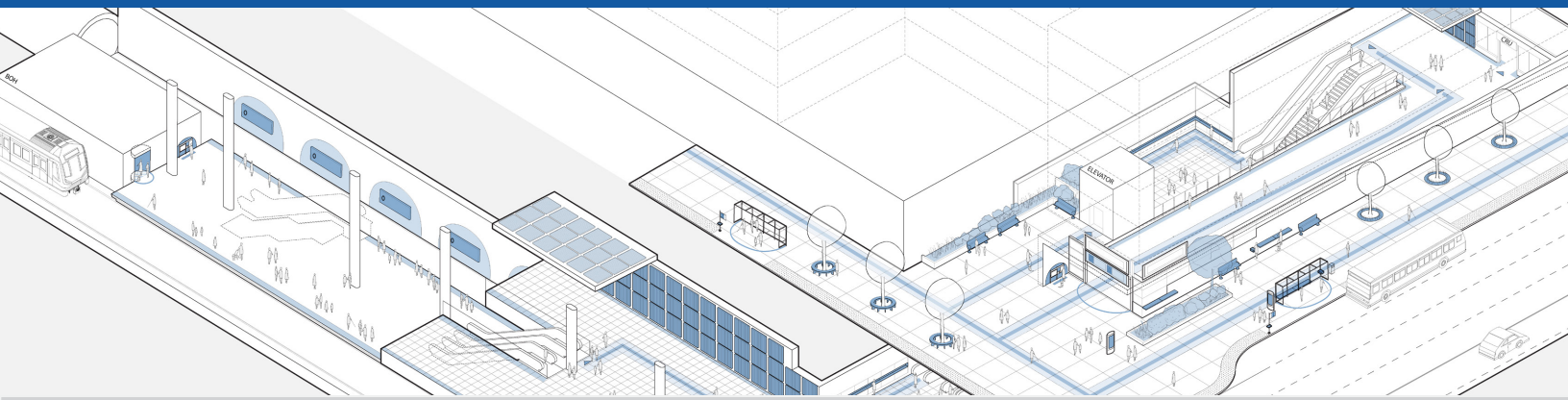
IMPROVING ACCESSIBILITY:

DESIGN STRATEGIES AND TOOLKIT FOR RAPID TRANSIT STATIONS AND PLAZAS IN VANCOUVER



Prepared by
Lea Papillon, UBC Sustainability Scholar, 2024;

Prepared for
Ruotian Tan, Planner I, Engineering Services, City of Vancouver;
Howie Jiang, Planner II, Engineering Services, City of Vancouver;

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DISCLAIMER

This report was produced as part of the UBC Sustainability Scholars Program, a partnership between the University of British Columbia and various local governments and organizations in support of providing graduate students with opportunities to do applied research on projects that advance sustainability and climate action across the region.

This project was conducted under the mentorship of the City of Vancouver staff. The opinions and recommendations in this report and any errors are those of the author and do not necessarily reflect the views of the City of Vancouver or the University of British Columbia.

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I extend my gratitude to the individuals listed below for their contributions, feedback, and support throughout the course of this project:

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Howie Jiang, Planner II, Engineering Services, City of Vancouver;

Steve Brown, Director, Projects in Engineering Services, City of Vancouver
Karen Lai, Accessibility Planner, City of Vancouver

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EXECUTIVE SUMMARY

IMPROVING ACCESSIBILITY AT TRANSIT STATIONS IN VANCOUVER

This project proposes a design toolkit aimed at enhancing accessibility at transit stations in Vancouver. It consists of 14 targeted interventions, which are further illustrated in a conceptual scenario of a typical transit station to demonstrate their practical application and benefits.

CONTEXT

A literature review of background documents revealed that existing policies, plans, and guidelines predominantly address the needs of mobility device users, often neglecting a more comprehensive approach to accessibility that includes a wider variety of impairments. This study identifies a critical gap in the complete inclusion and accommodation for visual, hearing, and cognitive impairments.

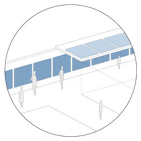
SITE INVENTORY

An analysis of five transit stations was conducted using a revised model of the typical Pedestrian Hierarchy of Needs. This evaluation assessed the spaces' modalities of comfort, convenience, and safety from the perspectives of three different impairments: visual, hearing, and cognitive. The findings highlighted several overarching shortcomings shared across multiple stations:

Lens	Main issues detected along the circulation of existing sites
Visual Impairments	Competing and insufficient wayfinding Limited space
Cognitive Impairments	Over-stimulating environment
Hearing Impairments	Noisy environment Limited wayfinding

RECOMMENDATIONS

Based on case studies and general research, the following 14 interventions are proposed in the design toolkit to address the major problem areas identified: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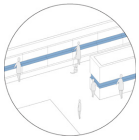
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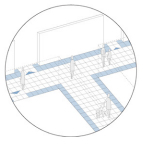
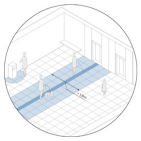

3. Corridor tiling

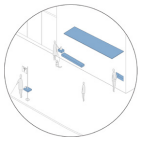

4. Floor signage


5. Temporary escapes

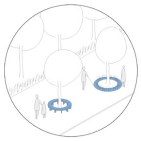

6. Color scheme

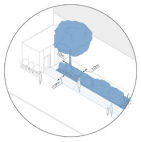

7. Demarcation strips


8. Obstacle clearance

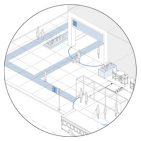

9. Pedestals


10. Signage paneling


11. Street tree design


12. Sensory planting


13. Non-visual open areas


14. Multimodal wayfinding

PROJECT CONTEXT

INTRODUCTION

CONTEXT, VISION, AND OBJECTIVES

CONTEXT

In alignment with the goals outlined in the City's Climate Emergency Action Plan (CEAP), which declares Vancouver's commitment to being a recognized leader in green transportation, the City's Transportation 2040 introduces a strategic framework to promote optimal transportation choices and help shape a more sustainable city. It highlights a vision that considers excellent transit as essential to the city's success. By **2040**, the aim is for **33% of trips** to be made using public transit. As one of the costliest infrastructure investments, rapid transit use has been steadily increasing.

Great transit is meant to be usable by everyone, including people with mobility, visual, hearing, and cognitive impairments. Enhancing accessibility to transit stations and plazas is crucial to inviting more people to use public transit and to ensure better safety and overall satisfaction. While attempts have been made in creating a transit system that caters to diverse needs, the imperative for enhanced accessibility at transit stations and plazas has been emphasized through feedback from a variety of sources, including the general public (heard through feedback from public engagement) as well as the Persons with Disabilities Advisory group.

VISION

The project aims to develop a **comprehensive toolkit of design interventions and strategies** for rapid transit stations in Vancouver, encompassing upgrades to existing stations and new constructions. This initiative seeks to raise attention towards designing for **commonly-overlooked impairments** while **enhancing the overall public experience** within these spaces.

OBJECTIVES

The research aims to assess the potential challenges faced by individuals accessing rapid transit stations in Vancouver. It involves:

- **reviewing existing accessible design guidelines** for rapid transit stations;
- engaging stakeholders to **gather lived feedback** from users;
- thereby **identifying key deficiencies** in current station designs.
- based on these findings, I will **propose actionable recommendations** through **case studies and site inventory analysis**
- they will be expressed via accessible design typologies tailored for transit station environments at various scales, **consolidated into a diagrammatic toolkit**
- this toolkit will be further **illustrated into a conceptualized design scenario** of a transit station, demonstrating the proposed interventions at play.

BACKGROUND REVIEW

SUBJECTIVE REVIEW OF EXISTING GUIDELINES, CODES, AND PLANS RELATED TO TRANSIT ACCESSIBILITY IN VANCOUVER

A review of **relevant background documents** can help identify the **strengths and shortcomings** in regards to accessible design, with a particular focus on the inclusion of various disabilities, such as **visual, hearing, and cognitive impairments**. By highlighting gaps and areas for improvement, this review seeks to inform future planning and policy-making to create more inclusive and accessible public spaces.

CITY'S RAPID TRANSIT PROJECTS - VANCOUVER PLAN 2050:

The Vancouver Plan 2050 is a high-level document that minimally addresses accessibility. It discusses rapid transit areas, public spaces, and mixed-use neighborhoods, including policies on Transit Integration and Public Realm. The transportation section emphasizes **connections to jobs and daily needs** as alternatives to driving. The Vancouver Plan 2050 states that accessibility improvements will play a crucial role in the City's upcoming rapid transit projects. (City of Vancouver, 2020)

BROADWAY PLAN:

This comprehensive, neighborhood-community-based area plan **lacks specific consultations with target groups**, particularly individuals with disabilities. The guiding principles address transportation, streets, and public spaces but do not directly reference accessibility. Indeed, the plan's general approach does not provide tailored strategies for accessibility. (City of Vancouver, 2022)

BC PROVINCE DOCUMENTS - BUILDING ACCESSIBILITY HANDBOOK 2020:

This handbook includes guidelines on accessible paths of travel through common areas, a focus on escalators and moving walks, and the requirement for appropriate signage for transitions between escalators and paths of travel. It also emphasizes the necessity of signage for washrooms and drinking stations and detailed considerations for non-slip materials and lighting conditions for accessible paths of travel. However, the document predominantly addresses the **needs of manual wheelchair users**, with **limited consideration for other disabilities** such as visual and hearing impairments. There is also a notable **lack of comprehensive wayfinding** and broader building strategies for these other disabilities. (Infrastructure BC, 2020)

ACCESSIBLE BC - B.C.'S ACCESSIBILITY PLAN:

This plan prioritizes integrated and active transportation systems based on universal design principles, as highlighted in Clean BC's Active Transportation Strategy, which promotes safe, accessible, and convenient networks mainly for **cycling**. However, there is a limited focus on comprehensive accessibility for all types of disabilities in public transit systems, suggesting a gap in fully addressing the **diverse needs of all users**. (Accessibility Standards Canada)

TRANSLINK - BUILDING CODE CRITERIA & ACCESSIBILITY PLAN 2023:

The TransLink Building Code Criteria document includes a section on **barrier-free design**, covering tactile warning zones, truncated domes, pattern differentiation, and color contrast. However, barrier-free egress often relies on elevators, which can become commonly out of service, and there are no mandates for accessible floor levels at aboveground stations, indicating a reliance on non-mandated features. The Accessibility Plan 2023 outlines 32 actions to remove barriers to accessibility across various durations, with key sections on investigating walking infrastructure to transit and general approaches that may appear as broad maintenance and upkeep strategies. These actions, while comprehensive, remain broad and could be **perceived as general maintenance rather than specific**, actionable improvements. (Translink, 2023)

TRANSLINK - TRANSIT PASSENGER FACILITY DESIGN GUIDELINE:

The TransLink Transit Passenger Facility (TPF) Design

Guidelines provide specific guidance on designing transit passenger facilities and their immediate context, with an important emphasis on accessibility. These guidelines make strong recommendations for enhancing bus access and comfort, showing promise for **improving the design of inter-modal connections**. Lighting is given significant importance in these guidelines, and although it supports accessible visibility for visually impaired users, there is an opportunity to **strengthen this with more explicit language**. Furthermore, a strong focus is placed on safety, particularly through slip resistance studies, which is essential for ensuring the overall safety and comfort of transit users. The document is thorough and represents a strong asset for successful transit station design. Nonetheless, the materials within the document remain design guidelines, thus allowing for **potential gaps to emerge during implementation**. Beyond new transit station design, the principles risk being overlooked within the architecture of existing transit stations, which should ultimately be held to a same standard as any new construction. (Translink, 2023)

BC BUILDING CODE 2024:

The 2024 BC Building Code is a thoroughly detailed document that addresses accessibility, especially for mobility device users, by **detailing dimensions and specific requirements within design**. These thoroughly specified dimensions present direct rules that designers can follow, where its certitude presents an incredibly valuable asset to navigating accessible design.

The document is mainly beyond the scope of the project. Nonetheless, it represents a **framework for the fundamental** requirements for accessible design in the built environment and **lacks innovative considerations** for specific impaired groups. For instance, accessible paths of travel (Section 3.8.3.2) mandate specific modalities convenient for wheelchair users by implementing specific dimensions, notedly with a width no less than 1000mm and 1700mm if it is more than 24m long. However, its approach to modalities convenient for visually impaired users is considerably less restrained, simply mandating for the path of travel to be equipped to provide illumination. (BC Office of Housing, 2023)

There is limited demonstration of **intersectional applications of design** for different impairments. In general, the code lacks strategies and specifications that address a **broader range of impairments**, demonstrating a gap between existing guidelines and the real needs of diverse user groups.

GAPS AND OPPORTUNITIES

The review of these background documents reveals recurring themes and gaps that can help guide the project scope:

1. INSUFFICIENT CONSIDERATION FOR OTHER DISABILITIES

Most plans and guidelines emphasize physical accessibility for wheelchair users, with insufficient consideration for other disabilities, such as the large range of different visual, cognitive, or hearing impairments. There is a clear need for a broader focus on universal design principles to cater to a wider range of disabilities.

2. LACK OF SPECIFIC STRATEGIES

In the reviewed documents above, there is a lack of specific strategies and mandates, leading to a **reliance on courtesy-based implementations**. Critical aspects such as intermodal transitions and wayfinding enhancements are **not comprehensively addressed**, creating potential barriers for users with disabilities.

3. EXPANSION OF SCOPE

There are **significant opportunities** to expand the scope of accessible paths of travel **beyond vertical displacements**, enhancing **wayfinding and design infrastructure**, and to implement actionable renovations and **design-focused strategies.** They may enhance wayfinding, reduce pathway obstructions, and improve overall accessibility in transit stations.

PROBLEM STATEMENT

Despite existing policies and guidelines aimed at improving transit accessibility, Vancouver's rapid transit systems face multiple potential gaps. Current measures mainly address ***physical accessibility*** *for mobility device users, neglecting a broader range of disabilities.*

This project aims to document these challenges and work towards recommendations that can enhance the accessibility of transit stations and surrounding areas through a broader lens and application of accessibility, seeking a more inclusive transit environment for more users.

It will analyze accessibility issues within the broader framework of ***multi-scaled circulation,*** *along* ***micro and macro*** *scales, across existing transit stations.*

It will seek to identify the challenges or areas of improvement for users experiencing disabilities ***beyond mobility issues,*** *that can be more commonly overlooked in the field of design. More specifically, it will address accessibility through the* ***lens of visual, hearing, and cognitive impairments****.*

SITE ANALYSIS

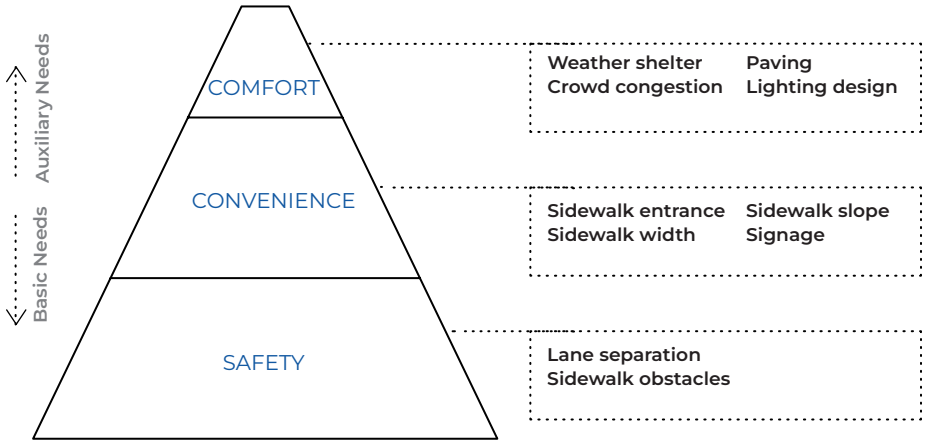
SITE ANALYSIS PARAMETERS:

THE PEDESTRIAN HIERARCHICAL NEEDS

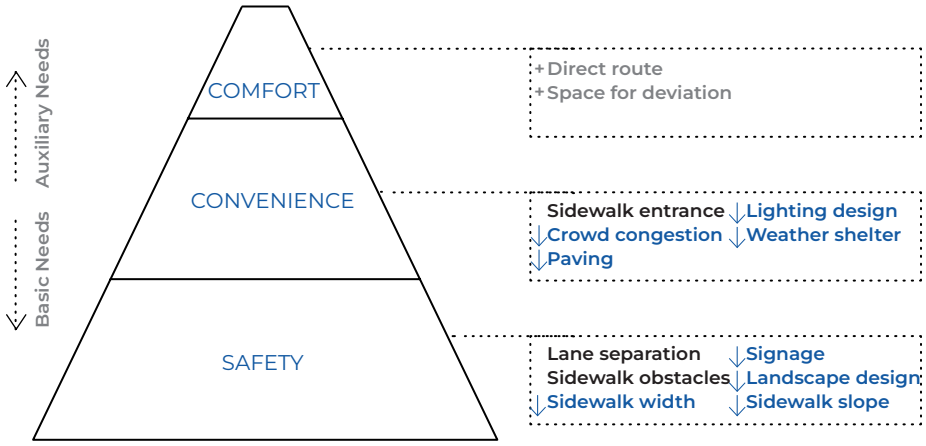
REVISION OF EXISTING FRAMEWORKS FOR PEDESTRIAN DESIGN, ADAPTING THE CATEGORIZATION OF DESIGN ELEMENTS INTO A REVISED RANKING OF PRIORITIES

Based on the **potential gaps** identified in the review of background documents, the analysis of existing transit stations in Vancouver seeks to **validate their existence in current infrastructure**.
To do so, I refer to the **typical model for Pedestrian Hierarchical Needs**. This model is popularly referenced in the design of public pedestrian spaces, and presents a high-level framework that can help establish the strengths and shortcomings of public spaces. (Larter, 2022) However, the model's generality and attempt to serve a grand public risks **excluding important accommodations** for users with specific impairments.

I thus guide my site inventory analysis through the framework of the Pedestrian Hierarchical Needs, as it **presents similar gaps regarding accessibility to those identified** in the background document review. I create my own **revised** version that incorporates considerations for users with disabilities beyond mobility issues. The assessment will be grounded into **three modalities: comfort, convenience, and safety**. Within the scope of this study, these modalities will focus on elements that **impact the experience for users with visual, hearing, or cognitive disabilities**.
They will help establish the consequent list of questions applied to site visits.



Generic Model: Pedestrian hierarchical needs, focusing on generalized, able-bodied priorities.



Revised Model: Pedestrian hierarchical needs, edited to integrate broader, non-able bodied needs, taking into specific consideration visual, hearing, and cognitive impairments.

The design components shift towards the lower, more essential classifications of the pyramid. New principles are also added to the lists of needs.

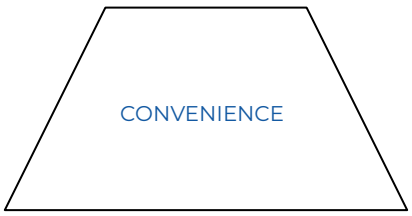
SITE ANALYSIS METHODOLOGY: QUESTIONS TO ASK

INFORMAL METHODOLOGY TO EVALUATE EXISTING SITES VIA FRAMEWORK OF THE REVISED PEDESTRIAN HIERARCHICAL MODEL, THROUGH LENS OF VISUAL, HEARING, AND COGNITIVE IMPAIRMENTS

Crowd congestion
- Are there areas of congested circulation, where sound or sight can be hindered?

Room to deviate
- Is there room for error (ie any tight spaces) along passages?
- Are doorways large enough to avoid bottlenecks?

Direct Route
- Is the main route of circulation relatively straightforward (straight as possible pathways, with clear sharp corners?) Could it be simplified to be more navigable?
- Is the elevator well integrated into the direct route?



Paving
- Does the ground plan material choice support minimal glare? Are there any reflective surfaces?
- Are there textures or ornamental patterns on the floor that could be mistaken for wayfinding?
- Are there darker tiles to indicate the way down the walkway?
- Guide dogs do not typically react to color or texture contrasts, but react to obstacles like curbs and barriers - would they have these physical boundaries to react to?

Materialities
- Is there distinction (ie different shades) between the surfaces, the levels, and the features?
- Are there any glass barriers, and if so is there sufficient visual indicator of the barrier?

Lighting Design
- Is the indoor lighting sufficiently intense and homogeneous? Does it create any shadows?
- Is there floor lighting creating glare?
- Is there floor lighting outdoors ensuring obstacles can be visible in the evening?

Weather Shelter
- Is the waiting area at the bus stop sheltered from the weather, with sufficient seating?

Sidewalk Entrance
- Does it have visual contrast and suitable lighting, or a guidance path if necessary to cross a large area to get there?

Sidewalk Passage & Width
- Can two bodies walk side-by-side, uninterrupted? Can assisted guidance, a guide dog, or a signing conversation be hindered by passage width?

Sound Design
- Do the inside spaces minimize echoes? Is there any sound distortion within stations?
- Is there potential for an extreme sensory background?

Landscape Design
- Does the landscape architecture hinder to the passage, like with trees roots against the sidewalk, hanging limbs, or tree trunks? Are trees along a walkway well marked through contrast or texture?
- Is the sidewalk uneven or unsafe due to landscape interference?
- Do trees create large or patterning shadows along the direct routes of access?

Slope and Stairs
- Are there any steps that could rather be sloped, flush, or ramped?

Signage
- Is there signage in large characters, with high-contrasting colors?
- Is signage also marked by symbols, not depending uniquely on color?
- Is large-lettered signage duplicated in pathways and interchanges with appropriate lighting?

Obstacles on Sidewalk
- Are there any physical obstacles on the sidewalks, permanent or impermanent?
- Are roadways and hazards given significant contrast?
- Are there low-lying obstacles, like signage?

Separator between Sidewalk and Non-Motorized Lane
- Is the streetscape arranged to prioritize shared spaces, or is there distinct separation between motorists, pedestrians, and cyclists?
- Would a guide dog or cane user be potentially startled within the shared spaces (ie not dependant on eye contact with a cyclist to proceed first)?

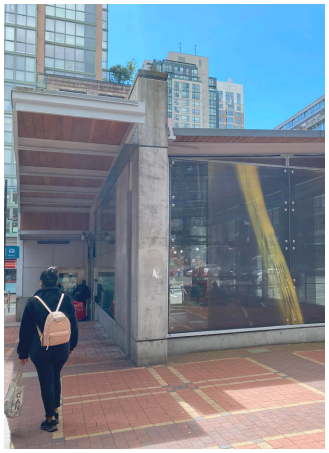
CONTENTS FOR SITE ANALYSIS

Five transit stations in Vancouver are assessed using the previously established site analysis criteria, grouped into responses addressing the modalities of comfort, convenience, and safety through the lens of visual, cognitive, and hearing impairments.

The ratings are based on the author's personal judgement of the accessibility of the transit station design.

Vancouver City Centre Station

Burrard Station



Yaletown-Roundhouse Station

King Edward Station

Langara - 49th Avenue Station

BURRARD STATION

Peak boardings and alightings: 8AM - 9AM

Rating: 2 / 5

Boardings: 5570

Alightings: 820

COMFORT

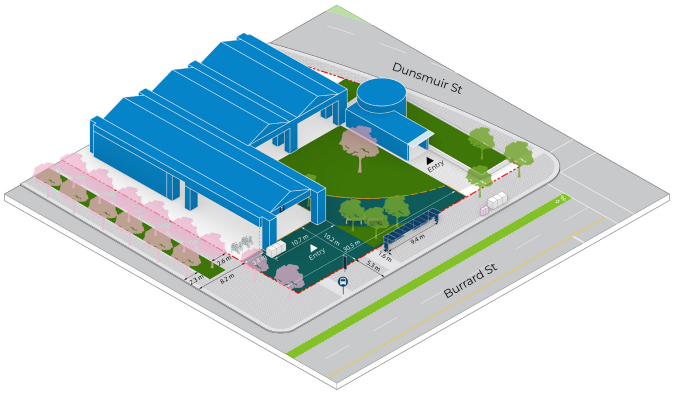
- High congestion at elevator doors in a confined hallway, marked by small, glare-prone signage in circulation that exacerbates this issue.
- Tight spaces and insufficient room for deviation in passages create navigation difficulties and little room for error.

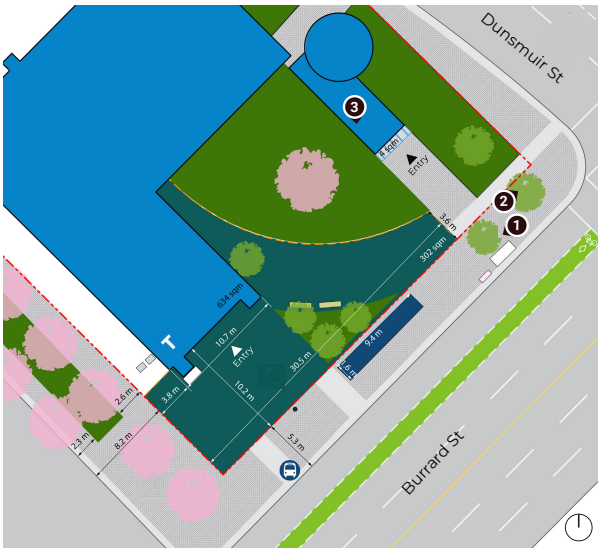
CONVENIENCE

- Multiple physical boundaries on the streetscape pose risk of collision.
- Clear glass barriers at the entrance with occasional posts and mullions can be potentially disorienting to certain visual impairments.
- Indoor lighting is uneven, creating shadows that can confuse visually impaired users. Outdoor shadows from street trees further complicate navigation.
- The bus station shelter is insufficient for the number of passengers, leading to overcrowding. This can be particularly challenging for people with mobility impairments or cognitive disabilities who may need a predictable environment.
- Walking with a partner or guide dog is difficult due to mixed, two-way circulation and tight spaces.

SAFETY AND PASSAGE

- Street tree roots create uneven sidewalks and tripping hazards, with poor visual and tactile markers.
- Indoor signage is prone to glare.
- Obstacles and narrow sidewalks increase the likelihood of conflicts with cyclists and other mobility devices.
- Dependence on visual cues for pedestrian-car interactions along the adjoining road poses challenges for visually impaired users.





Rapid Transit Station
Transit Plaza
Pedestrian Through Zone
Station Canopy
Bike Lane / Bike Crosswalk
Planted Area
Bus Stop
Station Signage
Bike Racks (6x)
Benches (2x)
News Kiosks
Waste Management Bins

Figure 1. Streetscape obstructions


Figure 2. Hazardous street tree


Figure3.Clearglassbarrier

Figure 4. Corridor towards elevator


Figure 5. Intersection of pathways

Figure 6. Direction to train platform

VANCOUVER CITY CENTRE STATION

Peak boardings and alightings: 5PM - 6PM

Rating: 3 / 5

Boardings: 2580

Alightings: 1550

COMFORT

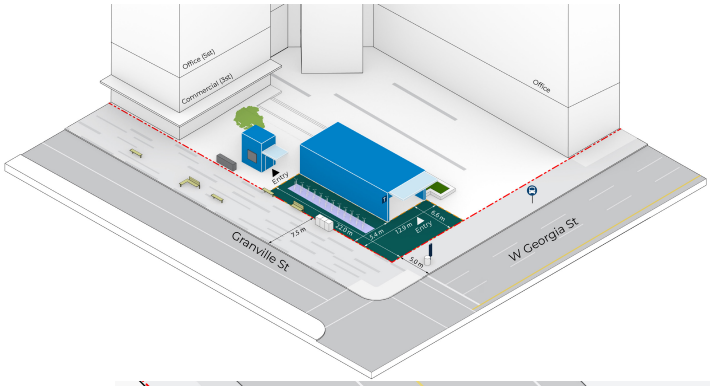
- Wide spaces and clear platform management enhance comfort, especially for users with mobility aids.
- Some entrances require detours to avoid stairs, which could be a ramp instead.

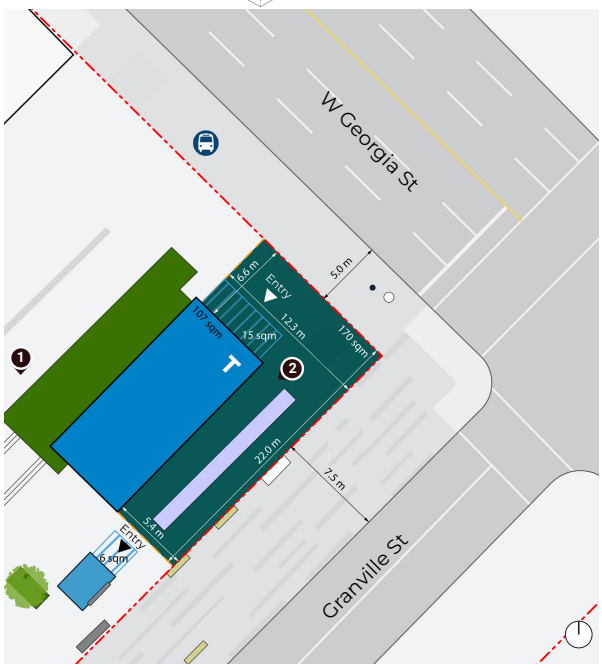
CONVENIENCE

- Strong material choices reduce slipperiness and glare, improving safety for visually impaired and mobility-impaired users.
- Confounding sound design with echoes and background noise from multiple sources within the urban station and its adjoining mall creates a challenging environment for users with hearing impairments and cognitive disabilities.
- While there are darker, tactile pavers to indicate accessible routes to the elevator, there is equally the integration of a darker paver as ornament. Ornamental floor patterns can confuse visually impaired users as they lead directly into columns and obstacles, representing a significant design flaw.

SAFETY AND PASSAGE

- Bikes blocking direct routes to elevators force users to realign and adjust their paths, which is challenging for visually impaired and mobility-impaired users.
- Stairs that could be replaced with ramps create unnecessary detours.





- Rapid Transit Station
- Transit Plaza
- Pedestrian Through Zone
- Station Canopy
- Planted Area
- Bus Stop
- Station Signage
- Benches (4x)
- FCP
- Waste Management Bins
- Mobi Bikeshare Station

Figure 1. Short, wide, unavoidable stair

Figure 2. Bike station along route to elevator

Figure 3. Noise-prone corridor

Figure 4. Wide, unused circulation

Figure 5. Intersecting ornamental and tactile paving

Figure 6. Darker paving directing towards obstacles

YALETOWN-ROUNDHOUSE STATION

Peak boardings and alightings: 5PM - 6PM

Rating: 4 / 5

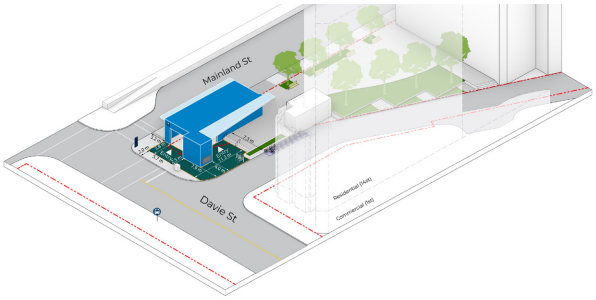
Boardings: 1140

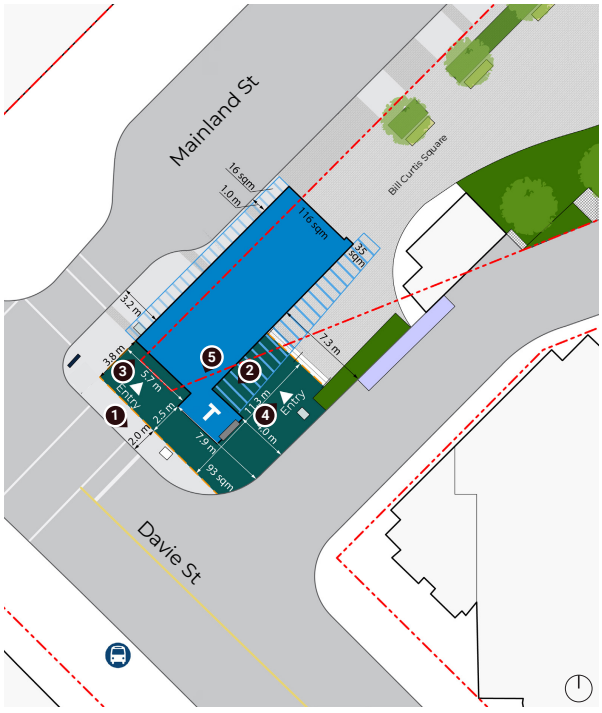
Alightings: 1160

COMFORT
- Certain narrow passages along the streetscape require alternate routes into the station.

CONVENIENCE
- Similar colors and materials on different planes create visual confusion, posing potential challenges for visually impaired users.

SAFETY AND PASSAGE
- Corners and intermittent walls form obstacles within the street-level station, creating hazards for visually impaired and mobility-impaired users.
- Stairs at the entrance pose another potential barrier.





- Rapid Transit Station
- Transit Plaza
- Pedestrian Through Zone
- Station Canopy
- Planted Area
- Bus Stop
- Station Signage
- Bike Racks (6x)
- Benches (4x)
- FCP
- Waste Management Bins
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Figure 1. Significant sloped grading


Figure 2. Navigation towards elevator

Figure 3. Potential confusion in visual depths

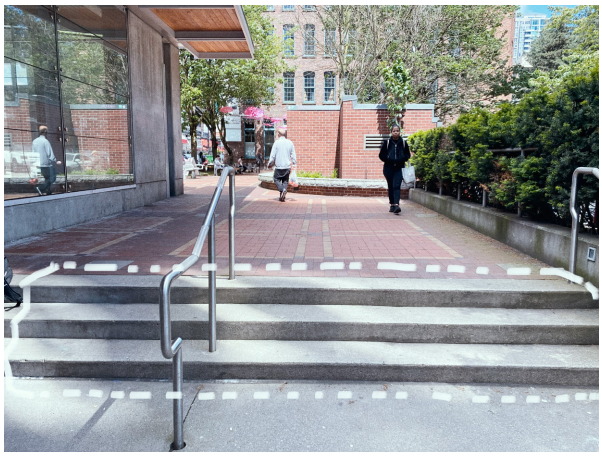


Figure 4. Short and wide stair


Figure 5. Walls as obstructions

Figure 6. Different colour palettes on multiple planes

KING EDWARD STATION

Peak boardings and alightings: 5PM - 6PM

Rating: 4 / 5

Boardings: 430

Alightings: 810

COMFORT

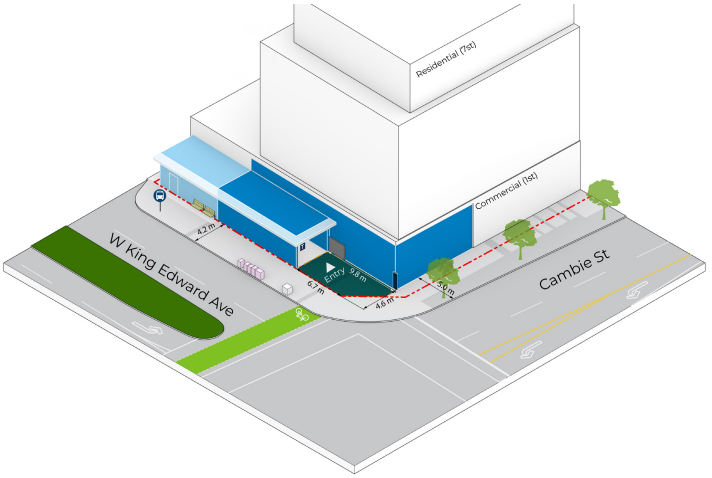
- The route of circulation involves a significant U-turn, creating potential collision points as pedestrians rush between buses and the station. This is challenging for visually impaired and cognitively impaired users who rely on straightforward pathways.

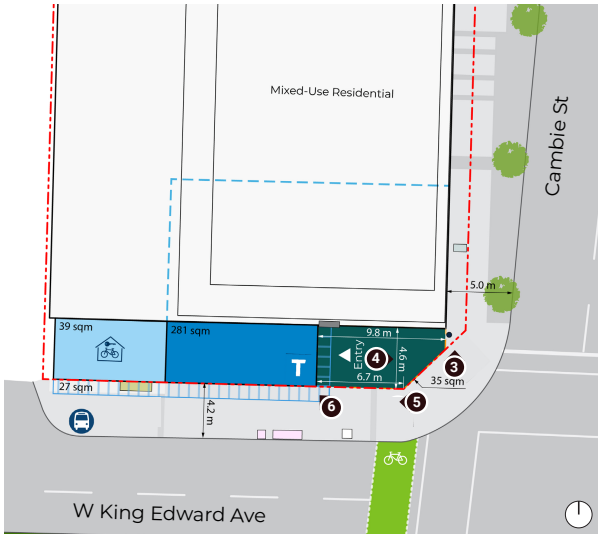
CONVENIENCE

- Insufficient protection and seating at the shelter lead to congestion in bad weather, posing difficulties for mobility-impaired and cognitively impaired users.
- Generally convenient materials are used, which is beneficial for all users, including those with impairments.

SAFETY AND PASSAGE

- Highly reflective signage is often illegible from multiple angles, posing challenges for visually impaired users.
- The transit system relies on color codes without symbols, making it difficult for color-blind users to navigate.
- Consistent signage across stations is needed, particularly at train arrival areas, to assist users with cognitive impairments in navigating the system.





Rapid Transit Station
Bike Parkade
Transit Plaza
Pedestrian Through Zone
Station Canopy
Bike Lane / Bike Crosswalk
Planted Area
Bus Stop
Station Signage
Bike Racks (3x)
Benches (2x)
FCP
News Kiosks
Waste Management Bins

Figure 1. Elevator wayfinding

Figure 2. Elevator wayfinding

Figure 3. Visual signage within streetscape

Figure 4. Visual wayfinding art

Figure 5. Direct route with U-turn, two-way circulation

Figure 6. Barrier before sightline clearance

LANGARA - 49TH AVENUE STATION

Peak boardings and alightings: 4PM - 5PM

Rating: 4 / 5

Boardings: 590

Alightings: 770

COMFORT

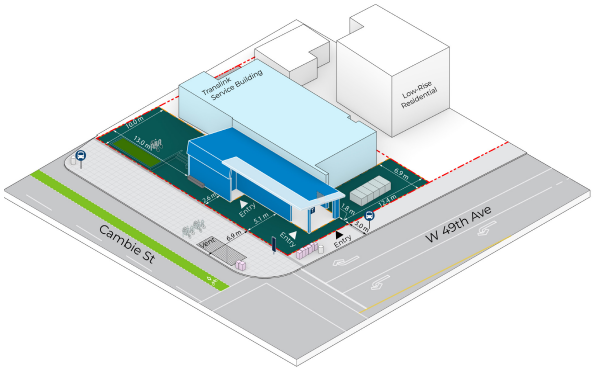
- The absence of guiding mechanisms in the grand open space make it difficult for guide dogs and visually impaired users to navigate. Small landmarks or thresholds could improve wayfinding.

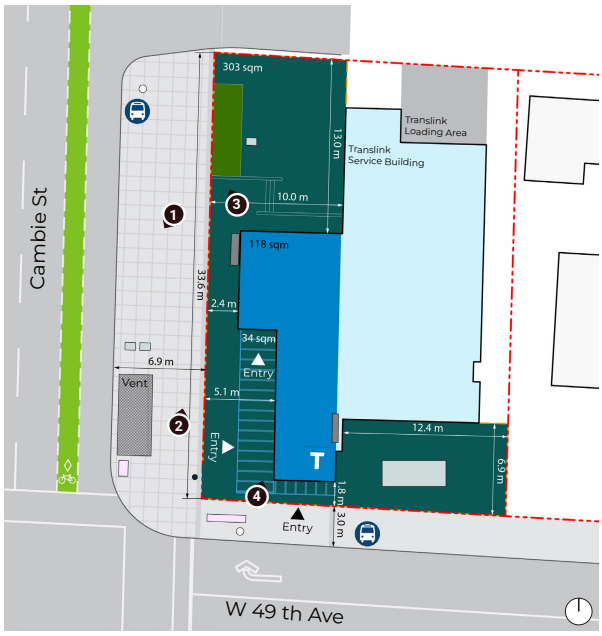
CONVENIENCE

- Certain walls and ground planes blend visually, creating challenges for visually impaired users in distinguishing different areas.

SAFETY AND PASSAGE

- Stairs that could be flushed with the ground plane and installations that blend into the streetscape create confusion and potential hazards for visually impaired and mobility-impaired users.
- The large open space relies on social cues and sightlines for order and hierarchy, posing challenges for visually impaired and cognitively impaired users.





- Rapid Transit Station
- Transit Plaza
- Pedestrian Through Zone
- Station Canopy
- Bike Lane / Bike Crosswalk
- Planted Area
- Bus Stop
- Station Signage
- Bike Racks (14x)
- FCP
- News Kiosks
- Waste Management Bins

Figure 1. Lack of cues in large open area

Figure 2. Large open area

Figure 3. Lack of landscape design

Figure 4. Potential collisions through multiple entrance access points

Figure 5. Competing ads with elevator wayfinding

Figure 6. Furniture along direct route to elevator

TAKEAWAYS FROM EXISTING CONTEXT

FROM THE REVIEW OF BACKGROUND DOCUMENTS AND SITE ANALYSIS

The research conducted encompassed a **dual approach**: a comprehensive review of background documents on transit station design principles in Vancouver, paired with an on-site analysis of six stations. This investigation aimed to evaluate the stations across the metrics of comfort, convenience, safety, and accessibility, particularly focusing on the experiences of users with disabilities.

AN ASSYMMETRY IN USER COMFORT

The foundation documents underscore a notable shift towards enhancing urban accessibility and inclusivity. Recent updates to the BC Building Code highlight a significant stride in accommodating mobility devices, reflecting broader municipal and metropolitan initiatives aimed at environmental and accessible advancements.

While mobility device accessibility is well-addressed in these guidelines, other forms of disability receive comparatively less emphasis. This asymmetry underscores a critical gap: while there is a **notable certitude** in designing spaces accessible to **mobility device users**, there is **uncertainty in extending** this assurance to users with **other impairments**. This challenge resonates not only within transit station construction, but also across the fields of architectural and landscape architecture.

DETECTING POTENTIAL IMPROVEMENTS

Among the stations surveyed, **older facilities** like Burrard Station presented the most pronounced challenges and concurrently, the **highest potential for improvement** through targeted interventions and upgrades. In contrast, newer stations showcased robust adherence to modern design principles, integrating accessibility more seamlessly into their architectural framework. Future enhancements for these newer stations can focus on **augmenting user comfort**, while older stations require comprehensive improvements across all facets of the revised pedestrian hierarchical model.

THE EXPERIENCE THROUGH DIFFERENT LENSES

The site visits revealed subtle yet impactful oversights that **disproportionately affect users** with specific disabilities. Minor inconveniences, such as misplaced steps or unclear signage, **amplify** into substantial obstacles for these users. Such discrepancies in design transform public spaces intended for universal use into environments that **inadvertently exclude certain groups**, thereby complicating the spatial experiences of these individuals. The project adopts lenses of the following impairments:

VISUAL IMPAIRMENTS

- Encompass a broad spectrum, including complete blindness, partial sight, and conditions such as glaucoma, macular degeneration, and diabetic retinopathy
- Can affect one's ability to navigate spaces, recognize faces, read signs, and perceive depth and contrast

COGNITIVE IMPAIRMENTS

- Include a variety of conditions that affect memory, problem-solving, attention, and comprehension, which includes individuals with developmental disabilities, traumatic brain injuries, dementia, and learning disabilities such as dyslexia

HEARING IMPAIRMENTS

- Range from mild hearing loss to profound deafness
- Conditions include age-related hearing loss, congenital deafness, and hearing loss resulting from illness or injury
- Individuals may rely on hearing aids, cochlear implants, or other assistive technologies

DESIGN OPPORTUNITIES FOR INTERVENTIONS

Lens	Main issues detected along the circulation of existing sites
Visual Impairments	Competing and insufficient wayfinding Limited space
Cognitive Impairments	Over-stimulating environment
Hearing Impairments	Noisy environment Limited wayfinding

CASE STUDIES

CONTENTS FOR CASE STUDIES

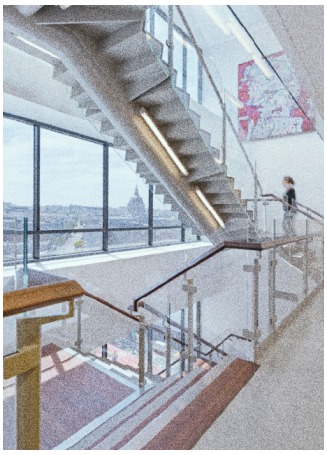
The selection of case studies focuses on projects tailored to serve users with specific types of disabilities. By understanding specialized design strategies relevant to users with visual, hearing, and cognitive impairments, we can learn how the experience in the public spaces of rapid transit stations and plazas can be improved for these targeted users.

James Lee Sorenson Language and Communication Center.
Washington, DC.
2020.

HEARING IMPAIRMENTS

Royal Institute for Deaf and Blind Children. Sydney, Australia.
Unbuilt.

VISUAL AND HEARING IMPAIRMENTS

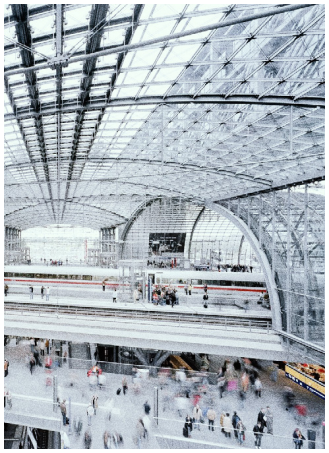


LightHouse for the Blind and Visually Impaired.
San Francisco, CA.
2016.

VISUAL IMPAIRMENTS

Hazelwood School.
Glasgow, Scotland.
2007.

VISUAL, HEARING, AND COGNITIVE IMPAIRMENTS



Berlin Central Station.
Berlin, Germany.
2006.

UNIVERSAL

34TH Street - Penn Station.
New York, New York.
1932.

UNIVERSAL

JAMES LEE SORENSON LANGUAGE AND COMMUNICATION CENTER

Washington, DC | 2020

Scale: 60,000 sft

Design Focus: Hearing impairments

Setting: Higher education

GALLAUDET UNIVERSITY, A LIBERAL-ARTS COLLEGE FOR THE DEAF AND HARD OF HEARING

Visual Elements

- Diffuse Natural Light: Soft, even lighting reduces glare and shadows, making it easier to follow signed conversations. Filters are added to windows to polarize the light and reduce glare.
- Color Contrast: Wall colors are chosen to contrast with skin tones, making gestures easier to see.
- Wide Entryways and Automatic Doors: Allow for uninterrupted communication, as users don't need to stop to open doors.
- Open Hallways and Glass Walls: Elements ensure clear sightlines, enabling visual communication across different levels and distances within the building.

Sensory Elements

- Reduction of Ambient Noise: Absorptive panels on upper parts of walls to absorb excess sound, and flooring materials that do not create unnecessary noise.

Circulation Elements

- Curving Walkways: Designed to avoid sharp corners, curved walls prevent collisions by allowing people to catch an earlier glimpse of each other. Ideally, the walls come to a point, but the top half is glass.
- Accessible Pedestals: Provide places for users to put down items, freeing their hands for signing.
- Sloping Walkways: Replace stairs, ensuring continuous visual contact while moving.
- Widened Walkways: To see each others and watch where they are going, hear impaired people travel at a 45-degree angle between themselves and require much wider hallways, increasing from 3 feet wide to 7 feet wide.
- Alcoves: Hallway alcoves create space for people to move out of the way of hallways traffic, helping widen entryways and avoid interruption of signing conversations.
- Furniture Arrangement: Seating arrangements avoid straight rows, which hinder signed communication, favoring configurations that allow all participants to see each other.

Application to Transit Station

For facilitation of signed conversations, enhancing the light and color contrasts, allowing for generous spacing within hallways, and aiding the circulation in heavily trafficked pedestrian intersections through curved walkways.

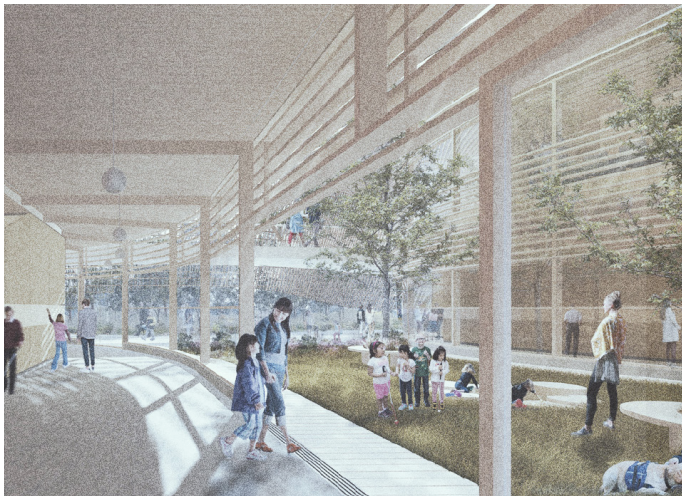
ROYAL INSTITUTE FOR DEAF AND BLIND CHILDREN CENTRE OF EXCELLENCE

Sydney, Australia | Unbuilt

Scale: 52,000 sft

Design focus: Visual and hearing impairments

Setting: Elementary education



ROYAL INSTITUTE FOR DEAF AND BLIND CHILDREN, FACILITY TO BE BUILT AT MACQUARIE UNIVERISTY

Visual Elements

- Visual Alarms and Signals: Incorporate visual cues that include flashing lights for alarms ensures that individuals with hearing impairments are equally prioritized in emergencies.
- Tactile and Visual Wayfinding: Clear, tactile pathways and high-contrast visual signage help visually impaired individuals navigate the space independently. Tactile features on vertical planes enrich the wayfinding experience.

Sensory Elements

- Integrated Natural Light and Ventilation: Each classroom features framed openable facades with windows and manually operated louvres, allowing for natural light and ventilation, which supports sensory comfort.
- Sensory Landscape Design: The landscape architecture focuses on establishing a sensory landscape through tree and groundcover planting design, enriching the outdoor experience to users.
- Acoustic Treatments: Specialized acoustic materials and designs minimize background noise, crucial for individuals with hearing impairments to be aided in focusing on conversations and instructions.

Circulation Elements

- Sloping Walkways: Stairs are avoided when possible, ensuring continuous visual contact while moving.
- Visual and Acoustic Communication: Open plan layouts and specialized acoustic treatments enhance both visual and auditory communication, as established in the open, covered hallway with distinct thresholds created through shadow and landscape.

Application to Transit Station

Enriching the wayfinding potential via the addition of tactile surfaces along vertical planes in the interior, and incorporating sensory qualities as selection criteria for outdoor planting.

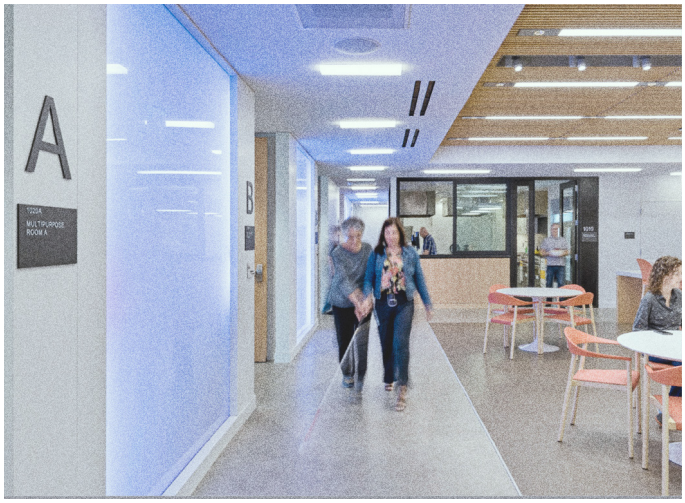
LIGHTHOUSE FOR THE BLIND AND VISUALLY IMPAIRED

San Francisco, CA | 2016

Scale: 22,000 sft

Design focus: Visual impairments

Setting: Support organization



SAN FRANCISCO LIGHTHOUSE SOCIAL SERVICE ORGANIZATION FOR THE BLIND AND VISUALLY IMPAIRED

Visual Elements

- Soft Lighting and Neutral Colors: By utilizing soft lighting with minimal brightness and a base palette of neutral colors, the approach reduces glare, which can hinder the slight vision many visually impaired individuals have. Soft lighting and neutral colors create a comfortable environment, making navigation easier and reducing visual strain.
- Saturated Colors: Bold colors are included in the palette for certain design elements because rich, saturated colors can be discerned by many with low vision.

Sensory Elements

- Acoustical Treatments: Sound is a critical sensory input for visually impaired individuals, where auditory cues can aid in navigation of space. The design incorporates acoustical treatments, like wood acoustical panels and bare cement floors, that reduce mechanical sounds and amplify positive sounds like footsteps.

Circulation Elements

- Tactile Feedback: Materials with distinct textures are used throughout the facility. Tactile feedback through floor textures and handrails helps users identify different areas and navigate safely.
- Material Transition and Demarcation: There is use of contrasting materials and demarcation strips for spatial understanding in public areas. A ring of polished concrete encircles public areas, while open spaces are defined by metal floor transition strips that allow for spatial demarcation to cane users. This wayfinding system help visually impaired individuals understand different zones within the space, aiding in spatial orientation and safety.

Application to Transit Station

The color palette within stations can be further outlined and reinforced, allowing for the important design elements to be highlighted. Materials transitions, like concrete strips, and demarcations along the ground plane can help offer spatial understanding of areas.

HAZELWOOD ELEMENTARY SCHOOL

Glasgow, Scotland | 2007

Scale: 34,000 sft

Design focus: Visual, hearing, and cognitive impairments

Setting: Elementary education

ROYAL INSTITUTE FOR DEAF AND BLIND CHILDREN, FACILITY TO BE BUILT AT MACQUARIE UNIVERISTY

Visual Elements

- Sensory Pathways: Designed with sensory pathways that use different textures and colors on all planes to help visually impaired and autistic students navigate. Tactile cues are strategically placed to guide users to key areas like bathrooms, classrooms, and exits.
- Tactile Wall Strips: In addition to textured floors, tactile wall strips are used at hand height to provide continuous guidance for visually impaired students.
- Color Coding: Specific colors are used to denote different zones or functions within the school. This helps students with cognitive impairments to understand and predict their environment, reducing anxiety and confusion.
- Soothing Palettes: The school uses calm and neutral color schemes throughout its interior to create a soothing environment. Bright and contrasting colors are used sparingly and strategically to highlight important features or areas without overwhelming the students.

Sensory Elements

- Natural Light Integration: Large windows and skylights are incorporated to allow natural light to fill the spaces, which has a calming effect and helps to regulate students' circadian rhythms.

Circulation Elements

- Quiet Rooms: Dedicated quiet rooms and alcoves provide a retreat for students who need to escape sensory overload.

Application to Transit Station

Tactile cues for key areas and color codes can denote different zones and functions, helping users understand and predict environments. Hallways can incorporate alcoves protected from sound, allowing moments for escape of the sensory environment.

TRANSIT: BERLIN CENTRAL STATION

Berlin, Germany | 2006

Scale: 1,180,000 sft

Design focus: Universal

Setting: Multi-modal transit station

TRANSIT: BERLIN CENTRAL STATION

Visual Elements

- Color-Coded Zones: Different areas of the station are color-coded to help passengers navigate the extensive and complex layout of the station efficiently. All city rapid transit signage, including directional signs, platform indications, and informational and digital displays, are yellow (regional trains are green, long-distance trains are blue, and subways connections are orange).
- Dynamic Signage: The station features dynamic digital displays that provide real-time information about train schedules, platform changes, and delays. These signs are strategically placed throughout the station to ensure visibility, adhere to the color-coding scheme, and ensure large, readable fonts.

Circulation Elements

- Coded Pathways and Transitions: Colored pathways and floor markings guide passengers from one service to another, ensuring smooth transitions between different levels and types of trains. For instance, a passenger transferring from a long-distance train (blue) to a regional train (green) can follow colored floor lines to navigate the change seamlessly.
- Interactive Kiosks: Touchscreen kiosks are available throughout the station, offering interactive maps and information in multiple languages.

Application to Transit Station

Station information to include more demarcation devices, including colors, symbols, and spatial differentiation to help navigation and allow for information to be accessible to different visual impairments.

TRANSIT: 34TH STREET - PENN STATION

New York City, NY | 1932 | 2018 retrofit

Scale: 20,000 sft

Design focus: Universal

Setting: Multi-modal transit station

TRANSIT: 34TH STREET - PENN STATION

Visual Elements

- Visual Displays: Electronic displays throughout the station offer visual information on train schedules, platform changes, and emergency instructions. These displays are designed with high contrast and large fonts to be easily readable.

Sensory Elements

- Audible Announcements: Real-time audible announcements provide information about train arrivals, departures, and any service changes. These announcements are made through a clear and high-quality PA system.

Circulation Elements

- Elevators: Provide access to platforms and concourses with an emergency two-way communications system.

Application to Transit Station

Auditory services incorporated in the station navigation to provide support to users with auditory impairments.

DESIGN TOOLKIT

DESIGN TOOLKIT CONTENTS

OVERVIEW OF THE MULTI-SCALAR DESIGN TOOLKIT

PROPOSING INTERVENTIONS

The collection of design strategies applied to specialized facilities in the case studies helped guide the proposal of realistic interventions for transit stations in Vancouver.

Below is a summary of the fourteen interventions proposed, moving from the stations' indoor to outdoor spaces.

DESIGN TOOLKIT:

APPLICABLE SPACES	SCALE OF INTERVENTION	TOOLKITINTERVENTION	TARGETED IMPAIRMENTS
Indoors	Micro	1. Acoustic Paneling	
		2. Tactile Paneling	
		3. Corridor Tiling	
		4. Floor Signage	
	Macro	5. Temporary Escapes	
		6. Color Scheme	
Indoors & Outdoors	Micro	7. Demarcation Strips	
		8. Obstacle Clearance	
		9. Pedestals	
	Macro	10. Signage Paneling	
Outdoors	Micro	11. Street Tree Design	
		12. Sensory Planting	
	Macro	13. Non-Visual Open Areas	
		14. Multimodal Wayfinding	

Visual impairments

Cognitive impairments

Hearing impairments

DESIGN TOOLKIT CRITERIA

PARAMETERS OF EVALUATION CRITERIA FOR DESIGN INTERVENTIONS

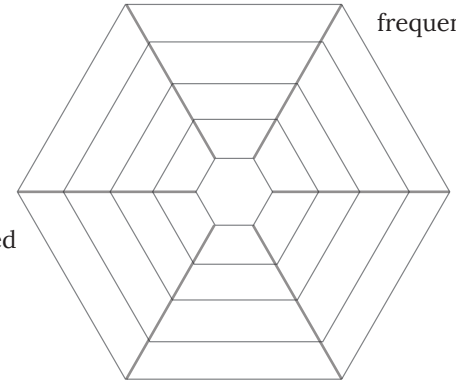
THE HEXAGONAL EVALUATION MATRIX

The following matrix can help evaluate the following interventions' feasibility and priority for implementation at transit stations. These evaluations are based on the author's current understanding of each practice, and further in-depth investigation is warranted.

The typologies shown for the following interventions are developed on hypothetical scenarios of transit station settings.

MAINTENANCE
The quantity and complexity of the required maintenance procedures.

DURABILITY
The durability of the intervention within consideration of a high-frequented transit station.



AVAILABILITY
The availability and accessibility of required products for the intervention.

BENEFIT FOR IMPAIRED USERS
The net positive impact of the intervention for users with the targeted impairments.

COSTEFFICIENCY
Based on rough estimations, the intervention's cost may be:
* = $100 - $300 / sqm
** = $300 - $500 / sqm
*** = $500+ / sqm

BENEFIT FOR GENERAL PUBLIC
The net positive impact of the intervention for all non-disabled and disabled users.

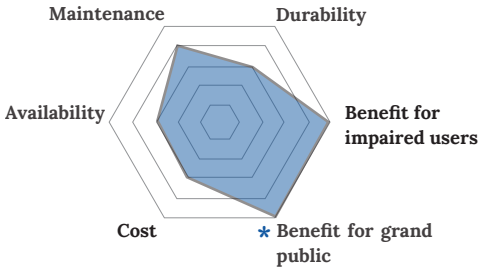
* Stars to highlight the intervention's highest strength.

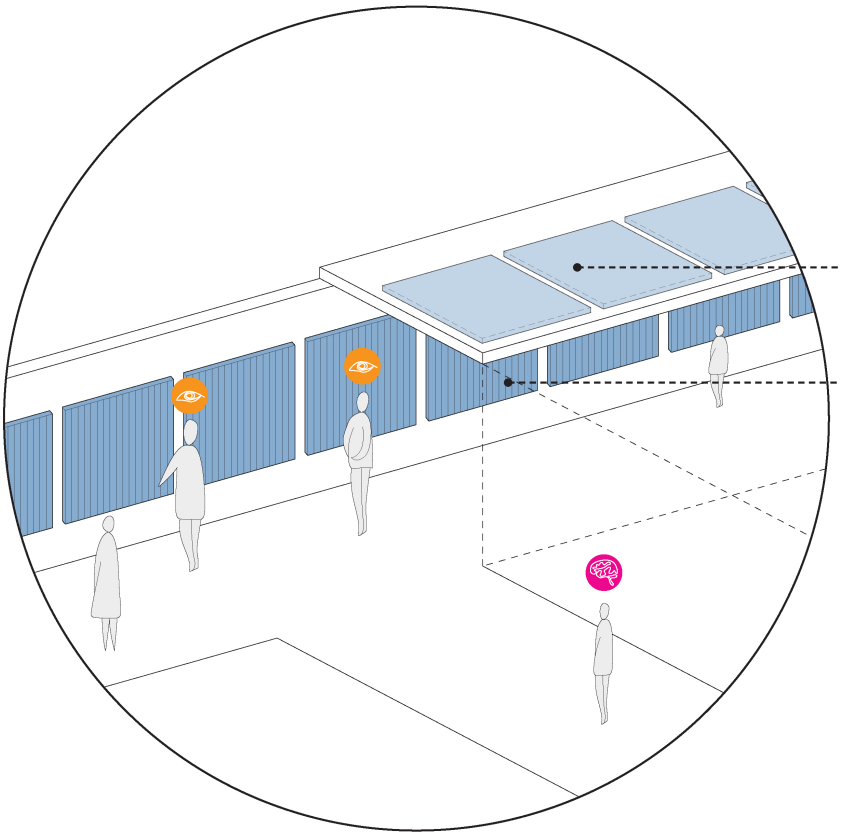
1. ACOUSTIC PANELING

Micro intervention

Applicable Spaces : Indoors

Targeted Impairments: Hearing and Cognitive





Improvements: Improve the overall experience of the space by reducing its noisy, over-stimulating auditory qualities.

Acoustic panels, made from absorbent materials, reduce noise levels by dampening unpleasant sounds in the environment. These panels can be installed in multiple hallways or localized to problem areas, such as long corridors that produce echoes in busy transit stations. By reducing ambient noise, these panels significantly benefit users with auditory and cognitive impairments.

The panels' color and material can be chosen to fit neutral, warm tones recommended for cognitive design, with wood slats encouraged for their recognizable qualities via other senses such as smell and touch.

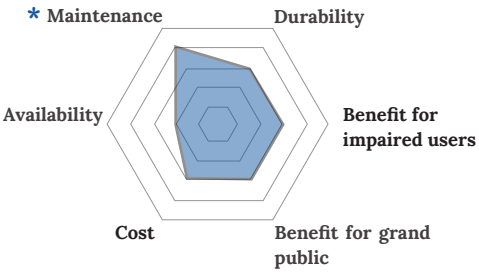
Note: Soundproofing qualities to the flooring is not recommended. The noise reflection of footsteps is encouraged to support auditory and visual impairments.

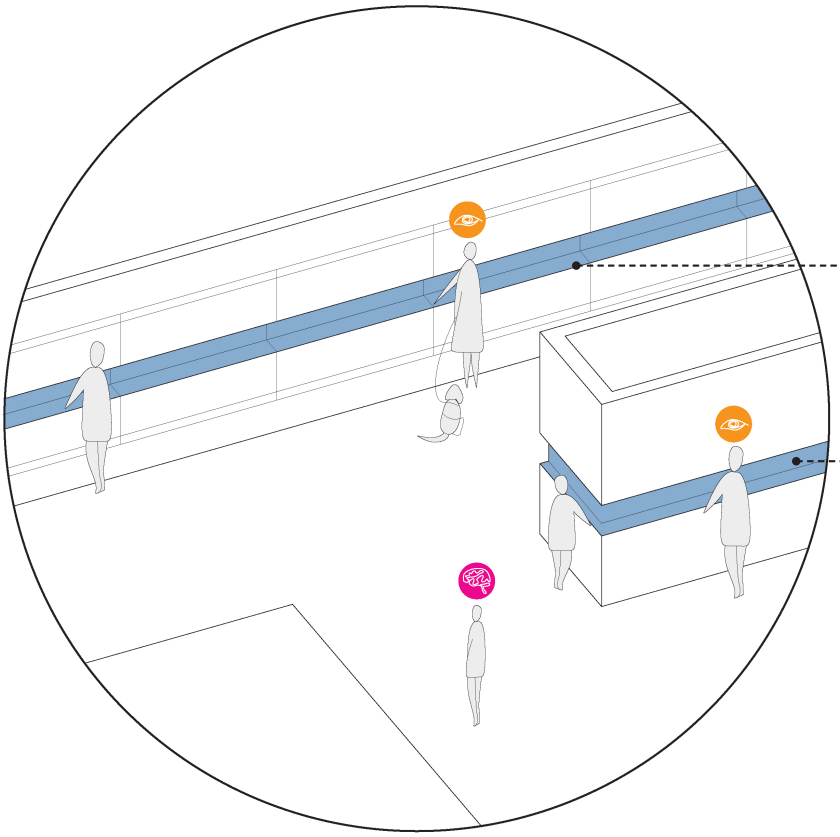
2. TACTILE PANELING

Micro intervention

Applicable Spaces : Indoors

Targeted Impairments: Visual and Cognitive





Tactile wall panels, allowing more options for wayfinding

Tactile indent, recessed into wall thickness at typical guardrail level, to substitute protruding guardrails

Improvements: Adding variety to navigational options through textural and aesthetic additions.

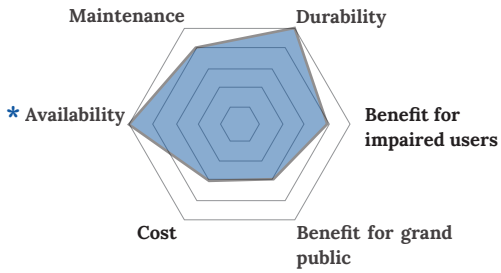
Tactile wall panels, embedded with textural strips or composed of smaller tiles, can be added along the walls in large open areas and narrow hallways. These panels provide an additional tactile option for navigation, accommodating various visual impairments and offering more navigational choices. For greater impact, these tactile panels can incorporate acoustic qualities to absorb noise, providing both wayfinding and sound mitigation benefits.

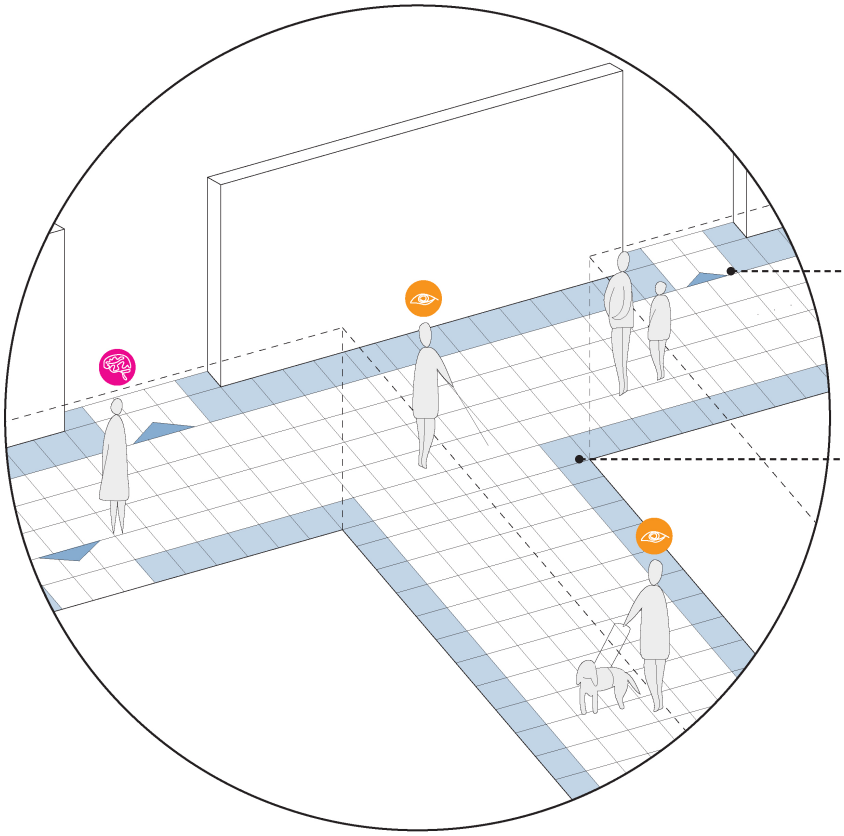
3. CORRIDOR TILING

Micro intervention

Applicable Spaces : Indoors

Targeted Impairments: Visual and Cognitive





Cut tiles, to incorporate permanently navigational cues within the flooring

Darker tiles along corridor edges to frame the circulation space and introduce spatial hierarchy

Improvements: Adding visual contrast and framing of spaces for improved spatial hierarchy and understanding.

Differently colored pavers, typically darker grey, can be added along corridor edges to frame circulation spaces. This contrast helps offer spatial understanding and introduce spatial hierarchy, supporting navigation in busier intersections. Cut tiles along these darker rows can also incorporate visual cues, forming pointing arrows as part of the flooring. These integrated signs direct users to entrances and corridors, creating a consistent system of contrast and framing across multiple corridors and stations.

Note: Including a consistent system for contrast and framing of spaces across the multiple corridors and stations can create a habit of spatial hierarchy.

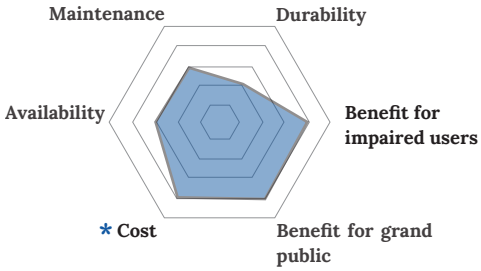
Remove and avoid use of pavers as ornamentation. They should lead to obstacles, and be potentially construed as navigational cues.

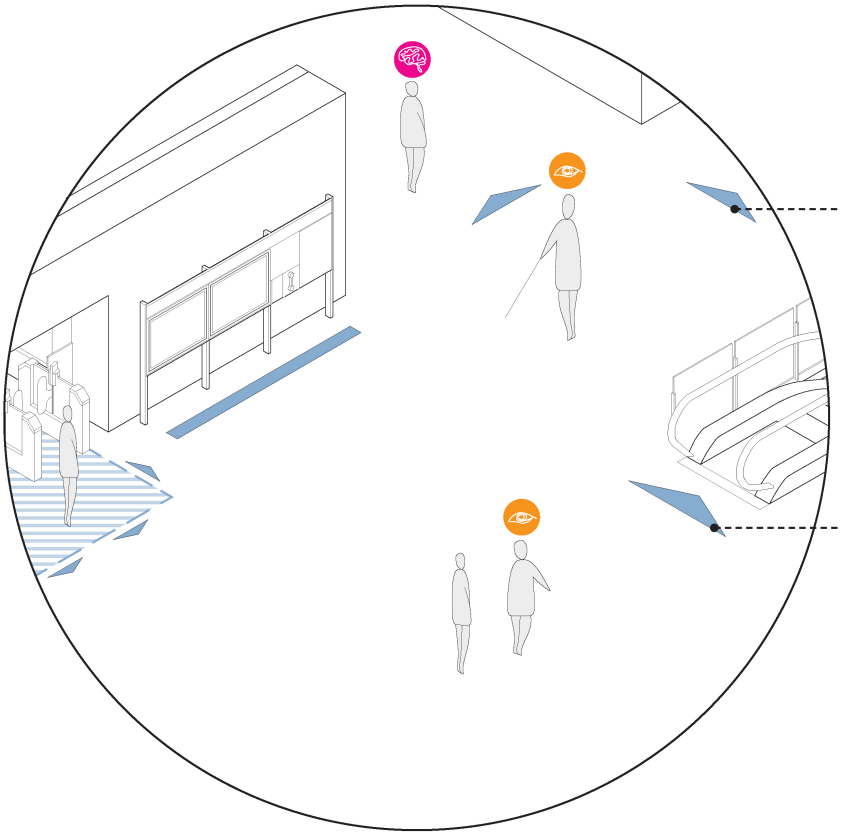
4. FLOOR SIGNAGE

Micro intervention

Applicable Spaces : Indoors

Targeted Impairments: Visual and Cognitive





Floor signage, painted or stuck on, to existing flooring

Larger indicators for potential obstacles and important routes, with optional incorporation of transit route information

Improvements: Adding wayfinding cues for both transit areas and spaces within the transit station.

Floor signage involves the strategic placement of non-slip stickers to guide users to essential areas and transit lines within the station. These stickers, designed to be highly visible and durable, point to key locations such as elevators, restrooms, and metro lines.

By providing clear visual cues on the floor, the signage helps users with visual impairments navigate the space more easily and safely. The use of contrasting colors ensures that the stickers stand out against the flooring, enhancing their visibility and effectiveness. Additionally, these wayfinding cues can contribute to a more organized and intuitive transit experience for all users, reducing confusion and improving overall accessibility.

Note: Including a consistent system for contrast and framing of spaces across the multiple corridors and stations can create a positive habit of spatial hierarchy.

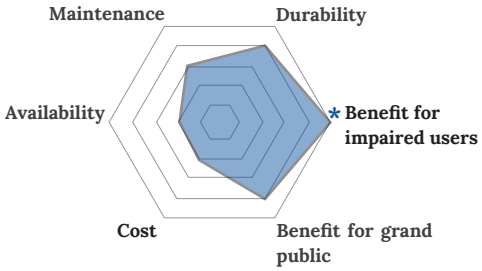
Remove and avoid use of pavers as ornamentation. They should lead to obstacles, and be potentially construed as navigational cues.

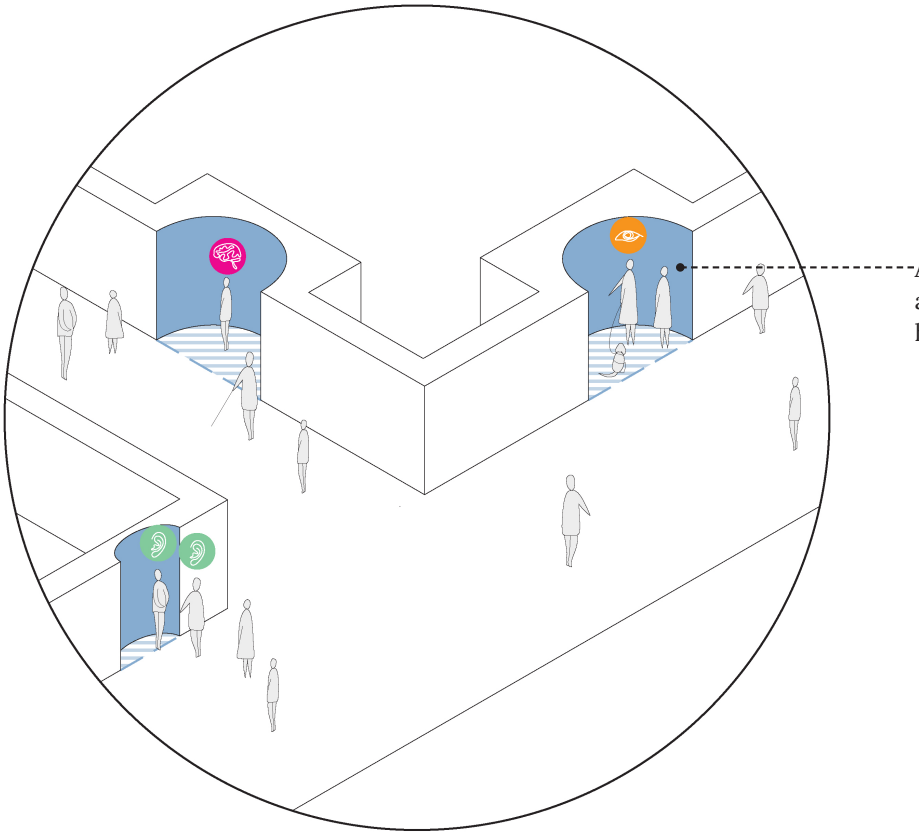
5. TEMPORARY ESCAPES

Macro intervention

Applicable Spaces : Indoors

Targeted Impairments: Cognitive and Hearing





Alcoves added or embedded into walls along passageways, with priority along high-circulation corridors

Improvements: Provides moments of relief and protection from sensory overload.

Temporary escapes could be dedicated quiet spaces or alcoves integrated into the circulation of transit stations, particularly along busier or narrower corridors. These nooks offer individuals a chance to retreat from the sensory overload common in bustling transit environments. By providing a space for temporary respite, these areas help reduce stress and anxiety for users with cognitive impairments.

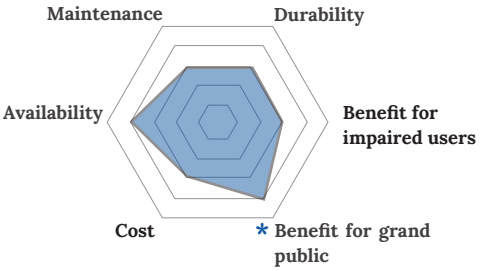
By enlarging the hallway, they allow individuals to move out of the way, creating space for conversations in signage to go uninterrupted. The spaces can also be equipped with seating, soft lighting, and sound-absorbing materials to enhance their calming effect.

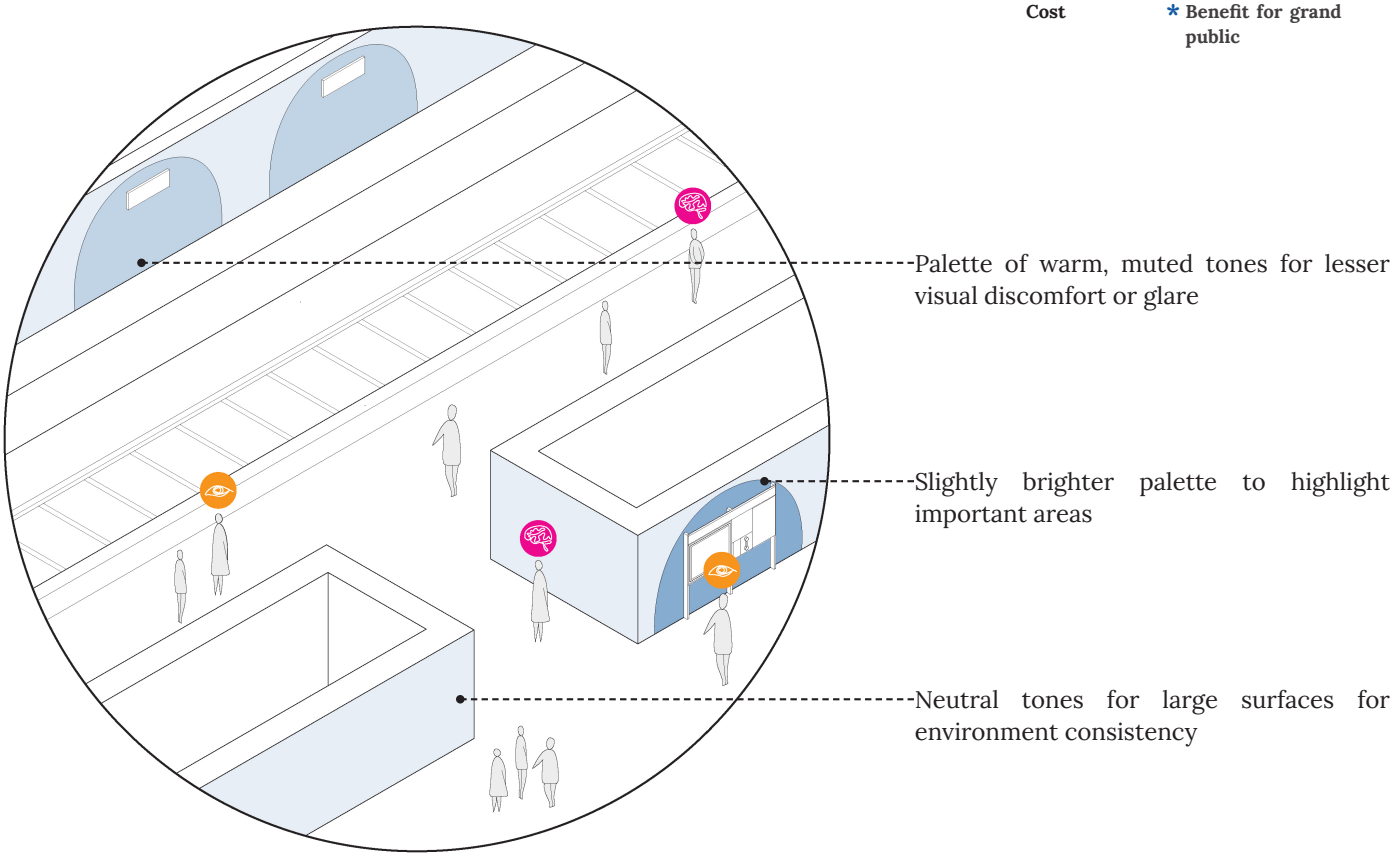
6. COLOR SCHEME

Macro intervention

Applicable Spaces : Indoors

Targeted Impairments: Cognitive and Visual





Improvements: Enhancing spatial understanding and creating a calming environment.

Incorporating a warm, neutral color scheme along interior facades can significantly improve the user experience for individuals with visual and cognitive impairments. Warm tones, such as soft beiges, muted browns, and gentle grays, create a calming and welcoming atmosphere, reducing over-stimulation and anxiety. These colors are less likely to cause glare or visual discomfort, making it easier for individuals with visual impairments to navigate the space.

Using neutral tones for large surfaces, such as walls and floors, helps to create a consistent and easily understandable environment. Accent colors in slightly brighter but still warm tones can be used strategically to highlight important areas or features, such as signage, seating areas, and entrances. This approach not only aids in wayfinding but also supports the overall aesthetic coherence of the space.

For cognitive impairments, a warm, neutral color palette can help reduce cognitive load by providing a soothing background that minimizes distractions. It supports a sense of orientation and familiarity, crucial for individuals with difficulty processing complex visual stimuli.

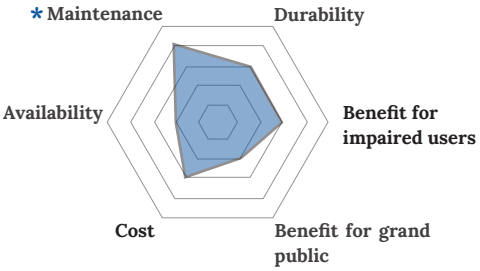
Note: Avoid overly bright or contrasting colors that may cause visual discomfort or confusion. Maintain a consistent color scheme throughout the transit station to enhance spatial understanding. Use accent colors sparingly to highlight key areas, without overwhelming the senses. Ensure hands of various skin tones are still contrastable, relevant for signing users.

7. DEMARCATION STRIPS

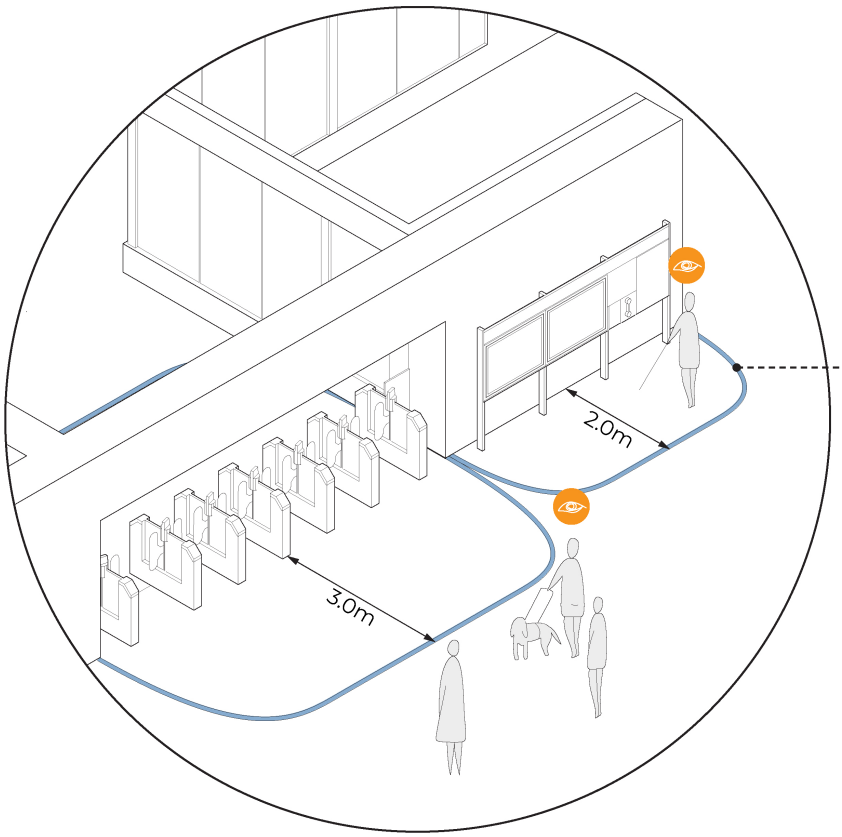
Micro intervention

Applicable Spaces : Indoors & Outdoors

Targeted Impairments: Visual



Indoor



Polished concrete strips or metal strips embedded into flooring, to mark a specific program or a transition towards a new environment

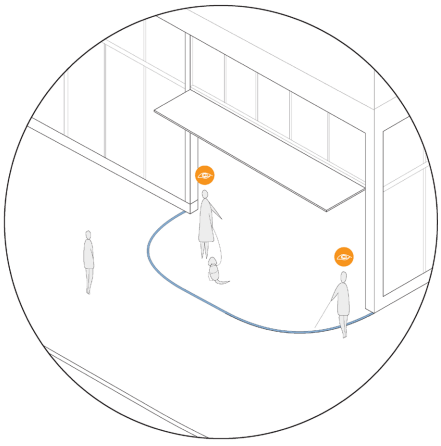
Improvements: Eases cane navigation and enhances spatial hierarchy.

Demarcation strips are tactile markers designed to aid visually impaired cane users in navigating public and circulation spaces. These strips help create a clear spatial hierarchy and improve spatial understanding.

In public areas, different materials can be used to demarcate key spaces, providing tactile feedback that helps users distinguish between various areas.

For example, polished concrete strips can be used to encircle key areas, creating a smooth, distinct boundary. In other spaces, metal floor transition strips can be employed to offer a different tactile language, signaling a change in the environment. These strips guide users through the space, enhancing their ability to navigate independently and confidently.

Outdoor

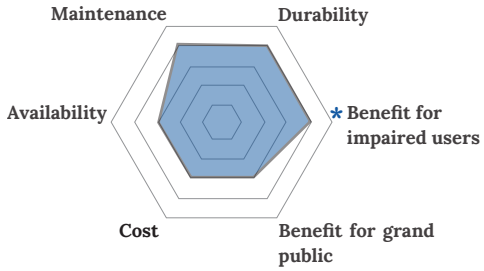


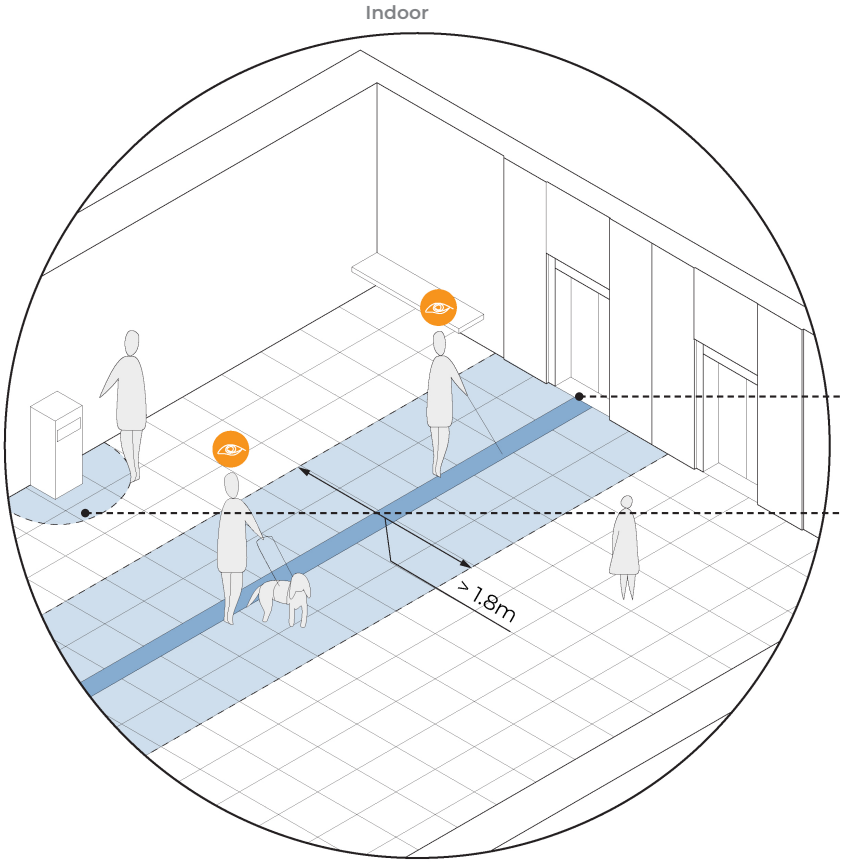
8. OBSTACLE CLEARANCE

Micro intervention

Applicable Spaces : Indoors & Outdoors

Targeted Impairments: Visual



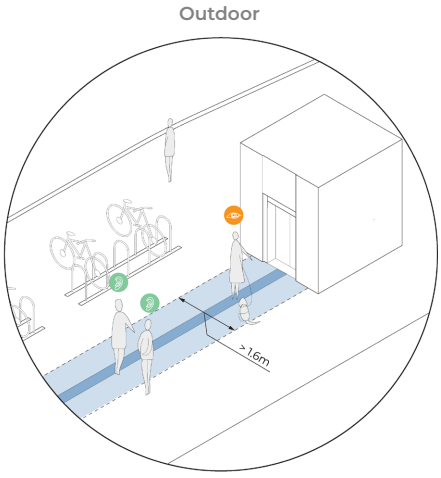


Generous clearance, of minimum 1.8m, given to the direct routes, currently indicated in paving pattern

Adjustment of potential existing furniture outside of clearance area

Improvements: Enhancing navigability by reducing physical obstacles and optimizing the use of landmarks.

Current potential landmarks, such as trash bins or other placed furniture, often act as obstacles rather than aids to navigation. By improving or relocating these objects, they can become helpful landmarks that support a clear and unobstructed path for all users. This intervention involves evaluating existing landmarks and obstacles along direct routes and making necessary adjustments. For instance, trash bins should be repositioned to avoid blocking direct route pathways while remaining easily accessible. Similarly, furniture and other fixtures should be strategically placed to guide rather than hinder navigation. This approach not only clears the way but also optimizes the use of landmarks for wayfinding, ensuring a safer and more intuitive transit environment.

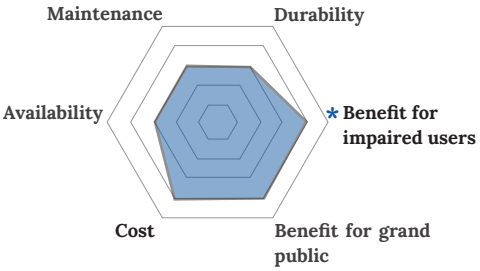


9. PEDESTALS

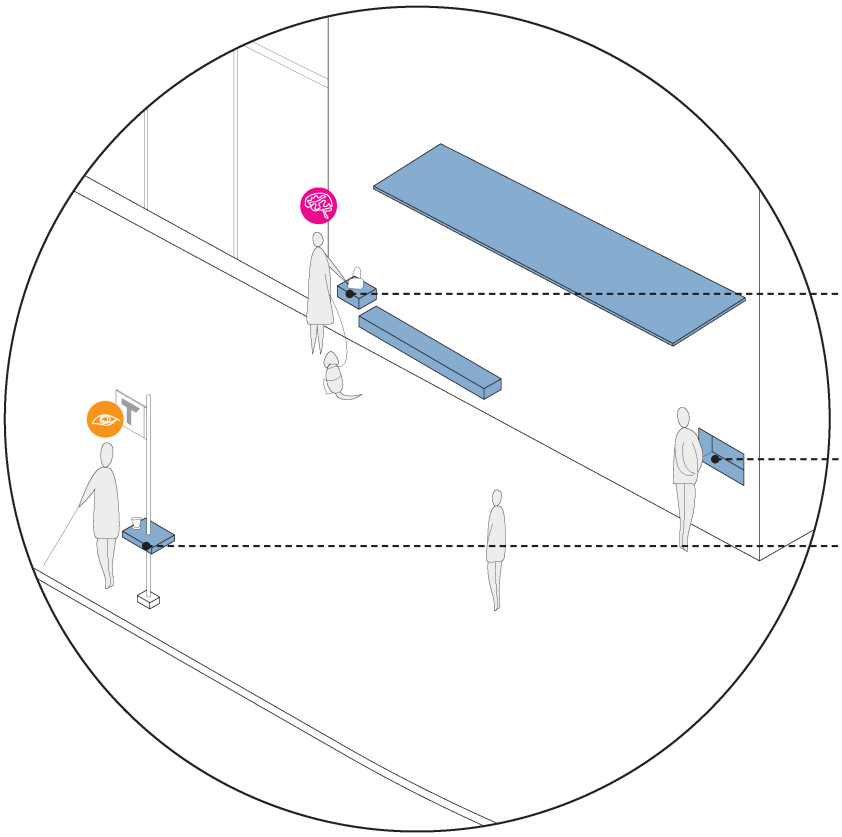
Micro intervention

Applicable Spaces : Indoors & Outdoors

Targeted Impairments: Visual and Hearing



Outdoor



Surface accessible for temporarily deposing hand-held items, created via similar a design typology to benches

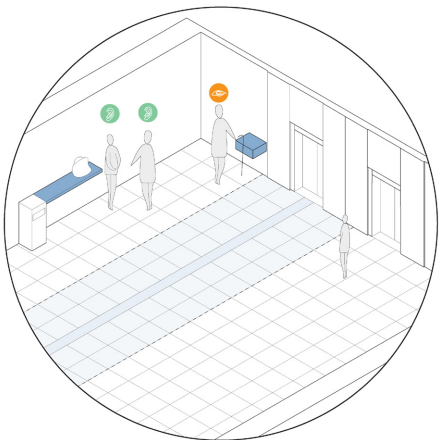
Surface created by indentation into wall thickness

Surface as added features to existing furnishings

Improvements: Providing convenient surfaces for users to place items, enhancing accessibility and ease of use.

Pedestals for accessories are strategically placed surfaces within transit stations that allow users to conveniently place their items, freeing their hands for other tasks. This feature is particularly significant for hearing impaired users, as it enables them to engage in signing communication more easily. It also benefits visually impaired users, who often have their hands partially occupied with navigation aids like canes or guide dogs. These pedestals should be strategically located in areas where users may need to pause or access their belongings, such as near ticket machines, seating areas, or platform edges. The design should ensure stability and durability, accommodating various items without tipping or causing obstruction.

Indoor



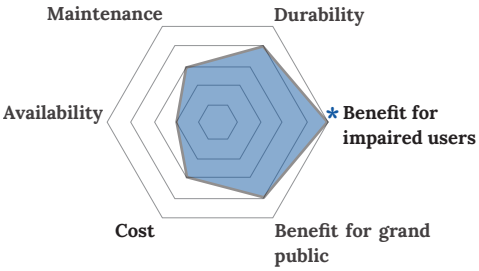
Note: Ensure pedestals are at an accessible height for all users, including wheelchair users. Consider adding tactile markers or contrasting colors to help visually impaired users locate the pedestals. Regularly maintain and clean pedestals to ensure they remain functional and inviting.

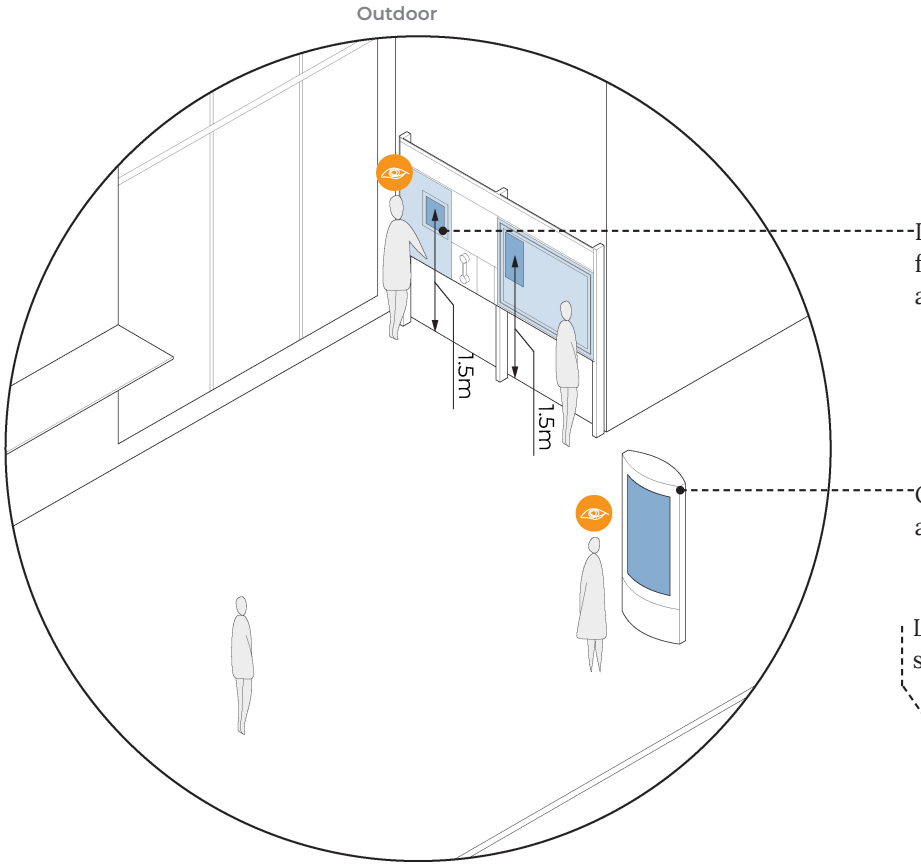
10. SIGNGAGE PANELING

Macro intervention

Applicable Spaces : Indoors & Outdoors

Targeted Impairments: Visual and Cognitive

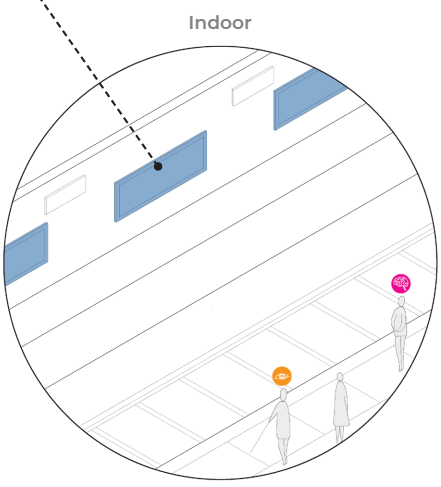




Inclusion of Braille and other textural features for information to be further accessible through tactile utility

Optimization of anti-glare technology along exterior informative paneling

Lowered and enlarged signage of the station title along arrival platforms



Improvements: Enhancing visibility, readability, and accessibility of signage through better materials and placement.

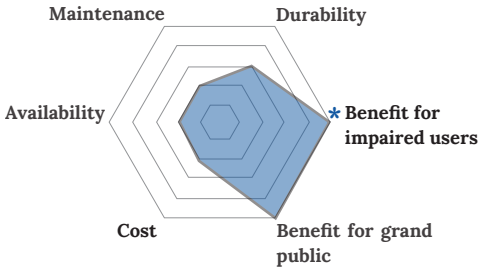
Signage paneling upgrades focus on improving the quality and accessibility of information displayed throughout transit stations. Station titles should be enlarged and positioned lower on walls along train platforms to enhance visibility for users sitting or standing within the train. Replace current signage covers with higher-end anti-glare protective covers, such as non-glare acrylic glazing, which features an etched surface that reduces reflection. This is especially important for outdoor posts exposed to direct sunlight. Continue to integrate tactile and braille signage into informational maps at transit stations, ensuring that all users, including those with visual impairments, have access to necessary information.

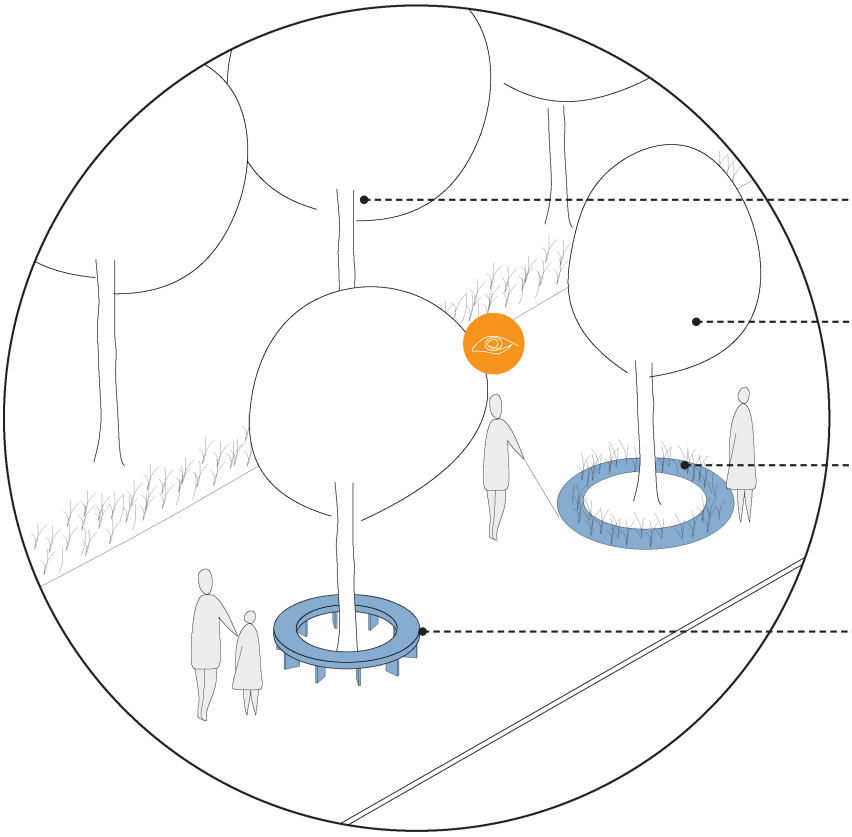
11. STREET TREE DESIGN

Micro intervention

Applicable Spaces : Outdoors

Targeted Impairments: Visual





Trees preferably situated in planted areas that adjoin circulation routes, minimizing interference

Minimal leaf debris as part of tree selection criteria

Landscape barrier of soft grass and mulch, providing protection and larger tree root growth area

Hard barrier, consisting of additional furnishing within streetscape

Improvements: Removing safety hazards along passages, improving tree health, and enhancing navigational experience.

The design and selection of street trees are critical to creating safe entry to transit stations. For users with visual impairments, leaf debris on sidewalks can create confusing visual patterns, posing a challenge to safe navigation. To mitigate this issue, trees with minimal leaf debris should be prioritized, minimizing potential visual clutter on walkways.

Street trees should ideally be planted in dedicated areas separate from the main circulation routes, avoiding direct integration into pedestrian paths. This helps to maintain clear and unobstructed walkways, enhancing safety and accessibility. To protect trees integrated within the streetscape, soft and hard barriers can be used. Soft landscaping elements such as grass and mulch areas can signal the presence of a tree trunk, while features like bench seating can dually function as additional markers and barriers.

For safety considerations, providing ample soil volume and growth space for trees is essential to prevent sidewalk damage from root growth. Generous warnings of potential obstacles should also be provided, ensuring that pedestrians are aware of changes in the path ahead.

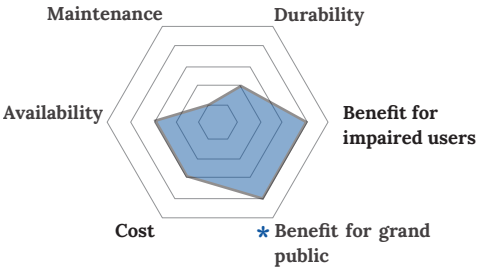
Note: Ensure that trees and other landscape plants adhere to the "3-7 Rule" (foliage does not grow above 900mm (3.0') and/or below 2100mm (7.0'), preserving sightlines through station plazas and maintaining a clear visual environment.

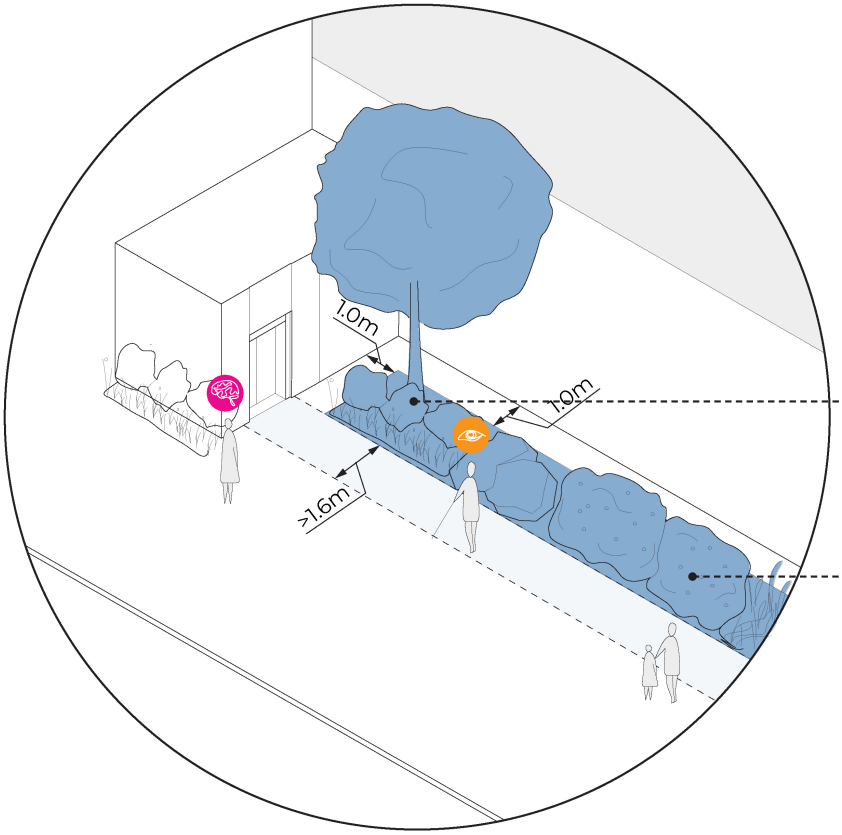
12. SENSORY PLANTING

Micro intervention

Applicable Spaces : Outdoors

Targeted Impairments: Cognitive and Visual





Selection of sensory plants, including potential smells, sounds, or bright colors

Landscaping grouped by pockets of different plantings, creating thresholds to traverse as cues

Improvements: Enhancing sensory experience and creating landmarks along pathways.

Integrate plant species that align with the sensory experience while adhering to practical considerations. This approach involves selecting plants that engage multiple senses, such as sight, smell, and touch, to create memorable and functional landmarks along pathways. By strategically placing plants into sections along circulation with distinctive textures, colors, or scents, the design enhances wayfinding and orientation. For example, small-leafed trees that do not drop fruit, sap, pollen, or honeydew are ideal, as they minimize maintenance needs, reduce slipping hazards, and allow for clear passsages.

Typical species might include:

- Lavender: calming scent and soft texture, ideal for low-lying areas.
- Rosemary: aromatic and hardy, for both scent and texture
- Japanese Maple (Acer palmatum): a small-leafed tree with ideal sightlines
- Thyme or Sage: Ground cover plants offering tactile and aromatic stimulation

Strategically position plants with distinctive textures, colors, or scents along key sections of circulation pathways. This not only aids in wayfinding and orientation but also contributes to a calming, sensory-rich environment that can benefit all users, including those with sensory impairments.

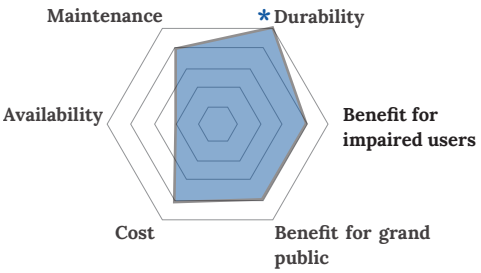
Note: Regular maintenance is essential to ensure the longevity and effectiveness of sensory plantings. This includes routine pruning, cleaning of fallen foliage, and monitoring plant health to maintain the intended sensory impact.

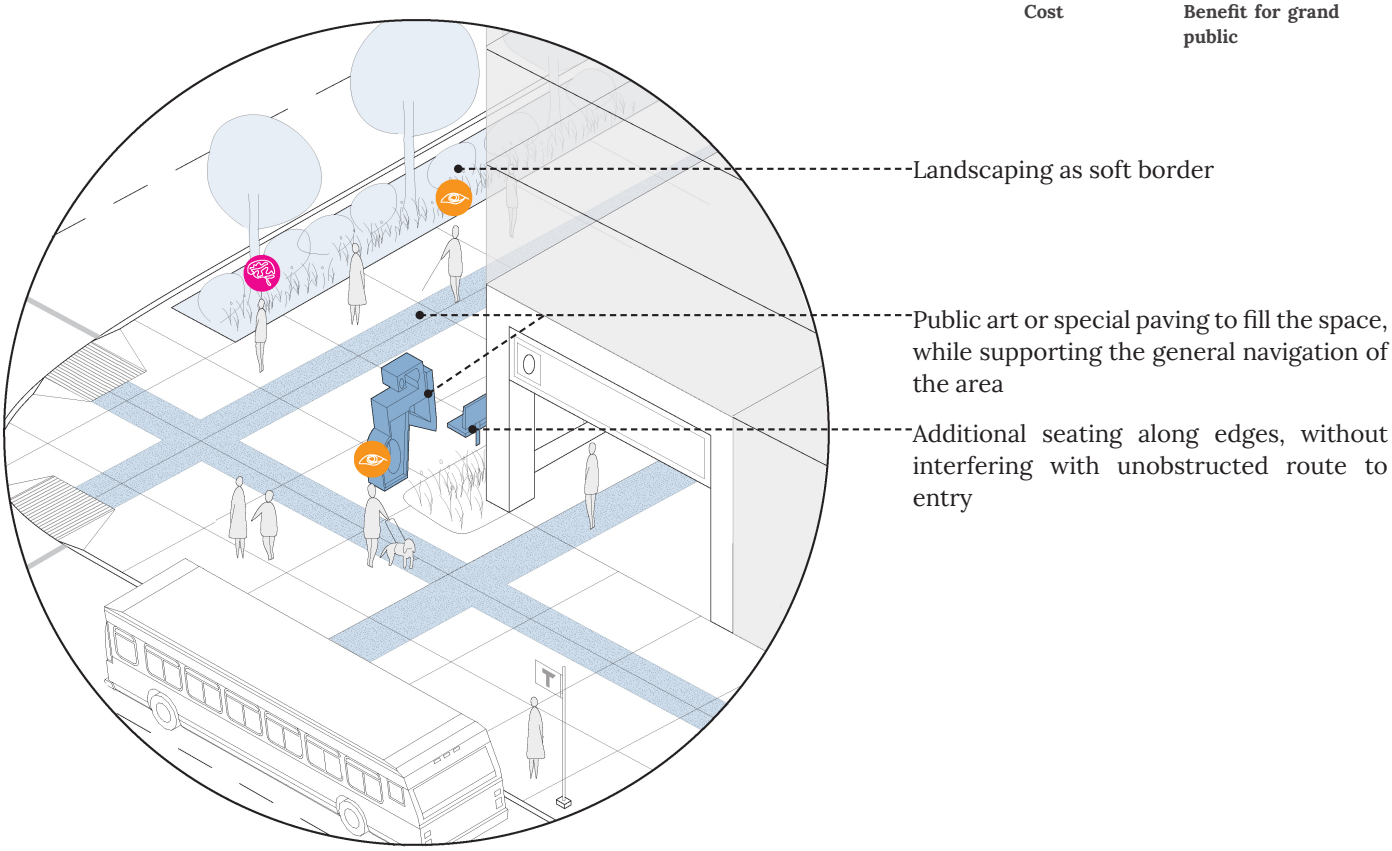
13. NON-VISUAL OPEN AREAS

Macro intervention

Applicable Spaces : Outdoors

Targeted Impairments: Cognitive and Visual





Improvements: Enhancing sensory experience and creating landmarks along pathways.

Instead of large, empty spaces, subtle design interventions such as strategically placed vegetation can create natural barriers and landmarks, guiding users towards the station. Plant selection can emphasize tactile qualities and scents to aid in wayfinding. Additionally, distinct landmarks like public art, seating areas, or architectural features can serve as orientation points, while tactile paving or textured surfaces denote pathways, enhancing the tactile experience for users.

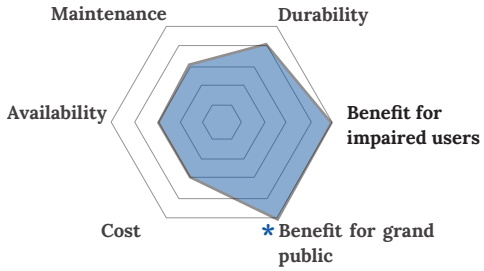
Emphasizing rights of way and crossings through signage, audible signals, or subtle changes in paving materials ensures safe and intuitive movement across the area. These interventions collectively reduce reliance on visual cues, promoting a more inclusive environment where all users can navigate confidently and independently.

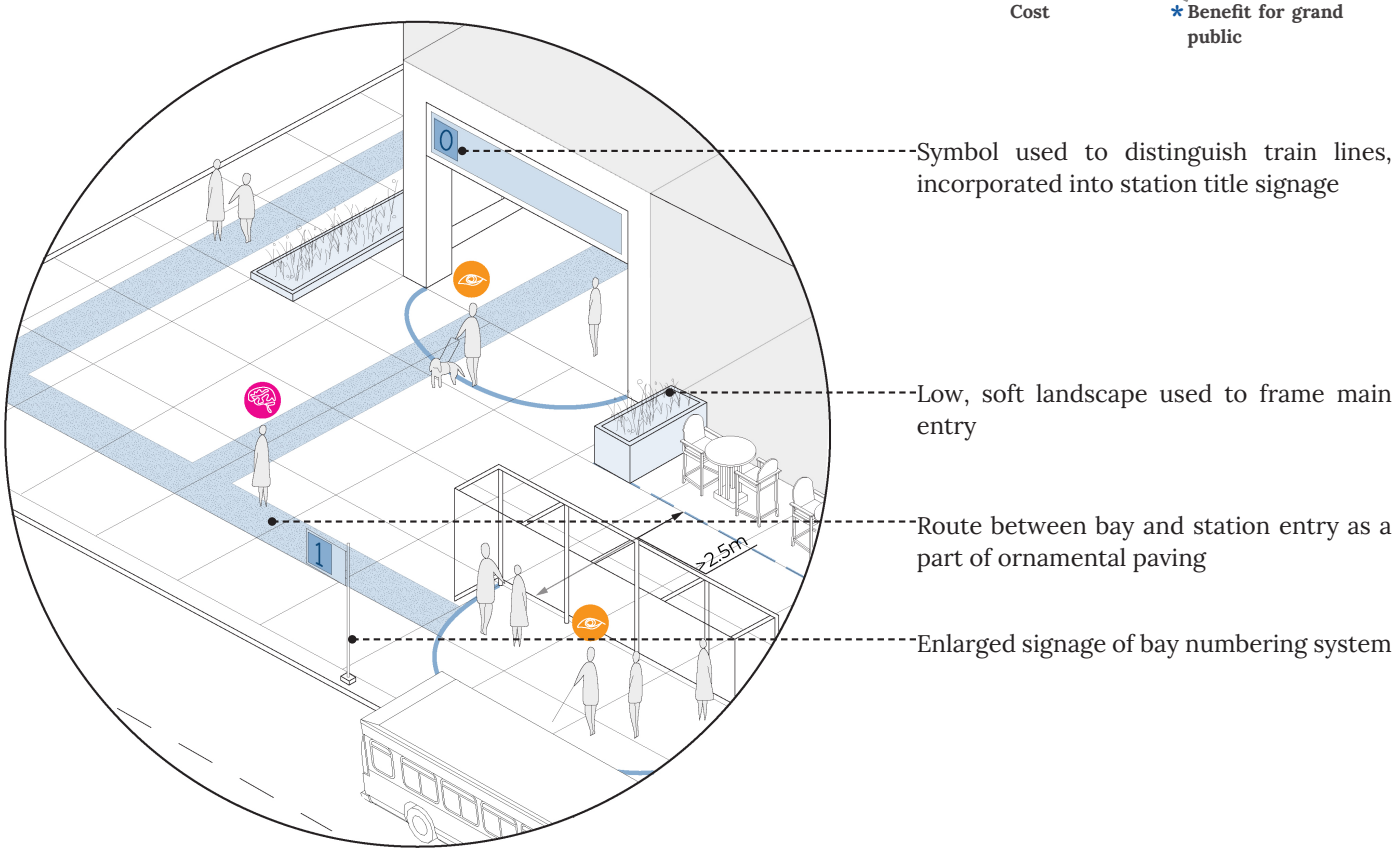
14. MULTIMODAL WAYFINDING

Macro intervention

Applicable Spaces : Outdoors

Targeted Impairments: Cognitive and Visual





Improvements: Enhancing navigability and orientation between multimodal transit, specifically the transition from bus to train use.

Multimodal wayfinding focuses on improving the ease of navigation and orientation for users transitioning between various modes of transit in outdoor spaces. This macro approach incorporates soft landscaping to frame entrances, providing low-risk obstacles that guide users without creating significant barriers, and designs unobstructed, direct paths with clear, straight corners leading towards entrances. Paths should be clearly marked and free from unnecessary obstacles, ensuring ease of navigation for all users. Emphasizing direct paths through distinctive paving patterns, the design uses tactile and contrasting paving materials to create a clear language that guides users from one transit mode to another.

Additionally, installing illuminated, larger panels indicating bus bay numbers and other important wayfinding information enhances visibility and readability, especially in low-light conditions. These strategies collectively enhance the overall multimodal transit experience, making it easier for users with visual and cognitive impairments to navigate multimodal transit routes.

DESIGN TOOLKIT RECOMMENDATIONS

OVERVIEW OF DESIGN TOOLKIT PARAMETERS AND CRITERIA

OVERVIEW OF THE EVALUATION MATRIX

The chart presented in this compilation outlines the evaluation outcomes for each design intervention, providing a clear and concise basis for future reference. It is important to acknowledge that these evaluations have been derived from subjective knowledge and insights, and as such, they necessitate further investigation to substantiate their findings with supporting data. This chart serves a preliminary tool to guide decisions-making and planning, and it underscores the need for more comprehensive research and data analysis to validate the outcomes presented.

CRITERIA / DESIGN	Cost	Availability	Maintenance	Durability	Benefit for impaired users	Benefit for grand public
1. Acoustic Paneling	●●	●●	●●●	●●	●●●●	●●●●
2. Tactile Paneling	●●	●	●●●	●●	●●	●●
3. Corridor Tiling	●●	●●●●	●●●	●●●●	●●●	●●
4. Floor Signage	●●●	●	●●	●	●●●	●●●
5. Temporary Escapes	●	●	●●	●●●	●●●●	●●●
6. Color Scheme	●●●	●●	●●	●●	●●	●●●
7. Demarcation Strips	●●	●	●●●	●●	●●	●
8. Obstacle Clearance	●●	●●●	●●●	●●●	●●●	●●
9. Pedestals	●	●	●	●●●	●●●	●●●
10. Signage Paneling	●●	●	●●	●●●	●●●●	●●●
11. Street Tree	●	●	●	●●	●●●●	●●●●
12. Sensory Planting	●●	●●	●	●	●●●	●●●
13. Non-Visual Open Areas	●●●	●	●●●	●●●●	●●●	●●●
14. Multimodal Wayfinding	●●	●●	●●	●●●	●●●●	●●●●

Poor ●
Fair ●●
Good ●●●
Excellent ●●●●

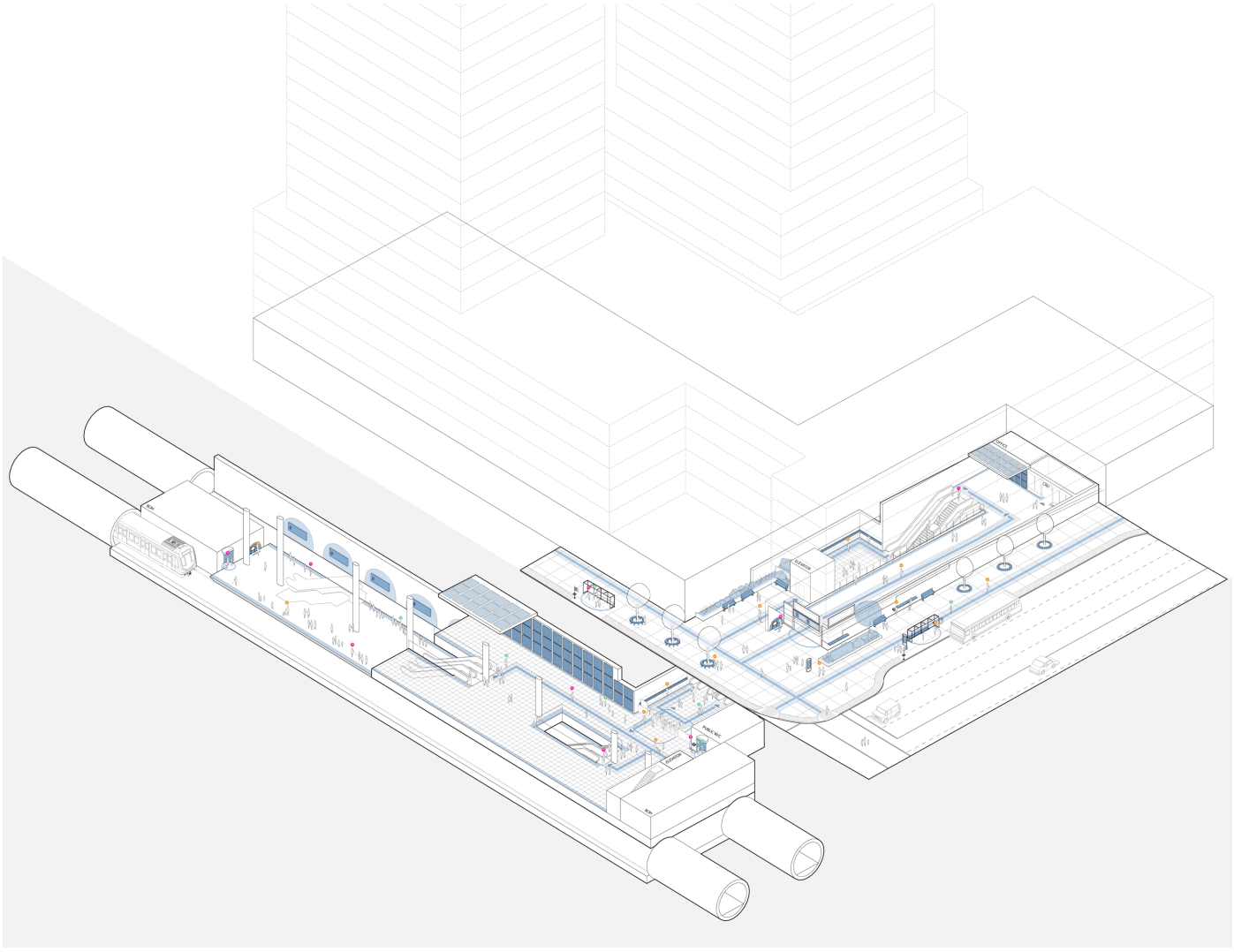
DESIGN SCENARIO

DESIGN SCENARIO

PROPOSED DESIGN INTERVENTIONS INTEGRATED INTO A TYPICAL DESIGN SCENARIO

THE SCENARIO

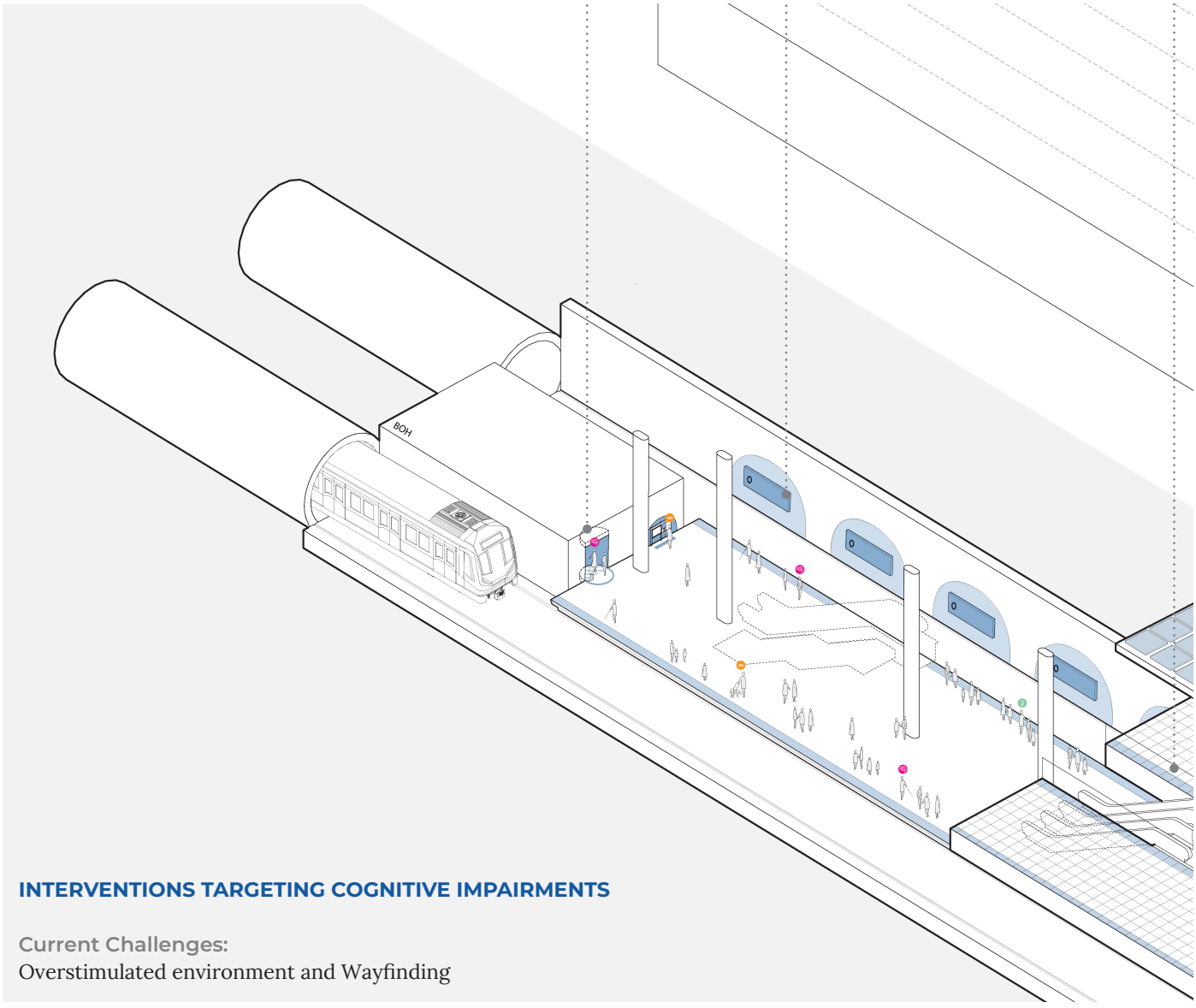
The following conceptual scenario of a typical transit station design integrates the proposed interventions from the design toolkit. It is important to note the intersectional value of multiple interventions that serve benefits to multiple impairments, in addition to that of improving the quality of a public space.



Signage paneling
with large, symbol-based station details that improve station wayfinding, and a
Color scheme
with careful selection that contributes to a more calming environment

Temporary escape
allows to remove oneself from over-stimulated environment, with
Acoustic panels
to mitigate the soundscape within the escape

Corridor tiling
encloses the ground plane visually



INTERVENTIONS TARGETING COGNITIVE IMPAIRMENTS

Current Challenges:
Overstimulated environment and Wayfinding

Signage paneling
with larger, lower station titles that are reliably visible from within a train

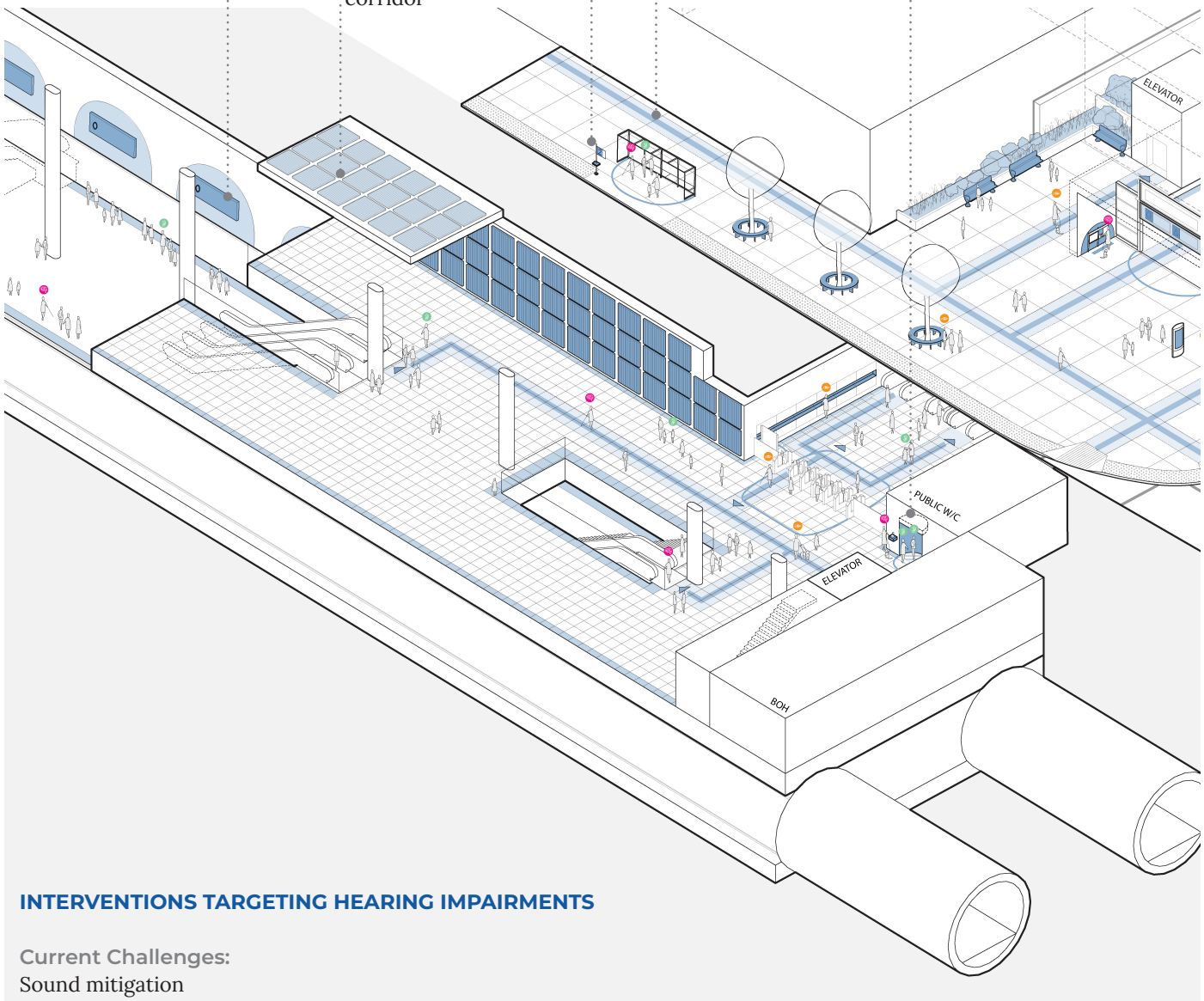
Pedestals
allow users to depose accesories and continue signage conversations

Temporary escapes
provide spacing that can be accessed for uninterrupted sign language within a crowded area

Acoustic panels
situated along walls and ceiling help mitigate the soundscape along a crowded, echo-prone corridor

Obstacle clearance
of minimum 1.8m along direct routes

Color scheme
supports the lighting of the environment, allowing proper contrast when using sign language



INTERVENTIONS TARGETING HEARING IMPAIRMENTS

Current Challenges:
Sound mitigation

Floor signage add visual cues along additional planes

Sensory planting within planter boxes frame the street entry

Demarcation strips visually and physically mark important spaces, especially relevant for cane-users

Corridor tiling presents a consistent pattern throughout the station, framing the floor and contrasting with other planes

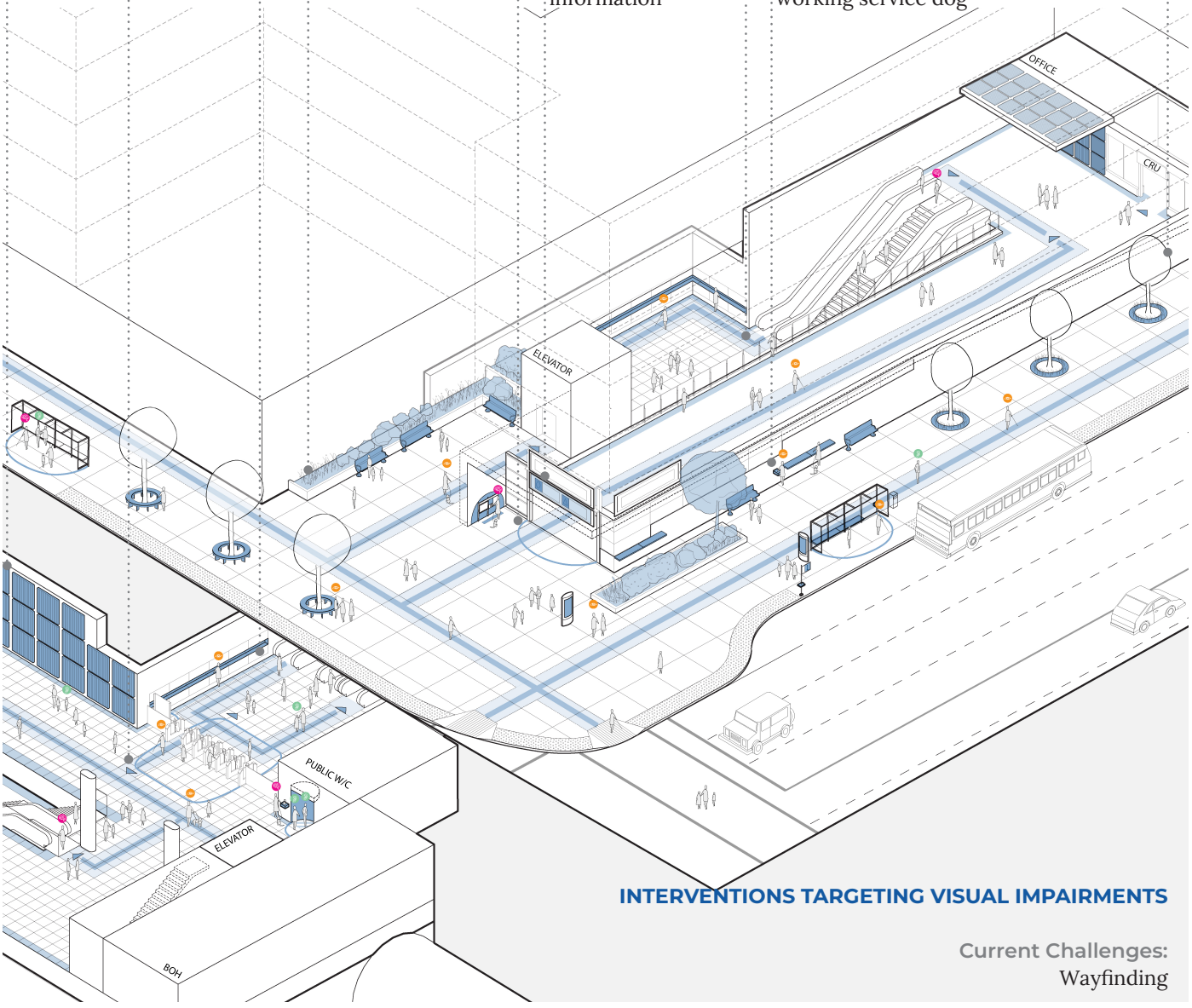
Street trees with controlled root growth, and protected by hard and soft barriers, like seating and soft landscape edges

Acoustic paneling serve a warm color scheme and additional tactile wayfinding along walls

Tactile paneling along walls, with a consistent pattern, lead to a specific platform

Signage paneling uses anti-glare technology, along with integration of Braille and tactile information

Pedestals allow users to depose accessories, whether it be to free a hand from a cane or to help manage working service dog



INTERVENTIONS TARGETING VISUAL IMPAIRMENTS

Current Challenges:
Wayfinding

CONCLUSION

RECOMMENDATIONS AND TAKEAWAYS BASED ON THE BACKGROUND REVIEW AND PROPOSED TOOLKIT

This proposal demonstrates the conceptual implementation of a design toolkit aimed at creating more inclusive transit stations for users with visual, hearing, or cognitive impairments. By **enhancing the physical and psychological well-being** of all users, the proposal underscores the **significant value that accessibility enhancements add to public spaces**. Given the urgency of climate change and the need to promote public transport usage, these improvements are extremely pertinent.

PROJECT METHODOLOGY SUMMARY

The study began with a comprehensive review of existing guidelines, plans, and policies, revealing significant gaps in addressing the full spectrum of disabilities. While mobility impairments were generally well-considered, others—particularly visual, hearing, and cognitive impairments—received less attention. This gap informed the development of the design toolkit, which focuses on addressing these overlooked areas.

The toolkit's interventions were supported by the findings of an analysis of five transit stations, guided by an adapted model of the Pedestrian Hierarchy of Needs. This analysis identified key issues related to comfort, convenience, and safety for users with various impairments. The overall findings informed the conceptual scenario design, which is intended to serve as a foundational framework for future upgrades and ongoing enhancements to transit station design.

THE TOOLKIT'S ULTIMATE GOALS

The toolkit addresses identified gaps in accessibility through targeted interventions tailored to specific impairments:

- For **visual impairments**: Interventions include enhanced visibility through contrast adjustments and glare reduction, alongside improved **wayfinding** strategies catering to varying degrees of visual impairment.
- For **cognitive impairments**: Measures focus on reducing **sensory stimuli**, particularly through acoustic interventions, supplemented by improved wayfinding to enhance comfort and independence during travel.
- For **hearing impairments**: **Acoustic environments** are optimized to mitigate challenges related to hearing impairments, ensuring clear communication spaces.

These interventions facilitate easier navigation and interaction within transit stations, accommodating the needs of diverse users. By implementing these recommendations and continually monitoring their impact, transit stations can evolve into spaces that promote accessibility, comfort, and sustainability for all users.

MOVING FORWARD WITH THE TOOLKIT

- The selection of design interventions should not be governed by a single factor. It demands a **holistic, community-based approach** that prioritizes feedback from local residents and accessibility experts.
- The toolkit's flexible structure emphasizes the importance of **engaging a broad spectrum of stakeholders**—including residents, community organizations, local authorities, and accessibility experts—in the design process to ensure inclusivity and effectiveness.
- **Incorporating lived experiences** into decision-making will also ensure that interventions are tailored to meet diverse needs effectively. The proposal and assessment of each design typology with the design toolkit aims to provide a **foundational framework** for future upgrades and the ongoing enhancement of transit station design.

GETTING STARTED WITH THE TOOLKIT

- **Choosing Projects**: To initiate specific implementation of accessibility enhancements, prioritize the first initiatives that **hold greater impact potential** for both the **general public and specific impairments**. Prioritize interventions that apply to multiple impairments and typologies that can serve various types of users. **Gaining positive momentum and feedback** is a strong starting point before moving into micro, smaller-impact interventions that remain important to specific groups.
- **Pilot Projects:** Implement interventions as pilot projects to test their performance and gather user feedback. This approach allows for adjustments before full-scale implementation. A potential strategy could be to combine **low- and high-cost interventions on micro and macro scales** into a **singular initiative**.
- **Performance Monitoring:** This can help understand user satisfaction and rate the accessibility improvements. Improvements can be integrated into **regular station upgrades** or conducted by **dedicated teams** to prioritize a simple implementation process. Interventions with specific targeted improvements, rather than broader applications, can be implemented according to **specific demand and community needs**.
- **Integration into Upgrades:** Improvements can be integrated into the regular station upgrades, or conducted by single action teams, as to prioritize a simple implementation process.

RECOMMENDATIONS AND REFLECTIONS

The selection of design interventions should not be governed by a single factor. It requires a holistic, community-based approach that prioritizes feedback from local residents and accessibility experts. Incorporating lived experiences into decision-making will ensure that interventions are tailored to meet diverse needs effectively. The recommendation is to use a **minimum of three mixed interventions per station**, each addressing at least **two different impairment areas**. For instance, an intervention like the acoustic paneling or temporary escape demonstrated high potential for benefits to a variety of impairments, in addition to benefiting the broader public.

Given that approximately 125,000 people in Vancouver have visual impairments, 200,000 have hearing impairments, and 50,000 to 75,000 have cognitive impairments, implementing these strategies could benefit thousands of users at a single station and tens of thousands across all stations in Vancouver. These improvements would make transit systems more inclusive and effective for all users. (Accessibility Standards Canada)

THE SYSTEMIC ISSUE

The **disparity in attention** given to different disability types in design guidelines highlights a **systemic issue in urban planning and architecture**. Bridging this gap demands concerted efforts from academia, researchers, and industry professionals to develop and implement universal design standards that foster truly inclusive public spaces.

It is crucial to recognize that what may appear as principles for **comfort** to some users are fundamentally principles of **convenience and safety for others**. By continuing to redefine standards for the design of public spaces in transit stations, we can progress towards a future where everyone, regardless of ability, feels welcomed and empowered to use public transportation. This holistic approach not only **enhances accessibility** but also promotes community **integration and equity**, ensuring that transit systems serve all members of society effectively and inclusively. In this way, the interventions of the design toolkit represent not only enhancements to transit stations, but also opportunities for **investment in the quality of public spaces**. As they come together in the schematic design scenario, we can envision a public space that can be safe, convenient, and comfortable for a broader spectrum of transit users.

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