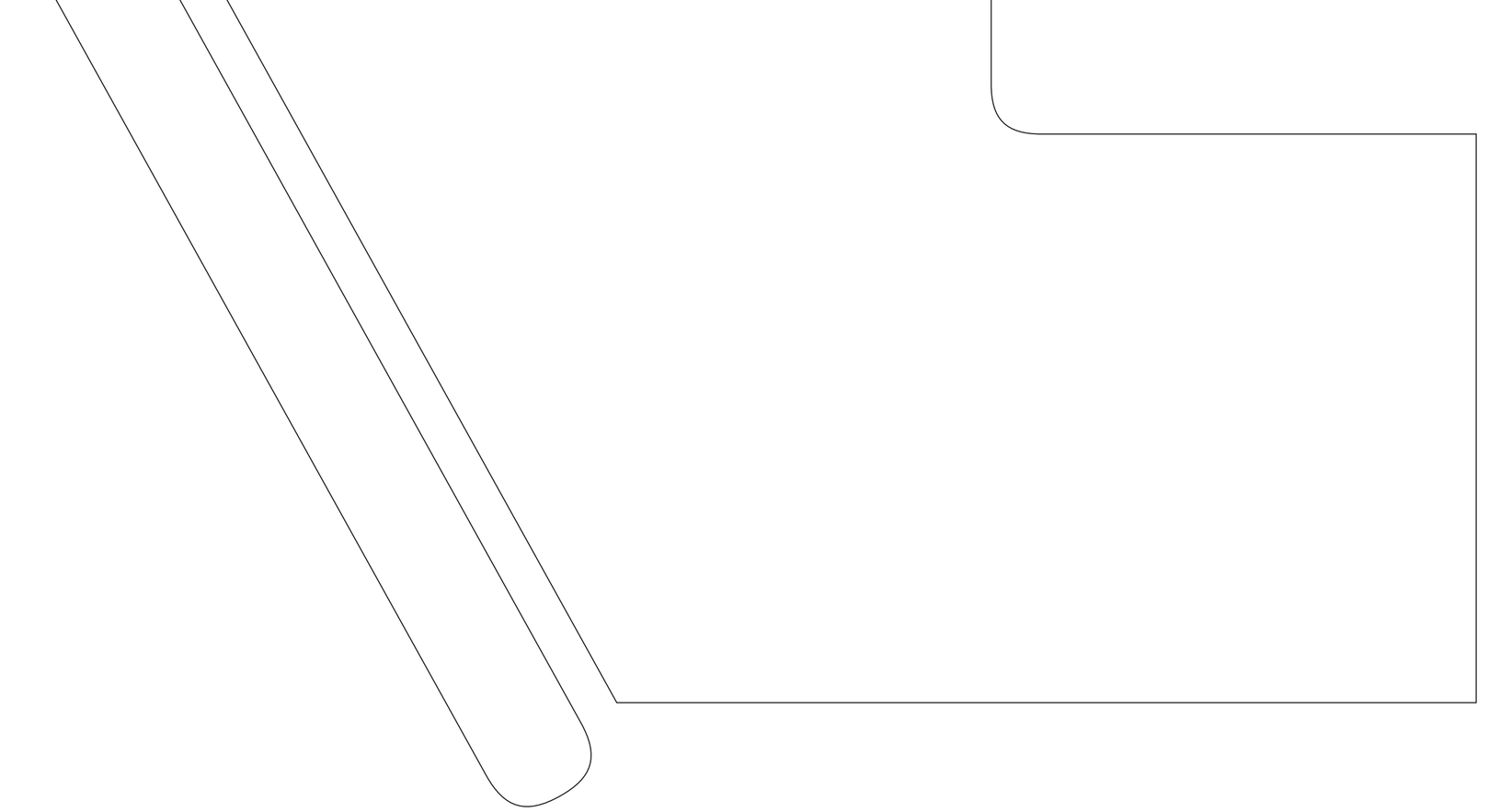
New Housing Model

Graduate Thesis

Aidan Quinn

Arch 593: Master Project
Prof. Dirk Denison
Prof. Tyler Waldorf
5/02/2012



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Aidan Quinn
quinn.177@hawk.iit.edu

Table of Contents

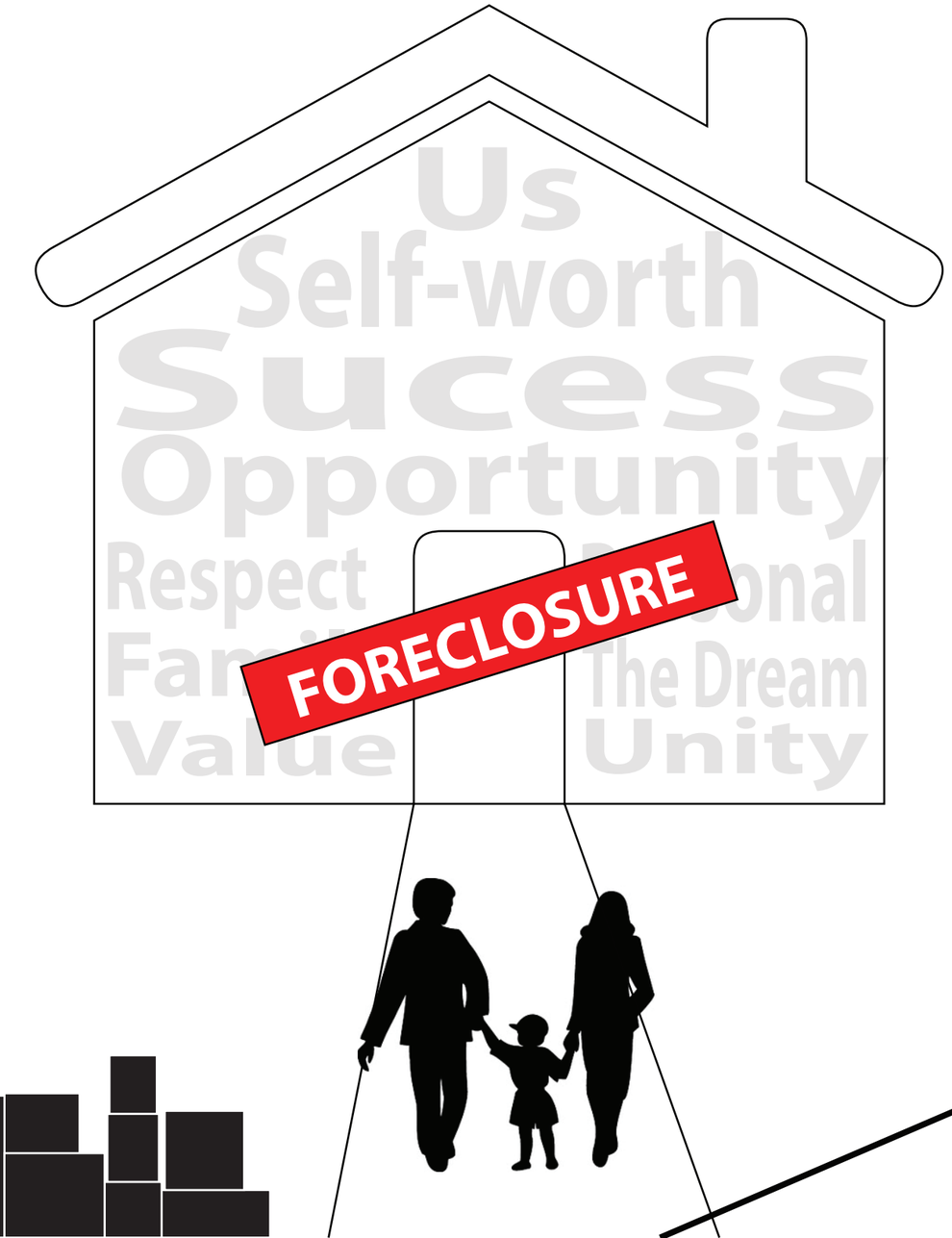
THEN

The Single Family Home

&

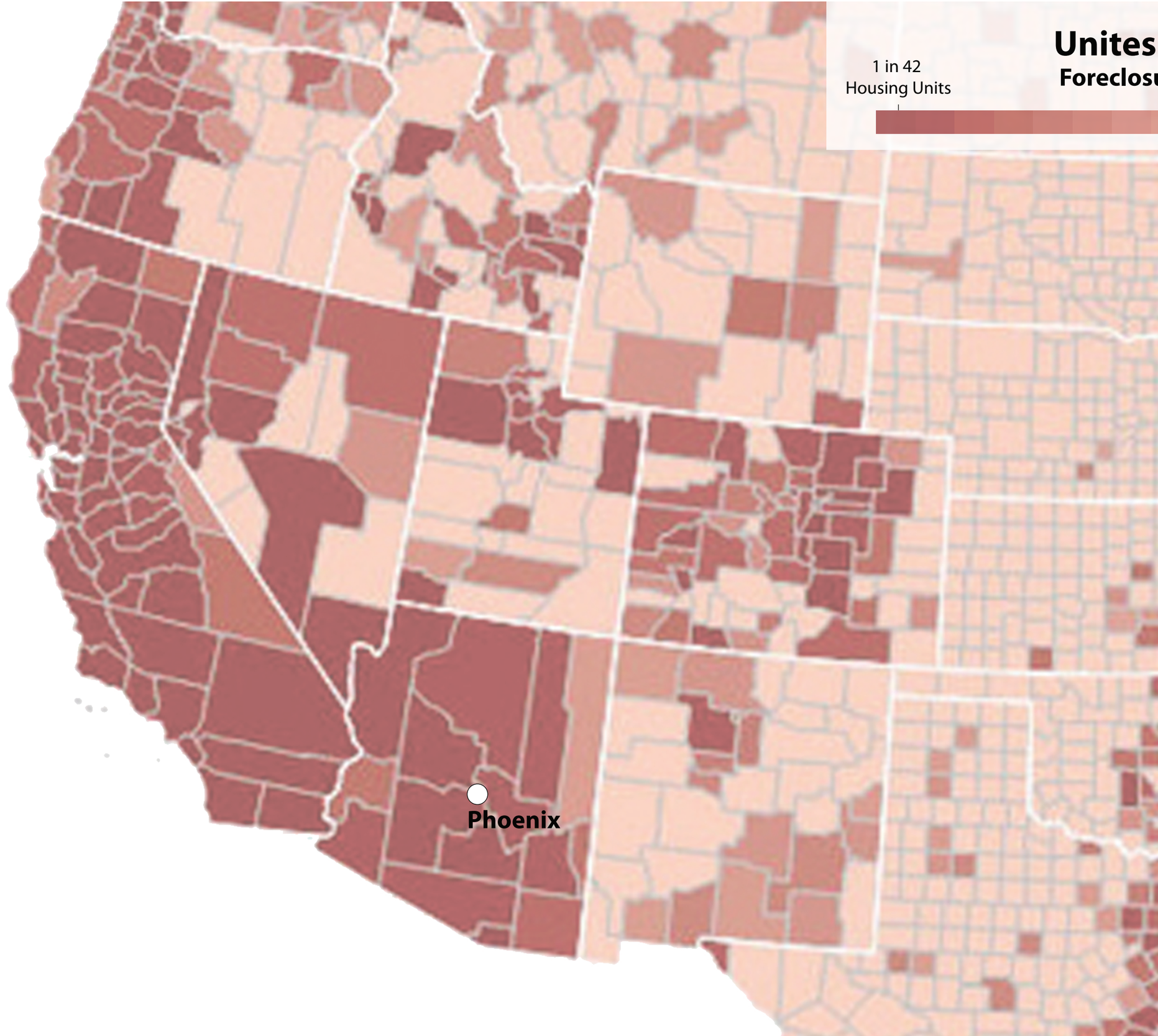
NOW

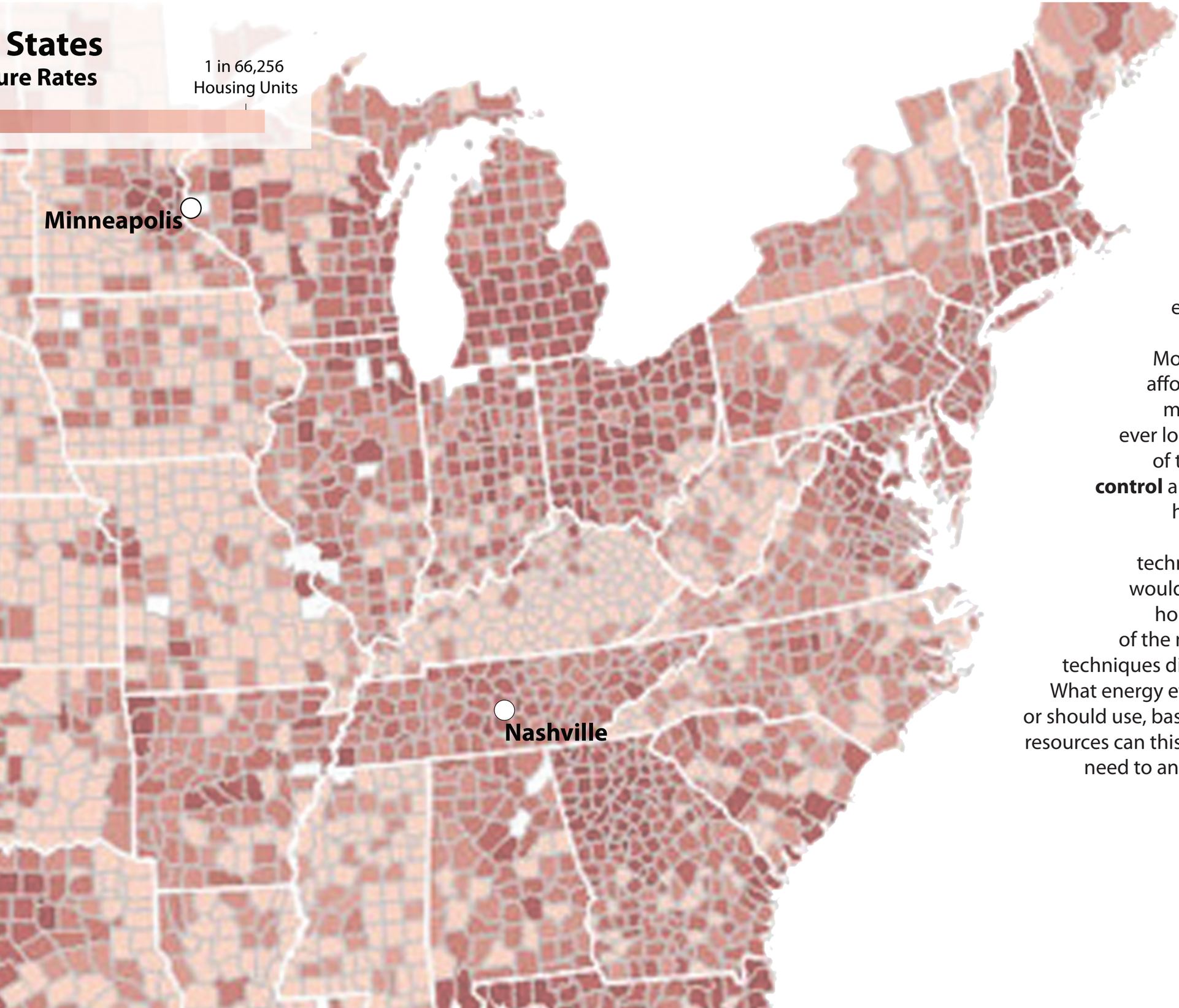
Housing Crisis of 2008



Elevator Statement

The housing crisis of 2008 has presented an opportunity to rethink and redesign housing for the middle class; an opportunity to usher in a new era of housing that addresses the ever rising costs of living. The "New Housing Model" will address these issues by focusing on construction techniques, energy efficient technologies, and flexible/efficient spatial planning.





Case Statement

With living costs continuing to rise, I believe that the era of oversized and inefficient homes have become obsolete. I believe that a new era of housing, driven by efficiency and fiscal responsibility, will be the new status quo. The "New Housing Model" is an attempt to create efficient and affordable housing for the middle class and, most importantly, be sustainable in which ever location the homeowner desires. Because of this, the model consists of two parts; **the control** and **the variable**. **The control** part is the home itself. Spatial organization, flexible spaces, quality of materials, interior technology; these are elements that I believe would remain consistent no matter where the home is located. **The variable** component of the model is location. How will construction techniques differ from one climate zone to the other? What energy efficient technologies can this model use, or should use, based on varying conditions? What natural resources can this model take advantage of? These issues need to and will be addressed in order to make the "New Housing Model" successful.

The Control

Housing Unit

Goals

For this model to be successful it needs to be made affordable to the medium/low income residents.

To keep residents in the home; maintenance and living costs will be minimized.

The quality of the atmosphere within the home mustn't suffer in an effort to alleviate costs.

The success of this model hinges on its ability to adapt to the unique qualities associated with any given location.

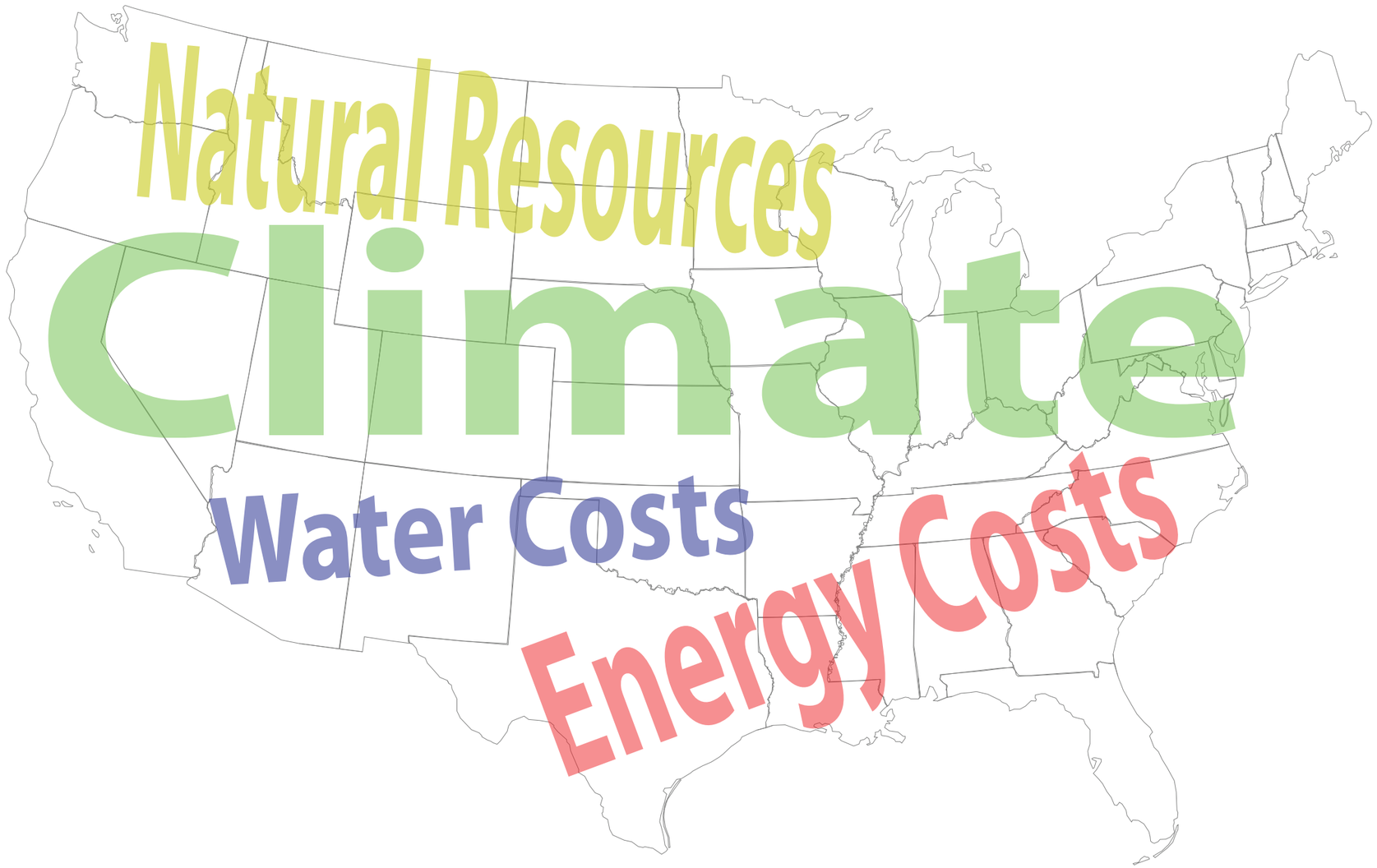
Principles

Responsible use of energy efficient technology will help reduce monthly bills.

The efficient use and re-use of space will lower the footprint and reduce costs.

Given the location, proper construction techniques and material selection will minimize maintenance and living costs.

Taking advantage of natural resources such as; energy, water, and weather, might help lower costs.



The Variable

Location

New Housing Model

The Control

Qualitative Parameters

While demonstrating high energy and spatial efficiency, the "New Housing Model" will be affordable for the average user.

Trailer Home

Loblolly House

Smart Home Exhibit

New Housing Model

New Housing Model

The Control

Program

Hard Space

	Quantity	Area
Nutrition *refrigerator, stove, dishwasher, sink*	1	TBD
Hygiene *toilet, shower, sink*	1	60 sqf.
Systems *washer/dryer, A/C, furn.*	1	24 sqf.

Soft Space

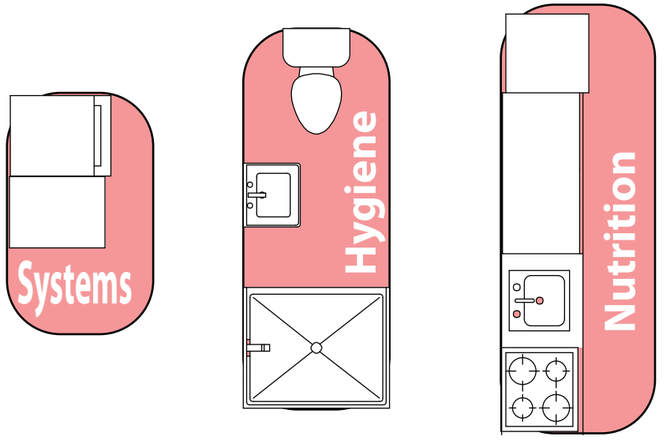
Primary Rest *Bed, closet*	1	120 sqf.
Secondary Rest *Bed, closet*	TBD	90 sqf.
Nourishment *dining table*	1	TBD
Relaxation *tv, couch, multi-use*	1	TBD

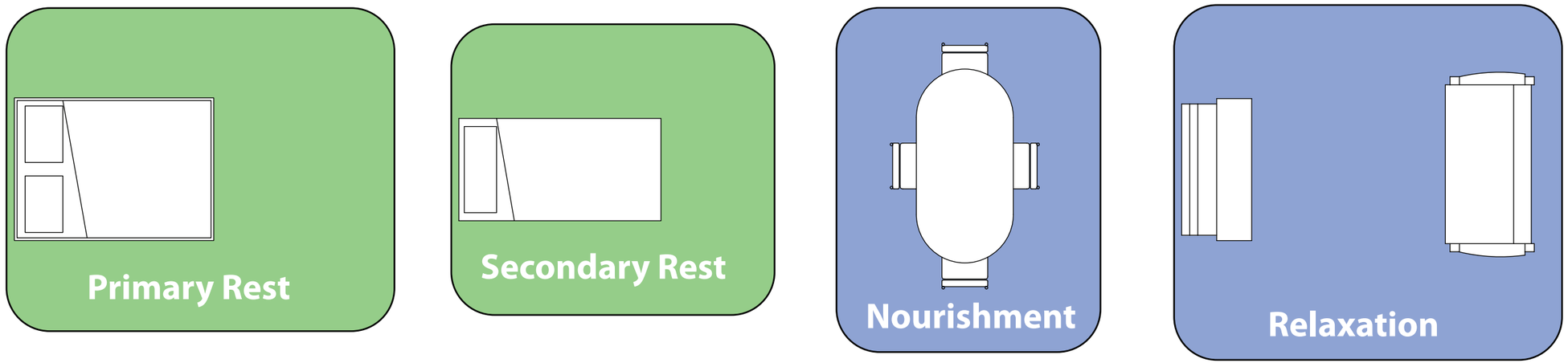
Shared Open Space

New Housing Model

The Control

Program





New Housing Model

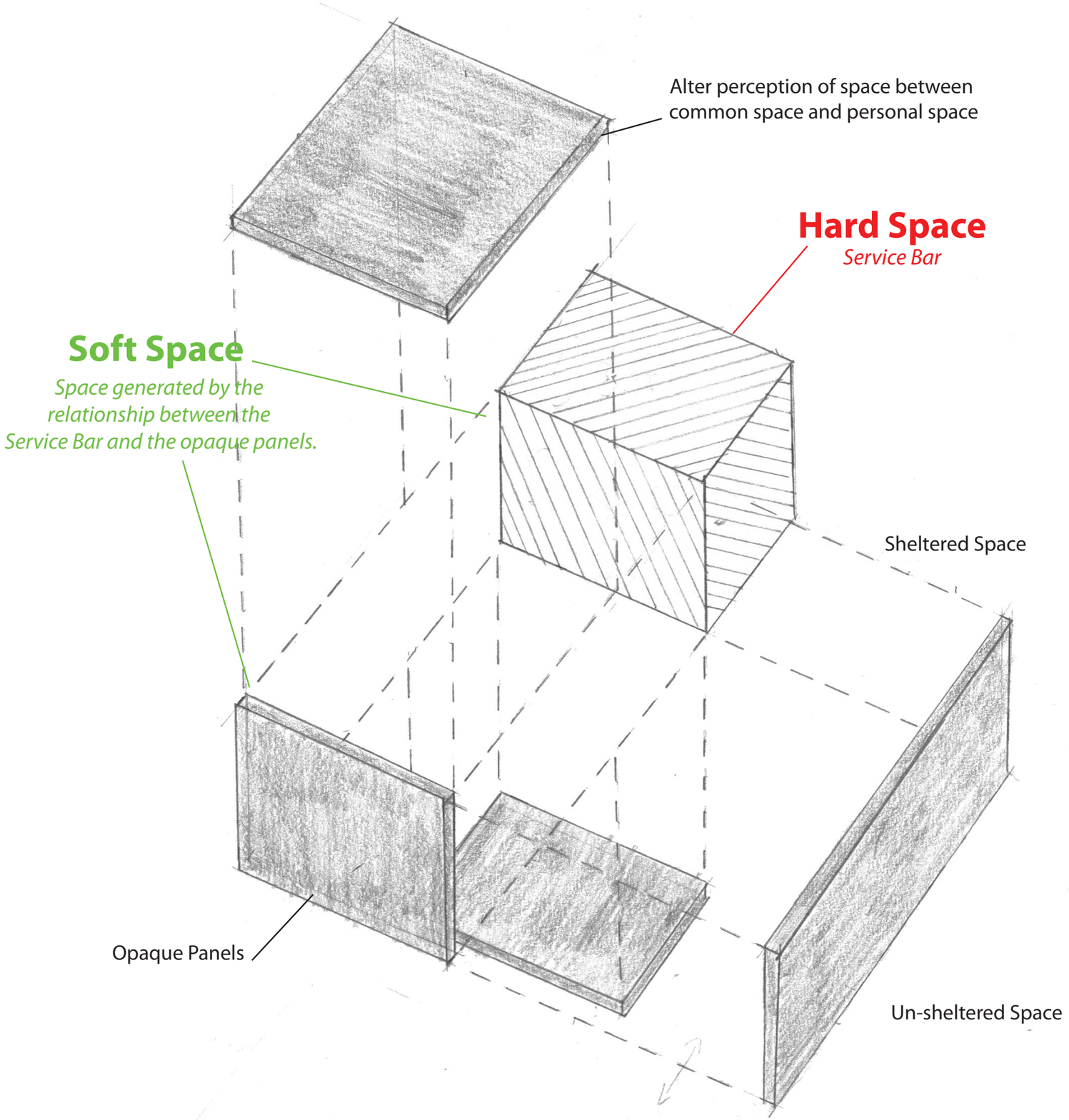
The Control

Spatial Generation

Focusing on flexibility to create a user defined space

My approach to the design is spatial flexibility. My goal is to generate a system that focuses on flexibility in order to create space that is defined by the user. By letting the user define how the space within the home will be used will lead to a more attractive and effective housing model.

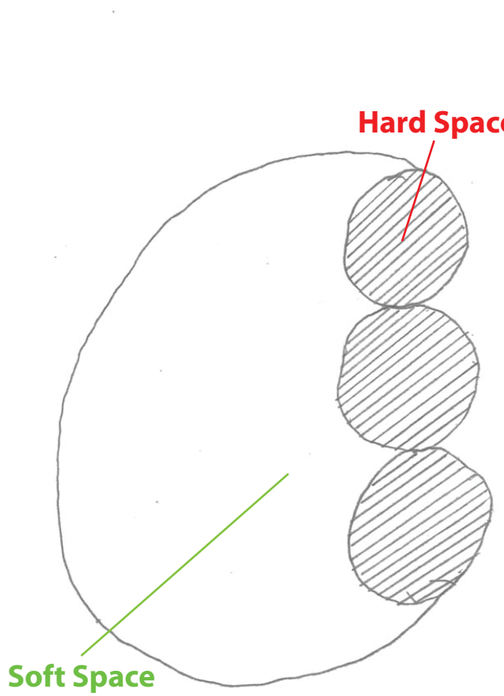
I began by consolidating all the "Hard Space" (space that is fixed due to plumbing systems, mechanical systems, etc.) into a single entity,which would then open up the rest of the area for the "Soft Space" (spatial functions that don't require hard elements to operate).



New Housing Model

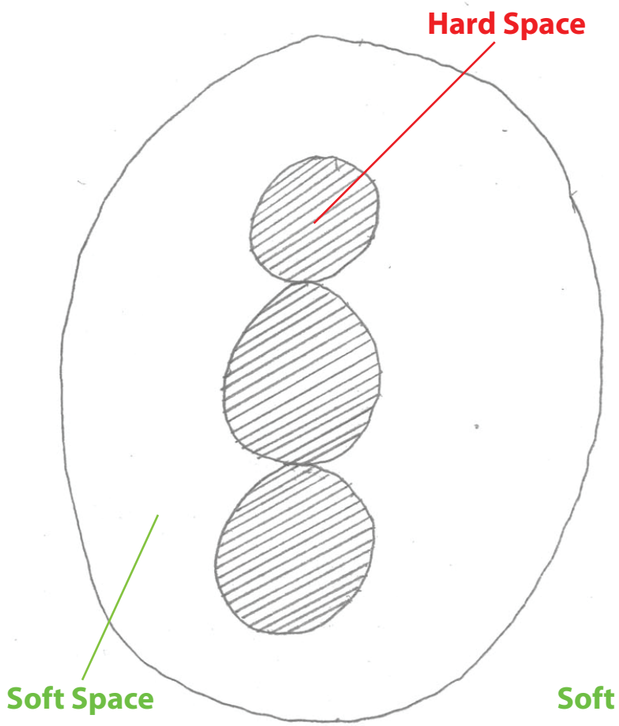
The Control

Organizational Schemes



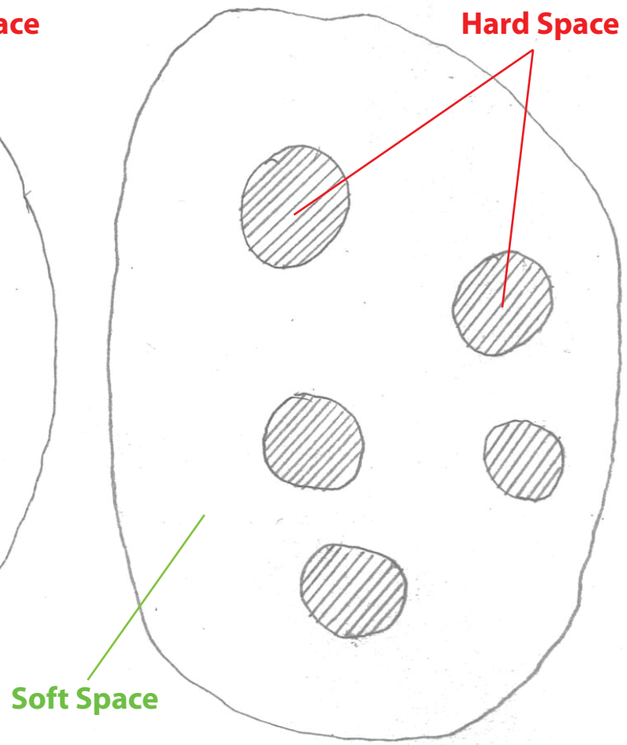
Scheme 1

Service Bar



Scheme 2

Floating Service Bar



Scheme 3

Fractured/ Floating Service Bar

Hard Space

Bathrooms
Kitchen
Systems
Vertical Circulation

Soft Space

Dining Area
Living Area
Sleeping Area
Study Area

New Housing Model

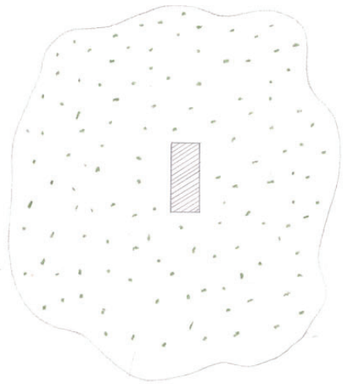
The Control

Spatial Exercise

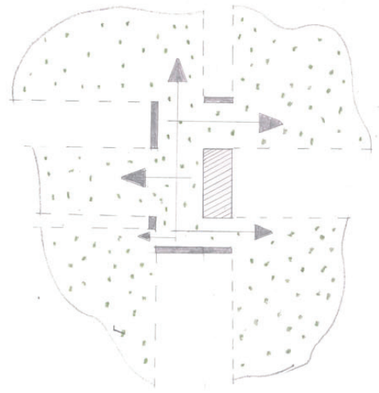
Scheme 1

Loaded Service Bar

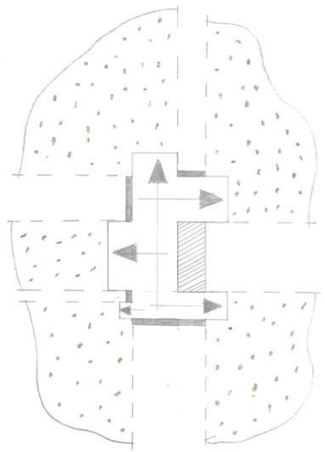
Version 1



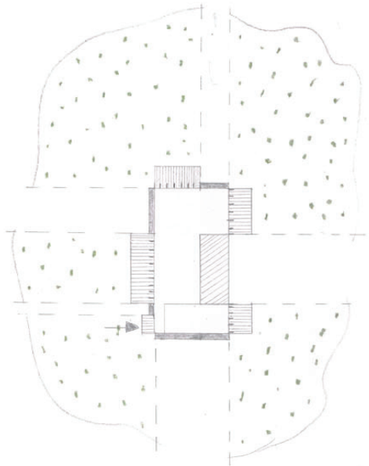
Service Bar within landscape



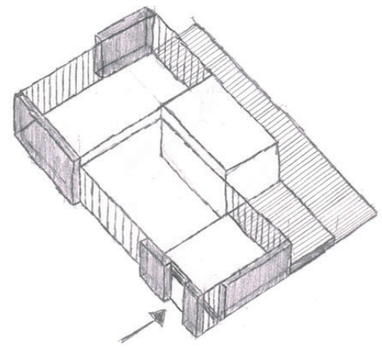
Spatial Generation



Projections



Entrance



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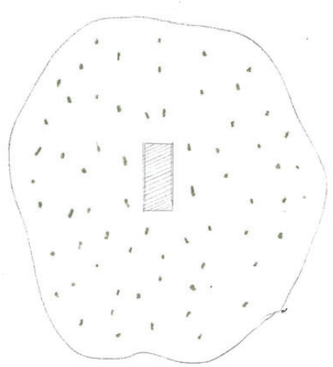
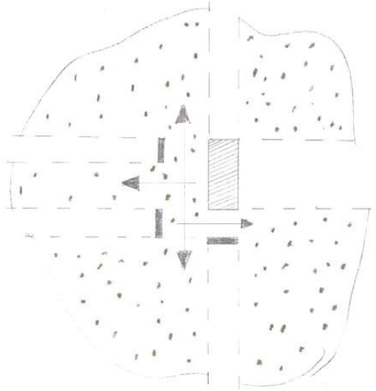


Service Bar within landscape



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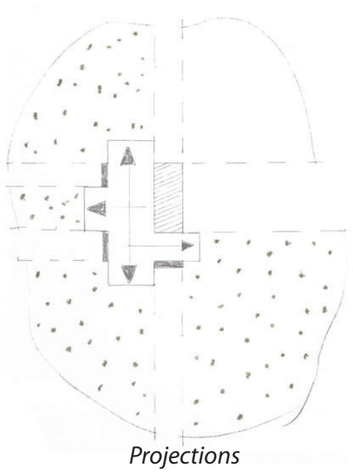

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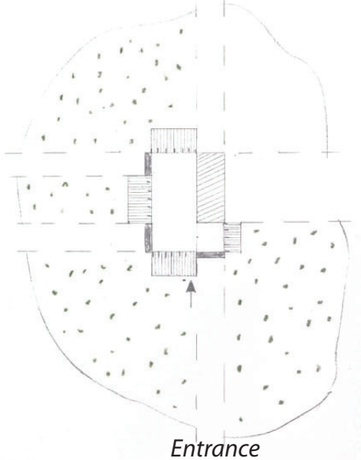

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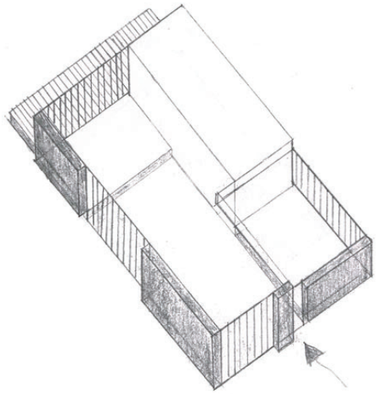

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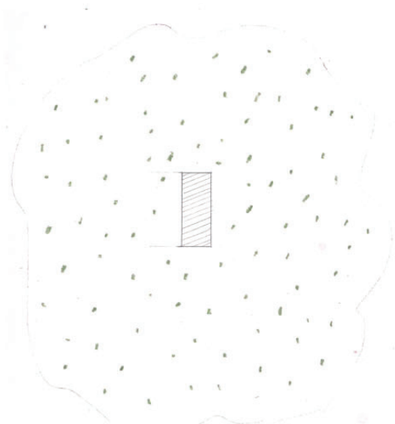
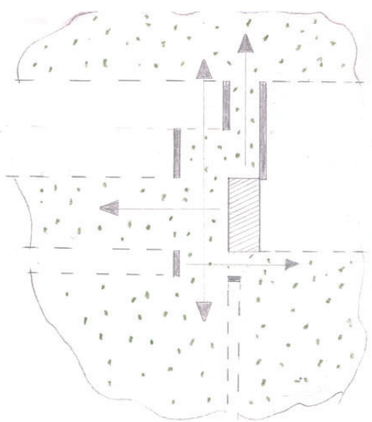


Service Bar within landscape



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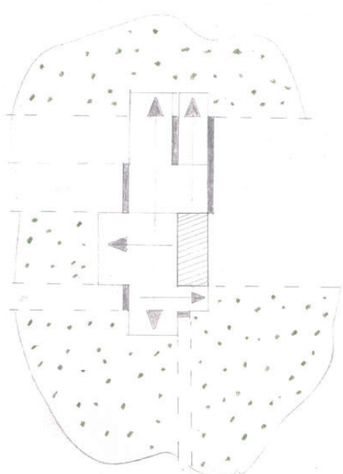

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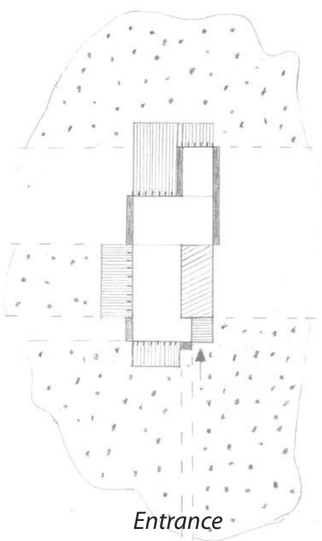

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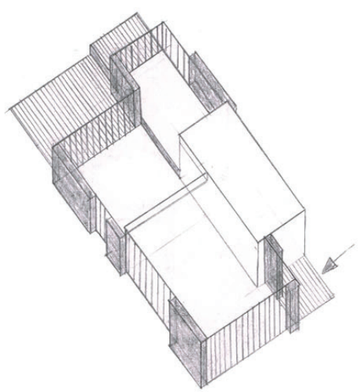


New Housing Model

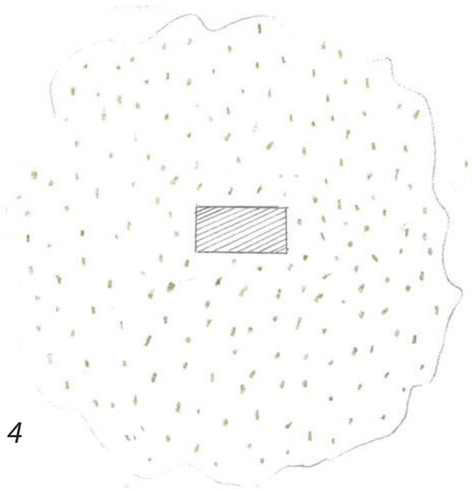
The Control

Spatial Exercise

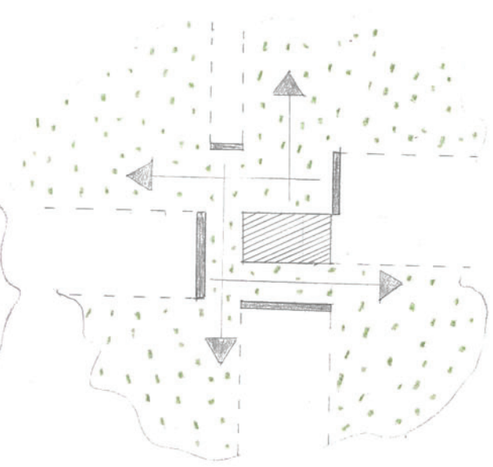
Scheme 1

Loaded Service Bar

Version 4



Service Bar within landscape



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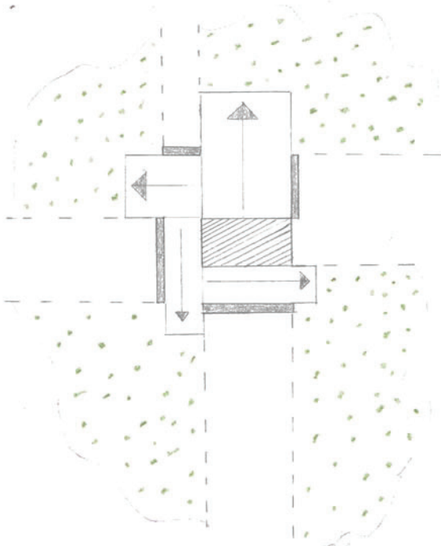

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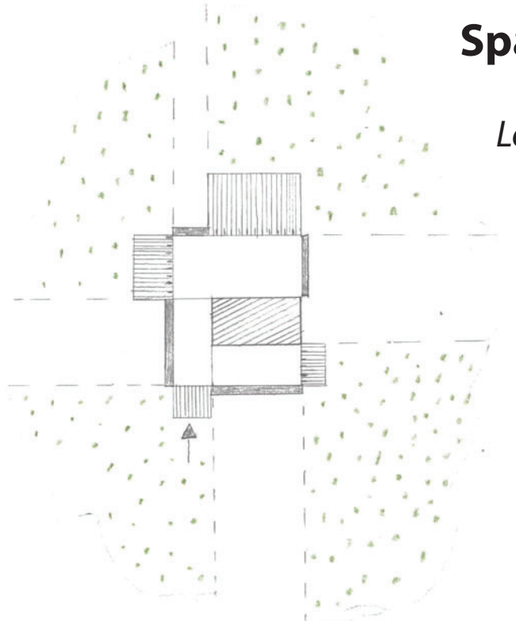
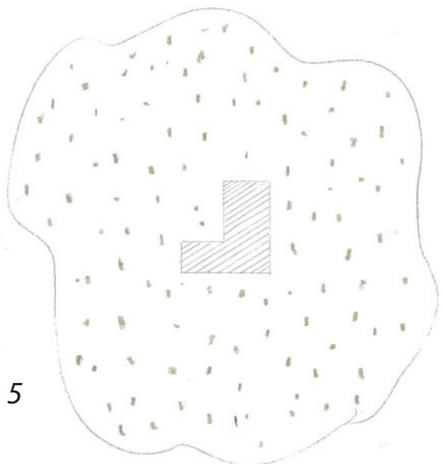


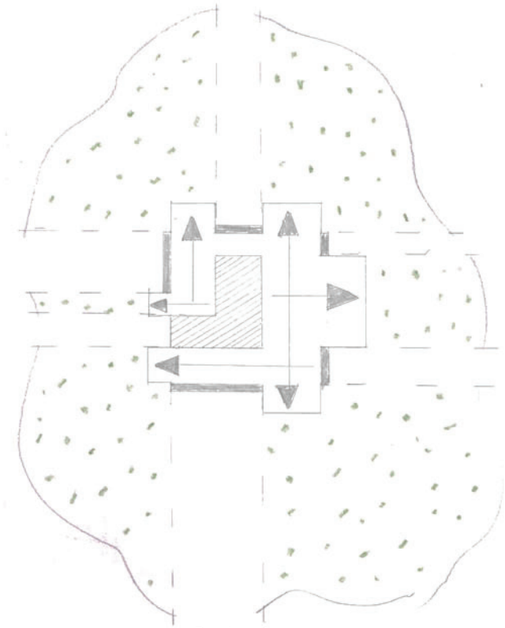
Entrance

Version 5



Service Bar within landscape

Spatial Generation



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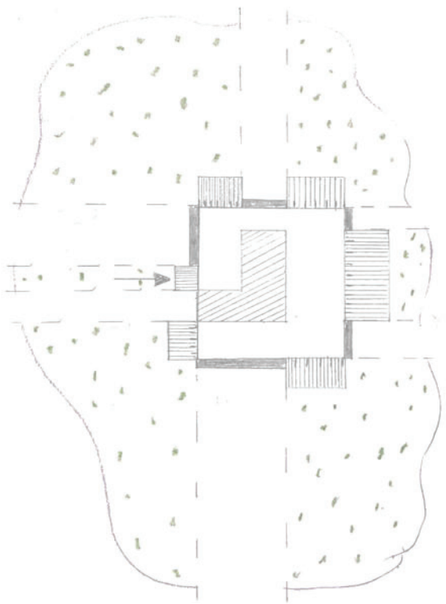


Entrance

New Housing Model

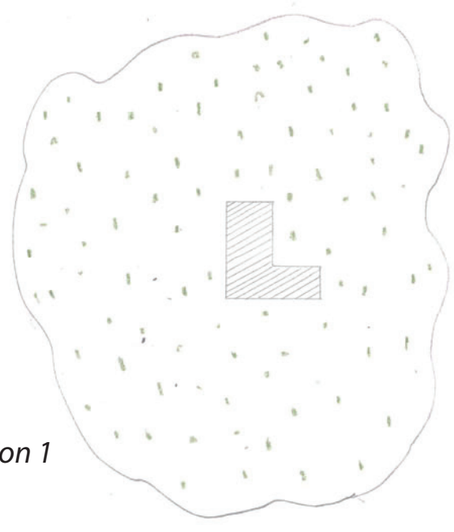
The Control

Spatial Exercise

Scheme 2

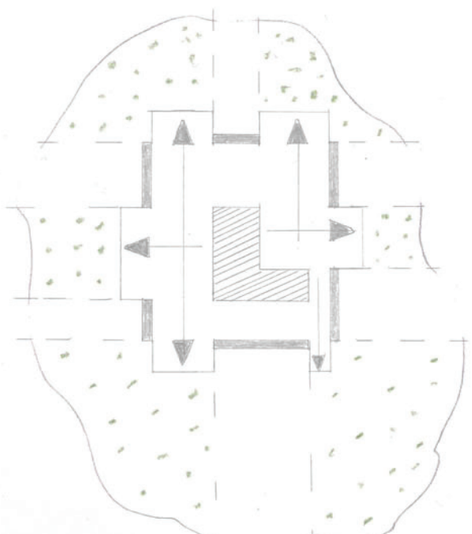
Floating Service Bar

Version 1



Service Bar within landscape

Spatial Generation



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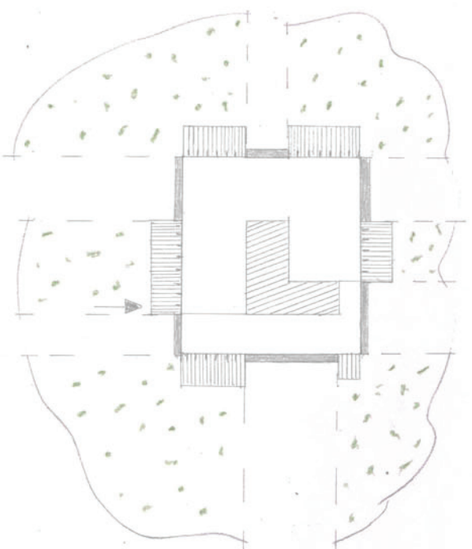

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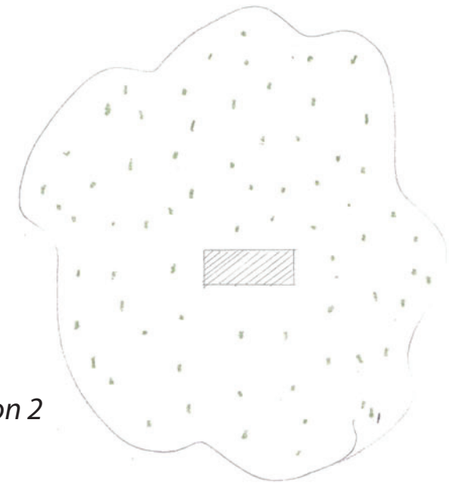
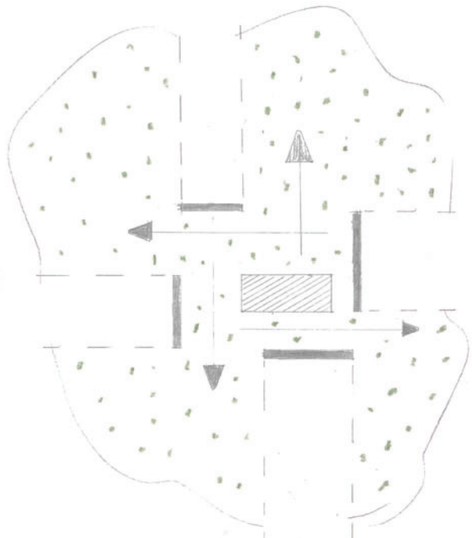
Version 2



Service Bar within landscape



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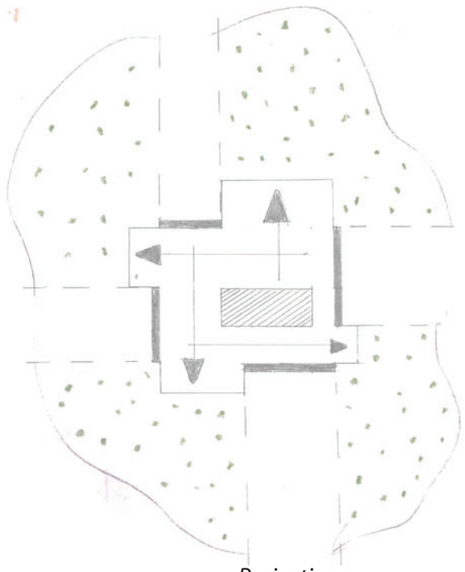

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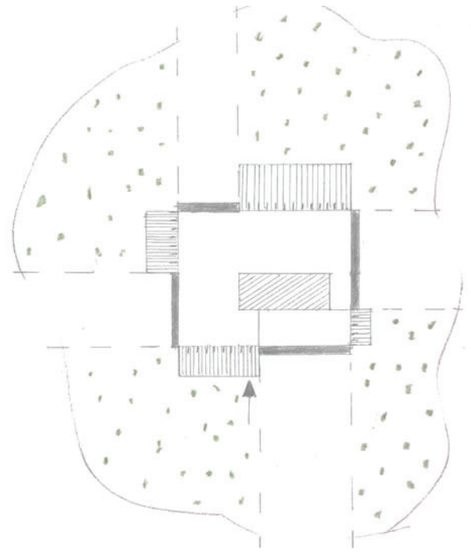


Entrance

New Housing Model

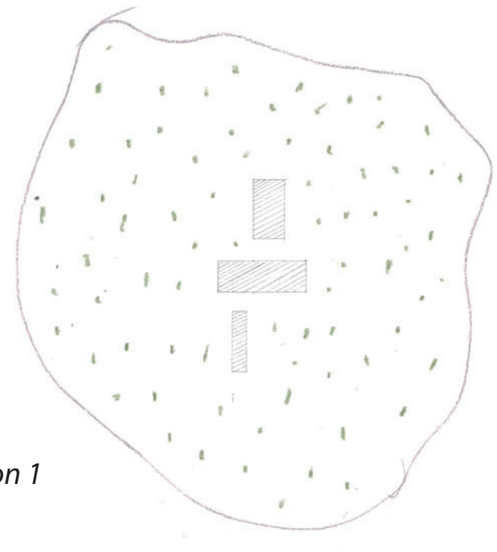
The Control

Spatial Exercise

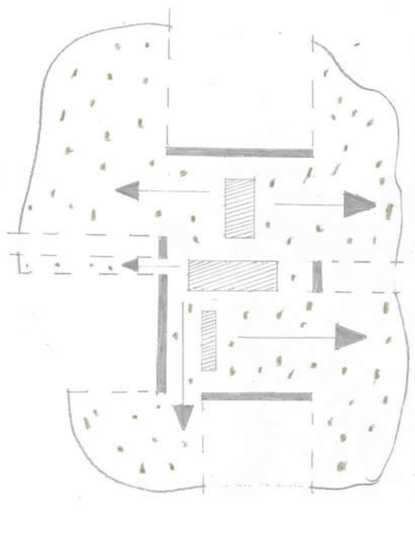
Scheme 3

Fractured/Floating Service Bar

Version 1



Service Bar within landscape



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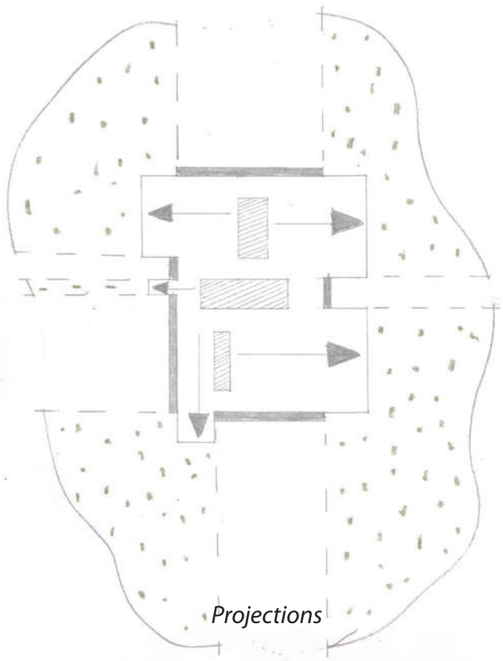

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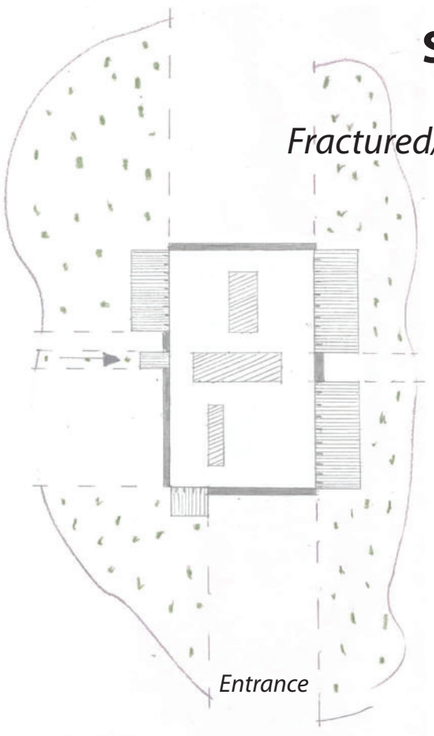
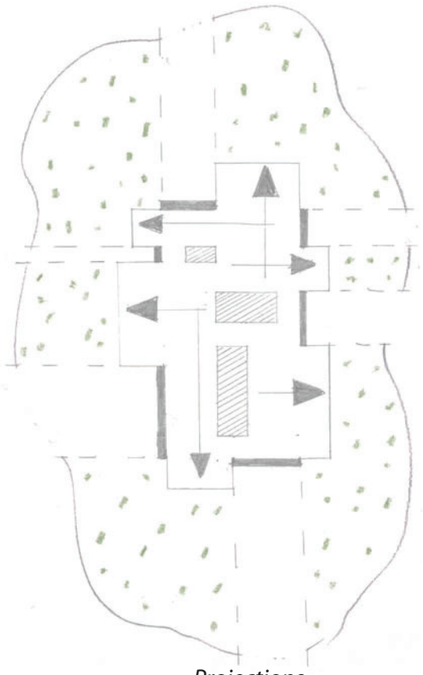


Entrance

Version 2

Service Bar within landscape

Spatial Generation



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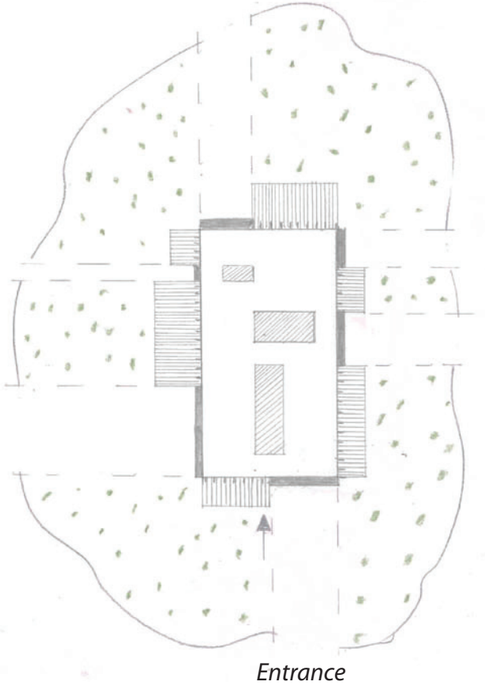


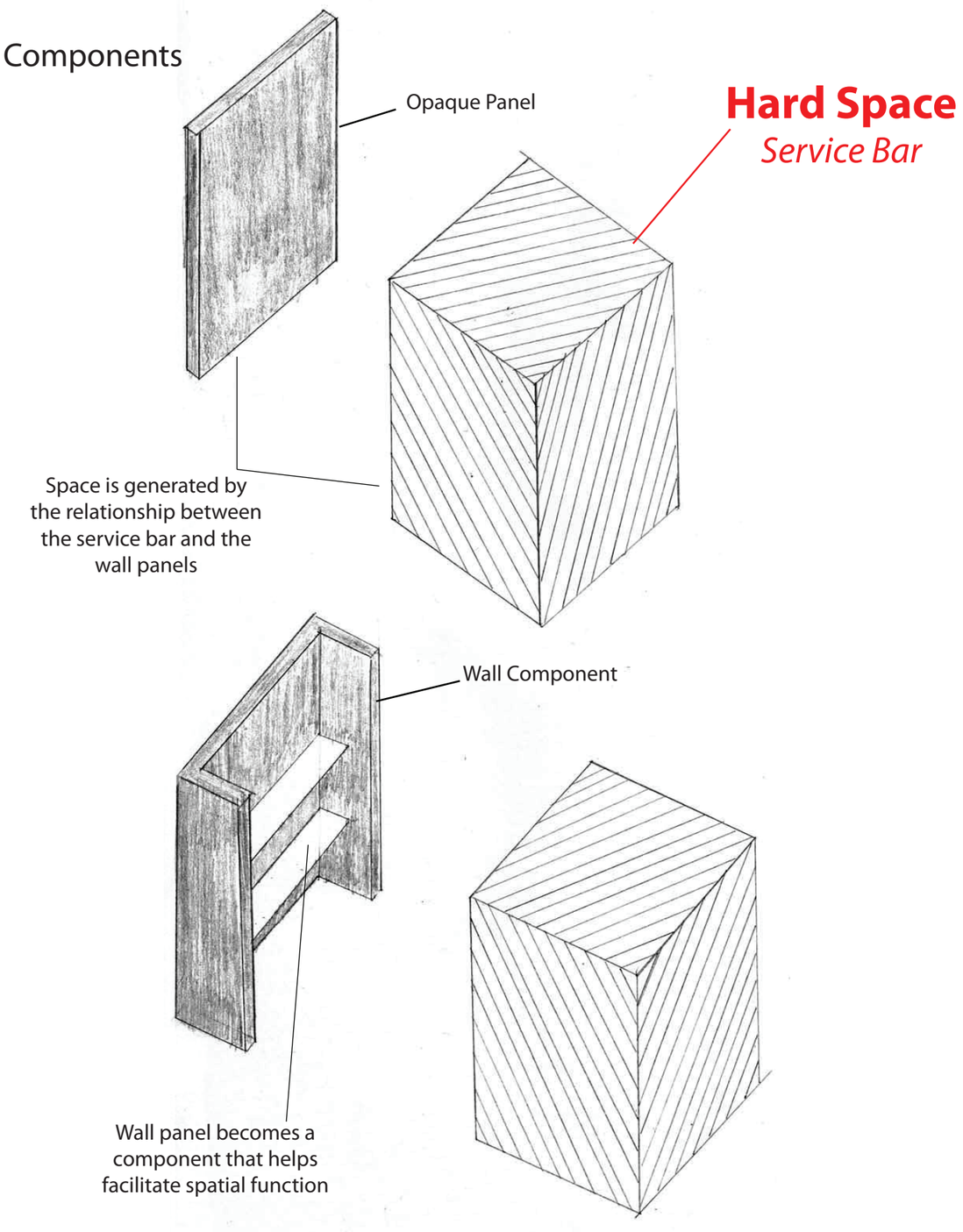
Entrance

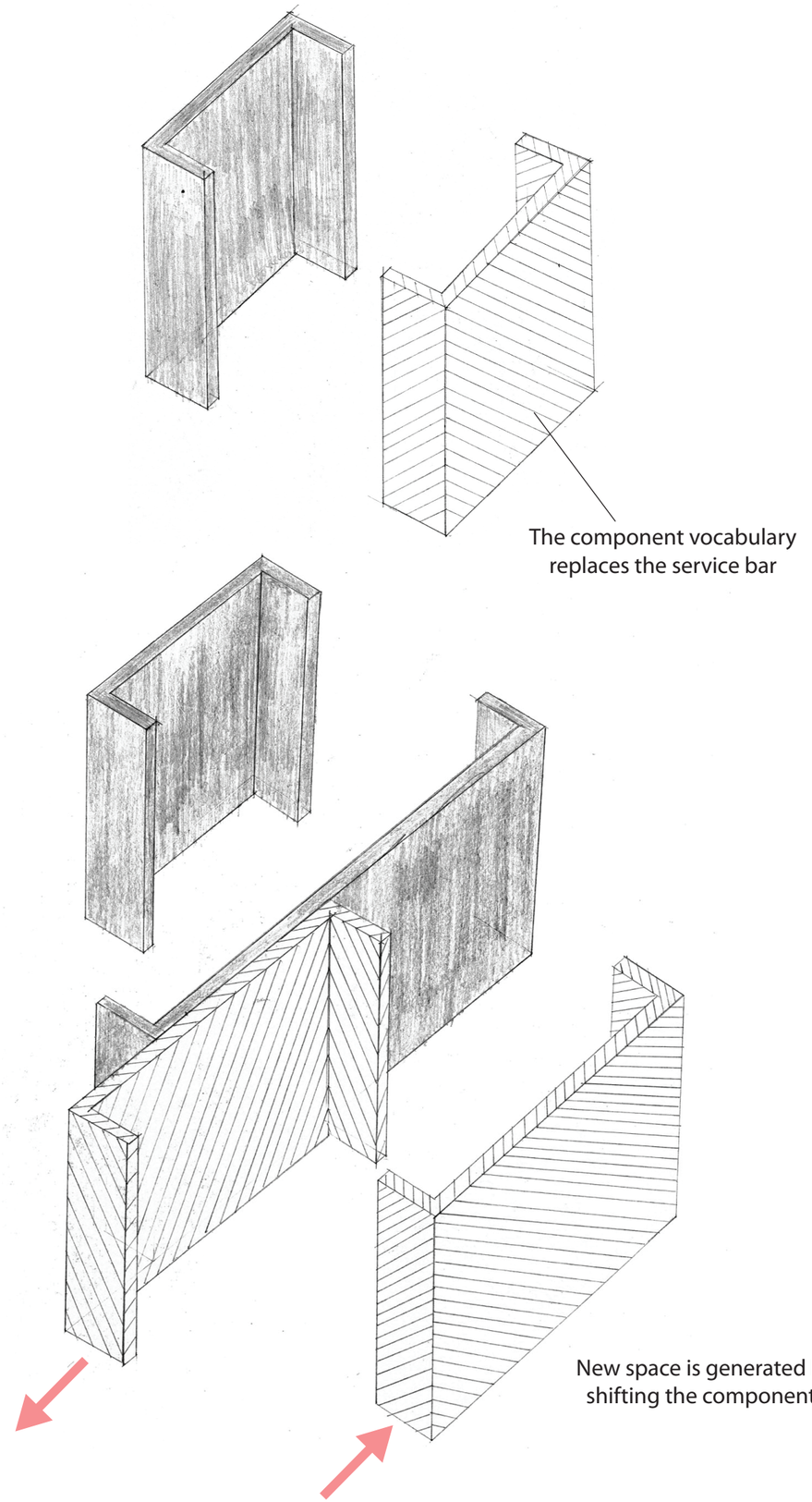
New Housing Model

The Control

Vocabulary

Flexible Housing Components





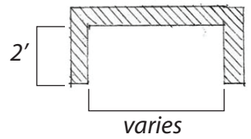
New Housing Model

The Control

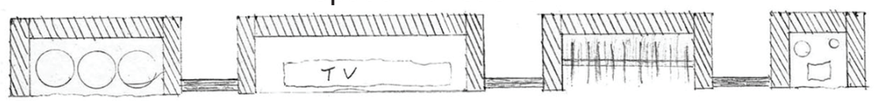
Vocabulary

Flexible Housing Components

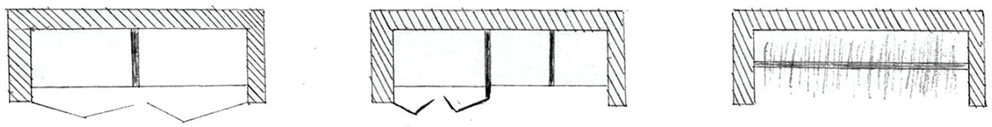
Flexible Housing Components



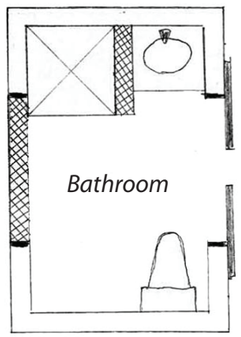
Spatial Functions

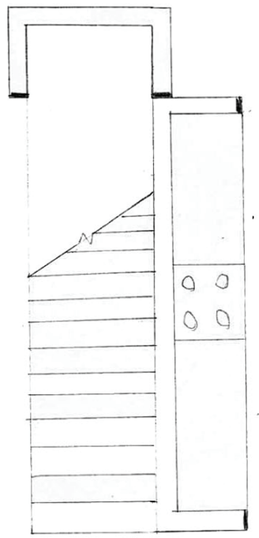


Varying Functions Defined By Users

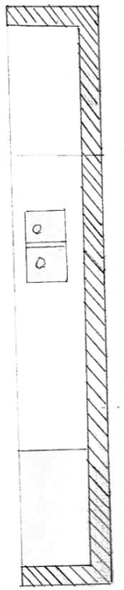


Service Components

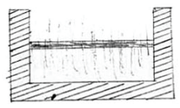




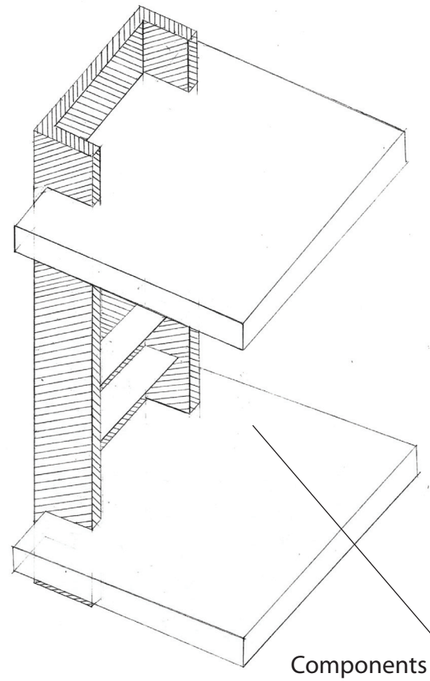
Kitchen

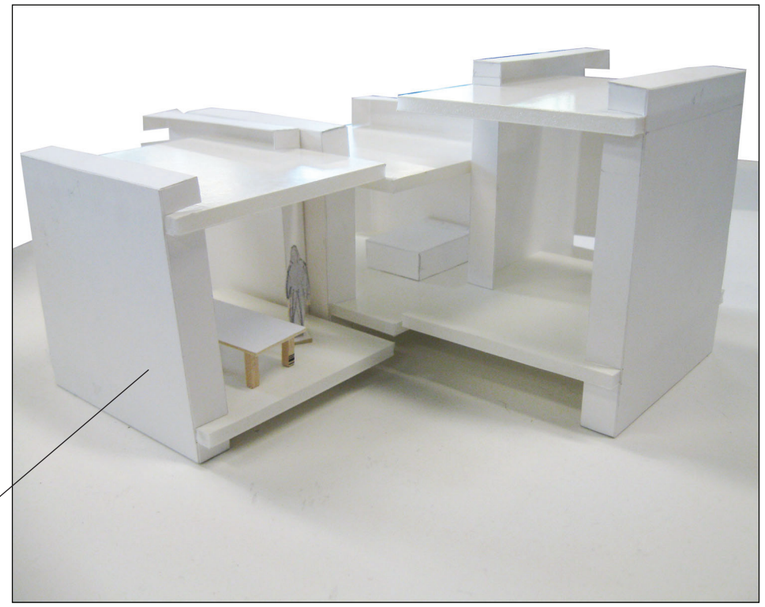


Vertical Circulation



Spatial Heights





Components begin to hold the horizontal planes; varying the heights and altering the perception of space.

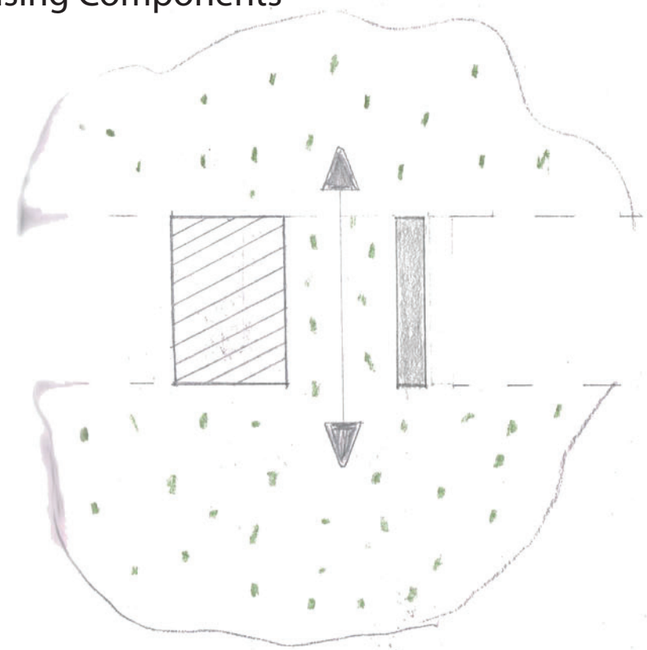
Study Model

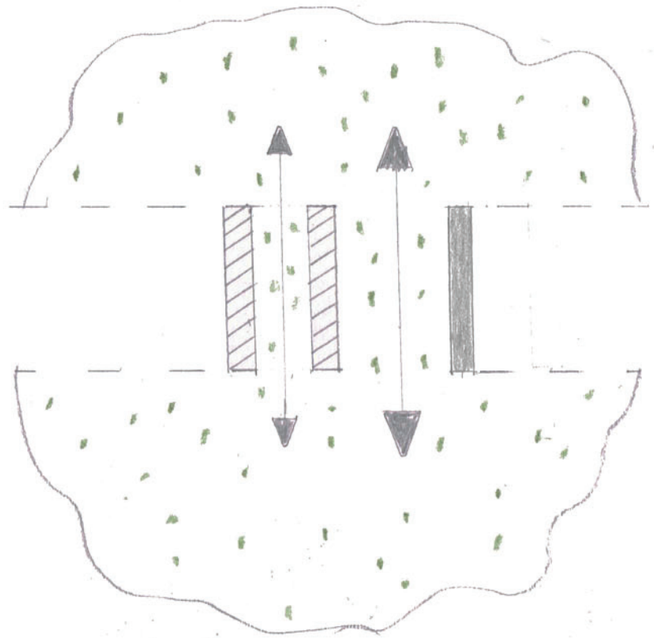
New Housing Model

The Control

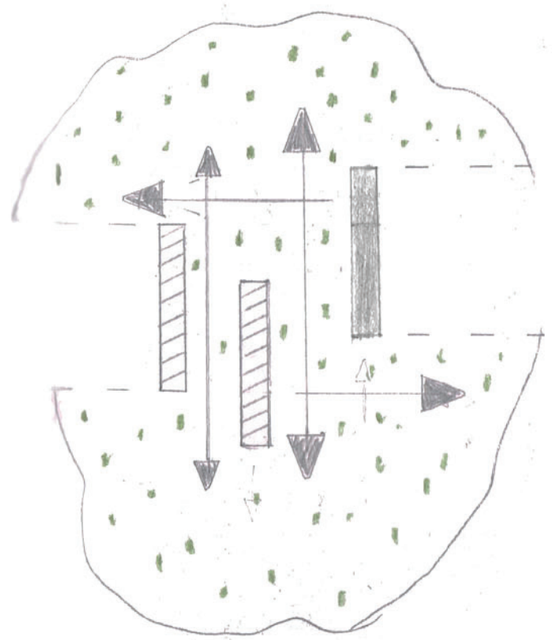
Spatial Exercise

Flexible Housing Components

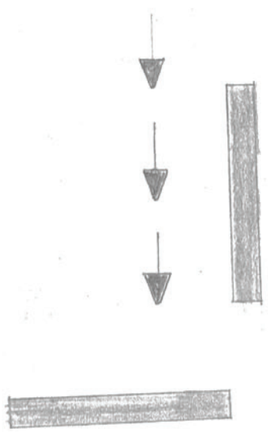




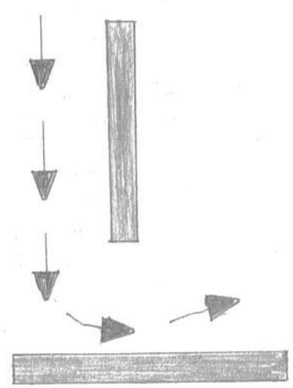
Component vocabulary
applied to service bar.



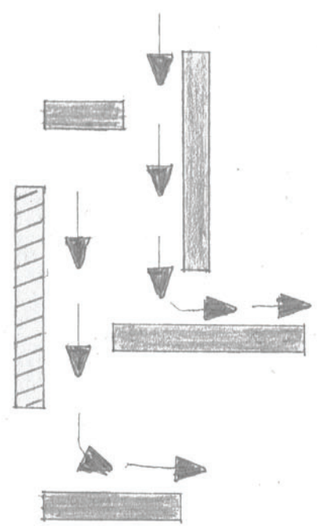
Spatial Overlap



Circulation



Components influence on circulation



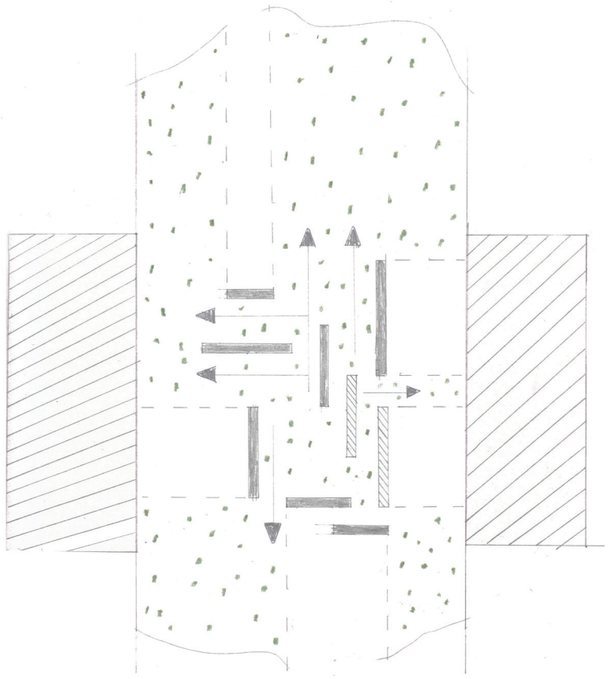
Components influence on circulation

New Housing Model

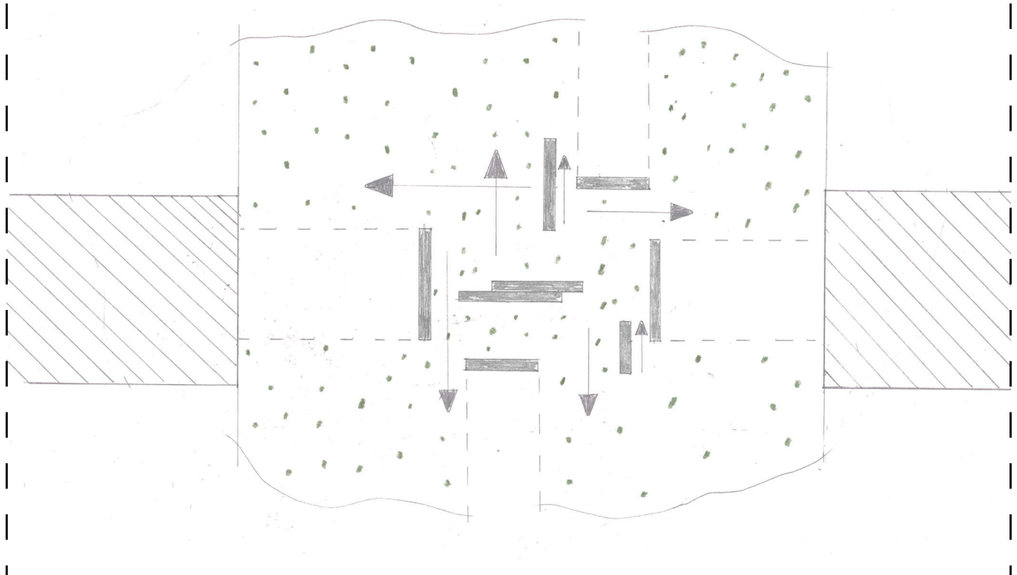
The Control

Possible Site Conditions

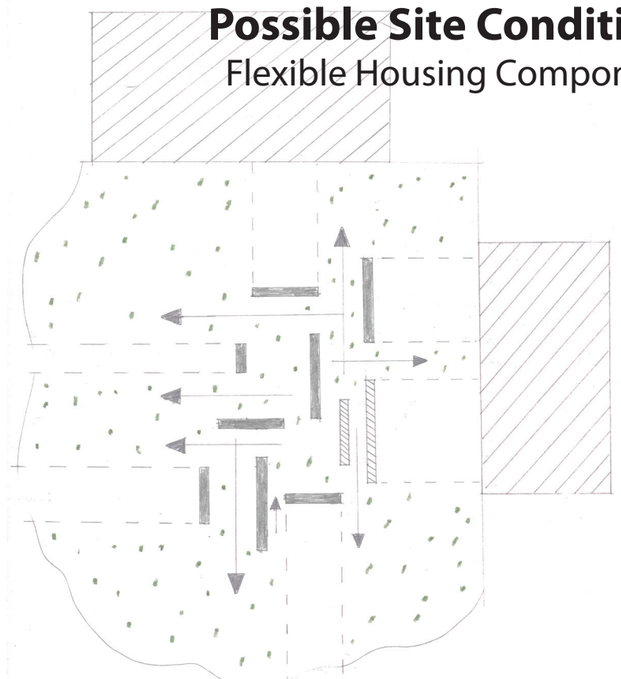
Flexible Housing Components



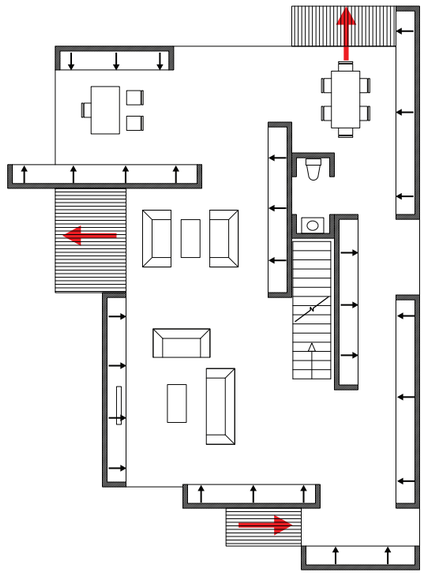
Perpendicular Site Condition

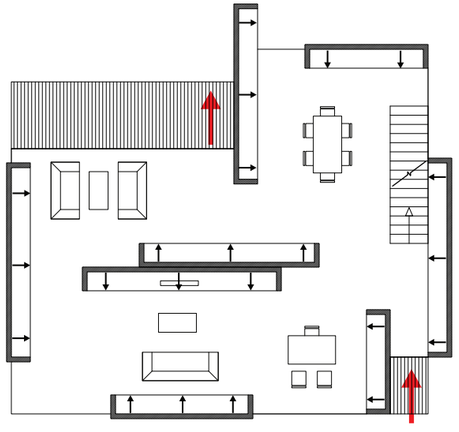


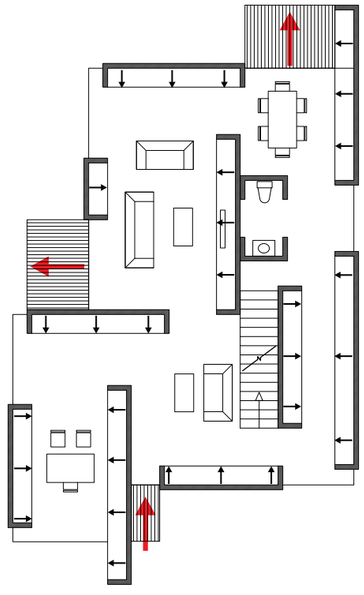
Horizontal Site Condition



Corner Site Condition





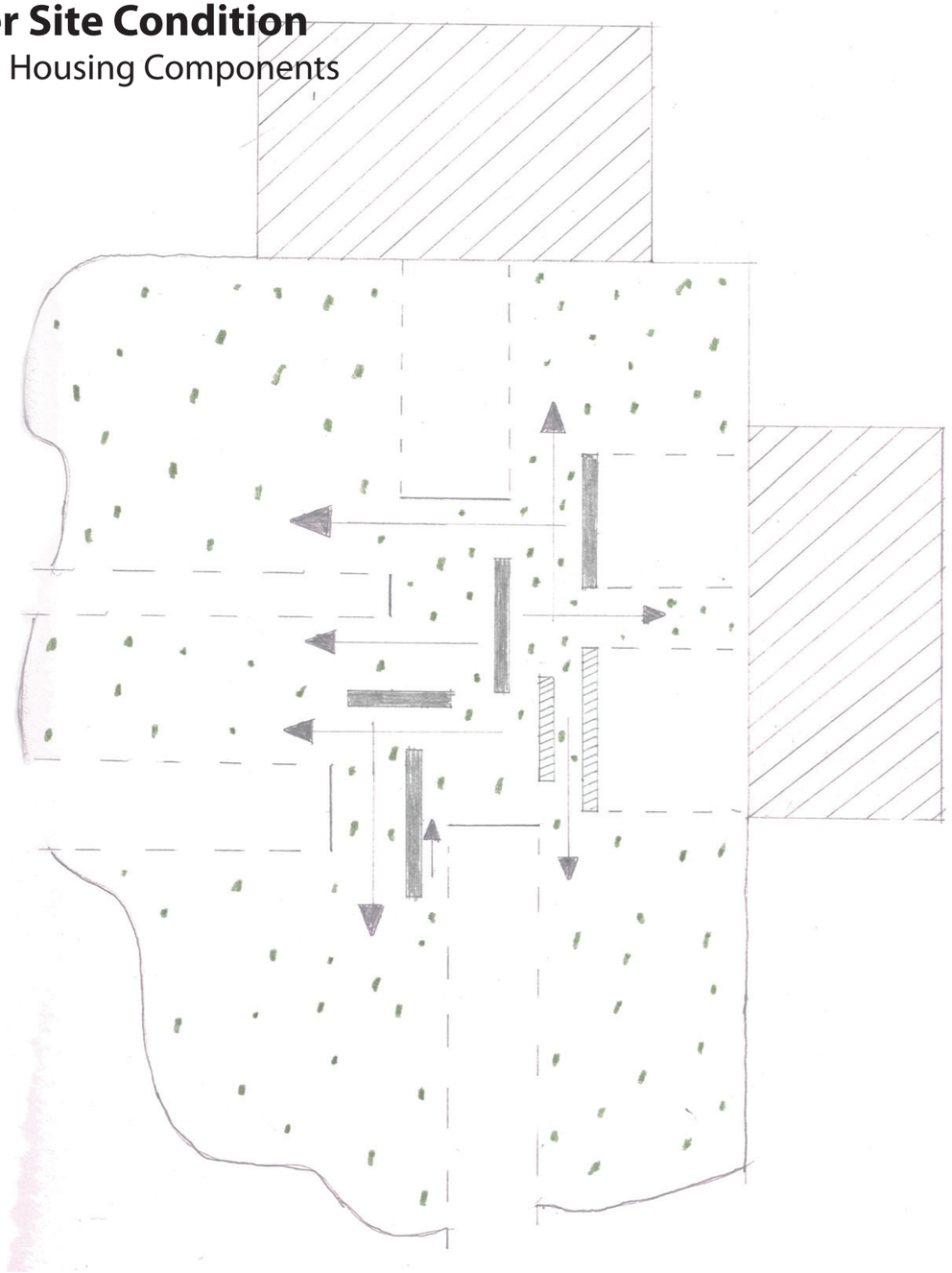


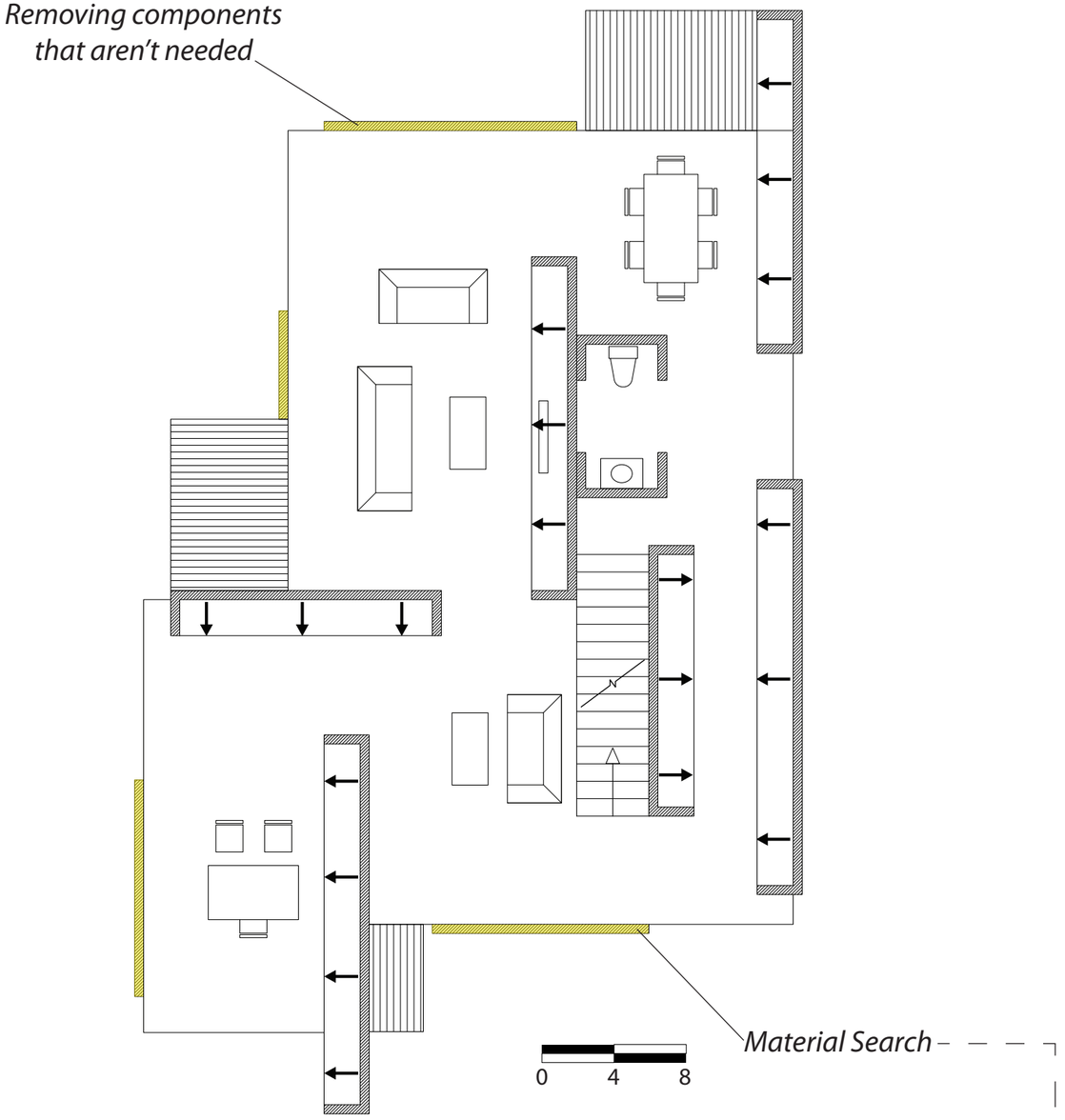
New Housing Model

The Control

Corner Site Condition

Flexible Housing Components



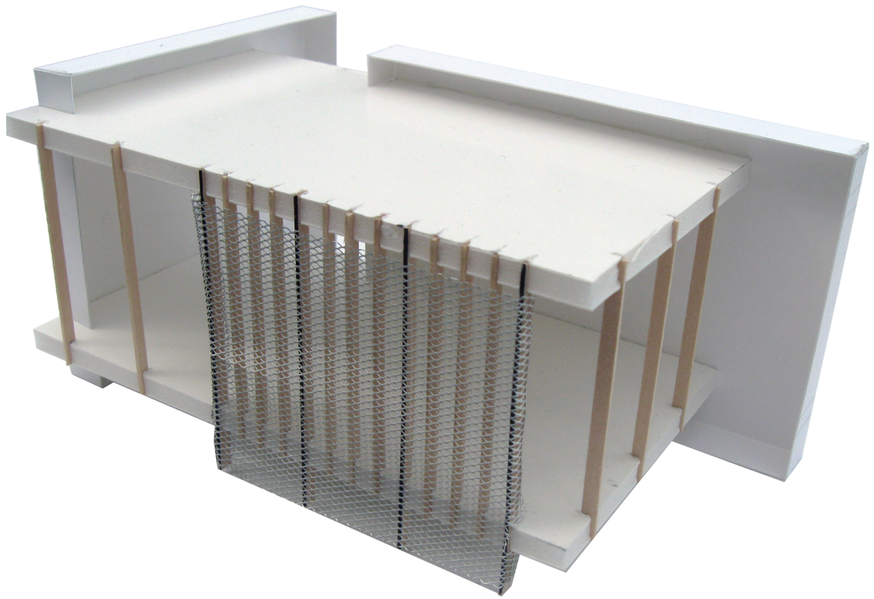


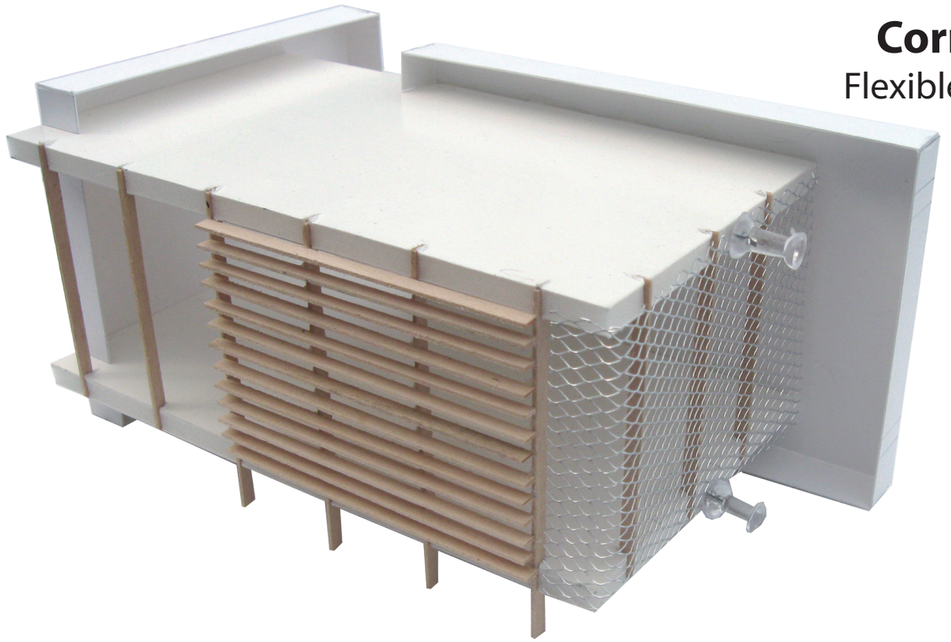
New Housing Model

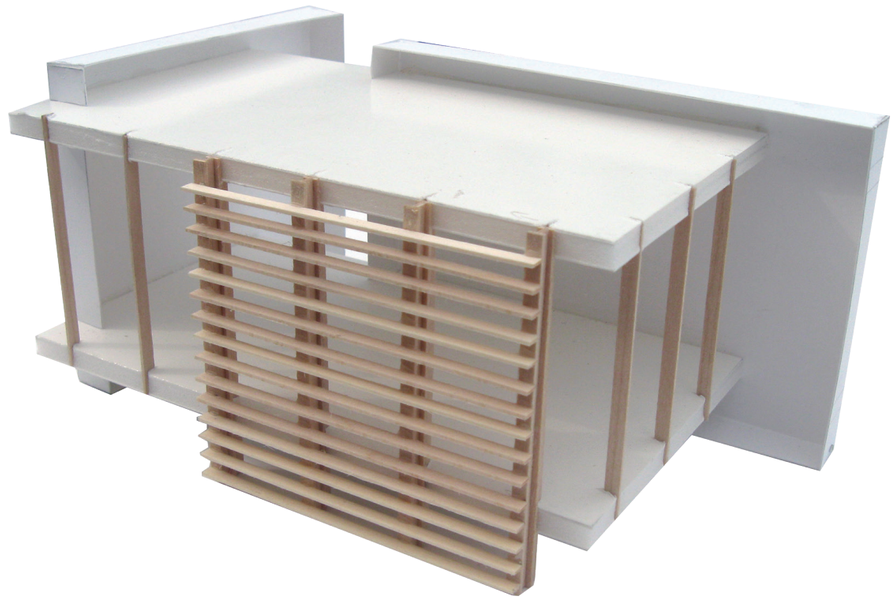
The Control

Corner Site Condition

Flexible Housing Components
Study Models







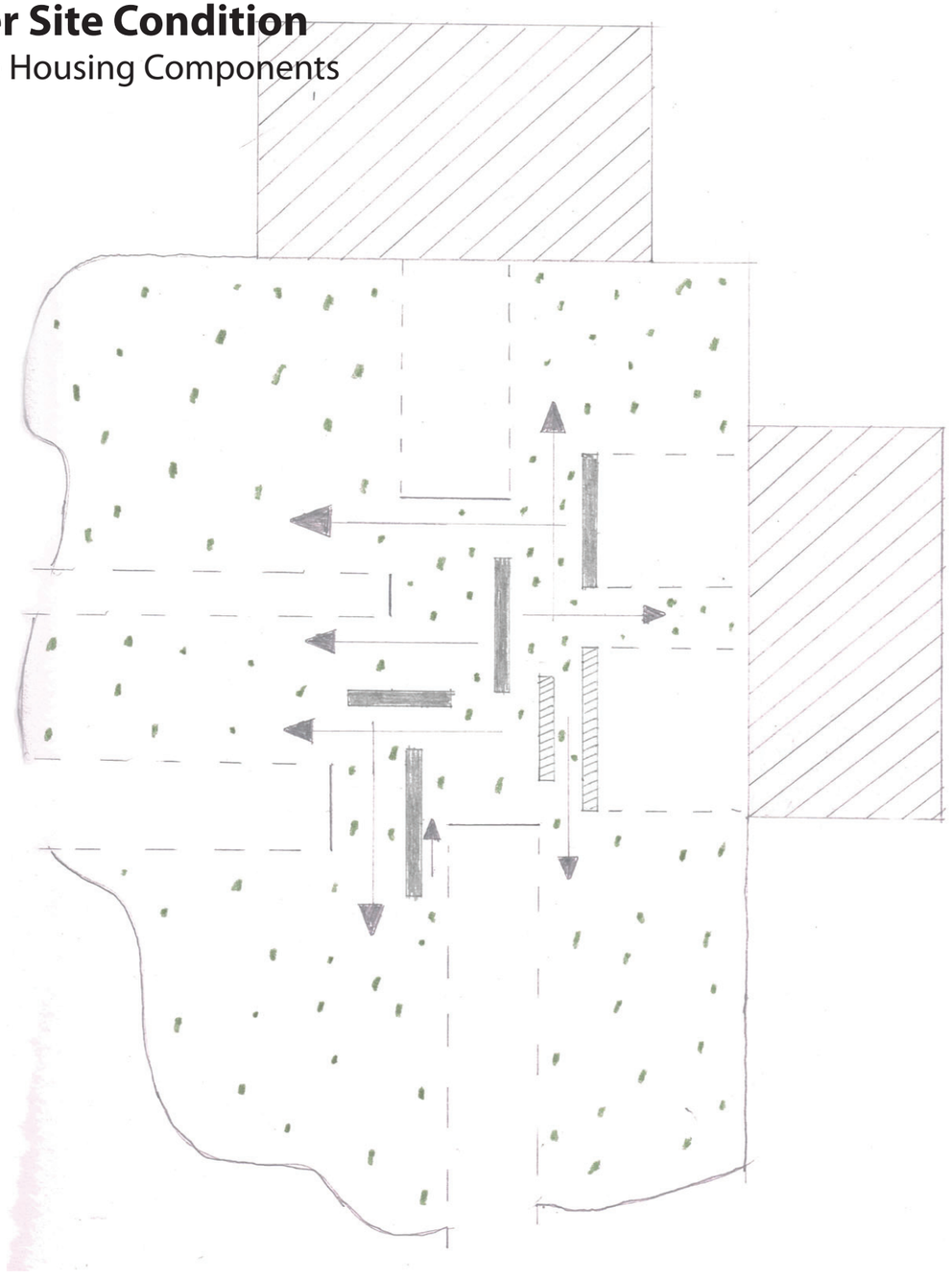
Searching for a system that resembles the heaviness of the removed components while maintaining its structural integrity

New Housing Model

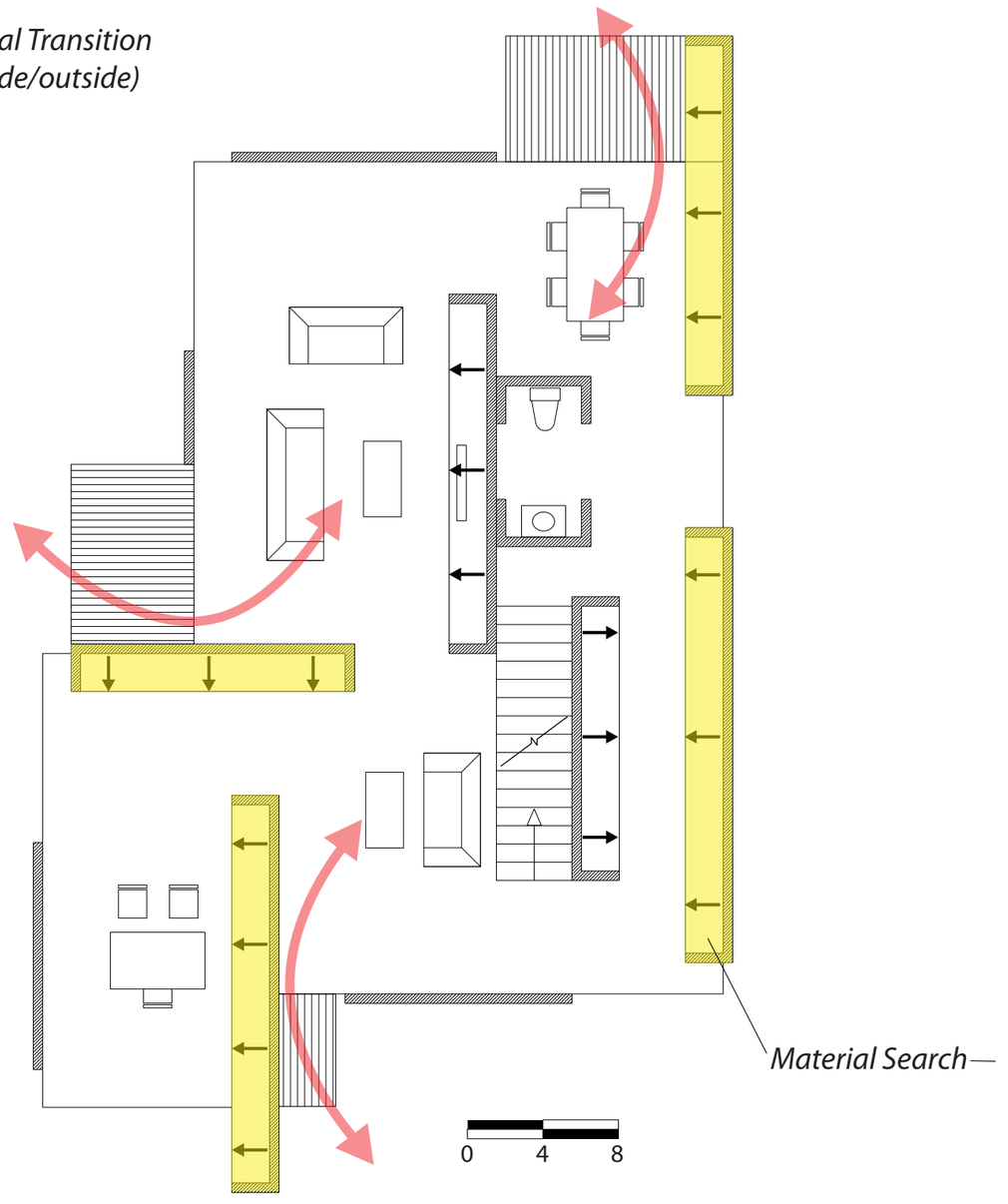
The Control

Corner Site Condition

Flexible Housing Components



Spatial Transition
(inside/outside)

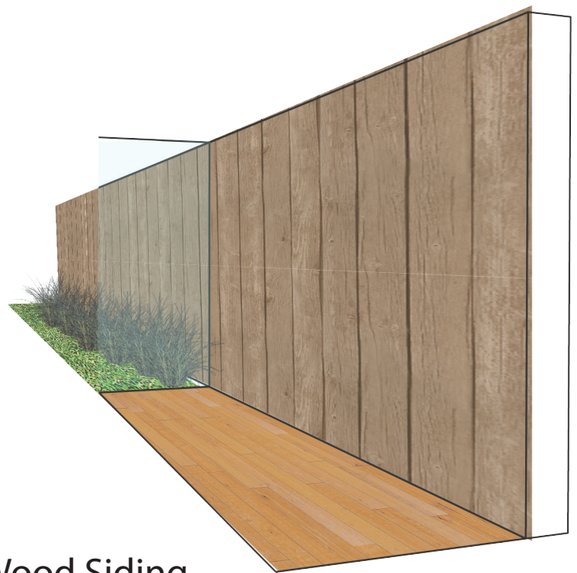


New Housing Model

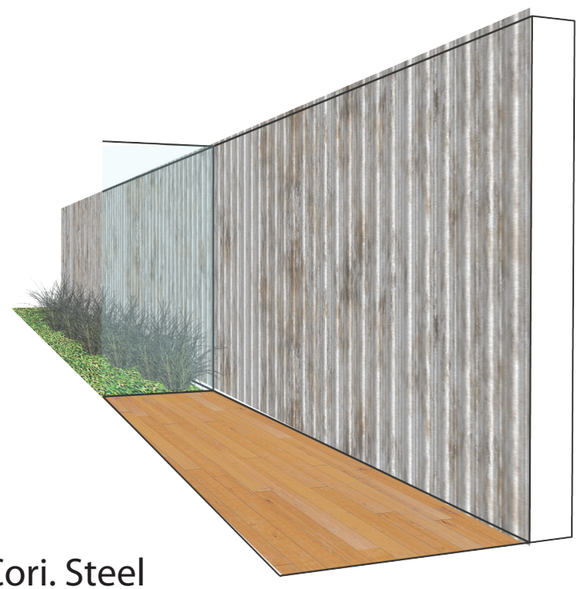
The Control

Corner Site Condition

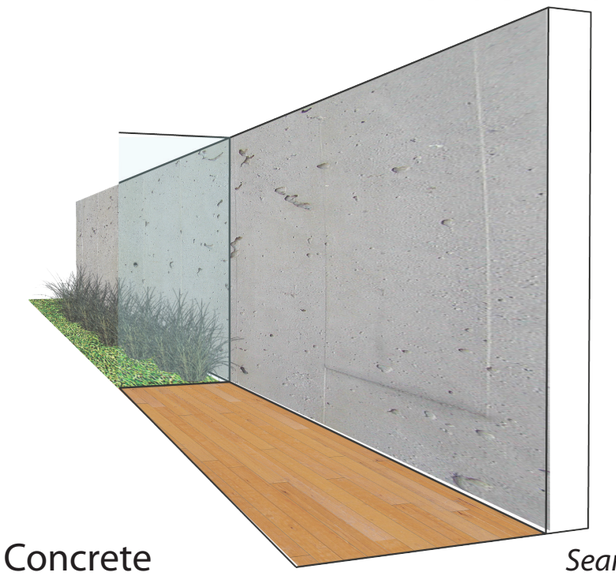
Flexible Housing Components
Material Study



Wood Siding

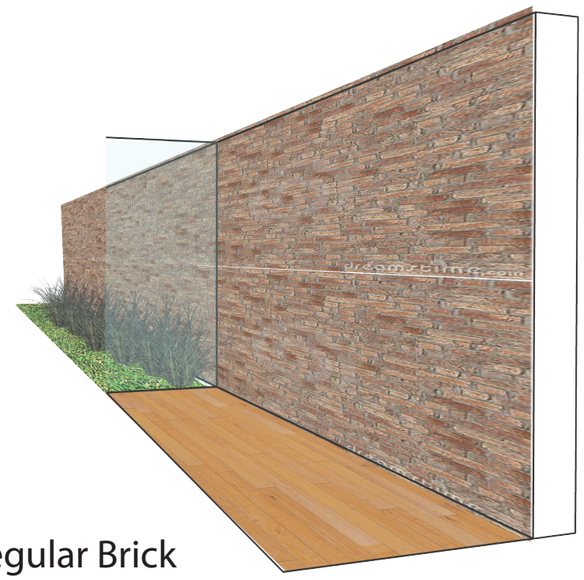


Cori. Steel



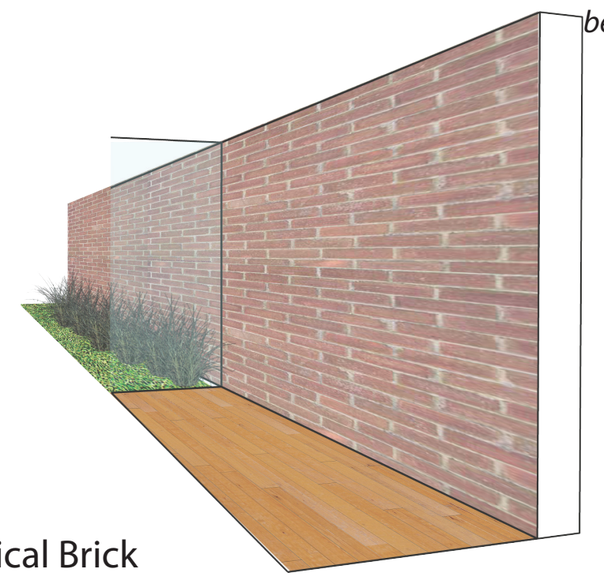
Concrete

Searching for a material that blends the transition between inside and outside



Irregular Brick

Irregular Brick



Typical Brick

New Housing Model

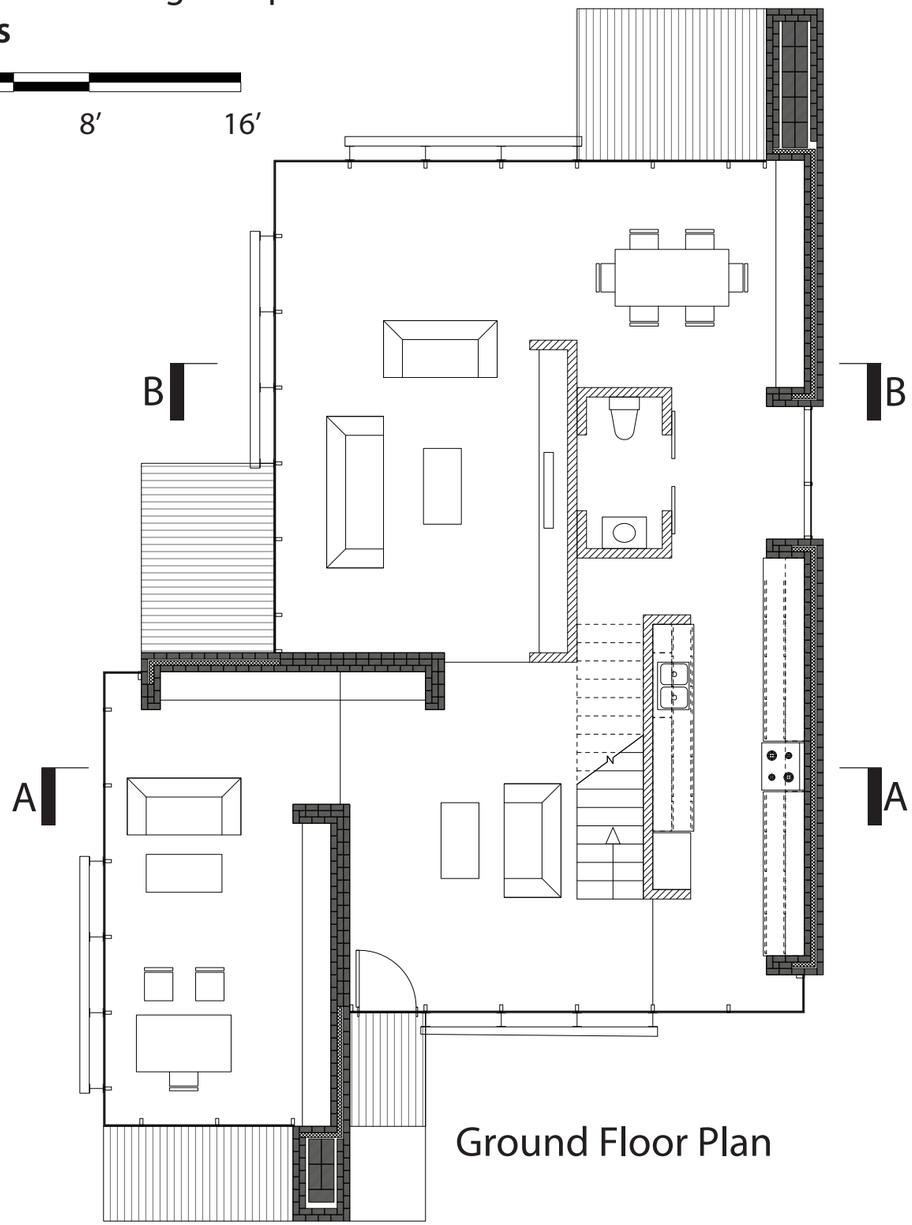
The Control

Corner Site Condition

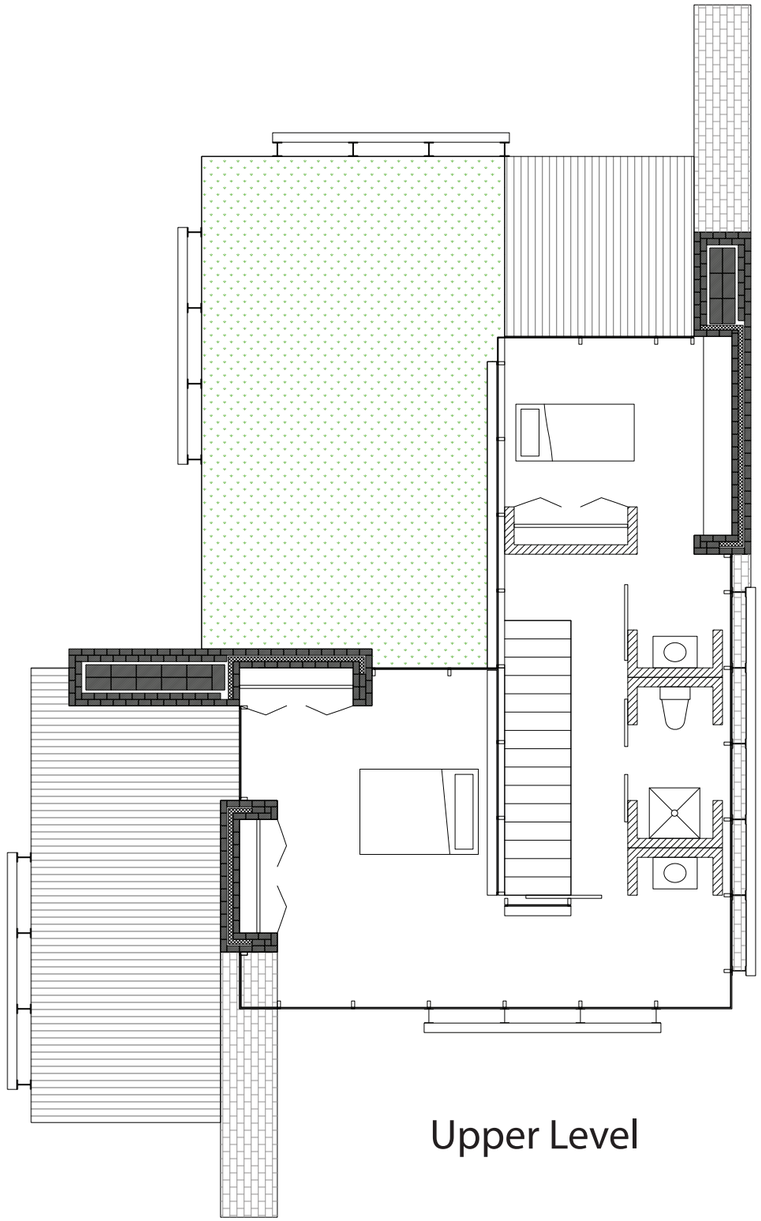
Flexible Housing Components

Plans

0 8′ 16′



Ground Floor Plan



Upper Level

New Housing Model

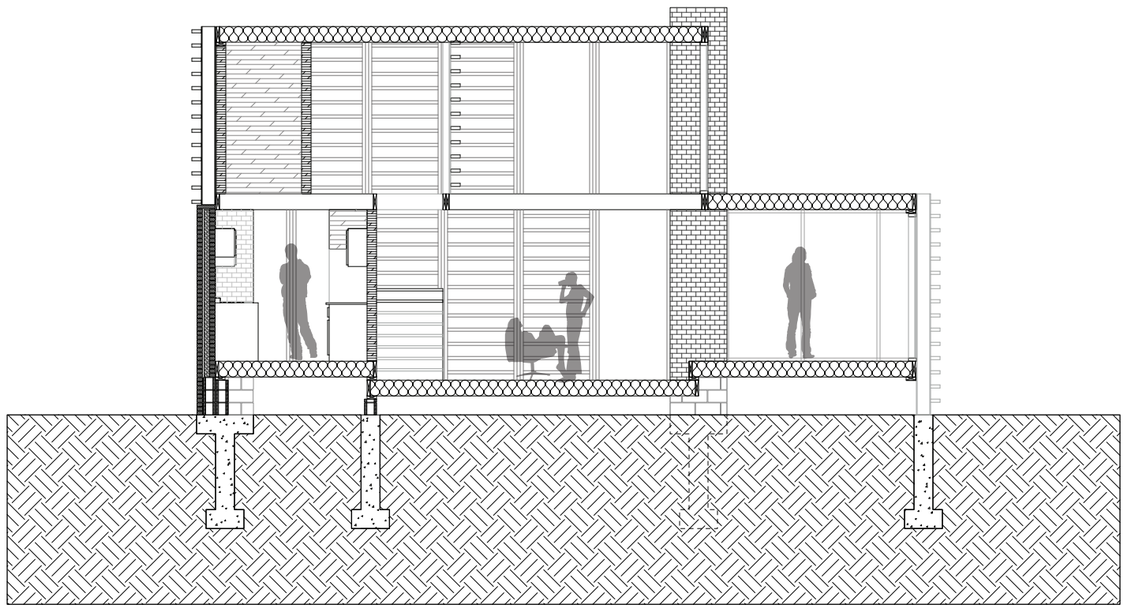
The Control

Corner Site Condition

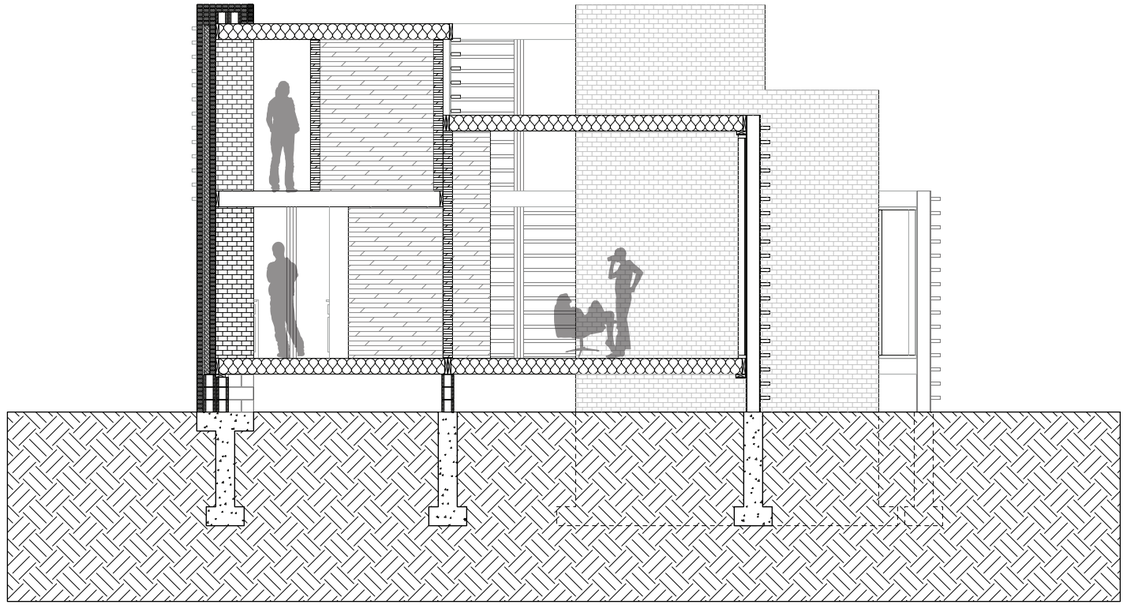
Flexible Housing Components

Sections

0 8′ 16′



Section “A”



Section “B”

New Housing Model

The Control

Corner Site Condition

Flexible Housing Components

Rendering

Front

Back

New Housing Model

The Control

Corner Site Condition

Flexible Housing Components

Rendering

Study

Living

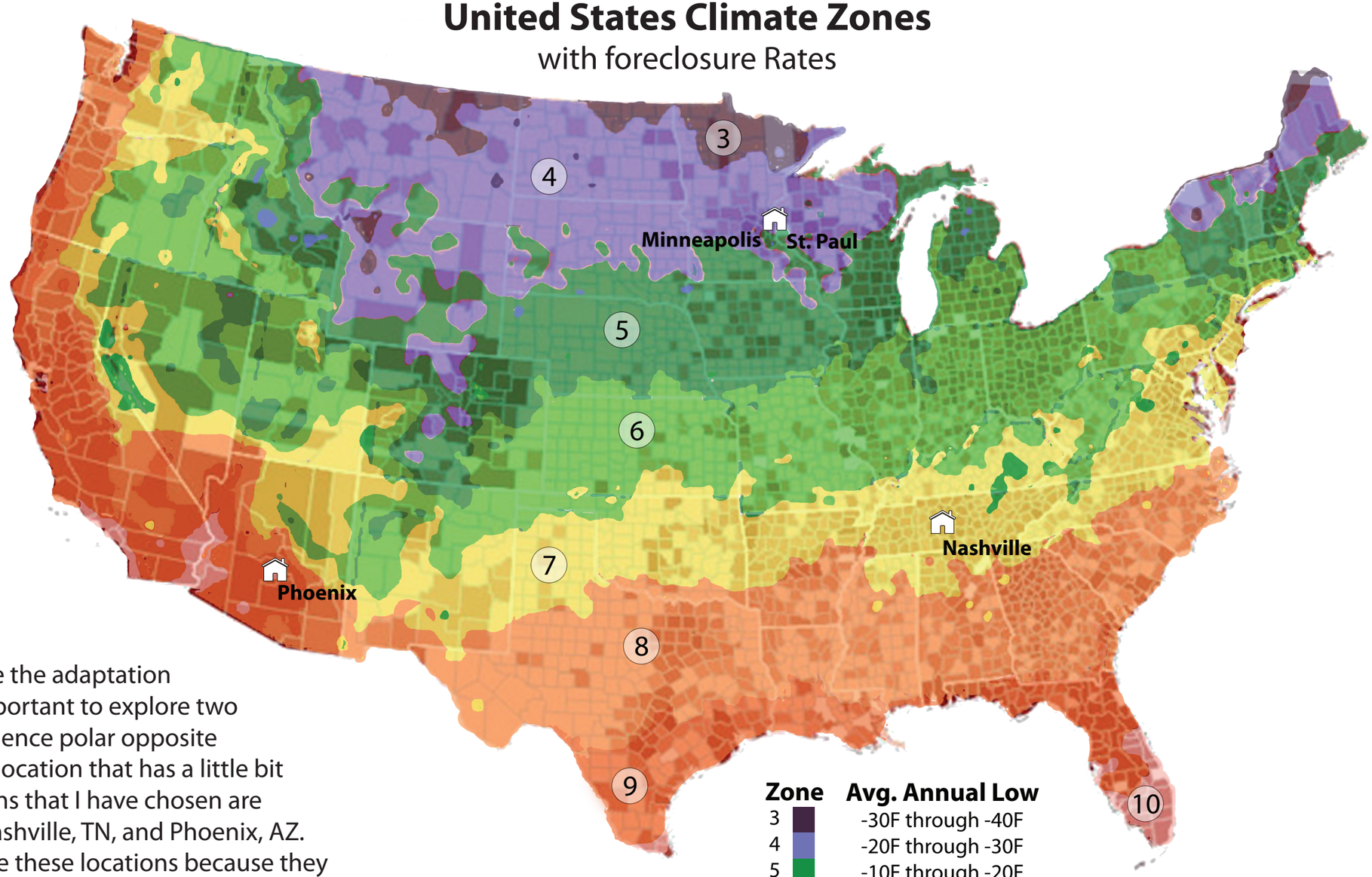
New Housing Model

The Variable

Location

United States Climate Zones

with foreclosure Rates



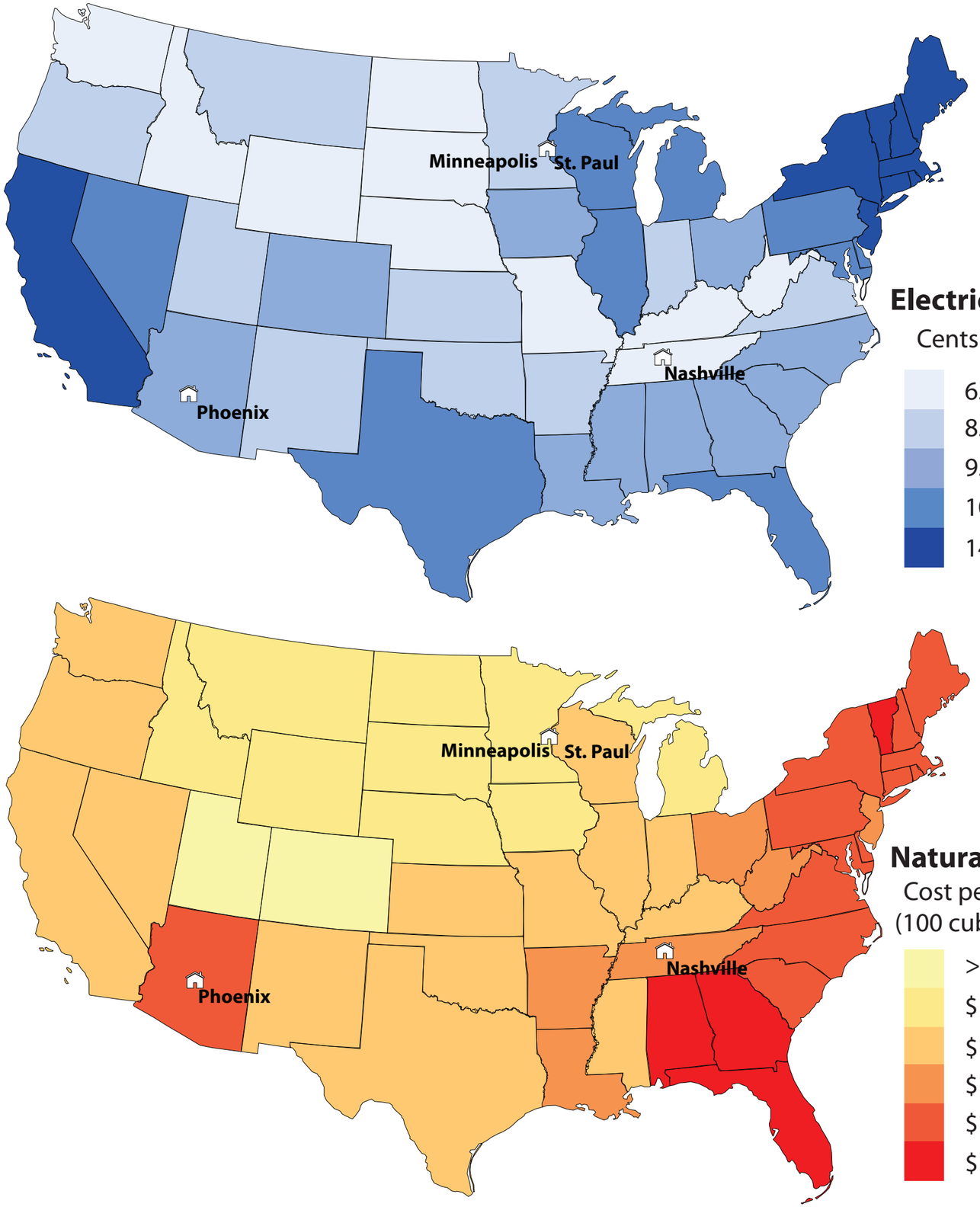
Zone	Avg. Annual Low
3	-30F through -40F
4	-20F through -30F
5	-10F through -20F
6	0F through -10F
7	10F through 0F
8	20F through 10F
9	30F through 20F
10	40F through 30F

In order to showcase the adaptation of the model, it's important to explore two locations that experience polar opposite conditions and one location that has a little bit of both. The locations that I have chosen are Minneapolis, MN, Nashville, TN, and Phoenix, AZ. Not only did I choose these locations because they meet the criteria I'm seeking, but also because they are experiencing extremely high foreclosure rates.

New Housing Model

The Variable

Energy Prices



Electricity Rates

Cents per kWh

- 6.35 - 8.01
- 8.12 - 9.03
- 9.07 - 9.66
- 10.26 - 13.17
- 14.02 - 24.13

Natural Gas Rates

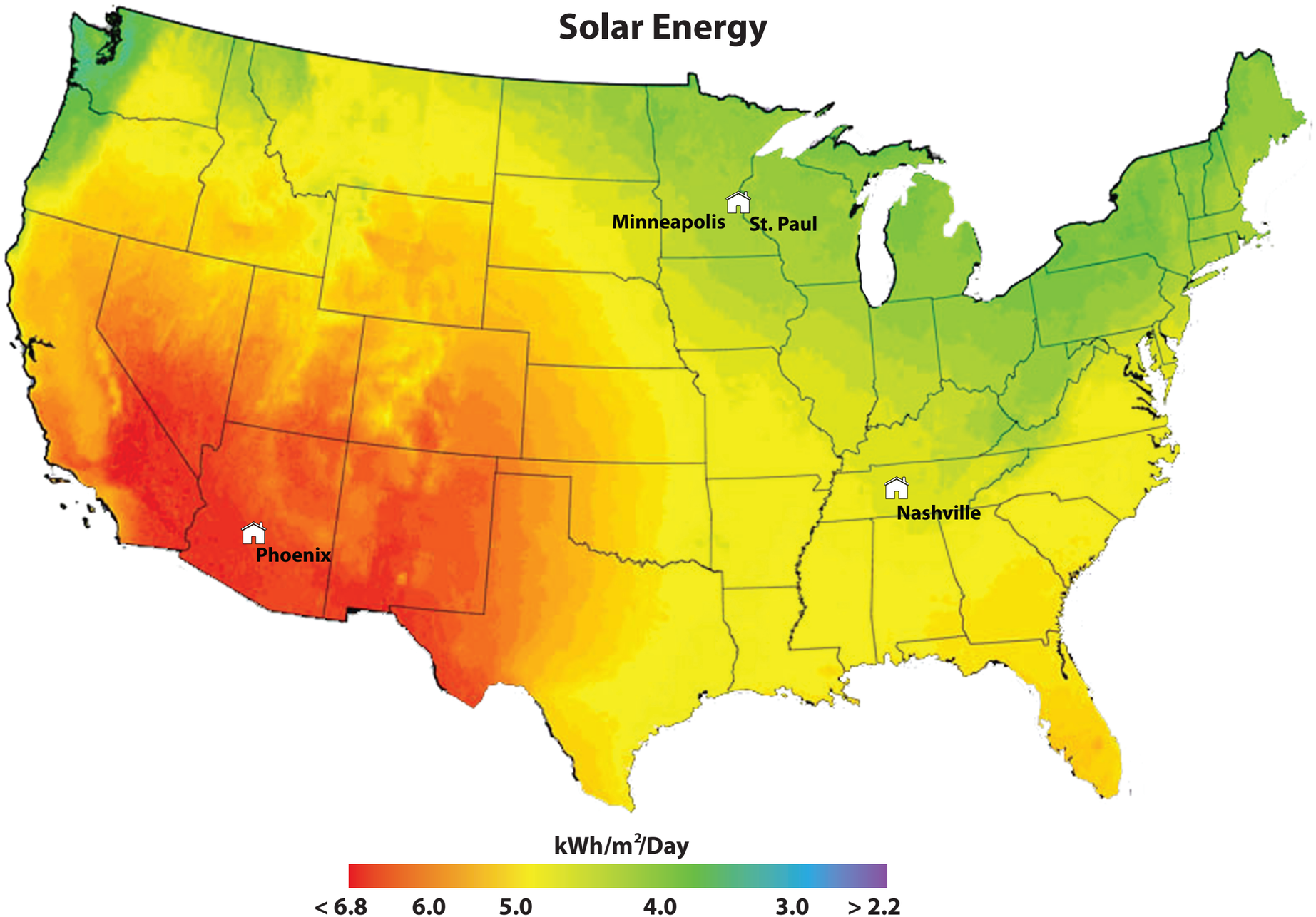
Cost per CCF
(100 cubic feet)

- >$1.0
- $1.0 - $1.2
- $1.2 - $1.4
- $1.4 - $1.6
- $1.6 - $1.8
- $1.8 - $2.2

New Housing Model

The Variable

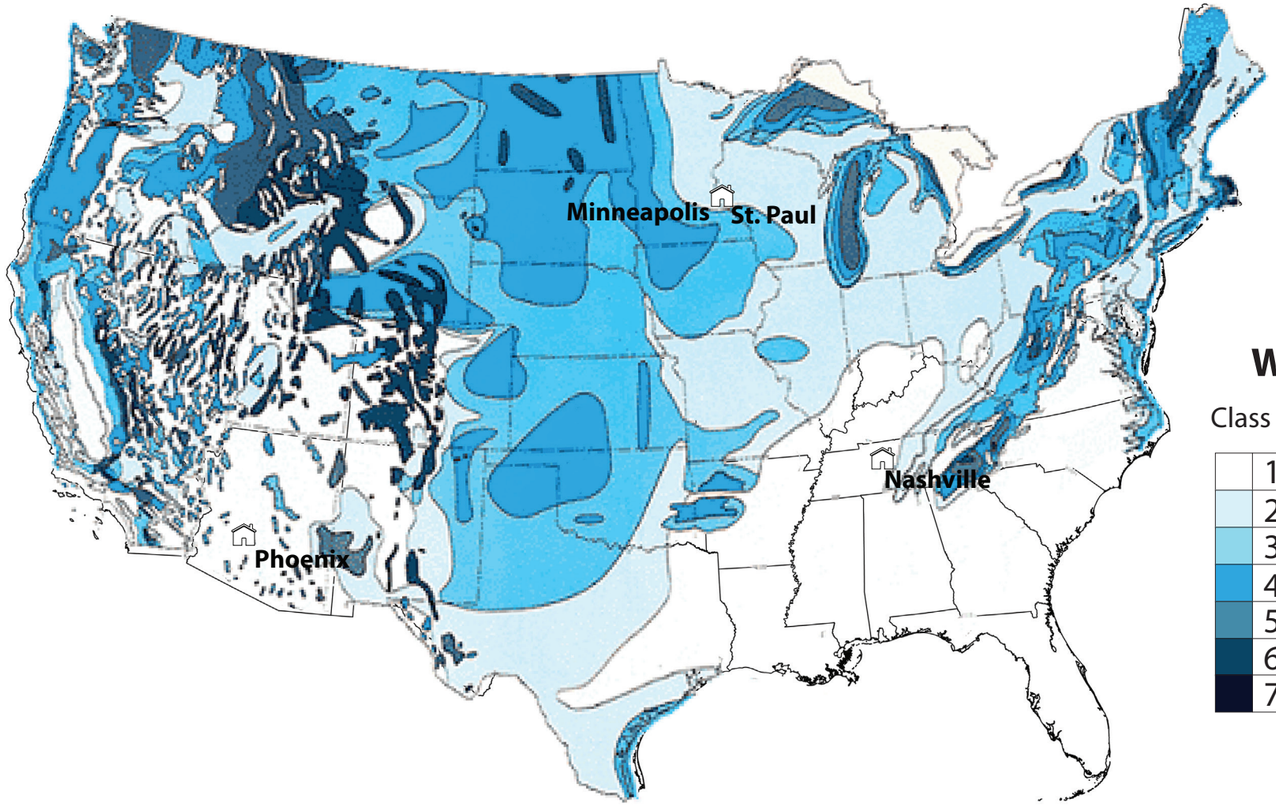
Natural Resources



New Housing Model

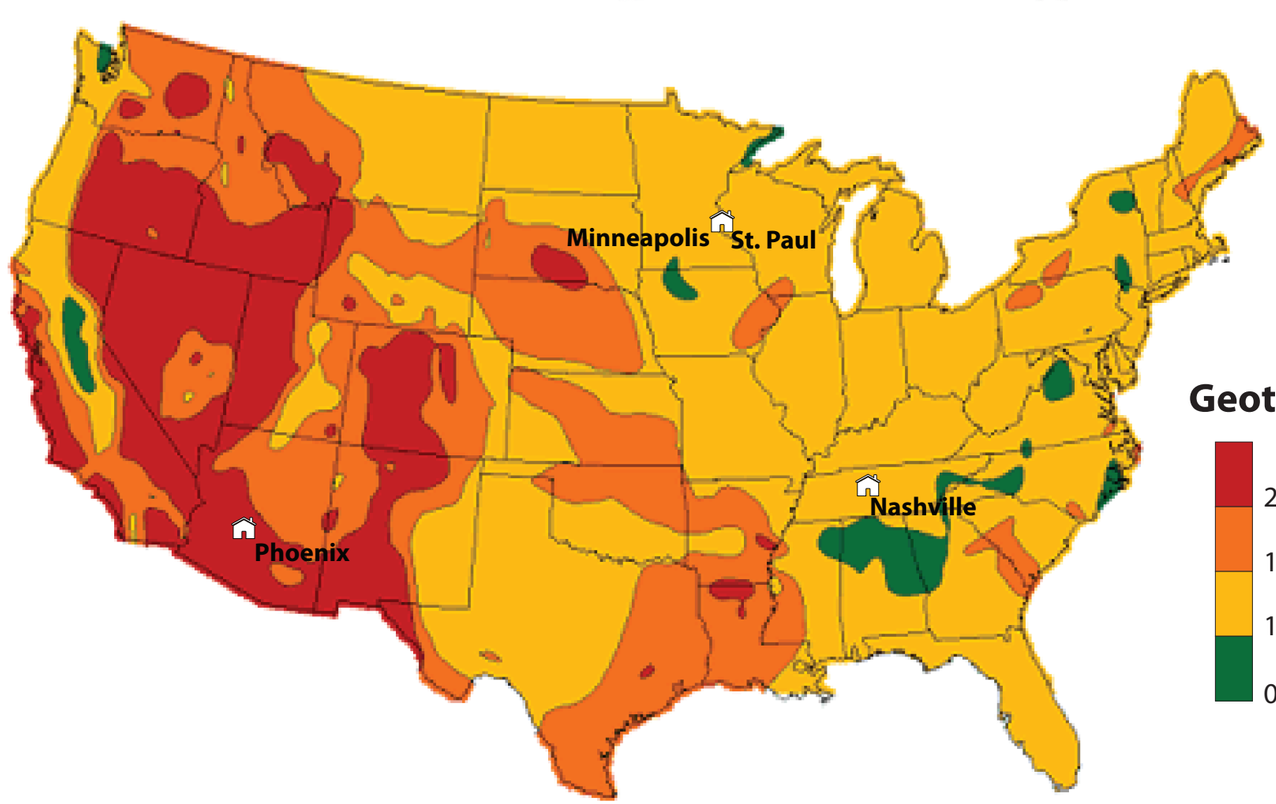
The Variable

Natural Resources



Wind Energy

Class	W/m^2	mph
1	0	0
2	100	9.8
3	150	11.5
4	200	12.5
5	250	13.4
6	300	14.3
7	400	15.7
	1000	21.1



Geothermal Energy

- 200° C
- 150° C
- 100° C
- 0° C

New Housing Model

The Variable

Site Selection

Minneapolis/St. Paul, MN

Population: 382,578
Density: 7,019/sq. mi

Climate Zone
4

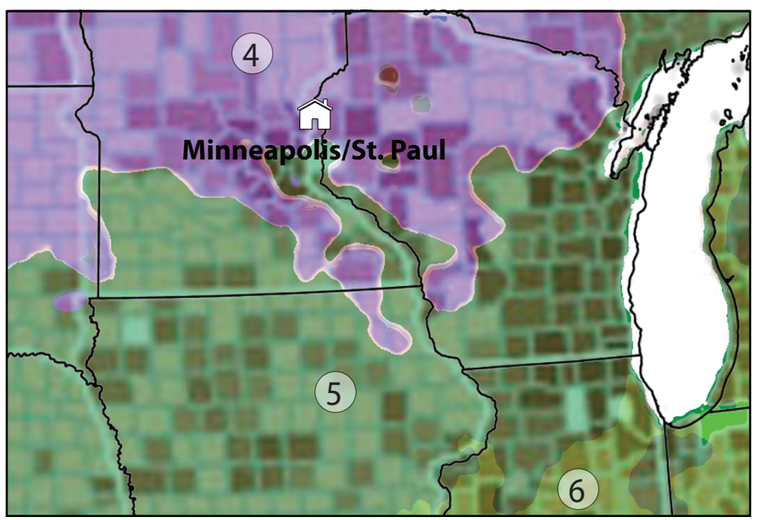
Avg. Annual Low
-20F through -30F

Eletricity Rates
$ 0.0902 per kWh

Natural Gas Rates
$1.0 - $1.2 per CCF

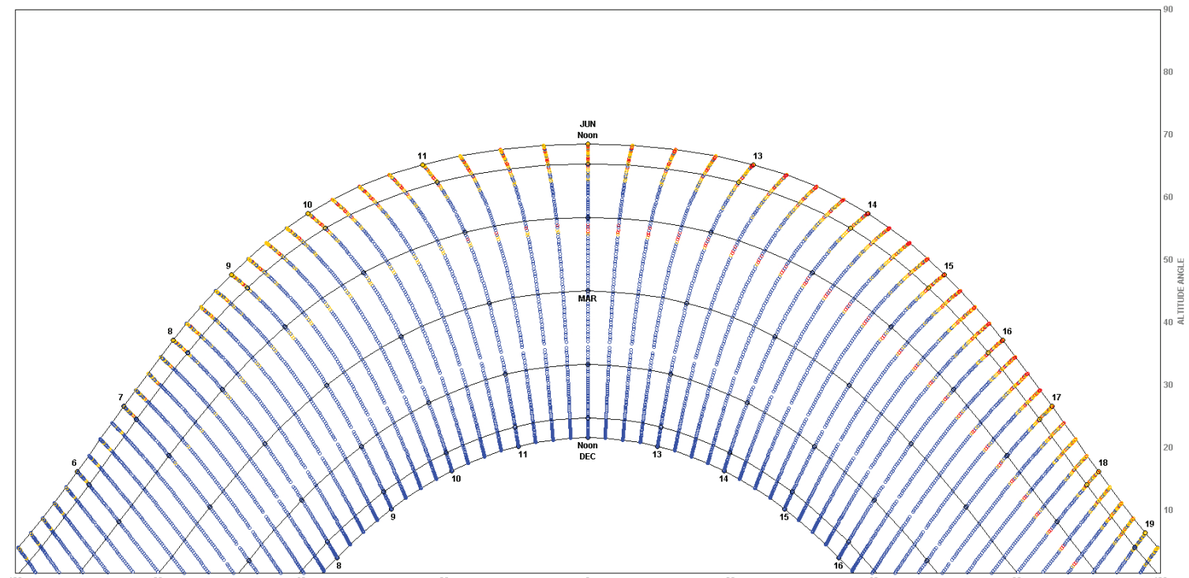
Solar Resource
4.2 kWh/m^2/Day

Wind Resources
Class 2 - 100 - 150 W/m^2



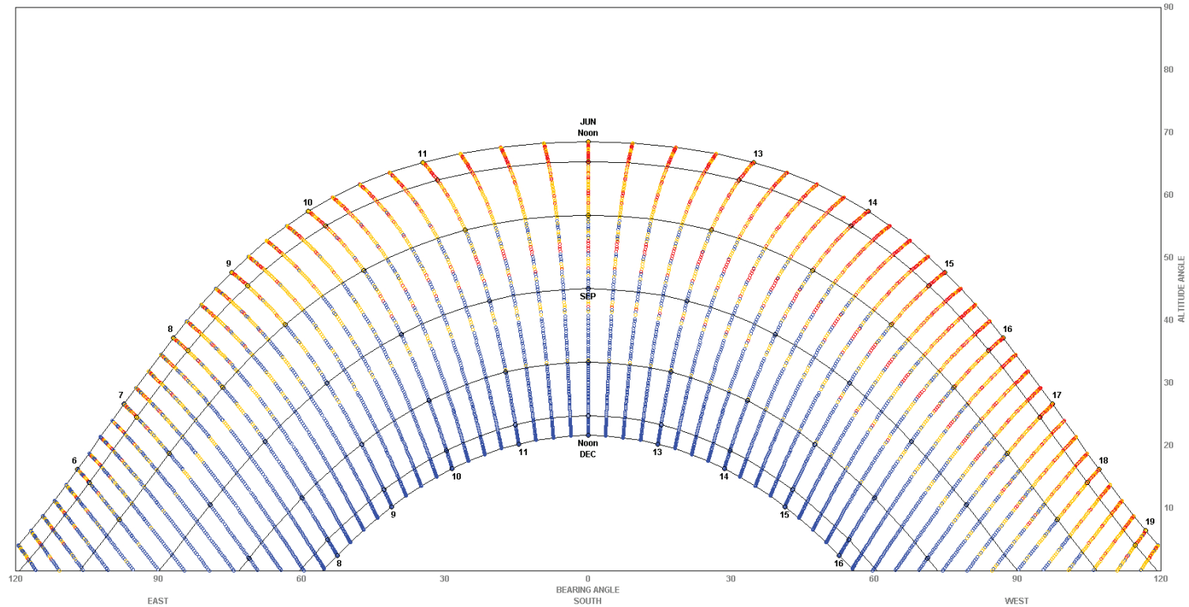
Sun Shading Chart
Winter

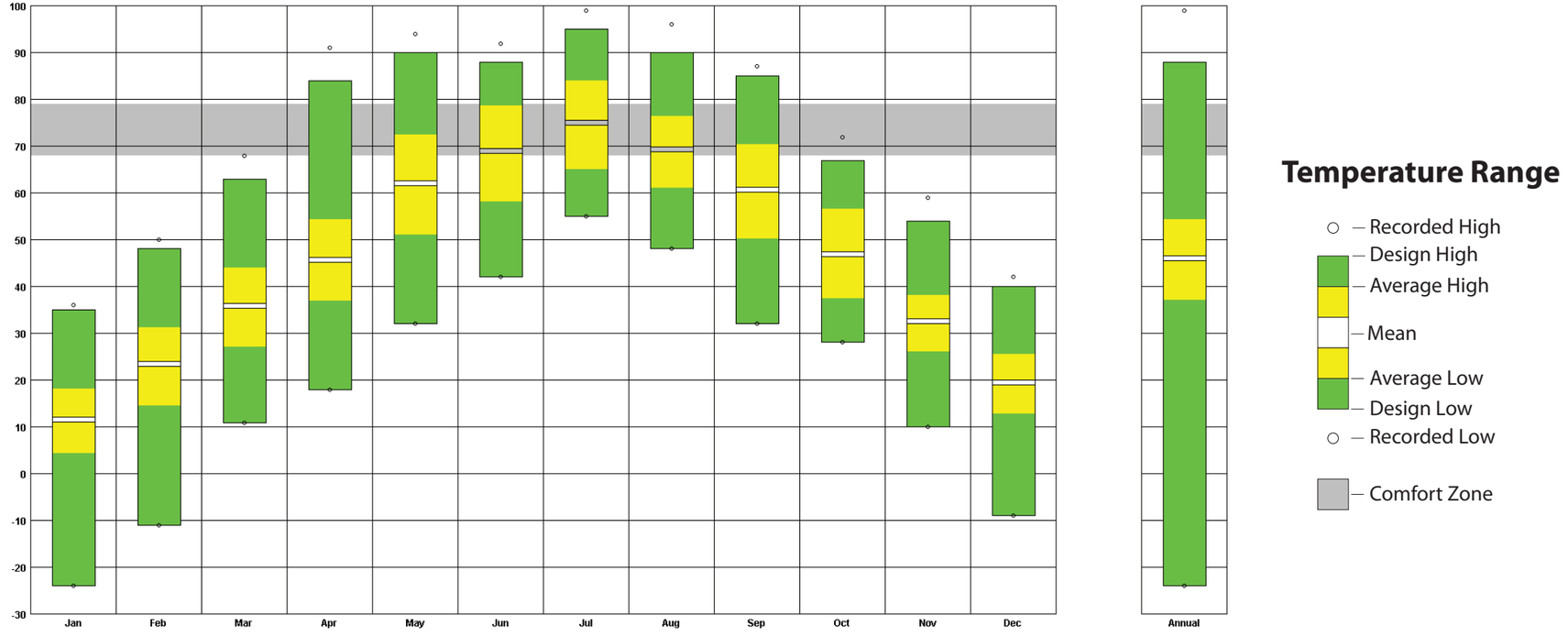
Warm/Hot > 79 F Comfort > 68 F Cool/Cold < 68 F

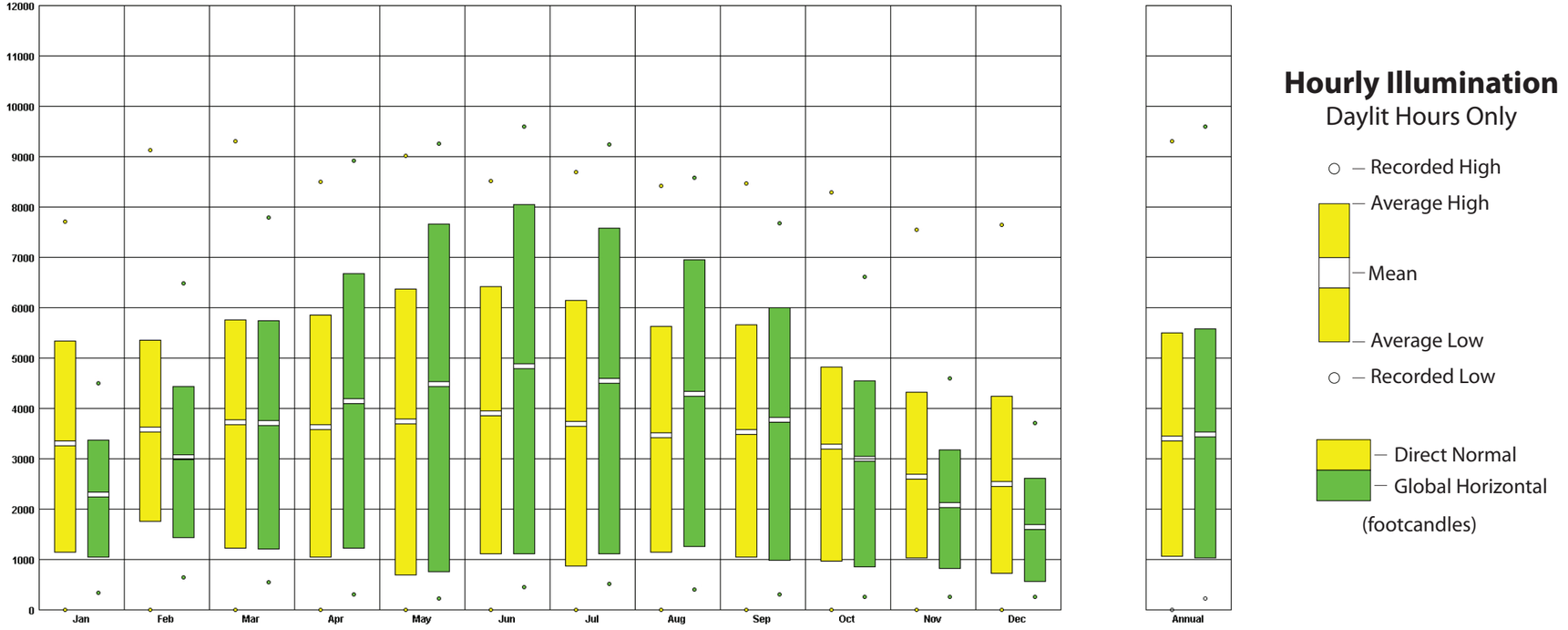


Sun Shading Chart
Summer

Warm/Hot > 79 F Comfort > 68 F Cool/Cold < 68 F




100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Annual
Temperature Range
Recorded High
Design High
Average High
Mean
Average Low
Design Low
Recorded Low
Comfort Zone


12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Annual
Hourly Illumination
Daylit Hours Only
Recorded High
Average High
Mean
Average Low
Recorded Low
Direct Normal
Global Horizontal
(footcandles)

New Housing Model

The Variable

Site Selection

Nashville, TN

Population: 605,473
Density: 1,146/sq. mi

Climate Zone
7

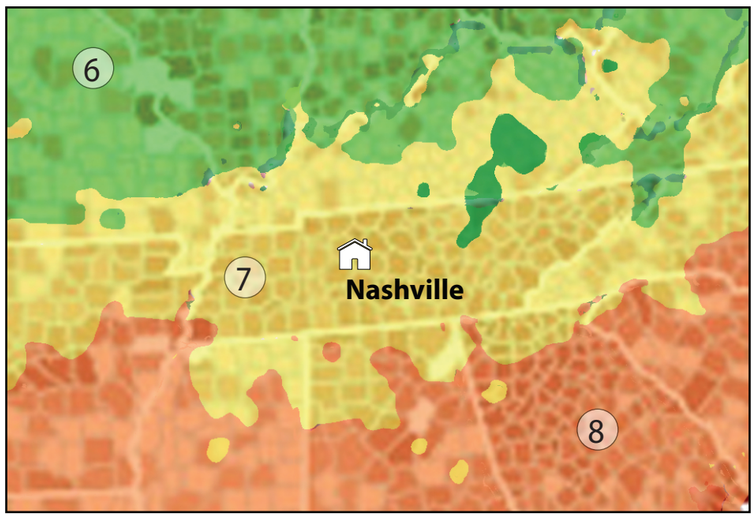
Avg. Annual Low
10F through 0F

Eletricity Rates
$ 0.0719 per kWh

Natural Gas Rates
$1.4 - $1.6 per CCF

Solar Resource
4.7 kWh/m^2/Day

Wind Resources
Class 1 - 0 - 100 W/m^2



Sun Shading Chart
Winter

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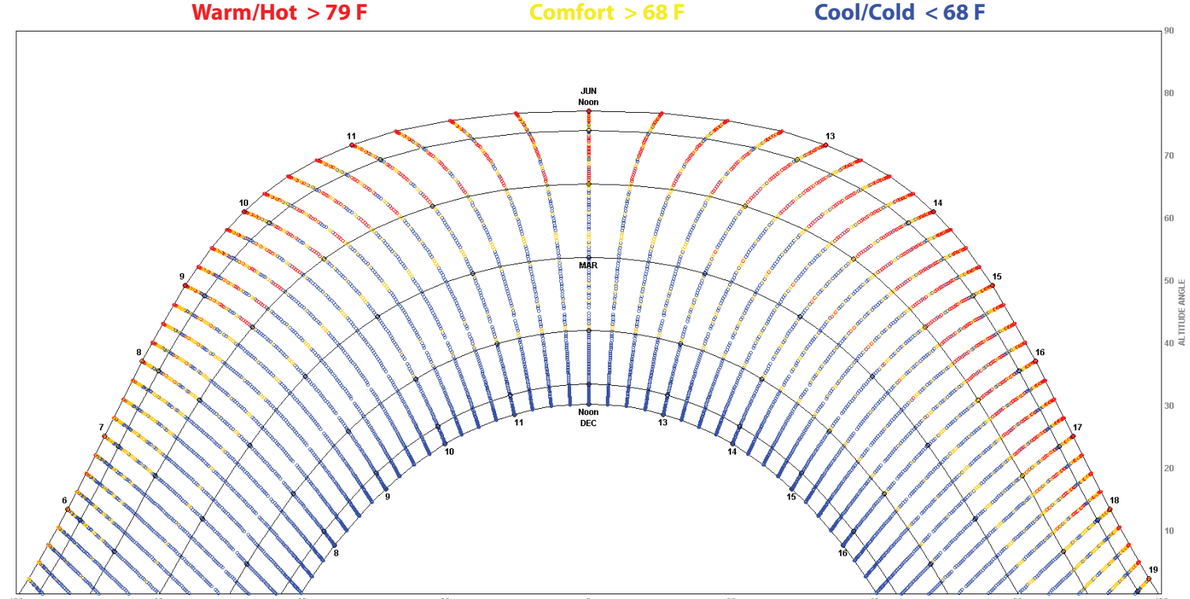
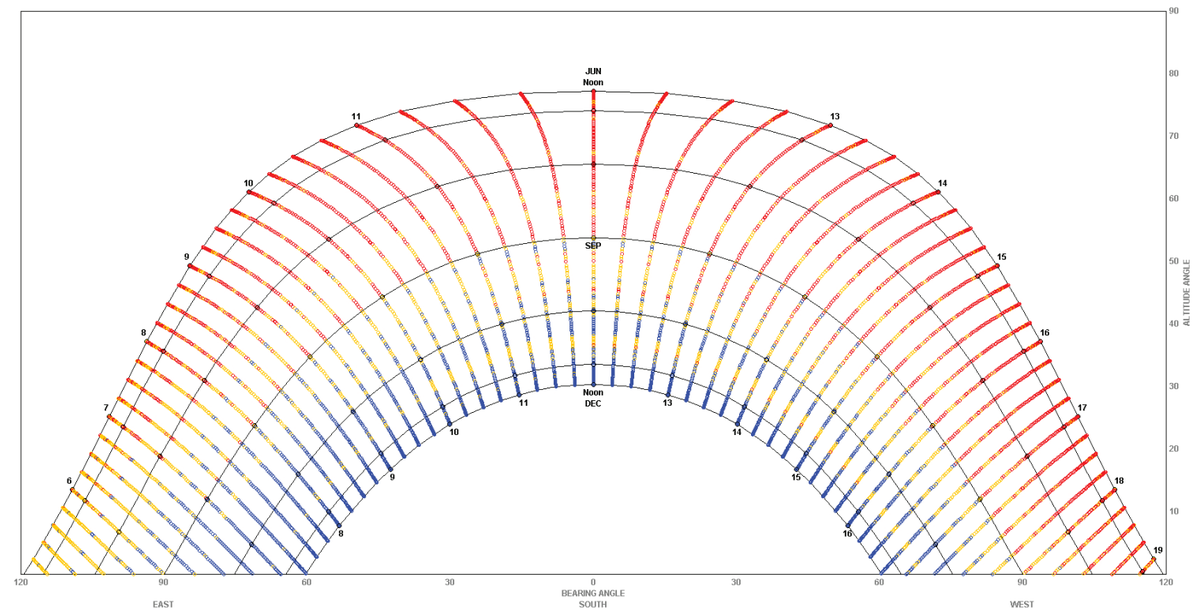
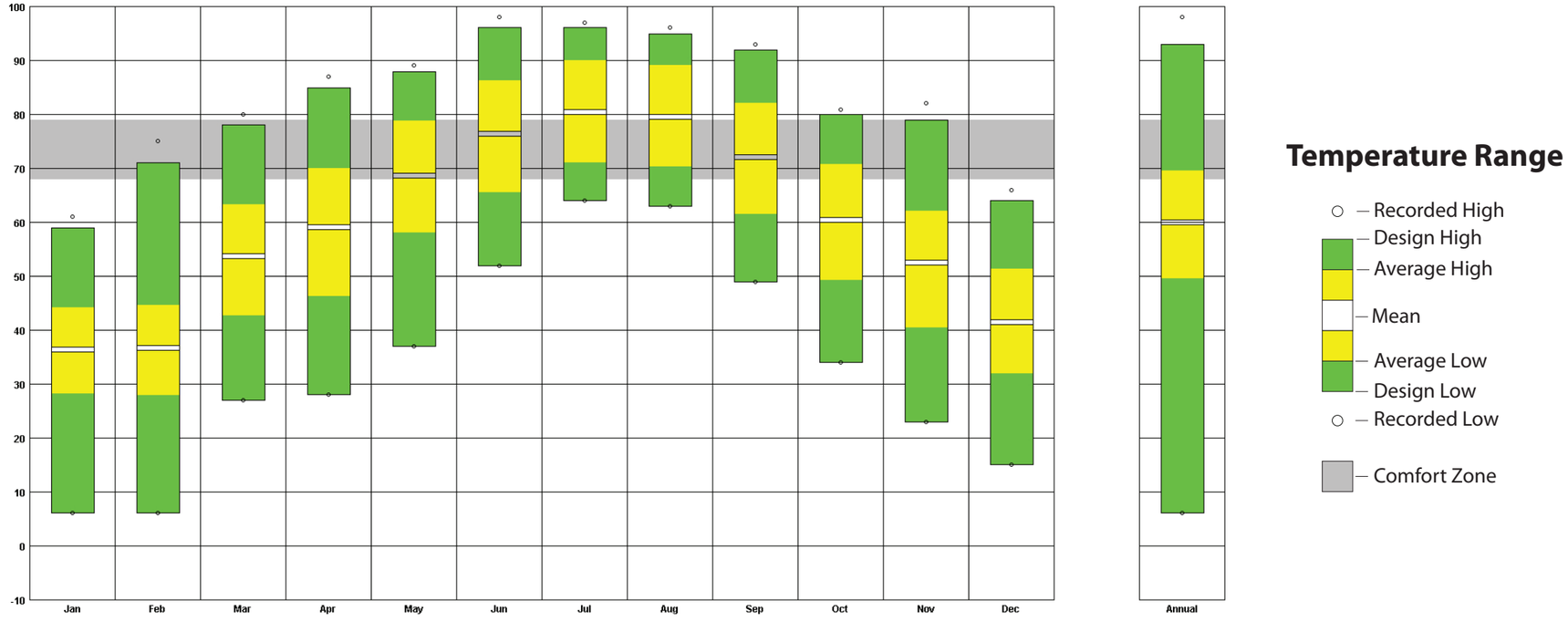


Sun Shading Chart
Summer

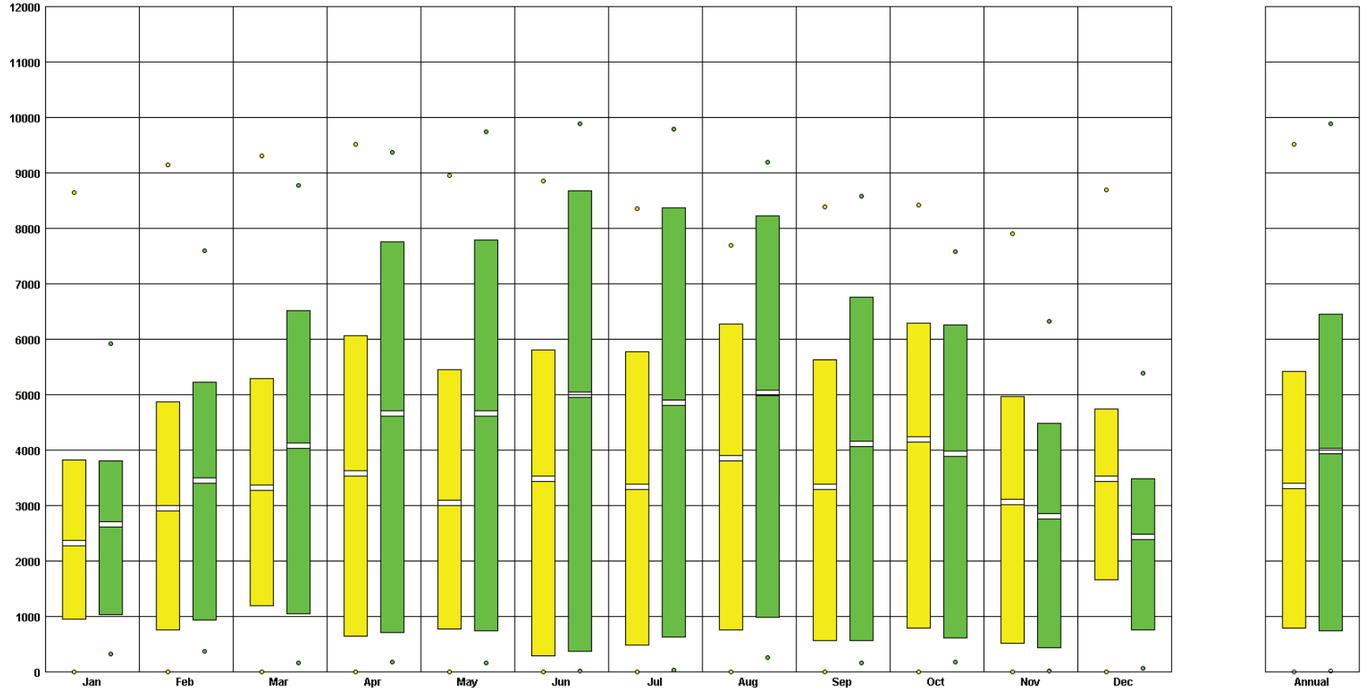
Warm/Hot > 79 F Comfort > 68 F Cool/Cold < 68 F





Temperature Range

- Recorded High
- Design High
- Average High
- Mean
- Average Low
- Design Low
- Recorded Low
- Comfort Zone



Hourly Illumination

Daylit Hours Only

- Recorded High
- Average High
- Mean
- Average Low
- Recorded Low

- Direct Normal
- Global Horizontal

(footcandles)

New Housing Model

The Variable

Site Selection

Phoenix, AZ

Population: 1,445,632
Density: 3,072/sq. mi

Climate Zone
9

Avg. Annual Low
30F through 20F

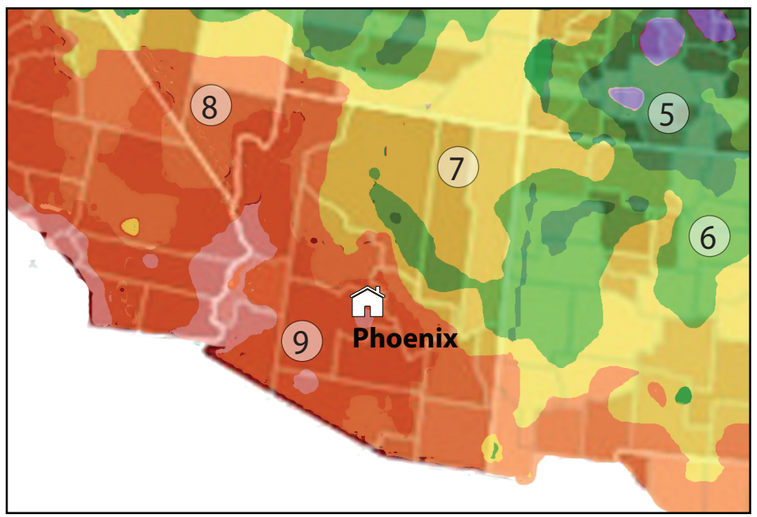
Eletricity Rates
$ 0.0966 per kWh

Natural Gas Rates
$1.6 - $1.8 per CCF

Solar Resource
6.8 kWh/m^2/Day

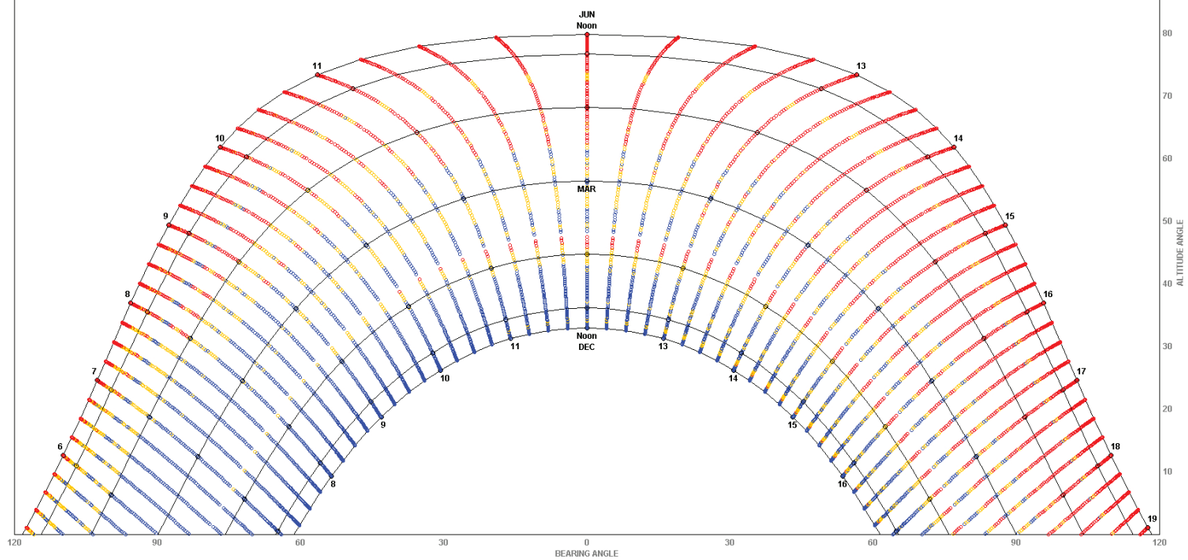
Wind Resources
Class 1 - 0 - 100 W/m^2

Geothermal Resources
200°C



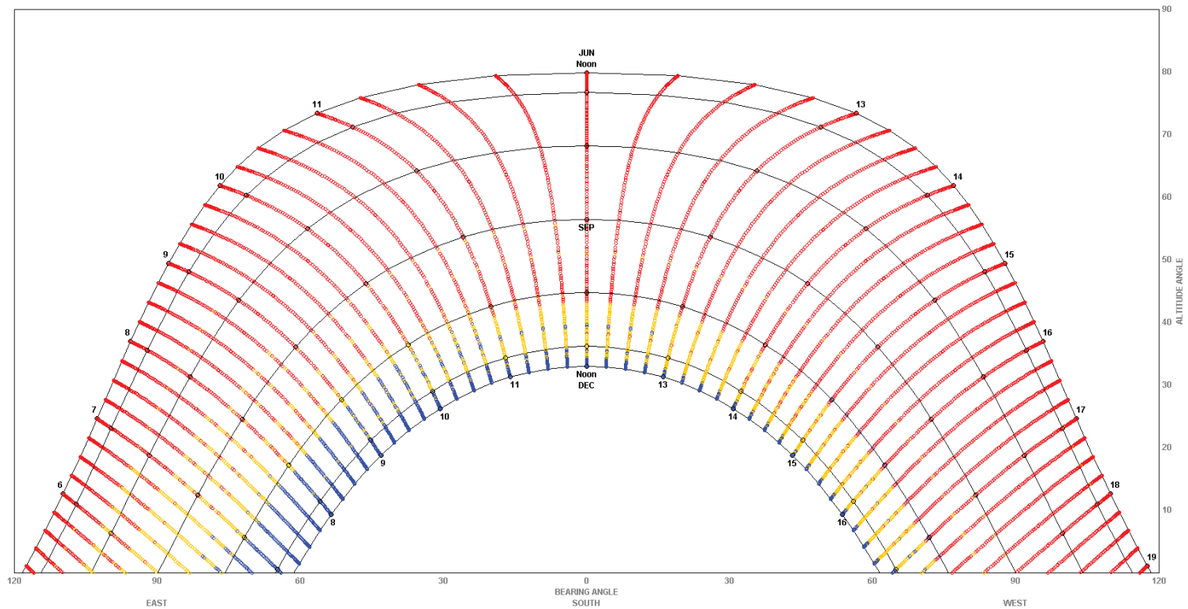
Sun Shading Chart
Winter

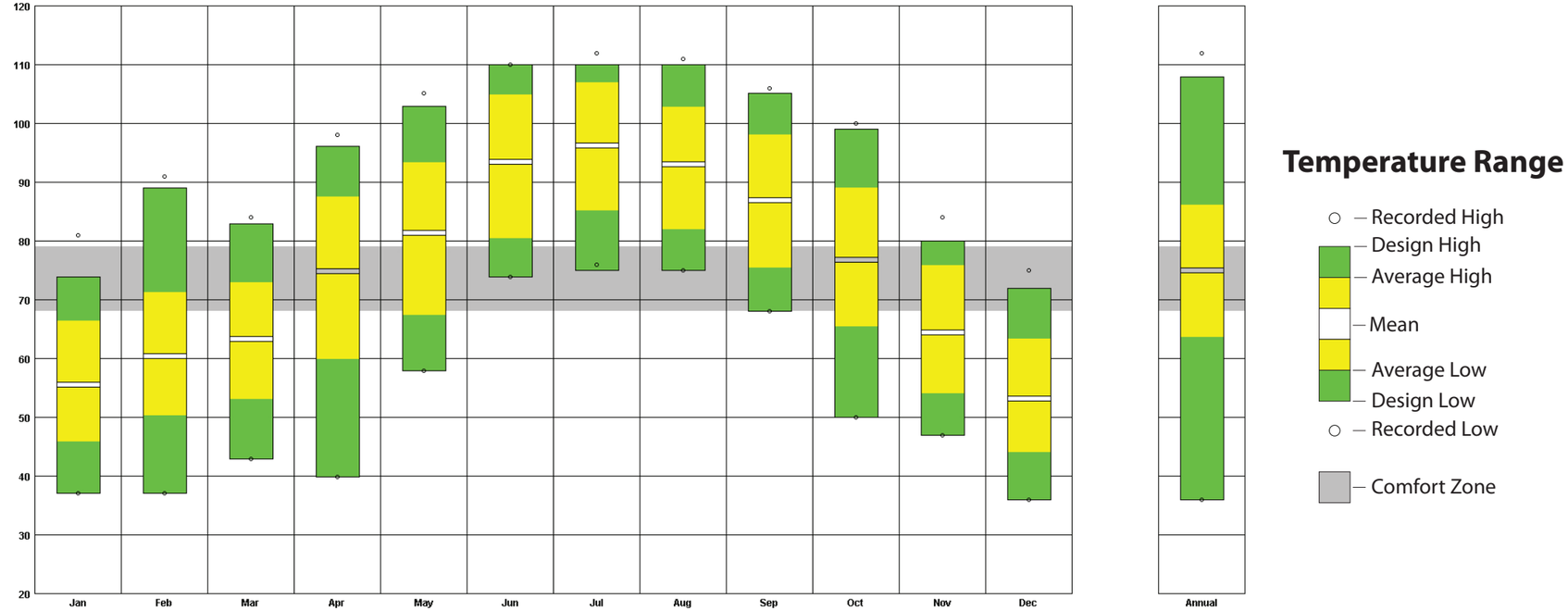
Warm/Hot > 79 F Comfort > 68 F Cool/Cold < 68 F



Sun Shading Chart
Summer

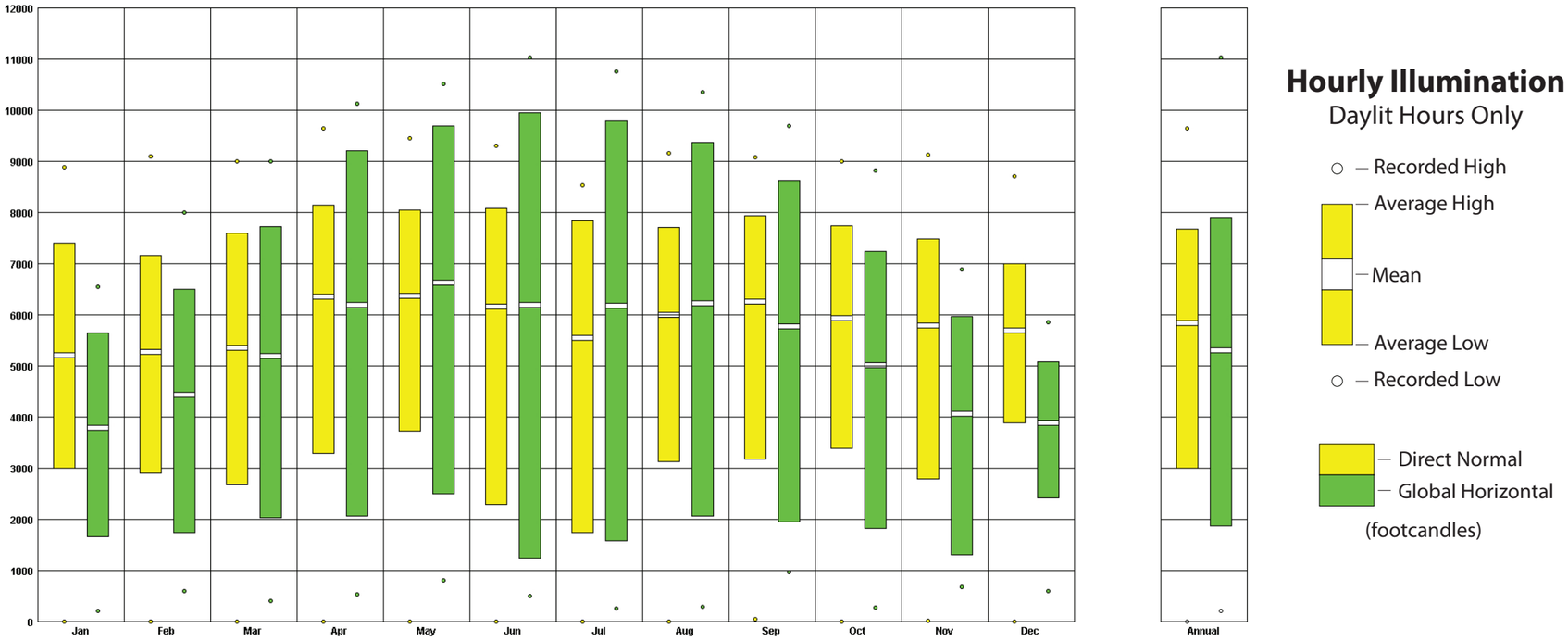
Warm/Hot > 79 F Comfort > 68 F Cool/Cold < 68 F





Temperature Range

- Recorded High
- Design High
- Average High
- Mean
- Average Low
- Design Low
- Recorded Low
- Comfort Zone



Hourly Illumination

Daylit Hours Only

- Recorded High
- Average High
- Mean
- Average Low
- Recorded Low

- Direct Normal
- Global Horizontal

(footcandles)

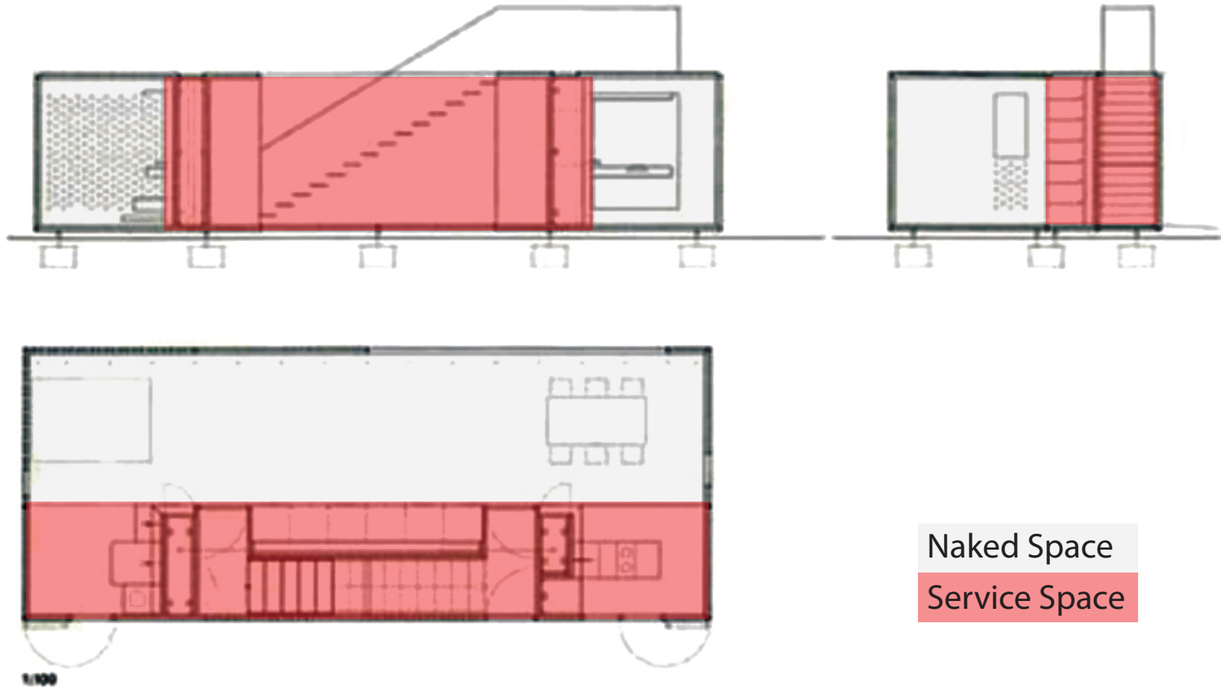
New Housing Model

Precedent Study 1

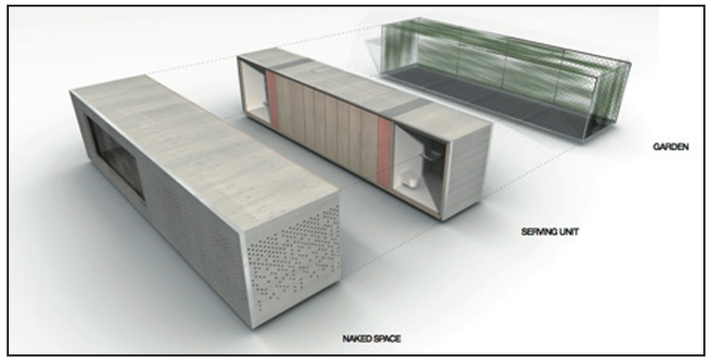
*System **3***

Oskar Leo Kaufmann

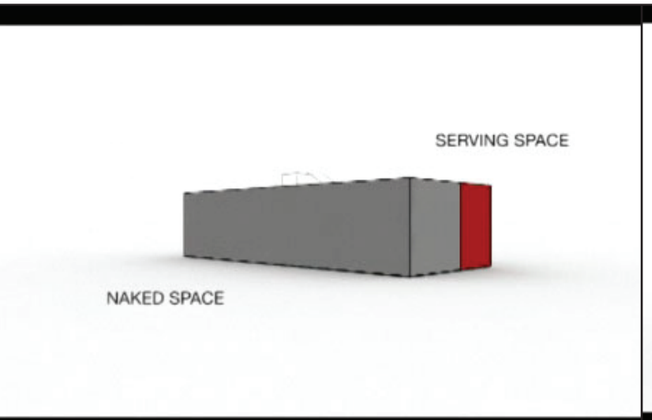
System 3 is a prefab housing model that consolidates all the service systems (bathroom, kitchen, building operations) into a central core which is then encompassed by the living space or (Naked Space). Its designed to evolve into a larger unit based on the users needs.



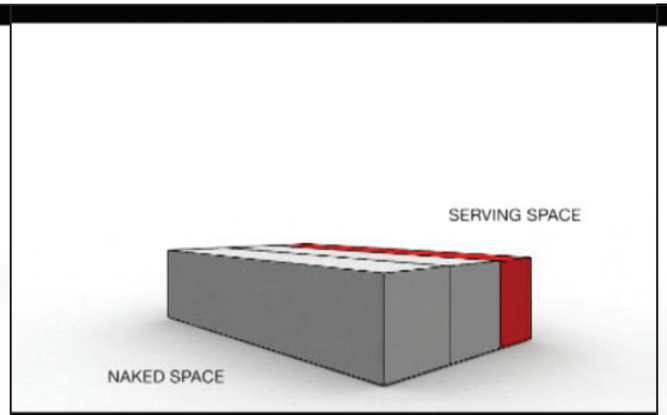
Naked Space
Service Space



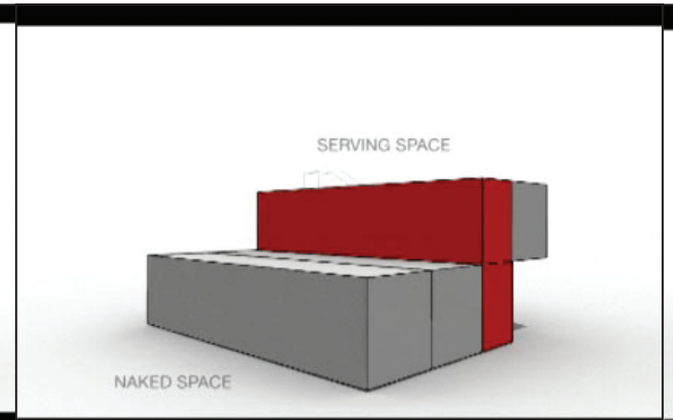
System 3
570 sqf



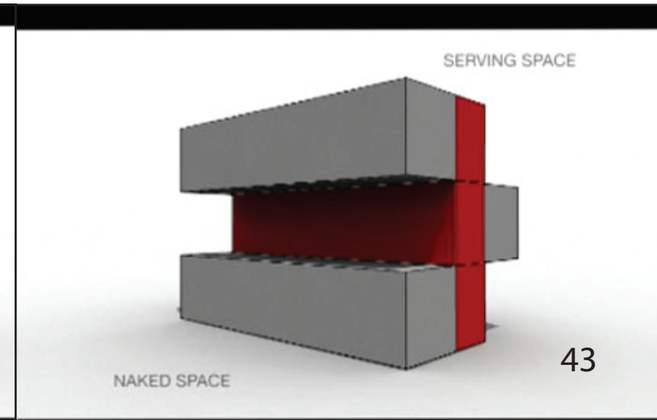
Expanded Living Space
930 Sqf



Expanded Living Space
2 Bedroom, 2 Bath
1500 Sqf



Expanded Living Space
3 Bedroom, 3 Bath
1715 Sqf



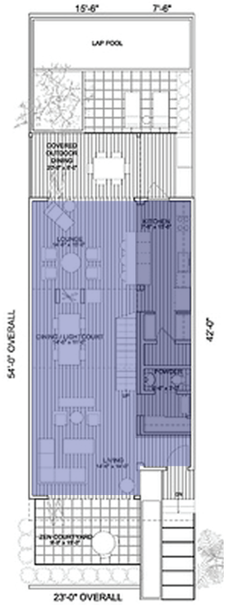
New Housing Model

Precedent Study 2

Smart Home Exhibit

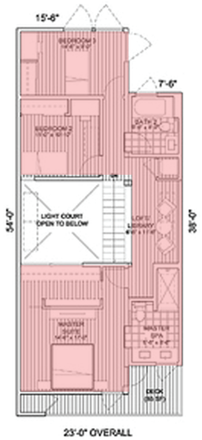
Michelle Kaufmann

The Smart Home is a prefab housing unit showcasing energy efficient technologies. The home consists of an open plan stack design to ensure natural ventilation. Among other things it uses solar and wind power for energy and a green roof to manage water run-off.



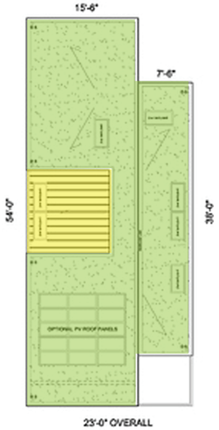
Ground Floor

Mixed Use Space
Nutrition Space



2nd Floor

Private Space

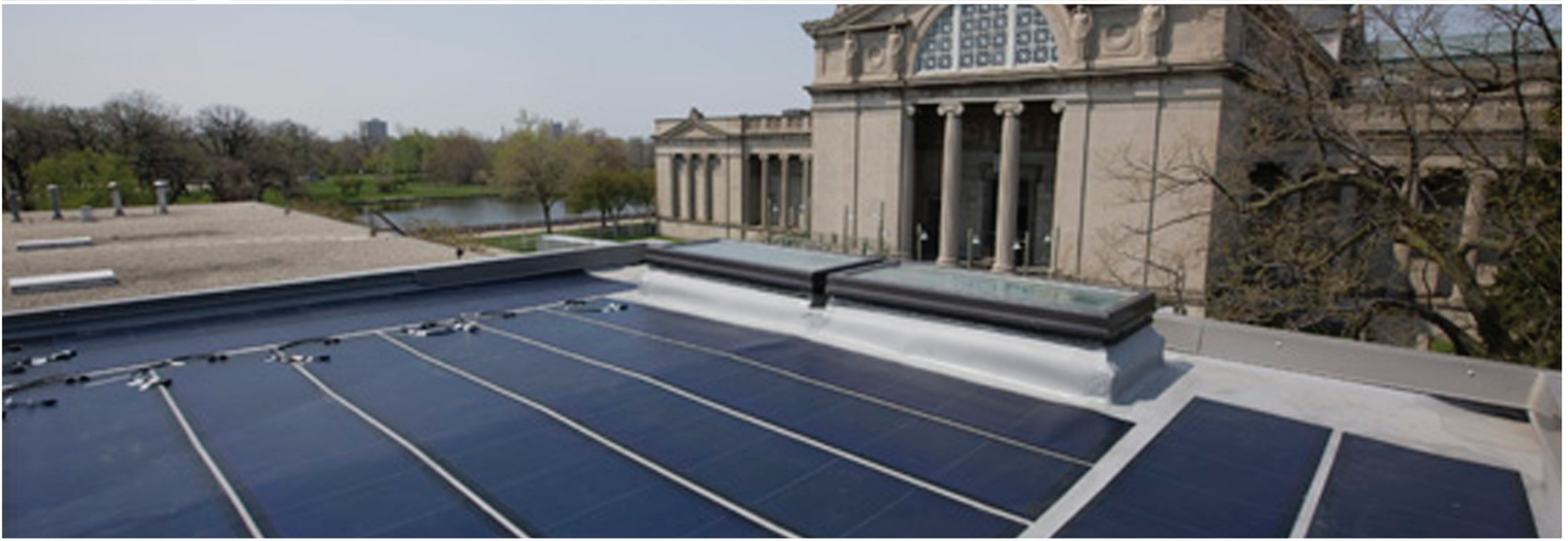


Roof Plan

Green Roof
Solar Collection

Green Roof

Wind Turbine



Solar Collection

Smart Home Exhibit
Michelle Kaufmann

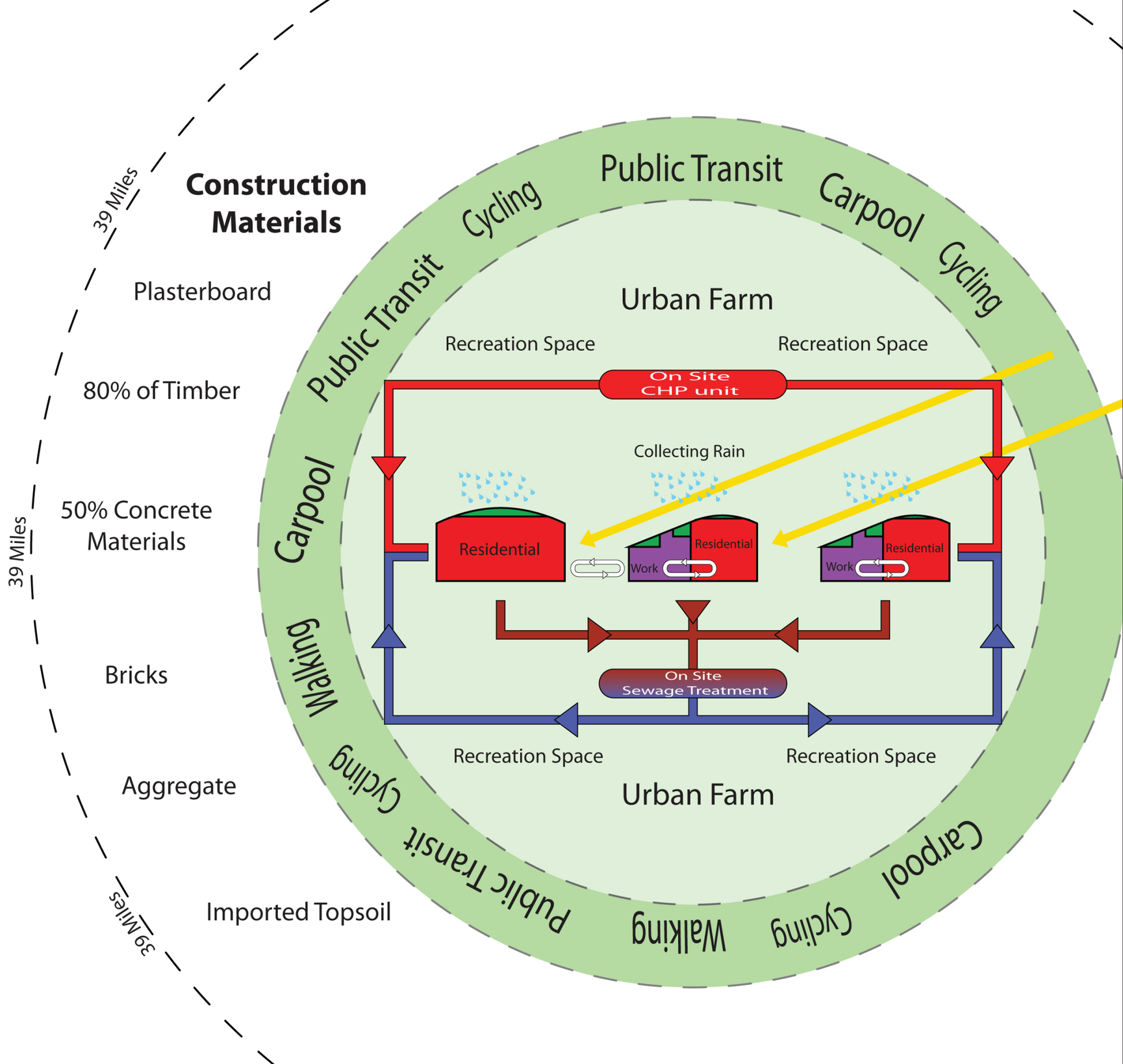
New Housing Model

Precedent Study 3

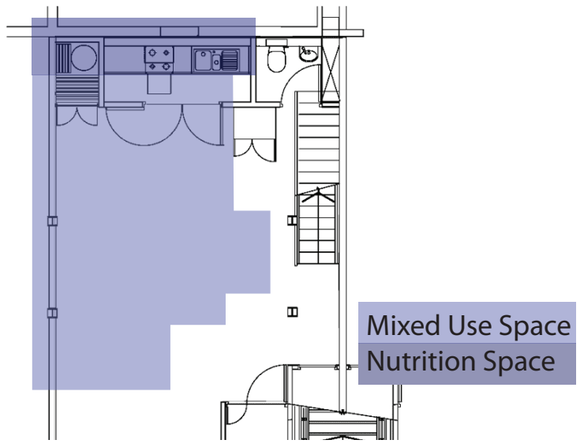
BEDZED

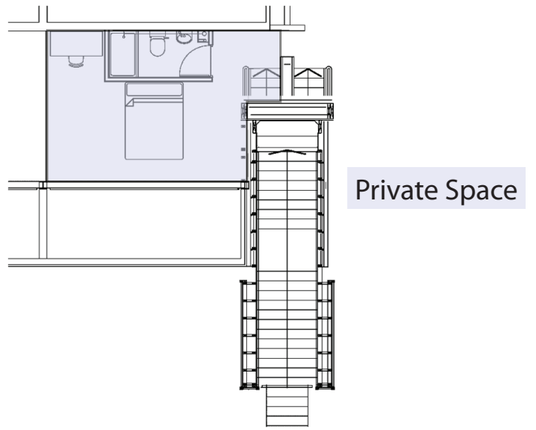
ZEDfactory

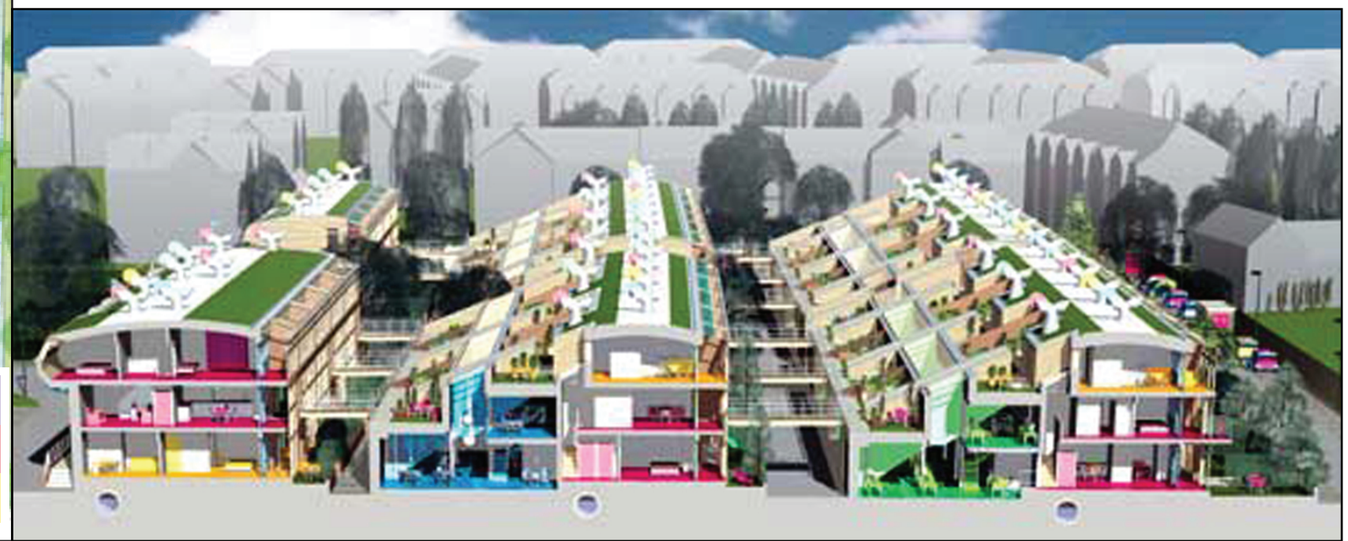
The core idea with BedZED is that sustainable housing isn't sustainable unless ALL aspects of modern life are addressed. This includes everything from the acquisition of construction materials to the users transportation methods. Even local economic impacts need to be explored. BedZED explores sustainability at the community level.




Route Through To
Proposed ECO-Park
London Road
CHP / Living Machine
/ Sports Clubhouse
Sports Pitch
1E Bed Flats
2 Bed Flats
Village Square
3 Bed Townhouses
Workspaces
3 Bed Maisonettes
3 Bed Maisonettes
Access Mews / Home Zone Hybrid
Workspaces
Workspaces
3 Bed Maisonettes
3 Bed Maisonettes
London Road
Residence
Work Space
Work Space 2


Mixed Use Space
Nutrition Space


Private Space



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   BedZED stresses that sustainable housing isn't sustainable unless ALL aspects of modern life are addressed

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   BedZED stresses that sustainable housing isn't sustainable unless ALL aspects of modern life are addressed.

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   This book explores the fundamental concepts behind container house construction.