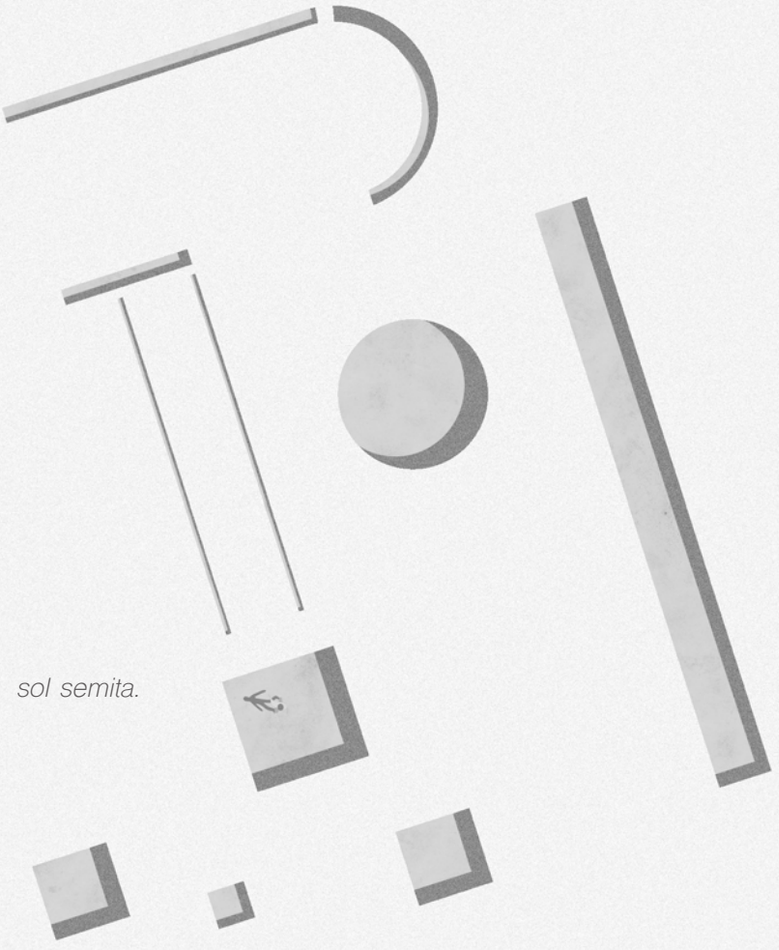

sol semita.

sol semita.

claire shimbashi hougan.

irn 800.
professor jonathon anderson.

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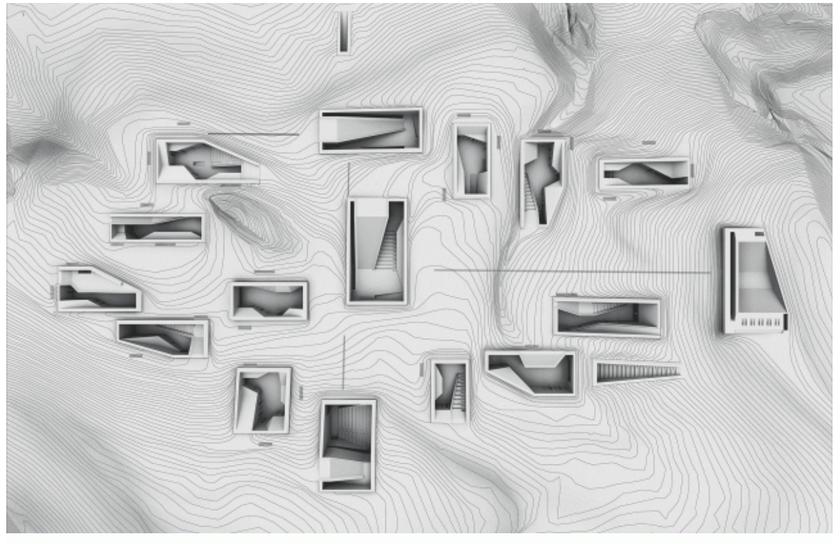
precedents.

project - Excavated Sanctuaries (concept proposal)
architect - Rasam Kamal of Oppenheim Architecture

Excavated Santuaries is a subterrannean building situated in a UNESCO-protected valley in the Jordanian Desert. The building consists of several complexes which are connected underground through a series of tunnels. The underground structure contains a hotel, museum and a train station, and aims to bring more people to the area, while still protecting the natural surroundings of the Wadi Rum.



project – Earthscape (conceptual proposal)
architect – BNKR

Earthscape is a conceptual proposal for a solution to Mexico City's issue of urban sprawl and heritage restraints. Due to these issues, and the city's overwhelming population, there has been growing concern over the future of infrastructure. As a response, BNKR created a conceptual design which takes the form of an upside down pyriamid. The structure would be situated in the middle of Historic Downtown, and would run 300 m deep into the ground, with housing for 5,000 people, Earthscape will consist of terraced floors, allowing each floor to have exposure to natural light through a glass ceiling. The glass ceiling was implemented to ease peoples fear of living underground, and to give people access to a healthy amount of sunlight.

research.

needs for subterranean interiors.

Across many cultures, there are negative connotations with underground spaces. Some of these notions originate from religious beliefs (undergound burials), fear of entrapment or disorientation, discomfort, and lack of sunlight. With population density increasing in many cities around the world, it is it vital that architects and designers start to focus on designing urban subterranean spaces that make the underground experience more enjoyable, and even sought out.

Exterior Indication of Scale of Building

With grade level buildings, users immediately get the sense of scale of the building as it is entirely visible from the outside. Since below grade buildings clearly do not have this advantage, it is important to incorporate some idea of what the scale of the interior building is before the user enters the space.

If one is not aware of how large the building is, it can cause a sense of uneasiness while navigating throughout, as the boundaries of the interior are unknown. Techniques used could consist of landmarks, skylights, change in landscape material, vegetation etc.

Wayfinding

Incorporating wayfinding and changing environments within underground interior spaces can help users feel more comfortable. There is often a fear of disorientation due to lack of wayfinding and too much consistency in interiors. In order to reduce this, more signage can be incorporated, and greater variations in materiality, lighting techniques, and acoustics can be used throughout the building. For example, flooring materials can change in colour, texture, and scale, and changes in lighting brightness, colour or techniques used can help differentiate between spaces.

Diverse sizes of rooms can also be helpful with navigation. Designers could incorporate variations in ceiling heights, room sizes and room and ceiling shapes to allow users to differentiate between the various areas in the building. Creating these environmental cues will allow users to be able to easily identify where they are, and where they need or want to go to. Having these cues will also increase efficiency of evacuation if needed.

Special Spatial Considerations

To ease feelings of claustrophobia, architects and designers should incorporate higher ceilings and wider corridors than usual to open up the space more. The use of low partitions or floating partitions could provide spatial relief.

Lighting + Access to Outside Environment

Lighting is often one of the most common complaints with subterranean spaces. When in underground buildings, users often do not have direct views outside or access to sunlight, and this can cause a feeling of loss of control over the environment. Due to the reduction of natural light entering the building, the interior tends to be darker and without changes in lighting levels throughout the day, and this can lead to one feeling disconnected from the outside world. When designing subterranean spaces, it is vital to incorporate sunlight into the interior as needed with skylights, atriums, light pipes or light wells. Doing so will give users a sense of connection to the outside environment, easing possible anxieties. Where access to sunlight is not possible, designers could mimic sunlight with hidden lights.

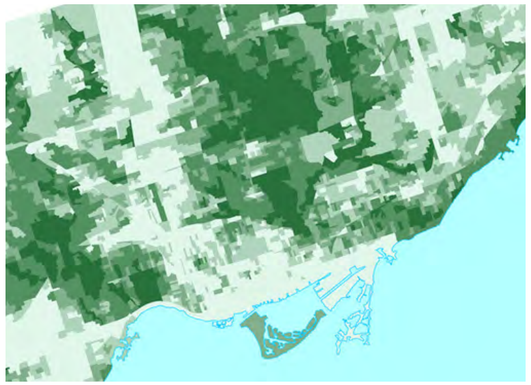
Greenery

Lack of greenery in subterranean spaces is known to be a large issue as to why people do not tend to like to go underground. Humans possess an inherent tendency to gravitate toward nature. Greenery is vital in promoting good human psychological and cognitive functioning, therefore incorporating it into underground spaces where people may feel uncomfortable, could help ease stresses and reduce negative connotations with the space they are in.

↑ population density ..... ↑ mass condo development .....

↑ urban heat island effect .....

..... ↑ harm to our health and environment



Percent of Dissesmination Areas Covered by Trees, 2007

- 0.0 - 15.0 %
- 15.1 - 25.0 %
- 25.1 - 35.0 %
- 35.1 - 50.0 %
- 50.1 - 77.4 %

Investing in subterranean urban development in Toronto would be beneficial to the city economically, environmentally and physiologically. Toronto's population density currently sits at 4,149.5 people/square km, and with mass condo development that has been taking place in the city, the density is expected to grow even more quickly. Toronto is not nearly as dense as cities such as New York or Tokyo, but it is important to take alternative building solutions into consideration to reduce the likelihood of facing the issues that they are dealing with now.

Toronto would be fit for a subterranean development in the downtown core due to its lack of vegetation, and increasing urban heat island effect. Implementing a greenspace would help mitigate these growing issues, and it would benefit people living or working downtown. Lastly, Toronto already has the infrastructure for underground spaces, so why not expand it and improve the underground experience?

Vegetation in Toronto

The lack of trees and greenspace in downtown Toronto has been caused by the mass development that has been seen in Toronto in the past few decades.

Research conducted on greenspace in Toronto concluded that only 0-15% of downtown Toronto was covered by trees in 2007. A more recent study conducted by MIT (in collaboration with the World Economic Forum), found that as of 2017, Toronto now has 19.5% of its land covered by trees with a population density of 4,150 people/km squared. Although the land coverage has increased, there is still room for improvement, as Vancouver sits at 25.9% land coverage with a population density of 5,249 people/km squared.

In 2015, the World Economic Forum added increased green canopy cover to the list of Top Ten Urban Initiatives, citing the ample benefits to increasing greenery in urban areas. Benefits include the mitigation of air pollution, decreased urban surface temperatures by blocking shortwave radiation and increased water evaporation.

Urban Heat Island Effect

Urban Heat Island effect has been a growing issue in Toronto due to the mass development that has been seen in the city. In untouched or low impacted lands, there is generally vegetation or bodies of water that help to keep the surface temperature consistent. The issue in Toronto is that relative to the population density, the city is not green enough. Downtown is dominated by concrete streets, high rise buildings, and high volumes of vehicle traffic, which all contribute to the increasing surface temperature in the city.

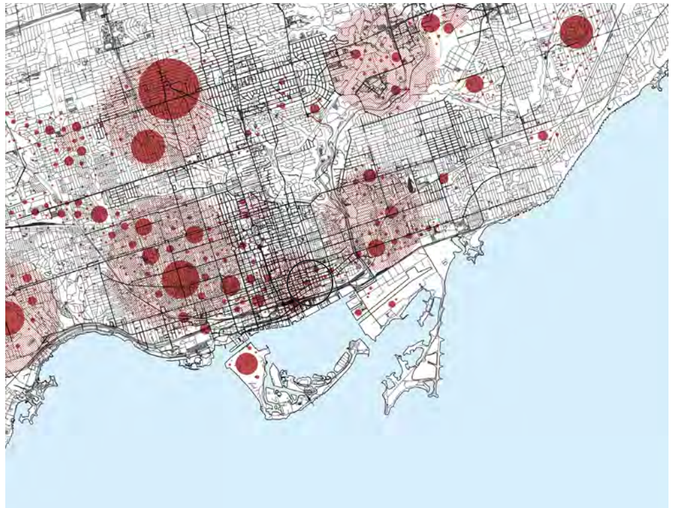
Building underground would allow for more implementation of green spaces in Toronto, contributing to the reduction of UHI effect. Additionally, subterranean buildings require less energy consumption as the subsurface temperature is consistent throughout the year, remaining warm in the winter and cool in the summer. This would also help in the reduction of UHI effect as air conditioning would not be required as much as above grade buildings, helping to reduce the surface temperature.

Health

Implementing more green spaces in urban environments has been proven to help people psychologically and physiologically. Humans are naturally biophillic, therefore creating more green areas in an environment which is mostly dominated by concrete and buildings can improve mental health and reduce blood pressure and stress levels. Trees also improve air quality greatly in urban environments, which can help to ease respiratory problems.

Toronto Infrastructure

Toronto currently has a subtereanean system in place



Map represents hotspots in Toronto that have surface temperatures ranging from 28.5 - 32 degrees. The smaller dots represent the lower end of the spectrum and the larger dots represent the highs. The black circle indicates the area that the site is on, which currently has a surface temperature of 31 degrees.

which makes the development of an urban undergound space in the city so fitting. The subway system and PATH allow city goers to travel underground, making commuting easier in the winter months. The issue with it though it that people use it out of need and tend to not want to stay underground for too long.

What I will be exploring for this project, is how can we change peoples perception of underground spaces, and design urban underground environents that people actually want to spend time in?

sol semita site

buildings affecting site lighting

surrounding buildings

Site

The site its located across from St. Lawrence Market at the corner of Front St. and Lower Jarvis St. The surrounding areas consist of parks, condos, grocery stores, restaurant/bars, a movie theatre, schools and performance centres. The culture of the neighbourhood heavily celebrates art and food, with the famous St. Lawrence Market in the area. It is also very pedestrian friendly.

The St. Lawrence Market is opened Tuesday-Saturday, with Saturday being the busiest day of all. People from all over the city flock to the area for local food and groceries.

Demographics

The site is at the intersection of three different neighbourhoods in Toronto: Church-Yonge, Moss Park and Waterfront. Due to this mixture, the area is rather diverse in terms of demographics.

The age demographic sits at the average for downtown dwellers:
Top age demographic in the area: 25 - 54 years
Second age demographic in the area: 15 - 24 years

The neighourhood consists of young low income families, young condo dwelling couples, fixed income seniors in subsidized housing, and first time buyers investing in luxury living, but as mentioned above, the majority of people living in the area are young to middle aged working professionals.

Altough this is the general census of people living in the area, people from all over the city with varying backgrounds go to, and work near the St. Lawrence Market.

Direction of Development

The neighbourhood is slightly more quiet compared to the core and west end, but it is only a few blocks away from the fast moving Financial District. For development in the area, it will be important to respect the residents, but with the location and reputation, a flexible space which can be used during the day by everyone and at night by young adults and working professionals would help boost revenue for the site.

sol semita.

concept.

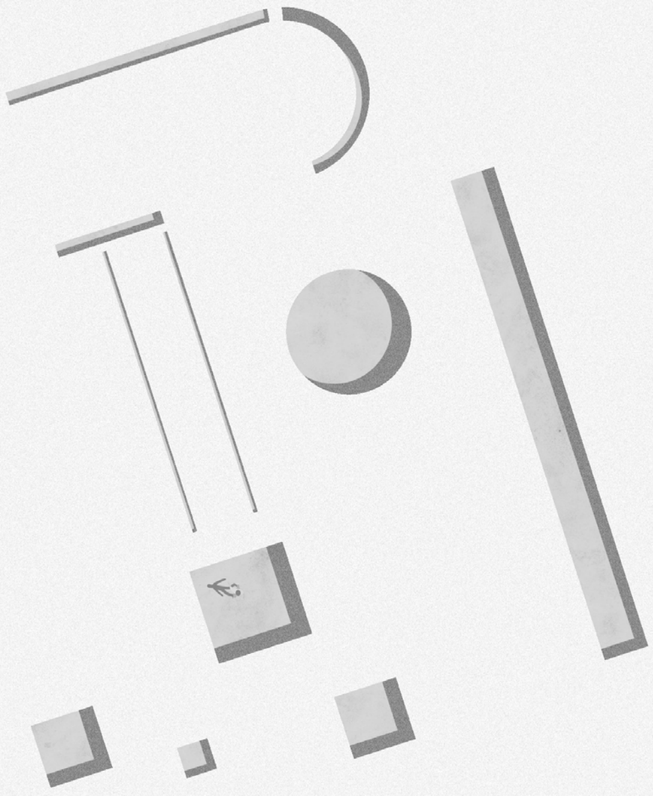
sol semita will be a green space, subterranean art gallery and farm-to-table restaurant, located across from the lively St. Lawrence Market. The concept of the building was inspired by the interaction between light and form, hence it's name, *sol semita*, meaning "sun path". The subterranean space will play with various forms of lighting techniques, to create a space that does not feel subterranean to the people within it - positively altering the underground experience in Toronto. *sol semita* consists of three vessels, the gallery, the passage and the farm-to-table restaurant and cafe.

The art gallery will be designed to be entirely adaptable to the needs of the user within the space, allowing it's use to evolve with the city. The four square voids will illuminate the interior, and will shift with the circulation of the sun throughout the day.

The passage will act as a threshold between the gallery and the restaurant. Using a more subtle and lighting technique than the gallery, the passage will intrique the visitors, and encourage them to explore the restaurant which uses only local food vendors from the St. Lawrence Market.

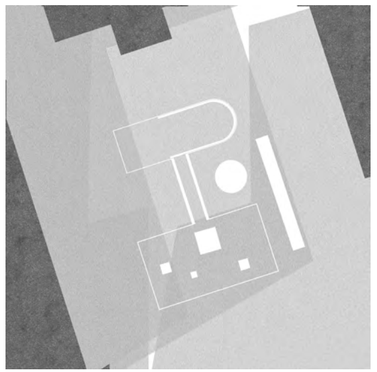
The restaurant will utilize a light shaft hidden from the users to create a lighting technique which allows sunlight to pour down the walls of the interior. It will be the newest destination in Toronto for delicious, local food.

sol semita will be a sought out urban subterranean space in Toronto, bringing the community together through art, food and community activities.



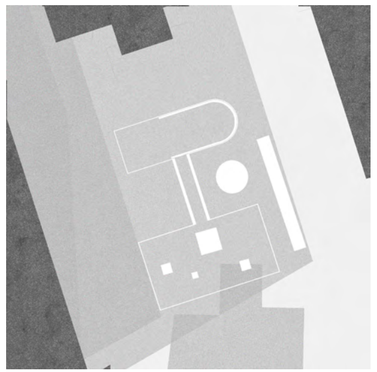
sun analysis.

The sun analysis was executed in Rhino to track the shadow patterns on the site throughout the year – to ensure that the site was appropriate for a subterranean space. Shadow mapping was performed in the morning, noon and late afternoon (within two hours of sunset) of every month, and the shadows were overlayed in order to have a clear understanding of how the building could be designed to allow the greatest amount of sunlight into the interior as possible.



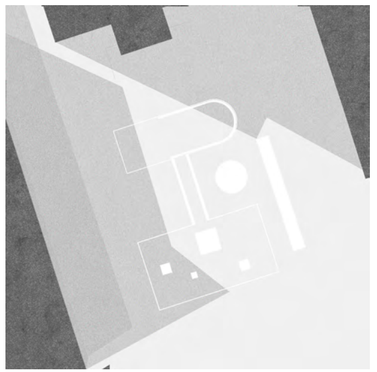
january

site receives least amount of sunlight throughout the day



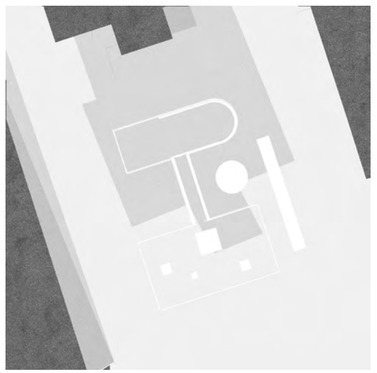
february

site is affected by shadowing only in the late afternoon, and minimally in the morning



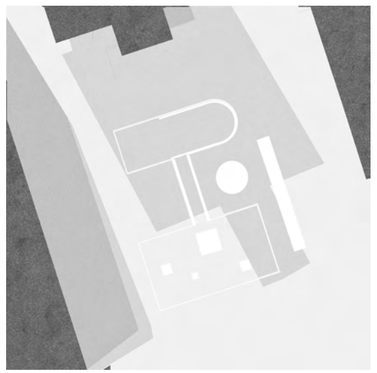
march

site is affected by shadowing only partially in the late afternoon



july

only the north half of the site is affected by shadowing in the late afternoon



august

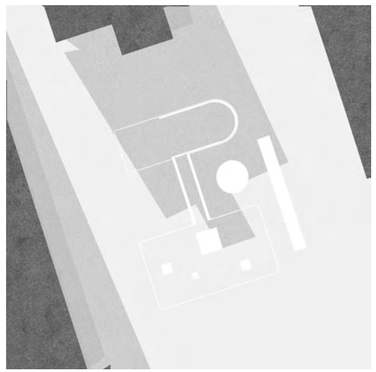
site is partially affected by shadowing in the late afternoon

september

half of the site is affected by shadowing in the late afternoon

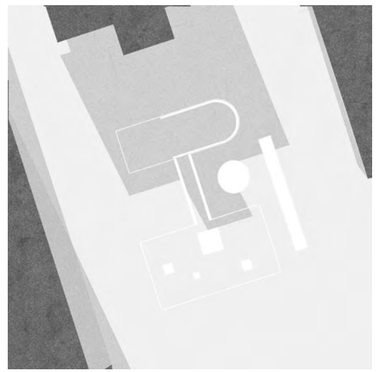
april

northern side of site is affected by shadowing only partially in the late afternoon



may

only the north half of the site is affected by shadowing in the late afternoon

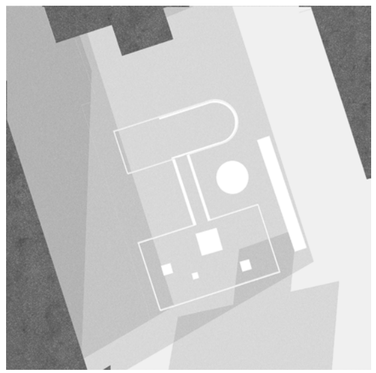


june

only the north half of the site is affected by shadowing in the late afternoon

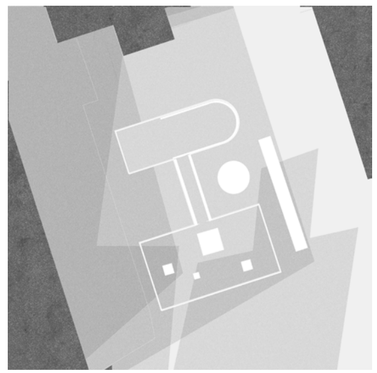
october

half of the site is affected by shadowing by late afternoon



november

site is fully covered by shadowing by late afternoon and minimally in the morning

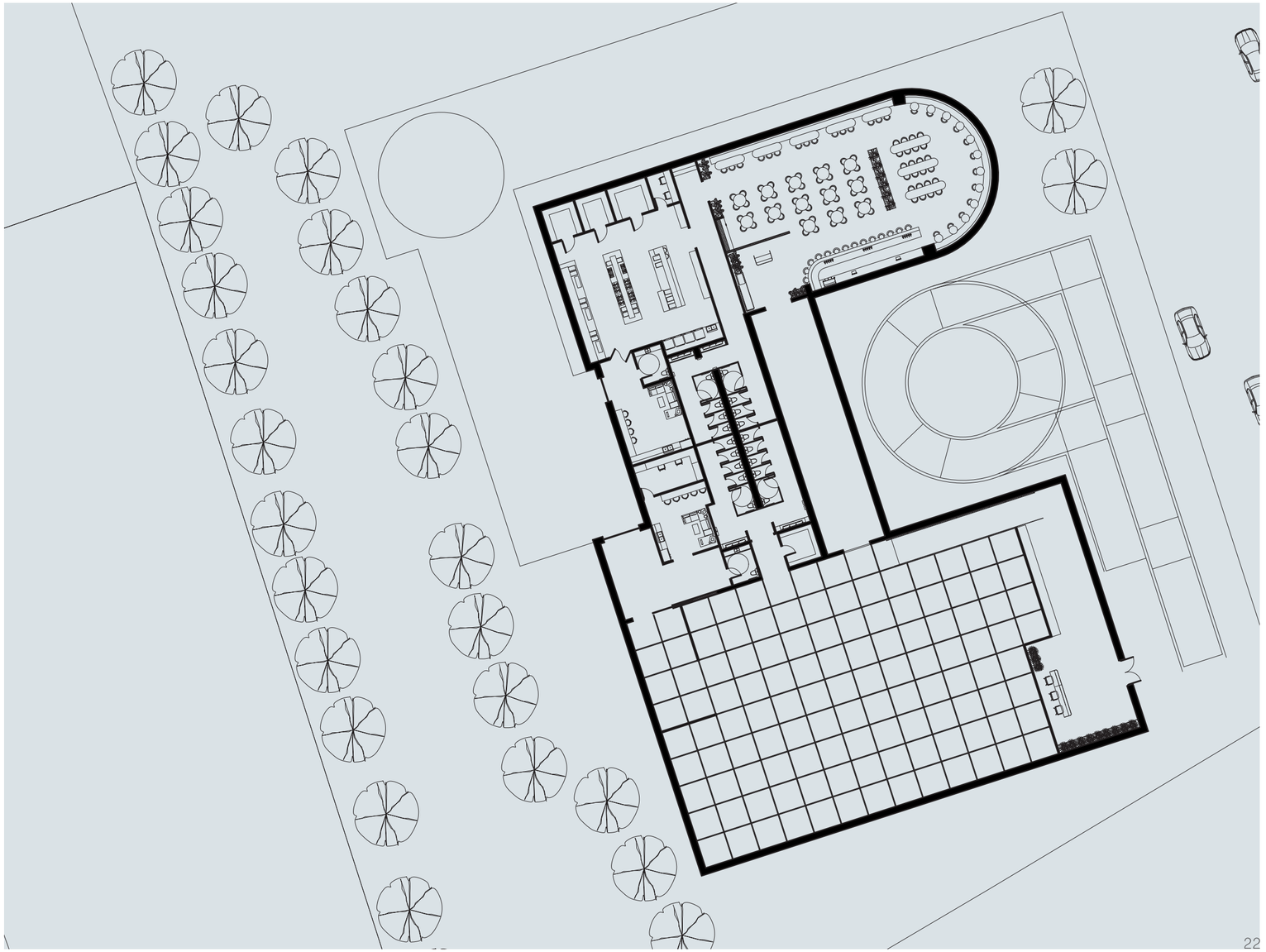


december

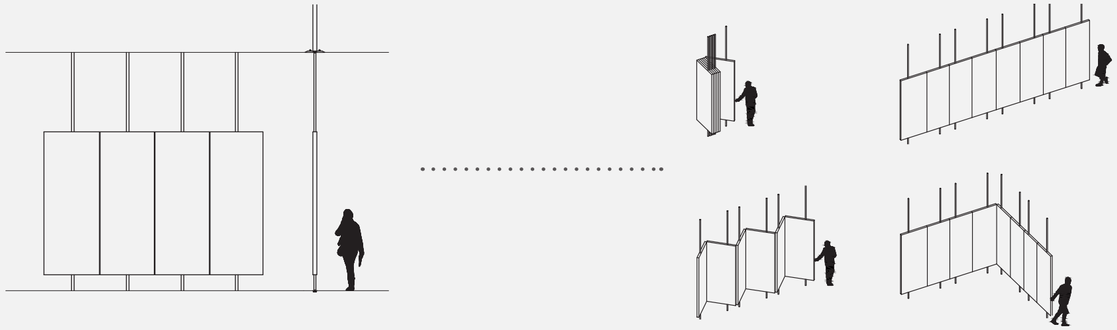
southern site is partially covered by shadowing in the morning, and full covered late afternoon

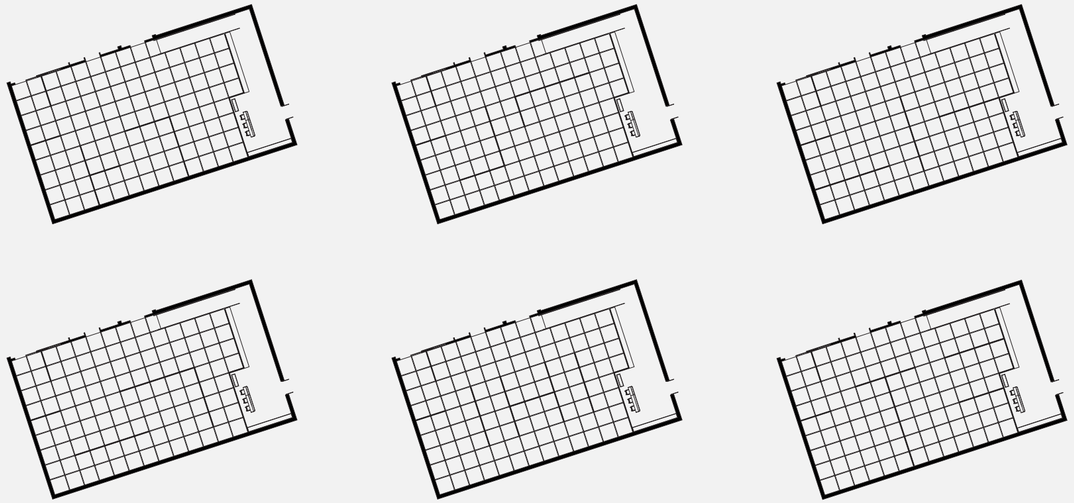
programming

1. pedestrian ramp
2. gallery entrance
3. retail space
4. open gallery space :
   gallery
   workshop space
   event space
5. passage
6. sol semita restaurant and cafe
7. back of house kitchen
8. restaurant management office
9. restaurant staff washroom and changeroom
10. restaurant staff break room
11. restaurant men's wash room
12. restaurant women's wash room
13. gallery women's wash room
14. gallery men's washroom
15. gallery management of fice
16. gallery staff break room
17. gallery staff washroom and changeroom
18. gallerystorage space
19. gallery unloading space
20. service ramp



gallery wall partitions.





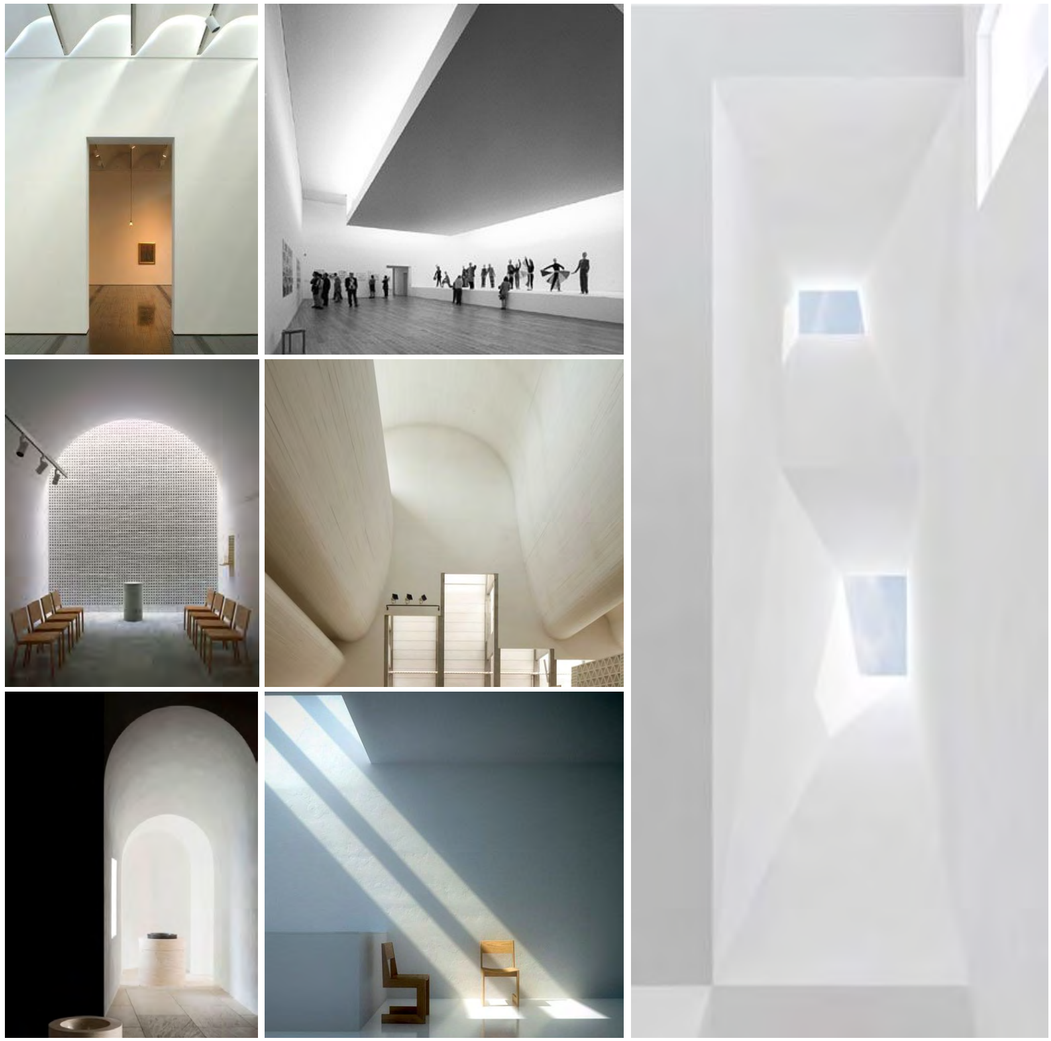
Toronto is constantly changing, therefore to allow the space to suit this, the gallery walls were designed to be completely adaptable to the needs of the users.

The gallery walls can be added or subtracted based on need, and can bend freely on a 180 degree axis.

The gallery floor consists of a matte silver track system which blends into the terrazzo tiles, and the ceiling also has a tracking system built into the wood grid ceiling. The system allows the gallery walls to move straight, and on 90 degree angles, therefore they are able to take on any configuration, or can simply be pushed along the walls if the space is needed for a large event..

Based on my research, lack of natural lighting was the greatest concern with subterranean spaces. Toronto's underground PATH relies solely on artificial lighting to illuminate the space. I began to ask myself, how can I incorporate natural lighting into subterranean spaces to change people's negative connotations with underground buildings? - And do it in a way which was aesthetically pleasing at grade, and works harmoniously with the interior space?

Sketch models were made to test the precedent images which sparked my interest, and from there new lighting techniques were explored to create the three spatial vessels.



lighting techniques.

natural lighting

Based on the sun analysis, skylights were placed in areas which received the appropriate amount of sunlight throughout the day. These skylights will work in tandem with the interior form to create three different lighting effects within the gallery, passage and restaurant. The gallery ceiling and passage drop ceiling will both have knife edges to create sharp shape shadows within the space.

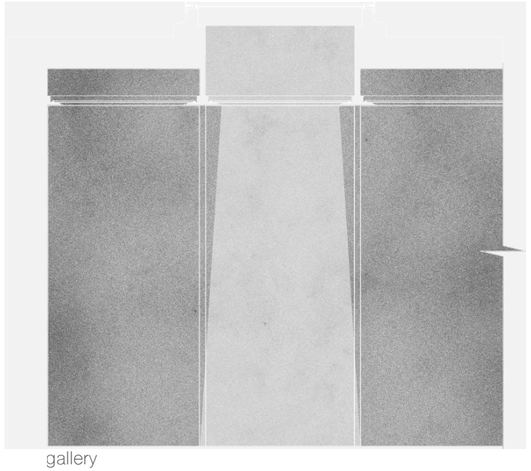
Gallery : utilizes square skylights with knife point edge ceiling grids to funnel sun light directly into the space

Passage : utilizes linear skylights with an interior curved drop ceiling with knife point edges to wash light down the walls, and sharply onto the perimeter of the floor

Restaurant : utilizes a light well and a flat edge drop ceiling to gently wash light down the top half of the walls.

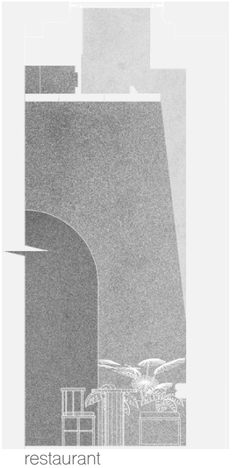
artificial lighting

Artificial lighting will be used to mimic the natural lighting effect in the evenings, and when there is not adequate sunlight. The LED lights will have daylight sensors that will automatically turn the light on, and adjust the light to the level recquired.

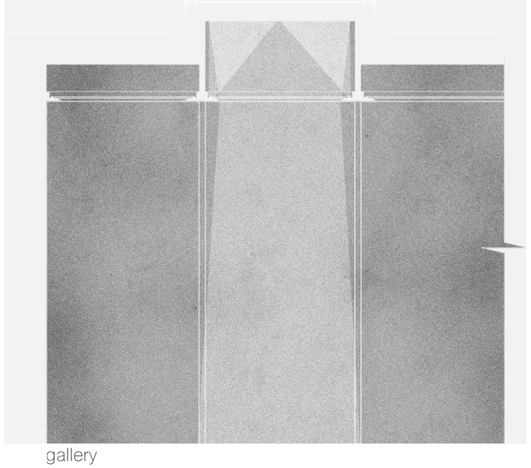


gallery

passage

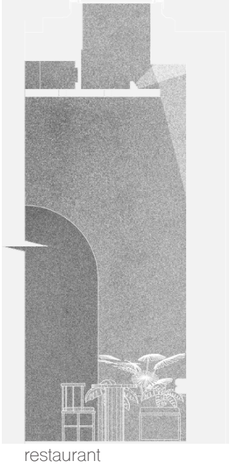


restaurant



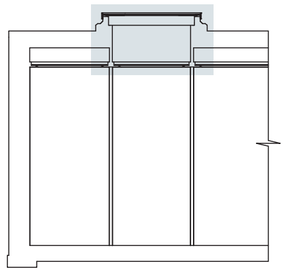
gallery

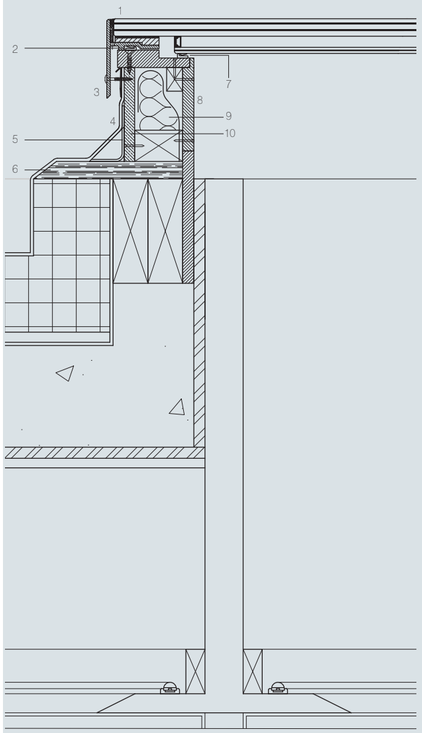
passage

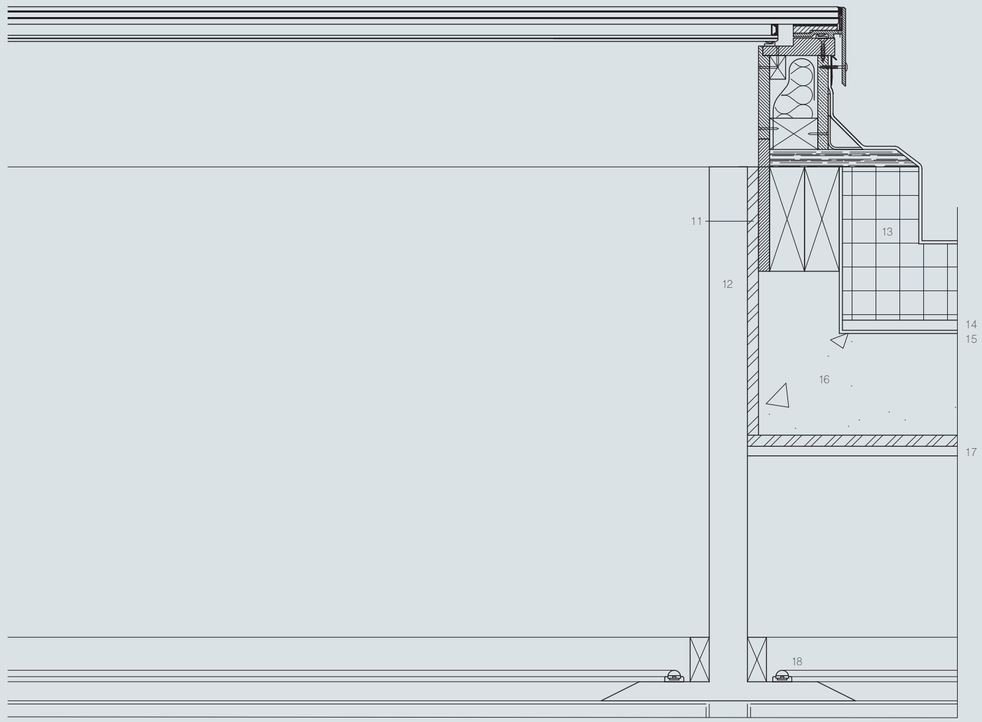


restaurant

lighting details.

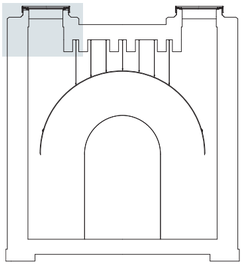






gallery

1. Double Glazed Unit:
   25 mm toughened and heat straightened
   16 mm argon filled cavity with TGI "warm edge" spacer
   8.8 mm laminated low 'E' float
2. Outer Gasket
3. Flashing
4. Roofing Membrane
5. Fixing Bracket
6. Timber Fillet
7. Inner Gasket
8. MDF Sheet
9. Insulation (70mm)
10. Plyboard
11. Furring Channel
12. Wood Ceiling Grid
13. Rigid Insulation
14. Drainage Mat
15. Membrane
16. Concrete Roof Slab
17. Wood Ceiling Panel
18. Flourescent Lighting



Passage

1. Double Glazed Unit:
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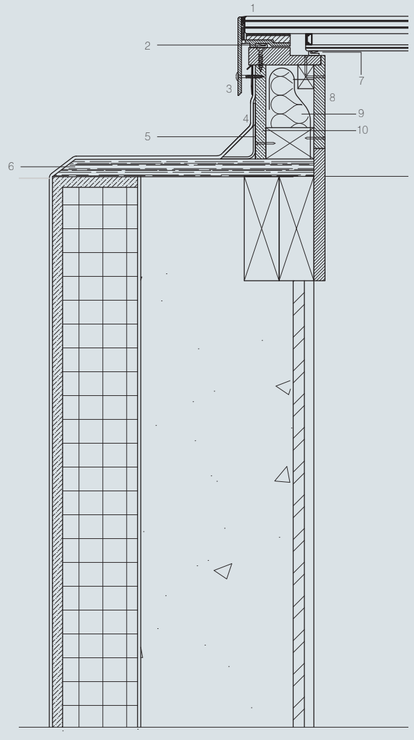
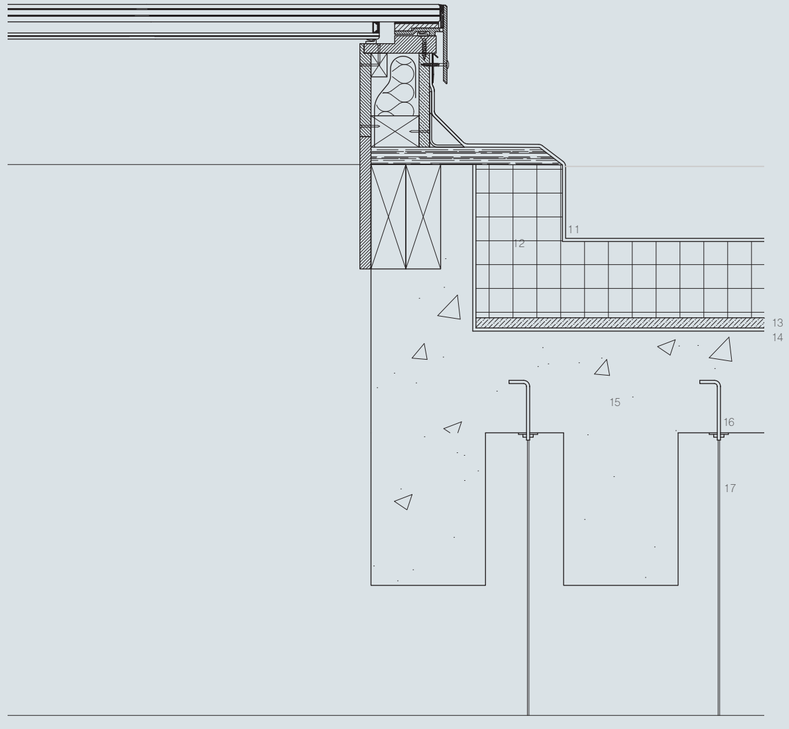
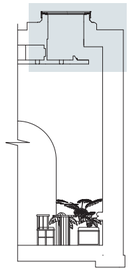
11. Roofing Membrane
12. Rigid Insulation
13. Drainage Mat
14. Membrane
15. Concrete Roofing Slab
16. L Anchor Bolt
17. Drop Ceiling Wire



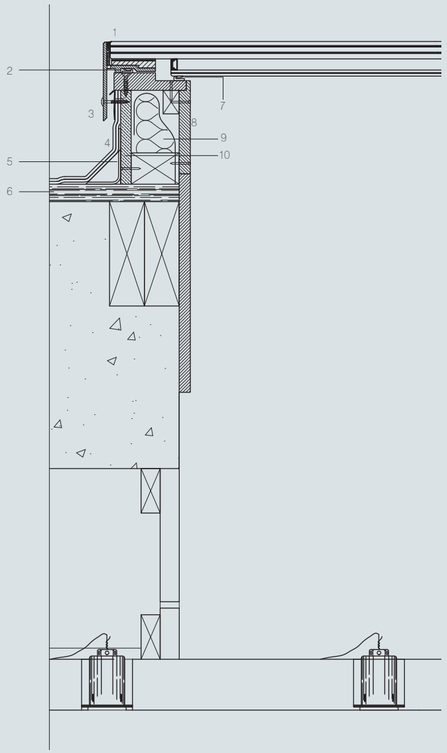


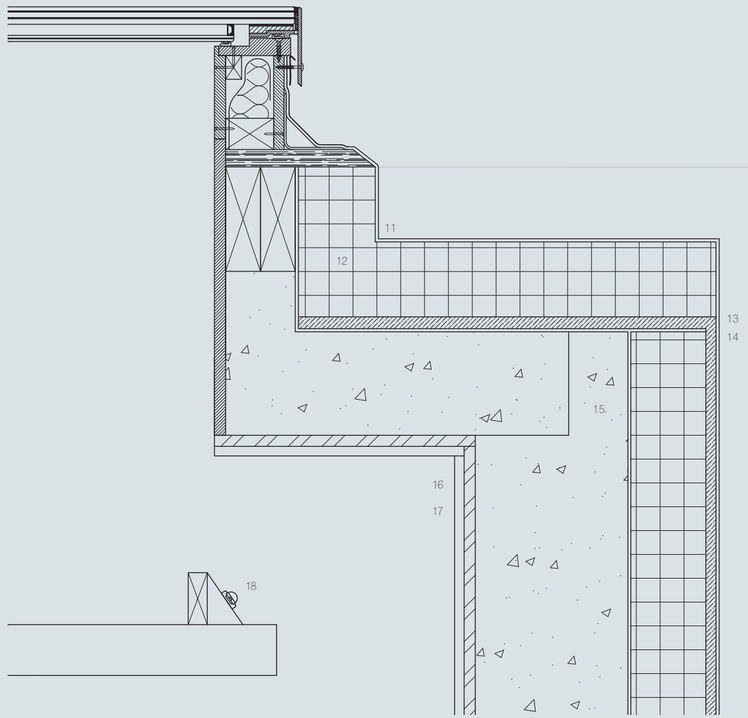
lighting details.



Passage

1. Double Glazed Unit:
   25 mm toughened and heat straightened
   16 mm argon filled cavity with TGI “warm edge” spacer
   8.8 mm laminated low ‘E’ float
2. Outer Gasket
3. Flashing
4. Roofing Membrane
5. Fixing Bracket
6. Timber Fillet
7. Inner Gasket
8. MDF Sheet
9. Insulation (70 mm)
10. Plyboard
11. Roofing Membrane
12. Rigid Insulation
13. Drainage Mat
14. Membrane
15. Concrete Roofing/Wall Slab
16. Furring Channel
17. Wood Panel
18. Flourescent Lighting

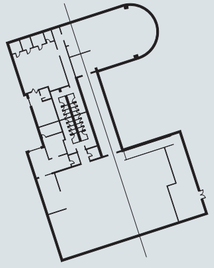


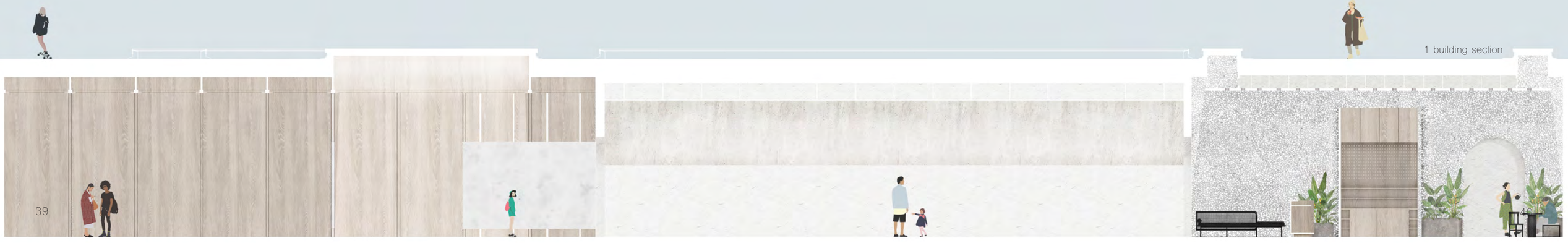


renderings.

entrance ramp elevation

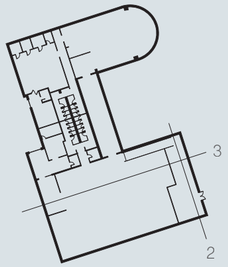
entrance ramp section

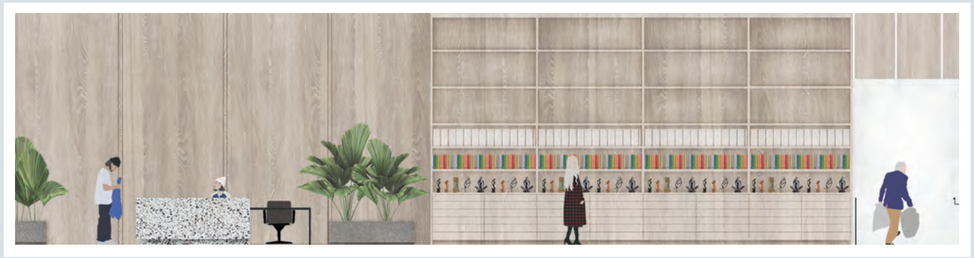




1 building section

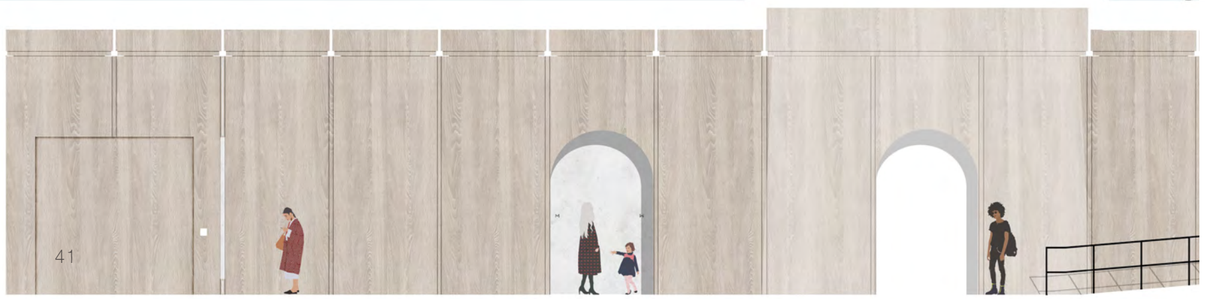
sections + elevations

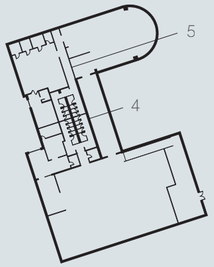


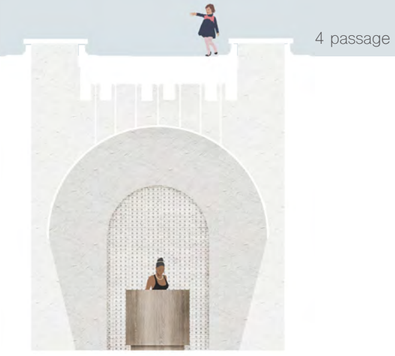


2 gallery entrance / retail

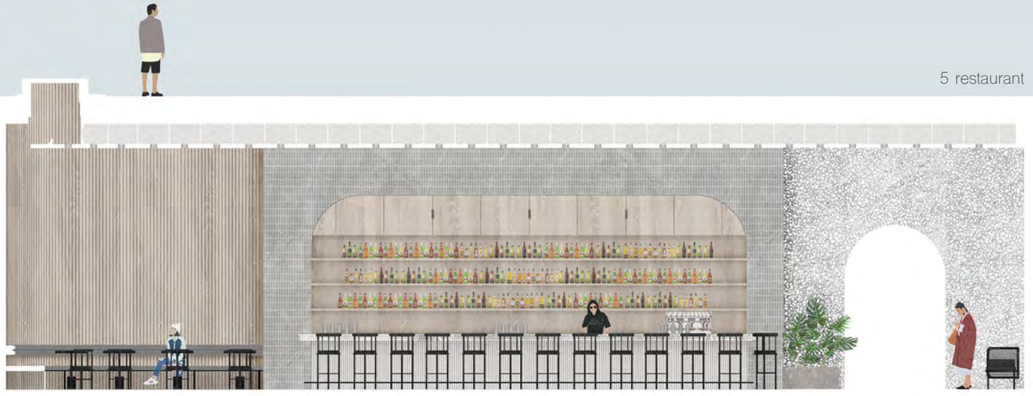
3 gallery





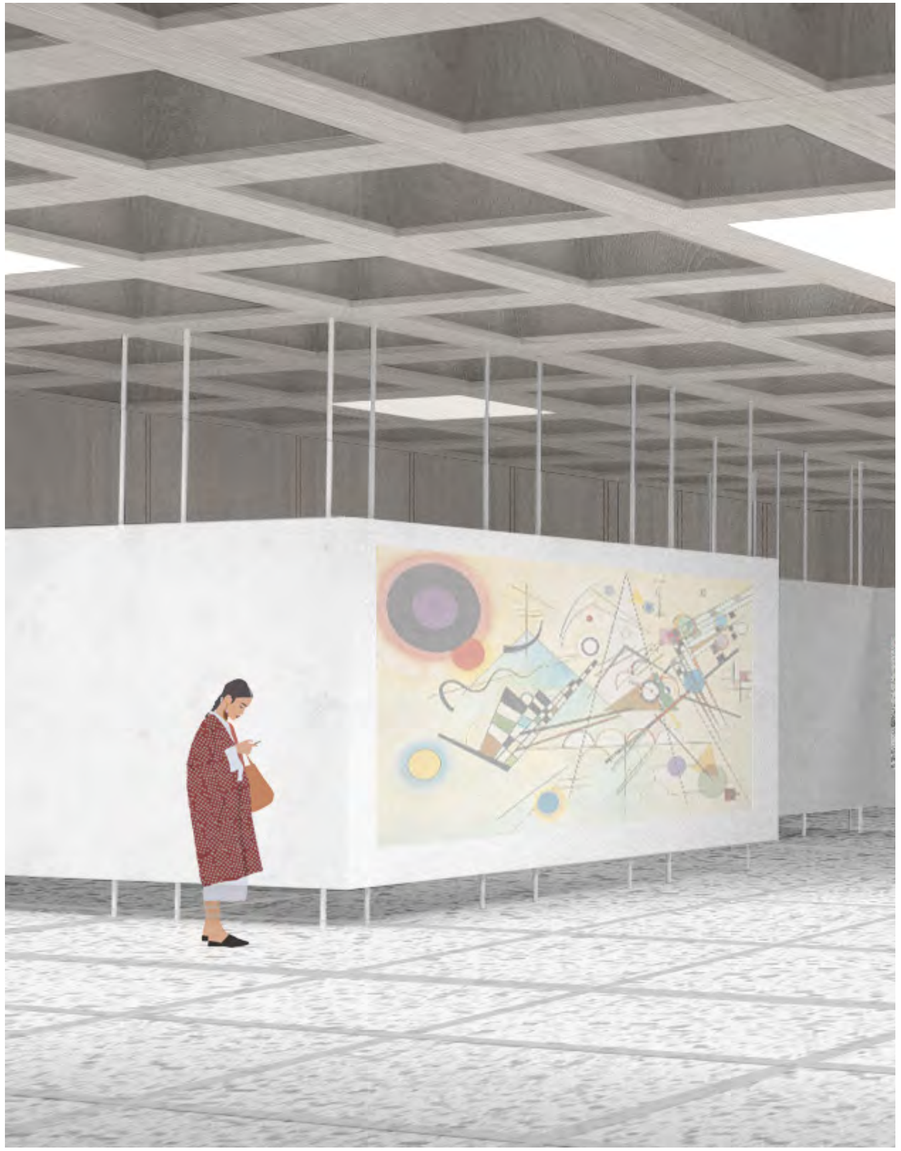


4 passage

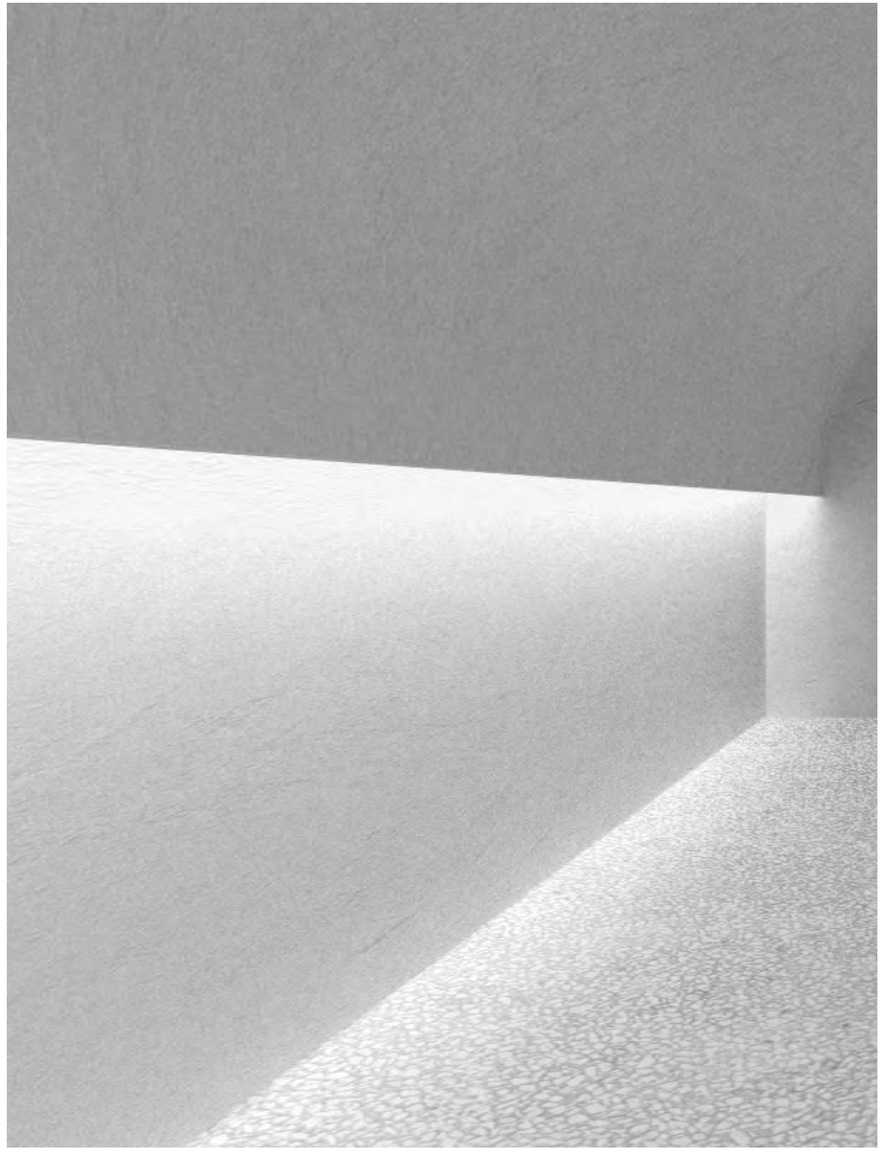


5 restaurant

gallery



gallery

passage view
to restaurant

passage view
to restaurant