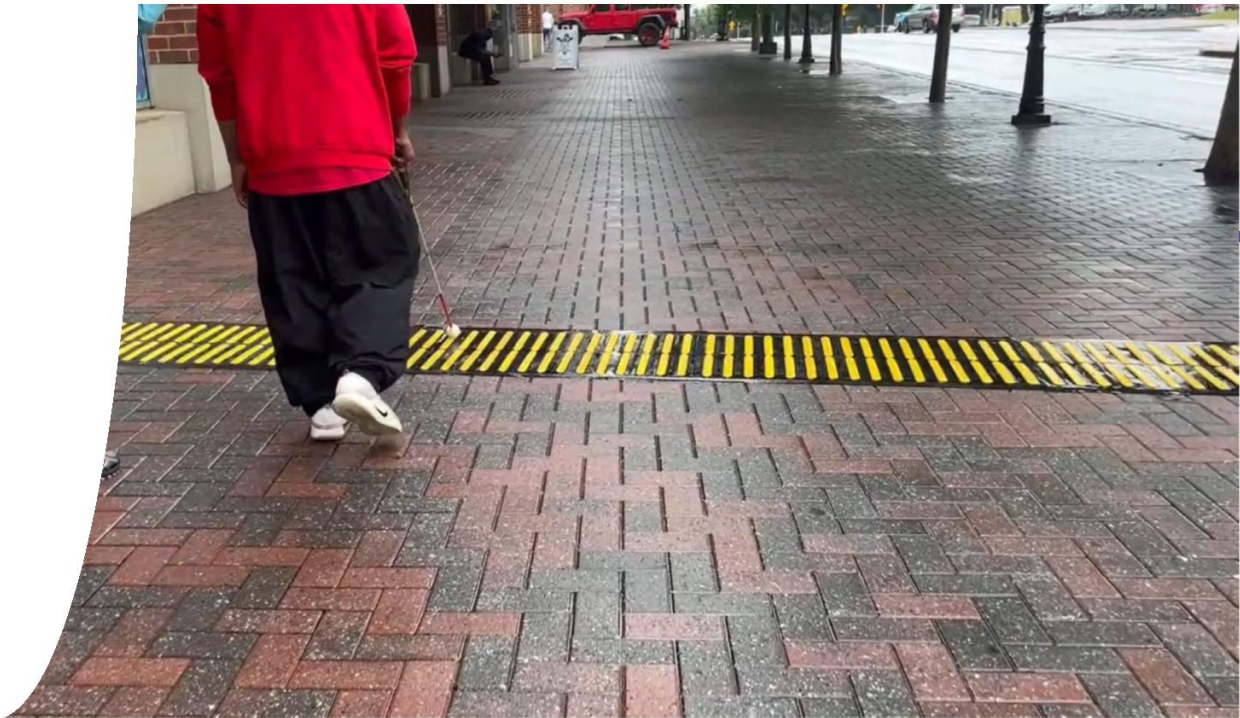


Photo Credits: Sarah Worth O’Brien

Lab Setting: Primary Findings

- Bars and domes discriminable
- Participants had no difficulty following the 12” wide, 4-bar TDI paths when straight.
- Route following through path intersections was more successful when there was a CPI.
  - DWS or blank space both equally effective
  - No CPI was not effective – need to indicate where paths cross

Photo Credit: Sarah Worth O-Brien

Field Study Experiment

Validate findings of past research while testing arrangements of TWSIs as a system in a mix of challenging real-world environments.

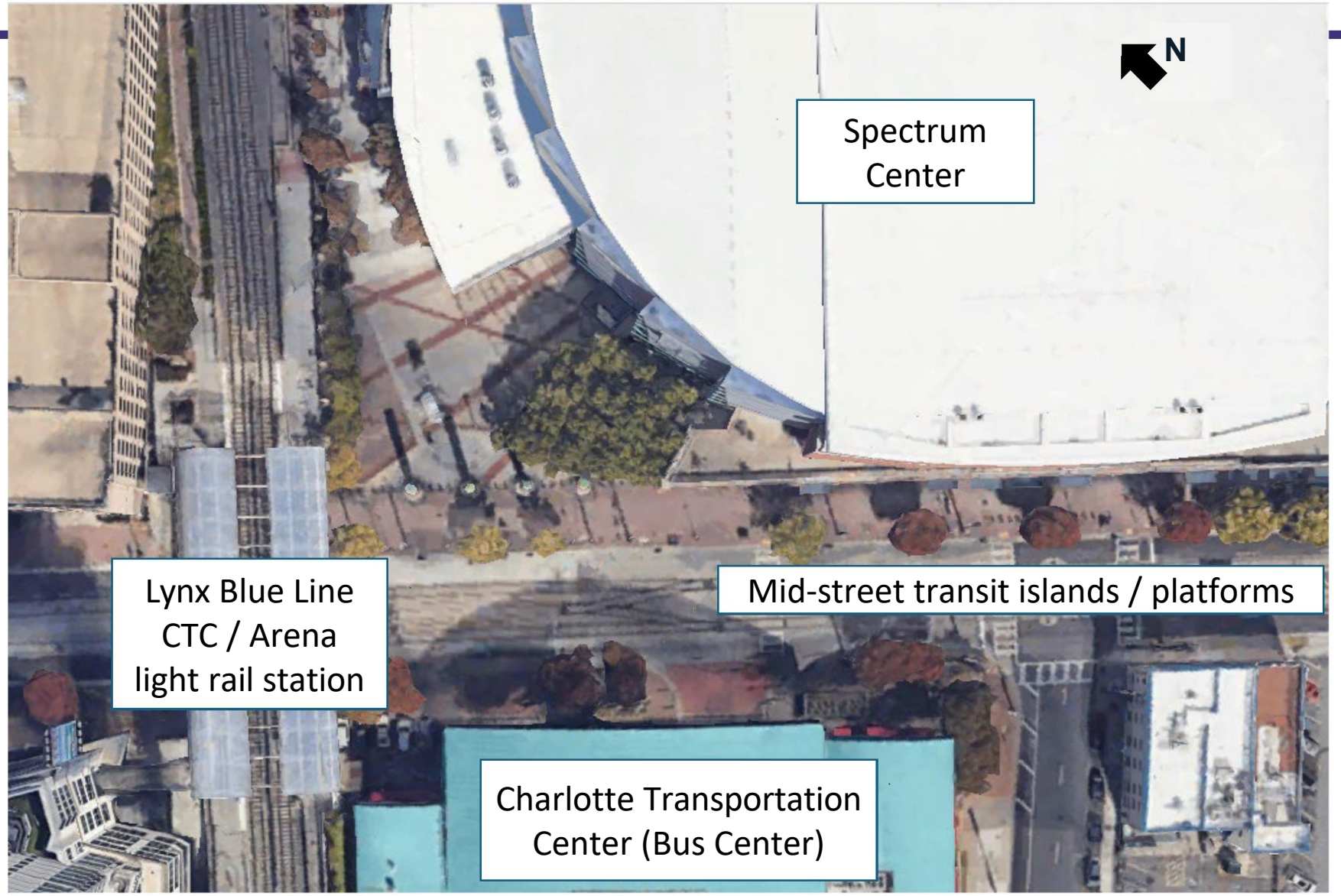


Photo Credit: Google Maps

TCRP Research Report 248 Documents

https://nap.nationalacademies.org/catalog/27777/tactile-wayfinding-in-transportation-settings-for-travelers-who-are-blind-or-visually-impaired

- Vol 1 – conduct of research
- Vol 2 – guide

Guide Overview & TWSI Applications

Photo : Beezy Bentzen

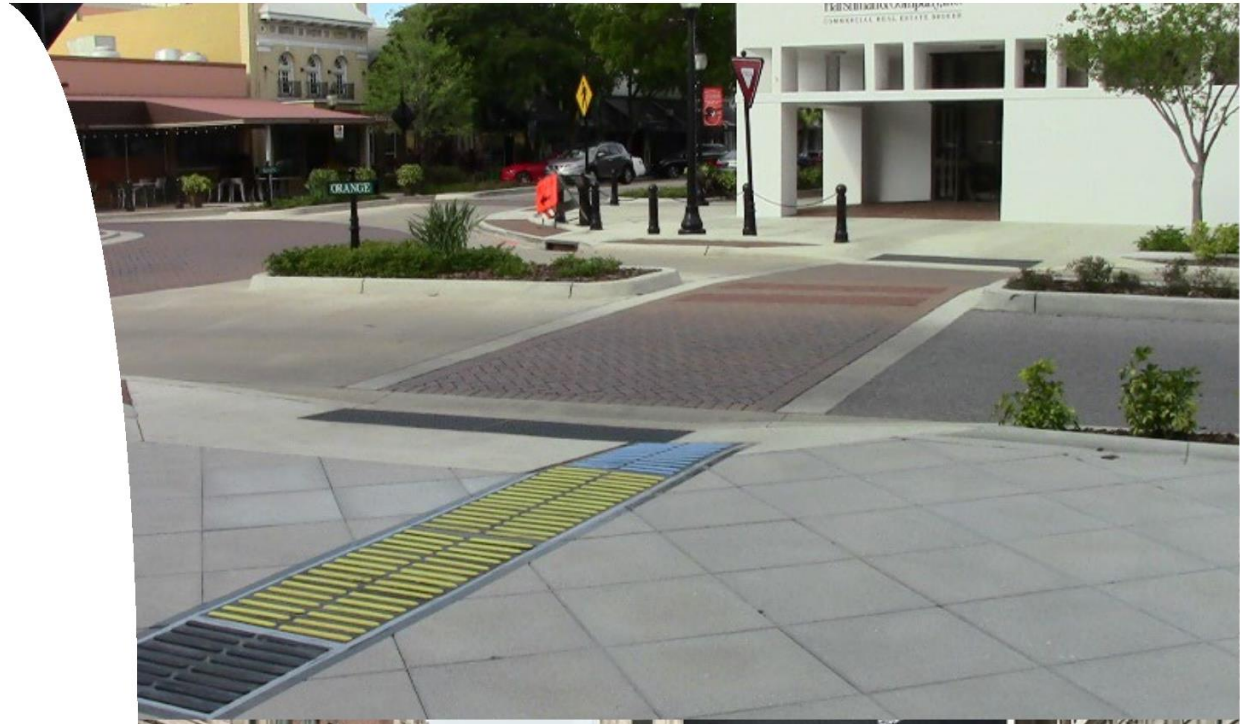


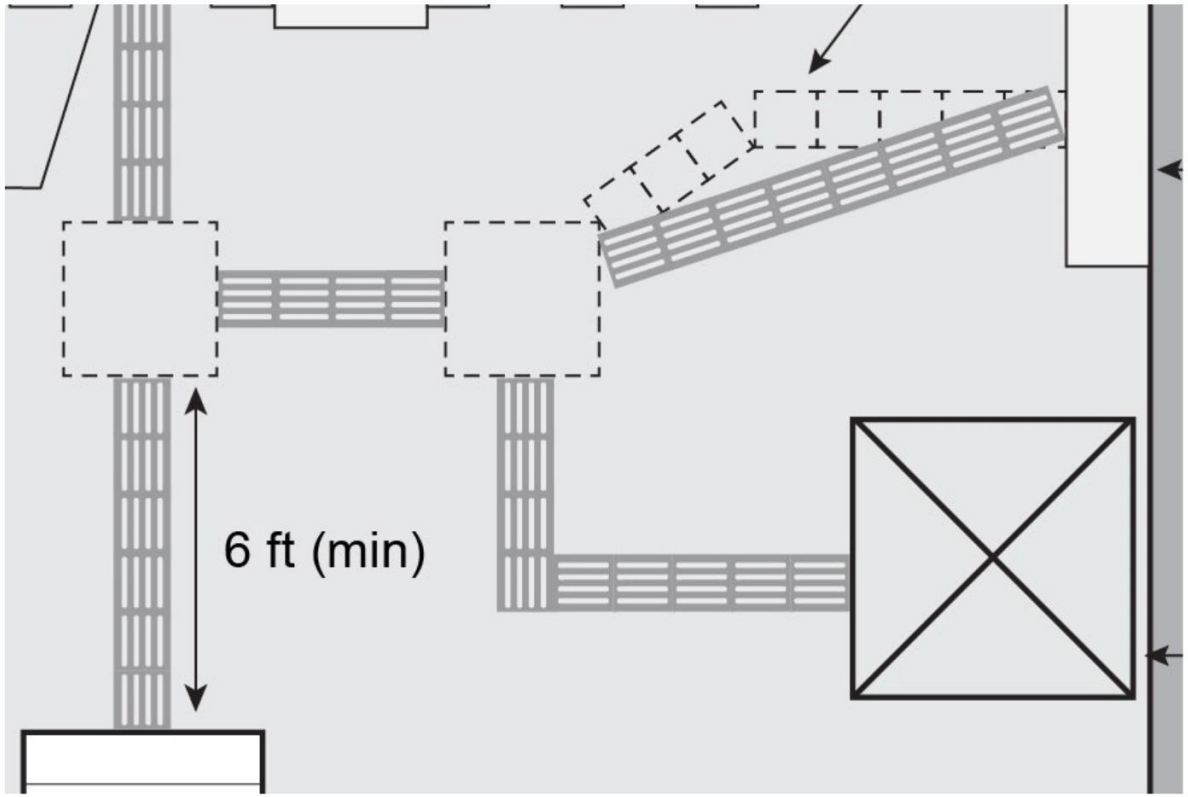
Photo : Paul Ryus

Structure of Guide

Chapter	Title
Chapter 1	Introduction
Chapter 2	Background
Chapter 3	Transit Facility and Other Plaza-Type Applications
Chapter 4	Crossing Applications
Chapter 5	Implementation
Chapter 6	Post-Implementation Activities
References	

TDI Use: Guide Bars

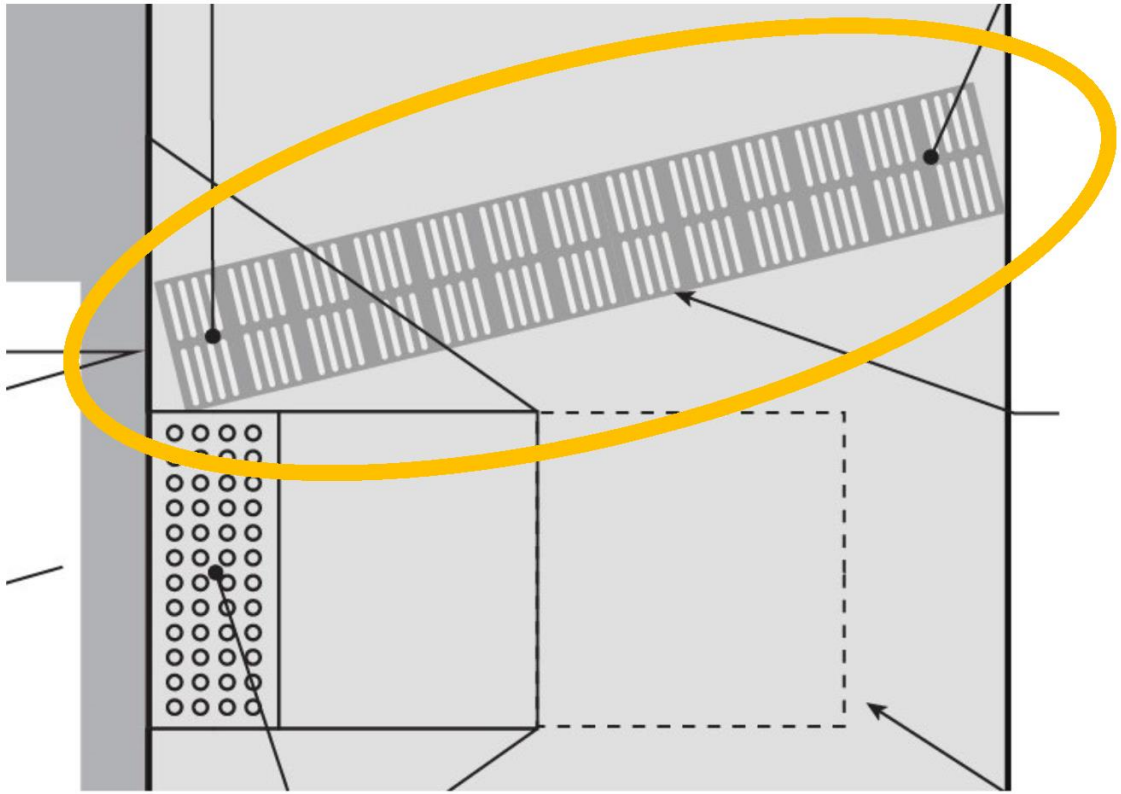
- 12-in.-wide (0.3 m) TDI defining an unobstructed path of travel in the direction of the bars. The bars are ~~oriented in the direction of travel~~, and the pedestrian is expected to follow them.



Portion of TCRP Research Report 248, Figure 15

TDI Use: Sidewalk Alert Bars

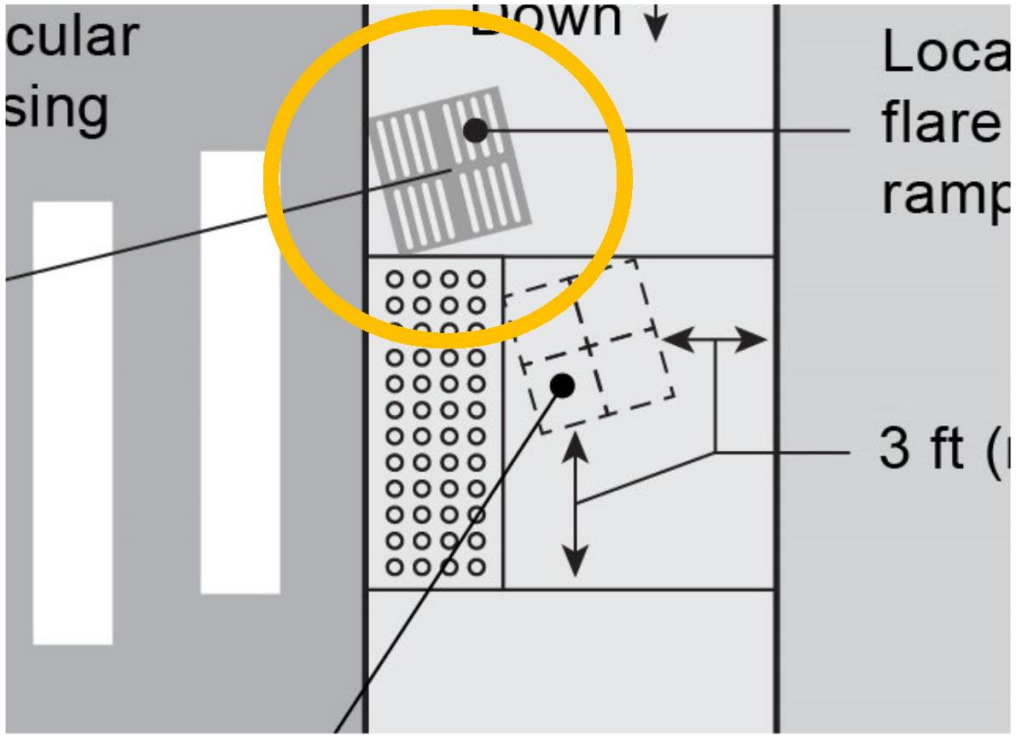
- A 24-in.-wide (0.6 m) TDI across the width of a sidewalk or walkway to indicate the location of a non-corner crossing or transit stop, and to provide a reliable cue for aligning to cross or to board. The raised bars are oriented perpendicular to the dire~~ction of travel across a crosswalk or onto a transit~~ vehicle ~~so they provide an accurate cue~~ for aligning to cross or board.



Portion of TCRP Research Report 248, Figure 28

TDI Use: Alignment Bars

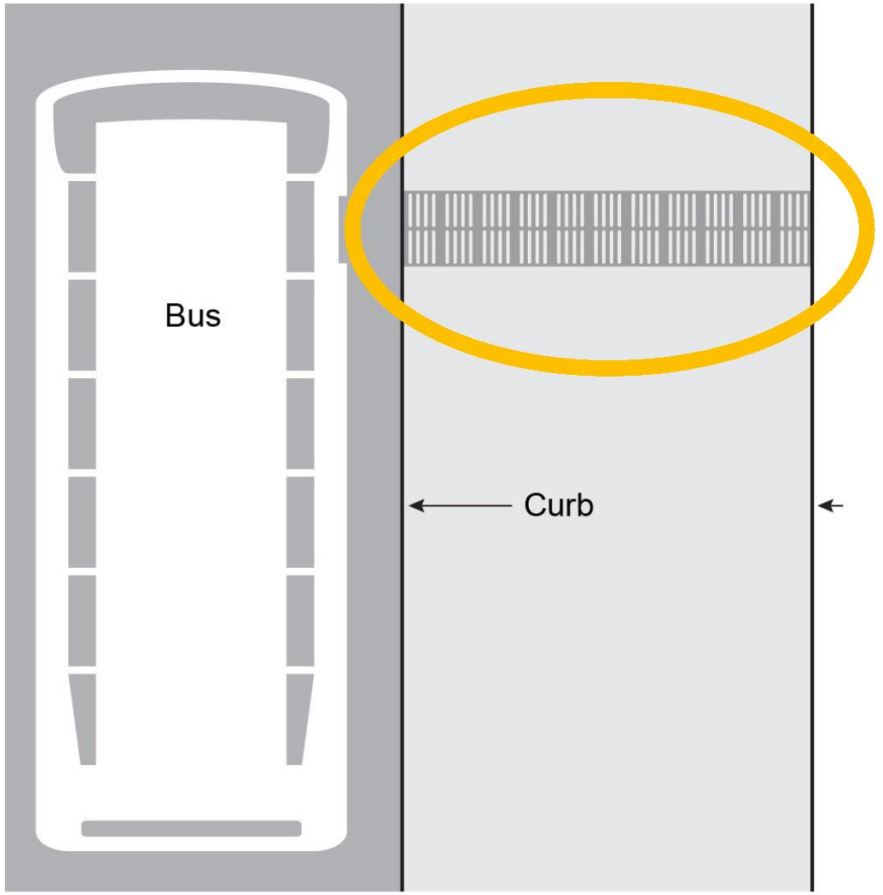
- A 24-in.-by-24-in. (0.6 x 0.6 m) square of TDI that provides an accurate alignment cue for crossing a street where other tactile or audible cues are absent or misleading. The raised bars are oriented perpendicular t~~o the dir~~ection ~~of travel across the associated crosswalk.~~



Portion of TCRP Research Report 248, Figure 36

TDI Use: Transit Door Location Bars

- A 24 in.-by 36-in. (0.6 x 0.9 m) rectangle of TDI, with the 24-in. (0.6-m) side parallel to the curb or platform edge, to indicate where transit boarding doors open. The raised bars are oriented perpendicular t~~o the dir~~ection of ~~travel onto a transit vehicle~~. ~~At boarding areas on a platfor~~m raised above standard curb height, the TDI surface will be flush with the DWS at the platform edge or curb.



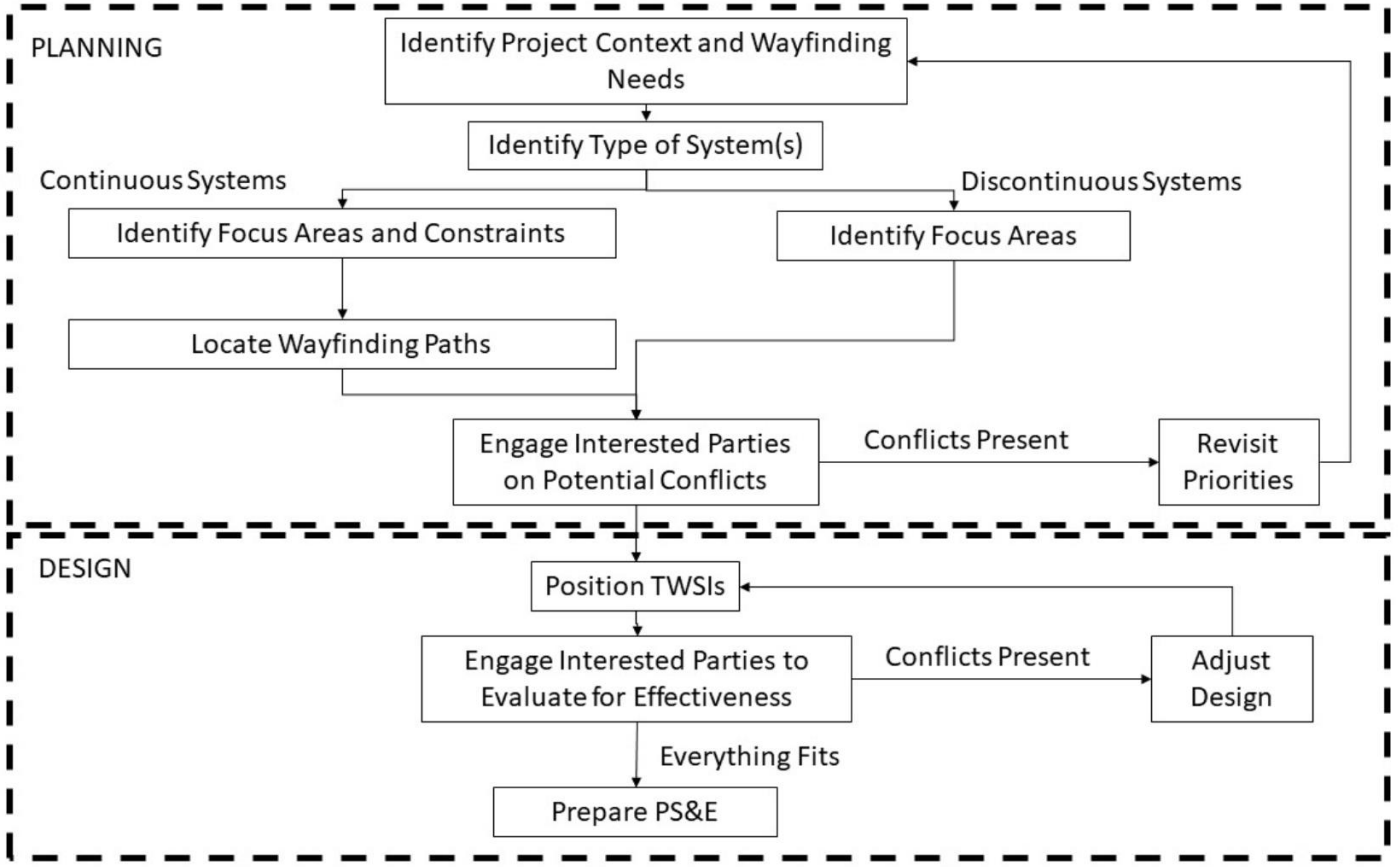
Portion of TCRP Research Report 248, Figure 24

Chapter 2: Background

- Designed for readers new to topic of tactile wayfinding
- Describes typical techniques and cues used for wayfinding by people who are blind or have low vision
- Describes need for tactile wayfinding
- Introduces types of TWSIs
- Brief history of tactile wayfinding in the U.S. and internationally
- Summary of current U.S. practice in applying TWSIs in public right-of-way and transit settings

Chapter 3: Transit Station and Other Plaza-Type Applications

- Introduction
- Planning process



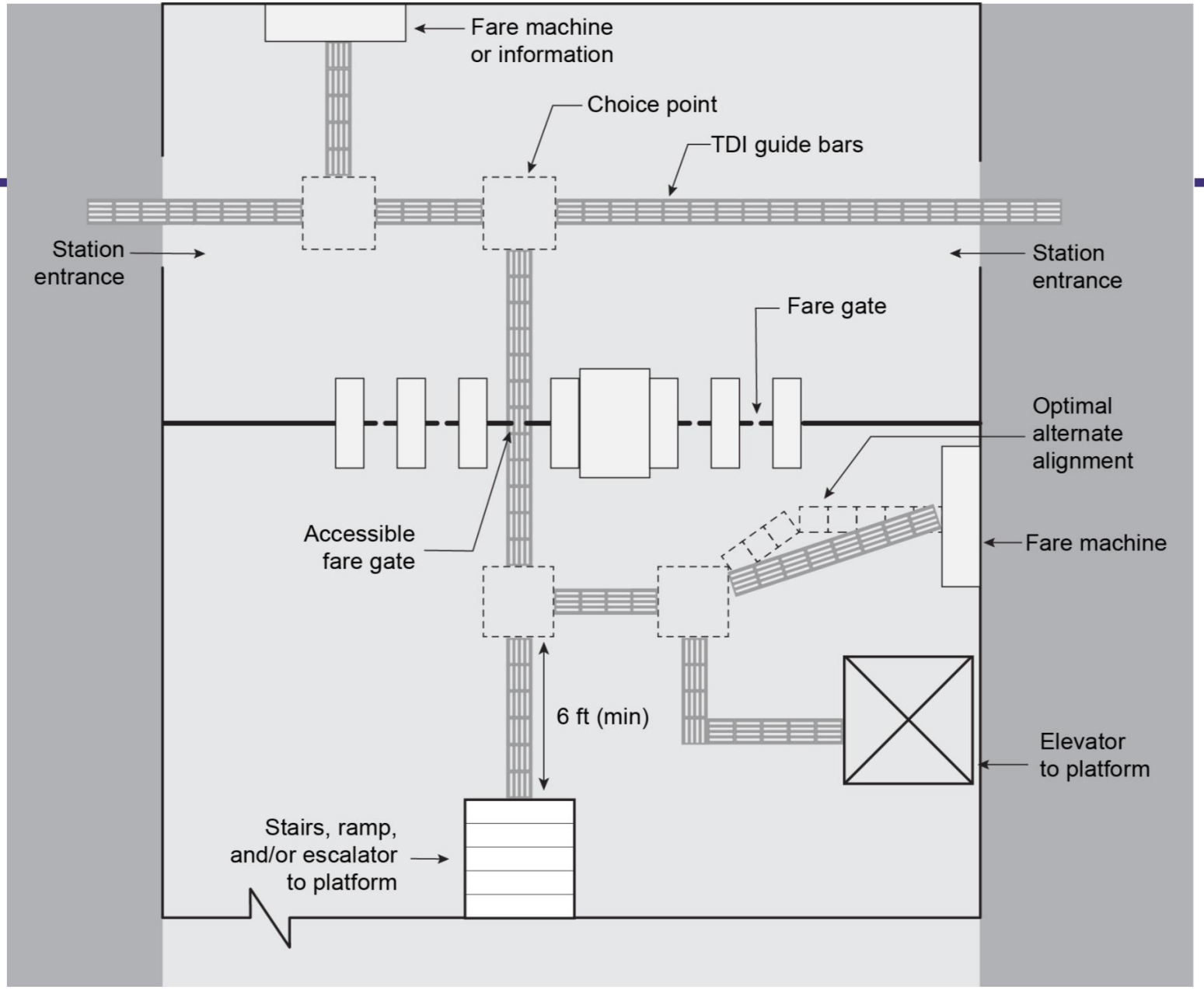
TCRP Research Report 248, Figure 15

Transit and Crossing Design Applications

- DWS (domes) placed first
  - Mark edges of transit platform if above standard curb heigh
  - At street or rail crossings, DWS are always installed in pairs
- TWDs (trapezoids) placed next
  - Mark boundary of pedestrian path next to vehicular path at same grade
- TDIs (raised bars) can be used as follows
  - Guide bars: 12-inch-wide along a path
  - Sidewalk alert bars: 24-inch-wide across a path
  - Transit door location bars: 24-inch-by 36-inch (or longer) rectangle to mark door ~~locations~~
  - Alignment bars: 24-inch-by-24-inch square to mark alignment with crossing

Use good geometry to do most of the work; TWSIs should be a supplement, ~~not a primary measure.~~

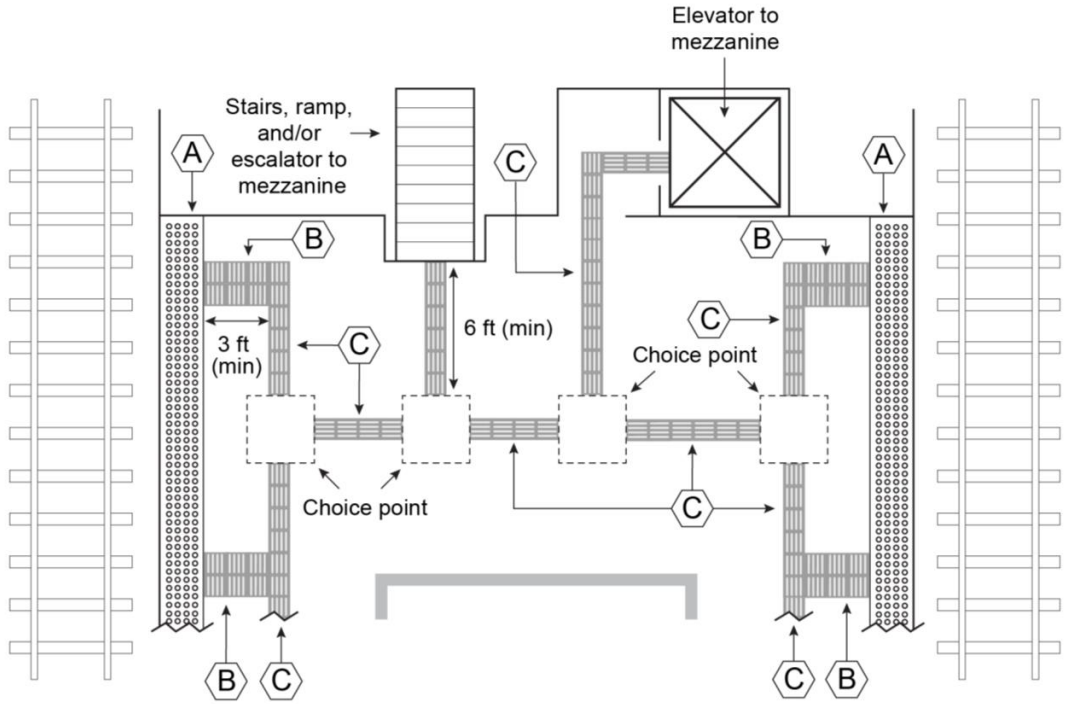
Transit Station Mezzanine



TCRP Research Report 248, Figure 18

Wide vs. Narrow Center Transit Platform

- Also figures for side platform

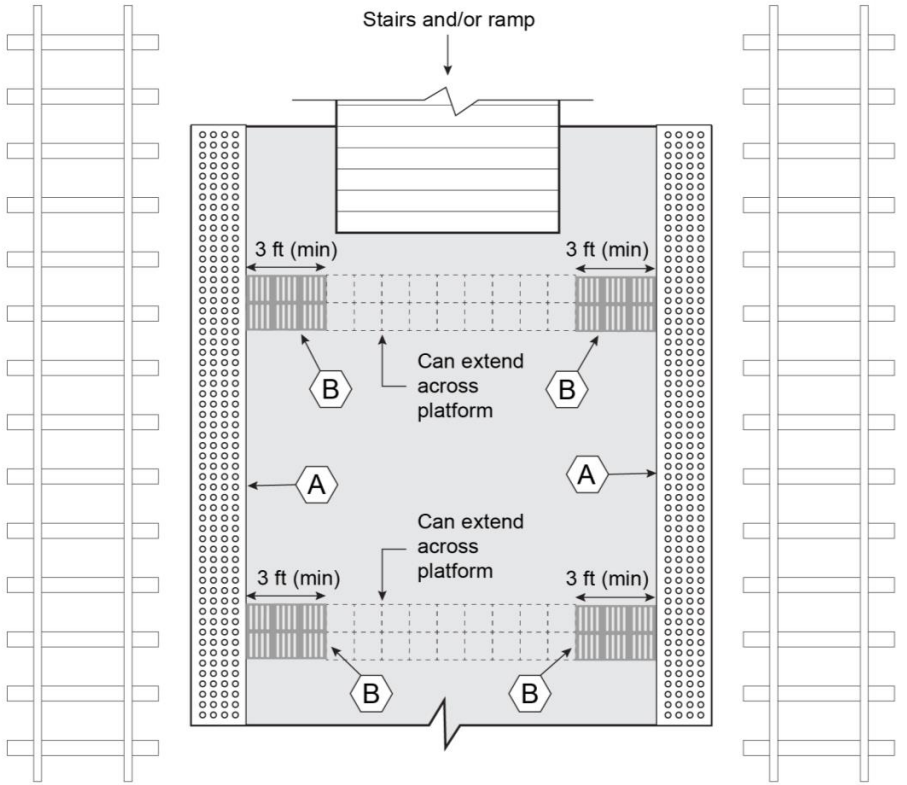


A DWS

B TDI transit door location bars (24-in width)
(bars may be rotated to meet local regulations or needs)

C TDI guide bars (12-in width)

TCRP Research Report 248, Figure 19

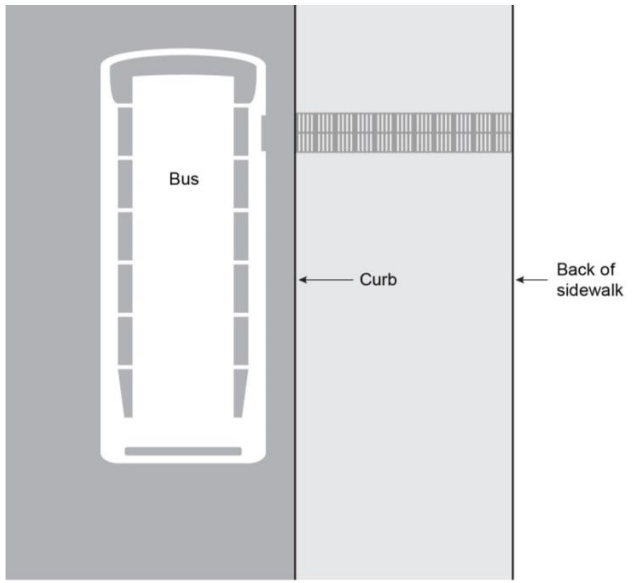


A DWS

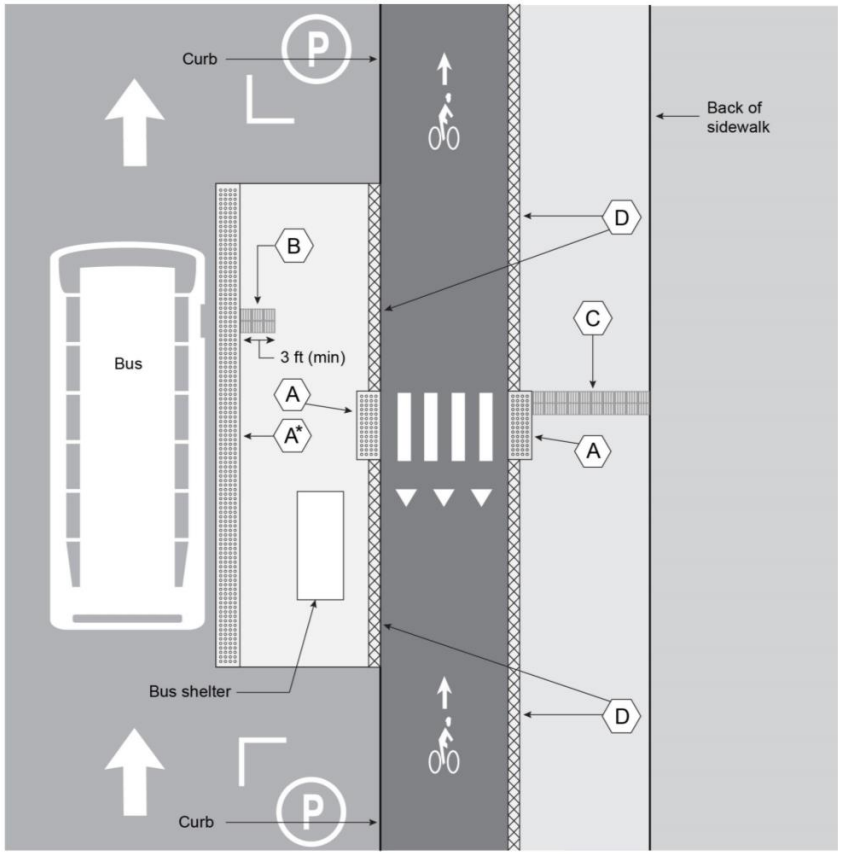
B TDI transit door location bars (24-in width)
(bars may be rotated to meet local regulations or needs)

TCRP Research Report 248, Figure 20

Bus Stops, Bus Boarding Islands, and Transit Center



TCRP Research Report 248, Figure 23



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

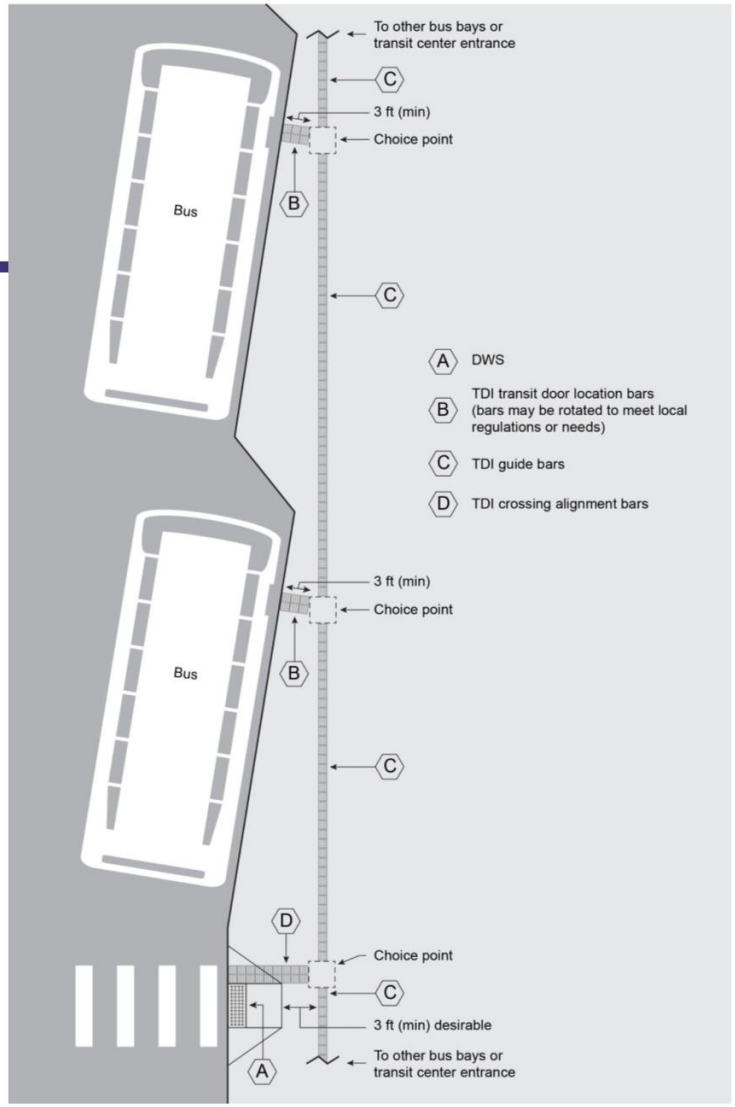
A DWS

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

C TDI sidewalk alert bars

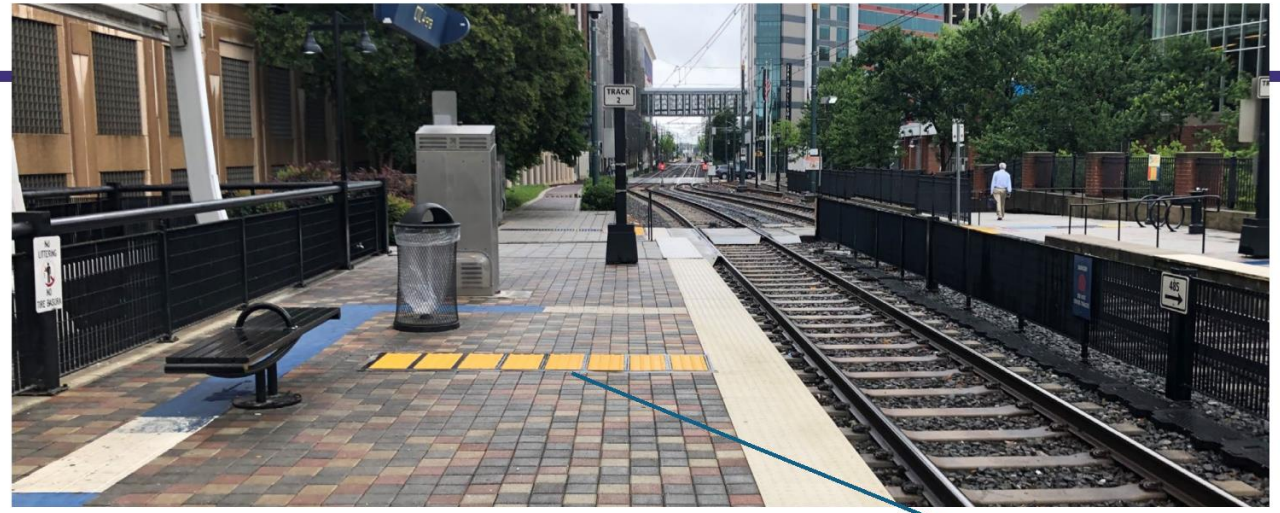
D TWD if bicycle lane is abutting and at same grade as pedestrian facility

TCRP Research Report 248, Figure 25

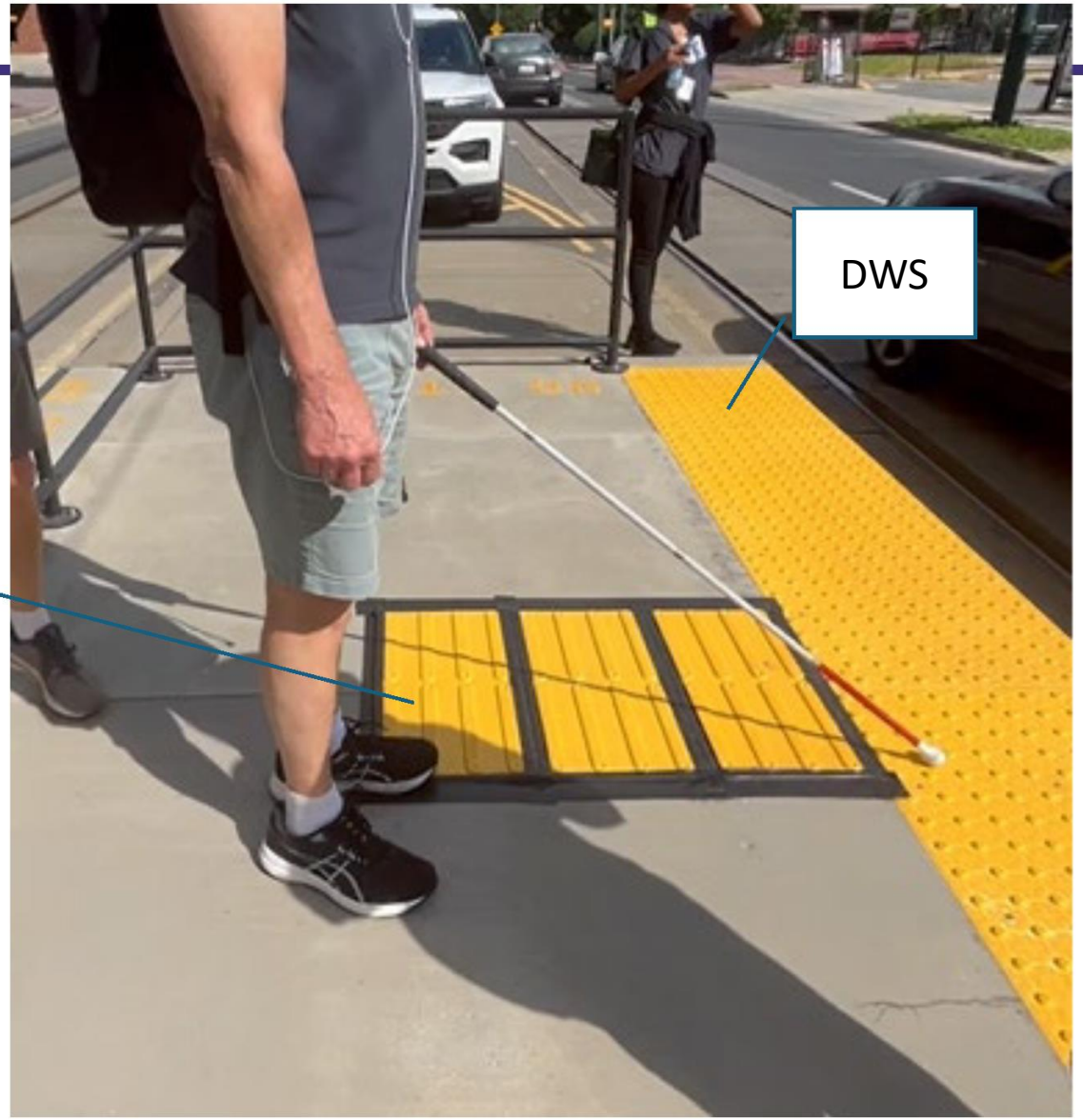


TCRP Research Report 248, Figure 24

Experimental Task: Find Boarding Locations



TDI bars

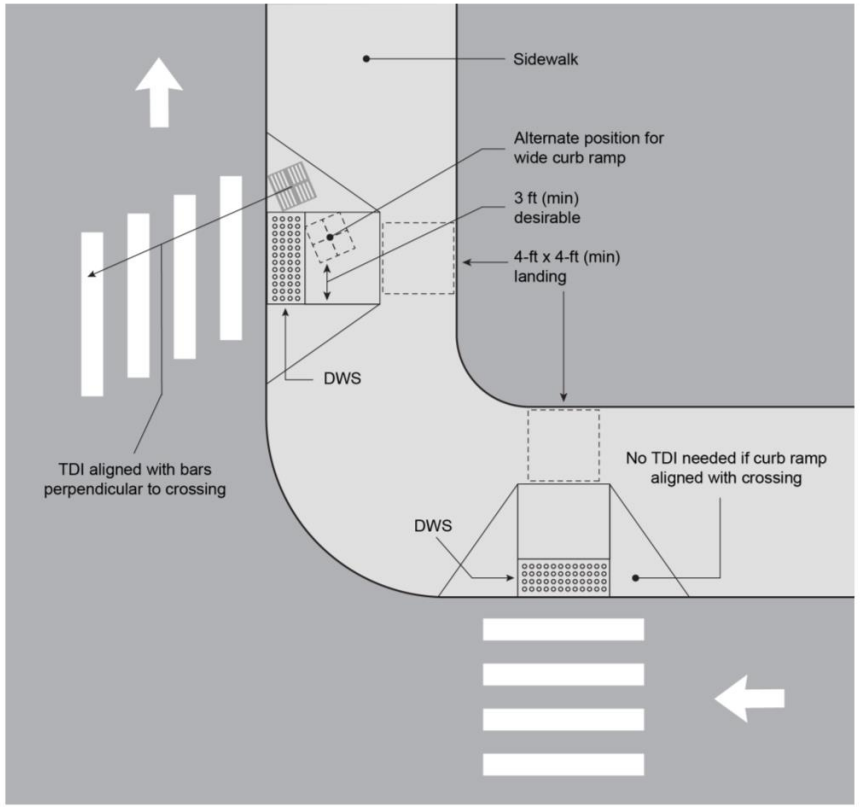


Principles for Installing TDIs (Raised Bars)

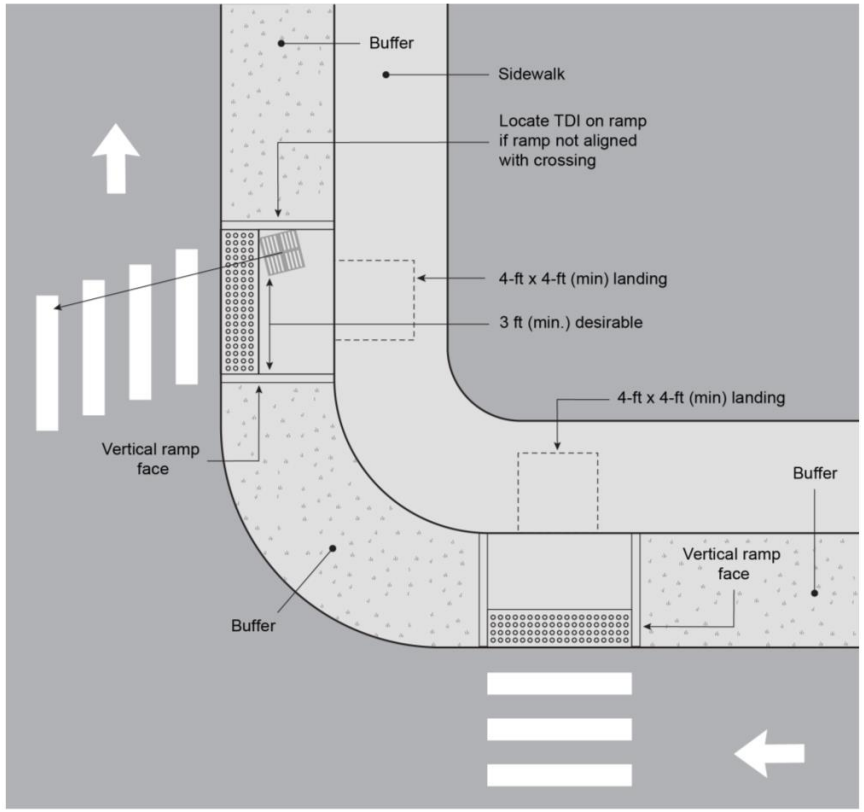
- At all TDI installations, consider avoiding the expected path of travel for people using mobility aids
- Corners: Install beside or behind DWS (domes) on side away from center of intersection
- Midblock/roundabout: Install on downstream side of DWS
- TDIs may be beside the DWS or behind it
- TDIs may extend across the flare of a curb ramp
  - Choice of materials may affect how the TDI bends over the grade break

Corner Applications: Perpendicular Curb Ramps with Flares or Returned Curbs

- Locate TDIs on side away from center of intersection

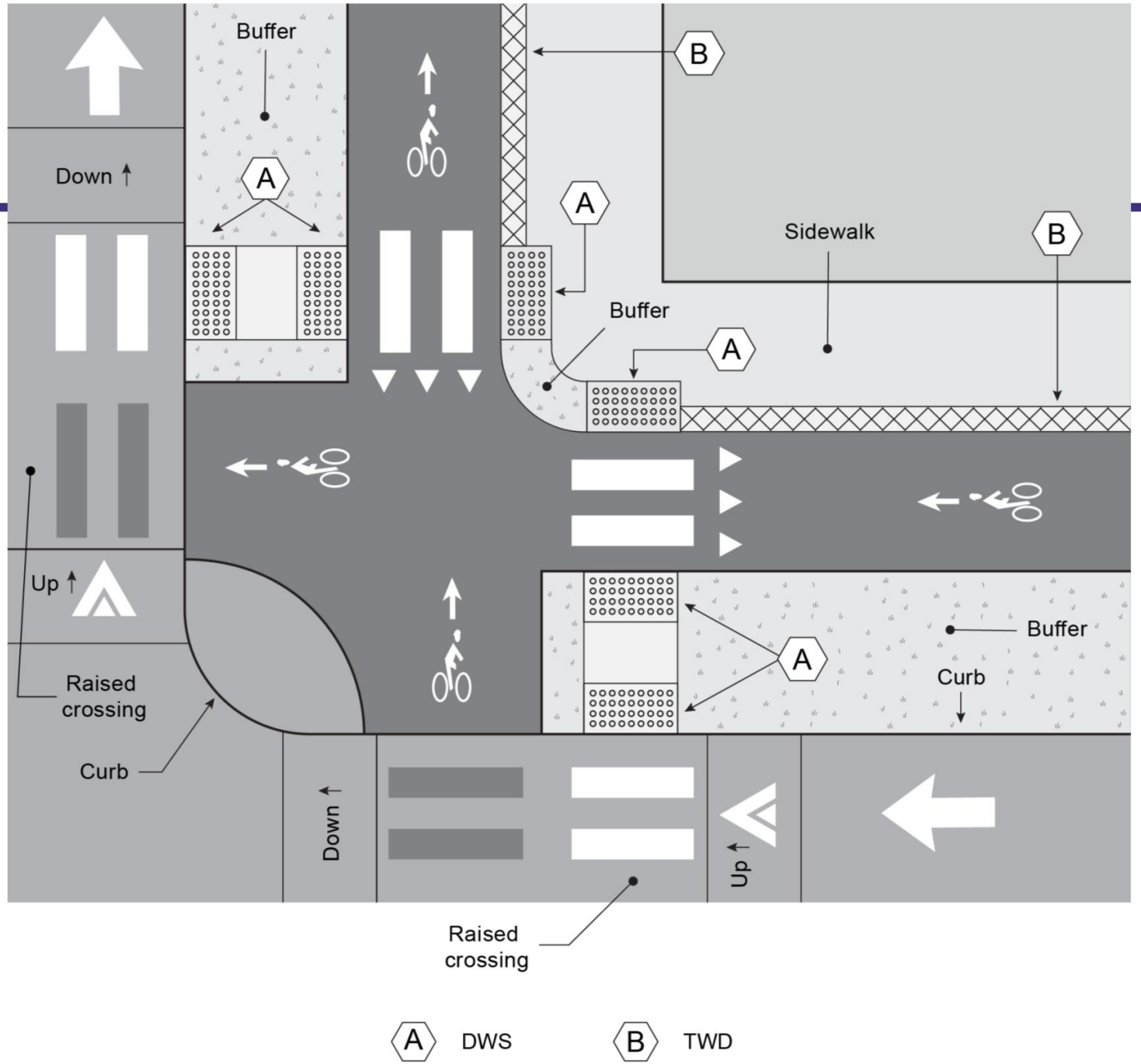


TCRP Research Report 248, Figure 34



TCRP Research Report 248, Figure 35

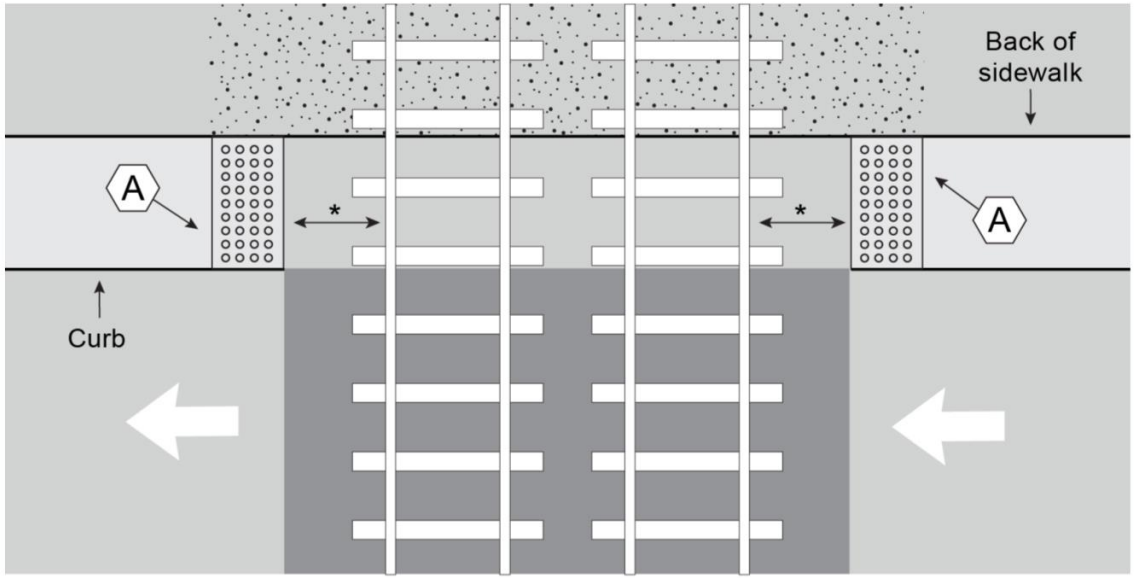
Separated Bike-Ped Facilities



TCRP Research Report 248, Figure 39

At-Grade Rail Crossing Applications

No offset in sidewalk alignment

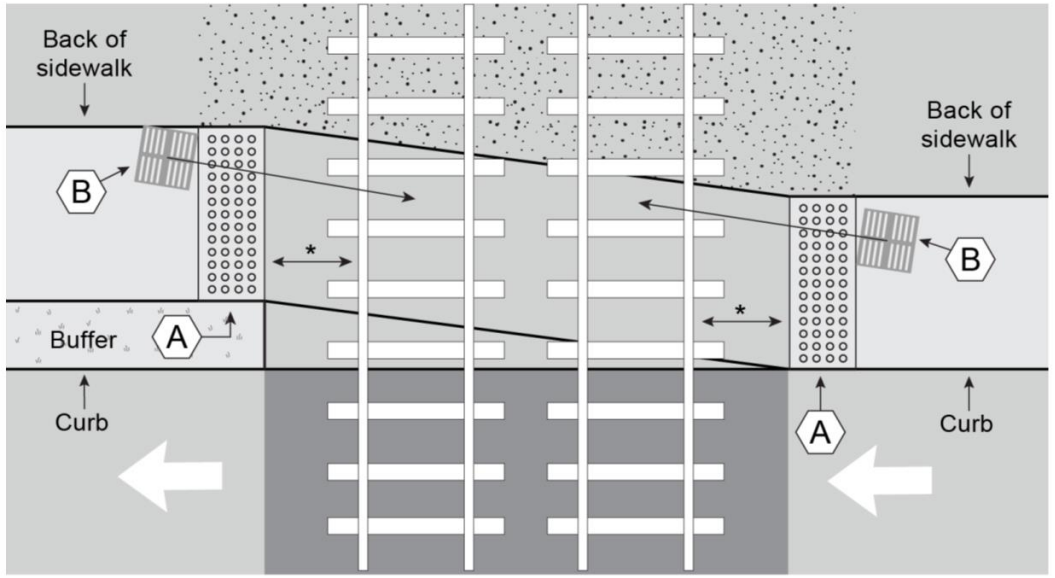


A DWS

*See PROWAG for dimensions

TCRP Research Report 248, Figure 41

Offset in sidewalk alignment



A DWS

B TDI crossing alignmnent square

*See PROWAG for dimensions

TCRP Research Report 248, Figure 42

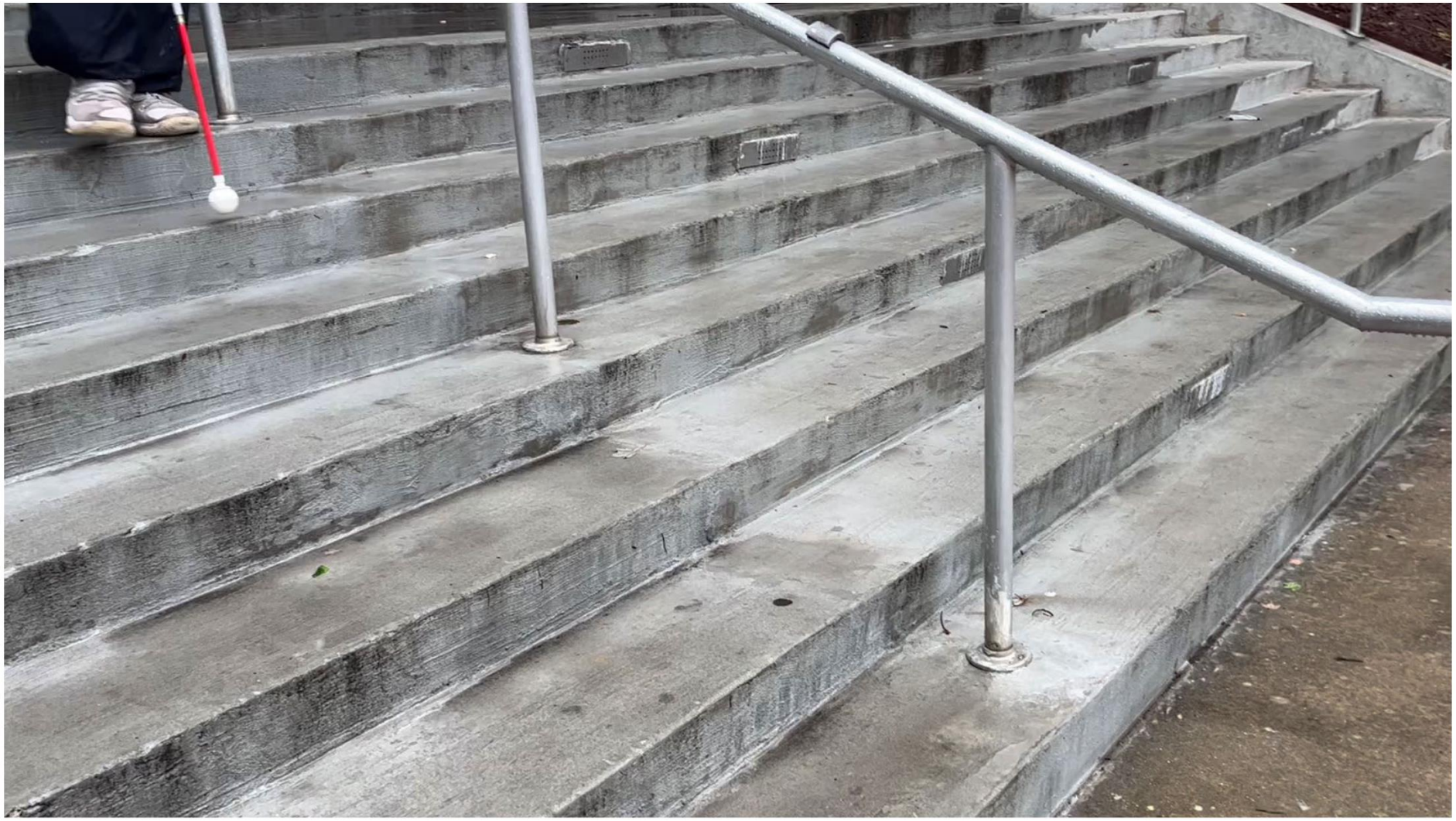
Chapter 5: Implementation

- Selecting TWSI materials
  - Maximizing durability and detectability
  - Minimize future maintenance
- Guidance for Orientation and Mobility (O&M) Professionals
  - Training potential users
  - Discussion of basic principles using terminology familiar to O&M professionals
    - **“Domes”, “Raised Bars”, and “Trapezoid**”
  - Discussion of locations where different kinds of TWSIs might be found
  - Cane technique for detecting TWSIs
  - Strategies for using TWSIs

Chapter 6: Post-Implementation Activities

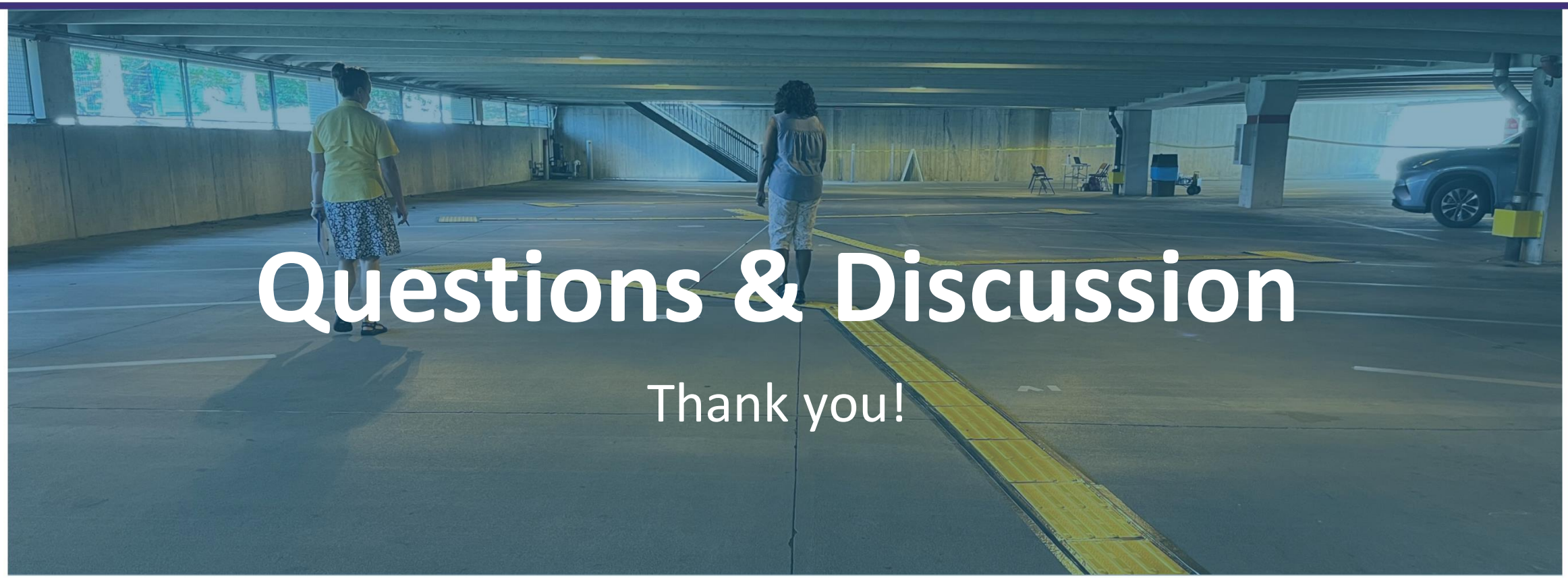
- Assessing effectiveness of tactile wayfinding system after installation
- System design to minimize future maintenance
- Routine maintenance activities
- Maintaining wayfinding during utility and construction work
- Brief case studies on four U.S. agencies
  - Bay Area Rapid Transit (BART), San Francisco Bay Area, California
  - Los Angeles Metro Rail, Los Angeles County, California
  - City of San Francisco, California
  - City of Seattle, Washington

Video – Following TDI path; identifying and turning at a path intersection



Future Research Needed

- Non-intersection path turns
  - Angled vs. curved? To what degree?
  - Need for CPI?
  - Messaging route instructions effectively?
- Further validation of TWD in real-world settings
- Height of TWSIs indoors vs. outdoors?
- TDI path beginnings and endings?
- Locator TDI lengths?
- Effectiveness of TWSIs with guide dogs?



Questions & Discussion

Thank you!

THE UNIVERSITY OF NORTH CAROLINA HIGHWAY SAFETY RESEARCH CENTER

Accessible Design for the Blind

KITTELSON & ASSOCIATES