wasted time

wasted energy

REDUCE

WASTE

wasted space

wasted materials

Hypothesis | Project Description

My project is a design strategy for low-cost housing that produces no construction waste.

The project is a prototype for an ultra-affordable and customizable single-family home that identifies and tests and integrated system of materials and construction methods that eliminates waste typically produced during construction.

My project will be developed because the largest single source portion of waste produced in the United States is from building-related construction and demolition (30%, 135.5 million tons)* and because the average construction project yields 3.9 pounds of waste per square foot of building area.+ With a palette of compatible materials that can be assembled together with little-to-no waste during the construction period and a set of design guidelines, these residents of low-cost housing can each have their own style while being able to take pride in their home's environmental achievements. This includes the size, style and arrangement of their home, as well as their budget, in order to "assemble" all of their desired programmatic elements to their home that fits their lifestyle. The materials and design guidelines will also take into consideration the length of life, so that the maintenance throughout ownership can be to a minimum.

* [http://www.buildings.com/Default.aspx?TabId=3321&ArticleID=5758]
+ [http://www.buildings.com/Default.aspx?TabId=3321&ArticleID=5758]

Hypothesis | Project Goals

1) The construction methods and material choices will result in homes that require minimal maintenance and upkeep in order to retain their appearance, performance and value over 100 years or more.

2) Customizable components will allow for individuality in the design and configuration of each home, in spite of its low cost, without adding more time or waste to on-site construction.

3) The project will serve to prove that a systematic approach to materials and construction results in efficient and low-cost, without adding more time or waste to, on-site construction.

Below: [Resource Yard which consists of re-usable materials]

Above: [Typical Housing Construction waste]

[On-site construction waste]

wasteLESS
modular housing

Melissa Brodmarkle-Emerson

Hypothesis | Project Goals

4) This idea will decrease the amount of time spent on site during construction to customize materials by at least 50%.

5) This idea will be successful by raising awareness to the amount of waste produced during new construction.

6) This idea is important because it will maintain individuality and expression within the design process for low-cost housing.

[Construction site waste removal from a single family home]

GUIDING PRINCIPLES:

1) A home can be a personal expression of an individual or family's personality and lifestyle.

2) The design of a home can reflect individuality regardless of its construction schedule.

3) A systematic approach to the designation of materials and construction methods can result in an efficient, affordable, and easily constructed home while also allowing for the expression of individuality.

[http://www.neo.ne.gov/home_const/factsheets/const_waste_min.htm]

wasteLESS
modular housing

Melissa Brodmarkle-Emerson

Hypothesis | Stakeholders

1) Direct
   a. Families and individuals who occupy the homes

2) Indirect
   a. Consumers who are environmentally conscious
   b. United States Green Building Council

   c. Neighbors surrounding the construction site
      i. Less noise because there is limited sizing of materials
   d. Manufacturers of eco-friendly products
   e. Managers of landfills
      i. Requires less work for them to dispose of it
   f. Construction companies
      i. More planning involved
      ii. Big changes with the overall construction process
      iii. Will it be more efficient?

3) General
   a. Environmental organizations
   b. Architects
   c. Public

Site Parameters | Selection Criteria

The location within a city or state is unimportant as each house is catered to its site and the owner's needs specifically.

The site should be located in either a residential or a mixed-use neighborhood.

It should be a location that gets a decent amount of pedestrian traffic so that this modular housing unit can inform the public of its limited waste during construction.

The zoning should be scheduled for residential or small-scale mixed-use projects.

The natural landscape of the site itself does not need to be specific as the modularity of the project should be able to cater to whatever the site has to offer.

The surrounding neighborhood should not have building heights higher than 6 stories, unless the modular housing being built on the site is of similar height to the surrounding buildings.

The site should have the possibility, with its orientation and surrounding context, to have direct sunlight into the house.

The site chosen does not need to cater to a specific income of the families occupying these homes.

The site does not have to specify the family size occupying these homes.

The site does not have to specify the population density of the neighborhood.

The temperature variation of the site does not need to be a factor of consideration when choosing a site, as each individual home will be designed for the site and owner's needs specifically.

The rainfall, snowfall and prevailing winds do not need to be a factor when selecting a site, as each individual home will be designed for the site and owner's needs specifically.

Several cities throughout the United States
Can compare the items that do not need to be site specific, such as the different climatic conditions of wind, rainfall amounts, snowfall amounts, etc.

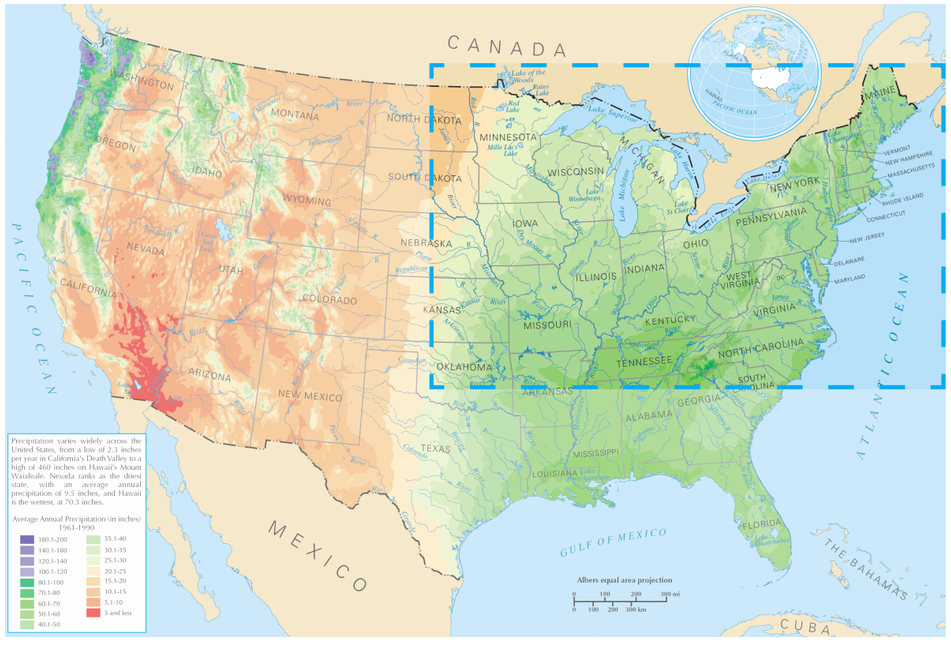
This list of criteria can help me identify how the construction and design of waste-less modular housing can change throughout the nation and I can follow-up with how this design problem can be solved.

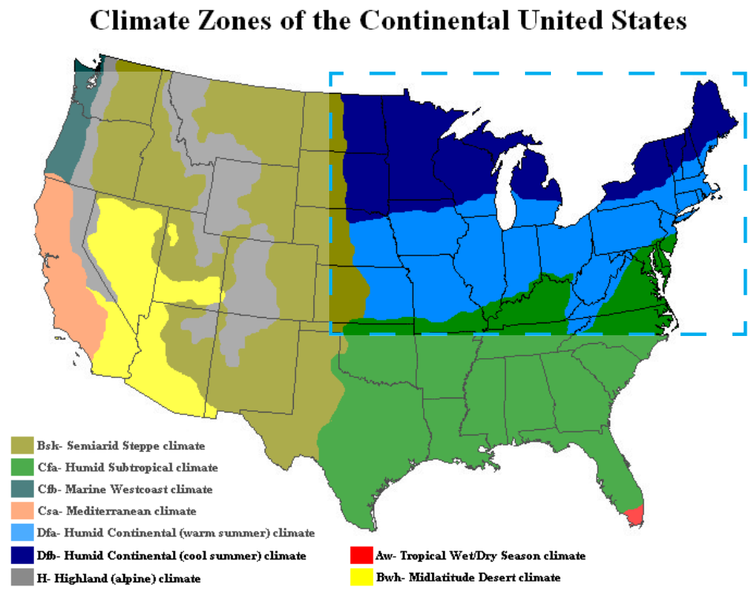
Site Parameters | Humid Continental Climate

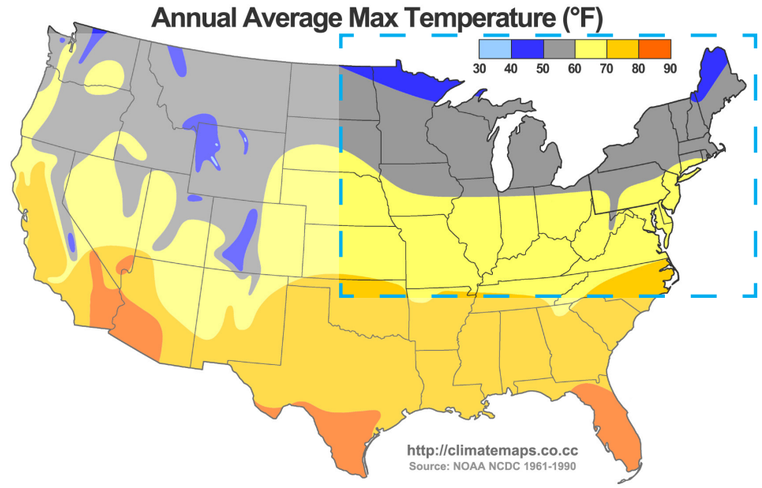
Represented in both the light blue and dark blue, this climate zone encapsulates nearly a third of the United States.

This area has the potential for severe winters months, including snow, negative temperatures and wind chills to account for.

Cities such as Chicago, Minneapolis, Cinncinati, Boston, and Washington DC are included in this climate zone.







wasteLESS
modular housing

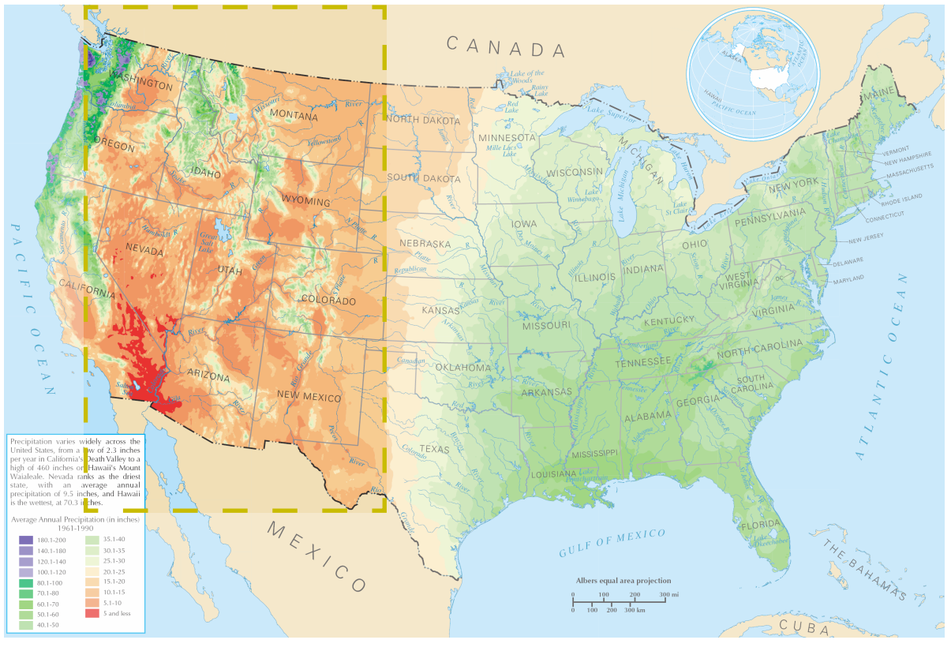
Melissa Brodmarkle-Emerson

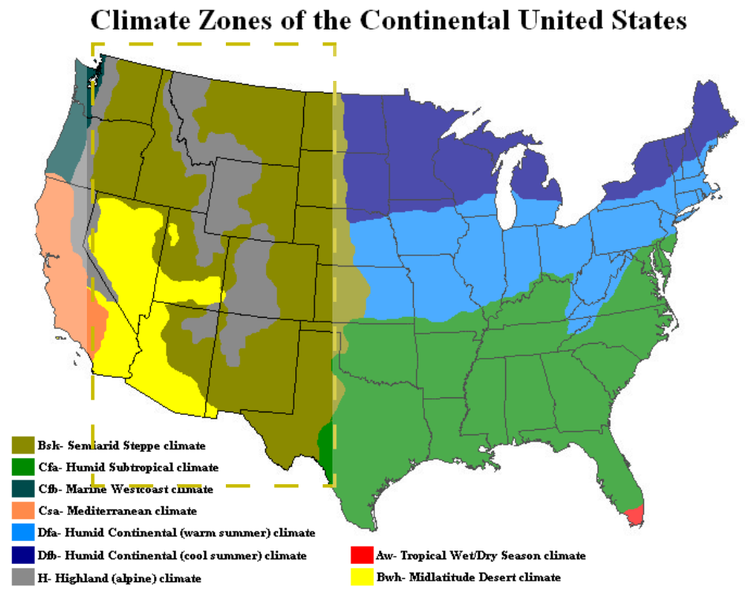
Site Parameters | Mid-Lattitude Desert Climate

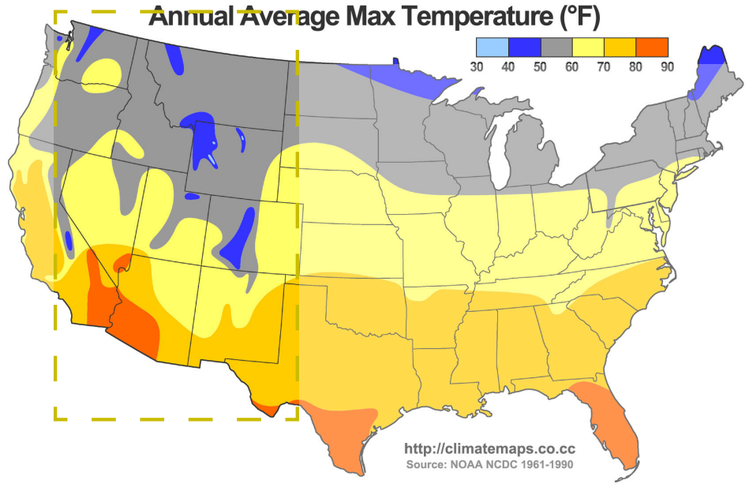
Represented in yellow, this climate zone encapsulates nearly a third of the United States.

This area has the potential for extremely dry conditions, with high temperatures during the day and low temperatures during the night.

Cities such as Las Vegas, Denver, and Pheonix are included in this climate zone.







wasteLESS
modular housing

Melissa Brodmarkle-Emerson

Other Research | Space Programming

BluHomes have spaces that are strategically designed to overlap space uses which allows for a reduction of required square footage, which results in a reduction of construction costs.

This particular design strategy gives the amount of gross to net square footage to be 90% / 10%. This is a very effecient use of space.

BluHomes [Balance]

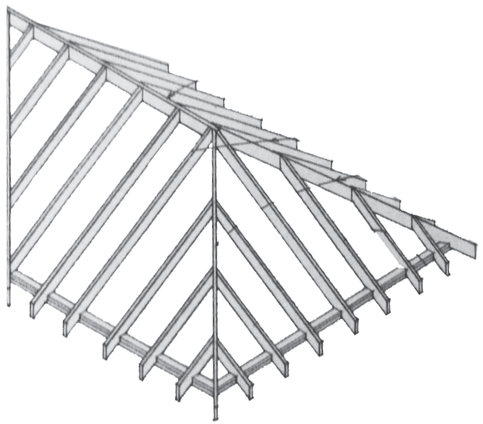
Names of the Space	SF	Net SF	#	Total Net SF	Total Gross SF
Dining/Living Area	21'x25'	556'	1	556	525
Kitchen	21' x 9'6"	200'	1	200	200
Master Bedroom	16' x 17'	272'	1	272	236
Master Bath	12' x 5'	60'	1	60	33
Closet	9' x 9'	81'	1	81	81
Bedroom 2	14' x 11'	154'	1	154	145
Bath	7'5" x 5'	38'	1	38	29
W/D	3' x 6'	18'	1	18	18
Bedroom 3	11'6" x 11'	127'	1	127	118
Mech	6' x 9'	54'	1	54	54
				1560	**1439**

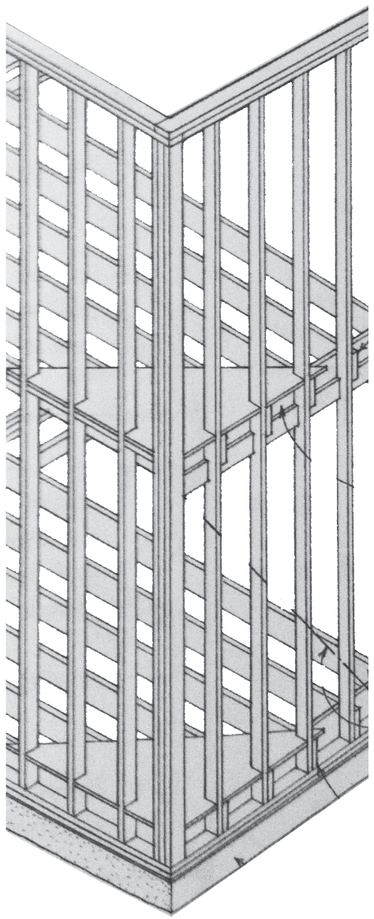
The space programming for this project will follow a similar strategy. Overlapping the program of living areas with the necessary circulation spaces significantly reduces the amount of square footage necessary for comfortable living conditions.

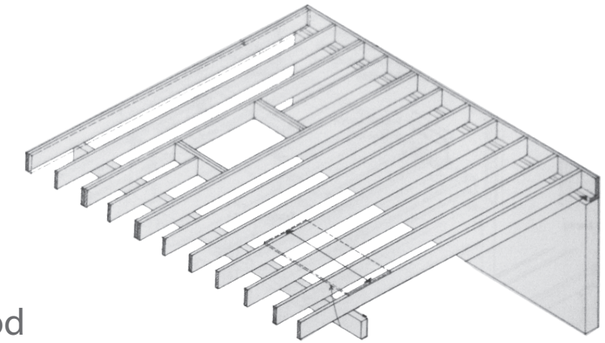
Names of the Space	Net SF	#	Total Net SF	Total Gross SF
Dining/Living Area	600'	1	600	550
Kitchen	200'	1	200	175
Master Bedroom	250'	1	250	220
Master Bath	60'	1	60	55
Closet	80'	1	80	75
Bedrooms	150'	2	300	250
Bath	40'	1	40	35
W/D	20'	1	20	18
Mech	50'	1	50	47
			1600	**1425**

Other Research | Housing Construction Types

Around 90% of all residential construction in the United States is made with wood. This type of construction is probably the most common because it is relatively quick to construct and is fairly cheap, especially in comparison to the alternatives.







Often times, with wood construction of residential buildings within the United States, the opening for windows and doors are simply cut out after the material is placed onto the framework.

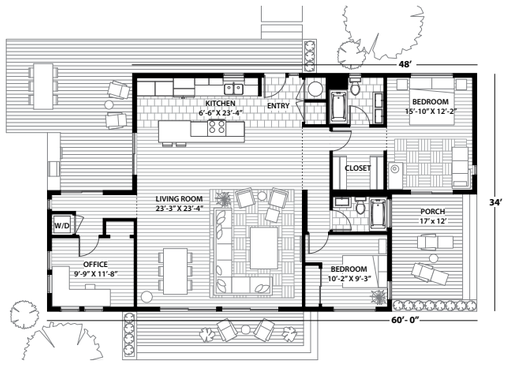
Knowing this, certain architectural moves can be done to reduce this unnecessary waste with how the openings within the framework are addressed.

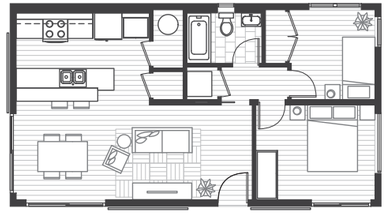
wasteLESS
modular housing

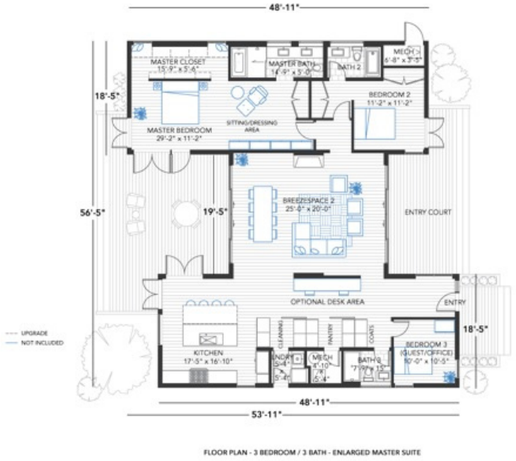
Melissa Brodmarkle-Emerson

Precendents | BLU Homes [custom prefab eco-friendly homes]

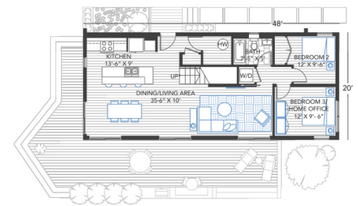
These pre-manufactured homes have a variety of styles. They also have "started homes" that can be added onto later if the size of the family increases. Their commitment to eco-technologies is also something to take note of.



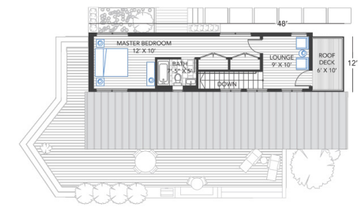




FLOOR PLAN - 3 BEDROOM / 3 BATH - ENLARGED MASTER SUITE



EVOLUTION – 3 BEDROOM GROUND FLOOR



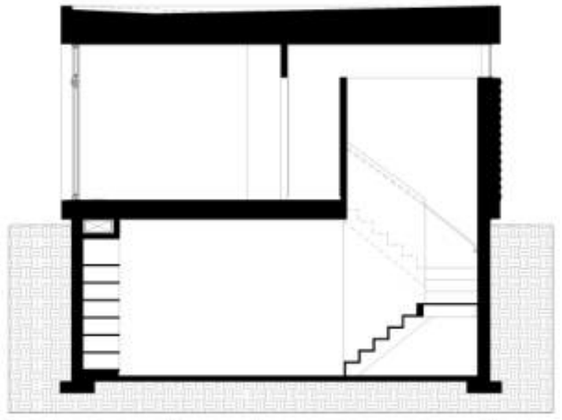
EVOLUTION – 3 BEDROOM SECOND FLOOR

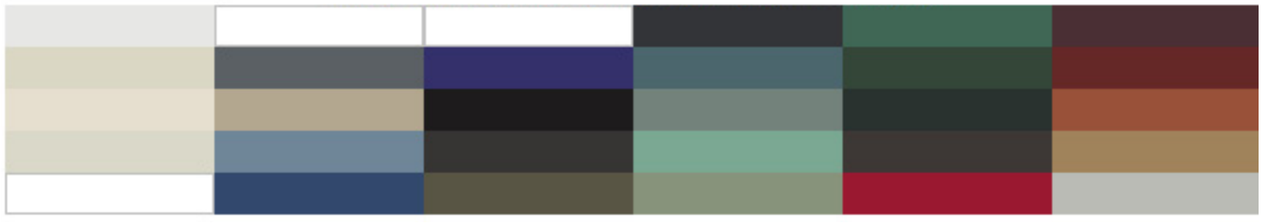
wasteLESS
modular housing

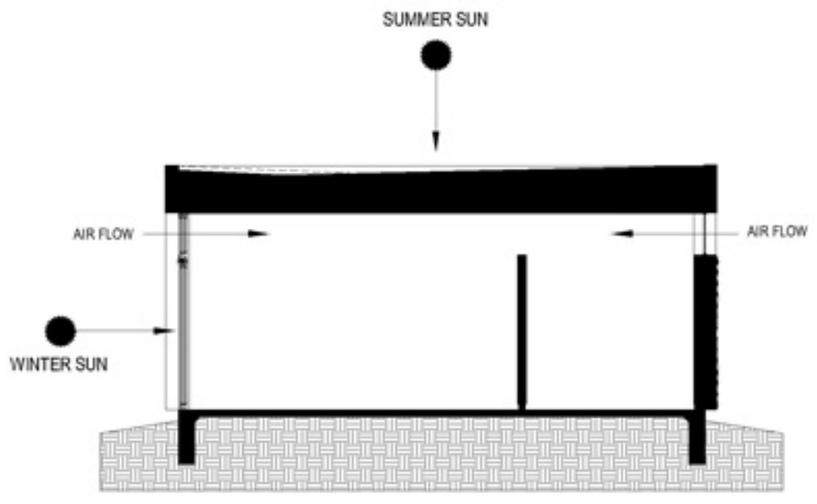
Melissa Brodmarkle-Emerson

Precendents | Rocio Romero [modern design and prefab architecture]

These pre-manufactured homes 0ffer many ways to individualize homes based on their lifestyle and preferences. Items from the color of the material used on the facade to the type of basement are all parts of the customization this firm gives to their clients.







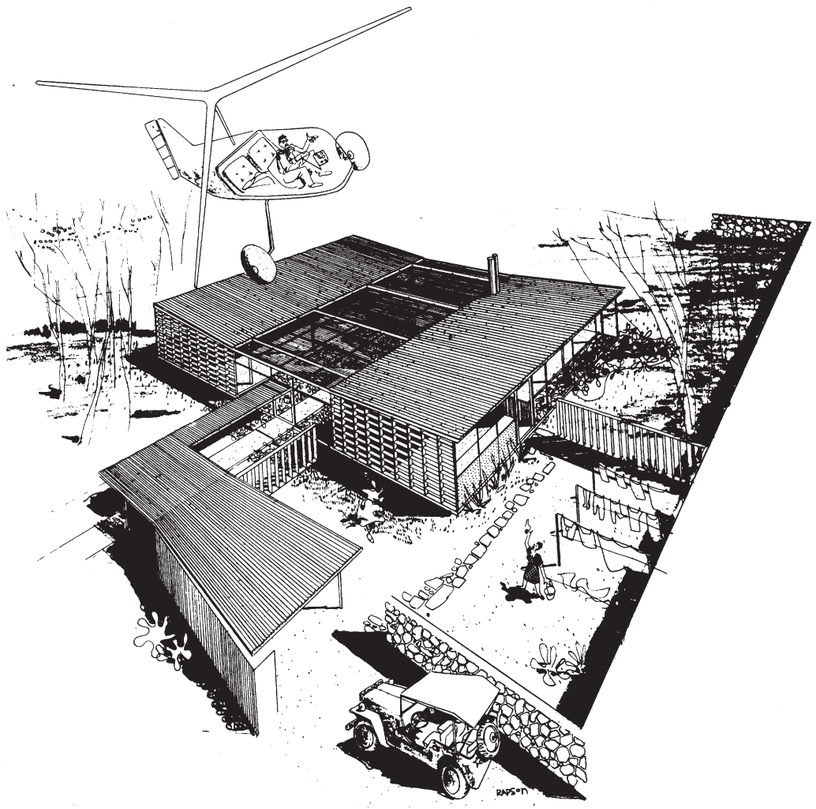
wasteLESS
modular housing

Melissa Brodmarkle-Emerson

Precendents | Rapson Greenbelt [case study house #4]

SHORT DESCRIPTION
Part of a larger movement in the between the 1940's and1960's that was trying to develop affordable, easy to construct housing for the general public because many architects were frustrated with the lack of designed homes of this time period.

SOURCES OF INFORMATION
- McCoy, Esther. Case Study Houses, 1945-1962. 2nd ed. Los Angeles: Hennessey & Ingalls, 1977. Print.
- Smith, Elizabeth A. T., and Esther McCoy. Blueprints for Modern Living: History and Legacy of The Case Study Houses. Cambridge Mass.: MIT, 1989. Print.



This is a classic case study house that focused on developing a program that the average american citizen would like an architect to be able to design at an affordable price. This particular one had a center core that doubled as living space and circulation space.

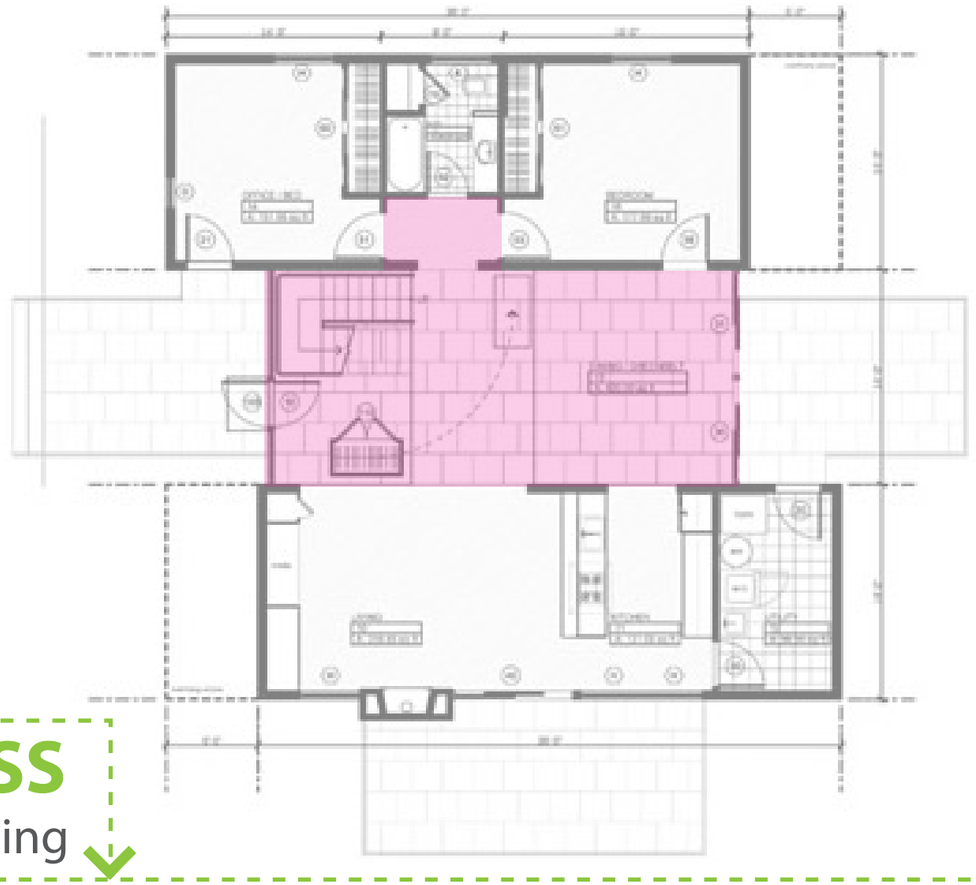
wasteLESS
modular housing

Melissa Brodmarkle-Emerson

Precendents | Modern Rapson Greenbelt [circulation]

SHORT DESCRIPTION
The Rapson Greenbelt designs (modernized from the original case study) are the perfect balance of design, value, and expandability. Greenbelt configurations range from 576 to 2,660 square feet, and are available with a wide variety of interior and exterior finishes.

SOURCES OF INFORMATION
Rapson, Ralph. "WIELER / Homes / Rapson Greenbelt / Designs / Greenbelt Designs. " WIELER / Live In A Work Of Art. WIELER. Web. 18 Sept. 2011. <http://wieler.com/homes/rapson-greenbelt/designs/all/>.

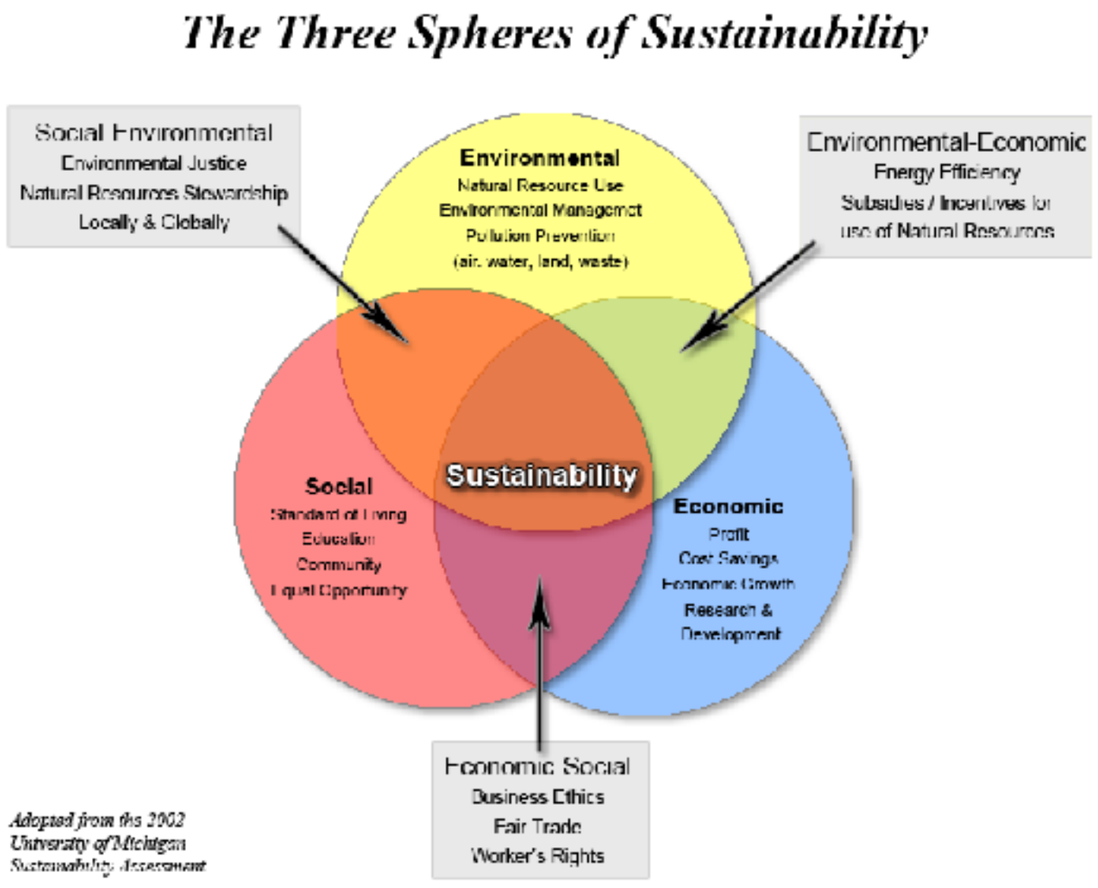


This is a modern take on the Rapson Greenbelt Case Study house. The large open floor plan allows for less necessary square footage without sacrifice. It also allows every american to have a designed house catered to their specific lifestyle.

Precendents | Modern Rapson Greenbelt [program separation]

wasteLESS
modular housing

Create **sustainable** residential options for Americans
with the ability to **personalize** for each individual's lifestyle.



wasteLESS
modular housing

Melissa Brodmarkle-Emerson

Why pre-fabrication?

- faster assembly

- better quality control

- climate controlled environment

- waste control

- cheaper labor costs

Why wood construction?

- nearly 90% of all residential construction in the USA is made with wood
  - cheaper material

- sustainable forest management

- 1 yard^3 = ↓ CO^2 emissions by ≈ 1.1 tons
  + CO^2 stored in wood ≈ 0.9 tons

saves a total of **2 tons** of CO^2 emissions

wasteLESS
modular housing

wasteLESS
modular housing

Why modular?

- can move into home faster

- customization does not considerably delay move-in time and is typically still faster than custom designed homes

- may not be able to afford a designed home otherwise

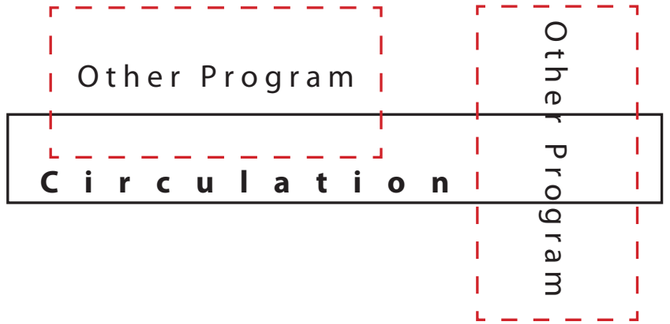
Melissa Brodmarkle-Emerson

Connection points

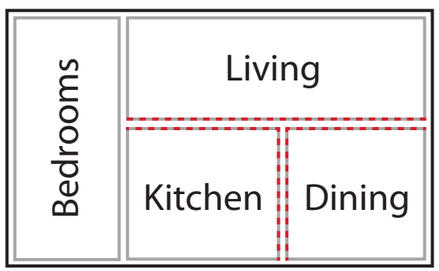
The biggest issues for modular design are the module connection points and the foundation.

Design Criteria

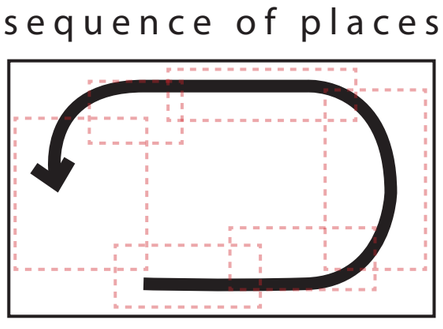
No single-use spaces:

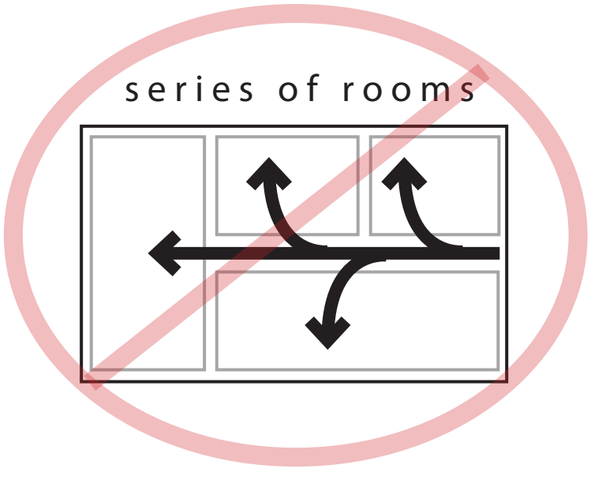


Flexibility of spaces:



Circulation flow:



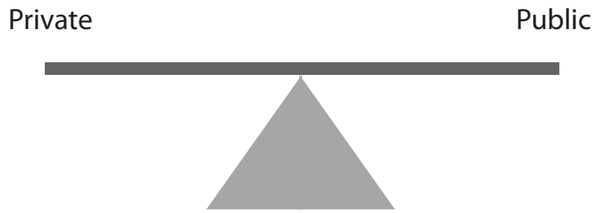


wasteLESS
modular housing

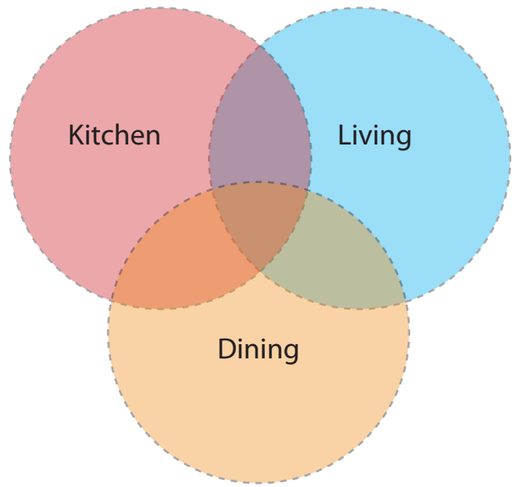
Melissa Brodmarkle-Emerson

Design Criteria

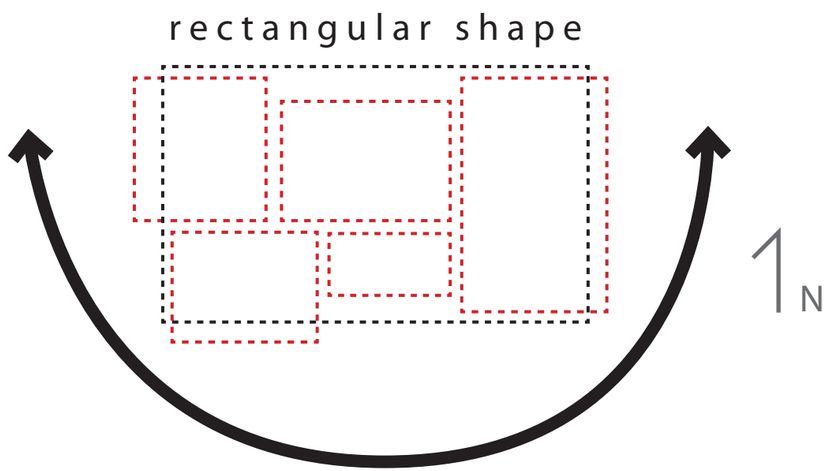
Balance of private + public:



Integrated kitchen, dining and living areas:



Solar orientation:

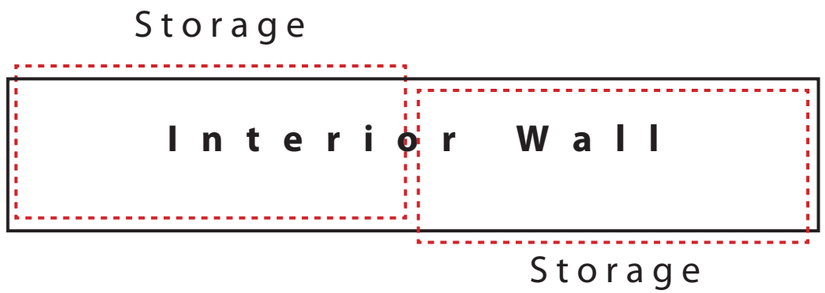


wasteLESS
modular housing

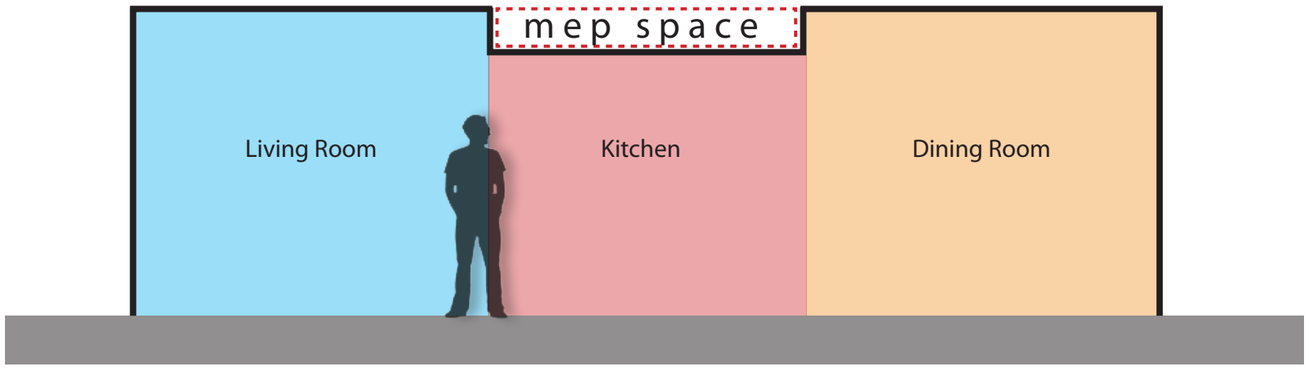
Melissa Brodmarkle-Emerson

Design Criteria

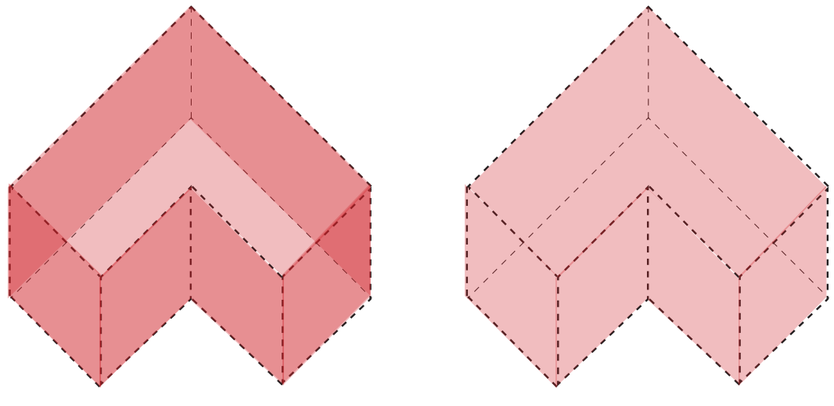
Usable wall space:



MEP Efficiency Integration:

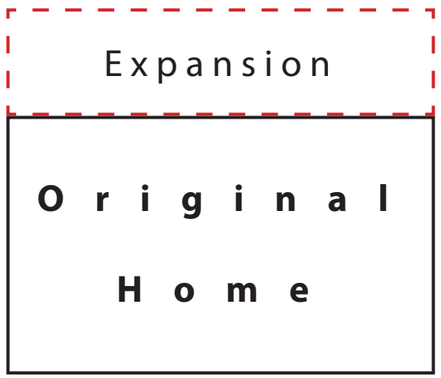


Surface to volume ratio:

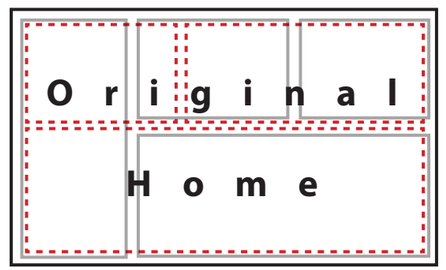


Design Criteria

Ability to change over time:

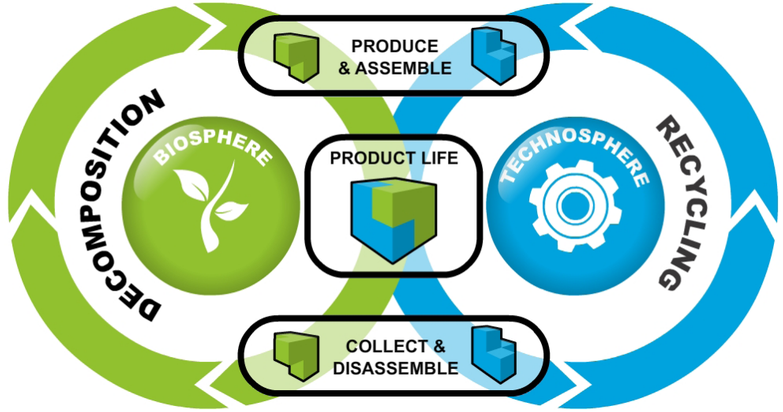


Flexibility in spatial arrangment over time



Materials selection:

(LCA, recycled or reused?)



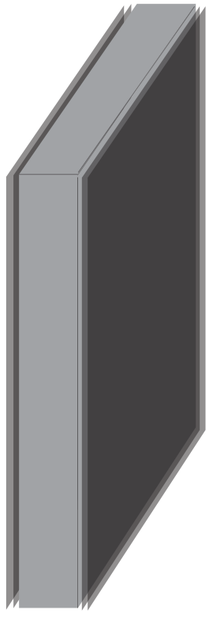
cradle to cradle

wasteLESS
modular housing

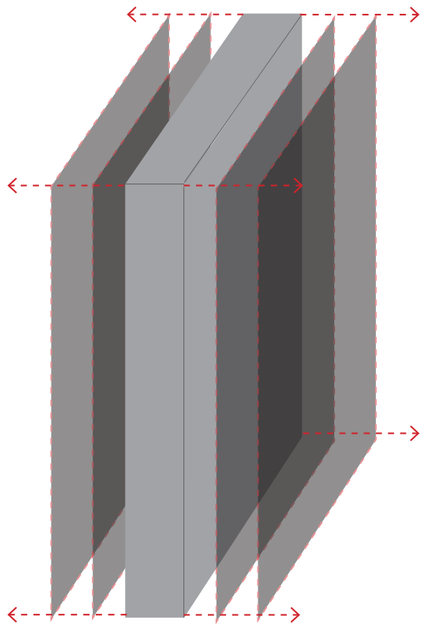
Melissa Brodmarkle-Emerson

Design Criteria

Adherence of materials within the module:

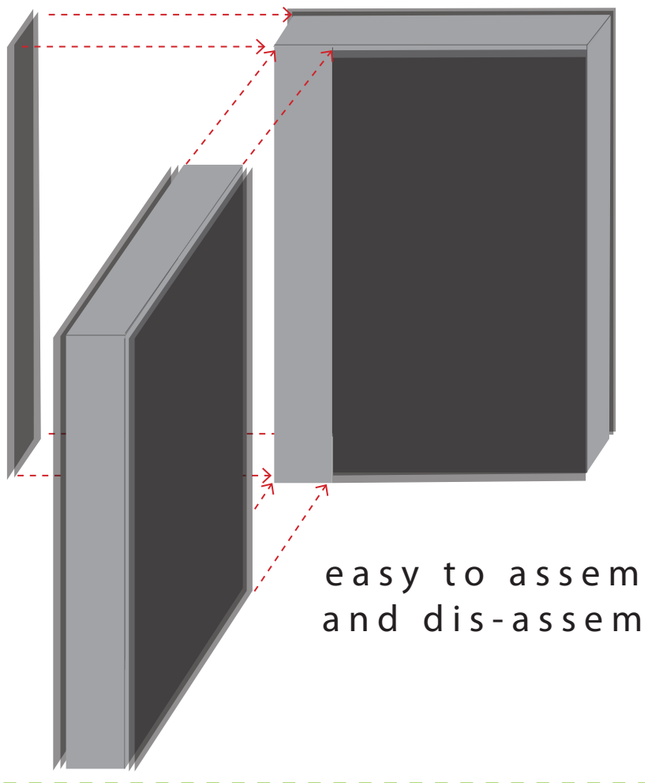


assembled materials

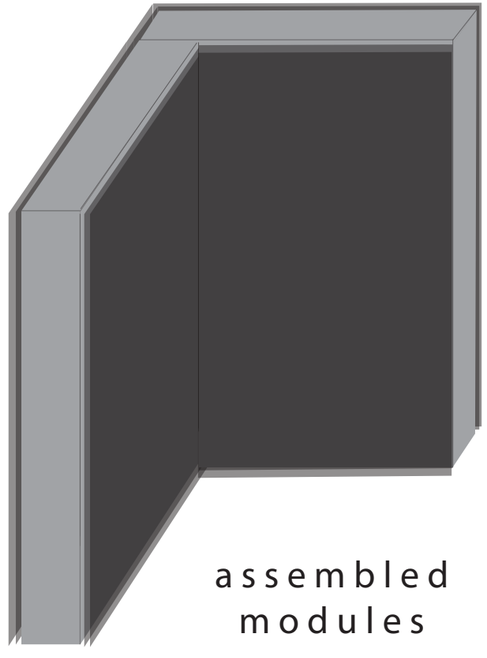


dis-assembled materials

Connection points:



easy to assemble and dis-assemble

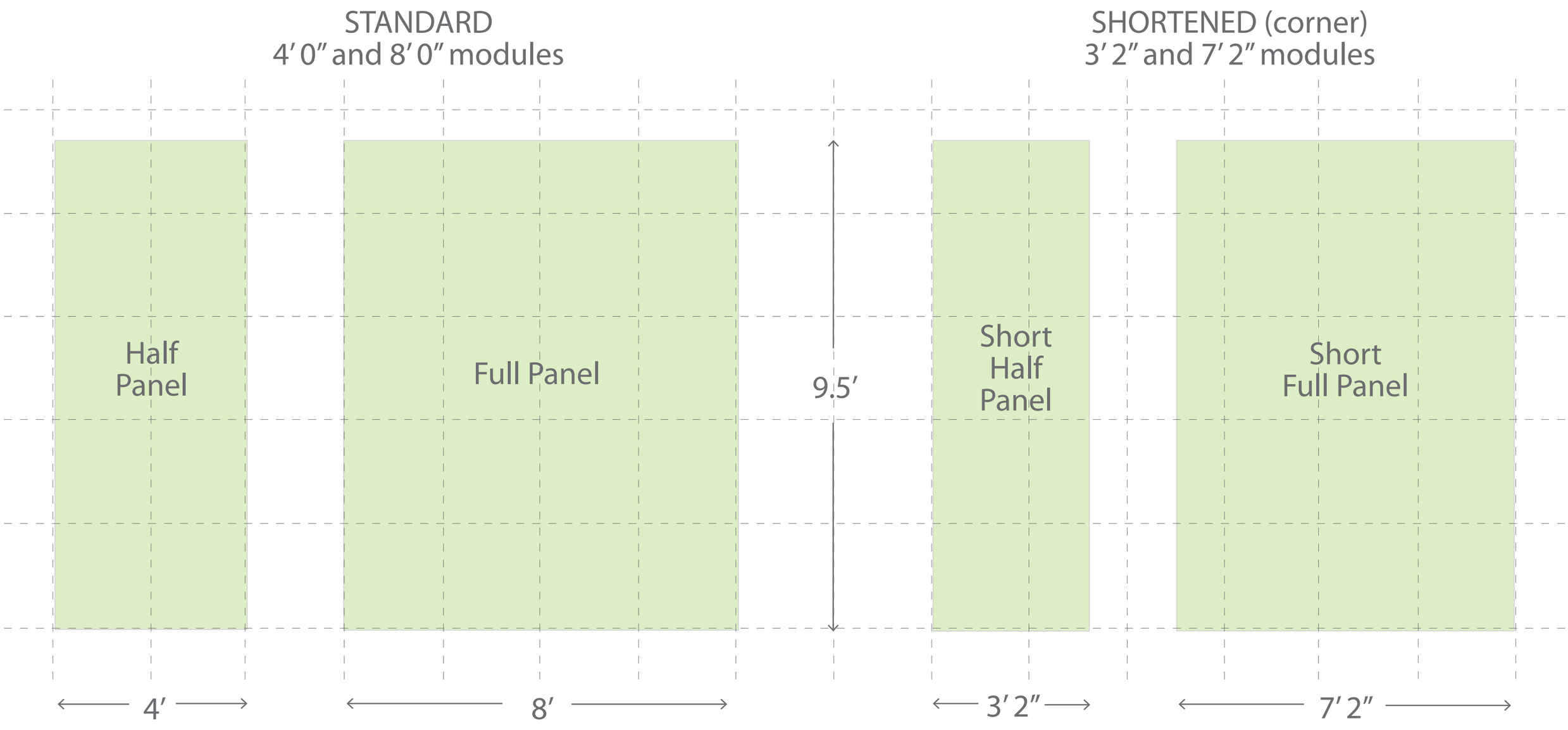


assembled modules

wasteLESS
modular housing

Melissa Brodmarkle-Emerson

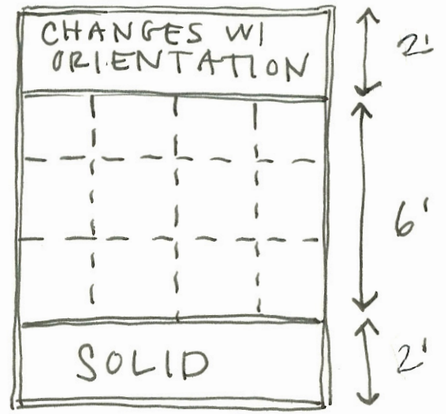
Exterior Panel Sizes

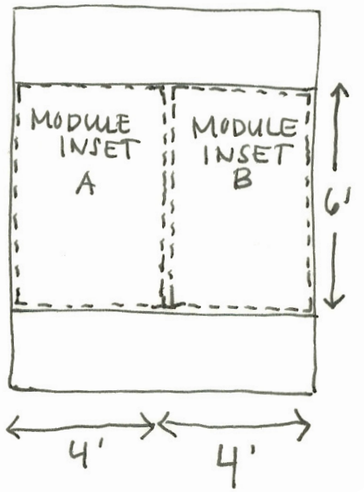


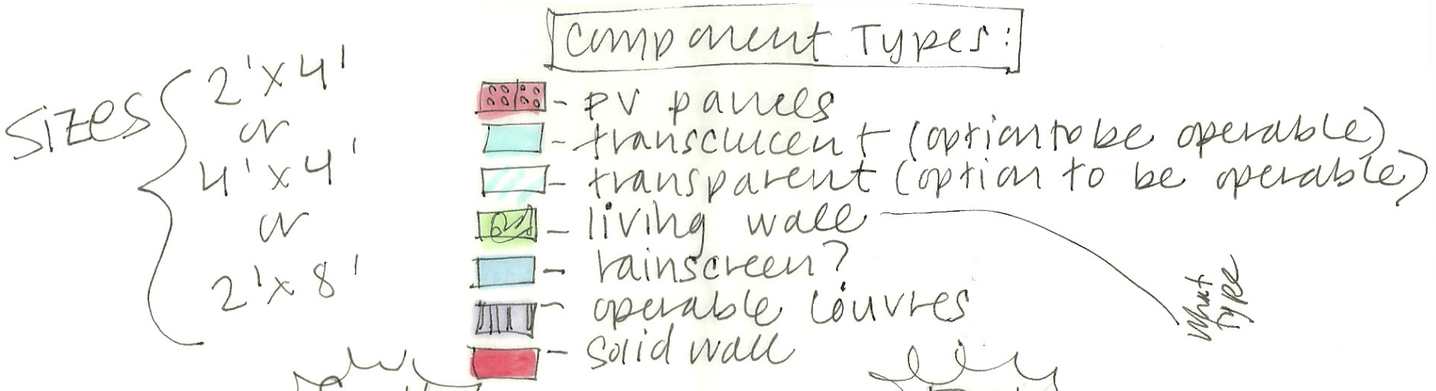
wasteLESS
modular housing

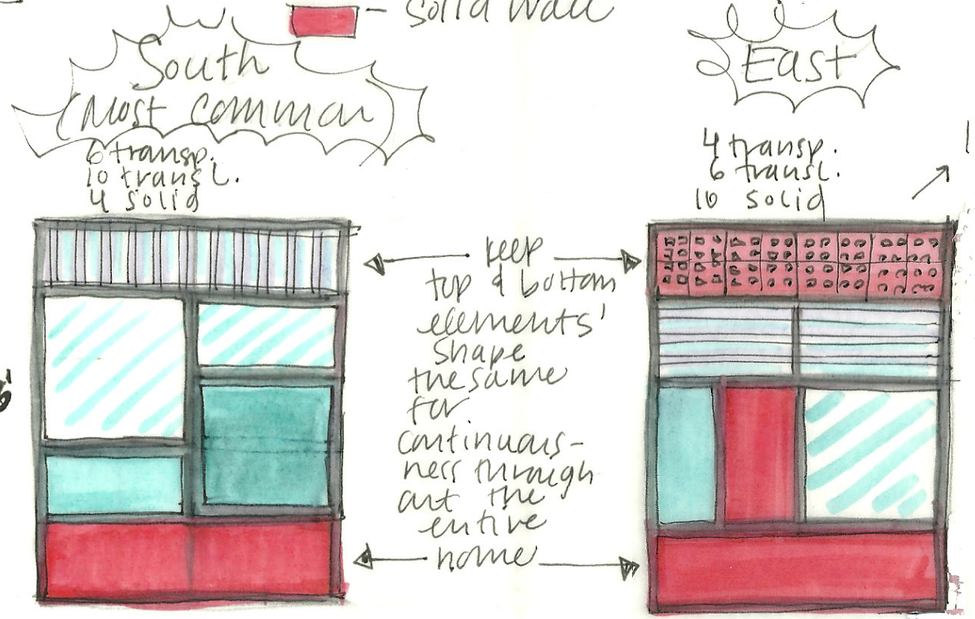
Melissa Brodmarkle-Emerson

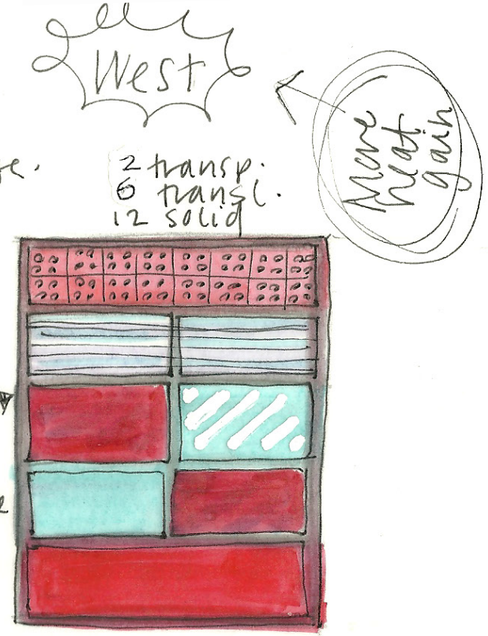
Process | Panel Customization









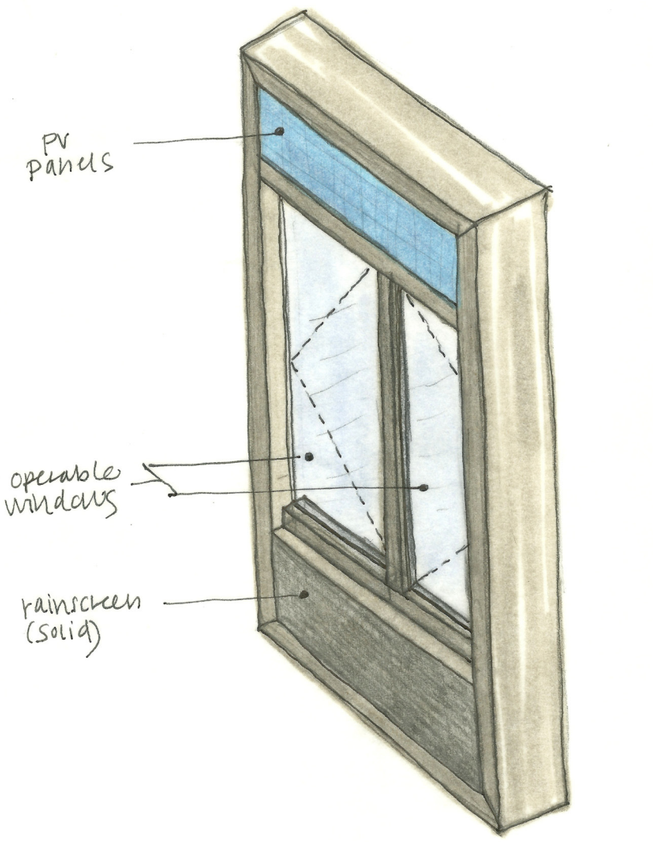


wasteLESS
modular housing

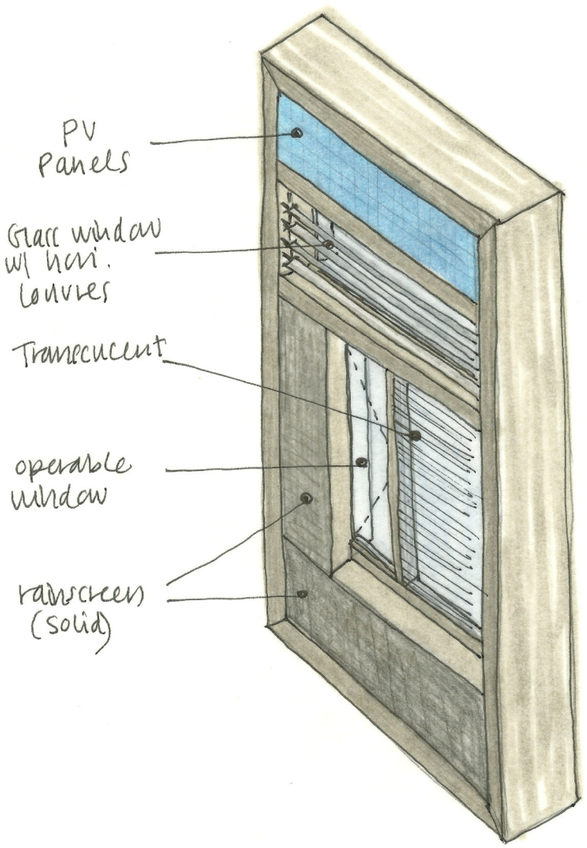
Melissa Brodmarkle-Emerson

* East & West will have alt. exterior shading devices as an option (recommended)

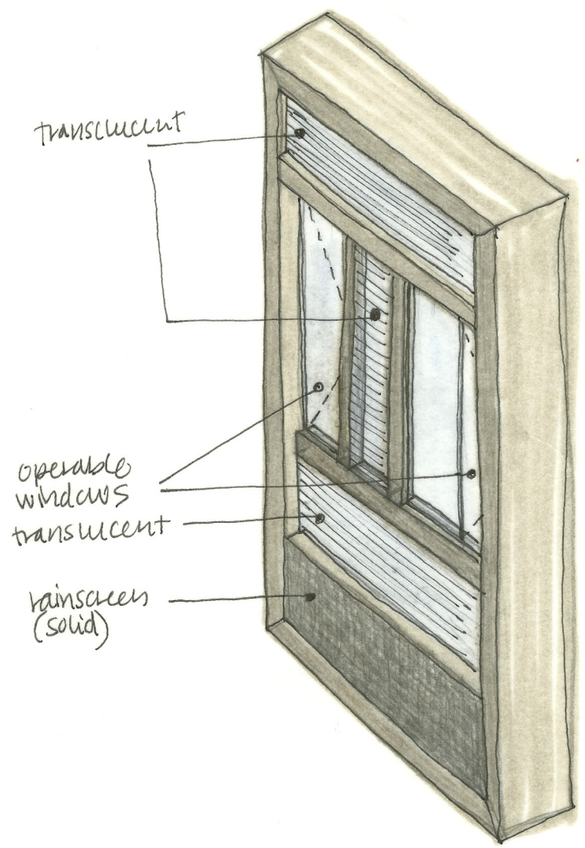
Process | Panel Customization



LIVING AREA PANEL
EAST



BATHROOM PANEL
EAST



BEDROOM PANEL
NORTH

wasteLESS
modular housing

Melissa Brodmarkle-Emerson

Climate Zones of the USA:

Northwest Pacific

(Includes states like Oregon and Washington to the crest of the Cascade Mountains)
This is the perhaps the wettest part of the country. There are scattered rain showers all year round. Temperatures are mild averaging around 40 degree F. (32.2 degree C). The summer months are pleasantly warmer but never too hot. You can see fogs along the coast during the warmer weather but the fog is less dense during mid-day.

Mid/South Pacific

(Includes states like California, Idaho, Montana, Wyoming, Colorado, Utah and Nevada)
These states have generally dry and delightful summers. California has excellent weather all the year round, with the northern part of the state somewhat cooler (quiet chilly in the winter but seldom freezing). There are very few places in California that experience snow, and the state is known for its nice weather. Mostly all the cities have tolerable winters. The winter months in the other states like Montana, Idaho and Wyoming can be very cold, with temperatures dropping well below 0 degree F. Colorado, Utah and Nevada are known for their excellent skiing.

Midwest

(Includes states like Dakotas, Kansas, Illinois, Iowa, Minnesota, Wisconsin, Michigan, and Indiana)
This region is moderately dry. Precipitation occurs mainly in late spring and early summer. Summers are pleasant but winter time can be harsh, with lots of snow and heavy chilly winds. Extremes within the Midwest can drop down to -50 degree F.

Northeast

(Includes states like Ohio, Pennsylvania, Washington DC, Maryland)
This entire area is moderately rainy. In winter, the region experiences heavy snow and freezing rain. Summers are usually pleasant, sunny and warm. The fall is especially beautiful in wooded areas.

Southeast

(Includes states like portions of Arkansas and Louisiana, Kentucky, West Virginia, Virginia)
Like the Northeast, this entire area experiences moderate rains fairly evenly throughout the year. The Spring, Summer and Fall seasons are all very pleasant. Some snow and freezing rain falls in winter but for the most part, the winters are quite mild and short lived. Southern Florida, like California, usually has excellent weather all the year round.

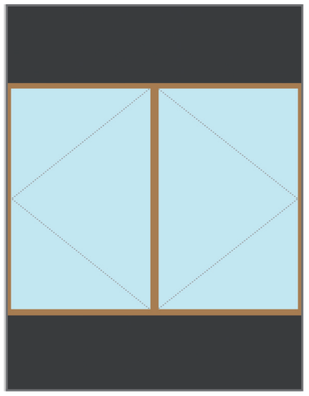
Southwest

(Includes states like Arizona, New Mexico, Texas, Oklahoma and western portions of Arkansas and Louisiana)
This is the hottest and high rainfall region of the US. You must be prepared to face heavy rains accompanied with thunder storms, dangerous lightening and occasional tornadoes. The winters are generally short but some freezing rains do occur. The spring and fall seasons are quite long and temperatures are generally excellent. The summers are very hot with temperatures approaching and exceeding 100 degree F on many days.

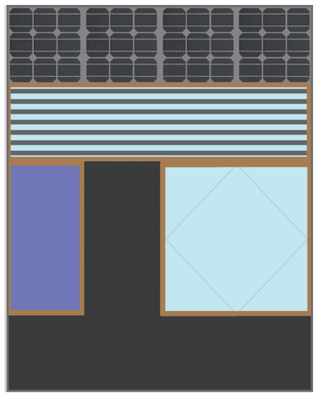
Midwest Catalog of Exterior Panels

LIVING AREA PANELS

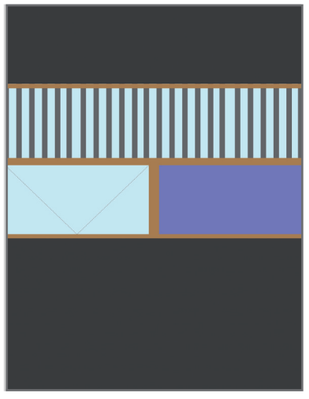
North



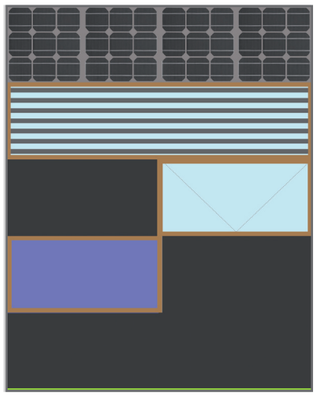
East



South

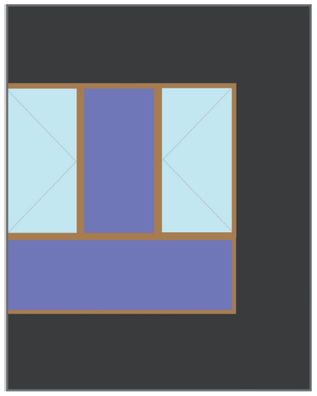


West

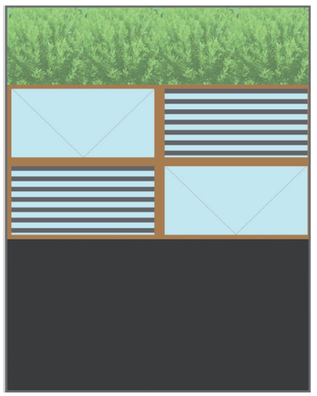


BEDROOM PANELS

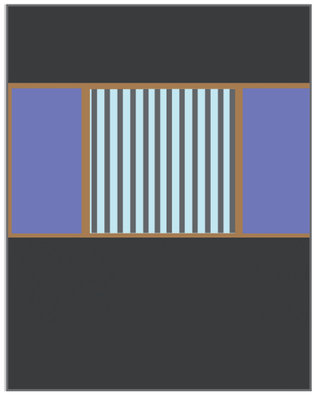
North



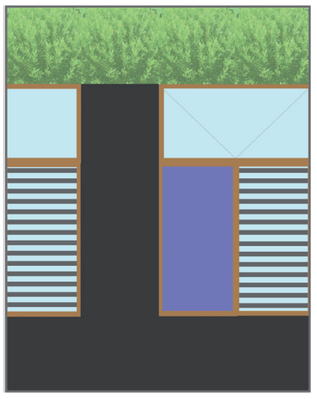
East



South

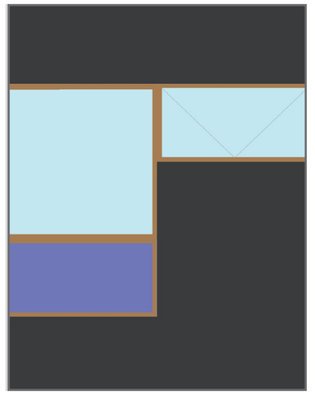


West

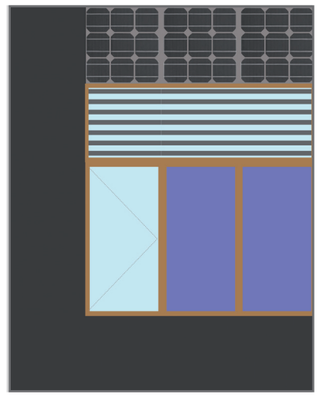


BATHROOM PANELS

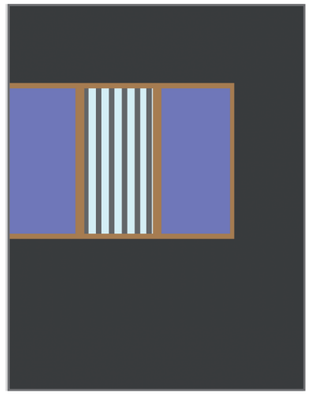
North



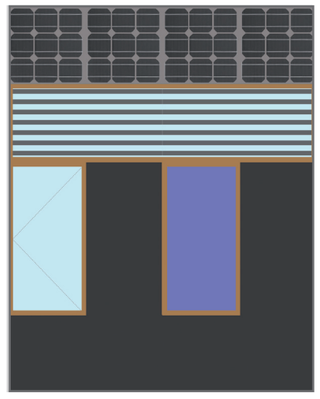
East



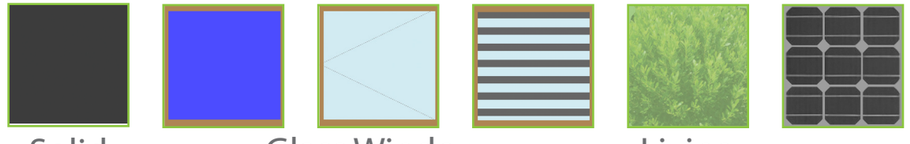
South



West



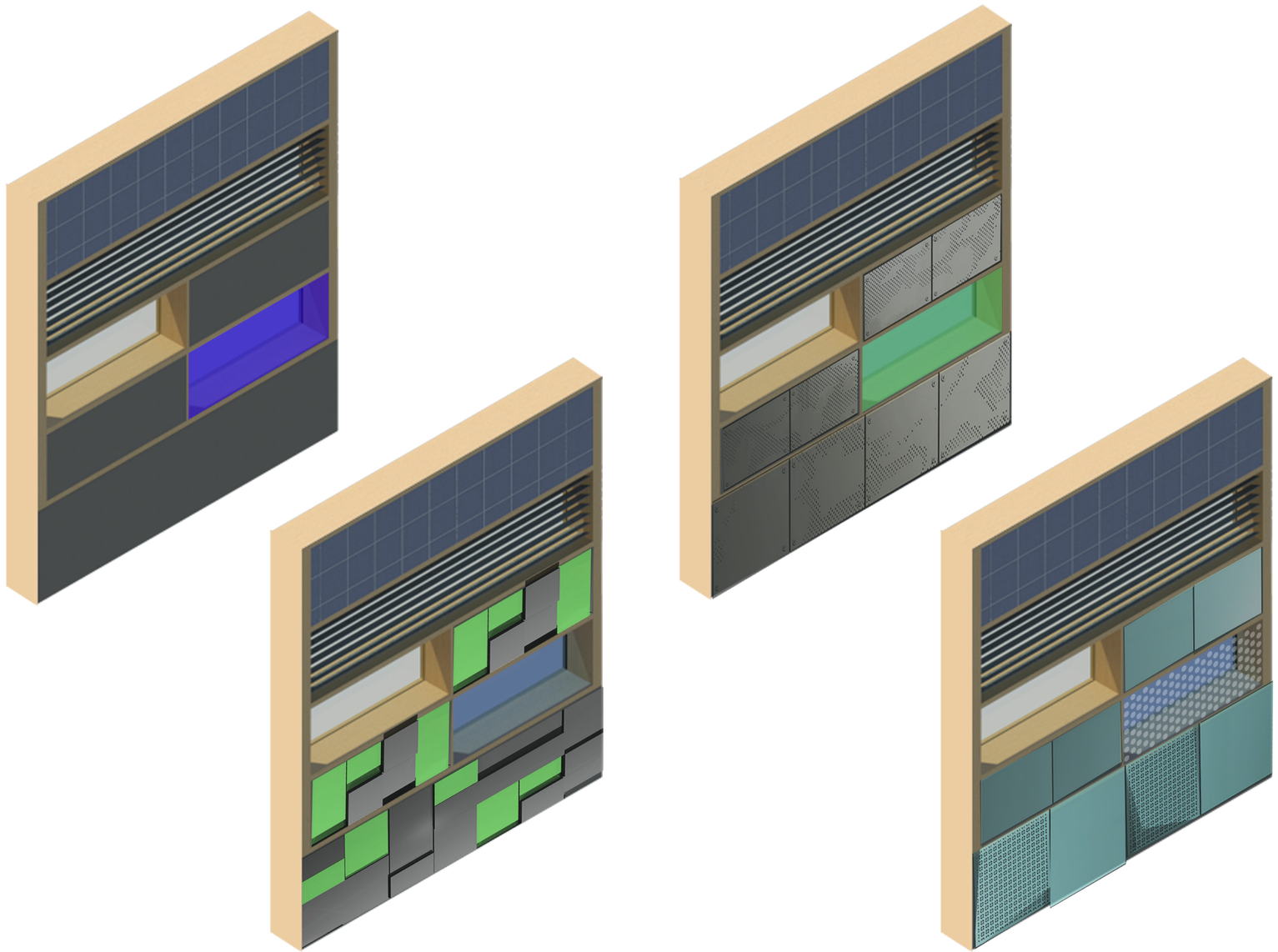
KEY:



wasteLESS
modular housing

Melissa Brodmarkle-Emerson

Homeowner Customization



Each homeowner can customize the exterior aesthetic that fits their style:

The rainscreen panels can have texture, reflectivity, perforations, or color.

The transluscent glass windows can be frosted, colored, or fritted

wasteLESS

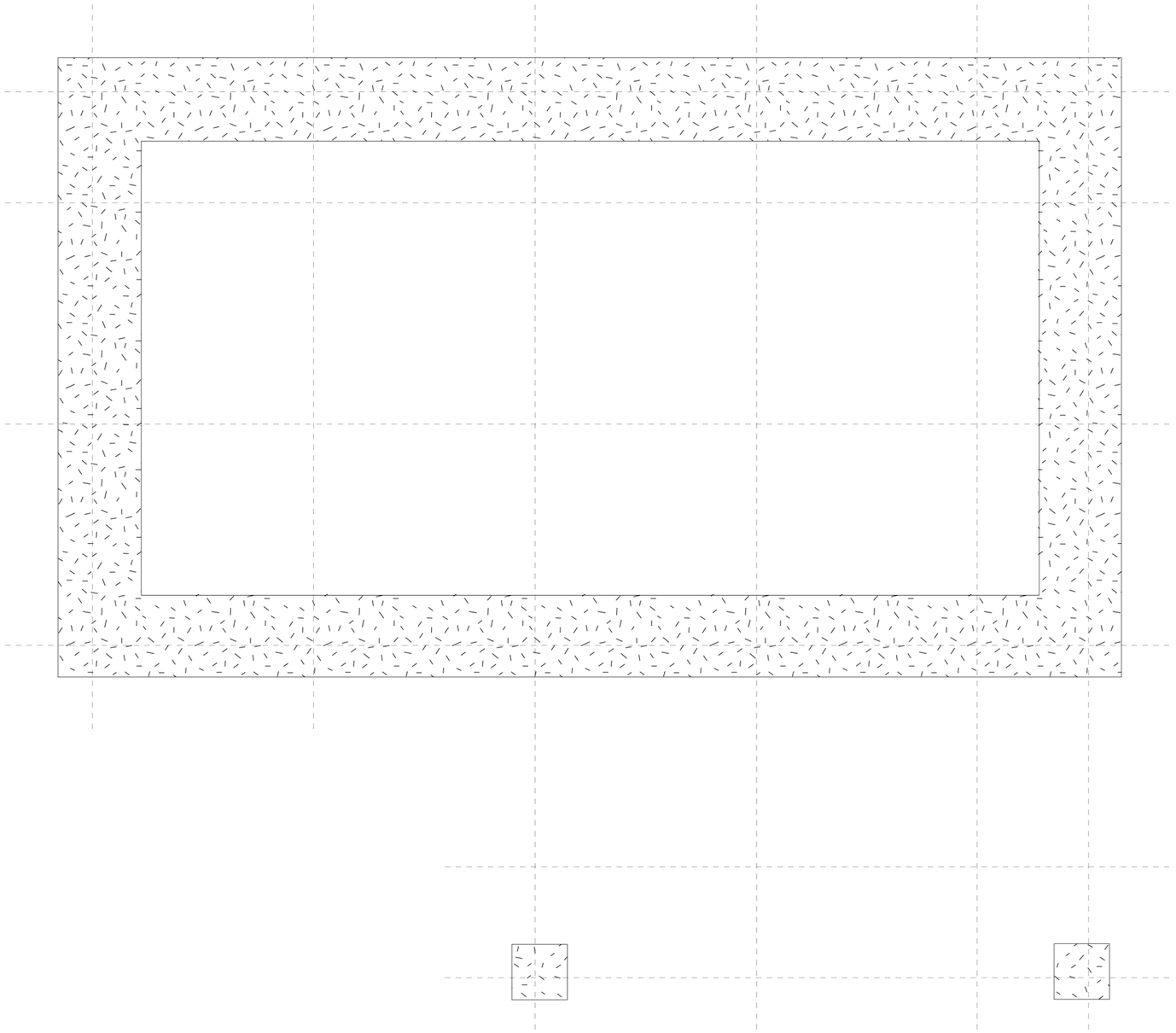
modular housing

Melissa Brodmarkle-Emerson

wasteLESS

Melissa Brodmarkle-Emerson

Foundation



Main Level

wasteLESS
modular housing

Melissa Brodmarkle-Emerson

Main Level | Modules

wasteLESS
modular housing

Melissa Brodmarkle-Emerson

Upper Level

wasteLESS
modular housing

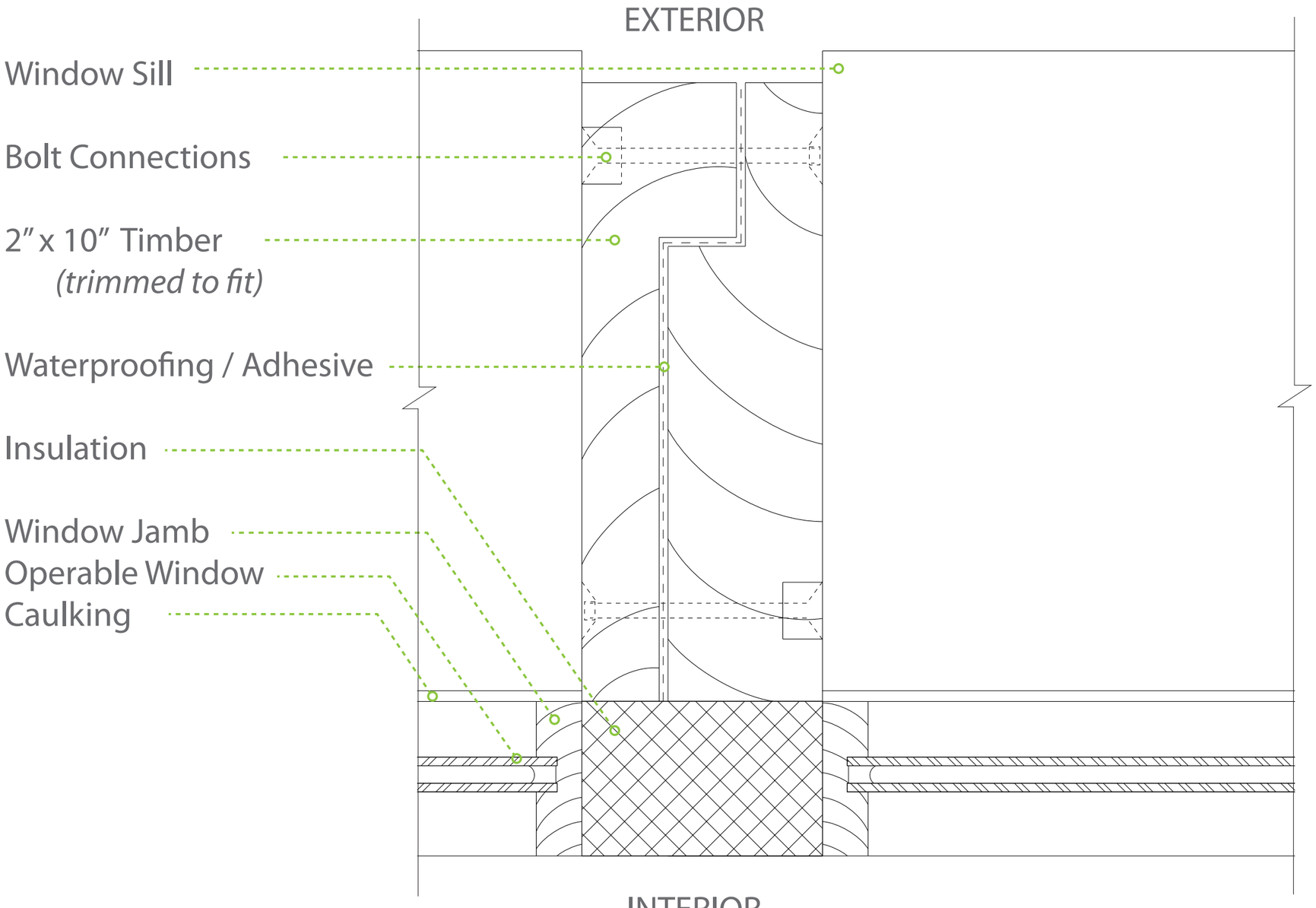
Melissa Brodmarkle-Emerson

Upper Level | Modules

wasteLESS
modular housing

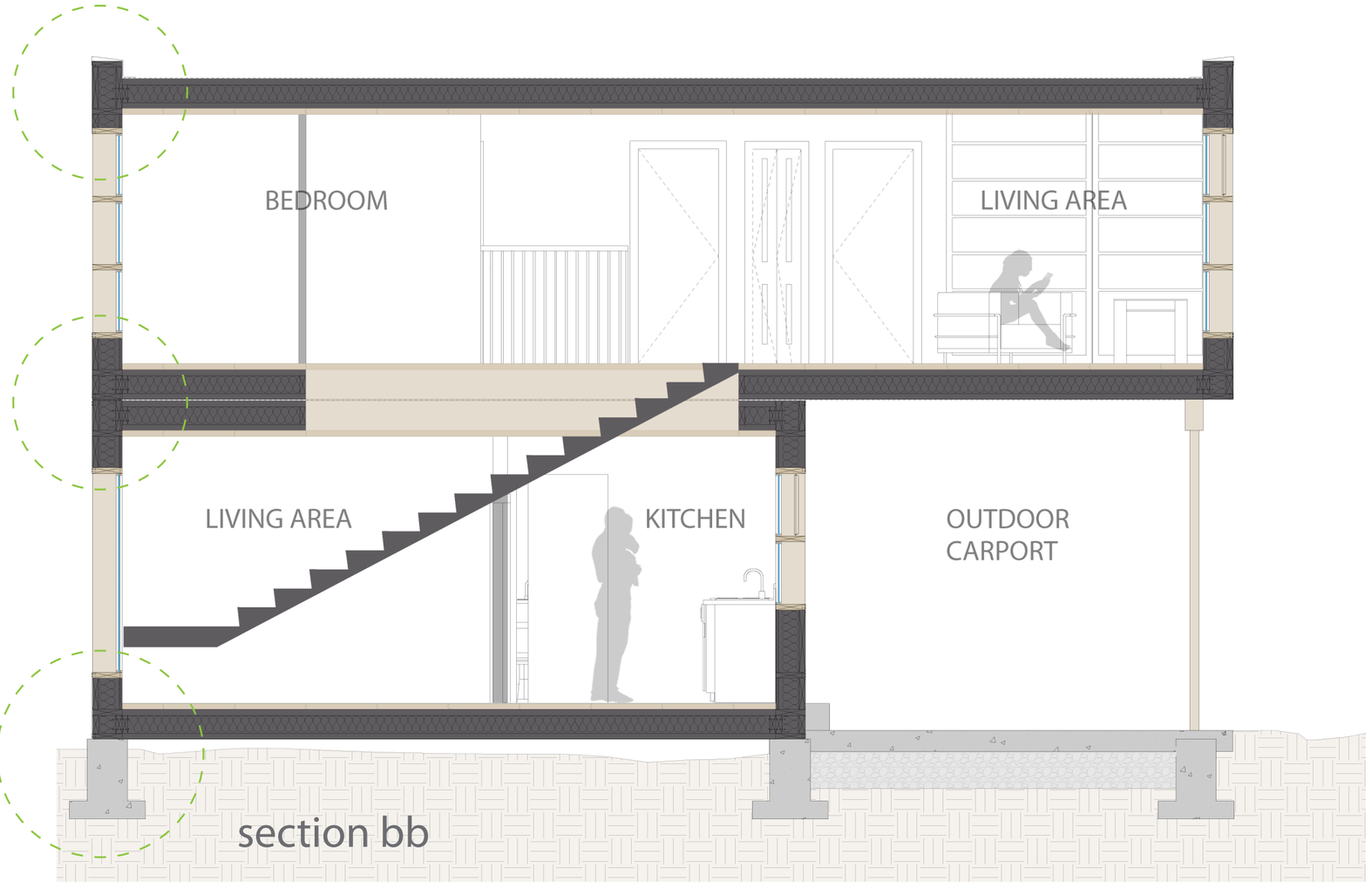
Melissa Brodmarkle-Emerson

Panel-to-Panel



wasteLESS
modular housing

Melissa Brodmarkle-Emerson

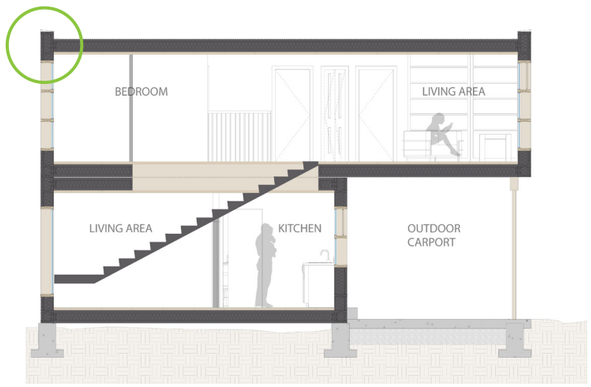


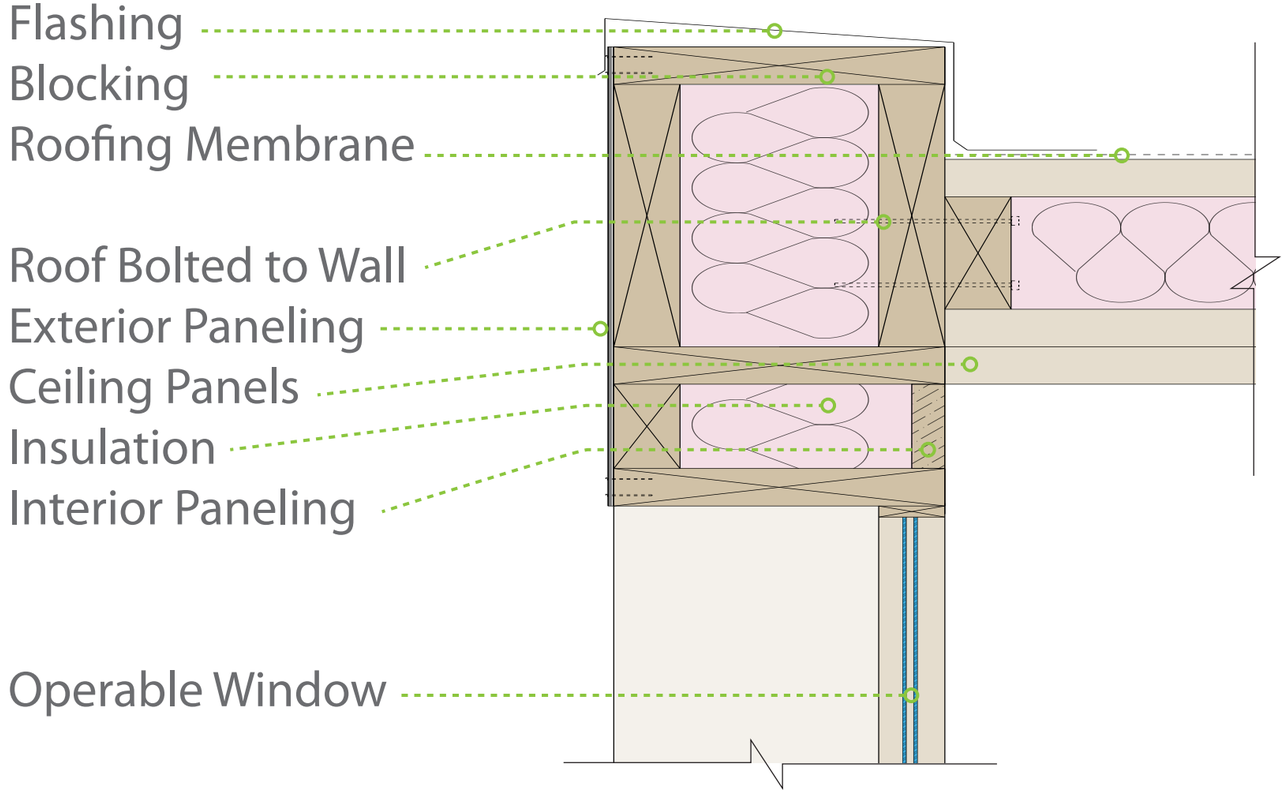
section bb

wasteLESS
modular housing

Melissa Brodmarkle-Emerson

Roof-to-Panel

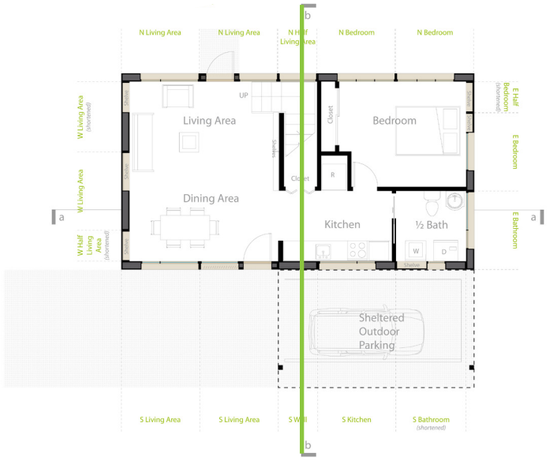


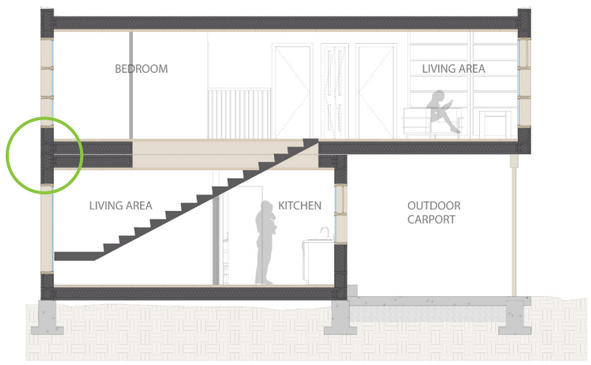


wasteLESS
modular housing

Melissa Brodmarkle-Emerson

Floor-to-Panel





Translucent Glass

Blocking

Insulation

Flooring

Floor Bolted to Wall

Roofing Membrane

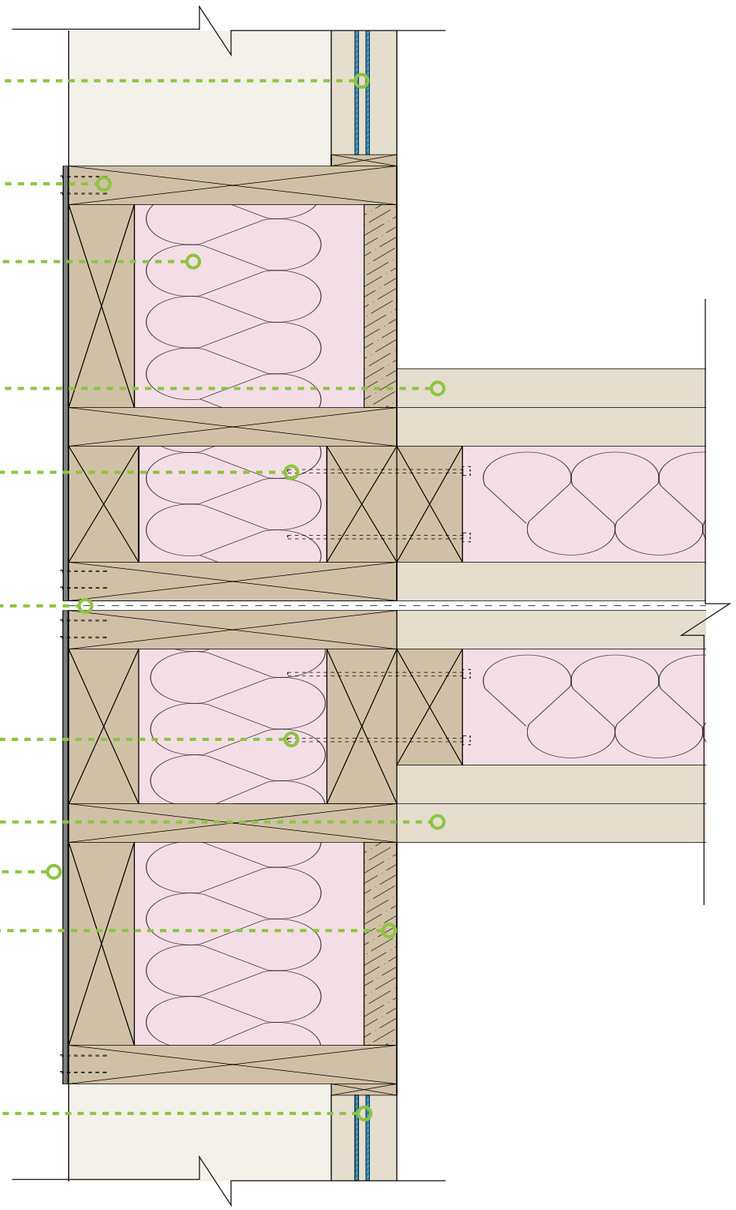
Ceiling Bolted to Wall

Ceiling Panels

Exterior Paneling

Interior Paneling

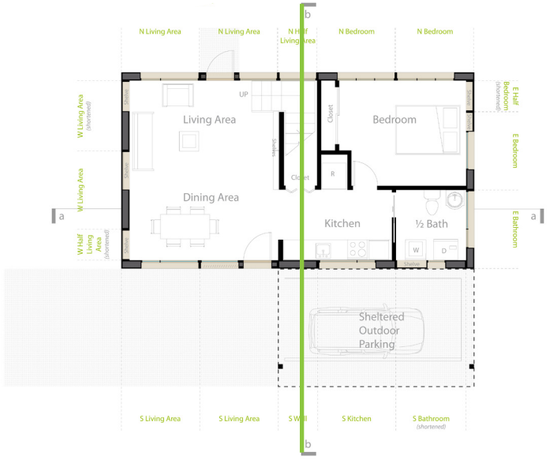
Operable Window

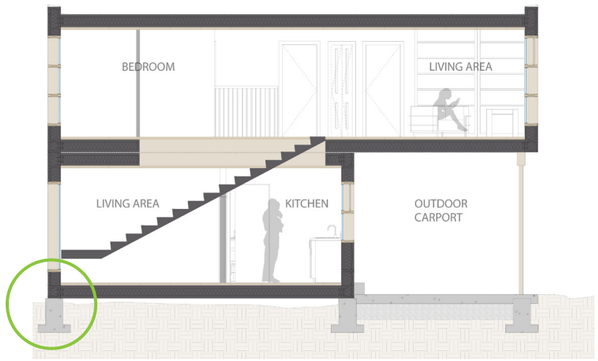


wasteLESS
modular housing

Melissa Brodmarkle-Emerson

Foundation-to-Floor-Panel





Exterior Paneling

Floor Panels

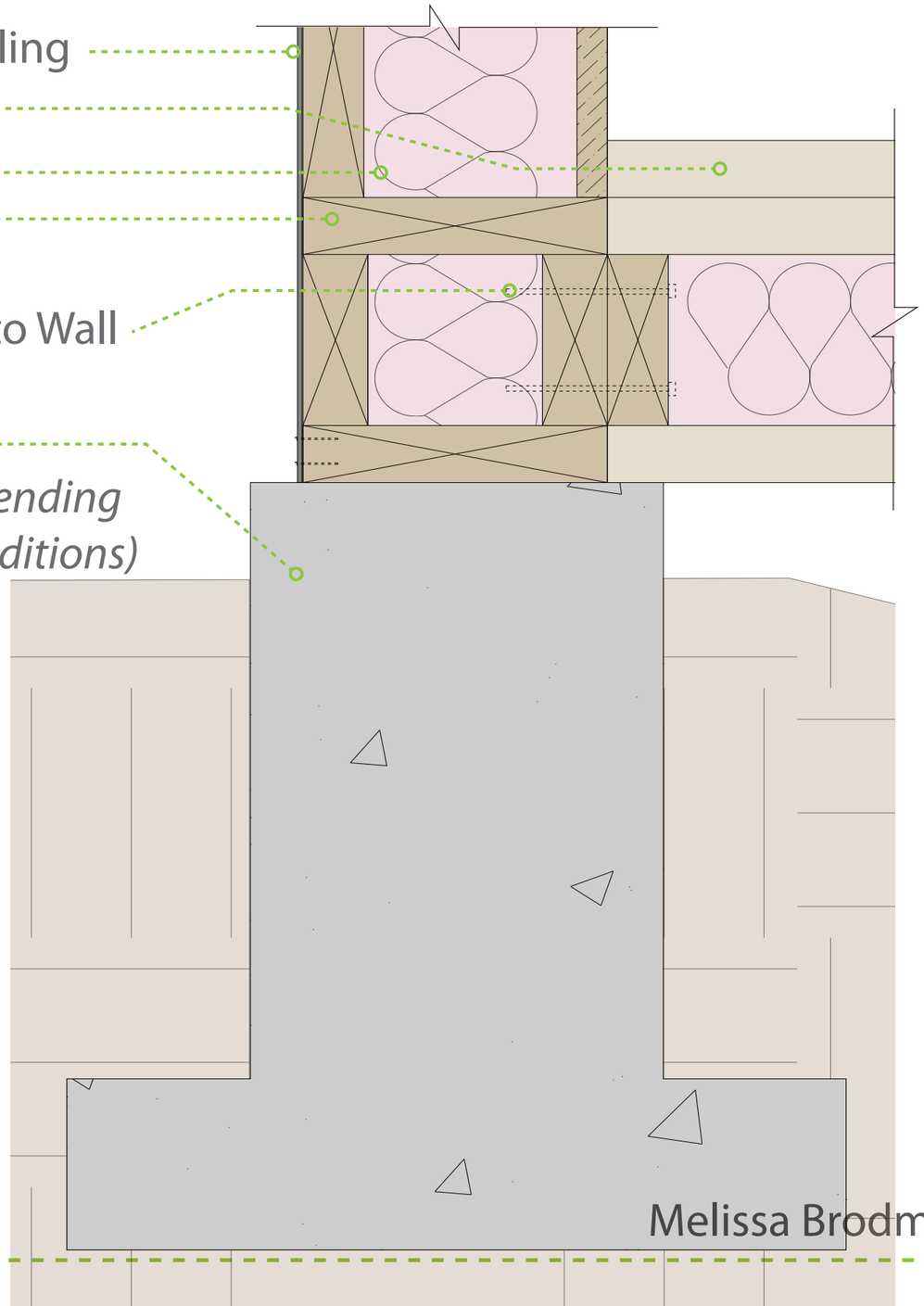
Insulation

Blocking

Floor Bolted to Wall

Foundation

(varies depending on soil conditions)



wasteLESS
modular housing

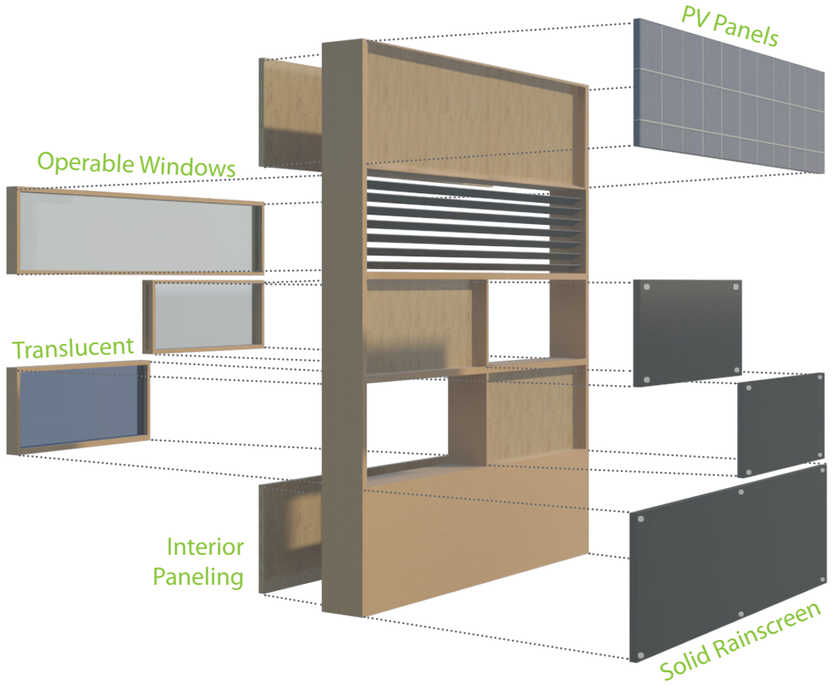
Melissa Brodmarkle-Emerson

North West Façade

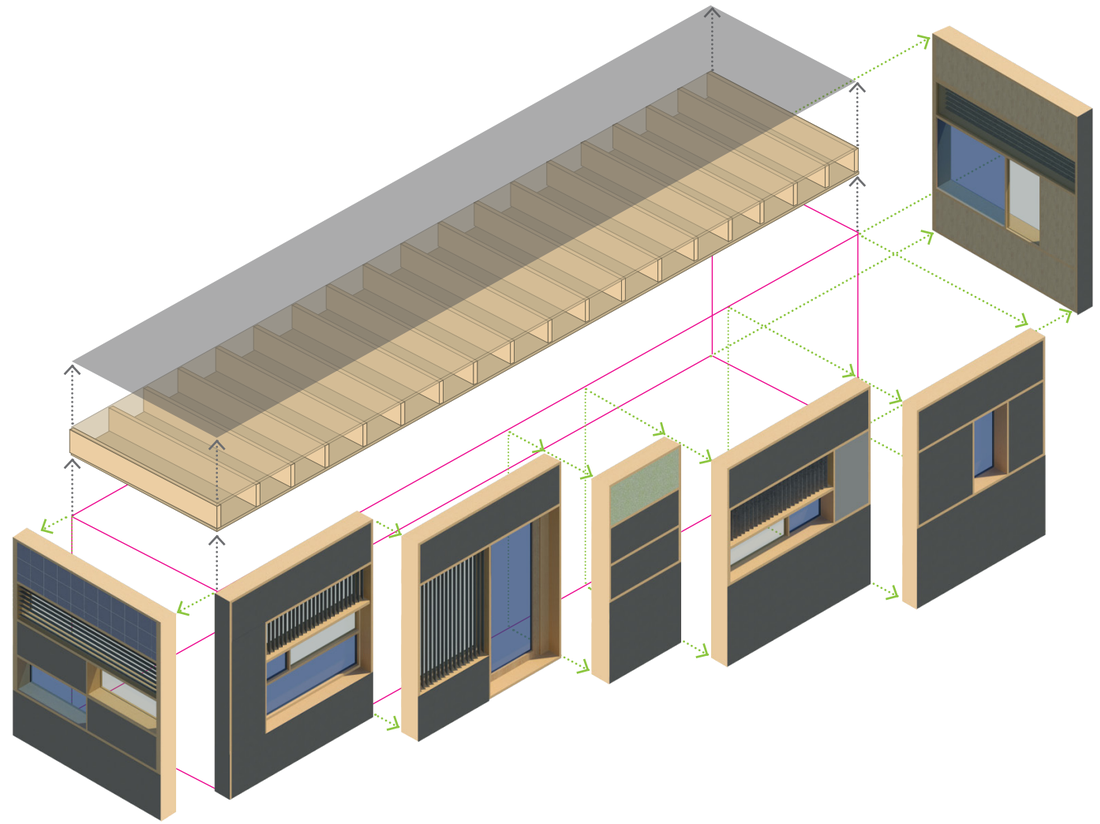
wasteLESS
modular housing

Melissa Brodmarkle-Emerson

Prototype Home



ONE PANEL



ONE MODULE

consisting of 8 panels

wasteLESS
modular housing

Melissa Brodmarkle-Emerson

ONE CUSTOMIZED HOME

Consisting of 4 Modules and 32 Panels

wasteLESS
modular housing

Melissa Brodmarkle-Emerson

Annotated Bibliography

Addis, William. *Building with Reclaimed Components and Materials: a Design Handbook for Reuse and Recycling*. London: Earthscan, 2006. Print.
[Details regarding what materials can be re-used and how these materials can be re-used.]

Allen, Edward, and Joseph Iano. *Fundamentals of Building Construction: Materials and Methods*. Hoboken: J. Wiley & Sons, 2004. Print.
[Details on standard construction materials and methods will help to understand opportunities for waste reduction within these processes.]

Allen, Edward, and Joseph Iano. *The Architect's Studio Companion: Rules of Thumb for Preliminary Design*. Hoboken, NJ: Wiley, 2007. Print.
[Design criteria and guidelines for choosing the type of structure, day lighting, openings, and other guides.]

Allen, Edward, Rob Thallon, and Joseph Iano. *Fundamentals of Residential Construction*. Hoboken, NJ: Wiley, 2011. Print.
[Construction details for typical housing will help to understand opportunities for waste reduction within these processes.]

Allen, C. Wesley. *Simultaneous Engineering: Integrating Manufacturing and Design*. Dearborn, MI: Society of Manufacturing Engineers, Publications Development Department, Reference Publications Division, 1990. Print.
[Definitions and explanations on the practice of simultaneous engineering, which is the designing the product and the manufacturing process at the same time.]

"American Housing Survey." *Census Bureau Home Page*. Web. 1 Dec. 2011. <http://www.census.gov>.
[Statistics on housing.]

"BEES Software." *National Institute of Standards and Technology*. NIST, 19 May 2009. Web. 14 Feb. 2012. <http://www.nist.gov/el/economics/BEESSoftware.cfm>.
[Software for life-cycle analysis, with an tools for both environmental and economic qualities of materials and applications.]

Blu Homes. "Blu Homes Custom Prefab Eco-Friendly Homes." *Blu Homes*. Blu Homes, 2011. Web. 15 Sept. 2011. <http://www.bluhomes.com/>.
[Example of modern custom prefab homes with several variations.]

Cherner, Norman. *Fabricating Houses from Component Parts: How to Build a House for 6000.* Reinhold; Chapman & Hall, 1957. Print.
[Floor plans, elevations, sections, etc. of different types of pre-fabricated homes. Details on how minimize cost and finance this type of home.]

Ching, Frank. *Building Construction Illustrated.* [S.l.]: John Wiley, 2002. Print.
[Details on standard construction materials and methods will help to understand opportunities for waste reduction within these processes.]

"Cité Du Design In Saint-Étienne." *Detail* 50.7 (2010): 730.
[Details on a case study of Cite Du Design with detailed drawings about the panelization system.]

Citè Du Design - Portail. Web. 09 Feb. 2012. <http://www.citedudesign.com/>.
[More information on a case study of Cite Du Design and its interclimatic design.]

"Construction Statistics: New Housing Starts Forecast, Construction Spending Statistics." *National Association of Home Builders*. Web. 1 Dec. 2011. <http://www.nahb.org/reference_list.aspx?sectionID=130>.
[Statistics on housing construction materials, etc.]

Crane-Smith, Neely. "Wasted, Wasted Energy « The Minnesota Energy Challenge Blog." *The Minnesota Energy Challenge Blog*. 7 Apr. 2008. Web. 18 Jan. 2012. <http://mnenergychallenge.wordpress.com/2008/04/07/wasted-wasted-energy/>.
[20% of US energy use in commercial and residential buildings is wasted.]

"Demand (Tankless or Instantaneous) Water Heaters." EERE: Energy Savers Home Page. U.S Department of Energy, 9 Feb. 2011. Web. 18 Feb. 2012. <http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=12820>.
[Energy saving with a tankless or instantaneous water heater.]

Energy.gov | Department of Energy. Web. 1 Dec. 2011. <http://energy.gov/>.
[Energy statistics for housing.]

"Fay Jones Collection: Thorncrown Chapel." *The University of Arkansas Libraries*. 4 Dec. 2009. Web. 24 Jan. 2012. <http://libinfo.uark.edu/specialcollections/manuscripts/FayJones/projectgallery.asp?project=THO1980&image=THO1980%5B10%5Dweb.jpg&caption=Looking%20up%20at%20Thorncrown%20from%20exterior&photographer=Fay%20Jones%20Studio>.
[Detailed drawings and construction images of Thorncrown Chapel.]

Findley, Lisa. "Color License Plates Join Wood Shingles and Recycled Goods in the Hester/McNally House." *Architectural Record* 7th ser. 188.July (2000): 225-28. Print.
[Example of how to use different recycled materials to create an interesting aesthetic appeal.]

Fowler, E. B. *Application of Component Construction to Multi-story, Low-income Housing*. Chicago: ITT Research Inst., Technology Center, 1968. Print.
[Details on how to design and implement component construction for multi-story/low-income homes.]

Green & Sustainable Buildings | Faswall® by ShelterWorks. Shelter Works Ltd., 2010. Web. 26 Jan. 2012. <http://faswall.com/>.
[Sustainable building technologies. Recycled wood fiber blocks for building well insulated 12" thick walls.]

Howe, Jeffery W. *The Houses We Live In: an Identification Guide to the History and Style of American Domestic Architecture*. San Diego, CA: Thunder Bay, 2002. Print.
[Historical references to residential housing in America.]

Jenesys Buildings. "Jenesys Buildings." *Jenesys Buildings*. Jenesys Buildings. Web. 16 Sept. 2011. <http://jenesysbuildings.ca/>.
[Modern example of a custom prefab homes manufacturers.]

Jones, E. Fay. *E Fay Jones | Buckley House*. 2010. Web. 24 Jan. 2012. <http://www.fayjones.com>.
[Case Study example of a home designed with high functionality and durable materials within a 4' by 4' grid system in an effort to reduce waste and have a smaller footprint.]

Annotated Bibliography (continued)

Jones, E. Fay. Thorncrown Chapel. 2008. Web. 24 Jan. 2012. <http://www.thorncrown.com/index.html>.
[Photos and details about the Thorncrown Chapel, which was designed based on a 4' x 4' grid system.]

Jones, Euine Fay, Robert Adams. Ivy, Euine Fay Jones, and Euine Fay Jones. *Fay Jones: The Architecture of E. Fay Jones, FAIA*. Washington, DC: American Institute of Architects, 1992. Print.
[Detailed information about Fay Jones' design principles and process for thoughtful and organic design.]

Jones, Robert T. *Authentic Small Houses of the Twenties: Illustrations and Floor Plans of 254 Characteristic Homes*. New York: Dover Publications, 1987. Print.
[Provides many variations of small home examples for different types of lifestyles, etc.]

"Kitchens .com - Kitchen Design: The Work Triangle." Kitchens .com - Kitchen Design, Photos, Pictures, Remodeling, Videos, Products, Decorating and Ideas. Web. 18 Feb. 2012. <http://www.kitchens.com/Design/Layouts/Work-Triangle.aspx>.
[Information regarding the Kitchen "Work Triangle" rule.]

Life Cycle Assessment Software. Athena Institute, 2011. Web. 14 Feb. 2012. <http://calculatelca.com/>.
[Software for life-cycle analysis, specifically for different regions.]

LivingHomes. Web. 22 Jan. 2012. <http://www.livinghomes.net>.
[Kieran Timberlake and Ray Kappe sustainable modular housing. Detailed information about their goals and how they were able to achieve all of them.]

McCoy, Esther. *Case Study Houses, 1945-1962*. 2nd ed. Los Angeles: Hennessey & Ingalls, 1977. Print.
[Details and an explanation for all of the Case Study Houses, including floor plans, sketches, photos, etc.]

McMorrough, Julia. *Materials, Structures, and Standards: All the Details Architects Need to Know but Can Never Find*. Gloucester, MA: Rockport, 2006. Print.
[Specific details on material types and sizing.]

Meinhold, Bridgette. "Cité Du Design: Solar Powered International Design Center Unveiled Read More: Cité Du Design: Solar Powered International Design Center Unveiled | Inhabitat - Green Design Will Save the World." Inhabitat. 6 Nov. 2009. Web. <http://inhabitat.com/cite-du-design-solar-powered-international-design-center-unveiled/>.
[Environmental details of a case study: Cite Du Design.]

Nadel. "Sustaining Green Design." *Oculus* 62.1 (1999): 22. Print.
[Statistics regarding how green design is on the minds of the majority of the American population as well as references to several professionals in the field of green building.]

Nebraska Energy Office. "A Series of Factsheets on New Construction Issues: Construction Waste Minimization Methods." *Nebraska Energy Office*.
Nebraska Energy Office. Web. 12 Sept. 2011. <http://www.neo.ne.gov/home_const/factsheets/const_waste_min.htm>.
[Text with a detailed description on ways the construction industry can minimize waste.]

Nebraska Energy Office. "A Series of Factsheets on New Construction Issues: Efficient Design and Construction." *Nebraska Energy Office*. Nebraska Energy Office. Web. 10 Sept. 2011. <http://www.neo.ne.gov/home_const/factsheets/effic_design_and_const.htm>.
[Text with a detailed description on ways the building industry can produce more efficient architecture.]

"NREL: U.S. Life Cycle Inventory Database Home Page." *National Renewable Energy Laboratory (NREL) Home Page*. NREL, 5 Jan. 2012. Web. 14 Feb. 2012. <http://www.nrel.gov/lci/>.
[U.S. life-cycle Inventory Database.]

Pollard, David P. "IIT MS Arch Thesis Project 2011." *Housing2.0*. 30 June 2011. Web. 18 Jan. 2012. <http://www.housing2point0.com/>.
[Similar project case statement to mine and had Dirk Denison as an advisor.]

Prefabcosm. "Prefab and Modular Homes - Prefabcosm." *Prefab Homes, Modular Homes - Prefabcosm*. 2011. Web. 16 Sept. 2011. <http://prefabcosm.com/home/>.
[Search engine for current prefabricated home designers that break it down by style, size and price.]

"Project Nomad- The Elements Group." *Air Water Earth Sun - The Elements Group*. Web. 14 Feb. 2012. <http://airwaterearthsun.com/html/community/project_nomad.php>.
[Chicago project that was designed by students with the intent to be transported and temporarily displayed in urban parks to feature green living, sustainability and information to the general public.]

"Rainwater Harvesting: Water Hog." *US Hydro Tech - Environmental Solution*. Web. 18 Feb. 2012. <http://www.ushydrotech.com/rain-water-harvesting-water-hog.asp>.
[Water Hog information and details on how they can be applied to homes.]

Rapson, Ralph. "WIELER / Homes / Rapson Greenbelt / Designs / Greenbelt Designs." *WIELER / Live In A Work Of Art*. WIELER. Web. 18 Sept. 2011. <http://wieler.com/homes/rapson-greenbelt/designs/all/>.
[The Ralph Rapson design for the Case Studies that was transformed into a successful modern practice with all of Rapson's principles in mind.]

Revkin, Andrew C. "A Shift in the Debate Over Global Warming - NYTimes.com." *The New York Times - Breaking News, World News & Multimedia*. 06 Apr. 2008. Web. 18 Jan. 2012. <http://www.nytimes.com/2008/04/06/weekinreview/06revkin.html?ref=weekinreview>.
[20% of US energy use in commercial and residential buildings is wasted.]

Rocio Romero. *Rocio Romero, Modern Design and Prefab Architecture*. Rocio Romero, 2011. Web. 19 Sept. 2011. <http://www.rocioromero.com/>.
[A modern example of prefabricated housing.]

"Sears Roebuck Kit Homes::Mail Order Houses::Historic House Plans." The Arts and Crafts Society. Web. 22 Jan. 2012. <http://www.arts-crafts.com/archive/sears/>.
[A Precedent study for modular housing from 1908 to 1940.]

Sheley, Bill. "Hi-Tech Housing, Inc. : Manufacturing for Today." Personal interview. 28 Feb. 2012.
[See how pre-fabricated housing is made first-hand and learn its benefits and shortfalls. Also got to see how several pre-fabricated modules can be combined on-site.]

Annotated Bibliography (continued)

Smith, Elizabeth A. T., and Esther McCoy. *Blueprints for Modern Living: History and Legacy of The Case Study Houses.* Cambridge Mass.: MIT, 1989. Print.
[A rehashing of the original *Case Study Houses* book with a different perspective on their influence in the housing industry years after its publication.]

Square Root Architecture + Design. Web. 29 Feb. 2012. <http://squarerootarch.com/>.
[Pre-fab housing examples in the Chicago area.]

Susanka, Sarah. "The Not So Big Showhouse." An Evening with Sarah Susanka. Room & Board, 55 East Ohio Street, Chicago, IL. 11 Apr. 2012. Lecture.
[Larger goal of the Not So Big Life.]

Susanka, Sarah, and Kira Obelensky. *The Not So Big House: A Blueprint for the Way We Really Live*. Newtown: Taunton, 2009. Print.
[Efficient space planning for housing today, with an emphasis on quality of spaces.]

Tedesco, Paul H., and James B. Tedesco. *Portable and Prefabricated Houses of the Thirties: the E.F. Hodgson Company 1935 and 1939 Catalogs: an Unabridged Reprint*. [Dover, Mass.]: JBT, 2007. Print.
[Goes through the catalogs of the E.F. Hodgson Company Catalogs of prefabricated homes for developers and potential home owners who were considering designing their own home. Will be able to assess one way a modular system could be put together in unique ways.]

Tennent, Scott, ed. *Jones, Partners Architecture: El Segundo : Designs for Words, Buildings, Machines.* New York: Princeton Architectural, 2007. Print.
[Modern pre-fabricated homes, which include floor plans, elevations and construction photos.]

Trulove, James Grayson., and Ray Cha. *PreFabNow*. New York, NY: Collins Design, 2007. Print.
[Modern pre-fabricated homes, which include floor plans, elevations and construction photos.]

Wentling, James W. *Housing by Lifestyle: the Component Method of Residential Design*. New York: McGraw-Hill, 1990. Print.
[Specific strategies to customize housing by a person's particular lifestyle and how these strategies can be compartmentalized and then merged together into a cohesive whole.]

www.melissajemerson.com