

PH TEAM



Passive to **POSITIVE**

PASSIVE HOUSE AND LOW IMPACT DESIGN



ZA+D, LLC

MATT FINE, CPHC[®], LEED AP[®]

- *DIRECTOR, ZA+Dpassiv*
- *SENIOR PROJECT MANAGER, ZA+D, LLC*

PASSIVE TO POSITIVE

MICHAEL HINDLE, CPHC[®],

CPHB[®], HERS

- *PRESIDENT, BOARD OF MANAGERS
PASSIVE HOUSE ALLIANCE – UNITED STATES*

HAMEL BUILDERS

TERESA HAMM, CPHC[®],

CPHB[®], HERS

- *PROJECT MANAGER*

THC, AFFORDABLE HOUSING

BLAISE RASTELLO

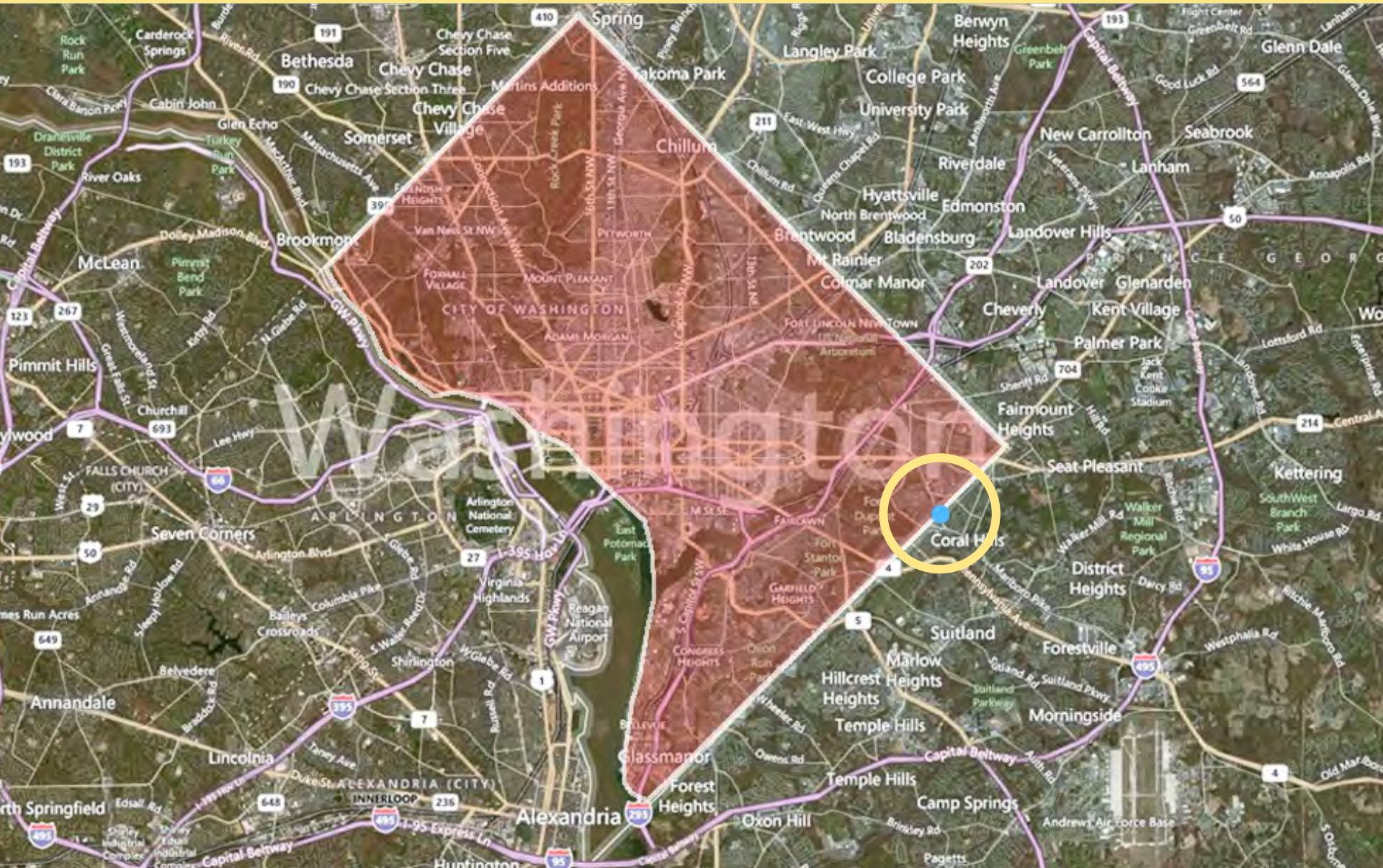
- *DIRECTOR OF AFFORDABLE HOUSING*

WEINBERG COMMONS

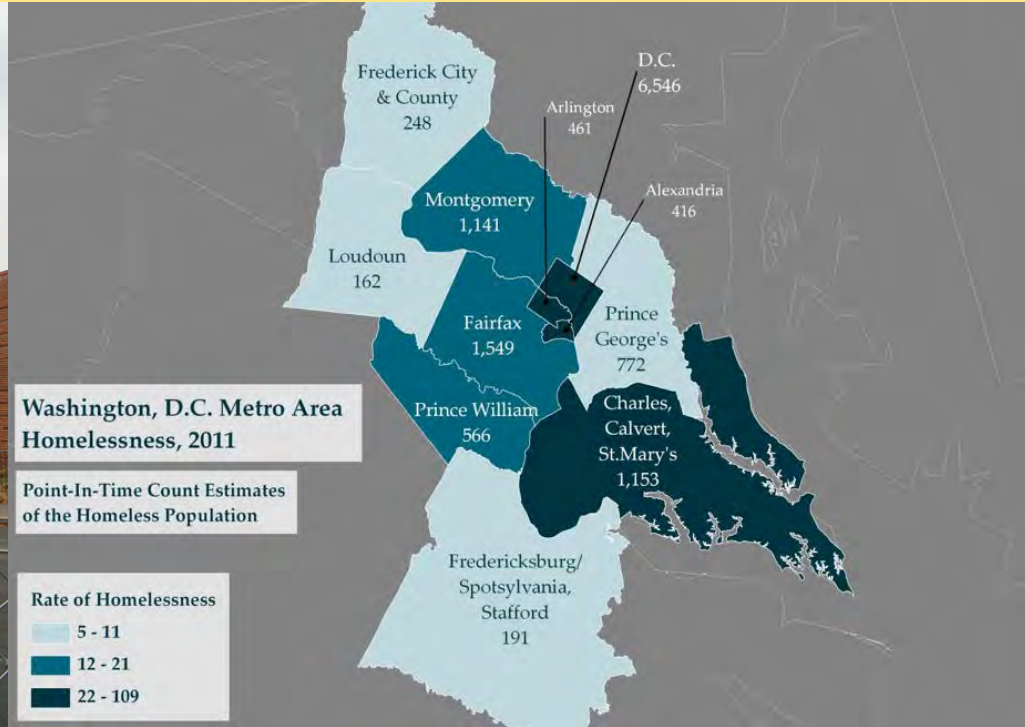
A PASSIVE HOUSE RETROFIT TALE OF EPIC PROPORTIONS



A LONG, LONG TIME AGO IN SE, D.C.

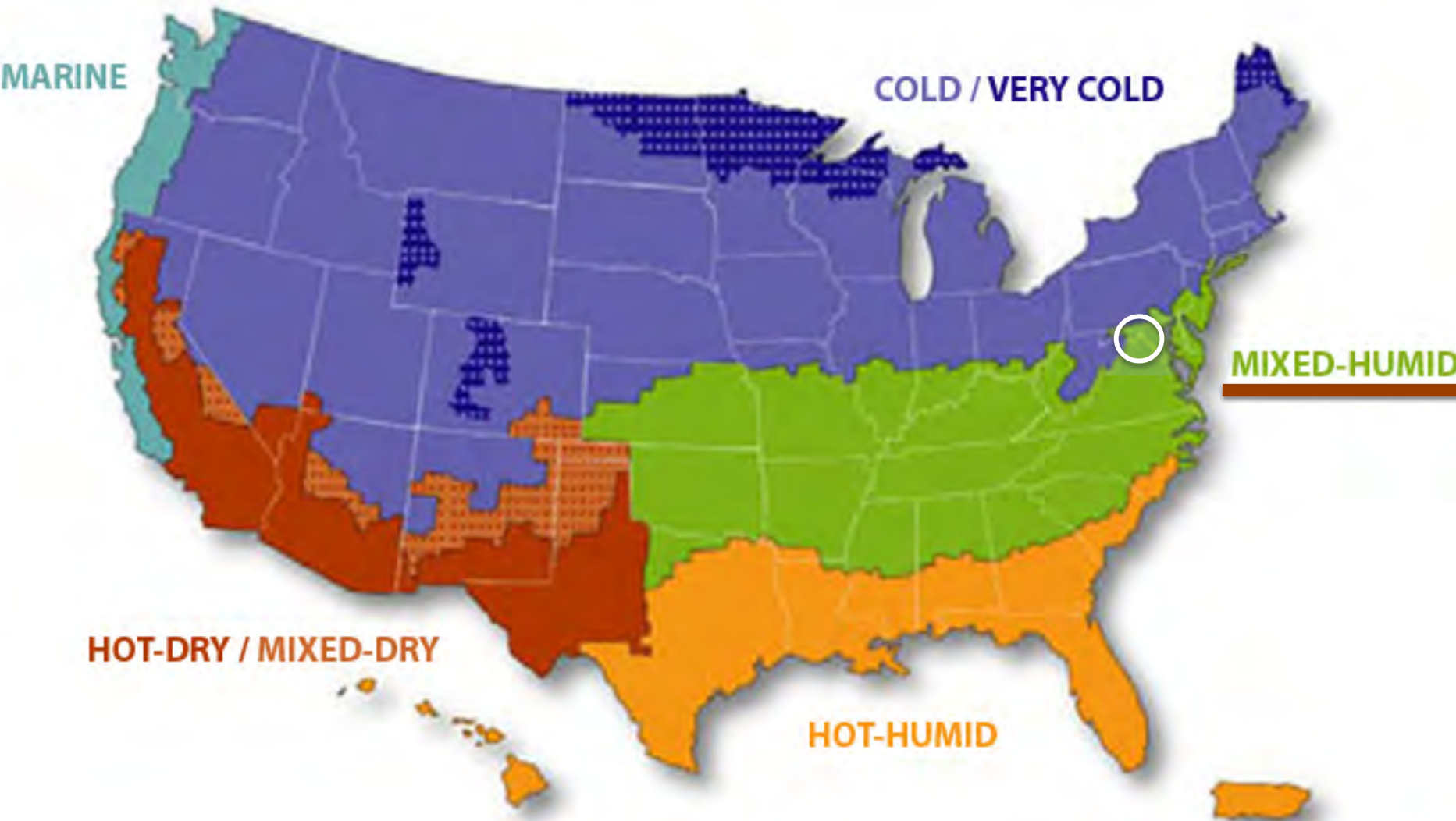


NEIGHBORHOOD & HOMELESSNESS



SOURCE: HOMELESSNESS RESEARCH INSTITUTE

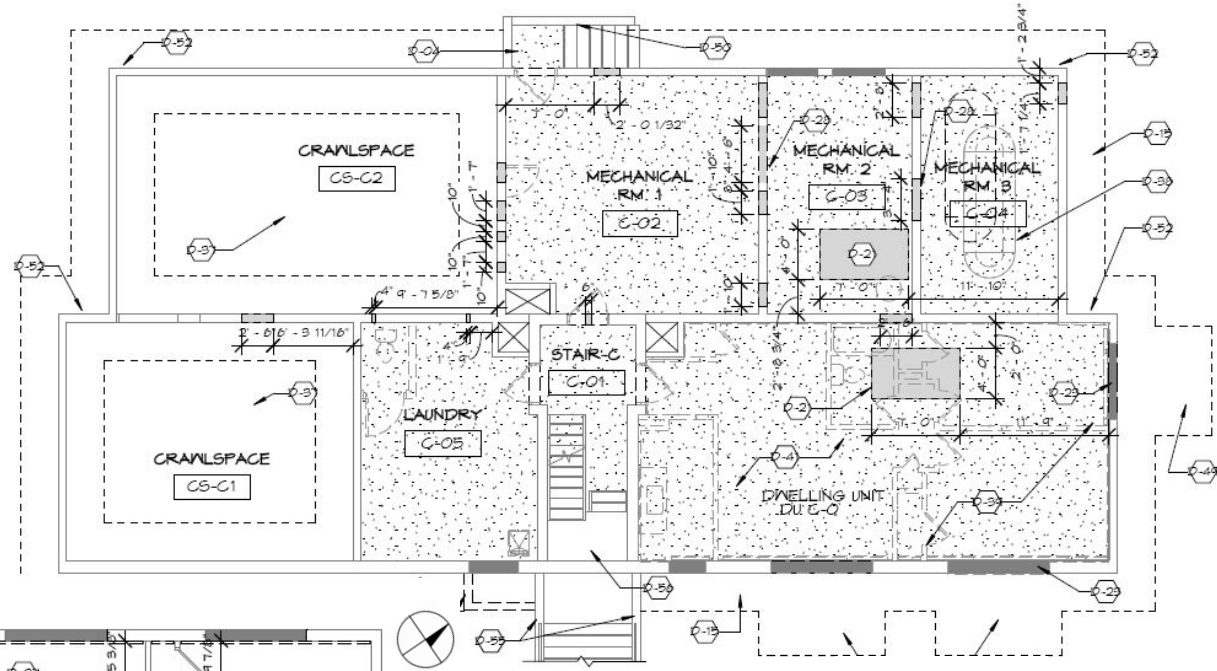
CLIMATE



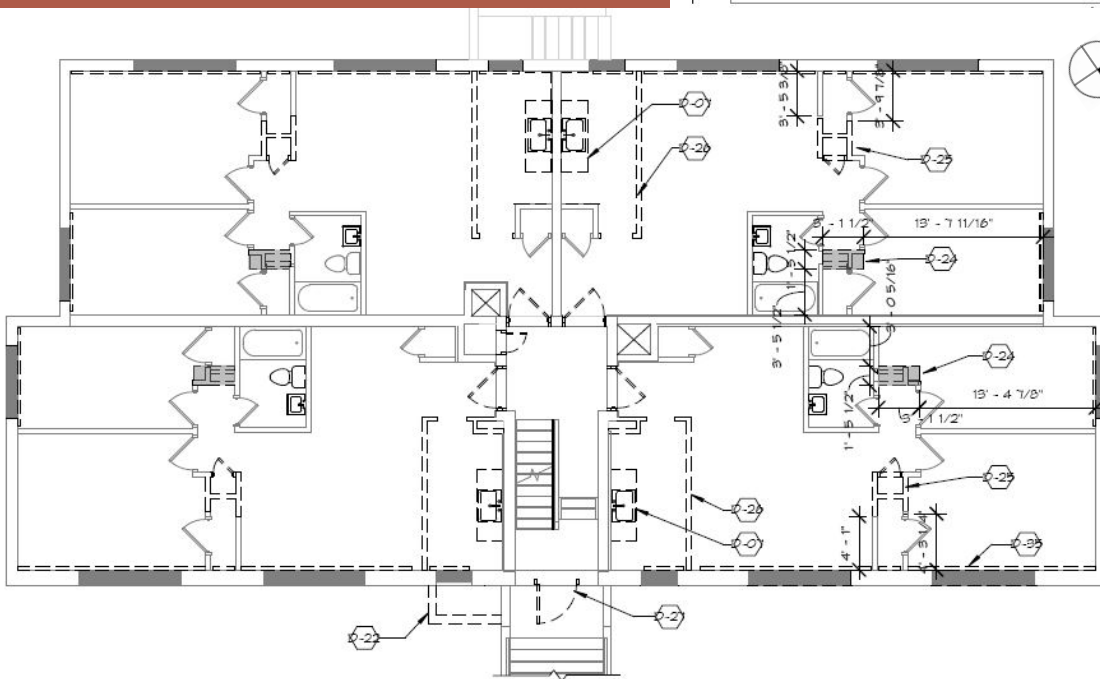
PROJECT BACKGROUND

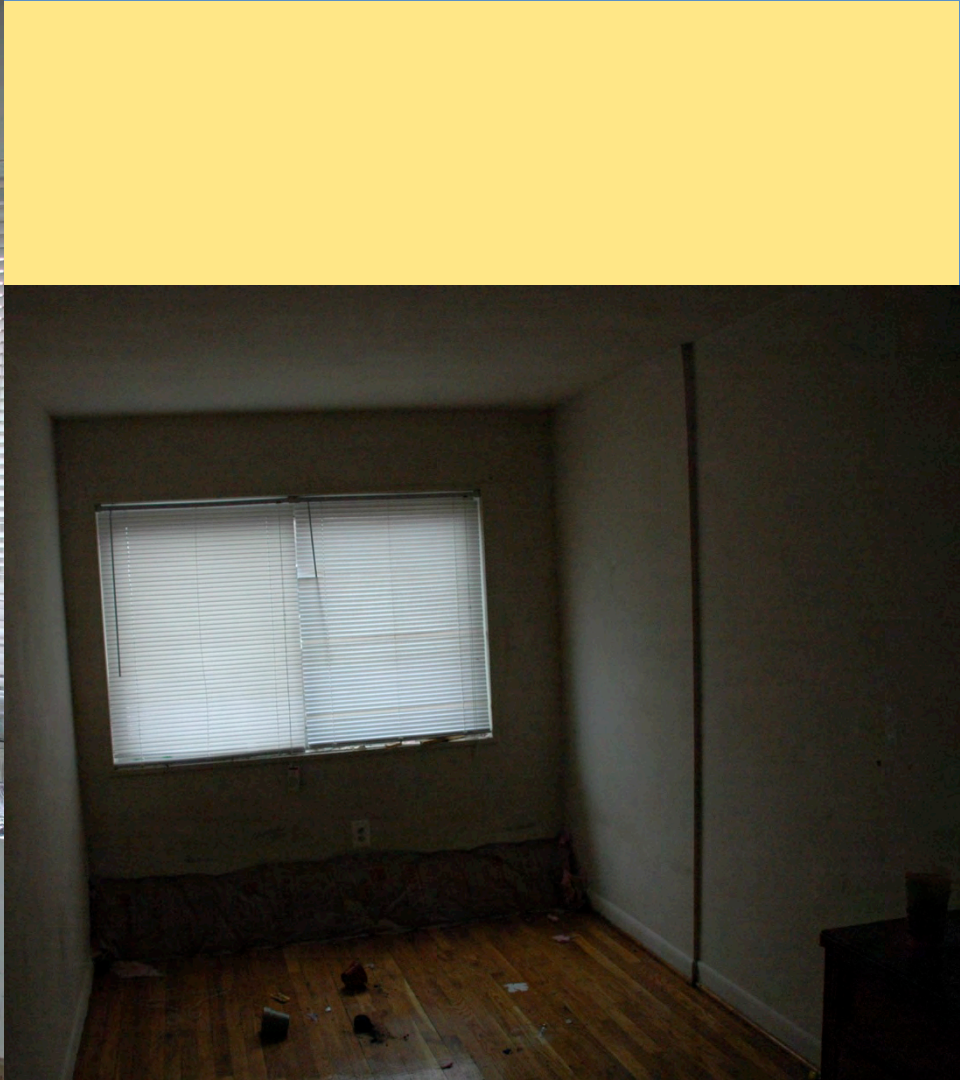
- (3) BLDGS. / 36 (2) BR UNITS
- 675 NRSF EA.
- PARTIAL BASEMENT / CRAWL SPACE
- (3) STORIES

EXIST. UPPER FLOOR PLAN



EXIST. BASEMENT PLAN





CHALLENGE:
POOR SPATIAL QUALITY
& CONSTRAINT

PROJECT BACKGROUND

- (3) BLDGS. / 36 (2) BR UNITS
- 675 NRSF EA.
- PARTIAL BASEMENT / CRAWL SPACE
- (3) STORIES

NON-DESCRIPT SENSE OF PLACE



WASTEFUL, INAPPROPRIATE,
AND OUT-DATED SYSTEMS

PROJECT BACKGROUND

LOW-TECH,
UN-INSULATED BUILDING ENCLOSURE



UNHEALTHY INTERIOR
ENVIRONMENT

EXISTING CONDITIONS

PRE-RETROFIT

NO MANAGEMENT OF
CONDENSATION PLANE
TEMPERATURES –

**MOLD GROWTH
ASSURED!!**



DEVELOPER ETHICS

- **TRUE AFFORDABILITY:** health, comfort and economic stability



THC Housing Families, Transforming Lives

ABOUT THC ENDING HOMELESSNESS GET INVOLVED STAY CURRENT

PERMANENT SUPPORTIVE HOUSING



THC's Permanent Supportive Housing (PSH) programs serves 94 families through one residential building and scattered sites throughout Washington, DC. Our PSH programs are based on the national, rights-based "housing first" model, which focuses on quickly moving families experiencing homelessness into permanent housing with leases in their own names, and then providing additional supports and services as needed. PSH is specifically targeted towards chronically homeless families with mental health disabilities, a history of substance abuse, HIV/AIDS, or other physical health disabilities. These families need intensive supports to remain in housing and are better able to move forward in their lives if they are first housed.

Partner Arms 1 is THC's "single site" PSH program, providing 14 families with stable residency in a 14-unit building in the Brightwood neighborhood of Ward 4. This program provides on-site case management, **mental health support**, **substance abuse counseling**, **life skills assistance**, **employment services**, and **youth enrichment** opportunities to assist families in both maintaining their housing and accomplishing their life goals.

Housing With Care, THC's "scattered site" PSH program, provides comprehensive case management for 80 families who are housed in apartment buildings located throughout the District. THC service teams provide the same case management and services as in our single site location, but meet the families in their homes and in different community locations.

Delta Commons @ Benning Road will open in late 2014 to provide 12 additional units of permanent supportive housing. **DC@B** will also provide 24 units of **affordable rental housing**.

Photo credit: David Moss

- HEALTH: GOOD IAQ ASSURED
- COMFORT: COMFORTABLE BY DESIGN, NATURALLY AND EASILY
- FINANCIAL STABILITY: LOW AND RELIABLE COST THROUGH EFFICIENCY – NO SPIKES – VERY PREDICTABLE

COMMON OCCUPANT HEALTH PROBLEMS

**PRIMARY
CONTRIBUTORS TO
OCCUPANT HEALTH
ISSUES**

MOISTURE IN ALL FORMS

- **BULK WATER**
- **MOISTURE CARRIED THROUGH INFILTRATION/EXFILTRATION**
- **MOISTURE CARRIED THROUGH DIFFUSION**
- **INTERNAL MOISTURE LOADS**

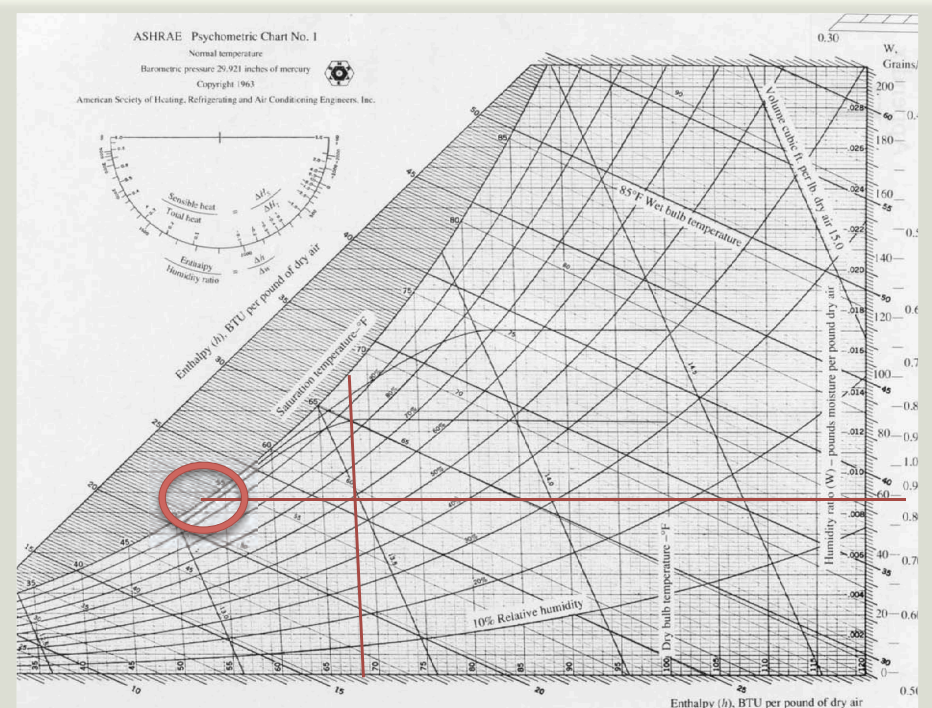
**MOLD GROWTH – ASTHMA,
ALLERGIES, AND OTHER AILMENTS**

AN ORDINARY RENOVATION?

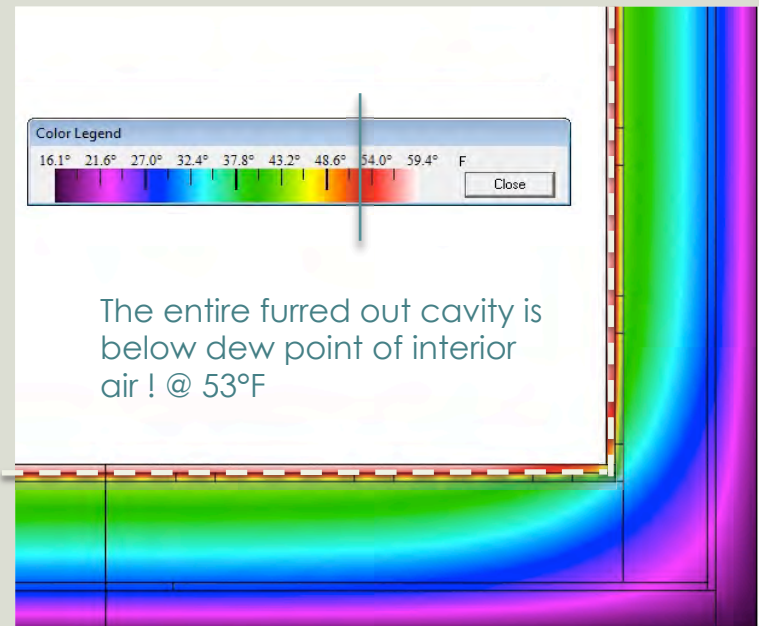
REPAIR-UPGRADE FINISHES, MINIMAL IF ANY INSULATION

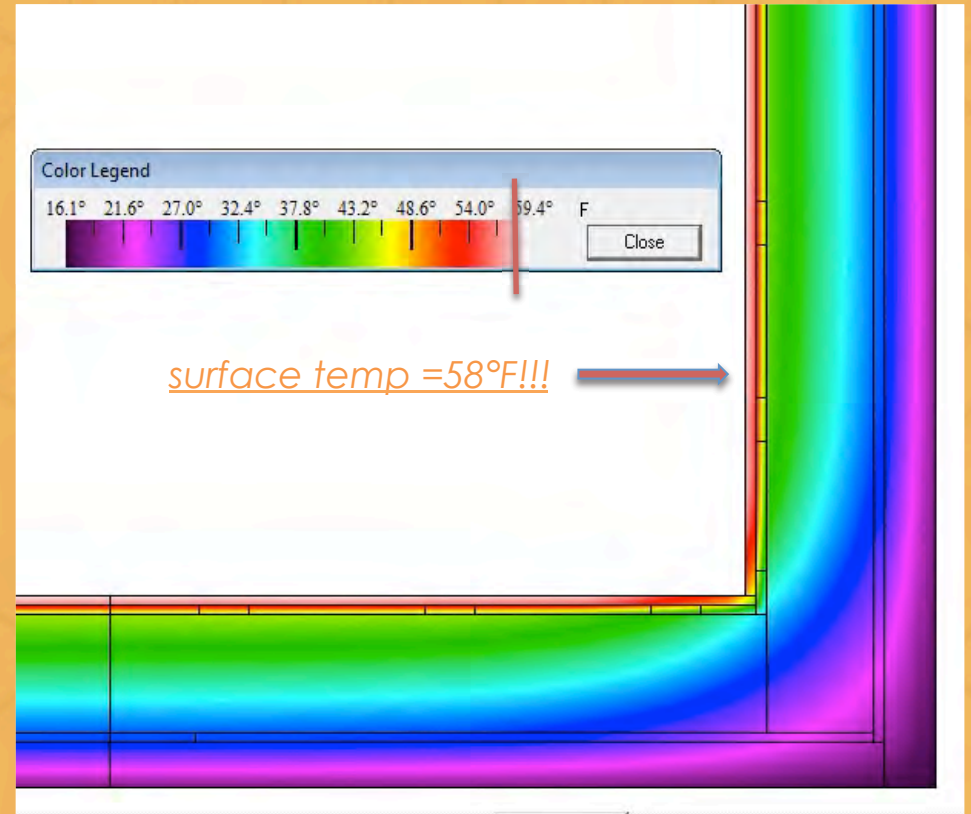
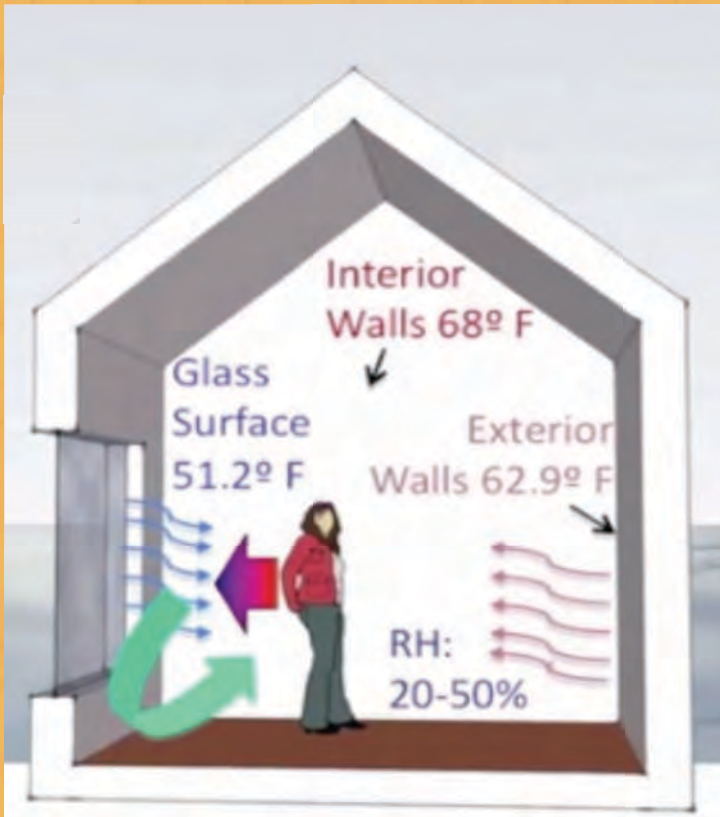
NO MANAGEMENT OF CONDENSATION PLANE TEMPERATURES –

MOLD GROWTH STILL ASSURED!!



Dew point of interior air = @ 52.5°F





UNINSULATED MASONRY?

COMFORT FACTORS?

Air temp

RH

Air velocity

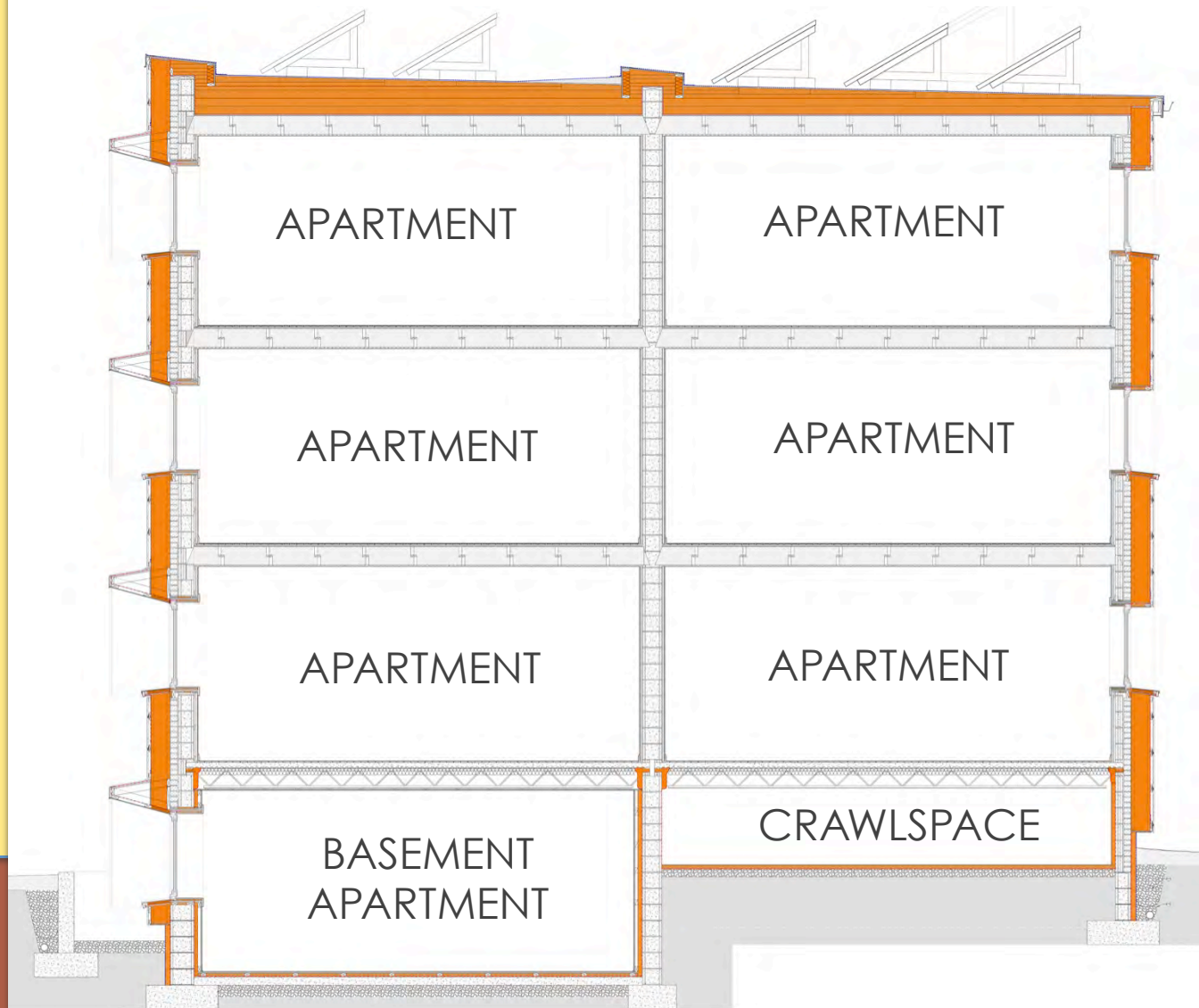
Mean radiant surface temps

ENTER: THE PH RETROFIT



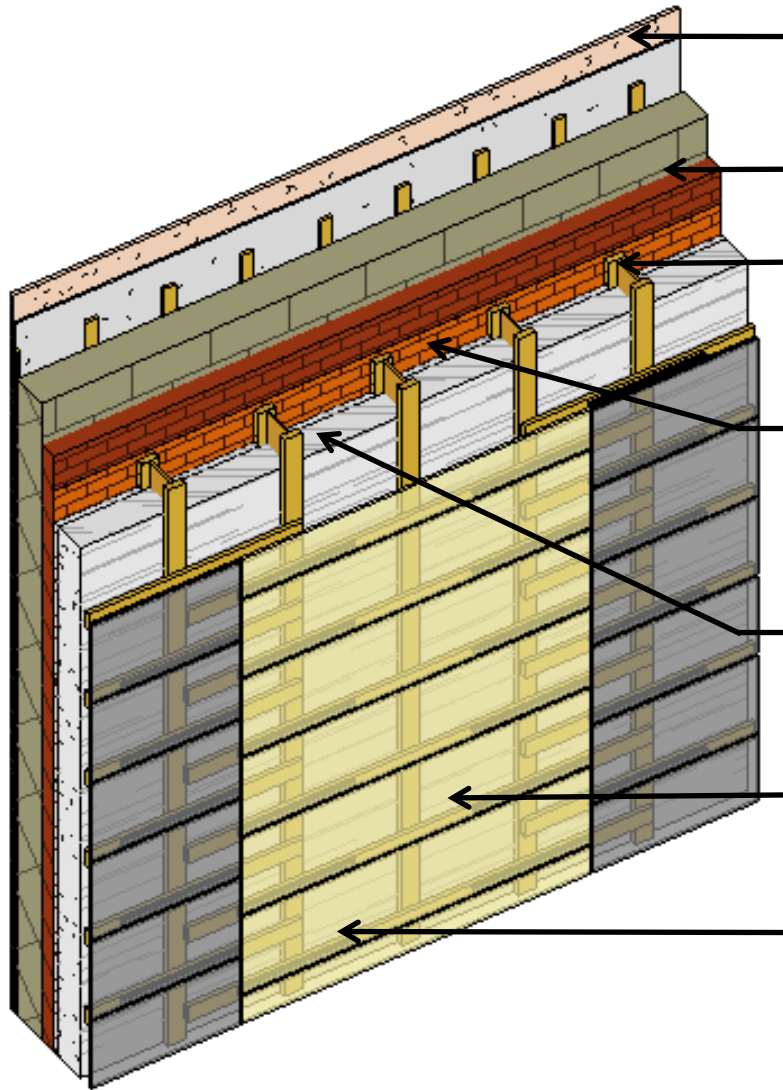
ELIMINATE LOSS: (almost!)

CONTINUOUS
INSULATION
DEFINING THE
THERMAL
ENVELOPE



SUPER-INSULATED AND VAPOR OPEN

PRE "VE" ENCLOSURE

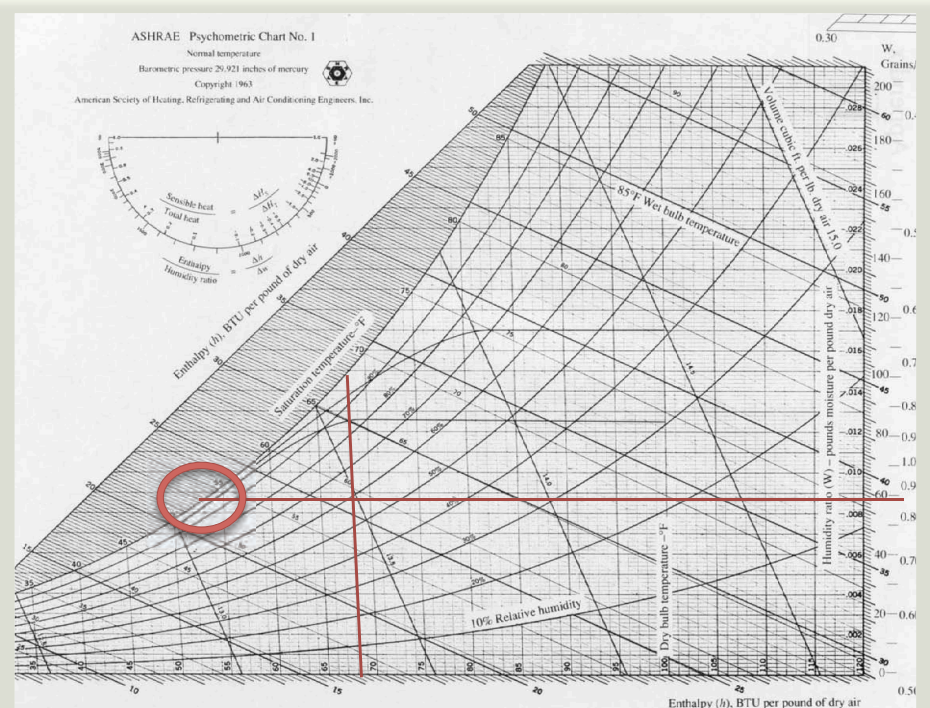


- EXIST. PLASTER OVER GYP. BD. SUBSTRATE & VERT. 1X FURRING
- BRICK & CMU BACK-UP
- 9 1/2" WD. '1'-JOISTS @ 24" O.C., MECH. ATTACH. @ 36" O.C., STAGGERED
- **FLUID-APPLIED AIR AND WATER RESISTIVE BARRIER**
- 8" MINERAL WOOL INSULATION @ 6 LB./CU. FT. DENSITY
- HORIZ. 5/4 WD. FURRING @ 18" O.C., STAGGERED
- 5/8" FIBER CEMENT CLADDING ON PROPRIETARY CLIPS

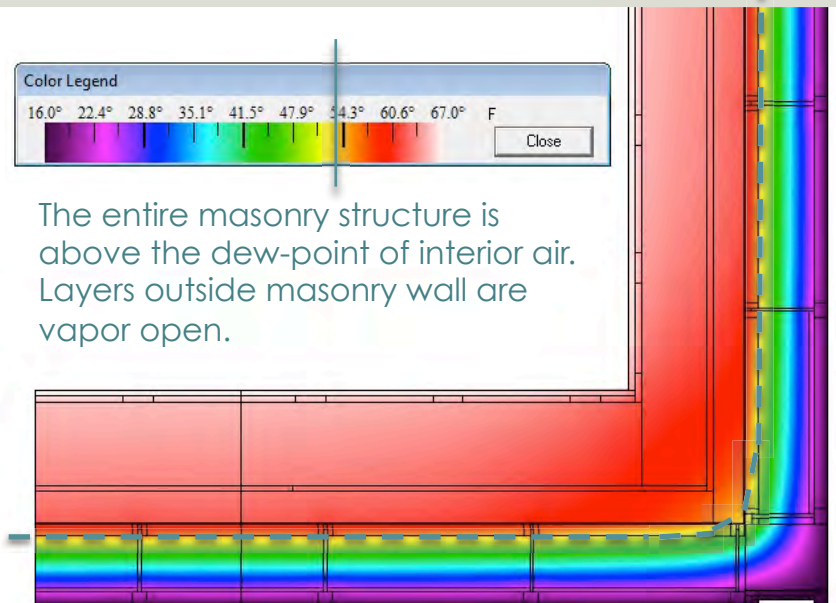
ENVELOPE DESIGN + OCCUPANT HEALTH

**RETROFIT-
MANAGE
CONDENSATION PLANE
TEMPERATURES –**

**THIS WALL WILL NOT
GROW MOLD**

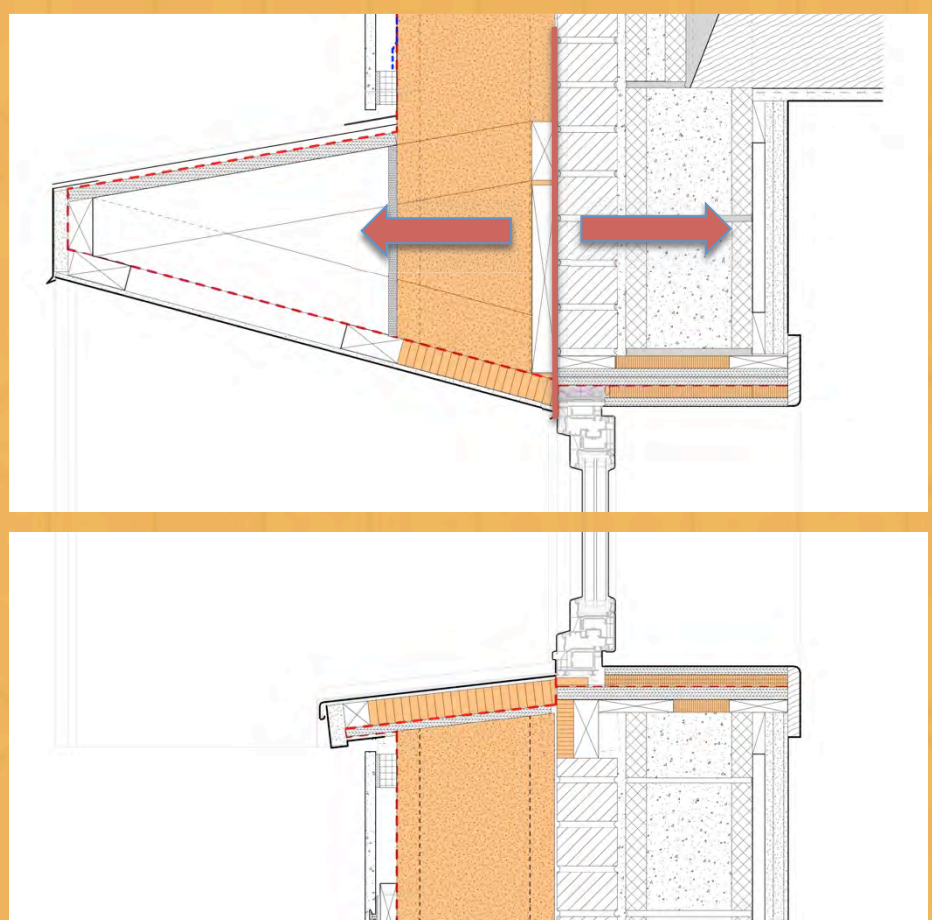


Dew point of interior air = @ 52.5°F

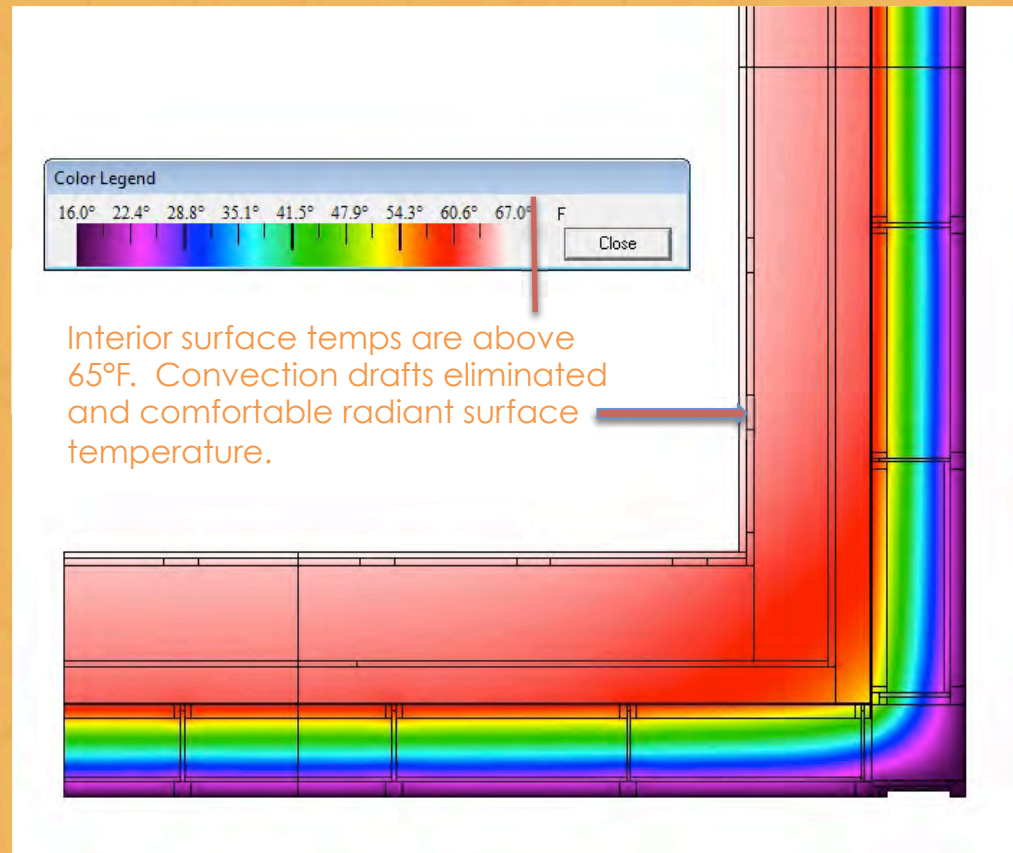


VAPOR OPEN
ASSEMBLIES DRY TO
BOTH SIDES

MANAGEMENT OF
FIRST CONDENSATION
PLANE TEMPERATURES



VAPOR OPEN ASSEMBLIES FOR
**HEALTH, SAFETY, AND
DURABILITY**



ENVELOPE + OCCUPANT COMFORT

COMFORT FACTORS?

Air temp

RH

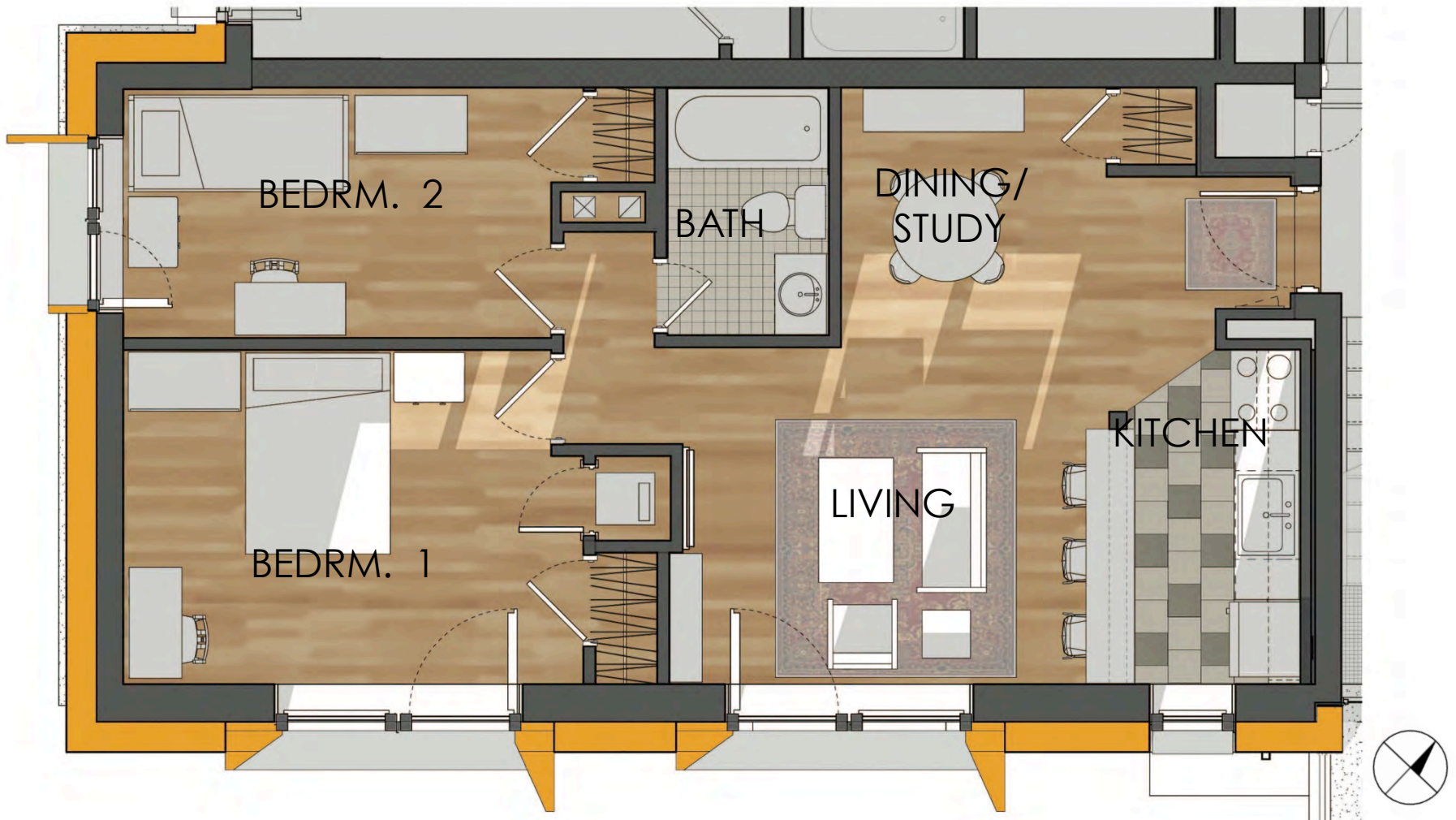
Air velocity

Mean radiant surface
temps



ORIENTATION:
PRE-DETERMINED SITING

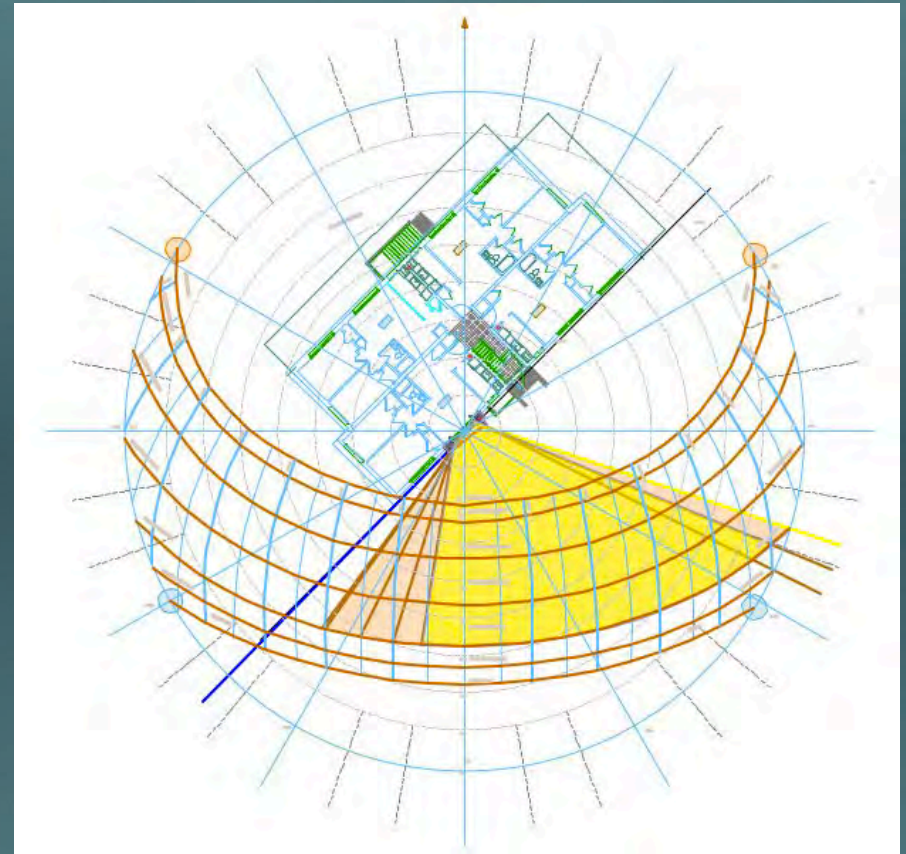
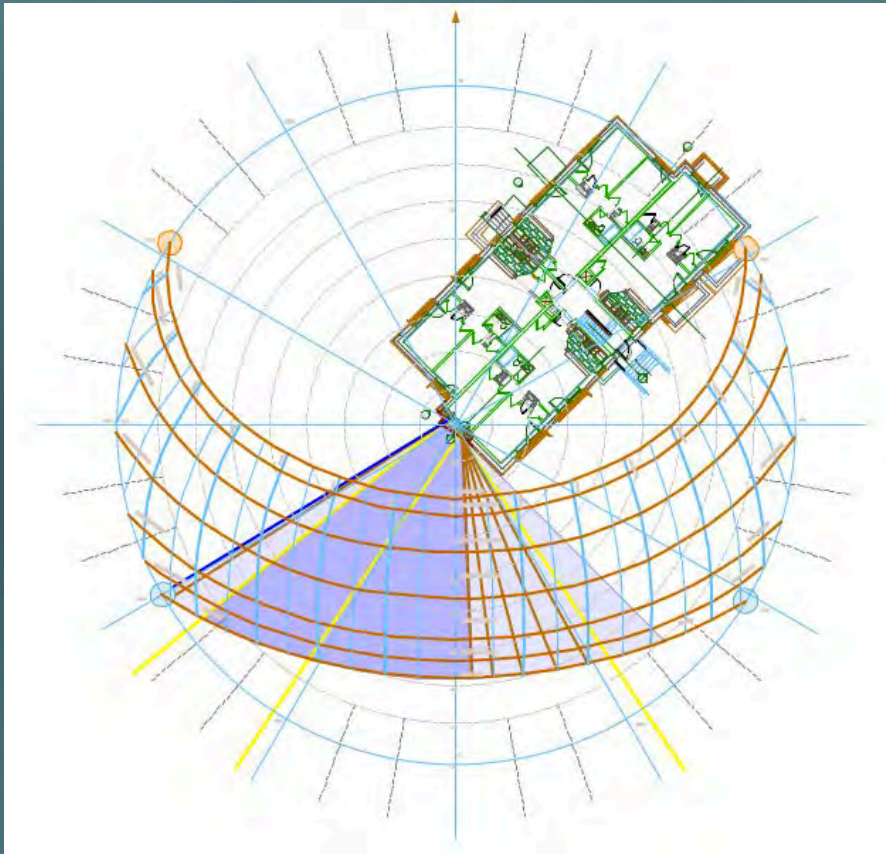
SOLAR GAIN CONTROL & QUALITY OF SPACE



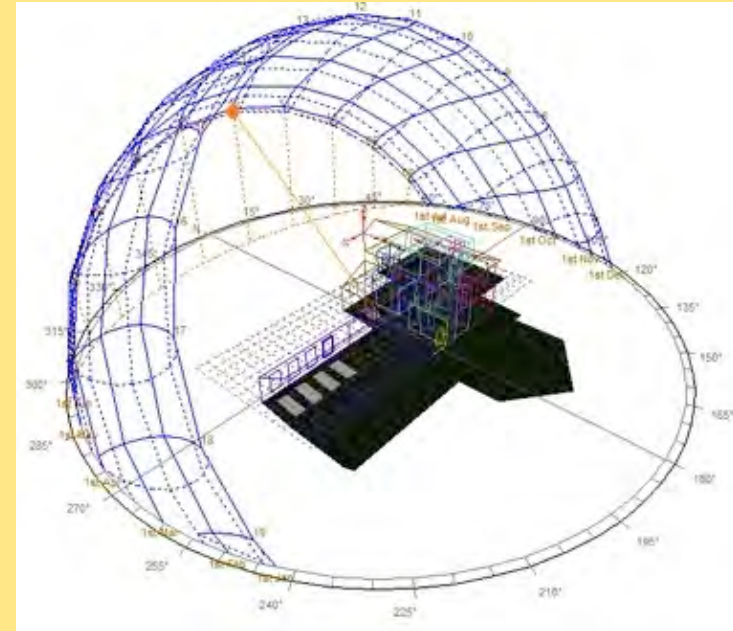
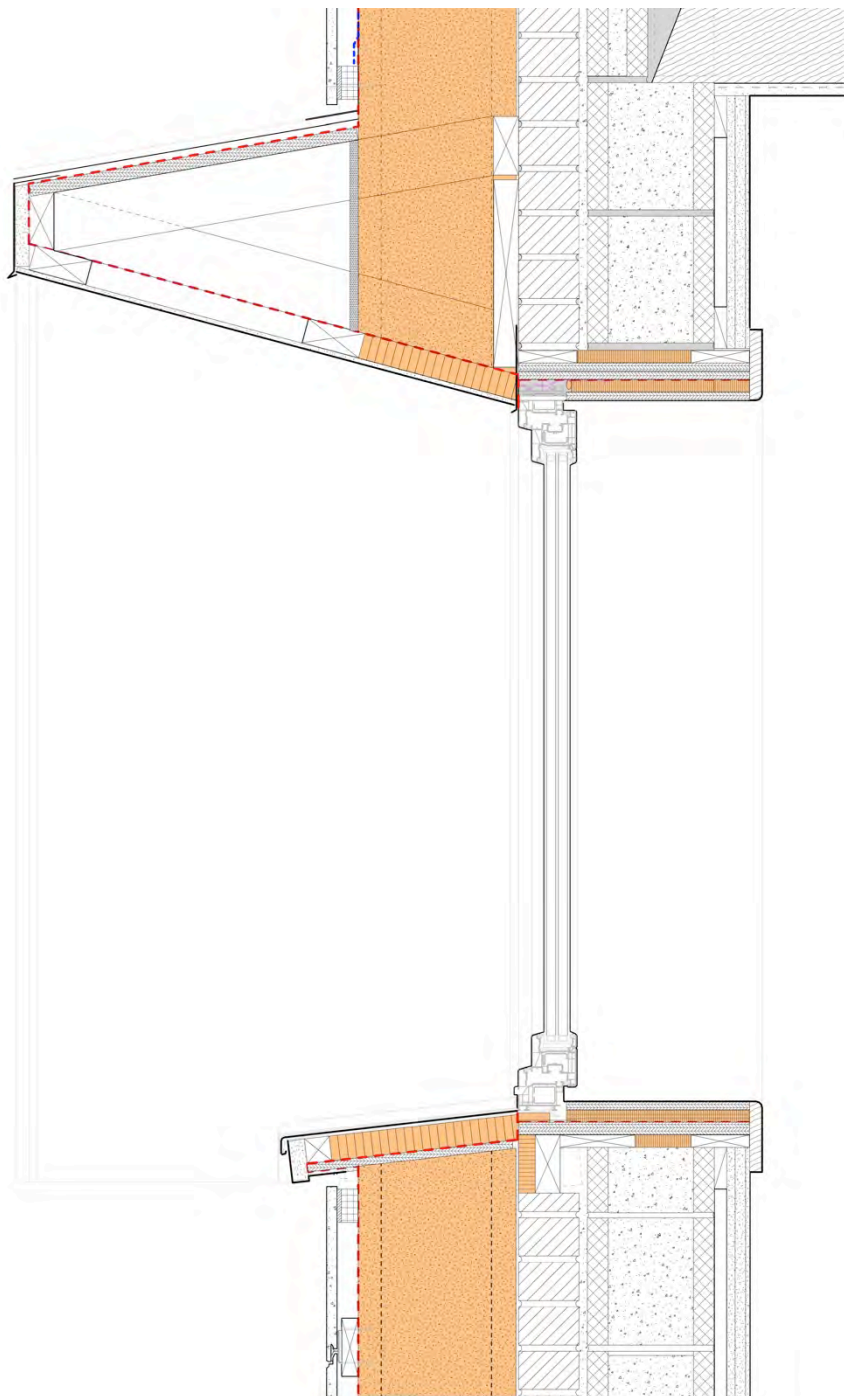
TYPICAL APARTMENT UNIT FLOOR PLAN

672 NET RENTABLE SQ. FT.

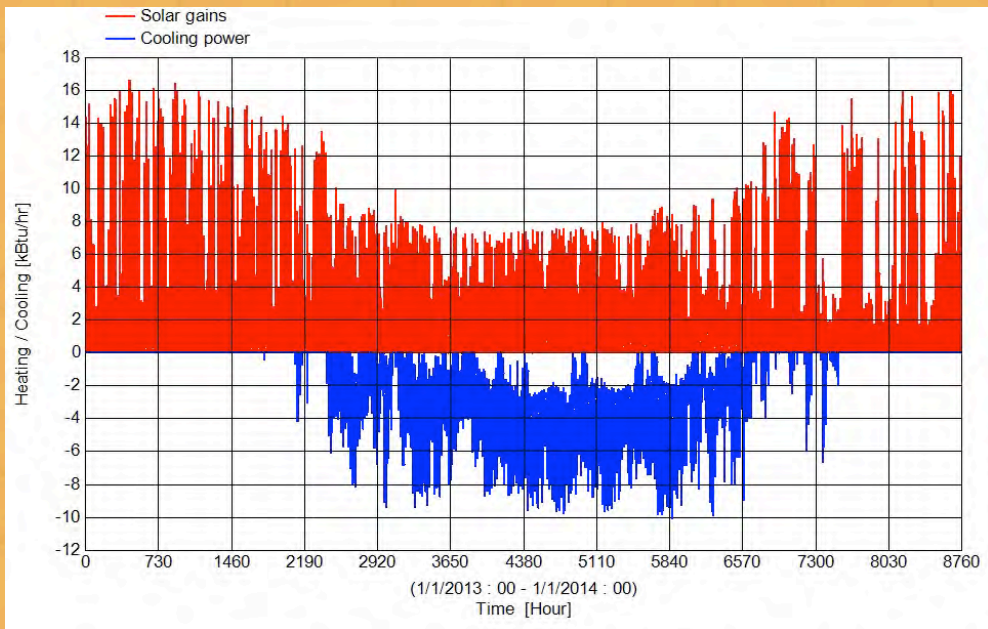
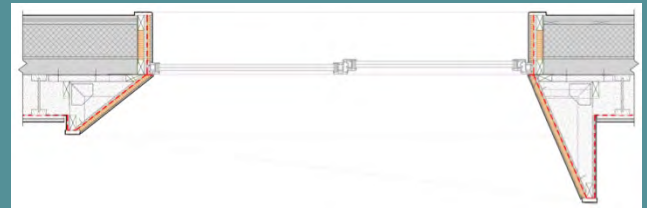
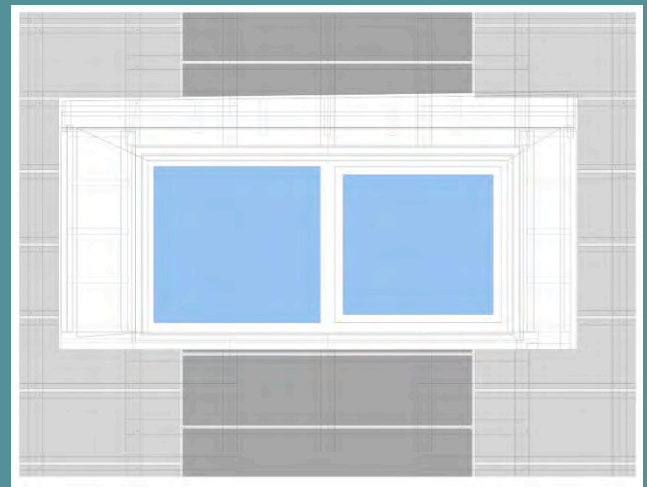
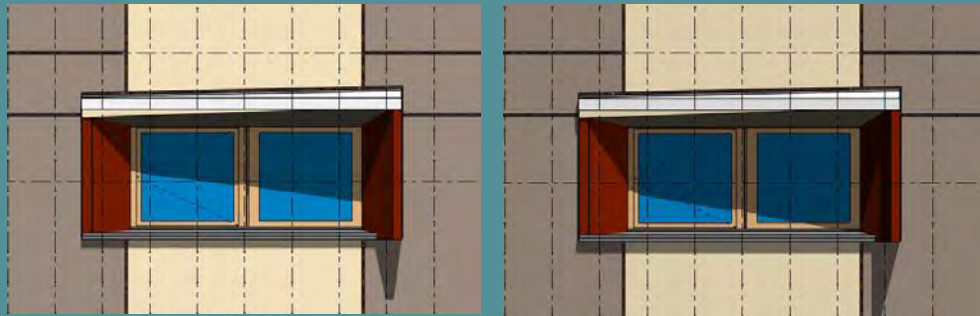
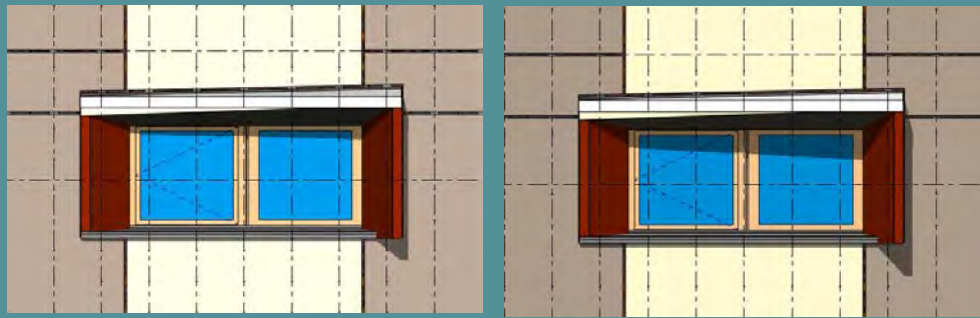
HEATING AND COOLING



ASYMETRICAL LOADS +
DISTRIBUTION

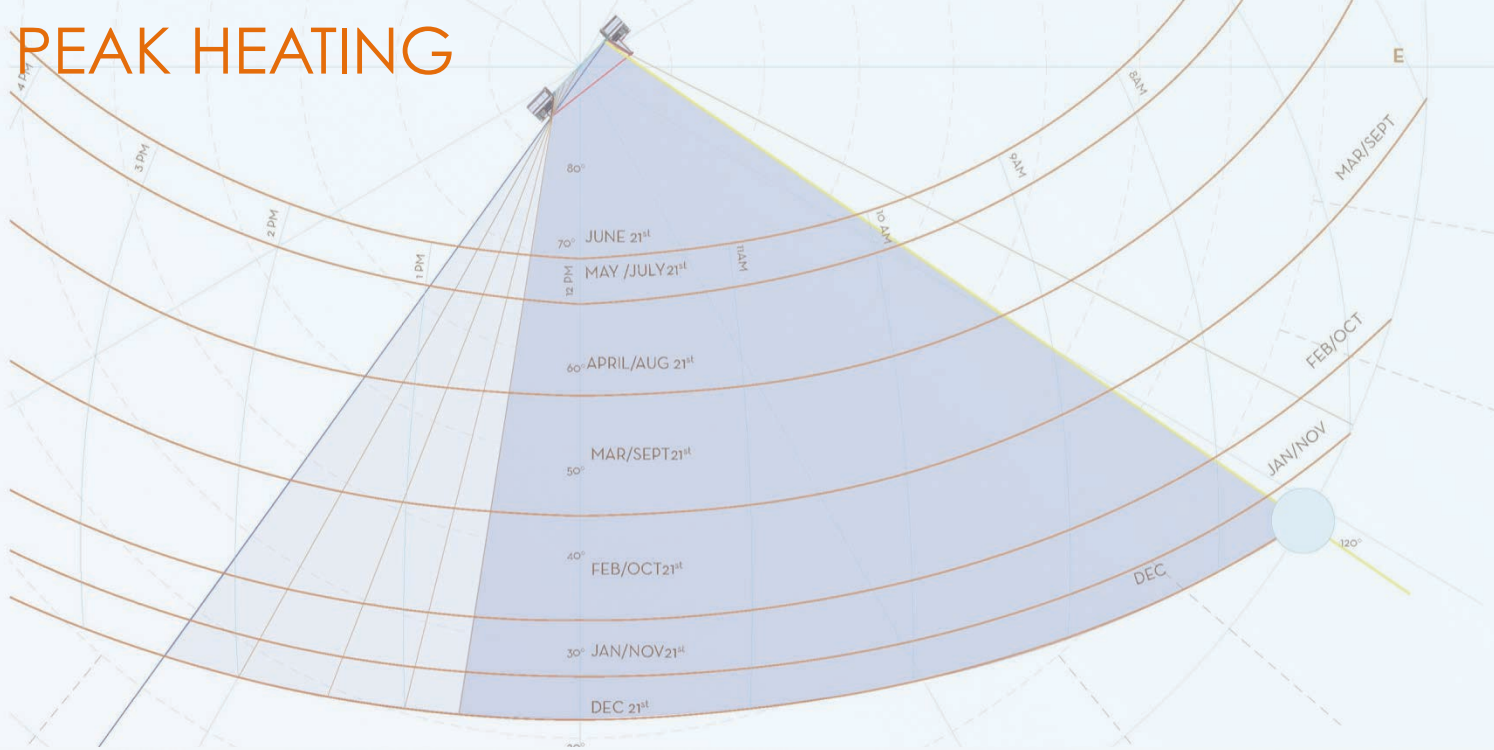


SOLUTION:
FIXED SOLAR
SHADING

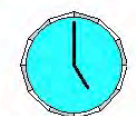
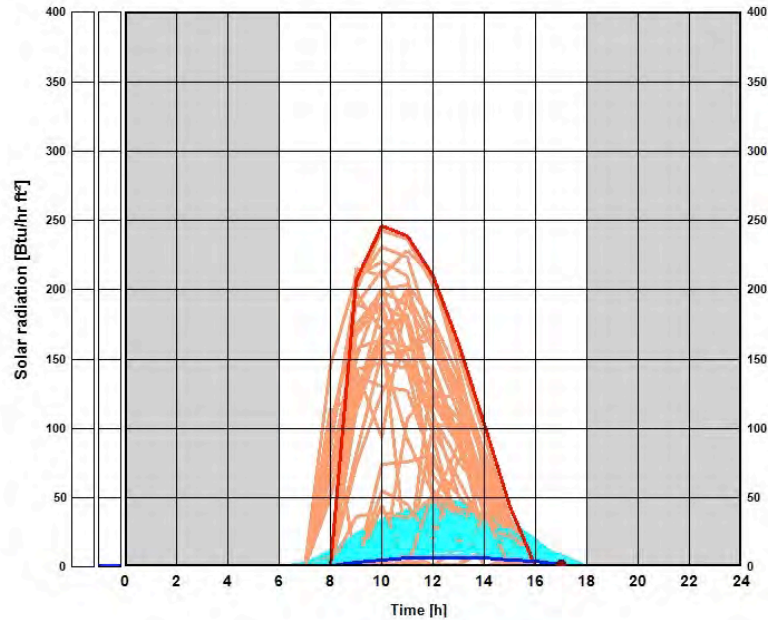
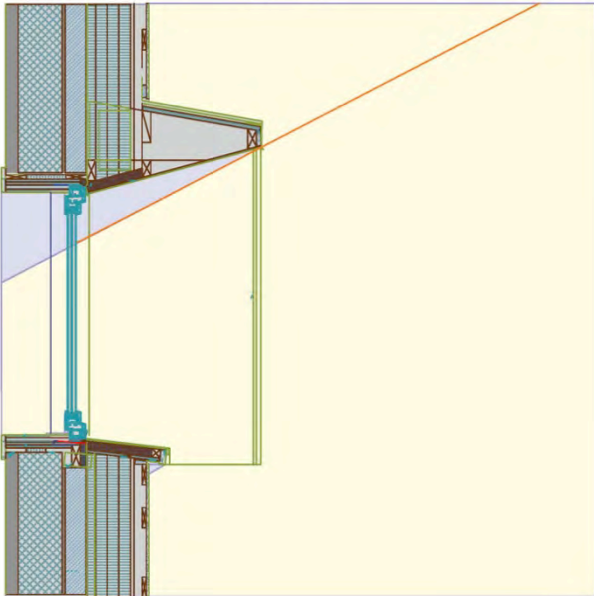


**SOLAR GAIN
WHEN YOU
WANT IT
(AND NOT WHEN YOU
DON'T!!)**

PEAK HEATING

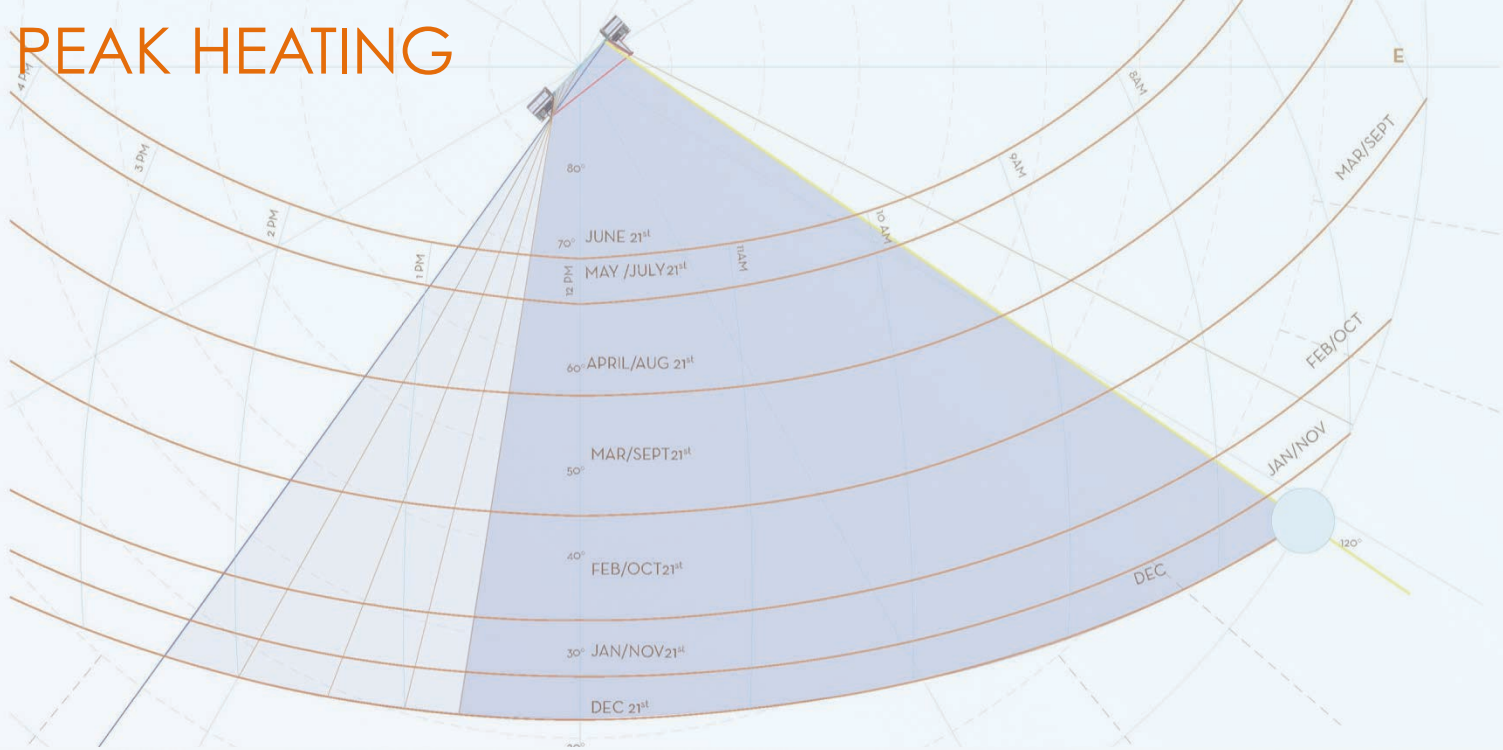


december

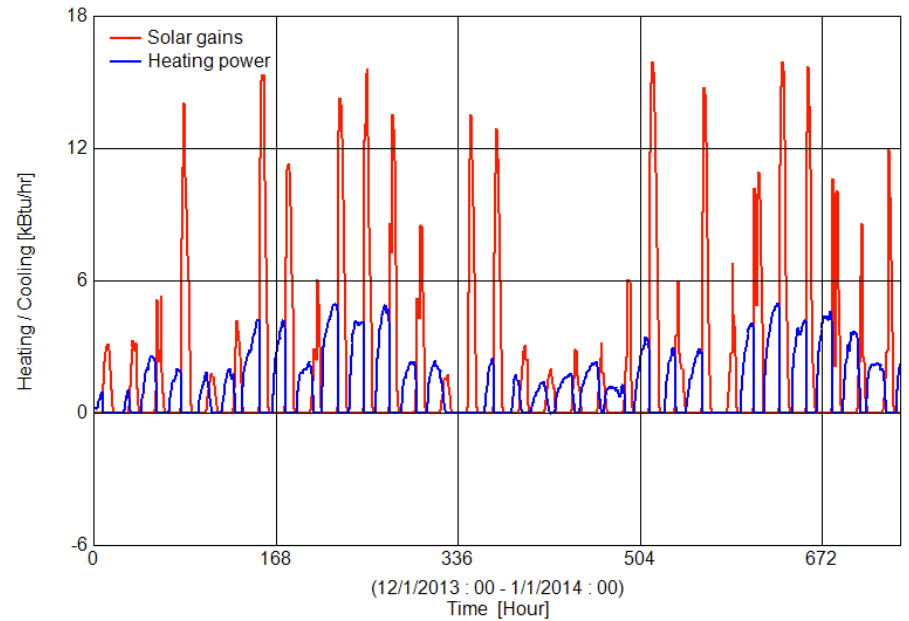
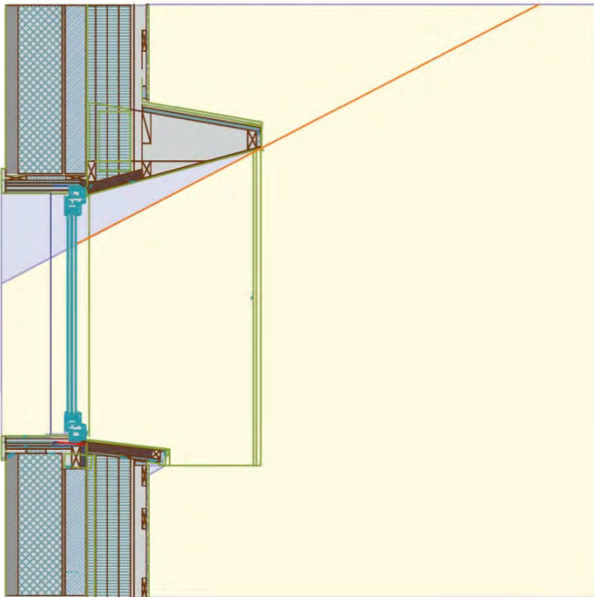


12/22/2013						
Mo	#	We	Th	Fr	Sa	Su

PEAK HEATING

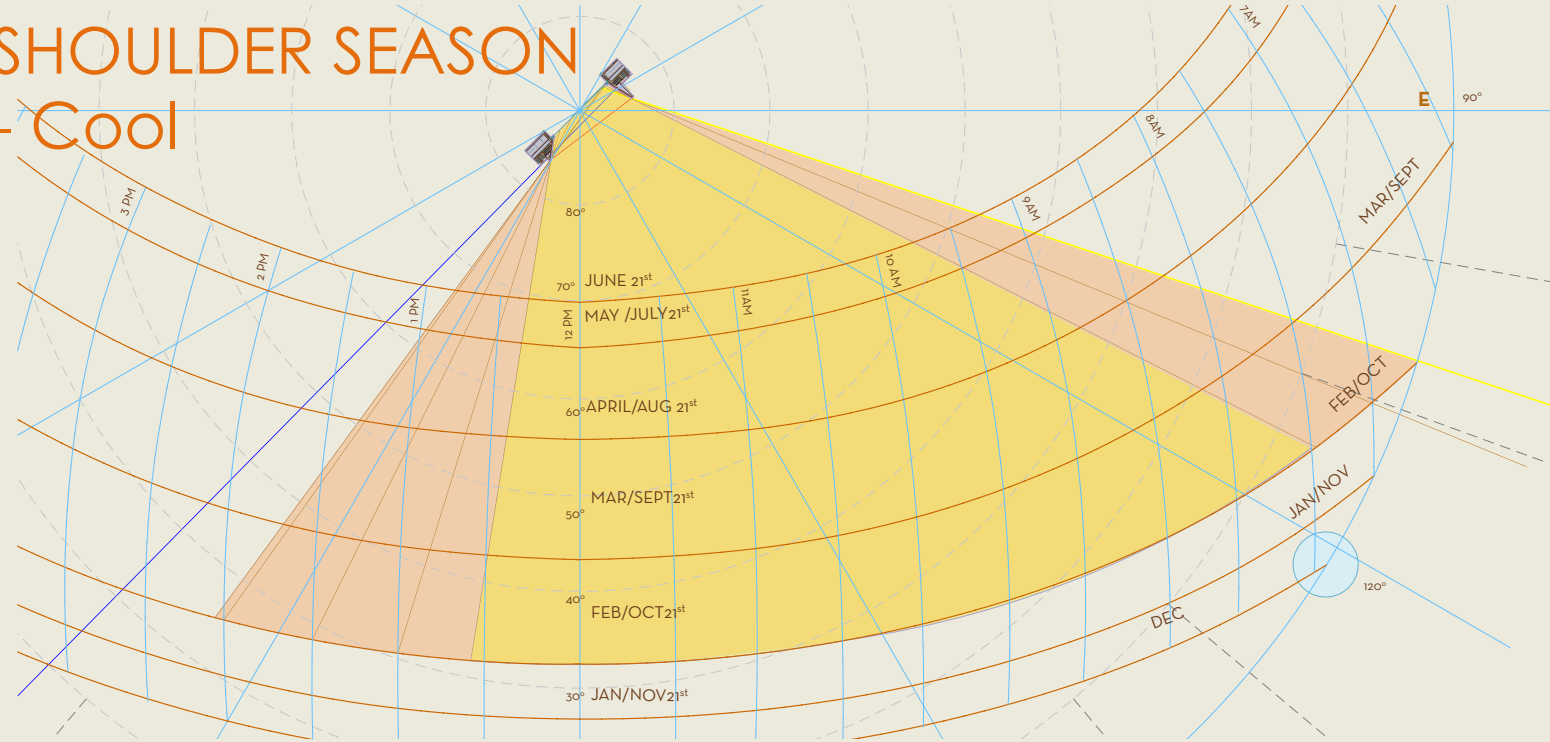


december

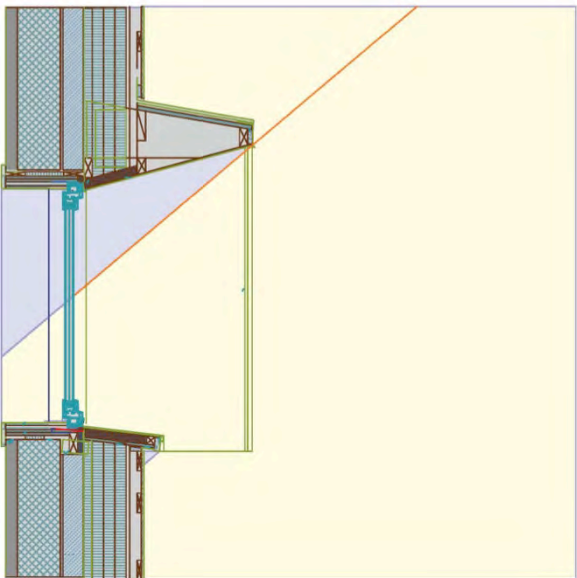


SHOULDER SEASON

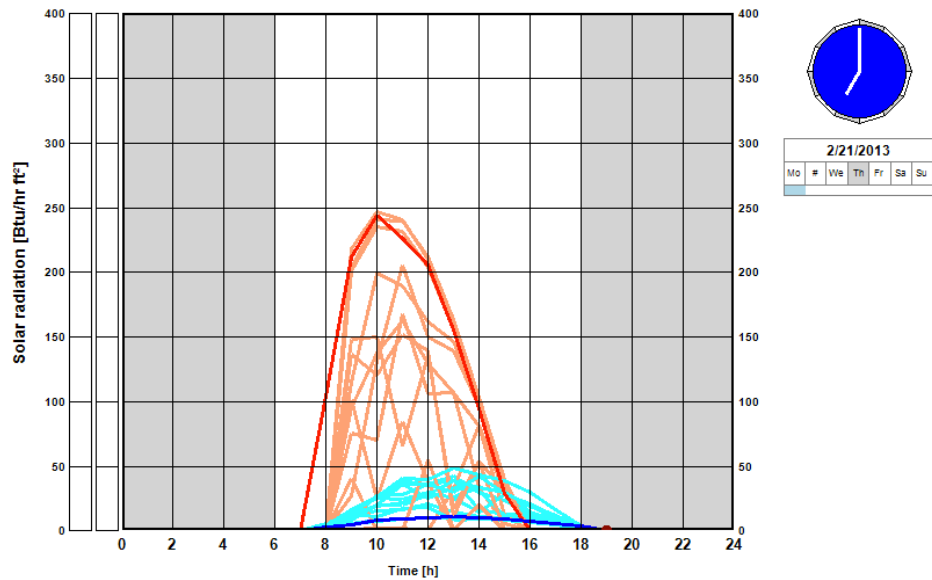
- Cool



February / October

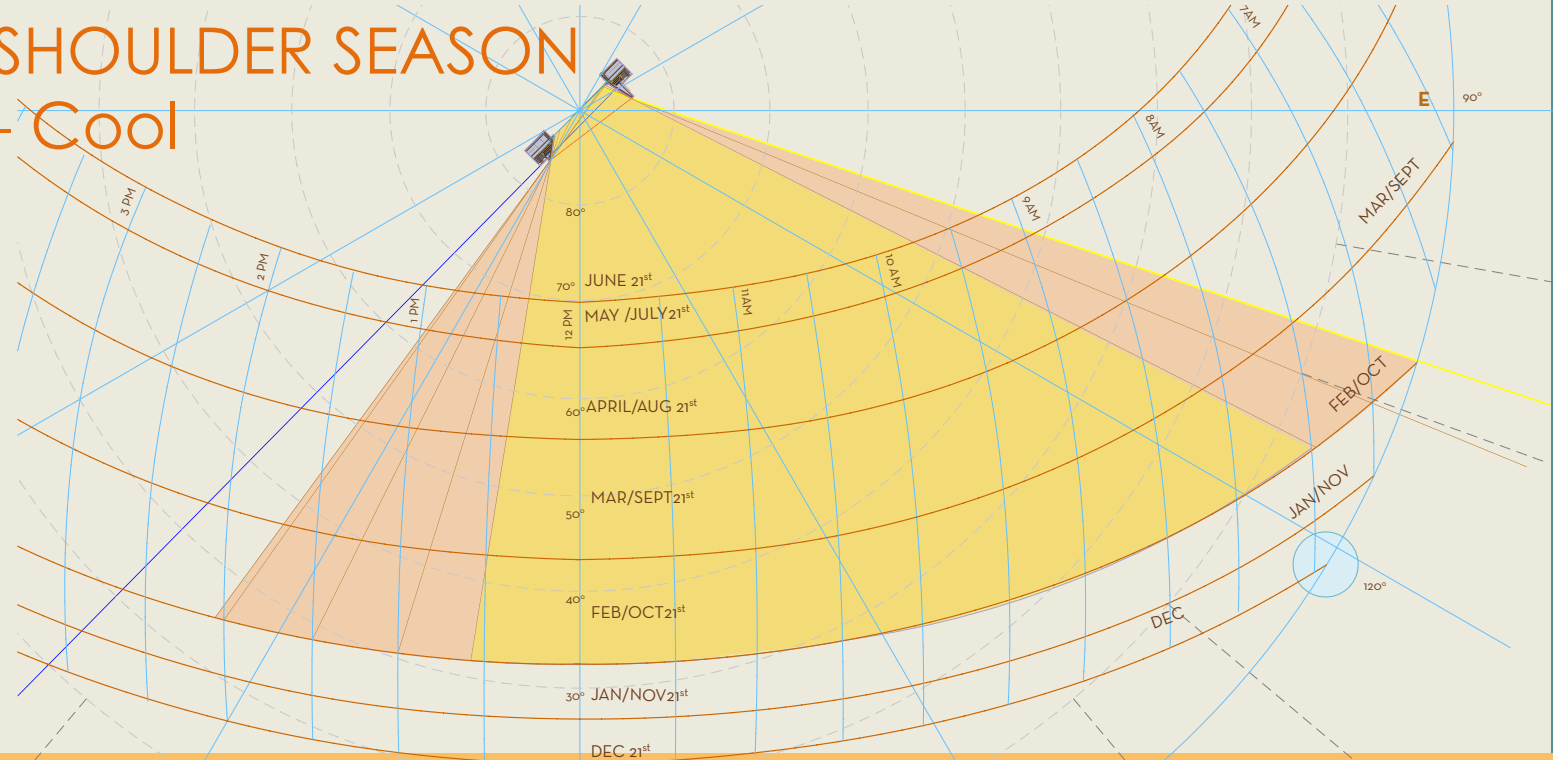


Solar Gain / Hourly – February 21

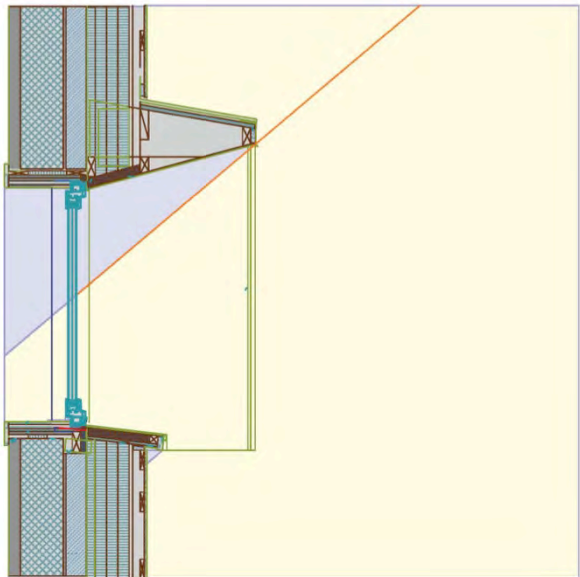


SHOULDER SEASON

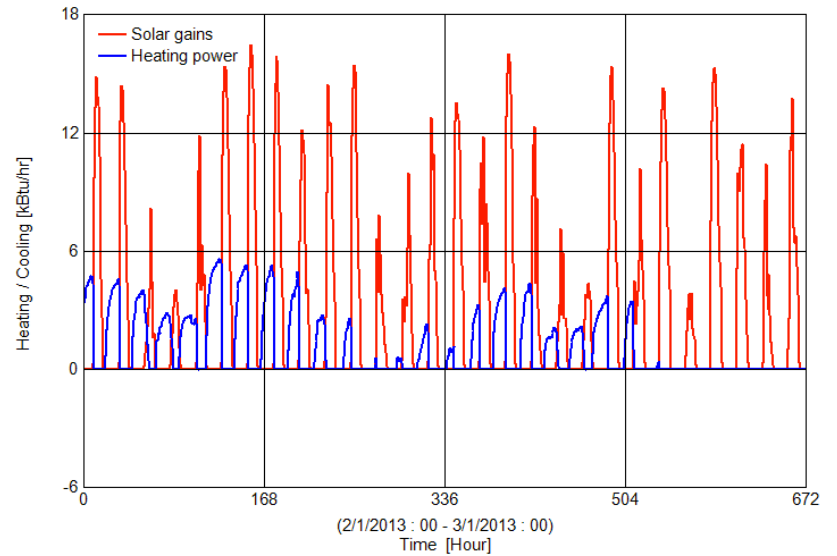
- Cool



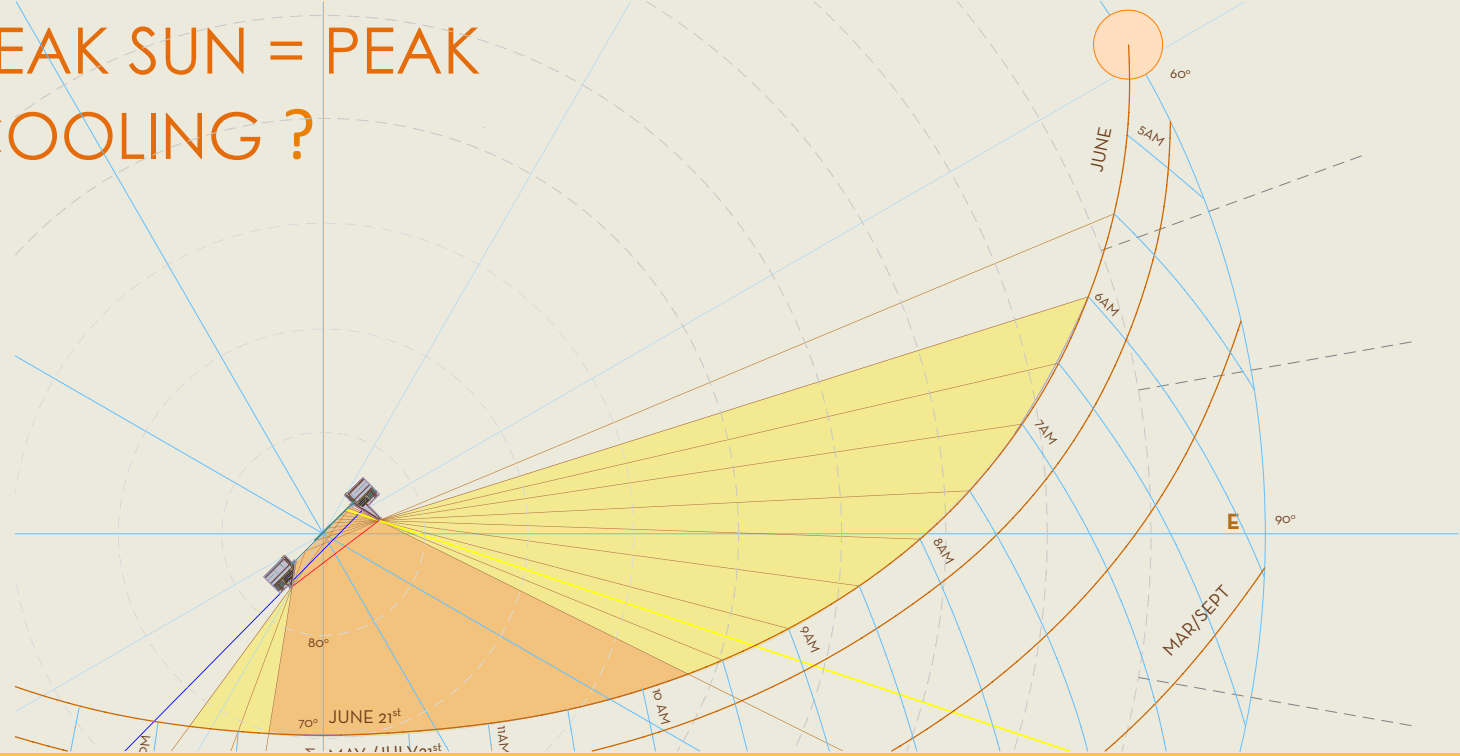
February / October



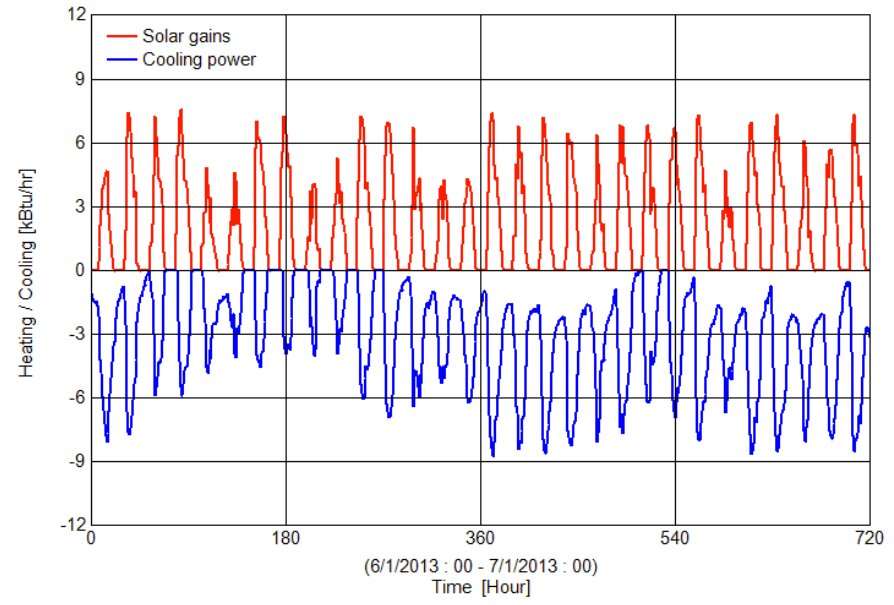
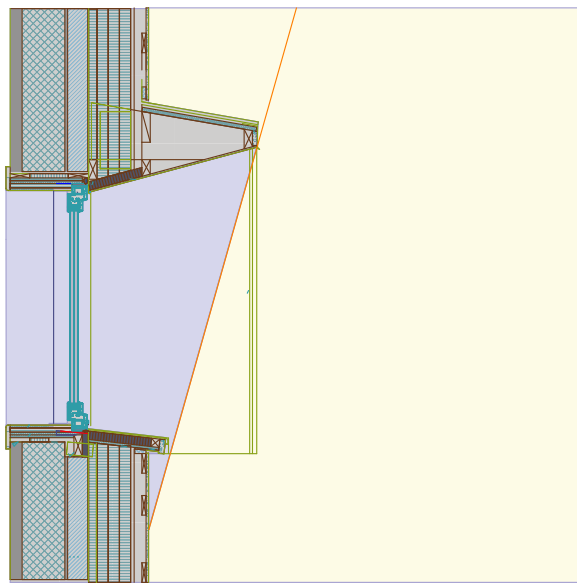
Solar Gain / Heating February



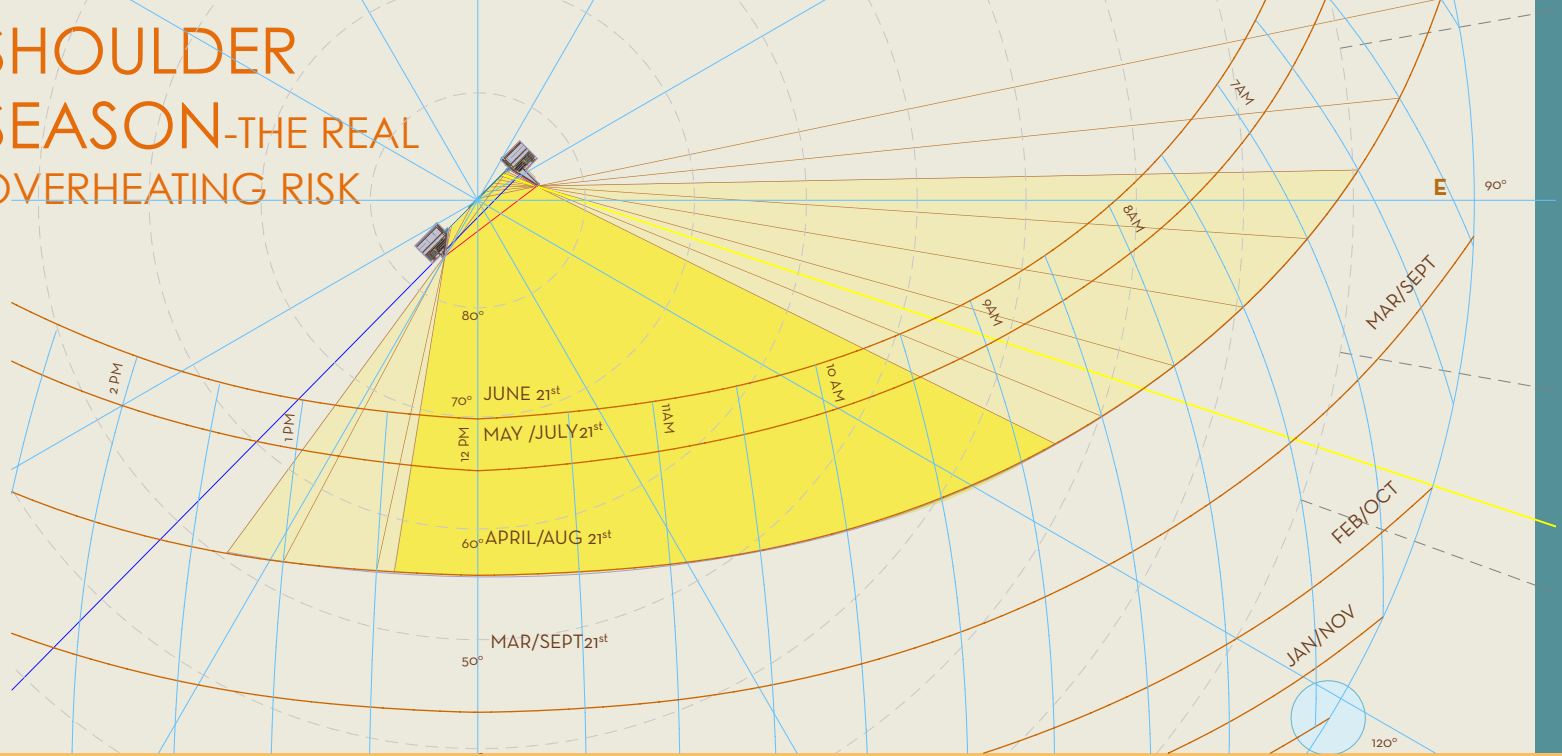
PEAK SUN = PEAK COOLING ?



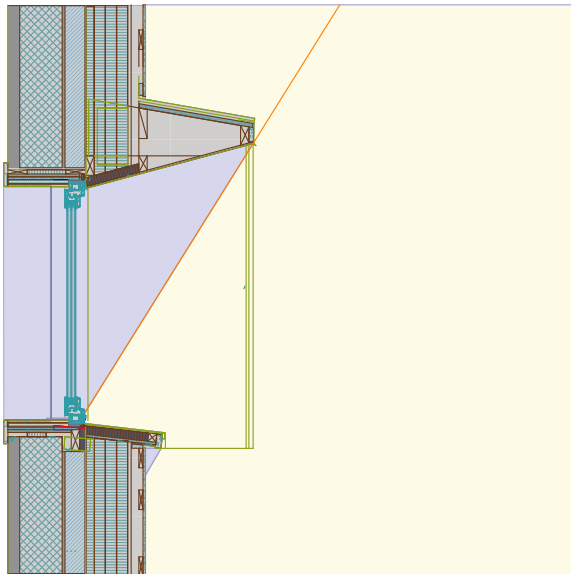
Solar Gain / Cooling June



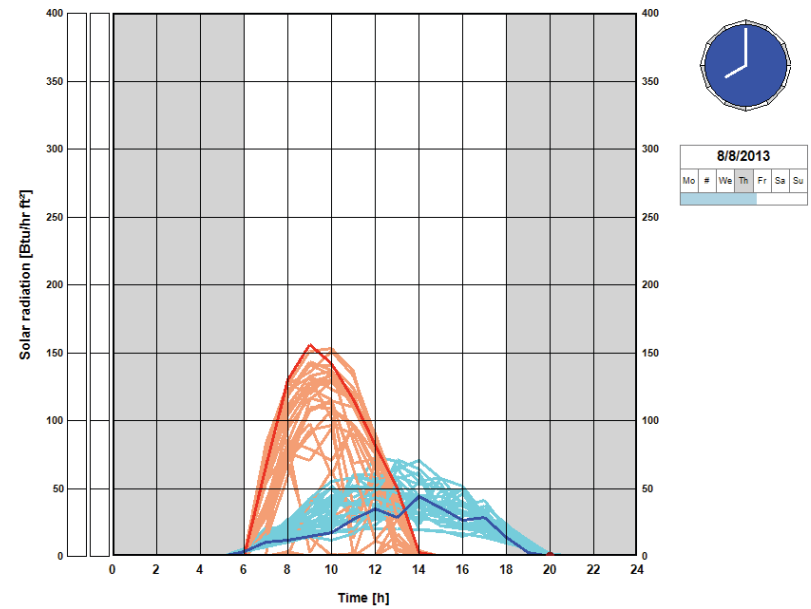
SHOULDER SEASON-THE REAL OVERHEATING RISK

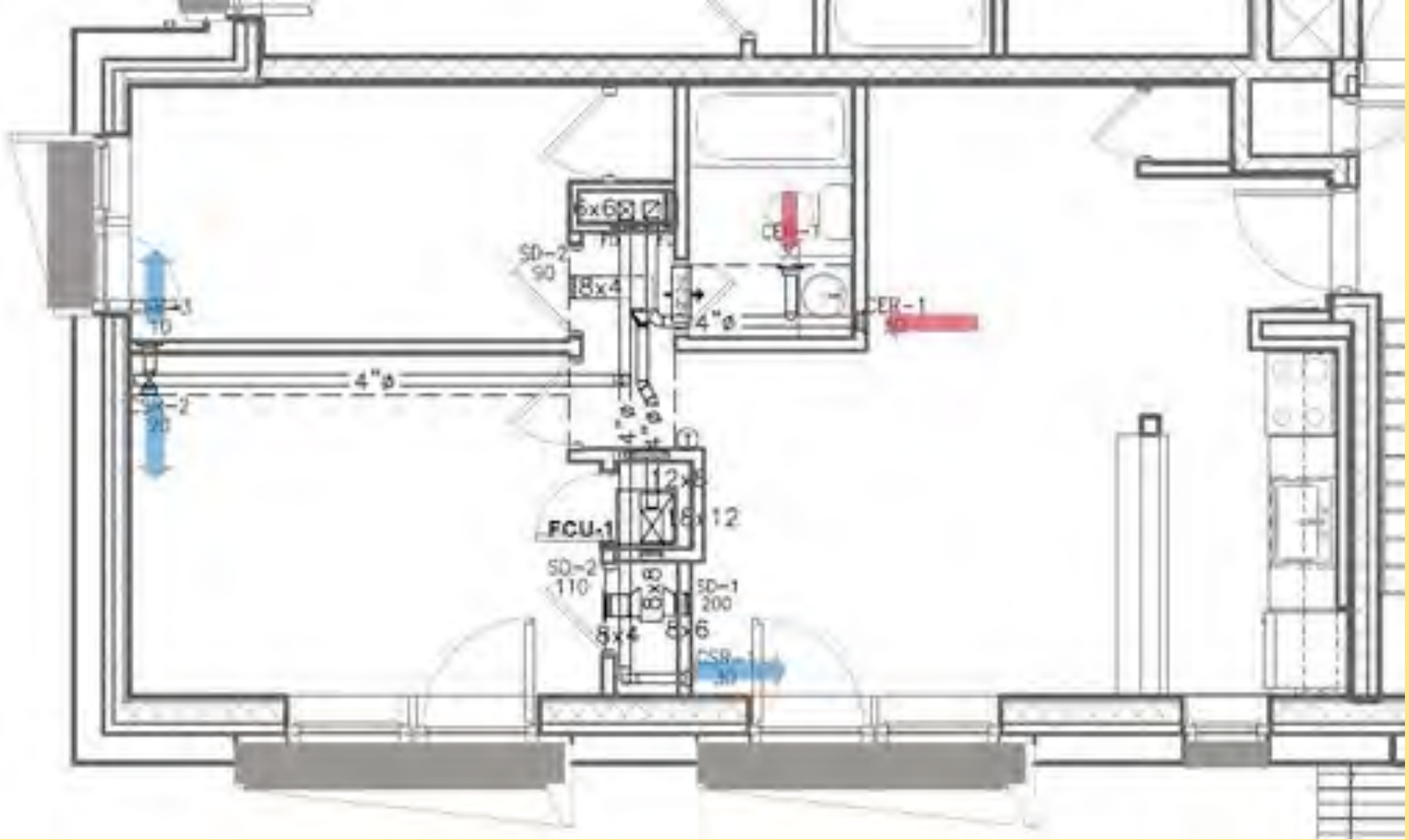


April / August



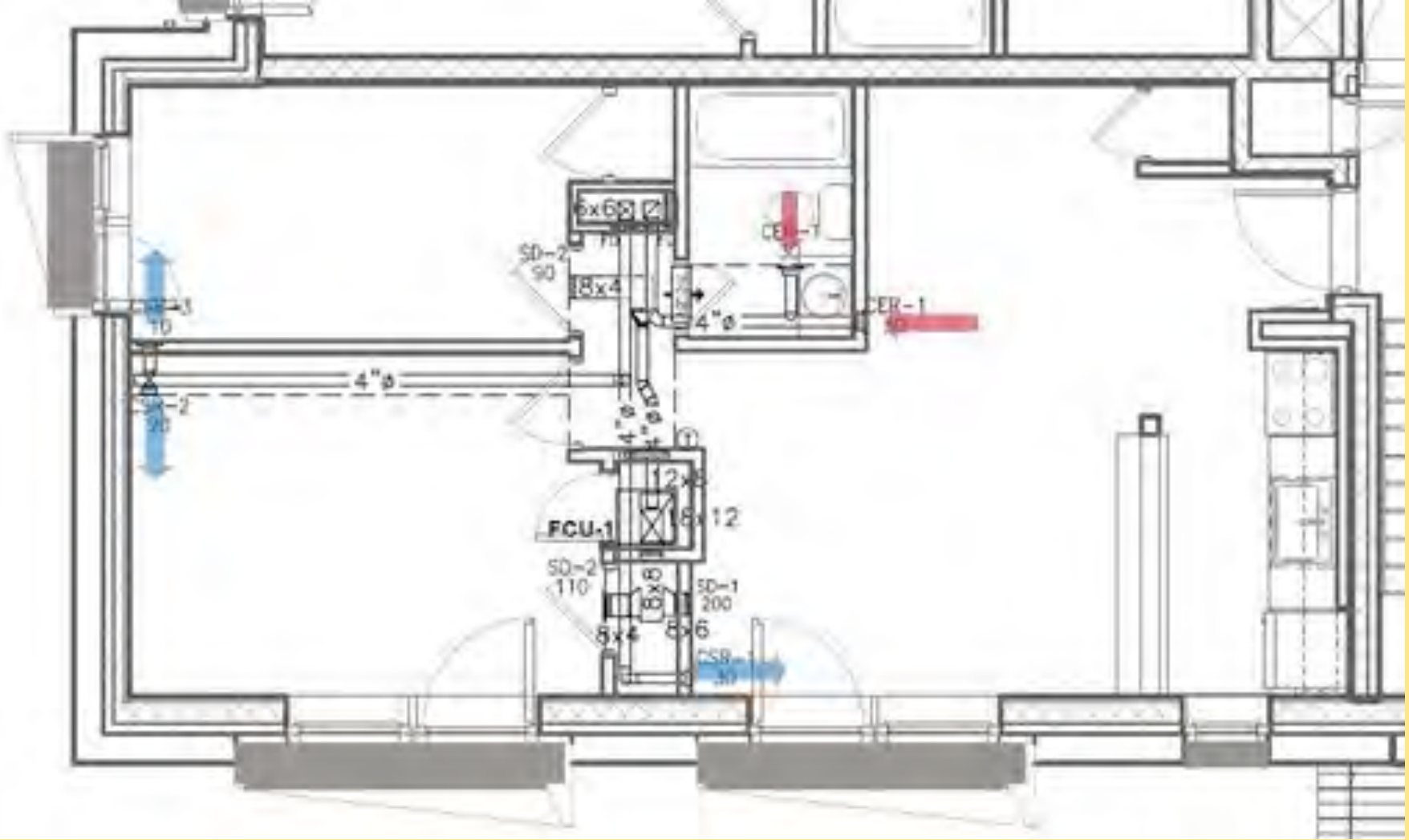
Solar Gain / Hourly - April / August





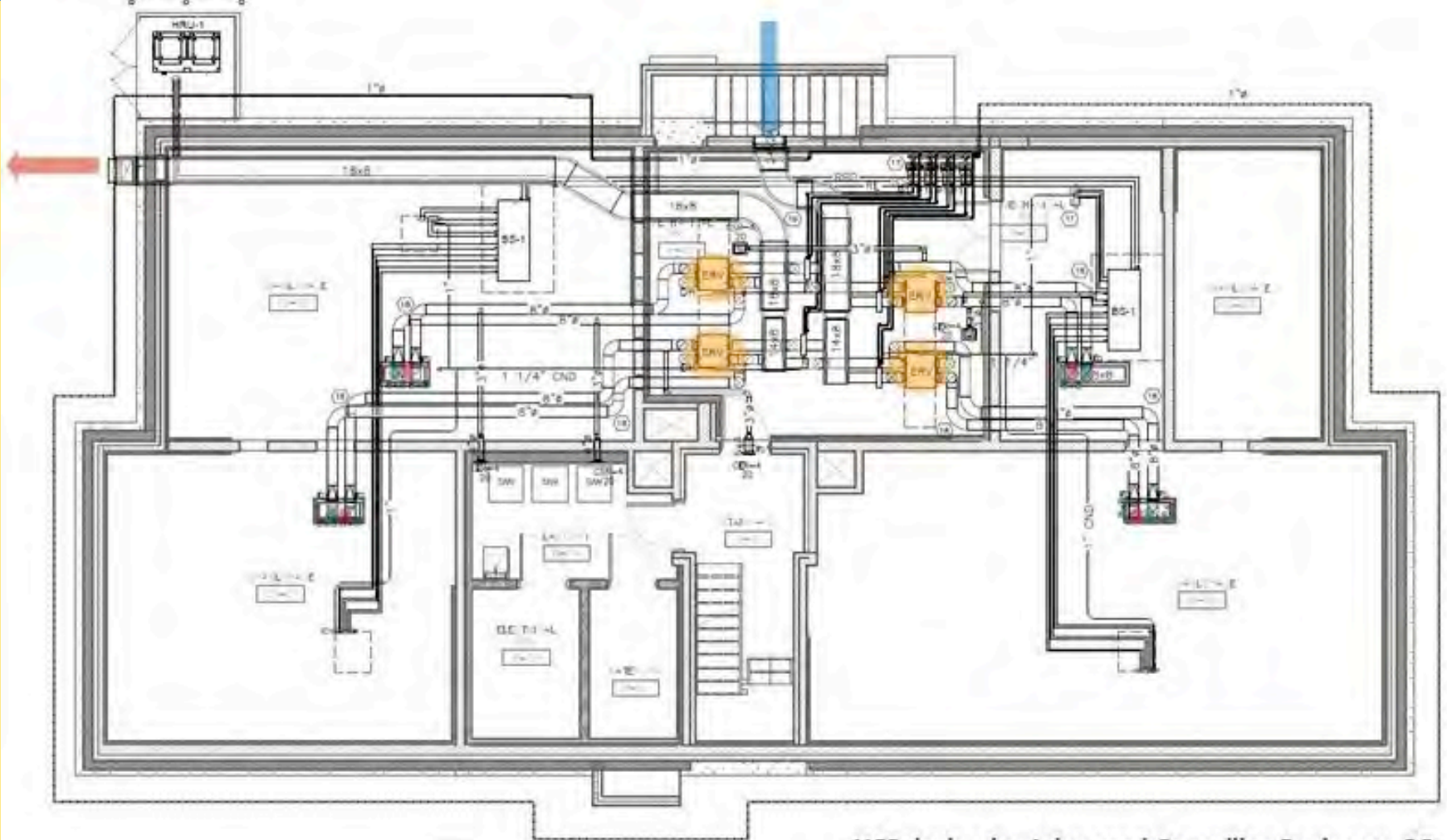
HEATING AND COOLING DESIGN

VRF WITH HEAT EXCHANGE:
EFFECTIVE LOW LOAD OPERATION,



HEATING AND COOLING DESIGN

VRF WITH HEAT EXCHANGE:
DUCTED DISTRIBUTION

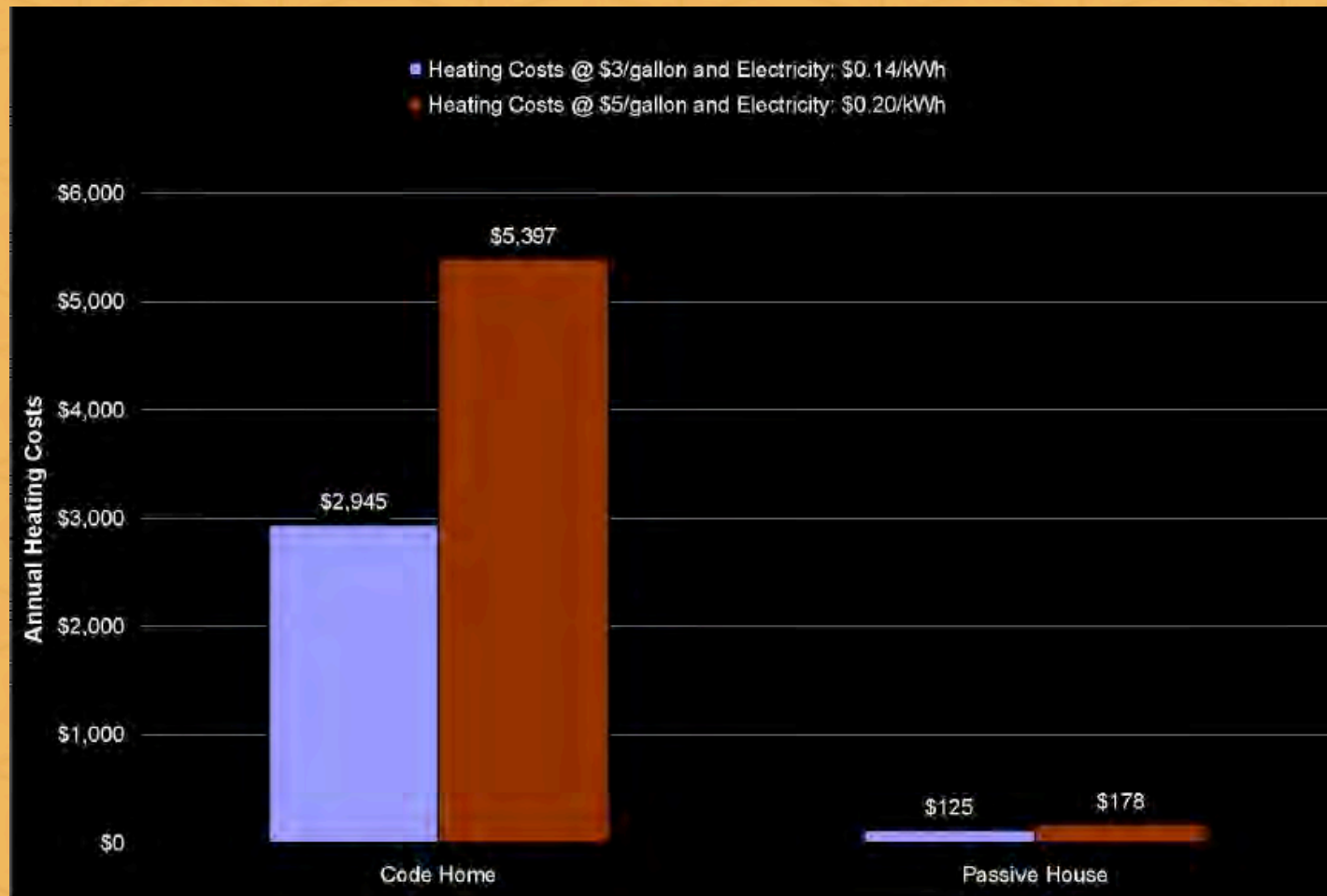


HVAC DESIGN

ERV COMMON VENTILATION & DISTRIBUTION BY QUADRANT

Energy Savings Yield

ECONOMIC STABILITY:



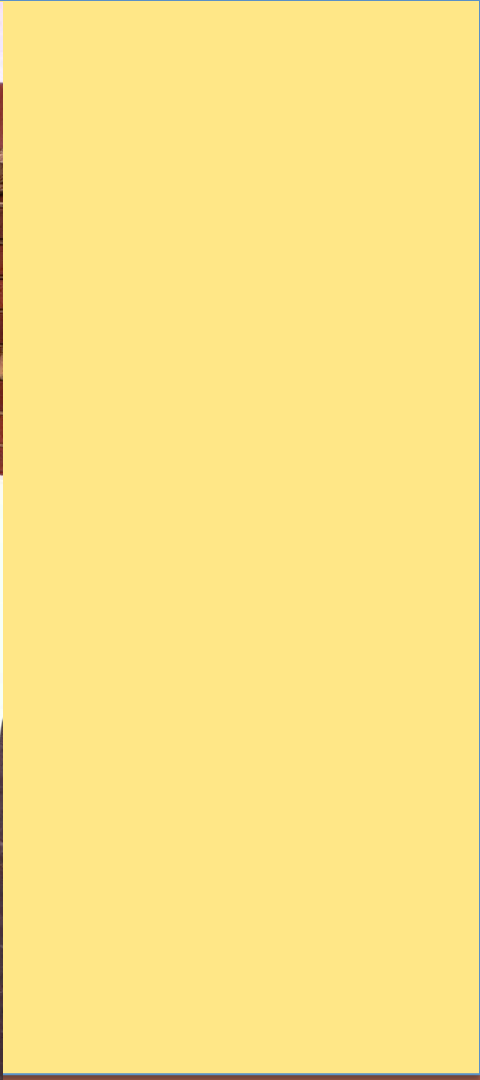
JB Clancy of Albert, Righter, & Tittmann Architects & Peter Schneider of Vermont Energy Investment Corporation, "Getting top Passive House in Vermont"



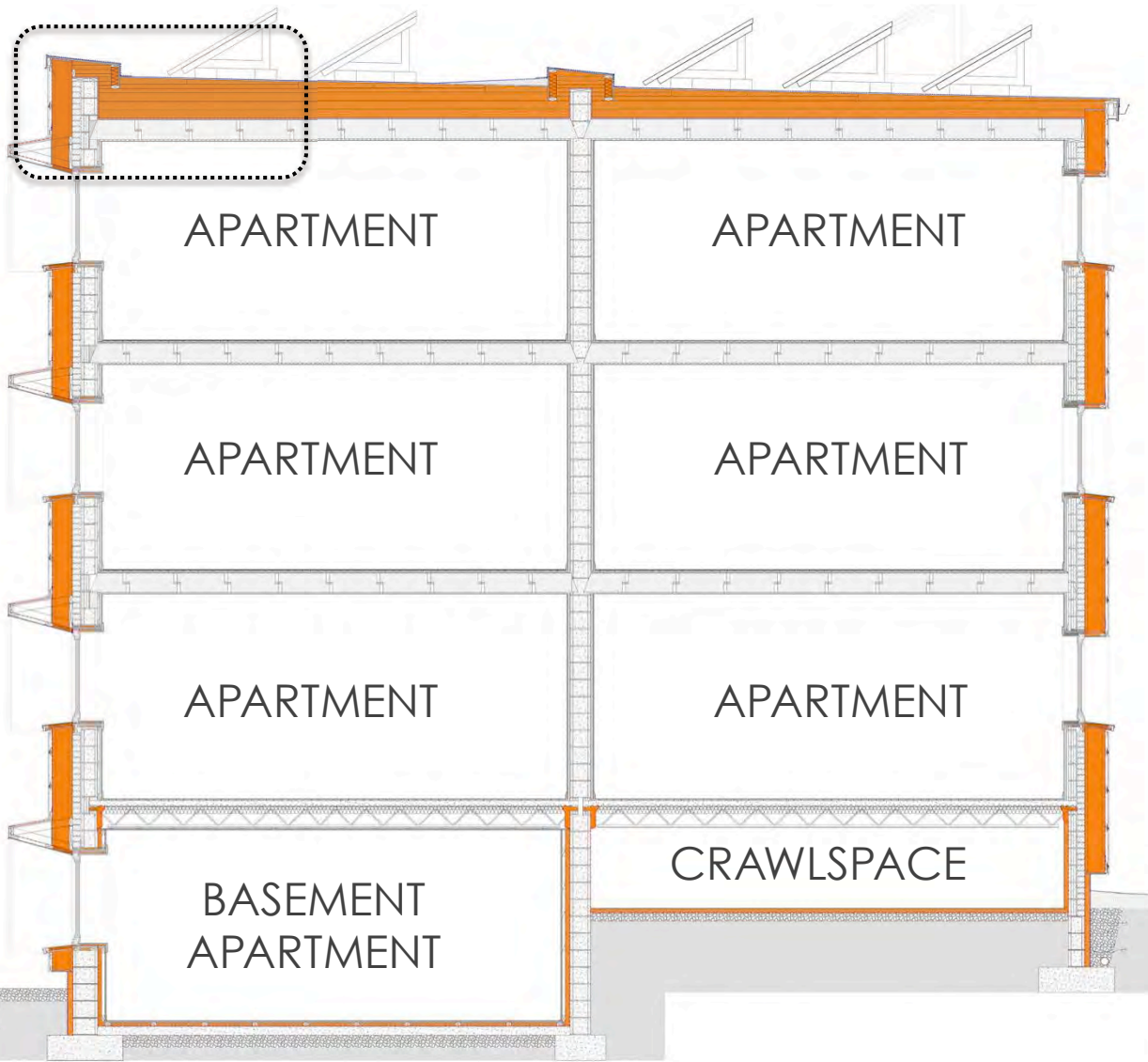
CASE STUDY:
FROM THEORY TO REALITY



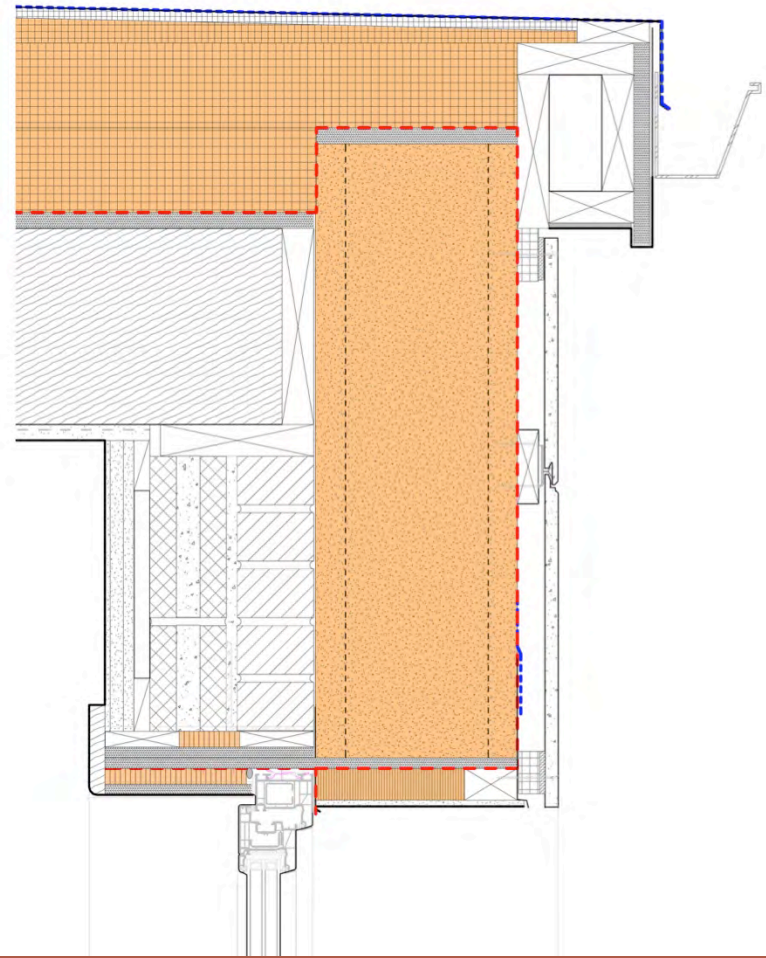
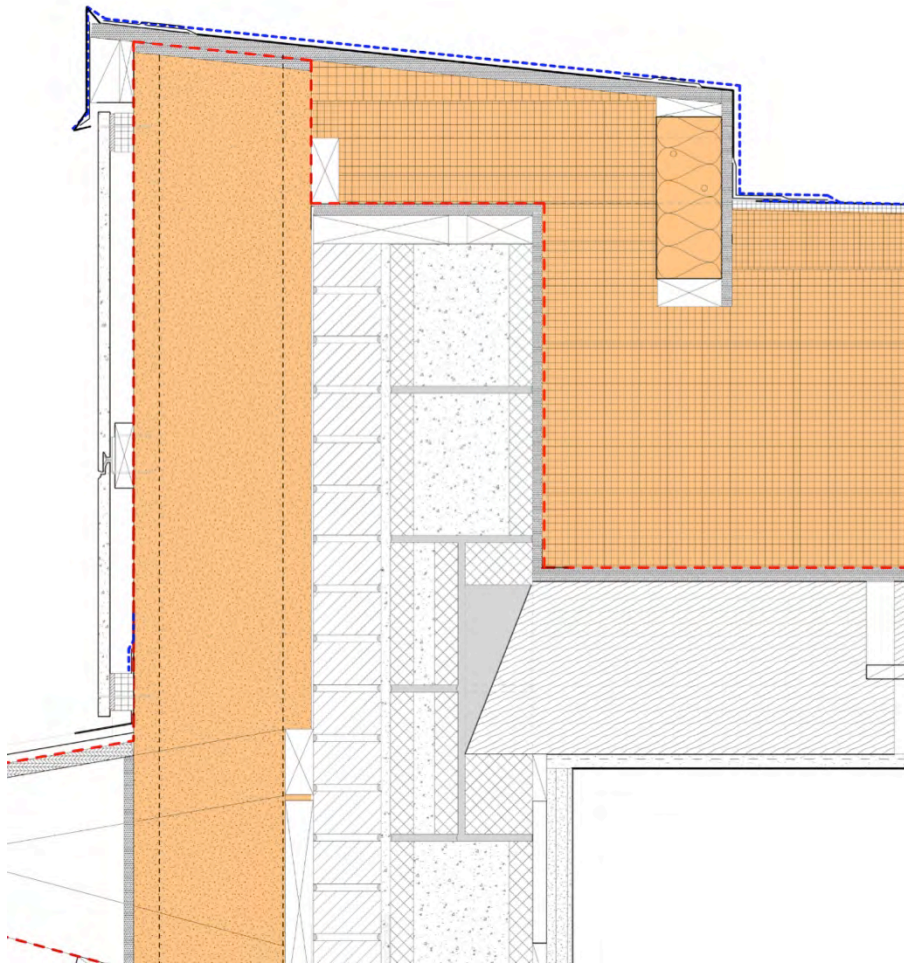
THE HIGH-PERFORMANCE ENCLOSURE



CHALLENGE:
ROOF DETAILS



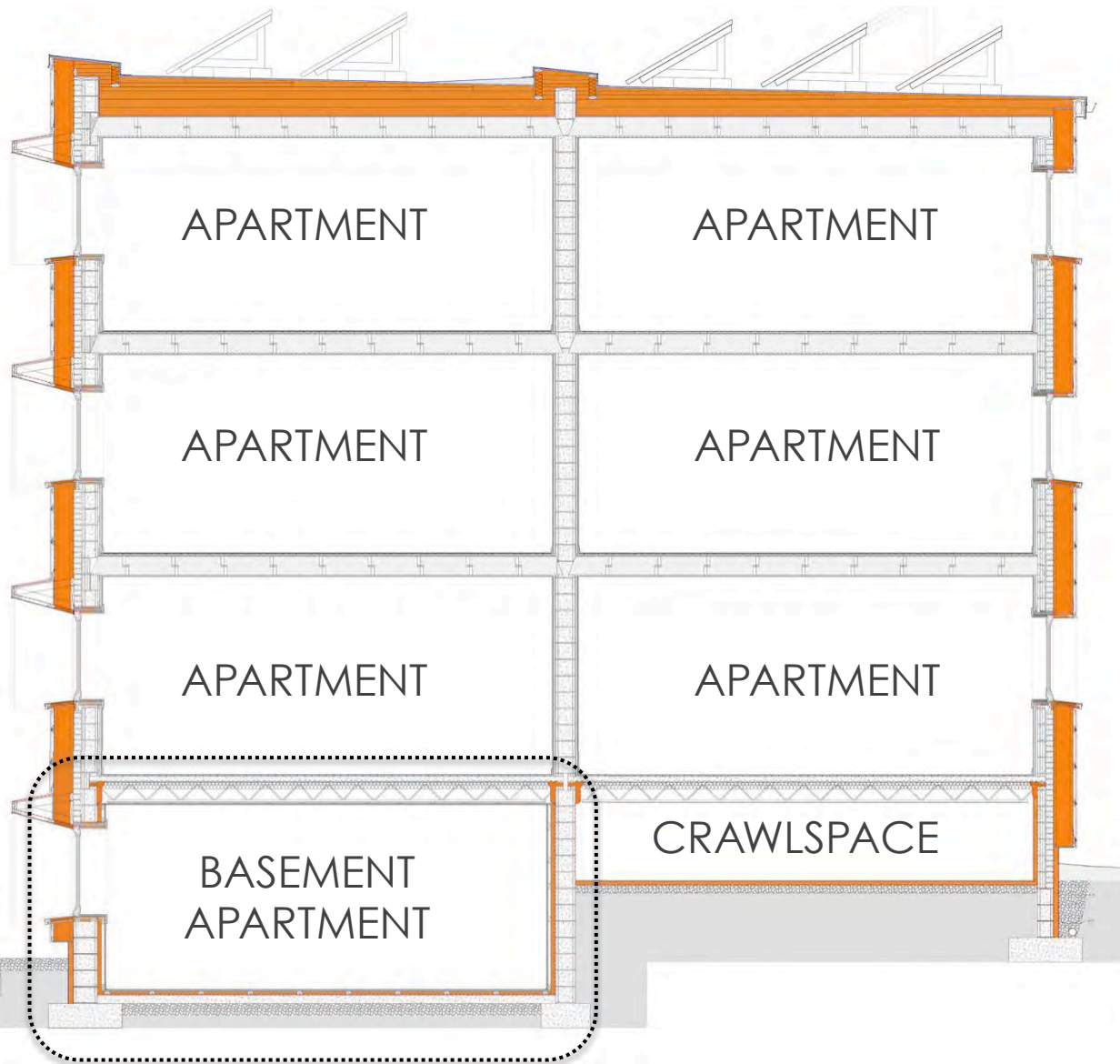
CHALLENGE:
ROOF
TREATMENT



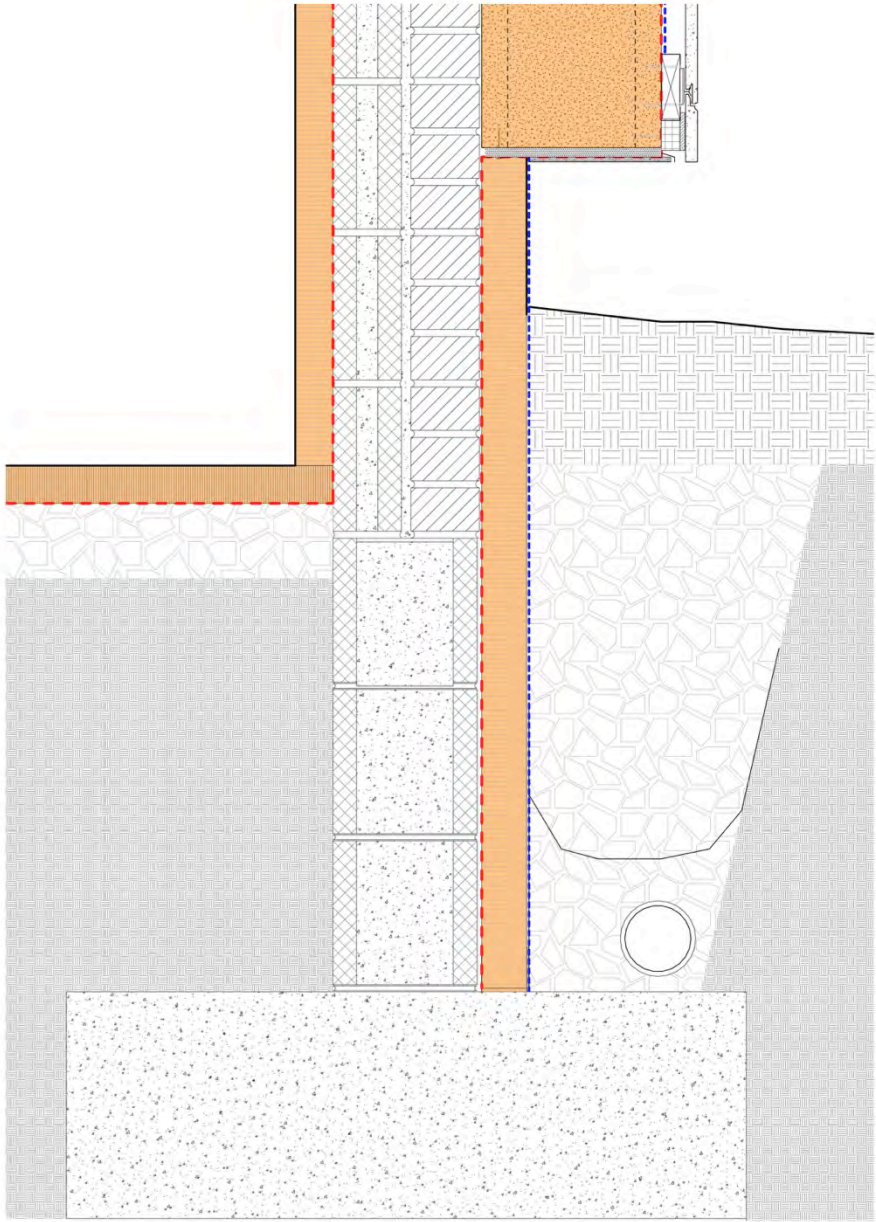
SOLUTION:
LOW-TECH FRAMING & TAPING



**SOLUTION:
KEEP IT SIMPLE –
TAPE AND SHEATHING**



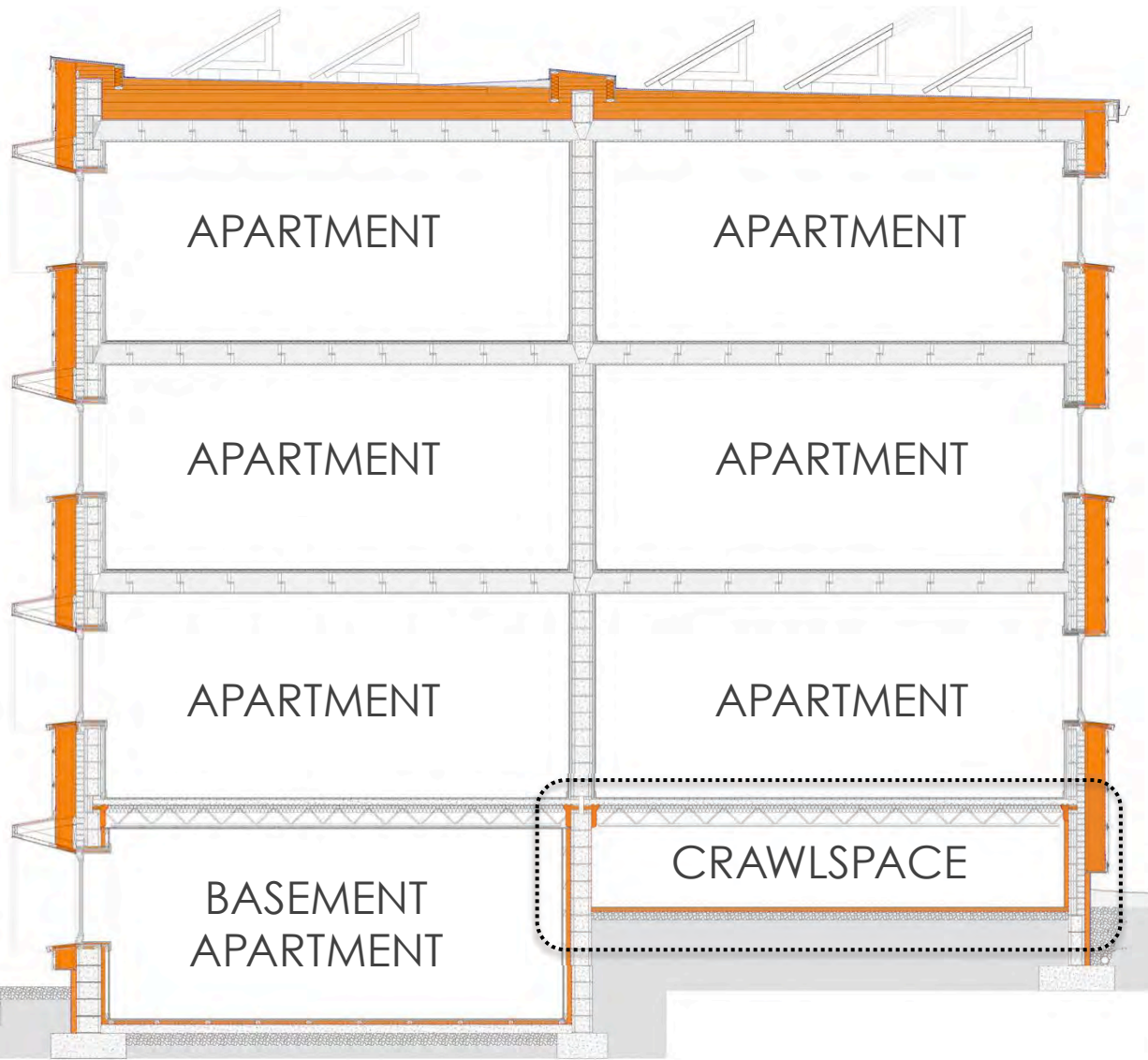
CHALLENGE:
BASEMENT
TREATMENT



SOLUTION:
INCLUDE IN VOLUME



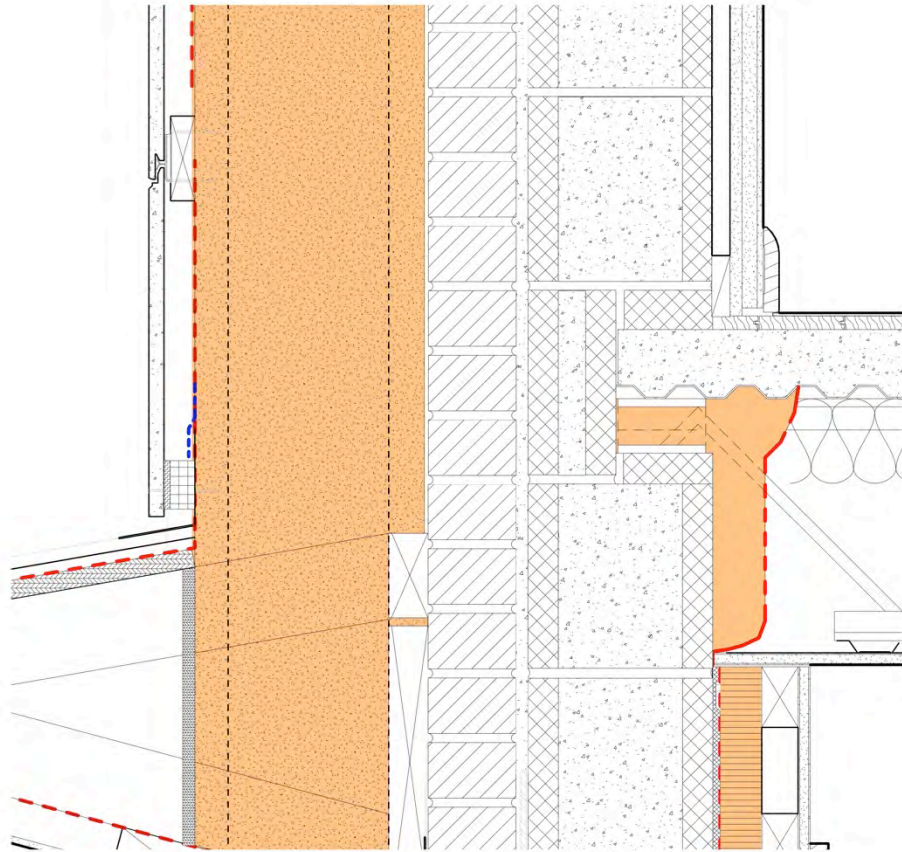
**SOLUTION:
UTILIZE HARDY
CONTROL LAYERS**



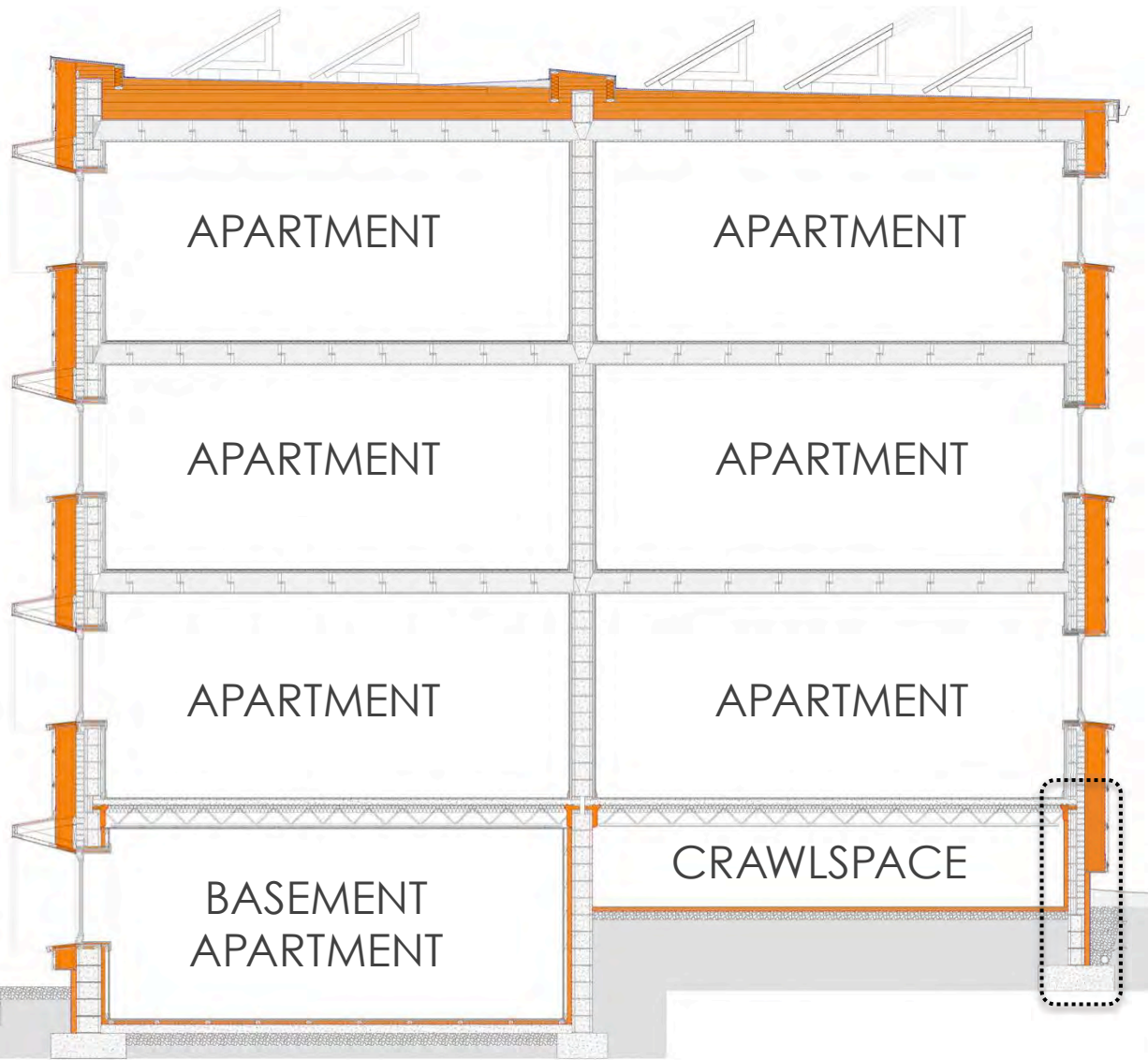
CHALLENGE:
CRAWLSPACE
TREATMENT



SOLUTION:
MINIMIZE RISK



SOLUTION:
BREAK ONE OF
OUR RULES



CHALLENGE:
FOUNDATION
TREATMENT



**FOUNDATION SOLUTION:
OPTIMIZE AND
CAPITALIZE**



CASE STUDY: CONSTRUCTION PROCESS

PRE- CONSTRUCTION MODEL/PROCESS

“Hey, could you give us some cost feedback on assemblies options?”

“Get all your “A-Team” subs in here and we will explain it all before they price it.”

“THAT MINERAL WOOL AND PROSOCO ARE UN-GODLY EXPENSIVE – YOU GOTTA GET THAT OUTTA THERE”

“Why is this an add? I thought you said the mineral wool and Prosoco were ungodly expensive”

ESTIMATING

— HOW DO YOU PRICE SOMETHING NONE OF “YOUR GUYS” EVER HEARD OF??

“PUT IN IN THE DRAWINGS AND I’LL PRICE IT”

“WE’RE GONNA PUT THIS OUT ON THE STREET.”

“Well it is not as robust, but if you are sure it will save us real money we can go with . . .”

“MY GUYS HAVE NEVER DONE THIS– THEY WAY UNDER-BID IT”

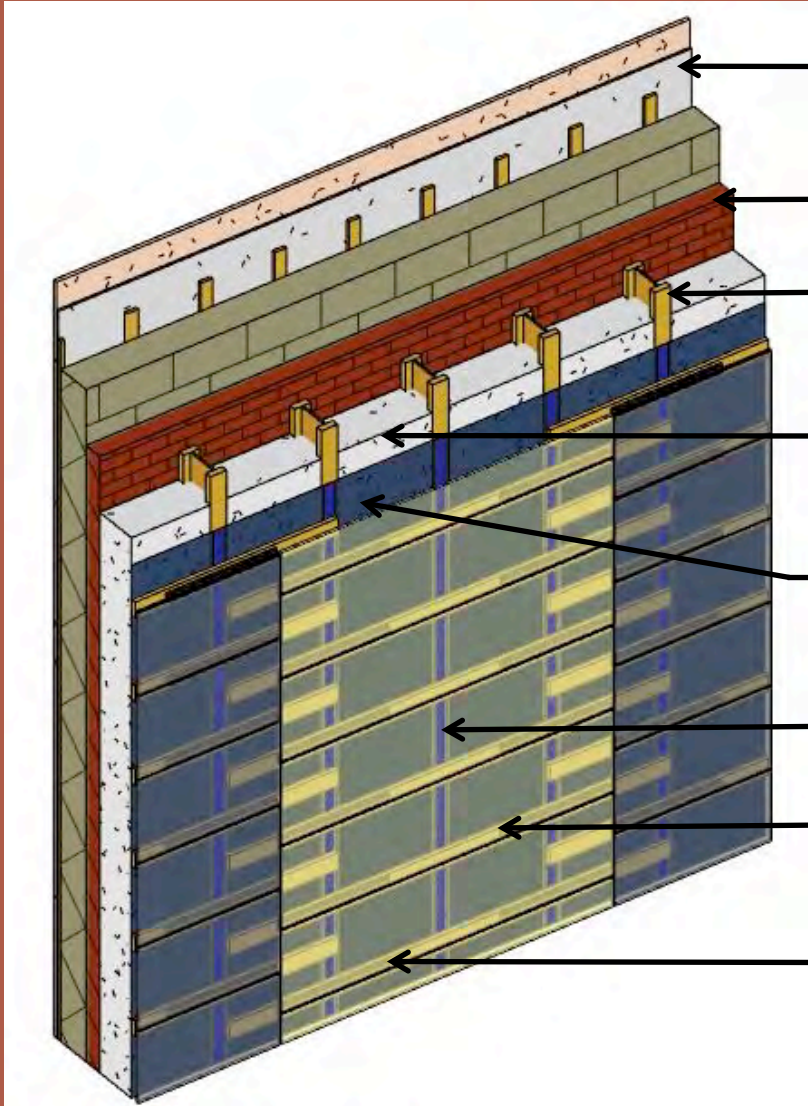
PRE-CONSTRUCTION CHALLENGES

SUBCONTRACTOR BUY-IN



LESS ROBUST AND HARDER TO BUILD

POST "VE" ENCLOSURE



- EXIST. PLASTER OVER GYP. BD. SUBSTRATE & VERT. 1X FURRING
- BRICK & CMU BACK-UP
- 9 1/2" WD. 'I'-JOISTS @ 24" O.C., MECH. ATTACH. @ 36" O.C., STAGGERED
- 2.2 LBS./CU. FT. DENSITY SPRAY-APPLIED FIBERGLASS
- **REINF. WRB SERVES AS AIR-TIGHT LAYER**
- VERT. 2 3/8" W. AIR SEALING TAPE
- HORIZ. 5/4 WD. FURRING @ 18" O.C., STAGGERED
- 5/8" FIBER CEMENT CLADDING ON PROPRIETARY CLIPS

AIR-TIGHTNESS: NOW TO THE EXTERIOR





ALL STRIPPED DOWN



CREATING THE INSULATION CAVITY



**CREATING THE
INSULATION CAVITY**



CREATING THE INSULATION CAVITY



H HAMEL COMMERCIAL
ElkrIDGE, Maryland

CONSTRUCTION
SCHEDULE
2024-2025



THE AIR-TIGHT LAYER SEQUENCE



**DETAILS AS A RESULT OF
“VALUE-ENGINEERING”**



CRAWLSPACE INSULATION AND VAPOR CONTROL SEQUENCE



CRAWLSPACE INSULATION AND VAPOR CONTROL SEQUENCE



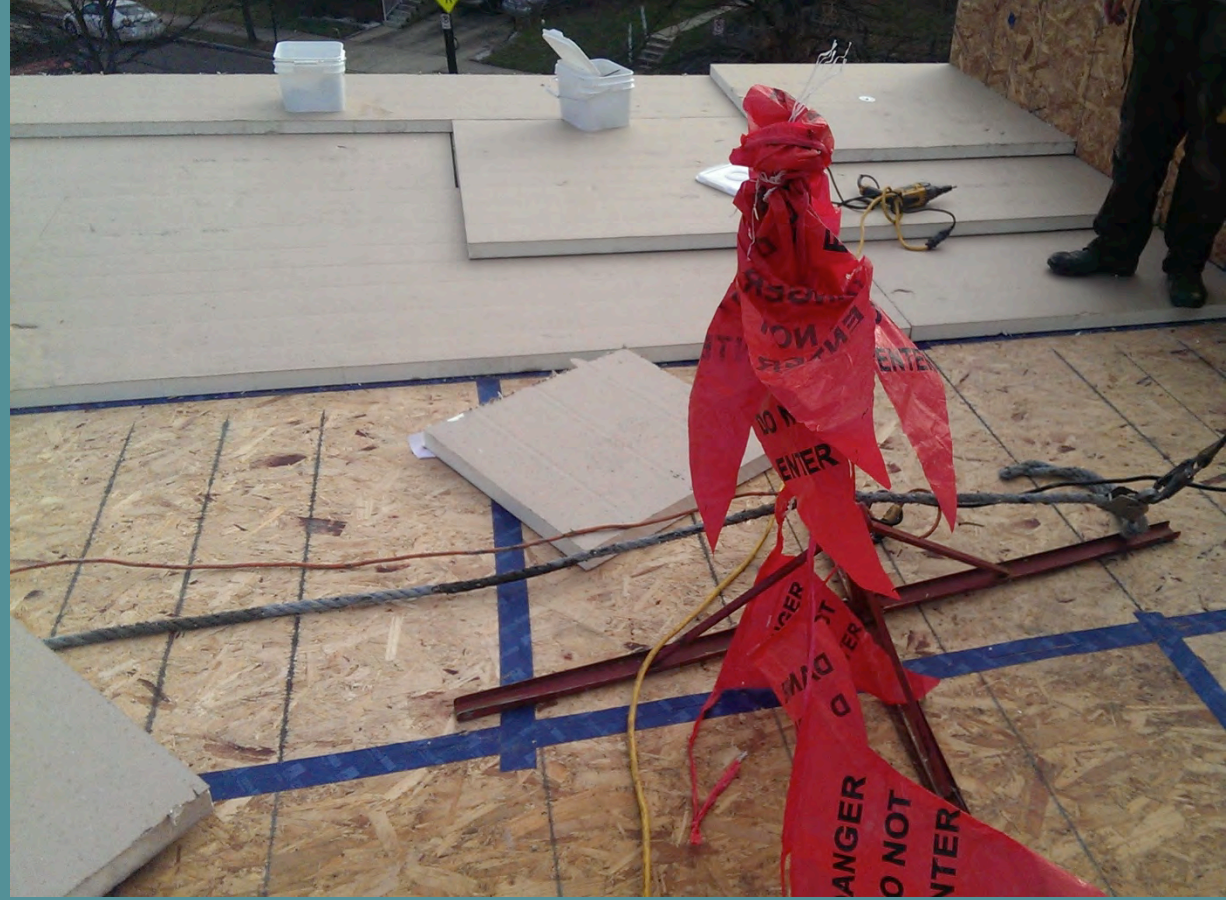
CRAWLSPACE INSULATION AND VAPOR CONTROL SEQUENCE



CRAWLSPACE INSULATION AND VAPOR CONTROL SEQUENCE



THE ROOF RETROFIT: AN AIR SEALING AND SEQUENCING CHALLENGE



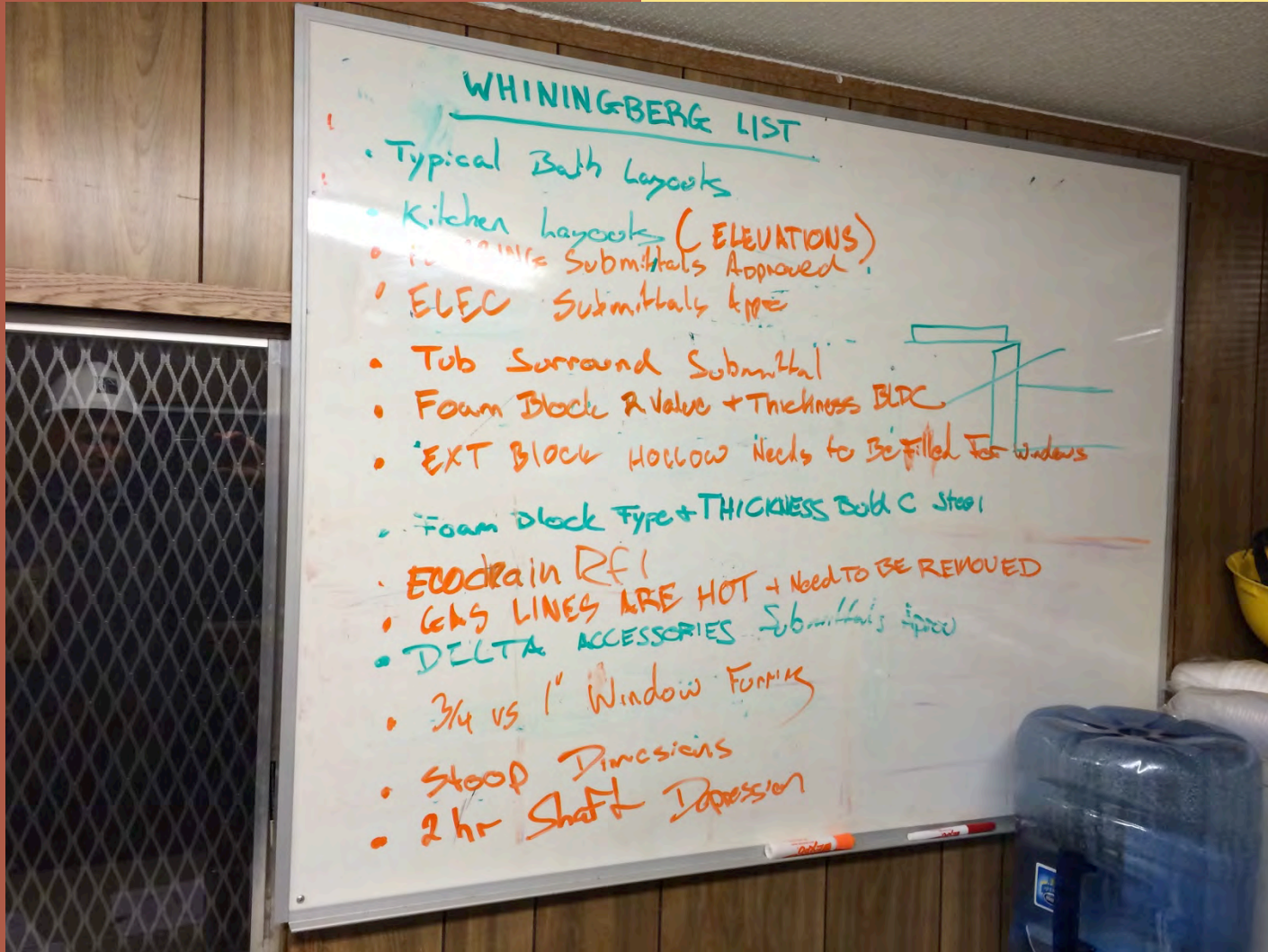
THE ROOF RETROFIT: AN AIR SEALING AND SEQUENCING CHALLENGE



THE ROOF RETROFIT: AN AIR SEALING AND SEQUENCING CHALLENGE

CONSTRUCTION CHALLENGES

COORDINATION INTENSITY



CONSTRUCTION CHALLENGES

SUBSTITUTION REQUESTS



CONSTRUCTION CHALLENGES



INSTALLATION AND CONTRACTOR CONTINUITY



CONSTRUCTION CHALLENGES

INSTALLATION QUALITY



“TRUST, BUT VERIFY” - EVERYTHING

CONSTRUCTION CHALLENGES

TEMPORARY MATERIAL PROTECTION AND SEQUENCE



CONSTRUCTION CHALLENGES

LACK OF SUBCONTRACTOR CONTROL



CONSTRUCTION CHALLENGES

LACK OF SUBCONTRACTOR CONTROL



CONSTRUCTION CHALLENGES

LACK OF SUBCONTRACTOR CONTROL



CONSTRUCTION CHALLENGES

TELL THEM...

PH SEQUENCING & AIR-TIGHT LAYER PROTOCOL

SEQUENCING REQUIREMENTS FOR ACHIEVING PASSIVE HOUSE AIR-TIGHTNESS:

- 1) ALL (5) BUILDINGS FOR THIS PROJECT ARE SUBJECT TO THE PASSIVE HOUSE AIR-TIGHTNESS CRITERIA. IT IS DEFINED AS 0.6 ACH50 Pa. (AIR CHANGES PER HOUR UNDER 50 PASCALS OF PRESSURE).
- 2) THE AIR-TIGHTNESS WILL BE MEASURED VIA WHOLE-BUILDING APPLICATION WITH BLOWER DOOR TESTING BY A CERTIFIED PHUS+ RATER ACCORDING TO PHUS+ GUIDELINES.
- 3) PRIOR TO COMMENCEMENT OF AIR-SEALING WORK, AN (AIR-SEALING-SPECIFIC) PRE-CONSTRUCTION MEETING MUST BE ACCOMPLISHED. THE GENERAL CONTRACTOR, AIR-SEALING/VAPOR CONTROL SYSTEMS CONTRACTOR(S), ARCHITECT, BUILDING SCIENCE CONSULTANT, AND THE OWNER/OWNER'S REPRESENTATIVE MUST BE IN ATTENDANCE.
- 4) PRIOR TO COMMENCEMENT OF WINDOW INSTALLATION WORK, A (WINDOW-SPECIFIC) PRE-CONSTRUCTION MEETING MUST BE ACCOMPLISHED. THE GENERAL CONTRACTOR, WINDOW AND DOOR CONTRACTOR(S), AIR-SEALING CONTRACTOR(S), ARCHITECT, BUILDING SCIENCE CONSULTANT, AND THE OWNER/OWNER'S REPRESENTATIVE MUST BE IN ATTENDANCE.
- 5) THE AIR-TIGHT LAYER INDICATED THROUGHOUT THE SET OF CONTRACT DOCUMENTS IS REPRESENTED BY A THICK RED, DASHED LINE. GENERALLY, FOR THE SUPERSTRUCTURE, THIS LAYER IS TO BE AT THE EXTERIOR FACE OF EXISTING BUILDING SHELL (MASONRY). THIS LAYER ALSO PERFORMS AS THE SECONDARY DRAINAGE PLANE TO THE ASSEMBLY. APPLICATION SPECIFICATIONS OF THE AIR AND MOISTURE BARRIER MUST BE STRICTLY ADHERED. REFER TO A-SPEC, SERIES SHTS., THIS SET. FOR THE ROOF, THE EXTERIOR SIDE (TOP) OF ROOF SHEATHING IS THE AIR-TIGHT LAYER. REFER TO APPLICABLE DETAILS FOR MORE SPECIFICS.
- 6) GENERALLY FOR SUB-GRADE CONDITIONS, THE AIR-TIGHT LAYER IS TO BE ON THE INTERIOR FACE OF EXISTING BUILDING SHELL AND THE TOP SIDE OF EXISTING BASEMENT/CRAWLSPACE FLOORS. REFER TO APPLICABLE DETAILS FOR MORE SPECIFICS.
- 7) ALL PENETRATIONS, FASTENINGS THROUGH, AND ATTACHMENTS TO MUST BE PERFORMED WITH EXTREME CARE AND ARE SUBJECT TO FIELD INSPECTION BY THE ARCHITECT, AND BUILDING SCIENCE CONSULTANT AT ANY TIME AND PRIOR TO COVERING OVER. SCHEDULING OF ALL COVERING INSTALLATIONS MUST BE GIVEN TO INSPECTING ENTITIES WITH 24 HRS. ADVANCE NOTICE.
- 8) A QUALIFYING AIR-TIGHTNESS TEST MUST BE ACHIEVED AFTER THE INSTALLATION OF ALL WINDOWS AND DOORS AND AFTER APPLICATION OF THE FLUID-APPLIED AIR AND MOISTURE BARRIER, AND PRIOR TO THE APPLICATION OF ALL EXTERIOR BUILDING FACE-MOUNTED FABRICATIONS, COMPONENTS, MATERIALS AND EQUIPMENT. THIS TEST MUST COINCIDE WITH AIR SEALING OF THE ROOF SHEATHING, PRIOR TO INSTALLATION OF ROOF INSULATION AND THE BALANCE OF THE ROOFING SYSTEM. THIS TEST MAY COINCIDE WITH AIR-TIGHTNESS TESTS ITEMIZED BELOW.
- 9) THE ROOF SHEATHING AND AIR SEALING JUNCTIONS (TAPED JOINTS, PARAPET AND EAVE CONNECTIONS, ETC.), MUST BE TEMPORARILY PROTECTED FROM CLIMATIC TEMPERATURE EXTREMES, WEATHER, WATER, AND MOISTURE UNTIL THE FINAL APPLICATION OF THE INSULATING LAYER(S) IS COMPLETE.
- 10) A QUALIFYING AIR-TIGHTNESS TEST MUST BE ACHIEVED AFTER THE COMPLETE INSTALLATION OF THE VAPOR AND AIR BARRIER LAYER (INCLUDING PERIMETER TERMINATIONS, SEAM CONNECTIONS, AND MATERIAL TRANSITIONS, ETC.), IN THE BASEMENT AND CRAWLSPACES. THIS TEST MUST COINCIDE WITH AIR-TIGHTNESS TEST ITEM 8) ABOVE.
- 11) AN ADDITIONAL, QUALIFYING AIR-TIGHTNESS TEST MUST BE ACHIEVED AFTER THE APPLICATION OF THE VERTICAL 1"-JOIST SYSTEM PROPOSED TO HOLD THE EXTERIOR INSULATION PANELS AND CLADDING SYSTEM, AND PRIOR TO THE APPLICATION OF EXTERIOR INSULATION.
- 12) PRIOR TO THE INSTALLATION OF THE VAPOR AND AIR BARRIER LAYER AND INSULATION IN THE CRAWLSPACES, ALL MECHANICAL, ELECTRICAL, AND PLUMBING ROUGH-IN WORK TO BE COMPLETE THESE SPACES.
- 13) IN THE CIRCUMSTANCE THAT ROUGH-IN WORK IN THE CRAWLSPACE IS NOT FEASIBLY PHASED AS OUTLINED IN ITEM 12) ABOVE OR THERE IS A SUBSEQUENT CHANGE TO THE SCOPE OF WORK, INSULATION AND AIR-TIGHT LAYERS MUST BE FULLY PROTECTED TO PREVENT PUNCTURE, COMPRESSION, OR DISINTEGRATION. THE CONTRACTOR IS RESPONSIBLE TO SUBMIT A PROTECTION PLAN PRIOR TO COMMENCING SUCH "OUT-OF-PHASE" WORK. THE PROTECTION PLAN IS SUBJECT TO REVIEW AND ACCEPTANCE BY THE ARCHITECT, BUILDING SCIENCE CONSULTANT, AND OWNER/OWNER'S REPRESENTATIVE WITH ADEQUATE/TYPICAL TIME ALLOWED FOR SUBMITTAL REVIEW PER CONTRACT.

CONSTRUCTION CHALLENGES

**...TELL THEM YOU
TOLD THEM...**



CONSTRUCTION CHALLENGES

...TELL THEM AGAIN.



CONSTRUCTION CHALLENGES

MOCK-UP



CONSTRUCTION CHALLENGES

MOCK-UP



FIELD CONDITION CHALLENGES

MOCK-UP



FIELD CONDITION CHALLENGES

MOCK-UP



CONSTRUCTION CHALLENGES

AHH....
ASSIMILATION



CHALLENGES WITH BUILDING

MOLD...



UNFORESEEN, INHERENT CHALLENGES, BULK WATER, CAPILLARY ACTION



CHALLENGES WITH BUILDING

...CAPILLARY...



CHALLENGES WITH BUILDING

...AND HYDROSTATIC
MOISTURE...



CHALLENGES WITH BUILDING

...AND BULK WATER.





INTERIOR ENVIRONMENT: QUALITY OF NATURAL LIGHT



**INTERIOR ENVIRONMENT:
QUALITY OF NATURAL LIGHT**



**INTERIOR ENVIRONMENT:
AVOID “TUNNEL VISION”**



...AND OPTIMIZED SOLAR GAIN.



HARRY AND JEANETTE WEINBERG COMMONS



THANK YOU



QUESTIONS?