# SEEING WITHOUT SIGHT

## Designing a Transit Hub that Aids in Navigational Strategies for the Vision Impaired

by

Emily V. B. Jones

A Practicum Submitted to the Faculty of Graduate Studies of the
University of Manitoba
In partial fulfillment of the requirements of the degree of

**MASTER OF INTERIOR DESIGN**

Department of Interior Design
Faculty of Architecture
University of Manitoba
Winnipeg, Manitoba

# abstract

This practicum outlines a conceptual design proposal for a mobility hub located in the existing Union Station terminal in Winnipeg, Manitoba. The investigation creates a framework for the importance of designing for multiple abilities in regard to users with a visual impairment and incorporates a study of theory and strategies that accommodate the independence and wellbeing of these individuals. The practicum uses four lenses of research and analysis to help design layers of sensorial information that act as tools for independent navigation and wayfinding for people with a visual impairment. These lenses include critical theories centered around narratology and perception, research on existing design conditions for people with a visual impairment, personal explorations, and an understanding of the building history of Union Station. The design will be an engaging, multi-sensorial experience of continuous networks and paths that act as a personal extension of the body to the built environment. The design will also offer options and choices that depend on the user's needs.

# acknowledgements

Thank you to my Advisor, Professor Tijen Roshko. I have sincere gratitude for the continuous support throughout my entire educational journey. Your ability to see, understand, and use my strengths and weaknesses pushed me further than I thought possible. Your motivation, enthusiasm, and immense knowledge have not only helped me through this practicum but also in my personal life.

I am thankful to Karen Wilson Baptist and Brian Everton for sharing your knowledge with me and encouraging me through constructive conversation, challenging questions, and overall support in this project.

I am so grateful to Doris Koop and Tasia Knysh for your willingness to help me understand the difficulties and triumphs you experience on a day-to-day basis. You showed me that there is no right way to experience the built environment and that good and bad design do not exist: it is all about choice.

I would also like to thank my family and friends for being so patient with me and willing to help whenever I needed it.

# table of contents

## 2 [two]



## 3 [three]



## 6 [six]



## 7 [seven]

# list of figures

# list of tables

# copyright material

Figure 53: Paul Raftery. "Milkshake Tree Playground in London doubles as an oversized xylophone". Photograph. Inhabitat.June 23,2016. https://inhabitat.com/milkshake-tree-installation-in-london-doubles-as-an-oversized-xylophone/. Used with permission from Paul Raftery. (pg 83)

Figure 54: Brandon Barre. "100 Broadview Lobby / Quadrangle Architects & Interiors". Photograph. July 12, 2016. https://www.archdaily.com/790771/100-broadview-lobby-quadrangle-architects. Used with permission from Brandon Barre Photography. (pg 83)

Universal Design Strategies


"The Center for Universal Design (1997). The Principles of Universal Design, Version 2.0. Raleigh, NC: North Carolina State University."

"The Principles of Universal Design were conceived and developed by The Center for Universal Design at North Carolina State University. Use or application of the Principles in any form by an individual or organization is separate and distinct from the Principles and does not constitute or imply acceptance or endorsement by The Center for Universal Design of the use or application."

# 1 [one]
# INTRODUCTION

## 1.1 Project Description

People engage with the environment in a variety of ways, and the most obvious way is through the sense of sight. What happens when individuals are not able to see or experience visual cues? How do individuals who are not able to see navigate and understand a space? There may be a disconnect between the person's surroundings and their experience of the space. These interactions within environments are done through ability and personalized characteristics, such as height, strength, and experience; however, it is also experienced through a degree of resistance.[1] This means that people's ability to interact with their environment is heavily dependent on how many barriers they must cross before reaching their goal. The term barrier, for the purpose of this practicum, is defined by the City of Winnipeg's Accessibility Standards as something (material or immaterial) that impedes people or separates users. It can be a circumstance or obstacle that limits access and/or prevents communication or progress in order to achieve an objective.[2] Barriers limit an individual's ability to fully participate in all aspects of society and move independently.[3] Unfortunately, barriers are designed unknowingly everyday by architects, interior designers, and many other professions.

Someone who lives with a visual impairment is consistently engaging with their surroundings and are, therefore, actively learning and understanding cues to navigate through spaces and over barriers independently. The interior environment needs to provide varying levels of support for users to reach their goals. As a result, design should be an adaptable tool that people can adjust to fit their needs.[4]

This practicum, titled "Designing a Transit Hub that Aids in Independent Navigational Strategies for the Vision Impaired," explores the challenges of people living with varying levels of visual impairment from total blindness to low vision. The research will be applied to the final design proposal using four lenses of research. The first lens communicates how theories related to perception and narrative can have an experiential and sensorial outcome on the design. The second lens includes a basic understanding of vision loss and research on existing codes and standards. Codes and standards considered include the *2015 City of Winnipeg Accessibility Design Standard Third Edition, Transport Canada's Intercity Bus Code of Practice*, and the *CAN/CSA B651-04 Accessible Design for the Built Environment*. Resources from the Vision Impaired Resource Network (VIRN) and the Canadian Institute for the Blind (CNIB) are also consulted. The third lens incorporates a personal, sensorial investigation supported by previous research and education from vision impaired resources. Lastly, the fourth lens focuses on precedent research on three existing projects that each relate to a specific topic of interest related to the project. These will help establish design guidelines to create an integrated design of Union Station that uses adaptive reuse strategies for the existing historical nature of the building.

The chosen space for this project is the existing Union Station in Winnipeg, Manitoba, and the intent of this project is to create a 'mobility hub.' The term 'mobility hub'[5] is generated from concepts being developed in large Canadian cities, such as Toronto. These hubs serve as the origin, destination, and transfer point for the majority of trips throughout the city.[6] This spatial type was chosen because it is a transitional space of connectivity where varying modes of transport, such as biking, walking, and vehicular, seamlessly come together.[7] It is a space that users of all ages, cultures, languages, genders, and abilities use for various reasons like daily commuting or touring the city. A mobility hub must incorporate the needs of everyone and provide a variety of options for users' respective needs.

In architecture and interior design, integrating individuals with disabilities is usually discussed in regard to universal design. Ron Mace, an architect and founder of the Center for Universal Design in North Carolina, defines universal design as "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design."[8] However, for the purpose of this practicum, the concept of universal design will not be used as a means of support or research towards the final design intervention because the focus for this practicum is towards the navigational strategies of vision impaired peoples specifically. This does not encompass the definition of universal design because all demographics of people will not be considered in this practicum.

This practicum topic was chosen to explore the seamlessness that design has the potential to create. Seamlessness is one of three key design components that Doris Koop, the Executive Director of the Vision Impaired Resource Network (VIRN) Inc., believes good design has. She defines seamlessness as design that is not obviously designed for a minority of people.[9] In this case, seamlessness means that the design is not obviously made for people with a visual impairment. For example, Ann Heylighen, Caroline Van Doren, and Peter-Williem Vermeersch, professors in the Department of Architecture at KU Leuven University in Belgium, wrote a research paper focusing on a case study of a person with a sensory impairment navigating through Museum Leuven.[10] The researchers examine how the user's experience related to the architect's overall intention for the building.[11] The user concludes that "many architects still seem to have troubles integrating accessible design elegantly within their architectural concept: Most buildings are first designed, and then these 'special' requirements' are merely pasted on."[12] Examples such as the Museum Leuven case study begin to explain the importance of integrating an architect's concepts and intentions with users' sensory experience. These design intentions can consciously or unconsciously be eliminated or emphasized by the designer to provide an interesting combination of initial concept versus use of the space.[13]

The intent of this practicum is to explore the boundaries of seamless design to facilitate an understanding of creating spaces that bring people together. The objective is to alter people's attitude towards design standards by introducing design guidelines and solutions that can be implemented into every scale and project, whether or not the projects scope is including users with vision loss.

## 1.2 Objectives and Goals

The objectives of this practicum are discussed on the following page in relation to the organizational, functional, and aesthetic goals of the final design proposal located in Chapter 8 of this document.

### Organizational Goal

The overall design of the building needs to account for the safety and wellbeing of the individuals engaging in the space. The City of Winnipeg employs certain policies and procedures to creating environments that place priority on quality of life for all citizens by creating responsive and innovative public services.[14] Therefore, the redesign of the Union Station Transit Terminal will achieve this goal by providing comprehensive wayfinding design strategies that consider circulation and space planning so that all users have a safe path of navigation and a positive, accessible experience while navigating through Winnipeg.

### Functional Goal

There is no definition of what successful design is, since every person who uses a space defines it differently. This practicum creates opportunities and options for all users' abilities, in regard to varying types and levels of visual impairment, so users can choose how they experience a space to their liking. For example, rather than materials, furnishings, and finishes only having a visual appeal, they can also function as guides, markers, and navigational tools for users with impaired perceptual capabilities.

### Aesthetic Goal

The built environment should provide independence and accessibility using a holistic design approach, rather than cultivating a feeling of disconnect and an unnatural flow of interior spaces based solely on ability. An integrated, barrier free design can include design standards from existing sources, such as the *City of Winnipeg's Accessibility Design Standards*, which is enforced by *The Accessibility for Manitobans Act*, which standardize clear space, heights of signage, accessible washrooms, colour contrast, etc. These physical features and the use of audible, visual and textural technology, as well as spatial layout, can aid in the idea of comfort, community, and accessibility that a public mobility hub should possess.

## 1.3 Questions of Inquiry

1. How can the existing space of Union Station create a narrative between the city, building, and user through multi-sensorial design interventions that are informed by the initial spatial design of the historical building and create a verbal communication between the building and user?

2. What innovative, visual and non-visual strategies can a designer use to support independence and safety, while also enabling first-time and recurring users to understand and navigate through a space to their intended destination using cues from their surrounding environment?

3. How can perception and memory be used to inform human movement and reaction within a space, and how can these responses inform the evolution of an integrative, logical interior environment?

## 1.4 Limitations

Although all theories, analyses, and investigations were carefully researched, there are still limitations in the final outcome of the design proposal. First, my interaction and education on visual impairment did not consist of a large body of people with different levels of vision loss. Therefore, the outcomes may be biased toward the types of visual impairment focused on in the resources I consulted. The research and strategies could be enhanced in the future through further data collection, questionnaires, surveys, and observation of a larger study of users to strengthen the outcomes presented. A second limitation is that I did not follow an existing 'checklist' on what to include and not include when designing an interior environment for people with vision loss. Therefore, some common design elements usually included in interior projects may be exempt from the final design. In turn, I chose to combine theoretical analysis, education on existing resources, personal sensorial experience, and existing projects (not necessarily relevant to visual impairment) to create an innovative design approach that integrates common standards and codes with other strategies from additional streams of research. Thirdly, because of the scope of the project, research on existing codes, standards, and any additional resources were limited to Manitoba specific or Canadian sources. This may not be considered a limitation with respect to design in Canada, however, there is additional research going on regarding accessible design all over the world that is not included in this research. Finally, the last limitation that presents

itself is the importance of the understanding that persons with disabilities are the first source of information on the way their limitation affects them and on how to accommodate their specific need.[15] Design assumptions are made throughout this practicum using research, analysis and educational explorations that are assumed to help users with vision loss navigate space.

## 1.5 Key Terms

**Accessible:** Describes a site, building, facility, public right-of-way, or portion thereof that complies with the requirements of the *2015 City of Winnipeg Accessibility Design Standards, Third Edition*.[16]

**Adaptable**: The ability of a certain building space or element to be added or altered so as to accommodate the needs of individuals with or without disabilities or to accommodate the needs of persons with different types of degrees of disabilities.[17]

**Barrier:** Something material or immaterial that impedes people or separates them. It can be a circumstance or obstacle that limits access or prevents communication and/or progress in order to achieve an objective.[18]

**Cane-Detectable:** Within the detection range of a cane as it sweeps or taps.[19]

**Clear Space:** The minimum unobstructed floor or ground space required to accommodate a single, stationary wheelchair, scooter, or other mobility device, including the user.[20]

**Colour Contrast:** A significant contrast in colour between the foreground and background of an element (e.g., light on a dark background or dark on a light background). [21] Refer to Section 2.3 of this document for more information on colour contrast.

**Detectable Warning:** A standardized surface feature built into or applied to walking surfaces or other elements to warn persons with vision impairments of hazards on a circulation path.[22]

**Indicator Surface:** A ground surface that is in colour contrast to an adjacent accessible route and textured differently to the surface of the accessible route to be cane-detectable.[23]

**Low Vision:** Low vision is an eye condition that can occur at any age and cannot be corrected or improved with regular eyeglasses.[24]

**Signage:** Display of written word, symbols,

pictorial, tactile, and contracted Braille information.[25]

**Trailing:** Trailing is a technique that most users will use in order to move safely through a space as well as to orient themselves as they travel. It is a way of moving the fingers or a white cane along a surface.[26]

**Total Blindness:** The inability to tell light from dark or total inability to see. Notably, few people are totally without sight: 85% of individuals with eye conditions have some sort of remaining sight and 15% are completely blind. [27]

**Visual Impairment:** Any level of reduction in vision that cannot be corrected with glasses, contact lenses, medicine, or surgery.[28]

**Wayfinding:** A term used to describe the spatial problem-solving process that a person uses to reach a destination. A mental 'map' is formed of the overall setting and the desired destination. This map is based on information obtained from orientation cues that are available from the setting's environment. These cues include not only signage but also overall spatial forms, structures, sounds, surface textures, colours, illumination levels, architectural features, etc. Wayfinding cues should reduce complexity and increase consistency in an environment.[29]

# 2[two]

# VISUAL IMPAIRMENT

## 2.1 Chapter Introduction

Understanding and designing for users with vision loss is a complex and challenging task because there is no right or wrong way of designing: everyone with a visual impairment 'sees' and experiences spaces in ways that are unique to their abilities. Therefore, this chapter provides a short background on what visual impairment is and what existing education, resources, and practices are available to designers and visually impaired users. Furthermore, existing Manitoba design standards and codes that are currently being implemented in design projects are reviewed. This summary of existing design strategies for vision loss will be combined with experiential and theoretical research to enable a more layered approach to designing for visual impairment. By using multiple research sources, the final design will benefit from consistent best practices, as well as provide variety for the needs of all users with vision loss.

## 2.2 Background

### What is Vision Loss?

Vision loss, or users with a visual impairment, refers to people who suffer from a severe reduction in vision that cannot be correct with conventional means, such as refractive correction or medication, which may reduce a person's ability to function at certain or all tasks.[1] It is estimated that in Canada, around 5.5 million people live with a vision impairment; of these, a large percentage are people aged 50 and above.[2] It is crucial to realize that visual impairment encompasses various degrees of blindness, and a large percentage of visually impaired people are also an aging population, meaning that they have specific needs that must be considered when designing.

These are four levels of visual function, according to the International Classification of Diseases: normal, moderate visual impairment, severe visual impairment, and blindness.[3] These can be further expanded through visual impairment categories: colour blindness—difficulty in perceiving or distinguishing colours; low vision—includes partial sight in one or both eyes, blurry vision, tunnel vision, clouded vision, and central field loss; and finally, blindness—a substantial vision loss in both eyes.[4] Due to the vast variations in visual perception, certain elements in space become less accessible to the user and therefore less meaningful. For example, Figures 1 and 2 are representations of how a webpage is viewed by someone with loss of acuity (blurred vision)

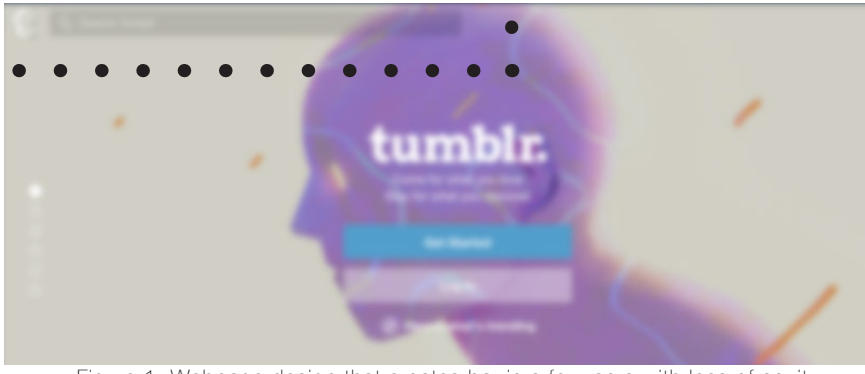



Figure 1: Webpage design that creates barriers for users with loss of acuity.


Figure 2: Webpage design that creates barriers for users with Tritanopia colour blindness.

and someone with Tritanopia colour blindness. Elements on the webpage that use colour as a source of information are lost by someone with colour blindness, while the blended-in, very minimal toolbar is lost by someone with blurry vision.[5] Therefore, it is important to make sure that elements such as colour do not convey meaning within a design context. However, if colour does need to be used, an alternative strategy for designers in all professions is to signify the meaning of an element through multiple avenues. For example, on the Google search page, the 'o' is highlighted through colour. The design could also incorporate a small line underneath the 'o' to signify meaning to people with different abilities of vision.

As mentioned previously, there are many different types of visual impairment, and within these types, there are also several subcategories. Figure 3 illustrates the visual field, which is defined as a person's entire visual range. It is usually measured in terms of degree from the center and is understood as what people with normal vision can see.[6] In Figure 3, the letter 'A' represents the field of 30 degrees. If there is less than 10 degrees in the visual field, blindness occurs.

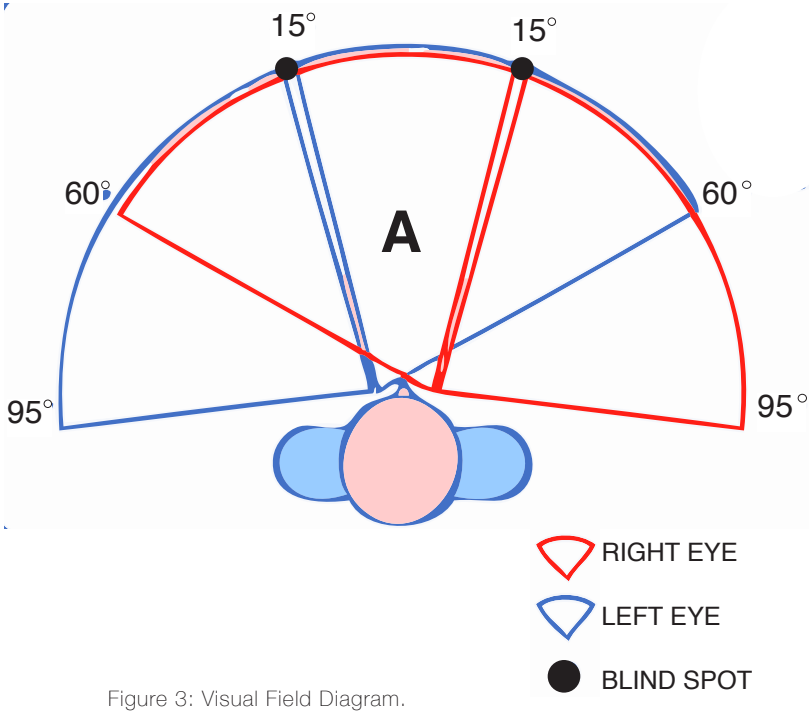



Figure 3: Visual Field Diagram.

## Common Types of Visual Impairment

The following page contains representational graphics of five examples of the most common types of visual impairment: retinitis pigmentosa, glaucoma, cataract, age-related macular degeneration and diabetic retinopathy. I used these five types of visual impairments, as well as complete blindness, and analyzed their defining characteristics to aid in my interior development. This method helped develop options of information, at different heights, scales, colours, etc. which aided in the creation of meaningful information for everyone.

Figure 4: Visual representation of Retinitis Pigmentosa

## 1. Retinitis Pigmentosa

Retinitis pigmentosa most commonly depicts tinnelling of vision and loss of peripheral vision. This is important when designing signage and wayfinding for someone who can't see out of their peripheries. Contrast is important when designing because it will communicate information and direct the eye.

Figure 5: Visual representation of Glaucoma

## 2. Glaucoma

Glaucoma, has a tunnel visioning effect where the person's centeral vision remains intact and they gradually loose peripheral vision

Figure 6: Visual representation of Cataracts

## 3. Cataract

Cataract includes clouding of the vision, inability to see light and double vision. Therefore, someone who may experience double vision would find busy patterns very confusing and disorientating.

Figure 7: Visual representation of Age-related Macular Degeneration

## 4. Age-related Macular Degeneration

Age-reglated macular degeneration, is characterised when the central area vision is kind of a woolly opacity that obscures the central part of vision. However a person may still be able to see out of their peripheries okay.

Figure 8: Visual representation of Diabetic Retinopathy

## 5. Diabetic Retinopathy

Diabetic Retinopathy commonly has black spots or floating shapes with a chance of complete vision loss in one or both eyes.

*Please note that the graphics shown on this page were created by the author and inspired through examples found on the National Eye Institute, National Institutes of Health.

## Manitoba Resources

The majority of people who are visually impaired were not born with a visual impairment but developed one at some point in their lives. Most likely, these individuals were referred to a community that could help them transition. In Manitoba, there are two key organizations: Canadian Institute for the Blind (CNIB) and Vision Impaired Resource Network (VIRN). Both have different overall missions, but both push for positive advancements for those who live with vision loss.

CNIB is a nationwide organization, with offices in Manitoba, that provides "community-based support, knowledge and a national voice to ensure Canadians who are blind or partially sighted have the confidence, skills and opportunities to fully participate in life."[7] Founded in 1918 by veterans blinded from WWI, CNIB has been developing programs and strategies to provide guidelines and resources to users. These programs are based off of their large, nationwide network that has created a strong community of advocates for changing the lives of people with vision loss.[8]

Throughout advocating for change on a larger scale, CNIB developed a new strategic plan called "Clearing our Path," which includes strategies for facilitating safe and independent navigation for users with a visual impairment. Below is an excerpt from the "Clearing our Path" website that fully describes the importance of advocating to the public.

> CNIB is committed to advocating for universal environments for all people with vision loss. Equal rights for all Canadians regardless of disability are enshrined in the Canadian Charter of Rights and Freedom and echoed in the UN Charter on the Rights of Persons with Disabilities. Governments, both in Canada and around the world, are passing groundbreaking disability rights legislation. Additionally, we are reaching new levels of societal awareness. We believe that public services and spaces that aren't accessible to people with disabilities cannot accurately be described as "public." Architectural design should incorporate elements that facilitate the safe use of a space or independent travel. . . Implementing these solutions mainly requires the application of simple techniques to make information about an environment available in an accessible way.[9]

"Clearing our Path" is explored further in the next section of this chapter, alongside existing Manitoba design standards and codes. These are used to analyze and understand existing resource available to architects and designers about design

for vision loss.

Another resource in Manitoba for individuals with vision impairment is VIRN. VIRN's overall goal is inclusion and finding solutions for day-to-day challenges for people living with vision loss.[10] Like CNIB, VIRN offers services, resources, and promotes healthy and independent skill sets. However, VIRN has a more individualized focus. VIRN states, "We are proud to focus on the needs of each individual person. We do not expect people who are vision impaired to change who they are by making it necessary for them to fit into a preconceived idea of what they are to be."[11]

These individual ideas were explained further by Doris Koop, the Executive Director of VIRN. Doris Koop explained to me that VIRN works very hands on with people. By using mentors as key educational tools, users learn that they still 'can' through first-hand experiences. VIRN's individualized program enables people who have recently been diagnosed with a visual impairment to learn that they still have the ability to continue living how they used to with a few adaptations.[12]

An example of a task that many people partake in on a daily basis is transportation. When a user begins to lose their vision, their driver's license is revoked. Therefore they may have to depend on handy-transit, which means they must follow handy-transit's time schedule rather than their own. A mobility hub is an example of an interior environment that has the potential to provide users with a visual impairment similar freedoms of travel that they may have felt were taken away from them. In contrast to handy-transit, a well-designed mobility hub can provide a comfortable, safe, and independent travel solution.

Doris Koop is a visually impaired person herself, and it is her professional and personal opinion that many designers are not experts in building environments for users with vision loss. When designers attempt to provide for this demographic, they generally work around the idea that tactile cues are the only way for visually impaired users to access information.[13]

1. logical
2. simplistic
3. seamless

However, Doris Koop noted several times that people with a visual impairment do not want to hang onto a wall or touch everything in a public space, just as others do not want to touch public surfaces unnecessarily.[14] VIRN has attempted to simplify design strategies into three characteristics that designers can use to benefit the visually impaired community: logical, simplistic, and seamless design. Logical design starts at the planning stage of a design and

includes the flow of how people use the space and consistency in layout. Simplistic design refers to maximizing on multiple design strategies for varied users without creating an overload of information, which can cause user confusion. Lastly, seamless design does not stick out as an "add-on" for someone with a disability; instead, it is integrated into the overall design and design concept.[15]

Doris Koop educated me on navigating a built environment the same way that she educates people with vision loss. She explained key factors and navigational processes that VIRN teaches users about public spaces and transit facilities. However, since I am not visually impaired, there were limitations in this process. For example, Doris Koop could only explain typical strategies used by others instead of user specific strategies that may vary from person to person.

The first navigational process is research: research on the building, how to get to the building, where a user will be entering the building, and where the user wants to go.[16] This step requires collaborative work with digital and available website resources for users. As of April 1, 2012, the *Intercity Bus Code of Conduct* states that websites for transit services and infrastructure must be accessible to people with disabilities and include information about schedules and terminals.[17] Therefore, if there is not enough online information, it is important to provide this information, using different methods of communication, at all entrances. For example, information could be provided through audible maps, tactile maps, or with a person available to answer questions. Providing ways for users to navigate on their own is an important piece in enabling a sense of independence. As Doris Koop noted, many visually impaired users do not necessarily want to draw attention to themselves nor do they always want assistance that people sometimes voluntarily offer.[18]

The second navigational cue is symbols.[19] Many vision impaired users want to know where the facilities are that they may need in an emergency situation. In the case of a mobility hub, users need to know where to purchase tickets and where information and maps are located. These symbols need to be easily identifiable and accessible. Using contrast is one way to highlight these symbols. As Doris Koop pointed out, the eye is directed towards contrast, and with the majority of the visually impaired community having some level of vision, contrast is an excellent way of providing informational cues.[20] By providing a variety of was to access these symbols, such as tactile, audible and so forth, gives the greatest probability

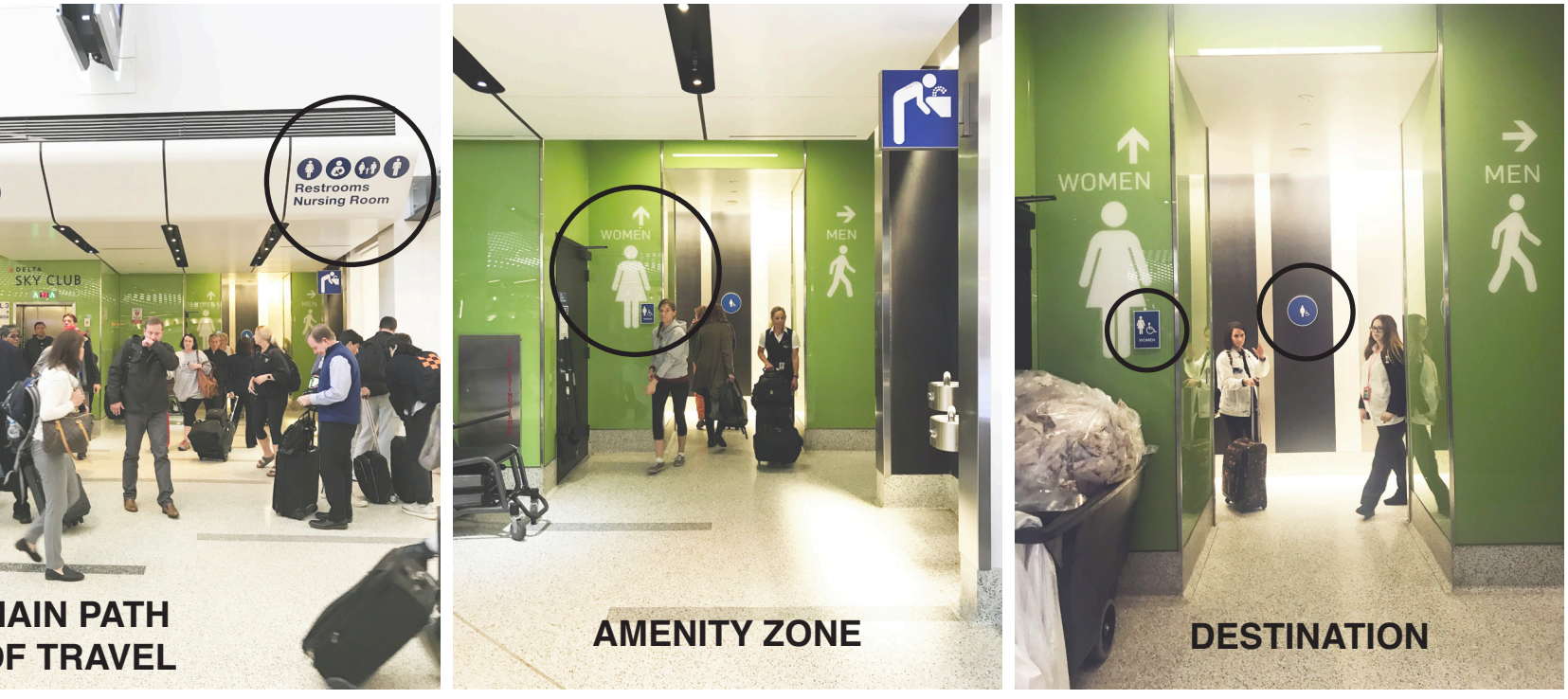



Figure 9: Signage levels at LAX Airport

of the symbol being recognized by different users.[21] As seen in Figure 9 above of an example of successful washroom signage in LAX Airport. Symbols on the floor and wall could include contrast and tactile features to enable those with low vision and complete blindness to access the cues.

Both CNIB and VIRN are excellent resource centers for people with vision loss. These centers offer different types of support, education, and resources that promote independent lifestyles for people with a visual impairment. Both organizations are striving to promote accessible design and not only educate the visually impaired community, but also the public on what visual impairment is and how these users have different skill sets that they excel at, just as everyone else is better at things over others. Designers need to provide appropriate interior design strategies and cues to allow for these unique skill sets to be utilized.

## Mobility

This section focuses on standard ways that visually impaired users navigate space. CNIB

defines mobility as the ability to move about or navigate a space from point A to point B.[22] Mobility can be categorized into three methods: (1) independent travel, relying on residual sight, or using a mobility aid; (2) combining residual sight with a mobility aid; and (3) travelling with a sighted escort.[23] Residual sight is defined as the usable vision that some people with vision loss still have.[24] All of these methods need to be thought of when designing a space because each utilize a specific distance of clear space, as shown in Figure 10.

For example, two of the most common forms of mobility aids are white canes and guide dogs. A long cane requires 750 mm of clear space, and a guide dog requires 1200 mm of clear space.[25] The third most common mobility aid is an electronic travel aid, which uses wave technology to detect objects and incorporates GPS technology to announce street names and building locations. I chose not to focus a great deal of attention on electronic travel aids because each user could be using a different product based on personal preference.

Therefore, my research focuses on understanding how long canes and guide dogs are used. White canes enable users to detect objects in their line of travel below 680 mm by tapping their

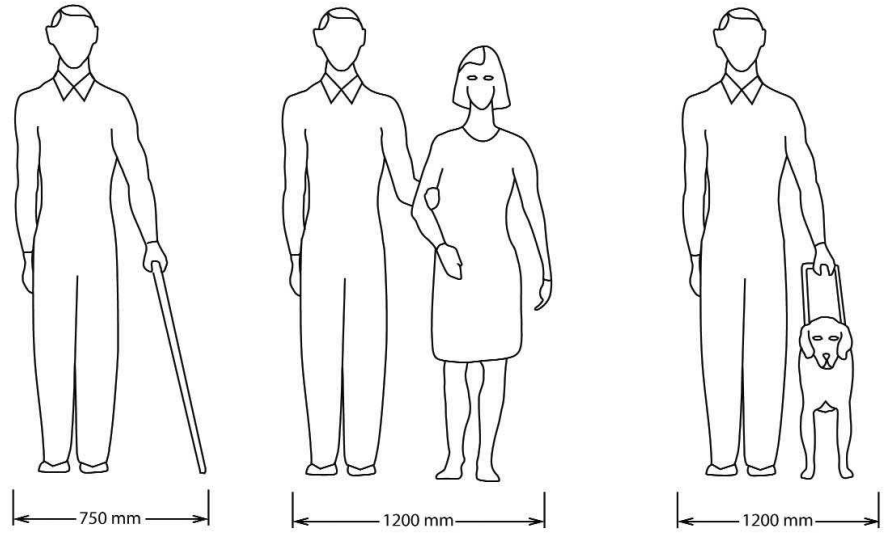



Figure 10: Mobility options availabe for visual impaired users.

cane on the ground from left to right in a wide arc, which is known as the "touch technique."[26] If objects protrude above this height, such as a water fountain, they will not be "cane-detectable." Therefore, the object needs to be properly identifiable at or near ground level to make them "cane-detectable." This could be achieved through textured flooring to note to users that they are approaching a hazard.[27] The "touch technique" can also provide the user with acoustic information about the space, such as room size, or the location of objects through echolocation.

For users who do not wish to use a white cane as their primary mobility aid, they could use a guide

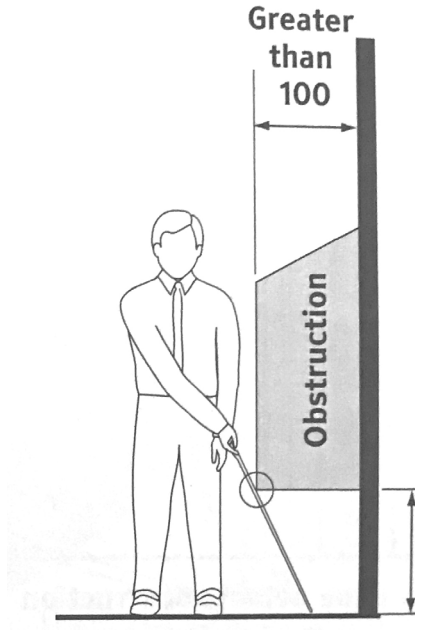



Figure 11: Limits of protruding objects

dog. A common misconception about guide dogs is that the dogs are guiding the handlers; however, the handler is actually the one who is always in charge of where they are going.[28] Guide dogs work in partnership with their handlers to react to obstacles, stop at elevation changes, and move around obstacles to aid the handler in getting to their destination safely.[29] When designing a public space, it is important to be conscious of the needs of guide dogs and their users. For example, animal relief areas and flexible seating and walking options that enable dogs and handlers to move around comfortably should be provided.[30]

Ease of mobility is an essential part in creating a positive environment for people to use. Since white canes and guide dogs are two of the most common mobility aids, design details need to consider how these aids are used to create a safe and more effective space.

## Communication

People with visual impairments learn to communicate and gather information through a variety of platforms. In this practicum, I focus on Braille, print, and audio to help understand signage requirements for the mobility hub design.

Braille is a writing system of tactile groupings of cells, or raised dots, that are felt with the user's fingertips. The groupings of cells represent the standard text alphabet and are used in two different ways. The first way is called integral, which is the standard Braille alphabet with no abbreviations or contractions. The second way is called abridged, which is used to increase the speed at which one can read by using contracting words. Developed in 1829 by Louis Braille, this technology has been around for almost 200 years and has been virtually unaltered, proving it is a successful method of communication for

visually impaired people.[31] However, there are users that are unable to read Braille. For example, some people are unable to read Braille because of decreased sensitivity in their fingertips resulting from diabetes.[32] Therefore, it is important to provide different options of communication, such as audio options. With new, advanced technology coming out yearly, there is more opportunity to incorporate levels of informative signage in mobility hubs that use Braille and audio as well as large format print for people with residual sight.

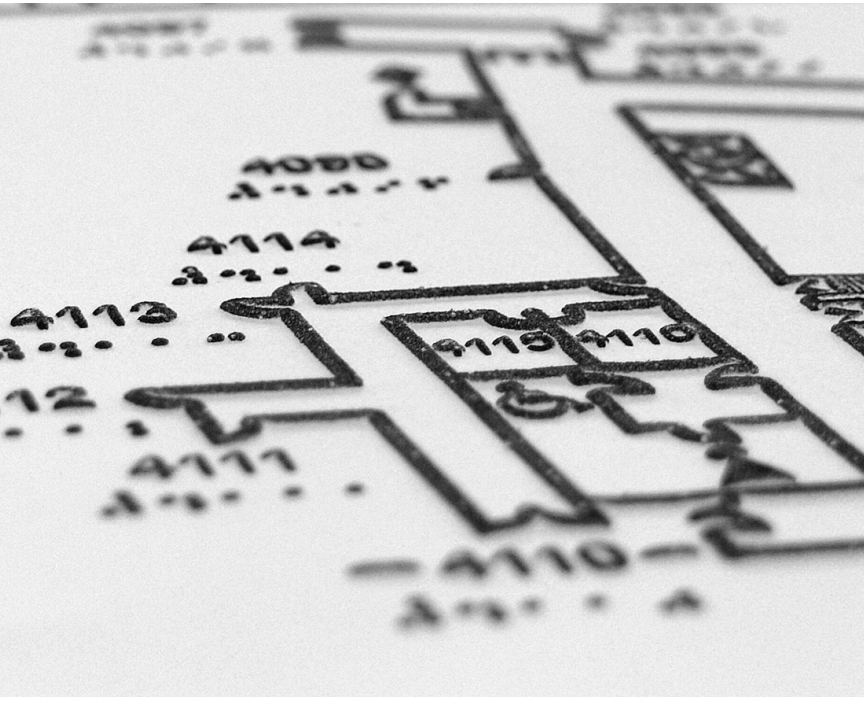



Figure 12: Example of a tactile map.

**Summary**

Since the type of vision loss varies from user to user, there is not a single or right way of navigating. Choices and preferences are personal and based on a user's ability and comfort. Good design is defined differently from person to person and from ability to ability. The most important thing to introduce into a design is options. Options may include variety in how to communicate, how to read, and mobility, which can all be used for varying navigational processes.

## 2.3 Existing Canadian Standards, Codes, and Resources for Accessible Design

**Purpose of Research**

This section focuses on established research that is used on projects regarding built environments in Manitoba. The sources used include:

- *2015 City of Winnipeg, Accessibility Design Standards, Third Edition*
- *CAN/CSA B651-04 Accessible Design for the Built Environment* *The 2004 version of CAN/CSA B651-04 was utilized for this practicum, however there is an updated 2012 version of this document that is available for use.

- *Intercity Bus Code of Practice* (and corresponding *Guide to Accessibility for Intercity Bus Services*)

- "Clearing our Path: Recommendations on how to make public places accessible to people who are blind, visually impaired and deaf blind"

These resources support in identifying the needs of visually impaired users in the built environment, and some resources pay specific attention to the needs of these users when inside a transportation facility. Although these sources address accessibility for all people, only concepts and recommendations regarding helping users with visual impairment to navigate a mobility hub are focused on in this practicum. These resources promote positive design intentions and solutions; however, there are notable limitations that standards and codes present in regard to accessible design. The *National Building Code of Canada* (which I did not directly source because many of the sources mentioned above refer to it) is considered the minimum requirement for building design but does not provide accessibility, therefore it should be supplemented with standards such as the *2015 City of Winnipeg Accessibility Design Standards* which are informative strategies for design solutions but unfortunately are not regulated in terms of final execution. The only code that trumps all design decisions is the Human Rights Legislation, which deals with all types of discrimination, including ability. Access to any and all services—by everyone—is the most important aspect of creative design and providing options derived from different streams of research is a step towards this goal. Therefore, this practicum uses existing standards, literary research, sensorial investigations, and educational research from a primary source to determine navigation solutions inside a mobility hub.

## Universal Design Principles

To reiterate, I am not focusing my research on universal design because I am only focusing on a small demographic of users. However, I believe it is important to incorporate the seven universal design principles into my research and apply them to aid the development of design strategies for visually impaired users.

The seven principles of universal design, as described and developed by the Center for Universal Design, are as follows:[33]

1. PRINCIPLE ONE:
Equitable Use The design is useful and marketable to people with diverse abilities.

*Guidelines:*
1a. Provide the same means of use for all users: identical whenever possible; equivalent when not.
1b. Avoid segregating or stigmatizing any users.
1c. Provisions for privacy, security, and safety should be equally available to all users.
1d. Make the design appealing to all users.

2. PRINCIPLE TWO:
Flexibility in Use The design accommodates a wide range of individual preferences and abilities.

*Guidelines:*
2a. Provide choice in methods of use.
2b. Accommodate right- or left-handed access and use.
2c. Facilitate the user's accuracy and precision.
2d. Provide adaptability to the user's pace.

3. PRINCIPLE THREE:
Simple and Intuitive Use Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

*Guidelines:*
3a. Eliminate unnecessary complexity.
3b. Be consistent with user expectations and intuition.
3c. Accommodate a wide range of literacy and language skills.
3d. Arrange information consistent with its importance.
3e. Provide effective prompting and feedback during and after task completion.

4. PRINCIPLE FOUR:
Perceptible Information The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

*Guidelines:*
4a. Use different modes (pictorial, verbal, tactile) for redundant presentation of essential information.
4b. Provide adequate contrast between essential information and its surroundings.
4c. Maximize "legibility" of essential information.
4d. Differentiate elements in ways that can be described (i.e., make it easy to give instructions or directions).
4e. Provide compatibility with a variety of

techniques or devices used by people with sensory limitations.

5. PRINCIPLE FIVE:
Tolerance for Error The design minimizes hazards and the adverse consequences of accidental or unintended actions.

*Guidelines:*
5a. Arrange elements to minimize hazards and errors: most used elements, most accessible; hazardous elements eliminated, isolated, or shielded.
5b. Provide warnings of hazards and errors.
5c. Provide fail safe features.
5d. Discourage unconscious action in tasks that require vigilance.

6. PRINCIPLE SIX:
Low Physical Effort The design can be used efficiently and comfortably and with a minimum of fatigue.

*Guidelines:*
6a. Allow user to maintain a neutral body position.
6b. Use reasonable operating forces.
6c. Minimize repetitive actions.
6d. Minimize sustained physical effort.

7. PRINCIPLE SEVEN:
Size and Space for Approach and Use Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.

*Guidelines:*
7a. Provide a clear line of sight to important elements for any seated or standing user.
7b. Make reach to all components comfortable for any seated or standing user.
7c. Accommodate variations in hand and grip size.
7d. Provide adequate space for the use of assistive devices or personal assistance.

## Navigating Transit Design

The following section uses information and research from the sources mentioned earlier to establish a set of guidelines required for each step of use in a transportation facility. These steps are broken down into entry, terminal navigation, waiting and rest areas, and exiting. Notably, because many strategies and standards presented

throughout the sources are recommendations for the whole built environment, there may be some overlap and repetition between "uses." If this is the case, it will be noted if a concept or strategy mentioned previously could also be used for the current "use" being talked about. For example, required clear space in ticket purchase areas could be referred to again for required clear space in rest areas and will be discussed accordingly per section.

It will be noted that any specific design guidelines and details within the final design proposal will be based upon the *2015 City of Winnipeg, Accessibility Design Standards, Third Edition.*

- **Entry and Exiting**

The entrance is the first point of access into a space and requires a means of access to information and assistance for passengers on arrival. Any sensory information located in the building entrance has the ability to explain the organization of the space and help with wayfinding.[34] Within Transportation Canada's *Intercity Bus Code of Practice*, it is mentioned that providing tools for navigation at the terminal's entrance helps provide users with key orientation information to help them navigate the building.[35] These navigational tools could include tactile signs, ticket counters, overhead contrasting signs, or tactile ground surface indicators. Tactile signage and maps should be placed at eye level (which is 1500 mm at center), above the finished floor surface, and to the right of any door.[36] Having signage at every entrance like this provides consistency to users trying to find signage locations.[37] The signs' tactile elements need to be raised 0.8 mm and be between 16 to 50 mm in height.[38] All signs accessible to touch need to not only include tactile qualities, but also include visual elements using contrast and text. The font should be a sans serif font, and the scale should be directly related to where the signage is intended to be read from.[39] Table 1 shows how high the character height should be in relation to the viewing distance.[40] Incorporating proper colour contrast, which ideally is 70% contrast between two colours, improves signage visibility and can provide consistent colour cues, making the signs easier to detect and understand.[41]

Contrast in signage is important, and it is equally important to provide levels of contrast in the flooring to differentiate floors from walls and delineate boundaries between spaces.[42] Flooring needs to be stable, slip resistant, produce minimal glare, and not be heavily patterned.[43] The flooring can be designed in strategic layouts to provide a logical, tactile guidance system

| Minimum character height, mm | Maximum viewing distance, mm |
|---|---|
| 25 | 750 |
| 50 | 1500 |
| 75 | 2250 |
| 100 | 3000 |
| 150 | 4500 |
| 200 | 6000 |
| 250 | 7500 |
| 300 | 9000 |

Table 1: Character height relative to viewing distance

that enables people with vision loss to find other communications systems, such as reception desks and tactile maps.[44] These paths should be linear and turn at 90 degrees where possible, as this type of layout is easier to memorize.[45] The actual passageway into the building is important when considering accessibility design standards. As noted in "Clearing our Path," it is important for all exterior doors to be easily identifiable by contrasting the door and frame to their immediate surroundings[46] and by providing visual cues that run the entire length of the door. These cues need to be located at eye level, 1500 mm above the finished floor, and at 1000mm above the finished floor.[47] If possible, a final cue should be located at 150 mm above the finished floor.[48] If doors are provided in a series, which is the case for all the exterior doors in Union Station, the vestibule should be a minimum of 1500 mm plus the width of the door swing.[49] The clear width of doorways need to be a minimum of 920 mm to account for the use of various mobility devices.[50] The use of double doors with center posts should be avoided because this door style can be problematic for handlers and guide dogs.[51] The preferred choice to is to use automatic, sliding doors because they do not require guardrails for doors opening into the path of travel, as seen in Figure 13.[52]

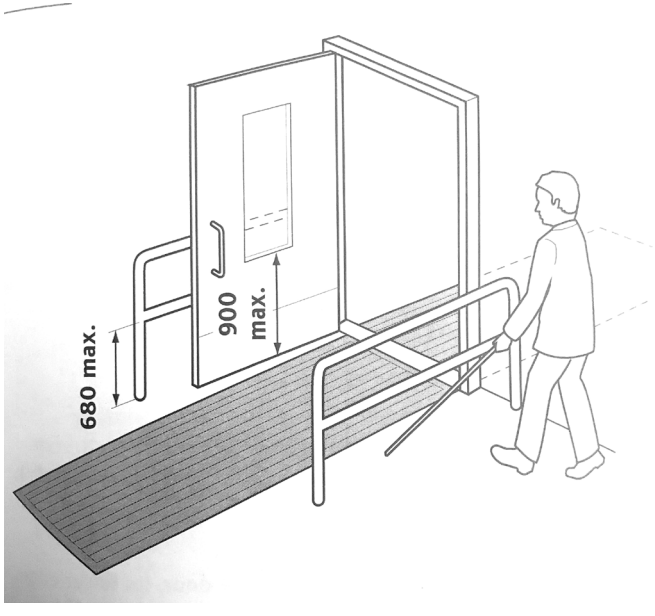



Figure 13: Guards at out-swinging power-assisted door

Once in the mobility hub, the next logical step for users would be to purchase tickets or find other information about routes, amenities in the building, and so forth. Information and communication markers, as noted above, should be locatable using textural contrasts in floor material that lead users toward information elements, such as a building directory.[53] Maps of the building should be placed at all entrances at 1500 above the finished floor and be located where a user can approach them within 100 mm.[54] Maps should include all signage characteristics previously mentioned, and principle paths of travel to features and services should be provided on the floor plan directory as well.[55]

Ticket machines and information desks need to be located adjacent to the principle routes.[56] These elements should be contrasted in colour to their immediate surroundings to help them stand out as important elements within the space.[57] Automated dispensing machines and information kiosks allow users with a visual impairment to purchase tickets and find information individually and at their own pace.[58] However, these machines need to be designed so that the tallest point of use is 1200 mm above the finished floor to enable access for users in wheelchairs, as seen in Figure 14.[59] Providing enough clear space in front of any communication element is critical so that the person reading or using a machine is not standing within the path of travel.[60]

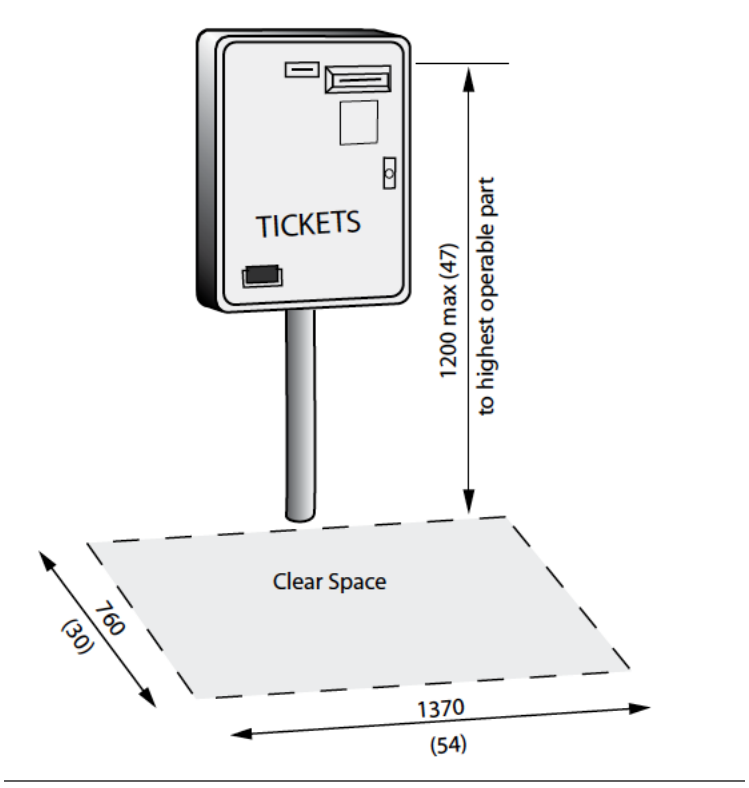



Figure 14: Ticket Dispensing Machine

- **Waiting and Rest Areas**

Waiting and rest areas are a required amenity in a mobility hub. Usually, any type of transportation terminal has areas of rest and refuge from the busyness. The location of seating areas can vary depending on use in a mobility hub. However, some seating should always be located within direct viewing distance to information screens that include up-to-date information about important activities, such as bus schedules and potential delays.[61] As well, seating should be dispersed throughout the terminal for people with disabilities and seniors to use. This is because these users may not be able to navigate the terminal at the same pace as others and can get mentally and physically exhausted. Therefore, providing seating options adjacent to main paths of travel and throughout corridors would be helpful for these users.[62] When approaching seating, a clear area needs to be provided that measures 920 mm by 1200 mm beside at least one seat to accommodate wheelchairs and guide dogs.[63] Physical characteristics are also important for someone with a visual impairment to be able to detect the seat. For example, providing a range of seating that includes benches, seats with and without backs, and seats with and without armrests can make it easier for seating to be detected and increase accessibility.[64] For instance, armrests can be used as a cue through touch to signal to a user the location of the seat. Additionally, no armrests can help accommodate larger passengers, while the incorporation of armrests may better serve someone who needs to push themselves up from a seat.[65] Seats need to have a seat height of 400-500 mm above the finished floor[66] and be detectable by white cane users at floor level.[67] Furthermore, seating needs to be differentiated from the floors and walls through the use colour and texture contrast techniques.[68]

Depending on the programmatic activities in a waiting area, using carpet or carpet tiles can be beneficial. Carpeting must have a low, firm level pile, be securely fastened to the ground, have a combined carpet height of no more than 13 mm, and include an edge trim.[69] This can help with acoustics in a space and provide a textural contrast to the paths of travel. The seating areas should not be placed in the path of travel. There should be at least a 1200 mm wide path of travel that is not obstructed by seating to provide room for handlers with guide dogs, white cane users, and users travelling with a sighted escort.[70]

- **Terminal Navigation**

Navigation throughout the terminal needs to be clear, logical, and safe and provide necessary information to locate all the amenities and facilities within the large space. As mentioned in the entry section, tactile walking surfaces can provide a level of guidance from the first point of access to the first informative communication tool. This strategy needs to be utilized throughout the whole building. This is known as detectable warning surfaces, or tactile attention indicators, which are standardized walking surfaces that convey information to people with vision loss through textural characteristics.[71] There are two types of tactile warning surface indicators (TWSI). The first type is attention TWSI, and they call

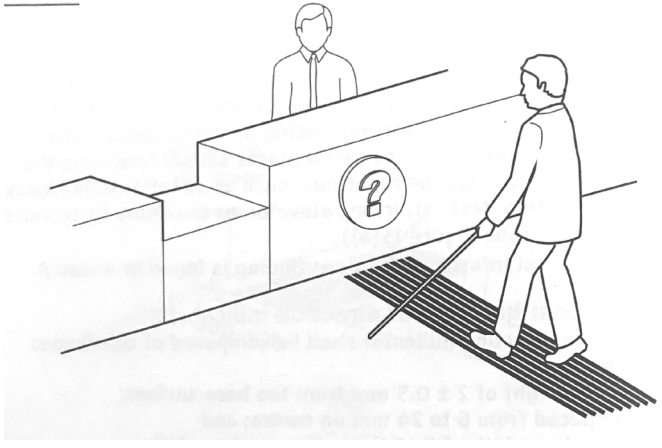


Figure 15: Detectable Direction Indicator Surface

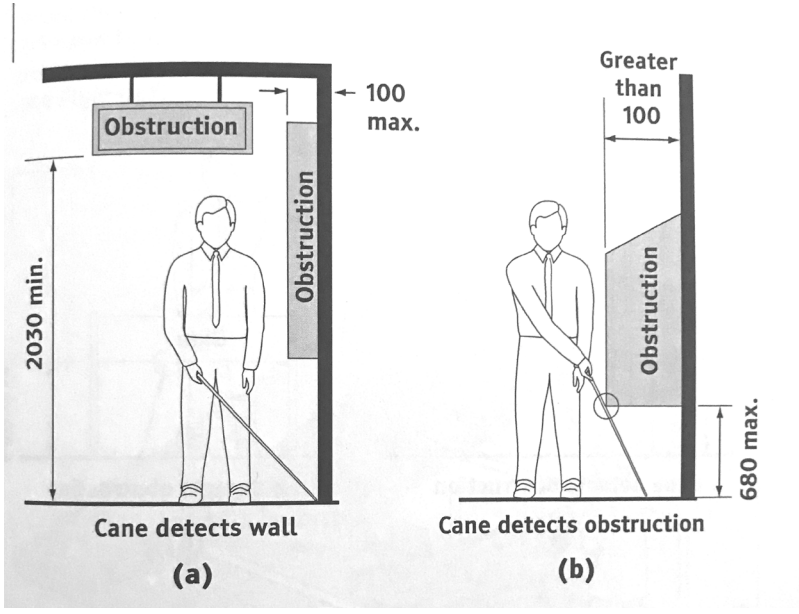



Figure 16: Limits of Protruding Objects

attention to key hazards, such as stairs, a level change, or a protrusion from a vertical surface.[72] The second type is guidance TWSI, which provide information about the direction of travel, as seen in Figure 15.[73] TWSIs should be used to help a person understand direction, indicate when a person should stop, and warn a person that caution should be taken.[74] For example, protrusion hazards are sometimes unavoidable in public spaces and cannot be recessed, as seen in Figure 16. Signs and objects that are mounted on any vertical surface within a pedestrian area should

not protrude more than 100 mm unless they are cane-detectable at or below 680 mm from the finished floor.[75] A clear floor space is necessary for ease of mobility for users using a manual wheelchair. The clear space should be at least 750 by 1200 mm in a stationary position, and 1500 by 1500 mm when a U-turn is in order.[76] Additionally, the minimum corridor width to allow people to comfortably pass with a guide dog or a sighted escort is 1500 mm, as seen in Figure 17.[77]

Large open areas can be difficult for a person with vision loss to navigate; therefore, the ability to locate intersections between primary paths of travel can help orient users to decision-making points.[78] These paths can also be supplemented with handrails that aid in establishing the feeling of safety. Handrails, as seen in Figure 18, need to be graspable and enable a comfortable grip to slide the user's hand along without any obstruction.[79] A circular design that is no more than 40 mm is stated to be the preferred shape.[80]

The final component that will be discussed in terms of successful terminal navigation is information sources. These sources can come in a wide range of strategies. For example, information sources could include tactile signage, signage noticed at a distance through colour contrast, and audible information. Public

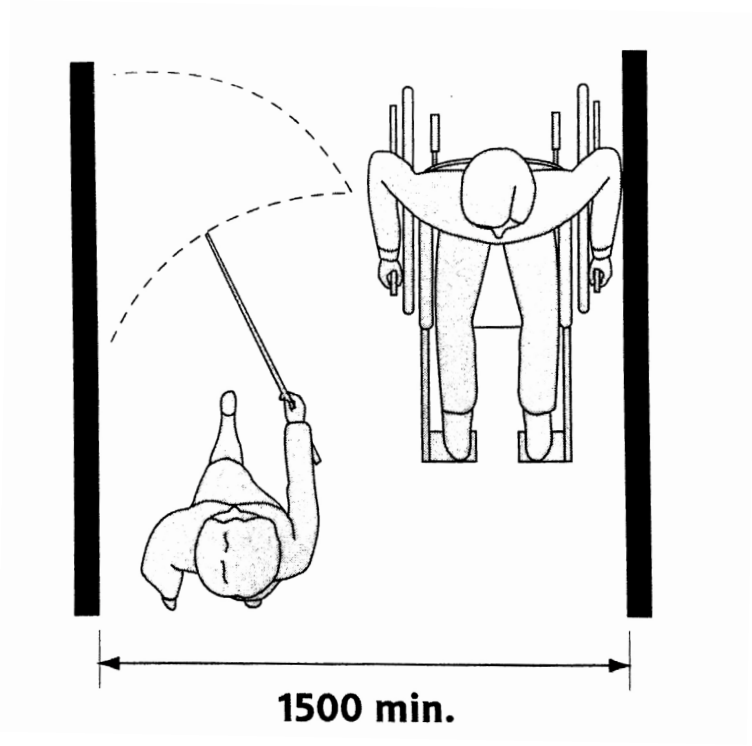



Figure 17: Width of Interior Accessible Route

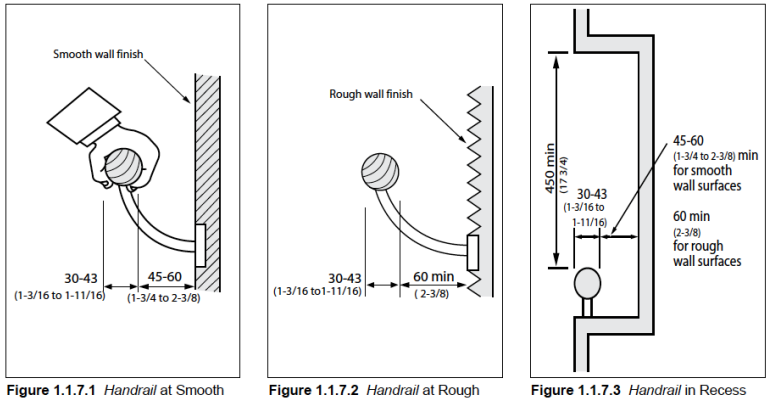



**Figure 1.1.7.1** *Handrail* at Smooth Wall

**Figure 1.1.7.2** *Handrail* at Rough Wall

**Figure 1.1.7.3** *Handrail* in Recess

Figure 18: Handrail at Varying Wall Conditions

announcements are important to provide both audio and visual formats that state departure delays, gate assignments, or schedule and connection changes.[81] This information should be placed at eye level and use strong colour contrast. Furthermore, no scrolling or flashing functions should be used, as these can cause confusion for many users, and glare should also be avoided.[82] Placing signage at eye level allows users to approach the signage at close range and touch the sign for tactile cues in a comfortable manner.[83] Signage needs to be located at key decision-making points, both at eyelevel and overhead, so that people with residual sight can use them as visual markers of intersections.[84]

**Summary**

This section briefly outlined key design strategies included throughout four important resources on accessible design in built environments and transportation terminals. These resources only scraped the surface of suggested strategies and standards that are available to designers to help provide safe environments to people with visual impairments.

## 2.4 Conclusion

In conclusion, there is no single document or resource that can be considered the definitive standard for successful design for visual impairment. Similarly, there is no single strategy that provides the perfect accessibility to information because every person with a visual impairment has a different experience. Therefore, utilizing ideas, concepts, and strategies from different resources is important to provide options of use for all users. The use of existing standards provides a level of design consistency that can help users locate signage or understand tactile warning surface indicators. Providing better communication systems that include visual and non-visual sensory elements can help everyone navigate a mobility hub. This can be accomplished through simple, strategic design strategies, such as varying material selection, colour contrast, cue consistency, redundancy, and the incorporation of information options. Information options could be accessed through the touch of a hand or the feel of a white cane, through audible public announcements, or individual information kiosks. Layers of strategies and standards that point to the same information sources can help a variety of users with varying visual impairments comfortably and safely navigate a mobility hub. Table 2 shows a further analysis of key spatial design considerations.

| Resource | Summary | Spatial Implications |
|---|---|---|
| Types of Vision Loss | • There are many types of visual impairment, so design needs to incorporate a variety of options of communicating the same information | 1. Redundancy in cues<br>2. Landmarks at key decision making points and intersections. |
| Educating Someone to Navigate in Transit | • Visual impaired users tend to research buildings before they go<br>• Symbols noting important route information and amentities are the first cues that users look for in case of emergency | 1. Highlight amenity areas through consistent use of colour and texture to create amenity zones that are easily decipherable<br>2. Design simple, linear and legible floor plans |
| Mobility | • There are a variety of ways that someone who is visually impaired<br>• can choose to help them navigate Design needs to incorporate spatial strategies and dimensions that relate to these mobility aids | 1. Tactile strips that are 1200 mm in diameter so that all mobility aids can comfortably walk along them<br>2. Textural differences in flooring to delineate between spaces and create detectable routes |
| Communication | • People with a visual impairment learn to gather information that suites their abilities<br>• Information needs to be provided in a variety of forms - tactile, audible, large print, etc. | 1. Information at different heights, scales, tactile, audible<br>2. Communication strategies that are accessible through other senses, such as sound, smell and touch |
| Existing Standards | • Standards help in consistency in location of design elements<br>• Standards are a good resource for designers to use to help make a space more accessible | 1. Consistent landmarks<br>2. Place signage in the same location, at the same height<br>3. Design standards as noted in section |

Table 2: Visual Impairment and spatial considerations

# 3[three]
# LITERATURE REVIEW

## 3.1 Chapter Introduction

This theoretical investigation is one of four lenses used to help develop and inform design strategies and solutions regarding the redesign of Winnipeg's Union Station as a mobility hub. The following chapter addresses theories chosen to support my initial goals and concepts regarding independence, design for visual impairment and accessibility. As seen in the theoretical framework diagram on the following page, the two theoretical concepts of narratology and perception help in the creation of a layered, dynamic, and multi-sensory space. Users with different degrees of vision loss receive aid, through varying levels of support, to successfully navigate the mobility hub at their own pace. The sub-theories explored include sensorial design, adaptive reuse, orientation, and wayfinding, which assist in the creation of a cohesive dialogue between the user and built environment through the existing structure.

## 3.2 Theoretical Framework

The Theoretical Framework diagram located on the next page, graphically explains how the theories chosen for this practicum help in determining design strategies, as well as an architectural language that will be used towards the proposed design of a mobility hub.

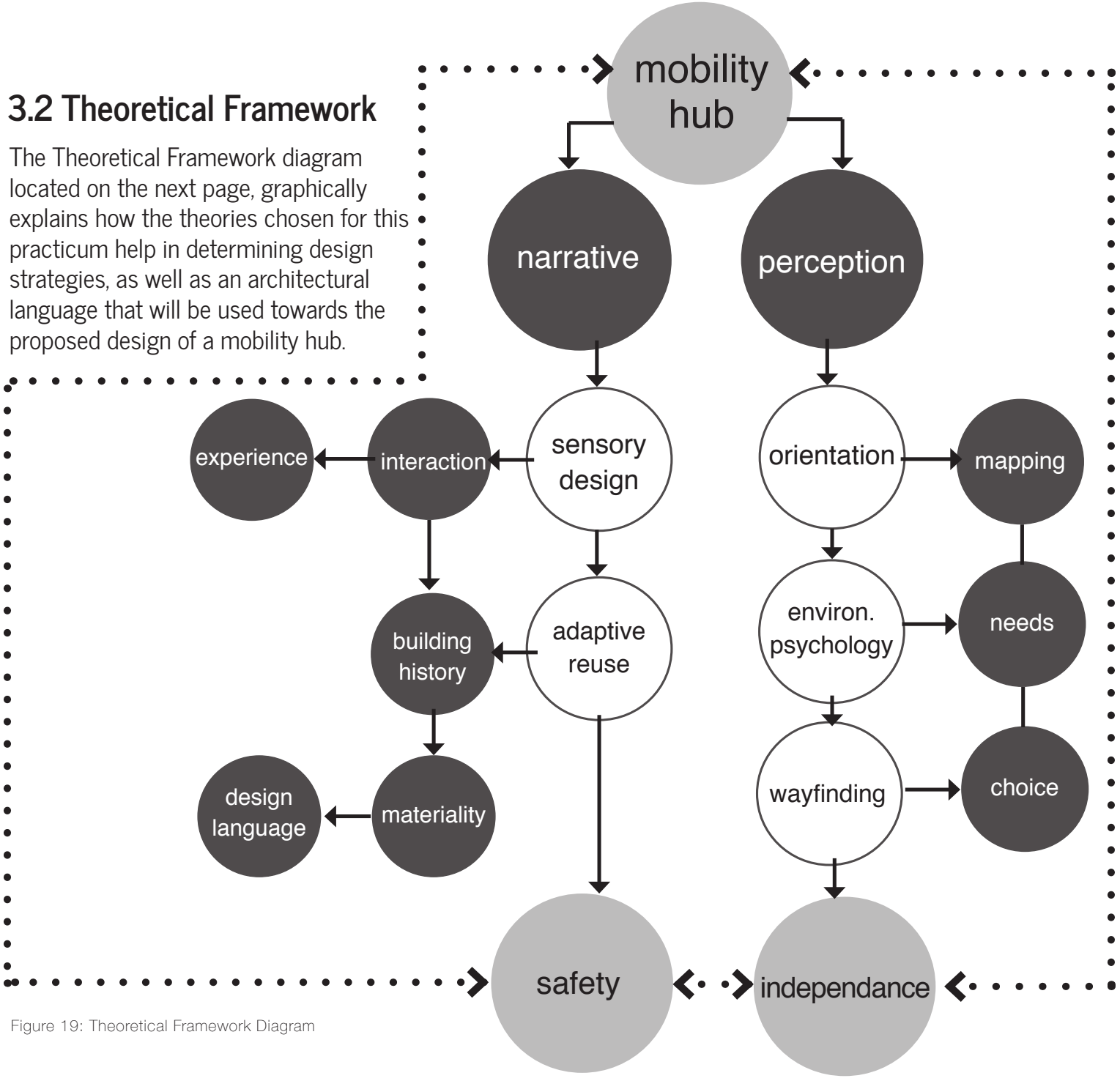



Figure 19: Theoretical Framework Diagram

## 3.3 Narrative

Narratology uses historical elements and user interaction of the existing space to inform new, context specific design solutions. Narratology offers design solutions that are suitable to the historic preservation demands of adaptive reuse, while also enabling creative and innovative design solutions. The theory of narratology is important for this practicum because it is crucial to understand that not everyone interprets things in the same way. There can be a variety of versions, different hierarchal components, and perceptual alterations that distort any given story or narrative from one user to the next.

Narratology has a vast number of definitions and applications that have been developed by a number of different theorists throughout the years. In 1969, Tzevetan Todorov, a Franco-Bulgarian philosopher, coined the term narratology and defined it as "the study of the narrative."[1] However, throughout the 1970s, the term was popularized by structuralism critics and theorists. Mieke Bal, a Dutch cultural theorist and critic, defined narratology as "the theory of narratives, narrative texts, images, spectacles, events; cultural artifacts that 'tell a story.'"[2] In this practicum, the term narrative will convey a meaning related through a particular medium or combination of mediums, such as imagery, building, material, and functions.[3]

The most recent definition of narratology comes from Susan Onega and Jose Garcia Land. Writing in 1996, they explain narratology as the semiotic representation of a series of events.[4] This definition, along with some of Bal's ideologies of the theory, expand upon the application of narrative to literature and open up possibilities of narrative in a variety of sectors,[5] such as adaptive reuse, interior design, and the interaction and exploration of user and environment.

Strong design is created from the inside out and applies knowledge from the intimate interactions of the users, which many people, designers, and architects take for granted. In the built environment, narrative is used to explore the stories of the users and the history of the building to inform new, site-specific relationships that create layers of information between the built environment and user.

The following two theories—sensory architecture and adaptive reuse—help support the connection between body and architecture by exploring the past and present history of memory and place.

## Sensory Architecture

The narrative of a building can relate to how a building 'speaks' to its users. Juhani Pallasmaa, a Finnish architect and author, states that "a constant exchange and dialogue between the body and space creates a complex network of paths and intersections between the physical world and the human body."[6] Pallasmaa's theories discuss the material components of architecture and how their sensorial characteristics can change the users' perception and experience of a space. In "Architecture of the Seven Senses," Pallasmaa uses personal narrative and graphic descriptions (mainly through material emphasis) to take the reader into the interior environment being described, allowing the smaller details and history of the building to form a vivid picture or a narrative in the reader's imagination.[7] The narrative is developed by Pasllasmaa who uncovers a building's sense based qualities, developed through an understanding of historical elements of the structure, such as materials and details that seem to be untouched overtime.[8]

The history, or narrative, that the building communicates over time can be described by using the physical building as an instrument to measure and understand the passing of time and history.[9] A machine-made plastic chair, for example, has a much different narrative than a wooden chair built by the hands of a carpenter. Pallasmaa describes the quality difference between machine made and handmade through the history that the handmade piece of furniture has gone through. For instance, the smell of the wooden chair could remind us of a hike we once took in a forest—a reference to where the wood for this chair may have come from. We may touch it and feel textural qualities of rough and smooth areas, reminding us that another hand shaped and formed the sanded, rounded edges of the chair.[10] Pallasmaa observes that this type of experience has been lost in the contemporary realm of architecture: "instead of experiencing our being in the world, we behold it from outside as spectators of images projected on the surface of the retina."[11]

This understanding of multi-sensorial design is important to this practicum because many current design solutions cater to the sense of vision. For example, a study by Lisa Wastiels, Hendrik N.J. Schifferstein, Ine Wouters, and Ann Heylighen investigates the visual and tactile assessment of materials in architecture, revealing a dominance of visually inspired materials opposed to the consideration of the materials' tactile quality.[12] They refer to examples such as Jørn Utzon's Sydney Opera House and Zaha Hadid's Fire Station, which the authors believe

were conceptually designed from an aesthetic point of view.[13] Pallasmaa's theories support the argument that physical environments need to address more than just the sense of sight—they need to interact and offer a depth of experience to a variety of users and contribute to narratives that the building may host.

Carmen Papalia is a young, Vancouver-based artist who focuses on his evolution into the inquiry of the senses and perception.[14] Papalia is blind, but his work is aimed at 'seeing' the potential for reshaping and enhancing one's relationship with the world. Papalia states, "we see through our brains, not our eyes; the eye is just one of the several channels through which sensory information is passed to the brain for processing."[15] His investigations between the body and a heightened experience of the world can also be characterized as a narrative of sorts: through the absence of sight, one's ability to use their other senses to construct images is harnessed, which can then produce an understanding of one's own reality.[16] The senses provide the interface between ourselves and the world;[17] our senses are a core component of our bodies, which are more involved with the built environment than we may think.

Sensory architecture refers to design that incorporates elements and experiential opportunities for all the senses: smell, touch, sound, sight, and taste. Pallasmaa points out that sight dominates the design profession and notes that buildings and other physical environments are designed to look good rather than feel good: "instead of an existentially grounded plastic and spatial experience, architecture has adopted the psychological strategy of advertising and instant persuasion; buildings have turned into image products detached from existential depth and sincerity."[18] With the majority of buildings designed with only visual qualities in mind, it can be difficult to consider how a complete sensorial experience could be developed to have a meaningful impact on the user. One reference is Harry Harlow's 1958 study regarding the effects of tactile stimulation:[19]

> In 1958, Harry Harlow famously demonstrated, in a still controversial and haunting study, that tactile stimulation can be more desirable than food. Harlow raised infant rhesus monkeys without mothers and gave them a choice between two artificial surrogate mothers. Both were constructed of wood and wire mesh. The difference was that one had a bottle of milk while the other one was covered in cloth. To most psychologists' surprise, the monkeys bonded with the cloth mother that lacked a source of nutrition. Since

> then, numerous studies from baby rodents to neonates have shown the importance of tactile stimulation.[20]

Harlow's study was one of the first to demonstrate the importance of tactile stimulation and its potential to affect a person's social behaviour, self-perception, and enjoyment of and comfort in a building's environment.[21]

To support this study in regard to interior design, Pallasmaa's theories on sensorial experience further illustrate how an interior space has the ability to develop familiarity towards a space. Pallasmaa also notes that interior space can create or recall specific memories, both positive and negative, from the past.[22] A certain scent, Pallasmaa examples, "may allow the user to re-enter a space that has been completely erased from the retinal memory."[23] This description can also be applied to other senses. For example, the smooth, cold texture of marble flooring may bring back a painful memory of falling on a similar surface and thus, your experience within the space may come with some hesitation. In contrast, if you have a positive memory of marble flooring from a past experience, your perception of the space and how you approach it may be enthusiastic and welcoming. This description of experience relates to Harlow's study by further illustrating the effects of tactile stimulation on a user's personal experience of a space.

Theorists such as Pallasmaa believe that architecture and design have become somewhat 'flat' due to the convenience of designing only for the visual sense of sight.[24] In this context, the term flat is used to describe design that is one dimensional or only catering to the sense of sight compared to multi-sensorial design. For example, materials used in contemporary architecture are designed for visual stimulation, which is a flawed design characteristic when creating equality focused environments because it eliminates an experiential quality for people without their sense of sight. In Pallasmaa's words, "In memorable experiences, space, matter and time fuse into one single dimension ... We identify ourselves with this space, this place, this moment and these dimensions become ingredients of our very existence."[25]

## Adaptive Reuse

Adaptive reuse is a strategic design process in which a full understanding of the existing building can be used to inspire the new design and function of the proposed space.[26] This strategy plays a critical role in interior design because it allows the narrative between the existing space

and the users to play a central role in the redesign of the space—from macro to micro—using the interior as a threshold between the built environment and the body.[27]

Graeme Brooker and Sally Stone's theories on adaptive reuse positively influenced interior design through the appreciation of the existing narrative of the space. They argue for the importance of adaptive reuse by focusing on the physical and historic architectural characteristics of an existing building, leading to a rich narrative specific to the past and present needs of the space. As stated by Bal, "Narratology is the theory of events and artefacts that tell a story."[28] These stories are essential when considering the redesign of an interior space because there should be no intention of erasing previous layers. Rather, the past should be incorporated to create a new, stronger image that only exists due to its careful consideration of its context.[29]

In Rereadings: Interior Architecture and the Design Principles of Remodeling Existing Buildings, Brooker and Stone outline a theoretical method in which an existing building can be transformed into a holistic design outcome that is an interpretation or adaptation of the existing space. The following describes the elements of analysis, strategy, and tactics that are part of Brooker and Stone's theoretical method, which I will be applying the theories presented towards the Union Station redesign.

1. Analysis: The analysis of the building requires an in depth reading, or rereading, of the building inclusive of the building's form, structure, history, past function, context, environment, and proposed function.[30] Brooker and Stone believe that through a reading of all these architectural components, they can offer significant conceptual opportunities. Furthermore, analysis enables appreciation and interpretation to form the basis for the redesign. Brooker and Stone contend that "a building occupies a specific place" and "has its own identity and a distinct relationship with its surroundings."[31] The reading of the original building can be accomplished through the reading of plans, elevations, and sections of the building; understanding rhythm by studying existing windows, doors, columns, etc.; and through considering the relationships between spaces. Through a successful analysis of Union Station, a narrative can develop between the old and new to create patterns, paths, and intersections that connect the past with the future.

2. Strategy: This method can be understood as the "device that will inform and order the building's overall design."[32] Although there is no right or wrong strategy to choose from, Brooker and Stone provide an outline to help understand and establish the strategic relationship between the old and new. There are three categories based on design integration between the host and new elements: intervention, insertion, and installation.[33]

> Intervention: If the original building accepts and establishes an intimate relationship with the new design, that is, the two become one.[34]
>
> Insertion: When the host building allows and accommodates new elements, which are built to fit the exact dimensions of the existing, to be introduced in or around it yet remains very much unchanged.[35]
>
> Installation: If the old and the new exist together but very little rapport between them is established.[36]

In this practicum, existing elements help dictate the placement and size of the new elements, which is categorized as the strategic method of insertion. Insertion allows the existing space and the redesign to exist harmoniously together, while also enabling the old and new elements to individually have strong, independent presences. Brooker and Stone reiterate that insertion, as its title suggests, "is the introduction of a new element into, between or beside an existing structure. The inserted object can often be seen as independent and confrontational, a single large powerful element that establishes surprising dialogues between itself and the existing structure."[37] New, independent elements can be categorized through contrasting qualities from existing elements but will be a result of characteristics analyzed and narrated by the historical building.

3. Tactics: The tactics, or details, can be seen as a manipulation of elements that support the remodelling strategy.[38] These elements can include plane, object, light, surface, opening, and movement. Tactics are crucial in the design of an environment for users with vision loss because the human scale of tactics create an intimate level of integration between user and

building. People with a visual impairment 'see' the world in a variety of ways, including through tactile elements, shade, shadow, and contrast. The manipulation of these elements can be understood as tools rather than decorative elements; therefore, they may have multiple levels of use within the overall design. Listed below are the list of elements and their assuming roles within an interior environment. (citations note entirety of definition below)

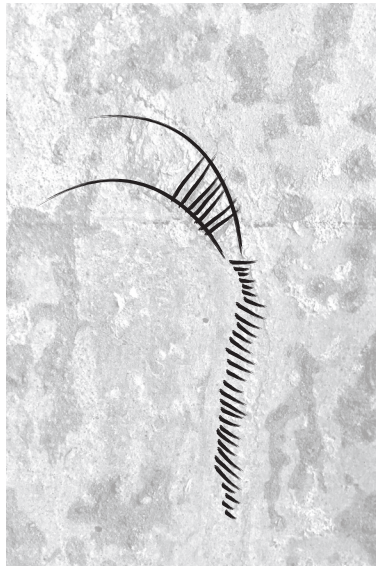
| | |
|---|---|
| Plane: | Vertical and horizontal planes define a space. It controls its visual and physical limits, directs movement, contains texture and manipulates light.[39] |
| Object: | The deployment of an object can provide focus to a space. Whether the scale of the elements is small or large its use enables movement, supplies rhythm or balance and facilitates function.[40] |
| Light: | Whether natural or artifical, light accentuates objects or spaces, suggests movement and circulation and aids the understanding of the interior of a building.[41] |
| Texture: | The specific choice of materials imparts character upon a space and establishes a direct relationship between the people who occupy the space and the building itself.[42] |
| Threshold: | The threshold marks the distinction between spaces and objects. It can indicate the next part of the journey or become a reminder of things experienced.[43] |

By applying the three methods outlined by Brooker and Stone, a narrative can be pieced together to connect the past and present, old and new, buildings and users, and materials and surface. A rereading of Union Station is included in the following section, 3.3.3 Architectural Design Concepts, as well as Chapter 6: Design Programme. This rereading from the building to the object, and from object to the user, establishes the relationships required to inform a sensorial narrative between user and space.

## Architectural Design Concepts

In interior design, narrative is the integration between varying scales of engagement to create a personal relationship between a user and space. The supportive theories of sensorial design and adaptive reuse are further explored to develop architectural design concepts to strengthen the narrative between two scales: the building and body.

First, I began to work at the building level to abstract the Union Station's existing elements, details and architectural forms. The concept sketches, seen in Figure 20, were developed in order to understand the historical geometries and patterns in the space. The sketches depict relationships between the horizontal and vertical architectural elements of the space. A rhythmic pattern of arches, columns, and entryways are uncovered. Here, many of the arches represent entrances and openings into deeper support spaces, creating dynamic thresholds through the use of ceiling heights and contrast.



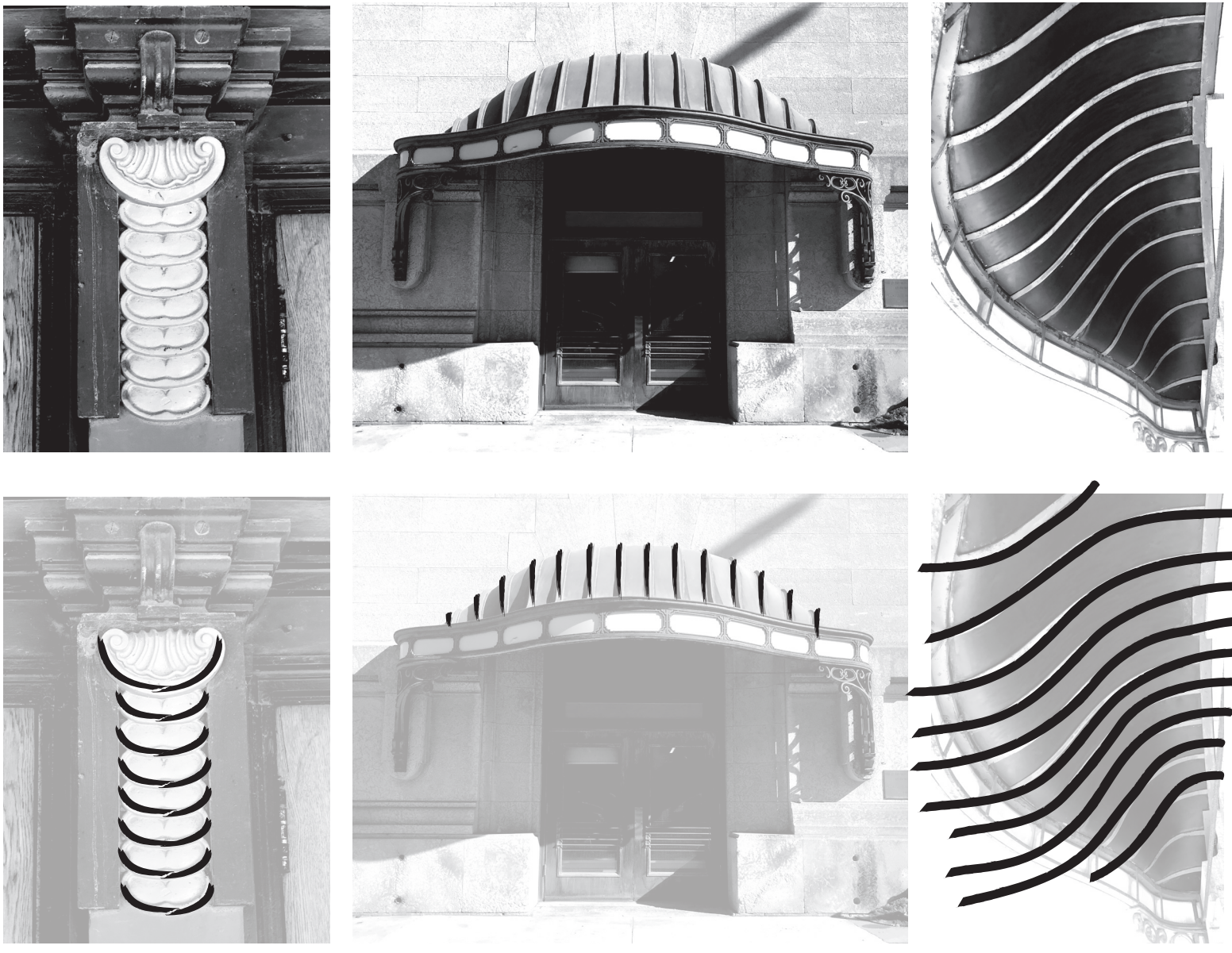
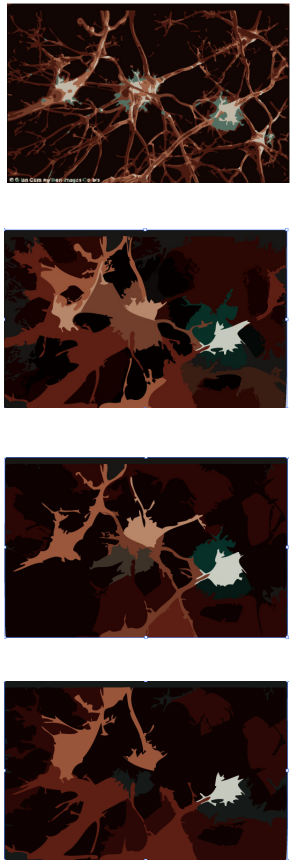


Figure 20: Architectural Language - Building

Second, the anatomy of the human body was conceptually abstracted to create organic forms, which, when combined with the contrasting historical building, develop a rich and dynamic architectural language used throughout the design. The spinal cord was the focus of the human anatomy abstraction because it is the central connector of the nervous system. The spine responds and reacts to environmental factors, creating a narrative between the body and external stimuli. Since this practicum has a focus on sensory experience, conceptual inspiration developed through graphic representations of the nervous system. The spine, a curved structure housing repetitive hubs of information are connected to a roadmap of intersections of nerves. The nerves travel through the interconnecting roadmap, leading to final destinations that creates responses through our bodies sensory engagement with the environment. Here, all the graphic studies presented of the body were explored and combined with the graphic abstracts of the existing building to create the architectural design language used throughout this final design proposal.



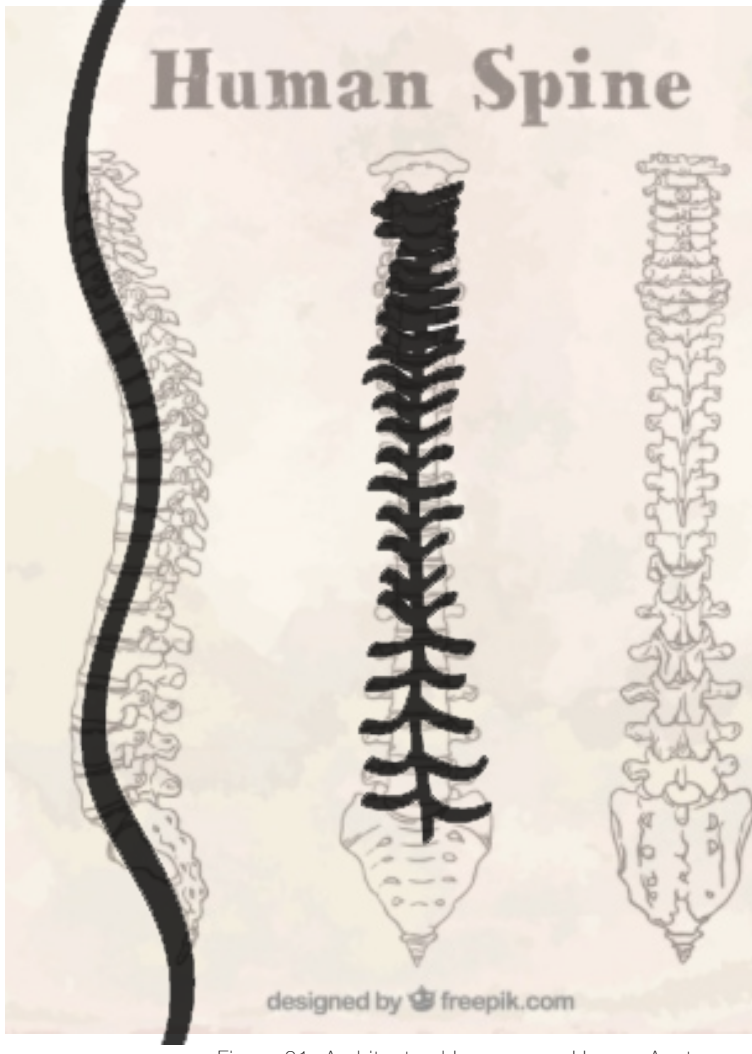



Figure 21: Architectural Language - Human Anatomy

The next section, titled "Perception Theory", builds on the concepts explored regarding narrative, sensorial design and adaptive reuse. The following theories focuses on the navigational processes required to successfully get from a starting location to a final destination.

## 3.4 Perception Theory

The second theory discussed, perception, is defined as the interplay between human beings and their surroundings, which therefore, begin to form a language that informs a user's understanding of a space.[45]

Environmental psychology is one discipline that has "recognized the importance of visual information in the process of enabling people to adapt to a wired range of environments."[46] Environmental psychology can be defined as "the interplay between human beings and their surroundings and relates to our present day perceptual habits to innate sensory mechanisms that evolved over time to enable the success of our species".[47] Environmental psychology allows architects and designers to rethink their title as "architect." Instead, these professionals can be defined as perceptual psychologists and experience designers in the lived environment.[48] The architects and designers can evaluate the surroundings using four basic filters.

1. Human instinct: we are hardwired to appreciate natural references and amenities, such as daylight, views, fresh air, natural materials, organic patterns, etc.[49]
2. Individual preferences: personality traits, having options, moods and emotional states, intellectual intrigue, individual motivations and aspirations.[50]
3. Sociocultural implications: institutional intentions, safety and security, and community benefits.[51]
4. Spatial functionality: congruence with context, activity, and purpose.[52]

Through these filters, architecture's perceptual communications can be conveyed through space, form, light, colour, object, and material.[52a] Together, these elements create a design language that informs the user's perception of a space.[53] The design solutions that users ultimately perceive are more than just buildings. Some environmental psychologists note, "architects are experience designers, brand developers, environmental psychologists; architecture is a stage for life through engagement of senses."[54]

The following two subsections, orientation and wayfinding, were chosen to support the theory of perception because both include characteristics of spatial planning that aid in the independence of someone navigating a space alone.

## Orientation

In a large, unfamiliar environment, there is information that needs to be processed before any real understanding of the space can take place. One of the most basic needs is to find one's location within a space by organizing and processing information to create an understanding of the informational cues provided. This allows a user to orientate themselves within his or her environment. Therefore, orientation can be defined as the process of determining one's location in the environment and deciding where to go next.[55] Additionally, orientation can be understood as employing three different principles:

1. General interest in relating the physical environment's design to human behavior;[56]
2. The individual's orientation needs;[57] and
3. Psychological concepts that provide insight into the mental activity involved in perceptual orientation, which also serve as a reference point in thinking about the user's orientation needs.[58]

The need to orient oneself was first explained by a Russian psychologist, Ivan Pavlov, who was the first to describe orientation as the initial reaction of an organism to a stimulus.[59] This observation came from his studies on the conditioning responses in animals. Pavlov concluded that "these types of activities and responses enable a living creature to reach its maximum potential for processing information about the environment and about any specific stimuli that triggers the general orientation responses."[60] The response can be based on a variety of physical attributes in the design.

In this practicum, the stimuli that could create an orientation response could be a variety of design strategies and architectural elements, such as texture, shape, and sound that enable the user to process information based on the environmental stimuli presented. In regards to this information, two courses of action can be taken related to the need to orient oneself.[62] Firstly, one must understand and locate themselves within the physical environment, and secondly, one must determine a course of action to be able to adjust themselves within that environment.[63] For example, a transit station can be defined in the category of a public access environment where users need to look for and understand physical features of the space in order to process where

they currently are and where they are going next.[64] Elements that a user could look for that would potentially provide orientation cues could be a ticketing kiosk or an information desk. These two elements would be considered information points and include simple, defining characteristics such as a simple plane, that may be enough information for you to process that this is where ticket transactions occur. The next step is a course of action as to where to go. Therefore, architectural elements such as openings, stairs, and doorways can be understood as transitional spaces that create cues for understanding the space and indicate where to go next.

Notably, disorientation comes with orientation. Disorientation can occur when a user is presented with an overwhelming, over stimulating environment that limits the cognitive processing of information needed to orient oneself.[65] This can be avoided through careful organization of elements and sensory cues by using architectural orientation, or wayfinding strategies, categorized into five layers: identification, direction, prohibition, information, and status.[66]

## Wayfinding

Wayfinding is about spatial problem solving. Specifically, wayfinding encompasses how users successfully navigate a space using cues provided by the designer. Good wayfinding techniques not only help people with vision loss but can also aid in a positive first experience for new visitors to a space. New visitors, whether vision impaired or not, can be thought of as being disabled through lack of knowledge,[67] when referring to a new space being explored.

In *The Image of the City*, Kevin Lynch addresses issues regarding wayfinding techniques. Lynch states that if wayfinding is done successfully (i.e. people are able to easily read and understand a place well), they will feel comfortable moving around it independently and will more likely return, which is an important characteristic for a mobility hub.[68]

This is especially important for individuals with a vision impairment because wayfinding has the potential to reduce isolation and aid in social integration.[69] "Cueing" is a strategy that incorporates elements of a design that are then used as prompts, which assists users in orientating themselves in a space, finding their destination, and identifying their location.[70]

However, how can someone with a visual impairment gain the same amount of knowledge about a space when the most commonly used form of cueing is visual?[71] The solution is to incorporate levels of audible, tactile, and olfactory cues. These can be essential cues for people with vision loss because the cues aid in understanding pathways and establishing interior landmarks. This enables users with visual impairment to navigate much more complex interior buildings through the legible spatial layout.[72]

Lynch states that legibility is the ability to describe the ease with which one can form a cognitive map of a city. Legibility is facilitated by the presence and organization of five main elements:[73]

1. Paths are the travel corridors and transitions;
2. Edges are features that limit or enclose districts and thresholds;
3. Districts are subareas with common, distinctive features;
4. Nodes are points of intersection at key points; and
5. Landmarks are visible and distinct features.

These elements can be translated from the large scale of a city to a more intimate scale within an interior environment using similar concepts and definitions. For example, the design at decision-making points, such as elevators, stairs, or corridors, can be thought of as nodes. In an interior setting, districts can be distinguished through similar texture, colour, pattern, and elements.

When planning wayfinding elements, it is important to understand that there is a hierarchal process that users expect to experience.[74] For example, people look or feel for particular landmarks at expected places, which helps to guide the user toward a destination. However, if these landmarks are not found, the user will need an alternative path of travel, or they may revert to emotions and reactions of feeling lost in the interior space.[75]

Wayfinding is an important design strategy that can be used with other theories to produce varying layers of information for the user. The more wayfinding integrates sensory cues into the design, the more successful elements, such as landmarks, will become 'visible' to the user. Wayfinding is concerned with how an environment can be 'read.' The reading of an environment can be done through visuals, tactile engagement,

sound, or even smell. Users are then able to analyze the information provided to interpret the scale, layout, character, and overall composition of their environment while avoiding danger and achieving their desired goal.[76]

## 3.5 Summary of Research

The typology of a central mobility hub is a gateway into the city. Through accessibility, a city is more inviting for residents and tourists to explore. However, many transit hubs do not cater to all abilities. This creates unfriendly environments and barriers for people with disabilities. Through theories on narrative and perception, an understanding of the spatial needs of users with vision loss developed relating to accessible, independent and safe navigation of an interior space.

The theory on narrative has two subsections: sensory architecture and adaptive reuse. When combined, sensory architecture and adaptive reuse illustrate the importance of understanding a space's historic past before designing begins. The existing building has a narrative to share, and the designer can implement design strategies that are informed by the building's narrative. By using existing architectural elements, the design intervention can complement the building rather than create a competing space. Narratology speaks to the idea of creating layers of information through the site context, building, and the interaction between space and body.

Perception theory discussed concepts of orientation and wayfinding, which can be applied to every user. The design needed to be able to have layers of navigational information so that new and frequent users could explore the space at his or her own leisure. Orientation and wayfinding intersect by creating depth in the design elements of form, light, colour, object, and material. These design elements begin to familiarize the unfamiliar through legibility and internal map making.

The above theories provided a basis for the design of the transit hub. Through the interconnectivity of concepts, the space must be interactive, legible, and adaptive to various users' needs. The next section will concentrate on a personal, sensorial experience of varying built environments that will add to the research explored from the first two chapters, with focus on sensorial awareness of interior processes.

Table 3 summarizes the six theories analyzed in Chapter 3: Literature Review and the spatial strategies developed based on the theoretical framework.

| Theory | Theorists | Summary | Spatial Considerations |
|---|---|---|---|
| Narratology | • Tzevetan Todorov<br>• Mieke Bal<br>• Susan Onega<br>• Jose Garcia Land | Uses elements, history and user interaction of the existing space to inform new, context specific design solutions | 1. Use history of the existing space<br>2. Historic preservation<br>3. Select finishes that are in contrast with the history of the space<br>4. Create layers of information that speak to specific user groups<br>5. Leave behind existing interior materials |
| Sensory Design | • Juhani Pallasmaa<br>• Carmen Papalia<br>• Harry Harlow | Physical environments need to address more than just the sense of sight; they need to interact and offer depth of experience to the variety of users and narratives that the building may host. | 1. Use tactile, visual, olfactory and sound as interior elements through material, layout and volume<br>2. Make size of the building more manageable by creating smaller spaces<br>3. Floor texture, sound as a threshold<br>4. Fluid connection to exterior through use of natural materials and elements (plants, sunlight, warmth)<br>5. Use materials that are easily identifiable |
| Adaptive Reuse | • Graeme Brooker<br>• Sally Stone<br>• Mieke Bal | Strategic design process in which full understanding of the existing building can be used to inspire the new design and function of the proposed space | 1. Overall design with be informed through the existing structure and its history<br>2. Use strategy of insertion to create contrast between old and new<br>3. Use historical layout to inform new spatial adjacencies |

Table 3: Theories and spatial considerations

| | | | |
|---|---|---|---|
| Perception | • Environmental Psychology | The interplay between human beings and their surroundings | 1. Spine of building to allow a user to know their location<br>2. Legibility - make the building easy and simple to understand with paths that are barrier free<br>3. Graphic symbols |
| Orientation | • Ivan Pavlov | The process of determining one's location in the environment and deciding where to go next | 1. Use sensory cues to indicate landmarks<br>2. Organize spatial layout so that there is a core and spaces branch off of it<br>3. Distinctive view or map stating "you are here" to help shape a cognitive map<br>4. Three dimensional map |
| Wayfinding | • Kevin Lynch | Wayfinding is about spatial problem solving- how a user is going to figure out how to navigate a space successfully using cues provided by the designer | 1. Create obvious entry points that lead into open areas with views of end points<br>2. Transition between floors clearly marked<br>3. Provide clear delineation zones through change in texture, color and pattern<br>4. Avoid sensory overload where decisions have to me made<br>5. Use scale and volume to heighten sensory cues |

# 4[four]
# EXPERIENCE

## 4.1 Chapter Introduction

How can you design for a demographic that you are not a part of? This was the dilemma that came to me whenever I told someone that my practicum topic was going to focus on designing for people with visual impairments. Firstly, there are a variety of levels of visual impairment, from low vision to total blindness. These users are still able to experience spatial characteristics but in unique ways that are specific to their abilities. Therefore, I decided that it would be an informative experiential experience to encounter spaces in a variety of settings and visual conditions. For example, I ate in a pitch-black restaurant to understand how eating was experienced without being able to see my food or who was approaching to serve me. Another space I visited was Union Station in Winnipeg, the proposed site for this practicum. I was blindfolded and guided through the space, while using a long cane, by a single-sourced informant with a visual impairment. This experience was done in order to understand a physical interior environment and the details that go into a space. However, I also wanted to experience design choices that may have unknowingly created barriers for visual impaired users. As

well as design choices that may have unknowingly helped aid in perception and wayfinding strategies to someone who is vision impaired. Lastly. I attended a photography exhibition titled "Sight Unseen" at the Canadian Museum for Human Rights. Here, I realized the varying degrees of visual impairment and that no one (sighted, blind, or low vision) experiences the world in the same way. These experiential experiences helped me gain a better, more personal understanding of the details, material choices, acoustic properties, and spatial organization that I had not noticed before in interior environments because I primarily experienced interior spaces through my sense of sight.

## 4.2 Dining in the Dark

Experiencing a simple task that you do three times a day may not seem very difficult. However, dining in the dark exceeded every outcome that I had initially predicted. I had a preconceived idea that I would be able to locate my plate on the table and eat like I do every other meal, with the exception of being unable to see what I was eating. Assuming that my sense of smell and taste would be heightened was a correct assumption; however, I was unprepared for the initial disorientating effect, which slowly subsided once my other senses began making sense of the space. To enter and exit the space, I was required to have a waiter guide me to and from my seats. At first, this process was overwhelming because it felt like noises were coming from every direction. The flooring had no textural changes, so there were no cues on the path of travel or where chairs were located to determine placement of tables. The waiter brought me to the table and directed each person at the party to put their hand out to feel for the top of a chair. Again, noticing that there were no textural cues anywhere, I felt unsure of what I was going to hit as I reached out. However, once I found the chair and got seated, I began to piece together what my senses were describing to me about the space. The table I was at was located next to a wall, which provided a starting point for understanding the spatial organization. I could hear, feel, and smell the waiters walking behind me with food and empty dishes, which allowed me to understand the main path of travel used toward the kitchen and exit. I listened to the noises coming from other tables, people entering, people leaving, and new guests taking their seats. Noise helped me to put together a general layout of tables, the scale of the room, and how many people were in the restaurant. I was surprised by what cues my body was using to understand the space. When our food arrived, I gave up using my utensils because I had no depth perception from

the plate to my mouth. I began using my hands to feel textures, like where I was spreading the butter on the bun and how much food I had left on my plate. I realized how important touch was because I was touching everything to understand where things were. For example, I noticed the correlation between all the objects on the table. I needed to pay attention to where I placed my water glass on the table so that I didn't knock it over unknowingly. I became aware of where I put my utensils when I was not using them. Therefore, my plate became a central reference guide for these small details that I never had noticed before were such important components of eating a meal. To say that my other senses were heighted would be an understatement. My senses worked together simultaneously to gather enough information to enable me to pick up small cues to develop an understanding of the space and the act of eating.

## 4.3 Photographic Exploration

From the time I was 9 years of age, I wore glasses with a prescription of -5 OS (left eye) and -4.75 OD (right eye). I understand what it is like to only be able to see blurry shapes of colour from one foot away. I am heavily reliant on my prescription glasses for everything I do, even everyday tasks. Figure 22 are photographic representations of how I see without my glasses. They are not exact representations, but they allow me to analyze what I do see. As the photographs show, colour contrast is the most prevalent feature. The white chair in the foreground against the dark wood table creates some depth perception. The object on the dresser does not stand out at all because

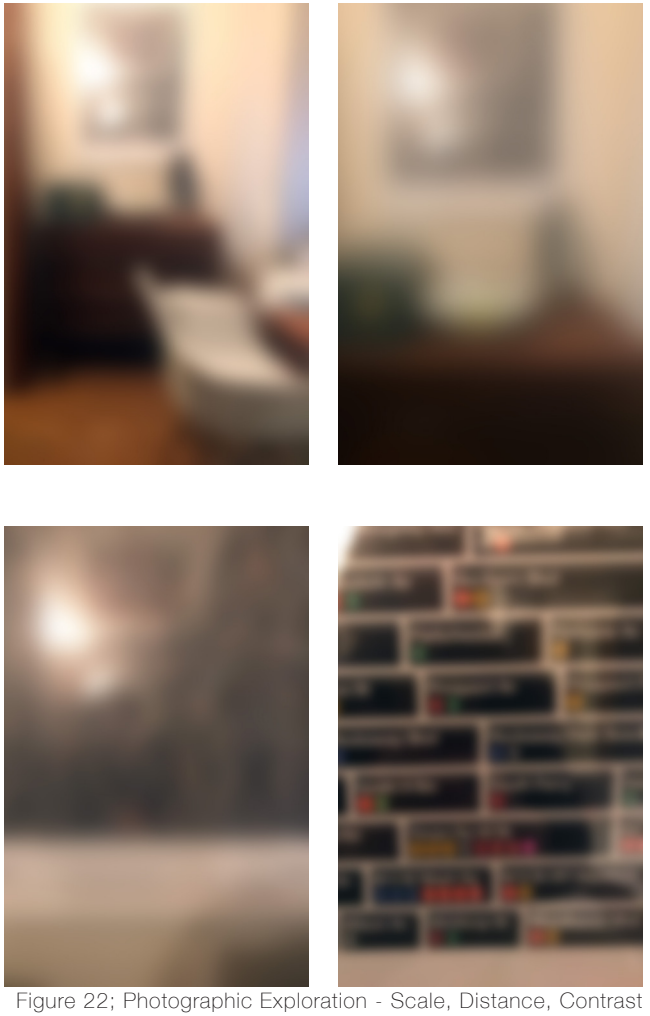


Figure 22; Photographic Exploration - Scale, Distance, Contrast

of the white frame and white wall. When I get closer to the object in question, more prevalent details begin to stand out. The black image against the white wall becomes more defined, and then, the white boarders around the black objects in the photo come into view. This exercise demonstrates the importance of design elements related to distance, scale, and contrast.

A second photographic investigation explored was attending a photography exhibition titled "Sight Unseen." The exhibition featured thirteen of the world's most well-known blind photographers who use different technologies and methods to express what they "see." The first observation I made was that all of these images, as shown through Figures 23 to 26, are vastly different in final execution. For example, in the photo "A Dream of Motion" by Evgen Bavcar, the photo was taken the moment that Bavcar sensed movement; therefore, the photo presumably describes how he sees the world through movement and sound. Alice Wingwall's photography can be explored through the stylistic juxtaposition of images she combines to form her final experiential photographs.[1] Wingwall brings together compositional elements through memories and associations with the objects she is photographing.[2] By creating associations with objects, she is able to intimately photograph the objects through her personal experiences.

Figure 23: Wingwall Marches On, Triumphantly, Alice Wingwall

Figure 24: A Dream of Motion, Evgen Bavcar

Figure 25 and 26 are two-dimensional images I took of three-dimensional photographs that were specifically made for the exhibit. Not only was the photographer's work inspirational, but the exhibit also gave visitors the opportunity to interact with photography through the sense of touch. Two-dimensional photographs were turned into tactile objects through the manipulation of shadow and light. The contrast that gives depth and dimension to photographs was translated into a tactile object.

This exhibit helped me further realize the amazing, multidimensional world that exists outside of the sense of sight. Art can be

Figure 25: Sight Unseen, Tactile Photograph - Top View

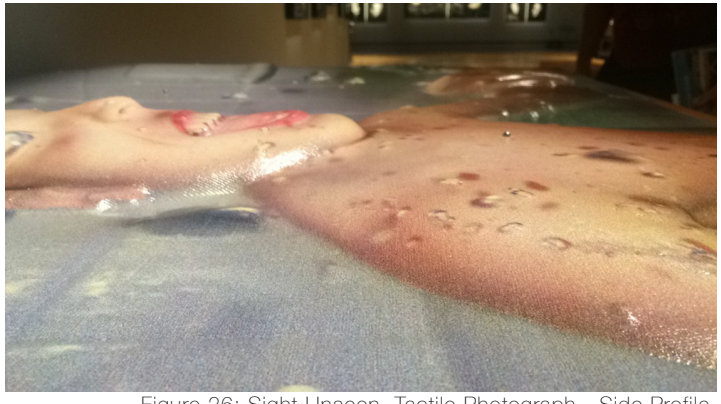


Figure 26: Sight Unseen, Tactile Photograph - Side Profile

experienced through a variety of layers of touch, sound, motion, and feeling. Since the experience was individual and personal, it supported the idea that design needs to successfully offer various options of experience within a space.

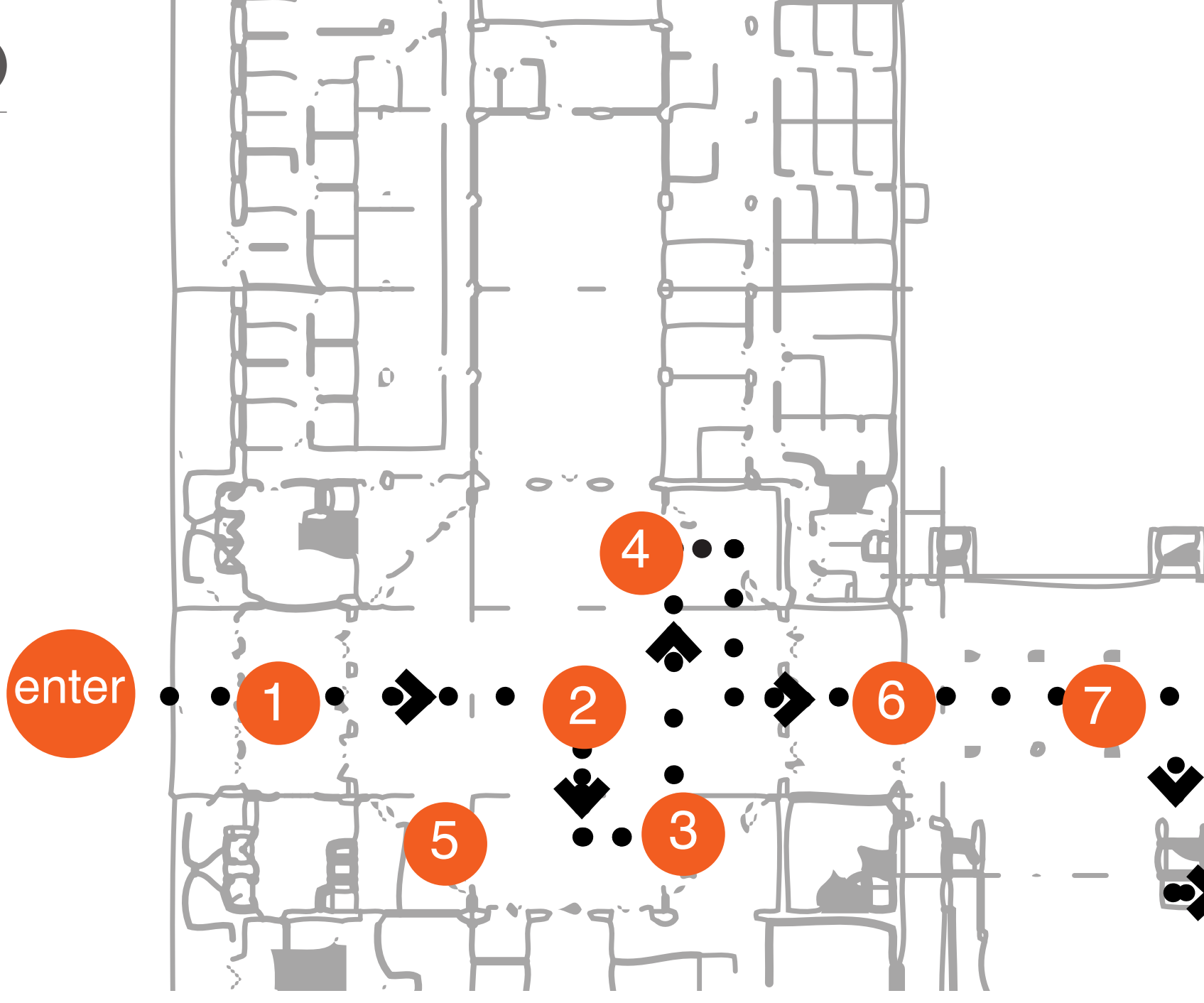
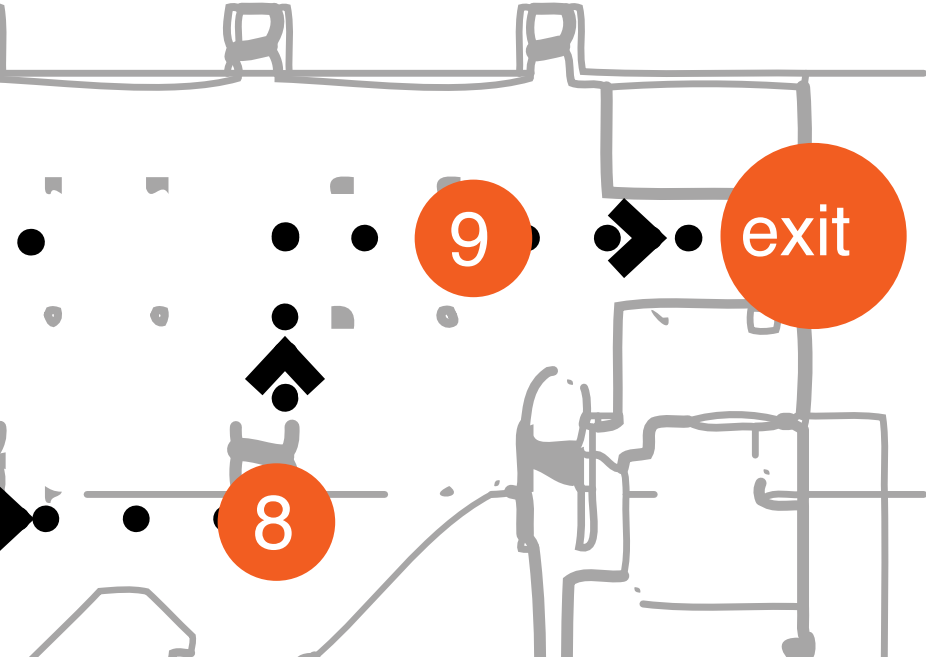



Figure 27: Union Station Walkthrough Map




## 4.4 Union Station Walkthrough

In previous chapters, I included research and analysis of concepts, theories, and examples that were incorporated into spatial design guidelines for the final design proposal of Union Station. However, not having a visual impairment myself, I have not experienced many of the spatial design guidelines I was proposing nor had I experienced how many of these design elements could help a user navigate space. Therefore, I wanted to have a first-hand experience through a single-source informant to understand the existing cues and processes that visually impaired patrons use to navigate in Union Station. One limitation was that I was learning a navigational process through a single-source user, so I was not experiencing how the space was navigated differently depending on the type of visual impairment. It would have been more effective to use a larger sample of courses with varying types of visual impairments. To make up for this limitation, the lessons I learned throughout this experience were supported with additional research from primary sources and information coming directly from an expert regarding visually impaired users in transit.

Throughout this process, I was taught how to use a long cane. I learned how to hold a long cane; how to make a sweeping motion to detect

hazards, objects, and tactile changes; and how to listen for navigational cues. The process of the audible information produced from the long cane tapping on the ground, called echolocation, takes extensive experience and practice, and was therefore not that informative to me being a first-time user of the long cane. Another limitation was that I was blindfolded and in total darkness, whereas my informant had diabetic retinopathy and still used residual sight to navigate. The informant was only able to inform me on what they presumed someone that is blind could use as navigational cues.

Similar to my experience of dining in total darkness, this experience allowed me to explore in total darkness using a mobility aid to help inform and guide me towards my intended destination and away from potential hazards. Total darkness allowed my other senses to be strengthened: I was more aware of touch, sounds, and the motion of people around me. Since I had been in the space prior to this experience, I did have a bias because I already understood the general layout and where amenities were located. However, determining available sensorial cues to navigate to these amenities was challenging. As seen on the map in Figure 27, my journey consisted of going through the front entrance on Main Street, into the rotunda, through the existing VIA terminal at the rear of the station, and existing through the back door.

1 The entrance to the station has multiple doors in a row that lead into a vestibule. These doors are centered amongst exterior columns holding up an exterior canopy. The canopy help understand the transition from interior to exterior, using ceiling height and a lighting shift that makes entering the building more transitional and less abrupt. The *City of Winnipeg's Accessibility Design Standards* recommend that buildings incorporate features, such as canopies, to minimize the impact of weather conditions and to highlight the area as the main entrance.[3] The lowered ceiling heights change the acoustic and lighting properties, which creates a gradual gradation from natural light levels on the exterior to the lighting conditions on the interior.[4] The columns helped inform

Figure 28: Union Station Existing Entrance - Main Street

the placement of the doors. Additionally, there were guards that told me which door would be swinging and advised me of potentially hazardous doors swinging near me. The series of doors with center posts are problematic for guide dogs because they may get tangled around the center post, which would cause the handler and animal unneeded stress.[5] Therefore, automatic sliding doors are the best alternative for visually impaired users.[6] If automatic sliding doors are not possible, using doors without a center post would be preferred.

2 The first thing that I noted on the interior of the space was that the rotunda (a large, open space) had no textural changes. I was unaware of what direction I was going or if I was moving toward my intended destination. This was very disorientating, and I ended up walking in diagonal lines even though I thought I was walking in a straight line. The use of a linear, consistent, tactile walking surface indicator or another material with contrasting texture to the rest of the space helps define a safe, direct route across the large open rotunda.[7] This detectable route could also be used to inform the location of information kiosks or counters.

3 The existing information and security counter in Union Station was located in the back corner of the rotunda, and there were no direct cues to locate this important landmark. The *Intercity Bus Code of Practice* and "Clearing our Path" recommend that information and communication services, such as a reception desk and tactile maps, be within the main entrance lobby and as close to the point of entry as possible.[8] Having access an information source right when I walked into the station could have

Figure 29: Union Station Existing Rotunda

helped me get verbal directions on where to go from an audible kiosk, or I could have asked for staff assistance on getting to my final destination.

The rotunda, because of its vast size and material selection, had very poor acoustic properties, which did not aid in my understanding of the

space because it provided no navigational cues or hierarchy on paths of travel. The *2015 City of Winnipeg Accessibility Design Standard*, Third Edition, mentions that finishes and materials chosen for walls, floors, and ceilings should be selected so that occasional noise is not amplified, and the shape of the ceiling should not be designed so that echoes occur.[9] However, being a historical building, many of these design choices cannot be altered. Therefore, other strategies can be put into place, such as incorporating sound absorbing elements, like carpets and upholstered furniture, that help dampen excessive noise.[10] Other tactics could include inserting elements that provide varied ceiling heights along corridors and around the perimeter of the space so that a person with a vision impairment can use reflective sounds to determine the presence of these circulation routes.[11]

4 Within this vast open area, a small café with tables and chairs was included. The sound and smell that this small space offered amongst the background of the large space it was contained in gave audible and olfactory cues that helped me to locate the direction of the amenity. However, once I was close to the café, there were no tactile changes on the floor to indicate where the counter was. There were also no cues to inform me if there

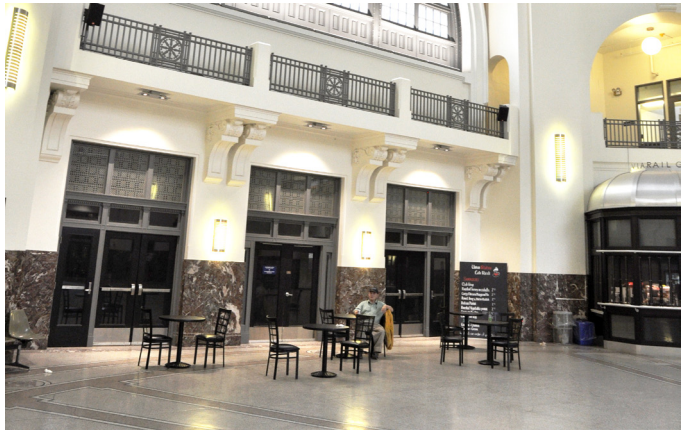


Figure 30: Union Station Cafe in Rotunda

was a queue, and the tables and chairs were positioned in the path of travel with no warning that I was approaching them. It is noted in the "Clearing our Path" initiative that seating and queuing should never be placed in a path of travel. If seating or queuing must be in the path of travel, then there should be tactile qualities detectable by a cane to delineate the space. Furthermore, colour and contrast should also be used to help differentiate amenities from their backgrounds.[12] These strategies help users identify these areas safely and effectively.

5 I also noticed that there was a lack of signage throughout the rotunda space. For example, the location of tactile signage for washrooms were located on the inside wall of the bathroom instead of outside the entrance. Signage should be placed so that the user can read the

sign through touch or vision at close range and out of a path of travel, before entering the space, especially in gendered washroom facilities.[12a] Typically, signs should be placed to the right of the door or on the latch side if a door is present.[13]


Figure 31: Union Station example of poorly placed existing signage

6 I felt that the transition from the rotunda space to the train shed, now used for VIA Rail passengers, was the most distinctive change from one space to another. The flooring had a definite change in texture in this transitional space that allowed me to understand that I was entering into a new area. As mentioned above, ceiling heights can provide acoustic changes that can help delineate paths of travel, differentiate between spaces, and locate transition areas. Therefore, the drastic change between the rotunda's ceiling height and the train shed reinforced that I had left one area and entered another.

Figure 32: Transition from rotunda to VIA Rail terminal

7 The main path of travel was long and linear, and through use of the existing columns on the side of the corridor, I was able to begin to locate amenities once I had explored the space a couple of times. The columns made the large space seem more manageable because I could use them as a verbal communication tool. For example, if a source of communication had been readily accessible for me at the point of entry, I could have received directions from a staff member who could have informed me on the steps required towards my destination. The staff member would have

provided cues, as to where I was located and what elements existed between me and my destination, such as thresholds, columns and room names. Therefore, I would know that once I crossed the threshold that was located to my left, I would count four columns, turn right and continue to walk in a straight path until I reached a carpet on the floor. The carpet signalled the entrance to the queue of the VIA check-in desk, my final destination.

These verbal communication cues were discussed thoroughly with the Executive Director of the Vision Impaired Resource Network, Doris Koop. She explained that different communication tools regarding ways a user receives information, is an important quality of an environment that can be used to support independent navigation. Communication tools could include verbal directions from a staff member, audible instructions from an information kiosk, and large print and tactile maps located at key decision-making points.[14] These tools help users reach their location and locate amenities throughout the building.

8 Although amenities, such as seating and baggage carts, were readily available to the users, there was a lack of cues to help users locate them. The seating was stationary and in a linear fashion, which created a simple and logical organization of the space. Logical, permanent layouts are more easily memorized by users with a visual impairment because the space uses consistent and straight forwards paths.[15] However, the seating did not have a base, so in order to detect the seating, I had to get relatively close and into other people's personal space. Flooring changes around the seating could have helped delineate these spaces away from the paths of travel.

Figure 33: Existing seating in VIA Rail terminal

9 Lastly, my journey took me to the rear exit of the building. This destination was one of the easiest to locate. Firstly, it had a lower ceiling height that changed the light level and acoustic properties and cued that I was moving away from the VIA terminal. There were two carpets on the floor that directed me

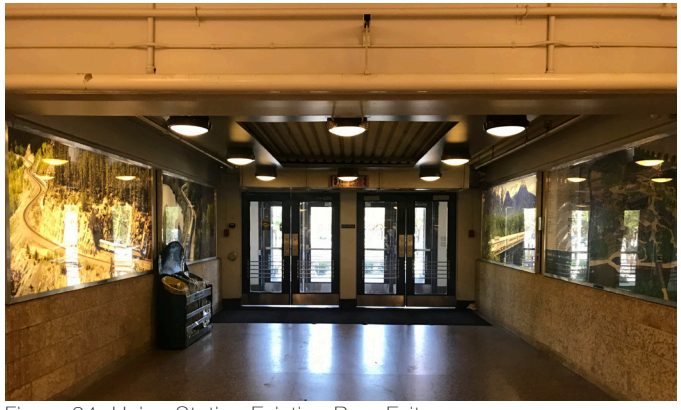


Figure 34: Union Station Existing Rear Exit

toward the doors that were illuminated from the bright lighting outside. The outside lighting contrasted the more muted interior lighting. Signage and wayfinding guides could be improved in this space. Upon entering the space, there was a large, backlight image to the right of the doors that could include a large-scale map of the building. The *2015 City of Winnipeg Accessibility Design Standard, Third Edition* indicates that buildings should include maps and signs as a form of wayfinding.[16] Maps are considered tools that can help all users navigate through a space, regardless of their familiarity to it.[17] These communication elements need to include tactile elements, Braille, and large format text in a sans serif font. Communication tools also need to be presented in contrast to the background and cannot have any barriers in front of them, so users can approach them within 100mm.[18]

This experience was very informative and increased my understanding of how sensorial cues not only help to navigate from point A to point B but can also help to locate amenities like a café or washroom. Although many common design standards were used throughout the station, the lack of redundant cues inhibited my ability to feel like I was successfully navigating toward my intended destination.

## 4.5 Summary of Research

These explorations taught me various things about how spaces can support people with visual impairments. For example, strategic design considerations of light, colour, contrast, texture on vertical and horizontal surfaces, sound, legibility, and smell can be very beneficial in aiding navigation. Texture on the floor can provide orientation cues when someone is approaching a hazard, such as stairs, but it can also be used to delineate space. Tactile maps and signage need to be located where they can be easily found, and so someone new to the space can orient himself or herself accordingly. Colour can be used strategically for wayfinding, and colour contrast is one of the most important design characteristics for users with vision loss. As mentioned in every existing design standard and resource used throughout this practicum, the design element of


Figure 35: Union Station push cart signage example

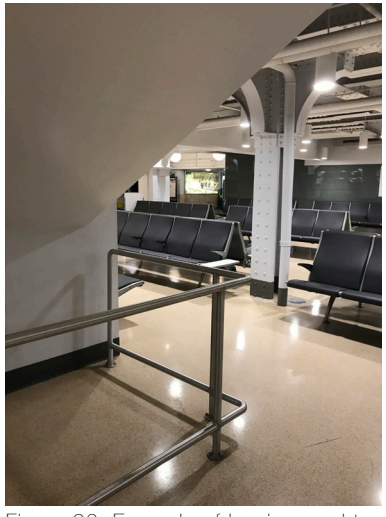


Figure 36: Example of barrier used to help users avoid a hazard


Figure 37: Current queuing set up for VIA Rail

contrast in colour and material helps elements such as signage, information desks, seating, and doors to be seen. Acoustics can be understood through motion and sound. Sitting in complete darkness, I was able to hear common paths of travel and people talking at an information desk. I could also hear sound differences when entering a new space through sound reverberation from ceiling height and material changes. Finally, regarding legibility of a space, simple repeating patterns were more helpful once I had revisited a site. Repetitive elements and redundant cues created familiarity, and orientation cues enabled me to understand distance and directed me toward my final destination. These three different experiences strengthened my understanding of what elements in the built environment can be used through senses other than sight to gather useful information about a site.

Table 4 on the following page summarizes the spatial strategies developed based on the experiential methods I explored throughout Chapter 4.

| Experience | Findings | Design Strategy |
|---|---|---|
| Dining in the Dark | • Using other senses to pick up cues that help develop spatial awarness<br>• Determining reference guides to help create relationships between objects<br>• A personal experience, such as eating, also uses a redundancy of cues to create associations between elements to gather useful information about a site | 1. Use textures to help guide users<br>2. Use sound absorbing techniques (upholstered furniture, wallpaper, carpet) so users can hear communication aids<br>3. Furniture that is solid and secure and can find easily |
| Photographic Exploration | • Legibility helps an object be easier to understand<br>• Colour contrast helps with depth perception<br>• Navigation is a personal experience, so design needs to offer various tools and options to support these personal needs and different ways of "seeing" | 1. Spatial layout simple and easy to understand<br>2. Simple and bold graphics/symbols<br>3. Large Scale Information Cues<br>4. Colour contrast can be used for signage, to differentiate between space<br>5. Use movement and sound |
| Union Station Walkthrough | • A lack of redundancy in cues inhibited my ability to navigate independently<br>• Design needs to support verbal communication and wayfinding techniques<br>• Large open space cause confusion when there are no permanent, detectable routes that lead to the feeling unsafe and unsure of the surroundings | 1. Continuity in path and free of obstacles<br>2. Have amentity zones that are differentiated through material colour and contrast on floors and walls<br>3. Incorrporate "open concept" coffee shop/restaurant to provide smells that can assist in defining zones<br>4. Texture to detect hazards or different zones<br>5. Communication Aids - texture, audible (signs, information desks, maps)<br>6. Ceiling heights to trigger entering a new space to change acoustic properties |

Table 4: Personal experience and spatial considerations

# 5 [five] PRECEDENTS

## 5.1 Chapter Introduction

The following chapter analyzes three very different projects to gain insight on topics relating to the proposed design. The first precedent, Hazelwood School, looks at an architectural project that focuses on how design can have positive outcomes for students with visual impairments. The second precedent, Milkshake Tree Playground, is a project interested in public design, sensorial experiences, and experimentation of materials. Lastly, the 100 Broadview Lobby example highlights an innovative design approach towards accessibility standards and wayfinding. This research will be applied to inform design decisions that are proven to work in specific situations. The projects are analyzed in terms of spatial layout and interior design elements. The concluding factors are used to communicate solutions to design problems that are being explored throughout this practicum in regard to designing for people with a visual impairment in a mobility hub.

# 5.2 Hazelwood School

**Location:** Glasgow, Scotland
**Type:** Education facility – pre-primary to upper secondary
**Completion Date:** 2007
**Designer:** Gordon Murray & Alan Dunlop Architects
**Size:** 26,700 sq ft
**Demographics:** 60 students with two or more impairments

**Description:**
Hazelwood School is designed specifically for children with a variety of sensorial and cognitive disabilities. The design aids in the creation of independence for students by allowing them to intimately experience and understand their surroundings, enabling them to learn at their own pace and in their own way.[1] Defining Hazelwood School simply as a centre for learning limits the opportunities that the school's design can offer its students.[2] The interior spaces of Hazelwood School are much more than a series of simple teaching spaces: the spaces offer the tools to enable an independent way of life that can be so elusive to multiple sensory or cognitively impaired individuals.[3]

**Relevance:**
The design of this school includes a variety of elements that are designed for individuals with sensorial impairments. Design elements such as line, colour, texture, and light work together to create a unique, engaging environment where individuals can learn without distraction and navigate the space independently.

**Design Analysis:**
Touch is the sense that the school's design primarily focuses on. Firstly, touch was incorporated using a variety of textural elements at varying scales on multiple surface planes. The


Figure 38: Hazelwood School Central Corridor.


Figure 39: Hazelwood School: Example of trailing wall throughout spine of building.

Figure 40: Hazelwood School Arial View.

change in surface enables users to understand that they are leaving one space and entering into another, as shown in Figure 38. Textural walls are most commonly used as a form of trailing,[4] which is a navigational aid where people with a visual impairment touch and feel as they walk alongside the surface to navigate and orient themselves in a space. In Hazelwood School, this surface is called Circulation Street,[5] shown in Figure 39. It runs the entire length of the school in between the classrooms and exterior play spaces.

Another important aspect of the design is the use of light. Subtle design changes in light can significantly register for people with vision loss.[6] Therefore, clerestory windows on the north side of the building allows for a maximum and even distribution of light throughout the classrooms.[7] Additionally, the use of different sized windows, various ceiling heights, and roof lights[8] help orient and create navigational markers for students with visual impairments. Students with varying levels of vision loss can use contrasting light and dark interior elements to orient themselves within the given environment.

## Design Elements:

**Entrance:** The entrance to the school incorporates a textural change on the ground level. Wood panels create a curve toward the door to guide the user to the entrance.

**Circulation Street:** Circulation Street is a tactile wall that runs the whole length of the school. It incorporates various tactile qualities to help students orient themselves. The sensory wall is primarily made of cork, which itself has a tactile quality. Cork also retains warmth, which is a sensory, tactile cue that users are able to feel. For example, if they are getting close to a window, the sun will warm the surface closest to that material.

**Materials and Colour Blocking:** Many of the materials and furnishings are made with natural materials so that users can use their sense of touch and smell. In the open plan dining area, the wood furniture gives off a strong aroma to let students know when they are approaching the dining room. Colour blocking can also be seen in this image to help boldly define and code space, making wayfinding in a school easier to understand as a child. Material selection contrasts heavily between interior and exterior spaces. Hard materials are used on the exterior, while softer materials, such as cork, used on the interior. This helps students with a visual impairment immediately understand when they are outside and when they are getting farther away or closer to the entrance. Figure 41 illustrates how wood panels are closest to the door and slate is used on the side walls.

**Clerestory Windows:** High clerestory windows on the north side of the building allow for maximum daylight to penetrate deep spaces for even distribution of light. This is done to avoid any harsh shadows, which helps users avoid spatial confusion within the space.[9]

Figure 41: Hazelwood School: Exterior View of Entrance.

Figure 42: Hazelwood School: Classroom example of clerestory windows and colour blocking strategies.

## Spatial Attributes:

The spatial design of the building is a simple, single story that is curved like the letter 'S.' This form was chosen strategically because it reduces the perceived scale and makes the building seem less intimidating and more welcoming and intimate. Smaller interior and exterior spaces are created within the curves of the 'S' shape.[10] The curved walls provide a small scale space where students


Figure 43: Hazelwood School site plan analysis.

navigating outside do not feel overwhelmed by a vast, large exterior. Instead, students feel safe and secure through sound echoing off the curved walls, close interaction with the building and textured floor planes, and material variations on walls. These elements aid students in determining where they are. Large, consistent walls with clerestory windows, as shown in Figure 42, help create a uniform path. In contrast, large, bright windows may confuse users and break up the consistency of the interior navigation path.

As shown in Figure 43, all classrooms are located on the same side of the building. Support spaces are located at the entrance, away from the student's navigational path from classroom to classroom. This keeps the spatial layout organized and simple to understand. The segregation on one side of the building also eliminates the barrier that doors can cause for someone with vision loss, such as the unexpected event of someone opening a door.

## 5.3 Milkshake Tree Playground

**Location**: London, England
**Type:** Playground installation
**Completion Date:** 2016
**Designer:** pH + Architects
**Size:** 380 sq ft
**Demographics:** Ages 5 – 12

**Description:**
The Milkshake Tree Playground can be considered an "experiential garden" of sorts. It was designed and conceived as an inclusive sensory space, which was inspired through the architect's previous design work for the London Centre for Children with Cerebral Palsy.[11] The installation has a variety of components. For example, there is a ramped walkway surrounded by screens of timber frames combined with a copper xylophone installation piece that can be played as children pass by.[12] In addition to being a playscape for children, the design is considered to be an overall exploration of the theme of community. [13] It is an example of how a platform can be intended for the target users, as well as the wider community.[14] As described by the London Design Awards Committee, "the installation has been successful in encouraging community interaction, discussions on the

Figure 44: Milkshake Tree Playground.

future of their built environment and has helped to promote inclusive design."[15] Overall, the Milkshake Tree Playground is a successful experimentation of a multi-sensory approach to design.

**Relevance:**

The Milkshake Tree Playground can be used and enjoyed by children and people of all abilities through the following design elements and strategies: sound, smell, movement, reflective surfaces, light, sight, and touch.[16] It is an all-encompassing sensory space. The comprehensive and welcoming features used to describe the structure means that it can also be enjoyed without interaction by commuters, the public, dog walkers, and so forth. The playground acts as a platform to share, engage, and educate the community on inclusive environments that help stimulate and support growth.[17] Milkshake Tree is an installation designed for all abilities, all demographics, and all types of users.

**Design Analysis:**

The structure's overall design uses creative design elements that engage not only the sense of sight but also the senses of smell, touch, and hearing. The result is a successful example of a multi-sensory landscape that enables children to discover, share, engage, and learn on their own.[18] As stated by London Architecture, "the goal of the Milkshake Tree Playground is to turn all parts of a child's day into an immersive learning situation—providing opportunities to practice an array of skills."[19]

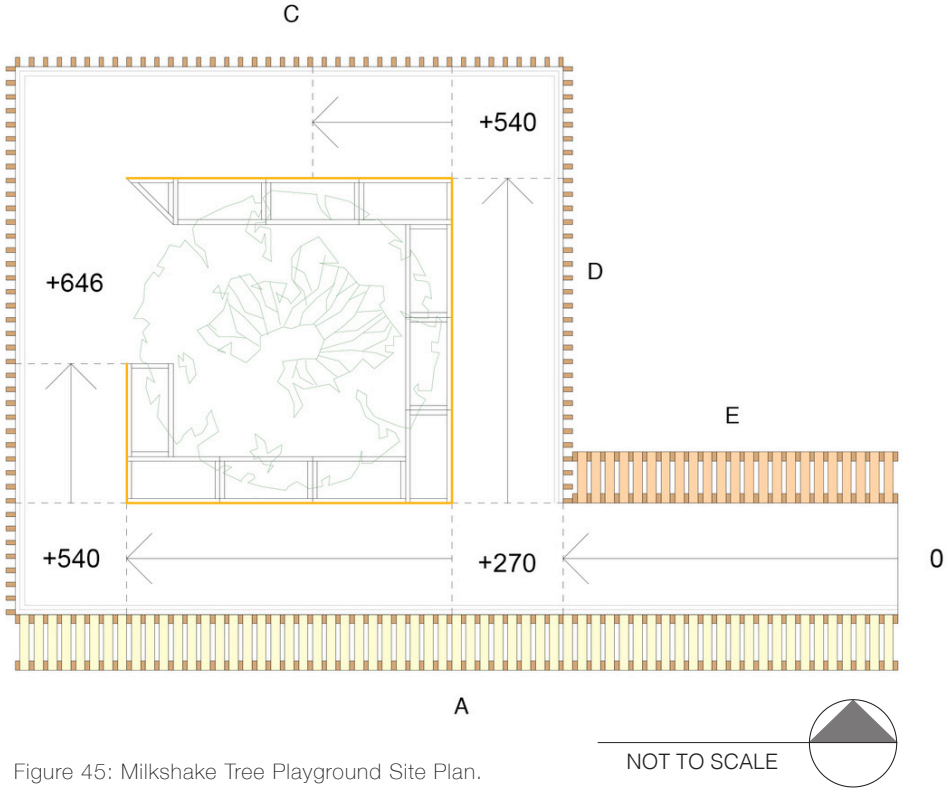



Figure 45: Milkshake Tree Playground Site Plan.

## Design Elements:

Circulation: Circulation is used as an integral design element to create an inviting and immersive atmosphere that encourages children and the public to interact with the installation. The entrance to this single structure, a multi-sensory ramp, is the first example of an equally designed space. There are no stairs for one demographic of people and a ramp for the other; rather, there is only one way in and one way out for everyone using the structure. The walkway is made of copper piping at one end and reflective cladding at the other, which creates a large-scale xylophone that can be enjoyed through use or sound. The reflective cladding promotes intrigue and possibly experimentation with surroundings by letting users observe and monitor their movements.

Materials: The materials in this project were deliberately chosen for their unique contribution to the multi-sensory sound-scape that are integrated within. To build a sensory space for children that surprises and engages the senses, all of the material elements create sound, smell, movement, light, and texture. For example, the reflective cladding allows for the visual sense of movement from all angles as well as light, the copper piping creates sound and texture, and finally the cedar cladding and garden space generate a variation in smells depending where the user in located within the installation. Altogether, these materials create a sensorial map of the playground, an immersive experience of a space through their own investigation of the senses.

Figure 46: Milkshake Tree Playground Circulation.

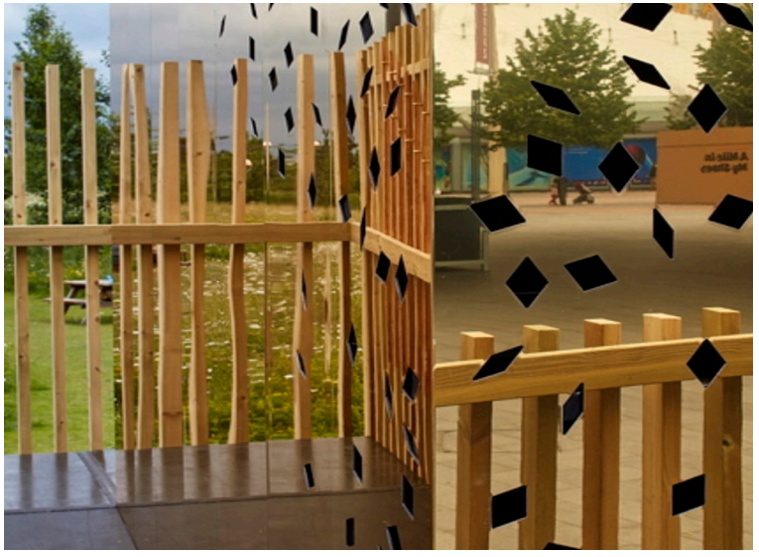


Figure 47: Interior reflective surfaces in Milkshake Tree Playground.

## 5.4 100 Broadview Lobby

**Location:** Toronto, Ontario
**Type:** Multi-use, condominiums, self-storage facility
**Completion Date**: 2015
**Designer:** Quadrangle Architects & Interiors
**Demographics:** Public and building tenants

**Description:**
Broadview Lobby began as a space in an unimpressive brick building at the corner of two busy streets that people walked by but never noticed. The building had a plain façade that faded into the background of the other buildings, and it was inaccessible to anyone with mobility issues.[20] The client decided that they wanted to make a bold statement at grade level.[21] Specifically, the client wanted "something that could set aside 100 Broadview as a creative hub"[22] and would draw in a new demographic of young individuals of all abilities. This project emphasizes and demonstrates how universal design can go beyond mere accessibility by using design standards in new, bold, and innovative ways.[23]

The architect used a bright, orange sign above the lobby entrance to contrast the red brick and grey mortar façade of the existing structure.[24] When entering the lobby, the user is instantly greeted by bold colours, geometric shapes, and contrasting elements, which contribute to an innovative, seamless design that blends accessible standards with bold design concepts.

**Relevance**:
The design of the lobby uses many design elements that correspond with a variety of wayfinding techniques. These elements have varying degrees of accessibility, which can translate differently depending on ability. For example, contrast colours can help people with a visual impairment understand vertical circulation, such as the black steel staircase contrasting going to a second level versus the light grey ramps which directionally moves people downwards.[25] The project effectively uses universal design principles, such as the integration of ramps and stairs, tactile warning strips, and wide corridors, while also creating a dynamic and interesting space.[26]

**Design Analysis:**
The variety of wayfinding layers is the primary focus of this precedent. Navigation of all levels and spaces was considered, including from the street to the interior and within the space. Wayfinding techniques add depth to this simple yet bold universal design project. For example, changes in surface and contrast enable users with visual impairments to quickly assess that

they are changing levels. The colours chosen, black and orange, are two contrasting colours that help visually impaired users differentiate elements through contrast, but can also be differentiated by someone with vision. The black refers to vertical circulation, and the orange to a downward circulation path. Colour coding can allow all users to be able to use the same wayfinding techniques, just with a different interpretation.

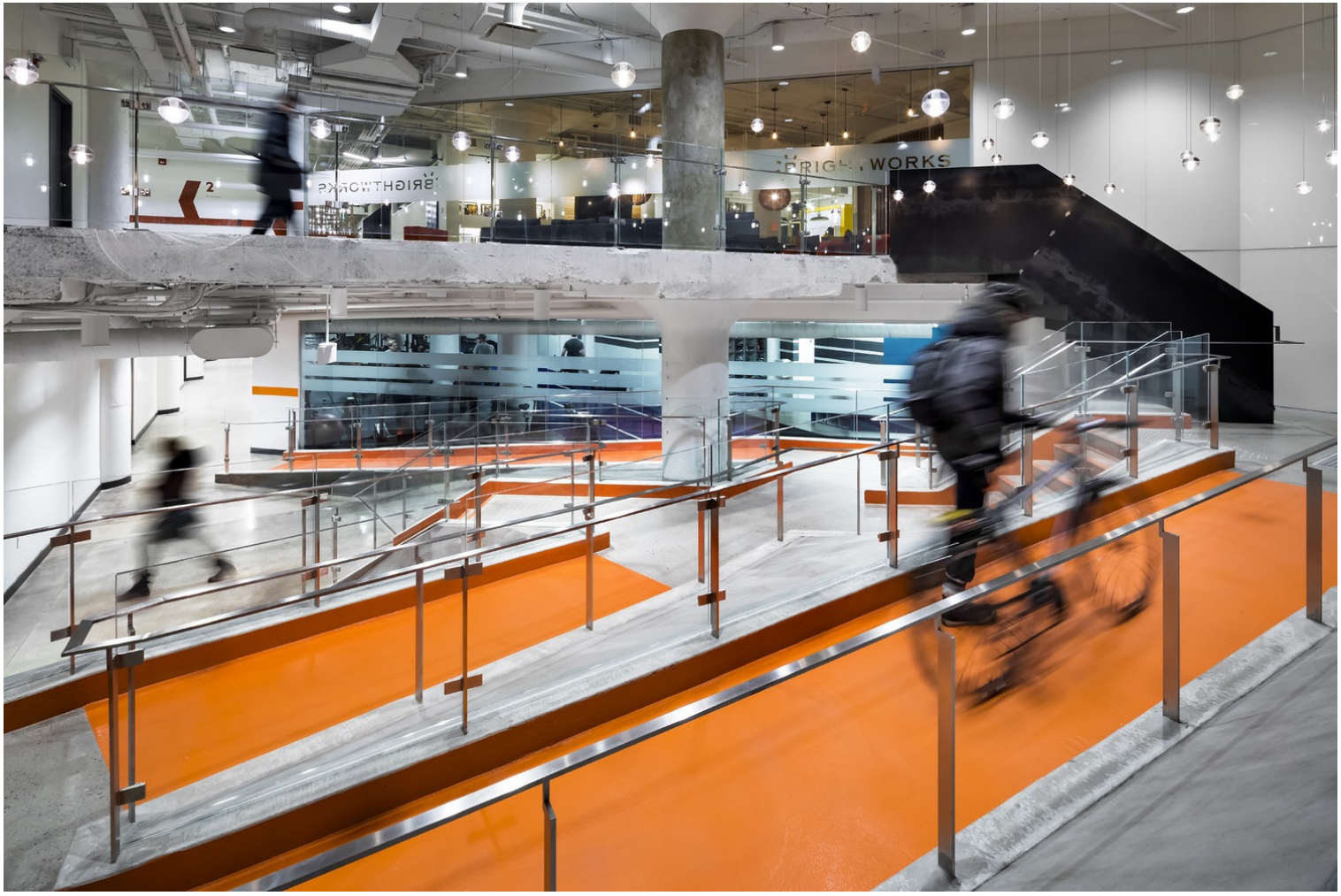



Figure 48: 100 Broadview Lobby Interior

## Design Elements:

Circulation: Bold exterior signage helps mark the entrance to the space by creating contrast with the surroundings. This allows the user to clearly identify where they are going and establish a smooth transition from the exterior to interior. Once the user has entered the building, there are a series of brightly coloured stairs and ramps leading down toward the office space in the back of the building. As shown in Figure 49, the ramp system at the front entrance may seem confusing; however, the ramps all lead to one main path of travel. This is a unique way of using universal design principles. Quadrangle Architects & Interiors won a silver award at the International Association for Universal Design for their integration of high contrast ramps and stairs into a dynamic space.[27]

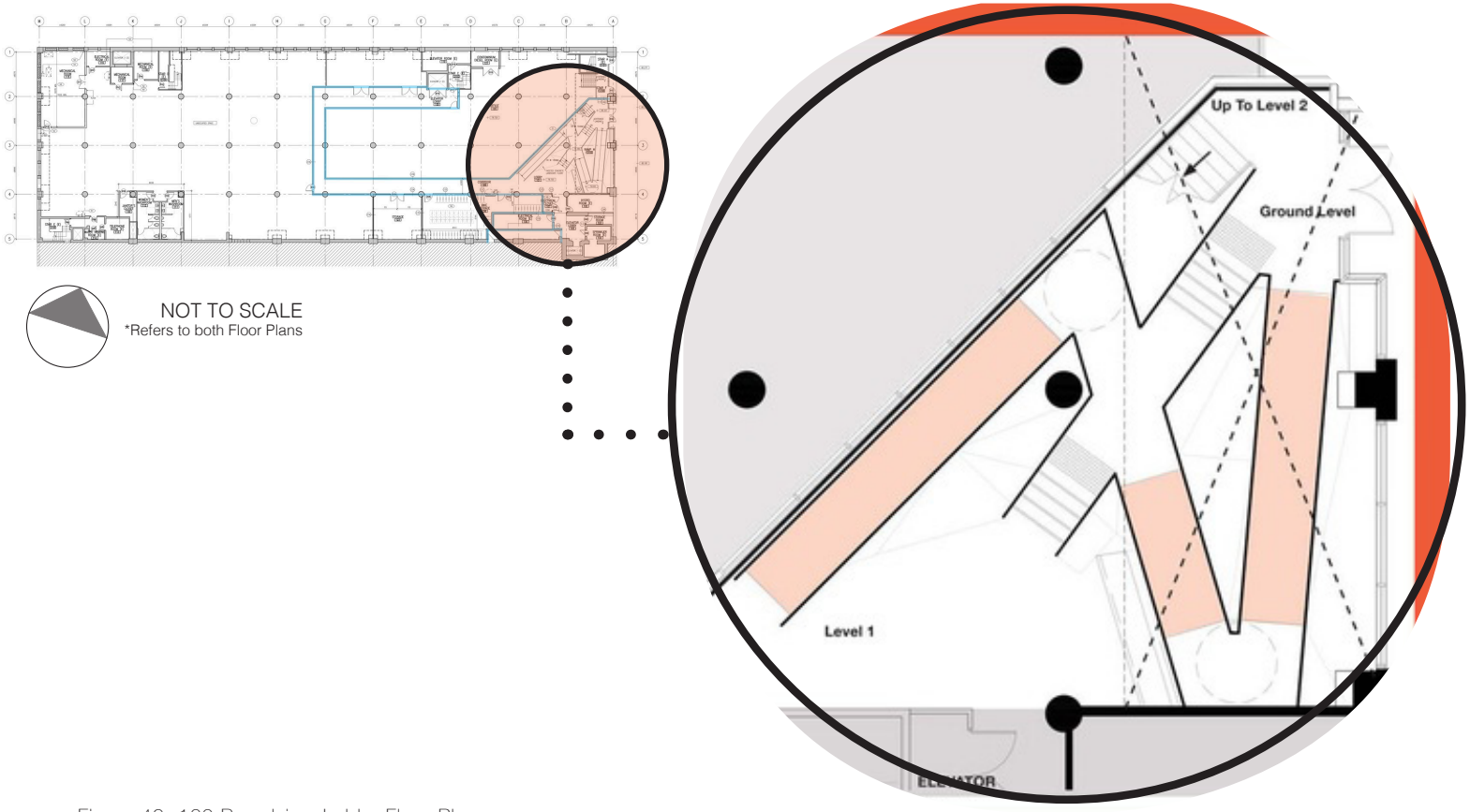



Figure 49: 100 Broadview Lobby Floor Plan.

Graphics: Bold colours and large graphics continue from the lobby throughout the rest of the public space in the building, including hallways, offices, and washrooms. The bold colours and large graphics provide clear navigation aids to users. The use of line and colour, as shown in Figure 50, helps to direct people to their next destination and also helps people avoid getting lost.

Wayfinding: As shown in Figure 48, the stairs are marked with orange visibility strips and textured tread. These let users know that there will be a level change in the path of travel. The stairs, although not entirely orange, have orange accent lines with stringers to create a continuous visual flow of movement. The descent is highlighted through the use of the colour orange, while the ascent is highlighted with the black steel staircase, as shown in Figure 48. These high contrast pathways can promote clarity and identify travel paths for users with low vision.[28]

Figure 50: 100 Broadview Lobby Wayfinding example.

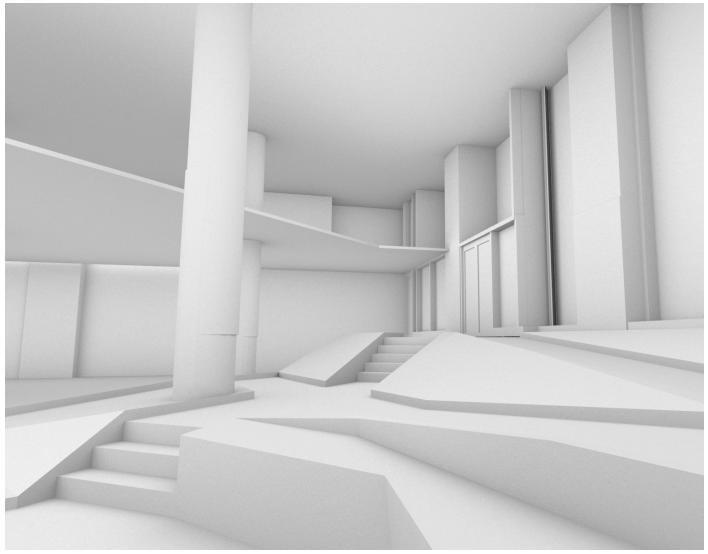


Figure 51: 100 Broadview Lobby- preliminary forms without wayfinding strategies implimented

Figure 52: Hazelwood School Circulation Path.

Figure 53: Milkshake Tree Playground Xylophone Walkway.

Figure 54: 100 Broadview Lobby Ramp System.

## 5.5 Summary and Conclusion

In conclusion, the precedents researched communicate positive physical and spatial design implications that can be incorporated into the Union Station Mobility Hub redesign. Spatially, Hazelwood School's concept of minimizing the overwhelming scale of a building into more manageable areas through a central, spine floor plan is important for successful orientation and perception. Trailing along the spine of the building should have little to no interruption and can be defined with varying levels of tactile qualities, similar to Milkshake Tree Playground's sensorial walkway. The various elements implemented into the redesign of Union Station, such as flooring, walls, furniture, and signage, can be organized using contrasting materials and colours to provide options for varying levels of visual impairment. By layering aspects from each precedent analyzed, a strong design that eliminates barriers and creates interactive and independent environments can take shape.

Table 5 summarizes the three precedents analyzed in Chapter 5: Precedents and their spatial considerations to the final design of the mobility hub.

| Project | Features | Spatial Implications |
|---|---|---|
| Hazelwood School | • Designing for Visual Impairment<br>• Overall design aided in creation of indepedence<br>• Connection of built environment to everyday scenarios<br>• Tried to eliminate barriers through design decisions | 1. Minimize space into smaller, more manageable areas<br>2. Constant flow of navigation without any interuption<br>3. Use varying degrees of tactile navigation<br>- material contrast,<br>- programme change<br>- trailing wall with navigational lines<br>- floor contrast<br>4. Contrast in color and light<br>5. Trailing wall with slight variations in directional change<br>6. Central "spine" |
| Milkshake Tree Playground | • Designing for a Sensorial Experience<br>• Explores the theme of community interaction<br>• Challenges the "play structure" typlogy through materiality use | 1. Sound as a landmark<br>2. Materials that emphasize sound<br>3. Small reflective materials to create<br>4. warmth on surface from sun<br>5. Choose materials that absorb warmth<br>6. Scents to orient oneself |
| 100 Broadview Lobby | • Different take on Universal Design<br>• Bold graphics and spatial delineation to aid in Wayfinding<br>• Universal design is able to go beyond mere accessibiltiy using innovative, bold strategies<br>• Connection from urban exterior to interior | 1. High contrasting colors to create delineation of<br>2. different types of spaces<br>3. Use contrasting elements for different use of space<br>4. Bold colors and lines, ramps, geometric shapes<br>5. Contrasting dark colors against light to highlight an element |

Table 5: Precedent analysis and spatial considerations

# 6 [six]

# PROGRAMMING

## 6.1 Chapter Introduction

The following chapter introduces the selected site and building and outlines the proposed programming document for the Union Station Mobility Hub. The site and building were chosen due to its central location in the city, accessibility to the downtown core for daily commuters, proximity to the Forks Historic Site for tourists, and because it is the existing location of Winnipeg's VIA Rail. The central location of the proposed mobility hub creates a core in the city and connects multiple modes of transit, such as walking, biking, driving, and transit. A mobility hub will also support and expand the existing business and recreational networks of the city to a larger demographic of users.[1] This encourages a comfortable, livelier downtown that creates more opportunities and access to users with visual impairments. The site and building analysis is described in relation to demographic and access. This section includes a brief history of the existing site and building, a building overview, and an analysis of the opportunities and constraints that the building and surrounding site have. This research will help inform programming decisions, materiality, and spatial planning in the final design proposal.

The programming information is specific to the incorporation of a mobility hub inside the existing Union Station. Only part of the building is to be used (the rest of the building will be considered untouched for the purpose of this practicum). The programming of the multi-use space will cater to all users but will pay specific attention to users with varying visual impairments. Activities and psychological and physical needs of all users are considered. The programme will help outline the spatial and programmatic functions of the final design of the Union Station Mobility Hub.

## 6.2 Site Analysis

This practicum project is located at Union Station on 123 Main Street in Winnipeg, Manitoba. The Union Station building was built between 1908 and 1911. The proposed site for the mobility hub is on the main level's 20,000-square-foot north wing. The mobility hub would incorporate various modes of transportation into one central hub. The hub will bring together long-distance train transportation, city transit, vehicular transport, biking, and walking by including support spaces for users of all of these activities. Being located in the city's core will enable more opportunities for public interaction, and the hub will act as a landmark between a user's origin and destination.

**Quick Facts**

Union Station
123 Main Street
Winnipeg, MB R3C 1A3

Total Sq. Ft : 248,000 $ft^2$

Figure 55: Union Station, Winnipeg, Manitoba.


Figure ##: Union Station in Winnipeg by Joe-Lynn-Design

| | |
|---|---|
| Type: | Transit, commercial, mixed use |
| Users: | Winnipeg transit employees, VIA Rail employees, public, commuters, and tourists |
| Site Location: | Entrance at intersection of Broadway Avenue and Main Street, Winnipeg, Manitoba |
| Levels: | 5 levels (4 above grade) – including train shed |
| Style: | Beaux-Arts |
| Architect: | Warren & Wetmore (1908-1911) Bridgeman Collaborative Architecture (2013 interior renovation) |
| Designation: | National Historic Site of Canada 1976 |

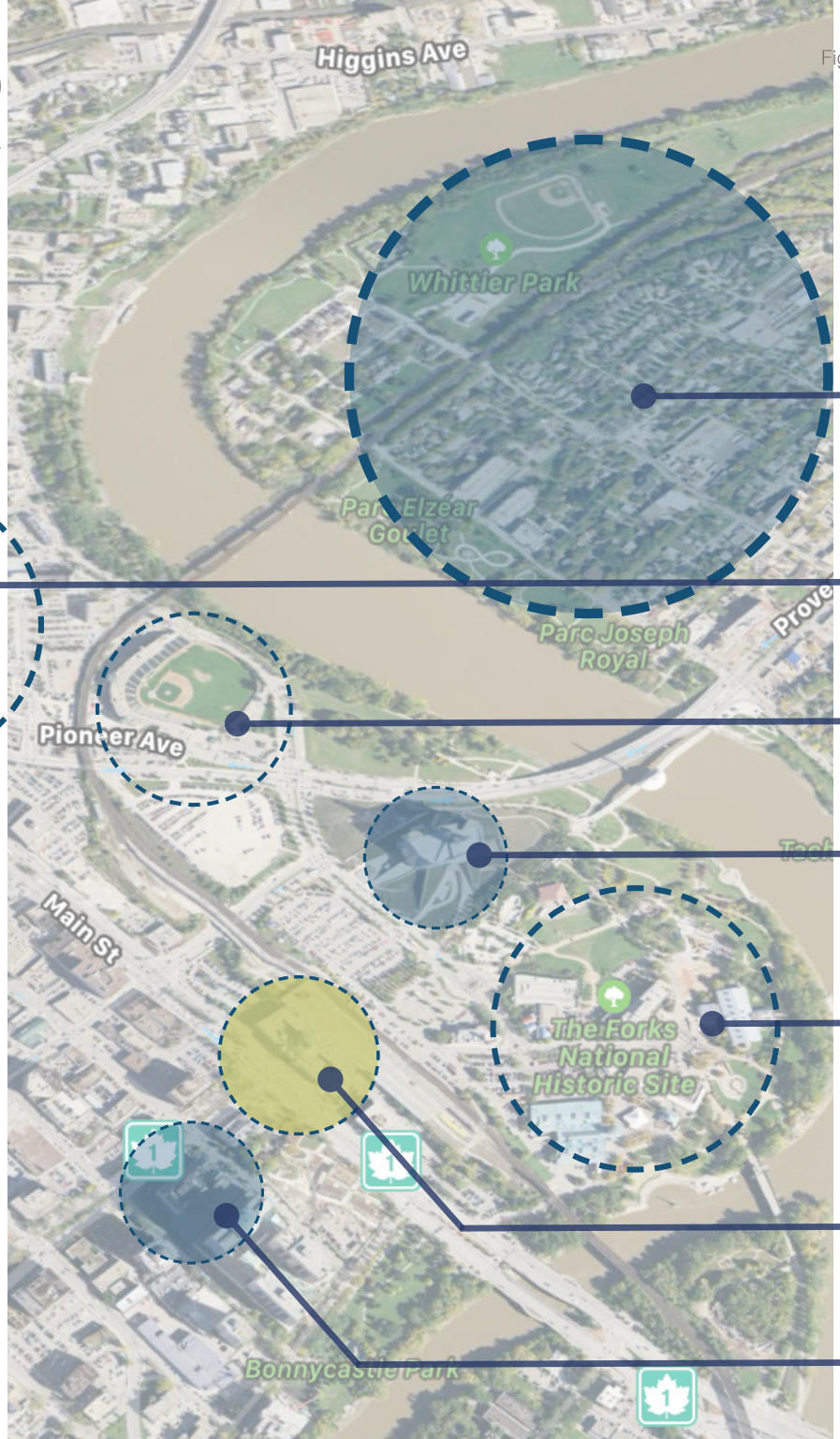
**Access and Pedestrian Movement**

Union Station is accessible by car, bus, train, and foot, as illustrated in Figure 57. The building is centrally located in Winnipeg's downtown core. As shown in Figure 56, the site is directly adjacent to the Forks Market, the Canadian Museum for Human Rights, and the Fort Garry Hotel. Directly in front of the building is the intersection at Broadway Avenue and Main Street. Behind the building, on the east side, are the original train tracks used for VIA Rail and cargo trains. The station can be used as a transitional space between Main Street and the Forks Market, and it acts as a gateway into the area.

Residents residing in the downtown core are more likely to walk to various downtown locations rather than drive. The following statistics are taken from "Winnipeg: A Downtown View," which provides insight into how Winnipeggers use transportation downtown[2]:

- 6.2% of Winnipeggers walk to work;
- 36.2% of downtown residents say they travel by foot;
- 24% of downtown residents say they use public transit to get to work (twice the citywide rate of 14%);
- Winnipeg Transit has 178 regular stops downtown and an average of 54,000 passengers disembark weekly downtown; and;
- Parking rates in downtown Winnipeg range from $80-$150/month.

Figure 56: Winnipeg Site Plan




Residential
15 - 30 min walk

Downtown
10 min walk

Shaw Park
8 min walk

Canadian Museum for Human Rights 5 min walk

Forks Market
5 min walk

Union Station

Hotel Fort Garry
2 min walk

## Basic Site Map

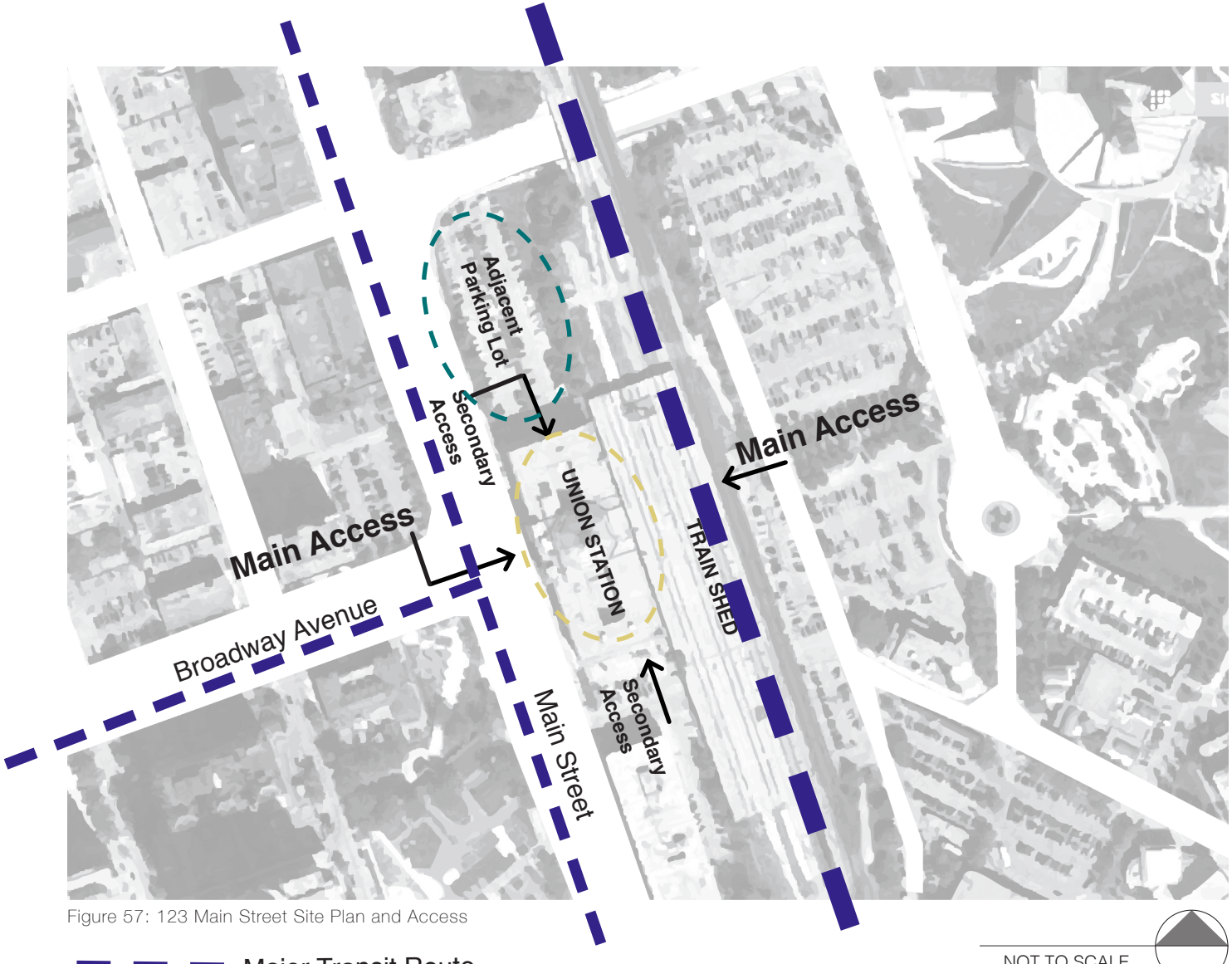



Figure 57: 123 Main Street Site Plan and Access

## Demographics

Downtown Winnipeg is home to approximately 13,000 residents and is intended to increase with the recent construction of loft converions and condo development in the Exchange District.[3] With the development of the downtown core, many of Manitoba's top employers are calling downtown Winnipeg home, employing approximately 11,000 staff.[4] Portage Place, CityPlace, Winnipeg Square, the Forks Market and the Exchange District include prime real estate for many retailers big and small to support the vibrant downtown community. Along with housing and business development, there are many of Manitoba's top secondary education facilities downtown. These include the University of Winnipeg, Red River College and the University of Manitoba's Bannatyne Campus, which enroll approximately 13,000 students on these campuses yearly.[5]

## Site Opportunities and Constraints

*Opportunities*

- Reuse of existing building on site as a sustainable option
- Existing infrastructure to be converted into Rapid Transit
- Access from multiple sides of the building Natural day lighting into building from above with no adjacent building to block sun
- Pedestrian access
- Downtown location includes users from varying demographic groups including, but not limited to, residential users, business owners, commuters, students and tourists
- Located downtown - the site is within walking distance to multiple Winnipeg Landmarks and the downtown business sector
- Large, open space gives the ability to insert elements, such as walls, to break up the open space
- Building is located on a snow route, meaning it will remain accessible during the winter months as well as the summer months

*Constraints*

- Traffic and noise from main intersection at entrance of building
- Excessive noise caused from trains

- Crime in the area
- Historical building
- Mixed use/shared space
- Train stations are difficult to expand, as the infrastructure is too expensive and invasive to alter

## 6.3 Building Analysis

### Fabric and Character

Physical Characteristics:

**Levels:** Four
**Construction:** Steel and masonry
**Cladding:** Tyndall stone
**Style:** Beaux-Arts
**Typology:** Railway terminal

The following are character defining elements of Union Station, as noted by Canada's Historic Places:[6]

1. The use of classical elements on a heroic scale.

2. The spatial relationship between its main components, including the domed central rotunda,

Figure 58: Union Station Existing Entrance

Figure 59: Union Station Rotunda


Figure 60: Union Station Main Street Vestible

the north and south winds, and the sub-grade passenger tunnel.

3. The classicism expressed in the combination of a monumental entrance with simplistic, set back wings.

4. The monumentality of the main entrance, achieved by a large, classically detailed arch, flanking columns, and dome above.

5. The form and detailing of the north and south wings, including the arrangement of paired windows of decreasing height under a broad cornice, the richly detailed ground-floor windows, and the ornate, metal-framed canopies over secondary entrances.

6. The use of Tyndall limestone on the building's exterior.

7. Its symmetrical arrangement and axial plan expressed as an interior sequencing of spaces around a central atrium, with the route to the passenger tunnel and platforms behind.

8. The Beaux-Arts decorative treatment of the principle interior public spaces, including railings, fixtures, wainscoting, grilles, mouldings, and finishes.

Figure 61: Union Station Architectural Detail

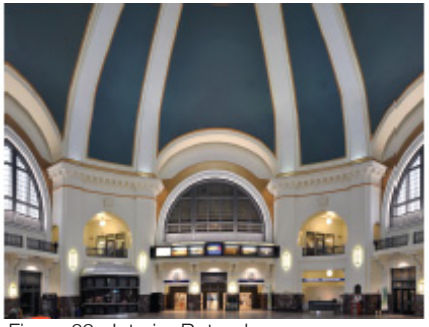


Figure 62 : Interior Rotunda

Figure 63 : Interior Rotunda Skylight

Figure 64 : North Wing (currently unused)

Figure 65 : Basement level of train shed

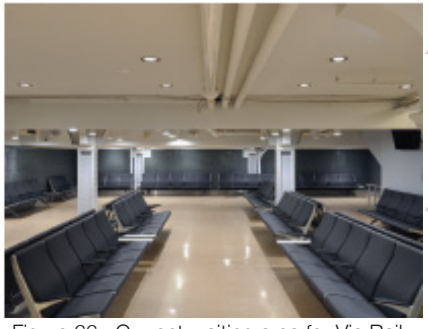


Figure 66 : Current waiting area for Via Rail

Area of Building used in Design Proposal



*Floor Plans provided by Bridgman Collaborative Architecture

**Main Floor Plan**

Figure 67: Existing Floor Plan of Union Station - Proposed Area Used in Design Proposal

## Building Opportunities and Constraints

*Opportunities*

- The building was not only built for function (as most railway stations are) but was also designed to evoke a sense of awe and amazement when immigrants from overseas disembarked the trains.
- There is dedicated parking on site for short and long-term travelers.
- Generous window sizing and placement allow natural daylight into the building.
- Ability to use the existing building's character and detail to inform new design elements relating to rhythm and pattern by following what is already there.
- Existing side access on the north side, adjacent to the existing parking lot, is good for pick-ups and drop-offs.
- Existing main floor does not have any sudden drops or level changes.

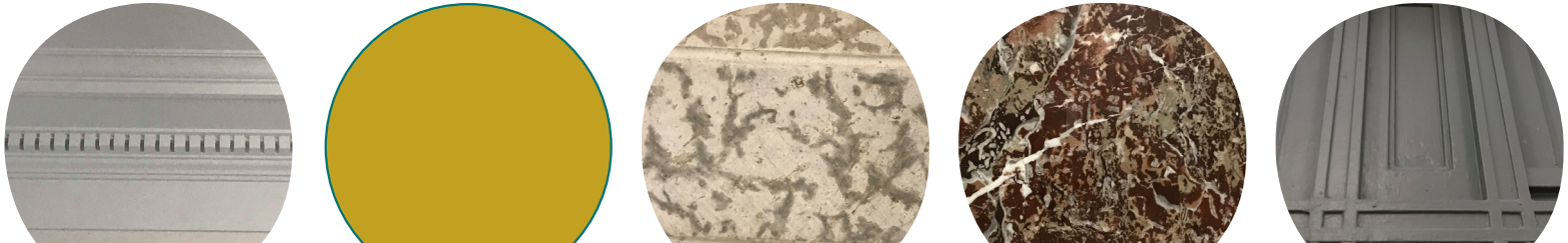
*Constraints*

- The building is designated as a heritage site and subject to heritage restrictions governing renovation.
- Accessibility—the building's main entrance is a large, open space that may feel overwhelming to many users.
- Need to manipulate the amount of daylight entering the space to avoid shadows and glare.
- Shared tenant space.

## History of Union Station

This section will include a "rereading" of the building's original floor plans, interior elevations, and photographs. A "rereading", as mentioned in Chapter 3 of this document, is a process developed by Brooker and Stone, that includes a set of guidelines to analyse a buildings existing characteristics which can help provide a vocabulary for the proposed redesign of the space.

Figure 68: Existing Building Fabric



Union Station was built between 1908 and 1911 for the Grand Trunk Pacific and Canadian Northern railways. At the time, the Manitoba Free Press said it was "the most modern railway terminal in the world."[7] The station was designed by Warren and Wetmore, the architects of New York's Grand Central Terminal. They designed Union Station in the Beaux-Arts fashion. Beaux-Arts is defined as a style that is a "theatrical and heavily ornamented classical style which strongly considers the function of space."[8] The style projected an image of grandeur and wealth, which matched the design's intent of creating a sense of awe from the thousands of immigrants walking through the doors into the booming city of Winnipeg.[9] Geographically, Winnipeg is located at the heart of the continent; therefore, Union Station was the gateway to the West and a symbol of progress and promise.[10,11]

Beaux-Arts style was popular between 1893 and declined shortly before the Great Depression.[12] It serves as a prime example of revival style because it looks for and borrows inspiration from the past.[13] It is derived from 'les beaux arts' in France and is emphasized through classical forms and features, elaborate detailing, massive plans, and heavy masonry.[14]

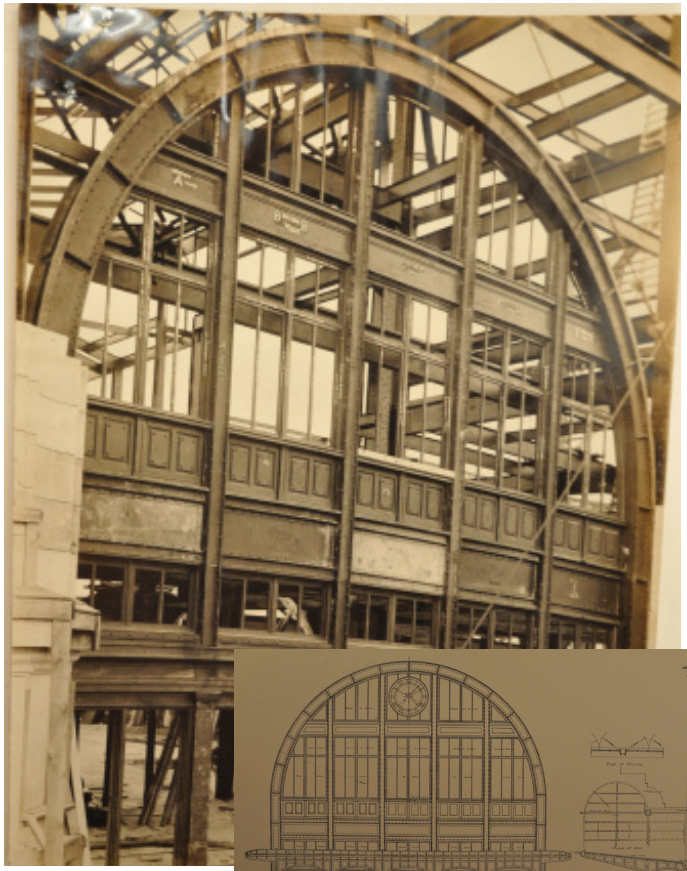


Figure 69: Construction of Union Station



Figure 72: Union Station Main Street Entrance - Elevation

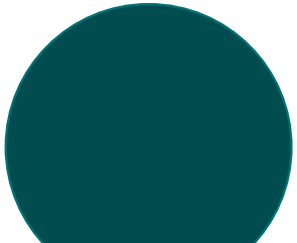


Figure 69 is a photograph taken while Union Station was being built between 1908 and 1911. The images depict typical characteristics of Beaux-Arts architecture incorporated into the building. For example, Figure 72 depict the many grand arches used in the building's exterior and interior. The arches were made of cast iron and created grand, open spaces that directed the eye upwards, so the building's grandeur was appreciated.

Figures 74 and 75 highlight the classical details and symmetrical design that the building contains. Balconies and columns outline the perimeter of the grand rotunda and create a light and airy feeling, which is contrasted by the heavy masonry.

Beaux-Arts style could be categorized through four defining architectural characteristics.

1. Classical Details
   Beaux-Arts architectural style combines classical elements from the Greek, Roman and Renaissance periods characterised by order, baulustrades, pillasters and balconies, columns. The interiors of these buildings are generally heavily ornamented using lavishly polished stones.[15]
2. Symmetry
   Buildings were designed in a symmetrical fashion. Interior's boasted symmetrical floor plans creating simple and logical circulation paths. The exterior facades also included very symmetrical designs including central columns, windows and door placements.[16]
3. Arches
   As seen in Figures 74 and 75 windows and doors, open archways linking halls, including arches of varying scales and contrased with the simple, heavy frame of the building plan.[17]
4. Construction
   These styles of buildings typically used heavy masonry construction, contrasted with thin, iron arches and atrium spaces that created a juxtaposition between classical and modern technique.[18]

The floor plan (Figure 73) shows the reader that the building was a mirror image of itself. Symmetrical layouts are typical of the Beaux-Arts fashion. The original space's floor plan was simple and functional, allowing the building to speak for itself and on behalf of the city that travelers were being welcomed into.

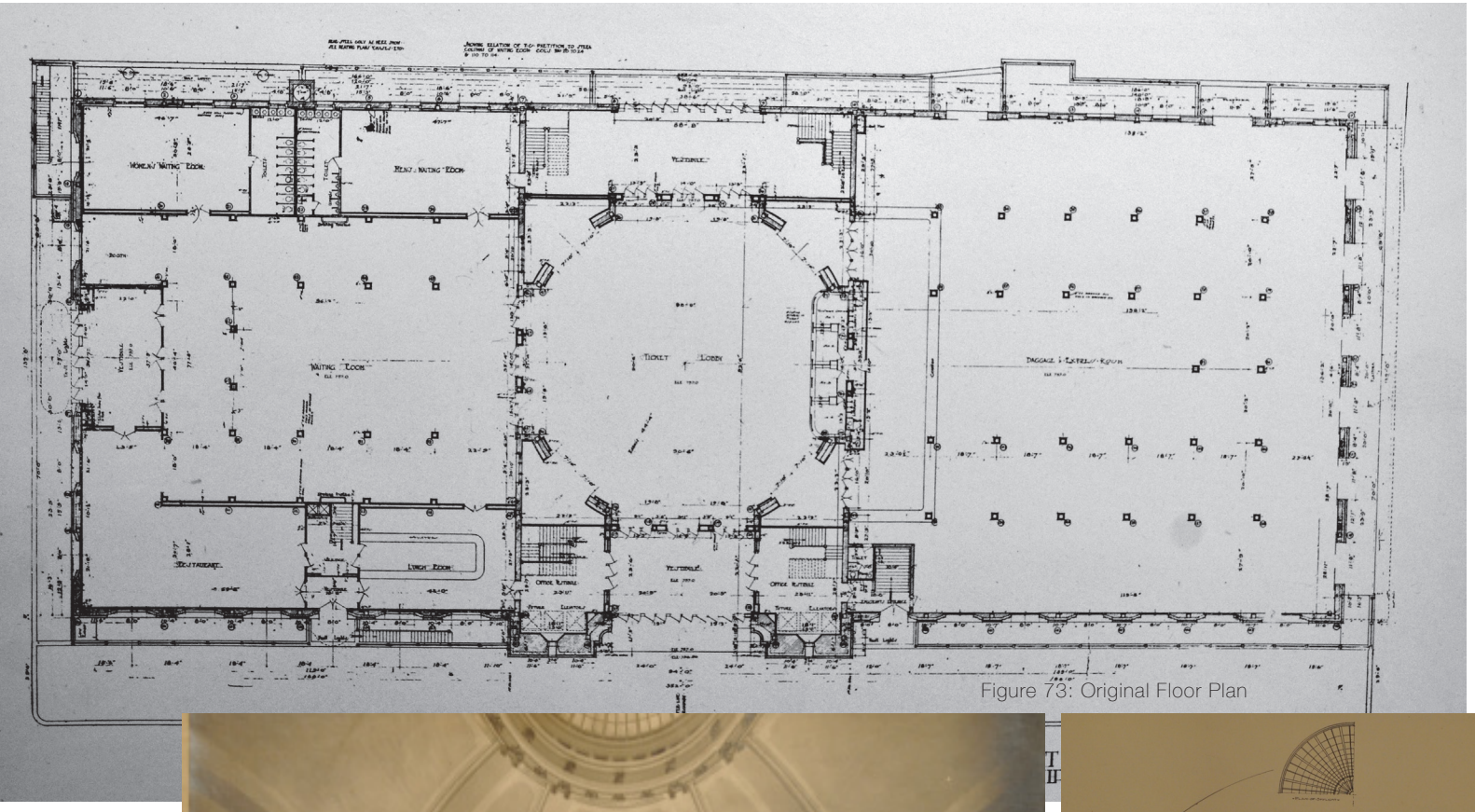



Figure 73: Original Floor Plan

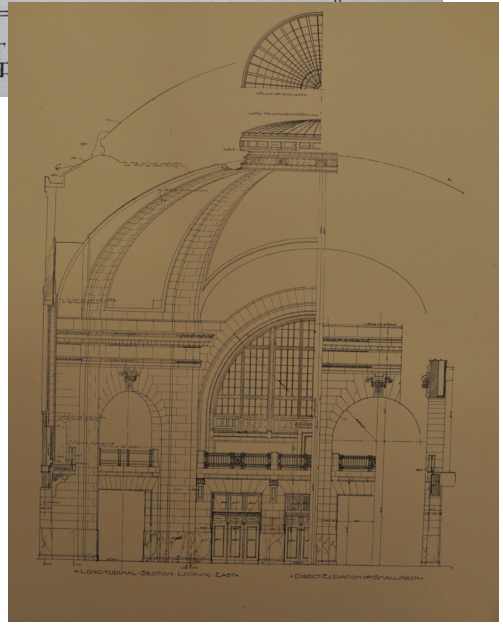


Figure 74: Historical Image of Rotunda

**Union Station is a designated heritage building, and would need to go through a heritage review for any design work on the interior of the building.*

## 6.4 Design Programme

This section is organized to outline the proposed programming document used in the design of a mobility hub at Union Station. The programme provides a human factor analysis of the client and user profiles, and also outlines intended activities that will happen throughout the space. These will help determine proposed square footage for required spaces, the required spaces functional requirements, and the final spatial adjacencies that will inform the spatial development of the proposed space.

The adaptive reuse of Union Station is being explored to incorporate the existing station into Winnipeg's Rapid Transit System. Furthermore, the implementation of various design strategies and interventions will contribute to successful wayfinding techniques for users of the mobility hub. By paying special attention to those with vision impairment, there will be equal opportunities for users to engage with the space. The design is intended to provide a sense of empowerment and independence for blind and partially sighted individuals. Empowerment and independence will be enabled by creating a sensory experience informed by educational research on vision loss, narrative and perception theories, personal experience, and precedent research. The theories and research will be implemented in the design through sensorial engagement with the environment using the senses of touch, smell, sight, and hearing. Comprehensive wayfinding techniques will be combined in a variety of forms to establish multiple experience options and different ways of user interaction.

Mobility hubs are home to various activities dependant on the needs of individual users. Union Station will provide the user with navigation tools and aids to promote personal comfort, a sense of security, and independence while using the transit hub.

**Values and Aims for the Project**

Community: Create a destination that enhances the accessibility of the transit system throughout the city. The space will also bring the community together by supporting businesses

and strengthening the function of the downtown core.

Safety: Promote a safe environment for people with vision loss. Users should feel that they will not cause harm to themselves or others in the space.

Comfort: Whether a local resident or visiting tourist, it is important that public transit is welcoming and comfortable. Amenities for short-term and long-term waiting should be provided to support the user's upcoming journey.

## Human Factor Analysis

*Client Profile*

The client is the City of Winnipeg, alongside Winnipeg Transit and VIA Rail. The City of Winnipeg's vision and corporate mission is to be a vibrant and healthy city that places its highest priority on quality of life for all its citizens by working together to achieve affordable, responsive, and innovative public services.[19] VIA Rail's vision and mission is to more conveniently and safely move people through innovation, 'know-how,' trust, agility, accountability, and integrity.[20] However, according to Statistics Canada, only 13% of people in Winnipeg take transit to work,[21] while 71% of people continue to drive their vehicles downtown for work every day.[22] By working together, the City of Winnipeg, Winnipeg Transit, and VIA Rail can aid in the future development of a positive and lively city.

*Current Needs and Future Goals*

Winnipeg Transit is responsible for providing detailed service information, including fares, maps, timetables, and stop schedules, for public transportation throughout Winnipeg.[23] This needs to be done in a user-friendly and accessible manner that aids in a positive, stress-free experience of navigating Winnipeg for both residents and tourists. The current needs of public transportation for the City of Winnipeg is a core hub downtown that serves as a destination spot and promotes public transit as a main mode of transportation. These objectives need to be met in the short-term and long-term.

*Goals*

- Community
- Development of downtown core
- Improve commuter transit access
- Improve efficiency, convenience, and

integration of transport services
- Aesthetic that caters to all genders, ages, cultures, and abilities
- Timeless building design that does not disturb the historical significance of the building
- Accessible design

*User Profile*

Everyday commuters, local residents of Winnipeg, and visitors to the city will use Winnipeg Transit and the Union Station Mobility Hub. VIA Rail passengers will also use the Union Station Mobility Hub. People will be coming and going at rapid speeds and will need a variety of options to cater to their individual schedules. Users expect a mobility hub that supports an efficient transit system. Furthermore, because of the wide range of people that will use the space, the design must consider accessibility, wayfinding for ability, culture, and language. For this practicum, particular attention is given to users with vision loss.

Other users of the station will be Winnipeg Transit and VIA Rail staff, local law enforcement, and tenants using office space within the building.

**Primary Users:**

Commuters - Local Residents - Restaurant Guests - Students - VIA Rail Passengers - Transit Staff - Tourists

**Secondary Users:**

Train Conductors - Bus Driver - Administration - Maintenance - Security - Food Services

**Tertiary Users:**

City Workers - Transit Police - Family (Pick Up/Drop Off) - Delivery

**Programmatic Features & Functional Requirements**

These tables are used to inform the spatial needs of different users using the space. The requirements needed to make a space usable is important in a mobility hub because travel and navigation can be stressful for many people. Therefore, users' comfort and safety are of utmost importance, as is ensuring that varying levels of sensory needs are accounted for, so all users can successfully engage in the interior environment.

*Refer to Tables 6 and 7 on the following pages.*

## User Activity - Primary Users

| Users | Behavioral Needs | | | Psychological Needs | | | | Spatial Needs | |
|---|---|---|---|---|---|---|---|---|---|
| | Activity | Freq. | Time | Aesthetic Preferences | Privacy Needs | Sensory Needs | Socialization Needs | Visual | Mobility |
| Commuters (Short Term) | Enter Station | 1X Day | 1-5 min | - ability to navigate with confidence<br>- safety and secure<br>- sit and rest comfortably on platform and in station<br>- social interaction<br>- Personal time<br>- stimulation<br>- engaging<br>- create calmness in a high energy space | no | - clean<br>- safe (rounded corners)<br>- transitional<br>- hierarchy<br>- bold<br>- contrast<br>- engaging<br>- textural<br>- acoustic<br>- smell<br>- wayfinding | - private areas<br>- intimate space<br>- individual<br>- public space | - easily accessible<br>- contrast<br>- comfortable<br>- intimate spaces<br>- wayfinding<br>- engaging<br>- sensorial (make a large open space feel more manageable)<br>- rhythm<br>- large text | yes |
| | Purchase/ Reloading Bus Card | 1X Day | 3-5 min | | yes | | | | |
| | Waiting on Platform | 1X Day | 1-30 min | | no | | | | |
| | Eating | 1X Day | 5min-2 hrs | | no | | | | |
| Commuters (Long Term) | Resting | varies | 5-60 min | | yes | | | | |
| | Carrying Baggage | 1X Day | 30min-2 hrs | | no | | | | |
| | Navigating | all day | 5min-2 hrs | | no | | | | |
| Ticketing/ Full Time Staff | Sitting | all day | 8 hrs | - comfortable space<br>- safe space<br>- ability to sit or stand<br>- community/local<br>- provide valuable information | no | - clean<br>- ergonomic<br>- exterior view<br>- acoustics<br>- natural light<br>- task light | - intimate space<br>- public space | - bright<br>- no distractions<br>- open<br>- comfortable<br>- natural light<br>- views | yes |
| | Selling Tickets | all day | 8 hrs | | yes | | | | |
| | Giving Info | all day | 8 hrs | | yes | | | | |
| Restaurant Guests | Eating | 1X Day | 30min-2 hrs | - relaxing and comfortable in a casual setting<br>- intimate spaces for socializing or being with oneself<br>- clear wayfinding - seating, to waste, to order/paying<br>- open and closed spaces | no | - clean<br>- task lighting<br>- wayfinding - contrast, texture<br>- smell<br>- acoustics | - intimate space<br>- individual<br>- public space<br>- group area | - easily accessible<br>- bright<br>- comfort<br>- engagement<br>- accessible<br>- contrast | yes |
| | Socializing | varies | 30min-2 hrs | | yes | | | | |

Table 6: User Activity - Primary

## Function, Aesthetic, & Technical Requirements

| Space | # | Activity | FF&E | Colour & Material | Atmosphere | Level | Spatial Req. |
|---|---|---|---|---|---|---|---|
| Entrance | 2 | Walking, navigating, resting | ATM, Tactile Map, Clock, Seating | durable, washable, contrasting color to the stone of the existing building, natural light, floor texture, threshold, braille information, large text | bright, simple, exterior qualities, interlacing, layered, inviting, bold, contrast to industrial with materials and colors, double volume (to alter acoustic), plants (smell) | Ground Level | 1000ft$^2$ |
| Exit | 1 | Walking, navigating, resting | ATM, Tactile Map, Clock, Garbage | durable, washable, contrasting color to the stone of the existing building, natural light, floor texture, threshold, braille information, large text | bright, simple, exterior qualities, bold, contrast to industrial with materials and colors, double volume (to alter acoustics), plants (smell) | Ground Level | 300ft$^2$ |
| Ticketing/ Information | 1 | Talking, listening, writing, paying, navigating, information, phone | metro card machines, computer, cash register, garbage, cabinets, counter, telephone | durable, washable, braille information, use color as wayfinding, floor texture as wayfinding, large text, frosted glass (diffuse daylight) | acoustics need to be controlled, simple space, desk contrast with rest of open area to be easily seen | Ground Level | 1000ft$^2$ |
| Circulation | 1 | Walking, navigating, resting, waiting, eating, talking on phone | trailing wall, seating surfaces, textural maps, braille information, durable, washable | touch - floor texture, trailing wall<br>smell - restaurants<br>hearing - acoustic paneling in contrast with loud material selection, continuous elements (handrail, flooring, wall) | "spine" of the building, used to create a more intimate space amongst the large, open area, high contrast color, materials. use of natural sunlight to warm surfaces and create hierarchy in spaces/information, rhythm | Ground Level - double volume | 7000ft$^2$ |
| Food Services | 2/3 | cooking, cleaning, storage, eating, talking, socializing, ordering | shelving, sinks, fridge, microwave, stove, oven, counter, cash register, seating (individual and group), tables, garbage, lighting, braille | sense of smell - use to guide users into the space, contrasting colors for seating, texture of floor to guide user, bold wayfinding graphics/ colors, soft colors with bold accents, use of items with a smell (ex Plants) large text | small, intimate spaces amongst large open space, acoustics controlled, contrast of light and dark, controlled natural day lighting (clerestory windows), welcoming, comfortable, use of curved corners, rhythm | Ground Level | 6000ft$^2$ |

Table 7: Function, aesthetic and technical requirements

## Function, Aesthetic, & Technical Requirements Cont'd

| Space | # | Activity | FF&E | Colour & Material | Atmosphere | Level | Spatial Req. |
|---|---|---|---|---|---|---|---|
| Platform-Short Term | 1 | Walking, navigating, waiting for train, sitting, getting on and off train | Platform barriers, bench seating, map, pods, braille | durable, washable, graphic and bold color contrast to differentiate tracks and platform/waiting area, transitional material from the interior to exterior, floor texture | bright, natural light (but without glare), open space with closed areas, bold graphics and contrast for wayfinding purposed, safe, public, acoustic strategy to minimize train noise, large text | Ground Level | 8,000 $ft^2$ |
| Platform-Long Term | 1 | Walking, navigating, waiting for train, sitting, getting on and off train | Platform barriers, bench seating, map, pods, braille | durable, washable, graphic and bold color contrast to differentiate tracks and platform/waiting area, transitional material from the interior to exterior, floor texture | bright, natural light (but without glare), open space with closed areas, bold graphics and contrast for wayfinding purposed, safe, public, acoustic strategy to minimize train noise, large text | Ground Level | 8,000 $ft^2$ |
| Washrooms | 21 | hand washing, toilet, makeup | accessible sink, mirror, hand dryer, soap, accessible toilet, sensor fixtures, braille | durable, washable, textural, simple, neutral with bold wayfinding graphics | simple, neutral, large text | Ground Level | 1000 $ft^2$ |
| Waiting Area | 2 | sitting, standing, talking, listening, talking on phone | bench seating, lounge seating, tables, plants | durable, washable, textural, simple, neutral with bold wayfinding graphics | comfortable, bright, enclosed space, public | Ground Level | 2000 $ft^2$ |
| Retail | 1 | browsing, storage, paying, information, phone calls | storage, cash desk, displays, large text, braille | durable, washable, textural, simple, neutral with bold wayfinding graphics | intimate spaces amongst large open space, acoustics controlled, contrast of light and dark, textural changes (floor and wall), ability to be hands on with display, large text | Ground Level | 300 $ft^2$ |

**Note: Platforms - Short Term & Long Term are not included in the scope of the final design proposal*

**Total Proposed Square Feet :** 18,600 sq. ft.

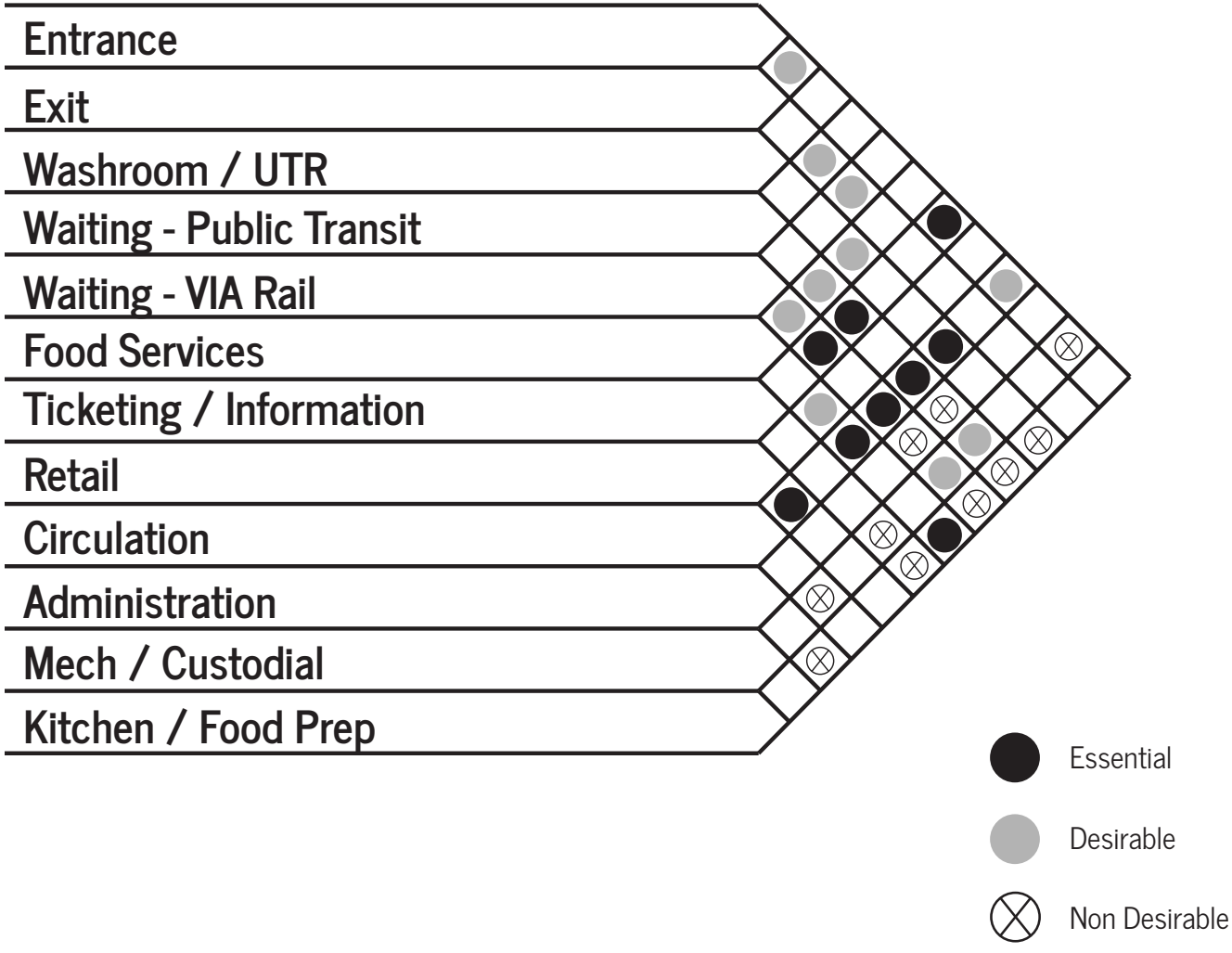



Figure 76: Spatial Adjacency Diagram

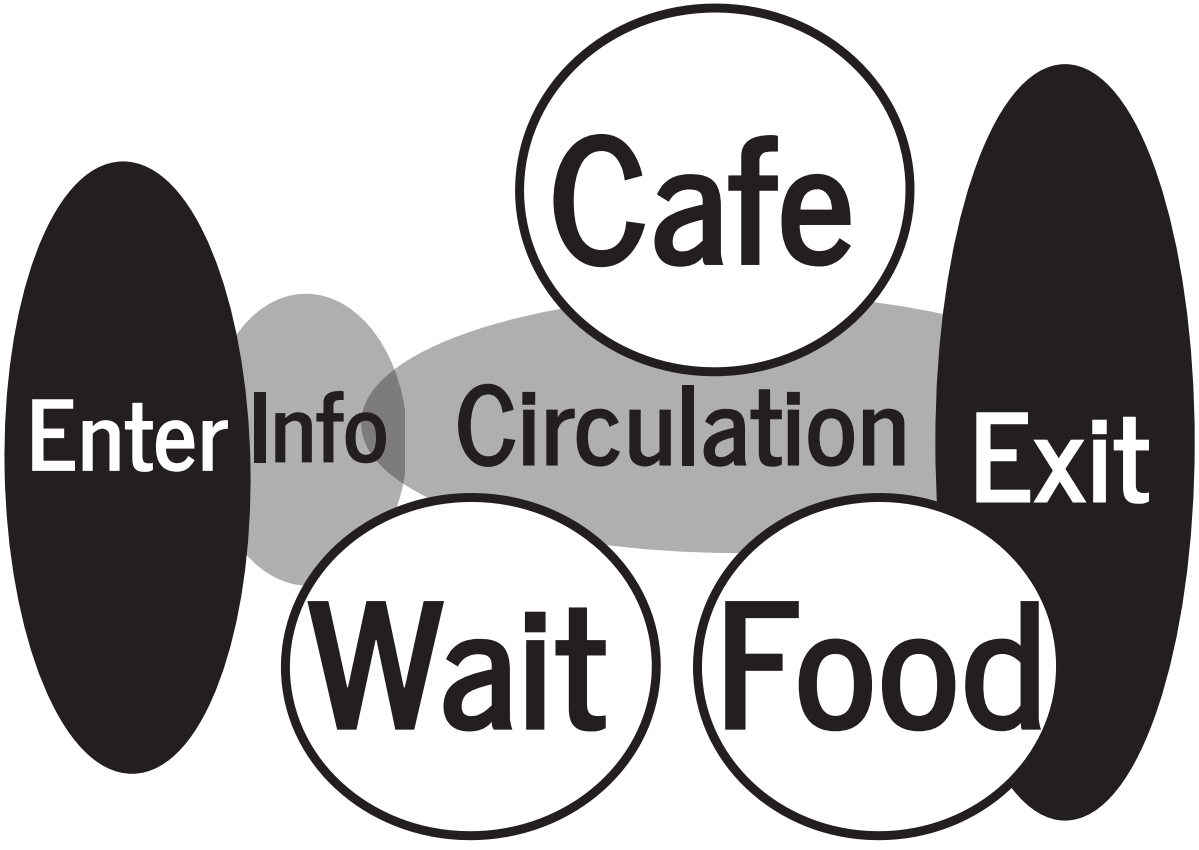



Figure 77: Bubble Diagram

*Spatial Organization*

The following maps depict how the theories and research analyzed throughout this practicum were used in the overall spatial development of the floor plan for redesigning Union Station into a mobility hub. The spatial zoning diagram incorporates spatial characteristics derived from the four lenses of research. These include a simple, legible center spine plan, smaller areas to make the vast space more manageable while keeping with a constrant flow of navigation through the hub. The "movement maps" on the following pages, harbor the human activities in a mobility hub and

use them to further the spatial organization and floor plan of the design. The maps illustrate the levels of movement a user may experience when using a mobility hub. Movements are categorized into three types: active, transient, and stationary.

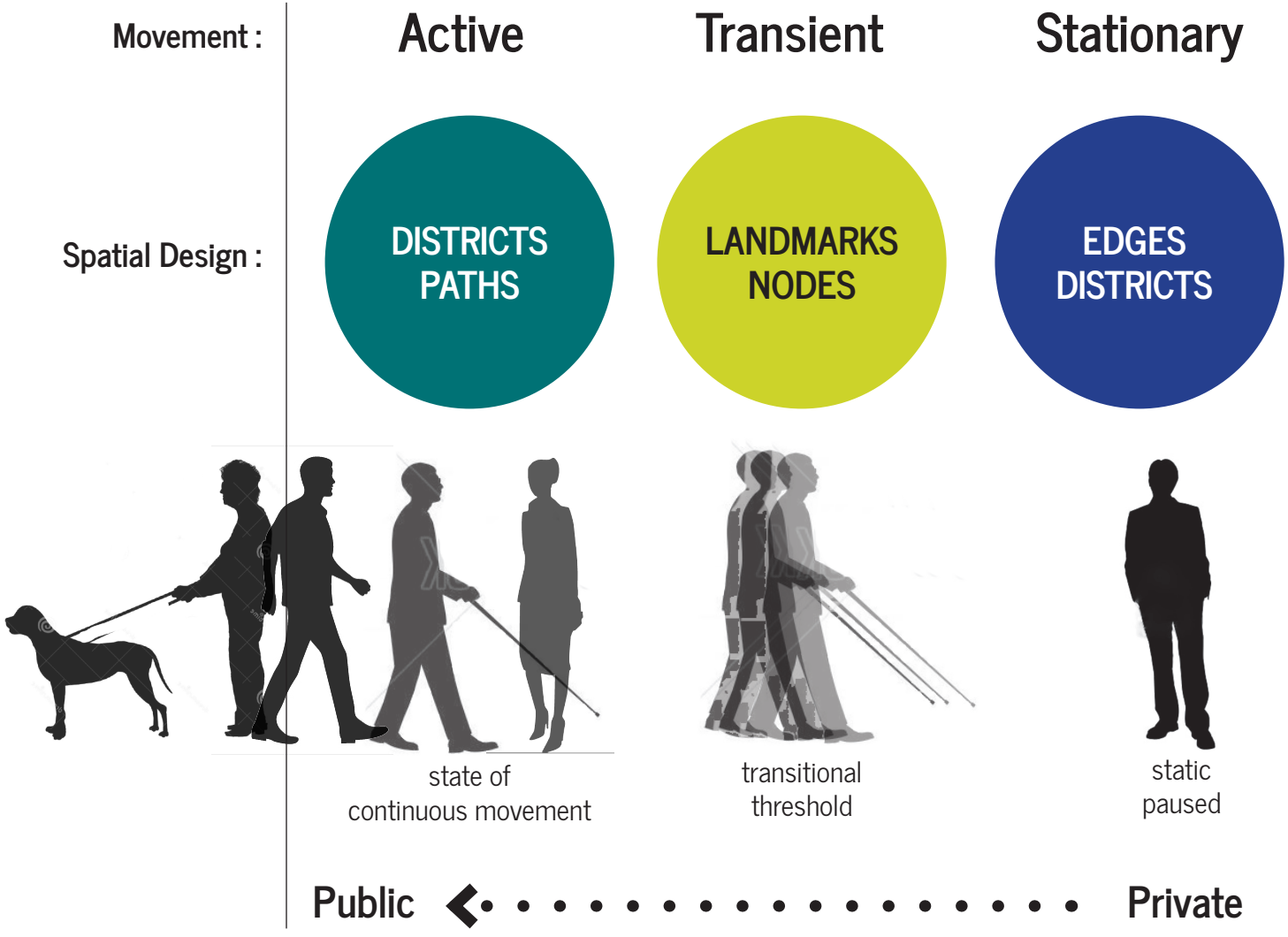



Figure 78: Spatial Organization Strategy using Movement

## Active

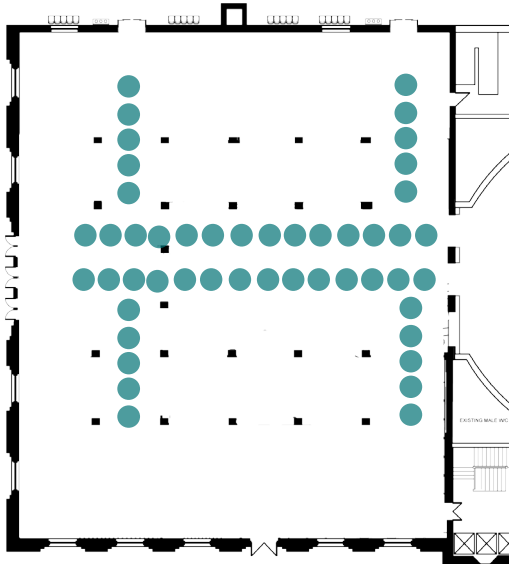


Figure 79: Active Movement Map

It is important in a large, open space to have a very simple navigational layout. This is accomplished using a simple 'H' pattern through the main corridors and paths of continuous travel throughout the space creating various districts.

## Transient

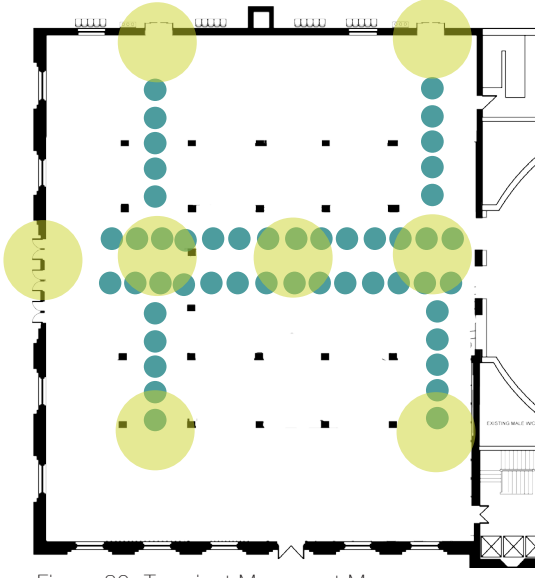


Figure 80: Transient Movement Map

Identifiable objects are used to direct and navigate a user through the space with ease. Landmarks, such as tactile maps, information desks and trailing walls are used at intersections to direct individuals to their end destination.

## Stationary

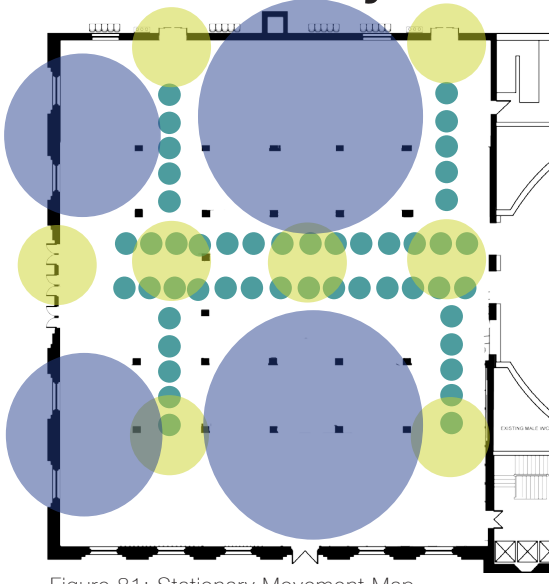


Figure 81: Stationary Movement Map

The use of bold, contrasting floors, baseboards and walls in large areas to distinguish boundaries. Acoustic ceiling pods are used to create districts of similar sensory experience through absorbing sound. These areas are located off to the edges of the overall floor plan and away from main traffic areas.

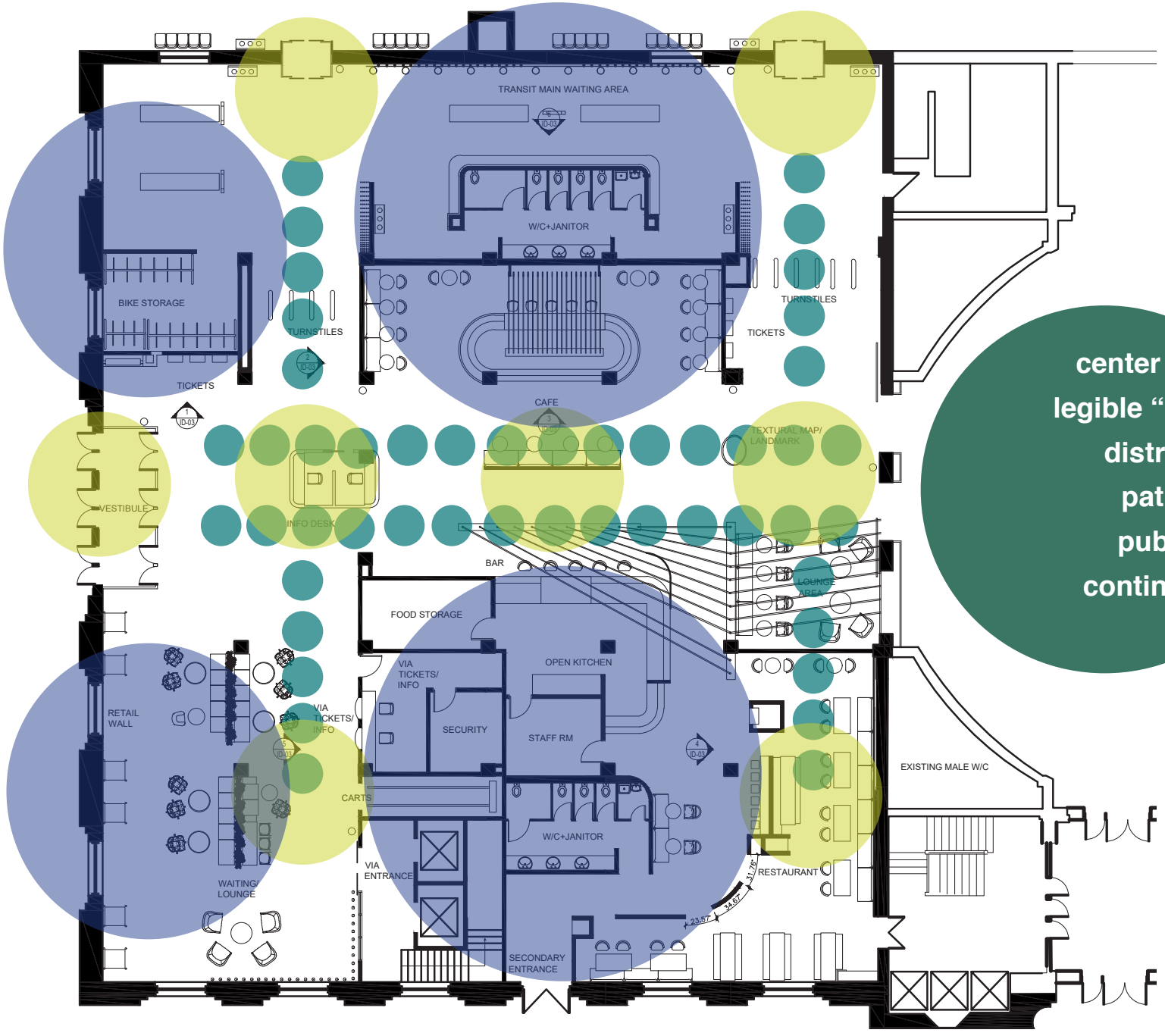
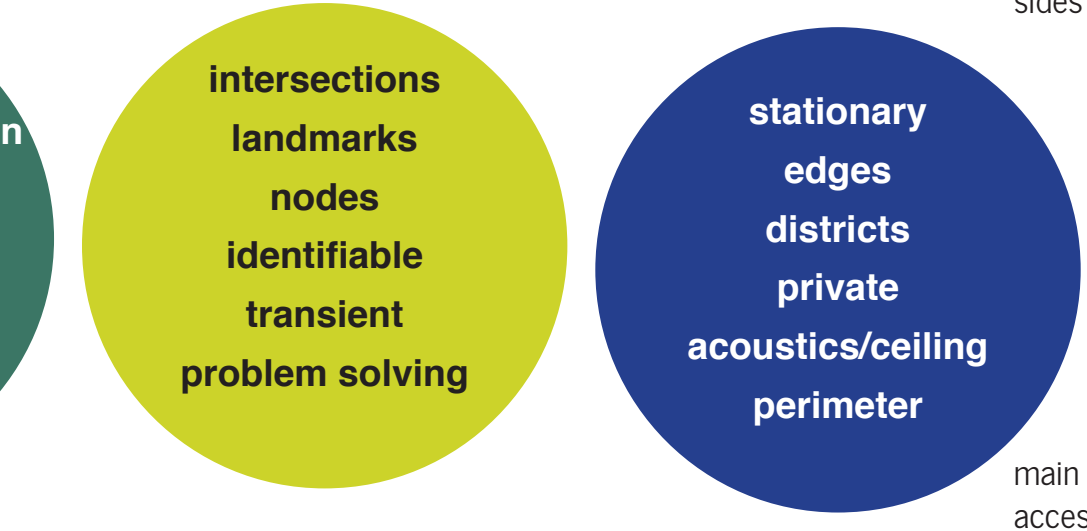



Figure 82: Spatial Organization of Wall placement derived from types of Movement

## 6.5 Summary of Research

Union Station's existing location at the intersection of Broadway Avenue and Main Street in downtown Winnipeg is a perfect location for a mobility hub. Union Station is easily accessible to pedestrians from multiple sides of the building and is within walking distance to businesses and some major Winnipeg landmarks. The final design proposal must be sensitive to the historic nature of the building, while also integrating modern design solutions to aid in navigational strategies for users. Because of the expansive scale and multi-use aspects of the building, the design will focus on strategic space planning of the main level's north wing. This space has direct access to the existing parking lot and main rotunda entrance. It provides the capability to keep most of the existing building tenants untouched, while increasing the building's accessibility for new and future tenants. An understanding of location, proximities, building analysis, and history of the existing building developed opportunities and constraints that challenge the final design proposal.



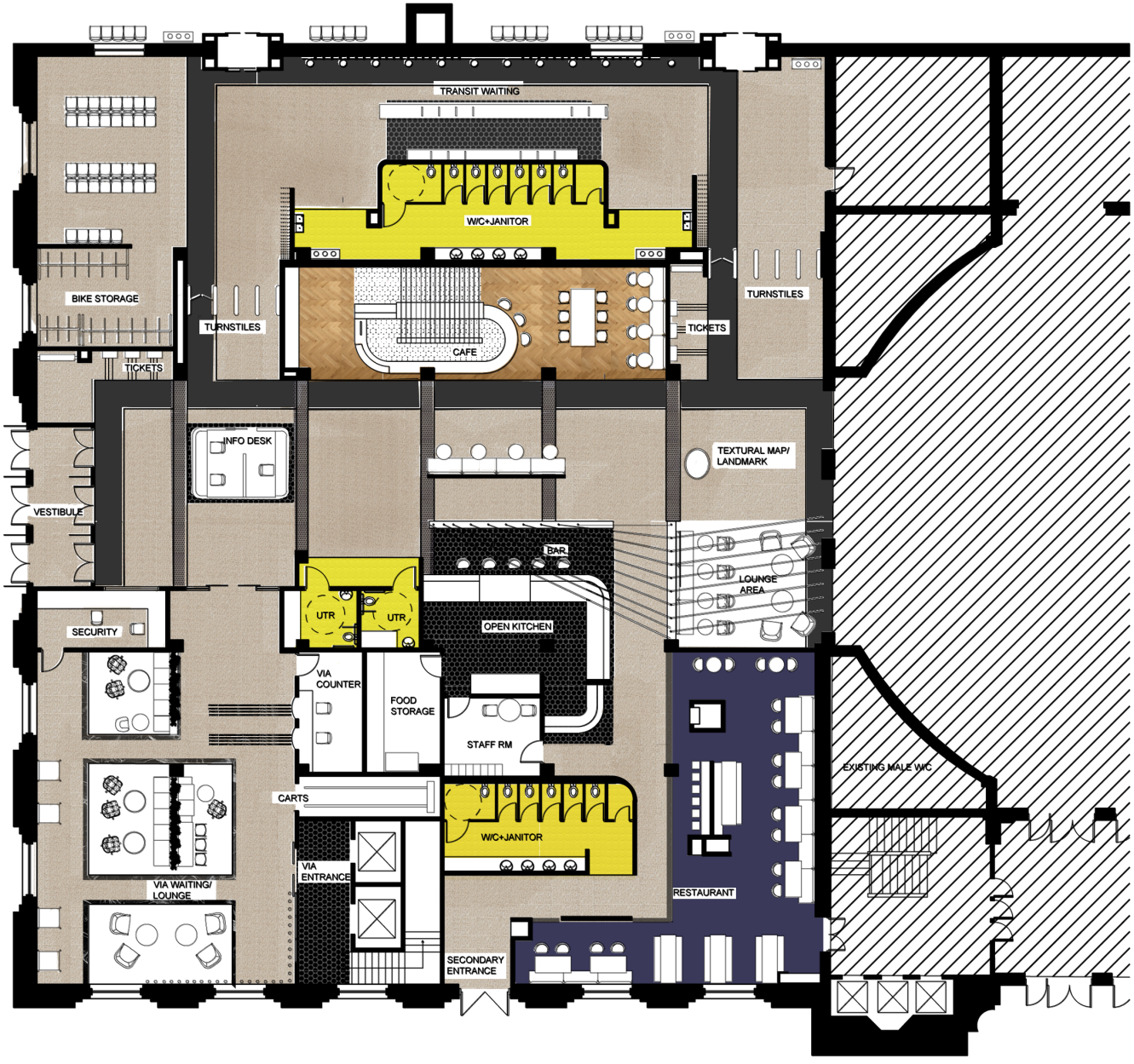

The final floor plan was developed through the use of the three degrees of movement: active, transient and stationary. These paths and intersections helped determine locations of detectable flooring, signage placement, information locations and amenity zones. These will be described further in Chapter 7: Design Proposal.

# 7 [seven]

# DESIGN PROPOSAL

## 7.1 Chapter Introduction

The final design proposal for the mobility hub, located in the existing Union Station building, features a semi-open concept spatial arrangement that is broken into several different areas: arrival, ticket purchase, terminal navigation, and waiting and rest areas. The administration and support spaces for the mobility hub are assumed to be located on one of the other four levels in the building. Public washroom facilities have been added to the new design, although the existing washrooms adjacent to the rotunda are accounted for as well. The semi-open concept is used to create smaller, more manageable spaces. However, characteristics of an open concept space are also used so that there is a seamless flow from one area to another. This is important for navigating a multi-sensorial space because it allows smells, sounds, and visual cues to overlap into adjacent spaces so a user is able to understand their surroundings. It also creates a more logical spatial arrangement with smaller programmatic areas off the main path of travel.




N

1 RENDERED FLOOR PLAN

Scale : NTS

Figure 83: Mobility Hub Floor Plan

The mobility hub has three direct ways of entering and exiting. The primary entrance is located on the north side, adjacent to parking, and includes a designated pick-up and drop-off area and relief space for service animals. The secondary entrance is located off of the rotunda space. The third is the entrance and exit for public transit boarding and disembarking. All three of these entrances are located off of the main path of travel, which is identified through a 4-foot linear, detectible path. The path helps direct users to exits, intersection points, and other cues that enable users to identify their location within the space. This strategy allows users to make appropriate decisions to reach their destination based on the cues accessible to them.

## 7.2 Arrival and Ticket Purchase

It is critical for the first point of entry to be simple, logical, and seamless. The entrance into a space is the first step in the user's journey toward their final destination. Therefore, the entrance needs to help users with varying visual abilities to orient themselves and find the tools they need to reach their end goal. The design of the transit entrance of Union Station utilizes design strategies that create multi-sensorial landmarks at intersection points. These landmarks allow a user to navigate based on different wayfinding strategies, such as contrast, tactile paths and signs, repetition, and audible cues.

As mentioned in Chapter 2, it is important to place information and communication services as close to the point of entry as possible. Therefore, three varying types of information services are placed directly at the main point of entry. The first is the information desk, which is in the centre of the lobby area and can be located through the detectible path of travel. This path is contrasted not only in texture but also in colour, which helps the path stand out to the vision impaired who are still able to use their residual site. The flooring around the desk is also contrasted with the existing terrazzo flooring to create an edge boundary that delineates the space from the other.


Figure 84: Ticket Kiosk Perspective

The second information service located at the entrance is the ticket kiosk stations. This area is located off of the main path of travel, which is cued through flooring texture, a contrasting border to create a boundary, and a lowered bulkhead that denotes a private area. Providing digital self-serve ticket kiosks gives users the opportunity to gather information from an audible source on their own. It also removes a potential language barrier that someone at an information desk may have with other users. The third option of communication in the entrance space is signage. Signage is located at different heights and uses contrasting elements to help direct users' eyes. Signage located at eye level can be found along the main path of travel and includes large-format font, tactile graphics, and braille.

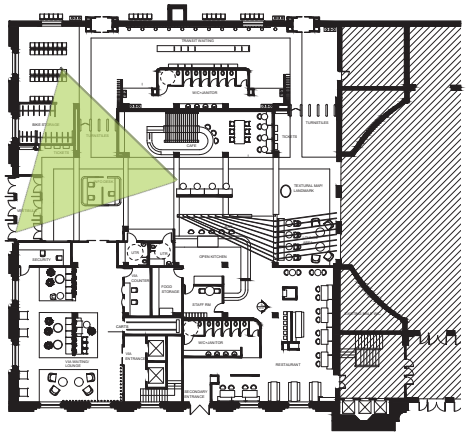


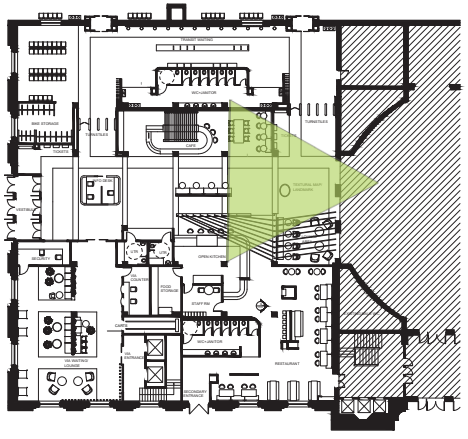
Figure 85: Information Desk Perspective


Figure 86: Entry Elevation - Chime Installation

This provides another level of options for people to engage with information. Another multi-sensorial design element includes an installation similar to a wind chime located directly after passing through the turnstiles. This installation is located at the threshold of the transit area so that when users are exiting a bus, the installation reacts to the movement of people. The sound provides a cue to other users that this is a transition space. Characteristics of a trailing wall are also included on the wall opposite to the detectible path of travel. This enables users to safely follow a handrail as a secondary option of travel that helps direct them passed various information cues.

## 7.3 Terminal Navigation

The central corridor, or the spine of the building, needs to be easy to navigate independently. It also must successfully direct people by using verbal, tactile, and audible cues into the adjacent supporting spaces. To accomplish this, a variety of multi-sensorial design interventions are integrated into the design. Audible strategies include the use of wool pods located above the seating and ordering areas in the bar and café. Sound absorption will create a feeling of comfort and privacy, as well as delineate the static activity away from the active path of travel. Varying levels of ceiling heights help to create audible paths and districts that a user can follow or use to identify their location within the main corridor space. Tactile navigational strategies are used to inform the user of a decision-making point. For example, the existing columns within the north wing are used to locate a repeating floor texture that can be used to understand distance and location. A reoccurring user may know through previous experience that if they walk straight and passed two of these recurring tactile strips, the washroom is located to the right. If they continue to the third tactile strip, the entrance to the café is located to the left. Redundancy and cues—and providing levels of communication to access these cues—is important to help someone independently navigate a wide-open area successfully.



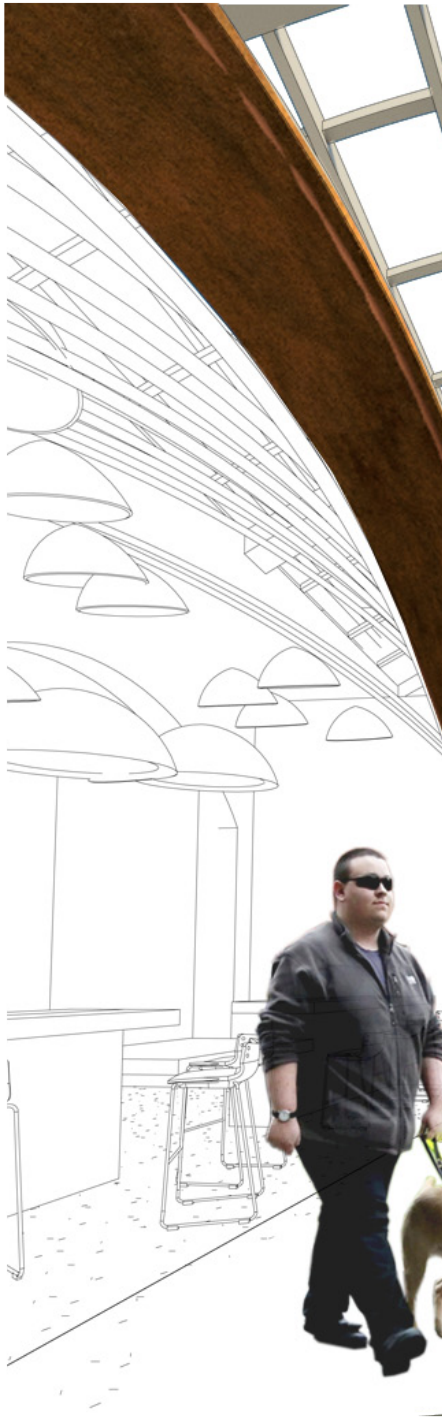



Figure 87: Main Corridor - North View Perspective

Two main features within the space are the curved forms encompassing the bar and café. These architectural pieces help eliminate the use of small, noise-controlled rooms and allow users to enjoy the sensory experience in the central corridor. Sounds of people running their hands against the metal pipes and the engaging smells admitted from the café and open kitchen restaurant are senatorial characteristics that help users to locate amenities. The pipes in the café use a controlled heating system that uniformly heats the pipes, which project warmth into the intimate space of a cafe.

The counter design in both the restaurant and café use contrasting materials to help differentiate between adjacent elements, such as walls or furniture. Contrasting elements help users locate seating and provide depth perception to users with low vision. Tactile flooring differences in both spaces help create distinct boundaries that are separate from the main corridor. This characteristic assist users in understanding when they are situated in a specific district and provides a cue when they are leaving one. These multi-sensorial characteristics are often controlled throughout a building, but in this design concept, the sensorial elements are layered together to help users understand and navigate a space.

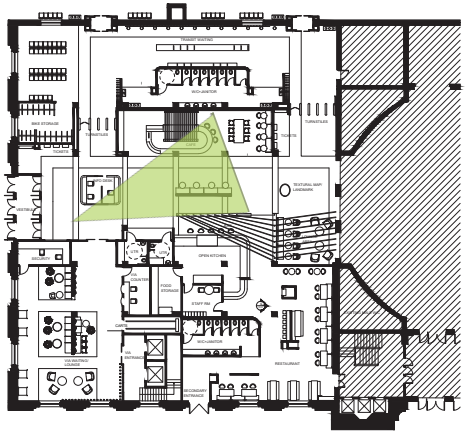


Figure 88: Main Corridor - South Perspective

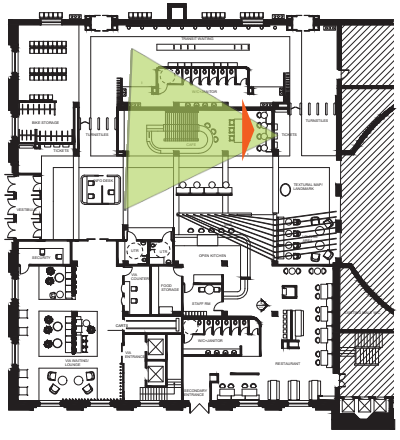


Figure 89: Cafe Interior Perspective


Figure 90: Cafe Seating Elevation

## 7.4 Waiting and Rest Areas

Seating is an essential part of mobility hubs. In this design proposal, there are two levels of transportation that both need different requirements for their waiting areas. The first is short-term waiting for Winnipeg transit buses. This area is located directly off the main path of travel. This waiting area features an organic wall and ceiling treatment that has multi-sensorial functions to help with navigation. The detectable path of travel continues along this wall, and lighting is also included in the floor. The lighting creates directionality of movement to direct users who need to catch a bus at the opposite gate from where they entered the space. The varying ceiling heights of this structure denote simple usage changes within the space through audible cues. Higher ceilings mean that this is a path of travel, while lower ceilings direct people to various seating options. There is seating with and without backrests and bench seating with and without armrests. This variation can help users with different mobility challenges get in and out of the seating. Feeling an armrest can note to someone who is blind that this is a seat. Signage helps users directly locate themselves when they enter the building from the bus stop entrance. When a user enters the space, tactile signage


Figure 91: Transit Waiting Area West Elevation

is immediately located to the right of the door and off of the main path of travel. For users who have some residual sight, there is bold signage at varying heights that note amenity zones, such as washrooms and water fountains. These zones are also delineated through colour blocking strategies. These strategies help to avoid people creating a visual barrier at eye level. The waiting area includes an audible and visual system that announces approaching busses and schedule delays.

The second waiting area is for long-term transportation offered by VIA Rail Transportation. This area is the only space that is directly separated from the rest of the terminal through the use of walls. This was done to create a distinct sound barrier to avoid confusion over general transit announcements that do not apply to VIA Rail passengers. The flooring in the space is separated through contrasting boarders.

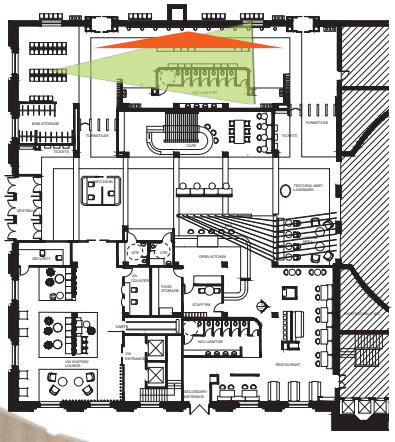
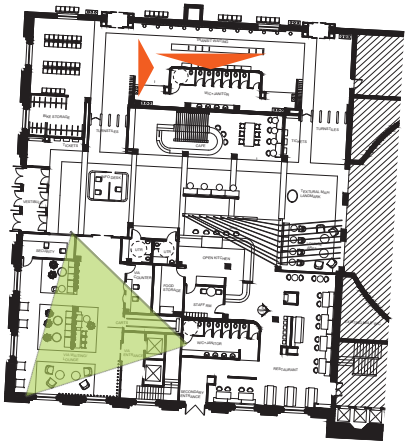





Figure 92: Transit Waiting Area Perspective


Figure 93: Transit Seating - Signage Elevation

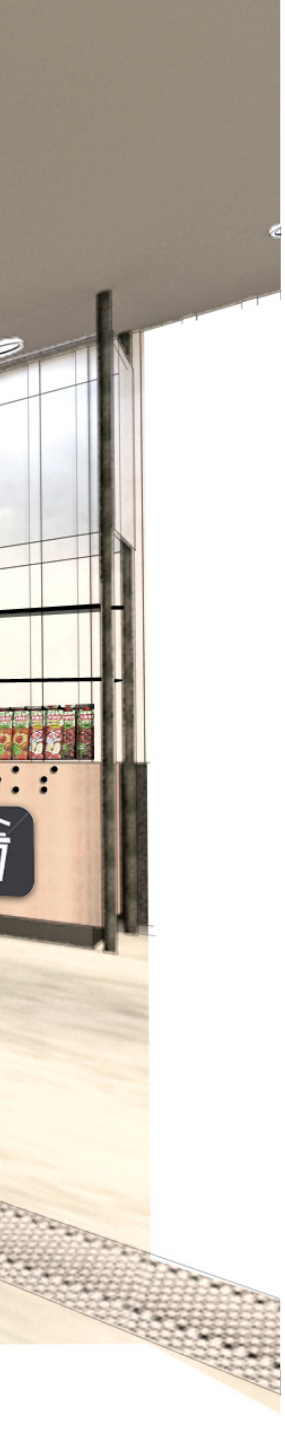

Figure 94: Transit Waiting Area West Elevation



The sound absorbing, soft texture of carpet in the seating districts is differentiated from the existing hard terrazzo flooring on the external paths of travel. This helps to direct users around the space without bumping into furniture or other elements. The furniture in this space has bases that go right to the floor so that furniture is quickly identifiable to people using white canes. The furniture is sturdy and heavy so that it cannot be moved with a light push. However, the furniture still offers some flexibly because it can be moved for users in wheelchairs or people using guide dogs.


Figure 95: Via Rail Entrance Perspective

Figure 98: VIA Rail Check-in Desk Perspective



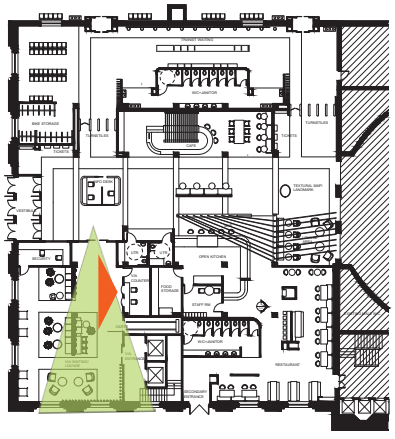



Figure 97: VIA Rail Check-in counter elevation

The acoustic ceiling pod installation used in the bar and café spaces is also used within this area. The ceiling pod absorbs sound to create intimate spaces that people can work, converse, or relax in before they get onto their train. In contrast to sound absorption techniques, sound emitting strategies are used to inform paths of travel. For example, small wool balls are hung from the ceiling around the elevator and bounce off of a copper backing. This installation harvests the movements from the opening and closing door to create a sensorial cue of a common transition path.

# 8[eight]
# CONCLUSION

# 8.1 Conclusion

**This final chapter summarizes the research and analysis through the four research lenses I used to inform the final design proposal of a mobility hub. These lenses included research and understanding on visual impairment, a literature review focusing on a theoretical framework, personal experiences, and precedent research. The conclusion of my findings answered and supported the rational, research questions, and project goals that were laid out in Chapter 1.**

Today, architecture—and in particular, many public spaces in North America—are designed to be simple, clean, and aesthetically beautiful. Examples of this were presented in the literature review, which explained that even though the overall conceptual design of spaces are created with good intentions, many designs often limit interactions of users with a visual impairment by creating unknown barriers that were overlooked during the conceptual design process. These barriers make it hard for people to reach their navigational goals, which can discourage people from using the space again. By incorporating layers of information that are accessible to varying abilities, interior environments are able to successfully adapt to the varying needs of the user. This allows the user the capabilities and tools to cross over the boundaries that they may encounter within interior spaces that they must navigate.

The design elements used in this practicum were strategically developed to address the various challenges that people living with vision loss may face. Through the use of the four research lenses, a set of spatial design considerations and guidelines were established. These guidelines were meant to connect the building to users by enabling them to form unique, personal experiences while navigating the built environment. These guidelines related back to the three goals presented at the beginning of this practicum:

1. Organizational goal to design a space that accounts for the safety and wellbeing of the individuals engaging in the space;

2. Functional goal to provide opportunities and options for all users' abilities in regard to varying types and levels of visual impairment; and

3. Aesthetic goal that incorporates a seamless and integrated design concept using a holistic design approach, rather than cultivating a feeling of disconnect through an unnatural flow of spaces

These goals were developed in response to issues I observed within general design processes. For example, standards and codes seem to be applied as an afterthought in the design concept. This can be viewed as a problem because initial issues that may arise during the conceptual design phase of a project, will most likely not be dealing with concepts relating to visual impairment, thus, the design solutions will be added on instead of incorporated into the project. Another example is material considerations are chosen merely for aesthetic value instead of placing priority on the functional qualities of materials that can help users to navigate through a space. I believe that through careful and thoughtful consideration, these requirements can be integrated into the overall design vision. This can give projects the capability to project an image of comfort, community and independence, instead of isolation and barriers.

In order for this integration to happen, an understanding of how someone with a visual impairment navigates a space is important because it helps to create a connection of elements that aid in the design process.

The first lens analyzed was visual impairment. This section was broken down into subsections. First, this analysis focused on a basic understanding of the barriers users with vision loss experience when navigating a space. Second, common mobility and communication options are explored and how these options can be reflected in design decisions. And finally, existing standards and codes are analysed to form design guidelines that can aid in navigation throughout a mobility hub. These included highlighting key orientation areas with varying communication options, strategic and consistent use in colour and texture to inform different spatial types, accounting for clear space needed for different modes of mobility, and contrasting elements in colour and texture. These

strategies aim to provide options and redundancy in communication to ensure users can access information when they need it.

The second lens, literature analysis, explored the theories of narratology and perception. Subsections focused on sensory design, adaptive reuse, orientation, and wayfinding. These explorations aided in the creation of a layered, dynamic, and multi-sensory set of design guidelines. These guidelines resulted in their own set of spatial considerations used in conjunction with the other three lenses of analysis to inform the final design of the mobility hub. Narratology, sensory design, and adaptive reuse guided the initial design concepts to connect the body with the building through a narrative between the two. This was done using sensorial and adaptive reuse strategies. Specifically, the architectural language and materiality were informed through a "rereading" of the building's existing elevations, tactics, and floor plans to develop an in-depth understanding of the historical building. This created the ability for the original space to play host to the new layers of new information being inserted. Through this creation of narrative between old and new, users can interact and ultimately perceive themselves in the space. Perception is the interplay between humans and how they interact with their surroundings. This practicum has focused on the further exploration of sequential interaction of navigation, the concepts of wayfinding and orientation. Orientation is the ability for the individual to determine their location within the context they are in, and wayfinding refers to the cues needed for the user to determine their next course of action.[1] Orientation and wayfinding strategies are integrated throughout the design using multi-sensorial landmarks or tactile surfaces, contrast and acoustics, logical spatial relationships, and levels of legibility for communicating information to the user.

Research from the first two lenses helped guide me through the third lens: personal explorations. I included this section because I am not visually impaired, and I heavily rely on my sense of sight as a convenient default; therefore, I wanted to learn and experience navigating spaces without my sense of sight. In this chapter, I discuss my experiences of dining in the dark, exploring photographs by visually impaired artists, and walking through the Union Station while blindfolded with a visually impaired informant. I further supported my findings with the literature and standards analyzed in Chapter 2: Visual Impairment.

The final lens of research analyzed three existing projects related to successful design for vision loss, experiential design, and innovative universal design strategies. Each precedent helped develop different spatial design considerations that can be layered together to inform a strong design that eliminates barriers and creates interactive and independent environments.

These four lenses aided in the development of the Union Station mobility hub design proposal and helped expand upon my initial research questions for this practicum.

## 8.2 Challenges & Design Solutions

Looking back on the research and final design of this practicum, it is important to highlight the challenges addressed throughout the development of the design and further note the design implications and spatial strategies that were used to satisfy these issues. The strategies presented in this practicum can provide a guideline for the future design of metro station typologies, as well as other terminal designs that maintain some of the same key programmatic spaces. The issues presented throughout this practicum are summarized into five key challenges: large open spaces, design demographic, segregation, heritage buildings, and wayfinding.

The first challenge was how to create a useful design for users with a visual impairment in a large open space. Large open spaces are challenging for people with vision loss for a multitude of reasons. Firstly, these spaces have very poor acoustic characteristics that create echoes, no hierarchy of sounds, and noise pollution. Secondly, large open spaces can cause confusion because providing access to wayfinding markers and cues can be difficult in a wide-open space. A solution to this challenge is to break up the space into smaller, more manageable programmatic areas that have different acoustic properties. This can be achieved by using varying ceiling heights, sound absorbing and emitting strategies, and upholstered furniture. Other strategies include textural characteristics on horizontal and vertical planes to delineate spaces and edge boundaries. These textural contrasts can also create linear paths that provide safe navigation and can lead a user to more informative cues.

The second challenge was designing for a demographic that I am not part of. However, as mentioned in Chapter 2, there are many different types of visual impairment and no two people experience a space the same way. Therefore, a solution to this unique challenge is to involve a multitude of people with varying abilities, levels of vision loss, and ages into the design process. This integration needs to happen from the concept stages of the design through to the design development. This is an essential strategy to create a successful design for the widest population of people as everyone defines "good" design differently based on biases they may have regarding ability.

The third challenge was how to limit or completely remove the idea of segregation within the design based on visual ability. Although this challenge can be further explored through other disabilities, such as mobility and auditory disabilities, only visual impairment was discussed in this practicum. Through the research and design development, it was concluded that users with a visual impairment require different options of accessing information about the building's layout and programmatic functions. This strategy of providing accessible information in different forms needs to be incorporated into the

design's beginning stages to create integrated and seamless design choices that are not pasted on after the fact. If this strategy is ignored until the end of the project, there is generally a feeling of disconnect between the design and the user. This can lead to an unnatural flow of cues and the feeling of segregation. In the final design of this practicum, special strategies that aid in seamless design include providing different sensorial cues to understand programmatic spaces. Specifically, colour-contrasting flooring acts as a visual cue, textural contrast on the floor is a tactile cue, sound absorbing ceiling pods in areas off the main travel path provide acoustic cues, and the semi-open concept floor plan enables olfactory cues by allowing smells to creep into the central corridor. These elements provide options in how a user may access information about the building through leveraging the many human senses. Seamless design options are further provided by presenting information in varying ways. Large print signage, consistent colour for amenity locations, the information desk located at the main entrance, and audible ticket kiosks are all strategic design solutions that convey options of information to users about the space.

The fourth challenge was implementing design strategies for visually impaired users in a heritage building. Not only was the large size of the building a challenge for acoustics and wayfinding, but the materials used in buildings from the Beaux-Arts period were generally cold, smooth, and hard stone surfaces (further explored in Chapter 6). However, by extracting characteristics about the original building, a designer can use the character of the existing building to inform new strategies that help users with a visual impairment. For example, many Beaux-Arts style buildings have a very linear floor layout overall, which is emphasized through the existing structural columns and window placements. By using these existing elements in conjunction with new design elements, such as redundant floor textures, locations of new linear wall placements that follow the existing columns and placement of varied suspended ceiling heights in between columns and windows, all help to form a simple and logical route of travel through the heritage building. Another challenge with many heritage buildings is that elements and materials that will alter the heritage status of the building cannot be removed. Therefore, implementing suspended or independent structures that are separate from the building, such as suspended acoustic ceiling pods, helps create strategic design solutions for an accessible space. Often, when heritage buildings were originally built, the designers did not consider accessibility issues or have to meet accessibility standards.

The final challenge was creating wayfinding strategies for people with low vision or complete blindness. The goal was to create non-visual wayfinding cues to enable users with visual impairments to navigate the space without needing to touch elements in the public space. This was an important challenge to address because many public spaces, especially public metro stations, are dirty and unsanitary, and

people with vision loss do not want to have to touch unclean surfaces. One design strategy to overcome this challenge is the incorporation of a common, linear detectable path that leads to varying information centers. Secondary detectable cues include repetitive floor patterns off of the main path that direct users to other specific programmatic spaces in the building, as well as tactile maps and audible information centers. This path is not only detectable but also colour contrasted to create hierarchy to users with residual vision. The path is straightforward and bold, creating a simple floor plan. Acoustic strategies that create sound hierarchies off of this main travel path also help users with wayfinding. Felt pods are used to absorb sound in support spaces, which are located off of the main circulation path. In contrast, noise-emitting installations act as a cue to users when they are walking toward a major transition point or intersection. For example, noise-emitting cues are located at the main intersection path for people getting on and off the bus. These wayfinding strategies are informative and highlight direction and decision-making points through non-visual cues. Users can follow tactile cues on the floor by using descriptive actions and verbal direction. Additionally, auditory wayfinding cues provide delineation between spaces along the central path of travel so users do not have to search for information to tell them they have entered into a new space.

The challenges that presented themselves throughout this practicum were unique to the topic of visual impairment in a metro station. However, many of the design strategies mentioned above and throughout this practicum can be used in similar ways in other interior design applications to help users with vision loss navigate a space independently and safely without losing the conceptual integrity of the design's initial concept.

## 8.3 Research questions revisited

Applying the theories, personal investigations, and precedent research to my initial research questions enables in-depth answers to the following questions:

1. How can the existing space of Union Station create a narrative between the city, building, and user through multi-sensorial design interventions that are informed by the initial spatial design of the historical building and create a verbal communication between the building and user?

Union Station has a rich history in Winnipeg. The station was once an extravagant gateway for immigrants to emerge into a new city. Now, it acts as a threshold between business and pleasure. The Beaux-Arts architectural design style of Union Station has been maintained through the final design. Elements such as columns, materials, and existing ceiling heights are used as existing tactics that inform new navigational elements throughout the space. For example, tactile navigational strips are placed in line with existing columns. Additionally, curvilinear details of the space are abstracted to form the architectural

language, which creates unique structures housing different amenities that break up the vast space into smaller areas. These design interventions integrate navigational layers that users with varying levels of vision loss can interact with on a personal scale. Mixtures of textures create an environment rich in information that can be explored independently through multi-sensorial elements, cues, and spatial layout.

2. What innovative, visual and non-visual strategies can a designer use to support independence and safety, while also enabling first-time and recurring users to understand and navigate through a space to their intended destination using cues from their surrounding environment?

My intention for this practicum was to design a space that created independence and empowerment for all users through a seamless design that did not segregate users with different abilities. Notably, "good" design can only be measured as an opinion, since design can enable access for one use while creating barriers for another user. Therefore, the ability to provide options in every aspect of the design where human interaction takes place is one of the most important design concepts. A mobility hub can be considered a transitional space that is used by a large population of people, all with different abilities. As a result, it is an excellent interior environment to apply concepts regarding the integration of options that can help and simplify the overall navigation of a building for new and recurring users.

Some visual and non visual strategies that can help a user navigate space can include linear, tactile flooring that creates a clear path of travel throughout the space. Users can be guided to information points where orientation decisions take place. A clear path can promote a feeling of safety because users know that following the path will not lead them to any hazards. Audible strategies can serve various purposes. For example, users can find stationary amenities, such as lounge spaces or coffee shops, by listening to the noises diffused from these spaces. Additionally, chimes can mark distinct paths of travel and transition points that be used as informative landmarks at decision making points. A visual strategy that can aid in navigation for almost anyone with some residual site is contrast. Contrast can not only help users using residual sight, but can also help navigate sighted people to. For example, imagine walking into a building and everything was white. Most new users to a space would feel some sort of disorientation because there are no distinct cues to follow. Contrast is a way that can direct a user's eye towards an information source and helps users to delineate spaces from one another without having to feel for cues.

3. How can perception and memory be used to inform human movement and reaction within a space, and how can these responses inform the evolution of an integrative, logical interior environment?

Spatial memory and a users' perception of

themselves in the space was accomplished through the spatial layout of the Union Station mobility hub. Making a vast, multi-use space legible was a primary concern when organizing and creating spatial boundaries. Detectable transition paths became the main path of travel through the central corridors by incorporating different levels of communication in terms of districts, landmarks, paths, and edges. These strategies dealt with the user's perception and memory within a space and harbored the movement of people to create sensorial landmarks. For example, stationary movement is categorized in this practicum as an interior space that encourages a pause or static motion. Spatial characteristics of these types of spaces in the design are influenced by absorption of sound and are spatially located out of the main paths of travel. Transient movement is a brief pause or a threshold between spaces. This type of space can be defined as the in between space that is scattered with various ways of communicating information. Landmarks (such as tactile maps), information desks, or audible kiosks located at intersections and decision-making points create identifiable cues that help direct and navigate a user through the built environment. Finally, active movement is a state of continuous movement. It is organized through detectable, linear surfaces that direct and segregate various districts to create a simple navigational layout. They direct users toward the intersections where information cues are located. This active level of movement is harvested to create sensorial cues that can direct a user toward a major path of travel. Active movement generates a level of navigational awareness that is often missed in the design of a large, multi-use public space.

## 8.4 Summary

In conclusion, the final design proposal for this practicum did not follow the typical "cookie cutter" approach that many visually stimulated designs follow. Throughout my research, it was discovered that there is not one definite solution because providing flexibility in options is better. The research and conclusion in this practicum add to the existing set of standards and codes that designers and architects can use to design spaces (particularly transit buildings) for visual impairment. Many of the existing standards referenced are adequate in addressing the needs of users with vision loss and provide solutions to ensure users can access necessary information. However, many of these solutions refer solely on tactile and contrast strategies, and they do not provide ways to combine elements so that information is communicated in various ways. As noted in Chapter 4, while I was dining in the dark, I was sitting in a stationary position for almost the entire dinner. I could not trail the wall and had no other means of tactile exploration. However, I was able to experience and understand the space through my senses of smell and sound. Existing codes and standards available to designers overlook how the senses of smell and sound can be used for navigation. Furthermore, by utilizing the specific, experiential functions of a proposed space, unique solutions can be used in the design to prompt

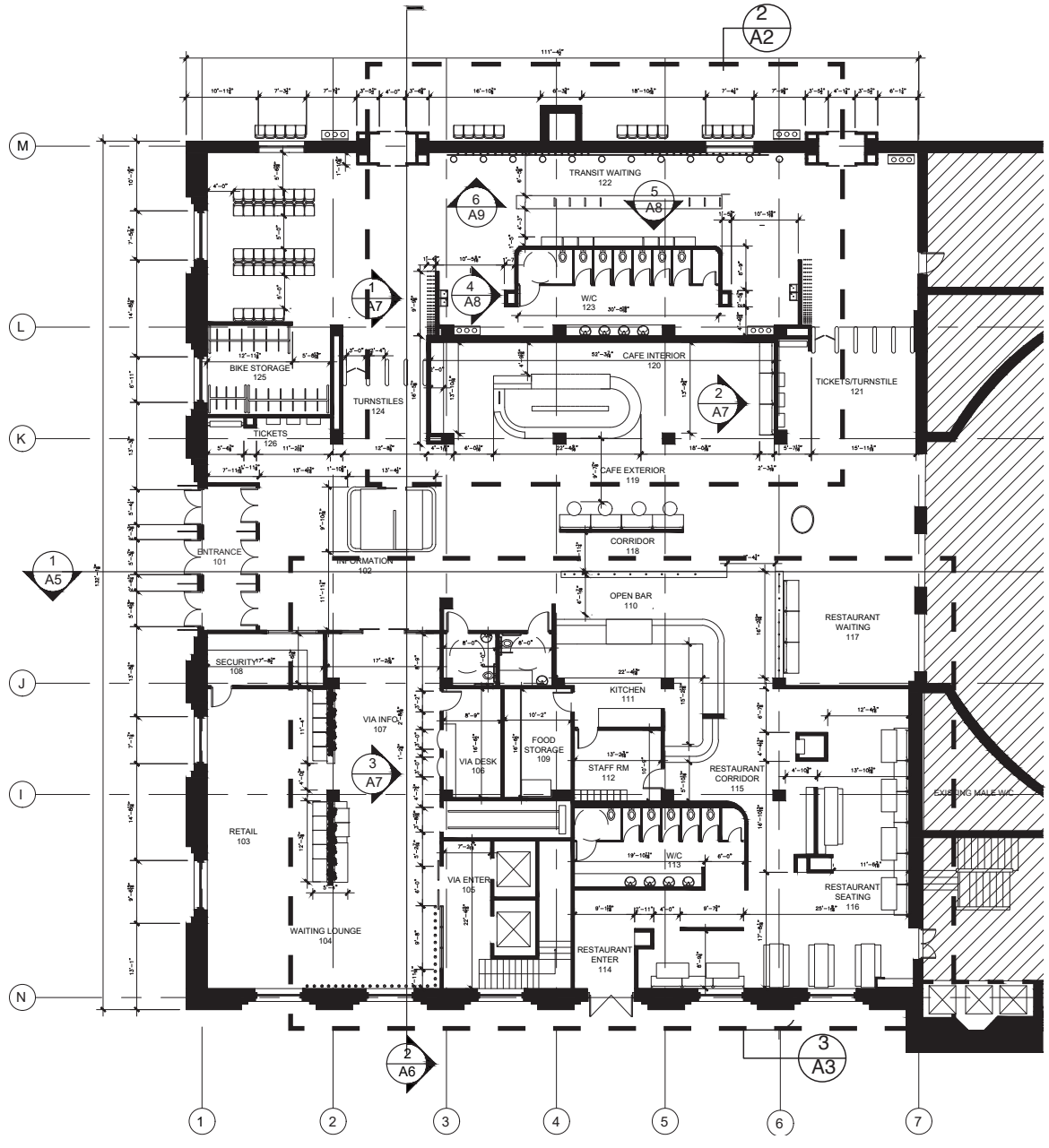
interesting yet effective navigational design strategies. In the mobility hub, varying degrees of movement was chosen as a consistent action that informed acoustic properties, organization of the space, and placement of information centers.

A mobility hub can be a complex network of spaces that create confusion and disconnect between the user's initial location and their ultimate goal. However, by providing wayfinding options, experiential design interventions, and sensorial cues, a space can be developed to aid in safe and independent navigational strategies for users with a visual impairment.

# A1

appendix A

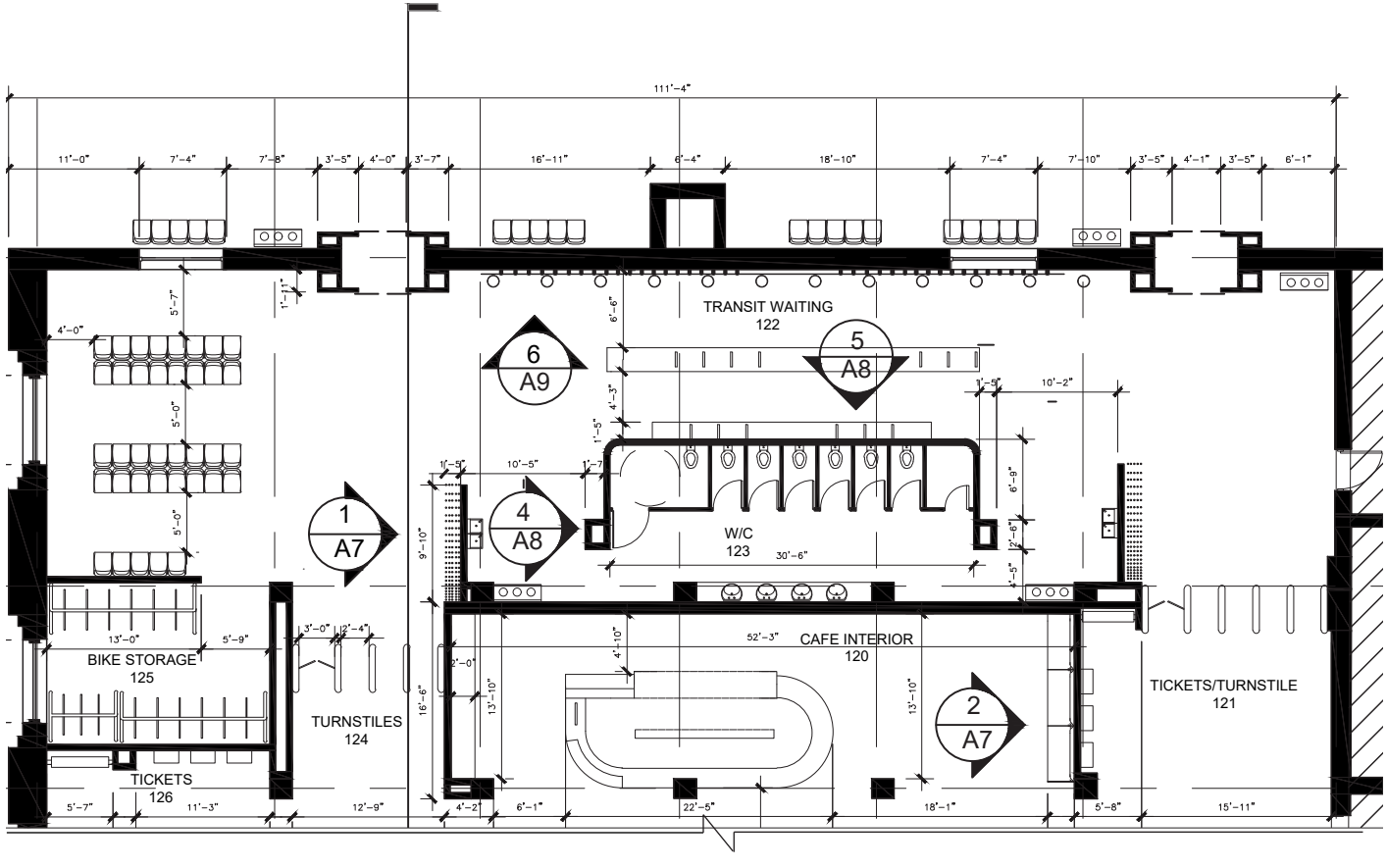
Construction Drawings




N 1 **Union Station Floor Plan**

Scale : 1/24” = 1’=0”

0 5 10 20 50



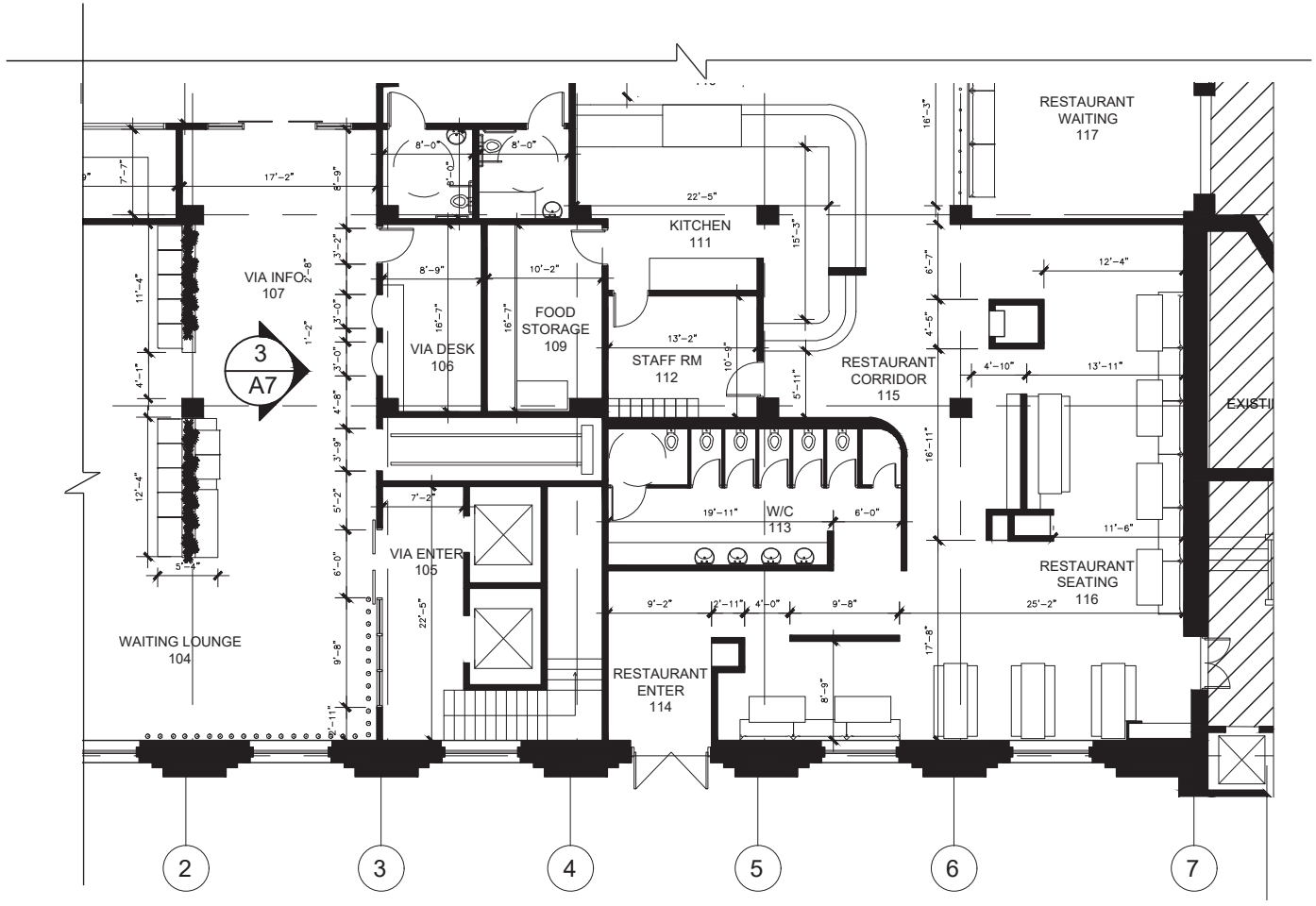

N

## 2 Transit / Cafe Callout

Scale : 1/12" = 1'=0"

0 5 10 20

# A3

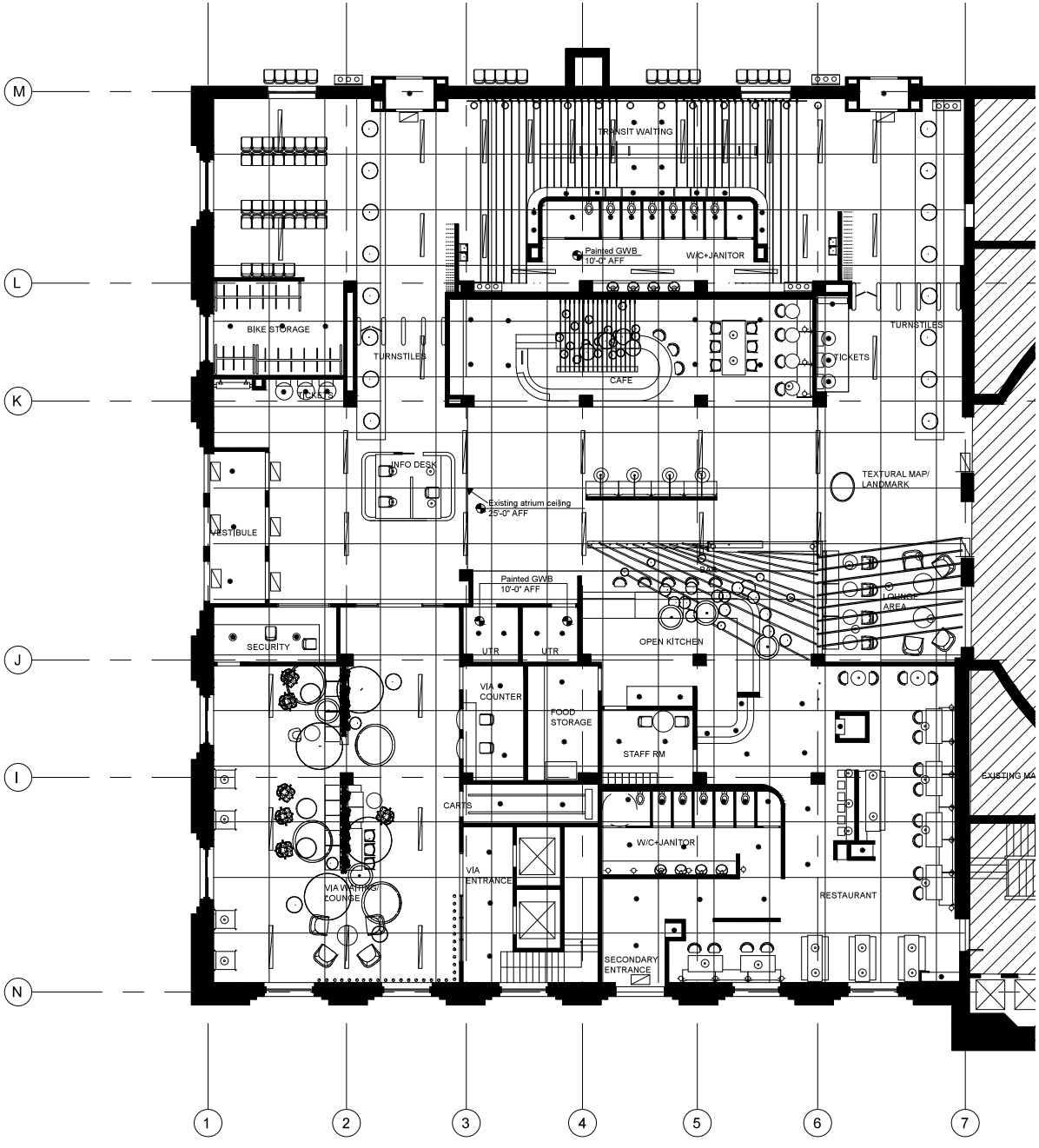



N

## 3 VIA Rail / Restaurant Callout

Scale : 1/12” = 1’=0”

0 5 10 20




| LEGEND | |
|---|---|
| | 48" DIRECT/INDIRECT LED, SUSPENDED |
| | 36" DIA. ACOUSTIC CEILING PODS WITH 6" LED PENDANT |
| | 24" DIA. ACOUSTIC CEILING PODS WITH 6" LED PENDANT |
| | 18" DIA. ACOUSTIC CEILING PODS WITH 6" LED PENDANT |
| | 6" RECESSED LED CAN. |
| | WALL SCONCE (COMPACT FLUORESCENT) |
| | 7" DIA. SUSPENDED LED PENDANT |
| | 6" CEILING MOUNTED LED W/ ADJUSTABLE HEAD. |
| | EXIT SIGN, LED, CEILING MOUNTED |
| | EXIT SIGN, LED, WALL MOUNTED |

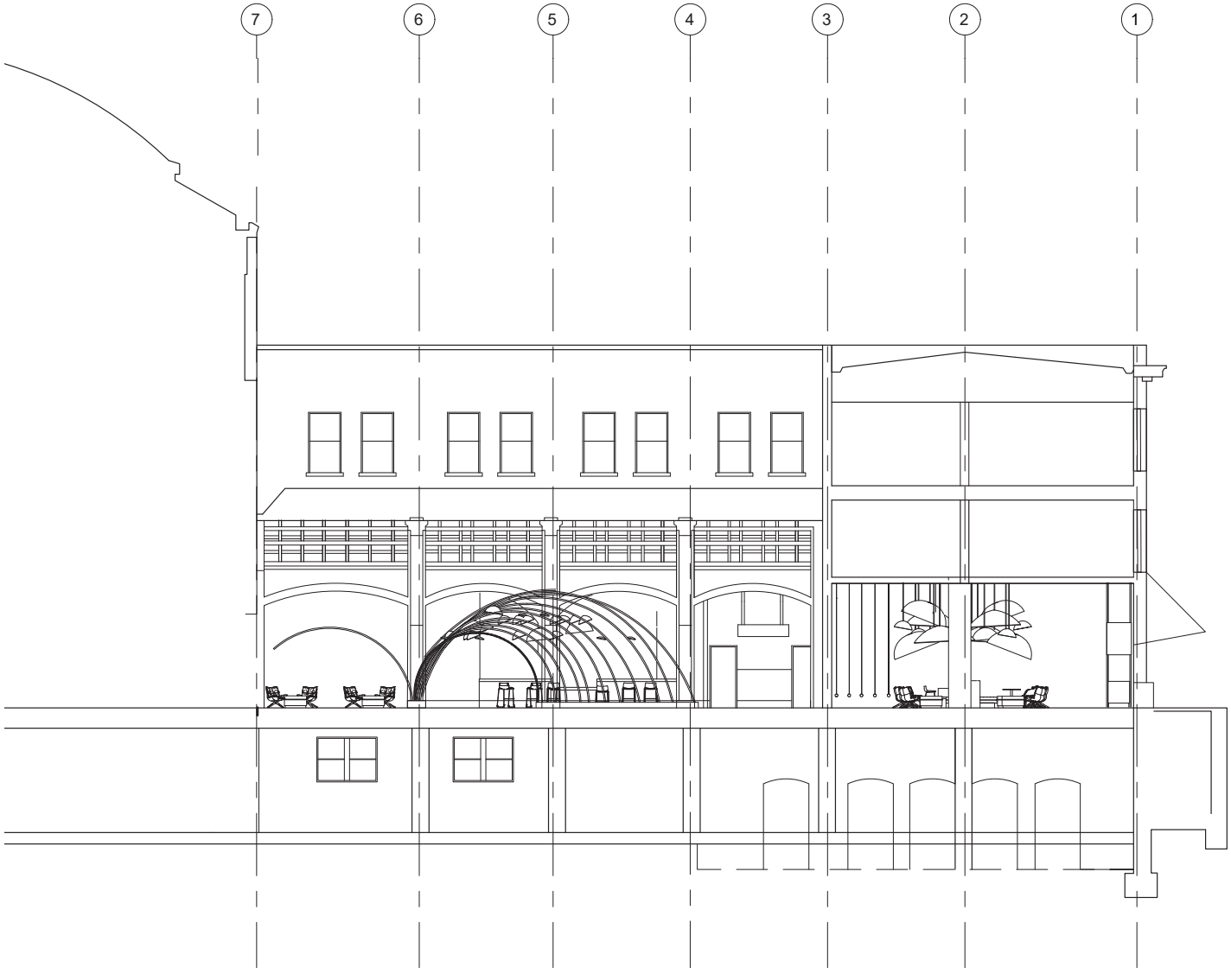
NOTE:
1. Typical ceiling 16'-0" AFF unless otherwise noted.
2. 4'-0" Ceiling Grid Denotes Required. Sprinkler System.

N 2 **Reflected Ceiling Plan**

Scale : 1/24" = 1'=0"

0 5 10 20 50

# A5



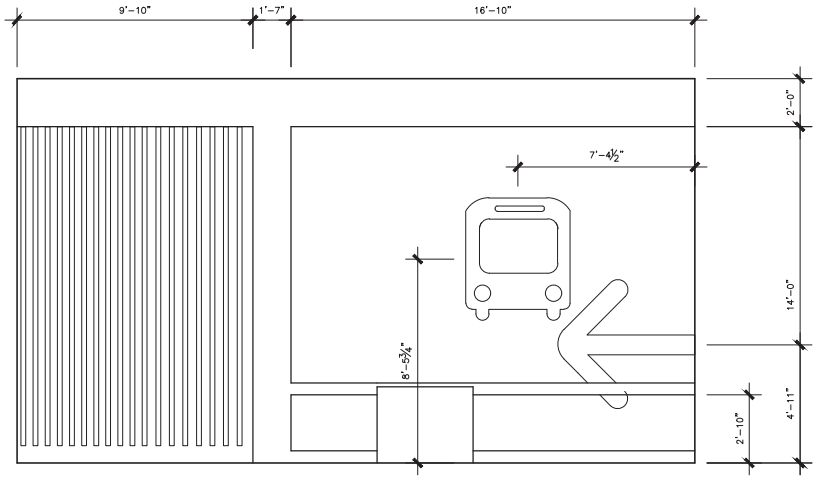

1 **Longitudinal Section - West**

Scale : 1/24” = 1’=0”


2 **Cross Section - South**

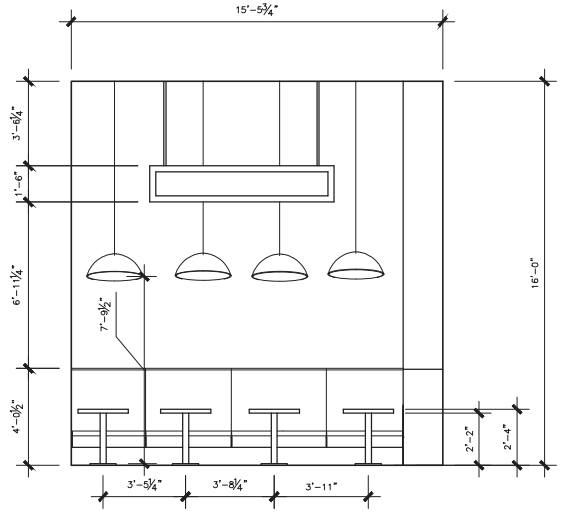
Scale : 1/24” = 1’=0”

# A7



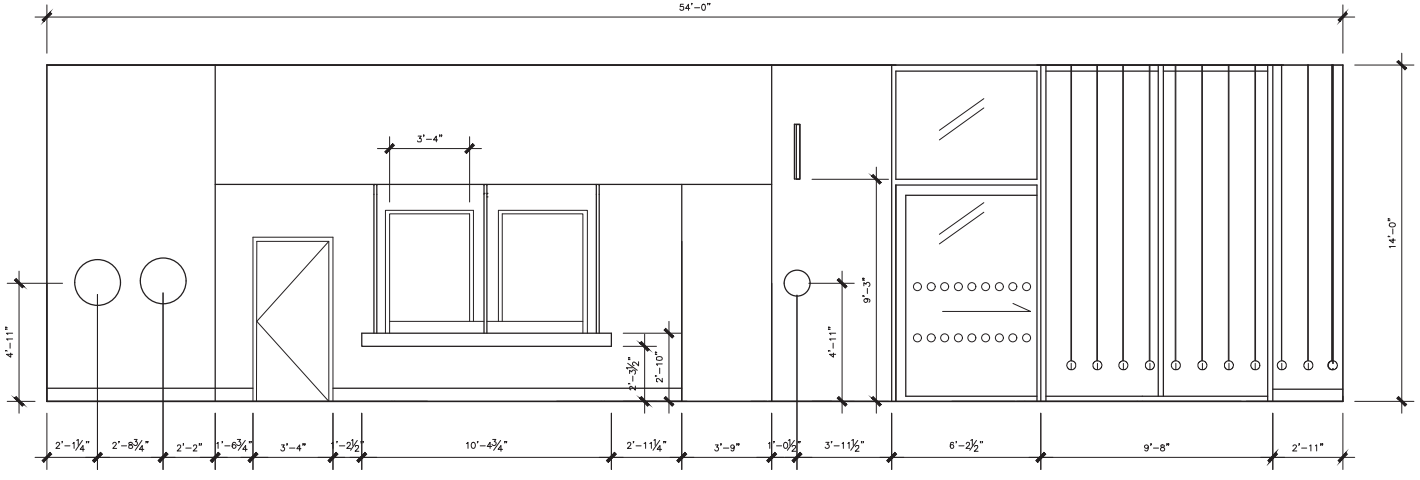

## 1 Entry Elevation - Chime Installation

Scale : 1/8" = 1'=0"



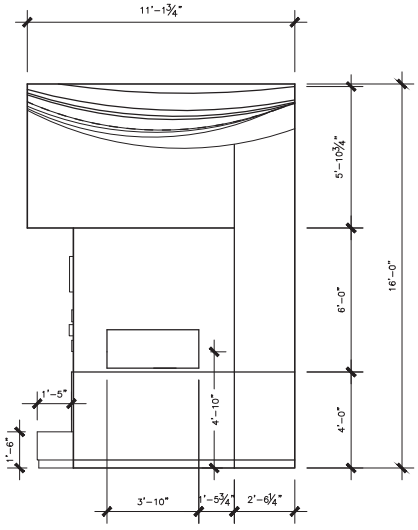

## 2 Cafe Seating Elevation

Scale : 1/8" = 1'=0"



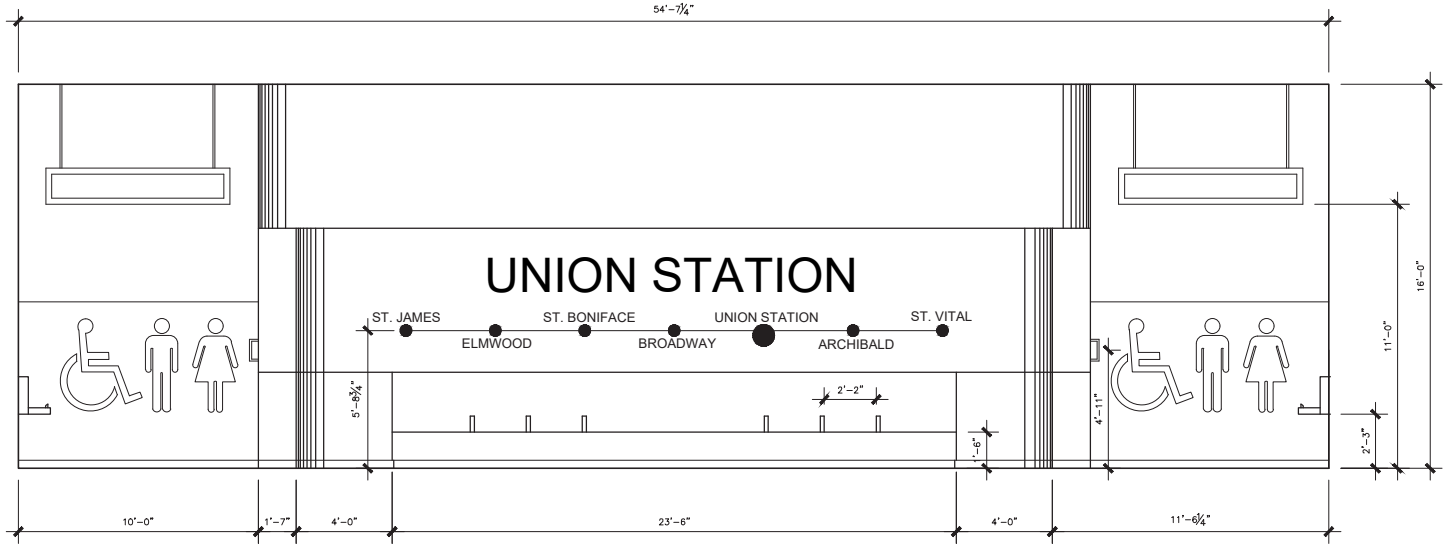

## 3 VIA Rail Check-in Counter Elevation

Scale : 1/8" = 1'=0"




4 **Signage Elevation - Transit Seating**

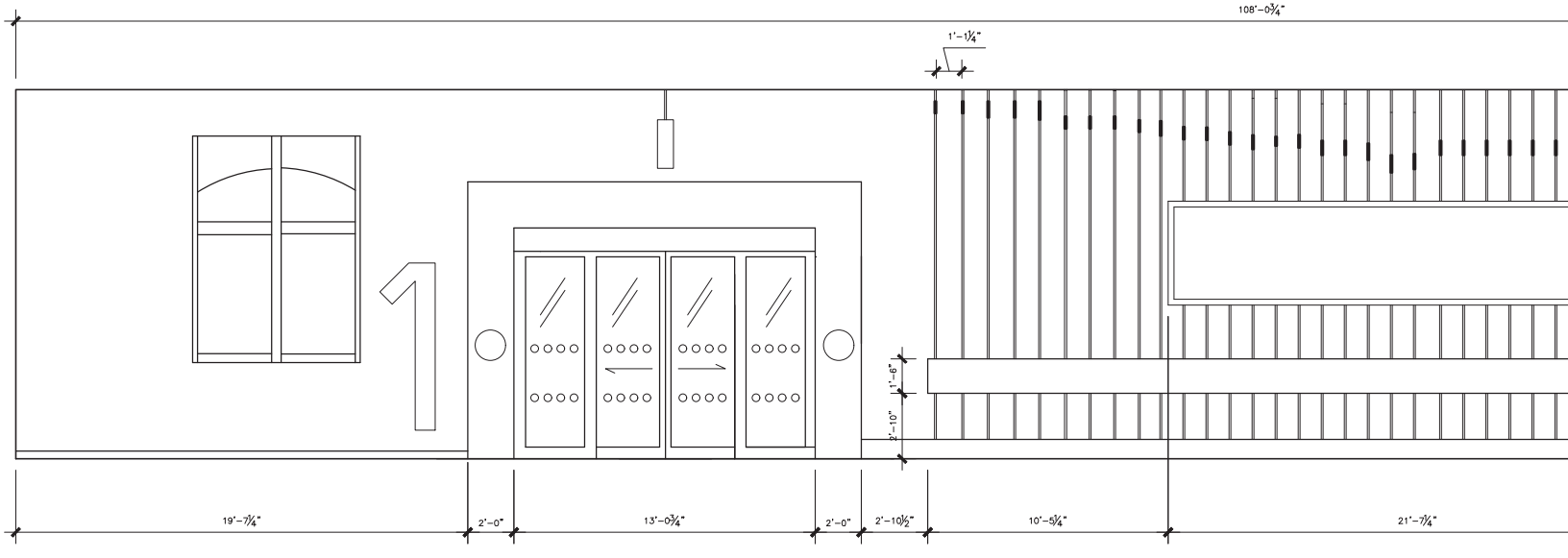
Scale : 1/8" = 1'=0"




5 **Transit Waiting Area West Elevation**

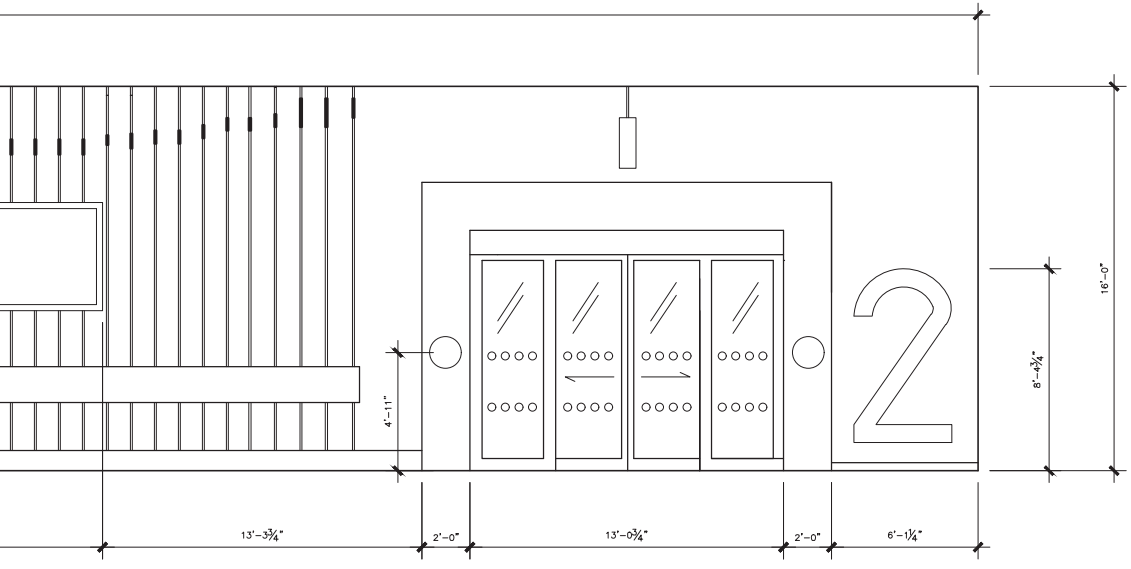
Scale : 1/8" = 1'=0"

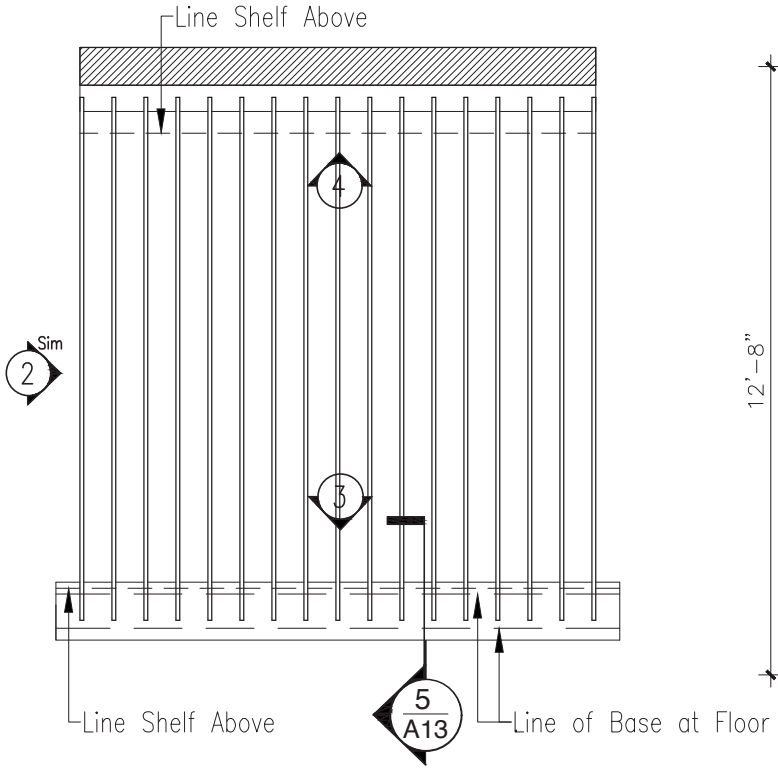
# A9




6 **Transit Waiting Area East Elevation**

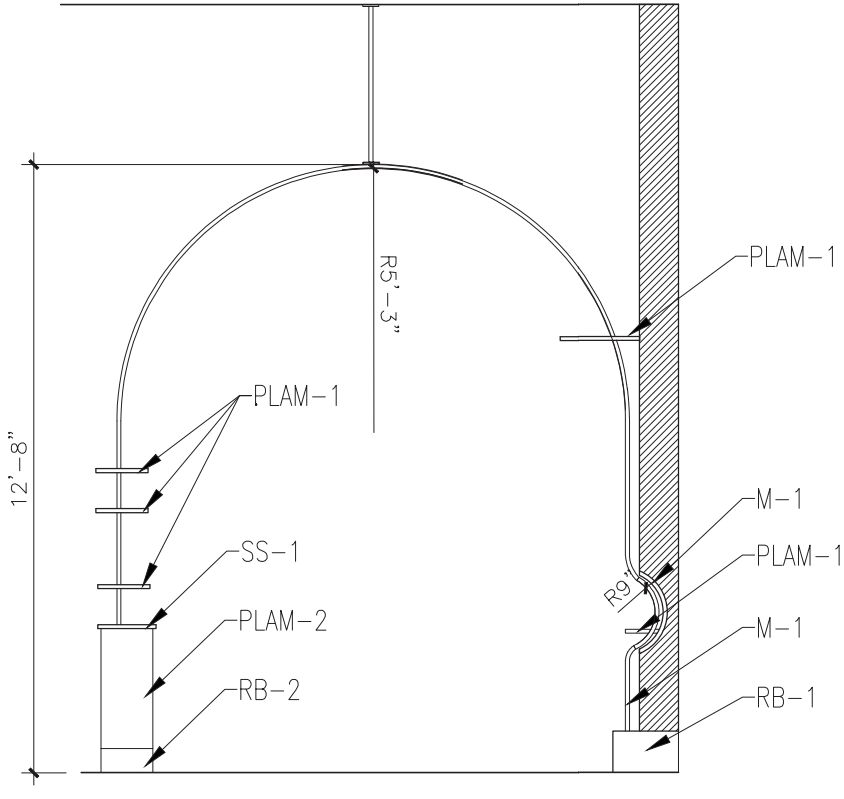
Scale : 1/8" = 1'=0"


4'-11"
8'-4¾"
16'-0"
13'-3¾"
2'-0"
13'-0¾"
2'-0"
6'-1¼"



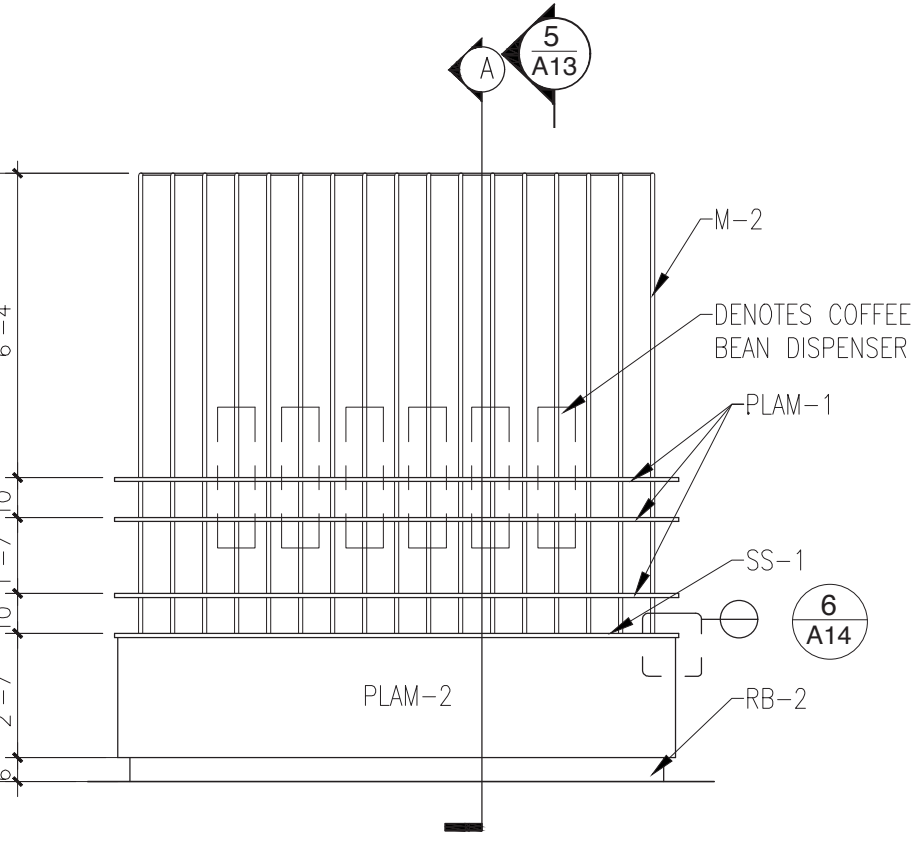

## 1 Cafe Structure Floor Plan

Scale : 1/4" = 1'=0"

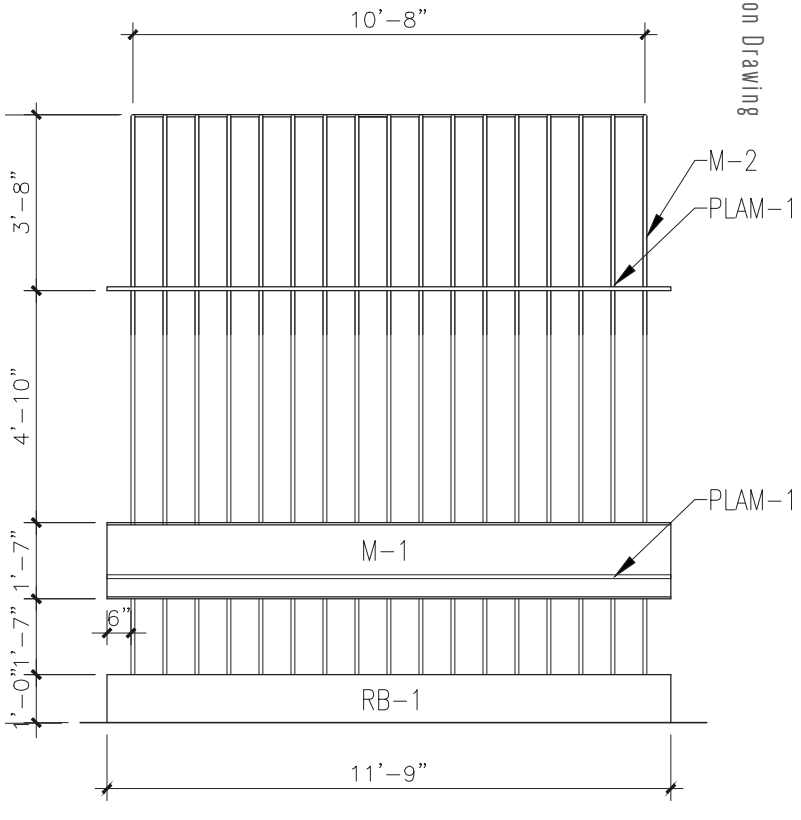



## 2 Cafe Structure North Elevation

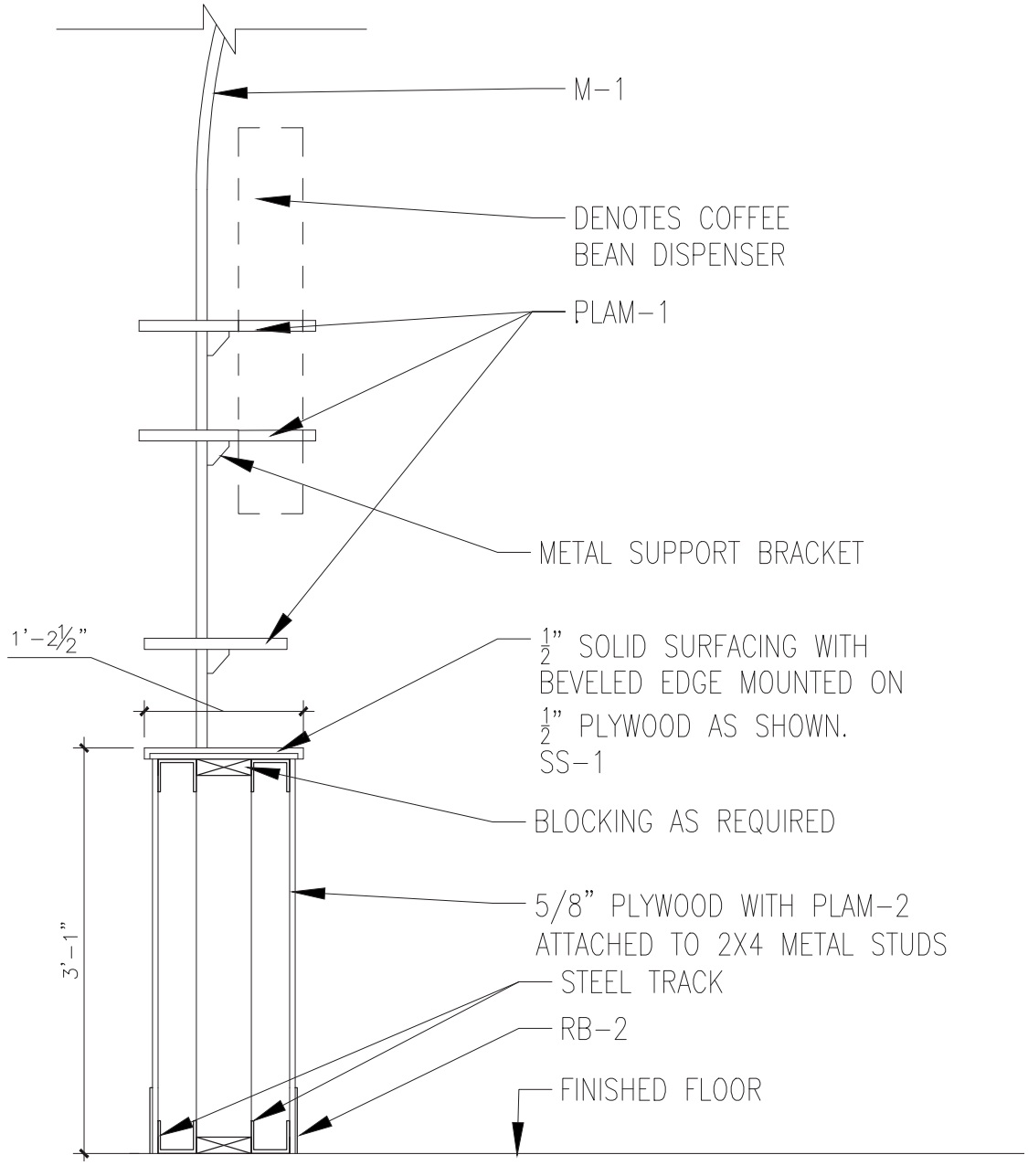
Scale : 1/4" = 1'=0"




3 **Cafe Structure West Elevation**
Scale : 1/4" = 1'=0"

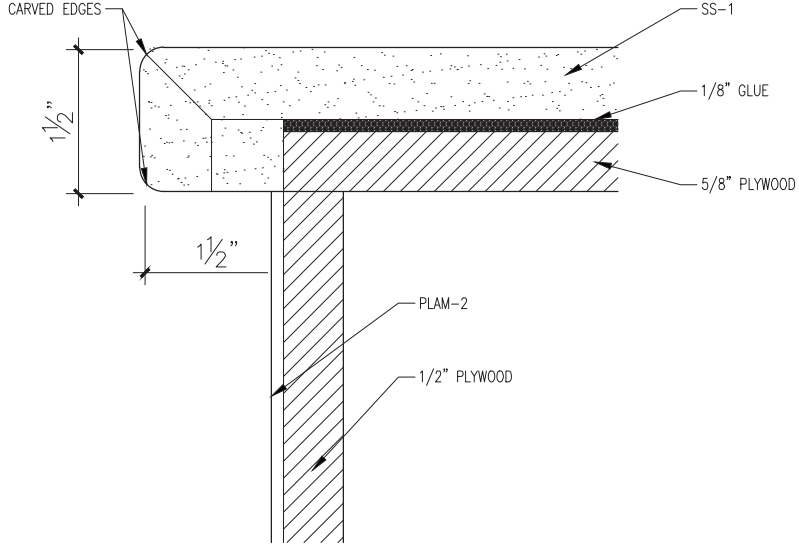



4 **Cafe Structure East Elevation**
Scale : 1/4" = 1'=0"




5 **Cafe Counter Section**

Scale : 3/4" = 1'=0"

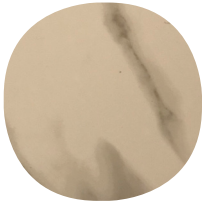



6 **Cafe Counter Detail**

Scale : 6" = 1'=0"

# appendix B Materials and Schedules


SS-1


T-2


MT-1

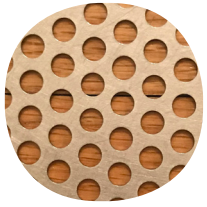

WC-1


RFT-1


FAB-4


MT-2


MT-3

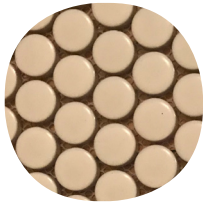

MT-4

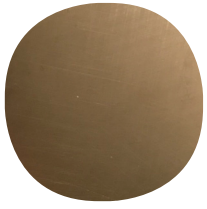

FAB-1

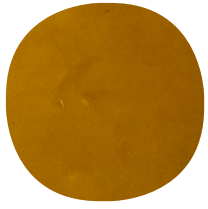

WC-2


RFT-3


T-4


T-5


SS-1

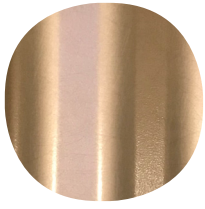

FAB-2


WC-3

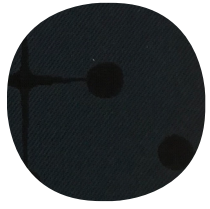

FAB-5


RFT-2


RB-1


MT-6


FAB-6


FAB-3


PLAM-1

| MATERIAL SCHEDULE | | | | | | |
|---|---|---|---|---|---|---|
| **CODE** | **TYPE** | **MANUFACTUER** | **COLOR** | **DIMENSION** | **SERIES** | **NOTES** |
| T-1 | FLOOR TILE | Olympia Tile | SNOW WHITE MATTE | 30x30cm | Penny Round Series | |
| T-2 | FLOOR TILE | Olympia Tile | BLACK MATTE | 30x30cm | Penny Round Series | |
| T-3 | FLOOR/WALL TILE | Carrara | MATTE WHITE | 30x60cm | Carrara X Series | |
| T-4 | FLOOR/WALL TILE | Carrara | PORT LAURENT | 30x60cm | Marmorea Series | |
| MT-1 | METAL | MoZ Designs | Clear Fog | 1/4" d perforation | Classic | Polycoat Flat Finish |
| MT-2 | METAL | MoZ Designs | 210 | .040 Aluminum | Blendz Patina | Polycoat Flat Finish |
| MT-3 | METAL SCREEN | MoZ Designs | 110 | .040 Aluminum | Blendz Patina | Polycoat Flat Finish |
| MT-4 | METAL BASE | MoZ Designs | Penny Copper | .040 Aluminum | Classic | |
| SS-1 | STAINLESS STEEL | MoZ Designs | Clear | 20 Gauge | SS Collection | Vertial Application |
| WC-1 | WALLCOVERING | Maharam | Gold 002 | 399600 | System | |
| WC-2 | WALLCOVERING | Maharam | Slate 016 | 399600 | System | |
| WC-3 | WALLCOVERING | Maharam | Plaster 005 | 395540 | Cobble | |
| RFT-1 | RUBBER FLOOR TILE | Johnsonite | TG1 | Tile | Safe Sense | Guide Tile |
| RFT-2 | RUBBER FLOOR TILE | Johnsonite | TW1 | Tile | Safe Sense | Attention Tile |
| RFT-3 | RUBBER FLOOR TILE | Johnsonite | Squashed 165 | Sheet | CBT-XX | |
| RB-1 | RUBBER BASE | Johnsonite | Burnt Umber 63 | 2.5" H | DCT-XX | |
| FAB-1 | FABRIC | Kvadrat | 180 | n/a | Divina Melange | |
| FAB-2 | FABRIC | Maharam | 022 Resolute | n/a | Cotton Velvet | |
| FAB-3 | FABRIC | Kvadrat | 120 | n/a | Divina Melange | |
| FAB-4 | FABRIC | Maharam | 005 Navy | n/a | Dot Pattern | |
| FAB-5 | FABRIC | Maharam | 016 Pear | n/a | Cotton Velvet | |
| SDS-1 | SOLID SURFACE | Carrara | PORT LAURENT | 30x60cm | Marmorea Series | |
| | | | | | | |

Table 8: Materials Schedule

| ROOM FINISH SCHEDULE | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ROOM # | ROOM NAME | FLOOR | WALLS | | | | CEILING | | NOTES |
| | | | NORTH | EAST | SOUTH | WEST | MAT | FIN | |
| 101 | Entrance | EXIST | GL-1 | P-1 | - | - | EX | PT-1 | |
| 102 | Information | EXIST | | P-2 | - | P-2 | EX | PT-1 | |
| 103 | Retail | EXIST | P-1 | - | - | P-1 | EX | PT-1 | |
| 104 | Waiting Lounge | EXIST/CPT-1 | P-1 | - | P-2/GL-2 | P-1 | EX | PT-1 | |
| 105 | Via Entrance | RB-1 | GL-2 | P-2 | P-1 | P-2 | EX | PT-1 | |
| 106 | Via Desk | EXIST | P-1 | P-1 | P-1 | P-1 | EX | PT-1 | |
| 107 | Via Info | CPT-2 | P-1 | P-1 | P-1 | P-1 | GB | PT-1 | |
| 108 | Security | SD-1 | P-1 | P-1 | P-1 | P-1 | GB | PT-1 | |
| 109 | Food Storage | CONC | SS-1 | SS-1 | SS-1 | SS-1 | GB | SS-1 | |
| 110 | Open Bar | EXIST/T-1 | - | - | - | WC-2 | EX | - | |
| 111 | Kitchen | CONC | P-1 | - | - | SS-1 | EX | PT-2 | |
| 112 | Staff Rm | CPT-3 | P-1 | P-1 | P-1 | P-1 | GB | PT-1 | |
| 113 | W/C | RB-1 | P-1 | P-1 | P-1 | P-1 | GB | PT-1 | |
| 114 | Restaurant Entrance | T-2 | - | - | - | - | EX | PT-1 | |
| 115 | Restaurant Corridor | T-2 | WC-1 | - | W-3 | P-2 | EX | PT-2 | |
| 116 | Restaurant Seating | CPT-4 | P-2 | P-2 | P-2 | P-2 | EX | PT-1 | |
| 117 | Waiting Area | CPT-5 | - | - | P-1 | WC-2 | EX | - | |
| 118 | Corridor | EXIST | - | - | - | - | EX | - | |
| 119 | Café Exterior | EXIST | - | - | - | - | EX | - | |
| 120 | Café Interior | HD-1 | WC-1 | P-2 | WC-1 | - | EX | PT-1 | |
| 121 | Tickets/Turnstile | EXIST | P-1 | - | P-1 | - | EX | PT-1 | |
| 122 | Transit Waiting | CONC | P-1 | P-1 | P-1 | WD-1 | - | PT-1 / WD-1 | Exposed |
| 123 | W/C | RB-1 | P-1 | P-1 | P-1 | P-3 | GB | PT-1 | |
| 124 | Turnstiles | EXIST | P-2 | - | P-2 | - | EX | PT-1 | |
| 125 | Bike Storage | RB-1 | P-1 | P-1 | P-1 | P-1 | - | - | Exposed |
| 126 | Tickets | EXIST | P-1 | P-1 | - | - | GB | PT-1 | |

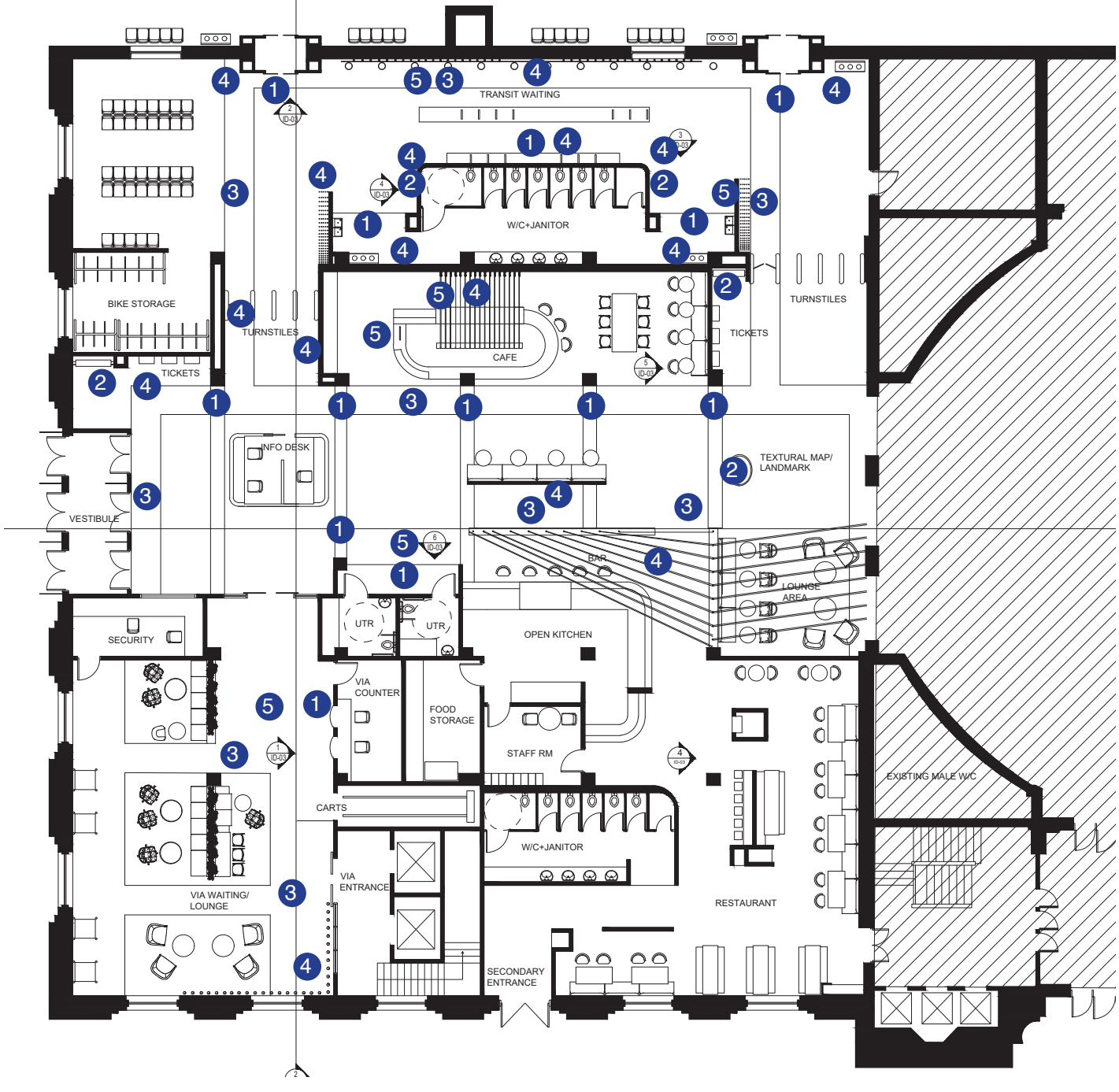
Table 9: Room Finish Schedule

# appendix C Lenses Applied to Design

## Visual Impairment

| | IDEOLOGIES | RESOURCE | ELEMENTS |
|---|---|---|---|
| 1 | Types of Vision Loss | n/a | a) redundancy in cues at intersection points;<br>b) use of contrast at varying heights and locations;<br>c) key decision making points highlighted through tactile cues and visual cues |
| 2 | Education | VIRN | a) place building directories at all entrances into the building;<br>b) signage be bold, contrasting to adjacent elements, tactile, visual and audible;<br>c) cues be able to direct users around the space, but also help direct them out;<br>d) use colour and texture consistency to create amenity zones that are distinguishable throughout the whole building |
| 3 | Mobility | CNIB | a) detectable, linear path be a size that accomodates use of all three mobility aids comfortably so that people can walk side by side, or their cane or guide dog is not walking on the edge of two different textures;<br>b) have main paths of travel be legible, linear and simple |
| 4 | Communication | CNIB | a) Large Print Signage;<br>b) Braille on all signage that is accessible to touch;<br>c) Tactile graphics;<br>d) Audible, digital information kisoks;<br>e) public announcements that are also supplemented by a monitor;<br>f) Strategies that can help orient users using audble cues, such as ceiling heights and textural intersections to note paths of travel |
| 5 | Existing Standards | - *2015 City of Winnipeg, Accessibility Desig Standards, Third Edition*<br>- *CAN/CSA B651-04 Accessible Design for the Built Environment*<br>- *Intercity Bus Code of Practice*<br>- “Clearing our Path” | a) locate signage at consistent heights and locations;<br>b) clear spaces<br>c) provide options of seating;<br>d) slip resistant materials;<br>e) materials that do not omit glare;<br>f) no protuding elements into paths of travel<br>g) queuing needs to be located out of the path of travel and noted through directional tactile flooring |

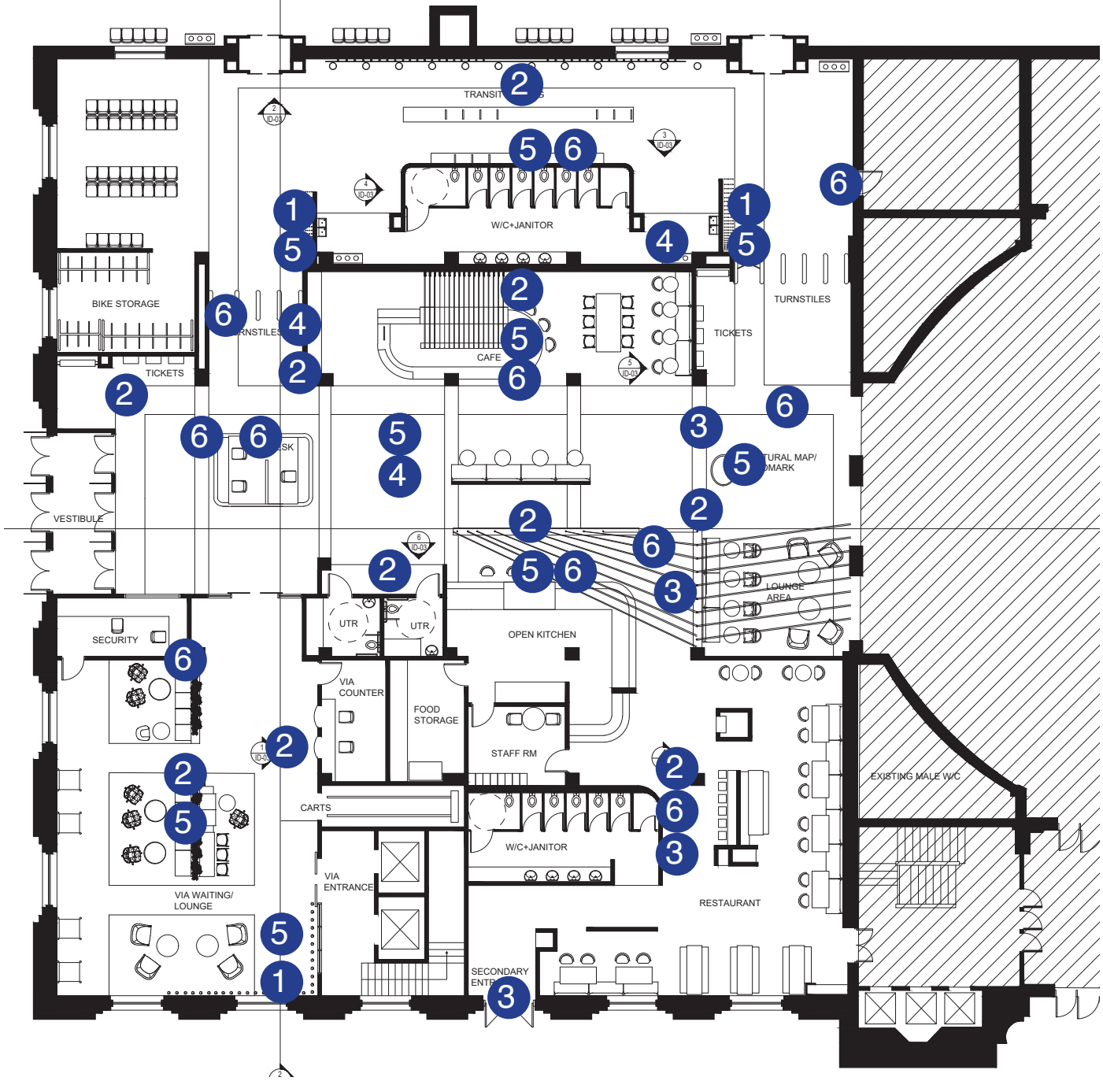
Table 10: Visual Impairment Spatial Considerations Applied to Design


TRANSIT WAITING
W/C+JANITOR
BIKE STORAGE
TURNSTILES
TICKETS
CAFE
TURNSTILES
TICKETS
INFO DESK
TEXTURAL MAP/
LANDMARK
VESTIBULE
BAR
LOUNGE
AREA
SECURITY
UTR
UTR
OPEN KITCHEN
VIA
COUNTER
FOOD
STORAGE
STAFF RM
EXISTING MALE W/C
CARTS
W/C+JANITOR
VIA
ENTRANCE
VIA WAITING/
LOUNGE
RESTAURANT
SECONDARY
ENTRANCE

# Literature Review

| | IDEOLOGIES | THEORISTS / ARTISTS | ELEMENTS |
|---|---|---|---|
| 1 | Narratology | Tzevetan Todorov, Mieke Bal, Susan Onega, Jose Garcia Land | a) use sound installations that become affected when others users move around the space<br>b) harvest the movements of users into installations |
| 2 | Multi-Sensory Design | Juhani Pallasmaa, Carman Papalia, Harry Harlow | a) metal poles that people can use as a trailing wall - hot and cold, creates sound when people run their hands across them<br>b) tactile artwork - feel and see a heavy contrast<br>c) varying ceiling heights for varying sound reverberation<br>d) use of plants close to exit (aromas) |
| 3 | Adaptive Reuse | Graeme Brooker, Sally Stone, Mieke Bal | a) tactile strips follow existing column pattern<br>b) exit and entry points are informed from existing door locations<br>c) organic vertical shapes are used to contrast the rectilinear design elements of original building design |
| 4 | Perception | Environmental Psychology | a) central corridors to allow for ease of navigation<br>b) legibility of space - create specific boundaries for different usages of space<br>c) large universal graphic symbols |
| 5 | Orientation | Ivan Pavlov | a) acoustic ceiling pods are used to create sound differences between static and active spaces<br>b) acoustic installations are used where there is a transient space to create ambient sound signalling a transition<br>c) tactile markers used as landmarks and “you are here” signage as soon as you enter the building from a bus<br>d) varying lighting conditions to distinguish between static and active space<br>e) center core (active) with branching off (transient) spaces at the exterior (static). |
| 6 | Wayfinding | Kevin Lynch | a) create obvious entry points with use of contrasting flooring (color & texture) with break points as entry points<br>b) transition of space clearly marked by floor pattern/texture<br>c) central core neutral color palette and support spaces colorful<br>d) ceiling heights vary to heighten sensory cue of path of travel or that you’ve entered into a new space<br>e) use of repetition in floor pattern, wall treatments |

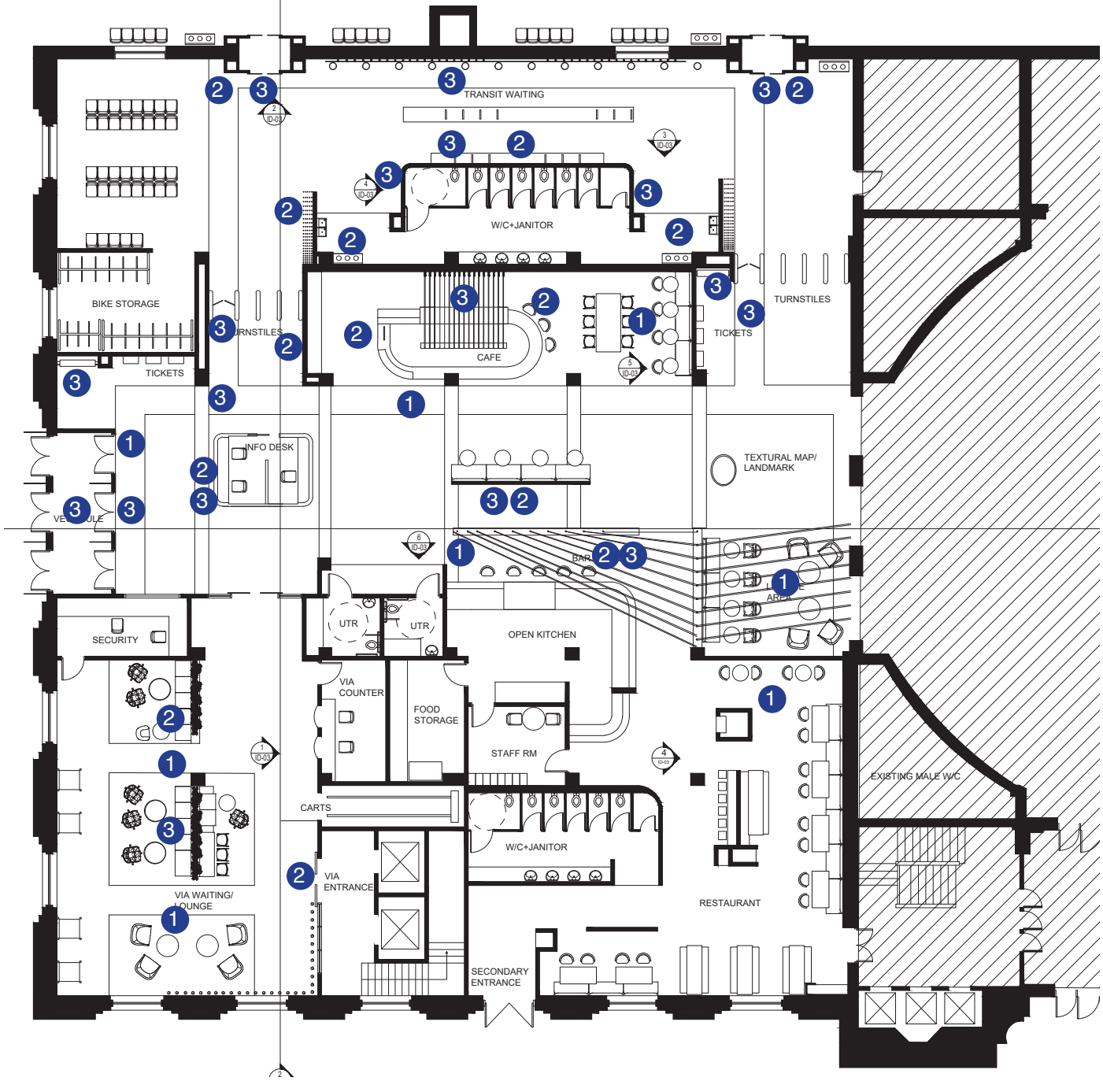
Table 11: Literative Review Spatial Considerations Applied to Design


TRANSIT
W/C+JANITOR
BIKE STORAGE
TURNSTILES
TICKETS
CAFE
TICKETS
TURNSTILES
VESTIBULE
DESK
TURAL MAP/
DMARK
LOUNGE
AREA
SECURITY
UTR
UTR
OPEN KITCHEN
VIA
COUNTER
FOOD
STORAGE
STAFF RM
EXISTING MALE W/C
CARTS
W/C+JANITOR
VIA
ENTRANCE
RESTAURANT
VIA WAITING/
LOUNGE
SECONDARY
ENTR

# Experience

| | IDEOLOGIES | RESOURCE | ELEMENTS |
|---|---|---|---|
| 1 | Dining in the Dark | O Noir Restaurant (Montreal) | a) use upholstered furniture in intimate areas for sound absorption;<br>b) use carpet versus stone flooring to delineate paths of travel and seating areas;<br>c) sound absorbing ceiling pods;<br>d) open concept to be able to smell cafe;<br>e) furniture should be easily identifiable;<br>f) heavy so they don't get pushed into the path of travel, use armrests, go right to the floor so a white cane can detect it and provides less of a tripping hazard<br>g) keep space open so that sounds of different spaces can be heard to help someone organize the space;<br>h) uninterrupted path of travel to walk along |
| 2 | Photographic Exploration | Sight Unseen Exhibit - Canadian Museum for Human Rights | a) contrast the furniture to their surroundings so they can be seen;<br>b) bold, large graphics on a contrasting background;<br>c) use movement of the space to cue paths of travel - intro-duce sound installations at main threshold spaces |
| 3 | Union Station Walkthrough | Single Source Visually Impaired Informant | a) doors have a path of travel to follow right upon walking in;<br>b) use a canopy or vestible wit lower ceiling height to help adjust lighting conditions from inside to outside;<br>c) use automatic sliding doors where possible;<br>d) have information desk right when walking in;<br>e) tactile map of building right when walking in;<br>f) detectable flooring to know what direction to do, or something linear to follow so a user knows it is a safe path of travel to another information/ decision making point;<br>g) acoustic strategies to create heirarchy within a space;<br>h) provide design elements that can be expressed through verbal communication, that is also supplemented with tactile building directory<br>i) include signage at varying height levels |

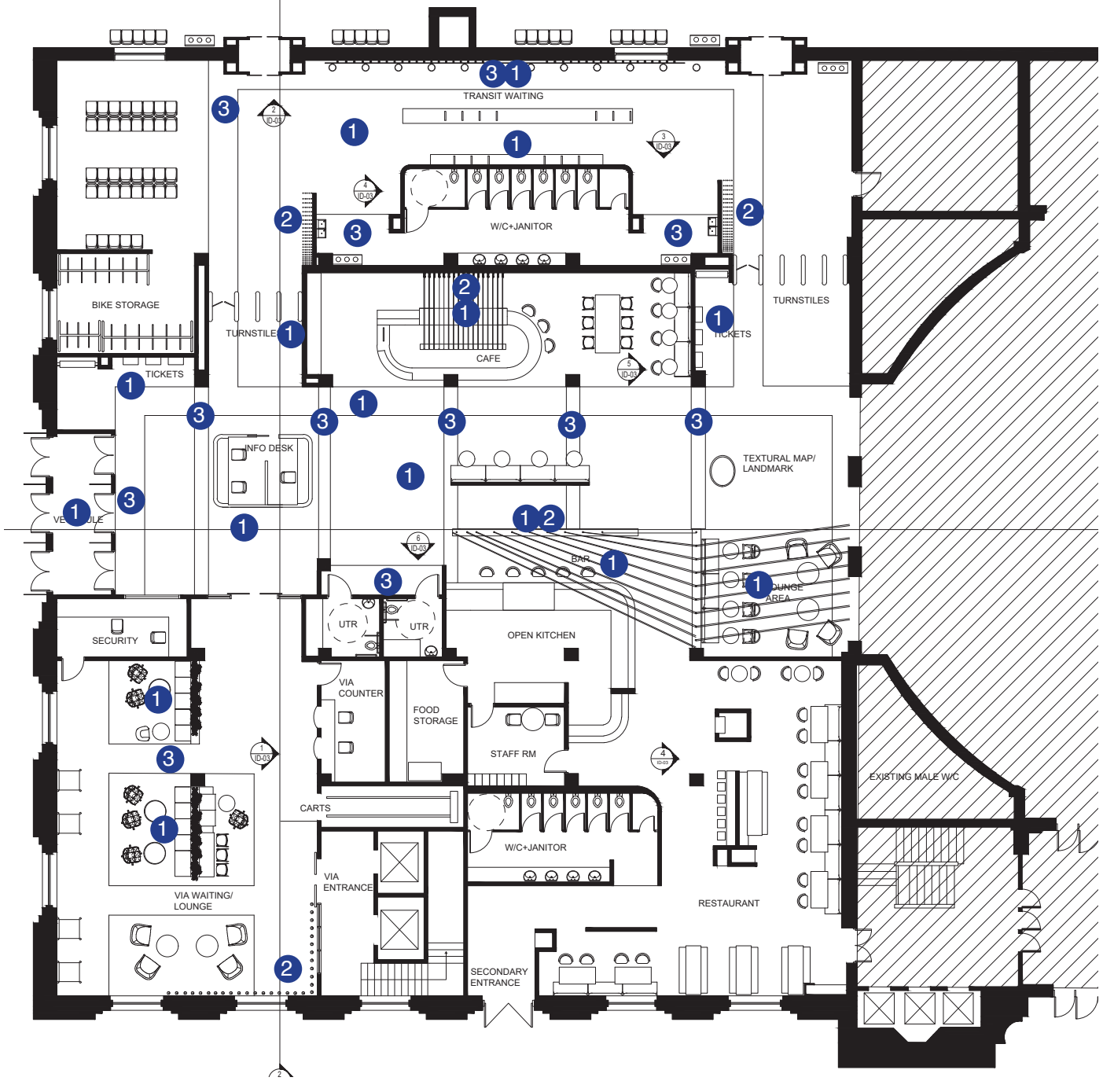
Table 12: Experience to Design Spatial Considerations Applied to Design


TRANSIT WAITING
W/C+JANITOR
BIKE STORAGE
TURNSTILES
TICKETS
CAFE
TURNSTILES
TICKETS
INFO DESK
TEXTURAL MAP/
LANDMARK
BAR
SECURITY
UTR
UTR
OPEN KITCHEN
VIA
COUNTER
FOOD
STORAGE
STAFF RM
EXISTING MALE W/C
CARTS
W/C+JANITOR
VIA
ENTRANCE
RESTAURANT
VIA WAITING/
LOUNGE
SECONDARY
ENTRANCE

# Precedents

| | IDEOLOGIES | RESOURCE | ELEMENTS |
|---|---|---|---|
| 1 | Design that creates successful navigation for students with a visual impairment | Hazelwood School | a) minumize the large open space into smaller areas through textural and acoustic cues;<br>b)incorrporate a trailing wall or other elements that can help someone shoreline - a path of navigation without any interuption;<br>c) use varying degrees of tactile navigation, such as thermal difference, hard versus soft materials, materials that make sound when touching them;<br>d) use light to define space;<br>e) central spine spatial layout |
| 2 | Project interested in public design, sensorial experiences and experimentation of materials | Milkshake Tree Playground | a) use materials that emit sound when touched;<br>b) integrate installations that react to human interaction through movement;<br>c) use smell to orient users;<br>d) make the space a sensory experience in a fun way (chimes, pipes to make sound, wool balls, etc) |
| 3 | Innovative design approach towards accessibility standards and wayfinding | 100 Broadview Lobby | a) integrate paths of travel into the design so they can help everyone with navigation;<br>b) highly contrast the main path of travel to help it stand out for adjacent spaces;<br>c) use same colours for same amentities, such as washroom walls and floors to create distinctive zones |

Table 13: Precedents to Design Spatial Considerations Applied to Design


TRANSIT WAITING
W/C+JANITOR
BIKE STORAGE
TURNSTILES
TICKETS
CAFE
TURNSTILES
TICKETS
INFO DESK
TEXTURAL MAP/
LANDMARK
BAR
LOUNGE
AREA
SECURITY
UTR
UTR
OPEN KITCHEN
VIA
COUNTER
FOOD
STORAGE
STAFF RM
EXISTING MALE W/C
CARTS
W/C+JANITOR
VIA
ENTRANCE
VIA WAITING/
LOUNGE
RESTAURANT
SECONDARY
ENTRANCE

# endnotes

## Introduction

1. Edward Steinfeld and Jordana Maisel, *Universal design : creating inclusive environments* (Hoboken, N.J. : John Wiley & Sons, 2012), 1.

2. 2015 City of Winnipeg, *Accessibility Design Standard*, 3rd ed. (City of Winnipeg, 2015), 18.

3. Council of Ontario Universities, *Module 1: Understanding the AODA and the Accessibility Standards for Customer Service*. https://carleton.ca/equity/aoda-modules/accessible/module-1/21.html (accessed July 2, 2018).

4. Edward Steinfeld and Jordana Maisel, *Universal design : creating inclusive environments* (Hoboken, N.J. : John Wiley & Sons, 2012), 1.

5. Metrolinx, *Mobility Hubs Development of a Regional Transportation Plan for the Greater Toronto and Hamilton Area* for Consulations, (Government of Ontairo, 2008), i.

6. Ibid., i.

7. Ibid., i.

8. Ron Mace, "About UD". *The centre for Universal Design Environments and Products of All People*. https://projects.ncsu.edu/design/cud/about_ud/about_ud.htm (accessed April 17, 2017)

9. Doris Koop (Executive Director of the Vision Impaired Resource Network) in discussion with author, February 20, 2018.

10. Ann Heylighen, Caroline Van Doren, and Peter-Willem Vermeersch, *Enriching Our Understanding of Architecture Through Disability Experience*, Open House International vol. 38, no. 1, (Open House International Association, 2013), 7.

11. Ibid., 7.

12. Ibid., 17.

13. Ibid.,17.

14. "Vision and Corporate Mission," http://winnipeg.ca/cao/vision.stm, City of Winnipeg 1996-2018, (February 6, 2015)

15. "Guide for Assessing Persons with Disabilities - How to determine and implement assessment accommodations - Vision disabilities," https://www.canada.ca/en/public-service-commission/services/public-service-hiring-guides/guide-assessing-persons-disabilities/guide-assessing-persons-disabilities/guide-assessing-persons-disabilities-determine-implement-assessment-accommodations-vision-disabilities.html, Government of Canada (August 15, 2007)

16. 2015 City of Winnipeg, *Accessibility Design Standard*, 3rd ed. (City of Winnipeg, 2015), 17.

17. Ibid., 17.

18. Ibid., 18.

19. Ibid., 18.

20. Ibid., 18.

21. Ibid., 18.

22. Ibid., 18.

23. Ibid., 19.

24. "What is Low Vision?," Canadian Ophthalmological Society, http://www.cnib.ca/en/your-eyes/eye-conditions/low-vision/Pages/default.aspx, CNIB (accessed May 16, 2018)

25. 2015 City of Winnipeg, *Accessibility Design Standard*, 3rd ed. (City of Winnipeg, 2015), 20.

26. Carmen Willings, *Mobility Skills*, Teaching Students. https://www.teachingvisuallyimpaired.com/mobility-skills.html

27. "Low Vision and Legal Blindness Terms and Descriptions," American Foundation for the Blind, http://www.visionaware.org/info/your-eye-condition/eye-health/low-vision/low-vision-terms-and-descriptions/1235, (accessed March 20, 2017)

28. "Definition of Visual Impairment," Plone Foundation, http://www.seniorvision.org/resources/definition-of-visual-impairment, (accessed March 15, 2017)

29. 2015 City of Winnipeg, *Accessibility Design Standard*, 3rd ed. (City of Winnipeg, 2015), 21.

## Visual Impairment

1. "Definition of Visual Impairment," Plone Foundation, http://www.seniorvision.org/resources/definition-of-visual-impairment, (accessed March 15, 2017)

2. "Vision Loss Basics Understanding the Needs of People with Vision Loss," CNIB, http://www.clearingourpath.ca/1.0.0-vision-loss-basics_e.php, (accessed June 2, 2017)

"Vision Loss Basics Understanding the Needs of People with Vision Loss." CNIB. http://www.clearingourpath.ca/1.0.0-vision-loss-basics_e.php. (accessed June 2, 2017)

3. Alan Dicey, "Levels of Visual Function," http://nfbnet.org/pipermail/nfbf-l_nfbnet.org/2013-September/011048.html, (accessed May 10, 2017)

4. Graeme Fulton, "Accessibility Basics: Designing for Visual Impairment," https://webdesign.tutsplus.com/articles/accessibility-basics-designing-for-visual-impairment--cms-27634, (accessed March 13, 2017)

5. Ibid.

6. "Vision Field," Vision and Eye Health, http://www.vision-and-eye-health.com/visual-field.html, (accessed March 20, 2017)

7. "About Us," CNIB, http://www.cnib.ca/en/about/Pages/default.aspx, (accessed May 30, 2017)

8. Ibid.

9. "About," CNIB, http://www.clearingourpath.ca/0.1.0-about_e.php, (accessed March 20, 2017)

10. "Who Is VIRN?," Vision Impaired Resource Network, http://virn.ca/multimedia/who-virn, (accessed March 15, 2017)

11. Ibid.

12. Doris Koop (Executive Director of the Vision Impaired Resource Network) in discussion with author, February 20, 2018.

13. Ibid.

14. Ibid.

15. Ibid.

16. Ibid.

17. "Code of Conduct," http://www.intercity-buses.com/?wp=code-of-conduct, (accessed March 12, 2017)

18. Doris Koop (Executive Director of the Vision Impaired Resource Network) in discussion with author, February 20, 2018.

19. Ibid.

20. Ibid.

21. "Information and Communications Systems," CNIB, http://clearingourpath.ca/3.8.0-ict_e.php, (accessed March 21, 2017)

22. "Mobility," CNIB, http://clearingourpath.ca/1.2.0-mobility_e.php, (accessed March 21, 2017)

23. Ibid.

24. "Residual sight," CNIB, http://clearingourpath.ca/1.2.1-residual-sight_e.php, (accessed March 21, 2017)

25. "Mobility," CNIB, http://clearingourpath.ca/1.2.0-mobility_e.php, (accessed March 21, 2017)

26. "The Long 'White Cane'," CNIB, http://clearingourpath.ca/1.2.2-the-long-white-cane_e.php, (accessed March 21, 2017)

27. "Tactile Walking Surface Indicator" CNIB, http://clearingourpath.ca/3.3.0-twsi_e.php, (accessed February 20, 2018).

28. "Guide Dogs,"CNIB, http://clearingourpath.ca/1.2.3-guide-dogs_e.php, (accessed March 21, 2017)

29. Ibid.

30. Ibid.

31. "Braille," CNIB, http://www.clearingourpath.ca/1.4.2-braille_e.php, (accessed March 21, 2017)

32. Ibid.

33. Copyright © 1997 NC State University , The Center for Universal Design
"The Center for Universal Design (1997). The Principles of Universal Design, Version 2.0. Raleigh, NC: North Carolina State University."

34. "Entrance-Lobbies" CNIB, http://clearingourpath.ca/5.1.0-entrance-lobbies_e.php, (accessed February 20, 2018).

35. Transportation Canada, *Intercity Bus Code of Practice* (Public Works and Government Services Canada, 2011) 12.
http://www.tc.gc.ca/eng/policy/acc-accf-accessintercitybuscode-711.htm.

36. "Location of Signs" CNIB, http://clearingourpath.ca/3.7.2-locations-of-signs_e.php, (accessed February 20, 2018).

37. "Signage" CNIB, http://clearingourpath.ca/3.7.0-signage_e.php, (accessed February 20, 2018).

38. "Tactile Signs" CNIB, http://clearingourpath.ca/3.7.5-tactile-signs_e.php, (accessed February 20, 2018).

39. Transportation Canada, *Intercity Bus Code of Practice* (Public Works and Government Services Canada, 2011) 9. http://www.tc.gc.ca/eng/policy/acc-accf-accessintercitybuscode-711.htm.

40. B651-04 *Accessible design for the built environment* (Mississauga, Ontario: Canadian Standards Association, 2004), 114.

41. "Colour on Signs" CNIB, http://clearingourpath.ca/3.7.4-colour-on-signs_e.php, (accessed February 20, 2018).

42. "Floor Finishes" CNIB, http://clearingourpath.ca/5.3.0-floor-finishes_e.php, (accessed February 20, 2018).

43. B651-04 *Accessible design for the built environment* (Mississauga, Ontario: Canadian Standards Association, 2004), 12.

44. "Counters-Kiosks" CNIB, http://clearingourpath.ca/5.4.0-counters-kioks_e.php, (accessed February 20, 2018).

45. "Interior Circulation" CNIB, http://clearingourpath.ca/5.6.0-interior-circulation_e.php, (accessed February 20, 2018).

46. "Building Entrances" CNIB, http://clearingourpath.ca/4.6.0-building-entrances_e.php, (accessed February 20, 2018).

47. "Glass Doors" CNIB, http://clearingourpath.ca/4.7.8-glass-doors_e.php, (accessed February 20, 2018).

48. Ibid.

49. "Multiple Doors" CNIB, http://clearingourpath.ca/4.7.6-multiple-doors_e.php, (accessed February 20, 2018).

50. "Clear Width" CNIB, http://clearingourpath.ca/4.7.1–clear-width_e.php, (accessed February 20, 2018).

51. "Door Action" CNIB, http://clearingourpath.ca/4.7.2-door-action_e.php, (accessed February 20, 2018).

52. "Automatic Sliding Doors" CNIB, http://clearingourpath.ca/4.7.5-automatic-sliding-doors_e.php, (accessed February 20, 2018).

53. "Information Desks" CNIB, http://clearingourpath.ca/3.8.1-information-desks_e.php, (accessed February 20, 2018).

54. "Location of Signs" CNIB, http://clearingourpath.ca/3.7.2-location-of-signs_e.php, (accessed February 20, 2018).

55. "Information Directories" CNIB, http://clearingourpath.ca/3.8.3-information-directories_e.php, (accessed February 20, 2018).

56. "Counters-Kiosks" CNIB, http://clearingourpath.ca/5.4.0-counters-kioks_e.php, (accessed February 20, 2018).

57. Ibid

58. Transportation Canada, *Intercity Bus Code of Practice* (Public Works and Government Services Canada, 2011) 13. http://www.tc.gc.ca/eng/policy/acc-accf-accessintercitybuscode-711.htm.

59. 2015 City of Winnipeg, *Accessibility Design Standard*, 3rd ed. (City of Winnipeg, 2015), 64.

60. "Counters-Kiosks" CNIB, http://clearingourpath.ca/5.4.0-counters-kioks_e.php, (accessed February 20, 2018).

61. Transportation Canada, *Intercity Bus Code of Practice* (Public Works and Government Services Canada, 2011) 13. http://www.tc.gc.ca/eng/policy/acc-accf-accessintercitybuscode-711.htm.

62. "Waiting Areas" CNIB, http://clearingourpath.ca/5.6.3-waiting-areas_e.php, (accessed February 20, 2018).

63. Ibid

64. Transportation Canada, *Intercity Bus Code of Practice* (Public Works and Government Services Canada, 2011) 14. http://www.tc.gc.ca/eng/policy/acc-accf-accessintercitybuscode-711.htm.

65. Ibid., 14

66. B651-04 *Accessible design for the built environment* (Mississauga, Ontario: Canadian Standards Association, 2004), 122.

67. "Amenities" CNIB, http://clearingourpath.ca/5.2.0-amenities_e.php, (accessed February 20, 2018).

68. Ibid.

69. B651-04 *Accessible design for the built environment* (Mississauga, Ontario: Canadian Standards Association, 2004), 15.

70. "Waiting Areas" CNIB, http://clearingourpath.ca/5.6.3-waiting-areas_e.php, (accessed February 20, 2018).

71. "Tactile Walking Surface Indicator" CNIB, http://clearingourpath.ca/3.3.0-twsi_e.php, (accessed February 20, 2018).

72. Ibid.

73. Ibid.

74. B651-04 *Accessible design for the built environment* (Mississauga, Ontario: Canadian Standards Association, 2004), 26.

75. B651-04 *Accessible design for the built environment* (Mississauga, Ontario: Canadian Standards Association, 2004), 15.

76. Ibid., 20

77. Ibid., 21

78. B651-04 *Accessible design for the built environment* (Mississauga, Ontario: Canadian Standards Association, 2004), 31.

79. Ibid., 51

80. Ibid., 51

81. Transportation Canada, *Intercity Bus Code of Practice* (Public Works and Government Services Canada, 2011) 11. http://www.tc.gc.ca/eng/policy/acc-accf-accessintercitybuscode-711.htm.

82. Ibid,. 12

83. Ibid,. 8

84. Ibid,. 8

## Literature Review

1. Wolf Schmid, "Narrativity and Eventfulness." in What is Narratology? *Questions and Answers Refarding the Status of a Theory*, edited by Tom Kindt and Hans-Harald Muller, (Berlin: Walter de Gruyter, 2003), 18.

2. Mieke Bal, *Narratology: Introduction to the Theory of Narrative*. (Toronto, University of Toronto Press, 1985), 3.

3. Ibid.,5.

4. Susana Onega and Jose Angel Garcia Landa. *Narratology: An Introduction*. (London: Longman Critical Readers, 1996), 3.

5. Paul Perron. *Narratology and Text Subjectivity and Identity in New France and Quevecois Literature*. (Toronto: University of Toronto Press, 2003), 11.

6. Juhani Pallasmaa.*The eyes of the skin: architecture and the senses*. (Chichester: Wiley-Academy, 2005), 69.

7. Juhani Pallasmaa, "An Architecture of the Seven Senses", in Toward a New Interior: An Anthology of Interior Design Theory, ed. Lois Weinthal (New York: Princeton Architectural Press, 2011), 40.

8. Ibid., 40.

9. Ibid., 43.

10. Ibid., 45.

11. Ibid., 41.

12. Wastiels, L., Schifferstein, H.N.J., Woutes, I., & Heylighen, A. (2013). "Touching materials visually: About the dominance of vision in building material assessment". *International Journal of Design.* 7(2), 31-41.

13. Ibid.

14. Georgina Krantz, "How Do You See a Museum with Your Eyes Closed?" Guggenheim, March 29, 2017, , accessed July 05, 2018, https://www.guggenheim.org/blogs/checklist/how-do-you-see-a-museum-with-your-eyes-closed.

15. Ibid.

16. Ibid.

17. Sarah Renshaw, "Designing the Sensorium," The Senses and Society 4, no. 2 (April 16, 2015): , accessed July 5, 2018, https://www.tandfonline.com/doi/abs/10.2752/174589309X425175.

18. Christopher N. Henry, "Tactile Architecture: Does It Matter?" Arch Daily, November 23, 2011, , accessed July 5, 2018, https://www.archdaily.com/186499/tactile-architecture-does-it-matter.

19. Harry Harlow, "The Nature of Love," *American Psychologist.* Vol. 13, 1958, p 673.

20. Ibid.

21. Ruth Newman, "Getting Tactile with Design", April 16, 2015. http://sourceable.net/getting-tactile-withdesign.

22 Juhani Pallasmaa, "An Architecture of the Seven Senses," in *Towards a New Interior: An Anthology of Interior Design Theory,* ed. Lois Weinthal (New York: Princeton Architectural Press, 2011), pg 44.

23. Ibid., 44.

24. Ibid, 41.

25. Ibid, 49

26. Graeme Brooker and Sally Stone, *What is Interior Design*? (Switzerland: RotoVision, 2010), 64.

27. Georges Teyssot, "Mapping the Threshold: A Theory of Design and Interface", Architectural Association School of Architecture, (2008), 11.

28. Mieke Bal, *Narratology: Introduction to the Theory of Narrative*, 3.

29. Graeme Brooker and Sally Stone, "From Organization to Decoration," in Thinking Inside the Box, ed. Gigli, Hay, Hollis, Milligan, Milton, Plunkett (London: Middlesex, University Press, 2007), 125.

30. Graeme Brooker and Sally Stone, "From Organization to Decoration," in *Thinking Inside the Box*, ed. Gigli, Hay, Hollis, Milligan, Milton, Plunkett (London: Middlesex, University Press, 2007), 125.

31. Ibid.

31a. Ibid.

32. Ibid.

33. Graeme Brooker and Sally Stone, "Rereadings", in *From Organization to Decoration: An Interior Reader*, ed Graeme Brooker and Sally Stone (New York: Routledge, 2013), 242.

34. Graeme Brooker and Sally Stone, *Basic Interior Architecture: Form + Structure* (New York: Watson- Guptill, 2007), 104.

35. Ibid., 110.

36. Ibid., 116.

37. Graeme Brooker and Sally Stone, *Basic Interior Architecture: Form + Structure* (New York: Watson- Guptill, 2007), 110.

38. raeme Brooker and Sally Stone, "From Organization to Decoration," in *Thinking Inside the Box*, ed. Gigli, Hay, Hollis, Milligan, Milton, Plunkett (London: Middlesex, University Press, 2007), 128.

39. Graeme Brooker and Sally Stone, *Basic Interior Architecture: Form + Structure* (New York: Watson- Guptill, 2007), 152.

40. Ibid.,148.

41. Ibid.,160.

42. Ibid.,168.

43. Ibid.,164.

44. Not in Use

45. "Environmental Perception - Oxford Reference," Social Class and Sport - *Oxford Reference*, June 16, 2017, , accessed July 16, 2018, http://www.oxfordreference.com/view/10.1093/oi/authority.20110803095753657.

46. Meghana Veeramachaneni, "Wayfinding for the Blind in a Retail Setting," Master's thesis, Iowa State University, 2014, 20.

47. Mark Vander Voort, "Sensory Perception Through Architecture", HKS, May 30, 2013., accessed April 13, 2017, http://stories.hksinc.com/?s=sensory+perception+through+architecture.

48. Ibid.

49. Ibid.

50. Ibid.

51. Ibid.

52. Ibid.

52a. Ibid.

53. Ibid.

54. Ibid.

55. Meghana Veeramachaneni, Wayfinding for the Blind in a Retail Setting, Master's thesis, Iowa State University, 2014. 21.

56. Ibid., 21.

57. Ibid., 21.

58. Ibid., 21.

59. Ibid., 21-22.

60. Ibid., 21.

61. No longer in use

62. Meghana Veeramachaneni, Wayfinding for the Blind in a Retail Setting, Master's thesis, Iowa State University, 2014. 20.

63. Ibid., 20.

64. Ibid., 20.

65. Ibid., 20.

66. Ibid., 24.

67. Kevin Lynch. *The Image of the City*. Cambridge: MIT Press, 1960., 276.

68. Scott Billings, "Pointers to the Future," Scott Billings, January 27, 2011, , http://www.scottbillings.co.uk/pointers-to-the-future/.

69. Kevin Lynch. *The Image of the City*. Cambridge: MIT Press, 1960., 276.

70. Ibid., 276.

71. Ibid., 276.

72. Ibid., 276.

73. Christopher Spencer and Kate Gee, Encyclopedia of Human Behaviour, 2nd ed., s.v. "Environmental Cognition.", 46.

74. Ibid. 47.

75. Ibid. 47.

76. Scott Billings, "Pointers to the Future," Scott Billings, January 27, 2011, , http://www.scottbillings.co.uk/pointers-to-the-future/.

## Experience

1. "Alice Wingwall," http://www.alicewingwall.com/biography.html, (accessed April 20, 2017)

2. Ibid.

3. 2015 City of Winnipeg, *Accessibility Design Standard*, 3rd ed. (City of Winnipeg, 2015), 116.

4. Ibid., 116,

5. "Clearing Our Path Creating accessible environments for people with vision loss," Design Needs, CNIB, http://www.clearingourpath.ca/8.0.0-design-needs_e.php, (accessed May 2, 2017)

6. Ibid.

7. Ibid.

8. Ibid.

9. 2015 City of Winnipeg, *Accessibility Design Standard*, 3rd ed. (City of Winnipeg, 2015), 53.

10. "Clearing Our Path Creating accessible environments ¬for people with vision loss," Design Needs, CNIB, http://www.clearingourpath.ca/8.0.0-design-needs_e.php, (accessed May 2, 2017)

11. Ibid.

12. Ibid.

12a. 2015 City of Winnipeg, *Accessibility Design Standard*, 3rd ed. (City of Winnipeg, 2015), 56.

13. Ibid., 56.

14. Doris Koop (Executive Director of the Vision Impaired Resource Network) in discussion with author, February 20, 2018.

15. "Clearing Our Path Creating accessible environments for people with vision loss," Design Needs, CNIB, http://www.clearingourpath.ca/8.0.0-design-needs_e.php, (accessed May 2, 2017)

16. 2015 City of Winnipeg, *Accessibility Design Standard*, 3rd ed. (City of Winnipeg, 2015), 57.

17. Ibid., 57.

18. "Accessible Design for the Built Environment," Standards Council of Canada, 2017, CAN/CSA-B651-04 (R2010), 116.

## Precedents

1. "Viewpoints," *The Scottish Government*, The Crown Copyright, http://www.gov.scot/Topics/Education/Schools/Buildings/CaseStudies/Glasgow/hazelwoodschool/viewpoints, (accessed April 3, 2015)

2. "Hazelwood School for the Multiple Sensory Impaired," *Urbnarama: Atlas of Architecture*, http://fr.urbarama.com/project/hazelwood- school-for-the-multiple-sensory-impaired-1489, (accessed April 3, 2015)

3. Ibid.

4. Ibid.

5. Ibid.

6. Johnny Rodger, "It Had to Be a Secure But Not Too Safe – So the Pupils Could Be Independent," *Architects' Journal*, 226.11 (2007): 25, EBSCOhost. http://web.b.ebscohost.com.proxy2.lib.umanitoba.ca/ehost/detail/ detail?vid=1&sid=8ca87661-3b9d-4532-80d4-d682fd672d20@sessionmgr110&hi d=106&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ==#db=aft&AN=505233774, (accessed April 7, 2015)

7. Ibid.

8. Ibid.

9. "Hazelwood School for the Multiple Sensory Impaired," *Urbnarama: Atlas of Architecture*, http://fr.urbarama.com/project/hazelwood- school-for-the-multiple-sensory-impaired-1489, (accessed April 3, 2015)

10."Hazelwood School, Glasgow, UK-Scotland," *Designing for Education: Compendium of Exemplary Educational Facilities*. OECD Centre for Effective Learning Environments, 2011. http://edfacilitiesinvestment-db.org/facilities/42. (accessed April 3, 2015)

11. "133 Wai Yip Street," DRIVENxDESIGN, https://drivenxdesign.com/LON16/project.asp?ID=15185, (accessed March 15, 2017)

12. "Milkshake Tree playground in London doubles as an oversized xylophone," Inhabitat, https://inhabitat.com/milkshake-tree-installation-in-london-doubles-as-an-oversized-xylophone/, (accessed May 16, 2018)

13. "133 Wai Yip Street," DRIVENxDESIGN, https://drivenxdesign.com/LON16/project.asp?ID=15185, (accessed March 15, 2017)

14. Ibid.

15. Ibid.

16. "Milkshake Tree playground in London doubles as an oversized xylophone," Inhabitat, https://inhabitat.com/milkshake-tree-installation-in-london-doubles-as-an-oversized-xylophone/, (accessed May 16, 2018)

17. "133 Wai Yip Street," DRIVENxDESIGN, https://drivenxdesign.com/LON16/project.asp?ID=15185, (accessed March 15, 2017)

18. Ibid.

19. Ibid.

20. "100 Broadview Lobby / Quadrangle Architects & Interiors," https://www.archdaily.com/790771/100-broadview-lobby-quadrangle-architects, (accessed April 10, 2017)

21. Ibid.

22. Ibid.

23. Ibid.

24. Ibid.

25. Ibid.

26. "100 Broadview Lobby wins IAUD Award," AccessAbility Advantage, http://accessabilityadvantage.ca/100-broadview-lobby-wins-iaud-award/, (accessed April 12, 2017)

27. Ibid.

28. "100 Broadview Lobby / Quadrangle Architects & Interiors," https://www.archdaily.com/790771/100-broadview-lobby-quadrangle-architects, (accessed April 10, 2017)

## Programming

1. Metrolinx, *Mobility Hubs Development of a Regional Transportation Plan for the Greater Toronto and Hamilton Area for Consulations*, (Government of Ontairo, 2008), 5.

2. "Winnipeg a Downtown View," www.theforks.com/uploads/ck/files/Publications/FNP_DowntownView.pdf (accessed May 1, 2017)

3. Ibid.

4. Ibid.

5. Ibid.

6. "Union Station / Winnipeg Railway Station (Canadian National) National Historic Site of Canada," Parks Canada, http://historicplaces.ca/en/rep-reg/place-lieu.aspx?id=4484&pid=0, (accessed May 16, 2018)

7. Randy Turner, "City Beautiful How architecture shaped Winnipeg's DNA," https://www.winnipegfreepress.com/city-beautiful/City-Beautiful--Part-1-Great-Expectations-273837201.html, (accessed March 25, 2017)

8. "Beaux Arts Architecture on Capitol Hill," https://www.aoc.gov/capitol-hill/architecture-styles/beaux-arts-architecture-capitol-hill, (accessed May 18, 2018)

9. Randy Turner, "City Beautiful How architecture shaped Winnipeg's DNA," https://www.winnipegfreepress.com/city-beautiful/City-Beautiful--Part-1-Great-Expectations-273837201.html, (accessed March 25, 2017)

10. Ibid.

11. Ibid.

12. "Beaux Arts," *Fullerton Heritage*, http://fullertonheritage.org/Resources/archstyles/beaux.htm, (Accessed May 10, 2018)

13. "Beaux Arts," *Architectural Styles of America and Europe*, https://architecturestyles.org/beaux-arts/, (accessed April 25, 2017)

14. "Beaux Arts," *Fullerton Heritage*, http://fullertonheritage.org/Resources/archstyles/beaux.htm, (Accessed May 10, 2018)

15. Jackie Craven, "Discover the Beauty of Beaux Arts Exuberant and Classical Architecture Inspired by France," https://www.thoughtco.com/what-is-beaux-arts-architecture-178195, (accessed May 10, 2017)

16. Ibid.

17. Amy Jackson, "Beaux-Arts Architecture: Definition, Characteristics & Style," https://study.com/academy/lesson/beaux-arts-architecture-definition-characteristics-style.html, (accessed May 20, 2017)

18. Ibid.

19. "Vision and Corporate Mission," http://winnipeg.ca/cao/vision.stm, City of Winnipeg 1996-2018, (February 6, 2015)

20. "SUSTAINABLE MOBILITY REPORT 2017 WORKING TOGETHER TOWARDS A SUSTAINABLE FUTURE," Via Rail Canada, https://www.viarail.ca/sites/all/files/media/pdfs/SMR_Final_ENGLISH.pdf, (accessed May 21, 2017)

21. "Commuting to work," Statistics Canada, http://www12.statcan.gc.ca/nhs-enm/2011/as-sa/99-012-x/99-012-x2011003_1-eng.pdf, (accessed May 12, 2017)

22. Ibid.

23. "Direction to the Future The Guide to Better Transit for Winnipeg," City of Winnipeg, http://winnipegtransit.com/public_content/pdfs/transitReport.pdf, (accessed March 20, 2018)

## Conclusion

1. Meghana Veeramachaneni, "Wayfinding for the Blind in a Retail Setting," Master's thesis, Iowa State University, 2014, 21.

# references


”100 Broadview Lobby / Quadrangle Architects & Interiors.” https://www.archdaily.com/790771/100-broadview-lobby-quadrangle-architects. (accessed April 10, 2017)

“100 Broadview Lobby wins IAUD Award.” *AccessAbility Advantage*. http://accessabilityadvantage.ca/100-broadview-lobby-wins-iaud-award/. (accessed April 12, 2017)

“133 Wai Yip Street.” *DRIVENxDESIGN*. https://drivenxdesign.com/LON16/project.asp?ID=15185. (accessed March 15, 2017)

2015 City of Winnipeg. *Accessibility Design Standard.* 3rd ed. City of Winnipeg, 2015.

“About.” *CNIB*. http://www.clearingourpath.ca/0.1.0-about_e.php. (accessed March 20, 2017)

“About Us.” *CNIB*. http://www.cnib.ca/en/about/Pages/default.aspx. (accessed May 30, 2017)

“Accessible Design for the Built Environment,” *Standards Council of Canada*, 2017. CAN/CSA-B651-04 (R2010).

“Alice Wingwall,” http://www.alicewingwall.com/biography.html, (accessed April 20, 2017)

*B651-04 Accessible design for the built environment*. Mississauga, Ontario: Canadian Standards Association, 2004.

Bal, Mieke. *Narratology: Introduction to the Theory of Narrative.* (Toronto, University of Toronto Press, 1985),

“Beaux Arts.” *Architectural Styles of America and Europe*. https://architecturestyles.org/beaux-arts/. (accessed April 25, 2017)

“Beaux Arts.” *Fullerton Heritage*. http://fullertonheritage.org/Resources/archstyles/beaux.htm. (Accessed May 10, 2018)

“Beaux Arts Architecture on Capitol Hill.” https://www.aoc.gov/capitol-hill/architecture-styles/beaux-arts-architecture-capitol-hill. (accessed May 18, 2018)

Billings, Scott. “Pointers to the Future,” Scott Billings, January 27, 2011, , http://www.scottbillings.co.uk/pointers-to-the-future/.

"Braille." *CNIB*. http://www.clearingourpath.ca/1.4.2-braille_e.php. (accessed March 21, 2017)

Brooker, Graeme, and Sally Stone. 2007. *Basics Interior Architecture: Form + Structure*. New York: Watson-Guptill Publications.

Brooker, Graeme, and Sally Stone, eds. 2013. *From Organisation to Decoration: An Interior Reader*. New York, NY: Routledge.

Brooker, Graeme, and Sally Stone. "From Organisation to Decoration." In T*hinking Inside the Box: A Reader in Interiors for the 21st Century*, edited by gigli, hay, hollis, milligan, milton, plunkett, 125-132. London: Middlesex University Press, 2007.

Brooker, Graeme, and Sally Stone. 2004. *Rereadings: Interior Architecture and the Design Principles of Remodelling Exisitng Buildings*. London: RIBA Enterprises Ltd.

Brooker, Graeme, and Sally Stone. "Rereadings." In *From Organisation to Decoration: An Interior Reader* edited by Graeme Brooker and Sally Stone, 242-248. New York: Routledge, 2013.

"Clearing Our Path Creating accessible environments for people with vision loss." *CNIB*. http://www.clearingourpath.ca/8.0.0-design-needs_e.php. (accessed May 2, 2017)

"Code of Conduct." http://www.intercity-buses.com/?wp=code-of-conduct. (accessed March 12, 2017)

"Commuting to work." *Statistics Canada*. http://www12.statcan.gc.ca/nhs-enm/2011/as-sa/99-012-x/99-012-x2011003_1-eng.pdf. (accessed May 12, 2017)

Council of Ontario Universities, Module 1: Understanding the AODA and the Accessibility Standards for Customer Service. https://carleton.ca/equity/aoda-modules/accessible/module-1/21.html (accessed July 2, 2018).

Craven, Jackie. "Discover the Beauty of Beaux Arts Exuberant and Classical Architecture Inspired by France." https://www.thoughtco.com/what-is-beaux-arts-architecture-178195. (accessed May 10, 2017)

"Definition of Visual Impairment." *Plone Foundation*, http://www.seniorvision.org/resources/definition-of-visual-impairment. (accessed March 15, 2017)

Dicey, Alan. "Levels of Visual Function." http://nfbnet.org/pipermail/nfbf-l_nfbnet.org/2013-September/011048.html. (accessed May 10, 2017)

"Direction to the Future The Guide to Better Transit for Winnipeg." *City of Winnipeg*. http://winnipegtransit.com/public_content/pdfs/transitReport.pdf. (accessed March 20, 2018)

"Environmental Perception - Oxford Reference," *Social Class and Sport - Oxford Reference*, June 16, 2017, , accessed July 16,

2018, http://www.oxfordreference.com/view/10.1093/oi/authority.20110803095753657.

Fulton, Graeme. “Accessibility Basics: Designing for Visual Impairment” last modified December 3, 2017. https://webdesign.tutsplus.com/articles/accessibility-basics-designing-for-visual-impairment--cms-27634

“Guide Dogs.” *CNIB*. http://clearingourpath.ca/1.2.3-guide-dogs_e.php. (accessed March 21, 2017)

“Guide for Assessing Persons with Disabilities - How to determine and implement assessment accommodations - Vision disabilities.” https://www.canada.ca/en/public-service-commission/services/public-service-hiring-guides/guide-assessing-persons-disabilities/guide-assessing-persons-disabilities/guide-assessing-persons-disabilities-determine-implement-assessment-accommodations-vision-disabilities.html, Government of Canada. August 15, 2007.

Harlow, Harry. “The Nature of Love,” *American Psychologist*. Vol. 13, 1958.

“Hazelwood School for the Multiple Sensory Impaired.” *Urbnarama: Atlas of Architecture*. http://fr.urbarama.com/project/hazelwood- school-for-the-multiple-sensory-impaired-1489. (accessed April 3, 2015)

“Hazelwood School, Glasgow, UK-Scotland.” *Designing for Education: Compendium of Exemplary Educational Facilities*. OECD Centre for Effective Learning Environments, 2011. http://edfacilitiesinvestment-db.org/facilities/42. (accessed April 3, 2015)

Heylighen, Ann, Caroline Van Doren, and Peter-Willem Vermeersch. “Enriching Our Understanding of Architecture Through Disability Experience.” *Open House International* 38, no. 1, 7-19. Accessed February 8, 2015. http://www.openhouse-int.com.

Henry, Christopher N.“Tactile Architecture: Does It Matter?” *Arch Daily,* November 23, 2011, , accessed July 5, 2018, https://www.archdaily.com/186499/tactile-architecture-does-it-matter.

“Information and Communications Systems.” *CNIB*. http://clearingourpath.ca/3.8.0-ict_e.php. (accessed March 21, 2017)

Jackson, Amy. “Beaux-Arts Architecture: Definition, Characteristics & Style.” https://study.com/academy/lesson/beaux-arts-architecture-definition-characteristics-style.html. (accessed May 20, 2017)

Koop, Doris. Executive Director of the Vision Impaired Resource Network) in discussion with author, February 20, 2018.

Krantz, Georgina. “How Do You See a Museum with Your Eyes Closed?” *Guggenheim*, March 29, 2017. (accessed July 05, 2018) https://www.guggenheim.org/blogs/checklist/how-do-you-see-a-museum-with-your-eyes-closed.

"Low Vision and Legal Blindness Terms and Descriptions." *American Foundation for the Blind*. http://www.visionaware.org/info/your-eye-condition/eye-health/low-vision/low-vision-terms-and-descriptions/1235. (accessed March 20, 2017)

Lynch, Kevin. *The Image of the City*. Cambridge: MIT Press, 1960., 276.

Mace, Ron. "About UD". *The centre for Universal Design Environments and Products of All People*. https://projects.ncsu.edu/design/cud/about_ud/about_ud.htm (accessed April 17, 2017)

"Metrolinx". *Mobility Hubs Development of a Regional Transportation Plan for the Greater Toronto and Hamilton Area for Consulations*. Governement of Ontario, 2008.

"Milkshake Tree playground in London doubles as an oversized xylophone." *Inhabitat*, https://inhabitat.com/milkshake-tree-installation-in-london-doubles-as-an-oversized-xylophone/.(accessed May 16, 2018)

"Mobility." *CNIB*. http://clearingourpath.ca/1.2.0-mobility_e.php. (accessed March 21, 2017)

Newman, Ruth. "Getting Tactile with Design", April 16, 2015. http://sourceable.net/getting-tactile-withdesign.

Pallasmaa, Juhani. T*he eyes of the skin: architecture and the senses*. (Chichester: Wiley-Academy, 2005).

Onega, Susana and Jose Angel Garcia Landa. *Narratology: An Introduction*. (London: Longman Critical Readers, 1996).

Pallasmaa, Juhani. "An Architecture of the Seven Senses", in *Toward a New Interior: An Anthology of Interior Design Theory,* ed. Lois Weinthal (New York: Princeton Architectural Press, 2011).

Perron, Paul. *Narratology and Text Subjectivity and Identity in New France and Quevecois Literature*. (Toronto: University of Toronto Press, 2003).

Renshaw, Sarah. "Designing the Sensorium." *Senses & Society 4*, no. 2 (2009): 247-51. Accessed February 8, 2015. EBSCOhost.

"Residual sight." *CNIB*. http://clearingourpath.ca/1.2.1-residual-sight_e.php. (accessed March 21, 2017)

Rodger, Johnny. "It Had to Be a Secure But Not Too Safe -- So the Pupils Could Be Independent." Architects' Journal, 226.11 (2007): 25. *EBSCOhost*. http://web.b.ebscohost.com.proxy2.lib.umanitoba.ca/ehost/detail/ detail?vid=1&sid=8ca87661-3b9d-4532-80d4-d682fd672d20@sessionmgr110&hi d=106&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ==#db=aft&AN=505233774. (accessed April 7, 2015)

Schmid, Wolf. "Narrativity and Eventfulness." in *What is Narratology? Questions and Answers Refarding the Status of a Theory*, edited by Tom Kindt and Hans-Harald Muller, (Berlin: Walter de Gruyter, 2003), 18.

Stienfeld, Edward, and Jordana Maisel. *Universal design : creating inclusive environments*. Hoboken, N.J. : John Wiley & Sons, 2012.

Spencer, Christopher and Gee, Kate. *Encyclopedia of Human Behaviour*, 2nd ed., s.v. “Environmental Cognition.”

“SUSTAINABLE MOBILITY REPORT 2017 WORKING TOGETHER TOWARDS A SUSTAINABLE FUTURE.” *Via Rail Canada*. https://www.viarail.ca/sites/all/files/media/pdfs/SMR_Final_ENGLISH.pdf. (accessed May 21, 2017)

“The Center for Universal Design (1997). *The Principles of Universal Design*, Version 2.0. Raleigh, NC: North Carolina State University.” Copyright © 1997 NC State University , The Center for Universal Design

Transportation Canada, *Intercity Bus Code of Practice* (Public Works and Government Services Canada, 2011) http://www.tc.gc.ca/eng/policy/acc-accf-accessintercitybuscode-711.htm.

Turner, Randy. “City Beautiful How architecture shaped Winnipeg’s DNA.” https://www.winnipegfreepress.com/city-beautiful/City-Beautiful---Part-1-Great-Expectations-273837201.html. (accessed March 25, 2017)

Teyssot, Georges. “Mapping the Threshold: A Theory of Design and Interface”, *Architectural Association School of Architecture*, (2008).

“The Long ‘White Cane’.” *CNIB*. http://clearingourpath.ca/1.2.2-the-long-white-cane_e.php. (accessed March 21, 2017)

“Union Station / Winnipeg Railway Station (Canadian National) National Historic Site of Canada.” *Parks Canada*. http://historicplaces.ca/en/rep-reg/place-lieu.aspx?id=4484&pid=0. (accessed May 16, 2018)

Vander Voort, Mark “Sensory Perception Through Architecture”, *HKS*, May 30, 2013. (accessed April 13, 2017) http://stories.hksinc.com/?s=sensory+perception+through+architecture

Veeramachaneni, Meghana. “Wayfinding for the Blind in a Retail Setting,” Master’s Thesis, Iowa State University, 2014.

“Viewpoints.” The Scottish Government. The Crown Copyright. http://www.gov.scot/Topics/Education/Schools/Buildings/CaseStudies/ Glasgow/hazelwoodschool/viewpoints. (accessed April 3, 2015)

“Vision and Corporate Mission.” http://winnipeg.ca/cao/vision.stm. City of Winnipeg 1996-2018. (February 6, 2015)

“Vision Field.” *Vision and Eye Health*. http://www.vision-and-eye-health.com/visual-field.html.(accessed March 20, 2017)

“Vision Loss Basics Understanding the Needs of People with Vision Loss.” *CNIB*. http://www.clearingourpath.ca/1.0.0-vision-loss-basics_e.php. (accessed June 2, 2017)

Wastiels, L., Schifferstein, H.N.J., Woutes, I., & Heylighen, A. (2013). “Touching materials visually: About the dominance of vision in building material assessment”. *International Journal of Design*. 7(2).

Willings, Carmen. Mobility Skills, Teaching Students. https://www.teachingvisuallyimpaired.com/mobility-skills.html (accessed May 16, 2018)

“Winnipeg a Downtown View,” www.theforks.com/uploads/ck/files/Publications/FNP_DowntownView.pdf (accessed May 1, 2017)

“What is Low Vision?.” *Canadian Ophthalmological Society*. http://www.cnib.ca/en/your-eyes/eye-conditions/low-vision/Pages/default.aspx. CNIB. (accessed May 16, 2018)

“Who Is VIRN?.” *Vision Impaired Resource Network*. http://virn.ca/multimedia/who-virn. (accessed March 15, 2017)