

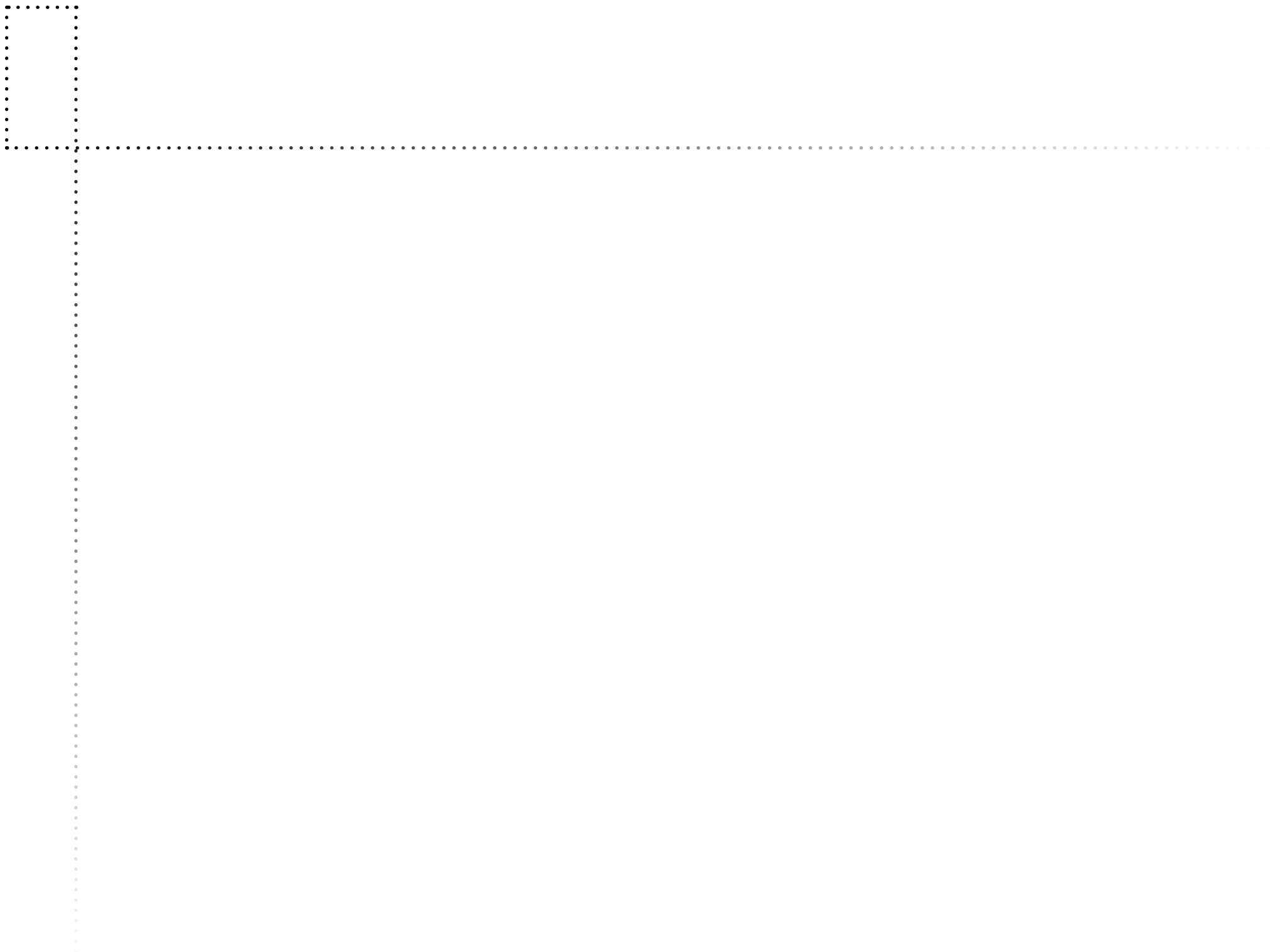
Sustainable

Connections

A Comprehensive Design of an Energy-Efficient
Convention Center

Produced by: Alexis Kautzman





Sustainable Connections

A design Thesis submitted to the
Department of Architecture and Landscape Architecture
of North Dakota State University

By:

Alexis Kautzman

In Partial Fulfillment of the Requirements
for the Degree of
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Primary Thesis Advisor


Thesis Committee Chair

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Abstract

Sustainable Connections: A Comprehensive Design of a Energy-Efficient Convention Center is a design thesis focused on the issue how can adaptive sustainable methods and technologies be applied to a convention center to design a energy-efficient structure? The design is of a convention center located in Shakopee Minnesota just off of the Minnesota River on the existing site of Huber Park. Creating a energy-efficient structure with new technologies will help build a connection to the environment, site and city through sustainable measures, to lessen the impact architecture has on the natural world. Architecture has a responsibility to protect, serve and improve society with sustainable design. With proper design strategies, technologies, and materials, large facilities such as convention centers can be created as energy-efficient structures serving to improve the environment and local community.

Key Words: Energy-Efficient, Sustainable, Convention Center

Problem Statement:

How can sustainable methods and technologies be applied to a convention center to design an energy-efficient structure to meld technology and nature as one?



Statement of Intent

A convention center presents a unique opportunity to test the limits of energy-efficient and sustainable technologies and materials. It must host numerous events with a variety of needs on a daily basis, and presents a great environment to test new technologies and materials in a variety of ways. The flexible program will push the boundary of sustainable design into the interior workings of the convention center. A convention center also must have a sense of transparency about it, which will expose the self-efficiency of the structure calling for the sustainable technologies and materials to present themselves in an artistic manner.

The primary usage of a convention center can range from weddings, graduations, concerts, organizational conventions and more. Convention centers usually have a mixture of large spaces, such as exhibition halls, ballrooms, and auditoriums, and smaller spaces like meeting rooms. Most convention centers are owned by the cities they are constructed in; rarely are they privately owned. Income for a convention center comes from renting out space, so making it valuable or desirable is important to consider while designing a convention center.

Premise/Unifying Idea

Claim:

Adaptive green materials can be tested on a convention center, provided problems of cost, testing, production and distribution are overcome.

Premises:

Action: Testing adaptive green materials on a convention center will bring to light problems not found in laboratories.

Object: Adaptive green materials can help improve the effectiveness, impact and future of sustainable design, decreasing the harm that a structure may have on the environment.

Actor: People developing, testing, manufacturing, and distributing these materials are a large factor in the success of making these green technologies and materials available in the public realm.

Theoretical Premise/Unifying Idea:

Architecture can provide an environment to solve problems of cost, testing, production and distribution of green technologies and materials tested on a small scale.

Justification:

Advancements in technology have created a surplus of new materials and design technologies, such as graphene and thermo-bimetals, which are in the early stages of production and testing. The potential for these new technologies still has yet to occur; some of them showing signs of limitless application possibilities. Some of the sustainable properties of these new materials and technologies could prove very valuable to architectural design but are slow to be applied into the construction industry. With growing concerns on the impact that buildings have on the environment, designers should be obligated to test these technologies in real design. In order to help perfect the maximum potential of new technologies which have only been tested in the laboratory, a connection between the inventors, producers and designers of such materials is needed. Architects can offer a new testing field through large scale design typologies such as convention centers, which require great flexibility in design programs, offering the perfect grounds for testing.

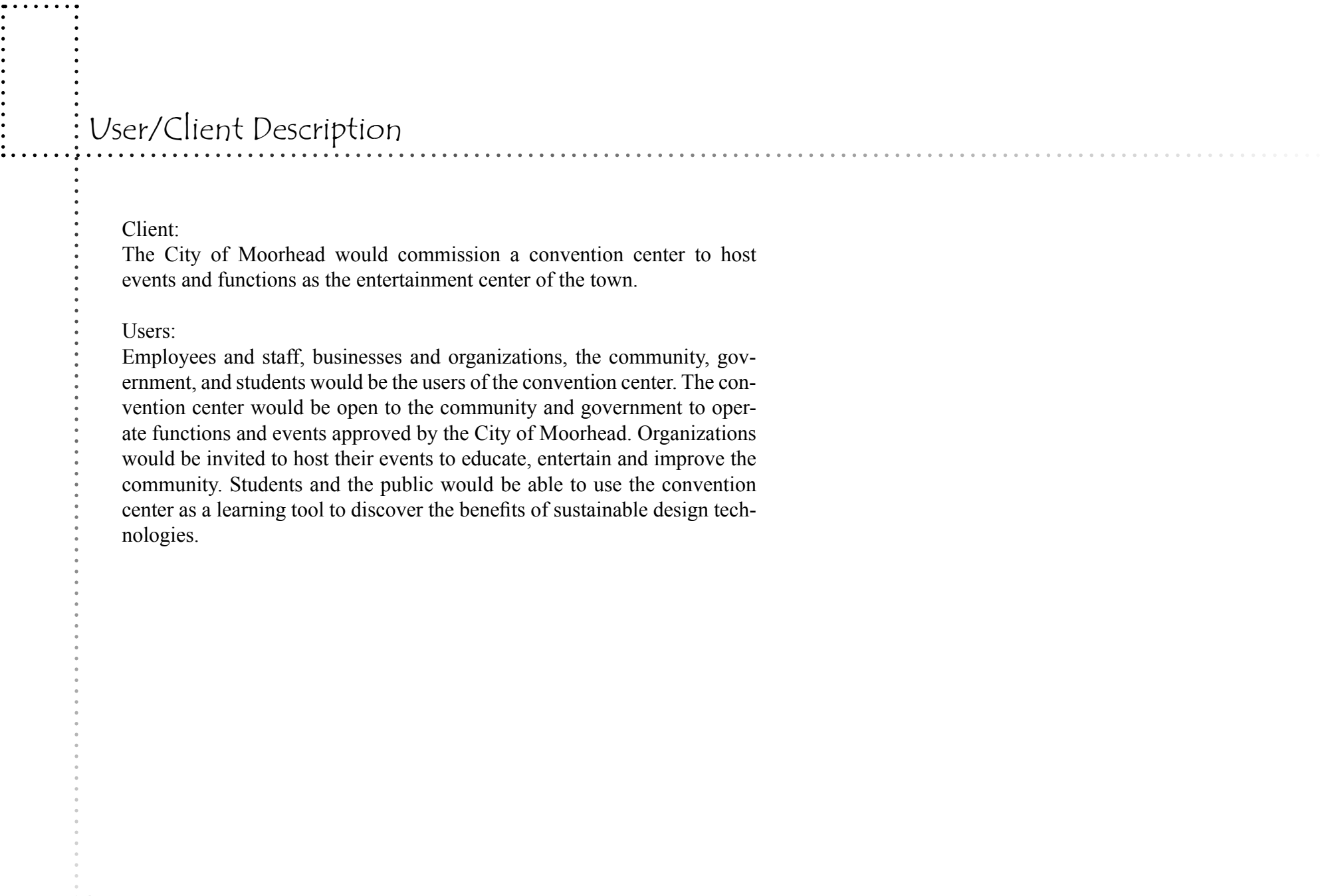


Proposal

With a rapid growth and demand for sustainable alternatives, can designers and developers apply these new technologies at a large scale to increase the sustainability of architectural structures? Careful analysis of the testing, cost, distribution, and production for such technology designers can Implement a new level of sustainable design.

Our increasing population and needs has a large impact on our environment and the need for sustainable technologies is at an all-time high. The construction industry is a factor contributing to waste and pollution and large scale structures contribute the most. Green technologies and materials can greatly reduce the impact a project will have on the environment if properly and efficiently conducted throughout the design process. Communication between designers and developers is an issue that can hinder the advancement of sustainable design.

In order for architects to incorporate green technologies and materials appropriately, they must be part of the testing process for such materials to fully understand their potential. Developers need architects to test their products at a large scale to further open doors of marketing for green technologies and materials. With this type of interaction, the flaws or success of marketable products will be uncovered and problems of cost, testing, distribution, and production can be addressed. Solving these issues will allow our society to gain confidence in choosing sustainable alternatives and gradually lead our culture to better design options

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User/Client Description

Client:

The City of Moorhead would commission a convention center to host events and functions as the entertainment center of the town.

Users:

Employees and staff, businesses and organizations, the community, government, and students would be the users of the convention center. The convention center would be open to the community and government to operate functions and events approved by the City of Moorhead. Organizations would be invited to host their events to educate, entertain and improve the community. Students and the public would be able to use the convention center as a learning tool to discover the benefits of sustainable design technologies.

Major Elements:

Exhibition Hall

A flexible space for large gatherings such as galleries, graduations, and shows. This space usually has an open floor plan making it easier for it to adapt to changing situations.

Ballroom

Slightly smaller than the exhibition hall, the ballroom is for more formal occasions; the most common use is for wedding receptions, dances and dinner parties. This is also has an open floor plan and usually very aesthetically pleasing.

Storage

Large amounts of storage will be needed to store chairs, tables and any other supplies available through the convention center. These spaces should be easy to access for efficient cleaning and setting up of events.

Meeting rooms

These are the smallest spaces available usually for small presentations or for more private needs.

Kitchen

A kitchen is needed to prepare food and beverage for events taking place in the convention center. It should be large enough to serve the maximum amount of people that can visit at one time and should also be easy to access for efficient serving. This part of the building should not be visible to visitors.

Bathrooms

Bathrooms will be needed on every floor and at a reasonable size to serve the maximum amount of people expected at one time. These should be easy for visitors to locate.

Auditorium

This space would be used for concerts, movies shows, or presentations and is usually another signature space for the convention center.

Site Information

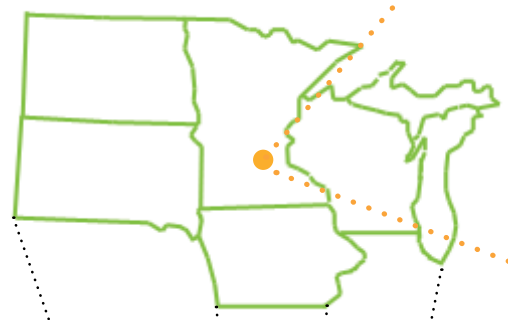
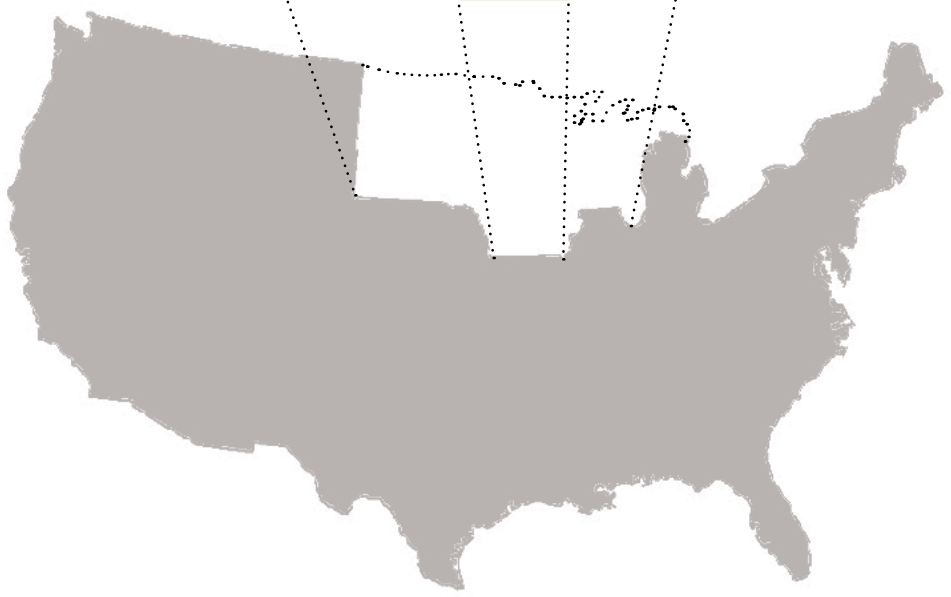


Photo Courtesy of Google Earth



Site Information

The site for this thesis is the current location of Huber Park located in Shakopee, Minnesota. This site was recently revitalized as a park located along the Minnesota River. Across the street from the site is Shakopee's downtown area and presents ample opportunity to connect the river back into the city. Shakopee is home to many well-known attractions, such as, Valley Fair and Canterbury Park. These attractions bring many people to Shakopee every year along with the large amount of events hosted by the city. But even with all of these attractions and events, Shakopee does not have a convention center or a suitable structure to host events for locals and travelers alike.

To contend with the local attractions in Shakopee, placing the convention center along the river provides wonderful views and a sense of place to the city, as most attractions in Shakopee are of tourist design. A major outlet into and out of the city, called Highway 101, is located on the West end of the site and a great location for an iconic building to welcome people into Shakopee. The site is a north facing hill sloping towards the river on the north side, making it a challenge for sustainable design decisions. But due to the land sloping away from downtown it also creates a wonderful sound and wind barrier. Sunlight to the site is consistent during the summer with no major shaded areas, but winter sunlight does create shade along the west side of the site. There are several major structures located on the site which include a playground, restroom structure, an amphitheater, small strip mall with housing above, and a very tiny car dealership.



Photo Courtesy of Google Earth

Project Emphasis

This thesis will focus on new sustainable technologies and materials and their application to a convention center as a means to test their potential effectiveness in reducing the impact buildings have on the environment and creating an energy-efficient structure. It will examine issues of cost, production, and application of new technologies into architectural design and produce a creative and elegant solution to any issues discovered. An underlying theme will be connection and flexibility; two concepts needed to create successful sustainable solutions and a diverse testing ground. A successful project will be able to serve as an example and educational tool to communities on advanced sustainable methods and become a gateway for Shakopee to begin taking sustainable measures throughout the city.

Research Direction

The theoretical premise/unifying idea will be the main focus of my research. A detailed site and climate analysis will be conducted to ensure a sustainable layout. Research of green technologies, business practices, economics, and the sciences developing sustainable materials will be essential to utilizing green technology to its potential at the architectural scale.

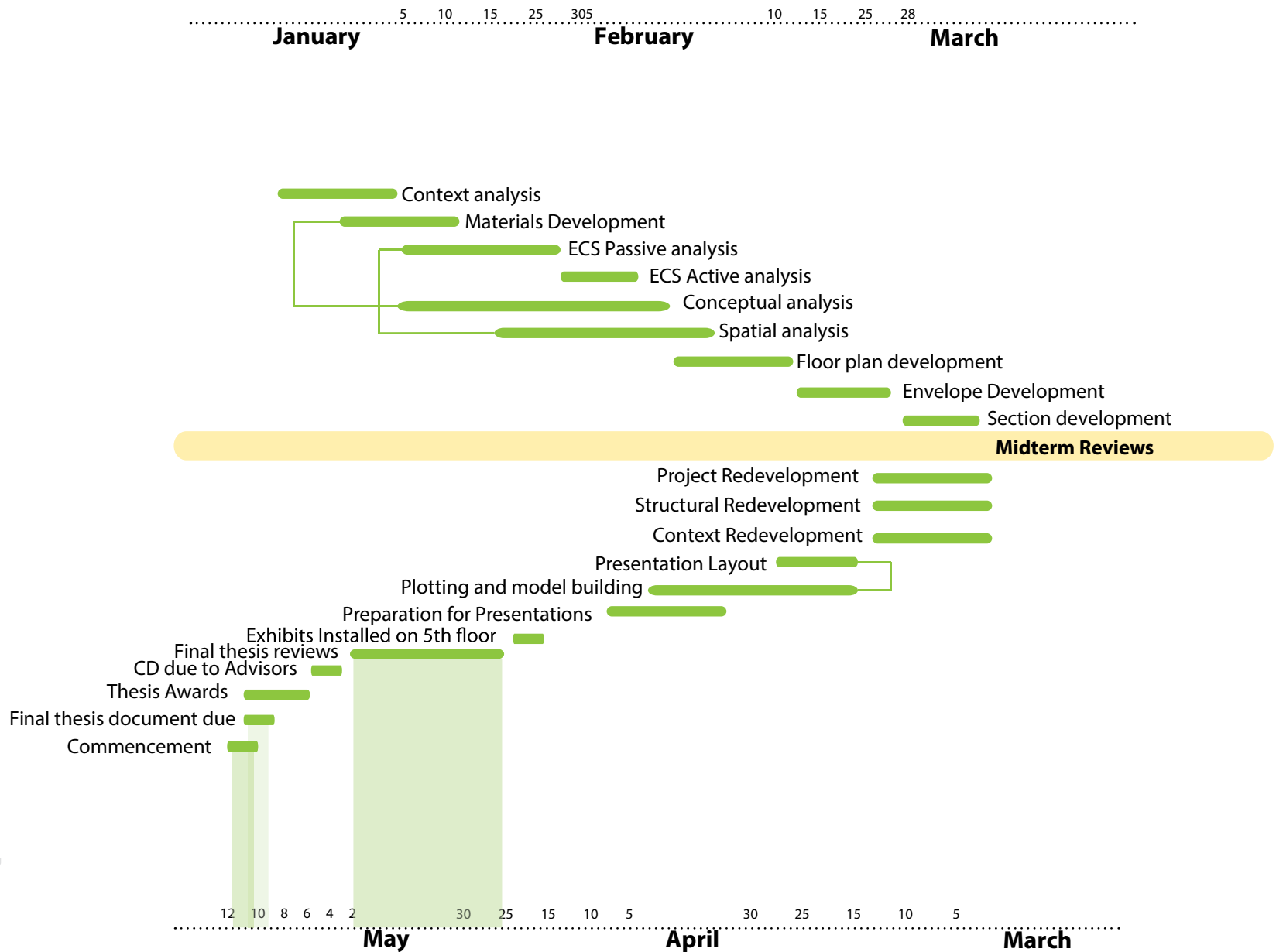
Design Methodology

Utilizing the mixed method model will result in qualitative and quantitative research based on the theoretical premise/unifying idea. This information will be gathered through case studies, internet sources, and library sources. By analyzing, organizing, and reviewing the information found, design decisions will be made.

Documentation

Documentation of design process will be saved digitally on a CD to be submitted at the end of spring semester. A hard copy of design process may be printed in a book format to be displayed with the final design. Sketches will be scanned every two weeks, at a minimum, towards the end of the week. Any 3-D models or process will be photographed on the same schedule as the sketches and kept in digital format. All process will be categorized based on dates created. Hard copies will be kept in folders or tubes and 3-D models kept in studio.

Plan for Proceeding



Program Document



Theoretical Premise Research

In recent times a move toward a more high-performance architecture has become a concern for many designers and professionals involved in the construction process. There is an increasing need to reduce architecture's impact on the natural environment, as natural resources are slowly depleting and evidence of global warming has become prominent. According to Green Building A to Z: Understanding the Language of Green Building by Jerry Yudelson, "Buildings account for more than 50% of all global carbon dioxide emissions, one of the main culprits implicated in the phenomenon of global warming."(Yudelson, 2007, p24).

With such a high contribution, it seems relevant that designers and industries should strive to reduce architecture's unsustainable nature. More and more we see growing populations putting strain on natural resources along with the industrialization of largely populated countries. In order to push a movement towards the advancement of high-performance design, architects must 'set an example' to the global society.

While designers have an ethical responsibility to strive for sustainable alternatives, they must also keep a practical mind set as well. It is impossible to completely reform the standards of the construction industry overnight, let alone societal or cultural barriers. "Chrissna du Plessis, a noted research architect and project leader on sustainable development at the Council for Scientific and Industrial Research (CSIR), has identified three major challenges we face in defining the future built environment: Taking the next technology Leap, Reinventing the construction industry, Rethinking the products of construction."(Kilbert, 2005, p16).

Theoretical Premise Research

Current trends in advanced technology point to a strong possibility of a next “leap” in technology happening in the very near future. Unlike the advanced technological gadgets on the market today, architectural technologies still need to be developed and tested. There have been great strides in recent years to begin to incorporate technologies and materials from small scale gadgets to the larger scale of architectural structures. Transitional glass and hydrophobic coatings are several technologies beginning to make their way to high-performance design.

But with new gadget technology it seems that high-performance design can only theoretically apply technologies not specifically designed for sustainable use, only modifying it for green purposes. It is not necessarily a bad idea to use these technologies that way, but the lack of development and testing of advance technologies tailored for architectural purposes is one issue holding back the advancement of sustainable architecture.

Traditional construction practices and products are also an issue holding back the advancement of high-performance technologies for sustainable use. New technologies and materials add “cost and complexity” requiring the construction industry to acquire new knowledge and training (Kilbert, 2005, pg18).

Many organizations, such as AIA and USGBC, are helping industries and designers strive for green architecture. Having a building with a LEED certification has become more common in recent years. Sustainable design has shown a trend from small scale projects to much more involved large scale design. According to Charles J. Kilbert, “LEED-certified buildings have increased in size from a few thousand square feet in 1999 to over 113 million square feet in 2003 (2005, pg18).” With this increase, we can begin to see the need for the implementation of high-performance technologies and materials for sustainable use.

Theoretical Premise Research

The most common sustainable design approach presented for LEED certification is of a vernacular nature, or the modification of historical knowledge to modern design. This strategy responds to site and climate conditions but is limited in what it can achieve in overall sustainable solutions. For extreme site and climate conditions, a vernacular approach is helpful but still relies on efficient energy and resource consumption to fill the gap. Implementing high-performance technology and materials along with vernacular design strategies can ultimately lead a design to its greatest goal of net-zero energy.

It would seem that using these advanced technologies and materials would be a bigger part of sustainable design than it is now. There are many great examples of high-performance technologies and materials used in architecture that has gained the global spotlight. But compared to the amount of construction done every year, the number of designs incorporating such technology is still a small percent. It should be the goal of every designer and professional to make the idea of high-performance technologies a standard in the design process. Understanding the issues and solutions surrounding the use of high-performance technology to create net-zero energy designs can launch sustainable architecture into the future as an expected standard process of construction.

To understand high-performance technologies and materials, designers have a need for knowledge on the process of how these materials and technologies are produced and tested. The design process for scientists and designers is completely different from each other. It is mentioned in *Materials Matters: New materials in Design*, by Philip Howes and Zoe Laughlin, that the scientific approach to material development and testing is based on the properties of the material, such as strength and density, rather than the a designers approach of aesthetics (2010).

Theoretical Premise Research

Learning the processes and approaches of each field may help architects and the construction industry better understanding of the use for new technologies. Likewise, if scientists and developers understand the manner in which designers wish to use high-performance technologies and materials, documentation of how they will react at a large scale design such as architecture, can create a larger opportunity for sustainable alternatives and ultimately create a list of construction materials free of any harmful impacts. “By using scientific methods to study those properties of materials that are largely ignored by the materials science community yet are vitally important to the likes of industrial designers, architects, artisans, and artist, it will be possible to develop a sensoaesthetic theory of materials that will act to bridge the science-arts materials divide.”(Howes and Laughlin, 2012, p42).

One design approach that may be the key to linking science and art is called biomimetic design or biomimicry. In 1997 Janine Benyus published a book called *Biomimicry: Innovation inspired by Nature*, in which she explains the benefits of biomimetic design. Biomimicry encompasses the idea of imitating nature by observation of natural processes. Applying the knowledge of the design and science behind the natural world to architecture, would be the greatest test of high-performance technologies of the modern age. Natural materials that have evolved for thousands of years can be synthesized for large scale use in architectural structures. These materials would naturally be sustainable and completely recyclable, replacing harmful products used in the construction industry today. Biomimetic design calls for a higher level of technology and materials which strives to use them not only in large scale architectural structures but to also enhance the aesthetics of such materials to highlight the natural beauty found in nature. Science has already made strides to create high-performance technologies and materials with discoveries in nanotechnologies and hydrophobic materials beginning to show a characteristic of biomimicry. With new technologies being discovered every year, the trend in biomimetic characteristics will only increase with a better understanding of our natural world.

Theoretical Premise Research

Another recent design strategy that has been developed recently to address sustainable issues are 'off the grid' architectural structures. Unlike energy neutral buildings that produce just as much energy as they consume, 'off the grid' buildings actually produce enough energy to not require any assistance from natural resources. This design strategy is found mostly in smaller homes or cabins but hasn't really been implemented into larger projects such as convention centers due to the extreme expense of 'off the grid' technology. According to Ed Melet, author of *Sustainable Architecture: Towards a Diverse Built Environment*, "There is no point in making every building 'off the grid'. Even if energy-efficient buildings were to become completely independent of external sources, a disproportionate amount of money would have to be invested in power-generating equipment. This investment would only repay itself if energy prices were to rise inordinately" (1999, p131). 'Off the grid' building design would have to invest high amounts of money in order to preserve heating and cooling gathered during the day since the sun is only present during the day.

Another issue Melet found in self-efficient design is that designers are no longer in control of the form of their buildings but rather slaves to the needs of the technologies to be successful. This contradicts Louis Sullivan idea of "form follows function." If the technology is allowed to take the hand of the designer than will the future of architecture become no more than a collection of technologies? This one issue is of great importance in thesis because a balance must be met between design and technology in order for it to connect to architecture and nature in a manner that can still be beautiful.

Theoretical Premise Research

“Smart buildings” are currently trying to create this balance. Due to their use of natural design strategies, smart buildings are more inclined to be in harmony with nature as they rely on natural forces. Self-efficient buildings rely on technology to produce their energy, leaving the building completely out of control of its own energy production. An interesting quote by Richard Rogers states that, “Architecture will therefore become more informed by the wind, by the sun, by the earth, by the water and so on. This does not mean that we will not use technology. On the contrary, we will use technology even more because technology is the way to optimize and minimize the use of natural resources” (Melet,1999, p133).

These alternate views on self-efficient buildings have begun to create questions concerning the ethical and practical issues concerning the design of self-efficient projects. Is the high cost of self-efficient technology worth its implications in a design? As an architect, can a designer overcome the problem of these technologies having complete control over a design? Some believe that off the grid architecture is the answer to these questions. The difference between off the grid design and self-efficient is that off the grid design highly values the use of passive systems. Instead of relying on technology as an energy creator, technology should only be used as an aid to passive systems. According to Lori Ryker author of *Off the Grid: Modern Homes + Alternative Energy*, there are three important factors to look at before deciding what types of energy systems to use in a project. These include the location of the project, the budget of the project, and the legal conditions concerning sustainable technologies on the given site. Knowing the location of your project and the conditions that it will endure is crucial for passive system design to properly keep stable temperatures, sufficient ventilation, and any renewable energies that are available.

Theoretical Premise Research

Learning about new technologies and materials that could help serve to maximize passive system effectiveness in sustainable design is very important when trying to create self-efficient or off the grid designs. It is also a great way to keep informed of new technologies, techniques and trends in the architectural field that you can propose to clients.

Now we will look at several new or recent technologies that have the potential to reform sustainable design. The first one we will look at is called *thermo-bimetals*, which has the ability to be moved based off of changes between the interior and exterior temperatures. This is very useful for natural ventilation and in allowing a building to regulate its own air exchange. (Howes and Laughlin, 2010). Allowing a building to react to temperature changes inside and outside a building would greatly reduce the need for active ventilation in a structure. This same principal can be applied to glass to keep light or heat from entering or leaving a structure through reactive methods. Insulated glass can greatly reduce heating usage in winter due to its ability to insult spaces using noble gases.

Thermoelectric glass is a product that behaves in the same manner as a radiator as it emits heat upon an electric current sent through it and could also reduce heating costs. For energy production, self-cleaning glass has the potential to reduce waste build up on solar panels allowing them to function effectively year round. *Aerogels* are a product that has already been applied to the architectural field, as a super insulator. The natural beauty of the product is a stunning blue color that is often hidden when applied to a building behind walls treated in the same matter as normal insulation, but the potential aesthetics of the project are enormous (Howes and Laughlin, 2010). There are several issues with aerogel production as it has yet to be produced in large sheets and is very costly. Strides have been made to make it more commercial friendly with a factory in Frankfurt, Germany producing the product since 2003 (Howes and Laughlin, 2010).

Theoretical Premise Research

Some of the out-of-the-box products that are being developed are reactive materials with the potential to react to the movement of people and to human input, to create a virtually endless flexibility to a space. *Graphene* is material that is currently receiving a lot of attention due to its endless potential and reform of modern technology. At only one atom thick, graphene is the strongest material in the world and is highly conductive. Its potential in solar panels, glass and other construction materials will be fun to watch in the next several years (Howes and Laughlin, 2010).

The potential for modern technology to create sustainable products has just barely been seen. With a creative spin, the future of sustainable design will see more products being implemented and discovered every day that could change the very way we see and design. Technologies like these will be able to support passive systems in buildings that can be applied to large scale buildings like convention centers to be more self-efficient. Soon we will be seeing off the grid structures, not just small homes, which are cost effective, efficient and ascetically pleasing. The goal of this thesis will be to address the issues found in the research concerning technology over powering the design of a project but rather taking control and making it into a project completely connected to the environment and to the community. The future of sustainable design has a positive outlook and designers are the key to starting the revolution of a sustainable standard of construction. A natural beauty long since forgotten behind the mechanics of modern technology, is reaching out its hand, we have only to reach out to that hand and embrace the essence that keeps us alive.

Case Studies



Vancouver Convention Centre

Project type: Convention center

Architects: LMN Architects

Location: Vancouver, Canada

Completed: 2009

Size: 1.2 million square feet

Existing Program Elements:

- 223,000 sq. ft. - exhibition hall
- 60,000 sq. ft. - meeting rooms
- 55,000 sq. ft. - ballroom
- 95,000 sq. ft. - retail space
- 400,000 sq. ft. - public space

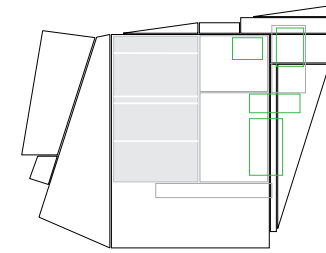
Distinguishing attributes:

- LEED Platinum rating
- 6 acre living roof
- Artificial reef foundation

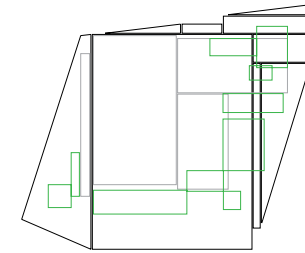


Figure 1.1
<http://www.ranacreekdesign.com/projects/vancouver-convention-center/>

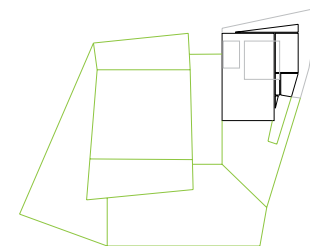
Geometry



Level 1



Level 2



Level 3

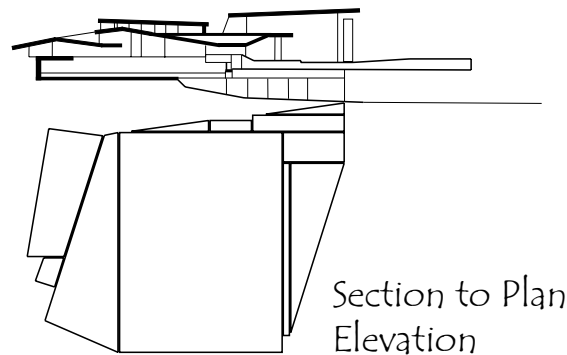
Vancouver Convention Centre



Figure 1.2



Figure 1.3



Located in Vancouver, British Columbia, Canada stands the 1.2 million square foot Vancouver Convention Centre West. The building was designed by LMN Architects and is a LEED certified platinum, becoming the world's first convention center to achieve platinum status. The West building is an extension to the existing convention center, or East building, which was also renovated during construction and connected by a skywalk over the shore. Included in the West centers program is an exhibit hall, meeting rooms, ballroom, retail space, walkways, bikeways, public open space and plazas doubling the space available from the East building. This unique program beautifully achieves a harmonious link between the public and the surrounding waterfront location offering views of the ocean, mountains, and parks (LMN, 2009). Floor plans consist of the large exhibit and ballroom spaces centrally placed with the smaller meeting rooms and bathrooms situated along the perimeter.

“The new west expansion is designed to bring together the natural ecology, vibrant local culture, and the built environment, accentuating their interrelationships through the architecture”(LMN,2009, p2). In response to its context, the Vancouver Convention Centre West has implemented several uncommon sustainable features including a six acre living roof, an artificial reef, and seawater heating to name a few. A six acre living roof is home to many indigenous plants and several bee colonies all reflecting the natural slopes of the mountains.

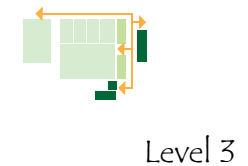
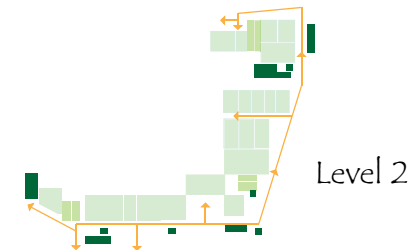
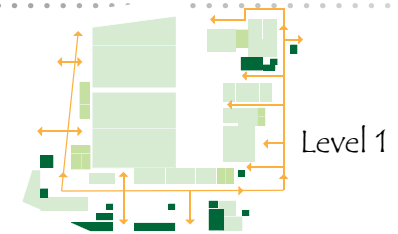
Vancouver Convention Centre

The roof also creates a green pathway between the surrounding parks and acts as an insulator to the structure. Built into the structure of the building located in the ocean is a concrete tier acting as a catalyst for marine life to thrive. The tiers allow for the structure to become part of the natural ecology of Vancouver, causing the very building to improve the local habitat.

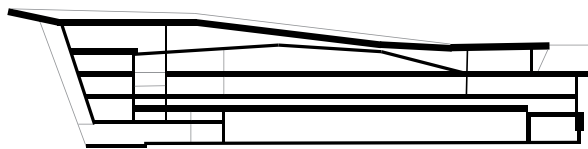
The give and take relationship is further strengthened as the building uses a seawater pump to heat and cool the interior with a steam heating system as a backup. Grey water is also treated by plants in the structure for added sustainability in maintaining the landscape and living roof. Local culture is embraced by the implementation of walkways and bikeways to connect the city to the surrounding ecologies.

A vast amount of public space and plazas bring people to the waterfront to strengthen the sense of community and to enforce the public nature of the convention center. The private portions of the building are located in the interior but an exterior skin of glass creates a transparency between the public and private while still maintaining distinct boundaries between the two. To further enhance the public nature of the building public terraces are located on the exterior of the structure offering wonderful views of the water front and live roof. The convention center becomes a host to many public events and festivities for cultural growth.

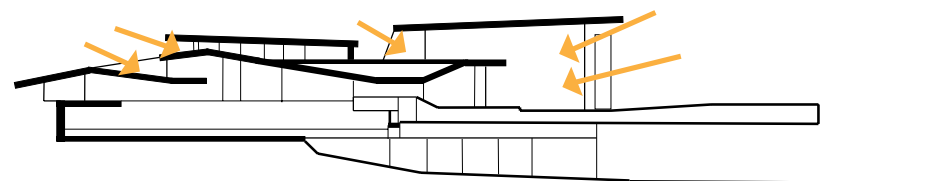
Circulation



Structure

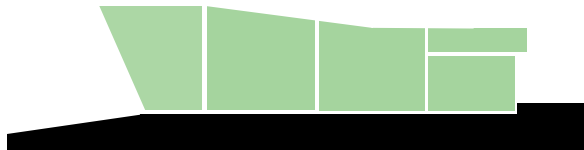
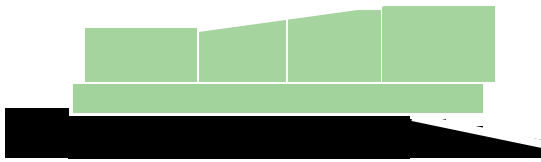


Natural Light



Vancouver Convention Centre

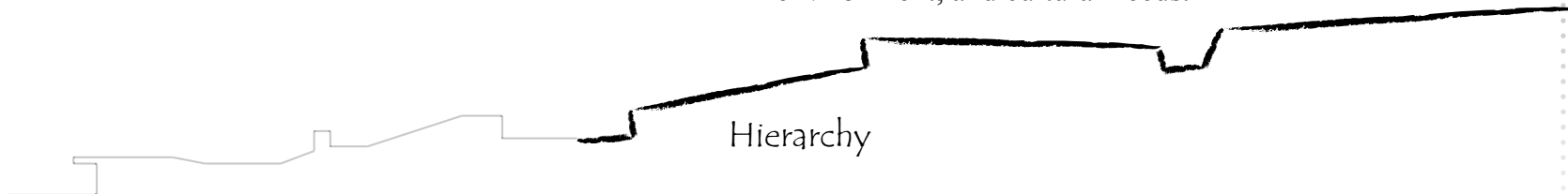
Massing



For urban growth, the center frames many views from both the urban side of the site and the ocean side maintaining the natural beauty of both the city and the environment as one. Not only does the building offer spectacular views, itself as an entity creates picturesque moments linked with both the ocean and urban sides. Retail space at the public level offers dining and retail opportunities drawing activity to the public spaces and financial support to the Vancouver Convention Centre.

This case study is an example of an absolute response to context, amplifying sustainable design and harmony between nature, culture, and the built environment. The architectural reaction to the concept of connection creates a transparency that is necessary for the design of a convention center meant for public use. Through sustainable measures architecture not only preserves the natural environment but can open public spaces to a stronger sense of community. Designating clearly defined public and private spaces with transparent boundaries keeps both realms of use open to the exterior raising the value of the spaces inside a convention center with iconic views. These ideas support that larger facilities can efficiently incorporate sustainable measures connecting architecture to the natural environment, the built environment, and cultural needs.

Hierarchy



China National Convention Centre

Project type: Convention Center

Architects: RMJM Architects

Location: Beijing, China

Size: 258,334 sq. feet (375,000sq. m)

Existing Program Elements:

- Plenary Hall – 6,400 sqm.
- Grand Ballroom – 4,860 sqm.
- Exhibit space – 23,000 sqm.
- Meeting rooms – 70
- Office buildings – 2
- Retail shops
- Food outlets

Distinguishing Characteristics: Curving roof



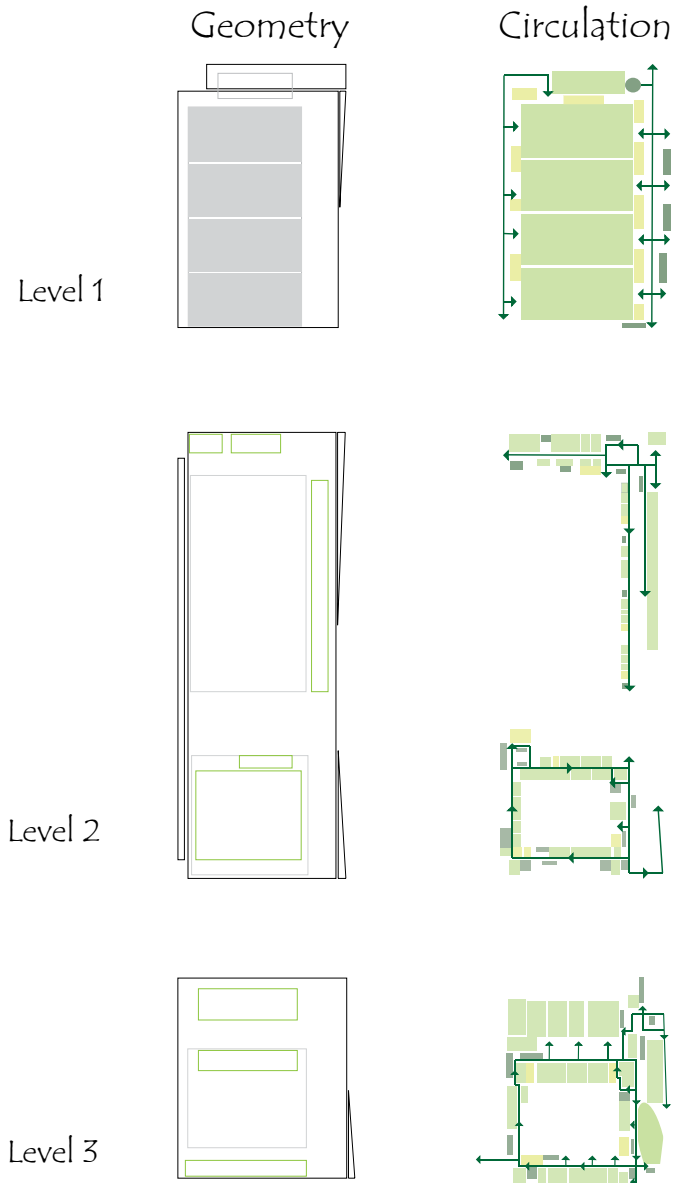
Figure 2.2
http://www.e-architect.co.uk/beijing/beijing_convention_centre.htm



<http://www.businesstraveller.asia/asia-pacific/news/meet-in-5-new-convention-centres>

Figure 2.1

China National Convention Centre



The Beijing National Convention Centre is a 258,334 square foot building that hosted the international broadcasting media of the 2008 Beijing Olympics. Located on the Olympic green boulevard in proximity of the Birds Nest and Water Cube, the convention center designed by RMJM Architects, encompasses a flexible design allowing the structure to serve two separate lives and host a variety of events and functions. After its purpose of housing the media center for the Beijing Olympics was replaced by its intended purpose as a national convention center, the building's design was left open to renovations at a low cost ensuring a value for the building even after the 2008 Olympics. The flexibility extends into the interior of the building with the ability of the exhibit hall to be sectioned off into four smaller rooms when necessary, a very valuable option for visitors. One of the most distinguishing features of the convention center is its merging of traditional Chinese architecture into a modern design. The curving roof is symbolic of traditional Chinese quoin, resulting in an elegant form unique to Chinese culture.

There are several sustainable features unique to this convention center dealing with both passive and active systems. A central vacuum system, central refuse system, and kitchen waste vacuum collection are several active systems in the National Convention Centre decreasing energy usage and waste. The central vacuum system is the longest in China, helping reduce noise and pollution in the building. Central vacuum systems minimize dust particles released in the air and reduce any odors that may develop, improving and maintaining air quality.

China National Convention Centre

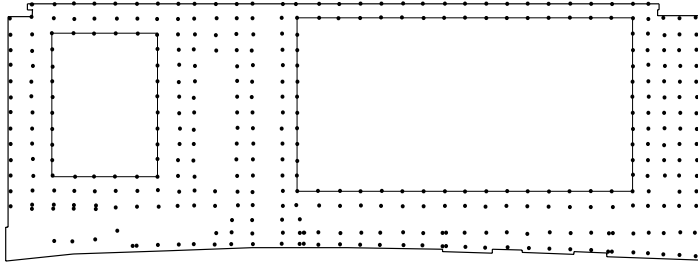
The Centre has also incorporated a sustainable kitchen waste system that makes even the daily functions of the staff a sustainable act. As China's first kitchen waste vacuum system, waste that is produced is reduced in volume before heading to the refuse system. The refuse system is a garbage compactor system that also helps reduce the carbon footprint of the convention center. These systems are helpful to the efficiency of functions in the convention center because of the large amounts of food and waste produced for every event hosted. By helping the internal functions reduce waste, the convention center starts to address the issues of appropriate and sustainable operations that run large scale facilities.

The passive systems incorporated into the National Convention Centre include part naturally air conditioned spaces and a roof rain water collection system. Similar to passive design strategies in the southern United States, air is run through the ground floor level and up lifted through the foyer and exhibit space. The building also has a curtain wall system designed for natural ventilation based on temperature levels inside the building. Cooling costs are reduced during the summer with these systems allowing for money to be put back into the building for maintenance and updating. The other sustainable feature of the National Convention Centre is the elegantly curving roof.



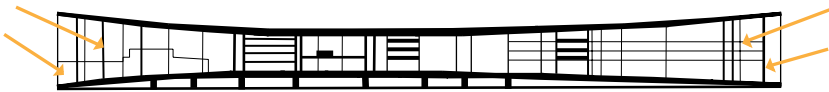
China National Convention Centre

Structure



A siphonic system drains rain water from a roof area of 645, 834 square feet and collects it for use on the landscape and vegetation surrounding the building. Again this reduces the demand for water the building may have and saves money to be used in other areas of the building.

Similar to the Vancouver Convention Centre, the Beijing National Convention Centre responds to community needs with a building meant as an outlet for the rapid growth of Beijing. It strives to bring a more developed and urban feel to Beijing through the mixed use of retail, food, and office spaces included in the convention center. Both buildings incorporated sustainable technologies and design, though the Vancouver Convention Centre solutions appear more developed and detail oriented. The cultural response to the structure of the Beijing Nation Convention Centre was approached in a different manner than the Vancouver Convention Centre, were the building encouraged cultural growth through its public space, the Beijing National Convention Centre response to cultural issues was a beautiful display of the history of the community to be recognized by the world, creating a sense of pride for the public.



Natural Light



Section to Plan
Elevation

Exhibition Hall 26

Project type: Convention Center

Architect: Thomas Herzog

Location: Hanover, Germany

Size:

466,100 sqm – covered space

58,000 sqm – open air space

Program:

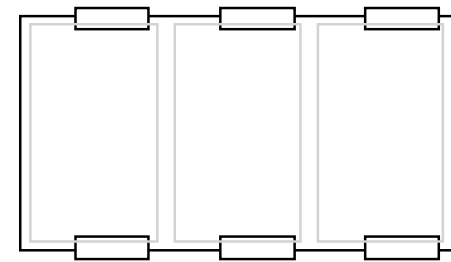
466,100 sqm - exhibit hall

Distinguishing Characteristics:

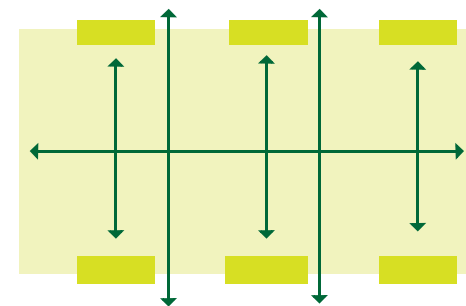
Cresting Roof, natural ventilation



Geometry



Circulation



Level 1

Figure 3.1

http://www.jersemar.org.il/english/speaker_Thomas_Herzog.aspx

Exhibition Hall 26

Designed by Thomas Herzog, Exhibition Hall 26 is located in Hanover, Germany and is part of the largest permanent exhibition site in the world. It was erected in 1996 as a reuse plan to reconstruct a former armaments industrial site, including a new infrastructure design. The entire site has 26 exhibition halls and spaces laid out as a small town, and became the first established exhibition site to house the Expo 2000. The total covered area of the exhibition hall is 466,100 square meters with 58,000 square meters of open air space and six service pods at its exterior. Hall 26 has a completely open floor plan except for six pods containing bathrooms, offices, cafes and meeting rooms. This design gives the exhibition space great flexibility in event layouts allowing for the space to adapt freely to different needs.

The signature characteristics of the building are the three crests formed by the roof appearing like waves over the exhibition hall and the exterior materials used. These crests in the roof are structural responses to the building's natural ventilation and natural day lighting. Natural thermal movement pushes air through the building, first entering from glass ducts four meters above ground level. Cold air entering the building naturally rises as it is heated and exits through flaps at the peak of the crests, the flaps are adjusted based on wind direction to prevent air from pushing back into the building. When heating is needed, mechanically heated air is sent through long-range nozzles connected to the ducts. The bellies of the crests are used to diffuse natural lighting into the building but also contain artificial lighting to be used when needed. Air conditioning and heating costs use is reduced to about fifty percent and lighting costs are minimized; both systems of design save the building money and shrink its carbon footprint.

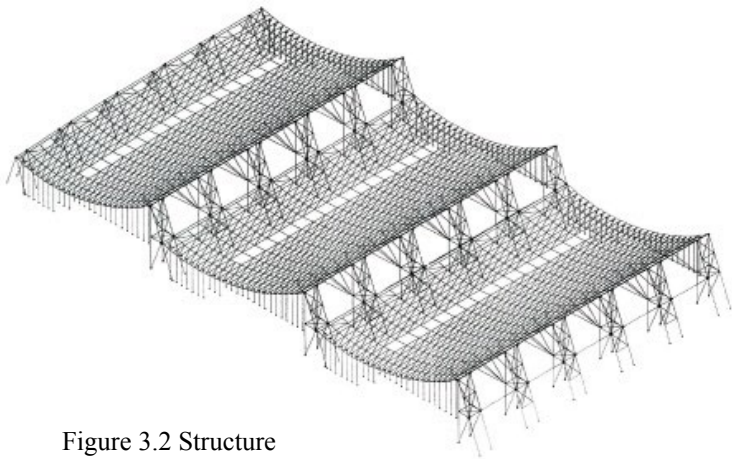


Figure 3.2 Structure

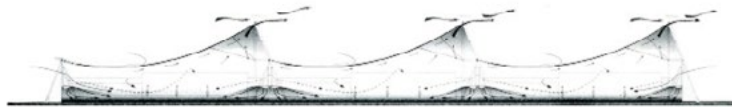
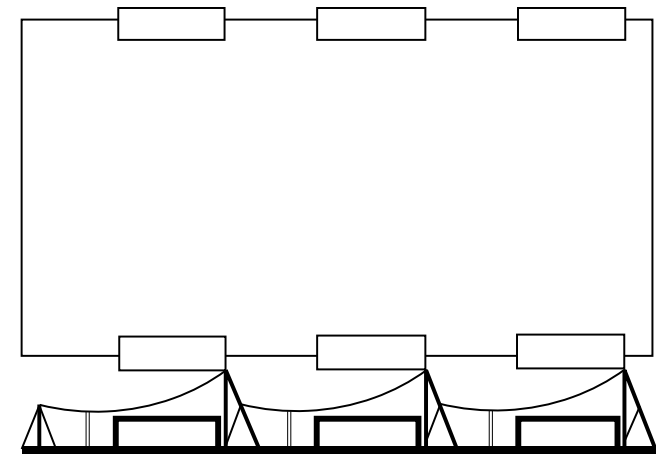


Figure 3.3 Air Flow

Exhibition Hall 26

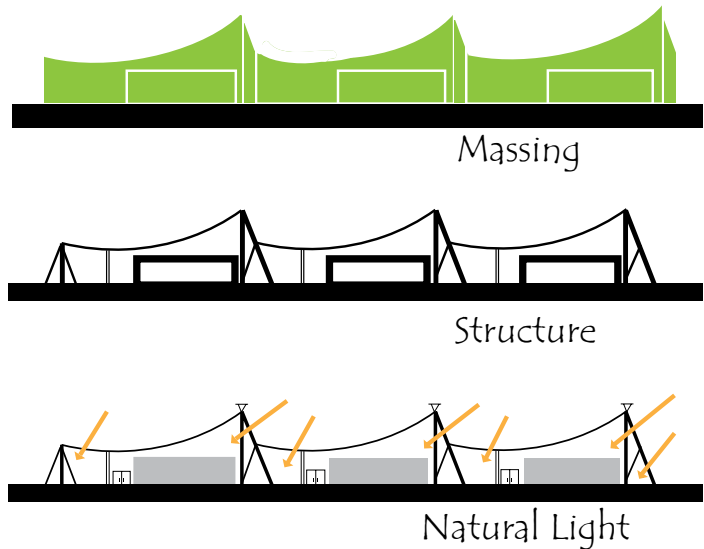
The materials used at Exhibition Hall 26 are similar to the previous case studies, such as a large amount of glass and wood. A common trend in convention design seems to be a transparent architecture meant to establish an invisible communication between the architecture and the community. This transparency is also a marketing tool to bring people to the convention center because it exposes the building in an honest manner. Glass also has the unique ability to make subtle boundaries designating the public and private separate but still connecting them through a line of sight. The six pods placed on the exterior boundaries of Exhibition Hall 26, are covered in beautiful wood slates adding a warming contrast to the glass and steel structure enclosing the exhibit space. The Vancouver Convention Centre and the Beijing National Convention Centre, also have prominent use of wood in their facilities. Each projects use of wood has a different intention such as the Vancouver Convention Centre's implementation of local materials and Exhibition Hall 26's desire for a complimenting contrast in materials but the warmth of the materials seems to give a familiar and comfortable feel to visitors.



Section to Plan Elevation

Hierarchy

Exhibition Hall 26



Exhibition Hall 26 use of natural ventilation through passive design allows the structure to form from a natural process. The influence of sustainable design on a building can even dictate the very form or structure. This contributes to the theoretical premise that a facility the size of a convention center can successfully implement green design and in some cases even be influenced by the very systems to create elegant designs. It also supports the theoretical premise that implementing even just one sustainable system can reduce the cooling needs in half and that incorporating several sustainable measures has the possibility of creating a self-efficient convention center. Even the choice of materials has an impact on the sustainability of a project, an example in Exhibition Hall 26 being the glass for natural lighting and added insulation. By exploring uncommon materials and technologies a project such as a convention center has the ability to be completely self-efficient based on the choices and comprehension of such technologies.

Historical Context

History of Sustainable Design

How did modern sustainable design come about? It is important to understand the birth and development of sustainable design in order to optimize its influence and successfulness in this design thesis. The idea of 'going green' is accredited to starting in Europe as far back as the medieval time period with simple sustainable forestry methods. Asian farmers were said to have practiced soil conservation through terrace farming around the same time. One man who contributed to the green movement was a man by the name of Thomas Malthus who, during the 1700's, wrote an article called An Essay on the Principle of Population in Europe causing many people to question the effects that over population could have on the environment if it were to reach the limit of what the environment could support (Lallanilla, 2012).

As the colonization of America was beginning, many Europeans migrating to the United States fell in love with the beauty of the new world and began to attribute sustainable measures with an intrinsic value rather than just a resource needing to be conserved. There were two people who headed this idea of conserving the beauty of the land called Ralph Waldo Emerson and Henry David Thoreau who proposed that "in wilderness is the preservation of the world" (Thoreau, 2011, p31). These men believed that the spirit of nature transcends mankind's needs giving them the name 'transcendentalists' (Lallanilla, 2012).

In 1760 England the Industrial Revolution began causing many heart aches for transcendentalists with a massive increase in resource depletion and pollution. A massive increase in population and agricultural productivity were a couple causes of this revolution. Demand for products from consumers developed through advertisement and the ability of the working class to purchase products due to increase in work.

Historical Context

This increase in wealth can be attributed to capital formation and accumulations in England while the increase in the working class due to technological advancements and entrepreneurship. With new technologies came and increased demand for coal, wood, and metals. Some of the new technologies included textile machinery, the steam engine, growth of factories, new methods of transportation, and the use of new minerals for energy production. The Industrial Revolution didn't take root in America until about 1820's with textile production. America, like England, had a large supply of resources for fueling industrial production but a short supply of labor so working conditions were much better than that of England's working class. A major contribution the United States gave the industrial revolution was the production line, decreasing production time. The effects of the Industrial Revolution seemed to intensify the worries of the green movement with an increasing population growth, standards of living, and industrial landscape. All of these changes putting sustainable issues in the background of the United States priorities until Teddy Roosevelt began putting aside large amounts of land beginning the formation of national parks.

The green movement was pushed aside again as worldwide conflicts arouse through WWI and WWII where people were focused on winning. After WWII green concerns came to light again as massive population growth and suburban development threatened the environment. In 1969 the burning of the Cuyanoga River, Colorado caused great outcry from citizens for changes to industry policies concerning environmental concerns. It was also in 1969 that the first Earth Day was celebrated later becoming a national holiday and eventually celebrated worldwide. Richard Nixon responded in 1970 by developing the Environmental Protection Agency, or EPA, to deal with the concerns of pollution from industries (Lallanilla, 2012).

Historical Context

Shortly after the establishment of these and other organizations, sustainability began to find its way into the educational systems and numerous acts began to pass to address environmental concerns. Like most changes there was a backlash from those affected, especially the industries relying on the consumption of resources and production of pollution.

The 1990's saw an explosion in the green movement followers, as younger generations began taking matters into their own hands chaining themselves to tree's and being branded the title of 'tree huggers'. In a way this behavior began to turn people away from the green movement because of the cultish behavior and ideals of environmentalists, hurting the movement rather than helping it. Barely a decade later the green movement was revived with a move away from the spiritual and intrinsic view on sustainable measures to a more scientific and measurable side, bringing credibility back to the movement.

Though the idea of the green movement dates back to the 18th century, sustainable architecture wasn't conceived until about 20-30 years ago. Sustainable architecture is a fairly new concept that was not even considered during the sustainable boom during the 1970's; the same time that the most unsustainable architecture was being built. It was an unknown problem that contributed the most to the growing waste and pollution issues being faced in the 1970's. Unsustainable architecture began its development during the industrial revolution with an increase in mechanical devices being incorporated in to architectural design. Every building type adopted these mechanical alternatives eager to follow the rising trends of technology. Before the industrial revolution it was discovered by recent studies that architecture had relied on sustainable methods for heating, cooling, lighting, and ventilation of buildings.

Historical Context

With no machines to do the work of heating, cooling, lighting, and ventilation, people relied on passive methods to make their buildings which were completely lost in the convenience of the new technologies developed in the industrial revolution. Passive methods of design have a history as old as the human race, so why did we feel the need to replace them to convenience?

The first traces of humans creating passive architectural structures dates back 30,000 years with tent like structures. Eventually branches were used for structure and animal hide for the covering of the tents, ventilation holes were put at the very top of the tents to let smoke from fires ascend out, most notable in Native American style tents. After the discovery of agriculture, humans began to develop more permanent structures. They began to build round houses out of sun dried brick which showed the first use of insulation by covering the walls in mud. The roofs remained cone-like with ventilation still placed in the center, the first combination of passive systems around 8,000 BC. By 6,500 BC straight walls were introduced with openings for windows with doors located through the roof. Lighting has now entered the equation in passive systems for humans, also triggering the first signs of infrastructure. From here the Mesopotamia period in Egypt begins what we coin as the beginning or architectural design as science and art form. Much of the passive systems from this period on remain relatively the same and unchanged due to its natural efficiency. Humans have survived thousands of years with these systems and need to find a balance between these ancient passive methods and modern design (History World, 2012).

Historical Context

History of the Context

To successfully implement passive design along with sustainable technologies and materials, it is important to know the history of the site that is being built upon by addressing issues concerning physical, social and historical context of the site. One of most famous physical features of Minnesota is the 10,000 lakes giving the state the nick name ‘The Land of 10,000 Lakes,’ which were formed by a large glacial mass that formed during the last Ice Age. Glaciers moved back and forth across the land depositing sediment that would trap ice underneath it and later would melt causing the sediments to collapse and form holes or ‘kettles’ that eventually filled with water and created a lake. Minnesota has been known to be very rich in natural resources due the deposited sediments and has two major iron ranges that produce 75% of the nation’s overall iron ore. Much of Minnesota is still farm land producing crops such as corn, soybeans, wheat, rye, sugar beets, and alfalfa. After the Industrial Revolution, Minnesota began to experience extreme temperature fluctuations along with several large natural disasters. In 1936 Moorhead sets a state record high of 114 degrees and in the same year, temperatures remained below zero for over a month. This trend continues through the 20th century producing several devastating snow storm records.

Minnesota came to statehood in 1858 becoming the 32nd state of the United States of America. By 1884 Minnesota began its iron ore mining, three of the more well-known being located in Mesabi, Cuyuna and Vermilion. Minnesota remained the leader in iron mining for the next 100 years but by 1963 the first signs of depletion of the resource began to show as the Vermilion mining range closed. The Cuyuna mining business closed in 1980 and shortly after in 1984 so did Mesabi. The demand for iron and the need to supply two world wars contributed to the depletion of the ranges as demand skyrocketed.

Historical Context:

Minnesota's power production roughly began in "1905 with the establishment of the Electric Bond & Share Company to hold the stock of small-town electric utilities owned by the General electric Company" (SGHresources.com); coal became the main source of fuel for these new plants. These power generators continuously grew in size and power output for the next fifty years. Minnesota's first hydroelectric power came from the Garrison Dam built in 1955 and was located in North Dakota; shortly after in 1957 the nation saw its first nuclear power plant in Pennsylvania. By the 1970's new environmental acts began to slow many businesses down and forced the United States Steel corp. to close down its furnace in Duluth, MN. By the 2000's renewable energy has become a concern for the entire world as more mandates and policies began to demand companies for renewable energy use. In Minnesota a state mandate was passed with a list of goals that 30% of the total state power production produced should be from renewable resources (Nationalwind.com). The response to the mandate has been an increase in development of wind farms in Minnesota and is still growing today.

The physical, social, and historical context histories guided America and the world to develop amazing technologies and ideas. Our excitement for the rapid progression of science and technology can sometimes blind us to the consequences that new technology can have on our environment. We are entering a new era where sustainable measures are being implemented in every corner of the world. Designers are now taking responsibility for sustainable measures and could be the key to reducing the impact that we have on the environment by properly using high technology to its greatest potential.

Goals for Thesis

With every new project comes a new opportunity to grow and discover what really matters to you and to the world. The connections created in a design are crucial to our understanding of the ideas and intentions or goals poured into a project. With a connection, a building can serve the community, the profession, and ultimately the global network in many ways. This thesis project focuses on connections and how such connections can be achieved through academic, professional, and personal goals.

As a graduate student at North Dakota State University, one goal of the design thesis is to achieve a master in architecture and successfully enter the work force. A connection of five years of education and knowledge is utilized in the design of this project; an accumulation of how much I have developed as a designer and as a person. By focusing on sustainable design for a convention center, this project also allows me to gain knowledge in an area of architecture that I wish to learn about. Understanding sustainable design through this project will open up the opportunity for the knowledge gained to be passed down to future designers and also to educate the community. A convention center has potential to become an iconic piece of architecture for a community which can invoke the curiosity of people initiating a desire to know more about the project. People are generally visual, and with the mundane architecture people see on a daily basis a project that catches the eye of a community can have a viral like effect spreading unique information that is not apparent on the surface of a design.

At the professional level the spreading of this knowledge becomes a matter of staying informed of current architectural trends and advancements. This thesis is a way of learning current trends in sustainable design and also to implement sustainable design in a professional manner that will help boost the design standard to consider alternative design strategies.

Goals for Thesis

By creating this standard, professionals are challenged to discover creative solutions to problems in sustainable design and technology and in doing so the advancement of the architectural field. My goal for this project is to express that the professional aspect of architecture does not just mean design but also innovation and involvement in the industries that make our visions a reality.

One of the personal goals I set for myself with this project as stated before is to gain knowledge in an area of architecture that I find interesting and one that I believe will have positive affects for the future development of the architectural field. Another goal I have for this project is to help the city grow and take that next step in the development of their community, by giving the city a design that symbolizes the identity of the land and people living there. This brings me to the goal of wanting to create a self-efficient building that is beautiful. The general public seems to shy away from the words green design due to a misconception that all green design projects are ugly based off of the products that are used in the design. By creating a beautiful building and using green technology in an artist and efficient manner, I hope to inform and show the public that green design does not mean just throwing solar panels on a roof but that sustainable measures can be poet. The last goal I have for this project is to present my skills in an overall professional design and manner in which I can sell my talents and land a job.

Connections with the academic, professional, and personal aspects of design will guide me into a successful thesis design project. Through sustainable design this project will educate communities and inspire professionals to embrace new ideas and design that can better the environment and the future of architecture. I hope to see how much I have grown and what I have learned from these past five years. Coming to North Dakota State University has been a great joy and has allowed me to discover what I am capable of and what I wish to achieve in the future.

Site Analysis



Site Analysis

Humans are naturally drawn to the life and tranquility of natural elements, almost as if it is a nostalgia that has been lost; a mystery waiting to be unlocked. If you place a small patch of life in an urban concrete jungle, people unknowingly migrate toward that little piece of paradise. This is not always the case, in fact some cities are blessed with beautiful natural features but either discard it all together or simply do not know how to create a proper connection. The city of Shakopee Minnesota is the location of my site and like many cities along river banks, is struggling to connect with the mystery of the Minnesota River. The site is home to the existing Huber Park just off of downtown Shakopee and near an important entrance to the city. In its natural state the site glimmers with several beautiful views extending from the river as if offering a hand and waiting for a response.

This site presents a unique challenge as it sits on a north facing slope with the Minnesota River lining the northern border. The wind pattern for the site comes mostly from the northwest in the summer and winter occasionally from the southeast in the summer. Due to many trees lining the river bank the wind speed tends to be calmer towards the river and stronger to the south or highest point. The slope on the site is fairly significant with about a 21% slope from the south to the north, curving as it follows the form of the nearby highway 101. The vegetation on site is made up of various trees such as oaks, maples and ash. The entire site is overlaid with green grass with small patches of wild grasses and scrubs lining the walkways through the park. On the site there are several buildings including an old strip mall with housing above and retail below, a very small car dealership, and restrooms for the park. Surrounding the location to the south is small commercial businesses many locally owned and to the east a small patch of residential near the river mixed with commercial. Due to the small stature of the buildings there are no concerns of light being blocked to the site. Because of the sloping hill to the north, the winter sun will sometimes have difficulty reaching the northern end.

Site Analysis

The northern side of the site facing the river offers a stunning view down the river and the surrounding trees giving the site a natural feel. The views to the south have potential to become windows into the heart of the city since many important entrances into downtown Shakopee are facing the site. The views to the west and east are mainly covered by trees and plant life making it difficult to see the surrounding manmade structures during the summer while the winter offers a slightly better view after the leaves have fallen. There are several ways to enter the site the south being the main entrance with highway 101 and 1st avenue curving around the south. An existing entrance to the parking lots on the site will be able to serve as a nice entrance to the convention center when complete. A bike path running along the northern end follows the rivers shape becoming another entrance to the site from the river. Human movement on the site is almost none existent in the winter, the most traffic being a small hill in the east where sledding has become common along with the small playground. In the summer the site becomes more active due to the increase in use of the bike path but the playground is still the only area that really sees any consistent use. It has been observed that the park is used more as a starting point for people wanting to use the bike path running along the Minnesota River.

The challenges presented on this site offer a wonderful opportunity to reconnect the city and downtown to the river. This reconnection can allow the site to thrive and offer a chance for the city of Shakopee to have an iconic building for the many functions it is home to. Knowing the site and everything it has to offer will help this project create an energy efficient structure that will embodied green design as a tool to bring life an nature back to the city of Shakopee Minnesota.

Views



South Panoramic



North Panoramic



West Panoramic

Views



East Panoramic

Site Analysis

Built Features

There are several built features on the existing site, the first being a restroom and service building for the park made out of brick that can be passed through to enter the west side of the site. A small strip mall and car dealership runs along the south east corner both which are out dated and slightly run down. The last structure on the site an amphitheater located in the middle of the site constructed of brick steel and wood. Most of the structures on the site will be removed though retaining the park qualities of the site is sought after.

Vegetation/plant cover

As mentioned before the plant cover on the site consists mainly of trees, scrubs and grasses. When the new park was completed around eighty percent of the ground was covered in lawn and the trees closest to the river were left untouched. Because of the wonderful natural features of the river this sites potential for a naturalistic site plan is endless and desired. It is noticed that a variety in trees gives the site a unique feel as the seasons change as the trees turn colors and the evergreens remain stable. Because the trees are mainly lining the northern end of the site, the shade of the trees does not affect the site all that much and would only really have an impact if planted on the southern end of the site.

Water

Since the site has the Minnesota River running along its northern border, the river becomes the biggest water feature of the site. It has potential to flood in the spring covering the bike path but rarely will go past it. Because of the slope of the site water drains very well towards the river. The river has potential to become a unique attribute of the design and has the ability to offer potential power production.

Distress

At first glance there is no strong presence of distress on the site and it looks to be fine but upon closer review it became obvious that the site does not attract many visitors. Even the buildings on the site are never overly busy and at a quick glance would appear to bring the most distress due to its out dated and boring appearance. Because of the natural beauty that this site has to offer its current functions do not take advantage of the opportunity that is given by nature. This site's potential is huge but it seems to be lacking in its current state.

Site Analysis

Light Quality

The light quality of this site is rather nice since there is a lack of trees and offers an opportunity for solar power production. But due to the north facing slope the design will have to be careful to not completely shade the northern end of the site. In winter the site's hill creates a small amount of shading to the east otherwise the summer sun is high enough to cover the entire site in light. The trees on the site create wonderful patches of light along the bike path.

Wind

Wind on the site is rather tame due to the trees lining the north and the hill on the south. Wind mainly enters from the northwest during the winter and summer. There are occasions where the wind comes from the southeast in the summer, otherwise it is pretty constant. The wind coming from the river is rather pleasant and should be considered when designing.

Human Characteristics

The site has many man-made features including buildings, path ways and the use of vegetation. The park itself is a very human developed site not really keeping its naturalistic potential. One very desirable part of the park is the beautiful bike path overgrown with trees which should be the foundation of what the site should be.

Soils

Sand, clay and silt are present on the site with a small amount of rock mixed in the soil. It has decent drainage but due to the river has a high water table to begin with. The soil on the site is ideal to build on but does present flooding potential and will have to be taken into consideration.

Water Table

Water table of the site has a range from 5 to 30 feet below the surface depending on the season and winter conditions of the area. The site drains well into the river but during flooding season the water table rises and can cause flooding. Careful consideration will have to be avoided designing too close to the river where the water table maybe too high.

Slope

The slope of the site varies from 10 to 12 percent sloping to the river in the north. It does cause slight lighting issues in the winter but acts as a natural barrier for the city when flooding. When designing on the slope there will need to be careful attention to perserving the natural form of the slope and also creating a structure that celebrates its unique qualities.

Site Analysis

Visual Form

The visual form of the site is of a curving hill that gently extends into the river. These gentle curving forms will be the biggest influence to my design and will most likely lend itself to a more organic and freeform design. In general the visual form seems to be a reflection of the river nearby and the process it has done to carve the land.

Site Characteristics

With the river bike path the character of this site seems to be one of connection and freeflowing nature. The unique slope of the site seems to create a natural pocket that draws people to it. Since it is north facing slope, the site seems to hide from the downtown but create a curious element of wanting to explore what is further down that hill. Utilizing this aspect of the site will help draw people to the site and also help re-purpose the site layout to invoke what people want to see the river.

Base Map

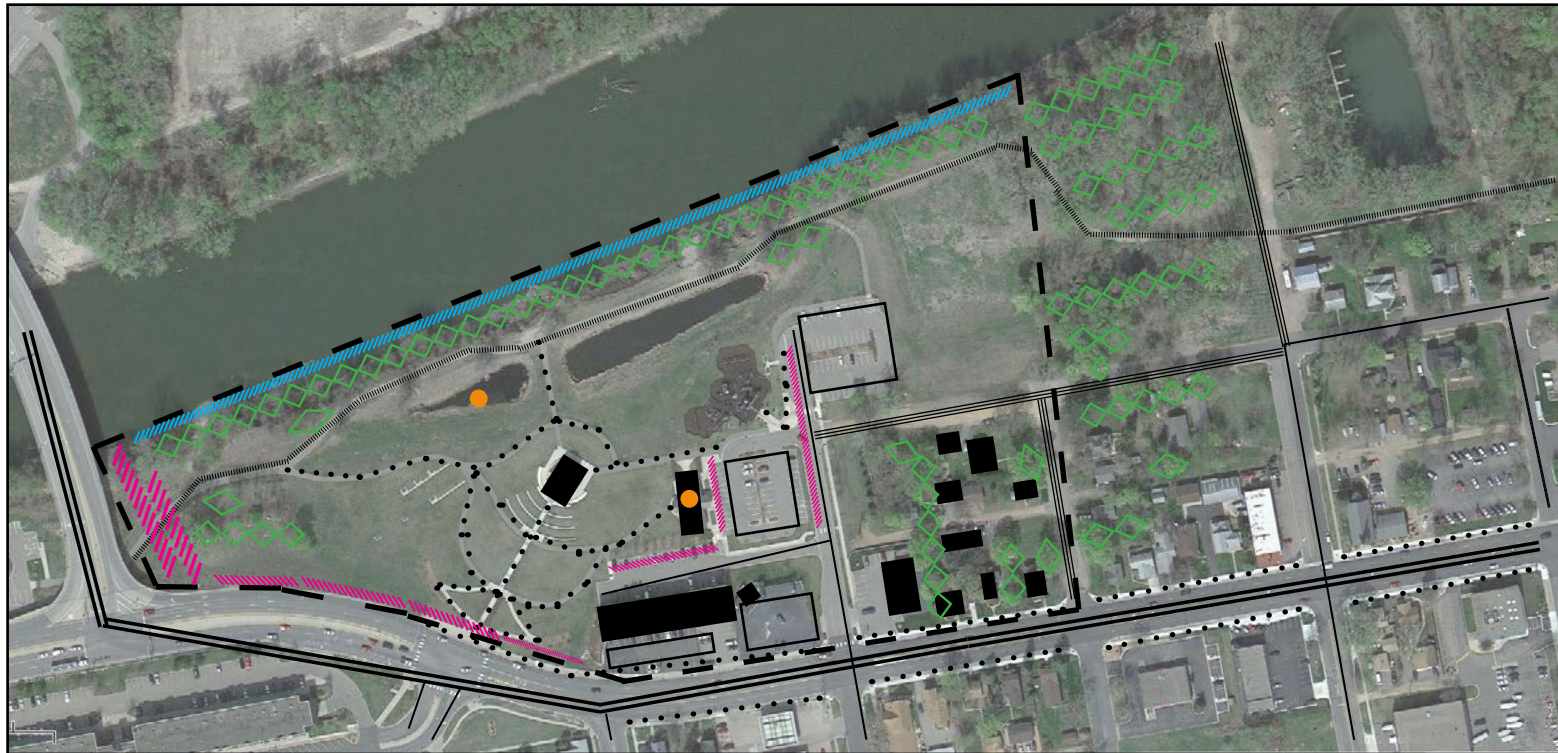
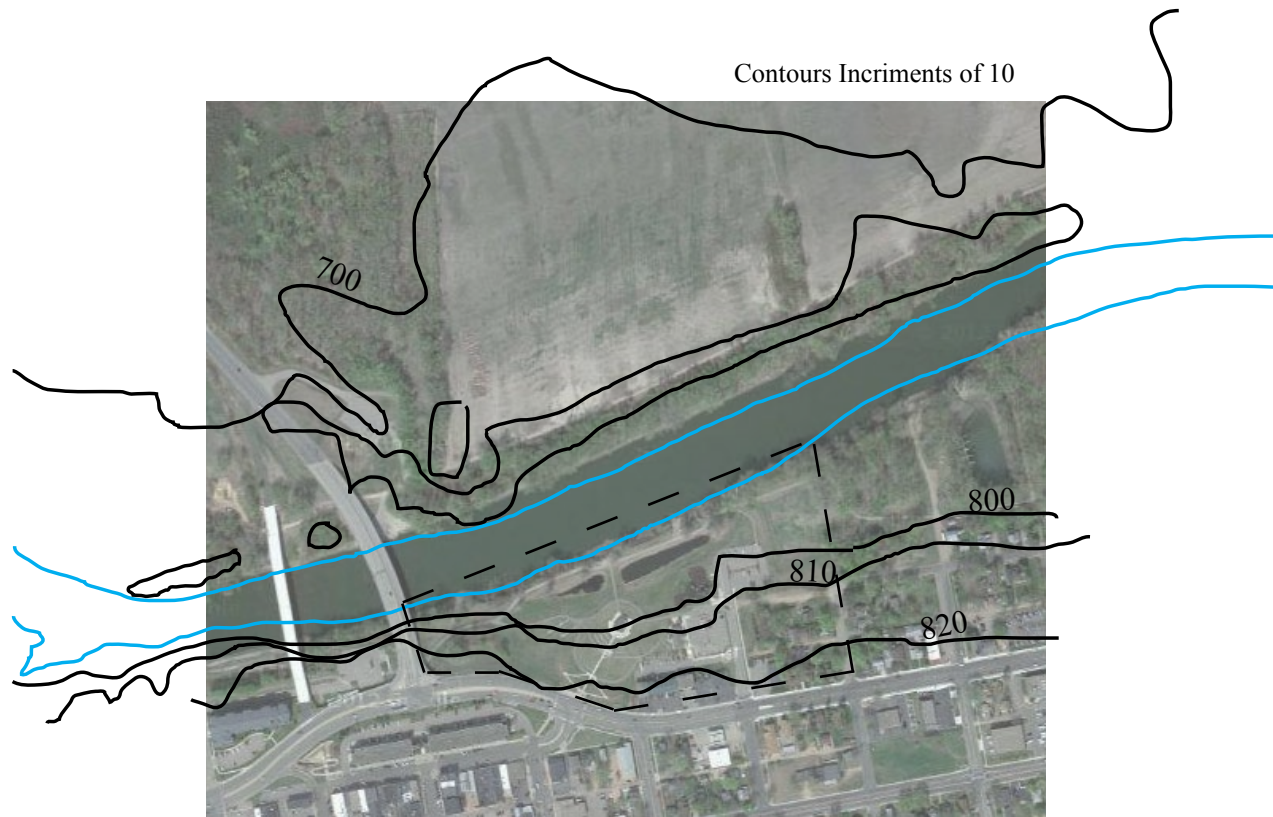


Photo Courtesy of Google Earth

- Heavy Traffic
- Light Traffic
- Bike Path
- Site Boundary
- Pedestrian traffic
- Structure
- Unwanted Noise
- Pleasant noise
- Utilities
- Tree

Site Analysis

Topography



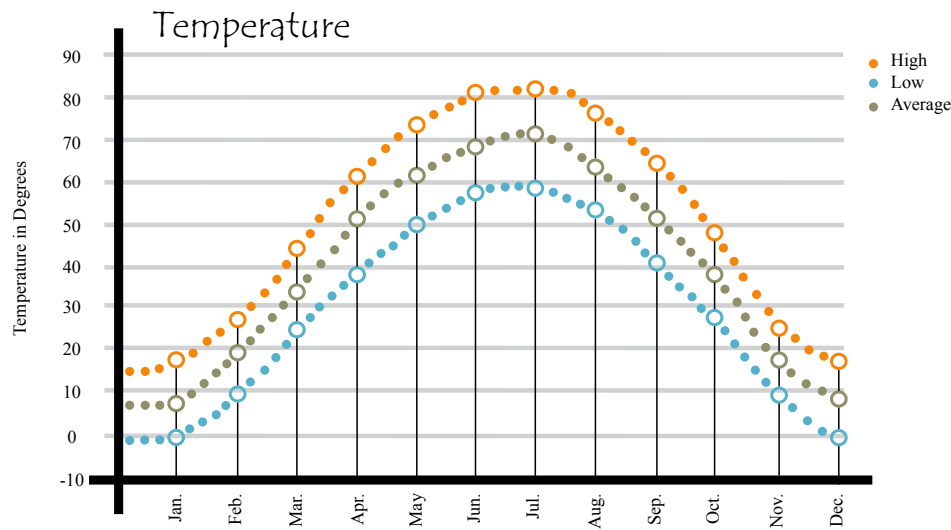
- Water
- - Site Boundary

Photo Grid

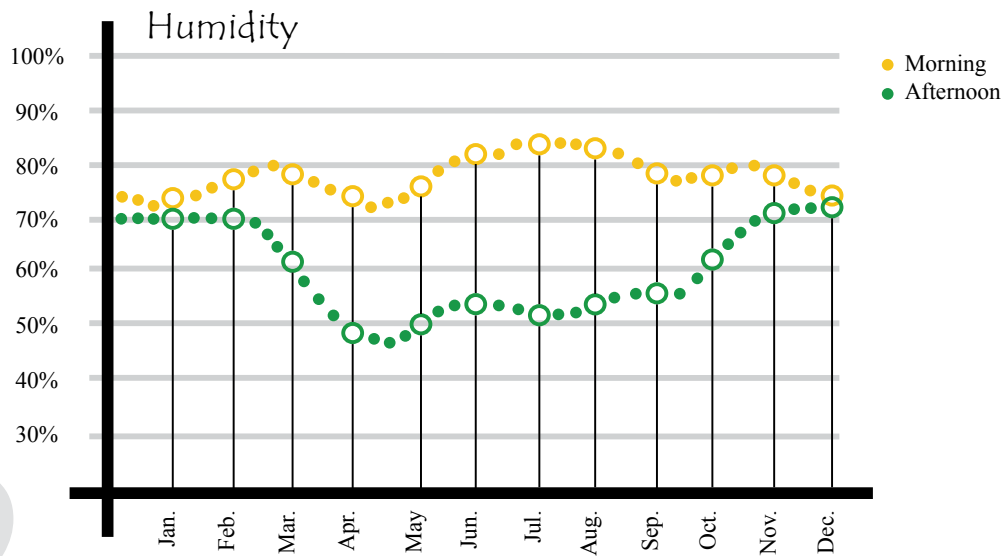


Photos: Kautzman, A. Moorhead Center Mall. 7 Dec. 2012. Taken: 6 Nov. 2012.

Climate Data



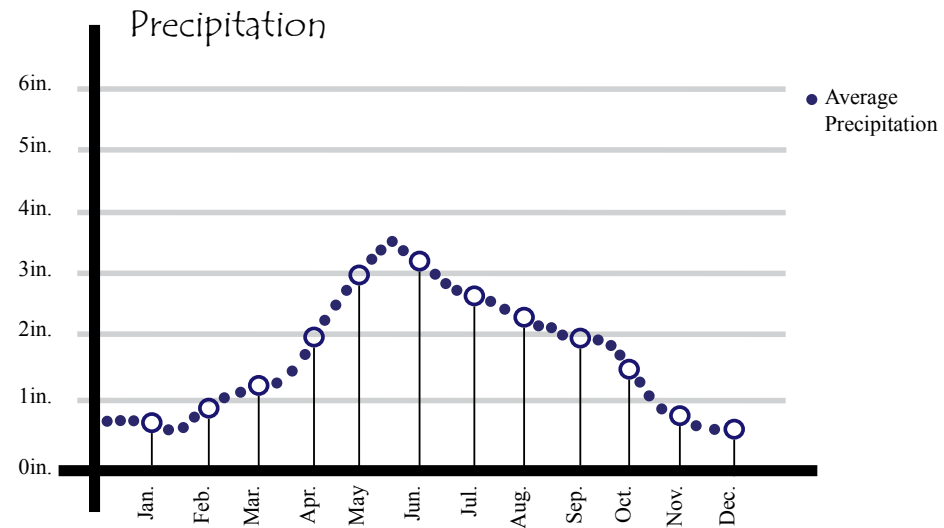
Average temperature in winter is 0 and average temperatures in summer are a little over 70. These temperatures will be important in designing for all temperature ranges to maximize heat gain and lose for the appropriate season.



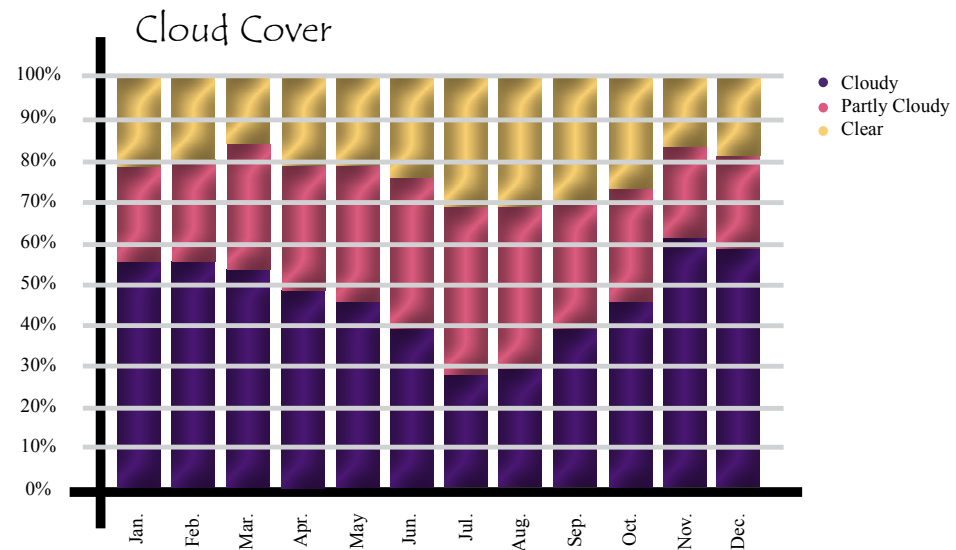
Humidity can get pretty high in the summer especially in the morning hours. This can prevent natural ventilation from being successful so caution is needed when dealing with ventilation in the summer.

Climate Data

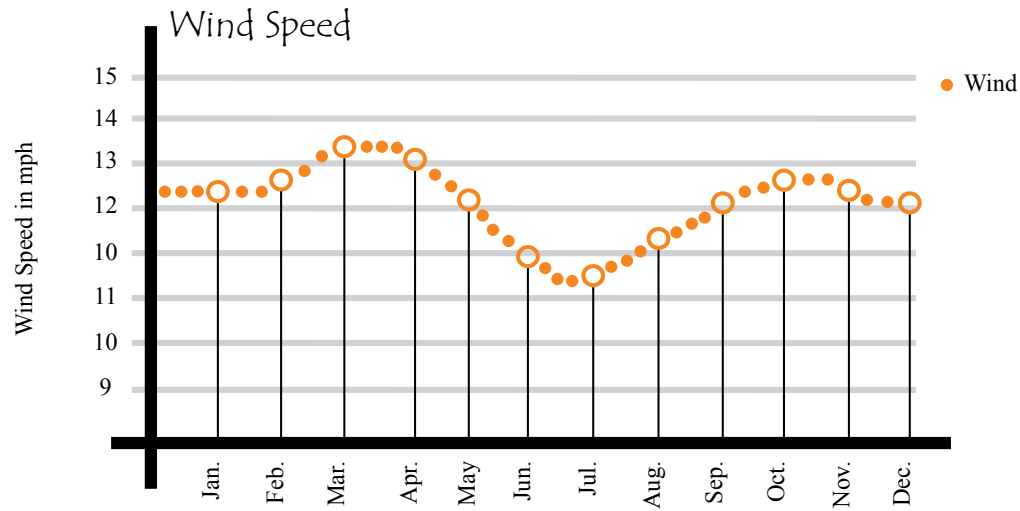
The most rain fall happens during May and June averaging around 4 inches. With the river close by sudden flash flooding may occur during the spring time or when there is a sudden down-pour above average rainfall.



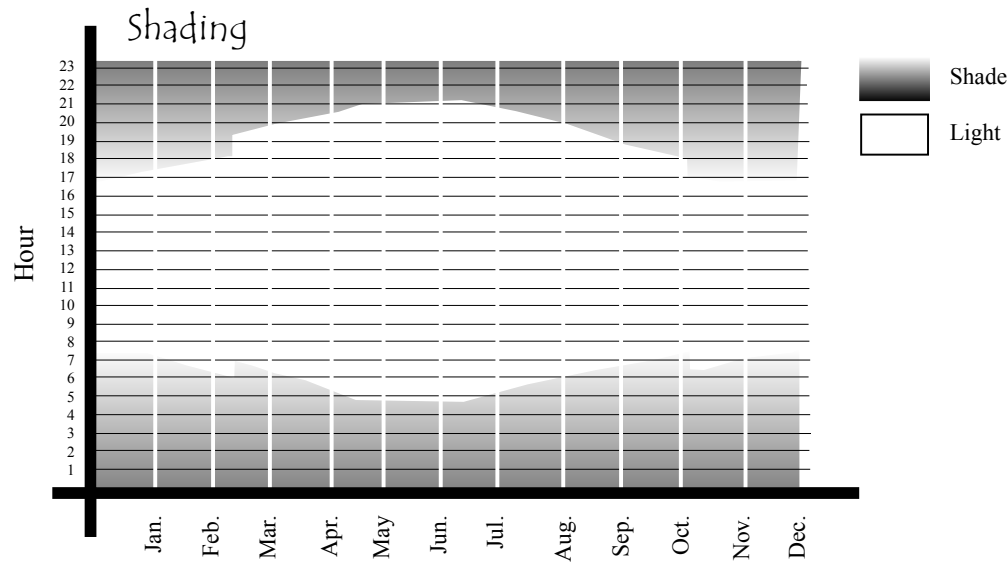
Cloud cover seems to be more pronounced during winter but overall the average is rather nice. This will help determine how much solar energy can be produced and at what times it is appropriate to use. Since the summer season has a lot of cloud free days, the greatest energy production will come from the summer months.



Climate Data



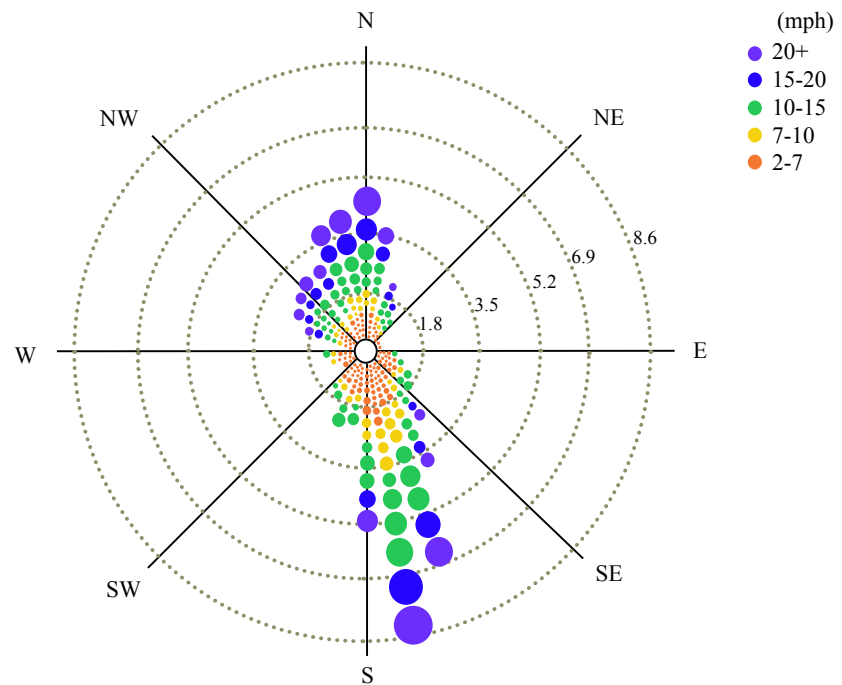
Wind is greatest during spring and in winter while July seems to be the lowest of the year. Summer ventilation may need some assistance while winter winds need to be kept out of the building. The skin will become very crucial to dealing with these constant changes.



Again similar to the cloud cover shading is lowest during the summer months and higher during winter. From around 8am to 7pm is the average length for the sun to be up. This will help calculate the amount of solar energy that can be produced.

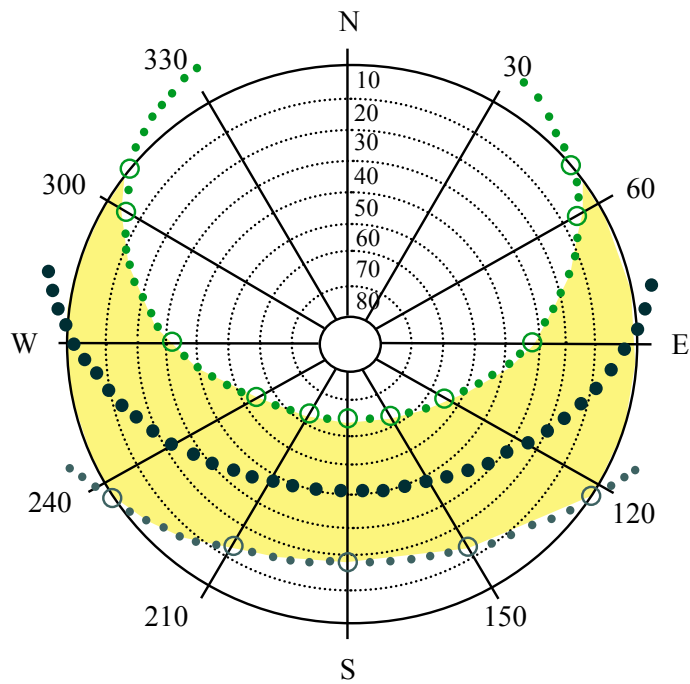
Wind Direction

Winds come from the north west and the south east for a majority of the time. The North west winds are more constant and the south east winds more random and at a higher velocity. Planting trees to prevent any unwanted winds will be important on the site plan development.



Site Analysis

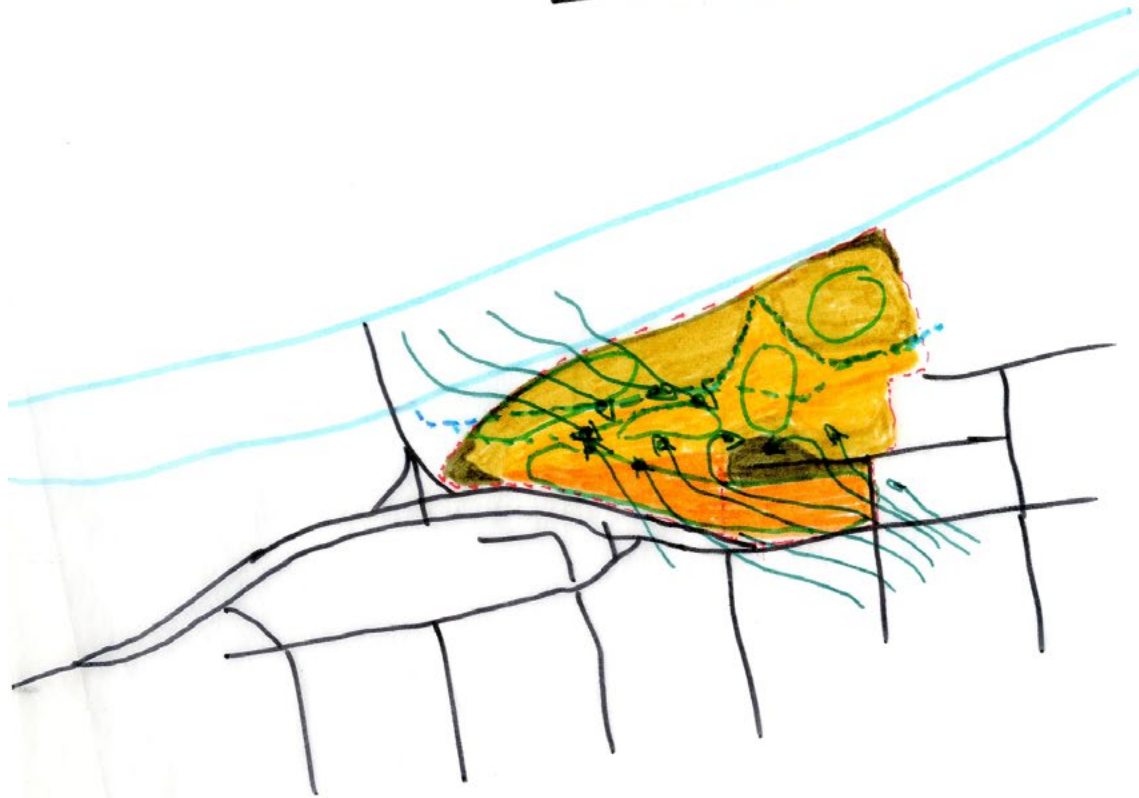
Sun Path



- June 21
- December 21
- Equinox (March and September)

As most four season climates experience the sun path is much higher in the summer than it is in the winter. This will help determine any shading issues and solar panel locations on the building. It is also important in deciding where vegetation will go so that the placement will allow the plants to thrive.

Climate Movement



Light intensity

- Most intense
- More intense
- less intense
- Least intense

- Minor Flood Range
- Major Flooding

- least windy areas
- windy area
- wind path

Programmatic Requirements

Matrix

- Important
- Somewhat Important
- Unnecessary
- Possibility

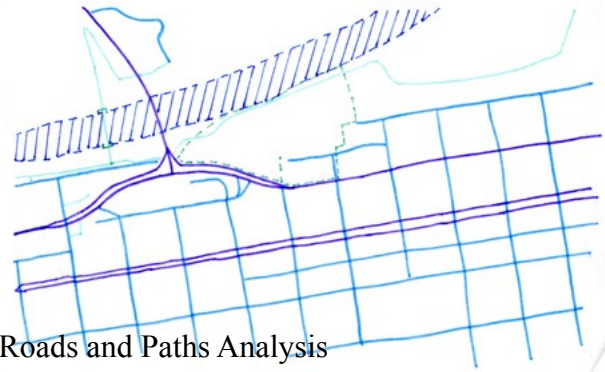
	Exhibit Space	Meeting Space	Ballroom	Bathrooms	Mechanical	Office Space	Storage Space	Performance Hall	Stairs	Elevators	Entrance/Atrium	Breakout Space	Kitchen	Employee Lounge	Janitorial Space	Balcony/Terrace	Reception Space	Conference Rooms	Cafe/Shop
Exhibit Space		○	●	●	○	○	●	○	●	●	●	●	●	○	○	●	○	●	●
Meeting Space	○		○	●	○	●	○	●	○	○	○	●	○	●	○	○	○	●	●
Ballroom	●	○		●	○	○	●	○	●	●	●	●	●	○	○	○	○	○	○
Bathrooms	●	●	●		●	○	○	●	●	●	●	●	●	●	●	●	●	●	●
Mechanical	○	○	○	●		○	○	●	●	●	○	○	●	○	○	○	○	○	●
Office Space	○	●	○	●	○		○	○	○	○	●	●	○	●	●	○	○	●	○
Storage Space	●	○	●	○	○	○		○	○	○	○	○	○	●	○	○	○	○	○
Performance Hall	○	●	○	●	○	○	○		○	○	○	○	○	○	○	○	○	○	○
Stairs	●	○	●	●	○	○	○	○		○	○	○	○	○	○	○	○	○	○
Elevators	●	○	●	●	○	○	○	○	○		○	○	○	○	○	○	○	○	○
Entrance/Atrium	●	○	●	●	○	○	○	○	○	○		○	○	○	○	○	○	○	○
Breakout Space	●	●	●	○	○	○	○	○	○	○	○		○	○	○	○	○	○	○
Kitchen	●	○	●	●	○	○	○	○	○	○	○	○		○	○	○	○	○	○
Employee Lounge	○	●	○	●	○	○	○	○	○	○	○	○	○		○	○	○	○	○
Janitorial Space	○	○	○	●	○	○	○	○	○	○	○	○	○	○		○	○	○	○
Balcony/Terrace	●	○	●	●	○	○	○	○	○	○	○	○	○	○	○		○	○	○
Reception Space	○	●	○	●	○	○	○	○	○	○	○	○	○	○	○	○		○	○
Conference Rooms	●	●	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○		○
Cafe/Shop	●	●	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	

Programmatic Requirements

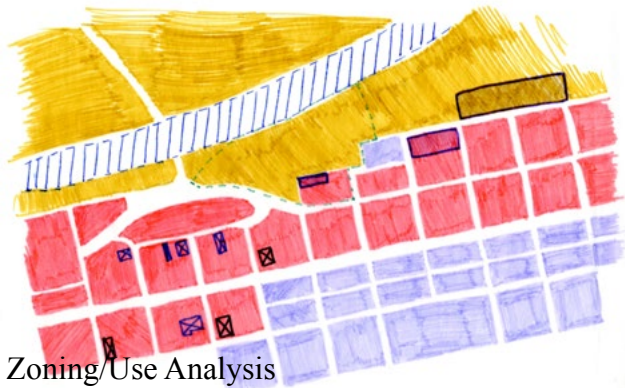
Space Allocation

- 20,000 sq. ● ● Exhibit Space
- 18,235 sq. ● ● Ballrooms
- 4,865 sq. ● ● Bathrooms
- 19,897 sq. ● ● Mechanical
- 15,332 sq. ● ● Office Space
- 19,468 sq. ● ● Storage Space
- 18,778 sq. ● ● Performance Hall
- 100 sq. ● ● Stairs
- 324 sq. ● ● Elevators
- 5576 sq. ● ● Entrance/Atrium
- 9,993 sq. ● ● Breakout Space
- 10,746 sq. ● ● Kitchen
- 1203 sq. ● ● Employee Lounge
- 3032 sq. ● ● Janitorial Space
- 400 sq. ● ● Balcony/Terrace
- 605 sq. ● ● Reception Space
- 769 sq. ● ● Conference Room
- 769 sq. ● ● Cafe/Shop

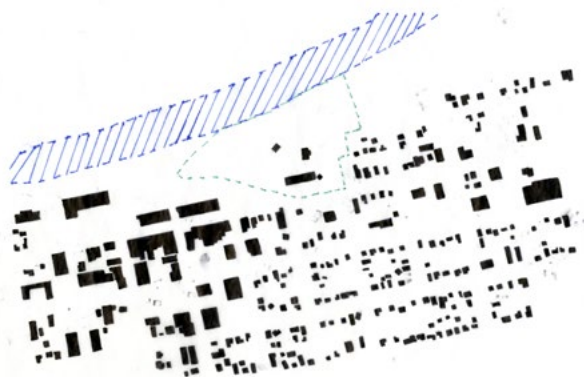
Design Process



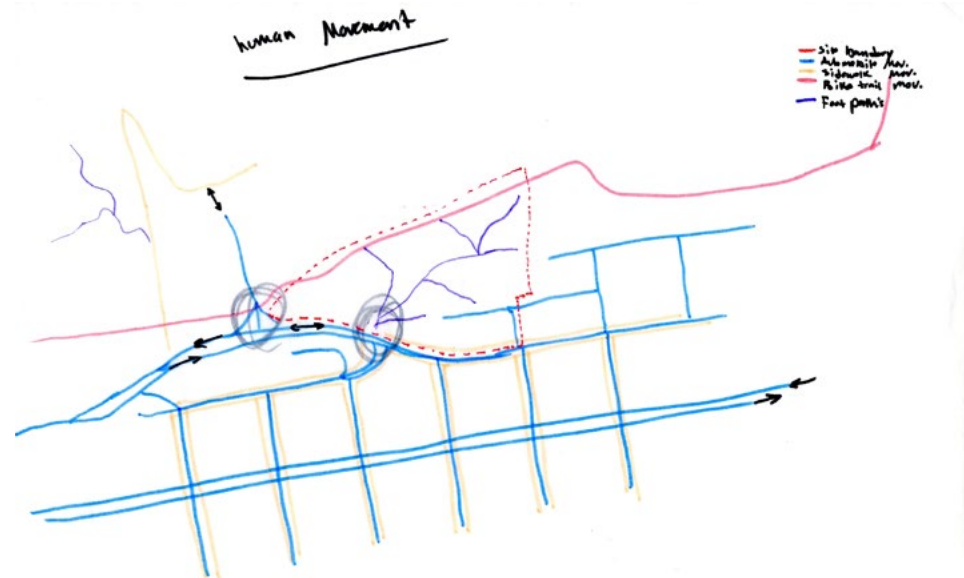
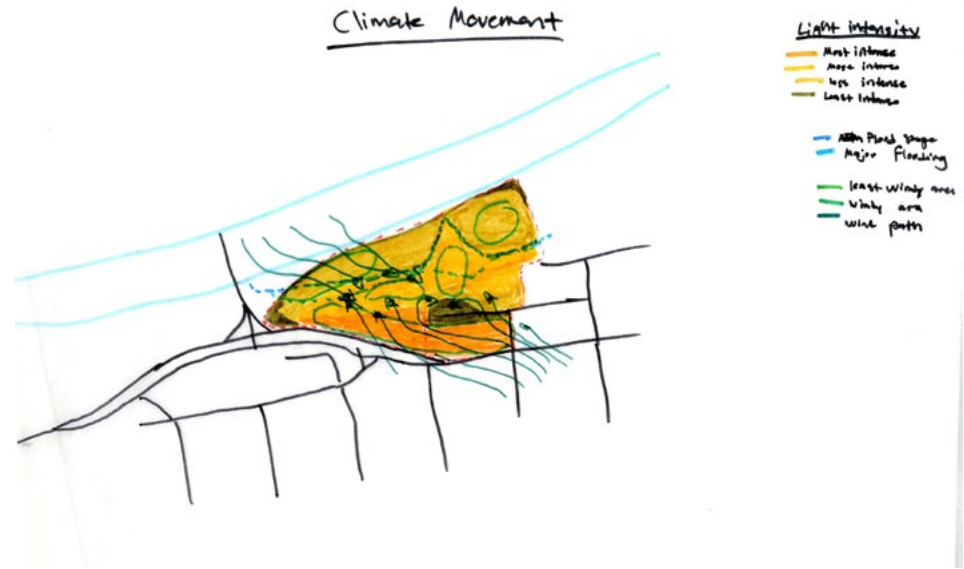
Roads and Paths Analysis



Zoning/Use Analysis

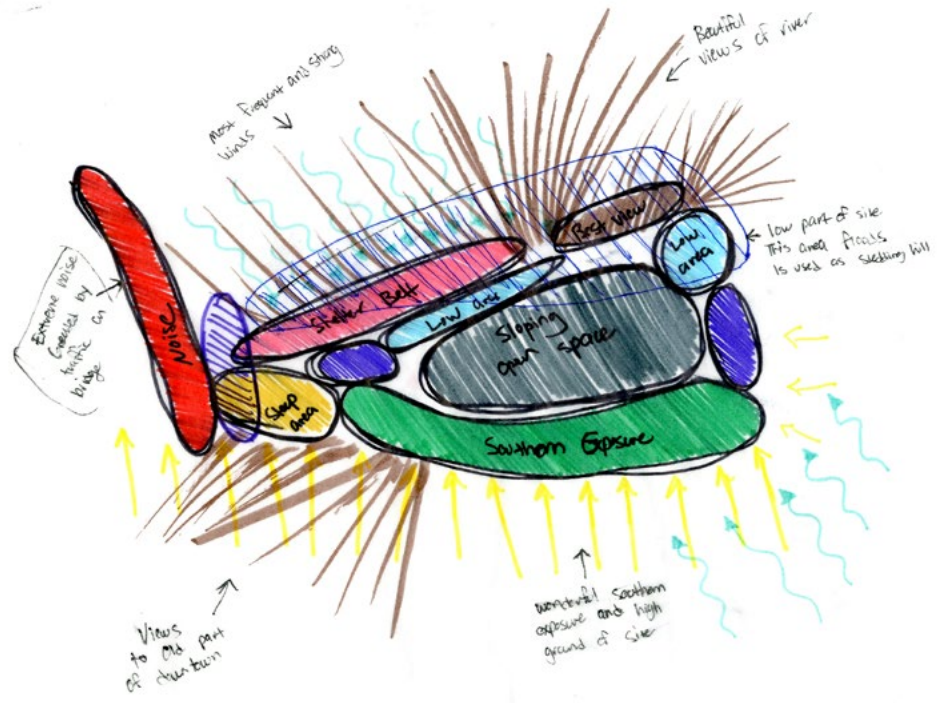


Figureground Analysis

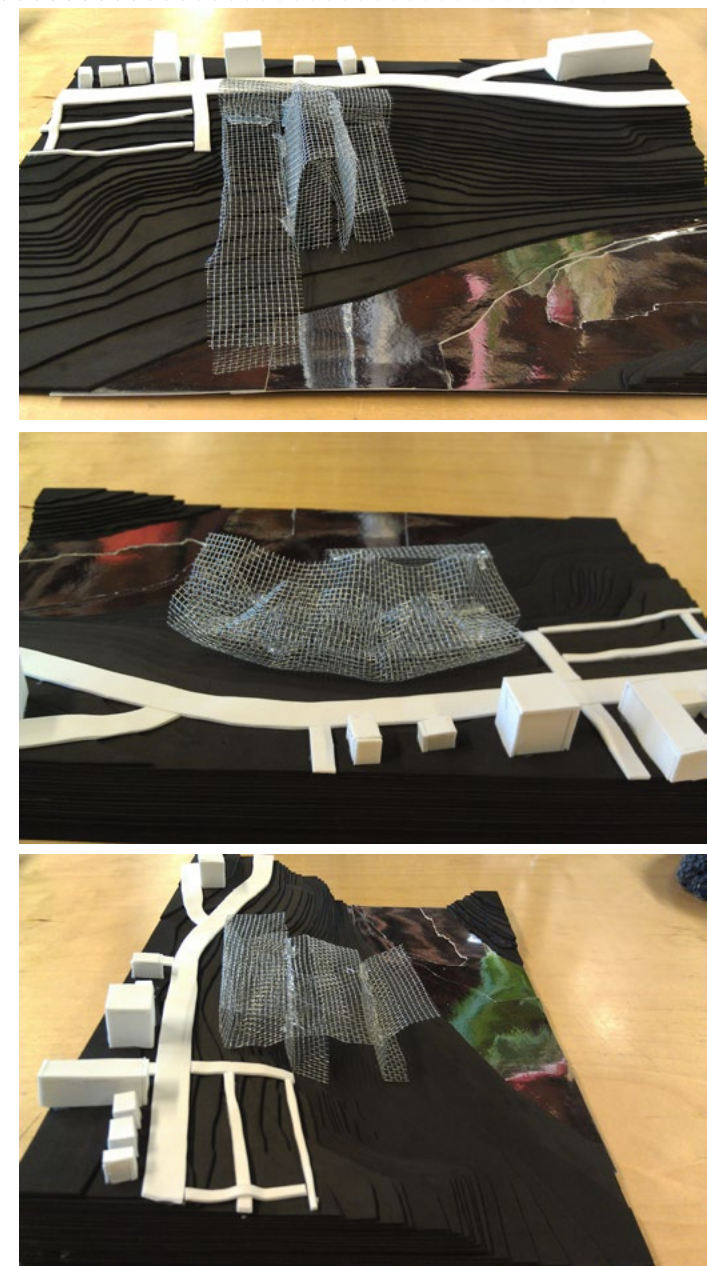


Design Process

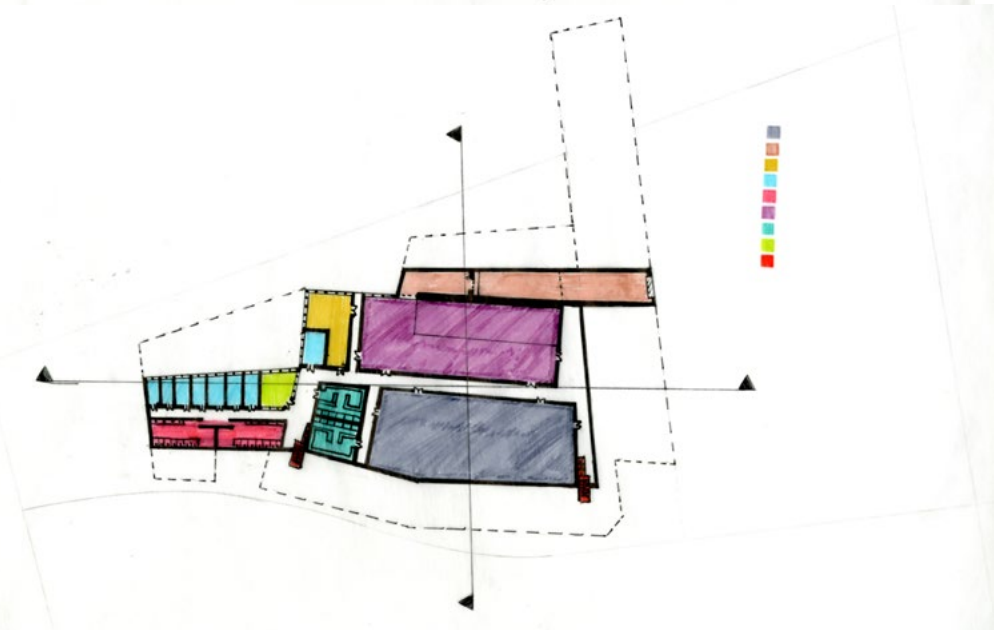
Process Form Models



Spatial Analysis



Floor Plans



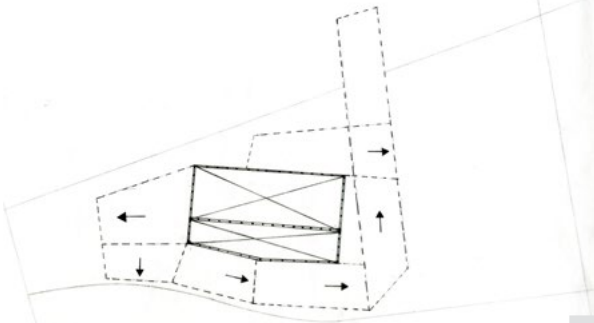
Design Process



Site Plan



Structure



Roof Plan

Final Design Drawings

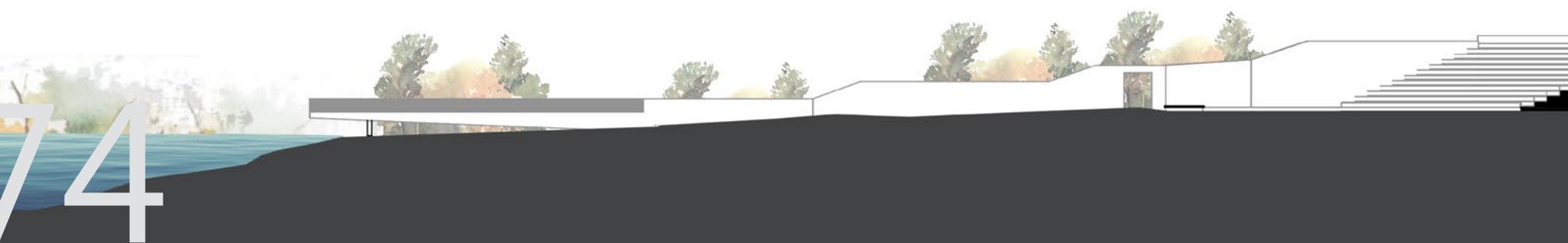
West Entrance Perspective



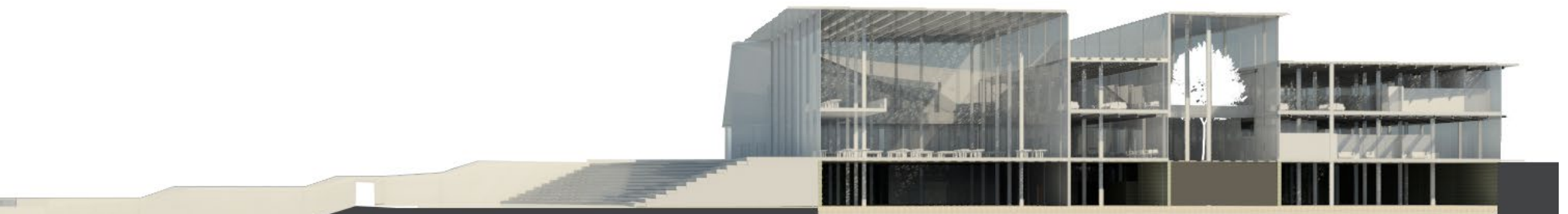
East Entrance Perspective



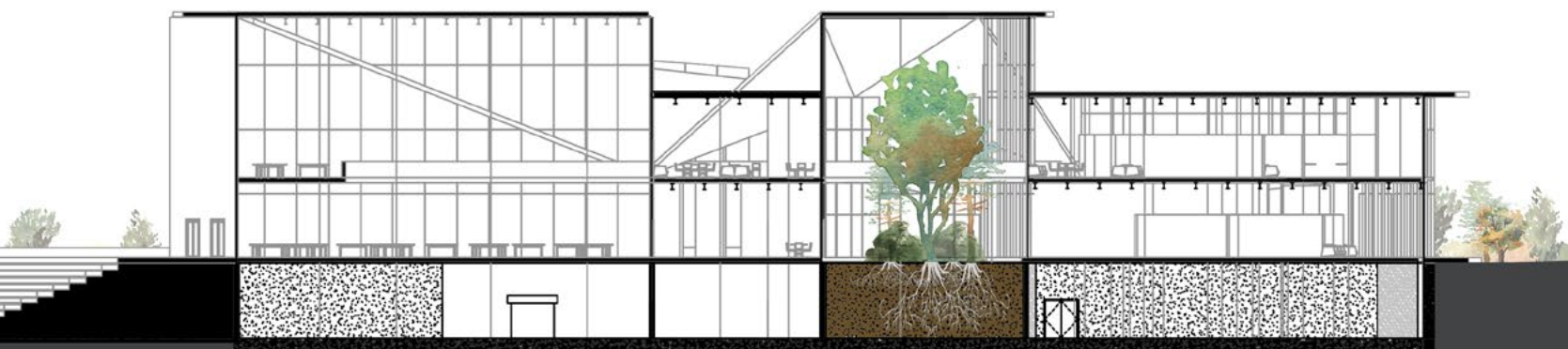
River Terrace Perspective



Final Design Drawings



Section Perspective



Section

Final Design Drawings

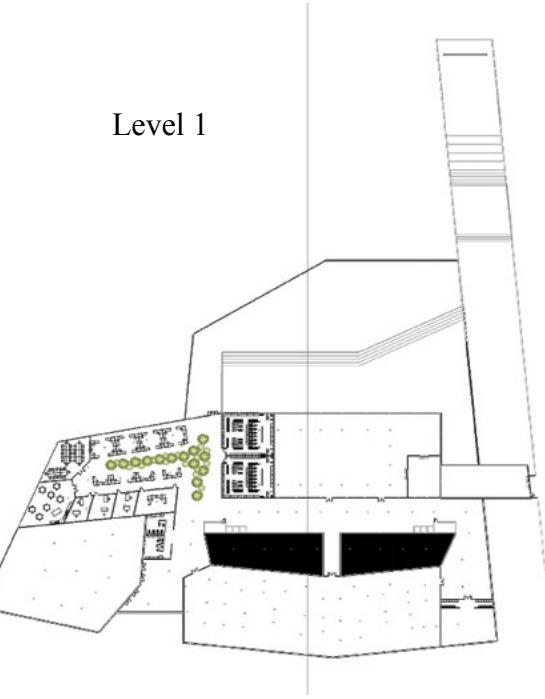


Southern Perspective



Final Design Drawings

Level 1



Level 2



Level 3



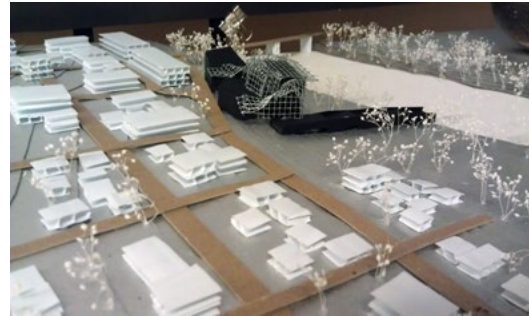
Eastern Perspective



Presentation Installation



Model



Reference List

- Attamann, O. (2010). *Green Architecture: Advanced Technologies and Materials*.
- Benyus, J. (1997). *Biomimicry*. Harper Perennial.
- History World. Web 15 Nov. 2012.
<http://www.historyworld.net/wrldhis/PlainTextHistories.asp?groupid=1515&HistoryID=ab27>rack=pthc>
- Lallanilla, M. *Green Living*. About.com. Web 15 Nov 2012.
<http://greenliving.about.com/od/greenprograms/a/What-Is-The-Green-Movement.htm>
- Levack, B., Muir, E., Mass, M., and Veldman, M. Pearson Education 1995-2010. Web 7 Dec 2012.
http://wps.ablongman.com/long_levack_wc_1/43/11053/2829693.cw/index.html
- Melet, E. (1999). *Sustainable Architecture: Towards a Diverse Built Environment*. NAI Publishers.
- Moskow, K. (2008). *Sustainable Facilities: Green design, Construction, and Operations*.
- National Wind. National Wind, LLC. 2007-2012. Web 7 Dec 2012.
http://www.nationalwind.com/minnesota_wind_facts
- Olympic Architecture Beijing 2008. Birkhauser Publishing.
- Ryker, L. (2005). *Off the Grid: Modern Homes + Alternative Energy*. Gibbs Smith Publisher.

Reference List

Slessor, C. (1997). *Eco-Tech: Sustainable Architecture and High Technology*. Thames and Hudson.

Sara. Web Ecoist Going Beyond Green. AtomicOnline, LLC, and Evlove Media Corp. company. Web 7 Dec 2012.
<http://webecoist.momtastic.com/2008/08/17/a-brief-history-of-the-modern-green-movement/>

SHG Resources. QuinStreet Inc. 2012. Time line. Web 7 Dec 2012.
<http://www.shgresources.com/mn/timeline/>

Soil Series. National Cooperative Soil Survey U.S.A. November 2002. Web 15 Nov 2012.
https://soilseries.sc.egov.usda.gov/OSD_Docs/B/BEARDEN.html
https://soilseries.sc.egov.usda.gov/OSD_Docs/C/COLVIN.html

Previous Studio Experience

2nd Year

Fall: 2009

Professor: Heather Fischer

Projects: Tea House, Boat House

Spring: 2010

Professor: Darryl Booker

Projects: Montessori School, Dwelling, Bird House

3rd Year

Fall 2010

Professor: Paul Gleye

Projects: Firehouse, Fishing Supply Store

Spring: 2011

Professor: Regin Schwaen

Projects: Homeless Shelter, Concrete Structure

4th Year

Fall: 2011

Professor: Don Faulkner

Projects: High rise

Spring: 2012

Professor: Ron Ramsay

Projects: Agincourt Iowa Conservatory

5th Year

Fall: 2012

Professor: Paul Gleye

Projects: Fargo Downtown Center, Signature Building,
Public Furniture

Spring: 2013

Professor:

Project: Thesis - Moorhead Convention Center

Personal Identification



Address:
795 Westchester Ave
Shakopee, MN 55379

Cell Phone:
(612) 968-6012

I am enough of an artist to draw freely upon my imagination.
Imagination is more important than knowledge.
Knowledge is limited. Imagination encircles the world.

~ Albert Einstein