Findings Report

Advancing Communication through Signage and Wayfinding

2023 | PEACH Research Unit

Advancing Communication through Signage and Wayfinding

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Abbreviations

ABCB: Australian Building Codes Board

ACA: The Accessibility Canada Act

ADA: Americans with Disabilities Act (United States)

BLC: Braille Literacy Canada

BSI: British Standards Institution

CNIB: Canadian National Institute for the Blind

CSA: Canadian Standards Association

ISA: International Symbol of Access

NDA: National Disability Authority (Ireland)

PEACH: Planning for Equity, Accessibility and Community Health

RGD: Association of Registered Graphic Designers

RHF: Rick Hansen Foundation (Canada)

SA: Standards Australia

Executive Summary

Signage is an essential tool used for the identification and navigation of the built environment – a process that is sometimes called, wayfinding. Yet despite over six million Canadians identifying as living with one or more disabilities, accessible signage design is understudied with little existing research to help enhance the standards.

In Canada, the Canadian Standards Association (CSA) B651-18 document includes recommendations for the design of accessible signage, such as the minimum mounting height of signage, minimum text size, braille specifications, and tactile markings. However, there is a gap in empirical evidence that tests the efficacy of these standards.

This Findings Report details the results of a collaborative research project between eyecandy SIGNS INC., and the PEACH Research Unit, which aims to fill part of this gap by examining and testing signage design standards from the experience of people who use them. This study tested three design attributes through a series of interactive public installations with prototype signage in locations around Halifax, Nova Scotia. The three attributes of signage accessibility that were tested are:

- the mounting height of wall signage from the finished floor surface,
- the placement of braille within a sign's content relative to other content, and
- the legibility of print characters from a distance.

Original data was collected through survey questionnaires, completed by 223 respondents who were of various age and gender, and had different types and levels of disability experience (n=78, 35%). Results found a majority of respondents preferred sign mounting heights, and character heights relative to viewing distance, that were consistent with current Canadian standards. However, qualitative responses from users with and without disability suggests that the standards may benefit from additional criteria that considers different sign types or contextual elements alongside specific measurements for signage. These include incorporating height ranges for overhead signage, circumstances where multiple signs might be appropriate, and developing standards related to maps. Responses from braille users suggest that the optimal placement of braille on a sign may also differ by sign type, with considerations being different between signs with little content, signs with a lot of content, and maps or signs with navigational information.

It is necessary to establish stronger evidence for the effectiveness of each of the existing standards, critically examining how surrounding environment and a wide range of user abilities together shape the design requirements.

Section 0: Introduction

Section Summary

The project lead, eyecandy SIGNS INC., and the research team, the PEACH Research Unit of Dalhousie University came together to investigate the effectiveness of current signage standards for accessibility, and to develop empirical evidence to support future research in this area. The content of this report provides an overview of accessible signage and wayfinding standards documents in Canada and overseas, summarizes the method and results of signage testing undertaken by this research, and proposes key findings and recommendations.

0.1. The Project Team

This report outlines findings from the research project entitled *Advancing Communication through Signage and Wayfinding*, conducted in partnership between the Planning for Equity, Accessibility, and Community Health (PEACH) Research Unit of Dalhousie University's School of Planning and eyecandy SIGNS INC.

eyecandy SIGNS INC., the lead of this project, is a professional signage company made up of a multidisciplinary team of designers and wayfinding experts. Since 1997, eyecandy SIGNS INC. has fabricated countless boutique signs for businesses and developed wayfinding systems for commercial and institutional environments. The creative team at eyecandy SIGNS has grown as a leader in accessible signage and wayfinding design across North America. Through this project, eyecandy SIGNS INC. aims to contribute to the future of accessible signage for all in Canada by informing future national guidelines. The PEACH Research Unit conducted the signage testing and analysis of the data collected. Since 2018, team members of the PEACH Research Unit have been performing research and community advocacy on topics relating to planning, accessibility, and health equity in Nova Scotia. PEACH initiates and collaborates on projects with community partners, like eyecandy SIGNS INC., which seek to address societal barriers preventing equitable and meaningful participation in communities for all. This project aligns with PEACH's efforts to build new knowledge to inform design solutions to the mismatch between the built environment and the needs of individuals living with disabilities.

Advancing Communication through Signage and Wayfinding investigates select accessible design standards for signage and wayfinding currently available in Canada to inform future recommendations for signage using experience-based evidence. This project was funded by the Accessibility Standards Canada, under its Advancing Accessible Standards Research grant.

0.2. Purpose of This Study

The purpose of this study is to collect empirical evidence for the effectiveness of standards for accessible signage and wayfinding in CSA by assessing whether the signs that comply with the standards reflect the needs of people who read them. The evidence will also support further development of accessible signage standards by helping identify future directions for research.

The project was guided by the following specific objectives:

Objectives

- To empirically assess sign installation/mounting height, braille placement on tactile signs, and character height as it relates to reading distance and legibility prescribed in the Canadian Standards Association (CSA) accessible wayfinding and signage standards from the user perspectives.
- To explore other factors that may help enhance the accessible wayfinding and signage standards for CSA.
- To develop recommendations for addition and modification in current standards relating to accessible signage and wayfinding in Canada, and identify future needs for research.

0.3. Structure of This Report

The report is organized as the following:

Section 1. Introduction

It describes the background rationale and explains some important concepts associated with the study.

Section 2. Overview of signage and wayfinding standards in Canada and overseas

It provides an overview of various signage and wayfinding standards existing in Canada and overseas, focusing on three specific attributes of signage accessibility: 1) sign installation/mountain height, 2) braille placement on tactile signs, and 3) character height.

Section 3. Summary of signage testing methods

It describes how we developed and conducted signage testing, focusing on the three attributes.

Section 4. What we heard from the participants of our signage testing

It synthesizes the findings from the survey we conducted. The findings include how adequate the CSA standards on the three elements were from the perspectives of survey participants, and what the participants also had to say about these elements and more.

Section 5. Recommendation and future needs for research

It presents a list of consideration for additions and changes, while also proposes possible area of further research, based on our study.

Section 1: Background

Section Summary

Signage is an essential but understudied communication tool used for identification and navigation of the built environment – sometimes called, wayfinding. Like other features in the built environment, signage is guided by accessible design standards, which are used to design signs to be more useful for people with a range of disability experience. For example, tactile markings, audio features, and colour contrast are design tools that can be required by standards to make signage more useful for people who experience sight loss. In Canada, more than 6 million individuals identify as living with a disability, and this number is growing. Standards for signage accessibility are important for guiding the design of signage that serves the needs of as wide an audience as possible.

1.1. Disability in Canada

Worldwide recognition of human rights for persons with disabilities has accelerated since the United Nations Convention on the Rights of Persons with Disabilities was first adopted in 2006 (Kanter, 2007). Human rights legislation largely recognizes a social model of disability -- which defines disability as occurring as a result of barriers in the social and physical environment rather than as a quality of an individual. With this lens, the design of the built environment plays a crucial role in enabling access and inclusion for everyone.

In 2019, Canada enacted the Accessible Canada Act as the first federal legislation to realize a barrier-free Canada for persons with disabilities. This legislation marks a growing momentum across the country to recognize and address the needs of persons with disabilities in the policies and design standards that are shaping Canadian communities.

Persons with disabilities make up 22% (Statistics Canada, 2018) of the population in Canada – more than 6 million individuals. In Nova Scotia, the population of persons experiencing disability is even higher than the national average at over 30% (Statistics Canada, 2018). Nova Scotia is the third province in Canada to adopt provincial accessibility legislation through the enactment of its Accessibility Act in 2017. The province has made a commitment to be fully accessible by 2030, which has motivated significant interest from public and private sector bodies alike to adopt more inclusive and accessible practices.

The Canadian Standards Association (CSA) 2018 document, B651-18, provides accessibility standards for buildings and open spaces, which guide the design and construction of new developments catering to multiple disabilities, i.e., physical, visual, and hearing, thus, making the surroundings a 'barrier free' environment. Once adopted into provincial code, CSA B651-18 is currently the only legally enforceable accessibility design standard in Canada. This study will focus on understanding user experience of three attributes of signage accessibility from the existing B651-18 guidelines to inform future best practices in wayfinding.

1.2. What is Wayfinding?

Wayfinding is the process of orienting oneself, and of planning and executing a navigational route through the built environment – i.e., the places in which we live, work, learn, and play (Fogli, Arenghi, & Gentilin, 2020). Wayfinding information can include use of touch, print, smell, signage, and architecture or landscaping to assist individuals in finding their path.

Wayfinding is most commonly implemented with signage. Signage is an essential navigational tool in the built environment that many may take for granted in daily life. Signage informs how we safely and effectively navigate different spaces, both indoors and outdoors. However, there are many ways that signage can fail to serve the needs of different users. Signs with small lettering, or without tactile or audible features, are not likely to be useful to people who are blind or who have low or partial vision, for instance.

1.3. Signage and Accessibility

Standards for the built environment (like CSA B651-18) are used to guide the construction of physical features that can facilitate greater accessibility. Accessible features for streets, building interiors, building entrances, and more, can include designing ramps at entrances, using slip-resistant materials on steps, or installing automatic doors. These are just some features that can improve the ease of navigation and useability of spaces by more users. Signage is a key component to accessibility in the built environment, as it facilitates access to information.

Signage may communicate information such as where to find other accessible features (e.g., universal washroom) or how to get to them (Guffey, 2018). Signs display explicit wayfinding information through directional information; implicit wayfinding guidance through sequential numbering and zone markings; functional information about rooms and other places through labeling; and safety information (Arthur & Passinis, 1992). Direction, location, safety information, and type of actions permitted (or not permitted) in a space are all communicated primarily through signs. Accessibility standards for the built environment, therefore, include many specifications to help designers create effective signage for people of diverse (dis)abilities.

Regardless of indoor or outdoor conditions or the user's sensory ability, effective signage and wayfinding communicates essential information to the user. Accessible signage uses a variety of modes (pictogram, verbal, tactile) to convey important information (Arditi, 2017).

1.4. Signage and Sight Loss

CNIB reports that an estimated 1.5 million Canadians identify as having some form of sight loss, and an additional 5.59 million have an eye disease that could cause sight loss (CNIB, 2022). Sight loss describes a spectrum of vision impairment, including persons with no sight and persons who are partially sighted. For users experiencing sight loss, braille, tactile characters (i.e., letters and numbers), colour-contrast, and character sizing are all particularly important considerations for signage design.

Individuals often experience more than one kind of disability. For instance, someone who experiences sight loss may also use a wheelchair to get around. Therefore, it is important to consider how design standards serve a diversity of signage users.

Accessibility standards and guidelines for signage provide important guidance on how to make signs that serve as wide an audience as possible. A key interest of the research contained herein is the current guidelines for people experiencing visual impairment and developing alternate signage and wayfinding design, using a survey to inform changes, if any, to the current practice.

Section 2: Overview of Signage and Wayfinding Standards in Canada and Overseas

Section Summary

In Canada, CSA B651 Accessible Design for the Built Environment offers the most comprehensive accessible signage standards that are enforceable when adopted by jurisdictions. A review and comparison of 13 standards documents from Canada and international, English-speaking countries summarized recommendations between the documents for three design attributes for accessibility – these are, (1) mounting height, (2) placement of braille, and (3) legibility from a distance. Recommendations for these three attributes vary between standards documents, and the way in which standards are communicated, whether by defining precise measurements for design or by describing a sign's intent and general guidance for design, also varies. There is a lack of empirical research into which approach or specifications are optimal, and an identified gap in consideration of sign users with a wide range or combination of disability experiences.

2.1. What are Signage Standards?

Accessible signage standards are typically developed alongside accessibility legislation to guide the design and construction of signs to align with the policies of the legislative document. Standards can be composed by governing bodies, or by organizations that specialize in knowledge-creation and knowledge-sharing. The latter can be adopted by a government and used as codes or published as public resources to inform design.

Currently, the Canadian Standards Association 2018 document, CSA B651, Accessible Design for the Built Environment, offers the most comprehensive enforceable standards (if adopted into regulations, as seen through the National Building Code) for accessible design in Canada. Several prominent national disability organizations in Canada also produce guidance documents for accessible design, including the Rick Hansen Foundation's Accessibility Certification, CNIB's Clearing Our Path, and Braille Literacy Canada's Accessible Signage Guidelines. These provide enhanced accessible design best practices, informed by people and professionals with a range of disability experience.

2.1.1. What Kinds of Standards for Accessible Signage Are There?

Standards documents for accessible signage provide guidance for visual and non-visual signage elements. Visual-only accessible signs are often guided by prescribing design elements such as:

- visual contrast between a sign background and its content,
- visual contrast between a sign and its surroundings,
- the size, spacing, and height of a sign's text or icons,
- the mounting height of signs, and,
- materiality of a sign (e.g., matte sheen), etc.

Non-visual components are integrated into visual signs where possible to include more users. Tactile signs that can be read by touch can include braille, raised figures, text, or pictograms, and are guided by additional specifications by standards for elements such as:

- height of character relief,
- when to use contracted or uncontracted braille,
- sign placement relative to surrounding features, or,
- the sign's mounting angle.

Both visual-only and visual-tactile signs can be used as part of accessible signage systems, with constraints dependent on the sign's functional type. For instance, an overhead sign is a type of visual-only sign because it is out of reach and, therefore, dysfunctional for tactile use.

Standards documents typically define at least some requirements for accessible signage in basic physical terms, such as applied measurements, ratios, or percentages. For example, CSA B651:2018's E.20.3.6 standard for Character Width (shown below) describes the minimum standard width of an uppercase "O" in a typeface as being between 55% and 110% of the height of the uppercase "I" of the same font.

Table 1: CSA B651-18, section E.20.3.6; Character width

A table with 2 columns and 1 row. The left column contains the source title and numbering of the standard with section title. The right column contains the corresponding text for the standard identified in the left column, taken directly from the source document.

CSA B651-18 E.20.3.6 Character width	The uppercase letter "O" shall be used to determine the allowable width of all characters of a font. The width of the uppercase letter "O" of the font shall be 55% minimum and 110% maximum of the height of the uppercase letter "I" of the font.

Standards like this provide a clear, direct requirement that can be applied and tested in practice. These types of standards allow designers, development officers, and others to more easily assess a sign's compliance with the standards (Jeter, 2016). However, sometimes this presentation of standards is seen as over-simplifying design elements into a list of easy-to-measure requirements, while neglecting the intent of the standards from user experience or its specific context (Arditi, 2017).

Some standards address this concern by providing more generalized recommendations. These kinds of standards aim to communicate an intent for designers to follow. For example, EN 17210:2021's 6.6.6 requirement for the Height of Signs (CEN, 2021, p. 49) (shown below) explains that the ideal placement of a sign depends on the intent of its function and the expected use of the space where it is located.

Table 2: EN 17210:2021, section 6.6.6: Height of signs

A table with 2 columns and 1 row. The left column contains the source title and numbering of the standard with section title. The right column contains the corresponding text for the standard identified in the left column, taken directly from the source document.

EN 17210:2021 6.6.6. Height of signs	b) Where it is likely that the sign may be obstructed, as in a crowded situation, the sign shall be placed at a height above the floor where it can be seen from a distance above the crowd. Signs fixed to the ceiling or projecting from walls shall be above head height. In that case, there should be two signs; one that can be seen from a distance above other people's heads, one as a compliment at a lower height.

Standard 6.6.6(b) prescribes that signs located in a space that is often crowded with people should be visible from a distance above the heads of people in the crowd. This type of description may offer more opportunity for designers to be creative with their solutions to achieve the described outcome. However, this requires greater interpretation, leaving more opportunity for misunderstanding or unintended results.

2.2. Key Standards Documents

The 13 standards documents reviewed for this study are from Canada, United States, Ireland, Australia, United Kingdom, and the European Commission. Table 3 lists the documents used for standards comparison.

Table 3: Accessible Design Standards Documents that contain signage standards

The table contains 21 rows and 2 columns. The first column, whose heading is "Title", includes the titles of the standards documents reviewed for this study. The second column, whose heading is "Author Organization", contains the organizations who wrote the corresponding standards. Rows with merged cells include the country of origin for each subsequent set of standards.

Title	Author Organization
Canada – Model Codes[1]	
National Building Code of Canada*	Canadian Commission on Building and Fire Codes; National Research Council of Canada
B651-18 Accessible Design for the Built Environment	Canadian Standards Association (CSA)
Canada – Best Practice Guidelines[2]	
Clearing Our Path	CNIB Foundation
Rick Hansen Foundation Accessibility Certification*	Rick Hansen Foundation (RHF)
Accessible Signage Guidelines	Braille Literacy Canada (BLC)
A Practical Handbook on Accessible Graphic Design	Association of Registered Graphic Designers (RGD)
United States	
Americans with Disabilities Act Standards for Accessible Design	Department of Justice
Ireland	
Building Regulations, Technical Guidance Document M: Access and Use	Department of Housing, Local Government and Heritage
Building for Everyone: A Universal Design Approach, Internal environment and services	National Disability Authority (NDA)
Australia	
Disability (Access to Premises-Building) Standards (2010)	Australian Building Codes Board (ABCB)

1 Model Codes are standards that are legally enforceable once adopted into provincial code.

2 Best Practice Guidelines are guidance documents that aim to provide enhanced design considerations for users with a variety of disability experience informed through direct consultation with persons with lived experience of disability.

AS 1428.2-1992: Design for access and mobility	Standards Australia (SA)
United Kingdom	
BS 8300-2:2018 Design of Buildings and their approaches to meet the needs of disabled people	British Standards Institution (BSI)
Other	
EN 17210-2021 Accessibility and usability of the built environment – Functional requirements	European Committee for Standardization (CEN)

*Standards provided in the National Building Code of Canada are equivalent to CSA B651-18. Similarly, RHFAC uses CSA B651 as their minimum standard for a accessibility as well.

2.3. Focus for the Study: Three Attributes of Signage Accessibility

We chose to compare specifications for three elements that are often prescribed in signage accessibility standards:

- the mounting height of wall signage from the finished floor surface,
- the placement of braille within a sign's content relative to other content, and,
- the legibility of print characters from a distance.

There were varying levels of detail and specificity for each of these elements within the standards we reviewed. The following provides definitions of these elements and explains how they are different among various standards and guidelines. For overviews of standards across standards documents on the three elements, please refer to Tables 5, 8, and 9 below.

2.3.1. Mounting Height

Mounting height, here, refers to how far up the vertical plane – usually a wall – a sign should be placed. This height is most often measured from the level floor surface to the horizontal centreline of the sign itself. It is provided for signs which contain tactile elements as well as visual content.

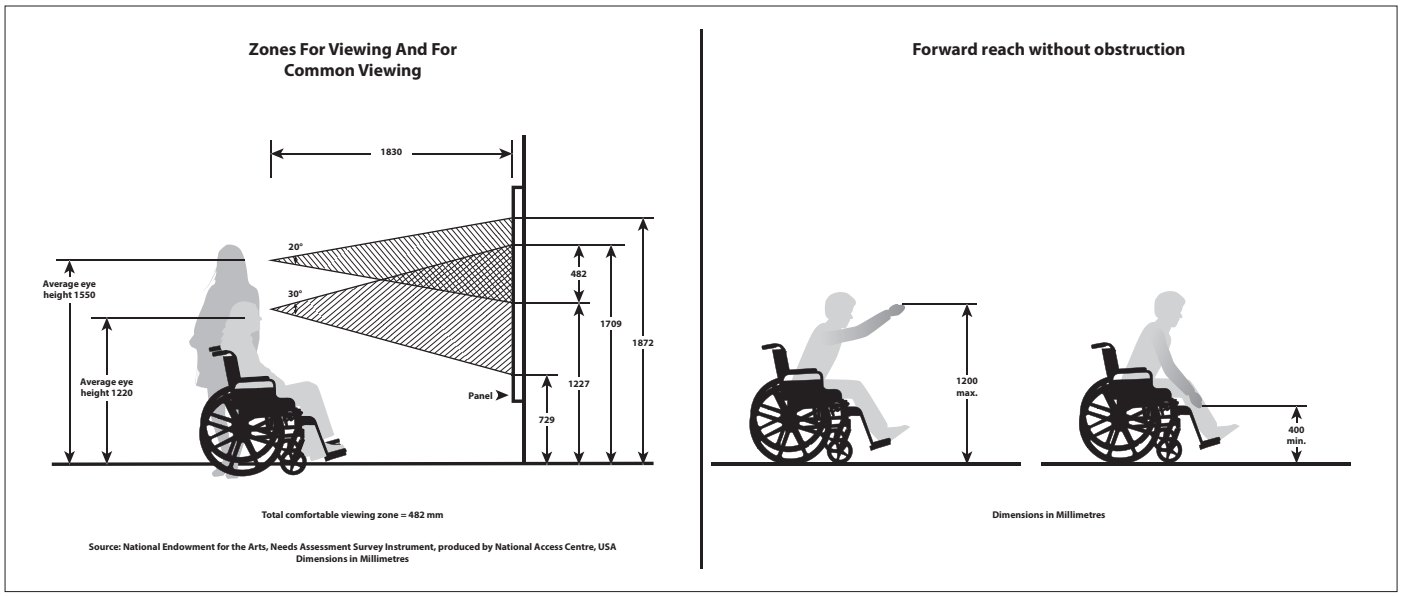


Figure 1: Two diagrams showing range of viewing height (left; from AS 1428.2-1992, p. 37) and range of reach by multiple users (right; from CSA B651-18, p. 206).

Both images are simple annotated line drawings of people standing and using wheelchairs viewing or reaching at specified height ranges

CSA B651-18 recommends that signs be mounted with their horizontal centreline 1500 mm from the floor, plus or minus 25 mm. This is prescribed for all signage containing tactile elements. Other standards provide ranges for mounting height, including 1220 – 1525 mm (ADA), 1015 – 1525 mm (CNIB), 1400 – 1600 mm (BLC, SA), and 1400 -1700 mm (NDA).

The highest mounting height among these is 1700 mm from the floor or ground surface (NDA, Table 4.7.). This is the higher of a range of measures recommended for signs requiring close viewing, such as directory signs and room identification signs. Other measures for mounting height recommended by the same standard cater to different types of signage (e.g., signs accompanying a control panel or an item of equipment should be between 900 – 1200 mm). Australia's Disability Standards (ABCB, 2010, D4.2.) similarly specifies mounting heights differently for different sign content. For instance, signs containing only single lines of tactile characters are prescribed a smaller range of mounting height (1250 – 1350 mm) than signs with more content (1200 – 1600 mm).

One of the lowest minimum mounting heights, 1015 mm, is provided by Clearing Our Path. This height considers the needs of braille users, "to ensure a reader never has to bend over to touch braille type." There are some mechanics of the body that are relevant to reading braille, including using curved fingers, dropped wrists, and keeping consistent proximity between hands to read along a line of type (Paths to Literacy, 2022). For this reason, the height of braille in relation to a reader's reach impacts their ability to effectively read braille on a vertical surface. A reader's stature or body position, either standing or sitting, is, therefore, an important consideration.

The lowest minimum mounting height appearing in the documents reviewed was 900 mm from the floor. Braille Literacy Canada recommends this mounting height

for signs in buildings "…where the main population is likely to be children" (BLC, p. 5), not by an overall audience. It is important to note that Braille Literacy Canada provides their measurements from the floor to the bottom of a sign, rather than to a sign's horizontal centreline. This may dramatically change the height of tactile content in practice depending on the size of a sign.

Some standards documents such as Ireland's Technical Guidance Document M and EN 17210-2021, offer standards prescribing the intent of mounting height and not technical specifications. These standards may better communicate the desired outcome for a sign's mounting height, but could lead to varied results in practice. The box below shows how EN 17210-2021 describes this requirement, as an example:

Table 4: EN 17210:2021, section 6.6.6: Height of signs

A table with 2 columns and 1 row. The left column contains the source title and numbering of the standard with section title. The right column contains the corresponding text for the standard identified in the left column, taken directly from the source document.

EN 17210:2021 6.6.6. Height of signs	(a), Signs shall be located at a height where they are clearly visible to people who are seated, standing or walking … (c) Directional and functional signs should be at a height where they are easy to approach, to touch, and read the raised tactile information and braille, with the fingers.

Table 5: Specifications of mounting heights for several international standards

A table with 8 columns and 2 rows (top row is the heading). Each heading contains standards documents and their corresponding countries. The second row includes the specifications directly from the source document.

CSA B651-18	**ADA** (United States)	**NDA** (Ireland) *Standards differ by type of signage	**BS** 8300-2: 2018 (UK)	**AS** 1428.2-1992 (Australia)	**RGD**	**BLC**	**CNIB**
1500 ± 25 mm …be mounted with the horizontal centreline 1500 ± 25 mm from the floor (4.5.6.4.5)	1220-1525 mm above the finish floor or ground surface, measured from the baseline of the highest tactile character (703.4.1)	1400-1700 mm above floor level, for directory signs and room identification signs (pg. 73) Duplicate signs (for detailed signs and instructions, fire safety notices, health and safety act notices) to be provided at 1000-1100mm and 1600-1700mm to suit close viewing by people at a range of eye levels (pg. 73)	n/a	1400-1600mm above the plane of the finished floor. (17.4) Where space in this zone is used up, the zone for placement of signs may be extended downward to not less than 1000 mm from the plane of the finished floor. Where a sign can be temporarily obscured, e.g., in a crowd, the sign should be placed at a height of not less than 2000 mm above the plane of the finished floor. (17.4)	n/a	1400-1600 mm from floor level to the bottom of the sign 900-1200mm if signs for children (pg. 5) If braille is placed on a separate sign, this can be lowered to 1350mm from the finished floor to the bottom of the sign plate. (pg. 5)	1500 mm Signs should be located with their centre line 1500 mm above the ground or floor surface Measured from the baseline of the braille text, braille should be located a minimum of 1,015 mm and a maximum of 1,525 mm above floor level to ensure a reader never has to bend over to touch braille type.

2.3.2. Placement of Braille

The *placement of braille* refers to the location of braille within a sign relative to other content. Significantly less specific guidance was found to guide this element of interest. Specifications for braille itself (e.g., dot diameter and height) are available in many standards and the type of braille (e.g., contracted versus uncontracted) appropriate for different types of signs are also defined by many, but its layout within a sign is relatively undefined.

CSA recommends that braille should be placed below its corresponding text. In the case of multi-lined text, the braille should be placed below the entirety of the multi-lined text (CSA E.20.4.4.). While other standards echo this provision, some include additional details to guide it in practice. For instance, some specify the minimum spacing between tactile or printed text and its corresponding braille. BLC recommends at least a 9.5 mm gap, and CNIB recommends at least 10 mm. BLC's Accessible Signage Guideline is unique in that it also directs braille to be placed below pictograms when they appear on a sign. Similarly, Building for Everyone (NDA) includes a provision for where arrows are included in a sign with braille. No other guidance for tactile icons was found.

Table 6: Building for Everyone (NDA), section 4.11.4

A table with 2 columns and 1 row. The left column contains the source title and numbering of the standard with section title. The right column contains the corresponding text for the standard identified in the left column, taken directly from the source document.

Building for Everyone (NDA) 4.11.4	Braille should be located directly below the text to which it relates and ranged to the left. Where arrows are included in the sign, a small, embossed arrow can be used to indicate direction and placed either to the left (to indicate left) or right (to indicate right) of the Braille

Some standards also direct braille to always be left-aligned on a sign (BLC, NBA), while others do not make a recommendation. Clearing Our Path also suggests that braille may be located adjacent to its corresponding text and not necessarily below it. Braille corresponding to multiple lines of text, however, should still be located below the text in its entirety (CNIB). In a couple cases, rather than specifying the location of braille in relation to other content, a standard recommended applying a "notch or tactile shape" along the left-hand edge of signs to indicate the location of the braille for users (BS, NDA). In this way, the location of braille may not need to be standardized if there is instead a standardized way to locate it.

Table 7: BS 8300-2:2018, section 12.4

A table with 2 columns and 1 row. The left column contains the source title and numbering of the standard with section title. The right column contains the corresponding text for the standard identified in the left column, taken directly from the source document.

BS 8300-2:2018 12.4	Where Braille forms part of a sign, a marker (e.g., a notch or tactile shape) should be located at the left-hand edge of the sign to help locate the Braille message

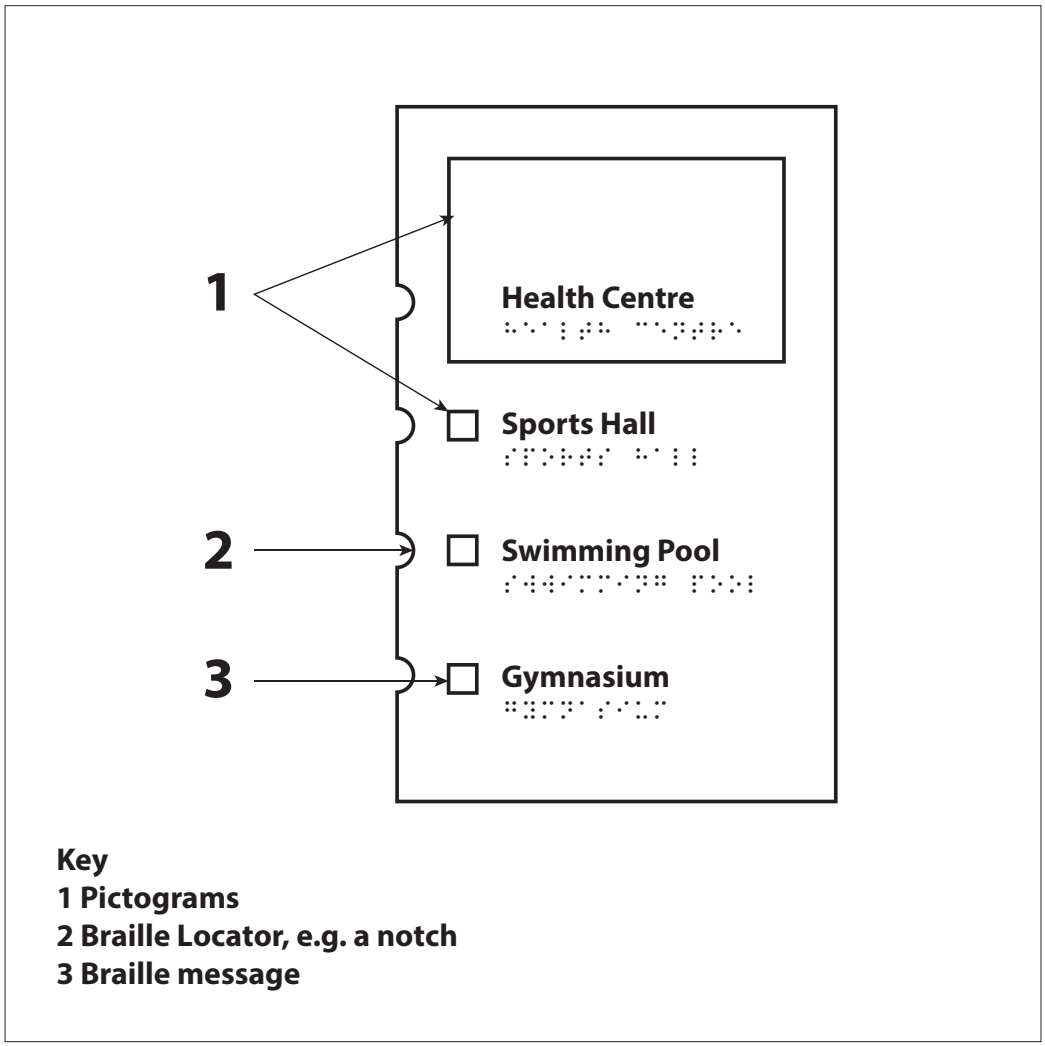


Figure 2: A sample diagram showing the location of braille on a tactile sign board, demonstrating the location of pictograms, text, braille, and notches. The diagram is from BS 8300-2:2018, p. 60.

The image is a simple line drawing of a sign with notches aligned with braille.

Table 8: Specifications for the placement of braille on signage across several international standards

A table with 8 columns and 2 rows (top row is the heading). Each heading contains standards documents and their corresponding countries. The second row includes the specifications directly from the source document.

CSA B651-18	**ADA** (United States)	**NDA** (Ireland) *Standards differ by type of signage	**BS** 8300-2: 2018 (UK)	**AS** 1428.2-1992 (Australia)	**RGD**	**BLC**	**CNIB**
Braille shall be below the corresponding text. If text is multilined, Braille shall be placed below the entire text. Braille shall be separated 10 mm minimum from any other raised characters and 10 mm minimum from raised borders and decorative elements. …accompanied by Grade 1 Braille near the bottom edge of the sign (4.5.6.2.4)	Braille shall be positioned below the corresponding text. If text is multi-lined, braille shall be placed below the entire text. (703.3.2) Braille shall be separated 9.5 mm minimum from any other tactile characters and 9.5 mm minimum from raised borders and decorative elements. (703.3.2)	Braille should be located directly below the text to which it relates and ranged to the left. (pg. 66) The presence of Braille on a signboard should always be indicated by a marker or notch on the left hand edge.	Figure 10: [shows braille directly under each text item on a sign] Where Braille forms part of a sign, a marker (e.g., a notch or tactile shape) should be located at the left-hand edge of the sign to help locate the Braille message (pg. 59)	n/a	Braille should be placed directly below corresponding raised text. (pg. 74)	Where print and braille appear on the same sign plate, place braille at least 9.5 mm below the corresponding print. (pg. 9) If text is multi-lined, place all the braille a minimum of 9.5 mm below the entire raised print text. (pg.11) All text and braille on a sign should be left-aligned and set horizontally (pg. 9)	Braille should be located directly below or adjacent to the corresponding print and separated from it by at least 10 mm. If the text is on multiple lines, the braille equivalent should be placed below the entire print text. Braille signs can be challenging to read if they are mounted vertically. Mount them ideally 5 to 10 degrees from horizontal.

2.3.3. Legibility from a Distance

Legibility from a distance, in this case, is referring to how readily a viewer can see and read the textual and graphic elements of a sign from their vantage point. This element of design is relevant to people with some sight (i.e., fully-sighted or partially-sighted persons) and not to users who are fully blind.

There are many factors that contribute to one's experience of the legibility of a sign. For instance, colour-contrast, illumination, and visual clutter, are just some of the design elements that can affect ease of legibility. However, for this study's purposes, we are interested in recommendations made for minimum character height (i.e., the height of printed letters and numbers) for non-tactile print relative to viewing distance.

Some of the documents that were part of this review recommend standards for different *types* of signs, anticipating that they are meant to be viewed at varying ranges of distance (e.g., NDA, CEN). For instance, a room identification sign placed next to a door along a hallway can typically only be viewed from as far away as the width of that hallway. However, an overhead directional sign oriented to face down a hallway, for instance, may be viewed from a much greater range of distances.

Similar to considerations for signage type, a few standard documents present mounting height as a factor to viewing distance (CNIB, ADA, BS). This is done with varying levels of specificity. For instance, CNIB and ADA use a consistent metric, categorizing viewing minimums and maximums for different heights of signage and recommending a calculation for minimum character height based on both viewing height and distance. In contrast, CSA B651-18's maximum viewing distance to minimum character height recommendations do not define types of signage nor height of signage, and present character height to viewing distance as a simplified one-to-one ratio.

Overall, this design element was found to be the most variable between different standard documents. For example, for a typical overhead sign viewed from distance of a distance of 6 metres, the following minimum character heights are recommended: 20 mm (SA), 30 mm (BLC), 50 -100 mm (BS), ~ 66 mm (ADA), or 200 mm (CSA, NDA, RGD) (see comparison chart below, Table 9). In this example, the largest recommended character height is 100 times greater than the smallest recommended character height to be viewed at the same distance. One practical consideration for this specification is that the minimum size of characters that is required will impact the size of an overall sign.

Table 9: Specifications for text size (mm) based on viewing distance (m) for several international signage standards.

A table with 9 columns and 22 rows. Columns 3 and 9 each have 3 sub-columns. The first column, whose heading is "Viewing Distance (Maximum) (m)", contains maximum viewing distance in metres. Columns 2 through 9 have headings for each of the source documents examined (Right to Left: CSA, ADA, NDA, BS, AS, RGD, BLC, CNIB) and contain the minimum character heights (mm) to be viewed at each distance, as recommended by each source document. A table with 9 columns and 22 rows. Columns 3 and 9 each have 3 sub-columns. The first column, whose heading is "Viewing Distance (Maximum) (m)", contains maximum viewing distance in metres. Columns 2 through 9 have headings for each of the source documents examined (Right to Left: CSA, ADA, NDA, BS, AS, RGD, BLC, CNIB) and contain the minimum character heights (mm) to be viewed at each distance, as recommended by each source document.

Viewing Distance (Maximum) (m)	**CSA** B651-18	**ADA** (United States)			**NDA** (Ireland)	**BS** 8300-2:2018 (UK)	**AS** 1428.2-1992 (Australia)	**RGD**	**BLC**	**CNIB**		
		1.015-1.78m high	1.78-3.05m high	Higher than 3.05m						1.015-1.78m high	1.78-3.05m high	Higher than 3.05m
0.75	25	16	51	75	25	15-25	-	25	15	16	51	75
1.5	50				50		-	50				
2	-				-		6					
2.25	75	19.2			75	50-100	-	75		19.2		
2.5	-	-			100		-	-		-		
3	100	28.5			-		-	100		28.5		
4	-	-			-		12		20	-		
4.5	150	47.5			-	150+	-	150	22.5	47.5		
4.6	-	-			150		-	-	-	-		
5	-	-	-		-		-	-	25			
6	200	60	66		200		-	200	30	60	66	
6.4	-	-	-						-	-	-	
7.5	250	75.8	81.7	86.5				250	-	75.8	81.7	86.5
8	-	-	-	-	-		25		40	-	-	-
9	300	91.5	97.5	102.3	-		-	300	45	91.5	97.5	102.3
12	-	-	-	-	-		40	-	60	-	-	-
15	-	-	-	-	-		50	-	-	-	-	-
25	-	-	-	-	-		80	-	-	-	-	-
35	-	-	-	-	-		100	-	-	-	-	-
40	-	-	-	-	-		130	-	-	-	-	-
50	-	521.7	527.6	532.4	-		150	-	-	521.7	527.6	532.4

2.3.4. Observations from the Review of Current Signage Standards Across Jurisdictions

A few observations can be made through the review of signage standards described across different documents. First, though similar, many measurement requirements are inconsistent between nations and jurisdictions. It is difficult to say which one of the specific measures is better than others, or whether creating universal standard measures across countries is necessarily beneficial. Perhaps more importantly, the way in which standards are communicated, whether by defining precise measurements for design or by describing a sign's intent and general guidance for design, also varies between standards documents. The former is beneficial for monitoring signage compliance but limits design freedom, while the latter may result in more user-friendly design but also may be interpreted incorrectly when applied.

Second, many of the standards we studied state that they employ a Universal Design or Design for All approach. These are concepts which aim to find design solutions that offer the greatest accommodation for the greatest number of people. However, the ADA and other similar standards have received criticism for only addressing the needs of a limited audience, such as wheelchair users or persons who are blind, while overlooking users with a combination of disability experience or the accommodation of a range of conditions. This criticism is voiced, for instance, by users who have low vision, for whom braille is often less helpful than requirements for enhanced visual contrast, for instance (Arditi, 2017), and by populations with neuroatypical conditions, such as cognitive or learning disabilities, whose needs may be better addressed through signage schemes using colour-coding, spatial zoning, and sequencing, rather than through single-sign specifications (Clouse, Wood-Nartker & Rice, 2019).

To address this limitation, experiential research into the needs of signage users who experience neuroatypical conditions, low vision, and other combinations or ranges of disability (e.g., Freedman et al., 2019) may help to inform standards that are more suitable for more people.

While not based on the review of the standard documents per se, we also found that there is a lack of studies that assess the quality of signage accessibility standards from user perspectives. There have been some empirical studies about optimal design requirements for accessible signage (Bosman & Rusinek, 1997; Gold, Zuvela & Hope, 2009; Luca & Narayan, 2016; Tseng et al, 2013; Ward, 2017; Wu & Wang, 2017). However, little research directly has tested or critiqued standards for design from a practical point of view.

Existing studies often catalogue barriers to wayfinding (Bosch & Gharaveis, 2017), test signage schemes for limited user groups (e.g., children with autism) (Irish, 2022; Gresham et al., 2019), or present frameworks for accessible signage design (Arditi, 2017; Wu & Wang, 2017). In one case conducted over a decade ago, researchers performed a similar experiment to our present study, comparing the legibility between two fonts used in transit signage (Gold, Zuvela & Hope, 2009). The most recent scholarship on accessible wayfinding, however, tends to focus on application of information technologies to aid navigation (Fogli, Arenghi, & Gentilin, 2020; Prandi et al., 2021), rather than critically examining effectiveness of current standards.

Section 3: Signage Testing Methods

Section Summary

Based on the review of signage-related accessibility design standards, the research team came up with a signage testing strategy – identifying survey locations, developing a questionnaire, and coordinating with site managers to arrange the signage testing labs. Prototype signs were designed by the eyecandy SIGNS INC. team and were displayed in three locations – two indoor and one outdoor – in the downtown core of Halifax, NS. These were the Dalhousie University Sexton Campus, the CNIB Halifax Office, and the Halifax Harbourfront boardwalk. The research team collected feedback through closed-format and open-format survey questions from passersby about the signs they interacted with on each testing site.

This section describes the methods we employed for our signage testing.

The design and use of signs are dependent on specific contexts where the signs are placed. Due to the experimental nature of the project, the process of developing a testing strategy was iterative—the questions to ask the users were developed pre-design of signs, while they were tweaked as the locations were determined, and pilot tested. At the same time, the signs themselves needed some detail changes to fit the characteristics of the spaces used for testing (size of the space, lighting, longest distance allowed for testing the signage legibility, availability of seating etc.).

3.1. Survey Sites

The study took place in both indoor and outdoor locations within the downtown core of Halifax, Nova Scotia. Since we were conducting the testing in spaces managed by public entities, we needed to obtain permission to install signs for the duration of the survey periods. When deciding which survey sites we would use to install the signage labs, we considered those that were wheelchair accessible, reachable by public transit, and where we could keep signage in place for several weeks at a time. We also wanted sites with many passersby that we could attract to take the survey.

- The following locations were ultimately selected:
- Sexton Campus at Dalhousie University (indoor)
- CNIB office in the North End of Halifax (indoor)
- Halifax Waterfront Salt Yard (outdoor)

Figure 3: Photos from the three survey sites. Left to Right – 1. The Sexton Campus testing site; 2. The CNIB Office testing site; 3. The Halifax Waterfront testing site

Image 1: A hallway in an indoor public corridor with a table and poster set up to promote the signage testing

Image 2: Two smiling research assistants wearing PEACH t-shirts standing outside the CNIB office.

Image 3: A sunny outdoor scene on the Halifax boardwalk with prototype signage mounted on a wooden wall and research assistants setting up the test site.

3.2. Signage Prototype Design

Because the signs were meant to mimic real-life wayfinding, the signs were designed using the existing branding schemes of the host institutions for each lab (Dalhousie University for the Sexton Campus lab and Develop Nova Scotia for the Waterfront lab) so that they would blend in with the signs already in those locations (since the signage used at the CNIB Lab was the same signage as the Sexton Campus Lab, they are the exception). Any sign elements that were not dictated by the standards we were testing were dictated by these branding schemes. It is important to note, therefore, that some of the survey responses we received, particularly to the open-answer style responses, were directed at features that are brand standards rather than CSA standards (e.g., specific colour schemes, icon choices).

3.3. Setting up the Signs on Site

3.3.1. Site 1: Dalhousie University Sexton Campus (indoor)

The first venue for signage installation and survey collection was within the Engineering complex on Dalhousie University's Sexton Campus (B-Building). Sexton Campus is centrally located in Downtown Halifax near popular shopping districts, government buildings, transit routes, and tourist attractions. It is a well-connected campus to the rest of Halifax's urban environment when compared to other Dalhousie campuses. The Central Public Library, which is a popular and highly accessible destination of the downtown, shares a city block with the campus.

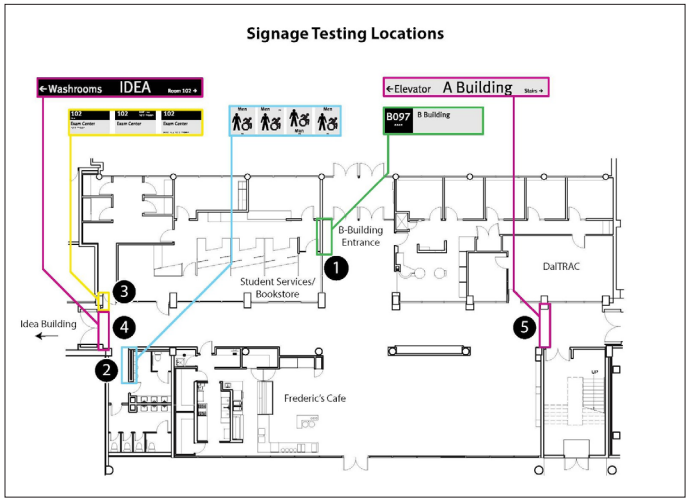


Figure 4: Site plan of the B-Building on Sexton Campus at Dalhousie University.

An architectural line drawing of the site with images of the signs being tested pointing to their respective locations on the map.

The B-Building entrance is accessible, equipped with pushbutton-activated automatic doors and an at-grade transition. Other entrances to the Engineering building complex are also accessible, although others are not. Due to being part of a larger complex with many entrances, the B-Building itself not street-facing and instead faces a wide laneway, shared by vehicles and pedestrians, that meanders through the campus. The interior of the B-Building is institutional, with fluorescent overhead lights, beige or brown brick walls, and light-coloured tile floors.

3.3.1.1. Signs Testing Mounting Height

A group of four destination signs[3] were mounted along a wall inside the entrance vestibule. The four signs were installed side-by-side at varied heights:1525mm, 1475mm, 1200mm, and 1100mm. The two highest

3 Destination Signs are limited to Classrooms & Departmental Main Offices Only - Destination signs indicate the name and title of the occupant, or the unit name. These signs are usually located adjacent to a door or short hallway as a permanent room descriptor.

options are within the mounting height range for signs recommended in CSA B651. The latter two options are also from CSA, but they are the recommended minimum heights for wall mounted devices (e.g., coat hooks, soap dispensers, 1200mm) and minimum eye level for a person in a seated position (1100mm). We decided to include these heights as options to test how well the existing CSA signage standards address the needs of users with a combination of disability experiences (e.g., wheelchair users who read using tactile characters).

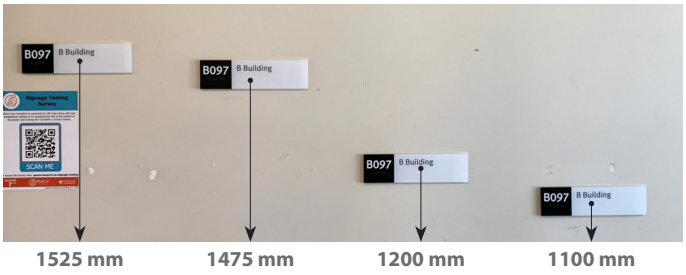


Figure 5: A photo of the sign prototypes testing mounting height

Four identical signs mounted at different heights. The image is annotated to include each sign's respective measurements from the floor (1525mm, 1475mm, 1200mm, and 1100mm).

Table 10: Rationale for mounting height of B-Building signs

A table with 2 columns and 5 rows. The first column, whose heading is "Dimensions (from floor to centreline)", contains the installation height (mm) of each signage. The second column, whose heading is "Reference for dimensions", contains CSA standards taken directly from the source document that informed each height.

Dimensions (from floor to centreline)	Reference for dimensions
1525mm	CSA 4.5.6.4; "A tactile sign shall be mounted with the horizontal centreline 1500 +/- 25mm from the floor"
1475mm	CSA 4.5.6.4; "A tactile sign shall be mounted with the horizontal centreline 1500 +/- 25mm from the floor"
1200mm	CSA Minimum height from the floor for many operating devices (e.g., coat hooks, soap dispensers)
1100mm	CSA Clause A.7; minimum eye-level for a person in a seated position

3.3.1.2. Signs Testing Placement of Braille

Male and female washrooms were located from a short distance with each other down the corridor, each equipped with accessible stalls. Four washroom signs were mounted side-by-side on the wall leading to the entrance of the men's washroom. All four signs displayed information for the men's washroom only. This was done to allow for easier direct comparison between the design options.

Figure 6: Prototype signage for washrooms testing the placement of braille.

The washroom signs are white with black letters and symbols and indicate a men's washroom. They include symbols of a man and of a person using a wheelchair. The image is annotated with red rectangles to highlight the differences among the four signs in the installation.

Table 11: Rationale for Washroom signs.

A table with 2 columns and 5 rows. The first column, whose heading is "Description", contains brief descriptions of the location of braille related to text shown on each of the Washroom signs. The second column, whose heading is "Reference", contains the CSA standards that inform each placement of braille.

Description	Reference
Braille is at the bottom of the sign below the tactile icon	CSA 4.5.6.2
Braille is in the top-right corner	Experimental/ control
Braille is at the bottom of the sign below the tactile text	CSA 4.5.6.2
Braille is at the bottom of the sign below the tactile icon, with an additional notch on the left edge of the sign	BS 8300-2:2018, Section 12.4, p. 59

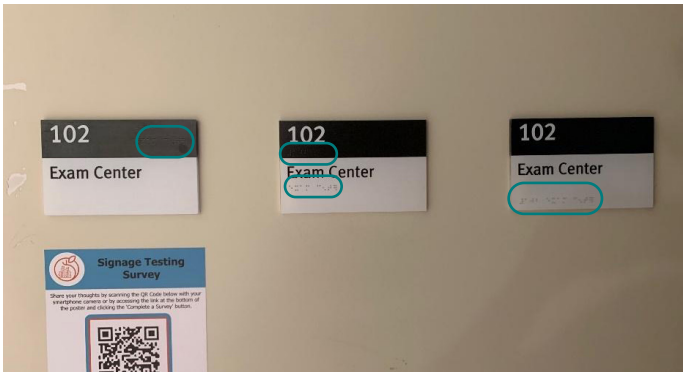


Figure 7: Prototype signage for Exam Center signs testing the placement of braille.

Three prototype destination signs all reading "102: Exam Center". The image is annotated with red rectangles to highlight differences among the three signs.

Finally, three destination signs identifying a nearby Exam room, located just off of the main corridor, were posted side-by-side.

Table 12: Rationale for Exam Centre signs.

A table with 2 columns and 4 rows. The first column, whose heading is "Description", contains brief descriptions of the location of braille related to text shown on each of the Exam Centre signs. The second column, whose heading is "Reference", contains the CSA standards that inform each placement of braille.

Description	Reference
Braille is at the bottom of the sign below the tactile icon	CSA 4.5.6.2
Braille is in the top-right corner	Experimental/ control
Braille is at the bottom of the sign below the tactile text	CSA 4.5.6.2
Braille is at the bottom of the sign below the tactile icon, with an additional notch on the left edge of the sign	BS 8300-2:2018, Section 12.4, p. 59

Table 13: CSA B651-18, section 4.5.6.2, Tactile characters

A table with 2 columns and 1 row. The left column contains the source title and numbering of the standard with section title. The right column contains the corresponding text for the standard identified in the left column, taken directly from the source document.

CSA B651-18 4.5.6.2 Tactile characters	On tactile signs, letters and numerals shall be: a) raised between 0.8 and 1.5 mm above the surface (see Figure 11); b) sans serif; c) 16 to 50 mm in height; d) accompanied by braille near the bottom edge of the sign; and e) colour-contrasted with their background by at least 70%.

3.3.1.3. Signs Testing Legibility from a Distance

In the main corridor, two overhead directional signs[4] were posted above hallway doors that face one another at opposite ends from the main entrance. These overhead signs displayed directional arrows and names to other wings of the building complex and a few select amenities. Both signs had an equal amount of contrast between text and background, but one had dark letters on a light background and the other had light letters on a dark background. CSA notes that light text on a dark background provides the greatest legibility (4.5.3.,CSA, 2018).

Distance markers were placed on the floor approaching the sign at the CSA recommended maximum distances for viewing that corresponded to each text size (1.5 m, 3 m, and 4.5 m). Distances exceeding these were also tested along the length of the hallway.

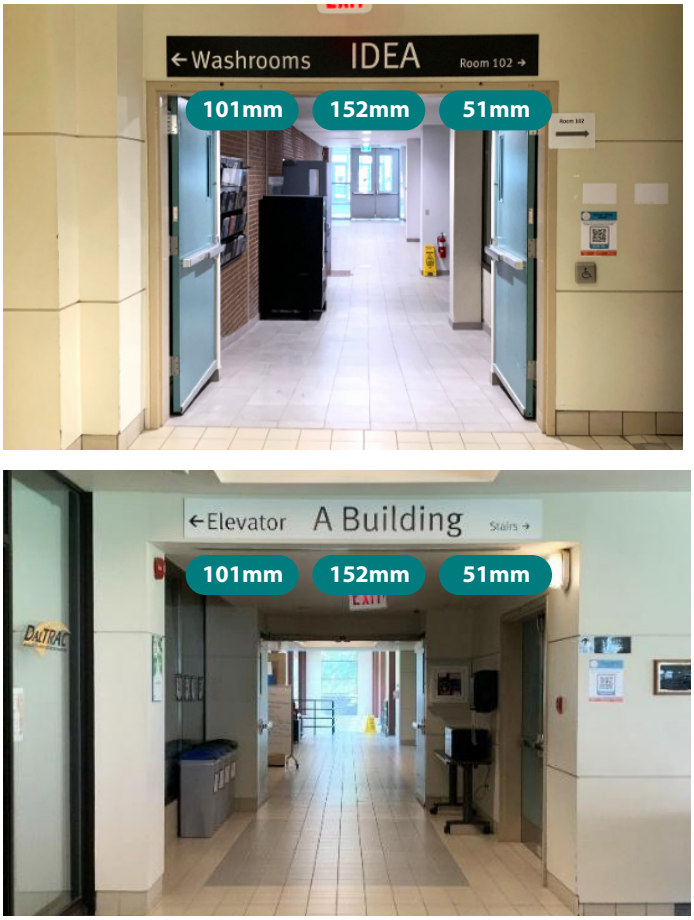


Figure 8: Photos of prototype directional signage mounted over a doorframe designed to test legibility of text from a distance.

Top: a sign with white text on a black background.

Bottom: a sign with black text on a white background. Both images are annotated to show the dimensions of the text on the signs (101mm, 152mm, and 51mm).

4 Directional Signs give users information at critical junctions along the path to their destination. These signs are usually located at building entrances, along hallways, and next to stairs.

Table 14: Rationale for overhead "IDEA" and "A Building" signs

A table with 4 columns and 4 rows. The first column, whose heading is "Light text on dark background", contains short portions of text that are printed on the directional sign in white text on a black sign. The second column, whose heading is "Dark text on light background", contains short portions of text that are printed on the directional sign in black text on a light gray sign. The third column, "Character heights", contains the height of the printed characters (mm) for each text. The fourth column, "CSA recommended maximum viewing distance", contains the maximum viewing distance (m) for each character height.

Light text on dark background	Dark text on light background	Character Heights	CSA B651-18 recommended maximum viewing distance
IDEA	A Building	152mm	4.5m
Washrooms	Elevator	101	3m
Room 102	Stairs	51mm	1.5m

3.3.2. Site 2: CNIB Halifax Office (indoor)

CNIB is a national, "non-profit organization driven to change what it is to be blind today" (CNIB, 2022). Members of the research team brought this project to the attention of the Community Engagement Manager, who generously offered the use of the local CNIB offices for signage installation.

The CNIB Halifax Office is located in the North End of the Halifax peninsula at Almon St. It occupies a split-level storefront (four steps above street-level) of a newer mixed-use building with residential units above and various commercial businesses and non-profit agencies below. The front entrance to the CNIB Halifax Office is accessible, with steps and a ramp available. The doors are motion-activated automatic sliding doors. Several bus stops are also located outside and in close proximity to the building.

To encourage participation from people with visual impairments, the same sets of signs installed in the B-Building were moved to the Halifax CNIB Office on July 21. The two overhead directional signs were omitted due to no ideal location within the office building. The signs were installed side-by-side as a gallery display since their content was not relevant to the surroundings of the CNIB office itself.

Figure 9: Two photos of signage for testing installed side-by-side at the CNIB office.

Left: Prototype signage testing braille and icon placement mounted on a white blank wall. Right: A woman in a blue dress reads a prototype sign by feeling the tactile letters and braille.

3.3.3. Site 3: Halifax Waterfront (outdoor)

The third and final site for signage testing was an outdoor location along the boardwalk of the Halifax Waterfront. The Halifax Waterfront is a lively and densely populated part of the downtown core. Situated along the harbour, it is a huge attraction for tourists, many of whom come and go from the cruise ships that dock at the south end of the boardwalk. The boardwalk of the waterfront is just under 8km long and extends from the Pier 21 Canadian Museum of Immigration to the south, up to Casino Nova Scotia to the north, with many destinations and attractions in between.
Signage for this research was installed on the Halifax Waterfront in a reserved location next to a seasonal commercial area called the Salt Yard, which consists of a collection of vendor's huts selling food, drinks, and other goods.

3.3.3.1. Signs Testing Mounting Height

Although the elements we tested for outdoors are the same as those for indoors, the signs were organized and tested in slightly different ways. For example, six signs identifying the nearby Container Stage (a large open space of the boardwalk where vendors set up shop in repurposed cargo containers) were installed side-by-side along a wall, three at 1200mm from the finished floor and another three at 1475mm. Placement of signs were also dictated by the availability of space at this site.

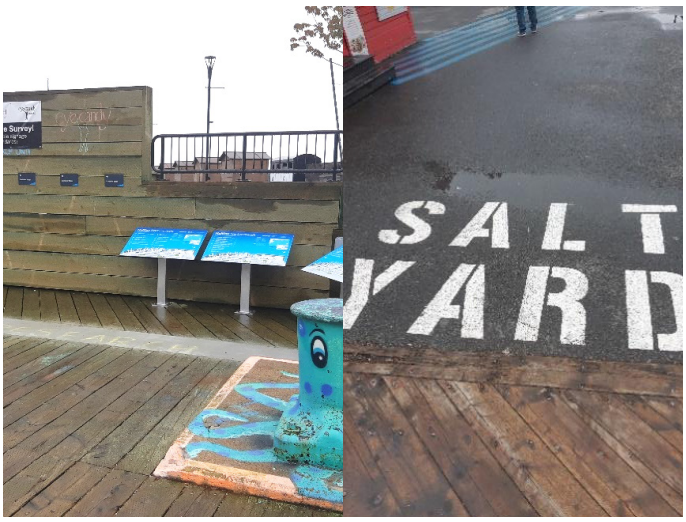


Figure 10: Two photos of the outdoor testing lab at the Salt Yard on the Halifax Waterfront.

Left: a view of the test site including some of the signage prototypes.

Right: the paved area at the edge of the site with the words "salt yard" stenciled on it.

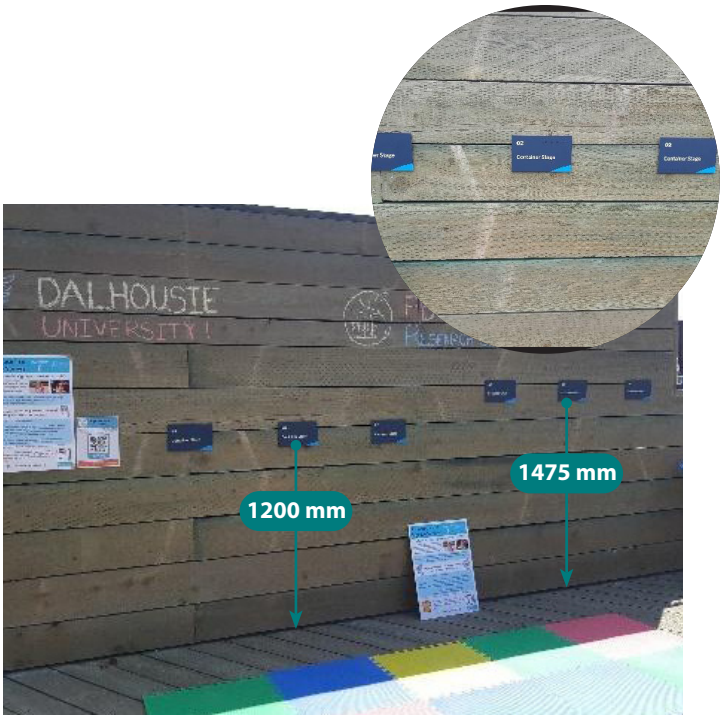


Figure 11: Photos of the sign prototypes testing mounting height.

Left: A photo of the signs is annotated to show the difference in height between the two sign prototypes (mounted 1200mm and 1475mm from the ground).

Top Right: A close-up view of the signs which read "Container Stage".

Table 15: Rationale for the mounting height of the Container Stage signs.

A table with 2 columns and 3 rows. The first column, whose heading is "Dimensions (from floor to centreline)", contains the installation height (mm) of the signage. The second column, whose heading is "Reference for dimensions", contains CSA standards taken directly from the source document that informed each height.

Dimensions (from floor to centreline)	Reference for dimensions
1200 mm	CSA Minimum height from the floor for many operating devices (e.g., coat hooks, soap dispensers)
1475mm	CSA 4.5.6.4; "A tactile sign shall be mounted with the horizontal centreline 1500 +/- 25mm from the floor"

3.3.3.2. Signs Testing Placement of Braille

A set of three pedestal-mounted signs contained a map of the Halifax Harbourwalk – a pedestrian path along the harbour's edge in the downtown core – with a list of popular waterfront destinations, and other typical components for information signage, such as title, map legend, and logos.

Each of these signs included braille, tactile lettering and symbols (i.e., directional arrows), and print-only content to communicate wayfinding and directional information.

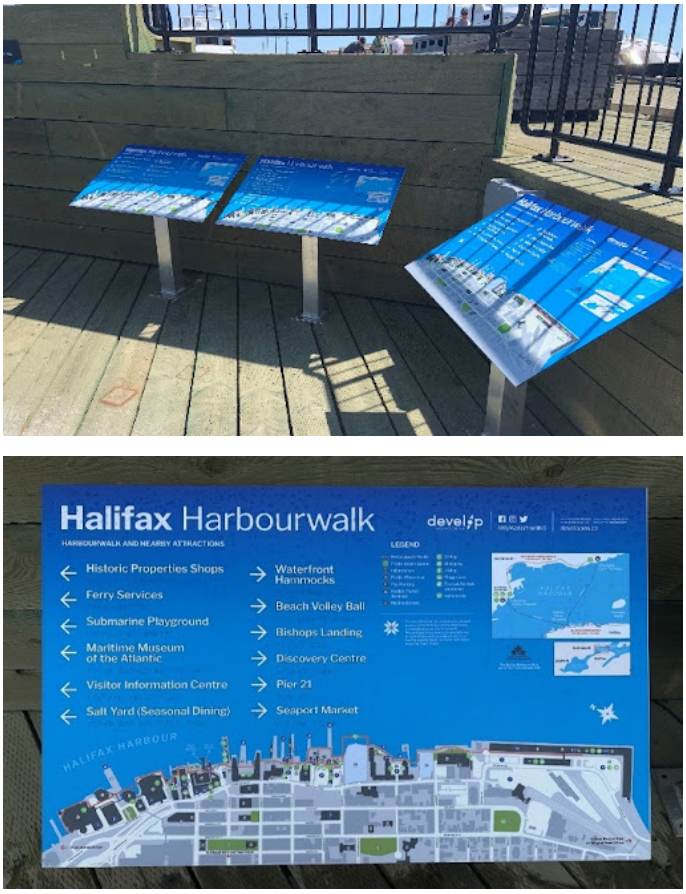


Figure 12: Photos of the outdoor prototype signs testing braille placement.

Top: Three pedestal-mounted signs located side-by-side on the boardwalk.

Bottom: A close-up view of one of the three Harbourwalk signs.

Table 16: Rationale for the Harbourwalk signs.

A table with 2 columns and 4 rows. The first column, whose heading is "Description", contains brief descriptions of the location of braille related to text shown on each of the Harbourwalk signs. The second column, whose heading is "Rationale for sign design/braille placement", contains CSA standards taken directly from the source document that informed each placement of braille.

Description	Rationale for sign design/ braille placement
All text organized into 2 columns; braille directly underneath text; tactile arrows are consistently located left or right	CSA E.20.4.4. "Braille shall be below the corresponding text. If text is multilined, braille shall be placed below the entire text."
Text and braille are separated into 2 separate columns	CSA E.20.4.4. "Braille shall be below the corresponding text. If text is multilined, braille shall be placed below the entire text."
All text organized into 2 columns; all braille is located at the bottom of the sign	CSA 4.5.6.2: "on tactile signs, letters and numerals shall be… accompanied by braille near the bottom edge of the sign"

Figure 13: A directional sign on the Halifax Waterfront tested legibility of text from a distance.

Left: A banner mounted on a railing lists several waterfront destinations in varying text sizes.

Bottom Right: Distance markers on the ground for participants to stand on and test how well they could read the directional sign.

3.3.3.3. Signs Testing Legibility from a Distance

Finally, a large directional sign was affixed to a metal railing on the waterfront. Text printed in four different character heights were included on this sign to test their legibility from various distances on the boardwalk. While the indoor signage tested three character heights (50 mm, 100 mm, and 152 mm), this sign also additionally tested 76 mm text. There was not the same opportunity as in the indoor site to install the same sign with opposite contrast (i.e., black text on white background).

Table 17: Distances and Rationale for the Harbourwalk directional sign. A table with 3 columns and 5 rows. The first column, whose heading is "Print Text", contains short portions of text that are printed on the outdoor directional sign. The second column, whose heading is "Character Height" contains the height of the printed characters (mm) for each text. The third column, "CSA recommended maximum viewing distance", contains the maximum viewing distance (m) for each character height.

Print Text	Character Height	CSA recommended maximum viewing distance
Seaport District	152mm (6")	4.5m
Visitor Information Centre	101mm (4")	3m
Accessible Washroom	76 mm (3")	2.25m
Waterfront Hammocks/Pier 21	51mm (2")	1.5m

3.4. Designing the Survey Questionnaire

User perspectives on each prototype sign were collected at site locations through an in-person survey. The survey questionnaire was designed to collect qualitative data from participants about the effectiveness of the signs specific to the three attributes of interest: mounting heights, placement of braille within a sign, and character height for text for legibility from distances.

For each sign group in the survey, participants were asked whether they were observing the signs from a seated or standing position to account for differences in use by reach and eye-level. Participants were also asked to define their method of reading each sign, either by sight, using raised characters (tactile), using braille, or a combination of two or more of these options. For instance, someone with low vision may read signs visually in combination with using tactile characters.

We opted to use a closed-answer format to ask respondents to select a preferred sign from each group of alternatives (e.g., which sign do you prefer; A, B, or C?) for most of the questions in the survey. For example, participants were asked to observe a set of four signs testing mounting height at the Sexton Campus and CNIB Halifax Office locations, and then identify which of the four was mounted to the wall at the best height for their use (Figure 14 below).

Figure 14: Sample closed-answer question from Sexton Campus survey.

Closed-answer format questions were also used to gather specific feedback on why a sign was preferred, in order to quantify this information later on. For example, for the Halifax Waterfront location, participants were first asked to select which of the three Harbourwalk signs they preferred most, and then select what elements they liked about that sign in a following question. These questions are shown below.

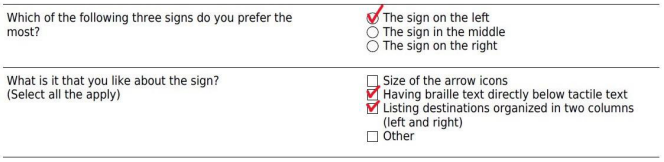


Figure 15: Sample closed-answer question and follow up question from Halifax Waterfront survey.

Surveys also included questions that were in an open-ended answer format, inviting participants to share their impressions, comments, and suggestions for each of the signs without restrictions. These questions were not limited to the three elements of interest for this study and, instead, invited comments from participants about any elements they felt were relevant to their use of the sign. This was done to identify elements of design that may indirectly relate to the three attributes of interest such as such as the contents of the sign, and the context where the signs were set up.

Digital and paper-copy surveys were available at all locations. We offered both of these formats so participants could choose to interact with the survey in whatever way was more accessible to them. Digital surveys were either accessed online, using smartphones or other WiFi-enabled devices, or as PDF files saved to a tablet.

Section 4: What We Heard: Survey Results

Section Summary

A total of 223 responses were collected (122 for indoors and 101 for outdoors). Participants were of various ages and genders, and 35% (n=78) identified as people experiencing disabilities. There were more older participants in the outdoor signage testing sample. A majority of respondents used signs visually, including many participants with partial vision who used visual sign elements in combination with braille or tactile characters. Responses pertaining to the three design attributes varied between indoor and outdoor settings, suggesting the need for more detailed requirements for text size, heights, and placements of sign elements differentiated by context. Open-ended responses revealed sign users' additional interest in the overall size of signs, use of colour contrast, use of symbols and icons, texture, and lighting considerations.

4.1. Respondent Profiles

A total of 223 responses were collected between all survey locations: 122 survey participants responded to the set of indoor signs displayed on Sexton Campus and at the CNIB Halifax office, and 101 participants responded to the outdoor signs displayed on the Halifax Waterfront.

4.1.1. Experience of Disability (Self-Identified)

Overall, about 35% of respondents (n=78) self-identified as experiencing one or more disabilities. For the signs tested at the Sexton Campus and CNIB Halifax Office locations, 38% of survey respondents (n=46) identified as persons with experience of disability. For the signs along the Halifax Waterfront, 32% of survey respondents (n=32) identified as persons with experience of disability.

Of the participants who identified as persons with disability, the greatest proportion experienced visual impairment (n=34) followed by persons experiencing sensory impairment other than sight or hearing loss (n=26). This group includes persons with autism spectrum disorder, learning disability, anxiety, vertigo, or other conditions which affect sensory-processing. Other disability experience identified by participants includes: 15 people who experienced physical or mobility impairment and 1 person who used a wheelchair, 7 people experiencing auditory impairment, 8 people who experience barriers to accessibility not included in the above, and 2 people who preferred not to disclose their disability experience. There were also 17 people with experience as a caregiver to someone else who lived with one or more of the described disabilities.

4.1.2. Age and Gender Identity

Survey respondents were asked to which of the following age ranges they belonged: 18 to 24 years of age, 25 to 44 years of age, 45 to 64 years of age, or 65 years of age and older.

At both indoor and outdoor sites, the majority of respondents were between 25 and 44 years of age (45% of respondents at Sexton Campus and CNIB, and 45% at the Halifax Waterfront). At the outdoor site, the next largest group of respondents were between 45 and 64 (26%) while at the indoor sites, the next largest groups of respondents were between 18 and 25 (30%). The smallest proportion of people at both sites were over 65 years of age (9% of respondents at Sexton Campus and CNIB, and 16% on the Halifax Waterfront).

Respondents were also asked to which gender they identified. While the majority of respondents at the indoor sites identified as male (57%), the opposite was true of respondents at the waterfront, where 60% of respondents identified as female. A small proportion of respondents at either location identified as non-binary or preferred not to identify their gender.

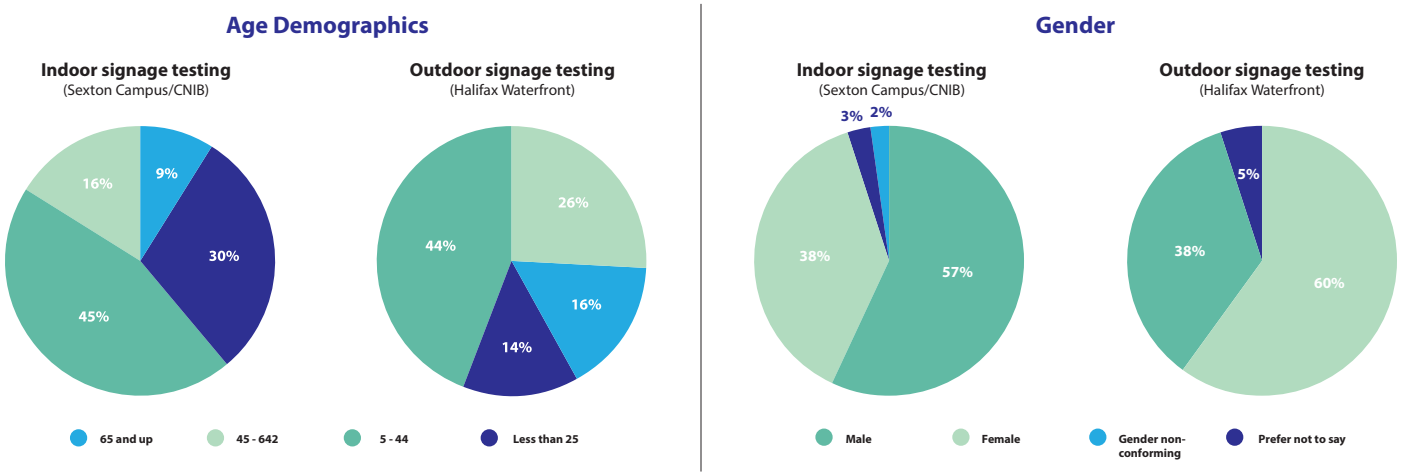


Figure 16: Four pie charts showing age demographics and gender of participants for indoor and outdoor signage testing.

Left: Age demographics - Indoor signage testing: 30% were less than 25; 45% were 25-44; 16% were 45-64; 9% were 65 and up.

Center Left: Age demographics – Outdoor signage testing: 14% less than 25; 44% 25-44; 26% 45-64; 16% 65 and up

Center Right: Gender demographics – Indoor signage testing: 57% were male; 38% were female; 3% were gender non-conforming; 2% preferred not to say

Right: Gender demographics – Outdoor signage testing: 60% were female; 35% were male; 5% were gender non-conforming.

4.1.3. Use of text, braille and tactile elements by persons with visual impairments

We asked participants to rank what sign features are most important to them for their everyday use of signage (on a scale of 1 as not important and 4 as very important). This was a question to understand individuals' typical use of signage, and not a value statement on what should be on a sign for general use. The sign elements were:

- Symbols/pictograms
- Braille
- Text (in English, French, or other language)
- Tactile characters (letters and numbers)
- Tactile icons

Overall, most participants considered **Symbols/ Pictograms** and **Text (in English)** to be the most important components of a sign. Braille and tactile icons and characters were given a higher ranking overall at the Sexton/CNIB site compared to the Waterfront site, likely because more individuals with visual impairments participated in the survey at that location.

Respondents with visual impairments (n=34) ranked braille and tactile elements highly. However, in addition to these, they ranked more visually-oriented sign elements highly as well; 19 people with visual impairments ranked text (in English) and symbols/ pictograms as "4 (Very Important)".

4.2. Responses to Signs Testing Mounting Height

4.2.1. Mounting Height in Indoor Settings (Dalhousie University Sexton Campus and CNIB Halifax Office)

Most participants preferred the highest (1525 mm) and second-highest (1475 mm) options for mounting height presented at the Sexton Campus and CNIB Halifax Office locations. Both of these options are within the CSA specifications for signage height (1500mm +/- 25mm). Of the two participants who preferred one of the lower options (1200 mm), one was a wheelchair user. No participants preferred the lowest option (1100mm). Only two participants answered that they read the signs from a seated position, therefore the responses have been combined in the graph.

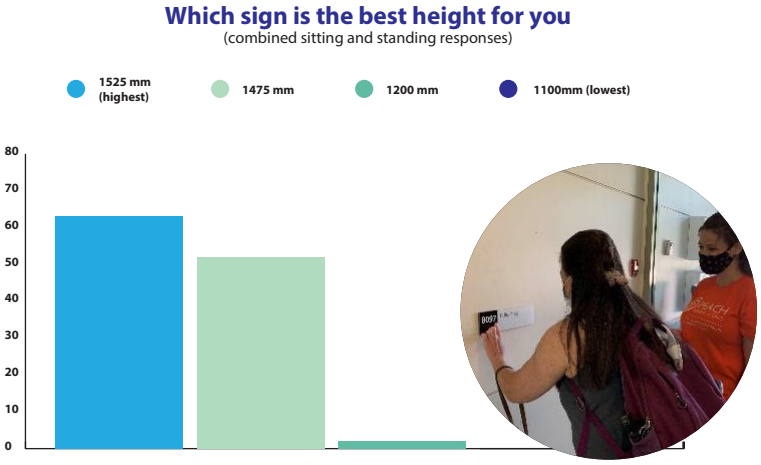


Figure 17: Bar graph showing the most preferred mounting height of indoor signs. Right: A photo of a participant testing signage testing height by reading the sign using tactile characters.

A vertical bar graph with a white background and bars in various shades of green to indicate height preferences. The y-axis represents the number of responses for each sign.

The image on the right is a photo of a participant reading a sign using the tactile letters and a research assistant administering a survey.

4.2.2. Mounting Height in Outdoor Setting (Halifax Waterfront)

Based on the results of the indoor survey, we only tested two heights for the outdoor signage, 1200mm and 1475mm. As with the indoor testing, most participants (~70%) preferred the placement of the higher set of signs. In this case, however, the highest sign was 50 mm lower than the highest options presented indoors. Interestingly, only a small proportion (~8%) of respondents said they would prefer the signage to be placed higher than 1475 mm, which is not consistent with indoor responses. Additionally, a higher proportion of participants also preferred the lower sign (1200mm) at the outdoor site (~20%) than at the indoor site (2%).

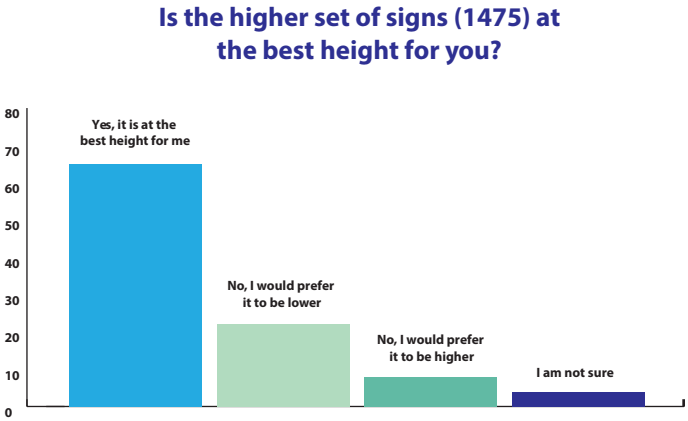


Figure 18: Two vertical bar graphs indicating mounting height preferences for the outdoor signage on the Halifax Waterfront.
Top: The bar graph has a white background with green and blue bars and shows the number of people who preferred the lower set of signs (1200mm)
Bottom: The bar graph has a white background with green and blue bars and shows the number of people who preferred the higher set of signs (1475mm)

4.3. Responses to Signs Testing Placement of Braille

4.3.1. Placement of Braille in Indoor Settings (Dalhousie University Sexton Campus and CNIB Halifax Office)

Only participants who read signs using braille or tactile features (n=14) were asked to respond to this set of signs. The sign being tested was a destination sign indicating the location of an exam room. The sign included tactile numbers at the top of the sign to identify the room number and smaller tactile letters underneath the numbers to identify the room.

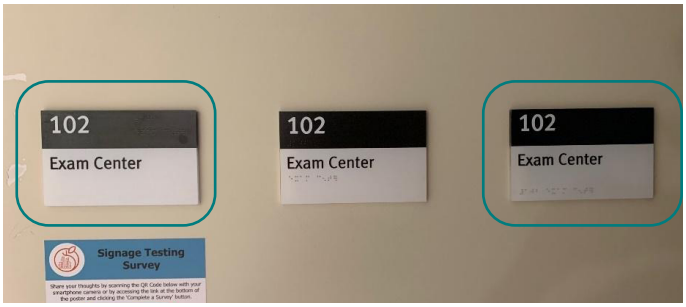


Figure 19: Photo of the three signage options testing braille placement.
The photo is annotated with green rectangles to indicate the preferred options (braille in top-right corner and braille at the bottom of the sign).

Table 18: Braille location preferences for "Exam Center" sign

A table with 2 columns and 6 rows. The left column, whose heading is "Placement of Braille", contains brief descriptions of the location of braille related to text shown on each of the Exam Center signs, one per row. The right column, whose heading is "Number", contains the number of respondents who preferred each placement option. Only responses by braille users are shown. The most preferred placement is to have braille at the bottom of the sign (6 people) followed by braille at the top right corner (5 people).

If you are reading this sign using braille, which of the three signs has the braille in the best location?

Placement of Braille	Number
Braille in top right corner	5
Braille directly below tactile characters	1
Braille at the bottom of the sign	6
N/A (not using braille)	2
Total	**14**

For braille users, there was a notable preference for the braille to be in either the top-right corner or at the bottom of the sign. For this style of sign, braille is conventionally placed at the bottom of the sign, making it a familiar option for many braille readers. Participants were also asked for their thoughts on the sizing of the tactile characters. For participants using tactile characters to read the signs, the sizing of the numbers (the larger of the two) was clearly preferred (n=8) to the sizing of the letters. No participants preferred the smaller characters, and, in fact, several expressed that these were uncomfortable to touch due to their sharp edges.

Figure 20: Washroom signs testing placement of braille and tactile characters/icons.

The washroom signs are white with black letters and symbols and indicate a men's washroom. They include symbols of a man and of a person using a wheelchair. The image is annotated with a green rectangle to indicate the most preferred option (braille is at the bottom of the sign below the tactile icon).

The washroom signs (above) tested whether the placement of braille is impacted by the placement of other tactile elements, such as letters, numbers, and icons. All participants, including fully sighted participants, were asked to respond to the washroom signs due to the combination of visual and tactile elements which could be commented upon. Most participants (57% of all participants) preferred the option where the text was on top with the icon directly below. For this set of signs, braille users (n=3) preferred the third option where tactile text and braille were both at the bottom of the sign. Participants who read the signs using tactile features were nearly evenly split among the first three sign options, with no one preferring the fourth sign, which was identical to the first sign with the addition of a notch along the left-hand edge.

Figure 21: A washroom sign with a "notched" edge.

Although our sample of people reading these signs with braille is small, it is perhaps telling that all three of them preferred the same option where braille is placed at the bottom of the sign directly below the tactile letters. Additionally, several participants with visual impairments were confused or unsure about the meaning of the active wheelchair user icon. No participants preferred the final 'notched' option, with several participants with vision impairment noting that it was confusing or that it made them think the sign was broken.

Table 19: Preferred layout for washroom sign by use

A table with 5 columns and 6 rows. The first column, whose heading is "Placement of Braille", contains brief descriptions of the location of braille related to text shown on each of the Washroom signs, one per row. Columns 2, "Braille readers", 3, "Tactile sign readers", and 4, "Visual sign readers", contain the number of each who preferred each placement of braille option. The fifth and final column shows the total number of all types of sign readers who preferred each placement of braille option. The bottommost row also summarises the totals for each column.

Placement of Braille	Braille readers	Tactile sign readers	Visual sign readers	All
Braille is at the bottom of the sign below the tactile icon	0	2	64	66
Braille is in the top-right corner	0	2	16	18
Braille is at the bottom of the sign below the tactile text	3	3	25	31
Braille is at the bottom of the sign below the tactile icon, with an additional notch on the left edge of the sign	0	0	0	0
Total	**3**	**7**	**105**	**115**

4.3.2. Placement of Braille in Outdoor Setting (Halifax Waterfront)

Three directional signs with maps of the Halifax Harbourwalk were used to test the placement of braille and other tactile elements on signage. The arrangement of the tactile text and icons and the placement of braille differed among all three signs.

The majority of participants who responded to this question read the signs visually (n = 99, 98%), although some reported reading signs using multiple methods. There were 12 participants experiencing visual impairment who responded to this sign, three who used tactile elements to read the sign, and only two participants who identified as braille users. Most participants who identified as having a visual impairment read the signs at least partially visually, with many of them utilizing multiple methods of reading (e.g., reading both visually and with the aid of tactile characters).

The majority of participants, both with and without visual impairment (76%), preferred the map where the destinations were arranged into two separate columns each with arrows consistently pointing to the left or the right. This option also had space underneath each section of text where braille was located. Most individuals who reported having a visual impairment (9 out of 12 participants) also preferred this option, and 1 of the 2 braille users preferred this sign. The second braille user preferred the sign option where all braille was located in its own separate column to the right of the tactile text.

Figure 22: The three variations of directional signage tested on the Halifax Waterfront.

The signs are blue with maps of the Halifax Harbourwalk along the bottom and contain text and symbols above. The image is annotated with a green rectangle to indicate the most preferred sign (destinations are arranged in two separate columns with arrows pointing consistently to the left or right).

Table 20: Preferred placement of braille and tactile text on directional signage

A table with 2 columns and 4 rows. The left column, whose heading is "Placement of Braille", lists brief descriptions of the location of braille related to text shown on the Harbourwalk signs, one per row. The right column, whose heading is "Percent", contains the percentage of respondents who preferred each placement option. Of 99 respondents, the most (76%) preferred when lists of text were organized into 2 columns with braille directly underneath corresponding text, and tactile arrows were consistently located left or right.

Placement of Braille	Percent
All text organized into 2 columns; braille directly underneath text; tactile arrows are consistently located left or right	76%
Text and braille are separated into 2 separate columns	5%
All text organized into 2 columns; all braille is located at the bottom of the sign	19%

Additionally, some sighted participants provided thoughtful comments informed by their knowledge of braille placement, as well as other impressions of visual and tactile elements of these signs (see section 4.5.). These comments were largely to do with the visibility/ tactility of the braille and tactile characters and the alignment of the braille on the signs.

All participants indicated that they were standing when they read the signs. The results from this section therefore are limited to perspectives of persons who are able to stand, and not necessarily reflective of people with disabilities who use a wheelchair or experience other mobility challenges that require seating.

4.4. Responses to Signs Testing Legibility from a Distance

4.4.1. Legibility from a Distance in Indoor Setting (Sexton Campus)

To test visibility from a distance, we created two sets of overhead signs. Both signs had an equal amount of contrast between text and background, but one had dark letters on a light background and the other had light letters on a dark background. Participants were asked which size of text was visible to them from which distances that were marked on the floor for each sign.

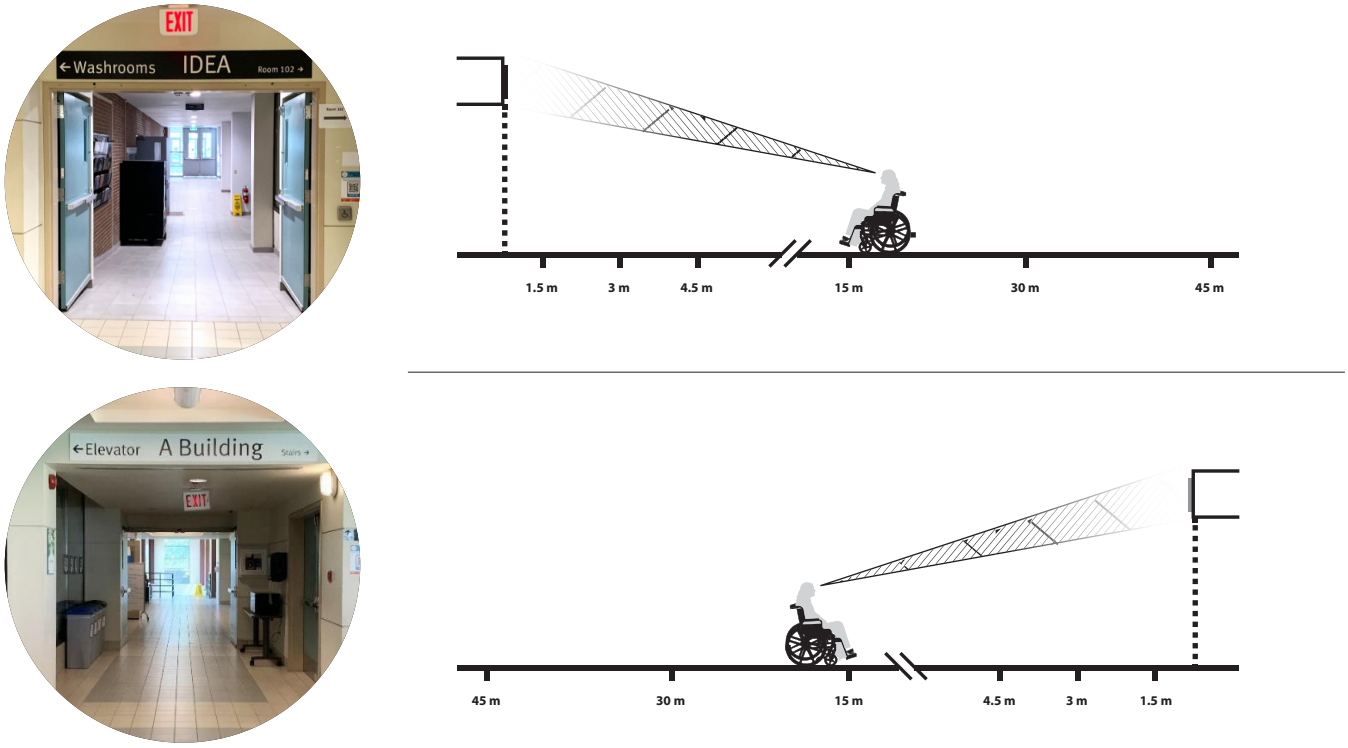


Figure 23: Photos of the indoor directional signage with accompanying illustrations to show the distances tested.

Top left: A photo of an indoor hallway of an institutional building. There is a large overhead sign above a set of doors. An enlarged image of the sign is above the photo. The sign has black text on a light grey background.

Top right: A diagram showing a grey silhouette of a person using a wheelchair facing a vertical surface where there is an overhead sign. Under the person is a horizontal line with markings showing distance markers from the sign.

Bottom left: A photo of an indoor hallway of an institutional building. There is a large overhead sign above a set of doors. An enlarged image of the sign is above the photo. The sign has white text on a black background.

Bottom right: A diagram showing a grey silhouette of a person using a wheelchair facing a vertical surface where there is an overhead sign. Under the person is a horizontal line with markings showing distance markers from the sign.

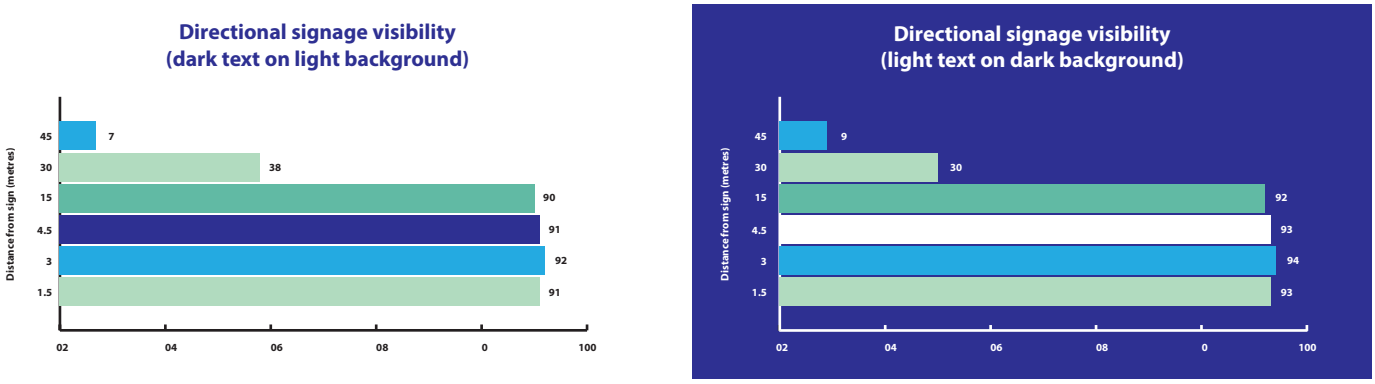


Figure 24: Bar graphs showing the number of participants who could clearly see all three font sizes at each distance marker (n=97).

Left: A horizontal bar graph with a white background, green and blue bars, and dark grey text. The y-axis, showing viewing distance (m), and the x-axis, showing participant counts, together display the number of participants who could read all the text contained in the sign with dark text on a light background from each viewing distance.

Right: A horizontal bar graph with a dark blue background, white, green and blue bars, and white text. The y-axis, showing viewing distance (m), and the x-axis, showing participant counts, together display the number of participants who could read all the text contained in the sign with light text on a dark background from each viewing distance.

All three sizes of text were most visible from 3 metres distance for both signs. At the farthest distance marker (45 metres), 95% of participants could see the largest font size (i.e., largest character height), and 82% (light on dark) or 77% (dark on light) could clearly see the second largest font. As may be expected, the text using the smallest font size was visible to over 3 times more participants at the closest distance marker (1.5 metres), than from the farthest marker.

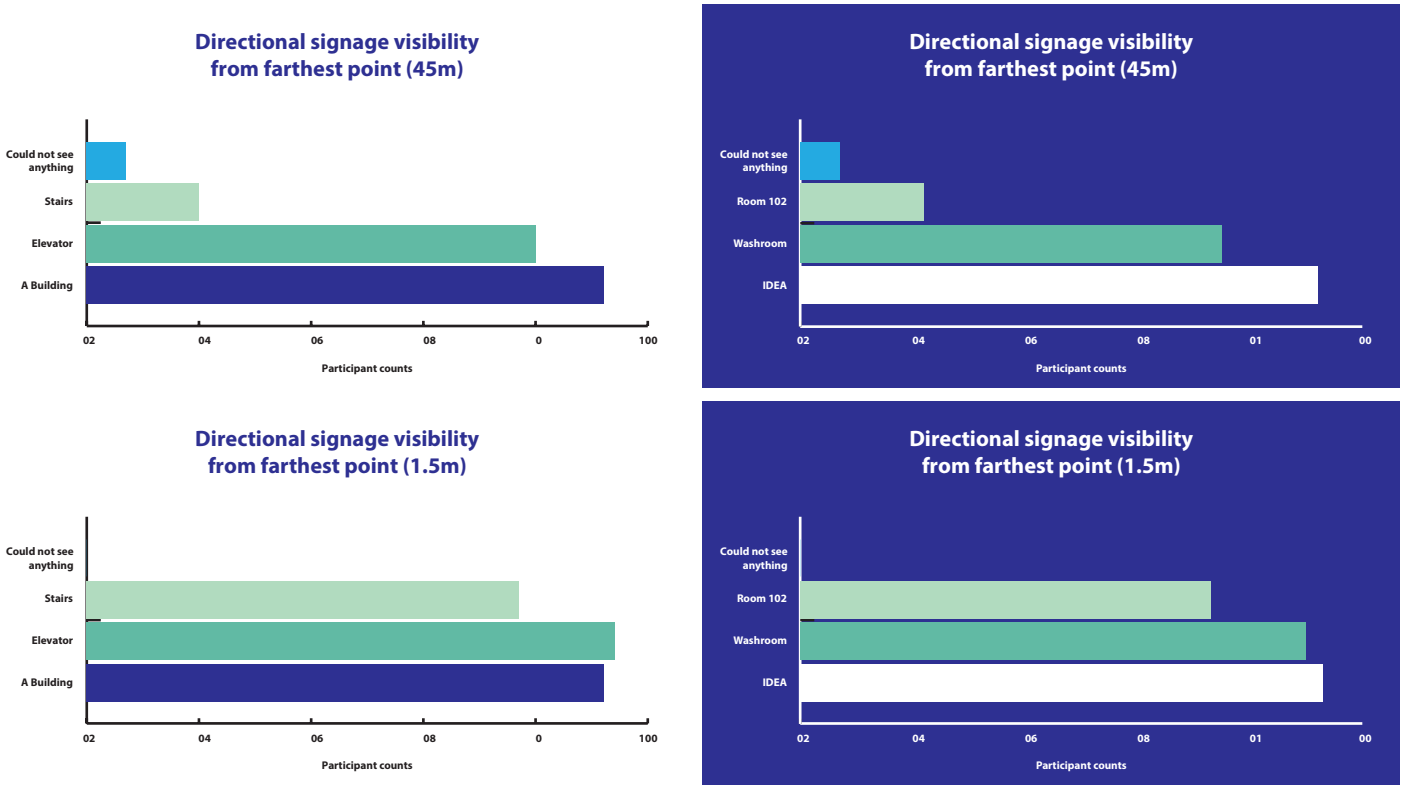


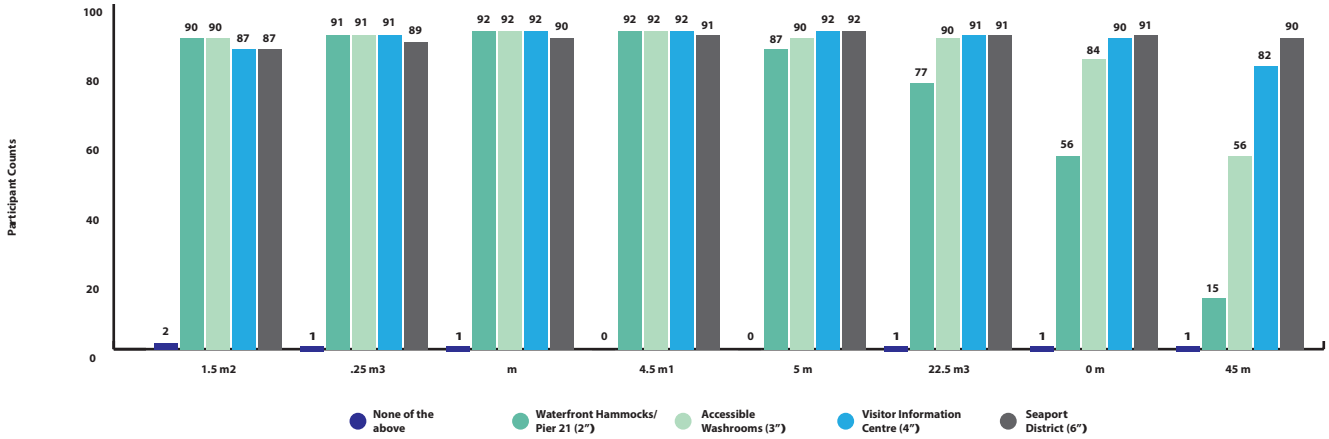
Figure 25: Four bar graphs showing the number of participants who could clearly see all three font sizes at each distance marker.

Top Left (45m, dark text on a. light background): A horizontal bar graph with a white background, dark green and blue bars, and black text. The y-axis, showing words appearing on the sign, and the x-axis, showing participant counts, together display the number of participants who could read each set of words from a 45m viewing distance.

Top Right (45m, light text on a dark background): A horizontal bar graph with a dark blue background, white, green and blue bars, and white text. The y-axis, showing words appearing on the sign, and the x-axis, showing participant counts, together display the number of participants who could read each set of words from a 45m viewing distance.

Bottom Left (1.5m, dark text on a light background): A horizontal bar graph with a white background, dark green and blue bars, and black text. The y-axis, showing words appearing on the sign, and the x-axis, showing participant counts, together display the number of participants who could read each set of words from a 1.5m viewing distance.

Bottom Right (1.5m, light text on a dark background): A horizontal bar graph with a dark blue background, white and green bars, and white text. The y-axis, showing words appearing on the sign, and the x-axis, showing participant counts, together display the number of participants who could read each set of words from a 1.5m viewing distance.



Although most participants were generally able to read all of the text from a close distance, we observed that most of them had difficulty reading any of the text once they were so close to the overhead signs that they had to look up at an uncomfortable angle to see them. The CSA standards determine letter size by distance, but do not consider the mounting height.

4.4.2. Legibility from a Distance in Outdoor Setting (Halifax Waterfront)

Outdoor signage testing distance was printed onto a banner and mounted at eye-level on the Halifax Waterfront along the boardwalk. This sign included text of varying sizes as well as icons. Participants were asked to move to stickers on the ground indicating various distances and check off which parts of the sign they could comfortably read from that distance.

Most participants were able to see all sign elements when they were between 4.5 -15 metres away from the sign. A handful (n = 5) of participants had difficulty reading the largest text from a very close range (1.5 m away from the sign).

Figure 26: Bar graph showing the number of participants who could clearly see each of the four font sizes at each distance marker for the outdoor directional signage (n=92).

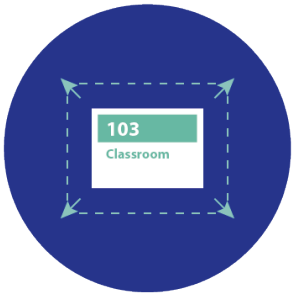
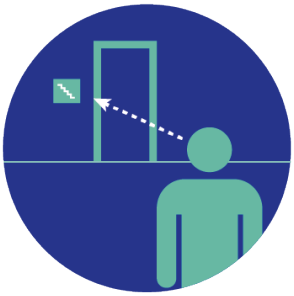
A vertical bar graph with a y-axis for Number of Participants and an x-axis for Viewing Distances (m). Five columns in different colours are shown per each distance, relating to five different character heights that were assessed.

4.5. Broader comments about the signs tested: open-ended responses

In addition to the survey questions, the research team also recorded comments from participants about each of the signs observed. We wanted to use this opportunity to hear comments or potential improvements that we may not have thought about. The following are common themes we observed from these comments.

Table 21: Broader comments about the signs tested

A table with 2 columns and 9 rows. The left column contains icons to symbolize each theme of the general comments heard from participants. The right column contains a title and description corresponding to each theme.

	**In general, participants wanted signs to be larger.** For the majority of the signs tested in this project, participants noted that they would have liked to see one or more elements of the signs enlarged. These included text size, icon/symbol size, and the dimensions of the signs overall. This was true of many different sign styles, regardless of whether or not they were intended to be read from a distance.
	**Large symbols/icons to be recognized from a distance** Since the prototype signs we used to test legibility from a distance was intended to test text size, we did not consider icon size in our questionnaire. Several people noted however that the size of symbols such as arrows or icons depicting important destinations (e.g., a stairwell) should be considered in addition to text size.
	**Texture matters** Signs in this study were manufactured on a few different materials, which had various textures that could be identified by sight and touch. Participants using raised characters and icons pointed out that sharp edges were uncomfortable to read. Participants using signs visually also commented that different surface textures reflected light differently, sometimes obscuring sign content.
	**Consider shadow and lighting** The illumination (or lack thereof) of several of the signs was mentioned by some participants. In cases where multiple prototype signs were placed side-by-side on a wall for instance, people commented that the signs directly under an overhead light were easier to read. Conversely, signs that were exposed to too much light (e.g., in direct line with the sun) were also difficult to read due to glare.

Use of more symbols (icons)

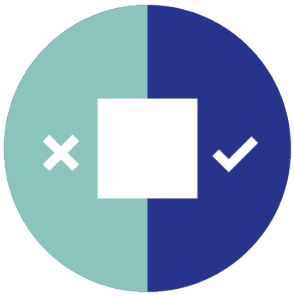
Several of the prototype signs did not include symbols because we were testing other features (e.g., braille placement or text legibility). However, several participants noted their absence, saying that the signs would be more intuitive and understandable if text was accompanied by icons or symbols.

Indicate 'you are here' on maps

The prototype sign with a map of the Halifax Harbourwalk did not include a 'you are here' icon because the placement of the sign was not yet determined when the sign was made. It is noteworthy that so many participants were expecting to find this feature on the map and expressed disappointment to not have it be there.

Maps and their legends need to have braille and tactile elements

The Halifax Harbourwalk map included braille and tactile characters to identify the destinations list, however the map imagery and the legend did not include tactile features. Several participants noted this and said they would have liked these features (e.g., buildings, pedestrian routes, map labels) to be tactile.



Colour contrast matters

Many participants commented on the colour combinations used on the prototype signage. Although all signs were designed with high-contrast elements, many participants pointed to preferences for either light-on-dark or dark-on-light, which differed by sign type, indoor and outdoor context, and even by individual preference. It is not clear from this study whether there are trends to be identified, but it is notable that colour-contrast and colour-combination influences participants' reception of signage.

Have the option to read signage using a smartphone

Some participants – most notably those experiencing vision impairment – pointed to opportunities where technology (e.g., phone applications) may supplement, or replace, signage. A QR code may be embedded into a physical map for users to scan and access a digital interface for this purpose. For instance, the Harbourwalk maps installed at the Halifax Waterfront site contained a lot of spatial and directional information that may be easier to navigate through an online tool where information can be categorized and communicated audibly or in other alternative formats.

The comments noted above were selected as prominent from respondents without accounting for particular type or level of lived disability experience (unless otherwise noted). For a comprehensive list of comments we received from only persons with experience of disability, and people with visual impairment particularly, for each individual sign, please refer to the appendix.

Section 5: Interpretation of Findings

Section Summary

The testing yielded some important takeaways:

(1) Lower mounting heights were preferred in the outdoor site where participants with a wider range of ages and heights were involved, compared to the indoor sites with most participants being younger adults. This suggests lower than current standard heights may be desirable where users with a wider range of ages and heights are expected.

(2) A few participants with vision impairment commented that they preferred the texts and corresponding braille being together when the content is simpler. However, when many pieces of information are displayed, they preferred the texts and braille to be located in separate sections, with braille at the bottom. Optimal braille and text placements may be different by type of signs (e.g., identification, directional, information, regulatory).

(3) Character heights were legible when viewed from CSA recommended distances and even further away for most participants, but not all. The legibility of the sign is likely influenced by factors such as insufficient mounting height for overhead signage in certain spaces, and environmental elements such as lights and shadows.

Additional comments made by the participants offered helpful suggestions about the signage standards related to the three elements we tested. They include the preference in having larger-than-minimum text size, having more (standardized) icons, and improving the texture of signs (soft and matte).

5.1. Findings for the Three Attributes of Focus

5.1.1. Mounting Height

Preferences of indoor respondents were consistent with 1500 mm +/- 25 mm mounting height, recommended by CSA B651-18 (4.5.6.4.5). Top choices by this group of respondents were 1525 mm (54%) and 1475 mm (44%). This sample validates the CSA standard mounting height.

However, a higher proportion of participants at the outdoor site (20%) preferred a lower mounting height of 1200 mm for the test signs than at the indoor site (2%). A mounting height of 1475 mm was the top choice by outdoor participants (64%) with about 22% saying ideal height would be even lower, but above 1200 mm. Only about 8% responded that they would prefer a sign mounted higher than 1475 mm outdoors.

This is likely because there are a wider range of characteristics in age and heights of the participants in the outdoor site (tourist destination) as opposed to the indoor site (university).

Some participants asked for duplicate signs to be placed at both higher and lower levels in a location to accommodate a wider range of people, including children. Duplicate signage is suggested by some standard documents already outside of Canada (e.g., BS, NDA).

5.1.2 Placement of Braille

Sample size of braille users in this study (n= 5, 2% of respondents) is not sufficient to conclusively say which location of braille is most ideal.

Top preference from braille or tactile sign users was for tactile text and braille to be grouped together, with braille directly below the corresponding text. For room signs (in this case, a washroom sign) it was also preferred that these be located together at the bottom of the sign.

For signs with more content (e.g., map directory sign), the top preference was also for braille to appear under corresponding tactile text, even in a list format. However, anecdotal comments from participants with visual impairment made some apt observations about how the alternating presentation of tactile and braille text may be time-consuming to read by touch only. A scheme for organizing the information, such as by alphabetizing list items, could be a solution.

5.1.3. Legibility from a Distance

Over 50% of respondents for outdoor signage reported that they could comfortably read 51 mm (2") text from as far as 30 metres away. About 77% said the same at 22.5 metres. CSA B651-18 currently recommends 50 mm as the minimum character size to be read at a maximum distance of 1.5 m. The highest proportion (about 92%) of outdoor respondents found 50 mm text and larger legible at 4.5 m, exceeding the 1.5 m maximum distance. Similarly, for indoor signage, most participants (~80% – 83%) were able to see all sign elements, including 51 mm text, from between 1.5 and 15 metres away from either sign. Based on these findings, it may be suggested that CSA's minimums for character height are more than sufficient for most users, perhaps even over-estimated.

However, this study included a limited number of persons experiencing low-vision, for whom these findings may differ. The indoor testing results, in particular, also found that a significant proportion of indoor participants (27%) said they could not read 51 mm text at the 1.5 m distance. Opposite to the above, this may suggest that 50 mm is not sufficient to be read by this proportion of individuals, and therefore, not adequate as the minimum for all sign users. This may also be due, however, to the mounting height of the overhead signage being too high overhead to be discernable up close, which was something heard from many participants who struggled to crane their neck to read the sign above. At the outdoor location, the directional signage was mounted 1490 mm from the ground to the sign's centreline, avoiding the challenge of reading it overhead. In this case, the criticism heard from participants more often was that other people posed as physical obstacles to clearly reading the sign, which was mounted low enough for people standing between the viewer and the sign to obscure it from view.

Other signage standards documents specify heights for directional signage to further contextualize what size of text may be appropriate to be read at what distance (e.g., ADA, CNIB). This factor was not taken into direct consideration through this study since it does not appear in CSA B651-18. Studies should be conducted with populations who are partially sighted, and take into account height in relation to legibility from a distance to investigate these findings further.

5.2. Additional Findings

5.2.1. Character Size

Many participants, particularly those with visual impairments, provided comments about the dimensions of letters and numbers. In general, it was suggested that most of the signs could have benefitted from larger text overall or could have been improved if the text had been bolded or capitalized. A study done by Arditi and Cho (2007) suggests results that are consistent with these comments; they found that

in many cases, the use of all uppercase letters can actually be more legible than the standard combination of lower and uppercase letters. Guidance for tactile lettering provided in CNIB's Clearing Our Path is consistent with this finding. However, it recommends the opposite (I.e., a mix of uppercase and lowercase lettering) "where signs are intended to be read visually" (CNIB, Clearing Our Path, 3.7.1.). This may pose a challenge to implementation when the same text is meant to be read visually and by touch.

Table 22: Clearing Our Path (CNIB), 3.7.1. Letter Size, Type Style and Distance

A table with 2 columns and 1 row. The left column contains the standards document title and numbering of the standard with section title. The right column contains the corresponding text for the standard identified in the left column, taken directly from the source document.

Clearing Our Path (CNIB) 3.7.1. Letter Size, Type Style and Distance	For lettering, a mix of uppercase and lowercase should be used where signs are intended to be read visually and not by touch. Mixing letter casing gives words a more defined shape, making them easier to identify. Type that is very fine or very thick can be difficult to read for people impacted by blindness and should be avoided. For signs meant to be read through either touch or vision, use all uppercase characters. Uppercase is easier to read by touch. The maximum message length on such signs is three words. More information can be found in the section Tactile Signs.

The size of the text was also an important factor when considering its tactility. Signs with the smallest lettering (e.gt., the 'Exam Center' sign) were criticized for having edges that were too sharp to the touch and for being too small to properly distinguish letters. The letters on this sign were within the range that CSA provides for tactile character height (16mm – 50mm), however they were on the smaller end of that range.

5.2.2. Signage Materials & Colour Contrast

Participants commented on various elements regarding the materiality and colour contrast of the signs. Glare was an issue in both indoor and outdoor sites, although it was more pronounced at the waterfront site where one sign was made with a semi-glossy finish and was mounted as a banner. Similarly, the indoor overhead directional signs with a light background, despite being made with a matte finish, was difficult to read at times of day when the sun was directly shining through a window directly onto the sign.

In addition to glare, the overhead sign with a light background, as well as other indoor signs with a similar colour scheme, were often not easily identifiable to participants unless a research assistant was available to point them out. Many participants suggested that the signs include a border or a contrasting colour with the wall in order to make the signs stand out more from their surroundings. This was particularly true of the washroom sign, which participants expected to be able to identify from a distance. There were also some comments about contrasting the braille colour with its background in order to make it more visible. While some noted the practical need for this intervention (i.e., making braille more visible for people with low vision), others observed that it could be used to highlight awareness of braille generally.

5.2.3. Iconography

Feedback from participants suggests that they were confused by – or at least unfamiliar with – the icon of the active wheelchair user. This feedback was regularly heard from persons with vision impairment. Some participants who experienced full blindness were not able to recognize the symbol through touch. One participant said it appeared to them like the wheelchair user "has a broken back" or was motioning like "he's trying to escape" from the male figure next to it.

The active wheelchair icon used on the signage from this experiment was developed by the Accessible Icon Project (https://accessibleicon.org/) to reimagine the International Symbol of Accessibility (ISA) as a dynamic figure with personal agency and direction (Fritsch, 2013). The change has been motivated by scholars like Ben-Moshe and Powell (2007) and others who point out that the ISA does not fully encompass the diversity of disability experience by limiting the representation of disability to wheelchair users. This project did not set out to gather perspectives on iconography, but this qualitative feedback on the active wheelchair icon was a noteworthy result.

It is clear from this study that for an icon to be effective, it must be recognizable. Barstow et al. (2019), who looks at public perception of new and old accessibility symbols, supports the importance of audience familiarity with symbols and the need for education and consistent use when introducing a new symbol. For instance, while the active wheelchair user icon has been adopted by several states in the United States and elsewhere, it was not yet commonly recognized by this study's participants.

Section 6: Recommendations and Future Needs for Research

Section Summary

Considerations for the next generation of model signage standards include; considering contextual elements alongside specific enforceable measurements; larger texts and icons that accommodate a wider range of heights of viewers; circumstances were multiple signs might be appropriate; incorporating height ranges into overhead signage standards; and, developing standards related to maps and location information. It is necessary to establish stronger evidence for the effectiveness of each of existing standards, critically examining how surrounding environment and a wide range of user abilities together shape the design requirements. The next generation of accessible signage standards in a Canadian context can benefit from this study's findings, and further study of users' perspectives of accessible signage design.

This study tested three attributes that are common among the signage standards we studied: mounting height, placement of braille, and legibility from a distance. As only a small proportion of the participants identified as having visual impairments, we cannot conclusively say which signage style is preferred by this demographic. Nevertheless, this study resulted in several interesting findings about each of the elements we tested that can contribute to the continued development and improvement of signage standards.

What was also valuable was the wealth of comments from the study participants that detailed how the signs tested can be improved from user perspectives. Such qualitative feedback pointed more nuanced details about how some of the elements are influenced by where the signs are placed—indoors or outdoors, presence of shadows and lights, and how far they are possibly viewed. For instance, it was clear that signage users prefer larger texts, icons, and tactile elements than they 'need to' read them, regardless of minimum requirements prescribed in CSA, or other standards. The participant feedback identified various elements in signage that are currently not considered in standard documents, such as needs of making non-text elements in signage (such as outline of a map), and how to reduce texts and use more icons. It is likely that these suggestions are currently considered as more of an aesthetic issue than the readability of signage.

6.1. Recommendations

Five main points for future consideration in enhancing wayfinding and signage components of the CSA-B651, emerged from our study.

Recommendation 1: In addition to specific enforceable measurements, consider the context in which the sign will be installed.

The current accessibility standards, in Canada or elsewhere, mainly serve as a regulatory tool, focused on the minimum required, quantitative specifications. It is, however, still possible to determine these minimum specifications in light of more diverse contexts. For example, signage standards may be prescribed for indoors or outdoors separately. Some considerations for lighting, temperature, and texture may accompany the respective settings.

Recommendation 2: Consider requiring large texts and icons, which can better accommodate a wider range of heights of viewers.

Size requirements for texts and icons are not only related to sight/vision of viewers, but also related to legibility for viewers with different heights. Our finding also suggests that larger than minimum standard text size was desirable for many users. Having larger size font signs can accommodate a wider range of people including adults, children, standing and seating

positions all at the same time, instead of having multiple mounting height requirements for smaller size fonts.

Recommendation 3: Consider circumstances under which multiple sign styles are appropriate (e.g., located at different heights where both children and adults read signs), and create standards to guide their installation.

In some circumstances, having multiple of the same signs at different heights in one location might be desirable. This may be the case with locations of braille signs, especially in buildings that are frequently used by both adults and children (e.g., libraries) where young children with vision impairment may need to find the location of washrooms but cannot reach the adult height sign.

Recommendation 4: Consider incorporating height ranges into overhead signage standards by farther viewing distance

Some overhead signs in large facilities or outdoors are viewed from farther distance. Depending on the functions of the space where signs are located, there can be many objects or people who block the sightline between the viewer and the signs. CSA-B651 currently only has some mounting height specifications for close proximity in indoor contexts, and does not have guides about mounting height and text size for viewing from distance in outdoor or large facility contexts. Ireland's Building for Everyone: A Universal Design Approach, Internal environment and services, for instance, prescribes mounting height by types of signage, providing descriptions for what the sign contains, its purpose, and typical context. The U.S.'s Americans with Disabilities Act Standards for Accessible Design even prescribes text size for signage according to the sign's mounting height relative to viewing distance. An approach like these examples could be emulated in CSA-B651.

Recommendation 5: Consider developing standards related to signs that show maps and textual location information.

Signs for wayfinding can be largely categorized to four types: identification (e.g., room numbers, street names, parking spots), directional (e.g., indicating which way to turn to get to a store), information (e.g., explanation of purpose/function, historical significance, how to use the space) and regulatory (e.g., warning signs) (Symonds, 2022). Signs in a map format can often encompass multiple of these types. Currently, design of maps showing directions and destinations in public spaces are outside of the scope of signage requirements in CSA-B651. In our study, a sign containing a map of amenities in vicinity was used for testing the braille and tactile elements at the waterfront site. Through the testing, we obtained many valuable user insights about how maps may be designed to better communicate the information in an accessible way for persons with a wide range of abilities (e.g., map outline should be tactile, map legend should have braille, indicate where the user is located in relation to the space the map is describing). Expanding the signage standards section to cover directional sign requirement will likely be valuable.

6.2. Future Needs for Research

Signage is an important means for people—with or without disability—to navigate our world and find their desired destination. Signs that effectively communicate the information at hand enhances accessibility to many destinations (e.g., services, places for recreation, work and school) in the built environment. However, design criteria of signage are not well-investigated beyond what are minimally required to be able to detect the information. Standards are typically used as regulatory tools to ensure that the minimum acceptable requirements are met for safety. Criteria that are considered desirable from user perspectives are not always incorporated.

Standards have a unique role in influencing the practice of accessible designs in a more extensive way because they are accepted as regulatory tools. Many accessible design standards in the world are already incorporating some requirements through a universal design lens. There is an opportunity to enhance the potential impacts of standards to the accessibility of the built environment, by clearly demonstrating the rationale of building professionals to design and build signs in certain ways that are conducive to user perspectives.

The future research around signage standards likely requires investigation of design requirements for different types of signs (directional, information, and regulation), from perspectives of what design will help people navigate the spaces, which goes beyond safety and ergonomic considerations. The five recommendations above are good starting point for such investigation.

Our study achieved a considerable level of public participation, with over 200 community members providing inputs about considerations for signage standards in various ways. While it was extremely helpful, the study results must be viewed with a caveat as the inputs from persons with disabilities were still limited. It is necessary to establish stronger evidence for effectiveness of each of existing standards. At the same time, it would be beneficial for research to consider the conceptual framework of standards themselves, critically examining how surrounding environment and a wide range of user abilities together shape the design requirements, and how these requirements can be explained in a way relatable and easy to understand to professionals who design and build our environments.

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Appendix

Table with additional comments from participants with experience of disability

A table with 3 columns and 7 rows. The first column, whose heading is "Signage", contains an image of each sign that was tested, one per row. The second column, whose heading is "Persons with Vision Impairment", contains lists of comments for each sign by participants who identified as having vision impairments. The third column, whose heading is "Persons with Other Disabilities", contains lists of comments for each sign by participants who identified as having one or more disabilities that are not visual. The comments were taken directly from the written survey questionnaires.

Signage	Persons with Vision Impairment	Persons with Other Disabilities
Container Stage Sign (Waterfront)	Braille… …is not visible because the sign is in shadow …should be on a different background colour …should be raised higher to the touch …left-aligned is best …to the right of the text is unusual …is disconnected on the right sign Text… …could be larger …white on dark is good	Braille… …is nice under the text, not clumped together Text… …could be bolder …should be bigger Is the font dyslexic-friendly? …is easy to read visually …that is sans serif font is good …contrasts well with background …is too small to read at certain distances …spacing between letters could be a bit larger Overall… …matte material is good …add icons …colour blocking may be used to differentiate information …I like them just the way they are …the sign is functional as-is …the whole sign should be bigger …what is the Container Stage? …having both heights offers a good range

Signage	Persons with Vision Impairment	Persons with Other Disabilities
Harbourwalk Map (Waterfront)	• Bigger map legend is better with braille under text • More of the sign's content should be available in braille, not just the destinations list (e.g., land acknowledgement) • Make the background darker if using white text • Like the size and space between the two columns of the sign on the right • Add distances to the destinations on the map • Legend is a bit small, there is room below • Equality of content layout on the left sign [text is arranged in two columns, each with consistent arrows pointing left and right]	• Braille on bottom of the sign takes away from the map • Content of the sign with braille under the text is less cramped, which is better • Braille should be both at the bottom and under the text (a combination of sign on the far left and far right) • Legend is not tactile but should be • Legend should be bigger • Good text hierarchy is used • Would like the signs to be higher • Relate the list of locations with the map below • List the missing information in the legend (add a cruise ship and ferry) • Put arrows between tactile letters and braille • List destinations in alphabetical order • Braille on the bottom of the sign is not visible; colour blocking could help • Add "You are here" • Like the space between bullet points on the left sign • Red raised line could be helpful as opposed to just a coloured line • Add numbers to the legend to match the ones on the map • Not too crowded on the bottom map on the left sign • List accessible fatures on the buildings on the map • Add QR code feature, with a listening option to the info right on top • Like the spacing of the text on the left sign • Father-in-law reads braille and he'd likely prefer the left one b/c text is directly related to braille • Having multiple options of braille placement could be helpful • Like the spacing of the text on the left sign • Maybe add the QR code to have a digital map • Good as it is! • Like the sign on the right for its use of visual space • Didn't notice the braille along the bottom of the right sign • No legend telling you what the numbers on the map mean • Like the spacing the left sign provided because of the text and braille placement

Signage	Persons with Vision Impairment	Persons with Other Disabilities
Seaport District Directional Sign (Waterfront)	• Increase spacing between wheelchair and toilet symbols • Change material to be more matte • More contrast for the arrows is needed • Need new arrows, "I can't notice which way the arrows go" • The arrow can be white and larger instead of red • Make the sign bigger	• Reading at 3 metres is a bit more natural than being at 1.5 metres • Change the arrow colour, maybe a brighter red colour • Increase font size of Pier 21 • Separate wheelchair and toilet symbols • Background colour can be lighter (match sea colour) • Icon can be bigger (washroom symbol) • Dark background blends in too much with surroundings • Not enough symbols • Symbols need to be bigger • Don't like the toilet icon • Bigger and more central arrows • Increase spacing between "Visitor" and "Information" • Make arrows green, not red • Small text shouldn't be tucked in the corner • Icons not visible from further away • Icons should be the same size, wheelchair icon too small • That up arrow pointing to the washroom is a little general (won't be helpful enough to direct people to where the washrooms are really, they are harder to find) • White text on black background is good contrast • Icons not visible from further distances (guessing at what they are) • Change arrow colour to yellow (higher contrast, better visibility at night) • Black and white is good contrast • Make arrows bigger • Make washroom and wheelchair symbol more separated from each other and make the wheelchair bigger • Wheelchair icon is small • Arrows look decorative, not functional • Arrows are too small • Wheelchair icon needs to be bigger • Contrast on arrows needs to be changed • Match the theme (dark blue) for the background • Contrast on arrows needs to be changed • Text can be bigger • Spacing between VIC can be increased • Symbols hard to see at far distances • Lots of glare from sun • Sign itself blends-in to its surroundings • Front view of the toilet icon is odd • Increase spacing between wheelchair and toilet symbols • Change material to be more matte • More contrast for the arrows is needed

Signage	Persons with Vision Impairment	Persons with Other Disabilities
B Building Signs (Sexton/CNIB)	• The second highest sign is ideal • • Text could be thicker and bolder • • Needs to be bigger and bolder	• Make B-Building text bigger • Can make the font size bigger • Add arrows to guide • Add French • Text can be bigger and located at a higher level • Bigger lettering on same size signage • Make a larger sign • Add a 5th height option between 2nd and 3rd option • My problem is with distance. I had to get close to the signs to read them
Directional Signs (Sexton)	• Pictographs for Stairs and Elevator would be more useful, especially with smaller fonts • Use icons • Use a different font, but the contrast is excellent	• Make the text bolder • Like the darker background better • Prefer the dark background with the light text • Have the smallest text bolder • Keep Elevator and Stairs the same font size • Use colours to help draw attention • Add symbols/icons • Bold "A" in A-Building • Washroom signage is too big • Make Room 102 bolder • Use icons for Washroom • Brighter lighting on the sign is needed if using a black background • Increase spacing between lettering • Arrows should be same size on both sides. • "g" in building is hard to read, decorative letters are not easily read • "IDEA" is unclear, add "building" • IDEA letters are crowded • Uppercase text is easier to read • Can see all but the smallest font, should be bigger (Room 102) • Stairs is not centered, don't catch your eye • Lower only "stairs" on white sign • Glare from outside overpowers signage on black sign • Add secondary sign for Room 102 • Add black border on white sign • Better lighting • Better identification for room 102

Signage	Persons with Vision Impairment	Persons with Other Disabilities
Exam Centre Sign (Sexton/CNIB)	• Easier to read braille when mounted at an angle, suggests 10-15 degrees off the vertical • Braille together always better • Reading braille higher or lower than eyelevel is better. Exactly at eyelevel is not comfortable • Offering both tactile text and braille is important • Visually, the sign is clear and well contrasted • Exam Centre letters are "pokey" to the touch • The number one was only recognizable to me because I was sighted before; a simple straight line to represent the number one would have been better. • The number two is good as it is. The letters are too small, sharp to touch, and I am frustrated when I try to read them. They are wasting my time. • Could put the braille above the numbers and text; this would indicate that the sign is accessible. • Use capital letters for text	N/A
Washroom Signs (Sexton/CNIB)	• Embarrassing to touch the "male" icon on the washroom sign. Feels inappropriate to touch a human figure • The wheelchair icon looks like "he's trying to escape" • Icons arrangement on the washroom sign gives the impression that the man in the wheelchair is quickly trying to get away from the standing man • Braille should be at the bottom left as folks read from left to right and may start there looking for braille • Use bolder text • The icons themselves aren't helpful; the symbol for men is not representative (it could be representing any human). • The wheelchair symbol was not familiar to me. • The notched sign felt like a broken piece of the sign. • The notch wasn't helpful for me. • Having the writing on the top was the most helpful for me (I didn't have to bend to read it) • Change the icon for wheelchair. • Background should be lighter. • Men washroom was used but question about transgender and non-binary washrooms • Wheelchair icons looks like he has a back injury	• Make text bold, bolder, thicker • Looks good as it is • Would be good if there were gender neutral washrooms • Place the icons lower and place the text a little lower as well • Can't tell that this is a washroom. Have a washroom icon • Ensure signage is doubled • Include wheelchair accessibility in writing as well • Make text capital letters