We Should Know Better:
Top 10 Multifamily Design Mistakes

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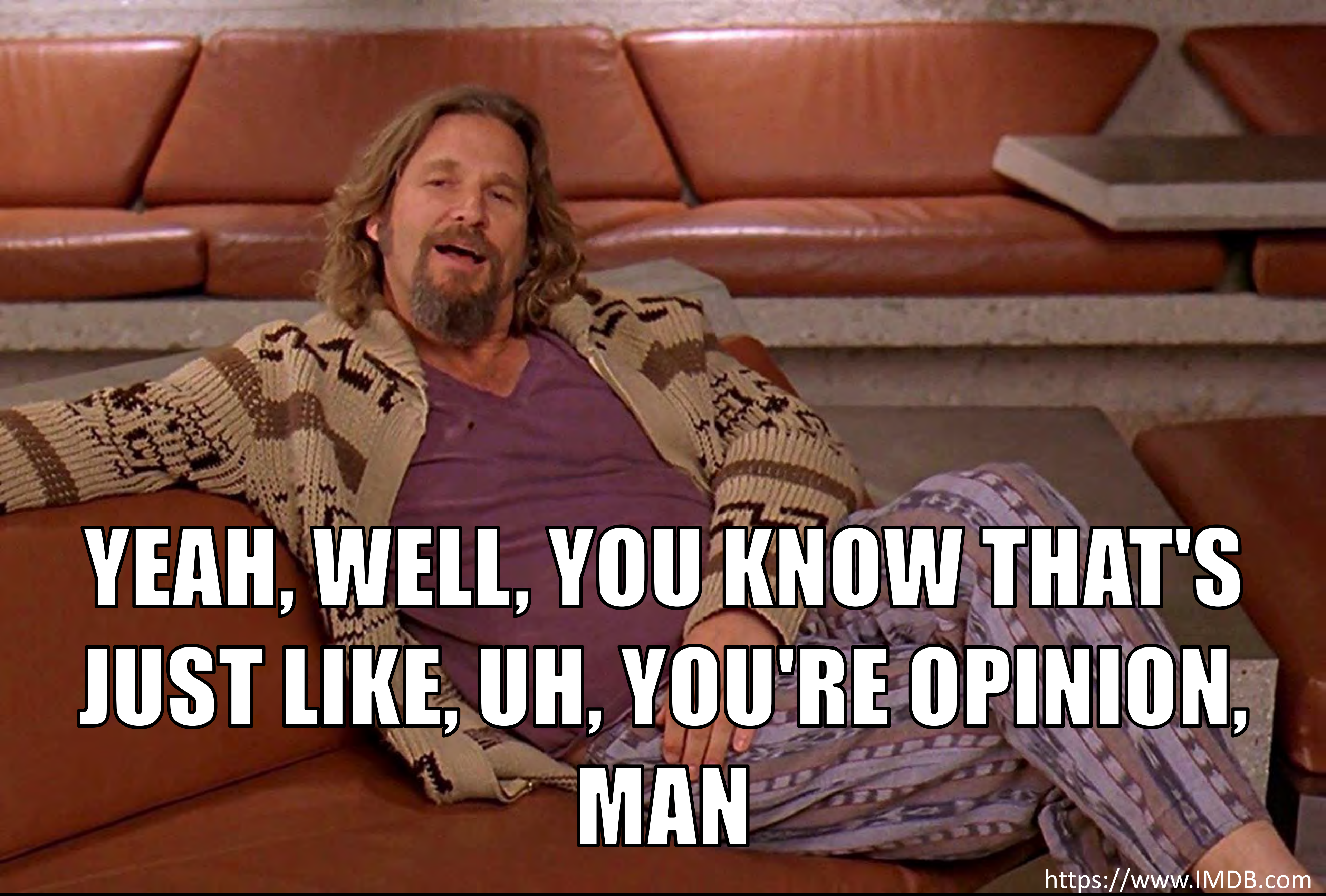
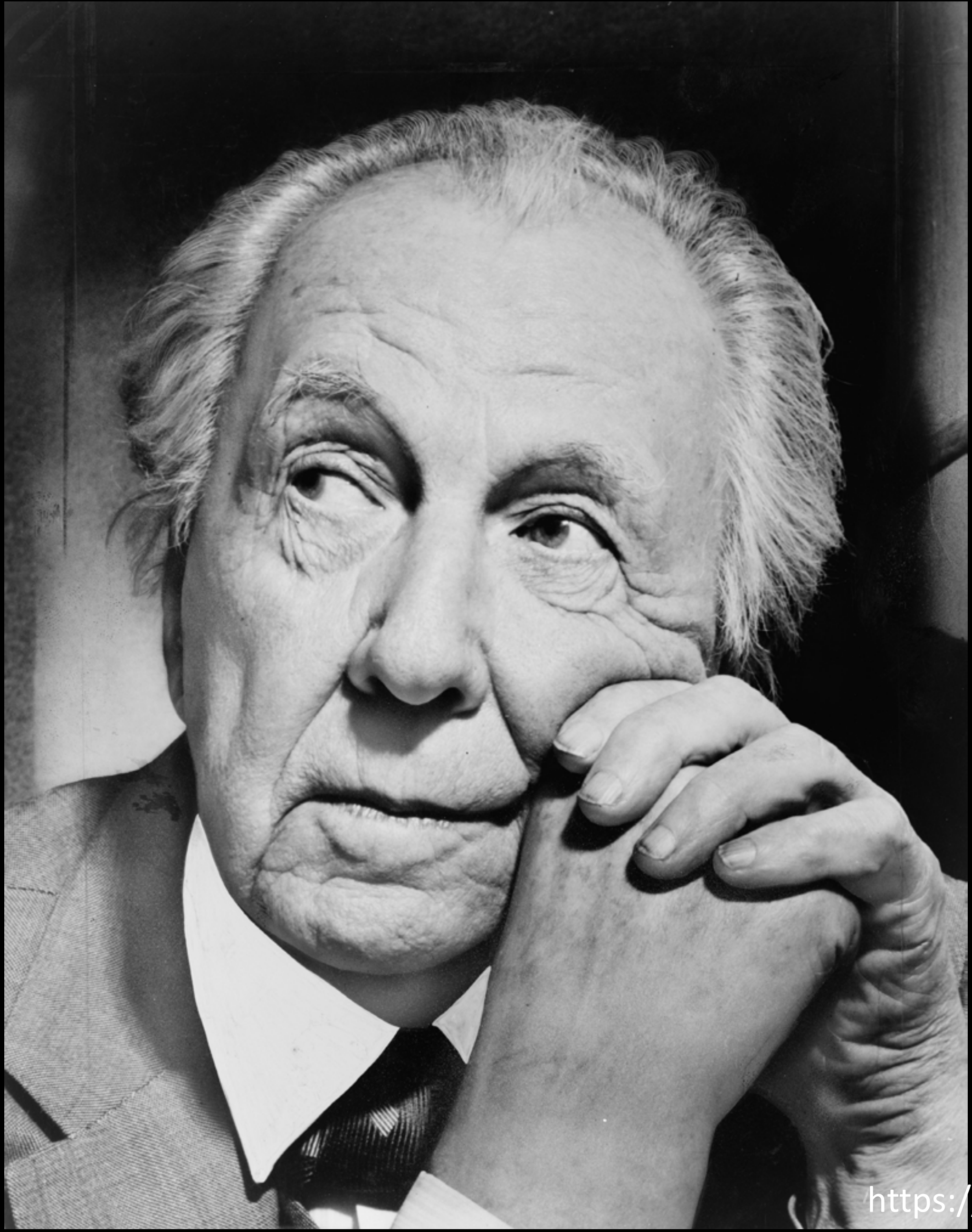
Steven Winter Associates, Inc.
Improving the Built Environment Since 1972

Learning Objectives

- List the top ten design mistakes that decrease constructability, affordability and overall quality of multifamily housing
- Choose the smarter design choices from a selection of scenarios
- Justify smart design alternatives to your clients and contractors in terms of time, money, energy and health
- Develop a smart design checklist for your team to use on future projects


YEAH, WELL, YOU KNOW THAT'S JUST LIKE, UH, YOU'RE OPINION, MAN
https://www.IMDB.com



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1. OVERCOMPLICATED GEOMETRY

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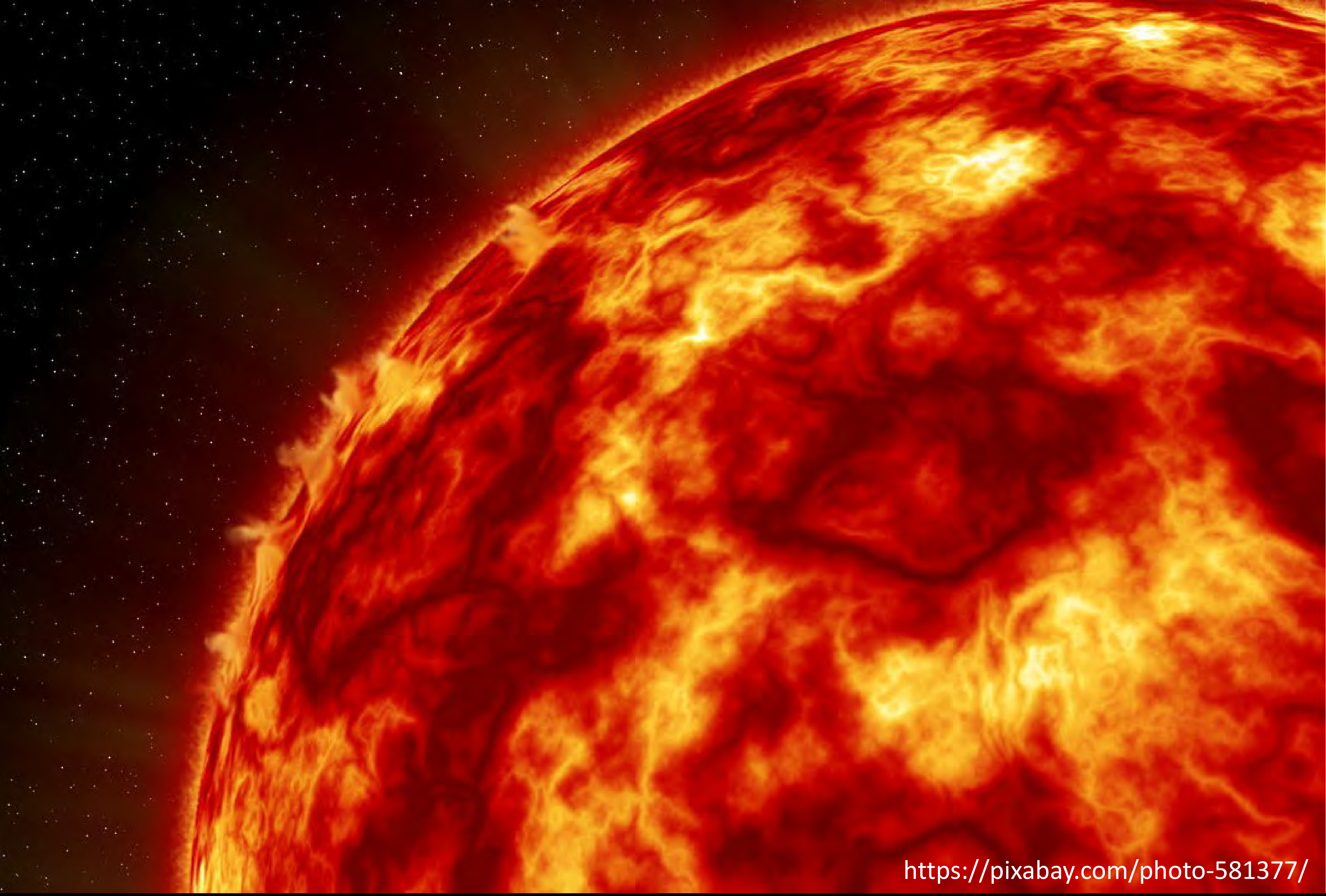
187 6th Ave
New York
Google, Inc.
Street View - Dec 2017
6th Ave &
Berkeley Pl
Grand
Union St
Google


https://pixabay.com/photo-2719255/

https://pixabay.com/photo-1461288/


https://pixabay.com/photo-581377/

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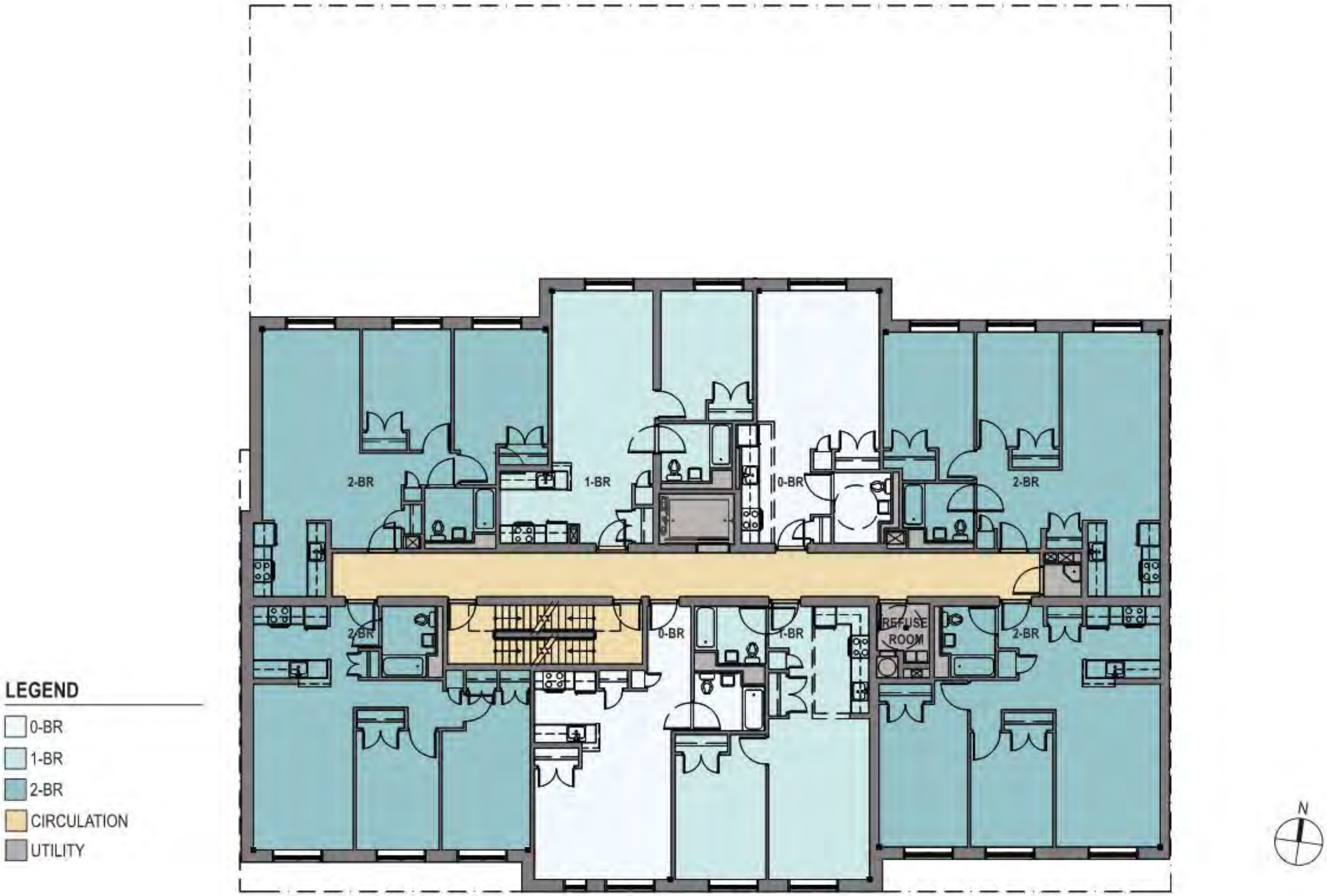
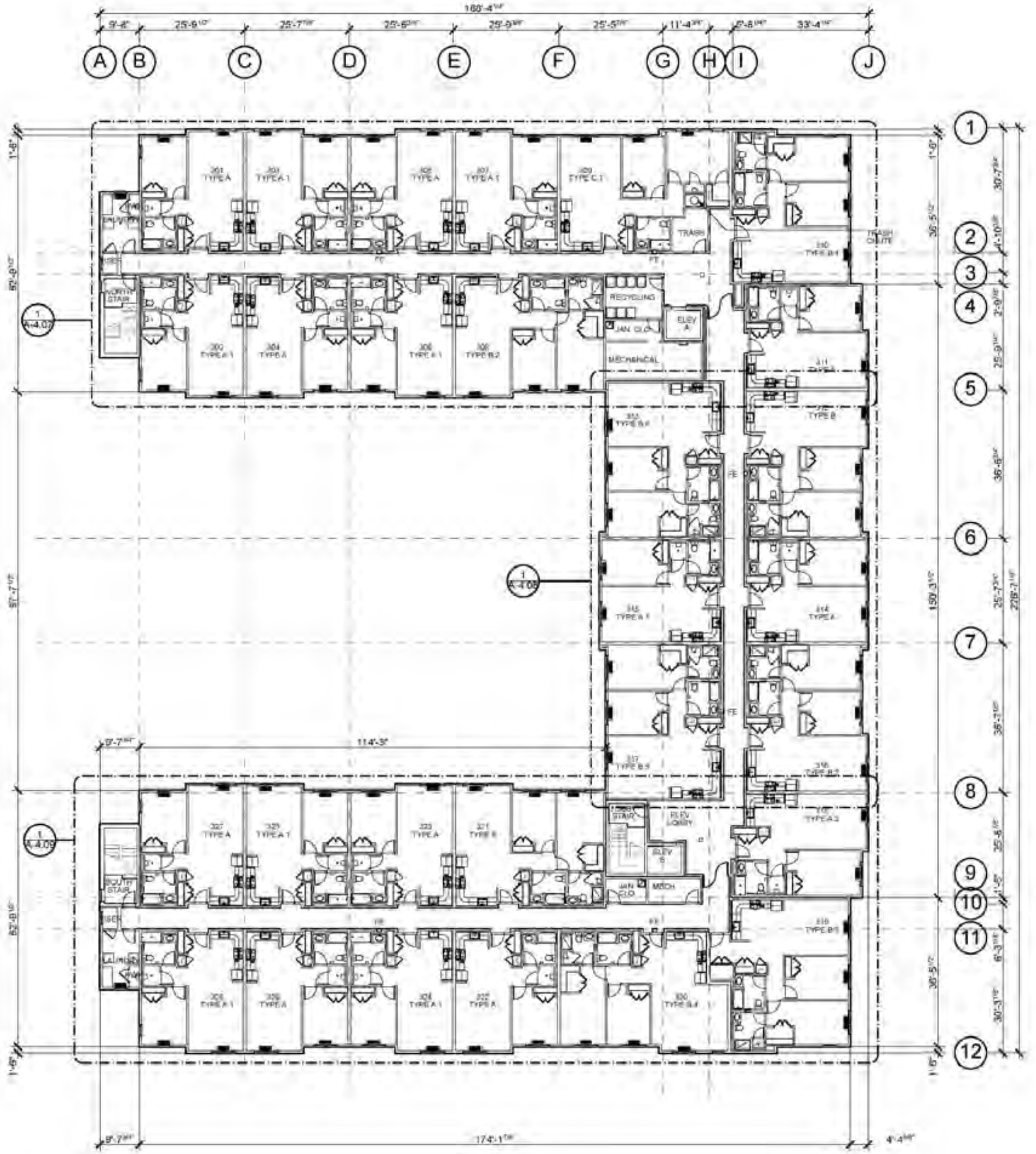
2. DESIGN IRREGULARITIES

https://www.amazon.com



Typical Floor Plan

Curtis + Ginsberg Architects LLP



THIRD FLR APT COUNT

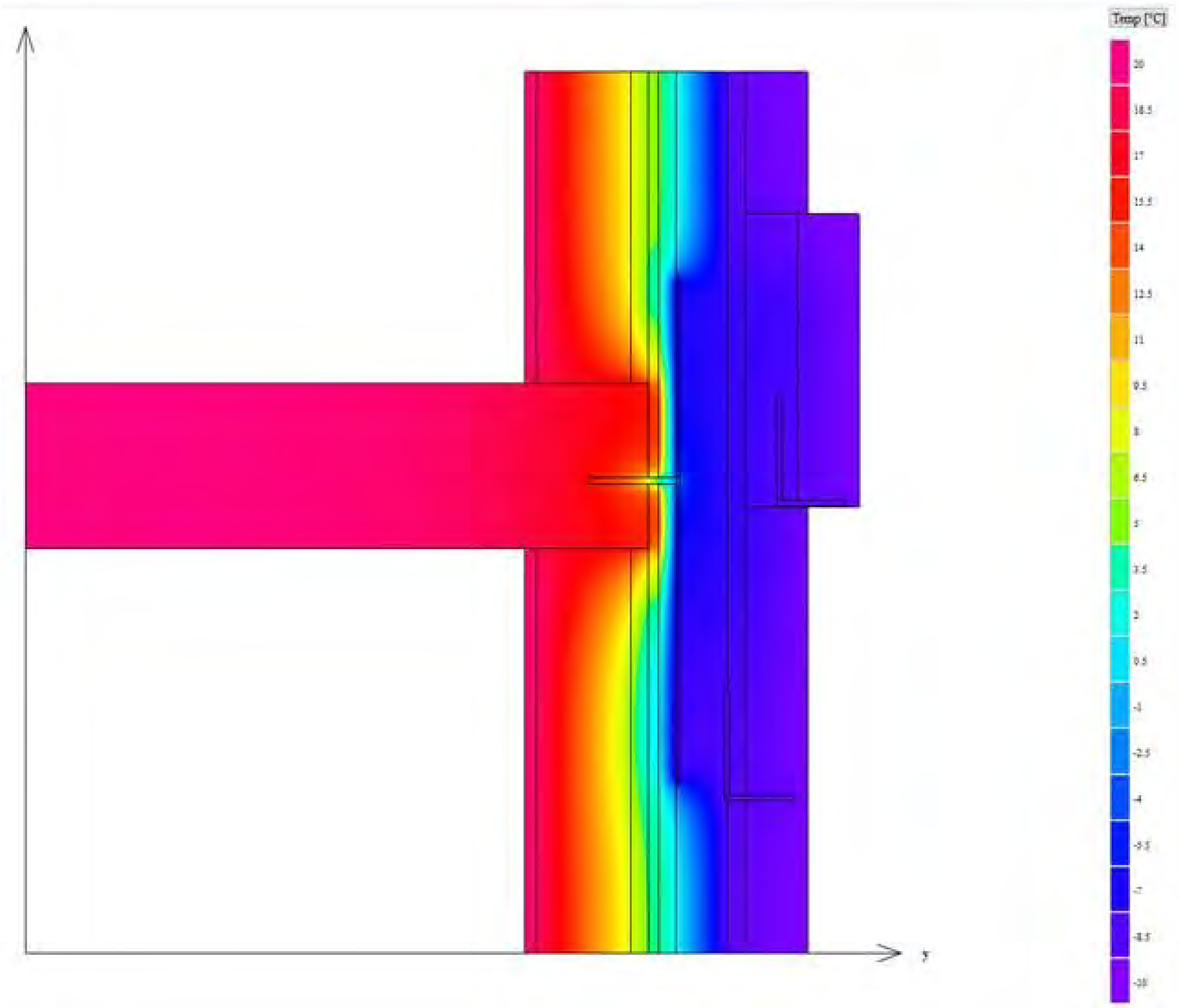
18 ONE-BED/ONE-BATH
9 TWO-BED/TWO-BATH
1 TWO-BED/ONE-BATH

1 THIRD FLOOR PLAN
1/16" = 1'-0"

Marsh & Woods Architects

https://www.flickr.com/photos/rs12240/16573795387/in/photostream/

3. THERMAL BRIDGING: ROOFS & WALLS



Temp [°C]
20
18.5
17
15.5
14
12.5
11
9.5
8
6.5
5
3.5
2
0.5
-1
-2.5
-4
-5.5
-7
-8.5
-10

NOTES:

1. ROOF DRAIN SIZE AND NUMBER OF DRAINS SHALL BE IN ACCORDANCE WITH THE LOCAL CODES.

2. ALL BOLTS OR CLAMPS MUST BE IN PLACE TO PROVIDE CONSTANT COMPRESSION ON WATER CUT-OFF MASTIC.

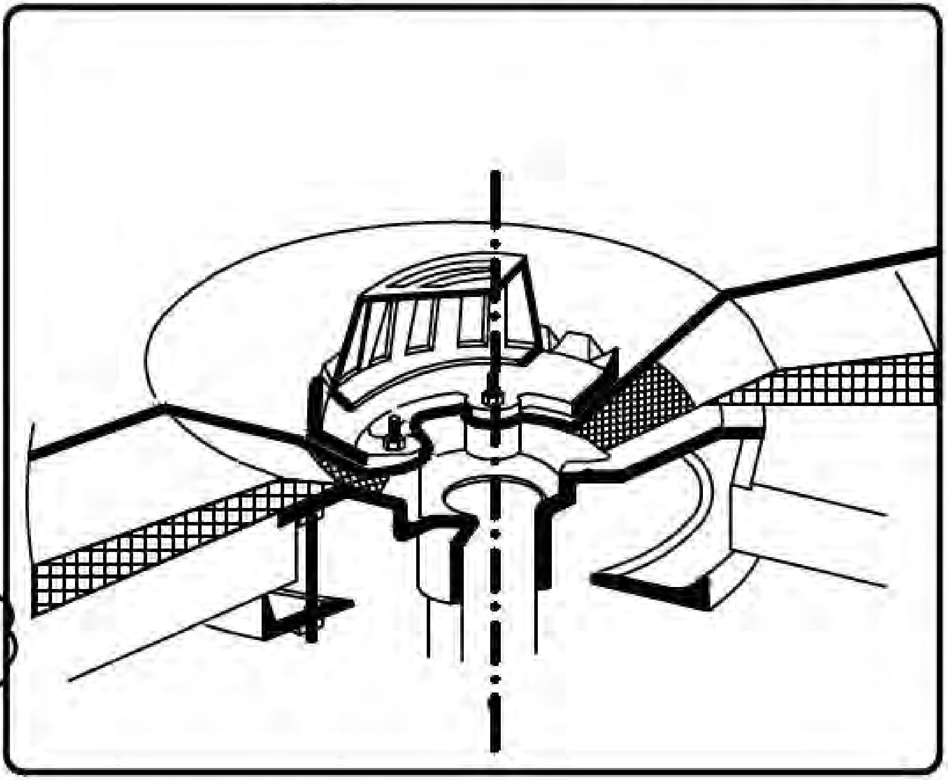
3. THE HOLE IN THE MEMBRANE SHALL EXCEED THE DIAMETER OF THE DRAIN PIPE, BUT SHALL BE NO LESS THAN 1/2" (13mm) FROM THE ATTACHMENT POINTS OF THE DRAIN CLAMPING RING.

4. FIELD SPLICES MUST BE LOCATED AT LEAST 6" (152mm) OUTSIDE THE DRAIN SUMP.

5. INSULATION TAPER SHALL NOT BE GREATER THAN 6" (152mm) IN 12" (305mm) HORIZONTAL.

6. PROVIDE MINIMUM R15 AT ROOF DRAINS

2



7
MR-A7.2

ROOF DRAIN DETAIL

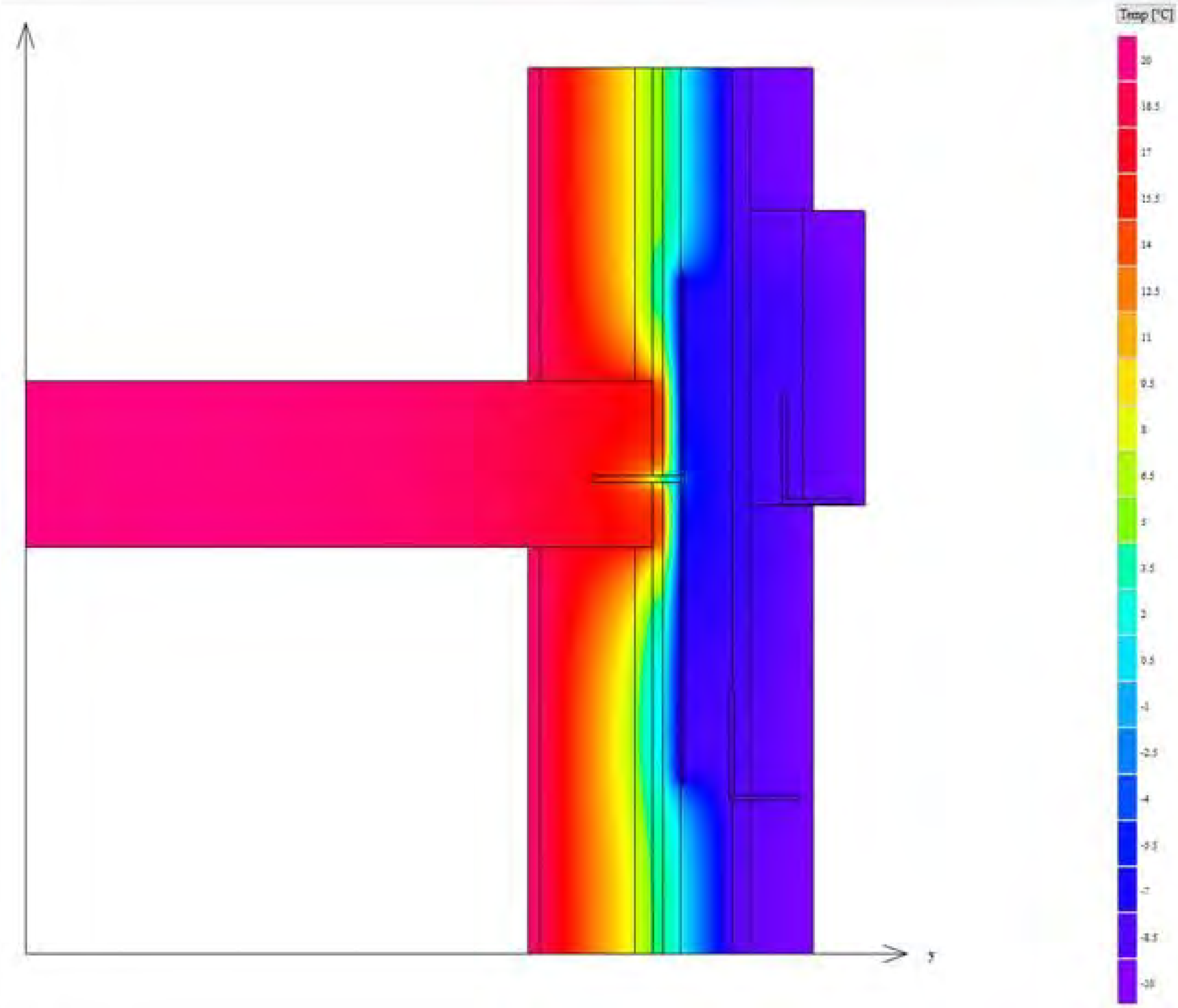
NOT TO SCALE

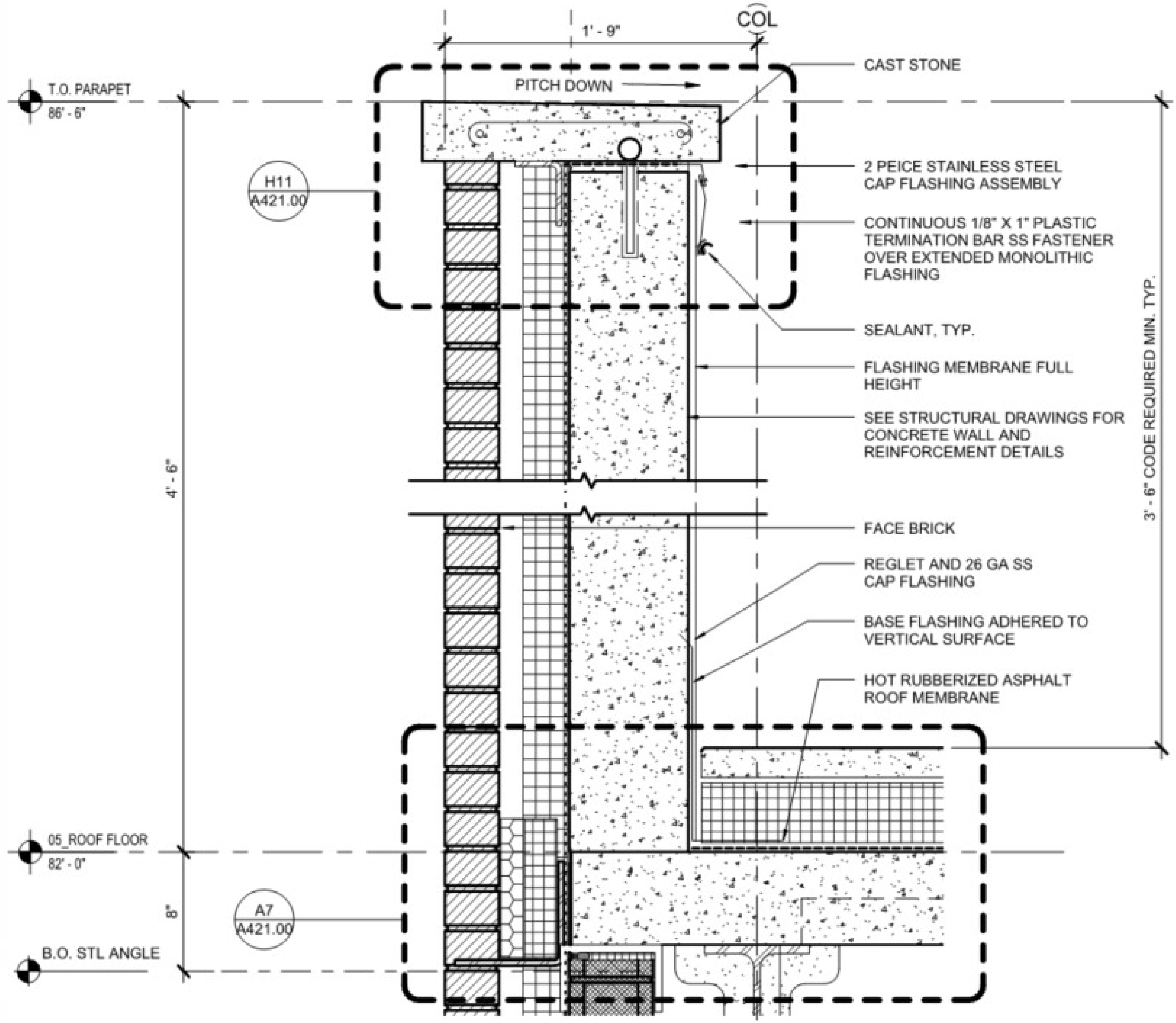
TABLE 1203.3
INSULATION FOR CONDENSATION CONTROL

CLIMATE ZONE	MINIMUM R-VALUE OF AIR-IMPERMEABLE INSULATION[a]
2B and 3B tile roof only	0 (none required)
1, 2A, 2B, 3A, 3B, 3C	R-5
4C	R-10
4A, 4B	R-15
5	R-20
6	R-25
7	R-30
8	R-35

a. Contributes to, but does not supersede, thermal resistance requirements for attic and roof assemblies in Section C402.2.1 of the *International Energy Conservation Code*.

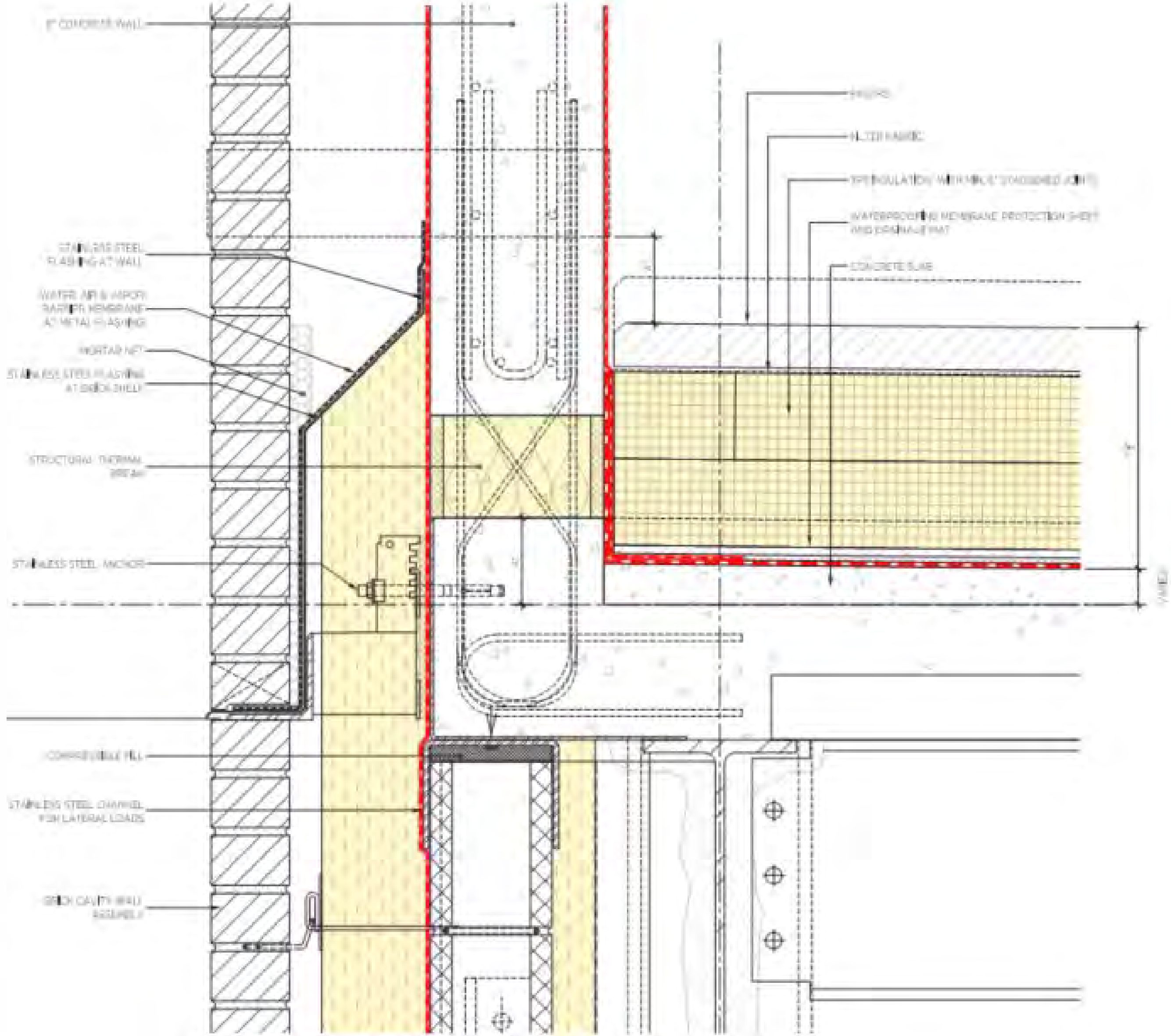
2015 International Building Code


Temp [°C]
20
18.5
17
15.5
14
12.5
11
9.5
8
6.5
5
3.5
2
0.5
-1
-2.5
-4
-5.5
-7
-8.5
-10

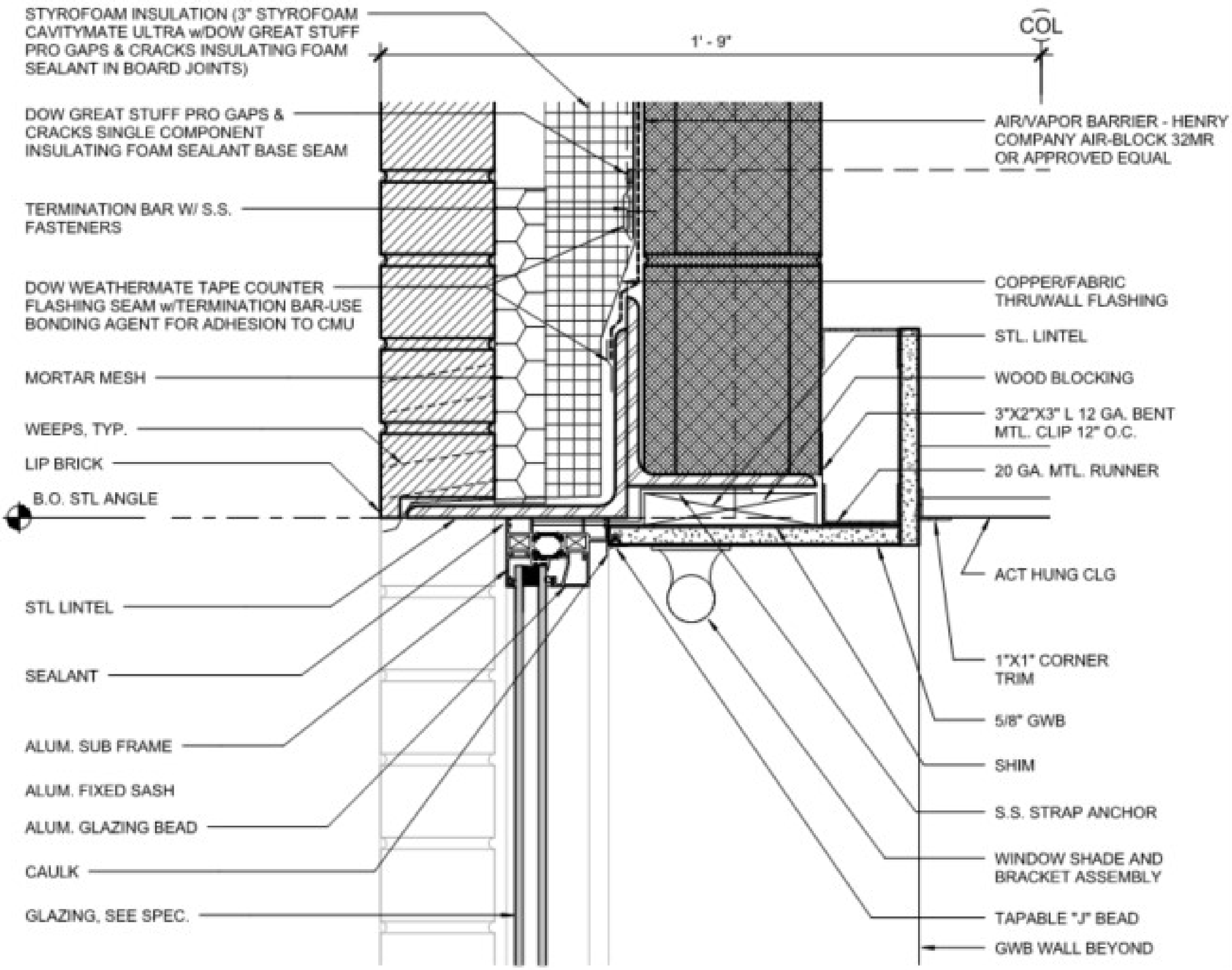


COL
1' - 9"
PITCH DOWN
T.O. PARAPET
86' - 6"
CAST STONE
2 PEICE STAINLESS STEEL CAP FLASHING ASSEMBLY
H11
A421.00
CONTINUOUS 1/8" X 1" PLASTIC TERMINATION BAR SS FASTENER OVER EXTENDED MONOLITHIC FLASHING
SEALANT, TYP.
FLASHING MEMBRANE FULL HEIGHT
SEE STRUCTURAL DRAWINGS FOR CONCRETE WALL AND REINFORCEMENT DETAILS
4' - 6"
3' - 6" CODE REQUIRED MIN. TYP.
FACE BRICK
REGLET AND 26 GA SS CAP FLASHING
BASE FLASHING ADHERED TO VERTICAL SURFACE
HOT RUBBERIZED ASPHALT ROOF MEMBRANE
05_ROOF FLOOR
82' - 0"
8"
A7
A421.00
B.O. STL ANGLE

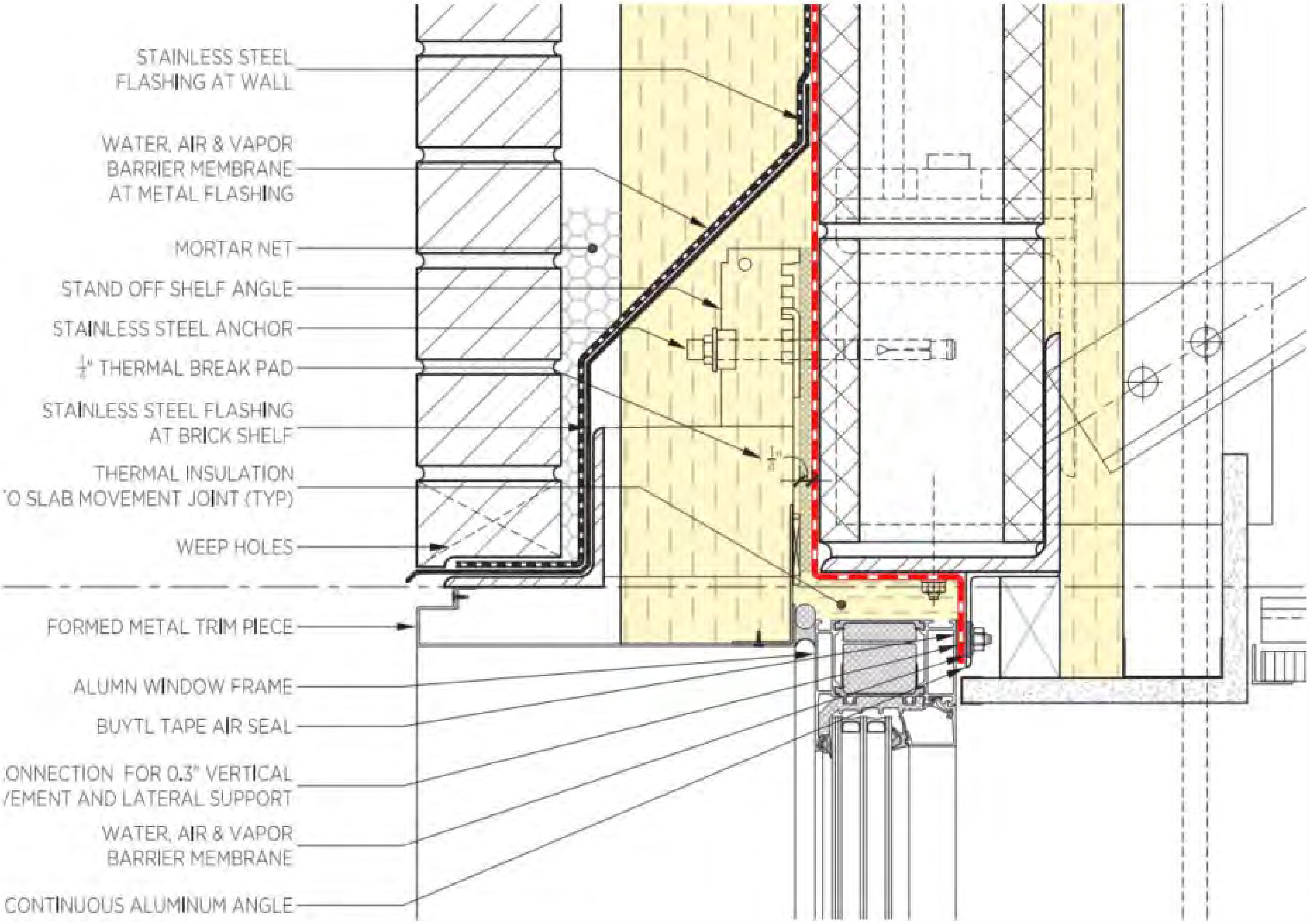
FXFOWLE


8" CONCRETE WALL
STAINLESS STEEL FLASHING AT WALL
WATER, AIR & VAPOR BARRIER MEMBRANE AT METAL FLASHING
MORTAR NET
STAINLESS STEEL FLASHING AT BRICK SHELF
STRUCTURAL THERMAL BREAK
STAINLESS STEEL ANCHOR
COMPRESSIBLE FILL
STAINLESS STEEL CHANNEL FOR LATERAL LOADS
BRICK CAVITY WALL ASSEMBLY
PAVERS
FILTER FABRIC
WATERPROOFING MEMBRANE PROTECTION SHEET AND DRAINAGE MAT
CONCRETE SLAB

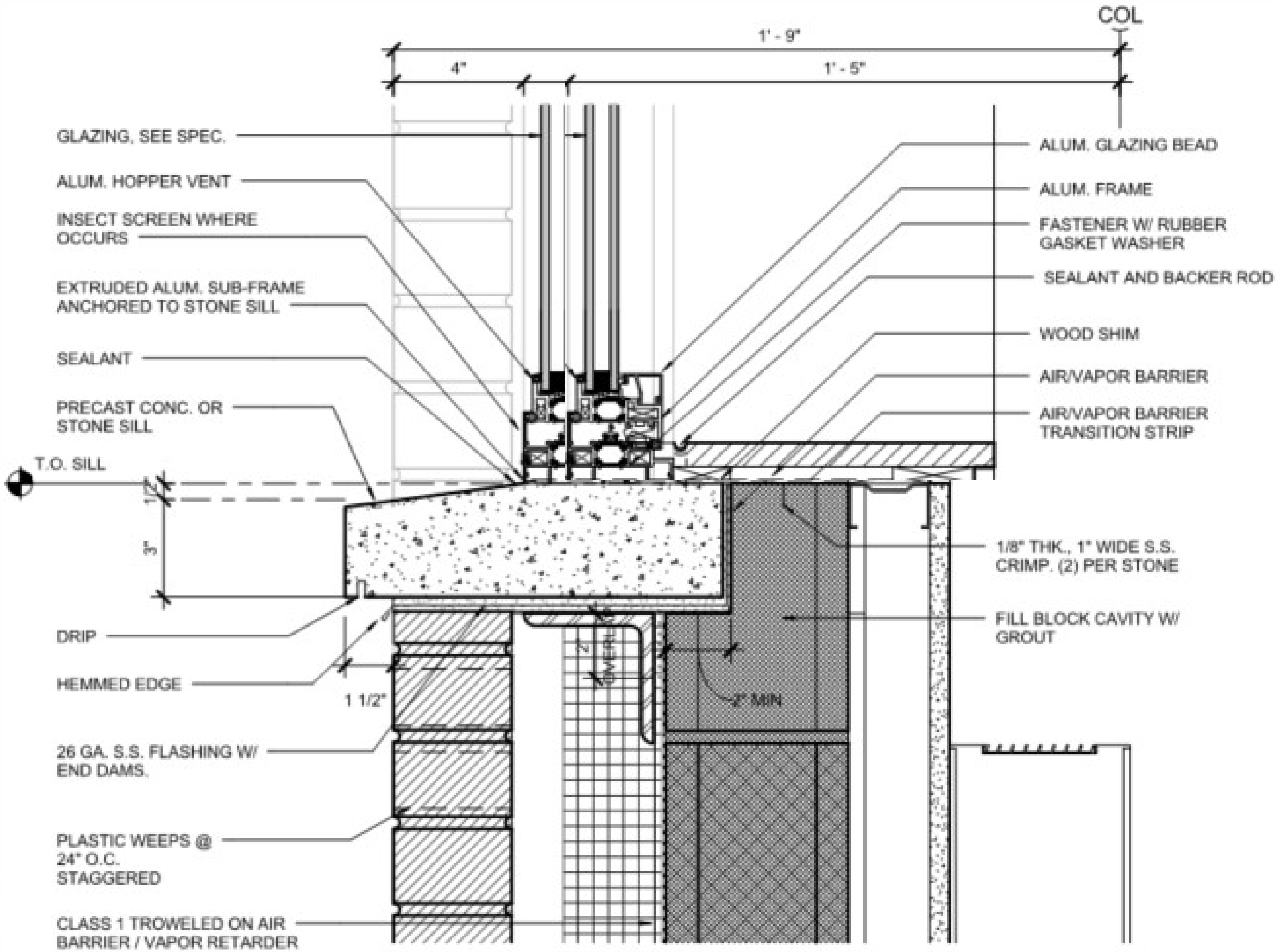
FXFOWLE


STYROFOAM INSULATION (3" STYROFOAM CAVITYMATE ULTRA w/DOW GREAT STUFF PRO GAPS & CRACKS INSULATING FOAM SEALANT IN BOARD JOINTS)
1' - 9"
COL
DOW GREAT STUFF PRO GAPS & CRACKS SINGLE COMPONENT INSULATING FOAM SEALANT BASE SEAM
AIR/VAPOR BARRIER - HENRY COMPANY AIR-BLOCK 32MR OR APPROVED EQUAL
TERMINATION BAR W/ S.S. FASTENERS
DOW WEATHERMATE TAPE COUNTER FLASHING SEAM w/TERMINATION BAR-USE BONDING AGENT FOR ADHESION TO CMU
COPPER/FABRIC THRUWALL FLASHING
STL. LINTEL
MORTAR MESH
WOOD BLOCKING
3"X2"X3" L 12 GA. BENT MTL. CLIP 12" O.C.
WEEPS, TYP.
LIP BRICK
20 GA. MTL. RUNNER
B.O. STL ANGLE
ACT HUNG CLG
STL LINTEL
SEALANT
1"X1" CORNER TRIM
5/8" GWB
ALUM. SUB FRAME
SHIM
ALUM. FIXED SASH
S.S. STRAP ANCHOR
ALUM. GLAZING BEAD
WINDOW SHADE AND BRACKET ASSEMBLY
CAULK
TAPABLE "J" BEAD
GLAZING, SEE SPEC.
GWB WALL BEYOND

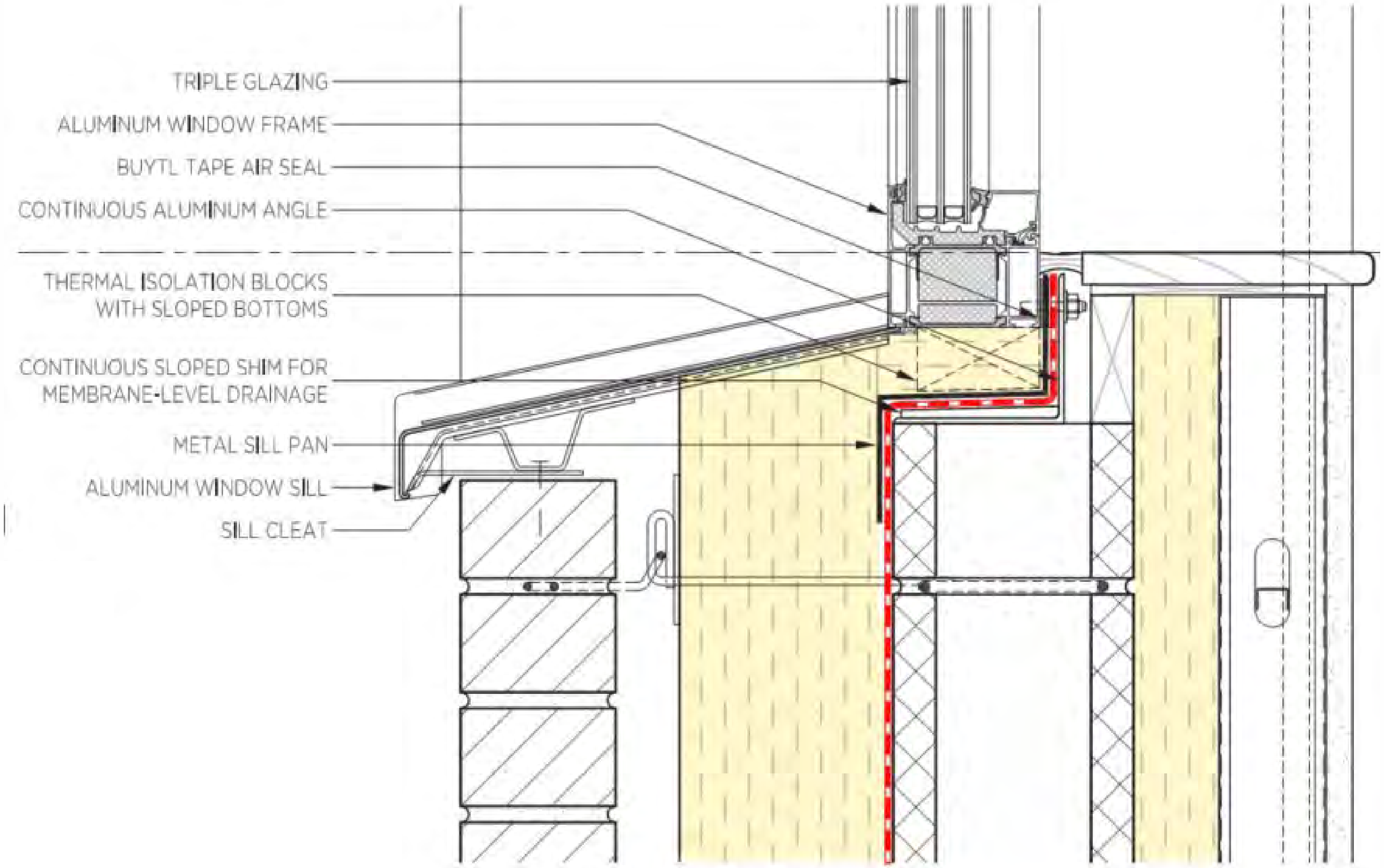
FXFOWLE


STAINLESS STEEL
FLASHING AT WALL
WATER, AIR & VAPOR
BARRIER MEMBRANE
AT METAL FLASHING
MORTAR NET
STAND OFF SHELF ANGLE
STAINLESS STEEL ANCHOR
1/2" THERMAL BREAK PAD
STAINLESS STEEL FLASHING
AT BRICK SHELF
THERMAL INSULATION
O SLAB MOVEMENT JOINT (TYP)
WEEP HOLES
FORMED METAL TRIM PIECE
ALUMN WINDOW FRAME
BUYTL TAPE AIR SEAL
ONNECTION FOR 0.3" VERTICAL
/EMENT AND LATERAL SUPPORT
WATER, AIR & VAPOR
BARRIER MEMBRANE
CONTINUOUS ALUMINUM ANGLE

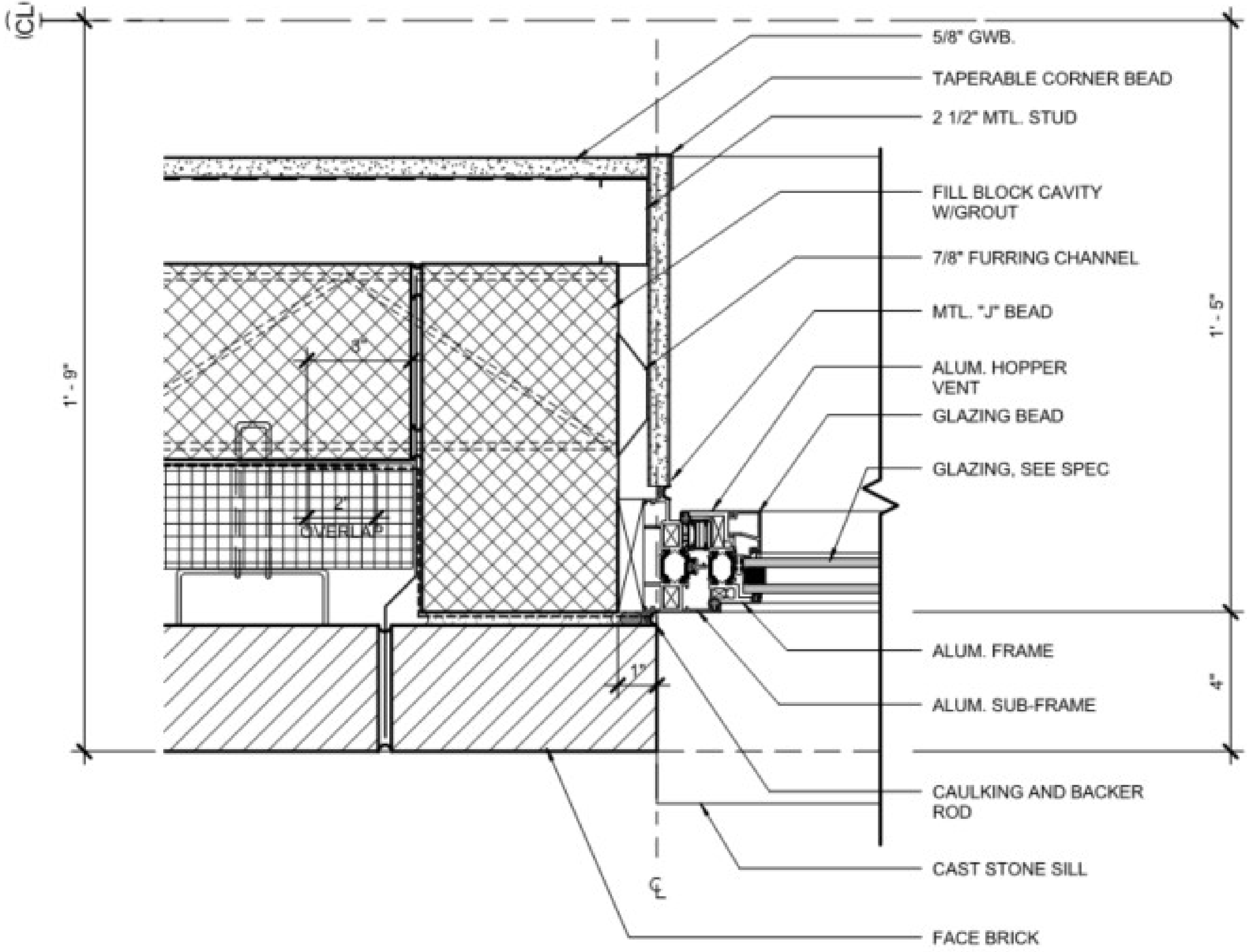
FXFOWLE


COL
1' - 9"
4"
1' - 5"
GLAZING, SEE SPEC.
ALUM. HOPPER VENT
INSECT SCREEN WHERE OCCURS
EXTRUDED ALUM. SUB-FRAME ANCHORED TO STONE SILL
SEALANT
PRECAST CONC. OR STONE SILL
T.O. SILL
1/2"
3"
DRIP
HEMMED EDGE
1 1/2"
26 GA. S.S. FLASHING W/ END DAMS.
PLASTIC WEEPS @ 24" O.C. STAGGERED
CLASS 1 TROWELED ON AIR BARRIER / VAPOR RETARDER
ALUM. GLAZING BEAD
ALUM. FRAME
FASTENER W/ RUBBER GASKET WASHER
SEALANT AND BACKER ROD
WOOD SHIM
AIR/VAPOR BARRIER
AIR/VAPOR BARRIER TRANSITION STRIP
1/8" THK., 1" WIDE S.S. CRIMP. (2) PER STONE
FILL BLOCK CAVITY W/ GROUT
2" MIN

FXFOWLE

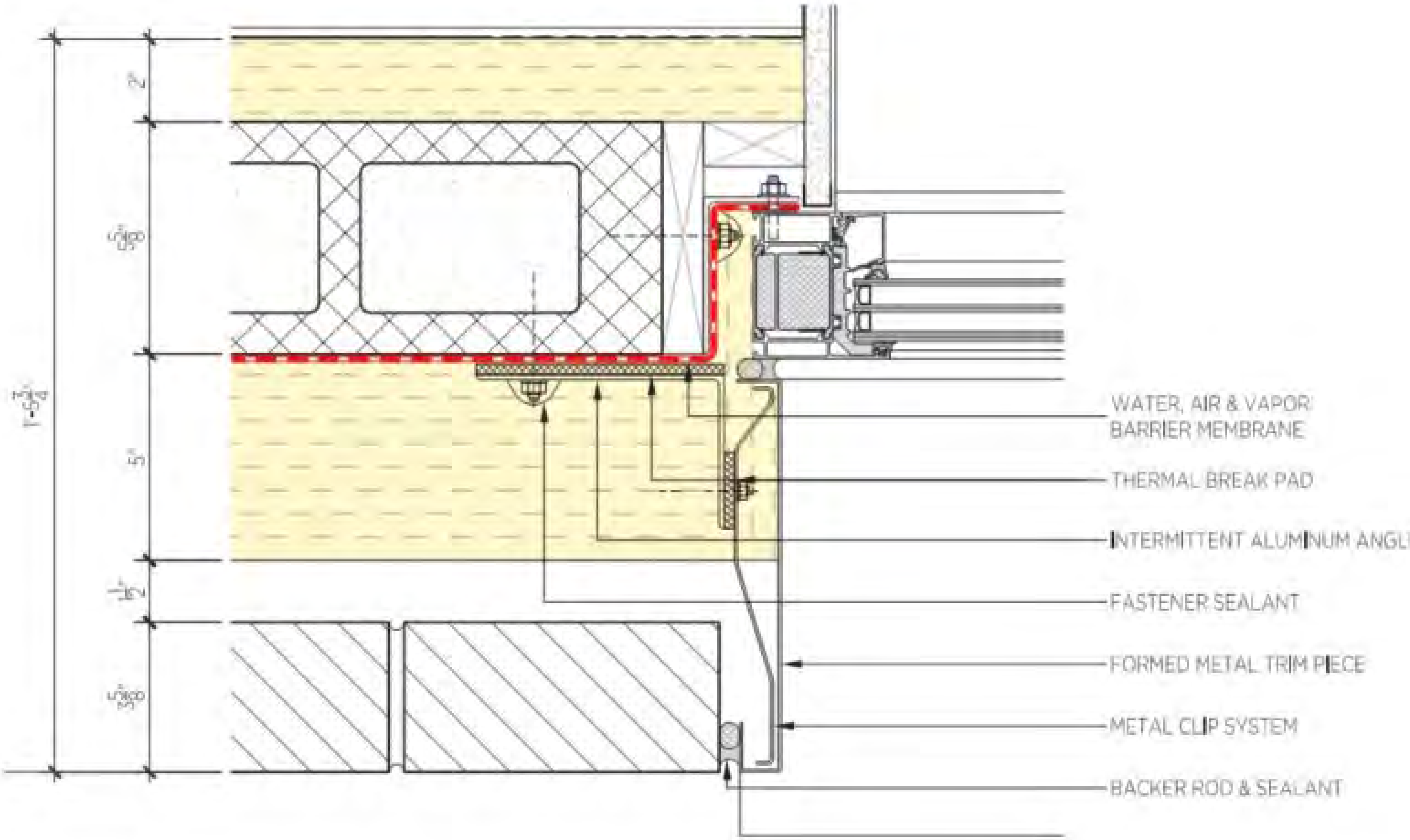


FXFOWLE/NYSERDA



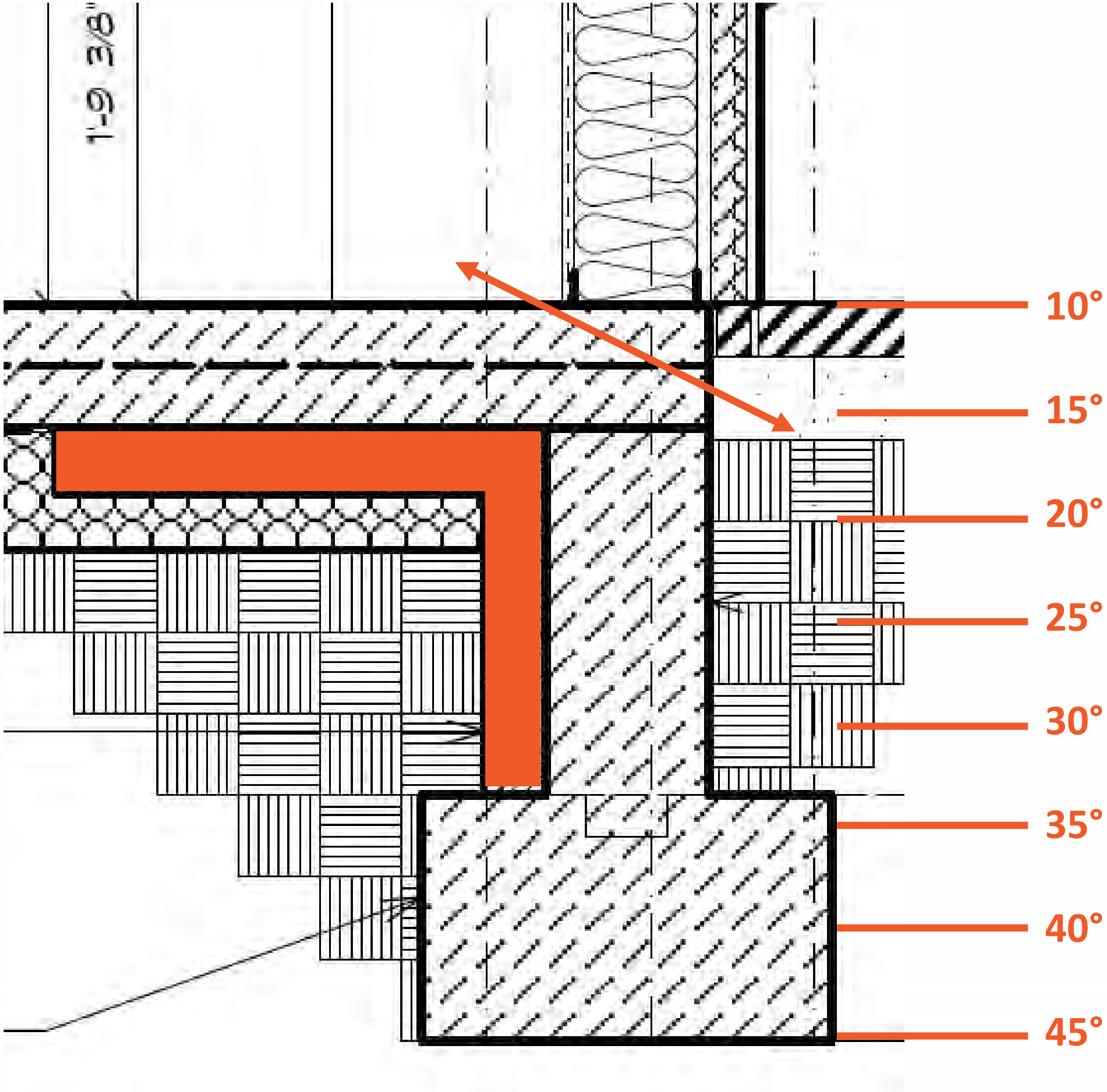
CL
1'-9"
5/8" GWB.
TAPERABLE CORNER BEAD
2 1/2" MTL. STUD
FILL BLOCK CAVITY W/GROUT
7/8" FURRING CHANNEL
MTL. "J" BEAD
ALUM. HOPPER VENT
GLAZING BEAD
GLAZING, SEE SPEC
ALUM. FRAME
ALUM. SUB-FRAME
CAULKING AND BACKER ROD
CAST STONE SILL
FACE BRICK
1'-5"
4"
2" OVERLAP
1"

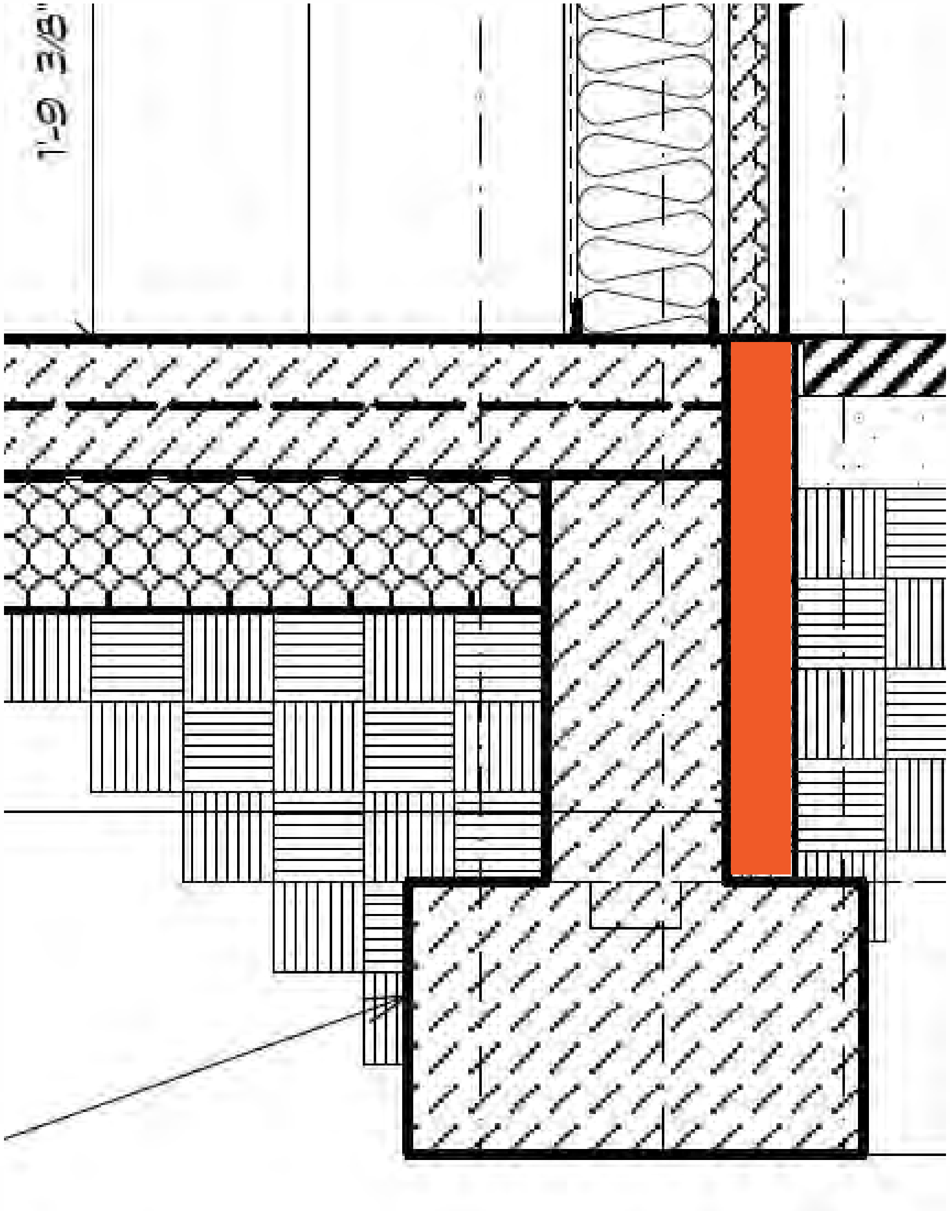
FXFOWLE

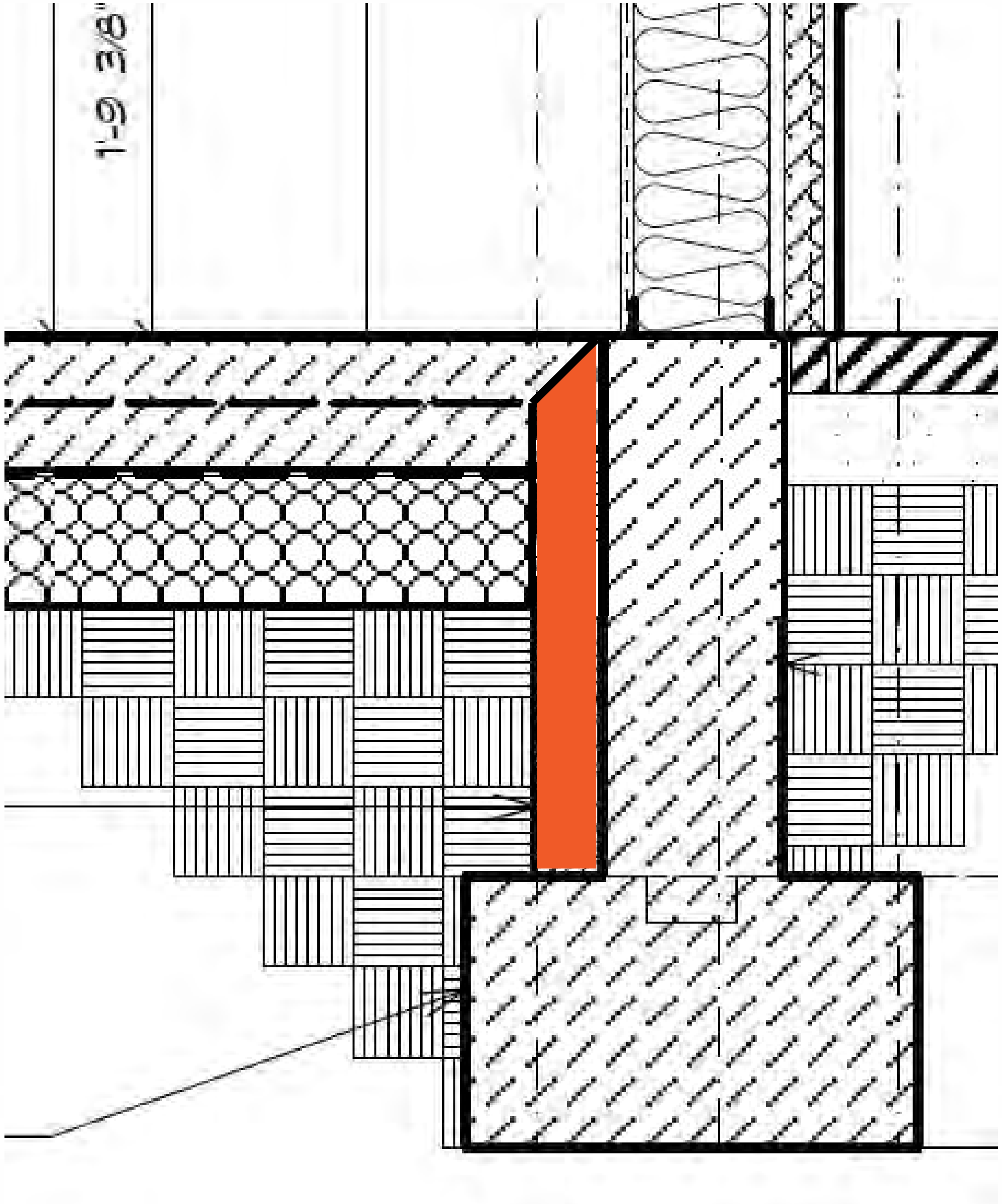

WATER, AIR & VAPOR BARRIER MEMBRANE
THERMAL BREAK PAD
INTERMITTENT ALUMINUM ANGLE
FASTENER SEALANT
FORMED METAL TRIM PIECE
METAL CLIP SYSTEM
BACKER ROD & SEALANT

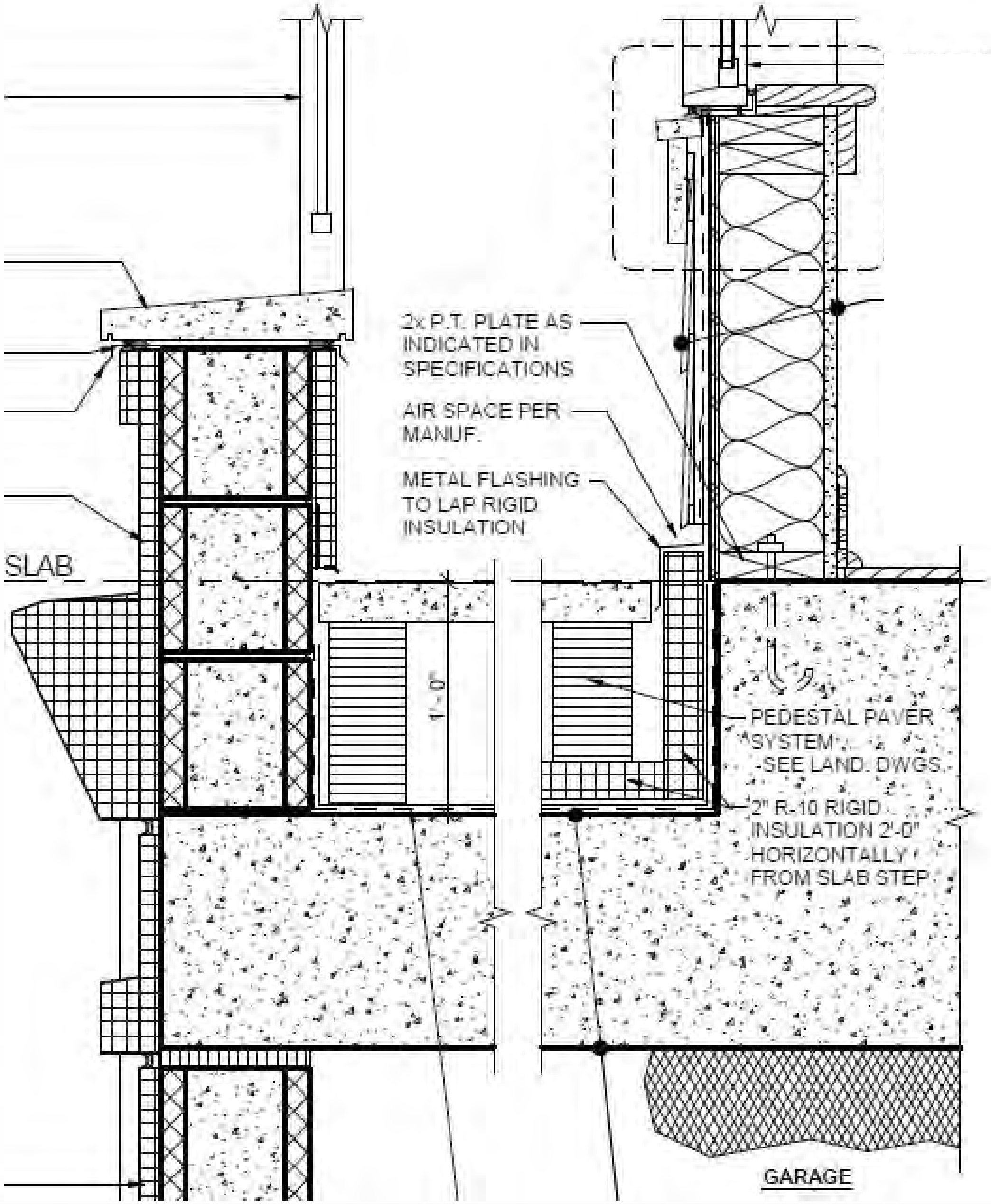
FXFOWLE

4. THERMAL BRIDGING: SLABS


1'-9 3/8"
10°
15°
20°
25°
30°
35°
40°
45°


1'-9 3/8"


1'-9 3/8"



SLAB
2x P.T. PLATE AS INDICATED IN SPECIFICATIONS
AIR SPACE PER MANUF.
METAL FLASHING TO LAP RIGID INSULATION
1'-0"
PEDESTAL PAVER SYSTEM - SEE LAND. DWGS.
2" R-10 RIGID INSULATION 2'-0" HORIZONTALLY FROM SLAB STEP
GARAGE

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BSI-062: Thermal Bridges Redux

Joseph Lstiburek

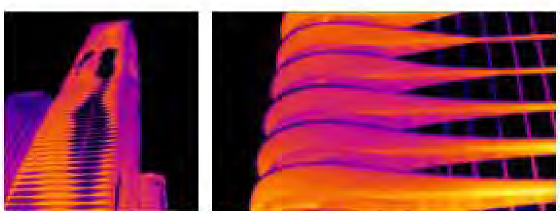
JUNE 2, 2015

It is a beautiful building. Quite stunning actually. It is an embodiment of everything that is right and wrong with architecture.[1] An orgy of glass and concrete. It is a thermodynamic obscenity while it takes your breath away. An 82-story heat exchanger in the heart of Chicago[2] (**Photograph 1a, b, c, d, e, f, g**).

Aqua-Naught*

Photograph 1a *(left)*: Baseboard Radiator; **Photograph 1b** *(right)*: Liquid Gas Heat Exchanger

Photograph 1c *(left)*: Extended Finned Surface – Aluminum; **Photograph 1d** *(middle)*: Extended Finned Surface – Concrete; **Photograph 1e** *(right)*: Aqua Tower Balcony's



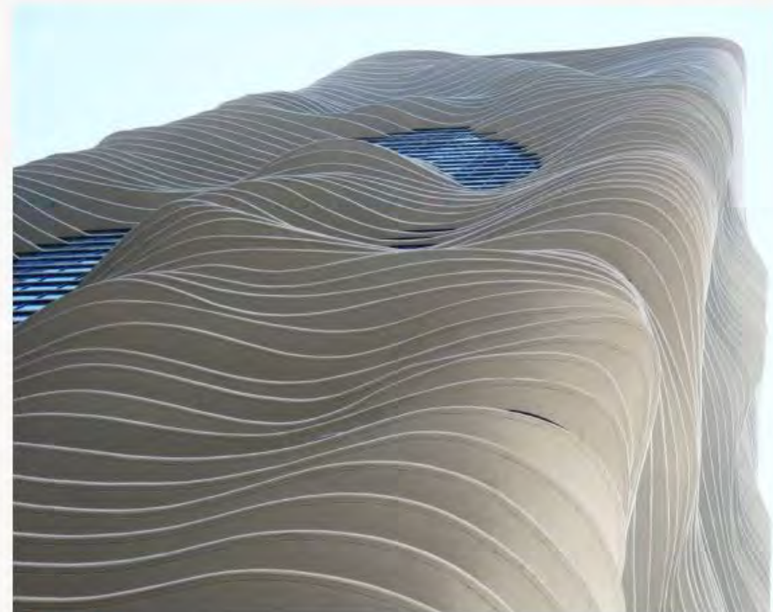
Photograph 1f *(left)*: Infra-red of Aqua Tower - Image courtesy of Dave Robley, Thermographer, Fluke Corp and Michael Stuart, L3 TI/IRT, Fluke Corp.; **Photograph 1g** *(right)*: Infra-red of Aqua Tower Balcony - Image courtesy of Dave Robley, Thermographer, Fluke Corp and Michael Stuart, L3 TI/IRT, Fluke Corp.

treehugger DESIGN LIVING SCIENCE TECHNOLOGY TRANSPORTATION BUSINESS ENERGY SLIDESHOWS

Design / Green Architecture

Gimme A Thermal Break Redux: Engineer Calls Chicago's Aqua Tower "Architectural Pornography"

Lloyd Alter @lloydalter
February 27, 2012



John Picken/CC BY 2.0

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Design / Green Architecture

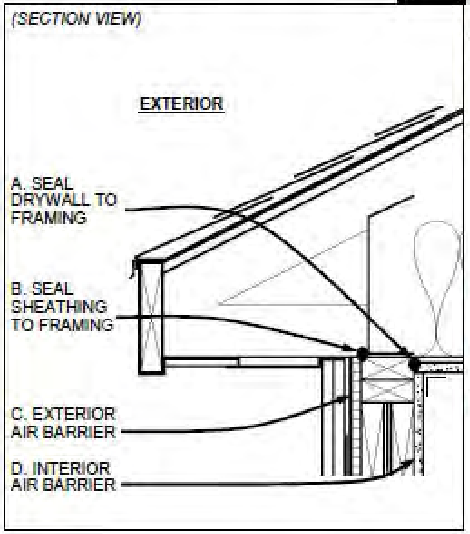
Studio Gang is going to gimme a thermal break in new Chicago project

Lloyd Alter lloydalter
October 20, 2015

© Studio Gang

5. POORLY DETAILED AIR BARRIER

1 EXTERIOR WALL - TOP



Notes:

A, B. Intent: reduce leakage between unconditioned attic and wall cavities

A. Option: apply drywall adhesive to framing BEFORE installing drywall ("screw & glue")

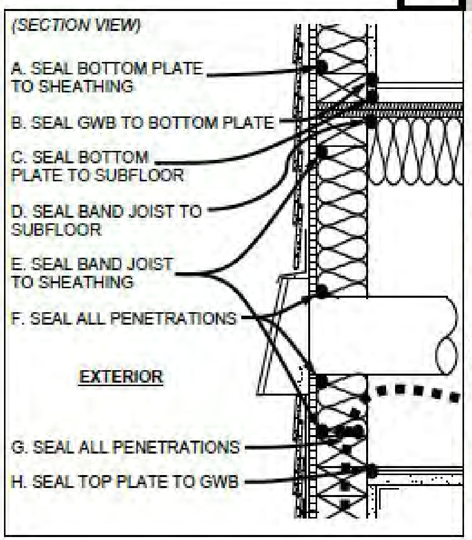
C. Options:
- Sheathing with seams sealed (i.e. ply wood or rigid foam board)
- Fluid-applied/adhesive membrane on sheathing (i.e. Grace / Henry products)

D. Typically drywall

Responsibilities:

Framing: B, C
Drywall: A, D

2 EXTERIOR WALL - PENETRATIONS, BOTTOM AND TOP PLATE



Notes:

A, C. Intent: reduce leakage between floor and wall cavities

B. Intent: reduce leakage between wall cavity and apartment

B, C. Option: self-leveling subfloor (i.e. gypcrete)

E, H. Intent: reduce leakage between floor and wall cavities

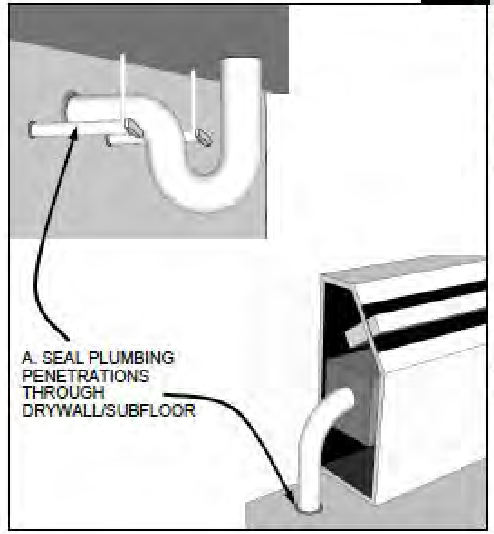
E. Continuous seal of the rim/band joist to sheathing, if a TJI joist seal at top and bottom

F, G. Includes ducts, pipes, wires, etc.

H. Option: apply drywall adhesive to framing BEFORE installing drywall

Responsibilities:
Framing: A, C, D, E
Drywall: B, H
Mech/Elec/Plumb: F, G

19 PLUMBING PENETRATIONS



Notes:

A. Seal all penetrations BEFORE installing cabinetry and escutcheons

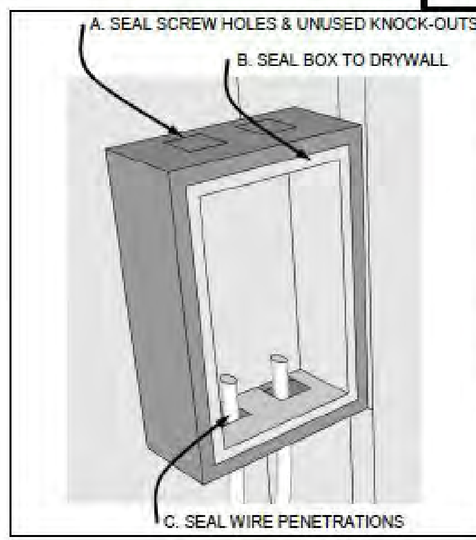
A. Intent: reduce leakage between wall cavities and apartment

Typical plumbing penetrations include:
- Sink faucet supplies & drain
- Toilet supply
- Showerhead stub-out
- Heating supply/return
- Gas supply
- Sprinklers

Responsibilities:

Drywall: A

20 ELECTRICAL BOXES



Notes:

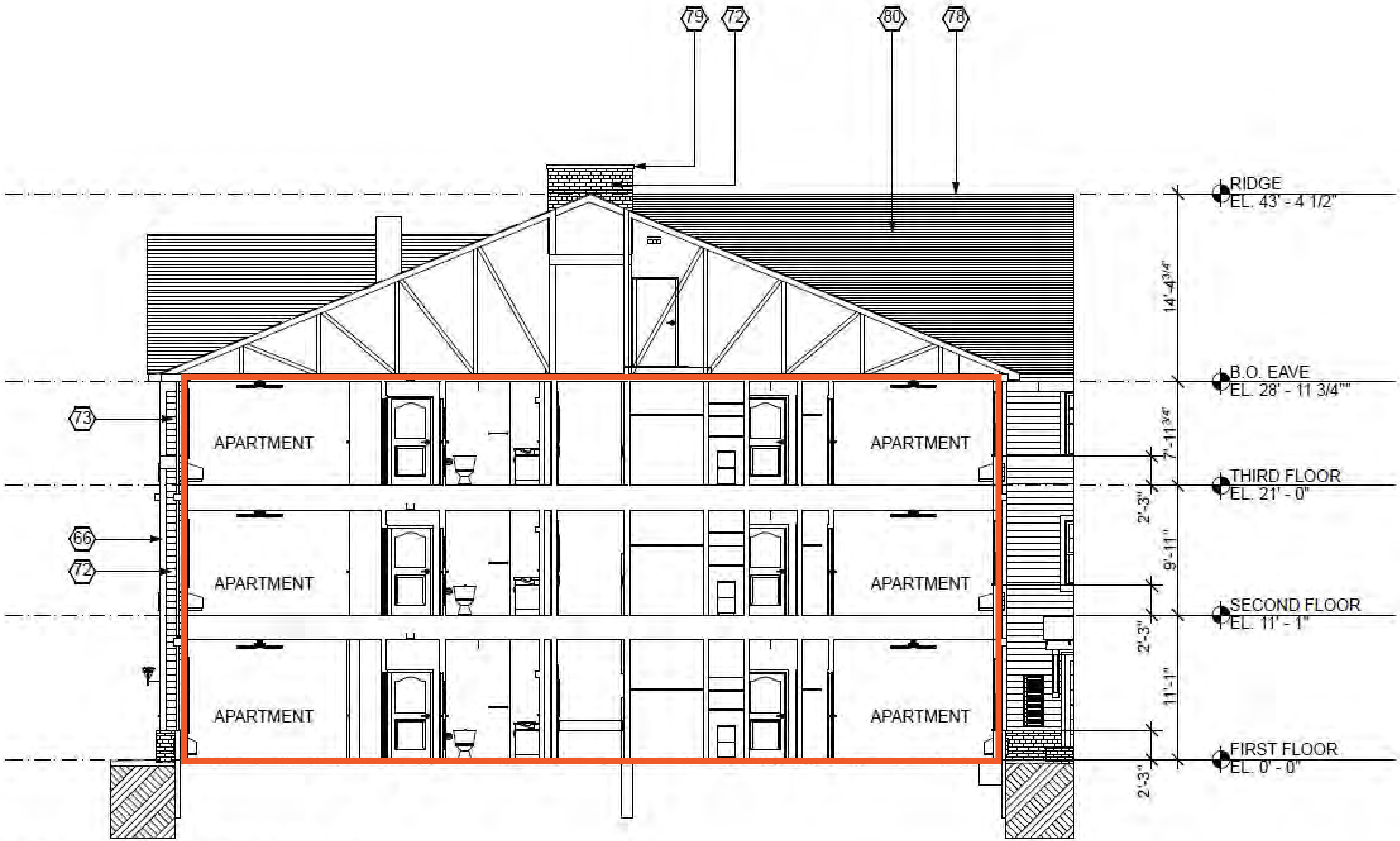
A, B, C. Intent: reduce leakage between framing cavities and apartment

A, B, C. Includes boxes in floors, walls and ceilings

A, C. Options:
- Caulk
- Foam
- Mastic (over entire box)
- Putty pack

Responsibilities:

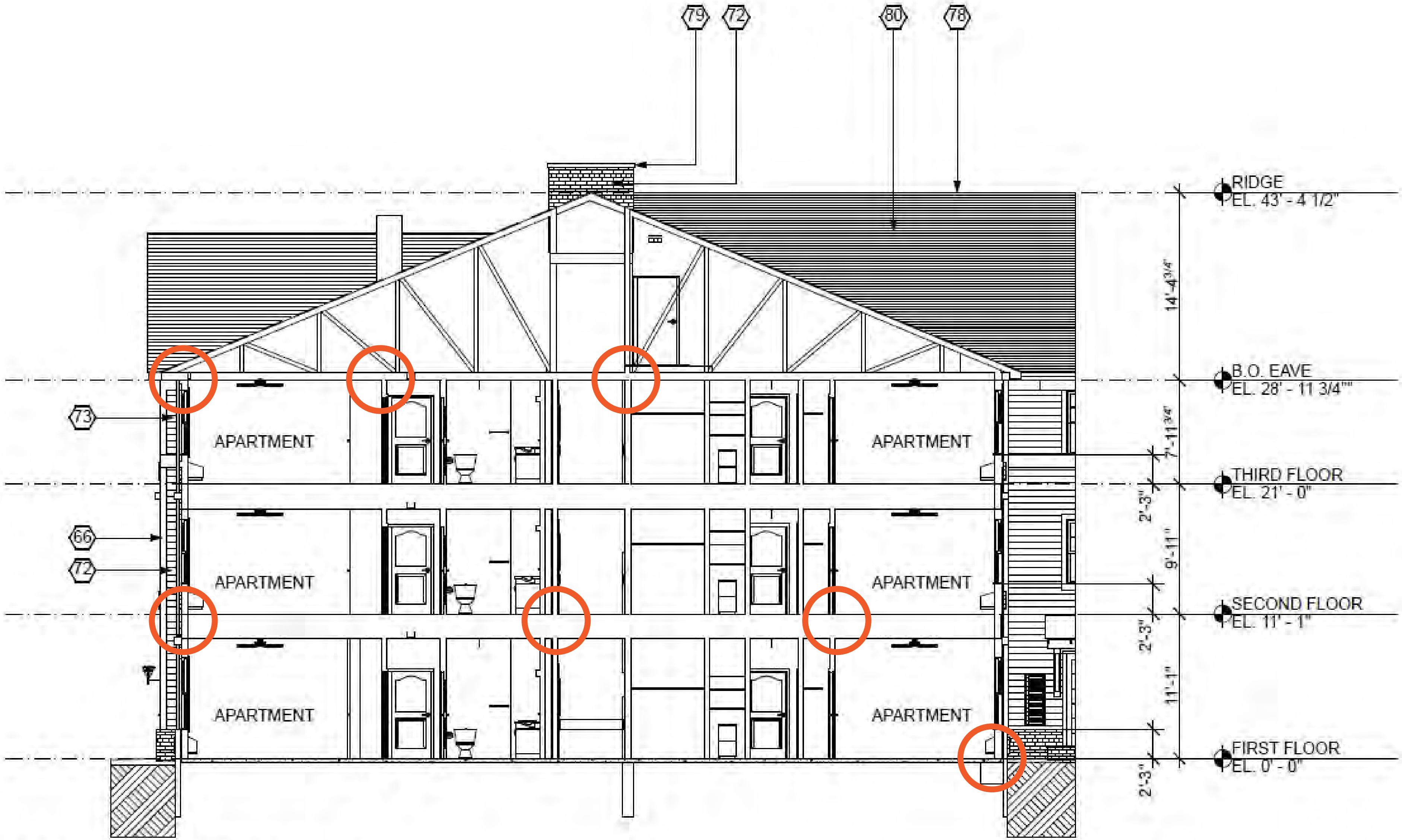
Drywall: B
Electrical: A, C



1

Typical Wing Section

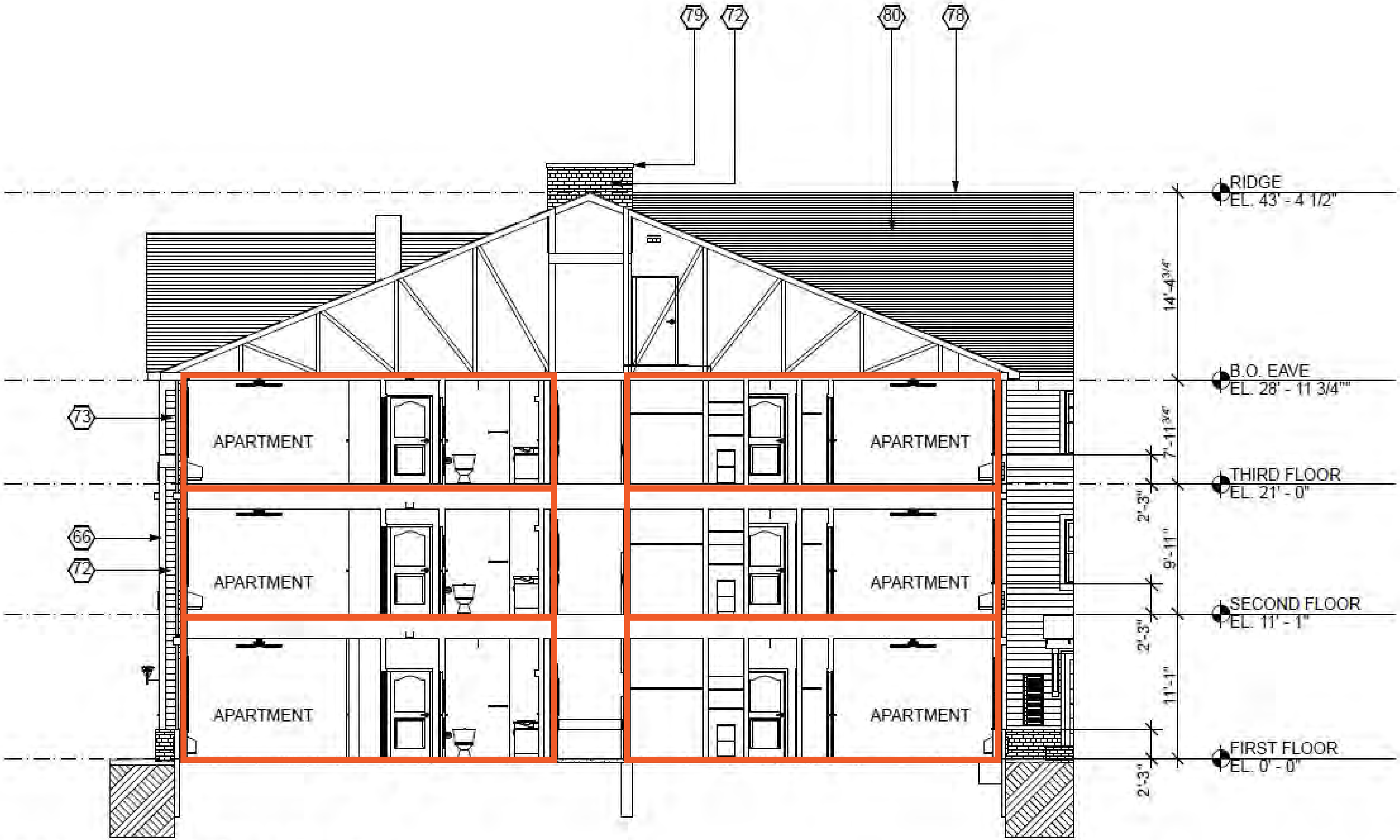
1/8" = 1'-0"



1

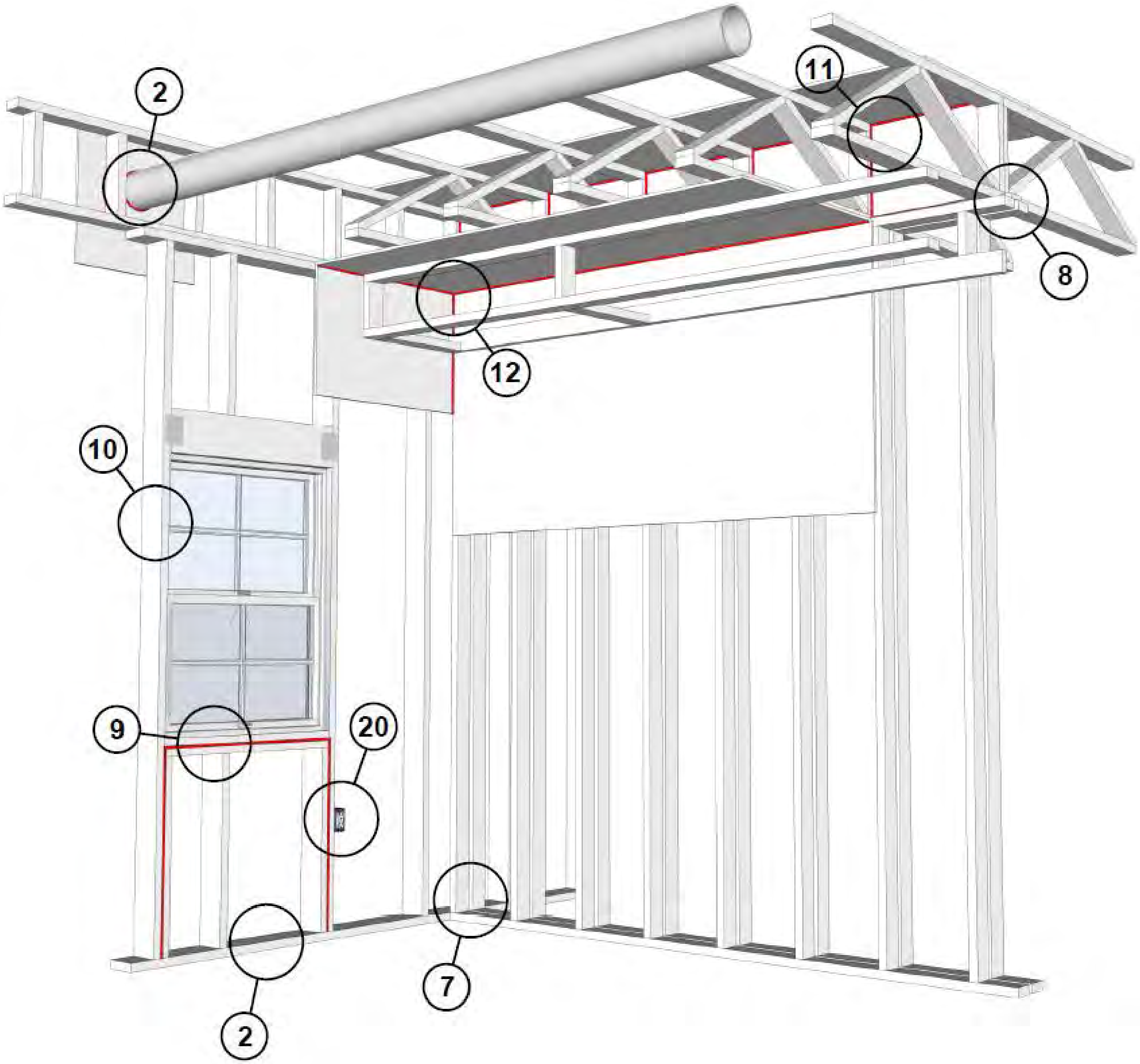
Typical Wing Section

1/8" = 1'-0"



1 Typical Wing Section

1/8" = 1'-0"


2
11
8
12
10
9
20
7
2

6. NO LIGHTING CONTROLS


LEVITON

C405.2 Lighting controls (Mandatory). Lighting systems shall be provided with controls as specified in Sections C405.2.1, C405.2.2, C405.2.3, C405.2.4 and C405.2.5.

Exceptions: Lighting controls are not required for the fol-lowing:

1. Areas designated as security or emergen
are required to be continuously lighted.
2. Interior exit stairways, interior exit ran
passageways.
3. Emergency egress lighting that is norma

C405.2.1 Occupant sensor controls. Occu
controls shall be installed to control lights in t
space types:

1. Classrooms/lecture/training rooms.
2. Conference/meeting/multipurpose roo
3. Copy/print rooms.
4. Lounges.
5. Employee lunch and break rooms.
6. Private offices.
7. Restrooms.
8. Storage rooms.
9. Janitorial closets.
10. Locker rooms.
11. Other spaces 300 square feet (28 m^2)
are enclosed by floor-to-ceiling height
12. Warehouses.

7.8 Illumination of Means of Egress.

7.8.1 General.

7.8.1.1* Illumination of means of egress shall b
accordance with Section 7.8 for every building
where required in Chapters 11 through 43. For th
this requirement, exit access shall include onl
stairs, aisles, corridors, ramps, escalators, and pass
ing to an exit. For the purposes of this requi
discharge shall include only designated stairs, aisl
ramps, escalators, walkways, and passageways
public way.

7.8.1.2 Illumination of means of egress shall b
during the time that the conditions of occupancy
the means of egress be available for use, unless oth
ded in 7.8.1.2.2.

7.8.1.2.1 Artificial lighting shall be employed at s
and for such periods of time as are necessary to
illumination to the minimum criteria values herei

7.8.1.2.2* Unless prohibited by Chapters 11 through 43, automatic lighting control devices shall be permitted to temporarily turn off the illumination within the means of egress, provided that each lighting control device complies with all of the following:

(1) In new installations, the lighting control device is listed
(2) The lighting control device is equipped to automatic
energize the controlled lights upon loss of normal pow
and is evaluated for this purpose.
(3) Illumination timers are provided and are set for a mi
mum 15-minute duration.
(4) The lighting control device is activated by any occup
movement in the area served by the lighting units.
(5) ... allations, the lighting control device is acti
... vation of the building fire alarm system.
(6) ... g control device does not turn off any lig
... for activation of photoluminescent exit si
... markers.
(7) The lighting control device does not turn off any batt
equipped emergency luminaires, unit equipment, or e
signs.

7.8.1.2.3* Energy-saving sensors, switches, timers, or controllers shall be approved and shall not compromise the continuity of illumination of the means of egress required by 7.8.1.2.

SECTION 1008
MEANS OF EGRESS ILLUMINATION

1008.1 Means of egress illumination. Illumination shall be provided in the *means of egress* in accordance with Section 1008.2. Under emergency power, means of egress illumination shall comply with Section 1008.3.

1008.2 Illumination required. The *means of egress* serving a room or space shall be illuminated at all times that the room or space is occupied.

Exceptions:

1. Occupancies in Group U.
2. *Aisle accessways* in Group A.
3. *Dwelling units* and *sleeping units* in Groups R-1, R-2 and R-3.
4. *Sleeping units* of Group I occupancies.

1008.2.1 Illumination level under normal power. The *means of egress* illumination level shall be not less than 1 footcandle (11 lux) at the walking surface.

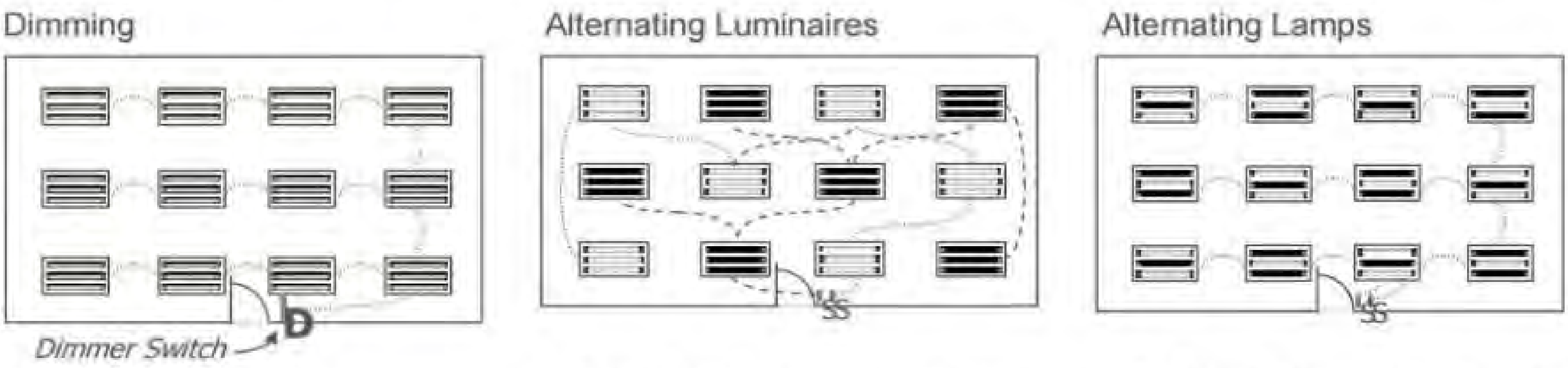
7.8.1.3 The floors and other walking surfaces within an exit and within the portions of the exit access and exit discharge designated in 7.8.1.1 shall be illuminated as follows:

(1) During conditions of stair use, the minimum illumination for new stairs shall be at least 10 ft-candle (108 lux), measured at the walking surfaces.
(2) The minimum illumination for floors and other walking surfaces, other than new stairs during conditions of stair use, shall be to values of at least 1 ft-candle (10.8 lux), measured at the floor.
(3) In assembly occupancies, the illumination of the walking surfaces of exit access shall be at least 0.2 ft-candle (2.2 lux) during periods of performances or projections involving directed light.
(4)* The minimum illumination requirements shall not apply where operations or processes require low lighting levels.

1205.3 Artificial light. Artificial light shall be provided that is adequate to provide an average illumination of 10 footcandles (107 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.

Sources: 2015 IBC/IECC, NFPA 101

Figure LE-4.
Light-Reduction Controls Method by
Source: energycodes.gov



a) Control of all lamps/luminaires

b) Dual switching of alternate rows of luminaries

c) Switching middle lamp luminaires independently

Source: https://www1.nyc.gov/assets/buildings/pdf/h2g_all.pdf

7. IMPROPERLY SIZED HVAC

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8. ANTIQUATED VENTILATION

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NEWS CENTER

Hidden Dangers in the Air We Breathe

Feature Story Julie Chao (510) 486-6491 • APRIL 10, 2013

CONNECT

For decades, no one worried much about the secondhand smoke or radon present. Then sc Lawrence Berkeley National Laboratory (Berke health consequences of poor indoor air qualit accidents or infectious diseases in the United the home is cooking.

The Berkeley Lab scientists are now working o based solutions, including better standards fo the hazardous pollutants. These efforts are th *Health Perspectives* in 2012 that described a ne of indoor air pollutants. That research uncove recognized as a cause for concern—fine partic

http://newscenter.lbl.gov/2013/04/10/hidden-dangers-in-the-air-we-breathe/

EHP Environmental Health Perspectives

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Research

Pollutant Exposures from Natural Gas Cooking Burners: A Simulation-Based Assessment for Southern California

Jennifer M. Logue, Neil E. Klepeis, Agnes B. Lobscheid, and Brett C. Singer

First Published: 5 November 2013 | Cited by: 4

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Abstract

Background: Residential natural gas cooking burners (NGCBs) can emit substantial quantities of pollutants, and they are typically used without venting range hoods.

Objective: We quantified pollutant concentrations and occupant exposures resulting from NGCB use in California homes.

Methods: A mass-balance model was applied to estimate time-dependent pollutant concentrations throughout homes in Southern California and the exposure concentrations experienced by individual occupants. We estimated nitrogen dioxide (NO_2), carbon monoxide (CO), and formaldehyde (HCHO) concentrations for 1 week each in summer and winter for a representative sample of Southern California homes. The model simulated pollutant emissions from NGCBs as well as NO_2 and CO entry from outdoors, dilution throughout the home, and removal by ventilation and deposition. Residence characteristics and outdoor concentrations of NO_2 and CO were obtained from available databases. We inferred ventilation rates, occupancy patterns, and burner use from household characteristics. We also explored proximity to the burner(s) and the benefits of using venting range hoods. Replicate model executions using independently generated sets of stochastic variable values yielded estimated pollutant concentration distributions with geometric means varying by < 10%.

https://ehp.niehs.nih.gov/doi/10.1289/ehp.1306673

Well

HEALTHY CONSUMER

The Kitchen as a Pollution Hazard

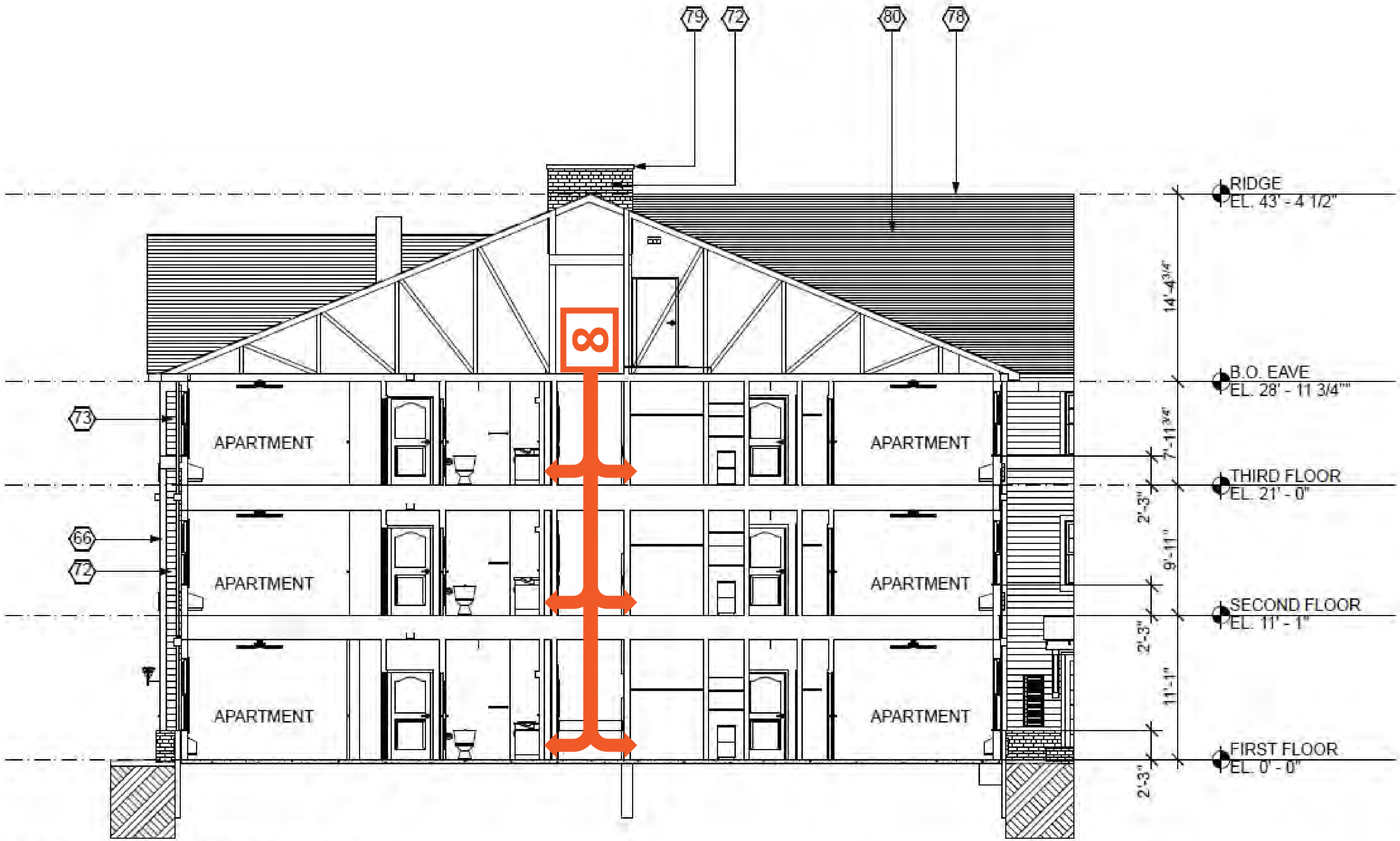
BY PETER ANDREY SMITH JULY 22, 2013 3:19 PM 100

Lisa Haney

By midmorning, the smell of hot peanut oil dissipated and inside the tightly sealed laboratory known as Building 51F, a pink hamburger sizzled in a pan over a raging gas flame. Overhead, fans whirred, whisking caustic smoke up through a metallic esophagus of ductwork.

Woody Delp, 49, a longhaired engineer in glasses — the Willie Nelson of HVAC — supervised the green bean and hamburger experiments. He sat at a computer inside a kitchen simulator, rows upon rows of numeric data appearing on his screen, ticking off the constituents of the plume sucked up the flue. A seared hamburger patty, as he sees it, is just a reliable source for indoor pollution.

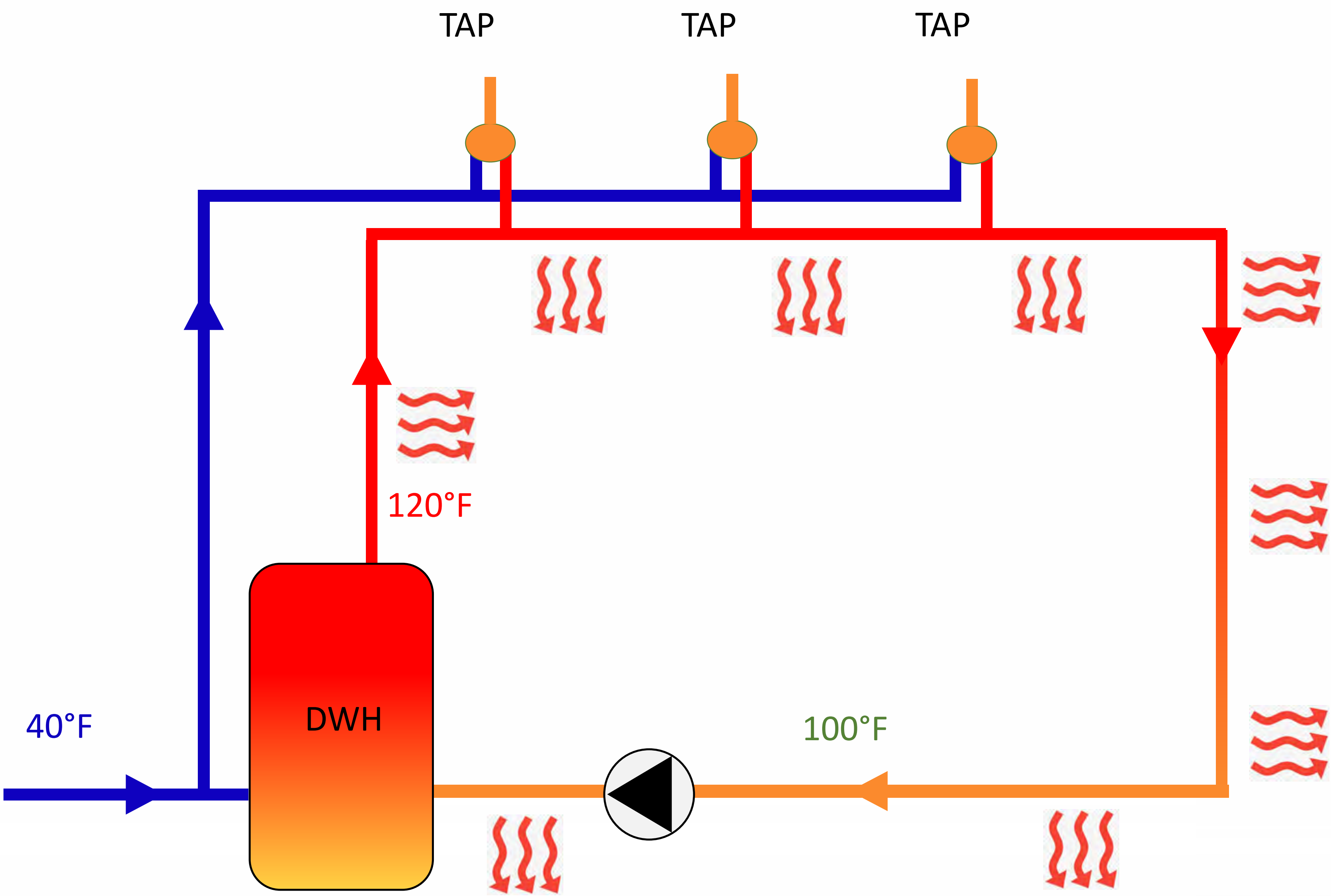
https://well.blogs.nytimes.com/2013/07/22/the-kitchen-as-a-pollution-hazard/



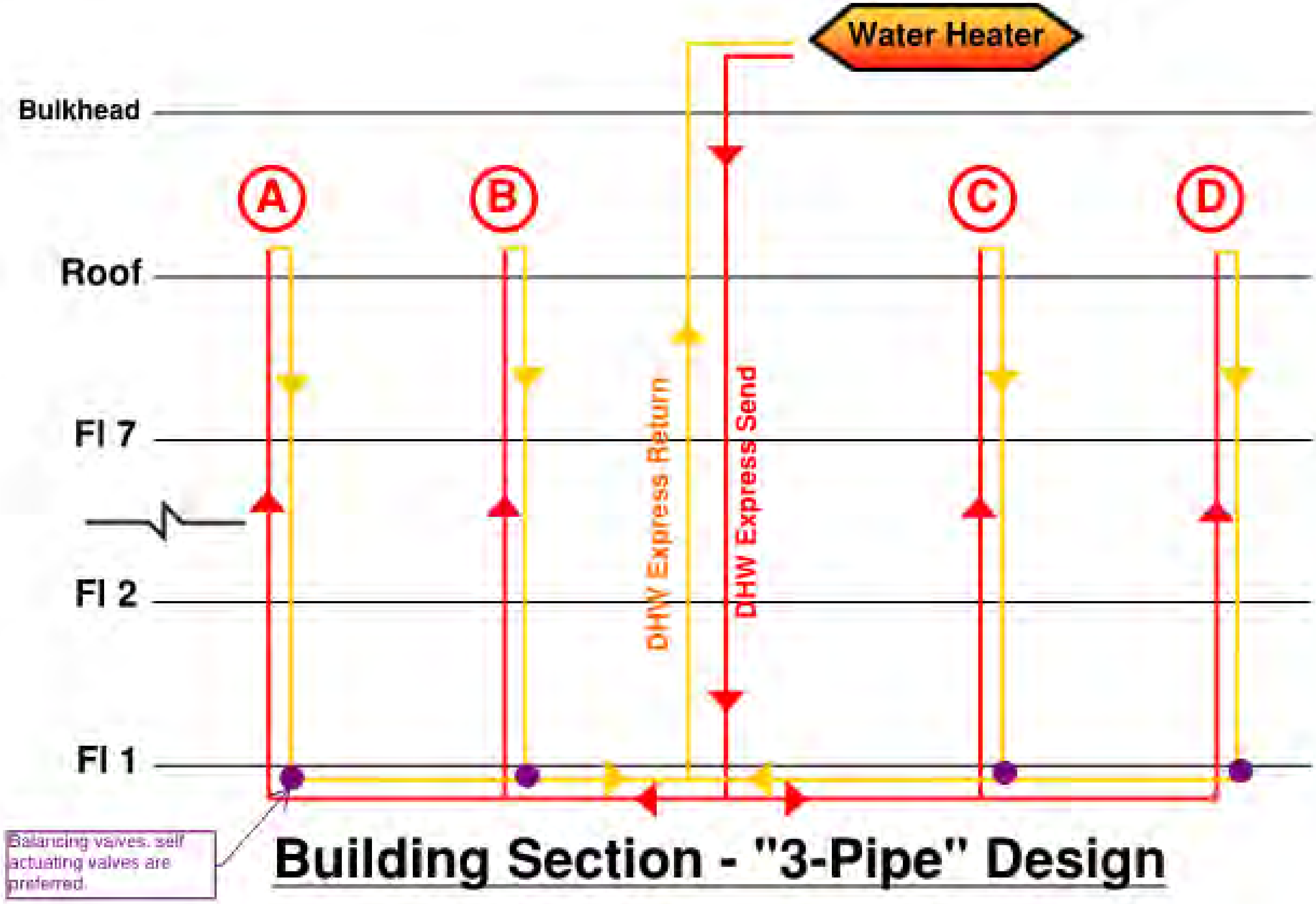
1 Typical Wing Section

1/8" = 1'-0"

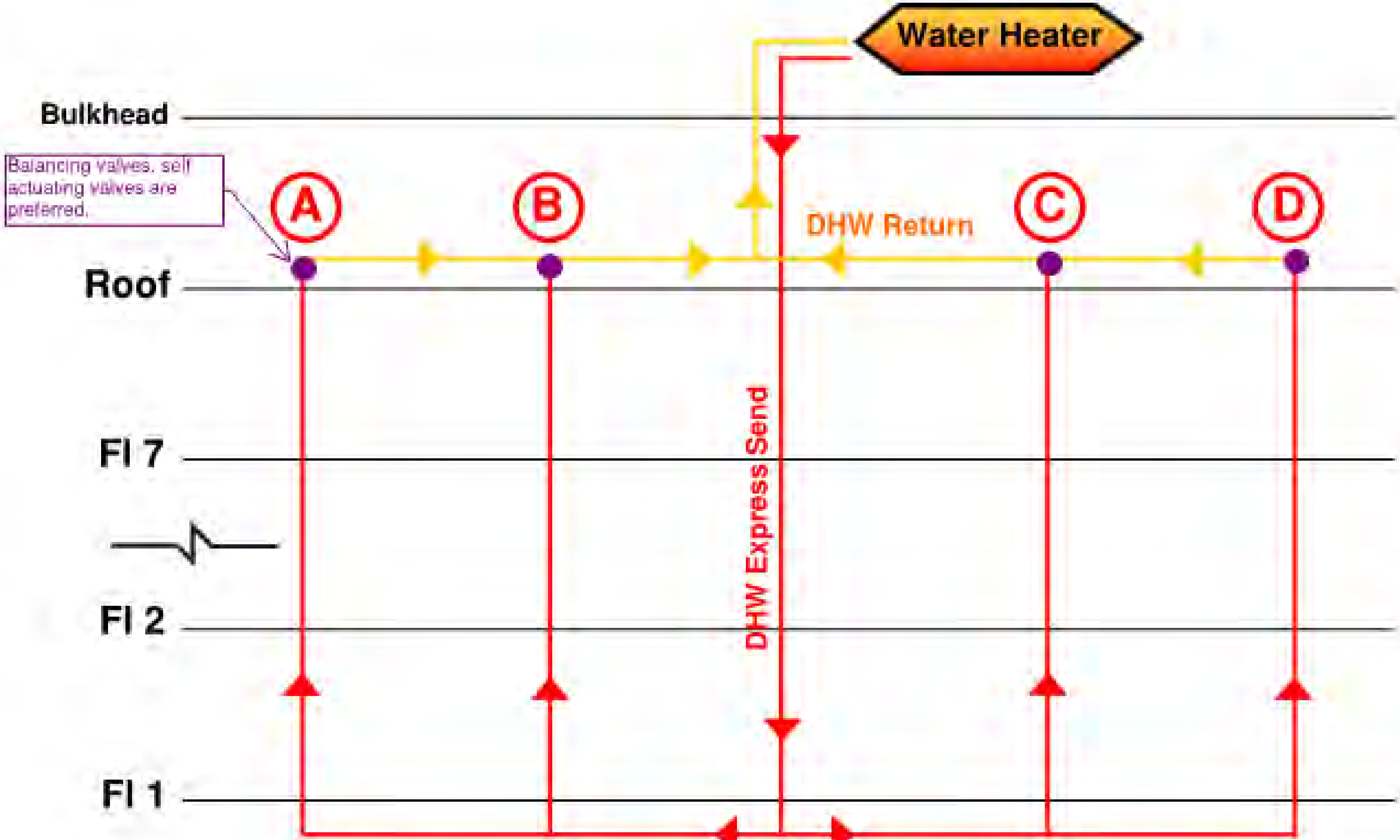
9. INEFFICIENT DHW DISTRIBUTION



TAP
TAP
TAP
120°F
40°F
DWH
100°F



Building Section - "3-Pipe" Design



Building Section - "Box" Design

Table 8 Hot-Water Demand and Use Guidelines for Apartment Buildings (Gallons per Person at 120°F Delivered to Fixtures)

	Peak Minutes							
Guideline	5	15	30	60	120	180	Maximum Daily	Average Daily
Low	0.4	1.0	1.7	2.8	4.5	6.1	20	14
Medium	0.7	1.7	2.9	4.8	8.0	11.0	49	30
High	1.2	3.0	5.1	8.5	14.5	19.0	90	54

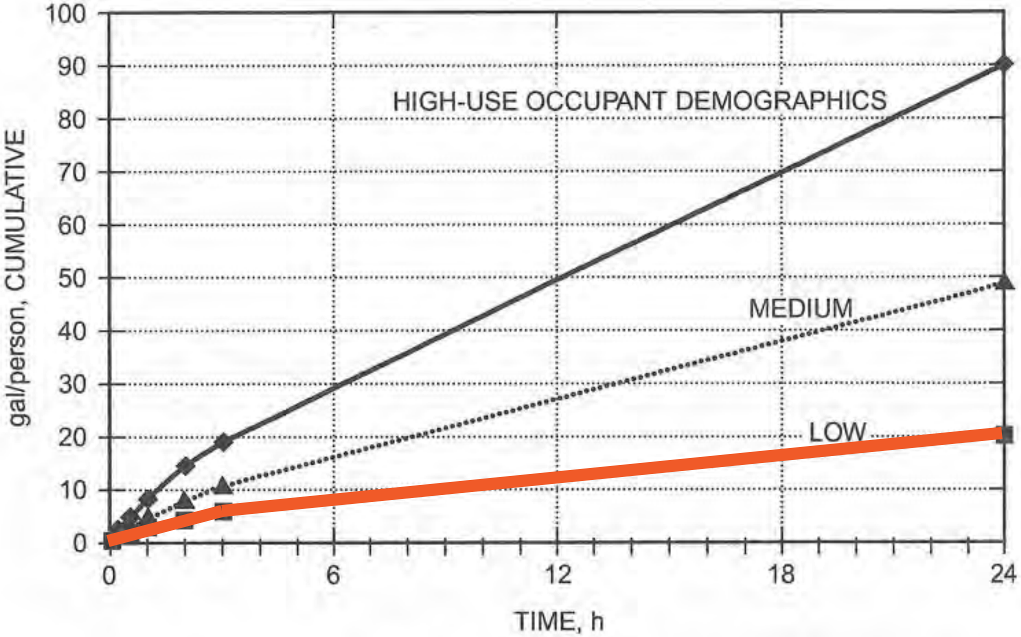
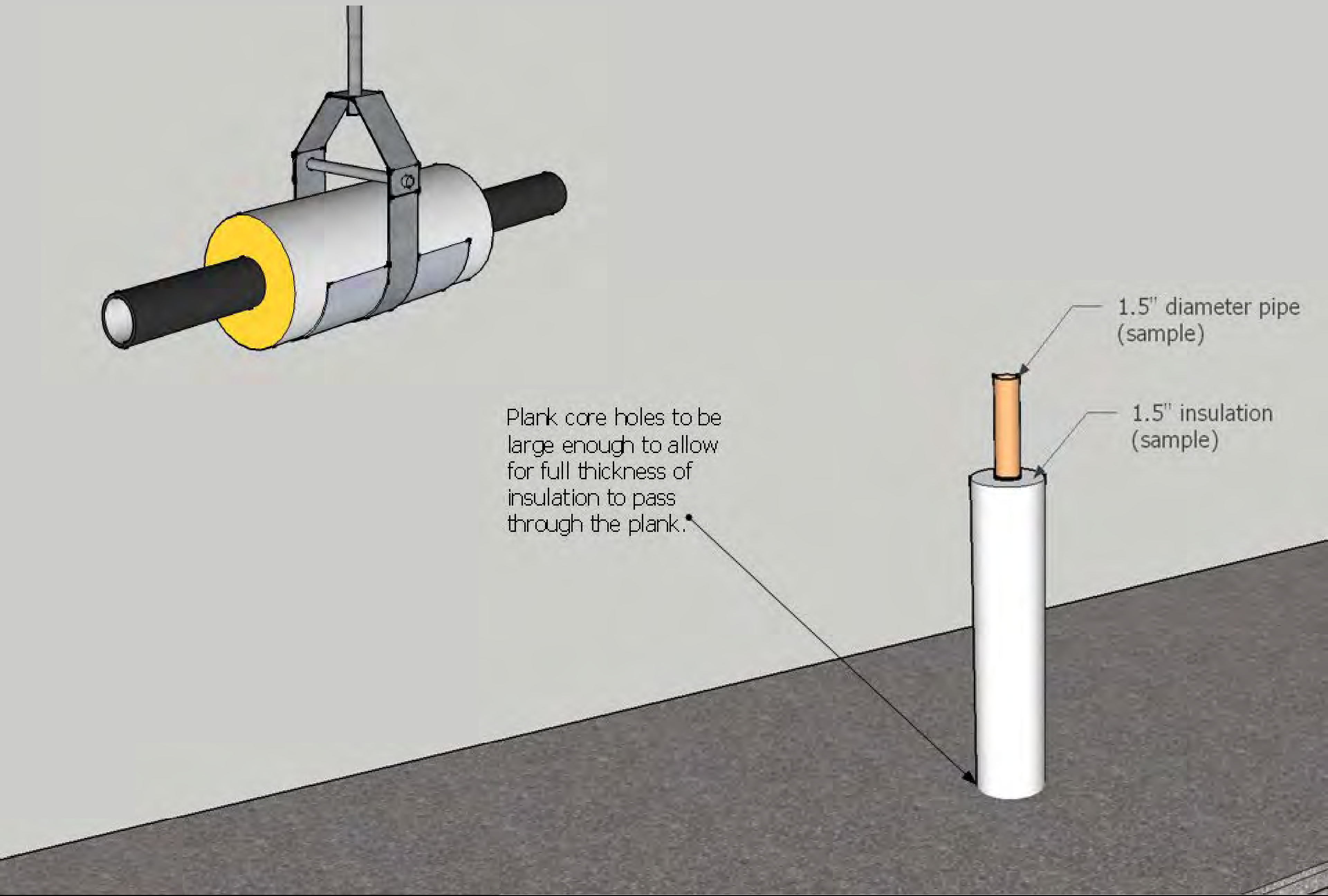


Fig. 15 Apartment Building Cumulative Hot-Water Use Versus Time (from Table 8)


CHARLOTTE PIPE


1.5" diameter pipe
(sample)
1.5" insulation
(sample)
Plank core holes to be large enough to allow for full thickness of insulation to pass through the plank.

10. POOR COMMUNICATION

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DISCUSSION

MOVING FORWARD

MINDSET

SKILLSET

TOOLSET

What are my priorities?
Am I being clear with my design intent?
Have I done this before? Do I know it will work?
What are the long/short-term cost factors?
Am I over-complicating this?
Where are the opportunities for failure?
How is this actually going to get built?
Have I thought about this in three dimensions?
What did we do right last time?
What did we do wrong last time?

SUMMARY

THANK YOU!!!

Steven Winter Associates, Inc.

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