

HEALING THROUGH MOVEMENT

by Lauren Stoymenoff

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PROLOGUE

One day everything changed.

A new person invaded your body and began taking control.

You gradually came to realize that you **could not move** the way you once did; you had **lost control** and understanding of your emotions; you saw the world through blurred and unfocused eyes.

For years you chased after the old you, but could never catch hold.

Now, looking in the mirror you see the person you once were, but know that the old version of yourself is gone forever.

This is acquired brain injury (ABI).

It can happen to anyone, at anytime. ABI comes fast, but leaves slowly – most often opting to stay for life.

“The brain is the one organ through which we understand everything.” - Ian Ritchie

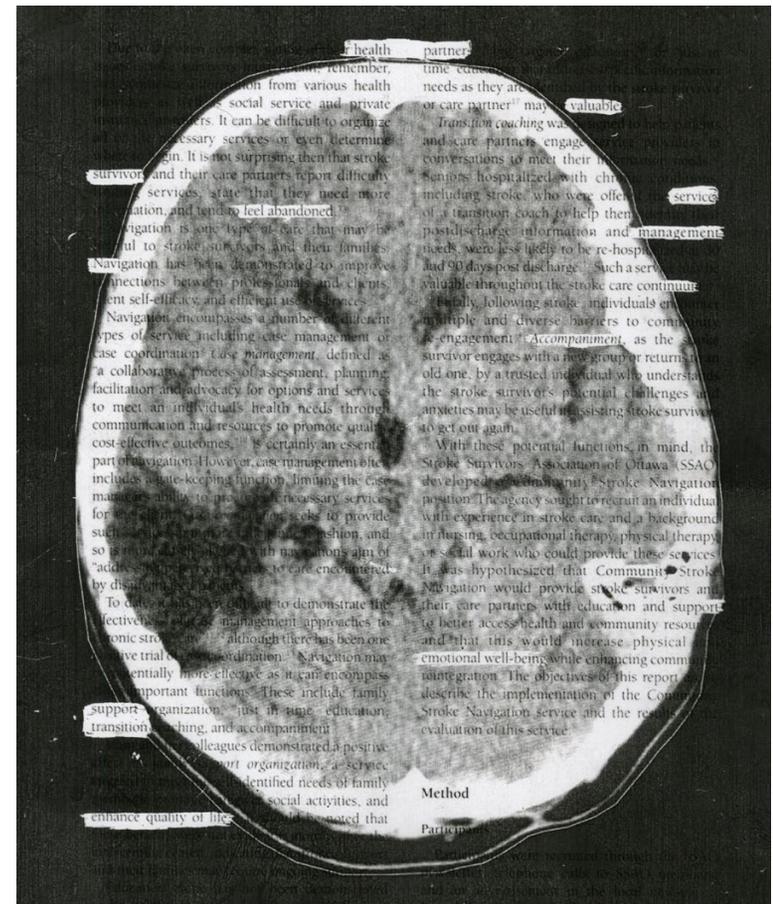


Figure 01: The Damaged Brain

ABSTRACT

Acquired Brain injury (ABI) is often referred to as the Silent Epidemic – as it is currently a leading cause of death and disability worldwide.¹ With an estimated 1.5 million Canadians currently living with the effects of ABI,² this thesis asks how architecture can contribute to the recovery of ABI survivors.

Increasingly, movement is being recognized as a rehabilitation tool that is linked to measurable physical, emotional and cognitive benefits. With this in mind, this thesis offers design ideas for the new rehabilitation centre proposed for the Ottawa region that focus on the theme of movement. Strategies to improve patient mobility are presented that address how people navigate a building, what supports they need to assist with their journey, and how circulation systems and design elements can serve as rehabilitation tools. To this end, the proposed design includes: multi-sensory navigation cues, expanded handrail systems, rest points and healing gardens.



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To my amazing friends in Ottawa and Toronto, thank you for all of the positivity, laughter and support that you bring to my life. I am so fortunate to have such wonderful networks of inspiring ladies.

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00 INTRODUCTION

As defined by the World Health Organization, Acquired Brain Injury (ABI) is “an injury to the brain which is not hereditary, congenital or degenerative.”³ With approximately 2,500,000 cases of ABI diagnosed worldwide each year, it is currently a leading cause of death and disability.⁴

Within Ottawa and the surrounding region, all moderate to severe cases of ABI are directed to the Ottawa Hospital's Rehabilitation Centre (TOHRC), which is unable to provide the best of care due to spatial constraints and a host of other issues concerning the facility and site.

In light of the current challenges faced by TOHRC, stakeholders are proposing the construction of a new facility aligning with the incoming Civic Hospital Campus. This thesis offers design solutions for the new rehabilitation centre – proposing ways

by which architecture can play an active role in the recovery of patients.

The proposed design will focus on the theme of movement and its relationship to architecture. Movement is a vital component of many forms of rehabilitation – offering an array of measurable physical, emotional and cognitive benefits to patients. While its advantages are far-reaching, movement is often restricted to formal therapy spaces and scheduled sessions. In an attempt to expand the role played by mobility in healthcare settings, this thesis will look at how people move through the building. It will focus on how building users find their way, what supports are needed to assist with their journey, and how circulation systems and outdoor spaces can serve as informal rehabilitation tools.

The proposed wayfinding system borrows from the redundancy that exists within the brain to facilitate neurological repair and relearning after damage to the brain. Mimicking this redundancy, the wayfinding system will provide overlapping navigational cues – offering different sensory stimuli to appeal to a broad spectrum of users with unique abilities and challenges. To further support the varied needs of building users, this thesis looks at what accessibility provisions are needed to promote and inspire increased movement. Finally, it evaluates how interior and exterior architectural spaces can be designed for use in both formal and informal rehabilitation. If achieved, each journey a patient takes within the building is moving them towards the ultimate goal of recovery.

01 THE INVISIBLE DISABILITY

There are two forms of ABI: Traumatic Brain Injury – caused by an external event such as a fall or a car accident, and Non-Traumatic Brain Injury – an internal injury to the brain itself such as a stroke or brain tumour. While brain injuries can happen to anyone, they are particularly common amongst males and younger people – with men being twice as likely to sustain an ABI.

In Canada alone, approximately 160,000 people sustain acquired brain injuries each year⁵ - a rate far greater than that of all known cases of Spinal Cord Injuries, HIV/AIDS, and Breast, Lung, Prostate and Ovarian Cancers combined.⁶ These rates do not include concussions (mild traumatic brain injuries), which account for an additional 400,000 cases per year in Canada.⁷ In spite of its prevalence, ABI receives far less funding nationally than any one of those aforementioned diseases and injuries.⁸

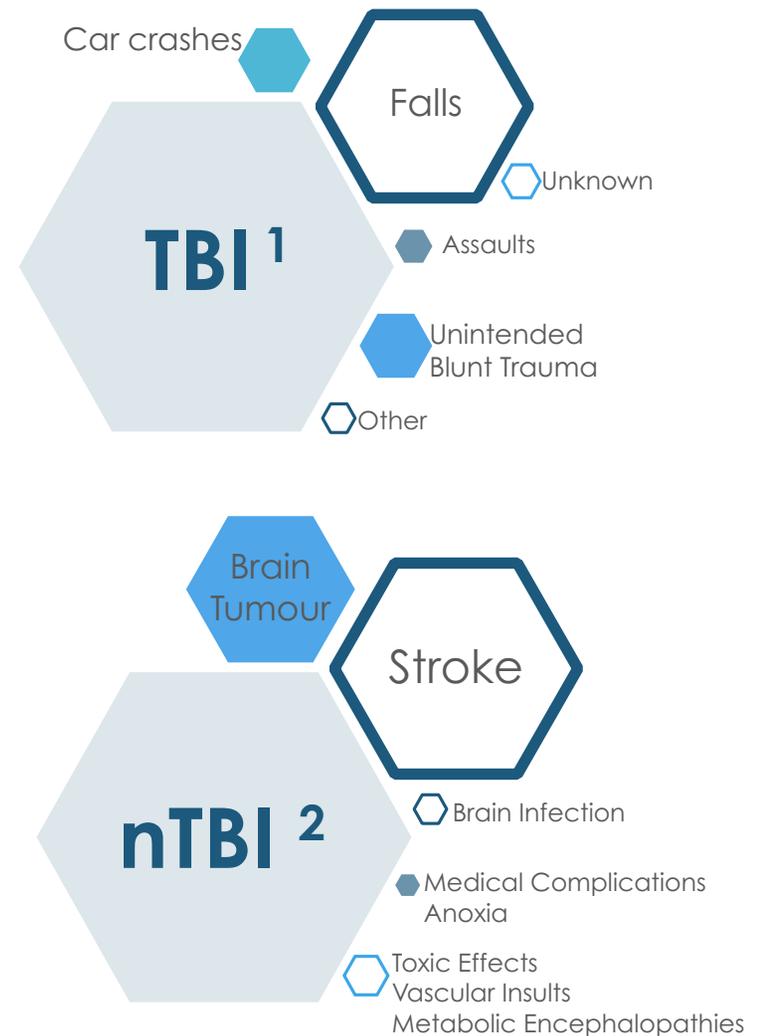


Figure 02: Common causes of Acquired Brain Injury

males are **2x** more likely to sustain a brain injury than females ⁶




every 3 minutes someone in Canada suffers an Acquired Brain Injury. ¹



every 1.25 minutes someone in Canada is diagnosed with a Concussion. ⁷



every 10 minutes someone in Canada suffers a Stroke. ⁴

18,000 Ontarians sustain ABI each year



160,000 CANADIANS ACQUIRE A BRAIN INJURY each year²

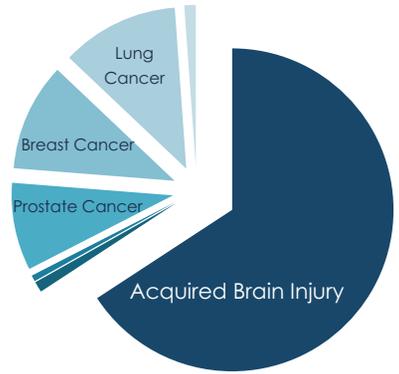
50,000 CANADIANS SUFFER A STROKE each year⁴

2,500,000 PEOPLE GLOBALLY ACQUIRE A BRAIN INJURY EACH YEAR³

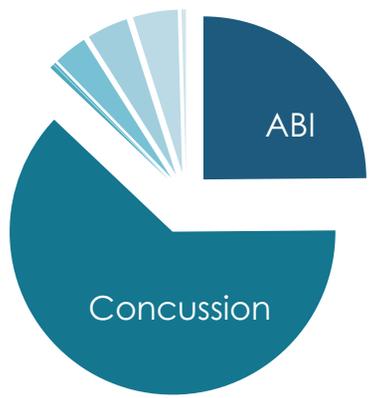


estimated **1.5 million** Canadians living with ABI¹

400,000 CANADIANS WITH DIAGNOSED CONCUSSIONS each year⁴



- Acquired Brain Injury
- HIV/Aids
- Spinal Cord Injury
- Prostate Cancer
- Breast Cancer
- Lung Cancer
- Ovarian Cancer

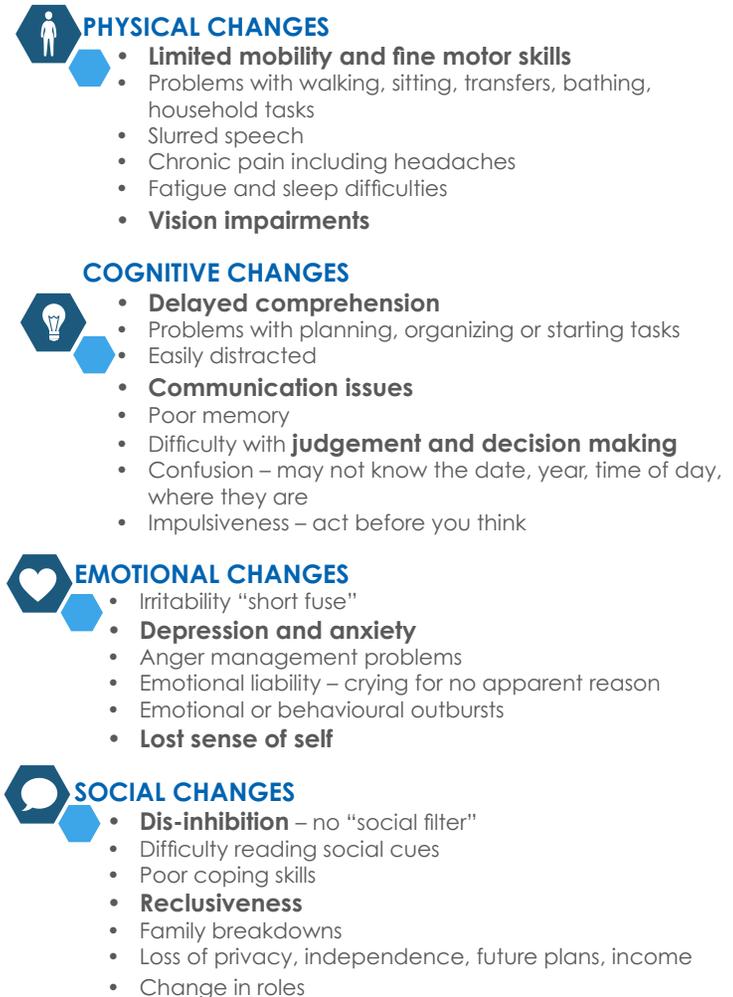


- Acquired Brain Injury
- Concussion
- HIV/Aids
- Spinal Cord Injury
- Prostate Cancer
- Breast Cancer
- Lung Cancer
- Ovarian Cancer

Figure 03: Prevalence of Acquired Brain Injury

While the statistics are staggering, they do not provide a picture of what brain injury truly means to the victim, their family and their friends. ABI can change the way a person thinks, feels, moves, talks and behaves. Every survivor has a unique set of functional changes based on the areas of their brain that are damaged (Figure 04). ABI is often referred to as an invisible disability because many of the resulting impairments are not immediately apparent.

Figure 04: Common deficits and challenges faced by survivors



Recovery from many of these hardships is possible, but occurs over long periods of time. The most significant improvements take place over the first year; however it is common for small progress to be seen throughout the survivor's lifetime. Sadly, some people are not as lucky – with approximately 22% of catastrophic brain injury survivors never leaving their homes.⁹

Given the lengthy recovery rates, it is estimated that 1.5 million Canadians are currently living with the effects of ABI.¹⁰ I personally have an acute understanding of the challenges resulting from ABI, because in 2011, I became one of these statistics.

There are several stages of treatment for brain injury survivors, aligning with the different phases of

recovery. Figure 05 documents the various points of care that survivors might enter as they move through the care continuum within Ottawa. The journey typically begins at a hospital's emergency department. From there, patients are admitted to structured rehabilitation—first in Inpatient Rehabilitation (IR), and then in Complex Continuing Care (CCC) or Outpatient Programs. Once discharged, transitional services are available through the hospital network and ongoing community-based supports.

The time that a patient needs in each stage differs based on the severity of the injury as well as on limits imposed by the Ontario Ministry of Health. This chapter will look at Ottawa as a case study to further explain current ABI treatment systems.

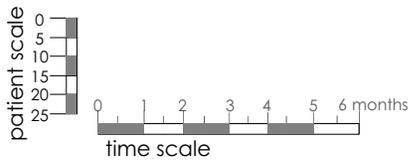
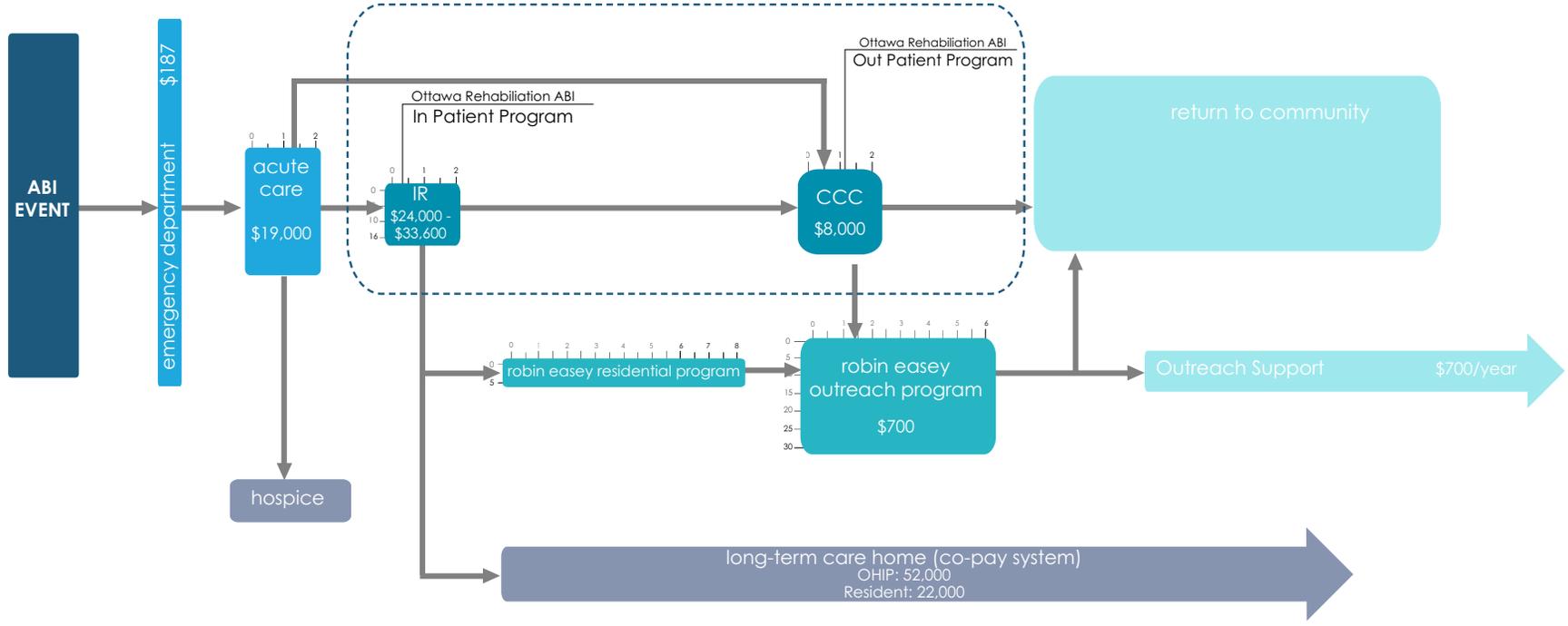
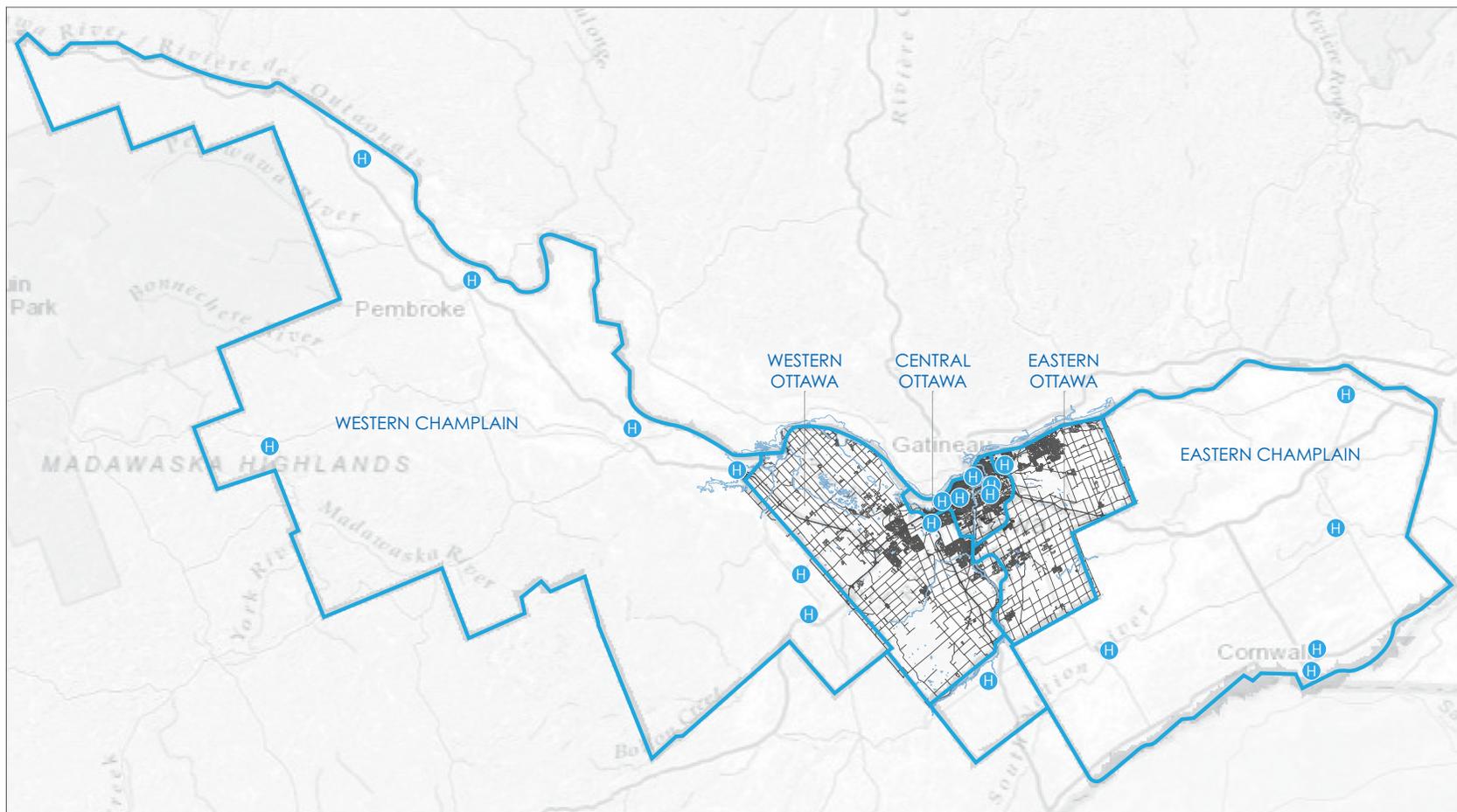


Figure 05: Care Continuum
 The length of the bars in the graph above shows the typical length of stay (LOS) at each stage. The height indicates the number of patients that can be cared for at a given time. The annual cost per patient in Ontario is also listed.

The healthcare system in Ontario is divided into Local Health Integrated Networks (LHINs). Ottawa is part of the Champlain LHIN, which represents a large portion of eastern Ontario.

Figure 06: Champlain LHIN subregions and hospitals



HOSPITALIZATION

In almost all cases, a patient will first enter the ABI care continuum through a visit to a hospital's emergency department. After diagnoses, they will be transferred to acute care.

IN & OUT PATIENT REHABILITATION

Once discharged from acute care at one of the hospitals, patients are transferred to the Rehabilitation Centre at the Ottawa General Hospital. Here, they enter inpatient and outpatient programs that work on retraining survivors in Activities of Daily Living (ADLs).

While the Ottawa Hospital Rehabilitation Centre (TOHRC) services all cases of Acquired Brain Injury in the LHIN, the inpatient ABI program only has the capacity to care for ten patients at a time, with a supplementary five beds available for a behavioural program. With over 1.3 million residents in our LHIN,¹¹

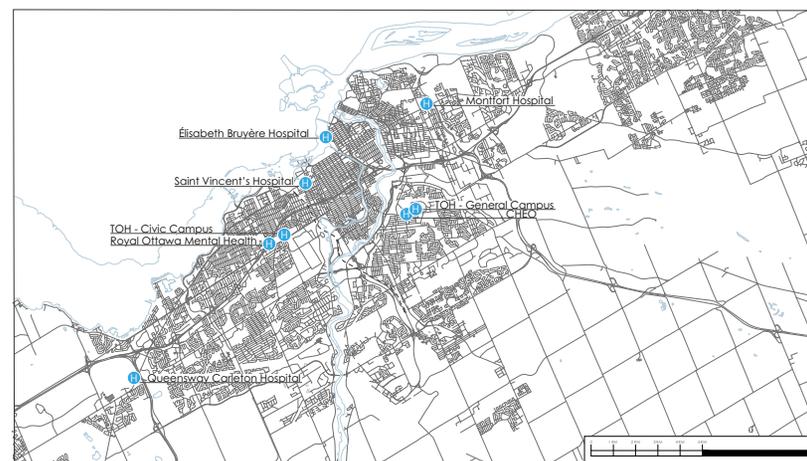


Figure 07:
Hospitals within Central Ottawa

TOHRC is not able to meet community demands, resulting in patients being forced to wait up to two months before accessing these vital services.¹² In this time, patients are discharged home, where they are left to learn about, and cope with, the devastating effects of their injury. More importantly, these survivors are losing their optimal healing window¹³.

Recovery after a brain injury happens in two phases: spontaneous recovery and training induced recovery (compensation). Spontaneous recovery takes place within the first three to six months after an ABI. While it occurs in the absence of rehabilitation, it benefits significantly from overlap of training induced recovery.¹⁴ Capturing this window of healing can be critical for later stages of rehabilitation and can have long-term impacts on a patient's quality of life.

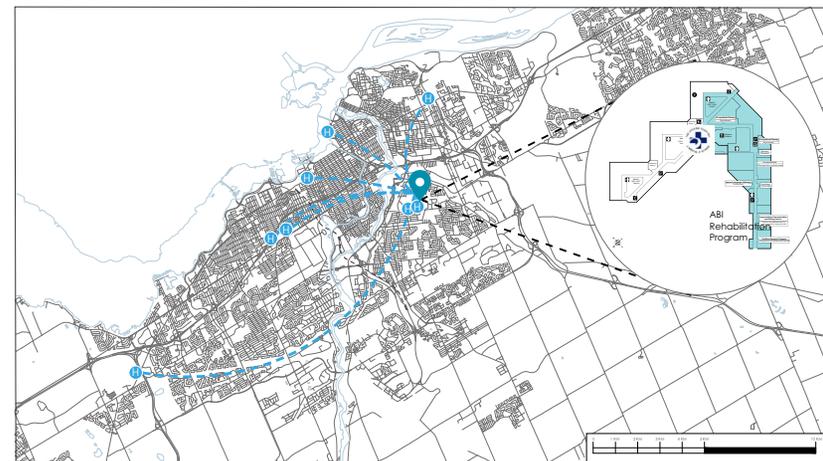


Figure 08:
TOHRC at the General Campus

TRANSITIONAL CARE

Beyond TOHRC, the Ottawa Hospital offers a unique transitional service through the Robin Easey Centre (REC). Camouflaged into a residential neighbourhood in Ottawa's west end, this centre equips patients and their families with the skills, experience and information needed to help with the transition back to community living.

The centre's services include a residential program where patients live on site and receive further training in Instrumental Activities of Daily Living (IADLs), as well as an outreach program where clinical staff members meet with survivors at their homes or in the community. REC also hosts support groups for family members and survivors at varying stages of recovery. For referrals made from outside of The Ottawa Hospital, wait times for these services are typically 6 months.



Figure 09:
The Ottawa Hospital's Robin Easey Centre

LONG-TERM CARE

For survivors whose injuries result in severe functional deficits and who are unable to return to the community, options for long-term care are limited. There are only two care centres in Ottawa that offer long-term care specific to ABI survivors, amounting to a combined total of ten available beds.

Since patients occupy the beds for the remaining years of their lives, the wait times are typically between 10 and 20 years. While waiting, patients with a dedicated caregiver can remain at home. Otherwise, survivors enter retirement homes where they can receive the ongoing supports they need – albeit in a context that may be misaligned with their demographic.¹⁵ In these cases, patients often feel isolated and alone, and do not have access to programs to aid in the recovery from, or adaptation to, their injury.

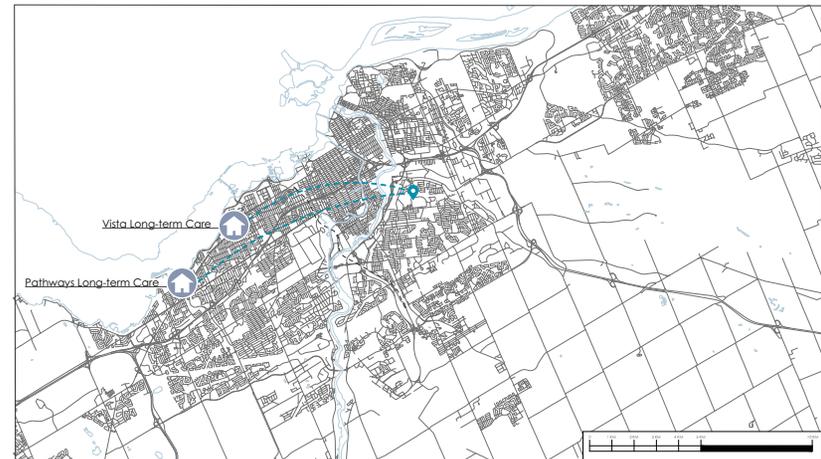


Figure 10:
Long-term care for ABI survivors within Central Ottawa

ON-GOING CARE

For survivors who are able to return to independent living, there are outreach support programs available across the region. These community-based organizations provide a range of services including: support groups, mindfulness training, individual assistance with ADLs, employment services, and more.

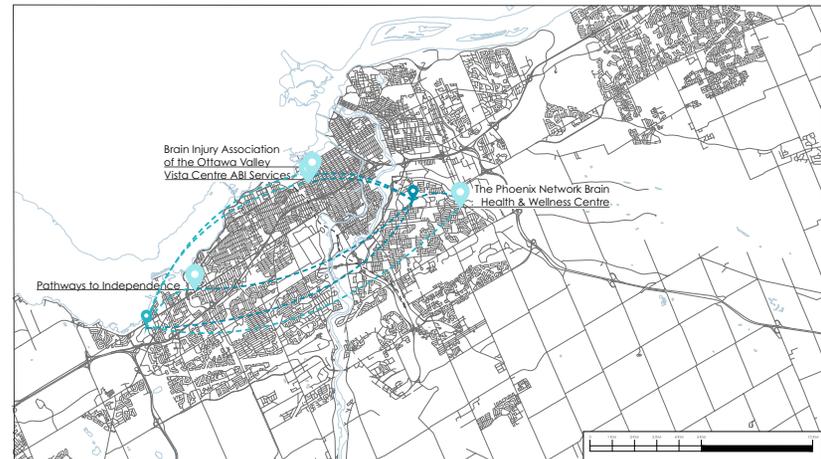


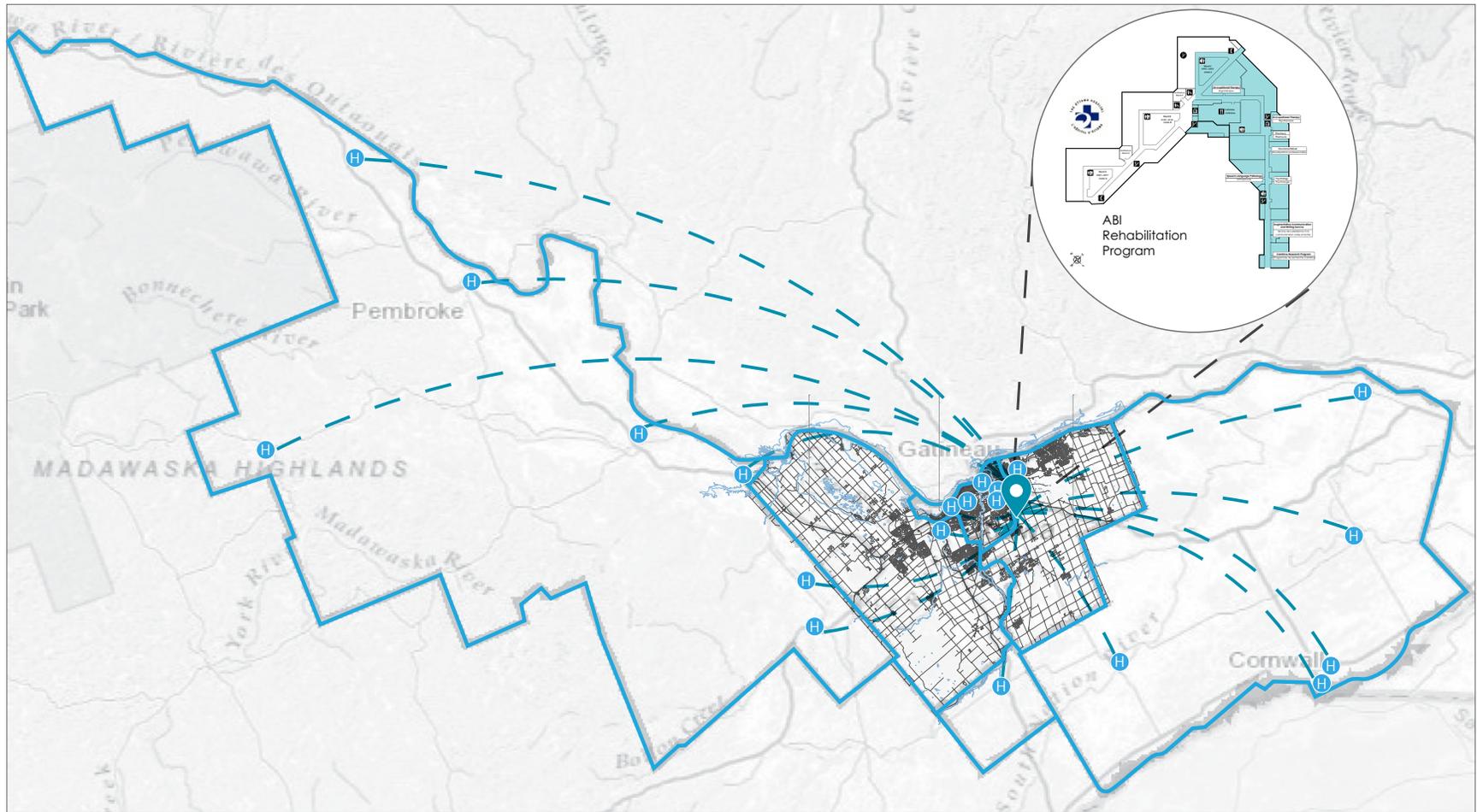
Figure 11:
On-going care for ABI survivors within Central Ottawa

02 A CENTRE FOR RECOVERY

Of the aforementioned treatment phases, this thesis will focus on the structured in and out patient programs offered by the Ottawa Hospital Rehabilitation Centre (TOHRC). As described in the previous chapter, TOHRC services all cases of Acquired Brain Injury in the Champlain LHIN. The ABI program is only one of the many care streams offered by the Rehabilitation Centre. Other care streams include: Locomotor and Neuromuscular Care, as well as an array of specialty services including on-site prosthetic and orthopaedic production, and a cutting-edge Rehabilitation Virtual Reality (RVR) Lab. The goals of the rehabilitation centre in all of the care streams are consistent: to return patients to community living, to aid in the re-learning of skills of everyday living, and to help them adapt to potential new challenges.

Following Page: Figure 12:

Map showing the catchment area for The Ottawa Hospital Rehabilitation Centre



While TORHC offers valuable services to our LHIN, its site and built form lead to notable limitations. When the building opened in 1981, its design was commended for incorporating a number of innovative features for the time. Over the years, TOHRC's programs have evolved and the population of the Champlain LHIN has grown. As a result, the centre's spatial requirements now exceed the building's capacity – often causing long wait times for essential services. Added to this is the building's overall layout. After entering through the dark and difficult to find main entrance (figure 13), patients, visitors and staff consistently find the space disorienting.¹⁶ Unclear navigation is detrimental in this context because “patients and visitors experience stress upon entering a [healthcare facility] and their sense of being lost amplifies stress.”¹⁷



Figure 13:
TOHRC Main
Entrance



Figure 14:
TOHRC corridor off
of the main lobby

Beyond the deficiencies within the building itself, its site is disadvantageous. Being located at the car-centric General campus (figure 15), TOHRC is difficult to access by public transit, walking, or cycling. The large campus is situated in a residential community, devoid of commercial and community amenities. This isolation prevents certain clinical practices aimed at the reintegration of patients into community life.

In light of these issues, the Ottawa Hospital network (TOH) is proposing the relocation of the Rehabilitation Centre to the incoming Ottawa Civic Hospital campus.¹⁸ By constructing a new facility, aligned with the '21st-century hospital', TOHRC can increase its capacity to satisfy community demands, and can update the building, the medical equipment and the systems of care to meet new health care

standards. Maintaining a close proximity to a hospital is also an important consideration in relocating the Rehabilitation Centre. As the region's only trauma centre, with a range of specialty programs such as cardiac, neurosurgery, stroke and vascular surgery,¹⁹ the Civic Hospital campus is an ideal candidate to host TOHRC.

Another key advantage to the proposed relocation is the chosen site's character and the qualities of its surroundings. The new campus is set to occupy the Sir John Carling site across from the existing Civic campus. The site's adjacency to the Dominion Arboretum, Dow's Lake and the Experimental Farm provides access to great outdoor recreational amenities, while its close proximity to Ottawa's Little Italy offers key community and commercial services. The close access to these amenities is advantageous

for the reintegration of patients into community living, as well as, offering beneficial services to all building users. Most importantly, the site is located across from an LRT station and along major public transit, pedestrian and cycling corridors – making it easily accessible by all.

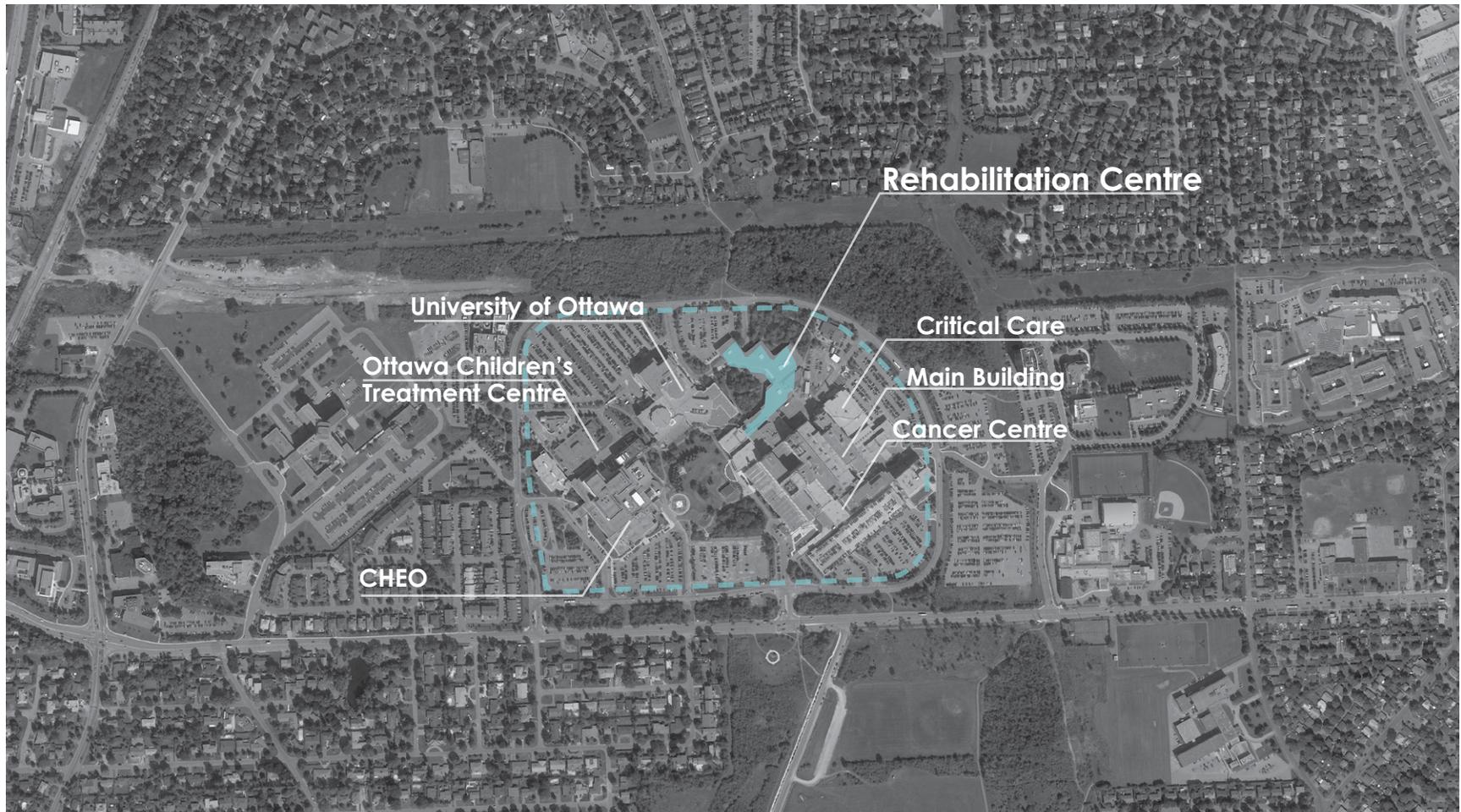


Figure 15:
The Ottawa Hospital - General Campus



Figure 16:
Context map showing the sites of the Ottawa Hospital's new and existing Civic Campuses

03 HEALING THROUGH MOVEMENT

While this thesis will surround the creation of a new Rehabilitation Centre, it will not attempt to tackle its complete redesign. That is something better suited for an experienced firm, working in collaboration with building users, key stakeholders and the community at large. Instead, this thesis will focus on one theme of the design – that of movement. It will look at movement through three questions: how do patients, visitors and staff find their way through the building? How can architecture support and inspire movement? And, how can the built environment serve as an informal rehabilitation tool?

Movement is a key element of many forms of rehabilitation including: physiotherapy, occupational therapy and vocational rehabilitation. Almost everything we do involves movement to a certain extent, be it walking, cooking, eating, speaking, or

writing. In spite of its far-reaching impacts, movement in rehabilitation is often isolated in dedicated rooms and scheduled sessions. In facility design, emphasis is typically placed on these assigned, enclosed spaces, with little attention paid to the connective systems. An analogy can be made here between the body and the building; where programmed rooms can be seen as major organs and the system of corridors and stairways can be equated to the connective tissue of the body. The dedicated functions performed by our organs are essential to our health and wellbeing, but would not be possible without the necessary connective tissue that supports them. It is recommended that circulation account for a minimum of 32% of the gross floor area (GFA) of a Rehabilitation Unit.²⁰ Elevating the status of the circulation systems could allow architects to harness

the untapped potential of these spaces.

Beyond contributing to physical rehabilitation, can circulation spaces support the morale of building users? The atmospheric qualities of a path have the potential to inspire patients to emerge from their rooms and engage in activity. By facilitating moments of rest, interaction, reflection, and gaze along the path, circulation spaces can positively impact the mental wellbeing of patients.

Before delving into design considerations pertaining to the circulation paths, it was first necessary to establish a base building program to work from. To begin, a site was selected within the 60 acres dedicated to the new Ottawa Civic Campus. For this thesis, the Rehabilitation Centre will occupy the northeast point of the campus at the corner of Preston Street and Carling Avenue.

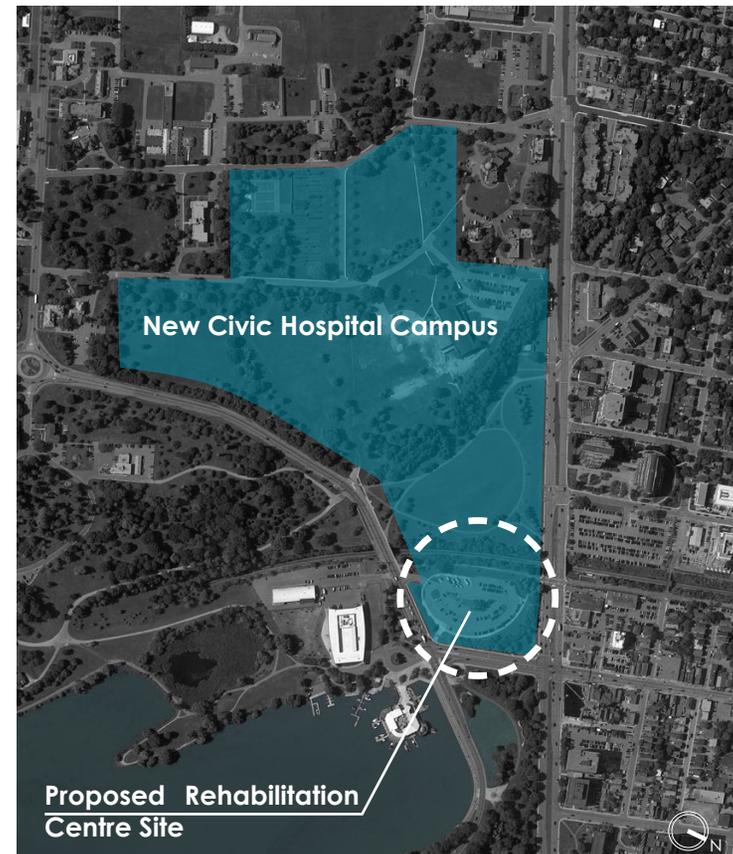


Figure 17: New civic hospital campus site with proposed rehabilitation centre location.



Figure 18:
View to Northwest corner of proposed site.



Figure 19:
View to Northeast corner of proposed site.



Figure 20:
View to Southeast corner of proposed site.



Figure 21:
Site analysis of proposed location of new rehabilitation centre.

This is a desirable location due to its direct access to the transportation and commercial amenities along Carling and Preston, as well as to the outdoor recreation offered by Dow's Lake and Commissioner's Park.

Being located directly across from the Carling LRT station and along well-serviced bus corridors is essential for providing outpatients, staff and visitors with transportation options to help them get to and from the centre. The short walk to Preston Street's commercial amenities is also advantageous, as it provides the opportunity for inpatient outings during therapy sessions, as well as offering desirable services to all building users. Beyond the recreation options offered by Dow's Lake and Commissioner's Park, these spaces provide attractive views from within the centre.



Figure 22:
Dow's Lake



Figure 23:
Commissioners Park



Figure 24:
Dominion Arboretum

With the site selected, the next step was to understand the programmatic needs of the rehabilitation centre. This began by looking at the existing centre and its spatial breakdowns (figure 17). A general massing was then developed using insight from the existing TOHRC, as well as a set of guiding principles gathered through a combination of new ministry standards, LEED for Healthcare recommendations, and discussions with clinical staff.

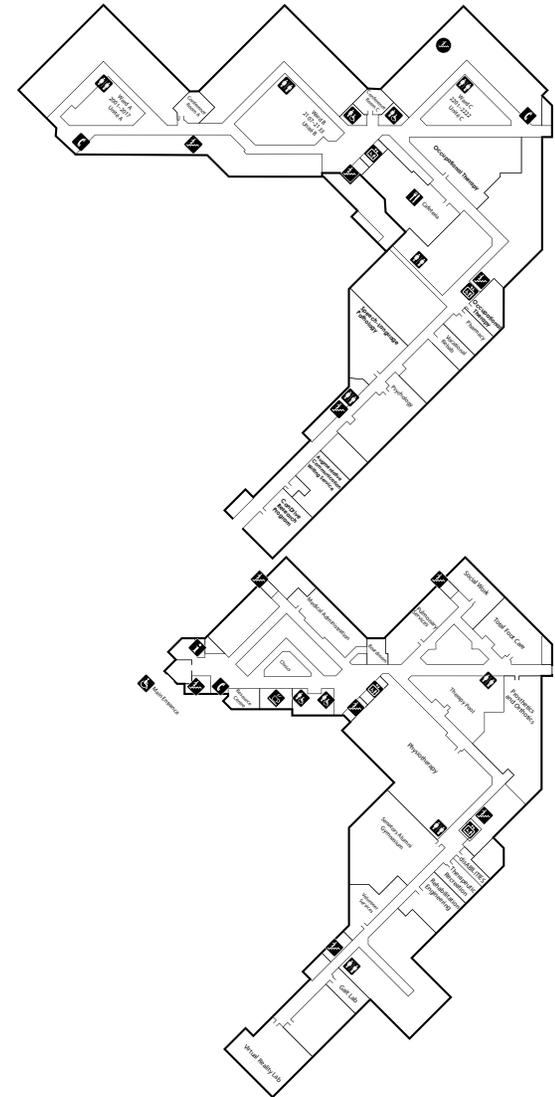
One key guiding principle is the shift from a departmental model where clinical disciplines are isolated, to a centralized model where disciplines are integrated within each care stream or program.²¹ The centralized model is beneficial in that it reduces travel distances for patients that may suffer from mobility issues. Also, having program teams together allows for informal communication between different

disciplines – resulting in a more comprehensive understanding of patients' health.²² Another significant shift in ministry standards is the requirement for single rooms, as opposed to the doubles, or quads, which exist in the current Rehabilitation Centre. While this practice is primarily aimed at reducing the spread of infections and contaminants, it has the added bonus of providing a quieter, more peaceful space that invites visitors to spend more time with patients.

Following Page: Figure 25:
TOHRC- Existing Building Breakdown

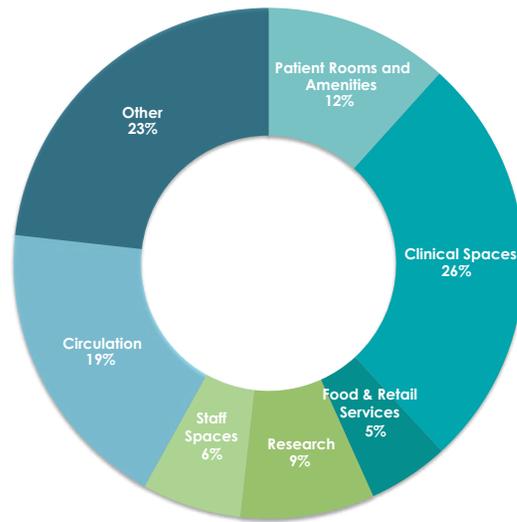
FACILITY BREAKDOWN (m²):

Main Entrance + Information	140	Pulmonary Services	170
Café/Shop	45	Social Work	130
Admissions	163	Psychology	245
Medical Administration	240	Therapeutic Recreation	70
Physiatrist Offices/Clinic	254	Shared OT Space	375
Conference Rooms	107	Vocational Rehabilitation	200
Boardroom	33	Speech Language Pathology	508
Offices and Staff Lounge	300	Augmentative Communication	215
Volunteer Service + Snack bar	120	Physiotherapy-Conventional Spaces	122
disAbility Awareness Program	37	Physiotherapy-Gym	292
Resource Centre	42	Physiotherapy-Weight Room	109
Pharmacy	75	Therapy Pool	251
Patient Rooms & Amenities - A	533	Foot Care	205
Patient Rooms & Amenities - B	523	Prosthetics & Orthotics	387
Patient Rooms & Amenities - C	507	Research Gait Lab	230
Indepent Living Unit	86	Research VR Lab	226
Food Services Kitchen	167	Rehabilitation Engineering	138
Cafeteria	280	CanDrive Research Program	155
		Driving Assessment	315



CURRENT CARE STREAMS:

- ACQUIRED BRAIN INJURY**
- inpatient program
 - outpatient dayprogram
 - behavioral rehabilitation service
- LOCOMOTOR CARE**
- including amputees, respiratory conditions, chronic pain and complex orthopaedic conditions
- NEUROMUSCULAR CARE**
- including ALS, MS, CerebralPalsy and spinal cord injuries
- SPECIALTY SERVICES**
- including prosthetics and orthotics, total foot care, driving rehabilitation and the Augmentative Communication and Writing Service



Other principles guiding the layout of the proposed Rehabilitation Centre relate to sustainable initiatives. Sustainable design has become a key concern within the healthcare industry, with the World Health Organization arguing that, “climate change is the greatest global health threat of the century.”²³ This worry is echoed by the Canadian Medical Association who has held a “long-standing concern about the impact of climate change on health.”²⁴

In light of the risks associated with environmental degradation, healthcare standards have begun incorporating sustainability measures, including the ministry requirement for new healthcare facilities to be able to accommodate community needs for at least 100 years. To accomplish this, designs must include provisions for future expansion and flexible soft spaces. The proposed design for the new TOHRC

accomplishes this by allowing generous space allocations for future growth and for programs outside of this thesis' scope.

Soft Spaces

In a healthcare setting, soft spaces house “soft functions” such as storage or offices. They can be repurposed and fit-out later to accommodate more “hard functions” such as surgery, imaging, labs, etc. – allowing adaptability and flexibility.²⁵

The final design guidelines build on innovative practices that are currently in place at TOHRC. These include independent living units and rentable spaces. The existing rehab centre has one Independent Living Unit that functions as a safe trial space for patients prior to discharge. With ABI, it is difficult to know your own limitations and deficiencies until attempting a given task and being confronted with unexpected challenges. This often results in hardships for survivors once they are discharged from rehab and thrust into the realities of everyday living with their newfound disability. Independent Living Units are set up as apartments where patients can spend time performing activities of daily living independently with the security of having professional help available if needed.

While independent living is addressed to a

degree at TOHRC, the single unit is insufficient for the volume of patients who could benefit from its use. As such, not all patients have access to this essential service, and time restrictions are in place for those that do get to use the space. The Robin Easey Centre is an alternative transitional service available through the Ottawa Hospital; however, as mentioned earlier, its wait times can be up to 6 months.²⁶ These discouraging wait lists cause undue stress for survivors and their caregivers, and prevent patients from capitalizing on their time sensitive healing windows.

This concern for supported housing has been long-held by the Champlain Acquired Brain Injury Coalition – a group of service providers, clinical professionals and ABI survivors who work towards improving the services and supports available for individuals living with ABI in our region.²⁷ The

rehabilitation centre proposed in this thesis looks at building on the existing Independent Living Unit at TOHRC by dedicating a large portion of the fifth floor to transitional services. As part of this, there will be 9 apartment units – allowing patients to stay in the spaces for longer time periods, and helping to reduce the current wait times for transitional services.

Another progressive practice at TOHRC is the rental of the large physiotherapy gym during off hours. Beyond the financial benefits, this practice welcomes community members into the centre – reducing the institutional stigma. To build on this, the new proposal looks at other spaces that can be used by both TOHRC and the general public. In this way, the building blurs the division between itself and the community by offering space and programs to the public.

04 ON THE RIGHT PATH

As described earlier, patients and visitors experience stress upon entering a healthcare facility, and their sense of being lost amplifies stress.²⁸ Choices, uncertainty and novelty add to these stress responses and can impact recovery.²⁹ When describing the feeling of being lost, Kevin Lynch explains that, “the sense of anxiety and even terror that accompanies it, reveals to us how closely it is linked to our sense of balance and well-being.”³⁰ How can the design of the rehabilitation centre ensure that all building users are able to navigate easily, thus minimizing anxiety and improving overall wellbeing?

It is commonly thought that wayfinding is resolved exclusively by graphic design; however, architects can play a significant role by laying out spaces in intuitive ways, and by incorporating landmarks that are identifiable to all building

users.³¹ To establish a clear layout, the spaces of the rehabilitation centre are organized around a central courtyard. Building users can view the courtyard from various points throughout the building to orient themselves. Circulation paths surround the courtyard on all levels to allow more access to views of the distinct landscaping. Beyond serving as a stabilizing landmark, the courtyard also brings light into the building and provides clear sight lines between spaces. This intervisibility is an asset, particularly for new visitors. Studies have shown that “estimating your current location is greatly facilitated by visual access between locations,”³² and that buildings with poor visual access result in decreased spatial abilities.³³

Around the courtyard, elements of the program have been stacked vertically to accommodate the building's increased spatial requirements without

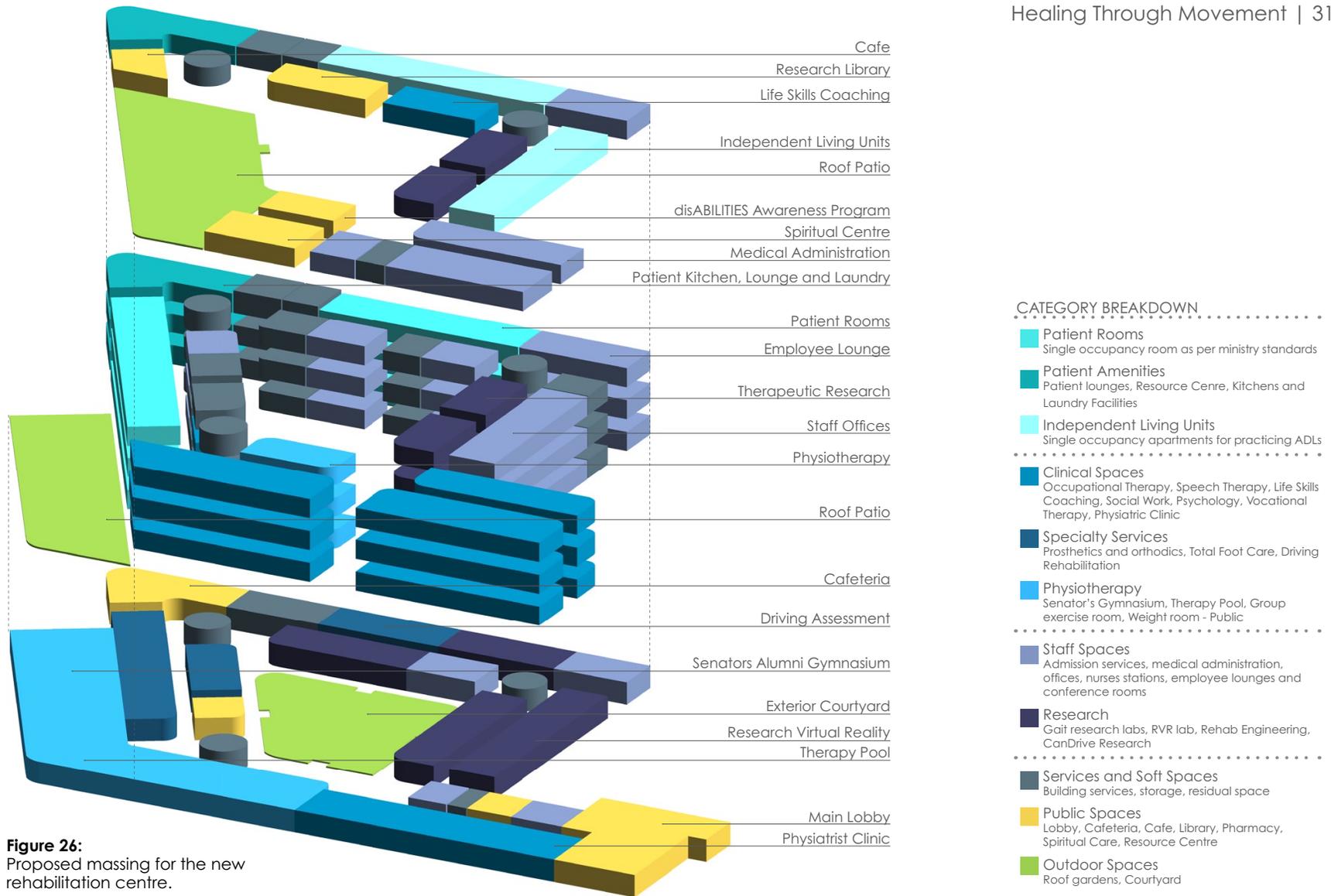
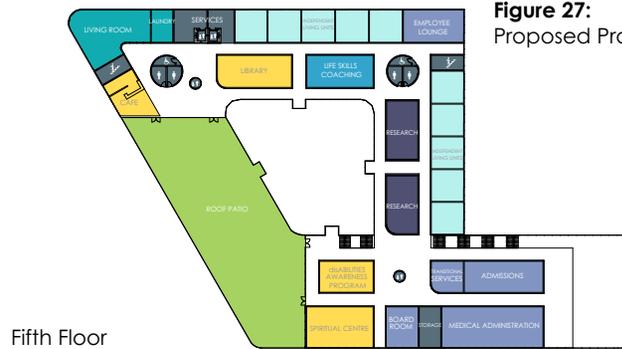
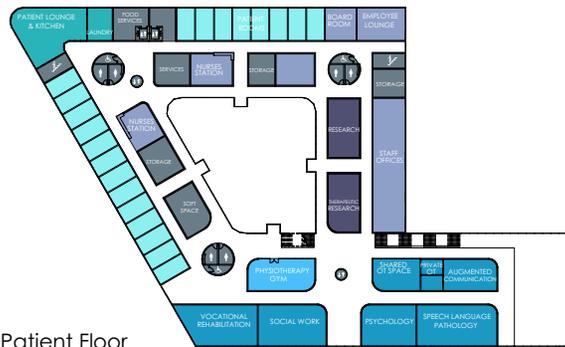


Figure 26: Proposed massing for the new rehabilitation centre.

Figure 27:
Proposed Program Layout Plans



Fifth Floor



Typ. Patient Floor



Ground Floor

increases to travel distances. The supplementary glazed corridors lining the perimeter of courtyard offer continuous views into the exterior space. These paths remove building users from the more institutional spaces, making their journeys between spaces into mini-escapes. The restorative paths also offer the opportunity to have restricted access for select internal corridors, without creating dead ends or impeding fluid movement. This would be beneficial for the behavioural program in the ABI ward, as well as for some research departments with sensitive material.

Elevators and washrooms are positioned at the corners of the courtyard for clarity and ease of access in emergencies. The washrooms themselves serve as landmarks due to their unique cylindrical form. The repetition of this consistent form and location on each floor adds to its value as an orientation tool.

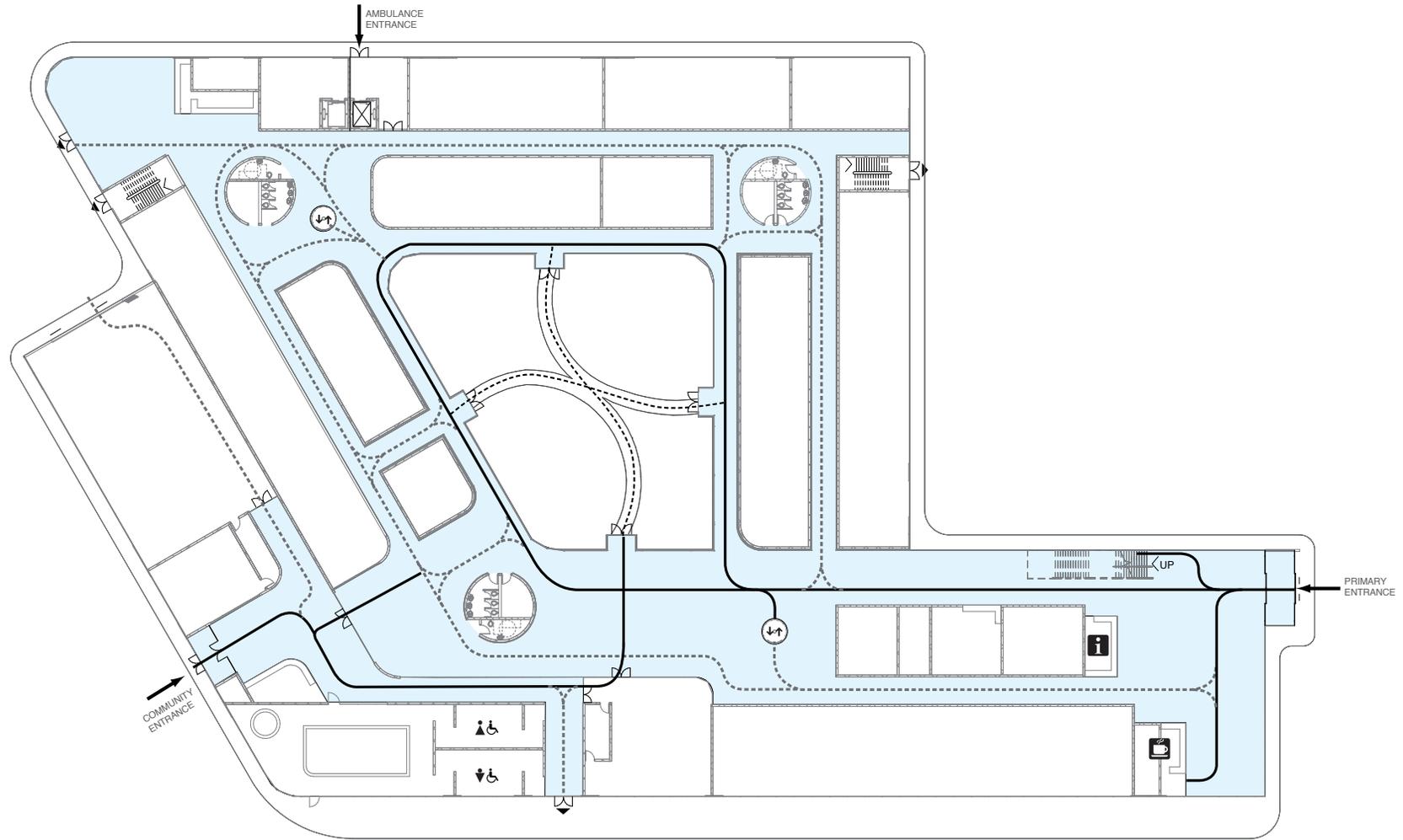


Figure 28:
Ground Floor Circulation Plan

Even with a clear spatial arrangement, wayfinding is a vital element in healthcare design. In the proposed rehabilitation centre, patients arrive into a bright and welcoming atrium. From the front doors, the information desk presents itself with large, clear signage. From there, the wayfinding systems step in to help guide users to their destinations through architectural elements including: landmarks, memorable views, tactile supports, aromatic and auditory cues.

Toronto's Bridgepoint Active Healthcare (BAH) rehabilitation centre serves as a useful precedent for the proposed design. BAH was part of an in-depth research project, which looked at how architectural design of healthcare facilities impacts the psychosocial wellbeing and health of its patients and the staff who care for them. The study involved a Post Occupancy

Evaluation (POE) that compared patient, staff and organizational outcomes across three facilities: the former Bridgepoint Hospital built in 1963, the new Bridgepoint Active Healthcare centre that opened in 2013, and West Park Healthcare Centre built in 1980.³⁶ A final report was later published documenting user feedback, as well as recommendations for future work.

With regards to wayfinding, the aforementioned study found that it should not be assumed that one wayfinding system will work for all users. This is particularly true in a rehabilitation facility where users have a broad array of physical and cognitive abilities and challenges.

Figure 29: Bridgepoint Active Healthcare, Toronto, ON
Stantec Architecture + KPMB Architects + HDR Architecture + Diamond Schmitt Architects



As explained by Architect, environmental psychologist and professor Romedi Passini, “Wayfinding difficulties tend to be exasperated for people with physical impairments and in particular, people with sensory impairments. These difficulties can amount to architectural barriers of a psychological nature, which in terms of reducing accessibility are just as obstructive as physical barriers.”³⁷ In an effort to promote inclusivity and accessibility, the design of the rehab centre put forth in this thesis aims to create a wayfinding system that can be universally understood. The proposed strategies were derived from looking at the recovery process of ABI patients. A survivor’s ability to relearn skills is made possible because “our brains have a tremendous amount of redundancy.”³⁸ The wayfinding system in the proposed rehab centre mimics this redundancy by

overlaying different navigation strategies.

Dr. Ester Sternberg claims that visual cues are the strongest in aiding navigation,³⁹ but can the other senses play a role in guiding users through the building? In current practice, wayfinding systems focus almost exclusively on vision – often reducing navigation to signs and labels. Many of the signs found in the built environment are not easy to comprehend due to their location, type of font, colours, and lack of raised tactile or Braille components.⁴⁰ This can be problematic in a healthcare setting where there is a diverse array of users with a varied range of abilities and limitations. For instance, how do people with visual impairments find their way?

When navigating through a space, we “use vision, hearing, smell, and touch to gather information about our surroundings.”⁴¹ These stimuli work together

to create a multidimensional, multisensory image of where we are in a building. By focussing wayfinding exclusively on visual elements, we miss out on opportunities to harness the multi-sensory perception that humans engage in unknowingly. Implementing redundancies in wayfinding allows architects to amplify these instinctive sensory perceptions beyond vision, and address the varied ways in which different individuals find cues for orientation. The resulting frequency of navigation cues further improves accessibility for blind or visually impaired (B/VI) users. Given that their perception is essentially proximal, B/VI people will typically make more wayfinding decisions than their sighted counterparts, thus requiring more units of information on a given route.⁴²

“Of all of the ways in which we sense the world, touch and smell are the only two in which we come

into direct contact with the things around us.”⁴³ Could these two senses become more integral to our wayfinding strategies? Tactile indicators are already well regarded as useful tools for orientation within the Blind or Visually Impaired community. In 2014, the Ontario Building Code (OBC) recognized their value and introduced requirements for tactile attention indicators at the tops of stairs.⁴⁴

Beyond dedicated tactile ground indicators, basic shifts in floor materiality have proven to be effective wayfinding cues. For this reason, the floor is used as an integral component in the wayfinding system of the new rehabilitation centre. One strategy involves 1000mm and 500mm wide continuous strips of contrasting flooring materials that run the length of the corridors. Three different flooring types are incorporated into each level of the building, indicating

“A distinctive and legible environment not only offers security but also heightens the potential depth and intensity of human experience”³⁵
– Lynch

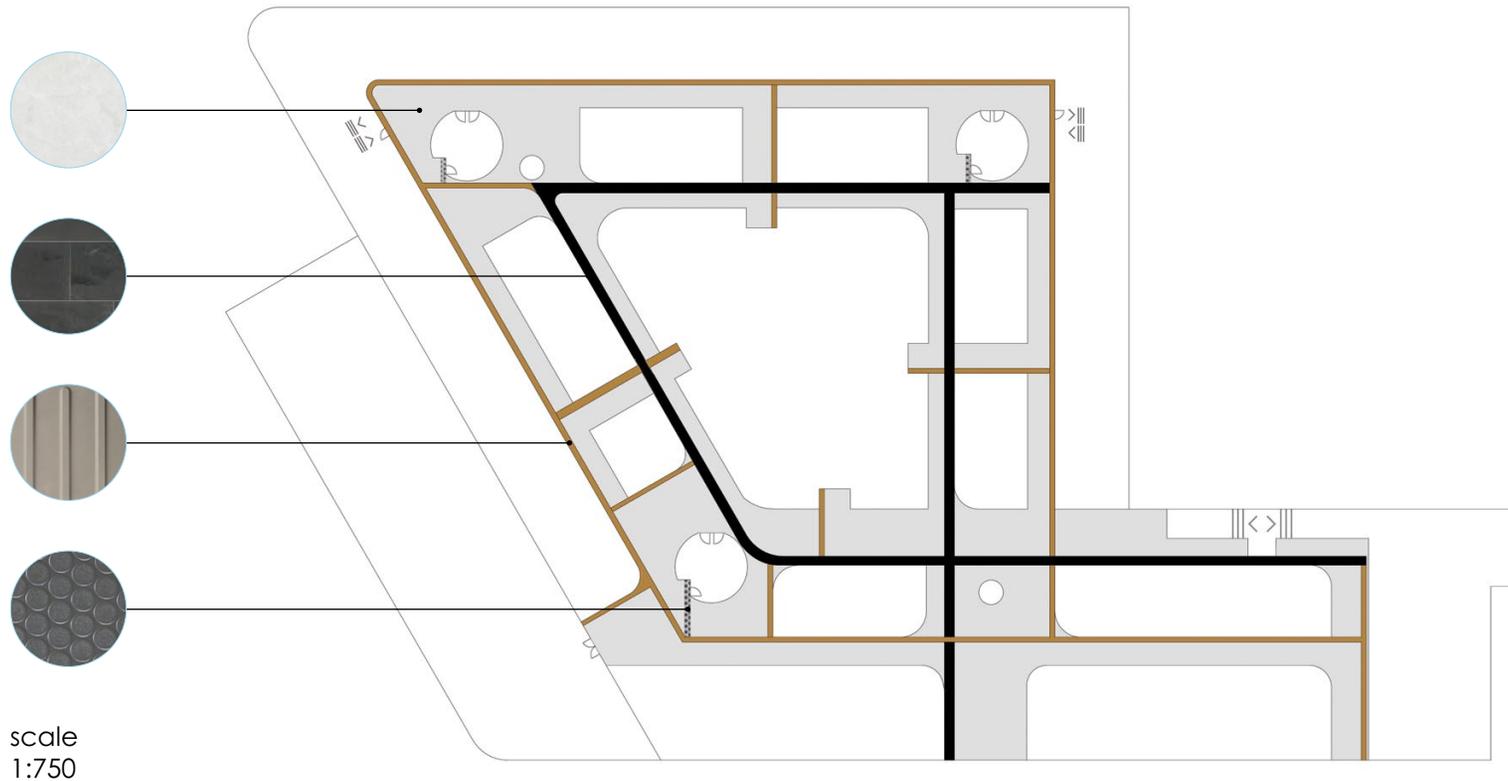


Figure 30: Typical Tactile Flooring Plan (levels 2-4)
Distinct dimensions, patterns and surface styles are assigned to different routes, helping to orient building users.

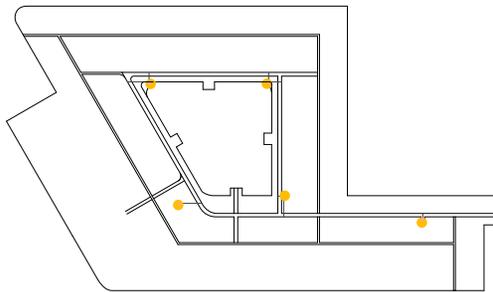
which path a person is on. These directional flooring strips also serve as guides for the crossing of large, open spaces, which is particularly difficult for B/VI people.⁴⁵ The flooring strips appear in distinct colours, making them effective cues for sighted building users as well.

Beyond the tactile cues incorporated into the floor, the hands can serve as prime transmitters of information. The human hand has a high concentration of merkel cells, which function as receptors and are responsible for stimulating sensory nerves that the brain perceives as touch.⁴⁶ To capitalize on the immense sensory capacity of the hands, the handrails throughout the building shift in materiality to indicate different zones. For instance, the stainless steel handrails in the clinical spaces become powder coated once you enter the patient room wing.

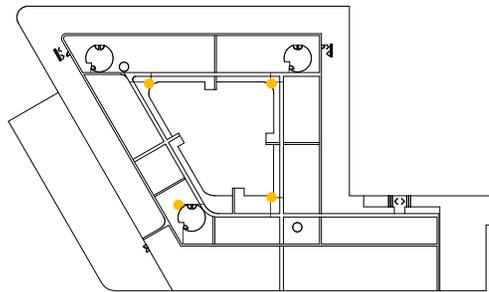
Another way in which the sensory perception of the hands is harnessed is through tactile maps. Tactile maps consist of raised, or etched lines and symbols. This engaging style of mapping helps visitors unfamiliar with the building to more easily learn about their surroundings. Placement, clarity, completeness and redundancy are key to the effectiveness of any map. Through the BAH study, it has been found that wayfinding “needs to be clear upon entry to the building and at various points where the user experiences a break in the flow.”⁴⁷ In line with these findings, the tactile You Are Here (YAH) maps at the rehab centre will be located in the front atrium and on each floor at the four corners surrounding the courtyard. Each map will be paired with a legend describing the symbols used.



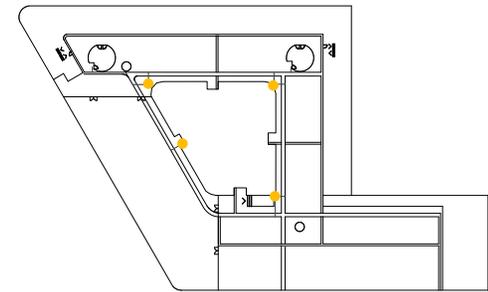
Figure 31: 3D view of Tactile Map and stand.



Ground Floor Tactile Map Locations



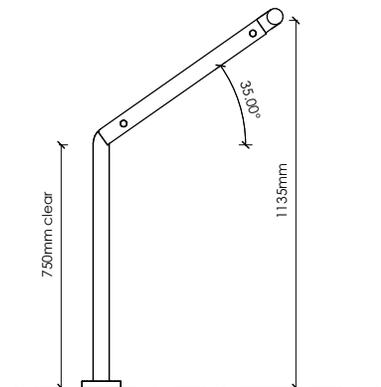
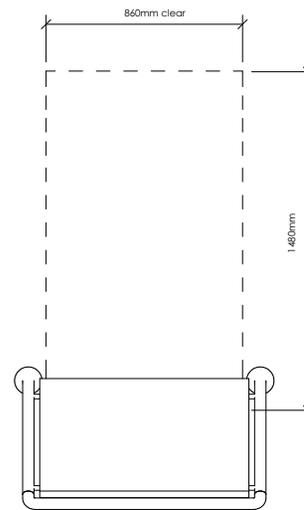
Patient Floor Tactile Map Locations



Fifth Floor Tactile Map Locations

Above: Figure 32: Tactile Map Locations Plans.
The tactile maps will be located at key decision points on each floor to aid in orientation.

Right: Figure 33: Tactile Map Stand Plan and Side Elevation
The maps are to be mounted on stands with clearances below and in front for universal accessibility.



Below: Figure 34a: Ground Floor Tactile Map Model. To be most effective, these maps will be clutter-free and simple to read.

Top Right: Figure 34b: Fifth Floor Tactile Map

Lower Right: Figure 34c: Patient Floor Tactile Map and Legend.

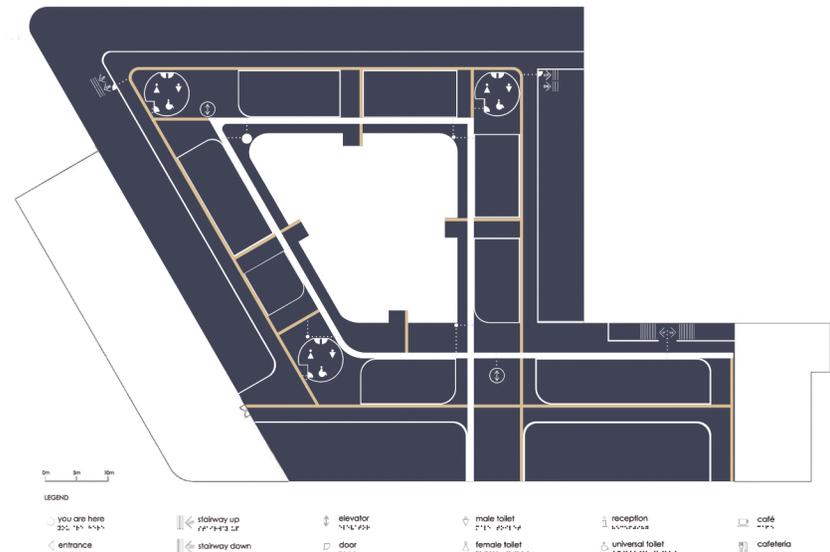
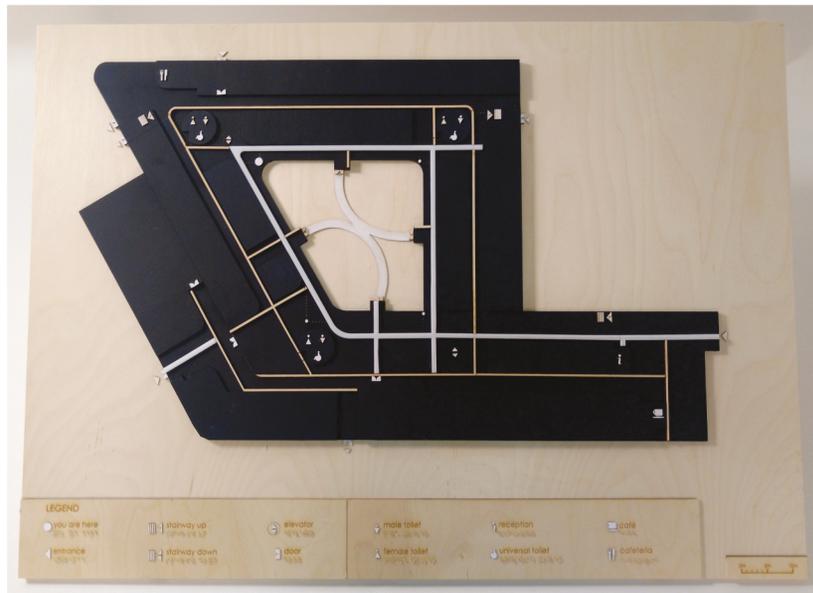
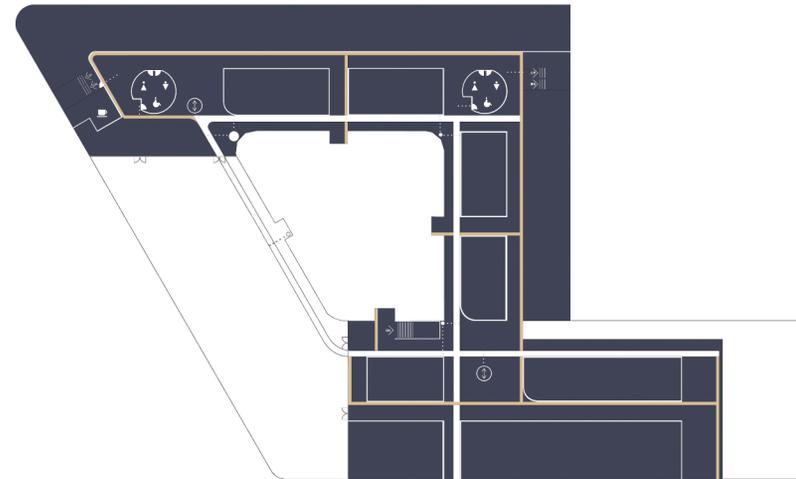




Figure 34d: Tactile Map Model

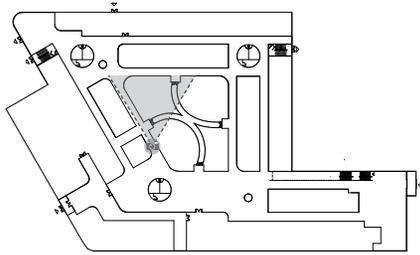


Figure 35: Front entrance
Upon entering the new rehab centre you are welcomed into a bright atrium with a clearly visible information desk. Directional flooring ushers you in, and a tactile map provides an engaging way to become familiarize yourself with the building's layout.



The other sense through which we come into direct contact with the things around us is smell. Some aromatic elements that aid in the orientation of building users occur naturally – being born from standard program elements. As part of a needs assessment study for the B/VI community, one participant noted that, “every time I go to class I walk down the hall and pass that location. And every time I do, I smell coffee right before I hit the rubber mat.”⁴⁸ Here, the aroma of coffee combined with a tactile shift in flooring is used to confirm the student's location. In the new rehab centre, programmatic elements such as the cafes, cafeteria, therapy pools and the courtyard would carry scents that can help building users orient themselves over time.

In an effort to respect people's potential sensitivities, healthcare settings are typically fragrance

free environments – making the introduction of aromatic navigation cues nearly impossible. However, studies are currently being conducted that look into the benefits of incorporating indoor plants and aromatherapy into standard healthcare practices. Indoor plants have been recognized for their health benefits since a 1989 study conducted by NASA showed that “the leaves, roots, soil, and associated microorganisms of plants have been evaluated as a possible means of reducing indoor air pollutants.”⁴⁹ A recent study from the Netherlands further supported the idea that indoor plants have beneficial effects on health and wellbeing – finding that pain tolerance increased for patients in rooms with indoor plants.⁵⁰

With regards to the associated smells, studies have shown that plant-based aromas have therapeutic properties that have the ability to calm agitation and aggression, influence moods, and reduce stress, anxiety and symptoms of depression.⁵¹ Beyond these benefits, a 2008 study found that *green odors* have anti-fatigue and anti-stress effects on humans.⁵²

Given the evidence supporting the introduction of plants and their subtle aromas into healthcare practices, scent-based navigation cues are proposed for the new rehab centre. These elements will be integrated into the building through built-in planters at the walls around the courtyard. Different plants will be assigned to different wings to help users orient themselves. The selected plants have been proven to grow well indoors, are non-allergenic, and do not

have any reported side effects unless consumed in concentrated, high doses. These plants include: lavender, which research has confirmed can produce calming, soothing, and sedative effects,⁵⁴ rosemary which is often used in aromatherapy to increase concentration and memory, and to relieve stress,⁵⁵ peppermint which has demonstrated improved cognitive performance measures,⁵⁶ and lemongrass which has shown accelerate recovery from some types of anxiety.⁵⁷

Green Odor

The aroma of green leaves. For experiments, green odor is a mixture of equal amounts 2E-hexenal and 3Z-hexenol, diluted with the odorless solvent triethyl citrate (TEC) to a concentration of 0.03% (w/w).⁵³

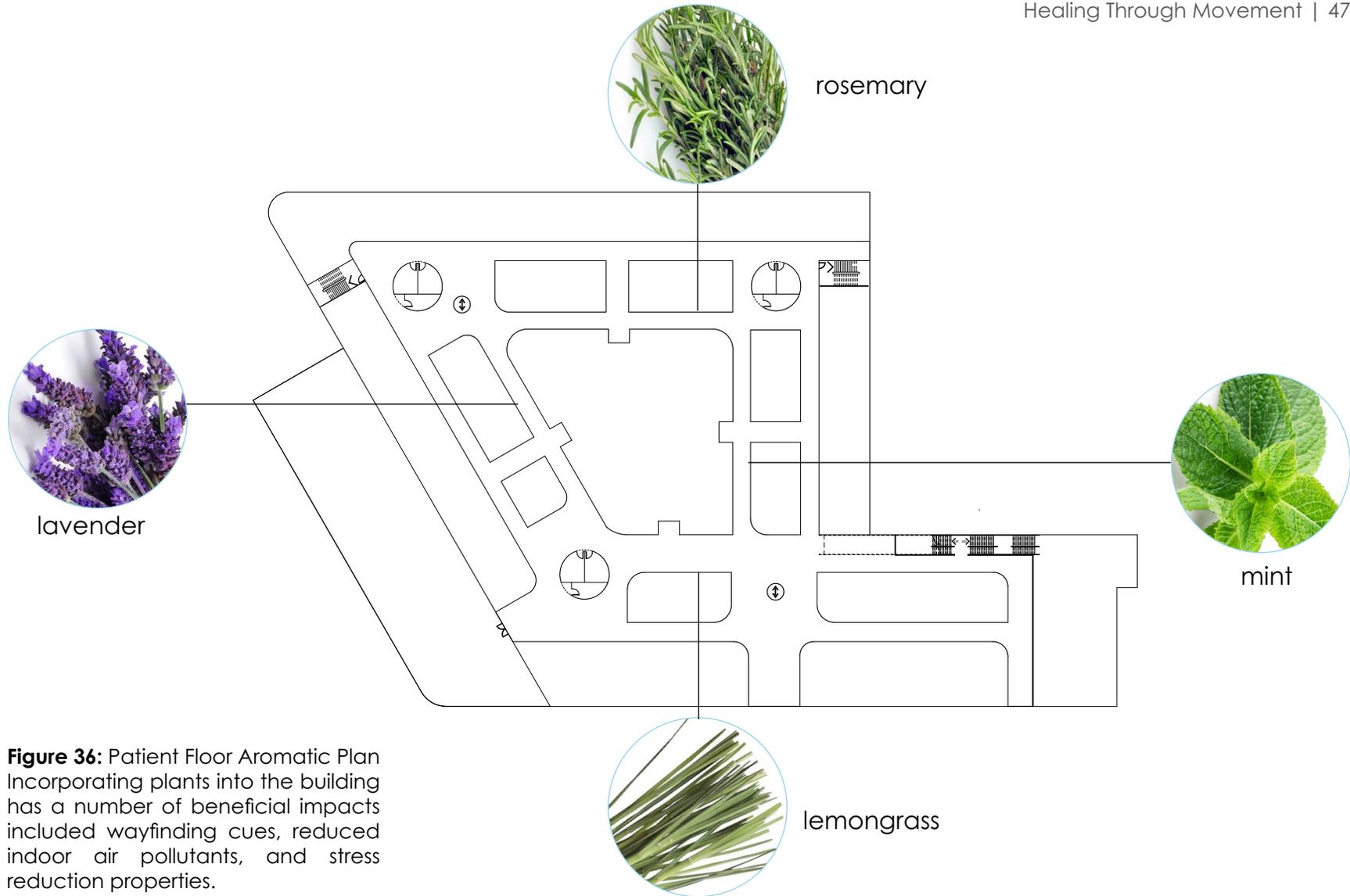


Figure 36: Patient Floor Aromatic Plan
Incorporating plants into the building has a number of beneficial impacts included wayfinding cues, reduced indoor air pollutants, and stress reduction properties.

Like smells, sounds are often intrinsic to certain elements of a building's program. Public buildings are full of sounds: the elevator arriving on a floor, the hum of a ventilation system, phones ringing at the reception desk, the clatter of dishes and the sizzle of a grill in a kitchen. When these sounds are consistent over time, they can serve as indicators as to where you are within a building. The design and form of spaces also results in marked changes to the soundscape. For instance, a grand, open space will have distinctly different acoustic properties from an intimate room or corridor. In the proposed rehab centre, a noticeable auditory shift occurs once you leave the large, glazed atrium and enter the corridors. Adding to this, the 3000mm ceilings which exist in the internal corridors are finished with an acoustic wood

panel ceiling system – offering an auditory contrast to the glazed corridors surrounding the courtyard that have a generous ceiling height of 3500mm.

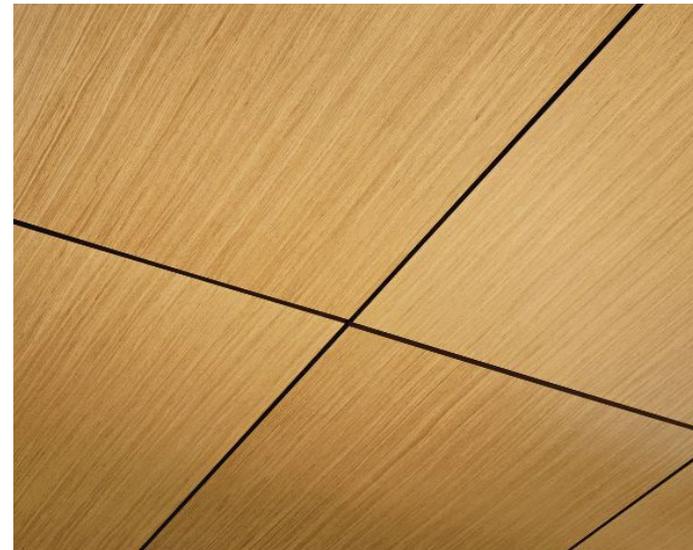


Figure 37: Engineered Wood Acoustic Ceiling
Wooden ceiling systems work to dampen unwanted noise in the internal corridors - offering an auditory contrast to the larger spaces within the rehab centre. The materiality provides warmth to the spaces, and defies typical clinical aesthetics.

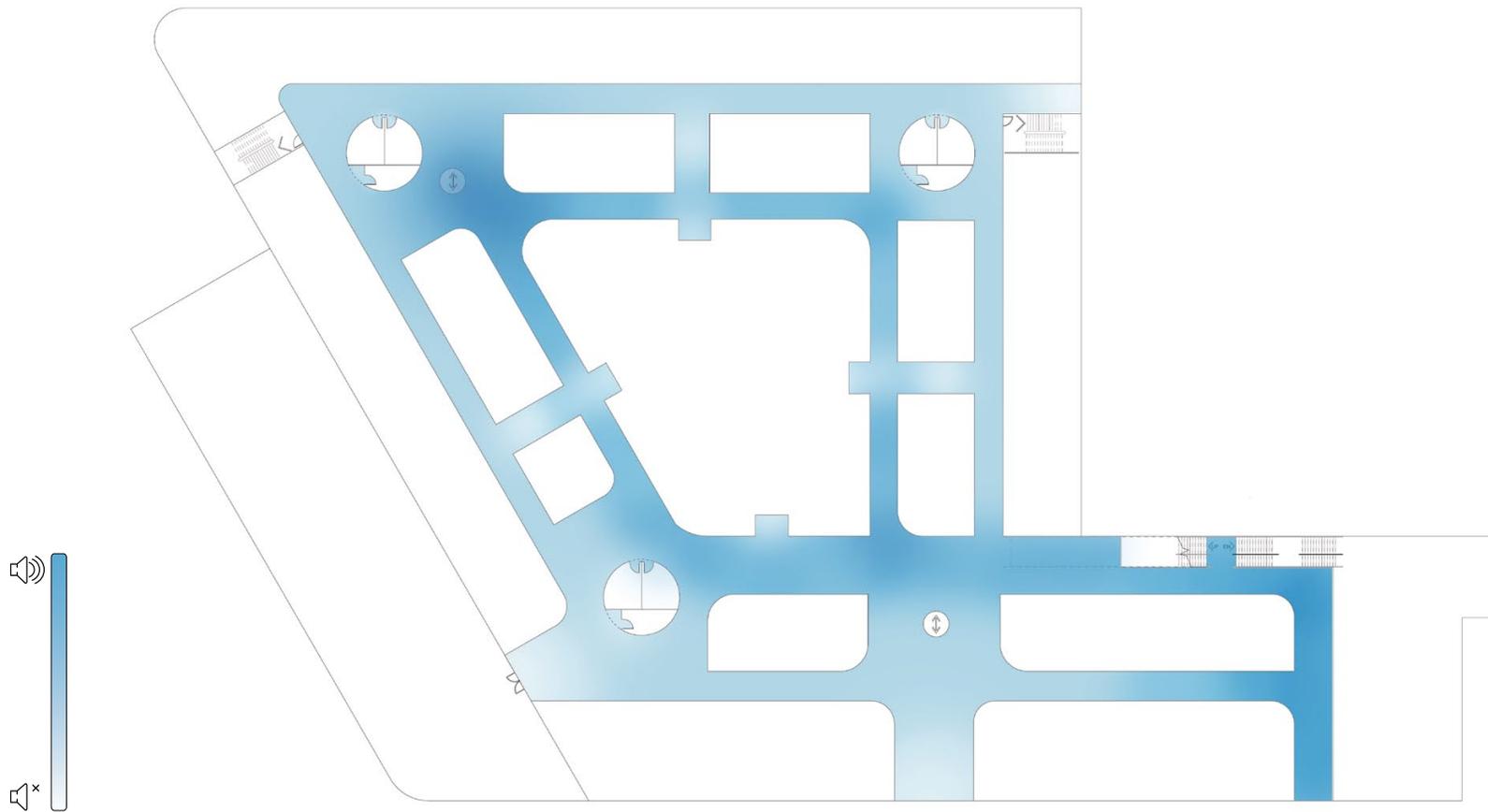


Figure 38: Patient Floor Acoustic Plan
The depth of the colour indicates the sound intensity of each space.

With regards to the visual components of the proposed redundant wayfinding system, the layout plays a significant role. As mentioned earlier, clear sightlines and memorable views are effective strategies in promoting ease of navigation. In this way, windows are placed at the ends of corridors with distinct views into the neighbouring lake, parks and Civic Hospital campus. The glazed corridors looking into the courtyard also help people get a sense of their current location. Distinct landscaping amplifies the effectiveness of this strategy.

Within the centre, different paint colours denoting each zone are used on the walls. Signage is also used to direct visitors. To ensure inclusivity and accessibility, all signs are to include: high visual contrast for legibility, large font sizes that are sans serif and in sentence case, and tactile elements mounted at 1200mm above the floor.

05 SUPPORTING AND INSPIRING MOVEMENT

Designing clear spatial layouts and wayfinding cues are fundamental to facilitating circulation; however, users' potential mobility issues present an additional challenge. The following chapter will look at what supports are needed to help facilitate and inspire inhabitants' movement through the building.

Universal Design is defined as, "the design and composition of an environment so that it can be accessed, understood and used to the greatest extent possible by all people regardless of their age, size, ability, or disability."⁵⁸ Architects are often criticized for reducing disability to a singular form of mobility impairment – that of a wheelchair user. It is imperative that we recognize the multiplicity of building users' needs, particularly in a rehabilitation facility where patients are dealing with a broad range of functional impairments.

The Ontario Building Code (OBC) has been recognized as a leader in accessibility requirements – with commendable advances having been introduced with Ontario Regulation 368/13 in 2015. However, in the architectural practice, inclusive design is most often seen as a burden, or an 'add-on' – considered only at the end of the design process. Minimum requirements are taken as maximums, and designers rarely consider innovative alternatives. This reality leads to unattractive, institutional aesthetics, and undermines the true objective of universal design. When fully actualized, true universal design draws attention away from people's impairments, minimizing the possibility of social ostracism and restoring disabled people's self-esteem, dignity and independence.⁵⁹

Providing multi-sensory wayfinding is the first step in creating an accessible, empowering environment by enabling users to find their way without being dependent on the assistance of others. However, some patients contend with physical challenges that limit their mobility. In an effort to facilitate movement for all users, the paths of the proposed rehabilitation centre will be equipped with added supports including handrails, ledges and rest points.

The handrail system looks at how to maintain the dignity of users by creating supports that do not perpetuate an institutional stigma. The concept of redundancy is applied here with a two-part system. One handrail is provided as per code specifications (graspable and appropriately sized). It is mounted onto a wall projection, clad with protective materials, which creates a ledge at 1100mm A.F.F. (above

finished floor). This ledge serves as a secondary rest area for elbows or hands, while the protective cladding eliminates the need for institutional wall guards. The subtly aromatic plants mentioned earlier have been incorporated into these ledges at points. As such, the wall projections are efficient in that they serve multiple functions: places of rest, wall protection and wayfinding tools.

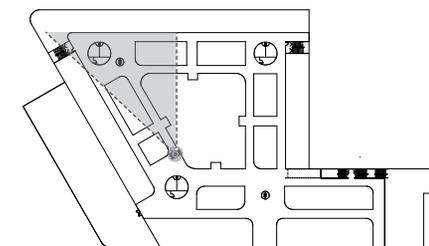


“An attractive window view of an outdoor garden might foster exercise by stimulating corridor trips that would promote patient emotional restoration as well as physical rehabilitation.”⁶²
- Dr. Roger Ulrich

Figure 39: Sectional Perspective into a corridor overlooking the courtyard.

Straight, clutter-free corridors with views into outdoor spaces make moving through the building pleasant for all users and entice patients to get out of their rooms.

The handrail system provides supplementary supports and plays host to the aromatic wayfinding cues.



For patients who are beginning their time in rehabilitation, fatigue and weakness are common issues. After spending weeks, or months in acute care with few opportunities to move, their muscles and cardiovascular systems have often been suppressed, and traveling the full length of a corridor might seem like an impossible task. The proposed rehab centre addresses this hardship by introducing rest points at manageable intervals – allowing patients to take breaks and regain their strength as they move towards their final destinations. The rest points include windows into green spaces and/or places of activity, providing positive distraction and feelings of visual escape. Sound attenuating panels line the sides of the rest points, providing a quieter area and a sense of privacy. Sound buffering seating with high backs and sides reinforce this sense of privacy and escape.

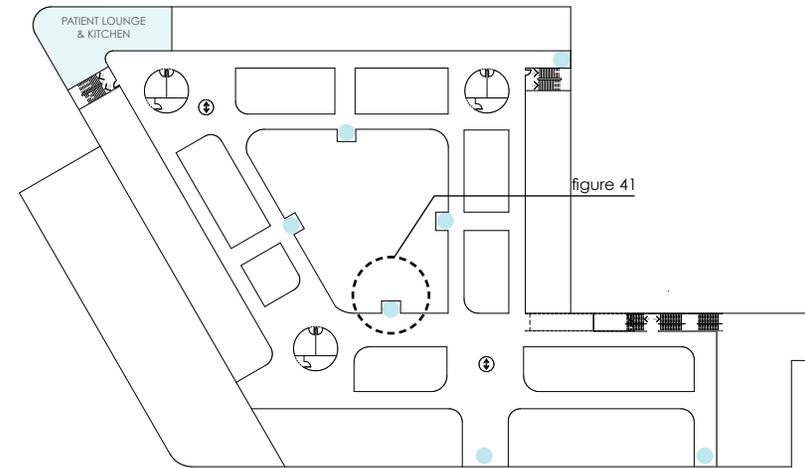
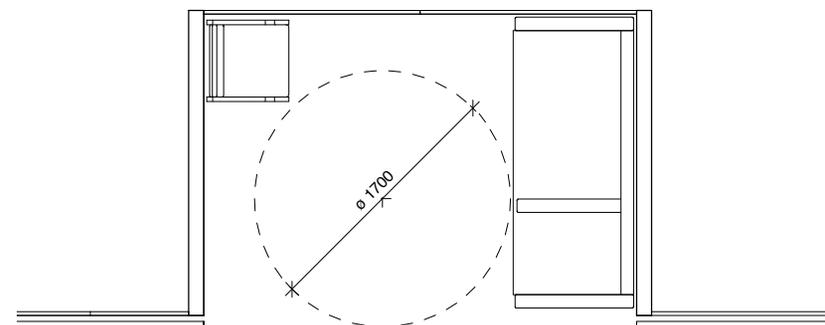


Figure 40: Rest Point Location Plan



Scale
1:50

Figure 41: Typical Rest Point Floor Plan

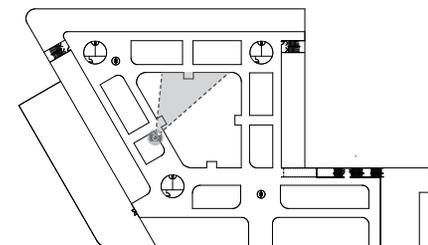
“Calming views or stabilizing references can help people orient themselves within a building.”³⁴
- Sternberg



Figure 42:
Places of Rest and Orientation

Rest points are located at the midpoint of the corridors surrounding the courtyard. These spaces provide a place of repite and rest for building users. Acoustic wall panels and furniture offer a sense of privacy.

Views to the distinct landscaping of the courtyard, and to other parts of the building help people orient themselves.



In healthcare design, spaces of rest and respite are often forgone in order to accommodate the spatial demands of hospitals and the costs associated with them.⁶⁰ These constraints also apply to corridors, which are kept to a standard 8 foot (2440mm) width to meet code minimums. While there is yet to be empirical proof, it is reasonable to hypothesize that by providing ample space and support for patients to conduct rehabilitation independently, or with a care partner outside of scheduled sessions, recovery would be expedited. This could result in significant cost savings as patients leave rehab centres sooner, and return to productive lives in the community. In line with this hypothesis, the corridors of the proposed rehabilitation centre are set to a width of 2700mm. These increased widths will accommodate growing assistive devices, as well as offering more space for

patients to do mobility exercises, or take moments to pause without impeding foot traffic.

As patients' rehabilitation progresses, they develop strength and curiosity that drives them to leave the security of their rooms. Having available supports give recovering patients the confidence to keep working on independent mobility. Bringing patients out of their rooms and into common areas has a number of advantages including: increased movement, psychosocial benefits, and improved rehabilitation beyond traditional therapies. This is increasingly important as healthcare facilities move to single occupancy rooms. The wide corridors with views into the courtyard garden serve as vehicles for inspiring exercise. The continuous loop and appealing atmosphere encourage lengthy indoor walks.

In ABI recovery, much of a patient's progress is qualitative and difficult to measure. Having a quantifiable mark of improvements can be a significant motivator to continue working towards recovery. As such, graphic distance markers are incorporated into the floor and subtle ridges are located in handrail. These elements also double as wayfinding tools, serving as additional markers for orientation.

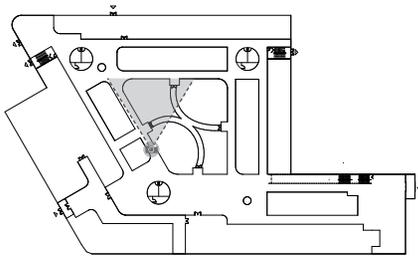


Figure 43a: Introducing Quantifiable Goals

The corridor surrounding the courtyard provides a continuous 110m loop with views into the garden and areas of human movement.

Patients can note their improvements through markers on the floor and handrails indicating the distance that they have travelled. These markers simultaneously serve as wayfinding tools, providing additional visual and tactile cues.



At Bridgepoint Active Healthcare, the design focused on drawing patients out of their rooms by luring them towards various amenities and open spaces⁶¹. Borrowing from this proven strategy, the new rehab centre includes patient lounges and kitchens located at the southern corners of each floor. These spaces are enticing due to their ample sunlight, useful amenities and picturesque views towards the Dominion Arboretum. Another point of interest is the interior balcony overlooking the atrium. The glazed façade at the front of the building provides attractive views towards Commissioners Park.

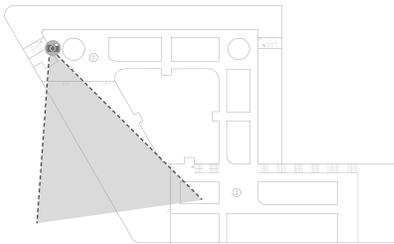
The fifth floor is also home to several desirable destinations including: a spiritual centre, library, café and an expansive rooftop garden. In addition to serving as a means of encouraging patients to venture outside of their rooms, these public spaces provide

areas of refuge for staff and visitors – contributing to the wellbeing of all building users.

To further inspire movement, the BAH study warns designers not to underestimate the power of watching others succeed in being mobile, and recommends that patients should have a sightline to observe others.⁶³ This observation can be explained in part by mirror neurons. Mirror neurons are interconnected nerve cells that fire when a person observes someone else performing a particular movement.⁶⁴ Dr. Gustavo Saposnik, director of the Stroke Outcomes Research Unit at St. Michael's Hospital at the University of Toronto, notes that engaging the mirror neuron system facilitates the formation of new brain connections and aids in recovery.⁶⁵ By creating inviting corridors and enticing amenities with views of human movement, architecture can contribute to improved, efficient rehabilitation.

Figure 43b: Enticing destinations

View from the fifth floor café out to the rooftop patio.



Access to outdoor green space is another key asset in promoting movement. People are more inclined to emerge from their rooms and engage in light physical exercise if there is an easily accessible outdoor space available with ample sunlight and comfortable seating options. Through studies, researchers have found strong evidence indicating a link between access to nature and positive health outcomes, including: decreased symptoms of depression and lengths of stay, and increased patient satisfaction. It also positively impacts staff, who have been found to have reduced stress and increased satisfaction. A patient at the Oregon Burn Center Garden in Portland supported these studies, remarking that, “the garden made me want to walk more and more. It helped me to build up my endurance so I could go back home.”⁶⁶

Biophilia: Defined by Edward O. Wilson as, “the innately emotional affiliation of human being to other living organisms.”⁶⁷



Figure 44: Garden @ Northeast Georgia Medical Center, USA

“Recognizing that healing goes beyond the bedside, the hospital’s goal was to create outdoor environments that promote hope and healing for patients and families, visitors, staff, and the community at large.”⁶⁸

06 ARCHITECTURE AS A REHABILITATION TOOL

The proposed rehab centre's goal of enabling and promoting movement throughout the building goes beyond the anticipated physical benefits. Studies have shown that movement can make measurable contributions to the emotional, functional and cognitive recovery of patients. Some of these proven benefits include neuroprotection, improved sleep quality, and decreased symptoms of depression⁶⁹ - with research showing that exercise can be as effective as antidepressants in treating mild or moderate depression.⁷⁰ Given the widespread benefits, movement plays an instrumental role in the holistic rehabilitation process and is considered an essential part of this design.

Light to moderate exercise is particularly valuable for Acquired Brain Injury survivors, as it has been proven to increase proteins that are important in neuronal plasticity and repair.⁷¹ Dr. Norman

Doidge, a psychiatrist, psychoanalyst and researcher, published "The Brain's Way of Healing," in which he explains the connection between physical activity and neurorecovery. His research shows that exercise triggers brain growth factors that help form new connections within the brain and improve the overall health of brain cells.⁷² In line with these findings, studies have been uncovering the positive effects of incorporating exercise into ABI rehabilitation. This chapter will look at how the circulation system, interstitial spaces and outdoor areas can be leveraged to play an active role in these burgeoning rehabilitation strategies. Beyond structured therapies, it will evaluate how the building can promote the incorporation of exercise into patients' daily routines so that every place patients go is moving them towards their goal of recovery.

Currently, most active therapies take place in assigned indoor physiotherapy spaces. In the centralized healthcare models, these spaces are separate and deployed to each of the wards. This is beneficial in that it reduces travel distances for patients; however, in discussions with clinical staff, this practice results in spatial constraints and redundancy of expensive equipment. For the proposed rehab centre, a large gym facility has been located on the ground floor, open to all patients. Small physio spaces are also available in each ward, with limited equipment to service patients who suffer from anxiety in large spaces, or those who prefer added privacy. Physiotherapy sessions are also invited into the connective systems of the building. The strategy of bringing patients out of the assigned rooms helps to increase stimulation and variety.

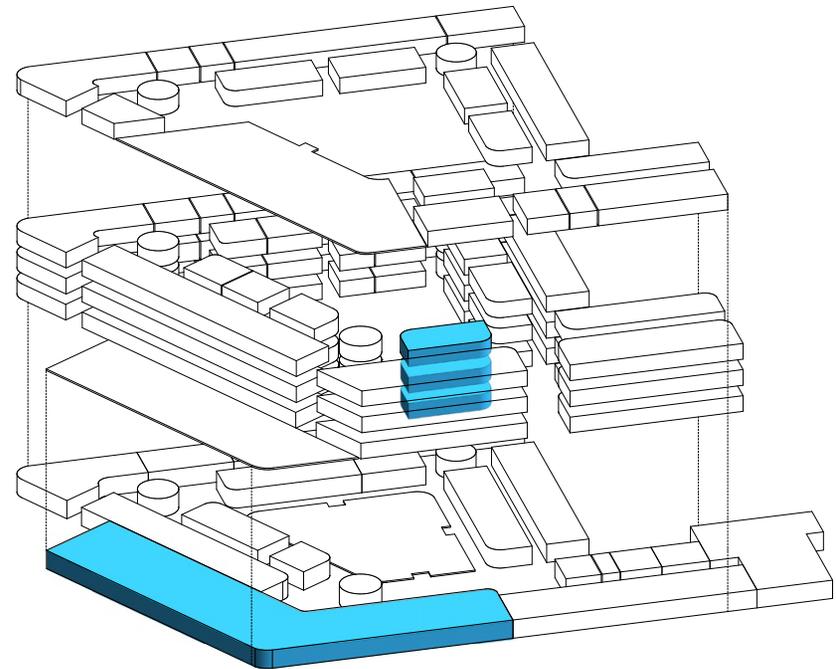
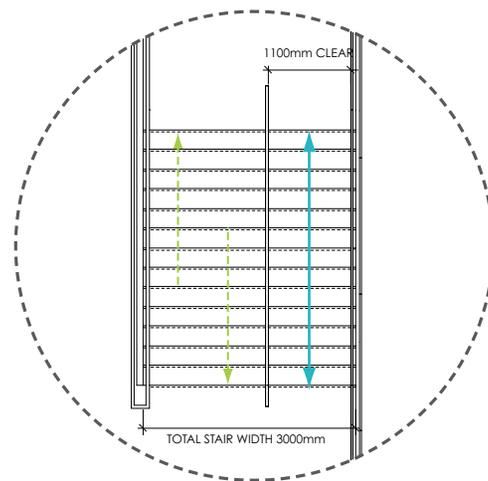


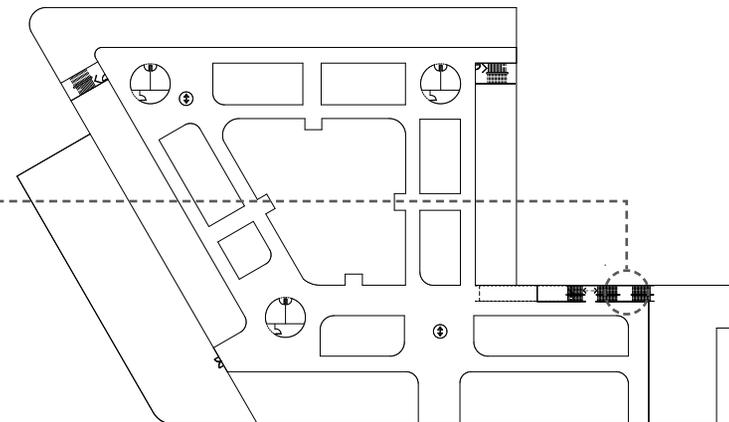
Figure 45:
Physiotherapy spaces

By locating the active therapy spaces adjacent to the generous corridor along the western façade, patients can use the building as a tool to practice elements of mobility. Once patients are comfortable moving on level surfaces, therapists commonly begin to incorporate stairs into their exercise regimens. In most rehabilitation centres this involves practicing in the dark, confined spaces of the building's exit stairs. In the proposed rehab centre, the celebrated stairs are easily accessible from the physiotherapy spaces and offer a bright, open space for use during, or outside of therapy sessions. The stairs include an intermediate handrail that provides a wide area for general use, and a narrow section for patient practice. The 1100mm width of the practice area allows patients to grab hold of both handrails for additional security as they ascend or descend the stairs.

Left: Figure 46:
Enlarged Partial
Plan of Stairs @
West Facade



Right: Figure 47:
Second Floor Key
Plan highlighting
celebrated stairs



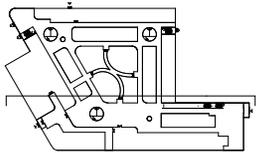


Figure 48: Sectional Elevation and Key Plan

The celebrated stairs and the length of the corridor are assets to patient rehabilitation, allowing physiotherapists to incorporate various activities into their practices.

The large active spaces on the ground floor include: a full sized gymnasium, a therapy pool, weight rooms, private and semi-private therapy rooms, and a group exercise studio. Building on TOHRC's current rental practice, the gymnasium (complete with basketball nets), therapy pool and group exercise studio will be available for rental outside of clinical hours. Welcoming the community into the rehab centre will help decrease the institutional stigma that most healthcare facilities face. These spaces are grouped together and include an additional entrance to allow for easy community access and added security.

'Together In Movement and Exercise'

The group exercise studio will host classes for both community members and TOHRC patients. One such class would be 'Together In Movement and Exercise' (TIME™) – a community-based group exercise program welcoming people with balance and mobility challenges to exercise.⁷³ The program was designed by physiotherapists at Toronto Rehab, and is currently being led by fitness instructors across the country. The collaboration between health care and community captures the spirit of the proposed centre's goal to bring movement (and all of its benefits) back into people's lives in a safe and effective way.

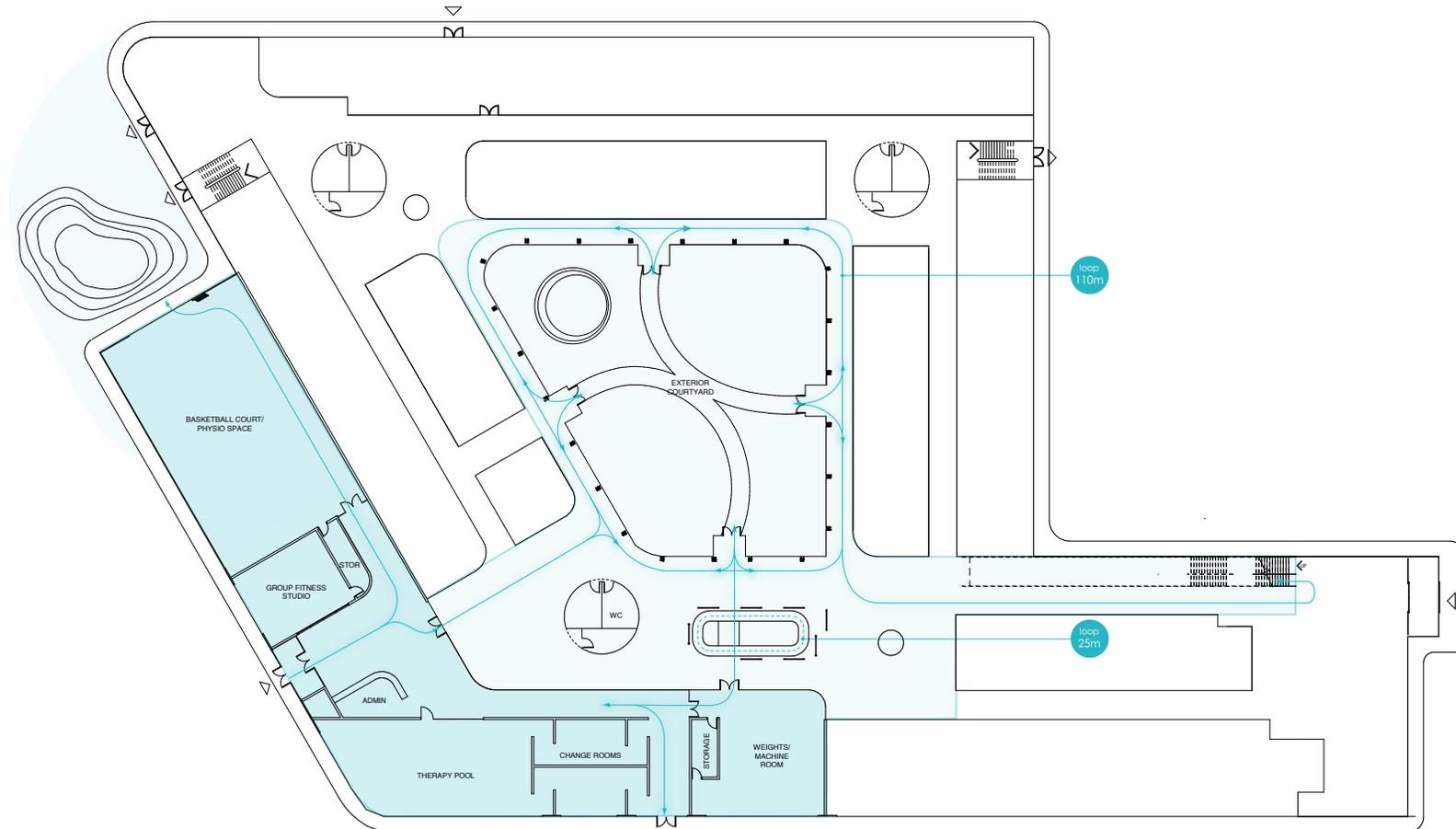


Figure 49:
Ground Floor Plan highlighting active spaces

To further aid with smooth transitions back to independent living, patients' movement is not confined to controlled interior spaces. In order to prepare patients for discharge, it is important to allow them to practice in areas that more accurately reflect the challenges of daily life. To achieve this, the large gym on the ground floor spills out into an exterior space. When ready, physiotherapists can take patients outdoors to hone their mobility skills on different slopes and surface materials, and in diverse weather conditions. With the support of a professional and adequate safeguards, patients are exposed to different elements and develop strategies for dealing with imperfect conditions. Being outdoors also challenges a patient's ability to multi-task and cope with distractions.⁷⁴

Positive Distraction

"A positive distraction is an environmental feature or situation that promotes an improved emotional state in the perceiver, may block or reduce unwanted thoughts, and fosters beneficial changes in physiological systems such as lowered blood pressure and stress hormones."⁸¹ These include laughter, comedy, music, art, companion animals and nature.

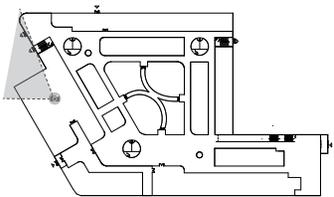


Figure 50: View into the Ground Floor Gymnasium.

The Physiotherapy Gymnasium spills out into an associated exterior area for diverse mobility training.

A 2011 POE (post occupancy evaluation) looked at the outcomes of a rooftop garden designed for physiotherapy at the Fort Sanders Regional Medical Centre in Knoxville, Tennessee. While the study found several shortcomings such as uncomfortable chairs, unhealthy vegetation and a lack of subareas for greater privacy, the response from patients was overwhelmingly positive. It was unanimously felt that the garden “helped patients regain life skills, such as mobility and self-confidence, in a way different from indoor areas.”⁷⁵ Participants found that the garden presented real-life situations, in contrast to the simulated situations offered by the indoor physiotherapy spaces. Almost all participants reported that they preferred the garden to the monotony of an indoor gym, and that being outside helped them maintain a sense of self and a more

positive outlook. These findings support those of a 2007 study conducted in the UK. The study showed that the reduction of stress and symptoms of depression resulting from exercise were far greater when participants engaged in *green exercise* or *ecotherapy* as compared to when exercise was performed indoors.⁷⁶

Ecotherapy

Ecotherapy, also referred to as green exercise, involves engaging in physical activities in an outdoor environment. “Whether it’s a horticultural development programme supervised by a therapist or simple walk in the park, being outdoors and being active is proven to benefit our mental health.”⁷⁷

Beyond the physical benefits, outdoor amenities contribute to the mental and social wellbeing of patients. Bringing patients outdoors provides contact with nature, sunlight and a normalized environment. "Patients can revel in the joys of breathing fresh outdoor air and feeling the sun on their skin."⁷⁸ Contact with nature has been shown to increase patient relaxation and distracts them from the pain and stress of recovery.⁷⁹ The recognition of the healing powers of nature dates back to ancient Greece. "At one time nature was seen as intrinsic to healing, but this important connection was largely lost by the twentieth century. Now, however, it is being rediscovered, in the form of healing gardens and therapeutic landscapes in healthcare settings."⁸⁰

There are currently two distinct styles of healing gardens for healthcare: enabling and restorative.⁸²

The outdoor space adjacent to the gymnasium would be categorized as an *enabling garden* in that the therapeutic benefits are derived from hands-on activities and exercise. Restorative gardens (also known as therapeutic gardens) differ in that the benefits are born from just being *in* the garden. These gardens can be experienced in any way a user would like; as a place to sit, walk, look, listen, nap, meditate, etc. The courtyard serves as a hybrid of the two styles, with different zones of activity and rest.

CASE STUDY: The Pearson Motion Garden
Guelph, ON, 2012
Designer: Glynis Logue

The Pearson Motion Garden in Guelph is an example of an enabling garden. It aims to reshape “the future of rehabilitation as it reduces stress, elevates motivation, and speeds healing beyond the current expectations of an indoor rehabilitation facility.”⁸³ The design focuses on five centres of recovery: strength, balance, agility, stability, and resilience. The features of this garden are intended to help each patient manoeuvre real-world obstacles such as climbing stairs and completing household chores. The design includes strength and agility apparatuses such as stairs with and without railings, ramps, flagstone and cobble surfaces, raised planters and multi-height seating.⁸⁴

Above: Figure 51:
Photo of completed rehabilitation garden.

Below: Figure 52:
Sketches of rehabilitation garden.



The courtyard, which is available for use during or outside of therapy sessions, serves as an easily accessible retreat for patients, staff and visitors. Given the enclosed nature of this space, it allows patients with cognitive impairments to be outside independently without the danger of becoming lost. The design of the courtyard draws from the research and precedents previously presented. The centre's overall goal of creating spaces that accommodate all levels of ability is maintained; however, areas of difficulty and complexity are incorporated to help people regain necessary life skills. In this way, the courtyard is subdivided into different areas, creating pockets of quiet and privacy, contrasting with areas of activity and stimulation.

Figure 53 includes a proposed plan of the courtyard garden. There are four well-marked

entrances into the garden, to ensure ease of access. The primary paths crossing the garden and those at the perimeter are flat and accessible. They are wide and constructed of large, slip-resistant concrete pavers. Seating options are located at intervals of no more than 25 feet (7.6m) apart, so that users can take rests along their journeys. Secondary paths are also implemented, with varied levels of difficulty. These winding routes include gradual slopes, steps and different materials such as wooden decking, flagstone, and pea gravel. Along the primary paths, the benches all have backs and armrests for comfort and accessibility; however, along the more challenging routes, the seating is at different heights and, at times, without armrests.

Hardscaped subspaces come off of the paths, offering areas of privacy, or spaces for social

congregation. These areas include both fixed and light, movable seating, allowing for flexible use. Combinations of covered and open areas provide a range of microclimate conditions, which serve as goals, or destination points. A water feature is included in one of these areas, providing positive visual distraction and soothing naturalistic sounds. These destinations, complete with ample comfortable seating, encourage people to stay in the garden longer – reaping more of the benefits offered by exposure to nature.

Much like the indoor spaces, the courtyard incorporates strategies to address challenges faced by users with vision, hearing, mobility and cognitive impairments. Creating spaces that stimulate all of the senses is important, regardless of the user's abilities. In an exterior space, there is more freedom to explore

different aromatic plantings, which appeal to all users and help guide B/VI users. The shifts in materiality along the paths, primarily intended to serve as rehabilitation tools, simultaneously act as tactile ground indicators. The water feature also serves as a wayfinding landmark due to its auditory component.

The southwest corner of the courtyard is dedicated to more challenging terrain. This zone is away from the main traffic areas and is surrounded by trees to create a sense of privacy as patients practice. Privacy is a recommended measure because recovering patients often feel self-conscious about their conditions.⁸⁵ The active area includes a ramp that descends into a sunken level for added privacy. It also includes stairs for practice.

Figure 53a:
Proposed
Landscape Plan

Varied green spaces are distributed around the building, serving as destinations to motivate increased movement. Having multiple gardens also maximizes access to sun at different times of the day.

Links to the Trillium multi-use pathway at the west edge of the site allow direct access to the Arboretum's network of trails.

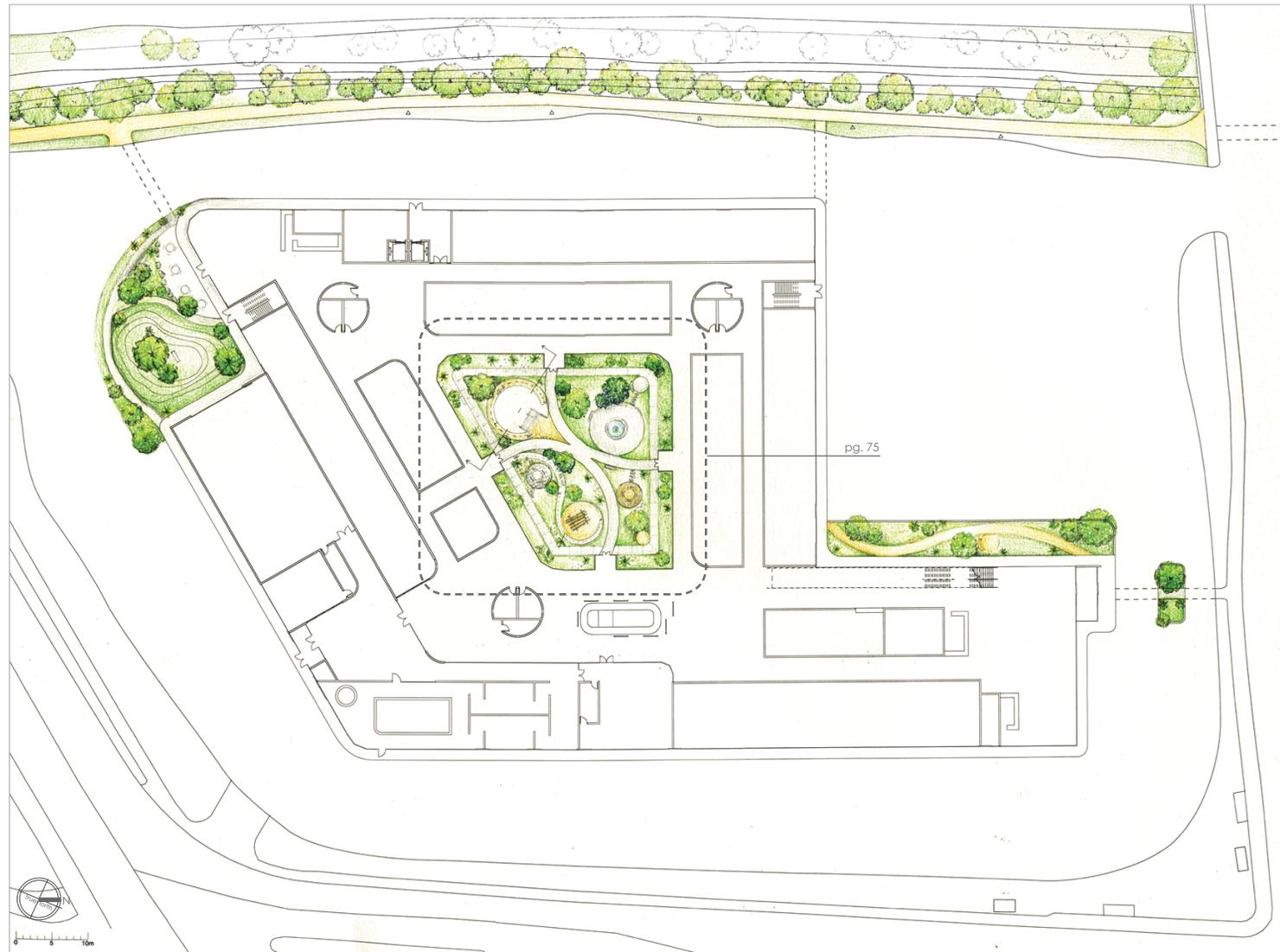
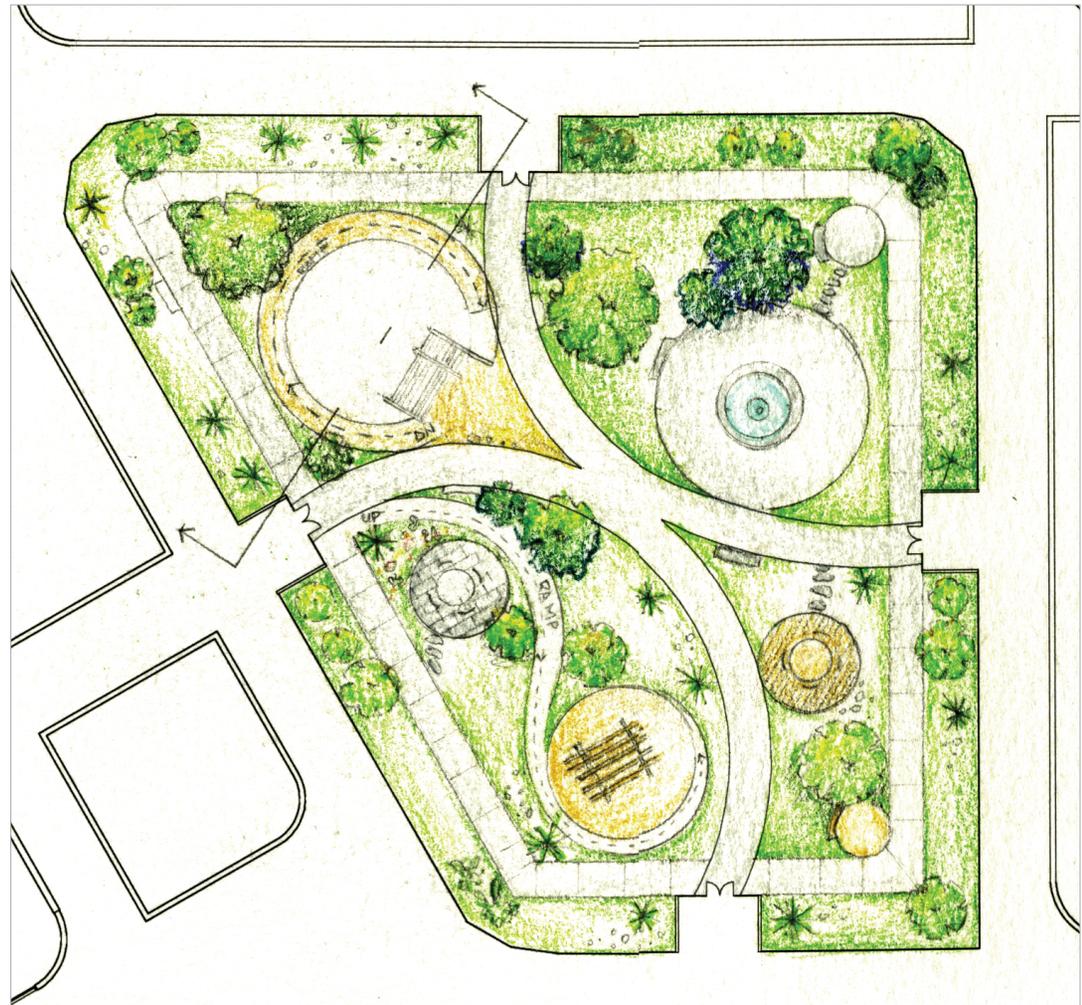
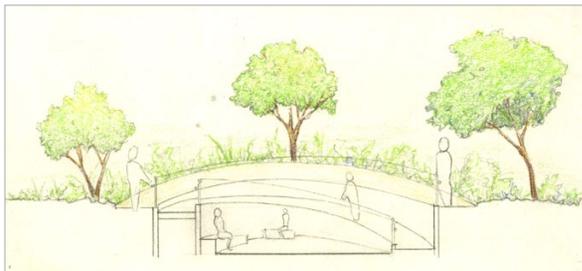


Figure 53b:
Enlarged Courtyard Landscape Plan and Section



07 CONCLUSION

This thesis began with the question: how can architecture contribute to the recovery of Acquired Brain Injury survivors? In spite of the estimated 1.5 million Canadians currently living with the effects of this invisible disability,⁸⁶ the devastating impacts of ABI are continually under-recognized. The incoming rehabilitation centre at the new Ottawa Civic Hospital campus offers a prime opportunity to remedy this gross oversight by creating spaces that are better suited to meet the needs of ABI survivors, along with those of patients in TOHRC's other care streams.

This thesis approached the design of the new rehabilitation centre with a focus on movement. Research has demonstrated that movement plays a vital role in rehabilitation - offering measurable physical, emotional and cognitive benefits. An essential component of promoting movement is

ensuring ease of navigation and orientation. In recognizing that wayfinding difficulties tend to create architectural barriers for people with physical or sensory impairments, multisensory navigation cues have been integrated into the design. To further improve the accessibility of the rehab centre, the proposed design introduces expanded handrail systems, wider corridors and rest points. These architectural elements not only support mobility, but also inspire increased movement.

Finally, this thesis looked at how the architectural spaces could simultaneously serve as tools for both formal and informal rehabilitation. Knowing that the circulation systems of rehabilitation centres are often incorporated into current therapy practices, the proposed design offers ways by which these spaces could become more user-friendly and desirable.

The design solutions presented above are linked to demonstrable benefits for building users. As such, they have the ability to inform current corporate architectural practices.

These concepts extend into the centre's outdoor spaces, which offer training environments for patients that more accurately reflect the challenges of daily life, while also serving as areas of respite for staff and visitors. In creating sensuous interior and exterior spaces of movement with moments of rest, reflection, and observation, the proposed design strategies contribute to the holistic wellbeing of all building users.



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