Accessibility in Motion: PROWAG Standards and the Impact of APS

POLARA

best practices, requirements, & examples for accessible pedestrian signals

Introduction

How far can you go from your home without crossing a street?

Could you walk to the essentials of life without using a crosswalk - getting groceries, going to the bank, attending your work or school?

Now let's say you're one of the millions of Americans with low vision or blindness - 1 in 5 seniors over 85 have a permanent vision disability. You can't drive, and it's not practical to get a ride everywhere. But could you walk where you need to go without being able to see?

This is why accessible pedestrian signals - APS - exist.

Vision disability statistics

Over 8 million Americans lived with vision disabilities in 2022, as estimated by the American Community Survey.[1] 2.5 million of those have difficulty both seeing and hearing.

Other sources are less optimistic. According to the National Health Interview Survey, an estimated 23% of people over the age of 65 - over 13 million people - have trouble seeing even with corrective lenses, and 1.5 million of those are blind.[2]

As the American population is aging at the fastest rate since 1880[3], this demographic will continue growing until at least 2060, when the US Census Bureau projects nearly 1 in 4 Americans will be 65 years or older.[4]

Vision disabilities are not rare.
But unfortunately, accommodations for them are.

WHY APS?

difficulty
2. afb.org/research-and-initiatives/statistics/older-vision-loss/estimates-nhis
3. census.gov/library/stories/2023/05/2020-census-united-states-older-population-grew.html
4. census.gov/library/stories/2018/03/graying-america.htmlry/stories/2018/03/graying-america.html

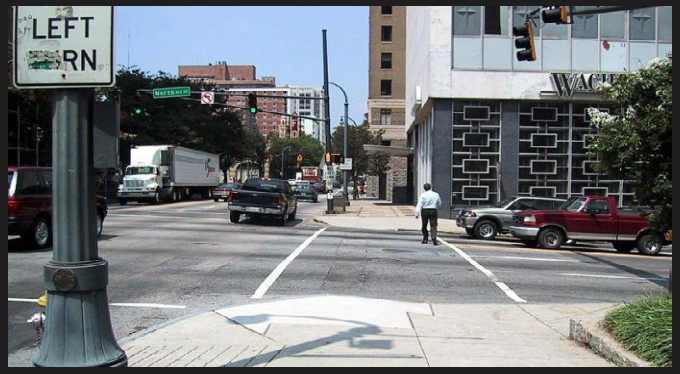

Figure 1: a street crossing seen with full vision.

1: A street crossing, seen with full vision.
Crossing features visible: buildings, cars, crosswalk markings, curbs, curb ramps, landscaping, pedestrian signals, poles, street signs, and vehicle signals.

Figure 2: a street crossing seen with overall reduced acuity.

2: People with overall reduced visual acuity can't see the pedestrian signal, read the street sign mounted beside the vehicular signal, or see the vehicular signal clearly.
Many individuals with vision similar to this do not use a white cane or other aid.

Figure 3: a street crossing seen with peripheral vision loss.

3: Severely restricted peripheral visual fields, sometimes called tunnel vision, is most often caused by a disease called retinitis pigmentosa, or glaucoma.
People with this vision disability can see the pedestrian signal as long as they're focused on it, but can only see a small part of the intersection at a time.
May use a long white cane or guide dog.

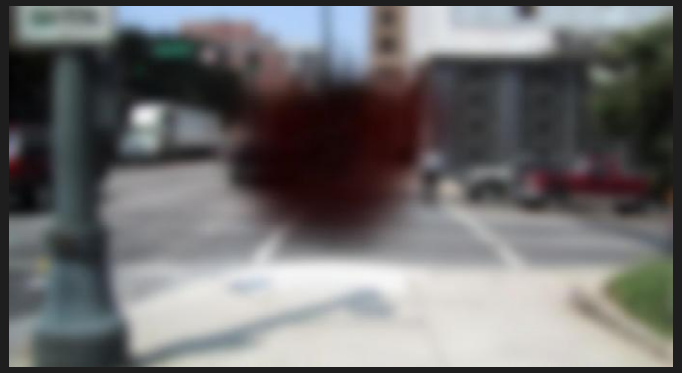

Figure 4: a street crossing seen with central vision loss.

4: Macular degeneration, the most common cause of vision loss in elderly adults, results in central vision loss. People with this vision disability can't see the pedestrian signal, read street signs, or make out details.
Many individuals with vision similar to this do not use a white cane or other aid.

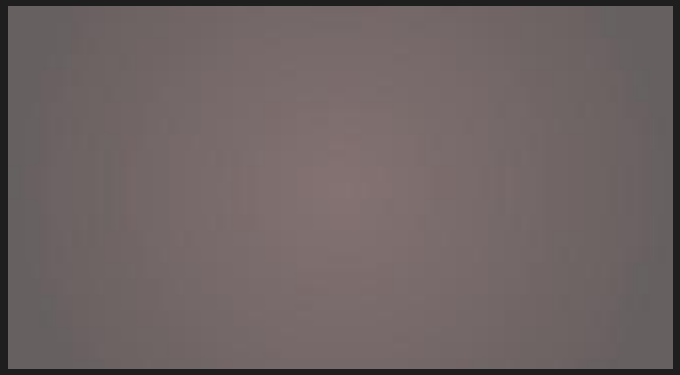

Figure 5: a street crossing seen with total blindness.

5: People who are completely blind have no visual information at the crossing. They must use other techniques to evaluate the intersection and cross, navigating by hearing and touch.

Vision disabilities illustrated

Example images and information on this page from NCUTCD Signals Technical Committee & ITE Traffic Engineering Council.

How do people with vision disabilities cross the street?

With limited or no visual information, pedestrians with vision disabilities rely on the sounds of traffic to infer the intersection geometry. They may use a long white cane to feel along the curb for curb ramps and detectable warning surfaces to locate a crosswalk. This approach can be frustrated by blended transitions, raised crossings, and crossings without a curb ramp, and curb ramps that are not aligned with the crossing they serve can direct pedestrians with vision disabilities into traffic.

If there is a properly-installed APS, the locator tone alerts the pedestrian to the presence of a crossing, and the raised arrow on the APS button is aligned with the associated crosswalk.

Navigating by sound and touch

Because the majority of navigation aids in the intersection are visual - signs, lights, painted lines - the challenge to traffic engineers is how to communicate the safest pedestrian paths through the intersection using only sound and touch.

Some physical methods for accomplishing this include fences, planters, or other cane-detectable barriers along curb edges where crossing isn't permitted; use of landscaping along the curb edge to delineate acceptable paths and make crossings apparent underfoot and by cane; and use of directional tactile paving to guide cane-users to crossings.

What are APS?

Accessible Pedestrian Signals (APS) are devices that communicate the information provided by pedestrian signal heads in non-visual formats (i.e. audible tones and vibrotactile indications) to pedestrians with blindness or low vision.[1]

APS provide essential information to pedestrians who are blind or who have low vision by alerting them to the status of the walk cycle without visual cues. For people who also have hearing disabilities, the arrow on the APS button vibrates for the WALK phase.

It is possible to configure APS to provide spoken information messages to communicate information that is readily available by sight, such as intersection geometry, street names, and unusual signal phasing.

Although APS have been in use since the 1970s, with some devices dating back even earlier, they were not included in the Manual of Uniform Traffic Devices (MUTCD) until 2000. Since then, driven by the Americans with Disabilities Act requirement for cities to provide access to public spaces, their prevalence in the U.S. has continued to grow; and with the release of the Public Right-of-Way Accessibility Guidelines (PROWAG) in 2023, more communities have accepted APS as a necessary feature for safe and walkable streets.

1. Polara.com "What is an APS?"

What's the difference between an APS and an AID?

Accessible Pedestrian Signals (APS) are used at street crossings with pedestrian signals.

Audible Information Devices (AID) are used at unsignalized street crossings.

The devices can be similar, and many of the requirements for APS also apply to AID. For a complete comparison of the required features, please see page 21.

◀ Accessible Pedestrian Signal (APS)	Audible Information Device (AID) ▶
Audio and vibrotactile communication of visual signals at signalized crossings.	Audio notification of warning beacons and RRFBs at unsignalized crossings.
Tells pedestrians when the **WALK signal is on.**	Tells pedestrians when the **warning lights are flashing.**
Button vibrates for WALK phase.	Button does not vibrate.
Rapid percussive tone or audible message for WALK phase: "Broadway, walk sign is on to cross Broadway."	Audible message: "Warning lights are flashing" (per 11th ed. MUTCD; previously "Yellow lights are flashing").

About this section

▶ Recommended best practices are bolded and marked with an arrow.

When to install APS

▶ In general, APS should be installed at every crossing that has a visual pedestrian signal. Any crossing that warrants the use of a visual pedestrian signal for the safety of sighted pedestrians, also warrants the use of an accessible pedestrian signal for the safety of pedestrians with visual disabilities.

Specifically, priority should be given to installing APS at the following signalized crossings:

- Where requested by a visually disabled person or an advocate for the visually disabled,
- At intersections with a Leading Pedestrian Interval (LPI), exclusive pedestrian phase ("Barne's Dance" or scramble crossing), or low traffic volume, which can prevent visually disabled pedestrians from discerning the pedestrian phase,
- At other intersections with complex geometry or complex traffic signal phasing,
- And at crossings used frequently by elderly or visually disabled pedestrians.

Once these priority crossings are made accessible, all remaining signalized intersections should be systematically upgraded with APS.

BEST PRACTICES

A policy implemented successfully by many agencies, including the transportation departments of San Francisco[1] and Seattle,[2] is to install APS at every new signalized intersection, at requested signalized intersections when funds are available, and retrofit APS into signalized crossings that lack APS whenever other alterations or repairs of similar scope are made.

This kind of systematic upgrade has benefits:

1. By primarily installing APS as part of larger projects, where APS will be a minor expense, funding can be easier to secure.
2. By committing to roll APS out to all signalized crossings under the agency's control, time and expense are saved on engineering studies to determine if APS is a priority for any particular crossing.
3. By installing APS during projects that give access to underground cables, agencies can significantly reduce the expense of APS installations - trenching costs to run wires for APS can exceed 50 times the cost of the APS units.
4. By having a clear, actionable, and in-progress plan to make all crossings accessible, the agency can demonstrate its commitment to and progress towards ADA compliance.
5. By proactively making progress towards PROWAG compliance, agencies can

1. sfmta.com/getting-around/walk/accessible-pedestrian-signals
2. seattle.gov/documents/Departments/SDOT/Services/PolicyMemo_APS_Final.pdf

avoid having to rework facilities they are planning now after PROWAG-compliant facilities become mandatory.

When to use speech information messages

Audible walk indications, which APS make at the beginning of the pedestrian WALK interval, should be percussive tones unless the APS units on that corner are less than 10 feet apart. Percussive tones have 8-10 ticks per second over multiple frequencies, with a dominant component at 880 Hz. This is designed to be audible to people with age related upper-frequency hearing loss, cutting through traffic noise, not easily mistaken for other environmental noises, and more quickly and accurately understood than a spoken WALk message at lower volumes.

In contrast, speech information messages that APS deliver when the button is pressed during the DON'T WALK interval, audibly provide information visibly available by viewing the intersection, on street signs, and on informational signs:

- names of the crossing streets,
- notification of unusual pedestrian phasing, such as leading pedestrian intervals, exclusive pedestrian phases, or split phasing,
- information about unusual intersection geometry, such as median refuges or islands, diagonal crosswalks, or channelized turn lanes.

Some, but not all, of this information can be conveyed through physical means - for instance, using landscaped edges to give a tactile separation between the sidewalk and the street so safe crossing points can be determined by the feeling of the pavement underfoot; or the use of cane-detectable fences or barriers to block crossing where a crossing cannot be made safely.

▶ **Use speech information messages wherever the potential for confusion cannot be relieved through physical barriers and navigational guides.**

Consider using speech information messages as an audio analogue for any safety or navigation signage available to sighted pedestrians, except for landmarks, detours, or other temporary traffic control conditions.

When to use audible beaconing

Audible beaconing provides additional navigation information to pedestrians with limited vision: in addition to telling them when to cross, it tells them where the other end of the crossing is.

Whether or not an APS has audible beaconing, it emits a tone or beep at regular intervals to help people with limited vision find the button. Known as a Locator Tone, this sound is designed to be audible from 6-10 feet away.

At crossings that have audible beaconing, an extended press (a button press of at least one second) will activate the beacon. During the next pedestrian change interval,[1] the APS then projects the locator tone through an external speaker mounted on the pedestrian signal head on the destination end of the crosswalk

Multiple studies have shown that APS with audible beaconing help pedestrians with vision disabilities remain within the crosswalk all the way across the street without veering into the roadway.[2][3] In one study comparing standard APS with beaconing APS at a complex intersection, blind pedestrians followed the crosswalk 68% of the time with an APS beacon, compared to 36% of crossings with standard APS.[4]

By providing an audible signal to home in on, audible beaconing can give pedestrians with blindness or low vision confidence that they are not veering out of the crossing.

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1. The interval while the orange hand is flashing and pedestrians have a calculated clearance time to finish crossing the street.

2. Wall, Ashmead, & Barlow, *Directional Guidance from Audible Pedestrian Signals for Street Crossing*, 2004

3. Scott, Bentzen, Barlow, et al., *Far-Side Audible Beaconing of Accessible Pedestrian Signals*, 2014

Figure 6: Audible beaconing.

4. Barlow, Scott, Bentzen, et al., *Effectiveness of Audible and Tactile Heading Cues at Complex Intersections for Pedestrians who are Blind*, 2014

The external speaker used for audible beaconing should be mounted on the pedestrian signal head, within the width of the sidewalk, 7-10 feet above the pavement.

Leading Pedestrian Intervals

Leading pedestrian intervals (LPIs) are a low-cost proven safety countermeasure that increase pedestrian visibility to turning cars. LPIs give pedestrians 3-7 seconds head start to begin their crossing before the parallel green light, allowing them to enter the crosswalk before turning vehicles begin to move.

Studies on LPIs are positive. A study in 2018[1] found a 13% overall reduction in vehicle/pedestrian crashes (at left turns), with individual results scoring much better, while a 2010 study[2] showed a 60% overall reduction in vehicle/pedestrian crashes.

The FHWA list of Proven Safety Countermeasures[3] gives the following benefits for LPIs:

- Increased visibility of crossing pedestrians.
- Reduced conflicts between pedestrians and vehicles.
- Increased likelihood of motorists yielding to pedestrians.
- Enhanced safety for pedestrians who may be slower to start into the intersection.

1. Goughnour, Carter, Lyon, et al., *Safety Evaluation of Protected Left-Turn Phasing and Leading Pedestrian Intervals on Pedestrian Safety*, 2018
2. Fayish & Gross, *Safety Effectiveness of Leading Pedestrian Intervals Evaluated by a Before–After Study with Comparison Groups*, 2010
3. highways.dot.gov/safety/proven-safety-countermeasures/

But vision-disabled pedestrians cannot benefit from the additional LPI crossing time if it is only communicated visually, and in fact may cross at increased risk because of the LPI.

Blind or visually disabled pedestrians are trained to use the sound of parallel traffic to identify the beginning of the Walk interval. LPIs delay the beginning of traffic movement, which can place blind pedestrians in front of turning vehicles, leave them without sufficient time to complete their crossing before the Don't Walk signal, or even lead them to begin crossing after the Walk interval ends.

At LPI crossings, blind pedestrians can be expected to cross after the Walk sign has ended 15-38% of the time, and end their crossing in the Don't Walk phase 40-82% of the time.[4]

Drivers may not expect blind pedestrians to begin crossing late, causing potentially fatal conflicts.

▶ APS should be installed wherever leading pedestrian intervals are implemented.

4. Bourquin, Bieder, Emerson, & Franck, *Leading Pedestrian Intervals at Urban Crosswalks: Effects on Safety for Travelers Who Are Blind*, 2023

1: Leading Pedestrian Interval:
The WALK signal begins 3-7 seconds before the parallel green light, allowing pedestrians to establish themselves in the crossing before vehicles start to move. Note the blind pedestrian in this image, not hearing a surge in traffic, is unaware of the WALK and remains on the sidewalk.

2. Vehicular Green:
Most pedestrians have had 3-7 seconds to proceed. Vehicles begin to move, and the turning vehicle #1 yields to pedestrians already in the crossing. Vehicle #2 sees the blind pedestrian waiting, and believes they are not going to cross. Now the blind pedestrian hears the surge in traffic, and believes the WALK interval has just begun.

Figure 7: Failure to yield to a blind pedestrian at an LPI-equipped intersection (YouTube).

Leading Pedestrian Interval: vehicle/pedestrian conflict

3. Pedestrian Clearance Interval:
The sighted pedestrians complete their crossings. The blind pedestrian begins their crossing, and comes in conflict with vehicle #2.

APS positioning

The pedestrian pushbutton positioning guidelines given in the 11th ed. MUTCD §4I.05 were written with APS positioning requirements in mind.

People with vision disabilities use the raised tactile arrow on the APS button, the edge of the curb, the curb ramp, the detectable warning surfaces, and the sound of traffic to orient themselves in space and align themselves with the crossing.

People with both hearing and vision disabilities use the APS' vibrating WALK signal to know when to cross, keeping their hand on the button until the WALK interval begins.

▶ When installing APS, ensure:

- **The APS button arrow is aligned parallel to the crossing,**
- **The APS is near the ramp for the associated crossing, where it can be accessed easily by someone who will keep their hand on the button until crossing,**
- **The APS is near the curb edge, so someone who is listening or feeling for the WALK signal can begin their crossing immediately when the pedestrian WALK begins,**
- **There is adequate level unobstructed space at and around the button for easy access and transit of people using mobility devices.**
- **The button is mounted 3.5 ft above the sidewalk.**

Personal accessibility devices

A number of systems exist that provide APS benefits only to pedestrians bearing an access key, often in the form of a senior card, key fob, remote, or a mobile app. These often operate as a typical pedestrian button until someone activates the APS functions using their key.

There are several drawbacks to this approach, compared with a standard APS:

1. **Non-compliant with MUTCD and PROWAG.** The regulations for APS describe a public device that provides an audible and vibrotactile WALK indication through a button, with a locator tone and raised arrow. Supplemental devices are not prohibited, but the required functions of APS need a public device.
2. **Multiple points of failure.** Adding devices and software that must all be working for the pedestrian to have access to the agency's facilities makes a breakdown of access more likely.
3. **Increased program scope.** In contrast to standard APS, which offers the same benefits to anyone who uses it, keyed systems burden the agency in perpetuity to provide an access key to everyone who needs APS.
4. **Inaccessible to visitors.** Visitors will lack the access key that make the local crossings accessible.

▶ Install APS that is publicly accessible, without barriers to operation.

Laws and regulations relevant to APS

The features, design, and placement of APS are subject to the requirements of the Americans with Disabilities Act, Section 504 of the Rehabilitation Act of 1973, the Architectural Barriers Act of 1968, and other federal, state, and local statutes.

Regulations and guidelines for APS under these statutes include the Manual on Uniform Traffic Control Devices (MUTCD), the Public Right-of-Way Accessibility Guidelines (PROWAG), and Sections 305 and 308 of the 2010 ADA Standards for Accessible Design.

This section will overview these in brief to give context to the next section, where we survey the specific requirements of the MUTCD, PROWAG, and the ADA Standards.

Overviews

Architectural Barriers Act of 1968

The Architectural Barriers Act (ABA)[1] was one of the first federal laws addressing public accessibility. The ABA requires facilities designed, built, altered, or leased with federal funds to be accessible to people with disabilities.

1. access-board.gov/aba/

REGULATIONS FOR APS

Section 504 of the Rehabilitation Act of 1973

The Rehabilitation Act prohibits discrimination on the basis of disability in federally funded programs. In several high-profile cases, courts have held this (alongside the ADA's similar prohibition) as a positive requirement to make pedestrian signals accessible.[2][3][4]

"No otherwise qualified individual with a disability in the United States… shall, solely by reason of her or his disability, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance."

— Section 504 of the Rehabilitation Act.[5]

Americans with Disabilities Act (ADA)

The Americans with Disabilities Act[6] is the broadest and most well-known American accessibility law. The ADA recognizes equal access to participation in public life as a civil right, and requires public services, programs, and activities to be accessible to people with disabilities.[7]

"No qualified individual with a disability shall,

2. Scharff v. County of Nassau
3. Am. Council of the Blind of NY Inc v. City of NY
4. Am. Council of the Blind of Metro. Chicago v. The City of Chicago
5. 29 U.S.C. § 794(a)
6. access-board.gov/ada/
7. polara.com/guide/ada-accessibility-requirements

by reason of such disability, be excluded from participation in or be denied the benefits of the services, programs, or activities of a public entity, or be subjected to discrimination by any such entity."

— The Americans with Disabilities Act (ADA), Title II [1]

Sections 305 and 308 of the 2010 ADA Standards for Accessible Design

"The 2010 [ADA] Standards set minimum requirements – both scoping and technical – for newly designed and constructed or altered State and local government facilities, public accommodations, and commercial facilities to be readily accessible to and usable by individuals with disabilities."

— 2010 ADA Standards - Introduction [2]

The 2010 ADA Standards are referenced by the MUTCD for the clear space and reach ranges required for pedestrian push buttons, including APS.

Manual on Uniform Traffic Control Devices (MUTCD)

Since it was first published in 1935, the MUTCD[3] has evolved from a 166-page document to standardize road signs and pavement markings to an 1161-page guide that has been described as the bible of American road design. It prescribes what is – and isn't – acceptable when it comes to signs, signals, markings, and other traffic control elements on public roadways.[4]

The 11th edition MUTCD, published in 2023, has specifications for pedestrian signals in section 4I, pedestrian pushbuttons are covered in 4I.05, and APS are regulated by chapter 4K.

ADA and ABA Accessibility Guidelines for the Public Right-of-Way (PROWAG)

PROWAG[5] is a set of technical guidelines developed by the US Access Board to help transportation professionals create accessible routes along public streets. Among other things, it mandates push buttons with specific accessibility features anywhere a pedestrian signal or pedestrian-activated warning device is provided.[6]

The U.S. Access Board began developing what would become PROWAG in 1999, releasing Proposed Draft Accessibility Guidelines for the Public Right-of-Way in 2013. Many agencies used the draft as recommended guidelines until the final rule was published in 2023. The DOJ and USDOT will adopt PROWAG as a minimum requirement, publishing their own versions; and these department-specific versions of PROWAG will have the force of law.

1. 42 U.S.C. § 12132
2. ada.gov/law-and-regs/design-standards/2010-stds/
3. mutcd.fhwa.dot.gov/kno_11th_Edition.htm
4. polara.com/guide/mutcd-accessibility-requirements
5. access-board.gov/prowag/
6. polara.com/guide/prowag-accessibility-requirements

How to read this section

Feature/Subject/Topic

M *MUTCD 11 §4K.04* P *: PROWAG R307.8*

M Should (P Shall): Maximum of 5 dBA louder than ambient sound.

M P Shall: Automatic volume adjustment to a

Initial(s) of the regulations that contain the specification

Strength of the specification:
Shall (mandatory),
Should (required with exceptions), or
May (optional/recommended)

Paraphrased specification

Regulations covered in this section

This section reviews APS and AID regulations from the Manual on Uniform Traffic Control Devices (MUTCD), the Public Right-of-Way Accessibility Guidelines (PROWAG), and Sections 305 and 308 of the 2010 ADA Standards for Accessible Design.

The following summaries are paraphrased; for the official language, please refer to the published versions.

Figure 8: two examples of high-contrast tactile arrows.

MUTCD & PROWAG REQUIREMENTS

Vibrotactile indication

M *MUTCD 11 §4K.03* P *PROWAG R307-8*

M Shall: Vibrotactile arrow on the push button.

P Shall: Vibrate the Push button.

M P S Shall: Vibrate during the walk interval.

High contrast tactile arrow

M *MUTCD 11 §4K.04* P *PROWAG R307.9*

M P S Shall: Have high visual contrast.

M P S Shall: Be aligned parallel to the direction of travel on the associated crosswalk.

M Shall: Be on the push button.

Locator tone

M *MUTCD 11 §4K.04* P *: PROWAG R307.8*

M P S Shall: Duration ≤ 0.15 second.

M P S Shall: Repeat at 1-second intervals whenever no other indication is given.

M P Y May: Activate with passive pedestrian detection within 12 ft radius.

P Shall: Be active while traffic signals are in flash.*

M Shall: Be inactive while traffic signals are in flash.*

M Should (S P all): Maximum of 5 dBA louder than ambient sound.

M P S Shall: Automatic volume adjustment to a maximum of 100 dBA, responding to ambient noise level.

M Should (S P all): Be audible 6-12 ft from button or to building line, whichever is less.

**Known contradiction – studies and discussions underway to resolve.*

Audible walk indication

MUTCD 11 §4K.03 PROWAG R308

- Shall: Be active during WALK interval only.
- Should: When signal rests in WALK, audible indication persists for 7 seconds, and is recalled with button.
- Shall: Be audible from beginning of crosswalk.
- Shall: At a single crossing or where APS are ≥10ft apart, indication is a percussive tone, 8-10 ticks/second, multiple frequencies with a dominant component at 880 Hz.
- Should (Shall): Maximum of 5 dBA louder than ambient sound.
- Shall: Automatic volume adjustment to a maximum of 100 dBA, responding to ambient noise level.

Speech Messages

MUTCD 11 §4L.03, 4K.03, 4K.05
PROWAG R307.7, 308.3

- Shall: No vibrating indications for AID at pedestrian activated warning devices.
- Should (Shall): AID at pedestrian activated warning devices have speech message "Warning lights are flashing."
- Shall: APS on different phases less than 10ft apart shall have spoken WALK messages.

If speech messages are used

- Shall: Spoken information messages only during Don't Walk interval.

If speech messages are used

- Shall: Spoken information messages follow this model: "Wait. Wait to cross Broadway at Grand," followed by intersection information if given.
- Should: No spoken information messages for landmarks, detours, traffic control conditions.
- Shall: Communicate the WALK interval has begun, and for which crossing.
- Should (Shall): WALK message for crossings with parallel vehicular traffic: "Broadway. Walk sign is on to cross Broadway."
- Should (Shall): WALK message for crossings with exclusive pedestrian phase: "Walk sign is on for all crossings."
- Should: WALK messages should not contain additional information except to avoid ambiguity.
- Should: WALK messages should not command pedestrians or say it is safe to cross.
- Shall: WALK messages outside the WALK interval begin with "Wait."
- Shall: At APS with pilot light, each actuation has spoken message "Wait."
- May: Provide WALK messages in languages other than English if needed.
- Shall: Multiple language WALK messages alternate, first English then second language.

Operable parts

MUTCD 11 §4I.05 PROWAG R403.4

Shall: Operable with one hand.

Should (Shall): No tight grasping, pinching, or twisting of the wrist.

Should (Shall): Require no more than 5lb (22.2 N) force.

Reach ranges

2010 ADA Standards 308
MUTCD 11 §4I.05
PROWAG R307, 403, 406

Should: Unobstructed and accessible within the reach ranges in Section 308.

Should: Approximately 3.5 ft above the sidewalk, no more than 4 ft.

Shall: Forward unobstructed reach: no higher than 48in, no lower than 15in above floor/ground.

Shall: Side unobstructed reach: no higher than 48in, no lower than 15in above floor/ground. Obstruction permitted, maximum of 10in deep, 35in high.

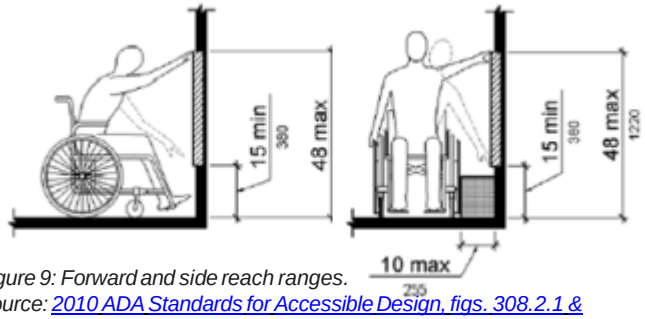


Figure 9: Forward and side reach ranges.
Source: 2010 ADA Standards for Accessible Design, figs. 308.2.1 & 308.3.1

Clear space

2010 ADA Standards 305
MUTCD 11 §4I.05
PROWAG R404

Should: As specified in Section 305 of the 2010 ADA Standards for Accessible Design.

Should: As level as feasible.

Shall: Changes in level are not permitted.

Shall: No more than 1:48 slope.

May: Match grade of pedestrian access route, even if slope is greater than 1:48.

Shall: Minimum clear space = 30in x 48in.

Shall: Forward or parallel approach.

Should (Shall): Outside curb ramp runs or flares.

Shall: One full side of space joins pedestrian access route (see R302).

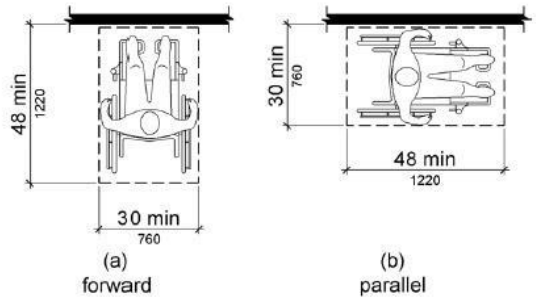


Figure 10: Forward and parallel approach clear spaces.
Source: 2010 ADA Standards for Accessible Design, figs. 305.5

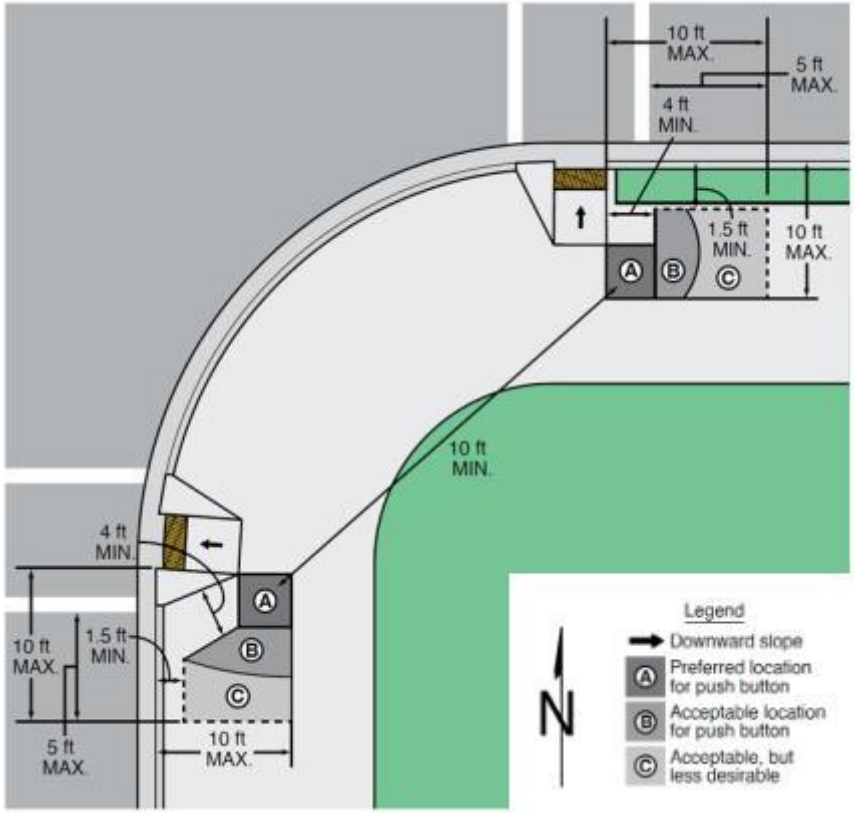


Figure 11: Push button locations. Diagram not to scale. Source: MUTCD, figure 4I-2.

Location

M *MUTCD 11 §4I.05* P/R *PROWAG R302, 307*

- M Should: Wheelchair accessible route to the ramp.
- M Should: On the side of the curb ramp farthest from the intersection center.
  - P Shall: ≤5 ft from the side of a curb ramp run or the crosswalk edge farthest from the intersection center.
- M Should: ≤10 ft from the side of a curb ramp farthest from the intersection center.
- M Should: ≤5 ft from the crosswalk edge farthest from the intersection center.
- M Should: Closer to the crosswalk than the stop line is.
- M Should: 1.5-6 ft from the curb face or shoulder edge.
- M Should (P Shall): ≤ 10 ft from the curb face or shoulder edge.[1]
- M Should (P Shall): Face of the button parallel to the crossing.
- M Should (P Shall): Allowing a minimum 4 ft wide continuous clear pedestrian access route.
- M Should: Outside the flared side of the curb ramp.
- M Should (P Shall): ≥10 ft between APS on the same corner.
- M P/R May: <10 ft, if impracticable[2] to space APS 10 ft apart.

Figure 12: R10-32P.

Extended press features

M *MUTCD 11 §4K.05* P/R *PROWAG R307.3*

- M May: Have increased crossing time, audible beaconing, or a speech information message on an extended button press.
- M P/R Shall: Where used, <1 sec. press = only pedestrian timing & accessible walk indication; ≥ 1 sec. press = pedestrian timing, accessible walk indication, and any additional features.
- M P/R Shall: Have a sign[3] mounted adjacent to or integral with the pedestrian push button if an extended press gives additional crossing time.

1. *MUTCD: if impracticable to place between 1.5-6 ft.*
2. *PROWAG: "infeasible"*
3. *MUTCD: R10-32P; see fig. 12*

M Should: Consider audible beaconing following an engineering study at:

A. Unbroken crossings longer than 70 ft

B. Skewed crossings

C. Intersections with irregular geometry

D. Crossings where audible beaconing is requested by a person with vision disabilities

E. Crossings where study shows audible beaconing would be beneficial.

M Should: Audible beaconing should be initiated by an extended push button press.

MP Shall: Audible beaconing: increase the volume of the locator tone[1] during the pedestrian change interval of the called pedestrian phase.

P Shall: Audible beaconing operates one of these ways:

- The louder audible walk indication and louder locator tone comes from the far end of the crosswalk, as pedestrians cross the street;
- The louder locator tone comes from both ends of the crosswalk; or
- The louder locator tone comes from an additional speaker aimed at the center of the crosswalk and mounted on a pedestrian signal head.

M Shall: The audible beaconing loudspeaker is mounted at the far end of the crosswalk, 7 -10 ft. above the pavement.

M Should: The audible beaconing loudspeaker is within the width of the crosswalk.

1. MUTCD: up to 100 dBA max.

MP May: An extended press may increase the walk indication and locator tone volume.

M May: Speech information messages may provide intersection identification, as well as information about unusual intersection signalization and geometry:

- exclusive pedestrian phasing
- leading pedestrian intervals
- split phasing
- diagonal crosswalks
- medians or islands.

MP Shall: Speech information messages only play outside the walk interval.

MP Shall: Speech information messages follow the model: “Wait. Wait to cross Broadway at Grand”, followed by intersection information, if given.

M Should: Speech information messages should not contain information about landmarks, detours, or temporary traffic control situations.

APS required features

A locator tone that repeats every second, audible 6-12 ft from the button or to the building line, intensity responsive to ambient sound.
— MUTCD §4K.04, PROWAG R307

Audible walk indication during the WALK interval. WALK indication should repeat 8-10 ticks/second, with dominant 880 Hz tone. If APS are closer than 10 ft, the WALK indication shall be a speech message.
— MUTCD §4K.03, PROWAG R308

If a pilot light is present, it should light when actuated and the word “Wait” should play. The light should stay lit until the WALK interval begins.
— MUTCD §4I.05, 4K.03, PROWAG R308

A tactile arrow with high visual contrast aligned with the crosswalk.
— MUTCD §4K.04, PROWAG R307

The arrow is on the pushbutton and vibrates during the WALK interval. — MUTCD §4K.04

The push button vibrates during the WALK interval.
— PROWAG R307

Automatic volume adjustment in response to ambient traffic sound level up to a maximum volume of 100 dBA.
— MUTCD §4K.03, PROWAG R307

Parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. Maximum force required to activate operable parts shall be 5 pounds (22.2 N).
— MUTCD §4I.05, PROWAG R403.4

AID required features

A locator tone that repeats every second, audible 6-12 ft from the button or to the building line, intensity responsive to ambient sound.
— PROWAG R307

Speech message indicating the status of the beacon.
— MUTCD §4L.03, 4S.03, 4U.02, PROWAG R307

A tactile arrow with high visual contrast aligned with the crosswalk.
— PROWAG R307

No vibration or percussive indication.
— MUTCD §4L.03, 4S.03, 4U.02, PROWAG R307

Automatic volume adjustment in response to ambient traffic sound level up to a maximum volume of 100 dBA.
— PROWAG R307

Comparison: APS vs. AID

Purpose of these examples

The following examples are intended to demonstrate what the guidelines and requirements for APS can look like when put into practice, as well as highlighting some less-than-ideal situations that you may encounter.

EXAMPLES

Figure 13, above: N. Caldwell St. & E. Trade St., Charlotte, North Carolina, in 2009.

Figure 14, below: The same corner in 2022.

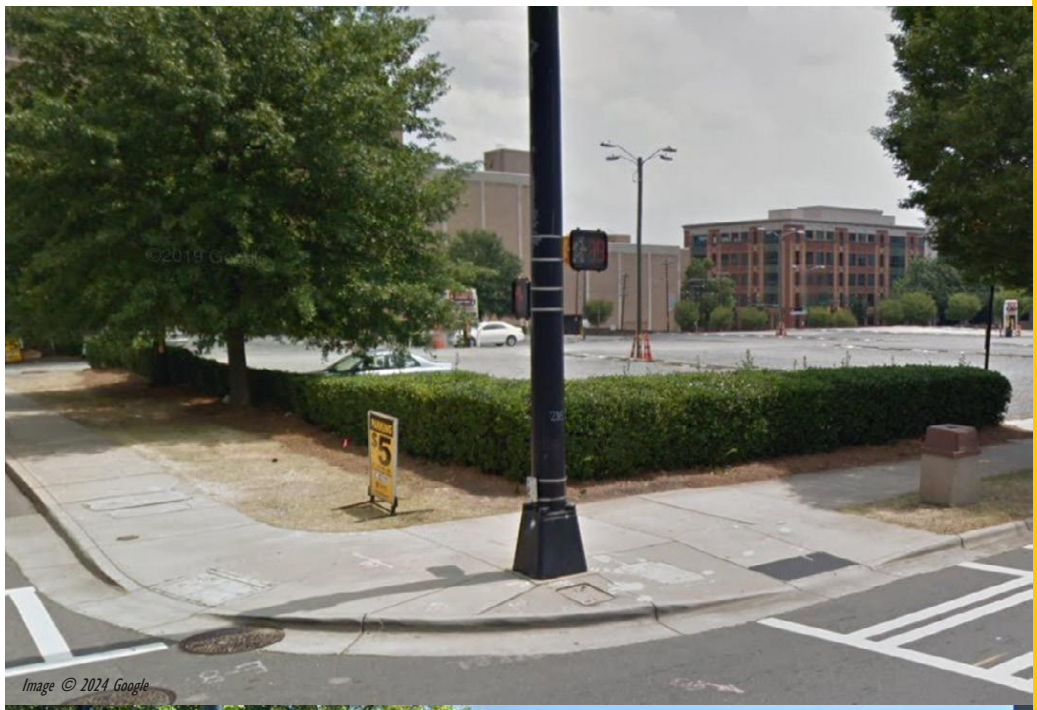
North Caldwell and East Trade St.

The pedestrian signals at this corner were mounted to the signal pole, and had no pedestrian push buttons or APS. Other accessibility improvements were already implemented, including high-visibility crosswalks, curb ramps, and detectable warning surfaces.

Major reconstruction of the road occurred between 2009 and 2022, and the traffic signals are now suspended on wires integrated with the light rail overhead lines. The signal pole was removed, and the pedestrian signals moved to separate poles.

This had the benefit of allowing MUTCD and PROWAG-compliant positioning of the newly-added APS; but note the position of the left pedestrian signal pole in the grass. It may be outside the required reach ranges given in section 308 of the 2010 ADA Standards.

Otherwise the install is compliant here: both APS buttons are mounted at the correct height, aligned parallel to the crossings they serve, and placed close to the outside edge of the crossing. This is ideal for locating the crossing without visual reference.



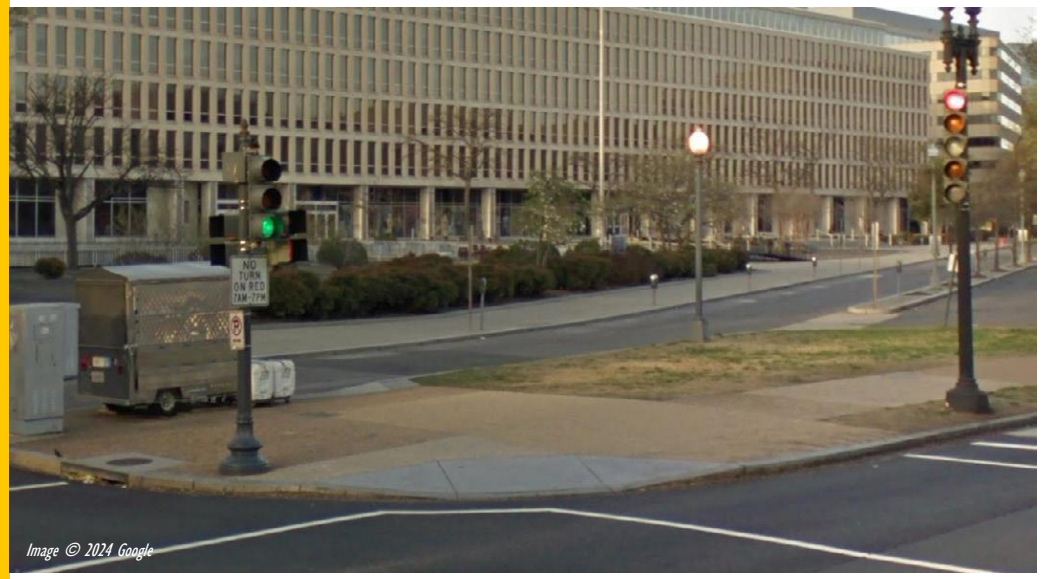


Figure 15, above left: Independence Ave SW and 4th St, Washington, DC, in 2014.

Figure 16, below left: The same corner in 2022.

Independence Ave SW and 4th St.

This corner underwent a significant change between 2014 and 2022. A parking area was converted into a plaza, and the entrance lane removed. The single common curb ramp without a detectable warning surface was replaced with two ramps with detectable warning surfaces within the crossings they serve. The traffic and pedestrian signals were replaced, and two stub poles were added for APS.

The APS here appear well placed: aligned with the crossing, within the width of the crossing with plenty of clear level space for approach and pedestrian routes.

One potential concern is the distance of the stub poles from the curb. APS should not be further than 10 feet from the curb face, and closer than 6 feet is better. This permits the pedestrian to keep their hand on the button to feel the WALK signal while staying near the curb, ready to cross.

Figure 17, above right: Dr Martin Luther King Jr and Martine Ave, White Plains, New York, in 2015.

Figure 18, below right: The same corner in 2024.

Dr. Martin Luther King Jr & Martine Ave.

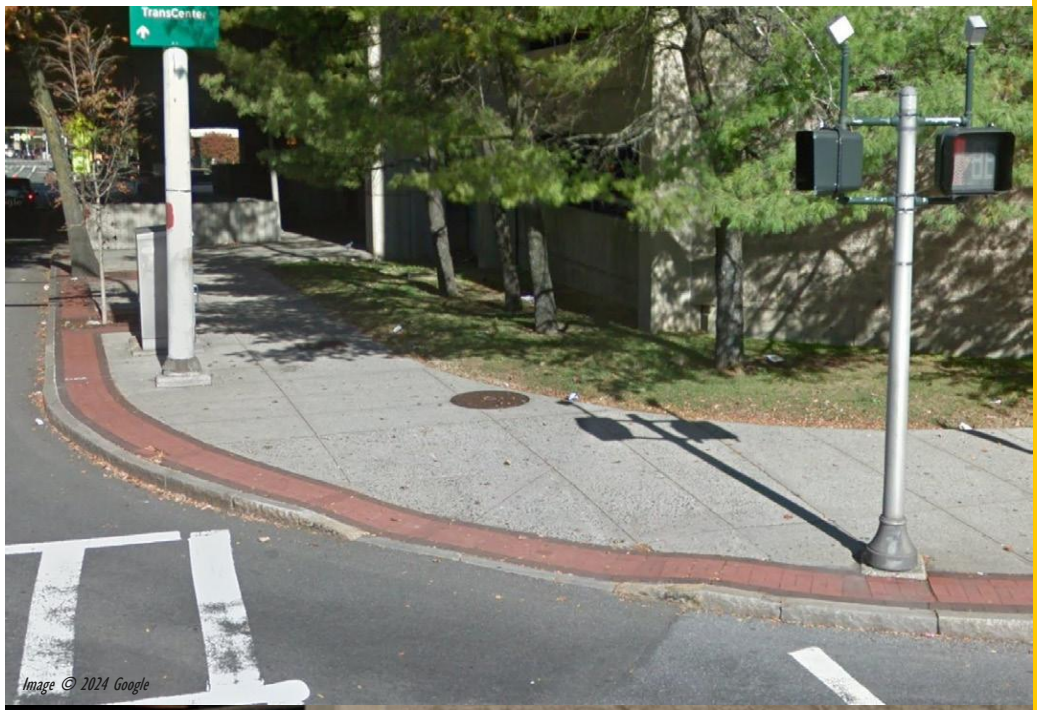
This corner had a curb ramp with no detectable warning surface, and a single pedestrian signal pole equipped with 1980's style speaker-type APS.

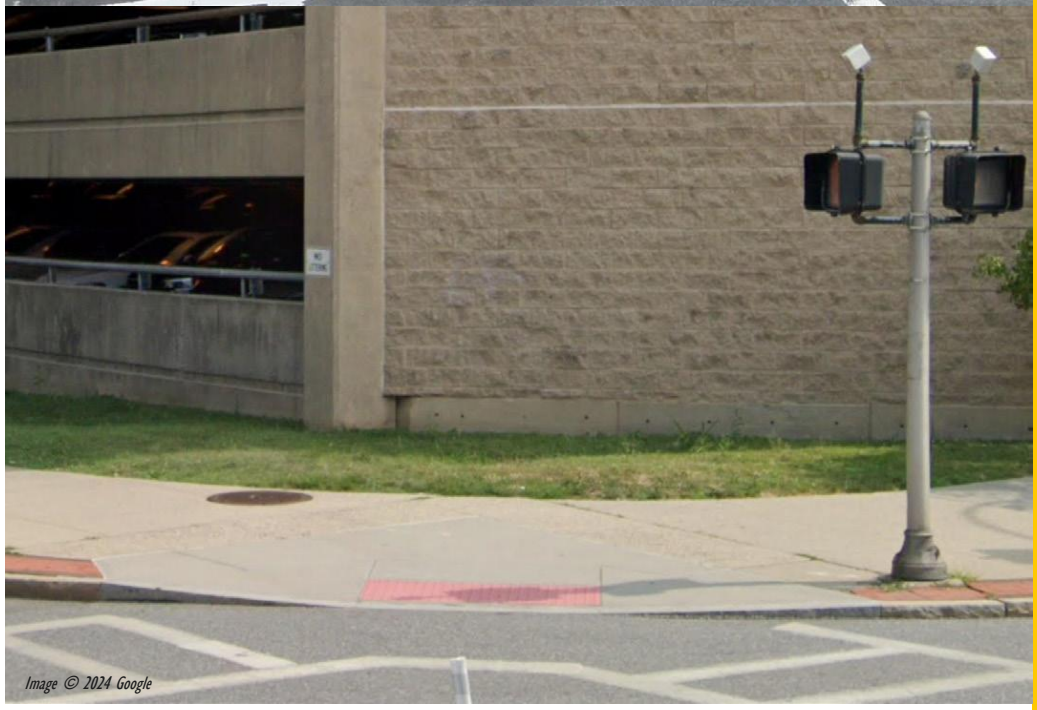
Speaker-type APS are no longer generally used because they are inaccessible to people with hearing disabilities, lacking any vibrotactile WALK indication. They also often led to confusion over which crossing had the WALK interval, and the standard "chirp-cuckoo" WALK signal was easily masked by traffic noise and hard to localize.

The 11th edition MUTCD requires APS to have a button with a high-contrast raised vibrotactile arrow and a locator tone, making speaker-type APS a non-compliant solution when used alone.

Between 2015 and 2024 the ramp was expanded and a detectable warning surface was added. Unfortunately, this opportunity was missed to update the APS to MUTCD-compliant APS buttons.

This corner should have an additional pedestrian pole added on the left of the ramp, and modern APS installed on both poles.





Broadway and Lincoln St.

The southeast corner of this intersection, shown in figure 19, has one signal pole to serve both crossings. The pedestrian signal head for the Lincoln St. crossing is blocked by the tree, and cannot be seen from the crosswalk; and there does not appear to be any pedestrian button or APS for the Lincoln St. crossing at all. The signal pole is placed in the grass, lacking a clear, level access space at the button for the Broadway crossing within the reach ranges from the 2010 ADA Standards.

Another pedestrian pole at this intersection, on the northwest corner, is similarly blocked, although it might be correctly placed and merely overgrown. (Figure 21)

For the three marked crosswalks at this intersection, there are five APS buttons installed. As of 2023, all of them were a model of APS that lack high-visual-contrast raised vibrotactile arrows on the button, making them non-compliant with the MUTCD or PROWAG. (Figure 20)

The Lincoln St. crossing should have its own signal pole for the pedestrian signal and APS, and the entire intersection equipped with compliant APS.

Image © 2022 RTB GmbH & Co. KG

Figure 19, above: Broadway and Lincoln St, South Portland, Maine.
Figure 20, right: The type of APS used. Note the lack of a high-contrast raised vibrotactile arrow on the button.
Figure 21, far right: Another corner on the same intersection.

Figure 22: Hawthorne Ln. and E 5th St., Charlotte NC, in 2022.

Hawthorne Ln. and East 5th St.

The widely-separated crossings on the west side of this intersection, shown on the right side of figure 22, have APS installed correctly. They have individual signal poles with one APS on each, with the button faces parallel to their crossings; there is ample clear and level access to the buttons, with open access routes; and the poles are positioned along the outside edges of the crossings they serve.

The southern corner of the intersection has a single signal pole that serves two crossings, and the sidewalk becomes narrow at the corner. The pole is in the grass, restricting the clear space at the button.

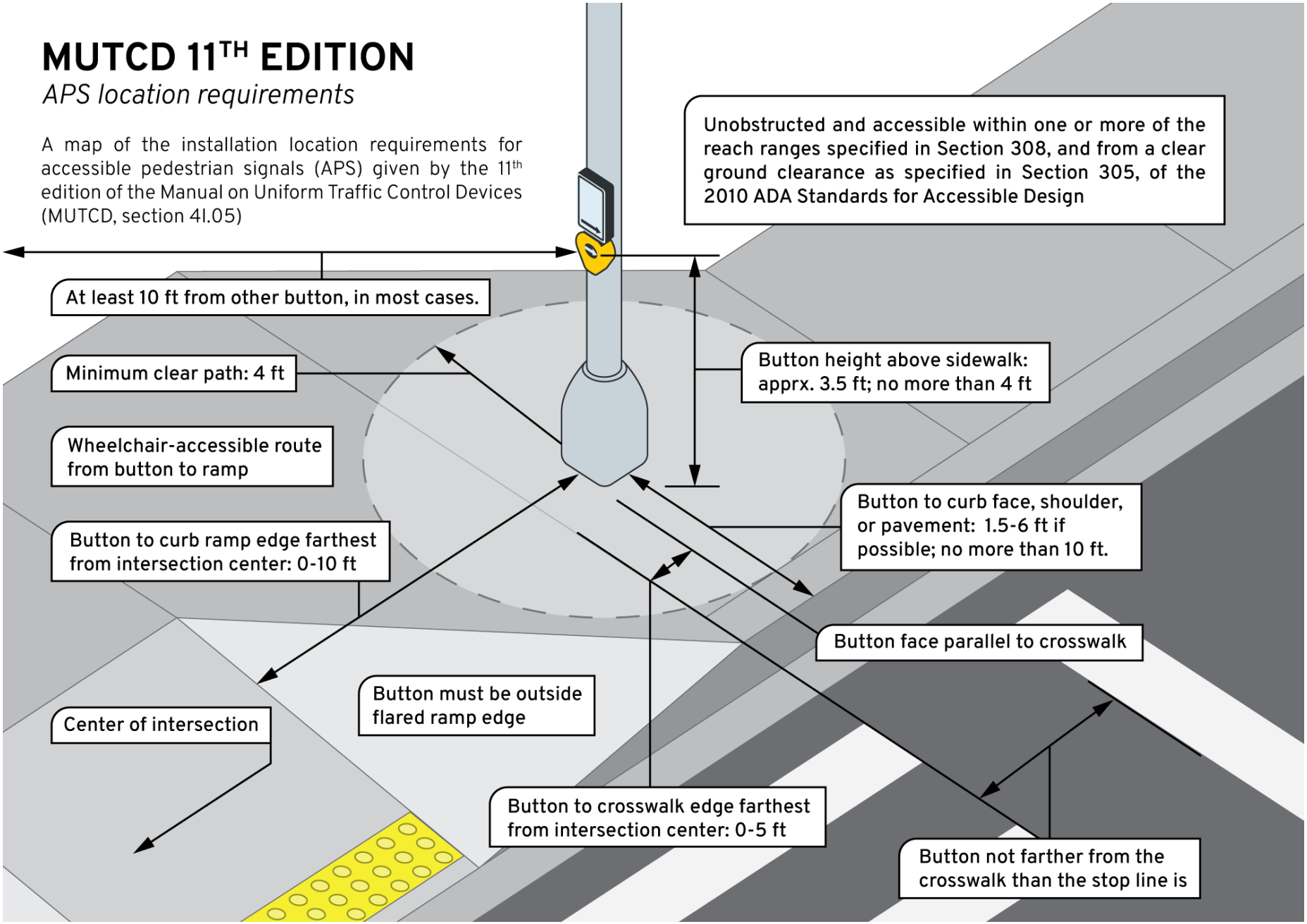
While two APS can be on the same pole if it is not possible to place them on separate poles, it is not ideal. But it is not clear where an APS pole could be placed for the Hawthorne Lane crossing without significantly widening the sidewalk or changing the ramp, since the flare of the curb ramp extends to the stop line.

If a second pole were placed, it would need to be no farther from the crossing than the stop line, with a minimum of 30x48 in. of level clear space at the button exclusive of the ramp and flare. To achieve this, one or both crosswalks might have to be moved, and the southern corner re-designed.

MUTCD 11TH EDITION

APS location requirements

A map of the installation location requirements for accessible pedestrian signals (APS) given by the 11th edition of the Manual on Uniform Traffic Control Devices (MUTCD, section 4I.05)



Scan for PROWAG-MUTCD11-factsheet.

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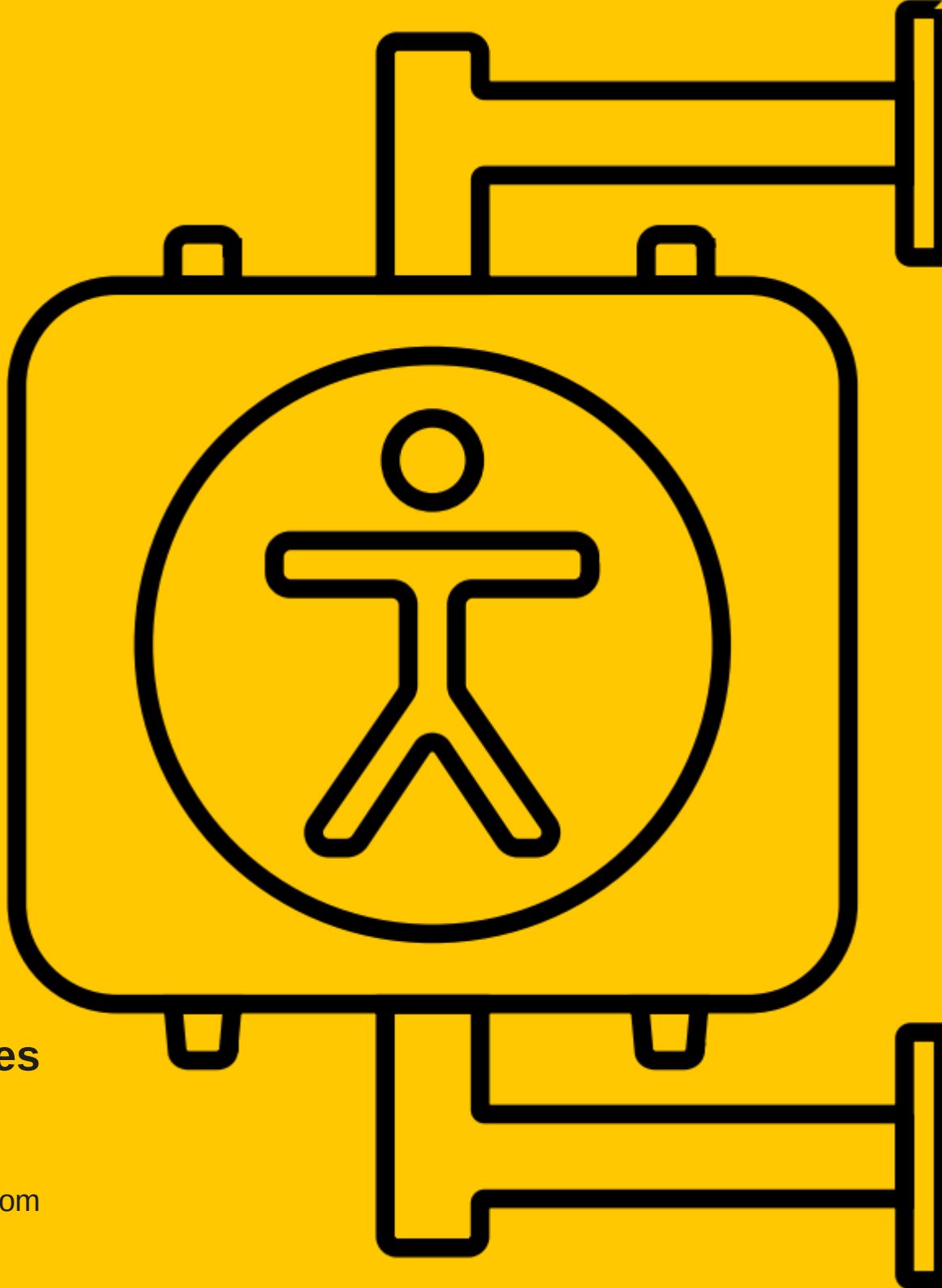

The ultimate APS application guide: best practices, requirements, & examples for accessible pedestrian signals

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