

# Engineering Strategies & Practice

**University of Toronto**  
**Faculty of Applied Science and Engineering**  
**ASP111 & APS112**  
***Conceptual Design Specifications (CDS)***

Team #	0072	Date	December 5th, 2022
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Project Title	Remodeling Sidney Smith entrance to an accessible and socially useable environment
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Please check off which components you are submitting for your assignment.

- ✓ CDS submitted as a PDF to Quercus with the following components:
  - ✓ Cover Page
  - ✓ Executive Summary
  - ✓ Introduction
  - ✓ Problem Statement
  - ✓ Service Environment
  - ✓ Stakeholders
  - ✓ Detailed Requirements (FOCs)
  - ✓ Generation, Selection and Description of Alternative Designs
  - ✓ Proposed Conceptual Design Specification
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# Engineering Strategies & Practice

## Executive Summary

The following document discusses the redesign of Sidney Smith's east entrance per the client's request, Christine Burke, the assistant vice president of the University of Toronto. The nature of the project is to design the entrance to be more accessible, permitting users to enter and exit more easily. This final document presents the conceptual designs and what each design entails.

The central issue with the current design is the absence of an accessible entrance that can be used in varying weather conditions. The entrance redevelopment will benefit several stakeholders, such as the students and faculty members who regularly use this entrance. There also exist stakeholders who have a strong influence but are not heavily affected by the redesign, like the companies funding the design.

The initial stages of generating a solution began with brainstorming ideas that fit specific objectives and the primary function– to provide entry and exit into the building and accommodate social gatherings. Following, a Morphological Chart was used to combine ideas to create solutions that fit the secondary functions. Subsequently, the use of the Scamper Chart helped generate new ideas. Lastly, using the method of Analogy and Triz helped improve the potential solutions through comparisons with existing designs.

The ideas were evaluated by removing redundant ideas. Furthermore, the ideas underwent a feasibility check to ensure they met the functions and constraints. Some constraints prevent the redesign of the emergency routes due to the design's public space standards and restrict changes to the door as per the client's request. Then using a multi-voting system, the ideas were reduced to fifteen solutions. Lastly, using a graphical chart, three potential solutions were selected: Multicolour Cultural Stairs, Weather Proofed Seating Areas and Outside Dining Bubble Tents.

The Pugh method was used to select an idea from the three. This led to the selection of the second design, a weatherproofed seating area. To improve this solution, features were added to maximize the functions, such as including LED lights on the stairs for safety at night.

The proposed solution is considerate of the service environment as the tempered glass enclosed area accounts for weather fluctuations. It provides a dry space during wet conditions and creates shade from the sun. The design also ensures the functions are met, as the ramps and stairs allow people to be transported vertically and horizontally, and the handrails separate the inflow and outflow. Furthermore, the objectives are also prioritized and can be tested for measurability through research, as the new design is more inclusive towards accessibility, Indigenous communities, social gatherings and ecologically conscious.

The next steps will include presenting the solution and discussing aspects such as the costs and possible trade-offs with the client.

## 1. Introduction

This project addresses the problems that the assistant vice president of the University of Toronto (UofT), Christine Burke, presented about Sidney Smith's east entrance in her client statement. This document aims to establish the client's needs and propose a feasible solution to the design problems. After identifying the service environment, stakeholders and detailed requirements, the best solution was selected through a feasibility check, Morph, Graphical and Pugh charts.

## 2. Problem Statement

The team was tasked by the client to address the absence of an accessible entrance and social gathering area that can be used in varying weather conditions in the current Sidney Smith building entrance. Although the building is home to the faculty of Art and Science, we can expect all UofT students and faculty members of the campus to use the entrance.

The gap is the absence of an accessible entrance that can be used in various weather conditions. The nature of the project is to design the entrance to be more accessible, permitting users to enter and exit more easily. Thus, the project's scope is the pathway and the elevated patio with a vertical height of nine meters. The scope allows the team to address the identified problems in a specific area while respecting the client's constraints.

## 3. Service Environment

The tables below demonstrate the apparent service environment around the design, located at, 100 St George St, Toronto, ON M5S 3G3 Canada. [1]

Table 1: Physical environment

Physical Environment		
Range of temperature	Temperature expected to range from -16°C to 27°C (Appendix A-1) [2]	<ul style="list-style-type: none"><li>• Large temperature differences</li><li>• Adapt for a large variation of temperature settings</li></ul>
Pressure Range	Air pressure ranges from 98.64 kPa to 104.67 kPa (Appendix A-2) [3]	<ul style="list-style-type: none"><li>• Standard atmospheric pressure: 101.3 kPa [4]</li><li>• Not be considered in the design.</li></ul>
Wind velocity	Maximum wind velocity in Toronto range from 59 km/h to 85 km/h throughout a year (Appendix A-3) [5]	<ul style="list-style-type: none"><li>• High wind velocity: structural damage [6]</li><li>• Solid structure</li></ul>
Humidity	The air humidity in Toronto ranges from 17% to 100 % throughout a year (Appendix A-4) [7]	<ul style="list-style-type: none"><li>• High humidity</li><li>• Prevent damage due to high humidity outdoors.</li></ul>

Pollution Concentration	2.5 average of 7.4 $\mu\text{g}/\text{m}^3$ (2019) [8]	<ul style="list-style-type: none"> <li>• Prevent the increase in air pollution</li> <li>• Using materials that will not emit dirty air or help to increase pollutants. [9]</li> </ul>
Rainfall	Yearly rainfall in Toronto ranges from 48.3 to 79.1 mm (Appendix A-5) [10]	<ul style="list-style-type: none"> <li>• Affection of this amount of rainfall is negligible</li> <li>• Not be considered in the system.</li> </ul>
Snow precipitate	Snow precipitation in Toronto ranges from 0 to 339.1mm throughout the year (Appendix A-6) [11]	<ul style="list-style-type: none"> <li>• Heavy snow</li> <li>• Removing weather buildup.</li> </ul>

Table 2: Living object

Living objects	
Pedestrians walking around the building and street	Aesthetics
Deliveries	Convenience
65,617 students (UTSG) [13]	Inclusive and large space
Animals such as Dogs, cats, pigeons, skunk, and squirrels	Environmental protection

Table 3: Virtual environment

Virtual environment	
Wireless network	The wireless network supports more than 130,000 devices and can generate almost 30 gigabits per second of traffic [14].
Cellular data	Campus-wide Wireless Network With average user of 18,754 [15].
Electricity	<ul style="list-style-type: none"> <li>- 24 hours service of electricity supply.</li> <li>- About 25% of the campus electricity is supplied by a 6 megawatts natural gas-fired cogeneration unit that also makes steam from the waste flue energy [17].</li> </ul>

## 4. Stakeholders

Table 4: Potential Stakeholders

Stakeholders	Impact by Design	Influence on Design
Current students and faculty members of UTSG	The patio is utilized as a seating area for socializing or larger gatherings if it meets the safety codes. The design benefits them, as it provides more space to socialize and gather during a wider range of weather conditions	Students have a high influence on the design. The design team considers the student needs and usability while planning for the redevelopment. Students can also include input on the design through the UofT Innovation Hub [18].
Prospective students of the Faculty of Arts & Science	They will benefit in the future from this design, in the same manner as the current students.	Similar to current students, they are also highly influenced, as the design process considers students' perspectives. This accounts for the growth of the number of students of the Faculty of Arts & Science, which was previously not considered
The government of the City of Toronto	Would be concerned about how the construction may affect the streets and sidewalks on Saint George Street. Additionally, they may provide funding for construction, as an investment for the city and university.	Government has the right to stop the renovation if the construction or design violates standards such as "Design for Public Space" [19]
Ravine and Natural Feature Protection Office	Any need to move or remove trees will need a permit. [20] [21]	They can prevent renovation due to the absence of permits.
Funding agencies - UofT has a sector that funds campus-related renovations	Will not waste money on designs that have minimal effect.	A strong influence on projects as any redesign can be restrained by the budget. Without proper funding, projects will strive to get the right resources. It will be hard to find the money needed [22]

## 5. Detailed Requirements

### 5.1 Functions

- Primary Function: Implement entry and exit into the building  
Secondary Function:
  - Transport vertically
  - Transport horizontally
  - Channel people going in and out of the building
  - Remove weather rainfall and snow buildup
- Primary Function: promote social gatherings  
Secondary Function:
  - Shield against harsh weather
  - Connect individuals
  - Maintain a comfortable atmosphere for users

## 5.2 Objectives

The objectives in this section were sorted from most to least important using the pairwise comparison method (Appendix C-1).

Table 5: Objectives

Objectives from Primary function 1	Metrics	Goals
Allow accelerated, optimized access to the building	The number of people using the Sidney Smith building entrance in any given weather condition	Between 150-250 people can use the entrance during any time and weather condition (Appendix C-2).
Provide safe, accommodating entrance and exit	The height of snow buildup on the entrance pathways over a specific period	To ensure the height of snow buildup does not exceed 15 cm within 12 hours or less [23]
Provide direct pathways for people with disabilities	The number of direct pathways open for the disabled	Has at least one direct open pathway at all times for disabled people (Appendix C-4).
Objectives from Primary function 2	Metrics	Goals
The design should facilitate social gatherings	The surface area available for gatherings	To have at least 5m <sup>2</sup> area available for social gatherings.

Comfortably accommodating social gatherings	The temperature range of the area in a month	To maintain the temperature below 27°C in direct sunlight and above 8°C during winter, excluding extreme weather conditions like blizzards (Appendix C-5).
Display the university's commitment to the land acknowledgment	The number of land recognition and direction representations at the entrance	Display at least four representations split in half between direction and land recognition

### 5.3 Constraints

The following table discusses the constraints of the design.

Table 6: Constraints

Features	Requirements
Doors (Exits and Entrances)	The doors cannot be changed for redevelopment
Doors (Egress route)	Any new design must maintain a minimum emergency egress route from the exits located on the podium down to the ground level.
Pathway (Egress route)	<ul style="list-style-type: none"> <li>Emergency egress route can be moved to another location, but the flow rate (which is sized to the building occupancy) must be maintained or increased. [24]</li> <li>Emergency egress route must be kept clear of obstacles (e.g. bikes, ice/snow in winter)</li> </ul>
Stair (Egress route)	<ul style="list-style-type: none"> <li>All landing guardrails, regardless of drop height, must be 42 inches high.</li> <li>Stair rails, whether they are mounted to the stairs or on walls, must be 36 inches high.</li> <li>Vertical pickets must be no more than 4 inches on center. [25]</li> </ul>
Structures (tents, light etc.)	According to <i>TORONTO MUNICIPAL CODE</i> , Chapter 313, Streets and Sidewalks, 313-64; any structure should not extend to the area above the section owned by the government. [26]

Drainage system	<ul style="list-style-type: none"> <li>• Snow and rainwater management shall not affect government-owned streets <ul style="list-style-type: none"> <li>○ According to 313-15 (<i>TORONTO MUNICIPAL CODE</i>), Melting snow and rainwater from Sidney Smith should not flow over or run across the government-owned sidewalk or street.</li> <li>○ According to 313-3 (<i>TORONTO MUNICIPAL CODE</i>), Snow or ice shall not be moved from private property onto a street.</li> </ul> </li> </ul>
Constructions	According to <i>TORONTO MUNICIPAL CODE</i> , Chapter 313, Streets and Sidewalks, 313-22; a permit is required when a street needs to be temporarily closed for construction.

## 6. Generation, Selection and Description of Alternative Designs

The following section describes the idea generation, selection, and alternative design solutions.

### 6.1 Idea Generation Process

The Design Space was created through iteration and the use of idea-generation methods. A morphological chart was used to document all the subfunctions and various ideas that would enable those subfunctions. A series of various combinations were taken to create various solutions that responded to the design problem (Appendix D-1). Later, Analogy and Triz were used by the team to compare similar real-world problems that have already been solved and apply a modified version to produce more ideas (Appendix D-2, D-3). Brainstorming was used to create solutions to the design problems or specific subfunctions (Appendix D-4). Following this, Scamper was used with the current entrance of the Sidney Smith building as a template to generate more design ideas (Appendix D-5). To keep track of the ideas, the team used a series of headings to reference each solution to its idea generation method and an overall numbering system to attribute to each idea a unique identifier. Most idea generation was done during team meetings where the team worked individually or individually to improve productivity and commitment.

### 6.2 Alternative Design Selection Process

During this process, the design solutions were reduced using methods and iterations to select the most feasible solution to the design problem.

#### 6.2.1 Consolidation of Ideas

Following idea generation, the team had to eliminate ideas that were repetitive. To achieve this, the team used a voting system where each team member attributed 0 or 1 to the idea they thought were repetitive or unique respectively. The process was divided into 8 rounds of twenty ideas



each. This process allowed the team to quickly reduce the number of ideas to 58 unique design solutions (Appendix D-6).

## **6.2.2 Feasibility Check**

Using the list of functions and constraints as a reference, the team modified design ideas or combined ideas to produce potential solutions that met all the functions and constraints. The team eliminated ideas that were not physically feasible or made no substantial addition to the actual solution. At the end of this process, the team reduced the list to 50 viable potential solutions (Appendix D-7).

## **6.2.3. Multivoting**

Multivoting allowed the team to reduce the design space even further. Each team member was given 15 votes (30% of the total 50 feasible ideas). Each team member voted for 15 ideas, provided that no team member could vote for the same idea twice. The votes were then collected, tallied and put into a table (Appendix D-8). By selecting the ideas with the highest score, the design team was able to reduce the ideas to 15 potential solutions.

## **6.2.4 Graphical chart**

Using the most important objective of each main function as the x and y axis of our graphical chart, the team was able to place each idea on the chart by assessing how they enable the function. Following this step, the team had 5 ideas in the top right corner of the chart, thus, iteration was used. The team made a second morphological chart with the second most important objectives of each main function. This reduced the number to 3 alternative design ideas (Appendix D-9)

## **6.3 Alternative Design Description**

### *Design 1 – Multicolor Cultural Stair*

Multicolor Stairs that can promote Indigenous communities are the focus of this design (Appendix E-1). The stairs will be painted with different colors to represent the different spiritual values of the Indigenous community. Five stairs facing St. George Street are divided by four flower plots. Each section will be painted a color with its represented meaning. The first color, orange, will honor the thousands of Survivors of residential schools. The rest of the colors will be the four colors from the Medicine Wheel – white, black, yellow, and red, representing Movement Behaviour (mental), Knowledge Feeling (emotional), Time Relationship (physical), and Vision Respect (spiritual) respectively. In addition to providing a more usable social space, umbrellas of two different dimensions are used. A total number of eight umbrellas, two larger ones (15ft in length) and six smaller ones (9ft in diameter), will be placed on the patio area. The dining table and chairs will also be placed under each umbrella. While redesigning the stairs, a heating system will be integrated to prevent snow build-up.

### *Design 2 – Weather Proved Seating Area*

The main focus of this idea is to create an outdoor seating area that promotes sociability under any given weather conditions without interfering with any existing infrastructure. Tempered glass will be used both as the wall (height: 2.8 m) and over the top (40m x 12m) as to have full coverage of the raised patio area right outside the Sidney Smith building with bearing columns distributed at 5-meter intervals to withstand the load of heavy snow (Appendix E-2). There will be ramps on the side of the stairs to provide accessibility to people with disabilities. The stairs will be built with internal heating systems to prevent the build-up of snow or speed up its melting. In order to prevent accumulation of water from melting snow or heavy rain, there will be 0.25-meter wide, 1-meter-long drainage wells at 5-meter intervals, where surrounding floors have a minimum slope tilting towards their edges, allowing better water flow.

### *Design 3 – Outside dining bubble tent*

The main focus is the outdoor dining bubble tents that can help increase the social usability of the space. The bubble tent will be semi-spherical and transparent. This structure allows it to receive sunlight from all directions and provides a warm and windless environment. This plan includes nine bubble tents in total, each 3.6 meters in diameter, distanced 2.4 meters from the building and 1.4 meters away from each other (Appendix E-5). The bubble tent will be located in the raised patio area outside the Sidney Smith building where the seating area is currently located. In order to fit the bubble tents, the old seating area, including the tables, chairs, fake grass, and the cover will be removed. The stairs and tree locations will remain the same. Other necessary designs, such as a heated floor that prevents snow build-up and a lift platform that helps people with accessibility needs are also within the design consideration. The design for the bubble tents will take into account the values of the Faculty of Arts and Sciences. Elements that demonstrate diversity, such as the country flag illustration or rainbow, will be integrated into the bubble tents.

## **7. Proposed Conceptual Design Specification**

In order to determine the final proposed conceptual design, the design team utilized the fifth step of the idea selection method, the Pugh Method (Appendix D-10). During this process, the team created a pairwise comparison table by using the objectives as the rows of the table and columns corresponding to the potential solutions. The alternative solutions in the third and fourth columns were evaluated against the standard concerning the corresponding objectives by situating the idea selected for comparison in the second column. Thus, summing up each entry in the columns into the final row will indicate the alternative solution against our standard proposed design. The design team could locate the proposed conceptual design by selecting the idea with the highest sum. Consequently, the team reduced the number to one viable conceptual design to initiate.

The team proposes the alternative idea to have three ramps included within the stairs for people with wheelchairs, optimizing tempered glass to create a covered area with seating space. Furthermore, the stairs will have a heating system to remove snow build-up, install LED lights

between the stairs, and drainage to remove water from the stairs. Furthermore, modifications and customized features will be added to the current design to enhance and maximize the function of the front entrance and facade by having a handrail between stairs leading up and down and indicating signs for directions (Appendix E-3, E-4). Specifically, the design introduced the idea of a glass-enclosed patio, using tempered glass to protect from sun and shade while protecting the users from external elements. They provide extra protection from snow during the winter as an extra barrier. Ultimately, They offer protection from pests and allow users to have more open space and purified air. The ideas proposed will resolve the client's problem because the critical issue with the Sidney Smith building lies within the accessibility and ergonomics of users.

## 8. Measures of Success

Table 7: Measure of Success

Objectives	Goals and Testing Methods
Allow accelerated, optimized access to the building	600 and 950 people using the dedicated entrance per day, including after snowfall
	<b>Test:</b> simulate the number of people using the new entrance per day and compare the result to the cited goal. <b>Testing procedure:</b> -During winter conditions, count the total number of people using the one open set of stairs of the current entrance for a month -Multiply this number by the number of open pathways in the proposed solution and divide by the number of university business days of the month
Provide safe, accommodating entrance and exit	Height of snow buildup does not exceed 15 cm within 12 hours or less
	<b>Test:</b> Use an overestimate of the snowfall rate in Toronto (Service environment: 33.91cm /year) to simulate snowfall on a heated plate <b>Testing Procedure:</b> - Use the overestimate of the snowfall given above to find the rate of snowfall over 1 meter squared - In a testing lab, take a 1 meter squared heating plate and add snow on the plate at the calculated rate - Continuously deposit the snow on the heating plate over 12 h and measure the height of snow on the plate at set interval - Use the calculated result to prove whether the objective has been achieved.
The design should facilitate social gatherings	At least a five square meters area available for social gatherings.
	Use the dimensions of the new design to estimate the area available

	for seating. This is a simple calculation of the total area in the scope minus the area used for stairs and green areas.
Comfortably accommodate social gatherings	Temperature ranges 8-27 °C at all times, excluding extreme weather conditions like blizzards (Appendix C-5).
	<b>Test:</b> Estimate the temperature inside the tempered glass area. <b>Testing procedure:</b> <ul style="list-style-type: none"> <li>- Three times a day for a month, record the outside temperature</li> <li>- Using the heat again of the specific tempered glass [27], calculate the temperature inside the tempered glass structure.</li> <li>- Compare the results with the range to prove that the goal is achieved.</li> </ul>
Display the university's commitment to the land acknowledgment	Display at least four representations split in half between direction and land recognition
	<b>Test:</b> Calculate the users' satisfaction percentage with the appointed Indigenous representatives. <b>Testing procedure:</b> Make a 3D prototype of the implemented design that includes the direction sign and land recognition, and regularly conduct surveys to receive users' information about the cultural representation of the Indigenous community. The results are considered a success if over 80% of users who completed the survey are satisfied with the given design.

## 9. Conclusion

In conclusion, this document was modified to improve our previous project requirements and provide a feasible solution to meet the client's needs. Using many different processes we were able to pick the main solution that met our objectives and functions. Our main solution was providing 3 ramps as well as a glass-enclosed area that has bubble tents. This solution met our objectives and functions as it accommodates social gatherings and protects everyone from harsh weather. Our next steps are to start implementing this design process with prototypes and eventually start working on Sydney Smith to meet the client's deadline to finish the project by the end of the year.

## 10. Reference List

- [1] University of Toronto Map “*University of Toronto*” *map.utoronto.ca*. [Online]. Available: <https://map.utoronto.ca/?id=1809#!m/494510?sbc/>. [Accessed: 04-Dec-2022].
- [2] Toronto Climate, Weather By Month, Average Temperature (Canada) - Weather Spark. “*Climate and Average Weather Year Round in Toronto*” [Online]. Available: <https://weatherspark.com/y/19863/Average-Weather-in-Toronto-Canada-Year-Round>. [Accessed: 04-Dec-2022].
- [3] Amateur Weather Statistics for Toronto, Ontario. “*Sea level pressure - annual data for Toronto*”[Online]. Available: [https://toronto.weatherstats.ca/charts/pressure\\_sea-yearly.html](https://toronto.weatherstats.ca/charts/pressure_sea-yearly.html). [Accessed: 04-Dec-2022].
- [4] Grand River Conservation Authority, “*Barometric Pressure*” [Online]. Available: [https://apps.grandriver.ca/waterdata/kiwischarts/bp\\_grand.aspx](https://apps.grandriver.ca/waterdata/kiwischarts/bp_grand.aspx) [Accessed: 2022]
- [5] Environment and Climate Change Canada, “*Wind Gust Speed and Direction - Annual data for Toronto*,” 23-Oct-2022. [Online]. Available: [https://toronto.weatherstats.ca/charts/wind\\_gust-yearly.html](https://toronto.weatherstats.ca/charts/wind_gust-yearly.html) [Accessed: 2022]
- [6] National Oceanic and Atmospheric Administration, “*Estimating Wind Speed*” [Online]. Available: <https://www.weather.gov/pqr/wind>[Accessed: 2022]
- [7] Environment and Climate Change Canada, “*Relative Humidity - Monthly data for Toronto* ,” 23-Oct-2022. [Online]. Available: [https://toronto.weatherstats.ca/charts/relative\\_humidity-monthly.html](https://toronto.weatherstats.ca/charts/relative_humidity-monthly.html). [Accessed: 2022]
- [8] IQAir and Ministry of the EnvironmentGovernment of Ontario, “*Air quality in Toronto*,” 23-Oct-2022. [Online]. Available: <https://www.iqair.com/ca/canada/ontario/toronto>. [Accessed: 2022]
- [9] United States Environmental Protection Agency “*Air Data Basic Information*,” 23-Oct-2022. [Online]. Available: <https://www.epa.gov/outdoor-air-quality-data/air-data-basic-information>[Accessed : 2022]
- [10] Weather Spark, “*Rainfall*,” 2022. [Online]. Available: <https://weatherspark.com/y/19863/Average-Weather-in-Toronto-Canada-Year-Round#:~:text=The%20coldest%20month%20of%20the,high%20of%2030°F>. [Accessed: 2022]
- [11] Environmental Canada, “*Toronto Snowfall Totals & Accumulation Averages*,” 2022. [Online]. Available:

- <https://www.currentresults.com/Weather/Canada/Ontario/Places/toronto-snowfall-totals-snow-accumulation-averages.php>. [Accessed: 2022]
- [12] K. Drew, R. Macfarlane, K. Sabaliauskas, T. H. Oiamo, H. Davies, and C. Rinner, “*Environment Noise Study in the City of Toronto*,” Apr. 2017 [Online]. Available: <https://www.toronto.ca/wp-content/uploads/2017/11/8f4d-tpH-Environmental-Noise-Study-2017.pdf>. [Accessed: 2022]
  - [13] University of Toronto “*Quick Facts*,” 01-Dec-2022. [Online]. Available: <https://www.utoronto.ca/about-u-of-t/quick-facts> [Accessed: 2022]
  - [14] University of Toronto “*Next-generation Wi-Fi is a cornerstone technology at U of T*,” 07-Jun-2021. [Online]. Available: <https://its.utoronto.ca/next-generation-wi-fi-is-a-cornerstone-technology-at-u-of-t/> [Accessed: 2022]
  - [15] University of Toronto “*St George Campus - Wireless User Total*,” 01-Dec-2022. [Online]. Available: <https://wifimap.eis.utoronto.ca/d/qrMXLDpGz/university-of-toronto-wireless-users?orgId=1&refresh=5m&kiosk=tv&var-campus=UTSG&var-vbuilding=Morrison%20Residence>[Accessed: 2022]
  - [16] University of Toronto “*Connect with U of T on social media*” 2022. [Online]. Available: <https://www.utoronto.ca/social-media-directory/all> [Accessed: 2022]
  - [17] University of Toronto, “*Energy Conservation and Demand Management Plan*,” Jul. 2019 [Online]. Available: <https://www.fs.utoronto.ca/wp-content/uploads/2021/04/Energy-Conservation-Demand-Management-Plan-St-George-Campus-July-2019.pdf>[Accessed: 2022]
  - [17] University of Toronto, “*Energy Conservation and Demand Management Plan*,” Jul. 2019 [Online]. Available: <https://www.fs.utoronto.ca/wp-content/uploads/2021/04/Energy-Conservation-Demand-Management-Plan-St-George-Campus-July-2019.pdf>[Accessed: 2022]
  - [18] University of Toronto, “*Campus Hub for the Faculty of Arts & Science(Sidney Smith Hall Redevelopment)*” [Online]. Available: <http://blogs.studentlife.utoronto.ca/innovationhub/sidney-smith-hall-redevelopment/> [Accessed: 2022]
  - [19] University of Toronto, “*About The Government Relations Office*.” [Online]. Available: <https://gro.utoronto.ca/about-us/>. [Accessed: 2022]
  - [20] Toronto, “*When to Apply For a Tree or Ravine Permit*,” 2022. [Online]. Available: <https://www.toronto.ca/services-payments/building-construction/tree-ravine-protection-permits/when-to-apply-for-a-tree-or-ravine-permit/>. [Accessed: 2022]
  - [21] C. C. John d. Elvidge, *CHAPTER 813, TREES*. [https://www.toronto.ca/legdocs/municode/1184\\_813.pdf](https://www.toronto.ca/legdocs/municode/1184_813.pdf), 2022.

- [22] Pinto, J. Â. C., “*Financing the project*,” 20-May-2009. [Online]. Available: <https://www.pmi.org/learning/library/financing-project-planned-value-6866>[Accessed: 2022]
- [23] Government of Canada, “*Snowfall*,” 20-May-2009. [Online]. Available: <https://www.canada.ca/en/environment-climate-change/services/types-weather-forecasts-use/public/criteria-alerts.html#snowFall>[Accessed: 2022]
- [24] The Ontario Building Code | Width of Means of Egress. “*BuildingCode.online*” [Online]. Available: <https://www.buildingcode.online/597.html>. [Accessed: 04-Dec-2022].
- [25] Omega Iron and Railings. “*Ontario building code and Toronto municipal code*” [Online]. Available: <https://www.omegairon.com/ontario-building-code.html>. [Accessed: 04-Dec-2022].
- [26] City of Toronto “*TORONTO MUNICIPAL CODE, STREET AND SIDEWALKS.*” , Toronto, 2006.
- [27] All Weather Windows, “*Glass Performance Chart*,” 2022. [Online]. Available: <https://www.allweatherwindows.com/the-pros/architect/glass-performance-chart/> [Accessed: 2022].

## 11. Appendices

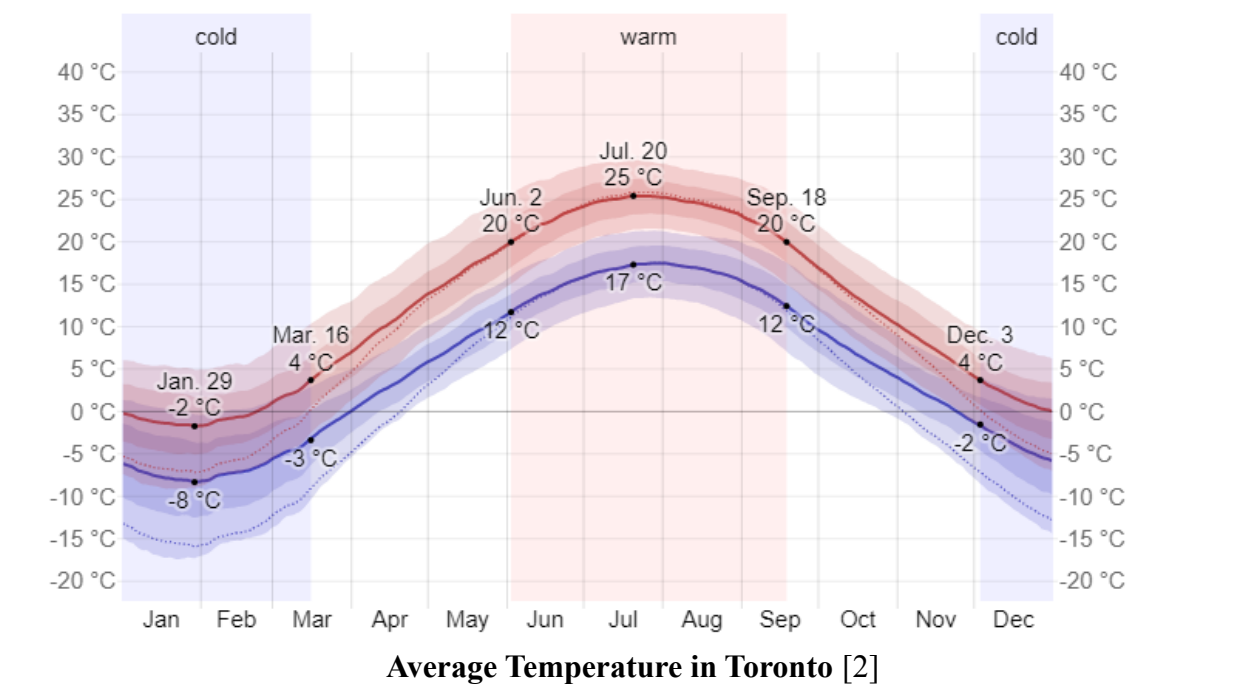
### Appendix A

#### Weather Conditions

This appendix consists of the weather conditions in Toronto throughout the years. Each graph explains the different elements of weather conditions we expect to see. The graphs represent the average temperature, sea level, wind speed and direction, humidity data, and average rainfall. The purpose of this graph was to prove the different weather conditions Toronto can receive.



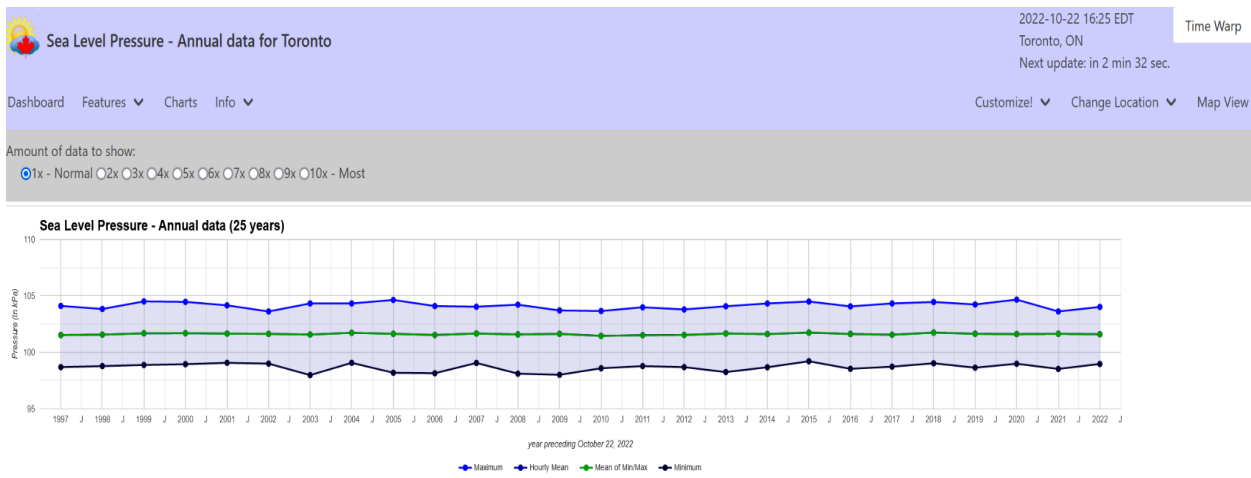
A-1: highest to lowest weather conditions [2]



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	-1 °C	-1 °C	4 °C	11 °C	17 °C	22 °C	25 °C	24 °C	20 °C	13 °C	7 °C	2 °C
Ave. Temp.	-5 °C	-4 °C	0 °C	6 °C	13 °C	18 °C	21 °C	21 °C	17 °C	10 °C	4 °C	-1 °C
Low	-8 °C	-7 °C	-3 °C	3 °C	9 °C	14 °C	17 °C	17 °C	13 °C	7 °C	1 °C	-4 °C

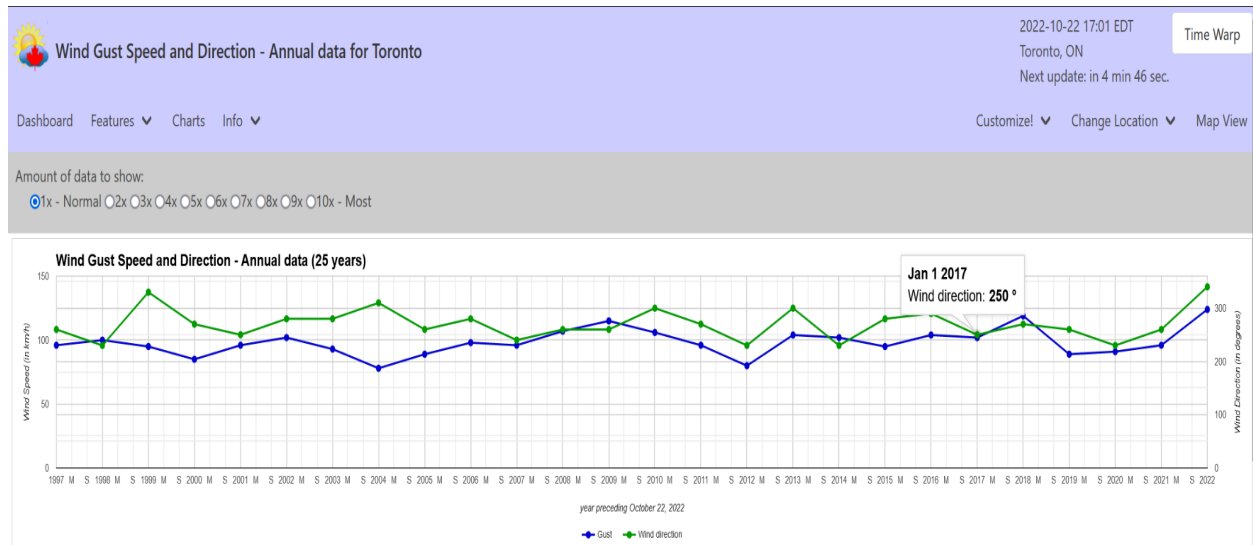
Scatter Plot Points Throughout The Year

A-2 Sea level pressure in Toronto [3]

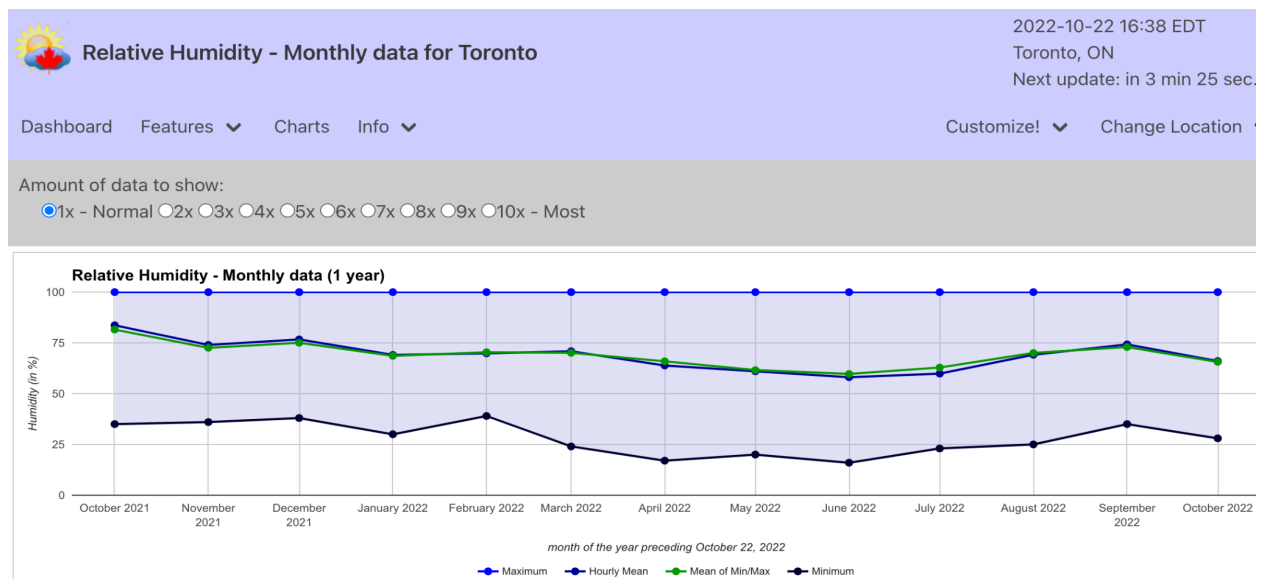




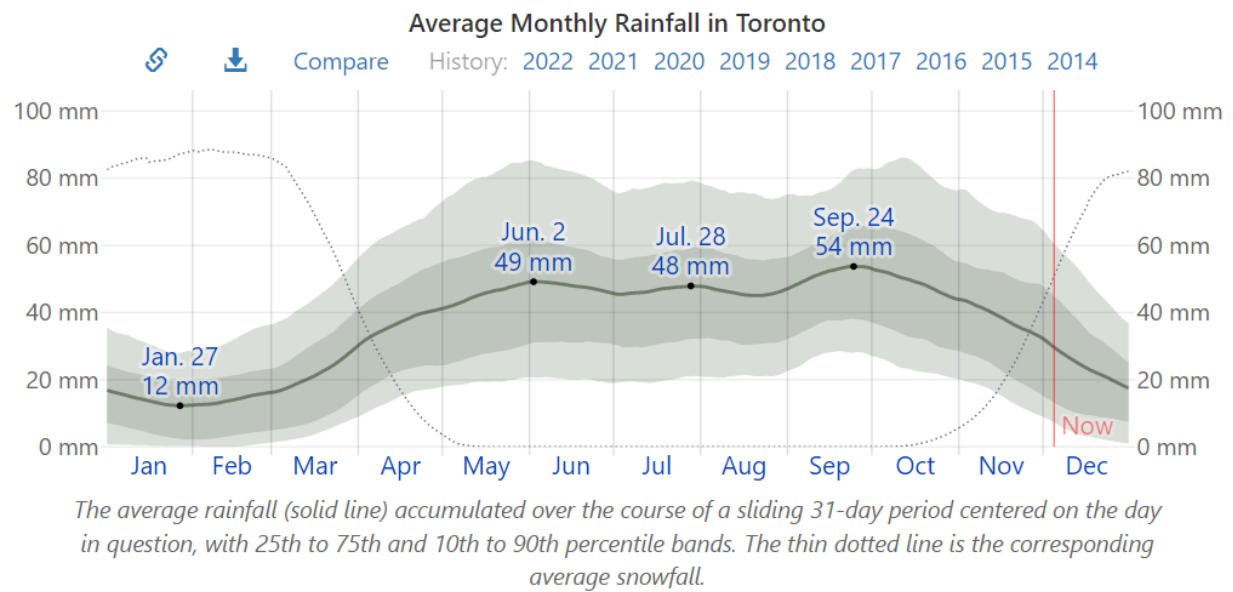
## A-3 Wind speed and direction for the past 25 years [5]



## A-4 Humidity data [7]



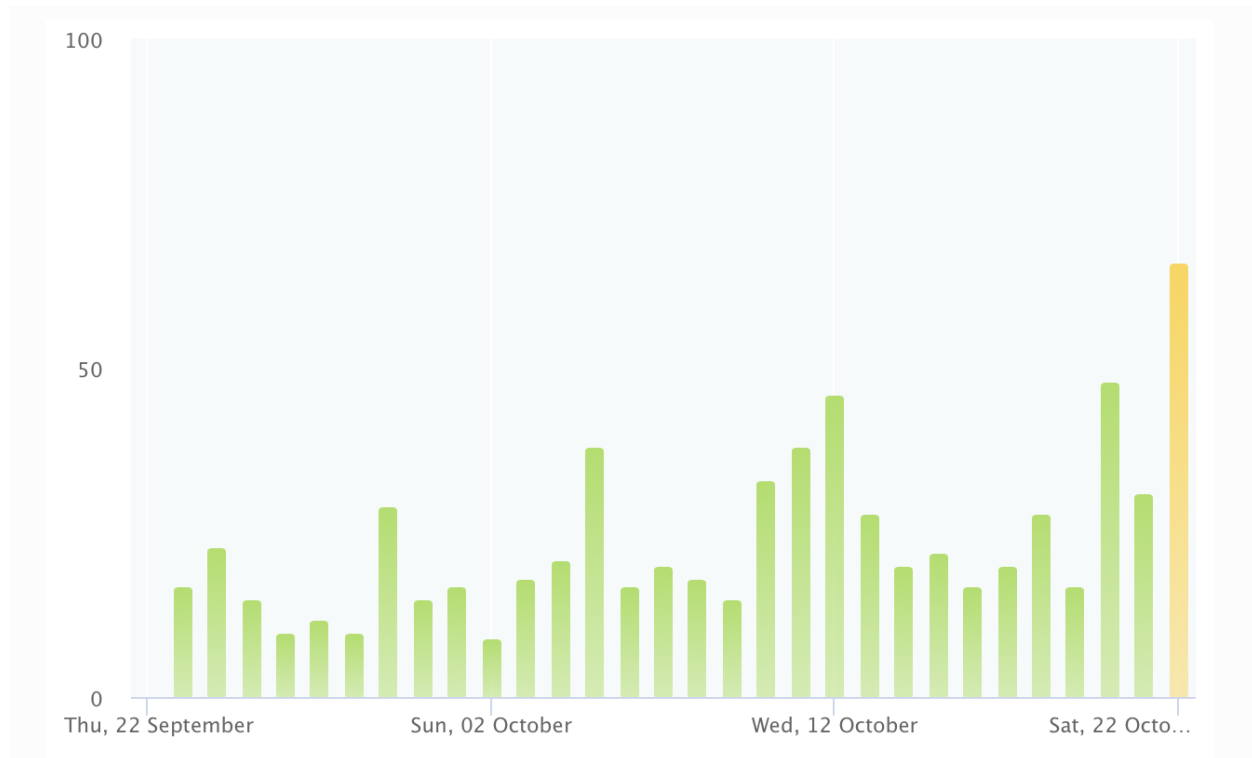
## A-5 Average rainfall [10]



A-6 Average snowfall each month on average in Toronto (2010 to 2019) [11]

	Centimetres
January	24
February	34
March	11
April	5
October	0
November	6
December	20

A-7 Air quality index [8]



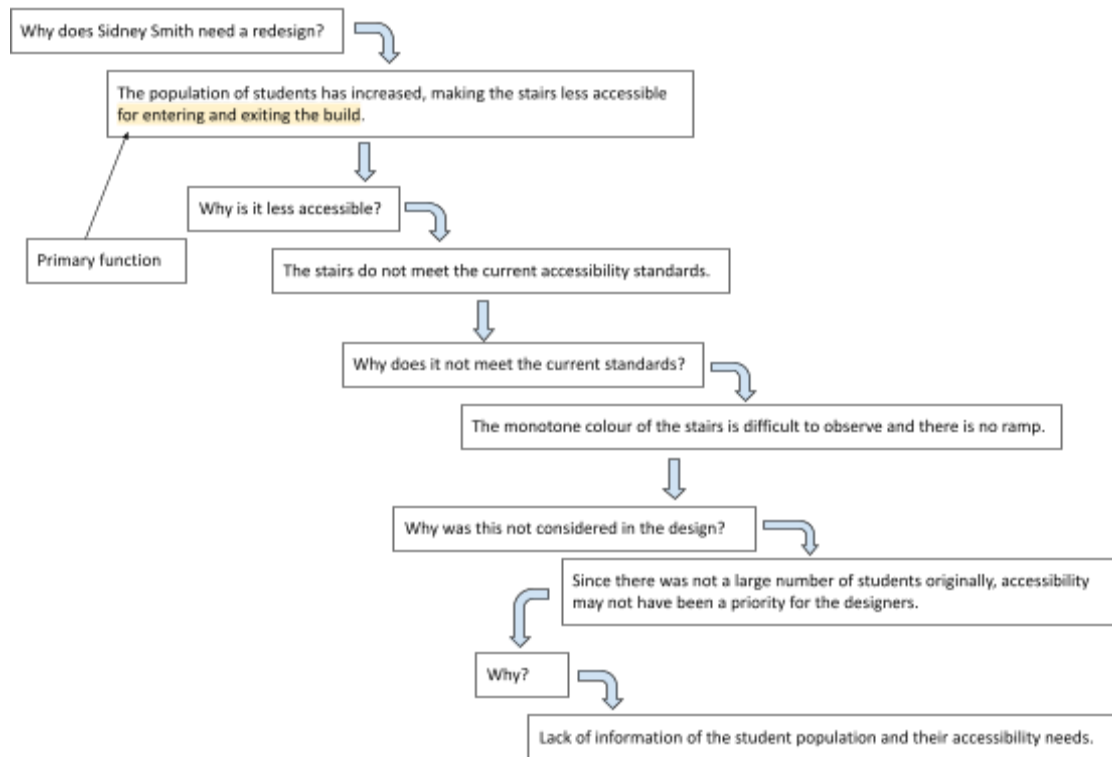
## Appendix B

### Methods Used to Determine Functions

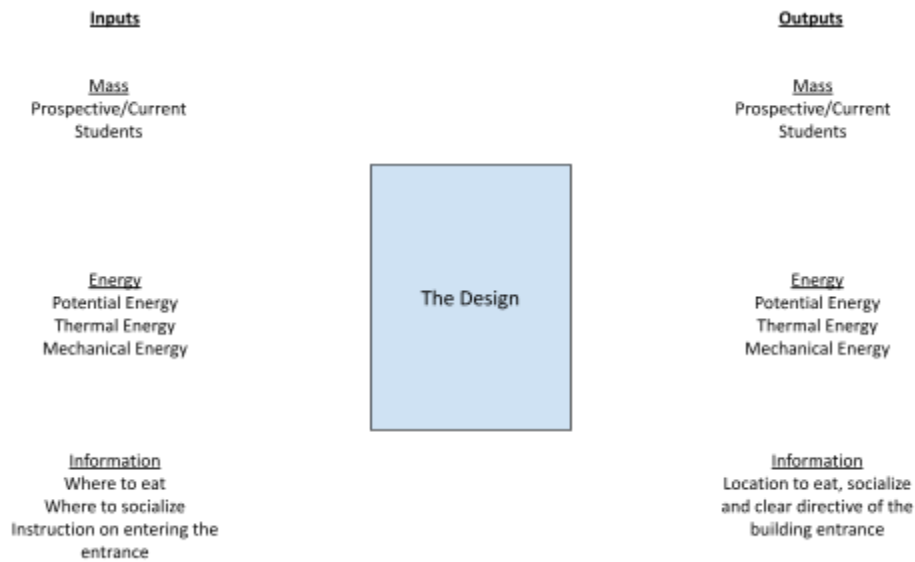
This section consists of the “Five Why Method” and the “Black Box method” we use to determine the functions for our design process. These graphs consist of the elements we needed to portray our ideas for the function. We choose to use these methods because they provide a clear way to figure out our functions. We choose to use the Five Why Method to ask ourselves every possible ‘why’ when thinking about our functions. Furthermore, we decided to use the Black Box method to evidently show the inputs and outputs of the design.

#### B-1 The Five Whys Method

## Five Whys Method



## B-2 The Black Box Method



## Appendix C

### Methods Used to Determine The Objective's Priority

#### C-1. Pairwise Comparison

1. Accelerated and optimized access
2. Facilitate social gatherings
3. Comfortably accommodate
4. Direct pathway for disabled
5. Commitment to land acknowledgment and entry indications
6. Safe entrance and exit
7. Aesthetics and ecological spaces

	1	2	3	4	5	6	7	Score
1	--	1	1	1	1	1	1	6
2	0	--	0	1	1	0	1	3
3	0	1	--	0	1	0	1	3
4	0	1	1	--	1	0	1	4
5	0	0	0	0	--	0	1	1

6	0	1	1	1	1	--	1	5
7	0	0	0	0	0	0	--	0

C-2: As stated in the client statement, the actual stairs of the building get covered in snow [Figure 1]. Due to expensive maintenance, only one set of stairs is open during winter thus creating congestion and extremely reducing the free flow of people entering and exiting the building.



*Figure 1. Conditions of access after snowfall*

C-3: The current solution has a low tonal contrast that is hindering people with impairments which goes against the subsection 8ii, article 80.25 of “ACCESSIBILITY FOR ONTARIANS WITH DISABILITIES ACTS”. Our own research revealed a severe lack of visibility, especially at night, on the site.

C-4: The current solution does not provide any facility for the disabled which goes against the commitment of the University of Toronto to provide accessibility accommodation for all people. Additionally, it is hard to navigate and does not display land acknowledgment which goes against the university’s commitment to land recognition. [13]

C-5: According to the standard of human comfort, the range of temperature for a human to be comfortable goes from 12 °C to 25 °C. We choose to set our goal a bit outside this range in order to broaden our potential design space. [14]

## Appendix D

### Idea Generation

#### D-1: Morphological Chart

	Means	Means	Means	Means
Transport vertically	Stairs	Lifted Platforms	Ramps	Escalator
Transport horizontally	Moving walkways	Ramps	Slides	Platforms on wheels
Channel people in and out	Barriers/Fences	Indication Signs	Inverse Moving Walkways	Separate entrance and exit
Remove weather buildup	Heating Systems	Snow Shovel Machine	Channels for water and melted snow	Salt dispenser
Shield against harsh weather	Canopies	Hard Ceiling	Artificial metal tree	Sunbrella (from the canvas)
Connect individuals	Giant chess games	Seating areas	Podiums (potentially for events)	Mini-golf
Maintain a comfortable atmosphere for users	Outdoor/Party tents	Trees	Outdoor heater	Transparent window

#### Potential Ideas:

1. Stairs and ramp leading up, the in and outflow is separated by a fence. A seating area protected by artificial trees and warmed by heating a heating system.
2. A combination of lift platform for people going up and slides for people going down with channels to remove water. An outdoor tent protected by a sunbrella with a minigolf inside
3. An Escalator going up and Escalators going up and down. Salt dispenser to remove wetness on the giant chess game below the artificial trees.
4. Stairs with signs up and down leading to a walkway. A hard ceiling protects the seating area below and transparent doors maintain a comfortable atmosphere.
5. Ramps going upward and downward to separate entrance and exit. A canopy is enclosed by transparent windows to protect the seating area below.
6. Ramps going up and down where a podium is protected by a giant outdoor tent.

7. Lifted platform going up with heating system below a canopy. The area is kept warm using a heating system
8. Lift platforms to carry people up and down, forward and backward moving walkways. A sunbrella covering a giant chess game with outdoor heaters to keep a warm atmosphere.
9. Ramps coupled with platforms on wheels to transport people vertically forward and backward. A canopy covering a podium with outdoor heaters.
10. Use ramps for accessibility and transporting vertically and horizontally, indication signs,
11. Stairs to transport vertically, Moving Walkways to transport horizontally, Barriers/Fences to channel people in and out, Heating Systems to remove weather buildup, Canopies to shield against harsh weather, Giant chess games to connect individuals, Outdoor/Party tents to maintain a comfortable atmosphere for users
12. Lifted platforms to transport vertically, Moving Walkways to transport horizontally, Barriers/Fences to channel people in and out, Heating Systems to remove weather buildup, Canopies to shield against harsh weather, Giant chess games to connect individuals, Outdoor/Party tents to maintain a comfortable atmosphere for users
13. Ramps to transport vertically, Moving Walkways to transport horizontally, Barriers/Fences to channel people in and out, Heating Systems to remove weather buildup, Canopies to shield against harsh weather, Giant chess games to connect individuals, Outdoor/Party tents to maintain a comfortable atmosphere for users
14. Escalator to transport vertically, Moving Walkways to transport horizontally, Barriers/Fences to channel people in and out, Heating Systems to remove weather buildup, Canopies to shield against harsh weather, Giant chess games to connect individuals, Outdoor/Party tents to maintain a comfortable atmosphere for users
15. Escalator to move vertically, then slide to the door. The heating system is used to remove the weather impairment on escalators and slides. Artificial trees protect a giant chess game.
16. Stairs leading up and down with moving walkways leading to different entrances and exits. Sunbrella covers a podium with trees for a comfortable atmosphere
17. Lifted platforms with moving walkways in different directions to different entrances and exits. Weather impairments can be shovelled out. A Canopy covering a minigolf.
18. Lifted platforms leading up and down with ramps and indications signs to show entry and exit. A hard ceiling covers a seating area with transparent windows to shield it against the weather.
19. Stairs leading up and down with moving walkways leading to separate entrances and exits. Hard ceiling covering a seating area with greenery.
20. Take the ramp to move vertically and horizontally, and use indication signs to channel people, snow shovelling machine can remove the snow, and canopies can be used to protect against harsh weather and seating areas can help connect individuals
21. Moving walkways combined with stairs to transport people, where barriers/fences Chanel people, a salt dispenser can aid in removing snow, an artificial metal tree can help shield against harsh weathers, mini-golf can connect individuals and trees can maintain a comfortable atmosphere
22. Lifted platforms and ramps to transport vertically and horizontally, have separate entrances and exit to Chanel people, use a heating system to remove weather buildup, build a hard veiling to shield against weather, include giant chess games to connect



- individuals and have a transparent window for a comfortable atmosphere
23. Use platform on wheels to transport, have indication signs to channel people, including a canopy to shield against harsh weather, seating areas to connect individuals, trees to maintain a comfortable atmosphere
  24. Stairs and ramps to transport vertically and horizontally, barriers/fences to channel people in and out, snow shovel machine to remove snow, outdoor heater to maintain a comfortable atmosphere for users
  25. Stairs and slides to transport vertically and horizontally, separate entrance and exit to channel people, salt dispenser can remove snow buildup, hard ceiling can shield against harsh weather, transparent windows can maintain a comfortable atmosphere
  26. Ramps and moving walkways to transport vertically and horizontally, inverse moving walkways to channel people in and out, channels for water and melted snow, artificial metal trees to shield against harsh weather, podiums for potential events to connect individuals and trees to maintain a comfortable atmosphere for users.
  27. Lifted platforms and ramps to transport vertically and horizontally, barriers/fences to channel people in and out, salt dispensers to remove weather buildup, sunbrellas to shield against harsh weather and trees can be used to maintain a comfortable atmosphere for users
  28. Stairs and Slides to transport vertically and horizontally, heating systems to remove weather buildup, canopies to shield against harsh weathers and seating areas to connect individuals
  29. Ramps and platform on wheels to transport horizontally, snow shovel machines to remove snow, artificial metal tree to shield against harsh weather, trees to maintain a comfortable atmosphere for users
  30. Escalators and ramps to transport vertically and horizontally, separate entrance and exit to channel people in and out, channel for water and melted snow to remove any weather buildup, giant chess games to connect individuals and outdoor heater to maintain a comfortable atmosphere for users
  31. Lifted platforms and slides to transport horizontally, indication signs to channel people in and out, hard ceiling to shield against harsh weather, podium to connect individuals and outdoor tents to maintain a comfortable atmosphere
  32. Escalator and platforms on wheels to transport vertically and horizontally, separate entrance and exit to channel people in and out, salt dispenser to remove weather buildup, artificial metal tree to shield against harsh weather, mini-golf to connect individuals, trees to maintain a comfortable atmosphere
  33. Stairs and moving walkways to transport horizontally and vertically, indication sign to channel people in and out, channels for water and melted snow to remove weather buildup, canopies to shield against harsh weather, seating areas to connect individuals and transparent windows to maintain a comfortable atmosphere for users
  34. Stairs and ramps to transport vertically and horizontally, fences/barriers to channel people in and out, heating systems to remove weather buildup, canopies to shield against harsh weather, mini golf to connect individuals, and trees to maintain a comfortable atmosphere for users
  35. Escalator and Platforms on wheels to move vertically and horizontally. Have inverse moving walkways and heating systems as a means to channel people in and out and to remove water/snow build-up. Furthermore, we can use the artificial tree, mini-golf and

transparent window to account for shielding against harsh weather, connect individuals and maintain comfort for users.

36. Take the stairs to go up and platforms on wheels to move horizontally. Use indication signs to signify directions for guests going in and out and a snow shovel machine to remove snow build-up. To improve user comfort and connect individuals, have outdoor tents and seating areas. Finally, optimizing sunbrella to combat harsh weather.
37. Utilized Ramps, and moving walkways, to move vertically and horizontally. separate exit and entrance channels for water and melt it down to move people in and out and remove weather build-up. Finally, optimizing the giant chess games and outdoor heater to connect students and maintain a comfortable atmosphere for users.
38. Escalator and Moving walkways to transport vertically and horizontally. Moreover, the design team can make use of the indication signs and heating systems to channel people in and out and to remove weather build-up. Finally, utilize the podiums and the outdoor/party tents to connect individuals and maintain a comfortable atmosphere for users.
39. Lifted platforms and ramps for vertical and horizontal transportation. indication signs to channel people in and out, snow shovel machine for weather buildup, canopies to shield against harsh weather
40. Stairs and slides to move vertically and horizontally. Hard ceiling to shield against harsh weather and ultimately use the mini-golf to connect individuals, salt dispensers to remove weather build-up.
41. Ramps for horizontal and vertical transportation. Inverse Moving Walkways and artificial metal trees channel people in and out as well as shield them against harsh weather.
42. The use of escalators and moving walkways to help with moving people horizontally and vertically. Seating areas and a transparent window to connect individuals and maintain a comfortable atmosphere for users
43. Use of lifted platforms and snow shovel machines to transport vertically and remove weather build-up. Additionally, we use the artificial metal tree shield against harsh weather as well as the giant chess games that connect individuals. Barriers/fences to channel people in and out.
44. Outdoor/Party tents and podiums to maintain a comfortable atmosphere for users and connect individuals. Utilize platforms on wheels and stairs for horizontal and vertical transportation. Use the heating systems to remove weather build-up.
45. Using ramps and slides to transport vertically and horizontally. In order to remove weather buildup, install the heating systems and shield against harsh weather, use canopies. Finally, put mini-golf and outdoor tents to connect individuals and maintain a comfortable atmosphere for users.
46. Use ramps to transport vertically and horizontally, and indication signs to channel people in and out. To make channelling and social interaction easier we can use salt dispensers and outdoor heaters to reduce snow on the stairs and canopies on top of seating to connect individuals
47. Use escalators and inverse walkways to promote the flow of people. Snow shovel machine and remove weather buildup and sunbrella to shield against harsh weather. Having no snow buildup will allow giant chess games and outdoor parties to connect individuals and create a comfortable atmosphere for users
48. Use stairs and slides to transport vertically and horizontally with barriers and fences to

channel people in and out. Having heating systems will allow the removal of weather buildup. Canopies on top of seating areas to promote the connection between individuals where outdoor parties can happen

49. Use platform on wheels and inverse moving walkway to transport people with a heating system and hard ceilings to shield against harsh weather and promote the use of the seating
50. Use ramps to transport vertically and horizontally with barriers and fences to control the flow of people. To promote more use of ramps we can use heating systems and umbrellas to shield against harsh weather. The use of umbrellas can connect individuals and make a comfortable atmosphere for users.
51. The use of stairs and ramps with inverse-moving walkways can promote better use of the area. The heating system and hard ceiling near the seating area can connect individuals and create a comfortable atmosphere
52. The use of lifted platforms and slides can promote the flow of people. During harsh weather heating systems, hard ceilings around the podium and trees will allow better connections and a comfortable atmosphere
53. The use of ramps and slides with indication signs will promote transportation in and out of the building. To make transportation easier we can use snow shovel machines and hard ceilings. This can allow people to feel included and connected as a hard ceiling can allow for outdoor events and chess games
54. Lifted platform on wheels with indication signs to control the flow of people. Heating systems with canopies over seating areas with a shield against harsh weather connect individuals and make people feel comfortable no matter the weather condition.
55. The use of escalators and ramps with indication slides can promote good walkways. Hard ceiling and seating areas with outdoor heater will allow people to feel comfortable connecting with people
56. Provide lifted platforms for people with accessibility needs, and use stairs to reduce the area needed to build ramps to improve the flow rate of people. Smaller Ramps will also be provided in case the malfunction of the lifted platforms. On the stairs, barriers and fences will be used to prevent cross walking to improve the flow rate. Stairs and ramps will be able to be heated to remove snow build-up during the winter. To connect individuals, more seating areas with hard ceilings and transparent windows will be built so that the area can be used despite the weather condition. Trees and other green plants will be around the area for a more comfortable atmosphere.
57. A simple design that uses wide ramps will be used for both vertical and horizontal transport while providing wintertime access with a heating system in built. A wider ramp combined with barriers and fences will also ensure a good flow rate. For socialization, mini-golf course canopies are built with canopies covered for usage in more weather conditions. An outdoor heater can also be built next to the seating area for winter use of the space.
58. Lifted platforms and moving walkways will provide the most accessible path for people with needs. Snow shovel machines will ensure winter access to the space. Sunbrella made with canvas will provide weather shielding while being flexible, while also making the seating area usable at most times. An outdoor tent will be built for a more comfortable area for social activity.
59. Stair will be used for vertical transportation, and the ramp can be used for people with

accessibility needs. An inverse-moving walkway will increase the low rate while making sure we can use salt dispensers throughout the whole area to prevent snow build-up. Canopies can be used above the seating area as a shield against harsh weather. Outdoor heaters will also be built in the area for winter use of the space.

60. Lifted and moving platforms can be used for transport vertically and horizontally for accessibility, and stairs can be used with indication signs to channel people in and out. To prevent snow build-up, heating systems with channels for water and melted snow will be built. Podiums with Hard Ceiling can be built for potential events and trees and plants will be in the area for a more pleasant atmosphere.
61. Escalators and moving walkways can be used for transport vertically and horizontally, smaller ramps will also be built with snow shovel machines and channels for water and melted snow will be built. A giant chess game with artificial metal trees can be built for potential events and a more pleasant atmosphere.
62. Ramps will be used for accessibility, and slides can be used as an alternative way for the exit while also being a way for socializing and ways to separate entrance and exit. A heating system will be installed for winter use of the space and the hard-ceiling-covered seating area surrounded by trees and other plants will be an area for people to connect with each other.
63. Ramps with salt dispensers will be used for accessibility, and slides can be used as an alternative way for the exit while also being a way for socializing and ways to separate entrance and exit. To connect individuals, more seating areas with hard ceilings and outdoor heaters will be built so that the area can be used despite the weather condition.
64. A wide ramp with salt dispensers will ensure a good flow rate in all weather conditions while providing pathways for people with accessibility needs. Canopies-covered mini-golf can provide activity for socializing. Transparent windows will ensure a better game experience.
65. Stair and ramp combined will be an effective pathway both for good flow rate and accessibility. Snow shovel machines will ensure winter access to the space. Hard ceilings will provide weather shielding, making the seating area usable at all times. An outdoor tent will be built for a more comfortable area for social activity.
66. The escalator and platform on the wheel will transport vertically and horizontally. Separate entrances and exits will channel people in and out. Also, adding salt dispensers and sunbrella will remove weather, and shield against harsh weather, which people have access to under any weather conditions. For socializing, we can add a mini golf to connect with individuals. At the same time, having a transparent window will maintain a comfortable atmosphere for users.
67. Having ramps, slides, and inverse moving walkways to transport vertically and horizontally when channeling people in and out. Adding a channel for water and melted snow to remove weather buildup. Then, having a podium for events and an outdoor heater will connect individuals in a comfortable atmosphere.
68. Lifted Platforms and ramps will transport horizontally and vertically. Indication signs promote transportation in and out. Under certain weather, snow shovel machines can remove weather buildup. Having a hard ceiling to shield against harsh weather. Moreover, giant chess games and outdoor/party tents connect individuals in a comfortable atmosphere.
69. Stairs and moving walkways to transport horizontally and vertically. Barriers promote

transportation in and out. The heating system and canopies remove weather buildup and shield against harsh weather. Increasing seating areas and trees connect individuals in a comfortable atmosphere.

70. Stairs and ramps to transport horizontally and vertically. Separate entrance and exit channels people in and out. The heating system and sunbrella remove weather buildup and shield against harsh weather. Transparent windows and a larger number of seating areas maintain a comfortable atmosphere for users to connect with others.
71. Having a moving walkway and heating system to transport horizontally and remove weather build-up. Additionally, we use the hard ceiling shield against harsh weather as well as the event's podium that connects individuals. Barriers/fences to promote transportation in and out.
72. Escalator and ramps to transport vertically and horizontally, inverse moving walkway to channel people, the eating system can remove snow buildup, the artificial metal tree can shield against harsh weather, outdoor heating can maintain a comfortable atmosphere
73. Ramps and platforms on the wheel will transport vertically and horizontally. Indication signs will channel people in and out. Also, adding a Heating system and hard ceiling will remove weather, and shield against harsh weather, w
74. which people have access to under any weather conditions. For socializing, we can add odium for events to connect with individuals. At the same time, having outdoor and party tents will maintain a comfortable atmosphere for users.
75. Lifted platforms, slides, and barriers/fences transport people vertically, horizontally, in, and out. Channel for water and melted snow to remove weather buildup. At the same time, canopies shield against harsh weather. Adding seating areas with trees connect individuals in a comfortable atmosphere.
76. A ramp with separate entrances and exits can control the flow of people. Salt dispensers and artificial trees beside seating areas against harsh weather connect individuals and maintain a comfortable atmosphere under any weather conditions.

## D-2: Triz

The actual sid Smith entrance can be modified to create a better solution for this problem. The modifications can be:

77. Changing the colors of the stairs to colors that promote the indigenours community and include automatic hot water dispensers on the surface of each stair to melt the snow. Separate each stair with a small channel for drainage of water. Equip each table with a metal umbrella and outdoor gas heater to maintain a good atmosphere.
78. Build underground tunnels that lead straight to the inside of the building. Inflow and outflow will be separated by a fence. Lower the patio to provide a straight horizontal walk between the road and the entrance. A glass ceiling to protect the atmosphere.
79. Enclose the whole area in the scope using concrete and a hard ceiling to maintain a good temperature

## D-3: Analogy

Using the current Galbraith Building entrance as a benchmark, we can concluded these solutions as potential designs:

80. Place heated plates separated by channels on every surface. Add a giant chess game and a seating area on the surface. Use a hard ceiling to protect against the weather and include indications to show the entrance and exit.
81. Use heated plates and small channels to remove weather impairment. Place a restaurant and cafe in the actual solution. Use a tempered glass, for the walls of the outside and a tinted giant glass for the ceiling..
82. The lifted platform will transport people vertically onto the patio area where the outdoor dining bubble tents will be. These bubbles will have seating for social usability, a heater for winter usability and have heated flooring around the bubbles which ensures the snow melts as it falls, preventing any snow buildup. The bubbles will be decorated in colors that promote the Indigenous community.
83. The stairs will include ramps for people with wheelchairs, using tempered glass to create an area with a coffee shop and a seating area. The stairs will have a heating system to remove snow build-up and drainage to remove water from the stairs.

## D-4: Brainstorming

84. Ramps for disabilities
85. Stairs that prevent snow
  - a. Heatable stairs
  - b. Salt dispenser
  - c. Stair that easier to shovel
86. Make the landing between each stair section easier to use
87. Create signs for accessibility features
  - a. Eg. ramps signs
88. Providing accessibility information on a website
89. Use simple language signs to be mindful of different reading levels
90. Better bike rack configuration to remove the blockage.
91. Wave/push automatic door openers that are easier to reach
92. Designated people on the call to help people in need of accessing the building
93. Stairlift for wheelchair
94. Stair sidewalk bumps for people with vision impairment
95. Change the colour of stairs for colour-impaired people
96. Illustrations that are easily understandable on signs for people with trouble reading or speak a different language
97. Replace steps with ramp etc.
98. For the signs in this location, have them in braille as well
99. Use a color scheme that is associated with promoting well-being (ie. cool colors are known to create a calming atmosphere)

## Safety

100. More street lamp lights around the areas
101. Staircase Lighting



102. Hand railings on the stairs
103. Anti-Slip stair material 138313
104. Warning signs for unsafe conditions
105. Scheduled cleaners for the area to prevent any barriers to hurting people
106. Security cameras
107. The emergency pole that calls 911, and the free telephone stand that allows emergency calls
  - These exist in front of MyHall and Library but not
108. More First aid kits
109. AED machine
110. Reflective signs with luminous light so people can see them at night
111. Indigenous Awareness
112. Indigenous flag
113. Indigenous pictures to raise awareness about the land where we are currently inhibited
114. Indigenous day
115. Indigenous art shows
  - a. Allow people to understand the history of Indigenous people
  - b. Provide an opportunity for students to learn about the design and technique for making those art pieces
116. Indigenous designs such as Spindle Whorls or totem poles with proper design to represent Arts&Sciences faculty's values
117. Put an Indigenous language on each staircase
118. Displaying the medicine wheel (either physically or as a mural)
119. A plaque that states which land each Indigenous community is from
120. More tents over sitting areas during weather conditions
121. Add an outdoor dining bubble to keep warmth during winter
122. More seating areas
  123. Bench and chairs that can easily be cleaned
124. Area for weekly events to allow connection between people
125. Plants that don't drop messy seeds during summer and have short periods for falling leaves
126. Plant flowers with no pollen (ex. pollen-free geranium) to prevent pollen allergically
127. Wifi coverage for outside sitting areas
128. Clock to allow people to know the time when studying or interacting
129. Different colour street lights for various holidays.
130. Decorations for seasonal events
131. Outdoor LED displays
132. Umbrella lending station for sudden rain or snow, or disposable raincoat
133. Wet umbrella cover machine

- 134. Misting system for dropping temperature during summer
- 135. Charging station so people can charge their devices
- 136. Closed trash cans for the animal problem

## D-5: SCAMPER

Substitute , Combine, Adapt, Modify, Put to other use, Eliminate, Rearrange or reverse

- 137. Add heated tiles to the stairs to the original stairs since there is snow build-up during harsh weather conditions
- 138. Change all covers on top of seats to ones with protected material against all weather
- 139. Add heating systems and canopies to protect individuals from harsh weather
- 140. Change the environment to prevent accidents due to harsh weather
  - a. Change seating areas with more coverage
  - b. This relates to the second idea in substitute
- 141. Decrease stair size in terms of transportation
- 142. Build ramps for accessibility need
- 143. Escalators for smoother transportation
- 144. Tents on top of seating area
- 145. Different colour pavement to help with colour impairment
- 146. Adding stair bumps for blind people
- 147. Staircase lighting
- 148. Use the covers on top of seats at the current time with added coverage
  - a. Add a layer of support to prevent harsh weather from getting in through holes in the ceiling
- 149. Use patio space for recognition of traditional lands
- 150. Eliminate the height difference between the ground and the patio
- 151. Improve stairs by making them anti-slip material
- 152. Interchange sunbrellas with umbrellas in harsh weather to protect patio space
- 153. Instead of using ramps, we are using Roll-A-Ramp (not a permanent ramp made from concrete or wood) can be set up easily or left in place
- 154. Using a conveyor belt to transport horizontally handicapped and people with disabilities instead of the normal stairs.



## Idea Selection

### D-6: Consolidation of ideas

Recorded of the votes for uniqueness

Ideas Number	Zac	Nathan	Rangajah	Nastaran	Robert	Uaena	Total
1	1	1	1	0	0	1	4
2	0	0	0	0	1	1	2
3	0	1	1	1	0	0	3
4	1	1	1	1	0	1	5
5	1	1	1	0	0	1	4
6	1	1	0	1	0	0	3
7	0	1	0	0	0	0	1
8	1	1	1	1	0	1	5
9	0	1	0	0	0	0	1
10	0	0	0	1	0	0	1
11	0	0	0	1	1	0	2
12	0	0	0	0	0	0	0
13	1	0	0	0	0	1	2
14	1	0	0	0	0	1	2
15	1	0	0	0	0	0	1
16	1	0	1	1	1	1	5
17	1	0	1	0	1	1	4
18	0	1	1	1	1	1	5
19	1	0	1	0	0	1	3
20	0	0	0	1	0	0	1

Ideas Number	Zac	Nathan	Rangajah	Nastaran	Robert	Uaena	Total
21	1	1	1	1	1	1	6
22	1	0	1	1	0	1	4
23	0	0	0	1	0	0	1
24	1	0	0	1	0	0	2
25	0	0	0	0	0	0	0
26	1	1	0	1	0	1	4
27	0	0	0	1	1	0	2
28	0	0	0	0	0	0	0
29	0	1	1	0	0	1	3
30	1	1	1	0	1	0	4
31	0	0	0	0	0	0	0
32	0	1	0	0	1	0	2
33	1	1	0	1	1	1	5
34	0	0	0	0	0	0	0
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36	0	0	1	0	0	0	1
37	1	0	1	0	1	1	4
38	1	1	1	0	0	1	4
39	0	0	0	0	0	0	0
40	0	0	0	1	0	0	1

Ideas Number	Zac	Nathan	Rangajah	Nastaran	Robert	Uaena	Total
41	1	0	0	1	0	0	2
42	0	1	0	0	0	0	1
43	0	0	0	0	0	0	0

44	0	1	1	0	1	1	4
45	0	1	0	0	1	0	2
46	1	1	1	1	1	1	6
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52	1	1	1	1	0	1	5
53	0	0	1	1	0	0	2
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55	0	1	0	1	0	0	2
56	1	1	0	1	1	0	5
57	0	0	0	0	0	0	0
58	1	0	1	1	0	1	4
59	0	1	1	0	1	1	4
60	0	0	0	0	0	1	1

Ideas Number	Zac	Nathan	Rangajah	Nastaran	Robert	Uaena	Total
61	1	0	1	1	1	0	4
62	0	1	1	0	0	0	2
63	0	0	0	0	0	1	1
64	1	0	1	1	1	0	4
65	0	1	1	1	1	1	5
66	1	0	0	0	0	1	2
67	0	0	0	0	0	0	0

68	0	1	0	0	0	0	1
69	1	0	1	0	1	0	3
70	0	1	0	0	1	1	3
71	1	1	1	1	1	1	6
72	1	1	0	0	0	0	2
73	0	1	1	1	0	0	3
74	1	0	0	0	0	1	2
75	0	1	0	0	1	0	2
76	1	1	1	1	1	1	6
77	0	1	1	1	1	1	5
78	0	1	0	1	1	0	3
79	1	0	0	1	0	1	3
80	1	1	1	1	1	1	6

Ideas Number	Zac	Nathan	Rangajah	Nastaran	Robert	Uaena	Total
81	1	1	1	1	1	1	6
82	1	1	1	1	1	1	6
83	1	0	0	0	0	0	1
84	1	1	0	0	0	0	2
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89	1	1	1	0	1	1	5
90	1	1	0	0	1	1	4
91	0	0	0	0	1	0	1

92	1	0	1	1	0	0	3
93	1	0	1	1	1	1	5
94	0	0	0	0	0	1	1
95	0	0	0	0	1	0	1
96	0	0	0	0	1	1	3
97	1	1	0	0	1	1	4
98	1	0	1	1	1	1	5
99	0	0	0	1	0	0	1
100	1	0	0	1	1	0	3

Ideas Number	Zac	Nathan	Rangajah	Nastaran	Robert	Uaena	Total
101	0	0	0	0	0	0	0
102	1	1	1	1	1	0	5
103	0	0	0	1	0	0	1
104	1	1	0	0	0	0	2
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109	1	0	0	1	1	0	3
110	0	0	1	1	0	0	2
111	1	1	1	0	0	0	3
112	1	1	0	1	1	1	5
113	1	0	1	1	1	0	4
114	1	0	1	0	0	1	3
115	1	1	1	1	1	1	6

116	0	0	0	0	0	0	0
117	1	1	0	0	0	0	2
118	1	1	0	1	1	1	5
119	1	0	1	1	1	0	4
120	1	1	0	0	0	0	2

Ideas Number	Zac	Nathan	Rangajah	Nastaran	Robert	Uaena	Total
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122	0	1	1	1	1	0	4
123	1	1	0	1	1	1	5
124	1	1	0	1	1	0	4
125	1	0	0	1	0	0	2
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133	0	0	1	1	0	1	3
134	1	1	1	0	1	0	4
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136	0	1	0	0	0	1	2
137	1	0	1	1	0	0	3
138	0	0	0	0	0	0	0
139	1	1	1	1	0	0	4

140	0	1	1	1	1	1	5
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Ideas Number	Zac	Nathan	Rangajah	Nastaran	Robert	Uaena	Total
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142	1	1	0	1	1	0	4
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145	0	0	1	1	0	0	2
146	0	1	1	0	0	0	2
147	1	0	0	1	1	0	3
148	0	0	0	0	0	0	0
149	1	1	0	1	1	0	4
150	0	0	0	0	0	1	1
151	0	0	0	1	0	1	2
152	1	1	1	0	1	1	5
153	1	0	1	1	0	0	3
154	0	1	1	0	0	0	2
155	1	1	1	1	0	0	4
156	1	1	1	0	1	1	5
157	1	1	0	0	0	0	2

Ideas chosen after consolidating ideas

1. Moving walkways combined with stairs to transport people, where barriers/fences Chanel people, a salt dispenser can aid in removing snow, an artificial metal tree can help shield against harsh weathers, mini-golf can connect individuals and trees can maintain a comfortable atmosphere
2. Stairs and ramp leading up, the in and outflow is separated by a fence. A seating area protected by artificial trees and warmed by heating a heating system.
3. Lifted platforms and ramps to transport vertically and horizontally, have separate entrances and exit to Chanel people, use a heating system to remove weather buildup, build a hard veiling to

- shield against weather, include giant chess games to connect individuals and have a transparent window for a comfortable atmosphere
4. Stairs with signs up and down leading to a walkway. A hard ceiling protects the seating area below and transparent doors maintain a comfortable atmosphere.
5. Ramps going upward and downward to separate entrance and exit. A canopy is enclosed by transparent windows to protect the seating area below.
6. Ramps and moving walkways to transport vertically and horizontally, inverse moving walkways to channel people in and out, channels for water and melted snow, artificial metal trees to shield against harsh weather, podiums for potential events to connect individuals and trees to maintain a comfortable atmosphere for users.
7. Escalators and ramps to transport vertically and horizontally, separate entrance and exit to channel people in and out, channel for water and melted snow to remove any weather buildup, giant chess games to connect individuals and outdoor heater to maintain a comfortable atmosphere for users
8. Stairs and moving walkways to transport horizontally and vertically, indication sign to channel people in and out, channels for water and melted snow to remove weather buildup, canopies to shield against harsh weather, seating areas to connect individuals and transparent windows to maintain a comfortable atmosphere for users
9. Lift platforms to carry people up and down, forward and backward moving walkways. A sunbrella covering a giant chess game with outdoor heaters to keep a warm atmosphere.
10. Utilized Ramps, and moving walkways, to move vertically and horizontally. separate exit and entrance channels for water and melt it down to move people in and out and remove weather build-up. Finally, optimizing the giant chess games and outdoor heater to connect students and maintain a comfortable atmosphere for users.
11. Escalator and Moving walkways to transport vertically and horizontally. Moreover, the design team can make use of the indication signs and heating systems to channel people in and out and to remove weather build-up. Finally, utilize the podiums and the outdoor/party tents to connect individuals and maintain a comfortable atmosphere for users.
12. Stairs leading up and down with moving walkways leading to different entrances and exits. Sunbrella covers a podium with trees for a comfortable atmosphere
13. Lifted platforms with moving walkways in different directions to different entrances and exits. Weather impairments can be shovelled out. A Canopy covering a minigolf.
14. Lifted platforms leading up and down with ramps and indications signs to show entry and exit. A hard ceiling covers a seating area with transparent windows to shield it against the weather.
15. Escalators and moving walkways can be used for transport vertically and horizontally, smaller ramps will also be built with snow shovel machines and channels for water and melted snow will be built. A giant chess game with artificial metal trees can be built for potential events and a more pleasant atmosphere.
16. A wide ramp with salt dispensers will ensure a good flow rate in all weather conditions while providing pathways for people with accessibility needs. Canopies-covered mini-golf can provide activity for socializing. Transparent windows will ensure a better game experience.
17. Stair and ramp combined will be an effective pathway both for good flow rate and accessibility. Snow shovel machines will ensure winter access to the space. Hard ceilings will provide weather shielding, making the seating area usable at all times. An outdoor tent will be built for a more comfortable area for social activity.
18. Having a moving walkway and heating system to transport horizontally and remove weather build-up. Additionally, we use the hard ceiling shield against harsh weather as well as the event's podium that connects individuals. Barriers/fences to promote transportation in and out.
19. Changing the colors of the stairs to colors that promote the indigenous community and include automatic hot water dispensers on the surface of each stair to melt the snow. Separate each stair



- with a small channel for drainage of water. Equip each table with a metal umbrella and outdoor gas heater to maintain a good atmosphere.
20. Build underground tunnels that lead straight to the inside of the building. Inflow and outflow will be separated by a fence. Lower the patio to provide a straight horizontal walk between the road and the entrance. A glass ceiling to protect the atmosphere.
  21. Use heated plates and small channels to remove weather impairment. Place a restaurant and cafe in the actual solution. Use a tempered glass, for the walls of the outside and a tinted giant glass for the ceiling.
  22. More street lamp lights around the areas
  23. Utilized Ramps, and moving walkways, to move vertically and horizontally. separate exit and entrance channels for water and melt it down to move people in and out and remove weather build-up. Finally, optimizing the giant chess games and outdoor heater to connect students and maintain a comfortable atmosphere for users.
  24. Escalator and Moving walkways to transport vertically and horizontally. Moreover, the design team can make use of the indication signs and heating systems to channel people in and out and to remove weather build-up. Finally, utilize the podiums and the outdoor/party tents to connect individuals and maintain a comfortable atmosphere for users.
  25. Moving walkways combined with stairs to transport people, where barriers/fences Chanel people, a salt dispenser can aid in removing snow, an artificial metal tree can help shield against harsh weathers, mini-golf can connect individuals and trees can maintain a comfortable atmosphere
  26. Stairs and moving walkways to transport horizontally and vertically, indication sign to channel people in and out, channels for water and melted snow to remove weather buildup, canopies to shield against harsh weather, seating areas to connect individuals and transparent windows to maintain a comfortable atmosphere for users
  27. Lifted platforms and ramps to transport vertically and horizontally, have separate entrances and exit to Chanel people, use a heating system to remove weather buildup, build a hard veiling to shield against weather, include giant chess games to connect individuals and have a transparent window for a comfortable atmosphere
  28. Ramps and moving walkways to transport vertically and horizontally, inverse moving walkways to channel people in and out, channels for water and melted snow, artificial metal trees to shield against harsh weather, podiums for potential events to connect individuals and trees to maintain a comfortable atmosphere for users.
  29. Escalators and ramps to transport vertically and horizontally, separate entrance and exit to channel people in and out, channel for water and melted snow to remove any weather buildup, giant chess games to connect individuals and outdoor heater to maintain a comfortable atmosphere for users
  30. The lifted platform will transport people vertically onto the patio area where the outdoor dining bubble tents will be. These bubbles will have seating for social usability, a heater for winter usability and have heated flooring around the bubbles which ensures the snow melts as it falls, preventing any snow buildup. The bubbles will be decorated in colors that promote the indigenous community.
  31. The stairs will include the ramps for people with wheelchairs, using tempered glass to create an area with a coffee shop and seating area. The stairs will have a heating system to remove snow build-up and drainage to remove water from the stairs.
  32. Create signs for accessibility features
    - a. Eg. ramps signs
  33. Providing accessibility information on a website
  34. Wave/push automatic door openers that are easier to reach
  35. Change the colour of stairs for colour-impaired people

36. Illustrations that are easily understandable on signs for people with trouble reading or speak a different language
37. More street lamp lights around the areas
38. Scheduled cleaners for the area to prevent any barriers to hurting people
39. Security cameras
40. Reflective signs with luminous light so people can see them at night
41. Indigenous pictures to raise awareness about the land that we are currently inhabited
42. Indigenous designs such as Spindle Whorls or totem poles with proper design to represent Arts&Sciences faculty's value
43. Put an indigenous language on each staircase
44. More tents over sitting areas during weather conditions
45. Add an outdoor dining bubble to keep warmth during winter
46. Add heated tiles to the stairs to the original stairs since there is snow build-up during harsh weather conditions
47. Change all covers on top of seats to ones with protected material against all weather
48. Add heating systems and canopies to protect individuals from harsh weather
49. Build ramps for accessibility need
50. Staircase lighting
51. Eliminate the height difference between the ground and the patio
52. More seating areas
53. Different colour street lights for various holidays.
54. Plants that don't drop messy seeds during summer and have short periods for falling leaves
55. Umbrella lending station for sudden rain or snow, or disposable raincoat
56. Change the environment to prevent accidents due to harsh weather
  - a. Change seating areas with more coverage
  - b. This relates to the second idea in substitute
57. Instead of using ramps, we are using Roll-A-Ramp (not a permanent ramp made from concrete or wood) can be set up easily or **left** in place
58. Using a conveyor belt to transport horizontally handicapped and people with disabilities instead of the normal stairs.

## D-7: Feasibility check

Modifying and combining ideas to ensure they meet the design functions and constraints

1. Moving walkways combined with stairs to transport people, where barriers/fences Chanel people, a salt dispenser can aid in removing snow, an artificial metal tree can help shield against harsh weathers, mini-golf can connect individuals and trees can maintain a comfortable atmosphere
2. Stairs and ramp leading up, the in and outflow is separated by a fence. A seating area protected by artificial trees and warmed by heating a heating system.
3. Lifted platforms and ramps to transport vertically and horizontally, have separate entrances and exit to Chanel people, use a heating system to remove weather buildup, build a hard ceiling to

- shield against weather, include giant chess games to connect individuals and have a transparent window for a comfortable atmosphere
4. Stairs with signs up and down leading to a walkway. A hard ceiling protects the seating area below and transparent doors maintain a comfortable atmosphere.
  5. Ramps going upward and downward to separate entrance and exit. A canopy is enclosed by transparent windows to protect the seating area below.
  6. Ramps and moving walkways to transport vertically and horizontally, inverse moving walkways to channel people in and out, channels for water and melted snow, artificial metal trees to shield against harsh weather, podiums for potential events to connect individuals and trees to maintain a comfortable atmosphere for users.
  7. Escalators and walkways to transport vertically and horizontally, separate entrance and exit to channel people in and out, channel for water and melted snow to remove any weather buildup, giant chess games to connect individuals and outdoor heater to maintain a comfortable atmosphere for users
  8. Stairs and moving walkways to transport horizontally and vertically, indication sign to channel people in and out, channels for water and melted snow to remove weather buildup, canopies to shield against harsh weather, seating areas to connect individuals and transparent windows to maintain a comfortable atmosphere for users
  9. Lift platforms to carry people up and down, forward and backward moving walkways. A sunbrella covering a giant chess game with outdoor heaters to keep a warm atmosphere.
  10. Utilized Ramps, and moving walkways, to move vertically and horizontally. separate exit and entrance channels for water and melt it down to move people in and out and remove weather build-up. Finally, optimizing the giant chess games and outdoor heater to connect students and maintain a comfortable atmosphere for users.
  11. Escalator and Moving walkways to transport vertically and horizontally. Moreover, the design team can make use of the indication signs and heating systems to channel people in and out and to remove weather build-up. Finally, utilize the podiums and the outdoor/party tents to connect individuals and maintain a comfortable atmosphere for users.
  12. Stairs leading up and down with moving walkways leading to different entrances and exits. Sunbrella covers a podium with trees for a comfortable atmosphere
  13. Lifted platforms with moving walkways in different directions to different entrances and exits. Weather impairments can be shovelled out. A Canopy covering a minigolf.
  14. Lifted platforms leading up and down with ramps and indications signs to show entry and exit. A hard ceiling covers a seating area with transparent windows to shield it against the weather.
  15. Escalators and moving walkways can be used for transport vertically and horizontally, smaller ramps will also be built with snow shovel machines and channels for water and melted snow will be built. A giant chess game with artificial metal trees can be built for potential events and a more pleasant atmosphere.
  16. A wide ramp with salt dispensers will ensure a good flow rate in all weather conditions while providing pathways for people with accessibility needs. Canopies-covered mini-golf can provide activity for socializing. Transparent windows will ensure a better game experience.
  17. Stair and ramp combined will be an effective pathway both for good flow rate and accessibility. Snow shovel machines will ensure winter access to the space. Hard ceilings will provide weather shielding, making the seating area usable at all times. An outdoor tent will be built for a more comfortable area for social activity.
  18. Having a moving walkway and heating system to transport horizontally and remove weather build-up. Additionally, we use the hard ceiling shield against harsh weather as well as the event's podium that connects individuals. Barriers/fences to promote transportation in and out.
  19. Changing the colors of the stairs to colors that promote the indigenous community and include automatic hot water dispensers on the surface of each stair to melt the snow. Separate each stair

with a small channel for drainage of water. Equip each table with a metal umbrella and outdoor gas heater to maintain a good atmosphere.

20. Build overground tunnels with ramps that lead straight to the inside of the building. Inflow and outflow will be separated by a fence. Lower the patio to provide a straight horizontal walk between the road and the entrance. A glass ceiling to protect the atmosphere.
21. Use heated plates and small channels to remove weather impairment. Place a restaurant and cafe in the actual solution. Use a tempered glass, for the walls of the outside and a tinted giant glass for the ceiling.
22. More street lamp lights around the areas to increase visibility on the current design of the Sid Smith entrance.
23. Utilized Ramps, and moving walkways, to move vertically and horizontally. separate exit and entrance channels for water and melt it down to move people in and out and remove weather build-up. Finally, optimizing the giant chess games and outdoor heater to connect students and maintain a comfortable atmosphere for users.
24. Escalator and Moving walkways to transport vertically and horizontally. Moreover, the design team can make use of the indication signs and heating systems to channel people in and out and to remove weather build-up. Finally, utilize the podiums and the outdoor/party tents to connect individuals and maintain a comfortable atmosphere for users.
25. Moving walkways combined with stairs to transport people, where barriers/fences Chanel people, a salt dispenser can aid in removing snow, an artificial metal tree can help shield against harsh weathers, mini-golf can connect individuals and trees can maintain a comfortable atmosphere
26. Stairs and moving walkways to transport horizontally and vertically, indication sign to channel people in and out, channels for water and melted snow to remove weather buildup, canopies to shield against harsh weather, seating areas to connect individuals and transparent windows to maintain a comfortable atmosphere for users
27. Lifted platforms and ramps to transport vertically and horizontally, have separate entrances and exit to Chanel people, use a heating system to remove weather buildup, build a hard ceiling to shield against weather, include giant chess games to connect individuals and have a transparent window for a comfortable atmosphere
28. Ramps and moving walkways to transport vertically and horizontally, inverse moving walkways to channel people in and out, channels for water and melted snow, artificial metal trees to shield against harsh weather, podiums for potential events to connect individuals and trees to maintain a comfortable atmosphere for users.
29. Escalators and ramps to transport vertically and horizontally, separate entrance and exit to channel people in and out, channel for water and melted snow to remove any weather buildup, giant chess games to connect individuals and outdoor heater to maintain a comfortable atmosphere for users
30. The lifted platform will transport people vertically onto the patio area where the outdoor dining bubble tents will be. These bubbles will have seating for social usability, a heater for winter usability and have heated flooring around the bubbles which ensures the snow melts as it falls, preventing any snow buildup. The bubbles will be decorated in colors that promote the indigenous community.
31. The stairs will include 3 ramps for people with wheelchairs, using tempered glass to create a covered area with seating space. The stairs will have a heating system to remove snow build-up and drainage to remove water from the stairs. Stairs leading up and down will be separated by handrail and indication will be used to show people directions.
32. Change the colour of stairs for colour-impaired people leading to the actual entrance

33. Illustrations that are easily understandable on signs for people with trouble reading or speak a different language, redirect the exhaust of the existing air conditioning units to blow the hot air on the ground to clear the stairs and raise the temperature on the patio
34. Add more incandescent lights on the stairs and the patio. The heat from the lamp will melt the snow and improve the atmosphere on the patio
35. Scheduled cleaners for the area to remove weather buildup and outdoor heaters to keep the users warm. The actual solution is mostly conserved.
36. Reflective signs with luminous light so people can see them at night. The reflected light is concentrated to the ground to melt the snow and increase the temperature
37. Indigenous designs such as Spindle Whorls or totem poles with proper design to represent Arts&Sciences faculty's value. Add indigenous coloured umbrellas and hard ceilings over the entire current solution.
38. More tents over sitting areas during weather conditions and add a metal ceiling over the stairs to stop snow from reaching the stairs.
39. Add heated tiles to the stairs to the original stairs since there is snow build-up during harsh weather conditions
40. Change all covers on top of seats to ones with protected material against all weather
41. Add heating systems and canopies to protect individuals from harsh weather and heated tiles on the stairs to remove weather build up
42. Build ramps for accessibility needs and a lift platform to transport vertically and horizontally. Add a hard ceiling over the actual design solution
43. Staircase lighting to improve night visibility and allow people to circulate and meet at night.
44. Eliminate the height difference between the ground and the patio by extending the elevation of the current patio to the sidewalk. Build a metal cover over the stairs to stop snow buildup on the stairs. The rest of the actual design is conserved.
45. Different colour street lights for various holidays.
46. Plants that don't drop messy seeds during summer and have short periods for falling leaves to protect against the heat and regulate the atmosphere. The actual solution will be conserved.
47. Giant umbrella is fixed to the ground to protect against snow and rain. Add an outdoor heater under the umbrellas and heated tiles 3 sets of stairs. The rest of the actual design is conserved.
48. Change the environment to prevent accidents due to harsh weather
  - a. Change seating areas with more coverage
  - b. This relates to the second idea in substitute
49. Use Roll-A-Ramp (temporary ramps made of plastic) can be set up easily and removed after use. The A roll will be added to the final design in case of harsh weather to improve flow of people. No modification is done on the actual entrance.
50. Adding a conveyor belt to the actual entrance of Sid Smith to transport horizontally and vertically handicapped and people with disabilities instead of the normal stairs.

## D-8: Multivoting

Each member was attributed 30 percent of the votes which is exactly 15 votes. A table of ideas was made and each team member used their 15 votes. Members were not allowed to vote twice for the same idea. At the end of the session, the votes were tallied and put into a table. The top 15 ideas were selected.

☺	✓		
Idea #		Votes	Total
1	<input type="checkbox"/>	I	1
2	<input type="checkbox"/>		0
3	<input checked="" type="checkbox"/>	IIII	4
4	<input type="checkbox"/>	II	2
5	<input checked="" type="checkbox"/>	IIII	4
6	<input type="checkbox"/>	I	1
7	<input checked="" type="checkbox"/>	IIII	4
8	<input type="checkbox"/>		0
9	<input type="checkbox"/>	I	1
10	<input type="checkbox"/>		0
11	<input type="checkbox"/>		0
12	<input type="checkbox"/>	II	2
13	<input type="checkbox"/>		0

☺	✓		
14	<input type="checkbox"/>		0
15	<input type="checkbox"/>	I	1
16	<input type="checkbox"/>	III	3
17	<input type="checkbox"/>		0
18	<input type="checkbox"/>		0
19	<input checked="" type="checkbox"/>	IIII	3
20	<input checked="" type="checkbox"/>	IIIII	4
21	<input checked="" type="checkbox"/>	IIII	3
22	<input type="checkbox"/>		0
23	<input type="checkbox"/>	I	1
24	<input type="checkbox"/>	II	2
25	<input type="checkbox"/>		0
26	<input type="checkbox"/>		0
27	<input checked="" type="checkbox"/>	IIIII	5

☺	✓		
28	<input type="checkbox"/>		0
29	<input type="checkbox"/>		0
30	<input checked="" type="checkbox"/>	IIIII	5
31	<input checked="" type="checkbox"/>	IIII	4
32	<input type="checkbox"/>	I	1
33	<input checked="" type="checkbox"/>	IIII	4
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38	<input type="checkbox"/>	II	2
39	<input type="checkbox"/>		0
40	<input type="checkbox"/>		0
41	<input type="checkbox"/>	III	3

☺	✓		
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43	<input type="checkbox"/>	I	1
44	<input checked="" type="checkbox"/>	IIIII	5
45	<input type="checkbox"/>		0
46	<input type="checkbox"/>	I	1
47	<input type="checkbox"/>	III	3
48	<input type="checkbox"/>		0
49	<input checked="" type="checkbox"/>	IIII	4
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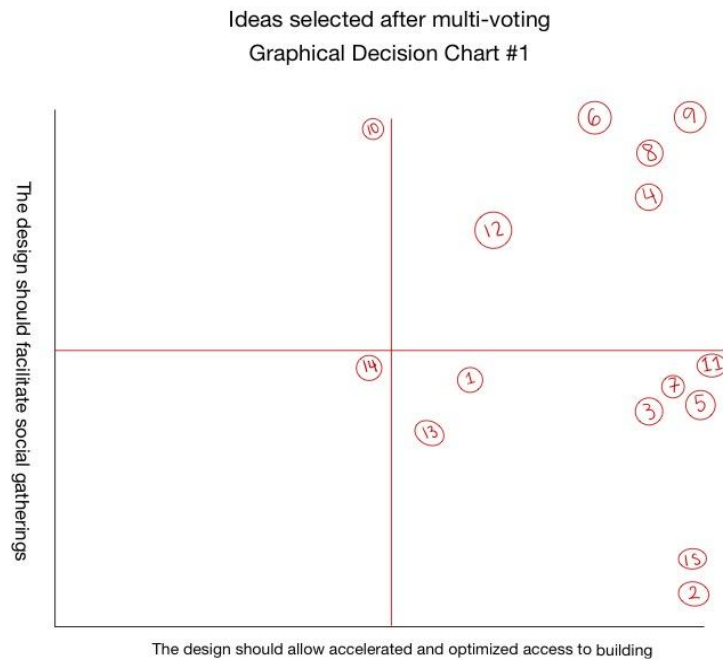
15 Ideas Selected after multivoting



1. Lifted platforms and ramps to transport vertically and horizontally, have separate entrances and exit to Chanel people, use a heating system to remove weather buildup, build a hard ceiling to shield against weather, include giant chess games to connect individuals and have a transparent window for a comfortable atmosphere
2. Ramps going upward and downward to separate entrance and exit. A canopy is enclosed by transparent windows to protect the seating area below.
3. Escalators and walkways to transport vertically and horizontally, separate entrance and exit to channel people in and out, channel for water and melted snow to remove any weather buildup, giant chess games to connect individuals and outdoor heater to maintain a comfortable atmosphere for users
4. Changing the colors of the stairs to colors that promote the indigenous community and include automatic hot water dispensers on the surface of each stair to melt the snow. Separate each stair with a small channel for drainage of water. Equip each table with a metal umbrella and outdoor gas heater to maintain a good atmosphere.
5. Build overground tunnels with ramps that lead straight to the inside of the building. Inflow and outflow will be separated by a fence. Lower the patio to provide a straight horizontal walk between the road and the entrance. A glass ceiling to protect the atmosphere.
6. Use heated plates and small channels to remove weather impairment. Place a restaurant and cafe in the actual solution. Use a tempered glass, for the walls of the outside and a tinted giant glass for the ceiling.
7. Lifted platforms and ramps to transport vertically and horizontally, have separate entrances and exit to Chanel people, use a heating system to remove weather buildup, build a hard ceiling to shield against weather, include giant chess games to connect individuals and have a transparent window for a comfortable atmosphere
8. The lifted platform will transport people vertically onto the patio area where the outdoor dining bubble tents will be. These bubbles will have seating for social usability, a heater for winter usability and have heated flooring around the bubbles which ensures the snow melts as it falls, preventing any snow buildup. The bubbles will be decorated in colors that promote the indigenous community.
9. The stairs will include 3 ramps for people with wheelchairs, using tempered glass to create a covered area with seating space. The stairs will have a heating system to remove snow build-up and drainage to remove water from the stairs. Stairs leading up and down will be separated by handrail and indication will be used to show people directions.
10. Illustrations that are easily understandable on signs for people with trouble reading or speak a different language, redirect the exhaust of the existing air conditioning units to blow the hot air on the ground to clear the stairs and raise the temperature on the patio
11. Add more incandescent lights on the stairs and the patio. The heat from the lamp will melt the snow and improve the atmosphere on the patio
12. Reflective signs with luminous light so people can see them at night. The reflected light is concentrated to the ground to melt the snow and increase the temperature
13. Build ramps for accessibility needs and a lift platform to transport vertically and horizontally. Add a hard ceiling over the actual design solution
14. Eliminate the height difference between the ground and the patio by extending the elevation of the current patio to the sidewalk. Build a metal cover over the stairs to stop snow buildup on the stairs. The rest of the actual design is conserved.

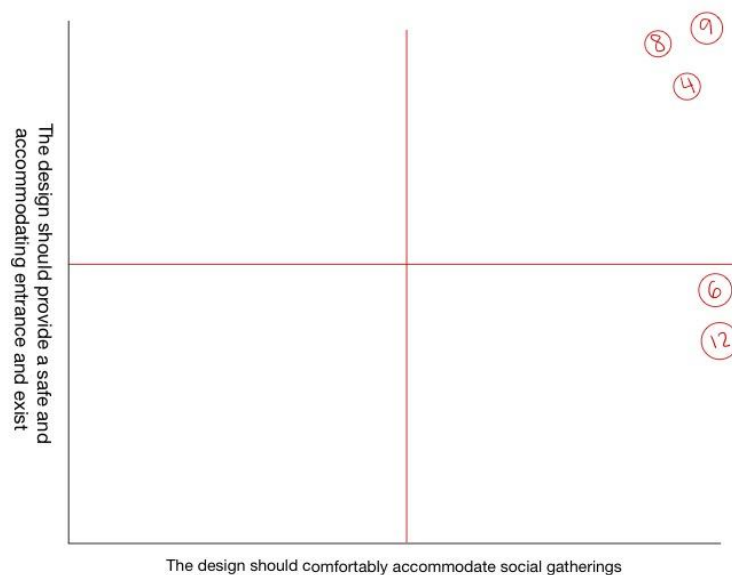
15. Use Roll-A-Ramp (temporary ramps made of plastic) can be set up easily and removed after use. The A roll will be added to the final design in case of harsh weather to improve flow of people. No modification is done on the actual entrance.

## D-9: Graphical Chart



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Graphical Decision Chart used once again to reduce the main 5 ideas into 3.  
Graphical Decision Chart #2





3 ideas

1. The stairs will include 3 ramps for people with wheelchairs, using tempered glass to create a covered area with seating space. The stairs will have a heating system to remove snow build-up and drainage to remove water from the stairs. Stairs leading up and down will be separated by handrail and indication will be used to show people directions.
2. Changing the colors of the stairs to colors that promote the indigenous community and include automatic hot water dispensers on the surface of each stair to melt the snow. Separate each stair with a small channel for drainage of water. Equip each table with a metal umbrella and outdoor gas heater to maintain a good atmosphere
3. The lifted platform will transport people vertically onto the patio area where the outdoor dining bubble tents will be. These bubbles will have seating for social usability, a heater for winter usability and have heated flooring around the bubbles which ensures the snow melts as it falls, preventing any snow buildup. The bubbles will be decorated in colors that promote the indigenous community.

## D-10: Pugh Method

Standard: The stairs will include the ramps for people with wheelchairs, using tempered glass to create an area with a coffee shop and seating area. The stairs will have a heating system to remove snow build-up and drainage to remove water from the stairs.

Alternative Solution 1: Changing the colors of the stairs to colors that promote the indigenous community and include automatic hot water dispensers on the surface of each stair to melt the snow. Separate each stair with a small channel for drainage of water. Equip each table with a metal umbrella and outdoor gas heater to maintain a good atmosphere

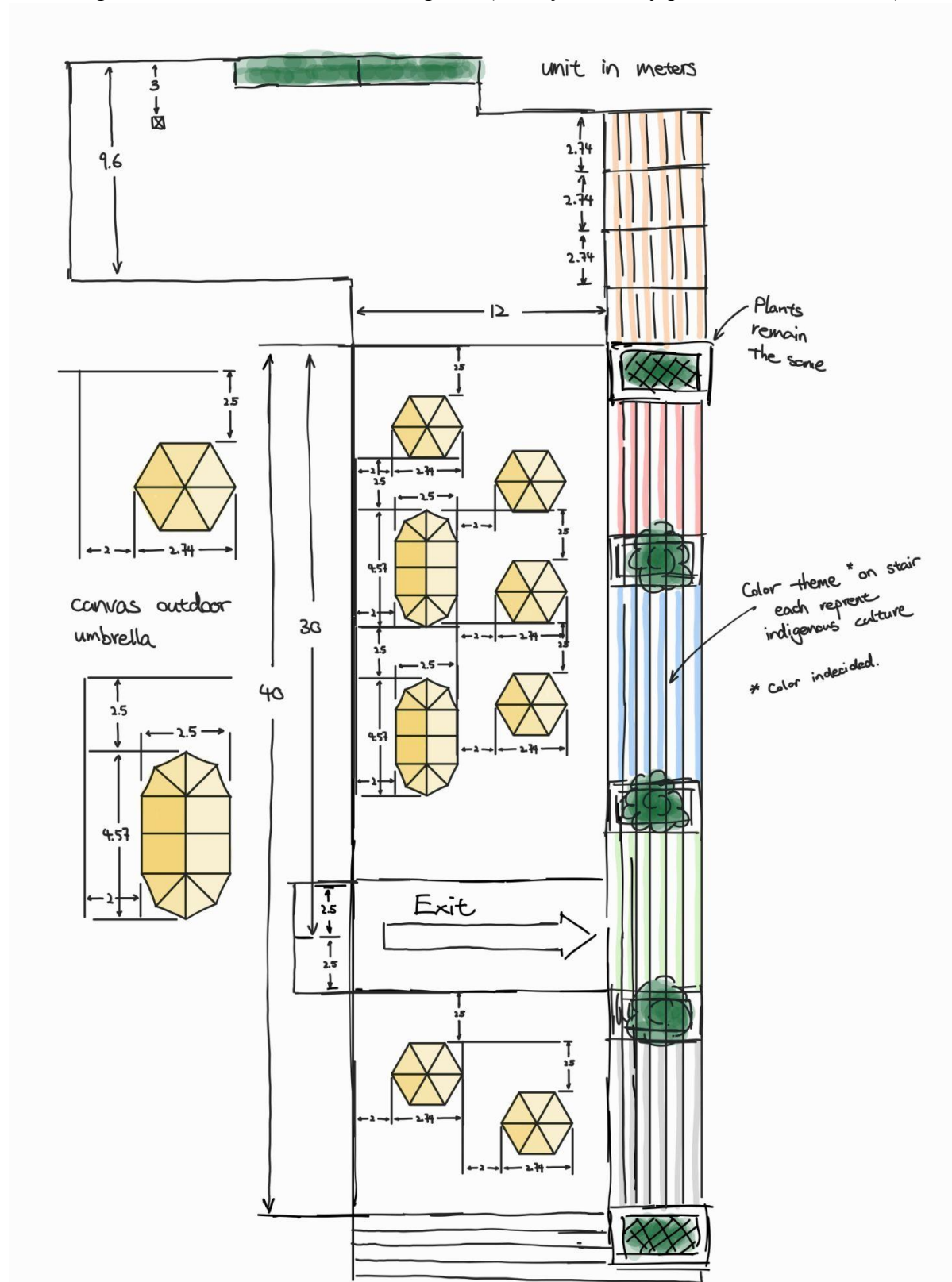
Alternative Solution 2: The lifted platform will transport people vertically onto the patio area where the outdoor dining bubble tents will be. These bubbles will have seating for social usability, a heater for winter usability and have heated flooring around the bubbles which ensures the snow melts as it falls, preventing any snow buildup. The bubbles will be decorated in colors that promote the indigenous community.

Objectives/Solutions	Standard	Alternative Solution 1	Alternative Solution 2
Allow accelerated and optimized access	S	1	-1
Provide safe and accommodating exit and entrance	S	1	-1
Direct pathway for people with disabilities	S	-1	-1

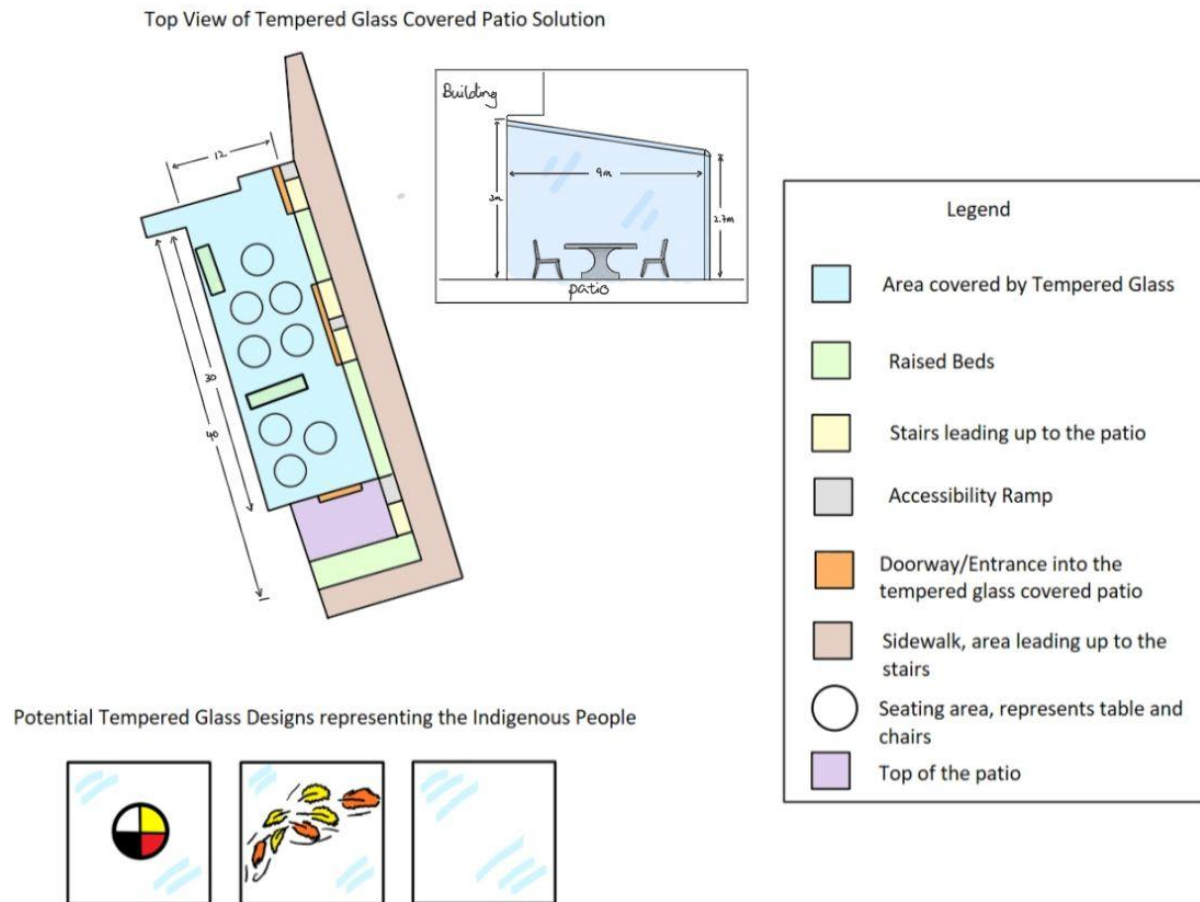
Facilitate social gatherings	S	-1	-1
Accommodate social gatherings	S	-1	1
Display the university's commitment to land acknowledgement	S	1	1
Incorporate environmental aesthetic and ecological space	S	-1	1
Sum	0	-1	-1

## Appendix E (all units are in meters)

E-1 Design sketch draft for alternate design #1 (2D layout - only patio area above stairs)



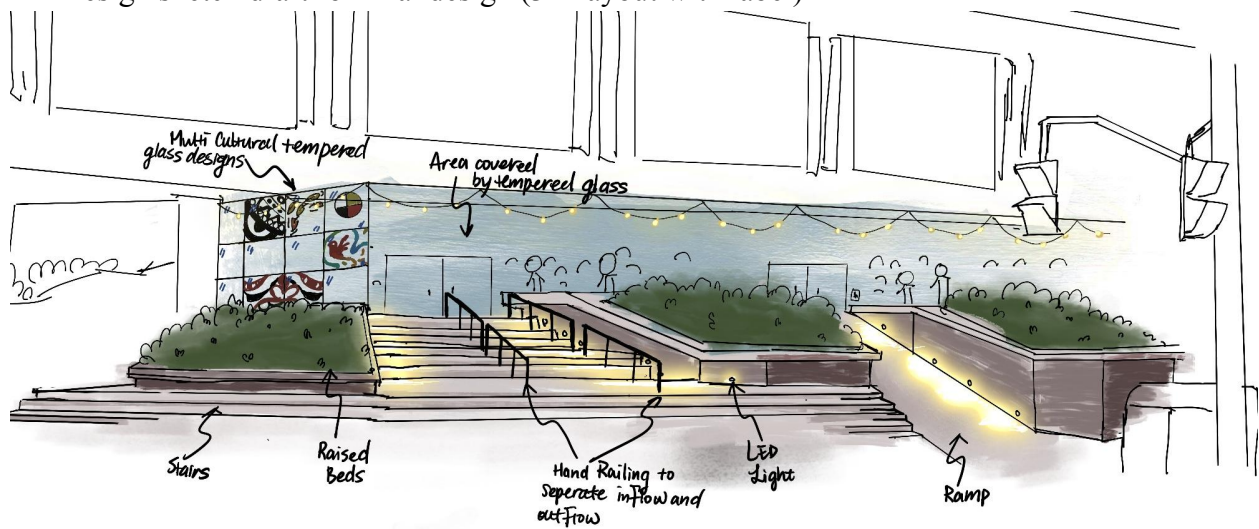
## E-2 Design sketch draft for alternate design #2 (2D layout)



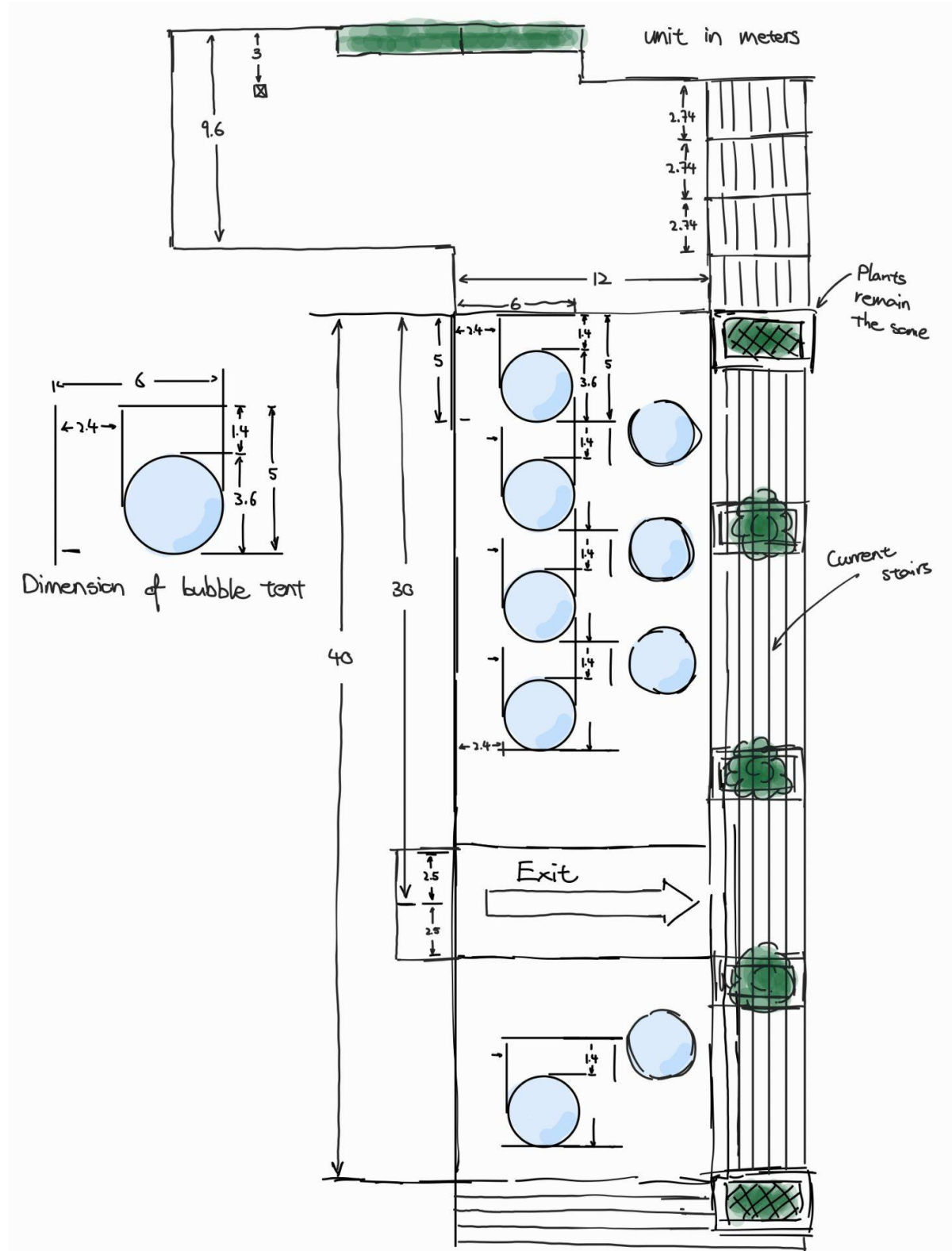
## E-3 Design sketch draft for final design (3D layout)



E-4 Design sketch draft for final design (3D layout with label)



E-5 Design sketch draft for alternate design #3 (2D layout - only patio area above stairs)



## 12.1 Attribution Table

Tutorial #:	Tut0113	Team #:	0072
Assignment:	Conceptual Design Specifications	Date:	December 4, 2022

Section	Student Names					
	Nathan Mugabe Cibonga #10087917 00	Robert (Tianyi) Guan #10089368 86	Rangajah Manoharan #10093418 74	Nastaran Noroozifar # 100906592 1	Uaena (Huijie) Tong #1007798 509	(Zac) Hoang Long Vo #10090749 93
Cover Page				FP	CM	
Executive Summary	ET FP		RS WD MR	FP		ET MR
Introduction	FP		ET FP	WD RS ET FP		ET
Problem Statement	WD FP		ET FP	FP		MR
Service Environment	RS MR FP		ET	FP	WD RS MR	WD MR FP
Stakeholders	FP	RS WD MR	RS WD ET FP	ET FP		ET
Functions	WD RS FP		ET	FP RS	RS WD	RS WD

Objectives	WD RS FP	ET	ET FP	FP RS		ET RS
Constraints	FP MR	WD RS2 RS3 MR ET	MR ET FP	ET FP MR		MR ET
Idea Generation process	WD FP MR ET	ET	ET FP	WD ET FP		RS MR
Alternative Design Description	WD FP MR ET	RS2 RS4 WD MR ET	ET FP	ET FP	RS4 WD MR ET	ET
Proposed Conceptual Design Specification			ET FP	ET FP		RS WD MR ET
Measures of Success	RS WD MR		ET FP	FP		RS WD MR
Conclusion	FP		ET FP	WD ET		ET
Reference List		MR ET		ET FP	RS WD MR ET	
Appendices	RS WD	RS1 RS2 OR2 ET	RS ET OR1	RS1 WD MR ET	RS ET MR OR1	RS ET



		MR		FP		
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Fill in abbreviations for roles for each of the required content elements using the abbreviations found on the next page. You do not have to fill in every cell.

## **Abbreviations:**

RS – Research (give details below) WD – Wrote Draft MR – Major Revision ET – Edited	FP – Final Proofread of COMPLETE DOCUMENT verifying for flow and consistency OR – Other (give details below)
--	---

## **“All” row abbreviations:**

CM – responsible for compiling the elements into complete document

If you put RS (research) please add a number identifier such as RS1, RS2, etc. Give the research question/topic:

RS1: Weather conditions in Toronto

RS2: Toronto Municipal code

RS3: Ontario Building Code

RS4: Market research for products (Bubble tent, umbrella, etc.)

If you put OR (other) please add a number identifier such as OR1, OR2, etc. Explain the role below:

OR1: Design illustration

OR2: Alternate design sketches

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