

Minimal & Modular Design

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Thesis Presentation | Spring 2023

In my past years
as a student...



Thesis Abstract

The cost of living has started to increase quite drastically over the recent years. From renting an apartment, to buying or building a home. Land and material prices have skyrocketed, especially during and after the pandemic. There are many people these days that have a job, but still have a hard time paying rent or a mortgage on a home. With the cost of living increasing, the amount of habitable space is decreasing. Intelligently reusing and reducing material usage as well as building footprint will be what brings living cost back down and ensure for less urban sprawl with more living spaces in currently developed areas.

This study focuses on creating smaller alternatives to today's maximalist trend for living. Research will be focused on how to build efficiently in regard to space and utility usage. Thinking of creative ways on where and how to build in certain urban areas will be an important aspect for site research. To accomplish this, multiple designs will be made for different family sizes in order to optimize living space while shrinking the classic home footprint.

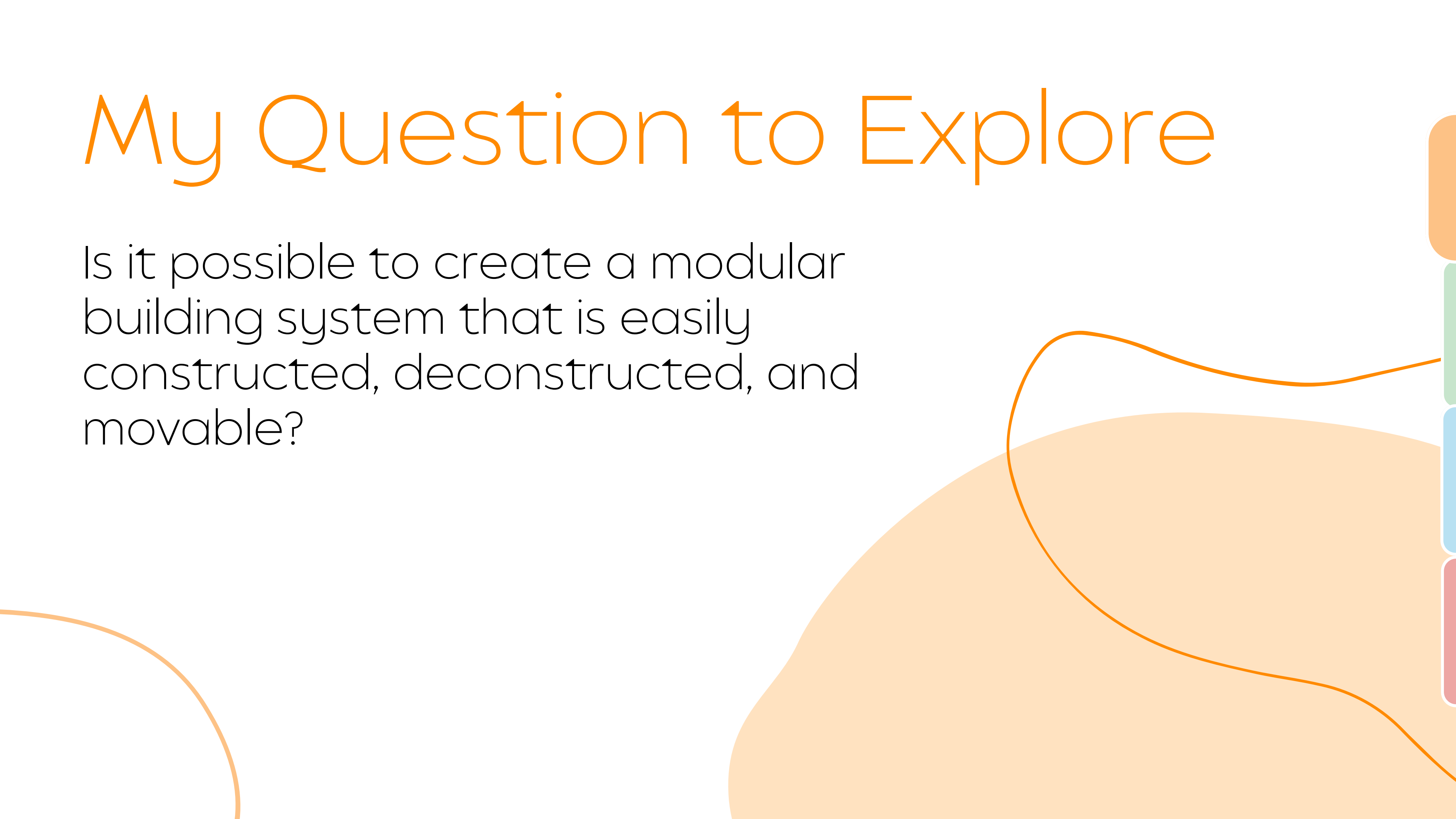
Thesis Narrative

Access to decent, affordable housing is very important to the well-being and health of people and contribute to the slick functioning of economies. When you think about advanced and developing countries, cities struggle with the challenges of housing the poorest of their citizens and providing housing at a reasonable cost for all levels of income. Addressing the affordable housing gap should be an important issue that cities should make a priority, it offers benefits of improved economic productivity, environmental sustainability, and equity for cities.

Across the United States, we've underbuilt housing by 7 million units and 3.5 million of those exist in California alone. Cities across the west coast has been struggling with housing cost and availability. Large cities haven't been able to accommodate for affordable living near the cities which has caused many to move further and further away. This has been an issue for those who rely on the cities public transportation systems, as they only go so far away from the city.

My Question to Explore

Is it possible to create a modular building system that is easily constructed, deconstructed, and movable?



Small Home Living



Minimal Design

Simple
Effective
Timeless



Prefabricated

Efficient
Easy construction
Easy transport to site



Tiny House

Easily movable
Multiple uses
Efficient layout

Benefits of Small Home Living

There are many benefits to living in a smaller space. Whether that be a full-on tiny house, or something that is smaller than you would think of living in.

Lower, or non-existent mortgage.

Less amount of unused items, and reduce clutter.

Footprint can fit on many different sites.

Tiny home communities promote more socialization.

Cons of Typical Small Home Designs

There are many benefits to living in a smaller space. Whether that be a full-on tiny house, or something that is smaller than you would think of living in.

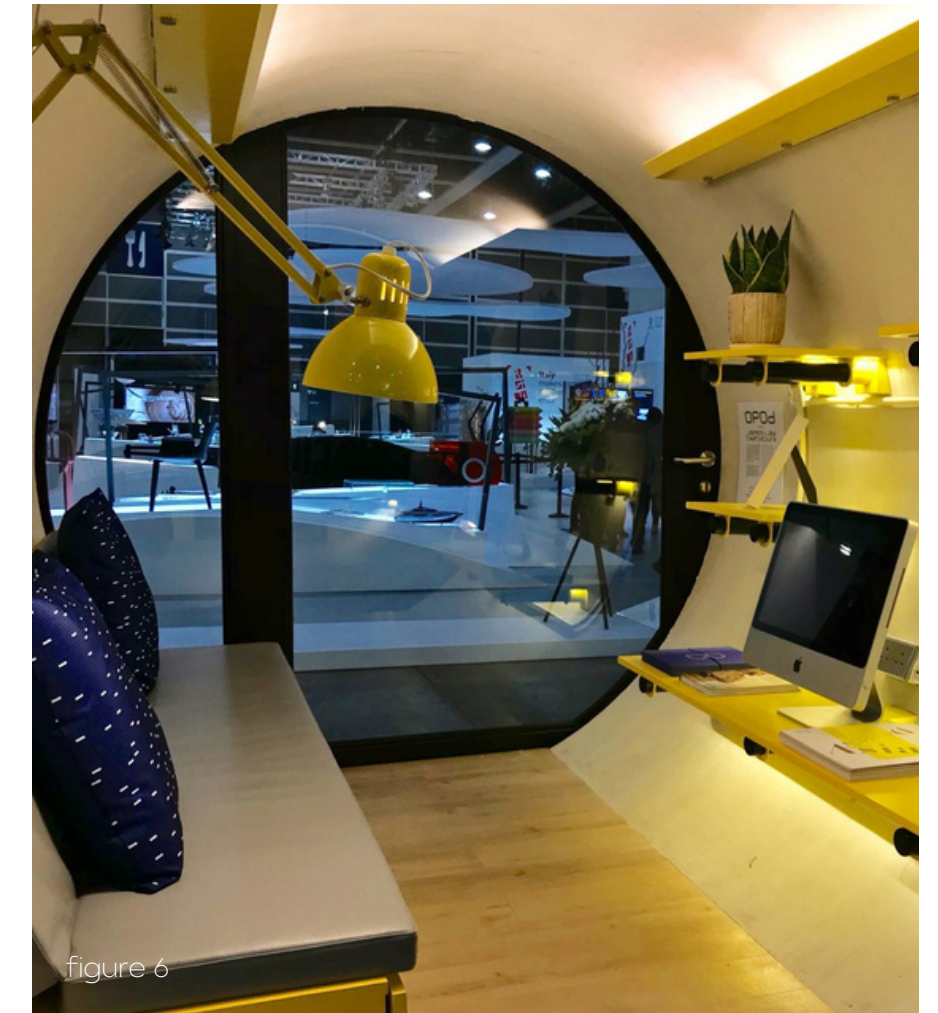
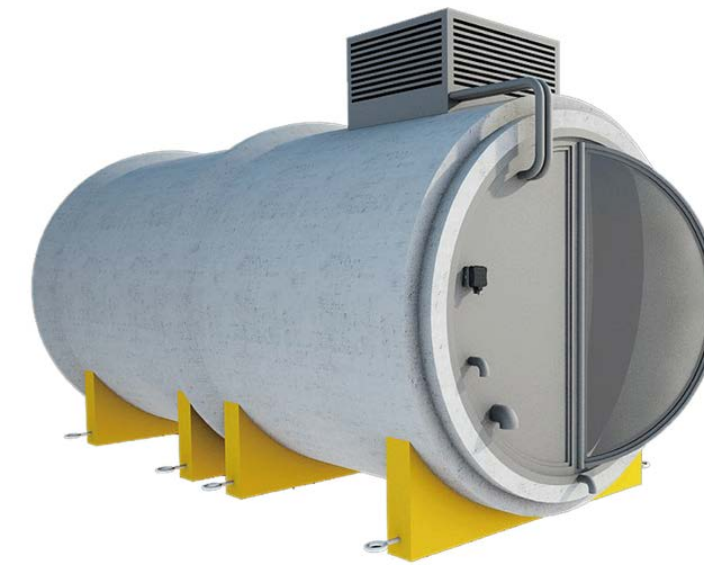
Either permanent, or on wheels.

Set footprint, not expandable.

Typical cumbersome construction process.

Most don't have any modular options.

O-Pod Tube Housing



Stackable

- Stackable shape
- Easy placement
- Scaffold entry system

Using Existing Material

- Precast concrete pipe
- Full utilities

Optimum Layout

- Multi-use furniture
- Compact layout
- Full bath

Pro: Stackable

Con: Not Modular

Boxabl



Amenities

Full Bathroom
Full Kitchen
Mini-Split



Foldable Design

Quick construction
Easy transport to site
Pre-fabricated



Semi-Modular

Flexible layout
Efficient design
Adaptable

Pro: Foldable

Con: Semi-Modular

Goals & Process

Goals to Achieve



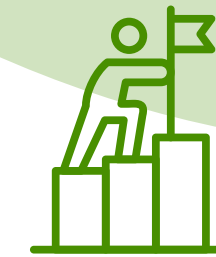
Multiple Use Cases

- Home
- ADU (Accessory Dwelling Unit)
- Apartment
- Rentable space (AirBnb)
- Office / Work space



Flexible Location

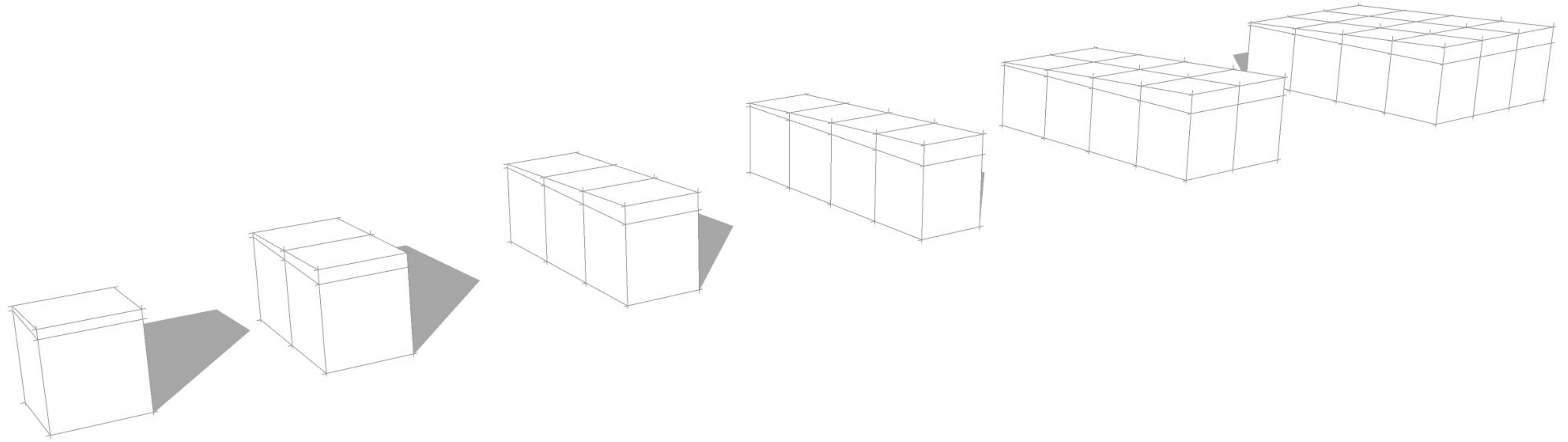
- Flat packable
- Modular layout
- Stackable
- Adjustable foundation



Obtainable & Sustainable

- Easy prefabrication
- Ease of assembly
- Minimal tools needed
- Use of common materials

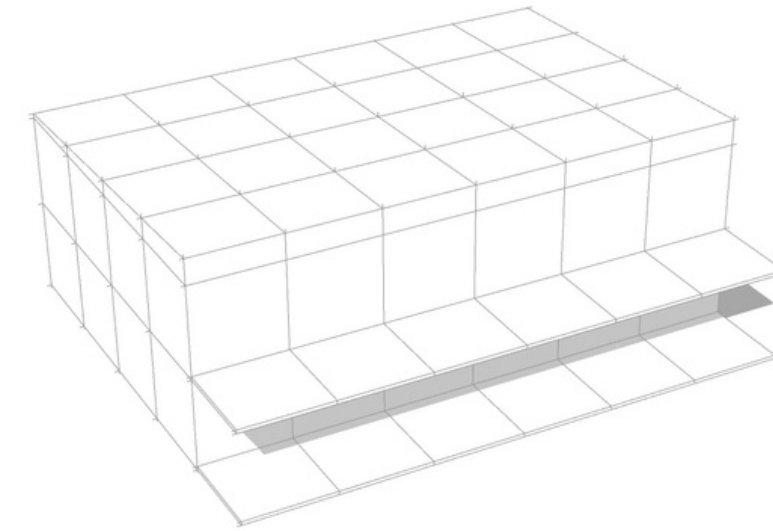
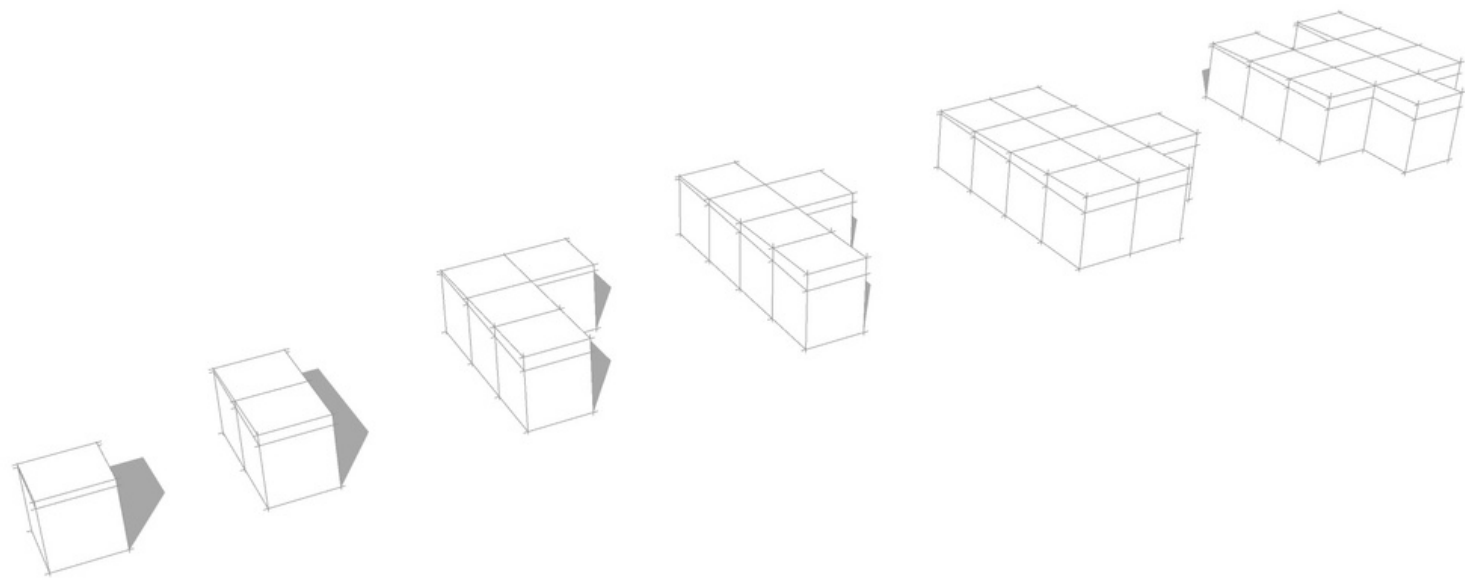
Process



Cube Structures

- 8x8' cubes
- Flexible orientation.
- Designated add on locations.
- Consistent structural support

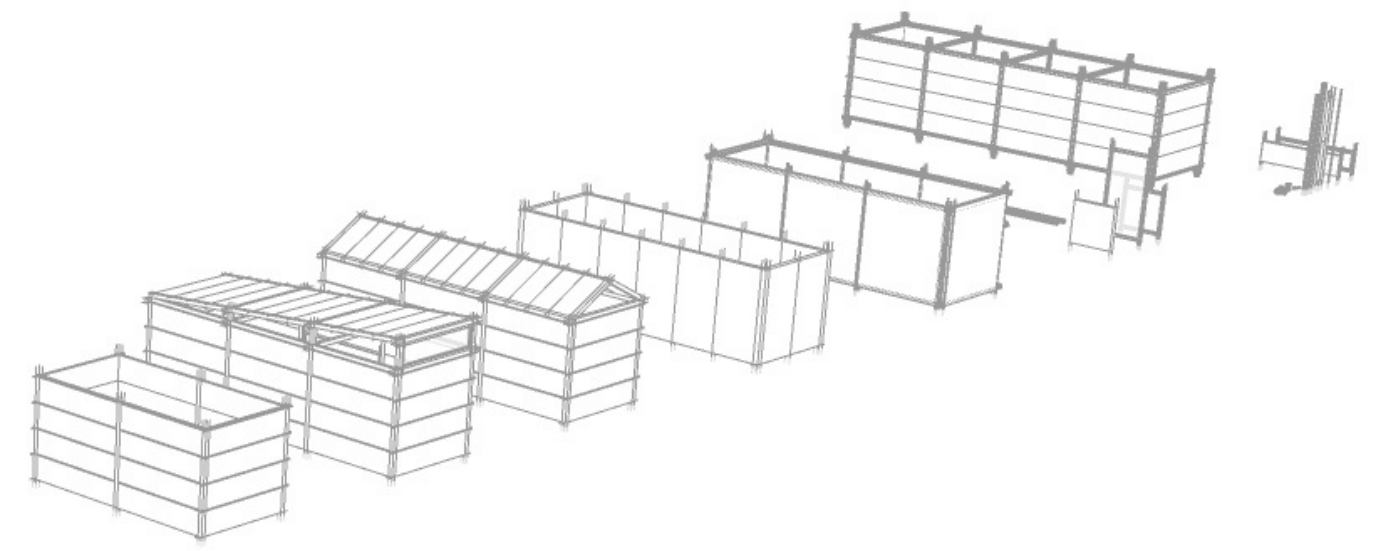
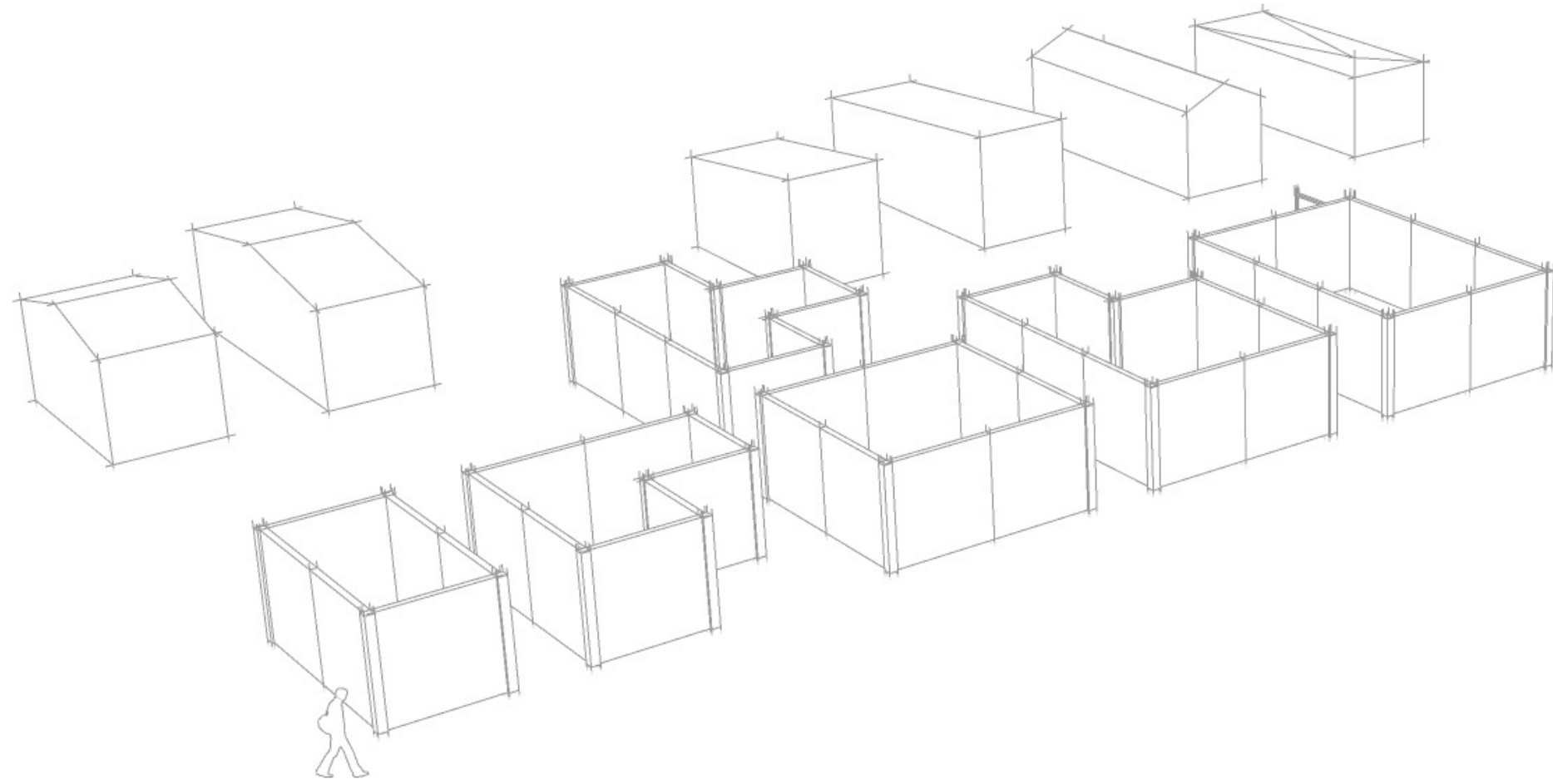
Process



Layout Options

- Cubes create flexible layout
- Attainable odd shapes
- Stackable layout possible

Process



Panel System

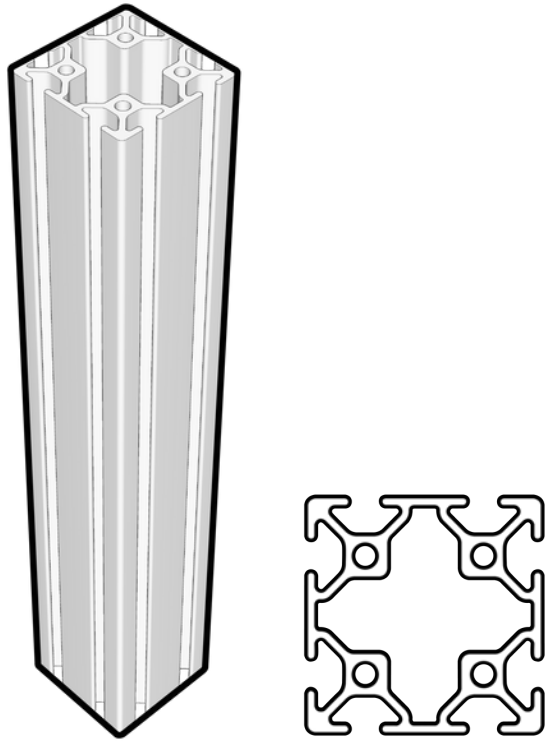
- Panel type system
- Prefabricated
- Arrangement flexibility
- Reduce material cost
- Same size

Structure

- Many different iterations
- Conventional ideas
- Extruded aluminum
- Modular
- Slot system

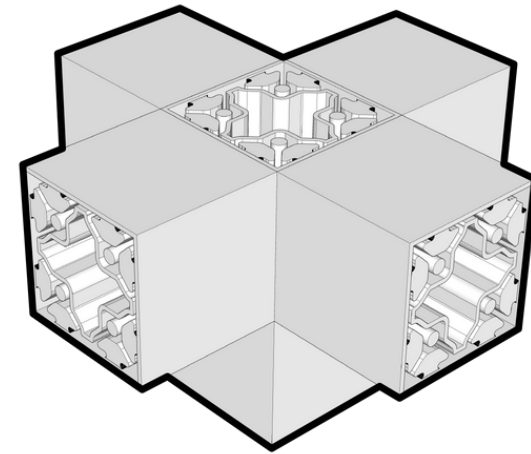
Building System

Structural System



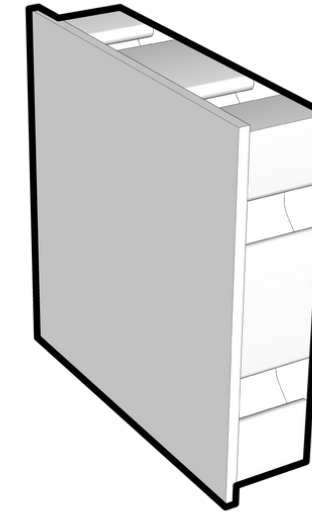
Extruded Aluminum Structure Post

4" x 4" extruded aluminum posts.



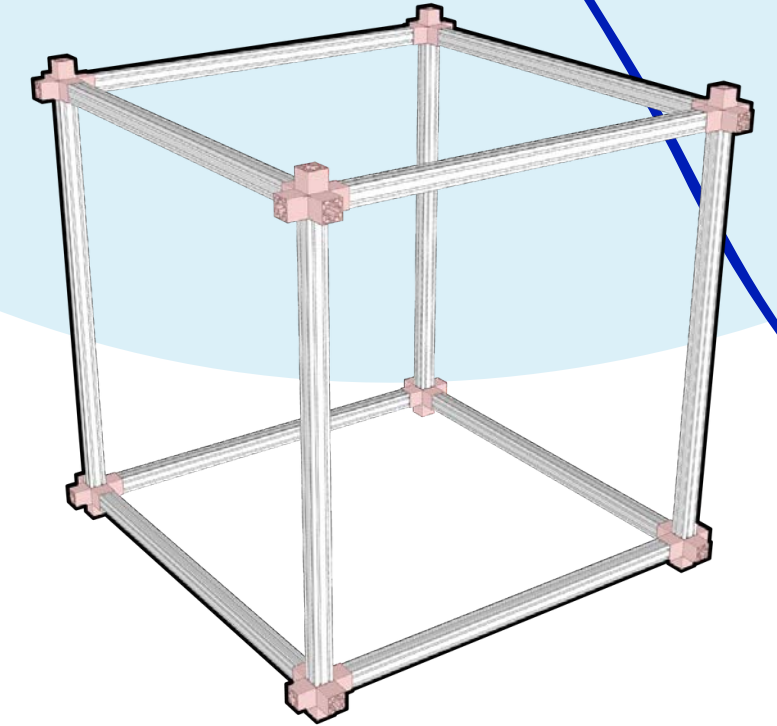
Post Joining Bracket

Each post will slot into this six sided bracket.



Joining Bracket Cap

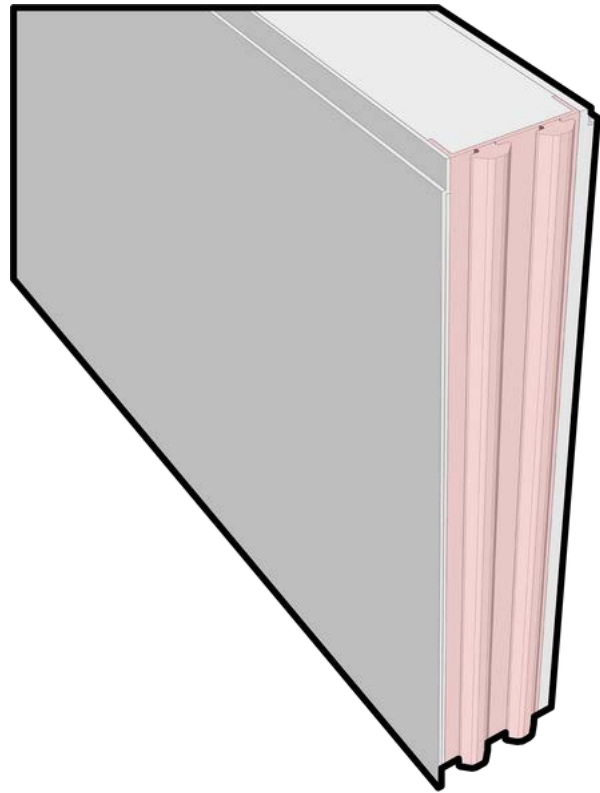
For those pesky sharp edges... Also weather sealing.



Constructed Aluminum Cube

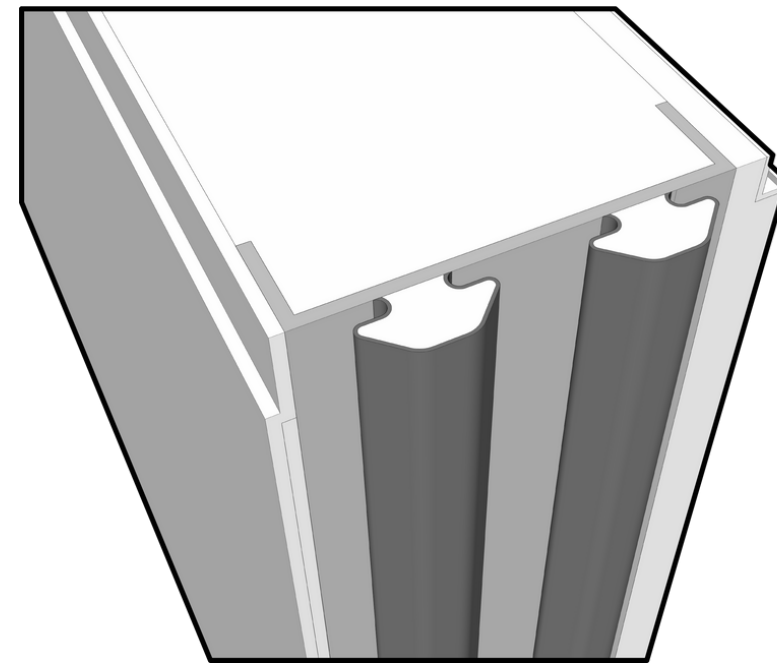
These pieces put together create the basic framework for each cube of the system.

Wall Panel System



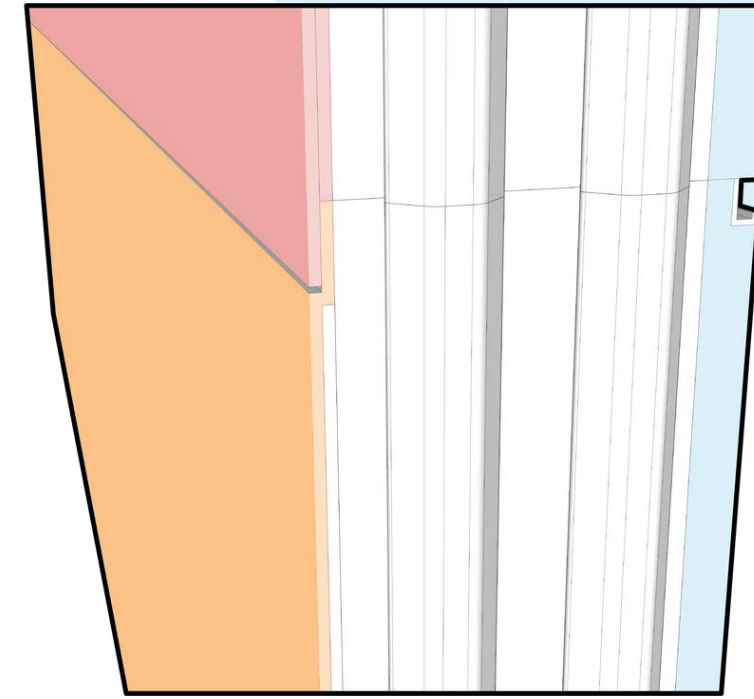
SIPs Wall w/ Aluminum Channel

2' x 8' wall panels that contain an aluminum channel in order to slot into the structural posts.



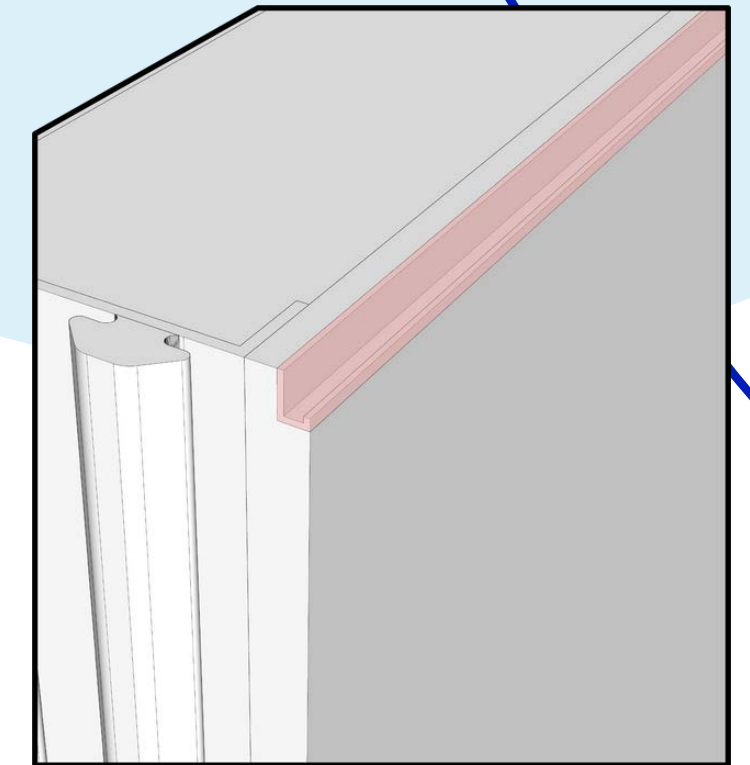
Aluminum Channel Weather Lining

A rubber lining surrounds the channel bracket to prevent the outside from getting in.



Wall Panel Exterior & Interior

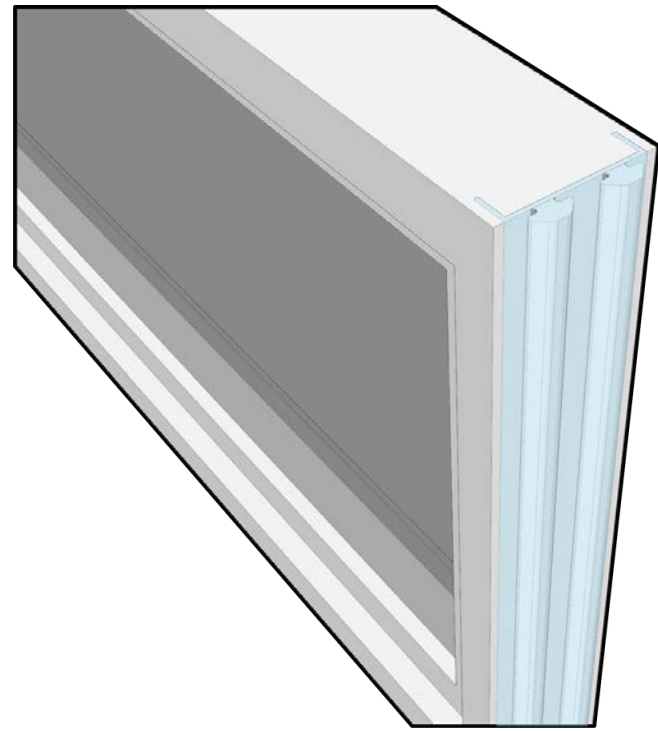
- Pink = Overlapping cladding.
- Orange = Aluminum panel cladding
- Blu = 5/8" Plywood



Aluminum Hanging Channel

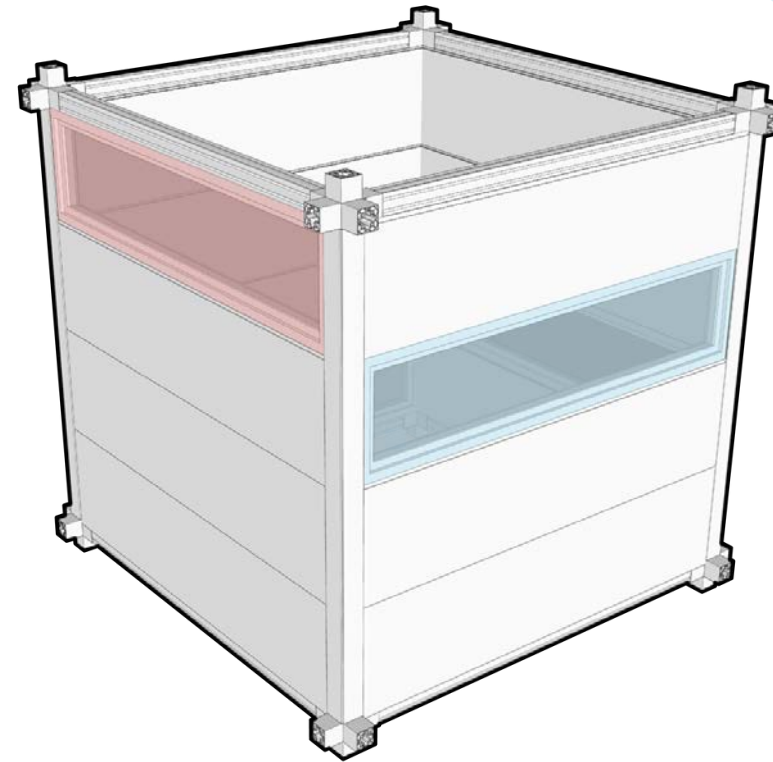
Interior aluminum channel gives the ability for hanging photos or art in a non-destructive manner.

Window Panel System



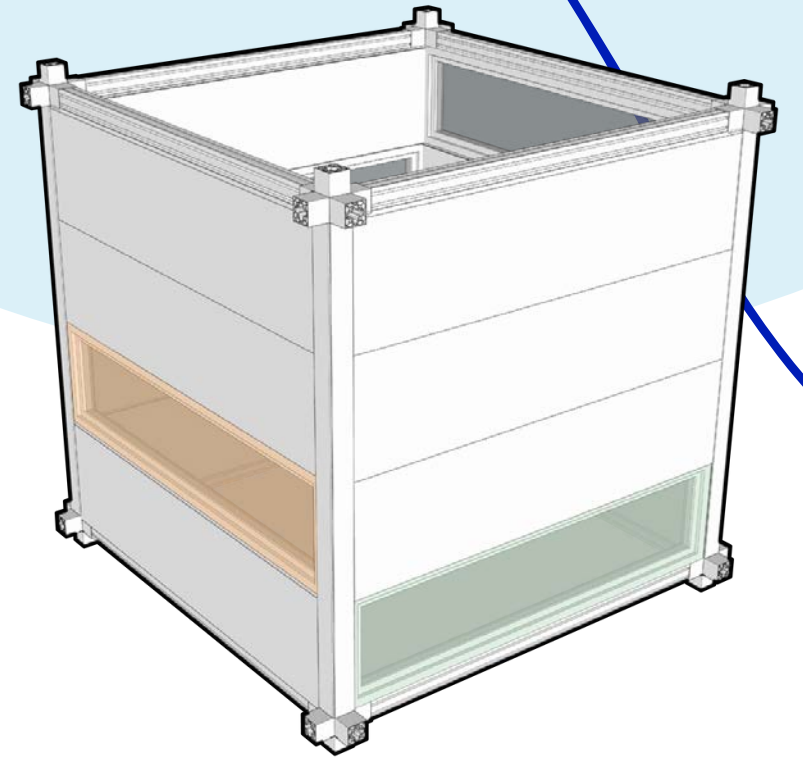
Window Panel w/ Aluminum Channel

2' x 8' window panels that contain the same aluminum channel as the wall panels.



Flexible Window Panel System

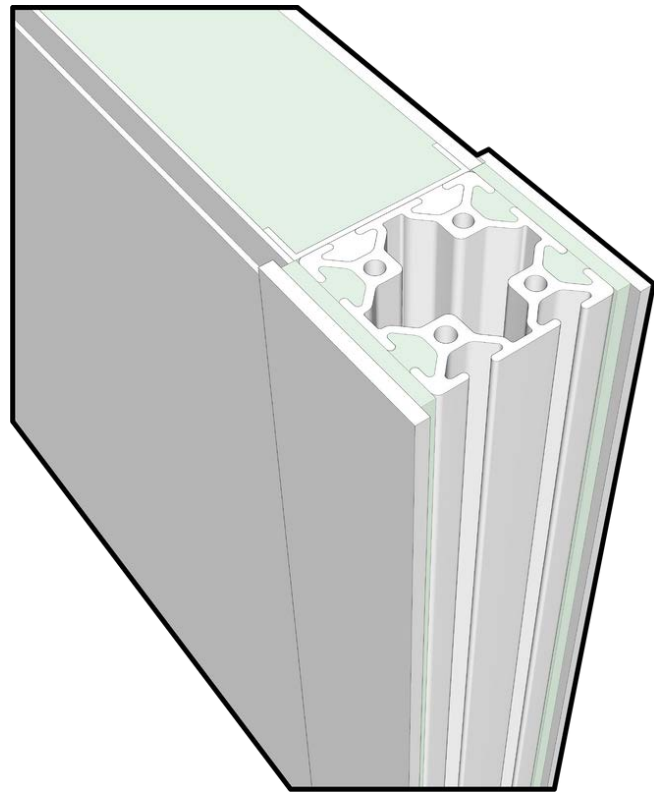
Windows are able to be placed in any of four different locations for optimal customization.



Flexible Window Panel System

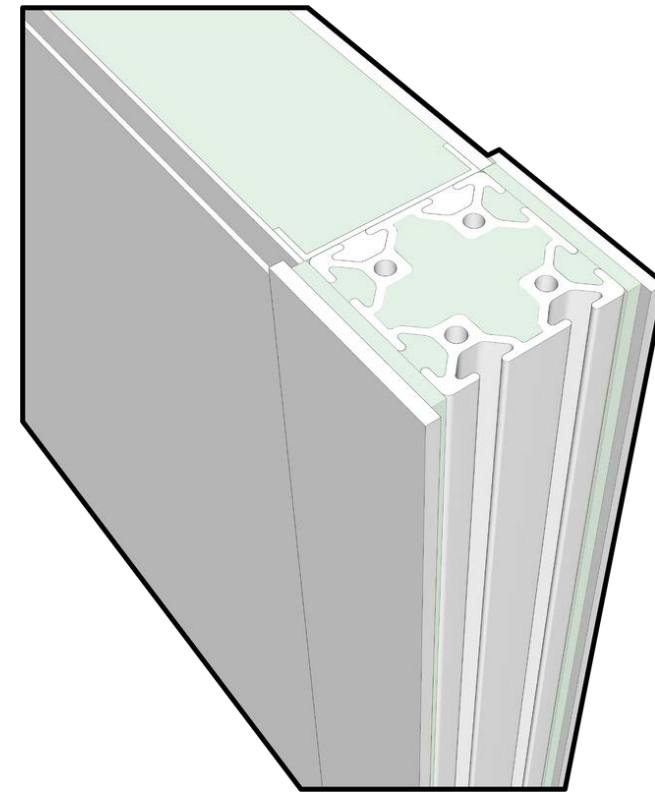
Windows are able to be placed in any of four different locations for optimal customization.

Insulation Integration



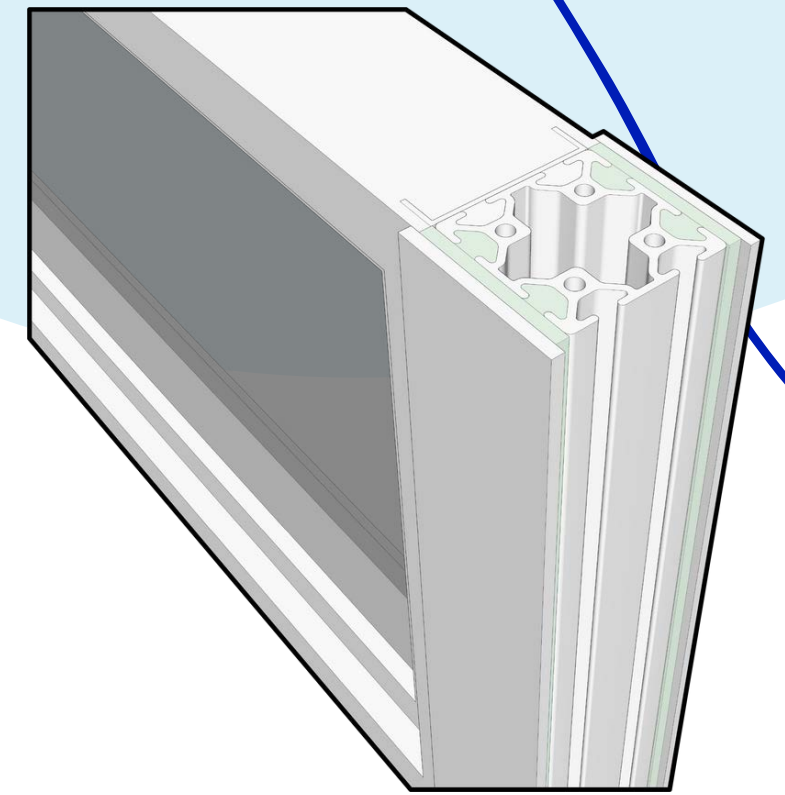
SIPs Wall Panel Insulation

Each wall panel is designed with 4" of rigid insulation between the interior and exterior panels.



Filler Insulation

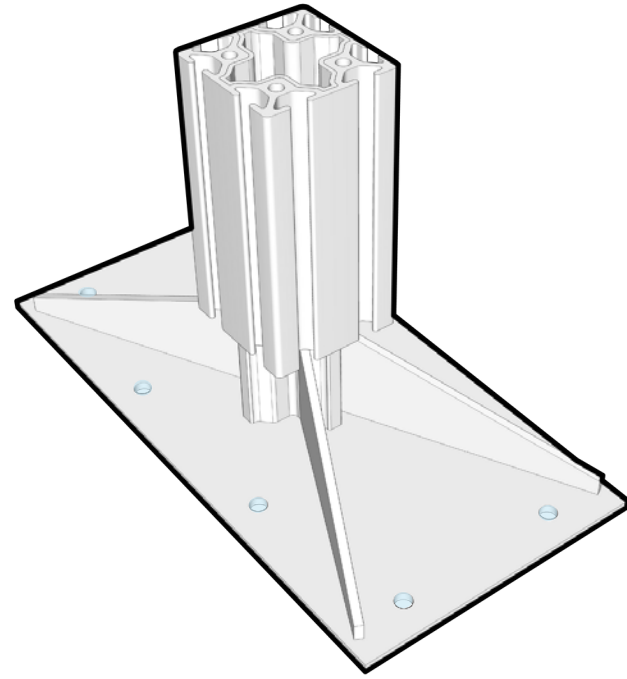
Formed rigid insulation is used in the middle and outside of the aluminum posts to help with thermal bridging.



Insulated Gap Panels

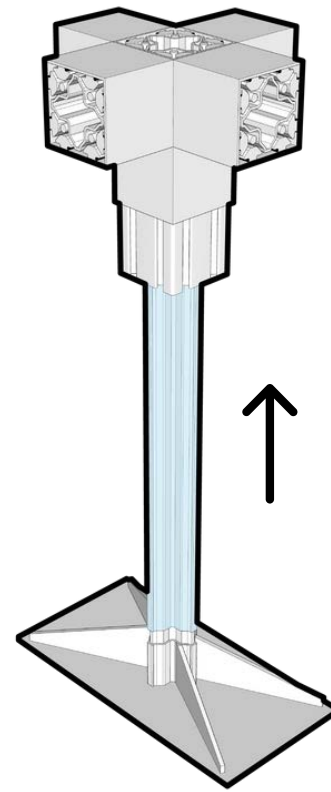
The Gap panels are a formed to slot into the aluminum system and have a 5/16" panel on the outside.

Foundation System



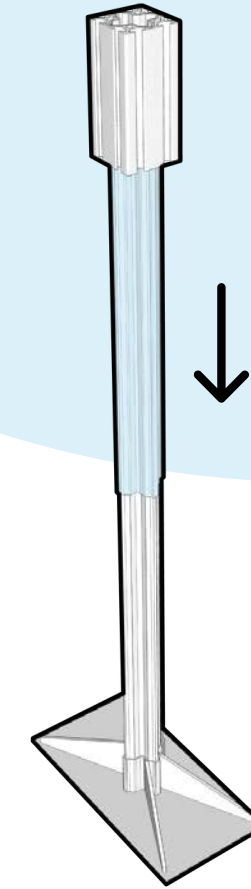
Stationary Foundation Feet

These foundation feet are indented to be used for even surfaces, such as a concrete slab or concrete foundation posts.



Adjustable Foundation Feet

These adjustable foundation feet are meant to be used on uneven surfaces, such as non-level terrain in a backyard.



Extended Foundation Foot

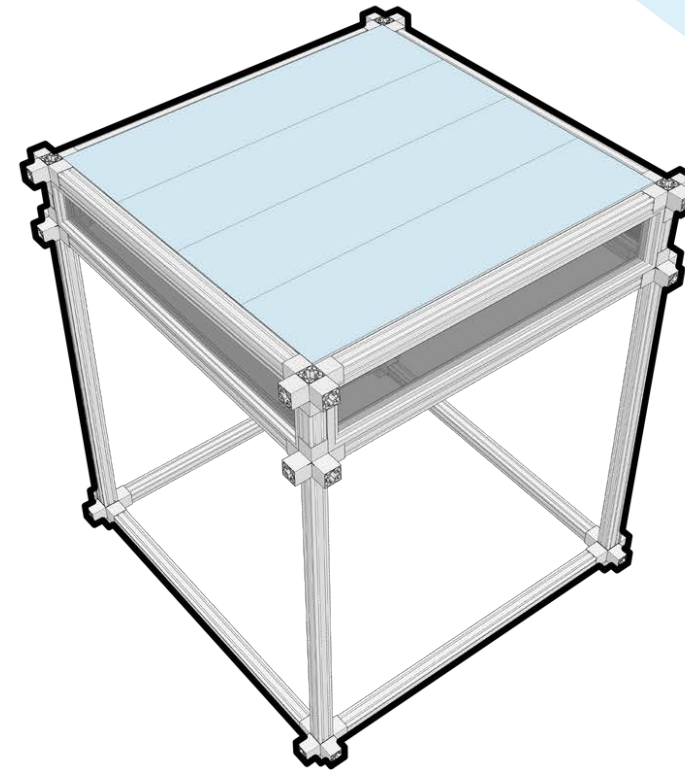
This is an image of an extended leg post. The legs are about 2' un-extended and 4' extended.

Roof / Floor System



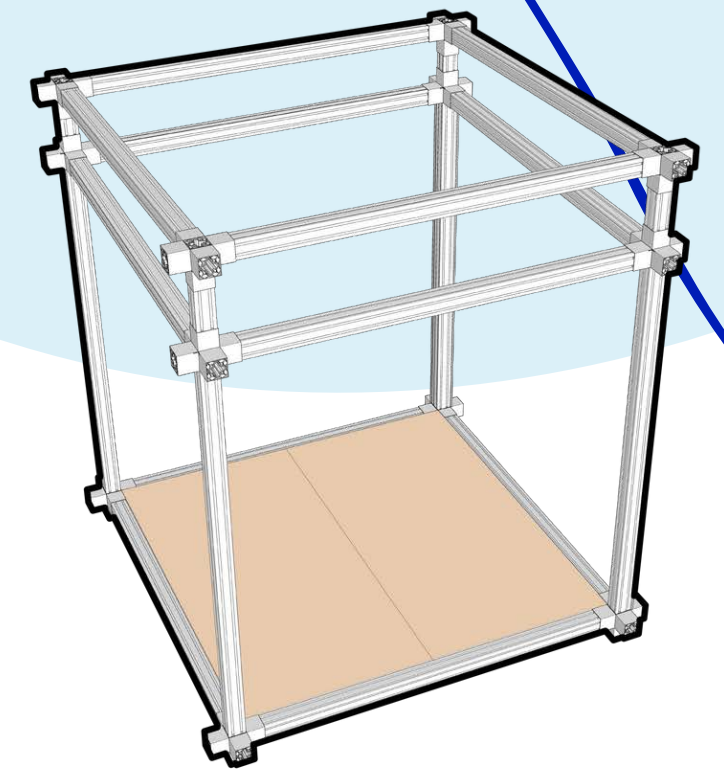
Roof Window Panel System

The window panels on the roof system add additional light to the space as well as still maintaining privacy.



Roof Panel System

The roof panels are the same 2' x 8' panels that the wall system uses. This allows for there to be less pieces individual pieces during construction.



Floor Panel System

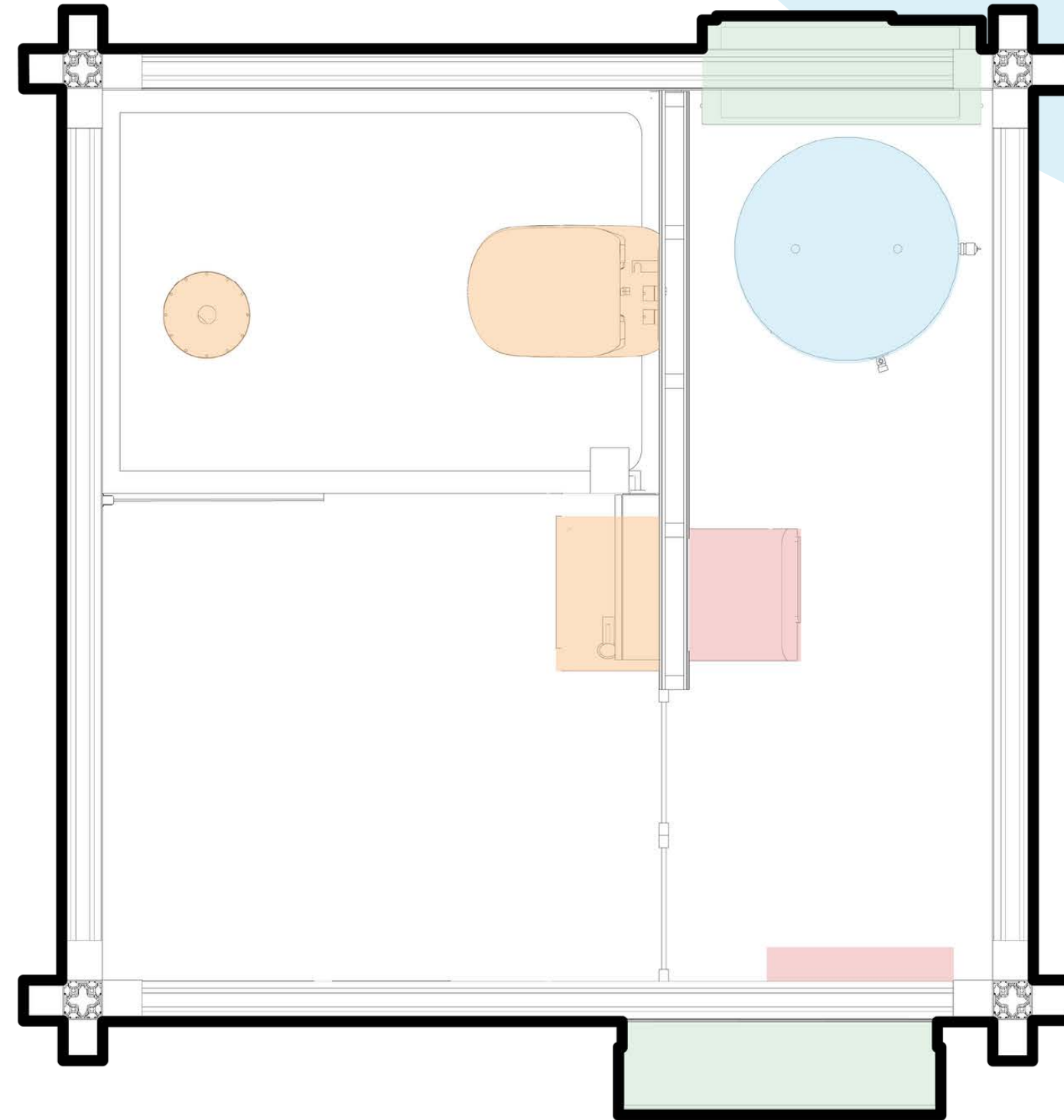
The floor panels are a similar construction to the walls, however they are 4' x 8'. This and a metal brace under the panels ensures for a sturdier floor system.

Utilities

Plumbing Fixtures
Off-Grid Capable



Mini-split A/C and
Heating System




Tankless Hot Water
Heater and
Electrical Breaker

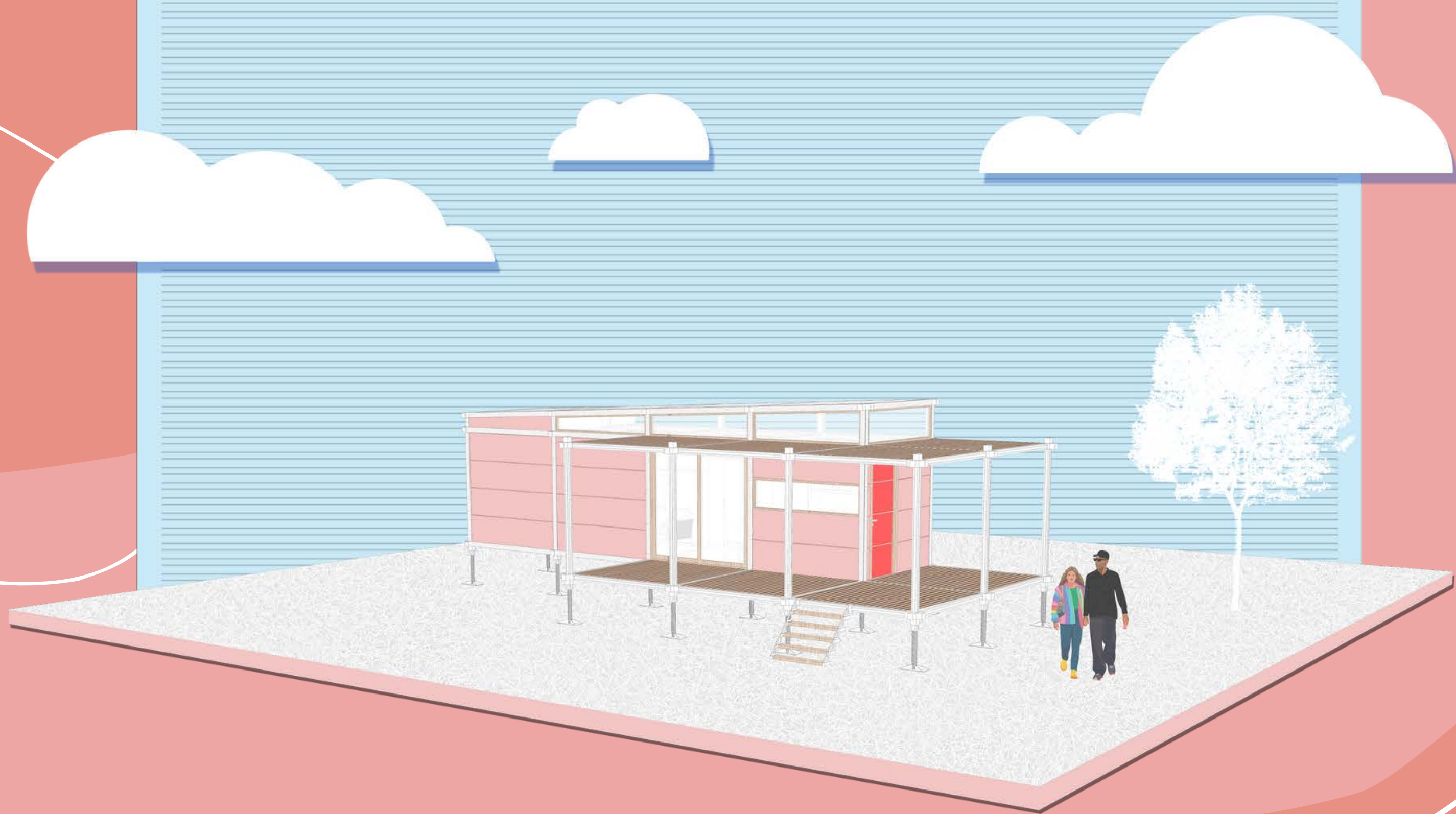


Water Tank for Off-
Grid Use or Hot
Water Heater





Introducing



multi-minimal



Site 01

295 Madrone Street
Redwood City, CA 94061
Type: Accessory Dwelling Unit (ADU)

Site 02

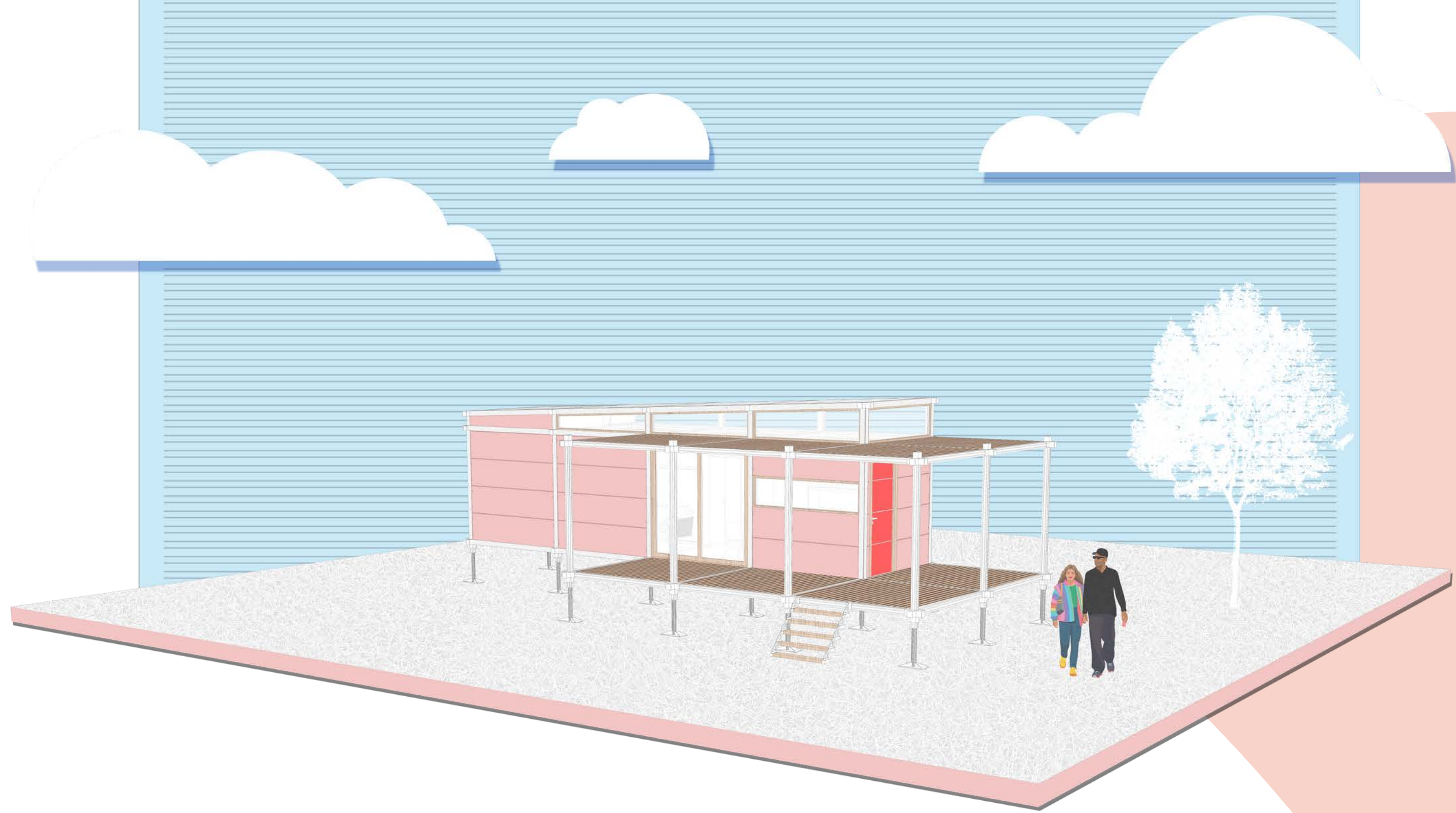
1612 South Jackson Street
Seattle, WA 98144
Type: Single Family Home

Site 03

530 Southwest 2nd Avenue
Portland OR, 97204
Type: Multi-family Residential

Site List

I chose to focus on three different sites for this project. These sites will be used as different typologies, yet are all located in areas that have very high living cost. These show that something affordable can be put in any type of area to help compress housing in areas that are increasing in price and decreasing in availability.

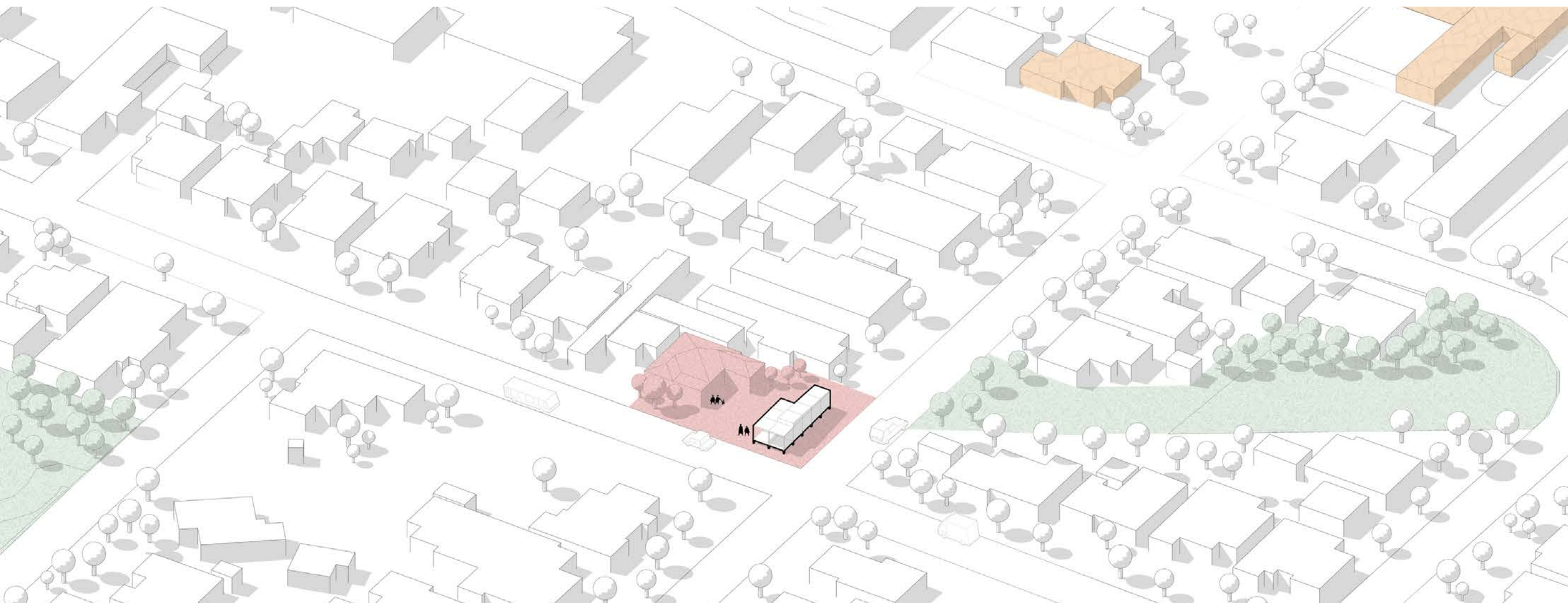


accessory dwelling unit

Redwood City

This unit is located in Redwood City which is a city just Northwest of Silicon Valley. It is currently a single family home in a neighborhood close to the center of the city. It is in a nice area that is in close proximity with two public parks. The lot is on the corner, so has plenty of yard space that is good for family activities.

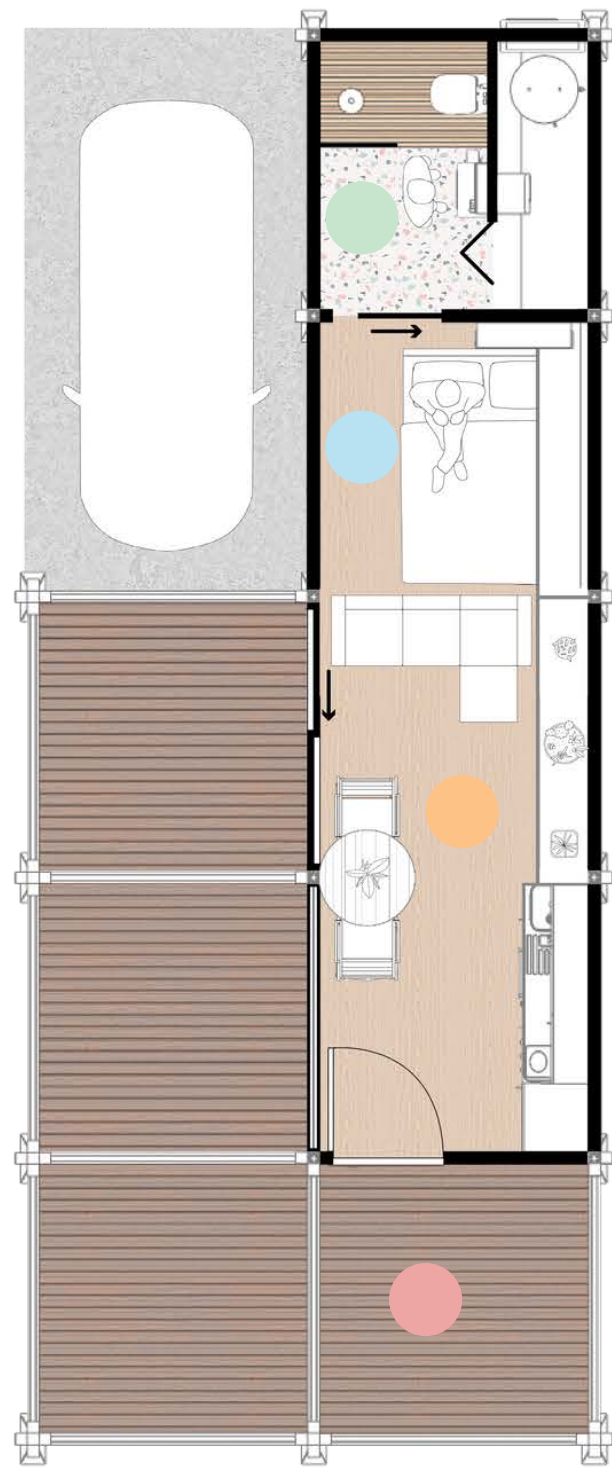
● Site Location ● Local Retail ● Local Parks



Floor Plan

- Wood Deck
- Kitchen / Dining
- Living / Bedroom
- Bathroom / Mechanical

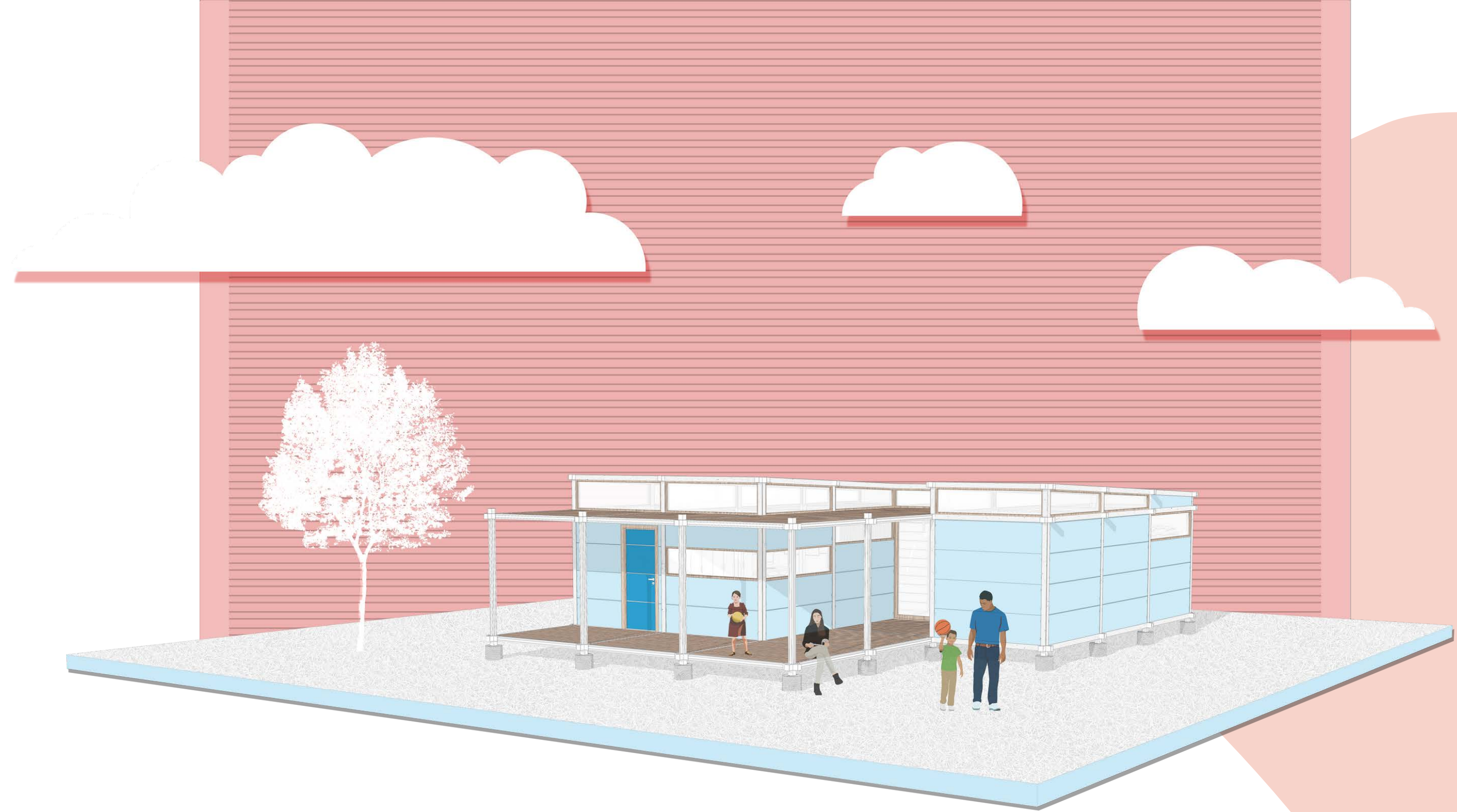
Studio Unit:
256 Square Feet



Murphy Bed Open



Murphy Bed Closed

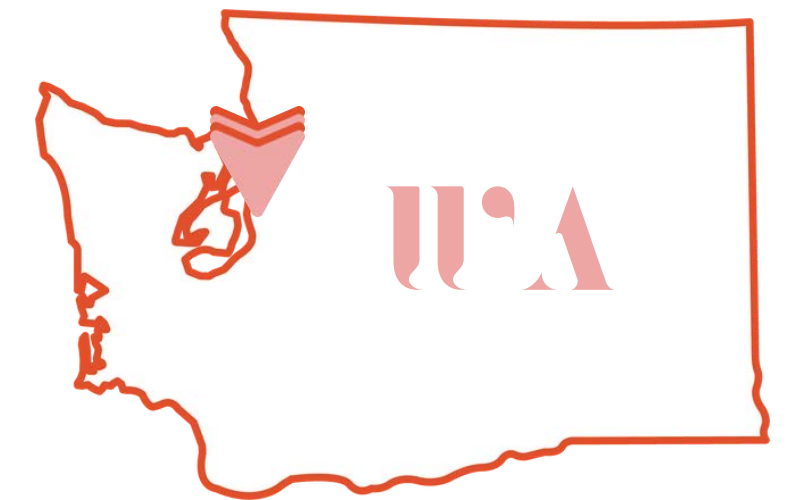
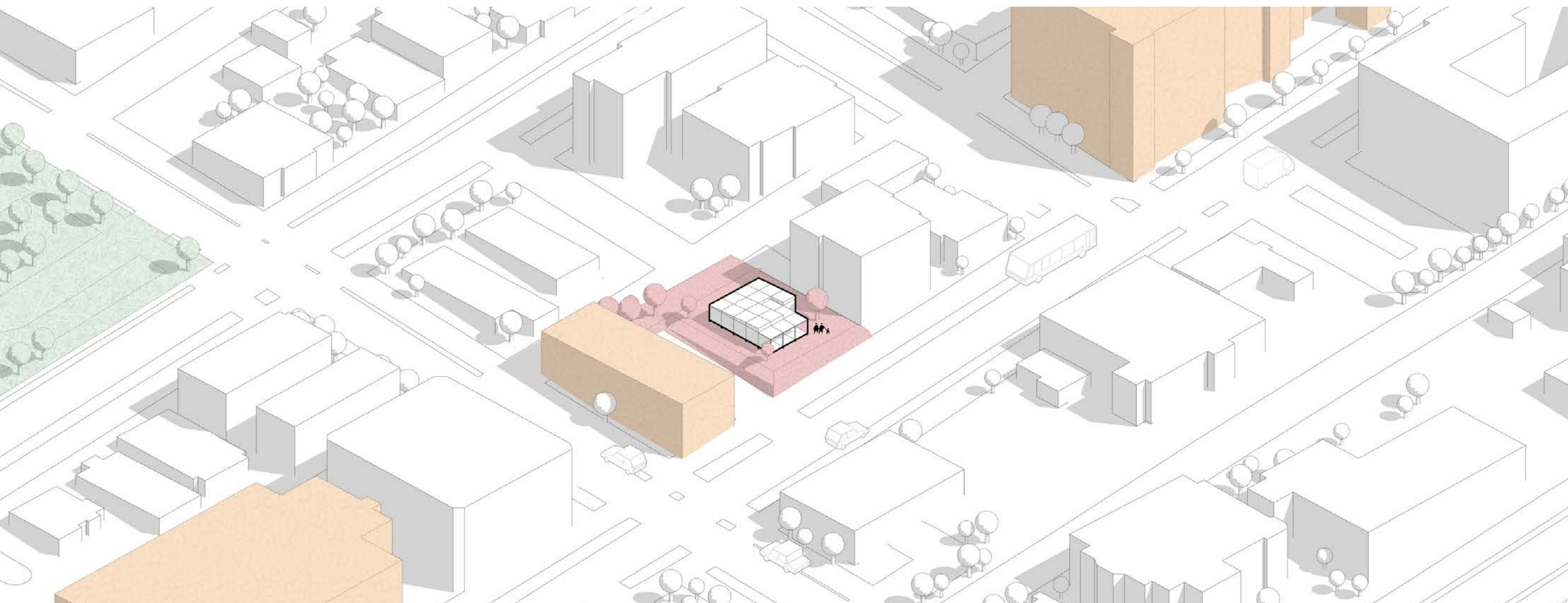


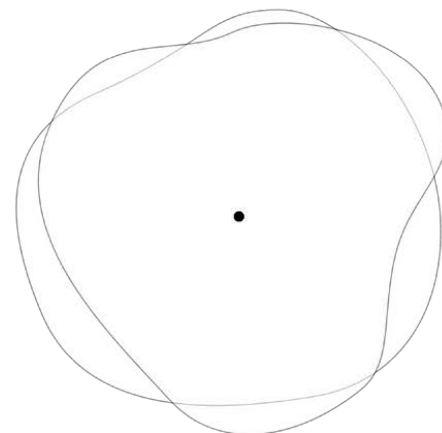
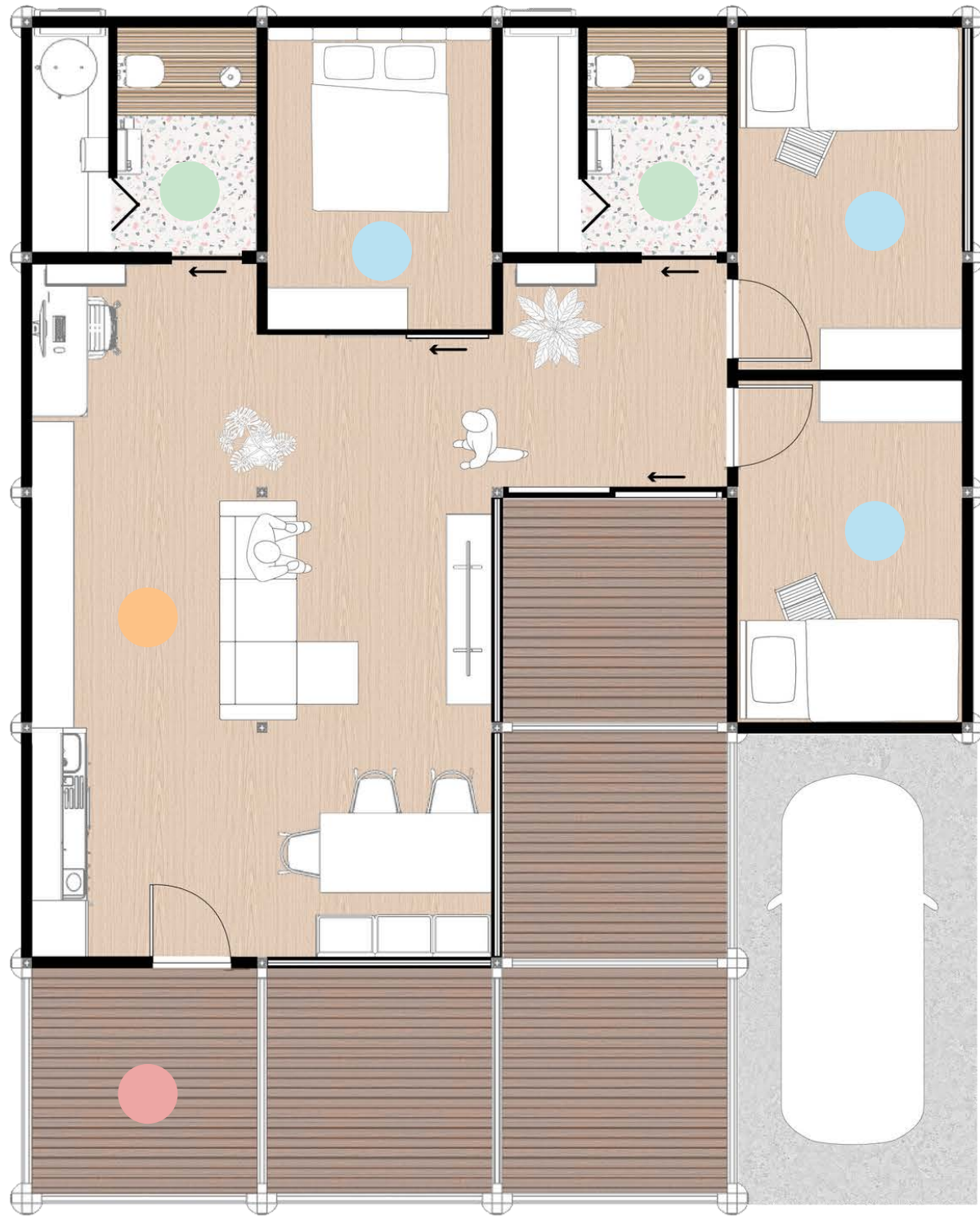
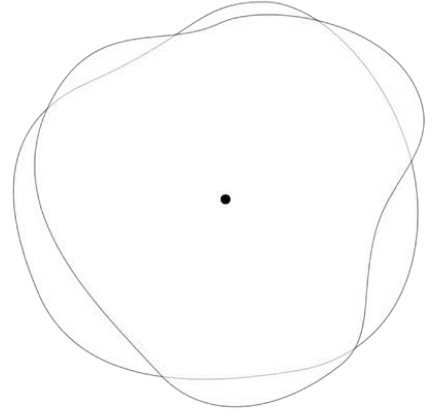
single family home

Seattle

This unit is located just East of downtown Seattle Washington. It is currently a vacant lot that hasn't any use at the moment. The area has been recently growing with many housing and apartment developments popping up, as well as many new retail locations. The lot is in between a market and a small apartment building.

● Site Location ● Local Retail ● Local Parks

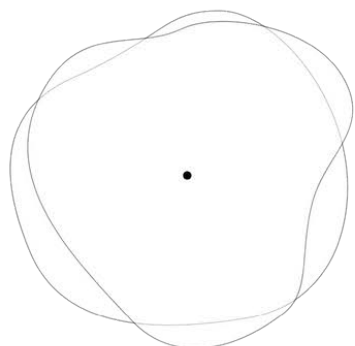


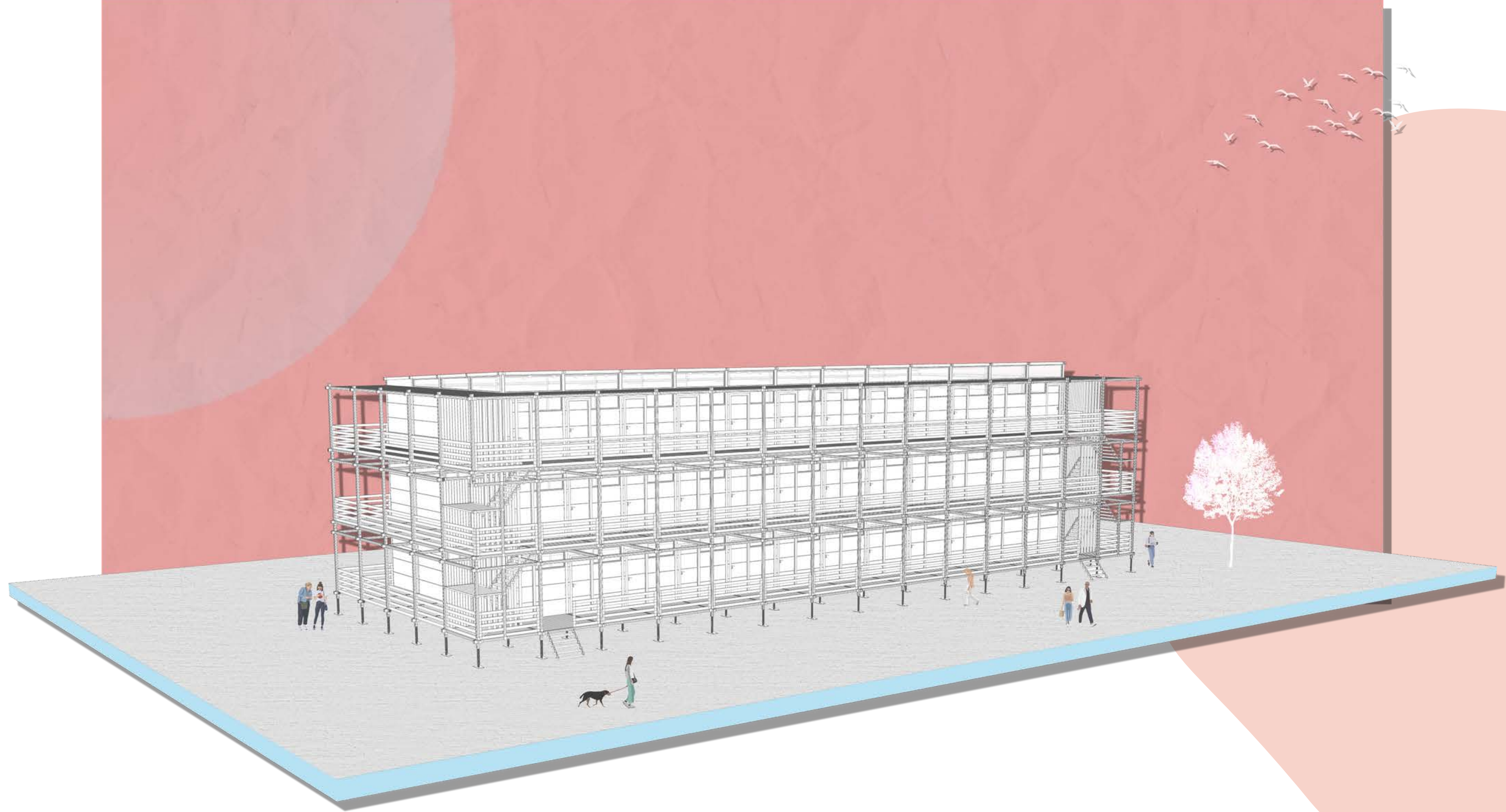


Floor Plan

- Wood Deck
- Kitchen / Dining / Living
- Bedroom
- Bathroom / Mechanical

Three Bedroom:
832 Square Feet



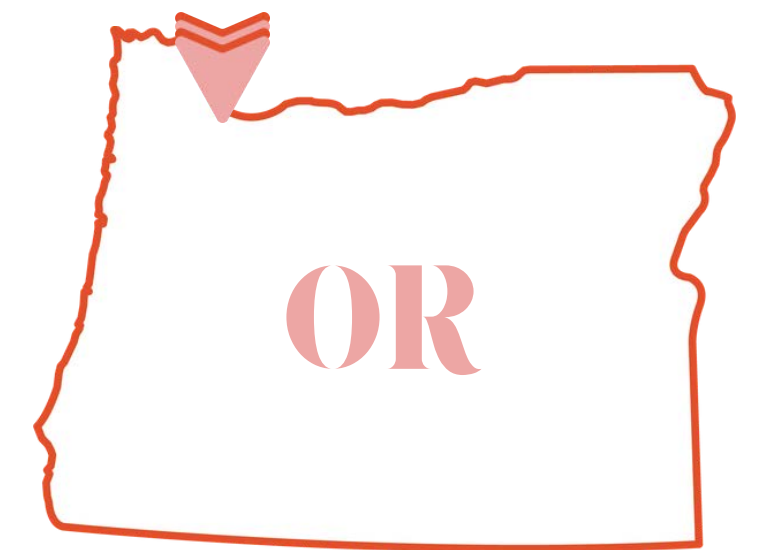
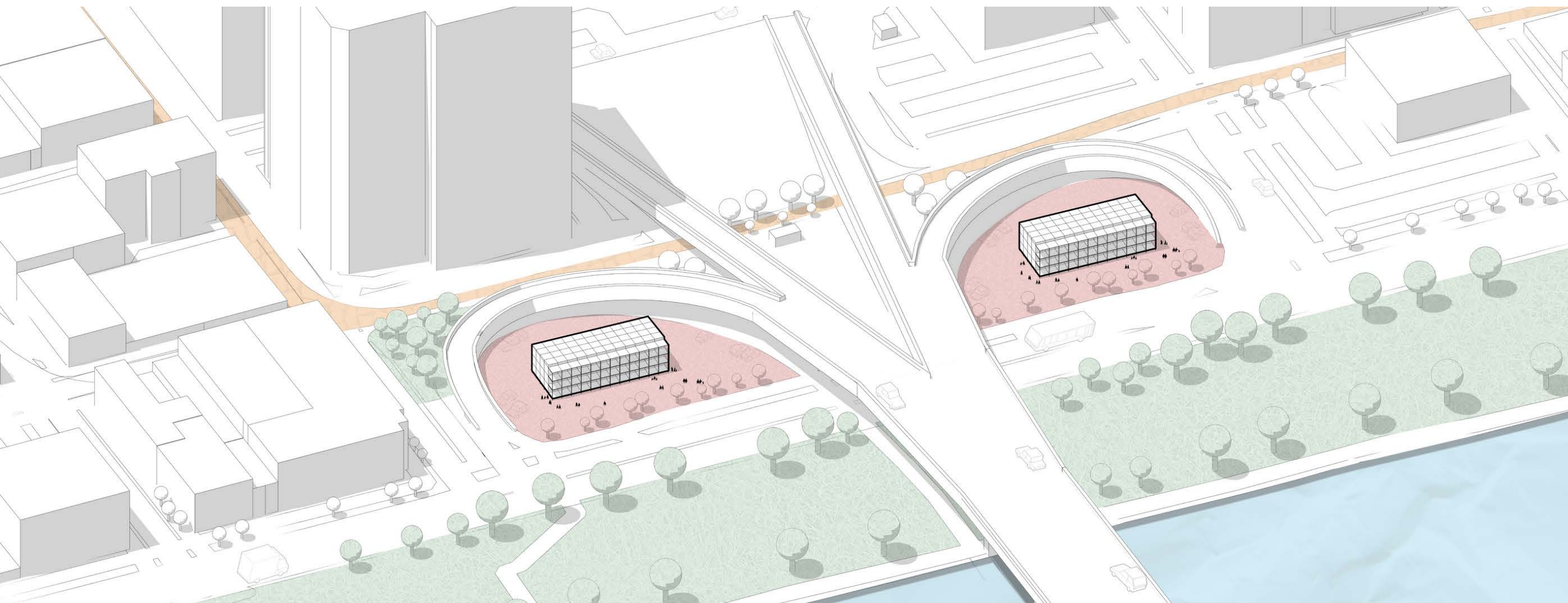


multi-family residential

Portland

- Site Location
- Public Transportation
- Local Parks

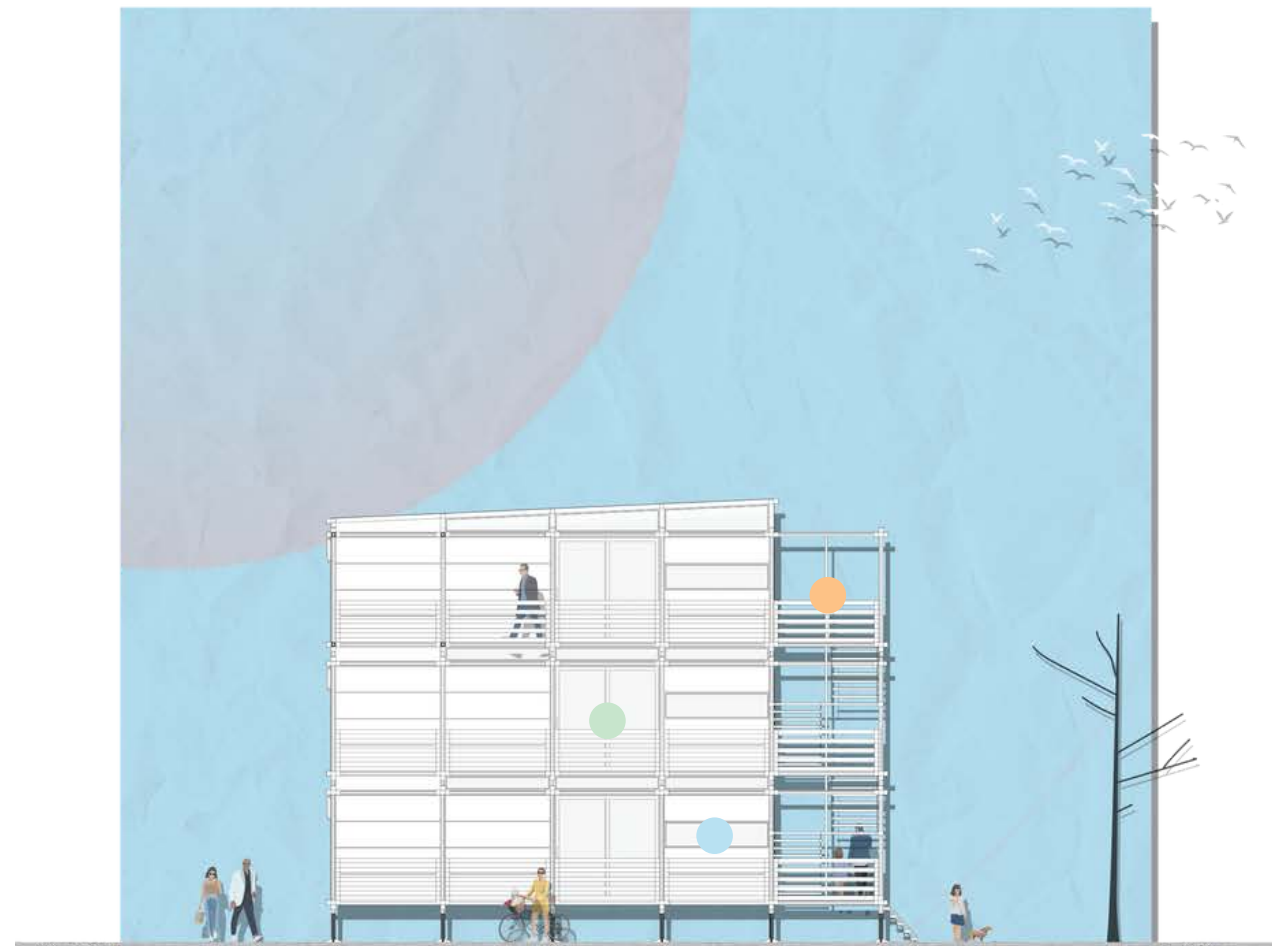
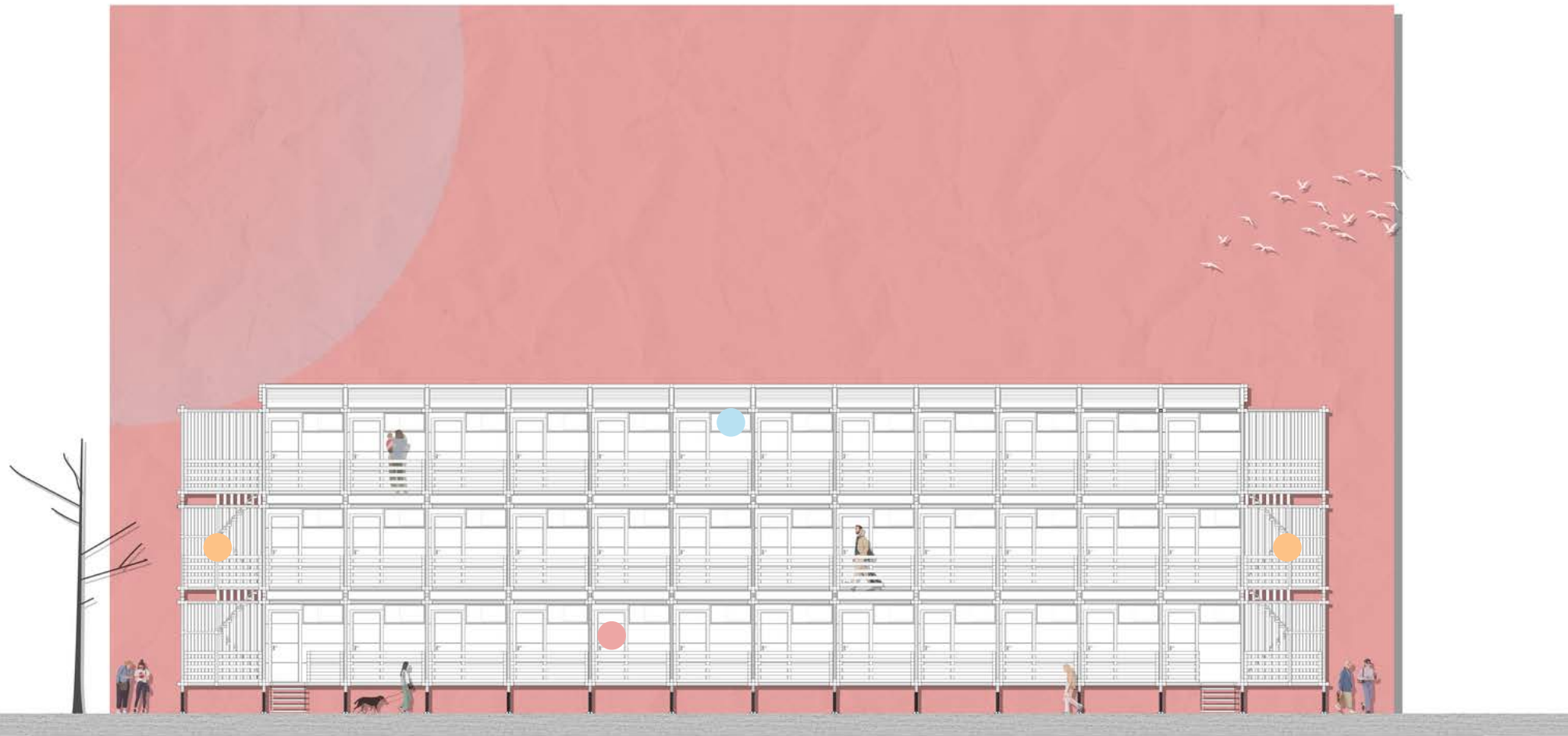
These units are located in the heart of downtown Portland Oregon. Nested between two off ramp loops, it is a prime location to get anywhere easily. The site is currently a parking lot, which is perfect for this structure to be set on. Close by is a bus stop and the local city train that runs right next to the site. With being so close to the river and right next to a park with walking trails, this is a prime location for people who want a well-rounded life in the city.



Elevations

- Door to exterior on all units
- Staircase to units
- Windows on all units
- Deck & sliding door for side units

36 Individual Units:
256 SqFt Each





multi-minimal



Thank You!

Figures Cited

Figure 1

Philip Johnson's Glass House: Interior & Floor Plan | Study.com

Figure 2

Writer's Modern/Retro Tiny House in the Woods...
(tinyhousetalk.com)

Figure 3

5 Energy Efficient Prefab Homes - BONE Structure

Figures 4, 5, 6

Micro homes in pipes designed to ease Hong Kong's housing crisis (dezeen.com)

Figure 7

5 Things Everybody Should Know About Boxabl Homes (and Some Extras) (tinyhouse.com)

Figure 8

The Future of Building Construction Worldwide? Boxabl Overview and Update Video! - YouTube

Figure 9

Boxable Casita Tiny House - Boxabl Homes (boxabl-homes.com)