Executive Summary

The Client, High Park Nature Centre, has tasked our team with finding an accessible means of travel from Keele Station to the High Park Nature Centre (HPNC) while maintaining the habitat and natural ecosystem of Black Oak Savanna (BOS). The existing path is steep, narrow, and uneven, resulting in accessibility challenges for users with mobility devices including wheelchairs and walkers. As a result, there is currently a lack of an accessible and equitable way to get from Keele station to HPNC. This creates a need for a mode of transportation that also allows users to interact with the BOS. This document identifies the requirements for the project, and outlines our solution as well as our process of generating it. The current stage of the project results in a proposed conceptual design.

The design solution will operate within the area between Keele Station and HPNC, which is situated in the ecologically sensitive BOS environment. Various data is collected to analyse the physical, meteorological and virtual environment, as well as the user demographics, which influences our potential designs. For instance, the presence of users with mobility challenges make it essential for one of design's functions to be an accessible and equitable method of transport from Keele station to HPNC. Major interest holders, including environmental organizations and local Indigenous communities, are involved in establishing objectives and constraints that ensure the project has minimal negative impact on BOS in an environmental and cultural context. Furthermore, there are more established objectives and constraints regarding resources and amenities to ensure certain users' needs for park amenities are satisfied.

With the established project requirements, our team has generated 281 preliminary ideas through methods including brainstorming, structured brainstorming, SCAMPER, analogy, benchmarking and morph chart development. The ideas are then consolidated into 77 full solutions, of which 49 are feasible. Our solutions are categorized in 6 thematic groups, which are solutions that have elements of paths, underground, boardwalks, aerial, mechanical, vehicles. The 49 feasible solutions are then evaluated by group multivoting according to the project objectives, narrowing down to 10 ideas, which are subsequently evaluated again through the 2 most critical objectives. This resulted in 3 alternative conceptual designs, which are The Floating Boardwalk, Sky Ride and Funicular Carrier. They were compared to the previous solution through the pugh matrix and scored +6, +3 and +2, respectively, with solution The Floating Boardwalk being the most well critiqued design since it meets all 6 objectives. The Floating Boardwalk provides an accessible and inclusive means of transportation for all users to travel across the BOS, while greatly aiding the conservation of BOS by providing an environmentally friendly solution by minimizing foot traffic on turf and requiring minimal energy inputs or emissions. This is an equitable way for users to interact with nature ultimately satisfying the goals of the client.

Moving forward, the current design will be proposed to the client, allowing the client to review and express feedback. The proposed conceptual design will be evaluated through a measurement of success, which involves creating a test plan based on the very objectives we established in this document. All in all, this report documented the established requirements and design process, setting a good foundation for potential future solutions.

1.0 Introduction

High Park is a well-known public green space in Toronto that serves as both an ecological retreat and a community hub. Pre-colonization, Toronto was home to Indigenous Nations and the Black Oak Savanna (BOS) was maintained through land care practices, such as controlled burns. Over time, urban development and added amenities to High Park have diminished this significant ecosystem [1].

Today, High Park contains a distinctive remnant of the BOS. The City of Toronto has been actively attempting to restore the BOS for over two decades, with efforts of controlled burns since 2000 [2].

The client for this project, the High Park Nature Centre (HPNC), is a City of Toronto organization dedicated to engaging communities with nature and promoting awareness and respect for the environment through education [3]. This document outlines the project requirements and proposes a conceptual design solution for the Creating Equitable Access to High Park project requested by the client.

2.0 Problem Statement

The HPNC promotes awareness about nature and connects local communities with High Park. Many people who visit the HPNC travel from Keele Subway Station and pass through the forested path surrounded by BOS as shown in Figure 1a. [2].

Figure 2 shows how this route has a very steep slope, an uneven terrain, and a narrow width. Even though the total elevation gain is 13 m, some portions of the route have grades as high as 25%, five times steeper than the AODA maximum of 5% for an accessible pedestrian route [4]. This creates a major issue for individuals with mobility challenges, including people using wheelchairs, mobility-scooter users, canes, walkers and families with strollers (Appendix B). Therefore, there is a lack of a physically accessible and equitable mode of transportation for groups with mobility challenges. Even though there is a more accessible path that starts at Keele Station and proceeds east along Bloor Street West (Figure 1), it does not provide the opportunity to immersively experience the BOS. That creates a need for a method of transportation that gives users the opportunity to experience BOS and it integrates with the ecosystem to promote conservation. The physical scope of this project will be the area highlighted in Figure 1a. The design will operate all year round [5].

Figure 1. Different Routes from Keele Station to HPNC: (a) Route 1 Goes Through BOS; (b) A more accessible route [6]

Figure 2. Elevation change measured by walking from Keele Station to HPNC [7]

3.0 Service Environment

As shown in Figure 1, the service environment consists of the given path and its natural surroundings, which can be divided into the physical environment, virtual environment, and living things.

3.1 Physical Environment

The physical environment of High Park consists of yearly meteorological factors and prescribed burns each spring [1]. Terrain of the park along the route is considered as part of the physical scope.

Table 1. Range of Meteorological Factors in High Park Village (2009-2024 [8][9])

Meteorological Factor	**Range**
Temperature	-24.9°C to 42.1°C
24h Precipitation	<44mm
24h Snowfall	<30 cm
Wind Gusts	<87 kph
Humidity	6-95%

Table 2. Terrain of Route 1

Factor	**Description**
Width of trail 201 - 470 cm	 

	Figure 3. Measured trail widths: (a) smallest width; (b) widest width
Elevation	Elevation ranges from 90-105 m (Appendix C)
Surface type	 Figure 4. Types of surfaces along trail: (a) flat dirt; (b) uneven dirt; (c) uneven, cracked pavement; (d) cracked stone
Obstacles	 Figure 5. Obstacles along trail: (a) barrier blocking trail; (b) 3 rail wood fence; (c) openable gate; (d) wood stick fencing
Roads	Spring Road intersects trail which has many cars using the road

3.2 Virtual Environment

The virtual environment in High Park includes available cellular data service and gps signals throughout the park. There is cellular coverage throughout the route, ranging from 18.8-52.1 mbps (Appendix D). Satellite and GPS coverage in the park can also be accessed through online mapping software such as contour maps shown in Appendix C.

3.3 Living Things

High park consists of thousands of living beings. Relevant living things are listed in Table 4.

Table 3. Observed Living Things in High Park During a 30 Minute Period

Category	**Observations**
Flora	The most notable flora observed was the BOS which is seen throughout the entire trail. Weeds, shrubs, birch and maple trees were also observed.
Fauna	A total of 14 leashed and unleashed dogs were seen using the trail. Many natural inhabitants were also observed, such as many birds perched on trees, moths resting on branches, and chipmunks and squirrels gathering food.
Humans	People were observed using the trail for various purposes listed below (Appendix E): 1. 5 seniors walking 2. 6 children walking with parents 3. 1 person with a stroller 4. 1 person with a walker. 5. 6 joggers 6. 14 dog walkers

4.0 Interest Holders

Primary Interest Holders are spanned among the accessibility, environmental, economic, and indigenous influences and/or impacts regarding High Park and the implementation of a new design, as analyzed in Table 1. Since the HPNC is the client, it isn't listed below. The interest holders are represented graphically in Figure 3 based on their influence and impact.

Table 4. Descriptions of Primary Interest Holders, their interests, impacts, and influence.

	Interest Holders	**Interest**	**Impact**	**Influence**
I.1	Park Visitors with Mobility Challenges	Desire a safe and equitable mode of traversing through High Park [10].	Design determines physical accessibility, impacting their usability and park experience	Low influence individually, but their interests are represented by

I.2	Families with Strollers	Benefit from accessible (stroller-friendly) routes to the HPNC [11].	[12].	accessibility organizations [13].
I.3	Toronto Accessibility Advisory Committee	They ensure compliance with AODA [14].	Not impacted by the design.	They mandate design's compliance with AODA.
I.4	Environmental Organizations (High Park Natural Environment Committee)	The protection and restoration of High Park's nature	Aim to represent the natural environment and consider environmental impact for proposals of new initiatives[15].	Influence the design's considerations for sustainability [15].
I.5	City of Toronto–Parks, Forestry, and Recreation Division	Manages maintenance and some services offered by parks. Have also invested in projects such as the Ravine Strategy and Biodiversity Strategy [16].	They face economic [17], environmental [18], and legal implications with the restoration and usage of High Park [19].	The City of Toronto's interests are represented through the HPNC. [20]
I.6	Local Indigenous Communities (Mississaugas of the Credit, Anishnabeg, Chippewa, Haudenosaunee and Wendat peoples) [21] [22]	To protect the cultural heritage, historical traditions and ecological integrity of the BOS.	The design and changes can impact heritage and cultural connections through the Park (i.e; archeological sites, burial mounds) [23].	Have some influence as High Park aims to preserve Indigenous voices [24].

An Impact vs. Influence matrix representing the distribution of interest holders can be found in Appendix F. Secondary interest holders pertaining to those who are indirectly affected by the design (including other users) are detailed in Appendix G.

5.0 Detailed Requirements

Functions, Objectives, and Constraints can be determined based on the criteria given in the problem statement.

5.1 Functions

The purpose of the design is to meet the client's goal of making the park more accessible. Based on the client interview questions from the site visit, these functions were derived using the BlackBox method (Appendix H) and refined through the use of ChatGPT 5 (Appendix A, Section 2.2).

Table 6. Primary and Secondary Functions:

Primary Function	Facilitate the transportation of park users from Keele station to the HPNC
Secondary Functions	● Allow park users who face mobility limitations, or who use wheelchairs/mobility vehicles, to move throughout the park. ● Indicate route progress/geographical position to users throughout the route.

5.2 Objectives

The objectives are based on the gap identified in the problem statement and the client's goals of restoration of the OS, community needs for natural amenities, and equitable access for users. They were generated using a how-why tree (Appendix I) and prioritized with a pair-wise comparison chart (Appendix J). Explanations of justifications with references can be found in (Appendix K).

Table 7. Objectives of the design, with their metric, goal, and justification

	Objective: The design should	**Metric**	**Objective Goal**	**Justification**
O.1	Autonomy of mobility device users' mobility	Point Score (See Appendix K.1)	3	Justifications are provided by guidelines for accessibility standards and outdoor lighting guidelines (Appendix K.1)
O.2	Provide accessible wayfinding for users of all abilities	Number of type of wayfinding methods	3	Using 3 methods of wayfinding (visual, auditory, tactile) aligns with the City's TO360 Wayfinding Project to ensure inclusivity in wayfinding. (Appendix K)
O.3	Preserve the tranquility* of the forest environment *the calm nature of the BOS environment	Ambient Noise Level (dBA)	~50	Aligns with findings from a study on recommended noise level for a restorative natural experience (dBA from the design and its immediate environment, excluding external noise) (Appendix K)

O.4	Provide rest areas for users with mobility challenges	Interval (m) between rest areas	30	Aligns with the City of Toronto's recommendations to improve accessible built environment standards. (Appendix K)
O.5	Withstand seasonal weather	% of materials used that are durable in a semi-continental climate	100%	Ensuring 100% of the materials used withstand Toronto's seasonal weather supports the long lifespan and safety of the design. (Appendix K)
O.6	Incorporate Indigenous Knowledge and Values	Number of Interpretive elements representing Indigenous values	19	Interactive elements representing the Seven Grandfather teachings should be included, based on the Plan for Truth and Reconciliation and calculations. (Appendix K, L)

5.3 Constraints

The constraints to the design are the absolute limits, through environmental, accessibility, and technical lenses.

Table 8. Descriptions of all relevant design constraints, their respective metrics, limits, and justifications, where the metrics for C.1,2 are explained in Appendix M.

	Constraint	**Metric**	**Limit**	**Justification**
C.1	The solution must operate irrespective of prescribed burnings in High Park and shouldn't significantly increase the Burn Complexity Analysis score.	The design doesn't exceed a score of 2 for the "threats to boundaries" component in the Burn Complexity Analysis [25].	Score ≥2	High Park's interest holders represent the historical and environmental significance of prescribed burnings [26]. Hence, the solution coexists with prescribed burnings (Figure 6).
C.2	The design must not disturb biodiversity (mustn't impede	ΔSpecies Richness (change in	ΔSpecies Richness = 0	The client's request for a design is in light of the conservation and restoration efforts of the BOS [2]; therefore, no

	BOS's conservation).	number of visible species, i.e. those in Table 4., in a given area) [27]		destruction of it is a given.
C.3	The design must not obstruct Spring Road.	Does the design obstruct it? (Y/N)	N	Due to the road's usage by utility task vehicles [2].
C.4	If the design is a path, it abides by an accessible width.	Minimum width (distance)	2100 mm [28]	An accessible path must meet the minimum clear width to account for pedestrians.
C.5	If the design is a path, it shall abide by an accessible clearance.	Minimum height clearance	2100 mm [29]	The clearance is to protect users from overhead obstructions.
C.6	If the design is a path, it must have a wheelchair accessible slope.	Angles (°)	≤2.87°	Accessibility guidelines specify a maximum running slope of 1:20(5%) to ensure user equity [29].
C.7	The design shall not remove natural obstructions (Appendix N).	Does the design inhibit natural obstructions? (Y/N)	N	Natural obstructions cannot be removed due to protected ESAs, and C.2 above. The City of Toronto's Ravine strategy limits any tampering with the natural topography.

Figure 6. A burn map for spring 2025, outlining sections for prescribed burns [30]. A past map with more sections within our scope is in Appendix O.

6.0 Generation, Selection and Description of Alternative Designs

In order to select the 3 best solutions, a wide range of solutions were considered. To generate means, function and constraints were taken into high consideration. Furthermore, objectives were used to combine ideas and formulate them into full solutions.

6.1 Idea Generation Process

Ideas were generated using a variety of methods. First, structured and free brainstorming was applied, followed by morph charts, SCAMPER, analogies and benchmarking as depicted in Figure 7. These methods allowed the team to generate a total of 281 means.

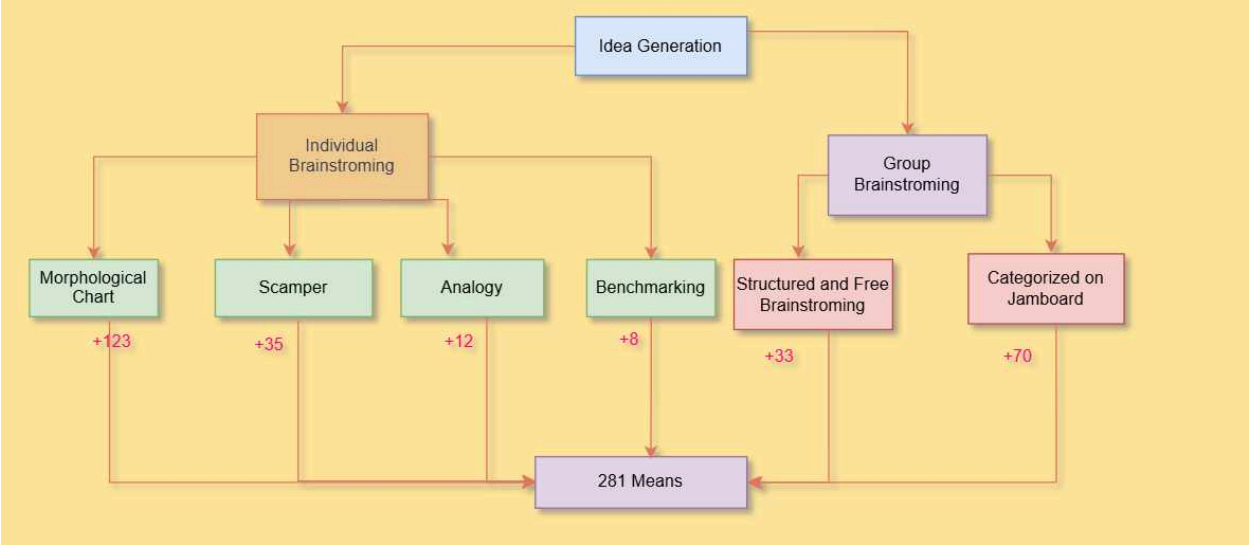

Figure 7. Idea Generation Overview [31]

Structured brainstorming was initially used to generate ideas, but the team struggled with a lack of organization resulting in many scattered ideas. To solve this, general categorization of themes (Appendix P.1,2) was done, making individual and group brainstorming more efficient and focused. Out of all of the techniques applied, the most effective technique was morph charts (Appendix P.3.) as it forced on systematic thinking about FOCs and it generated the majority of the 281 means (Appendix P.4).

6.2 Idea Selection Process

Our Idea selection involved 4 selection methods, to help ensure the final 3 proposed designs would meet both of the Functions and Constraints.

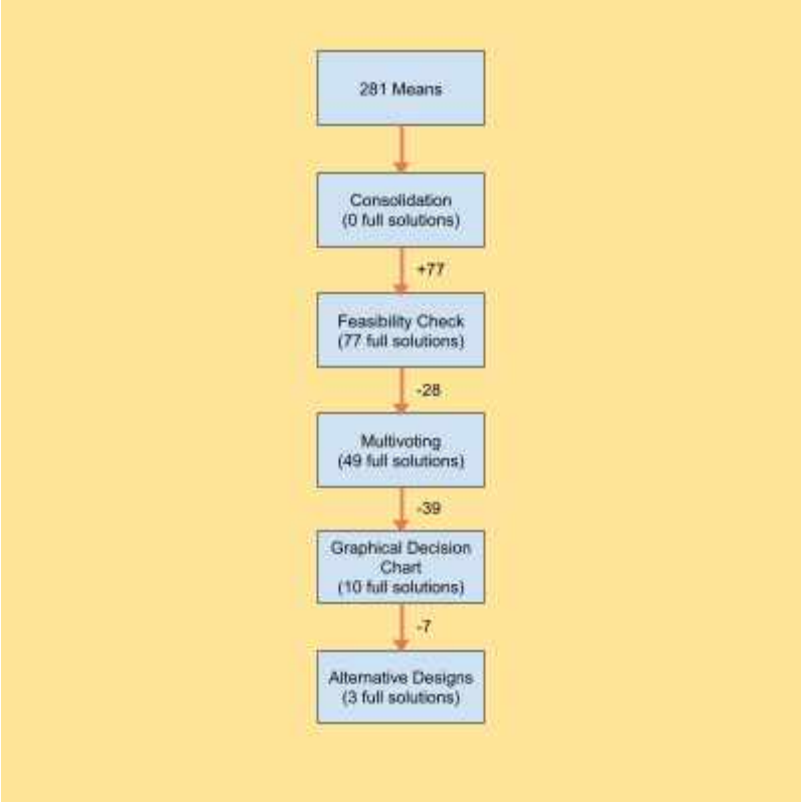

Figure 8. Idea Selection Overview [32]

6.2.1 Consolidation, Feasibility check, Multivoting

All full solutions were fully consolidated by combining our means into solutions which fit the themes: mechanical, path, boardwalk/bridge, underground, vehicle, aerial (Appendix P.5). A feasibility check reduced the number of solutions which did not meet functions and constraints (Appendix Q.1). Remaining Solutions (Appendix Q.2) went through a multivoting stage (Appendix Q.3) and were reduced from 49 solutions to 12. Done in 3 rounds, each member getting 10, 6, and 3 votes for each progressing round. The 2 solutions with the least amount of cumulative votes were also removed, leaving 10 full solutions (Appendix Q.3.2).

6.2.2 Graphical Decision Chart

The 10 full solutions were compared to the 2 most important objectives (O.1, O.2). As the gap in our problem statement was lack of accessible transportation, which prioritized immersiveness. Meeting O.1, and O.2, would allow users with mobility challenges to freely and easily navigate between the HPNC and Keele station, filling the accessibility gap. O.1 and O.2 narrowed down 10 full solutions to 3 (Appendix Q.4).

6.3 Alternate Design Descriptions

The details of each alternate design description were fully developed to show how they meet each objective.

6.3.1 Design 1: The Floating Boardwalk

The proposed design features a rigid floating boardwalk, coupled with leaning rails and different colored benches spaced along the boardwalk (Figure 9). The path will have 28 solar lights to enhance night time visibility. Solar panels will be integrated into the structure and will also power the floor heating system [33] that will melt snow in winter and dry the boardwalk after rainfall. Furthermore, to promote cultural engagement, indigenous history information panels will be added.

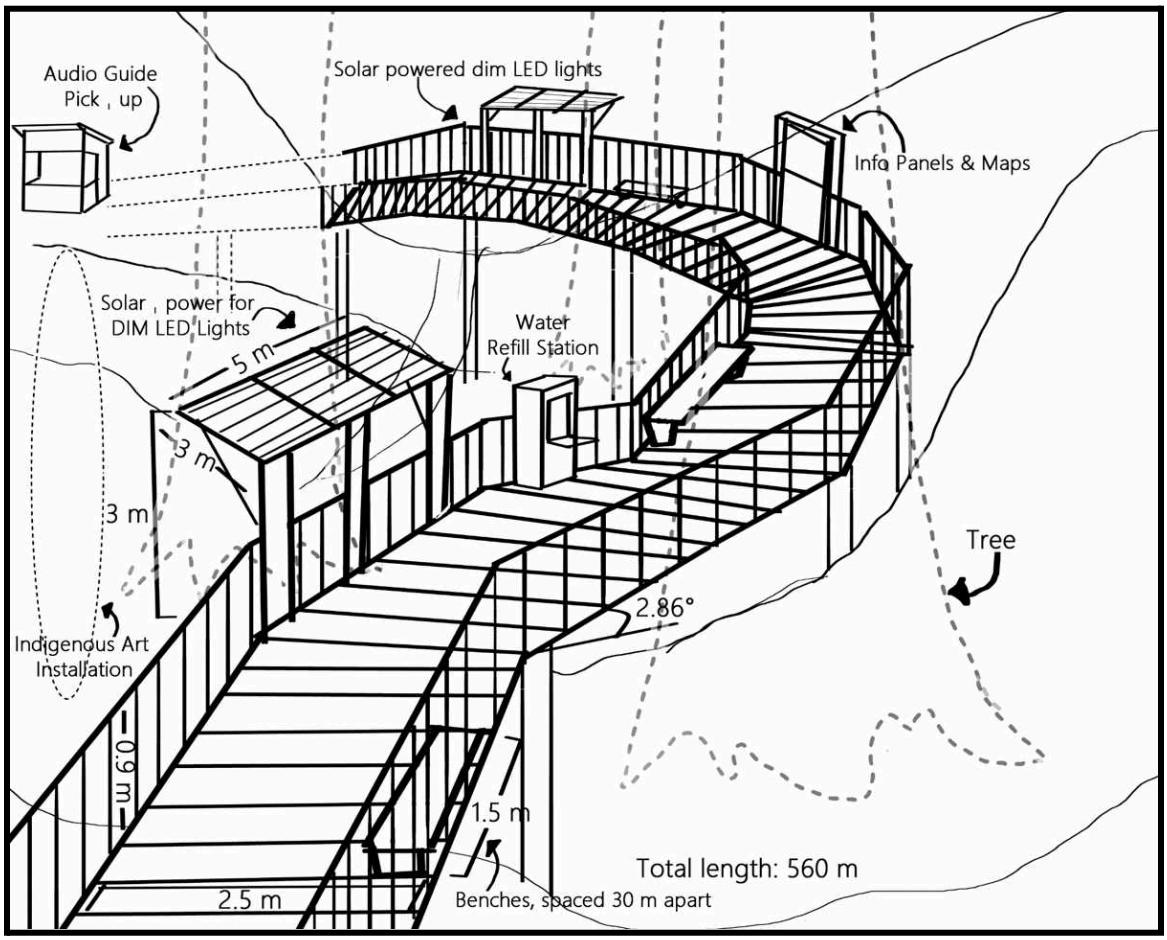

Figure 9. Sketch of Floating Boardwalk [34]

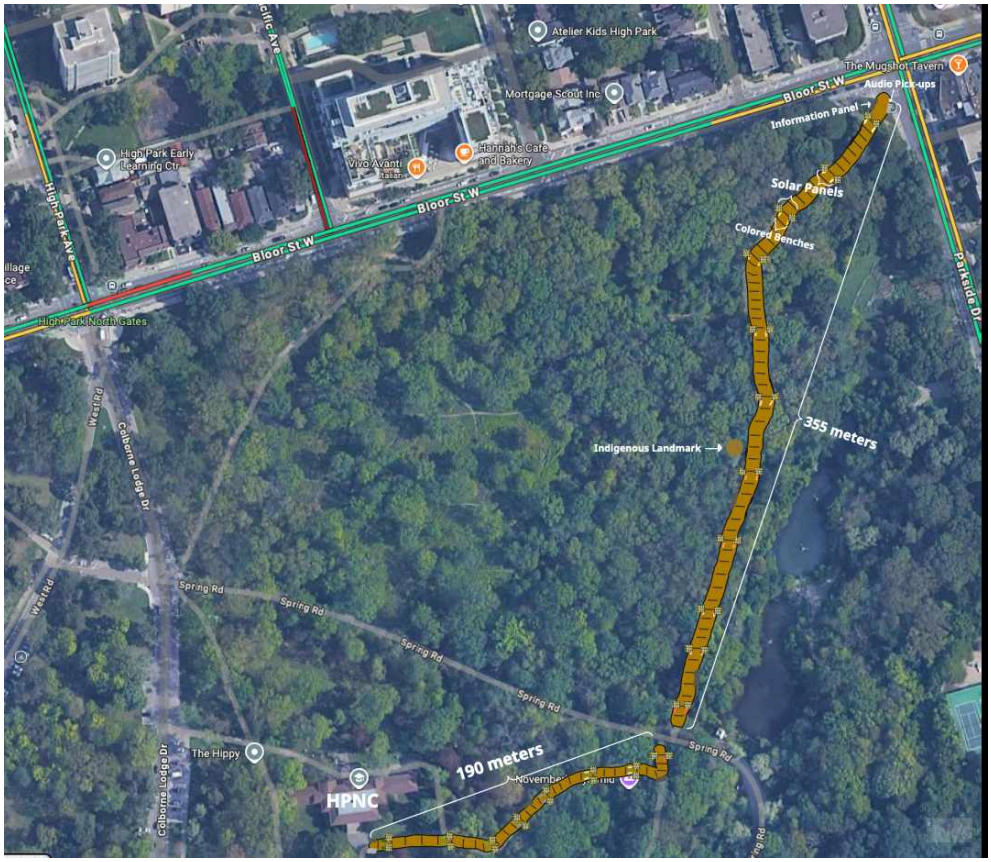

Figure 10. Birds-eye View of Floating Boardwalk [35] [6]

Table 9. Summarized Justification of Objectives for Floating Boardwalk (full justifications in Appendix R.1)

Objective	**Justification**
O.1	• 2500mm path exceeds 2100mm required turning diameter for a wheelchair user (Figure 9) • Deck board spacing of 6.35mm meets Accessibility Standards[36] • 28 lights installed along the path meet outdoor lighting guidelines
O.2	• Heating system creates 35.3 dbA which is less than 50dBA therefore it meets the objectives
O.3	• Railing provides tactile guidance for low vision users (Figure 9) • Colored benches, information panels act as visual wayfinding • Audio guides act as auditory wayfinding
O.4	• Boardwalk has 19 benches.

O.5	● Structure elements that will be chosen are composite deck board for surface, galvanized steel for leaning rails, pressure treated lumber for internal joists. All of these are resistant to Toronto's climate. ● The integrated heating system will reduce ice buildup
O.6	● The boardwalk can have multiple indigenous elements along its 560m length.

6.3.2 Design 2: Gondola Sky Ride

The proposed design is an electric bi-cable gondola system carrying users over the forest canopy. Cabins will have accessible ramps and removable seats. The seats will be able to be latched on and off to make room for users with mobility devices. Along the route, users can enhance the experience of the BOS with interactive cabin walls including maps, QR codes, braille pamphlets, and buttons for cultural and historical audio teachings, and audio guides.

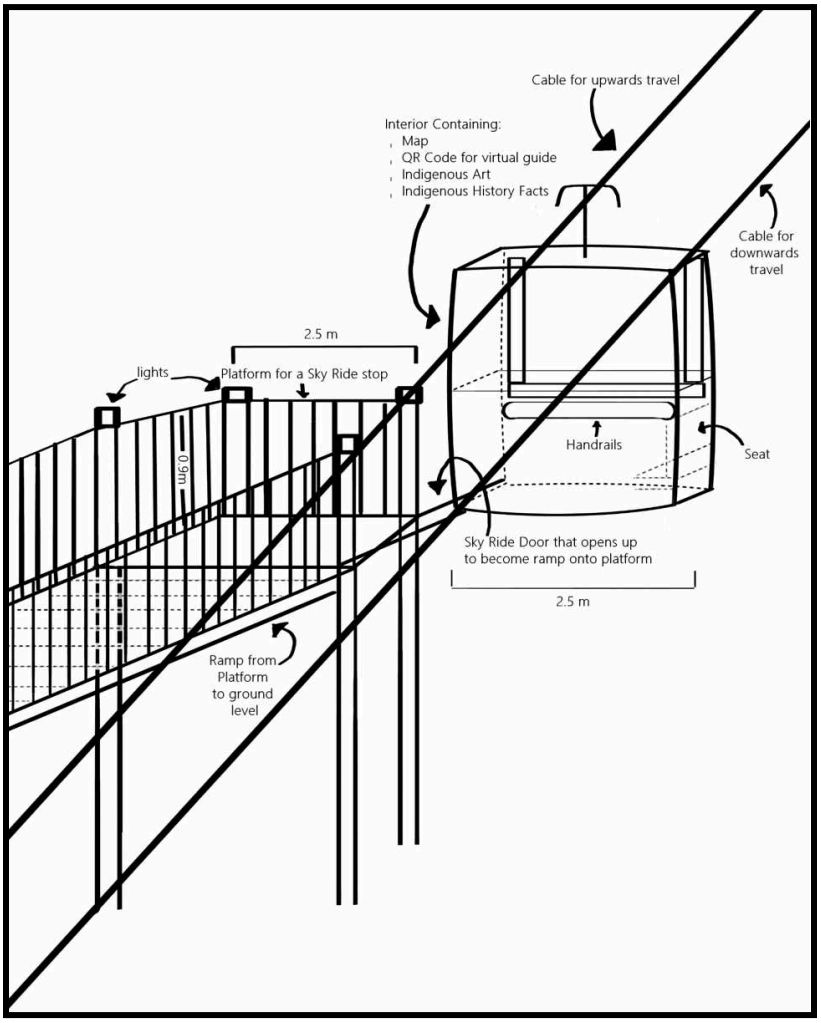

Figure 10. Sketch of the Gondola Sky Ride [34]

Figure 11. Birds-eye view of the Gondola Sky Ride [34] [6]

Table 10. Summarized Justification of Objectives for Gondola Sky Ride (full justifications in Appendix R.2)

Objective	**Justification**
O.1	• 2500mm width exceeds 2100mm objective • Platform and ramp use wood with gaps less than 13mm • Cabin interiors and platform stops have 9W compact fluorescent lights spaced roughly 6m apart
O.2	• Average dBA of gondola system ranges from 55-75, does not meet 50 dBA objective
O.3	• Visual maps, audio announcements, handheld maps with braille, and qr codes for digital navigation
O.4	• Metric doesn't apply
O.5	• Steel stations, towers, cables, and cabins are able to withstand yearly Toronto climate
O.6	• Has up to 19 combined elements

6.3.2 Design 3: Funicular Carrier

The funicular railway will transport users in an enclosed carrier along a sloped railway in major slopes within the park. It will have designated off-road sections spaced 200m apart. Frequent stops allow users to explore areas not accessible to all users in the current design. The carrier will be equipped with braille plaques, audio navigation, and information panels.

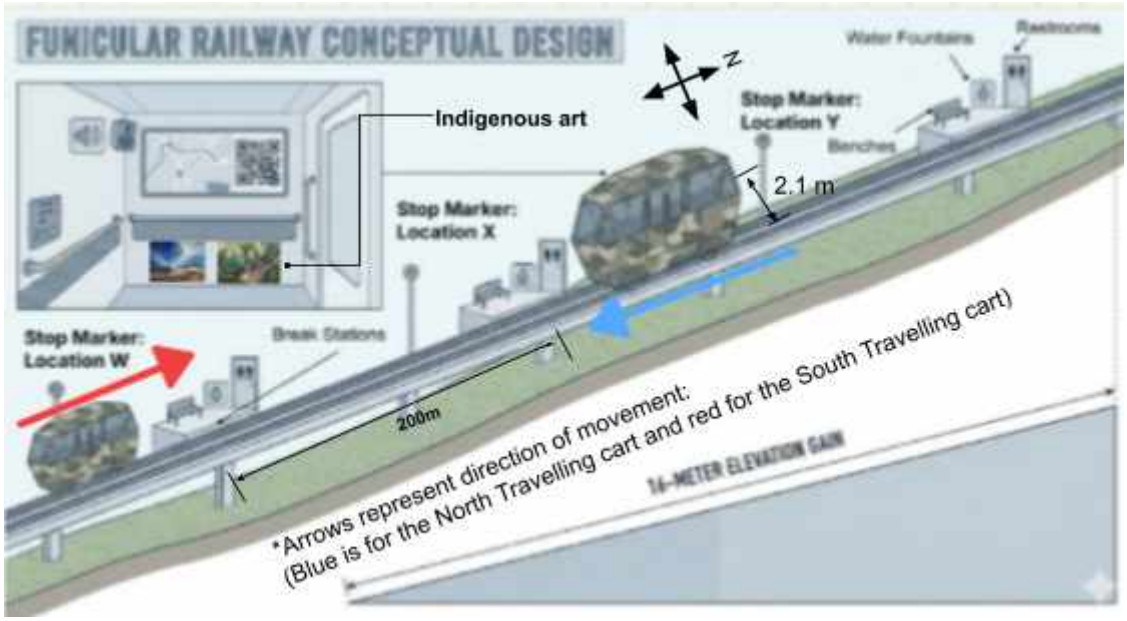

Figure 12: Close Up Sketch of Funicular Carrier Design using Gemini Nano Banana [37], [38], (Appendix A.2.4)

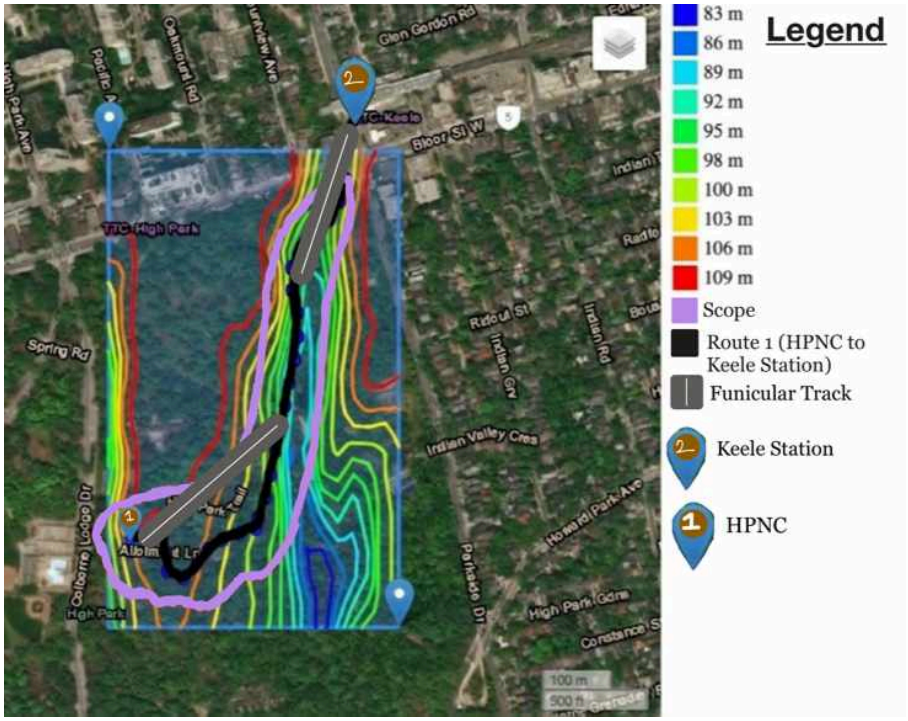

Figure 13. Birds-eye View of Funicular Railway [6], [39] (Appendix A.2.4)

Table 11. Summarized Justification of Objectives for Funicular Carrier (full justifications in Appendix R.3)

Objective	Justification
O.1	● Carrier width of 2100mm meets 2100mm requirement ● Ramps ensure no gap between vehicle and platform ● Component 3 is not applicable
O.2	● Objective is met as 3 wayfinding methods are incorporated in design ○ Information screens ○ Braille plaques ○ Audio navigation
O.3	● Estimated volume range of 75 - 110 dBA, therefore the objective of dBA <55 is not met
O.4	● Metric doesn't apply
O.5	● Only operable above -25°C and with minimal snow on the roof and trails; objective is not met
O.6	● The carrier had up to 19 elements that reflect Indigenous teaching, meets objective

7.0 Proposed Conceptual Design Specification

A pugh chart was used to quantify how well each solution met the objectives when compared to the current route (Appendix T). The floating boardwalk scored a 5, while the Funicular Carrier and Sky Ride scored a 2 and 3, respectively.

The Floating Boardwalk functions as the most optimal solution that balances the need for an accessible method of transportation that gives users the opportunity to immersively experience the BOS, while not being at the cost of its conservation [2]. The accessibility of the park is improved from the datum [40] due to features such as the rest areas (as O.4 aims to prove accessibility): leaning rails and benches, and the slope (≥2.86°, as per C.6), rails, and material of the Floating Boardwalk. Additionally, the proposed idea has increased immersiveness, as the Floating Boardwalk allows users to engage more with High Park. The lights allow people to engage with the environment for longer hours of the day, and allow for accessible and safe navigation for users with mobility challenges, (O.1, (K.1), whereas the current physical scope of high part is not lit. Furthermore, the more frequent rest areas allow users to appreciate the park at their own pace, and improves the quality of the space [41]. The "floating" aspect of the boardwalk also prevents foot traffic on vegetation and near any ESAs [42], promoting the conservation of High Park's biodiversity (C.2).

8.0 Conclusion

This document identifies the gap in the client statement: a lack of accessible transportation that allows users with mobility issues to experience the BOS. Through site visits, users with mobility issues, among other park users, were determined to be the most important interest holders. The primary function outlines the means of facilitating transportation, which closes the outlined gap, while the objectives, quantify accessibility for users with mobility issues, and preservation of the sensitive BOS. The constraints identify clear standards which a solution must follow to meet Toronto Accessibility Design Guidelines. Using the FOC's, ideas were generated through a variety of techniques, generating 281 means compiled into 77 full solutions. A feasibility check, multivoting, and graphical decision chart determined the 3 best alternative designs. The final solution was ultimately chosen to be "Floating Boardwalk", which scored the highest on the pugh chart, as it provides the best accessibility because of its width and slope. Furthermore, it is the most natural solution, preserving the BOS as it does not produce extra noise, exceeding the most important objectives. Next steps for the client would be to evaluate the "Floating Boardwalk," before proceeding with implementation.

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Appendices

Appendix B: Subu's Engineering Notebook notes taken during a Client Interview Site Visit on October 4th.

Appendix C: Slope Details Along Route 1

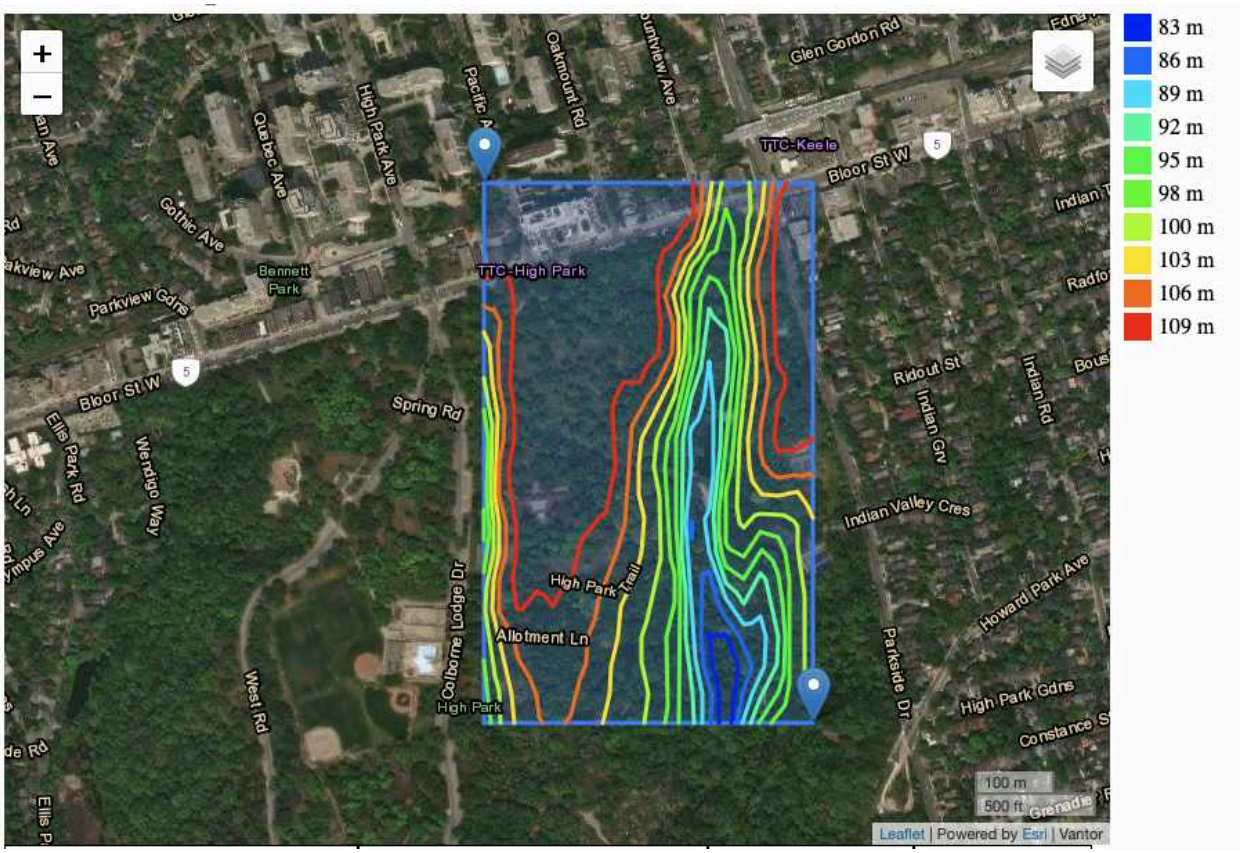
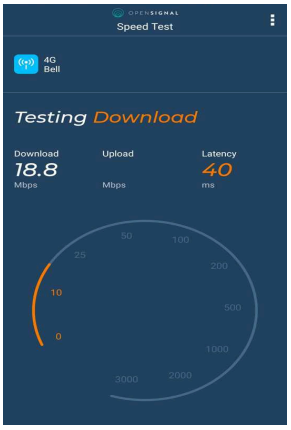
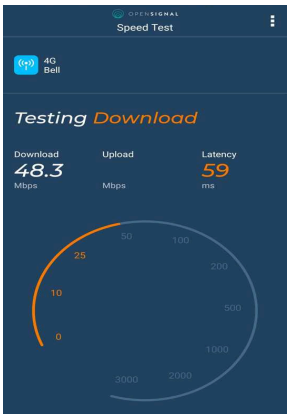
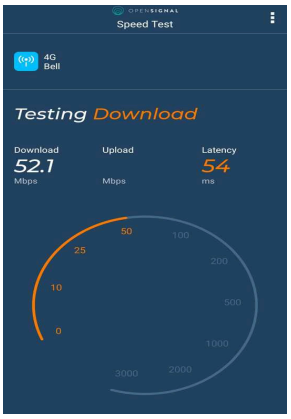


Figure C.1. Contour map of route 1 [37]

Appendix D: Cell Phone Service Test

Table D.1. Cell Phone Speed Test Done Along Route 1

Location	Speed
Outside of Keele station	 [43]
Halfway through route	 [43]
At HPNC	 [43]

Appendix E: Jarvis' and Sajenie's Observations During High Park Visit

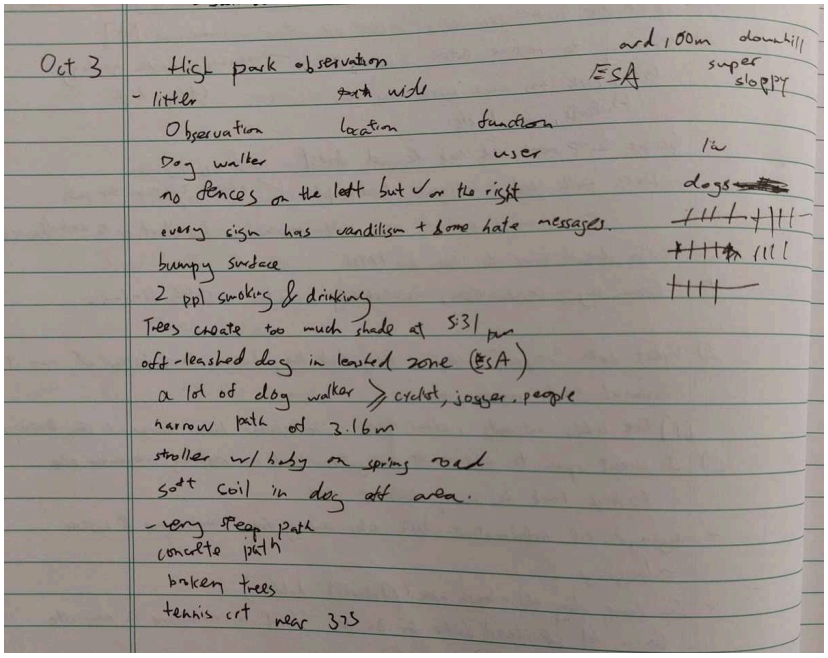


Figure E.1. Jarivs' engineering observations

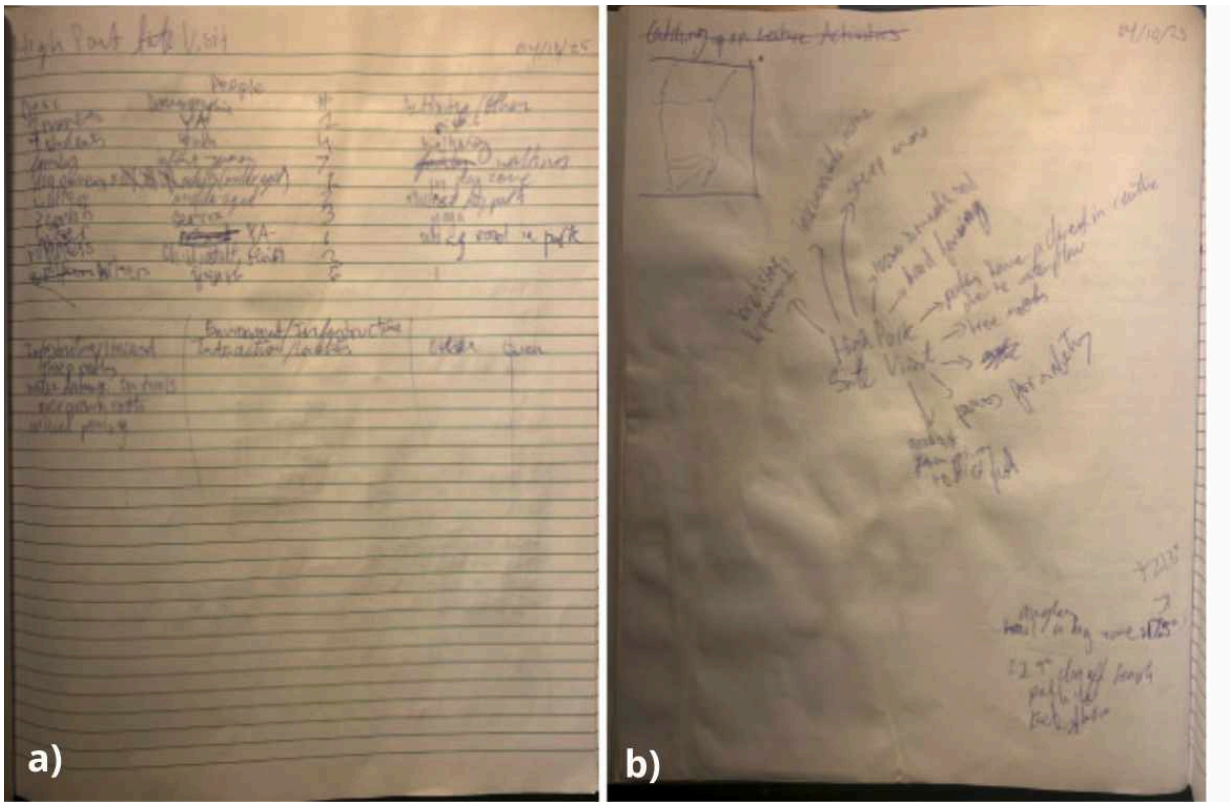


Figure E.2. Sajenie's engineering notebook: (a) Page 1; (b) Page 2

Appendix F: An Impact vs. Influence of Interest Holders

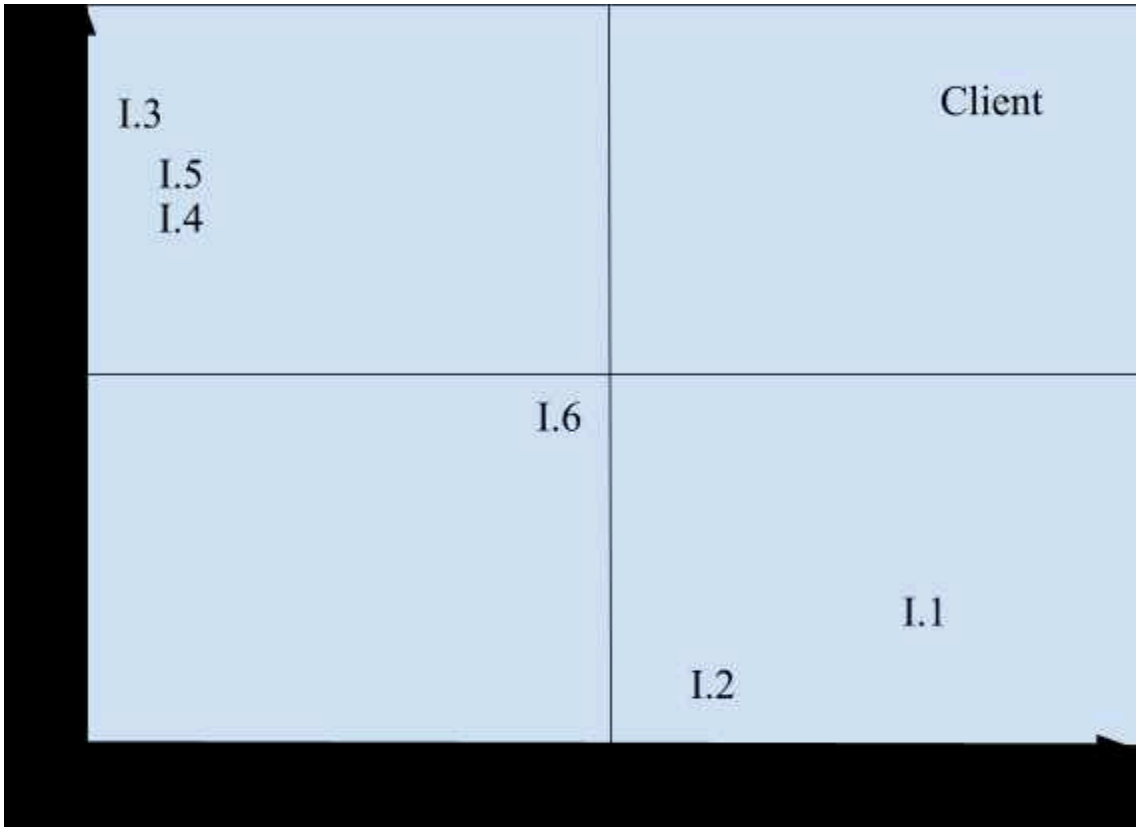


Figure F.1. Impact vs Influence matrix representing the distribution of interest holders

Appendix G: Secondary Interest Holders

Table G.1. Descriptions of Secondary Interest Holders, their interests, impacts, and influence.

Interest Holders	Interest	Impact	Influence
Running Clubs, i.e., High Park Rogue Runners [44]	Recreationally involved with High Park. Facilitate usage of High Park for Athletics.	Such clubs are impacted by the design as elements including slope, materials used, and dimensions impact usage.	Conflicting interests that may arise would not hold high consideration in the design, but may also be shared interests with other groups of higher priority (i.e., TAAC).
Residents and community groups	Would want minimal disturbance to their local nature sanctuary.	High Impact: They may face noise or traffic during the implementation of a design. Moreover, they might be restricted from using some areas of High Park.	They have a very minimal say because there is no group to advocate their opinions.
Emergency Services (Toronto Fire and Paramedic Department)	The design should not obstruct routes used for emergency access.	Design determines accessibility of their services to certain areas of the park.	Most trails must accommodate emergency vehicles to an extent. (Relevant if design is a trial) [45].
Maintenance Personnel	They operate within the design.	The design may determine the accessibility of maintenance work.	Their inputs are minimally represented.
Wildlife Within BOS	The species depend on the natural habitat conditions	Noise pollution, habitat loss, and disruptions in behaviour could be caused.	They have no voice in the design but are represented by advocacy groups.

Appendix H: Subu's Engineering Notebook Notes of Methods to Derive Functions

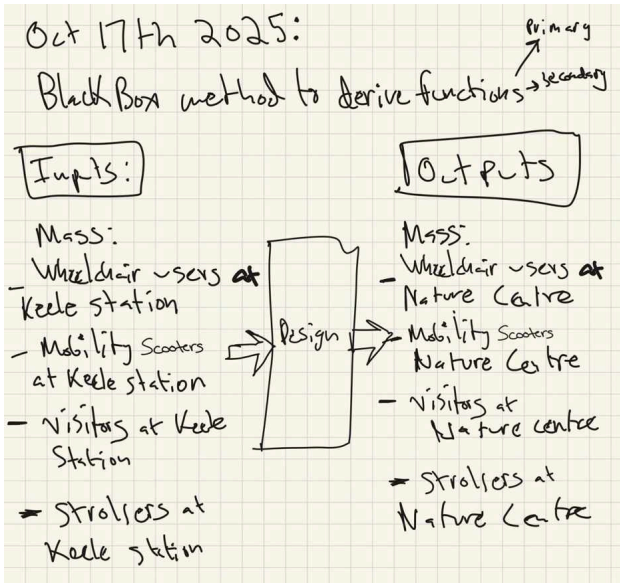


Figure H.1. Subu's Black Box method notes

Appendix I. How-why Tree Used to Generate Objectives

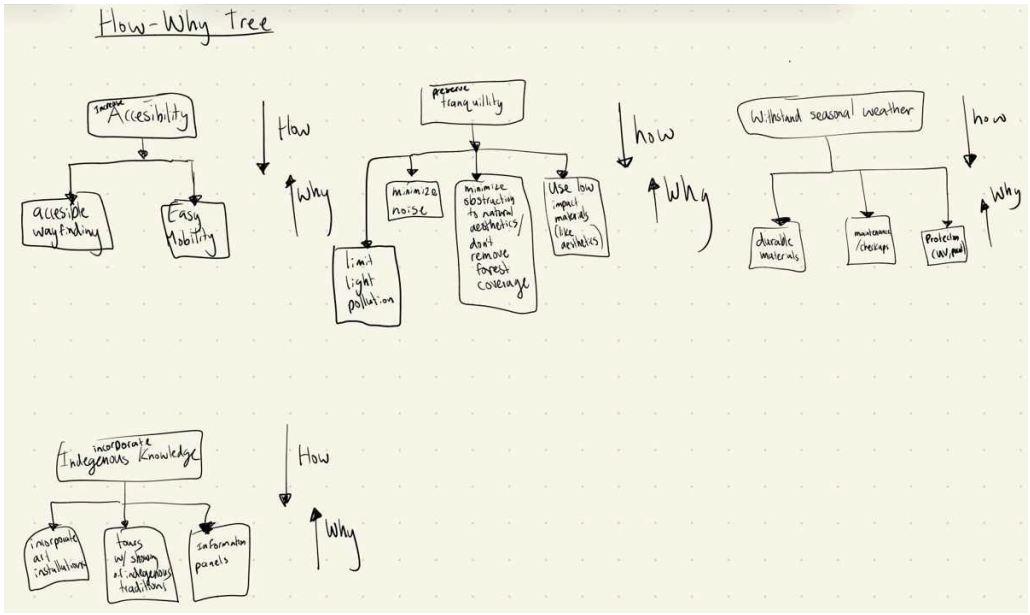
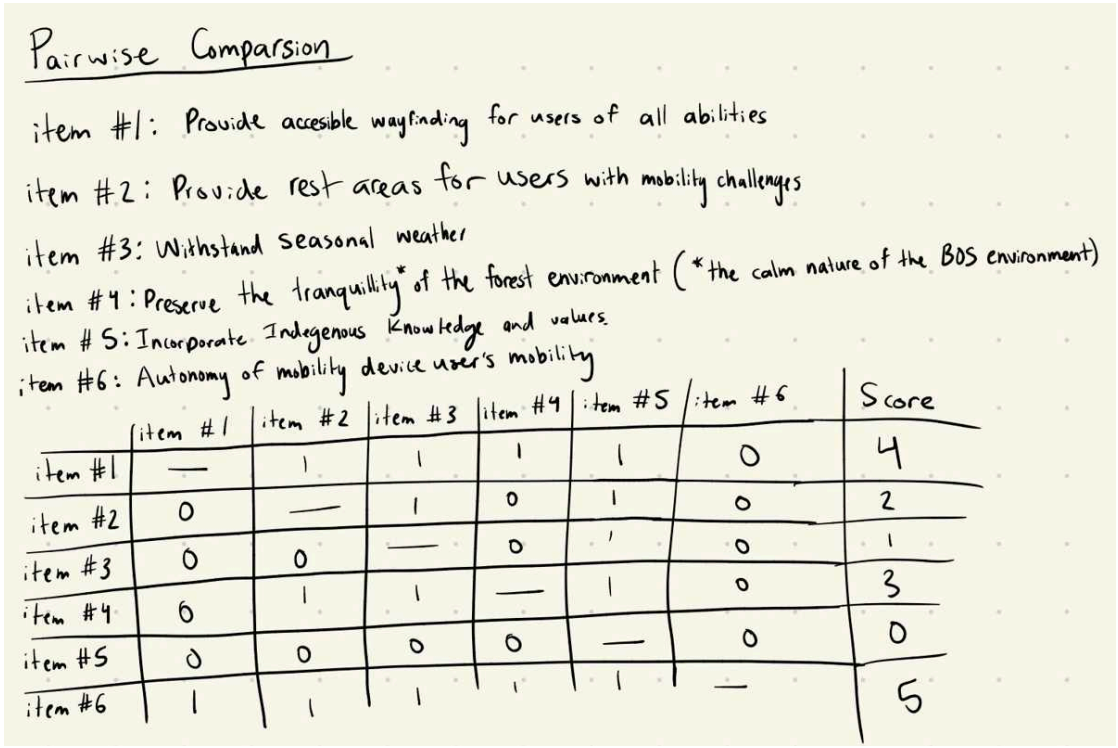


Figure I.1. Shahad's how-why tree from her Engineering Notebook

Appendix J. Pairwise-comparison chart used to Prioritize Objectives



Pairwise Comparsion

item #1: Provide accesible wayfinding for users of all abilities

item #2: Provide rest areas for users with mobility challenges

item #3: Withstand seasonal weather

item #4: Preserve the tranquillity* of the forest environment (*the calm nature of the BOS environment)

item #5: Incorporate Indegenous Knowledge and values

item #6: Autonomy of mobility device user's mobility

	item #1	item #2	item #3	item #4	item #5	item #6	Score
item #1	—	1	1	1	1	0	4
item #2	0	—	1	0	1	0	2
item #3	0	0	—	0	1	0	1
item #4	0	1	1	—	1	0	3
item #5	0	0	0	0	—	0	0
item #6	1	1	1	1	1	—	5

Figure J.1. Shahad's pairwise-comparison chart from her Engineering Notebook

Appendix K. Explanations for the Justifications of Objectives

Appendix K.1: Objective 1 - The components of the score for the objective developed to measure how much autonomy the design provides for mobility device users' mobility through park route.

Each component has a value of 1 point if achieved in design, adding to a maximum score of 3 points, which is the objective goal for the design.

Component of Autonomy of mobility device users' mobility score	Metric	Objective Goal	Justification
1. Ability to turn freely	Width of surface in design to allow for a wheelchair user to perform an 180° turn	≥2100 mm [46]	The objective goal aims to promote the ease of mobility of users with mobility devices.
2. Movement not impeded by gaps in surface	Size of openings in surface	≤13 mm [47]	The objective goal aims to provide seamless travel by users with mobility devices so as to not experience any drop of their devices' wheels in any surface gaps.
3. Lighting for safety and visibility (only applicable if solution is path/path-adjacent. If solution is not either, then the score for this objective component becomes a 1)	Brightness/Area by installed lights	1 Lumen / m^2 [48]	The guideline for illuminated pathways is provided to be ~1 lux (which is = 1 Lumen / m^2).

Objective #2 Provide accessible wayfinding for people of all abilities

The client emphasizes equitable access for users of all abilities, noting that groups such as seniors with mobility challenges, persons with mobility and/or sensory impairments, and families with strollers and wagons struggle to navigate High Park. Since sensory impairments include vision, hearing, or touch impairments, wayfinding should not rely on a single sense. Providing a combination of visual, auditory, and tactile methods (e.g. clear signage, braille and raised elements, and audible cues) ensures all users can navigate safely and independently.

This approach aligns with the City of Toronto's TO360 Wayfinding Project [49], which prioritizes inclusivity and communicates wayfinding information through multiple touchpoints, such as physical signage (visual), handheld maps (tactile), and digital/interactive media (auditory/multi-sensory). By adopting these methods of communication, the design ensures accessible, equitable navigation along route 1 of High Park.

Objective #3 Preserve the tranquility* of the forest environment (*the calm natural environment of the BOS)

The client notes that the design should allow users to travel the route without compromising the tranquility of the forest environment. The 2025 Budget Notes for Parks, Forestry and Recreation [50] mention that city parks provide significant physical, mental health, environmental and social benefits to residents.

A scientific study examined the effects of natural sounds at different sound levels on recovery from noise-induced stress [51]. Participants were first exposed to a stress-inducing traffic noise (80 dBA), followed by a controlled environment with natural sounds (bird chirps and flowing water) at 40, 50, and 60 dBA to evaluate their effects on stress relief. The study found that 50 dBA natural sound produced strong restorative effects for most participants, while 40 dBA was restorative for only some participants, and 60 dBA increased stress.

Given that High Park is located within a busy urban area, this study provides a reasonable benchmark for setting target noise levels in the design to preserve tranquillity for users.

Objective #4 Provide rest areas for users (especially for those with mobility limitations: wheelchairs, canes, walkers, strollers)

To support users with mobility limitations, such as canes, walkers, and strollers, accessible rest areas can be provided along the design. The 2023 AODA Built Environment Standards Developmental Committee Recommendations Report recommends that rest areas should be provided every 30 metres, unless not feasible [52]

Objective #5 Withstand all weather conditions (durability)

The design will remain in place permanently, including during winter months to meet user demand [53] even when maintenance is absent [site visit notes where they said they don't maintain during winter], so the design should be durable in all seasonal weather conditions to ensure it is safe and preserve structural integrity. Toronto has a semi-continental climate, with hot, humid summers and cold winters [54].The Masonry council of Ontario states that summer temperatures can reach 40 ℃ , while winter temperatures can reach -30℃ [55].

Canadian infrastructure should withstand both seasonal weathering and everyday weathering processes, which can deteriorate materials and reduce their lifespan [56]. It also notes how future climate variability due to climate change will increase the risk of damage to building materials and outdoor structures, emphasizing the need for durable, resilient materials.

Therefore, it is reasonable to deduce that a design goal should be that all materials be durable and resilient under these conditions to ensure the structure's long lifespan and safety: 100% of the materials should be durable in a semi-continental climate.

List of some durable materials:

1. Masonry materials (concrete, stone, brick)
   They have the capability of absorbing heat and releasing it over time. Harsh cold and hot climates can stress most building materials, decreasing their integrity through rapid expansion and contraction [56].
2. Preservative-treated wood
   This is highly durable for Canadian climates, because its chemical treatment protects against moisture, decay, fungi, insects, and weather-induced stresses, allowing it to maintain structural integrity in both hot summers and cold, wet winters. [57] [58]
3. Metals
   - Weathering Steel has been widely used in Canadian infrastructure due to its corrosion resistance and durability in outdoor climates. However, note that maintenance (drainage) is important since constant wetness or salt reduces its corrosion-resistant abilities. [59]
   - Aluminium is corrosion-resistant and long-lasting since it naturally generates a protective oxide coating. Different types of surface treatment can further improve corrosion resistance. [60]
   - Galvanized steel offers proven durability and corrosion-resistance for outdoors structures in extreme conditions. [61]
   - Stainless steel is proven to be durable and resist corrosion across a wide range of temperatures and conditions [62]

Objective #6 Incorporate Indigenous Knowledge and Values

It is important to integrate Indigenous knowledge and values into the design as outlined in the City of Toronto's Reconciliation Action Plan 2022-2032 [63], which includes actions to enhance Indigenous civic engagement, support Indigenous place-keeping, and celebrate Indigenous arts and culture. Another City document on reconciliation values and principles [64] mentions the Seven Grandfather teachings (Wisdom, Love, Respect, Bravery, Honesty, Humility, and Truth), a fundamental set of values in Indigenous Culture.

Together, these documents support the idea of incorporating interpretive elements (art installations by Indigenous Artists, fact boards, storyboards, interactive kiosks, observation decks with binoculars, storytelling posts, plaques, etc.) along the route. To determine an exact number of these installations for an objective goal, the Downtown Parks and Public Realm Plan [65] explains that observing where people move and stay in a delineated space can help identify where elements like seating should be located. Since our site is delineated, and people naturally gather around interpretive elements, we can reason that seating should be placed near them.

Therefore, we can draw from the metric and objective goal of another objective, the 30 m interval between rest areas, to determine a reasonable objective goal for installations. Along the 560 m (Appendix I) route:

$$\frac{560}{30} \cong 19$$

We can infer that there will be 19 rest areas, so the design should include up to 19 interpretive elements reflecting the Seven Grandfather Teachings.

Appendix L: Calculation of Path Length within the Scope Using Google Maps Measurements

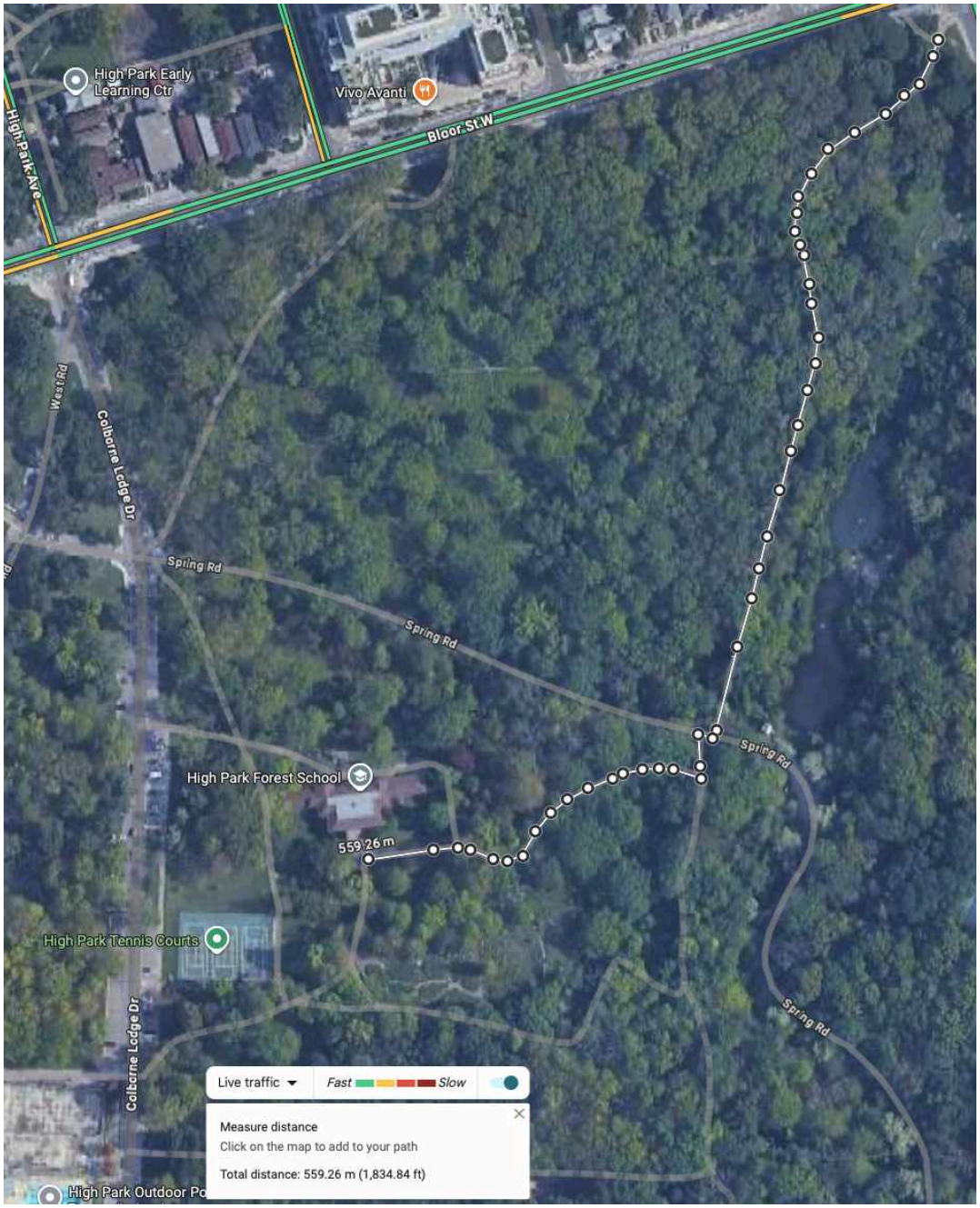


Figure L.1. Distance of length of route 1[66]

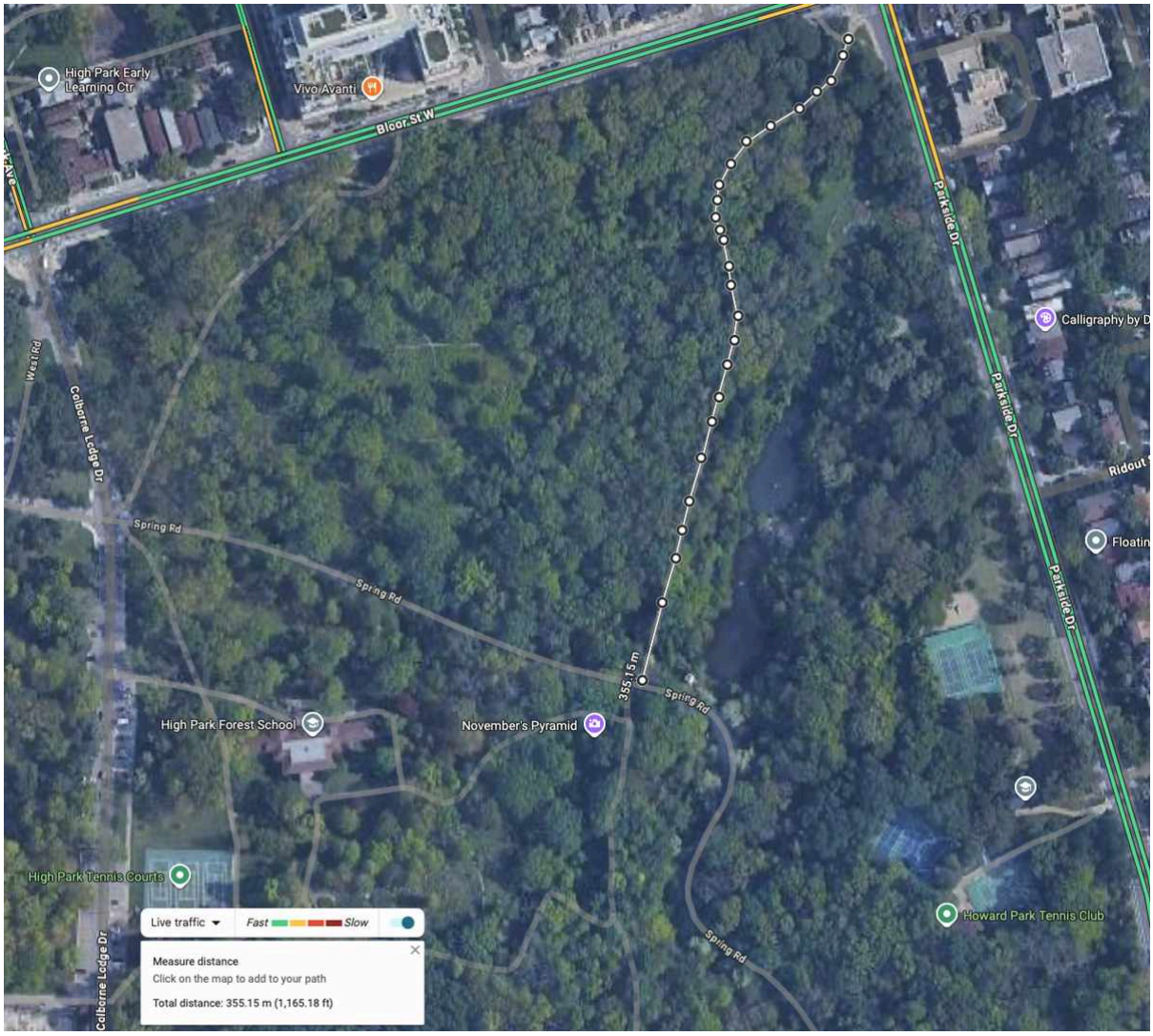


Figure L.2. Distance of length of route 1 up to Spring Road [67]

Figure L.3. Distance between HPNC and Spring Road [68]

Appendix M: Further Details about Constraint C.1 And C.2

Table K.1. A breakdown of the metrics found for certain constraints (C.1,2).

	Constraint	**Metric**	**Limit**	**Justification**	**Explanation of Metric**
C.1	The solution must operate irrespective of prescribed burnings in High Park and shouldn't significantly increase the Burn Complexity Analysis score.	The design doesn't exceed a score of 2 for the "threats to boundaries" component in the Burn Complexity Analysis [25].	Score ≥2	High Park's interest holders represent the historical and environmental significance of prescribed burnings [26]. Hence, the solution coexists with prescribed burnings (Figure 5).	This can be measured prior to and after the implementation of the design. The assessment for threats to boundaries encompasses criteria including the natural defensiveness of boundaries, the accessibility of the burn unit area to holding resources, the site preparation required, and the resource density of the area [25].
C.2	The design must not disturb biodiversity (mustn't impede BOS's restoration).	ΔSpecies Richness (change in number of visible species, i.e. those in Table 4., in a given area) [27]	ΔSpecies Richness = 0	The client's request for a design is in light of the restoration efforts of the BOS [2]; therefore, no destruction of it is a given.	Species Richness is the number of species in a region [15]. This metric can be measured prior to and following implementation by inspecting many small regions of the scope and conducting a record of visible species to measure the impact on biodiversity. If numerous small regions are accounted for, overall, we can see if ΔSpecies Richness = 0.

Appendix N: Example of a Natural Obstruction

Appendix O: A Past High Park Burn Map

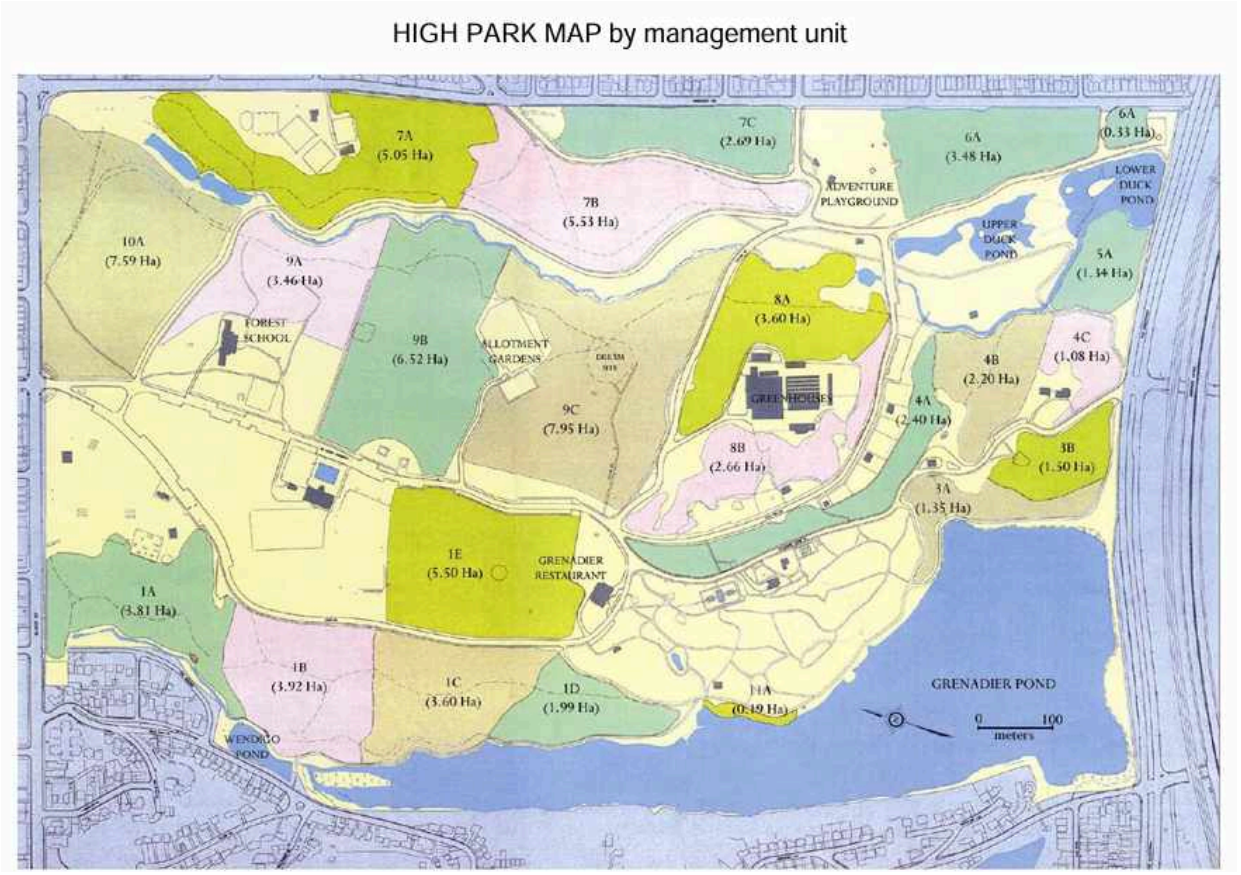


Figure M. Past High Park Burn Map, outlining different sections for the prescribed burns [69]

Appendix P: General Overview of Idea Generation Process Using Different Techniques

This part of the appendix will explain the various techniques used to generate ideas and means.

Appendix P.1: Structured Brainstorming

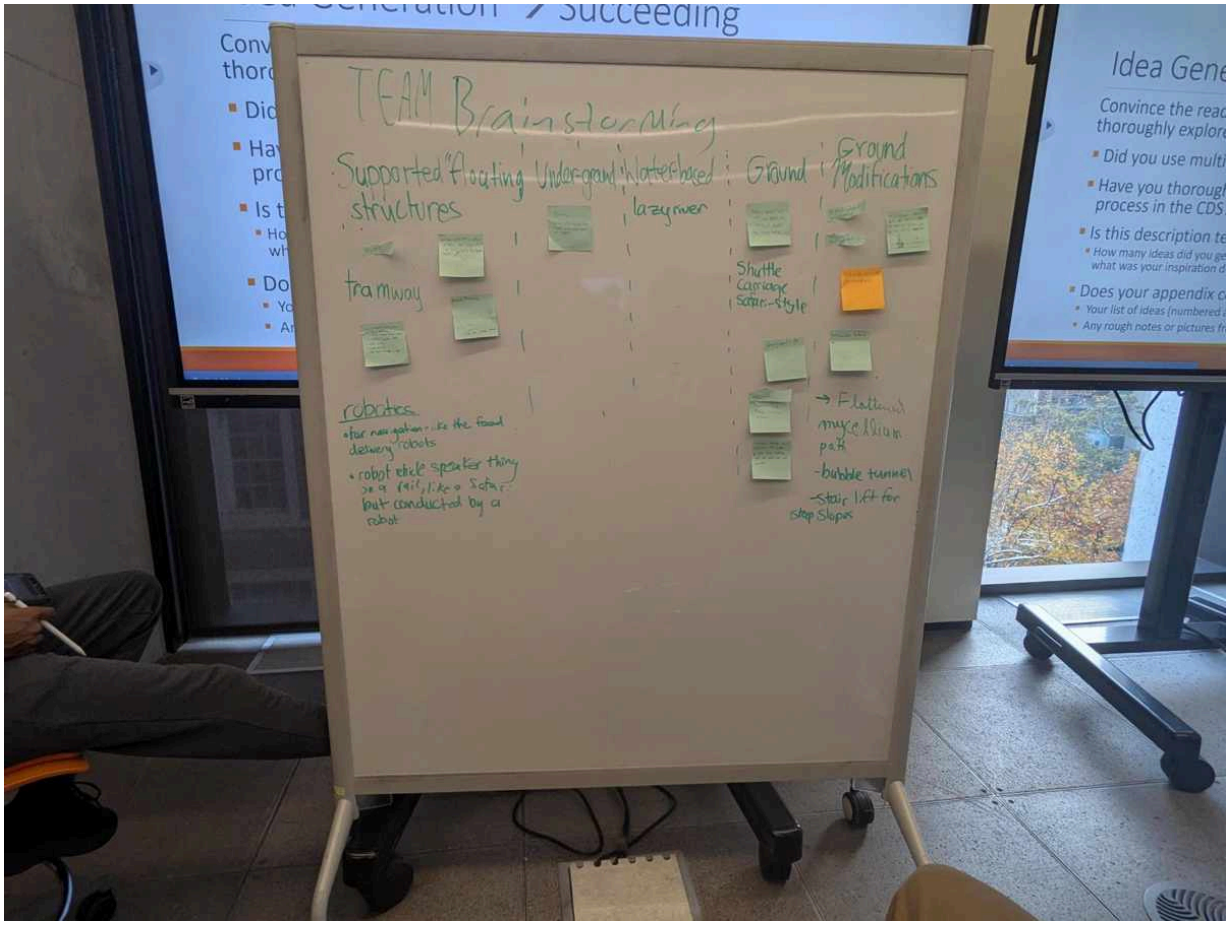


Figure P.1.1. Structured Brainstorming Session where Each Member Had 20 Minutes to Come Up With As Many Solutions As Possible, Which Were Then Organized Into Themes

Appendix P.2: Categorized Brainstorming Using a Jamboard [70]

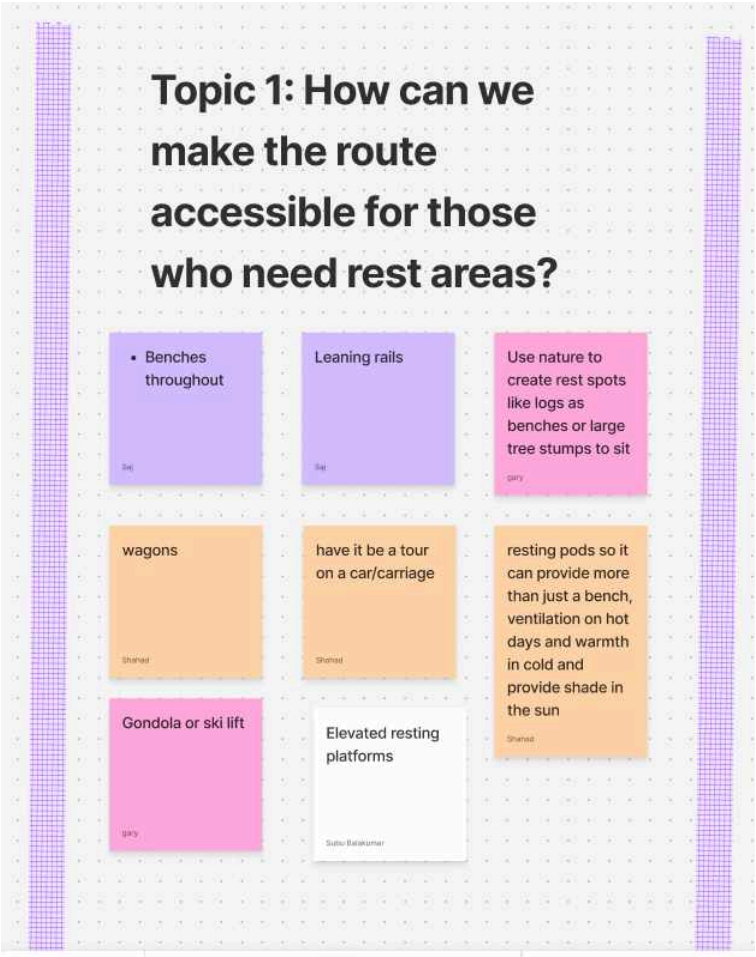


Figure P.2.1. Jamboard of Means Generated From Structured Brainstorming

Figure P.2.2. Jamboard of Mechanical Means Generated

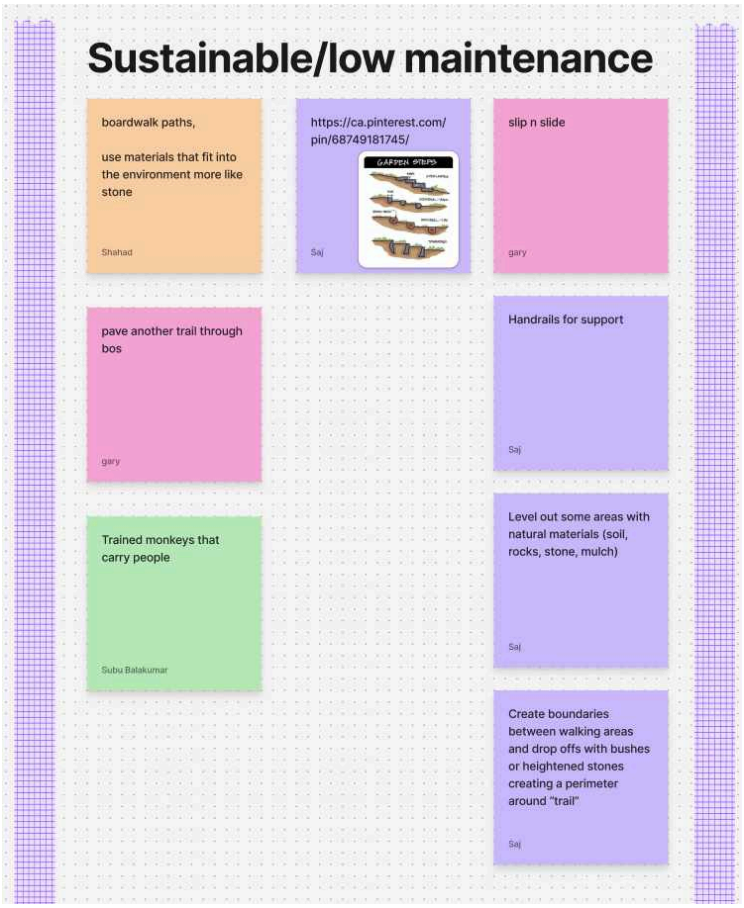


Figure P.2.3. Jamboard of Sustainable/Low Maintenance Means Generated

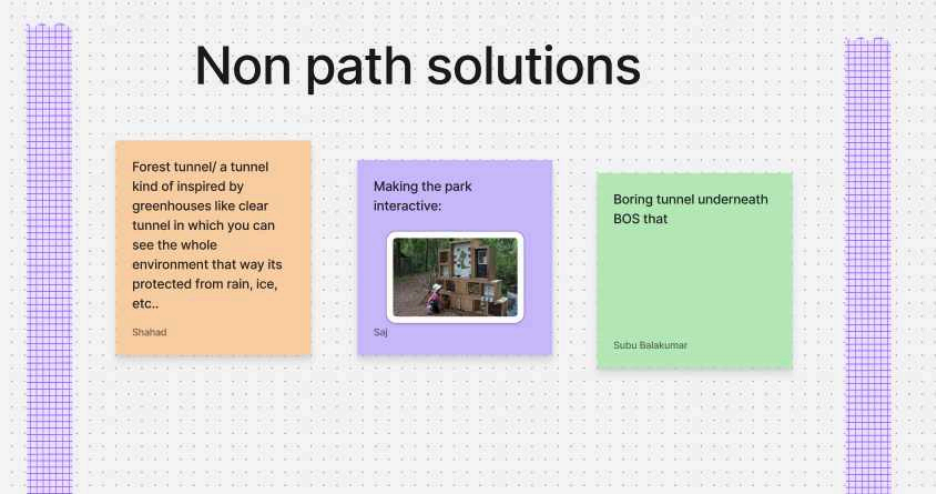


Figure P.2.4. Jamboard of Non Path Means Generated

Figure P.2.5. Jamboard of Means for Navigation Generated

Figure P.2.6. Jamboard of Material Means Generated

Appendix P.3: Each Members Morph Charts

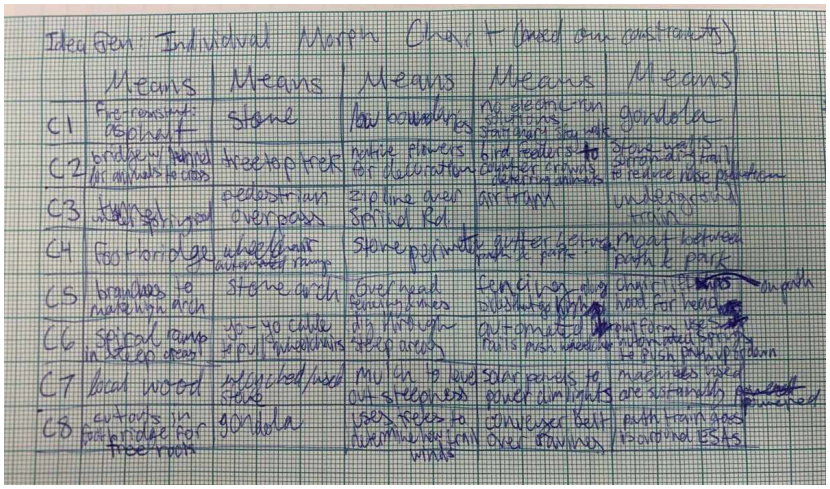


Figure P.3.1. Sajenie's morphological chart based on constraints

FOCS	Means	Means	Means	Means	Means
Indicate route progress to users throughout the route (Secondary Function)	Map (Virtual/Physical)	VR Headset that uses geotrackers to identify where you are gives a percentage of path completed	Signs	Wristband interface that connects to gps signal transmitter across the park that showcases how far you are.	Symbol landmarks
Be usable year-round	Interchangeable/modular/tank tracks.	Air Transport (Gondola)	Heated car that takes traveller on the path	A snow plow	Salt/ natural salt (snow melter)
Allow park users in wheelchairs or mobility vehicles to move throughout the park.	Vehicle Clasping attachment system	Escalator	Descending slide	Boring tunnel (go underground)	Robotic apparatus
Provide rest areas for users	Benches	Elevated stationary platforms that connect via a ramp	A guided automated tour that incorporates break stops	Bridge overpasses to let other users go under	Tunnel break station to let other users pass above.

Figure P.3.2. Subu's morphological chart based on secondary functions

Morphological Chart based on the objectives

	Means	Means	Means	Means	Means
Be easy to navigate	Visual signage	auditory cues	Tactile cues	ground markings	digital navigation
Be usable year-round	surfacing (anti-slip, composite of gravel that drains well, light colours to be heat absorbed)	Drainage systems (pipes) & backup)	Shaded areas (for hot/warm weather, sunny days)	(cooling/warming 'stations'/'shelters' (fireplace, tables, water refills, UV protecting glass, provide shade, solar panels for energy in summer/heating stoves, heating lamps)	Wind breaking structures
Incorporate Indigenous Knowledge and Values	Art installations (from Indigenous Artists)	Story telling/story plaques	QR codes to online education: native stories, knowledge on history, teachings	panels/signage	posts/sculptures (can be interactive)
Preserve the tranquility of the forest environment	Quiet materials (rubber, mulch, gravel, ...)	natural materials that absorb sound	minimize vehicle access	natural sound makers in chosen areas (wind chimes)	designated "quiet" area installments
Preserve the natural aesthetics of the forest environment	use natural materials: wood, stone,	maintain the tree canopy	use a natural colour pallate in design	minimize built structures	hide/camoflauge utilities to maximize natural experience
Provide rest areas for users	benches (backrest, arm rest)	natural seating (logs, boulders,	hammocks (relaxing vibe)	Canopies/ dayBed	picnic tables

Figure P.3.3. Shahad's morphological chart based on objectives

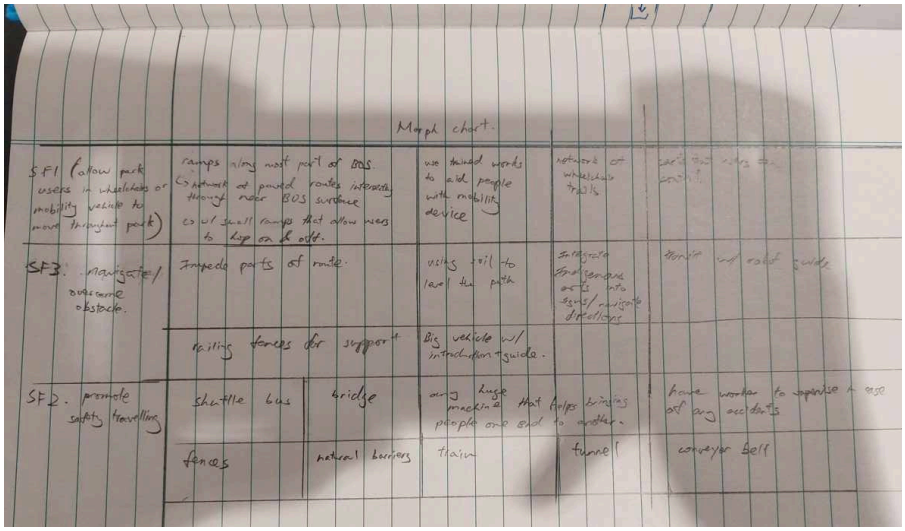


Figure P.3.4. Jarvis' morphological chart based on secondary functions

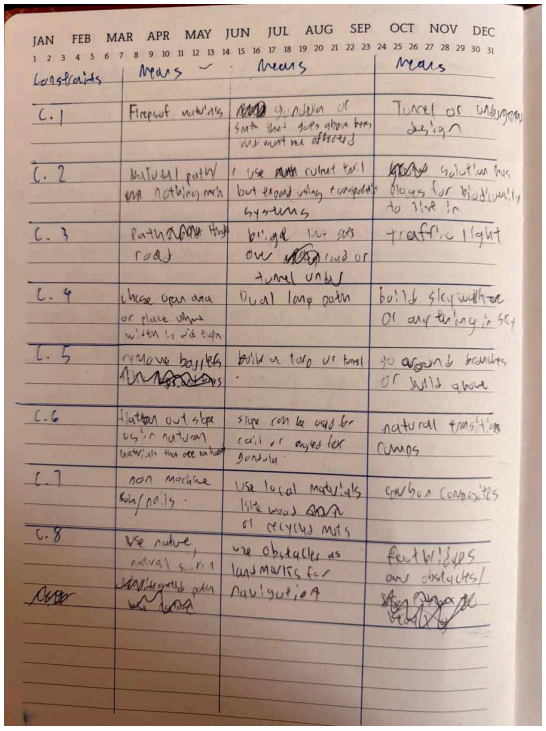


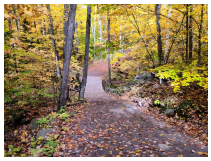
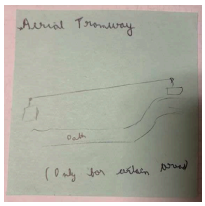
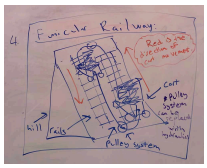
Figure P.3.5. Gary's morphological chart based on objectives

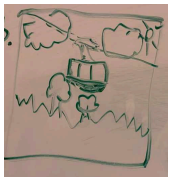
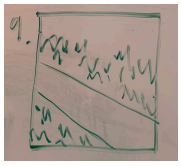
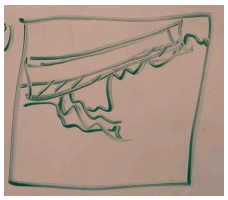
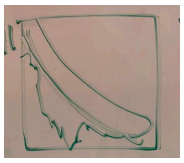
Appendix P.4: First Draft of all Ideas

Table P.4.1. Legend For Full List of Ideas and Means

Idea Generation Technique	Highlight colour	Number of ideas/means
Structured brainstorming (via Whiteboard & Sticky notes)		28
Morph Charts		123
Categorized Brainstorming (via Jamboard)		70
Unstructured Brainstorming		3
Analogy		12
SCAMPER		35
Benchmark		8

Table P.4.2. Consolidated List of Ideas Using Generation Techniques in Table A

Column #1			Column #2	
#	Solution	Photo or Sketch	#	Solution
1	Hanging board bridge		141	Shuttles from A to B
2	Aerial tramway		142	Non slip/grippy mats in winter
3	Train/Go Cart		143	QR codes about location/educate
4	Funicular railway		144	Natural landmarks or build new ones
5	An elevated/floating trail		145	Virtual apps track location of people in park

6	Ramp escalator		146	Trails have patterns that signifies where they are
7	Tunnel (with sections of pathway clear so tunnel can look above)		147	Railings for boundaries + rest
8	A really big gondola		148	Designated break zones
9	Path		149	Natural canopies for shade/prevent rain
10	Bridge		150	Underground tunnels/subway for transport
11	Slide		151	Fireproof materials
12	Tree top bridges		152	Gondola or lift that goes above trees to avoid fire
13	A swing transport (envision swinging from a monkey bar to another)		153	Natural path forged by hand

14	Horse chariots		154	Expand current trail and add a transport method
15	Portal		155	Animals can live in creation or wtv sln
16	Trained workers		156	Make a road/path through roads
17	Litter chariot		157	Make a flat tunnel connect over road
18	Flattened mycelium path		158	Traffic lights
19	Trained monkeys		159	Follow widest regions to build wide path
20	Rental mobility device station		160	Dual lane path that can be used as a wide single
21	Bridge through forest		161	Flatten out slope naturally by eroding land
22	Conveyor belt - styled uphill lift		162	Build a rail on the slope
23	Rail system where park has a vehicle that can go on trails		163	Natural transition ramps
24	Trail with rail slots for wheelchairs		164	Use localized materials found in park to do wtv
25	Boardwalk		165	Use carbon composites designs to minimize waste
26	Airport-styled escalators		166	Footbridges over obstacles
27	Ski lifts		167	Use obstacles as landmarks for navigation
28	Senior Stair chair lift styled mechanism		168	Copy pearson airport design where they have like a shuttle and

				there are flat escalators on the ground to get people who have heavy luggage around terminals
29	Benches throughout		169	Amusement parks where they have like a kid train that goes through the important parts of the park and doesnt really inhibit anything
30	Leaning rails		170	Make a canopy village where its flat and people can walk around and chill and have like elevators that bring people up and stairs for able bodied people idk
31	Rest spots using logs or tree stumps		171	Combine rest areas with signs and make it informative with regards to indigenous cultures or ecologically
32	Wagons		172	Eliminate signs which can act as barriers and implement qr codes and satellite imagery instead
33	Have it be a tour on a car/carriage		173	Substitute handrails and fences with logs and vines which people can rest on but also widens path and allows for navigation
34	Resting pods so it can provide more than just a bench, ventilation on hot days and warmth in cold and provide shade in the sun		174	Merge benches with animals and transportation to get like a horse carriage or donkey pulling cart
35	Gondola or ski lift		175	Borrow golf carts in the summer and get tour guides to drive people around in them
36	Streetcar styled cables to pull wheelchairs		176	Use like a snow tubing ramp on steep hills
37	Nature roller coaster slides		177	Adapt wristbands to gps and educational stuff so people can look at them while resting or just while theyre walking through trail
38	Shuttle along a		178	Modify the existing path by

	designed path			widening and flattening using dirt to keep it natural
39	Electrified rail carts		179	Magnify sign visibility and landmark visibility by making indigenous designs (my idea is to have a tree thats like permanently on fire to show burnings or something since its like symbolic)
40	Helicopters		180	Add solar powered lights at night that detect movement so they can save energy during daytime
41	Wheelchair rails		181	Add texture to hills or ground to prevent tripping and help with hiking
42	Slow moving bench? On a rail kind of like a shuttle but open		182	Use logs as dividers when paths split
43	The carts/shuttle you can bike to power with spots that don't need to pedal		183	Use dead trees as resting areas since everythings dead anyway nothing to see there
44	Yo-yo or blinds inspired cables that will retract that people can hold on to that will pull them up		184	Remove trail and add water so people can swim idk maybe any other design
45	Hybrid solution of boardwalk and shuttlesystem. The shuttle could carry wheelchairusers for a certain distance where the elevation is not ideal for manual wheelchairs.		185	Rearrange fencing so that people go to a wider path and non fenced path can be a do at ur own off trail risk typa thing
46	Using a spring system to help level platforms		186	Swap fences for led lights so people can see at night and its cool
47	Scissor lifts for wheelchair users		187	Combine trees and lights to make landmarks like cool lights on trees

48	Something robotic. Maybe a autonomous cart which acts like a guide and can also carry multiple passengers. It will follow the path we program. And we can make it so it can be charged using solar power		188	Expand overlapping paths to make 1 path
49	Around 12 walkers available to rent and they will have electric wheels to help it roll forward.		189	Rearrange rest spots to be higher up so people can rest before they go all the way
50	We can attach underground cable system and have a cart that is pulled by it.		190	Modify slope into stairs or escalator or stepping ramp
51	Skating path in winter		191	Use like one of those elevators that doesn't use electricity and is purely mechanical that you have to time to walk into properly since it never stops idk
52	Handcycle and tricycle friendly path and then we can again have a renting station along the Bloor West entrance.		192	Fallen trees can be landmarks or tribute to BOS or something
53	For some highly sensitive areas maybe we can have a path that is rollable. For example Mobi-Mat is a company that sells something like that. This can be used to protect soft and sensitive areas for BOS and we can just		193	Integrate heaters into trees so it stays warm and gives off cozy vibes

	put the portable path to make the surface firm.			
54	Use cut down tree branches or logs to be perimeters for a path		194	Make a canal and add water to get lazy river vibes in summer and you can skate on it in the winter
55	Zipline		195	Modify slope into like a stepping ramp/threshold ramp wtv its called
56	Interlocking tiles that can be remove and added based on requirement on a section of the path.		196	Modify animal into a robotic transport machine that is powered by the biodegradables of the dead animals
57	Elevated train		197	Add a go cart system on the hill so its fun
58	Wheelchair guidance rails. I think could be put on the side along the whole path from keele station to HPNC.		198	Natural fencing barried (i.e. using hawthorn or blackthorn)
59	A elevated, horizontal spinning (slowly) wheel that its diameter is from keele station to HPNC and the thing spins roams above BOS		199	Switchback path (winds around sort of like a river)
60	a ski lift, kind of like the sky ride at the cne		200	Rentable hiking sticks
61	Switchback Ramps		201	Elevators
62	Gyro monorail		202	Automated off-road wheelchair
63	boardwalk paths, use materials that fit into the environment more like stone		203	Mobile GPS/High Park Map

64	Garden step designs		204	Audio guides
65	Slip n slide		205	Interactive audio kiosks
66	Pave another trail through BOS		206	Accessibility service personnel
67	Handrails for support		207	Boardwalk with constant spots to get off (Benchmark (BM) Highline from NYC)
68	Level out some areas with natural materials (soil, rocks, stone, mulch)		208	Adjustable inclined platform (BM construction)
69	Create boundaries between walking areas and drop offs with bushes or heightened stones creating a perimeter around “trail”		209	- Individual vehicles (autonomous) with GPS system that prevents them from going out of the area
70	Navigation signs at intervals		210	BM: Self-driving technology (Tesla/Waymo) - Robotaxi allow users to have autonomy over BOS but prevents dangers
71	Online map		211	Vehicles that can easily transport through terrains of various dampness, slope Benchmark: ARGO 8x8 XTD
72	Maps on the ground		212	s**C**amper combination of ideas 209, 210, 211
73	‘checkpoints’ like colourful structures that honour indigenous practices/culture		213	The use of Indigenous art (ie colour patterns, integrate Indigenous languages + translation in signs, Indigenous motifs) in signs to aid with navigation while promoting Indigenous culture (BM: Rouge national urban park)
74	Guide rail		214	Integrate tactile paths using soft landscaping materials to aid with navigation and accessibility for people of vision impairment

				(analogy?) (BM: tactile pavement at crosswalks)
75	Augmented reality glasses/phone screen to navigate directions & introduce BOS?		215	1. A wood constructed platform that supports a way of transport on railings above. Design can use existing trees for support (BM Hong Kong bamboo scaffolding) 2. (BM All wood roller coaster from Wonderland)
76	cool landmarks		216	Combining 3. Web of paths/ treetop bridges (e.g 12,101) 4. Conveyor belt type of ramps (22) 5. Switchback ramps
77	guide robot or dog or animal		217	Visual Signage (wayfinding)
78	Automated interactive kiosks		218	Auditory Cues (Wayfinding)
79	Locally sourced stone		219	Tactile Cues (Wayfinding)
80	Turn pulled weeds and yard waste into mulch to level out steep areas		220	Ground Markings (Wayfinding)
81	Hard pack soil (on top of a leveled path)		221	Digital navigation
82	wood from dead trees		222	Surfacing (anti-slip, composite materials ex. Gravel that drains well, light colours to reduce heat absorption, pervious materials to prevent water buildup)
83	Rubberize ground to make smooth		223	Drainage systems (prevent ice buildup, water build-up)
84	Using Resin-Bound Aggregate. This is a permeable material.More Description:https://dr		224	Shaded areas (for hot/warm weather, sunny days, rainy weather)

	eampave.ca/the-benefits-of-resin-bound-aggregate-surfaces/			
85	Log Corduroy Path.https://boreal.ducks.ca/reinventing-corduroy-roads/		225	cooling/warming stations/shelter (pergolas trellis, water refills, UV protective glass, provide shade, solar panels for energy in summer/sunny days, heating lamps)
86	Cobble/Stone Paver Pathhttps://www.truegridpaver.com/cobblestone-driveway-pavers/?srsltid=AfmBOorTQasr26zpPV7Fy9JwMPPMYFVp-W2aHc-eRTA23ryVnk3NEjfr		226	Wind breaking structures
87	Forest tunnel/ a tunnel kind of inspired by greenhouses like clear tunnel in which you can see the whole environment that way its protected from rain, ice, etc..		227	Heated path
88	Making the park interactive (with wooden interactive materials, objects, and info-posters		228	Art Installations (by Indigenous Artists)
89	Guided Bus		229	Story telling/story plaques
90	eVTOL (Electric Vertical Take-Off and Landing) - Air Taxi		230	QR codes to online education (native stories, knowledge on history, teachings)
91	Autonomous Electric Ferry for some portion of the path		231	panels/signage for education
92	Driverless Electric Pods (Autonomous Shuttles)		232	posts/sculptures (interactive)

93	Skytrain (Elevated Railway track)		233	Quiet materials (rubber, mulch, gravel…)
94	Biofuel (B100) Vehicle		234	Natural materials that absorb sound (cork, jute, coconut and coir, date palm, sugarcane bagasse, kapok)
95	Tree Canopy Walkway/Bridge		235	Minimise vehicle access
96	Asphalt (for fire-resistance)		236	Natural sound makers in chosen areas for calmness/tranquillity (wind chimes)
97	Stone		237	Designated “quiet” area installments
98	Low boundaries of solution		238	Use natural materials (wood, stone, etc.)
99	Gondola		239	Maintain the tree canopy
100	Bridge w/ tunnel for animals to cross		240	Use a natural colour palette in design
101	Treetop trek		241	Minimize built structures
102	Native flowers for decoration		242	hide/camouflage utilities to maximize natural experience
103	Bird feeders to counter crowds deterring animals		243	Benches (backrests, armrest)
104	Stone walls surrounding trail (if trail) to reduce noise pollution and disruption to biodiversity		244	Natural seating (logs, boulders)
105	Tunnel under spring road		245	Hammocks (relaxing)
106	Pedestrian overpass (over spring road)		246	canopies/daybed
107	Zipline over spring road		248	Picnic tables

108	Air tram		249	Parachute
109	Underground train		250	Interconnected natural structure in the trees, but also multi level so
110	Footbridge		251	Paragliding
111	Wheelchair automated ramp		252	Sky ride like the CNE
112	Stone perimeter		253	Slides elevated in the air interconnected within the trees
113	Gutter between path and park		254	Canals with boats like in venice
114	Moat between path and park		255	Teleportation portals for all of the key spots in the trail
115	Branches to make high arch		256	Compass
116	Stone arch		257	Underground boring tunnel
117	Overhead fencing & vines		258	Interchangeable modular tank tracks
118	Chairlift on path that has hood above head		259	VR Headset that uses geotrackers to identify where you are gives a percentage of path completed
119	Spiral ramp in steep areas		260	Air Transport (Gondola)
120	Dig through steep areas		261	Signs
121	Automated rails push wheelchair		262	Wristband interface that connects to gps signal transmitter across the park that showcases how far you are.
122	Platform uses automated springs to push pedestrians up or down		263	Heated car that takes traveller on the path
123	Locally sourced wood		264	A snow plow
124	Recycled stone		265	Salt/ natural salt (snow melter)

125	Mulch to level out steepness		266	Vehicle Clasping attachment system
126	Solar panels to power dim lights for visibility		267	Escalator
127	Machines used to construct solution are powered sustainably		268	Descending slide
128	Cutouts in footbridge for tree roots		269	Robotic apparatus
129	Conveyor belt over ravines		270	Elevated stationary platforms that connect via a ramp
130	Path train winds around trees and ESAs		271	A guided automated tour that incorporates break stops
131	Tour cart that can go on rough terrain		272	Bridge overpasses to let other users go under
132	Rent out mobility devices suited for park		273	Tunnel break station to let other users pass above.
133	Lights that guide route		274	A tunnel system (that has transparent tops to view the BOS) that mimics a digestive system with rain filters, grates and exterior lids to help with seasonal changes
134	Robot navigation		275	SCAMPER idea: Underground tunnel that incorporates a lazy river.
135	Night security		276	Reinforced steel path
136	Text helpline		277	Mycelium path
137	Animal transports		278	Pulley elevator
138	Make a canal and use a boat		279	Hydraulic pump elevator (like minecraft)
139	Removable path panels		280	Jet pack

140	Heated sections for rest or melting snow on path		281	Magnetic bridge

Appendix P.5: Consolidated Full Solutions List

Table P.5.1. Consolidated 77 Full Solutions Categorized into Themes

#	**Description**
Theme:	**Path Related**
1.	Reinforced steel path mixed with Mycelium in highly sensitive areas with resting benches in every x meters.
2.	A path with anti-slip and gravel that drains water properly and prevents any ice buildup. It would also include shaded areas (for hot/warm weather, sunny days, rainy weather). The path will be made using Resin-Bound Aggregate. This is a permeable material. (more description:https://dreampave.ca/the-benefits-of-resin-bound-aggregate-surfaces/)
3.	A path equipped with solar panels to power dim lights for visibility. Furthermore, it will have features like pergolas trellis, water refills stations, sheds to get some shade during summer.
4.	A Cobble Paver Path that will follow all the AODA slope guidelines and will be leveled using natural materials such as mulch.
5.	A mix of two types of paths. Only will be for some highly sensitive areas within the current scope and for those we can have a path that is rollable. For example Mobi-Mat is a company that sells something like that. This can be used to protect soft and sensitive areas for BOS and we can just put the portable path to make the surface firm. For other parts we will have a reinforced steel path mixed with Mycelium.
6.	A path with information signs about indigenous history. It will also have indigenous art displayed. The slope of the path will be leveled to abide by the AODA guidelines.
7.	A path equipped with boundary railings and has heated sections for resting or melting snow on the path. The slope of the path will be leveled to abide by the AODA guidelines. It will have around 12 walkers available to rent and they will have electric wheels to help it roll forward.
8.	A wide enough path that on one side you have wheelchair guidance rails. The path will be made of asphalt.
9.	For most part it will be a path that has been leveled to abide by the AODA guidelines. In some highlighted sensitive areas there will be a boardwalk. Overall, it is a handcycle and tricycle friendly path and then we will have a renting station along the Bloor West entrance. Furthermore, high power electric mobility wheelchairs will also be available.
10.	Make a wide spiral path around hills or slopey areas, making sure it is slip resistant
Theme:	Underground

1.	Carve out tunnel or dig straight through steep hills while to create a path that meets AODA requirements. Tarp can cover the top during winter seasons and provide shelter from snow. In summer seasons it can be a shady rest spot.
2.	Dig a tunnel directly from the entrance to HPNC and cover the top with a glass dome so users can still see the outside nature.
3.	Underground tunnel system with lifts every few hundred meters that go up to rest points or nature points above. Have emergency ramp exits and employees in case of emergency
4.	Fast underground lift or railcart system that quickly transports a number of people from stations to other stations while being extremely efficient.
5.	Carve out a canal that can be filled with infinitely flowing water that becomes a lazy river during summer and can also become an ice rink in the winter.
6.	Dig out a huge tunnel underneath the route and layer the floors with panels that detect movement of individuals. Give them VR headsets and nunchucks that control virtual robots who move along the given route so they can still experience walking through the route, but safely without worry of falling.
7.	Build a subway line kind of like a Kipling line subway where some of it is like in a tunnel kinda but users can still see outside but it's slow and windows are big.
8.	Have a revolving ramp right before big slopey areas that quickly goes down into a tunnel where they can take a lift to HPNC
9.	Carve out a snow tubing section but instead of snow tubes its like a slide that goes straight down. Also an escalator ramp that brings users up so they don’t have to walk.
10.	Build an underground ecosystem that has new BOS and fake natural sunlight so users think that they are in the actual route but terrain can be controlled.
Theme:	**Bridge and Boardwalk**
1.	A hanging board bridge that users can get onto through a ramp escalator
2.	A pulley elevator that lifts users to a platform connected to the main tree top bridge
3.	A hydraulic lifting system that connects to a lazy river that pushes people using water current and is coupled with a VR headset to indicate progress on the Route.
4.	A rocket powered jet pack lift that attaches to wheelchairs and mobility vehicles that connects to an elevated moving flat escalator (like the ones found in airports)
5.	Spiral ramp that connects to mycelium + stone bridge that has gaps for trees and then also is coupled with landmark symbols

6.	Tree top bridge that connects to a magnetic railway that is powered with solar panels.
7.	Floating polymer wetland boardwalk, coupled with leaning rails and different colored benches every 100m. The slope and width of the boardwalk has to follow AODA guidelines. It will be equipped with solar panels to power dim lights for visibility. Furthermore, it will have features like water refills stations, pick up paper maps and information panels that use natural colours placed throughout the path, indigenous landmarks, and borrowable audio guides that users can use to be directed.
8.	Permeable metal grated boardwalk that has log fencing to protect the nature, and uses indigenous landmarks to help users navigate.
9.	Dual-level boardwalk bridge (bottom for wheel chair, mobility vehilce users andtop for walking pedestrians) that uses pontoons for structural stability, and incorporates pull out bays for users for breaks.
10.	Footbridge with wildlife underpass, that incorporates meandering paths to go past steeper slopes.
11.	Elevated boardwalk with ramp exits, that is coupled with a VR Glasses to show progress and key points on the route.
12.	Boardwalk with patterned flooring for navigation.
13.	Canopy walkway with trained monkeys to car users across.
Aerial/'Floating' Solutions	
1.	Sky ride - a simple aerial gondola/sky ride system that transports users above the forest canopy. Quiet, electric gondola cars can glide along a cable path, stopping at elevated stations which double as look out points (The carts themselves stop/slow down for a period of time and users can take time to look). The gondola itself can have measures to ensure comfortability for users: heating/cooling methods, a small table in the middle in which a map and QR code for a digital tour and link to Indigenous art, stories, teachings, etc.. Each gondola can have a type of interactive system in which the users can press a button of their choice to hear a story, teaching, history on the BOS, etc..
2.	Zipline/parachute. - inspired by the locomotion of sugar gliders. A system of ziplining/paragliding which will go from platform-to-platform. The ziplines will have a small parachute integrated into the system. At each platform, users can get up and down by means of a ramp or power-lift system. The number of platforms will be decided by the amount of major areas designed. The system can be made accessible to users with mobility issues and devices. To get these users up to the platform, a ramp or power-lift system. For the actual zipline, specialized harnesses/seats can be deployed in which these users can use (e.g.). The platform will be larger than normal to accommodate. For wayfinding the base of each platform can have posts with signage/maps, QR codes for digital navigation.
3.	A system of elevated slides that are wide, slow, and accessible. Users can sit in cushioned carts (like a mini toboggan). Specialized carts made that have slots for wheelchairs can be deployed, or specialized sleds designed for wheelchair users and users with mobility issues/other mobility

	devices. For navigation, a QR code for digital navigation and the choice of an auditory tour on the users phone. The QR code can also lead to online education (teachings, storytelling,) The slide can be designed with Indigenous art made by Indigenous Artists.
4.	“Aerial” adventure park with treetop courses (such as the aerial adventure park at the Arapahoe Basin Ski Resort in Colorado). This can consist of other ideas: Brachiation, nets (crochet playground), platforms, ziplines, etc.. (SCAMPER of other ideas in here)
5.	Brachiation - inspired by the locomotion of primates. A system of monkey-bars between the tree tops. For safety there will be a harness on a sliding track to support users. Could incorporate this with the idea of the accessible ziplines to ensure an inclusive, accessible environment.
6.	An elevated “train”/shuttle/tramway that is placed on a rail. There are different “stations” you can get off at, like a subway system. Each station will be a floating pavilion in which there will be stairs or a ramp to get down to ground level. (If a ramp design, that is long enough to accommodate those with mobility devices and strollers, isn’t possible to design due to space, a raising/lowering system for users with mobility devices.) The vehicle can have maps on it (like the subway maps) on the park, with auditory __ (like a tour)
7.	Hammock system - a system of interconnected boardwalks elevated up near the tree branches. On the sides there will be a series of hammocks for rest and relaxation. On the sides there will also periodically be platforms with installations, posts, water refill stations, etc.. These platforms can resemble floating pavilions for a natural aesthetic.
8.	Elevated flat boardwalk that has platforms that are inspired by treehouses/huts around trees. Each of these huts will have things mentioned in other ideas, such as water refills, seating for rest, hammocks can be hung around the perimeter of the hut, (within the fenced boardwalk and have nets around the perimeter as well for safety), designs by Indigenous artists, each hut can be an allocated station for aft installations, water refill/recovery stations, storytelling, teachings, etc..
9.	Rotating system - like the 360 restaurant at the CN tower. A gondola/sky ride system with pods in which there are seats situated around a table in a circular formation and they rotate. The seats will have a mechanism with which they can latch off and on their place in the pod, and then wheel chairs can be latched onto the same mechanism. The inside of each pod can be designed to have art by Indigenous Peoples. Similarly to number 2 it can have maps/QR codes in the middle to maps, indigenous art, stories, teachings, etc. As well as the interactive system of buttons to hear a story, teaching, history, etc.
10.	Rollercoaster
11.	Floating puff balls - machines that look like clouds that have a mechanism where they’re “floating” and they rotate, and users can lay down on them, stand, sit, and have wheelchairs. At night they can mimic the faint light of the moon or something
12.	webs/nets made out of bamboo and leaves
13.	Suspended canal with boats, like the canals in venice
14.	Top gun themed roller coaster with airplane seats, have pilots fly users
15.	Suspended roller coaster with accessibility carriages that's low to the ground. Travels from keele

	station to HPNC and users can look outside the window and get the same experience as walking.
16.	Robotic dog/animal/cloud machine that can fly with a jet pack or drone mechanism and it can carry people. Latches for wheelchairs and has chairs. Carries people from Keele Station to the HPNC hovering above the ground while they can look out to the scenery and also there can be designated “parking” spots that the machine is programmed to know, and there can be some sort of
17.	“Floating cars/people” have everyone wear a jetpack that is programmed to fly a certain path and there can be “duo/multi” jet packs in which they can be attached for when a family or duo is going together. They can have glasses that have holograms(?) on it like iron man's suit and it can be a choice to see it or not. Can have holograms explaining indigenous art, stories, teachings, etc. can have auditory tours with it.
18.	Train monkeys to carry people with a harness attached and have them carry people via brachiation (make it ethical pls)
Theme:	**Mechanical**
1.	Airport-styled (or ski-hill escaators) escalators along where original high park paths are, that can be heated to melt snow. They can also have clear hoods over them to block precipitation. They can have an emergency stop button. Parts of the route can have a wooden rest area with benches. GPS Kiosks along the route.
2.	Rollable path (i.e. Mobi-Mat) in areas above the maximum slope for wheelchair users. Use trees to make an archway to cover the mat from precipitation and harsh weather. Stone perimeters surround a rollable path and signs to show locations and distances to other locations in the park. Low lights for visibility.
3.	Ski lifts in steep areas. Go around trees. Audible system providing wayfinding information and facts about the park’s history. Route has leaning rails and
4.	Trail with slots/rails for wheelchairs. Operates using a roller/conveyor belt system. Has handrails. Provides self–guided GPS audio guide devices for users. Rails are heated to melt snow, and have a gutter system on either side of the rail to allow water to escape.
5.	Switchback path that has rubberized ground. Wood from dead trees can be used to bound the switchback trails.
6.	Even out small cracks or pits with mulch. Rentable mobility vehicles & accessibility service helpers. Has leaning rails and flat wide steps on side for all users (including those with wheelchairs) to stop at the side. Maintenance is conducted by salting route, and by adding removable “patio covers” during heavy precipitation.
7.	Automated off-road wheelchair. The route has bright, easy to read wayfinding signs with visuals. Off roaded wheelchairs can brake and park safely.

8.	Ground markings and tactile paths. Usage of indigenous art for wayfinding signage. Windbreaker structures to provide rest areas. Vehicle clasping attachment system for mobility scooters, wheelchairs, and other aids. The route is made of anti-slip composite materials with good drainage.
9.	Camouflage utilities for retractable cable systems that can assist users by pulling them up steep areas. Ground is maintained year-round with consistent maintenance. Moat surrounding either side of the trail for drainage. Motion-detecting solar-powered lights at night. Landmarks and markings for wayfinding.
10.	Hydraulic pump elevator in steep areas. Natural colour palette is used in designs for interactive modules, ground markings, and landmarking structures. Picnic tables for rest areas. Other areas have smooth paved surfaces.
11.	Robot navigation: An accessibility service robot who guides users through the park and provides audio navigation. The robot can also latch onto and pull wheelchairs or mobility scooters, as well as carry people if needed.
12.	“Walking” Zipline- similar to an auto-belay when rock climbing. Hooks up to a cable above users and supports users as they traverse, allowing them to not fall if they stumble or lose their balance. Signage throughout the park for wayfinding.
13.	Treadmill on all paths activated by movement, helping to pull users along a path. The route also has landmarks everywhere for navigation. These landmarks use natural colours, but stand out fonts or designs to maintain the natural beauty of the park.
14.	Bouncy castle slides/structures along steep areas to allow for easier descent, but also supports users if they fall or stumble. These structures have important wayfinding information.
15.	A funicular railway that brings users onto a conveyor belt type elevated platform which also has off road sections every 200 meters for users to take a break if needed (for water, washroom etc.) , and a screen showing progress of the route. Has maps inside each funicular train car.
Vehicle-based full solutions	
1	A scheduled shuttle bus that provides stops at every stable area that is safe for people to roam around, so people can get on & off the vehicle. The shuttle doesn’t have to be trailed but must follow a specific route. Ramps and assistant workers will be present to assist people to get on & off.
2	A system of rails of carts that transports from Keele station to HPNC. The system should resemble existing gravity-powered mountain coasters. Each cart should be equipped with manual brakes that allow users to slow down when desired.
3	An electric-powered skytrain that transports directly from Keele station to HPNC.
4	A constructed waterway from entrance of High Park to HPNC, and docking stations will be present on both ends. Users can take canoes to transport through the waterway.

5	Hand/leg powered tri cycle. The solution will be accompanied by a constructed cycle friendly path made out of rock, paved thoroughly in the BOS. Renting stations will be available at Keele station and HPNC.
6	Air Taxi (eVTOL) that transport straight from Keele to HPNC with landing/take off areas.
7	A solar powered shuttle that navigates the BOS with tour guide present to introduce BOS to visitors.
8	Biofuel shuttle
9	An underground cabled power/trailed, slow moving vehicle with clear windows. The vehicle will go through underground and sometimes surface level of the soil that allow you to closely observe the nature of BOS. There can also be information panel boards in the underground tunnel that provide information while users pass through them
10	Small vehicles that are provided for individual users or small groups that users have autonomous control over. The design should utilize GPS system and self driving technology and therefore users can have autonomy while accidents and prevented. Vehicles should be limited to specific speed limit and users can have control over where the vehicle go by choosing on map. The vehicle must also be equipped with tank treads/ 4 wheel driving so it allows the vehicle to navigate through terrain of different dampness, slope and hardness.
11	Rent out wheelchairs and strollers that are built for the terrain

AI Ideation was used for the Bridge/Boardway themed solutions (Appendix A 2.3).

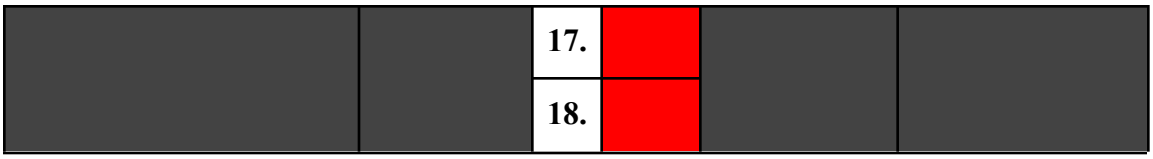
Appendix Q: General Overview of Idea Selection Process

This part of the appendix delves into the techniques used to narrow down the ideas generated.

Appendix Q.1: Feasibility Check

Table Q.1.1. Ideas That Passed or Failed Feasibility Check

Feasibility Check Y/N											
Theme: Path Related		Theme: Underground		Theme: Bridge and Boardwalk		Aerial/ Floating Solutions		Theme: Mechanical		Theme: Vehicle-based full solutions	
1.	Y	1.	N	1.	N	1.	Y	1.	Y	1.	Y
2.	Y	2.	N	2.	N	2.	N	2.	Y	2.	N
3.	Y	3.	N	3.	N	3.	Y	3.	Y	3.	Y
4.	Y	4.	N	4.	Y	4.	N	4.	Y	4.	N
5.	Y	5.	N	5.	Y	5.	N	5.	Y	5.	Y
6.	Y	6.	N	6.	N	6.	Y	6.	Y	6.	N
7.	Y	7.	N	7.	Y	7.	N	7.	Y	7.	Y
8.	Y	8.	Y	8.	Y	8.	Y	8.	Y	8.	N
9.	Y	9.	Y	9.	Y	9.	Y	9.	Y	9.	Y
10.	Y	10.	Y	10.	Y	10.	N	10.	N	10.	Y
				11.	Y	11.	Y	11.	Y	11.	Y
				12.	Y	12.	N	12.	Y		
				13.	N	13.	Y	13.	N		
						14.	N	14.	N		
						15.	Y	15.	Y		
						16.	Y				



Appendix Q.2: List of Ideas After the Feasibility Check

Table Q.2.1 List of numbered solutions after the feasibility check

#	**Feasible Solution**
1.	Reinforced steel path mixed with Mycelium in highly sensitive areas with resting benches in every x meters. The slope and width of the path will be leveled to abide by the AODA guidelines. The route has various signs with bold lettering and benches differentiated by colour to indicate route progress.
2.	A path with anti-slip and gravel that drains water properly and prevents any ice buildup. It would also include shaded areas (for hot/warm weather, sunny days, rainy weather). The path will be made using Resin-Bound Aggregate. This is a permeable material. (more description:https://dreampave.ca/the-benefits-of-resin-bound-aggregate-surfaces/)
3.	A path equipped with solar panels to power dim lights for visibility. Furthermore, it will have features like pergolas trellis, water refills stations, sheds to get some shade during summer. Information panels that use natural colours are placed throughout the path.
4.	A Cobble Paver Path that will follow all the AODA slope guidelines and will be leveled using natural materials such as mulch. Maps on wooden posts are found throughout the route.
5.	A mix of two types of paths. Only will be for some highly sensitive areas within the current scope and for those we can have a path that is rollable. For example Mobi-Mat is a company that sells something like that. This can be used to protect soft and sensitive areas for BOS and we can just put the portable path to make the surface firm. For other parts we will have a reinforced steel path mixed with Mycelium. Borrowable audio guides that users can use to be directed through the path.
6.	A path with information signs about indigenous history. It will also have indigenous art displayed. The slope of the path will be leveled to abide by the AODA guidelines. Interactive kiosk (like in a mall) to find landmarks, route distances, path lengths, etc.
7.	A path equipped with boundary railings and has heated sections for resting or melting snow on the path. The slope of the path will be leveled to abide by the AODA guidelines. It will have around 12 walkers available to rent and they will have electric wheels to help it roll forward. GPS system on walkers that shows location and progress of user.
8.	A wide enough path that on one side you have wheelchair guidance rails. The path will be made of asphalt. Users can pick up paper maps at entrance of park at the start of the route.
9.	For most part it will be a path that has been leveled to abide by the AODA guidelines. In some highlighted sensitive areas there will be a boardwalk. Overall, it is a handcycle and tricycle friendly

	path and then we will have a renting station along the Bloor West entrance. Furthermore, high power electric mobility wheelchairs will also be available. On the boardwalk there will be maps/ information panel for information of BOS.
10.	Make a wide spiral path around hills or slopey areas, making sure it is slip resistant. Fencing or walls along the sides of the spiral path feature information about the park's history and wayfinding information.
11.	Have a revolving ramp right before big slopey areas that quickly goes down into a tunnel where they can take a lift to HPNC
12.	Carve out a snow tubing section but instead of snow tubes its like a slide that goes straight down. Also an escalator ramp that brings users up so they don't have to walk.
13.	Build an underground ecosystem that has new BOS and fake natural sunlight so users think that they are in the actual route but terrain can be controlled.
14.	A rocket powered jet pack lift that attaches to wheelchairs and mobility vehicles that connects to an elevated moving flat escalator (like the ones found in airports). The route has various signs with bold lettering and benches differentiated by colour to indicate route progress.
15.	A funicular railway that brings users onto a conveyor belt type elevated platform which also has off road sections every 200 meters for users to take a break if needed (for water, washroom etc.) , and a screen showing progress of the route. Has maps inside each funicular train car.
16.	Spiral ramp that connects to mycelium + wide and flat stone bridge that has gaps for trees and then also is coupled with landmark symbols to show progress along the path.
17.	Floating polymer wetland boardwalk, coupled with leaning rails and different colored benches every 100m. The slope and width of the boardwalk has to follow AODA guidelines. It will be equipped with solar panels to power dim lights for visibility. Furthermore, it will have features like water refills stations, pick up paper maps and information panels that use natural colours placed throughout the path, indigenous landmarks, and borrowable audio guides that users can use to be directed.
18.	Permeable metal grated boardwalk that has log fencing to protect the nature, and uses indigenous landmarks to help users navigate.
19.	Dual-level boardwalk bridge (bottom for wheel chair, mobility vehicle users and top for walking pedestrians) that incorporates pull out bays for users for breaks.
20.	Footbridge with wildlife underpass, that incorporates meandering paths to go past steeper slopes. The width of the footbridge has to follow AODA guidelines. It can have paper maps at the entrance and then couple with landmark sign maps.
21.	Elevated boardwalk with ramp exits, that is coupled with VR Glasses to show progress and key points on the route. The slope and width of the boardwalk has to follow AODA guidelines.

22.	Boardwalk with patterned flooring for navigation, that adheres to AODA guidelines. It will have navigation maps all around the path.
23.	Sky ride - a simple aerial gondola/sky ride system that transports users above the forest canopy. Quiet, electric gondola cars can glide along a cable path, stopping at elevated stations which double as look out points (The carts themselves stop/slow down for a period of time and users can take time to look). The gondola itself can have measures to ensure comfortability for users: heating/cooling methods, a small table in the middle in which a map and QR code for a digital tour and link to Indigenous art, stories, teachings, etc.. It has lights at platform stops and in each sky ride. It would not obstruct prescribed burning as it will be placed at an ideal height. Each gondola can have a type of interactive system in which the users can press a button of their choice to hear a story, teaching, history on the BOS, etc…
24.	A system of elevated slides that are wide, slow, and accessible. Users can sit in cushioned carts (like a mini toboggan). Specialized carts made that have slots for wheelchairs can be deployed, or specialized sleds designed for wheelchair users and users with mobility issues/other mobility devices. For navigation, a QR code for digital navigation and the choice of an auditory tour on the users phone. The QR code can also lead to online education (teachings, storytelling,) The slide can be designed with Indigenous art made by Indigenous Artists.
25.	An elevated “train”/shuttle/tramway that is placed on a rail. There are different “stations” you can get off at, like a subway system. Each station will be a floating pavilion in which there will be stairs or a ramp to get down to ground level. (If a ramp design, that is long enough to accommodate those with mobility devices and strollers, isn’t possible to design due to space, a raising/lowering system for users with mobility devices.) The vehicle can have maps on it (like a subway map)
26.	Elevated flat boardwalk that has platforms that are inspired by treehouses/huts around trees. Each of these huts will have things mentioned in other ideas, such as water refills, seating for rest, hammocks can be hung around the perimeter of the hut, (within the fenced boardwalk and have nets around the perimeter as well for safety), designs by Indigenous artists, each hut can be an allocated station for aft installations, water refill/recovery stations, storytelling, teachings, etc..
27.	Rotating system - like the 360 restaurant at the CN tower. A gondola/sky ride system with pods in which there are seats situated around a table in a circular formation and they rotate. The seats will have a mechanism with which they can latch off and on their place in the pod, and then wheel chairs can be latched onto the same mechanism. The inside of each pod can be designed to have art by Indigenous Peoples. Similarly to number 2 it can have maps/QR codes in the middle to maps, indigenous art, stories, teachings, etc. As well as the interactive system of buttons to hear a story, teaching, history, etc.
28.	Floating puff balls - machines that control pods which look like clouds that have a mechanism where they’re “floating” by standing on a glass platform. Users can lay down on them, stand, sit, and have wheelchairs. At night they can mimic the faint light of the moon, and also tell you which area of the park you’re in.
29.	Suspended canal above the canopy with slow moving boats, like the canals in Venice, that move through the park and pass by important landmarks.
30.	Suspended roller coaster with accessibility carriages that's low to the ground and dictates the route. Travels from Keele station to HPNC and users can look outside the window and get the same

	experience as walking.
31.	Robotic dog/animal/cloud machine that can fly with a jet pack or drone mechanism and it can carry people. Latches for wheelchairs and has chairs. Carries people from Keele Station to the HPNC hovering above the ground while they can look out to the scenery and also there can be designated “parking” spots that the machine is programmed to know.
32.	Airport-styled (or ski-hill escalators) escalators along where original high park paths are, that can be heated to melt snow. They can also have clear hoods over them to block precipitation. They can have an emergency stop button. Parts of the route can have a wooden rest area with benches. GPS Kiosks along the route.
33.	Rollable path (i.e. Mobi-Mat) in areas above the maximum slope for wheelchair users. Use trees to make archway to cover mat from precipitation and harsh weather. Stone perimeters surrounding rollable path and signs to show locations and distances to other locations in the park. Low lights for visibility.
34.	Ski lifts in steep areas. Go around trees but it doesn’t obstruct prescribed burns or any biodiversity. Audible system providing wayfinding information and facts about the park’s history. Route has leaning rails and
35.	Trail with slots/rails for wheelchairs. Operates using a roller/conveyor belt system. Has handrails. Provides self–guided GPS audio guide devices for users. Rails are heated to melt snow, and has gutter system on either side of rail to allow water to escape.
36.	Switchback path that has rubberized ground. Wood from dead trees can be used to bound the switchback trails. Has pedestrian bridge overpass at Spring Road intersection. Audible guides are provided for navigation and direction throughout route.
37.	Even out small cracks or pits with mulch. Rentable mobility vehicles & accessibility service helpers. Has leaning rails and flat wide steps on side for all users (including those with wheelchairs) to stop at the side. Maintenance is conducted by salting route, and by adding removable “patio covers” during heavy precipitation. Wayfinding posts are scattered throughout route.
38.	Automated off-road wheelchair. Route has bright, easy to read wayfinding signs with visuals. Off roaded wheelchair can brake and park safely.
39.	Ground markings and tactile paths. Usage of indigenous art for wayfinding signage. Windbreaker structures to provide rest areas. Vehicle clasping attachment system for mobility scooters, wheelchairs, and other aids. Route is made of Anti-slip composite materials with good drainage.
40.	Camouflage utilities for retractable cable system that can assist users by pulling them up steep areas. Ground is maintained year-round with consistence maintenance. Moat surrounding either side of trail for drainage. Motion-detecting solar-powered lights at night. Landmarks and markings for wayfinding.

41.	Robot navigation: An accessibility service robot who guides users through the park and provides audio navigation. The robot can also latch onto and pull wheelchairs or mobility scooters, as well as carry people if needed. Robot can go to its designated spot when not working where it does not obstruct fires when they are conducted
42.	"Walking" Zipline- similar to an auto-belay when rock climbing. Hooks up to a cable above users and supports users as they traverse, allowing them to not fall if they stumble or lose their balance. Signage throughout the park for wayfinding. Can put a track to further help wheelchairs ** for zones with a slope larger than admissible
43.	A scheduled shuttle bus that provides stops at every stable area that is safe for people to roam around, so people can get on & off the vehicle. The shuttle doesn't have to be trailed but must follow a specific route. Ramps and assistant workers will be present to assist people to get on & off.
44.	An electric-powered skytrain that transports directly from Keele station to HPNC.
45.	Hand/leg powered tri cycle. The solution will be accompanied by a constructed cycle friendly path made out of rock, paved thoroughly in the BOS. Renting stations will be available at Keele station and HPNC. Information panel and maps will be throughout the route something for attaching wheelchairs/strollers, and seats for those who can have a hard time supporting themselves like elderly, and also wayfinding (signs/posts), tricycles can have auditory wayfind/gps showing route and key features
46.	A solar powered shuttle that navigates the BOS with a tour guide present to introduce BOS to visitors. Shuttle can have ramps so people with wheelchairs, strollers, walkers, canes, can easily get on. And can also have designated accessibility areas in the shuttle that these wheelchairs and strollers can latch on, and where elderly and those with mobility challenges have priority seating.
47.	An underground cabled power/trailed, slow moving vehicle with clear windows. The vehicle will go through underground and sometimes surface level of the soil that allow you to closely observe the nature of BOS. There can also be information panel boards in the underground tunnel that provide information while users pass through them can have ramps so people with wheelchairs, strollers, walkers, canes, can easily get on the vehicle during boarding. And can also have designated accessibility areas in the vehicle that these wheelchairs and strollers can latch on, and where elderly and those with mobility challenges have priority seating.
48.	Small vehicles that are provided for individual users or small groups that users have autonomous control over. The design should utilize GPS system and self driving technology and therefore users can have autonomy while accidents and prevented. Vehicles should be limited to specific speed limit and users can have control over where the vehicle go by choosing on map. The vehicle must also be equipped with tank treads/ 4 wheel driving so it allows the vehicle to navigate through terrain of different dampness, slope and hardness.
49.	Rent out wheelchairs and strollers that are built for the terrain and also have built in maps of the park to help navigation

Appendix Q.3: Multi Voting

Table Q.3.1 Multi Voting Results

Solution Number	**Round 1 (10 votes each) Ideas voted for in Round 1 are yellow**	**Round 2 Ideas voted for in Round 2 are orange (6 votes)**	**Round 3 Ideas voted for in Round 3 are Red (3 votes)**	**Total Score**
1.	Subu	Subu		2
2.	Devansh Jarvis Gary	Devansh Gary	Gary Devansh Shahad	8
3.	Gary Sajenie Subu	Gary		
4.				
5.	Jarvis Sajenie Shahad Subu	Jarvis Devansh	Jarvis	7
6.	Devansh	Jarvis		
7.	Devansh			
8.				
9.	Gary	Devansh Shahad		
10.				
11.				
12.				
13.	Gary			
14.	Gary			

	Shahad			
15.	Sajenie Shahad Gary Subu	Gary Sajenie Subu	Subu	8
16.				
17.	Sajenie Devansh	Sajenie Subu	Sajenie (combined with #35)	5
18.				
19.				
20.	Jarvis Shahad			
21.				
22.				
23.	Gary Devansh Sajenie Jarvis Shahad	Gary Sajenie Jarvis Devansh Shahad Subu	Gary Sajenie Devansh Subu Jarvis shahad	17
24.				
25.	Devansh Jarvis Shahad Subu	Jarvis Devansh Shahad Subu	Devansh Shahad	10
26.	Sajenie Jarvis Shahad	Shahad	Subu shahad	7
27.	Subu			
28.				
29.				

30.	Sajenie (if silent roller coasters)	Sajenie		
31.				
32.	Gary Sajenie	Gary Sajenie	Gary Sajenie	6
33.	Jarvis Subu			
34.	Devansh Sajenie			
35.	Devansh	Devansh	Sajenie (combined with #17)	3
36.	Subu			
37.	Devansh Subu			
38.	Gary			
39.	Gary Jarvis	Gary Shahad	Shahad (combined w vote for 2)	5
40.				
41.				
42.	Sajenie			
43.				
44.				
45.	Shahad	Jarvis Shahad	Shahad (combined w 2)	4
46.	Devansh Shahad			2
47.	Sajenie	Sajenie	Jarvis	5

	Jarvis Subu			
48.	Jarvis Shahad	Jarvis Subu		
49.				

Table Q.3.2. Cumulative Votes of Voted Solutions

Design #	Votes
2	8
5	7
15	8
17	5
23	17
25	10
26	7
32	6
35	3
39	5
45	4
47	5

Solution 35 and 45 were removed as they had the lowest number of votes, indicating that the solution was voted by mostly 1 person.

Appendix Q.4. Graphical Decision Chart

Figure Q.4.1. Graphical decision chart based on objectives 1 and 2, narrowing down the idea selection to the top three ideas: #15, #17, and #23

Appendix R: Overview of Appendices that explore the three alternative designs

Appendix R.0: Alternated Design Solution Justification

It contains calculations along with extra justification to explain how the 3 alternate designs meet certain objectives.

Appendix R.1: The Floating Boardwalk

O1.
This calculation shows the number
1 lux = 1 lumen/m^2
1 lux = (x_{lights}*50 lumens)/(Total area of boardwalk)
1 lux = (x_{lights}*50 lumens)/($width_{boardwalk}$*$length_{boardwalk}$)
1 lux = (x_{lights}*50 lumens)/(2.5 m*560 m)
1 lux = (xlights*50 lumens)/(1400 m^2)
1400 m^2/50 = x_{lights}
x_{lights} = 28

Therefore the number of required lights is 28. So, we can install 28 lights in the boardwalk to meet the objective.

O2. The only component that creates the most sound in the heat system will be the circulating pump. It has a sound of less than 25dbA [71]. Since 25dbA is less than 50dbA which is the tranquility threshold the boardwalk heating system will not disrupt the calm BOS environment.

O4. According to figure 4 the total length of the path is 560 m. If each rest area is 30m apart then the total number of rest areas will be 560/30 which is approximately 19.

O5. Material 1: Composite decks
Composite decks are very resistant to high temperatures.[72] They don't deform easily and they have properties of absorbing heat rather. These materials also have special layers of protection from UV rays of sun. Additionally, during cold weather composite decks are very safe because they have anti-slip surfaces[73].

Material 2: Pressure Treated Lumber
The joints of boardwalks are made up of pressure treated lumber[74]. This material is resistant to moisture, UV radiation and most importantly changes in temperatures[75].

Material 3: Galvanized Steel for railing
It can resist temperatures as low as -40°C[76]. So it is usable during extreme winter weather and it has properties that protect it from corrosion as it is composed of zinc and iron.

Appendix R.1.1: Elaboration of Justifications

Table R.1.1.1. Elaboration for each justification

Objective	**Justification**
O.1	This design will have a score of 3. As shown in Figure 9, it will be 2500mm width and that exceeds the required turning diameter for a wheelchair user. Furthermore, the deck board spacing will be 6.35mm [36] this will ensure it meets Onatio's Integrated Accessibility Standards. Lastly, there will be 30 lights installed along the path, which meets outdoor lighting guidelines.
O.2	Boardwalk does not inherently create any sound however the heating system creates 35.3 dbA which is less than 50dbA therefore it meets the objectives (Appendix P.1.). Noise levels contributed by the audio guides to overall ambient noise can be considered negligible (Table R.2.1)
O.3	As shown in Figure 10, since the boardwalk has leaning rails it provides tactile guidance for users with low vision. The different colored benches and information panels act as visual wayfinding markers. Additionally, audio guides aid auditory wayfinding.
O.4	The boardwalk is 560 m long so it can have 19 benches (Appendix P.1) .
O.5	The boardwork’s walking surface would be made up of composite deck board. Furthermore galvanized steel and pressure treated lumber will be used for leaning rails and internal joists respectively. All the structure elements are chosen such that they are resistant to withstand Toronto’s Climate (Appendix N.1). Additionally, the integrated heating system will reduce ice buildup which results in extended lifespan of the material.
O.6 Incorporate Indigenous Knowledge	The boardwalk can have multiple indigenous elements along its 560 m length.

Appendix R.2: Gondola Sky Ride Elaboration of Justifications

Table R.2.1. Elaborate Justification of Each Objective

Objective	Justification
O.1	Components (1, 2, and 3): 1) The width of the sky ride is 2.5 m which is greater than the objective goal of a width of 2.1 m for the ease of turning freely for wheelchair users. 2) The platform and ramp will be produced with wood with gaps no greater than 13 mm, to comply with accessibility standards for O.1 and Boardwalk Design Guidelines [77] 3) Cabin interiors have adjustable lighting. The platform stops and ramps have 9 W Compact Fluorescent lights spaced roughly 6 m apart, to which the lumens would be ~1.2, slightly more than the objective goal of 1 [78]. Therefore, this design achieves 3 points for the overall objective, meeting the objective goal.
O.2	Average dBA of a 3S gondola system, a type of bi-cable gondola system (a subtype called tri-cable), ranges from 55-75 dBA. [79] According to the TransLink Burnaby Mountain Gondola Route Selection Report, the gondola is silent except when passing over towers, where a slight rumbling that is about the level of a normal conversation occurs[80]. TransLink also states that tri-cable gondolas are significantly quieter than buses, as most machinery and noise sources are located at stations of the gondola system, and that the sound produced at stations is much less than the sounds at bus stops. [79] For reference: ● Average dBA on a bus ride: 78.1 dBA [81] ● Average dBA at bus stops: 84.1 dBA [82] ● dBA of a normal conversation: 60-70 dBA[83] Noise levels emitted from the speakers during audio announcements would generally remain close to the surrounding ambient noise. Speakers in public spaces (drive-thru speakers) use Automatic Volume Control (AVC), which continuously measures the ambient noise level of the environment and adjusts the speaker output so it stays a certain decided clearance over the ambient level (no info regarding AVC standard clearance in Ontario is public)[84]. For example, an analysis on drive thru noise level [85] recommends that the kiosk speakers should increase the ambient noise level by no more than +6 dBA during daytime and +3 dBA during nighttime. With this in mind, we can infer that noise level from audio kiosks will be slightly higher than the ambient level. For instance, if the ambient noise level is 50 dBA, the speaker output will have to be a few dBA above this (based on AVC clearance). While this would exceed the objective goal of 50 dBA, the increase is minimal, and the speaker is not

	continuously active (only operates when a user initiates it). Therefore, the contribution of the speaker to overall ambient noise can be considered negligible. Overall, the design does not meet this objective.
O.3	The gondola cabins include visual maps, audio announcements, handheld maps with raised braille, and QR codes for digital navigation, satisfying the minimum 3 wayfinding method types (visual, auditory, tactile) (Figure 10)
O.4	This objective's metric doesn't apply to this design.
O.5	Gondolas are typically used for ski applications, but also for summer activities like hiking and mountain biking [86]. An example of a gondola system that is open year round is the Sky Gondola [87]. To be used in different weather conditions, materials of the lift must resist harsh weather conditions. The gondola system design will use weather-resistant steels for structural components (stations, towers, cables, cabins) to ensure durability and longevity in cold environments. Stainless steel is used for components exposed to snow, moisture and temperature fluctuations for its corrosion resistance [88]. For windows and doors, a hardcoated polycarbonate or acrylic will be used. [89] Polycarbonate sheets are very durable in different weather conditions and can maintain around 85% of their tensile strength even when cold as to -40℃, and can withstand temperatures from -40℃ to 135℃[90]. It meets this objective.
O.6	It would have 19 combined elements through handheld map, audio stories, teachings, and histories about the Seven Grandfather teachings. It meets this objective.

Appendix R.3: Funicular Carrier

O.2. While no information of volume of funicular railways can be found, research is conducted for similar vehicles including light trails, streetcars and trains. The vehicles are reported to reach up to 75 [91], 95 [92] and 110 dBA [93], respectively. We can estimate funicular railways will therefore have a volume range of 75 - 110 dBA, and the objective is not met.

O5. Despite funicular railway operates normally under normal circumstances and is sometimes used in winter, it is stated that extreme cold will require slower moving speed for railways. It is also stated in extreme cold (below -25°C) the steel in railway will contract and increase likelihood of stressing, and according to our service environment data the temperature in past years has met -25°C. It is also stated snow must be removed from tracks and roofs of the vehicle, and blizzard prevents vehicles from operating[94]. Therefore the objective isn't met.

Table R.3.1 Elaborate Justification of Each Objective

Objective	Justification
O.1	The design will obtain a score of 3. As shown in figure 11, the inside of the carrier has a width of 2100mm. Users board on the vehicle using portable ramps so therefore there will be no gap between the platform and the carrier. Component 3 does not apply.
O.2	As illustrated in Figure 10, the solution will aid with navigation and wayfinding since users are provided with information screens, braille plagues and audio navigation, which satisfies the objective of 3 ways of navigation.
O.3	Estimated volume range of 60 - 110 dBA, therefore the objective of dBA <55 is not met. (Appendix N) Noise levels contributed by the audio navigation to overall ambient noise can be considered negligible (Table R.2.1)
O.4	The objective's metric doesn't apply to this design.
O.5	Funicular railways need to operate above -25°C and with minimal snow on the roof and trails. Therefore objective is not met (Appendix N)
O.6	The solution will be able to incorporate 19 design elements of Indigenous knowledge. The vehicle will include space for Indigenous arts, while the information panel and auditory guide can provide knowledge on Indigenous history and culture about the BOS and prescribed burns. Users can also first hand expose to Indigenous connection with land through the various stops.

Appendix S: Rough Sketches

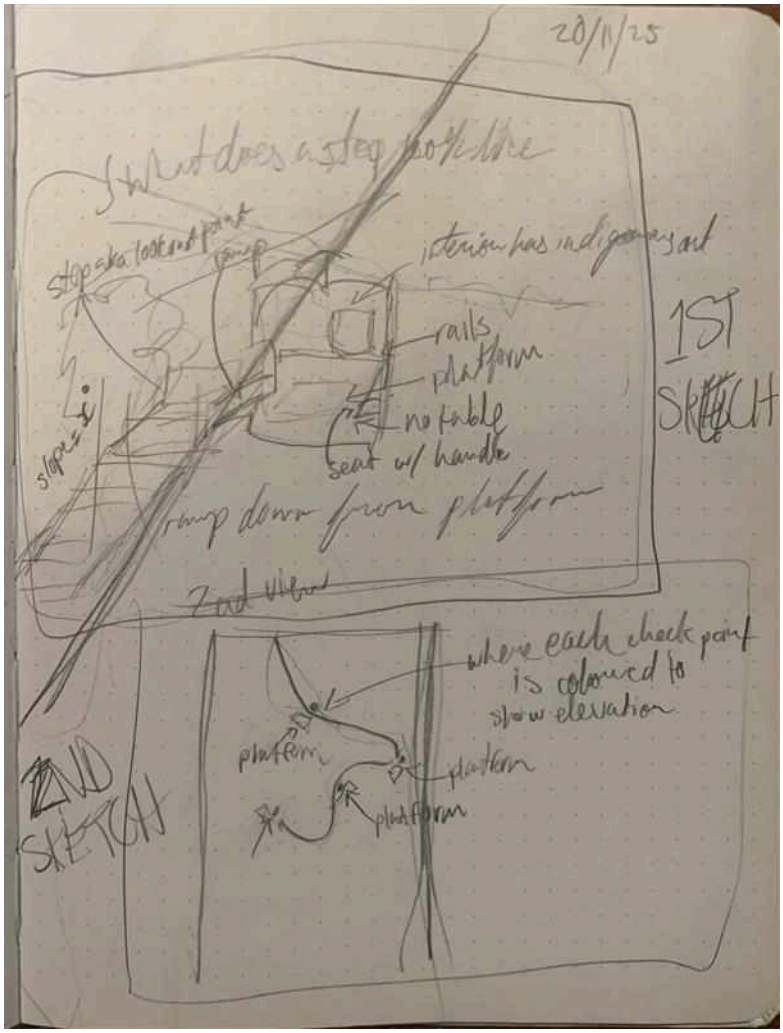


Figure S.1. Sajenie's rough sketch for sky ride design

Appendix T: Pugh Chart

Table T.1. Complete Pugh Chart Scores with Justifications

Solutions' Objectives	Current route (Datum)	Funicular Carrier	Justification	Boardwalk	Justification	Sky ride	Justification
O.1 Autonomy of mobility device users' mobility	S	1	The dimensions of the carrier meets the requirement, there are no gaps in the carrier floor and ramp, and the third component does not apply to the design. Better than datum.	1	Path is wide enough for turns, no space between boardwalk panels, and has ample lighting. Better than datum.	1	The dimensions of the gondola cabin meets the requirement, there are no gaps in the cabin floor,ramos, or platforms, and the lighting levels meet the objective. Better than datum.
O.2 Provide accessible wayfinding for people of all abilities	S	1	Incorporates 3 wayfinding tools into design that meets the 3 wayfinding methods (visual, auditory, tactile): Information screens, braille plaques, audio navigation. Better than datum.	1	4 different types of wayfinding - 1 audio, 3 visual. Better than datum.	1	Has 4 wayfinding tools satisfying all 3 wayfinding methods (visual, auditory, tactile): visual maps, audio announcements, handheld maps with raised braille, and QR codes for digital navigation (maps, videos, audio). Better than datum.
O.3 Preserve the tranquility* of the forest environment *the calm nature of the	S	-1	Average dBA exceeds datum.	0	Boardwalk doesn't amplify noise, heaters and lights make negligible noise.	-1	Average dBA exceeds datum.

BOS environment							
O.4 Provide rest areas for users with mobility challenges	S	0	Objective does not apply to design.	1	Benches and spots with covers every 30m	0	Objective does not apply to design.
O.5 Withstand seasonal weather	S	-1	The funicular railway cannot perform well under extreme weather due to the stressing of rails and excess snow.	1	Materials can withstand hot and cold temperatures, as well as dry itself and melt snow along its path. Better than datum.	1	Gondolas are made of galvanized and stainless steel, and polycarbonate sheets; materials are durable and withstand seasonal weather conditions. Better than datum.
O.6 Incorporate Indigenous Knowledge and Values	S	1	Objective is met and better than datum.	1	Indigenous landmarks, audio guides, information panels. Better than datum.	1	Contains up to 19 design elements inside of the cabin, through interactive audio stories, handheld maps. Better than datum.
Total Score		1		5		3	