ARCH 684

A modern landmark for a historic landscape

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What can we define as urban space? There are so many definitions; the area beyond your house, spaces both expansive and intimate that we occupy with other people. It is the buildings and connecting places, the places we spend our time in, walking, waiting, learning, playing, and living. How we inhabit or take control of our environment and our enjoyment with our surroundings depends partly on these spaces. What about the physical characteristics of the site? A public space cannot be only an open space, it must have a core that all activity revolves around. From Nathan Philips Square in Toronto to Times Square in New York, they each have a dominant artifact where all activity radiates. These artifacts are usually a statue or building which adds dimension and character to the space. The scale of these artifacts can range from something as small as an obelisk (Fig. a) or a hovering railroad (Fig. b) that was once used.

Fig. a – Piazza del Popolo[1]

Fig. b – Manhattan High Line[2]

Regardless of whether these artifacts serve a good purpose, they undoubtedly act as memory for the identity of the city in a historical and modern day perspective. Everyone is occupied consciously or unconsciously with identity, one's origin, and the question of one's place in humankind and society, past, present, and future. It is not until we can truly understand the identity of the city that we can

[1] Rome, Italy
http://www.bluffton.edu/~sullivanm/italy/rome/obelisk/0089.jpg

[2] Friends of the High Line
http://www.thehighline.org/images/gallery_historic.html

proceed to understand the historic artifacts that permeate throughout it.

"The "artifact" is to the object as society is to the subject. To most, an artifact is what we hold in our hand or what we propel to the moon. To others, the landscape itself is an artifact, worked and reworked through human intervention until it too is assimilated into our own productive processes and subject to the "sciences of the artificial". (Jacobs)[3]

As a landmark begins to play a more permanent role in society, spatial character within the city can be easily gauged because of this. The designer must situate themselves to perceive how the landscape will be seen through perspective views, which is known as Three-dimensional sequencing. Finally, there must be special attention paid to boundaries and surroundings as to anticipate the next space. These relationships *"are constituted by transitions, sequences, visual connections, the calculated capture of surroundings. The complex combination of these articulations creates the overall sense of the site." (Marot)*[4]

The new nature museum to be situated on Chicago's Northerly Island holds tremendous potential to bring about concepts of landmark and history as the site holds a special status and appears to be one of the few green spaces left in Chicago's dense urban fabric. The nature museum is a place where sensation and experience rely heavily on how elements are placed together. The site location provides a great opportunity to act as a cultural hub for the more natural setting of the site.

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[3] Jacobs, Peter and Swaffield, Simon, ed. Theory in Landscape Architecture: De/Re/In[Form]ing Landscape (1991) Philadelphia: University of Pennsylvania Press, 2002. p. 119.

[4] Marot. P.52.

The experience

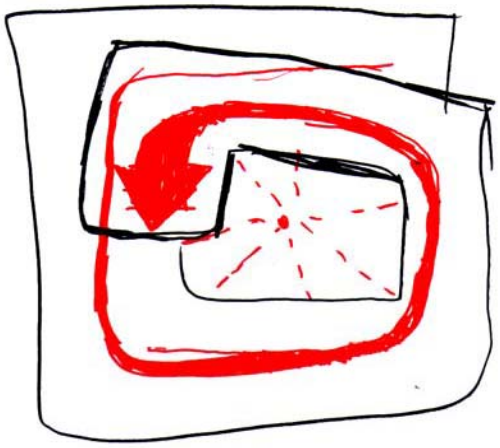


Fig. c – interior circulation

As people travel through the building, it unfolds in different angles to allow for constant visual alteration. This is a building designed to be understood inside out. It is expected to upend assumptions about structure. A truly rational building will not look rational. In this day in age, a building will not necessarily be a box with function forced to fit the space, but rather space expanded here and contracting there to fit function. It is like a house with the naturalness of add-ons built over generations but these add-ons are integrated from the beginning. In a more specific case of the nature museum, the skin's sculptural qualities address the main circulation ramp within the interior. (Fig. c)

The design choices made were used for applying the building itself as large 'DNA helix'(Fig. d) using the concrete ramp structure as the element that 'spins' its ways through spaces. Just like nature, everything has an order to it which is set in stone.

Fig. d – the helix[5]

[5] The Future of Forensic DNA Analysis
http://www.esr.cri.nz/competencies/forensicscience/dna/DNAfuture.htm

The experience

The most dominant aspect of the nature museum is the structural facade of the building. Throughout the report, further exploration will show how this system works and how these structural elements also act as an aesthetic denomination for the design. From the ambitions of the project, it is appropriate to explore the way the structure and skin meld together to form this sculptural 'shell' around the nature museum.

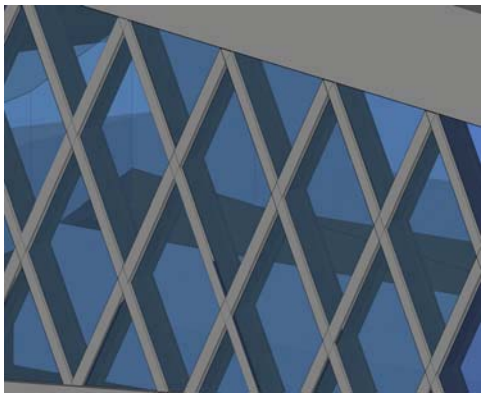


Fig. e – 'Steel mesh'

Throughout this paper, concepts and precedents will be explored that relate heavily to both the composition of the structure and the design aesthetic used to create the landmark in an already historic landscape.

The Site

Chicago's Northerly Island is one of the few urban parks in Chicago's already busy development fabric. Keeping that in mind, it is important that one does not intervene on a character that is already so rare. It is vital to keep a level of contextualism when designing. Contextualism attempts to make architecture compatible to the context surrounding it.[6]

To add more infrastructure than necessary would impede on the natural quality of the site. The reclamation of the open-pit coal mine of the Brikettfabrik Witznitz on the outskirts of Leipzig provides a good example of dealing with an unused site effectively. Faced with uncertainty about the long-term ecological consequences of mining and the potential difficulty of attracting new uses to the site, the scheme by Florian Beigel Architects consists of a "mining garden" to enhance the attractiveness of the site for future developers and investors. The design features a series of activity fields that in their openness to unpredictable uses are the tangible expression of the idea of indeterminacy. If development doesn't take place, the city will still have a garden for people to enjoy. This is a process-oriented scheme where at any point the development may stop or continue without detrimental consequences to the original vision.

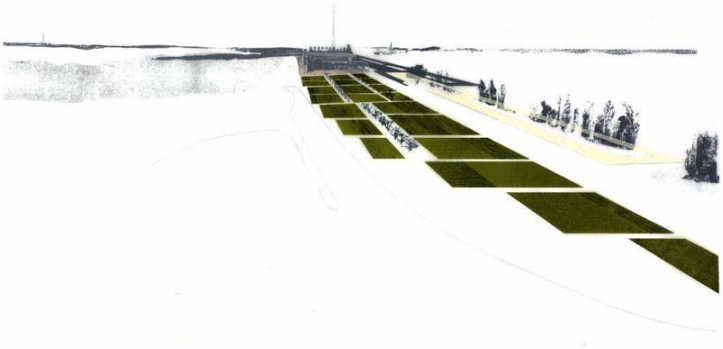


Fig. k. - Brikettfabrik Witznitz – Exterior Gardens[7]

[6] Tyler, N. Historic Preservation. New York: Norton and Co., 2000, p. 139

[7] Architectural Research Unit
http://aru.londonmet.ac.uk/works/witznitz/

The Site

The pathways were designed to mimic the irregularity of nature by having a more organic quality with no predetermined direction. The 'curves in the site (Fig. l) allow users to engage the whole site as the routes cut and weave throughout different areas of the site but do not create rules for the users of the site. Every path leads in a different direction, there isn't just one route to take.

It would be beneficial to add trees and accompanying plant life to add to the concept of the 'curved' paths. It will allow users to experience difference sensations as they travel in different routes since some areas can be for more intimate settings (more trees) and some can be used for more public gatherings.

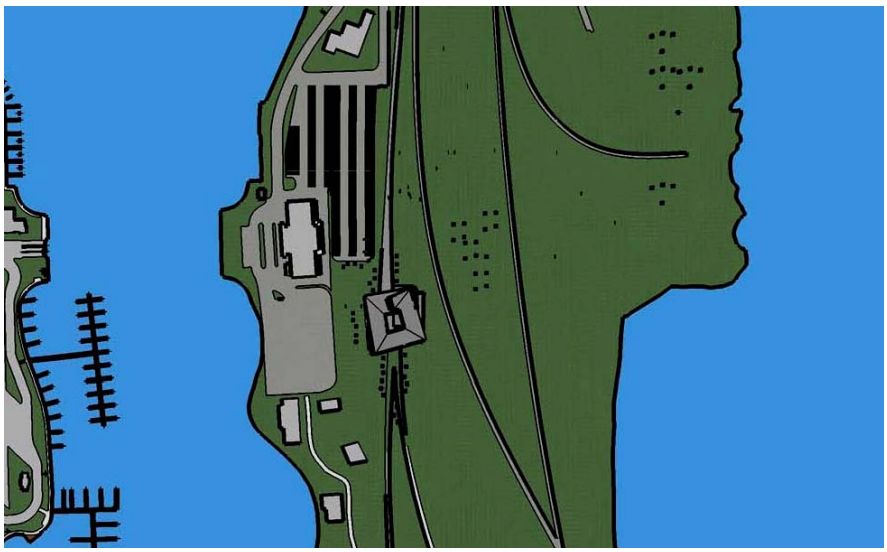


Fig. l – Site Plan (nts)

The Building

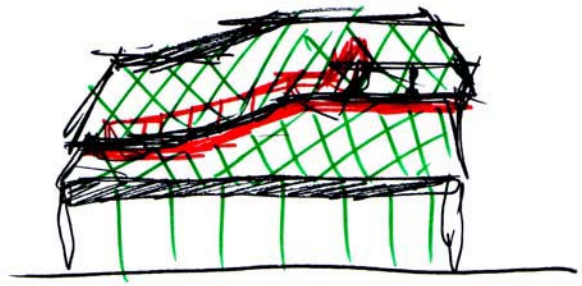


Fig. b1 – Building Exterior Sketch

Keeping in mind the idea of contextualism, the building must also be able to embrace but not intrude on the Northerly Island's natural habitat. The way I chose to tackle this task was to use the structure as a guiding design for the building. What came about was a structure that combines the efficiency and simplicity of structural steel, glass, and concrete.

As individuals travel towards the building from the north or south, the building will begin to 'unravel' visually as the building elements are not oriented to face directly to the pathways. (Fig. b2) The inspiration behind this falls under the idea of a rock in a river.(Fig. b3) As these paths of circulation hit the building, elements and perceptions begin to alter, and change direction(Fig. b4). Though the individual is not confined to stay in that space, he or she has the option of continuing and leaving the building, or they could explore the building.

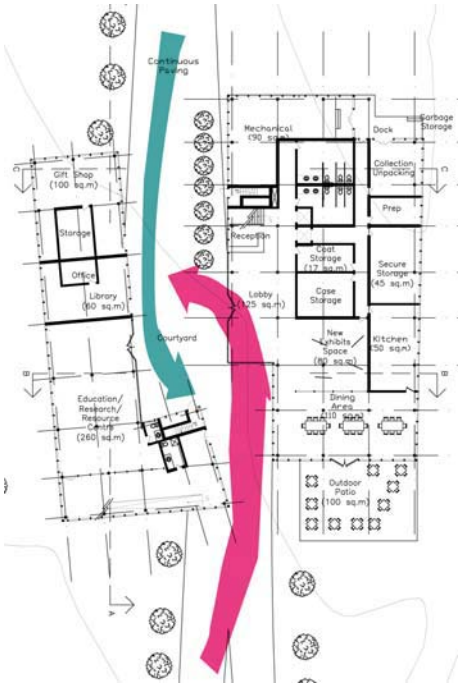


Fig. b2 – Plan (nts)

The Building

Fig. b3 – Rock in a river[8]

In an urban society, buildings stand amongst us like rocks in stream. We can choose to recognize and respect it, or we can just pass it by. Regardless, it is the individual's option.

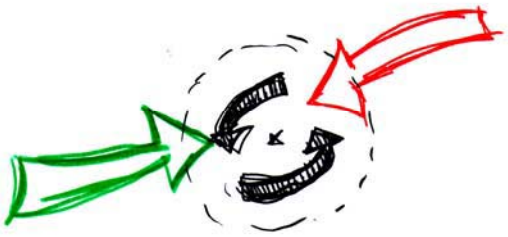


Fig. b4 – 'spin' concept

As both circulation paths enter the building's courtyard, the user has the option to continue on the pathway out or enter the museum

Incorporating all these natural qualities into the dynamic of the building's presence on the site is essential as it respects Chicago's Northerly Island's historic identity. It is important not to impose new forms of design rhetoric on the past.

The Strijp S industrial area of Eindhoven was formerly occupied by a Philips Electronics factory. In 2000, West 8 proposed transforming this site, into a round-the-clock living place and "creative heart" for the southern Netherlands. The plan features a green avenue as the main axis of alignment for a series of "icon buildings." One large imperfection is that it does not recognize the surrounding existing fabric, which resultantly cripples its unique reuse potential. It does not succeed in acknowledging the nature of existing structures and landscapes, ignoring their potential for reuse. Instead, completely polished surfaces and normalized spaces create typified areas that force a new architectural image onto the site.

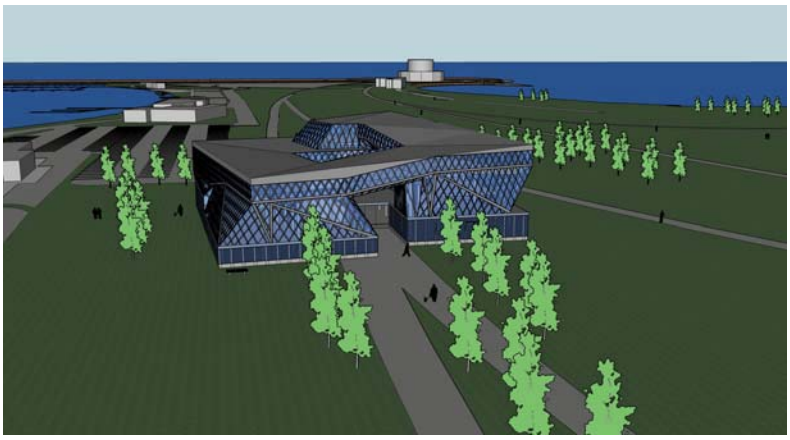
[8] Annie Tiberio Photo Gallery – "Boulder Brook" http://www.a-tiberio.com/gallery.htm

The Building

Why the need of such a statement creates a cultural clash of old and new? The decay of the old structures, a kind of ugliness we experience as beauty, is not accepted as a quality of place in this scheme. There is no adaptation. Rather than suggesting a free appropriation of place,

Fig. N. – Strijp S Master Plan[9]

revitalization seems to proceed according to a kind of amnesia for existing buildings and landscape qualities. It is important not forget how historic places hold special qualities of attraction. Incremental design schemes that retain the best qualities of the given while infusing entirely new and innovative elements are the best response and I strive through this in the building's presence on the island.



[9] JSA Rotterdam – "JSA at Strijp S Manisfestation"
http://www.jsa-rotterdam.nl/english/nieuws/2007/1128.php

Structural System

What differentiates this building from a more traditional one is that the facade is both structural and aesthetic. In a nutshell, the building consists of a sculptural steel mesh of diagonal mullions that are perched on top of a more traditional single storey curtain wall system all encasing a concrete structure.

The idea of the steel mesh was noted from the new Seattle Public Library (Fig. c1) but that is the only aspect that has influenced the overall make up of the building. The museum represents an amalgamation of precedents that retrofit it to fit into the natural fabric of Northerly Island.

Fig. c1 – Seattle Public Library, Seattle[10]

The massing of the museum provided opposing structural challenges. In order to make the system work, it is important to note that every element acts as member for eliminating lateral forces due to the different ways that the walls angle down.

[10] Deconstructivism
http://architecture.about.com/od/20thcenturytrends/ig/Modern-Architecture/Deconstructivism.htm

Structural System

Concrete

Composition

The concrete columns (300mm) are placed on a 5m grid system with 900mm x 900mm x 250mm foundation footings.

Some foundation walls (300mm) were used.

Each floor slab is 300mm thick. At ground floor, the foundation walls allow for irregular column placement along the second floor for the rotated ramp.

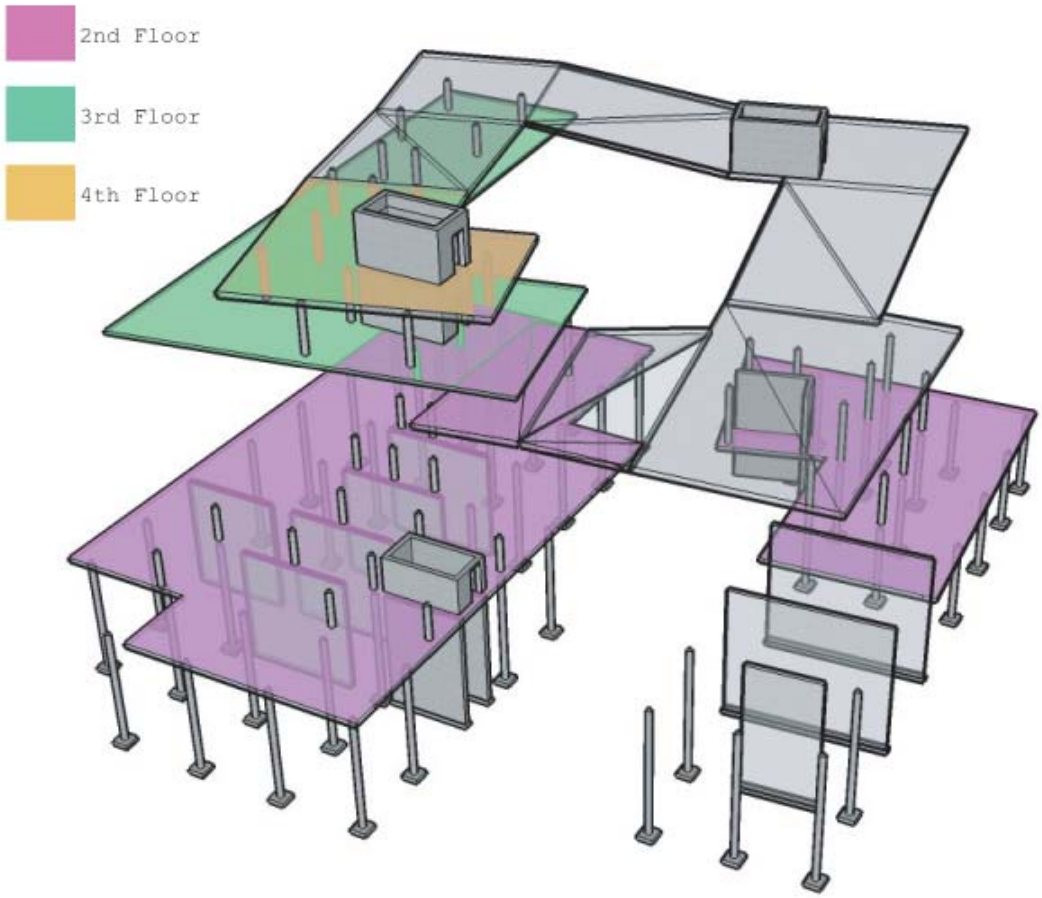


Fig. c2

Structural System

Concrete

Concept

All of the concrete used was applied to the interior of the building. As stated in the introduction (Fig. c), the interior circulation's main artery is a spinning concrete ramp space similar to that of the Guggenheim Museum in New York. (Fig. c3)

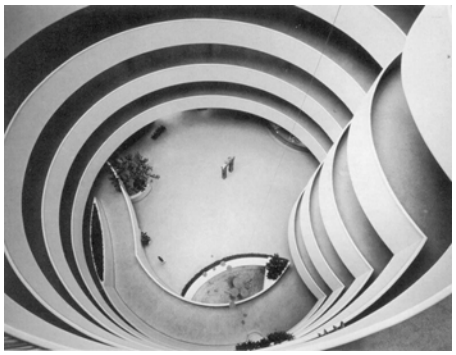


Fig. c3 – Guggenheim, NY

The idea of walking a predetermined path in the nature museum is quite contradictory to that of the site strategy (no predetermined pathways). This was purposely done for two reasons:

1) To allow for a ying-yang theory to be implemented. I find that the Chinese perspective to achieve balance and harmony is very applicable to that of nature. Just like the circle of life, there must be balance. So in that sense, I've chosen to instill a level of order in the building. I hope that this transports the user to a new place when they enter and it acts as a welcome break from the purposeful "chaos" of the park.

   EXTERIOR **VS.** **INTERIOR**

   NO PATH **SET PATH**

2) I rely heavily on the DNA Helix model for not only the circulation direction but potentially the program function. As this is a centre for learning, it would be appropriate for users to learn everything in a predetermined order and as a museum for nature, looking at how things evolve from the past (bottom of the ramp) to the present (top of the ramp) is quite appropriate.

Structural System

Steel

Composition

The steel mullions for the mesh skin are angled at about 30 degrees and spaced 1 metre apart. Not all the columns are angled exactly the same due to the various angles of the curtain wall. With this being said, understanding the design intention is important. The angled mullions appear two-dimensional in elevation but the various angles of each column appear more clear and unravel as one comes closer. Each mullion is 100mm x 300mm.

The roof incorporates 300mm steel trusses spaced at 3m.
The roof is covered in a thermoplastic membrane to induce reflectivity.

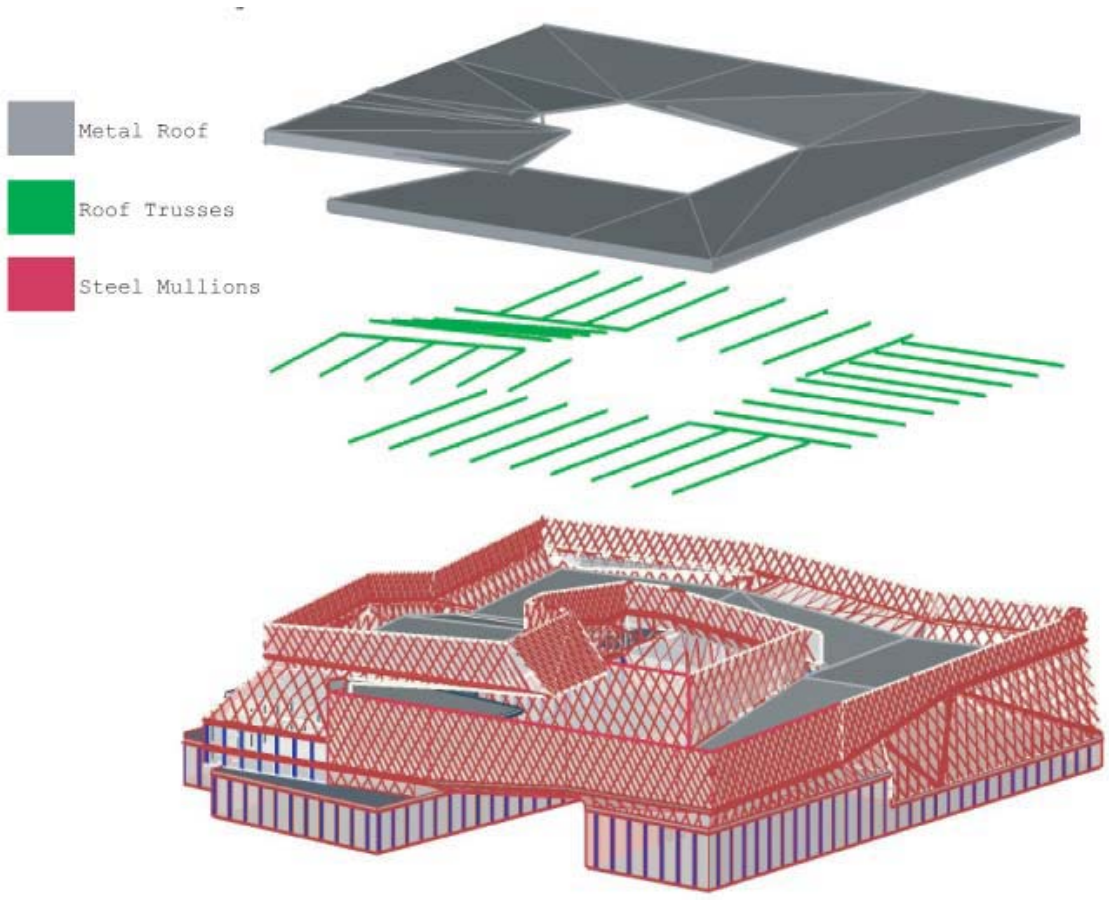


Fig. s1

Structural System

Steel

Lateral and Vertical Movement

The building's facade is essentially a collection of angled curtain walls made up of diamond-shaped panes of glass set into a diagonal steel grid. The shell of the building bulges and retreats, rises and drops, all without ever using a complex curve. From the plan and section (Fig. s2/s3), the structure goes off at different angles. But because these angles remain consistent as the building wraps around, the forces eliminate themselves and the roof acts becomes a diaphragm for holding the pieces together. The structure skin would be responsible for lateral loads and the concrete structure that it rests on would take care of the vertical loads. This construction allows the steel mesh to be free of column support within which ultimately allows the skin to remain as a singular entity.

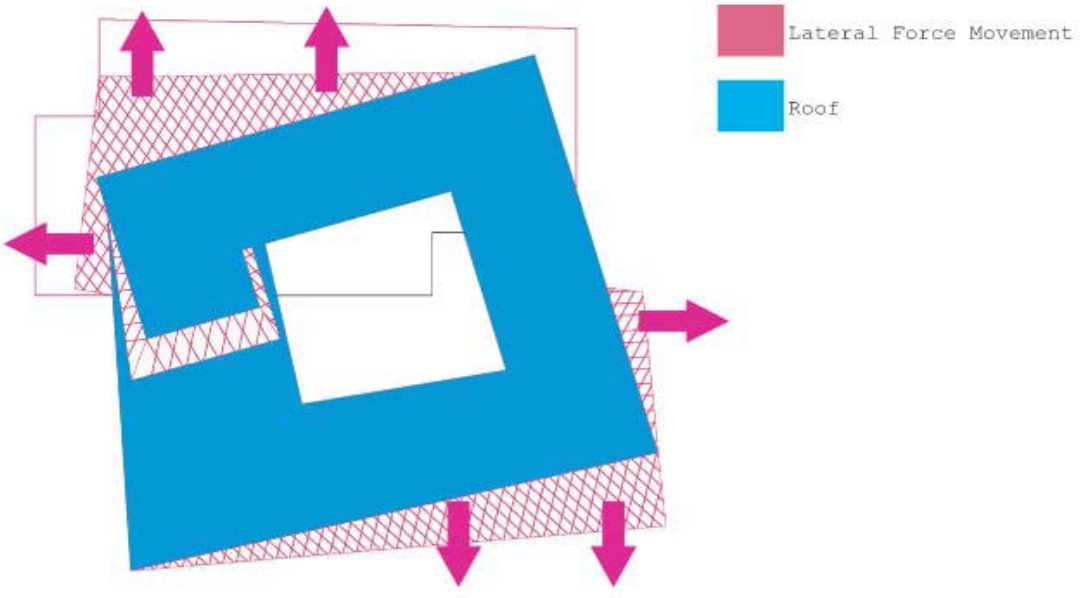


Fig. s2 – Plan (nts)

Structural System

Steel

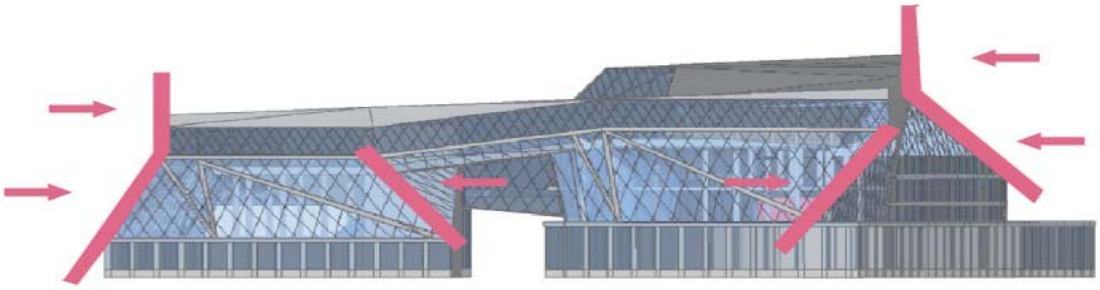


Fig. s3 – Elevation

Concept

The steel strategy implemented is almost identical to the Seattle Public Library but for a good reason. As I would like this building to become a part of the natural landscape of Northerly Island, it must be able to address all aspects of the site. The use of glass and angled steel allows the building to act as visual reflectors for the various characteristics of the landscape. Whether it is the lush greenery, blue skies or birds flying, all are essential ingredients to retain the identity of the historic landscape.

The use of steel also allows the building to maintain the concepts of the design intention, which is to reflect the natural and unpredictable quality of nature itself. As one approaches it from any angle, the building folds inwards or begins to protrude in another direction allowing the building to assume an organic entity in the landscape.

The Wayne L. Morse Courthouse in Eugene, Oregon is an example of a building that morphs as you approach it. In some areas even, the building seemingly peels away its skin as if to reveal another layer or a whole different type of structure beneath. (Fig. s4)

Fig. s4 – "peeling"

Materials & Finishes

The choices of materials were incorporated to provide two contrasting systems that conjure up varying sensations both visually and physically.

The exterior skin's material choice was logically steel mullions capped with aluminum and glazing. Since the structural skin is the dominant element of the building, steel would be much more cost efficient since it will be recycled material as opposed to wood.

The interior provides a more raw and natural feel with a concrete slab and column structure. The steel mullions that support the angled mesh will be visible only from the interior and hence will convey an unrefined sensation throughout the interior.

Prefabricated Mullion Components

In order to simplify the construction process of the design, the exterior steel system will be composed of prefabricated components that will be shipped to the site. The steel mullions are bolted in groups and welded at points where the wall changes angles. (Fig. m1) These connection plates are called vertical slot connectors. The connectors are two interlocking combs, and are rigid horizontally but allow some give up and down. This allows for more ease of construction and less complication with using individual mullions to construct the facade.

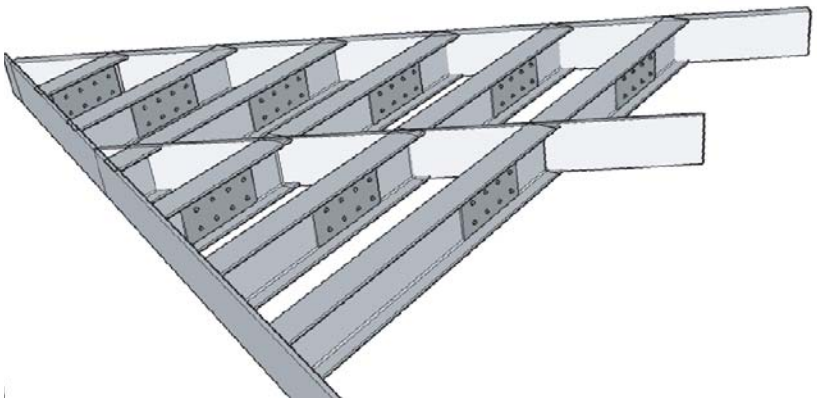


Fig. m1 – Prefabricated mullions used for exterior skin

Materials & Finishes

Steel and Glass

The choices of structural elements in the building are broken down into two typologies: exterior and interior. The exterior is an exoskeleton of steel mullions with aluminum capping and glazing giving an idea of a steel mesh encapsulating the building. The interior presents itself as a simple concrete slab and column construction.

Steel and Glass

Since the exposed steel is visible to the interior and covered in fire resistant intumescent coatings, the result is aesthetically pleasing and saves money for interior finishes. The obvious reason for coating these structural steel members is used to offset the building from collapsing if there was a fire. In order to see how the elements are joined together and differentiate the exterior from the interior, a closer look at a plan detail would be required. (Fig. s4)

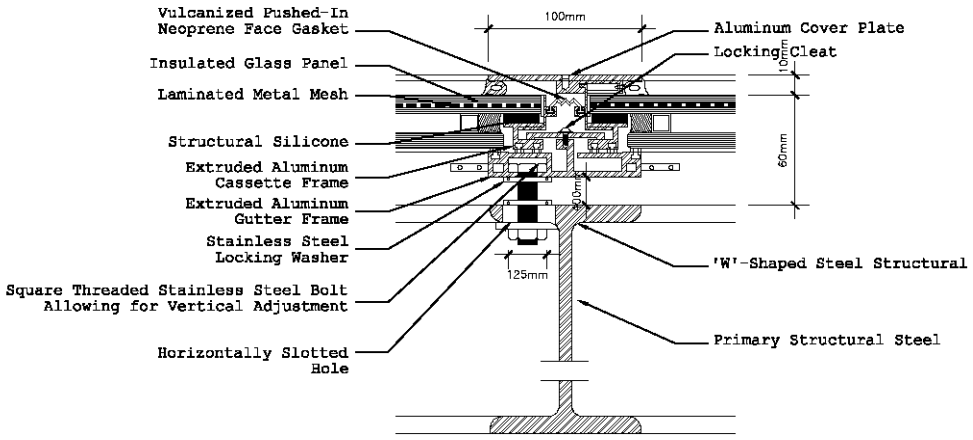


Fig. s4 – Plan Detail (1:5)

Materials & Finishes

Steel and Glass

Concept

Being able to utilize an elaborate exterior skin enables the potential for it to serve more than one purpose. In this case, the steel mesh doubles as an exterior skin as well as an interior finish. Keeping in line with the rustic quality of nature, I believe that altering the interior walls of the building to look completely different would disconnect the interior from the exterior. Besides allowing users inside the building to maintain a constant visual connection with the outside because of all the glass, the mullions are required to create the sense of 'natural chaos' that one would experience when in a forest. Not all trees are alike, and as one will soon find out, not all mullions are alike too. (Fig. s5/ s6)

Fig. s5 - forest[11]

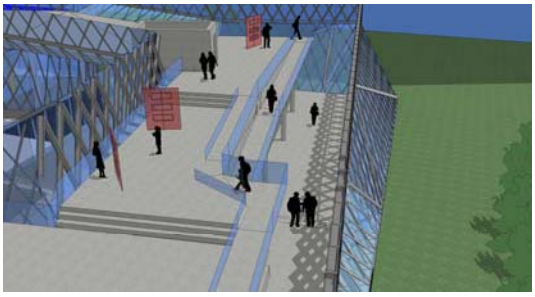


Fig. s6 – museum exhibit space

The space mimics that of a steel forest which keeps the user in a natural setting.

[11] Redwood National Forest
http://www.hickerphoto.com/redwood-national-forest-8433-pictures.htm

Materials & Finishes

Concrete

The interior is constructed with flat, two-way concrete slabs supported by round concrete columns at 300mm in diameter. The main circulation ramp for the galleries is also constructed of 2-way flat slab concrete. Because the ramp is angled and off axis with the ground floor grid, an irregular column grid to support the floor was required, hence the use of extensive foundation walls at grade to allow for flexible column placement on the upper floors.

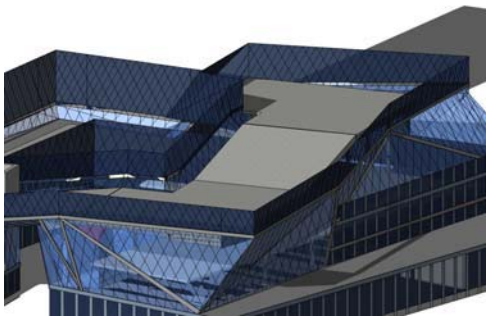


Fig. s7 – Concrete ramp

Concept

Concrete is a very raw material and is frequently used primarily for structural purposes or for places where finishes are not as important (parking lots). But there are times where the use of concrete can invoke a whole new level of experience. The Water Temple (Fig. s8) by Tadao Ando (and most of his other projects) use extensive amounts of concrete primarily because of its raw, yet natural tonal quality. It represents man's footprint on land but does not seem interfere with the natural surroundings.

Fig. s8 – Water Temple

For the nature museum, using concrete as the interior was a natural choice for 2 reasons:

1) The rustic quality of concrete conveys a sense of harmony and does not take away from the surrounding 'steel forest' of mullions.
2) The concrete appears like an element that has sprouted out of the ground and slices through the pattern of steel and glass as if tying the building together.

Structure is Design

What makes the building skin so unique is that not only does it play an aesthetic role, but also a structural role, hence combining functionalism and beauty in one package. From the section diagram, there is a clear separation of how the exterior and interior are separated, where the skin is a porous, transparent membrane, and the interior is an opaque monolithic element.(Fig. ds1) It is also important to note the different types of glazing used on the whole building. (Fig. ds2)

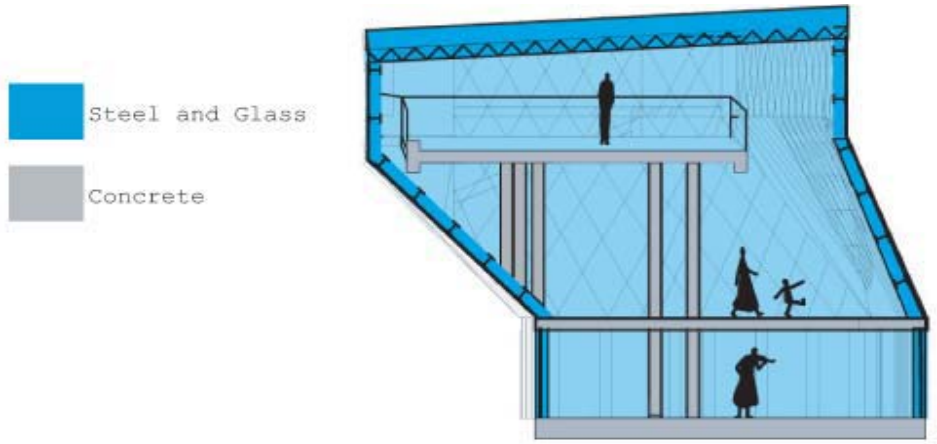


Fig. ds1

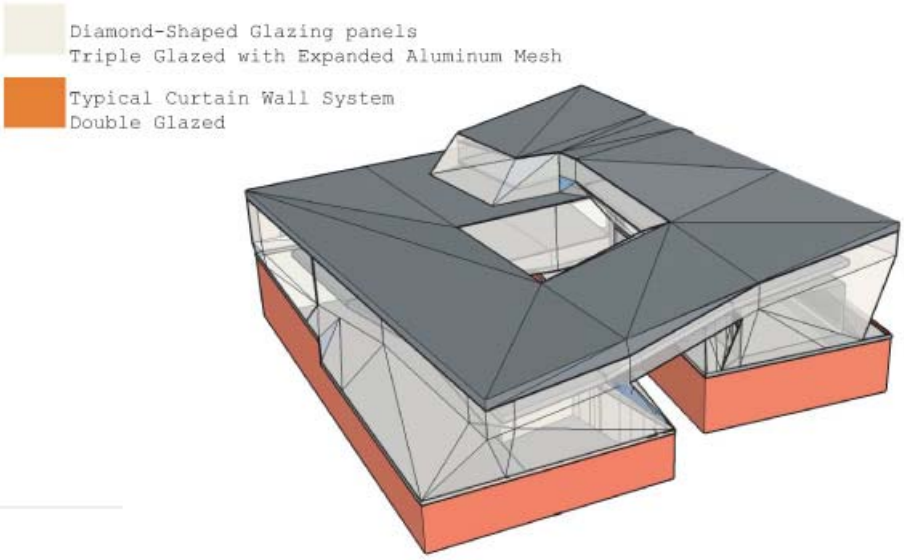


Fig. ds2

Structure is Design

Glazing

Exoskeleton diamond shaped glass

The triple glazed glass, cut in approximately 4-foot by 7-foot diamond-shaped units, promotes energy efficiency by letting in natural light, reducing the need for artificial light, and lowers solar heat gain which lessens the use of cooling systems. The metal mesh - aluminum sheet metal that is cut and stretched and placed between layers of glass with krypton gas filled inside. This type of glass is similar to a tint coating, except that it only filters non-visible wavelengths. To maximize the performance of the glass and double-layer glazing. An extremely high-efficiency, low-e coating. (Fig. ds3)

When seen from a distance, the panels appear transparent, but as you move closer to them, the shading device becomes more apparent.

Lower Curtain wall

The ground floor utilizes a more typical curtain wall system with double glazing.

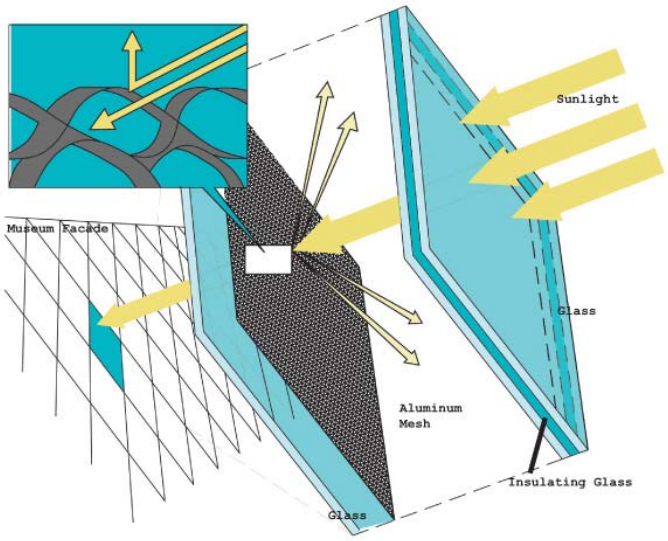


Fig. ds3 – the makeup of diamond shaped glass

Structure is Design

Glazing

The skin is a different entity from the interior of the building. The angled skin steel mesh of mullions rest on the second floor of the concrete slab via bolted connections. Then on the ground floor, a simply curtain wall construction is put in place to mimic the continuation of the steel mesh to the ground floor. A closer look at the facade shows the diamond shaped glass interlaced in between the prefabricated steel mullions.

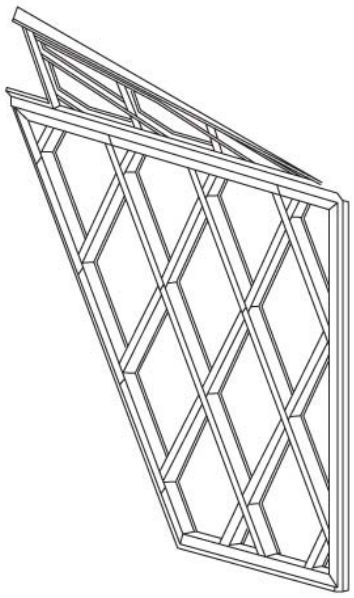


Fig. ds4

The most important connections are not how the skin meets the ground but how the skin connects the roof of the first floor. The typical curtain wall at ground floor is non-structural so it merely acts as a façade that continues a glazing skin typology for the 'mesh' above.

Environmental Systems

Ventilation

As this is a building for nature, it is ideal that it utilizes energy efficient methods for maintenance.

Ventilation

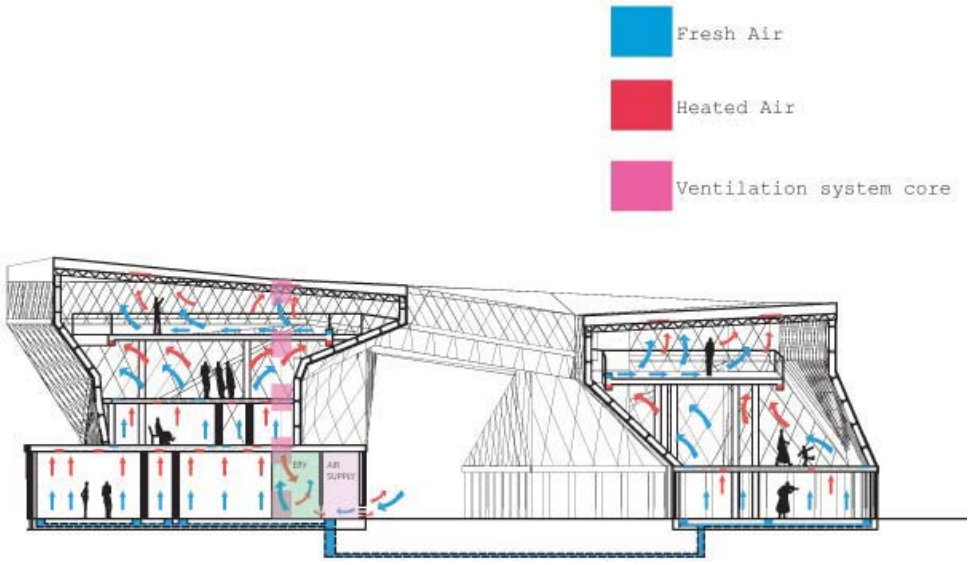
The museum uses a unique type of air distribution system called displacement ventilation. This ventilation comes from the floor and is opposite traditional systems where fresh air is blown down from above against the flow of rising warm air. Displacement systems are more energy efficient. Because air can be delivered at higher temperatures (65 degrees versus 55 degrees) when cooling is needed and with the summer and fall's temperate climate, a displacement ventilation system gives the advantage of "free cooling." This happens when the temperature of cooled air is not much different from the outside air. This delivery system also provides more fresh air at a person's working height, as only about the bottom 2 to 3 metres of airspace is being cooled or heated. A unique case presents itself with the integration of the air ducts at the corners of the ramp. This allows the ramp to still remain a thin slab that 'hovers' over the space.

The ventilation system is also combined with an Energy Recovery Ventilator(ERV) which will save on the use of energy for mechanical equipment. As the indoor air is sent outside, an ERV inside the ventilator extracts the warmth and uses it to preheat the incoming fresh air before it reaches your furnace. During the summer, the ERV works in reverse to expel heat from the incoming air as it heads toward your air conditioner. An energy recovery ventilator will also regulate humidity levels which are crucial for a nature museum.

Environmental Systems

Ventilation

Fig. e1 - Section - Displacement Ventilation



Fresh air is supplied at the ground floor and passes through an ERV system for air to be de-humidified. ERV systems will also re-use heated return air once it has cooled it.

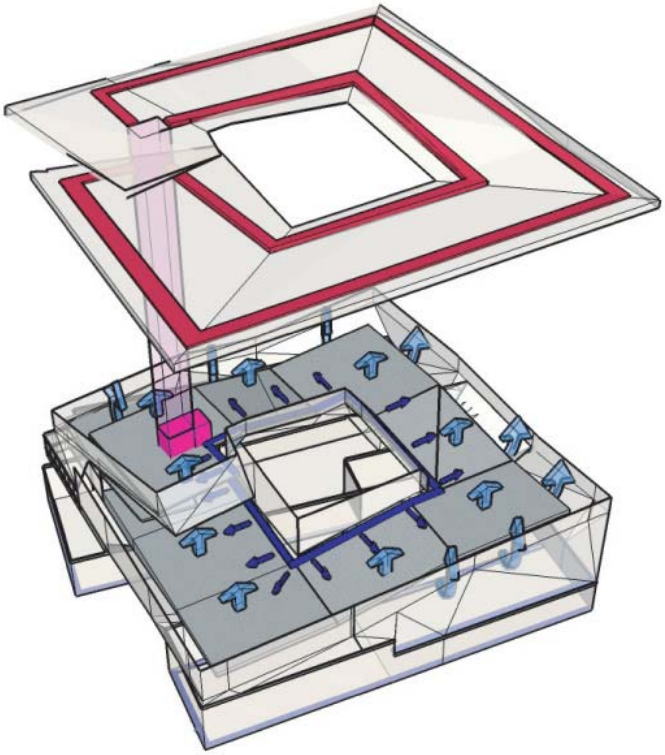


Fig. e2 - Axonometric - Displacement Ventilation

Because of the skin does not attach to the circulating ramp, heated air is able to diffuse not only to the floor above but can diffuse to the ceiling above, hence reducing the load on the air intake systems.

Environmental Systems

Lighting

Artificial Lighting

From the section (Fig. e3), it is paces become open to double heights as the main circulation ramp weaves through the shell unsupported by the skin but only columns below. With this scenario, light is able to penetrate from the roof to the third and second floor because of this, which reduces the need for additional lighting on each floor.

Electrical lighting throughout the building was selected for color rendition, low cost and easy maintenance. Light and motion sensors are used to further increase efficiency.

The building's glass exterior lets in plenty of natural daylight, which decreases the need for artificial light. In effect, the building becomes a "light-catcher." At night, because of the angled steel mesh leans towards the interior of the courtyard and other exterior spaces, light from the roof is able to penetrate from the interior of the building and act as 'glowing walls' of light for pedestrians. Also, because of the angled walls and placement of lights at high angles, this reduces light from light pollution from emitting from the building.

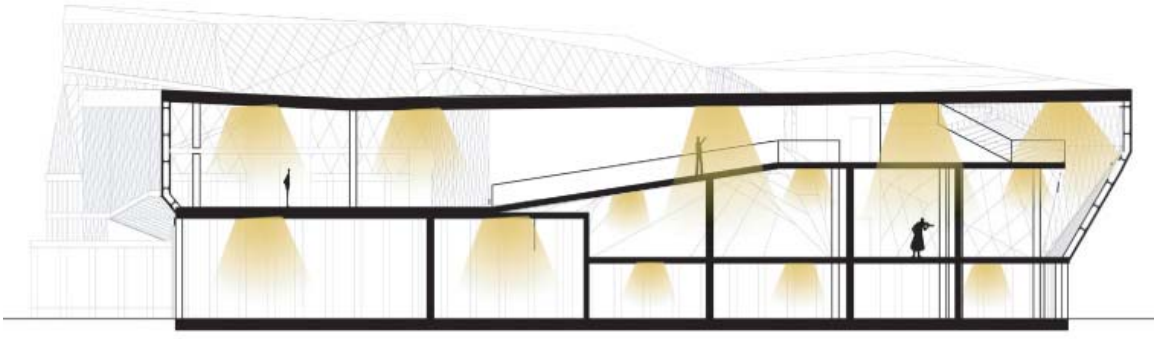


Fig. e3 - Section - Artificial Lighting

Light from highest ceiling can penetrate space below due to the "floating ramp" and unattached skin.

Environmental Systems

Lighting

Natural Lighting

Because of the building entirely covered in glass, light penetrates almost every part of the building due to its open concept on the second and third floor.

Sunlight is able to penetrate the courtyard because there is an ample opening on the south facade that allows daylight to enter the space.

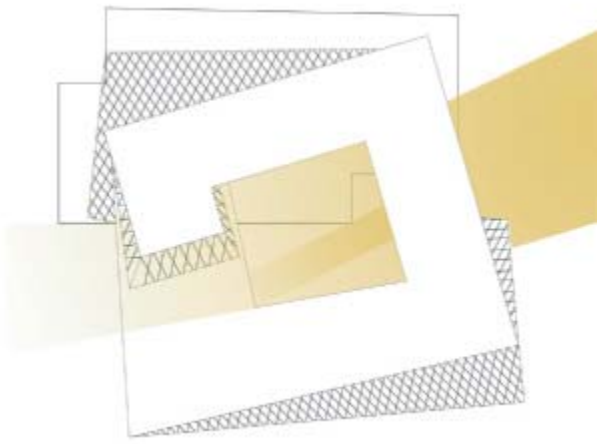


Fig. e4 - Plan –
Natural Light from the South

Fig. e5 - Section - Natural and Artificial light

Light penetrates the courtyard from the south and the angled glass allows the building to act as over-arching walls of light at night.

Environmental Systems

Heating & Cooling

The building incorporates radiant flooring throughout the concrete flooring. Concrete presents the greatest thermal mass of any of the radiant floor heating methods, which can be a tremendous benefit for the building since it has high ceilings Radiant flooring can also be used for cooling during the hot climates. The floor temperature is held at 68°F (20°C) by using the steady 55°F (13°C) temperature. In most climates, the cool floor can be used to supplement or replace standard ducted air systems. Tubing is installed in the slab. Temperature-controlled water then circulates though the tubing in the slabs: this process turns the slab into a radiant panel.

The source of heating and cooling will be geothermal heat pumps. Geothermal heat pump systems tap the constant temperature of the earth to provide efficient heating and cooling. The systems operate by using water-source heat pumps which can be distributed throughout the building. Heat energy can be extracted from the earth in the winter, and added to the building. In the summer the process can be reversed. Unwanted heat is extracted from the building and added to the earth.

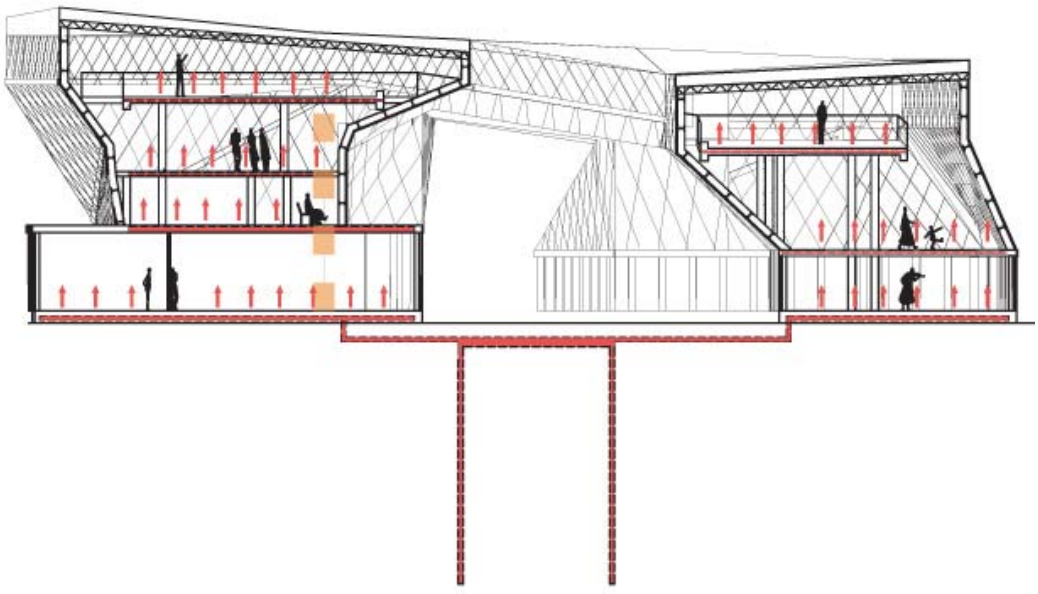


Fig. e6 - Section - Radiant Flooring

Environmental Systems

Heating & Cooling

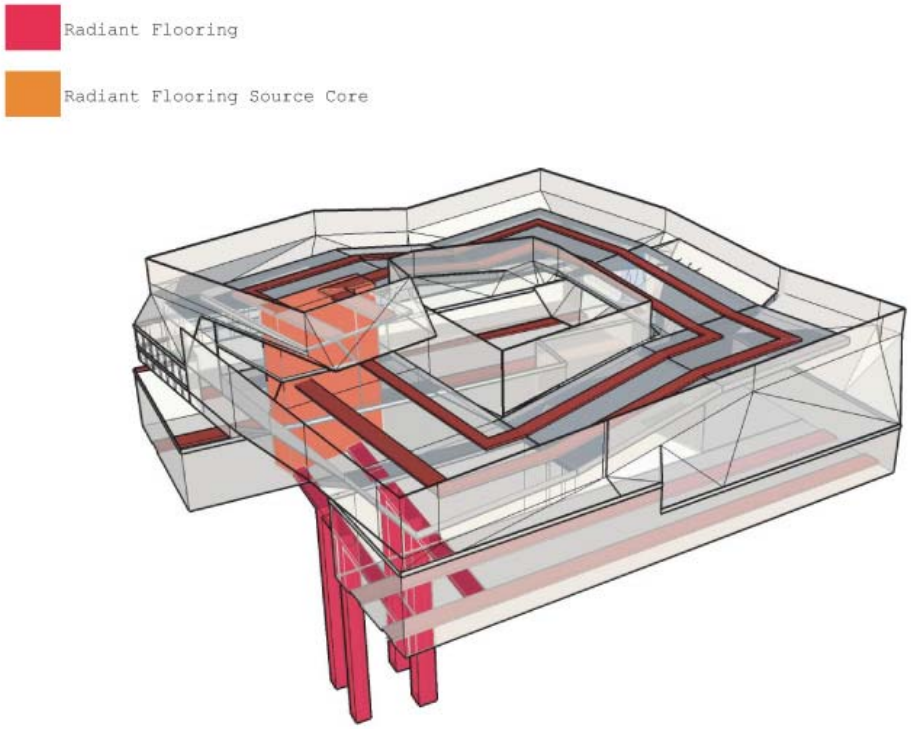


Fig. e7 - Axonometric - Radiant Flooring

The Radiant Flooring source is located near the core of the building and supplies every floor.

Environmental Systems

Rainwater Collection

Rainwater is collected, stored in a 10,000-gallon tank and used for landscape irrigation. As a result, zero potable water is required in the treatment of the landscape. The system not only saves water, but also helps prevent combined sewer overflows, which negatively impacts water quality. The system is expected to save about 20,000 gallons of water per year.

The various angles of the walls allow for easy collection of rain in a traditional gutter system placed at every point where the sloping surfaces halts. Because the ground floor is composed of two separate buildings, the water will be channeled to underground pipes that connect to the water storage tank.

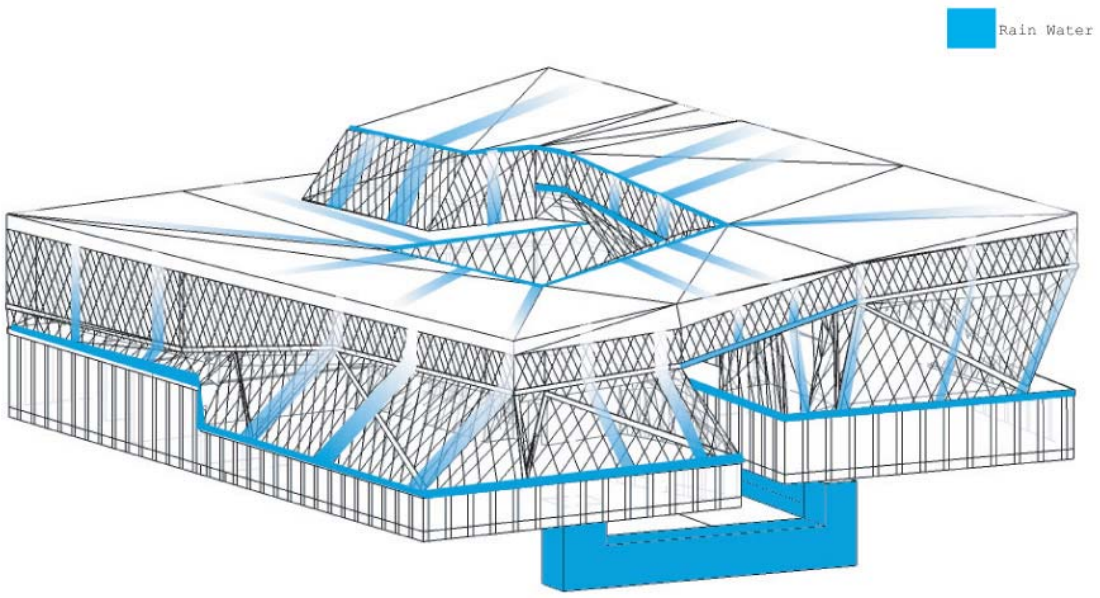


Fig. e8 - Axonometric - Rainwater Collection System

The areas of most Rainwater intensity indicate the placement of the gutter for rainwater collection.

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The building's skin and structural system allowed for many points to be allotted. The building utilizes minimal aesthetic finishes for the interior. Throughout the design, there was preference for elements that were capable of serving a functional purpose and aesthetic purpose together. The exterior facade may be visually appealing but also serves a very functional purpose by allowing the building to draw in natural light. The interior is an exposed concrete structure that requires minimal labour maintenance due to its simple form.

The energy systems incorporated allow for energy to be saved in the long run and are worth the investment. Systems such as radiant flooring and displacement ventilation do not intrude on the intention of the design but instead will amplify the space. Both systems can be hidden within the slabs and roofs to allow for the building interior to maintain its minimalist concrete construction.

The building will ideally be able to receive a **LEED GOLD** rating.

"Green" Materials

Besides incorporating environmentally friendly systems, it is important to address materiality in a more specific manner.

Structural Steel Mesh

Efficient Use of Materials Eliminate Waste

Materials and systems with elements that serve more than one purpose are integral to the museum's efficiency. The diamond grid structural steel of the exterior serves as a backup for the curtain wall exterior and also is an interior finish. In the core of the building, the structural concrete also serves as a finish. Some spaces have lighting shielded with polycarbonate panels that diffuse the light, finish the ceiling and act as a return air plenum.

Fireproofing on interior structural steel serves as the finish and a sound absorber. Minimizing the use of finish materials reduces the amount of materials used, maintenance needs and costs.

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Green Materials

Recycled Materials

New products made with construction waste and curbside recycling items are examples of recycled content materials. Using such materials helps lessen landfill waste and reduces the environmental impact of extracting, harvesting and manufacturing new materials.

Examples of recycled-content materials at the museum include:

- Concrete rubble used as fill before construction
- Structural steel: 90 percent recycled scrap
- Steel rebar: 97.5 percent recycled scrap
- Exterior aluminum: 30 percent recycled content
- Steel doors and frames: 48 percent recycled materials

Local and Regional Materials

Materials purchased locally or regionally support a healthy economy and reduce transportation impacts. At least 20 percent of the building products will be manufactured within 500 miles of Chicago, including:

- Steel rebar
- Concrete
- Cabinetry/casework
- Miscellaneous metals
- Gypsum wall board

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Environmental Strategies

Drought-Tolerant Landscaping

Landscape plants were chosen for low water use and low maintenance. In addition, by watering plants from the rainwater collection system, zero potable (drinking) water is used for landscaping.

Waterless Urinals

An innovative new technology eliminates the need for water in urinals. These waterless or no-flush urinals use a trap to block odors and each can save up to 45,000 gallons of water per year.

Water Controls

The museum uses automatic shut-off faucets to save even more water. Meters that monitor irrigation water help detect leaks. A drift eliminator system that recaptures fine mist in the cooling process is also a feature of the cooling towers to increase water efficiency.

Acoustics

The building is organized efficiently in terms of program location. The second and third floors are almost all open space for the exhibition and camp/meeting space below. Sounds coming from these program areas will only increase the dynamic of the space for a nature museum

Roof Heat Island Reduction

The temperatures in urban areas tend to be several degrees warmer than adjacent rural areas. This is known as the Urban Heat Island Effect and it can increase energy and water use during warmer months. Providing shade to exterior spaces and a light colored Energy Star® roof that reflects heat and light lessens this effect.

Transportation

Motor vehicles are the primary source of air pollution in our region. Smart transportation solutions such as reducing the number of city employees who drive alone to work and reducing the city's use of fossil fuels, improves environmental quality. Features that lower air pollution include:

- Bicycle storage and showers with lockers encourage staff to bike to work.
- Nearby access to public transit, encourages staff and patrons to leave their cars at home.

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LEED Point Summary

LEED Point Summary and Compliance Strategies
Nature Museum - Chicago, IL
POINTS

yes	possible	no		Description of Point		Compliance Strategy
9	0	4		Sustainable Sites	Possible Points 14	
Y			Prereq 1	**Erosion & Sedimentation Control**	0	Erosion and sediment control plans will be implimented to ensure topography and soil conditions will remain stable and unharmed.
1			Credit 1	**Site Selection**	1	The building will be built on an existing parking lot which minimizes the building footprint on the site while adding new landscape.
			Credit 2	**Development Density**	1	
1			Credit 3	**Re-devoplment of Contaminated Site**	1	The proposed building is being built in an area where adjacent properties have had soil contamination. This site will be decontaminated
			Credit 4.1	**Alternative Transportation**, Public Transportation Access	1	
1		1	Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1	There will be bicycle storage which encourages other means of transportation
		1	Credit 4.3	**Alternative Transportation**, Alternative Fuel Refuelling Stations	1	
1			Credit 4.4	**Alternative Transportation**, Parking Capacity	1	Minimal parking space encourages walking. Also adjacent to another parking lot.
		1	Credit 5.1	**Reduced Site Disturbance**, Protect or Restore Open Space	1	
		1	Credit 5.2	**Reduced Site Disturbance**, Development Footprint	1	
1			Credit 6.1	**Storm water Management**, Rate and Quantity	1	Rainwater collection that runs off building gets channeled to a water storage tank to re-use for landscape irrigation. Water-less urinals used throughout building.
1			Credit 6.2	**Storm water Management**, Treatment	1	natural treatment sytems and bioswales will be implimented into the landscape to help treat the water before it is stored for re-use.
1			Credit 7.1	**Landscape & Exterior Design to Reduce Heat Islands**, Non-Roof	1	Constructed surface of building incorporates unique glazing properties to reduce heat gain. Trees are planted around building ground floor to provide some shading
1			Credit 7.2	**Landscape & Exterior Design to Reduce Heat Islands**, Roof	1	Roof incorporates Energy Star rated roof to reduce heat gain.
1			Credit 8	**Light Pollution Reduction**	1	The site does not require much exterior lighting due the angled glazing walls of the building which behave like walls of light.
4	0	1		Water Efficiency	Possible Points 5	
1			Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1	Refer to below.
1			Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1	All site rainwater will be treated and kept in a sistern for landscape irrigation and greywater re-use
		1	Credit 2	**Innovative Wastewater Technologies**	1	
1			Credit 3.1	**Water Use Reduction**, 20% Reduction	1	High eficiency fixtures, dry figxtures, and occupant sensors will be installed. Greywater re-use will also be implimented
1			Credit 3.2	**Water Use Reduction**, 30% Reduction	1	High eficiency fixtures, dry figxtures, and occupant sensors will be installed. Greywater re-use will also be implimented

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LEED Point Summary

LEED Point Summary and Compliance Strategies
Nature Museum - Chicago, IL

POINTS

yes	possible	no		Description of Point		Compliance Strategy
12	0	3	Energy & Atmosphere	Possible Points	17	
Y			Prereq 1	**Fundamental Building Systems Commissioning**	0	Commissioning authority will adopt a commissioning plan
Y			Prereq 2	**Minimum Energy Performance**	0	Building envelope and systems will maximize the energy performance.
Y			Prereq 3	**CFC Reduction in HVAC&R Equipment**	0	All HVAC systems are CFC refrigerant free
2			Credit 1.1	**Optimize Energy Performance**, 20% New / 10% Existing	2	Refer to below.
2			Credit 1.2	**Optimize Energy Performance**, 30% New / 20% Existing	2	Refer to below.
2			Credit 1.3	**Optimize Energy Performance**, 40% New / 30% Existing	2	150-250btu/sq ft./y should be the energy budget for a museum according to Ashrae. Because of the various glazing and lighting strategies employed,f this should be optimal for optimizing energy performance.
		1	Credit 1.4	**Optimize Energy Performance**, 50% New / 40% Existing	2	
		1	Credit 1.5	**Optimize Energy Performance**, 60% New / 50% Existing	2	
1			Credit 2.1	**Renewable Energy**, 5%	1	Refer to below.
1			Credit 2.2	**Renewable Energy**, 10%	1	Refer to below.
1			Credit 2.3	**Renewable Energy**, 20%	1	The use of geothermal ground source pumps for radiant heating and cooling will reduce the mechanical load.
1			Credit 3	**Additional Commissioning**	1	Commissioning authority involvement will begin in all design phases to ensure the entire building is design, constructed and operating as
1			Credit 4	**Ozone Depletion**	1	CFC materials have already been phased out of use; HCFC-based refrigerants are being phased out. The building's refrigerants contain no HCFCs and the fire suppression system uses no halons, another ozone depleting class of chemicals.
1			Credit 5	**Measurement & Verification**	1	All Building systems will be computer controlled to regulate and quantify performance and efficiency to maximize the operation of maintaing a healthy building.
		1	Credit 6	**Green Power**	1	
6	0	8	Materials & Resources	Possible Points	13	
Y			Prereq 1	**Storage & Collection of Recyclables**	0	Garbage and Recyclables will be sorted and stored on site. There will be recycling bins placed around building.
		1	Credit 1.1	**Building Reuse**, Maintain 75% of Existing Shell	1	
		1	Credit 1.2	**Building Reuse**, Maintain 100% of Existing Shell	1	
		1	Credit 1.3	**Building Reuse**, Maintain 100% Shell & 50% Non-Shell	1	
1			Credit 2.1	**Construction Waste Management**, Divert 50%	1	Surplus glass, insulation, steel, concrete used in construction will be sorted and redirected back to manufactuers for recycling, and/or donated to the Habitat for Humanity
		1	Credit 2.2	**Construction Waste Management**, Divert 75%	1	
		1	Credit 3.1	**Resource Reuse**, Specify 5%	1	
		1	Credit 3.2	**Resource Reuse**, Specify 10%	1	
1			Credit 4.1	**Recycled Content**, Specify 7.5%	1	Refer to below.
1			Credit 4.2	**Recycled Content**, Specify 15%	1	Much of the building materials are recycled.
1			Credit 5.1	**Local/Regional Materials**, 10% Extracted and manufactured	1	
1			Credit 5.2	**Local/Regional Materials**, 20% Extracted and manufactured	1	Since construction elements are simple, material is able to be shipped locally.

LEED

LEED Point Summary

LEED Point Summary and Compliance Strategies
Nature Museum - Chicago, IL

POINTS

yes	possible	no		Description of Point		Compliance Strategy
		1	Credit 6	**Rapidly Renewable Materials**	1	
		1	Credit 7	**Certified Wood**	1	
1			Credit 8	**Durable Building**	1	High performance systems of glazing and alumnium and lighting allow the building to last.
13	**0**	**2**		**Indoor Environmental Quality** Possible Points	**15**	
Y			Prereq 1	**Minimum IAQ Performance**	0	Displacement Ventilation system implemented improves IAQ
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	0	All smoking is prohibited through out the building.
1			Credit 1	**Carbon Dioxide** (CO_2) **Monitoring**	1	Carbon Dioxide monitoring controls will be implimented into the HVAC controls.
1			Credit 2	**Increase Ventilation Effectiveness**	1	Displacement Ventilation system implemented improves IAQ
1			Credit 3.1	**Construction IAQ Management Plan**, During Construction	1	IAQ management plan will help protect the HVAC system during construction
1			Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	1	IAQ management plan will help protect the HVAC system before occupancy
1			Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1	All sealants, adhesives and fire rated sprays will have a specified low-VOC material content.
1			Credit 4.2	**Low-Emitting Materials**, Paints	1	Drywall paints, and partition coatings will all have a specified low-VOC material content
		1	Credit 4.3	**Low-Emitting Materials**, Carpet	1	
		1	Credit 4.4	**Low-Emitting Materials**, Composite Wood	1	
1			Credit 5	**Indoor Chemical & Pollutant Source Control**	1	Permanent entryway systems, containment drains in plumbing devices, filters will be installed to control undesirable pollutants from entering the building.
1			Credit 6.1	**Controllability of Systems**, Perimeter	1	Refer to below
1			Credit 6.2	**Controllability of Systems**, Non-Perimeter	1	The system is designed with task lighting and manageable temperature adjustment around the room
1			Credit 7.1	**Thermal Comfort**, Comply with ASHRAE 55-1992	1	The building envelope and HVAC system was designed above the ashrae standard 55-2004.
1			Credit 7.2	**Thermal Comfort**, Permanent Monitoring System	1	Computer systems will help monitor the performance of the interior thermal comfort for its occupants and sensative galleries.
1			Credit 8.1	**Day lighting**, Daylight 75% of Spaces	1	The building envelope is entirely glazed.
1			Credit 8.2	**Views**, Views for 90% of Spaces	1	The building envelope is entirely glazed.
1	**0**	**0**		**Innovation & Design Process** Possible Points	**5**	
1			Credit 1.1	**Innovation in Design:**	1	The glazing system of the building allows for light to penetrate the building and prevent heat gain and does not require any external shading device. This saves on building costs and allows for the building to remain porous.
			Credit 1.2	**Innovation in Design:**	1	
			Credit 1.3	**Innovation in Design:**	1	
			Credit 1.4	**Innovation in Design:**	1	
			Credit 2	**LEED™ Accredited Professional**	1	

45	45	18	TOTAL POINTS			
YES	?	NO	Certified 26 to 32 points	Silver 33 to 38 points	Gold 39 to 51 points	Platinum 52 or more points

Summary

Through this essay, issues have been investigated and successfully dealt with. Understanding how the structural facade works is just as important as understanding the concepts as they both depend on each other. How it molds in with the exterior and interior of the building remains a crucial connection point for the successfulness of the project. The design of the building's interior relationship to the skin provides a glimpse of the future of building skin design. Allowing the skin to remain as a separate entity from the interior structure gives an idea of a dome or shell. The angles in the walls almost make the skin seem physically impossible but because the skin's condition is similar on the other side of the building, lateral loads are cancelled out and it is able to stand straight without the use of columns. The strategies employed into incorporating sustainable systems like radiant flooring and displacement ventilation are incorporated in a manner so that they do not take away from the design aesthetic of the building.

Whether Central Park in Manhattan, Plaza Hidalgo in Mexico City, or Nathan Phillips Square in Toronto, every great city has a great landscape that expresses its unique personality through its historic precedents and buildings that inhabit the space. Such spaces link economically diverse neighborhoods and draw people from all walks of life that would otherwise not socialize together. They are a hub of activity for a range of interests and ages and, at the same time, offer quiet spots for peace and reflection. Because of their beauty and vitality through the commemoration and identity of the city’s history, they are among the community's most proud and cherished places.

Public buildings can shape how we live in community. They form the backdrop for many of our most powerful memories and are a manifestation of our collective values. The combination of a historic artifice/nature and modern building types can intensify the feeling of unity. The cities that we love to visit and long to live in all have attractive public spaces that bring people together and enrich daily life. Whether planned by visionary leaders or created by fortuitous accidents of history, these places for people offer a view into a city’s past and bring hope to towns facing a more urbanized future.

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