BE16 : REVITALIZING MASONRY MULTIFAMILY

WEINBERG COMMONS

ZA+D, LLC

BRUCE ZAVOS, AIA

MATT FINE, CPHC®, LEED AP®

- *SENIOR PROJECT MANAGER*

PASSIVE TO POSITIVE

MICHAEL HINDLE, CPHC®, CPHB®, HERS

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

HAMEL BUILDERS

PHIL GIBBS, PRESIDENT

TERESA HAMM, CPHC®, CPHB®, HERS

- *PROJECT MANAGER*

THC, AFFORDABLE HOUSING

PHIL HECHT, CEO

BLAISE RASTELLO

- *DIRECTOR OF AFFORDABLE HOUSING*

ART CREDIT:
A FRIEND IN NEED - C.M.COOLIDGE

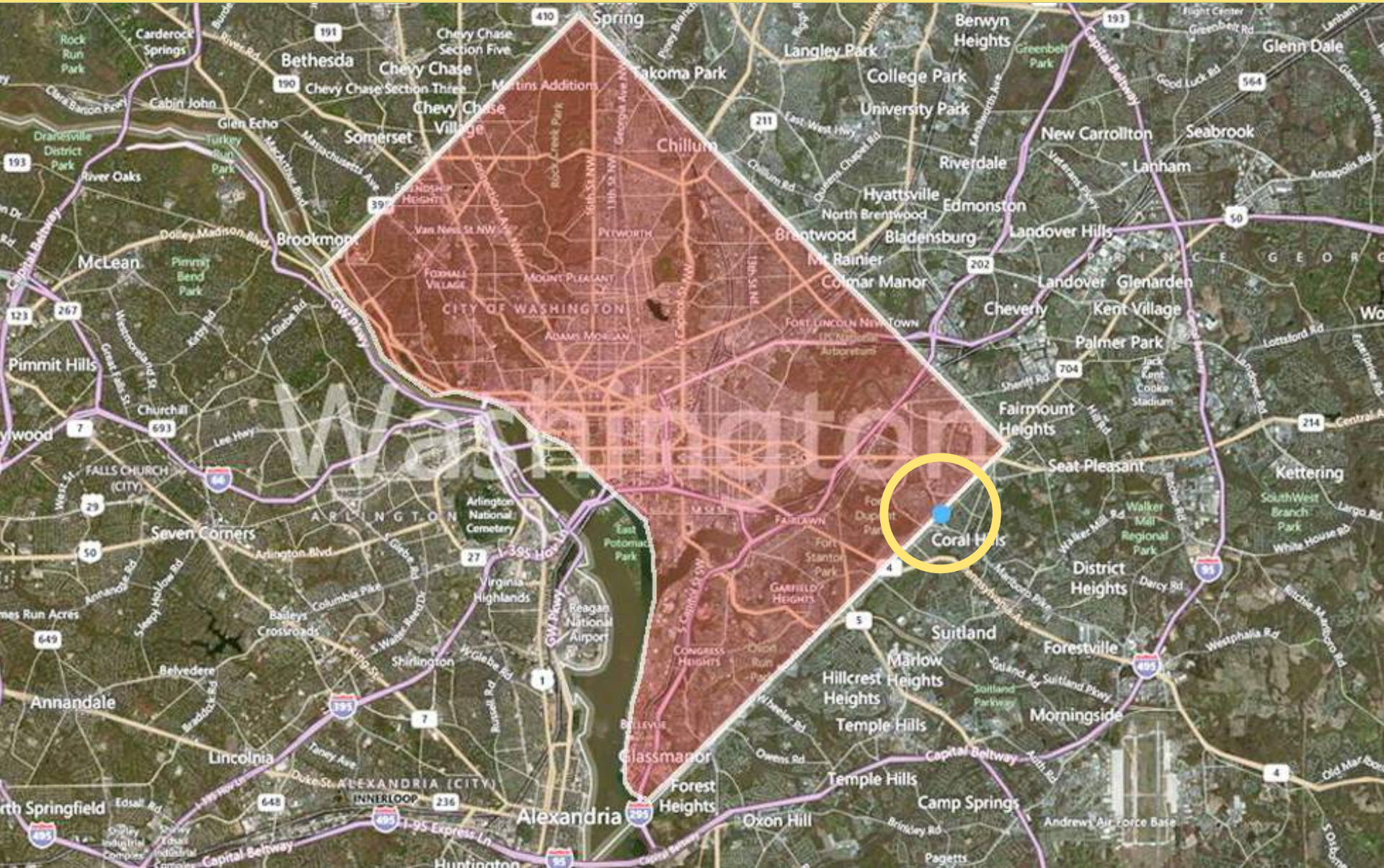
THC Housing Families, Transforming Lives

ZA+D

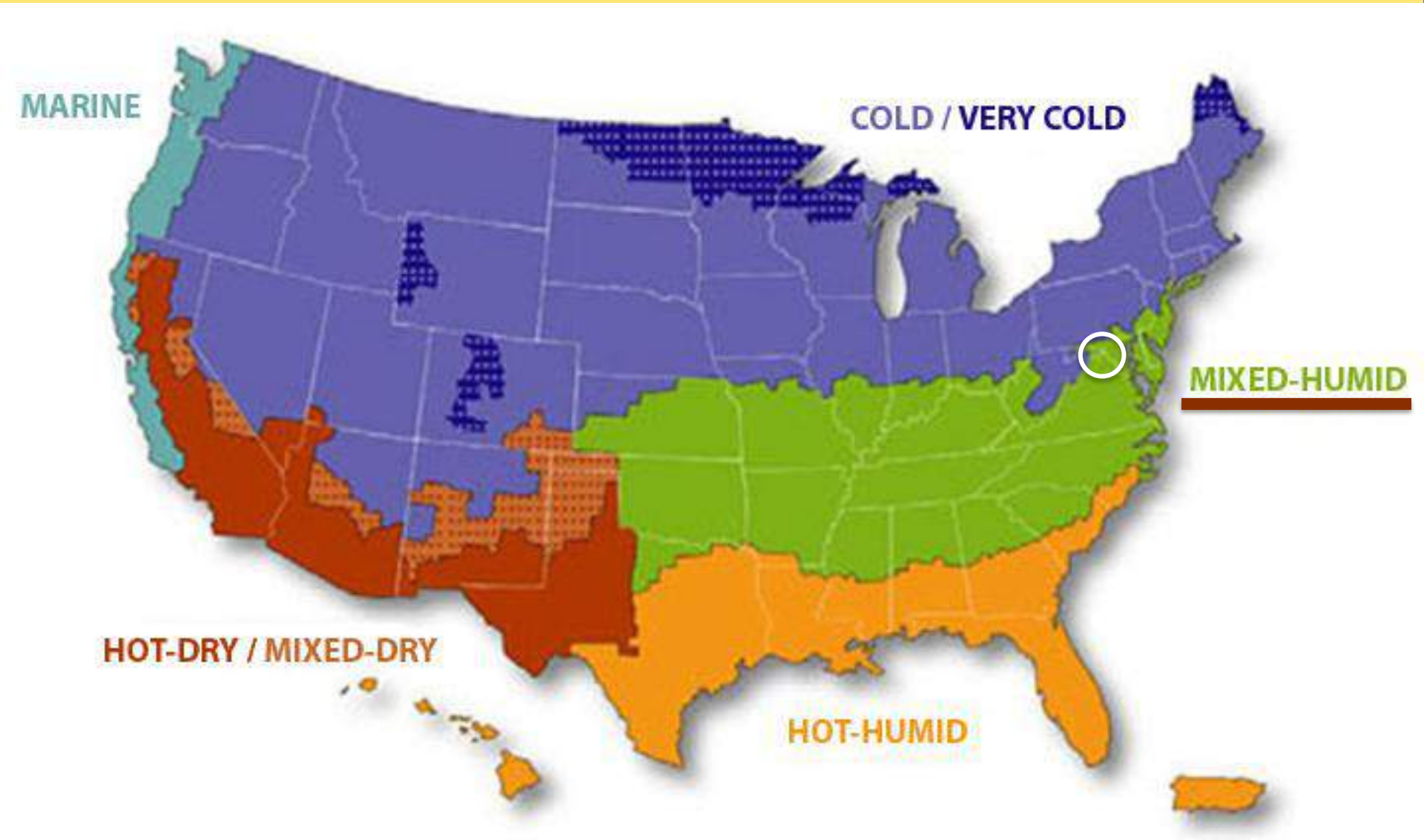
HAMEL BUILDERS

Passive to POSITIVE
PASSIVE HOUSE AND LOW IMPACT DESIGN

SITE LOCATION



CLIMATE

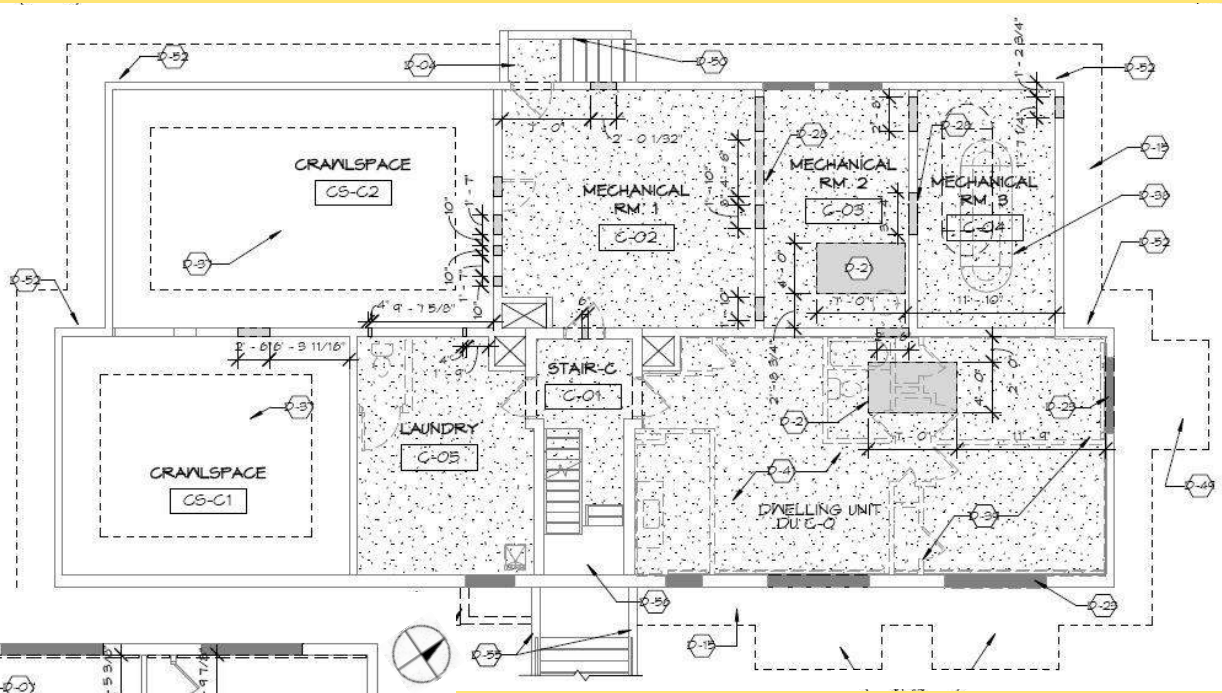


SOURCE: TBOAKE.COM

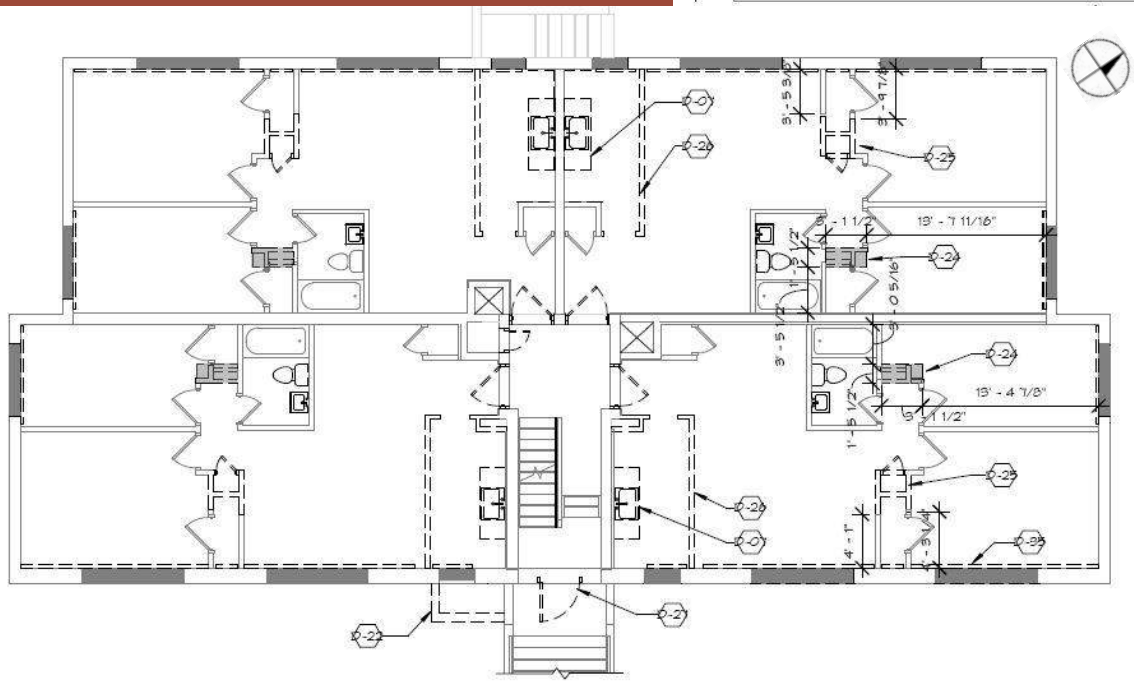
PROJECT BACKGROUND

- (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

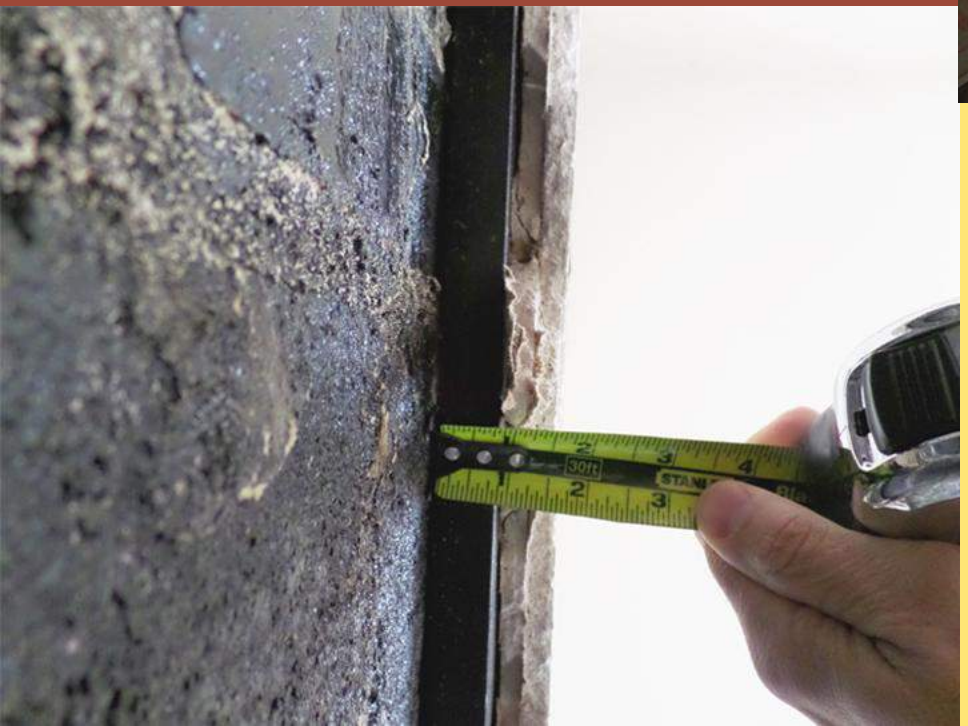
- (3) BLDGS. / 36 (2) BR UNITS
- 675 NRSF EA.
- PARTIAL BASEMENT / CRAWL SPACE
- (3) STORIES

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!!

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

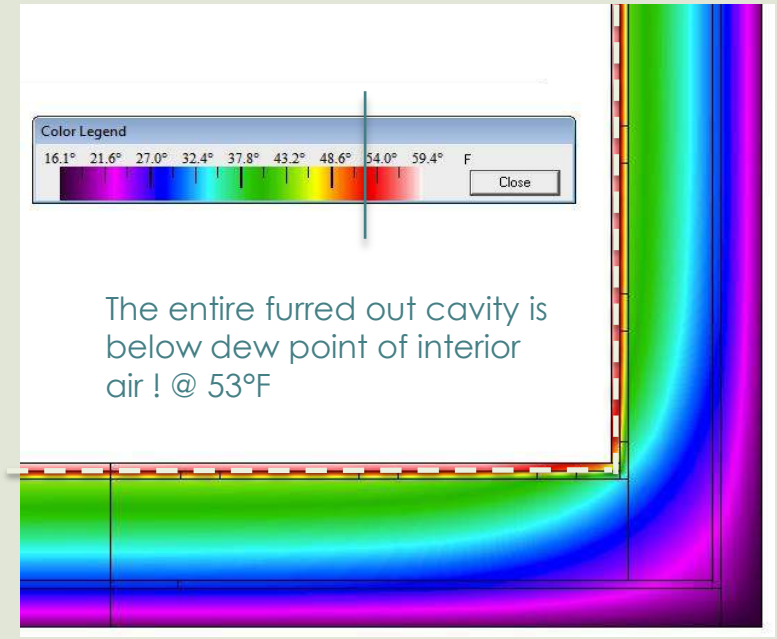
AN ORDINARY RENOVATION?

REPAIR-UPGRADE FINISHES, MINIMAL IF ANY INSULATION

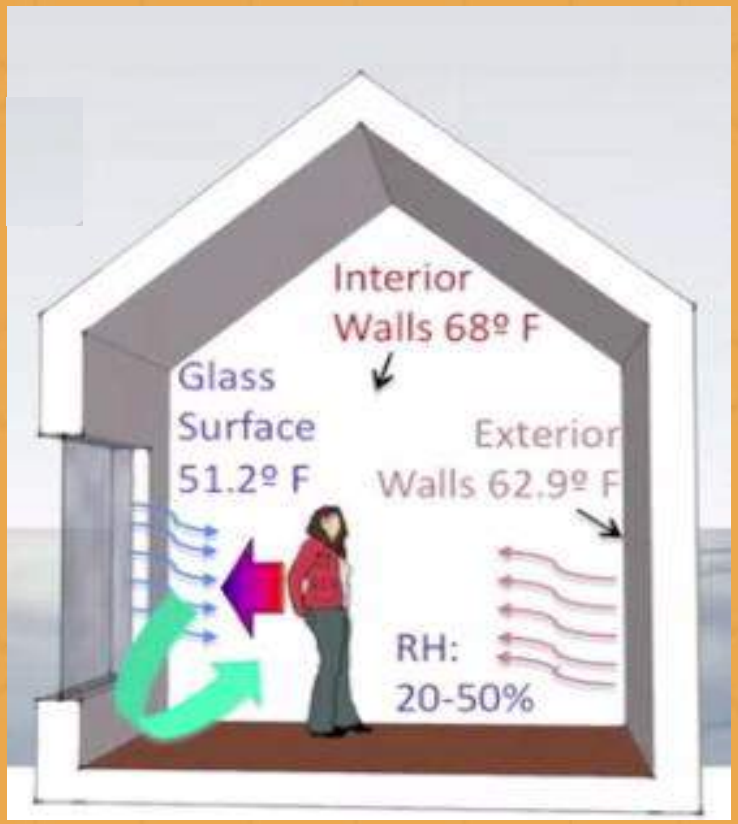
NO MANAGEMENT OF CONDENSATION PLANE TEMPERATURES –

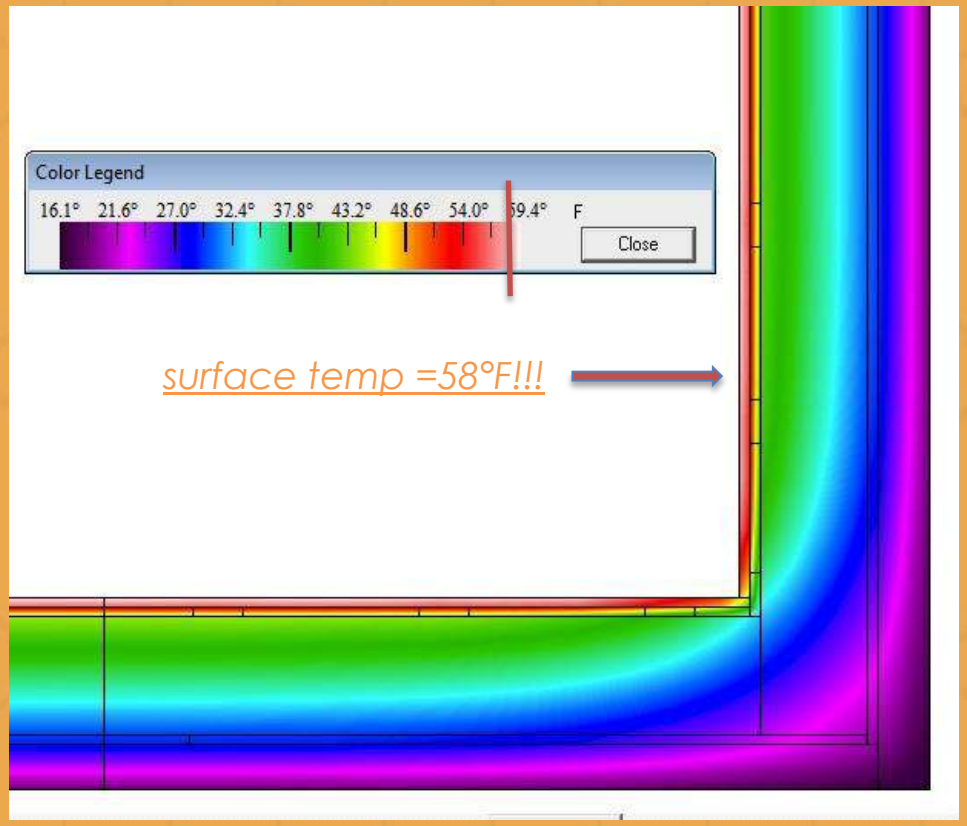
MOLD GROWTH STILL ASSURED!!

Dew point of interior air = @ 52.5°F



The entire furred out cavity is below dew point of interior air ! @ 53°F





UNINSULATED MASONRY?

COMFORT FACTORS?

Air temp

RH

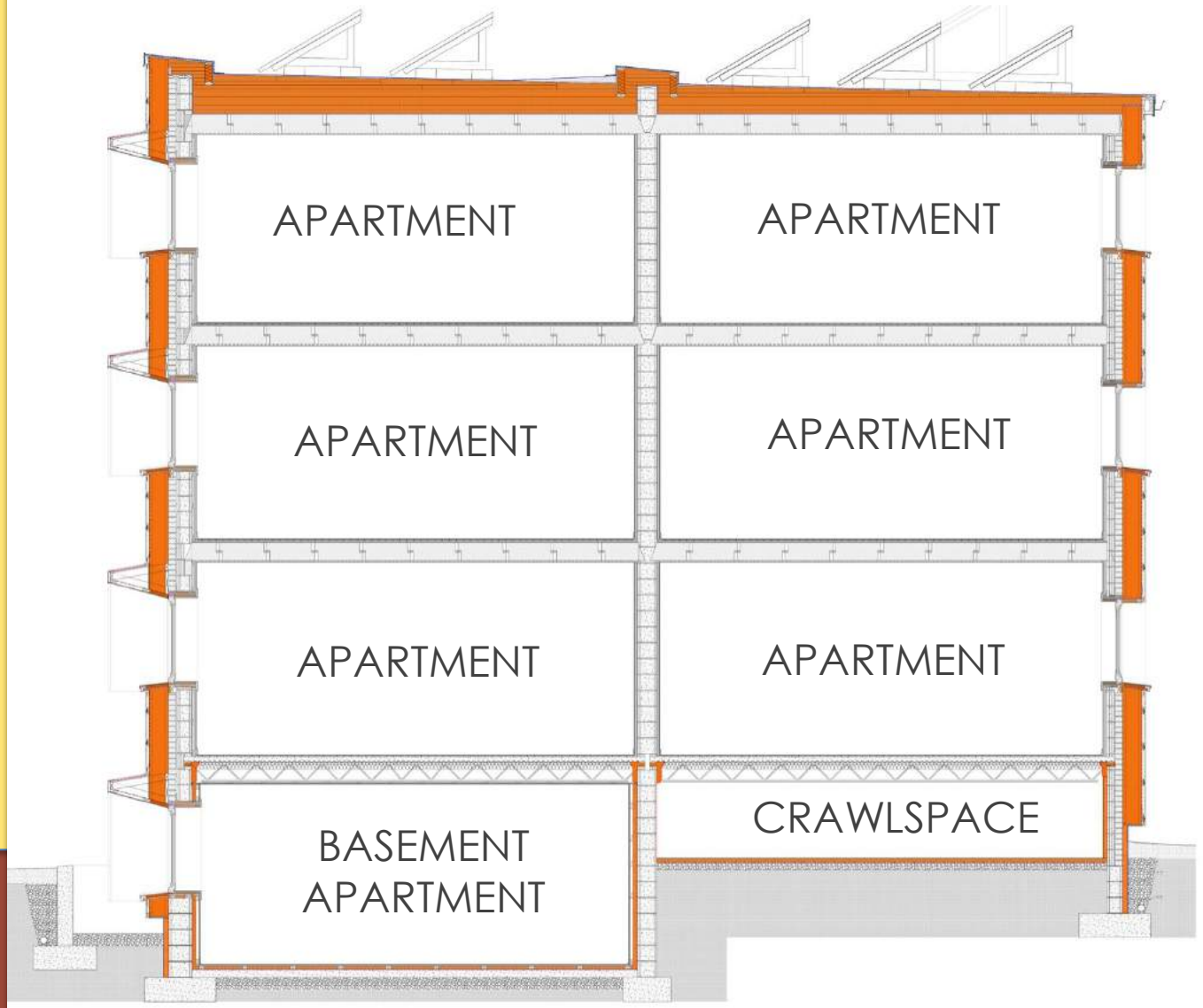
Air velocity

Mean radiant surface temps

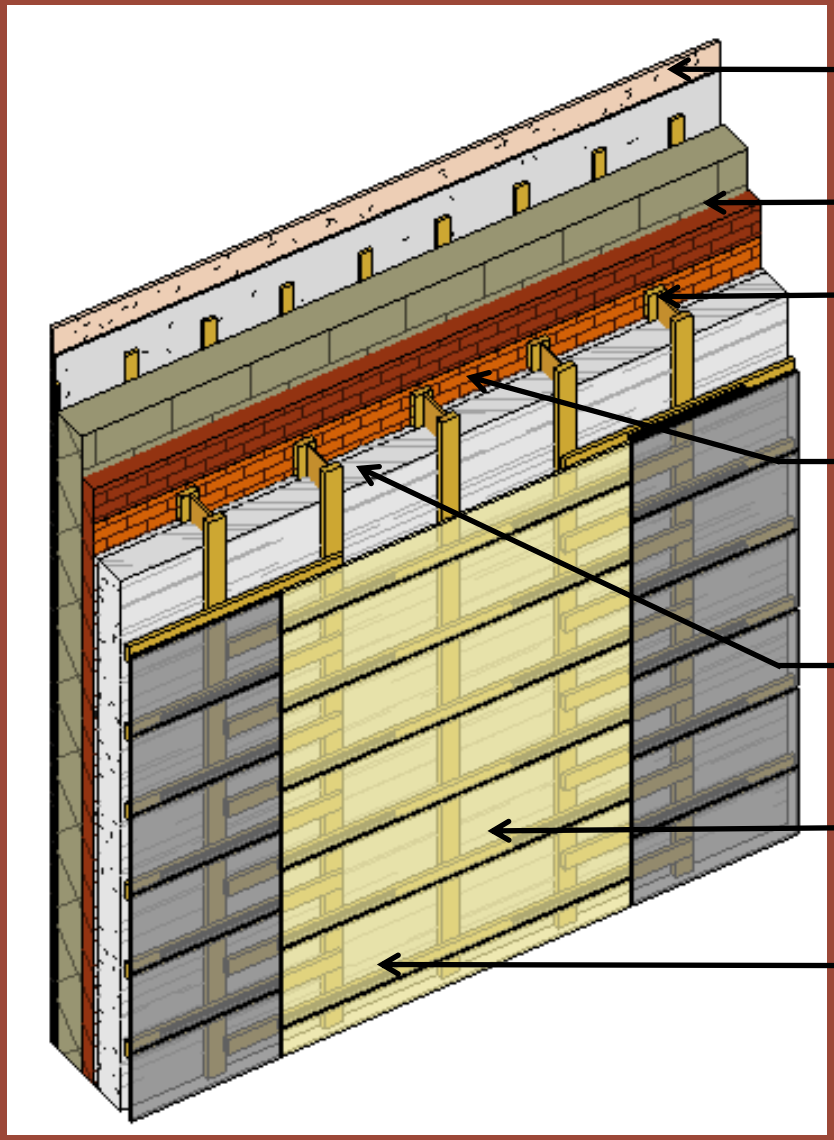
ENTER:
THE PH MASONRY RETROFIT

ELIMINATE LOSS: (almost!)

CONTINUOUS INSULATION DEFINING THE THERMAL ENVELOPE



SUPER-INSULATED AND VAPOR OPEN



PRE "VE" ENCLOSURE

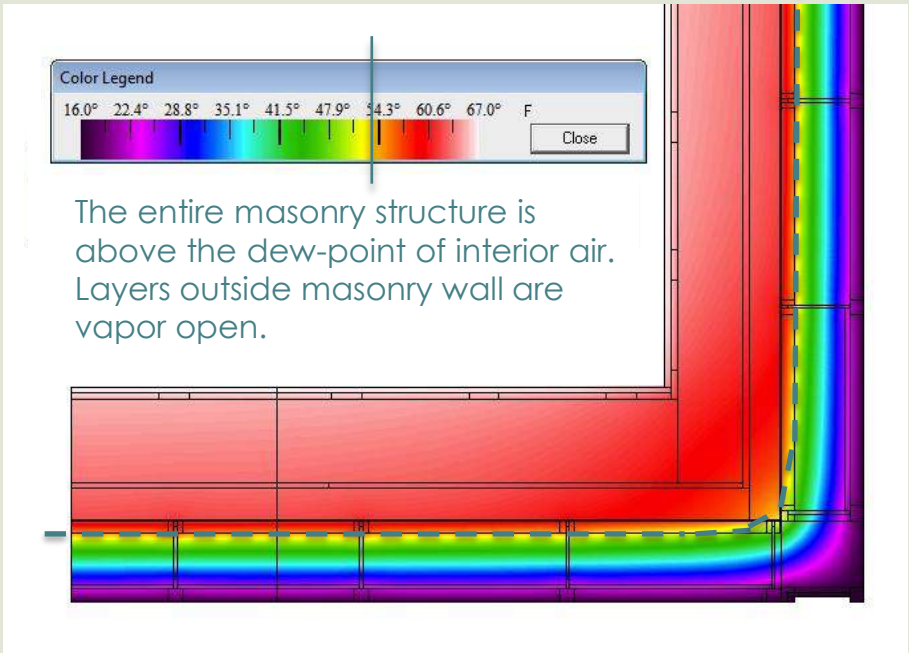
- EXIST. PLASTER OVER GYP. BD. SUBSTRATE & VERT. 1X FURRING
- BRICK & CMU BACK-UP
- 9 ½" WD. 'I'-JOISTS @ 24" O.C., MECH. ATTACH. @ 36" O.C., STAGGERED
- **FLUID-APPLIED AIR AND WATER RESISTIVE BARRIER**
- 8" MINERAL WOOL INSULATION @ 6 LB./CU. FT. DENSITY
- HORIZ. 5/4 WD. FURRING @ 18" O.C., STAGGERED
- 5/8" FIBER CEMENT CLADDING ON PROPRIETARY CLIPS

ENVELOPE DESIGN + OCCUPANT HEALTH

RETROFIT-
MANAGE CONDENSATION PLANE TEMPERATURES –

THIS WALL WILL NOT GROW MOLD

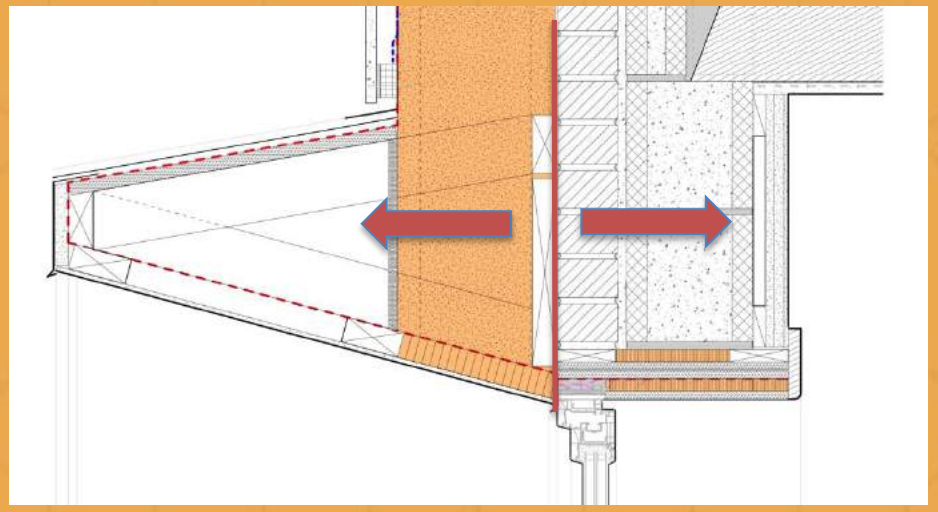
Dew point of interior air = @ 52.5°F

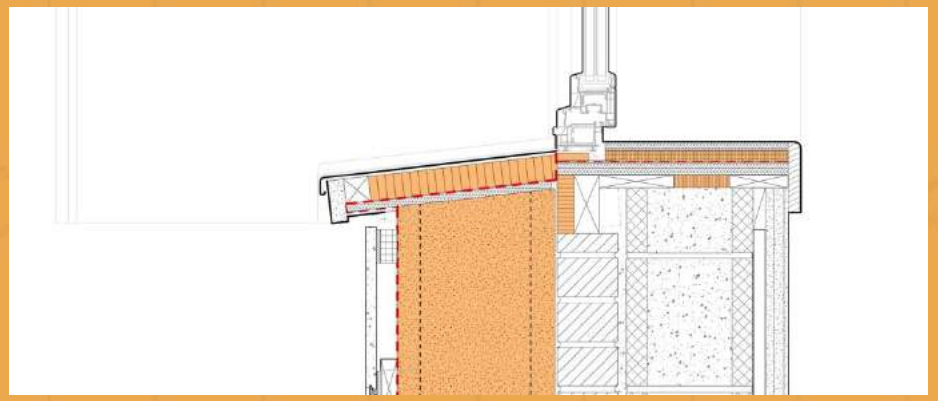


The entire masonry structure is above the dew-point of interior air. Layers outside masonry wall are vapor open.

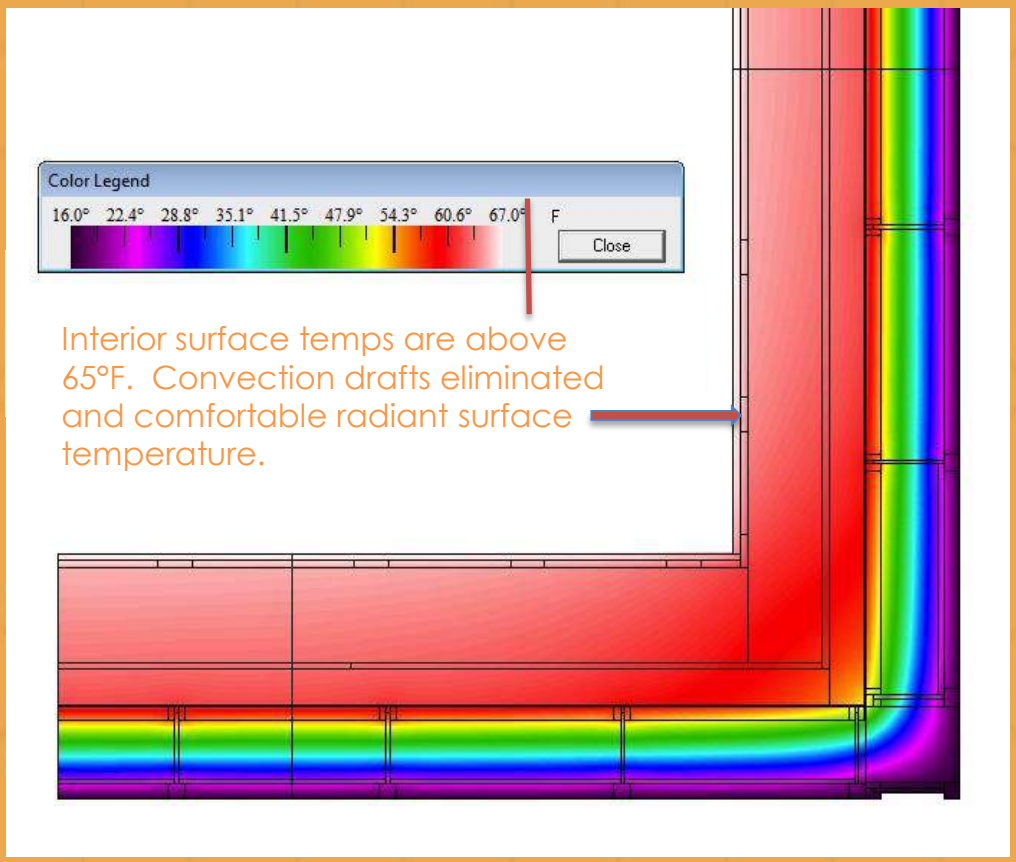
VAPOR OPEN ASSEMBLIES DRY TO BOTH SIDES

MANAGEMENT OF FIRST CONDENSATION PLANE TEMPERATURES





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



Interior surface temps are above 65°F. Convection drafts eliminated and comfortable radiant surface temperature.

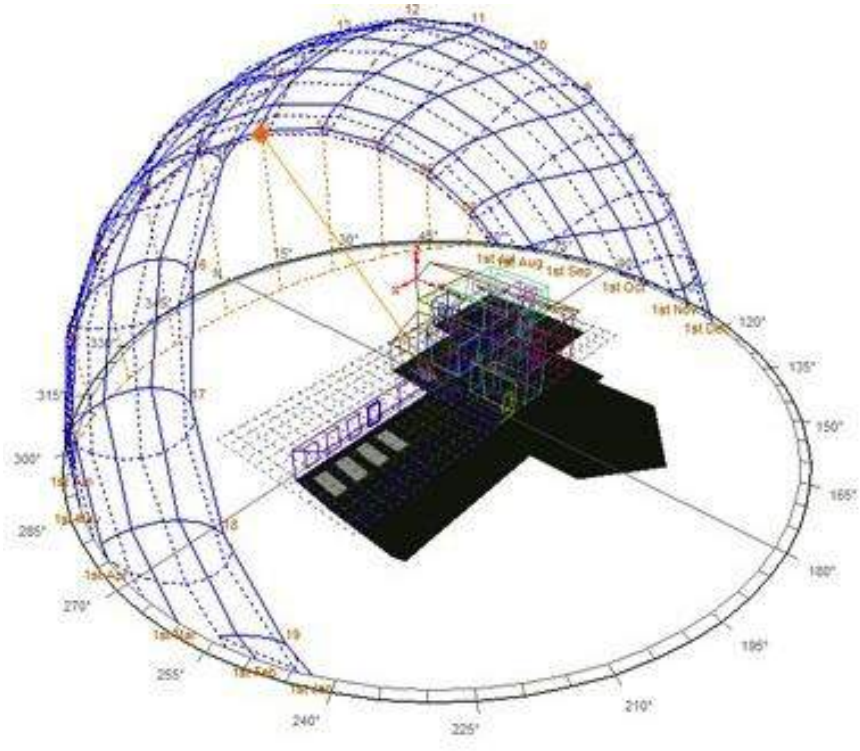
ENVELOPE + OCCUPANT COMFORT

COMFORT FACTORS?

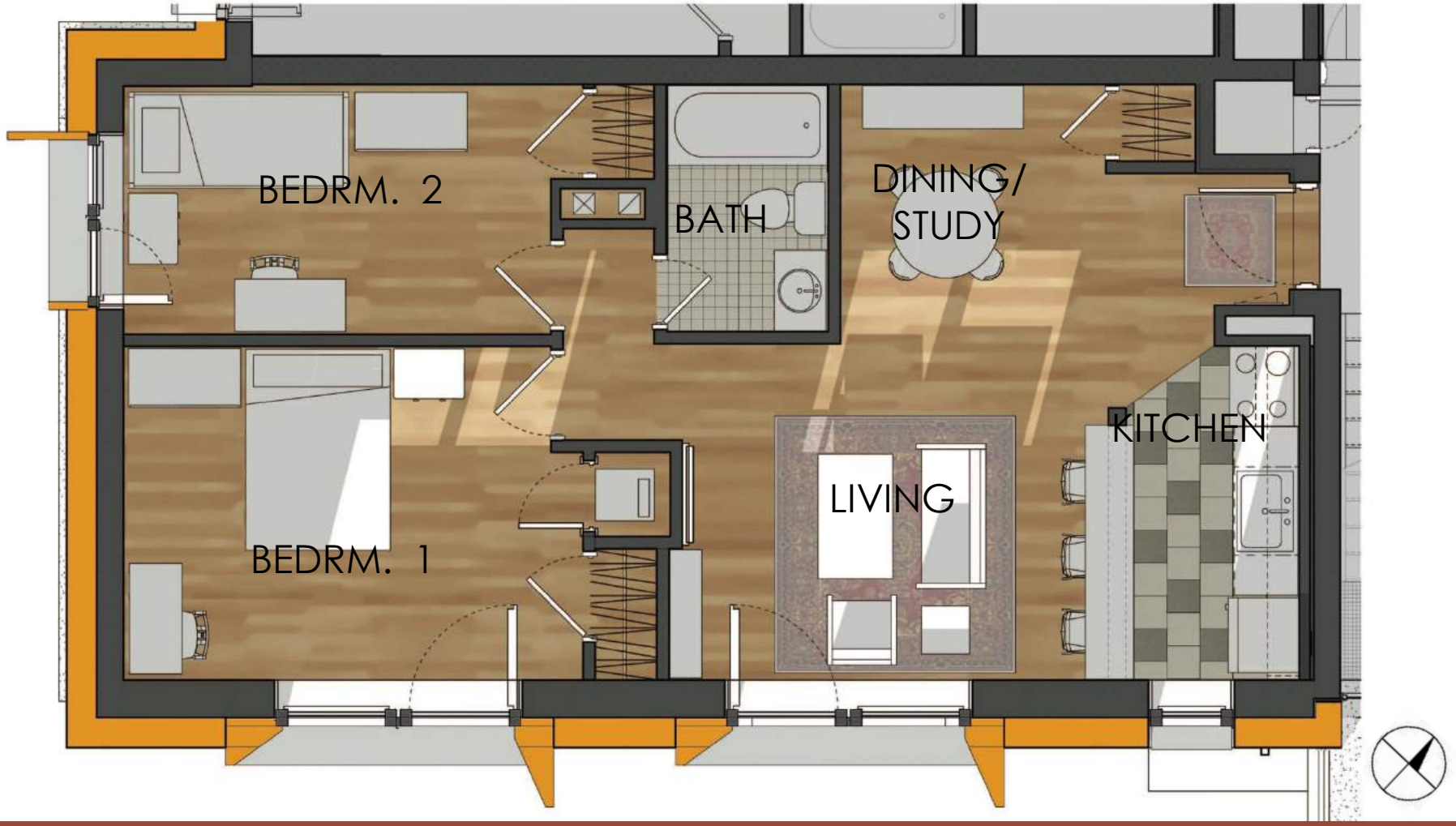
Air temp
RH
Air velocity
Mean radiant surface temps

ORIENTATION:
PRE-DETERMINED SITING

ORIENTATION AND SOLAR GAIN
OPTIMIZING COMFORT



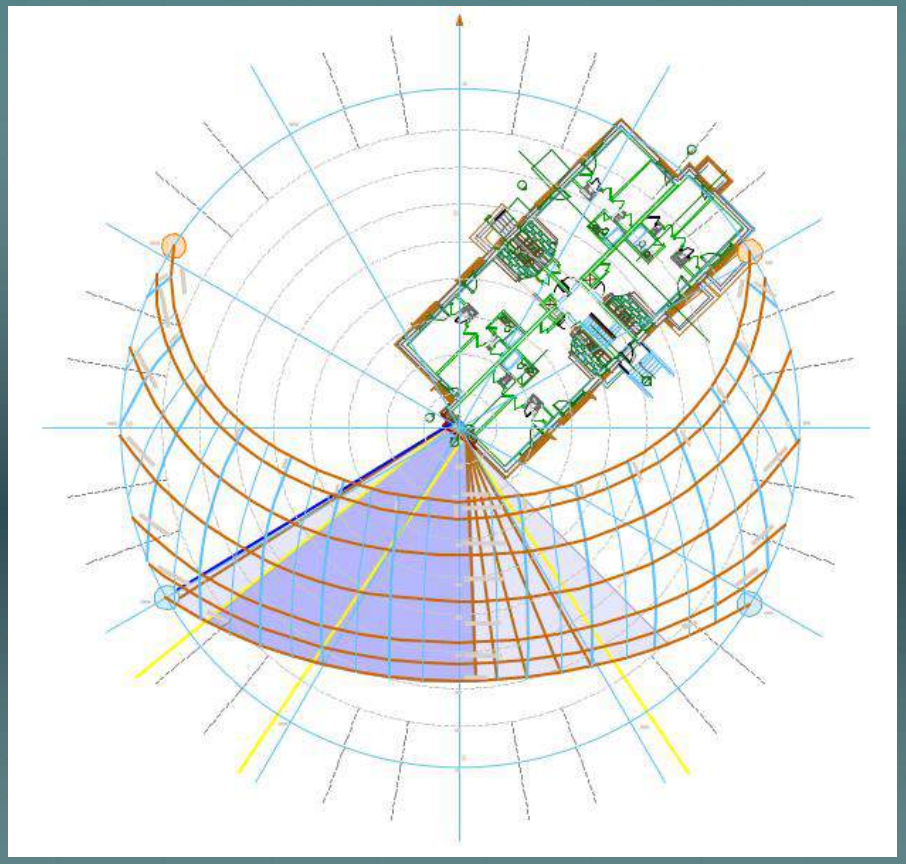
SOLAR GAIN CONTROL & QUALITY OF SPACE

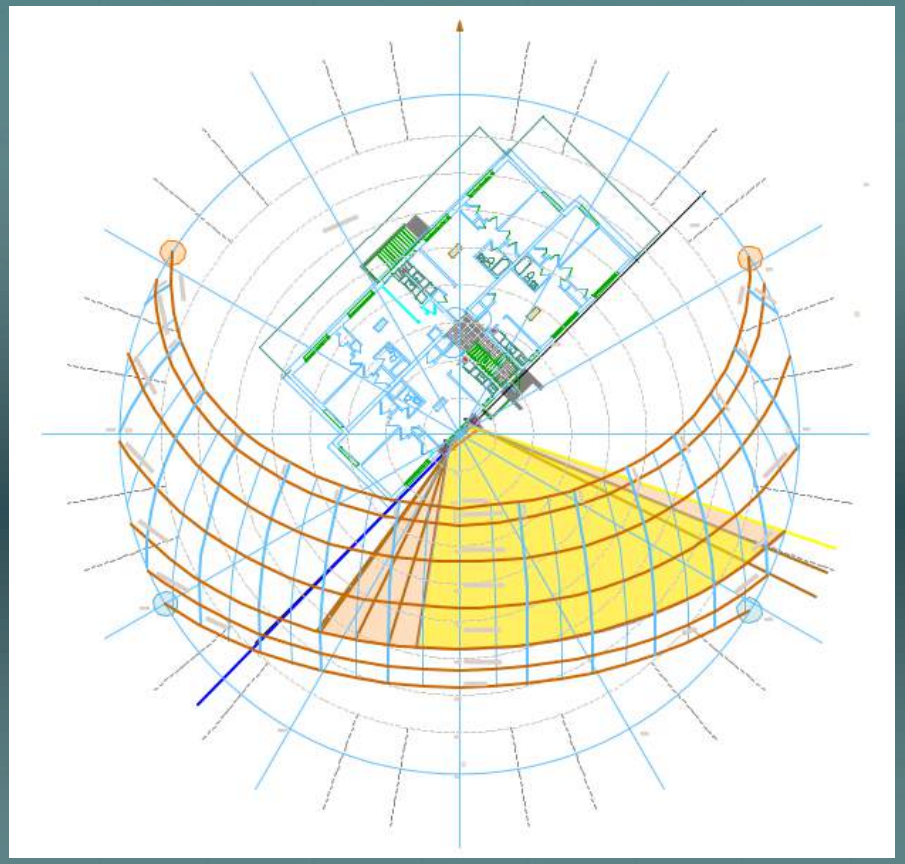


TYPICAL APARTMENT UNIT FLOOR PLAN

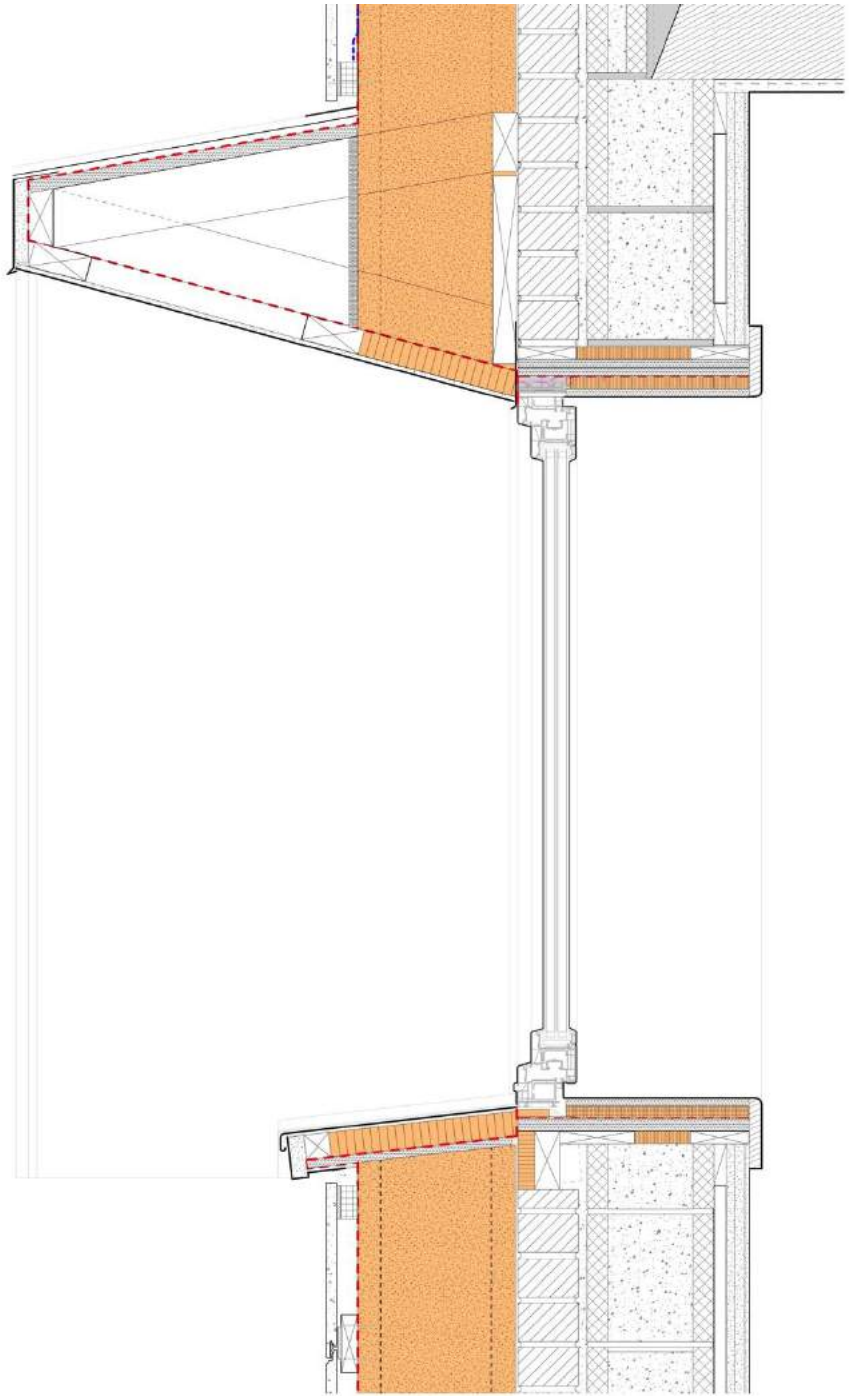
672 NET RENTABLE SQ. FT.

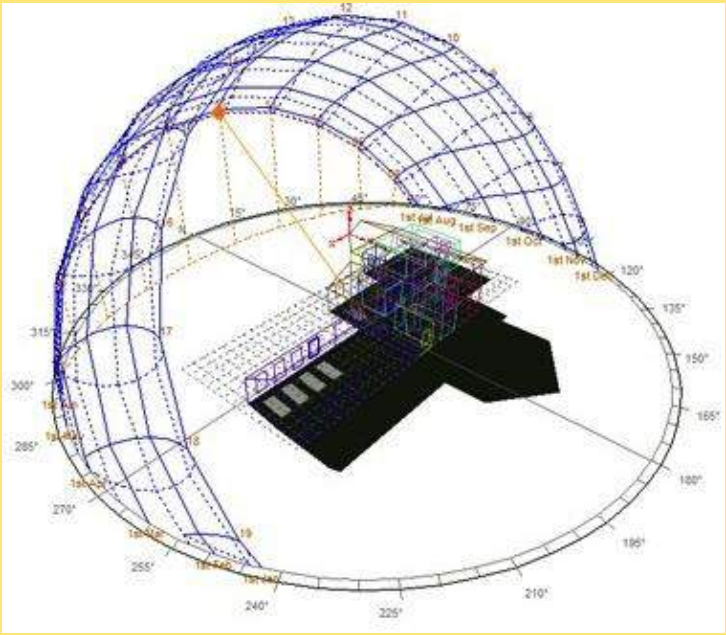
HEATING AND COOLING





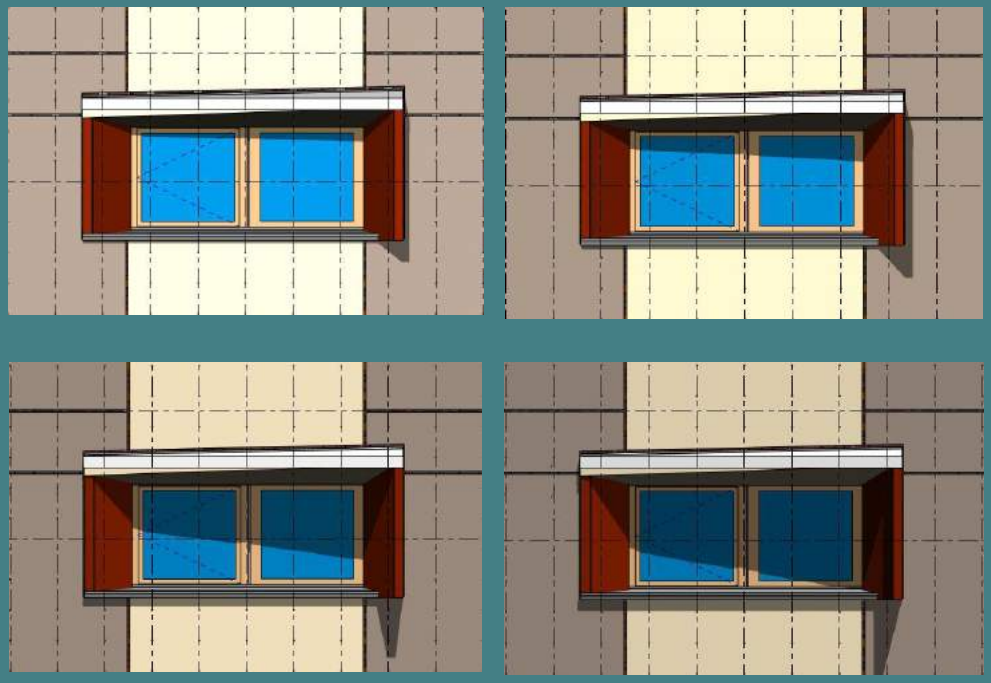
ASYMETRICAL LOADS + DISTRIBUTION

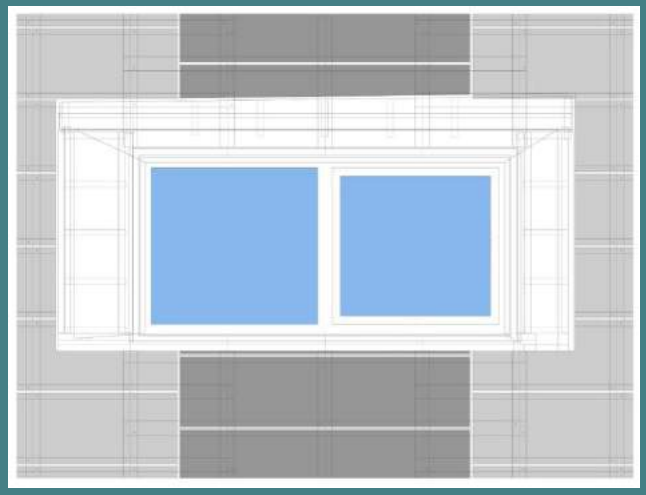


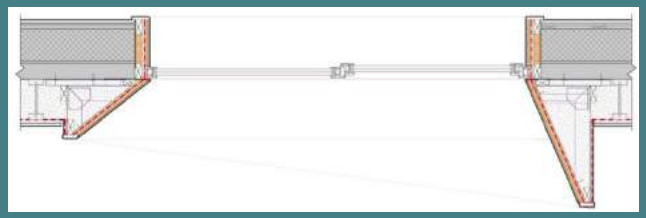


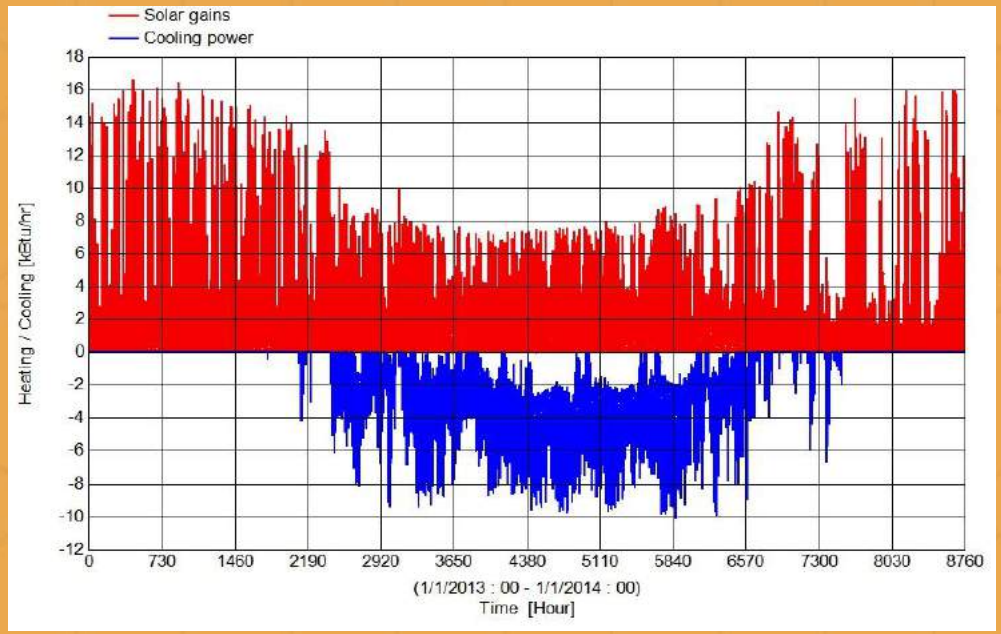
SOLUTION:

FIXED SOLAR SHADING





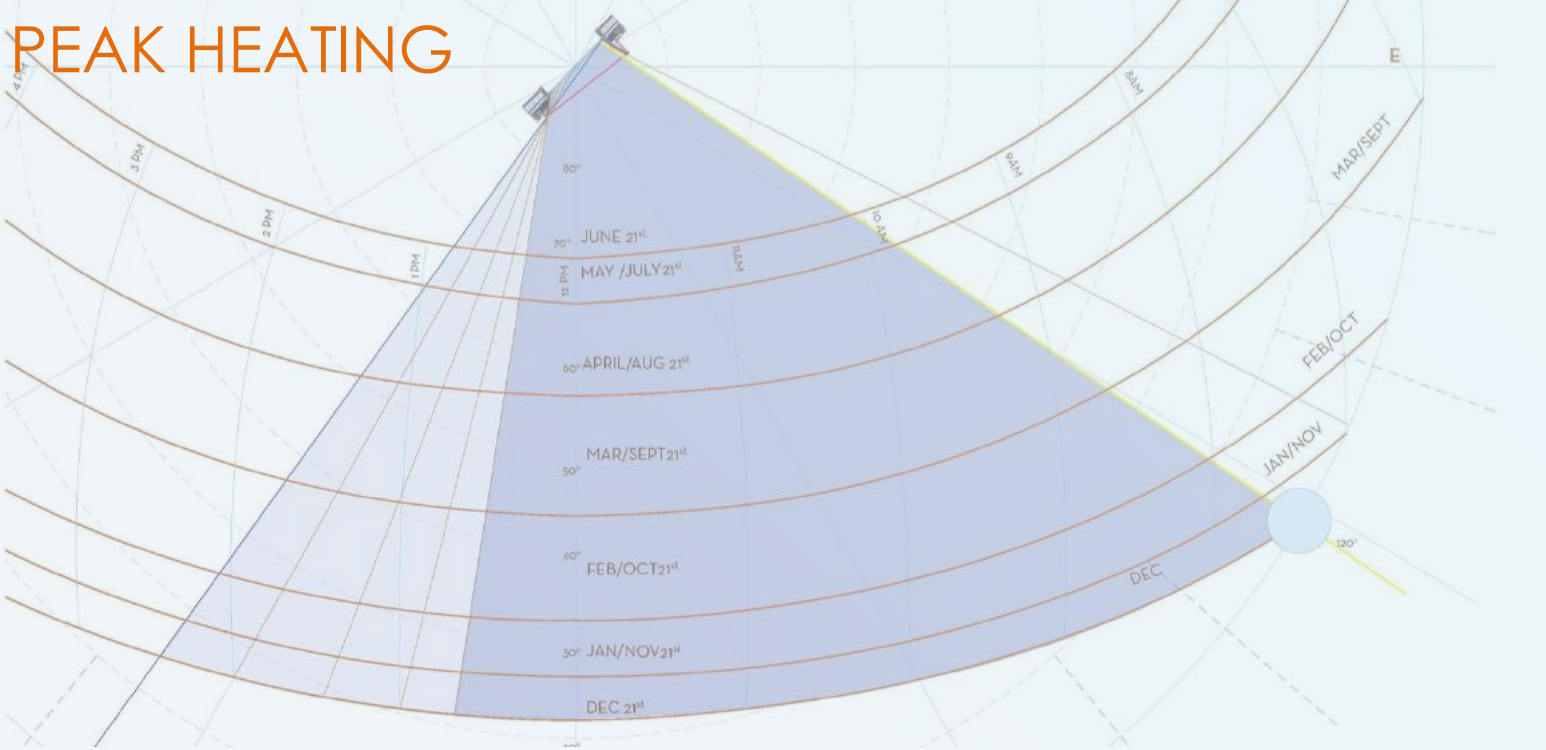


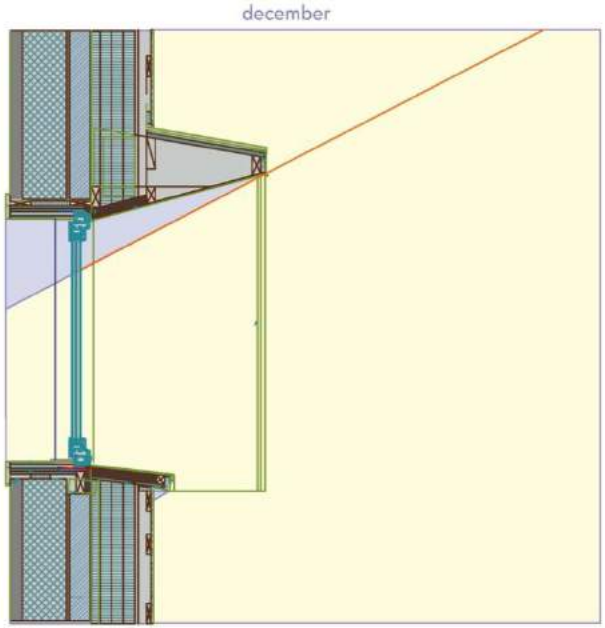


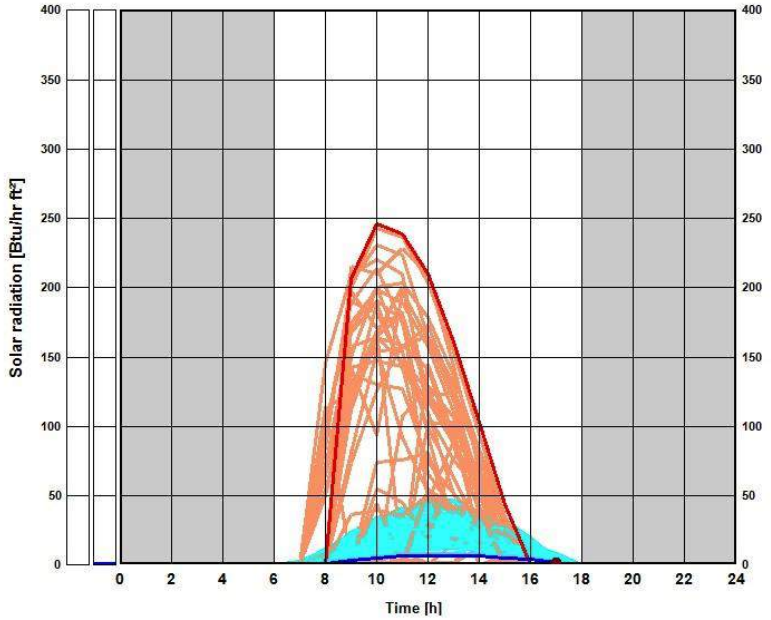
SOLAR GAIN WHEN YOU WANT IT

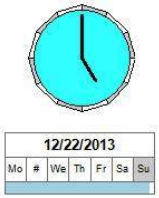
(AND NOT WHEN YOU DON'T!!)

PEAK HEATING

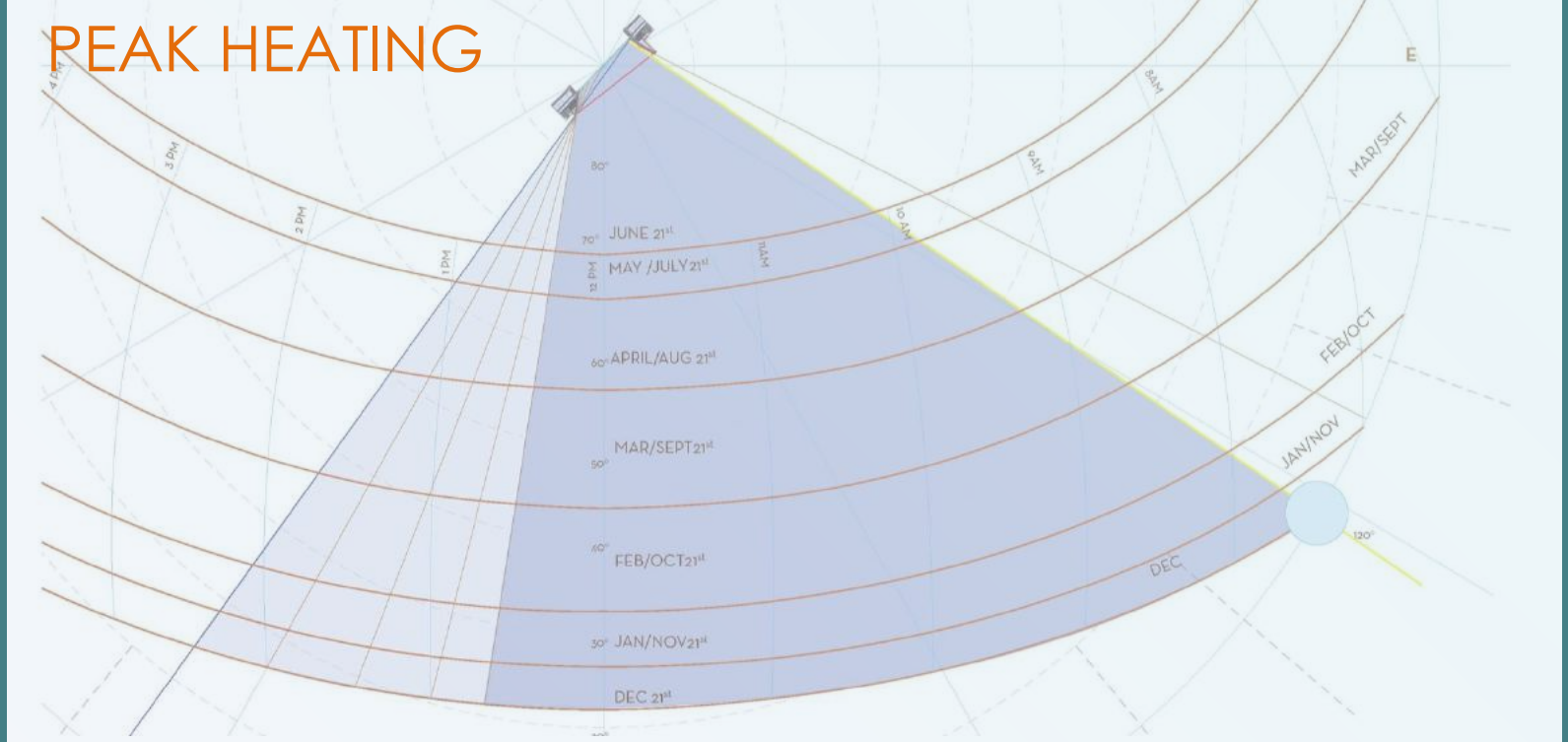


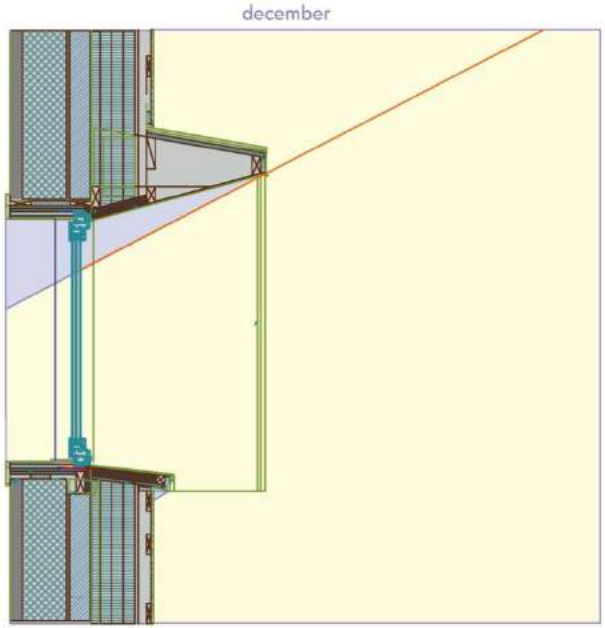


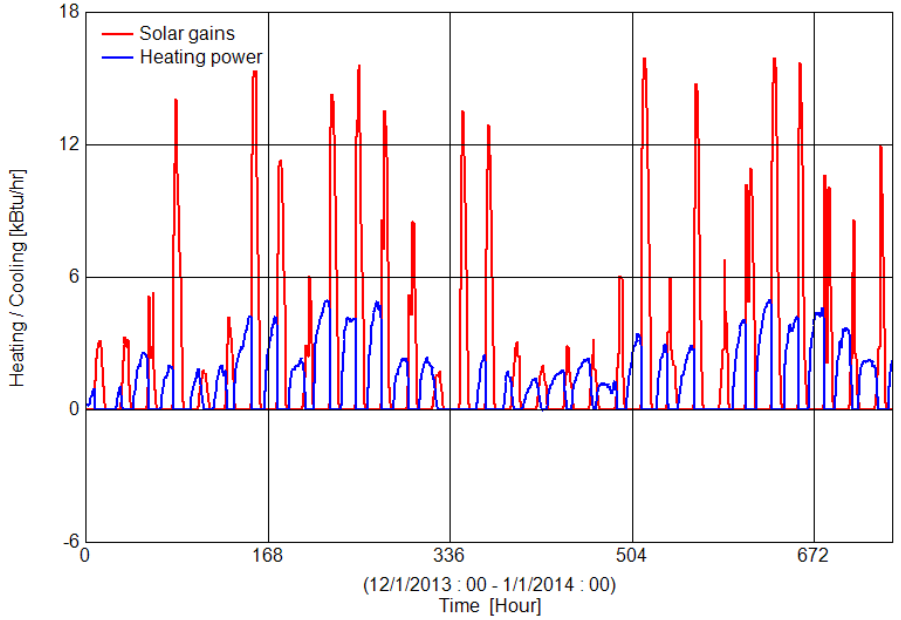




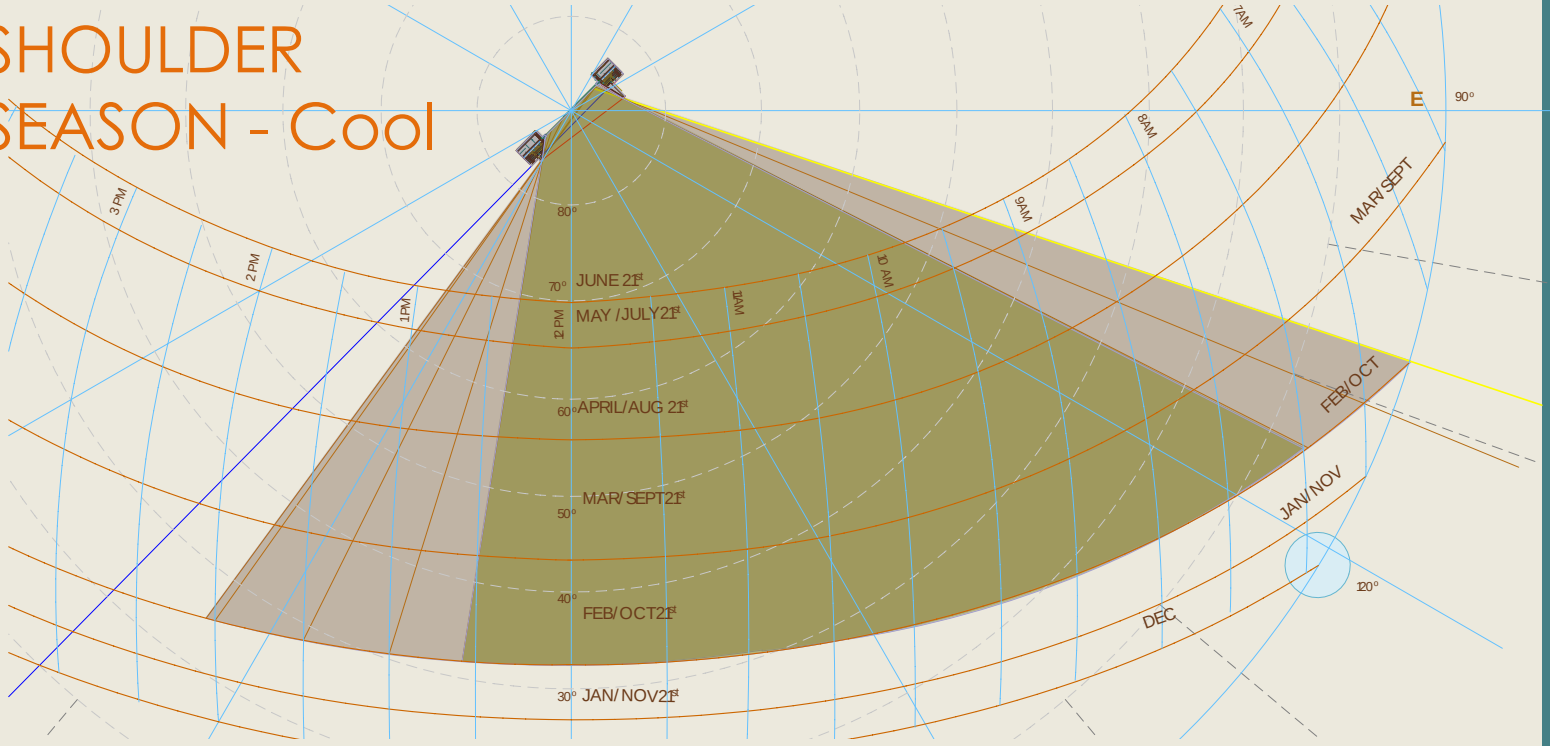
PEAK HEATING



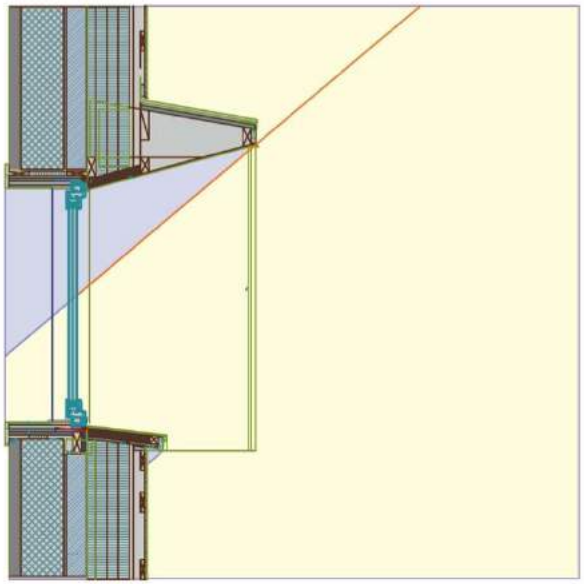




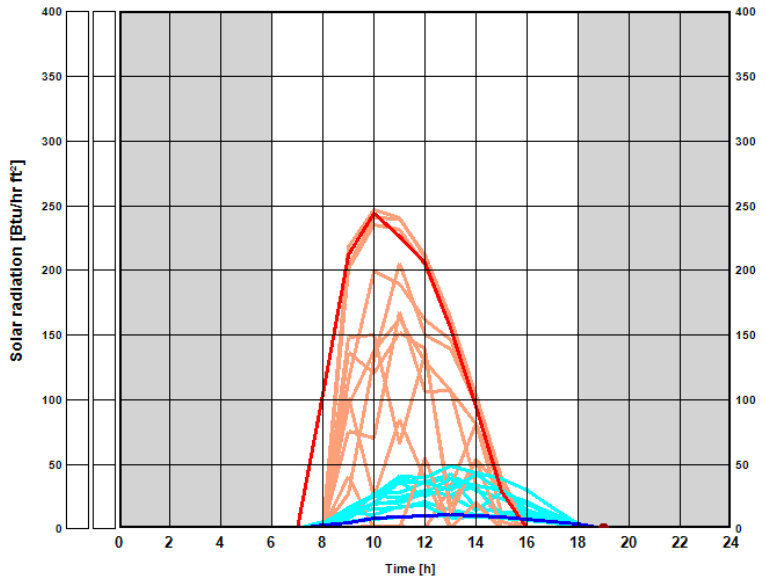
SHOULDER SEASON - Cool

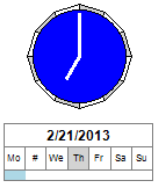


February / October

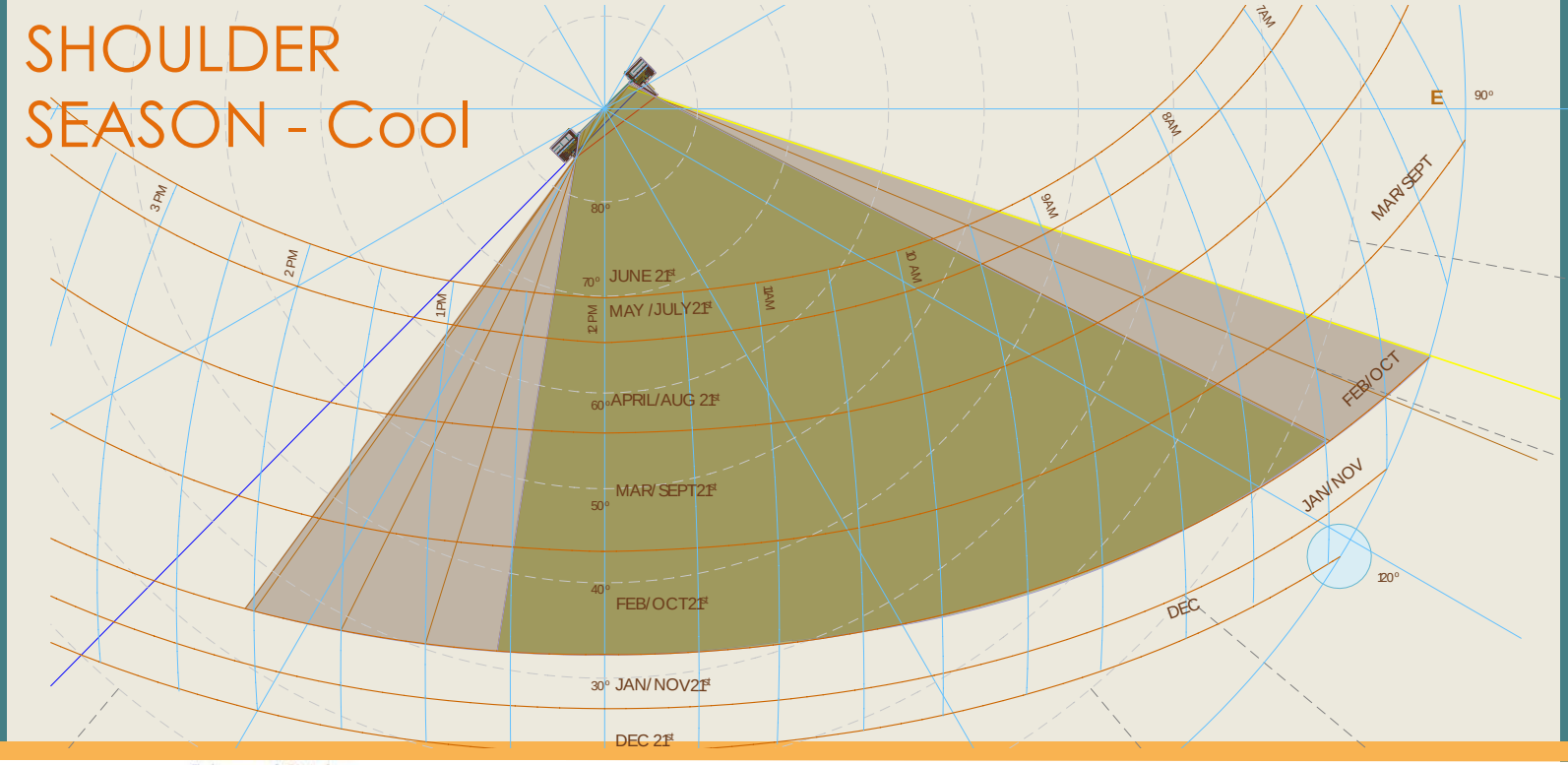


Solar Gain / Hourly – February 21

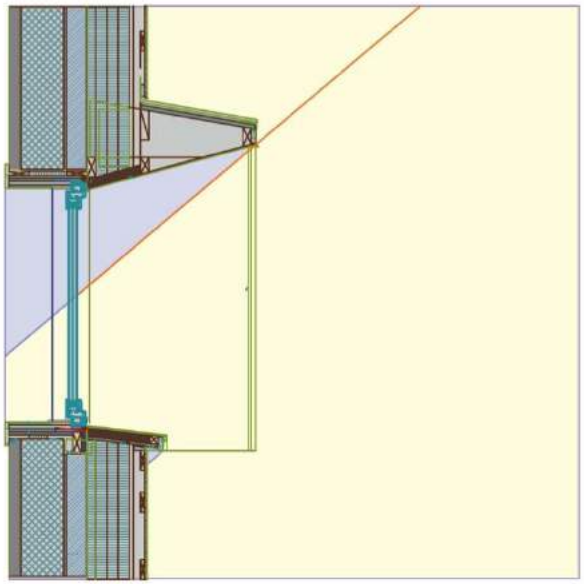




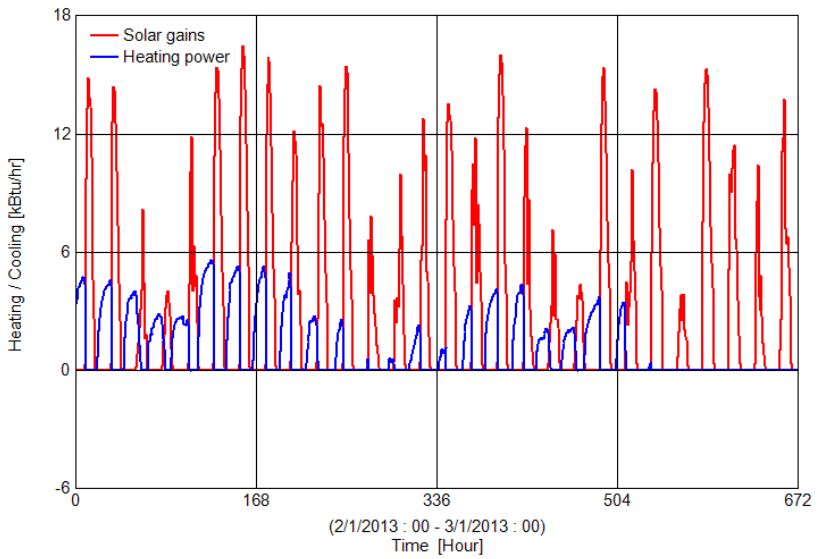
SHOULDER SEASON - Cool



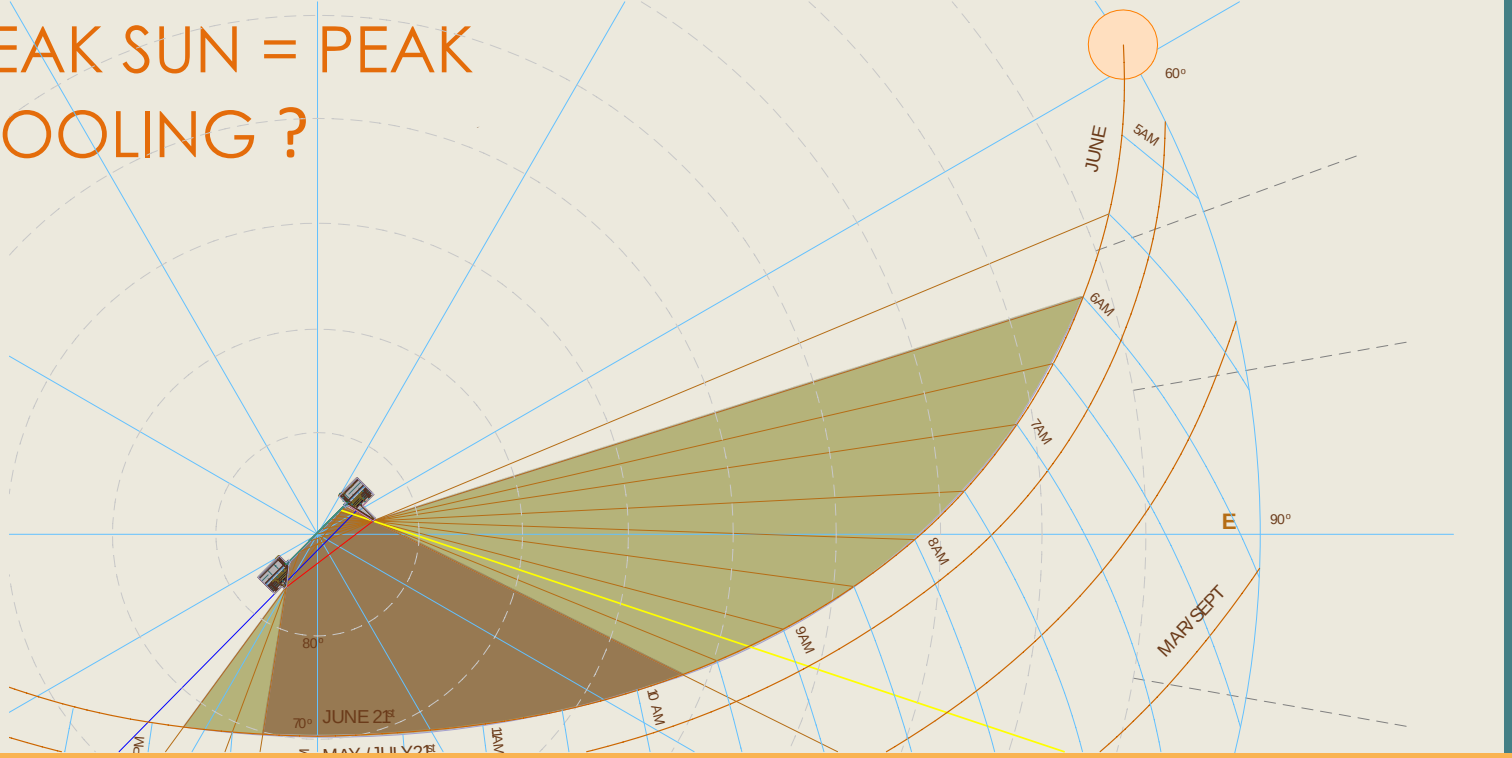
February / October

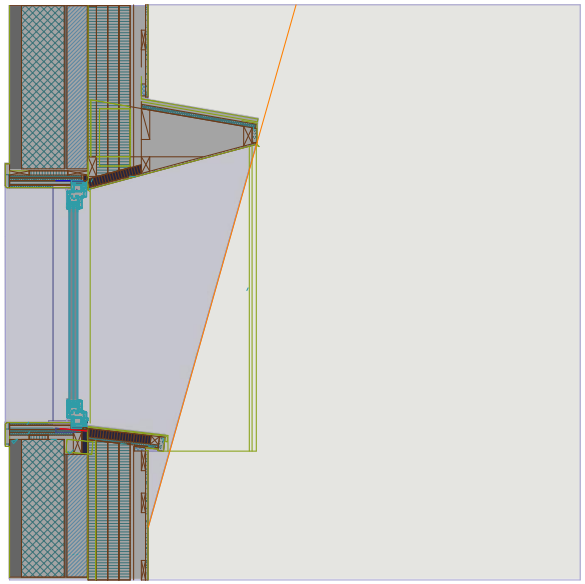


Solar Gain / Heating February

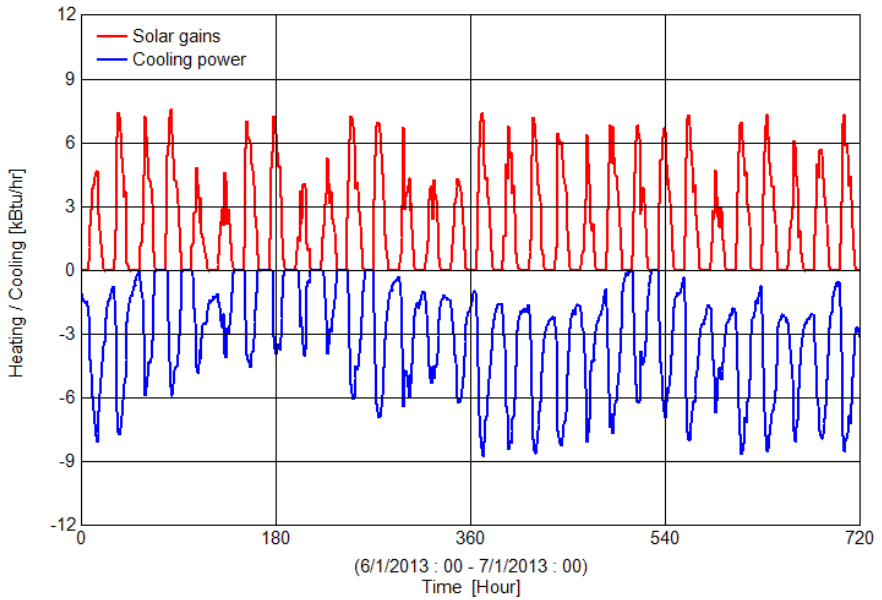


PEAK SUN = PEAK COOLING ?

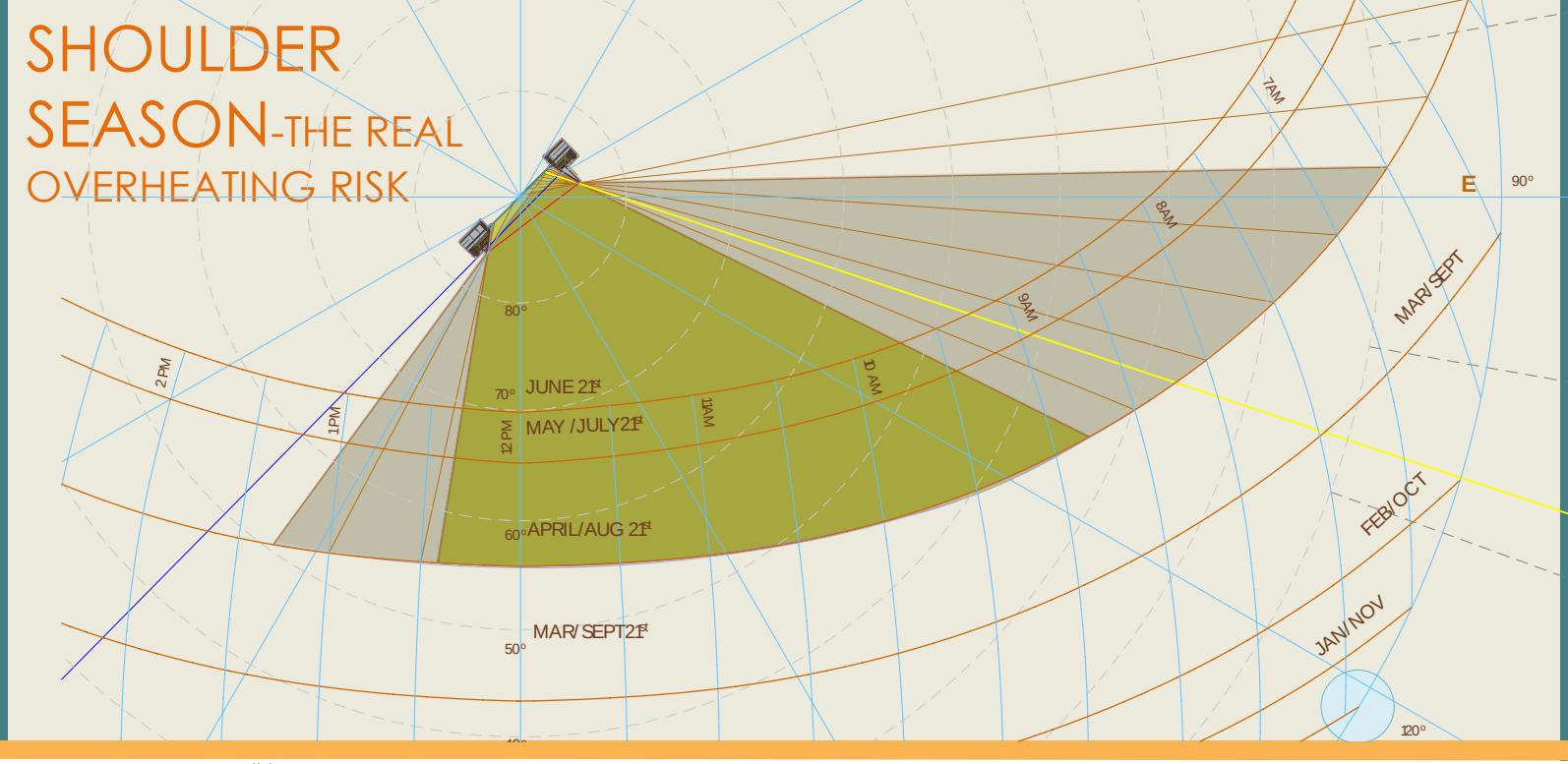




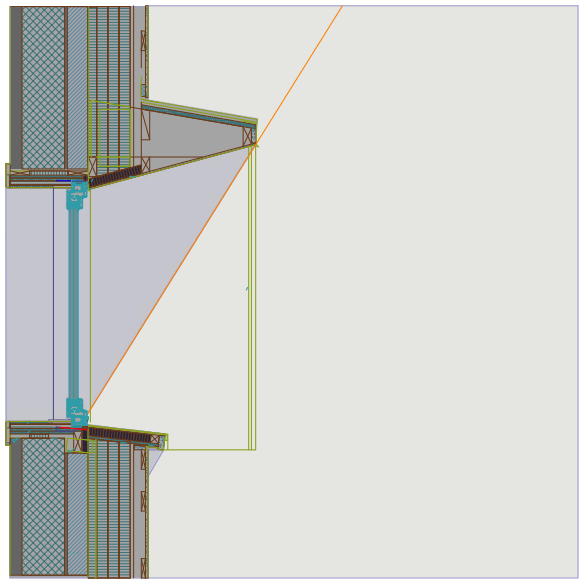
Solar Gain / Cooling June



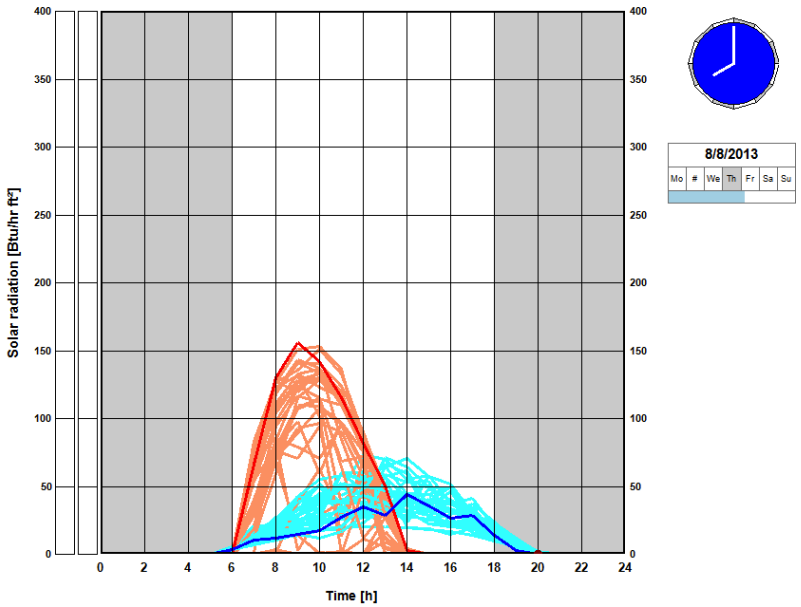
SHOULDER SEASON-THE REAL OVERHEATING RISK

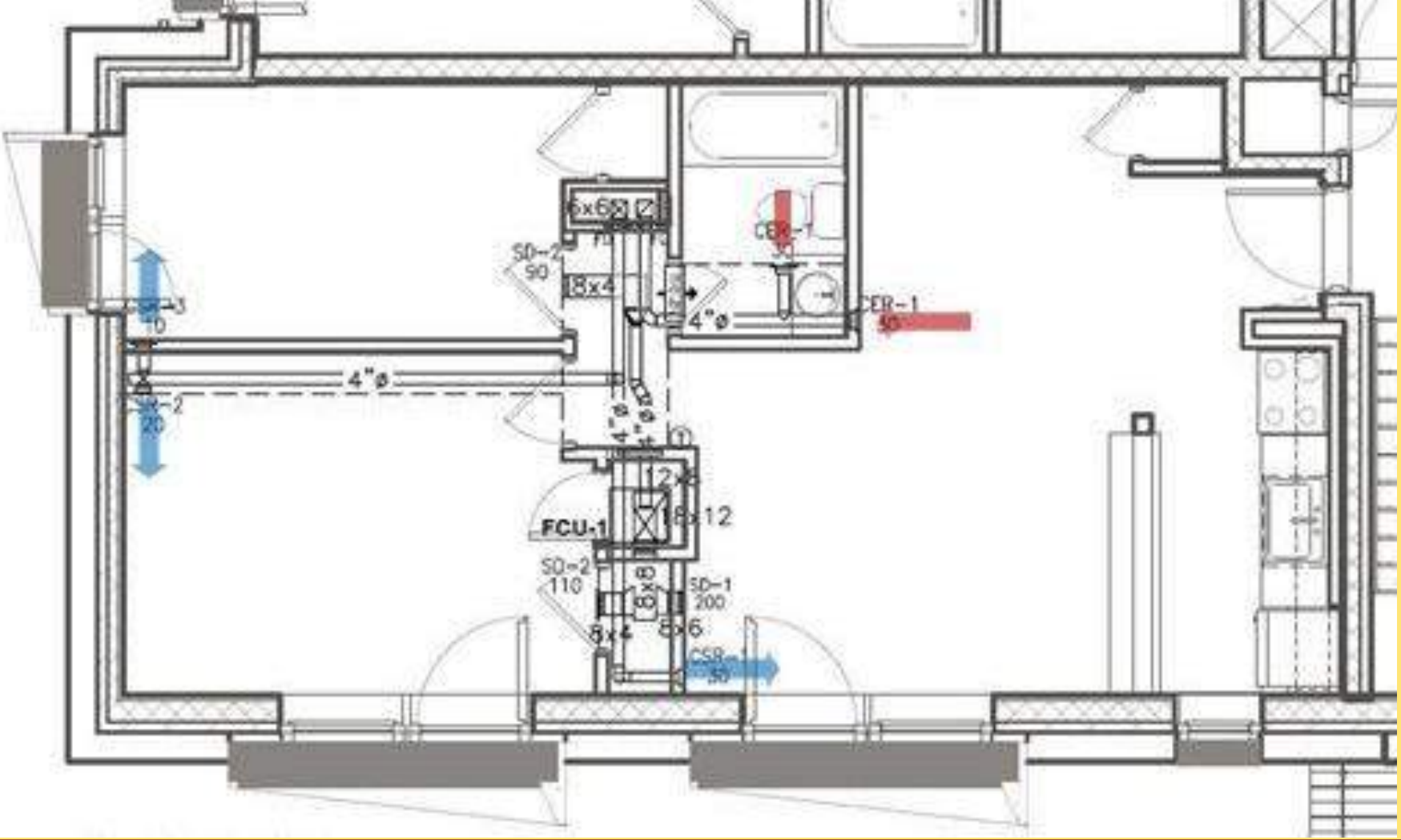


April / August



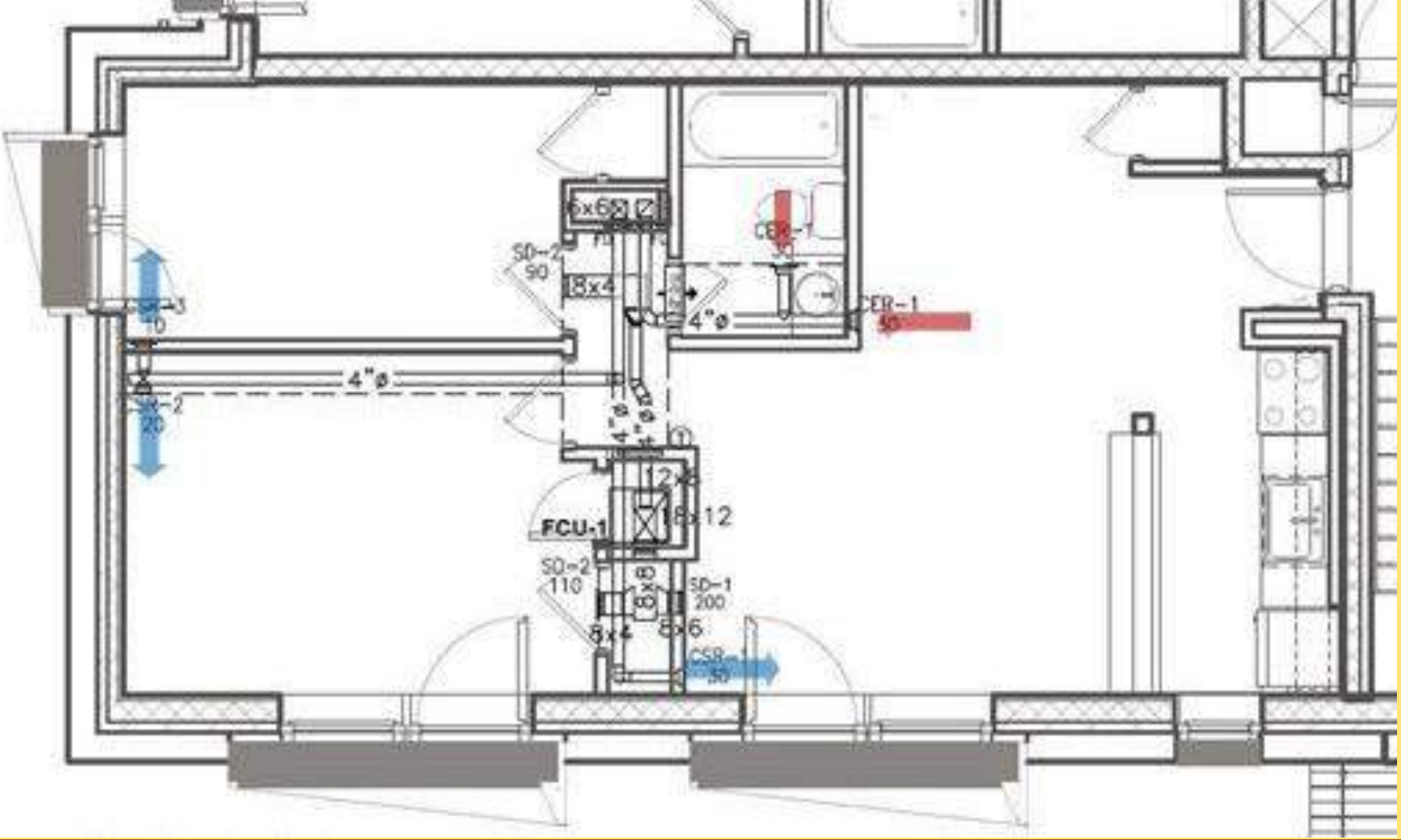
Solar Gain / Hourly - April / August





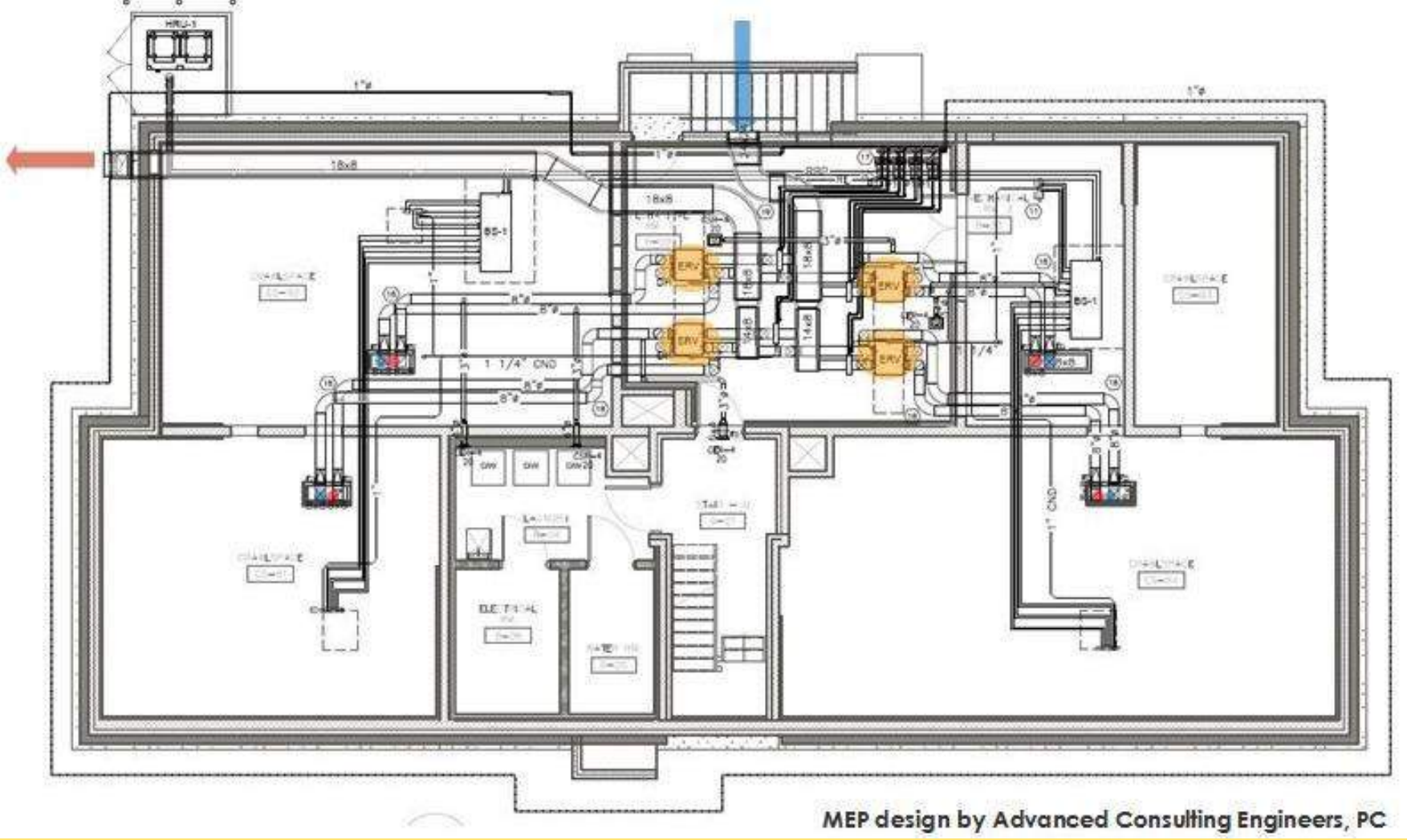
HEATING AND COOLING DESIGN

VRF WITH HEAT EXCHANGE: EFFECTIVE LOW LOAD OPERATION,



HEATING AND COOLING DESIGN

VRF WITH HEAT EXCHANGE: DUCTED DISTRIBUTION



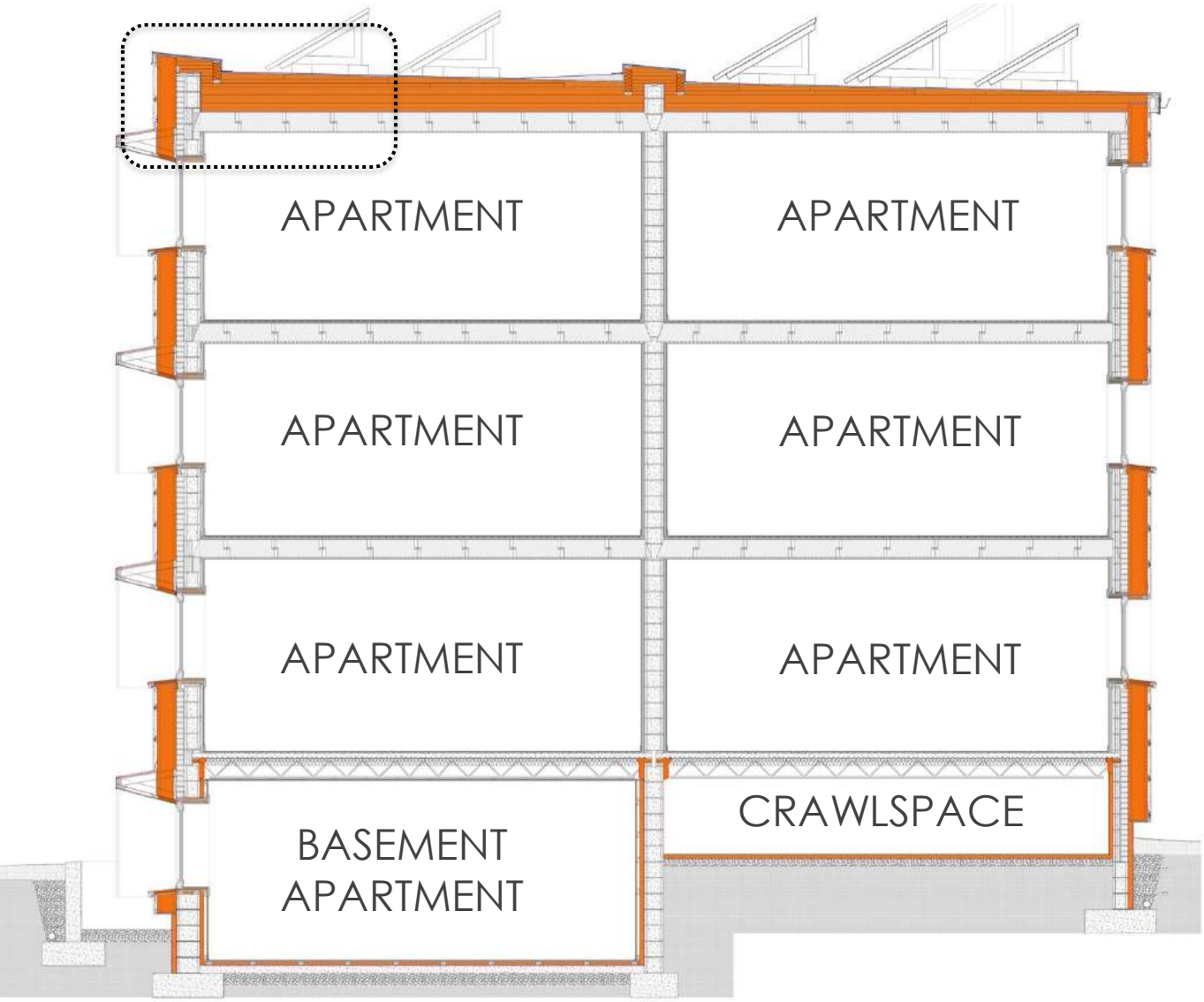
HVAC DESIGN

ERV COMMON VENTILATION & DISTRIBUTION BY QUADRANT

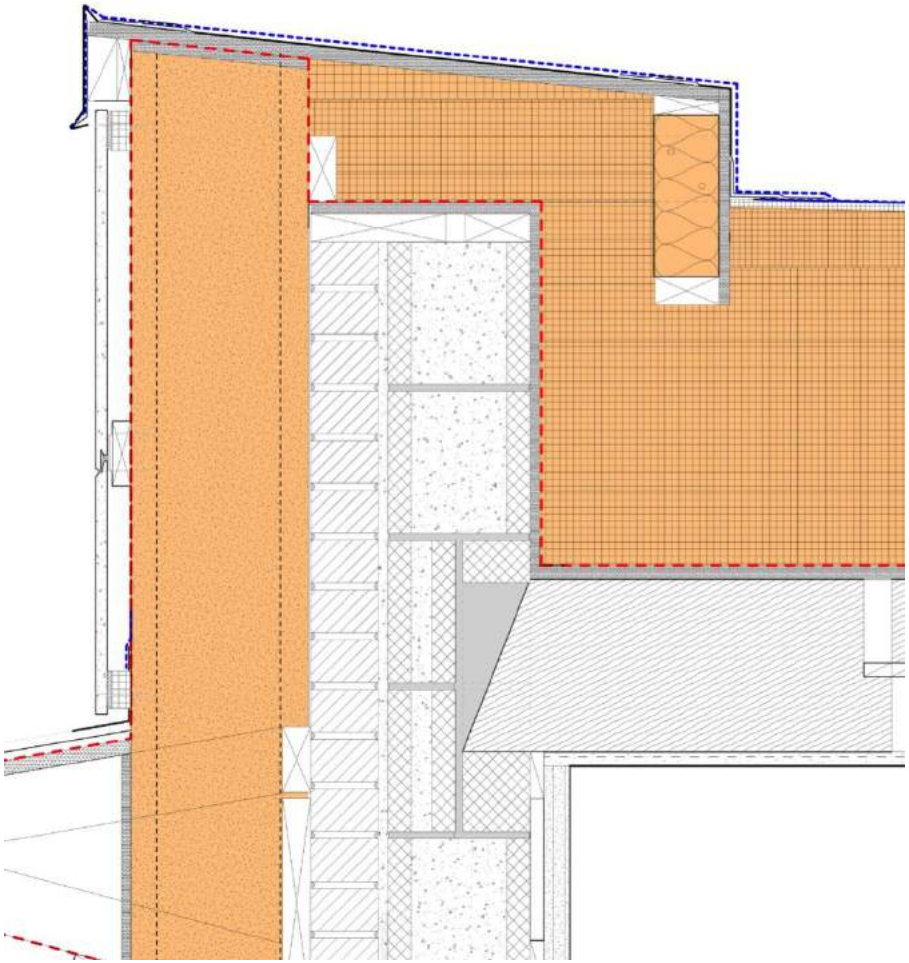
CASE STUDY:
FROM THEORY TO REALITY

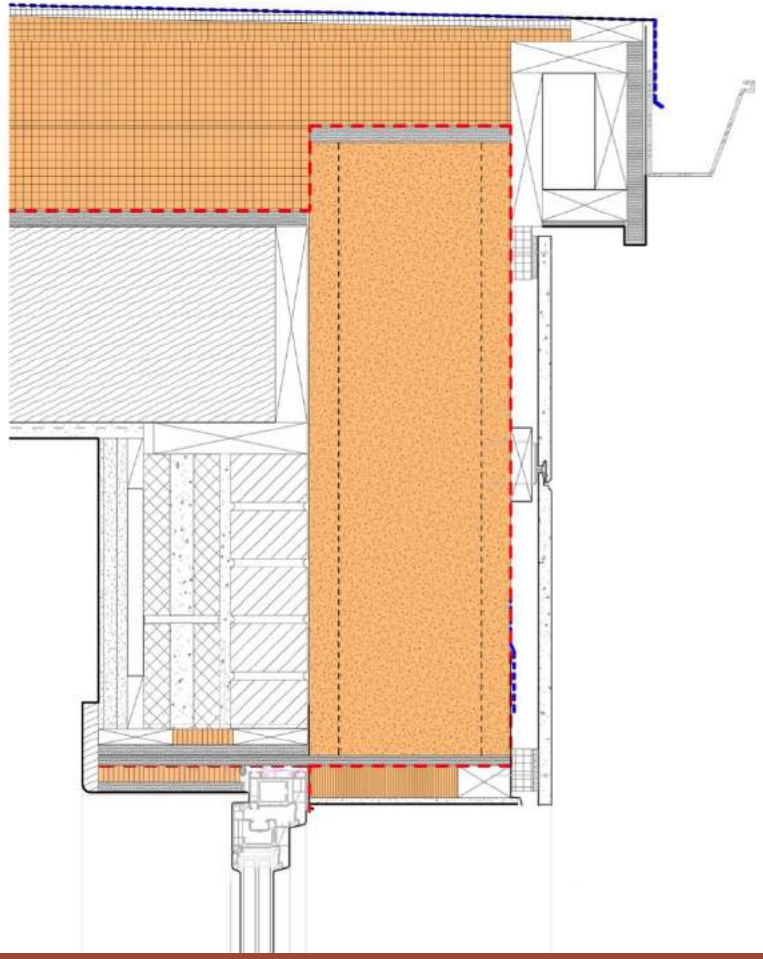
THE HIGH-PERFORMANCE ENCLOSURE

CHALLENGE:
ROOF DETAILS



CHALLENGE:
ROOF
TREATMENT

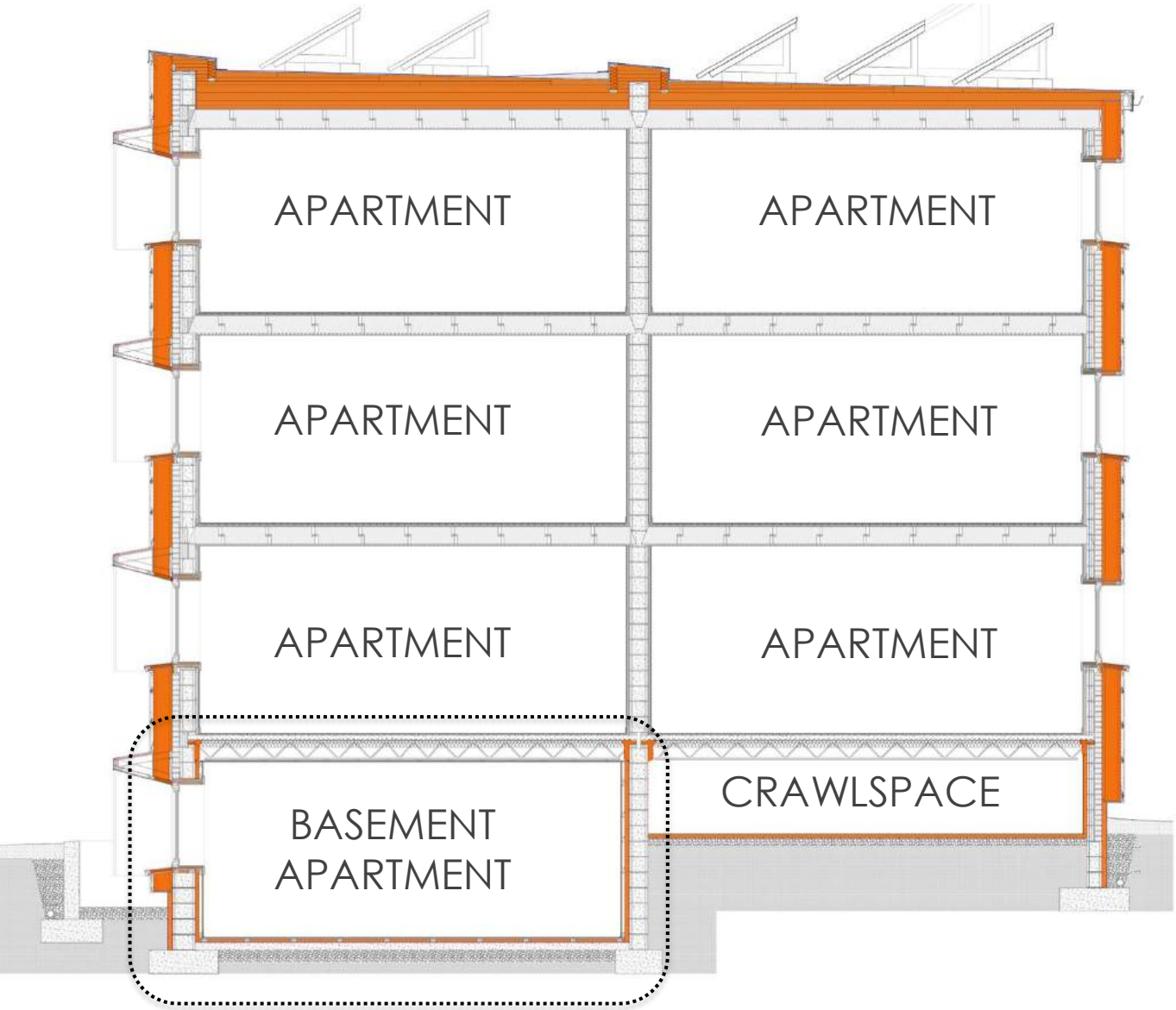




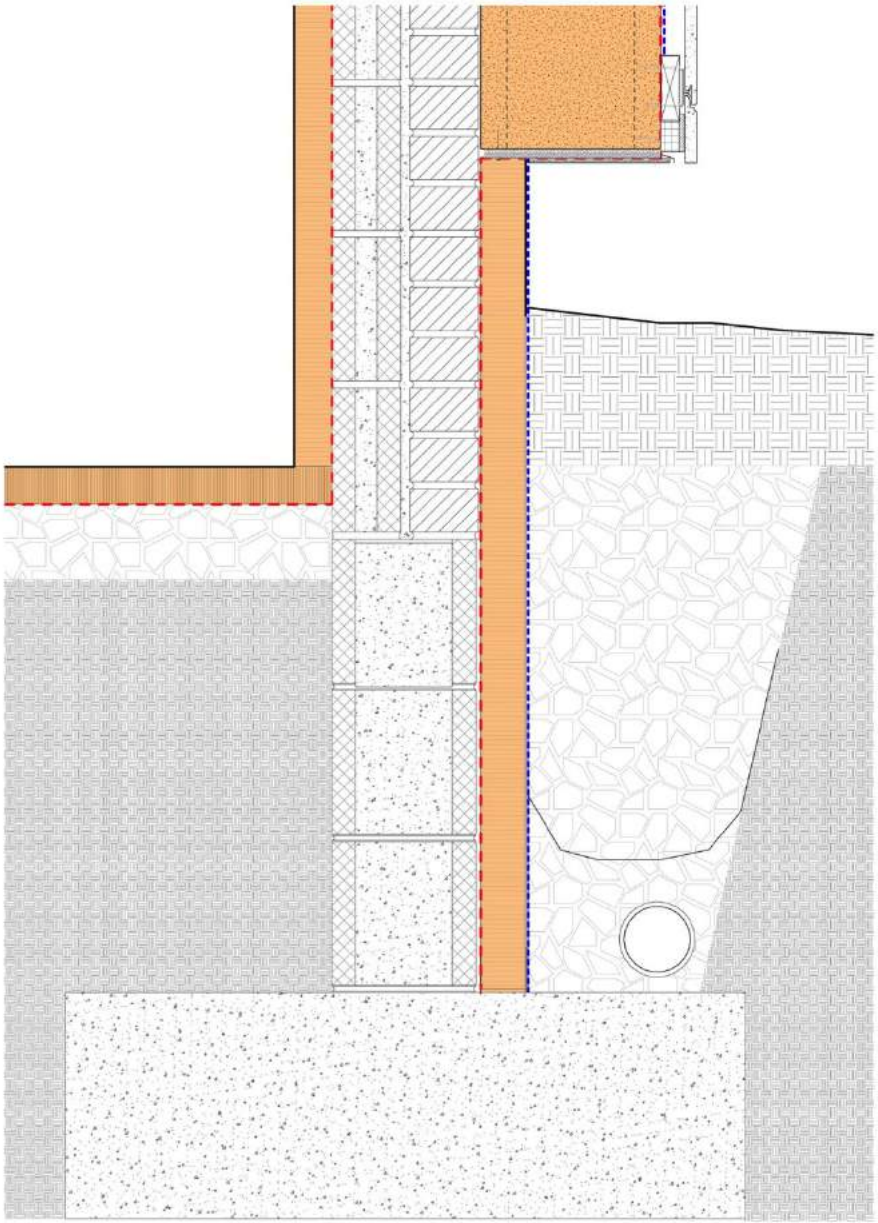
SOLUTION:

LOW-TECH FRAMING & TAPING

SOLUTION:
KEEP IT SIMPLE – TAPE AND SHEATHING



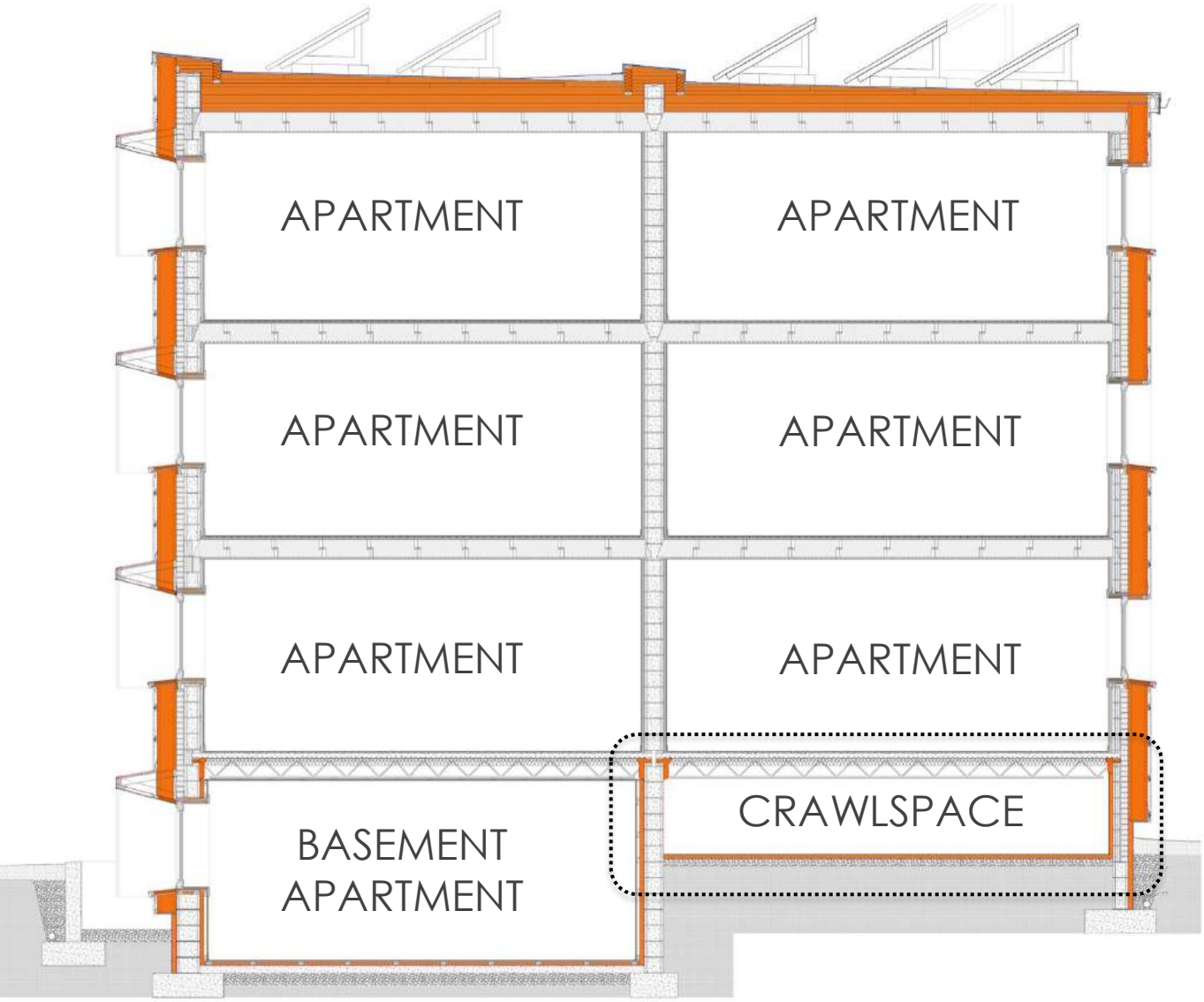
CHALLENGE:
BASEMENT
TREATMENT



SOLUTION:

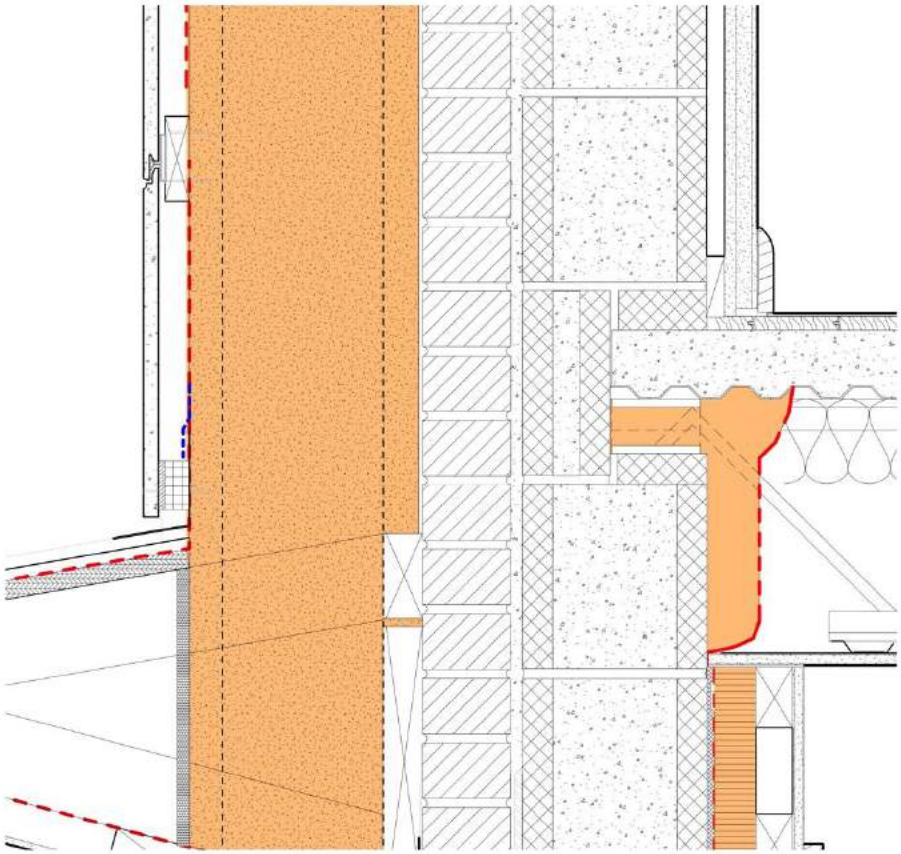
INCLUDE IN VOLUME

SOLUTION: UTILIZE HARDY CONTROL LAYERS



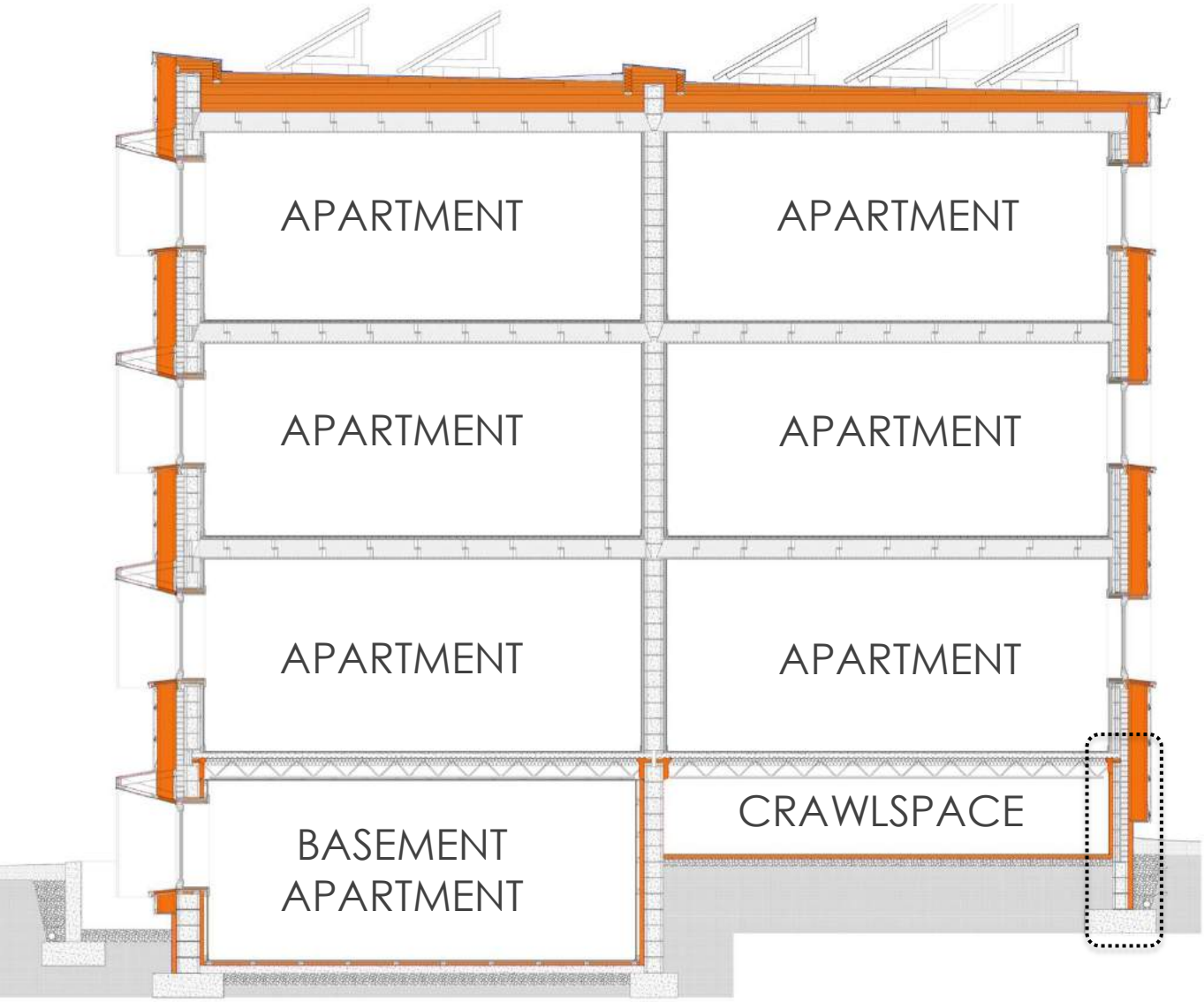
CHALLENGE:
CRAWLSPACE TREATMENT

SOLUTION:
MINIMIZE RISK



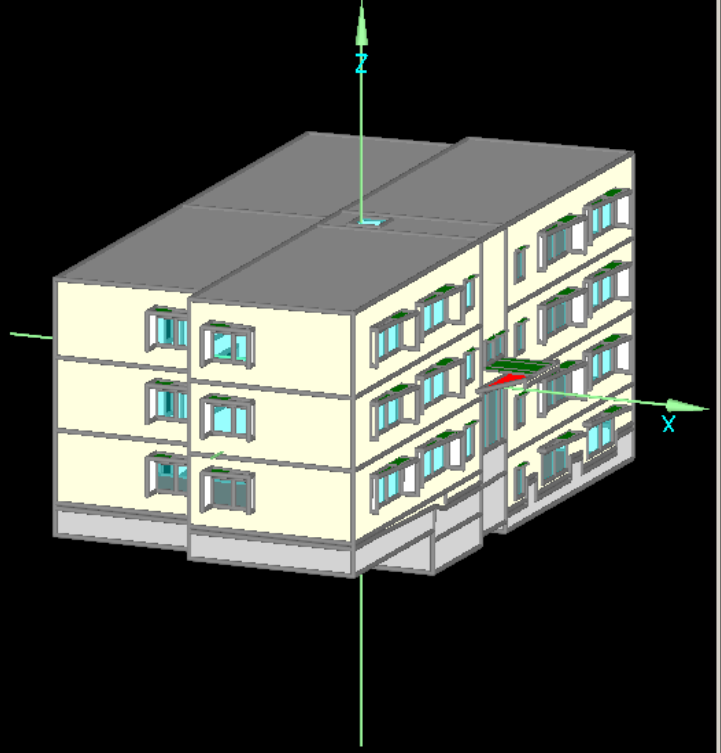
SOLUTION:

BREAK ONE OF OUR RULES



CHALLENGE:
FOUNDATION TREATMENT

FOUNDATION SOLUTION: OPTIMIZE AND CAPITALIZE



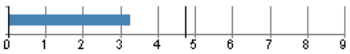
Scope: Passive House Verification View: Normal

PASSIVEHOUSE REQUIREMENTS

Certificate criteria: **Default Standard**

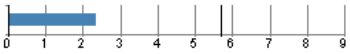
Heating demand

specific:	**3.26**	kBtu/ft²yr
target:	**4.75**	kBtu/ft²yr
total:	30532.29	kBtu/yr



Cooling demand

specific:	**2.36**	kBtu/ft²yr
target:	**5.71**	kBtu/ft²yr
total:	22162.79	kBtu/yr
latent:	1.56	kBtu/ft²yr

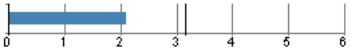


Heating load

specific:	**3.13**	Btu/hr ft²
target:	**3.17**	Btu/hr ft²
total:	29361.36	Btu/hr

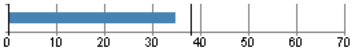
Cooling load

specific:	**2.11**	Btu/hr ft²
target:	**3.17**	Btu/hr ft²
total:	19777.82	Btu/hr



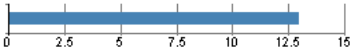
Primary energy

specific:	**34.81**	kBtu/ft²yr
target:	**38.04**	kBtu/ft²yr
total:	326471.92	kBtu/yr



Site energy

total:	12.96	kBtu/ft²yr
building systems:	68.38	kBtu/yr
photovoltaic savings:	0	kBtu/ft²yr



Air tightness

ACH50:	**0.54**	1/hr
target:	**0.6**	1/hr
CFM50 per envelope area:	**0.04**	cfm/ft²
target:	**0.05**	cfm/ft²

ENERGY SIMULATION RESULTS:
WELL WITHIN CRITERIA

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."

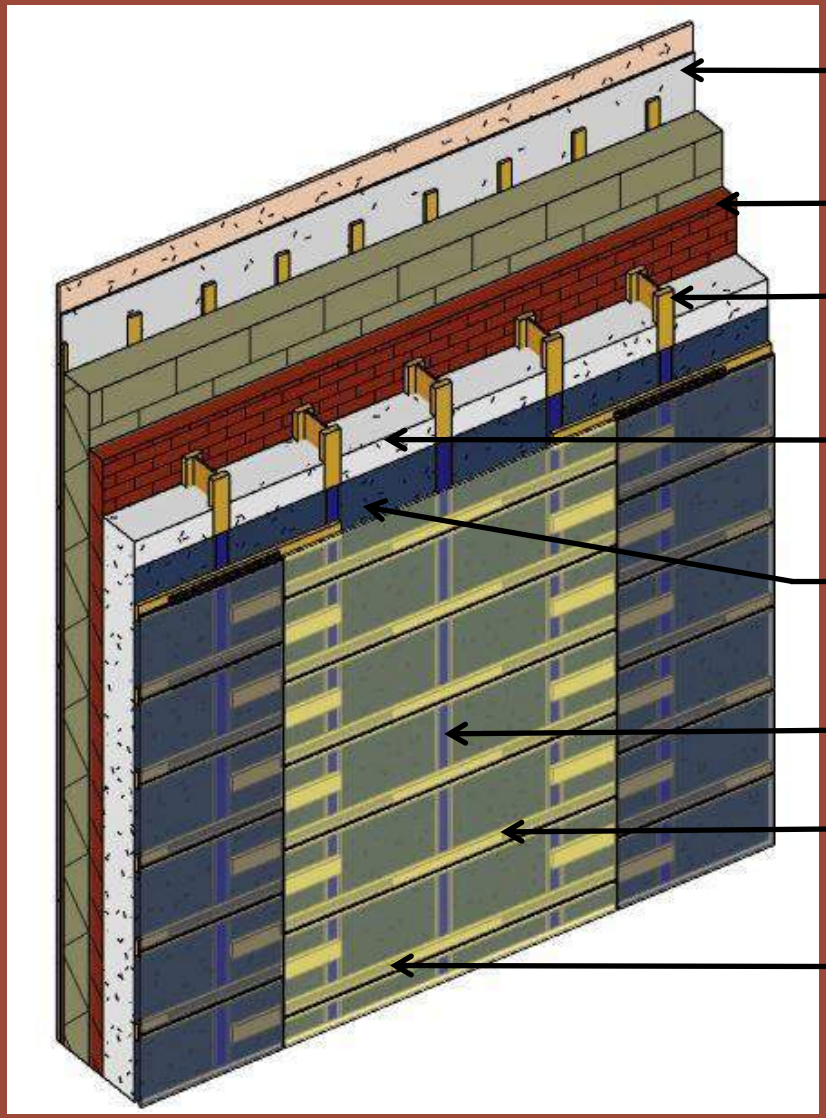
"Well it is not as robust, but if you are sure it will save us real money we can go with . . ."

"**MY GUYS HAVE NEVER DONE THIS– THEY WAY UNDER-BID IT**"

PRE-CONSTRUCTION CHALLENGES

SUBCONTRACTOR BUY-IN

LESS ROBUST AND HARDER TO BUILD

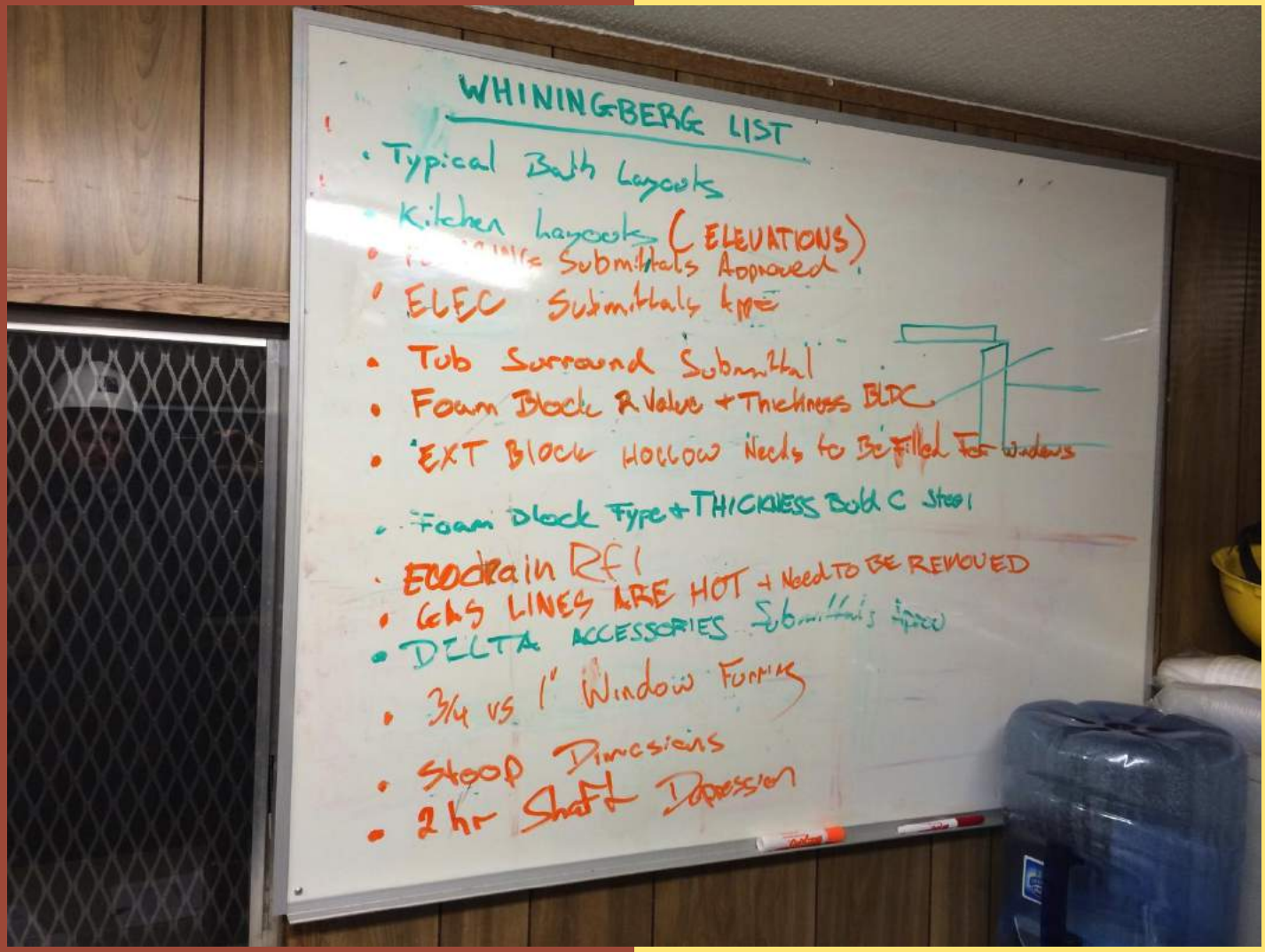


POST "VE" ENCLOSURE

- EXIST. PLASTER OVER GYP. BD. SUBSTRATE & VERT. 1X FURRING
- BRICK & CMU BACK-UP
- 9 ½" 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

CONSTRUCTION CHALLENGES

COORDINATION INTENSITY



CONSTRUCTION CHALLENGES

SUBSTITUTION REQUESTS

CONSTRUCTION CHALLENGES

INSTALLATION AND CONTRACTOR CONTINUITY

CONSTRUCTION CHALLENGES

INSTALLATION QUALITY

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 (3) 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 PHIUS+ RATER ACCORDING TO PHIUS+ 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 I"-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

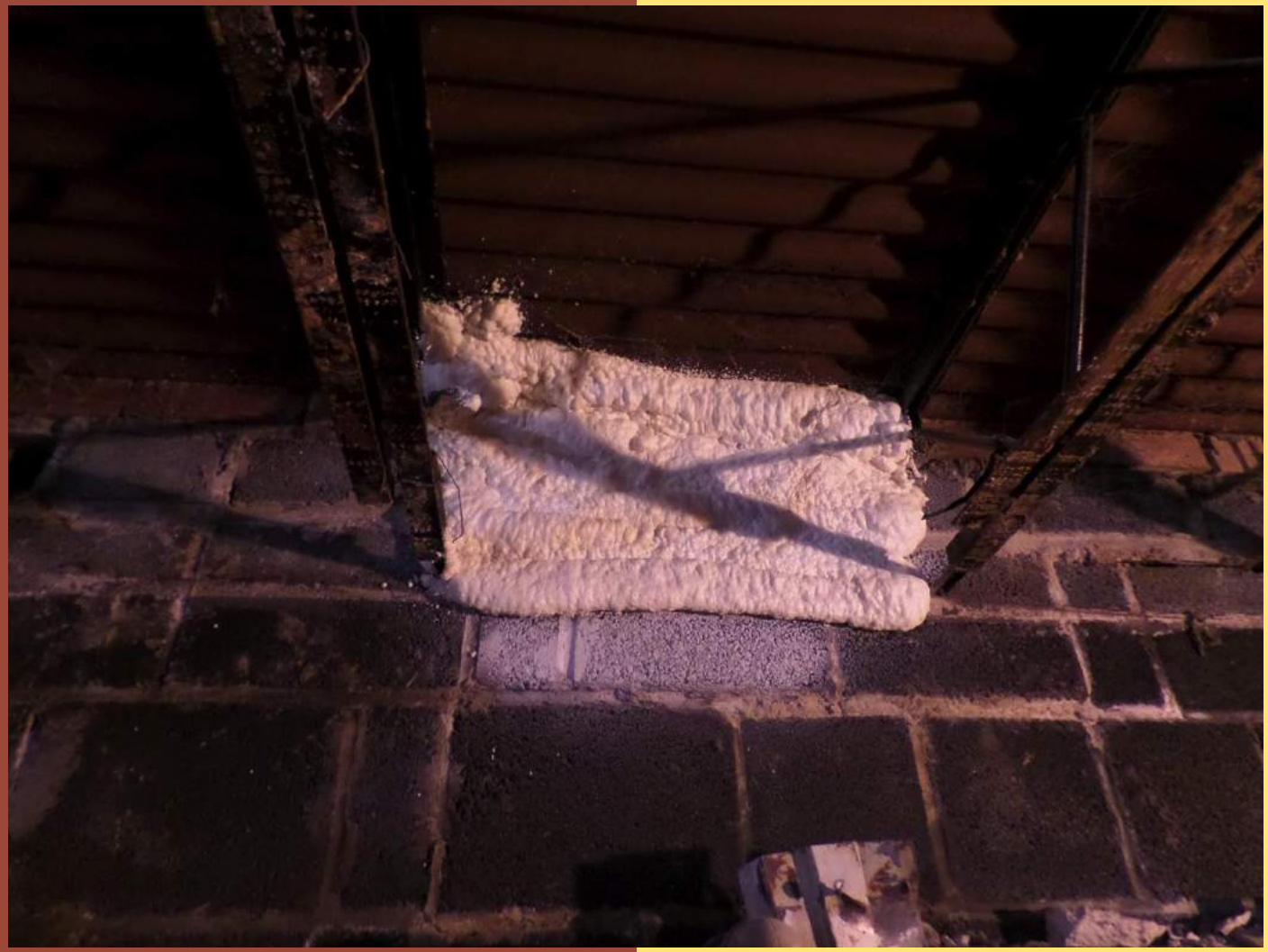
MOCK-UP

FIELD CONDITION CHALLENGES

MOCK-UP

FIELD CONDITION CHALLENGES

MOCK-UP

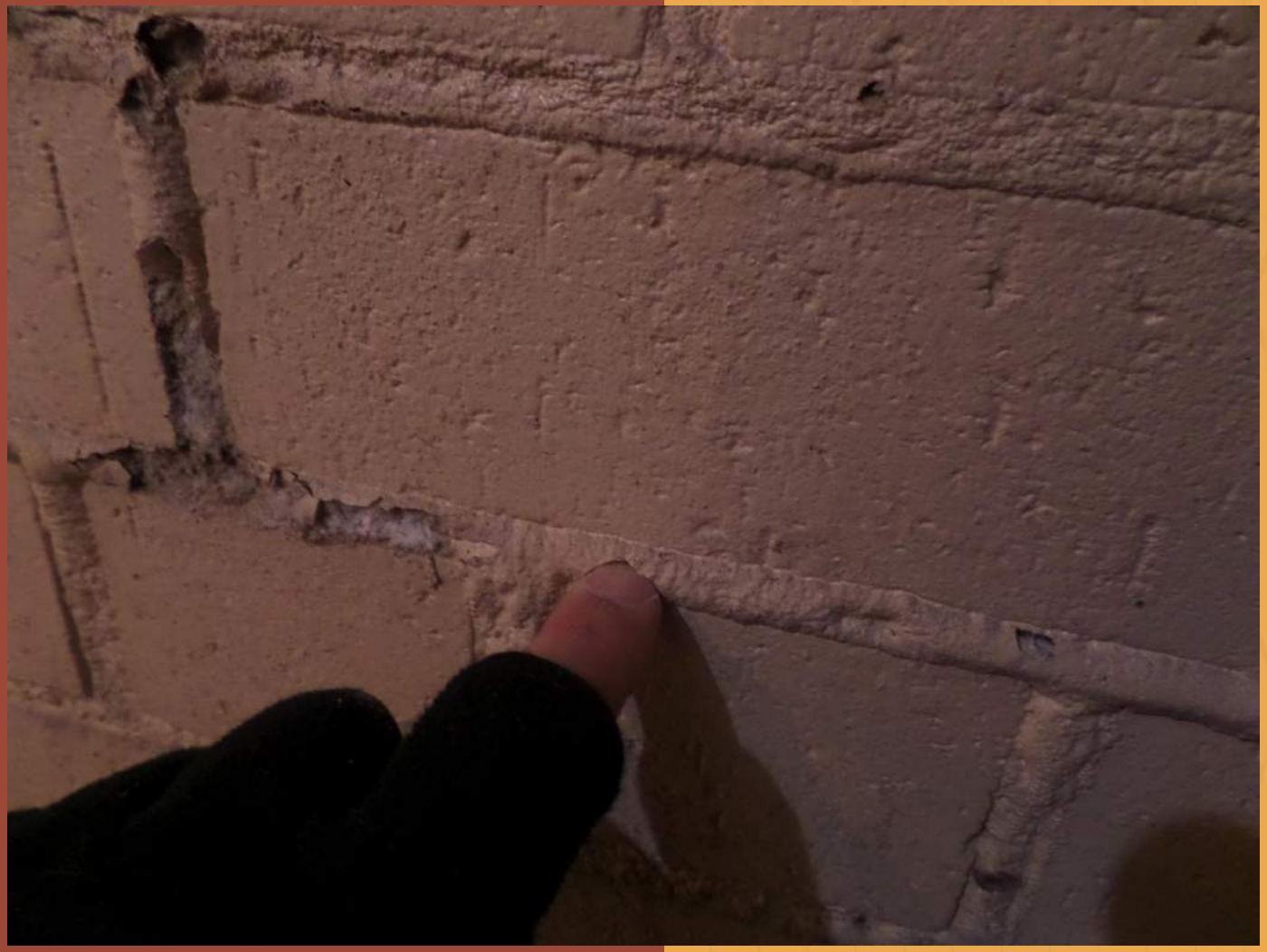


CHALLENGES WITH BUILDING MOLD…

INHERENT CHALLENGES,
BULK WATER, CAPILLARY ACTION

CHALLENGES WITH BUILDING

…CAPILLARY…



CHALLENGES WITH BUILDING

…AND HYDROSTATIC MOISTURE…

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.

AIR-TIGHTNESS:
NOW TO THE EXTERIOR

ALL STRIPPED DOWN

CREATING THE INSULATION CAVITY

CREATING THE INSULATION CAVITY

CREATING THE INSULATION CAVITY


HAMEL COMMERCIA
Elkridge, Maryland

THE AIR-TIGHT LAYER SEQUENCE

DETAILS AS A RESULT OF "VALUE-ENGINEERING"

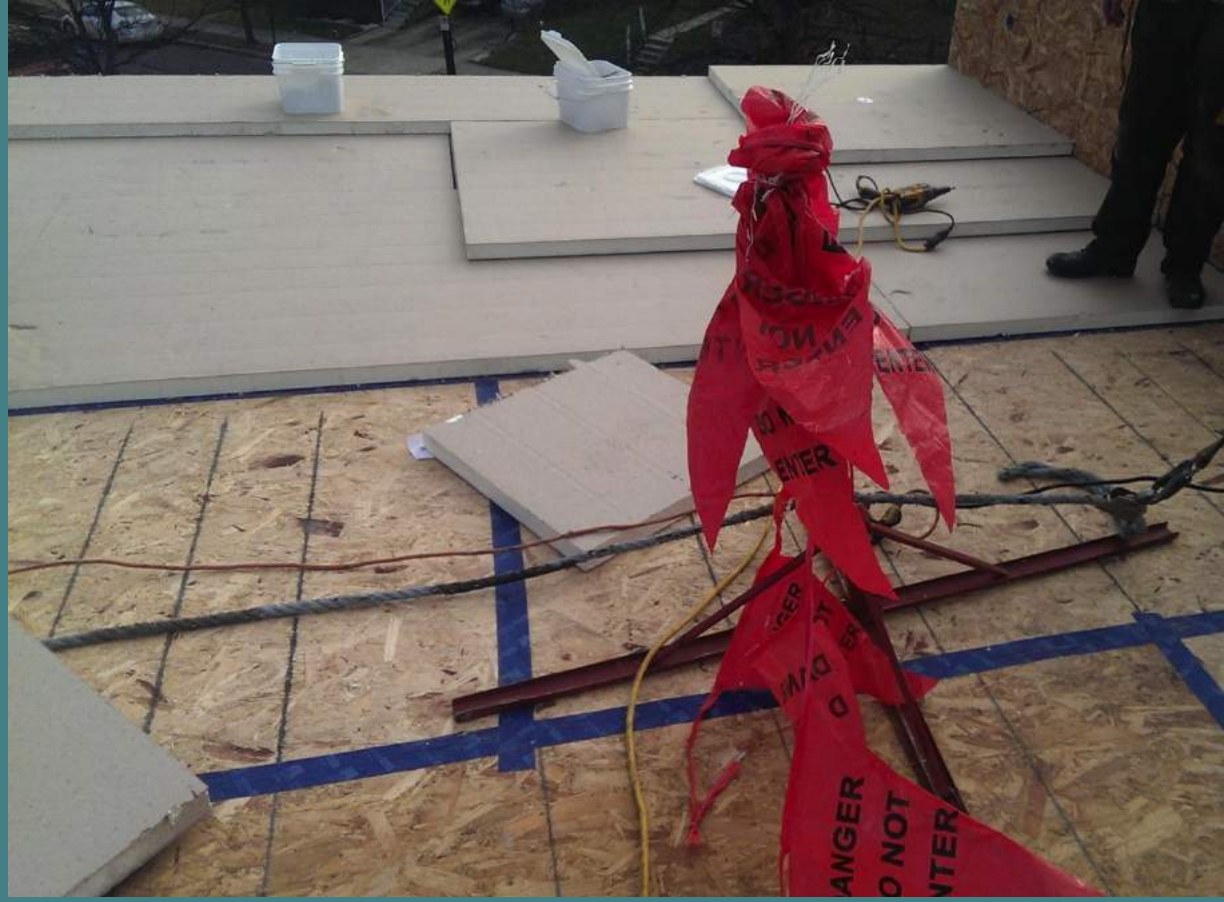
CRAWLSPACE INSULATION AND VAPOR CONTROL SEQUENCE

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

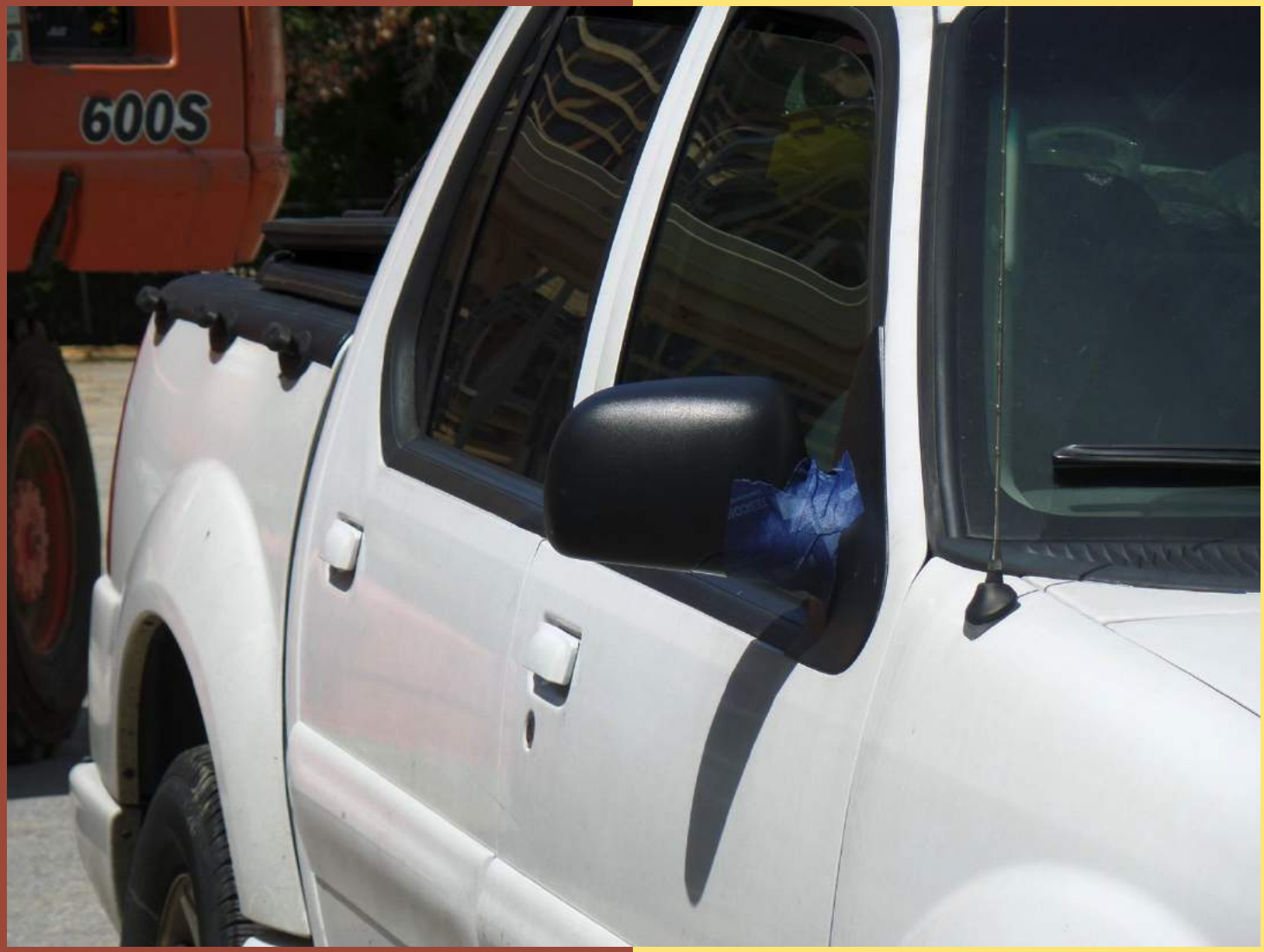


THE ROOF RETROFIT: AN AIR SEALING AND SEQUENCING CHALLENGE

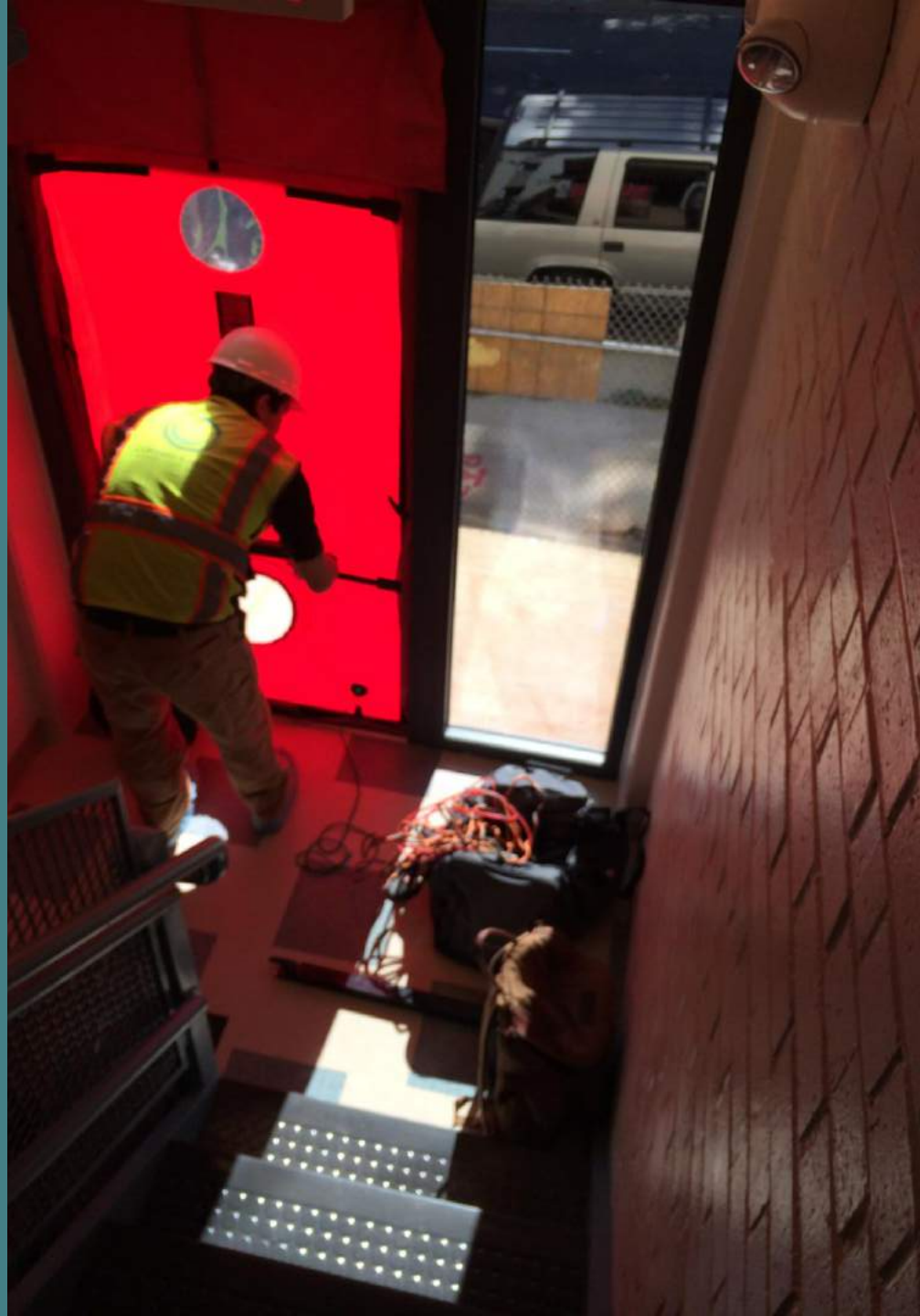
THE ROOF RETROFIT: AN AIR SEALING AND SEQUENCING CHALLENGE

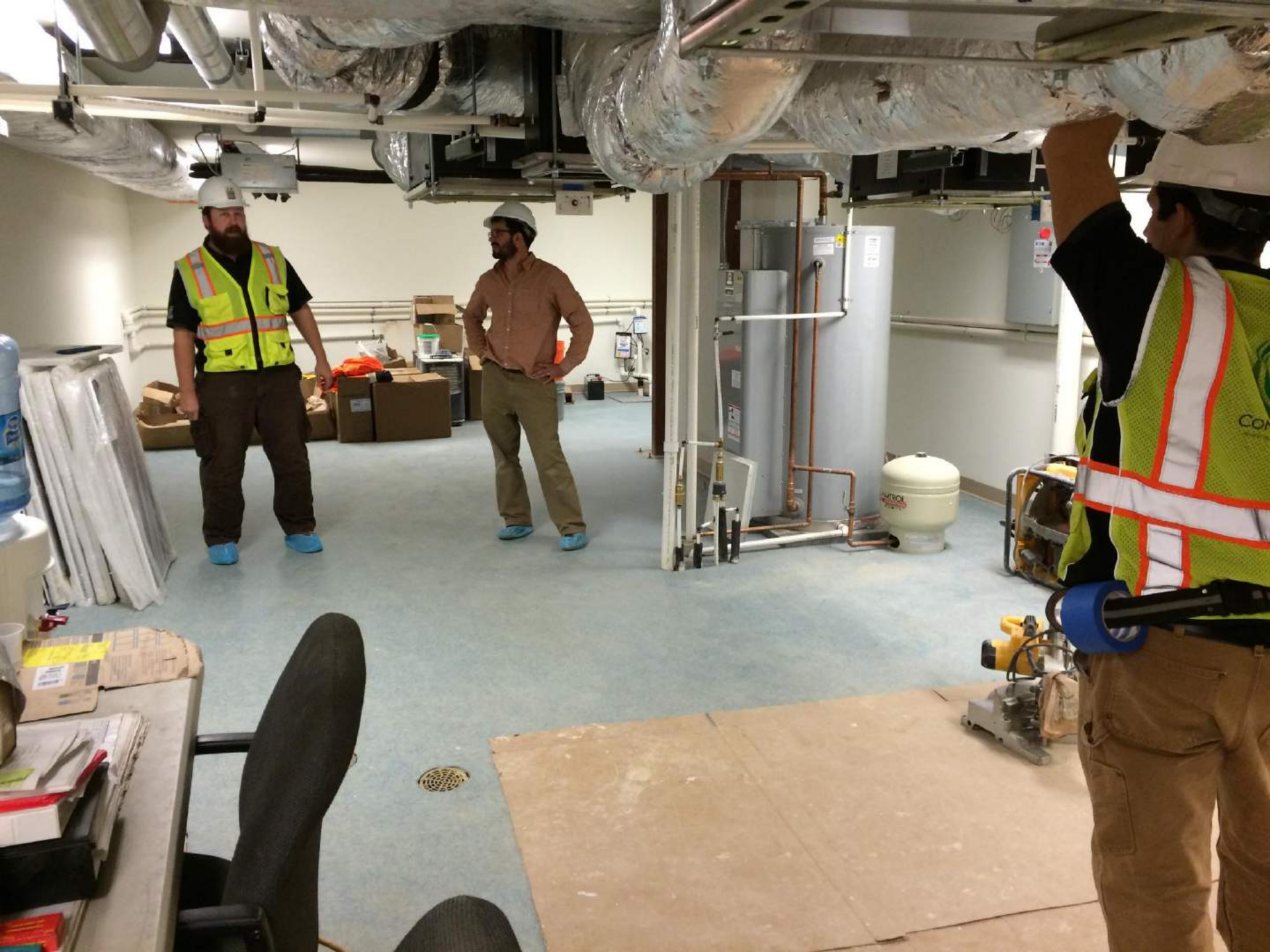
CONSTRUCTION CHALLENGES

AHH…. ASSIMILATION




DG-700 Pressure & Flow Gauge
DEVICE
CONFIG
- 75.0
726
MODE
TIME AVG
DEVICE
UNITS
CONFIG
MODE
CLEAR
TIME AVG
BASE LINE
START
ENTER
INPUT
A
REF
ON/ OFF
LIGHT
HOLD
The ENERGY CONSERVATORY
ON
OFF
LOW
HIGH
Minneapolis Duct Blaster®
The ENERGY CONSERVATORY



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Welcome
to
Washington,DC

THANK YOU.