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PAPi Design + Build

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PAPi Design + Build

By

Eric Engler

A Design Thesis

Presented to the faculty of

The college of Architecture at the University of Nebraska

In Partial Fulfillment of Requirements

For the Degree of Master of Architecture

Major: Architecture

Under the Supervision of Professor ***Jason Griffiths***

Lincoln, Nebraska

May 2019



PAPi

Design + Build

Abstract

My thesis explores design build. I set out this thesis to try and explore the relationship between my experiences doing design build and the implications it can have in the built environment. My maker experience started with furniture in high school and shifted into cabins and micro dwellings through architecture school. Design Build is what I want to pursue after graduation with an aim of setting up a practice where I can do design build projects. My current interest lies in microarchitecture because it's a scale I feel I can be in complete control of the outcome. Also a smaller scale is within the scope of my capabilities to produce. My capabilities consist of a workshop near Cortland, tools and equipment that will assist me in the process of construction and delivery, and various other things that will contribute to the finished building. The challenge is: Given my capabilities, how can I construct a dwelling using a combination of modules where the design is successful in an assortment of different situations. This process has helped guide me to have a more clear vision and path towards my professional goals.

Papi Design + Build isn't just a business name or a thesis project title. It is a representation of the knowledge I have gained through the experiences I have endured. This is the beginning of my reality, a future attempting to make each person's experience of architecture in this world better.

Spring 2019

Contents

Molded by Making 09 - 23

Business 24 - 35

Design 36 - 51

Precidents 52 - 75

Construction 76 - 83

Chapter 01: Molded by Making

Early Years:

During my time in high school I took a wide variety of classes. Surprisingly enough it was what I learned in the hands-on classes I find to be the most applicable in college. I started working with my hand as a child playing with Legos and Lincoln Logs. These toys sparked interest that grew into a hobby. I built many things at home from bike ramps to a tree house. As I grew older and went into high school, I enrolled in shop class where I learned the proper technique and function of woodworking tools.

In high school everyone wanted the best speaker system. I started making sub boxes for my own use, my friends, and then I started making custom boxes and which I sold. This was my first taste of business even though there was no formal business plan however, it was something I was thought I was good at and could make enough money to full my car up with gas.

Making these sub boxes was something I enjoyed doing, but also, I learned a lot. I used many tools such as a jig saw, circular saw, drills, caulk, silicone and so on. Learning how to use these tools was just the start. When you make a correct sub box it requires some design and many calculations. First, you need to know what subwoofer you want so you can make the box perform at its peak. You also need to measure the volume of the box in, the size of the port, and proper sealing techniques





Over time I started finding ways to work with tools and materials to make higher quality pieces with more complex details. I usually kept these pieces I made or gave them away as gifts and would sometimes sell them. These projects gave me greater insight with a new array of tools, how to redesign details through material testing, creating a bill of sale and proper technical drawings.

When I finished each piece there would be this sense of joy and accomplishment I can still recall. I would stare at the piece and remember every step I took to achieve the final piece. I have continued to use those skills throughout my life both professionally and when needed around my house or other projects. The knowledge I acquired through my early maker experience gave me the perfect foundation to build on going into architecture school.

Professional School:

The first project I designed and built was in a class called Design Thinking and the group I was in designed and built a phone case. The intention of the phone case was to allow the user to have the ability to store more things using while taking up less space than the traditional phone, wallet, and keys. This process forces me think critically and strategically into what people want to carry vs what they need to carry, and what they carry but don't want to or need to. Overall, I learned about how every detail in the form affected not only the feeling the user got in their hand, but the non-obstructive feel in while in their pocket as well. This was more of a product design exercise that taught me the importance of detail.

The next project was in a class called Design Make. When furniture is located along a wall and there is a plugin behind it, usually people have to leave a 1" or 2" gap for the back of the plug in to stick out. I designed a sliding shelf that could be pulled up from in that space that could store extra items. I used a kiddie door that is meant to go in the door frame to keep kids in a certain room. Using the kiddie as the starting point, I took it apart and pieced it back together so it would fit and slide up from behind furniture in a 2" gap. I cut out circular holes in the backing that could be used to hang items in such as a tv remote, DVD's, and other smaller items. This project taught me the purpose of functionality and understanding how to use common objects and shapes to create something new.

Fast forward to my third year. I was in a studio where we designed a mixed use building roughly 100,000 sqft to be a sustainable and efficient space. We did site research at scales that were generic to Lincoln and the surrounding

area. We found adjacencies to local markets, and educational hubs. The design of the building was the hard part. Just one year ago I was designing an object the size of one sqft and now I'm supposed to design 100,000 sqft. Given the outcomes of the class, we all incorporated sustainable features into our design which also added a level of difficulty. When the project came to an end, I had to present it. I felt I was presenting an idea of what I wanted the building to look like and perform like. There were so many unanswered questions and concerns I had about the technical and logistical aspects of it I didn't like sense of not knowing. However, the learning curve was more about the process of how to design a building that gave the user the desired experience and how to create a building that was site specific, implementing ideas that were driven by the user.

During this same studio, we made lots of models. The site of the project was in a forested area with lots of trees. I started take natural pieces of wood and sanding them down to make the topo. I found sticks and twigs and inserted them into holes that I drilled into this wood to make the site as rigid and natural as possible. I started making bigger models that could only be moved by cart and so big I would only take pictures of them. This way of model making allowed me to better understand the details, and more clearly represent ideas behind moves. These models led me to getting introduced to Jason Griffiths. Jason at this time was looking for a group of students to take to do a 3-week project out in Oregon. This sounded very interesting to me even though I had no idea what to expect, so I agreed to go.

This was the summer going into my 4th year. I took the 24 hour drive out to Crow, Oregon where we stayed at The Baumann Tree Farm. We learned about the history of tree farming and the current practice of sustainable forest tree farming. The aim of the project was to design and build a cabin using Cross Laminated Timber (CLT). We chose to use this material to showcase to other locals and educators the aesthetic, structural, and sustainable advantage. We started with generic shape of a 10' by 8' pitched roof. We made other permutations but ultimately stuck with this one so the design wouldn't take away from the material we were using.





CLT is a sensitive material, it can't be directly exposed to the elements. Direct sunlight and consistent water will damage the CLT causing it to delaminate. During the time in Oregon we had to find ways to protect the cabin from these elements, we made drawings and models that gave us new ideas and unique solutions. As a group we came up with a variety of ways to solve these problems but working through the details and using the materials we had on site it wasn't too difficult to make a decision about what we should ultimately decide to do. The last week was all fabrication. My past tool and maker experience brought a great amount of value to the group. When we had finished, I not only felt this project was something I was very proud of, but I had also made a lot of new friendships that I still have today.

The Oregon Design Build led me to second one. This time I was employed to help guide the process and educate students about the shop tools and the process of making. The following design build was a cabin in Ogallala, Nebraska. Using CLT that was designed by a previous class our challenge was designing and building everything else on, in, and around the building. Again, this experience was fun and rewarding. We got to see our ideas change from a sketch to drawing to a model, back to a sketch, and eventually find its way on the cabin. This cabin was far from a 3-week design build seminar. It took me two years of constant revisiting to finally finish. I was present when the donor's wife cut the ribbon. She had brought family and friends to see the cabin and what we had done. This to me ended up being the most rewarding part. Seeing the reaction and emotions this cabin has brought people has been the most memorable part to me.

All of these experiences and more are what lead me to pursue a thesis project. They are what molded me as a designer and a maker.



Design Small Think Big

As we go through design school my intuition told me I needed to get a job at a firm and work towards getting my license. This was driven by my peers and society that suggested this would be my best option. In our undergraduate we take internships to better prepare ourselves for implication in the office. I like most of my peers during my schooling took an internship in Reno, NV at a firm called TSK during the summer of 2018.

I got connected to TSK by a wrestling coach who had an uncle that was one of the principals. I was excited about this new job and the opportunity to live in a completely new area. I learned many things during my time at TSK but ultimately when my time came to an end felt that this isn't where my talents and past knowledge is best used or applied.

Going into my final year of graduate school I felt that my understanding about the technical side of architecture and building was very minimal and, in some cases, nonexistent. This really bothered me not knowing if a design I had would work, if it was an efficient use of material and space, and if people would even like it. I don't want to have to design a building and later fit into it the structure, HVAC, and other formal additives. In the end I want the building to perform as a collective where every detail is considered and every piece has a purpose.

The complexity that is included within architecture today is enough to drive a person crazy. The engineering, codes, performance, and everything in-between makes designing and building a project that meets or exceeds all of these formalities extremely difficult and time consuming.

I often look back at architects such as Rem Koolhaas, Mies van der Rohe, and Eero Saarinen who started off designing and building furniture. They started off designing a career producing a smaller product where every detail mattered. The connections of joints, the use of materials, the shape or geometry of the seat itself, all were part of the design and human experience. A chair is a fair representation of how I would do as a designer. These architects had the ability to control every possible feature the chair could possess. This amount of delicate design carried on into their practice and is clearly exemplified through their work.

Mirroring this approach to design is what I look to ultimately achieve with Papi Design + Build. I look at small spaces as a product. A product I have complete control over.

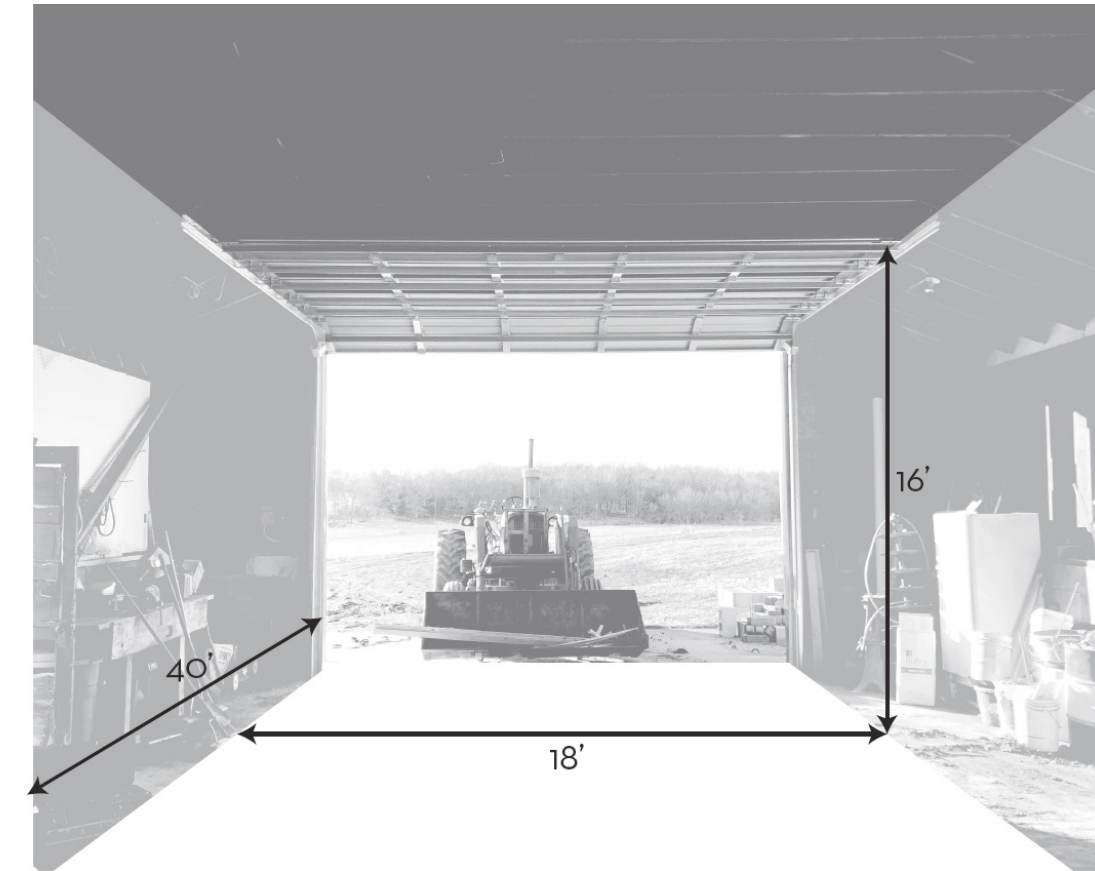
Chapter 02: Business

General

Papi Design + Build sets out with the goal to design and build micro architecture that can add quality and income to the user. Given my past experiences I knew that this opportunity could wouldn't last forever. My past maker and design background add a unique quality to micro architecure that doesn't exist today. Cabin's such as the ones in Colorado are on one of two sides of the spectrum. The first is a mulit million dollar mansion on a mulit million dollar lot, and the other is a run down P.O.S. which require a lot of fixing up. The scales don't align leaving a gap for well deisgned cabin at a smaller scale. This was the start of what I wanted to pursure and I set out to see everything I needed to make this happen. I started writing down everything I needed to start. The first being a shop.

01 - Shop

I knew that if I had a shop space that could facilitate an operation like this that would be a great start. My uncle is a farmer near Firth Nebraska, I reached out to him to see if there was some space he wasn't using and that I could set up a space to work in.



02 - Tools

What good is a shop with no tools. I collected tools growing up and did some work on my house in which I traded labor for tools.

03 - Truck

This was a concern from the start but through a series of fortunate events I have a truck that I can call mine. It is far from new or in any kind of decent condition, but it works.

04 Trailer

A trailer to haul big loads and final assembly is something I felt was necessary. I have permission to use a friends for the time being.

SHOP

01 MATERIAL DELIVERY

Delivery located in the rear corner reduces congestion in the front of the shop.

02 MATERIAL STORAGE

Material is stored along the rear wall running parallel to the the material drop off allows for quick drop off and easy storage.

03 MATERIAL STORAGE

Material is stored along the rear wall running parallel to the the material drop off allows for quick drop off and easy storage.

CUSTOM FABRICATION 04

This is where most of the detail work happens before being placed in the building, a solid table with necessary tools.

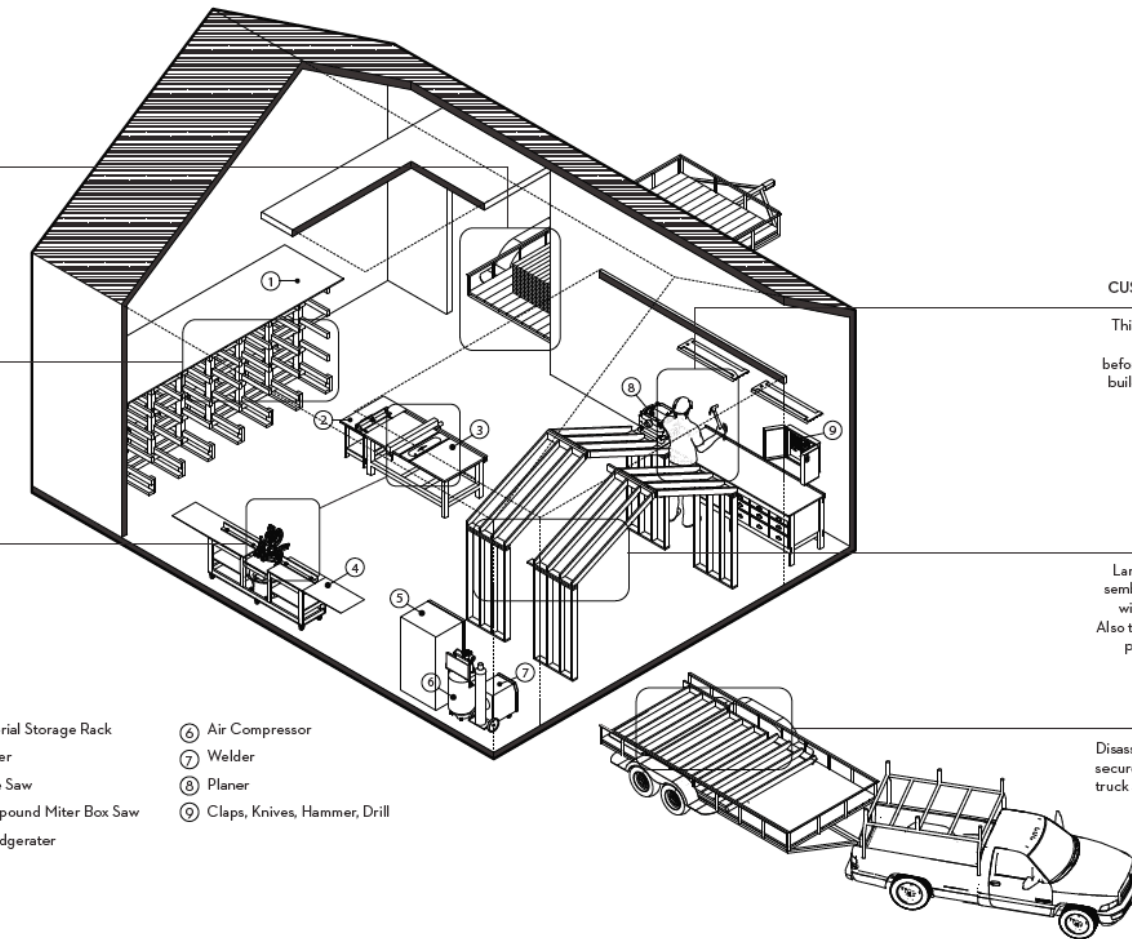
ASSEMBLY / TEST 05

Large and small scale assembly to assure the build will go smoothly on site. Also testing out details and prototyping new ideas.

SHIPMENT 06

Disassemble structure and securely fasten materials to truck and trailer for an easy and safe shipment

- ① Material Storage Rack
- ② Router
- ③ Table Saw
- ④ Compound Miter Box Saw
- ⑤ Refridgerater
- ⑥ Air Compressor
- ⑦ Welder
- ⑧ Planer
- ⑨ Claps, Knives, Hammer, Drill



Code & Restrictions

Although I like to consider the structures I will be building micro architecture, legally they are considered tiny houses. There are a number different types of houses that can be considered a tiny house. The individual characteristics of a tiny house determine what standard C structures must comply with.

They can be anywhere from a tiny home built on a rolling chassis, manufactured home, Factory Built house, or site constructed home.

The **tiny homes built on a rolling chassis** are required to comply with standards other than the building code and the NFPA standards and required to be certified by the manufacturer. Where the manufacturer must comply to the standards. The local building departments have no role or responsibility for code compliance on a tiny house on a rolling chassis. They are suppose to be self certified. Structures on a rolling chassis are considered recreational vehicles approved for permanent uses.

Small manufactured structures can also be considered a tiny house these are under the purview of housing community development who oversee construction and verify compliance with HUD standards. Local jurisdictions typically take over when the house is delivered to a lot. The building inspector would ensure that the foundation and utility connections are code compliant.

Factory build houses are constructed using the residential code or building code. Although the construction in the factory is not overseen by the building inspectors local jurisdictions do get involved when the house is delivered to the site. They inspect the foundation and utility connections.

Site built tiny house on a permanent foundation are required to comply with the building codes enforced in each specific community. The only major difference between a tiny house and a typical home is the size. Both a tiny home and other site built homes are required to comply with the locally adopted building codes.

Official definition of a tiny house according to appendix Q of the 2018 IRC is as follows

"A dwelling that is 400 sq ft or less in area excluding lofts"

Homes that range from 400 - 1000 sqft are Accessory Dwelling Units (ADU) are small structures that sit on an existing lot with an existing single family dwelling. They sit on the same piece of property as another house. ADU's have typically been restricted when it comes to allowable square footage. However recent legislation in the state of california allow for up to 50 percent of the size of the existing home and not to exceed 1200 sqft. The legislation allows ADU's to be built without having to pay a lot of the typical fees.

ADU's have become popular in places that have a higher cost of living, and or a large amount of homeless. ADU's allow owners to build these smaller homes or tiny homes at a significantly lesser price than a new single family home at the same size. Homeowners can rent out ADU's which create a new and significant source of income. Challenge with site built tiny homes is when the designer incorporates a loft for sleeping into the tiny house.

Appendix Q is valuable and necessary because it allows flexibility that is necessary for tiny house construction and also provides the level of consistency so each jurisdiction or state doesn't have to come up with its own standards.

Appendix Q states size and height requirements for the loft and emergency egress. Alternate loft access options include, smaller stairs, platforms, ladders, alternating tread devices.

If you incorporate a loft into the structure for anything other than storage, it requires a compliant staircase which isn't practical for a tiny house.

Appendix Q can only be used if adopted by the local jurisdiction or you can use Appendix Q as an alternate method. The scoping section of Appendix Q states: A tiny house has to comply with all requirements used in residential code not just those requirements that are listed in appendix Q. All other requirements that are applicable to single family housing are applicable to tiny houses.

Permitting

It is necessary to get a permit to ensure that the building is safe to occupy. All potential hazards that the code address for single family also are found in a tiny house. The primary reason to get a permit is to ensure the structure is safe for the occupants. A secondary reason to get a permit is to protect the investment.

If you build a tiny house without a permit and it comes to the attention of the local jurisdiction the structure could be considered substandard and therefor be illegal. At that point it may be very difficult without significant added cost or design changes.

Location & Purpose

The original plan was to design and build cabin in a rural area where I would but land and begin to establish a collection of them. I found that in most zoning either AG, or residential it only allows for one single family house. You can additionally add a dwelling if under the ADU requirements. But unless the piece of land is zoned for commercial use the option of having multiple dwelling on a single piece of land isn't possible.

I had to reconsider the business model making Papi Design + Build a product this I made for someone else.

Covering just the rural parts of Colorado left me with much less covered ground. ADU units are an up and coming solution for families with an elderly one they want to keep close, a dwelling the owner can rent out, or a place to live in while you rent your house out.

Lincoln has recently updated and added to the restrictions of ADU units. They now are allowed in residential zoning districts from R-1 - R-8 and agricultural zones AG.

Table 27.72.120(d) Maximum and Expanded Maximum* Cumulative Allowable Area for Accessory Buildings on Single Family or Two Family Residential Lots or Tracts						
*#Expanded Maximum only applies in accordance with the applicable Note *# below (e.g. *1)						
		Lot or Tract Size				
		less than 7,500 sq. ft.	7,500 sq. ft. to less than 20,000 sq. ft.	20,000 sq. ft. to less than 1 acre	1 acre or more	
R1- R-8 Accessory Building sq. ft.	Maximum	1,000	1,500	2,000	2,000	
	Expanded Maximum	1,500* ¹	3,000* ²	3,000* ²	5,000* ³	
		less than 1 acre	1 acre to less than 2 acres	2 acres to less than 4 acres	4 acres to less than 10 acres	10 acres or more
AGR Accessory Building sq. ft.	Maximum	2,000	2,000	2,000	2,000	2,000
	Expanded Maximum	3,000* ²	6,000* ⁴	8,000* ⁴	20,000* ⁴	No maximum* ⁴
AG Accessory Building sq. ft.	Maximum	2,000	2,000	2,000	2,000	No maximum
	Expanded Maximum	3,000* ²	6,000* ⁴	8,000* ⁴	20,000* ⁴	

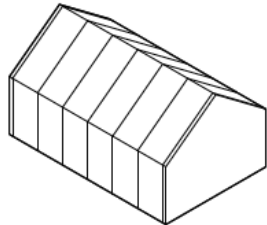
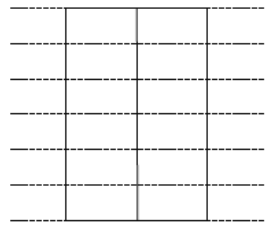
Image from Lincoln Municipal Code
Chapter 27.72 Height and Lot Regulations
27.72.120 Accessory Buildings

Chapter 03: Design

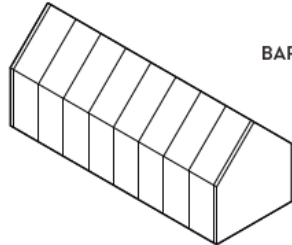
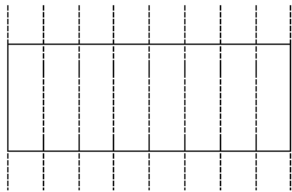
The overall design of the dwelling is derived from research that was done on the common house geometries. I started by using a 4' x 8' grid to minimize waste and avoid using extra material.

The control is 16' x 20' totalling 320 sqft. Staying under the 400 sqft to allow it to still be considered a tiny house. Using the footprint I changed the morphology to better understand what and how that floorplan can shift into. Each morphology went through another analysis where the rooftype would change. This added a dimension of complication, but gave me greater insight into what would work and what wouldn't.

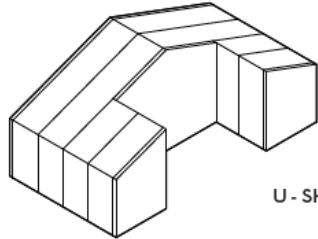
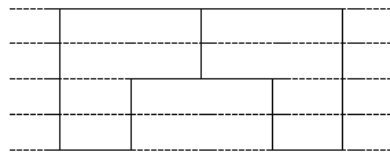
MORPHOLOGIES



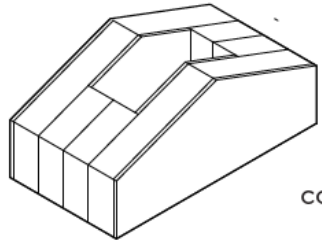
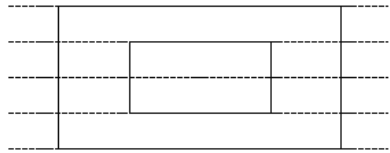
CONTOL 16' x 20'



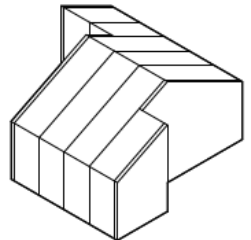
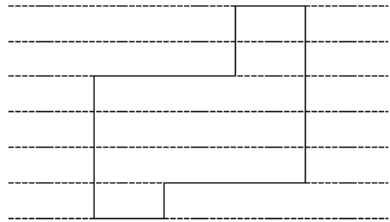
BAR



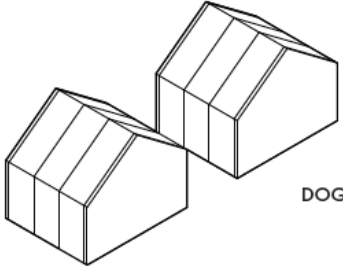
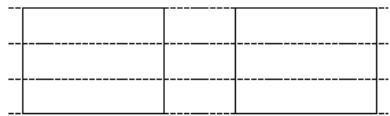
U - SHAPED



COURTYARD



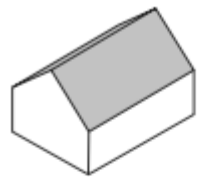
SPIN WHEEL



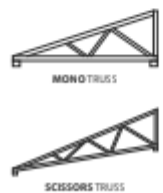
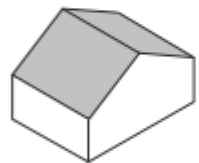
DOGTROT



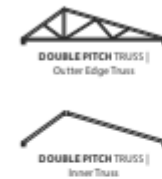
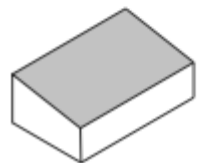
FRONT GABLE ROOF



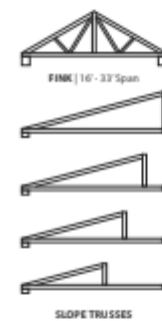
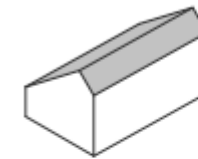
SIDE GABLE ROOF



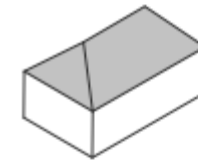
SKILLION ROOF



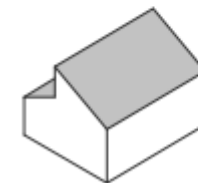
SALTBOX ROOF



SIMPLE HIP ROOF



CLERESTORY ROOF



Control Module

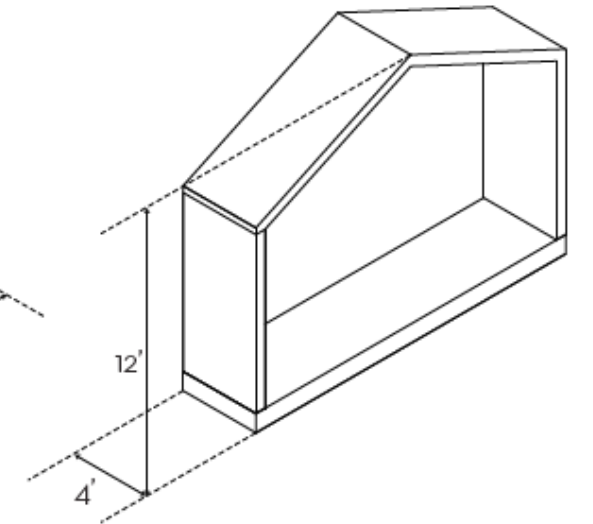
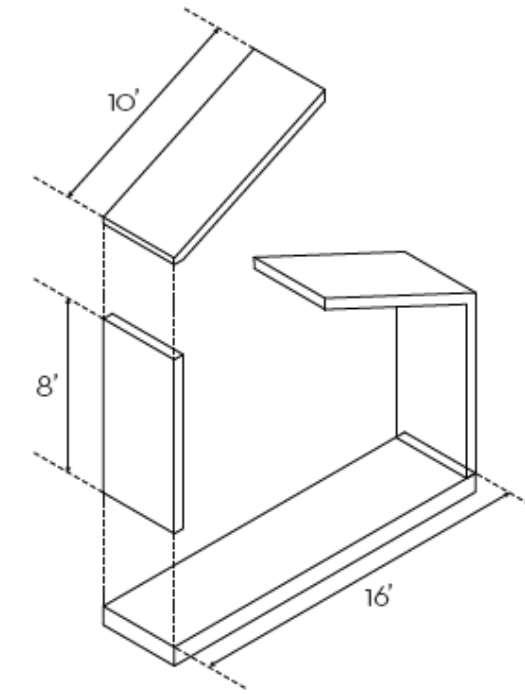
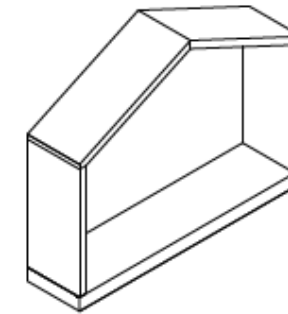
To construct one of these configurations using the tools and other elements I am equipped with I decided to modularize. Using the 4' grid I established I will construct each module to fit next to one another able to be interchanged and adjusted based on user preference and location.

This footprint of one module is 16' x 4' using two uncut pieces of sheathing. The walls are 8' using a common 2" x 4" stud and the pitched roof uses 10' long 2" x 6" studs. All together there is limited waste and an efficient use of materials.

GENERAL

01 MODULE 01 DIMENSIONS

The dimensions of module 01 is based on the 4' x 8' sheathing size, and 16" O.C. 2 x 6 stud spacing.



Studs				
2 x 10 - 16'	4 Total	\$23.39	Ea	\$93.56 Total
2 x 6 - 10'	8 Total	\$5.68	Ea	\$45.44 Total
2 x 6 - 92"	8 Total	\$4.17	Ea	\$33.36 Total
2 x 8 - 8'	2 Total	\$7.71	Ea	\$15.42 Total
2 x 6 - 8'	4 Total	\$3.75	Ea	\$15.00 Total

Sheathing				
4' x 8' - 7/16"	5 Sheets	\$9.56	Ea	\$47.80 Total
4' x 8' - 3/4"	2 Sheets	\$16.92	Ea	\$33.84 Total

Fasteners				
Nails 10DX 1 - 1/2"	1 Box	\$6.23	Ea	\$6.23 Total
2" Deck Screw	1 LB	\$5.75	Ea	\$5.75 Total
Adhesive DAP	1 Bottle	\$5.75	Ea	\$5.75 Total
2 - 1/2" Deck Screw	5 LB	\$19.19	Ea	\$19.19 Total

TOTAL \$410.68

Pricing

Pricing is important because it not only signifies the investment, but is a selling point since I will be able to apply a price to each module. This gives instantaneous cost estimating. If I have a price allocated to every module, whenever a client chooses to have a certain panel configuration they can know the cost impact each one has.

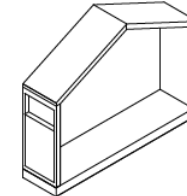
The control cost breakdown is as follows.

Module Permutations

Based on site conditions, budget, and overall squarefootage a client is given an array of modules to choose from. They all keep the individual module shape and size, but differ in an assortment of items starting with apatures and windows. Pricing is included to act as if this was being used by the client to give them instant feedback into what they are spending. Modules differ from eachother based on:

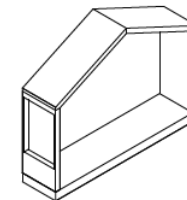
- 1- Wall Windows
- 2- Roof Windows
- 3- Speciality Items
- 4- End Pieces

02 WALL WINDOWS



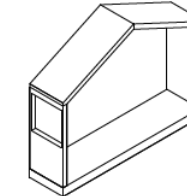
4' x 2' | Wood Window
Including Frame, Screens, and Grilles

Casement Type	\$279.83	Ea
Awning Type	\$236.78	Ea



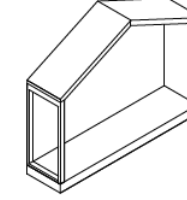
4' x 6' | Wood Window
Including Frame, Screens, and Grilles

Casement Type	\$871.25	Ea
Awning Type	\$747.33	Ea



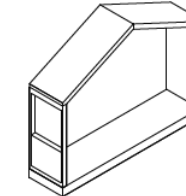
4' x 4' | Wood Window
Including Frame, Screens, and Grilles

Casement Type	\$609.88	Ea
Awning Type	\$527.33	Ea



Full Wall | Float Glass
Including Frame, Screens, and Grilles

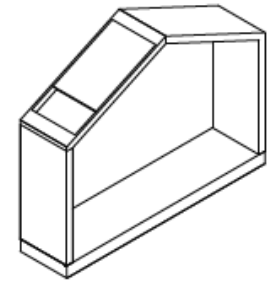
1/2" Clear	4' x 8'	\$18.26 psf	\$854.32
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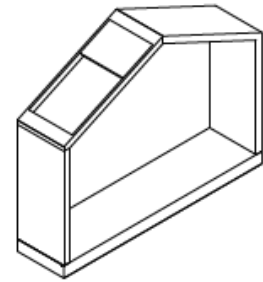
4' x 5' | Wood Window
Including Frame, Screens, and Grilles

Casement Type	\$773.88	Ea
Fixed Type	\$599.63	Ea
Sliding Type	\$430.82	Ea

03 ROOF WINDOWS

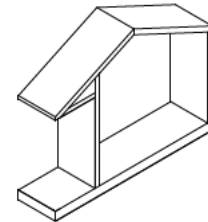
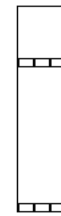


4' x 2' | Metal Window
 Fixed high performing tempered glazing
 Fixed Type \$283.93 Ea

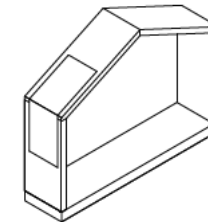


4' x 5' | Metal Window
 Fixed high performing tempered glazing
 Fixed Type \$753.13 Ea

04 SPECIALITY

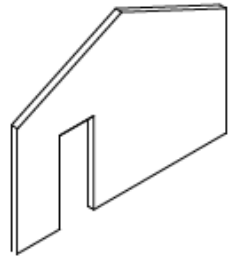


4' | Roof Overhang
 Covered porch area
 Additional Framing Cost \$143.93 Ea



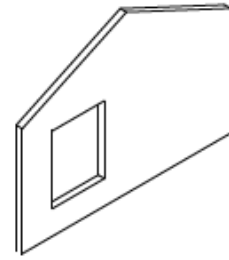
4' Corner Window | Roof Overhang
 Tempered Glass, Includes Frame
 Additional Framing & Material Cost \$1,243.93 Ea

05 END PANELS



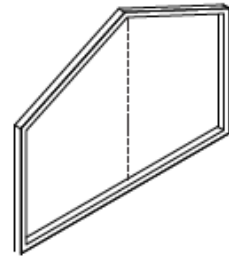
3' x 6' - 8" | Smooth Wood Doors
Exterior, Combination Storm & Screen

Pine Door	\$346.73	Ea
Burch Door	\$156.29	Ea
Mahogany	\$727.65	Ea



4' x 2', 4', 6' | Wood Window
Including Frame, Screens, and Grilles

	2'	4'	6'
Casement Type	\$279.83	\$609.88	\$871.25
Awning Type	\$236.78	\$527.33	\$747.33



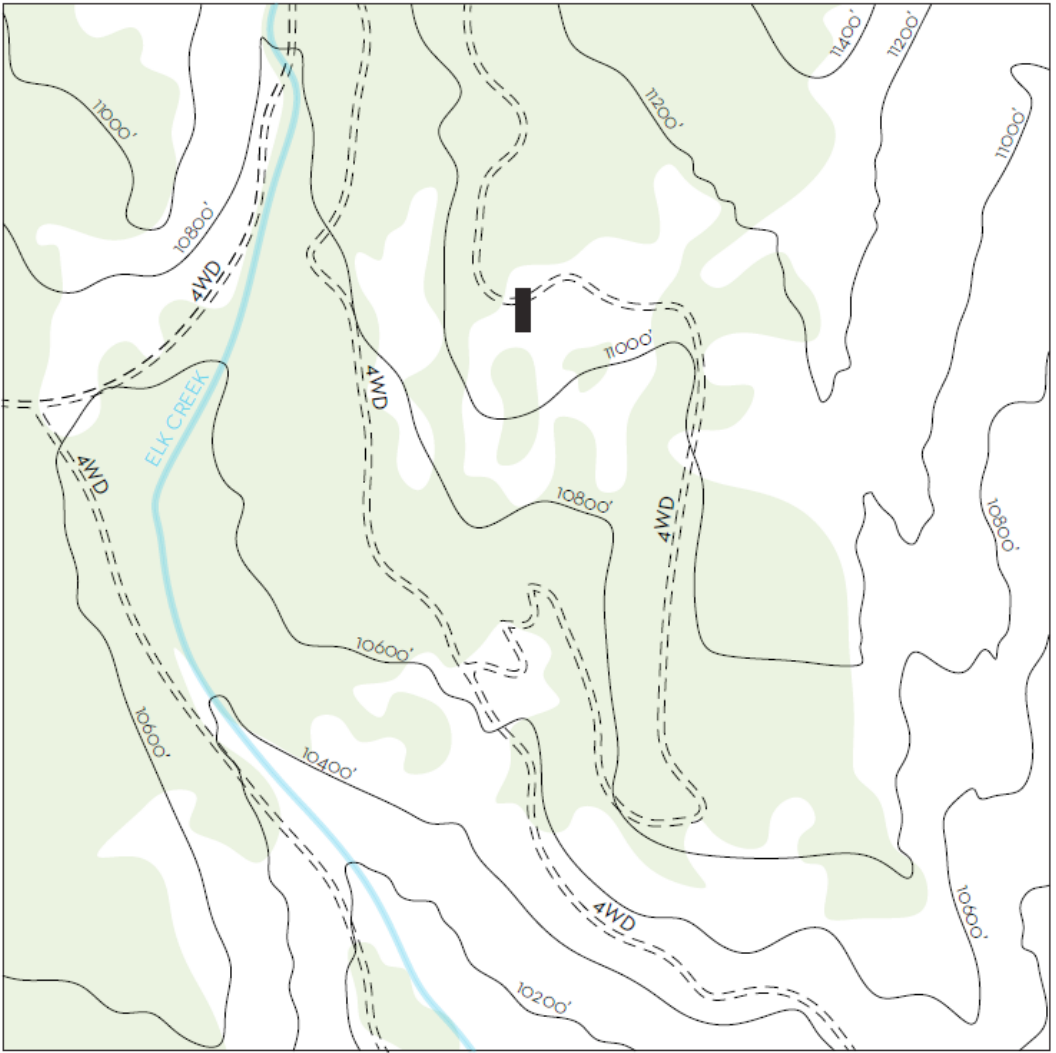
Full or Half Wall | Float Glass
Including Frame, Screens, and Grilles

Half Wall 1/2" Clear	\$18.26 psf	\$1,837.12
Full Wall 1/2" Clear	\$18.26 psf	\$3,674.24

Chapter 04: Precidents

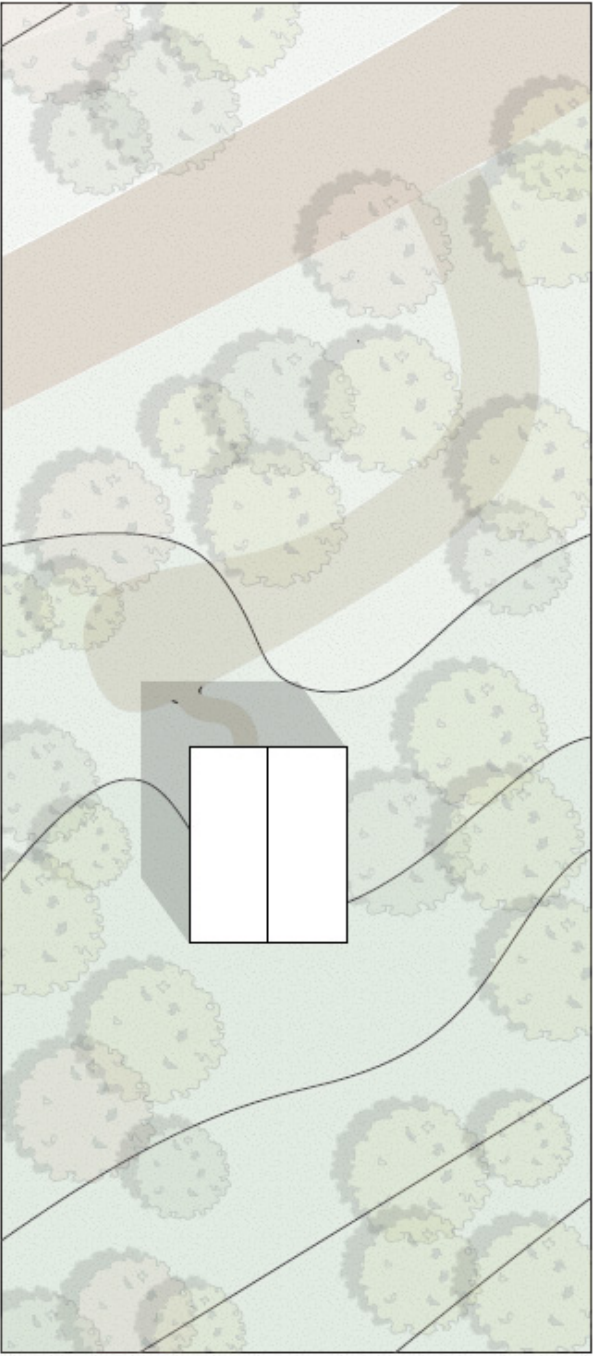
Module 138

Location: Idaha Springs, Colorado
Size: 256 Sqft
Zoning: AG
Total Cost: \$8,369.74



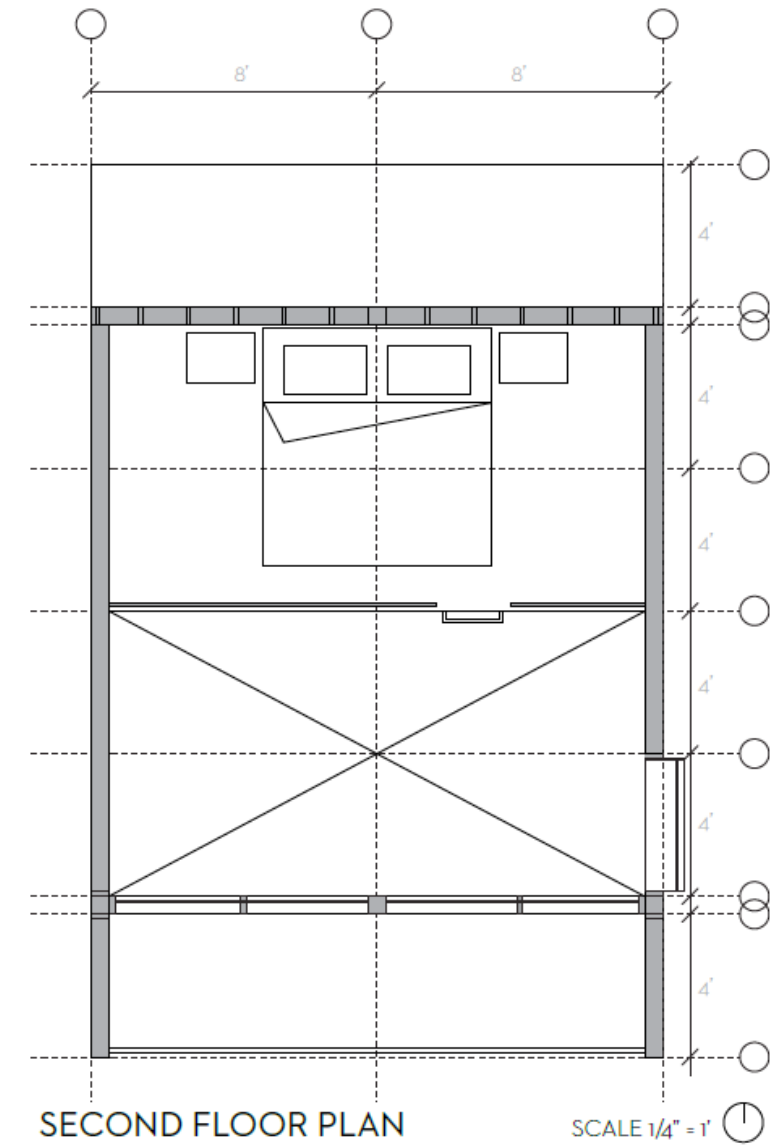
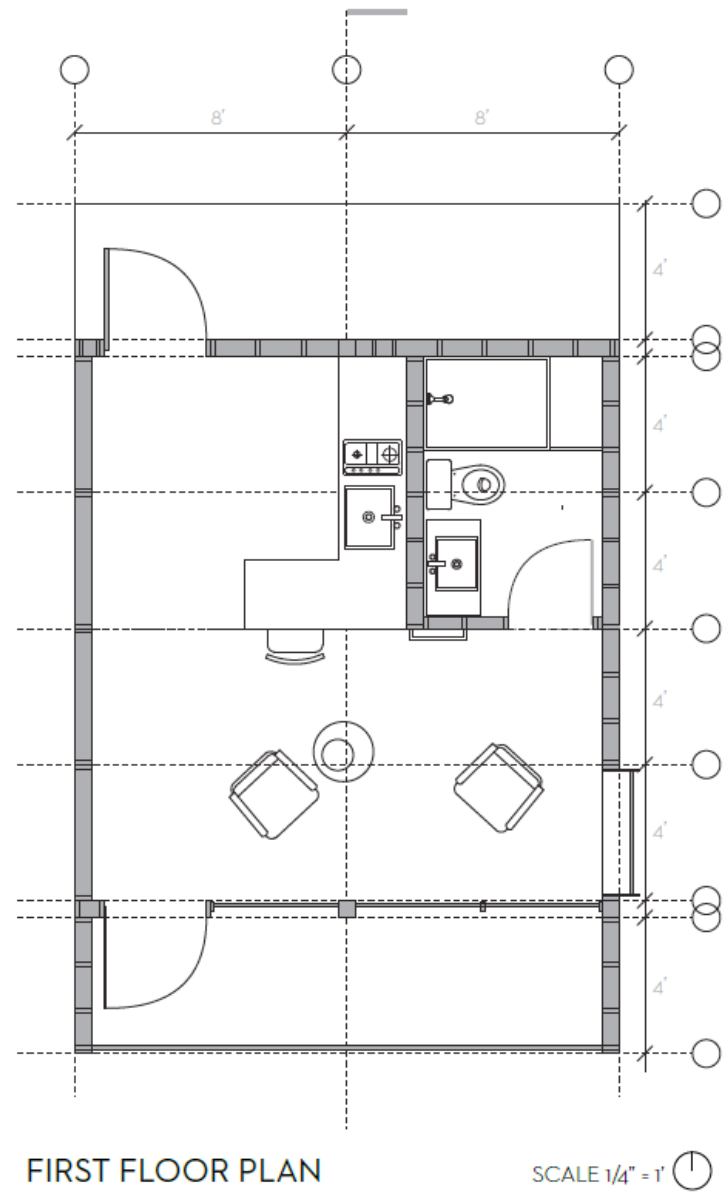
SITE PLAN

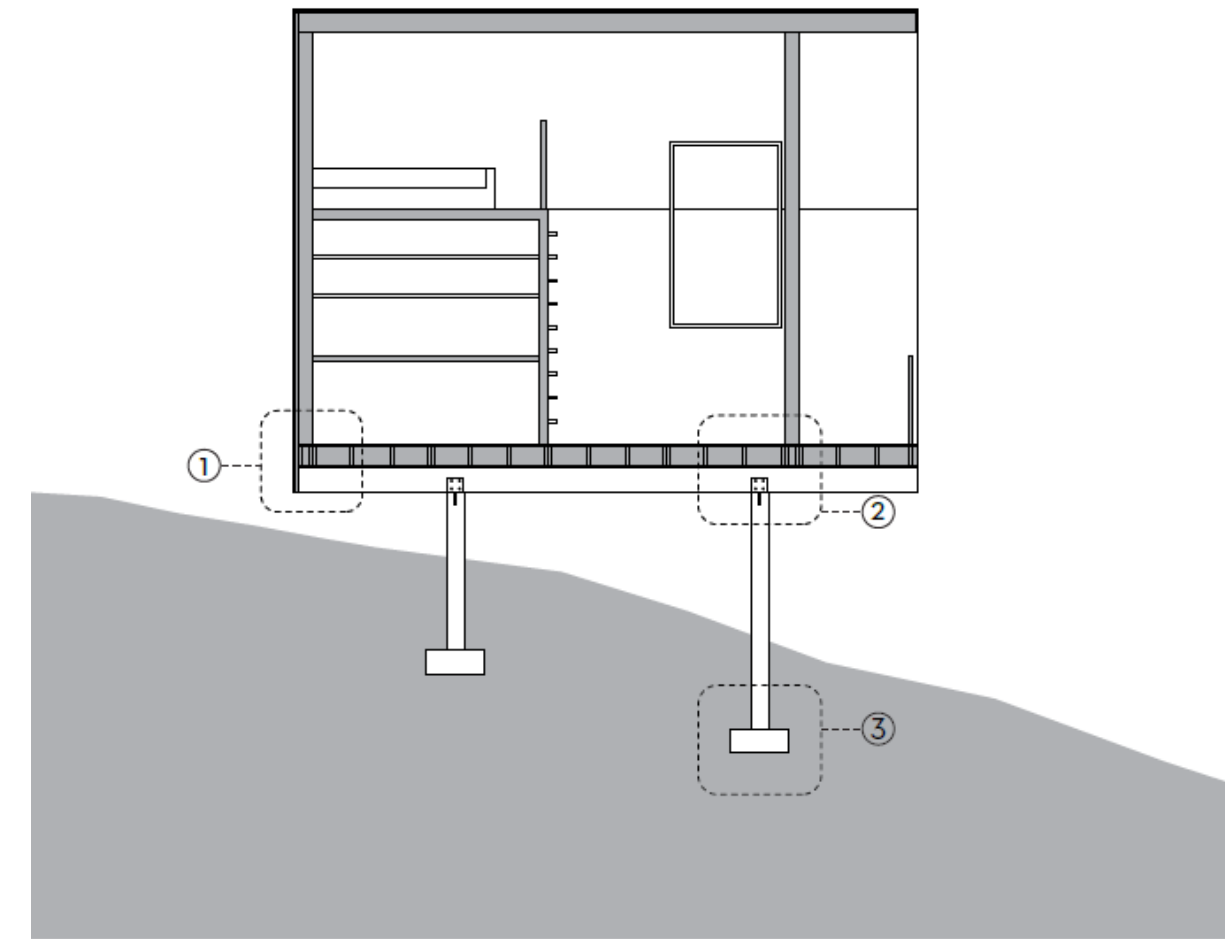
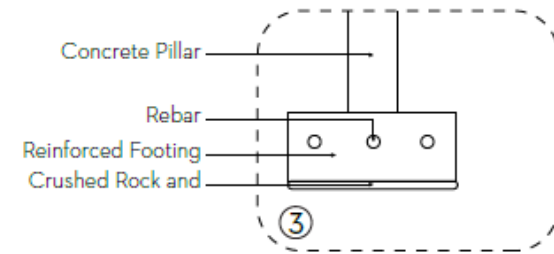
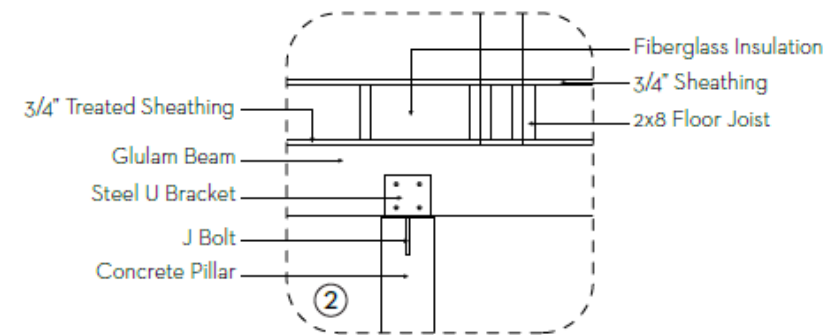
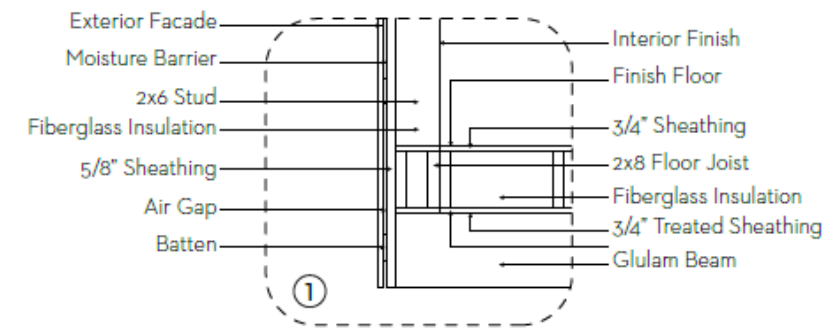
SCALE 1" = 300'



SITE PLAN

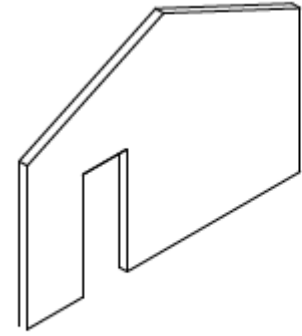
SCALE 1/8" = 1'



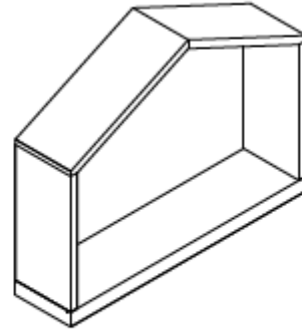


EAST SECTION

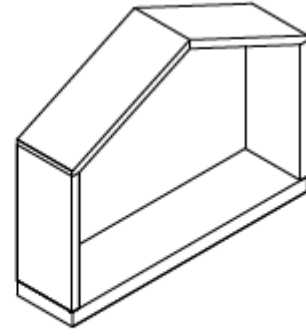
SCALE 1/4" = 1'



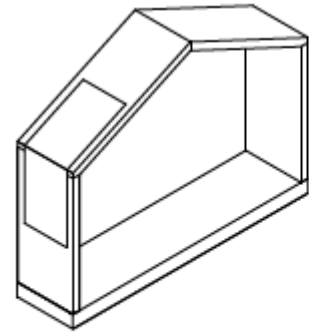
End Panel O1
Pine Door \$346.73 Total



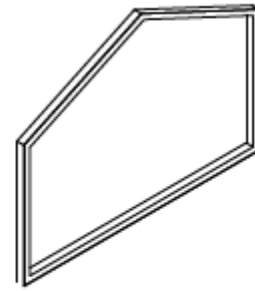
Interior Panel O1
Framing Price



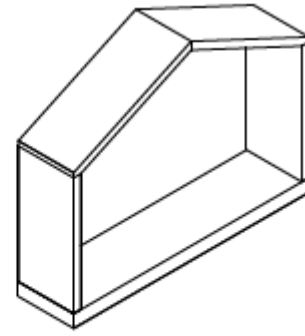
Interior Panel O2
Framing Price



Interior Panel O2
Corner Window \$1,243.93 Total

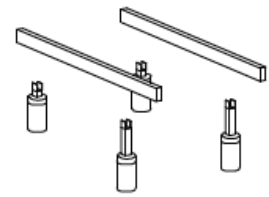


End Panel O2
Glass Door \$646.73 Total
Full Wall 1/2" Clear \$3674.24 Total

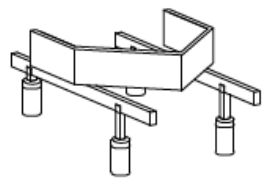


Exterior Panel O1
Framing Price

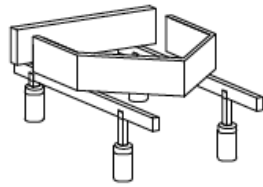




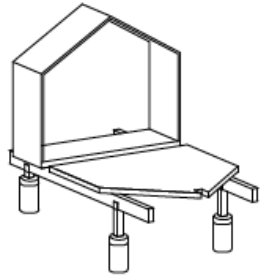
Insert glulam beams into the post



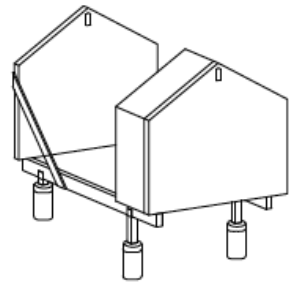
Assembly walls and roof of unit O1 while laying down



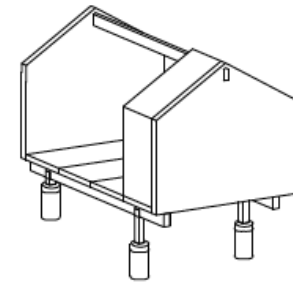
Attach floor of unit O1 while laying down



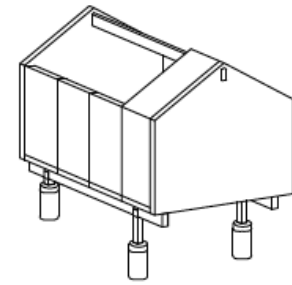
Rotate unit O1 up on floor.



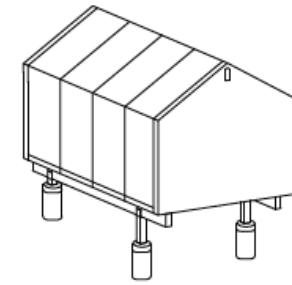
Place end O2 and brace with 2 x 8 stud



Insert ridge beam to both end panels



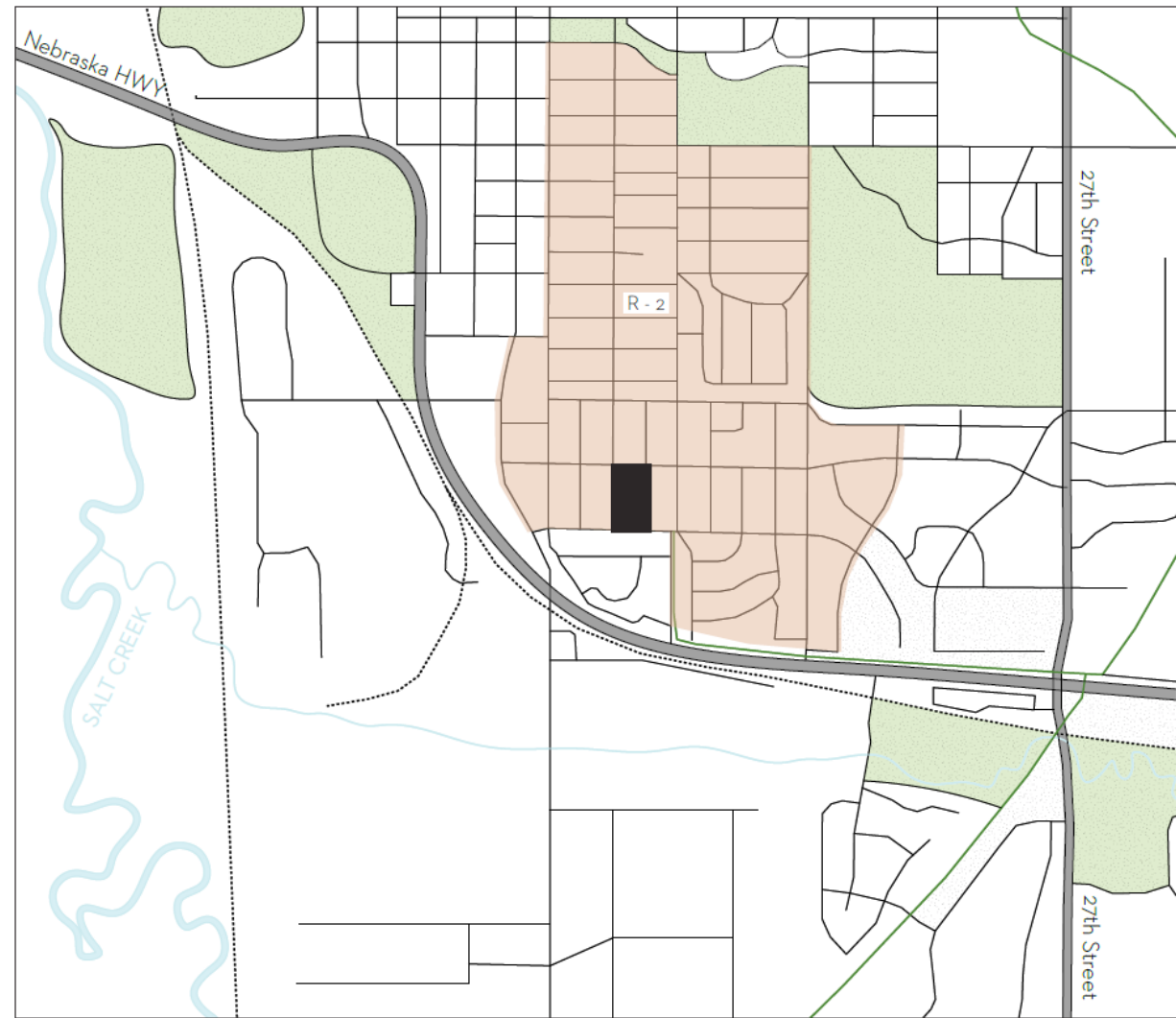
Place walls and roof for units 2, 3, 4



Finished

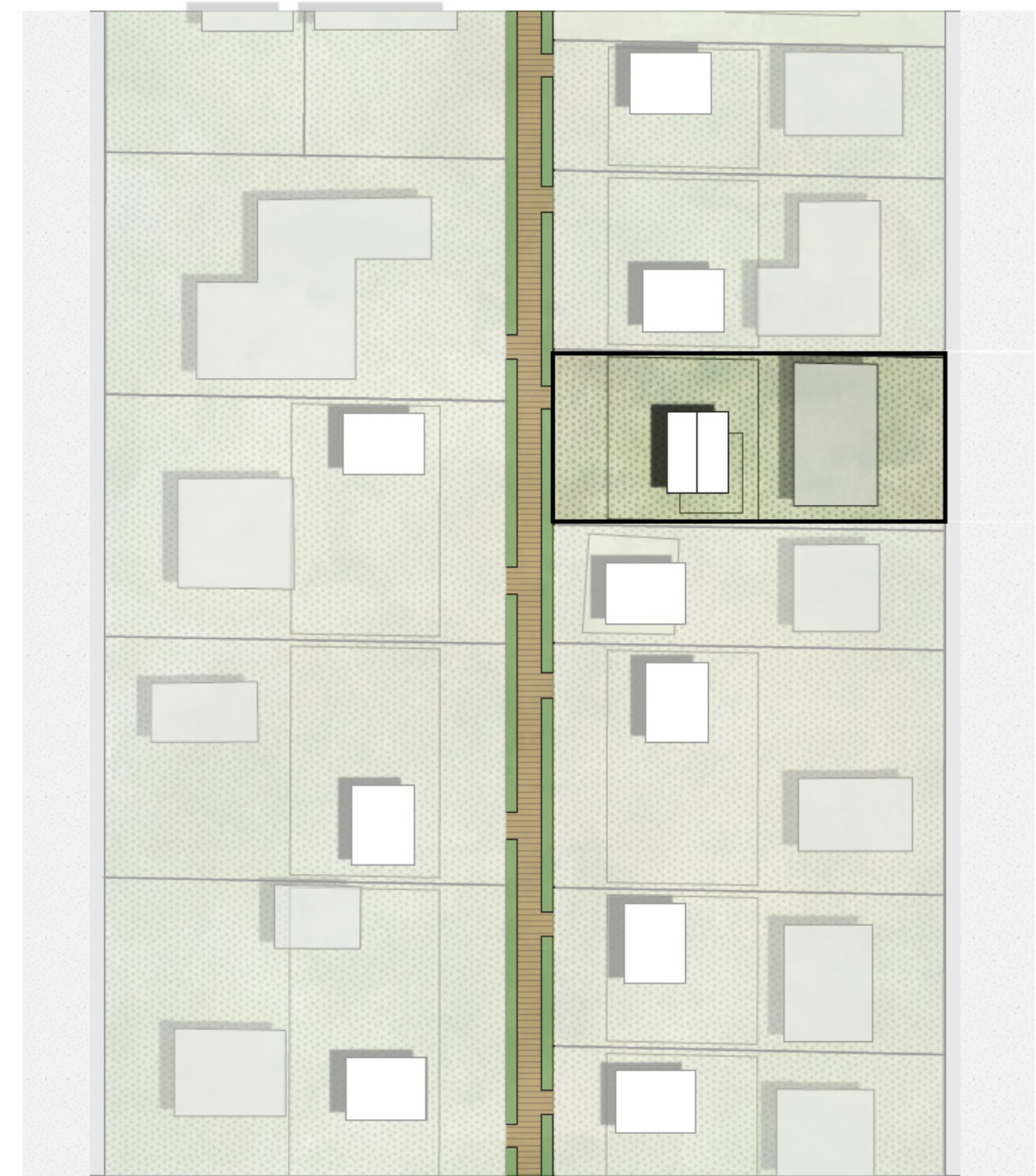
Module 726

Location: Lincoln, Ne
Size: 256 Sqft
Zoning: R-2
Total Cost: \$6,032.88



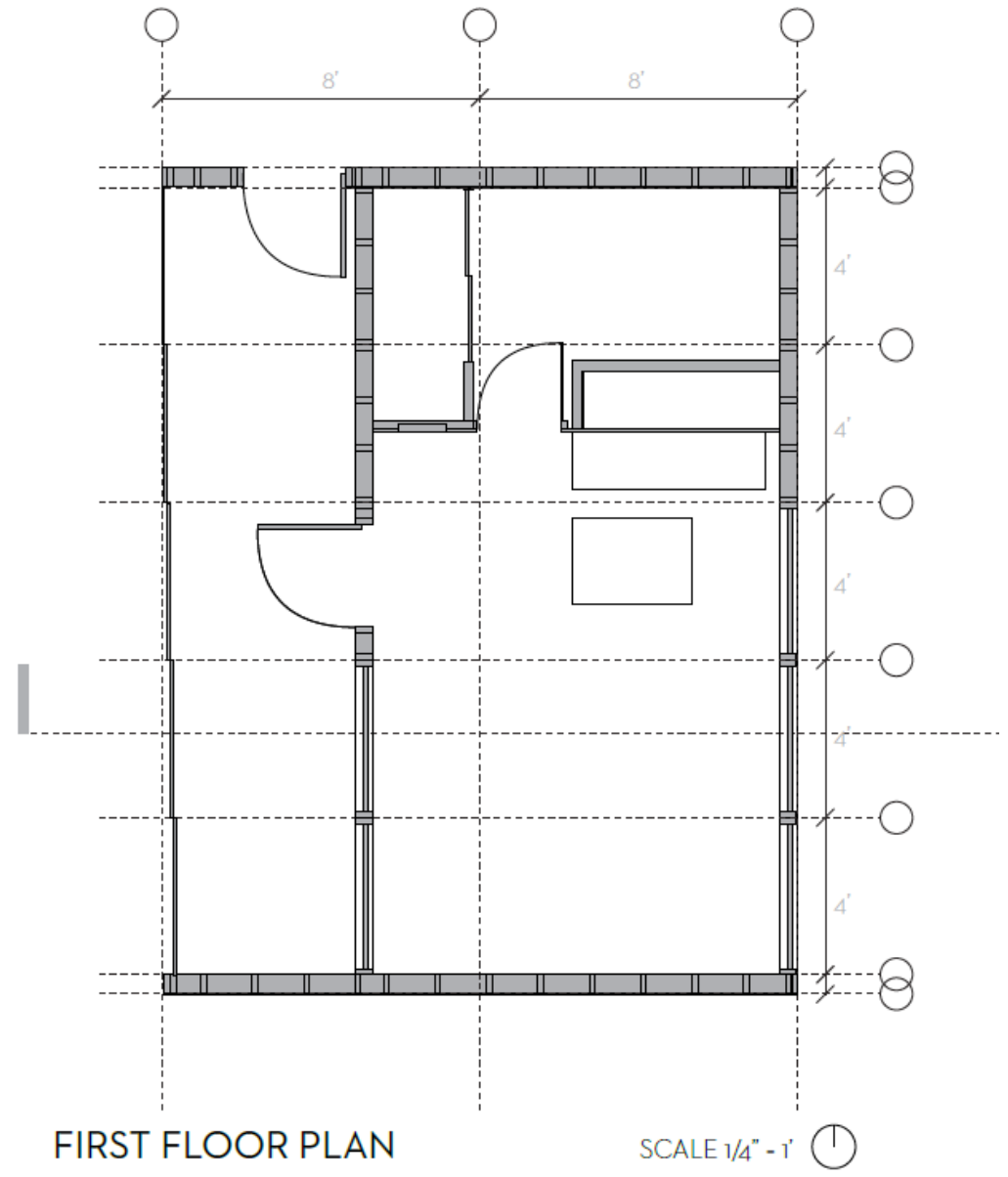
SITE PLAN

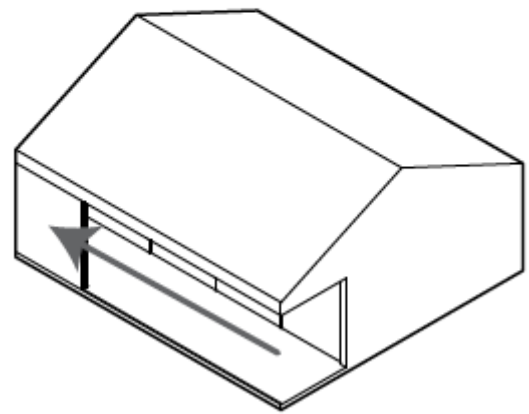
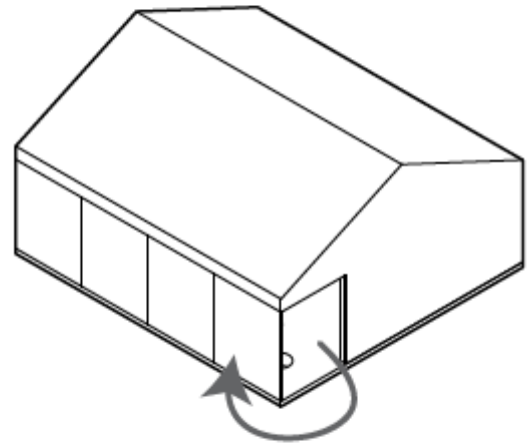
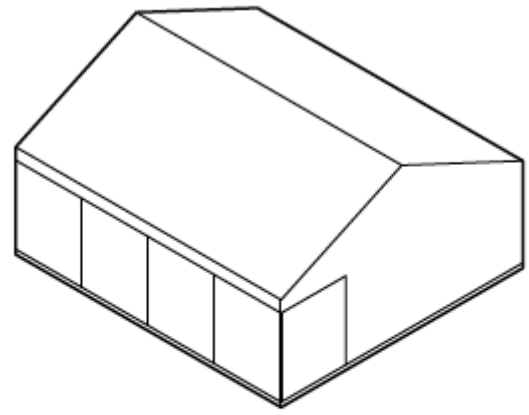
SCALE 1" = 300'



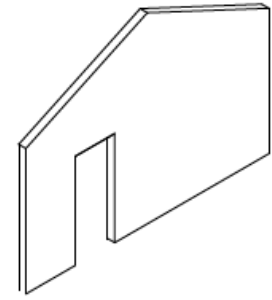
SITE PLAN

SCALE 1/16" = 1'

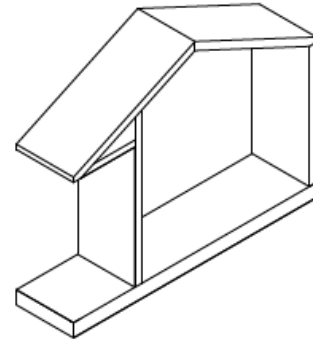




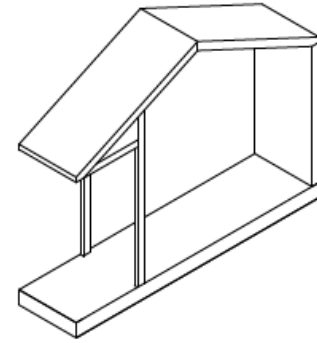
SECTION AXON



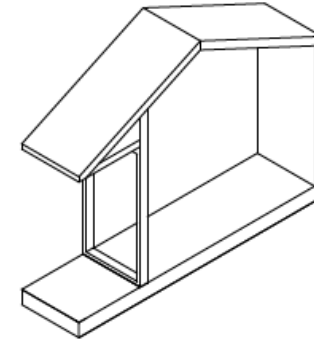
End Panel 01
Pine Door \$346.73 Total



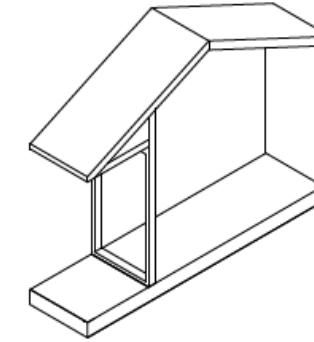
Interior Panel 01
Overhang \$143.93 Total



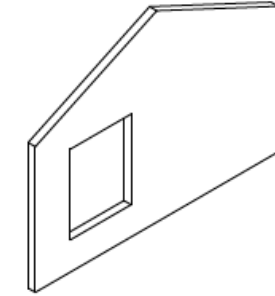
Interior Panel 02
Overhang \$143.93 Total
Pine Door \$346.73 Total



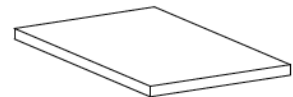
Interior Panel 03
Overhang \$143.93 Total
Full Window \$854.32 Total



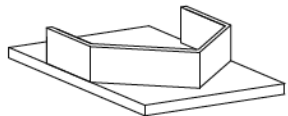
Interior Panel 04
Overhang \$143.93 Total
Full Window \$854.32 Total



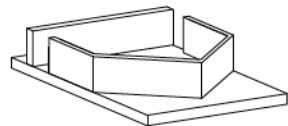
End Panel 02
4' x 4' Casement \$609.88 Total



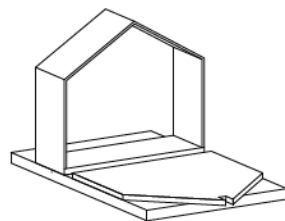
Pour level engineered concrete slab



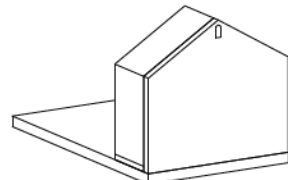
Assembly walls and roof of unit 01 while laying down



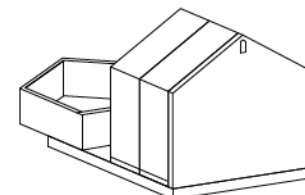
Attach floor of unit 01 while laying down



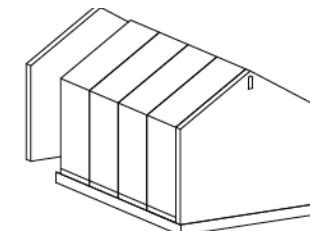
Rotate unit 01 up on floor.



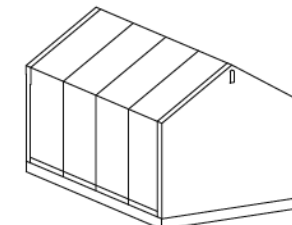
Rotate end 01 up and slide back into final position



Repeat steps 2 - 4 for units 2, 3, 4



Rotate and place end 02



Finished

Chapter 05: Construction

Module 001

Location: Beatrice, Nebraska
Size: 64 Sqft
Zoning: N/A
Total Cost: \$410.68







