Designing Through Disaster

Lauren Peterson

Designing Through Destruction

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

By

Lauren Peterson

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

Title and Signature Page

Primary Thesis Advisor 5/7/12

Thesis Comittee Chair 5/9/12

Table of Contents

Cover Page I

Title & Signature Page II

Table of Contents III

Thesis Abstract 1

Problem Statement 2

Statement of Intent 3

The Narrative 4-5

User/Client Description 6

Major Project Elements 7

Site Information: Macro & Micro 8

Project Emphasis 9

Plan for Proceeding: Research Direction 10

Plan for Proceeding: Design Methodology 11

Plan for Proceeding: Quantitative & Qualitative 12

Plan for Proceeding:Documenting Design Process 13

Work Schedule 14

Research 15-25

Summary of Research 26-27

Case Studies 28-54

Summary of Case Studies 55-57

Historical Context 58-62

Goals of Thesis Project 63-64

Site: Qualitative Aspects 65-66

Site: Quantitative Aspects 67-72

Climate Graphics 73-78

Programmatic Requirements 79

Previous Studio Experience 80

Project Documentation: Process 81-89

Project Documentation: Final Images 90-126

Reference List 127-131

Personal Identification 132

Thesis Abstract

This thesis project is about how we can provide a cost and time effective source of emergency housing for those just affected by a natural disaster. Natural disasters rarely have a warning signal to them, and even when they do there is no way of predicting what the damages will be. Within a split second, thousands of people can be left homeless.

With a simple yet effective design, people in high disaster zones like Minneapolis, MN, can live in emergency housing while the rubble is pushed away, and permanent homes are built. Emergency units are 85 to 125 square feet, and about 220 units can fit on the Minneapolis site. After permanent houses are built, the temporary structures can be taken down and used again for another natural disaster that is about to destroy another community.

Key words: Emergency Housing, Natural Disasters, Homeless, Temporary Structures, Permanent Housing

What designs can be implemented into making emergency structures that are readily available after a natural disaster strikes?

Problem Statement

Statement of Intent

Statement of Intent

Project Typology:
Emergency Housing

Claim:
Rebuilding communities recently destroyed by a natural disaster, by having victims and workers come together and construct cost and time effective structures that are welcoming yet effective for the victims to temporarily reside in.

Premises:
Architects, and engineers, who are the workers, come together to fight a problem of destruction and loss by rebuilding a destroyed city. Emergency structures are built and dispersed to victims of the storm. The community members are able to learn how to construct the structures from the workers, to later build and help others in need. The nonprepared victims of the natural disaster have been thrown into a state of homelessness and exposes them to a state of helplessness in a matter of seconds. As Kate Stohr (2006), founder of Architecture for Humanity, states, "Whether in countries rich or poor, nature has proved that no feat of engineering can completely shield a city from the rumblings of the earth or the rising of its waters." (p.34)

Theoretical Premise:
Through the work ethic and technique of the workers combining the emotional drive and need of the victims there is purpose and direction to build and recreate a community torn apart by a natural disaster.

Project Justification:
We really do not know when a natural disaster is going to strike, or where. All we do know is that when it does, we have no way of protecting ourselves from its path. From all of this we are able, through the power of design and skill to rebuild the damages. We cannot bring back what was lost, but we can try to design and build a new beginning. Taking all the bad and creating them into milestones that we will conquer.

Proposal

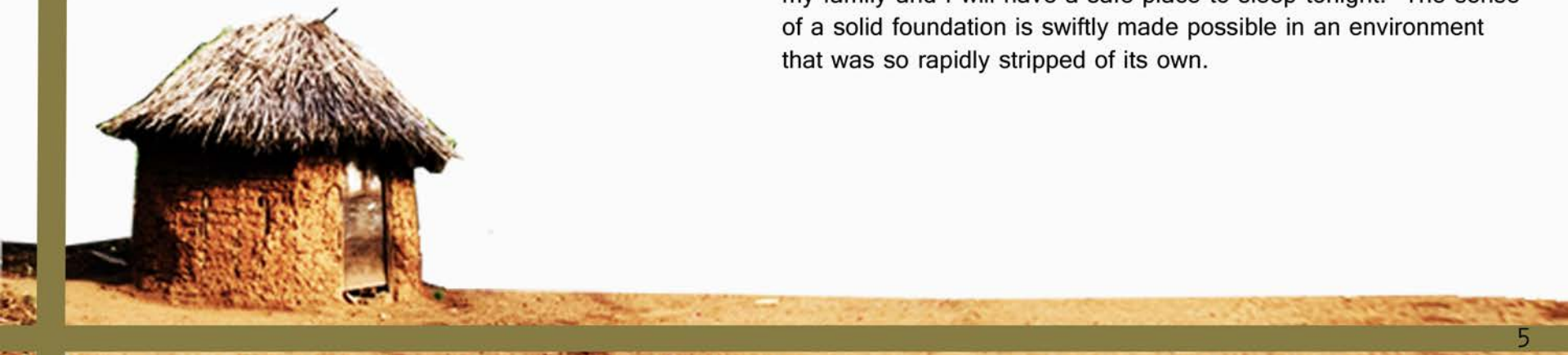
The Narrative

I am sitting in my home on Sumatra Island with my family. It's the day after Christmas and everybody is still filled with holiday cheer. Warm baked goods are just placed on the table. I was just about to reach out my hand to grab a dessert when all of a sudden...sirens...panic... I looked up to see the happiness and cheer suddenly replaced by fear on all of my loved ones surrounding me. We have all heard on the news a couple years ago now, that scientists had been predicting a tsunami to strike our home coast area of Sumatra, Indonesia. Nobody really took the newscasters seriously though. Those thoughts of the possible tsunami were way out of reach, especially now that there were bigger and better things to think about at the time, like Christmas. Now happiness is gone, and all I can do is escape, evacuate, run with my loved ones to avoid being swept away into a forceful wave of water. My home will be no more. Tonight I will not sleep in my comfortable bed, and I will not wake up to my mom's wonderfully crafted breakfast waiting for me on the counter. From this point on, my life will never be the same as it once was. I am now a part of what the world will know as the 2004 Tsunami.

Running, running. I have my sister's hand in my left, and my mom's shaky hand in my right. I have to help her as she limps along in a search for safety. We are running across downtown Sumatra. A place where I used to meet up with friends to hang out, and grab fried fish cakes. Now the Dutch inspired architecture and street vendors will soon be flooded and swept away. Running, faster.

Somehow I have managed to escape the deadly storm. Not without a cost. My heart sinks as I start to look around in a panic of people and realize my sister is nowhere to be found. I can only pray now that she is in the multitudes of people racing around me. The first night has set in. I am too wound up to sleep. I stay up all night trying to play back to horrific events that have just occurred in my life.

The Narrative



With trying to help doctor my mother's badly cut up leg, think about where my sister could be, and trying to ignore people of all ages crying, there is no sleep to be had here. I keep wondering when I will be allowed back into my community, and what I will be living in for the next couple weeks or years of my life.

We start to learn about the death tolls of the tsunami, and know that the numbers will probably still rise. There are so many that have died already. With over 150,000 people from all over the region and 110,229 killed in Indonesia, I wonder how many of my family members and friends are included in those numbers ("Indonesia" 2005).

I finally get to start to make the journey back to my community, and my surroundings become a living nightmare. People everywhere are dead. I try so hard not to look, but it is inevitable. Then off in the distance, I see her lying there so peacefully. Almost as if she is resting in the afternoon sun that was so displaced in the nightmarish scene. How did she not make it? When did I lose her in the race to safety? My sister was there the whole time. I don't remember losing her hand, but she did. And now she is gone.

As I continue on through the devastation and sense of loss surrounding me, I finally see a sense of hope. When I reach what would have been my home, a woman is standing there. I approach her, she tells me she is here to help, and has a temporary structure that can be put up in a matter of an hour. She tells me my family and I will have a safe place to sleep tonight. The sense of a solid foundation is swiftly made possible in an environment that was so rapidly stripped of its own.

User Description

Emergency housing units will be used by the victims of the natural disaster.

The supplies for the project will be owned and distributed by UNHCR organization and distributed by the government. Once distributed the housing will be owned by the client.

The clients will be placed in family pods ranging from 2-4 families during the transitional housing process to permanent housing.
The transitional dwelling will be constructed right after the disaster into pod groups. After the rubble is moved away, then the permanent structures will continue to be built.
There will be physical restraints in which both the temporary and permanent structures will need physical labor to be built and assembled together.
It is important to look into the medical issues (injuries) that have risen from the storm, and assess those as needed.
From a design aspect it is very important to look into the cultural aspects of the victims. These dwellings will be used all over the world, but it is important to assess the cultural differences of living, and different climate issues. Small alterations will be made to the dwellings to adapt correctly into the site it is placed in.

The two most important elements to the dwellings are public and private spaces. One area for each.

Public spaces will be placed in the front of the dwelling since the temporary dwelling will be shared with many family memebers, and with different families. These spaces will include kitchen and bath-rooms.

Private spaces will be placed in the back, with lockable barriers for safety of women and children. This space will be the bedrooms.

Major Project Elements

Site Information: Macro & Micro

Region: Upper Midwest
City: Northeast Minneapolis, Minnesota
Site: Columbia Park

This site is of interest for the project, since there are comparisons that can be pulled out of the climate, and types of natural disasters that occur here.
Columbia Park will be used as a base site to be compared to other disaster sites around the world that the emergency dwelling can be used in.

Columbia Park offers a study of the 2011 North Minneapolis Tornado, and what destruction can do to a major city. The process of how the city analyzed the houses after the tornado, how they housed the victims if necessary, the clean up process, and lastly to finally build permanent houses.

The site area for Columbia Park, and all other high hazardous climate zones, will have to comply with the new city boundaries that will be made after disaster strikes. Destruction may or may not take down certain major defining elements of a city meaning that major landmarks and views will all have changed after a natural disaster strikes.
The current site area is 183 acre park run by the Minneapolis Park and Recreation Board. It is bound off by 37th Ave on the North, Central Ave on the East, 27th Ave on the South, and St. Anthony Ave on the West. The main area views are ponds, and golf course in the park, the Mississippi River to the West, residential to the north, and transportation utilities to the south. Also there are other light industrial uses around the boundaries of the site.

Project Emphasis

The first step for this project is getting a place for people to sleep the same night a natural disaster takes their home away. People need a place to sleep, and escape the horror that has just entered into their lives.

The second step, which is also the most important step of the entire project, is to put up transitional dwellings while the rubble is cleared away. Transitional dwellings will be effective, since the materials used to build the transitional dwellings can be reused in the construction of the permanent dwellings.

The third step is to make a more efficient way of clearing the rubble from the city. The faster the rubble is cleared, the faster permanent dwellings can be constructed.

The last step is then to construct the permanent dwellings for the victims. From this point on, the victims can start theirs new lives in their new homes.

Plan for Proceeding

Definition of research direction

The Theoretical Premise and Unifying Idea will be more defined with the research of what techniques the workers will need to possess to be able to construct these dwellings.

The project typology will become more defined with the research of what the meanings of temporary, transitional and permanent dwellings are. Choosing which type is the most effective for each climate, and type of disaster. Also defining what materials can be incorporated into the final designs.

Historical context research will be looking into the different cultures around the world that are in high disaster zones. This will help alter the private and public spaces within the dwellings, temporary or permanent.

Research relating to the site analysis is learning about the major disaster zones around the world, finding what disasters occur most in the zones, whether it being a hurricane, tornado, or tsunami. The site analysis will be also looking into local materials, and the existing infrastructure.

The programmatic requirements will be looking into the basic needs that have to be accounted and designed for the victims.

Plan for Proceeding

Design Methodology

Figuring out the distribution of the materials and the supplies of victims will be done using the mixed method.

Graphic analysis will show the mapped out disaster zones across the world. Also finding different material mainly used for each region across the world.

Digital analysis will account for the majority of the resources I will use to gather other information.

Interviews would ideally be held with victims from past natural disasters, Cameron Sinclair, founder of Architecture for Humanity, and Greg Helsner, who worked for Architecture for Humanity.

To gather and sort research I will use the Concurrent Transformative Strategy.

Plan for Proceeding

Quantitative & Qualitative Data

Statistical data will include how often natural disasters hit certain areas of the world, populations of cities, number of families per unit, water and sewage usage of current city, and lastly environmental efficient water and sewage systems, for post disaster.

Scientific data will include studies of what natural materials of a region hold up most effectively. This data will also look into the current buildings of a city and research their materials, to see what buildings may hold up the longest under stress and water pressure. Lastly looking up material durability for the emergency dwellings that will be used after the disaster.

Direct observations will be done during the site visit. The site in New Orleans will show how the city has recovered from a natural disaster, remnants of the past destruction, and how citizens have moved on.

A local survey will be asking people what they would prefer to live in if they were placed in a situation where they lost their home. What would be the most comfortable living conditions for the victims of a natural disaster.

During the site visit it will be important to interview victims of Katrina, to capture the feelings of being in a natural disaster.

Plan for Proceeding

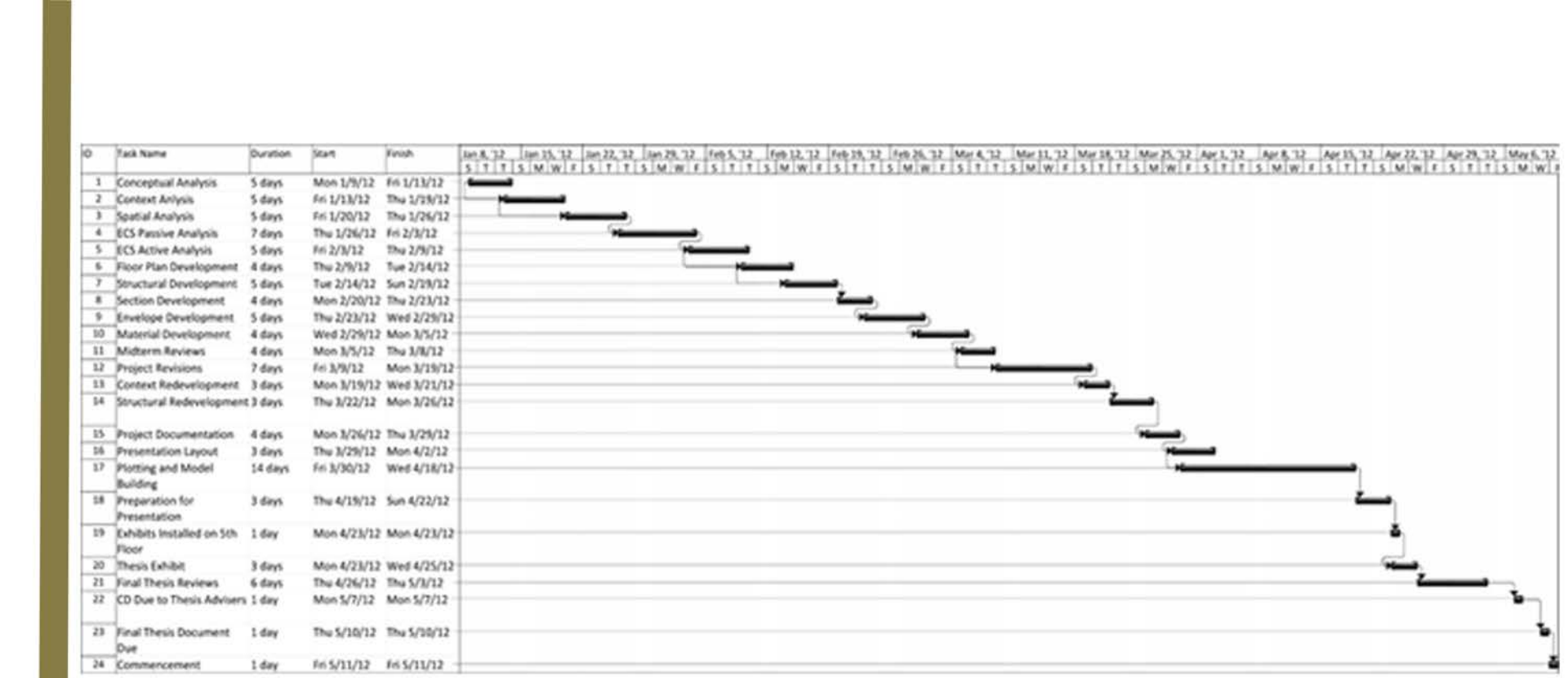
Documenting the Design Process

The final RFP document will be in a PDF form so it can be easily printed out into a book, or stay as an electronic document. It will also be preserved in the NDSU Architectural Library online repository. Scholars can access my work on NDSU online repository.

The physical aspects of the thesis project will have a full scale model that the audience will be able to walk into and experience the emergency dwelling. The digital aspect will have animations and a digital model to show elevations, sections, and perspectives.

All this will be accomplished by using time management, and looking at the Blackboard website for further instructions and previous examples. Time intervals will be blocked out to show how much time should be spent on each section of the project.

ID	Task Name	Duration	Start	Finish
1	Conceptual Analysis	5 days	Mon 1/9/12	Fri 1/13/12
2	Context Anlysis	5 days	Fri 1/13/12	Thu 1/19/12
3	Spatial Analysis	5 days	Fri 1/20/12	Thu 1/26/12
4	ECS Passive Analysis	7 days	Thu 1/26/12	Fri 2/3/12
5	ECS Active Analysis	5 days	Fri 2/3/12	Thu 2/9/12
6	Floor Plan Development	4 days	Thu 2/9/12	Tue 2/14/12
7	Structural Development	5 days	Tue 2/14/12	Sun 2/19/12
8	Section Development	4 days	Mon 2/20/12	Thu 2/23/12
9	Envelope Development	5 days	Thu 2/23/12	Wed 2/29/12
10	Material Development	4 days	Wed 2/29/12	Mon 3/5/12
11	Midterm Reviews	4 days	Mon 3/5/12	Thu 3/8/12
12	Project Revisions	7 days	Fri 3/9/12	Mon 3/19/12
13	Context Redevelopment	3 days	Mon 3/19/12	Wed 3/21/12
14	Structural Redevelopment	3 days	Thu 3/22/12	Mon 3/26/12
15	Project Documentation	4 days	Mon 3/26/12	Thu 3/29/12
16	Presentation Layout	3 days	Thu 3/29/12	Mon 4/2/12
17	Plotting and Model Building	14 days	Fri 3/30/12	Wed 4/18/12
18	Preparation for Presentation	3 days	Thu 4/19/12	Sun 4/22/12
19	Exhibits Installed on 5th Floor	1 day	Mon 4/23/12	Mon 4/23/12
20	Thesis Exhibit	3 days	Mon 4/23/12	Wed 4/25/12
21	Final Thesis Reviews	6 days	Thu 4/26/12	Thu 5/3/12
22	CD Due to Thesis Advisers	1 day	Mon 5/7/12	Mon 5/7/12
23	Final Thesis Document Due	1 day	Thu 5/10/12	Thu 5/10/12
24	Commencement	1 day	Fri 5/11/12	Fri 5/11/12



Work Schedule

Research

Climate Control

Natural disasters have been occurring since the beginning of time. Ranging from fires to tsunamis, they can threaten an entire city's existence. Increasing temperatures rising from an average of -.2 degrees Celsius in 1000 to over 4 degrees Celsius 2000 is changing agriculture production (increase in food risks), ecosystems, water supplies, and more importantly the numbers of natural disasters (Dow and Downing, 2007, p. 35). The numbers of floods have increased from 8 worldwide in 1960 to 170 in 2005. Wind storms have increased from 20 worldwide in 1960 to 122 in 2005 (Dow and Downing, 2007, p. 26). As natural disasters have increased in numbers, they have also intensified and have started to affect more people. For every one weather-related disaster (accounting for droughts, extreme temperatures, floods, windstorms, landslides, or wild fires) there are about 10 people who are killed, and 100 people who are in a state of emergency, or need of international assistance. North America, Lithuania, and China are the top three countries that had over 100 natural disasters from 2000-2005 (Dow and Downing, 2007, p. 26). Scientists are currently researching an earthquake that could strike the New Madrid fault line located on the Missouri, Arkansas, and Tennessee boarder. FEMA has estimated it would cause $70 billion of damages. That is compared to the $50 billion dollars caused by Hurricane Katrina in New Orleans, Louisiana. The earthquake will be considered the biggest natural disaster for North America if it does occur. (Architect the AIA Magazine, 2011, p.169). States that reside around the New Madrid fault line are discussing whether it is worth the cost of bringing buildings up to code in order to prepare them for the predicted earthquake. More and more of our coastal cities are becoming risks points with the rising of sea levels, coastal erosion, and more severe storms striking there. This leaves the 40% (100 million people) that live in coastal cities at a higher chance of being affected by a natural disaster. (Dow and Downing, 2007, p.64).

Research

Some scientists predict that with the 4 centimeter per year rising sea level, by 2100 Bangkok will be entirely under water. Also predicted is that by 2080 sea level rising factors will overtake 33% of the world's coastal wetlands and turn them into open water (Architect the AIA Magazine, 2011, p.166). Just building a massive seawall is not going to prevent the flooding waters from coming. More high risk spatial planning needs to be done to save more lives and infrastructure. The saltwater passing upstream into freshwater areas will strain sanitary water supplies. This will leave poor countries even less clean water.

There has already been a 77% increase in the water distribution by the Southern Nevada Water Authority for the city of Las Vegas from 1990-2008 (Architect the AIA Magazine, 2011, p.167).

Rising sea levels and the damages brought by the 2004 Japanese Tsunami have resulted in new building restrictions limiting buildings to 100 meters away from the coast. In the southwest area of Sri Lanka they are pushed back 200 meters from the coast. The law's intention is to be helpful, but citizens of Sri Lanka who did not have their homes destroyed by the Tsunami, lost them to relocation. The residents need an accelerated solution that could stand up against the powerful forces of a Tsunami if one were to strike again.

With the increasing numbers of natural disasters there will be a greater need for emergency housing. Buildings are having to be brought up to current codes to comply with the increased risk that they bear of being easily destroyed by storms. There is no true way to completely be protected from these more severe and more constant storms. It is our duty as architects to help citizens better prepare their homes to increase the chance of having their homes survive the natural disasters they face.

Research

Temporary vs. Transitional

With increased numbers of refugees, disaster victims, and displaced victims, the need for both temporary and transitional housing is greater now than ever before. According to the "Protracted Refugee Situations" UNHCR, June 2004 there was estimated to be 6,200,000 refugees in 2003. The number increased to 9,200,000 a year later according to "2004 Global Refugee Trends," (UNHCR June 2005). Also according to the "Protracted Refugee Situations," the length of displacement has increased from 9 years in 1993 to 17 years in 2003. These refugees are mostly women and children with 49% being females, and 47% being children (UNHCR, 2004). Internally displaced persons (IDPs) have also seen similar increase in numbers. As of 2004 there were 25,000,000 IDPs throughout 49 countries (UNHCR, 2005). The Internal Displacement Monitoring Centre, Norwegian Refugee Council reports that there is an average of 14 years from which people are forced out of their homes from the beginning of a conflict or war to the end, when they can move back to their homes. 70-80% of IDPs are women and children, and half of all these victims live in Africa (Norwegian Refugee Council). Design solutions need to account for day-to-day realities like "providing a roof, clean water and sanitation to families in need" (Architecture for Humanity, 2006, p. 34).

Research

Temporary Housing

Since the 1906 San Francisco earthquake, and fire tents have always been the first immediate response for temporary shelter on site. There are many advantages to them. They can be easily stockpiled, they can be easily put up by women and children, they can easily be replaced, and they are lightweight so they do not cost a lot to ship. In most natural disaster refugee situations the temporary solution is not meant to last long. The longer the temporary shelters stay up the longer it will take victims to get aid for permanent houses. With temporary shelters that last for a long amount of time, help aids see the the victims having homes and can move on to the next disaster. They forget to come back and finish the job. The UNHCR provides victims with a canvas if there are not local materials around to use right after a natural disaster. Some negative aspects of tents are that if they are stockpiled for too long they rot, and also the waste material that comes from them after they have been torn and worn out is a costly factor for the environment.

The best layout for a tent is a tunnel shape, for the most head room and length of space. The dome shape is the best shape to resist the wind. Using a bathtub liner will help insulate and can be used as flooring. Placing the tie ropes in the front and back will allow more tents to be lined up closer to one another rather than if they were placed on the sides. Partitions are used for dividers and also a source of security for women and children, and distinguishing between public and private spaces.

New designs for tents have been in development for 20 years. The process is slow, utilizing different tests of each design. The designs have to be surveyed to see how well they hold up. There have been other design solutions instead of tents such as the Global Village Shelters, and the Shelter Frame Kit Project. Working with prefabrication the units can be swiftly assembled into place. The down side is they are not as cheap to ship. They are also more bulky, so less can be shipped at a time.

Research

Another fast temporary housing solution we see in the United States are FEMA trailers. They can be easily shipped to different parts of America for families to share a secure space. Instead of using tents placed in rows and rows for emergency housing for victims of Hurricane Katrina there were lines and lines of FEMA trailers.

Whether sites use trailers or tents, it is crucial to locate the temporary units on the site of the disaster. If the units are too far away from town the units will go unused or the victims will be forgotten. The victims do not want to be relocated. They want to stay in their home communities. Their home communities are where their work and social networks are.

Transitional Housing

Architecture for Humanity states, "An important strategy for speeding reconstruction has been to design and build transitional housing using materials that can be repurposed for the construction of permanent housing" (p. 98). Transitional houses reduce and reuse their recycled materials from their temporary place to their permanent homes. Using the materials from the temporary unit to create a permanent house helps reduce waste materials and building costs. Pallet housing has become popular across the world. Since shipping pallets are in mass supply from other supplies being shipped to the site they can be constructed in a matter of hours for a more temporary solution and later used as foundations in permanent homes. The pallets can be used as walls and can be filled for insulation in colder climates or left open for hot climates. Gabion walls are also widely used for structure. They can be placed alongside a destroyed wall of another building to construct against or used in its own right for a new home. They are cheap to construct, and can be made from materials ranging from wire mesh to bamboo. All transitional housing has the opportunity to incorporate the Self-Help Movement and provide education to the citizens.

Research

They also allow residents to be paid while they build their own homes.
Transitional housing seems the most realistic solution for my thesis project. Temporary housing solutions have been set in stone with the shipping cost and easy availability. There are more options to work with transitional homes and explore different materials and different designs.

Recycling to Make Old Products New Again

Working with a site that is completely destroyed, it is hard to find new materials to build with. For first initial dwellings it is important to know how to work with the materials around. More and more people are building with recycled materials every day. In order to keep our designs sustainable and our environment intact, using recyclable materials should be a first thought in the design process. However, when someone is looking around to what was their neighborhood, and all they see is destruction, they are probably not thinking about how sustainable they can be. All they want to do is clean up the mess and start rebuilding their new home as quickly as possible. It is important to think about how someone can reuse their red brick siding or their half of a demolished concrete deck before they go ahead and bring all those good materials to the land fill. "Downcycling" is a concept under research in Germany. Different organizations are testing the validity of a material after it has been used once to see if the material can be used again. If it cannot be reused for its original purpose, but indeed for another, it is considered to be "downcycled".
For example, glass cannot be reused for glazing. The material is subject to clouding and discoloration after its original use. So the material is used for foam insulation instead.
Materials that are able to hold up to original qualities are considered to be recyclable. Research shows that metals are 60% recyclable; timber is at 65%, while steel is 100%.

Research

These materials are from construction waste, and there is more opportunity to reuse these materials on site. Actual building materials like concrete can cut the construction cost by 25% if they are used as recycled materials. Concrete, like glass, may not always be able to be recycled, but instead "downcycled" into asphalt for different pavements for a project. Bricks can usually be recycled if they are not damaged or broken. Tests have shown that they have the same strength after one use compared to when they are originally installed.
By using both reuse of whole materials and part of recycled materials, new buildings and especially new homes can be constructed with the materials present. This will help lower the costs of buildings, and the energy wastes, pollution in the environment, and quicken the building process on a disaster site.

Identifying Building Types, Cultures, Climates, and Natural Disasters around the World

North America:
Typical building materials in North America are concrete and wood. Wood is a renewable and maintainable material. It is not fossil-fuel-based so the material is also sustainable. Wood is very durable and can be used in a wide-range of purposes. Concrete is economical and flexible. It allows builders to easily construct a building. If pre-cast concrete is used, it will not rust or corrode and is easy to maintain.

Minneapolis:
These two materials are used in these typical housing styles for Minneapolis: craftsman, arts and crafts, bungalow, mission, post-war, split level or Tudor. The houses around the site are mostly ranch or split level style houses.

Research

Minnesota as a state experiences the four season with cold winters, mild spring and falls, and hot humid summers. A Minneapolis average for low temperatures is about 7 degrees Fahrenheit in the winter and 84 degrees in the summer.
Minneapolis, along with the Midwest, experiences the most tornadoes in the world. A tornado has struck every month from March to November in Minnesota's history. The majority of the tornadoes that strike Minnesota are in late spring and early summer. In May 15% of tornadoes strike, June 37%, and July 25% making up ¾ of all tornadoes that occur in Minnesota. The deadliest tornado Minnesota has ever experienced was on April 14th of 1886. It injured 213 people, and killed 72 (including a bride and groom). The tornado started in St. Cloud and continued on to Sauk Rapids. More recently, and more connected to my thesis project, was the May 22nd 2011 tornado. The three tornadoes that struck the metro area that day killed one person and injured at least 30. Three dozen people were left homeless after the storm, and many other houses were damaged. From 1950-2010 there have been 1653 tornadoes in Minnesota, with an annual average of 27. There have been 98 deaths, with a 1.61 annual average, and 1933 injured with a 31.7 annual average.

New Orleans:
The two main building materials of North America are used in these typical housing styles for New Orleans: bungalows, creole cottage, American and creole townhouse, raised center-hall cottage or villa, shotgun house, or double-gallery house. These styles have existed for two hundred years.
Louisiana as a state has a semitropical climate. In New Orleans the average daily temperature is 68 degrees Fahrenheit. The yearly high is 82 degrees in July, and the average low is 52 degrees in January. There is rarely snow in the south part of the state, but sometimes in the north.

Research

The city of New Orleans experiences hurricanes quite frequently in the summer and fall. One of the most destructive hurricanes to strike New Orleans was on August 14th of 1969. Were it not for the early evacuation warnings the 262 people that Hurricane Camille did take could have been multiplied by the thousands. It was a hurricane 5, and with its destructive winds and flooding left 15,000 people homeless. A more recent destructive hurricane was Hurricane Katrina that struck on August 29th of 2005. It killed more than 16,000 people, destroyed 200,000 homes, and displaced 1 million people. It was recorded as the worst modern natural disaster in US history. It left 80% of the city underwater.

Japan:
The islands of Japan are of volcanic origin and most of the buildings are made of wood and timber construction, since stone is in low supply. Timber construction is also light weight so it is easy to construct. Some major styles of roofs are gables or saddle. There is a wide use of clay tiles for roofs on Japanese houses. As with the famous Shinto Shrines and ceremonial tea houses the use of a garden and bamboo fence are widely used in residential design all over Japan. It is important to note the Japanese do not use central heating except in the northern part of Japan. They instead use heaters that can move around with them inside their homes. This is also true for commercial buildings.

In Japan there are four different climatic regions. These include Pacific coastal which has high summer rainfall. The Japan Sea coastal which has heavy winter snows. Thirdly, the inland region has generally less rain than the other regions of the country. Lastly, the Ryukyu Island region has subtropical to tropical climates. The country's northern area has an average of 44 degrees Fahrenheit. The central area's average is 59 degrees, and the southern area is 73 degrees.

Research

Japan is imperiled by tsunamis. Out of the top ten worst tsunamis recorded in history starting in year 365, Japan was involved in 5 of them. The largest tsunami that affected the country was in 1498, which was also number four on the list. It claimed over 30,000 lives. More recently the country was struck by a tsunami in March of 2011. The death toll was 12,690 with 14,700 people still missing. There were 500,000 evacuated and displaced from the disaster. There were about 400,000 homeless, which were mostly elderly. There were entire towns that were swept away by the water.

Pakistan:
Use of timber frame x-bracing and stone filler for light weight construction is a commonly used building technique in the country of Pakistan. Simple reinforcements are used to make homes earthquake resistant. Homes in Pakistan tend to not use concrete which makes the homes more expensive. In the country of Pakistan buildings have to be built to resist seismic waves.

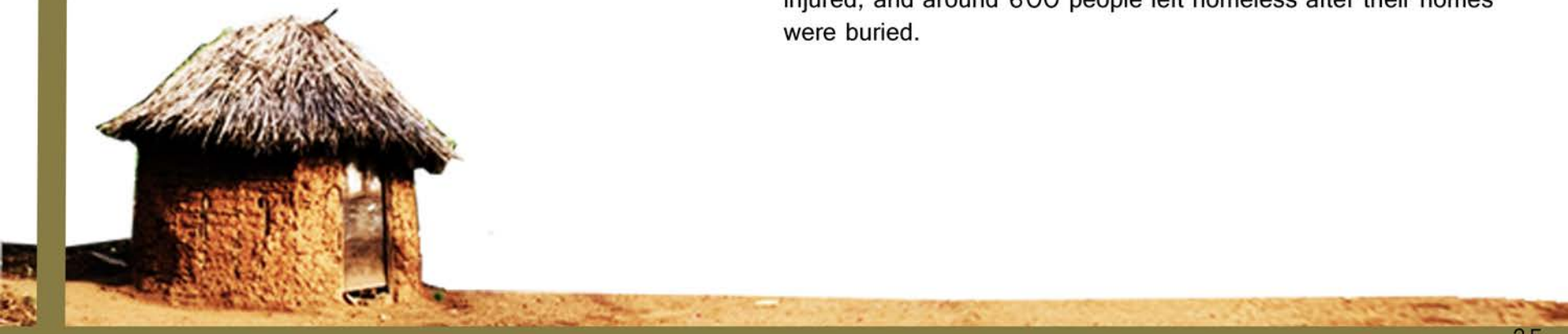
The temperature range in Pakistan varies greatly from day to night. The central part of the country has hot summers and cold winters, while the northern part of the country stays mostly cold throughout the year being surrounded by snowcapped mountains, and the southern part stays hot while being surrounded by deserts. The overall averages of temperatures are 104 degrees Fahrenheit in the summer to 36 degrees Fahrenheit in the winter. In the north eastern region of the country earthquakes are a reoccurring natural disaster. In 2005 the biggest earthquake to ever strike Pakistan took 86,000 lives. It also injured over 69,000 people. In the region of Kashmir entire villages were destroyed, and Uri had 80% of its town destroyed. There were 4 million people left homeless in that aftermath. The latest monumental earthquake was in 2008 and killed 166 people. There were approximately 3,487 homes destroyed.

Research

Peru:
Local Building materials are adobe, tapial (big blocks of earth), and quincha (in which the earth is used as a filling element) in the country of Peru. Materials used for quincha can be straw, plaster, or rock. As in Pakistan, buildings in Peru also have to be protected against seismic waves. Adobe is made of Sand – 55-75%, Silt – 0-28%, Clay – 15-18% for the best strength combination against seismic waves. Qunicha is made of Gravel – 0-15%, Sand – 40-50%, Silt – 0-35%, Clay – 15-25% for the best combination against seismic waves.

Peru has many different climate regions. The regions range from the Andean cold mountain air, to the Amazon's humid thick air. The average air temperature ranges from about 70 degrees Fahrenheit in the summer to 50 degrees in the winter for the entire tropical based country. In the Sierra the range is only from 54 degrees to 48 degrees. In the Amazon the temperature average stays at about 90 degrees all year long. Their extreme temperatures range from about 50-90 degrees Fahrenheit.

The main natural disasters Peru experiences are landslides. The deadliest landslide the country has experienced was in 1970 in the town of Yungay where 20,000 people lost their lives. More recently in April of 2010 the north-eastern region of Peru was struck by a landslide. The death toll was around 50 people, 50 injured, and around 600 people left homeless after their homes were buried.



Summary of Research

It is important to understand the changes in our environment, not only how they effect us today, but also many years from now. How our storm patterns are changing and growing. When working with new houses or buildings it is important to take into account the rising of sea levels. As the people of Sri Lanka have already discovered, homes close to the coast will have to be demolished and rebuilt further inland. More flood planning will have to be done in coastal cities as well. A major example of how dependance on huge levees to protect a city from disaster failed is New Orleans, with Hurricane Katrina. Naïve thinking can cost thousands of people their lives and homes. We have to do more detailed planning to compete with the bigger and stronger storms that are destroying our cities.

If cities are destroyed, tents and trailers are readily available to victims. These temporary housing options serve as a quick response to help give people a space to sleep on the very first nights after a disaster hits. Tents are a concrete temporary option because of simplicity, and cheap shipping costs. The second step to emergency housing is transitional housing. It is important that disaster victims are not left in temporary housing for long periods of time. 8-12 months is considered too long. With the plethora of options and designs for transitional houses there should be less of an issue getting people into permanent homes than what is actually occuring. Transitional houses are a more structured option to emergency housing, and also allow owners of the transitional units to use materials from the units in their permanent houses. I think this is the most beneficial option, since it is helping people live in a more structured and insulated unit than a tent, and it is helping them build their permanent homes. Transitional units can be made in prefabrication or materials from the immediate site, or in combination.

Summary of Research

If the materials from the site are used, it allows useful materials to be recycled and not bulldozed away. The concept of "downcycling" is a new concept on recycling which can be very beneficial in the practice of working on natural disaster sites. It is important to spread detailed information about what construction materials are valuable, and which should not be reused because of the loss of strength in the material after its first use. This way a victim trying to rebuild their home does not reuse bad materials or throw away good ones.

With each natural disaster researched for my five sites many people were left homeless or displaced. Dealing with different climates and housing styles are important aspects of design, to make sure every one is able to make their transitional unit their own oasis from the destruction around them. By finding the local materials of the five main sites for my thesis project I am able to look at the different possible materials to construct my design without making them too expensive. Also the idea of "downcycling" partially demolished materials at the current disaster sites helps give opportunities for building materials for permanent houses.

Understanding the severity of the natural disasters and the quantity that strike each of the sites is important to understand, to accommodate the thousands of people that could be potentially left homeless.

It is important for each city to have a plan for emergency, so they can be prepared, and NGOs can be available to distribute shelter to all who have lost their own.

Case Studies


Global
Village
Shelthers

Case Study Research

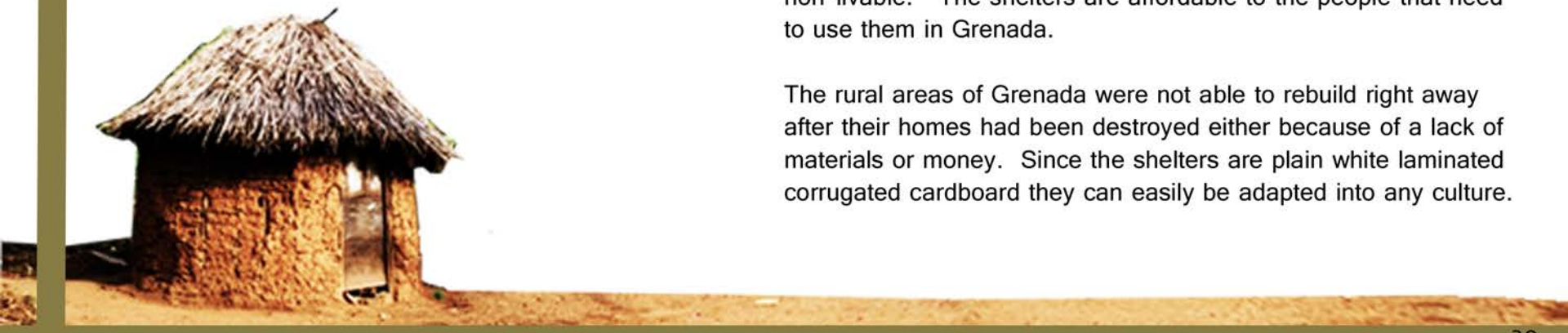
Global Village Shelters are temporary emergency shelters. They were created in Connecticut, USA, and are now placed all over the world, including Pakistan and Grenada. They are 67 square feet and contain an open floor plan for living and sleeping. Other units contain joint toilets for community use (Open Architecture Network, 2011).

The characteristics of the shelters are that they give a different option to fast emergency housing besides a synthetic tent. The same structure can house joint toilets, or shared kitchen spaces. A key factor is that they can withstand cold climates. They are a short lived option for victims of a natural disaster like other common temporary emergency housing options. Organizations do not want long-term temporary housing as it retards the re-building aid process to the victims.

The Global Village Shelter has a lifespan of 8-12 months. It can also be shipped quickly anywhere around the world. In contrast to the typical first response tent shelter for emergency situations, Global Village Shelters are made of corrugated cardboard. Since it is made out of a more durable material it also makes it heavier and a lot more costly to ship. This is a huge problem, since the shelters are mainly used overseas, and not in the continental US. They are not able to be shipped in large amounts like tents. For every 88 Global Village Shelters, you can ship 500 to 1,000 tents (Open Architecture Network, 2011).

The corrugated cardboard has shown some faults in the upkeep of the material. The Global Village units are not supposed to last long, although during their short term use areas with heavy rains and humid temperatures have experienced water damaged to their units. More tests and analyzing more material choices may have prevented the onset of water damaged.

Case Study Research



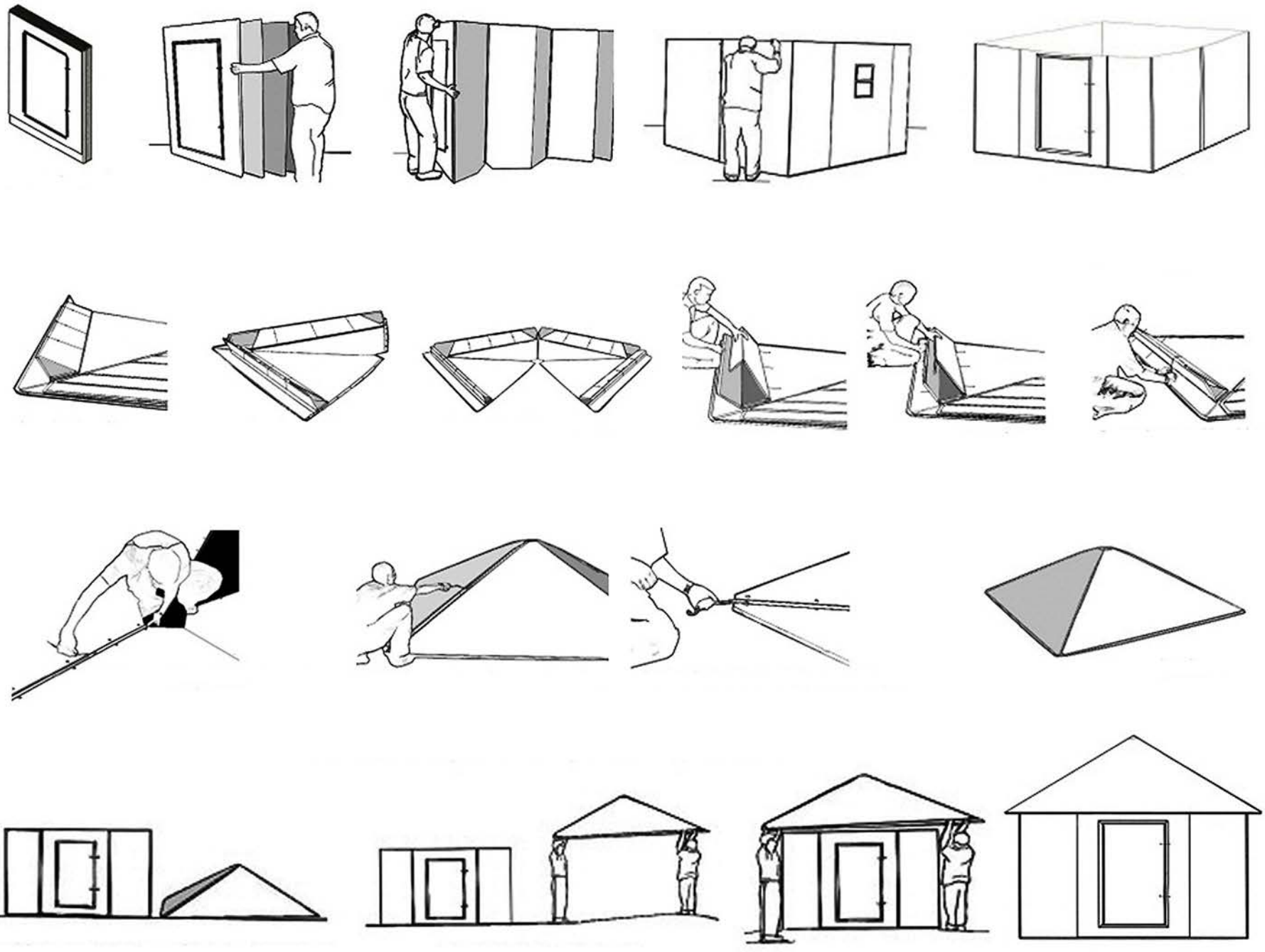
Throughout the faults of the material, the users of the Global Village Shelters were able to use resources to protect their units. Some places, like in Pakistan, added a tarp for more protection from the outdoor elements. Other places used wooden crates left over from shipping supplies to the natural disaster site to help lift the units off of the wet ground.

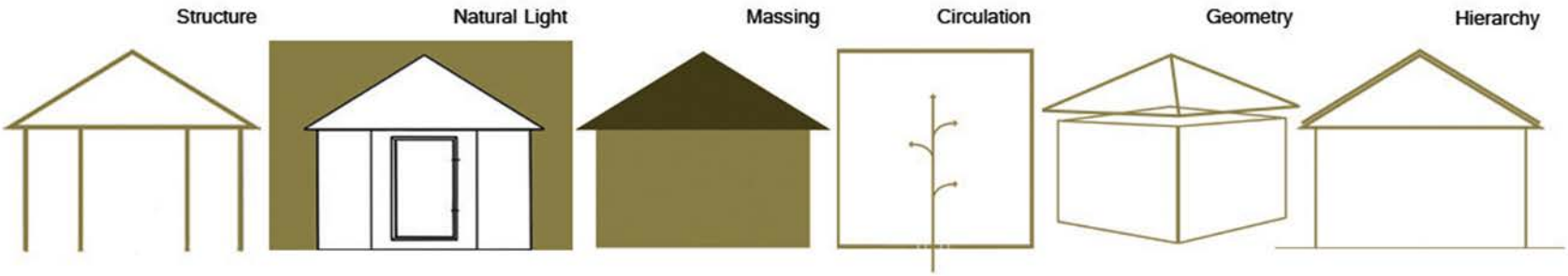
The use of corrugated cardboard has proven to be a successful building material even through its faults. The protection of its users and its ease of being culturally adaptable has shown to be one of the better temporary emergency housing options.

Global Village Shelters have a more desirable security option compared to tents with the use of a durable material, corrugated cardboard. One of the major issues in designing an emergency shelter is how to protect women and children in small compact communities. Tents are easily broken into leaving the users vulnerable to crime. It is the conflict of choosing to ship more tent units at one time, or ship less Global Village Shelters to compromise the safety of its users.

The Global Village Shelters are adaptable to Grenada, as they have fulfilled the loss of housing after a hurricane. It can withstand the climate issues there within the needed lifespan of the shelter. Rain has affected the roofs, but not enough to make them non-livable. The shelters are affordable to the people that need to use them in Grenada.

The rural areas of Grenada were not able to rebuild right away after their homes had been destroyed either because of a lack of materials or money. Since the shelters are plain white laminated corrugated cardboard they can easily be adapted into any culture.




Structure
Natural Light
Massing
Circulation
Geometry
Hierarchy


Mobile
Dwelling
Unit

Case Study Research

Lot-EK's Mobile Dwelling Units are small-scale portable architecture. They are 9'-6" tall x 40'-0" long x 8'-0" high. Lot-EK's Mobile Dwelling Units are completely mobile, so they can move with the user. The spaces within can be condensed or expanded to accommodate for the moving process. There is an area for storage, cooking, dining, sleeping, and living. The entire unit is prefabricated so it can be made quickly and be ready to use when it arrives on site (Scoates, 2003, p. 12).

Mobile dwelling options have been around since the beginning of housing options. Lot-EK's wanted to use existing transportation systems so the units would be easily shipped to any port in the world. They are small like other trailer homes and tents. Unlike other mobile options Lot-EK mobile dwelling units are made of cargo cars, instead of traditional building materials (Lot-EK, 2011). The mobile dwelling units are a perfect example of downcycling, by taking an object that already exists in excess and turning it into something useful and sustainable.

The steel material of the cargo car is a crucial part of the design in how it protects the interior parts of the unit while it is shipped either by train or boat. The steel frame also helps protect the owners of each unit from outdoor elements and other people. The steel material is tough enough to be reused over and over again. Leaving the original exterior paint of the cargo car gives an individual feel to the unit.

Lot-EK has experimented with combining more than one cargo unit to make larger units. Connecting the units can give extra space to larger families, or community spaces. The community spaces would allow people living in a group of cargo cars a space to meet up with friends or hold group meetings.

Case Study Research

In disaster relief housing communities, it is important to give the victims an alternative community space while they are living in their small relief shelters.

Mobile dwelling units can be seen as an unattractive option of living. Some views have portrayed the concept of living in cargo cars as living in stacked boxes in masses, allowing people to have no personal expression to the outside world.

Mobile dwelling units can also be seen as a non-stable living option that is meant to be short term. To attract the mobile dwelling units as a more stable option of living, they are usually referred to as manufactured units to attract consumers of all economic range, high and low. Lot-EK are focused on industrial prefabrication, and on not mobility, since most of the units do not move after they have been occupied. Although the majority public opinion express that cargo car living is an admirable simple low cost living option.

Mobile dwelling units have an adaptable floor plan for the main use of the unit. For example, if the user is not going to be cooking a lot there would be more living space and less cooking space. This allows for a very efficient use of small space.

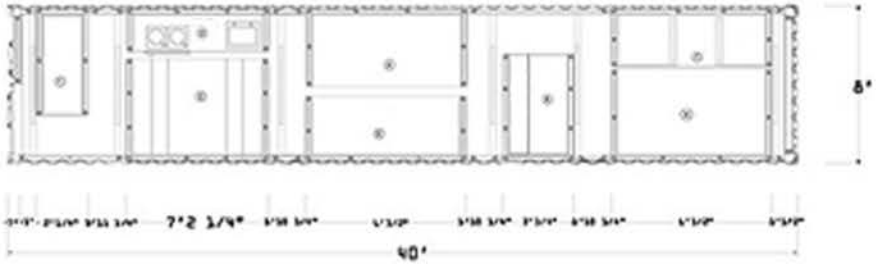
With the flexible floor plans, fast construction, and availability of the cargo units, mobile dwelling unit designs have flourished over the world. As an option for an emergency housing option it does help protect the users compared to a synthetic tent. The unit also allows for a bigger floor plan for more living space. One downside of the mobile dwelling units is the low number of units that are able to be shipped to a location at one time.

A train cargo car is a universally acceptable industrial object because of its usefulness and practicality. This helps the unit be culturally accepted all over the world.

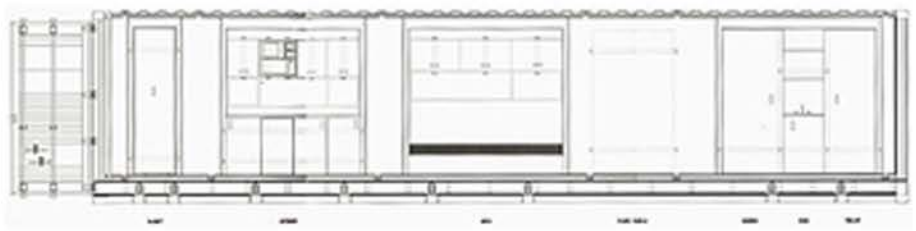
Front Elevation

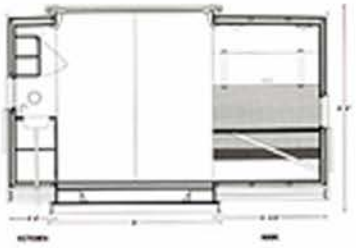
Back Elevation

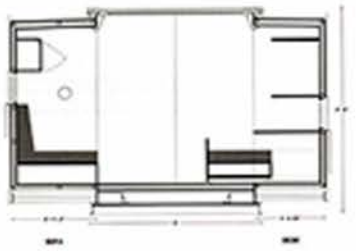
Closed Plan

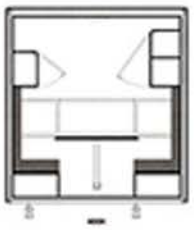


Open Plan

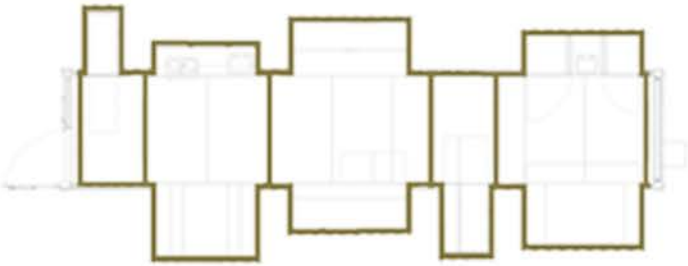




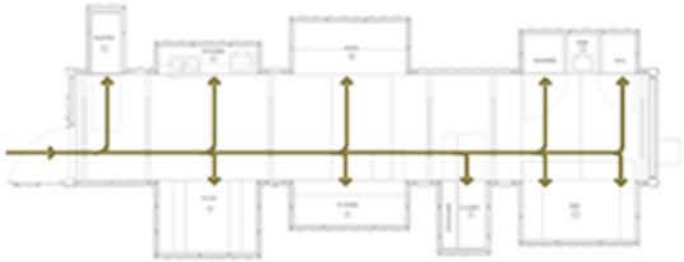




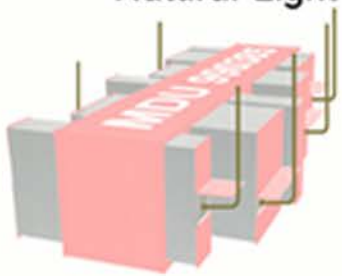
Structure



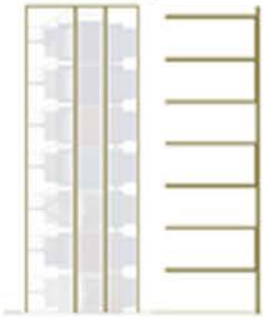
Circulation



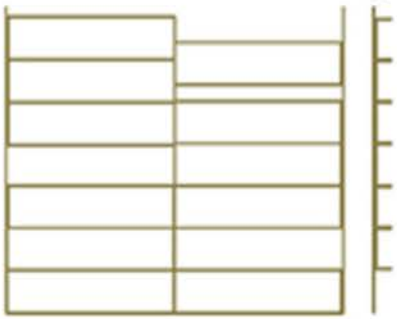
Natural Light



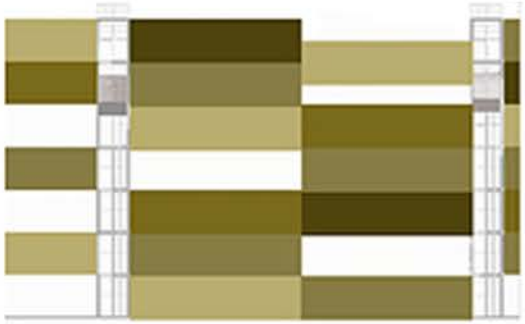
Hierarchy



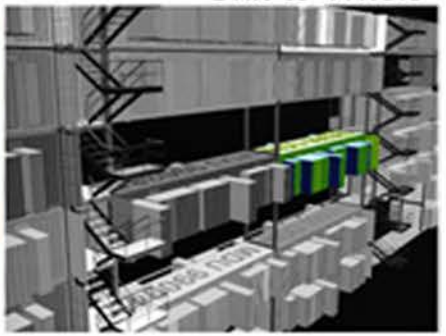
Geometry



Massing



Unit to Whole




Safe
House

Case Study Research

The Safe(R) House is a transitional housing option. They are located in Dodanduwa, Sri Lanka. Safe(R) Houses are 400 square feet/ 37 square meters. The houses contain one to two bedrooms, an open kitchen/living area, and a bathroom (Open Architecture Network, 2011).

After the 2004 Tsunami the Security Ministry of Sri Lanka changed the building restrictions to push back construction to 100 meters away from the shore (Open Architecture Network, 2011). This left one million people needing to tear down their houses and rebuild them elsewhere. The Safe(R) House is a design solution to rebuild for the same cost as people's original houses.

The Safe(R) House has the same exterior elements as homes in Sri Lanka. It uses the local materials to make the homes specific to the native culture. This design solution, however, does not use the regular concrete block walls, with a couple of windows, one door, and a tin roof. Instead it has 4 concrete cores in the center of the house to allow for flexible designs and to relieve the pressures of flooding and to resist tsunami waves. Bamboo or woven partitions are used as ventilation for the structure. It is also elevated so it is less likely to flood.

The Safe(R) Houses have a porous structure that allows natural ventilation and over hanging elements to protect them from the sun. They help improve internal comfort. They also use traditional woven partitions as the siding, made from local materials.

The core columns inside the house are flexible to go around sleeping and entertainment spaces. The cores allow the house to be expandable and have different variations so they are not all the same design. The building process of the Safe(R) House teaches the citizens to help build their homes together as a community.

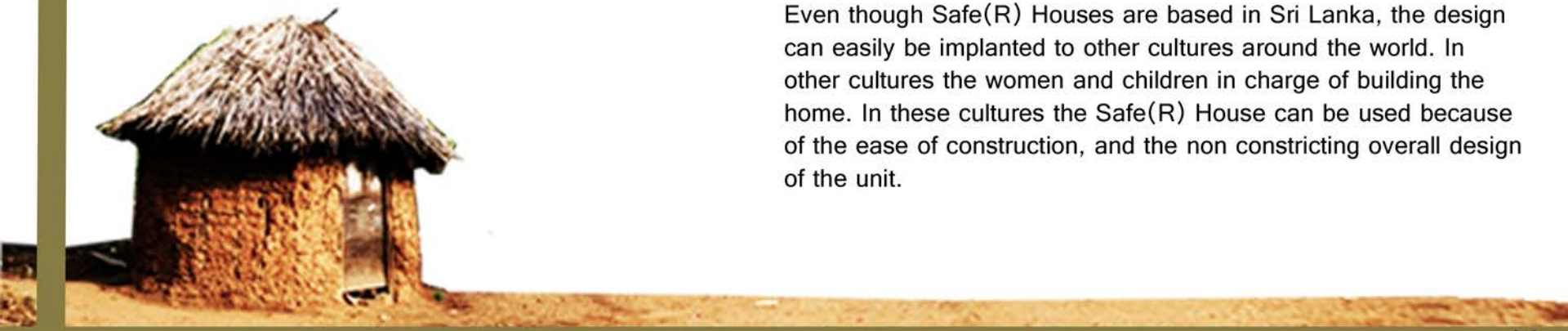
They are able to rebuild their homes if they need to in the future. Being able to help out fellow community members can help family, friends, and strangers come together and make their destroyed community into something new and personal to them. Using local materials will allow the Safe(R) House to be easily adaptable to surrounding Sri Lankan houses.

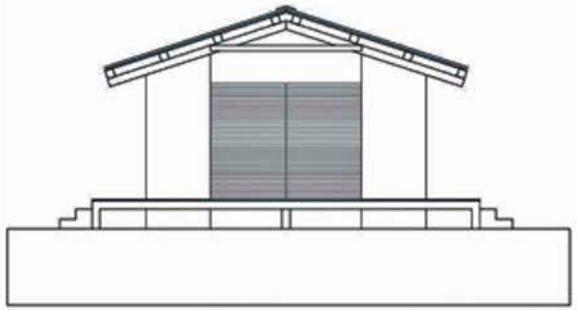
The easy access to materials and the knowledge of being able to build a home gives the community a sense of ownership over its new units. An issue with emergency shelters is that even if they are designed well for their users and the climate they are placed in, victims of a natural disaster can be tentative to move into the home at first. There are so many changes going in the victim's life at one time, moving into a new home at the same time can be overwhelming. For the owner to be able to work with the house from the foundation to the construction of the roof, it gives the sense of ownership and originality.

There is a plan to make community buildings like the Safe(R) House, for meetings and other events. This can easily be done with the flexible floor plan the Safe(R) House has. In the political realm there is a plan to build 1,000 Safe(R) Houses around the Southern and Eastern coastlines where the 100-Meter Rule has not been implemented yet (Open Architecture Network, 2011).

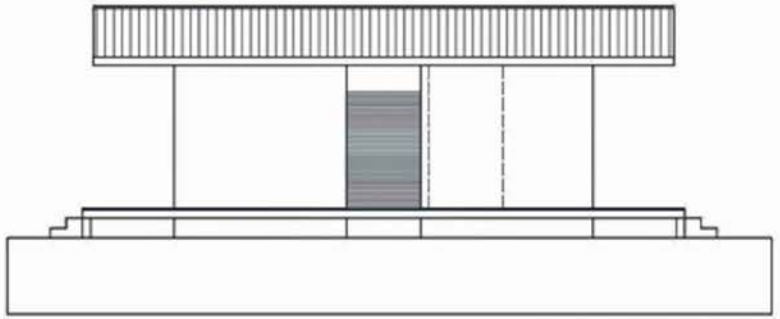
Even though Safe(R) Houses are based in Sri Lanka, the design can easily be implanted to other cultures around the world. In other cultures the women and children in charge of building the home. In these cultures the Safe(R) House can be used because of the ease of construction, and the non constricting overall design of the unit.

Case Study Research

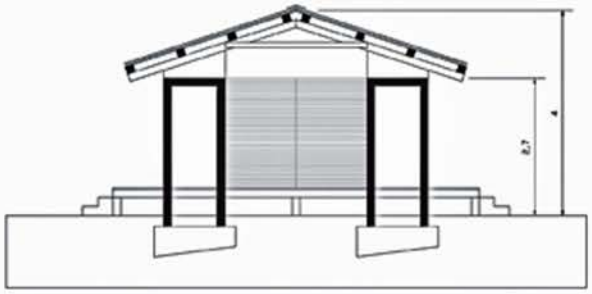




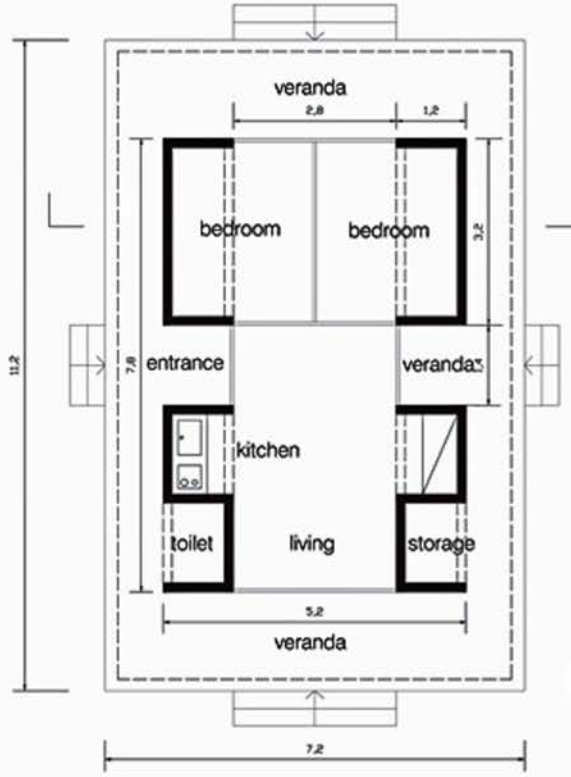
Front Elevation



Side Elevation



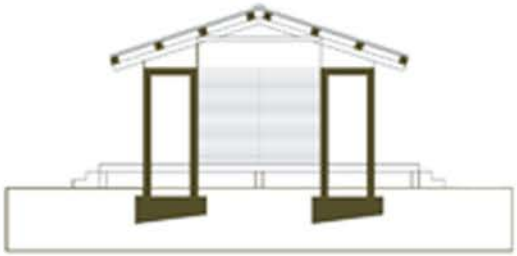
Section

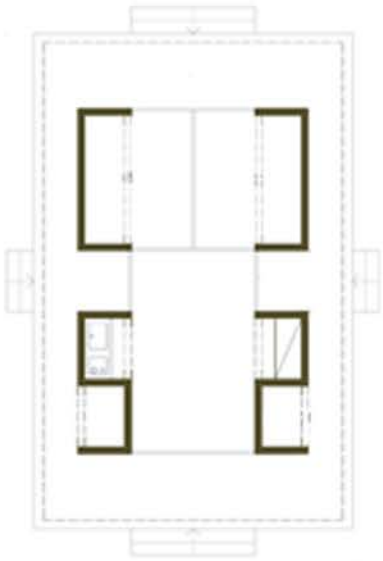


Plan

scale 1:100

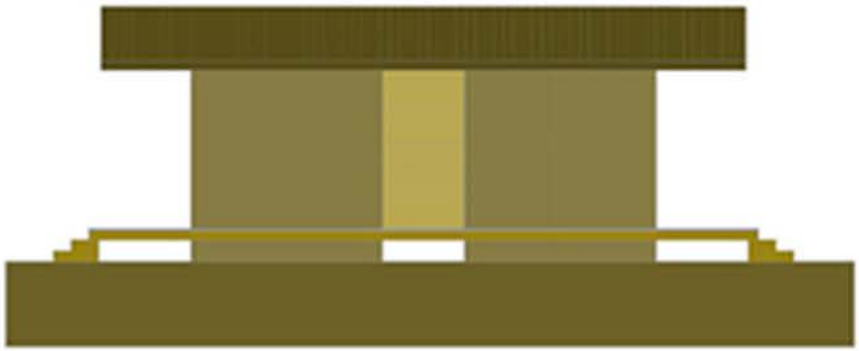
Structure

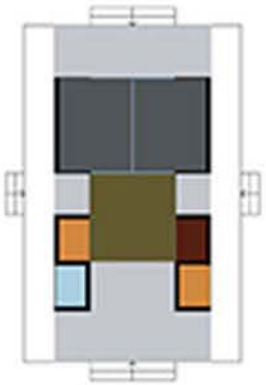


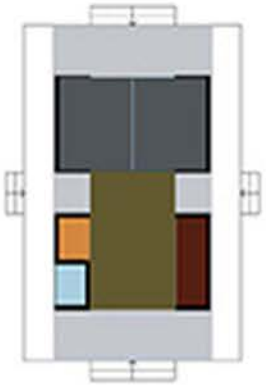


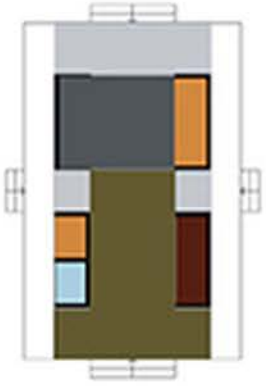
Circulation

Massing





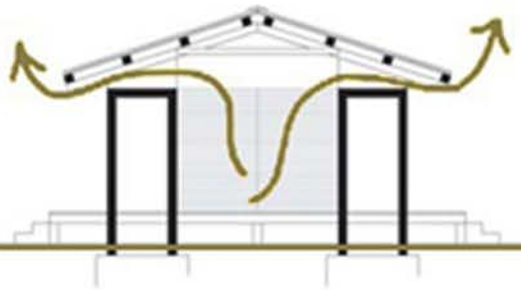




Hierarchy

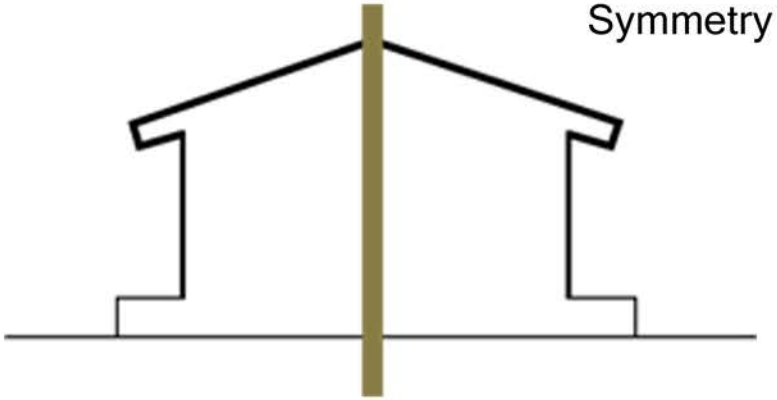
Geometry

Ventilation

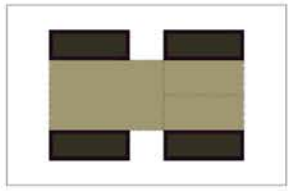


Natural Light

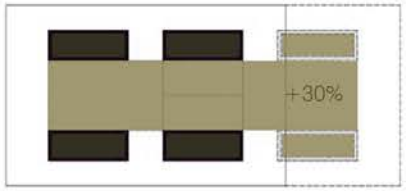
Symmetry



Additive

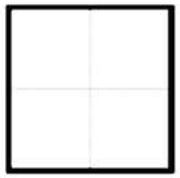


4 people - 50 m²



6 people - 50 + 25=75 m²

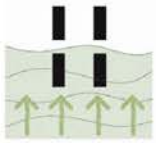
Repetitive to Unique



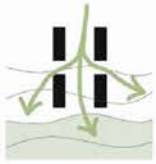
existing house

=

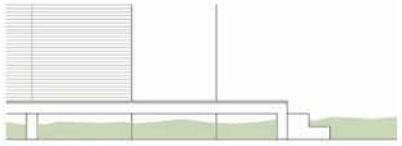
safe(r) house



coast line



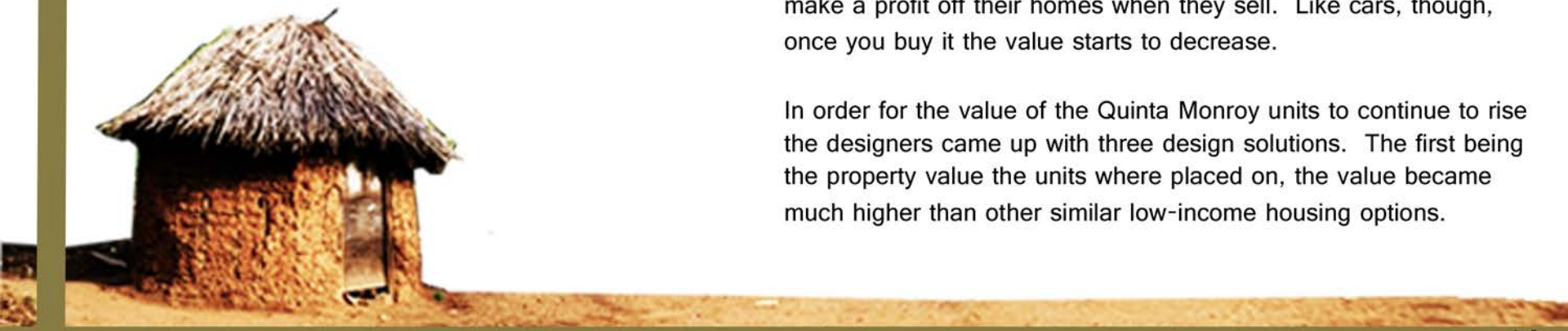
water flow



raised platform

Quinta Monroy Social Housing Complex

Case Study Research



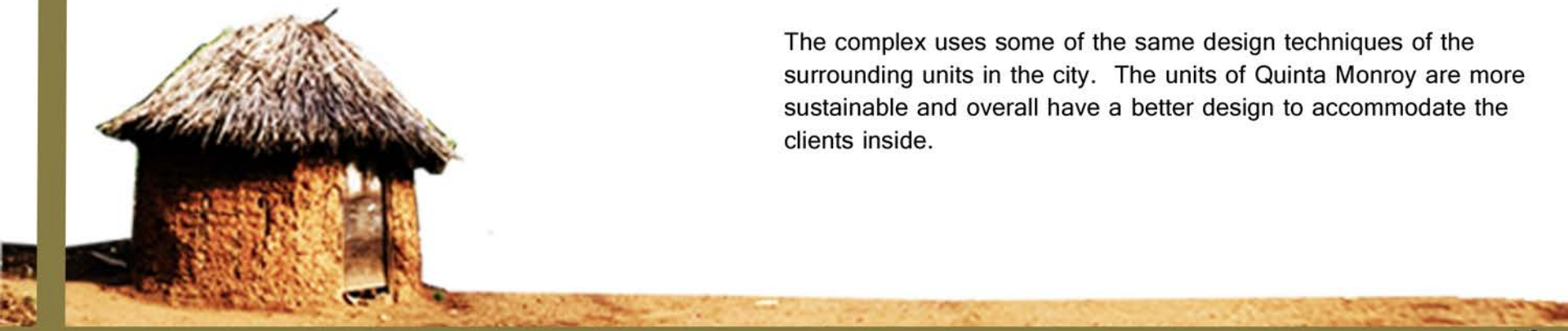
Quinta Monroy is a social housing complex located in Iquique, Chile. The size of the project is 430 square feet/36 square meters containing 93 households Architecture for Humanity, 2006).

Working with the constraints of government funding for low-income housing is a difficult task. When working with social housing units it is essential to avoid the vertical slum high rise form. The Chile-Barrio program recently changed families loans and subsidies from $10,000 to $7,500, which made it harder for nonprofit groups to finance construction for a home. This increased building costs for the Quinta Monroy social housing complex. The cost was also increased since the land was located close to the city center. The housing units needed to be stacked in order to fit in the number of needed 93 units into the allowed space. The units were then offset from each other from being single to double units (Architecture for Humanity, 2006). With their porous structure, the units can be self-built in the future. The units were not meant to limit the clients from views and ventilation which would have occurred if the units were in row housing or high rise form. Now even if spaces are added, they will not take away from the original unit.

In the next 20 years Chile will be spending approximately 10 billion dollars to overcome a housing deficit. Home owners want to make a profit off their homes when they sell. Like cars, though, once you buy it the value starts to decrease.

In order for the value of the Quinta Monroy units to continue to rise the designers came up with three design solutions. The first being the property value the units where placed on, the value became much higher than other similar low-income housing options.

Case Study Research



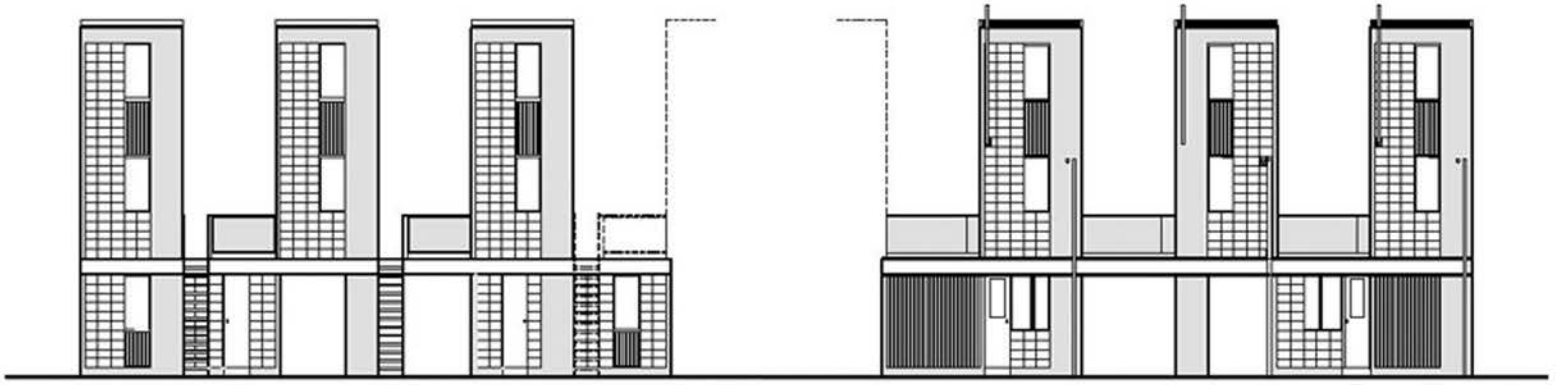
Second, there was a community space designed for the "extensive family." This space is there for people of the complex to gather under personal controlled access. Lastly with the porous structure the units are not finalized in the allotted space. Spaces can be added on to accommodate for the current clients.

The interconnections of the units is a key element in the design. It allows for less land use and expendability. In emergency situations there is sometimes not a lot of excess land that can be used to put up temporary shelters. The open areas by the center of a destroyed city are needed to rebuild community buildings. To have the shelters take up less ground space allows for them to be placed closer to the city center.

Combining units also gives the opportunity for the victims of a natural disaster to be in close knit community. Family and friends can stay close to each other in a time of despair. This is an issue for victims of a natural disaster, the sense of community is sometimes lost in the set up of emergency shelters that are spread all over a city.

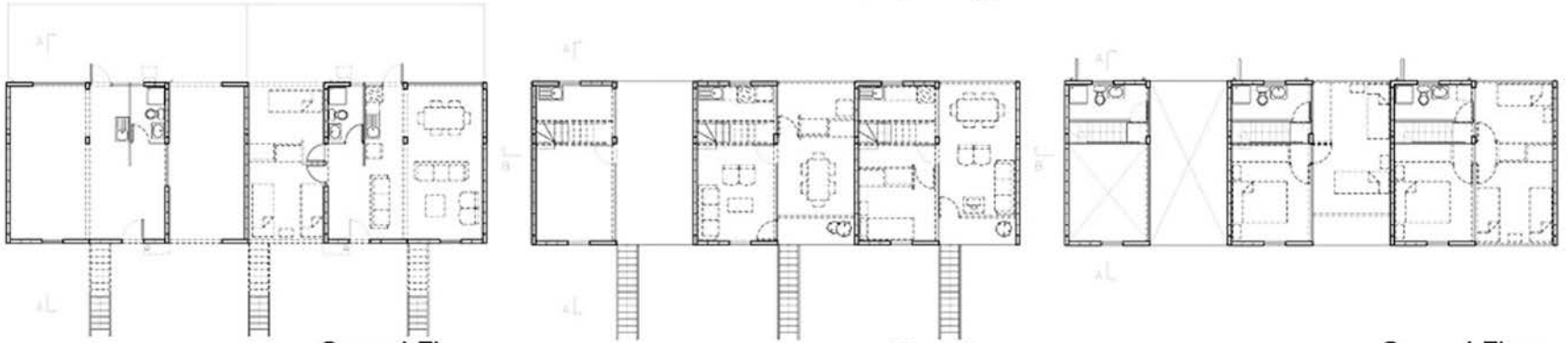
Having the budget Quinta Monroy had to work with showed the importance of using local materials to make a well designed complex with less. Using local materials in a design helps to eliminate the issue of how the design will be accepted into a culture.

The complex uses some of the same design techniques of the surrounding units in the city. The units of Quinta Monroy are more sustainable and overall have a better design to accommodate the clients inside.



Front Elevation

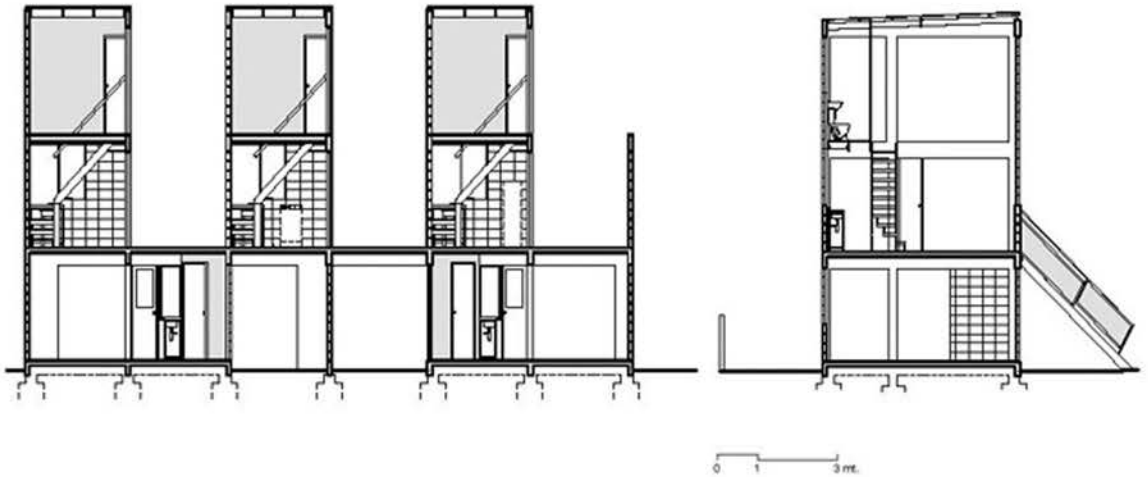
Back Elevation



Ground Floor

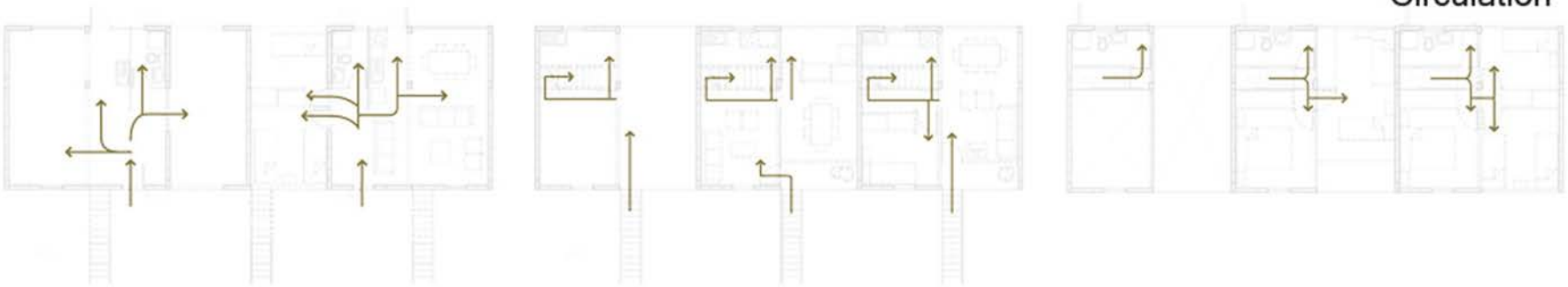
First Floor

Second Floor

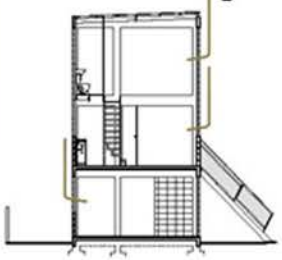


Structure

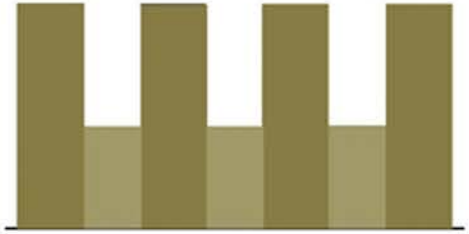
Circulation



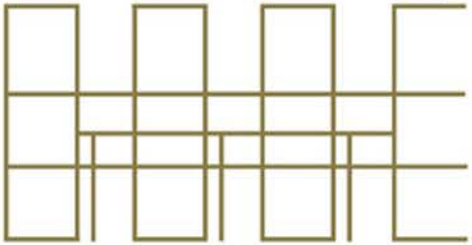
Natural Light



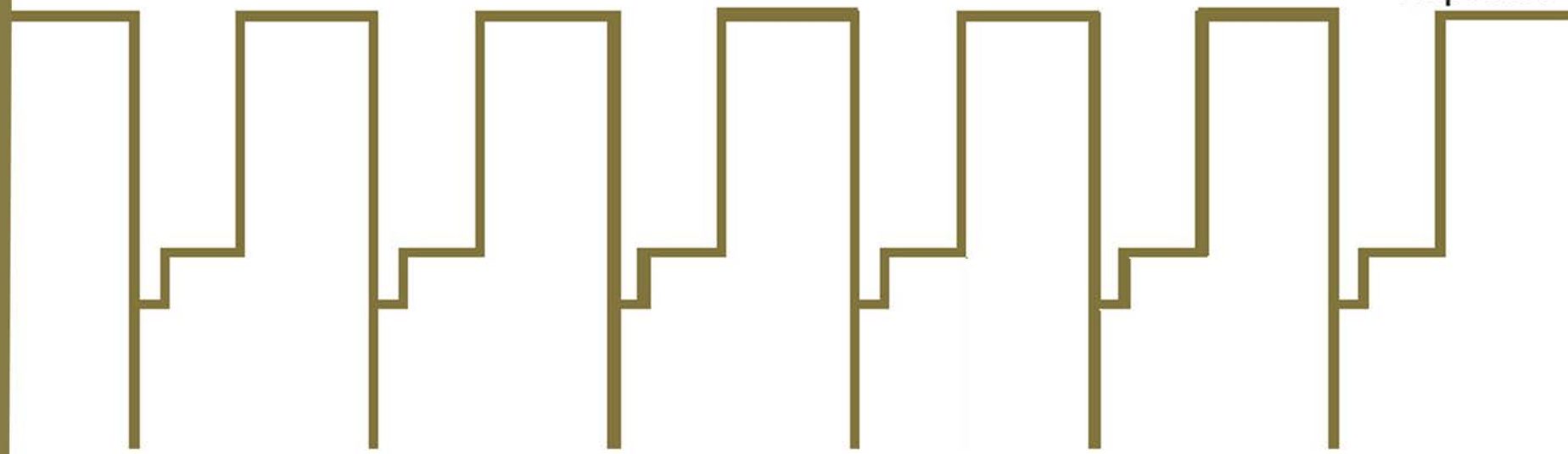
Massing



Geometry



Hierarchy


Repetitive

Summary of Case Studies

I chose Global Village Shelters as my first case study because of its small scale. During the first parts of my research I could only find tents as an option for a first housing option after a natural disaster. I felt there could be better options out there for colder climates. After reading about the materials and construction it became clear why tents dominated so much. The weight of the corrugated cardboard the units use is greater than tents. The Global Village Shelters are not as efficient compared to tents for shipping costs, which for emergency housing is half the battle. Even though the heavy materials made the Global Village Shelters less efficient I still thought the case study was beneficial for my research. I now know that the materials that I use for my design can make or break the opportunity it will have to be actually used out in the real world. A positive element of the corrugated cardboard, is that the designers were able to make separate units that contained joint toilets. They had toilets fill the void of the open floor plan. This design solution is helpful to the different ways I can have joint spaces not take away space from the smaller units for my design solution.

The Mobile Dwelling Units were chosen to be my second case study because they are flexible for the mobility aspect of the design. It was designed to not stay in one place. I found this to be a great case study. I would like to pull out different design aspects from this case study. These units could be reused if they needed to be, just by simply cleaning them. For my thesis project I want my units to be able to do just what the mobile dwelling units were designed for: moving and reuse. I was also drawn to the design aspect of the collapsible parts within the unit. This goes along with its ability to move from location to location easily. While the unit is condensed it can fit onto a train, ship or oversized semi. This opens a larger window on how the units can be shipped around the world. Cargo cars are a universal object so they can easily be accepted into many different cultures.

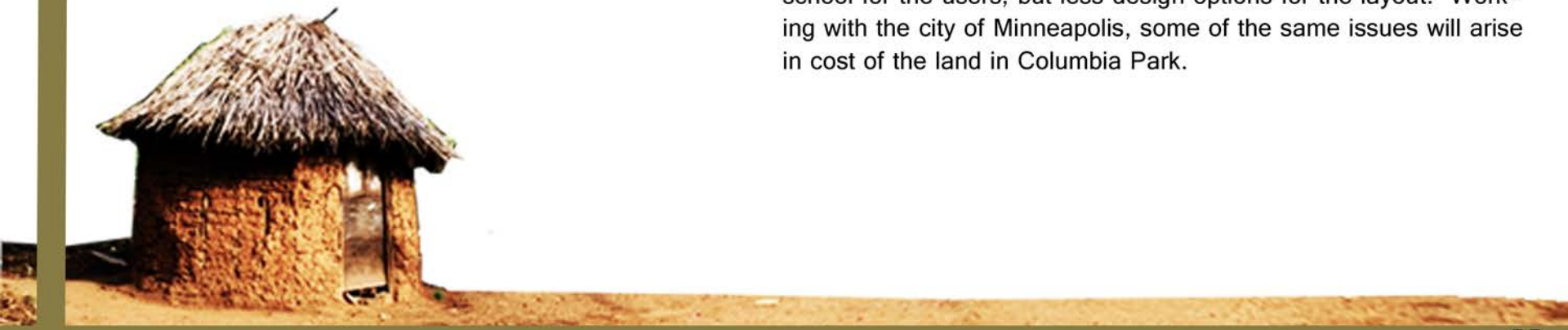
Summary of Case Studies

The Safe (R) House was my third case study in low-income housing. In contrast to the Mobile Dwelling Units the Safe(R) House is stationary in Sri Lanka. I found this study to also be very beneficial. The study was so interesting to me because of the simple design solution that was made to help the houses of Sri Lanka stand up against their own environment. Just changing the core layout allowed the new homes to have a more flexible floor plan, and stand up against the high winds of occurring hurricanes in their area. For my design thesis I want to focus on having my solution be easy to construct for men, women, and children. The Safe(R) House is designed to be constructed by the people of its community, who do not know much about construction. This allows women and children to be easily involved in the construction process that is easy and swift.

For my last case study I chose the Quinta Monroy Social Housing Complex in Iquique, Chile. I wanted to use a social housing complex to understand the different ways smaller units can come together, intermix, and make new spaces. In researching this complex I was reminded that working with social housing complexes means dealing with the different subsidized loans that are given out by a government. As for the country of Chile, their government decided to change the amount of subsidies and loans from $10,000 to $7,500, making difficult for the designers to develop a good design for that amount of money. Again, with simple design solutions, just offsetting the units compared to stacking, the designers were able to fit the 93 units they needed into the space within the budget.

Throughout my case study analysis of graphics and diagrams I was able to discover similarities between all of them, even though they ranged in size from being one small open foot print to a large 93 unit complex. Quinta Monroy is similar to the units of Global Village Shelters that are added or subtracted from each other. Simple spaces mixed together to give a low cost effective solution to a housing deficit in Chile.

Summary of Case Studies



The Mobile Dwelling Units and the Safe(R) House both have flexible floor plans to be adaptable to the conditions they need to serve. The Mobile Dwelling Units are mobile and the Safe (R) House is stationary. Lastly, in both the Safe(R) House and the Quinta Monroy units, one simple design solution was made to accommodate better efficiency of the actual units. For the Safe(R) House, the cores were divided into four instead one to make the living and response to the exterior elements more beneficial. For the Quinta Monroy, the simple action of shifting instead of stacking gave more views, more ventilation options, and more flexibility to add on to the individual units.

Emergency housing has been with us for many years now. There has been more exploration in the past decade with more options to emergency housing. As I found with the Global Village Shelter study, there has been a tentative exploration of on site housing replacing the tent. This is mainly for that fact that even with newer and better tent designs it takes many years for them to pass surveillance tests and be used in a natural disaster. Nongovernmental Organizations put these designs under surveillance to make sure they have the agility and ability to hold up in different areas of the world.

In most cases like the Quinta Monroy social housing complex, the units are subsidized for low-income families. Location is essential for these projects. For Quinta Monroy, since it was placed closer to a main city in Chile, it allowed easy transportation to jobs and school for the users, but less design options for the layout. Working with the city of Minneapolis, some of the same issues will arise in cost of the land in Columbia Park.

Historical Context

The Developments of Social and Emergency Housing

The American Red Cross was established in 1881, 25 years before the horrific San Francisco fire and earthquake. They were the first, along with the US Army, to be on the scene to bring assistance in San Francisco. They provided focus on relief, recovery, and reconstruction of the city. They provided tents for people to sleep in (Architecture for Humanity, 2006, p. 33). The tents were meant as a short lived and immediate solution for people while they found a permanent home to live in. One month after the disaster there were still 40,000 people living in tents. While most of the tent dwellers still had jobs the government decided to build a complex of cottages that the residents could rent and eventually pay off within a year and a half after the disaster. By 1909 5,343 cottages were in use and the last camp of tents had closed down. With the help of the government, the low pay plan meant the cottages helped many that would not have been able to afford a house on their own. (Architecture for Humanity, 2006, p.34). In 1930, England passed the Housing Act. It provided for the construction of government subsidized housing. This began after the end of World War I and continued into the great depression. The slums were growing with the increase of low-income workers who could not afford the high payments of a home. By 1934 there were 200,000 people displaced from the inner city of London to the suburbs (Architecture for Humanity, 2006, p.38). This would later become an issue since most of these low-income people had to travel to the inner city for work. Also in 1934, the United States of America passed the National Housing Act to respond to the tens of thousands of people evicted from their homes, because of the Depression. From the National Housing Act came the Federal Housing Administration (FHA), which created mortgage plans that are similar to today with a 30 year repayment periods and a 10% down payment. The National Housing Act helped the rate of home ownership go up from 40% in the 1930's to 67% today (Architecture for Humanity, 2006, p.39).

Historical Context

While the end of World War I brought the attention of social housing and ended with the solutions of National Housing Acts, World War II disclosed the issue of emergency shelters. World War II displaced millions of people worldwide. Bombs leveled cities and caused major damage to others. With plans like the Marshall Plan, Europe was given $12 billion for reconstruction and humanitarian aid. The US Army took on a large role in reconstructing elements of cities like bridges and roads. New organizations started popping up to help out with efforts. These organizations included nongovernmental organizations (NGOs), United States Agency for International Development (USAID), International Rescue Committee, CARE, and Oxfam. NGOs provided not only emergency shelters to America and Europe during the war, but also helped in the third world (Architecture for Humanity, 2006). Alvar Alto played a role at this time by designing emergency shelters that could accommodate four families with a shared heating unit.

After the World War II ended soldiers came home and needed a house for their families to move into. This began yet another building boom, and mass development. Le Corbusier's Unite d'Habitation and Gropius and Wachsmann's Packaged House were both design solutions that did not fit the culture and locations they were placed in (Architecture for Humanity, 2006). The French resisted the modern style of the Unite d'Habitation. They found the rooms too narrow and confining. The mixed level shopping area was contradictory to their daily marketing habits. The Packaged House was not successful for reasons of cost.

The postwar building boom became ironically the "slum boom." France passed the Debre Act in 1964 to create a slum clearance around Paris. Congress passed the 1949 Housing Act creating 810,000 publicly financed houses to create better living environments in towns and cities (Architecture for Humanity, 2006).

Historical Context

In the process, changes in this act caused the bulldozing of houses of the people they were trying to help. Zoning codes brought roads and government complexes. The Housing Act in the end made areas of slums formerly nice neighborhoods, and left people enraged. The development of high rise housing created "vertical ghettos" and criminal environments.

When all seemed lost the Self-Help Movement developed. This movement was an approach to architecture that allowed the user of the home to be involved in the building process. This way the architect could teach the users how to construct their own home so they could help others, or build their own house down the road if they moved or it was lost in a natural disaster. It also reduced construction costs as the owner became the contractor. Hassan Fathy, who lived in Egypt, was a true leader of this movement in the 1930's. Two issues with organizations using the Self-Help design concept were that they were not able to keep up with population growth and the land they could afford was on the outskirts of town, where work was far away. The Self-Help Movement is still in use today for disaster housing. Now it is even possible for the citizens to be payed for their part in the construction process. This is a very important aspect in developing countries where incomes can be low (Architecture for Humanity, 2006).

An example of the Self-Help Movement in use is the Transitional Community in Sri Lanka. The city of Tangalle, Hambantota, was destroyed during the 2004 Tsunami and had to be rebuilt. Community members were able to help erect the transitional community on a daily wage after attending a few workshops on construction. Since the transitional community is meant to be taken down after a few years, the homeowners will know how to construct their final permanent homes when the time comes.

Historical Context

The Self-Help Movement influenced many people and organizations, and in 1976 Habitat for Humanity was established in America. Habitat for Humanity is a Christian ministry that has a developed program to help community members get involved with the building process for low income families (Architecture for Humanity, 2006).

In the 1970s, tents were still being handed out to natural disaster victims. The 100 organizations that were assisting with disaster relief were disorganized in the way they were helping to get families into shelters. Fred Cuny became a man with a mission to help clear up this process and improve it. He worked with Oxfam and created a disaster relief design to help the victims of Turkey with a severe earthquake. He also pulled apart the process of getting families into permanent homes. Two changes he brought to the process were to have aid agencies pay the victims to help clean up the rubble so they could find and reuse materials, instead of having the government come in and bulldoze every resource away. This helped cut down on construction costs for the families if they could reuse materials. He worked a lot with transitional housing instead of tents since they usually went unused from late arrival or they would be placed far away from the victims' original houses. It is important to note that victims in a natural disaster do not want to move away from their destroyed community. They want to help the process of cleaning up the area and building their new permanent houses in the same place.

Since the 1970s architects have been diligently working on ideas for social housing by starting up CDC (Community Design Centers) for people to come and get architecture and planning services for free. These are community workshops for local projects that allow community members, no matter how poor, to voice their opinions on buildings or housing being built in their community.

Comparing the 1985 Mexico City earthquake to the 1995 earthquake that struck Kobe, Japan, community members were more attentive and involved in the rebuilding of Mexico City; the city was rebuilt in less than two years. It took Kobe, Japan, over ten years to rebuild, and it left half as many homeless. Mexico City also had their temporary housing units inside the main streets while new homes were being built.

They were not segregated and could still go to work and stay involved. In Kobe, more housing was destroyed than commercial space, and the temporary units were placed in parking lots away from the city. Victims could not reach their work or social networks. Left on their own, they were separated from their part of the city for a longer amount of time. Getting the community involved is important to the process of redesigning and rebuilding an outstanding city.

Historical Context

Usually when you tell people you are an architecture student, their usual response is "Sweet! So are you going to design fancy houses or a high rise?" When I respond with, "No I want to work with emergency housing," their faces go blank, and look at me like I am crazy. For the most part people don't really understand what that truly entails, and I guess for the majority I don't either. All I know is that designing for the fancy few people that can afford to hire an architect are not the clients I want to have. I would rather be helping the 9,200,000 displaced victims worldwide (Architecture for Humanity, 2006, p. 59). There are too many people who need us that outweigh the people who want us. I believe it is up to us as students, interns, and registered architects to step up to the plate and figure out housing options to give shelter to the millions of people worldwide displaced from natural disaster or worldly conflict so they have a place to rest their heads at night. These people did not choose to have their homes destroyed by a natural disaster. Most people might say that emergency housing is not important and we need to focus on the needs of people in our own country. These people are deafened to the screams for help around the world. We need to open up our ears and listen to their calls.

Goals for Thesis Project

For my thesis project, I want to make the issues with emergency housing known to the general public. I want people to see numbers of just how many people have to rely on government aid, because their homes were recently destroyed. I also want to show what the entire process is from the storm hitting to placing a "Welcome" mat on the victims front door step for victims of a natural disaster.

For my actual design I want to create a transitioning space that is calming for the user to go inside and escape the horrific views and memories of the recent natural disaster they have just experienced. The space should be only for them and close family to temporarily live and recover from the recent events.

To not completely isolate individual families from others, I want to have communal spaces for about 3-5 families. These spaces would be for main utility spaces like laundry, stoves, and access to clean water. I want to have clean water on supply at all times on my sites. This will be especially important the more damage there is around the site. The most important communal space would be the green spaces. In the green spaces there would be space to hang laundry or grow plants. This space would appear closer to when the families are about to transition from their temporary homes to their permanent homes.

Since my entire design is meant to be temporary, I want to design units so they can be easily cleaned, packed, and relocated after the user is done with them so they can be reused.

The entire make-up of the unit needs to be light weight construction so any person old or young can help pack or unpack the unit. If the user decides to use part of my design for their permanent homes, they are able to keep elements, which would be immediately replaced before its next use.

Goals for Thesis Project

I want my units to be used worldwide. The exterior and interior of the design needs to be adaptable to different climates; tropical to freezing. Also the units have to be adaptable to many different cultures. Not everybody lives like Americans do, nor does everybody live like a Middle Easterner. The cultural aspect is essential to make the living space calm, relaxing, and comforting to the current user.

My goal with my thesis project is to develop a design solution that can help people that need our architectural design and knowledge. Who doesn't want to make a change or difference in the world around them? We might as well make that a change for the better, for those less fortunate than ourselves.

Site Narrative

Columbia Park first caught my attention by its great open area it possesses in a dense setting of Minneapolis. The area has the potential to house hundreds of victims when a tornado passes through the city and destroys many homes. The park is surrounded by blocks upon blocks of single family houses to the east, with mixed used buildings acting as a divide in between my site and the housing. To south and west of my site there is a huge industrial plant that contains many cargo cars, railroads, and industrial buildings. This area is a huge contrast to the well-kept green space to the north of my site. In the north is the Columbia Park golf course. The golf course has a club house, putting area, a driving range, and another smaller recreation building. When I first got to the site it was about noon on a Sunday. People were walking around the sidewalks along St. Anthony's Parkway that runs the entire length of the park. There was a car in the driving range parking lot that was being used as somebody's house that someone was sleeping in. Columbia Park is located in Northeast Minneapolis, where there are 4,035 homeless people in Hennipen county (City of Minneapolis, 2011). In the summertime the site would be more full with people golfing on the golf course, running, and playing tennis on the northern most part of the park. For the winter months, the people using the area around Columbia Park were the workers at the industrial plant, and those working on the railroads that surrounded the site as well.

Textures of the site ranged from asphalt and concrete to vegetation of trees and grasses. There were only some spots of dying grass. To the south and west there seemed to be more distress from the production at the industrial plant. The tall trees on the site seemed to make a fence between the parkway and the golf course. This made the site seem more enclosed and secure from winds.

When I visited the site there was some wind. Most of it is blocked by the tall trees. According to the National Climatic Data Center (2011) when the wind is heavy it prevails mostly from the southeast, and spring and fall possess the months with the strongest winds.

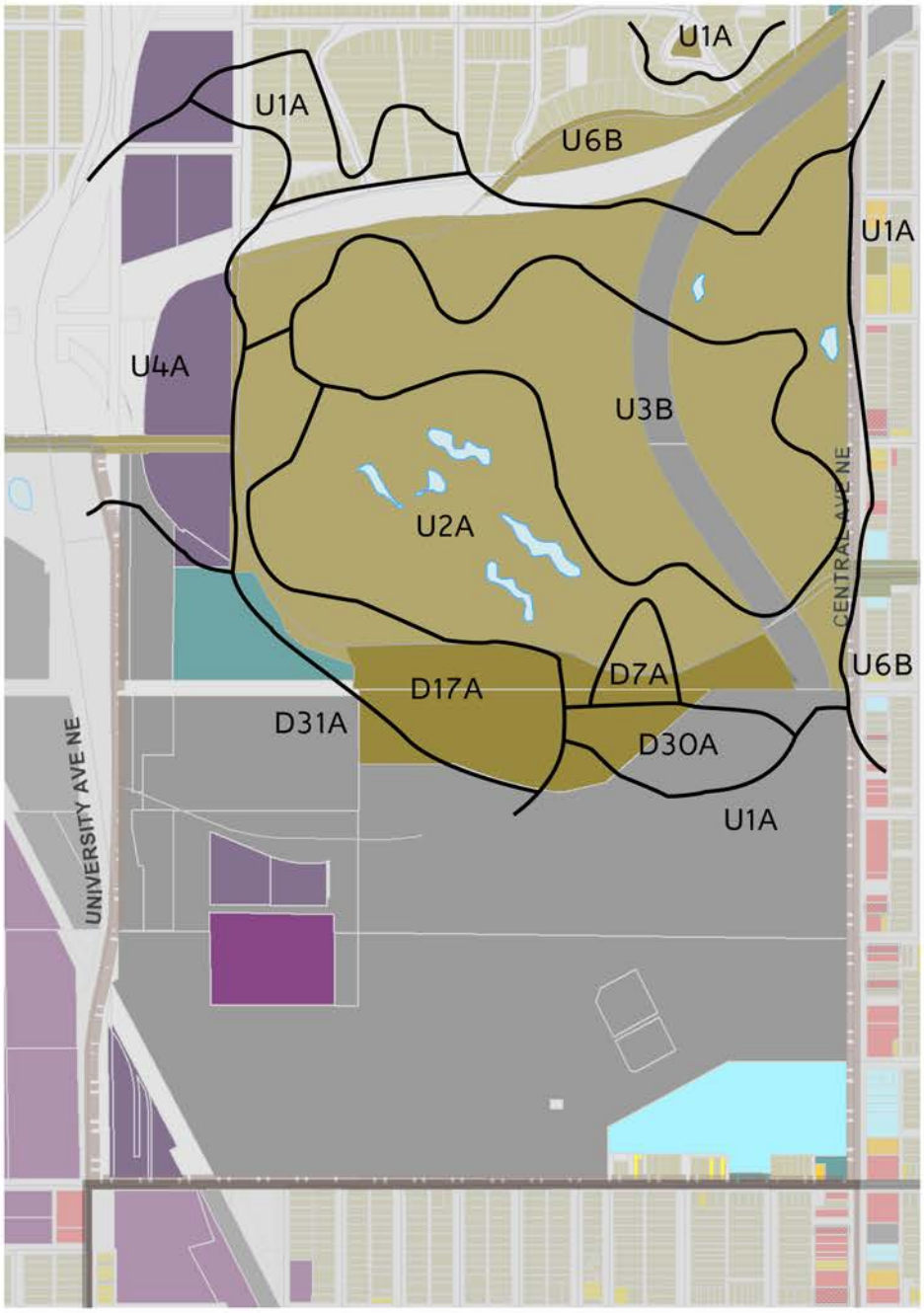
Site Narrative

The trees that block the wind also surround the ponds located on the golf course. The ponds are still, nonmoving bodies of water. They are clean, and provided a sense of tranquility on the site. The Mississippi River is located about 4000 feet west of my site. This river is still running freshwater. This body of water can provide clean water, after being filtered, to the clean water stations I plan on incorporating into my design.

Since there are three main buildings on my site, there is barely any active lighting. There are some light posts that line St. Anthony's parkway; otherwise all the light is passive. The passive and active light is diffused by the trees on the site. The industrial plant to the west creates the most active lighting to the area. Some lights strike the site from the buildings and houses to the east of the site.

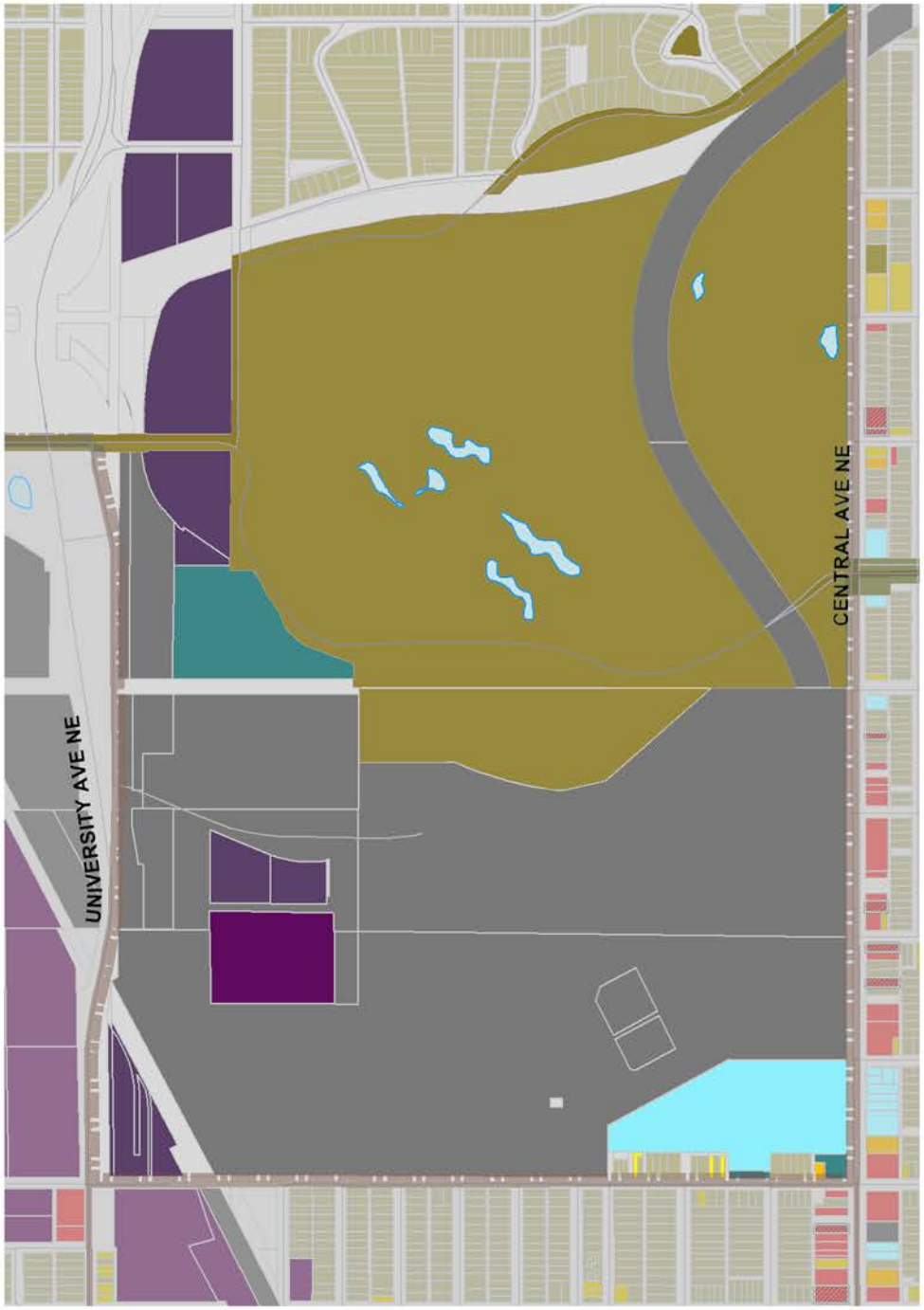
Overall, the site gives off a serene feel to contrast the busy city it is placed in. The bodies of water allow for an opportunity of use for clean water, after filtration. The openness of the area promises to have less destruction than other parks in the area directly in the center of other buildings. The parkway, the industrial plant, and the golf course allow for an open area for many transitional housing units to be placed in.

Type of Soil	Coverage	Slope
D7A: Hubard Loamy Sand	.8%	0-2%
D17A: Duelm Loamy Sand	5.7%	0-2%
D30A: Seelyeville and Markey Soils	2.0%	0-1%
D31A: Urban Land-Duelm Complex	11.0%	0-2%
U1A: Urban Land-Udorthents, Wet, Substratum Complex	12.1%	0-2%
U2A: Udorthents, Wet, Substratum	22.5%	0-2%
U3B: Udorthents (Cut and Fill Land)	12.5%	0-6%
U4A: Urban Land-Udipsamments (Cut and Fill Land) Complex	8.3%	0-2%
U6B: Urban Land-Udorthents (Cut and Fill Land) Complex	25.2%	0-6%



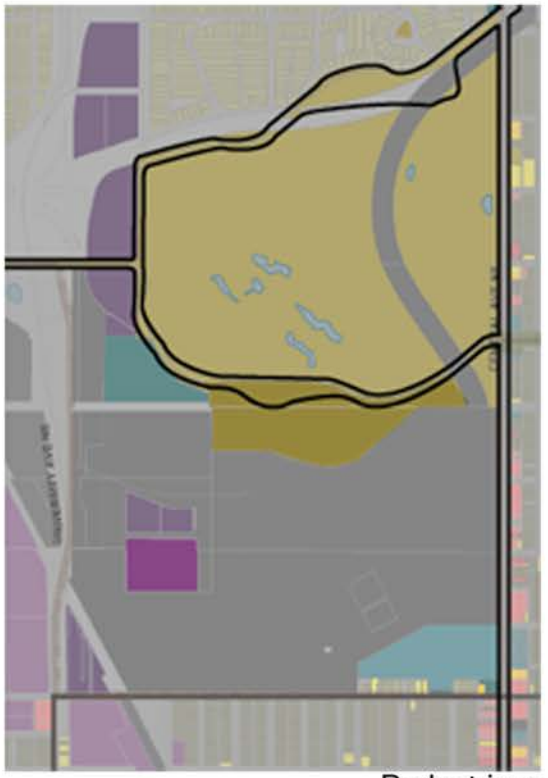
Soil and Slope Map

- Parks/ Open Space
- Light Industrial
- General Industrial
- Transportation/Communication/Utilities
- Housing
- Mixed Used: Shops and Restaurants
- Commercial
- Cultural/Entertainment



Utilities

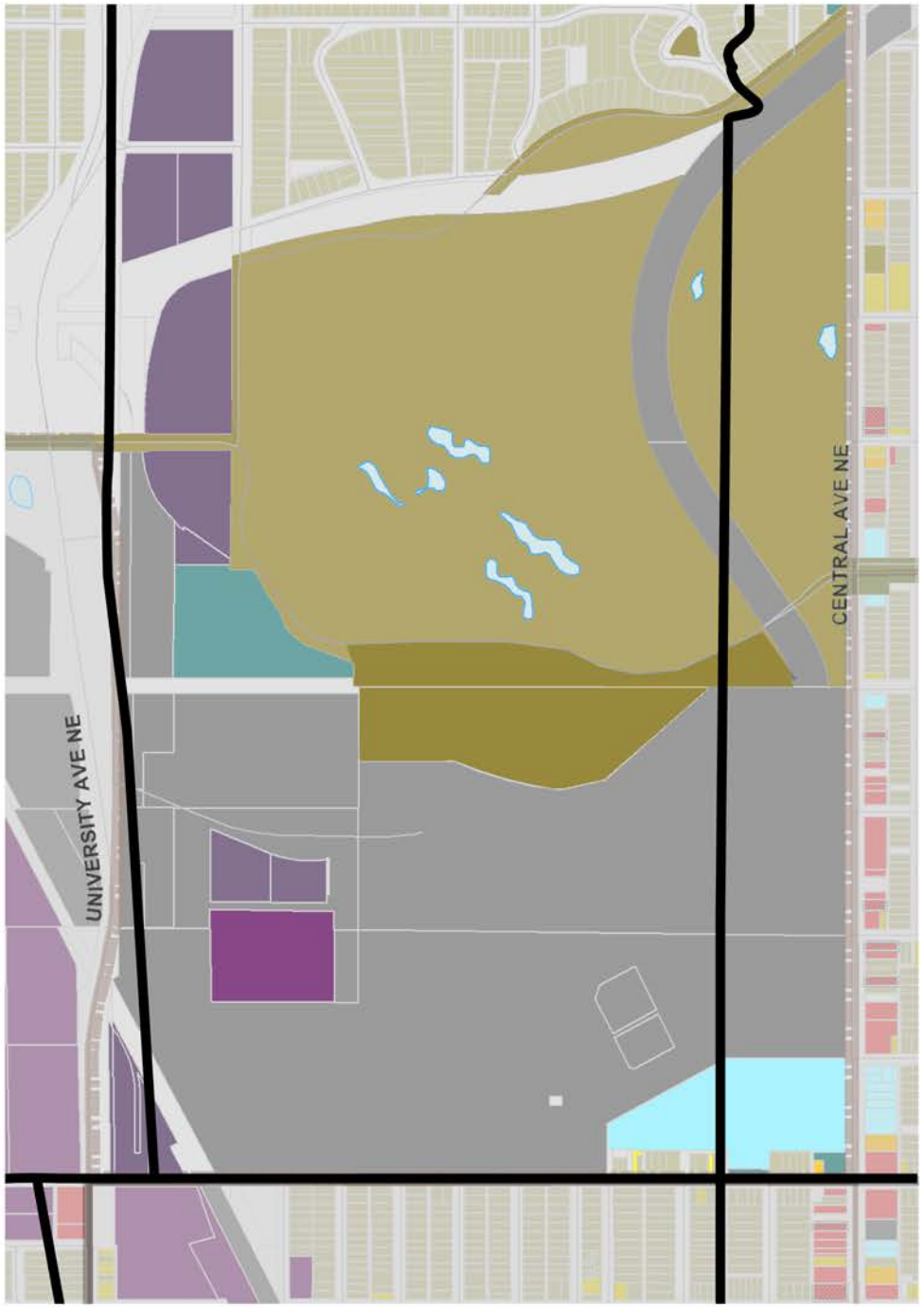
Automobiles and Trains



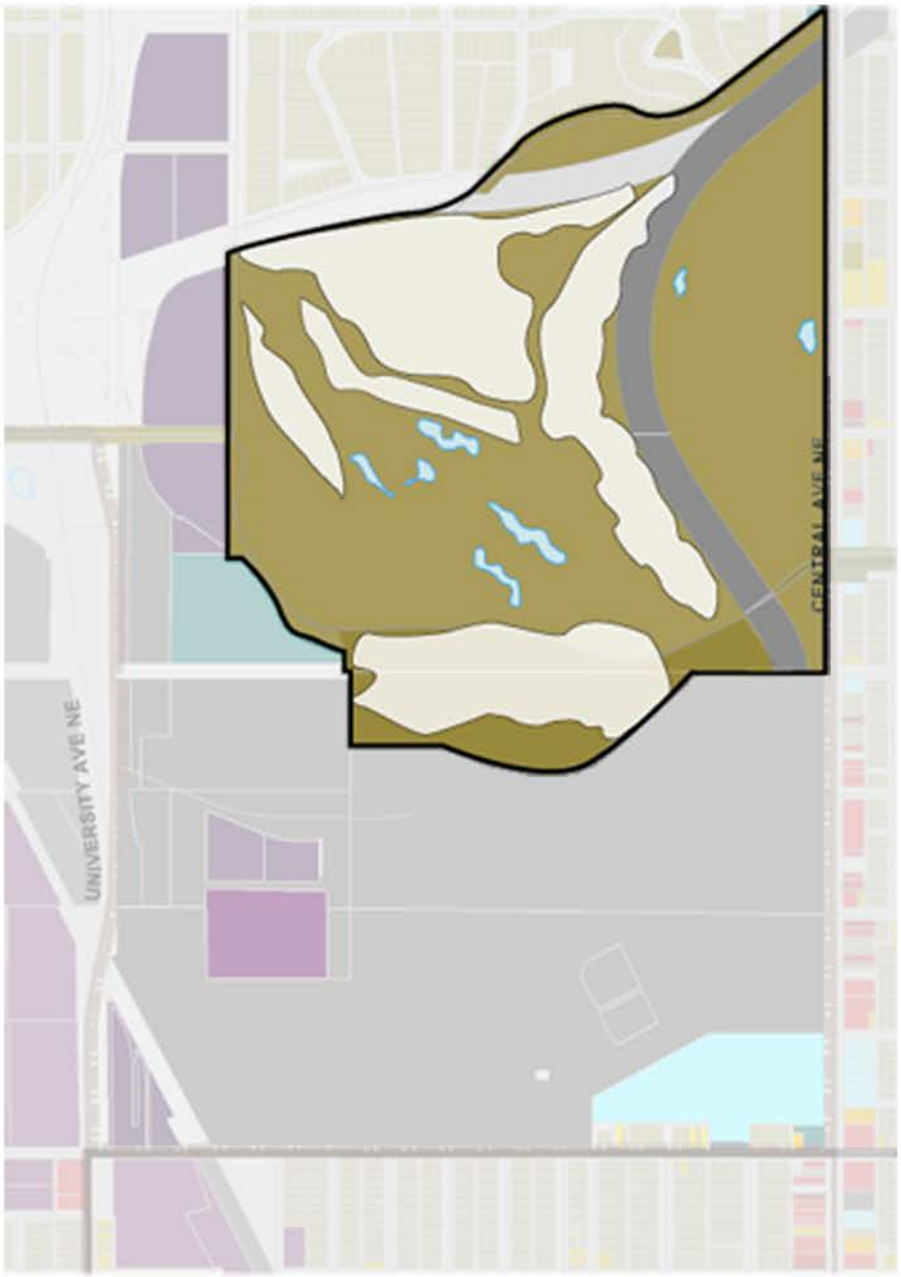
Pedestrians

Traffic Patterns

Zoning Lines



Vegetation and Tree Coverage



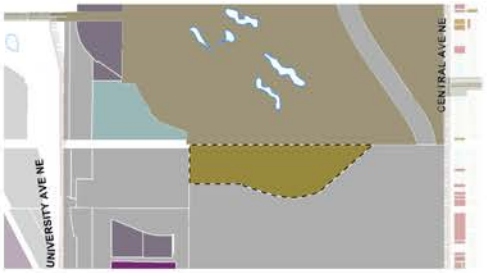
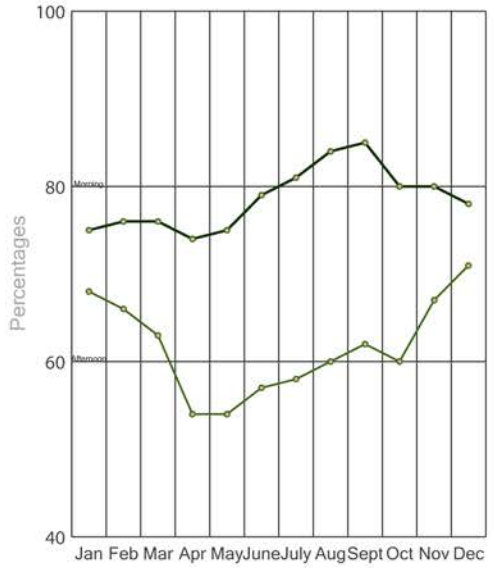


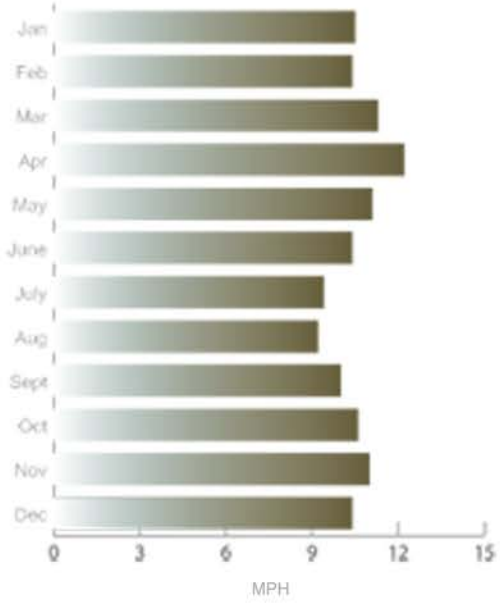
Photo Grid

Climate Graphics

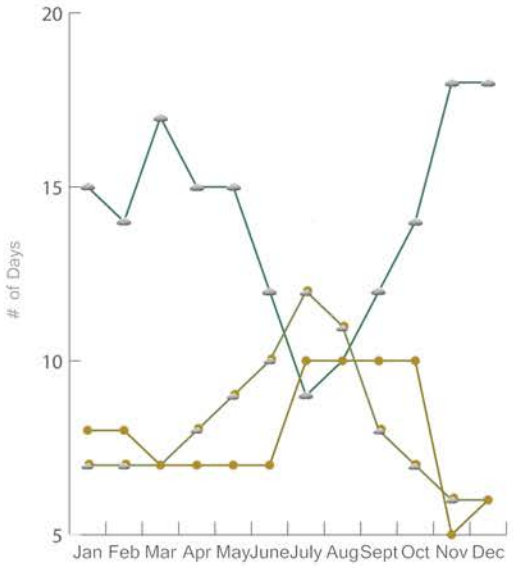
Humidity



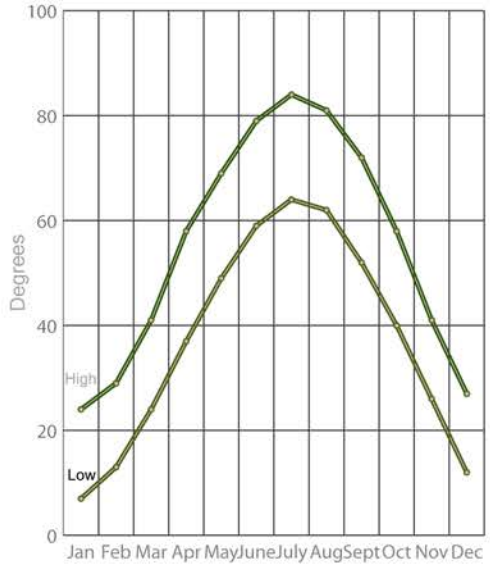
Wind Speed



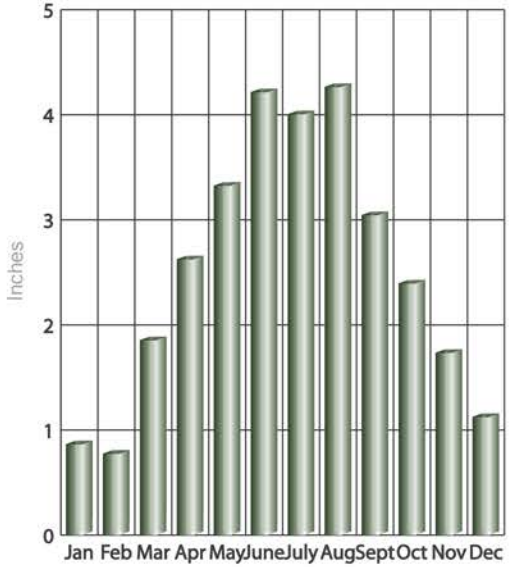
Cloud Cover



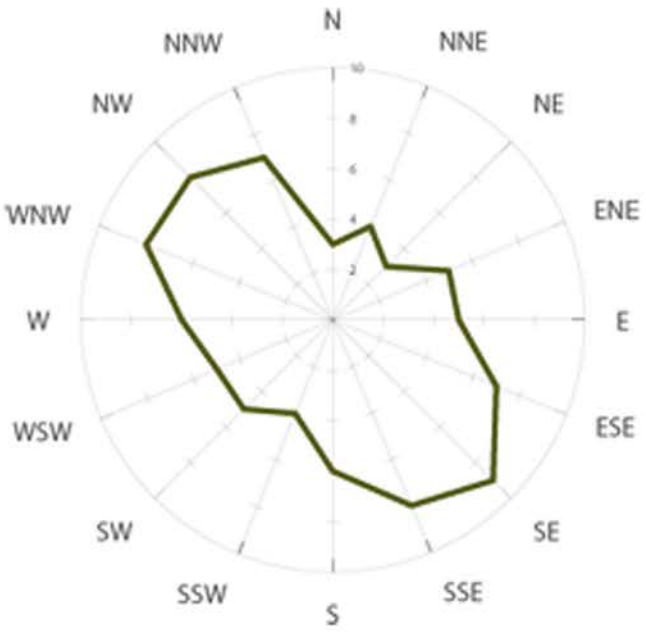
Temperature



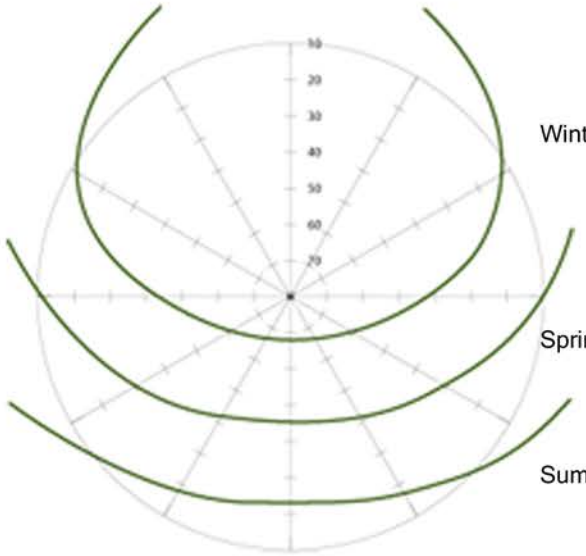
Precipitation



Wind Direction



Sun Path

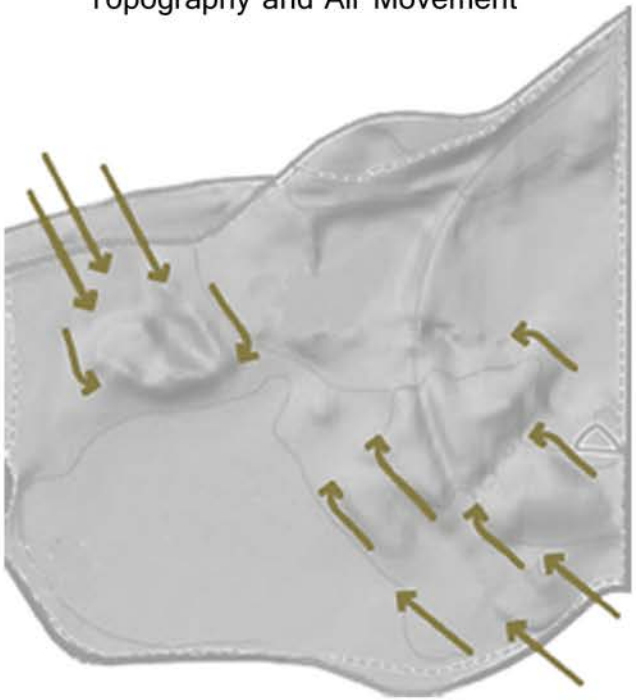


Slope and Climate

More than 10% slope

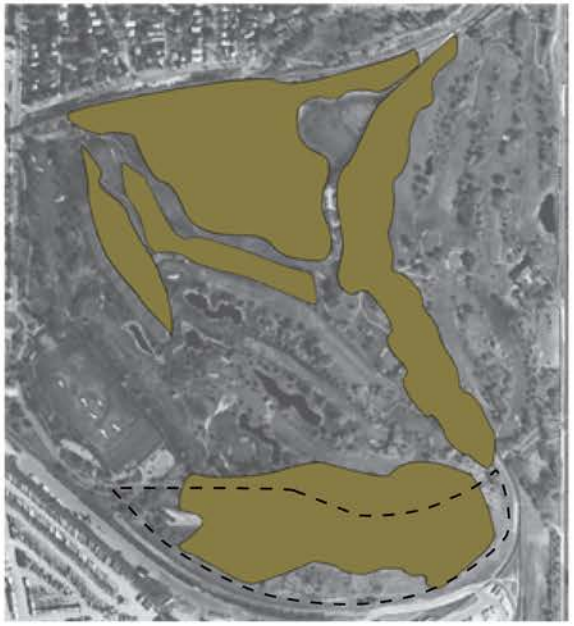
NW faces

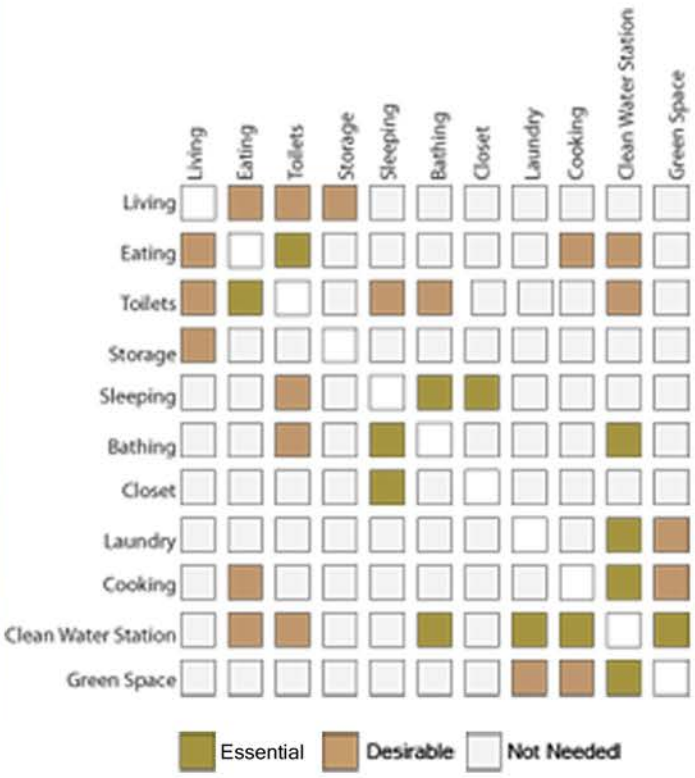
Topography and Air Movement



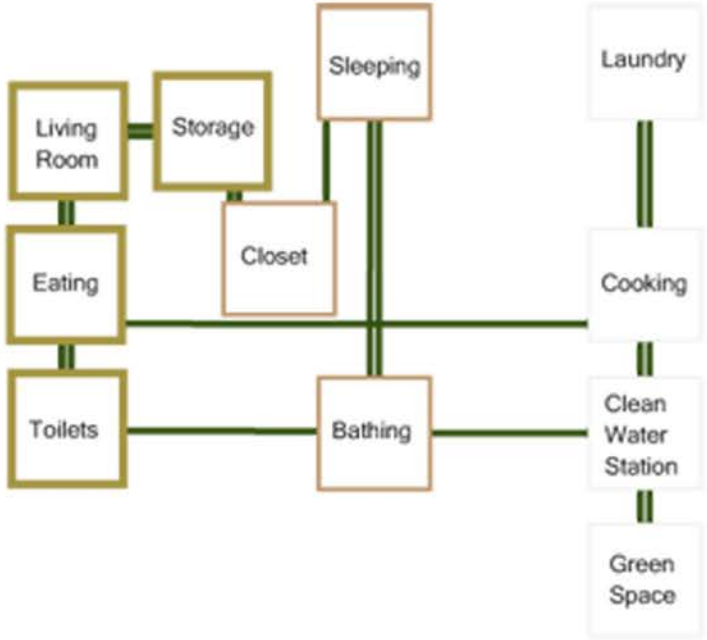
Noise

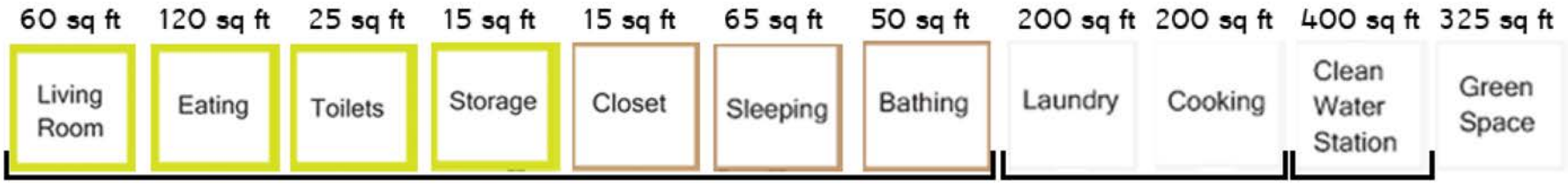
Shading




Living
Eating
Toilets
Storage
Sleeping
Bathing
Closet
Laundry
Cooking
Clean Water Station
Green Space
Essential
Desirable
Not Needed


Public
Private
Interacting Spaces
Formal Connection
Informal Connection


Living Room
Storage
Sleeping
Laundry
Eating
Closet
Cooking
Toilets
Bathing
Clean Water Station
Green Space



Total ≈ 400 sq ft per unit

Programmatic Requirements

Previous Studio Experience

2nd Year Fall: Heather Fisher & Meghan Duda
Japanese Teahouse
Minneapolis Rowing Club Boat House

2nd Year Spring: Darryl Booker
NDSU Dance Academy
Community Dwelling

3rd Year Fall: David Crutchfield
Pobtsfield Farm Visitor Center
NDSU Main Campus Library
Fargo Analysis
Wax Snow Sculpture

3rd Year Spring: Ronald Ramsay
Boston Symphony Orchestra Concert Hall
Chicago Hotel

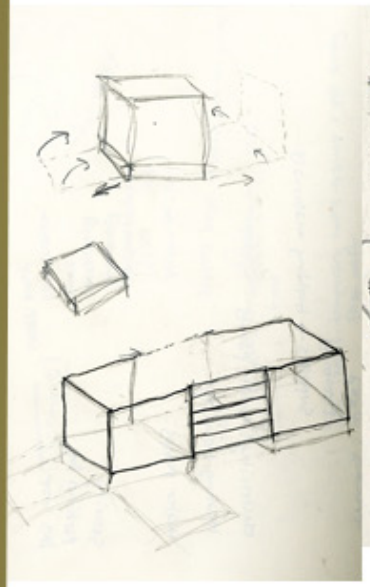
4th Year Fall: Bakr Aly Ahmed
San Francisco High Rise

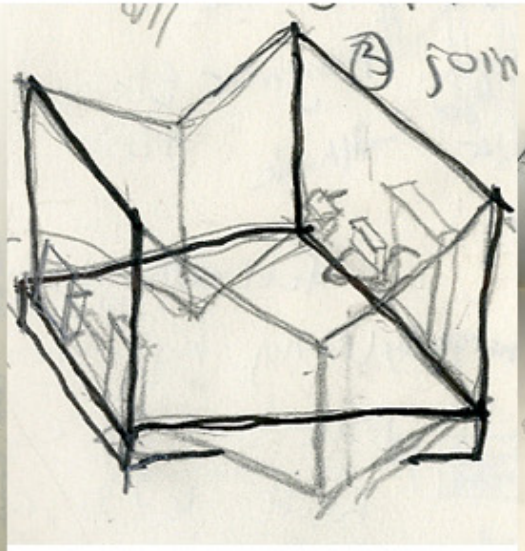
4th Year Spring: Paul Gleye
Blois Charrette Plaza Design
Design Firm on Rhiour Plaza

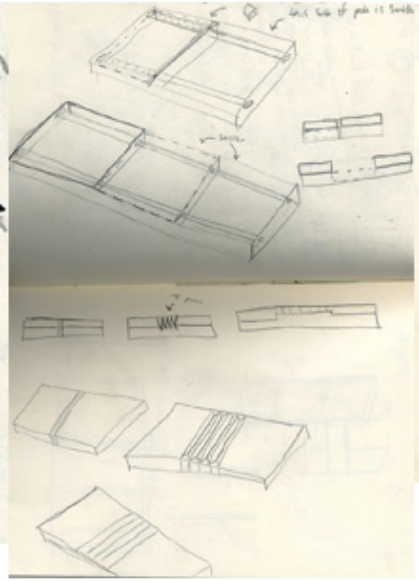
5th Year Fall: Mark Barnhouse
Water Analysis
3 Part Analysis
Water Treatment Facility

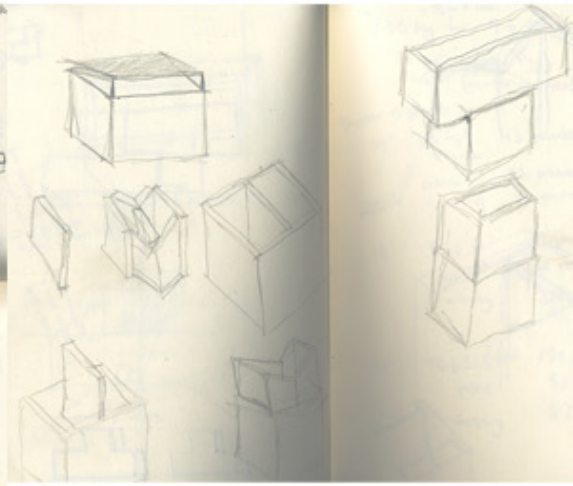
Project Documentation

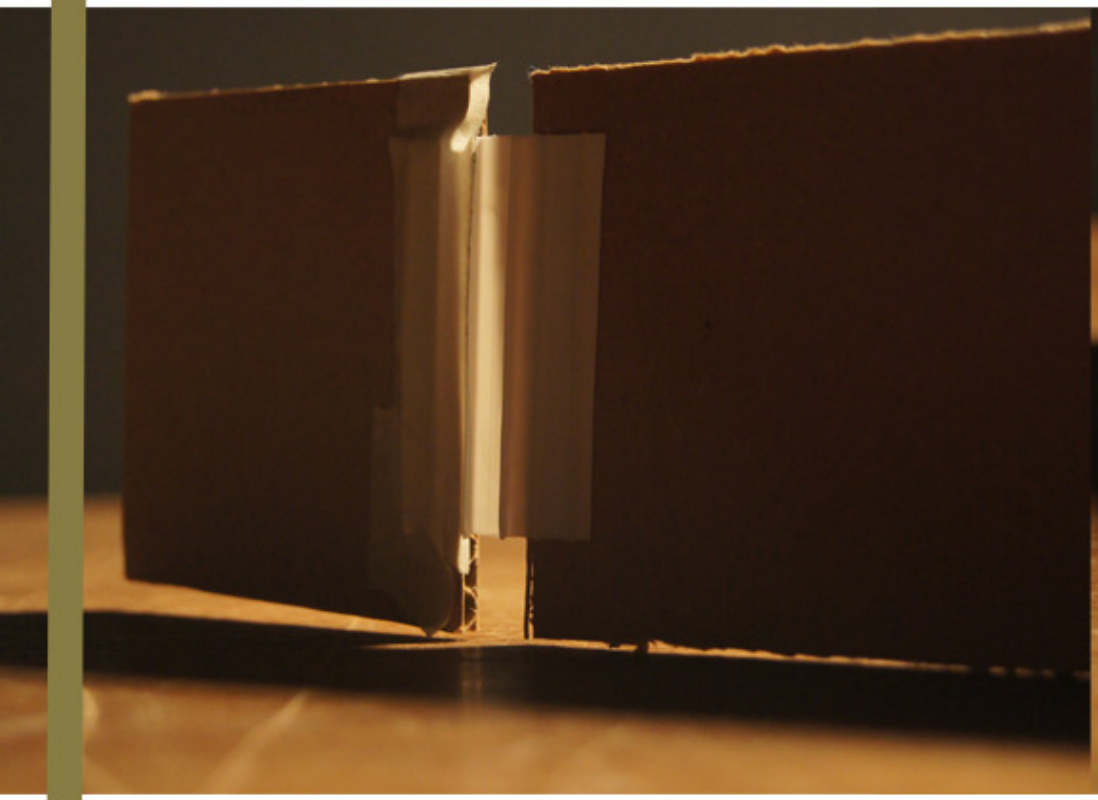
Process

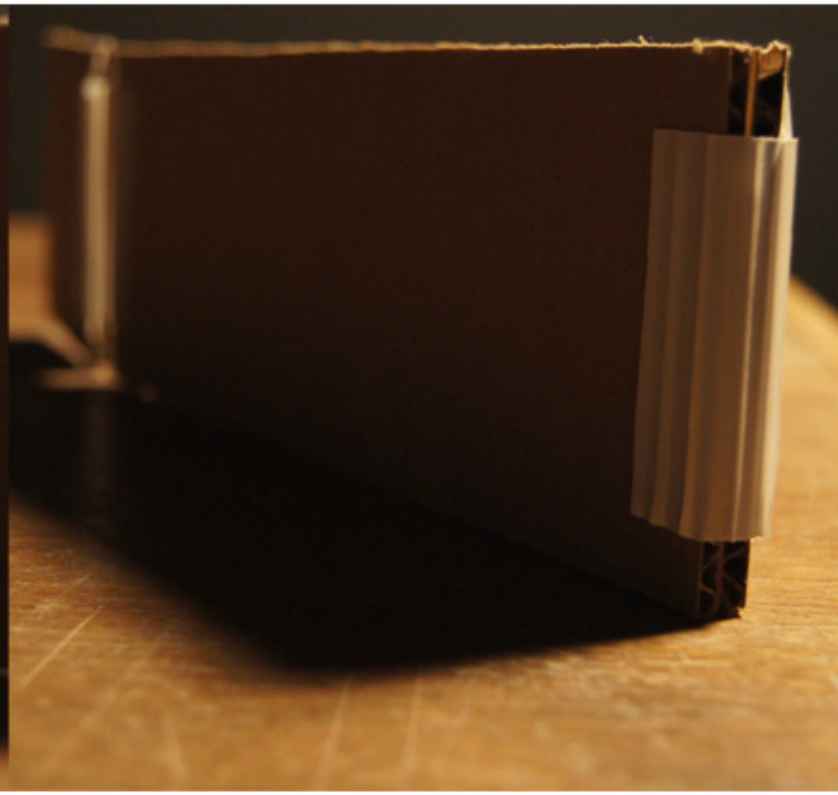


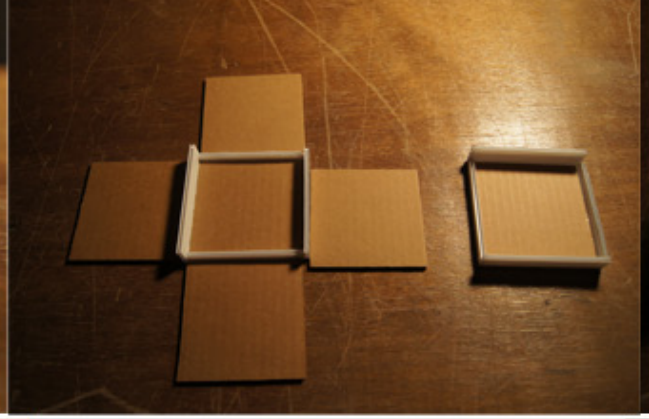


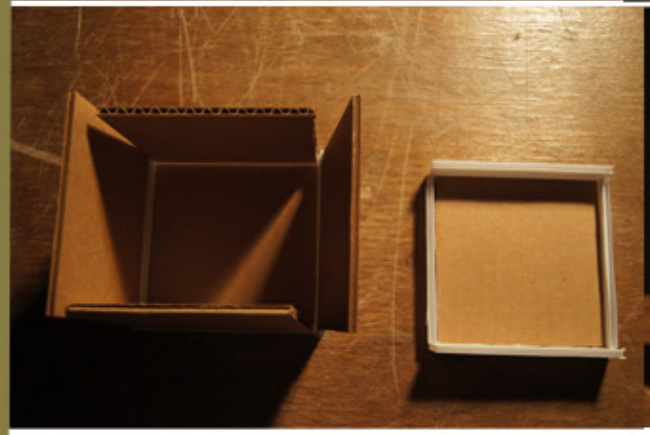
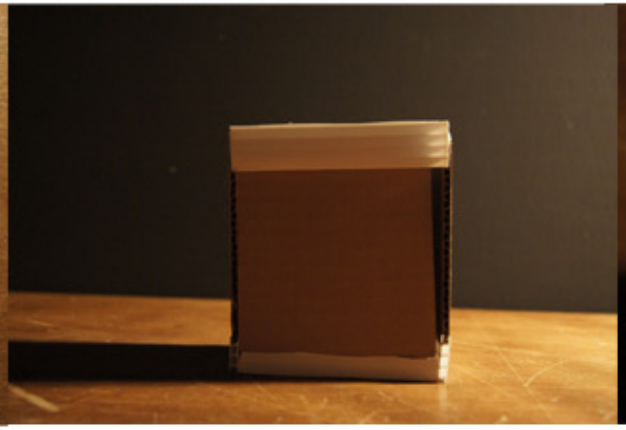
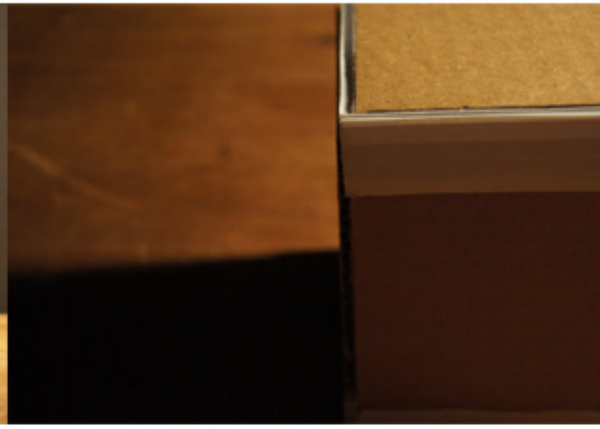
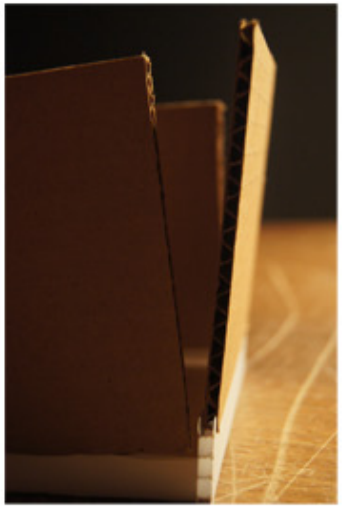


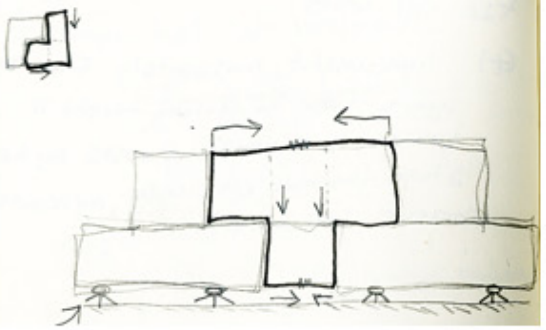


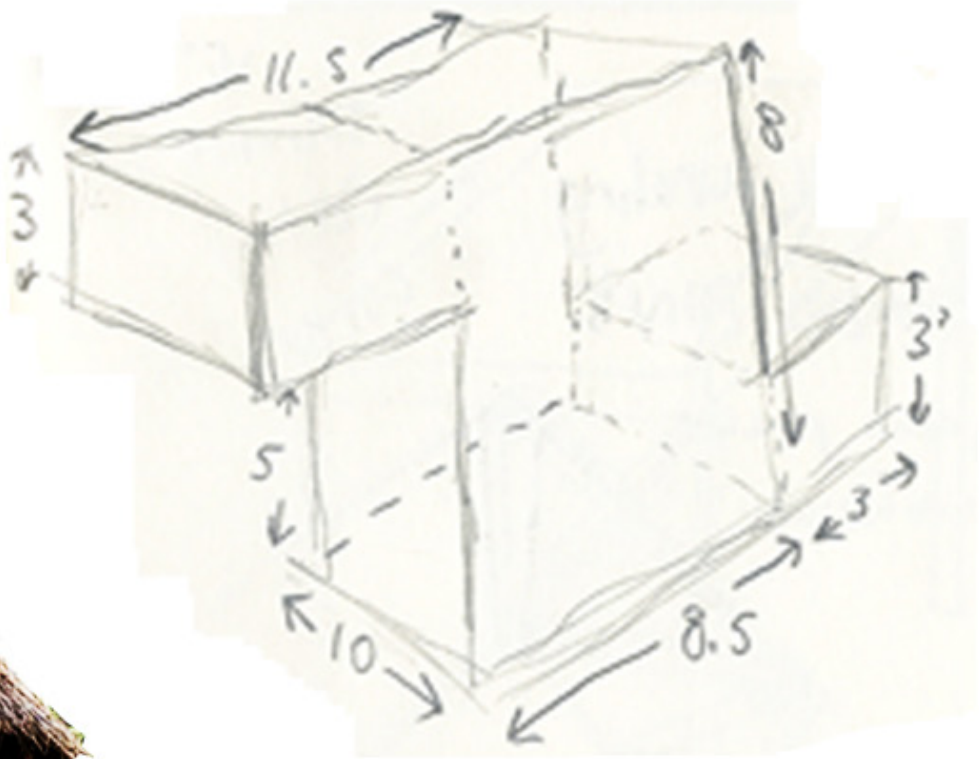


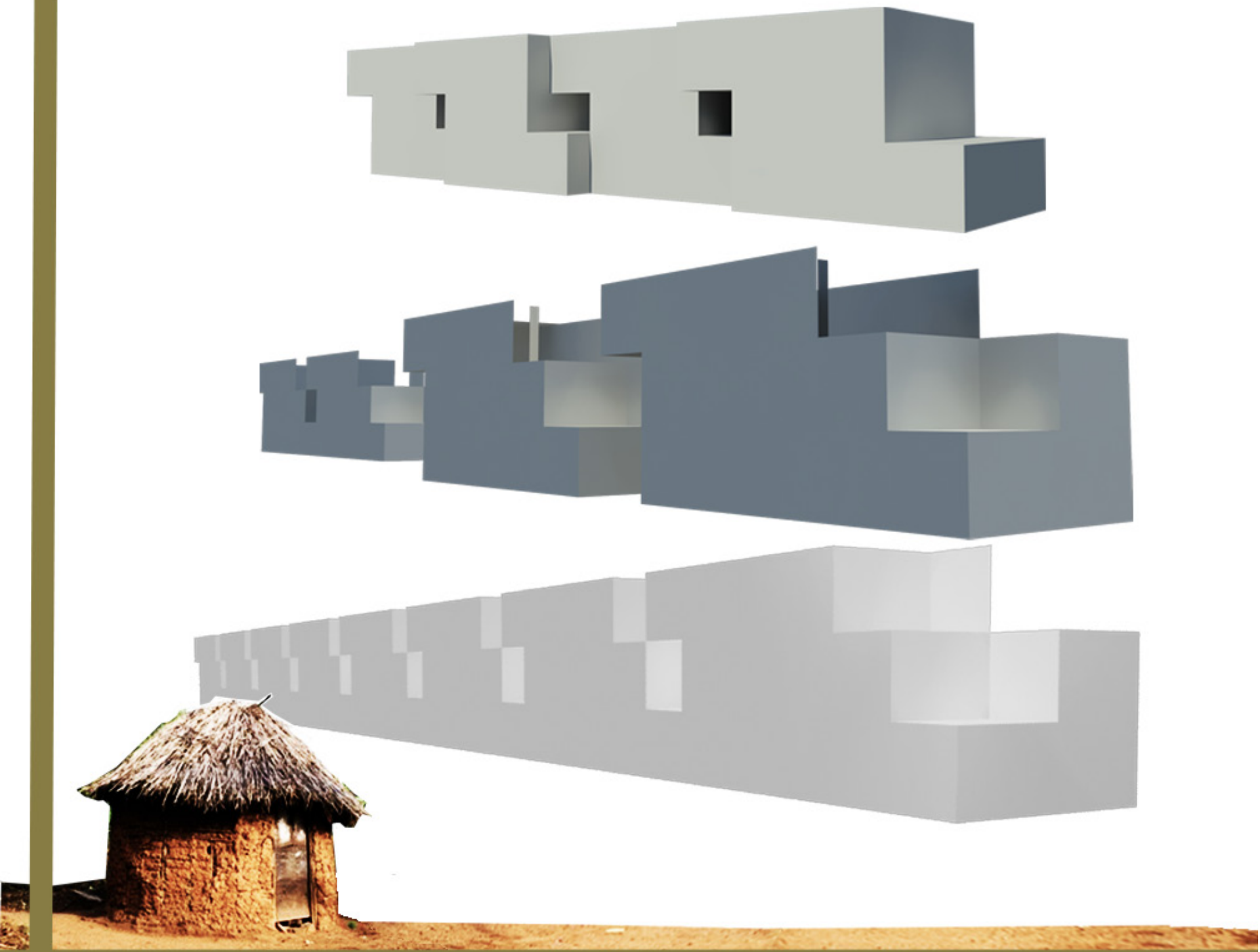


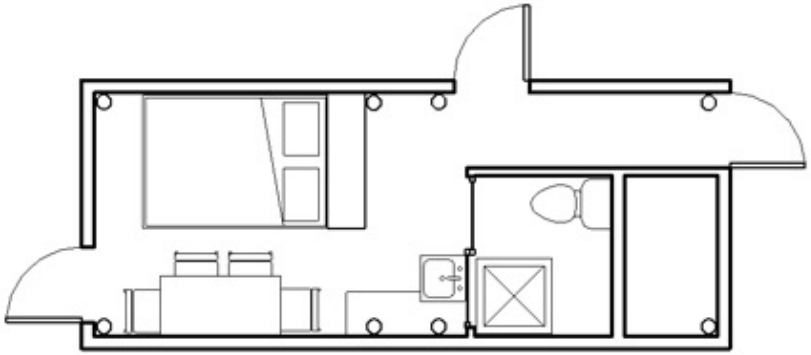



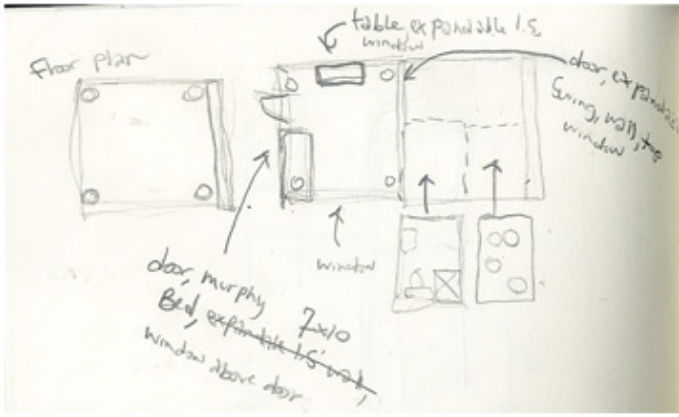





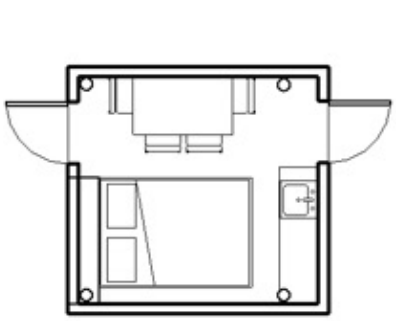



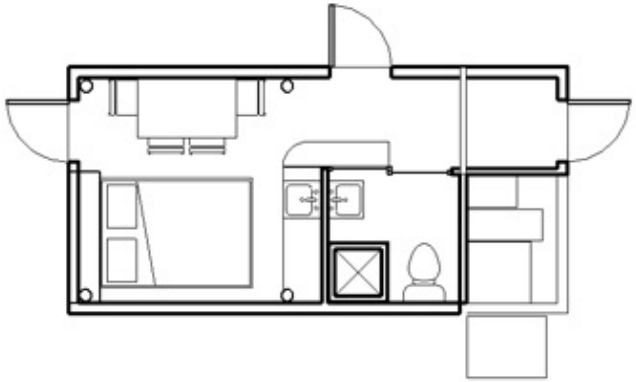

11.5
8
3
3'
5
3
10
8.5



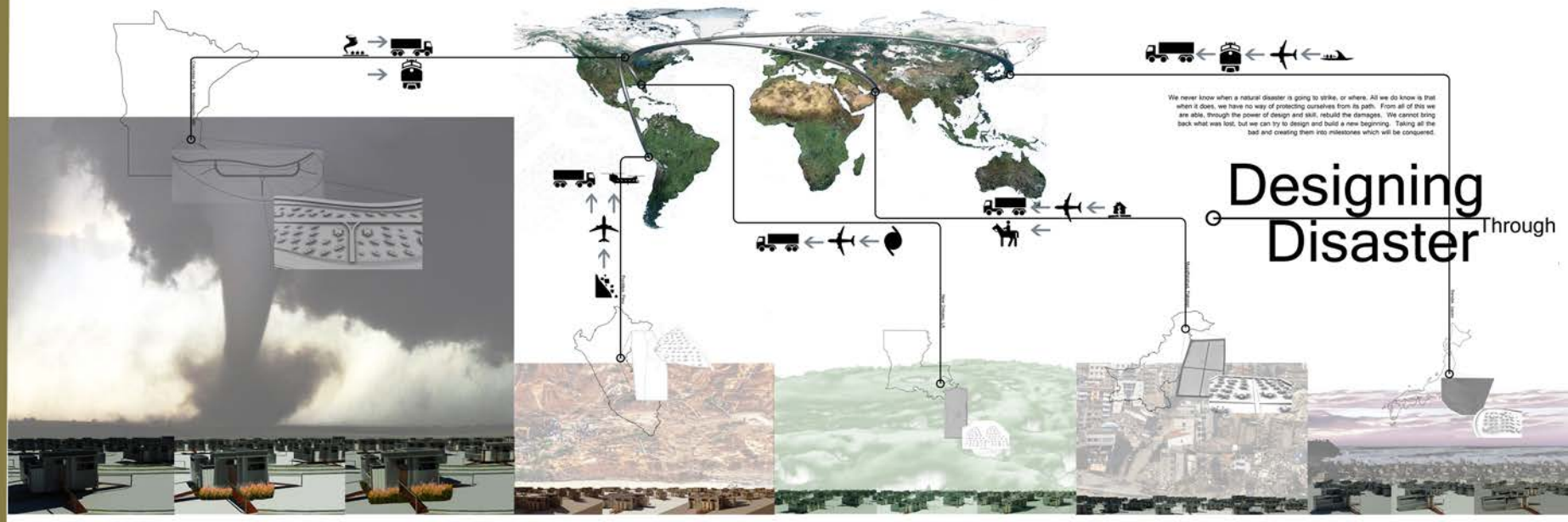


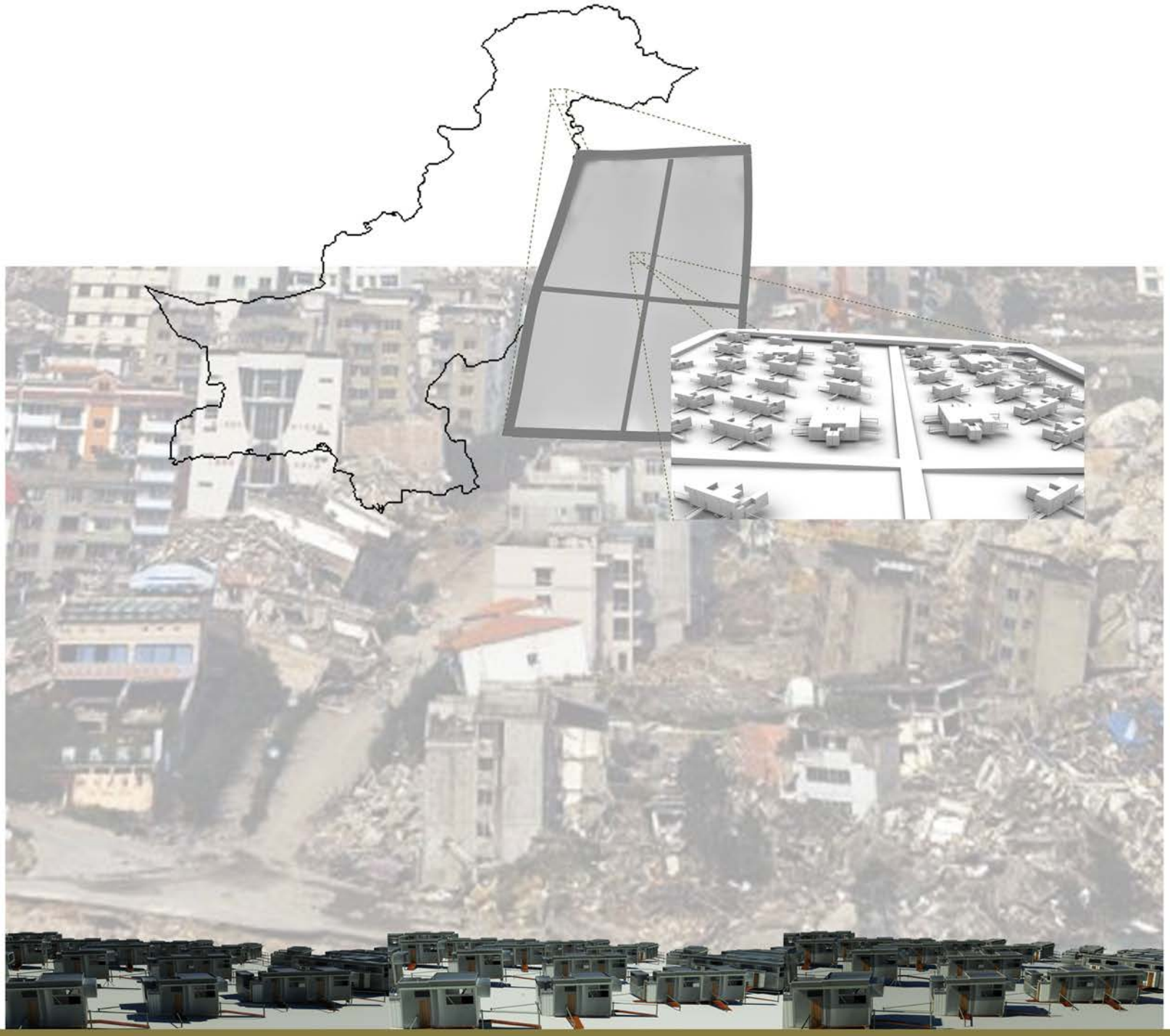

floor plan
table
window
door, murphy
Bed,
window
window above door

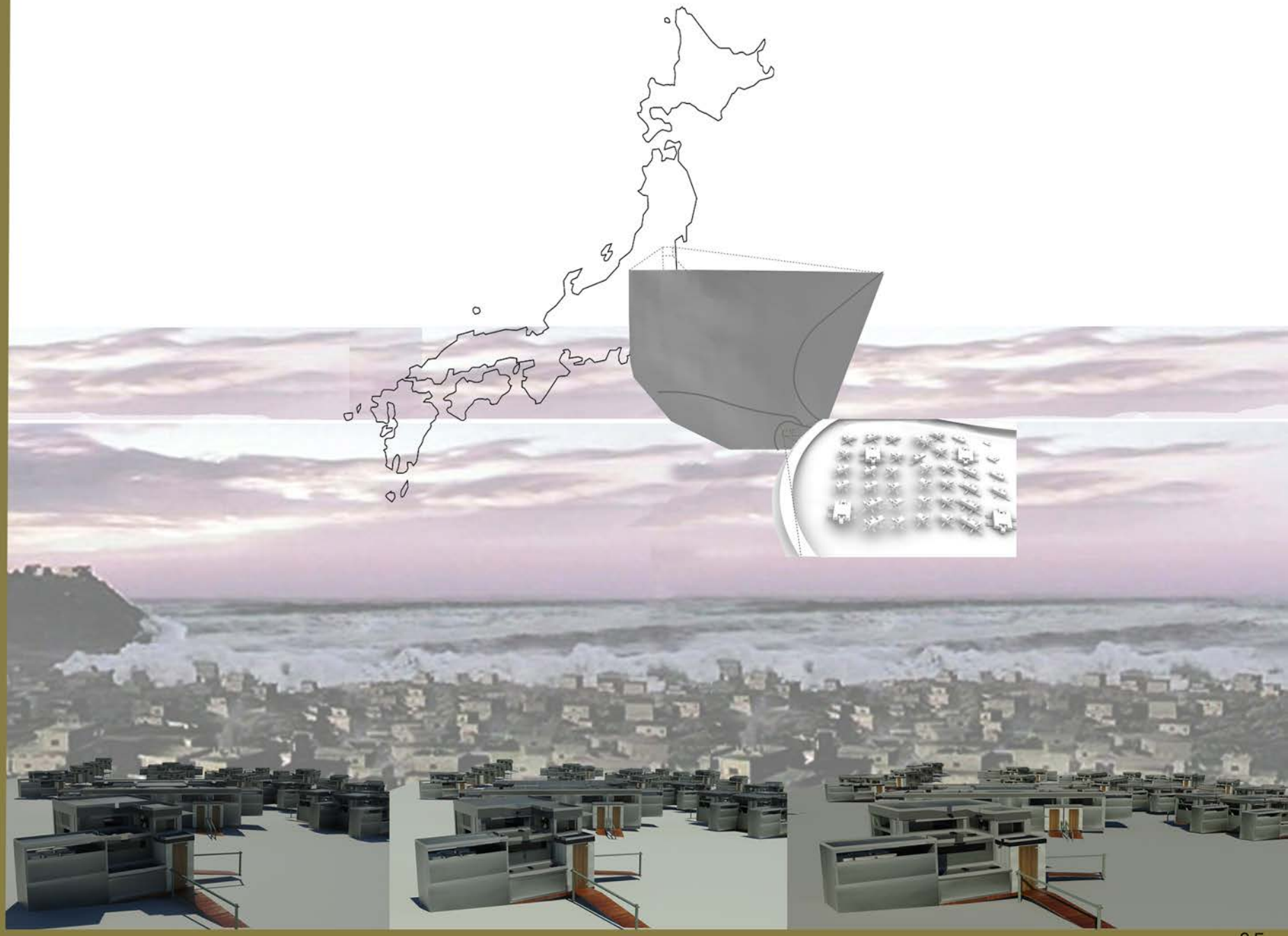


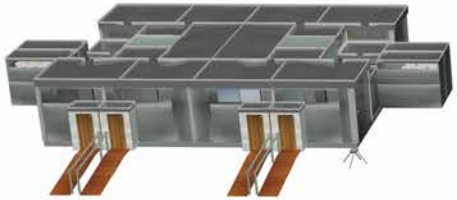


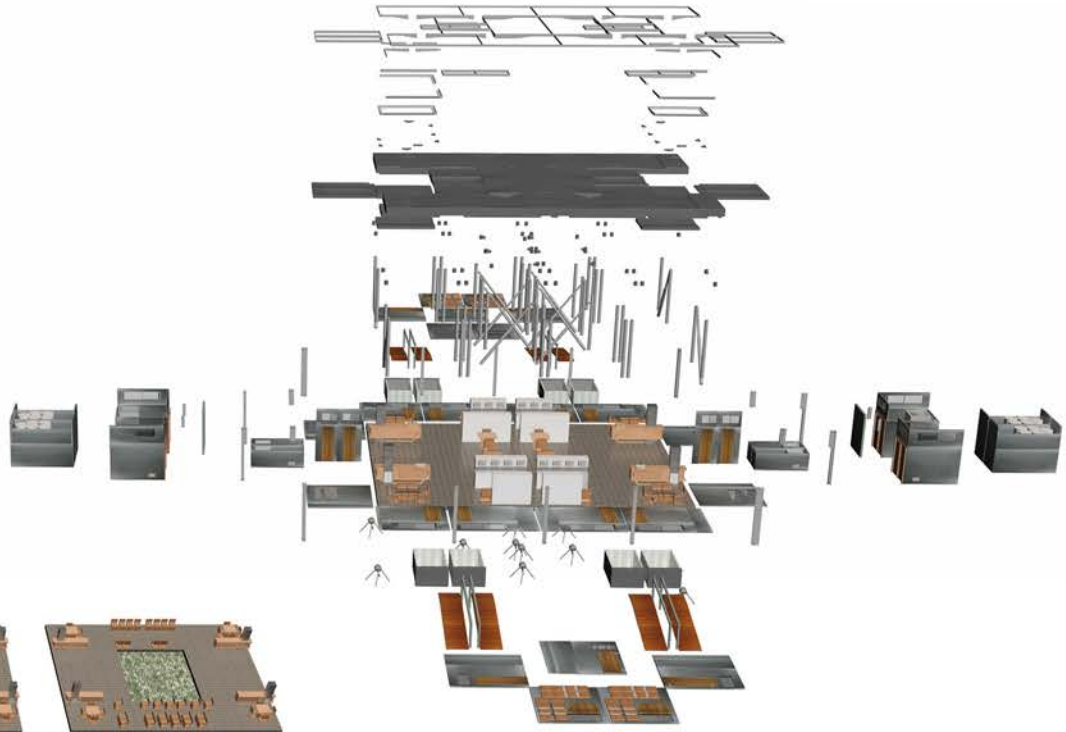
Final Images

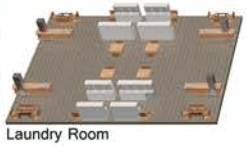

We never know when a natural disaster is going to strike, or where. All we do know is that when it does, we have no way of protecting ourselves from its path. From all of this we are able, through the power of design and skill, rebuild the damages. We cannot bring back what was lost, but we can try to design and build a new beginning. Taking all the bad and creating them into milestones which will be conquered.
Designing Disaster
Through



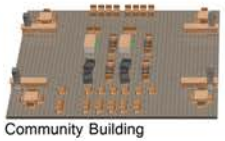




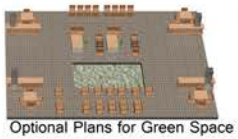




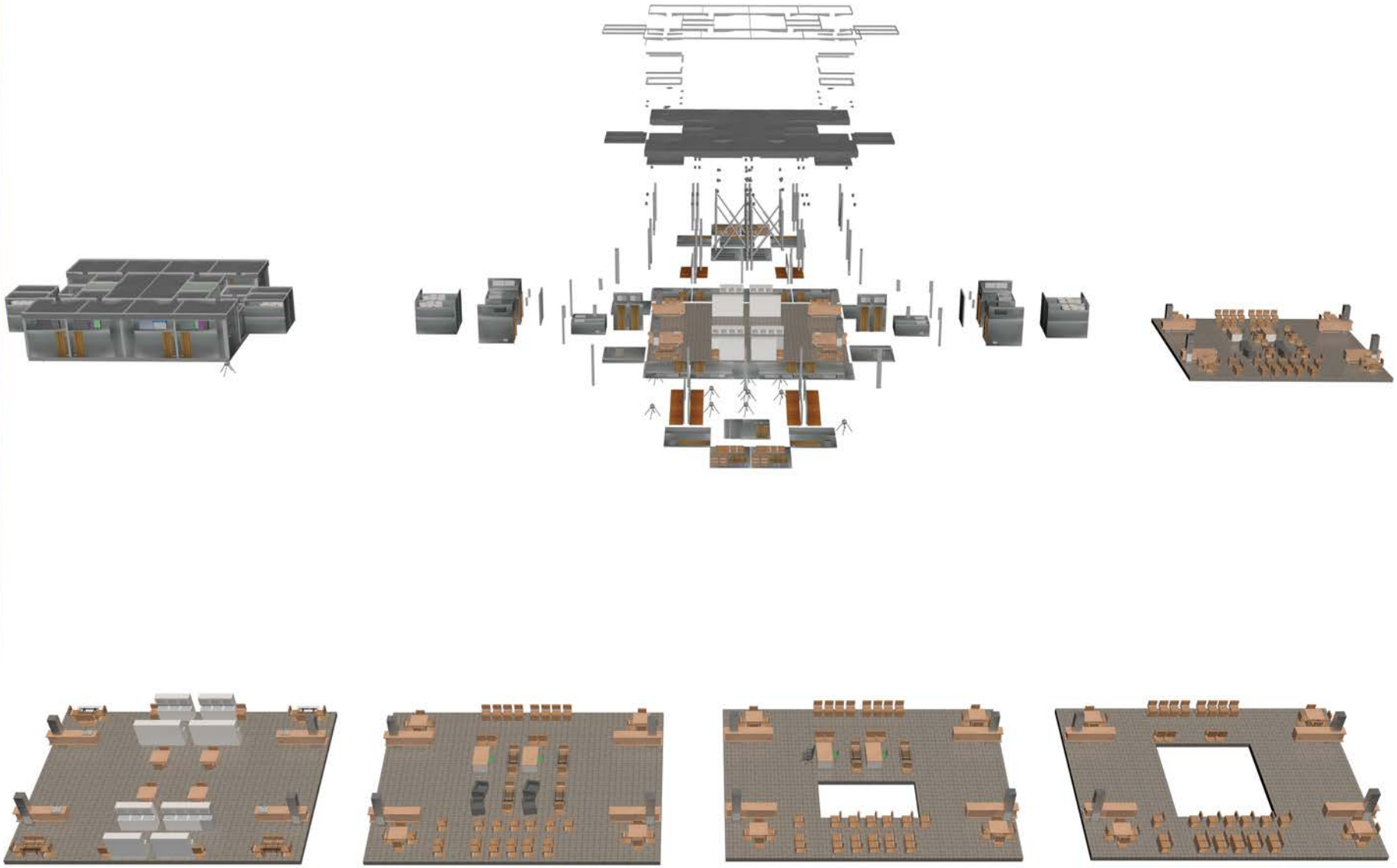
Laundry Room

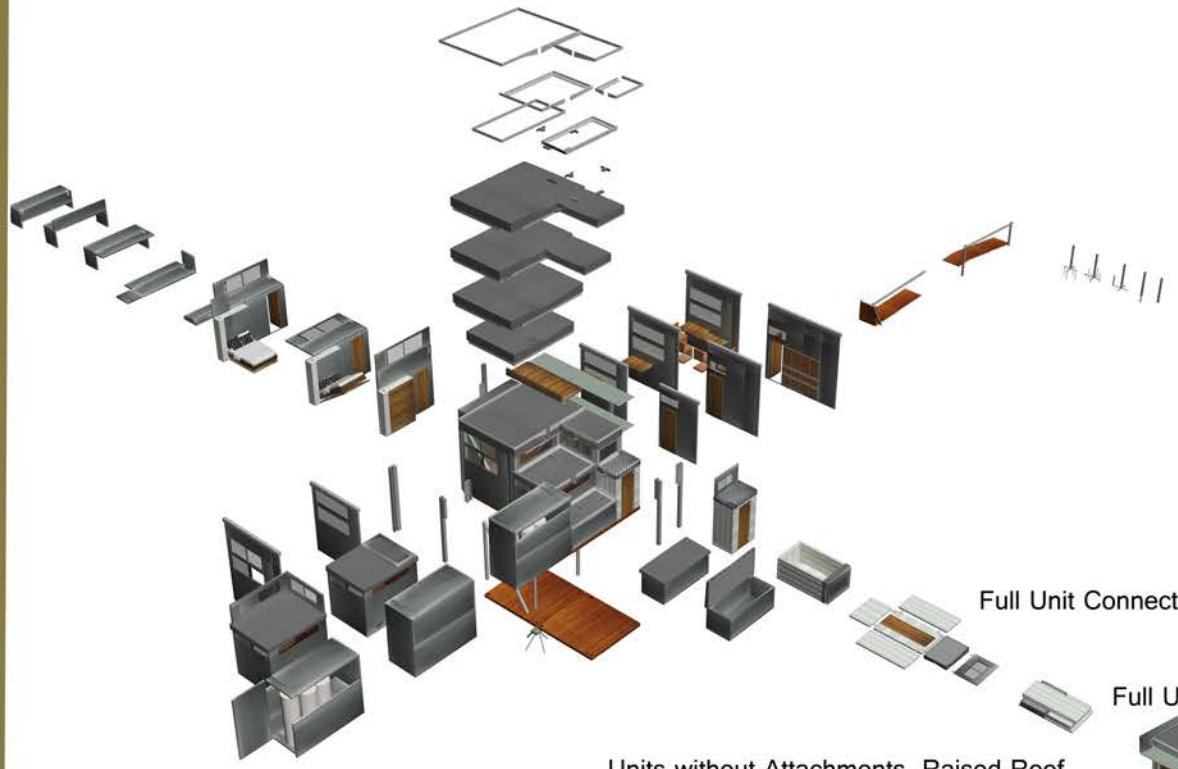


Community Building



Optional Plans for Green Space in Laundry or Community Building





Numbers:

Size of a Single Unit when Shipped: 8'6"x10'x4'6"
Size of Unit when Constructed: 8'6"'x10'0"x10' up to 10'x12'6"x10'

Number of Units per Semi Truck: =15-18 units
Size of Semi-Truck: 8'6"x 13'6"x =50'-80'

Number of Units per Cargo Car: =16-20
Size of Cargo Car: 9'6"x13'x= 80'-100'

Size of Tanks:
Water Tank: (for a family of four averaging 30 gallons a person per day)
120 gallon tank: 2'6"x2'6"x3'
Grey Water Tank: 3'x1 ¼'x1 ¼'
Black Water Tank: 2'x 1 1/3'x 1'

Population Compared to Number of Units:

	Population	Possible # of Units on Site	# of Beds (4 beds per unit)
Minneapolis:	382,578	220	880
New Orleans:	343,829	1360	5440
Pucallpa, Peru:	206,859	280	1120
Muzaffarabad, Pakistan:	19,748	70	280
Sendai, Japan:	1,031,704	440	1760

*Note: All locations have secondary sites to compensate for larger natural disasters that cause the need for more units.

2 Full Units Connected

Full Unit Connected to Smaller Unit

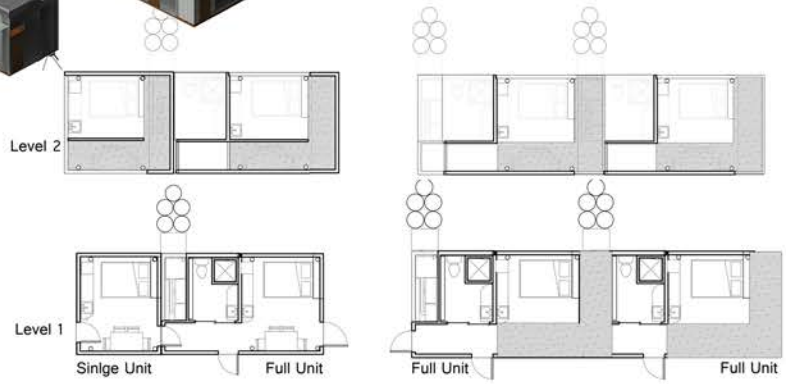
Full Unit

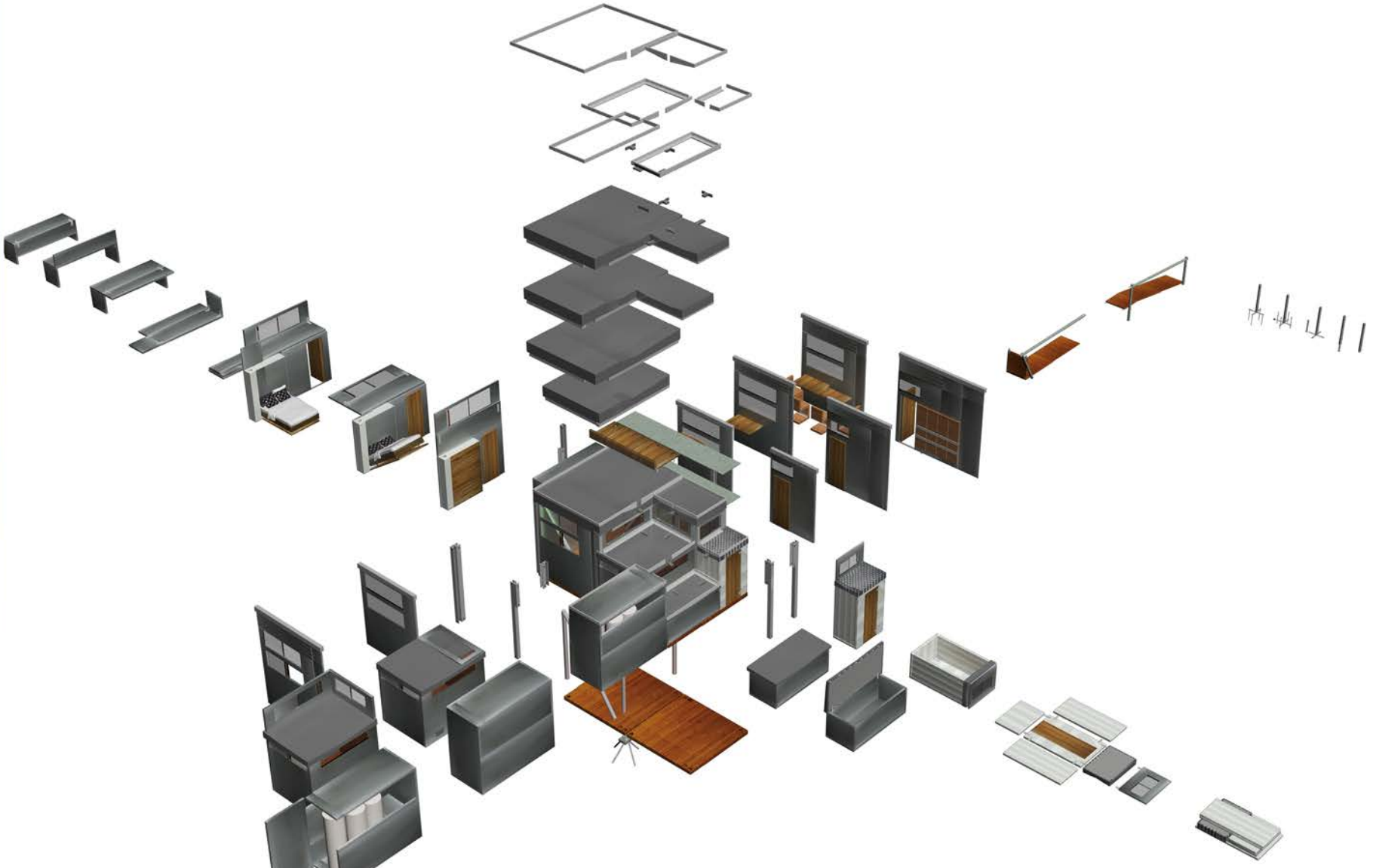
Units without Attachments, Raised Roof

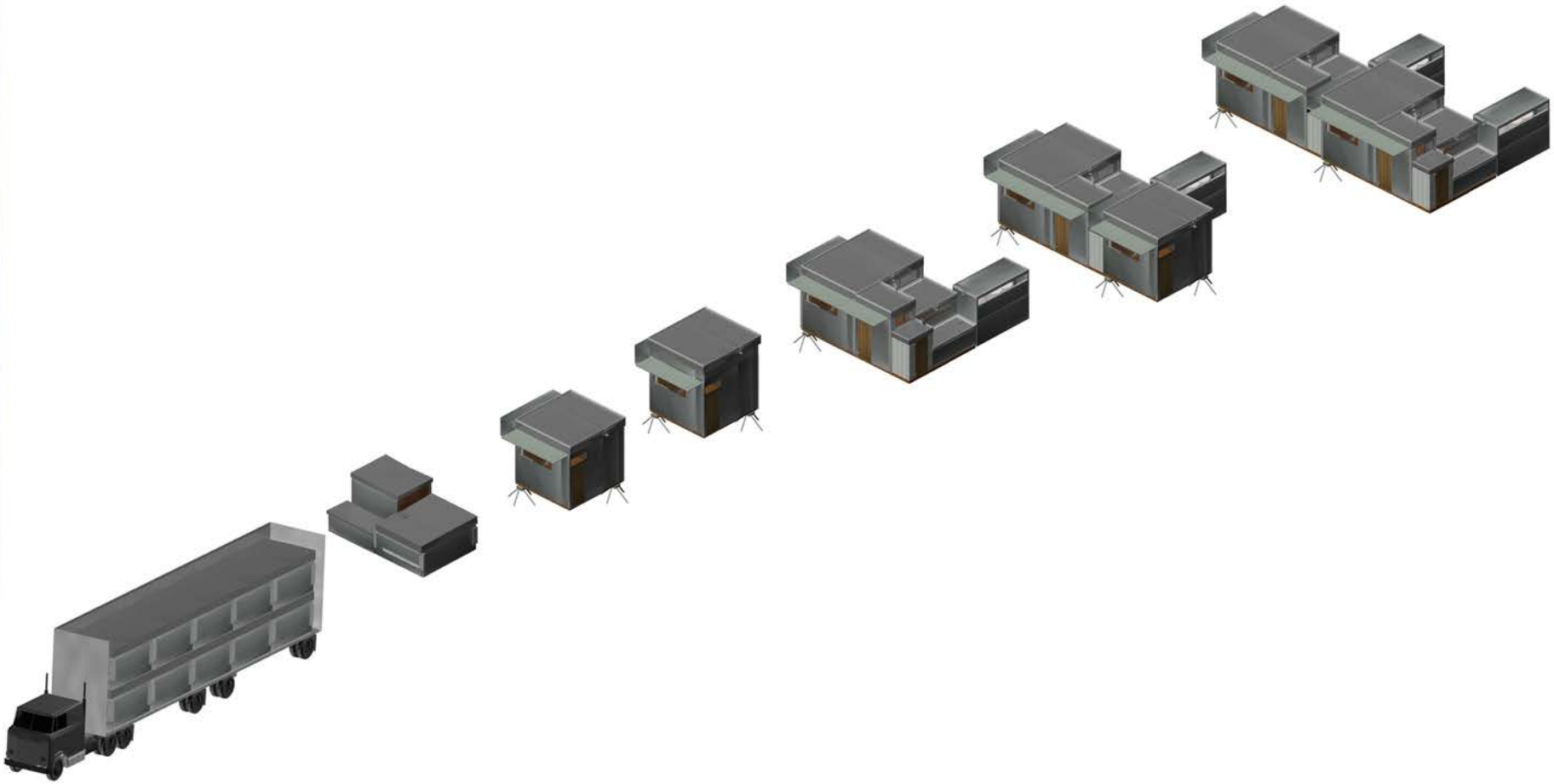
Unit without Attachments

Units as Shipped with Bathroom & Electrolyzer Unit Attchments

Units Shipped by Semi Truck







Numbers:

Size of a Single Unit when Shipped: 8'6"x10'x4'6"
Size of Unit when Constructed: 8'6"'x10'0"x10' up to 10'x12'6"x10'

Number of Units per Semi Truck: ≈15-18 units
Size of Semi-Truck: 8'6"x 13'6"x ≈50'-80'

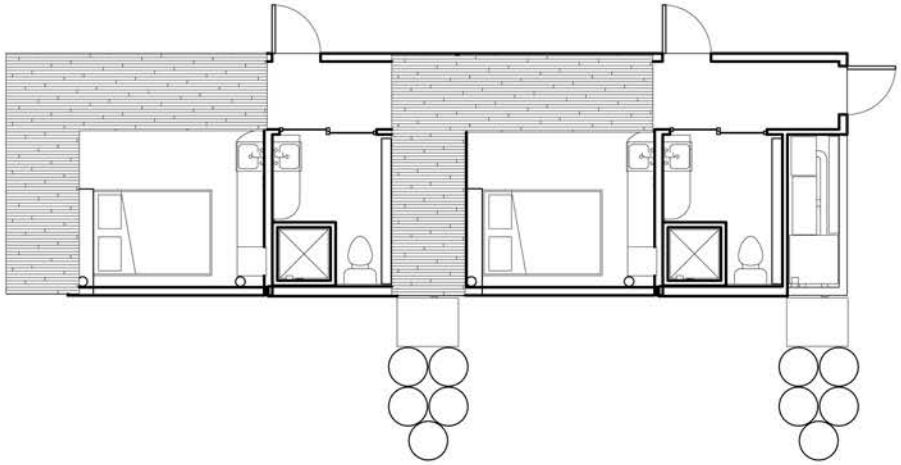
Number of Units per Cargo Car: ≈16-20
Size of Cargo Car: 9'6"x13'x≈ 80'-100'

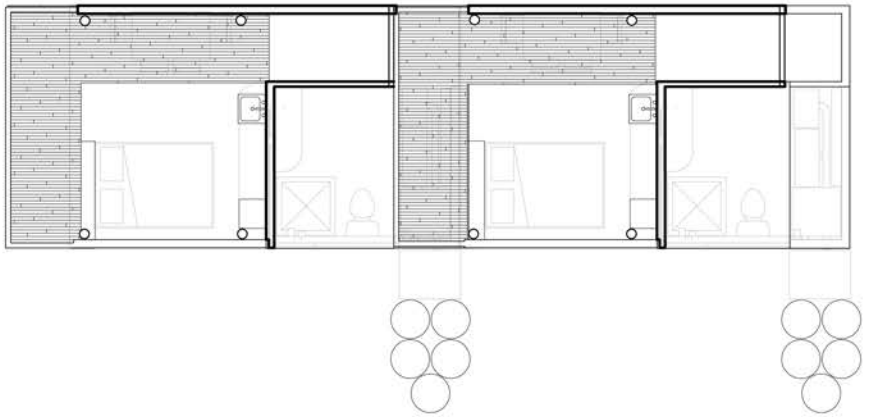
Size of Tanks:
Water Tank: (for a family of four averaging 30 gallons a person per day)
120 gallon tank: 2'6"x2'6"x3'
Grey Water Tank: 3'x1 ¼'x1 ¼'
Black Water Tank: 2'x 1 1/3'x 1'

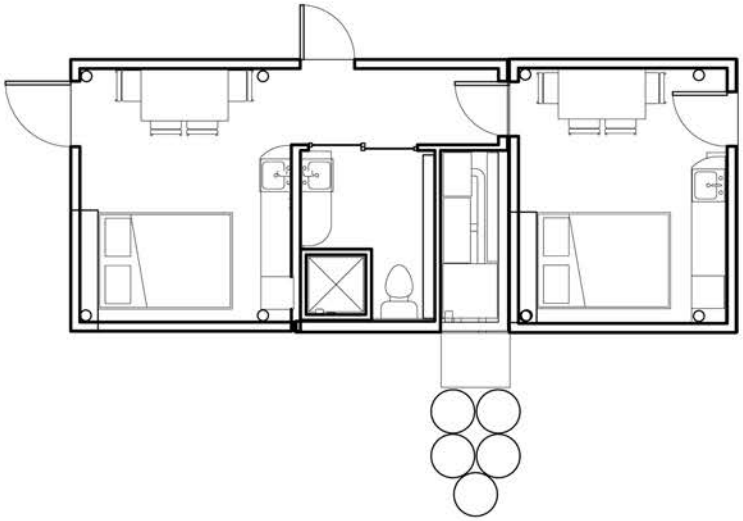
Population Compared to Number of Units:

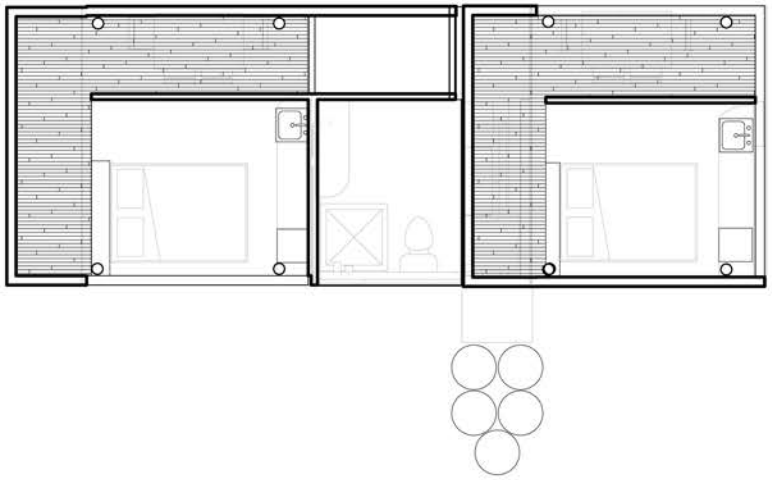
	Population	Possible # of Units on Site	# of Beds (4 beds per unit)
Minneapolis:	382,578	220	880
New Orleans:	343,829	1360	5440
Pucallpa, Peru:	206,859	280	1120
Muzaffarabad, Pakistan:	19,748	70	280
Sendai, Japan:	1,031,704	440	1760

*Note: All locations have secondary sites to compensate for larger natural disasters that cause the need for more units.

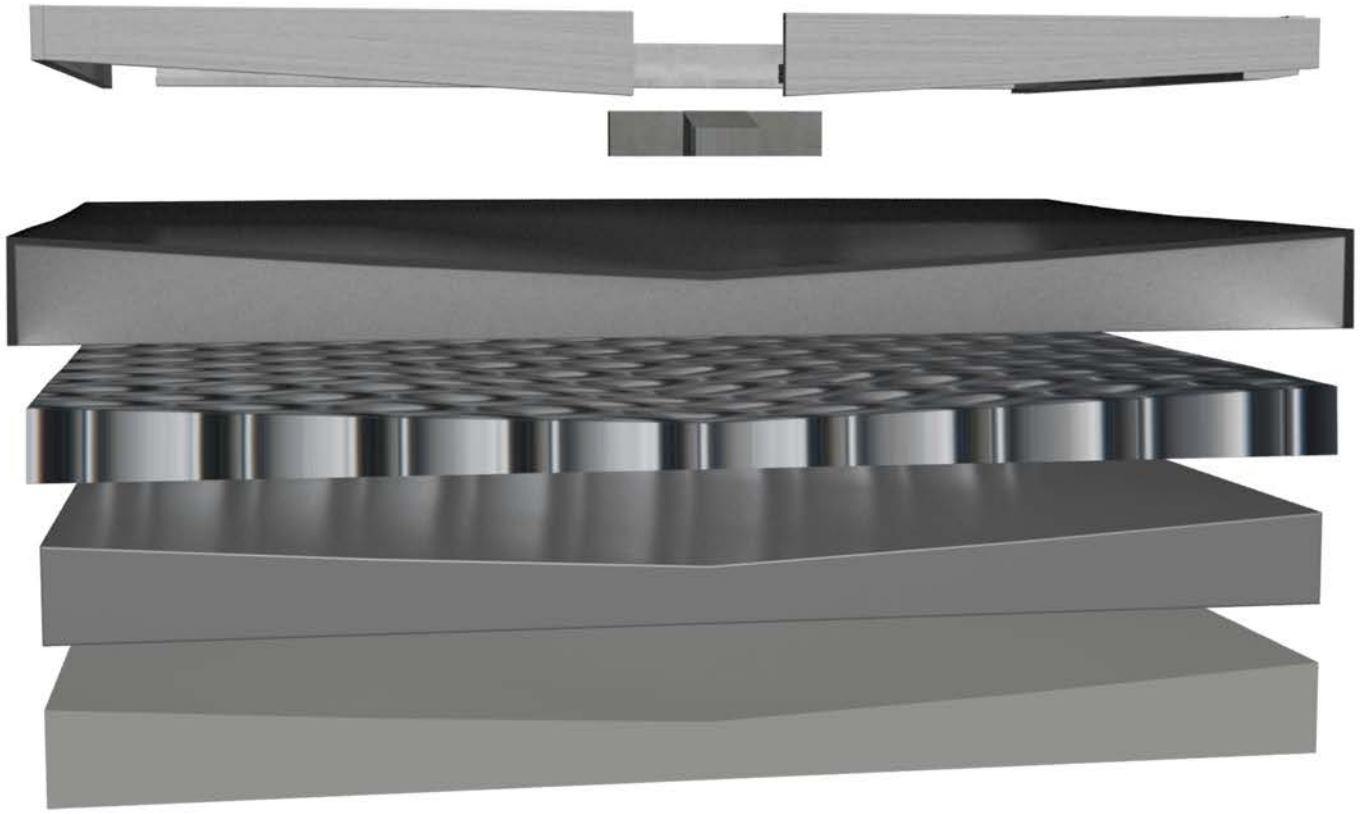


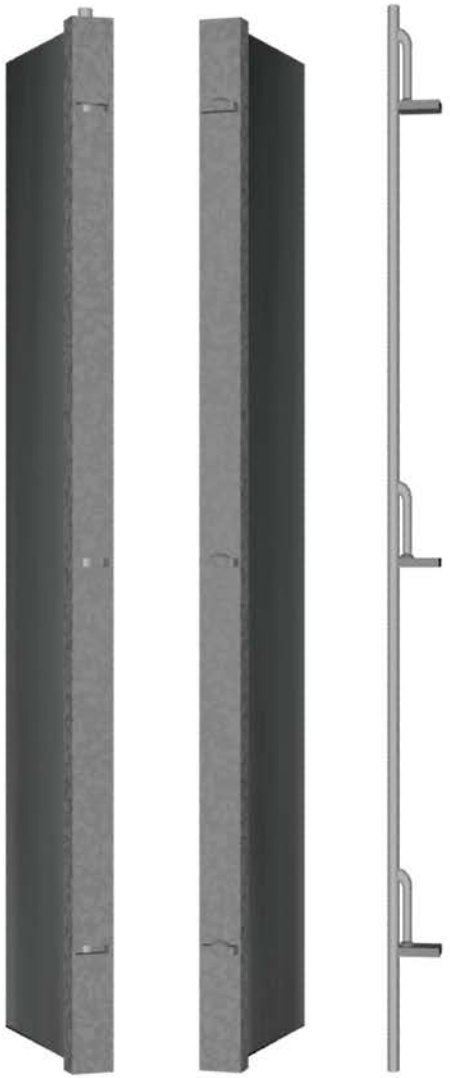


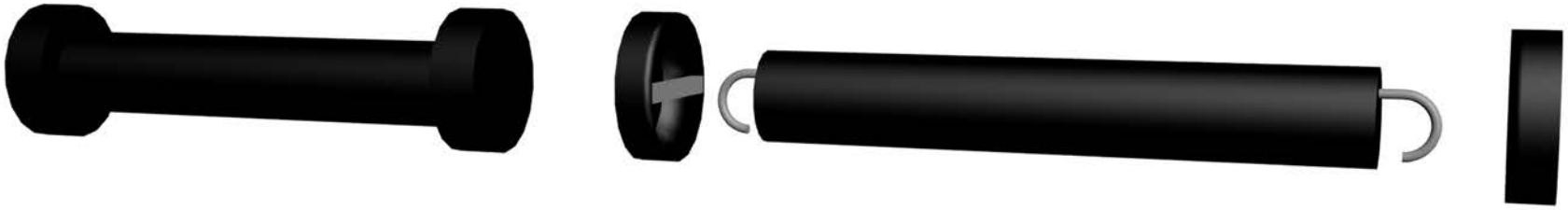


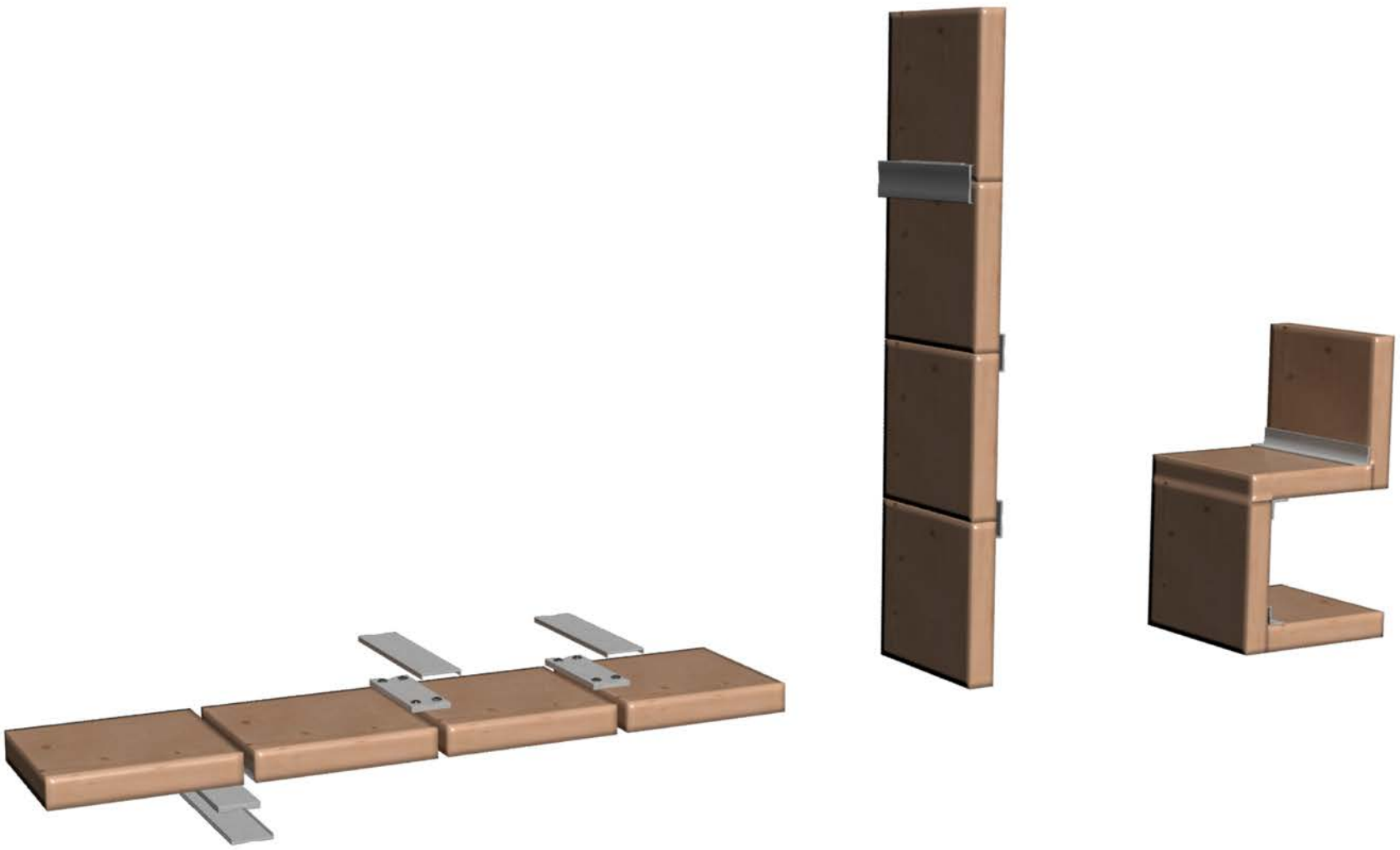


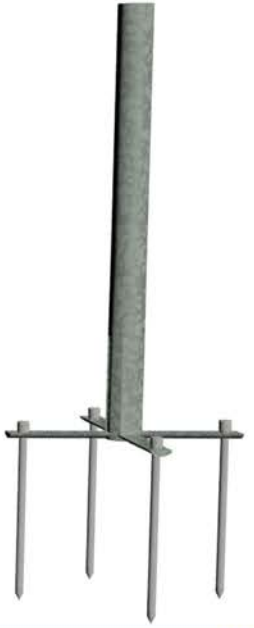

Wall Joint: A clip-in pressure system allows for panels to easily coupled to each other during the manufacturing process
Corner Units:
These elements help insulate the unit
Corner Unit Joints:
These are high strength rubber elements that hook in and secure the corner units together.
Operation of Aluminum Structure Poles
Roof Panel (Top to Bottom):
Protective Covering, VAPOUR GUARD, Roof Membrane, Sloped Insulation
HoneyComb Paneling:
This lightweight material makes up the wall on each unit for fast and easy construction
Adjustable Awning:
Handrail Pole Design
Table Panel:
This wall panel has a table attached to it, for storage or dining
Telescoping Panels:
This part of the wall project up to accommodate for when the unit is raised from 10 feet to 12 feet.
Ramp:
Multiple ramps can be attached to the unit to adapt to the local topography.
Pin Foundation:
A pin pile foundation system, has a precast concrete top. It does not require pouring concrete or digging large holes.
Pole Covering:
Covers telescoping pole joint
Murphy Bed Panel:
Each unit is equipped with a Murphy bed to ensure a relaxing place to sleep
Plumbing and Electricity:
The water tank, black water and grey water tanks provide plumbing for two sinks, a shower, and a toilet . The electrical system, powered by a silicon solar panel and five hydrogen fuel tanks, gives power to the fan coil unit, lights and outlets placed around the unit in raceway tracks.
Chair:
Designed to hang on a wall while not in use to preserve floor space in the unit

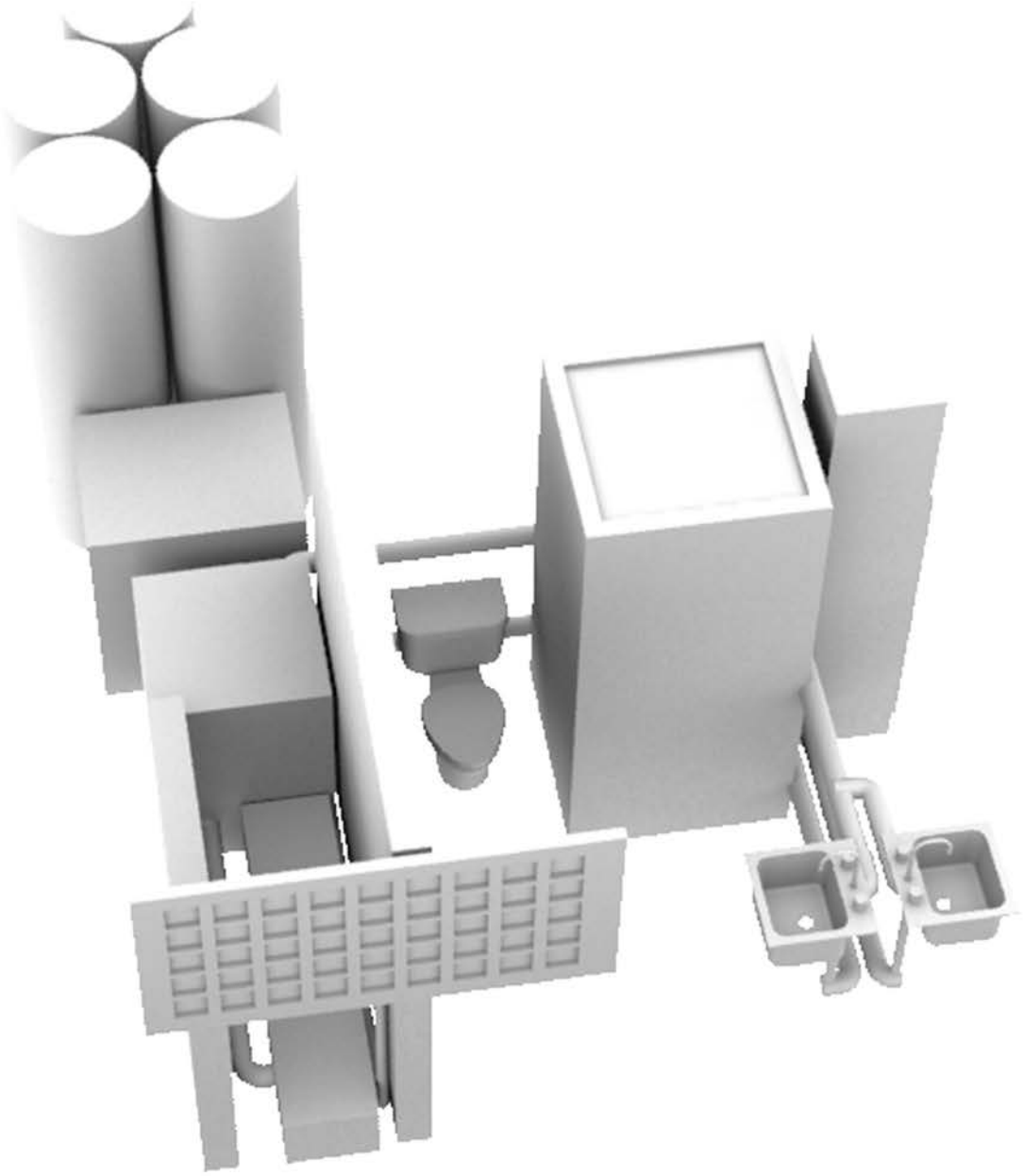


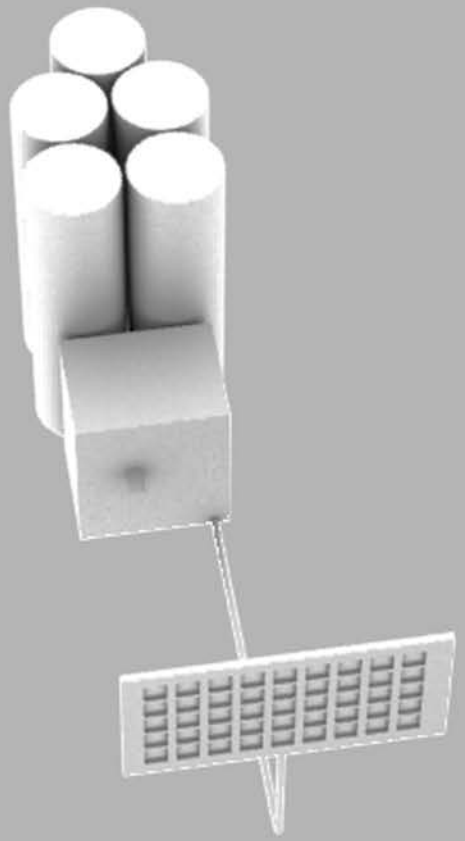


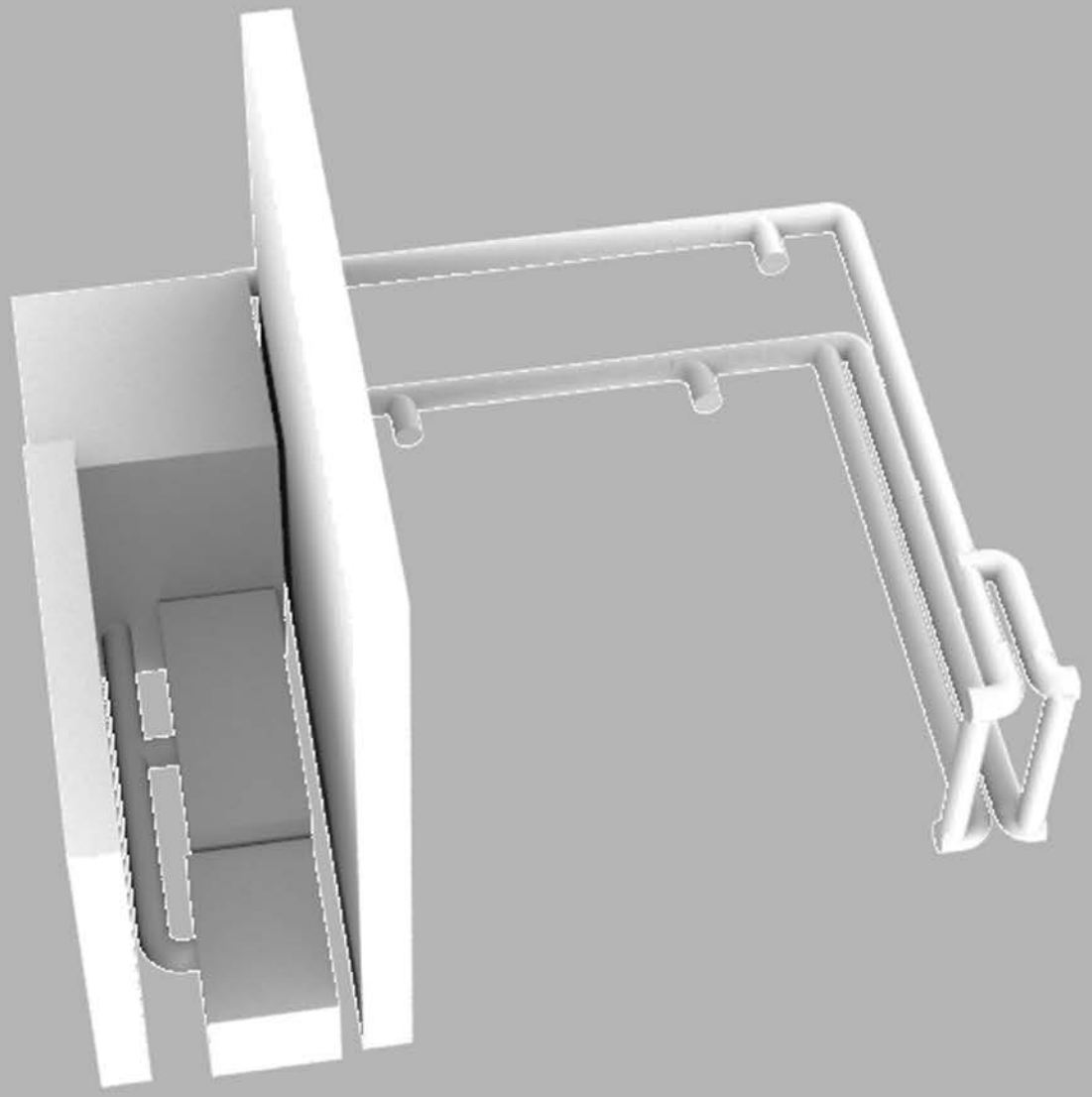


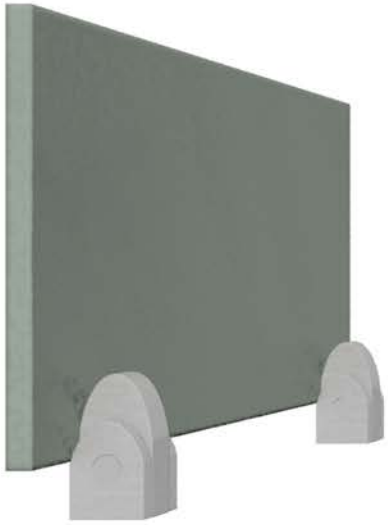


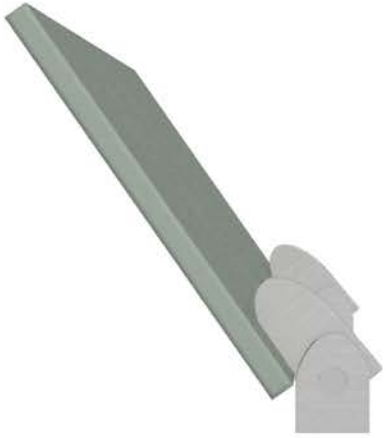


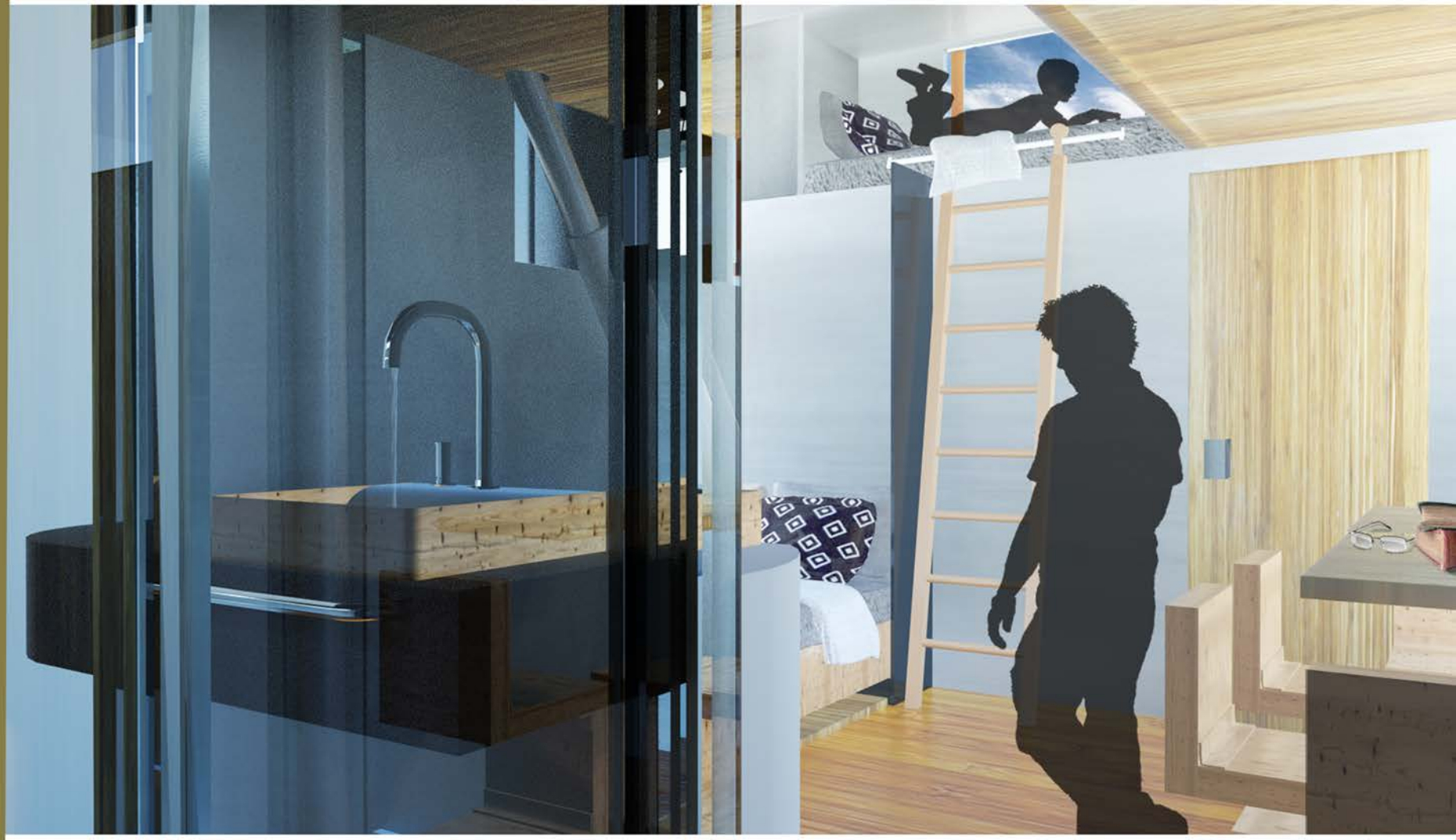


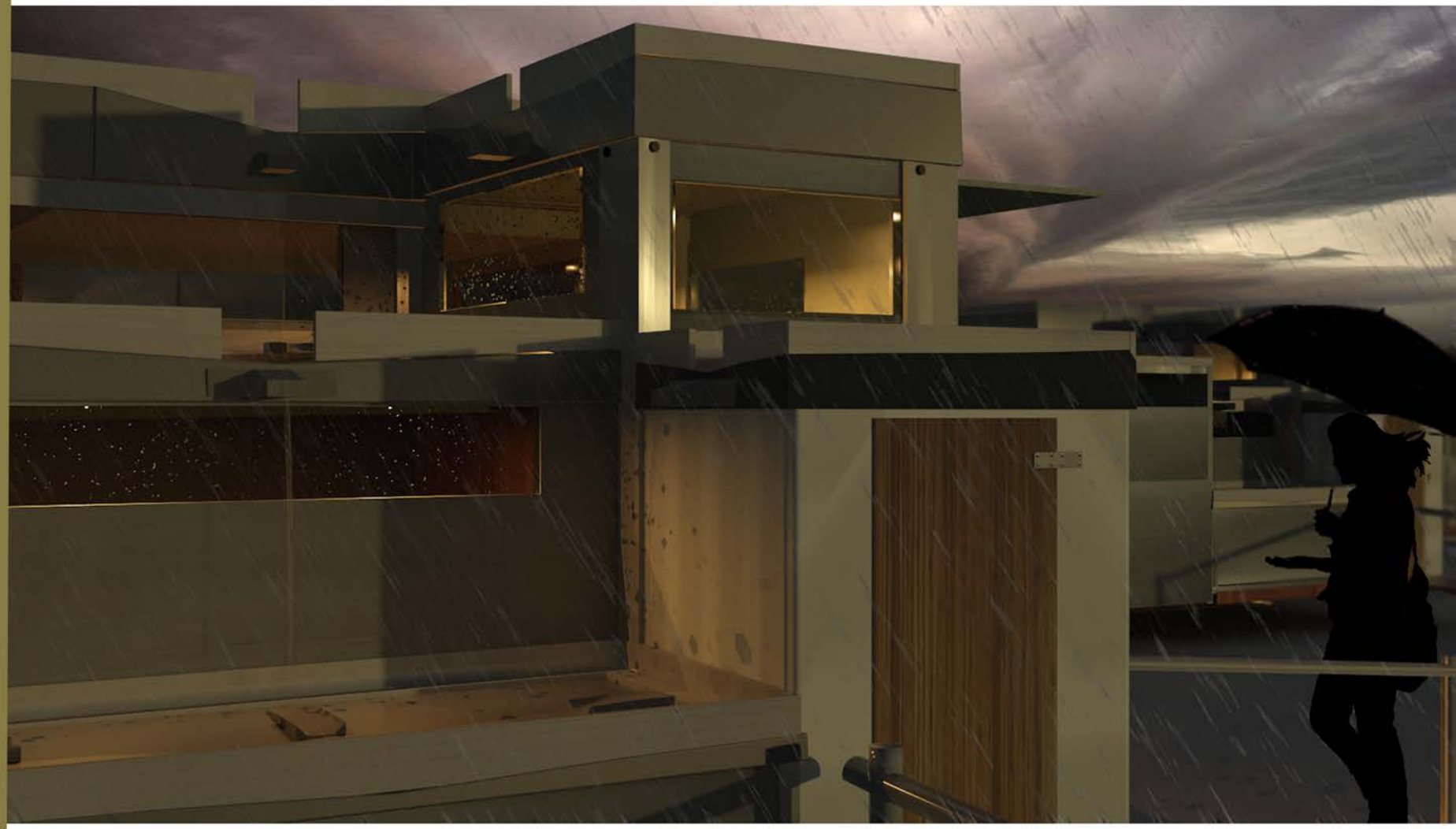




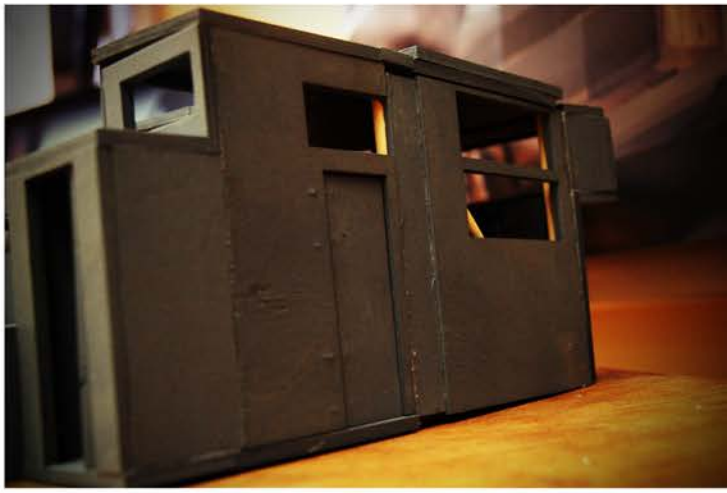


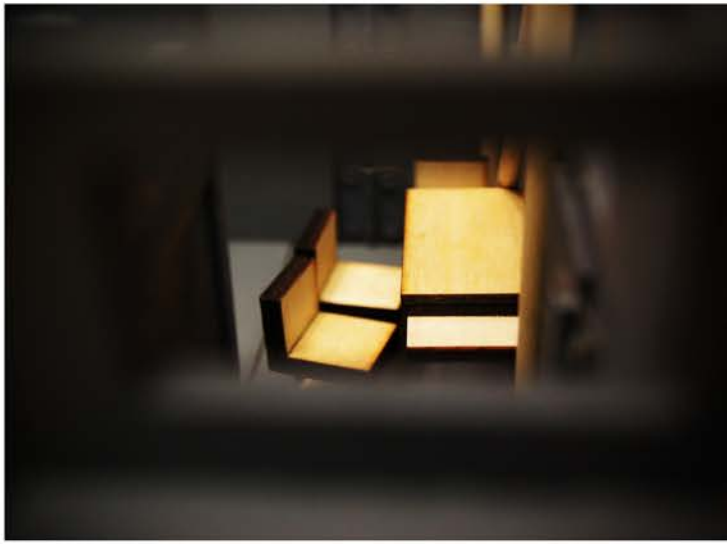







Designing
Disaster
Lauren Peterson





References

"2004 Tsunami Map - Indonesia Tsunami Map - GEOLOGY.COM." Geology.com - Earth Science News, Maps, Dictionary, A ticles, Jobs. N.p., n.d. Web. 3 Oct. 2011. <http://geology.com/articles/tsunami-map.shtml>.

Average Weather for Minneapolis, MN - Temperature and Precipitation. (n.d.). National and Local Weather Forecast, Hurricane, Radar and Report. Retrieved November 28, 2011, from http://www.weather.com/weather/wxclimatology/monthly/graph/USMN0503

Climate Information for Minneapolis - St.Paul - Minnesota - Midwest - United States - Climate Zone. (n.d.).Climates of the world - Climate Zone. Retrieved November 30, 2011, from http://www.climate-zone.com/climate/united-states/minnesota/minneapolis-stpaul/

Curtis, W. (2011, September). Altruism, Architecture & Disaster. Architect the *AIA Magazine*, 150-175.

Dow K., & Downing, T. E. (2007). *The Atlas of Climate Change: Mapping the World's Greatest Challenge* (Rev. and updated ed.). Berkeley: University of California Press ;. Hawthorne, C., Capps, K., Greenblatt, A., Wills, E., &

Humanity, A. f. (2006). *Design like you give a Damn: Architectural Responses to Humanitarian Crises*. New York, NY: Metropolis Books.

Google Maps. (n.d.). Google Maps. Retrieved December 1, 2011, from http://maps.google.com/

Results Minneapolis: Homelessness. (n.d.). City of Minneapolis, Minnesota - Official Web Site. Retrieved December 8, 2011, from http://www.minneapolismn.gov/results

References

Minneapolis - St. Paul Relative Humidity - CityRating.com. (n.d.).Best Places To Live - CityRating.com. Retrieved November 29, 2011, from http://www.cityrating.com/cityhumidity.asp?City=Minneapolis+-+St%2E+Paul

Minneapolis, Minnesota - Sunrise, Sunset, Dawn and Dusk Times for the Whole Year - Gaisma. (n.d.). Sunrise, Sunset, Dawn and Dusk Times Around the World - Gaisma. Retrieved December 1, 2011, from http://www.gaisma.com/en/location/minneapolis-minnesota.html

Wind- Average Wind Speed- (MPH). (n.d.). NCDC: * National Climatic Data Center (NCDC) *. Retrieved November 30, 2011, from http://www.ncdc.noaa.gov/oa/climate/o

Windfinder - Wind & Weather Statistic Minneapolis-St Paul Airport. (n.d.).Windfinder - wind, wave & weather reports, forecasts & statistics / webcams, satellite images, isobar maps, tides. Retrieved December 1, 2011, from http://www.windfinder.com/windstats/windstatistic_minneapolis-st_paul_airport.htm#

Global Village Shelters | Open Architecture Network. (n.d.). Open Architecture Network | Helping communities sustainably improve living conditions through innovative design and construction.. Retrieved October 25, 2011, from http://openarchitecturenetwork.org/node/234/oanattachments

::: LOT-EK :::. (n.d.). ::: LOT-EK :::. Retrieved October 31, 2011, from http://www.lot-ek.com/

Scoates, C. (2003). *LOT-EK: Mobile Dwelling Unit*. New York, NY: Distributed Art Publishers.

Safe(R) House | Architecture for Humanity. (n.d.). Architecture for Humanity. Retrieved October 15, 2011, from http://architectureforhumanity.org/node/875

References

Safe(R) House | Open Architecture Network. (n.d.). Open Architecture Network | Helping communities sustainably improve living conditions through innovative design and construction.. Retrieved October 20, 2011, from http://openarchitecturenetwork.org/node/375

Saieh, N. (n.d.). *Quinta Monroy / Elemental* | ArchDaily. ArchDaily | Broadcasting Architecture Worldwide. Retrieved October 31, 2011, from http://www.archdaily.com/10775/quinta-monroy-elemental/

Category. (n.d.). Hurricane Katrina - Statistics - Third Anniversary of Katrina . US Politics. Retrieved December 4, 2011, from http://uspolitics.about.com/od/katrina/l/bl_katrina_stats.htm

Climate - Peru - average, temperature. (n.d.). Encyclopedia of the Nations - Information about countries of the world, United Nations, and World Leaders. Retrieved December 5, 2011, from http://www.nationsencyclopedia.com/Americas/Peru-CLIMATE.html#b

FACTS: Japan earthquake, tsunami, nuclear crisis March 2011 ~ liberal sprinkles. (n.d.). liberal sprinkles. Retrieved December 4, 2011, from http://liberalsprinkles.blogspot.com/2011/03/facts-japan-earthquake-tsunami-nuclear.html

Falk, R. H. (n.d.). Wood as a Sustainable Building Materia. Wood as a Sustainable Building Materia. Retrieved December 4, 2011, from http://www.fpl.fs.fed.us/documnts/fplgtr/fpl

HURRICANE CAMILLE - August 14-22, 1969 - Worse than Katrina, Camille barely spared New Orleans from destruction (Lessons we did not learn) - by Dr. George Pararas-Carayannis. (n.d.). DISASTER PAGES OF DR. GEORGE PC / Welcome Page. Retrieved December 4, 2011, from http://drgeorgepc.com/Hurricane1969Camille.html

References

Historic World Earthquakes. (n.d.).U.S. Geological Survey Earthquake Hazards Program. Retrieved December 6, 2011, from http://earthquake.usgs.gov/earthquakes/world/historical_country.php#pakistan

Houses Of Minneapolis | . (n.d.).Houses Of Minneapolis | . Retrieved December 2, 2011, from http://www.housesofminneapolis.com/

Japan's Weather. (n.d.). Korean History Project - "Where the Past is Always Present". Retrieved December 3, 2011, from http://www.koreanhistoryproject.org/Jta/Jp/JpWX0.htm

Jurin, L., & Righett, M. (n.d.). Traditional Building in Peru. Traditional Building in Peru. Retrieved December 3, 2011, from http://www.icomos.org/iiwc/seismic/Juri

Louisiana - Climate. (n.d.). Stats about all US cities - real estate, relocation info, house prices, home value estimator, recent sales, cost of living, crime, race, income, photos, education, maps, weather, houses, schools, neighborhoods, and more. Retrieved December 3, 2011, from http://www.city-data.com/states/Louisiana-Climate.html

Minnesota Tornado History and Statistics. (n.d.). Minnesota Climatology Working Group. Retrieved December 3, 2011, from http://climate.umn.edu/doc/historical/tornadic.htm

Mudslides in Peru kill at least 20, 50 Injured. (n.d.). Top - Digital Journal. Retrieved December 5, 2011, from http://digitaljournal.com/article/290027

New Orleans Architectural Styles . (n.d.). Official New Orleans Tourism Web Site - NewOrleansOnline.com. Retrieved December 1, 2011, from http://www.neworleansonline.com/neworleans/architecture/archtypes.html

Pakistan Climate. (n.d.). World Map, Map of the World. Retrieved December 5, 2011, from http://www.mapsofworld.com/pakistan/climate.html

References

Seismic Resistant Housing Pakistan | Open Architecture Network. (n.d.).Open Architecture Network | Helping communities sustainably improve living conditions through innovative design and construction.. Retrieved December 5, 2011, from http://openarchitecturenetwork.org/projects/seismicresistanthousing

The 10 most destructive tsunamis in history - Australian Geographic. (n.d.). Australian Geographic – the best images and stories about Australia - Journal, Society, Outdoor magazine, Education - geography, photography, wildlife, adventure and science - Australian Geographic. Retrieved December 4, 2011, from http://www.australiangeographic.com.au/journal/the-10-biggest-tsunamis-in-history.htm

The Top 5 Deadliest Avalanches and Mudslides in History. (n.d.). Top 5 of Anything . Retrieved December 5, 2011, from http://www.top5ofanything.com/index.php?h=890edd2d

retval;}, e. (n.d.). North Minneapolis tornado | StarTribune.com.StarTribune.com: News, weather, sports from Minneapolis, St. Paul and Minnesota. Retrieved December 2, 2011, from http://www.startribune.com/projects/122439504.html

The Art of Japan: Architecture: History. (n.d.). ThinkQuest : Library. Retrieved December 6, 2011, from http://library.thinkquest.org/27458/nf/architecture/history.html

Concrete reasons: most common building material abetter choice. | Indiana Business Magazine | Professional Journal archives from AllBusiness.com. Small Business Advice | Business News & Articles | AllBusiness.com. Retrieved December 5, 2011, from http://www.allbusiness.com/north-america/united-states-indiana/380697-1.html

Personal Identification

Address:
708 lake point
Chanhassen , MN 55317

Telephone Number:
612-508-6887

E-Mail Address:
laurenpeterson28@gmail.com
lauren.peterson.1@my.ndsu.edu

Home Town:
Chanhassen, MN

"If you think you are too small to make a difference, try sleeping with a mosquito." - The Dalai Lama