



FLEXIBLE . ADAPTABLE . TRANQUIL

*'re-envisioning subdivisions'*

AUTHOR CONRAD SZAJNA  
ARCH593 MASTERS THESIS

---

# Contents

---

**Author**  
Conrad Szajna

**Class**  
ARCH 593 : Masters Thesis

**Thesis Advisor**  
Dirk Denison  
Tyler Waldorf

**Semester**  
Fall 2011

**School**  
Illinois Institute of Technology

Introduction / Objectives	01
Qualitative / Quantitative Parameters	02
Design Flaws / Statistics	03
Past Dream / Recent Dream	04
Suburban Utopia	05
Growth Consumes US	06
What's the point?	07
Housing Market	08
Housing Renovation & Demolition	09
Effects of Waste	10
<b>The FAT Proposal</b>	<b>11</b>
Flexible	12
1924   Gerrit Rietveld   Schroder House	
Adaptable	13
1948   Richard Neutra   Case Study House #20	
Tranquil	14
2008   Sou Fujimoto   House - N	
Site Analysis	15
City Context	
Site Analysis	16
Street Context	
Surrounding Context Photos	17
Present Site Conditions	18
Future Site Conditions	19
Goals	20
Site Evolution	21
3D Renderings	24
Physical Model	28

## Elevator Statement

Re-thinking the 21st century suburban home in terms of space planning, material usage, orientation, both to the environment and street condition, and construction application. The main intent will be to re-examine what a typical space means to an individual and to a family in our modern technological times, while at the same time, figuring out ways to decrease waste in terms of material, space, energy and time. The emphasis will be put back on the quality of space and not the quantity of it.

## Case Statement

As the world around us continues to evolve, the spatial and formal concept of a home has changed very little. While technology gets better, smaller and faster, the single family home has gotten larger, cheaper and more inefficient. However, in recent years, due to the economy collapsing, our countries mind-set has changed from wanting more to doing more with less. LeCorbusier once stated that a home should be 'a machine for living in', and his design for Villa Savoye portrayed just that. Unfortunately, what we have now are homes that are instead 'places to store things in'.

Too often we see cookie cutter homes that have a front, back and sides that are very inefficient and do very little for the psyche of the individuals inhabiting it or we instead see large McMansions that have so much square footage within that many spaces are left to little use or they simply never get used at all. In all accounts, homes should not be machines nor should they be storage spaces. Instead, as Gaston Bachelard puts it, "the house shelters day-dreaming, the house protects the dreamer; the house allows one to dream in peace." Can this be achievable? Can a design do just that - encourage and protect dreamers.

It is time to reconsider the single family home. We must ask ourselves what the intention of a home really is. Is it much more than a place of sleeping, eating and communicating? The answer is yes. Whether it be due to financial burdens, economic forces or simply changes of perception in society, the home has also become a place of work, a place of income, and a place of entertaining. Furthermore, a home is also a place of solitude, a place of refuge, a place of peace and a place of intimacy. Those activities have not been addressed in the design of cookie cutter homes, additions and/or McMansions.

Spaces and programs must be re-examined and applied to today's current technological advances. We live in an age where business can be conducted from any place in the world, at any time, with any person in the world simply by connecting through the internet. Such an idea was a mere fantasy some five years back. So when we apply technology to a home, are we allowed to adjust, change, merge or eliminate any program or space? As we are faced with the idea of global warming one solution has been to apply 'green' technology to our life or homes. When faced with financial burden from overspending we re-treat back to the idea of 'buying less'. But in both cases, we miss the underlying issue. What spaces are we 'greening', or are we buying 'less' of? Are these spaces even needed is the question.

America(ns) accepted growth without thought. This is where, we as a nation, went wrong.

The project will : respond to climate and site conditions

minimize waste in construction, space and energy.

look to incorporate prefab elements within the design.

include local building materials to reduce the need of transportation.

attempt to consume little to no energy.

be designed for easy assembly / disassembly at the end of its lifespan.

be responsive to context and climate.

seek to do more with less through the smart design of spaces

be cost efficient

be adaptable/flexible for each family generation.

## Goals

### Flexibility & Adaptability

Spaces will have multiple uses and will have the possibility of being transformed to users needs at any given time.

### Constructability

The project will be designed for easy assemblage and disassembly at the end of its life span.

### Efficiency

Energy consumption will be reduced by integrating environmental conditions such as natural heating from the sun, cross ventilation and water collection.

### Cost Effectiveness

Local materials and prefab elements will be used whenever possible.

### Vision

The idea is to not just design a home, but to instead re-think of what a home is and how it should be used. It will be re-designed for the 21st century based on technological advances and current users needs.

## Guiding Principles

# Qualitative Parameters

## Users

The intent of the design is not to take away from current living standards but instead, this project aims to elevate them. The goal is not to take away space, but instead to enhance it. The idea is to find out what currently works and what does not in a typical suburban home. The housing market grew so quickly that many jumped right in without hesitation. This new house typology seeks to find a compromise between public and private space, indoor outdoor qualities, material importance but most importantly, usable versus wasted space.

The design will be tested on a family of four; two adults and two children. The focus will be on how spaces were once used, are currently used and how they can be used in the future. The end result will encompass many aspects that should already be incorporated within the housing sector such as ecologically smart design, local materials and the re-use of natural forces; such as water, earth and sun.

Comfort is in America's DNA, and to want it is not a crime. While many feel strongly against the suburban living situation, the fact is that this condition will not be eliminated. Privacy, greenery, safety and health all contribute to the success of the suburbs. Instead of focusing on location, we should instead put the focus on enhancing the lifespan and efficiency of buildings, automobiles but most importantly, on human lives.

# Quantitative Parameters

The following program list was generated from a conversation with the clients (withheld) Subject to change as design phase progresses due to the fact that my intent is to find ways of mixing, blending, merging and / or eliminating unnecessary space.

Program	Area	Quantity	Total
Master Bedroom	140 s.f.	1	120 s.f.
Bathroom	80 s.f.	1	80 s.f.
Bedrooms	100 s.f.	2	200 s.f.
Office	144 s.f.	1	144 s.f.
Mechanical	48 s.f.	1	48 s.f.
<b>TOTAL:</b>			<b>592 s.f.</b>

## Private

Program	Area	Quantity	Total
Bathroom	60 s.f.	1	60 s.f.
Half Bath	20 s.f.	1	20 s.f.
Kitchen	300 s.f.	1	300 s.f.
Living / Dining	680 s.f.	1	680 s.f.
Circulation Space	TBD		
Storage	40 s.f.	1	40 s.f.
Mud Room	48 s.f.	1	48 s.f.
Garage	1000 s.f.	1	1000 s.f.
(excluding garage) <b>TOTAL:</b>			<b>1148 s.f.</b>

## Shared

Program	Area	Quantity	Total
Roof Deck	400 s.f.	1	400 s.f.
Sheltered Pavilion	160 s.f.	1	160 s.f.
<b>TOTAL:</b>			<b>560 s.f.</b>

## Outdoor

# Current Design Flaws

# Statistics

## Residential Housing

Nearly **128 million** residential housing units existed in the U.S. in 2007.<sup>2</sup>

Approximately **7.188 million** new housing units were built between 2005 - 2009.<sup>3</sup>



<sup>2</sup> American Housing Survey for the United States- 2007. U.S. Department of Housing and Urban Development and U.S. Department of Commerce, September 2008.  
<sup>3</sup> Ibid.

## Flexibility

Architects and builders typically **do NOT** design homes with easy renovation or deconstruction in mind.

The **average U.S. family moves every 10 years**.<sup>38</sup>

Homes often undergo many renovations over their lifetimes, or complete building removal is carried out to make room for a newer home.<sup>39</sup>



<sup>38</sup> US EPA, Lifecycle Building Challenge: <http://www.lifecyclebuilding.org/files/Lifecycle%20Construction%20Resource%20Guide.pdf>  
<sup>39</sup> Ibid.

## Construction Waste

We generate enough construction and demolition debris in the United States each year to fill a typical city street four feet tall with trash and run that wall from New York, NY to Los Angeles, CA six times – an estimated **136 million tons annually**.<sup>2</sup>

Sources of the building-related C&D debris wastestream include **demolition 48%, renovation 44%, and new construction 8%**.<sup>3</sup>

According to the National Association of Home Builders (NAHB) study, an estimated **8,000 lbs of waste is created from the construction of a 2,000 sq. ft. home**. The majority of the 8,000 is wood, cardboard, and drywall. Almost all of that waste ends up in landfills.



<sup>2</sup> Calculated from statistics from US EPA, 1998. "C&D Wood Debris Management Trends" Resource Recycling, November, 1998, p 22. and Wisconsin Department of Natural Resources "Recycling Facts and Figures" publ. CE-163 2003 Rev. Trash Trivia  
<sup>3</sup> Ibid.

## Indoor Environment

On average, **Americans spend about 90% or more of their time indoors**.

**Indoor levels of pollutants may be 2 - 5 times higher, and occasionally more than 100 times higher, than outdoor levels**.<sup>22</sup>



<sup>22</sup> The Inside Story: A Guide to Indoor Air Quality. U.S. EPA/ Office of Air and Radiation, Office of Radiation and Indoor Air (6609J) Cosponsored with the Consumer Product Safety Commission, EPA 402-K-93-007.

## Water Use

**Building occupants use 13 percent of the total water consumed in the United States per day**. Of that total, 25.6 percent is used by commercial building occupants, and **74.4 % by homeowners (1995)**.<sup>13</sup>

Of the **26 billion gallons of water consumed daily in the United States**, approximately 7.8 billion gallons, or **30%, is devoted to outdoor uses**. The majority of this is used for landscaping. **17 The typical suburban lawn consumes 10,000 gallons of water** above and beyond rain-water each year.<sup>18</sup>



<sup>13</sup> Estimated Water Use in the United States in 1995. U.S. Geological Survey. <http://water.usgs.gov/watuse/pdf1995/html/>  
<sup>18</sup> US EPA, WaterSense program: [http://www.epa.gov/WaterSense/docs/water-efficient\\_landscaping\\_508.pdf](http://www.epa.gov/WaterSense/docs/water-efficient_landscaping_508.pdf)

## Energy Use

The **average household spends at least \$2,000 a year on energy bills** — over half of which goes to heating and cooling.<sup>8</sup>

**Out of the total energy consumption in an average household, 50% goes to space heating, 27% to run appliances, 19% to heat water and 4% goes to air conditioning**.<sup>9</sup>

**Buildings in the United States contribute 38.9 percent of the nation's total carbon dioxide emissions, including 20.8 % from the residential sector and 18.0% from the commercial sector (2008)**.<sup>10</sup>



<sup>8</sup> US EPA ENERGY STAR program, [http://www.energystar.gov/index.cfm?c=thermostats.pr\\_thermostats](http://www.energystar.gov/index.cfm?c=thermostats.pr_thermostats)  
<sup>9</sup> Changes in Energy Usage in Residential Housing Units. DOE/EIA. <http://www.eia.doe.gov/emeu/recs/recs97/decade.html#totcons4>  
<sup>10</sup> Emissions of Greenhouse Gases in the United States 2007. DOE/EIA-0573(2007). Energy Information Administration, U.S. Department of Energy, December 2008 <http://www.eia.doe.gov/oiat/1605/ggrpt/index.html>

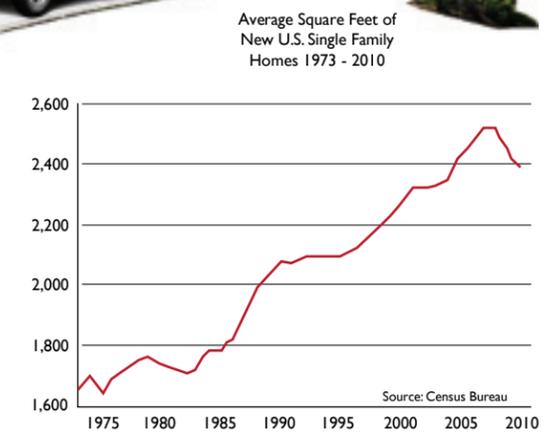
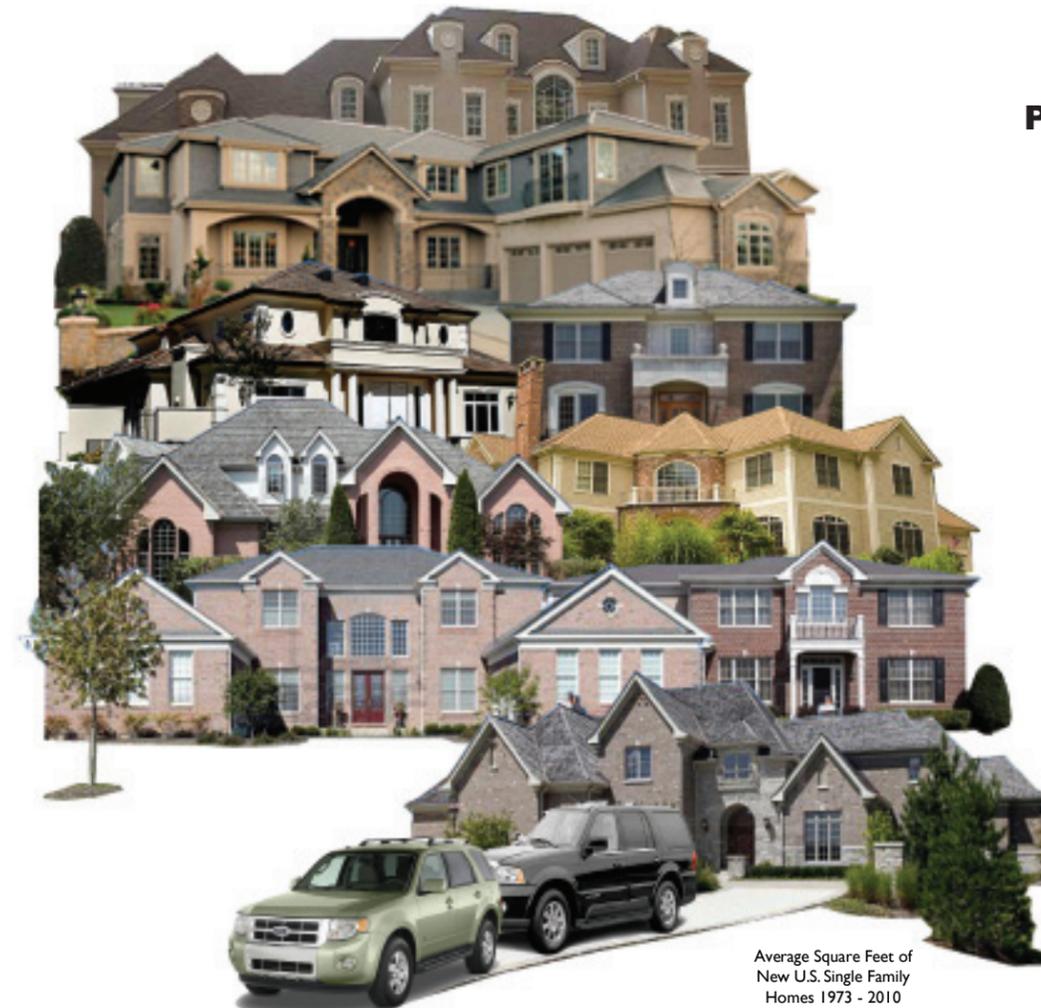
# Past Dream

**1950's**  
Modest Living  
at its finest.



# Recent Dream

**Prior to 2008**  
Consumed by  
consumerism  
perpetrated  
by media  
expectations.





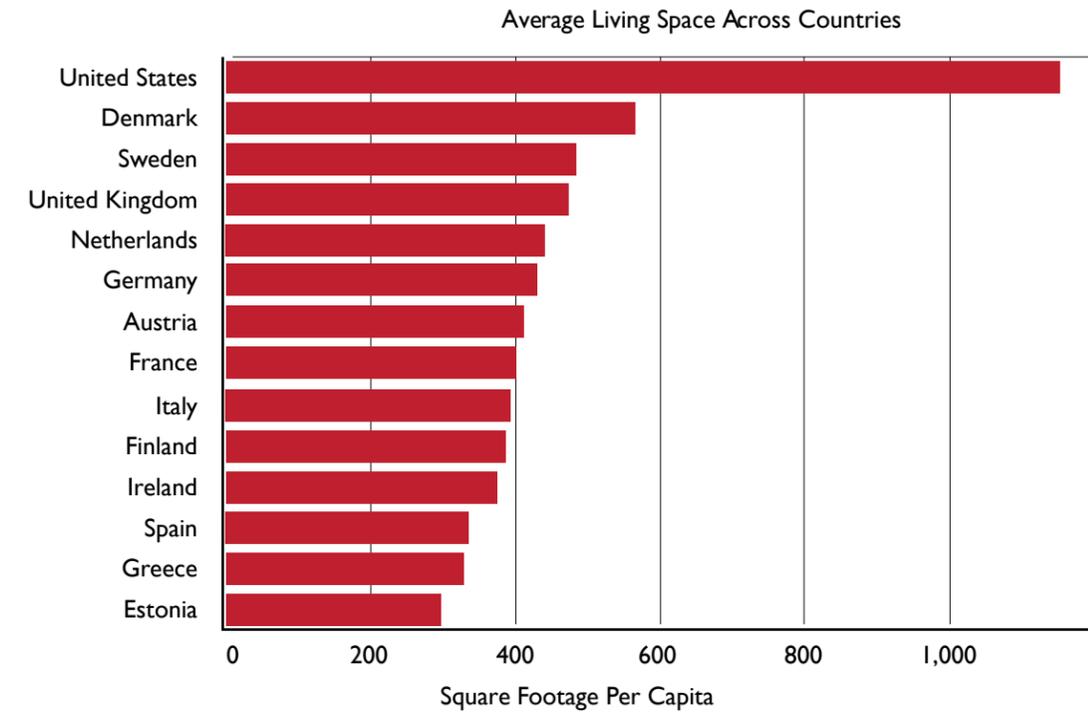
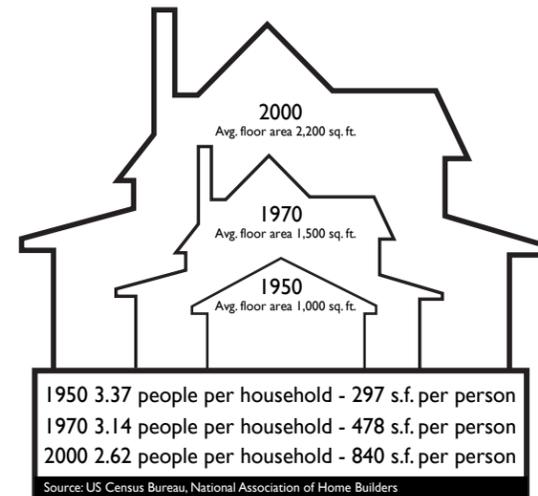
# SUBURBAN UTOPIA???

We are all unique and different as individuals -  
so why are the places we call 'home' not?

# GROWTH CONSUMES US

As we continue to expand our square footage in the United States, we continue to consume more energy. Are we alone in the world?

## YES!



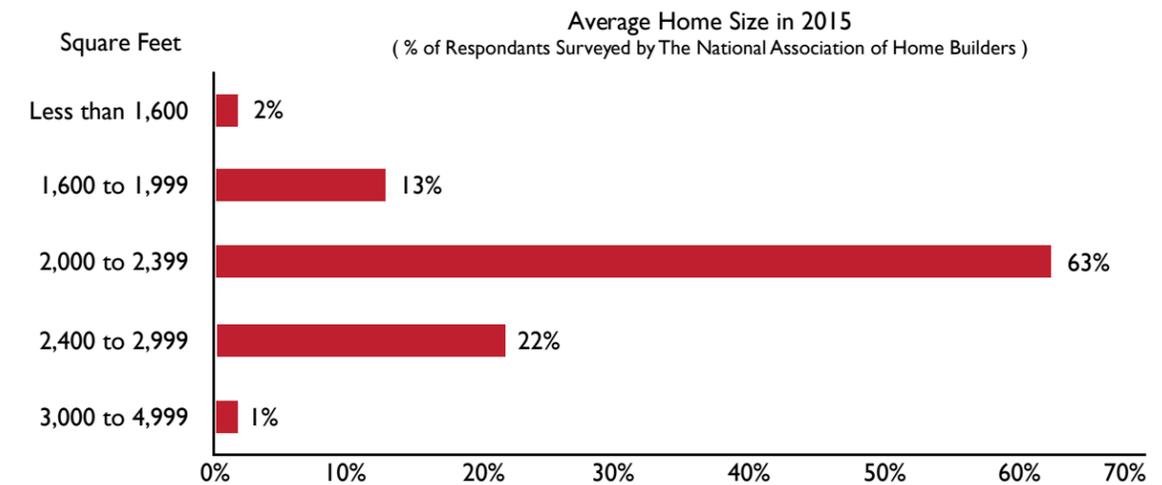
According to the survey, the future shows a slightly smaller house footprint. Unfortunately, it's not by much.

## Residential Energy Consumption

Delivered Energy Consumption Intensities in 2005

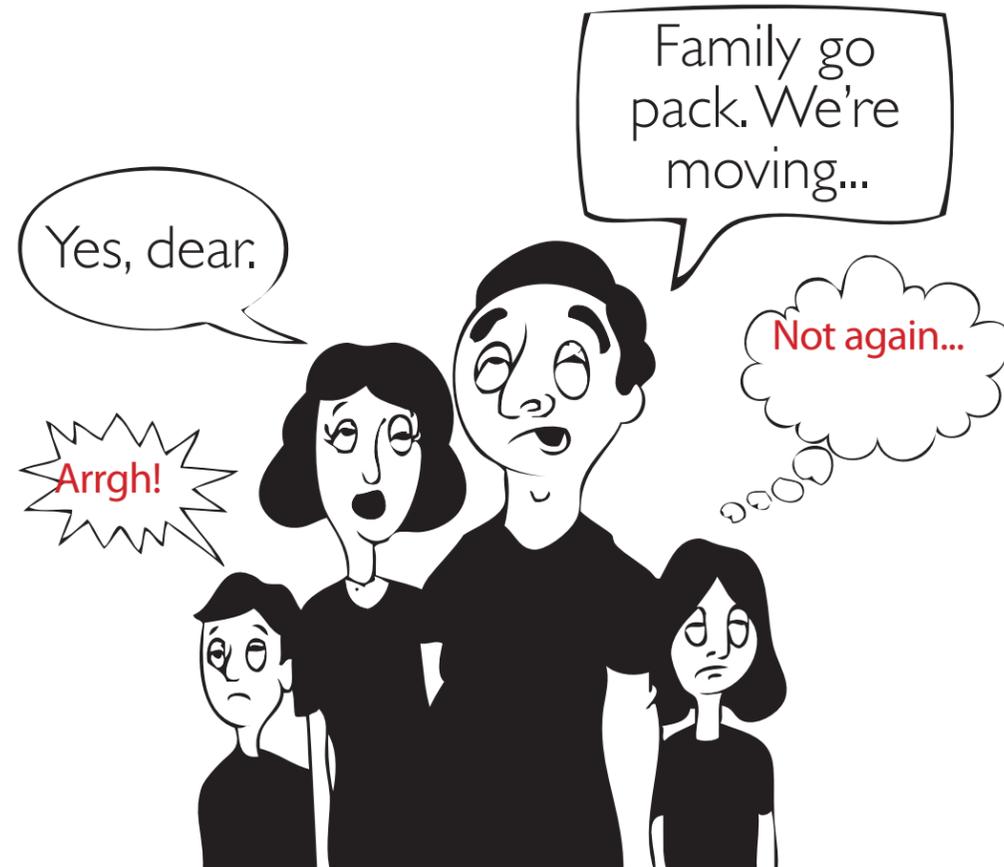
Residential Housing Type	Per Square Foot (Thousand BTU)	Per Household (Million BTU)	Per Household Members (Million BTU)	Percent of Total Consumption
<b>Single Family</b>	<b>52.9</b>	<b>106.6</b>	<b>42.6</b>	<b>80.5 %</b>
Detached	39.8	108.3	39.7	73.9 %
Attached	47.3	91.7	37.0	6.6 %
<b>Multi Family</b>	<b>67.6</b>	<b>63.7</b>	<b>29.5</b>	<b>14.8 %</b>
2 - 4 units	77.6	84.5	34.9	6.3 %
5 or more units	61.7	53.8	26.4	8.5 %

Source Energy Information Administration, Residential Energy Consumption Survey, 2005, June and October 2008, Table HC 1-1-2 Table US-1 part 1, and Table US-4, at [http://www.eia.doe.gov/emeu/recs/recs2005/c&e/detailed\\_tables2005c&e.html](http://www.eia.doe.gov/emeu/recs/recs2005/c&e/detailed_tables2005c&e.html) (May 26, 2009)



# SO IS THERE A POINT TO THIS OR...

YES! With such a large housing market, Architect/builders typically make the mistake of **NOT** designing homes that are easy to renovate or deconstruct at the end of their lifespan.



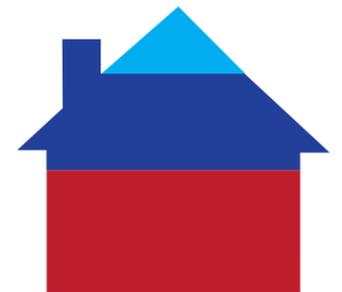
According to the 2011 Census, the average American moves 11.7 times in their life!

# AND WHY IS THAT AN ISSUE?

Each family has different needs. Homes often undergo many renovations over their lifetimes, or complete building removal is carried out to make room for a newer home

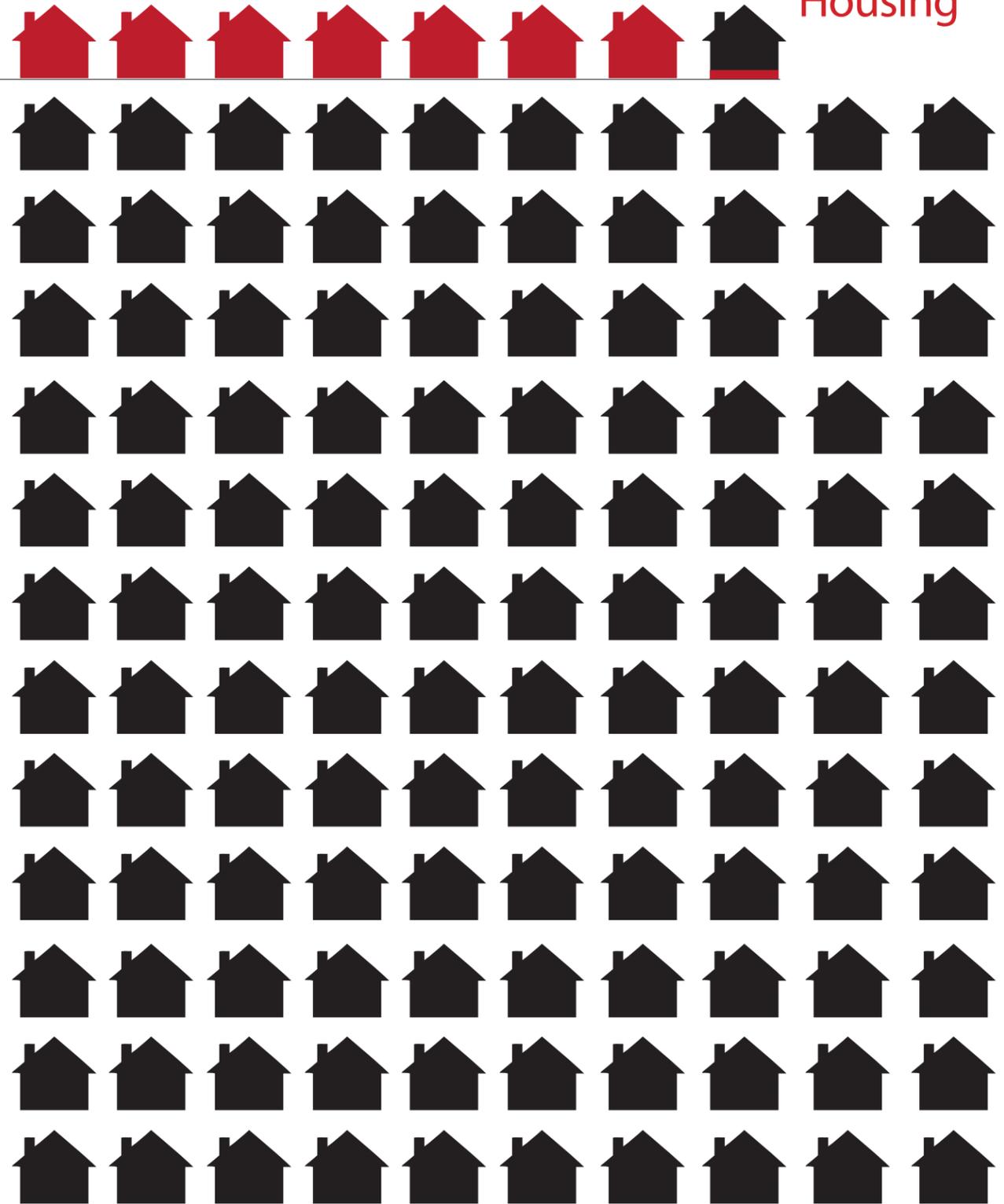
Sources of the building-related C&D debris waste stream include

*new construction* 8%  
**renovation 44%**  
**demolition 48%**



Nearly **128 million** residential housing units existed in the U.S. in 2007.

Approximately **7.188 million** new housing units were built between 2005 - 2009.



(source: American Housing Survey for the United States- 2007. U.S. Department of Housing and Urban Development and U.S. Department of Commerce. September 2008.)

**A** Example  
**Typical**

**An** Example  
**Extreme**



**Type** Renovation

**Rough Cost of home** 150-300,000

**Rough Square footage** 1,600-2,800

**Culprit** Middle Class\* America

*\* on endangered species list*



**Type** Demolition

**Rough Cost of home** 12,000,000

**Rough Square footage** 9,000

**Culprit** Tiger's ex-wife

## The Reality

We generate enough construction and demolition debris in the United States each year to fill a typical city street **4' tall** with trash and run that wall from New York, NY to Los Angeles, CA **6 times** – an estimated **136 million tons annually**.

the sooner you park your car,  
the sooner you can stop thinking

(SOURCE: 2 Calculated from statistics from US EPA, 1998, "C&D Wood Debris Management Trends" Resource Recycling, November, 1998, p 22, and Wisconsin Department of Natural Resources "Recycling Facts and Figures" publ. CE-163 2003 Rev. Trash Trivia )

# WHAT DO YOU PROPOSE?



**FLEXIBLE**  
*interior spaces*

+

**ADAPTABLE**  
*exterior building components*

=

**TRANQUIL**  
*a balance between  
inside vs. outside*

# FLEXIBLE

Promote social activity with a well thought out interior layout by merging rooms and **eliminating excessive space.**

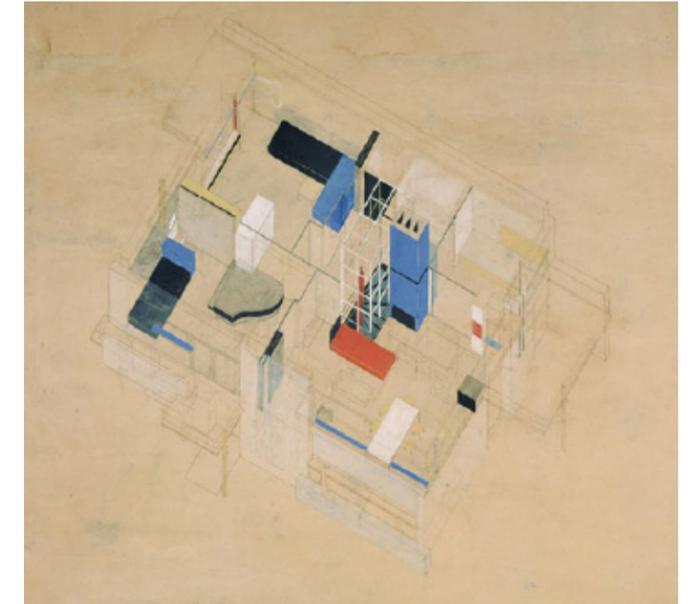
The interior needs to **contour** the inhabitants lifestyle.

GERRIT RIETVELD

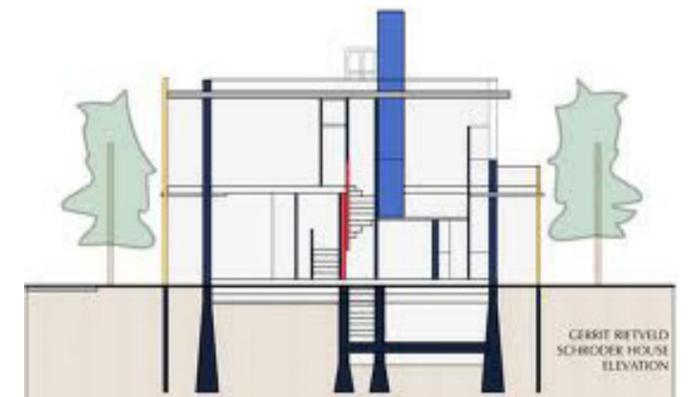
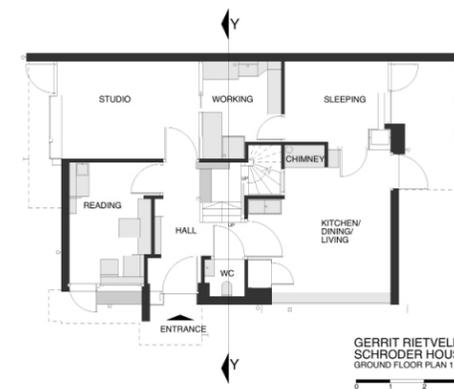
## SCHRODER HOUSE

UTRECHT, NETHERLANDS

1924



*Flexible & Adaptable  
Horizontal  
Vertical Planes  
Openness*



# ADAPTABLE

Building components should be designed to allow for **easy assembly and disassembly** at the end of its lifespan.

If certain components are no longer needed, they then can be constructed elsewhere for other uses.

Components should be able to be **recycled.**

RICHARD NEUTRA

## CASE STUDY HOUSE #20

PACIFIC PALISADAS, CALIFORNIA

1948



*Flexible & Adaptable  
Affordable Prefab  
Inside vs. Outside*

# TRANQUIL

Definition *a* : free from agitation of mind or spirit

Each home should have a **unique interior and exterior presence**. It should strike a peaceful **balance between structure and nature** while at the same time providing a calm and relaxing setting.

WHY?

On average, Americans spend about **90%** or more of their time indoors.

Indoor levels of pollutants may be **2 - 5 times higher**, and occasionally more than 100 times higher, than outdoor levels.

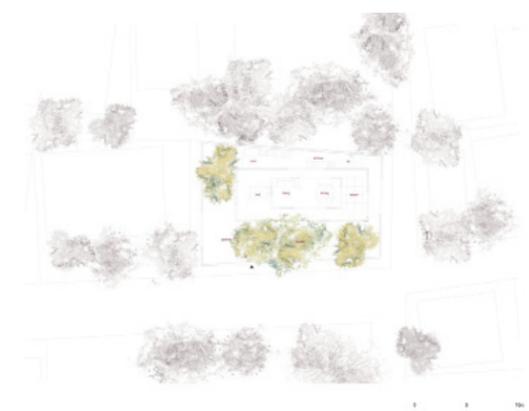
(SOURCE The Inside Story: A Guide to Indoor Air Quality, U.S. EPA/Office of Air and Radiation, Office of Radiation and Indoor Air (6609)) Cosponsored with the Consumer Product Safety Commission, EPA 402-K-93-007.)

SOU FUJIMOTO

## HOUSE - N

OITA, JAPAN

2008



*Inside vs Outside  
Scale + Openings*

# SITE ANALYSIS

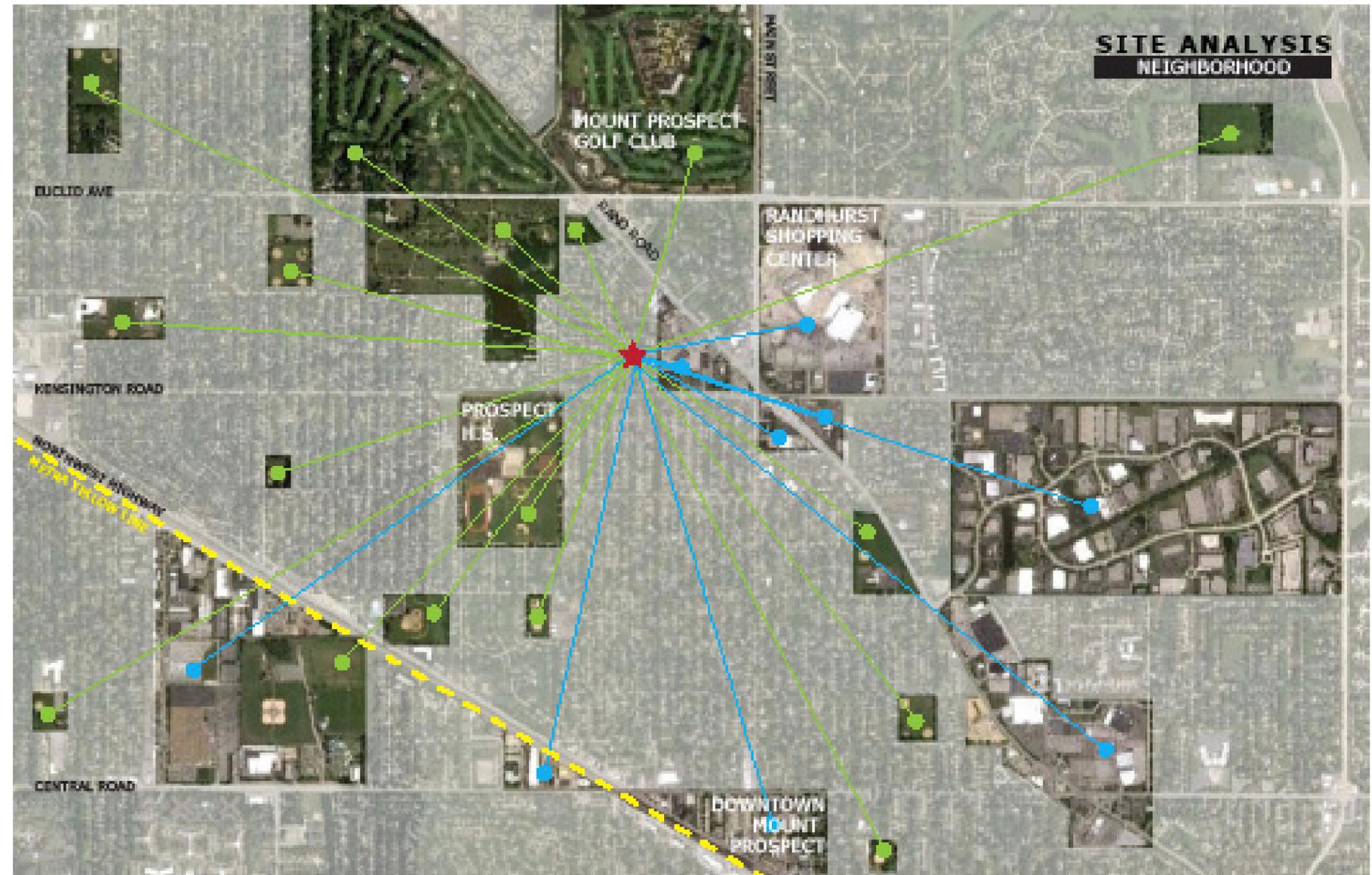
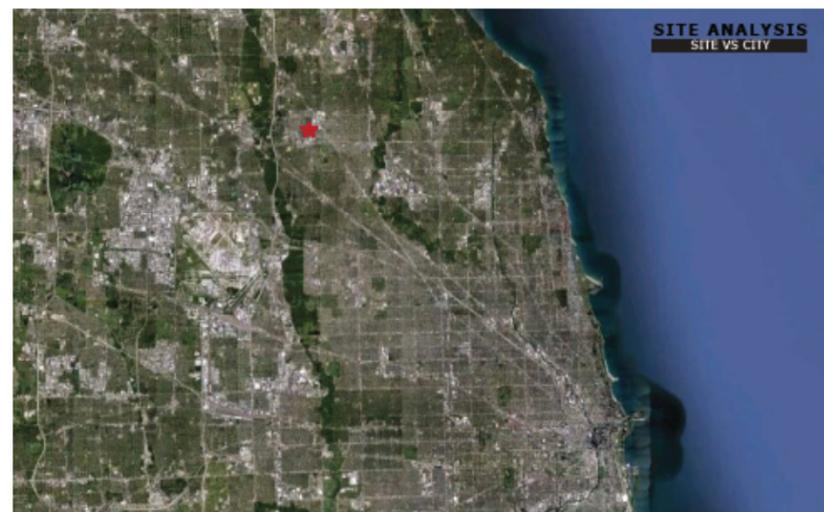
## MOUNT PROSPECT, IL. 60056

### Mount Prospect

is a village in Elk Grove and Wheeling Townships in Cook County, Illinois, about 22 miles northwest of downtown Chicago. As of the 2010 census, the village had a total population of 54,167.

Average household size = 2.60

Average family size = 3.14



According to the census of 2000

Population 56,265  
Households 21,585

Pop. density 5,513.1  
per square mile

Housing Units 21,952  
Average density 2,151.0  
per square mile

### Racial makeup

White	78.13%
African American	1.82%
Native American	0.20%
Asian	11.18%
Hispanic or Latino	13.77%
Pacific Islander	0.05%
Other races	4.14%
Two or more races.	2.02%

A census survey conducted between 2005 and 2007 estimate the current median income for a family to be \$81,574.

Males had a median income of \$44,585 versus \$32,218 for females.

The per capita income for the village was \$26,464.

About 3.1% of families and 4.6% of the population were below the poverty line, including 6.2% of those under age 18 and 3.7% of those age 65 or over.

Mount Prospect has a number of distinct and award winning school districts.

Business Week in 2008 voted Mount Prospect as the "Best Place to Raise your Kids."

# SITE ANALYSIS

MOUNT PROSPECT, IL. 60056



416 West Larkdale

CONTEXT PHOTOS  
VIEWING NORTH



CONTEXT PHOTOS  
VIEWING SOUTH



Even though there is a set site picked out, the intent is to create a solution that is adaptable to any site within the suburbs of Chicago, or with minor modifications due to climate, other suburbs around the United States.

## Zoning Ordinance : R-1

Floor Area Ratio	0.5
Front Yard Setback	30 feet
Interior Yard Setback	10 feet
Exterior Yard Setback	20 feet
Rear Yard Setback	25 feet
Height Limitations	28 feet

*Future investigations will take place on how this solution can be invested within the greater urban context.*

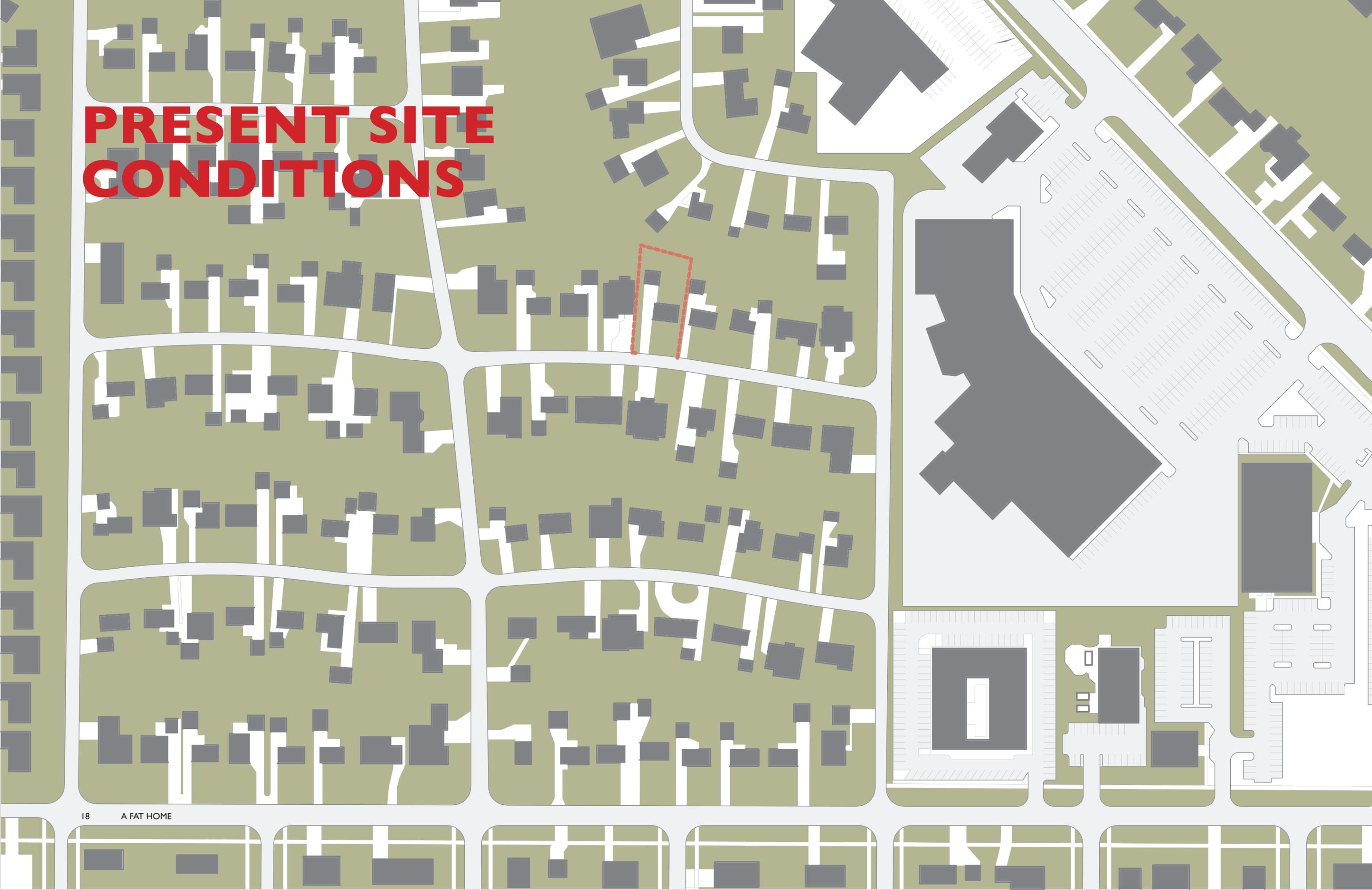




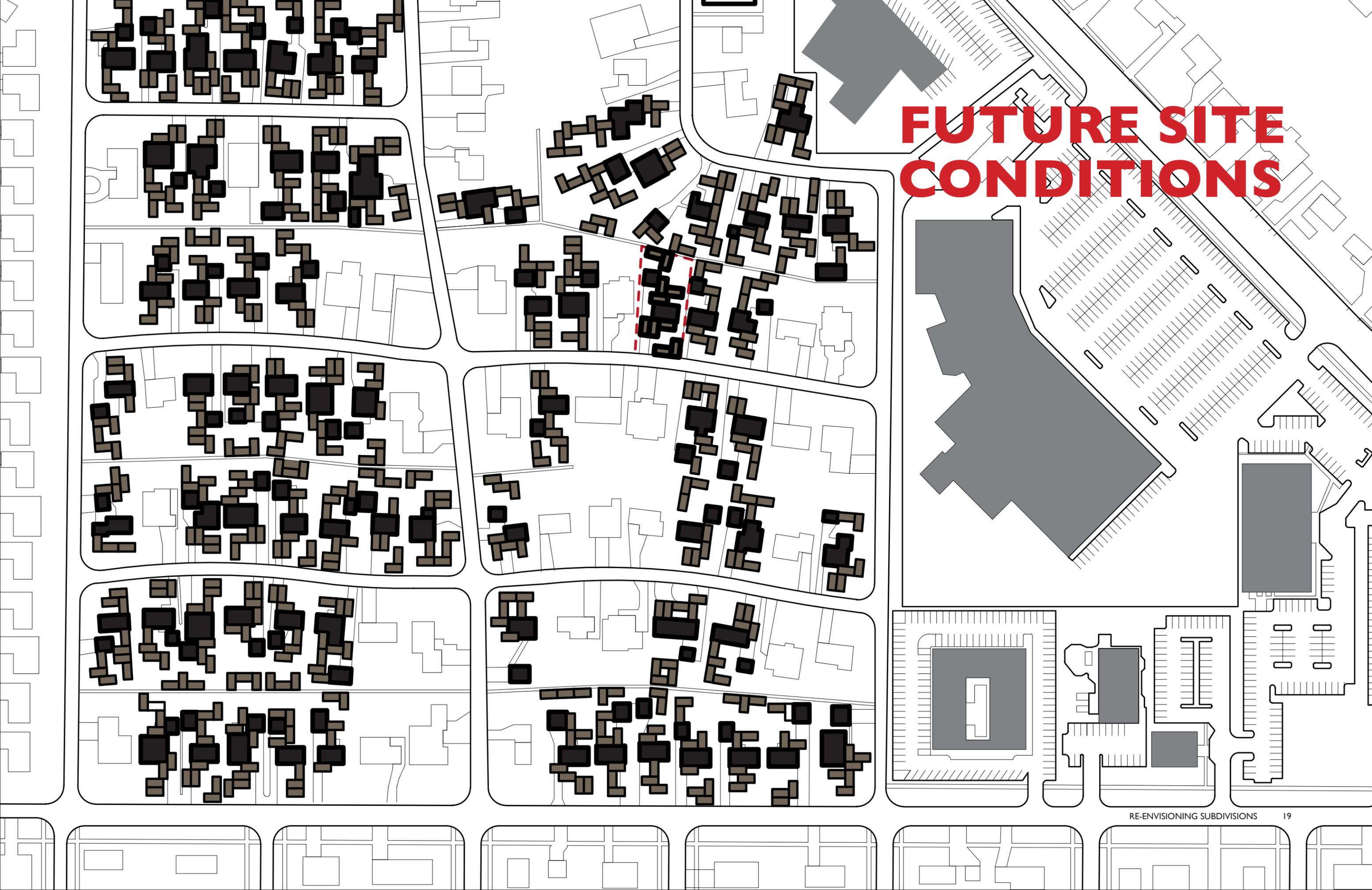
**SURROUNDING  
CONTEXT**



# PRESENT SITE CONDITIONS



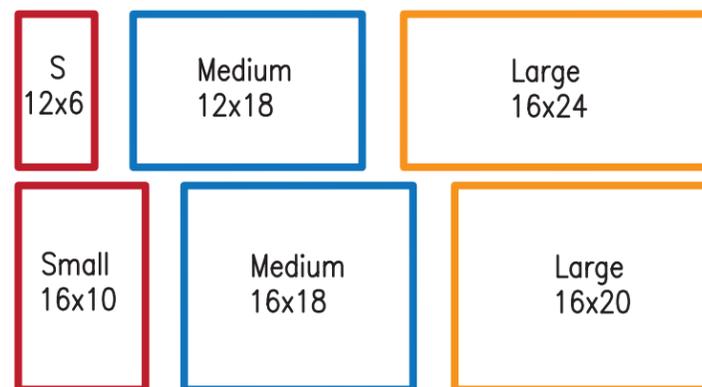
# FUTURE SITE CONDITIONS



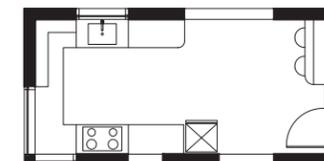
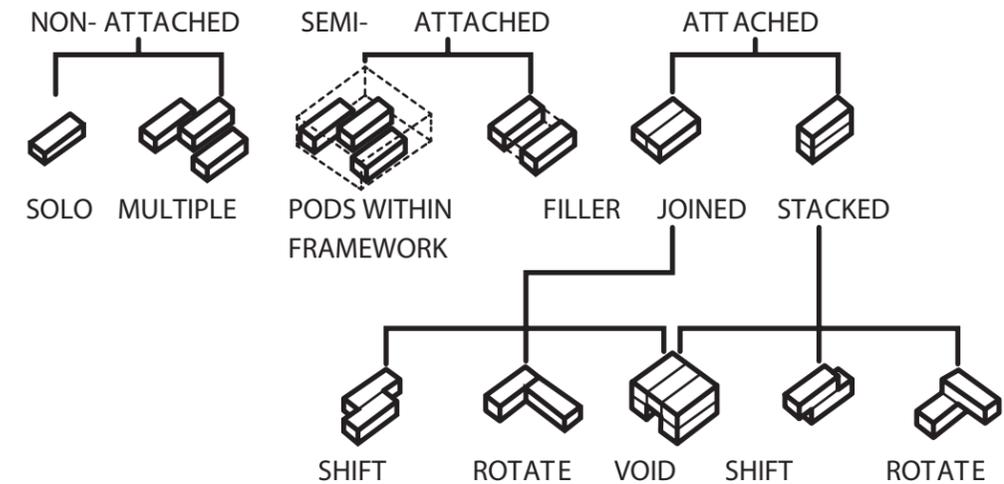
# GOALS

- Use as much of the existing structure as possible
- Use the plot of land more efficiently
- Design spaces to promote social interaction
- Find ways to add density to existing plot of land
- Ass possibly revenue streams from renting
- RE-THINK ZONING

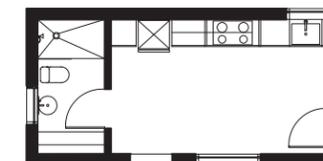
## Building Components



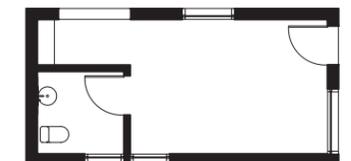
# HOW?



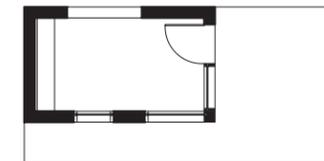
KITCHEN + BREAKFAST NOOK



KITCHEN + BATH



1/2 BATH + WORKSHOP



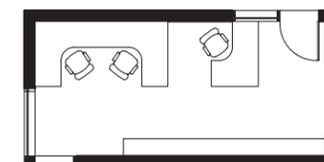
ENTRYWAY



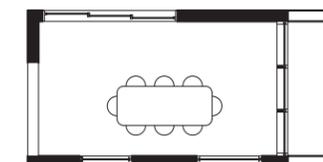
TWO BEDROOM



SINGLE CAR GARAGE / WORKSPACE



OFFICE



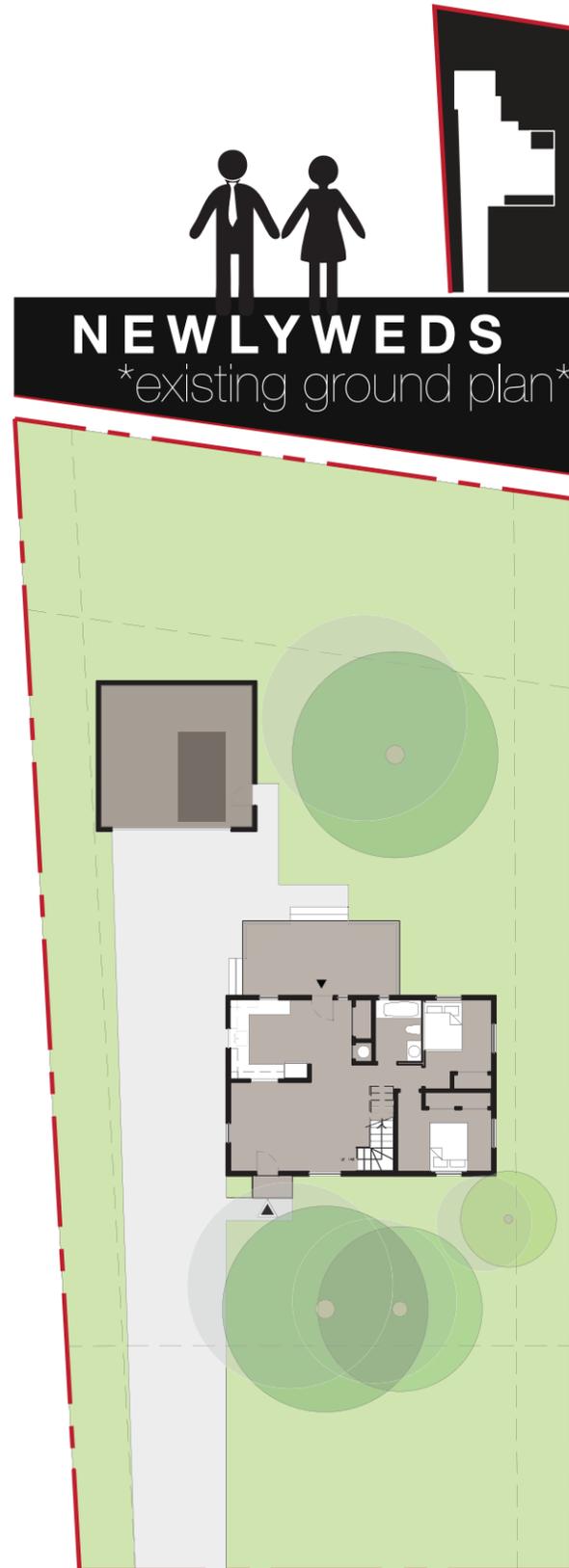
DINING



1/2 BATH / MUDROOM / LAUNDRY

**EXISTING GROUND LEVEL PLAN**

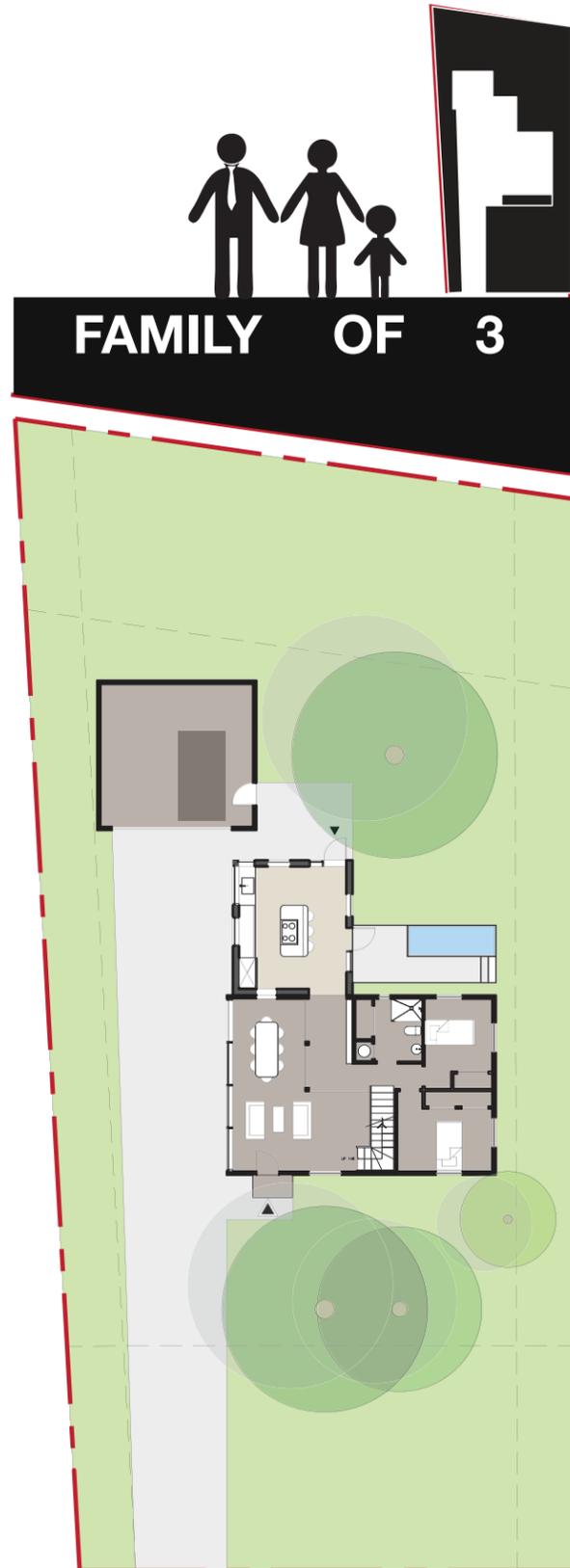
- 2 bedroom
- 2 bath
- Kitchen
- Living Room
- Porch
- 2 Car Garage



**FAMILY OF 3**

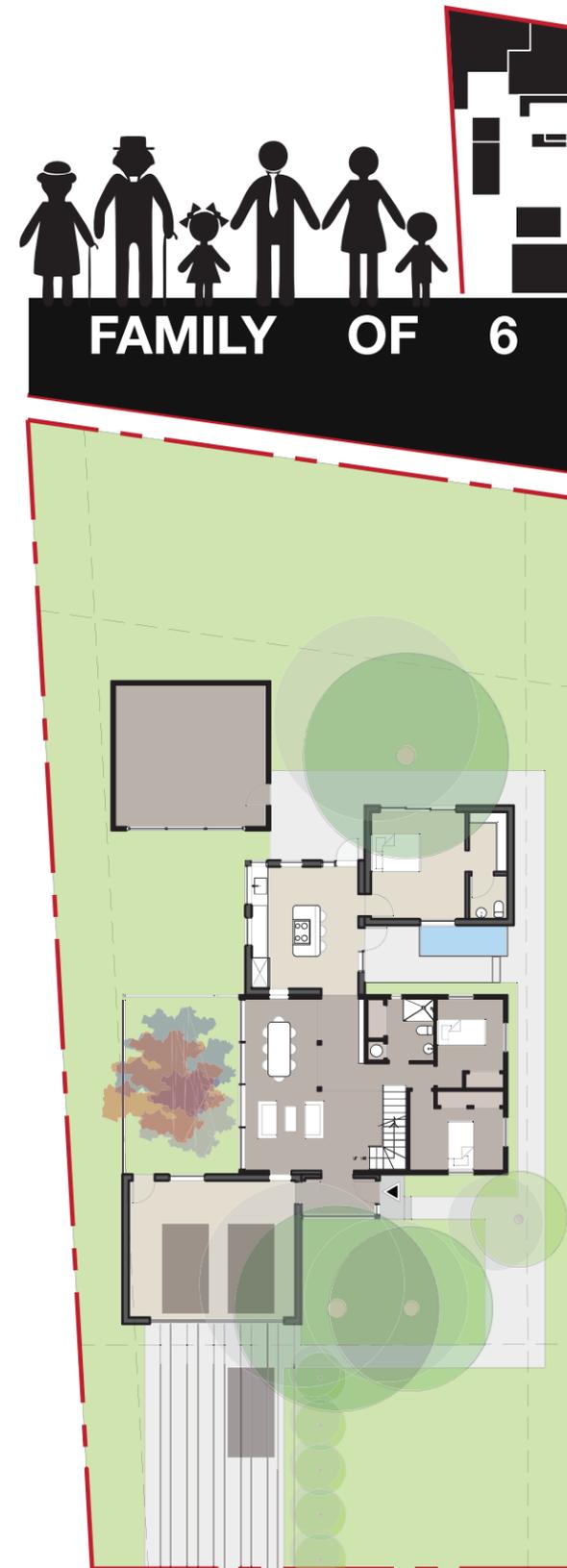
**EXISTING GROUND LEVEL PLAN**

- 2 bedroom
- 2 bath
- Kitchen (expanded)
- Living Room (expanded)
- + Dining Area
- Porch (replaced to include water feature)
- 2 Car Garage



**EXISTING GROUND LEVEL PLAN**

- 2 bedroom
- + Master Bedroom
- 2 bath
- + 1/2 Bath
- Kitchen (expanded)
- Living Room (expanded)
- + Dining Area
- Porch (replaced to include water feature)
- 2 Car Garage



**EXISTING GROUND LEVEL PLAN**

- 2 bedroom
- + Master Bedroom
- 2 bath
- + 1/2 Bath
- Kitchen (expanded)
- Living Room (expanded)
- + Dining Area
- Porch (replaced to include water feature)
- 2 Car Garage (relocated to front)
- + Existing driveway gets placed with a courtyard and garden

\*Old garage has the possibility of becoming a workshop, a storage or multi-purpose space

**EXISTING GROUND LEVEL PLAN**

- 2 bedroom
- + Master Bedroom
- 2 bath
- + 1/2 Bath
- + Full Bath
- Kitchen (expanded)
- Living Room (expanded)
- + Dining Area
- Porch (replaced to include water feature)
- 2 Car Garage (relocated to front)
- + Existing driveway gets placed with a courtyard and garden
- + Laundry/Mudroom
- FRONT:** + workshop (\$)
- + Shed for gardening (\$)

\*Old garage has become a separate living space for grandparents moving back in or older siblings returning from college



**EXISTING GROUND LEVEL PLAN**

- 2 bedroom
- + Master Bedroom
- 2 bath
- + 1/2 Bath
- + Full Bath
- Kitchen (expanded)
- Living Room (expanded)
- + Dining Area
- Porch (replaced to include water feature)
- 2 Car Garage (relocated to front)
- + Existing driveway gets placed with a courtyard and garden
- + Laundry/Mudroom
- FRONT:** + workshop (\$)
- + Shed for gardening (\$)
- BACK:** + Additional living Space for rent (\$\$)

\*Old garage has become a separate living space for grandparents moving back in or older siblings returning from college



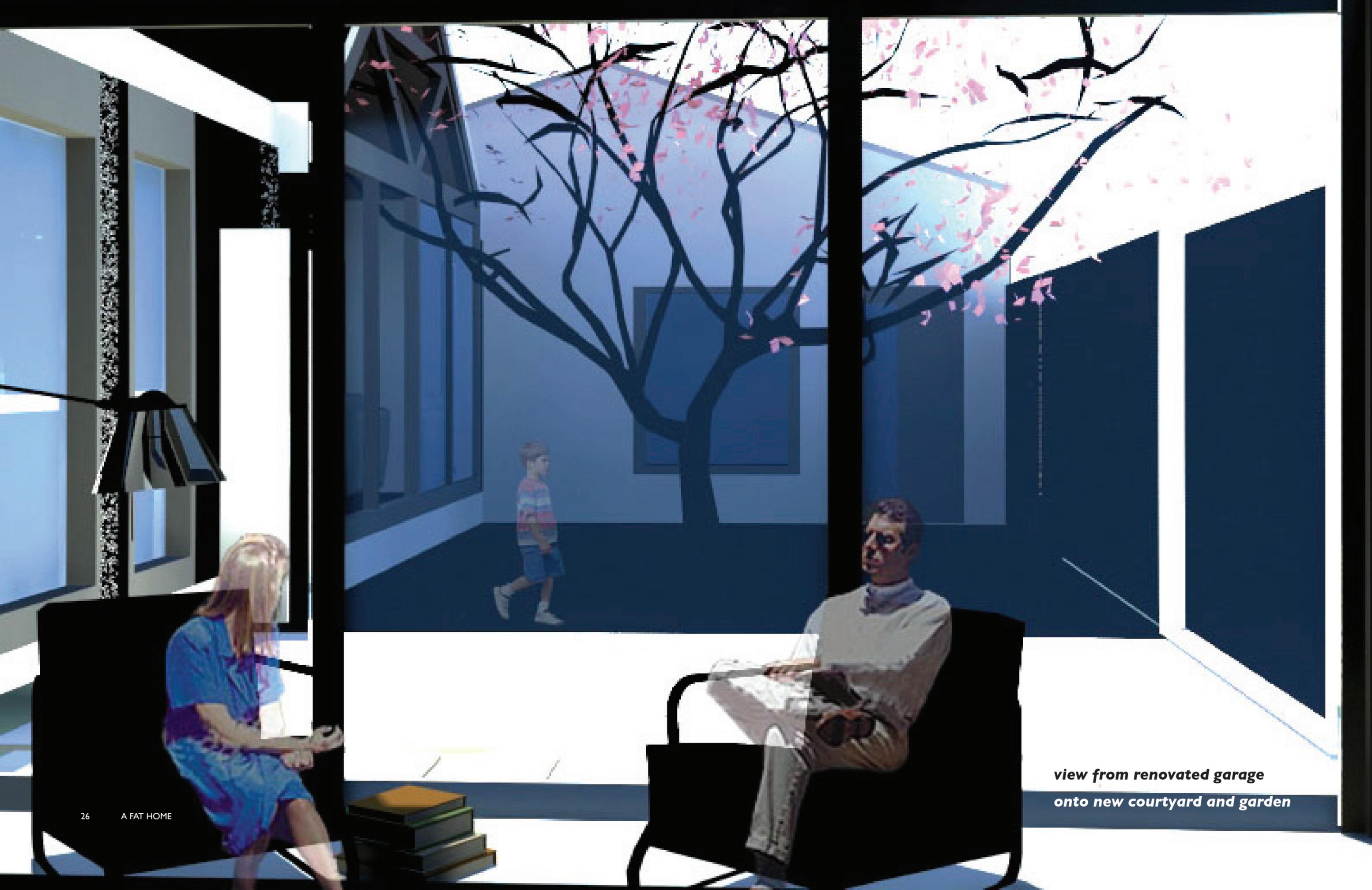
*south view of site from street*



***view of new rental workshop, garage and entry to the existing home***



***view of upon entry of existing home looking at new expanded living space***



*view from renovated garage  
onto new courtyard and garden*



*view of outdoor patio and water feature as seen from next door neighbor*

