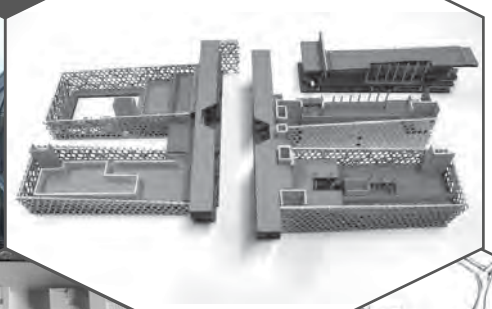
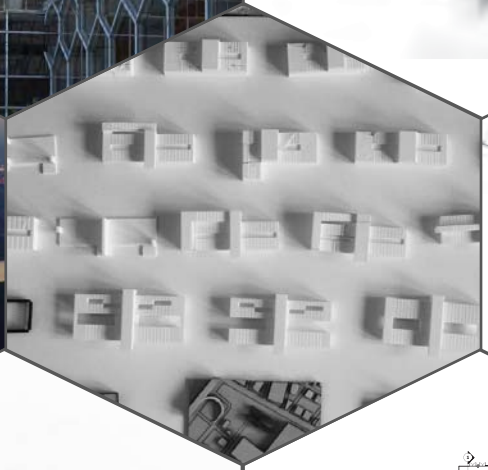
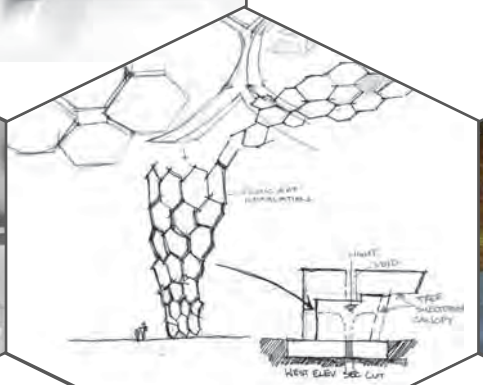
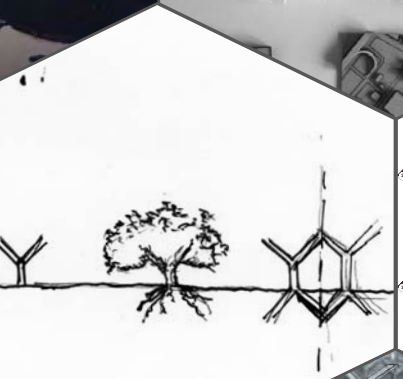
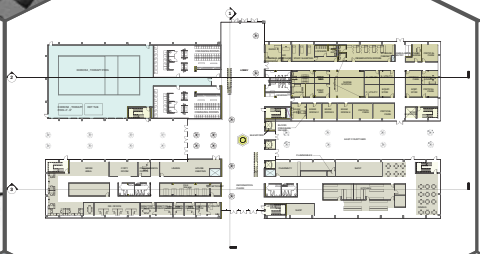
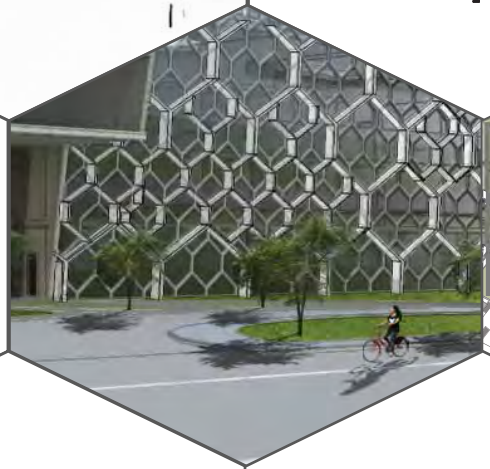
Oak Hospital

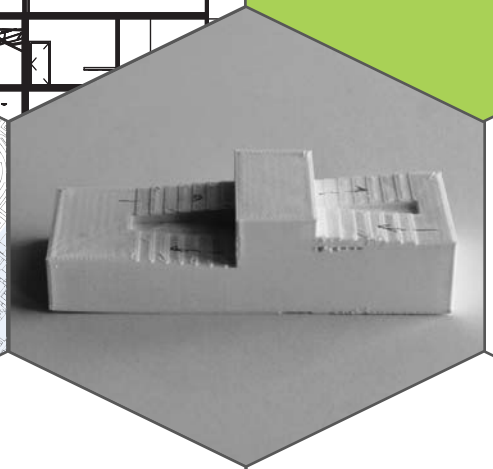
A Holistic Approach to Healthcare



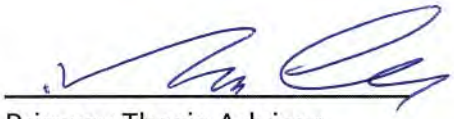
Oak Hospital
A Holistic Approach to Healthcare

A Design Thesis Submitted to the
Department of Architecture and Landscape Architecture
Of North Dakota State University

By

Esau Misael Rodriguez Padilla

In Partial Fulfillment of the Requirements
for the Degree of
Master of Architecture



Primary Thesis Advisor

Thesis Committee Chair

September 2014
Fargo, North Dakota

Photo © Esau Rodriguez

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Tables and Figures

All Images, Figures and Tables are done or taken by Esau Rodriguez unless otherwise noted

Abstract

Biophilic design has the ability to influence lives physically and mentally. Unbalanced health issues, lack of assistance at home, and lengthy distances to medical facilities, create life and death scenarios. Due to these problems, I have designed a 109 thousand square foot rehabilitation center just outside the French Quarter of New Orleans. My research methodologies consist of: literary research, case studies, hospital walkthroughs and interviews. From these investigations, I designed a biophilic healthcare facility inspired by a biomimicry basis. Within the thesis I will explain my theory, which is that a built environment allows patients to recover faster through different dimensions of biophilia such as: geography, environmental influences, space, light, and biomimetics. It is anticipated that the results of this theoretical study will reinforce my theory and that a new healthcare design strategy will emerge. This investigation will be of great interest to anyone involved in healthcare design, architecture, biophilia, biomimicry and any other related fields of design.

Healthcare Design

Key Terms

Biophilia / Biomimicry / Medical Facilities / Rehabilitation / Hospital / Recovery

Statement of Intent

Problem Statement

How can a biophilic healing environment be established by implementing a biomimetic design?

Unifying Idea: Biophilia Heals

A biophilic environment increases bodily and psychological healing.

By mimicking dominant elements in nature, a biophilic healthcare environment will nourish and restore humans physically and psychologically.

"An object's beauty emanates how well it works, how snugly it fits its function and how elegantly - with a minimal of effort or extras - it is made".

Janie Benyus 2008.

Premises

Theoretical Premises

Bridging the Gap

Past generations appreciate and recognize the importance of nature. As technology advances and new imitational materials are introduced into our society, a reduction in natural materials occurs throughout buildings. *"A healthy environment became associated with the visually sterile, industrial look of polished metal or porcelain surfaces"*. Nikos A. Salingaros and Kenneth G. Madsen 11

Biomimicry

Biomimic designs offers ideas that has been solved by nature millenniums ago. By mimicking our environment, solutions are generated that integrate dominant elements into the fundamentals of designs. By using these natural solutions they begin to restore the approach to nature that we once had. A biological foundation to a design will not only save our environment but save the designer time and money.

Biophilia

The integration of a biophilic design should be an essential principle included in current healthcare facilities. By implementing biophilia into environments it allows nature to distract our attention and reduce pain. Biophilia permits for a holistic approach to healthcare by adding pleasant sensations that subconsciously experiences that restore patient, doctors and nurses in a physically and psychologically manner.

Justification

Neuroscience

This thesis incorporates neuroscience studies that prove how nature positively influences a design, positively physical and psychological healing. Before neurological studies existed, a dynamic amount of social studies were done which, distinguished what environments people preferred. With current technology, we are now able to evaluate what is being subconsciously processed within our brain giving investigators more accurate results in studies.

Narrative

New Orleans, also known as The Big Easy, is branded for its large parties, parades and festivities including Mardi Gras. Throughout the community a mixture of great architecture, food and culture exists; creating a lively environment. Unfortunately, in August 2005 a catastrophic hurricane called Katrina destroyed and flooded most of the town. According to datacenterresearch.org there were 986 deaths in New Orleans and 80% of the city was flooded leaving 135 Billion dollars in damage.

Due to the hurricanes, many people were traumatized requiring a place to recover. In addition to trauma, healthcare designs should be focusing on rising healthcare conditions such as be heart conditions, diabetes, cancer and asthma. Through a holistic approach, we should not design one hospital but a campus that creates a connection with nature and other specialized facilities. Overall, designing a well-rounded healthcare facility should embrace the landscape and context, allowing the spaces to heal occupants physiologically improving healthcare architecture.

Biomimicry: Natural Design "Design Influenced From Biology"

A solution exists. The next step to this conundrum is to observe how biological evolutions have survived around the proximity of New Orleans where Hurricane Katrina struck. These studies will allow for discoveries on how specific natural features can generate architectural structures. By researching biomimetic elements throughout New Orleans (specifically the Seven Sister Oak Tree) I will hopefully discover elements that will create a design that will withstand future natural disasters.

Biophilia: Partnering Nature with Design

As we continue to separate from nature, we are potentially decreasing the ability to cultivate our imagination and gain knowledge to its full potential. These results can be explained from studies that have been obtained from young rats raised in environments full of information. The studies prove that the brains size increased 20% through natural connectivity. (Squire and Kandek 1999,2000).

Within this thesis I will improve healthcare facilities by investigating biophilic practices and architectural functions. In addition, I will explain and illustrate why architecture is vital when designing healthcare facilities. With a fundamental biomimetic design I will design an environmentally passive structure. In addition, the spaces will incorporate nature physically in some areas but physiologically and metaphorically in others areas creating a biophilic environment.

Due to technology advancements, I am now available to focus my research on scientific studies that prove how people interact and subconsciously feel within different spaces. The results found are possible by using functional magnetic resonance imaging. These studies will aid my design strategies directly so that the facility can have a prominent positive effect with the patients and society.

Project Typology

Images Courtesy of NBBJ

Landscape

A forest or a national park could have simply been selected to establish a complete submergence with nature for the patients. Nevertheless, a strong consideration for the environment and our future was considered. The selection of the site within a city was the key component to the design. An indirect relation to the context is that it will be placed within an **urban environment** using **art nouveau** for a masked connection with nature. In addition, the images to the left show how the VA Medical Center adjacent to the site could share similar thoughts in nature allowing my biophilia theory to sprout.

Building Type

Due to my facility relating with rehabilitation, the most suitable building type would be a **Health care facility.**

700,000 SF (Type B Occ. Institutional group 2A)

Typology Research

Courtesy of Stantec

Djavad Mowafaghian Centre for Brain Health

Research Findings

The DjavadMowafaghian Centre for Brain Health is located in Vancouver, British Columbia and is 134,500 square feet. The healthcare center was designed with sustainably in mind and a

metaphorical twist: healthy brains depend on the frequency, quality, and intensity of an electrical impulse. This metaphor creates a social environment enhancing collaboration and an environment that allows inhabitants to have optimistic thoughts.

The massing of the building was created from metaphorically relating it to electrical impulses as well as the structure which is based on a grid of steel beams. Natural light is very important within healthcare which is why most of the facility utilize it.

The facility responds to the site environmentally and is certified as a LEED Gold building. The social interaction in the facility is accepted and encouraged that a collaborative environment is present.

Structure: Steel

Existing program elements

Laboratory, Laboratory Support, Clinical, Office, Meeting Space, Lobby, Building Support

Nexus - with other case studies

Common Features -

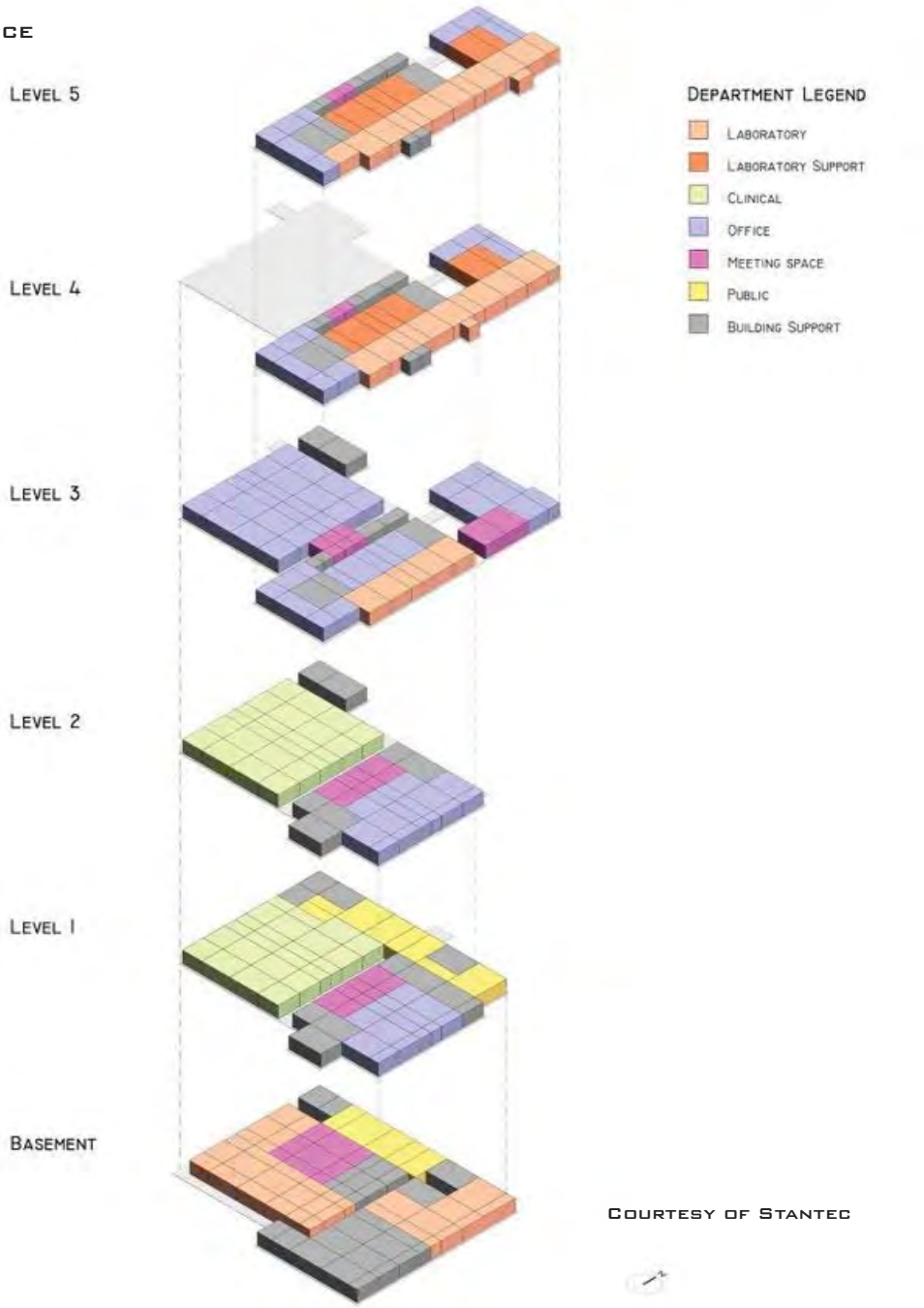
Sustainability, metaphor, nature, healing garden, maximize light, minimum travel distance, therapeutic healing environment.

Uncommon Features -

Urban environment, Brian metaphor, typology neurological, psychiatric and related.

Typology Research

Linking Space Reference



Courtesy of Stantec

Djavad Mowafaghian Centre for Brain Health

Conceptual underpinnings

The DjavadMowafaghian Centre for Brain Health case study does a superb job illustrating the use of nature and describing sustainable features used through the healthcare facility. The electrical impulse metaphor creates a bond between the facility and people; in addition, it allows me to envision different metaphors within healthcare. The space use image does a great job identifying the spaces required and may influence my idea the most.

Overall, the DjavadMowafaghian Centre is a related case study to my topic and the use of the metaphor is vivid with relations to the facility. In regards to my theoretical premise, the gardens throughout, as well as the lighting, create a biophilic engagement.

Courtesy of Stantec

Typology Research

Courtesy of Stantec

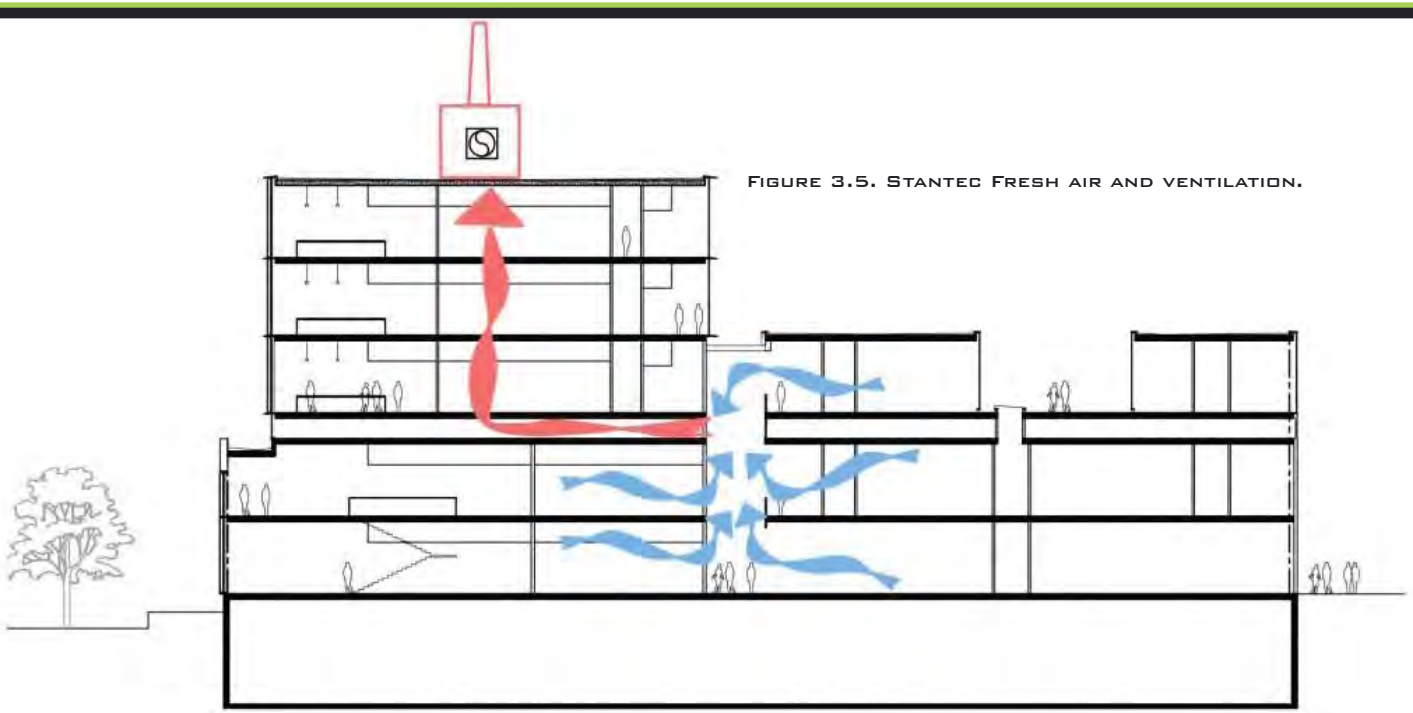


Figure 3.5. Stantec Fresh air and ventilation.

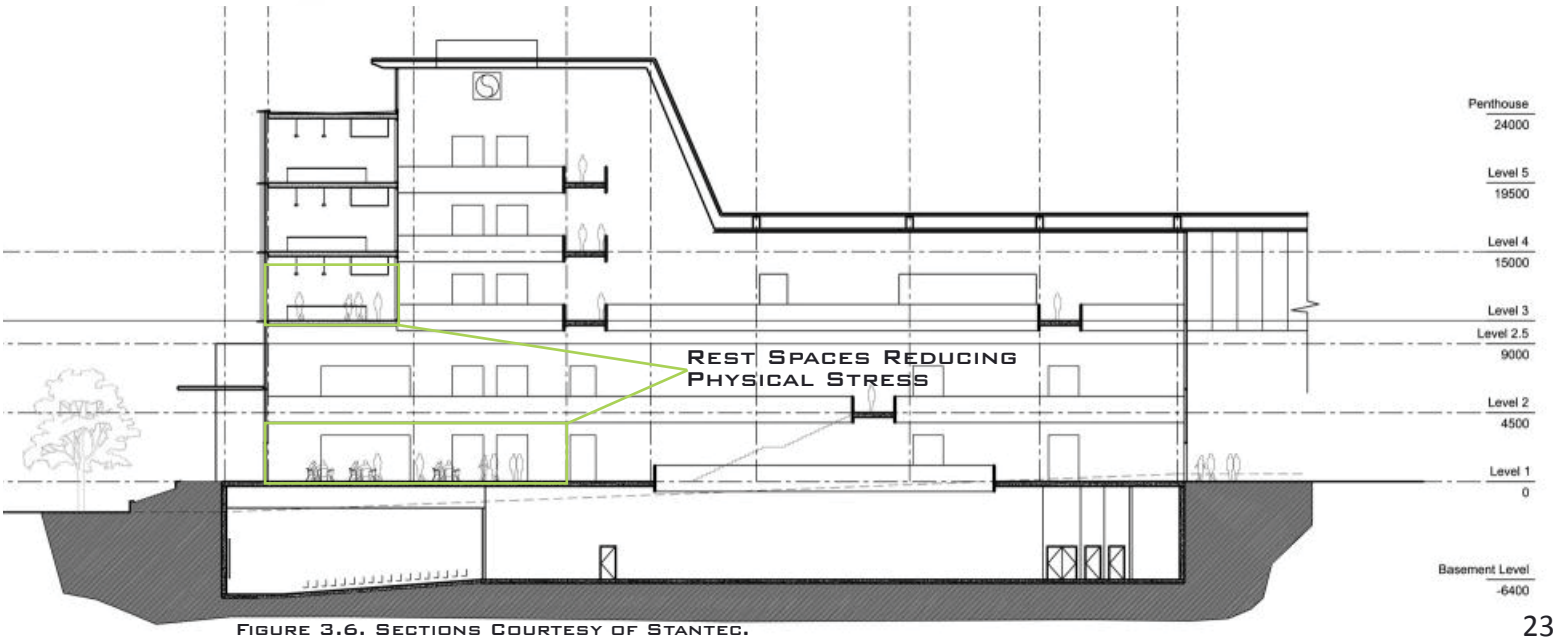
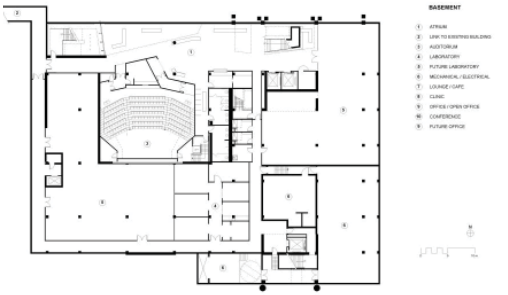


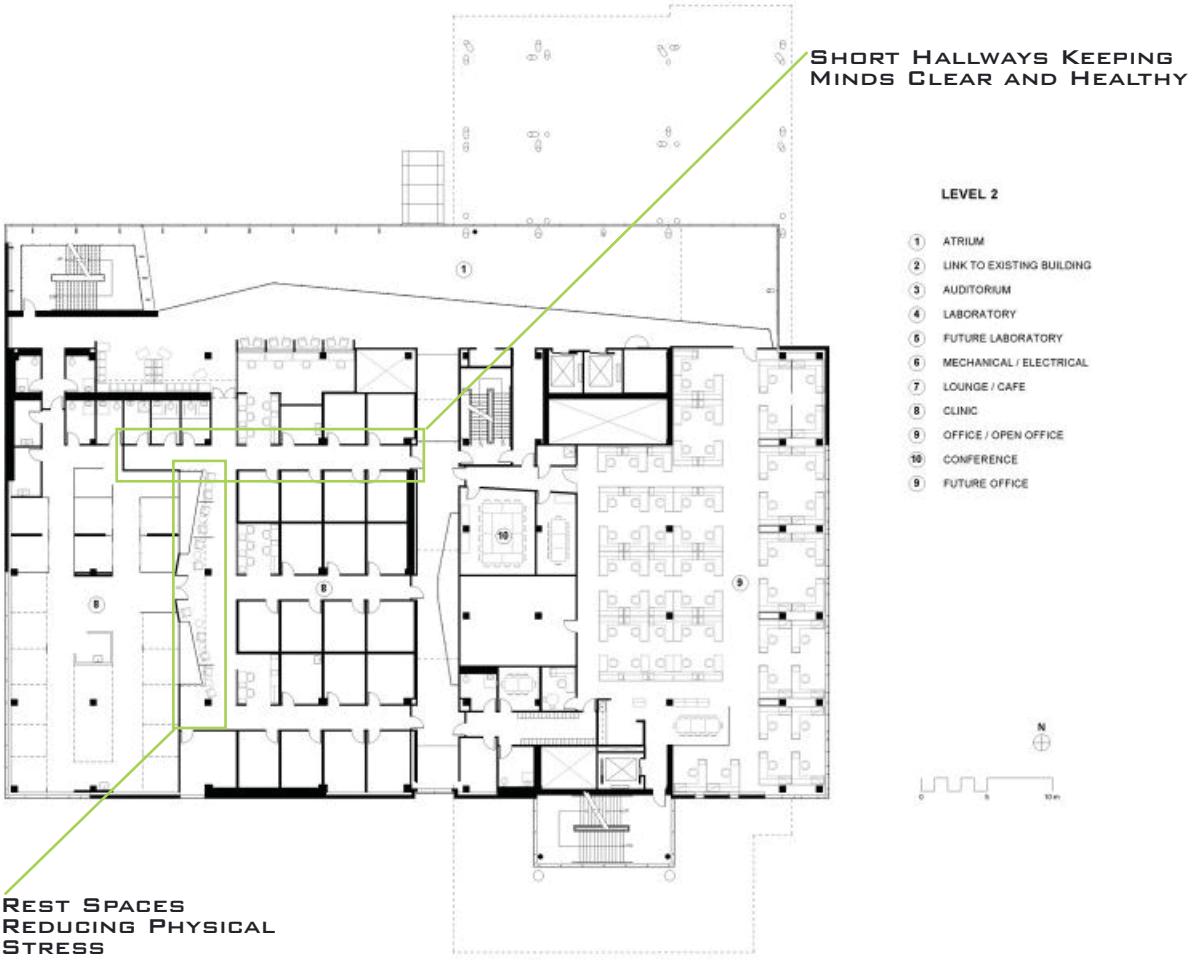
Figure 3.6. Sections Courtesy of Stantec.

Typology Research



Floor plans Courtesy of Stantec

Djavad Mowafaghian Centre for Brain Health



Floor plan Courtesy of Stantec

Typology Research

St. Anthony Hospital

Research Findings

St. Anthony Hospital is located in Pendleton, Oregon and is 105,200 square feet large. The size of the renovation is half of the original and hosts the same amount of users saving space and money.

A distinguishing project characteristic is that it was designed based on the surrounding wheat field allowing the building to blend into the context which is 90 acres of hills. The hospital was proposed to save money since the previous facility maintenance was expensive. By placing the building within the context it benefited from the hills allowing it to avoid wind speeds of up to 70 mph. In addition to the context, the building uses old objects for form? The area and places them within the site.

The materials create a rustic feeling mixed with the contemporary materials used. When a patient enters the building, the materials blend, creating a direct and seamless connection to the exterior gardens. Meanwhile a parallel hallway creates three sets of rows for rooms, allowing for staff and emergencies rooms within the hallways.

An additional characteristic is that the entrance to the chapel is cleverly designed. A ramp is slanted towards the entrance and within the chapel great views can be found to the healing garden. These views also give the users privacy since the windows are placed high enough so that people within cannot be seen from the outside.

Structure: Steel

Existing program elements

Main Entrance, Emergency/ After Hour Entrance, Ambulance Entrance, Staff And Heliport Entrance, Admitting, Emergency Department, Imaging, Respiratory Therapy, Infusion, Lab, Surgery, Central Sterile, Chapel, Pharmacy, Medical Surgery, ICU, Family Birth, Gift / Coffee Shop, Inner Courtyard, Healing Garden, Materials/ Management, Environmental Support Services.

Typology Research

Natural Landscape

Photo © Benjamin Benschneider

The Chapel

Photo © Benjamin Benschneider

St. Anthony Hospital

Nexus - with other case studies

Common Features -

Sustainability, metaphors, nature, healing garden, maximize light and minimum travel distance.

Uncommon Features -

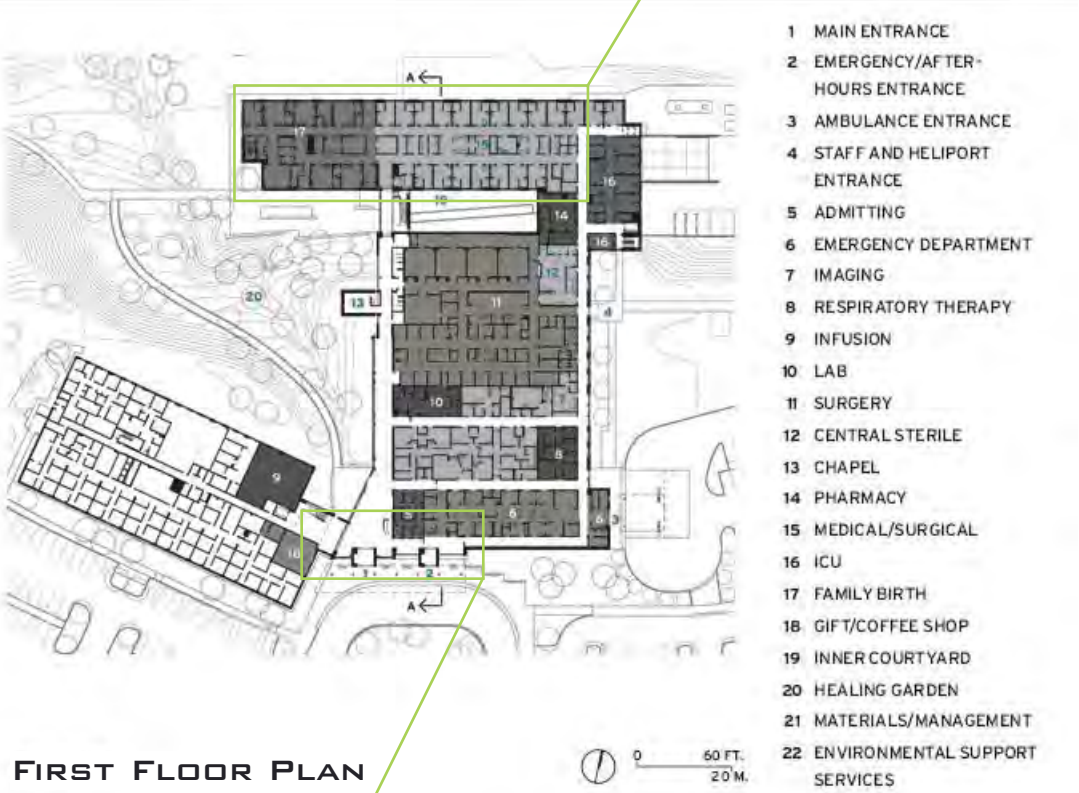
Next hospital is 28 miles away, small town with a close community, large area with rolling hills, wood reception and chapel/ religion.

The Cafe

Photo © Benjamin Benschneider

Typology Research

Center rooms are used for staff, allowing patients to have views to nature.



1 MAIN ENTRANCE
2 EMERGENCY/AFTER-HOURS ENTRANCE
3 AMBULANCE ENTRANCE
4 STAFF AND HELIPORT ENTRANCE
5 ADMITTING
6 EMERGENCY DEPARTMENT
7 IMAGING
8 RESPIRATORY THERAPY
9 INFUSION
10 LAB
11 SURGERY
12 CENTRAL STERILE
13 CHAPEL
14 PHARMACY
15 MEDICAL/SURGICAL
16 ICU
17 FAMILY BIRTH
18 GIFT/COFFEE SHOP
19 INNER COURTYARD
20 HEALING GARDEN
21 MATERIALS/MANAGEMENT
22 ENVIRONMENTAL SUPPORT SERVICES

First Floor Plan

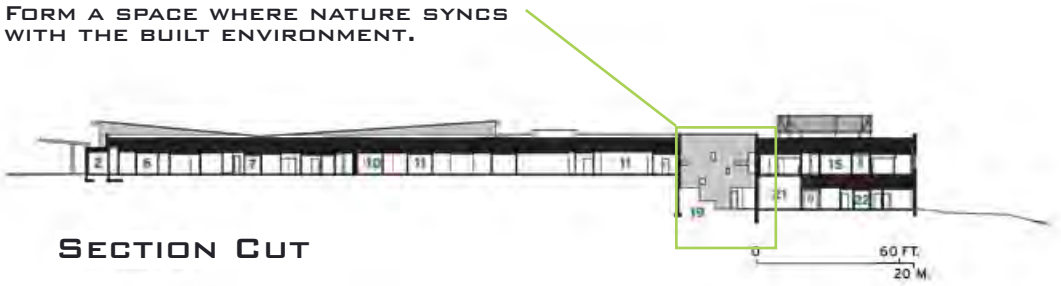
use entry as a node diving the hospital and clinic

courtesy of ZGF Architects

St. Anthony Hospital

Conceptual underpinnings

Over all, the St. Anthony Hospital will benefit my thesis in many ways. The first thing that I will incorporate in my design is a ramp that intentionally guides occupants to a specific location. Secondly, the design doesn't have to be based on a metaphor but can be driven from the landscape. Finally, the floor plans should assist with the program spaces required within a hospital. For more images or information visit http://issuu.com/zgfarchitectsllp/docs/st_anthony_hospital_pendleton?e=5145747/7599831 .



Section Cut

1 MAIN ENTRANCE
2 EMERGENCY/AFTER-HOURS ENTRANCE
3 AMBULANCE ENTRANCE
4 STAFF AND HELIPORT ENTRANCE
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13 CHAPEL
14 PHARMACY
15 MEDICAL/SURGICAL
16 ICU
17 FAMILY BIRTH
18 GIFT/COFFEE SHOP
19 INNER COURTYARD
20 HEALING GARDEN
21 MATERIALS/MANAGEMENT
22 ENVIRONMENTAL SUPPORT SERVICES

courtesy of ZGF Architects

Typology Research

Samsung International Hospital

Research Findings

The Samsung International Hospital is located in Seoul, North Korea and is 1,665,000 square feet and hold up to 310 beds. The hospital is designed based off patient needs, allowing it to create a visually holistic approach to nature. Emblematizing a forest the hospital highlights tranquility by creating a therapeutic healing environment.

"Light is filtered like a tree canopy, landscape flows through the lobby, and abstracted patterns of trees are grafted."

By incorporating contrast in demographics the hospital created a new typology. This was made possible by "Repositioning of program elements resulted in distinct points of entry and flows customized for each patient group."

Existing program elements.

Main Entrance, Emergency/ After Hour Entrance, Ambulance Entrance, Staff And Heliport Entrance, Admitting, Emergency Department, Imaging, Respiratory Therapy, Infusion, Lab, Surgery, Central Sterile, Chapel, Pharmacy, Medical Surgery, ICU, Family Birth, Gift / Coffee Shop, Inner Courtyard, Healing Garden, Materials/ Management, Environmental Support Services.

Nexus- with other case studies

Common Features -

Sustainability, metaphor, nature, healing garden, maximize light, minimum travel distance and a therapeutic healing environment.

Uncommon Features -

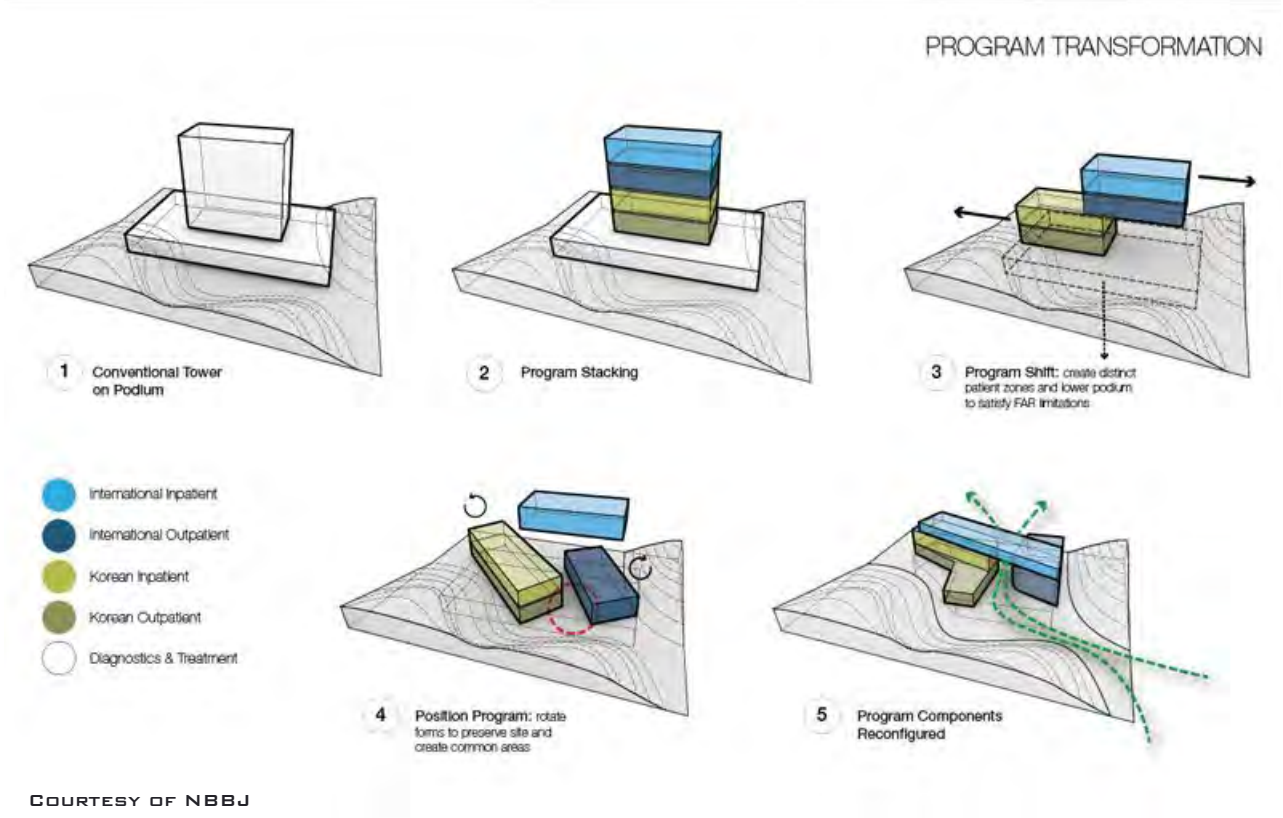
Contrast in demographics, new typology, high standards syncing with nature creating a high bar for the healthcare architecture, urban area and clear way finding.

Typology Research

Images Courtesy of NBBJ

Conceptual underpinnings

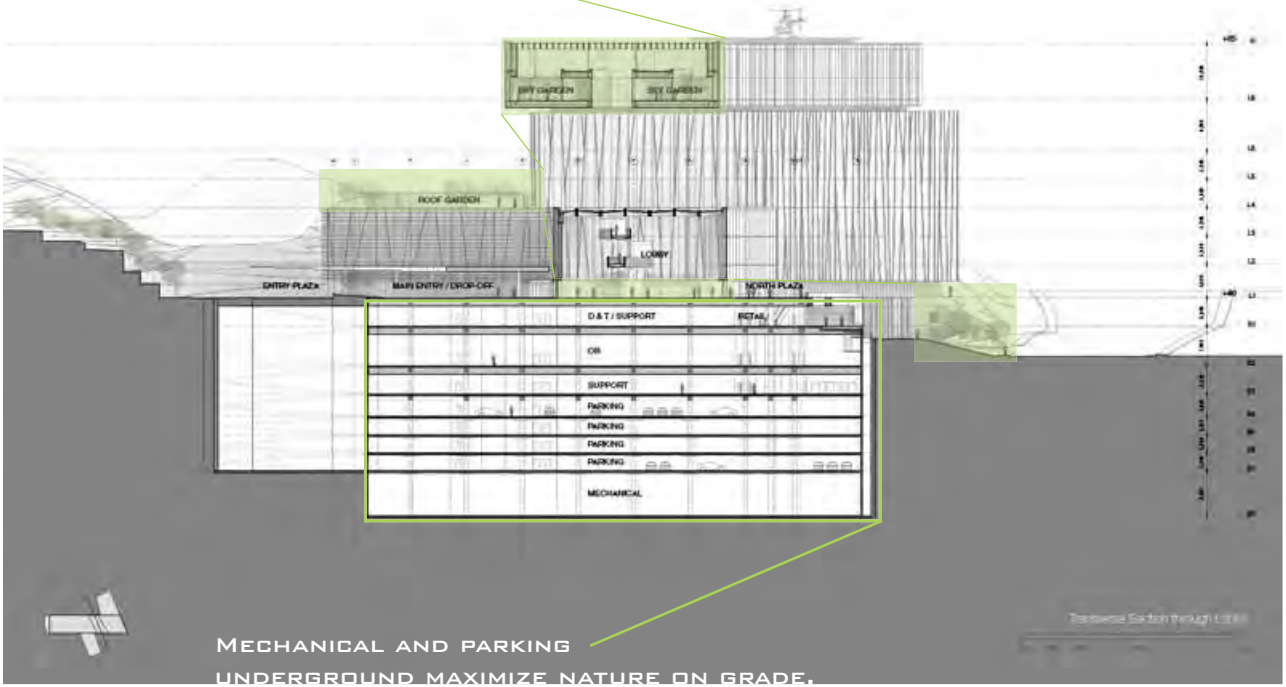
The Samsung International Hospital parallels with my design creating a great case study. It responds environmentally by having a sustainable design relating to a forest/tree. In addition to sustainability, biophilia enhances the spaces allowing patients to be nurtured through light, sound and nature. Culture and social class was also implemented within the design in a methodical way by stacking, shifting and extruding boxes. This discovery then allowed nbbj to assist multiple social and cultural classes within the same building.



Courtesy of NBBJ

Typology Research

Multiple gardens - enhancing Biophilia
and a separation for an urban environment.



Mechanical and parking
underground maximize nature on grade.

Images Courtesy of NBBJ

Samsung International Hospital

Canopy metaphor -
Creates shade, but allows natural light in.

Typology Research

Images Courtesy of NBBJ

Samsung International Hospital

Water may be an agent spawning bacteria, but if glass is placed over the water the agent it is then contained.

Typology Research

Every case study was used to research a specific purpose to assist my theoretical premise and design. Researching the case studies allowed me to understand metaphors relating to biomimicry, a biophilic environment and similar locations. The Djavad Mowafaghian Centre for Brain Health has a similar size, context, and uses a great metaphor. St. Anthony Hospital integrates the building with the surrounding rolling hills and uses materials within the facility connecting the facility with nature. In addition, it considerately placed specific floor heights, ramps and windows so that the users would subconsciously be connected with nature. Finally, the Samsung International Hospital not only has high standards but also creates a new typology. The facility also relates to biomimicry with the metaphor of a forest and the canopy of a tree. Likewise, it has strong relationship to nature, similar urban environment and is near the ocean.

Other related project that did not sync to the project completely are: BC Cancer Research Center, St. Mary's/ Duluth Clinic First Building, Geriatriezentrum Favoriten, Alexanda Hospital at Yishun, Spaulding Rehabilitation Hospital, Legacy Salmon Creek Hospital, Bloorview Kids Rehab, REHAB Basel Center for spinal cord brain injuries finally but not lease The Carlo Fidani Peel Regional Cancer Center.

Over all, the three case studies that I selected were very different aesthetically but had many resemblances regarding sustainability and biophilia. A few similarities occurred repetitively with different areas such as the hallway with short distances that included as many views to nature as possible. The integration of nature into facilitates that are located within the city is the best solution; nonetheless, the most important solution is that the facility become an ornament within the site.

Summary

Djavad Mowafaghian Centre for Brain Health

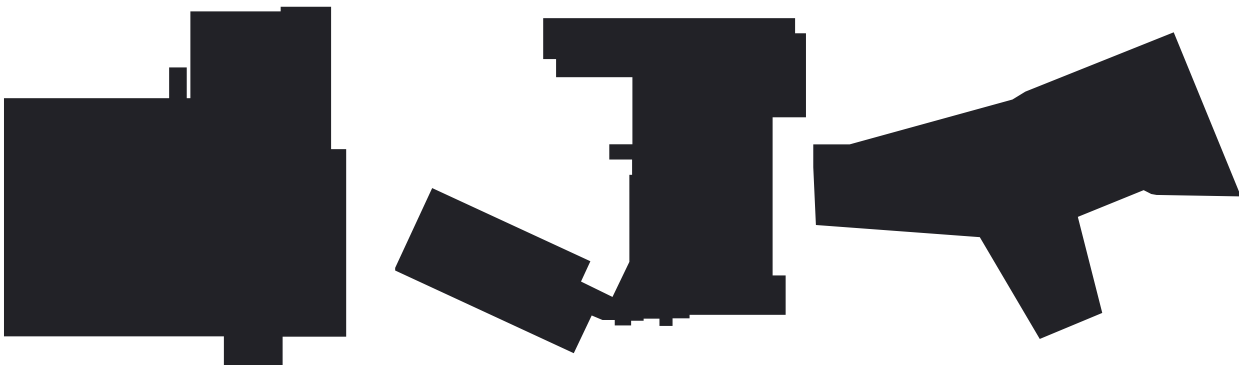
The Djavad Mowafaghian Centre for Brain Health provided a helpful diagram regarding to the relations and links between spaces. Similarly, it made me realize that rest spaces are important and allow for the reduction of physical stress. Furthermore, ventilation images provided show a great example on how fresh air may flow through a building, allowing me to envision how light may fill the atrium with this same technique.

St. Anthony Hospital

St. Anthony's Hospital was culturally different by inserting a chapel that is more significant due to hierarchy, it is then a dominating factor within the design. Views to nature are increased by placing a natural courtyard in the center of the site that is precisely designed to relax patients. Parallel hallways create a center row of rooms for technical and staff needs; allowing patients to have as many views to nature as possible. By using the entry as a node, it divides the hospital and clinic forming a space where nature syncs to the built environment.

Samsung International Hospital

The Samsung International Hospital is multi-cultural by considering how Koreans and non-Koreans fill the spaces. Through special relationships and creating separate blocks for different cultures the building established a layout that fulfilled the necessities, while simultaneously solving social problems. Technical issues within these case studies made me realize that mechanical and parking should be below grade if possible. Over all, this case study is the most relevant to my project due to the metaphor, biomimicry, the functions and site.



Typology Research

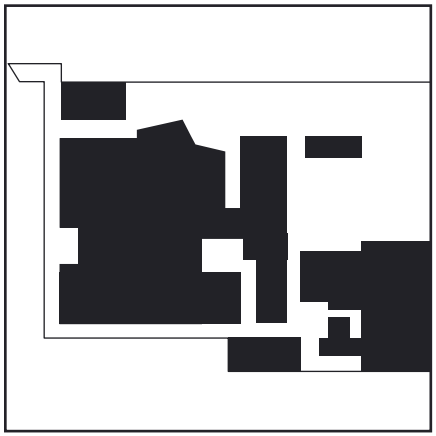


Figure 6.2.1. Section
Djavad Mowafaghian Centre

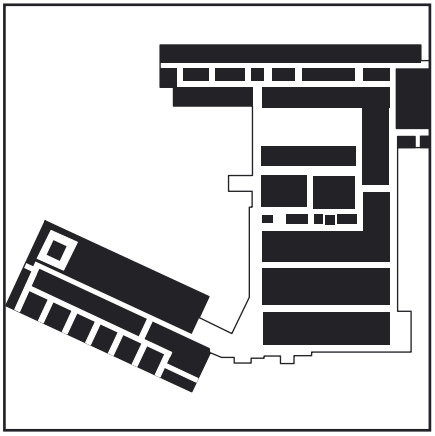


Figure 6.2.2. Sections
St. Anthony Hospital

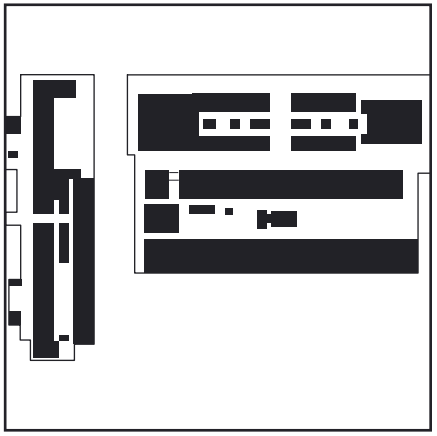
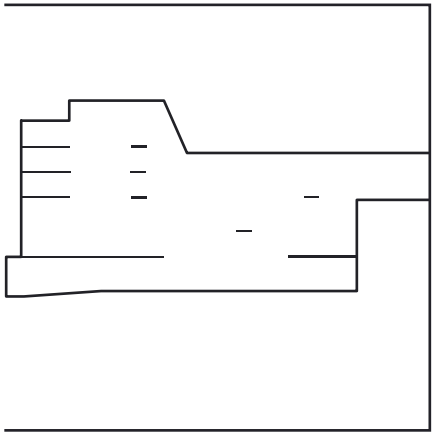
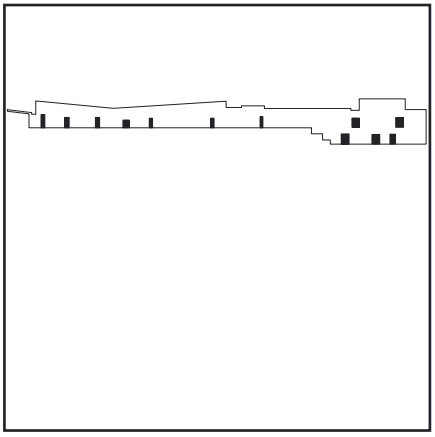
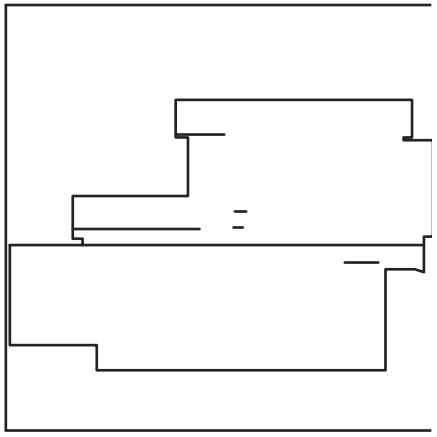


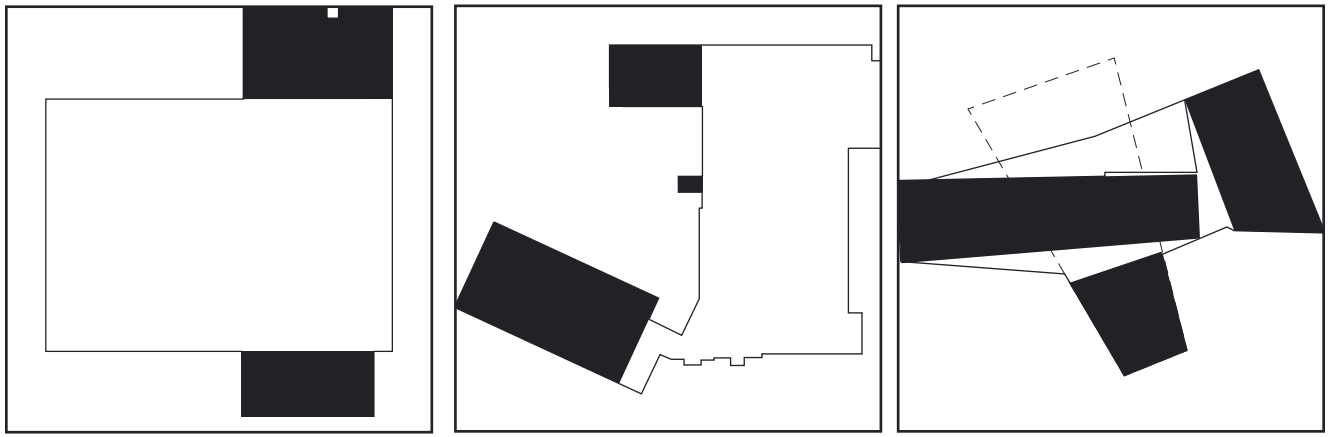
Figure 6.2.3. Section
Samsung International Hospital

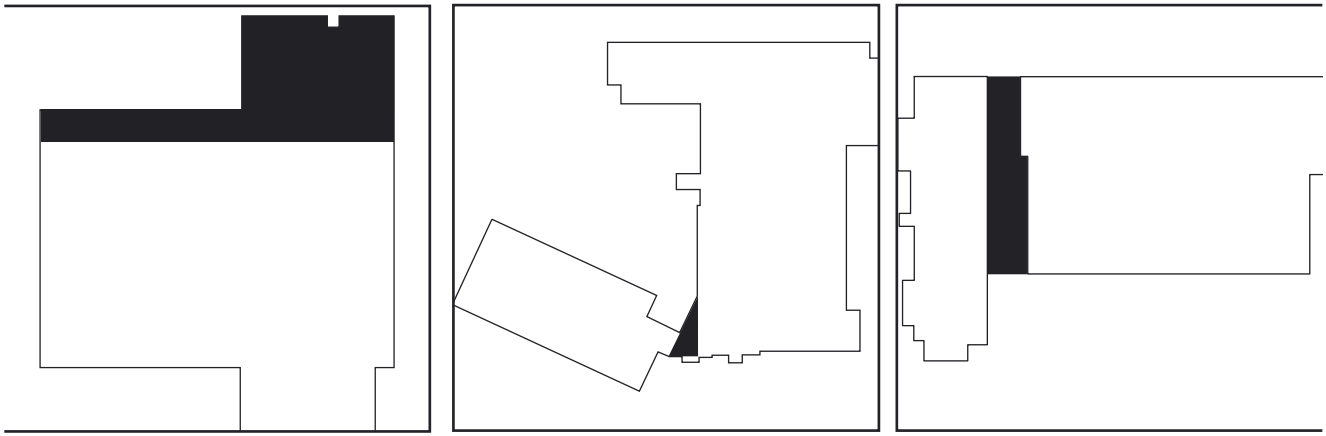






Space Study





Major Project Elements

General

Gardens - Creates a biophilic atmosphere throughout the hospital.

Parking - Underground and consider overnight stays.

Pharmacy - Supply patients with medication.

Security - Patients with mental illness episodes may require special security for their own safety and the safety of others. Patients with mental illness episodes may require special security for their own safety and the safety of others. Bipolar disorder and other attitudes may need to be controlled. Sometimes special security is required for patients in danger of others.

Mechanical rooms - Underground.

Storage - For medication, emergency equipment and cleaning supplies.

Janitor rooms, Rest spaces, Rest Rooms

Specialized Rooms

– Should be sterilized and easy to clean- enclosed area- extra clean air

Examination Room – Checkups and examine patients.

Medical Lab – Collect blood, urine and stool samples to be examined.

Radiology- Allows doctors to examine internal body problems.

Emergency Room – Instant access helping with severe suffering or diseases.

Emergency Room Entrance – Allows the ambulance to have instant access.

Recovery/Nursery- Allows nurses to have close surveillance on a recovering patient.

Physical Therapy – Skilled techniques to recover in physical wellness.

Surgery Rooms

Operation Rooms - Where operations happen rooms juxtapose should be:

Doctors and nurses locker room .

Anesthesia Room.

Frozen Section - Nearby access to a cold-room.

Communal

Reception - Allows for check-ins, appointments in addition to general questions.

Lounge - Creates a space where visitors can wait.

Café - Give the works, patients, and patients loved ones a place to gather.

Shopping / Bookstore - A small gift shop with necessities.

Cafeteria

Workers

Office - allows for reviews on patients and to follow up on work

Work out area - destress after a long day or before work

Changing room

Laundry room – Cleaning bed sheet and patients robes.

Kitchen/ Break room

User / Owner

Owner

The project will be owned by the city of New Orleans and Scenery Healthcare. It will be used by the entities below.

Peak hours

8am - 5 pm but the recovery and emergency facilities will be available year around.

Users

Full time

(Typical 8 hours) but the facility operates year around.

20- Doctors - Require examination rooms and office.

50 - Nurses - Supporting doctors with patient checkups and essential tasks.

20 - Specialists - Specialize in pharmacist, physical therapy, MRIs, and testing bodily fluids.

20 - Administration - Front desk and work room.

10 - Security - Cameras to supervise, should walk around as much as possible.

Building operator - Will need to know the building and systems for upkeep.

Cooks, Janitors

Part time

Out-Patient - will visit the hospital for a few hours or less.

50 Beds

In-Patients – Will have severe medical or mental problems; if patient undergoes surgery they may be required to stay the night and will require a bed.

25 Beds

50- Visitors - will visit in-patients and need spaces to rest or sleep.

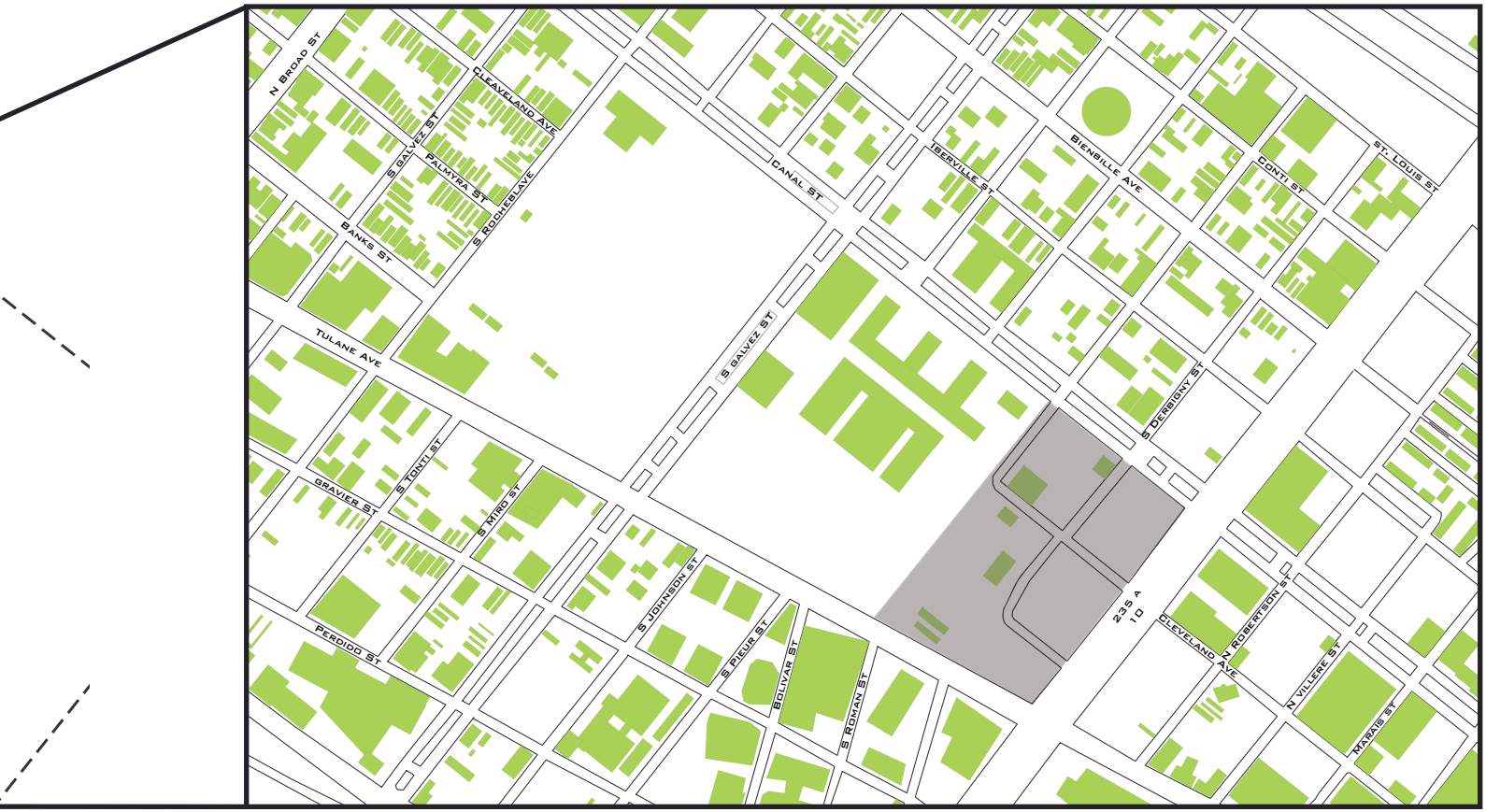
Site

Before an urban analysis, I wanted to design my site within the wetlands of New Orleans, allowing the occupants to be directly connected with nature. After thinking about distances and access to a medical facility it was not an ethical selection so I began to search for a different site.

Site 2 and 3. New Orleans City Park or the parking lot near the Treme Center were my next thought; it had the space required as well as the framework linking the facility to nature. I did not want to damage nature and current green spaces within the city so I continued my search.

Site 1. Finally, after researching the city's master plan, I ran into Project Legacy which is a project for the Health Care System for the Southeast Louisiana Veterans. This was perfect. The location was near the center of the city and on a brownfield site. This inspired the idea to cluster several medical facilities together into an all-inclusive medical campus submerged in nature.

Site


N BROAD ST
CLEVELAND AVE
S GALVEZ ST
PALMYRA ST
S ROCHEBLAVE
BANKS ST
TULANE AVE
CANAL ST
IBERVILLE ST
BIENVILLE AVE
CONTI ST
ST. LOUIS ST
S GALVEZ ST
S DERBIGNY ST
GRAVIER ST
S TONTI ST
S MIRO ST
S JOHNSON ST
S PIEUR ST
BOLIVAR ST
S ROMAN ST
PERDIDO ST
235 A
10
CLEVELAND AVE
N ROBERTSON ST
N VILLERE ST
MARAIS ST

Project Emphasis

I do not consider biophilia as a design style, but as an integration that should be a fundamental within healthcare design. Due to this, I have directed my project emphasis towards biomimicry relating it to the form and incorporating biophilia in a therapeutic way, to fill the spaces.

Core arguments

Within the design, a subconscious healing environment will be created through the fusion of biophilia and the built form. Spaces will be formed by natural materials followed by a passive systems; forming an ecological building. A key element to my design will be the integration of **air, light, water, and plants** within every room, if possible.

Emphasis

My design will be inspired by The Seven Sister Oak Tree but might change as I continue to research biomimicry. By understanding how the oak tree is structured, grows, and can survive a hurricane the research will allow me to design a better healthcare building structurally and environmentally. The facility will also relate to the Seven Sister Oak Tree in a metaphorical way to further symbolize healing.

Metaphors

Metaphors are a significant feature to design. Giving spaces meaning and symbolic representation evokes feelings, creating a memorable moment. These spaces may be designed with a deeper meaning than the eye can capture. Nonetheless, designers must never forget how spaces will be occupied and function for the occupants.

Goals of the Thesis Project

Academic

Over the past 6 years of my life I have learned about architectural drafting, estimating and design. Now it is time to go beyond and learn about a specific area of interest. After much thought, I selected architectural healthcare as my building type that emphasis on biophilia and biomimicry.

An academic thesis is important; it allows current students to document what they have learned over the past 5 years and pass their knowledge down. This allows for future generations to have an advanced basis on certain design ideas and data. From that data healthcare facilities can then be modified allowing patient to spend less time in hospitals due to improvements from biophilic design. In addition, a healthier work environment will generate happier, more productive workers.

Professional & Personal

Personally, I think that the healthcare industry will always need designers and specialists. If the facilities are not designed new a restoration will be needed. Indicating a positive outcome for this field and my thesis.

Theoretical

The combination of my research will allow me to investigate how biophilia influences the recovery time of patient in hospitals. By integrating nature into a design I want to impress the users while creating a healthier environment.

My goal for biomimicry is that it will help me form a metaphor, structure and or a layout. At the same time I plan to create an ecological building through this process. By observing what wants to be there the spaces will hopefully inform the design and form of the building.

Physical and Social

By creating a biophilic environment patients will feel healthier physically and mentally. I addition to patients' health the workers should feel physically healthy as well which is why they will have a physical wellness center for the staff.

Time is what my personal goals come down to. I would like to run or workout at least 3 times a week. Unfortunately with the mixture of work, school, homework, academic clubs, and sleep sometimes my days are just not long enough, but I will do my best to fit a physical activity in my schedule. Let's not forget about free time so I don't go crazy!

Plan for Proceeding

Tasks to be done

1. Visit site - New Orleans - local survey

- October 22, 2014
- Observe sites and document sites

2. The Theoretical Premise/Unifying Idea

- Go to the library and find resources relating to biophilia and biomimicry
    i. Seven Sister Oak Tree
    ii. Hurricanes
    iii. Street Circulating
- Find Ted talks related to my project
- Research the structure of oak trees.
- Develop a metaphor

3. Historical Context

- Swamps
- Hurricanes
- Restoration
- Housing
- Topography

4. Project Typology

- Research healthcare spaces
- Sustainability of healthcare facilities
- Special needs in spaces

5. Programmatic Requirements

- Interior Images - direct interviews
- Floor plans - direct observation – Archives – Case studies

Task Analysis

My tactics to accomplish the work is by analyzing, searching archives and exploring. To begin I will read Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life, Sustainable Healthcare Architecture and locating other resources from the library. In addition, I will look for additional articles that state how biomimicry and biophilia effect architecture.

Next, I need to contact healthcare facilities and possibly take tours, allowing me to interpret and document spaces firsthand. I will continue working on case studies and perform a “Stocking the Bank” exercise that was taught to me by Steve Martens. Through analyzing I will be allowed to correlate spaces and define the appropriate sizes.

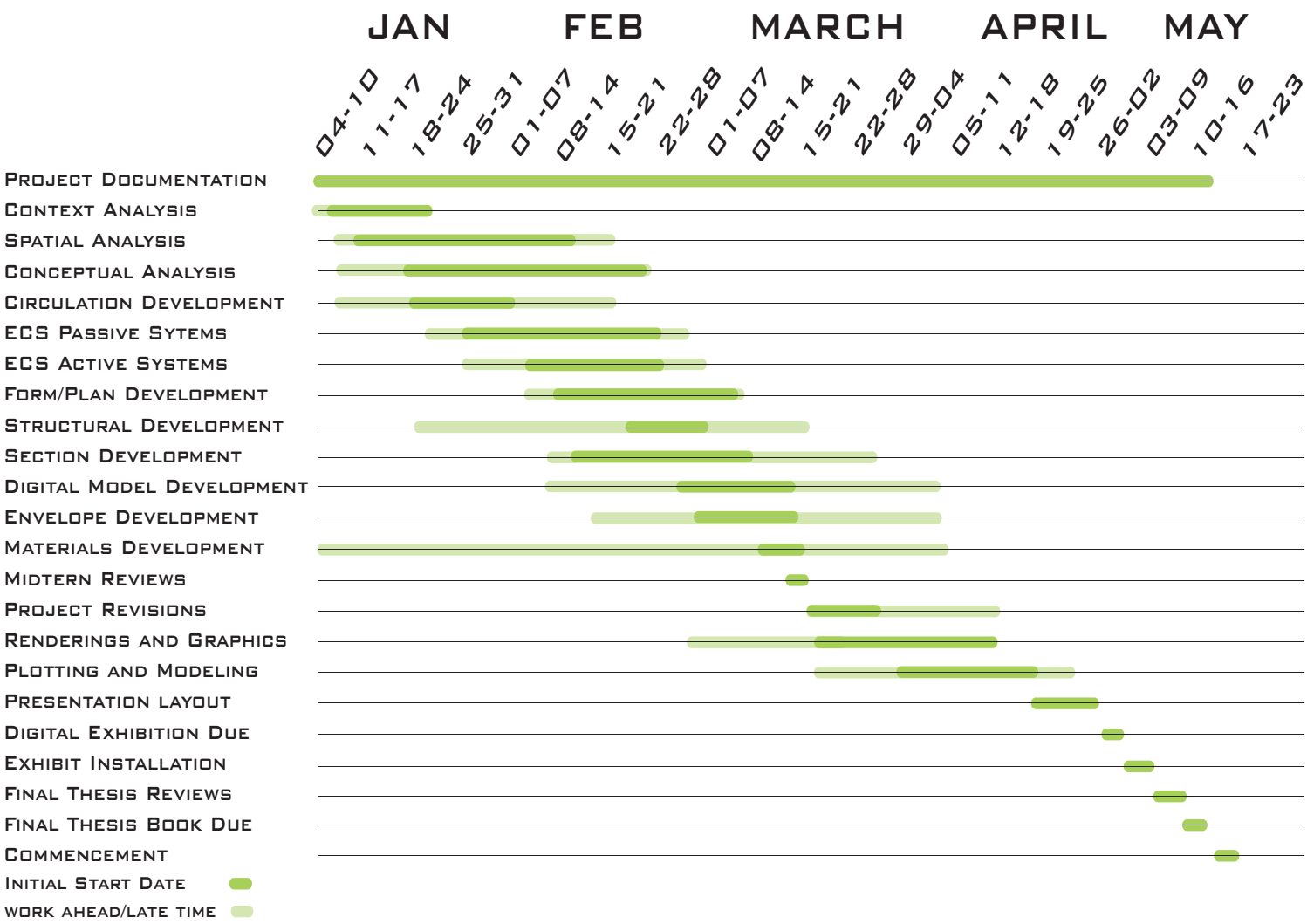
When I have obtained enough data, I will then create a physical site plan allowing me to relate the context of the site to my building. The investigation of the site will go in depth including contours, a wind rose, yearly temperature, and geographical data if possible.

Once I understand the site and spaces required, I will then work on a schematic design followed by a metaphor relating to a biomimetic structure. These designs will include: space diagrams, sketches, sustainable strategies and rip and tear models.

As soon as I have figured out how the building spaces come together and are in symbiosis with the landscape, I will begin to transfer the information onto digital software allowing me to create clear floor plans, sections, renderings and run digital test on how the building may perform with the environment.

Finally, I will place these images on my final boards and a power point so that I may present it to the public. In addition to the presentation I will have a physical context map and detailed model. My presentation and boards will be saved in a PDF format and will be available in the NDSU library repository for the public and following scholars.

Schedule


JAN
FEB
MARCH
APRIL
MAY
04-10
11-17
18-24
25-31
01-07
08-14
15-21
22-28
01-07
08-14
15-21
22-28
29-04
05-11
12-18
19-25
26-02
03-09
10-16
17-23
Project Documentation
Context Analysis
Spatial Analysis
Conceptual Analysis
Circulation Development
ECS Passive Sytems
ECS Active Systems
Form/Plan Development
Structural Development
Section Development
Digital Model Development
Envelope Development
Materials Development
Midtern Reviews
Project Revisions
Renderings and Graphics
Plotting and Modeling
Presentation layout
Digital Exhibition Due
Exhibit Installation
Final Thesis Reviews
Final Thesis Book Due
Commencement
Initial Start Date
work ahead/late time

Theoretical Research

With current technological advancements, nothing needs to be rediscovered, we must parallel nature with technology creating enhanced design solutions.

"Biomimicry is the action of learning from nature, borrowing designs and strategies that have worked in place for billions years" (Benyus, 2008). These design strategies produce structures that mimic biological objects, minimizing the work that the buildings need to produce. A great example of this is PAX Scientific. The company uses bio-inspired technology. They study efficient and optimal flow patterns allowing them to reduce energy and flaws with the design. Benyus states "*Compared to conventional fans, they reduce energy use by 30-80 percent, noise by 75 percent.*"

Everything has a specific place in an environment except for humans. Still, we have the ability to adapt, allowing us to select our living environment (Flato, 2014). Do to this, we must now find a way to design a structures that are integrated into the environment demonstrating sustainable practices while blurring the connections between the built environment and natural environment.

Previous examples of biomimicry in architecture (Benyus, 2008).

- Eiffel Tower : Femur bone
- Crystal Palace : Ribbing of Amazon water Lilly
- Munich Olympics Stadium : Spiders and crab shells
- Buckminster Fuller Geodesic Dome : Radiolarians
- Swiss RE Building : Water transport systems of the marine sponges
- Eugene Tsui : Barnacles

The proposal mentions that I would practice biomimicry by designing a building using The Seven Sister Oak Tree as inspirations. This will link to my design by allowing the foundation to be similar to a root system, by attaching the superstructure to the foundation with wires and anchors. For the design I have also allowed myself to use other biomimetic examples. Allowing for broader biomimetic research and creating an optimal design.

Biomimicry works within a building in more than one perspective. Woolford provides examples of this within previous buildings that HOK and himself have worked on. In one building he describes how the California Brown Pelican creates thermal comfort for themselves by expanding and contracting their body. His next example relates to light and how a Spookfish has a light extension of 20 feet. This is connected to the max distance natural light will enter form a window. Ventilation is described with the Picasso Sponge and how its pores and clear stacks allow it to vent. He then relates the example to multiple scales of ventilation within a building similar to double screen windows. (Woolford et al., 2014).

Biomimicry

Thermal confront is related to a monkey pod tree when the air breeze reaches the base the air ventilates the tree. Similar to a building warm air rises and escape through the roof. Leaves are then observed to solve hot spots. Similar to a tree, the layering of leaves creates a barrier that reduces heat while allowing diffused light to reach the base of the tree. A building may then place objects that block heat, allowing light to trickle to the base of the building (Woolford et al., 2014).

Everything has a specific environment that it belongs to yet humans have the ability to adapt, allowing us to select our living environment. However, this has allowed us to create a disconnection from nature which is why as designers we must pursue design that blends with nature. Figures 9.0 resembles a seashell and 9.1 mushrooms both being great examples . As bio-innovative designers we must have abstract view towards nature that considers scale, texture and enticement (Brager, 2014).

"When did a healthy environment became associated with the visually sterile, industrial look of polished metal or percaline surfaces"(Madesn K.G.ll, Salingaros Nikos A., 2008). Even though we have moved away from a biophilic world, we have found alternatives for this missing piece through designs. Linking buildings to nature with biomimicry distorting the boundaries with biophilia and the more we observe the more we begin notice these traces of nature. Through these distortions we search meaning in objects created by nature. For example a tree can metaphorically link a design by evoking comfort and prospect refuge. As bio-innovative designers we must have an abstract view towards nature, yet a world that is balanced with nature similar to Falling Water designed by Frank Lloyd Write. (Brager et al., 2014)

Understanding Biomimicry can be a complicated task when relating it to architecture but with the help of books, biologists, asknature.org and biomimicry.net before the design begin will allow me to adapt the most efficient biomimetic solutions.

Tips:
Sensors save water, many and are convenient but have a manual switch in case of an emergency
Automatic windows with sensors allow adequate natural ventilation and temperature.
Closed loop geothermal system may be used for thermal comfort.
Photovoltaics use light to provide energy.

Theoretical Research

By integrating biomimicry into a design it allows for the birth of a biophilic environment that current health facilities should include. This theoretical premise is important to our current society because it creates a built environment that allows patients to be mentally, physical and, emotional healthier. In addition, biophilia spawns a cultivating environment allowing for a reduction in shorter healing period and reduces sick building syndrome.

Biophilia does not only heal but prevents health problems (Sherman et al., 2005). In the nineteenth century people worried about diseases that where spread though poor hygiene and sanitation conditions. These problems were solved though heath interventions. In our current age we should be more concerned about long-term chronical illnesses such as cancer, heart disease and strokes caused by the built environment (Lee, K., 2008). Many new materials used may have not been tested creating indoor environments that are ten times more pollinated than outside air (Wolverton 1997;Coward et al. 2001)

Buildings and urban spaces from the past have presented us with the highest sensory to connection to the built environment (Alexander, 2002-2005; Salingaros, 2005,2006; Madesn, 2008). Biophilic spaces and views of nature make significant differences when relating physical and neurological responses to pain, stress, and physical recuperation. In an investigation involving three hospitals, results show that calming elements such as gardens reduce emotional stress for all users. Both the built environment and nature have a fundamental quality in design, but together they present the ability to create a healing environment (Maldor, 2008). To prove this I have done extensive research from vast creditable sources that have studied these aspects and compiled them into my thesis. I have divided biophilia into nine subtopics making it simple to locate and learn about: plants and air quality,direct view to nature, nature in multimedia, light,neuroscience, stress, and thermal comfort .

Bill Zorana allows us to portrait how biophilia maybe integrated within a design. He mentions many influencing factors on linking biophilia to nature. Consequently through his studies he discovers that biophilic and well-designed cities are resilient and allow the population to have a healthier and more social lifestyle. (Woolford et al. 2014)

Biophilia

Tips By Bill Browning - Designing Biophilicly

Water

Perceived to be clean, meaning we should be able to touch, hear and see it.

Light

Dynamic and diffused lights should be within the environment.

There is more than one side to a room.

Consider different light angles.

Add multiple light types.

Temporal light changes as the seasons change.

Melatonin influences.

Blue light during the morning.

Red light in evenings.

Biophilic Case Study - Paley Park

Creates a large room suggesting biophilic refuge.

Canopies overhead.

Vine walls and water create the walls.

Water wall, creates an attraction and pattern when it's on people are present.

Vegetated Roofs

Garden Roof tops may not feed many, but will evoke feelings and new biophilic experiences.

Biophilia

Plants and air quality

As marvelous as plants are, they are should not be the only method of linking a biophilic design to a restorative environment. In addition to plants we should incorporate natural forms and elements into the spaces we inhabit ornamenting our life style.

Plants within a hospital are aesthetical and purposeful by purifying air, filtering waste, masking sound and controlling humidity levels. The National Aeronautics and Space Administration (NASA) has undertaken extensive studies of air and water treatments to show how effective plants may be in space. (Wolverton, 1997; Sassi, 2006). From these studies they found that the Boston Fern and the Florist Mums reduce the most formaldehyde, The Areca palm, dwarf date palm and the moth orchid reduce toluene and xylen and the Lady Palm absorbed the most ammonia (Wolverton, 1997; Sassi, 2006). In addition to interior air quality, we must consider the exterior surroundings and how dust may be buffered before it reaches the hospital. Trees create great buffering barrier, having the ability to trap dust and act as a filter for pollutants before they reach the hospital.

Air quality and circulation of air is very important. Without this sick building syndrome may occur. Sick building syndrome is when a specific illness cannot be identified because of building. These agents may be created from exterior sources or biological contaminants such as mold, pollen and carpeting. Symptoms related to sick building syndrome may vary but are typically: "*caught, chest tightness, allergies, upper respiratory congestion, muscle aches and Pontiac Fever*" (EPA, 1991).

When designing a building the air maintenance must also be thought of. When spaces lack fresh air quality an increased rate of air changes might be required or as simple as changing a dirty air filters will reduce the pollutants within the interior environment.

Top 30 chemical absorption, Transpiration rate, ease of growth and maintenance and resistance to insect infection. Rating 1-10

Lady palm	8.5
Bamboo palm	8.4
Areca palm	8.0
Rubber plant	8.0
Dracaena 'Janet Crig'	7.8
English ivy	7.8
Dwarf date palm	7.8
Ficus alii	7.7
Boston fern	7.5
Peace lily	7.5
corn plant	7.5
Golden pathos	7.5
kimberly Queen	7.4
Florist's Mum	7.4
Gerbera daisy	7.3
Dracaena 'Warneckei'	7.3
Dragon tree	7.0
Red emerald-philodendron	7.0
Syngonium	7.0
Drum cane-Exotica compacta	6.8
Parkour palm	6.6
Weeping fig	6.5
Scherrlera	6.0
Wax begonia	6.3
Lacy tree-philodendron	6.3
Heart-leaf-philodendron	6.3
Snake plant	6.3
Dumb cane-Diefenbachia Camilla	6.2
Elephant ear-philodendron	6.2
Norfolk Island Pine	6.2

Direct View

Direct views to nature are important to minimize pain, medication, recovery time, complaints and evoke better emotions. Within his presentation Browning states that a visual connection with nature reduces blood pressure, and faster healing rates (Africa, 2014). through this section my research is specifically related to the relationship between direct view to nature and humans. This section covers studies that have been completed reinforcing my theory which is that - *biophilia within a hospital environment makes a significant difference in the pain and recovery time of a patient*.

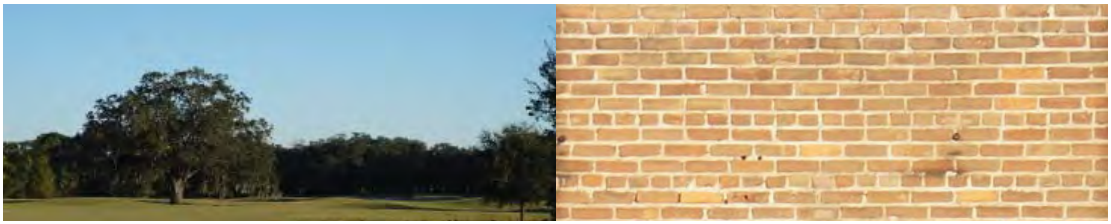
Several studies using experimental or quasi-experimental design have shown convincingly that nature can produce distractions creating substantial and clinically important alleviation of pain. *"A study of patients recovering from abdominal surgery found that those assigned to rooms with a bedside view of nature (trees) had better postoperative recovery course that matched patients assigned to Identical rooms with windows overlooking a brick building wall"* (Ulrich 1984, 2008). The images 9.4 and 9.5 show the contrast. "Patients with window view of nature, compared to those with the wall view, suffered significantly less pain, as indicated by needing far fewer doses of strong narcotic pain medications than their matched counterparts with a brick wall view. Furthermore the views with nature had shorter post-surgery stays, better emotional well-being and fewer minor complications such as nausea or headaches" (Ulrich, 1984,2008).

Number of pain drug doses (Days 2-5 after Surgery)

Analgestic Strength	Nature View Patient	Wall View Patient
Strong	0.96	2.49
Moderate	1.74	3.65
Weak	5.39	2.57

Figure 9.3. Pain drug doses (Ulrich, 1984)

Through the practice of biophilic design a healthier hospital environments has seventy five percent less patient falls, eleven percent less hospital infections, sixteen percent less medication use and ninety five percent higher patient's satisfaction (Figueiro, 2014).



Biophilia

According to Stephen R. Keller there are 6 dimensions of biophilia that must be included in an environments (Keller 2008).

1. Environmental features
2. Natural shapes and forms
3. Natural patterns and processes
4. Light and space
5. Place based relationships
6. Evolved human-nature relationships

Biophilia - Distraction and the Gate Theory

Ulrich continues to explain biophilia and why nature reduces pain. Within this section he mentions two theories the gate control and distraction theory. The gate control theory written by Melzek and Wall is explained by relating it to opening and closing a gate. If the gate is open you are allowing pain to travel up your spinal cord causing negative emotions, anxiety and depression. These factors also typically are the factors that "open the gate". To close the gate you must think positive or be distracted. The distraction theory consists of observing nature which take conscious thought reduces pain since you are concentrating on a different matter. Brewer and Karoly say "Distraction is defined as concentrating on aspects of the environment that are outside oneself" but there is Limit in the amount of available conscious we pertain. (McCaul and Malott, 1984; Ulrich, 2008)

Finally a biophilic environment helps with more than a patient's impact by influences doctors and nurses in a positive way. Kampschroer presented facts on why biophilia is important with the work space, to begin he mentions that thirty percent less errors occur in a biophilic environment that is well lit. This environment also causes a lower nurse turn over and higher staff satisfaction in their job (Figueiro et al., 2014). Creating an overall better solution.

Figure 9.6. View to nature

Tip:
It is always a positive if the occupant has control over the temperature, humidity and lighting.

Nature in Multimedia

In the article B*iophilic Theory and Research for Healthcare Design* by Roger S. Ulrich many discoveries are presented relating to the direct and undirected views to nature. In this section, I will prove how nature in multimedia creates a biophilic environment by providing a positive effect on the space. Thoughtful alternative natural materials, forms and multimedia imitating nature within an environment have proven to make a difference with design by assisting the recovery process. "*Another direction of research has uncovered undisputed clinical advantages (faster healing hospitals) of natural environments, including artificial environments mimicking geometrical qualities of natural environment*" (Frumkin 2001; Ulrich 1984,2000,2008).

In 1984 Katcher discovered that if an aquarium was present in the lobby where a patient was going to experience surgery, stress levels would be lower compared to days when the tank was not present (Katcher, 1984; Ulrich, 2008). This test might have inspired Heerwagen due to the study. In 1990 Heerwagen tested how large natural mural influence waiting rooms; the results show that murals would lessen stress (Keller et al. 2008). These breakthroughs where great and continued to inspire others; in 1997 Whall et al. wrote about the qualities of natural sounds and natural images for patients with dementia including Alzheimer's (Whall et al., 1997). The discovery with this study shows that patients have less stress and are less aggravated reducing physical harm such as self-strikes and cutting. The next study is done by Ulrich, In his study he has three controlled conditions: one is a nature video, two is an urban video and, the third is daily shows on the television. The discovery made was that patients had lower blood pressure and pulse rates when the nature video was playing (Ulrich, 2003,2008). The final study was done by volunteers and proves that patients have a greater pain tolerance when assigned to a nature video tape on an eyeglass display suchas (waterfall, mountains, landscape) in contrast to looking at a blank ceiling (Tse et al., 2002; Ulrich, 2008).

Other studies that include artistic forms of nature have shown results that have a positively impacted with the recovery rates. Two examples prove that Bronchoscopy (Diette et al., 2003 ; Ulrich, 2008) and dressing a burnt patient (Miller et. Al, 1992; Ulrich 2008) have less pain and a higher pain tolerance. A different study shows that Colposcopy patients will have less pain but they will still require the same amount of required medications (Lee et al., 2004; Ulrich 2008).

Through these studies we have found that even with artificial connections to nature patients still have a more positive experience during a hospital stay. In addition to a positive stay they have calmer heart rates, lower blood pressure and a higher pain tolerance to a certain degree. An artificial environment has proven to reduce self-strikes, cutting from patients; concluding that multimedia within a healthcare environment will benefit the patients and users.

Biophilia

Light

Circadian Cycle and melatonin levels

Light similar to plants is one of the most important elements an environment pertains; in fact plants would not exist without light. Light has the abilities to prevent, restore, and purify an environment but without enough light humans may begin to feel sluggish and overtime depression may begin to sink in (Sassi, 2006). Ulrich then supports Sassi by stating *"Daylight affects levels of hormones melatonin, which influence levels of energy, alertness and activity."* For a human having adequate levels of melatonin is important, these levels are balanced through natural or artificial lighting and reduce the drowsiness and depression (Ulrich, 2008).

As you may begin to see light is used for more than just seeing. The positives of having the correct amount of melatonin in our system means we have less stress, better sleep and a reduction of smoking for smokers. *"Less stress does not stop the flu but does reduce getting sick."* By receiving the correct amount of light and sleep chances of anxiety and depression are lowered in addition to cardiovascular diseases and breast cancer (Figueiro et al., 2014).

With this in mind we must think about syncing the lighting environment to our circadian cycle. Light brightness and colors affect humans as well. Brighter or blue lights should be used in the morning while a darker warmer light in the evenings increases melatonin levels causing a better nights sleep. This may be done simply by swapping the light switch and adding a dimmer allowing for dimmer lights in the evenings. Finally but most important, lighting should be based on human needs and not energy savings for a heathier lifestyle (Figueiro et al., 2014).

Vitamin D

Light allows for humans to regulate their circadian cycle, and live a healthy life providing them with Vitamin D. The radiation provided by the sun is absorbed through our skin benefiting chemicals reactions such as the metabolism of vitamin D (Hoick, 2005). Vitamin D prevents certain chronical diseases such as rickets, osteoporosis diabetes type 1 and Rheumatoid arthritis. Vitamin D maintains the musculoskeletal system healthy which prevents muscle loss and strength. This is important for the elderly who are placed in long term healthcare facilities (Holick, 2005; Ulrich, 2008). Alternative studies show that agitation and aggression is minimized with dementia if they are treated with light with 2 cycles of 10 day repetitions. The best result is when the patient is exposed to bright light in the morning. The study then mentions that patients where more agitated on days that they were not treated (Lovell. et al., 1995).

Rapid Response

Lighting studies have been done all over the world. A study done in Turkey shows that people who were exposed to natural light for more than three hours would experience less stress and have a higher work satisfaction (Alimoglu and Donmez, 2005; Sassi, 2006). *"In Canada patients that would visit a hospital with severe depression would stay substantially shorter if they were in sunny room versus a shaded one."* Mortality rates where also was lower in sunny room than in rooms with north shaded rooms" (Beauchemin and Hays 1996; Sassi, 2006).

Compared to antidepressant drugs, light works much faster. Studies show that light can alleviate depression after two weeks while antidepressants have a lag time of 4-6 weeks resulting in longer healing period. (Martiny, 2004; Sassi, 2006).

Precaution

Even though light is an essential part of our life we must be aware that too much can cause aging of skin, eye damage and cancer (Sassi, 2006).

When design we must be thoughtful of spaces that do not require light or should be over lit to reduce glare and contrast; such as a pharmacy. In addition, direct light will generate heat and may create uncomfortable environments for patients. This is why studies have shown north facing windows use less screens benefiting from direct light at certain times of the year (Figueiro et al. 2014).

Biophilia

Neuroscience

Allostatic load is the wear and tear on the human body growing with stress over time. By researching into current technology we may begin to see how a person interacts within different environments. We might not realize it yet, but through the use of neuroscience, scientist have the ability to easily monitor health with the fit arm bands and beta testers creating a standard for stress in different environments. (Africa et al., 2014).

Uncertainty may be revealed with previous biophilia studies. Before tests where based on opinions. Technology now allows us to state facts such as *"Neuro Biological monitoring in particular of the damping of the alpha wave, during presentations of -abstract designs, have shown that the brain Is most aroused by patterns in which there are 20% redundancy of elements, or simple maze or two turns of a logarithmic spiral or an asymmetrical cross"* (Willson 2008).

After reading *Neuroscience, the Environment, and Building Design* by Nikos A. Salingaros and Kenneth G, Madsen II, I began to find key neurological studies and examples on the importance of incorporating biophilia into built environments. Within the article it is mentioned that a pathological wanting of a natural ambience is desired. Without stimulating, lively and imaginative places, individuals may respond in a physiological damaging way causing *"macular degenerations, stokes, cerebral achromatopsia and visual anosmia"*. By using Functional Magnetic Resonance imaging it is now possible to conclude that anxious feelings are created by sensory deprivation which may lead to a neurophysiological breakdown. Studies now show that *"Humans have an innate deprivation for certain types of information: the circuits for this have been associated with the brain's pleasure centers, which also control the reduction of pain"* (Birdman and vessel, 2006; Madesn, 2008).

With the ability of using neurological and physiological test, we now see how environments affect us physiologically. In a clinical experiment, after-effects show that people prefer a room with *"hierarchical subdivisions and natural detail."* Furthermore, when the individuals were asked they didn't seem to prefer a certain room. The research was done by comparing two rooms one which was **drab** and the other had **wooden beams** specifically placed" (Tsunetsugu, Miyazaki, and Sato 2005; Madesn, 2008).

Nikos A. Salingaros and Kenneth use an applicable example on the biophilic effects on zoo animals. The results showed considerable behavioral improvements if the animal was placed in a habitat similar to theirs. They also noted that they had better behavior patterns and it improved the animals *"psychological as social wellbeing".* Furthermore, rats raised in information rich environments allowed them to understand more resulting in a twenty percent increase in natural connectivity (Squire 1999; Madesn, 2008).

Stress

Biophilia can be used as a shield against stress by buffering stressors (Kaplan 1993; Ulrich 2008).

Stress has two extremes one is anxiety from too many tasks happening, on the other hand there is depressing with not enough going on. To avoid these two factors studies look into the anxious side which stimulates your brain through shadowy enclosure spaces, unwanted spiders or reptiles as well as sharp jagged objects (Ohman, 1986; Coss, 2003; Ulrich1993). On the other adjacent we have a space that does not stimulate your brain enough, slowly depriving you of motivations which may lead to depression. This concludes that spaces must be balanced with stress reducers and stressors to maximize productivity and health (Figueiro et al., 2014).

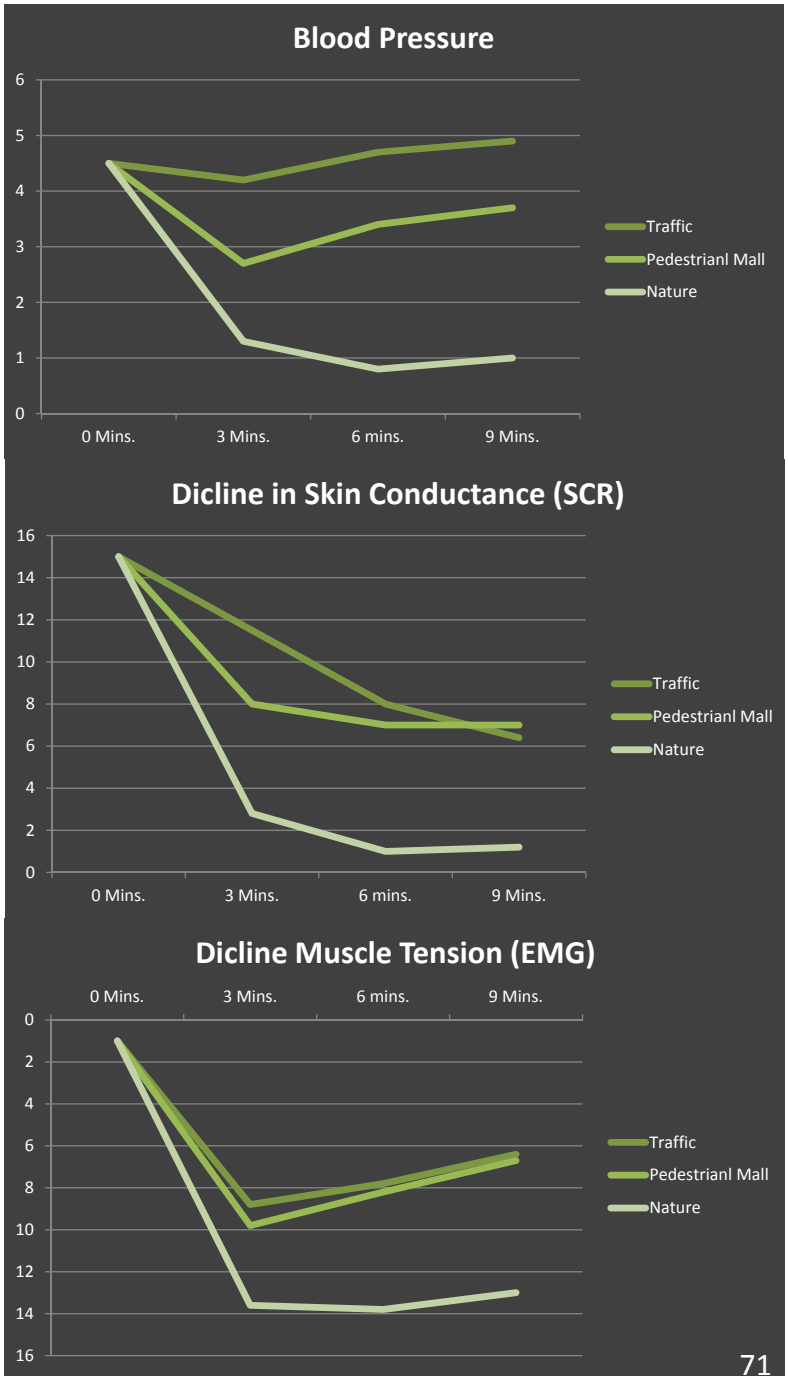


Figure 9.7. Blood, SCR and EMG Chart (Ulrich, 1984)

Biophilia

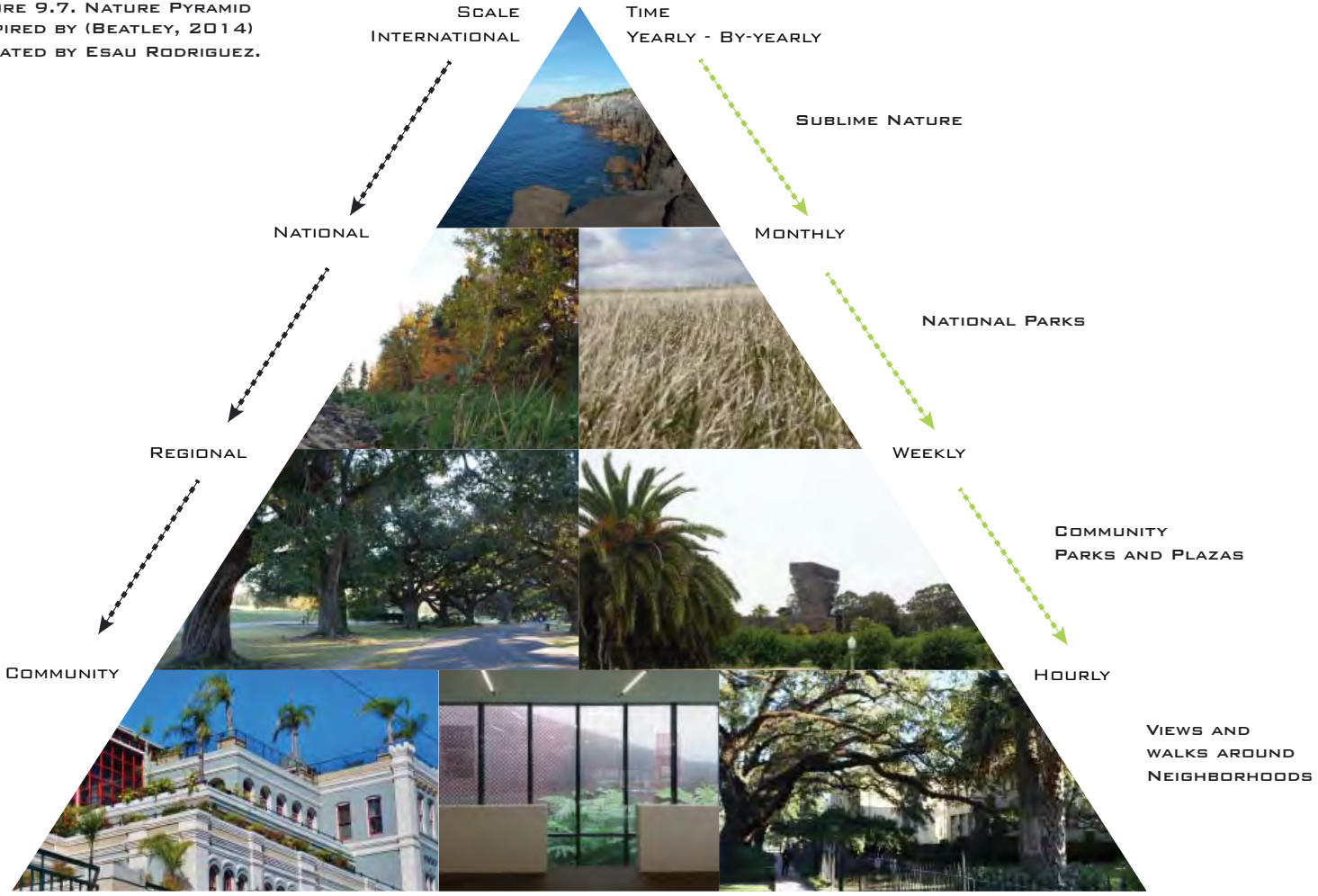
Stress Influencing Factors (Figueiro et al., 2014.)

Stress Reducers: views, lights, sounds, fragrances and labyrinths.

Stress Trigger: noise, crowding, light, odors and mazes

Bently mentions how biophilia may reduce stress and essentially reduce long term chronical stress. While describing Singapore's nature pyramid Bently describe the dose rate of nature for a healthy life from an hourly to a biyearly rate. *"Biophilia… is innately emotional affiliation of human's beings to other living organisms… Life encounters us exceeds in complexity and beauty anything else humanity is ever likely to encounter"* (Keller and Wilson, 2008).

Figure 9.7. Nature Pyramid inspired by (Beatley, 2014) Created by Esau Rodriguez.



Thermal Comfort

Thermal confronts relates to temperature, humidity, air velocity. In addition to having the correct temperature, if air velocity is increase 0.3 meters per second thermal comfort increases by 35°F *"Relative humidity levels are important and should be 40-50%. levels under 35% may cause dryness of the eyes nose and through."* Higher levels of humidity allows for the growth of mold on the contrast if the humidity is less than 61°F dust mites are then a problem (Sassi, 2006).

We must realize that at home we always need clean air since *"humans are the source for mites, mildew and mold causing our own dirty buildings".* Due to this we must be knowledge in how we manage thermal comfort within facilities in our environment. To avoid the problems above it is recommended that thermal comfort should be achieved by mixing radiant heat and ventilated air as shown on the thermal comfort figures. (Brager, 2014).

When entering a building, before setting the thermostat we must consider aesthesia. This may be described as a sudden burst of cold air when you walk into a building. This maybe what the public wants, but this will cause thermal discomfort since the climate is to cold over a few minutes. (Brager et al., 2014)

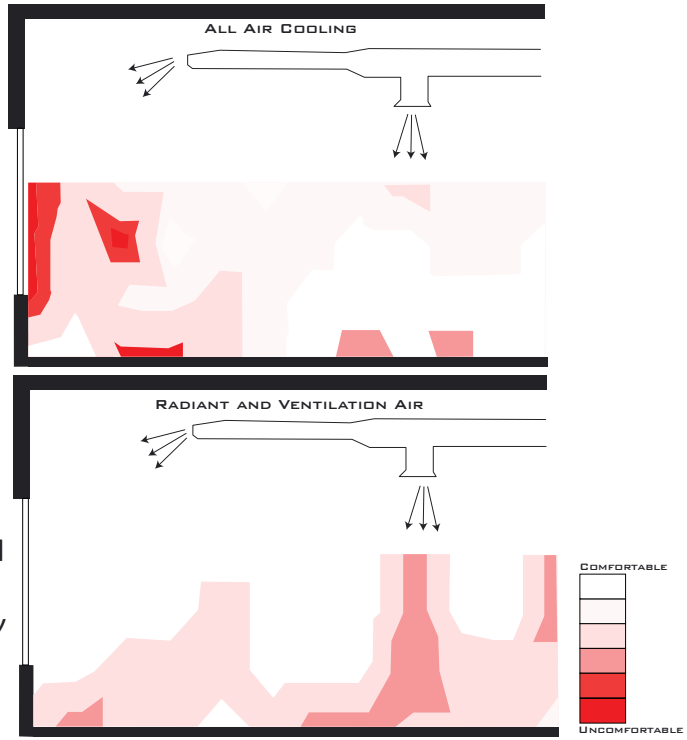


Figure 9.9. Ventilation and Health (Brager, 2014)

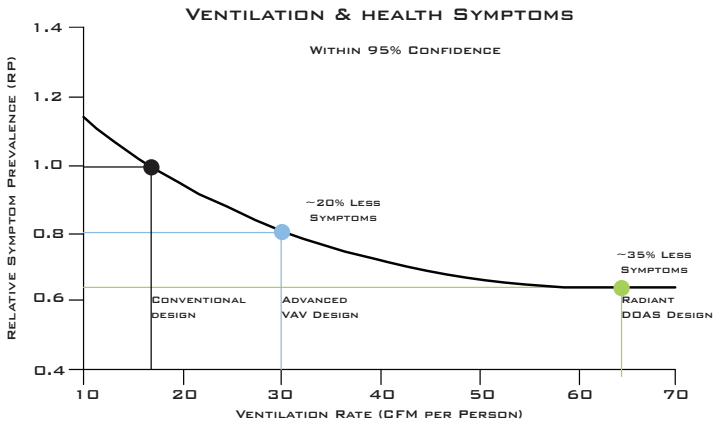


Figure 9.10. Thermal Heating Diagrams (Brager, 2014)

Biophilia

Indoor Environment

There are many vital factors that affect a healthcare facility . So far I have presented you with biophilic design strategies and thermal comfort and why it is important to design with nature. This section describes how noise can influence a healthy environment by increasing physiological and bodily fatigue through noise. The fatigue may begin at about 65 DBA where noise begins to interfere with mental activity and rise blood pressure. When the noise levels reach 80dBA and higher stress is experience; heart stress begins at 90dBA and by 145dBA ear drum may rupture (Sassi, 2006).

Kampschroer noted that people stop and talk most commonly in corridor environments and up to fifty-six to fifty-nine percent of people overhear what is going on (Figueiro et al., 2014). By adding plants within an environment we are lowering the noise level by placing matter that absorbs sound. According to the GSA people don't have the voice privacy they want. Offices also have high levels of dissatisfaction due to acoustics and people talking nearby (GSA, 2011). which is why it is very importan to consider acoustics into medical facilities.

Sustainability

"The larger challenge is to transform a wasteful society into one that meets human needs with elegant simplicities." (David Orr 2004; Guenther2008)

Sustainability should always be included in every project around the world. Hospitals in particular should consider sustainability since they are the second leaders in energy waste and have the least amount of LEED buildings being built (Hua 2010). Hospitals should be concerned more about the importance of sustainability and not as much concerned about the price. What they don't see is that by designing a sustainable hospital it will cost on average according to the Pebble Experiences $12,029,800 and save them $11,475,4062 (Berry et al. 2004).

Consequently Biophilic and well-designed spaces are resilient and allows the population to have more of social lifestyle, friendships and a healthier lifestyle. (Africa et al. 2014)

Design Tip

"Irregular, curved or angled walls can help mitigate unwanted sound reflections." (GSA 2011)

Tips By Bob Harris - Designing Biophilicly (Brager et al., 2014.)

Thermal

- Interior Air Temp
- Average temp. of enclosing surface
- Interior humidity
- Air Movement

Acoustical

- Frequencies
- Noise Levels
- Reverberation

Visual

- Lighting Contrast
- Glare Sistribution of lumans
- Colors, color composition
- Outside views

Olfactory

- Odors
- Carbon dioxide and other gasses
- Dust

Others

- Air pressure
- Electrical charge in interior air

Conduits

- Clothing
- Activity
- Adaptation and Acclimatization
- Daily and annual rhythms
- Room occupancy
- Psychosocial factors

Design Tip

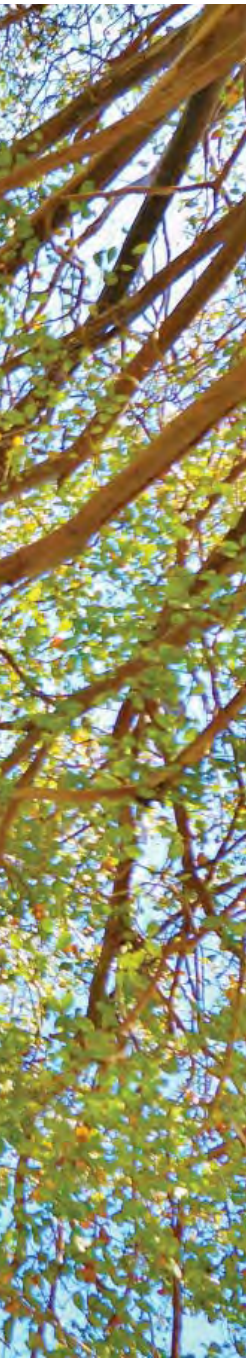
Include Highly hygroscopic materials such as clay, cork, timber, lime plaster, cellulose fiber insulation, and natural fibers.- Absorb moisture in high Relative humidity.

40-50% relative humidity is good

Theoretical Research

Figure 10. Light Trickeling through leaves

Summary



As technology advances so does desire, there was a time when representational surfaces where thought to be more sterile. (Kellert and Wilson, 1993). We now know better and have begun to use technology symbiotically with the environment. That explains why now is the time that we must return to a ***holistic design***, understanding the importance of ***biophilia*** and ***biomimicry***. My thesis in healthcare facility proves to have positive impacts when incorporating biophilic spaces and designing with foundation based on biomimicry - *linking biological systems with architecture*.

Assertive information that I acknowledged about biomimicry is that multiple biomimetic ideas should be used with in designs. If more biomimetic concepts impact a build in a positive way, why not make those possibilities transpire.

Biomimicry

Biomimicry is a direct move blurring the design boundaries between nature and architecture. As we move closer to a biophilic world we must remember the importance of borrowing designs strategies from nature and adapt them to our buildings. With current technology we are able to use bio-inspired designs improving buildings and blend them into the environment.

Overall my structural design will be inspired from the Seven Sister Oak tree but the overall design will be influenced from multiple subjects such as the monkey pod tree for breezes, leaves for shading, and duck feathers for thermal comfort. *Ultimately, with current technological advancements, nothing needs to be rediscovered we must parallel nature with technology creating enhanced design solutions.*

Biophilia

By integrating biomimicry into a design, it allows for the birth of a biophilic environment that current health facilities should include. After extensive research done my conclusion turned out to be positive on biophilic environment, meaning that I will continue a healthcare biophilic design.

When a biophilic design is present, it allows for the prevention on long-term chronical illnesses in addition to health problems. This is done thought a neurological relationship with nature that allows us to relate to it in positive ways since biophilia has been around from the begining of human kind. Our ancestors have been sounded by it and to this day we find indirect ways to relate a design to nature creating pleasant environments and emotions.

Summary

Emotions we have are then cause by our environment and what our sensory levels experience. Together the built and natural environment poses the ability to create a healing environment. We search for a biophilic design in response to less pain, stress, and physical recuperation views. Throughout the writing I touch on how elements such as vegetation, light, air and water make a large influence with a biophilic design. In addition to being ornamental, plants assist with air purification, filtering waste, masking sound and controlling humidity levels. Vegetation improves the overall interior air quality and assists with the prevention of sick building syndrome.

Biophilic View

When in a healthcare facility direct views to nature are important to minimize pain, medication, recovery time, complaints and evoke positive emotions. This in the long run causes lower blood pressure and faster healing rates. Studies such as the abdominal recovery show that patients show less pain recover faster and use less medication if a vegetated view is provided. In addition biophilic views are important regarding the workers assisting with higher staff satisfaction, less errors and a lower nurse turn over.

Nature in Multimedia

Undirected views to nature using multimedia might not create a complete biophilic environment but it still influence the user. Though the use of imitating natural materials human response to recovery are show to improve.

These environments are presented through, videos, painted ceilings, murals, portraits and sounds. The results show lowers stress, blood pressure, heart rates and reduced self-harm. In addition it provides higher pain tolerance to a certain degree creating an overall positive experience.

Lighting

One of the most important things that I learned from researching light is that we should base it on our needs. Light has the ability to give life to an environment or a gloomy feeling. Light levels allows for the circadian cycle to regulate causing better sleep and reducing sluggishness during the day. Melatonin levels are highly impacted with light levels. Brighter levels cause more activity and alertness reducing the possibility of depression and lowering stress. In addition to prevention depression, studies show that it also alleviates depression at a much faster rate than antidepressant drugs.

Through light our body receives Vitamin D which prevents diseases such as rickets, osteoporosis, diabetes, and arthritis and muscle loss. The positive effects that light has on us reduces the chances of getting a cardiovascular disease and breast cancer. Even though light is a desired attribute we must considered that excess light may cause harm to eyes, skin and may even cause cancer.

Neuroscience

We may now draw data from humans in what environments they prefer through brainwaves and emotions. Monitoring our health through functional magnetic resonance imaging and innovative technologies has made this information possible. Results show that we prefer biophilic environments with hierarchical patterns. Neuroscience will allow us to continue design for specific human needs and obtain a healthier psychological as social wellbeing.

Stress

Biophilia serves as a shield blocking us from stressors that create anxiety and long term chronical stress. Meanwhile different aspects of biophilia such as lighting focus on reducing emotional depression. Simultaneously these two health factors must be in balance to produce an environment that allows the user to be calm while maximizing productivity and health.

Thermal Comfort

Thermal comfort is very important in healthcare facilities. A well balance in humidity, air velocity and temperature is required. If the air is to dry it may cause irritations in patient eyes, nose and through as well as dust mites; if it is too humid mold may occur. To solve this we must consider materials, the use of radiant heat and ventilated air within the facilities.

Indoor Environment

Healthy indoor environments consider noise due to physiological and bodily fatigue. This is due to distracting noise causing annoying sounds that stress out patients. In some cases noises may even rupture ear drums.

Sustainability

Designing sustainably will not only reduce the carbon footprint but create natural environments that create resiliently in spaces. Hospitals being the second leaders in energy waste need to get closer to current design strategies while implementing strategies that creates a healthy environment for the patients. Even though LEED buildings may cost more, initially that cost will be recovered through well designed biophilic sustainable facility.

Project Justification

Healthcare facilities, hotels resorts and museums have always interested me. By selecting this project it was specially targeting healthcare facilities however, my theoretical aspects of biophilia and biomimicry have no restrictions into what building they are implanted within. Even though biophilia may be implemented in any design, healthcare facilities receive the most benefit form nature and the wellbeing of an environment.

Healthcare facilities are constantly improving requiring knowledge designers who know specifics about healing environments, medical spaces, materials and user necessities. These topics inspired me to research, discover and learn about design methods within healthcare facilities. While I am not a guru in hospital designs, I have learned an abundant amount on healing environments and hospital layouts. With this in mind I have established a building block that will hopefully complete a complex solution with the integration of nature, sustainability and emotions.

Justifying this project through data was simple. When relating my thesis project to other building types healthcare was predicted by the American Institute of Architects to Increase by 8.8 present in 2015 (AIA, 2014). Subsequently, I believe that having knowledge of the specific spaces will allow for an enhanced design environment.

The abilities are there, we have experiments supporting biophilia and biomimicry. There for more Hospitals should be designed this way while incorporating a resilient design. By designing a sustainable healthcare facility it will not only be a step closer to a carbon neutral planet but save the facility money within three and a half years at a thirty-three percent return rate. (Pradinuk, 2005)

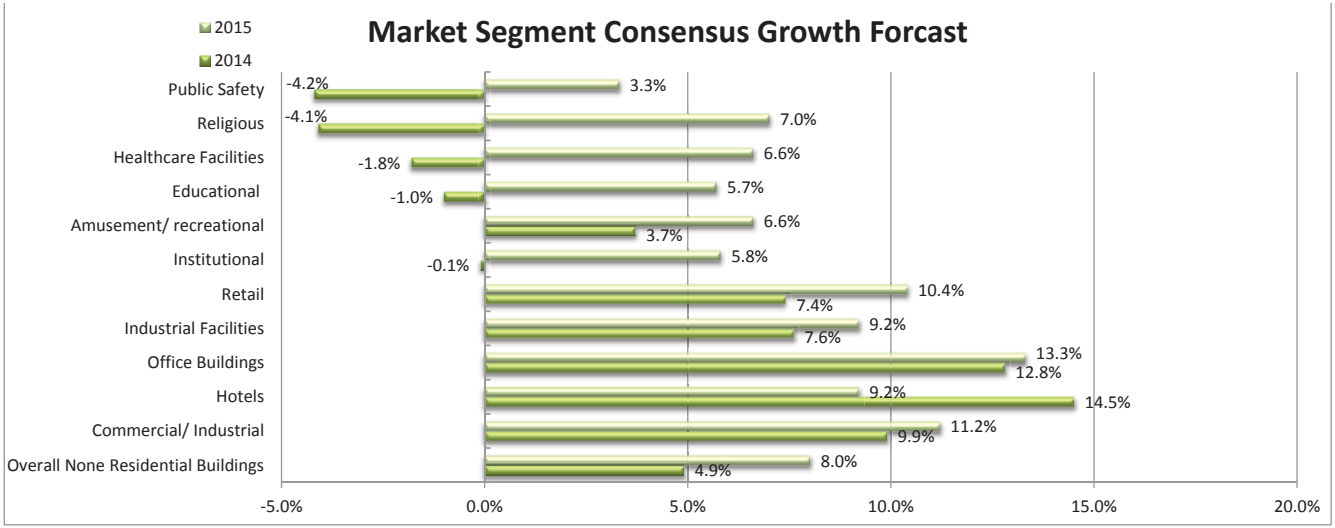


Figure 11.1. Market Growth Forcast

Figure 11.2. LEED Certified Buildings

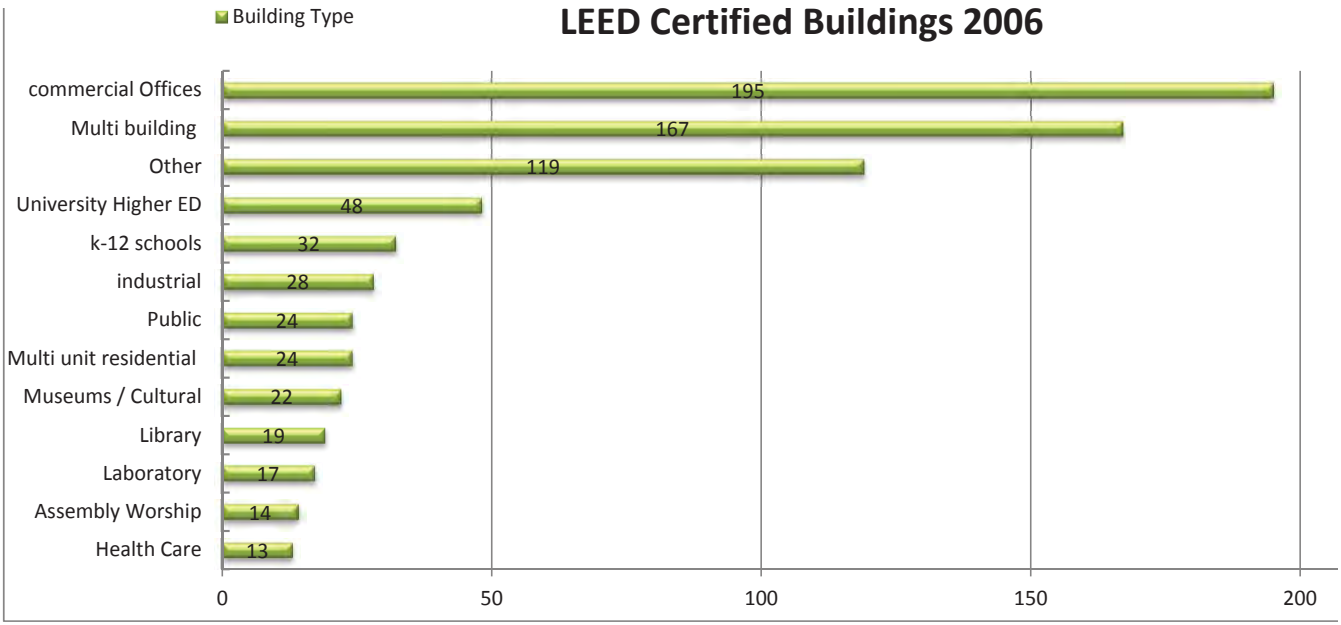


Figure 11.3. LEED Certified Building Types (Guenther 2014)

History

"Old paradigm hospitals are neither an accident nor mistake it is a product of the evolution idea of society, science, and the status of medical communities (Miller and Swensson, 2002).

New Orleans

French & Spanish

Originally named La Nouvelle Orleans was built around Jackson square which was originally name Place d'Arms. New Orleans, was a desired location due to the shipping industry, unfortunately it was five feet underground making it difficult to create a city and port. In 1718 New Orleans was founded by Sieur de Bienville a Frenchman, which was able to solve the topography issues. (New Orleans Conservation & Visitors Bureau 2014).

In 1762 King Charles III received Louisiana from Louis XV. Making it officially Spanish territory allowing for high trades patterns with Cuba and Mexico until 1801. During that time New Orleans had two massive fires one 1788 and 1794 destroying over 1000 structures; meaning that most off the current building within the French Quarter are actually Spanish (Ibid).

Figure 12.0. Light Trickeling through leave

Louisiana Purchase

In 1801 Louisiana gave power back to France, They owned it for twenty days and sold it for only 15 million dollars. The United States bought Louisiana which was 828,000 square miles from Napoleon *"Doubling the Size of the United States"* and what is "*considered one of the greatest real estate bargains in history"* (History, 2014). With this land New Orleans was able to become the third-largest city and wealthiest due to its porting incomes and slaves (New Orleans Conservation & Visitors Bureau 2014).

Figure 12.1. 1803 Louisiana Purchase

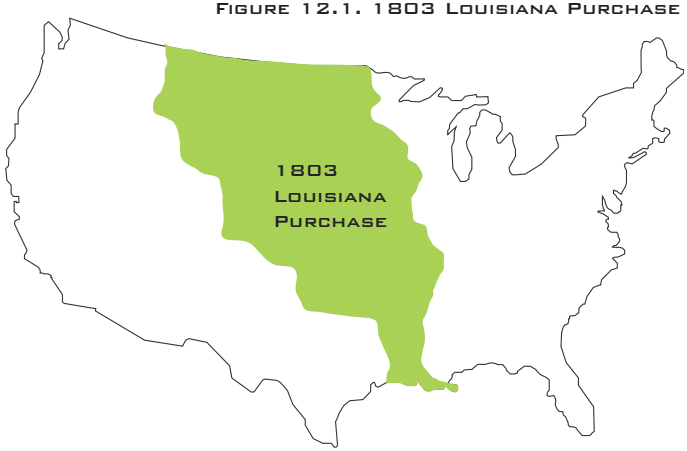
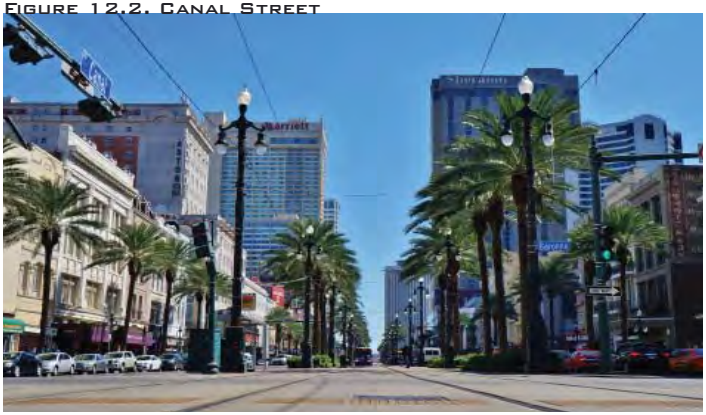


Figure 12.2. Canal Street



Once America purchased the land, Europeans immigrated migrated to Louisiana. After a while they used non-european habits making them creoles. In addition to this in 1804 the Haitian Revolution appealed the afro Caribbean community making New Orleans more diverse. Until 1830 the community was mainly French speaking. Through out this time there was many arguments with the community so Canal Street became a neural place for the incoming American and current European settlers which lead to a central business district. (New Orleans Conservation & Visitors Bureau 2014).

During the 1870 many social and economic changes were happening due to Ku Klux Klan forcing black out of the area. In addition, the rail road industry had grown reducing the necessity of shipping supplies mainly cotton thought the Mississippi (Ibid).

HISTORY

Twentieth Century

In the 1900 the city's streetcars were electrified and are currently running on the same network. With the advancements of technology in that time, new pumps and levees, allowed for the growth of the city by emptying swamps. Even though, the levees helped to expand, during Katrina they failed leaving eighty percent of the city flooded. After the flood it was found that it would cost 135 Billion dollars' worth of damage and leave 986 dead (Plyer, 2014).

Walking though the city, many damaged building express scars left from the hurricanes. New Orleans today continues to restore what it has lost but better intentions by integrating sustainably and energy saving methods to the reconstruction of the city.

Figure 12.3. Streetcar

Figure 12.4. Scars of Katrina

Hospital

Throughout history Illnesses have transferred from person to person in hospitals. With this in mind people used to visit hospitals in short period of time, if it wasn't because of illnesses money was good cause. Throughout time insurance and prices have been adjusted as well as the layouts and designs. The layouts have been altered due to successes and failures. Currently healthcare design is interested in the environment of the hospital; how can a design be built that physiologically improves the patients' health. (Miller and Swensson, 2002).

The History of Healthcare from Emotional to Psychosomatic Inspired by (Miller and Swensson, 2002).

1200 B.C.	First hospital patients cared for in Greek temples- baths, fresh air, sunlight, rest, baths, exercise, and reasonable diet is available.
600 B.C	Priest Physicians- administrate prescribe drugs perform surgery.
273 & 232 B.C.	India Cikistas – better surgery and efficacious medication, overnight stay.
Dark Age & Middle East	Ecclesiastic set up hotels next to church patients treated through carrying passion spiritual comfort. Cairps Al Mansur Hospital for separate in patients, serious patients, nurses, and long term. Physical medication evolves – wide range of drugs.
Renaissance	Word hospital became know from Latin meaning guest or host.
1700	Century Palladian Model different floors with different functions.
1762	Stonehouse Plymouth most advance medical design of the period. Theory of Miasmatic: bad air causes disease.
1800	Total institutions including architectural elements bureaucratic. Hospitals become institutional.
1850	Miasma takes over new hospitals through stagnant air. Separate buildings joined by an arcade.
1870	Hospital become more expensive due to social, cultural and profession values.
1900	Physicians consolidate prestige from science. Hospitals attract patients from all social classes. More humane environments are created. Designs reduced noise, improved lighting and beds. Medical technology is included with design.
1980	Ulrich medical test are done to improve medical facilities.

Figure 12.5. Health Care Time line

HISTORY

Social

Today New Orleans continues with discrete racism. Walking through the city many pockets and neighborhoods of races exist proving that it still lingers. To solve this problem there are current organization that exist in reducing racism so that it becomes extinct.

Education has changed dramatically in New Orleans. In the beginning they had segregated schools. After the civil war student where able to enter segregated schools but the whites would leave; "leaving a core that was increasingly African-American and impoverished" (History, 2014).

Figure 12.5.0.0. Trombone Shorty

Statistics

Religion: Currently sixty-four percent of the population there is Christian. (City Data, 2014)
Economic Status: poverty rate was about twice the national average. (The United Sates Census Bureau, 2014)
Crime: The crime rate was 25 percent higher (Crime Mapping, 2014)
Education: Most of the public schools were failing (Specifically with Special Education) but have been improving after hurricane Katrina. (New Orleans Conservation & Visitors Bureau 2014).

Figure 12.5.1. NEW Orleans

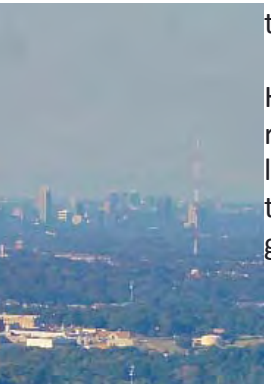
Mardi gras New Orleans, also known as The Big Easy, is branded for its large parties, parades and festivities including Mardi Gras which happens at the end of Easter. But the party don't end here since Jazz was born here it has a large influence on the community and tourist scene.

New Orleans has particularly changed overtime compared to the rest of the United States. This was caused by ethnicities bringing their own customs and cultural values but adapting the current ones. It began with the French and Spanish but continued with the Americans Italians, Greeks, Filipinos and Sicilians.

New Orleans creates a foreign place for most Americans. It begins in a broad scale with the traditional Spanish architecture. After that you begin to catch the smaller details such as the sounds and the jazz players on every other corner of the French quarter. Art also has a large scene with in the community; it has its place in the morning throughout the city and a market at might within the French Quarter. After exploring for a while you might get hungry and with so many different cultures you might not know what to select but they make it easy by specializing in: chicken, sea food, po' boys, spicy meals and jambalaya.

Due to the shipping market, trading was very important with and so was the port. Large cargo ships can be found in this area traveling on the Mississippi connecting New Orleans to the rest of the country. If business is not what you are looking for steamboats allow for travelers to travel thought water, some even carry cars allowing them to avoid driving across Lake Pontchartrain attracting many tourists throughout the whole year.

FIGURE 12.5.2 FERRY BOAT



Hurricanes are going to happen here. Everyone knows it which makes designing in certain areas more restrictive than others. In 1909,1915,1947,1965 and 2005 major hurricane affected New Orleans leaving many resident in poverty. The most recent was Rita and Katrina a category five storm, after the hurricane only eighty percent of the population returned. Ten years later the population is still growing and hospitals are in need creating key developments within the society.

History

Figure 12.5.4. VA Hospital

Verification

Due to hurricanes, many people were injured and have traumatic stress requiring a place to recover. Since then, many medical centers have not been reopened due to the damage caused by Katrina. While some are in construction they may not be for the general public such as the VA. Distance to a hospital is another key reason why I have selected New Orleans. The nearest facility that is similar to this healthcare facility is across town making it difficult for ambulance during high traffic times .

Figure 12.5.5. VA Hospital

Site Analysis

Grids

Exploring though New Orleans may be confusing unless you know the grid patterns. Throughout my site the grid is in a radial pattern. The node of the grid pattern for New Orleans lies where Earhart Blvd, Washington Ave and S. Jefferson Davis Parkway where they create a weaving and meshing pattern. The neighborhood sizes then vary from this point, as you get farther; the neighborhoods get larger until they reach the Mississippi River.

Figure 13.1. Road Grid

Figure 13.2. Site Panorama

Nature

Figure 13.3.2. Existing Nature

Built

Figure 13.3.2 Built

Site Analysis

Existing Textures in PLAN

Throughout time New Orleans has seen many natural disasters, but for the past ten years many developments have been made throughout the community. Around the site we can see old weathered homes, a church and new VA hospital have integrated nature into the design allowing for a biophilic environment.

Figure 13.4.1. Site Image

Site Reconnaissance

Figure 13.4.2. Site Image

Figure 13.4.3. Site Images

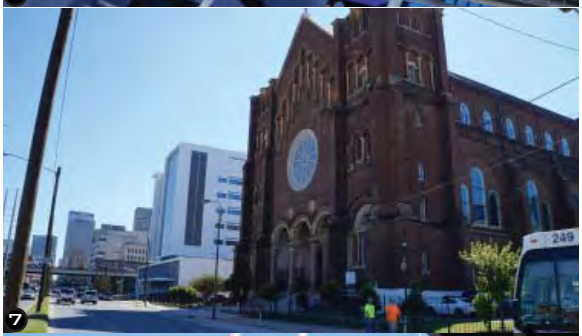


Figure 13.4.4. Site Images

Shapes & Shadows

Geometry near Site

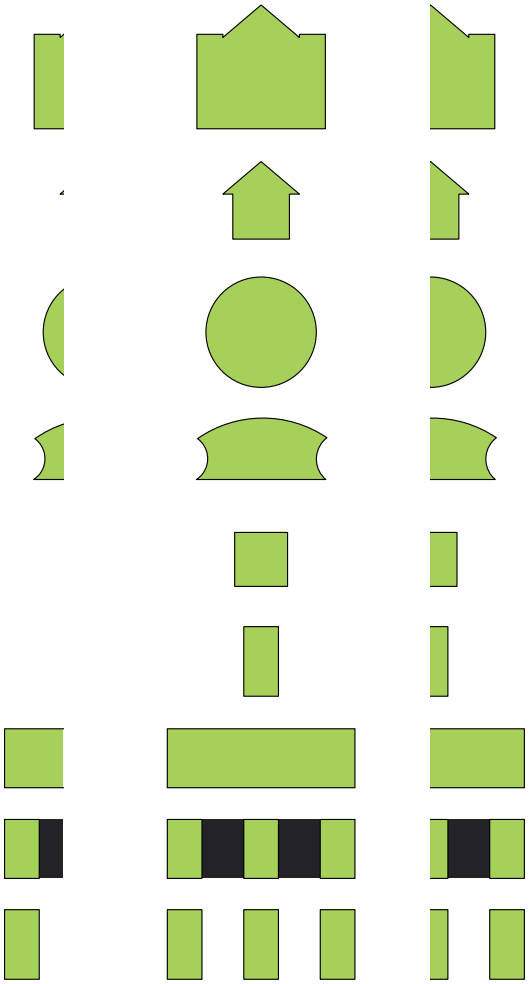
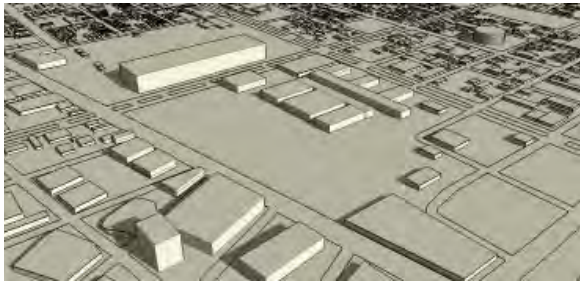


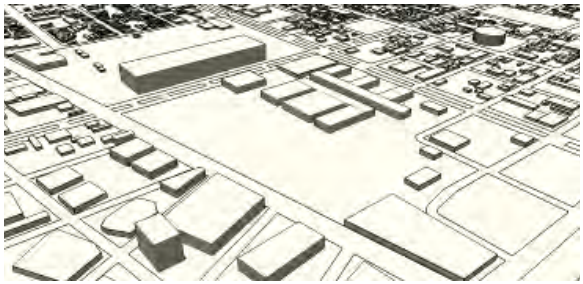
Figure 13.5.1 Shape Geometries

June 21/22

Morning



Noon



Evening

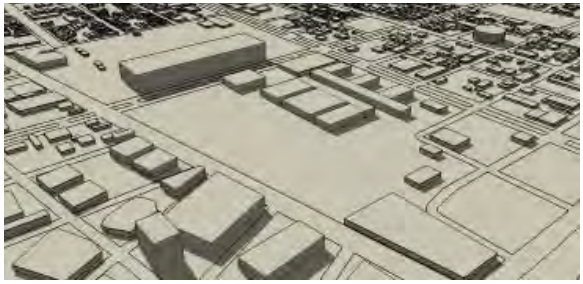
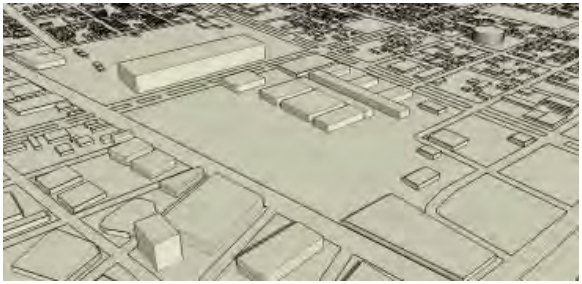


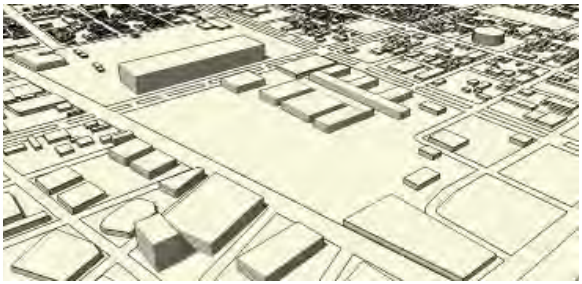
Figure 13.5.2. Solstice and Shades

March, September 21/22

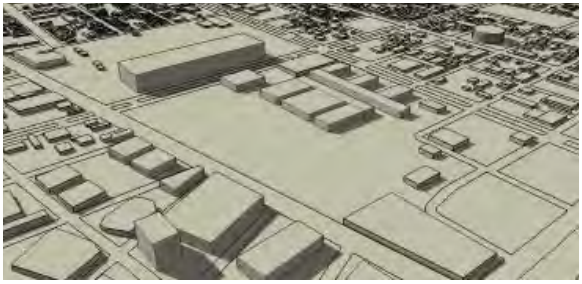
Morning



Noon

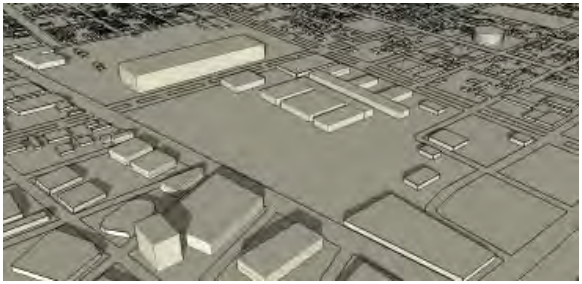


Evening

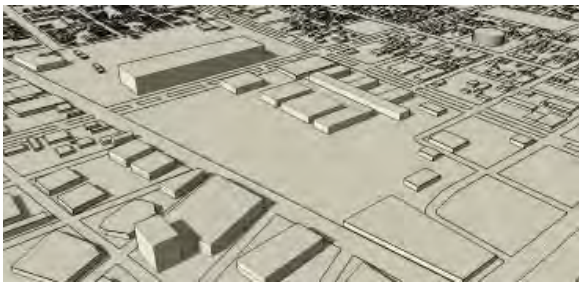


December 21/22

Morning



Noon



Evening

As we can see from the diagrams the site received plenty of natural light though out the whole year.

Topography

Due to the site location of New Orleans some areas fall below sea level. Laying between the Gulf of Mexico and Lake Pontchartrain the New Orleans topography ranges from negative ten in some area to positives topography. The average height of New Orleans is near or below sea level but Levees protects the city from flooding.

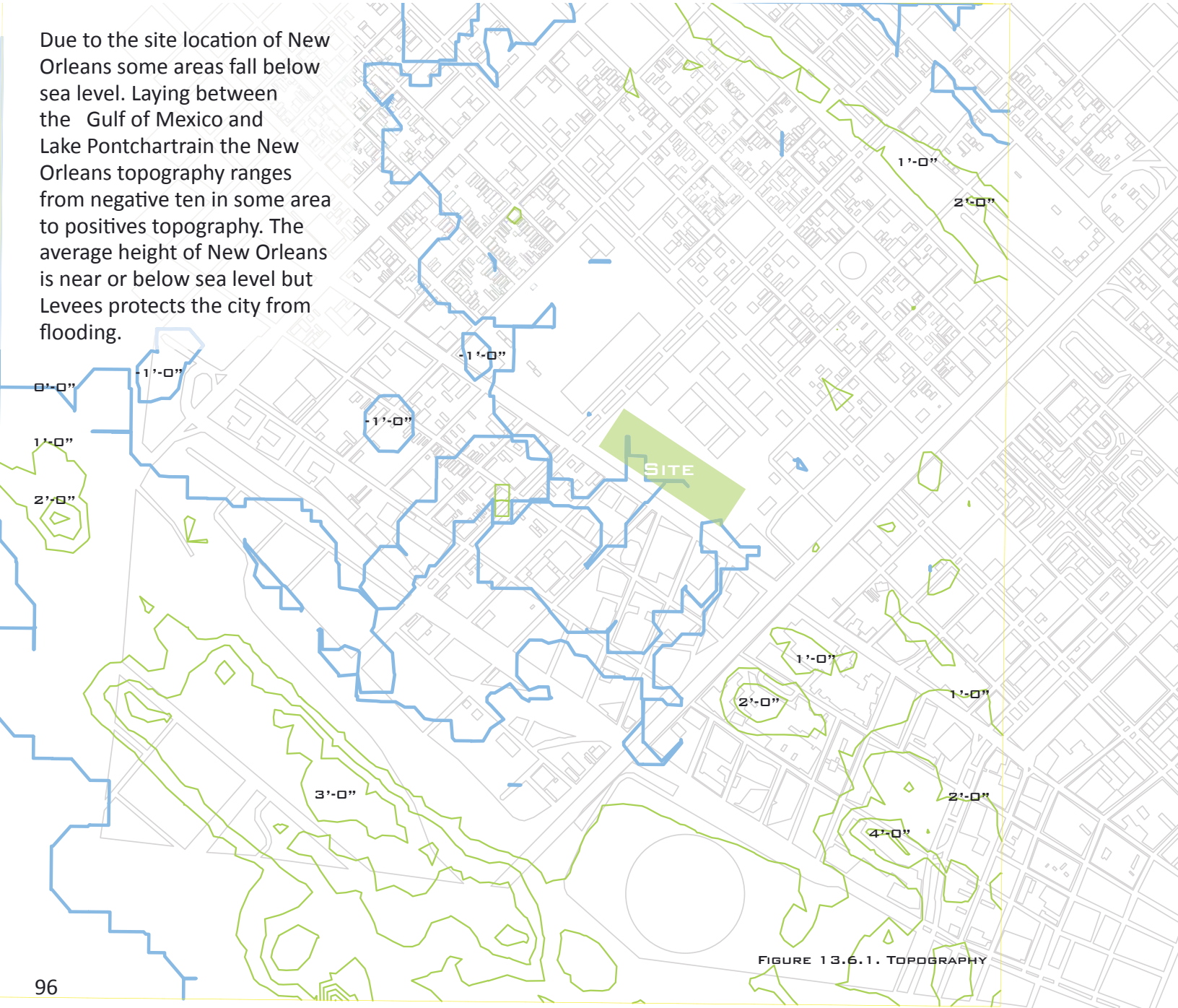


Figure 13.6.1. Topography

Zoning & Master Plan

Currently the site is on an empty site which is next to a VA Hospital and Louisiana State University. After looking at the zoning map my site falls within a medical Zone; In addition to correct zoning the current master plan has planned to set other medical facilities there fitting my idea.

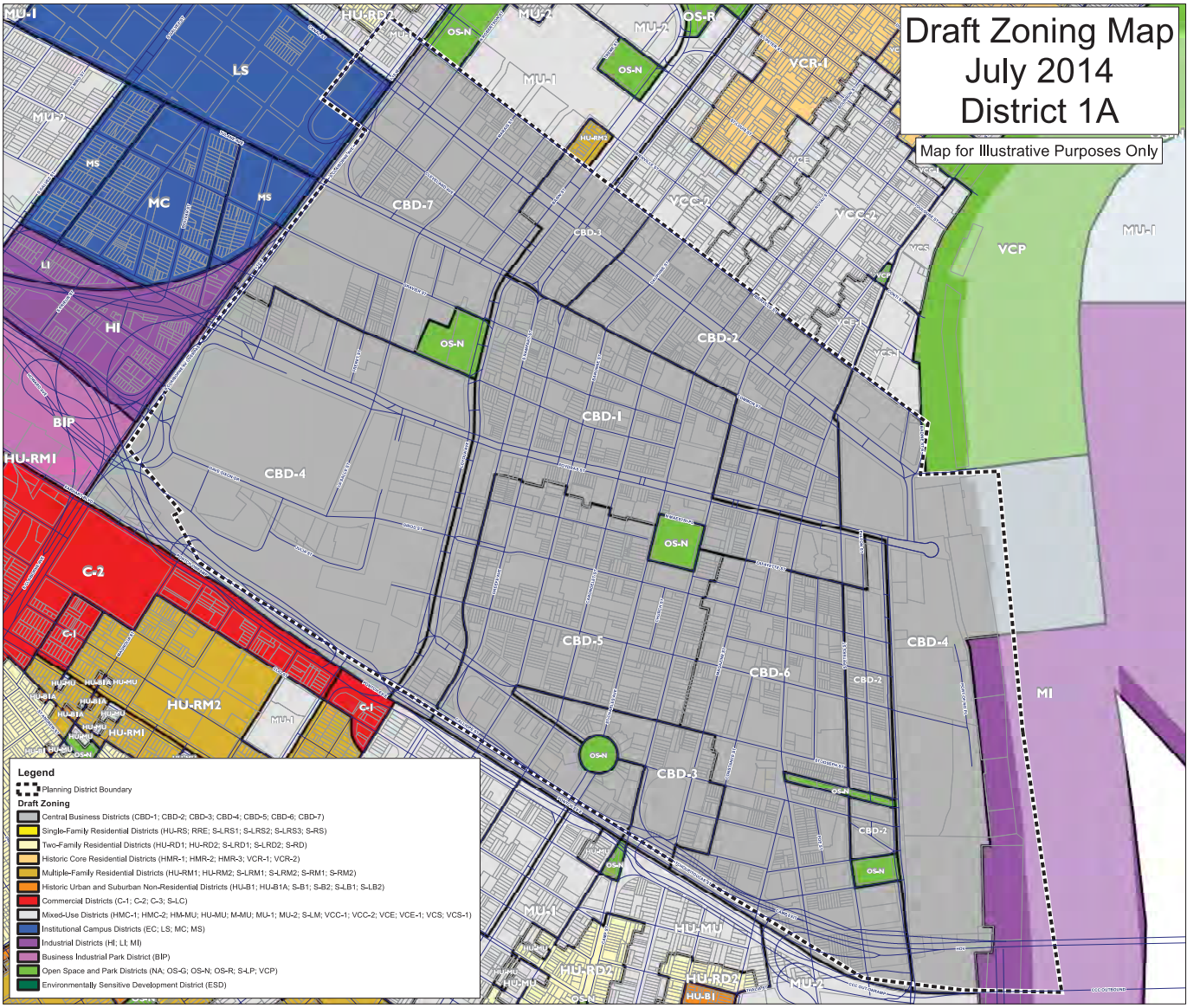


Figure 13.6.2 Zoning

Soils

Due to the Mississippi River and the Location of New Orleans the soil classification of New Orleans tends to be on the clay side.

Description Soil

Dark Brown:

Dominant Order: Vertisols Soil order 95%,
Soil Suborder: Aquerts, 95%,
All areas are prime farmland

Light Brown:

Dominant Soil Order 95 % Inceptisols
Dominant Soil Suborder:
Aquepts All areas are prime farmland

White:

Area has null classification
Not prime farmland. (ArcGIS, 2014)

Soil Texture

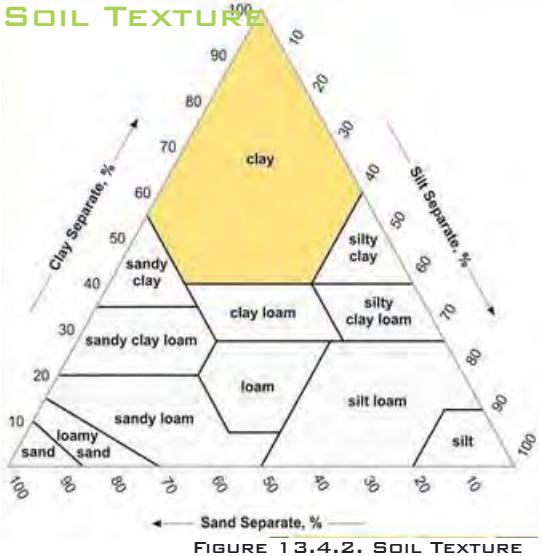


Figure 13.4.2. Soil Texture

Soil Legend

Figure 13.4.2. Soil Legend

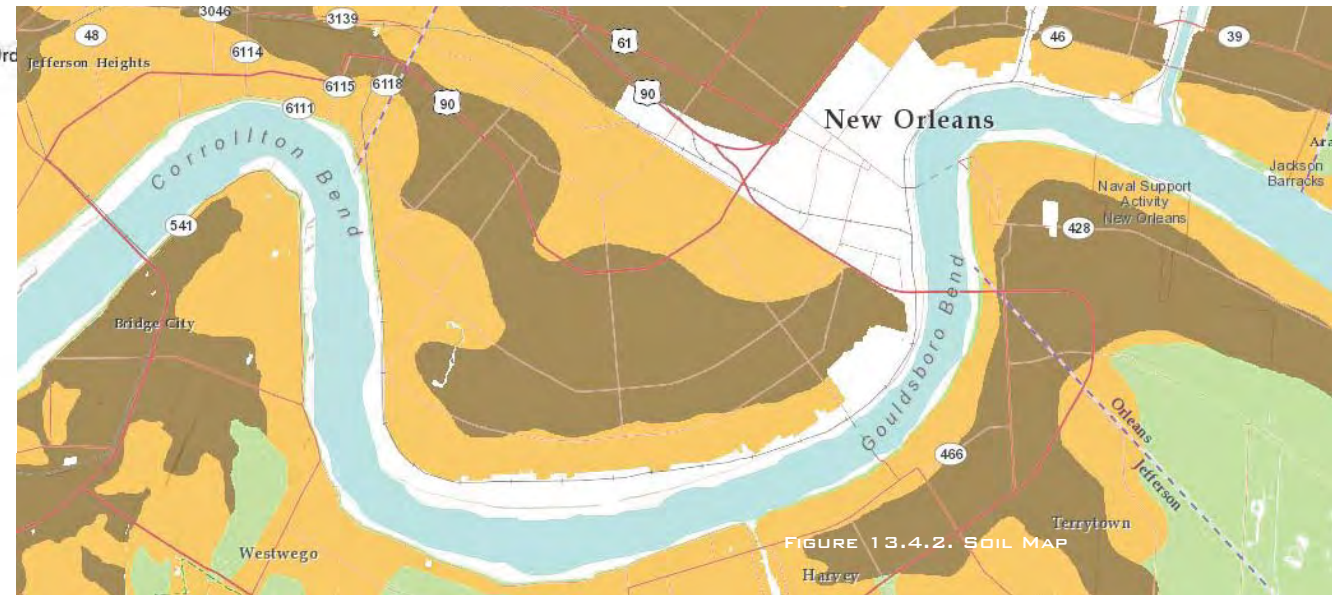


Figure 13.4.2. Soil Map

Water Table

Within a mile from my site lies the Mississippi river. Even though it is within walking distance it is not visible. Throughout its path the Mississippi collects many contaminates and toxins from boats and human waste. By the time the tail end of the river reaches New Orleans and the Gulf of Mexico delta the water is certainly not potable.

There are not many other water features around the site but I do plan to add a rain garden or retention pond allowing for the watering of vegetation and other non-potable uses.

(ArcGIS, 2014)

Annual Minimum Soil Depth to Water Table (beta

Water Table Depth - Annual - Minimum

- 0 - 25 cm from the surface
- 26 - 50 cm
- 51 - 75 cm
- 76 - 100 cm
- 101 - 125 cm
- 126 - 150 cm
- 151 - 175 cm

Figure 13.4.3. Water Table

Wind

Throughout the year New Orleans experiences mild summer wind. During the summer wind speeds can be as low as 6mph but during hurricane season they have been recorded to reach up to 175mph. The average high, medium and lows wind speeds are: January and December 10 mph, May and June 8, Sept, Oct 8 mph, June and Aug 6 mph.

By creating wind diagrams I was able to analyze that the wind pressure near my site will increase during the summer allowing for a passive wind system during the summer. During the winter the site didn't seem to be affected much by the wind but to reduce wind speeds I will buffer the Northeast side with vegetation increasing thermal comfort.

Wind Rose

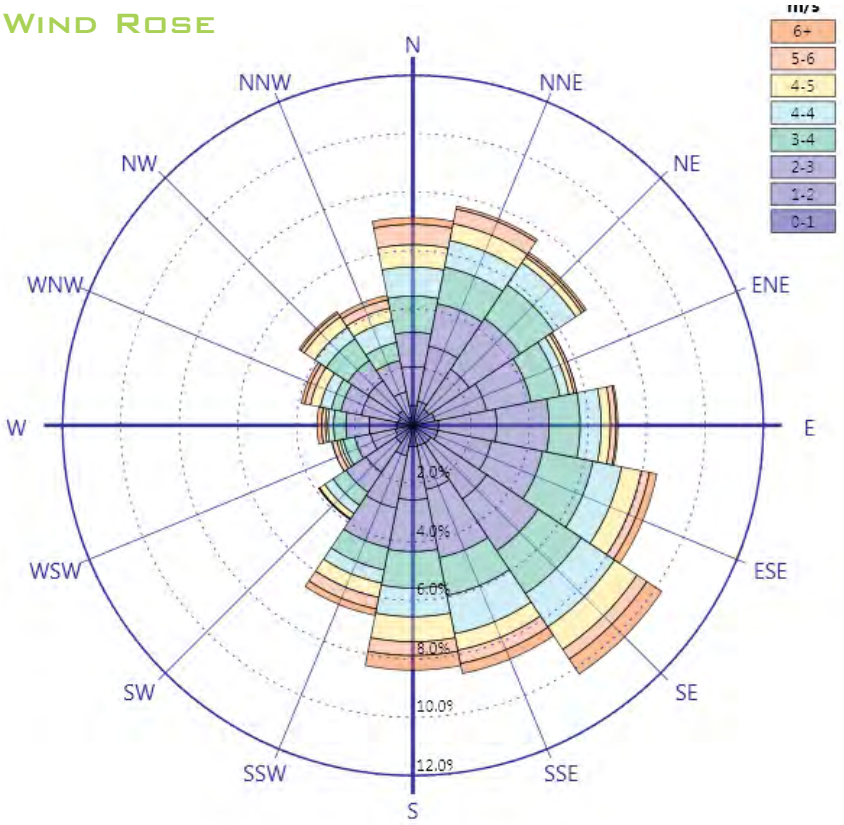


Figure 13.7.0. Wind Rose (Vasari 2014)

Wind Speed MPH

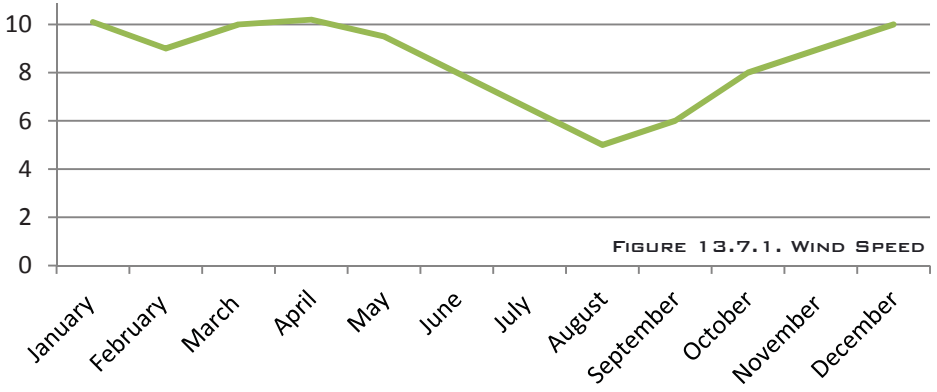
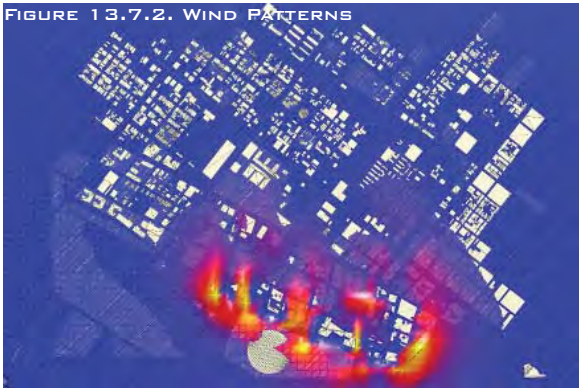


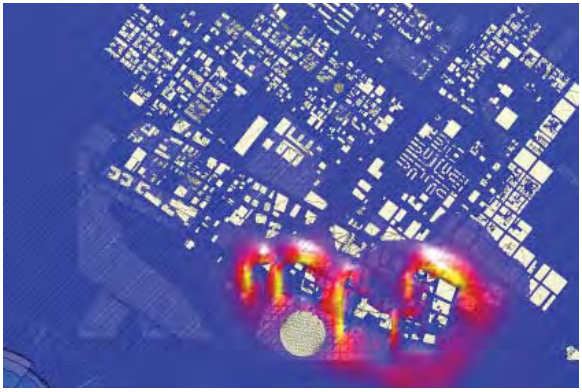
Figure 13.7.1. Wind Speed

South

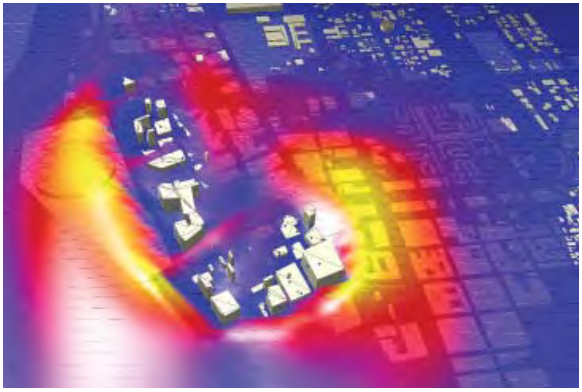
Figure 13.7.2. Wind Patterns



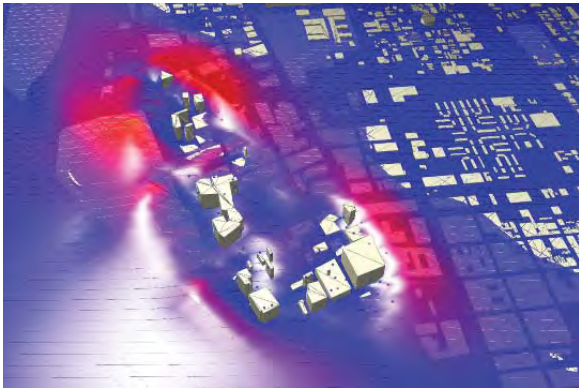
North East



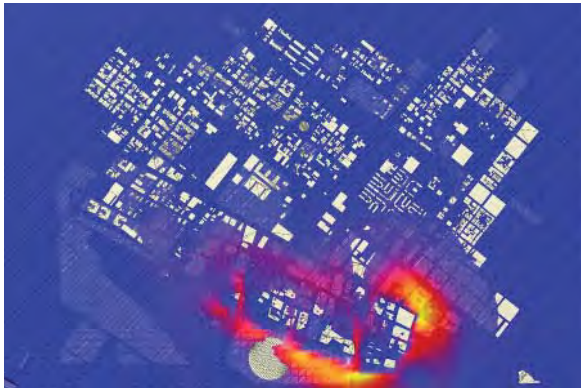
Summer



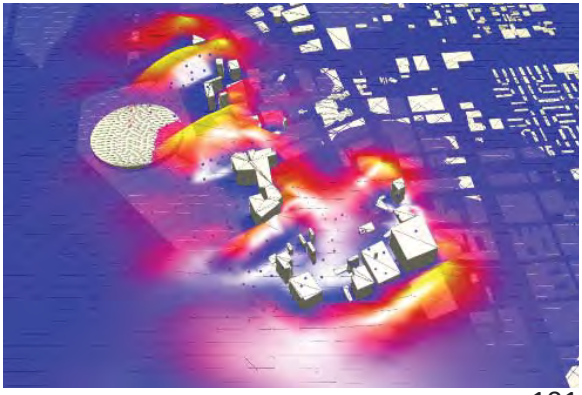
Winter



South West



North East



Site Analysis

Human Characteristics

The site overall is improving drastically to the west there is a church, North South and West will have new medical facilities and educational buildings. With this in mind they need more restaurants since there was only one in walking distance which was at its max occupancy. Other alternatives available for lunch are food trucks by they are surrounded by construction workers. Other than that the alternative would be taking the trolley or driving a few blocks out. Currently the majority of people there are construction workers working on the VA, doctors and nurses working in the VA.

Figure 13.8.0. Crime

(Crime Mapping 2014)

Being next to a campus the site is much calmer than many colleges. Since bars don't have to close most of the parties happen on Bourbon Street and Canal meeting that much more crime happens in those areas. The site is not perfect though, there has been a few crimes reported within the perimeter and bad will happen anywhere.

Figure 13.8.1. Visual Forms

For more images refer to Page 91.

Boundaries and Easements

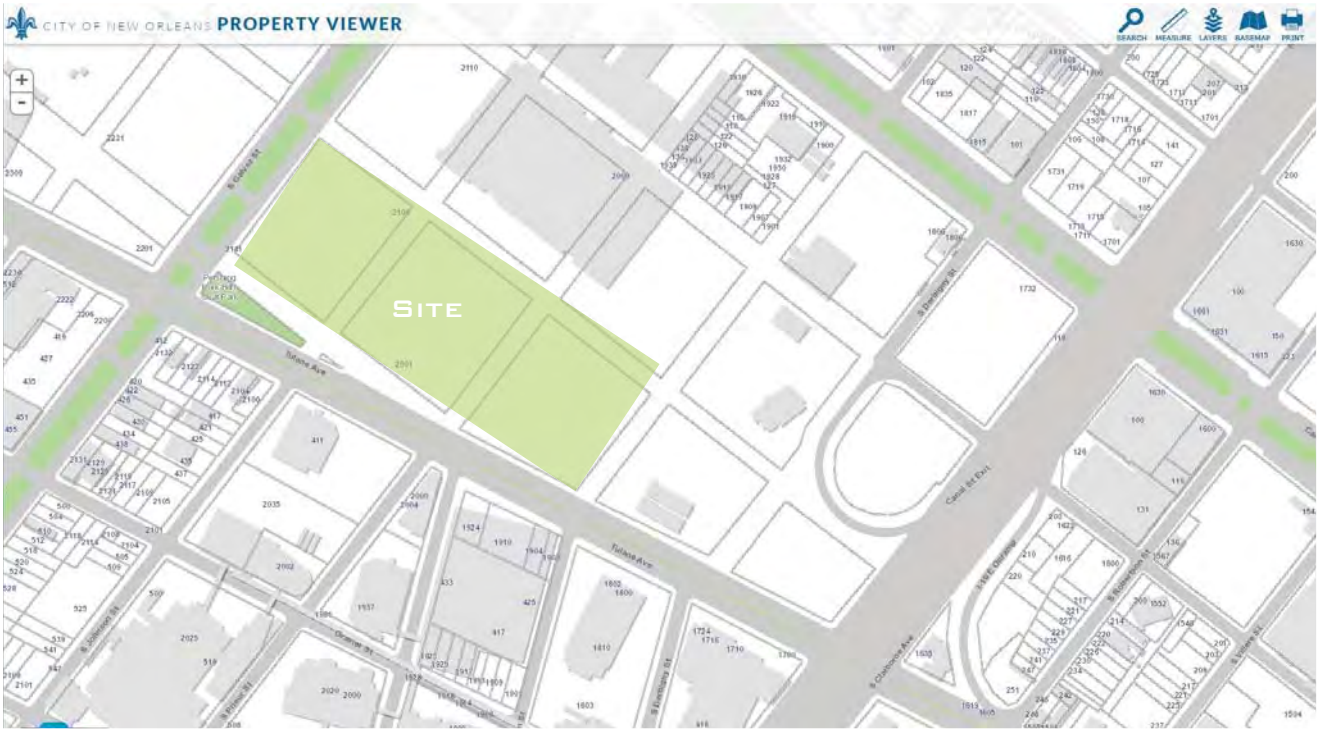


Figure 13.9.2. Boundaries
(Property Viewer, 2014)

Land Price: $362100

Maximum hight: - Typ. 50-70 ft.
on lots adjacent to residential districts : maximum height permitted in adjacent residential district1
on lots adjacent to nonresidential districts : none
Minimum depth of front yard : Average of block per Section 15.5.8.5; otherwise 20 ft.
Minimum side yard : 10 ft.
Minimum rear yard : 10 ft.
Minimum floor area (for permitted office building, restaurant, clinic or nonaccessory shop) : 1,000 sq. ft.
Maximum Floor Area Ratio : 4.00

Site Analysis

Vegetation

The site currently does not have vegetation due to the VA construction. Throughout the city oak trees create allies, canopies and an ornamental feature. The trees are places about every twenty feet and near my site there are also palm trees. Most of the vegetation is fully grown except for the trees on the south side which look young. Trees are great in all aspects but better when they are larger and older, allowing them to cast shades and shadows while cooling the environment and purifying the air.

Negative: Some people may avoid heavy vegetated neighborhoods because may be afraid that someone may be hiding in the bushes.

Expected Vegetation on site

Date Palm trees, Live Oak trees, Dwarf Palmetto, American Elms, Logleaf, Banana Tree, Cast Iron, Algerian Ivy, switch grass, little blue stem and sago palms.

Parks

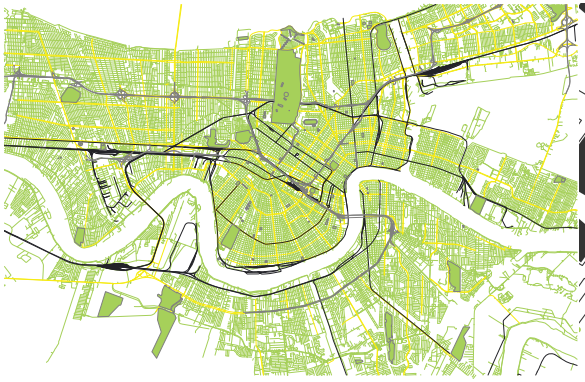


Figure 13.9.3. Parks

Vegetation Around Site

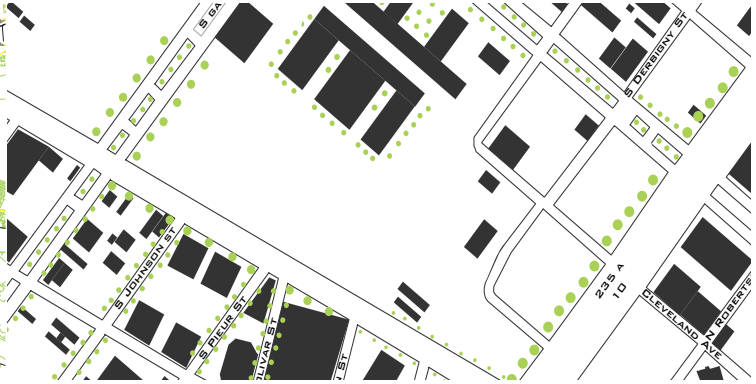


Figure 13.9.4. Vegetation

Distress On Site

The site is currently under construction but when it is finished the surroundings will implement a biophilic environment. The biophilic movement throughout the city is currently on a micro scale but it getting closer to a macro scale as nature spreads throughout the city by the process of reconstruction.

Temperature

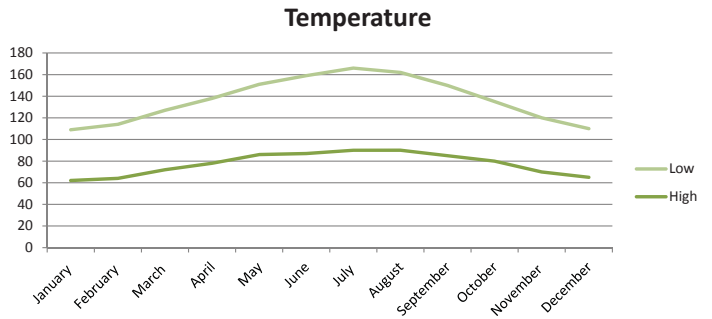


Figure 13.9.4. Temperature

Humidity

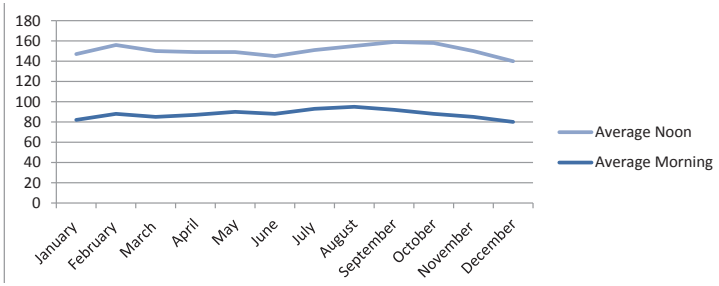


Figure 13.9.4. Humidity

Rain

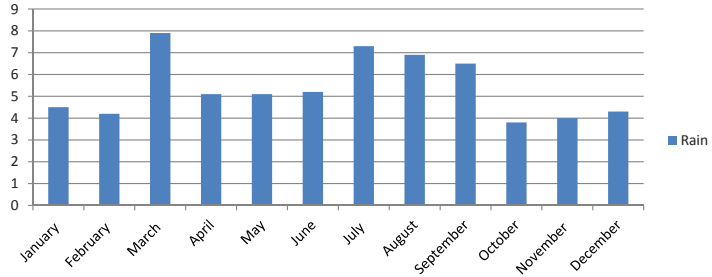


Figure 13.9.4. Rain

Due to its costal location the temperatures of New Orleans are not extreme. The temperatures stay within a common range during the day and night due to the humidity levels, since it takes more heat to warm dense air. With high humidity rain is common but we can see that March gets much more than the rest of the year. On average they get around 108 days of rain, 210 days of Light and 50 cloudy days though out the year (US Climate Data).

Site Analysis

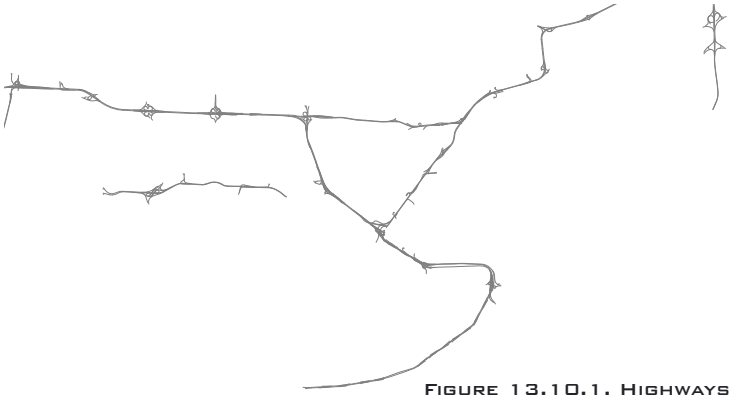


Figure 13.10.1. Highways

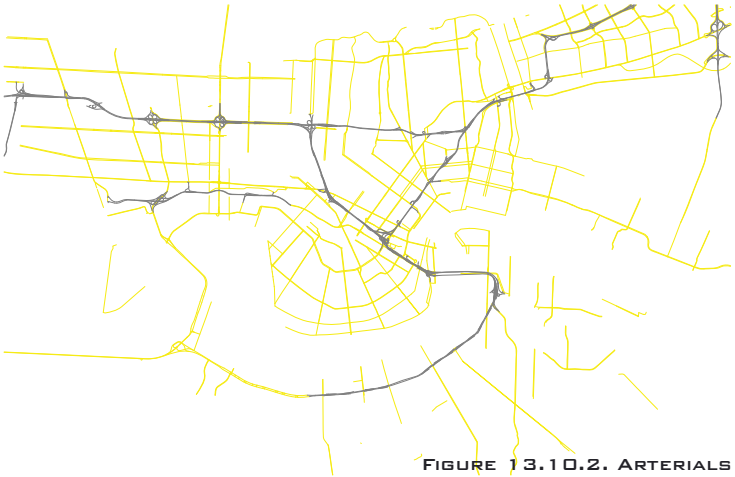


Figure 13.10.2. Arterials

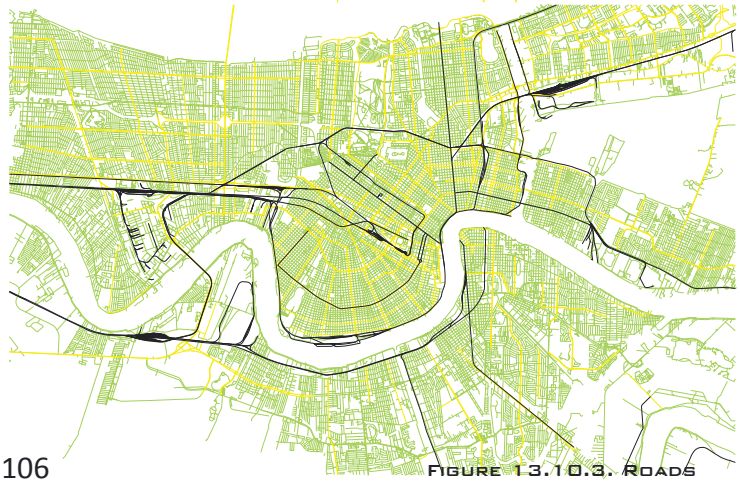


Figure 13.10.3. Roads

Circulation & Sounds

The circulation within the site and inner roads is pedestrian friendly but Tulane Gravier has a high traffic rate. Begin an arterial road it allows travelling throughout the city faster simplifying access to the hospital by the quickly flowing traffic. On the other of the block lays Canal Street which is also busy. Both of these streets have moderate traffic with cause reasonable amount of noise.

On Canal Street the bus and trolley line passes through creating easy access for visitors who are not privileged or able to drive a car. To the southwest of the site about one block away sits interstate 10 which increase the accessibility time to the hospital in emergencies but maybe noisy. Currently there are large oak tresses along the highway to buffer the sound.

The site is currently not the most adequate site for walking or biking around. Even though there are sidewalks the empty site makes the street look larger causing drivers to dive with less care and faster. With this in mind adding vegetation near the street may cause them to drive with more caution. I plan to add flashing light at the crosswalks so that pedestrians are notice quickly.

Figure 13.10.4 Road chart

Sun Path

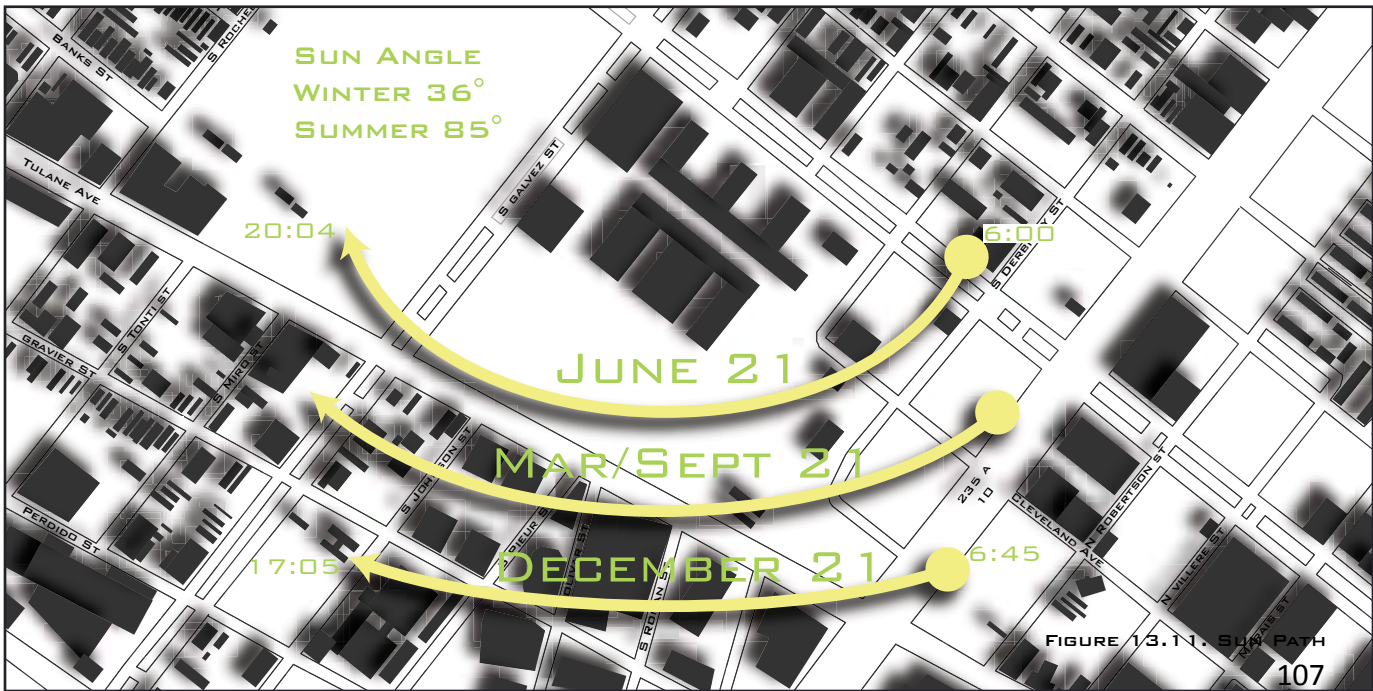


Figure 13.11. Sun Path

Summary

The layout of New Orleans is set in a radial pattern around the Mississippi river. Being in the delta of the Gulf of Mexico it has a high possibility of getting struck by a storm or hurricane approximately every 2.8 years. This has allowed the city to grow preserving and restoring its historic buildings and create a modern city.

Although the city may have hurricanes the weather is typically enjoyable with mild summer wind and warmer winters than many other states. The site specifically will get more natural wind according to Vasari in the summer by the wrapping motion of the wind around the city

Next to the site a new VA Hospital is being built and the Louisiana State University has its health school there. With the amenities provided the location as a hospital will be beneficial to all of the other facilities and there medical necessities in emergencies.

Since New Orleans is on or below sea level and between the Gulf of Mexico and Lake Pontchartrain it is prone to flood which is why levees are set. To relax on the Mississippi river a ferry ride may be nice but not swim in due to all of the contaminants. The typical soil is clay with a 95%, Vertisols Soil and Inceptisols which is 95 %, Dominant. These two soil types range evenly throughout the city.

The sun around my site is rarely affected by other buildings and vegetation since it is currently an empty site used to hold materials for a project on the lot next to it. The city is full of vegetation and I plan to continue the pattern by setting an oak tree every twenty feet by the street. The sun in the winter the sun rises at 6:45 which is 45 min earlier than in summer. The Sunset on the other hand has a three hour difference going down at 8:04 in the summer and 5:05 pm in the winter.

The current human characteristics are currently very different due to all of the construction. Typically students, locals, tourist, patients, nurses and doctors would walk around the site. Since it is next to a medical campus facility there may be a few disturbances but they should be minimal according to the crime chart.

Over all the circulation of the site is perfect for a medical facility. It has quick access off of the highway and an arterial road passing the site. Creating a cycling, pedestrian friendly site will be a challenge but something worth designing.

Psychrometric chart

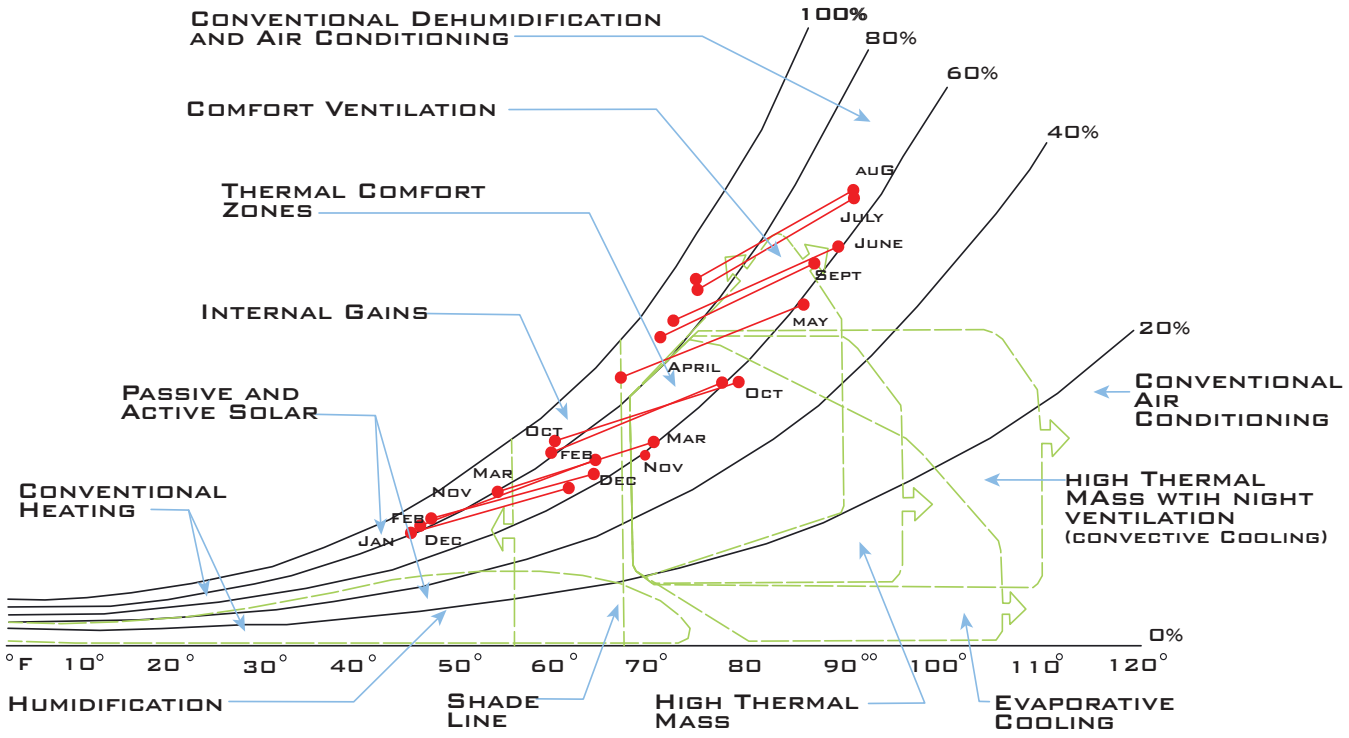


Figure 13.12. Psychrometric chart

Building Program

Lighting chart

Assembly	Lux	Foot-candles
General	100-200	10-20
Autopsy	500-1000	50-
Autopsy table	2000-5000	200-500
Morgue	200-500	20-50
Cardiac Function		
Lab General	500-1000	50-100
Inspection	1000-2000	100-200
Work area	200-500	20-50
Storage	200-500	20-50
Corridors	100-200	10-20
Night	50-100	5-10
Operation, Delivery, Recovery & Labs	500-1000	50-100
Critical Care	100-200	10-20
Examination	500-1000	50-100
Surgical Light	5000-10000	500-1000
Hand washing	1000-2000	100-200
Emergency Room	500-1000	50-100
Locker Rooms	100-200	10-20
Examination Rooms	500-1000	50-100
Laundry Linens	200-500	20-50
Nursing Station		
General	200-500	20-50
Desk	500-1000	50-100
Medical Station	500-1000	50-100
Patient Rooms	50-100	5-10
Observation	20-50 2-5	

Assembly	Lux	Foot-candles
Critical Examination	500-1000	50-100
Pharmacy	50-100	5-10
Night Light	20-50 2-5	
Gymnasium	200-500	20-50
Post Anesthetic Recovery Room	500-1000	50-100
Local	5000-10000	500-1000
Radiology	20-50 2-5	
Waiting Area	100-200	10-20
Reading	200-500	20-50

Table 14.1. Lighting Required (Brager, 2014)

Light quality is very important for the patient's wellbeing and satisfaction with the space. For long term patient it allows for the circadian cycle to stay regulated and if the lights are managed correctly they will improve sleep, health and moods. In addition to mood and wellbeing lights are very important while examination a patient and during surgery. The light must be selected correctly creating the perfect contrast with the least amount of glare.

Sounds barriers are important within hospitals. Regularly the correct amount of comfort and stress is important for optimum performance and by adding noise it can assist to create that balance. Even though the workers should be at peak performance the patient's room should be stress free so that their recovery time increases by focusing on their recovery instead of noise. The levels wanted in these spaces would be 0dB but in reality they will be 20-25dB. If conventional heating was not used the noise level would probably increase to 40dB.

The spaces define have been divide in to 5 broad sections that separate the facility between interior, exterior, public and staff. I began the space descriptions as if I was arriving to the hospital and what would make me feel welcome. With this in mind instead of a parking lot there is a plaza that binds the entry with the building. All the lobby spaces within the building will hopefully have a view or interaction with nature creating a subconscious positive effect on stress and health. With this in mind there will be gardens and courtyards throughout the building allowing the users access to nature and light.

Next we have staff spaces that range from security to therapy. These spaces are the spaces that support the primary users increasing health and efficiency. These spaces will be placed throughout the hospital and may be used as buffers due to noise levels and the amount of time that is spent within them. By including a wellness center in the design I allow workers who are stressed and work long shifts an alternative to a healthier break instead of watching television.

Building Program

Area, Usage, and Noise

Space	Area in SF	Usage per day	User Time	Noise in dB
Public Spaces				
Entry/Plaza	1800	24 hours	∞	70
Circulation	165000	24 hours	5-10 min	50
Lobbies and Waiting Rooms	5000	24 hours	10min-24 hours	30
Gardens throughout-Hospital	1900	24 hours	∞	30
Exterior Court Yards	900	24 hours	∞	50
Gift Shop/ Book store	900	8am-10pm	5-30 min	40
Dining	1500	8am-10pm	5-60 min	60
Pharmacy	600	8am-10pm	5-15 min	50
Out Patient Services/ Examination Room	10000	8am-5pm	60 min	60
Staff				
Wellness Center	1000	24 hours	30-120 min	70
Changing Rooms	900	8am-5pm	10 min	30
Admin	1500	8am-5pm	8 hours	50
Physicians Office	200	8am-5pm	60 min	60
Physical Therapy	5000	6am-6pm	60 min	60
Security	600	24 Hours	24 hours	60
Kitchen/ Break room	1000	8am-5pm	10-60 min	70
Storage	3200	24 hours	-	50
HSK housekeeping	200	8am-5pm	-	50
Staff housing	1000	8am-5pm	60 min	40
Medical Office				
Doctors Office	400	8am-5pm	60 min	40
Nurses Station	600	8am-5pm	8 hours	40

Space	Area in SF	Usage per day	User Time	Noise in dB
Emergency Care				
Ambulance entry	1200	24 hours	-	110
E.R. wait	900	24 hours	10 min- 240min	70
ICU Intensive Care unit	2000	24 hours	1 day - 1 weeks	20
CCU Critical Care Unit	2000	24 hours	long term	20
Surgery	30000	24 hours	30min-16hours	40
Central Sterile Support	900	24 hours	2hours 50	
In Patients	15000	8am-5pm	1 day - ∞	60
SICU Surgical - Intensive Care Unit	5000	8am-5pm	30min-16hours	20
MICU Medical - Intensive care units	5000	8am-5pm	30min-16hours	20
Lab	10000	8am-5pm	8 hours	70
Total SF	**275,200**			
SF Per Floor	**91,733**			
Under Ground				
Underground parking	29400	24 hours	∞	90
Underground Mechanical	6000	-	-	100
Underground Total	**35400**			

Table 14.1.2. Area, Usage, and Noise

Budget for the project.

Cost per Square Ft: $211.49	65688794
Contractors Fee with overhead 25%:	16422198.5
Architects Fee 9%:	235911991.46
Total: per Square Ft	**$88,022,983.96**

Table 14.2. Budget
(RSMeans, 2013)

Building Program

Medical offices is where doctors and nurses will have their office. For the placement of these units I must consider the frequency traveled to other locations specifically nurses. Yale University studied the locations that nurses would travel to allowing them to create frequency chart assisting designers.

Frequency %	Nursing Staff links
19.1	Patient room to patient room
16.7	Nurses station to patient room
14.1	Utility rooms to patient room
9.8	Nurses station to utility room
6.1	Nurses station to elevator
5.8	Nurses station to medical clinic

(Kobus, R. 2008)

Emergency and Recovery rooms is the primary reason why the facility will be designed. This area should have purified air and have materials that are sterilized and easy to clean in emergencies. This area should also have changing room, a frozen section and anesthesia. In the emergency care area is where most all of the inpatient and intense care patients will be located.

I selected to place the parking underground to increase vegetation around the city. The mechanical room will also be placed below grade making it less noisy and creating more space above ground for the users. Circulation was determined by taking thirty three percent of the overall building area.

The materials used will be hurricane resistant on the exterior and hygienic within. I will select materials that create and resemble a biophilic environment. The materials and colors will be based on pleasing subconsciously for example green and blue are used to relax people which is why most scrubs are mainly green and blue relating to nature and the ocean. The wellness center will then be red increasing adrenal and heartrate of the user for a better workout (Sanders, 2008).

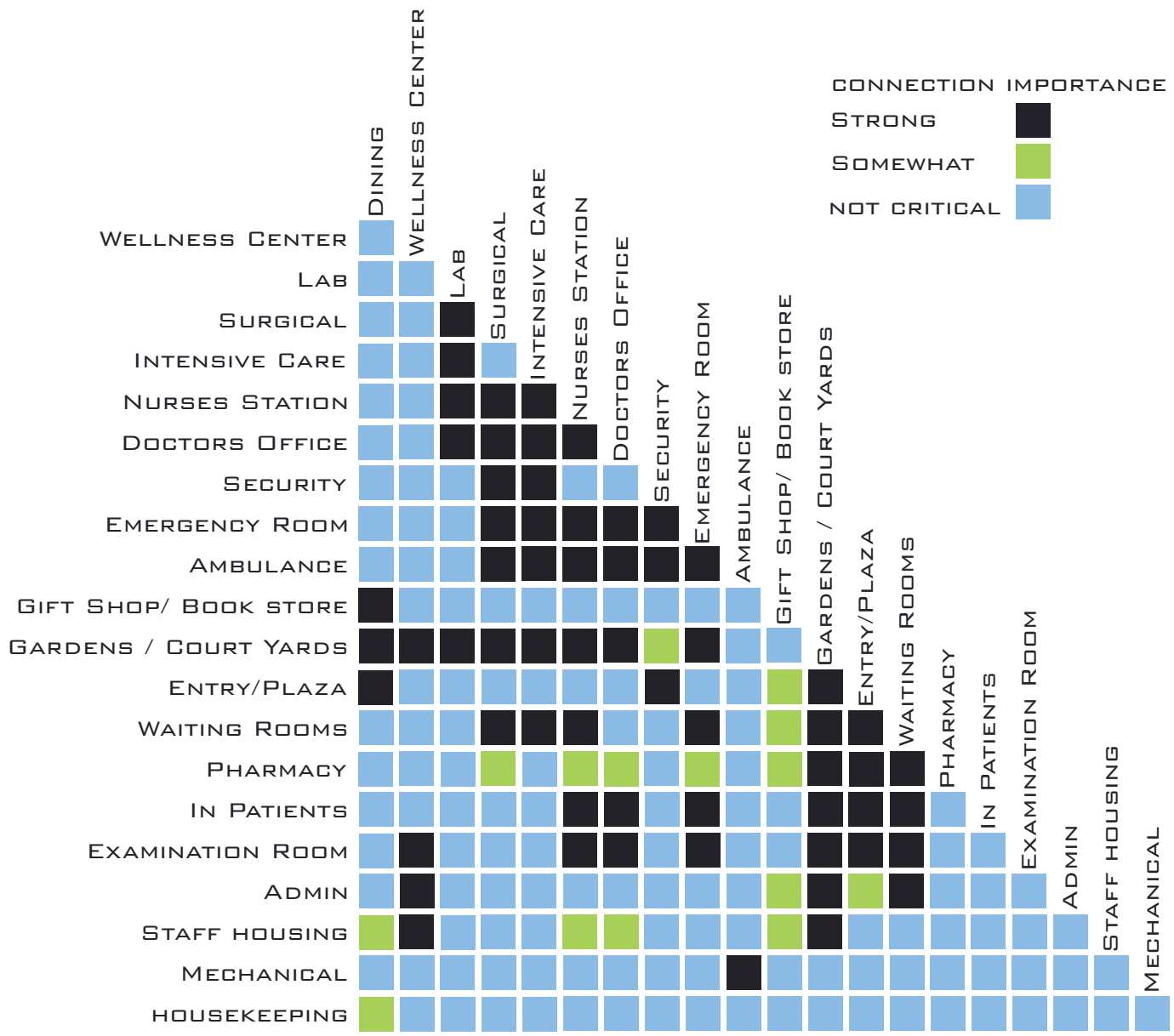


Table 14.2. Project Space

SPACE RELATIONSHIP

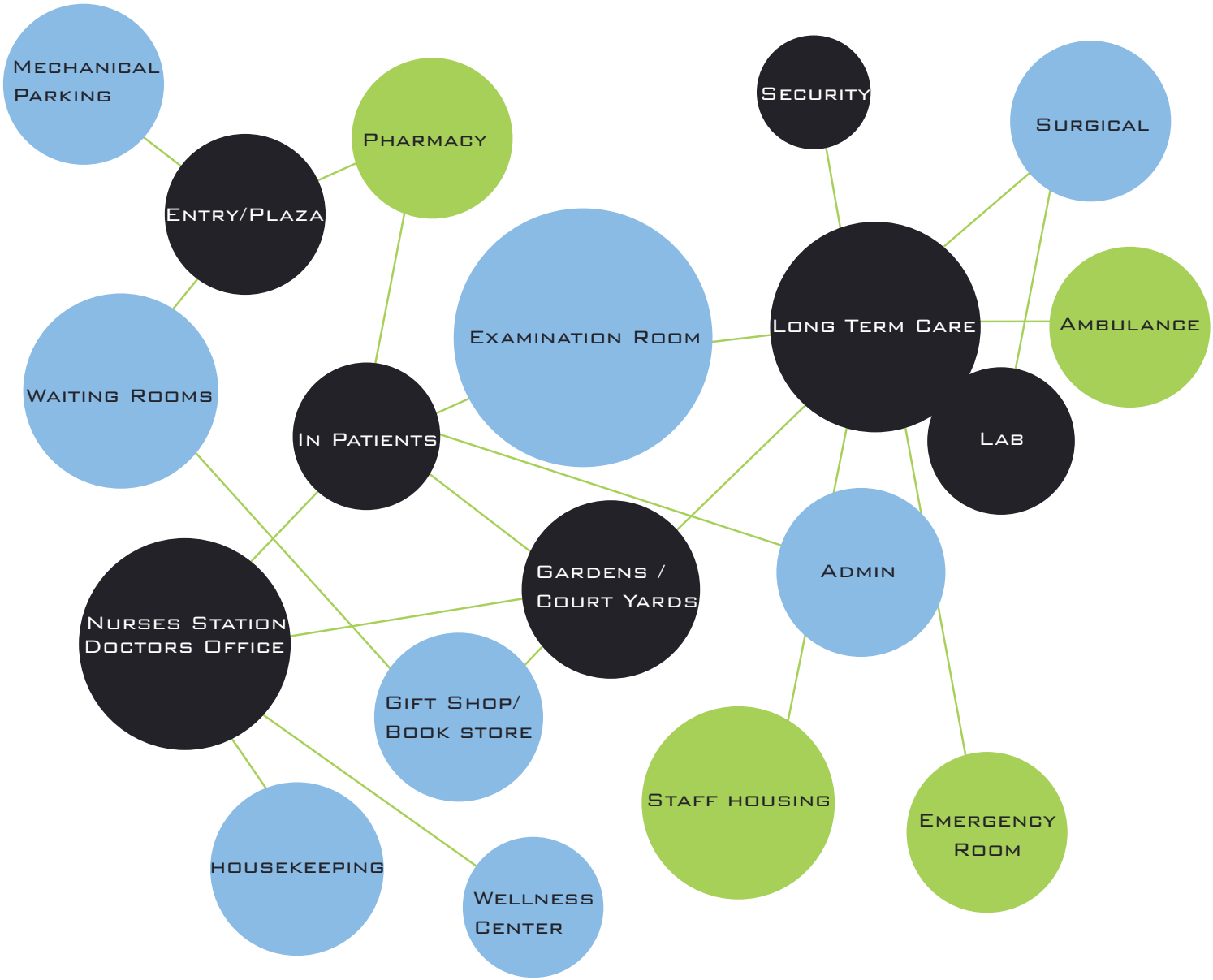


Table 14.3. Space Relationships

Notes

Process

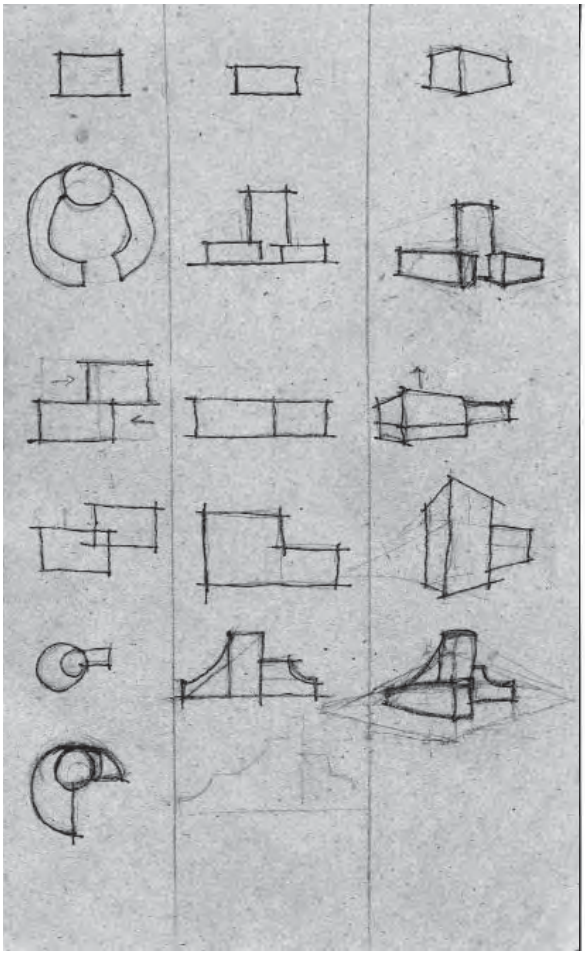


Figure 15.1 Froms

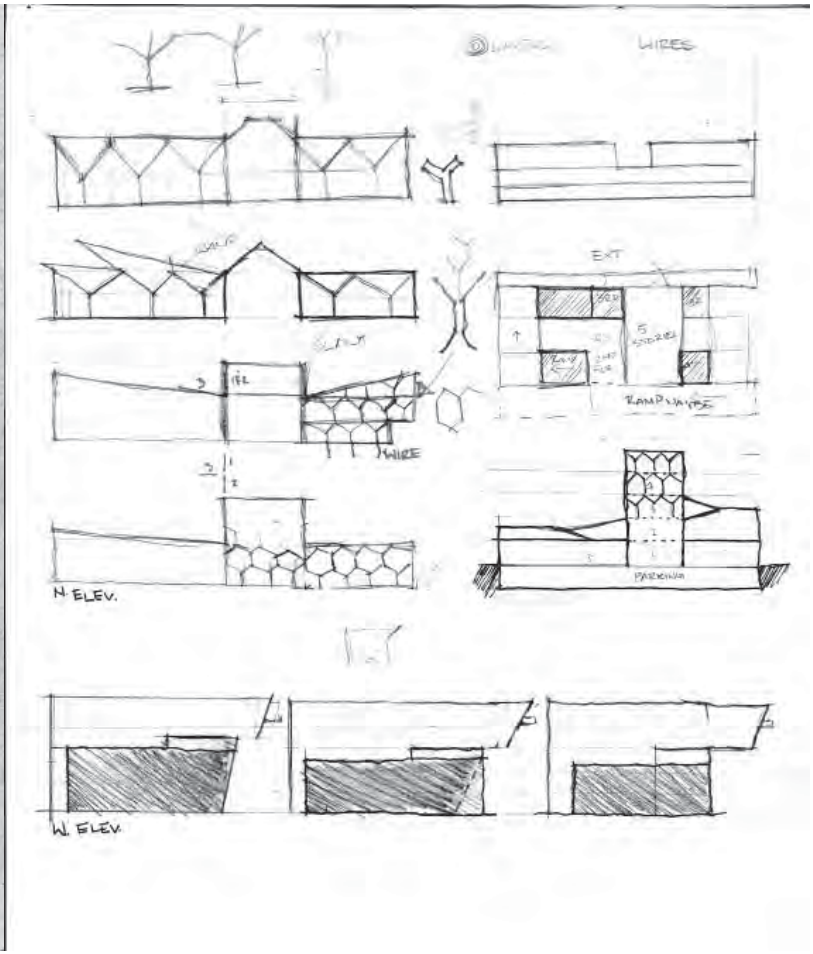


Figure 15.2 Structure 1

After reviewing my site studies and inspecting the wind and sun diagrams; the design for Oak Hospital began by searching a way in which I could link the structure to biomimicry. I looked at the oak tree in plan and was not inspired. I continued to investigate the shape of the oak tree. I then realized that the tree trunk resembled a column and by making it a “Y” shape it allowed the tree to branch out. I then added roots to the “Y” structure giving me a C shape, when I mirrored the structure it then revealed a hexagon.

I then moved on to search for possible ways to create a shading device. I wanted to link this to the oak tree structure so I thought of how leaves shade the base of the tree. This allowed me to envision a link and design a curtain wall in front of the structure acting as “leaves”. I continued to research and observed how leaves functioned. While this was in process I discover Murray’s law. This is the process in which leave have a main vain that carry water it then branches out and the veins further the vains get from the core the smaller they get.

Murrays law then allowed me to think about the structure and how Murray’s law could be incorporated into hexagon shape. I began to shrink the hexagon structure as they got further from the ground unveiling a structure that reminded me of an oak tree and its extensive branches.

Now that I had a basis for biomimicry, I began to search for ideas on how I could link my building to biophilia. Due to the context, the site would have natural views allowing for the boundaries to blur nature and the built environment. I continued to link my building to biophilia by allowing my lobby to be open to the outside. By doing this I was then allowed to include passive systems in my design such as stack ventilation and dog trot ventilation. Within the lobby there would be a large metaphoric tree that would represent refuge and remind patients of shelter and safety.

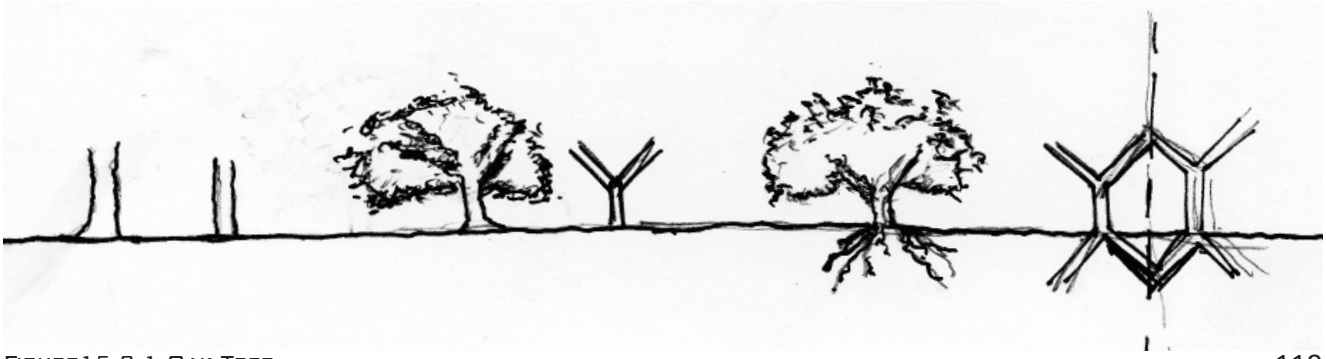


Figure15.2.1 Oak Tree

Process

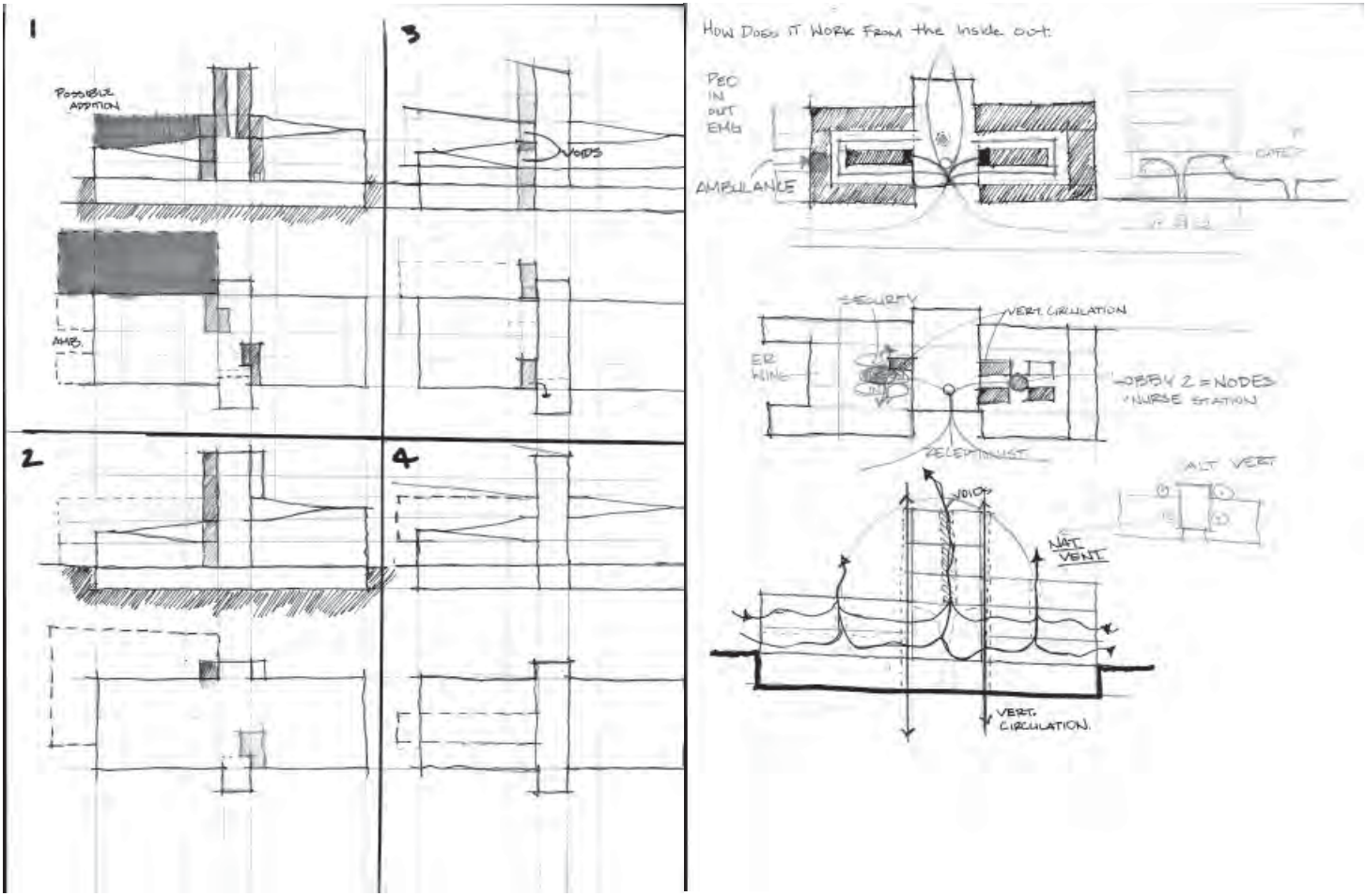


Figure 15.3 Circulation

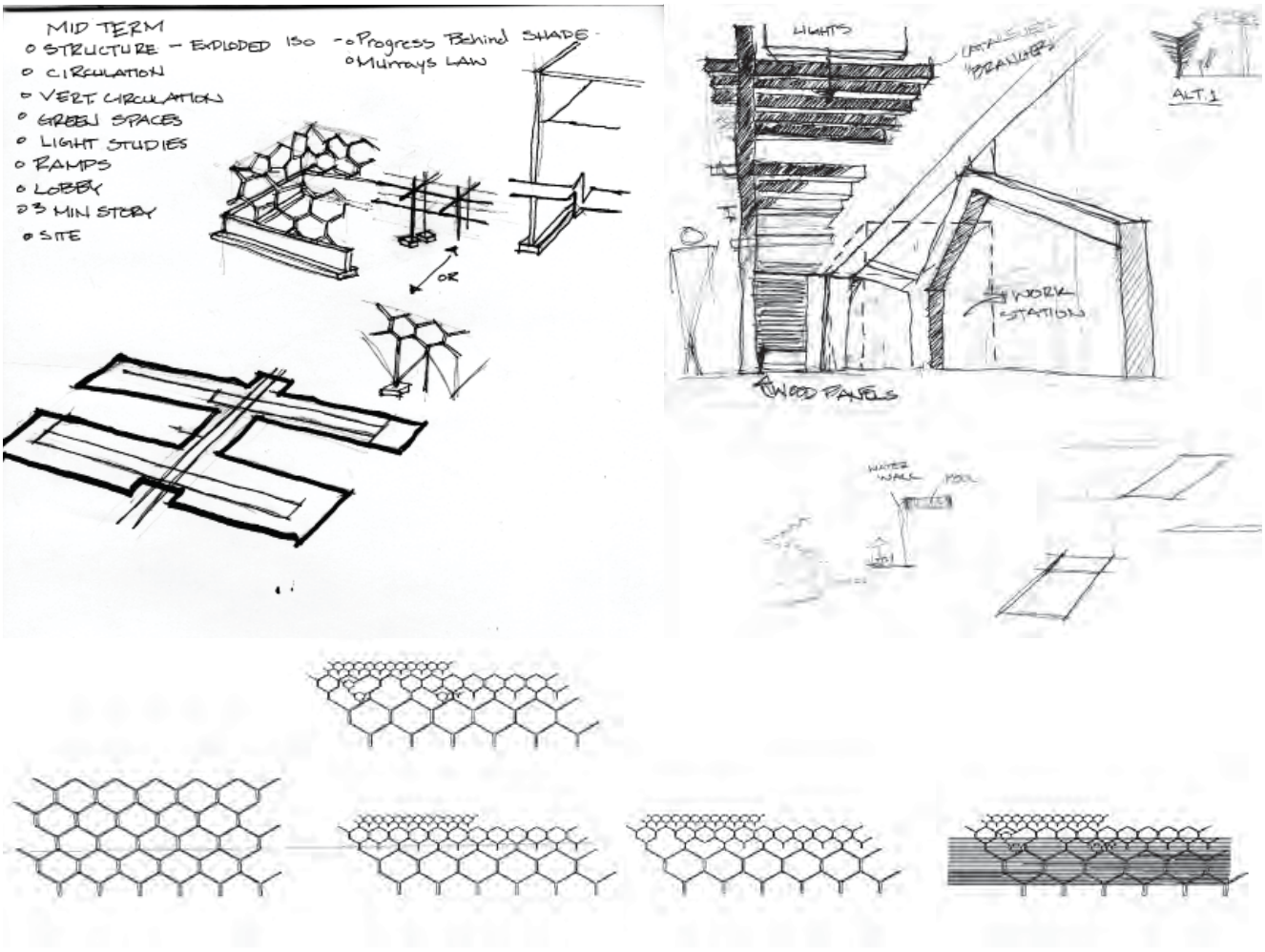
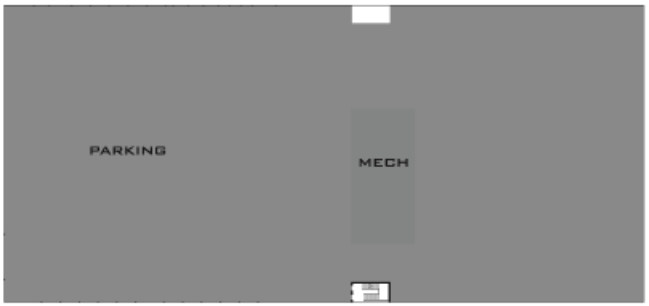
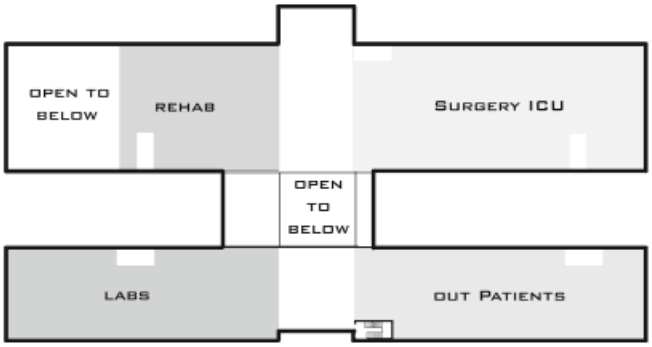


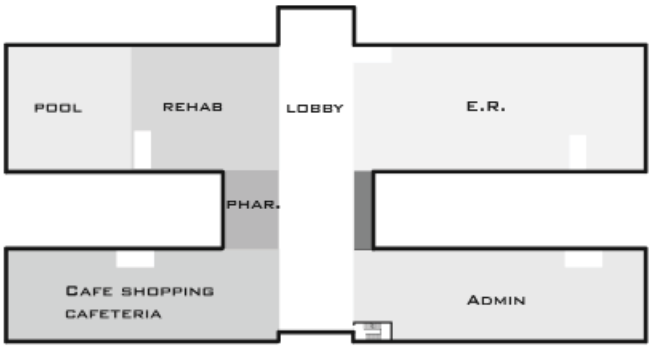
Figure15.3 Structure 2

Process

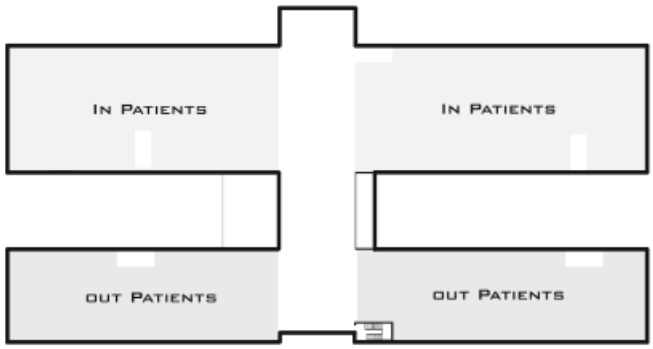




SECOND FLOOR



MAIN FLOOR



THIRD FLOOR

FORTH FLOOR

Figure15.4 Schematic Images

The ramps are thought off as a path to recover, as you travel up the ramps there is feeling of accomplishment. On the journey there are ladings in which the patient plateaus, linking the patients to a moment in which they feel as if they are not recovering and stranded. As the journey continues the path then begins to rise allowing them to see a finish line and a place to rest. When they reach the top they are then rewarded by having a great view, a place to rest and are surrounded by nature.

The ramp also allows for natural views to occur at higher points within the hospital. In addition to this the building is split into wings allowing for courtyards to created. These courtyards allow for additional views to nature and light to enter every patient room.

The patient rooms are them placed around the perimeter maximizing the amount of light and views the patient has. Vertical gardens are then placed within the core of the building allowing for patients to have direct access to light and nature while walking thought hallways. In addition to these nature pockets, staff and maintenance rooms are placed within the core so that they don't take away benefits from the patient rooms. The circulation to the hospital is then simplified so that when patient's walks throughout the hospital and wings they don't get confused or lost which may increasing tension and stress.

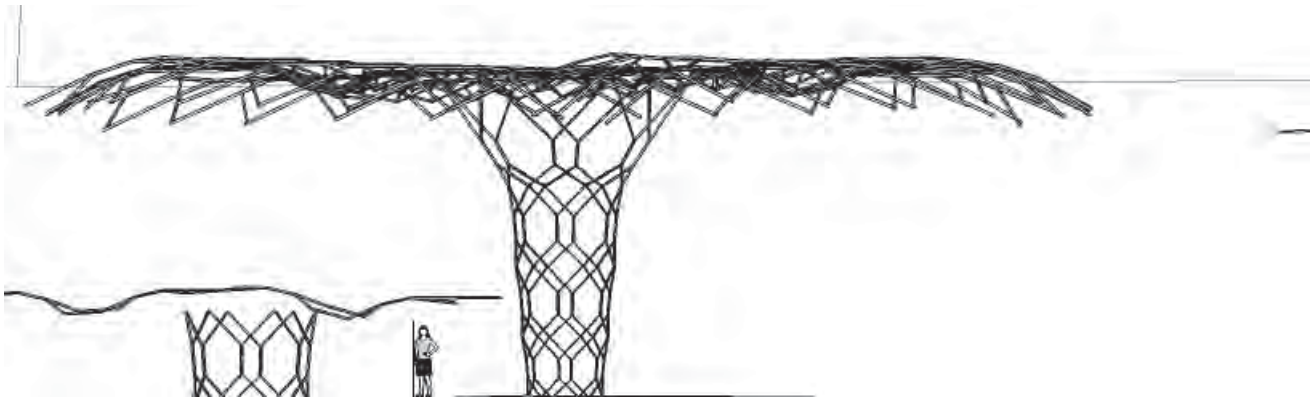


Figure15.5 Lobby Tree

Code Review

Oak Hospital	Type 11 or 11-B
Categories	I-2

Options	1	2	sprinkled	
Allowable building Type	11-A	11-B		
Stories	2	3	add 1	200
Area	15,000	11,000	add 2	

Chart 1004.1.1	
Institutional	
out patient	100
in patient	240

Area	Length	Width	Total	Overall	Category
Basement/ Parking	158	360	56880	28440	
1st floor			41349	41349	in patient
2nd Floor			35302	35302	out patient
3rd Floor			23428	23428	out patient
4th Floor			9628	9628	out patient
Total Area				109707	

Net Occupancy				Male and Female	
Overall out	68358	100	683.58	2	341.79
Overall in	41349	240	172.2875	2	86.1438

Water Closet		
Overall out	1 per 25	13.67
Overall in	1 per room	46
visitors	1 per 75	10

Lavatories Staff	1 per 100	1.21	In Patier 1 per room
Lavatories Visitors	1 per 35	5.714	
Drinking Fountains	1 per 100	4.279	

Chart 1004.1.2		Max		egress	
Exit Occupancy	100 ft per occupant	Travel Distance	250ft	Travel	75ft

HVAC				
Cooling Capacity	1800	Mcal/sec	cooling air volume	1,000,000
Boiler Room and Water Plant	1200	Ft2	Supply return area	500
Cooloing Towers	2000	ft2	supply return ducts	1000
	56' x 56'		fan rooms	10,000
			fresh air louvers	1250
			exhaoust air louvers	1200

Transformer and Switch Gear Room	30 x 30'
Fire Pump Room	8'X12'
Domestic Water pump	8'x12'

Process

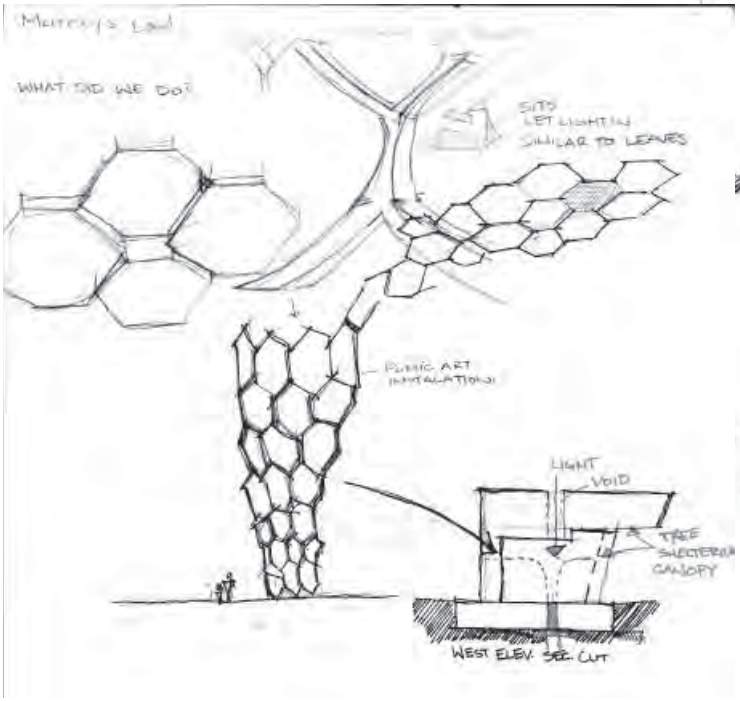


Figure15.5.2 Lobby Tree

Figure15.5.3 Lobby Tree

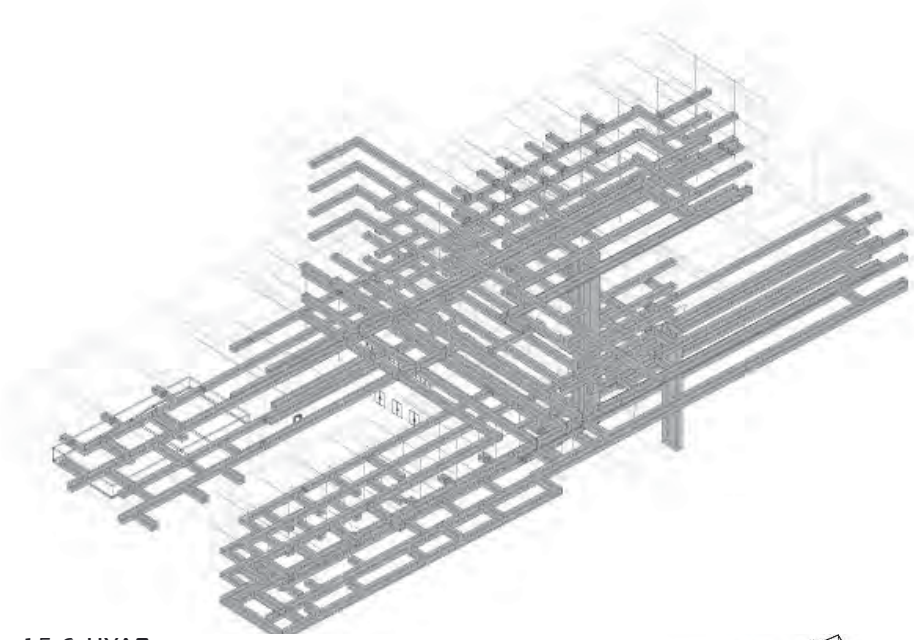


Figure15.6 HVAC

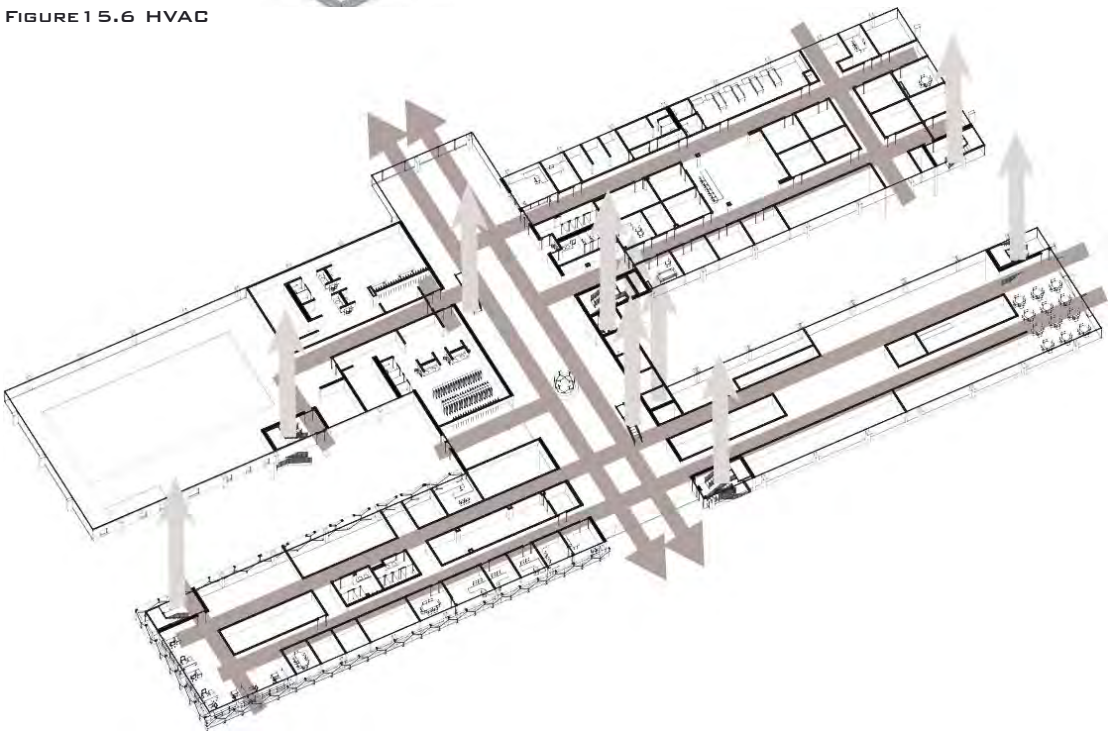


Figure15.6 Circulation

Process

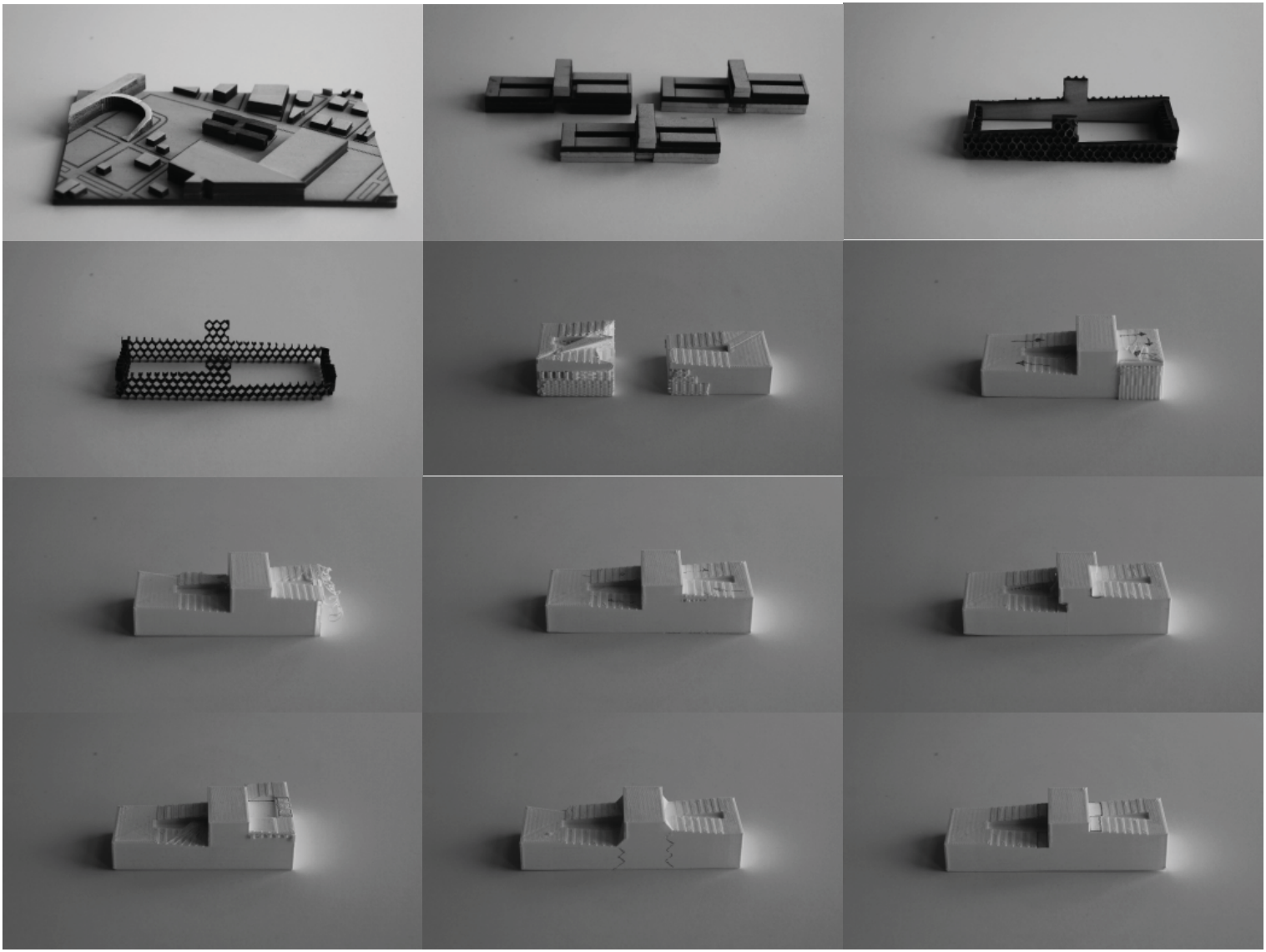
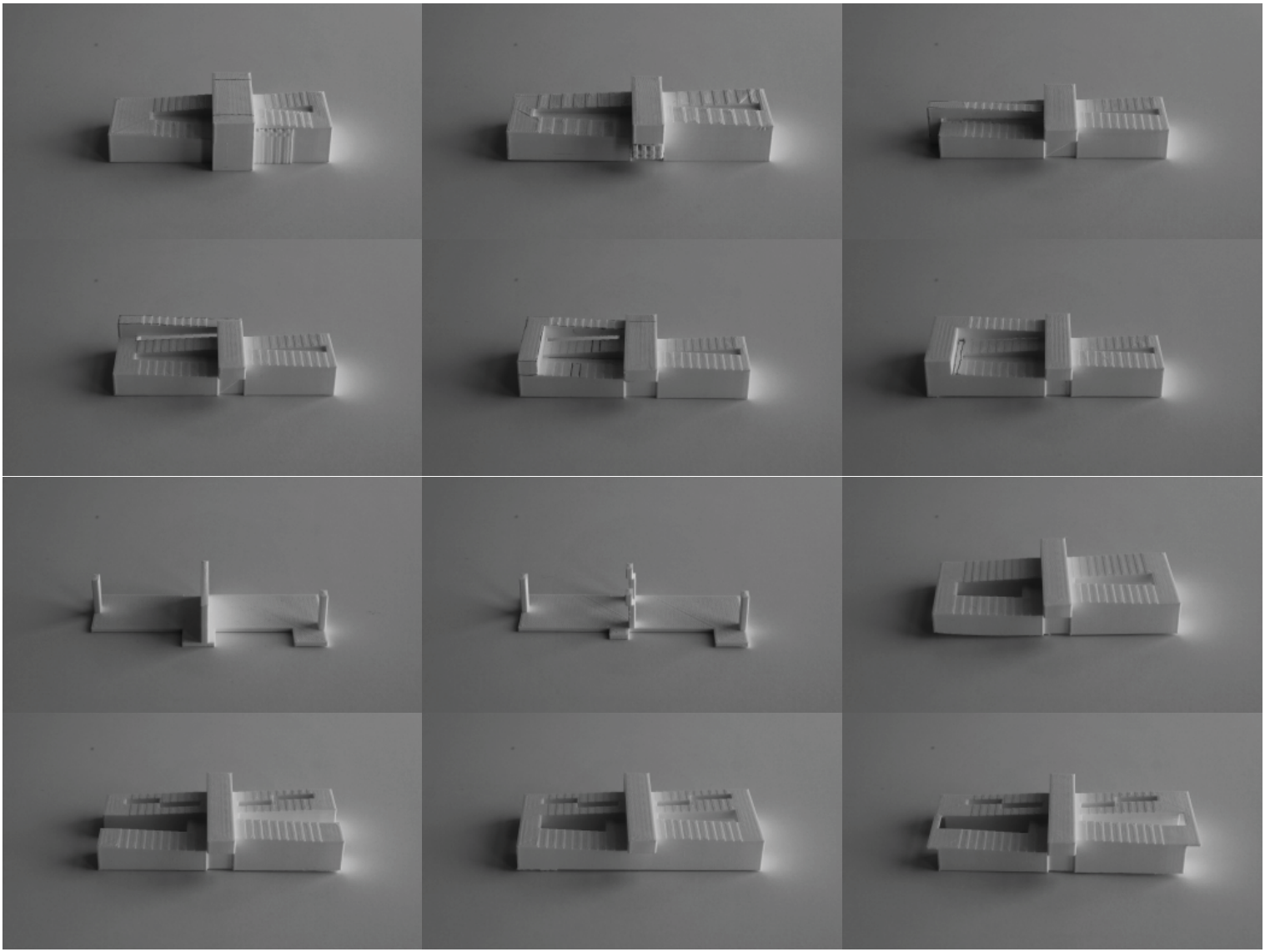


Figure16 Massing Models

Massing



Site Plan

Figure 17.1 City Site Plan

Figure 17.2 Site Plan

PLANS

Figure 18.1 First Floor Plan

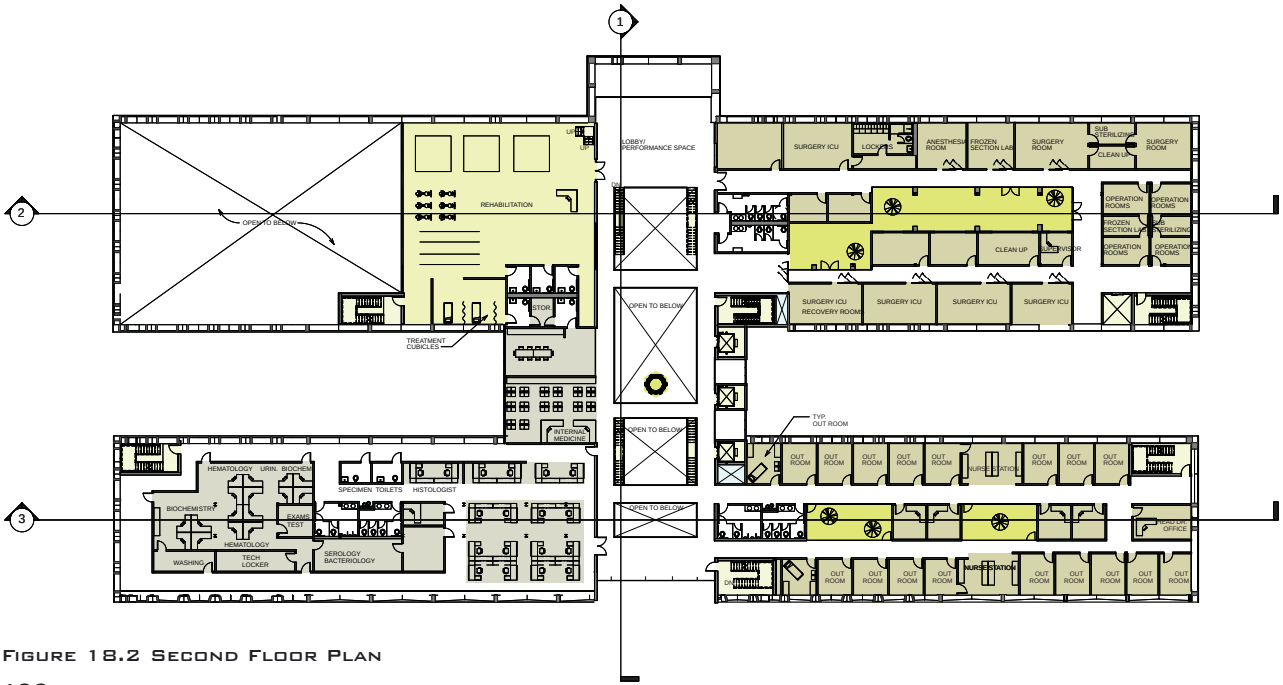


Figure 18.2 Second Floor Plan

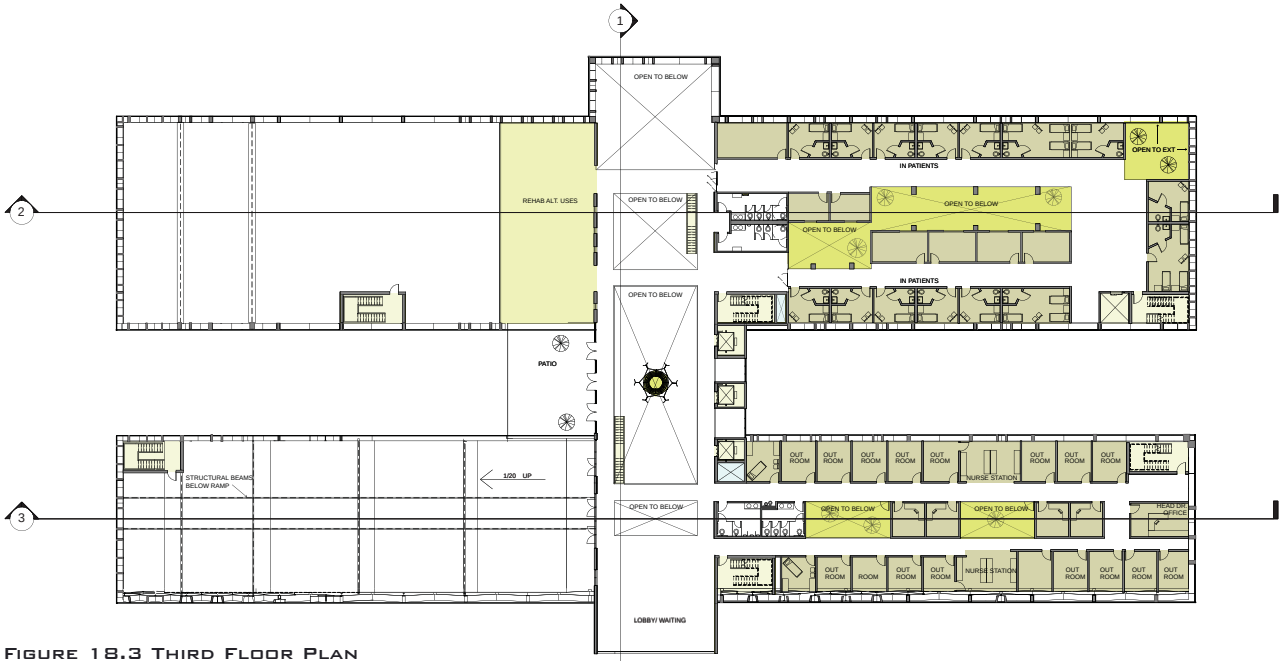


Figure 18.3 Third Floor Plan

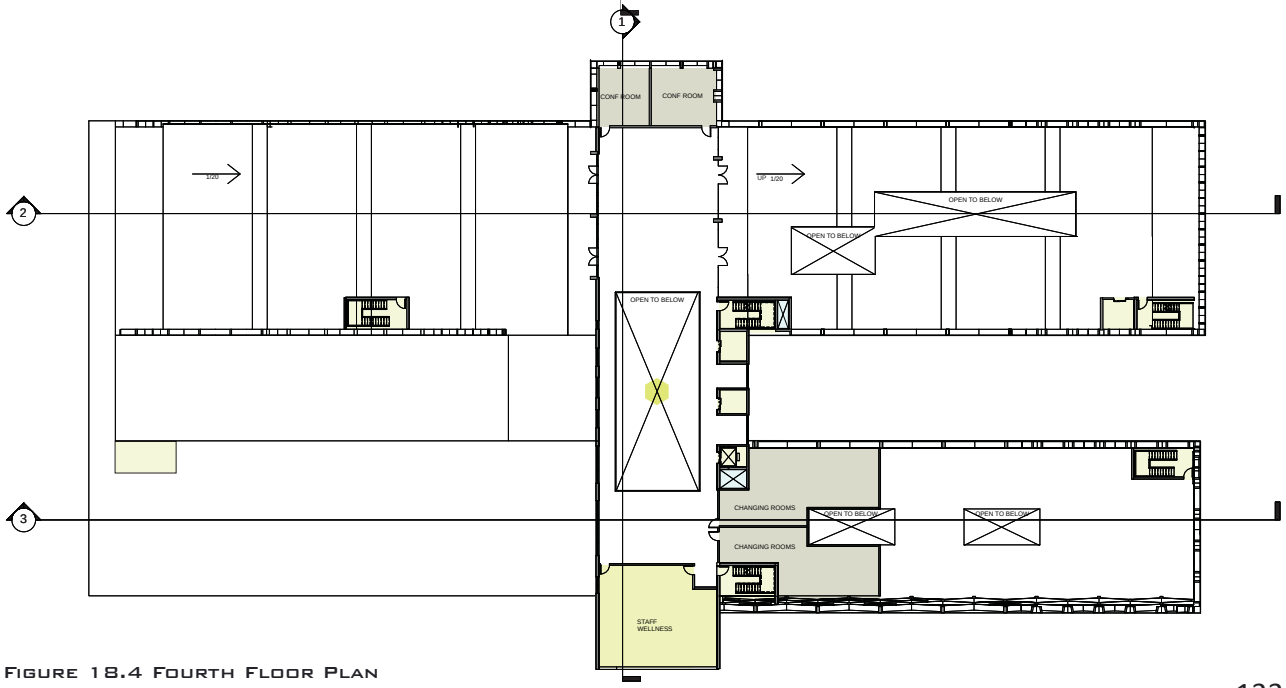


Figure 18.4 Fourth Floor Plan

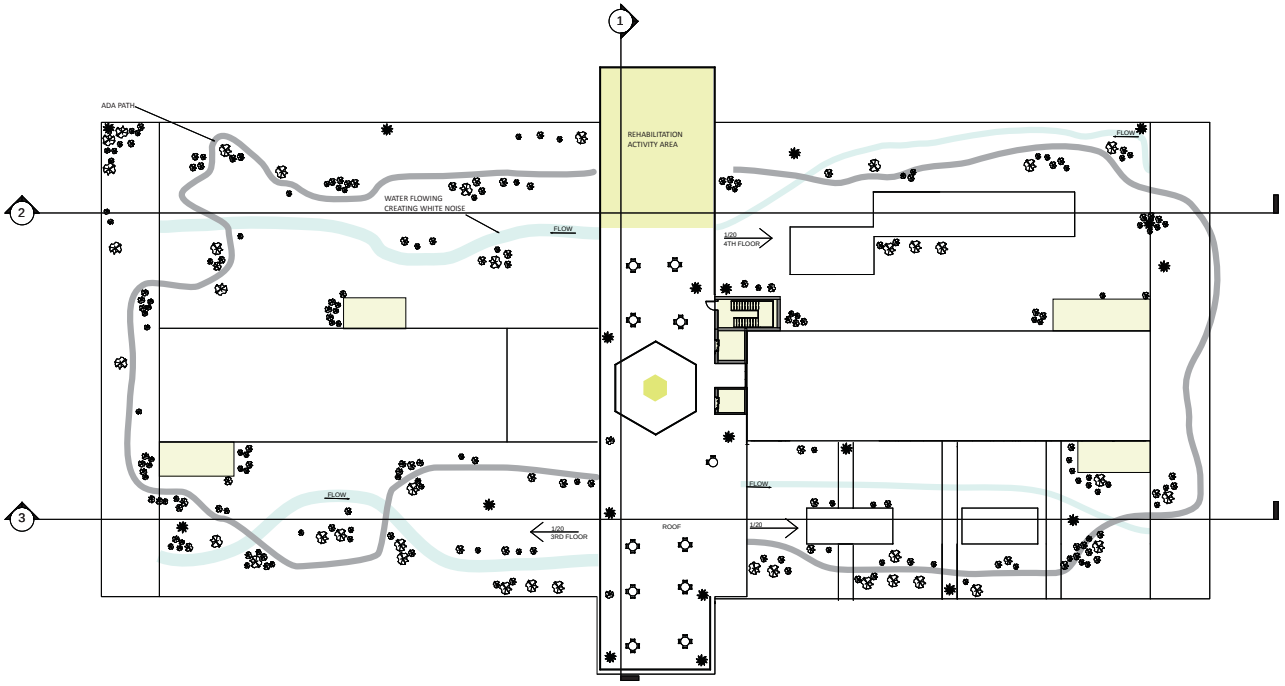


Figure 18.5 Green Roof

Elevations

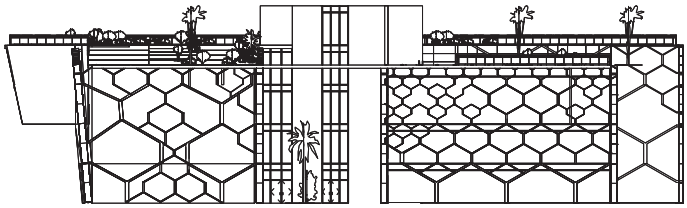


Figure 19.1 East Elevation

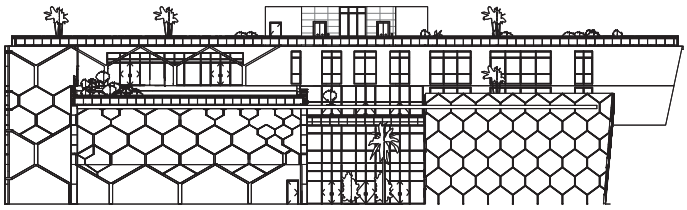


Figure 19.2 West Elevation

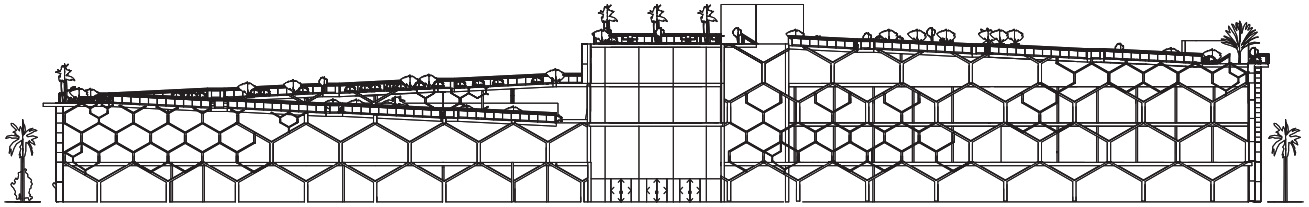


Figure 19.3 South Elevation

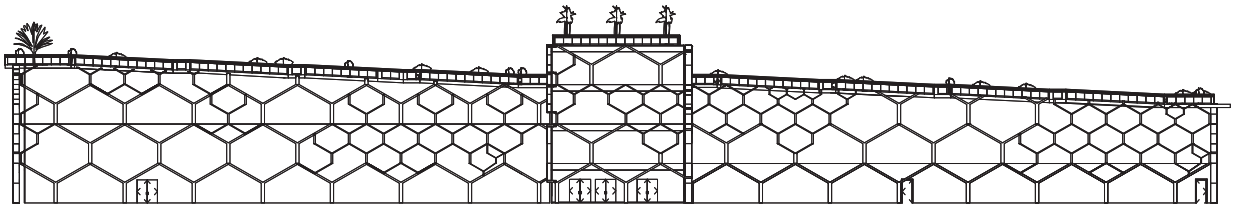


Figure 19.4 North Elevation

Sections

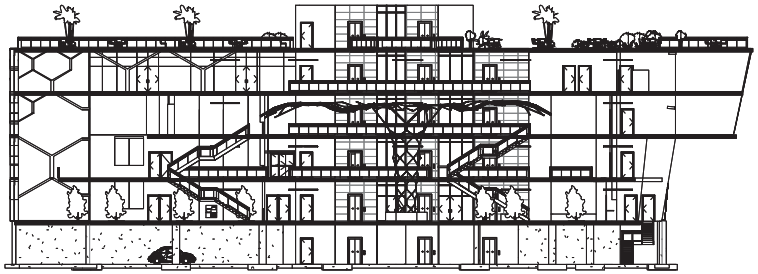


Figure 20.1 Section 1

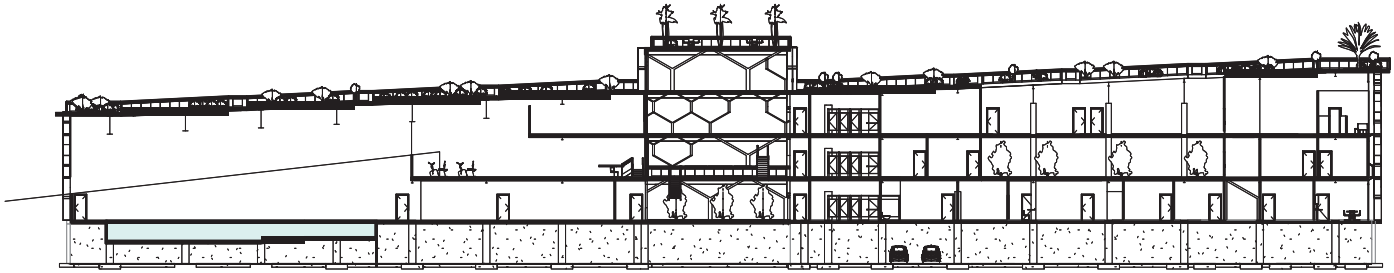


Figure 20.2 Section 2

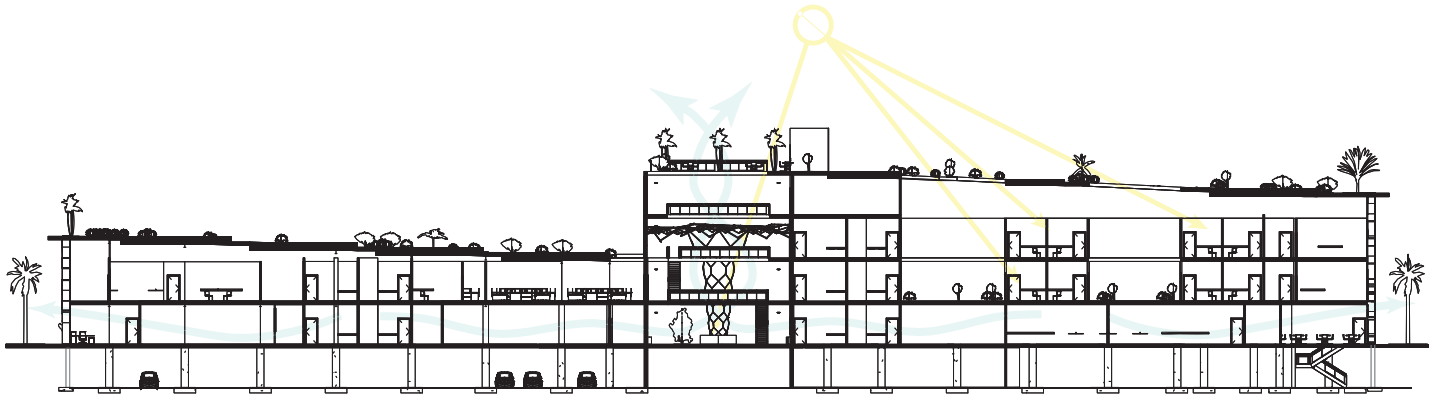


Figure 20.3 Section 3

Details

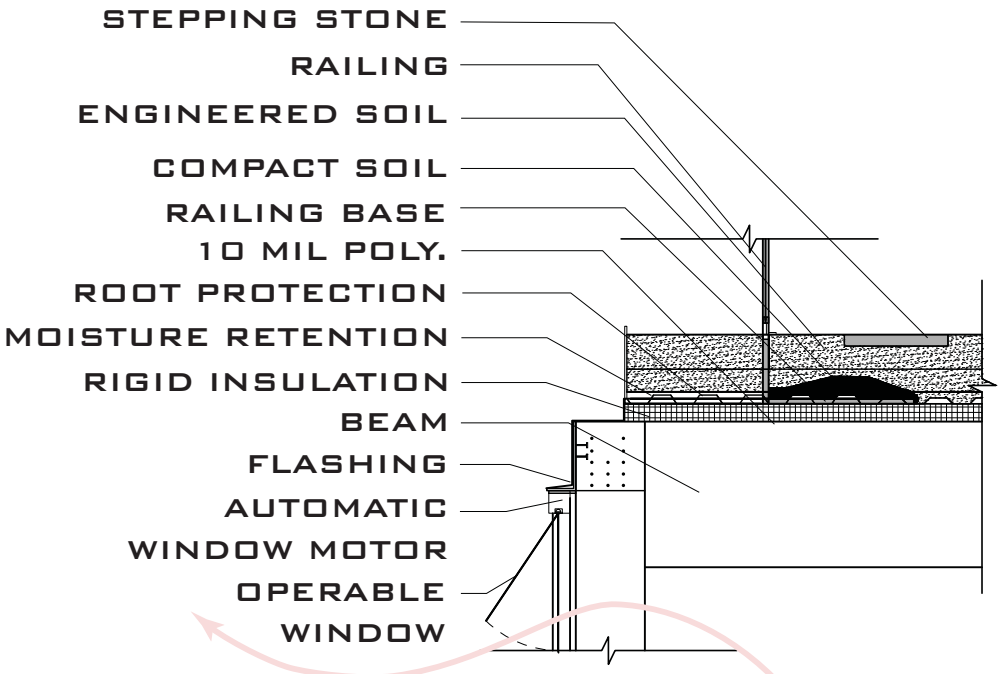


Figure 21.0 Roof Detail

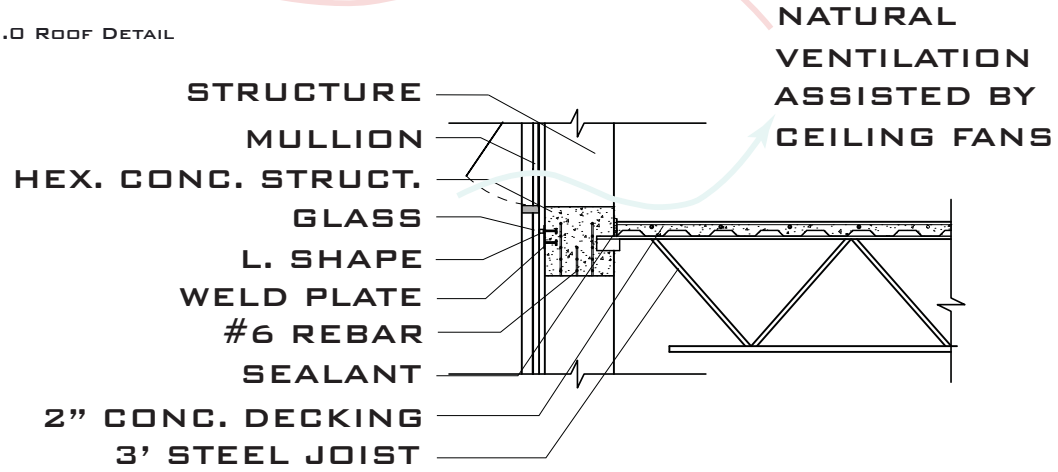


Figure 21.1 Floor Detail

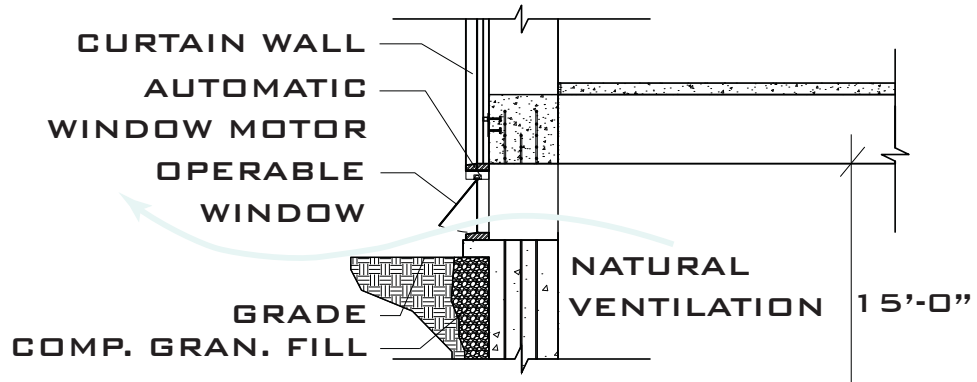


Figure 21.3 Grade Detail

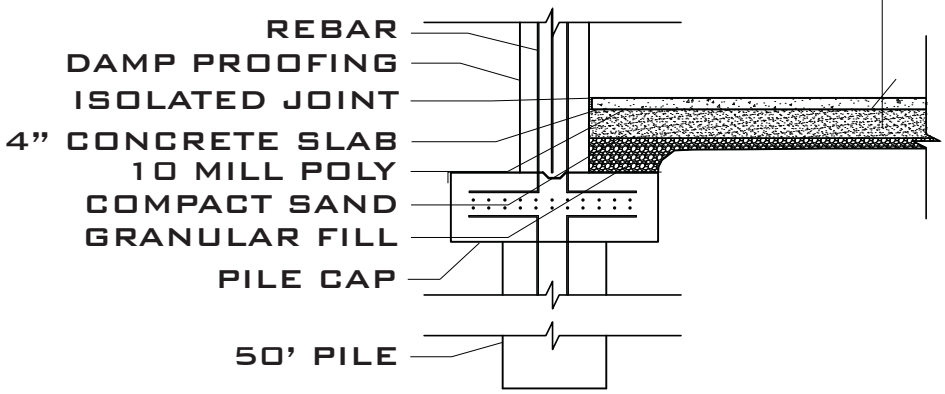


Figure 21.4 Foundation Detail

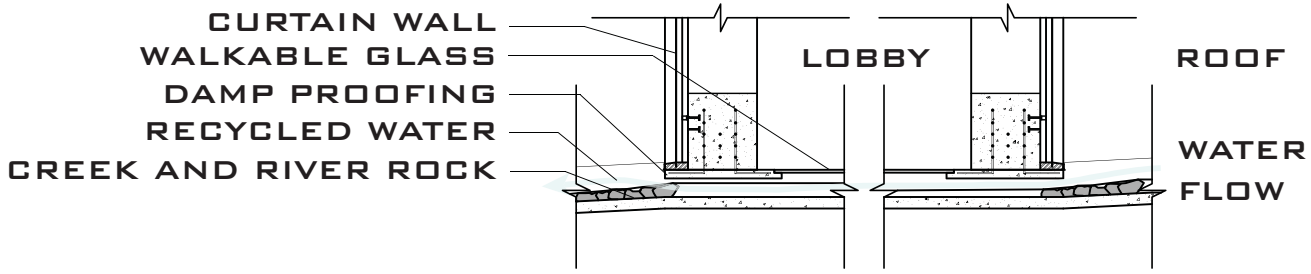


Figure 21.5 Water at Catwalk

Renderings

Figure 22 Main Entry

Figure 22.2 Lobby

Figure 22.3 Courtyard

Figure 22.4 Nature Pocket

Structure

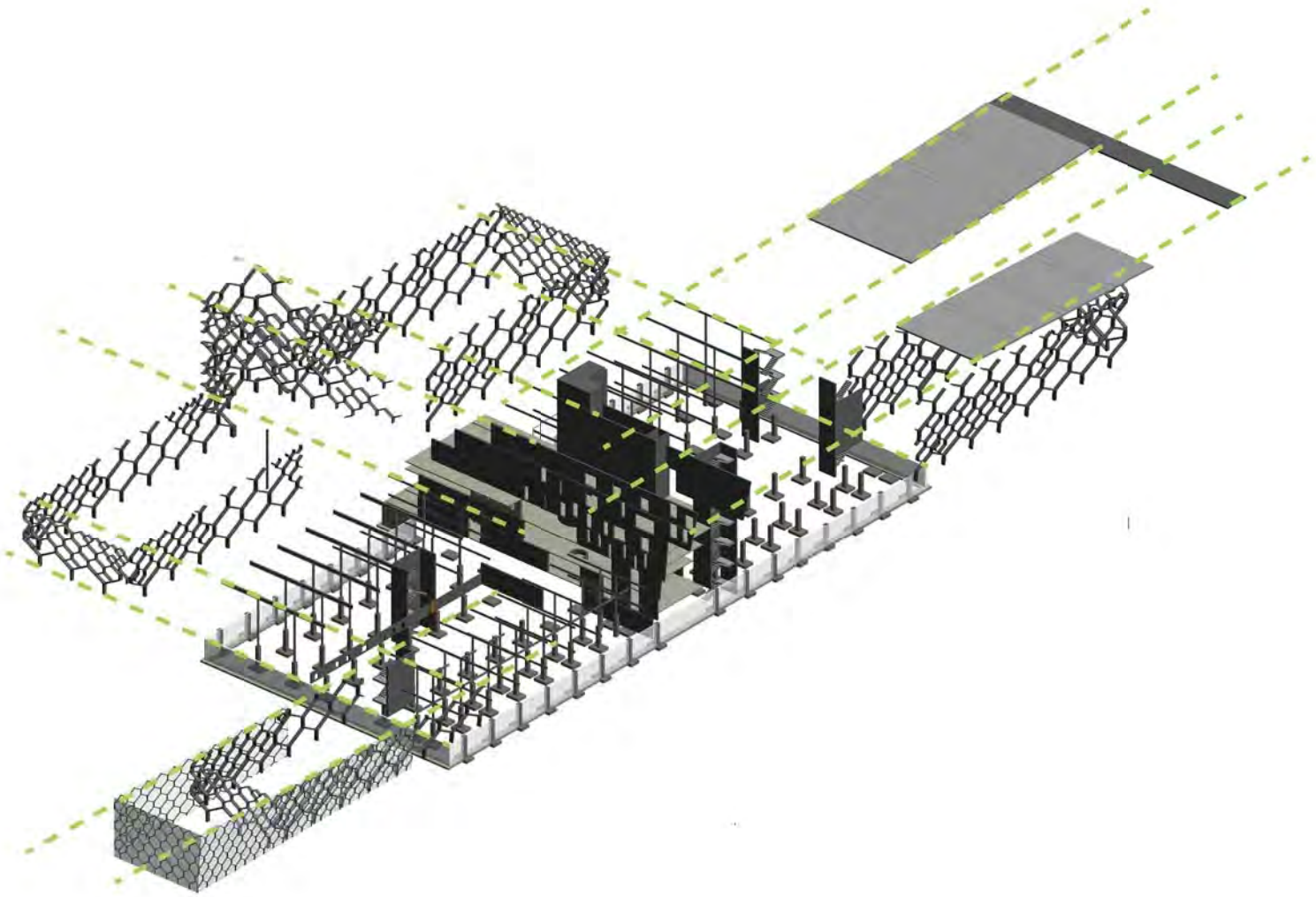


Figure 22.5 Exploded Structure

Model

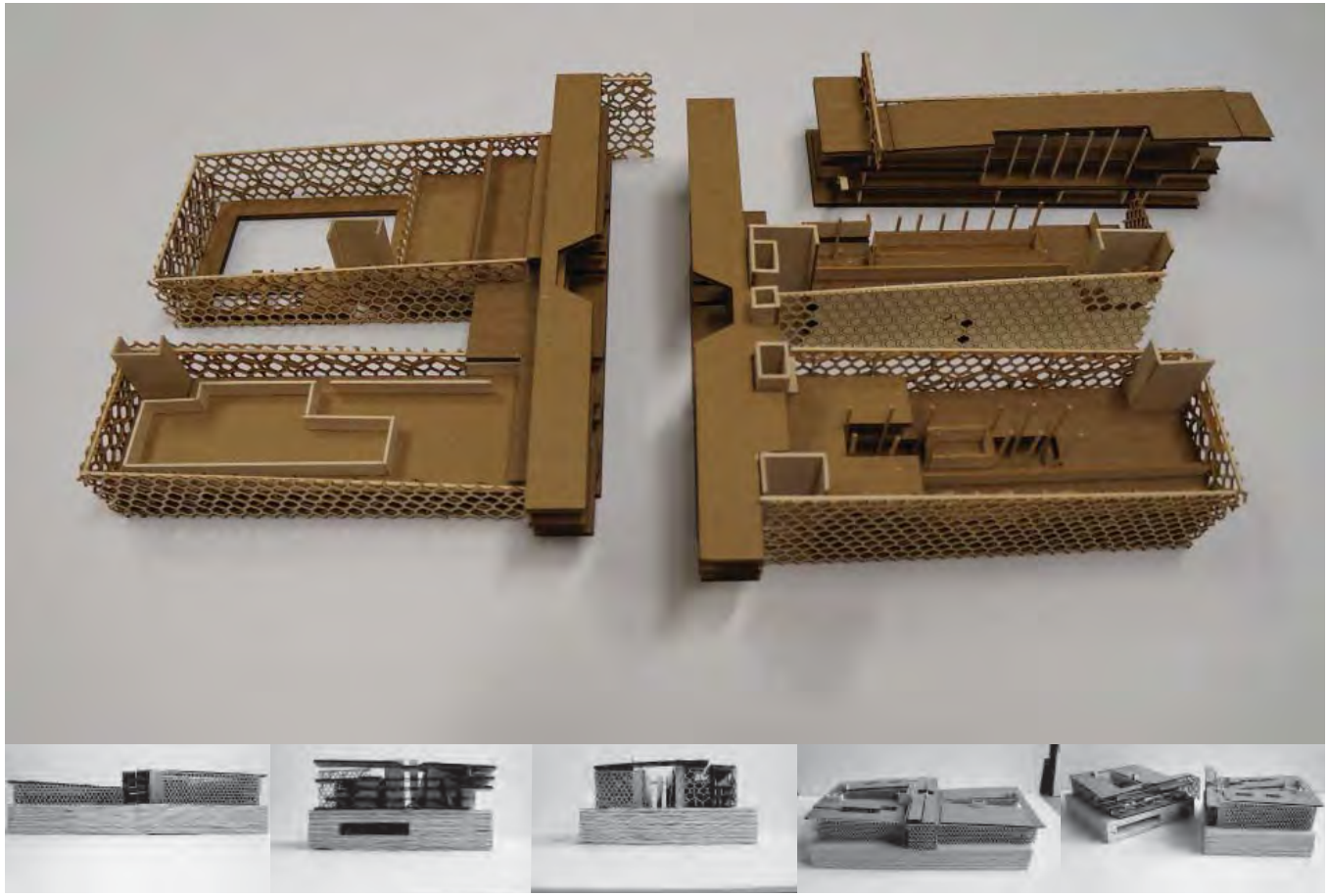


Figure 22.6 Final Model

Installation

Figure 22.6 Installation

Appendix

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Studio Experience

Architecture development

2008-2010

Associates of Applied Science in Architectural Drafting and Estimating

Dunwoody College of Technology taught me how important education is. I received my Associates of Applied Science in Architectural Drafting and Estimating and became Construction Document Technologist (CDT) Certified through the Construction Specification Institute.

While studying architecture at Dunwoody I learned about hand and computer drafting within AutoCAD. I also learned REVIT in depth and how complicated BIM software's may be.

The ESTIMATING portion of the program taught me how to estimate quick take off as well as to how to work with estimating databases such as Timberline. In addition I learned how calculate load capacities, sheer tension, distributions and compression which then allowed me to select beam and columns for a structure.

Project management taught me how buildings schedule are put together. Buildings codes were an important part of the program they introduced me to construction types, zoning, ADA and other important codes.

Certification: Construction Document Technologist (CDT)

2010-2011

Pre-Architecture

2011-2012

Tea House

The Tea House project was an introduction for designing ceremony and ritual spaces. The design process began at the site, Island Park. There we used senses to indulge the site. We later interpreted our senses and designed a Haiga. After that we design a wabi-sabi tea cup that would be part of the ritual. The Rogi was an important part of this design because it made me realize the importance of an entrance. The Tea House was last and most important since we had to incorporate the haiga, tea cup and ritual into our design.

Rowing Clubhouse

The Minneapolis Rowing Club project is designed based on the motion done by scullers or rowers. The motion is begun by the compression and extension of a body followed by a gliding motion in the water. This project also had program requirements that had to be met in addition to designing creative functional spaces.

When it rains, the roof slope directs the water to the entrance creating a water wall hallway. The water is then gathered and used as grey water.

Galley House

The Galley House was where I began implementing metaphors within my designs. For this project a story was to be created and an artefact was to be created to go along the story and model. Presentation was also a large part of the process.

The Galley house was designed for a man looking for the love of his life; but that person had to have the same passion about cooking as the host. The house was designed with a narrow hallway allowing for the visitor to become comfortable and closer with the host. In addition house has many fire places with burning embers so that when the right person was found a fire could be ignited creating the begging of their relationship.

Contrapuntal Hall

The design of Contrapuntal Hall applied my ability to design with metaphors. It also allowed me to explore a bit into poetics. This project had a fugue songs as well as an artefact that was to go along with the design and model. Presentation was also a large part of the process.

This design relates to the sails of a boat fighting with the wind as a fugue would with music. The building has a concept hall and a room for unique instruments in addition to practice rooms.

2012-2013

Askanase Hall Remodel

Askance was a semester long project. For this project we were to add a proscenium, fly space and update the black box theater. I begun by exploring: Askance auditorium, Concordia theater and theater B. After that I explored Askance in depth. Plans and models were created of the structural elements to define what would be kept in the remolded. After many case studies the class and I exchanged our project with a different person, we switched project three times. By the end of the project we got into groups and partnered up with a student from the theater department and entered a competition.

Our design was simple we would add a curtain wall on the second floor so that the lobby could look into the fly space. There would also be descending ramp with tables so that student could take a break and have lunch. We added more things that where suggested form our theater specialist student partner such as class rooms and offices that were needed. We tried to keep the changes minimal and ethical so that the addition would not be too expensive.

The most complicated part about the design was incorporating accessibility ramps and vertical circulation. The theater had so many floors and the floor plans where not very long making it difficult to create ramps to code. That meant we had to get creative with our design. We solved this problem by overlaying the ramps to reduce the length.

Stratum Museum

Stratum is defined as the layering of bedrock. Within this project, I focused on the layering of the earth's layers and discovering fossils. The main exhibition space is the ramp which was symbolic for digging for fossils; the farther down you dig and investigate the more you learn. This relates to the ramp because the farther down you travel and explore the more you learn about fossils and dinosaurs.

The wall with in the ramp is actually a water wall. Similar to how fossils are created by being covered in water. The water wall has fossils embedded into it so that the visitors and kids can interact with it by touching the fossils.

The museum was designed so that a viewer could see completely through and perceive the context of an excitation site by viewing pretty butte mountain in the background. Stratum Museum is also one with the landscape by continuing with the landscape it become an ornament of the site.

The entrance is the tallest space and attracts attention. This allows the visitor to travel towards the node and focal point. When in the museum they see a roof that is being held by eight slanted columns merging the loads to two main coulombs. The floors are then cantilevered by the main corridor walls and the second floor is suspended by cables from the ceiling creating a floating effect, allowing the main floor to be open and free for exhibitions.

Elevation case studies were done to place windows so that they meshed with the design.

2013-2014

Di-vert Tower

The Di-Vert Tower is a partner capstone project. Sam Erickson and I designed a versatile tower for the community of San Francisco. The design began with lots or research and a few case study towers.

The next challenge was to collaboratively designing a building that would interest both of us. From there, a structure for the tower had to be designed; we investigated many high-rises but selected 121 Leadenhall.

Incorporating a metaphor to our design was important. We considered many symbolic topics that San Francisco had to offer such as: the transit systems, views, harbors, and San Andrea's fault line. I began to research and play around with ideas so that could incorporate a metaphor into our design. No metaphors inspired me more than the shifting of tectonic plates; so we agreed on San Andrea's fault. This building would show the public that a dia-grid structural system could withstand an earthquake.

From there on, we had to incorporate the idea of shifting. We applied the metaphor to the structure by shifted half of the tower vertically. The shift created a gap on the Southwest façade, creating a wind tunnel. The tower would now be able to naturally ventilate itself, due to the Bernoulli Effect.

Next, we explored into mixed use towers and interior organization. Since we wanted a community within the tower, we created 3 story tall atriums. On the base floor of the atriums, we placed gardens and, social areas. The atrium, also allows for enough natural light during the day so that units on the interior do not need artificial light. This space also allows kids to spend time and meet other kids with in the vertical community. Linking the commercial floors to the residential was a challenged. We approached this by extending the end of the atrium an extra floor down. Now, residential and commercial spaces were linked. Finally, we create a unique form of vertical transportation throughout the commercial spaces. We designed ramps that wrapped around the floor and reinforced the shifting metaphor.

Additional spaces that the Di-Vert high-rise has are made to convince the residents. These are amenities such as: gyms, libraries, restaurants, cafes and a mini mart. We supported the current changes in the work force, so we allowed for spaces where people stay within the same apartment or building to work productively. This inspired us to create and fuse areas where entrepreneurs may begin their businesses working alongside stay at home workers.

Masuistraat Strip

This semester I studied abroad and explored Europe meanwhile designing an urban environment. We explored urban, modern and historic architecture. We looked into Masuistraat Strip because it was underdeveloped. Our design would lower the pedestrians underground meanwhile the stone on the walls would become more rustic. In addition to this I learned Sketchup at a proficient level and learned Maxwell allowing me to render my thesis project.

Certification: USGBC Green LEED Green Associate

2014-2015

Oil Patch - Inheritance

Creating a home for 1000 new residents was the objective, while considering the cost of materials and land as well as the location from where the materials would be imported from. The goal was to find materials that would be local or located within 300 miles from the site to provide jobs for people near the site and leave a smaller carbon footprint from the initial source.

The project Inheritance was similar to working in a firm since Mike had us swap projects half way through the semester making us design with something we may have not been familiar with. At the end of the semester a jury ranked us considering how we dealt with: cost, light, air, structure, mechanical systems and the overall design

My solution to the project inherited was to create a park in the middle of multiple buildings increasing social interaction. Allowing every room to have natural daylight was my next task; to do this I separated every building by 25 feet allowing plenty of light and air into every room from either the East or West in addition to the light already gained from the North or South facing into the park. The corridor connecting the buildings then do not split the building symmetrical as they are at the end of the apartment leaving a 25 foot void and vertical circulation would then be made out of natural and adaptive plants and glass catching the public's attention so that they enter the plaza/ greenspace.

Aesthetics was also thought about since I did not want all of the buildings to look the same. With this in mind I had interchangeable units that slide out of the structure. Meaning of you own or inherit a unit and have to go to school or work in an alternative place you may ship the unit by train to its new destination. As long as a structure exists within the area you may slide your unit into the structure. The main level of the building is then multi-use so that the resources are conveniently placed for the owners and renters, decreasing car use due to the location. With this in mind I selected to infill a parking lot and reduce urban sprawl.

Additional programs learned and used thought this class where Rhino and Grasshopper.

Oak Hospital - A Holistic Approach to Healthcare

Peter F. McKenzie Award Finalist

Personal Identification

Contact
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"There should not be a *production week*, we should always be *producing*".
-Mike Christenson

About me

I was born and spent the first five years of my life in Jalisco, Mexico. The next couple of years were difficult learning a new culture and, language. Roseville, Minnesota is where I grew up and began my architectural career. The earliest memory I have is in fifth grade, when our class had to design our dream house.

After high school, I proceeded to btain my Associates of Applied Science in Architectural Drafting and Estimating from Dunwoody. By 2010, my goal was obtained. I continued my education at North Dakota State University, where I now expect to receive my Masters in Architecture by May of 2015.

My architectural perspective significantly changed these last couple of years. At first, I perceived architecture as “space equals money” and “design sustainably”. Even though these are both true; I now implement fundamental design features, such as correlating the design to the context, landscape, wind and sun paths. My philosophy also plays a large role in how I design.