

S U S 2 0 1 9 GREEN RESIDENTIAL REMODELING + RENOVATION  
INSTRUCTOR: DONALD GROSE - SPRING 2015

F I N A L P R O J E C T / L O R I H A N C O C K



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# INTRODUCTION

THE PROJECT I AM INVESTIGATING IS A REMODEL-  
IN-PROGRESS OF A FAMILY FRIEND. THIS IS THE SAME  
STRUCTURE I USED IN THE ENERGY CONSUMPTION  
ASSIGNMENT ON WEEK 1. THE HOME WAS DESIGNED  
IN 1979 BY SAN FRANCISCO ARCHITECT, JIM  
JENNINGS. CONTEMPORARY IN STYLE, THE THREE  
STORY HOME HOSTS THREE BEDROOMS AND TWO FULL  
WITH ONE PARTIAL BATHROOMS. TOTAL SQUARE  
FOOTAGE, DISREGARDING SQUARE FOOTAGE FOR THE  
2-CAR GARAGE, COMES UP TO 1,640 SQUARE FEET. THE  
EXTERIOR FAÇADE IS STUCCO, WITH VARYING LEVELS  
OF WOODEN PATIOS, ALONG THE SIDE AND BACK  
ENTRANCES. HEATING IS FORCED AIR WITH ONE ZONE,  
GAS, AND THERE IS NO COOLING SYSTEM. THERE IS  
ONE WOOD-BURNING FIREPLACE IN THE LIVING ROOM  
AS WELL AS 220 VOLT WASHER AND DRYER.

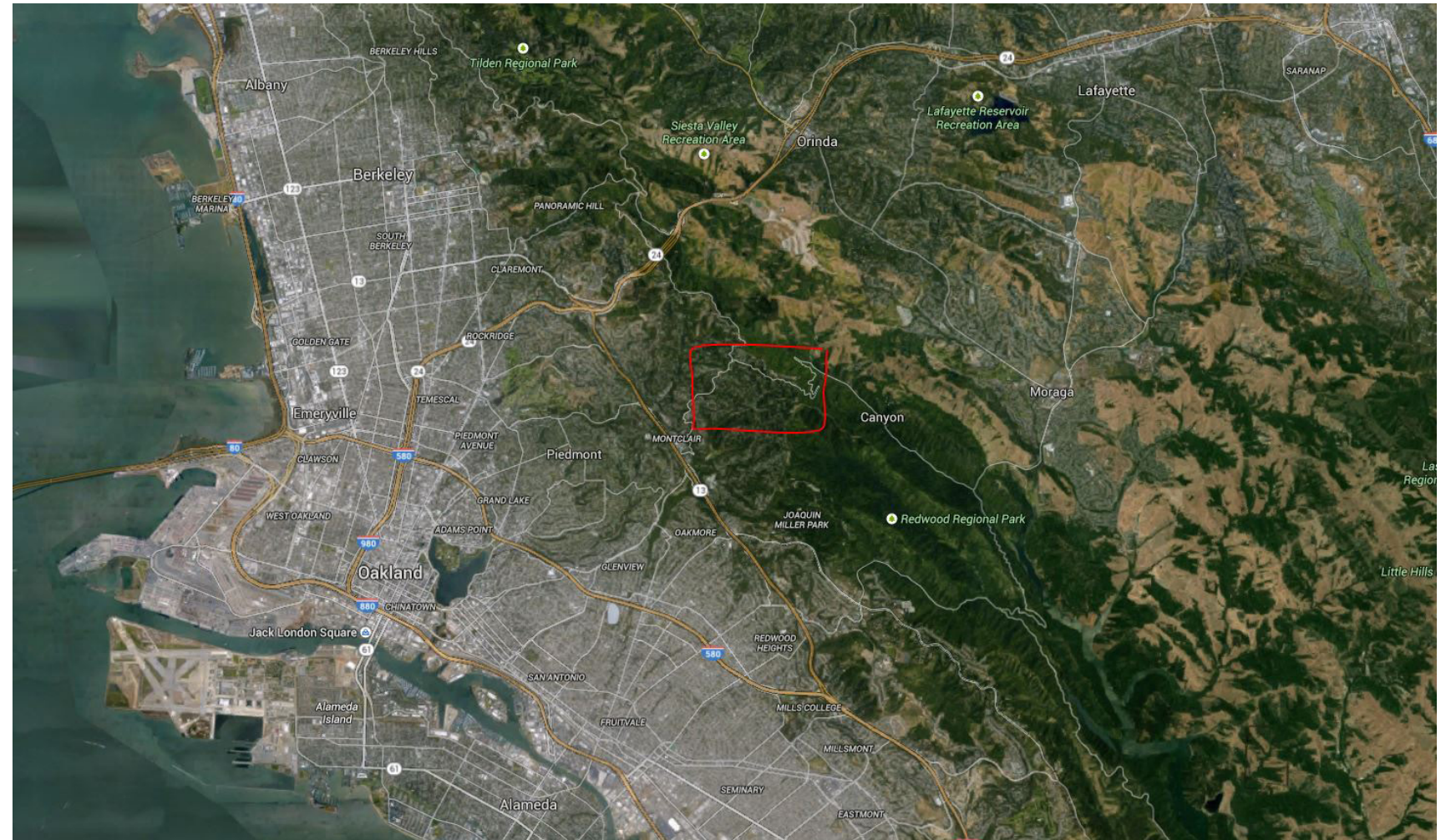
THE CLIENT PURCHASED THE HOME IN APRIL  
21ST, 2014 AND HAS DONE A SERIES OF EXTENDED  
RENOVATIONS CONTINUING THROUGH THEIR MOVE  
IN JUNE 16TH, 2014, AND FOLLOWING EVEN UNTIL  
NOW. IN THIS PROJECT I WILL CATALOG SOME OF THE

KEY SUSTAINABLE AND HOLISTIC DESIGN RELATED  
RENOVATIONS THEY HAVE COMPLETED ON AS WELL AS  
OFFER SUGGESTIONS I HAVE COMPILED FROM CONTENT  
LEARNED IN THIS COURSE.

# CLIMATE ANALYSIS

## OVERVIEW

THE HOME IS LOCATED ALONG THE FOOT HILLS OF OAKLAND, CALIFORNIA, WITH A BASIC LATITUDE OF 37.75 NORTH AND LONGITUDE OF 122.2 WEST. HEATING DEGREE DAYS FROM A BASE OF 65F IS 2909 AND COOLING DEGREE DAYS FROM A BASE OF 80F IS 128. DESIGN DAY DATA FOR 99% - WINTER IS 34F, AND 97.5% - WINTER IS 35F, WITH A RECORD LOW OF 14F. DESIGN DAY DATA FOR 1% - SUMMER IS 85F, AND 2.5% - SUMMER IS 80F, WITH A RECORD HIGH OF 114F. WINTERS ARE MODERATELY COLD AND SUMMERS ARE WARM AND DRY. RELATIVE HUMIDITY IS FAIRLY CONSISTENT, AROUND 60-80%, WITH A HIGHER HUMIDITY RATING IN THE MORNINGS, YEAR ROUND. WIND SPEED REACHES AN AVERAGE HIGH DURING THE MONTHS OF MAY AND JUNE OF 10 MPH AND A LOW OF 6 MPH DURING THE WINTER MONTHS.<sup>1.01</sup>



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1.01 CALIFORNIA CLIMATE ANALYSIS - [HTTP://WWW.ENERGY.CA.GOV/MAPS/RENEWABLE/BUILDING\\_CLIMATE\\_ZONES.HTML](http://www.energy.ca.gov/maps/renewable/building_climate_zones.html)

# CLIMATE DATA

## LOCATION AND CLIMATE DETAILS:

CALIFORNIA CLIMATE ZONE 3

REFERENCE CITY: OAKLAND

LATITUDE: 37.75 N

LONGITUDE: 122.2 W

ELEVATION: 10 FT.

### BASIC CLIMATE CONDITIONS:

SUMMER TEMPERATURE RANGE: 29F

RECORD HIGH TEMPERATURE: 114F

RECORD LOW TEMPERATURE: 14F

### DESIGN DAY DATA:

WINTER 99% : 34F

WINTER 97.5% : 35F

SUMMER 1% : 85F

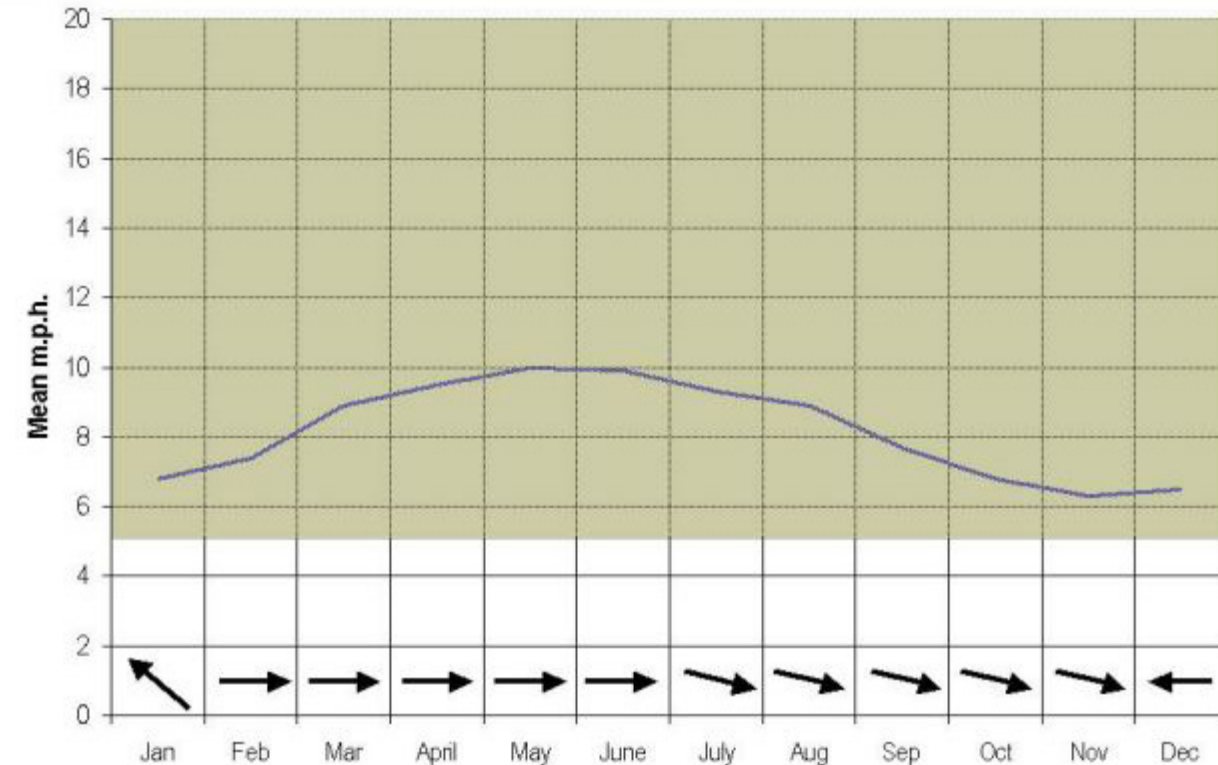
SUMMER 2.5 % : 80F

### DEGREE DAYS:

HEATING DEGREE DAYS (BASE 65F): 2909

COOLING DEGREE DAYS (BASE 80F): 128

## Wind Speed



Prevailing Wind Direction  
Summer: WNW  
Winter: E / W

Natural Ventilation is most effective when wind speed is 5 mph or greater.

Zone 3: Oakland  
4 of 4

“THE CLIMATE OF ZONE 3 VARIES GREATLY WITH ELEVATION AND THE AMOUNT OF COASTAL INFLUENCE. AREAS WITH MORE COASTAL INFLUENCE EXPERIENCE MODERATE TEMPERATURES YEAR ROUND WITH PRECIPITATION IN THE WINTER AND FOG LIKELY FROM JUNE THROUGH MID-AUGUST. INLAND FROM THE BEACHES AND SEA CLIFFS, LOCAL GEOGRAPHY MAY REDUCE THE FOG COVER, LESSEN THE WINDS, AND BOOST SUMMER HEAT. WINTERS ARE MODERATELY COLD WITH MOST OF THE ANNUAL RAIN FALLING BETWEEN OCTOBER AND MARCH. WINTER SUNSHINE NEVERTHELESS IS PLENTIFUL. SUMMERS ARE WARM AND DRY, BUT THE NIGHTS ARE COOL. RAIN IS RARE DURING THE SUMMER MONTHS. A NEED FOR HEATING IS THE DOMINANT DESIGN CONCERN, BUT THE CLIMATE IS MILD ENOUGH THAT ENERGY CONSUMPTION IS RELATIVELY LOW.”

- ZONE 3: OAKLAND PAGE 1 OF 4,  
CALIFORNIA CLIMATE ANALYSIS

#### CLIMATE DESIGN PRIORITIES

##### WINTER:

INSULATE  
REDUCE INFILTRATION  
PASSIVE SOLAR

##### SUMMER:

SHADE  
ALLOW NATURAL VENTILATION

#### TITLE 24 REQUIREMENTS

##### PACKAGE:

##### CEILING INSULATION

C: R38

D: R30

##### WOOD FRAME WALLS

C: R25

D: R13

##### GLAZING U-VALUE

C: 0.42

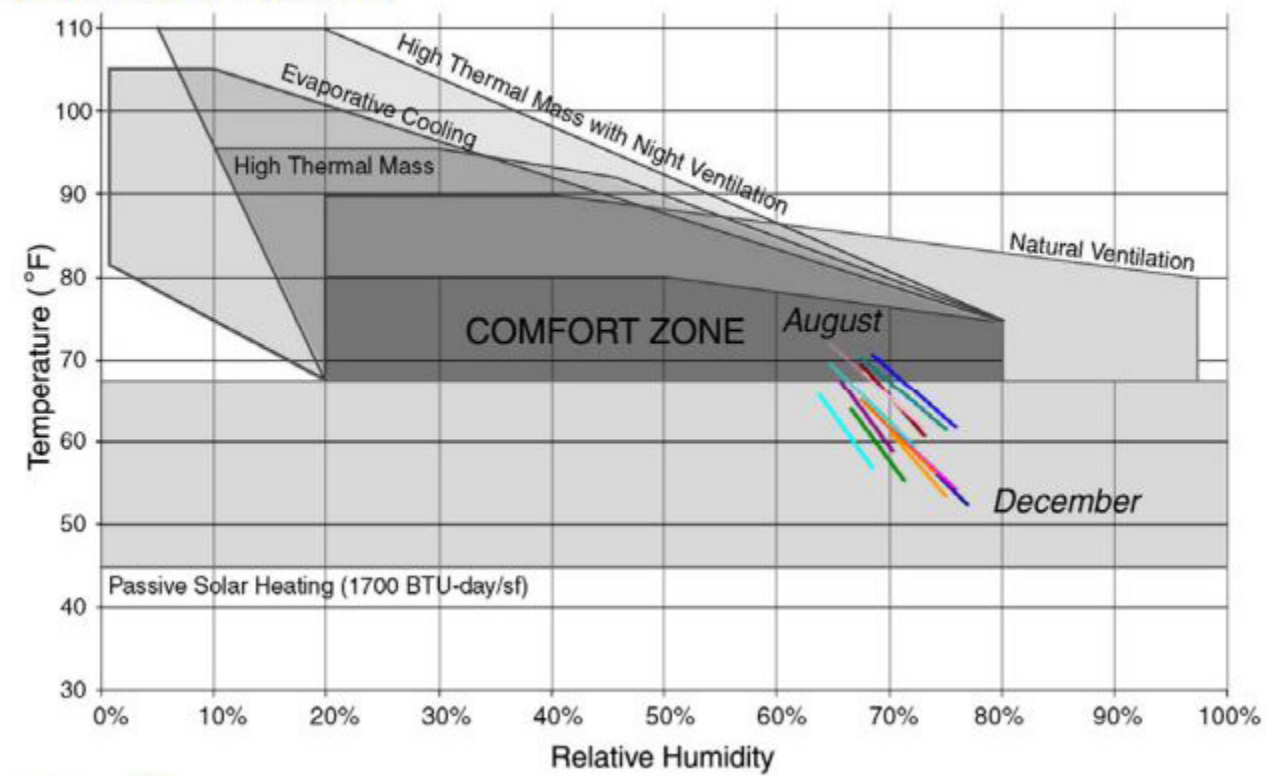
D: 0.67

##### MAXIMUM TOTAL AREA

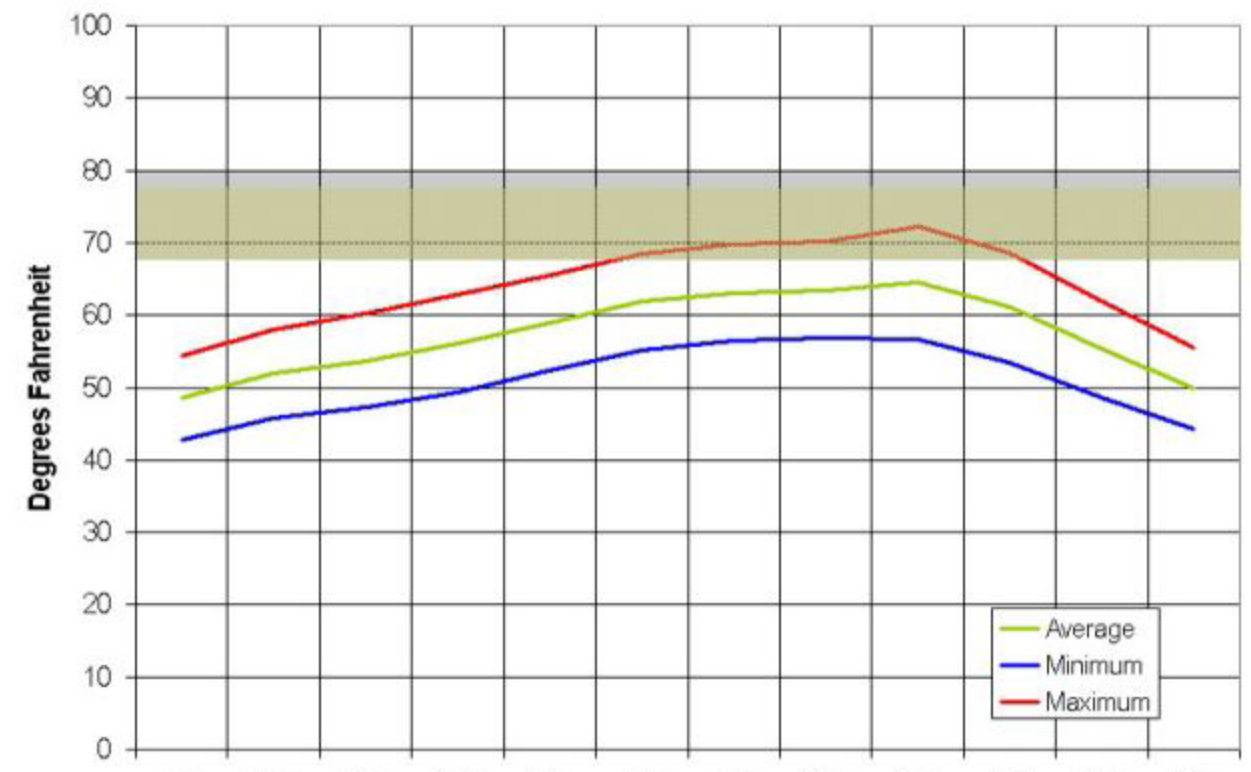
C: 14%

D: 20%

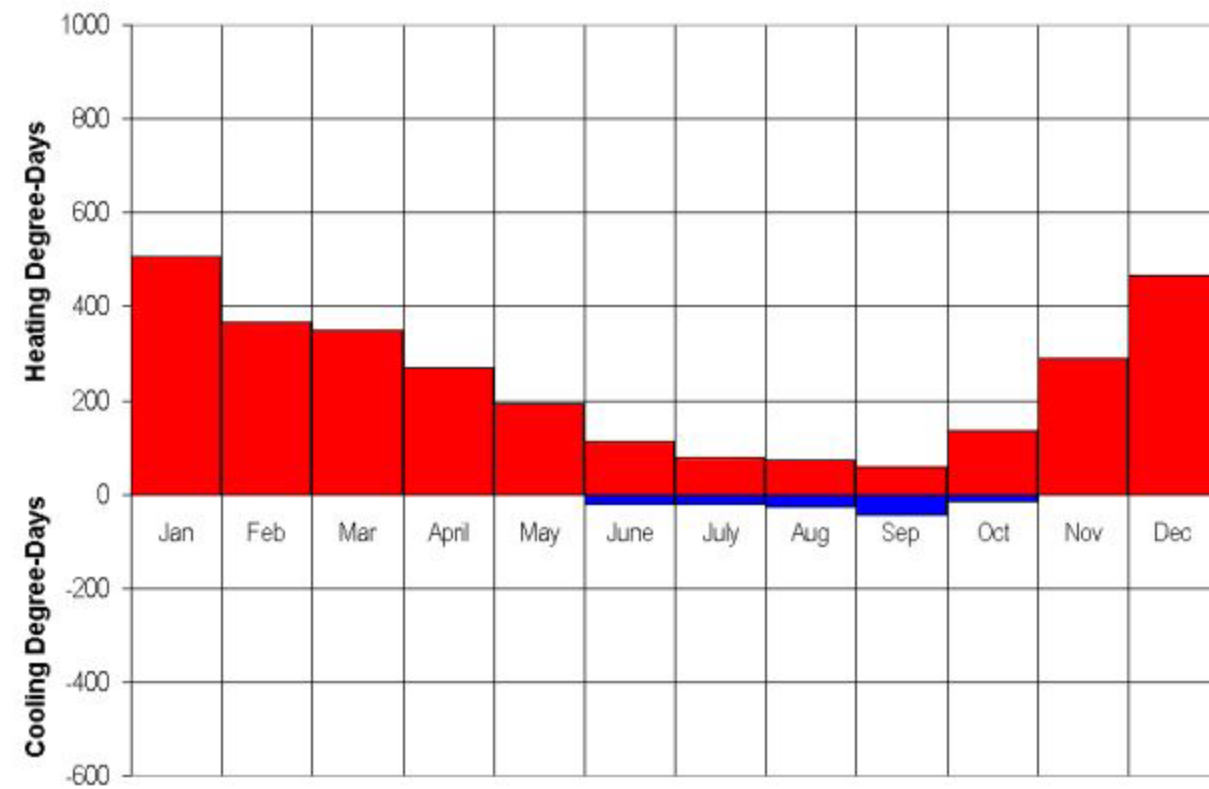
**Bioclimatic Chart (Oakland)**



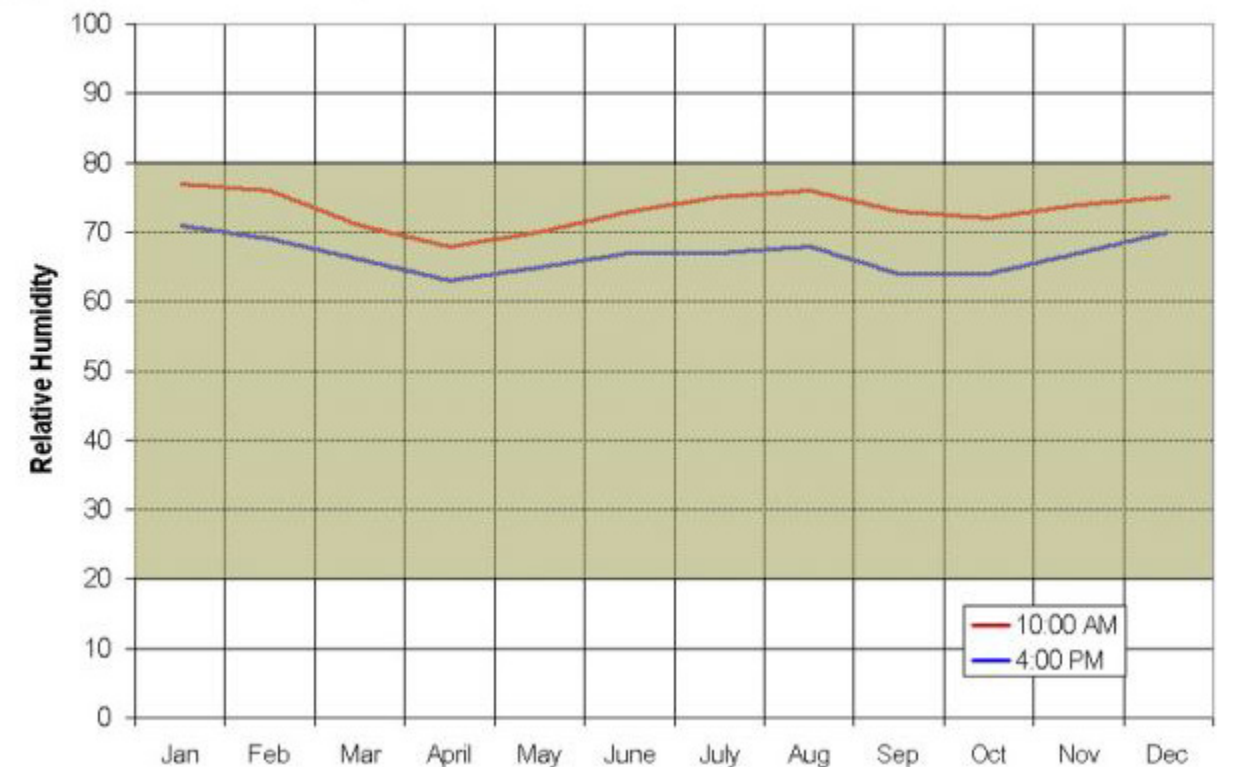
**Temperature**  
(Typical Comfort Zone: 68-80°F)



**Degree Day**  
(Base 65°)



**Relative Humidity**  
(Typical Comfort Zone: 20-80%)





# ENERGY CONSUMPTION DATA

## ENERGY COMPUTATIONS:

THE SQUARE FOOTAGE (MINUS THE GARAGE) EVENS OUT TO BE 1,640 SF

ELECTRICITY CONVERSIONS (1 KWH = 3,413 BTU'S = 2216 BTUs/LB OF CO-2)

AVERAGE OF 380 KWH A MONTH, 4,560 KWH A YEAR

4,560 TIMES 3,413 = 15,536,280 BTU'S A YEAR

15,536,280 DIVIDED BY 2216 BTUs/LB OF CO-2 = 7,023.14 LB OF CO-2

15,536,280 BTU'S A YEAR DIVIDED BY 1,640 SF = 9,475.34 EUR

9,475.34 EUR DIVIDED BY (2909 HDD + 128 CDD (3,037 TOTAL))

DEGREE DAYS OF OAKLAND, CA = 3.12 BTU'S/SF/YR/DEGREE DAY

GAS CONVERSIONS (1 THERM = 100,000 BTU'S = 8,403 BTU'S/LB OF CO-2)

AVERAGE OF 28 THERM A MONTH, 336 THERM A YEAR

336 TIMES 100,000 = 33,600,000 BTU'S A YEAR

33,600,000 DIVIDED BY 8,403 BTU'S/LB OF CO-2 = 3,998.57 LB OF CO-2

33,600,000 BTU'S A YEAR DIVIDED BY 1,640 SF = 20,487.80 EUR

20,487.80 EUR DIVIDED BY 2909 HDD + 128 CDD (3,037 TOTAL))

DEGREE DAYS OF OAKLAND, CA = 6.75 BTU'S/SF/YR/DEGREE DAY

# INDOOR AIR QUALITY

## OVERVIEW

“LIVING BUILDING CHALLENGE, A VISIONARY PATH TO A RESTORATIVE FUTURE” SETS A LIST OF CRITERIA TO PROMOTE GOOD INDOOR AIR QUALITY IN RENOVATIONS AND OTHER PROJECTS.<sup>1.02</sup> “LIVING BUILDING CHALLENGE, A VISIONARY PATH TO A RESTORATIVE FUTURE” SETS A LIST OF CRITERIA TO PROMOTE GOOD INDOOR AIR QUALITY IN RENOVATIONS AND OTHER PROJECTS. PARTICULARLY IN TERMS OF PROVIDING AN EXTERNAL AND INTERNAL DIRT TRACK-IN SYSTEMS; REQUIRED VENTILATION AND EXHAUST TO OUTSIDE AIR IN ALL KITCHENS, BATHROOMS, COPY ROOMS, JANITORIAL CLOSETS AND CHEMICAL STORAGE AREAS; COMPLYING WITH ASHRAE 62 AND MONITORING CARBON DIOXIDE, TEMPERATURE, AND HUMIDITY LEVELS; AS WELL AS PROHIBITING SMOKING.

IN REFERENCING VENTILATION AND EXHAUST EFFORTS IN ALL VOLATILE ORGANIC COMPOUNDS

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1.02 “LIVING BUILDING CHALLENGE, A VISIONARY PATH TO A RESTORATIVE FUTURE”

LORI HANCOCK - SUS2019 GREEN RESIDENTIAL REMODELING + RENOVATION - SPRING 2015

(VOCs) HIGH-RISK AREAS (IE: JANITORIAL CLOSETS AND CHEMICAL STORAGE AREAS, ETC.), I FOUND UNITED STATES ENVIRONMENTAL PROTECTION AGENCY’S WEBSITE ON INDOOR AIR QUALITY PARTICULARLY INSIGHTFUL.<sup>1.03</sup> THEY HAVE PROVIDED A SERIES OF STEPS TO REDUCE EXPOSURE TO VOCs THAT ARE PERTINENT TO THE HEALTH AND WELL-BEING OF THE INDIVIDUAL, SUCH AS, KEEPING EXPOSURE TO EMISSIONS FROM PRODUCTS CONTAINING METHYLENE CHLORIDE TO A MINIMUM, IE: PAINT STRIPPERS, AEROSOL SPRAY PAINTS, ETC. THESE ARE SIMPLE AND IMPORTANT STEPS WE CAN INFORM OUR CLIENTS ON AND ARE CRITICAL TO SUSTAINABLE DESIGN AND HOLISTIC THINKING AND ARE CERTAINLY ESSENTIAL TO THE HOME RENOVATION IN OAKLAND, CALIFORNIA WE HAVE BEEN ADDRESSING HERE.

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1.03 UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, AN INTRODUCTION TO INDOOR AIR QUALITY (IAQ), [HTTP://WWW.EPA.GOV/IAQ/VOC.HTML](http://www.epa.gov/iaq/voc.html)

# SUSTAINABLE SYSTEMS

## OVERVIEW

THERE ARE THREE MAJOR SYSTEMS I'D LIKE TO ADDRESS IN MY PROJECT. FIRST, INCREASING NATURAL VENTILATION AS THE PRIMARY (AND SOLE) COOLING METHOD OF THE HOME. THIS PLAYS INTO THE SECOND, WHICH IS ADDRESSING THE LARGE PANED GLASS WINDOWS ON THE SOUTHERN-WESTERN SIDE TO 1) BE REPLACED WITH A MORE HEAT EFFICIENT AND OPERABLE SYSTEM AS WELL AS 2) ADDRESSING THE NEED TO HAVING AN EXTERIOR SHADING SYSTEM. AND THIRD, ISOLATING THE HEATING SYSTEM INTO ZONES, SPECIFICALLY BETWEEN EACH LEVEL OF THE HOME.

IMAGE ON RIGHT:

VIEW TO THE SOUTH BAY FROM THE LARGE SOUTH-WEST FACING WINDOWS IN THE LIVING ROOM



# 1. VENTILATION

I'D LIKE TO LOOK INTO USING A BROAN "BALANCED VENTILATION" SYSTEM WHICH EXCHANGES EQUAL VOLUME OF INDOOR AND OUTDOOR AIR, AVOIDING PRESSURIZING OR DEPRESSURIZING THE HOME, SPECIFICALLY DURING THE WINTER MONTHS WHERE NATURAL VENTILATION WILL BE TOO COOL. BROAN'S SYSTEMS REMOVE POLLUTED INDOOR AIR WITH A HEPA FILTRATION SYSTEM WHILE BRINGING INTO THE HOME FRESH OUTDOOR AIR. THEIR ENERGY-RECOVERY VENTILATION (ERV) SYSTEM CONTROL DIRECTION OF VENTILATION TO MINIMIZE ENERGY LOSS BY TRANSFERRING HEAT AND HUMIDITY FROM THE WARM INSIDE THAT IS EXHAUSTED TO THE FRESH OUTDOOR AIR IN THE WINTER, AS WELL AS, COOLING INSIDE AIR IN THE SUMMER. THE ERV SYSTEM BRINGS OUTDOOR AIR INTO THE HOME WHILE EXCHANGING THE EXHAUSTED STALE AIR FROM INSIDE THE HOME, AND ALLOWS MOISTURE FROM THE INDOOR AIR IN THE WINTER/OUTDOOR AIR IN THE SUMMER TO TRANSFER.<sup>1.04</sup>

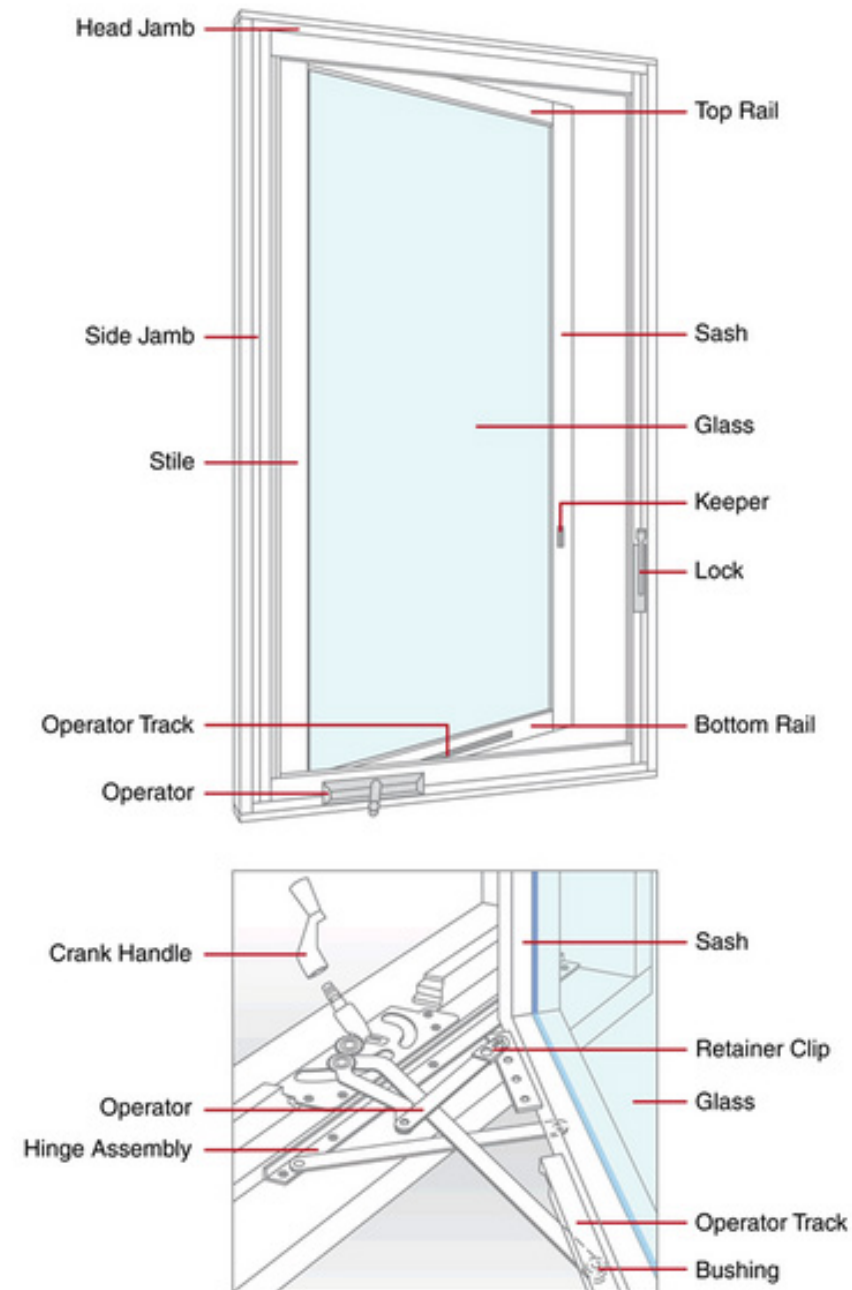
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1.04 [HTTP://WWW.BROAN.COM/PRODUCTS/PRODUCT-LINE/  
BALANCED-VENTILATION-SYSTEMS](http://www.broan.com/products/product-line/balanced-ventilation-systems)



SOUTH-WEST FACING LIVING ROOM WINDOWS

HAVING OPERABLE WINDOWS IS ESSENTIAL TO EMBRACING NATURAL VENTILATION. CURRENTLY THE HOME HAS LARGE SINGLE PANE WINDOWS IN THE LIVING ROOM. (SEE IMAGE ON THE RIGHT.) THERE IS A SMALL PORTION OF THE ON THE BOTTOM OF THE WINDOW FRAME THAT IS OPERABLE. I WOULD LIKE TO PROPOSE A NEW CASEMENT WINDOW SYSTEM THAT WOULD ALLOW THE ENTIRE WINDOWS TO BE OPENED TO ALLOW GREATER NATURAL VENTILATION INTO THE HOME, PARTICULARLY ALLOWING THE RAISED WARM AIR TO FILTER OUT MORE EASILY WITH THE HIGHER OPENINGS IN THE WINDOWS. (SEE DIAGRAM ON THE RIGHT.)<sup>1.05</sup> AS WELL AS A DOUBLE PAN, LOW E GLASS SYSTEM THAT I WILL ADDRESS IN THE FOLLOWING SECTION.



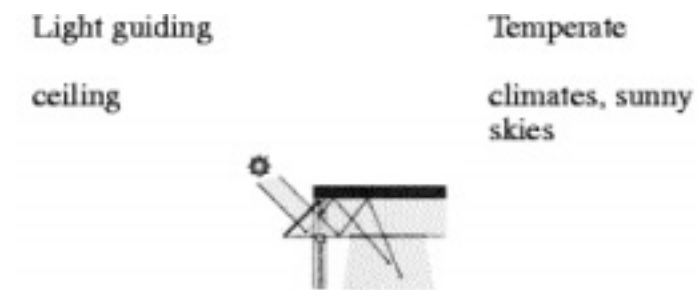
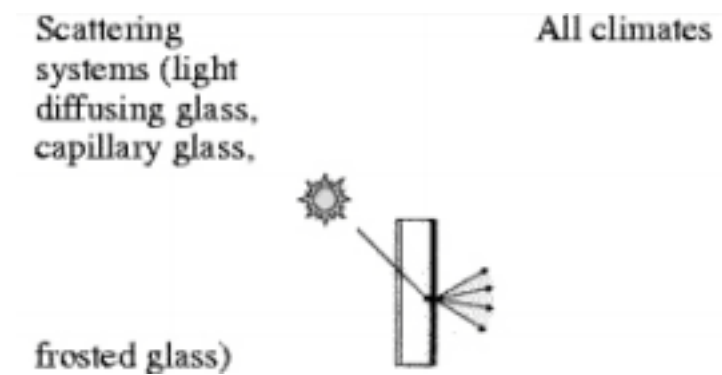
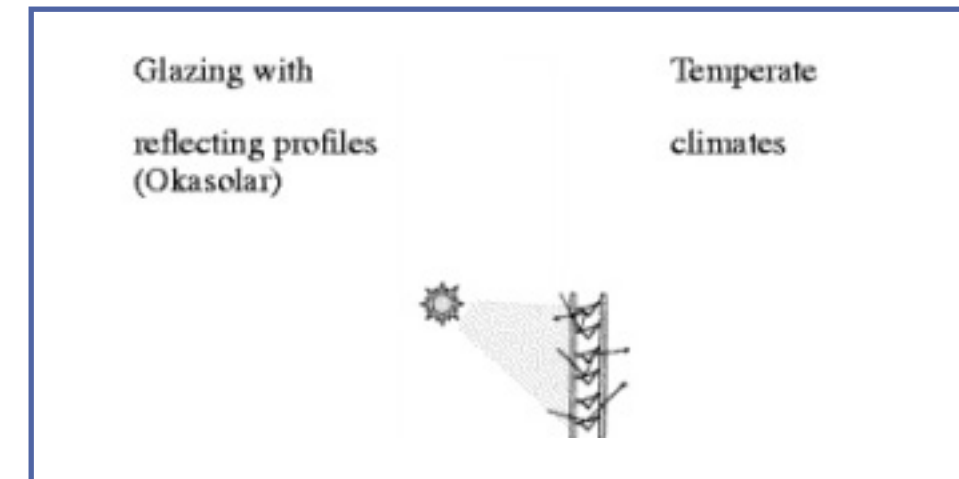
1.05 [HTTP://WWW.THEWINDOWMEDICSNE.COM/CASEMENT-WINDOW-DIAGRAM.HTM](http://www.thewindowmedicsne.com/casement-window-diagram.htm)

## 2. SHADING

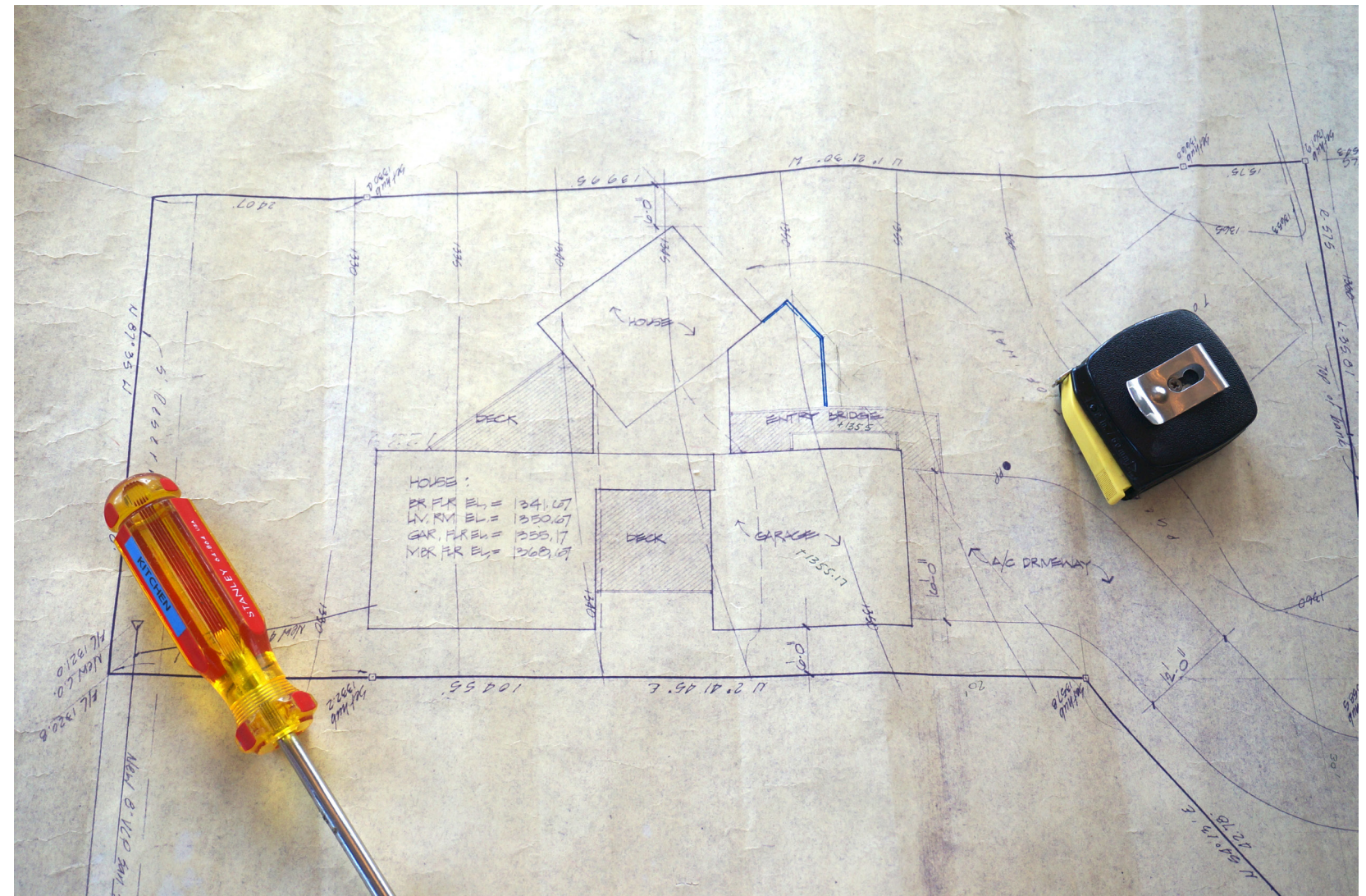
THE CASEMENT WINDOW SYSTEM I'M LIKE TO IMPLEMENT ARE PELLA'S ENERGY EFFICIENT "ADVANCED LOW-E INSULATING GLASS WITH ARGON" FEATURING TWO PANES OF GLASS, BLOCKING 84% OF ULTRAVIOLET, WINDOWS. THESE INSULATE WELL FROM THE COLD IN THE WINTER AS WELL AS PREVENTING OVERHEATING IN THE SUMMER<sup>1.06</sup>.

THE BUILDING ORIENTATION IS PRECISELY ALONG THE NORTH AND SOUTH AXIS. THE ENTRANCE AND GARAGE ARE DIRECTLY NORTH, AND THE OPPOSING WINDOWS ARE ALONG THE SOUTHERN FAÇADE. SOUTHERN LIGHTING IS THE MOST OPTIMAL YEAR ROUND, WITH NORTHERN LIGHTING BEING SECOND BEST. LIGHTING FROM THE EAST AND WEST ARE BEST TO AVOID BECAUSE OF THE LOW SUN ANGLES AND POTENTIAL FOR SUMMER OVERHEATING. THE MAJORITY OF THE "MAIN" WINDOWS ARE LOCATED ON THE SOUTHERN FAÇADE OF THE HOME, HOWEVER, THE LIVING ROOM WHICH IS THE RECTANGULAR SHAPE "OFFSET" FROM THE REST OF THE ORTHOGRAPHIC

1.06 [HTTP://WWW.PELLA.COM/FEATURES-AND-OPTIONS/ENERGY-EFFICIENCY/GLASS-OPTIONS.ASPX](http://www.pella.com/features-and-options/energy-efficiency/glass-options.aspx)



“OFFSET” FROM THE REST OF THE ORTHOGRAPHIC GEOMETRY OF THE BUILDING (SEE FLOOR PLAN ON THE RIGHT.) THIS GIVES THE LARGEST, AND TALLEST WINDOW FRAMES A SOUTH-WEST, NON-OPTIMAL, ORIENTATION, ESPECIALLY CONSIDERING THERE IS NO MECHANICAL COOLING SYSTEM IN THE HOME, SO SUMMER OVERHEATING IS A CONCERN. WHILE INTRODUCING PELLA’S ENERGY EFFICIENT ADVANCED LOW-E INSULATING GLASS WITH ARGON DOUBLE PANE CASEMENT WINDOWS, I WOULD ALSO SUGGEST THE USE OF OKASOLAR’S REFLECTING PROFILES SUN-SHADING SYSTEM. THIS SYSTEM REFLECTS DIRECT LIGHT TO HELP PREVENT SUMMER OVERHEATING WHILE STILL ALLOWING REFRACTED LIGHT AS THE PRIMARY LIGHTING SOURCE.<sup>1.07</sup>

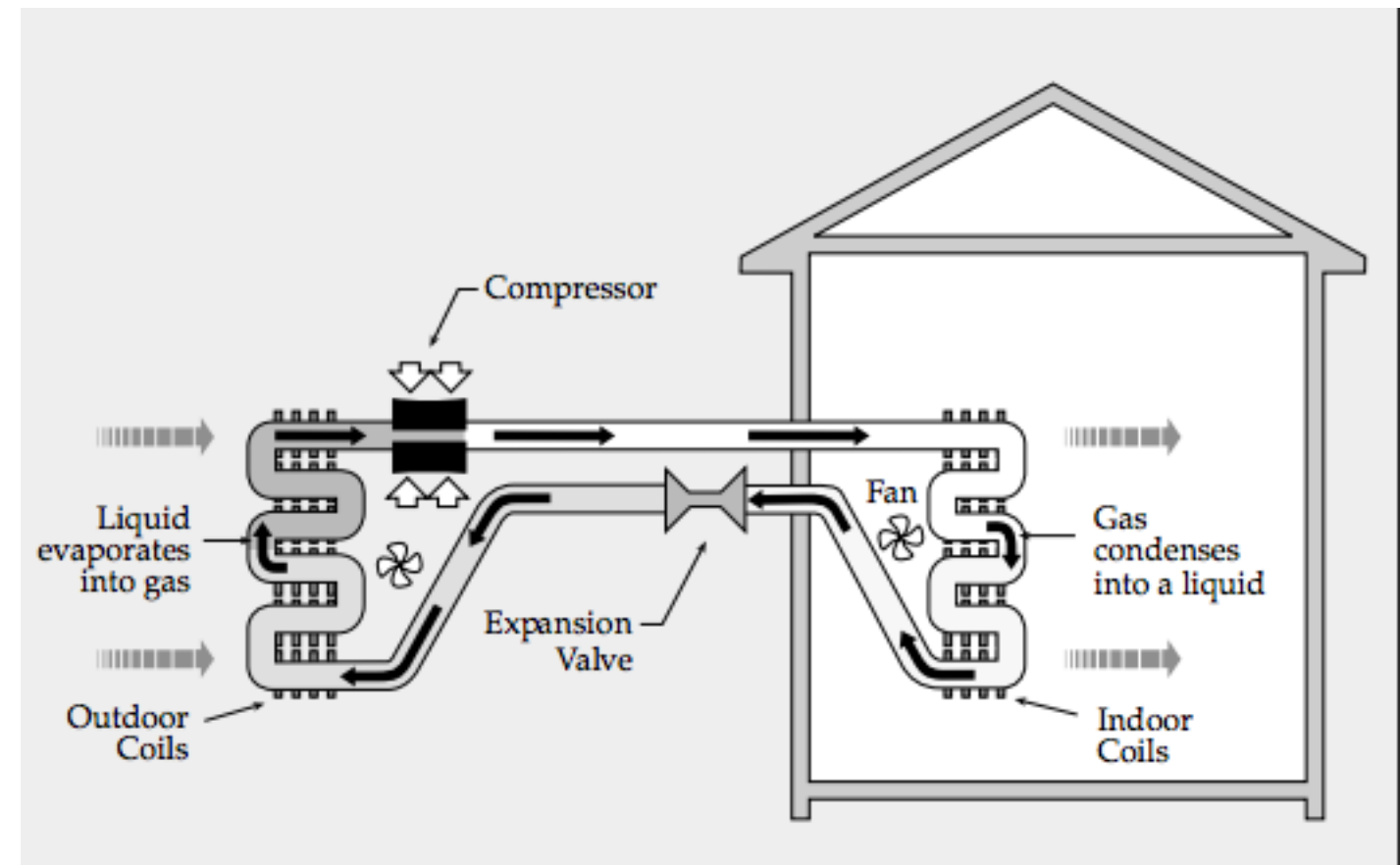


1.07 [HTTP://WWW.OKALUX.DE/EN/SOLUTIONS/BRANDS/OKASOLAR/OKASOLAR-F/](http://www.okalux.de/en/solutions/brands/okasolar/okasolar-f/)

### 3. ZONING & HEATING

THE HOME, BUILT IN 1979, USES A GAS FORCED AIR HEATING SYSTEM WITH ONE ZONE. BY IMPLEMENTING APRILAIRE'S MODEL 6504 TEMPERATURE CONTROL SYSTEM WHICH USES "POWER DAMPERS" THAT OPEN AND CLOSE TO ALLOW OR RESTRICT HEATED AIR FLOW THROUGHOUT THE HOME, THE AIR SYSTEM BEGINS TO BE MUCH MORE SUSTAINABLE IN THAT THE OCCUPANTS HARDLY INHABIT EVERY ROOM EVERY DAY, SO IT WILL ALLOW THEM TO CONTROL WHERE THE HEAT IS DIRECTED TO.<sup>1.08</sup> THE HOME IS PREDOMINATELY VERTICAL IN DESIGN AND IS HOUSED BY A COUPLE IN THEIR LATE 50'S WITH THEIR CHILDREN ALREADY GROWN AND OUT OF THE HOME. NINETY PERCENT OF THE YEAR THE HOME IS SOLELY OCCUPIED BY THE COUPLE, WHO FREQUENT THE LIVING AND KITCHEN SPACE ON THE MAIN FLOOR AS WELL AS THEIR BEDROOM ON THE TOP LEVEL. THE TWO GUEST BEDROOMS ARE LOCATED IN THE BASEMENT AND ARE REALLY ONLY OCCUPIED DURING HOLIDAYS. DURING THE WINTER MONTHS WHEN

1.08 [HTTP://WWW.PELLA.COM/FEATURES-AND-OPTIONS/ENERGY-EFFICIENCY/GLASS-OPTIONS.ASPX](http://www.pella.com/features-and-options/energy-efficiency/glass-options.aspx)



A SPLIT-SYSTEM HEAT PUMP HEATING CYCLE <sup>1.09</sup>

1.09 ENERGY EFFICIENCY AND RENEWABLE ENERGY - AIR SOURCE HEAT PUMPS - THE U.S. DEPARTMENT OF ENERGY (DOE) BY THE NATIONAL RENEWABLE ENERGY LABORATORY (NREL), [HTTP://WWW.NREL.GOV/DOCS/FY01OSTI/28037.PDF](http://www.nrel.gov/docs/fy01osti/28037.pdf)



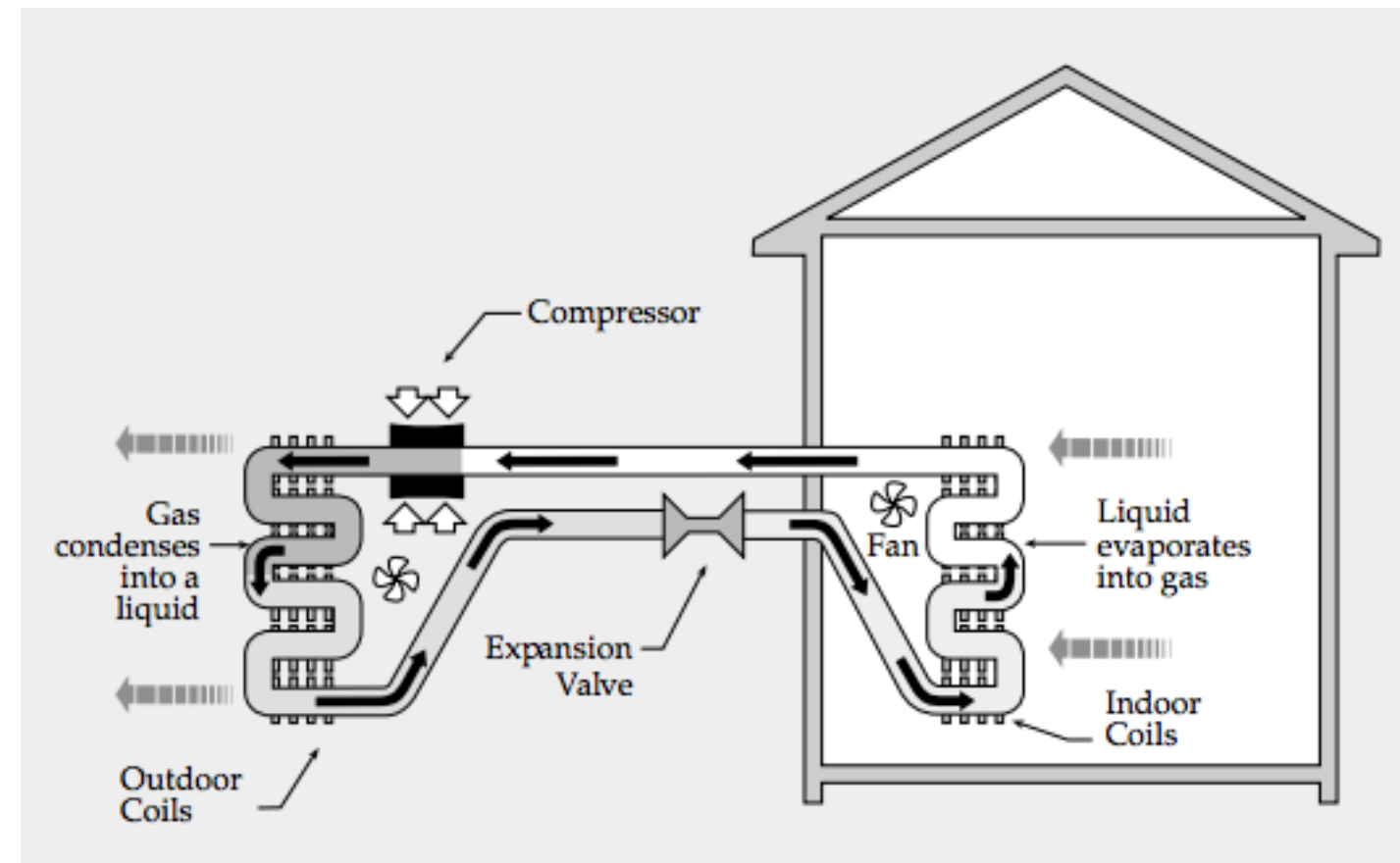
GUESTS ARE NOT STAYING WITH THE COUPLE, THERE IS NO REASON THE BASEMENT NEEDS TO BE HEATED AS THE OTHER FLOORS ARE. THIS IS THE IMPORTANCE OF AN AIR ZONING SYSTEM - BEST UTILIZING SPACES IN THE HOME BY ADDRESSING HOW EACH SPACE FUNCTIONS.

ANOTHER ASPECT TO ADDRESS IS HOW BEST TO GET THE HOME OFF OF AN NATURAL GAS SYSTEM, WHICH IS BOTH ESSENTIAL FOR THE SAFETY OF THE HOME AND FOR THE CARE OF THE ENVIRONMENT. BECAUSE OF THE MILD WINTERS OF THE SOUTH BAY, THE MOST PRACTICAL ECONOMICALLY AND ENVIRONMENTALLY WOULD BY AN ELECTRIC AIR-SOURCE HEAT PUMP.

I WOULD RECOMMEND WORKING WITH THE LOCAL BIGHAM'S ONE HOUR HEATING & AIR CONDITIONING IN OAKLAND, CALIFORNIA TO INSTALL A SYSTEM THAT MEETS THE ENERGY STAR REQUIREMENTS.<sup>1-10</sup>

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1.10 [HTTP://WWW.ONEHOURHEATANDAC.COM/HEAT-PUMPS/](http://www.onehourheatandac.com/heat-pumps/)



A SPLIT-SYSTEM HEAT PUMP COOLING CYCLE <sup>1-11</sup>

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1.11 ENERGY EFFICIENCY AND RENEWABLE ENERGY - AIR

SOURCE HEAT PUMPS - THE U.S. DEPARTMENT OF ENERGY

(DOE) BY THE NATIONAL RENEWABLE ENERGY LABORATORY

(NREL), [HTTP://WWW.NREL.GOV/DOCS/FY01OSTI/28037.PDF](http://www.nrel.gov/docs/fy01osti/28037.pdf)

# DEEP ENERGY RETROFIT

## “SEVEN STEPS TO NET ZERO ENERGY USE”

IN RESEARCHING DEEP ENERGY RETROFIT INFORMATION ON GREEN BUILDING ADVISOR I FOUND “SEVEN STEPS TO NET ZERO ENERGY USE.”<sup>1-12</sup> THESE STEPS WILL BE THE GUIDELINES I WILL EXPOUND ON HERE.

### 1. UPGRADE MECHANICAL SYSTEMS

BUILT IN 1979, THE HOME IS HEATED BY A GAS, FORCED AIR SYSTEM WITH ONE ZONE. THIS WOULD BE A GREAT FIRST-STEP AND MAJOR UPGRADE IN REDUCING ENERGY TO ADDRESS.

### 2. BRING THE BASEMENT AND CRAWLSPACE INSIDE THE HOUSE

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1.12 GREEN BUILDING ADVISOR “SEVEN STEPS TO NET ZERO ENERGY USE.” [HTTP://WWW.GREENBUILDINGADVISOR.COM/GREEN-BASICS/REMODEL-PROJECT-DEEP-ENERGY-RETROFIT](http://www.greenbuildingadvisor.com/green-basics/remodel-project-deep-energy-retrofit)

THERE IS NO “BASEMENT”, BUT THE HOME IS BUILT ON THE APEX OF A CLIFF-FACE SO THE STILT-LIKE CONSTRUCTION DOES GIVE SPACE FOR VARIOUS CRAWLSPACES THAT

### 3. SUPER-INSULATE AND AIR-SEAL THE ROOF

THE HOME HAS A FLAT ROOF, AND COULD ALSO USE SPRAY FOAM INSULATION WHICH COULD ELIMINATE THE NEED FOR ROOF VENTING.

### 4. REPLACE THE WINDOWS

THE TYPES OF WINDOWS I’D LIKE TO INTRODUCE ARE PELLA’S ENERGY EFFICIENT ADVANCED LOW-E INSULATING GLASS WITH ARGON DOUBLE PANE WINDOWS, WHICH I ADDRESSED IN THE MIDTERM ESSAY LAST WEEK.

5. INSULATE THE WALLS

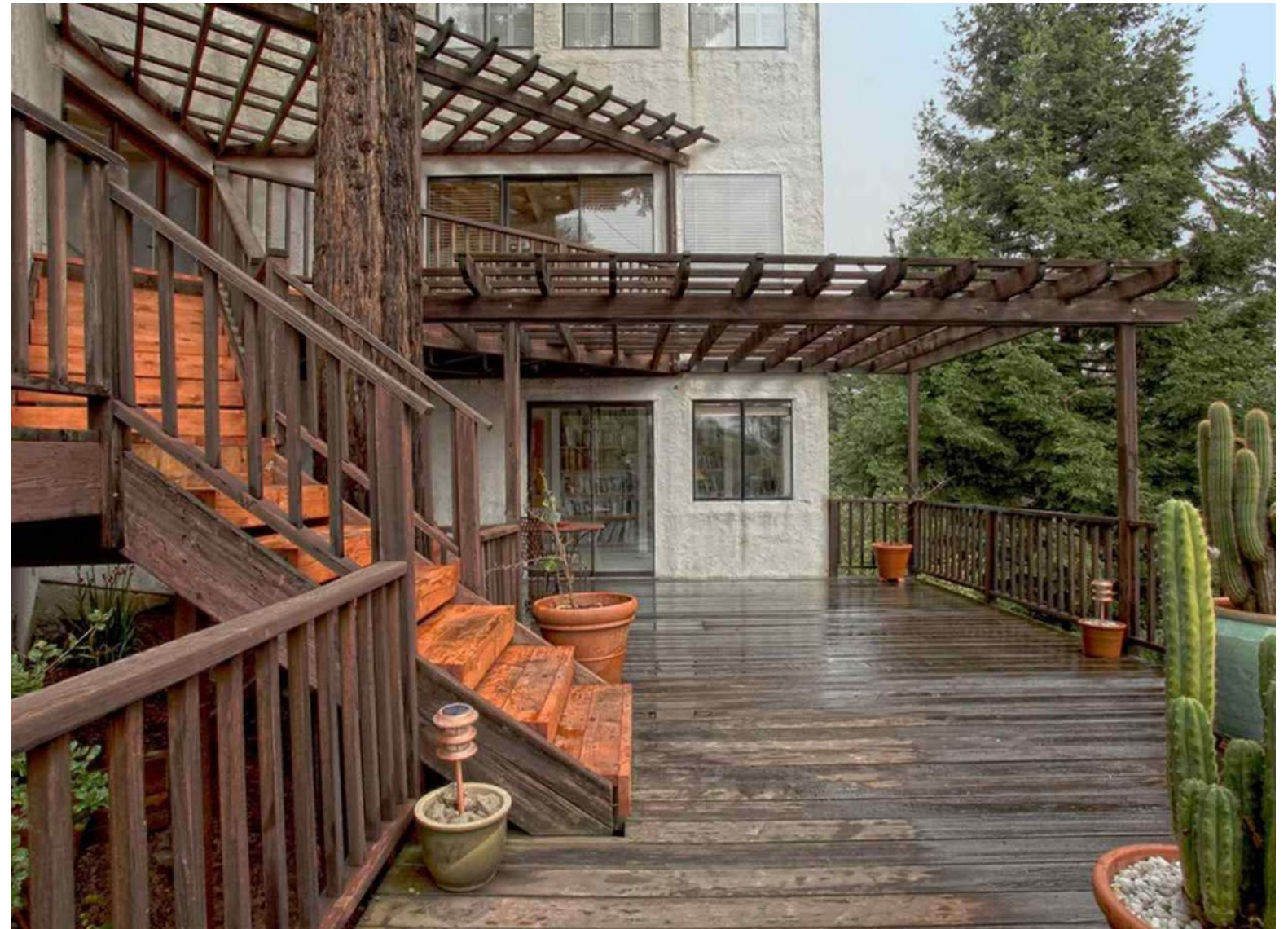
FILLINGS WALL CAVITIES WITH CELLULOSE WOULD BE A NO-BRAINER. IT WOULD ALSO BE USEFULLY TO CHECK ALL VOIDS HAVE BEEN FILLED WITH INFRARED CAMERAS.

6. BUY ENERGY STAR (OR BETTER)

THIS IS ALSO A NO-BRAINER. FIXTURES, APPLIANCES AND LIGHTING WOULD ALL MAXIMIZE ENERGY EFFICIENCY.

7. ADD A RENEWABLE-ENERGY SOURCE

WITH WIND SPEED REACHING AN AVERAGE HIGH DURING THE MONTHS OF MAY AND JUNE OF 10 MPH AND A LOW OF 6 MPH DURING THE WINTER MONTHS, INTRODUCING A WIND POWER HARNESSING SYSTEM COULD BE VERY BENEFICIAL.



BACK DECK ON SOUTH SIDE OF TEH HOME

# CONCLUSION

THE RESIDENTS OF THIS HOME IN OAKLAND, CALIFORNIA ARE IDEAL CANDIDATES FOR EVERY SOLUTION MENTIONED IN THIS PROJECT. THEY ARE VERY MUCH SUSTAINABLY AWARE OF THEIR ROLE AS HOMEOWNERS AND ARE AT A PHASE IN LIFE WHERE THEY HAVE BOTH THE MEANS AND THE AVAILABLE TIME TO REALLY MAKE SERIOUS CHANGES. I AM EXCITED TO BE ABLE TO SHARE THIS PROJECT WHEN I STAY WITH THEM THIS SUMMER AND HOPE TO BE ABLE TO BEGIN MANY DISCUSSIONS ABOUT THE KEY TOPICS ADDRESSED HERE.

BEFORE THIS COURSE, MY UNDERSTANDING OF GREEN REMODELING AS A PRACTICE REVOLVED AROUND THE IMPROVEMENT OF ENERGY EFFICIENCY AND RESOURCE EFFICIENCY OF EXISTING STRUCTURES. AFTER THIS WEEK'S STUDY, I UNDERSTAND THAT YES, THESE ARE IMPORTANT FACTORS, BUT THEY ARE ALSO THIRD AND FOURTH ON THE LIST - SECOND, BEING THE DURABILITY OF CONSTRUCTION METHODS, AND MOST IMPORTANTLY, FIRST, THE IMPROVEMENT OF HEALTHY INDOOR ENVIRONMENTS.



MASTER BEDROOM - THIRDS FLOOR