

California Polytechnic State University, San Luis Obispo

From the Selected Works of Thomas Fowler IV, DPACSA, FAIA

Spring/June, 2016

Romberg Tiburon Center (RTC) Head House 2016

Thomas Fowler, IV

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Available at: <https://works.bepress.com/tfowler/33/>



Romberg Tiburon Design Collaboratory April-June 2016

CAL POLY

The Architecture and Architectural Engineering Departments are two of the five departments that comprise the College of Architecture & Environmental Design.

The other departments are:

City & Regional Planning
Construction Management
Landscape Architecture



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College of Architecture and Environmental Design
Architecture Department
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San Luis Obispo, CA 93407*



architecture

ARCHITECTURAL ENGINEERING

Thomas Fowler
Kevin Dong

2016 – 2017 Design Collaboratory

College of Architecture and Environmental Design
Cal Poly, San Luis Obispo, CA

The team that worked on San Francisco State University's Romberg Tiburon Center (RTC) for Environmental Studies was composed of a talented group of undergraduate, graduate and visiting international students. We thank the RTC and John Kern for providing the opportunity to research and design this Head House Project. It will provide instructional support space for the future greenhouse structures that will be constructed adjacent to this newly designed structure.

The Design Collaboratory is an award winning (NCARB Prize, Auto Desk Grant and national student design competition recognition), multi-disciplinary group of undergraduate and graduate students, and faculty (from architecture and architectural engineering, joined occasionally by planning, construction management and civil engineering), that work directly with industry partners in developing building design projects. Professors Dong and Fowler have collaborated on these types of projects, which use interdisciplinary student groups, for more than 10 years. They bring more than 30 years of professional experience which provides avenues for insightful research and innovative design proposals, and leverage approximately 40 years of teaching experience to mentor and enable students to create holistic design solutions.

We have enjoyed seeing how much students learn in their interactions with one another, with the RTC, and with us. They have grown as designers, problem solvers, and innovators by solving "real world" building design challenges since they worked directly with the building users, John Kern and Kathy Boyer.

Sincerely,

Professor Kevin Dong
Professor Thomas Fowler



Professor Thomas Fowler, DPACSA, NCARB, AIA

The Director of the Graduate Program of Architecture and a Professor of Architecture.

Thomas' teaching responsibilities include third and fourth year design and building technology courses, working with a range of four and fifth year independent study students and has been co-teaching as part of the Collaboratory Building Design Studio since 2007.

Prior to beginning his teaching career at Cal Poly, Thomas worked with a range of architecture firms in New York City and Washington, DC for over a 13 year period. His work was highly collaborative with a range of disciplines on small to large scaled building types.



Professor Kevin Dong, PhD, SE

The Associate Dean of Administration of the College of Architecture and Environmental Design and Professor of Architectural Engineering.

Kevin's teaching responsibilities range from 2nd year technology classes through graduate structural systems and seismic engineering courses, and has been co-teaching the Collaboratory Building Design Studio since 2007.

Prior to beginning his teaching career at Cal Poly, Kevin practiced holistic design with Ove Arup & Partners (ARUP) for 13 years, starting as an Arup Fellow in London and then moving to the San Francisco office. During his tenure with ARUP he worked on numerous projects nationally and internationally that required collaboration and integration of all disciplines from design inception through construction and occupancy.

project research | site analysis

group a

group b

Contents



01-15



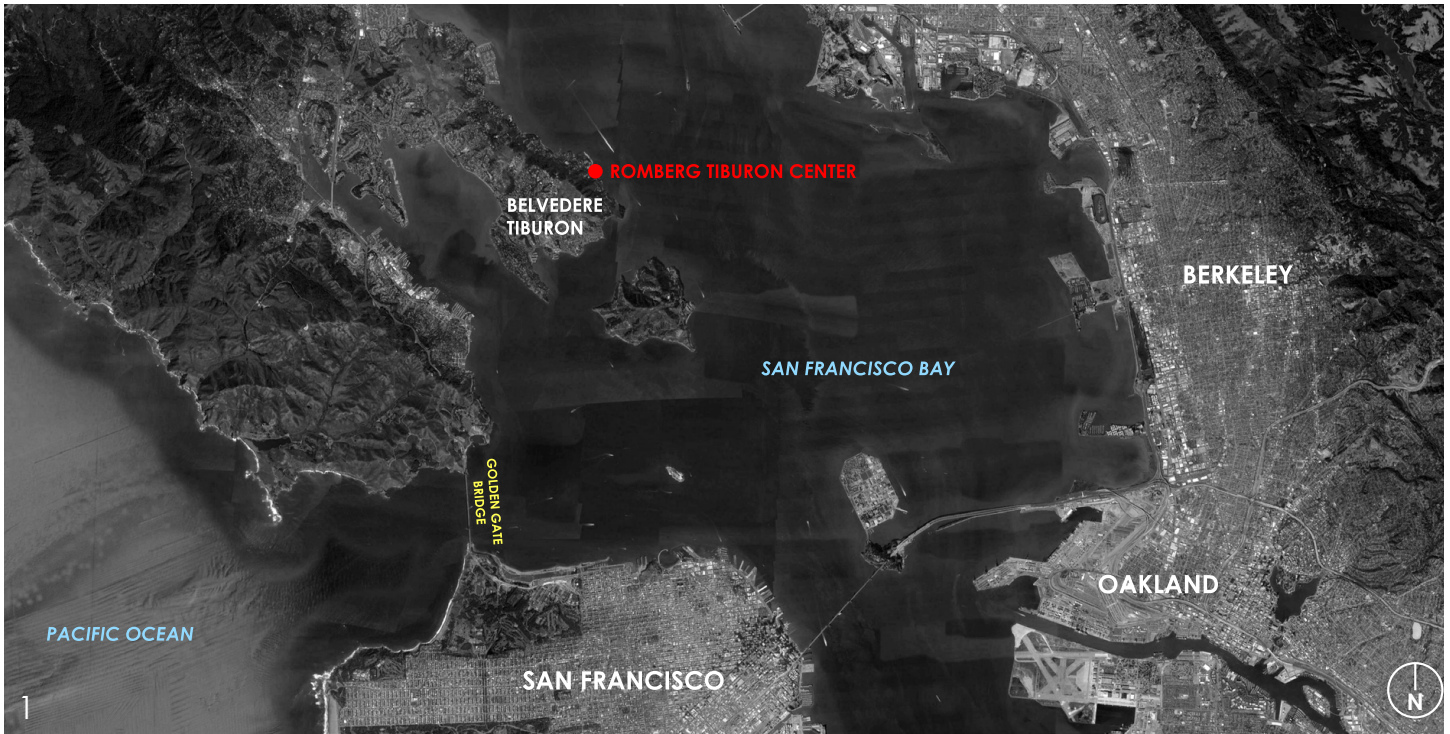
16-33



34-49



project research | site analysis
Tiburon, California



LOCATION



The Romberg Tiburon Center is located in the Southeastern region of Marin County on the Tiburon peninsula. This sunny and quaint area of town is accessible by one road past the San Francisco Bay bridge, about 20 minutes drive from San Francisco State University. The site is located next to an east facing slope, adjacent to the wharf that was used during World War II and connects to San Francisco.

The unique aspects of this site include the water depth in the bay and connection to the Sacramento River. The RTC is located at the deepest part of the bay along the peninsula. This was an advantage when the site was used as a boating dock for the Navy in the early 1900's. The Sacramento River flows from the north end of the site, through the site, then into the San Francisco Bay. The fresh water flow allows the RTC to have a constant salt water source for ma-

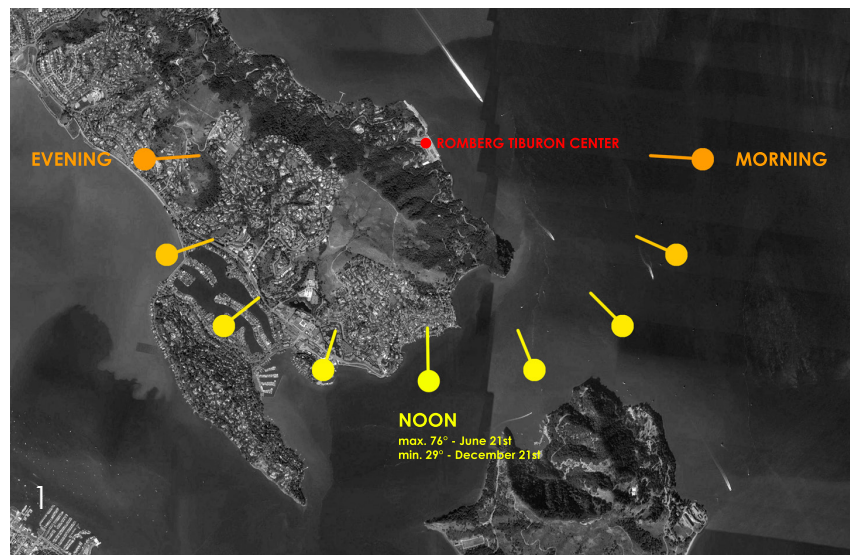
Location



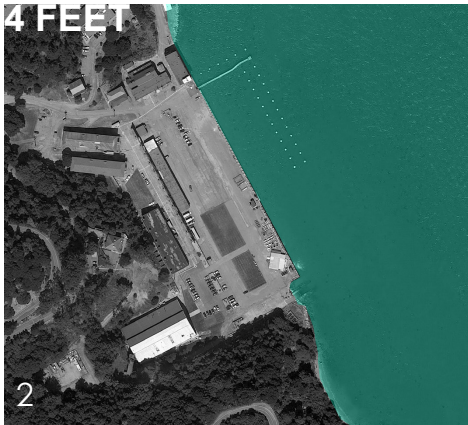
WIND DIRECTION

Marin County weather is mild with mediterranean like temperatures around 60 degrees Fahrenheit. The warmest month is September when the region averages about 70 degrees Fahrenheit. The coolest month is January, which averages about 46 degrees Fahrenheit.

The wind direction comes from the south-east and eastern sides, ranging from 10-15 mph. As shown in figure 1 (on the right), the morning sun is low and from the east, the noon sun is at its highest coming from the south, and the evening sun is at its lowest from the west. The days are mostly sunny from spring to fall and partially cloudy and foggy for the rest of the year.



SUN ANGLES



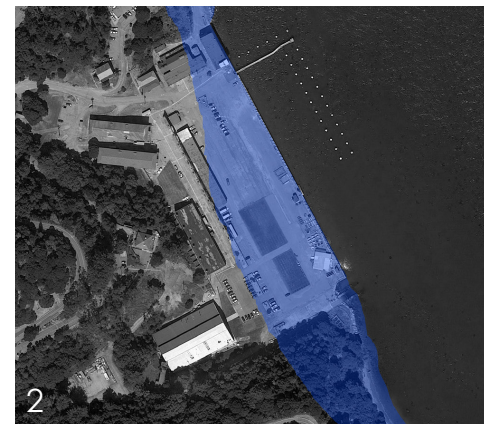
SEA LEVEL RISE

Considering global warming, we analysed the effects of sea level rise to our site. The bay sea level at zero is about eleven feet below the foundation of our site. This ranges from low tide at negative one foot to high tide at seven feet above sea level. The environmental research we gathered informed us that sea levels are expected to rise four to five feet in the next century. The conclusion is that the site will be affected by sea level rise within the next century.

The global environmental issues also include seismic activity and liquefaction in the soil. This region of the new RTC facility will be located in a high seismic and liquefaction zone. This is considered and integrated in the design proposals, which will be further explained by each group.



SEISMIC ACTIVITY



LIQUEFACTION



SITE ANALYSIS



SITE PICTURES

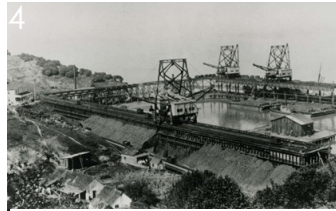
Site Analysis



1870

Cod Fish Production

- Because of its deep water location
- Flight path due to Sacramento River



1900

Coaling Station for Navy Ships

- A central location for coal and oil
- Cable reeling during construction of the Golden Gate Bridge



1940

Net Depot

- Construction of anti-torpedo and anti-submarine nets



1958

Marine Service

- National Oceanographic and Atmospheric Administration
- Few labs
- Makeshift greenhouses

The RTC has been around since the late 1800's and it was originally used as a cod fish facility, where fish were dried and sold at the local markets.

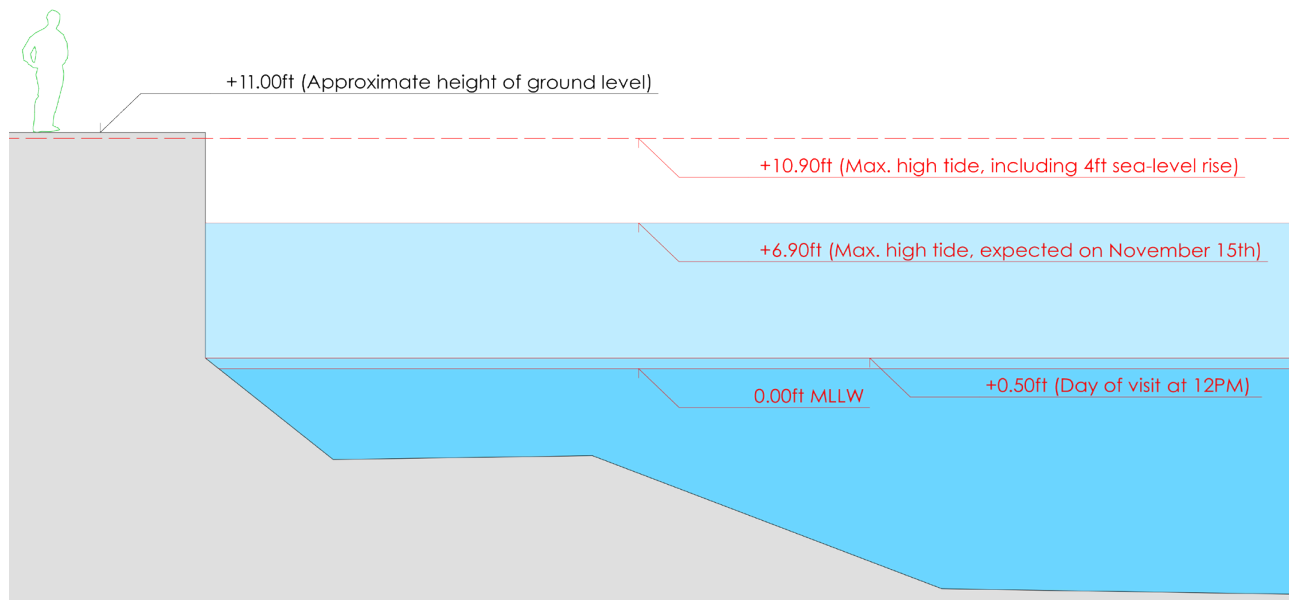
Coal was used as fuel in the early 1900's, and the site was used as a fueling station for the navy ships.

During WWII, The navy continued to use the area as a coaling station and for manufacturing large metal torpedo nets that were used under the Golden Gate Bridge.

The site was sold to SFSU for \$1.00 and it is now being used for biology and marine research.

HISTORY

Site Background



TIDES



6



7



8

The design process involved an in-depth understanding of the spatial types that were used as a guideline for the RTC facility. Classrooms are not organized in a traditional column and row set-up of desks and a chalkboard. Both design proposals incorporate classrooms that emphasize flexible furniture layouts and space, which allows for a collaborative teaching and a healthy learning environment.

CLASSROOMS AND CONFERENCE ROOMS

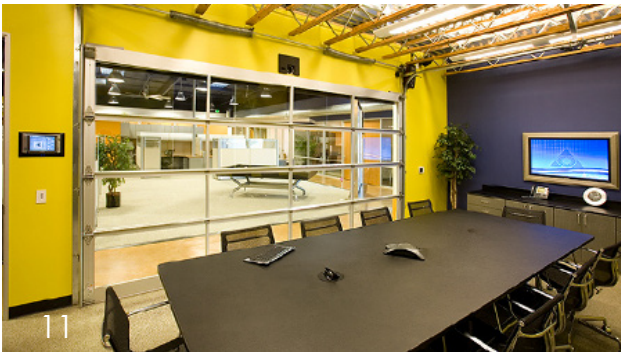


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Photo © Tim Griffith / Kohn Pederson Fox



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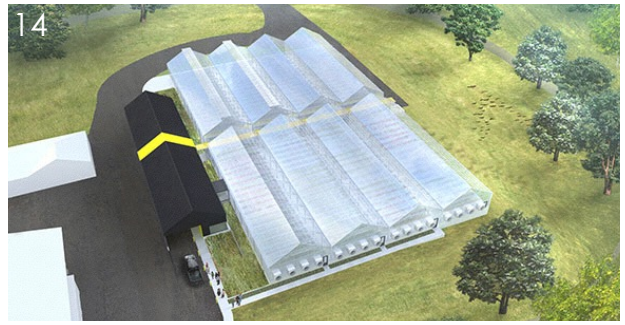


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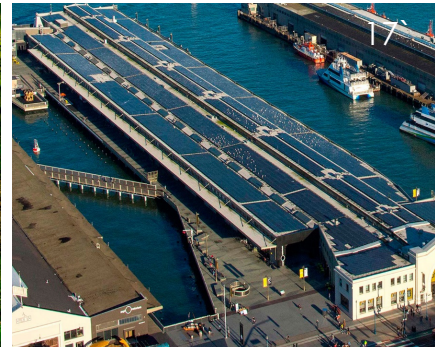
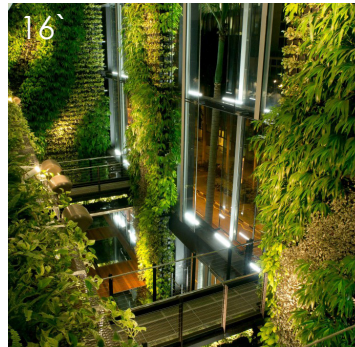


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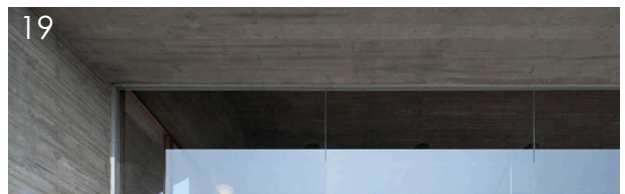
FLEXIBILITY



GREENHOUSES



ENERGY



MATERIALS

A portion of the building will be dedicated to a control room for the future greenhouses. Studies have shown that a head house placed adjacent to a greenhouse incorporates the most efficient function and communication between the two. With that, the head house, includes a room to control and regulate climatic levels within the greenhouse units, and is located directly north and adjacent to the greenhouse.

GREENHOUSES

The RTC site is a predestined location for an ecologically responsive space. We wanted to incorporate a flexible indoor/outdoor learning space by utilizing the surrounding environments, which is called "biophilia". Biophilia is defined as one's ability to learn and work more efficiently when exposed to nature, such as natural daylight and ventilation of the beautiful bay.

ENERGY

With the RTC being next to the San Francisco Bay, the selected materials can withstand the salt water exposure. Proposed materials include concrete, steel, and possible wood veneers made with natural rewoods in the area.

MATERIALS

Client Requirements

Rooms

Controls for greenhouse
Two classrooms for 20 - 25 students

Restrooms and unisex showers

Small multiuse office
Small office for technician
Small library for greenhouse operations

Overall area: **4500 - 5000 sq. ft.**

Proposal

| Group A | | Group B | |
|----------------------------------|---------------------|----------------------------------|---------------------|
| Rooms | Sq. ft. | Rooms | Sq. ft. |
| <i>Fulfilled Requirements:</i> | | <i>Fulfilled Requirements:</i> | |
| Control room | 210 | Head House / Technician | 223 |
| Classroom 1/Laboratory | 560 | Classroom 1 | 569 |
| Classroom 2 | 560 | Classroom 2 / Laboratory | 569 |
| Greenhouse storage and equipment | 210 | Greenhouse storage and equipment | 220 |
| Restrooms | 95 | Restrooms | 65 |
| Showers | 140 | Showers | 65 |
| Lockers | 100 | Lockers / Storage | 100 |
| Flexible office | 275 | Flexible office / Work space | 371 |
| Part of the control room | | Office 1 | 170 |
| Part of the conference room | | Office 2 | 170 |
| <i>Added:</i> | | <i>Added:</i> | |
| Conference room | 575 | Flexible area | 687 |
| Break area | 575 | Kitchen / Breakroom | 530 |
| Storage | 135 | Workspace / Conference | 530 |
| Flexible area | 945 | | |
| Office 1 | 140 | | |
| Office 2 | 140 | | |
| Total: | 4660 sq. ft. | Total: | 4269 sq. ft. |

| Room Type | Equipments | AC or DC? | Wattage | Quantity | Hours | kwh/day | no. of days | kwh/month |
|-------------------------|-------------------------|-----------|---------|----------|-------|---------|-------------|-----------|
| Conference / Library | Microwave | AC | 1450.0 | 1 | 8.0 | 11.60 | 5 | 232.00 |
| | Refrigerator | AC | 325.0 | 1 | 12.0 | 3.90 | 5 | 78.00 |
| | Coffee Maker | DC | 1200.0 | 2 | 4.0 | 9.60 | 5 | 192.00 |
| | Toaster | DC | 1150.0 | 1 | 4.0 | 4.60 | 5 | 92.00 |
| | Charging station - USB | DC | 10.0 | 4 | 4.0 | 0.16 | 7 | 4.48 |
| | Projector | DC | 250.0 | 1 | 4.0 | 1.00 | 5 | 20.00 |
| Office - John and Kathy | Desktop Computer | DC | 100.0 | 2 | 10.0 | 2.00 | 7 | 56.00 |
| | Charging USB | DC | 10.0 | 4 | 4.0 | 0.16 | 7 | 4.48 |
| | Laptops | DC | 50.0 | 2 | 6.0 | 0.60 | 7 | 16.80 |
| Break Area | Charging station - USB | DC | 10.0 | 4 | 4.0 | 0.16 | 7 | 4.48 |
| | Laptops | DC | 50.0 | 4 | 6.0 | 1.20 | 7 | 33.60 |
| Flexible workspace | Desktop Computers | DC | 100.0 | 4 | 12.0 | 4.80 | 5 | 96.00 |
| | Laptops | DC | 50.0 | 3 | 6.0 | 0.90 | 5 | 18.00 |
| | Charging station - USB | DC | 10.0 | 8 | 10.0 | 0.80 | 7 | 22.40 |
| Central lobby space | Charging station - USB | DC | 10.0 | 4 | 4.0 | 0.16 | 7 | 4.48 |
| | Laptops | DC | 50.0 | 6 | 10.0 | 3.00 | 7 | 84.00 |
| Shower | Hair Dryer | DC | 600.0 | 2 | 1.0 | 1.20 | 5 | 24.00 |
| Locker | Charging station - USB | DC | 10.0 | 4 | 4.0 | 0.16 | 7 | 4.48 |
| Restrooms | | | | | | | | |
| Classrooms -2 | Projectors | DC | 250.0 | 2 | 4.0 | 2.00 | 5 | 40.00 |
| | Speakers | DC | 1.0 | 6 | 4.0 | 0.02 | 5 | 0.48 |
| | Microphone | DC | 10.0 | 2 | 4.0 | 0.08 | 5 | 1.60 |
| | Conference Video Camera | DC | | | 4.0 | 0.00 | 5 | 0.00 |
| | Flat Screen TV | DC | 150.0 | 2 | 6.0 | 1.80 | 5 | 36.00 |
| | Desktop Computers | DC | 100.0 | 20 | 12.0 | 24.00 | 5 | 480.00 |
| | Laptop Computers | DC | 50.0 | 20 | 10.0 | 10.00 | 5 | 200.00 |
| Control Room | Computers | DC | 100.0 | 4 | 24.0 | 9.60 | 7 | 268.80 |
| | Tv Screens | DC | 150.0 | 2 | 24.0 | 7.20 | 7 | 201.60 |
| | Ipad | DC | 10.0 | 2 | 12.0 | 0.24 | 7 | 6.72 |

| | | | | | | | | |
|----------------|---------------------|----|--------|----|------|-------|---|---------|
| Equipment room | Growth Chamber | AC | 2500.0 | 1 | 24.0 | 60.00 | 7 | 1680.00 |
| | Drying Oven | AC | 365.0 | 1 | 24.0 | 8.76 | 7 | 245.28 |
| | Deep Freezer | AC | 400.0 | 1 | 24.0 | 9.60 | 7 | 268.80 |
| | Larger Refrigerator | AC | 615.0 | 2 | 24.0 | 29.52 | 7 | 826.56 |
| | Vaccum Cleaner | AC | 1600.0 | 1 | 3.0 | 4.80 | 5 | 96.00 |
| Fans | FANS | DC | 70.0 | 15 | 12.0 | 12.60 | 5 | 252.00 |
| Lights | Linear Lights | DC | 6.3 | 6 | 12.0 | 0.45 | 7 | 12.70 |
| | Down Lights | DC | 3.0 | 33 | 12.0 | 1.19 | 7 | 33.26 |
| | Exterior Lights | DC | 48.0 | 10 | 12.0 | 5.76 | 7 | 161.28 |

NOTE:

*4 weeks per month

*12 months per year

*See reference page for images of the items listed.

| | kwh/day | kwh/month | kwh/year |
|-------|---------|-----------|----------|
| AC | 128 | 3427 | 41120 |
| DC | 105 | 2372 | 28460 |
| TOTAL | 234 | 5798 | 69579 |

PV SUPPLYING DC LOADS ONLY *

SCENARIO 1: WITHOUT BATTERY \$ 39,000

SCENARIO 2: WITH BATTERY FOR 1 AUTONOMOUS DAY \$ 206,000

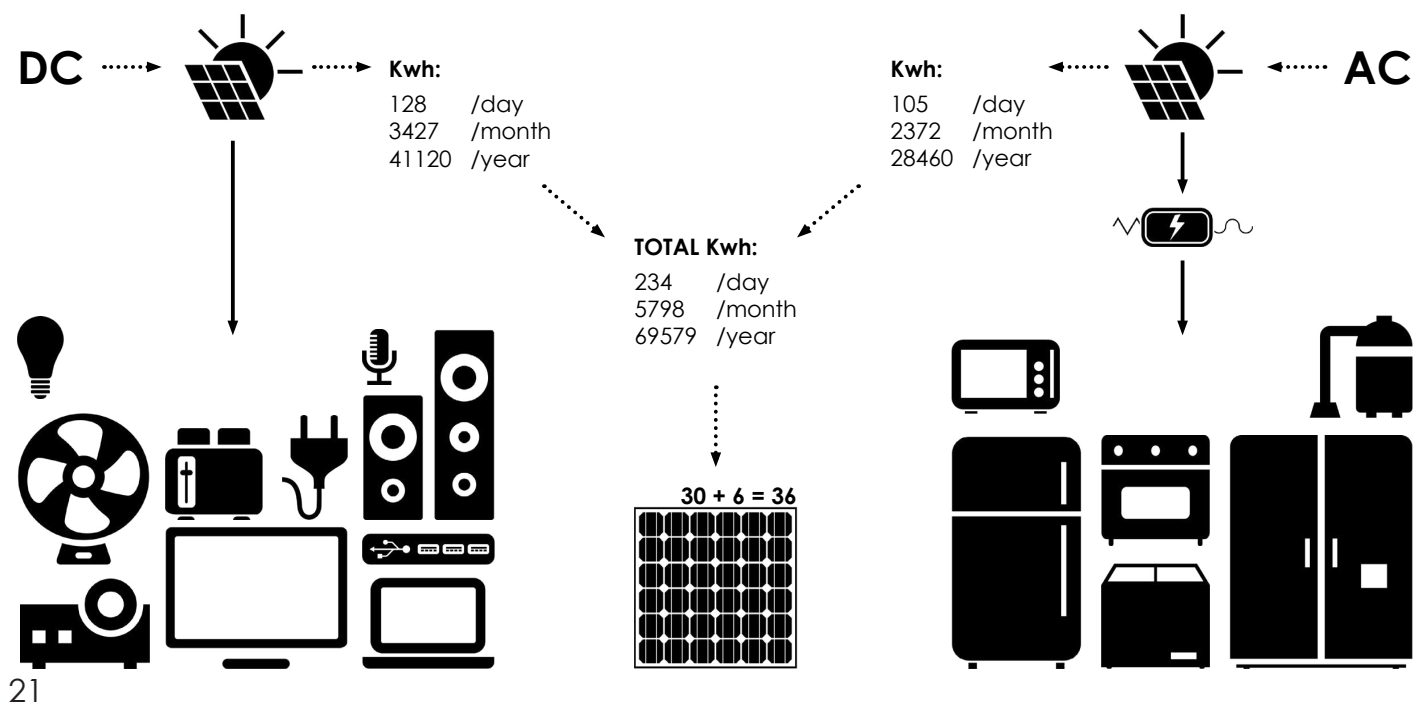
PV SUPPLYING AC AND DC LOADS *

SCENARIO 1: WITHOUT BATTERY \$ 174,000

SCENARIO 2: WITH BATTERY FOR 1 AUTONOMOUS DAY \$ 540,000

Advised by Prof. Taufik
Director of Electric Power Institute, Cal Poly

EQUIPMENT POWER SUPPLY



21

AC / DC

In direct current (DC), the electric charge (current) only flows in one direction. Electric charge in alternating current (AC), on the other hand, changes direction periodically. The voltage in AC circuits also periodically reverses because the current changes direction.



1. Biophilia

Biophilia, as defined by the famed biologist E.O. Wilson, is "the innate emotional affiliation of human beings with other living organisms." Some argue that biophilia is the result of "genetic memories."



2. Energy Efficiency

Using less energy to accomplish the same amount of work. Getting the most work per unit of energy is often described as a measure of energy intensity.



65 % Efficiency Improvement



Solar Ready



3-5 % of skylights



20 % of Daylight / Room



Integrated Design Implementation



3. Flexibility

As Georgia Institute of Technology professor Craig Zimring, PhD, explains, "Flexibility is not an innate architectural quality, but the ability of the built environment to accommodate change between a defined start-state and end-state."



Interaction



Collaboration

Snehal Daliya
Parinaz Faridnia
Kristina Lam
Stefan Schermaier

team A



*Snehal Daliya
Pune, India*

As a first year graduate student from MS Arch program at Calpoly, I really enjoyed this interdisciplinary project. I am grateful of the opportunities i got.

I believe, working in a team is about the process quality which involves lot of opportunities and challenges. It was an amazing experience working with people having different



*Parniaz Faridnia
Shiraz, Iran*

I am a first year graduate student in MS Arch program at Cal Poly. I have learned how to collaborate with ARCE students and work as a team and how to develop the design project both aesthetically and structurally. I learned how to improve my skillset as an Architect and developed my knowledge in structural engineering.



*Kristina Lam
Sacramento, CA*

I am a fourth year undergraduate Architectural Engineer at Cal Poly and it has been a great opportunity to work with three master's international architects. It has been a lot of fun learning about different cultures as well. I have gained valuable knowledge about creating a structural design that encompasses flexibility and collaboration, while still achieving a modern/ industrial look.



*Stefan Schermaier
Graz, Austria*

As a graduate student in Architecture coming to California to work on my Master thesis, I am grateful that I got involved in this project.

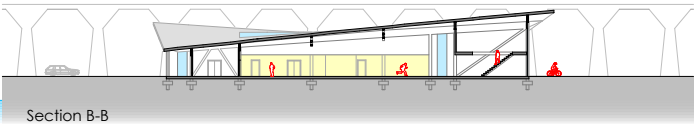
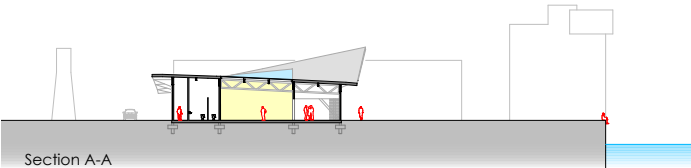
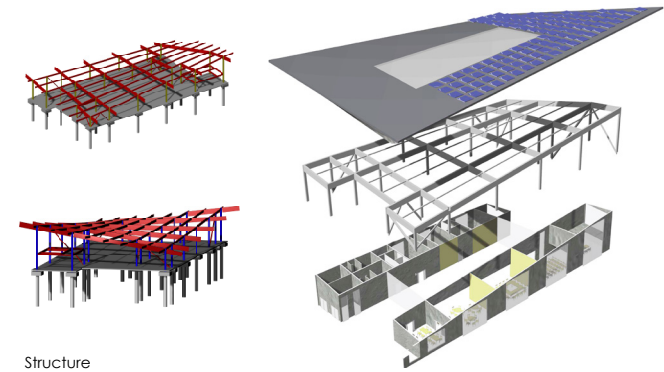
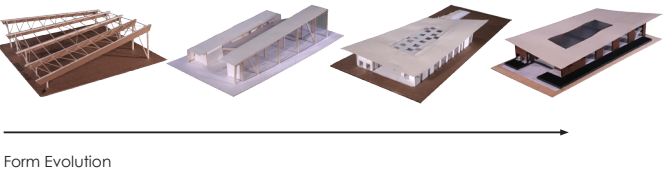
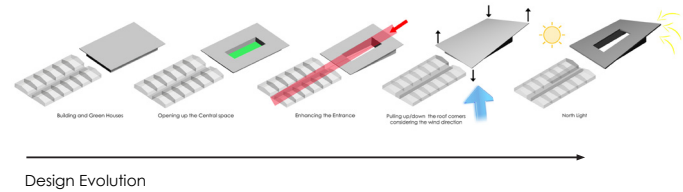
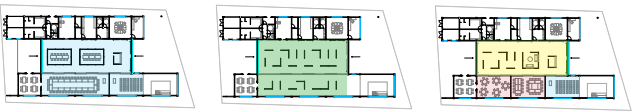
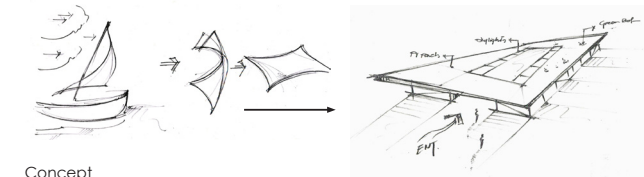
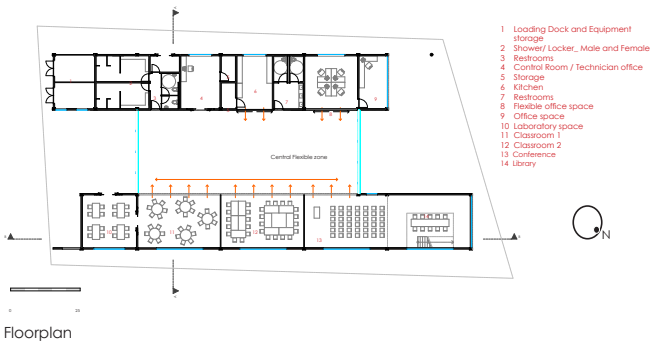
Architecture is a unique combination of design and technology that integrates a wide range of challenges. Working on these challenges with people from very different backgrounds was an amazing experience.

*We believe that,
Fall in love with the Process, and the results will come.
-Eric Thomas*

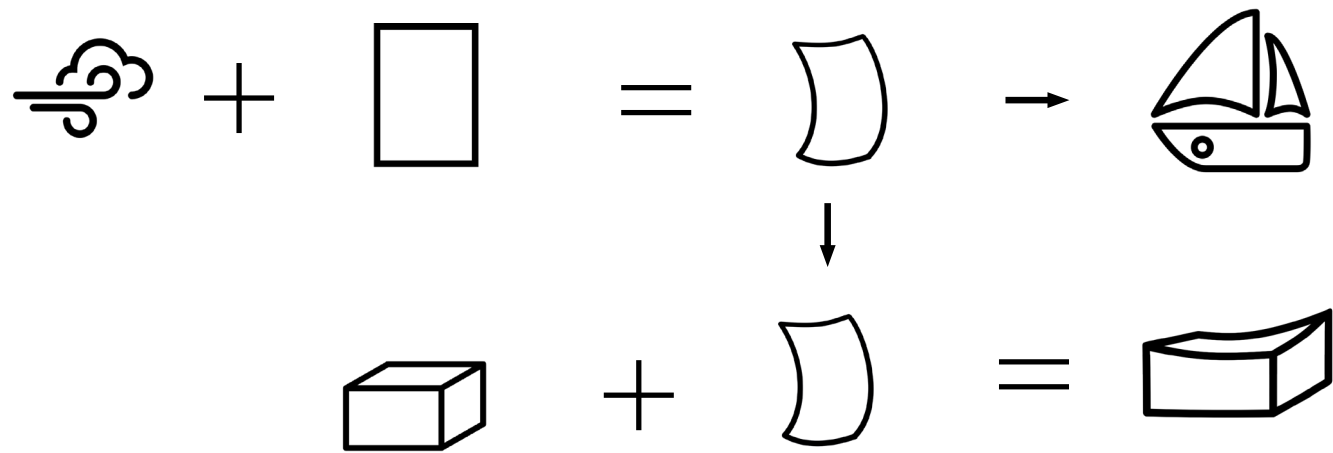
The Sail



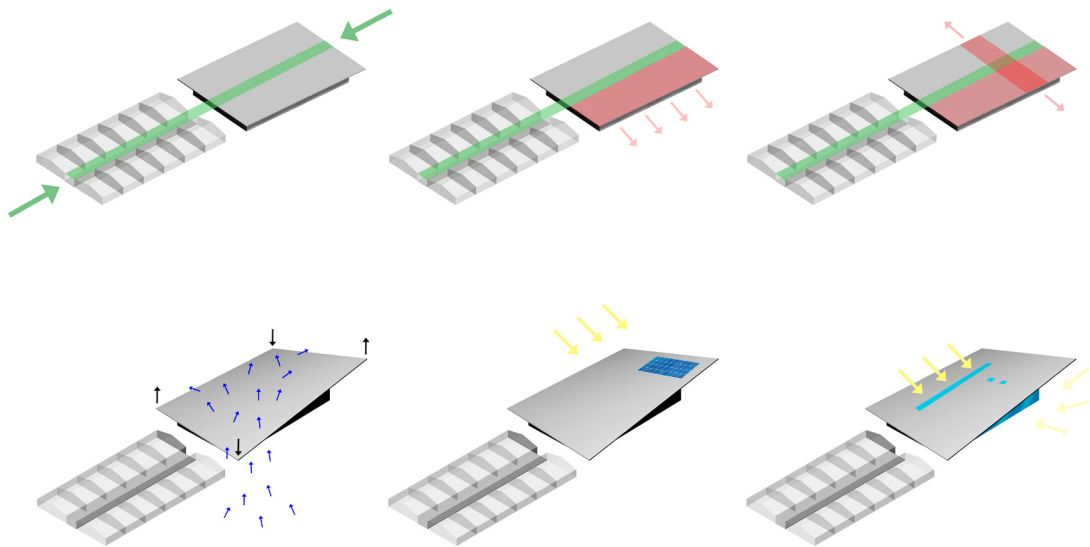




Form Concept



Evolution of Design



Concept



Talk



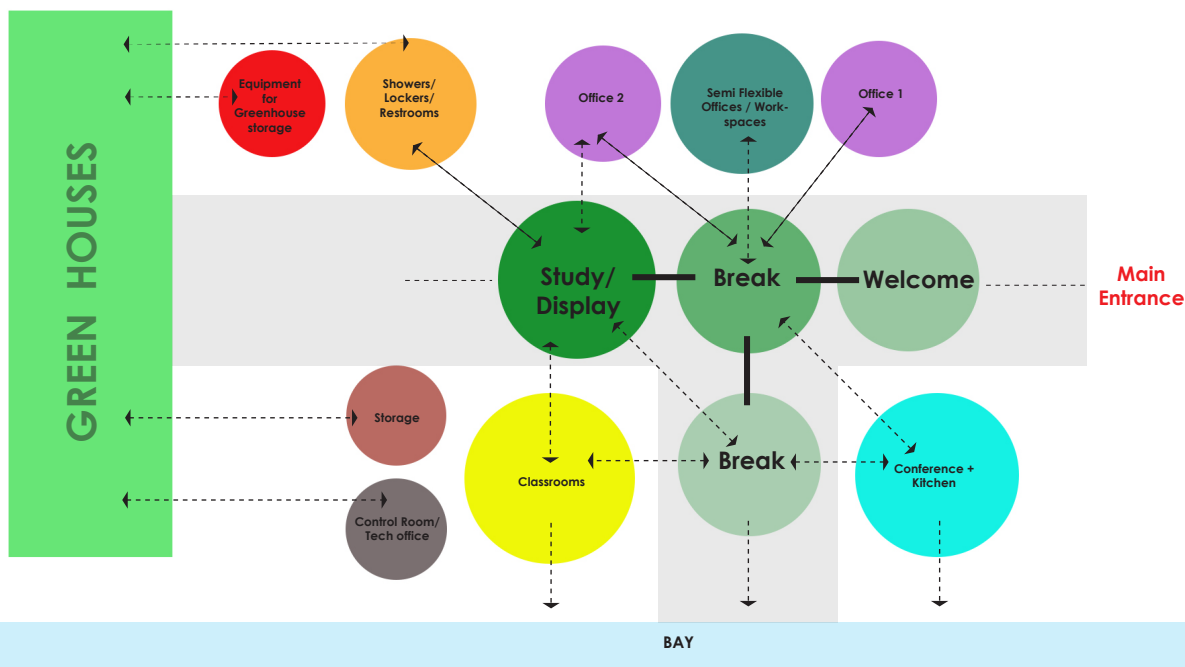
Interaction



Working



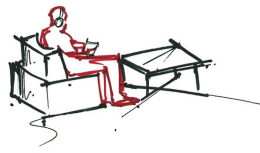
Eat



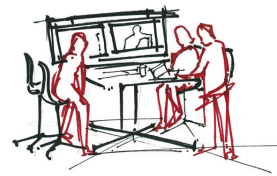
Presentation



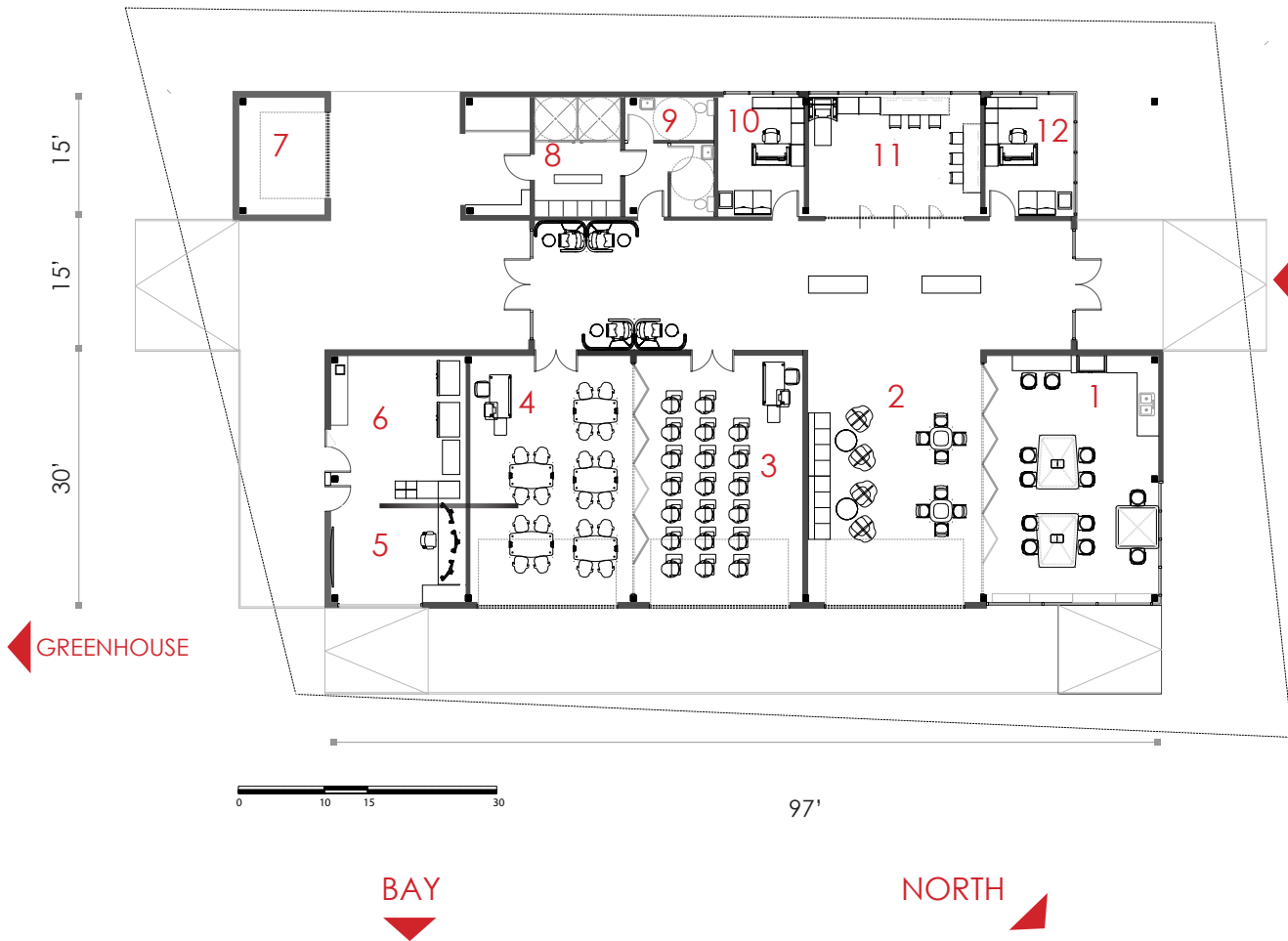
Teaching



Relax

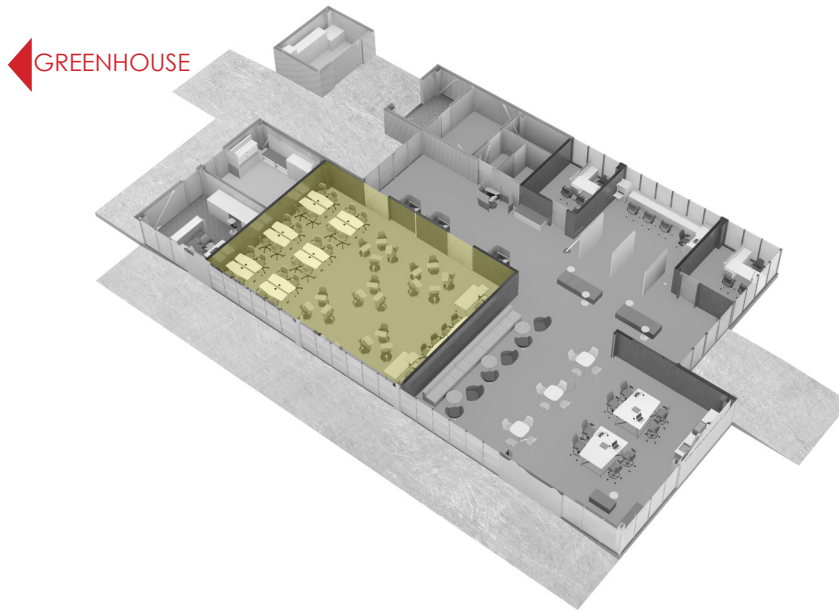


Collaboration



- | | | | | | |
|---|----------------------|---|----------------------------|----|------------------|
| 1 | Kitchen / Conference | 5 | Control Room / Tech Office | 9 | Restrooms |
| 2 | Break Area | 6 | Equipment Room | 10 | Office 1 |
| 3 | Classroom 1 | 7 | Storage Room | 11 | Flexible Offices |
| 4 | Classroom 2 | 8 | Locker+Shower Area | 12 | Office 2 |

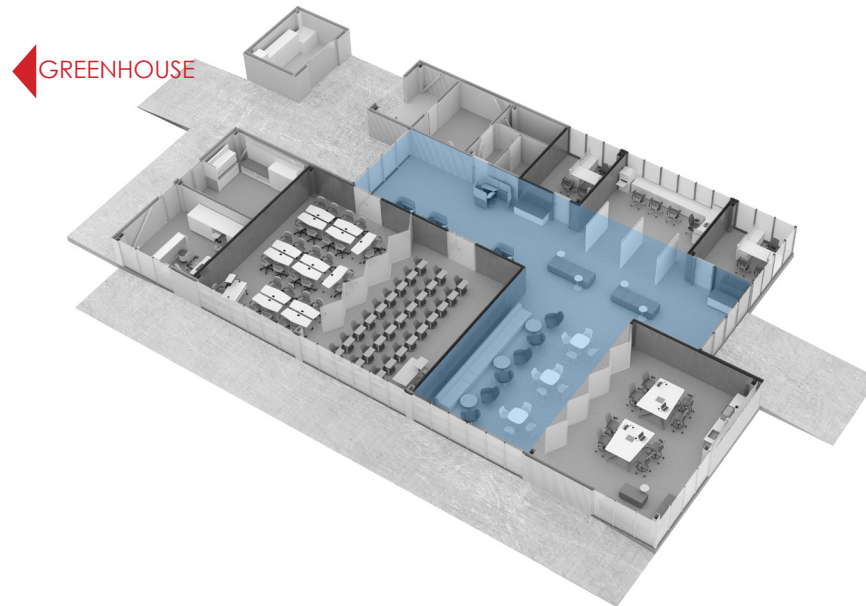
Flexible Configurations



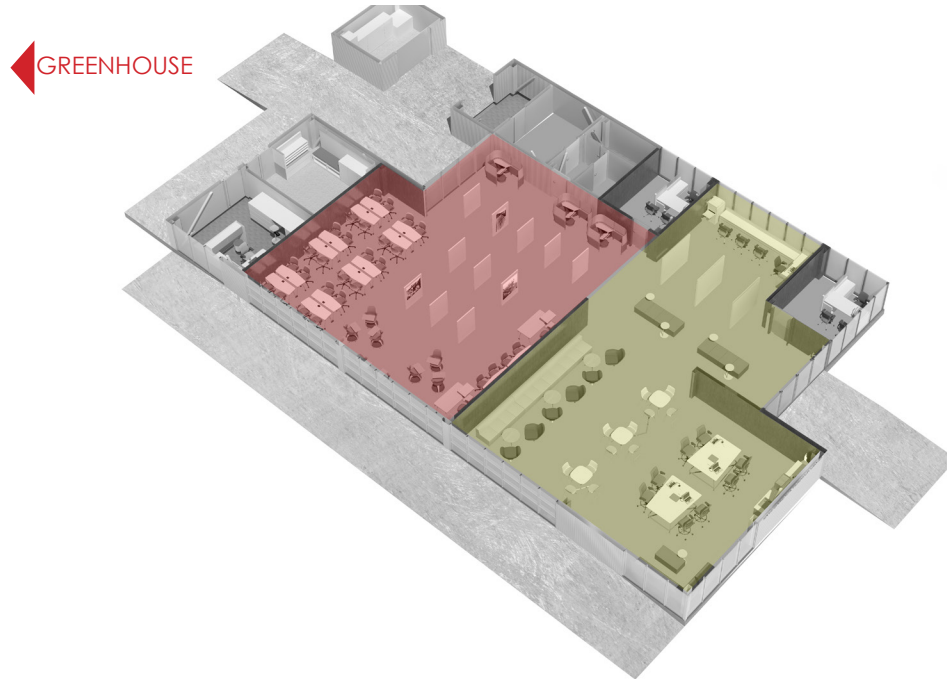
Combined classroom configuration



Combined collaboration space

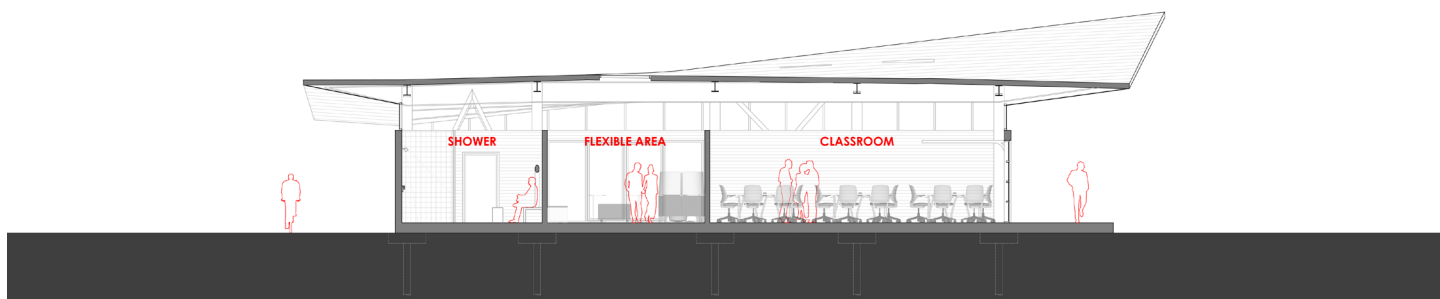


More collaborative spaces

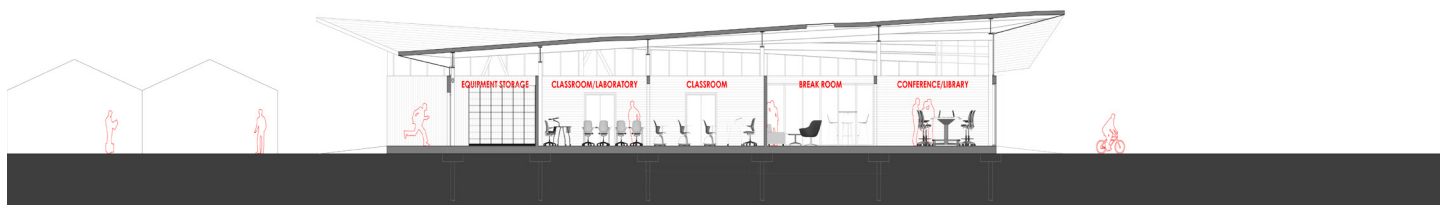


Flexible possibilities for a multi-use set up

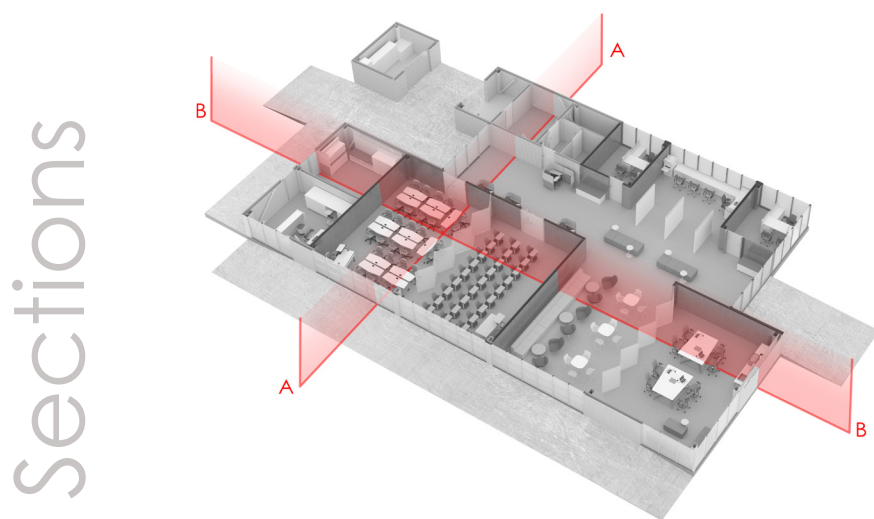
Flexible Configuration



SECTION A-A



SECTION B-B



Sections

Glass



Kalwall



Corrugated Metal



East Facade Elevation



Metal Roofing



Garage Doors

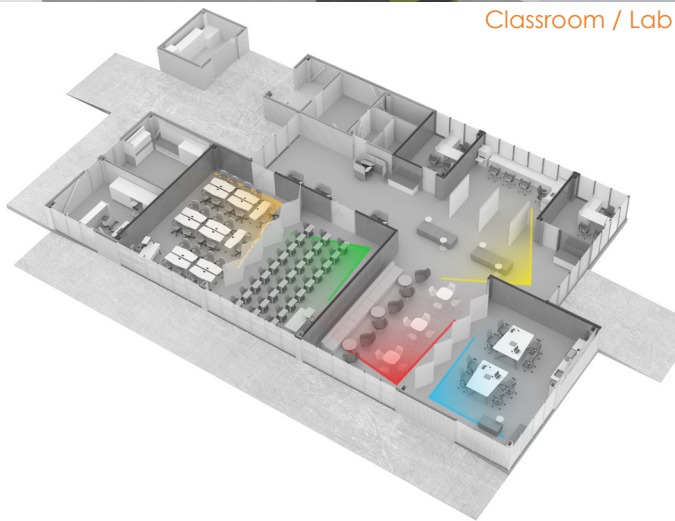
Exterior Precedents



Classroom / Lab



Break Area



Conference

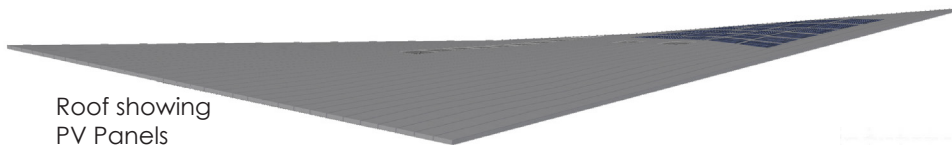


Classroom

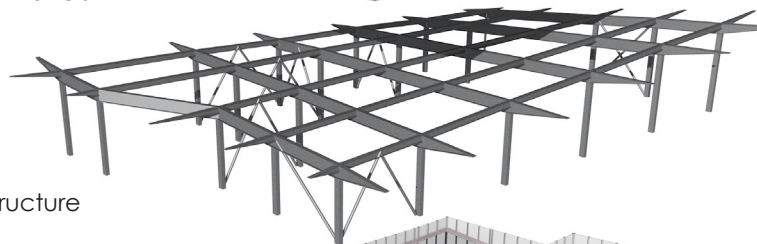


Entrance view

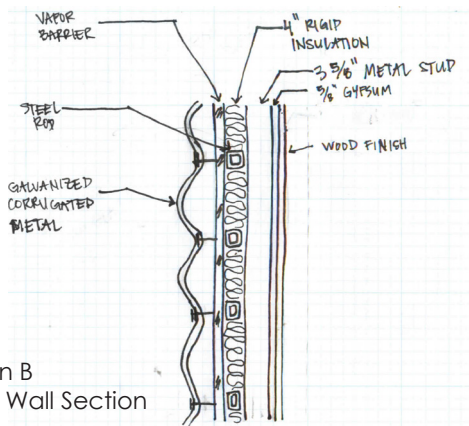
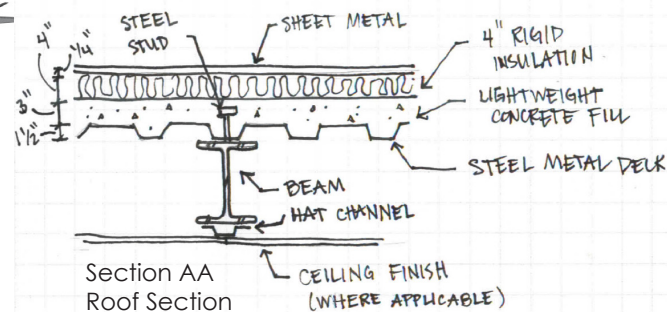
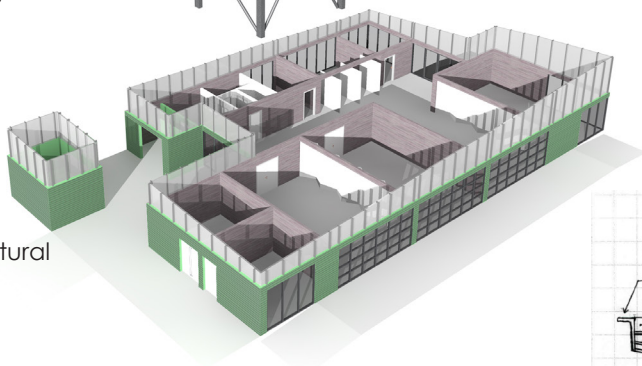
Roof showing
PV Panels



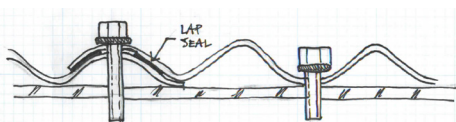
Structure



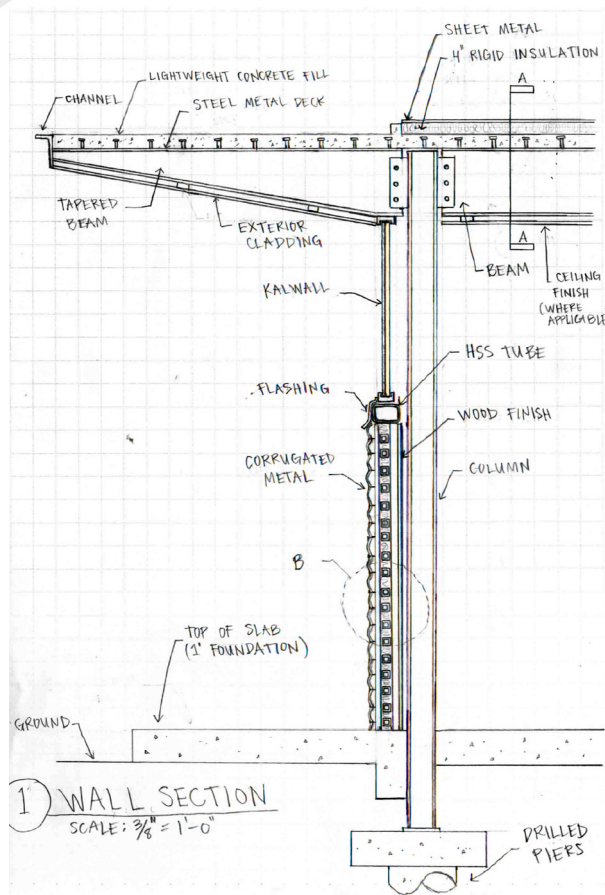
Architectural
walls



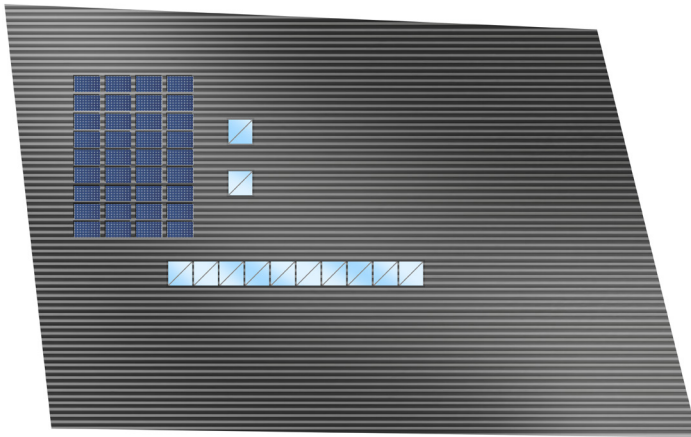
Section B
Closer Wall Section



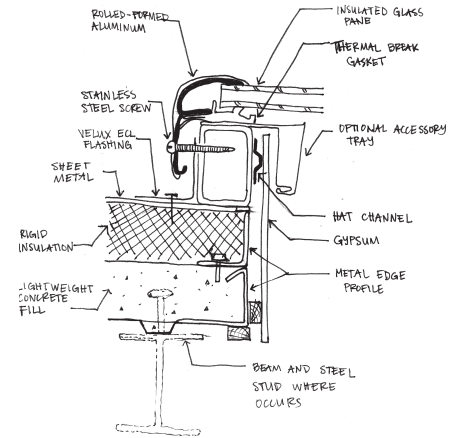
Corrugated Metal Connection



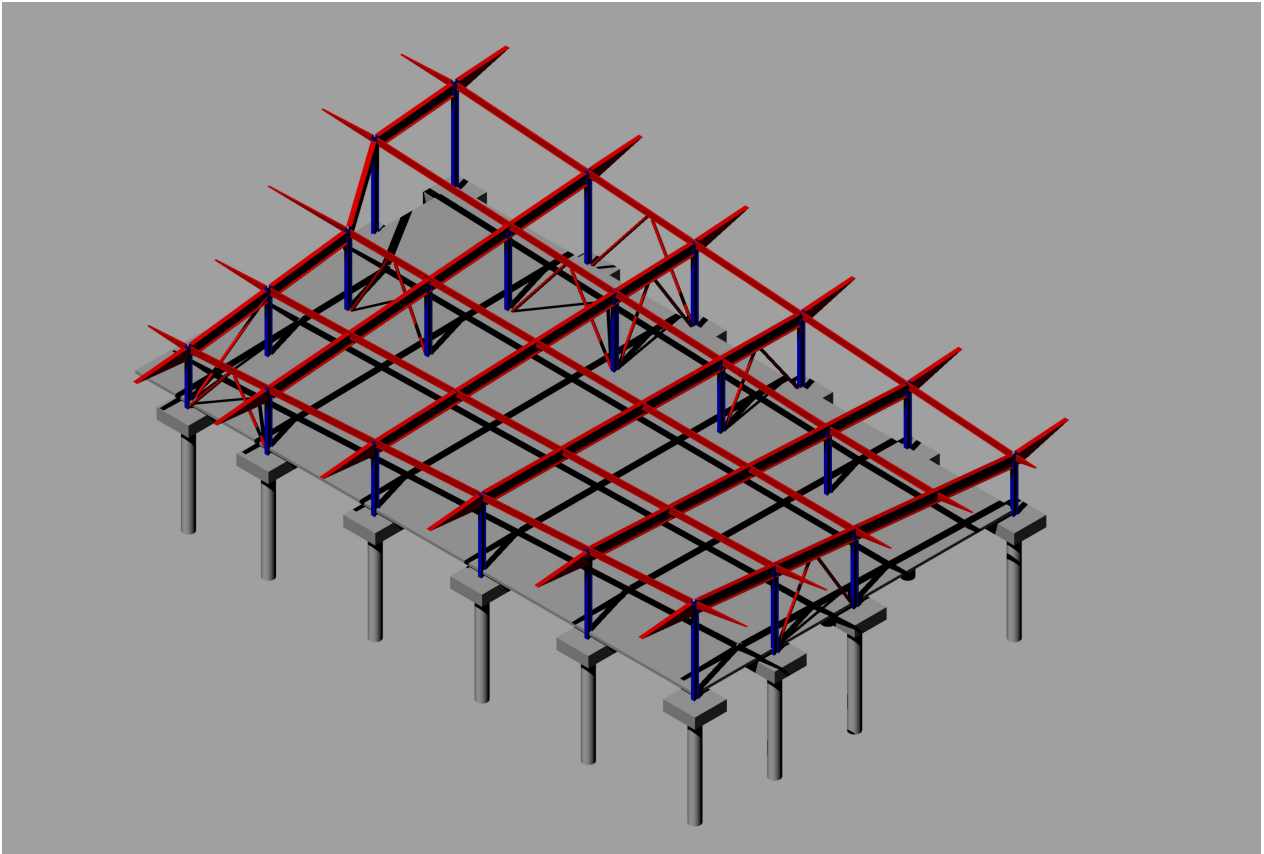
Structure

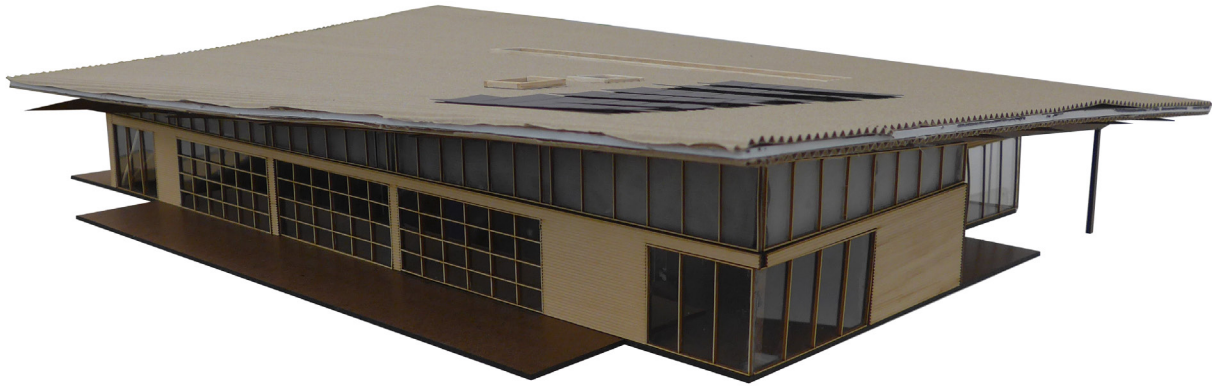


Roof Plan showing PV Panels and Skylights

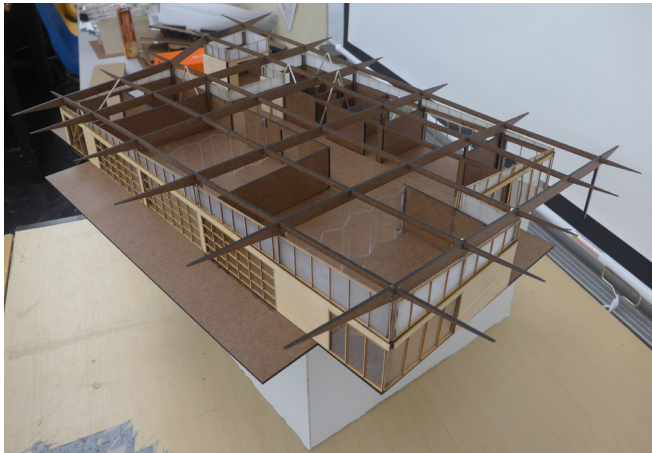


Skylight to Roof Detail





North-East Elevation



From North-East View



From South-West View





ROMBERG TIBURON
ENVIRONMENTAL RESEARCH CENTER

Mia Sheperd
Iris Gomm
Paul Truong
Sandra Froschauer
Tanvi Save

team B



Mia Sheperd
San Diego, CA

Being a General Engineering undergraduate student at Cal Poly, I was thankful to participate in the ARCH 551 studio. I was able to see how a building is designed in an upper division architecture studio with integrated design.



Iris Gomm
Graz, Austria

The Arch 551 Studio was a great opportunity to work on the design process alongside others in separate fields of study. I am glad, I was able to participate in this collaboration and after all I experienced a considerable learning process and the group project allowed me to understand how a interdisciplinary design process occurs.



Paul Truong
Encino, CA

I come from Encino, CA in southern California. I have always wanted to be in the A/E/C industry and look forward to working up north after graduating in the winter. This project has greatly improved my ability to work in an interdisciplinary environment.



Sandra Froschauer
Graz, Austria

Getting involved in this interdisciplinary project has been a great experience.

Through interdisciplinary work I have gained an insight that has allowed me to consider all aspects of building design and it was a great opportunity to improve my knowledge especially in structural and environmental design.



Tanvi Save
Maharashtra, India

I am MS Arch graduate student in California Polytechnic State University. My interest includes but not limited to space planning, physical modeling, designing parametric design and learning new software. Interdisciplinary work studio was a great experience which led me in interacting with client, understanding their requirements, realizing efficient yet cost effective design.

The Wave 



ROMBERG TIBURON CENTER

FLOOR PLAN



RENDERS



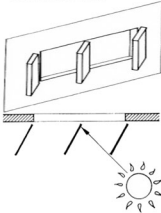
CONCEPT



VERTICAL SHADING



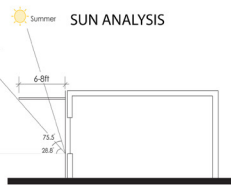
SUN ANALYSIS



HORIZONTAL SHADING



SUN ANALYSIS



FLY ASH CEMENT



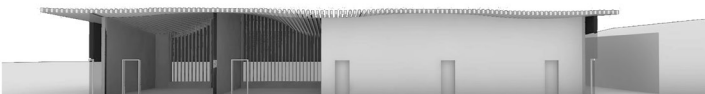
SHOTCRETE

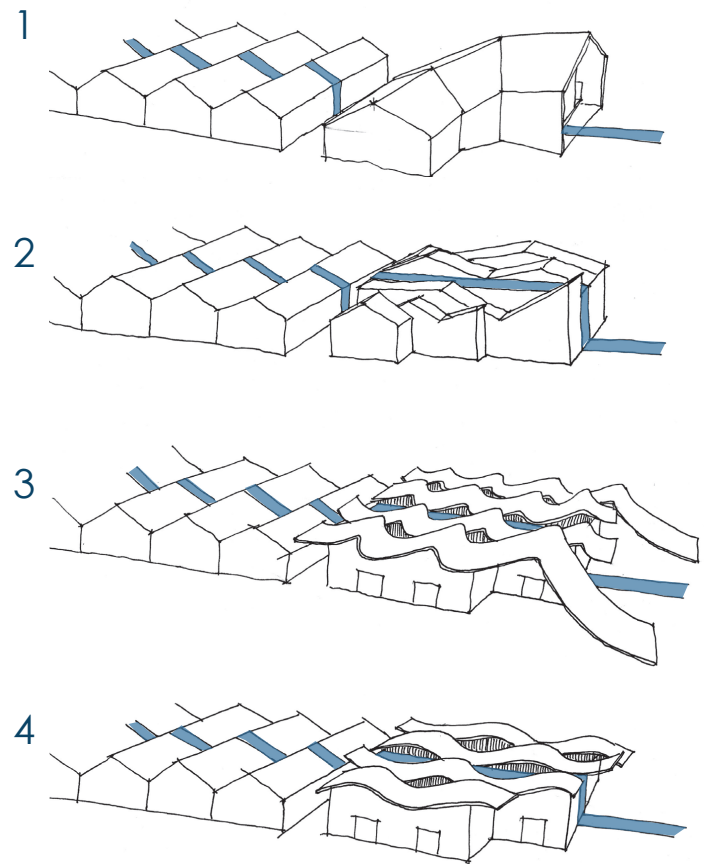
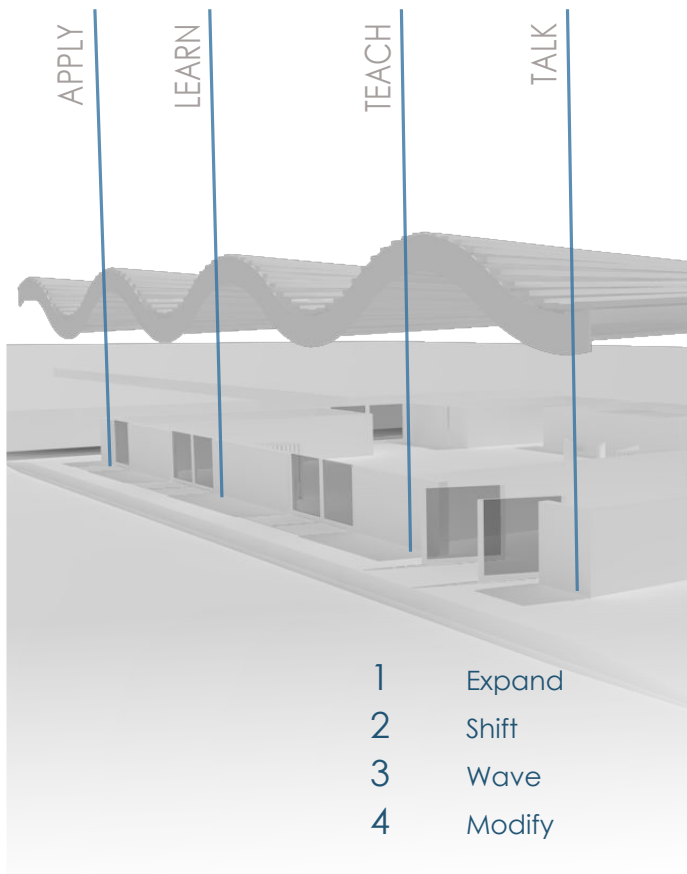


STEEL



SECTIONS





FORM

Our concept of the wave roof originates from the form of the greenhouses purposed to be placed on the leach fields on the site. The repetitive roofs were a style that we felt attracted to and wanted to emulate in the final design. Using the inspiration we also got from the surrounding water, we developed the wave form.

STRUCTURE

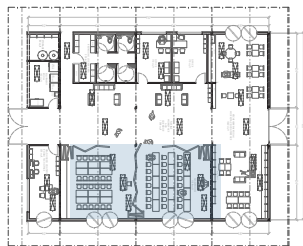
The structure of the building is much simpler than its facade. Each column is placed at 12ft spacing that is placed at each bottom peak of the wave. The structure and wave form work together to enhance the floor plan, which is designed to be open and flexible. The columns are also placed in the grid of the floor plan while leaving the main spaces completely open for transition.



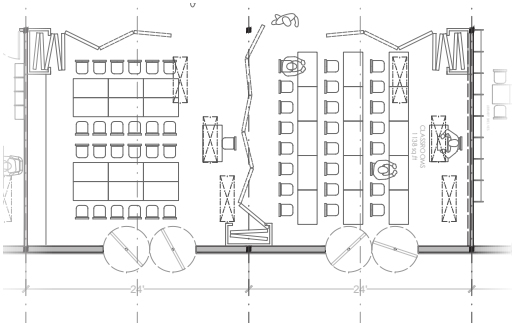
Planning

- | | | |
|--------------------------------------------------|----------------------------------------------|--------------------------|
| 1 Kitchen / Break Room Workspace / Conference | 4 Head House / Control Room / Tech Office | 8 Restrooms / Showers |
| 2 Classroom 1 | 5 Equipment Room | 9 Office 1 |
| 3 Classroom 2 | 6 Greenhouse Storage | 10 Office 2 |
| | 7 Locker Area | 11 Flexible Working Area |

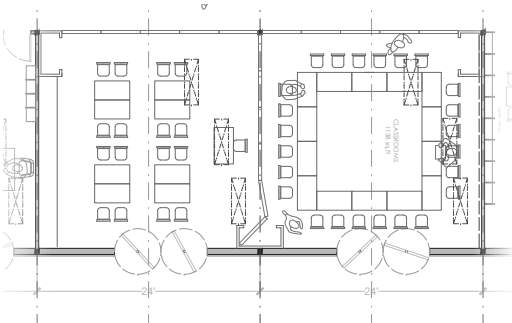
CLASSROOM



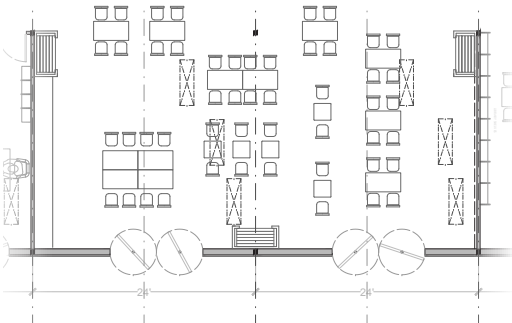
Version 1



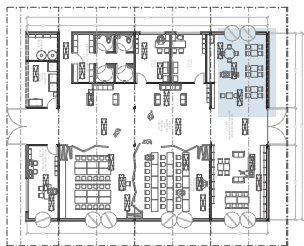
Version 2



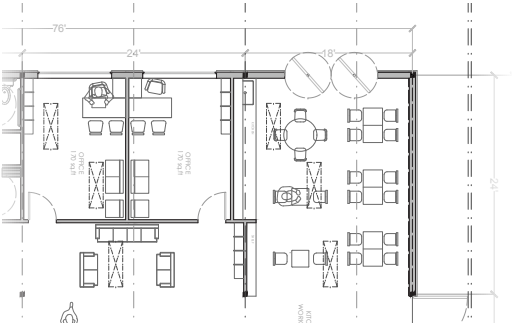
Version 3



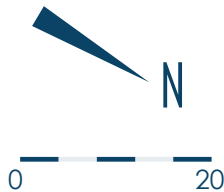
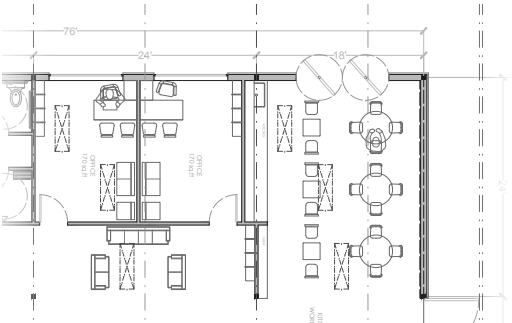
BREAK ROOM

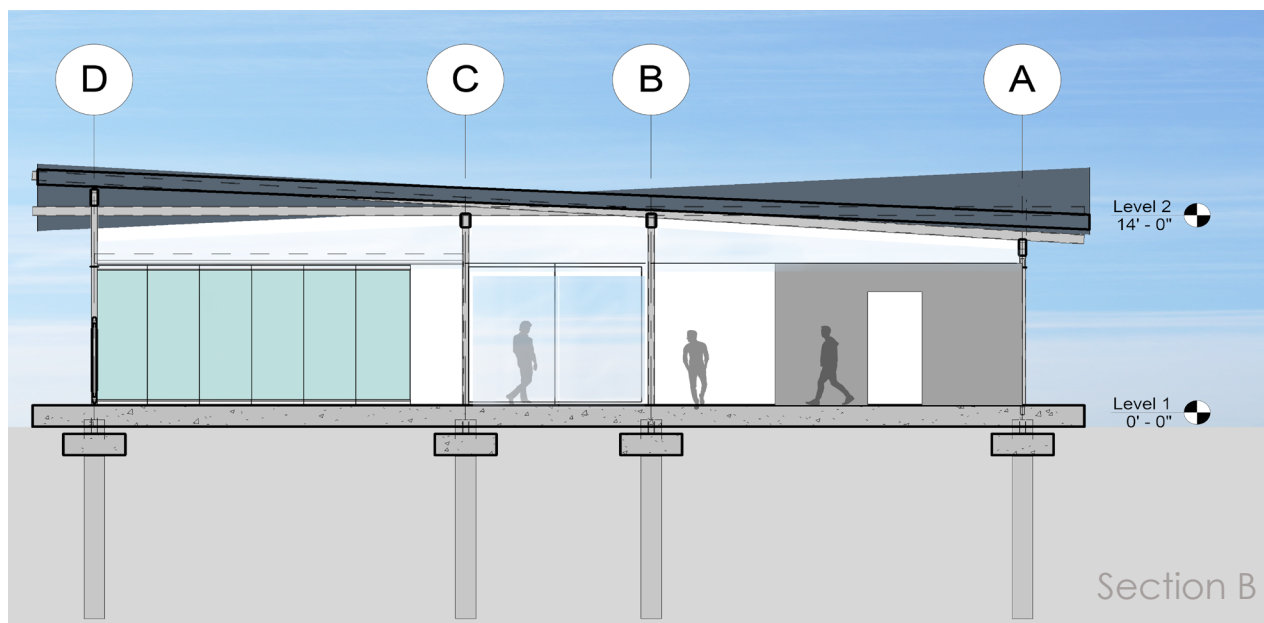
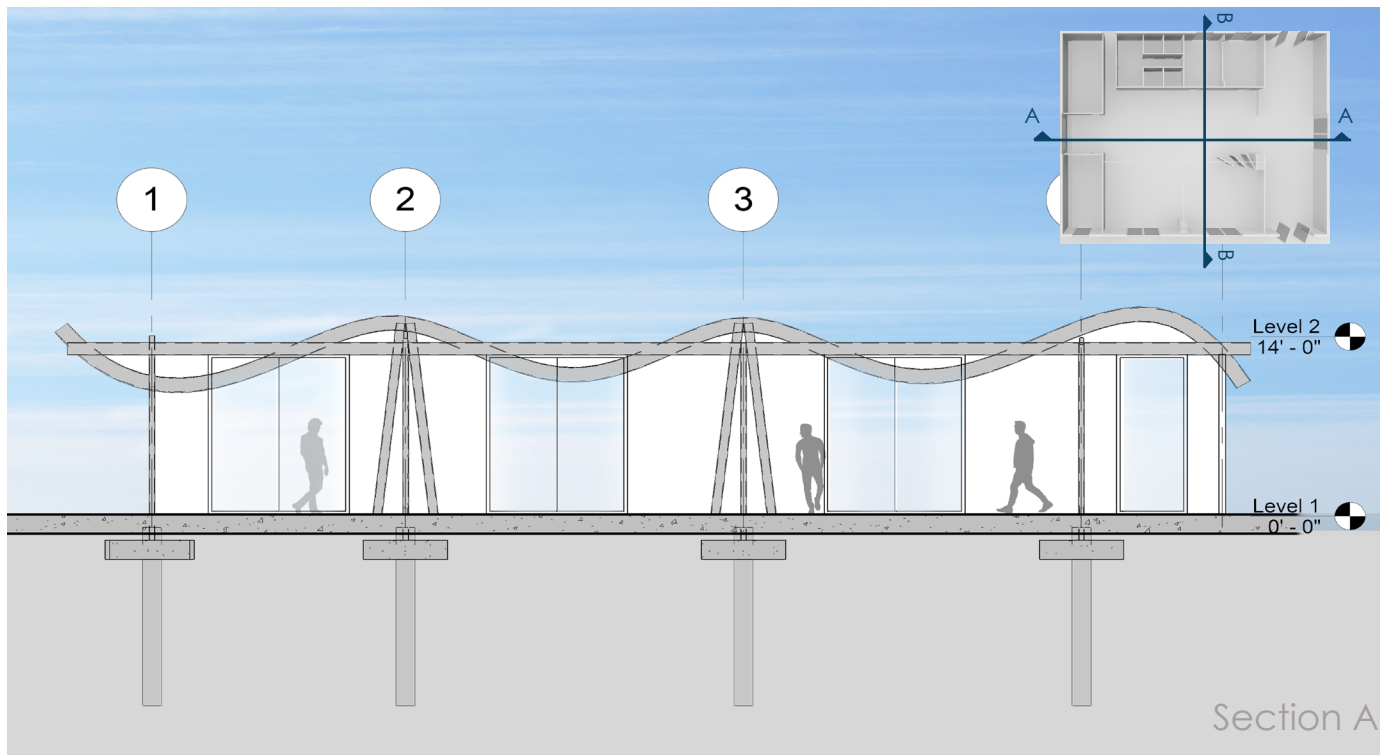


Version 1

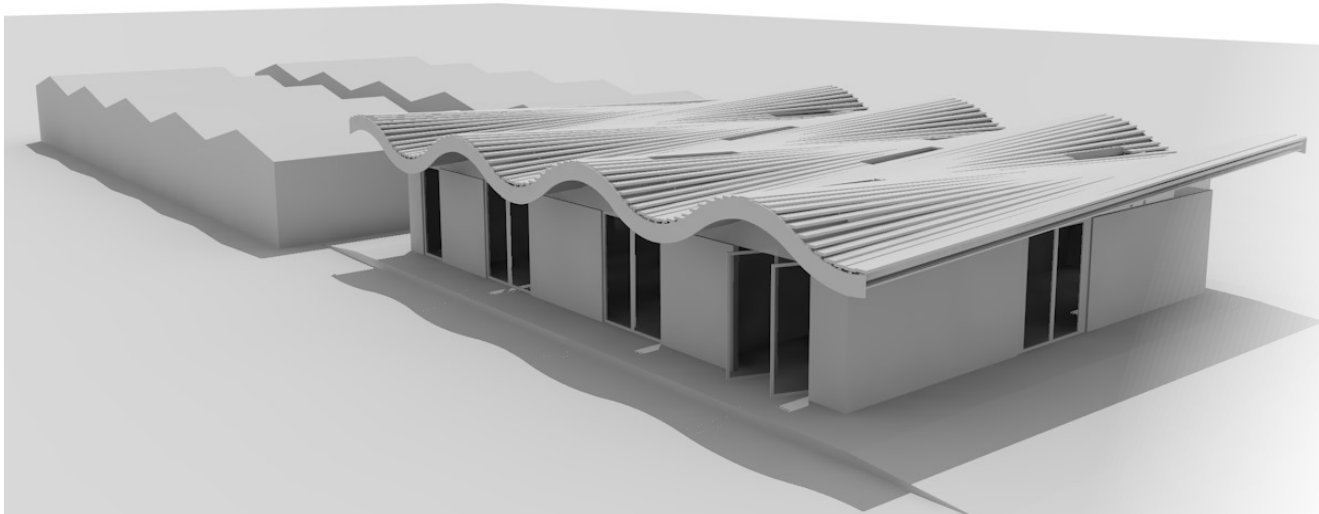


Version 2





Sections



W A L L
C O N C R E T E

27



28



29

S T R U C T U R E
S T E E L

30

D O O R S
G L A S S



31



32



33

I N T E R I O R C E I L I N G
W O O D

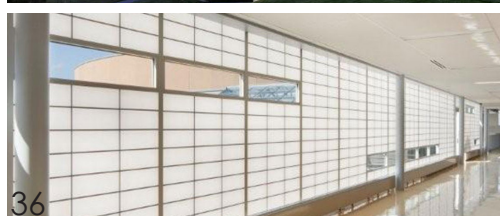
34

T R A N S O M W I N D O W
K A L W A L L

35



36



Exterior

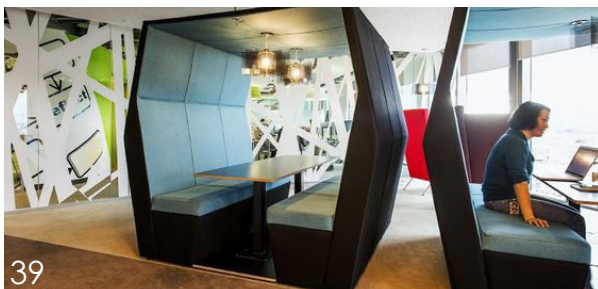


37



38

WORKING SPACE



39



40

FURNITURE



41

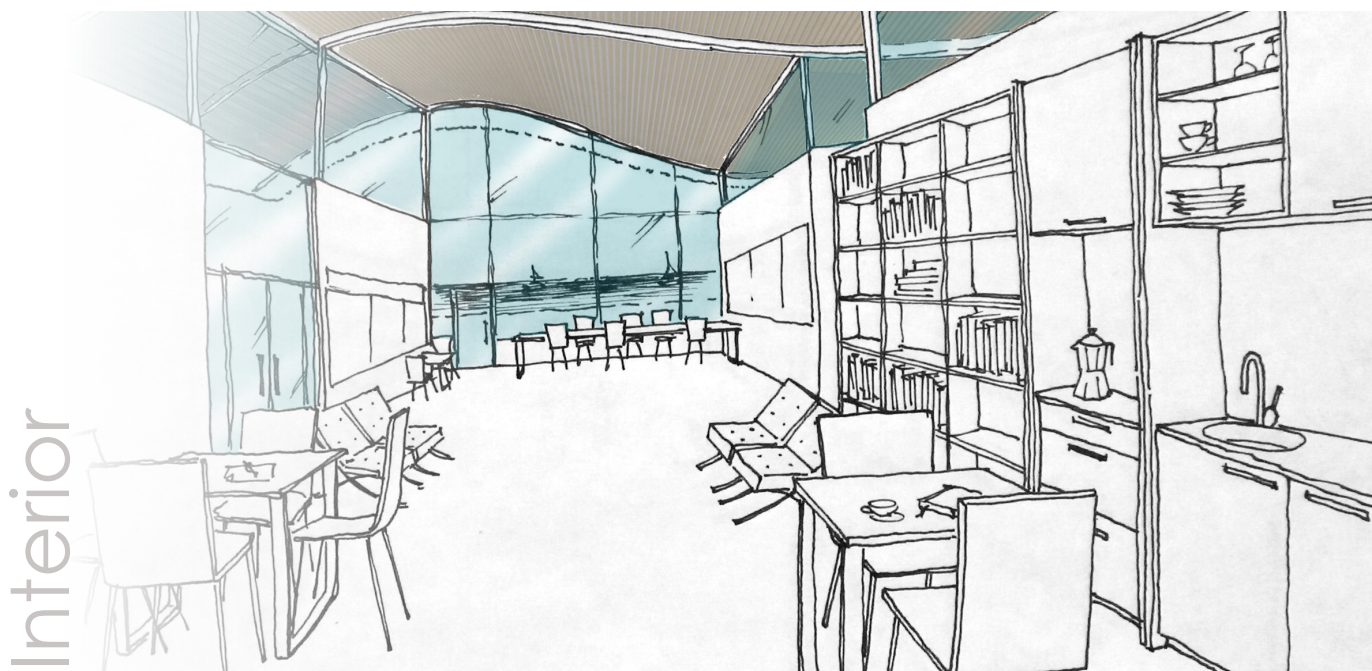


42



43

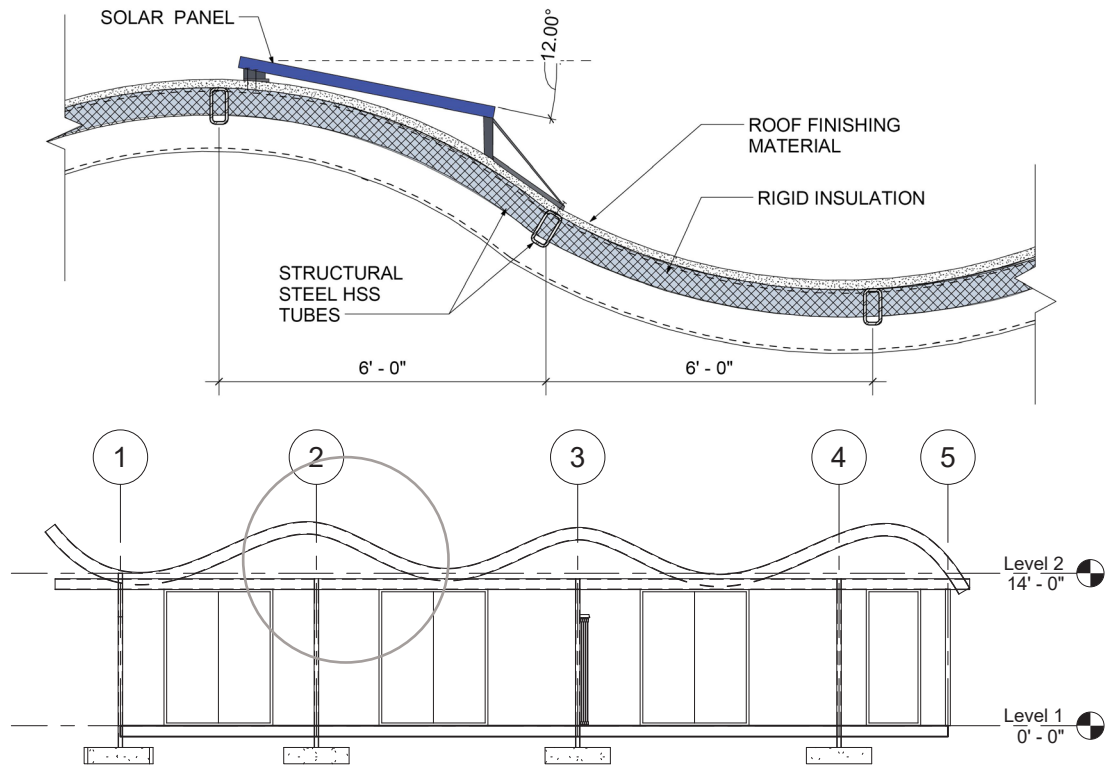
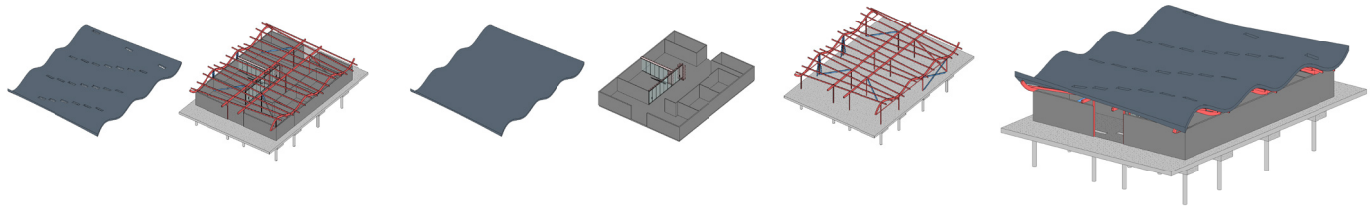
KITCHEN

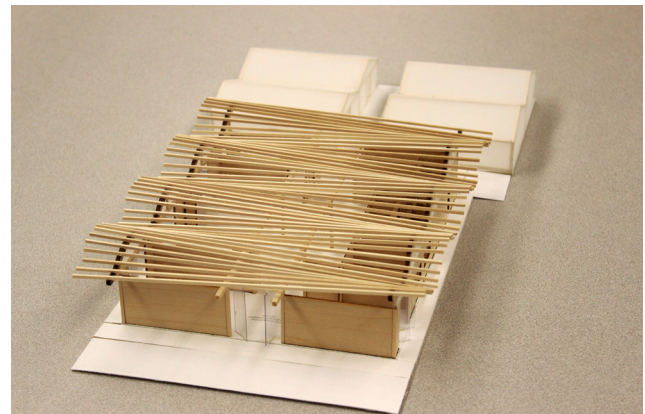
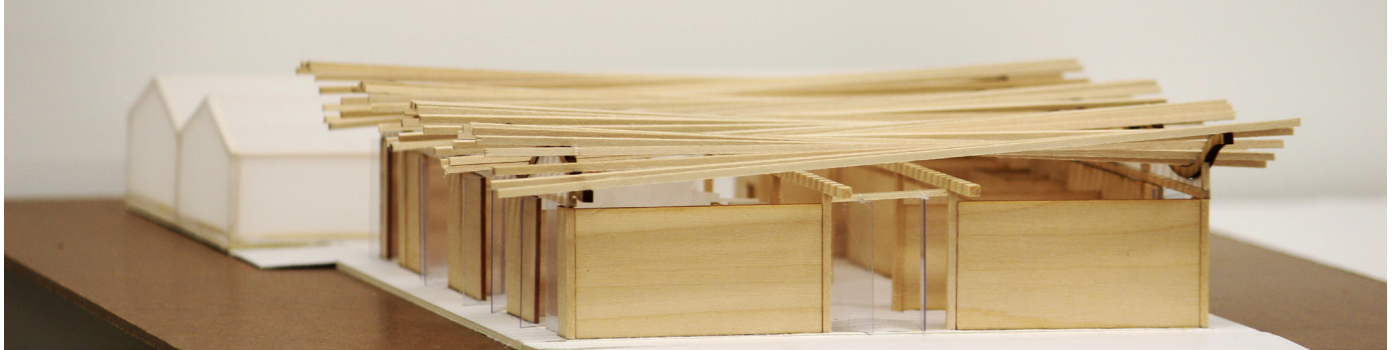
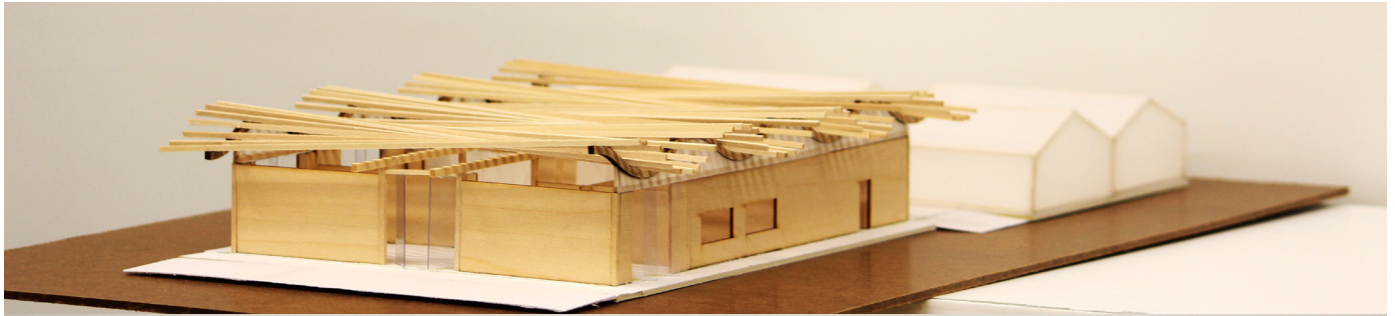


Interior



Interior





Physical Modelling



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