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Guidelines for Understanding, Use and Implementation of Accessible Pedestrian Signals
May 2008

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Abstract

The guidelines for understanding, use and implementation of accessible pedestrian signals (APS) were prepared in response to the evolving needs of people with vision loss, technological advances in the accessible pedestrian signals industry and the need to address the high degree of variability amongst installations in Canada.

This document is intended to provide deploying agencies with practical information on public liaison, accessible pedestrian signals installation prioritization and design, installation, operations and maintenance. It provides guidelines to meet the accessible pedestrian signal needs of people with vision loss, but do not constitute a set of standards.

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Supplementary Information

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Executive Summary

These guidelines have been prepared in response to the evolving needs of people with vision loss, technological advances in the accessible pedestrian signals (APS) industry, and the need to address the high degree of variability amongst APS installations in Canada.

The objective of this document is to act as a set of stand-alone national guidelines for the understanding, use and implementation of APS in Canada, and to expand upon the APS provisions within the Manual of Uniform Traffic Control Devices for Canada (MUTCDC). The

guidelines

are to provide deploying agencies with practical and uniform information on public liaison, APS installation prioritization and design, installation, operations and maintenance. Above all, they are to provide the instructions necessary to meet the accessible pedestrian signal needs of people with vision loss. It should be noted that these are strictly guidelines and do not constitute a set of standards.

The new guidelines have significantly revised the APS provisions of the Manual of Uniform Traffic Control Devices for Canada. The guidelines now provide details on all stages of an APS installation starting with community liaison and APS prioritization to design, installation, operation, and maintenance.

1. Introduction

1.1 Background

The primary objective of these guidelines is to provide deploying agencies with the uniform installation, operation and maintenance instructions necessary to meet the accessible pedestrian signal needs of people with vision loss.

Accessible pedestrian signals (APS) are technologies that supplement traditional traffic control signal technology to assist pedestrians with vision loss in their road crossings. These technologies provide audible and vibrotactile indications that act as the “walk” signal for this community and any other users who may benefit from additional sensory prompts (e.g. senior citizens and children).

There have been three catalysts necessitating an update to the Manual of Uniform Traffic Control Devices (MUTCDC) APS provisions:

- i. There has been on-going research into the needs of people with vision loss. Their stated needs have also been evolving as APS are installed and new operational experiences are gained;
- ii. The private sector has continued to develop new and increasingly effective technologies to assist in road crossings. These technological advancements have been in reaction to needs, and have sometimes also influenced stated needs. In the last fifteen years APS technology has advanced significantly, and the potential opportunities and impacts need to be better understood by deploying agencies; and

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Despite previous guidance, it was determined that new guidelines were needed to address the high degree of variability amongst Canadian APS installations. Common variance in operation and design include:

- the APS indications used (e.g. the common bird sounds)
- the duration of the APS tone
- the concurrent signal displays
- means of actuation
- strategies for non-conventional intersection geometries
- the type of APS technology
- strategies for sound impact abatement
- use of beaconing
- placement of pushbuttons

- use of pushbutton poles
- use of conflict monitoring

A certain degree of this variability is driven by competing vendor products advocating differing approaches to installation.

In all instances, the guidelines presented here have been developed to meet the needs of pedestrians in the roadway environment. Pedestrian safety has been the primary objective in the preparation of these guidelines while cost and roadway capacity were considered as secondary objectives.

This document focuses exclusively on accessible pedestrian signal guidelines for use at signalized intersections employing pedestrian crossing signal (i.e. walking person and steady hand) displays. It should be noted that accessible pedestrian signals are only one element amongst a range of systems and design strategies required to improve pedestrian safety and convenience for people with vision loss. Other elements include alternate pedestrian crossing strategies (crosswalks employing amber beacons, signs and pavement markings, island refuges, etc.), effective pedestrian walkway planning, sidewalk design, street furniture layout, pole locations, lighting, etc. Practitioners should seek additional guidance concerning the full range of pedestrian design elements.

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1.2 Objective and Approach to the Undertaking

The objective of these guidelines is to establish a set of stand-alone national guidelines for the understanding, use and implementation of APS in Canada. This work has significantly revised the previous guidelines for APS within the Manual of Uniform Traffic Control Devices for Canada (MUTCDC). It provides relevant authorities with a practical guide for APS justification, design, public liaison, operations, and maintenance.

The preparation of the guidelines included the following tasks:

- An investigation of best practices and industry standards for APS within Canada, the United States, Japan, Australia, Sweden and Denmark;
- An investigation of the impacts of provincial legislative requirements – such as the Ontarians with Disabilities Act and Québec’s Act to secure handicapped persons in the exercise of their rights with a view to achieving social, school and workplace integration;
- Stakeholder consultation with national, provincial and local representatives of people with vision loss; and
- Review of APS technologies, their appropriate application, pros and cons, potential pitfalls in their use, and lessons learned in installation and maintenance.

1.3 Content of the Guidelines

The following summary describes the nine sections of the document and provides a brief overview of the guidance provided.

Section 1 – Introduction

This section provides the background information, objectives and approach taken to revise the accessible pedestrian signal provisions within the Manual of Uniform Traffic Control Devices for Canada (MUTCDC). Definitions and acronyms are provided as well.

Section 2 – The Pedestrian Context

It is important for agencies deploying APS systems to understand the experiences of people with vision loss when they cross at signalized intersections. This section provides a description of the user’s road crossing procedures and the needs that may be addressed by APS.

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Section 3 - Community Liaison

Communication between the deploying agency and individuals, or organizations representing people with vision loss is highly recommended to ensure that community needs are identified and dealt with in a timely manner. This section provides guidance on establishing dialogue with local users and/or representatives of people with vision loss.

Section 4 - Establishing Installation Priorities

Prioritizing sites for APS installation is an essential part of APS program management. This section should be used to help establish APS installation priorities. Factors that may be considered include pedestrian safety, pedestrian usage, traffic conditions, mobility and other site specific factors. An accessible pedestrian signal (APS) installation prioritization procedure is provided in Appendix A.

Section 5 - APS Operational Guidelines

Direction regarding the preferred means of operating APS is described in this section, including the use of pushbutton locating tones, orientation guides, APS actuation, types of APS indications, volume adjustment, and the associated traffic control signal operations and phasing.

Section 6 - APS Design Guidelines

Design criteria that are considered desirable for the effective operation of APS are described in this section, including the design and location of pushbutton installations, consideration of pedestrian walking path, APS unit location and alignment, use of pedestrian information signing, and pedestrian accessibility challenges related to intersection configuration and operation.

Section 7 - APS Deployment Guidelines

This section identifies installation procedures to ensure that an APS deployment meets the needs of the person or agency that requested the installation. Pre and post-installation notifications are recommended as well as installation inspections and a user orientation walk-through. It should be noted that this section does not relate to electrical installation

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Section 8 - APS Maintenance & Adjustments

Operational adjustments may be requested by the user or the general public, and this section provides some common strategies for mitigating public concerns. Also described in this section are guidelines for monitoring APS and the different types of routine and emergency maintenance requirements.

Section 9 - References

The details of the references presented through-out the guidelines are provided in this section.

1.4 Definitions and Terms of Acronyms

Table 1.1 provides definitions for the terms and acronyms used within these guidelines.

Table 1.1 – Terms and Acronyms

Item: APS

Definition: Accessible pedestrian signals

Item: APS beacons

Definition: Beacons are APS indications with high sound pressure that emanate from APS emitters on either side of the crosswalk and that may be heard throughout the crossing.

Item: APS indication

Definition: The term indication is used to represent APS tones, complex melodies and vibrotactile signals emanating from the APS technologies.

Item: Contrast ration

Definition: The contrast ratio between two objects is the measurement of the difference in brightness (i.e. lighter or darker) between the objects. People with vision loss can more readily differentiate between two objects when there is a high contrast ratio between the objects.

Item: Deploying agency

Definition: Any agency responsible for decisions concerning APS planning, design, installation, operation and maintenance.

Item: O&M

Definition: Orientation and mobility

Item: People with vision loss

Definition: This term encompasses all people who are blind, deaf-blind, or experience any other form of vision loss.

Item: "Press-and-Hold" or beaconing actuation of a pedestrian pushbutton

Definition: Occurs when a pedestrian presses and holds (i.e. keeps pressed in) the pedestrian pushbutton for a specified period of time.

Item: "Press-and-Release", or normal actuation of a pedestrian pushbutton

Definition: Occurs when a pedestrian briefly presses and releases the pedestrian pushbutton. They do not push and keep pressing the pushbutton.

Item: Pushbutton locating tone

Definition: Audible tones used to assist pedestrians in (a) identifying that APS are present at a particular site, and (b) to assist in locating the pedestrian pushbutton.

Item: Should

Definition: The term "should" indicates a preferred characteristic or process. Such characteristics are provided as design, installation, or operational guidance.

Item: Ambient sound

Definition: This is a reference to the sound pressure level surrounding an APS site that varies over time as a function of the various vehicles, people and activities creating background noise in the vicinity of the subject APS.

2. Pedestrian Context

Pedestrian travel for people with vision loss often requires careful consideration of the local traffic conditions. Therefore, it is important for agencies deploying APS to understand how people with vision loss cross at signalized intersections, and thus how APS technology, and these guidelines, may be used to mitigate risks for these pedestrians.

The steps taken by people with vision loss to cross a street are generally as follows:

1. Locating the street or intersection - The first step for pedestrians with vision loss is to determine that they have arrived at a street or intersection. To determine this, they use indications such as the curb, downslope of a ramp, textured surface treatments (e.g. truncated dome surfaces), sound of traffic, and the presence of other pedestrians etc. to recognize the edge of the street environment.
2. Identifying the street - Next, the pedestrians with vision loss must identify the street that has been reached. To accomplish this, the individuals can either use their knowledge of the area from past experience (including auditory and kinesthetic information), any accessible media that provides local street information (e.g. tactile or audible street indicators), or other pedestrians by asking for assistance.
3. Assessing the intersection - The pedestrians must obtain critical information concerning intersection geometry and operation before crossing the street. The types of information needed include: where the traffic is located, whether the intersection shape is irregular (e.g. T-intersection, offset intersection, etc.), whether the site has traffic control signals, whether they need to push a pedestrian button, whether the intersection is equipped with APS, where they must walk to and in what direction, the location of the crosswalk, and when to start walking. Ideally, they would also be able to determine if there is a median island that would act as a barrier, or alternatively as a refuge. Usually, some of this information is gathered by listening to a few cycles of traffic signal operations. In some locations, pedestrian pushbuttons and pedestrian information signs may be used to (a) identify the presence of APS via the pushbutton locating tone, and (b) align the pedestrian with the crosswalk. However, traffic conditions may have a significant impact on the pedestrians' ability to assess their crossing requirements. For example, advanced turn phasing, fully actuated control, right turns on red, excessive ambient noise, and locations that are quiet (e.g. due to low traffic volume, low vehicle noise, etc.) all represent circumstances that may be a typical of the pedestrian's normal experiences in crossing the street. Consequently, these situations may pose challenges for people with vision loss.

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4. Crossing the street - Before leaving the curb, pedestrians need to determine if the "walk" interval has begun. They typically listen for one stream of traffic to stop, and for traffic moving on the parallel street to accelerate from stop

If the signalized intersection is equipped with APS, then the pedestrian will listen for the tone and begin walking. Once they have started to walk, maintaining alignment can be problematic if the sound of turning vehicles masks the sound of the parallel traffic stream, if there is unusual intersection geometry, or if the volume of parallel traffic is low.

Note: Additional information concerning the challenges faced by pedestrians, and street crossing strategies for people with vision loss may be found in the: "Accessible Pedestrian Signals - Synthesis and Guide to Best Practices"(1), "Accessible Pedestrian Signals" (5) and "CNIB Standard for Accessible Pedestrian Signals"(6)-see Section 9.

3. Community Liaison

To the greatest extent possible, deploying agencies should consult with local representatives of people with vision loss to assist in

the identification of APS needs, issues, and in determining installation priorities. Deploying agencies should ensure that they are proactive in their efforts to identify APS needs within their community. This will improve the chances of these needs being identified in a timely manner and assist in the programming of funding.

Depending on the size of the deploying agency, this liaison may take many forms. They range from informal discussions with local representatives of advocacy groups, to formal standing advisory committees that incorporate a broad range of views from people with vision loss, in support of APS programs. Such advisory groups may include diverse representation, as appropriate for the local program and the issues or challenges to be addressed. Representation may include (but is not limited to) any of the following:

- Orientation and mobility (O&M) specialists;
- Organizations such as the Canadian National Institute for the Blind (CNIB), L'Institut Nazareth-et-Louis-Braille, Alliance for Equality for Blind Canadians, Advocates for Sight Impaired Consumers, Canadian Council of the Blind, etc;
- Consumers (i.e. users of technology for people with vision loss);
- Formal committees recognized by local government agencies;
- Ophthalmologists or other experts in vision and vision loss issues; and potentially
- Representation from other local formal or informal disability groups (e.g. people with loss of mobility).

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It is recommended that an advisory committee provides assistance in identifying locations that require APS technology, as they are not always evident to the local deploying agency. An advisory committee can be the sounding board for the community by providing assistance in the identification of candidate sites, acting as a liaison with individuals and organizations to establish needs, providing assistance in the prioritization of any backlogged and future candidate installations, participating in the establishment of application criteria to determine where APS are best installed, providing input concerning new and preferred technologies (as these are not static over time), assisting in the development and implementation of an educational and public awareness program. An advisory committee may also provide advice on procuring orientation and mobility (O&M) specialist services that will help individuals develop or re-establish the skill of independent travel. The size and composition of the committee should be suitable for the size and nature of the community it represents.

As important as it is to communicate with people with vision loss, it is similarly important to communicate the importance of a deploying agency's APS program to the remainder of the local community. Outreach to the broader public should build a broader awareness of the issues and provide useful feedback on how the program is being received within the broader community.

Deploying agencies should consider all reasonable means of providing APS program information to the general public, and ensure that the relevant information is available in various formats. This may include websites, brochures (in print and Braille), posters, and information for call centre representatives (or equivalent) where applicable. The public should be able to readily identify how to contact the deploying agency to provide feedback, or for further information concerning the program.

All educational material should follow applicable accessibility guidelines, and should be re-released to the public to reinforce public awareness of local programs.

Also, as part of this community liaison process, a deploying agency should ensure that it has procedures for:

- Receiving and prioritizing requests for new APS installations;
- Assessing and handling sound impact complaints related to APS installations; and
- Receiving public information concerning equipment failures, and ensuring that this information is relayed to the appropriate maintenance technicians for attention.

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4. Establishing Installation Priorities

Ideally, funding levels for APS and related pedestrian amenities should be set to accommodate local needs. Including APS with new installations may efficiently advance APS installation programs, as they typically represent a marginal increase in the overall cost of newly signalized installations. However, it is recognized that demand for APS installations may exceed available funding to retrofit existing signalized intersections.

Therefore, whether as part of a proactive program, or as part of a list of requested sites, potential APS sites must be prioritized for installation funding. Operational experience in Canada and the United States suggests that as the number of APS sites increases within a jurisdiction, so does the APS installation programs' public profile, and thus the number of requests for installation will increase as well. As demand increases, so will the costs of installation, and typically, deploying agencies will be faced with a backlog of APS requests. A prioritization process is a fundamental tool to help demonstrate progress, while setting new installation requests into the context of those requests that have been received earlier.

To this end, the following sections discuss a number of factors that are indicators of a need for APS. These include:

- Intersection safety, including intersection configuration, width of crossing, and vehicle speeds;
- Pedestrian usage, including the number of potential users, proximity to pedestrian generators and transit;
- Traffic conditions; and
- Difficulty in crossing the road without the use of APS.

A summarized APS installation prioritization procedure is provided in Appendix A. This procedure serves two functions: to assist in the identification of new candidate sites, and also to assist deploying agencies in the prioritization of incoming requests for installation.

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4.1 Pedestrian Safety

Pedestrian safety will be assessed through a number of means. First, one indication of a potential need for APS is the intersection and geometric configuration of the proposed site. Such conditions that present a challenge to people with vision loss include:

- The number of approaches to an intersection and the geometric configuration of an intersection. In particular, traffic at three-leg intersections generally does not provide adequate audible cues to enable people with vision loss to effectively judge the signal phase. Other unusual configurations (such as offset intersections) may also pose challenges for these pedestrians.
- Wider streets are more difficult for people with vision loss to cross. Intersections with wider crossings are therefore given a higher priority for APS installations. As well, pedestrians with vision loss have difficulties interpreting traffic cues at medians and islands. Efforts should be made to set the design walk speed to accommodate people with vision loss, thereby permitting road crossings in one continuous movement.
- Audible signals help pedestrians with vision loss to recognize the beginning of the walk phase, thereby assisting them in clearing the intersection in a timely manner. However, ambient sound conditions may vary, and cause orientation challenges for pedestrians. In these instances, their total crossing time may increase.

Each of these crossing environment issues should be considered within Part B of the installation priority guidelines in Appendix A.

Where appropriate, deploying agencies may consider conducting a safety assessment of the site under consideration to determine how (or if) these and other considerations impact upon pedestrian safety and ease-of-use of the existing crossing. This may include an

assessment of the pedestrian collision history, explicit observation of pedestrian movements, an assessment of safe and accessible alternate routes, and potential alternate means to address the specific concerns related to the site.

4.2 Pedestrian Usage

It is important for deploying agencies to remember that people with vision loss have the same mobility needs as the sighted population. Specifically, they travel to public places, businesses, social, educational and medical facilities, and they do this at all times of the day and evening. They also have a greater reliance on public transportation than sighted persons. Priority should be given to APS sites that improve the mobility of the greatest number of people with vision loss, and sites that make more facilities and services accessible to them. Therefore, the proximity of APS to transit facilities may assure a greater degree of utilization. Also, consideration should be given to proposed sites that serve as transfer points between two or more transit routes.

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Intersections near facilities for people with vision loss, such as the Canadian National Institute for the Blind, related medical facilities, etc. would have a higher probability of use by pedestrians with vision loss. Special consideration may also be given to senior citizens complexes or public housing facilities that have one or more people with vision loss in residence. APS installations are also applicable to intersections close to key facilities (i.e. high pedestrian generators) used by all pedestrians.

The proximity of a potential APS site to an alternative crossing is also a prioritization factor, as an accessible pedestrian signal is most needed where there is no other appropriate crossing site nearby. In addition, how often the APS would be used (e.g. many times daily, a few times per week, etc.) is also an indicator of need.

4.3 Traffic Conditions

Vehicle volumes, traffic distribution, traffic congestion and flow characteristics all impact upon a pedestrian's ability to cross the street. Pedestrians with vision loss function best when crossing the street at the signalized intersection of two streets that meet at right angles, that have a moderate but steady flow of traffic on each leg, and that have a minimal number of turning movements.

Audible cues are presented by traffic that accelerates from stop on the roadway parallel to the pedestrians walking direction. This traffic noise acts as a guide for the pedestrian. Therefore, it is beneficial to have traffic that stops on each leg, during each signal cycle, so that regardless of direction, pedestrians will be able to take advantage of these traffic noise cues. Conversely, traffic that is either very light (i.e. no audible cues), very heavy (i.e. excessive ambient noise), very quiet (e.g. low volume of trucks, high volume of hybrid vehicles, etc.), or erratic in its flow (e.g. highly platooned traffic) makes it difficult for people with vision loss to pick up audible cues as to the signal phase. In such cases, APS assist in identifying the beginning of the "walk" interval.

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4.4 Mobility and Other Factors

Intersections often have unique circumstances that will make the installation of APS more (or less) likely to be beneficial to a pedestrian. Operational factors that affect the ability of pedestrians to use traffic noise as a guide should be considered, including:

- Complex signal phasing (including advanced left and right turn movements, leading pedestrian phasing, etc.);
- High ambient noise;
- Heavy right turn volumes;
- The presence of a right turn island or right turn signal;
- A single crosswalk at the intersection; and

- Recurring congestion and queues through the intersection, etc.

As appropriate for the circumstances, an orientation and mobility specialist may provide assistance in evaluating potential APS sites.

5. APS Operational Guidelines

5.1 Overview

The following operational guidelines provide direction regarding the preferred means of operating APS. The guidelines represent best practices derived from interviews and documentation from national and international standards, advocacy groups, deploying agency practices, and researchers. It is the intention throughout these guidelines that the form of APS (i.e. what and how equipment is installed) should follow the functional needs (i.e. how it should operate to meet user needs). A typical operation may feature:

- Pedestrian wayfinding through pushbutton locating tones;
- Pedestrian orientation guidance through signs and other tactile and/or audible assistance;
- APS (audible and vibrotactile) is to be used as an indication of start of “walk”, and not generally as a guide across the intersection. Beacons (i.e. louder sounds to be heard throughout the crosswalk) may be used to address specific operational circumstances, as outlined in Section 5.5.5 of these guidelines;
- Stringent limitations on the practical sound range of the APS units to mitigate the sound impacts on the surrounding neighbourhood;
- Fixed or actuated APS operation; and
- A “cuckoo” sound for the north-south direction and a melody sound for the east-west direction.

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It is recognized that these guidelines represent a departure from the previous guidance that recommended beaconing. Consequently, there are many Canadian jurisdictions that have deployed beacon-style APS over the interim years. Beacon-style APS still provide benefits to people with vision loss in these jurisdictions, and may be required to fulfill local operational needs, as discussed further in Section 5.5.5. These guidelines provide a design target that should be followed for all new APS installations, as APS equipment attrition occurs, and as modification opportunities arise.

The following sections detail the various desirable operational characteristics for APS, including:

- How pedestrians are to find pedestrian signal pushbuttons (i.e. provisions for user wayfinding);
- How pedestrians are to orient themselves (or navigate) to successfully cross the street;
- When to actuate APS, and how to best accomplish actuation of APS; and
- How the APS units themselves should operate (including type of indications, when to use beaconing, hours of operation, etc.).

5.2 Pushbutton Locating Tones

Where an intersection is equipped with APS technology and the APS operation is actuated, locating tones should be used to assist pedestrians in:

- identifying that an intersection is APS equipped, and
- in locating the pushbuttons. Where the APS is not actuated, no pushbuttons (or associated locating tones) are required.

The pushbutton locating tone should be a clearly distinct sound from the APS indications. There is no requirement to have distinct pushbutton locating tones for different directions of travel.

The pushbutton locating tone should operate at all times, except when the APS indications for the associated crosswalk are active, during the actuation acknowledgement for that pushbutton, or during any verbal message associated with that pedestrian pushbutton.

The volume of the pushbutton locating tone should automatically adjust (up and down) with the volume level of the ambient sound. Sound volume level (or sound pressure) is measured in decibels (dB). The decibel is a logarithmic unit widely used to describe the ratio of the sound pressure levels between the ambient noise and the APS device. The relationship between the sound pressure ratio and the decibel level is described in the Table 5.1.

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Thus, if the loudness of an APS unit were doubled, the difference in dB would be 3dB. If the same unit were adjusted to four-times louder than its original setting, it would be 6dB louder (refer to Table 5.1).

The pushbutton locating tone should be no less than 2dB greater than the ambient sound, and no more than 5dB greater than the ambient sound.

Notwithstanding any other guidelines provided in this document, the pushbutton locating tone should be adjusted to be audible at no more than 3.7m from the pushbutton, or at the closest building line, whichever is closer.

Table 5.1 – Sound Pressure Ratio

Ratio: 1
dB: 0

Ratio: 1.25
dB: 1

Ratio: 1.6
dB: 2

Ratio: 2
dB: 3

Ratio: 2.5
dB: 4

Ratio: 3.2
dB: 5

Ratio: 4
dB: 6

Ratio: 5
dB: 7

Ratio: 6.3
dB: 8

Ratio: 8
dB: 9

Ratio: 10

dB: 10

The pushbutton locating tone should be no longer than 0.15 seconds in length and should be repeated every one or two seconds.

The pushbutton locating tone should be emitted by a speaker that is contained within the pushbutton casing, or mounted externally and immediately adjacent to the pushbutton.

Further information on pushbutton placement is found in Section 6.3 of these guidelines.

5.3 Orientation Guides

In addition to the APS indications, supplemental information should be provided at each APS location to assist pedestrians in orientation for their crossing. All APS sites should be accompanied by a pedestrian information sign (for sighted pedestrians) and a tactile arrow indicating the direction of crossing for the subject pushbutton.

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To supplement these features, APS sites may also identify the street to be crossed by incorporating the following supplemental indicators with the pedestrian information sign or pushbutton: Braille characters, tactile characters, high-contrast lettering, audio street announcements and/or tactile crosswalk mapping. These orientation guides are described here in additional detail.

5.3.1 Pedestrian Information Signs

Commonly, pedestrian information signs provide sighted pedestrians with information concerning the use of the pushbutton and the meaning of pedestrian clearance display. These signs may also be used to assist people with vision loss in orienting themselves to their intended crosswalk.

The signs are typically mounted above a pedestrian pushbutton or are incorporated into the pushbutton housing. For this reason, the pushbutton control face, and the face of the sign, should be aligned such that the sign face is parallel to the crosswalk that is controlled by the associated pushbutton.

A high contrast ratio between the sign lettering and background should be provided to make the letters easier to read for people with vision loss (see term "Contrast ratio" in Table 1.1).

Lastly, deploying agencies should consider whether there is a need to provide street lighting to ensure signs are legible.

5.3.2 Tactile Arrows

A tactile arrow should be provided as part of the pushbutton assembly or as part of the pedestrian information sign. Tactile arrows point in a direction parallel to the crosswalk that is controlled by the associated pushbutton. The arrow should have the following characteristics:

- Raised a minimum of 0.8mm from the surrounding surface;
- Between 35mm and 45mm in length;
- A stroke width between 10 and 15 percent of the length of the arrow; and
- An open arrowhead at 45 degrees to the shaft and not exceeding 33 percent of the length of the shaft.

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5.3.3 Braille

The name of the street to be crossed may also be provided in Braille. The Braille markings should be dome-topped (or hemispherical), a minimum of 0.8mm ± 0.1mm in height, and have a 1.5mm base diameter.

5.3.4 Tactile Lettering

For those who do not read Braille, the name of the street to be crossed may also be provided in raised, or tactile lettering. Where used, the tactile raised letters should have a 70 percent contrast to the surrounding surface. Letter font style should be Sans Serif. The letters (and/or characters) should have a vertical height between 15mm and 50mm based on the height of the uppercase "I" and a proportional width of between 3:5 and 1. Also, the characters should have a rounded cross section. Stroke thickness of the uppercase "I" should be between 10 and 30 percent of the height of the character measured at the base of the cross section. Stroke thickness at the top of the cross section should be a maximum of 15 percent of the height of the character.

5.3.5 Audible (Voice) Orientation Messages

An audible orientation message is a voice message that provides the name of the street crossing associated with the pushbutton used. These messages may also be used to provide additional information concerning intersection geometry and/ or signal operations.

These messages would be provided upon actuation, and are intended to be audible from a range similar to the pushbutton locating tone. Deploying agencies should be careful to provide clear and unambiguous voice messages for pedestrians. It should be noted that research has shown that such messages may be difficult to convey without potential for variability in interpretation, and that voice messages are relatively difficult to hear in noisy environments. Further, the language needs of local users should be considered when deploying such a feature.

A significant amount of additional information to assist deploying agencies in the use of voice messages is available from the Pedestrian and Bicycle Information Center (PBIC) at the www.walkinginfo.org. As of April 2008, the relevant pages could be found at <http://www.walkinginfo.org/aps/6-12.cfm>

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5.3.6 Crosswalk Mapping

Crosswalk mapping may also be used to illustrate the number of lanes, direction of traffic, orientation of the curbs, and presence of median islands. The raised icons used for this mapping should have characteristics similar to that used for the tactile lettering identified above. This mapping may be located on the sign or pushbutton face, or on top of the pushbutton housing.

5.4 APS Actuation

Actuation of APS is not considered essential. The sound distance limits for APS outlined in Section 5.5 of these guidelines are considered adequate to mitigate APS sound impacts on the local community. However, should there be a need to further reduce sound impacts, actuation for the APS should be considered.

5.4.1 Pedestrian Pushbutton

APS actuation should be accomplished through the use of pushbutton technology, and where desired, other forms of active detection (e.g. personal actuation devices such as audible sign technology). Passive detection technologies (e.g. microwave detection, pressure pads, etc.) are not preferred.

At APS locations, pushbuttons should actuate both the visual "walk" indication and the APS signals (audible and vibrotactile). APS

installations should not incorporate supplemental pushbuttons (i.e. separate pushbuttons for “walk” and APS indications). They should not require separate pushbutton sequences to be used for APS actuation alone (except for beaconing as described in Section 5.5.5).

Whether the pushbuttons used for APS have, or do not have moving parts, they should have a minimum diameter of 50mm. The surface of the APS pushbutton should be raised from its casing and have a slip-resistant surface. In all instances, a person should be able to operate the pushbutton with a closed or gloved fist (or with an equivalent sized object).

As with the pedestrian information signs, there should be a high contrast ratio in light reflectancy between the pole and the pushbutton casing. (see term “Contrast ratio” in Table 1.1)

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5.4.2 Types of Actuation

Where actuation is employed for an APS installation, there are two distinct potential forms of actuation: normal actuation and beaconing actuation.

Normal actuation occurs with the simple press-and-release of the pedestrian pushbutton. With a simple press-and-release actuation, the traffic control signals cycle to the visual “walk” indication requested, and the APS features (i.e. audible and vibrotactile) of the associated pedestrian crosswalk are actuated.

Beaconing actuation occurs when the pedestrian pushbutton is pressed and held for a predefined time period (typically 3 to 6 seconds). With this press-and-hold actuation, the traffic control signals cycle to the visual “walk” indication requested, and the APS features (i.e. beacon and vibrotactile) of the associated pedestrian crosswalk become active, as described in Section 5.5.5. At these locations, should a pedestrian use a simple press-and-release of the pedestrian pushbutton, the traffic control signals will cycle to the visual “walk” indication requested without the APS features.

5.4.3 Acknowledgement of Actuation

Upon actuation of the APS, there should be an audible, visual, and vibrotactile acknowledgement of the actuation. This applies to both normal and beaconing actuations as described above. For a normal actuation, these acknowledgements should be provided immediately upon the press and release of the pedestrian pushbutton. For a beaconing actuation, these acknowledgements should be provided only once the pedestrian pushbutton is pressed and held for the predefined time period. There is no need to have different acknowledgement tones for different directions of travel.

The visual acknowledgement message should be a small lamp (or similar) that is activated upon receipt of an actuation. The visual acknowledgement message may be part of the pushbutton casing, or mounted immediately adjacent to the pushbutton.

The audible acknowledgement message should consist of two pushbutton locator tones in quick succession (i.e. two tones within a 0.5 second period). The silent period between the two tones should have a duration between 0.15 to 0.20 seconds.

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For each audible actuation acknowledgement, the pedestrian pushbutton should also provide a coinciding vibrotactile acknowledgement. This vibrotactile signal is typically provided through a vibrating plate behind the raised directional arrow. As with the audible acknowledgement, the vibrotactile acknowledgement should consist of two short periods of vibrotactile signal (i.e. two within 0.5 second period). The “still period” between the two short vibrotactile signals should have a duration between 0.15 and 0.20 seconds.

5.4.4 System Response to Actuation

It is common practice for pedestrians with vision loss to wait for the start of a new “walk” indication prior to crossing the street. APS systems should accept pedestrian actuations during the pedestrian clearance and “don’t walk” displays. For those pedestrians that arrive during a “walk” indication that has already begun:

- If the APS is active, do not acknowledge the actuation, and complete the APS “walk” indication; or
- If the APS is inactive (i.e. “walk” display only), ideally (and where technically feasible) the APS system would accept the actuation and hold the actuation through to the next APS indication opportunity.

5.5 APS Operations

Audible and vibrotactile signals for APS are generally to be provided as an indication of the start of “walk”, and not as a guide to cross the street (also see Section 5.5.5 on the use of APS beacons). The following sections provide guidance on preferred APS operating characteristics.

5.5.1 APS Indications during the “Walk” Interval

APS should provide an audible and a vibrotactile indication for the entire “walk” interval. One exception to this guideline is provided in Section 5.6.2. Literature generated by organizations representing people with vision loss recognizes the need to mitigate sound impacts on the surrounding neighbourhood, and advocates that the practical sound range be limited. Therefore, the APS should have the following operational characteristics:

- The volume level for the APS “walk” indication should automatically adjust (up and down) with the volume level of the ambient sound;
- Unless beaconing is used (see Section 5.5.5), the volume level for the APS “walk” indication should be no less than 2dB greater than the ambient sound, and no more than 5dB greater than the ambient sound; and
- The APS “walk” indication should be adjusted to be audible at no more than 3.7m from the pushbutton (presumed to be co-located with the preferred pedestrian waiting area), or at the closest building line, whichever is less. To accommodate people with vision loss, additional pedestrian crossing time may be considered in those conditions that could slow or delay a pedestrian crossing the street. These conditions could include (but are not limited to):
 - The pushbutton cannot be located within 3m of the curb, thereby significantly increasing the pedestrian crossing distance;
 - The running grade of the crosswalk exceeds 1:20;
 - The cross-slope of the crosswalk exceeds 1:48;
 - Long crosswalk lengths; and
 - Observed pedestrian crossings skills would suggest that additional walking time be provided.

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The vibrotactile signal should operate at 20Hz. Vibrotactile signals may only be used on their own (i.e. without audible signals) where there is a need to mitigate sound impacts safety concerns

5.5.2 Operations during the Pedestrian Clearance and “Don’t Walk” Intervals

These guidelines do not advocate the use of APS during the pedestrian clearance interval. The following rationale is provided for guidance purposes:

- The audible signals for the APS are intended to signal only the start of the “walk” interval (i.e. the period during which pedestrian may begin their crossing), and not as a guide to cross the street. Thus beaconing is not required (except in those circumstances identified in Section 5.5.5);
- Per the current guidelines, APS have an audible range of only 3.7 metres; and

- Orientation & mobility (O&M) experts instruct pedestrians to always actuate the pushbutton and wait for the beginning of a new “walk” indication to begin their crossing; and

Even at a slow pedestrian walking speed, a pedestrian will walk beyond the audible range of the APS unit prior to the end of the “walk” interval.

Therefore, in practical terms, crossing pedestrians will not be able to hear any pedestrian clearance interval APS indication provided. Similarly, no vibrotactile indication needs to be provided during the pedestrian clearance display. This is because the user will have left the curb by the end of the “walk” interval and will no longer be in physical contact with the pedestrian pushbutton.

In addition, no clear general practice related to APS during pedestrian clearance has emerged, nor has any substantial research been conducted in this respect. The Pedestrian and Bicycle Information Center (at www.walkinginfo.org) suggests that some form of audible pedestrian clearance signal may be warranted for use with beaconing only, but does not suggest a specific tone, and further suggests that the notable lack of research and practical experience with such indications (note these have only been deployed in Japan and some parts of Canada) may lead to pedestrian misinterpretation of the clearance sound as the “walk” indication.

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5.5.3 APS Audible Indications

Intersections equipped with APS technology should employ distinct audible indications for each discrete direction of travel as indicated in the Table 5.2.

Table 5.2 – APS Indications

Direction of Travel: North-South
APS Concurrent with Visual “Walk” Display: A “cuckoo” sound*

Direction of Travel: East-West
APS The “Canadian APS melody” sound**

*Using the industry standard “cuckoo” sound that is prevalent amongst major APS vendors.

** Excerpt from the “Montreal melody”, authored by Mons. S. Poulin. The sound file is available for download at <http://tac-atc.ca/english/cdn-aps-melody.wav>

The “Canadian APS melody” sound incorporates multiple (i.e. mixed or changing) frequencies, ranging from 500 Hz to 1000 Hz, with higher harmonics. These are ideal for localization of sounds, mitigating lateral deviation, and for pedestrians with age-related hearing loss. The A-Weighted sound pressure levels should conform to ISO 1996-1:1982 and ISO 1996-2:1987.

If additional audible indications are required to address unusual intersection configuration or phasing, the sounds should:

- Alternate on and off with approximately the same repetition rate and tone-to-silence ratio as the “cuckoo” sound; and
- Incorporate multiple frequencies as described for the standard “cuckoo” and melody tones above.

It should be noted that these alternate audible indications are to be considered under special circumstances only. Alternate solutions employing the standard audible indications should be attempted first.

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As noted in Section 5.5.1, the APS tone should be adjusted to be audible at no more than 3.7m from the pushbutton, or at the closest building line, whichever is closer. Consequently, the APS tone should be no louder than the pushbutton locating tone unless beaconing is enabled (see Section 5.5.5).

5.5.4 Use of Voice Messages

There have been successful deployments of voice messages combined with APS indications in Canada (e.g. Saskatoon SK and Kingston ON), the United States and in Japan. A model spoken word message for a “walk” signal would be: “Street name. Walk sign is on to cross Street name”. Where the spoken word message is being used in combination with APS indications, the APS would immediately follow the above-noted message.

For each potential deployment of voice messages, deploying agencies should carefully consider the linguistic makeup of the local community and plan their messages accordingly. Unilingual (i.e. English or French only) messages may not be appropriate for the local community. In these instances, the deploying agency should consider multiple-phase multilingual messages, while exercising caution in maintaining an easily understood audible message.

It should be noted that many deploying agencies in the U.S. have used spoken word messages as an alternate to the common bird sounds. However, APS advocates also have concerns regarding spoken word messages. There is evidence that suggests that voice messages are too frequently ambiguous, and more importantly, difficult to hear in a noisy street environment. For this reason, voice messages are best used in combination with the APS indications identified in Section 5.5.3.

5.5.5 Use of APS Beaconing

APS beacons use the same APS indications but operate at a higher volume so that they can be heard throughout the crosswalk and from across the street. Beacons have been widely deployed in North American applications. However, recent research indicates that the broader community of organizations representing people with vision loss no longer favours the use of APS beacons. The reasoning provided is that beacons tend to mask parallel traffic noise, and people with vision loss consider this traffic noise to be the volume APS that provide a start of crossing indication, over the use of beacons. However, audible beaconing may provide benefits under a number of scenarios:

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- When the intersection has an unusual geometry (e.g. skewed crosswalks, 5+ legged intersections, offset intersections, etc.) to provide added guidance;
- When the continuous crossing distance (i.e. no refuge area) exceeds 22m to reduce the potential for “drift” in the pedestrian’s walking path; and
- When pedestrian scramble phasing is used, or other conditions exist that remove, or significantly limit, the parallel traffic noise.

In these circumstances, the APS should be actuated, and the method of actuation should be a press-and-hold of the pedestrian pushbutton. (See “Beaconing actuation” in Section 5.4.2) Without an actuation, the APS should remain silent. Therefore, for any signal cycle, there is either an actuated beacon, or no APS.

Upon actuation, the APS should provide a vibrotactile acknowledgment of actuation from the pushbutton (or vicinity) and an audible indication from the beacon. This acknowledgement is the same as described in Section 5.4.3.

The audible APS beacon may be emitted from the pushbutton or from supplemental overhead speakers directed toward the pedestrian walking in the crosswalk. The APS beacon should employ the APS audible indications described in Section 5.5.3. Due to the potential impact on the surrounding environment, the use of voice messages (as described in Section 5.5.4) is not recommended.

To be effective as a crossing beacon, these beacon APS indications are emitted at a higher sound volume than the APS emitted from the pushbuttons. As with regular APS, the volume of the APS beacon should adjust (up and down) with the volume level of the ambient sound. However, the volume of the beacon signal should not exceed 89dB and should be audible across the length of the pedestrian crossing.

The beacon signal should alternate between the ends of the pedestrian crosswalk. In this way, regardless of the direction of travel, the sound should alternate between a source in front, and behind the pedestrian. This assists in pedestrian navigation improving the pedestrian ability to locate the source of the APS indication and reducing the degree of lateral deviation.

Where used in combination with pedestrian scramble phasing, beacons for conflicting directions should not be activated at the same time. Instead, pushbuttons should actuate the APS beacons associated with that pushbutton only. Should there be multiple actuations in one signal cycle, APS indications should be provided in the order that the actuations were received.

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5.6 Traffic Control Signal Operations and Phasing

5.6.1 Two-Phase Non-Actuated (Fixed) Operation

In this type of operation, the traffic control signals cycle continuously without the need for either vehicle or pedestrian actuation. APS operation (audible and vibrotactile) may be fixed (always active with each successive “walk” display in each direction) or actuated. Actuation would typically only be used to mitigate sound impacts if operating the APS in a fixed mode results in noise complaints that cannot be mitigated through sound level adjustments.

Where the APS is actuated, pedestrian pushbuttons should be used to activate the APS technology. Pushbutton locating tones should be used to identify the pushbuttons.

Where the APS is “fixed”, the APS would be active with each successive “walk” display. Pedestrian pushbuttons (and corresponding locating tones) are not used in this type of installation.

5.6.2 Two-Phase Actuated Operation

In this type of operation, the traffic control signals typically rest in a main street green light display until there is a vehicle or pedestrian actuation to serve the side street. At these locations, the existing pedestrian pushbuttons should be used to actuate the side street “walk” and green light displays, and the APS technology. If a side street vehicle and pedestrian are detected, the side street green light and “walk” would be provided, and these displays would be accompanied by the APS indication appropriate for the side street. If a side street vehicle were detected without a pedestrian actuation, no side street “walk” indication or APS would be provided.

Pedestrians walking along the main street should also have the ability to use the pushbutton actuations (to cross the side street) to assist them in continuing to walk along the main street. Once actuated, the signal would transition to the main street “walk” and APS, as appropriate for the control technology used at the site. If the traffic signals normally rest in the main street green and “walk”, the deployer may consider discontinuing the APS (and continuing with the “walk”) after a predefined period so that the APS is not active indefinitely. The deployer’s ability to do so may be constrained by signal controller capabilities. If so, the deployer should consider whether there are any potential noise impacts on the surrounding neighbourhood, and develop appropriate strategies to mitigate these impacts.

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5.6.3 Multi-Phased Operations

When installing APS within a multi-phased signal operations environment, deploying agencies should evaluate whether pedestrian movements during APS can be adequately segregated from conflicting movements. Specifically, pedestrians waiting to cross the street may hear an APS intended for another movement, interpret that tone as the beginning of their “walk” display, and begin to cross while in conflict with a vehicle movement. Where this potential exists, deploying agencies should take precautions to ensure that such problems do not occur. As a minimum, post-installation inspections should occur to assess the potential for these sound conflicts during various traffic conditions.

5.6.4 APS Sound Mitigation and Deactivation

Where APS are provided and sound impact concerns persist, the deploying agency should attempt mitigating strategies, including:

- Adjusting the volume levels and ambient sound reaction adjustments;
- Actuation of the APS;
- AAPS use by time-of-day; and
- Use of vibrotactile indications alone.

Where the operation of APS by time-of-day is deemed desirable or necessary, the deploying agency should seek agreement with the principal users and/or the local advisory committee regarding the operational hours, type of operation, etc.

Traffic control signals equipped with APS technologies are not typically placed on flash for overnight, low-volume (or other) operations. Normally flash operation is only used at APS sites in times of emergency, or for maintenance purposes, and during these instances APS operation is disabled entirely and re-established only under normal operating conditions. However, some deploying agencies do use flash in instances where the user-base is fully identified and can be informed in advance of the normal flash operation schedule.

Deactivations may also be appropriate where the physical condition of the roadway makes the pedestrian crossing temporarily unavailable, such as during sidewalk, roadway or other construction activities. Some deploying agencies have also deactivated APS on a temporary basis to accommodate film productions. In each of these temporary deactivation scenarios, the deploying agency should take appropriate action to meet the needs of pedestrians at the subject location.

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5.6.5 APS and Traffic Control Signal Pre-emption

In designing traffic control signal pre-emption timing and transition plans, deploying agencies should remember that the APS is to be used as a signal to begin the pedestrian “walk”. Appropriate pedestrian clearance times should always be provided to accommodate the pedestrians typically found at the subject site.

6. APS Design Guidelines

6.1 General

Consistency of APS infrastructure layout is important to people with vision loss as it establishes norms concerning how and where to find APS devices. This section identifies design criteria (including pushbutton location, pole location, etc.) that are considered desirable for the effective operation of APS.

These APS design guidelines serve two purposes:

- To identify desirable design criteria to be used when installing new traffic control signals; and
- To identify target design guidelines to work towards upon retrofit of equipment and reconstruction of traffic control infrastructure.

It is recognized that many APS installations deployed today in Canada may not meet these design criteria. Instead, the guidelines provide design direction for consideration when installing new traffic control signals, and so that appropriate modifications may be introduced as changes or upgrades are made to the intersection. Deploying agencies should note that in some provinces, the rate at which APS installations must be upgraded to meet accessibility criteria (such as these guidelines) may be influenced or mandated by the presence of provincial accessibility legislation.

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6.2 Layout

APS installations should be designed to consider the needs of the requesting party, and the needs of other pedestrians who may benefit from the installation. The decision regarding whether to incorporate all legs of an intersection should be made on a case-by-case basis, and should be based principally on local user needs. Deployers should consult with local stakeholders (as appropriate for the circumstances) to determine these local needs.

6.3 Pushbutton Location

Preferred location for the placement of APS pushbuttons. Where poles are not suitably located to meet these placement criteria, one of the following strategies may be pursued:

- Realignment of the pedestrian crosswalk lines to better suit the needs of the pedestrians with vision loss;
- Installation of supplemental pushbutton poles to achieve the desirable pushbutton placement; or
- Implementation of actuators that result in an APS operation for two consecutive signal cycles.

In theory, the latter strategy will provide pedestrians with sufficient time to orient themselves for the next crossing. However, it is not the preferred approach as it does not address the needs of people with both vision and hearing loss who use the vibrotactile signal exclusively, nor does it provide an intuitive operation for pedestrian with other forms of vision loss.

It should be noted that in all instances, pole placement should provide approximately 1 .5m of clearance for people in wheelchairs, powered chairs, and maintenance vehicles (e.g. snow and garbage clearance vehicles) to circulate.

6.3.1 Pushbutton Location Relative to Walking Path and Curb

Wherever possible, APS pushbuttons should be located adjacent to a clear level ground surface acting as the pedestrian waiting area. This may be adjacent to, or part of the pedestrian sidewalk. The clear ground surface should be stable, firm and slip resistant. The pedestrian pushbutton should be located within 0.3m of the clear ground surface of this pedestrian waiting area.

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Designers should remember that for a vibrotactile system to be useful for a pedestrian, they should be able to reach the pushbutton from their position at the start of crossing. The pushbutton should be placed on the side of the pole facing the pedestrian waiting area and aligned such that the face is parallel to the associated crosswalk. APS pushbuttons should be located nearest to the extended crosswalk line that is furthest from the movement of parallel traffic. The APS should be set back no further than 0.6m from the extended line of this crosswalk.

In urban environments, the pushbutton may be located close to the curb, as deemed appropriate for the environment. In suburban environments, APS pushbuttons should be located further from the curb to avoid damage due to vehicles tracking across the corner. In these instances, the pushbutton should be located between 1m and a maximum of 3m from the curb line of the roadway (as measured along the pedestrian walking path) to ensure accessibility of the pushbutton from the pedestrian waiting area.

Access to the APS pushbutton should be free and unobstructed at all times and under all weather conditions. Materials and objects that may make it difficult to locate the pushbutton are media boxes and garbage cans abutting the pole, ploughed snow, etc. Notwithstanding the above guidelines for pushbutton placement, the pushbutton pole location:

- Should conform to local guidelines for minimum sidewalk clear path, and in all instances, not obstruct the pedestrian walking path;
- Should provide approximately 1.5m of clearance for wheelchairs, powered chairs, and maintenance vehicles (e.g. snow and garbage clearance vehicles) to circulate; and
- Should not be located on the pedestrian ramp.

Where the median island is sufficiently wide to safely act as a pedestrian refuge, supplemental APS (and pushbuttons where applicable) should also be installed to allow stranded pedestrians to use the APS on the next cycle. To support these users, APS (and possibly push buttons as appropriate for the operation) should be provided on the islands and a total of three APS units would be installed for each long crossing (i.e. one at either end of the crossing, and one on the refuge). In this way, deploying agencies may avoid providing their users with APS for only the first half of a long crossing.

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6.3.2 Pushbutton Mounting Height and Alignment

An APS pushbutton should be mounted on a pole or pushbutton pole at a height of 1.1m (± 0.15 m).

The surface of the APS pushbutton control face should align parallel to the direction of the crosswalk that the pushbutton controls. This should allow users to use the face of the signs and associated markings to orient themselves for the crossing.

6.3.3 Pushbutton Appearance

Ideally, the pushbutton, sign, and locating tone would be incorporated into an integrated unit, however, this is not considered necessary for satisfactory operation of the APS systems.

The high visual colour contrast ratio between the pushbutton and the surrounding pushbutton casing should be provided (see term "Contrast ratio" in Table 1.1).

6.3.4 Locating Pushbuttons on a Single Pole vs. Separate Poles

Where two separate APS pushbuttons are located on the same corner (i.e. for two separate directions of travel), the pushbutton and APS emitter (if separate from pushbutton) for each crosswalk should be separated by 3m. This assists pedestrians in orientation by associating separate pushbutton sites with specific APS indications.

However, in some locations (e.g. proposed retrofit locations, dense urban locations, etc.) circumstances may dictate the placement of APS pushbuttons for two directions of travel on a single pole. In these instances, the same design principles identified in Section 6.3.1 still apply. Each pushbutton (and pedestrian information sign if applicable) should be on the side of the pole facing the pedestrian waiting area and aligned such that the face is parallel to the associated crosswalk. APS pushbuttons should be located nearest to the extended crosswalk line that is furthest from the movement of parallel traffic.

In these instances, it is important that the APS provide supplemental and unambiguous information that clearly identifies the street to be crossed. In addition to the proposed raised arrows, supplemental information may include Braille, raised text, and audible voice announcements, as described in Section 5.3 of these guidelines.

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6.4 Pedestrian Walking Path

It is also important that the pedestrians be provided with a reasonable path between where they await their signal and the far side of their crossing. The straightline path between the probable pedestrian waiting area and the far side of the crossing should (as closely as possible):

- Follow the pedestrian crosswalk;
- Make use of the existing pedestrian ramps;
- Guide pedestrians away from potential conflicts with parallel travelling traffic;
- Guide pedestrians away from median islands that do not provide an appropriate pedestrian refuge area;
- Guide pedestrians in such a manner that they do not come into conflict with stopped and/or queued vehicles facing the red display.

These guidelines are particularly pertinent for sites incorporating beaconing technology. Where beaconing is used, the location of the beacon speaker should also support these alignment guidelines.

6.5 Beacon Mounting Height and Alignment

As described in Section 5.5.5, APS beacons may be emitted from a pushbutton or from supplemental overhead speakers directed toward the pedestrian walking in the crosswalk. Where overhead APS beacons are employed, the beacons should be:

- Mounted between 3m and 4m above the ground;
- Mounted to comply with the above-noted guidelines to mitigate obstacles in the pedestrian walking path; and
- They should be pointed at a point within the pedestrian path two-thirds of the way across the crosswalk, and should be heard throughout the length of the crosswalk.

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6.6 Pedestrian Information Signing

Information signs should be incorporated into the housing for the APS pushbutton, or mounted immediately above the pushbutton. The signs should be aligned such that the sign face is parallel to the crosswalk that is controlled by the associated pushbutton.

6.7 Challenges Related to Intersection Configuration

There are a number of intersection geometric configurations that pose challenges for agencies deploying APS. While no definitive solutions have been identified for these challenges, the following provides some insight to assist deploying agencies in their deployment programs.

Tactile mapping (see Section 5.3.5) may provide added assistance in wayfinding in these unusual crossing configurations.

Median Islands

Median islands that extend into pedestrian crosswalks represent potential hazards. For people with vision loss, the islands may cause delays, act as a tripping hazard, or may be misinterpreted as the far side curb. The islands are also a tripping hazard for people with

vision loss. Therefore, it is not desirable for centre median islands to extend into the crosswalk at intersections operating APS, unless they are appropriately designed as a pedestrian refuge area. For proposed APS sites, the intersection should be evaluated for the need to truncate any existing median islands.

Two-Stage Crossings With Median Islands

Median islands are occasionally used as a refuge area in a “pelican” crossing configuration. In these instances, pedestrians are provided with two discrete crossing stages. However, the crossings may be within audible distance of each other, and therefore, providing discrete tones for each crossing may be necessary.

Right Turn Channelization

Right turn channels typically allow right turns to yield and continue, regardless of the traffic signal indication. Pedestrians may have difficulty crossing the channel depending on local traffic conditions, local compliance with yielding to pedestrians, number of lanes to cross, etc.

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Additional Intersection Legs

Multi-legged (5+) intersections usually result in complex traffic signal phasing including more than two pedestrian phases. This may introduce ambiguity for pedestrians if a specific APS tone or melody is used for more than one direction.

Offset and T-Intersections

T-intersections and offset intersections often result in confusing T-Intersections audible cues for people with vision loss, as side street traffic may not travel parallel to the pedestrian crossing, and in some instances, the turning movements onto the main street are perpendicular to the pedestrian direction of travel.

7. APS Deployment Guidelines

The following deployment strategies are recommended to ensure that an APS deployment meets the needs of the person or agency that requested the installation.

7.1 Pre and Post-Installation Notifications

In preparation for each new APS installation, the person or agency that requested the installation should be advised of the planned installation date. This should occur sufficiently in advance of the activation date to ensure that the pedestrians with vision loss are adequately advised of the activation date. In addition (and where applicable), the deploying agency should advise the local APS advisory group and/or local advocacy groups, and ensure that the deploying agency’s normal means of public communication (e.g. websites, fliers, etc.) are used to inform their constituents. Similar information should be conveyed to confirm that the installation is complete.

7.2 Installation Inspections

The deploying agency having designed the APS installation on behalf of a user, or group of users, should assign a competent person to inspect the installation on the day that it is installed. The inspection should:

- Confirm that the APS was installed as de-signed;
- Ensure that pedestrians cannot hear APS indications that would put them in conflict with vehicular movements (e.g. from APS used on split phasing, adjacent intersections, etc.) and that sound levels and directionality are adjusted to ensure that conflicts do not occur;
- Confirm that the APS is operating as intended and that all other related functionality (e.g. pedestrian signal indications, timing,

etc.) has not been affected in a manner that was not intended;

- Confirm that no new hazards have been introduced as a result of the installation (e.g. sidewalk pavement not restored properly, exposed wiring, etc.); and
- Identify preferred actions for any deficiencies identified.

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7.3 User Orientation

An operational orientation walk-through is an effective strategy that may be used to ensure that the primary users are comfortable with the operation of the APS, and understand how to recognize any future maintenance needs. Representatives of the deploying agency, mobility trainers, and the users tour the installation to discuss orientation strategies, actuation (if applicable), meaning of the APS indications and vibrotactile signals, etc. Other objectives for these on-site meetings include the building of relationships with the user community and to provide contact information should there be a future need for system maintenance.

8. APS Maintenance and Adjustments

8.1 Operational Adjustments

Typical requests for operational adjustments include:

- Users requesting adjustments of the APS volume levels because they are too low, particularly during peak traffic conditions; and
- Property owners, businesses and residents in the vicinity of the APS requesting volume adjustments because the volume levels are considered too high, particularly overnight.

Some common strategies for mitigating these concerns include:

- Adjustments to the ambient sound. These include shifting the potential sound range up or down as appropriate, or perhaps broadening the potential range of sound volume; and
- Where APS technology allows, having it adjust the volume (or volume range) by time-of-day.

Where an operational adjustment fundamentally changes the operation of the APS installation, appropriate user and community liaison should be provided to communicate the changes in advance of their implementation.

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8.2 Emergency Maintenance

Once APS units have been installed, the deploying agency should ensure that their staff or maintenance contractor have the appropriate training to troubleshoot and perform all appropriate routine and emergency maintenance on the APS units installed.

The deploying agency should maintain appropriate spare parts, including replacement units to expeditiously repair or replace faulty equipment in a timely fashion.

Required maintenance on known APS faults should have a priority similar to a “signals out” condition, and should be repaired as soon as possible.

8.3 Routine Maintenance

8.3.1 Conflict Monitoring

APS units should be monitored for conflicts. As with pedestrian signal heads, APS are a type of display that indicate assigned right-of-way. For this reason, APS should be monitored (preferably through the signal controller with other potentially conflicting displays to ensure that electrical malfunctions do not result in safety concerns.

8.3.2 Operational Inspections

Operational inspections should include:

- Confirmation that the APS and all other related functionality (e.g. pedestrian signal indications, timing, etc.) are operating as intended;
- Observations of the APS and pushbutton locating tone sound pressure levels to confirm the levels meet the guidelines during (a) peak ambient sound conditions, and (b) low ambient sound conditions (i.e. overnight); and
- Once sound levels are confirmed per above, ensuring that pedestrians cannot hear APS indications that would put them in conflict with vehicular movements (e.g. from APS used on split phasing, adjacent intersections, etc.) and that sound levels and directionality are adjusted to ensure that conflicts do not occur.

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8.3.3 Equipment Inspections

The deploying agency should maintain a regular program of equipment inspections to ensure that the APS units remain aligned and in a state of good repair. Such inspections will ensure basic functioning of push buttons, tone/vibration emitters and other APS hardware. These inspections will also mitigate the negative impacts of:

- Obstructions caused by media boxes chained to the pushbutton pole, postering, garbage bins, and other obstructions that limit access to the pushbutton;
- Snow clearing operations that restrict access to the pushbutton; and
- Vandalism or damage that may affect the normal performance of APS devices.

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Appendix A

Accessible Pedestrian Signals Intersection Evaluation Procedure

Priority: Lowest
Level of use: Very light
Estimated numbers of discrete crossing daily: 1 - 10

Priority: Lowest
Level of use: Light
Estimated numbers of discrete crossing daily: 11 - 20

Priority: Lowest
Level of use: Moderate
Estimated numbers of discrete crossing daily: 21 - 50

Priority: Highest
Level of use: Heavy
Estimated numbers of discrete crossing daily: 51 and above

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5. Purpose

The purpose of this prioritization process is to establish factors to be used in creating a ranking amongst candidate sites to be retrofitted with accessible pedestrian signals. Note that this is not intended as an installation warrant process.

6. Process

6.1 A. Pedestrian Crossing Demand

1. Anticipated level of use: An estimate of the number of people with vision loss (and the number of deaf-blind) who will use the facility. Factors that influence the potential number of pedestrians with vision loss include:

- Proximity to facilities and services for people with vision loss (e.g. a medical centre, an educational or training institution, etc.);
- Transit transfer points; and
- Any high pedestrian volume locations.

6.2 B. Crossing Environment

2. Proximity to alternative crossings: An audible pedestrian signal is most needed where there is no appropriate crossing site nearby.

Priority: Lowest
Proximity to alternative crossings:
Good crossing within 100 meters
Good crossing within 200 meters
Good crossing within 300 meters

Priority: Highest

Proximity to alternative crossings:
No good crossing within 300 meters

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3. Traffic conditions: Vehicle volumes, traffic distribution, traffic congestion and flow characteristics may assist or impede a visually impaired traveler in crossing an intersection. Visually impaired pedestrians function best when crossing at signalized intersections that have moderate but steady flow of traffic through the intersection and parallel to the desired crossing. Traffic that stops on each leg during each signal cycle is particularly helpful. Traffic that is either very light (traffic sounds are absent), erratic in its flow (e.g. pronounced platooning), or sufficiently heavy that traffic tends to back-up through intersection, make it difficult for visually impaired travelers to pick up audible clues as to the signal phase. In such cases, audible signals will assist in determining when it is possible to cross the street.

Priority: Lowest
Meets above-noted criteria:
Location has favourable traffic conditions
Location demonstrates some unfavourable traffic conditions

Priority: Highest
Meets above-noted criteria:
Location has unfavourable traffic conditions

4. Other factors: The physical environment of the candidate site may create challenges for people with vision loss. APS can assist pedestrians in identifying crossing opportunities for a number of these site-related conditions, including (but not limited to):

- Complex phasing
- High ambient noise
- Heavy right turn volumes
- T-intersection
- A single crosswalk
- Mid-block pedestrian signal
- Leading pedestrian indicator
- Offset intersection
- Intersection with additional legs
- Right turn signals
- Skewed Intersection

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Priority: Lowest
Meets above-noted criteria:
Location has none of the above-noted site conditions

Priority: Highest
Meets above-noted criteria:
Location has one or more of the above-noted site conditions

7. C. Where Beaconing Is Used

5. Width of crossing: Wider streets are more difficult for visually impaired travelers to cross, as there is a higher probability of the pedestrian veering off course. Crossing width should be measured at the point pedestrians normally cross the street, and include islands and medians.

Priority: Lowest

Proximity to alternative crossings:

12 meters or less

12 to 16 meters

16 to 21 meters

21 to 24 meters

Priority: Highest

Proximity to alternative crossings:

24 meters or more



WOODSTOCK TRANSIT
GO GREEN
5
BUS ARRIVES:
00
30
RUSH HOUR INTERAGENCY SCHEDULE
3:00pm - 3:45pm - 4:00pm
PROHIBITED

Wilson St

Alliance360 Inc.

ONE WAY
ONE WAY
ONE WAY
ONE WAY









Button For
Audible
Signal Only

