THE UNIVERSITY OF MANITOBA

FACULTY OF GRADUATE STUDIES

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Transitional Geo-landscape Network at University of Manitoba Fort Garry Campus

BY

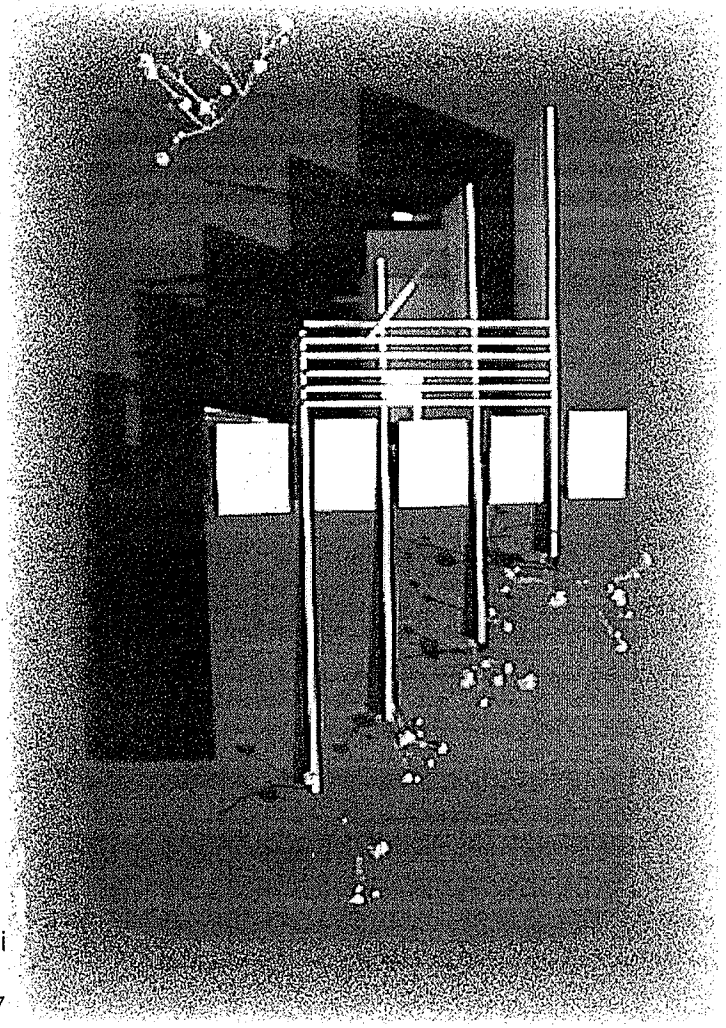
Tian Dai

A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University of Manitoba in partial fulfillment of the requirement of the degree

Master of Landscape Architecture

Transitional Geo-landscape Network

at University of Manitoba Fort Garry Campus



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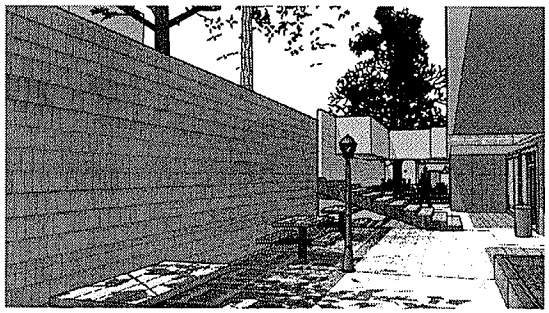
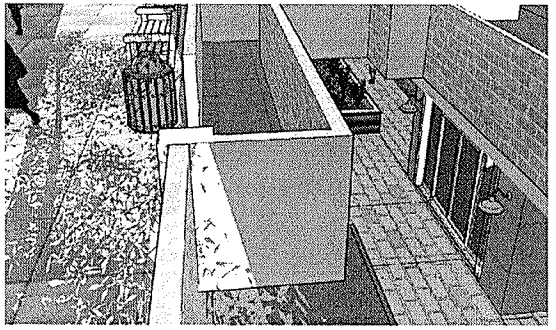


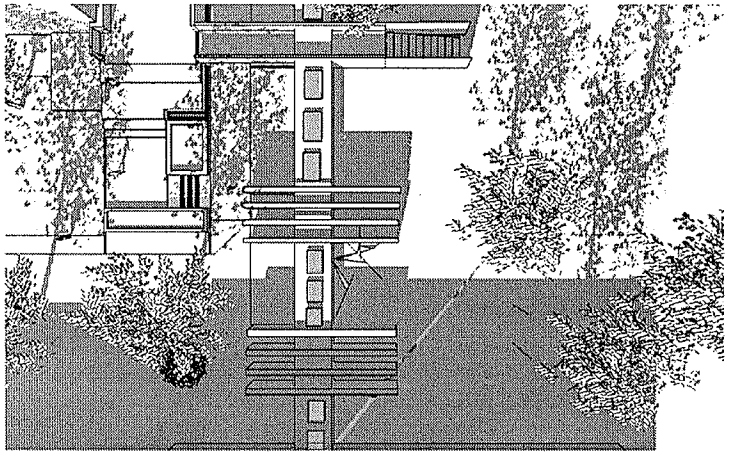


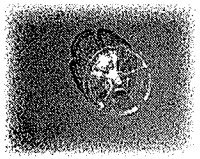
"In my architecture, I seek to create situations where man and nature can commune. I want to realize spaces within my buildings which promote conversations with natural materials. Where one can feel light, air, and rain".

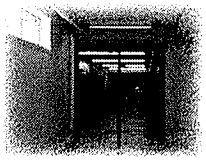
-- Tadao Ando

"Such things as light and wind have meaning only when they are introduced inside a house in a form cut off from the outside world. The isolated fragments of light and air suggest the entire natural world. the forms I have created have altered and acquired meaning through elementary nature (light and air) that give indications of the passage of time and the changing of the seasons ..."

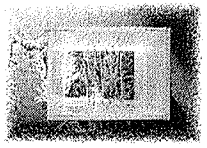
-- Tadao Ando

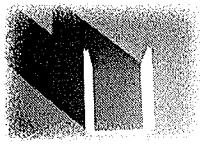


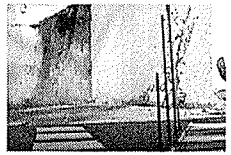




To my daughter, Qiaoya
and
my grandfather, Dequan Dai

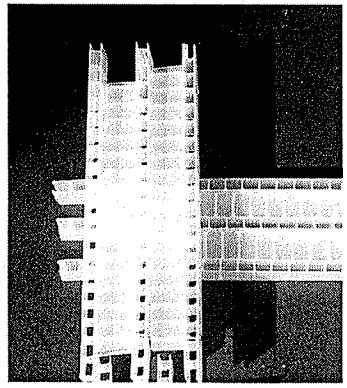


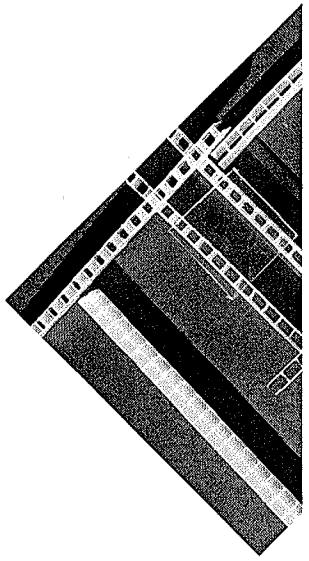




Abstract

During this century, the movement called Geo-space Urban Design emerged to address horizontal urban sprawl by focussing on the development of vertical space extending from above to below ground. This work is an examination of Geo-space Urban Deaign with a specific focus on landscape architecture. This design approach is to research Geo-space through a reinterpretation of the underground pedestrian transportation system at the University of Manitoba Fort Garry Campus. The intent is to redefine the quality of the walking experience in the University of Manitoba's pedestrian tunnel system. The design portion of this practicum develops seven interventions at seven different tunnel locations on campus. These seven site designs illustrate the geo-landscape in different environments with different spatial conditions.





Acknowledgements

I would like to take this opportunity to express thanks to those who have supported me and offered me guidance throughout this experience.

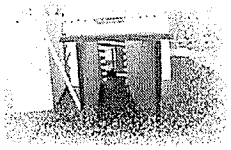
To the entire faculty and staff, they are great professors, technicians and supporters.

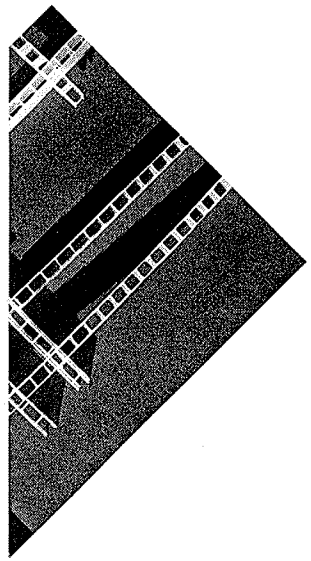
To my committee, Professor Richard Perron, chairperson, Professor Eduard Epp and Douglas B Clark for their encouragement, advice, and direction.

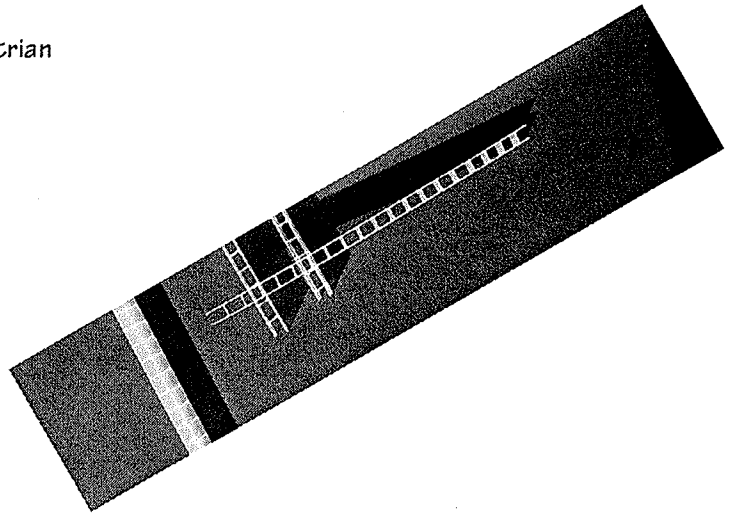
To all my friends for their kind encouragement.

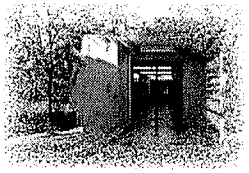
Especially for Dawn Harris who helped me a lot.

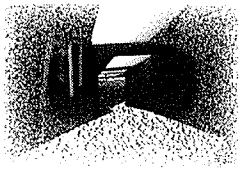
Contents

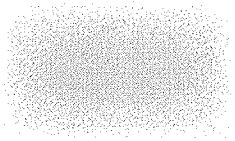


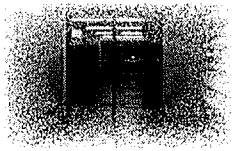


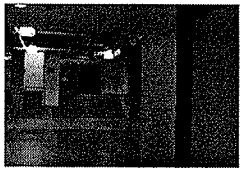


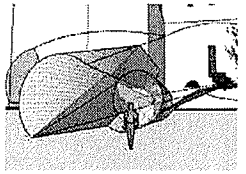












1..... Introduction .....

1 Introduction

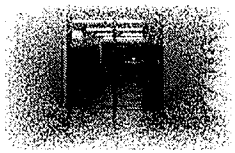
1.1. Introduction

"Since both approaches have been explored extensively, it is our belief that the city of the 21st century will expand downward into the geo-space potentialities and, most importantly, due to its positive developmental effect on the conventional supra-space city."

— GIDEON S.GOLA

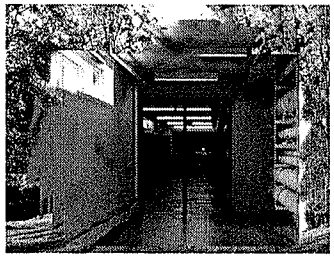
Distinguished Professor of Urban Design, Pennsylvania State University

(Golany/Ojima 1996)



All over the world, city development now involves careful consideration of issuses regarding energy consumption. During this century, urban sprawl not only extended into space horizontally but also vertically. The movement called Geo-space Urban Design has emerged with the use of underground space, encompassing sunshine penetration, efficient ventilation and multipurpose land use. Rather than replacing existing "supra-space cities" or developing new towns, this method of development complements what already exists by addressing adverse climate, land preservation and high urban land prices. Because Geo-space development is primarily underground, environmental and aesthetic aspects are generally lacking. While the development focus on practical activities and multipurpose land use is integral to the operation and economic survival of Geo-spaces, the outdoor landscape should not be disregarded. Landscape is usually thought of as existing above ground. By weaving together or integrating the above-ground landscape with the below-ground space, a Geo-landscape is created. In fact, with upfront investment in the Geo-landscape, pleasant, attractive, and multifunctional geo-spaces can be created that support more stabilized social activities year-round, which in turn can attract more social activities and business. The theory of Geo-space development encourages sunlight penetration into the Geo-space often creating new landforms external to the Geo-space resulting in new "Geo-landscape" designs.

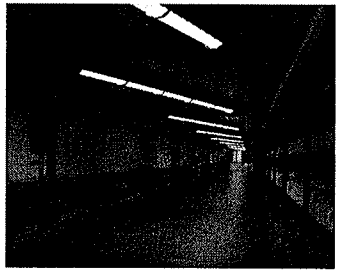
The Geo-landscape is a way to draw together the economic, social and environmental aspects of the Geo-space site, and mitigate any spatial disconnection with the outdoor environment. With a focus on transitional change from outdoor to indoor space and enhancement of a sense of place, an otherwise disconnected landscape can acquire a distinct character based on the surrounding landscape.



Top image: The existing underground space

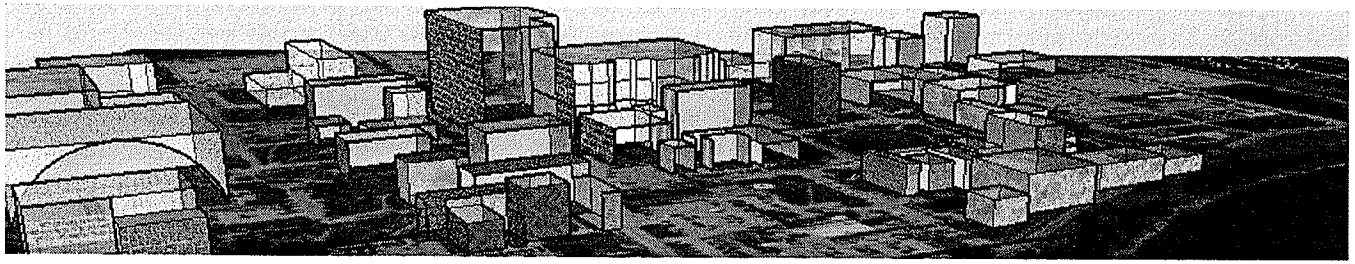
Bottom image: Integrating the external landscape with a Geo-space creates a Geo-landscape.

1.2 Site selection and context



The photos show examples of current tunnel conditions on campus and their disconnection from the external environment.

The University of Manitoba Fort Carry Campus is located at the centre of Canada where the climate is dry-cold in the winter and dry-hot in the summer. Temperatures can range from -35°C in the winter to 35°C in the summer.This campus has more than fifty buildings with three-tunnel systems that connect more than twenty buildings, allowing people to avoid inclement weather while walking from building to building under the campus. Unfortunately, the tunnel system, which we can call a Geo-space, has not been well developed. Orientating oneself is confusing and sunshine penetration and natural environment are lacking, creating a dreary, mundane environment. This situation calls on the landscape architect to ameliorate this space in order to weave the Geo-space and natural environment together throughout the existing tunnel network.



Bottom image: The image shows the above-ground campus environment of University of Manitoba Fort Garry Campus

1.3 Goals & objectives

The goal of this practicum is to redesign the tunnel system at the University of Manitoba. This redesigned tunnel system, called Transitional Geo-landscape Network, while segregated from the campus by its very nature, should be an integrated part of the existing campus environment. The existing tunnel system will be used as the basic site to develop a systematic, all-season pedestrian landscape. A symbolic landmark for each building/faculty is developed to assist with wayfinding.

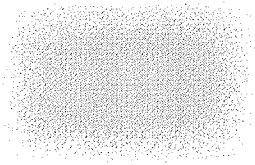
The objectives in accomplishing this goal include:

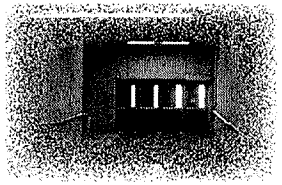
- defining Geo-space, Geo-landscape and architectural landscape and the relationship of each;
- identifying seven types of tunnel in terms of their physical and spatial characteristics
- ameliorating the tunnel system and related environment in terms of sunlight penetration and energy efficiency to improve the underground experience;
- creating a relationship for each tunnel site with its exterior/interior environment; and
- structuring a symbolic landmark for each Geo-landscape segment;

1.4 Scope and Site issues

There are a number of issues to be addressed in understanding the practicality of this exercise as a practicum.

The university's underground pedestrian pathways are located in building basements, which are connected by tunnels developed to accomodate the infrastructure for utilities. Consequently, the tunnel system is of poor quality for social activity; connection to the natural environment is lacking; and there is often no spatial separation from the utilities area. Regardless of the existing constraints, the intention of this practicum is to provide an opportunity to illustrate the concepts and guidelines that can be applied to certain types of tunnel segments to build vertical landscape layers.



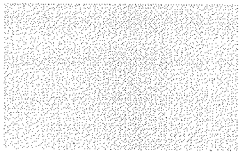


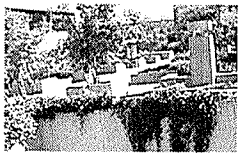
1.5 Methodology

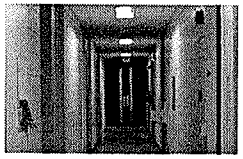
The first step of the practicum was to research the current design of Geo-spaces and related theories. A literature search was done on such topics as connectivity to the external environment; spatial layering; spatial forms, particulalry Chinese and Japanese garden form; and sunlight penetration and lighting design. The information gained through this step provided the background for fundamental design ideas and concepts for application to each particular site.

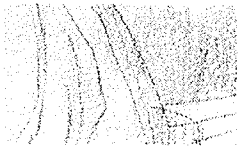
This was followed by site inventory that examined and recorded the existing physical and psychological characteristics. Analysis of the site was accomplished through a series of analytical maps that help in the identificention of specific issues.

The final step was the site design proposal which synthesized the information gathered and generated during the previous stages. Finally a master plan was developed with serial design drawings, models, a program of appropriate activities, spatial organization and symbolic landmarks for each site.





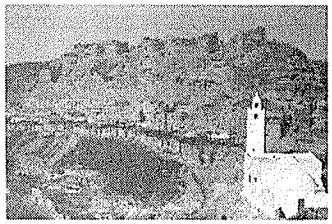




2 ..... History & definitions .....

2. History & definitions

2.1 Past and present



An indigenous cliff village in Tunisia. Dwellings are in horizontal layers following the geological stratification of the mountain.

(Golony/Ojima 1996 p. 326)

Historically, underground human settlements have existed mostly in rural centers to meet a variety of needs:

- to save precious agricultural land
- for defense
- to escape religious persecution
- for protection from harsh climate
- for low-income and homeless users often relegated to below-ground space
- for high populations with a limited land base.

As a result, a negative impression has often been associated with underground settlements.

Currently, underground spaces are a new development for addressing urban sprawl. Development of underground space could moderate a number of modern conditions:

- high energy consumption
- high urban land prices
- harsh weather
- loss of agricultural and recreational land
- seasonal constraints on the use of public sppaces.

These conditions have emerged as a reuslt of urban sprawl, city development, and modern urban life. New developments and highly advanced technology are searching for ways to solve the stresses associated with modern life.

2.2 Definitions & relationship

The emerging terms Geo-space, Geo-landscape, Geo-landscape architecture are closely related but have different meanings.

Geo-space is a term that refers to the built space within the earth.

Geo-landscape is a term that refers to the landscape design which develops the natural and built Geo-space's environment.

Geo-landscape Architecture is a term that refers to the application of creative and technical skills and scientific, cultural and political knowledge in the planned arrangement of natural and constructed elements in the Geo-space.

The Geo-space Urban Design still focusses on the architecture of the building. At this point in time, Geo-space urban design primarily focusses on the physical aspects of Geo-space, such as land use, hazards and safety, and climatic considerations. It needs to become more than that. It is a way to draw together economic, social and environmental aspects, while solving physical problems by employing Geo-landscape architecture to create Geo-landscapes.

Geo-space should include careful considerations of the site itself, Geo-landscape would thereby include the environmental elements introduced of the site (including existing and proposed elements), and Geo-landscape architecture is the act of applying the techniques to create a Geo-landscape.

2.3 Typology

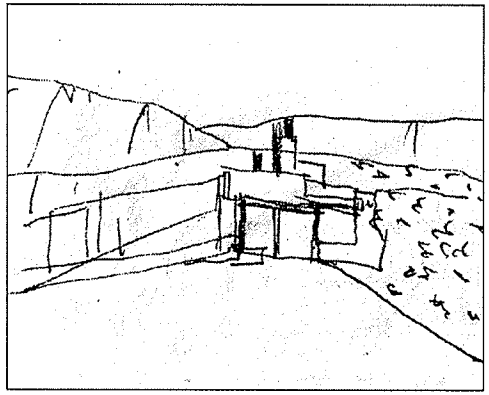
Five types of underground space have been defined by professors Gole and Ojima at their book, *Geo-space Urban Design*. They have assigned Geo-spaces to type categories according to their form, relationships with the external environment, and spatial traits.

Gole and Ojima's Type 5, which references Geo-space (Japanese concept), may confuse readers of this practicum. I have chosen to use the term, Geo-space, to describe any space within the ground, whereas the two professors use the term to describe a complex city-like underground development.

The following texts are sourced from Golany/Ojima's Geo-Space Urban Design, pages 3-7.

Type 1: Earth-sheltered Habitat

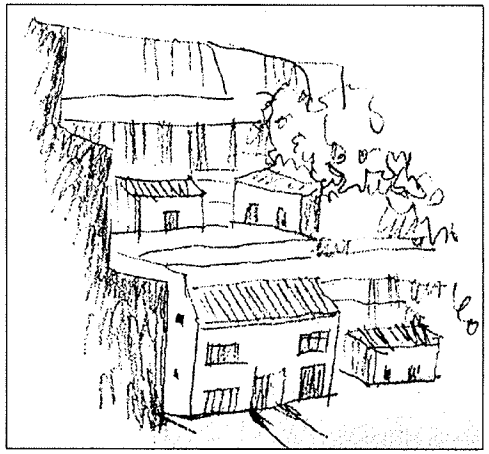
The term earth-sheltered habitat, or supraterranean habitat, is now commonly used in the United States to describe a habitat constructed mostly above ground and enveloped by a layer of earth, usually about one-half meter in thickness.



Earth-sheltered Habitat
Recent American

Type 2: Semi-below Ground

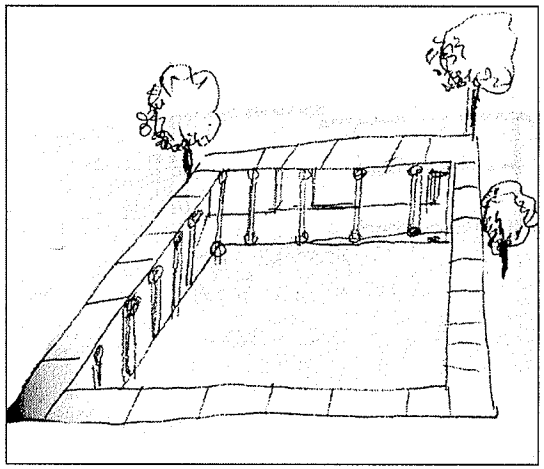
A semi-belowground dwelling is a unit constructed partly below and partly above ground. This is one of the most common human-make housing forms and was used in Neolithic village communities in China, Japan, and other places of the ancient world, It is still in use in rural commuinities in Africa.



Semi-below Ground
Mediterranean

Type 3. Subsurface house

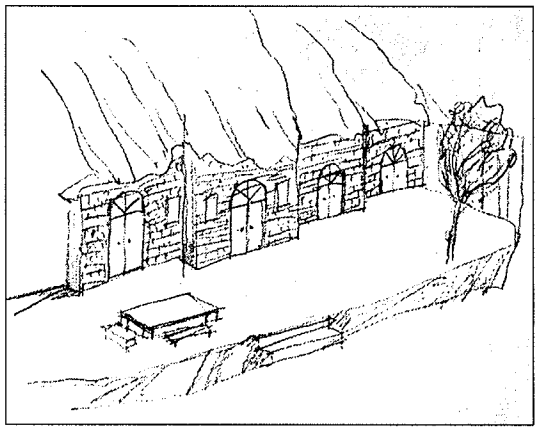
A subsurface house is a shallow belowground dwelling with a short distance between its ceiling and the soil surface, usually about one-half meter or less.



Subsurface house
Northern Tunisia

Type 4 Belowground (Subterranean Space)

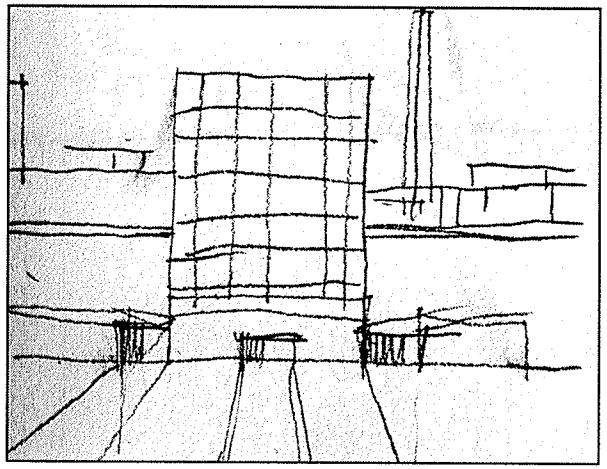
Belowground or subterranean space has been the most common form of earth-integrated space used throughout history.



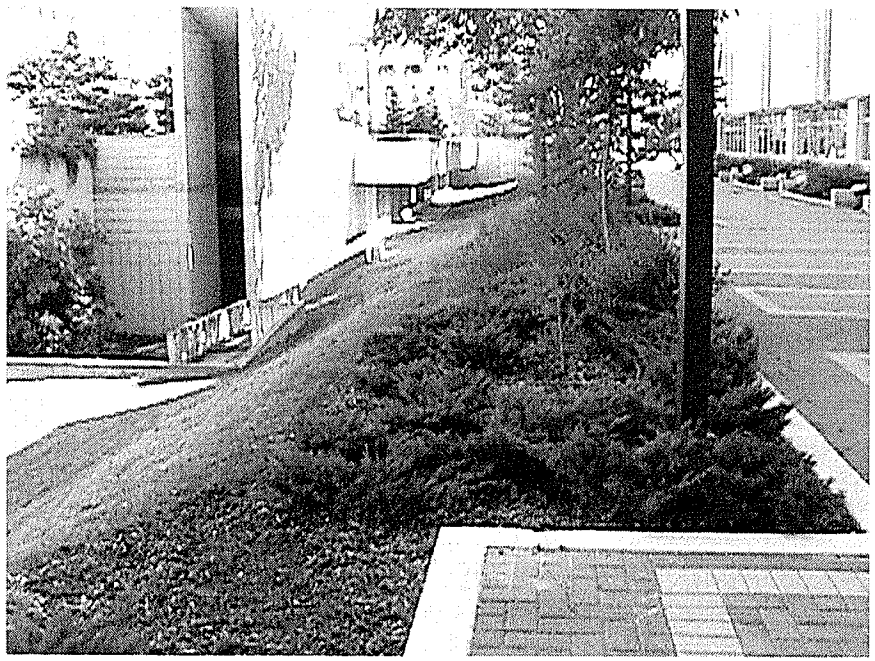
Belowground
China

Type 5 Geo-Space

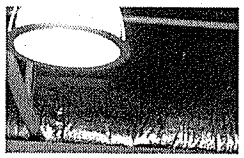
The term geo-space is currently used by the Japanese to describe space that is fully submerged deep with in the earth. Japanese designers have introduced some innovative and pioneering concepts of geo-space forms for multipurpose human activities at depths of 50 meters or more.

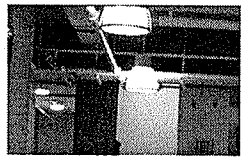


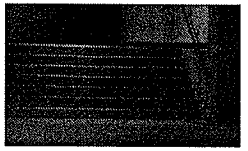
Geo-space
Japan



Modern Geo-space below grade. Above ground are paths.







3..... Site analysis .....

3. Site analysis

3.1 Site location

"The University of Manitoba Fort Garry Campus is situated on 278 hectares (680 acres) of river basin land extending from Pembina Highway to the Red River." (Netplan Office) Since this campus was established in 1912 as an agricultural college, the campus plan has changed significantly. These changes have included developing new buildings and a new research park; pedestrian and vehicular circulation redevelopment; and other infrastuctural network development. All these changes have resulted in this campus becoming "a wide range of service places rather than a primarily academic institution." (Netplan Office)

The tunnel system is located in the central area of this campus. It links most of the buildings to University Centre, the University of Manitoba Student Union complex.

Site location map

Image source: www.googlearth.ca

Legend:

Site boundary

Campus boundary

3.2 Site access

As it shows from the site access map, most of the existing tunnel system has no universal pedestrian access.

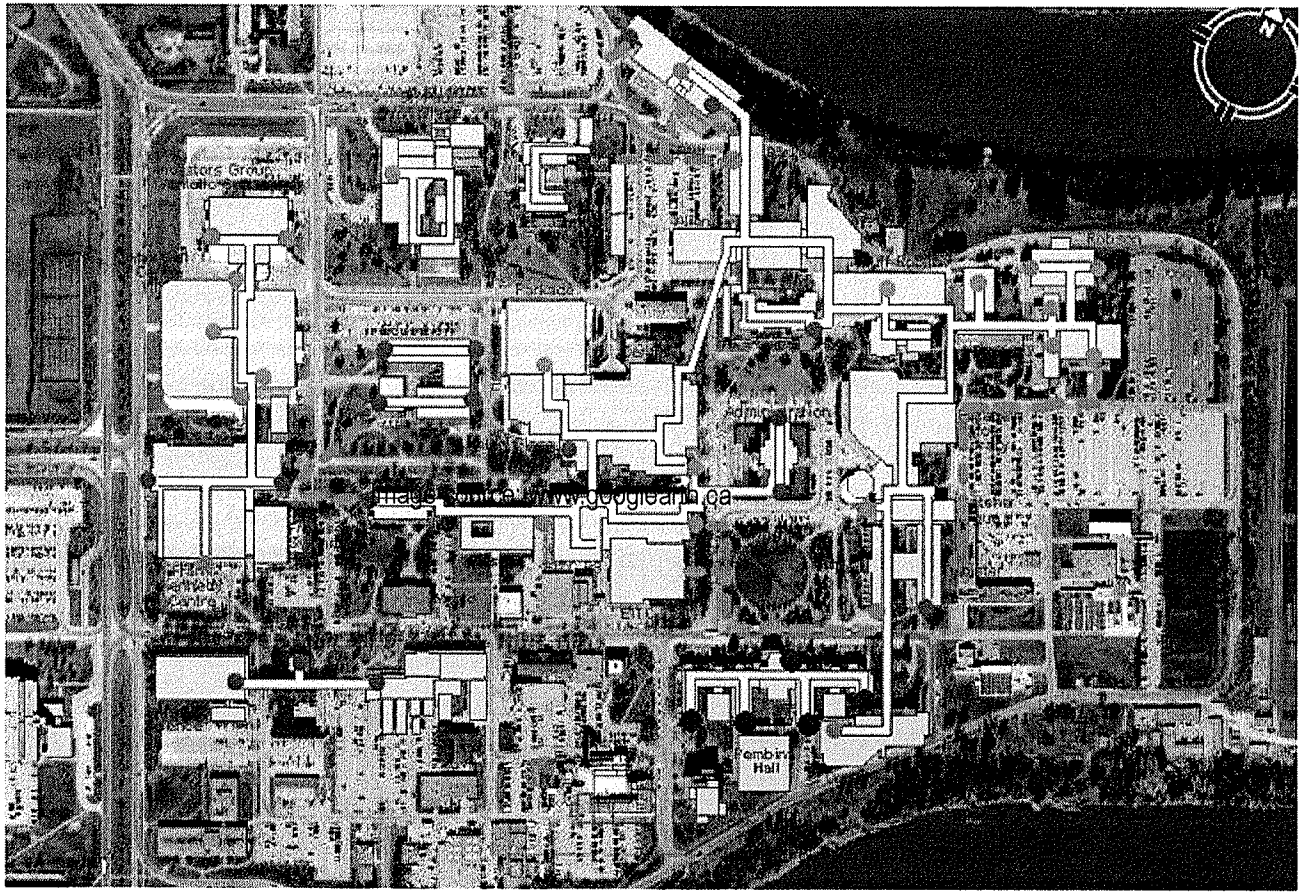
The green dots show the locations where there is universal pedestrian access.

The red dots show the loacations that have no universal pedestrian access.

Also, on this campus, there are tunnels are not linked to the public system, ex. the Tache Hall tunnel.

On this map, the seasonal walking circulation,

the orange broken line, represents the most popular walking paths from bus stops or vehicle drop off/parking lots to the buildings.



Site access map

Image source: www.googlearth.ca

Legend:

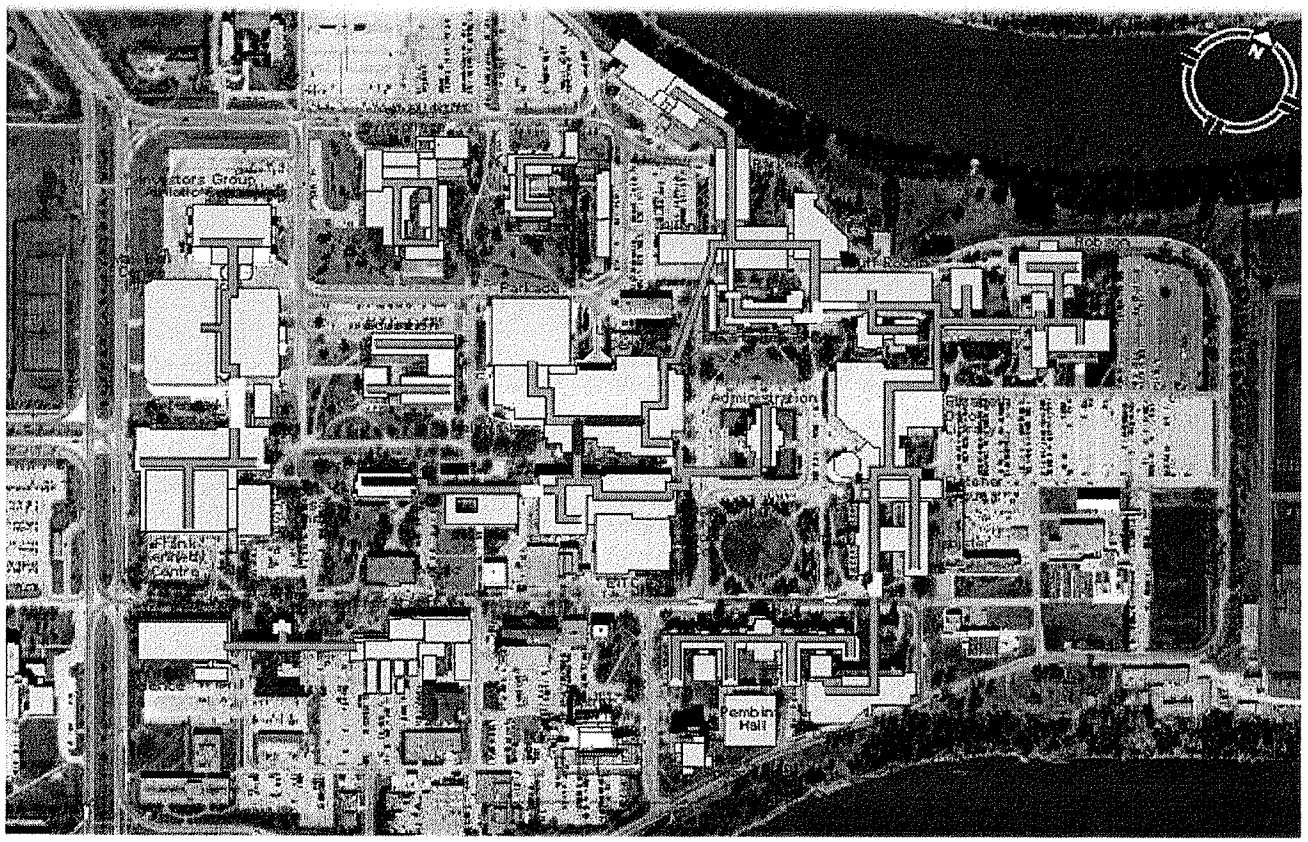
- Universal pedestrian access
- Nor universal pedestrian access
- No public access
- Tunnel
- External seasonal path

3.3 Sunlight penetration

The sunlight penetration map indicates where natrual light reaches into the tunnel space.

The three colors indicate the potential for natural lighting within the tunnel space. Most of the tunnel system is marked in pink which means there is no sunlight penetration opportunity.

The blue color indicates an opportunity for indirect natural lighting which means windows inside the underground space relay natual light from other windows while the yellow color shows there is an opportunity for direct sunlight penetration in this part of the tunnel space. Some of these tunnels have high windows on the wall and some have ceiling windows that let sunshine into tunnel.



Site sunlight penetration map

Image source: www.googlearth.ca

Legend:

- With sunlight penetration opportunity
- With in direct sunlight penetration opportunity
- Without sunlight penetration oppportunity

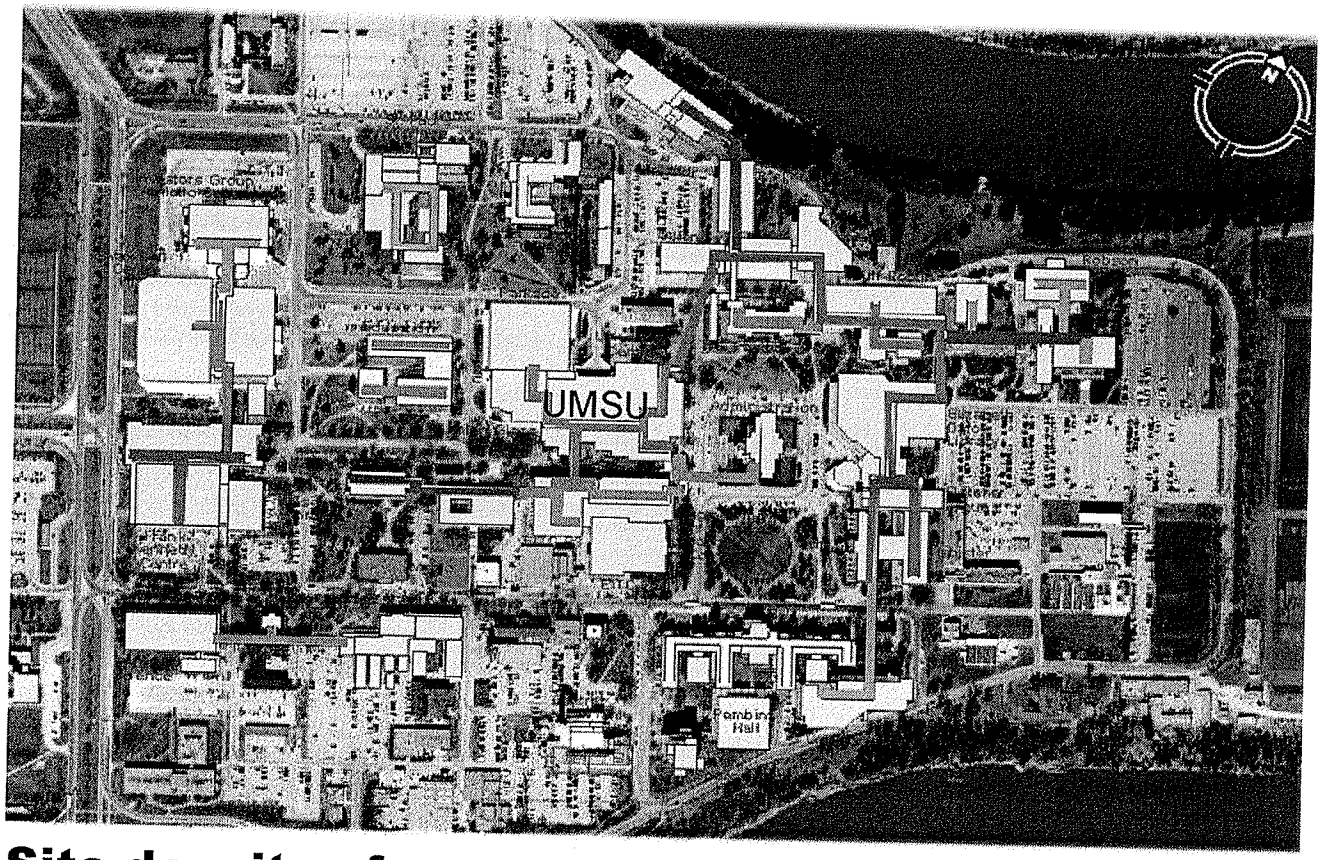
3.4 Density of movement

The density of movement map shows the level of pedestrian use in this tunnel system.

Gathering tunnel use data took place in the winter time during class hours.

Overall, the most popular tunnel segments are those linked to UMSU (University of Manitoba Student Union Centre)

The tunnel becomes less popular as it moves further away from the UMSU centre. Most walkers use the tunnels for their coffee break, walking to the gym during lunch break, and walking to the other faculties.



Site density of movement map

Image source: www.googlearth.ca

Legend:

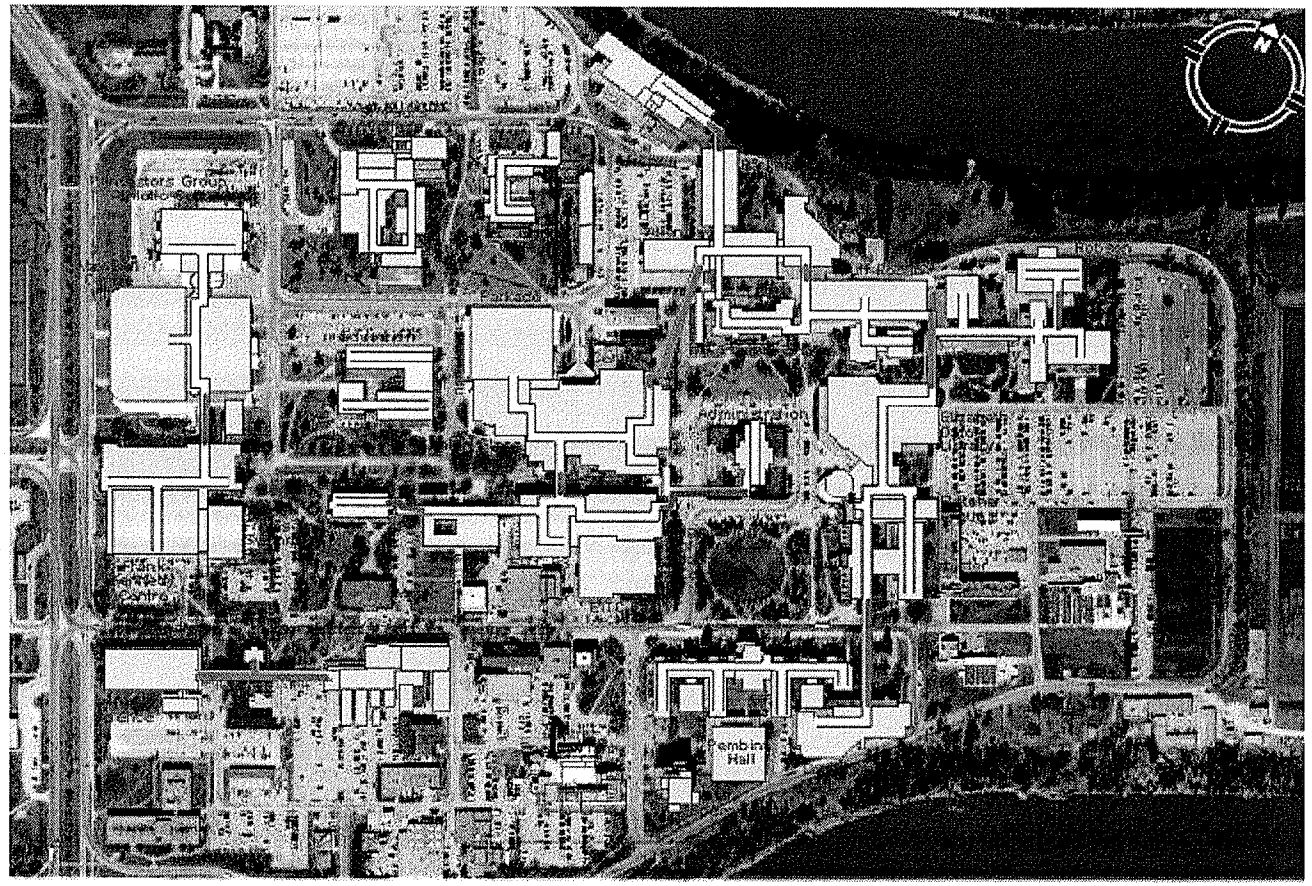
- Less than 5 people in 30 mins
- 5-10 people in 30 mins
- 11-20 people in 30 mins
- 21-30 people in 30 mins
- 31-50 people in 30 mins
- More than 50 people in 30 mins

3.5 Movement & interruption

The movement map measures walking/moving fluidity in the tunnel spaces.

There are a lot of segments/areas where movement changes direction or intersects other tunnels. When people come to those segments, they have to avoid people moving perpendicular to them or the opening of hallway and room doors.

These areas are identified as multi-directional movement tunnel segments. On the other hand, the tunnels have some segments that are single or dual directional walking paths. These segments mostly extend from building to building and share space with utilities.



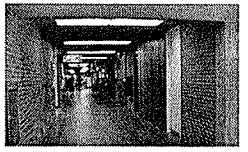
Site sunlight penetration map

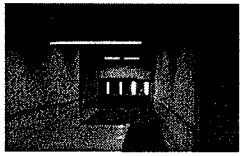
Image source: www.googlearth.ca

Legend: Single direstional movement

Multi-directional movement

Tunnel view with sunlight penetration and out-door environment





4 ..... Typology .....

4. Typology

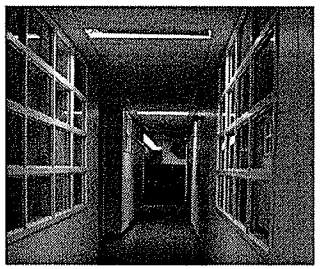
The site analysis maps in the previous section illustrated that there are a variety of conditions in the tunnel system.

The most effective way to understand and study these tunnel conditions is to categorize them by type. Based on their physical/spatial dimension and their relationship with the out-door environment the tunnel conditions on campus can be assigned to one of seven types. All of these types can be considered as Earth-Sheltered Habitats, as described by professors Golany and Ojima in their book *Geo-space Urban Design*, although the depth of space of these types within the earth differs from the Golany/Ojima Earth-Sheltered Habitat.

Images:

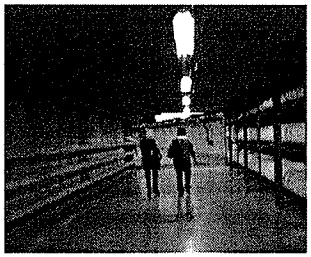
WINDOWS

The wide open window connects tunnel with out-door environment.



The classroom aisle's windows in the tunnel

SPATIAL DIMENSION



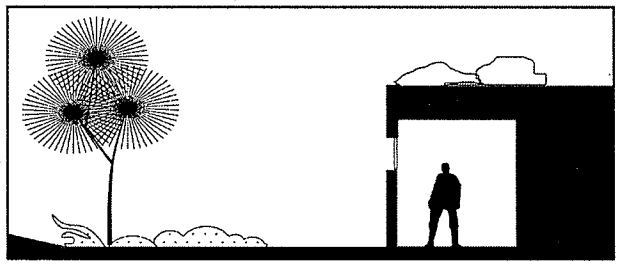
The tunnel with a wide walking space under the Engineering Building.

The wide walking tunnel with a long space depth.

LIGHTING

The tunnel view of the artifical lighting system with reflecting floor.

The tunnel view of full natural lighting and shadows.

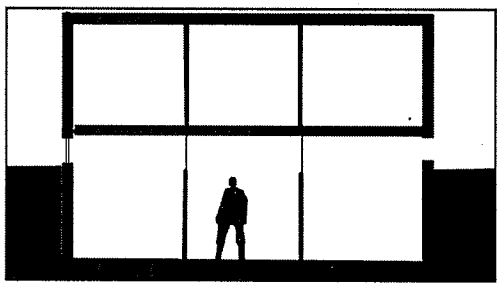


Type 1 – section of tunnel

4.1 The Geo-space of seven tunnel types

4.1.1 Type 1

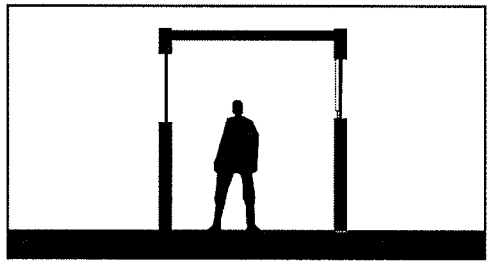
This type of tunnel is located at the drop off area between the Russell Building and Engineering Building in the south-west area of campus. It is a popular walking path for architecture students and staff going to the UMSU centre during coffee/lunch break. There is only one location of this type on campus. The section drawing shows the tunnel is one wall away from the outdoor environment. There are windows on this wall where natural lighting can come into this tunnel/geo-space. Hours in which natural light can reach into the tunnel are limited because of the window size which allows only certain angles of the sun to reach into the space. Inside the tunnel, circulation is single directional except for one spot where there is a door to outside. Exterior to the tunnel, there is a paved incline to grade, which serves as a loading dock and pedestrian route.



Type 2 – section of tunnel

4.1.2 Type2

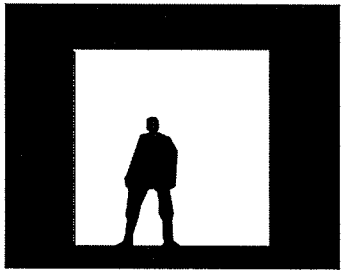
This type of tunnel is located in various places in the tunnel system. Basically, this type is situtated in the building's basement. Some segments of this tunnel type have an opportunity to introduce indirect sunlight penetration through basement windows. This type has mixed lighting, both natural and artificial. Normally, these segments of the tunnel are full of students/staff during class break time. Segments of this tunnel type often have infructure pipes. Circulation in this type of tunnel is multi-directional which means walkers often interfere with one another.



Type 3 – section of tunnel

4.1.3 Type 3

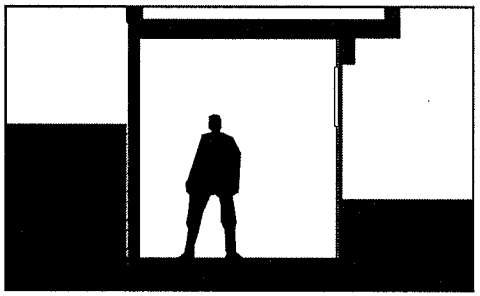
Type 3 is the segment between the Continuing Education Building and Max Bell Centre. This segment connects the Continuing Education Building's basement to the Max Bell Centre's ground floor. It is situtated in a sloped tunnel with two sides of windows to the outside landscape. The design of the tunnel allows people to visually experience the four seasons when walking between the two buildings. The outside environment includes two gardens; the west side garden opens onto University Crescent, while the east side garden is enclosed by three buildings. Natural light can reach inside the tunnel; however, its time is limited. The round windows along the two sides of this tunnel frame the landscape view. Circluation in this tunnel type is a single directional.



Type 4 – section of tunnel

4.1.4 Type 4

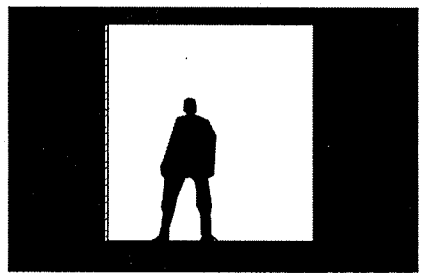
Type 4 is a very typical tunnel on the Fort Garry Campus. This type of tunnel has no windows, only artificial lighting is used. There are no classrooms associated with this tunnel type. It is situated between two buildings. It is also associated with infrastructure pipes. The ground to tunnel ceiling layer of this type of tunnel is thicker than that of Type 6. Circulation is normally a single directional movement. This type of tunnel has three locations on this campus: one is between the Tier Building and Drake Centre; one is between the Adminstration Building and Universtiy Centre; one is between the Parker Building and Wallace Building. All these locations have a roadway over them.



Type 5 – section of tunnel

4.1.5 Type 5

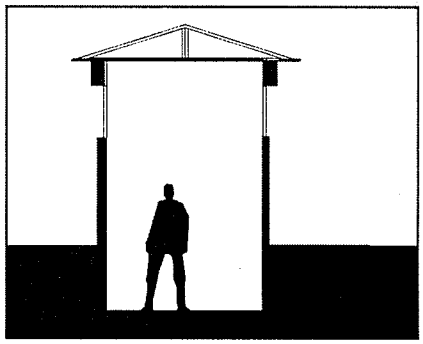
Type 5 is half inside a building's basement with one side that has an openning view to the out-door environment. It is located in the University Centre (UMSU) basement and the Machray Hall basement to the Armes Lecture Building. This type at these two locations has limited hours of sunlight penetration because of the relationship of the angle of the sun to the window opening.The windows to the out-doors are large, framing the view well and introducing nature to the inside of the tunnel. The circulation at the UMSU location is multi-directional. The one at the Machray Hall is mostly single directional. The UMSU location has doors that open to an exterior sunken garden, the south side of which is sloped that divides the garden from the upper level path on the north side of the Engineering Building. The one at the Machray Hall has a door that leads to the out-doors where there is a garden with benches.



Type 6 – section of tunnel

4.1.6 Type 6

Type 6 has no windows and is built completely underground. Normally, it is the linkage between two buildings and under a garden or path, consequently the ceiling layer is thinner than that of the Type 4. Circulation in this type is single directional. The Type 6 tunnel has various locations on campus: one is located at the west side of the Pharmacy Building; east side of the Buller Building; in front of the Fitzgerald Building; between the Animal Science/Entomolgy, the Lecture Block and the main Agriculture Building. There are other such linkages between buildings on this campus but they are shorter than the ones mentioned.There is no sunlight penetration, only artificial lighting.



Type 7 – section of tunnel

4.1.7 Type 7

Type 7 has only one location on this campus. It is located at the south side of the Tier building. This tunnel segment faces the bus loop and Tache Hall. It acts as a bus shelter, a circulation node and building entrance people walk to this point, a ground level tunnel, then will take stairs or the elevator to the underground tunnel. Circulation at this segment is muti-directional and both horizontal and vertical. This type of tunnel emerges at ground level with ceiling and wall windows that bring bright sunlight into the tunnel. It is a bright/white space with full sunlight penetration. It may considered as a hut but is still part of the tunnel system. This segment of tunnel has very good visual connection with the out-door environment.

Out-door environment view

4.2 The location of seven tunnel types on the Campus tunnel system

This tunnels/types location map shows the seven tunnel types with their segments and locations on the Fort Garry Campus map. The predominant tunnel type is in yellow which indicates these segments are all Type 2. In the UMSU centre, the tunnel is predominantly Type 1; however, it has some features of Type 5. The walking area in the middle of UMSU centre is similar to Type1 with one wall/one room away from the out-door environment, subsequently extending into a public seating space with the window openings directly connected with the out-door environment. Type 7 is very short and beside the Type 4 at the south side of the Tier Building.

Seven tunnel types location map

Image source: www.googlearth.ca

Legend:

Type 1

Type 2

Type 3

Type 4

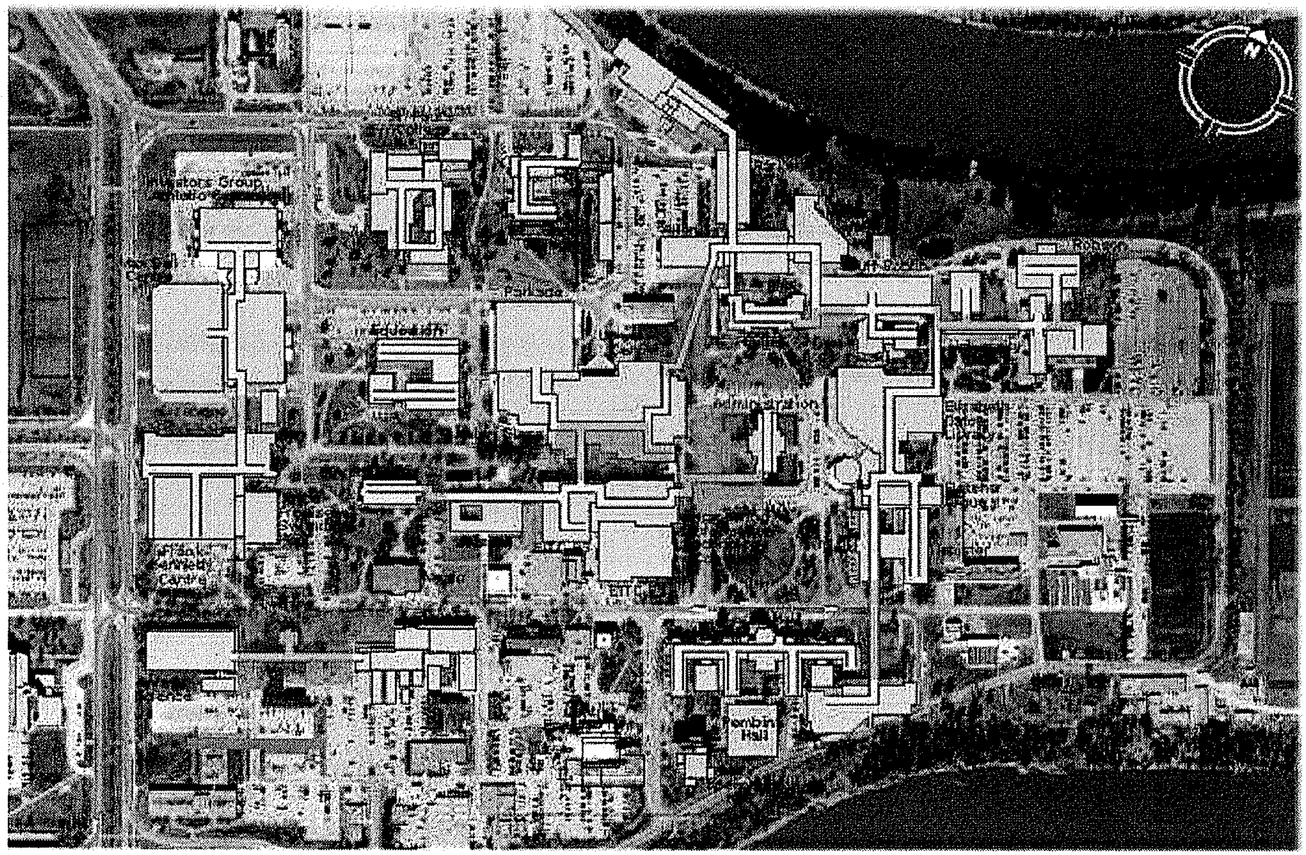
Type 5

Type 6

Type 7

4.3 Relationship to the outdoor environment

The Relationship to the out-door environment map indicates the tunnel system and how it relates to the out-door environment. There are two types of relationships on this campus: one is direct where there is a direct connection either visually or physically to the out-doors; the other is indirect where the closest outdoor environment is not visually or physically connected with the tunnel. In the latter case, the tunnels may be covered by the earth which blocks the potential connection. The area between buildings can be considered as part of the tunnel site. Currently in some places there are gardens, but they have no connection to the tunnels. They do offer possibilities for future design which would be linked to the tunnels. The intention is treat the tunnel as the central visual point to view for the whole site. The buildings serve as the edge or boundaries of a site, and where there is no building, the boundary extends as far as the eye can see.



Relationship with outdoor environment map

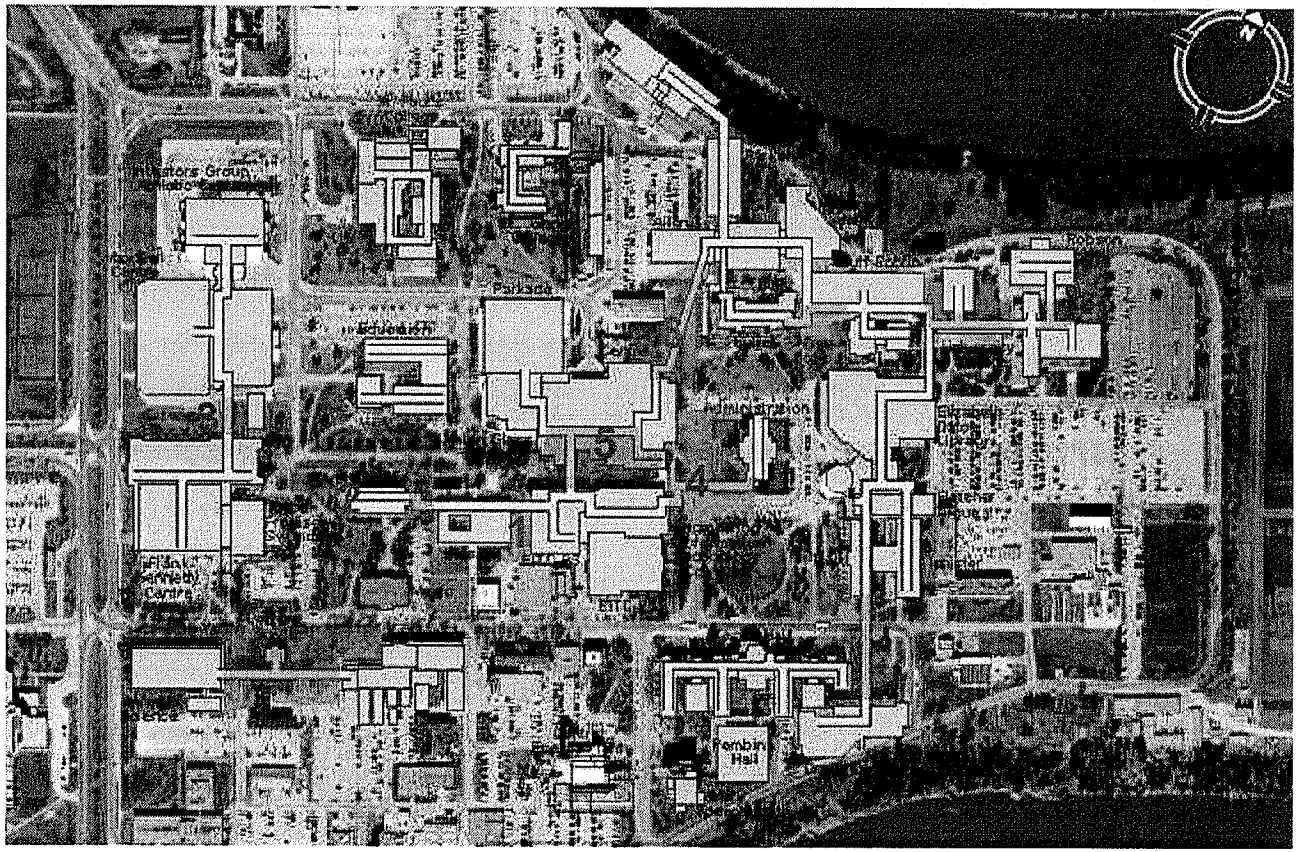
Image source: www.googlearth.ca

Legend: Indirect opportunity

Direct opportunity

4.4 Design sites for the seven tunnel types on campus

This map shows the selected locations with seven tunnel/types. These seven locations which will be the seven site's designs described in section five of this document. The clearly boundary will be defined at the following sections too. These boundaries are different from the map of Related outdoor environment. They clearly analyzed the future development opportunity for each segment of tunnel as well as the outside environment's plan.



Design sites of the seven types location map

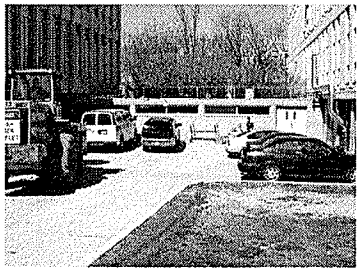
Image source: www.googlearth.ca

Legend: types/sites numbers and their locations **1 - 7**

4.5. Analysis the seven sites

3.5.1 Site/type 1

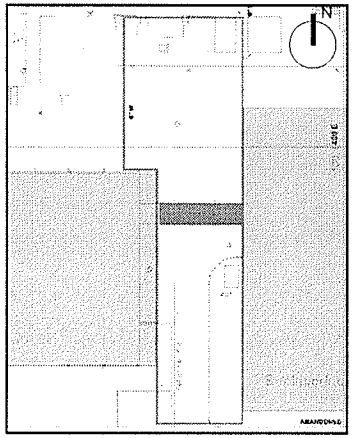
Site/type Site/type1 is situated between two buildings where there is mixed loading and pedestrian use. The tunnel entrance is very convenient for the walkers to enter the tunnel. The slope here is from ground level to the underground level. This loading area is the main entrance for equipment and materials to both the Faculty of Architecture and the Faculty of Engineering. This site has universal accessibility to the tunnel system.



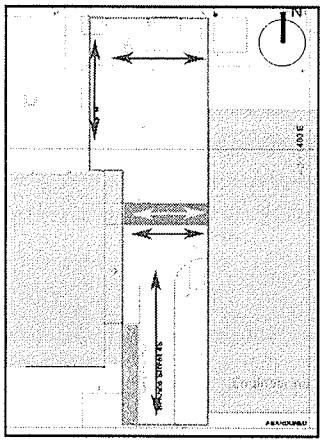
Environment view of site 1

Site boundary & buildings

The Boundary & Building map shows the exterior/condition with respect to the building. The gray rectangles are buildings. The shaded area to the left represents the Russell Building and the shaded area on the right represents the Engineering Building. The dark gray color indicates the tunnel's location. The red line shows the boundary line between side of the tunnel site to the Nursing Building offering a whole new site to the future development.



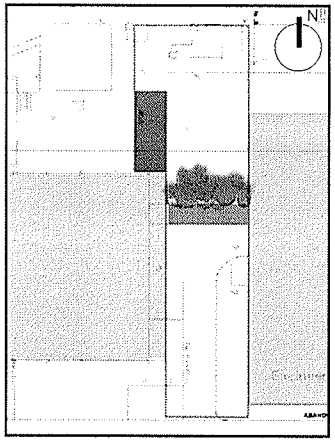
Site boundary & buildings map



Site circulation map

Site circulation

The Circulation map shows pedestrian movement on the site. The purple line shows the outside environment. The yellow line shows the inside circulation.



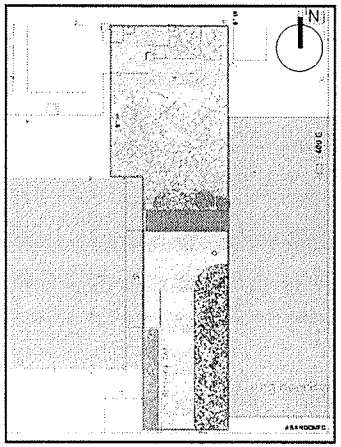
Site shadow map

Site shadow

Shadows from buildings have little impact on this site, except where indicated by the black squares. Shadow from vegetation is cast by small shrubs.

Site land form/land use

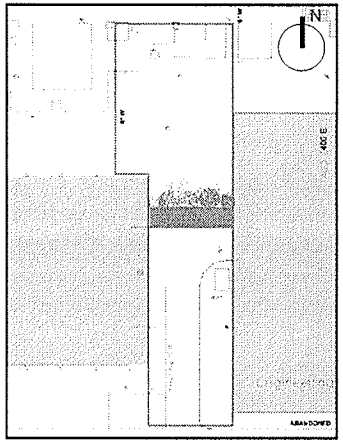
The green color indicates the vegetation; the light grey pattern illustrates the walking and loading/drop off area by the tunnel door in the south area; on the upper-level, north side, the light gray pattern shows the walking path; on the south east side the purple gray area represents a flower bed under development.



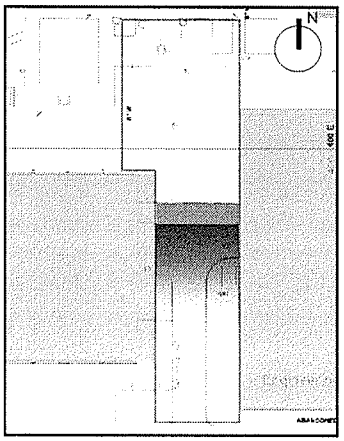
Site land form/land use map

Site vegetation

The vegetation map indicates the vegetation's location at this site. The vegetation here includes shrubs and grasses. At the left side of the loading area, wild shurbs are growing.



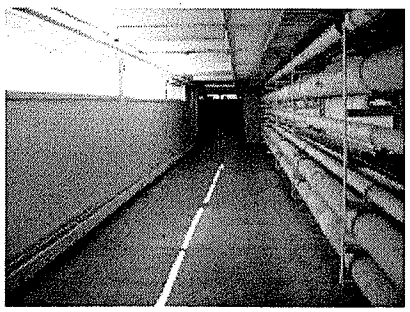
Site vegetation map



Site view opportunity map

Site view opportunity

Analysis of the site shows that the current view is very limited. Any view is towards the south and it is restricted by buildings and the sloping ramp. One of the goals in developing a design for this site is to expand the view shed (the blue area on the map).



Tunnel view

Tunnel view opportunity

Inside the tunnel, the view is very uni-directional. The windows on the wall do not provide a visual opportunity for most tunnel users. There may be a view opportunity for some people who are taller than normal. Otherwise, the tunnel views are only of the interior space. The photo shows the actual view inside the tunnel and the natural lighting of the tunnel space. Most pedestrians will turn their heads in the direction of the natural light when they go past the windows.

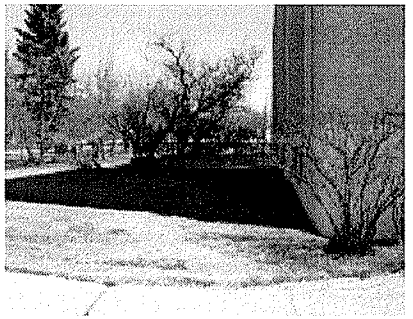
Conclusion

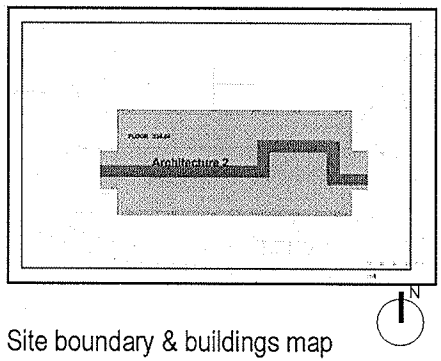
This Type 1 site exists in an infrustucture tunnel that connects two building's basements with a link to the outside via a door to a loading/walking area. The tunnel currently isolates the outdoor environment on the north side from that of the south side loading dock area. There is potential to connect these two areas.

3.5.2 Site/type 2

Site/type 2 is a typical tunnel on this campus. This type is typically situtated at the basement of buildings. The selected site is located in the basement of the Faculty of Architecture's Architecture II Building. There are computer laboratories, classrooms, staff offices, equipment rooms in the basement. This building's basement has high windows to introduce the natural light. This also is the tunnel's only indirect natural light opportunity.

Environment view of site 2

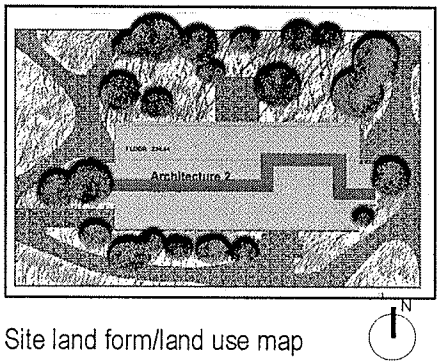




Site boundary & buildings map

Site boundary & buildings

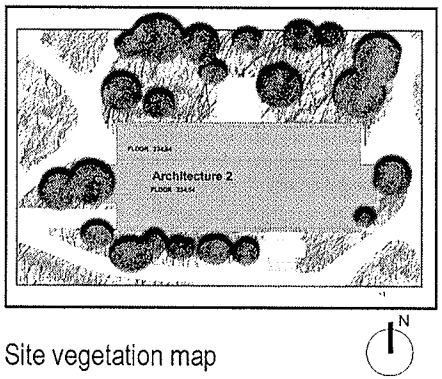
The boundary is the red line which indicates pathways around the building and includes the front and back of this building. On this map, the building is the white area.



Site land form/land use map

Site land form/land use

This map shows three zones of this site: the gray zone is the yard area; the black dot pattern is the tunnel location; and the white is the building. The blank color indicats a small, below grade courtyard.



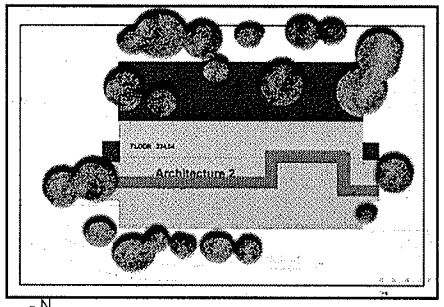
Site vegetation map

Site vegetation

The vegetation map illustrates the tree locations as green circles. Most of the area around the building is grassed with some shrubbery beside the walking path.

Site shadow

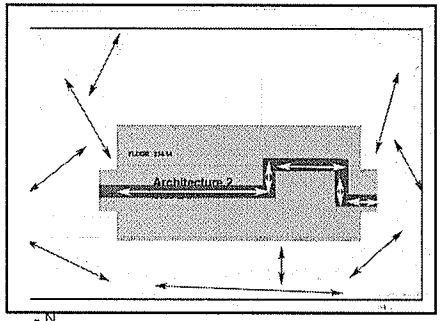
The site shadow map illustrates shadow locations. The big, dark purple square on the north side of the building is the shadow cast by the building



Site shadow map

Site circulation

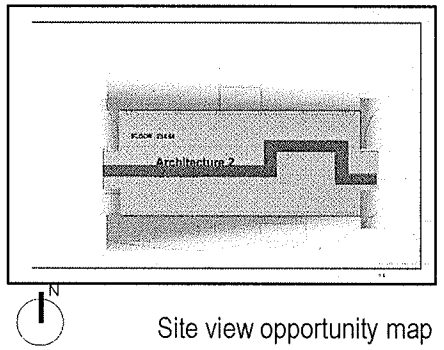
The circulation map shows the walking path. The purple lines along the boundary line are the actual path. At the front, the purple line going to the building is the main entrance. At the rear, there is no path to the below ground courtyard; the only access is from the building. The yellow lines illustrate the major walking direction.



Site circulation map

Site & tunnel view opportunity

The site view opportunity map illustrates the views currently on this site. View sheds are the blue areas. Inside the tunnel, the views are short and channel-like. The windows on the two sides of the walls can transfer light, both natural and artificial, to the tunnel space from adjoining rooms.



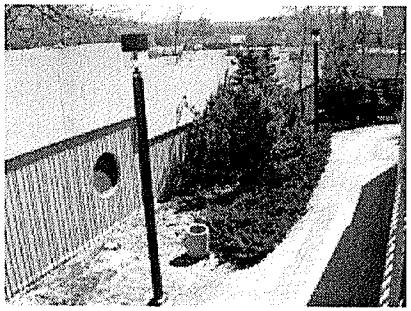
Site view opportunity map

Tunnel view

Conclusion

Type 2 is a typical tunnel on this campus. The windows on the wall provide indirect lighting. In any future development, it will be very hard to open up the space to natural lighting, to change the walking conditions or to integrate with the outdoor environment.

3.5.3 Site/type 3

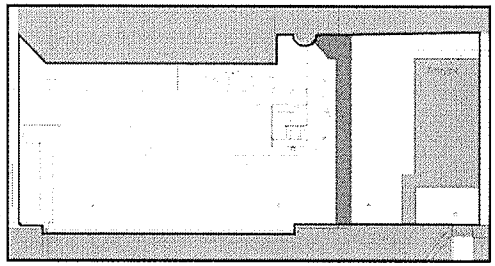


Environment view of site 3

Site/type 3 is the above ground tunnel that connects the Max Bell Centre at ground level to the Continuing Education Building's basement tunnel. The outside environment extends to University Cresent. There is a garden on the east and west sides of this tunnel segment. This tunnel is very important for people who use the gyms in these buildings.

Site boundary & buildings

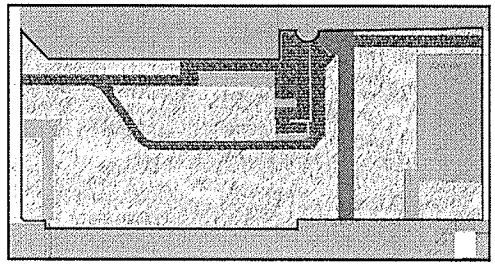
The site 3 boundary extends from University Cresent to the east side entrance to the Max Bell Centre. The red line illustrates the boundary of the site. The grey areas are buildings and blue grey area is the tunnel.



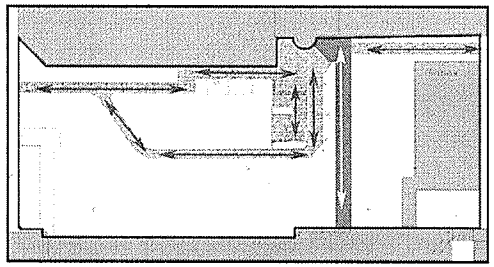
Site boundary & buildings map

Site land form/land use

The site 3 map shows the walking path from University Crescent to the landscape structure (stairs and ramp) that allows pedestrians access to two levels. One level is to the entrance of the tunnel/first floor of the Max Bell Centre; the other is to the second floor of the Max Bell Centre. The garden area gradually slopes upwards from the basement level to ground level.



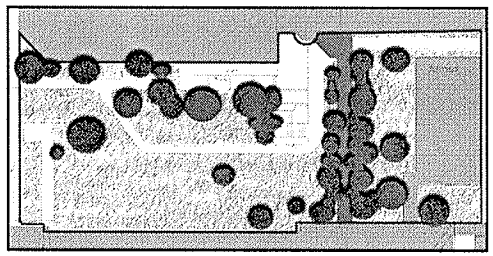
Site land form/land use map



Site circulation map

Site circulation

The circulation map uses dark gray double arrows to illustrate the walking direction. They basically follow the walking path in the west side garden. Inside the tunnel, circulation is a single directional movement.



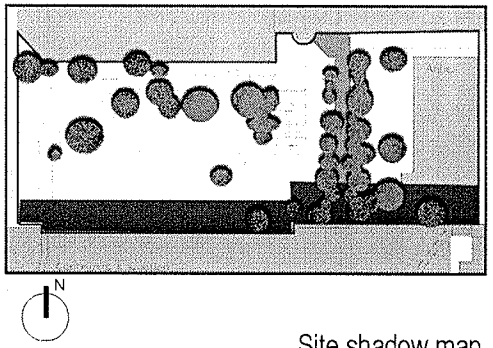
Site vegetation map

Site vegetation

Plants, which are trees for the most part, are along the two sides of the tunnel.

Site shadow

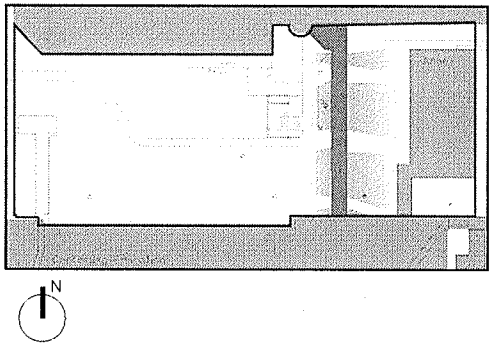
The shadow map uses the dark gray color to illustrate the shadows cast by both the vegetation and buildings.



Site shadow map

Site & tunnel view opportunity

This segment of the tunnel has a very good connection to the outdoor environment. The windows on the wall provide good view ports as well as natural lighting. The view shed, the blue area, at this site are only the parts between the two windows of the tunnel. Inside the tunnel, the space has mixed natural and artificial lighting.



Site view opportunity map

Tunnel view

Conclusion

The site/type 3 tunnel has a very good visual connection with the out-door environment. While it acts as a bridge between the two buildings, it also acts as a barrier between the west and east side gardens. Any future development should treat the west and east side gardens and tunnel as a whole site, and include universal access to the second floor of the Max Bell Centre from the east garden.

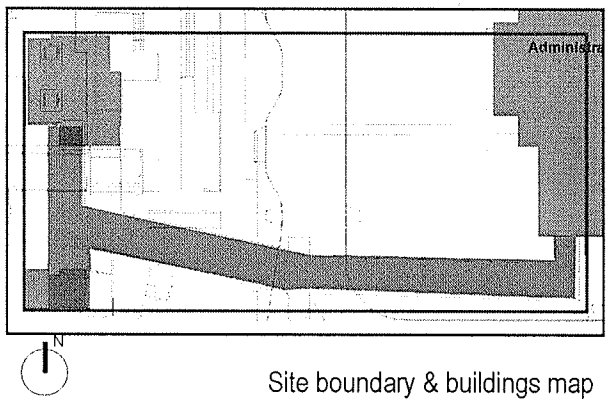
3.5.4 Site/type 4

Site/type 4 is located at the west side of the Adminstration Building and east side of the UMSU centre. This is the central area of the campus. There are two entrances to the tunnel on the UMSU side, one from the UMSU centre itself and one from the Engineering Building. There is one entrance on the Administration side. These three buildings represent the history and change that has occurred on this campus. The Administration Building was built in 1912; UMSU in 1969; the new envelope for the Engineering Building (finished in 2006) represents the most modern building style.

Environment view of site 4

Site boundary & buildings

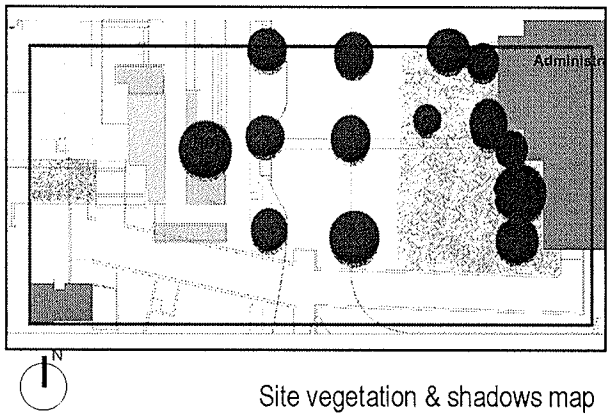
This map includes the space between these two buildings as well as tunnel's location. The dark gray area at the east side is the Administration Building; the dark gray color on the west side are structures.



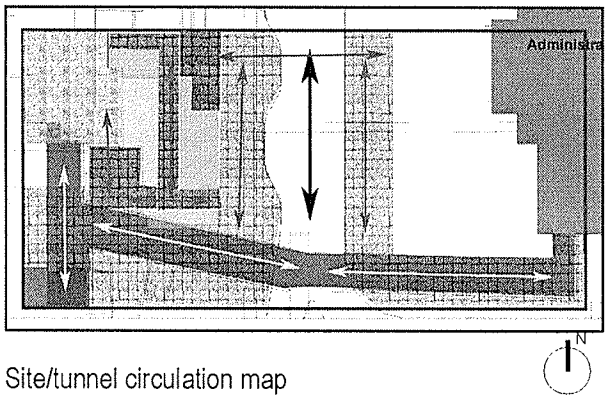
Site boundary & buildings map

Site vegetation & shadows

This map shows the vegetation and the shadows it creates. Most plants are at the fronts of these two buildings. The Administration Building has more plants.



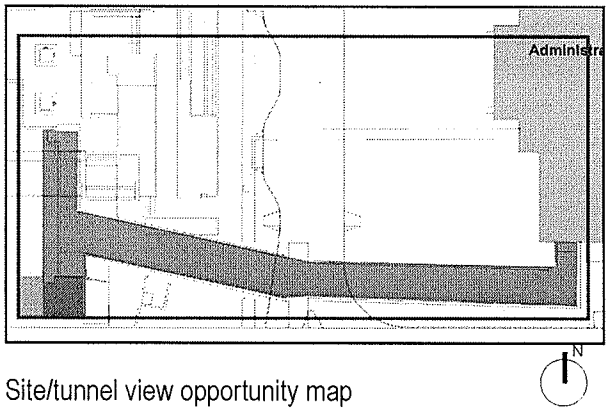
Site vegetation & shadows map



Site/tunnel circulation map

Site/tunnel circulation

The site circulation is very open with the multi-directional walking. There are walking paths in front of both buildings and a road way between the buildings, allowing drop off/pick up and parking. This site also provides a two level walking path for entry to the UMSU centre. The circulation on this site is complicated with multiple level and universal access/ramps. The yellow double arrows illustrate the tunnel circulation. The path is very straight and single directional.



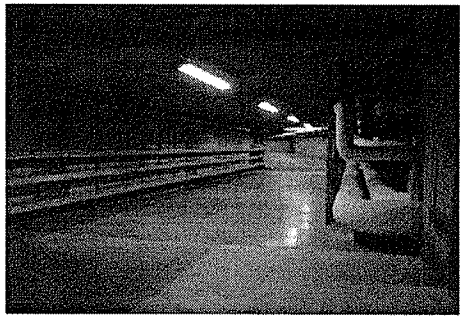
Site/tunnel view opportunity map

Site & tunnel view opportunity

The map shows that the view opportunity on the site is quite open, no blue color shows the view shed. The site has a wide, multi-directional view angle. However, the tunnel view (blue area) opportunity is very limited.

Conclusion

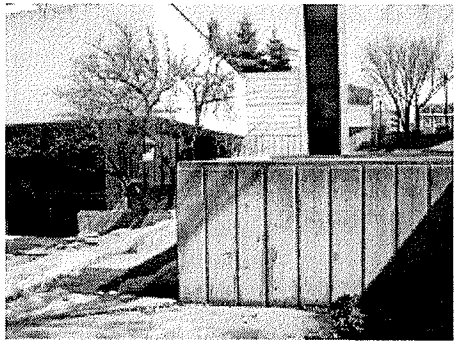
Site/type 4 is an open site that is complicated because of its many layers. It is at the centre of campus. It represents this campus's evolution through time. The future development should provide more opportunities that would encourage more social activities because of the significance of this site.



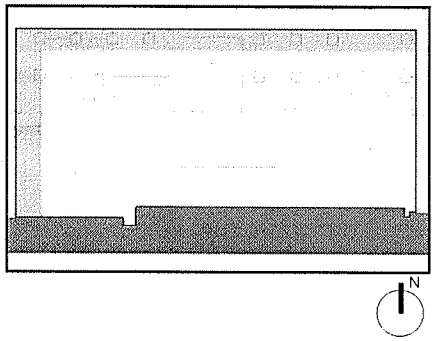
Tunnel view

3.5.5 Site/type 5

Site/type 5 is situated between the Engineering Building and the UMSU Plaza. This segment of tunnel is under the UMSU plaza and allows the educational, commericial and social interaction. It is the largest public indoor space on this campus. The extended seating area next to the windows introduces nature to this sapce year round.



Environment view of site 5

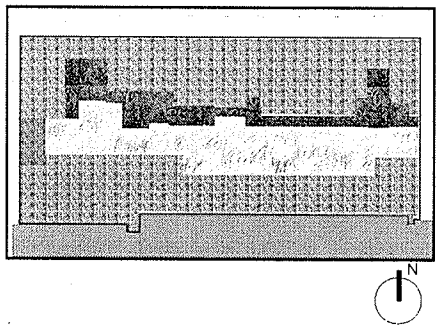


Site boundary & buildings map

Site boundary & buildings

This site includes the space from the north side of the Engineering Building (in dark gray color) to the south side of the UMSU Building. The red line illustrates the site boundary with the tunnel shown in a blueish gray color.

Site land form/land use

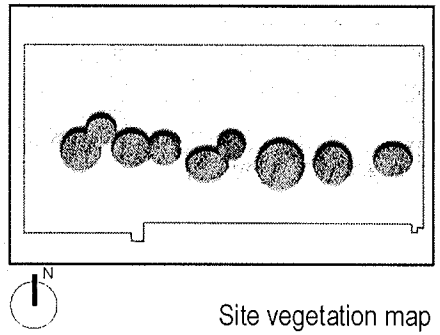


Site land form/land use map

At this site the exterior and interior are strongly connected. It is the only site that has significant commercial development. There is an out-door walking path (the dark gray pattern in the middle) connected with the tunnel through doors. Large windows give a clear view to the exterior as well. There is a ground level walking path (the lighter gray pattern area) parallel to this below-grade walking path. Not only does the difference in elevation separate the two paths, there is a physical barrier in the form of a concrete wall enclosing flower beds (the green grass pattern).

Site vegetation

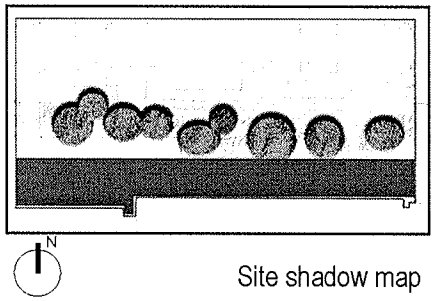
The vegetation runs down the middle of the site. It is contained in the concrete barrier structure.The vegetation consists of shrubs, grass, flowers and trees.



Site vegetation map

Site shadow

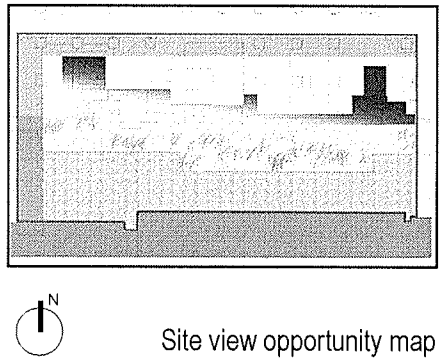
Shadows on this site are affected by the Engineering Building and the trees. The dark, gray color at the south side is the building's shadow.



Site shadow map

Site & tunnel view opportunity

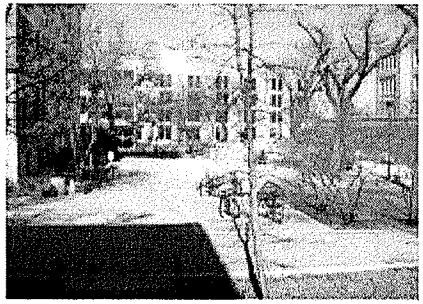
This site has a well developed view connection from the interior tunnel space to the out-door sunken garden; however, the below grade walking path is not well connected with the ground level walking path, the blue area shows the view shed on map. Inside the tunnel, there are several places that allow people to look outside. The shops along the two sides of the tunnel path provide rich views.



Site view opportunity map

Tunnel view

Site/type 5, one side has a visual connection with the outdoor environment and provides an excellent opportunity to enhance the connection with the exterior environment. The high density of people walking and sitting in this space provides a very good basis for commerical activity. Future development should improve the quality of this tunnel segment's experience. For example, the sunken garden does not attract many visitors because it is isolated and disconnected from the main focus of activity. As well, there are no visual signals to alert walkers to the presence of the garden.



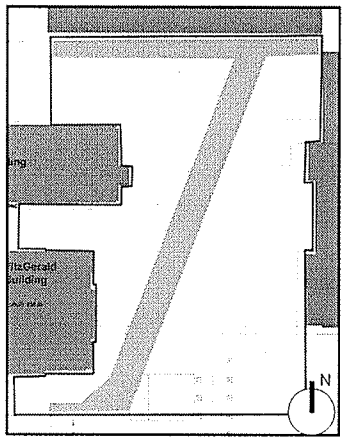
Environment view of site 6

3.5.6 Site/type 6

This tunnel is an important path for walkers from the UMSU centre to the Buller Building and other buildings at the north side of the campus. It has some similarity to type 4, except that it has a thinner ceiling layer. This site has a visual connection with the UMSU plaza at the north-east side and is impacted by UMSU activities; however, this area is enclosed by buildings which provide separation from UMSU.

Site boundary & buildings

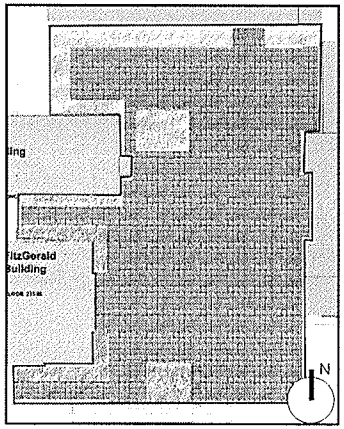
Site/type 6 is a courtyard located at the north side of the UMSU centre; east side the FitzGerald Building, (the School of Fine Arts), and the Pharmacy Building; south side of the Allen Building; the west side of the Buller Building. The boundary of this site is shown by the red line.



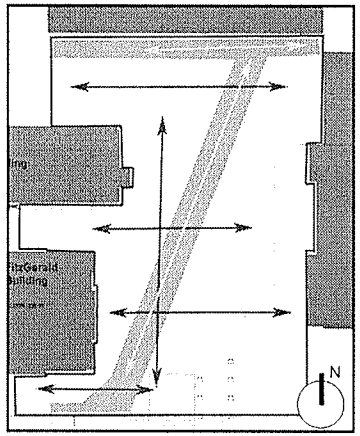
Site boundary & buildings map

Site land form/land use

There are only two land forms on this site. The gray pattern shows the paved walking path of this courtyard. The green pattern inside the red line are the flower beds.



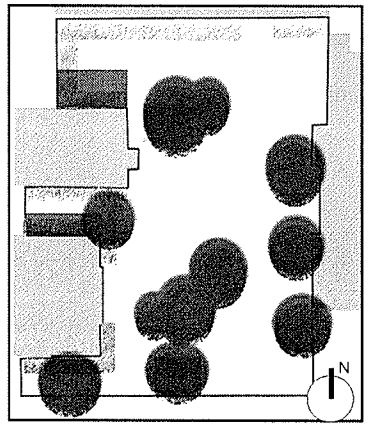
Site land form/land use map



Site circulation map

Circulation

This map shows circulation on the site and in the tunnel. The purple double arrowed lines represent the site circulation, while the yellow double arrowed line shows the tunnel's circulation pattern.



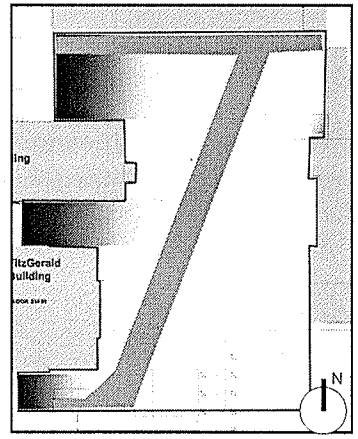
Site vegetation map

Vegetation

There are flower beds around each building. These flower beds also have trees (shown in dark green color). There are trees (dark green color) in the middle of the seating area. This site's shadows are from plants and buildings. The dark gray area indicates shadows.

Site & tunnel view opportunity

This site has very open views except the blue area, the view shed area has the limited view angle in between the two buildings. At the south end, the view from the UMSU centre takes in the whole site. Inside the tunnel, there is only one view direction, looking straight ahead to the end. This tunnel has no openings to the exterior, consequently the future development should open an opportunity to create a view to the outdoor environment.

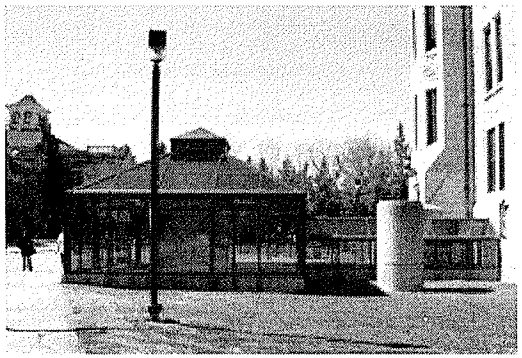


Site & tunnel view opportunity map

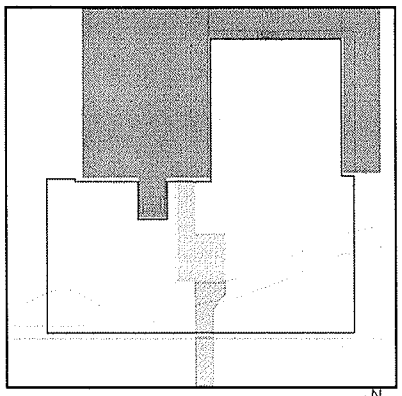
Conclusion

Currently, this site has no sense of place. It can be anywhere on campus. Components of this site are disconnected, seating is isolated to individual pieces. Future development would be directed at creating a gathering center, which would unite those pieces as a place. Plantings at this site provide enough shade for people to enjoy the outdoor space. The space in front of the Fine Arts School has the potential to provide an area for quiet discussion and reflection. The shade and good view opportunity in this space offer the potential to develop this area as a

Tunnel view



Environment view of site 7



Site boundary & buildings map

center. Future development should emphasize this center space and connect the above ground space with the underground space, while maintaining the site's existing uses.

3.5.7 Site/type 7

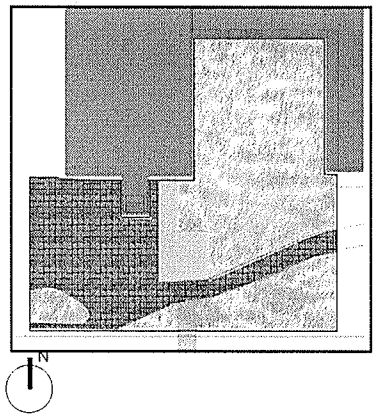
Site/type 7 faces the main bus stop and is situtated in front of the Tier Building. This segment of tunnel is a transportation node which connects two tunnels at different levels: one is an extended tunnel from the Tier Building at ground level; the other is from the underground tunnel to the Law School. This segment has a glassed ceiling and large windows making this segment very popular year round.

Site boundary & buildings

The red lines illustrate the area of this site which includes the north-east side garden, walking path to the main bus station, and front yard of Tier Building.

Site land form/land use

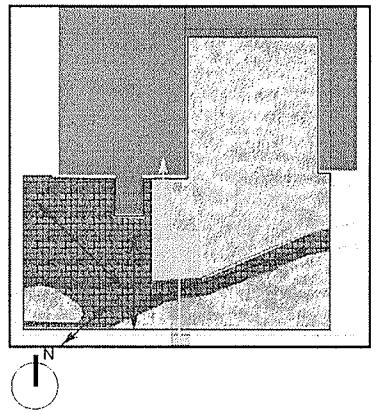
This is an open flat site with a large paved pedestrian area, indicated as the gray pattern on this map, and lawn as the green pattern.



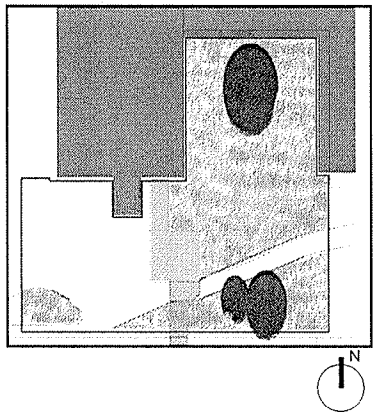
Site land form/land use map

Site circulation

This site's path is basically in an east/west direction (see the purple double arrowed lines). The south boundary is a oneway road way heading west, heavily used by buses. Pedestrians randomly cross this road. On this map, the gray color shows the tunnel location. Tunnel's walking circulation are shown in yellow.



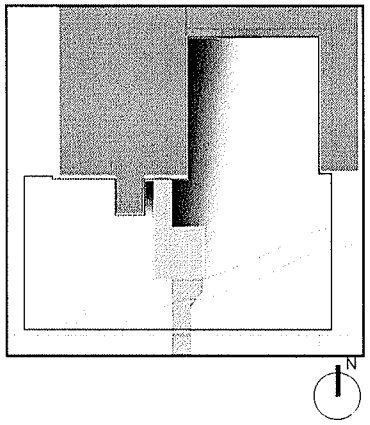
Site circulation map



Site vegetaion & shadows map

Site vegetation & shadows

The plants are located at the north-east side of the tunnel. The yellowish green color illustrates the grass location. the dark green color shows the plant locations. Basically, this is a very open site with very limited shadows caused by the trees.



Site & tunnel view opportunity map

Site & tunnel view opportunity

The view opportunities at this site are open and wide. Outside this tunnel, the site is largly open and few corners have view sheds (blue area). The tunnel has wide windows on the walls, providing an unlimited view.

Conclusion

The site/type 7 provides an excellent opportunity to connect the tunnel with the out-door environment. In fact, they are already connected. However, the connection to the environment has not been well developed. Future development should focus more on the north-east side garden.

Tunnel view

4.6. Conclusion

All in all, these seven sites/types are varied in their spatial traits, locations, vegetation, sunlight penetration opportunities, circulation patterns and view opportunities. The analysis of each site provided background for the succeeding stage — the design approach. The analysis of these seven sites/types is an attempt to capture the variety of conditions on this campus. The more conditions that are identified and analyzed, the more complexity is possible in the final design stage. This encourages the consideration of a range of approaches to address each site's individual issues. The existing conditions also reveal what is lacking with respect to a public space at each site. The designs for these spaces should all respond to people's physical and emotional needs and activities, such

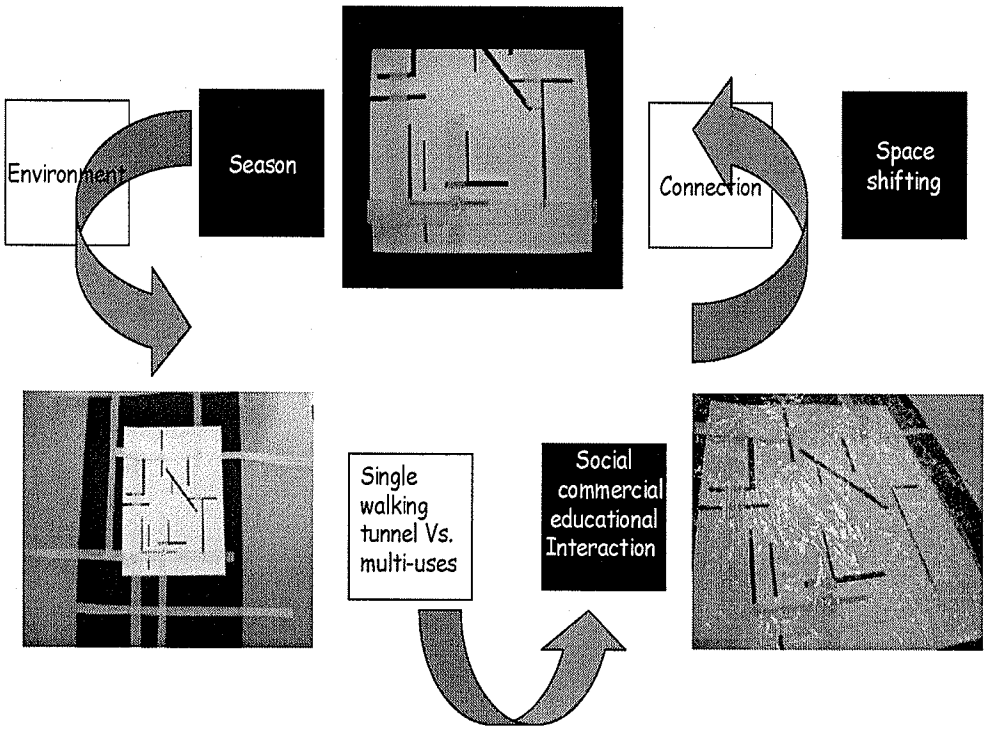
as wondering, pausing, sitting, talking, gathering, and watching as well as issues of directed circulation. In exploring humans' social needs within the context of the tunnel conditions, it became apparent that there were three primary areas to address:

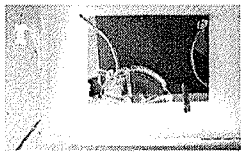
1.the need to create a friendly environment within a harsh seasonal climate;

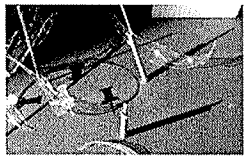
2.the need to build connection between the underground level's interior space and the above ground's exterior environment; and

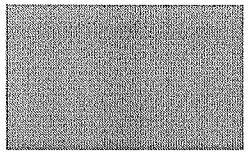
3.the need to infuse the social, commercial, and educational functions into a single walking tunnel system.

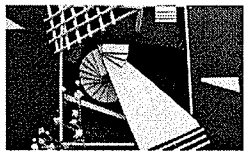
In approaching the design for these tunnels, the key is to understand the relationship between these three areas of consideration. There is no simple answer as to how to develop such below ground spaces. The complexity in developing these tunnels involves not only the action of "glueing"/opening/connecting two levels of space, but also the creation of friendly, year-round public spaces in sync with a modern lifestyle that is subject to energy and climatic constraints. In order to develop the underground pedestrian tunnel into a public social, commercial, and educational space, as illustrated in the next chapter the design is an attempt to push the envelope and shift thinking in terms of space, the environment and social, commercial, and educational interactions.

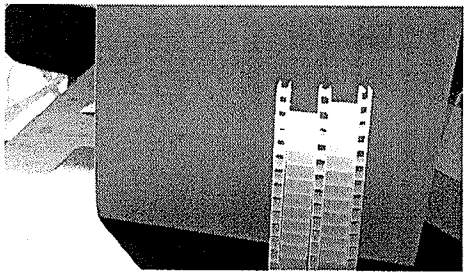

Environment
Season
Connection
Space shifting
Single walking tunnel Vs. multi-uses
Social commercial educational Interaction









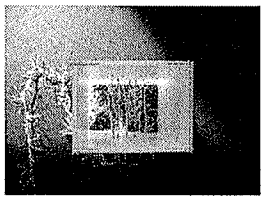
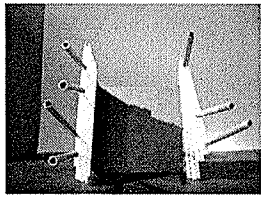
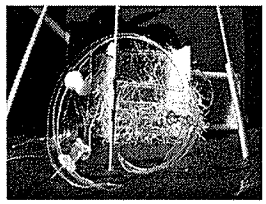


5. Design

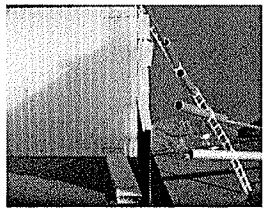
5.1. Conceptual design study for seven sites/types

In developing the conceptual design material from the previous section the following was taken into account: precedents in geo-space design, site analysis issues, and the design opportunities and constraints generated from the analysis. From this, it was decided to focus on spatial traits and lighting opportunities within the Geo-landscape. This decision resulted in a number of questions that needed to be asked.

- How can a tunnel become a Geo-landscape design space?
- How can sunshine penetration play a key role in both the tunnel, Geo- space, and the outdoor environment?
- What kind of design strategies can be applied to link the tunnel space to the outdoor environment?

Based on the features of these seven locations, the following conceptual spatial studies explore these questions in the manner of spatial language. They are abstract, elegant rather than practical.



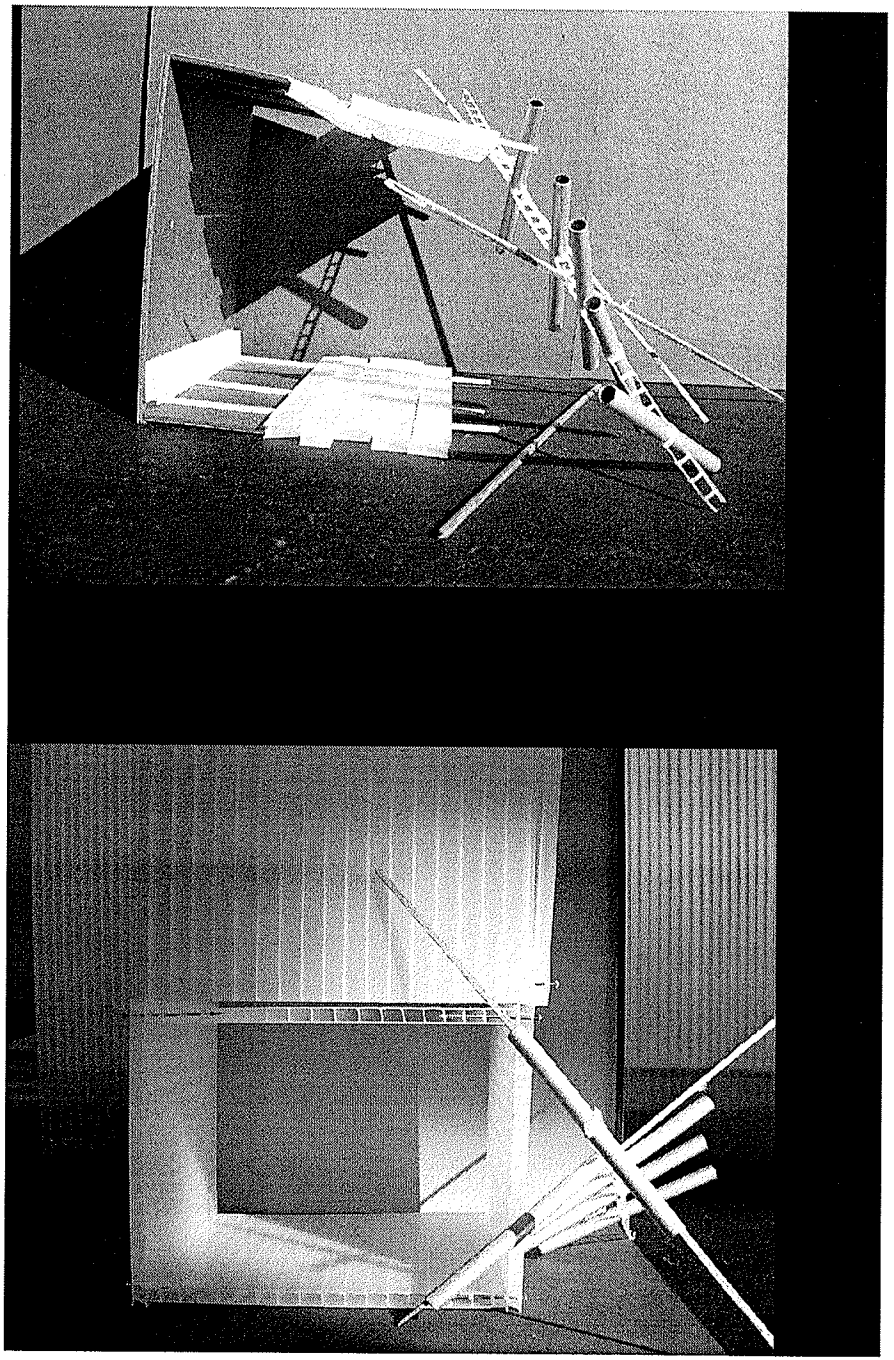
Study 1: Site 1

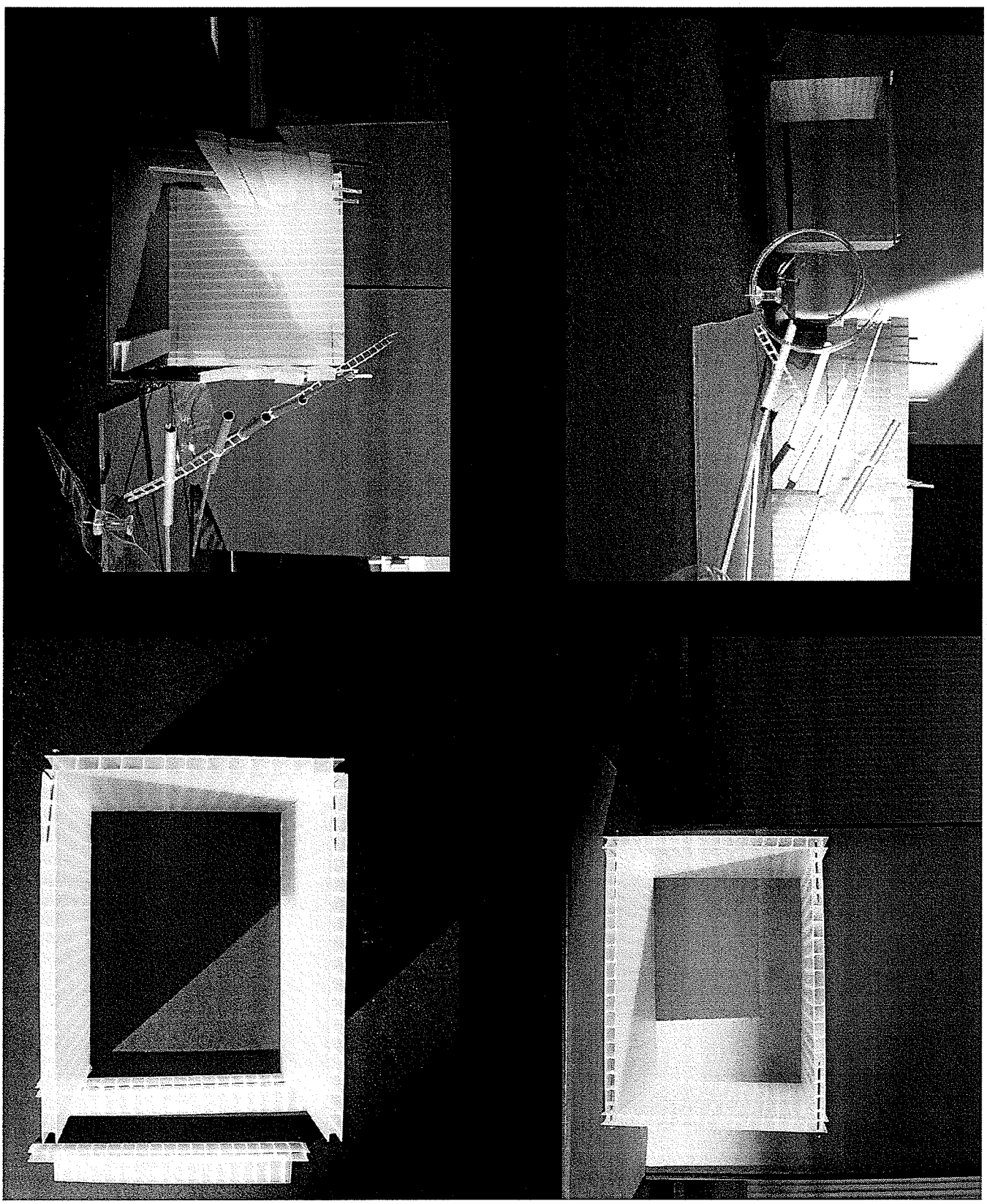
Spatial topics:

- Openness and enclosure
- Out-door environment as part of indoor space.
- Entrance landmark
- Connection & separation

Lighting topics:

- Sunlight pertretation
- Translucent or opaque wall material affecting sunlight
- Light & shadows
- Framed (controlled) sunlight vs. unconstrained sunlight





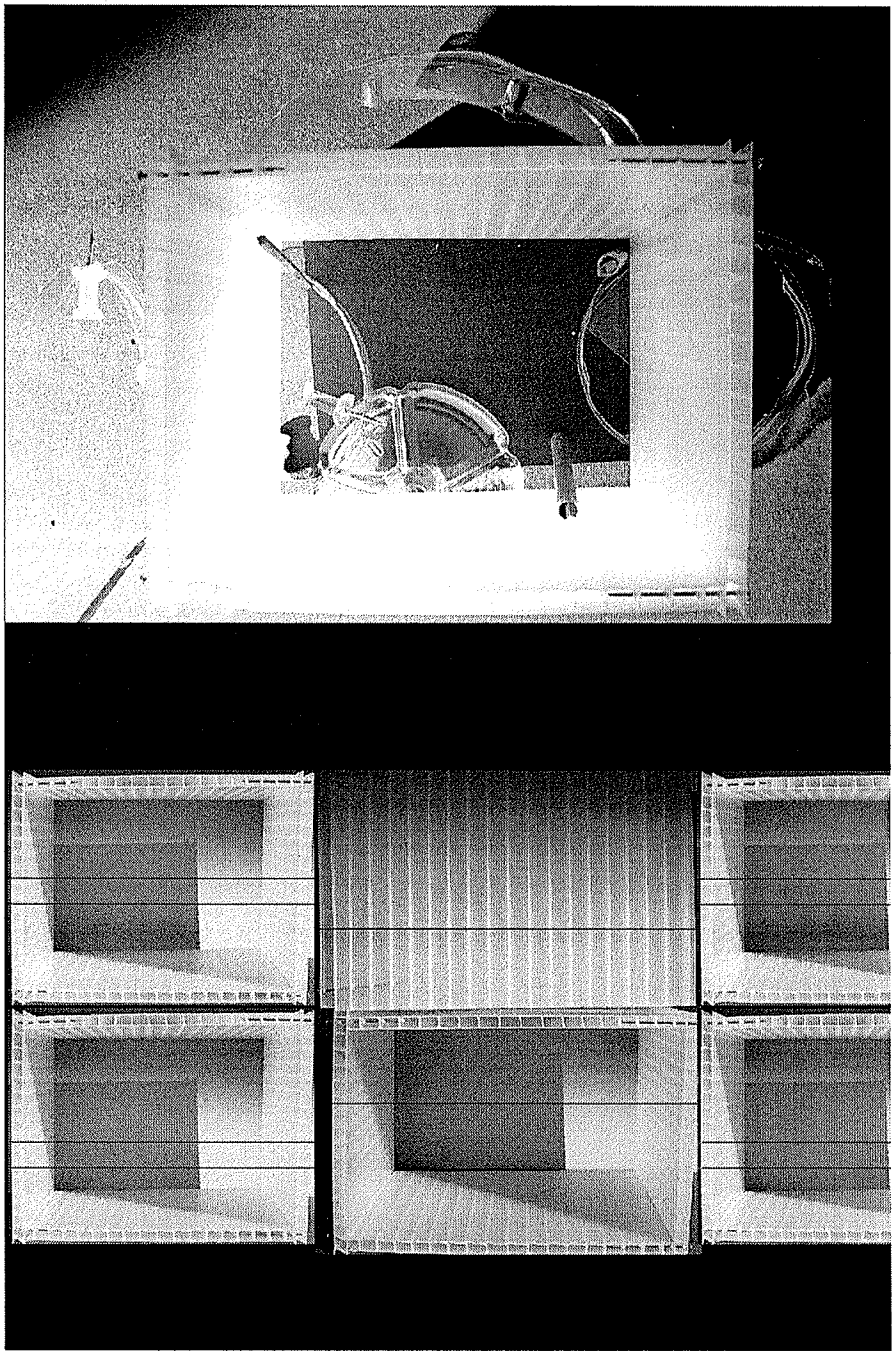
Study 2: Site 2

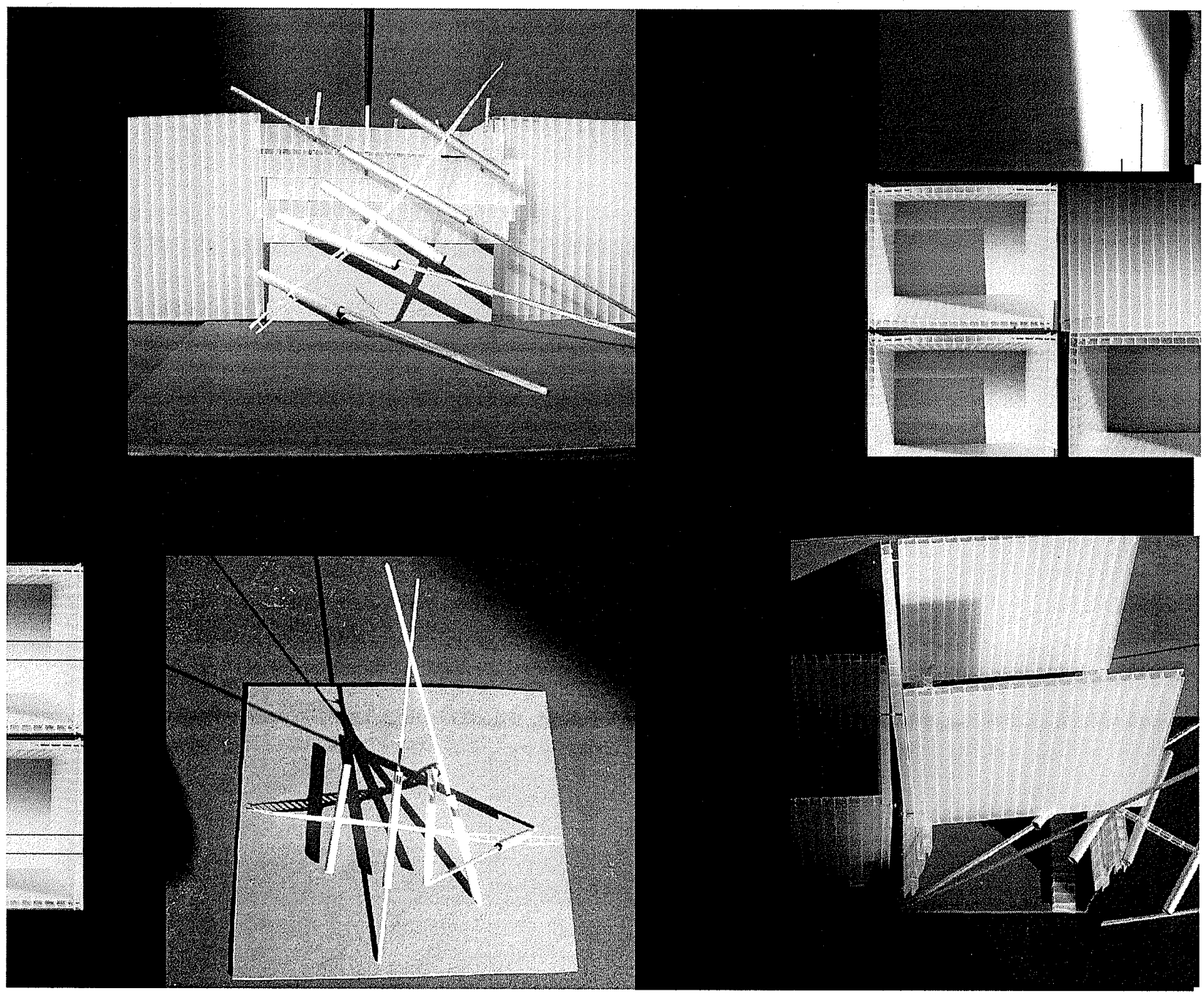
Spatial topic:

- Entrance landmark
- Movement inside the tunnel space

Lighting topic:

- Light transferance
- Translucent materials vs. opaque materials
- Light & shadow





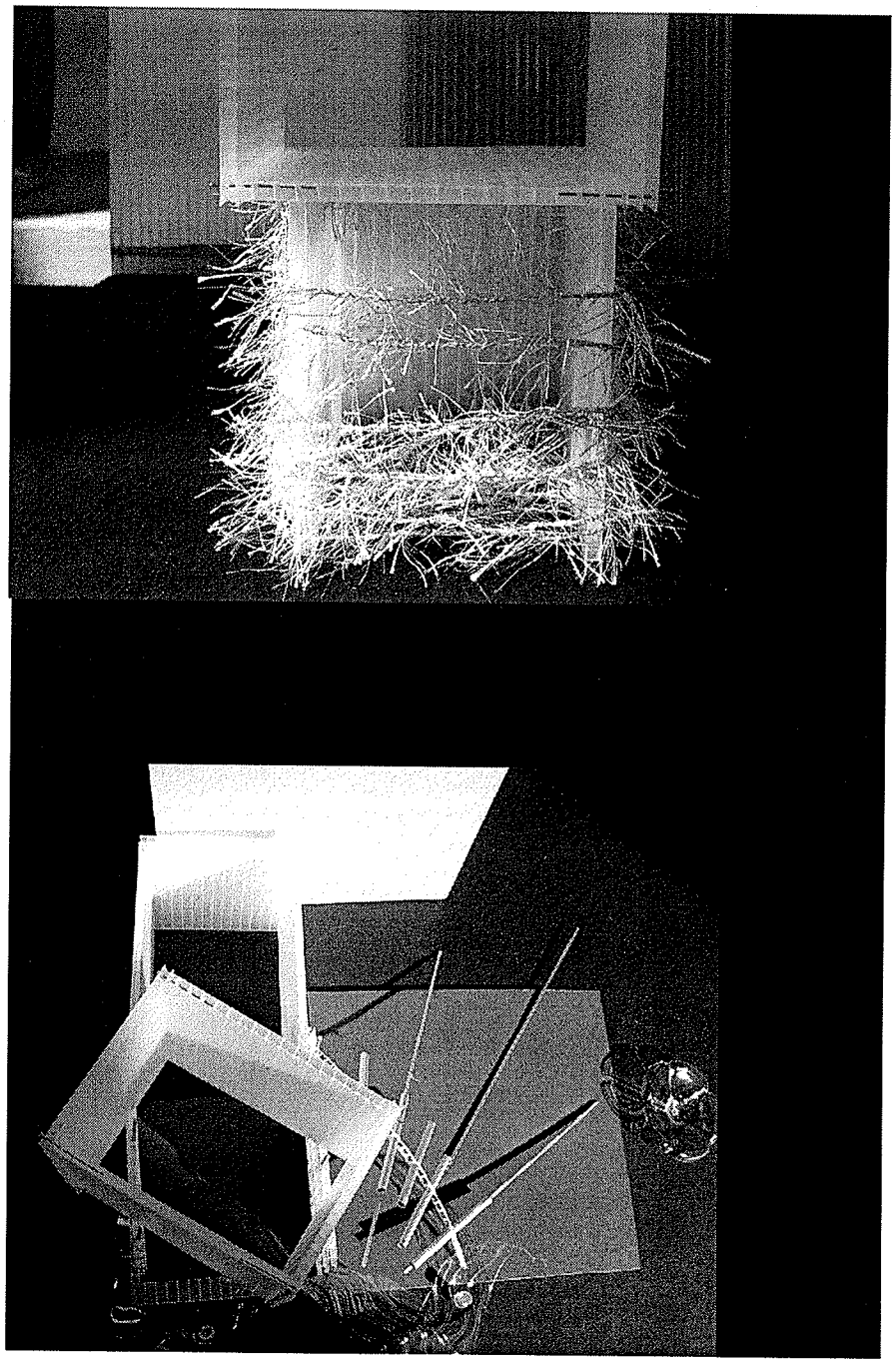
Study 3: Site 3

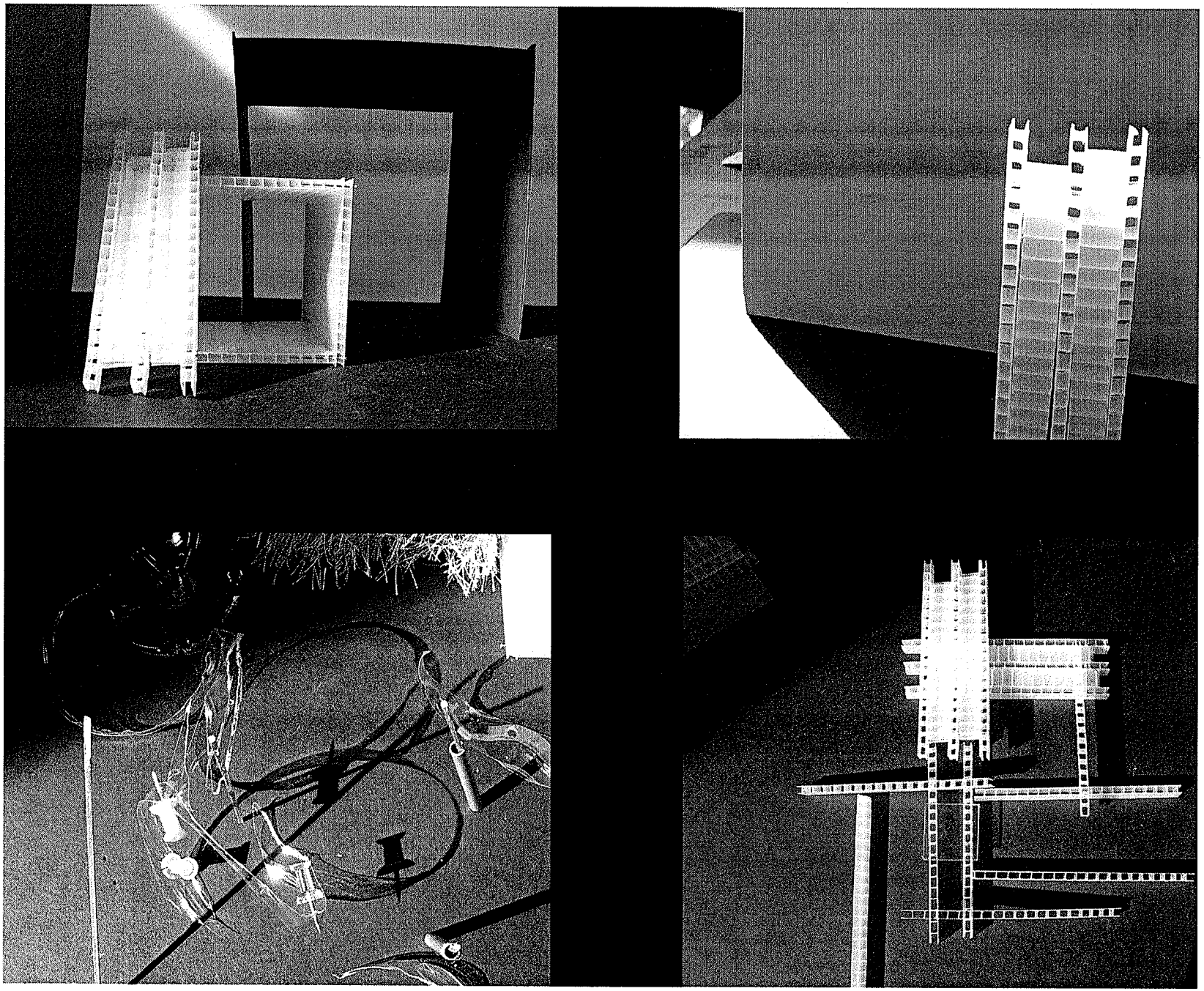
Spatial topic:

- New space creation through introduction of different lighting and materials.
- Movement order
- Lines, curves
- Entrance landmark

Lighting topic:

- Tunnel space/geo-space under full sunlight
- Lighting impact on different materials within this geo-space
- Lighting & Shadows





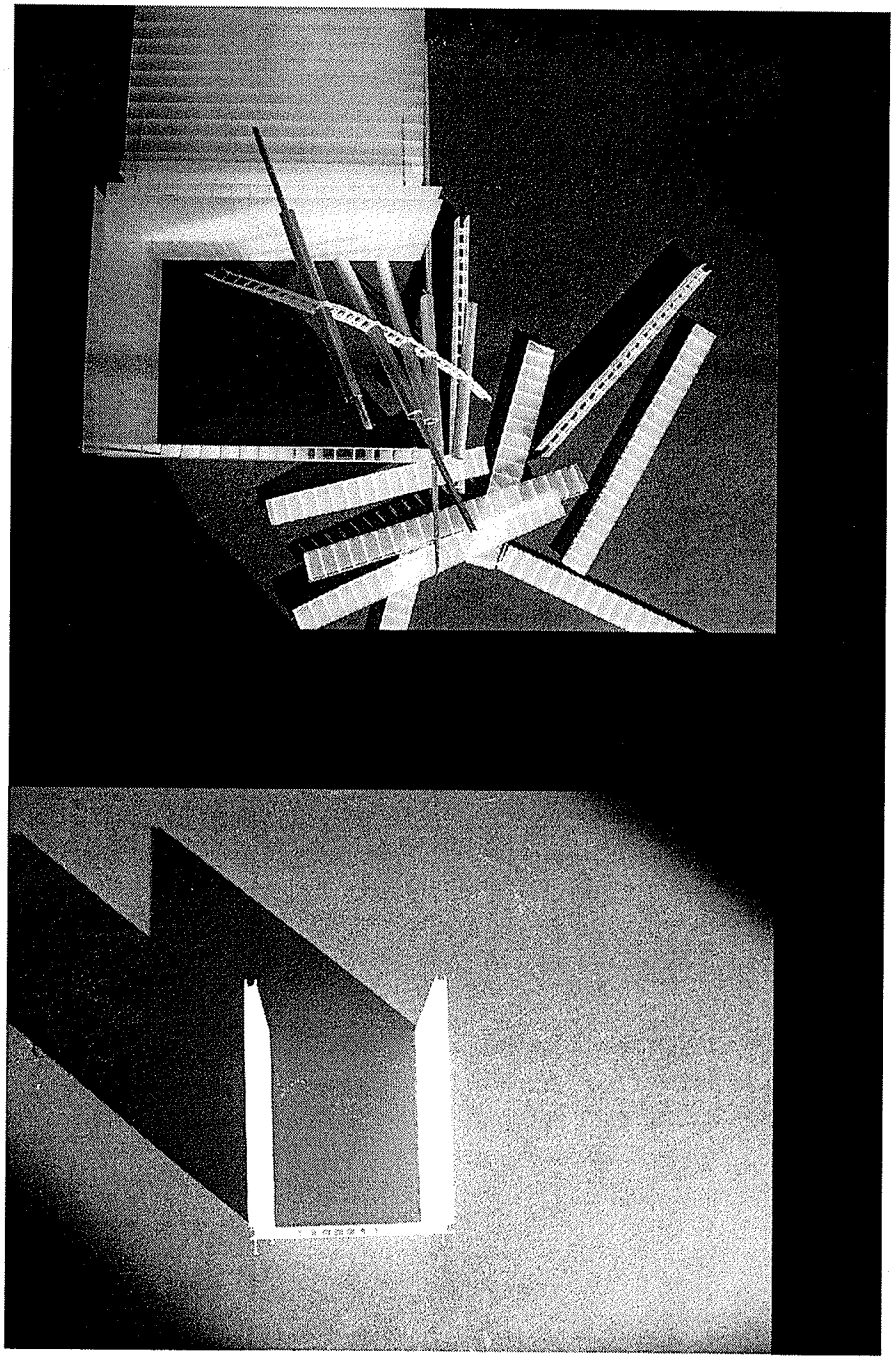
Study 4: Site 4

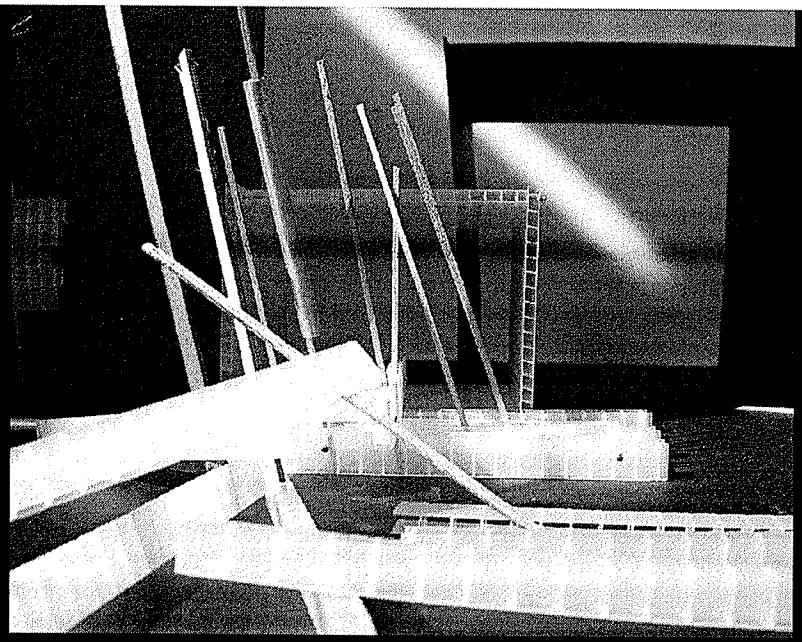
Spatial topic:

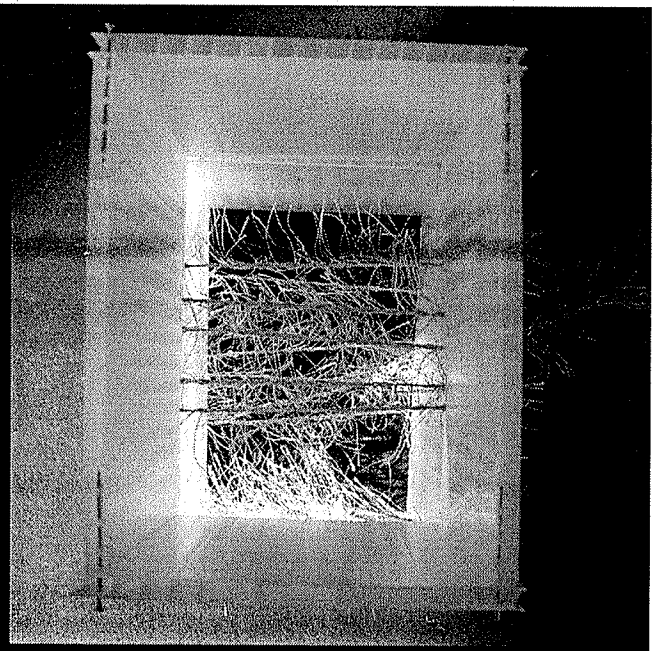
- Order of movement
- Entrance landmark
- Collection vs. dispersal points

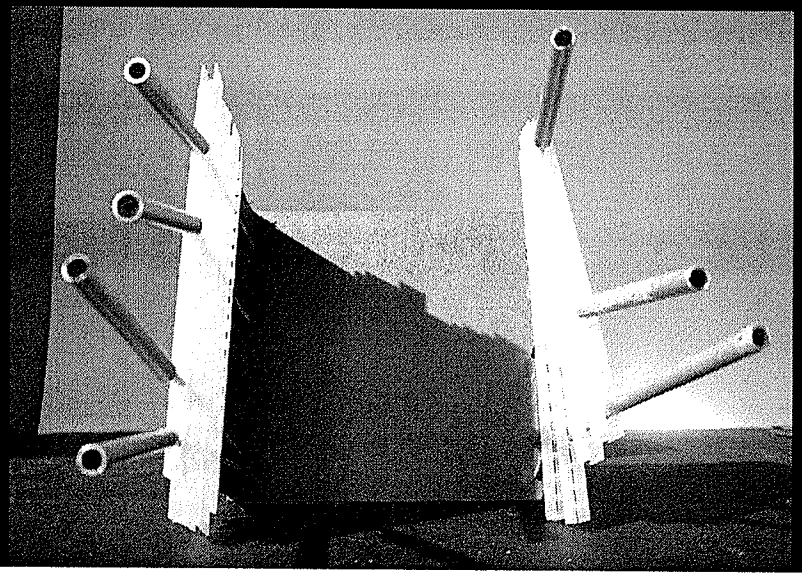
Lighting topic:

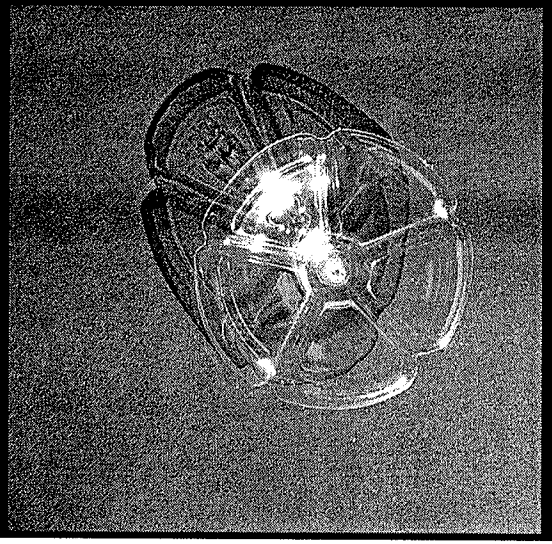
- Translucent material











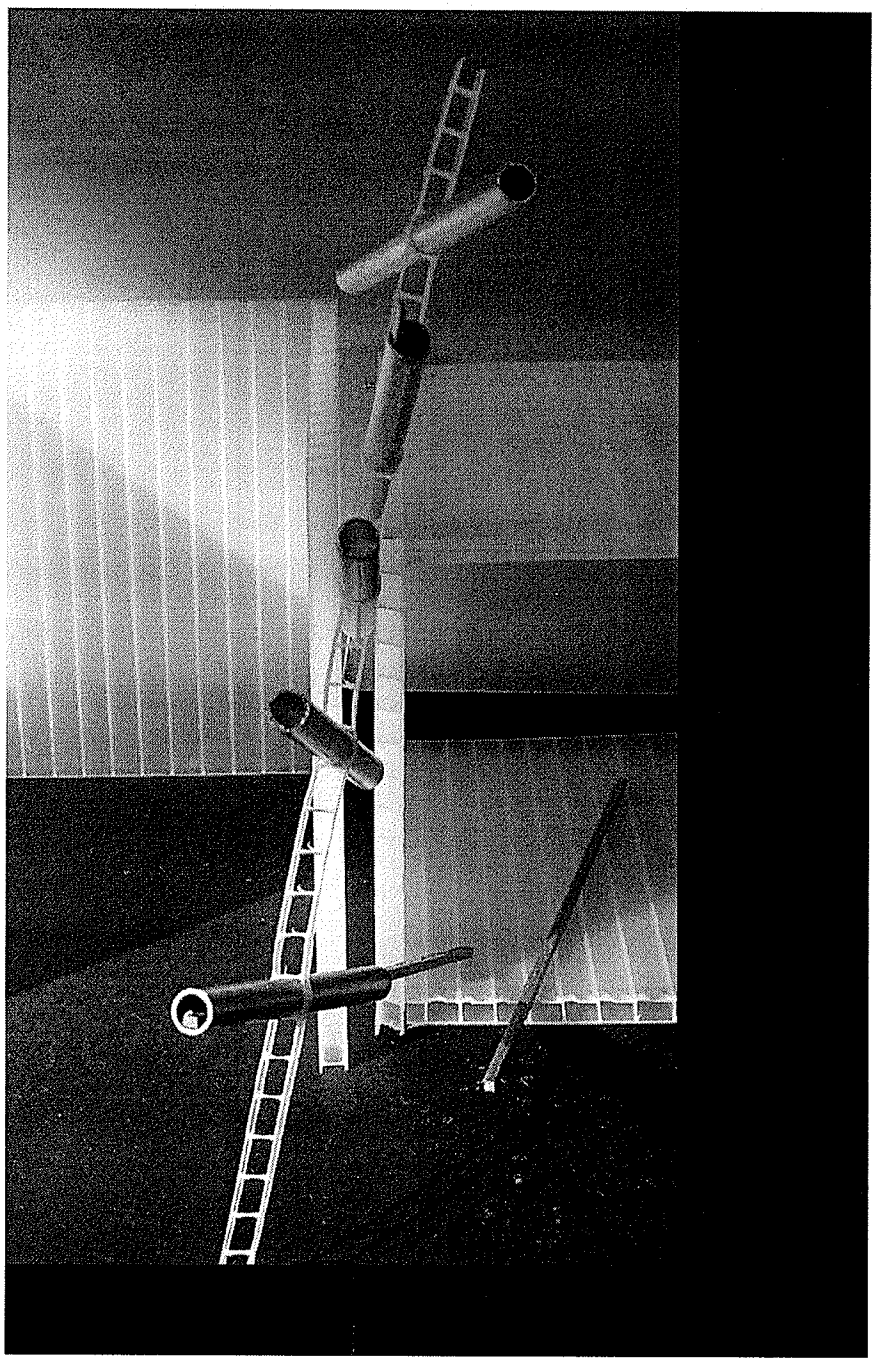
Study 5: Site 5

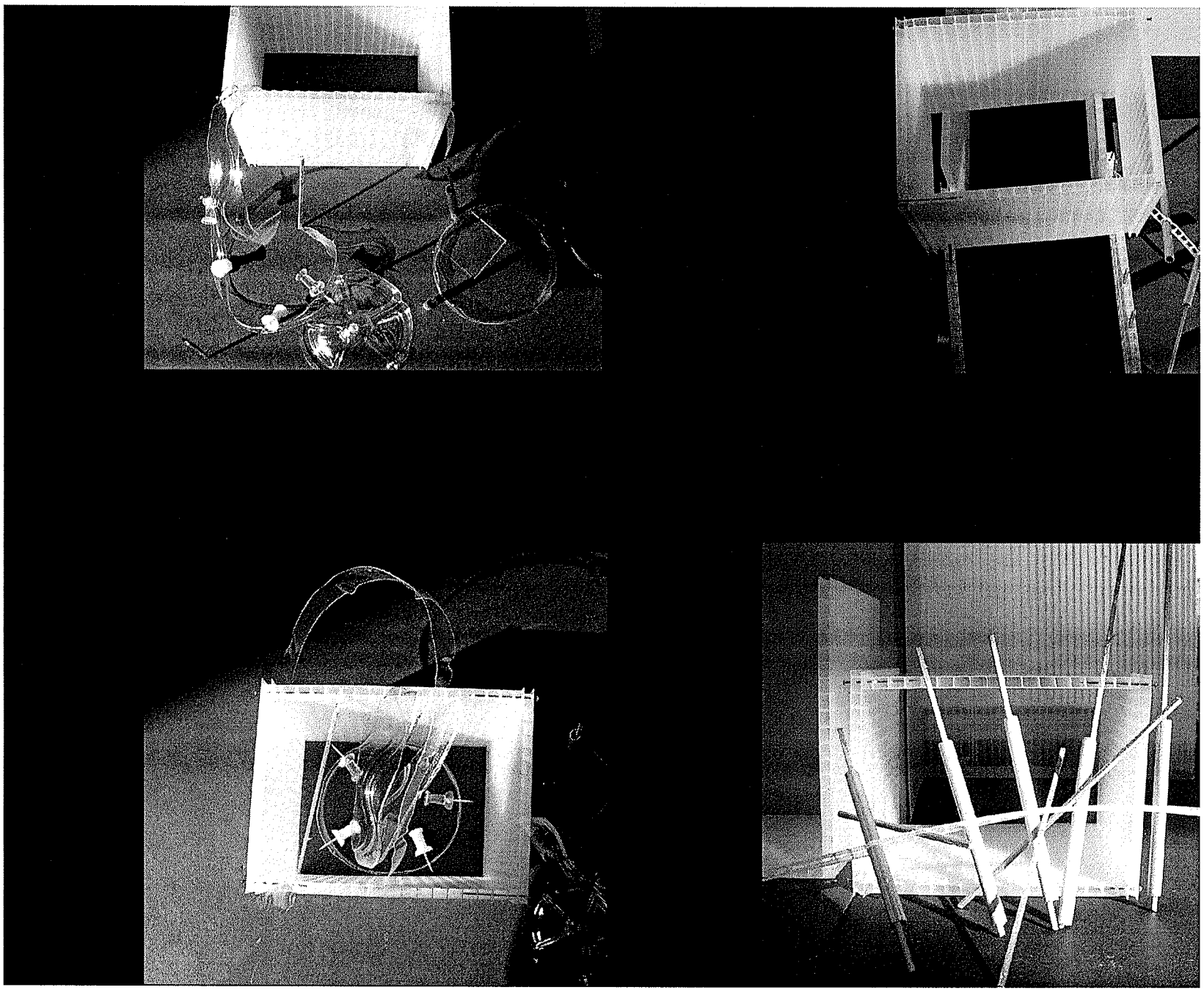
Spatial topic:

- Movement in the tunnel space
- Elements intruding into/intersecting tunnel space
- Space within other spaces

Lighting topic:

- Design within a limited lighting regime
- Lighting with translucent materals





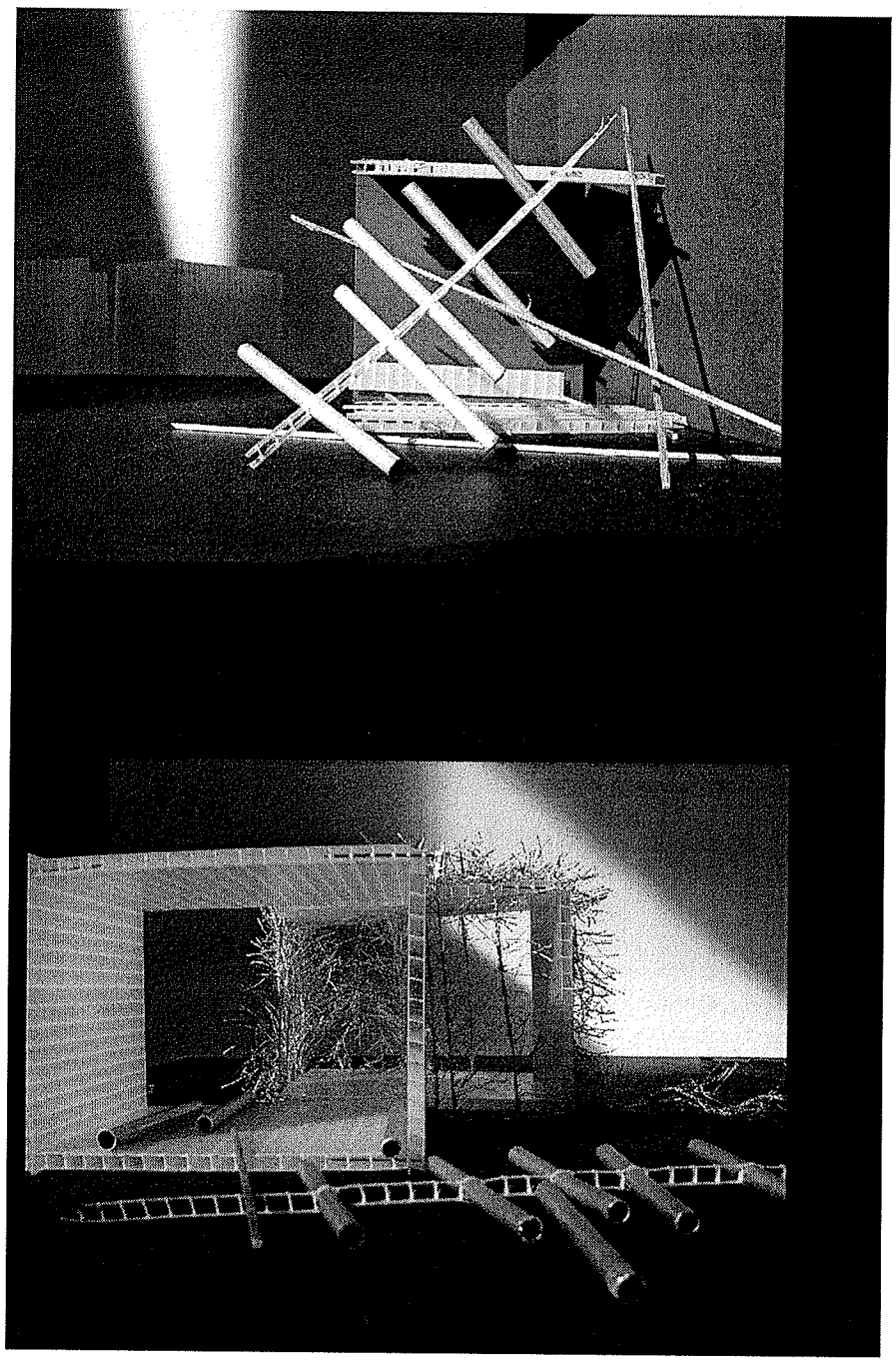
Study 6: Site 6

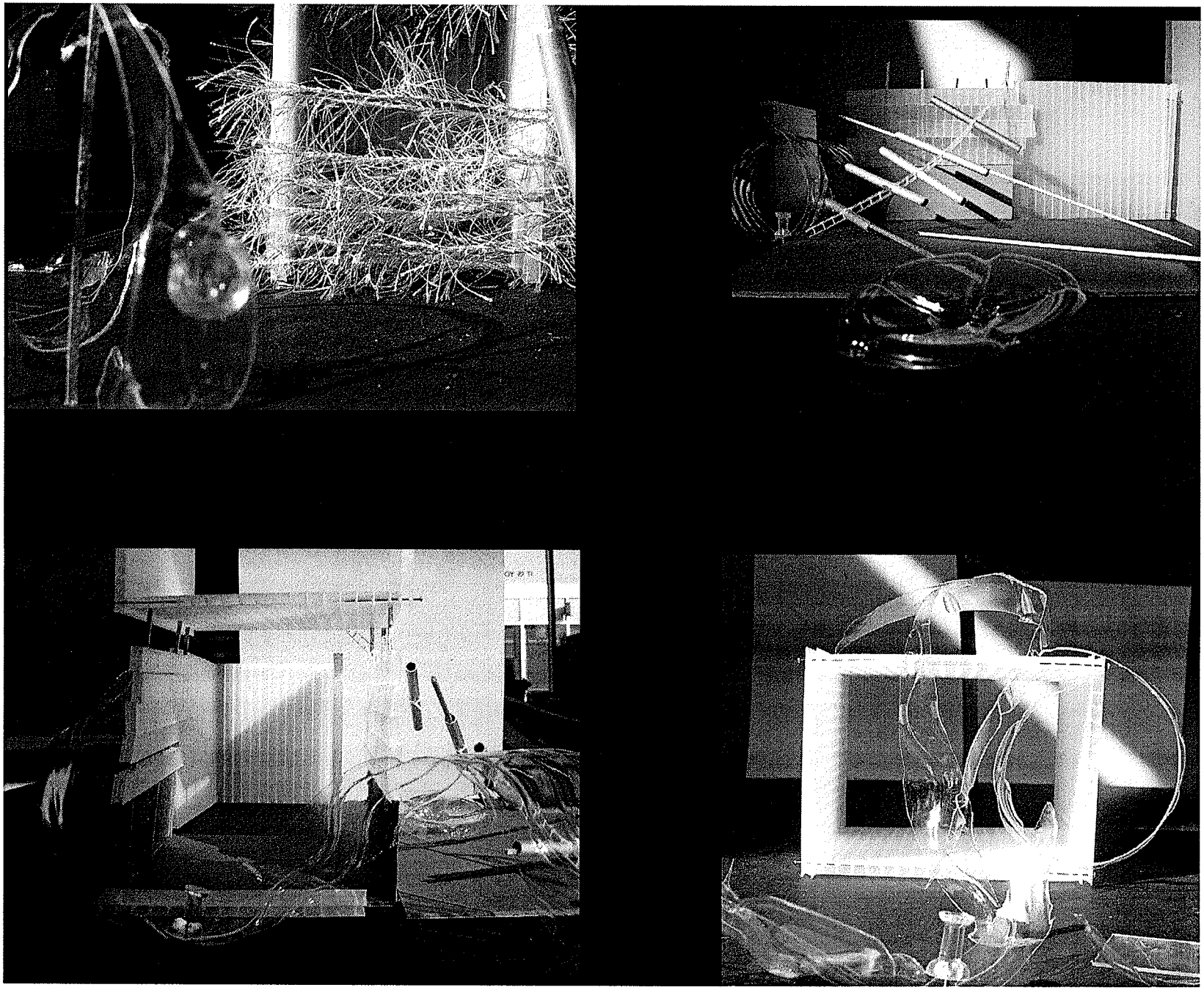
Spatial topic:

- Design elements into tunnel space
- Deconstruct tunnel space
- Connect deconstructed tunnel space with outdoor environment
- Landscape structure within tunnel space

Lighting topic:

- Light vs. shadow





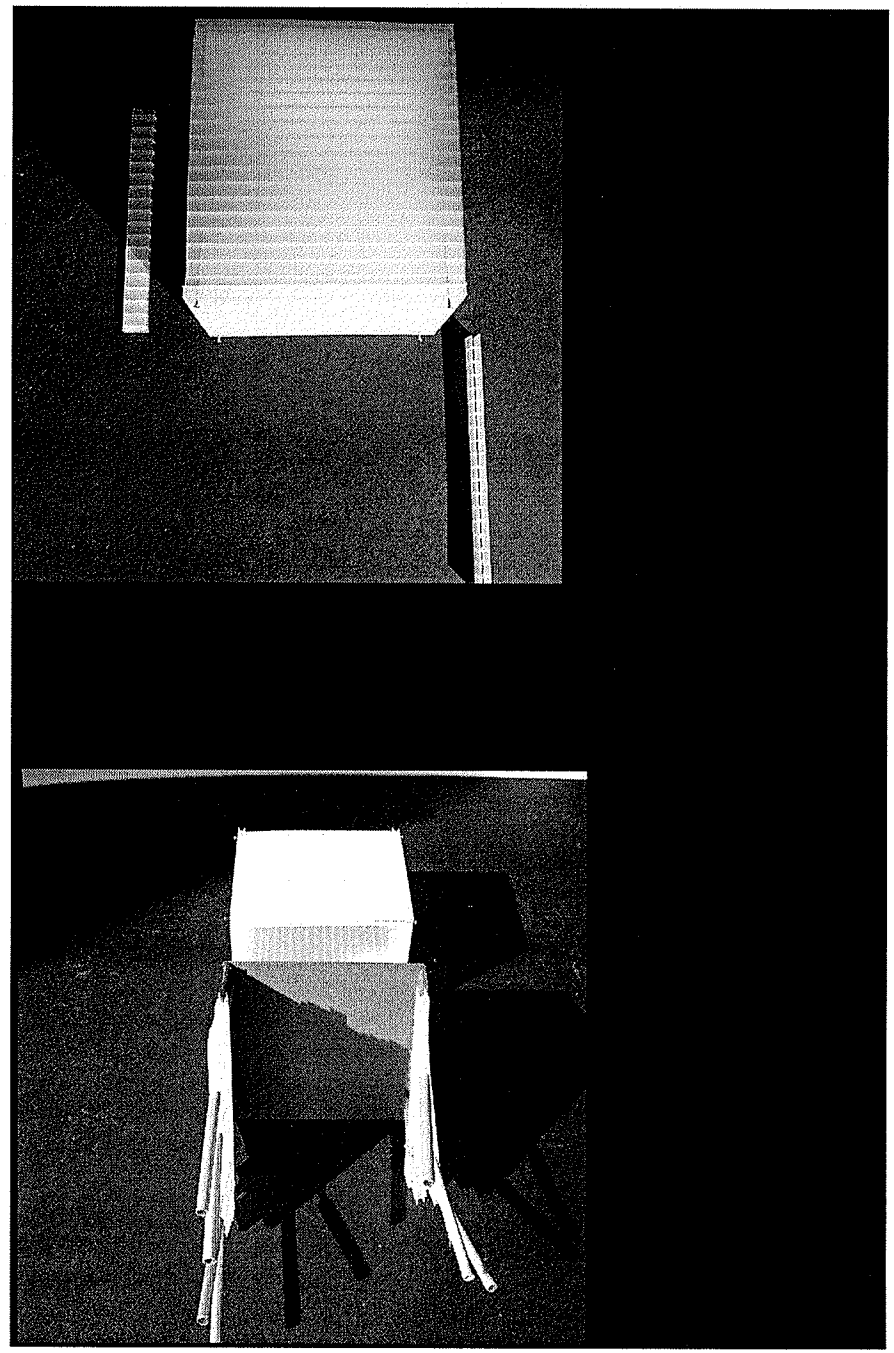
Study 7: Site 7

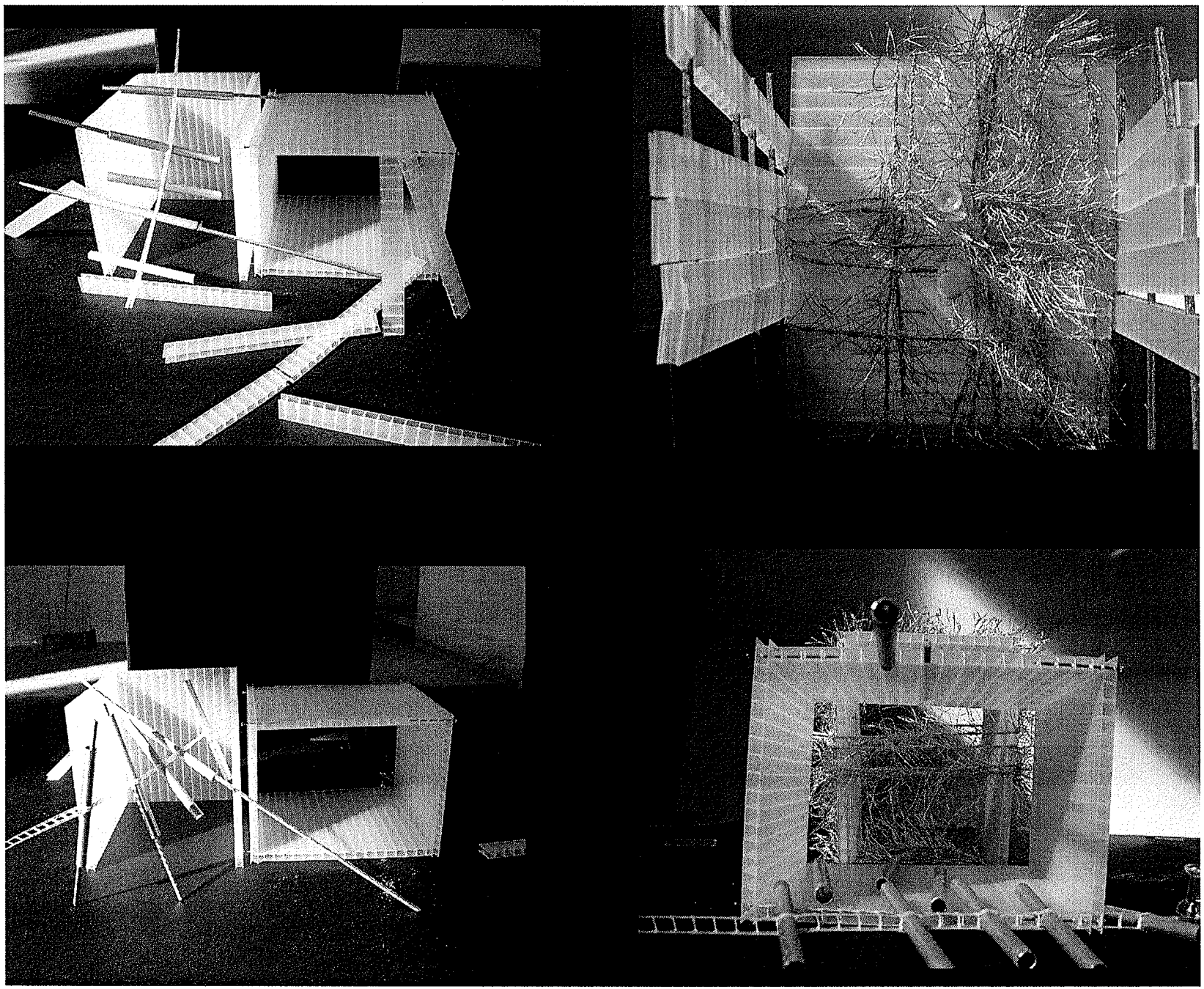
Spatial topic:

- Landscape structure connected to tunnel space
- Movement & order
- Reflective material

Lighting topic:

- Material reaction with the lighting
- Plants as a lighting frame





5.2 Design strategies for seven sites

The development in these types of tunnel/geo-space is intended to build a "walking heaven" that includes the following aspects/principles.

Place

Place is a principle that requires these geo-landscape designs have unique identities. This may include the one of physical products, such as landmarks, structures, buildings, benches, and the elements that evoke emotional experiences, memories, reactions, actions. Place as a principle of development links each site's unique context, building form, land form, history, activity and climate. The performance of place is manifested in each tunnel/geo-space as a main component of identity and is related to its outdoor environment through an appropirate technological response.

Complexity

Complexity as a site development strategy acknowledges that each site's characteristics are intricate. This may require an inter-disciplinary approach, such as a socio-cultural approach, bio-physical approach, architectural-cultural or technological-structural. This transforms the simple act of walking through the tunnel into a rich, attractive, educational, playful, walking experience.

Diversity

Diversity encourages variety. Diversity as a strategy in the geo-space/tunnel development is intended to build a cultural, natural and structural system that reflects the varied existences of this campus, the layers of spaces, the plants, lighting, wind, movement and the time changes/seasons. This design principle explores options, supported by the environment, that will foster meaningful experiences for each individual who uses this space.

Accessibility

Accessibility builds more supportive access for people with different needs, such as universal access. The easier the access for different needs the more people will use the tunnel space. This principle seeks to improve accessibility for the whole system as well as each site.

Connection

Connection implies an investigation of opportunities to link parts of the campus into a network thereby improving covenience. This includes connecting two sites together, and openning up extra access in order to improve the connection between the tunnel and an out-door environment. Connection is not only about structural connection with other sites or spaces but also connection with the social activities and with the environment.

Aesthetic integrity

Aesthetic integrity should be part of all design work. This means, as well as being practical, the design should display poetic expression. Aesthetic integrity is realized through delightful experience of the inner space and of the landscape. In the design for the university of Manitoba tunnels, this landscape design strategy heightens human enjoyment of the space.

Liveability

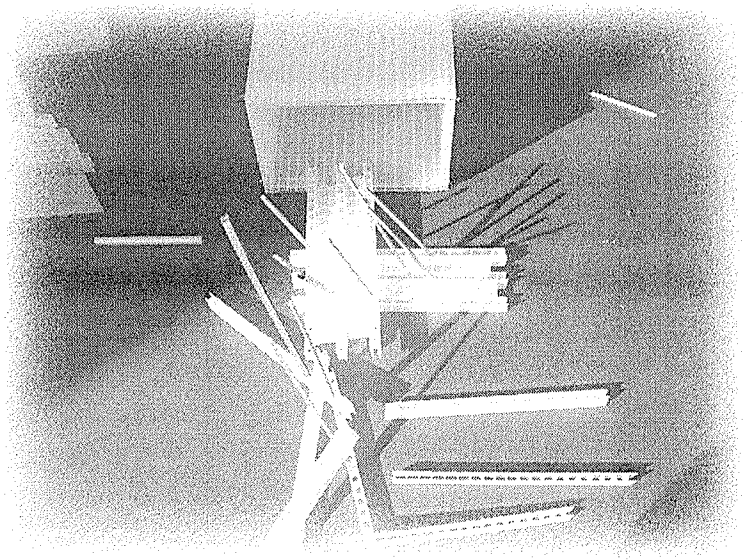
Liveability as a development strategy means developing a meaningful, supportive design for all the individuals who live, study, teach, and do research on this campus. The design seeks to improve the quality of people's social activities, espically walking as a primary way of moving alongs campus life. For this campus and this project, the development of liveability is more about improving the quality of the year-round walking experience.

Playfulness

Playfulness as a design strategy is not only required in the design forms and structures, but also the meaning or emotional experience should be playful. This is an educational site where most of the population is younger. Their views of the design is a very important dimension.

Structure

Structure as a tunnel development strategy ensures spatial satisfaction. The new structures are part of the architecture and the landscape, linking the two, thereby connecting the natural environment with the soical activities of the campus.



5.3 Designs for seven sites

This section intends to demonstrate the final design approachs at these seven locations. These designs are searching for the opportunities with the social, environmental and architectural connection and interruption rather than simply providing a landscape view or structure. These designs are based on the various existing conditions, representing the design strategies – place, complexity, diversity, accessibility, connection, aesthetic integrity, livability, playfulness and structure.

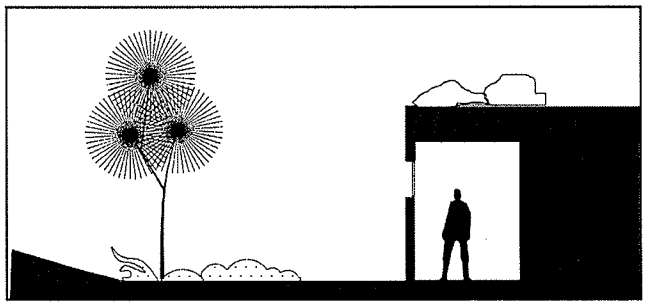
5.3.1. Site/type 1

This is the place between the Russell Building and the Engineering Building. The analysis table (Table 1) shows the opportunities and constraints at this site related to the design principles. The strength of this site is its good accessibility. The development strategy is determined is as follows:

1. Build a connection between the upper level and lower level environments and connect the tunnel space with the outdoor environment. (place, connection, livability)
2. Introduce the connectional landmark to the site. (connection, place, structure)
3. Separate the loading/drop off area and walking area. (livability)
4. Increase the sunshine penetration opportunity to the tunnel. (livability, diversity,)
5. Adjust the visual connection and walking connection. (aesthetic integrity, structure)

Table 1. Type/Tunnel 1 analysis table

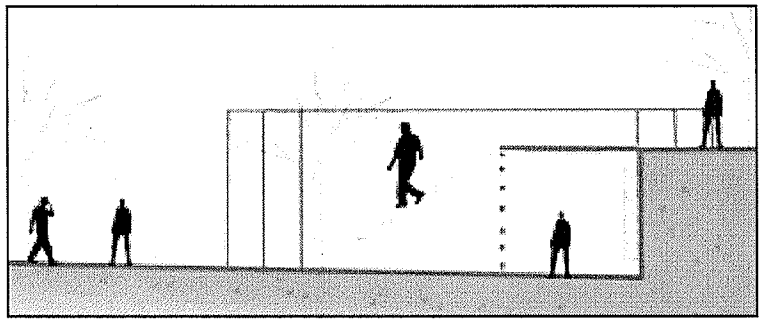
Quality / Aspects	Good	Normal	Not Good
Place			●
Complexity		●	
Aesthetic Aspect			●
Liveability			●
Accessibility	●		
Structure		●	
Connection			●
Diversity			●



Site/type 1-a

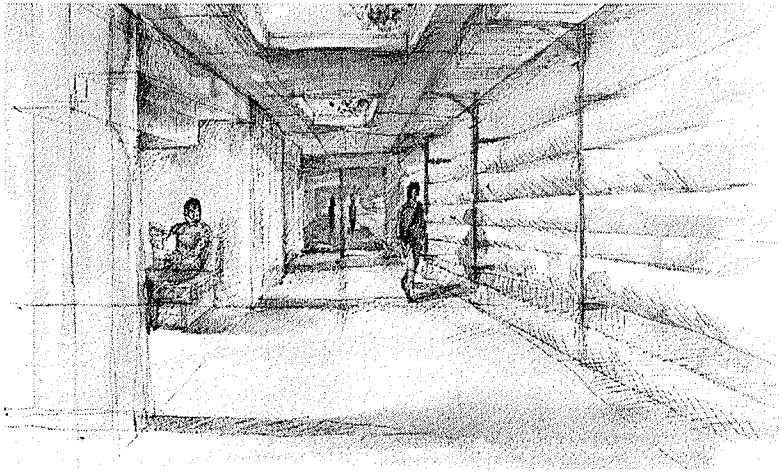
The tunnel/type1 section

These two section drawings demonstrate the changes to the tunnel. The drawing (Site/type 1-b) shows the proposed tunnel section. This shows the relationship between the tunnel and the outdoor environment as well as the increased walking opportunities across this tunnel



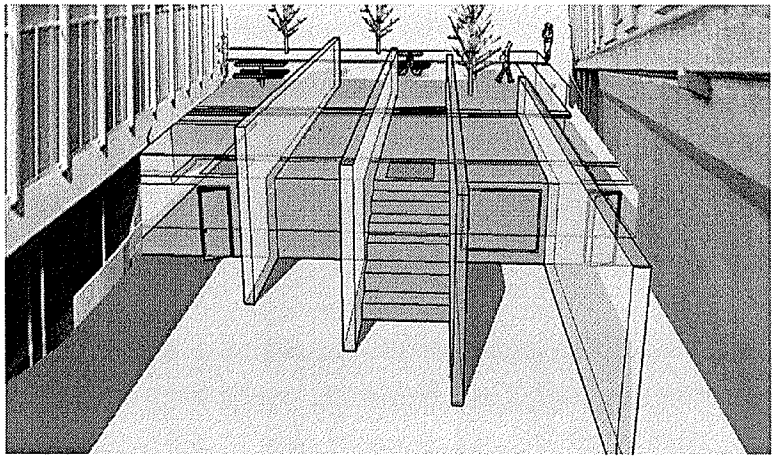
Site/type 1-b (proposed)

The tunnel's section drawing



Tunnel view

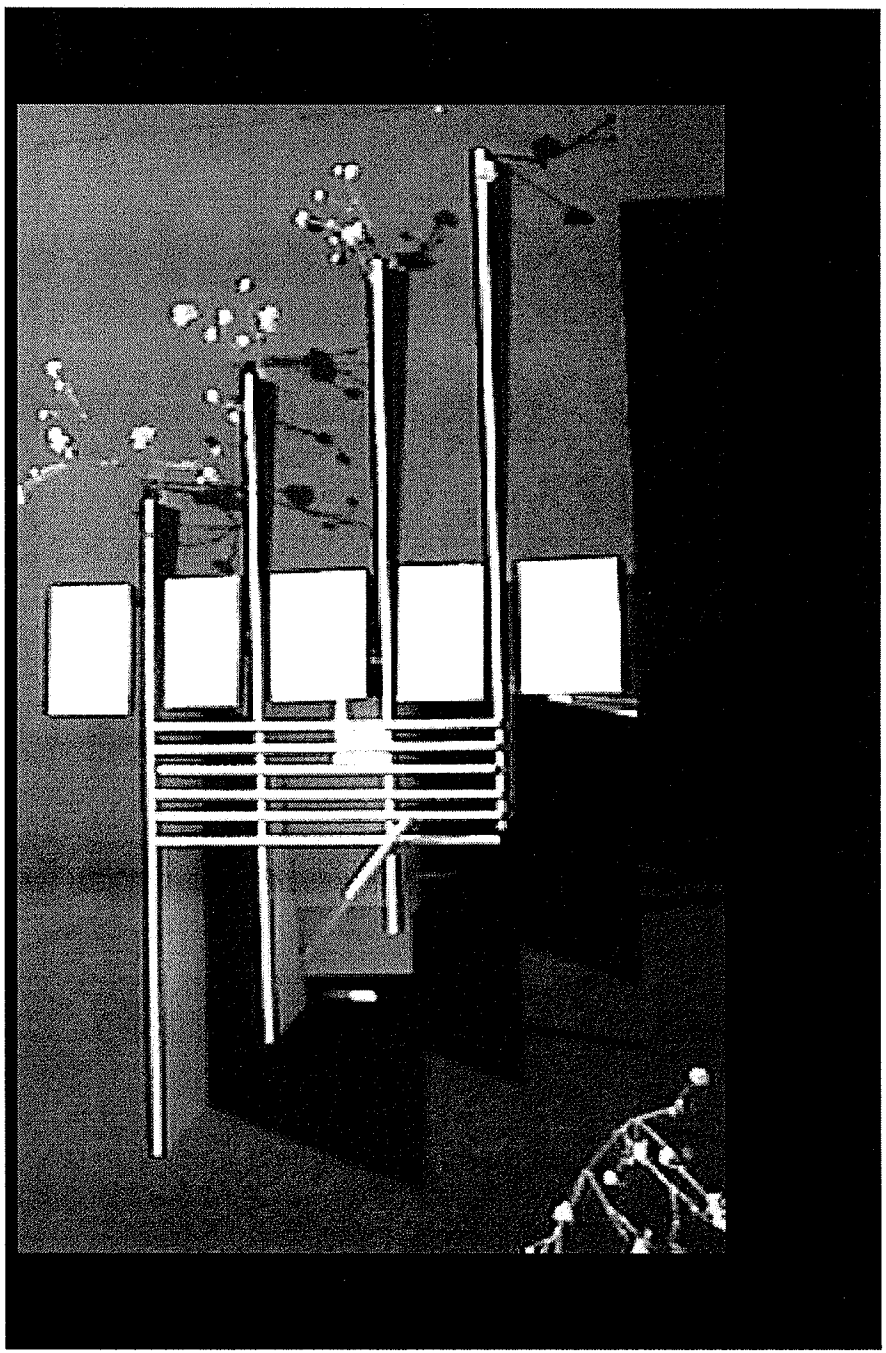
The tunnel is still in the same place as before but now its south wall becomes a movable wall that could be opened during good weather. New ceiling windows allow sunlight penetration and build a visual connection with the outdoor environment.

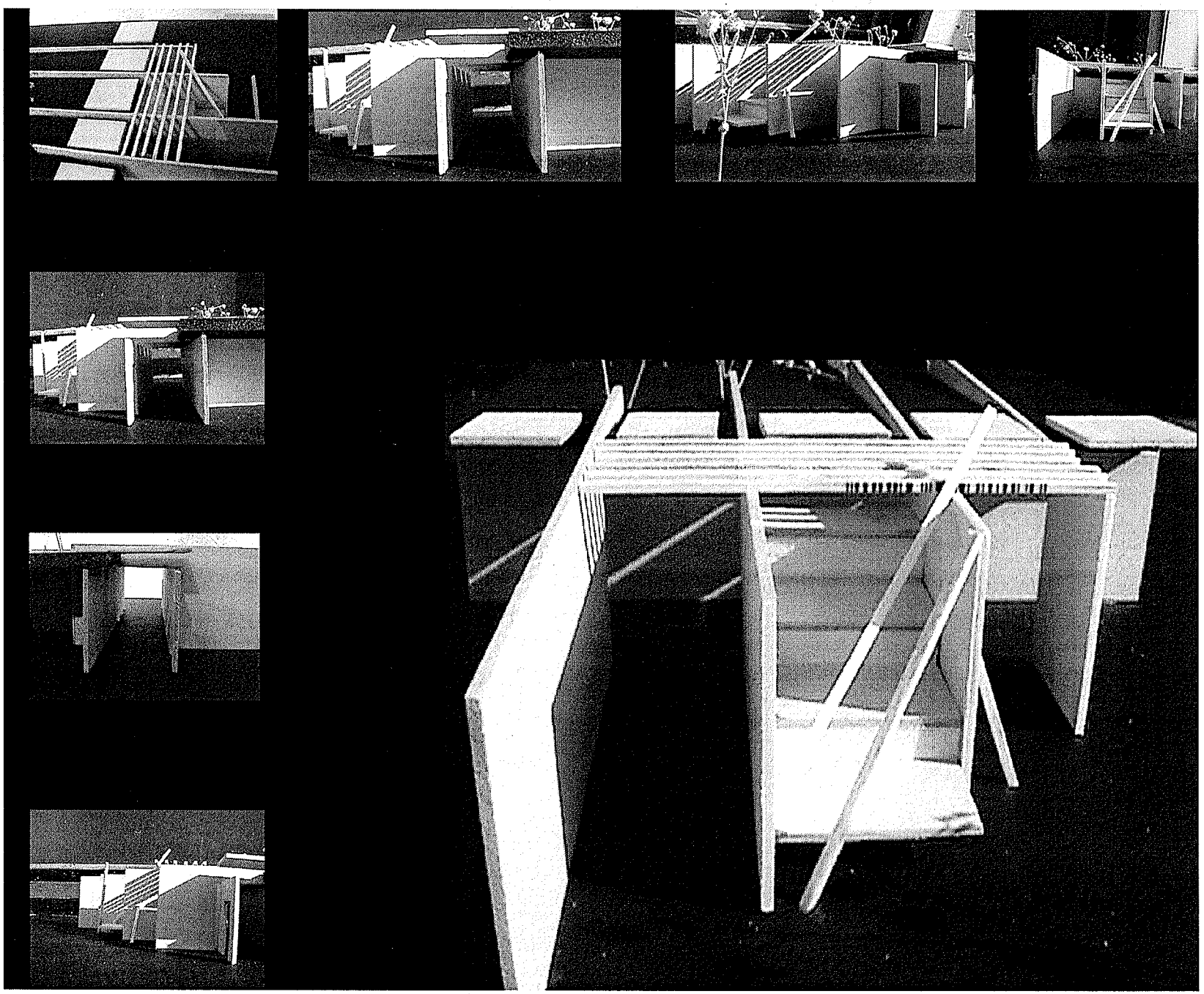


Exterior view

Addional north-south wall extensions are introduced, connecting the upper level environment with below grade environment. Additionally the wall form imitates the buildings' form. Meanwhile, these walls also help to mitigate the tunnel temperature.

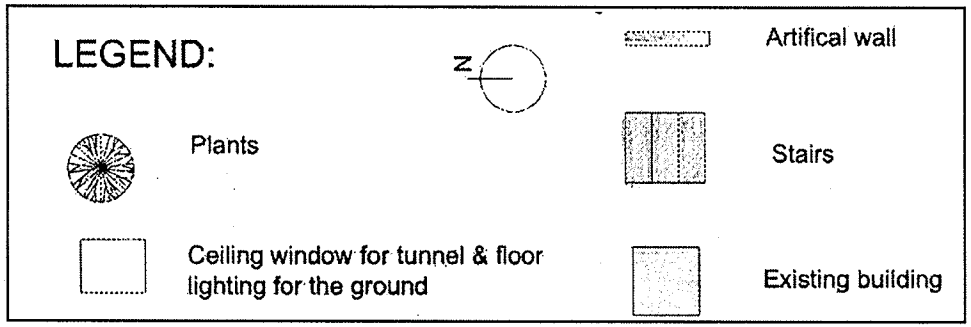
This site design demonstrat a landscape structure that connects the outdoor environment and tunnel. The structure supports the connection, direction, interruption and seperation functions. This site is now in a place that accommodates the social activities and physical and emotional needs of people – chatting with friends, pausing at any corner of the site, enjoying the sense of nature. The design framing the sunlight/shadows within the tunnel, increasing the visual connections with the environment, people, and nature.

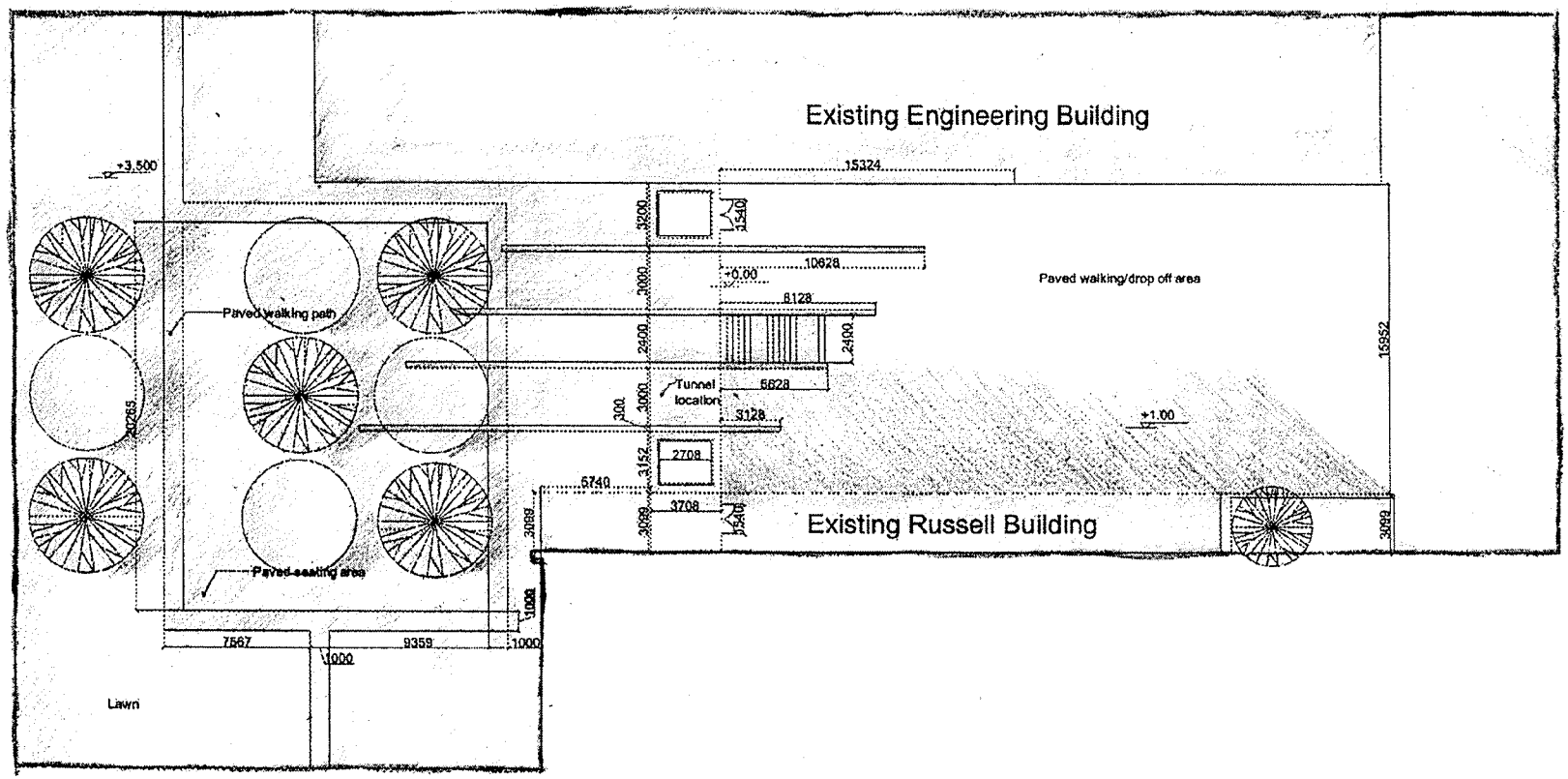




Site/type 1 plan

Scale: not to scale




Existing Engineering Building
+3.500
15324
3200
3540
10628
+6.00
Paved walking/drop off area
8128
Paved walking path
2400
2400
15952
Tunnel location
6628
3128
+1.00
2708
6740
3152
3708
3540
Existing Russell Building
3099
3099
Paved seating area
1000
7567
9359
1000
1000
Lawn

5.3.2. Site/type 2

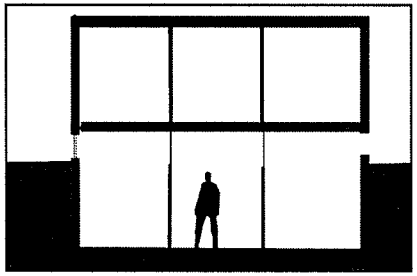
Site 2 is the Architecture II Building's tunnel.The analysis table (Table 2) shows this segment of tunnel needs developing with respect to place, aesthetic aspect, livability, accessibility, structure, connection, diversity. The development strategy then determined is as follows:

1. Develop more than one universal access to this segment. (accessibility)
2. Introduce the access/opening landmark to this tunnel. (structure, place)
3. Search for an oppotunity to bring natural lighting to this tunnel. (connection, livability)
4. Connect the tunnel to the outside environment at the beginning of this tunnel. (connection, diversity)

Table 2. Type/Tunnel 2 analysis table

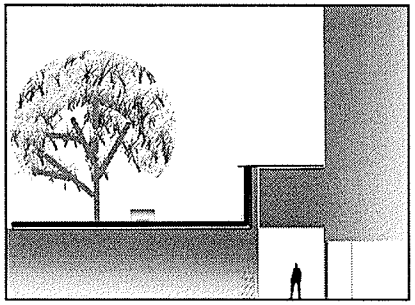
Quality / Aspects	Good	Normal	Not Good
Place			●
Complexity	●		
Aesthetic Aspect			●
Liveability			●
Accessibility			●
Structure		●	
Connection			●
Diversity			●

The proposed design for this segment of tunnel addresses the ending/access component. The two proposed section drawings illustrate the access part of this tunnel.



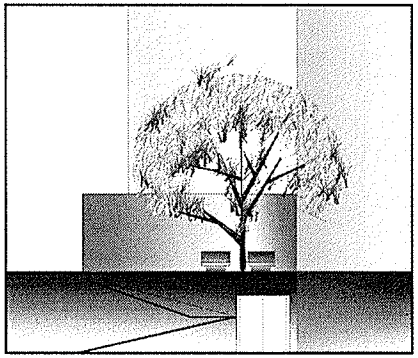
Site/type 2-a

The tunnel/type 2 section

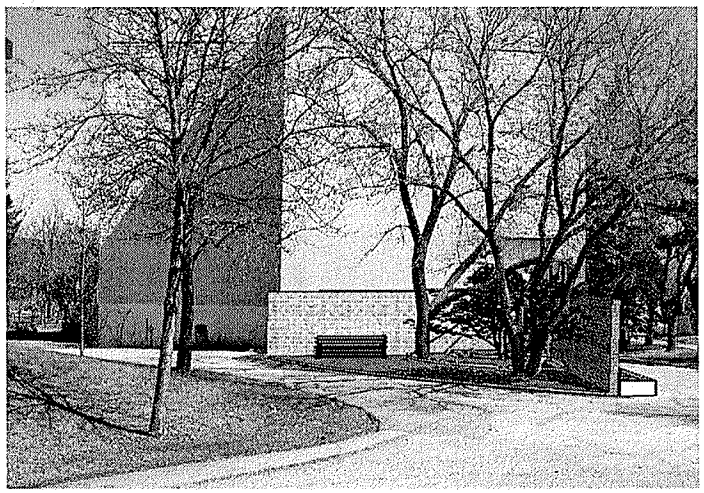


Site/type 2-b, c (proposed)

The tunnel's section drawing



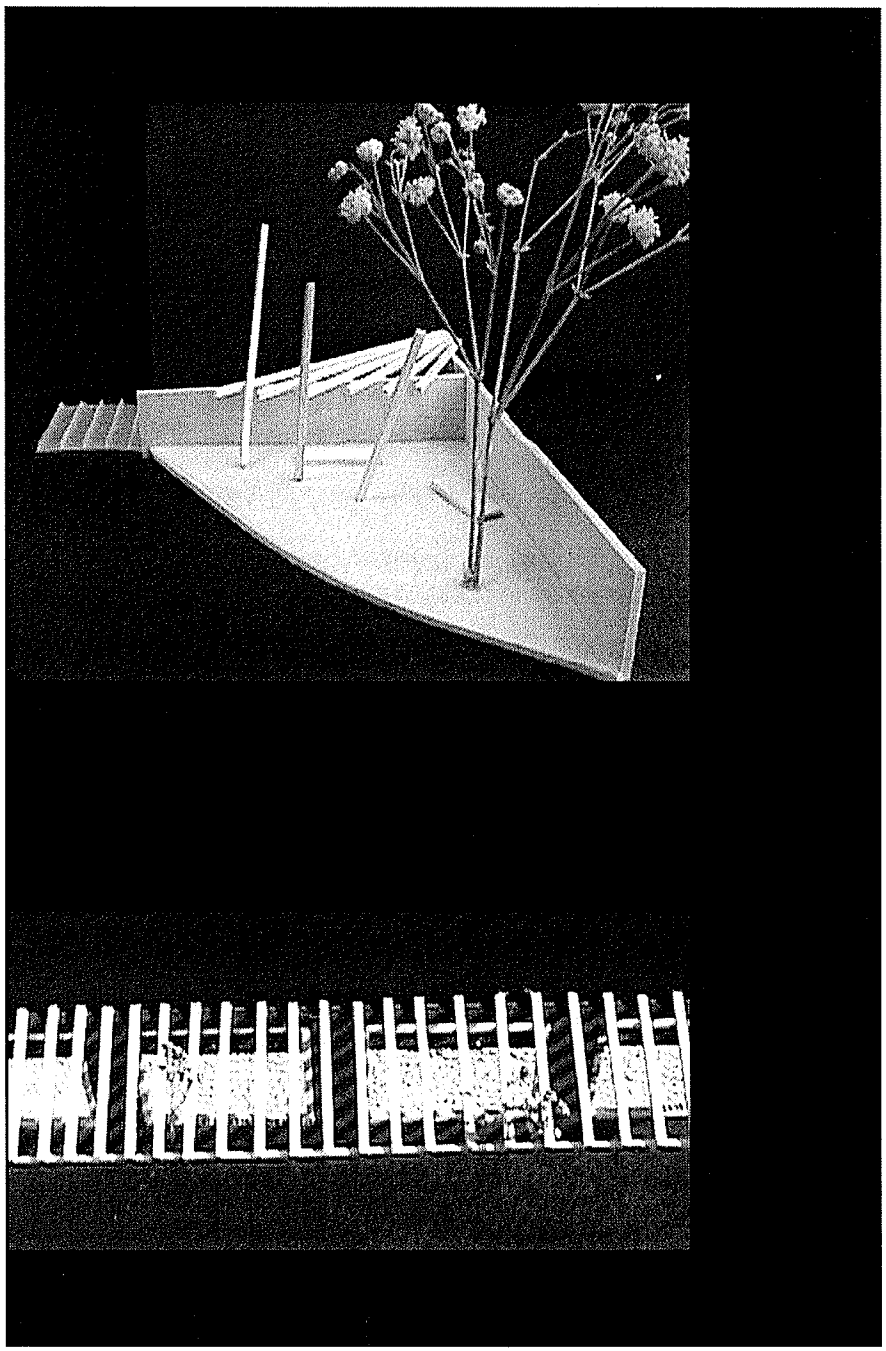
Tunnel view

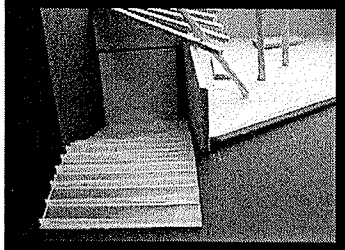


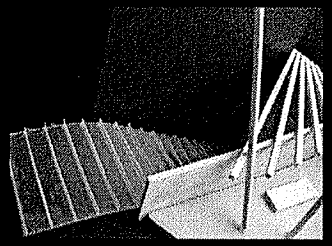
Exterior view

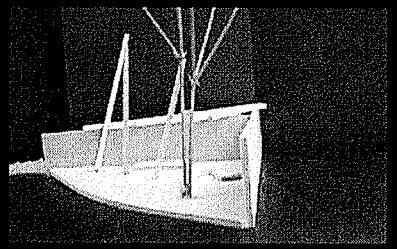
The impact of this access design is to frame the natural view. This natural view brings the wind, movement of leaves, sunshine, shadow, smells of plants to the tunnel/geo-space. This serves to create a memorable place. Universal access for this site is very important as it is the farthest access point to the main tunnel system for people coming onto campus from the west and from the Continuning Education Building.

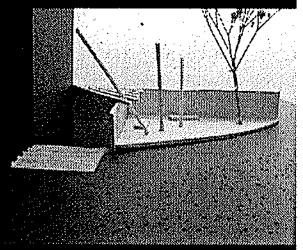
The structures for this tunnel create the landmark as well as provide directional cues for walking to tunnel. The curved line outside brings people into the tunnel and provides a boundary line for a seating area. The two "L" shaped walls associated with this area make it more quiet and safe. The landmark for this place consists of vertical poles with horizontal poles creating a partial roof over the access point. Another structure is the roof windows' frame at the both north side and south side of the building. These windows providing indirect sunlight opportunity for the tunnel.

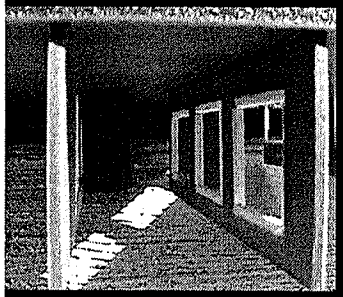


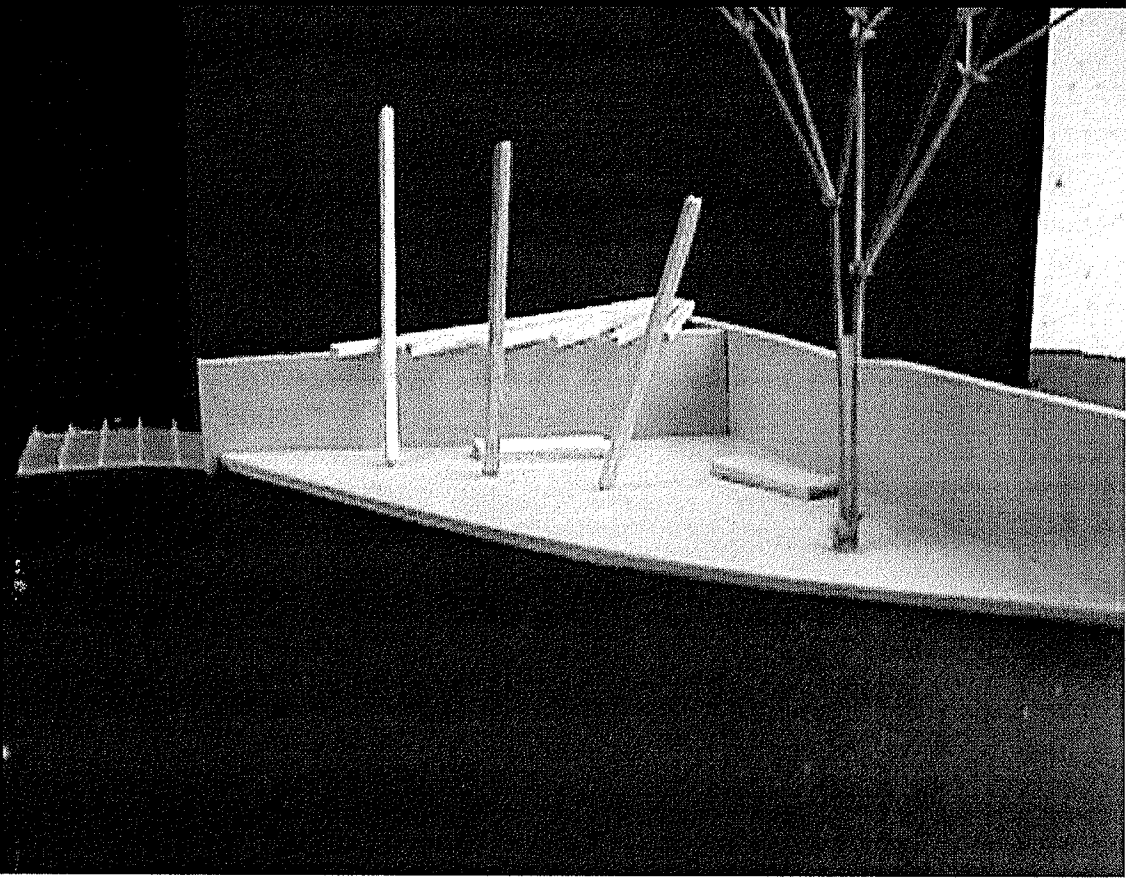






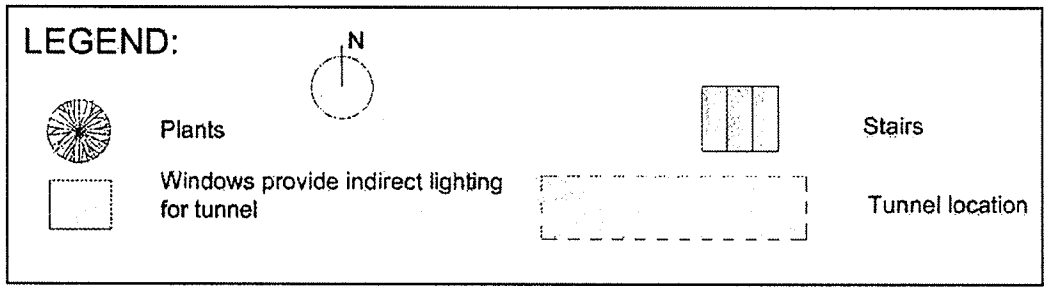


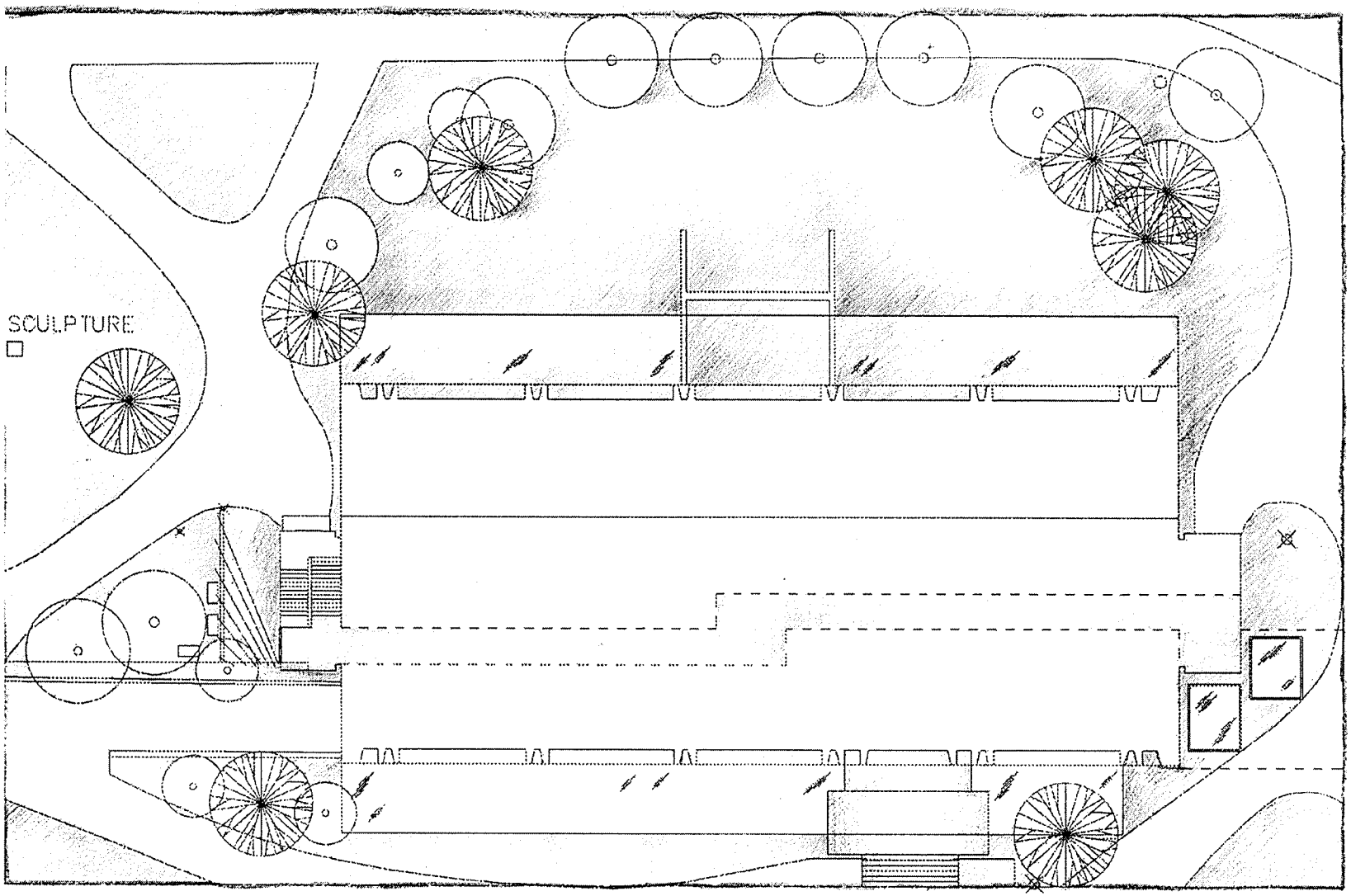




Site/type 2 plan

Scale: not to scale




SCULPTURE

5.3.3. Site/type 3

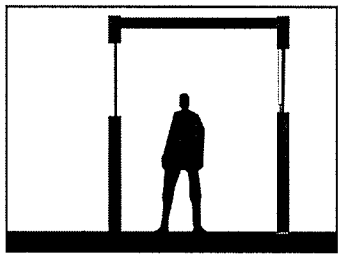
This segment of tunnel is between the Continuning Education Building and the Max Bell Centre.The analysis table below provided a development reference. The strengths of this site are good sense of place, the aesthetic aspect, and accessibility. Diversity needs to be addressed. The development strategy determined is as follows:

1. Build a connection between the external west east side environment. (connection, diversity)
2. Develop a connection between the west side and the east side garden. (connection, liveability, accessibility)
3. Increase the sunshine penetration opportunity to the tunnel walking area.(complexity)
4. Expand the opening at the west side of this site. (accessibility, diversity)

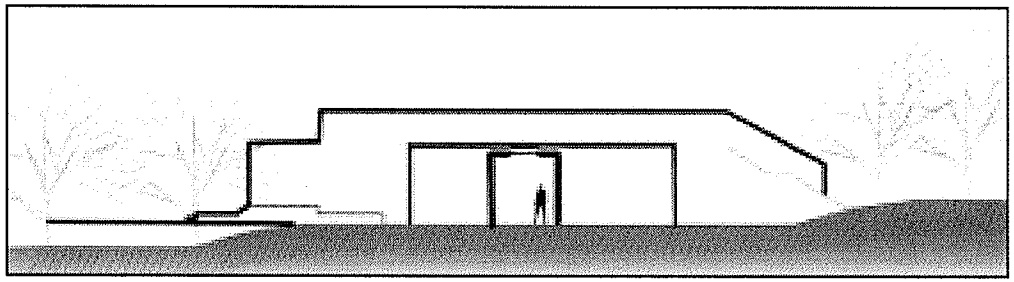
Table 3 Type/Tunnel 3 analysis table

Quality / Aspects	Good	Normal	Not Good
Place	●		
Complexity		●	
Aesthetic Aspect	●		
Liveability		●	
Accessibility	●		
Structure		●	
Connection		●	
Diversity			●

This segment of tunnel design provides more connections for the west side garden and east side garden. Here doors open in the middle of the tunnel to create the connection; above the tunnel, a bridge is proposed to allow travel from the second floor to the east side garden. New, expanded ceiling windows provide a nice view of nature and allow sunshine penetration.

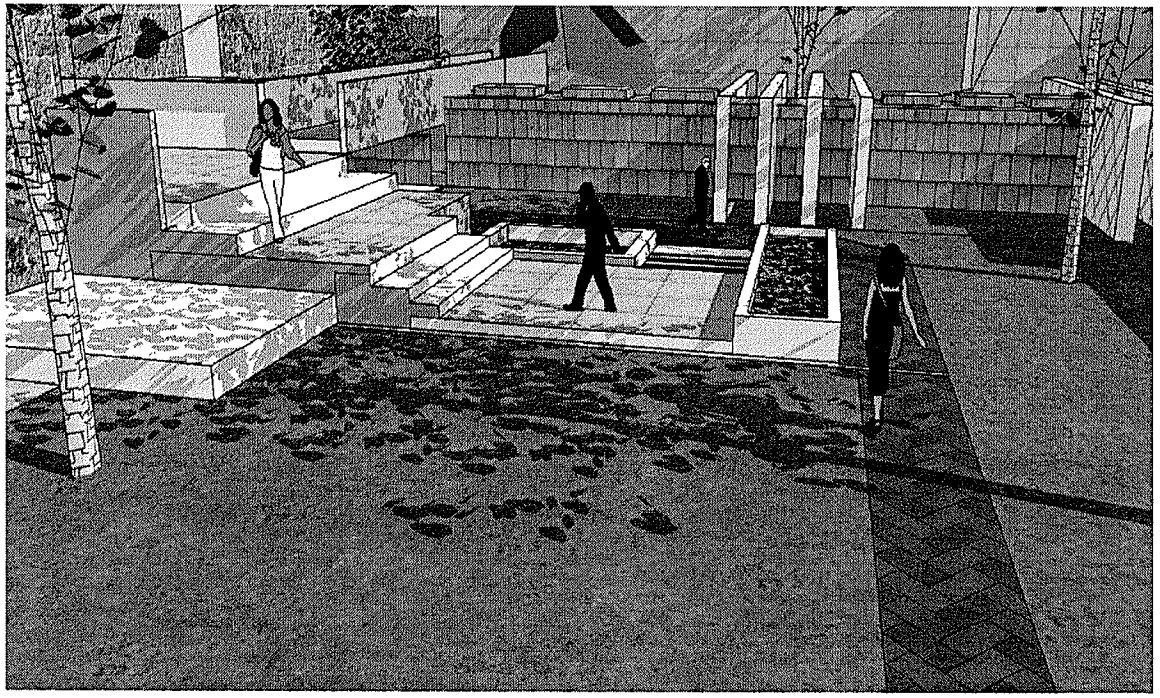


Site/type 3-a
The tunnel/type 3 section



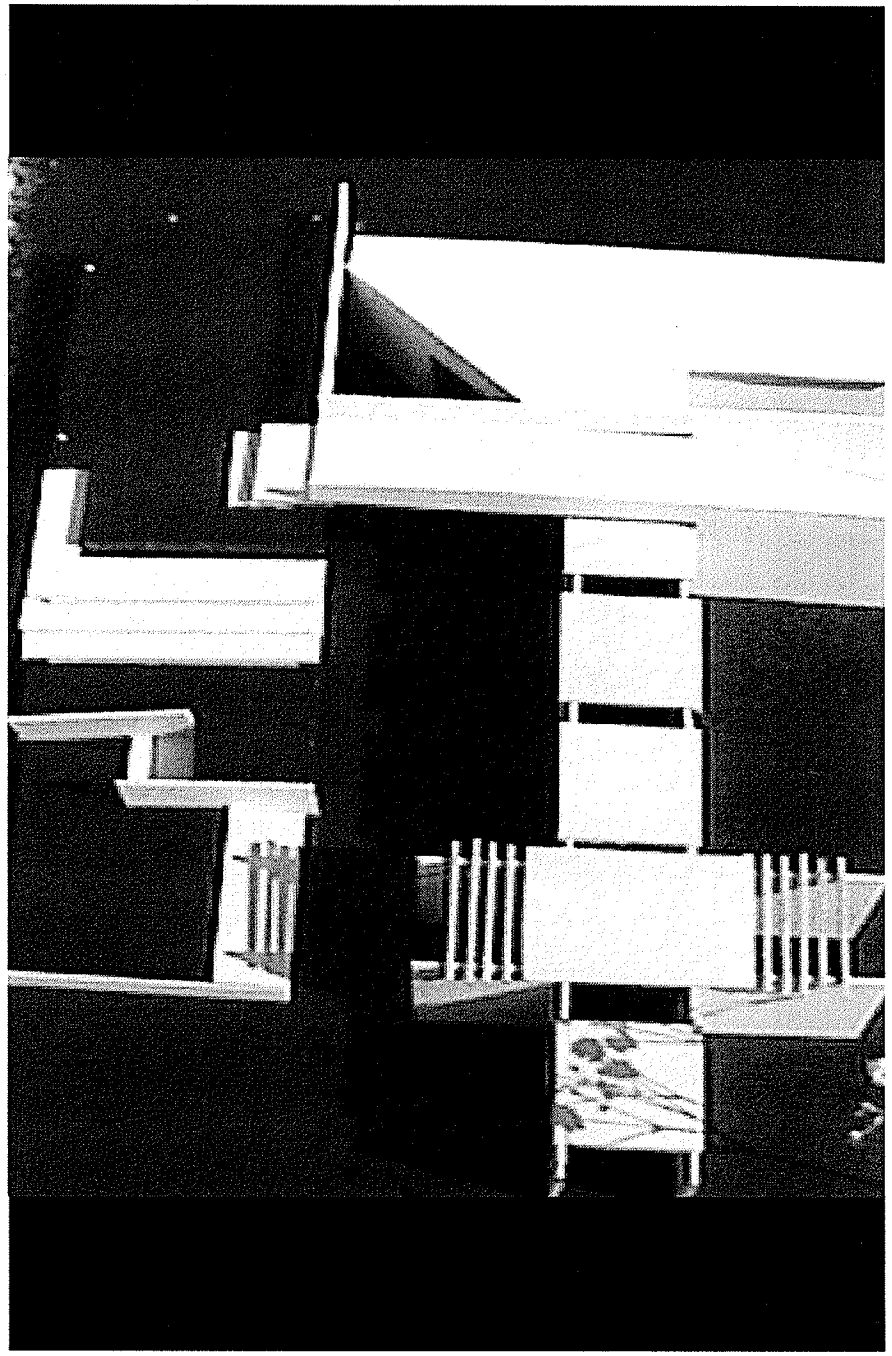
Site/type 3-b (proposed)
The tunnel's section drawing

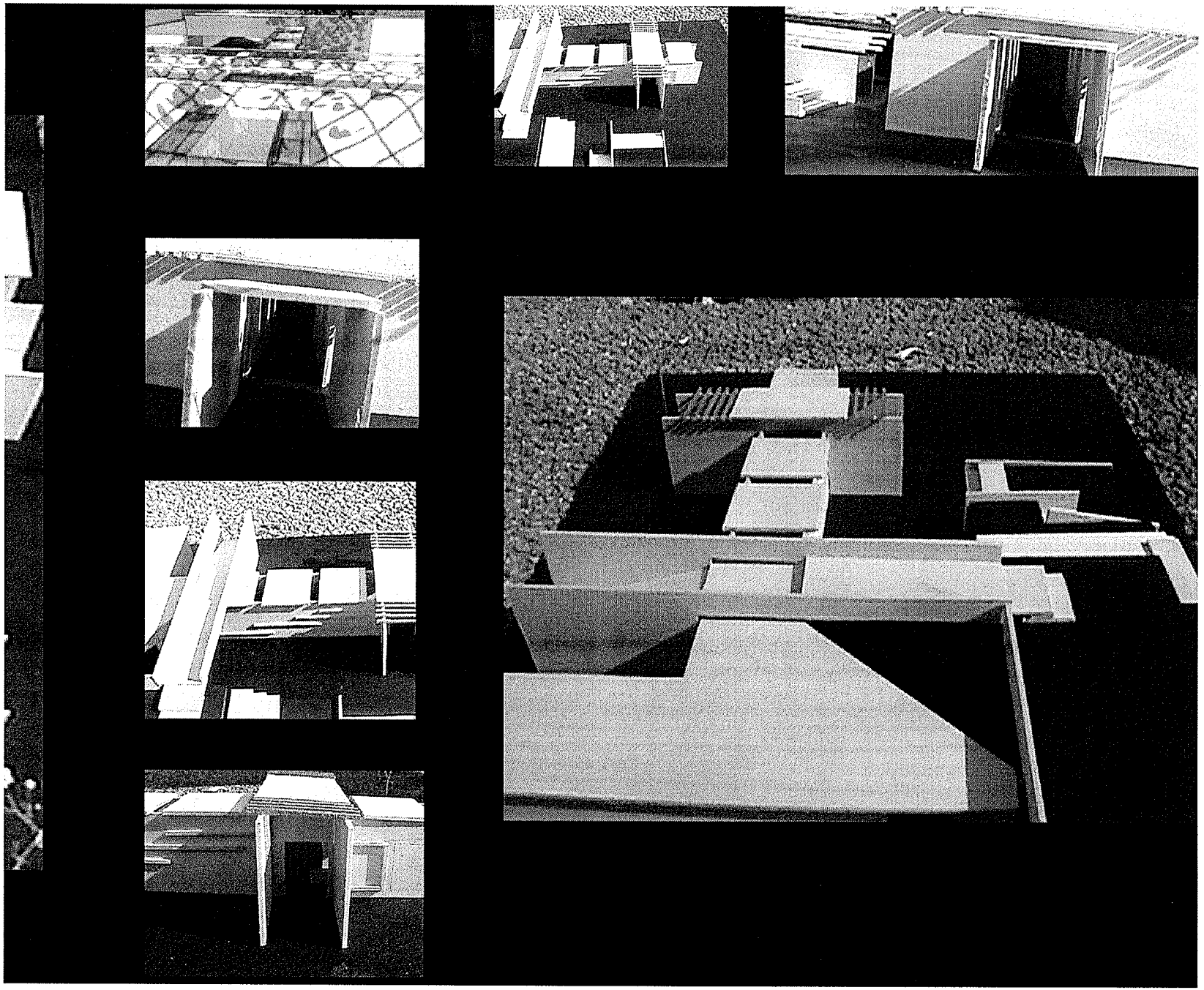
Tunnel view



Exterior view

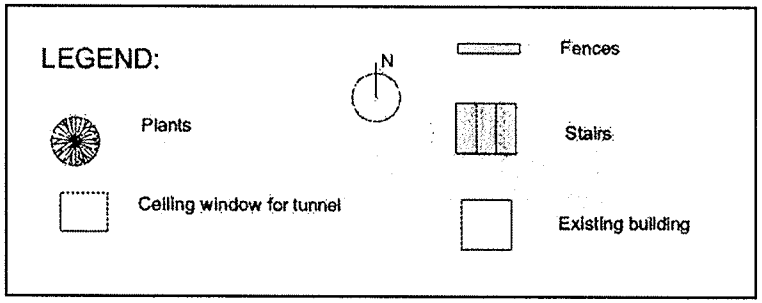
The structure of this site is the bridge from the west to the east side garden. The connections include two levels. One is from the second floor of Max Bell Centre to the east side garden; the other is through doors in the middle of this tunnel that open at ground level to the west garden. The structure reflects the forms and shapes of the tunnel, ceiling window and existing landscape structures

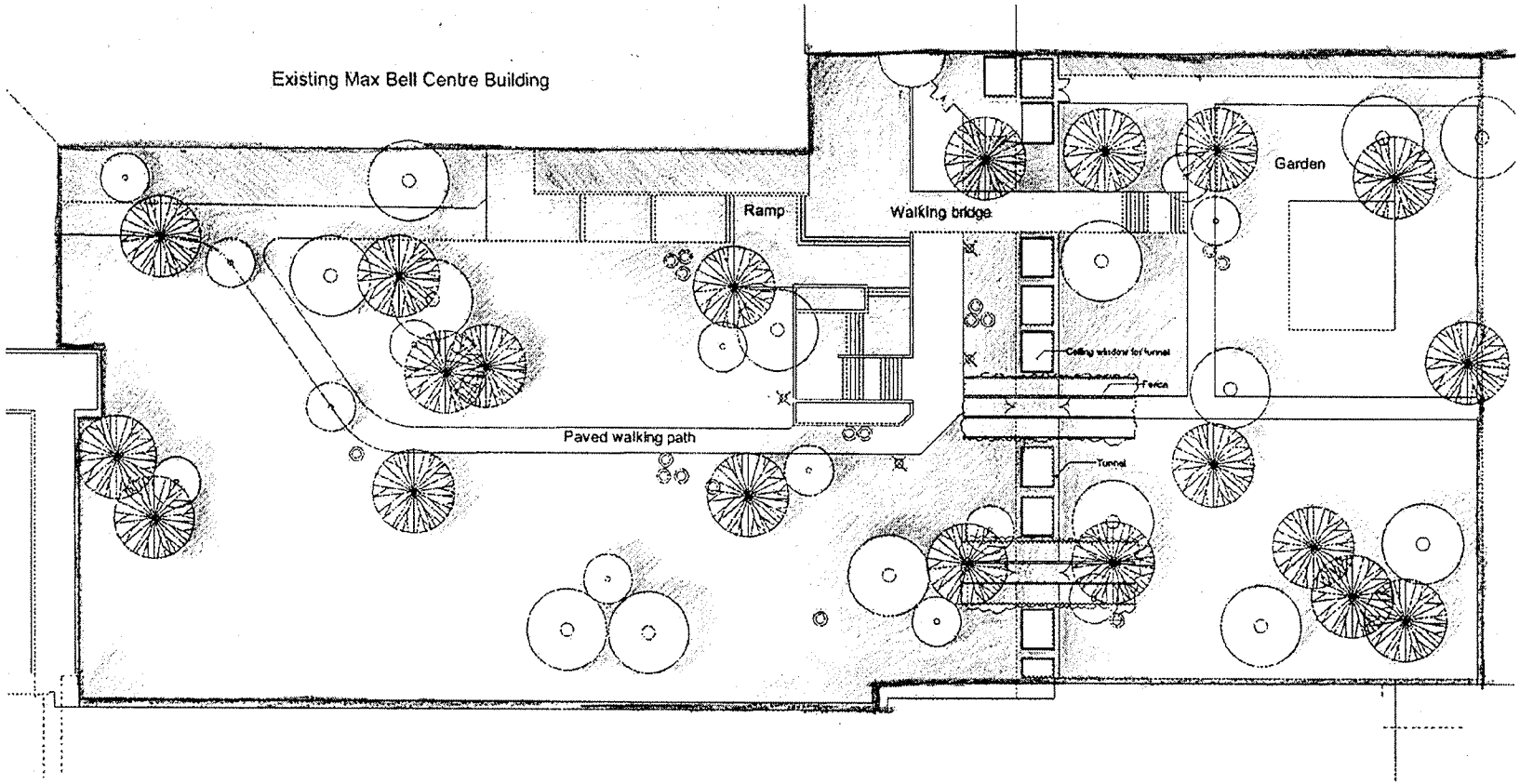




Site/type 3 plan

Scale: not to scale




Existing Max Bell Centre Building
Ramp
Walking bridge
Garden
Paved walking path
Tunnel

5.3.4. Site/type 4

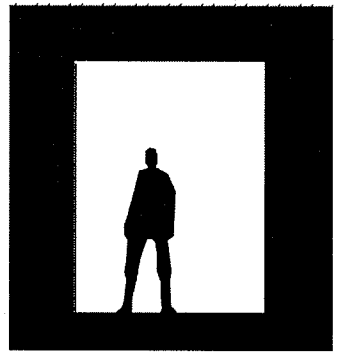
This is the place between the Administration Building and UMSU centre. The analysis table (Table 4) shows the strength of this site being its good accessibility. The design needs to develop place, complexity, aesthetic aspect, liveability, connection, diversity and structure. The development strategy then determined is as follows:

1. Build a connection between the above ground and underground spaces. (diversity, connection, diversity)
2. Develop the vertical landmark to show that there is a tunnel below. (structure)
3. Build the transitional space from the interior to the exterior space. (complexity, liveability, aesthetic aspect)
4. Increase and frame the sunshine penetration into the tunnel. (aesthetic aspect)
5. Develop more livable seating/walking space between the tunnel and the ground space. (liveability, diversity)

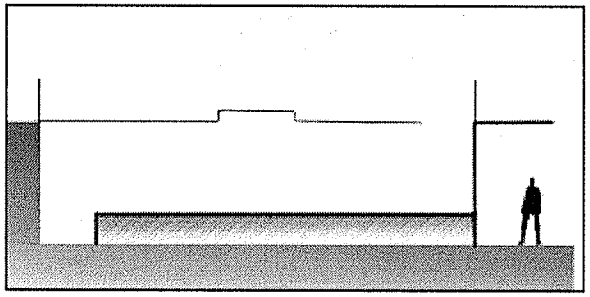
Table 4 Type/Tunnel 4 analysis table

Quality / Aspects	Good	Normal	Not Good
Place			●
Complexity		●	
Aesthetic Aspect			●
Liveability		●	
Accessibility	●		
Structure			●
Connection		●	
Diversity			●

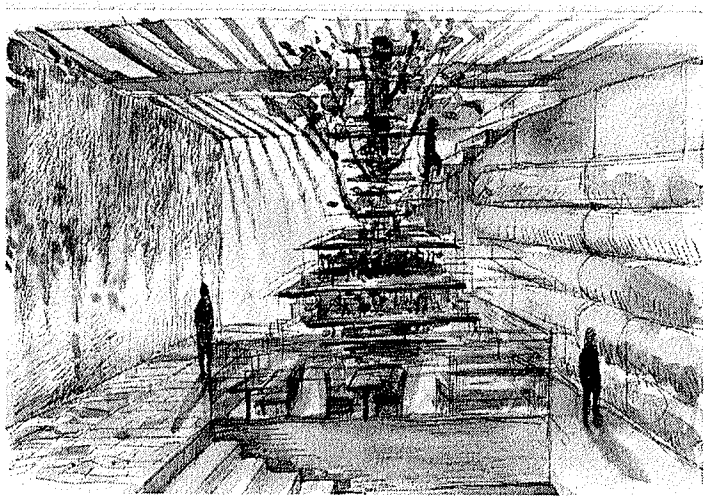
This segment of the tunnel design creates two vertical gardens. One is on the UMSU side, one is on the Administration side. These two gardens, midway between grade and tunnel level, provide access to the pedestrian and seating area.



Site/type 4-a
The tunnel/type 4 section



Site/type 4-b (proposed)
The tunnel's section drawing

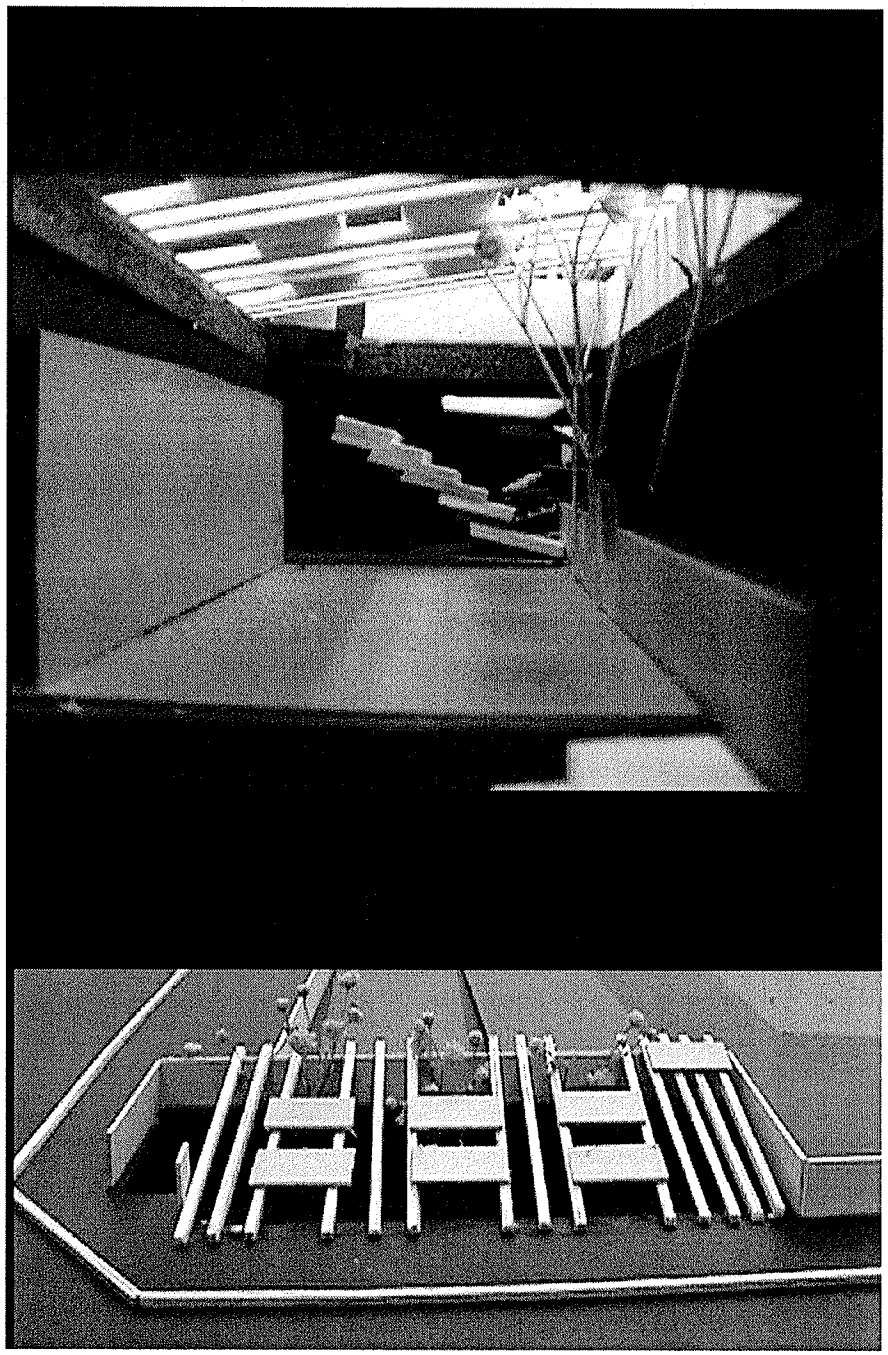


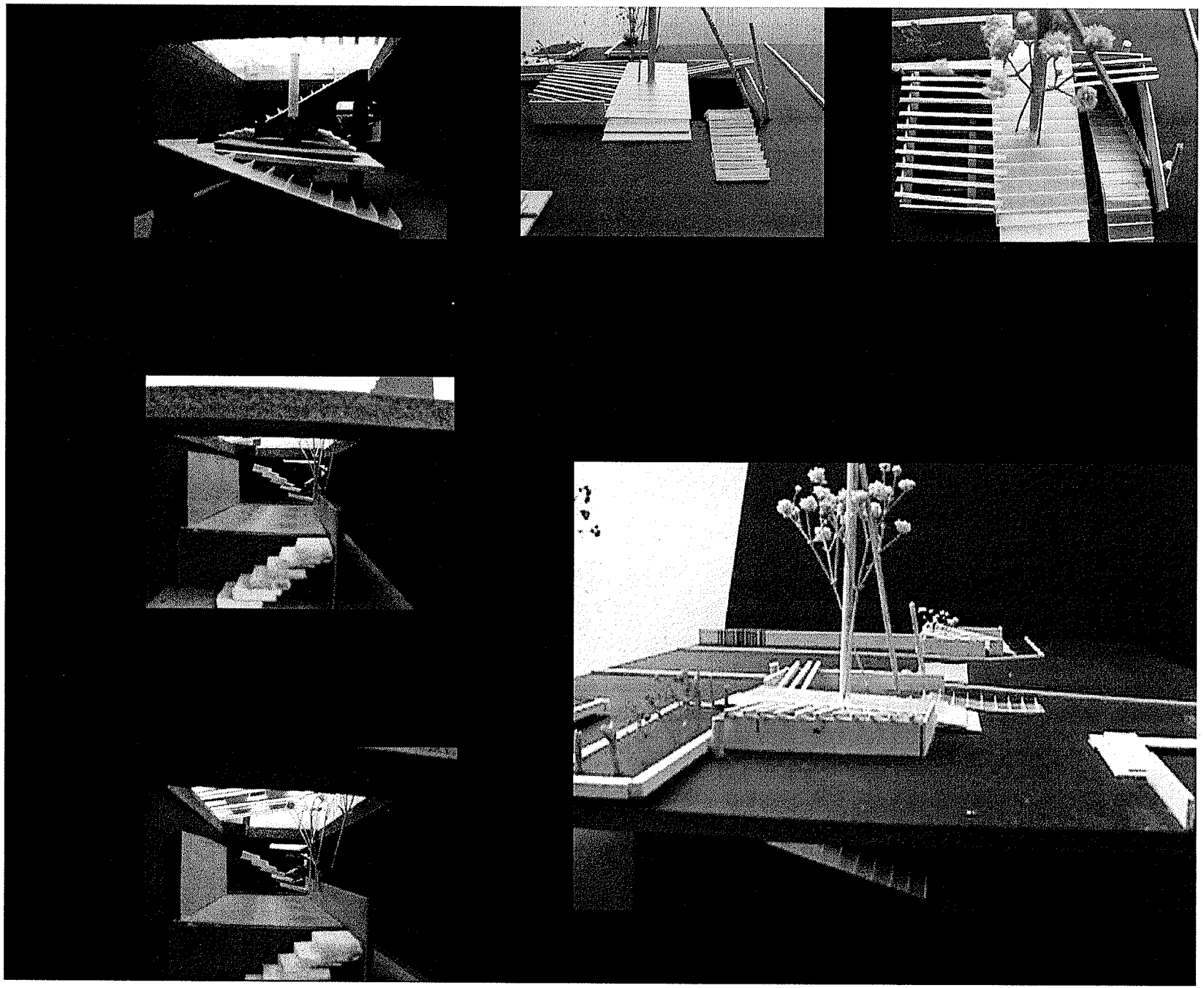
Tunnel view

The plants on the wall are ivy which are from the above ground's flower bed. In the middle is a tree underplanted to flowering plants. The ceiling window provides sunlight penetration to these plants as well as the tunnel. In front of the UMSU centre, there is a bridge at ground level which crosses over the tunnel's ceiling window. This bridge maintains the existing walking path also provides nice shadows to the seating area.

Exterior view

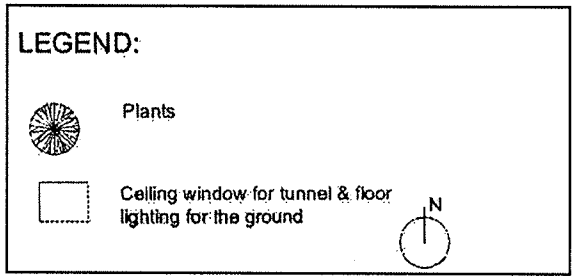
The structure on this site has a vertical garden with a sun roof structure associating the tunnel space with the environment. This structure also provides a seating, chatting, pausing, reading, walking area within the vertical garden.

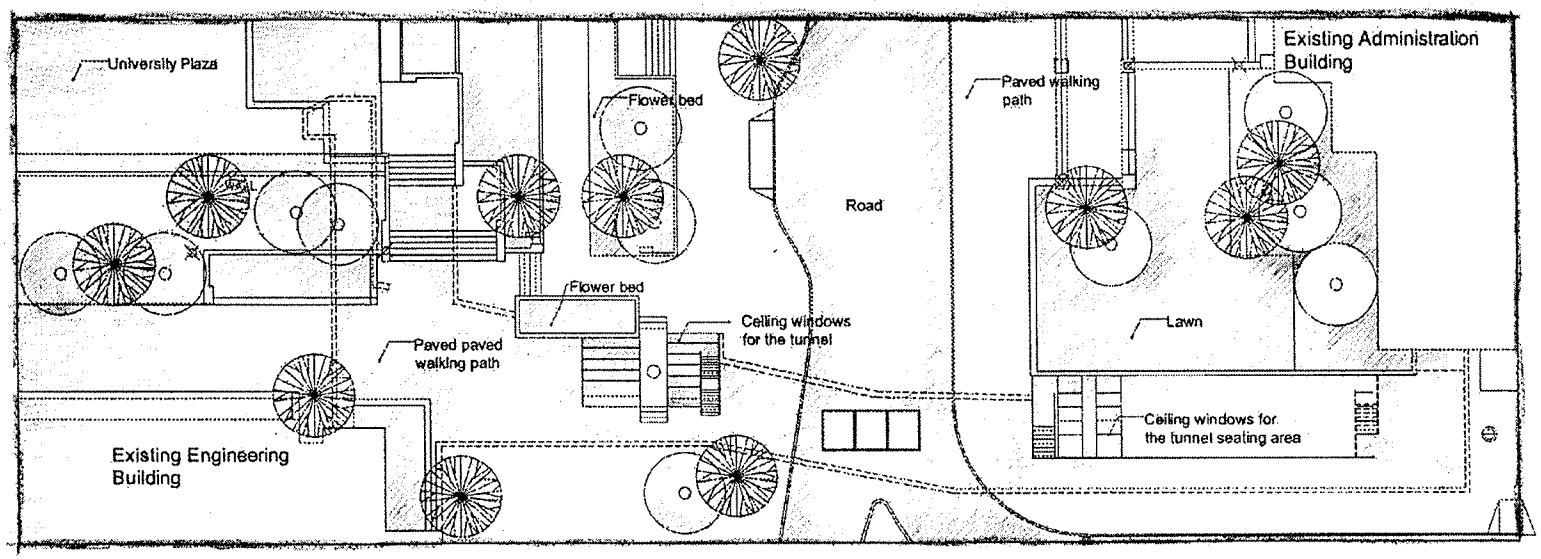


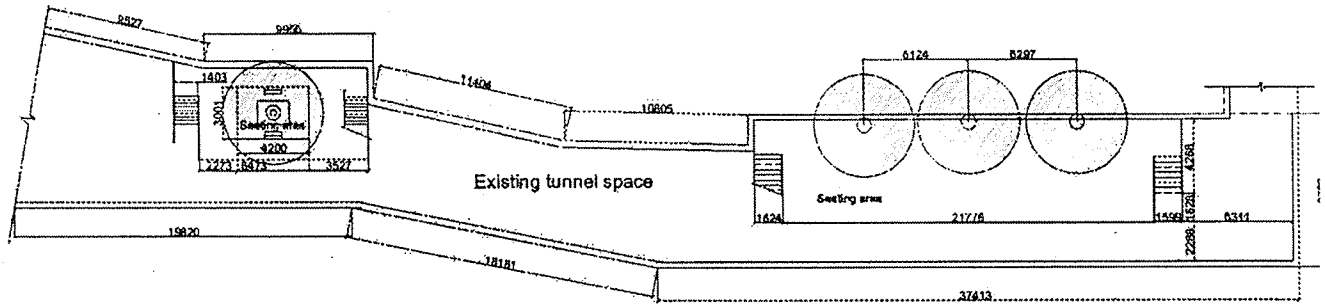


Site/type 4 plan

Scale: not to scale







Underground level layout

5.3.5. Site/type 5

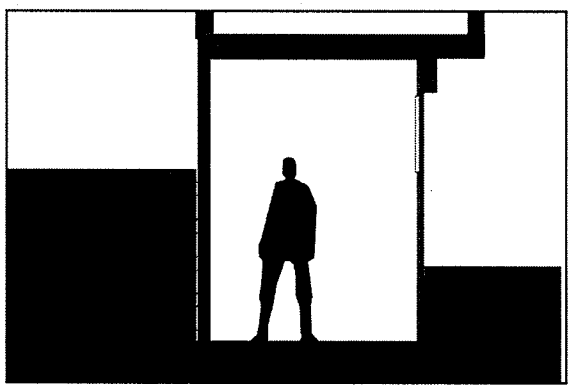
This is the place between UMSU Centre and the Engineering Building. The analysis table (table 5) shows the site has a good sense of place and aesthetic aspect.-complexity, liveability, accessible, structure, connection and diversity need to be developed. The development strategy determined is as follows:

1. Develop the livable, playful out-door environment that is close to the tunnel space.
   (liveability, playful, accessible, place)
2. Build a connection linking the tunnel to the out-door environment and upper level pedestrian walkway.
   (diversity, place)
3. Connect the UMSU plaza to this site. (connection, structure)
4. Expand the lower level's walking environment, build the walking/sitting garden/geo-landscape.
   (liveability, diversity, accessible)
5. Connect this site with site 3.
   (connection, diversity, complexity, accessible)

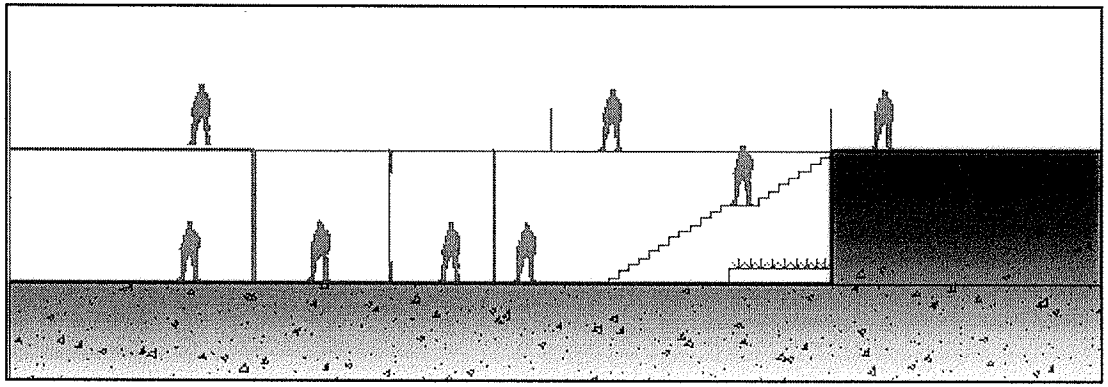
Table 5 Type/Tunnel 5 analysis table

Quality / Aspects	Good	Normal	Not Good
Place	●		
Complexity		●	
Aesthetic Aspect	●		
Liveability		●	
Accessibility			●
Structure		●	
Connection		●	
Diversity			●

The majority of the design associate with this segment of tunnel is related the out-door environment. There is an exterior walking path connected with this tunnel. This below grade walking path has trees, flowers around the seating areas and two stairs to the above ground walking path.

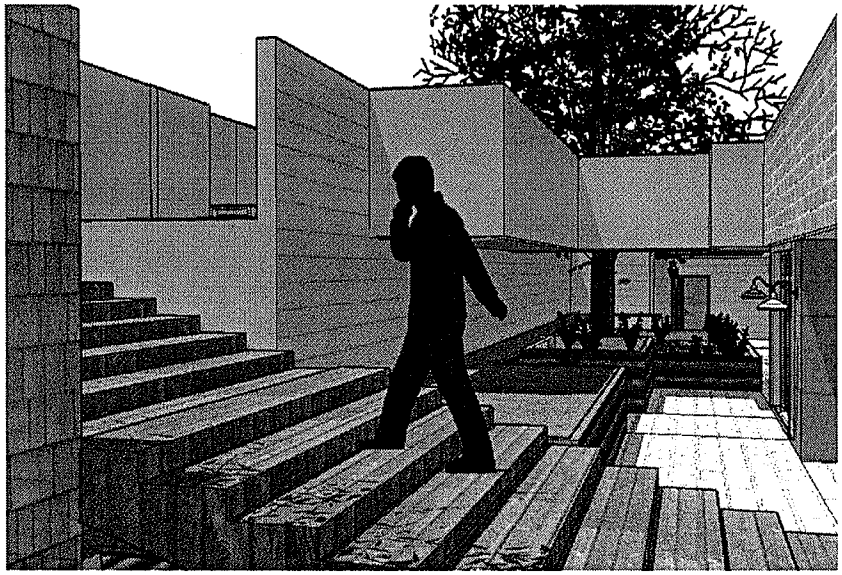


Site/type 5-a
The tunnel/type 5 section



Site/type 5-b (proposed)
The tunnel's section drawing

Tunnel view

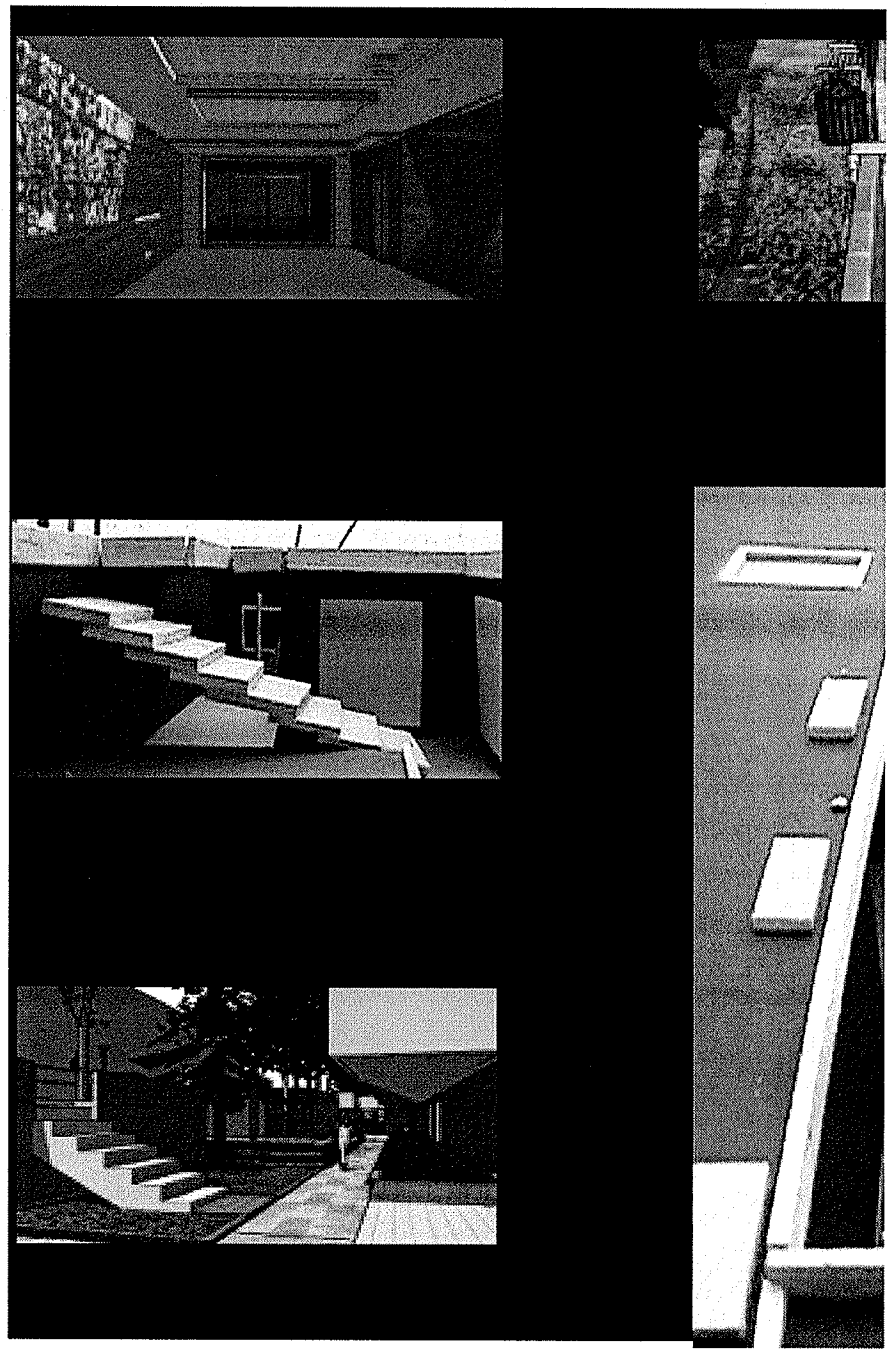


A ground level walking path, is connected by a bridge to the UMSU Plaza.The below grade walking path could be connected to the site 4 tunnel if an access door is located in the site 4 tunnel, providing a new walking option. If this were done, the new path could reduce the pedestrian density in the UMSU centre.

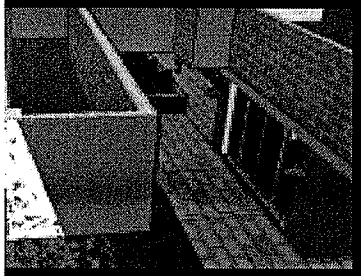
Exterior view

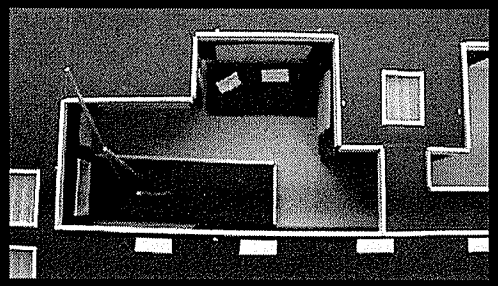
The bridge beside the above ground walking path has stairs to the below grade garden

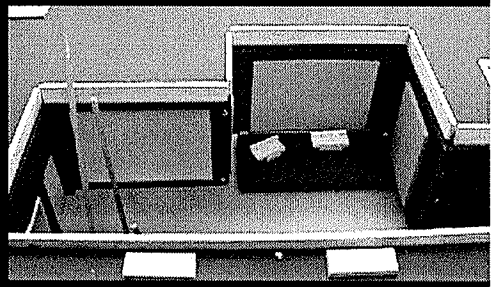
The purpose of the structures on this site are to create an attractive out-door walking path below grade. This path is connected to the ground walking path through two staircases. A bridge connects the ground walking path to the UMSU Plaza. The below grade walking path is shaded by trees or overhead structures. The seating area in the below grade garden has an nice open view, yet it is private and quiet. At the end of this path is the potential access to the tunnel of site 4.

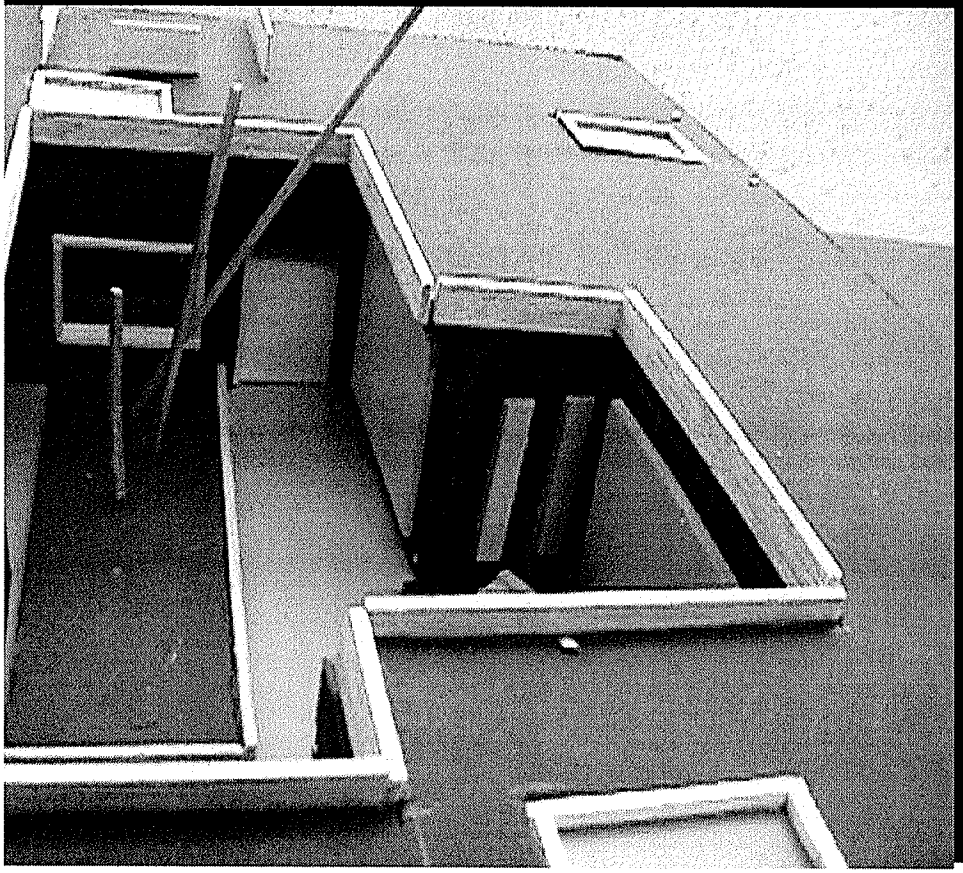


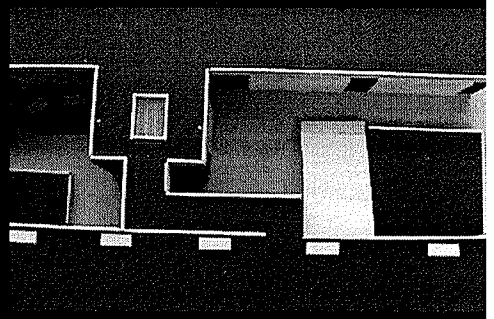
Tunnel views/forms





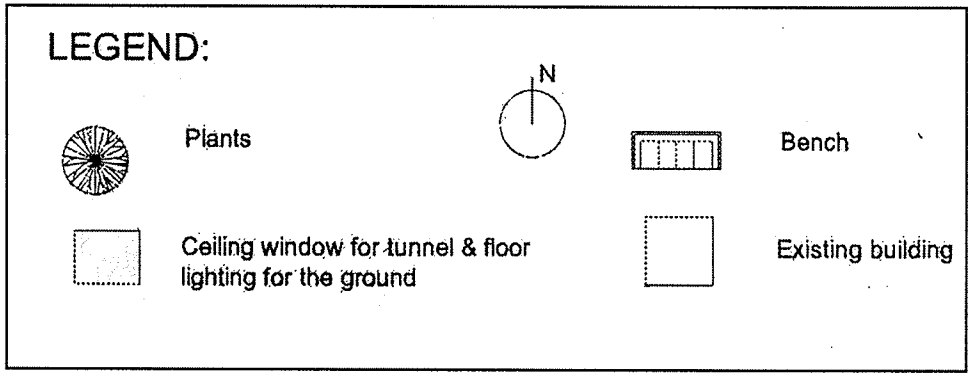


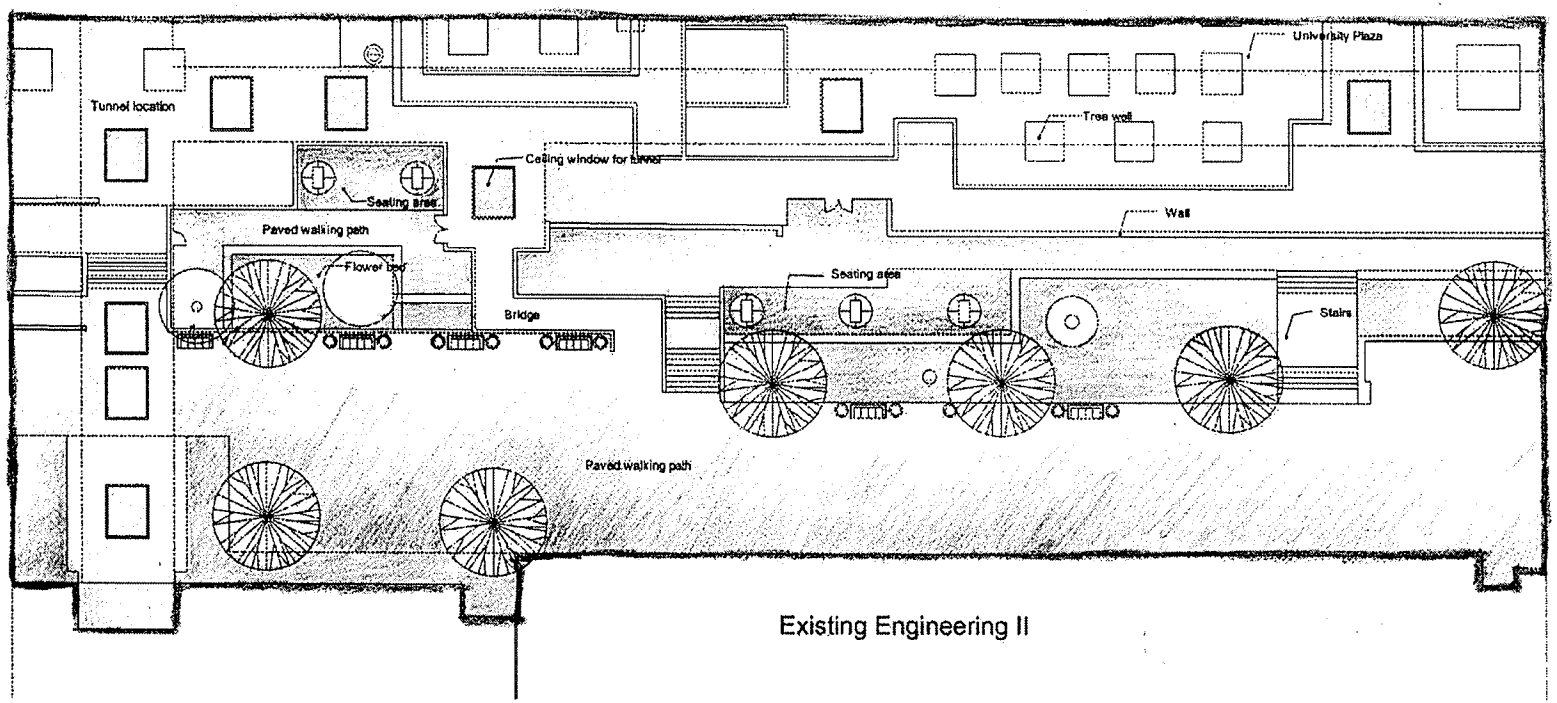




Site/type 5 plan

Scale: not to scale





Existing Engineering II

5.3.6. Site/type 6

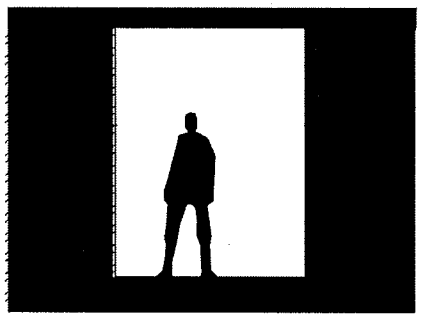
This is the place in front of the Fine Arts School. The analysis table (Table 6) shows that this site needs to develop complexity, liveability, accessibility, structure, connection, diversity and the sense of place. The development strategy determined is as follows:

1. Create a center space for the ground garden which connects the ground garden and the underground tunnel space. (liveability, structure, place)
2. Create the vertical connection landmark to the site. (place, complexity, accessibility)
3. Develop a livable, playful, transitional space between the underground and ground environment. (playful, diversity, connection)
4. Increase and frame the sunshine penetration to the tunnel walking area.(aesthetic aspect)
5. Introduce plants into the underground space. (diversity, complexity, place)

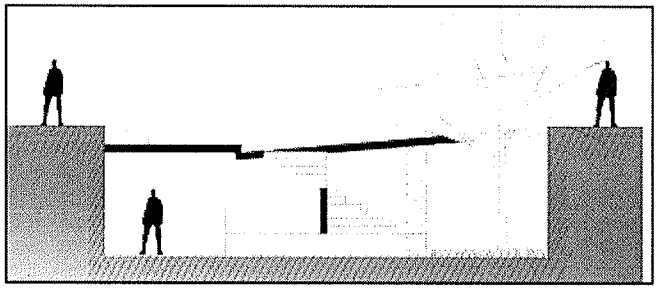
Table 6 Type/Tunnel 6 analysis table

Quality / Aspects	Good	Normal	Not Good
Place			●
Complexity		●	
Aesthetic Aspect	●		
Liveability		●	
Accessibility			●
Structure			●
Connection		●	
Diversity		●	

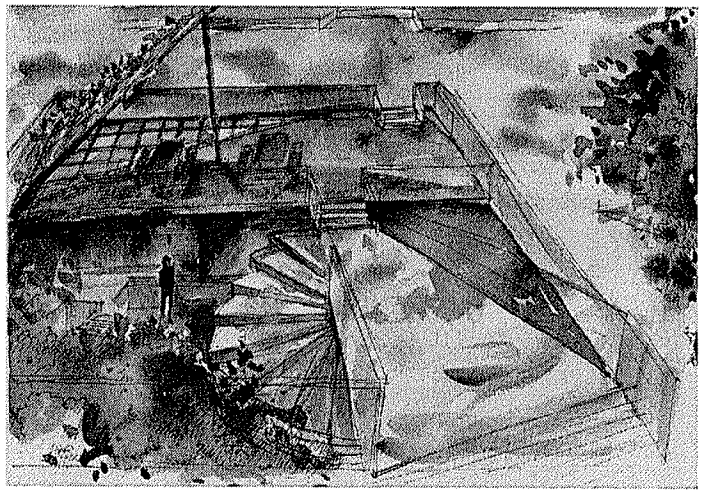
This segment of tunnel design provides a centre space that would unite the tunnel spaces with the above ground walking and seating areas. This centre space is based on a vertical garden.



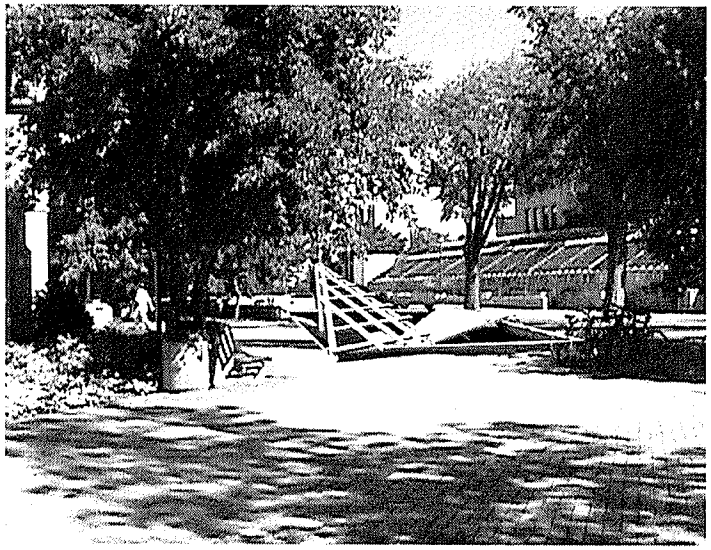
Site/type 6-a
The tunnel/type 6 section



Site/type 6-b (proposed)
The tunnel's section drawing



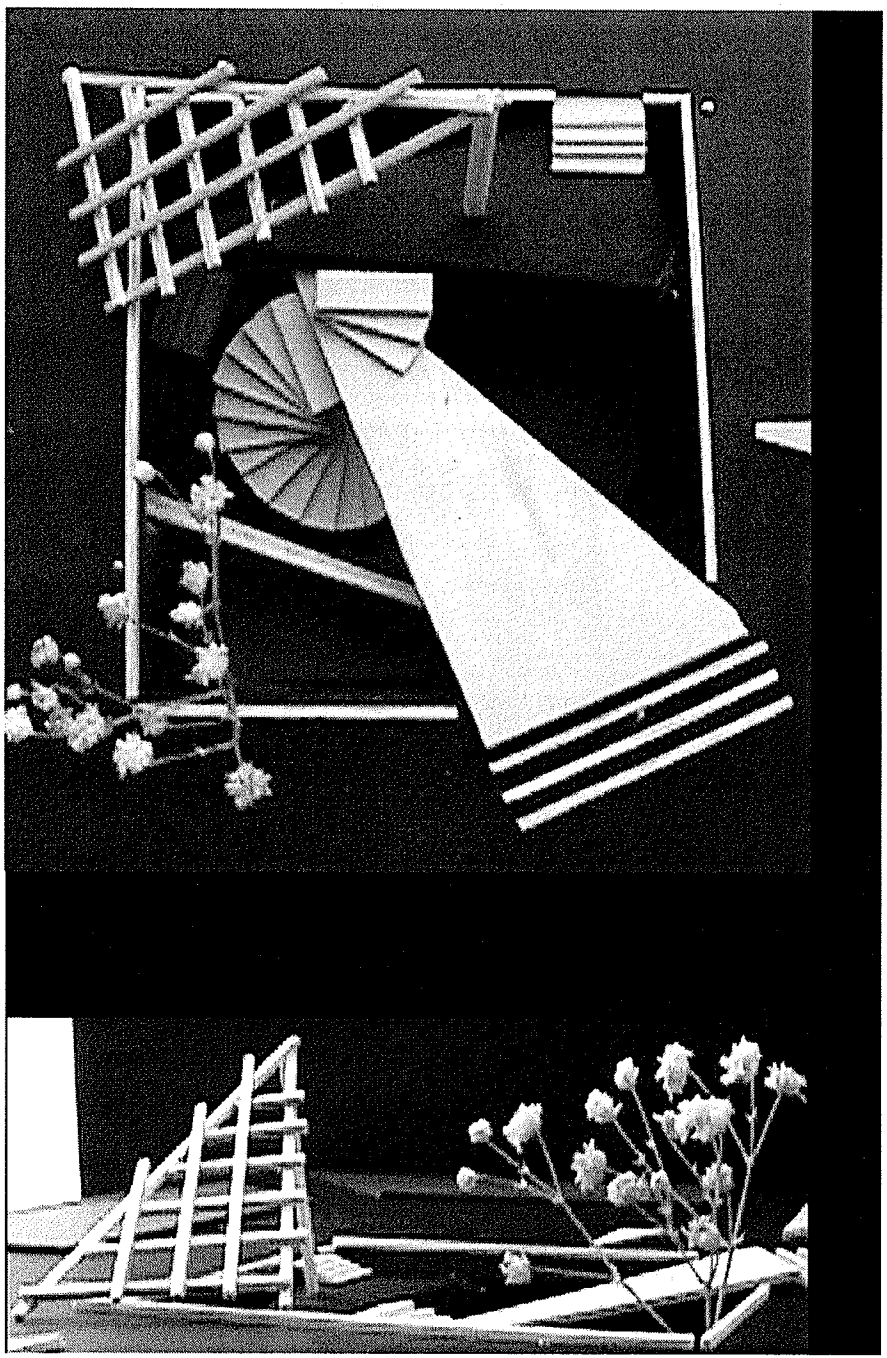
Tunnel entrance view

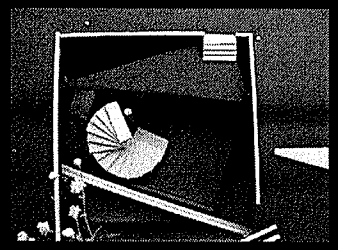


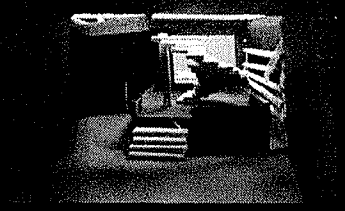
Exterior view

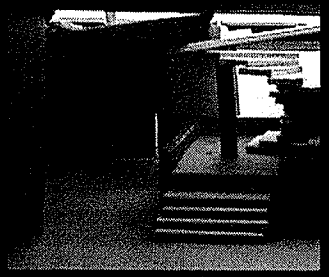
There are two seating areas along this vertical garden. The one above ground is currently located in front of the Fine Arts School; the other, inside the tunnel, is the new seating area. This area has a half-open ceiling and spiral stairs. There are trees growing inside the tunnel that cover almost half of the seating area inside.

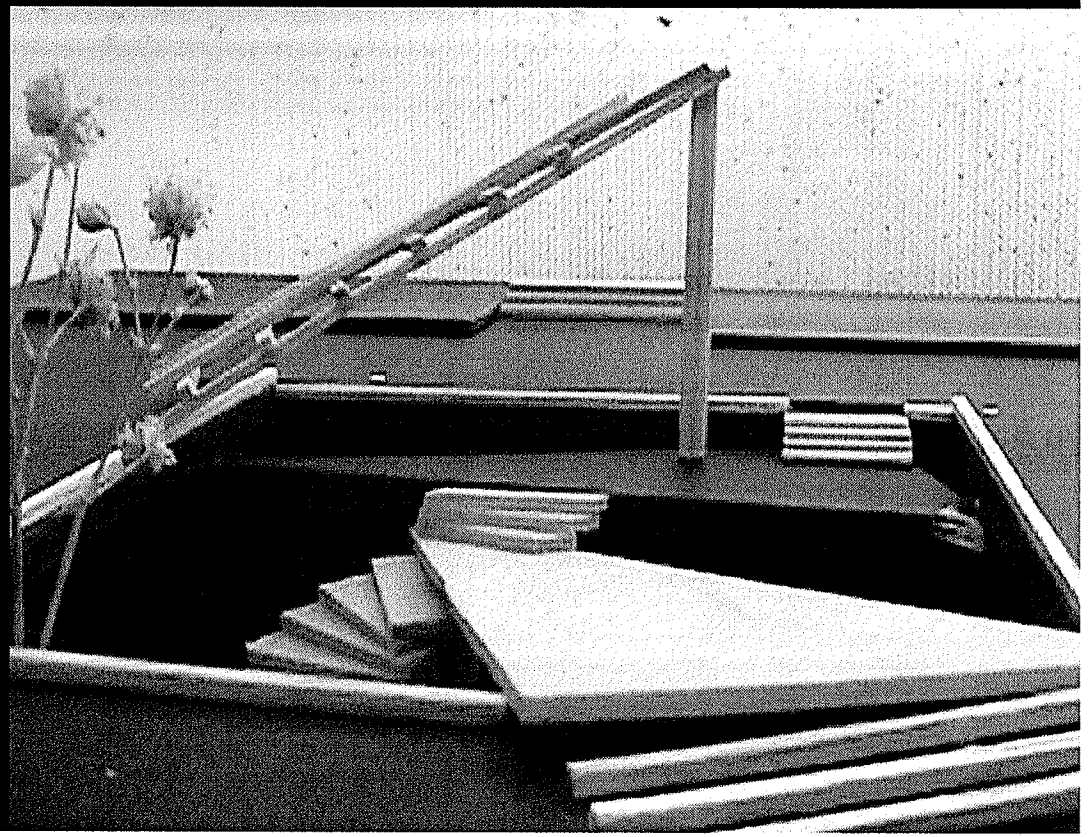
This structure's design creates a central seating area at two levels and an new access from ground level to the tunnel. The structure creates an interesting vertical garden from below ground to above ground. The triangular trajectory provides a nice shadow as well as privacy too.





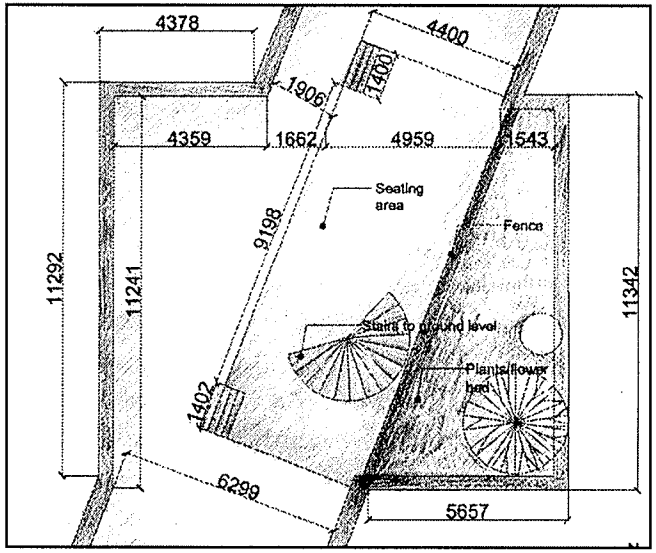




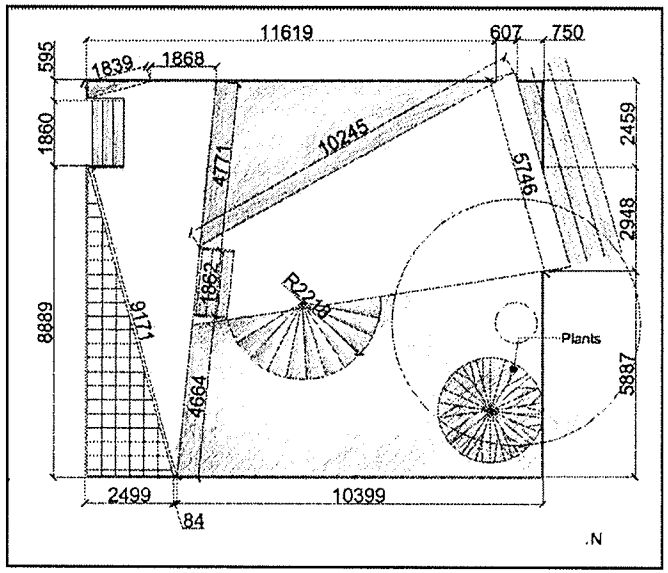


Site/type 6 plan

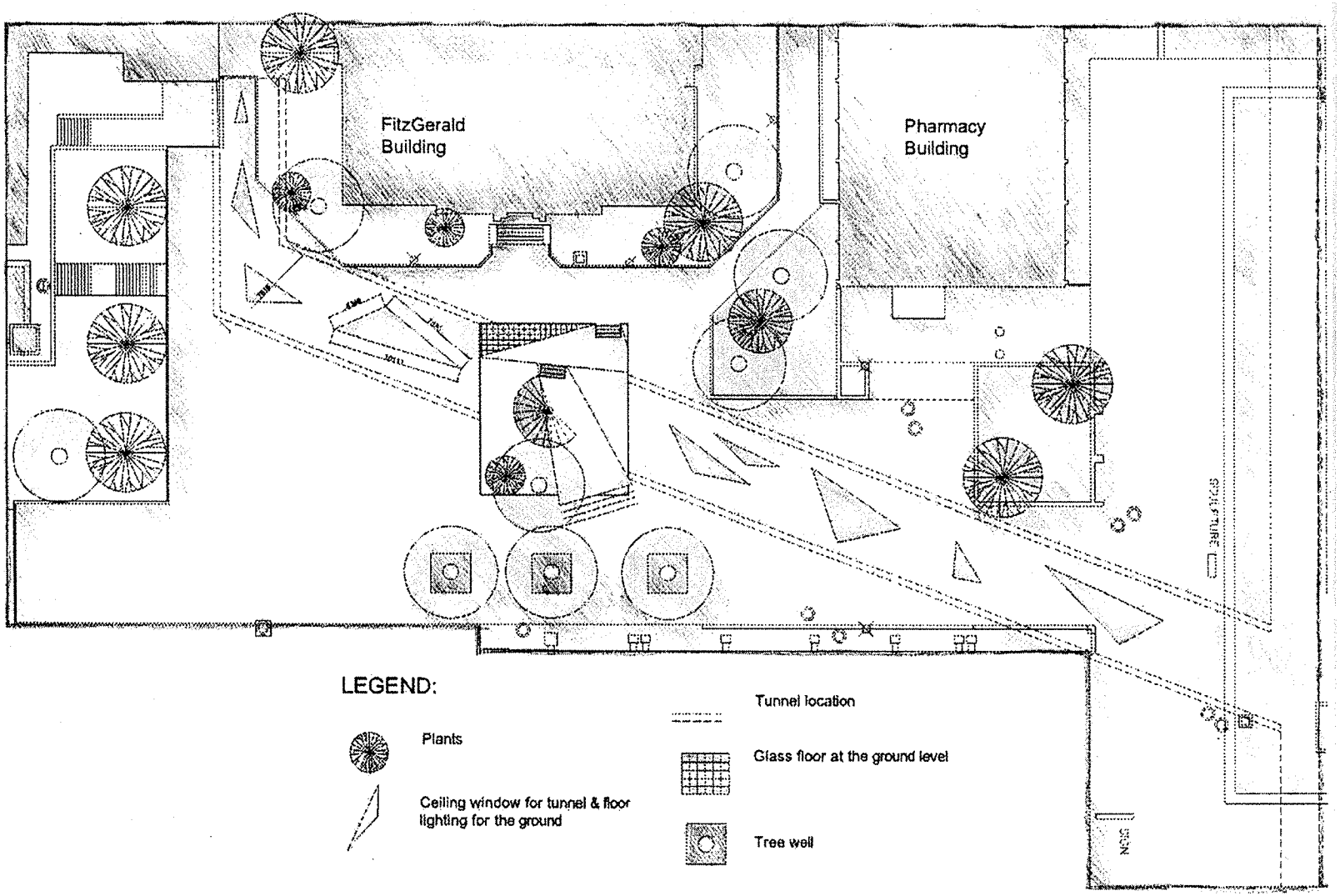
Scale: not to scale



Underground/tunnel layout



Tunnel entrance layout


FitzGerald
Building
Pharmacy
Building
LEGEND:
Plants
Ceiling window for tunnel & floor lighting for the ground
Tunnel location
Glass floor at the ground level
Tree well

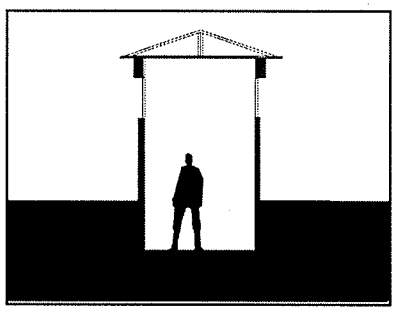
5.3.7. Site/type 7

This is the place in front of the Tier Building and main the bus on campus. This segment of tunnel has wide open windows, stairs, and an elevator. This site has a very good sense of place, aesthetic aspect, liveability, and accessibility. The development needs to focus on complexity, connection and diversity. The development strategy determined is as follows:

1. Frame the sunshine penetration. (liveability, aesthetic aspec, diversity)
2. Introduce the landmark to the site. (place)
3. Build the north side garden with a transitional connection with the tunnel space. (structure, complexity, connection)

Table 7 Type/Tunnel 7 analysis table

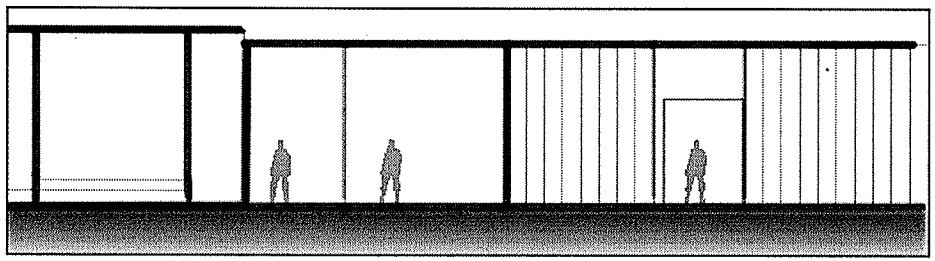
Quality / Aspects	Good	Normal	Not Good
Place	●		
Complexity		●	
Aesthetic Aspect	●		
Liveability	●		
Accessibility	●		
Structure			●
Connection		●	
Diversity		●	



Site/type 7-a

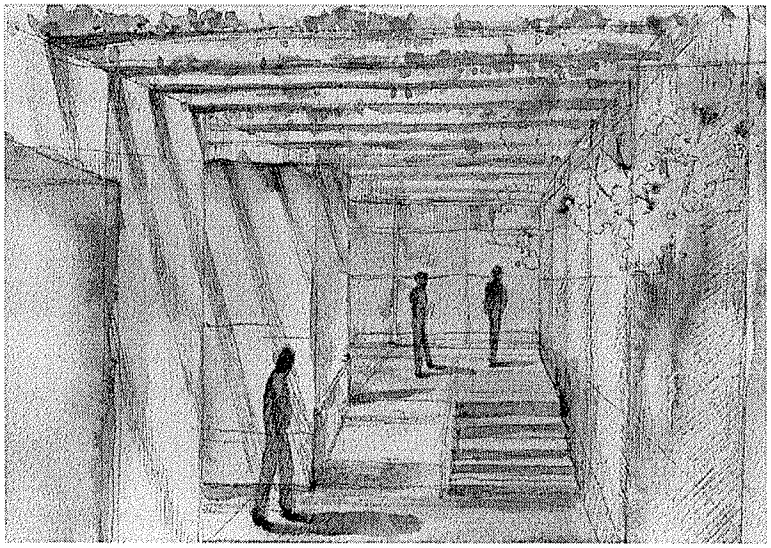
The tunnel/type 7 section

This segment of the tunnel design develops a place that provides sitting, observing, and walking opportunities year round.

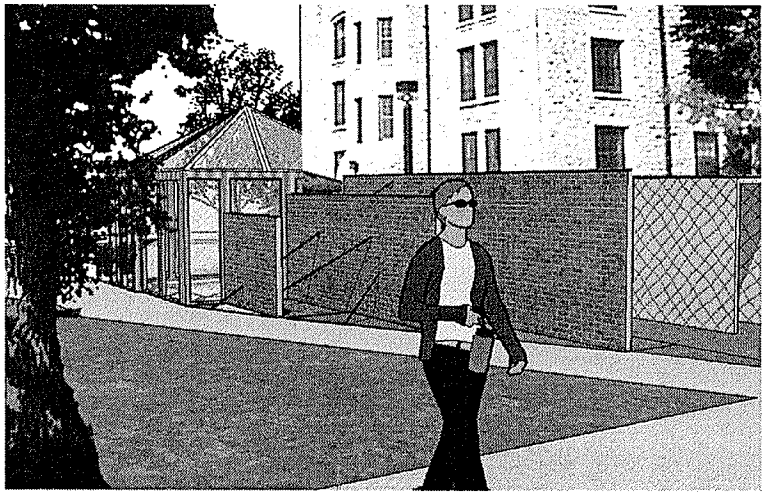


Site/type 7-b (proposed)

The tunnel's section drawing



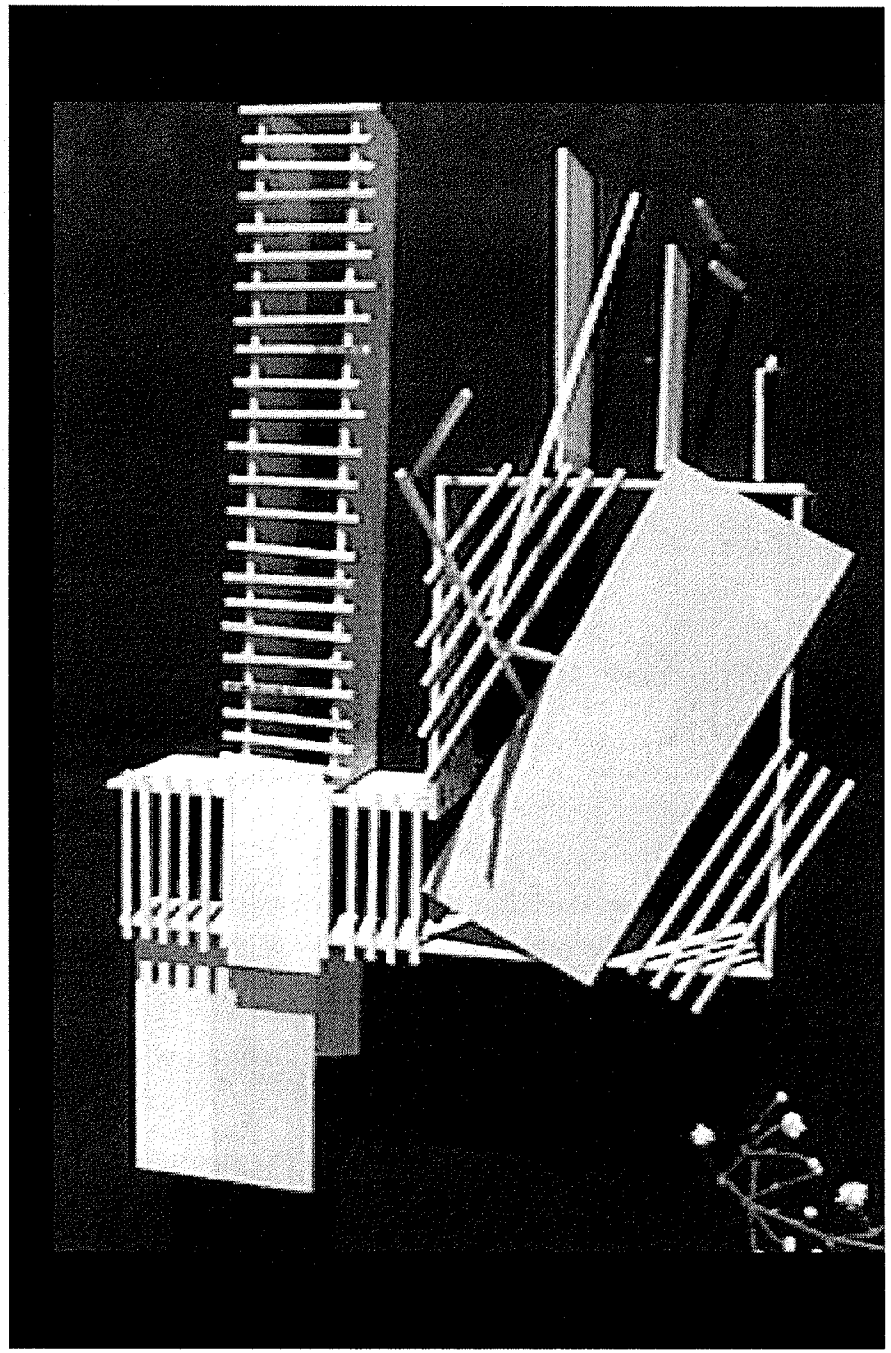
Tunnel view

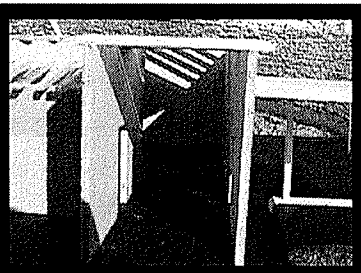


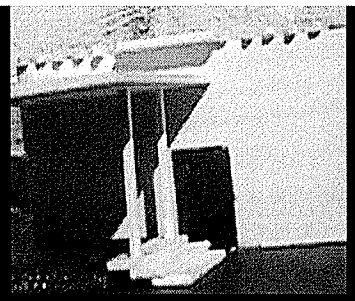
Exterior view

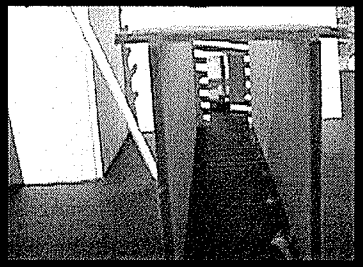
The design joins a walking path to the existing tunnel. This leads to a newly developed north side courtyard. The other development includes the three-wall arrangment at the east side of the tunnel. These walls create a connection between the tunnel and the courtyard, providing interesting private spaces at this site and a networked landmark.

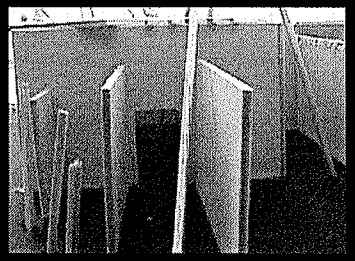
The structure design at this site attempts to moderate the often bright, hot sunlight at this segment. Wood slats frame window glass, creating nice shadows and enhancing the sunlights presence. The structure also includes the extended walking path that leads people to the newly developed north side garden.

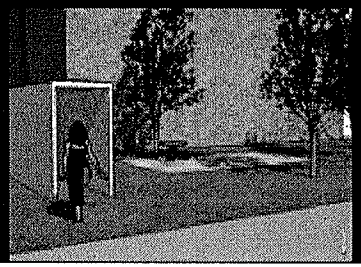


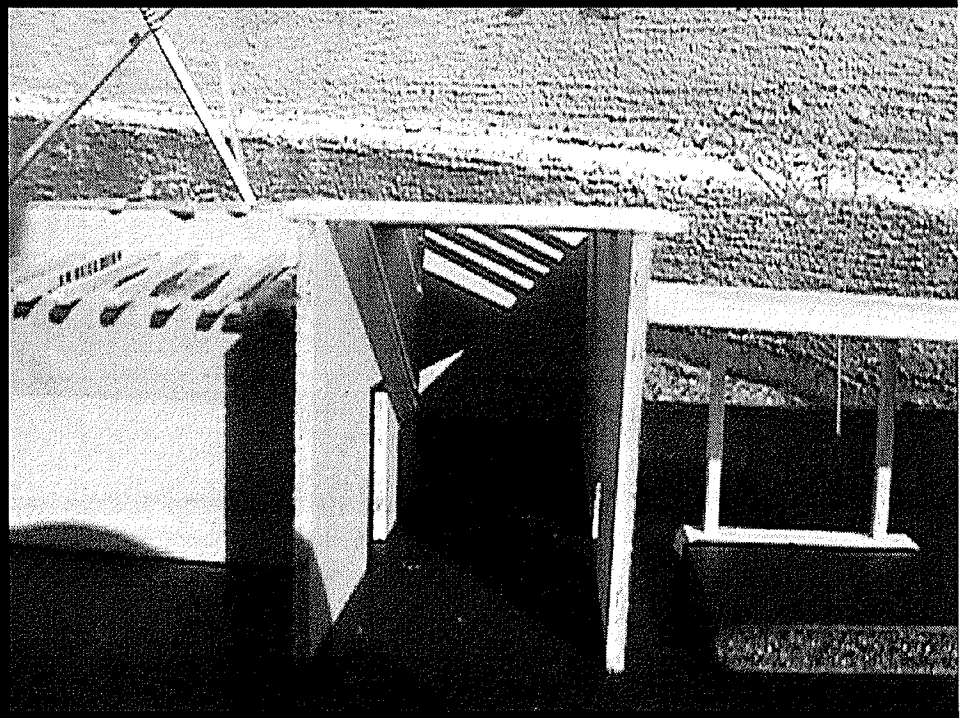






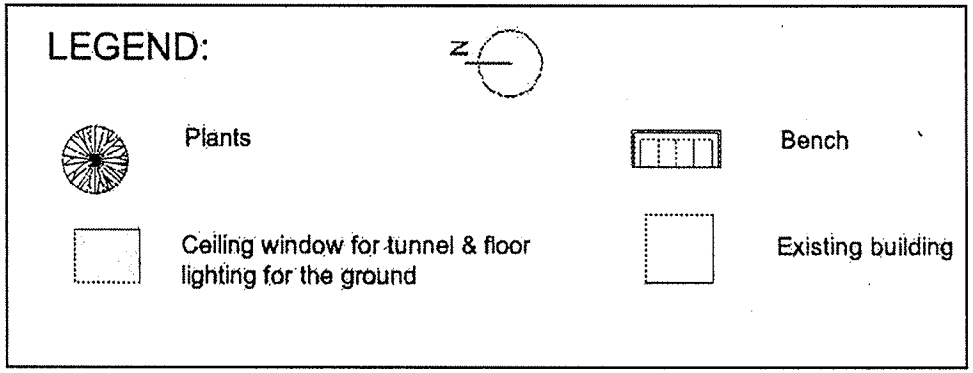


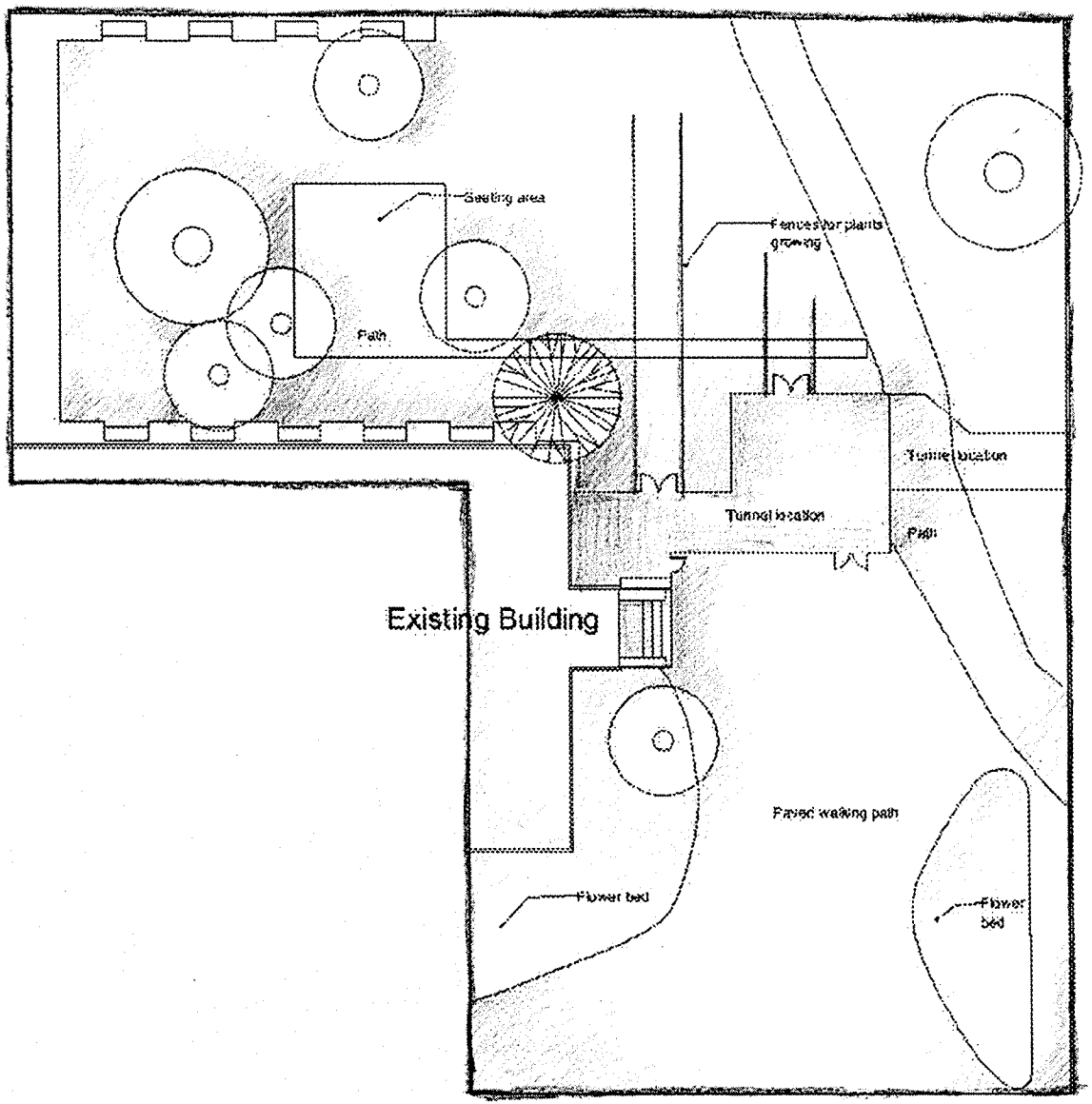




Site/type 7 plan

Scale: not to scale




Seating area
Fence for plants growing
Path
Tunnel location
Tunnel location
Path
Existing Building
Paved walking path
Flower bed
Flower bed

5.4 Conculsion

In conclusion, the purpose of this practicum is to explore landscape architecture in the context of Geo-space design to address the stresses of modern life, such as unfriendly climate, potential energy shortages, increasing urban land prices, and interpersonal conflicts due to poorly planned spaces. The development of "Geo-space Urban Design" is a new development method that extends the city into underground spaces. This new direction for landscape design is the departure point for this project. The constraints in designing such underground public spaces are varied; however, sunlight penetration is key for design.

The chosen site, University of Manitoba Fort Garry Campus, is an educational site with a large population, long periods of harsh weather, and underground pedestrian tunnels covering long distances. These tunnels are the underground public spaces that can be redesigned to encompass all the functions for living, studying, working and learning. These tunnels also vary significanlty with respect to their spatial forms as well as their relationship with the outside environment. Consequently, the designs process sorted the tunnel spaces into seven forms which resulted in seven different design approaches.

The outcome of this activity has resulted in a natural, cultural and structural celebration that has created places that may support greater "human dignity". The types of geo-space/tunnel designs proposed herein demonstrate there can be a relationship between man and nature even in geo-space. I realized that the connection/interruption between the environment and geo-space can create communication by introducing to the geo-landscape complexity, diversity and playfulness resulting in an enhanced, livable space. Whether the space should be transitional, that is to say moving people from above ground to underground, or a network that connects with all the other types of the site's geo-landscape, all depends on the context.

Future research should focus on new geomorphology and new infrustructure, such as, HVAC (Heating, Air Conditioning and Cool) systems for vegetation growth in underground spaces and new hydrology systems development. More futuristically, new research could include soil profile, texture and conditions analyses that could result in new species or new systems to enchance the underground enviroment. Exploration is also needed into the effects of varying sunlight penetration on plant growth.

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