Welcome

We Should Know Better: Top 10 Multifamily Design Mistakes

Energy & Environmental Building Association

Certificate of Completion

is hereby granted to:

Steven Klocke

to certify completion of 8 hours of training
AIA Provider Number G138, Program Number 000HTW

Houses That Work™

June 12, 2006

Cedar Rapids, IA

Dona Schneider

Dona Schneider, Conference and Program Administrator

HOUSES That Work™

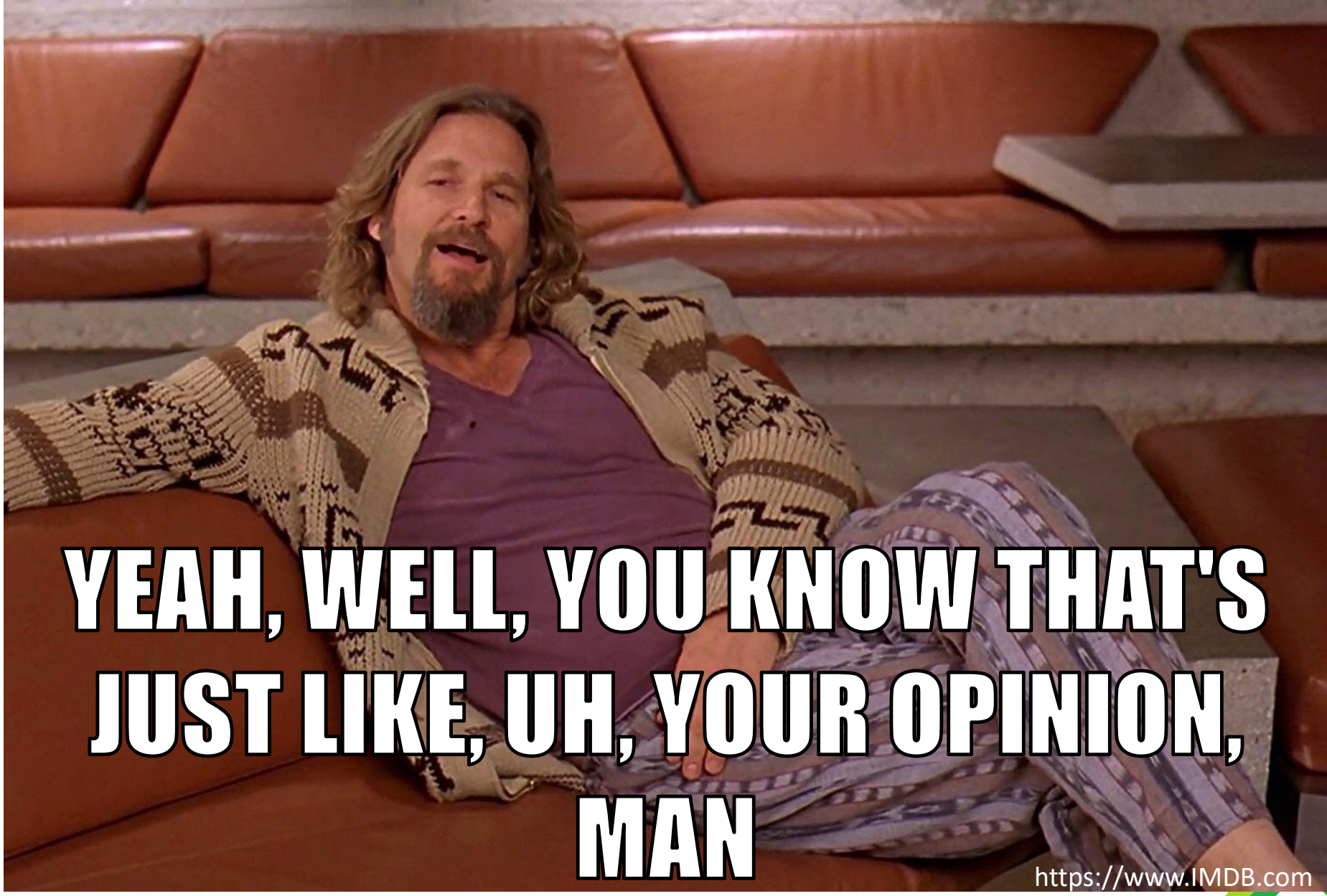
An EEBA Educational Series

EEBA

1. Overcomplicated Geometry
2. Design Irregularities
3. Thermal Bridging: Roofs & Walls
4. Thermal Bridging: Slabs
5. Poorly Detailed Air Barrier
6. No Lighting Controls
7. Improperly Sized HVAC
8. Antiquated Ventilation
9. Oversized DHW Distribution
10. Poor Communication

We Should Know Better

Top 10 Multifamily Design Mistakes


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

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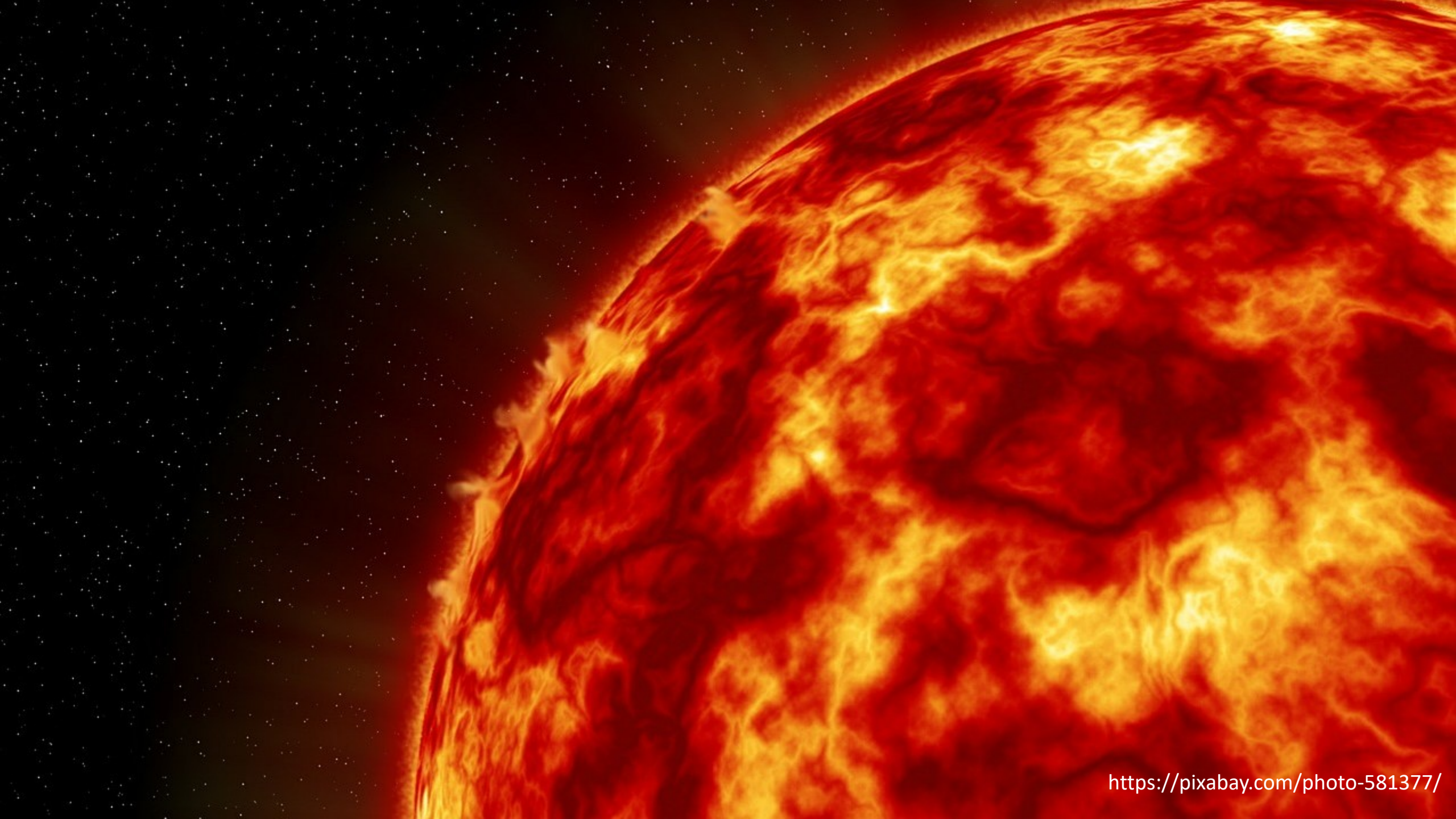
Top 10 Multifamily Design Mistakes


9247-E
9247-E
9247-C
9247-D
9248-G
9248-E


187 6th Ave
New York
Google, Inc.
Street View - Dec 2017


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


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

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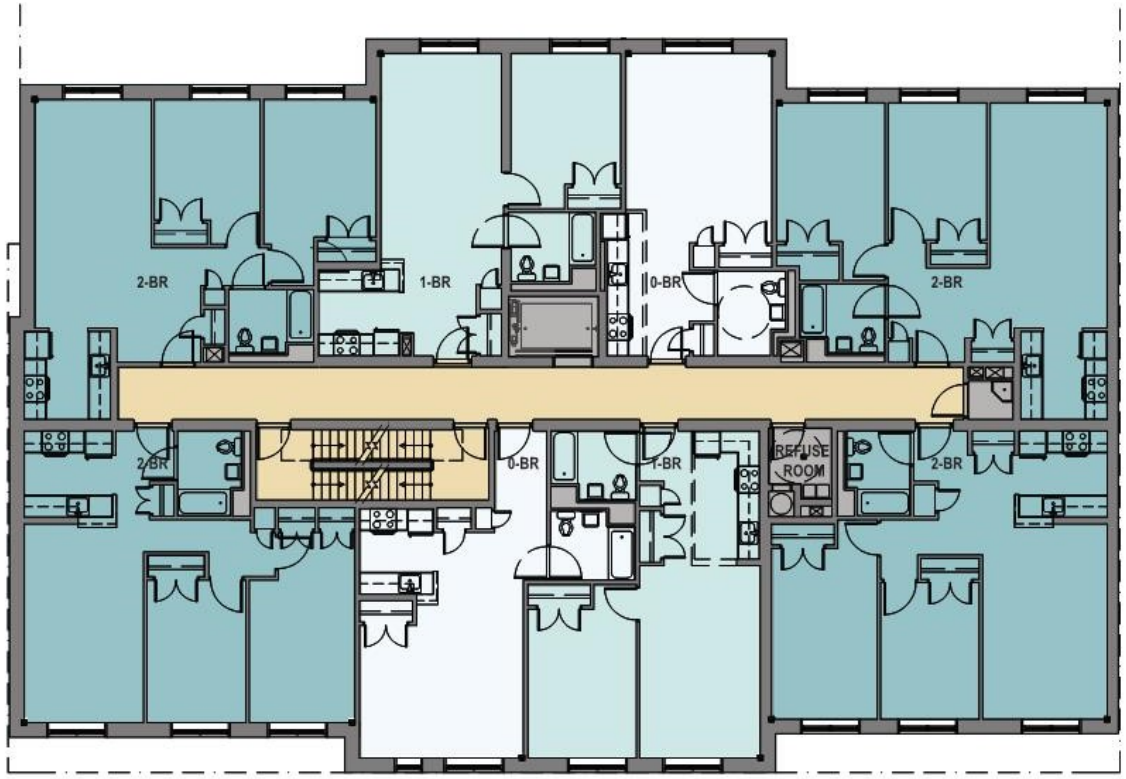
9247-F
9247-E
9247-C
9247-D
9248-G
9248-E



LEGEND

- 0-BR
- 1-BR
- 2-BR
- CIRCULATION
- UTILITY

Typical Floor Plan

Curtis + Ginsberg Architects LLP

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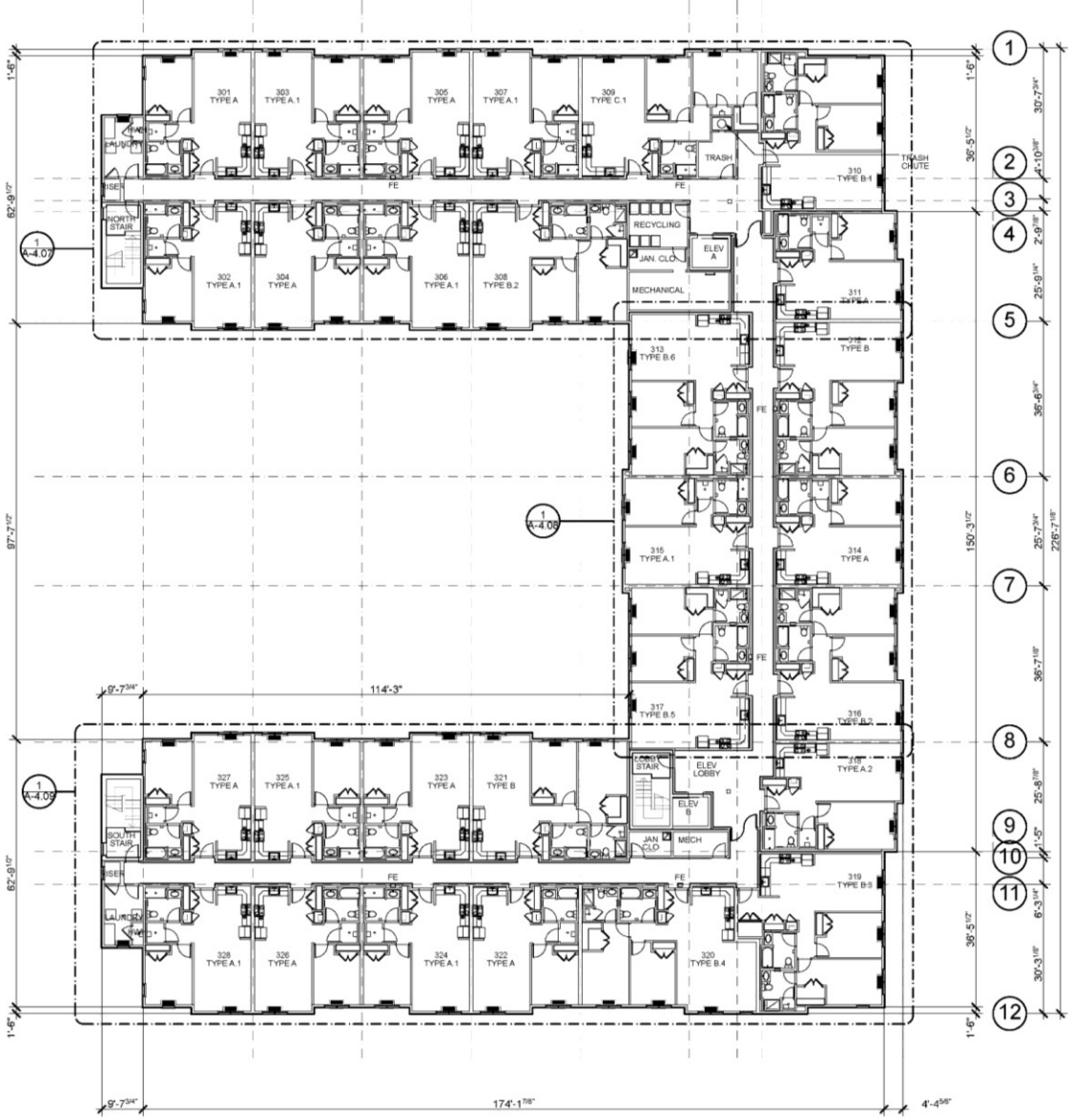

THIRD FLR APT COUNT

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

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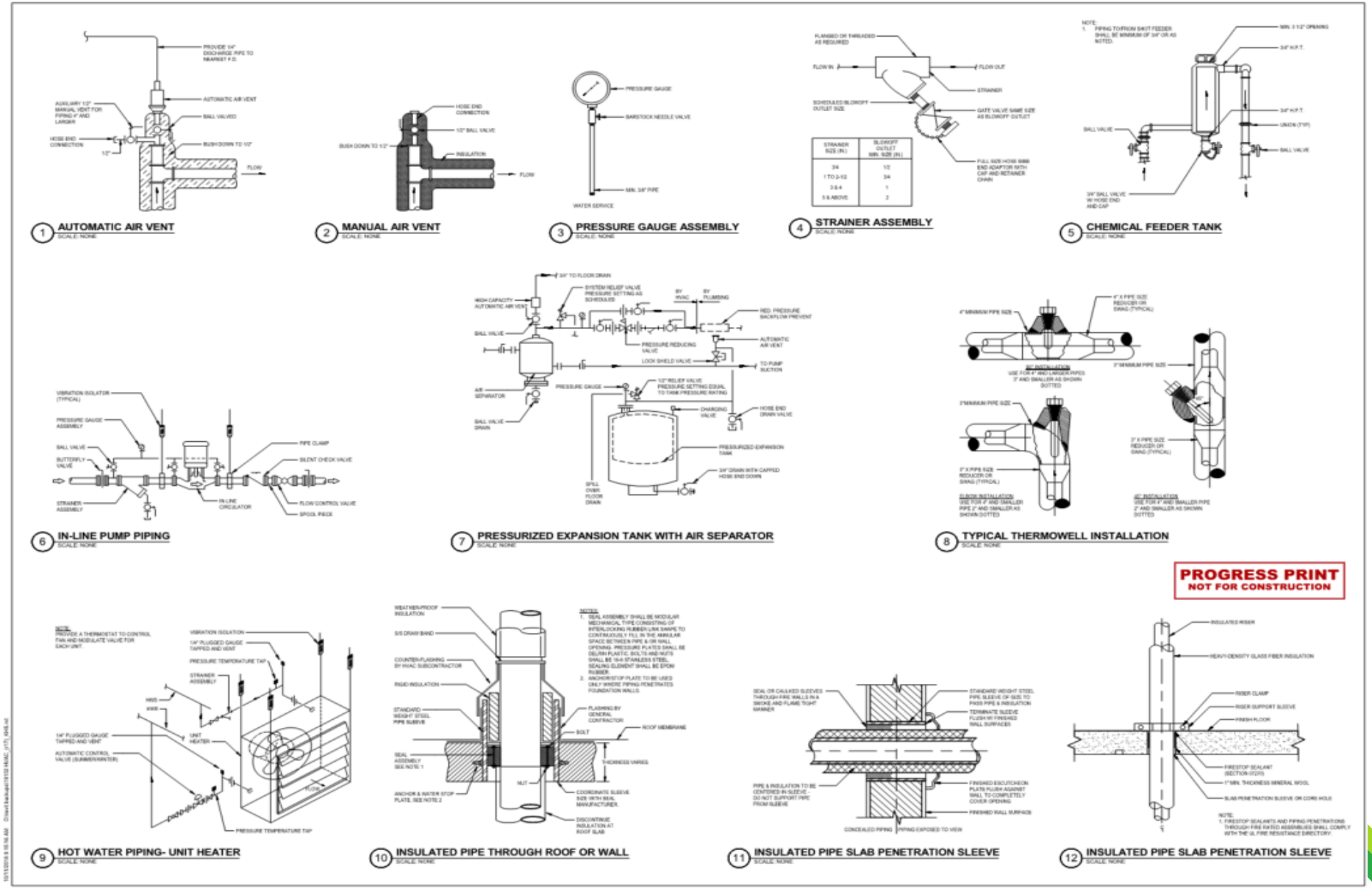
https://www.flickr.com/photos/rs12240/16573795387/in/photostream/


1 AUTOMATIC AIR VENT
SCALE: NONE
2 MANUAL AIR VENT
SCALE: NONE
3 PRESSURE GAUGE ASSEMBLY
SCALE: NONE
4 STRAINER ASSEMBLY
SCALE: NONE
5 CHEMICAL FEEDER TANK
SCALE: NONE
6 IN-LINE PUMP PIPING
SCALE: NONE
7 PRESSURIZED EXPANSION TANK WITH AIR SEPARATOR
SCALE: NONE
8 TYPICAL THERMOWELL INSTALLATION
SCALE: NONE
PROGRESS PRINT
NOT FOR CONSTRUCTION
9 HOT WATER PIPING- UNIT HEATER
SCALE: NONE
10 INSULATED PIPE THROUGH ROOF OR WALL
SCALE: NONE
11 INSULATED PIPE SLAB PENETRATION SLEEVE
SCALE: NONE
12 INSULATED PIPE SLAB PENETRATION SLEEVE
SCALE: NONE


ST. LAWRENCE
FOOTBALL

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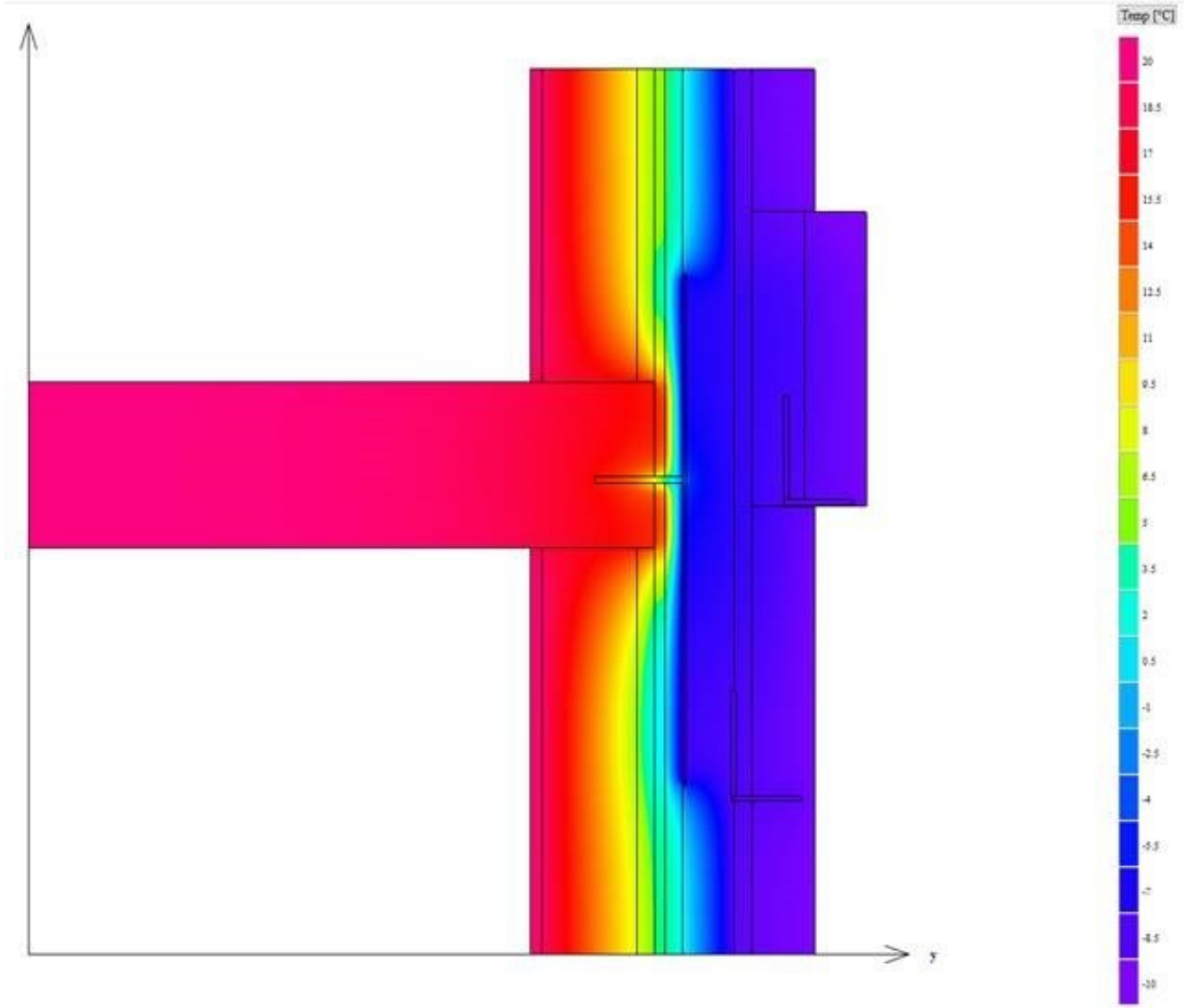
Temp [°C]
20
18.5
17
15.5
14
12.5
11
9.5
8
6.5
5
3.5
2
0.5
-1
-2.5
-4
-5.5
-7
-8.5
-10

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*.

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TABLE A9.2-2 Effective Insulation/Framing Layer R-Values for Wall Insulation Installed Between Steel Framing

Nominal Depth of Cavity, in.	Actual Depth of Cavity, in.	Rated R-Value of Airspace or Insulation	Effective Framing/Cavity R-Value at 16 in. on Center		Effective Framing/Cavity R-Value at 24 in. on Center	
Empty Cavity, No Insulation						
4	3.5	R-0.91	0.79		0.91	
Insulated Cavity				Penalty		Penalty
4	3.5	R-11	5.5	50%	6.6	40%
4	3.5	R-13	6.0	54%	7.2	45%
4	3.5	R-15	6.4	57%	7.8	48%
6	6.0	R-19	7.1	63%	8.6	55%
6	6.0	R-21	7.4	65%	9.0	57%
8	8.0	R-25	7.8	69%	9.6	62%

ASHRAE 90.1-2013 Appendix A

[redacted]

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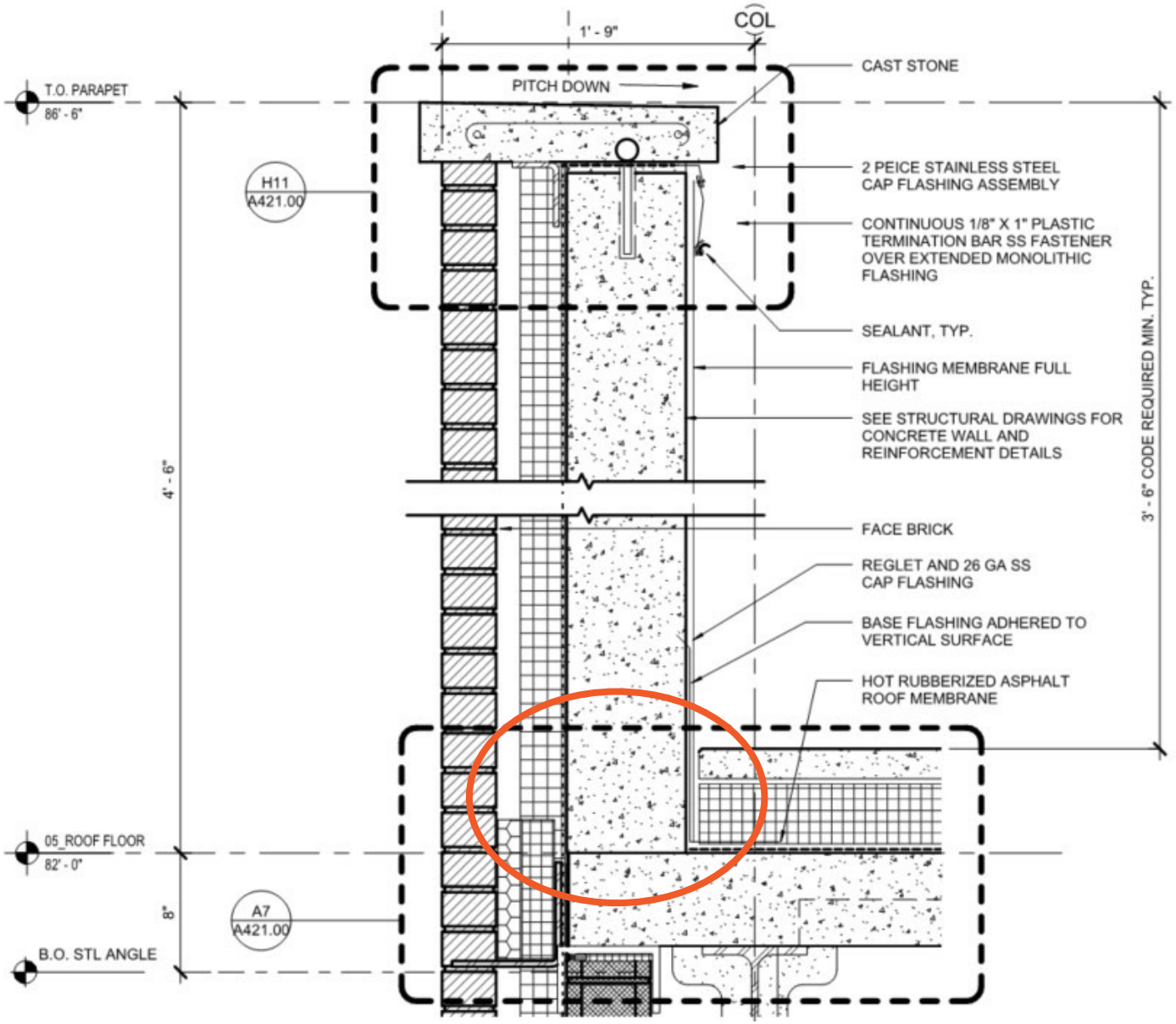

FXFOWLE

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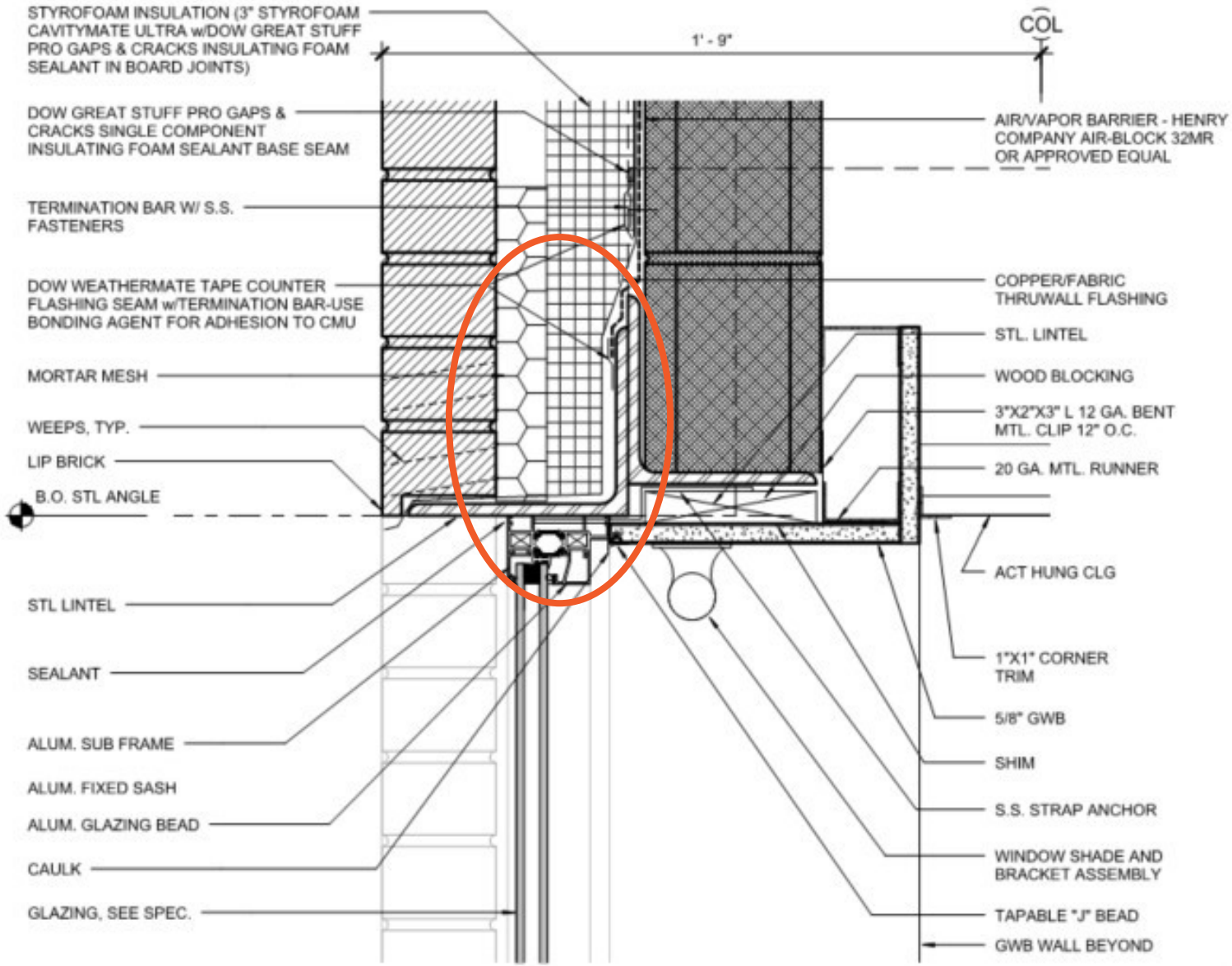

FXFOWLE

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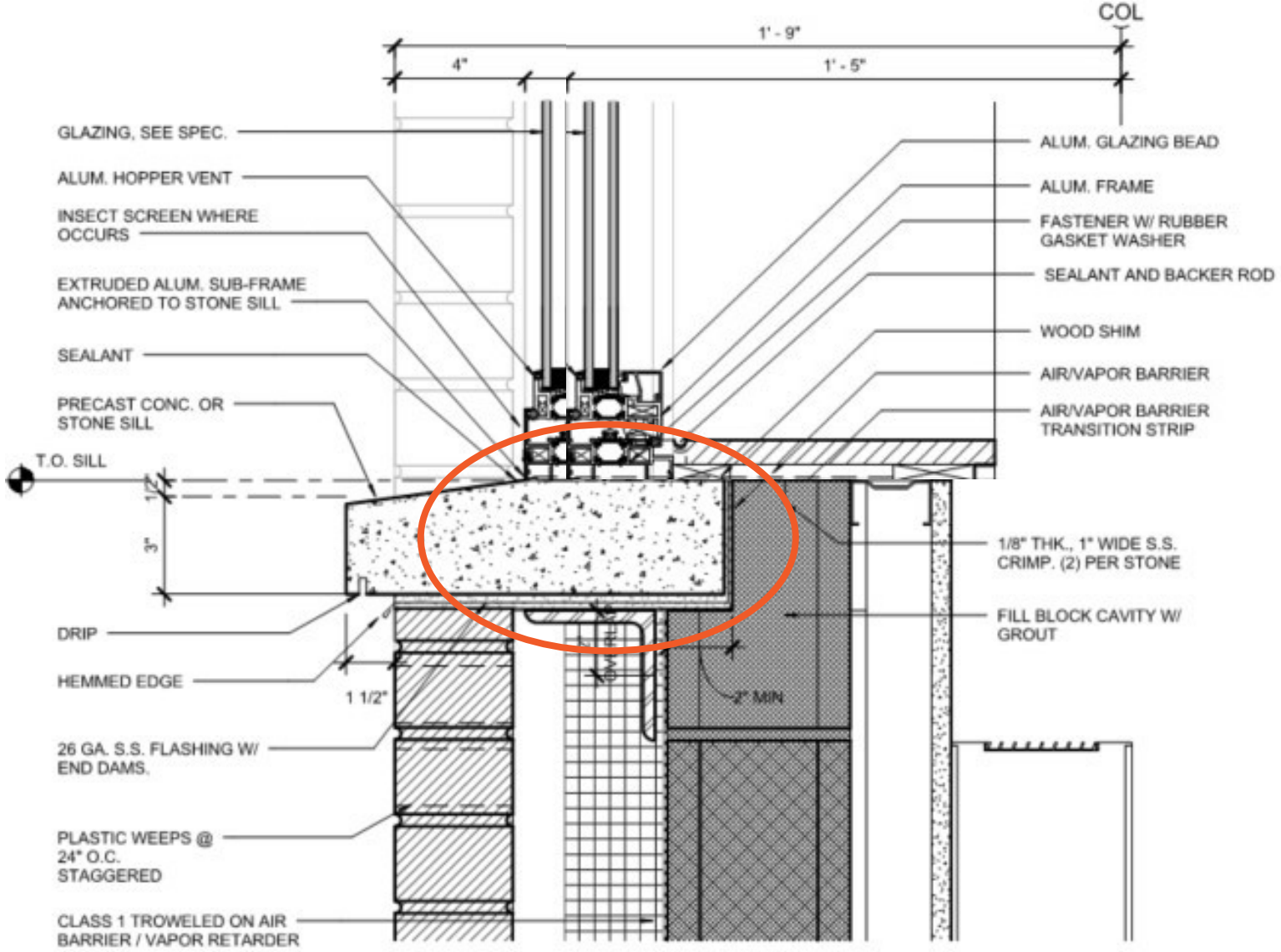

FXFOWLE

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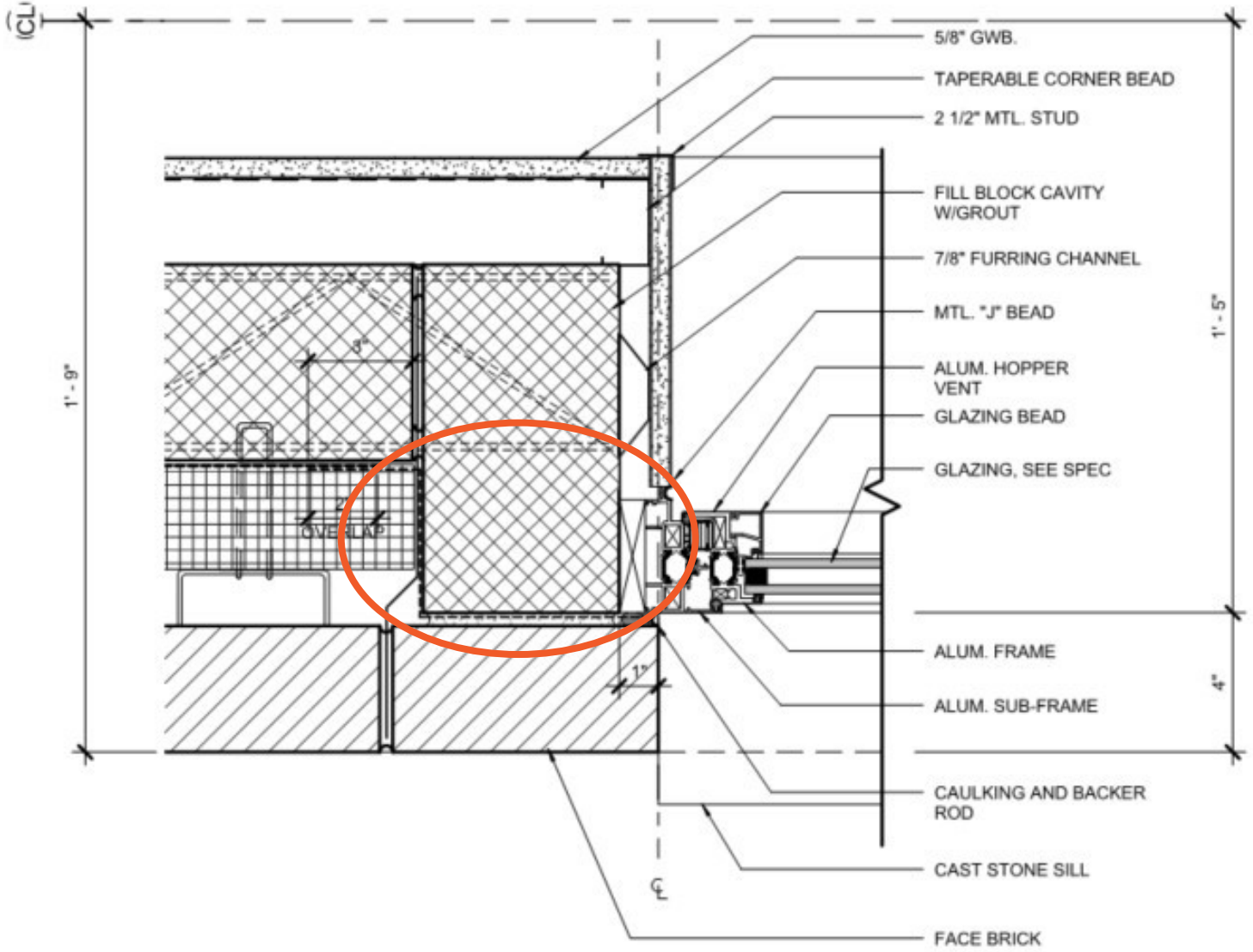

FXFOWLE

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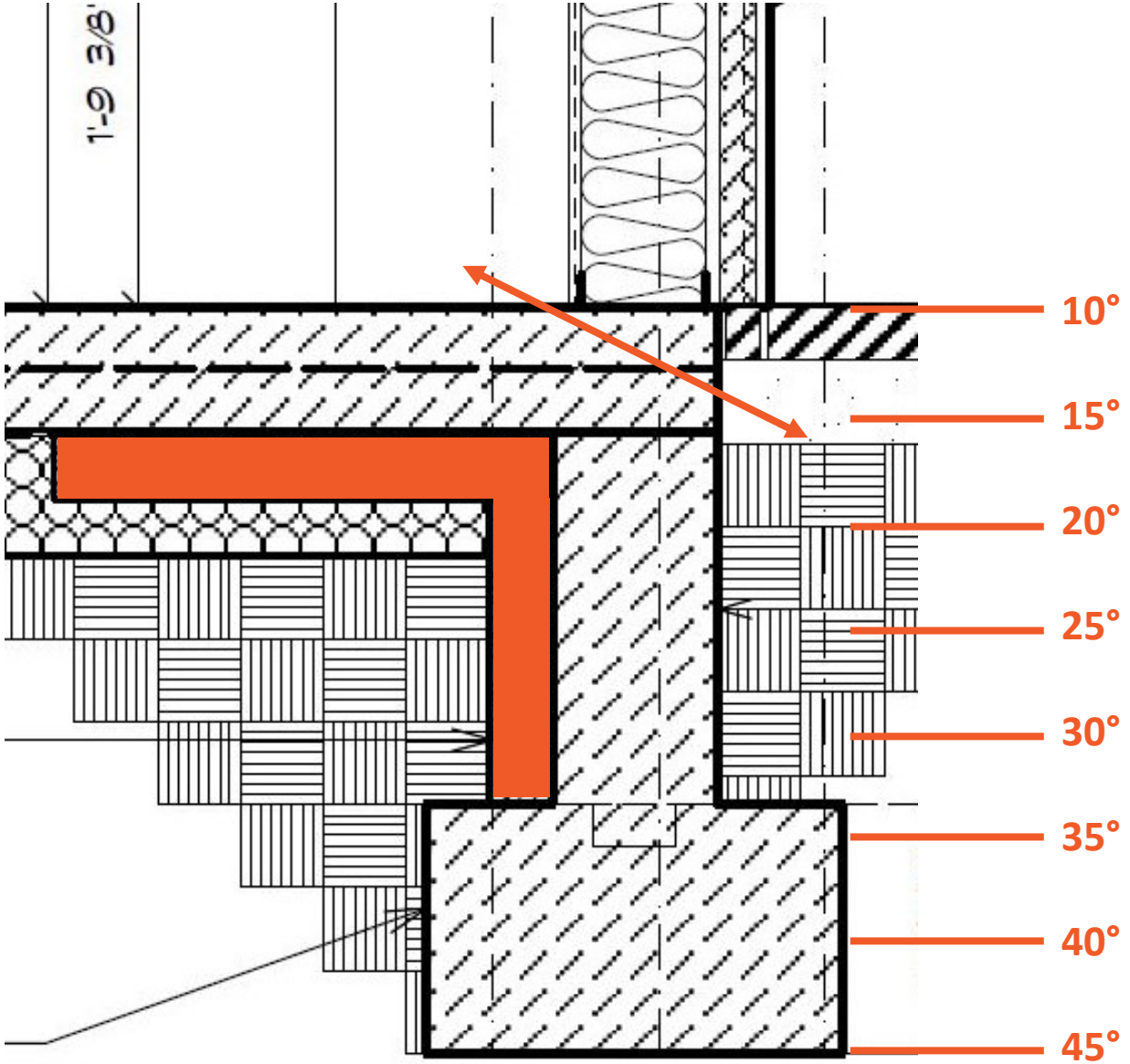
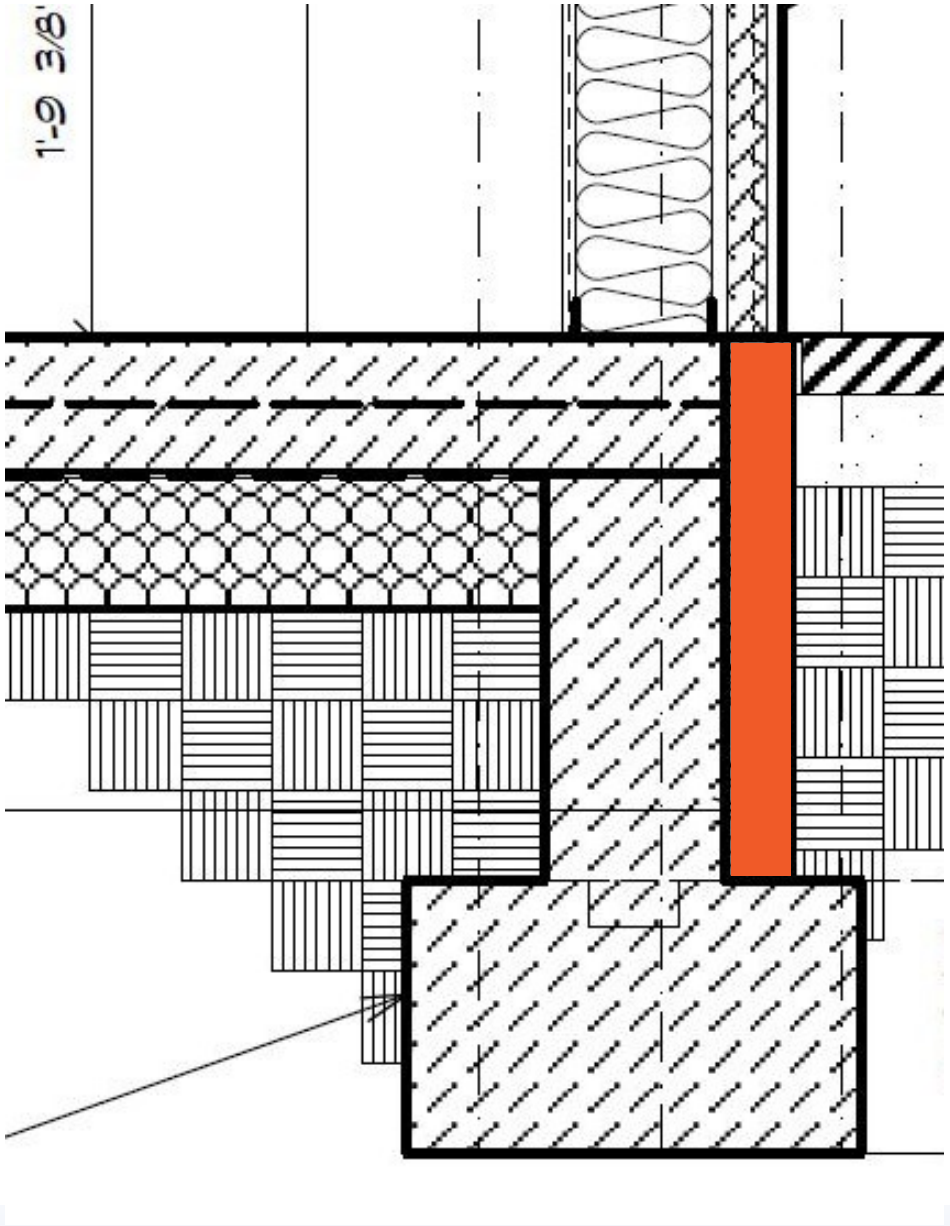
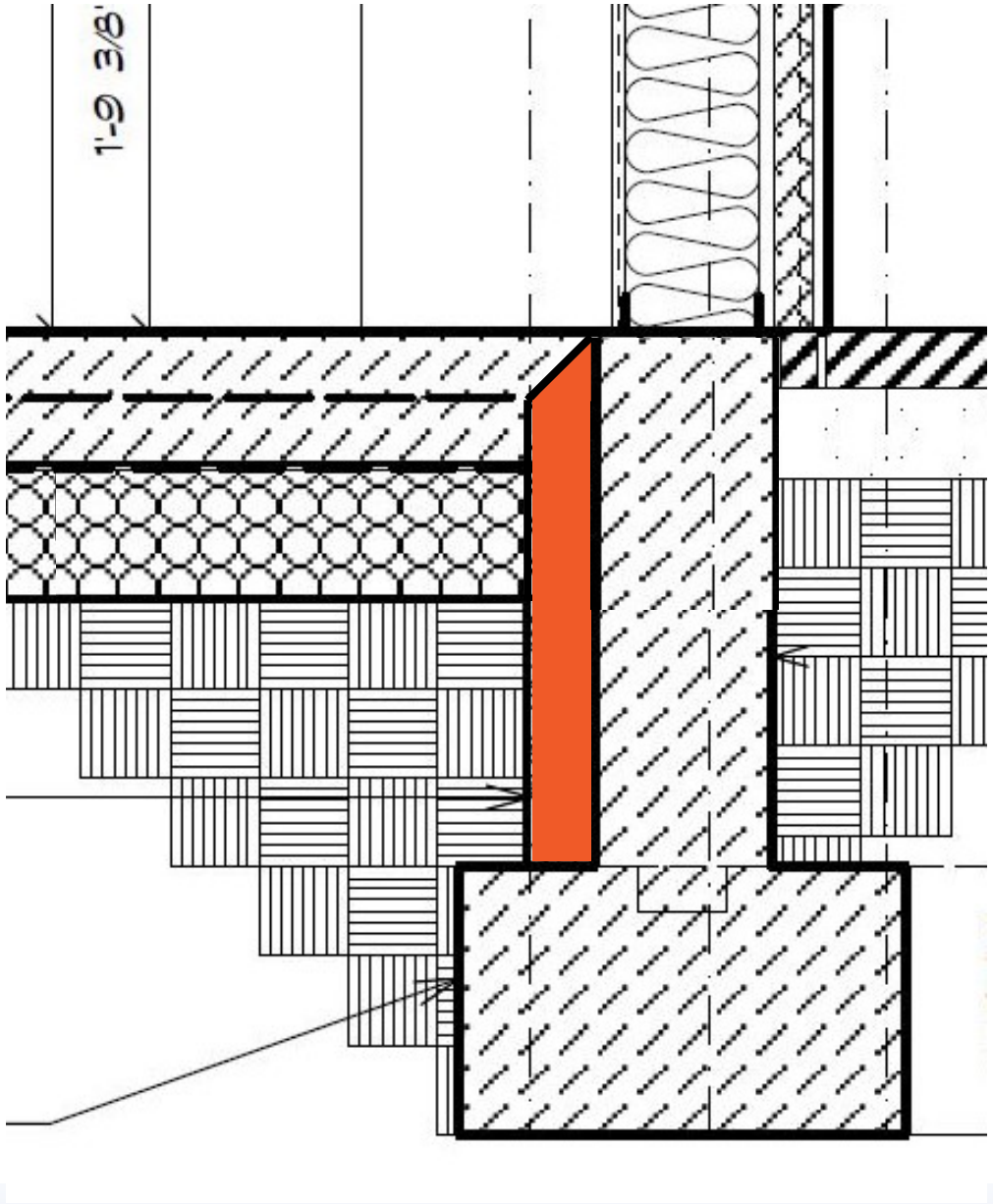
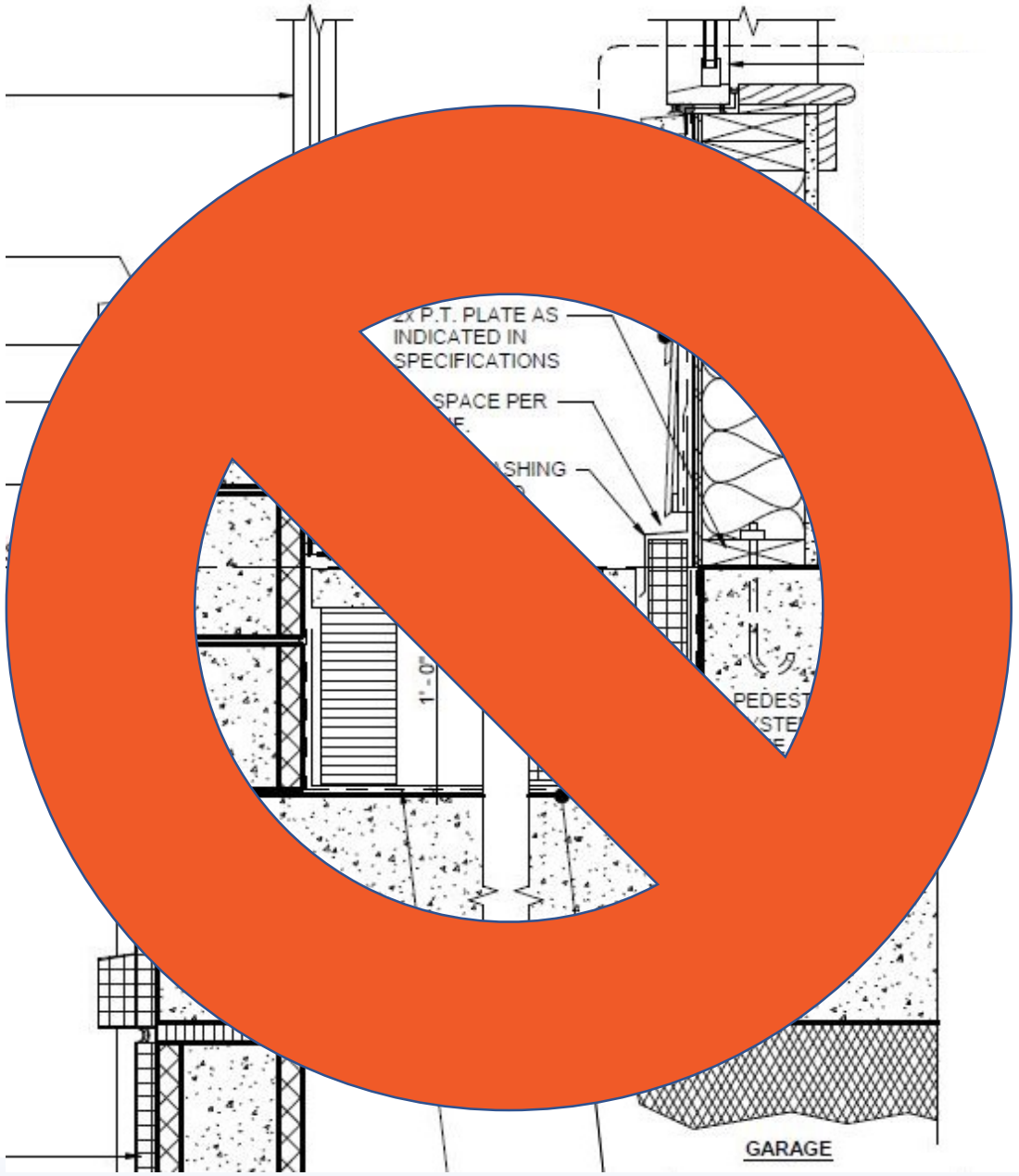

1'-9 3/8"
10°
15°
20°
25°
30°
35°
40°
45°


1'-9 3/8"


1'-9 3/8"


2x P.T. PLATE AS
INDICATED IN
SPECIFICATIONS
SPACE PER
SHING
1'-0"
PEDEST
GARAGE

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BSI-062: Thermal Bridges Redux

Joseph Lstiburek

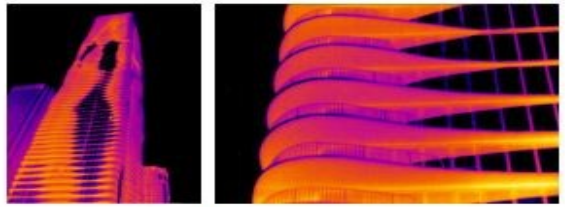
JUNE 2, 2015

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



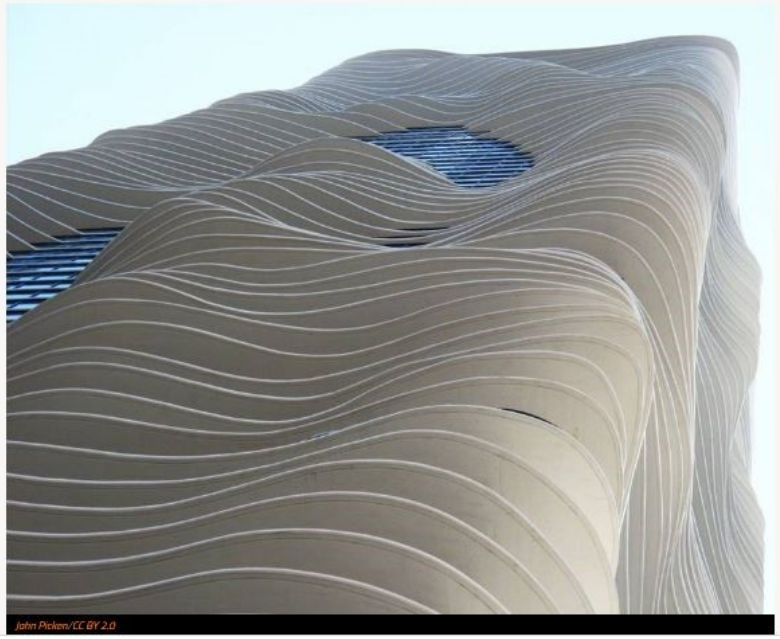
Photograph 1f *(left)*: Infra-red of Aqua Tower - Image courtesy of Dave Robley, Thermographer, Fluke Corp and Michael Stuart, L3 TI/IRT, Fluke Corp.; **Photograph 1g** *(right)*: Infra-red of Aqua Tower Balcony - Image courtesy of Dave Robley, Thermographer, Fluke Corp and Michael Stuart, L3 TI/IRT,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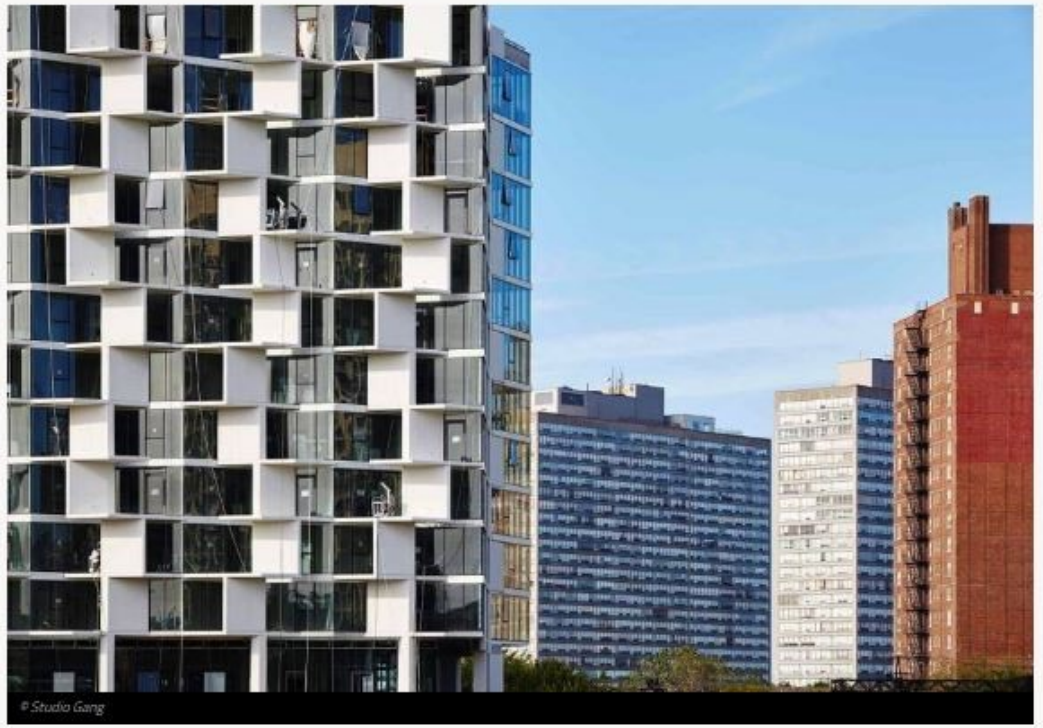
Design / Green Architecture

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

Lloyd Alter lloydalter
October 20, 2015



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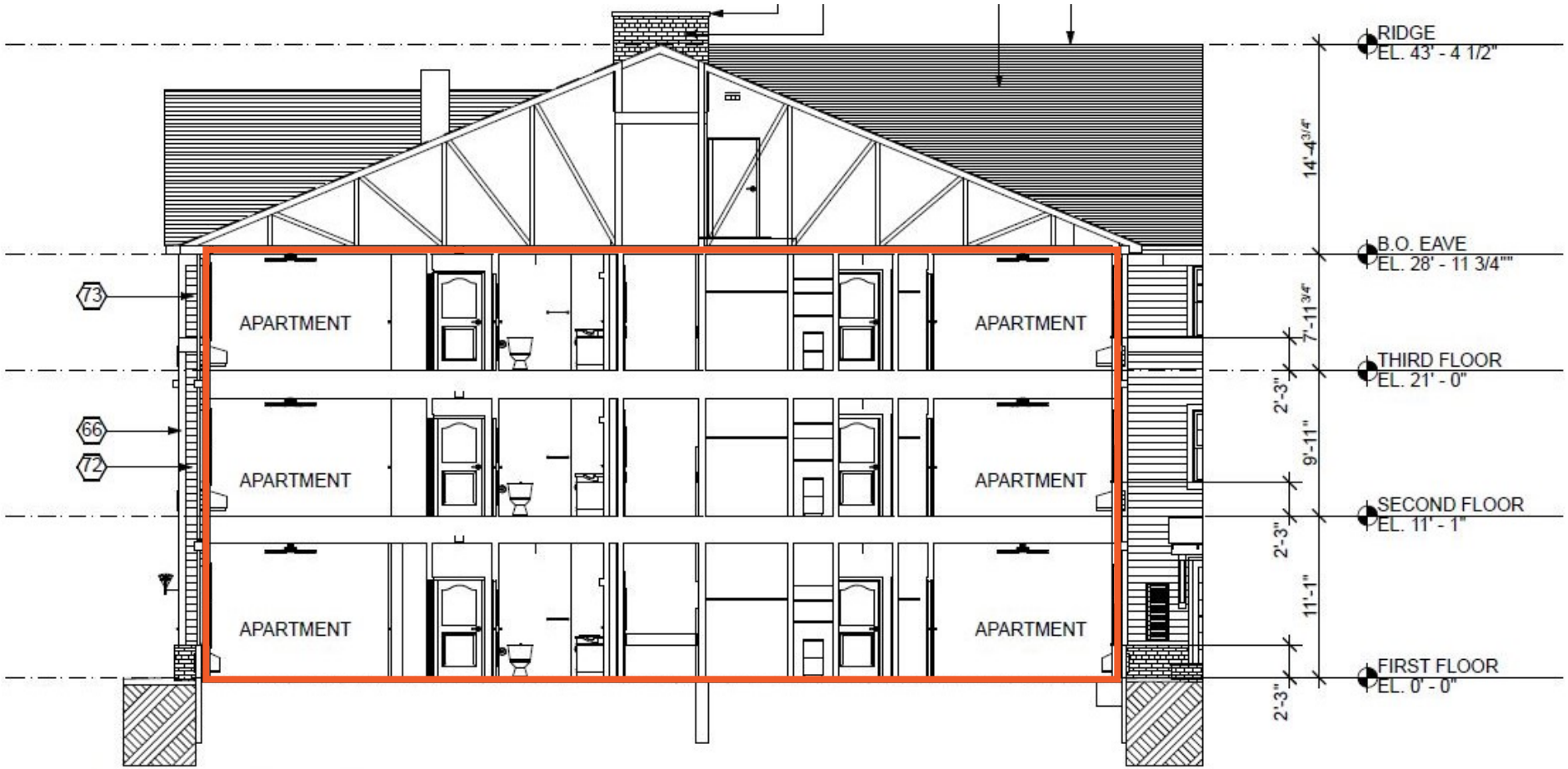

1 Typical Wing Section

1/8" = 1'-0"

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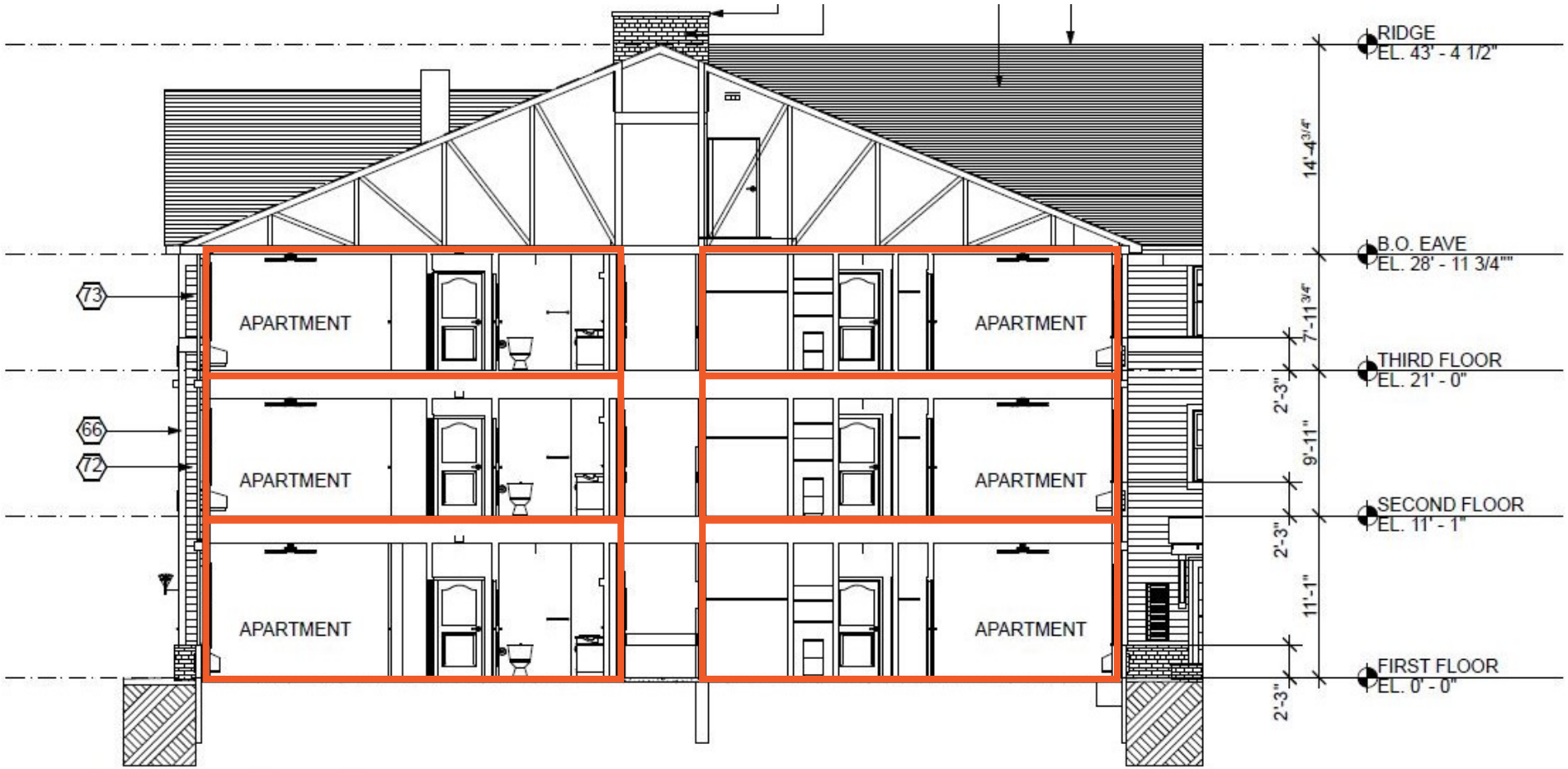

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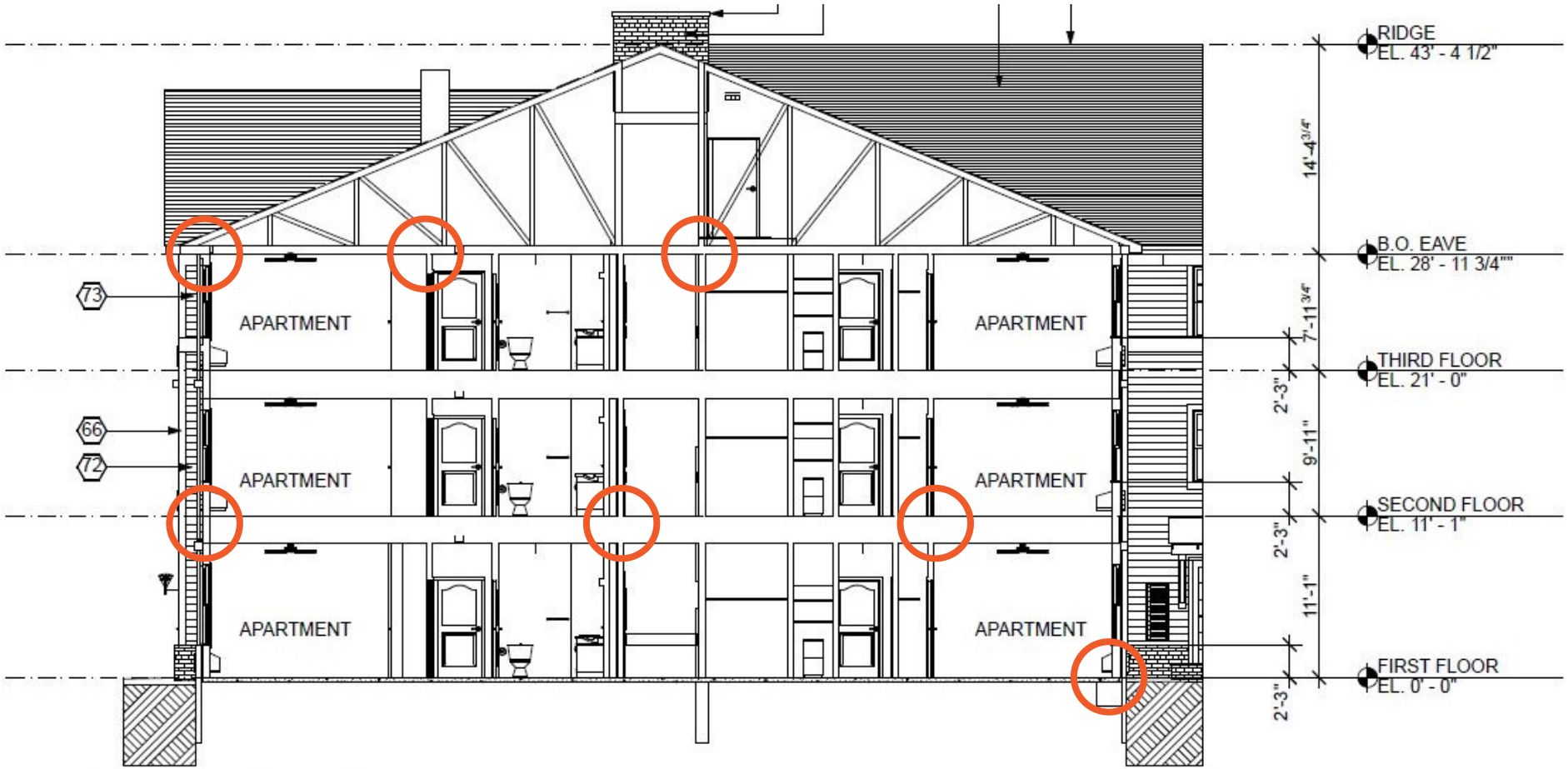
EEBA



1 Typical Wing Section

1/8" = 1'-0"

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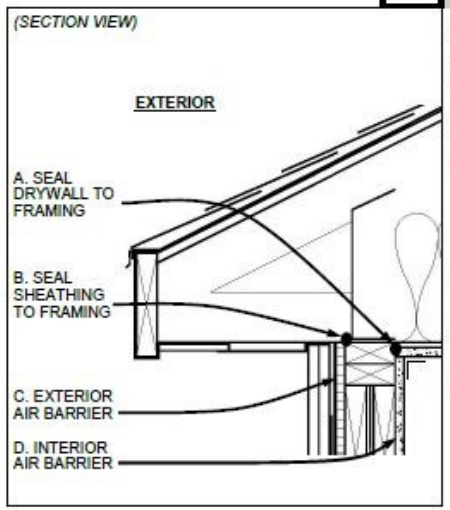
1 EXTERIOR WALL - TOP



Notes:

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

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

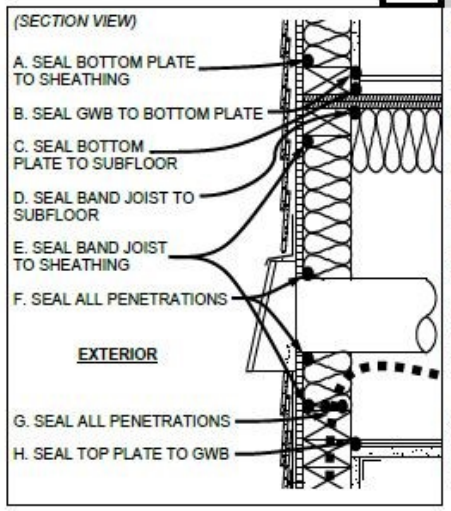
C. Options:
- Sheathing with seams sealed (i.e. ply wood or rigid foam board)
- Fluid-applied/adhesive membrane on sheathing (i.e. Grace / Henry products)

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

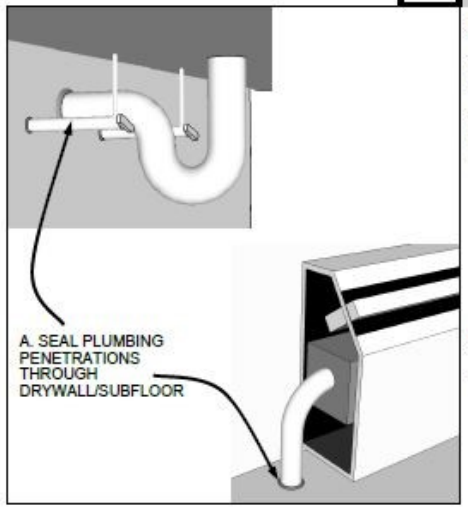
E. Continuous seal of the rim/band joist to sheathing, if a TJI joist seal at top and bottom

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

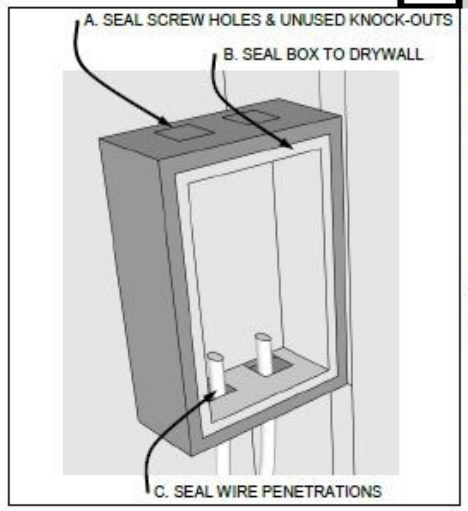
A. Intent: reduce leakage between wall cavities and apartment

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

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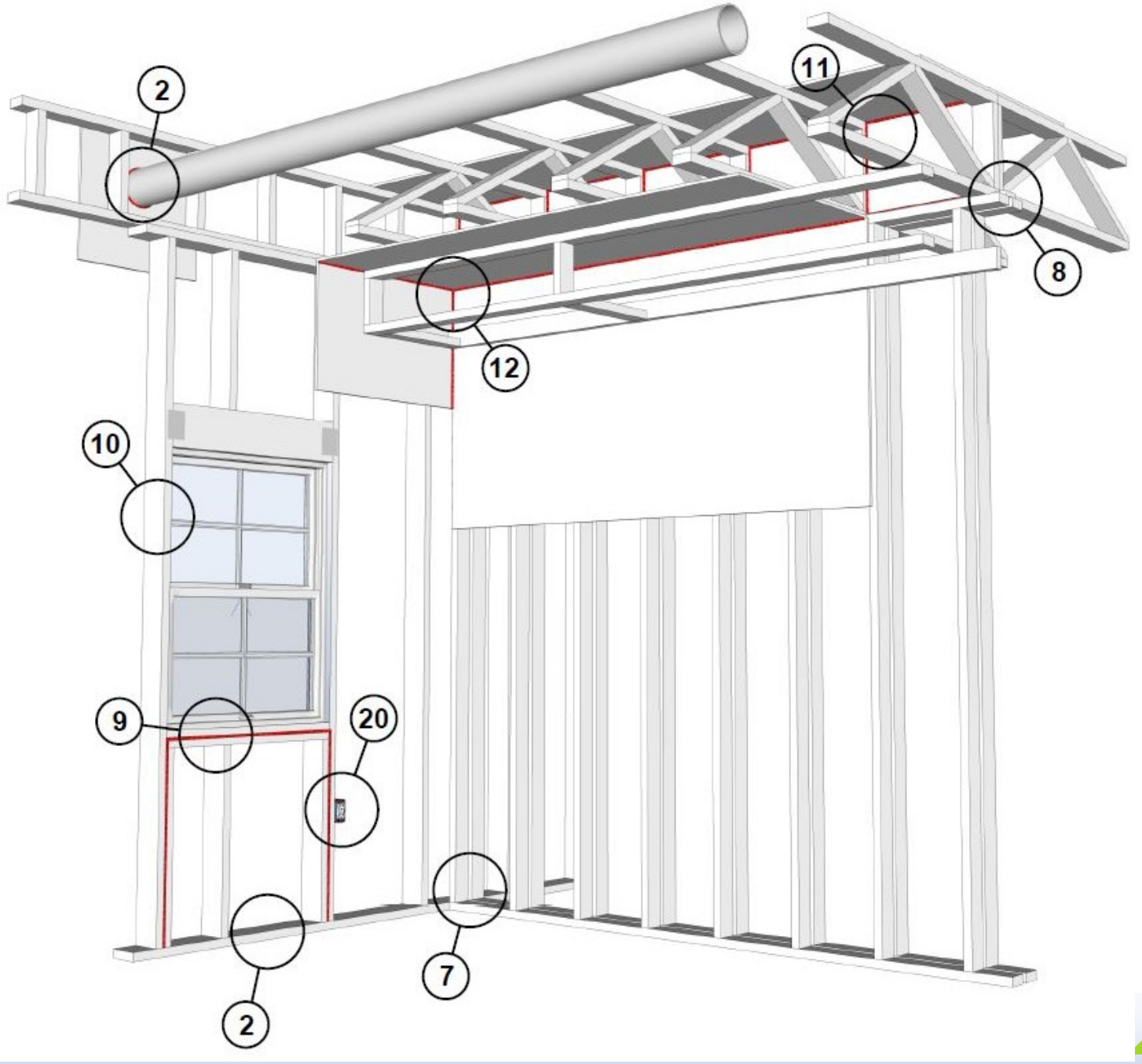
2
11
8
12
10
9
20
7
2

R402.4 Air leakage (Mandatory). The *building thermal envelope* shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.4.

R402.4.1 Building thermal envelope. The *building thermal envelope* shall comply with Sections R402.4.1.1 and R402.4.1.2. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

R402.4.1.1 Installation. The components of the *building thermal envelope* as listed in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table R402.4.1.1, as applicable to the method of construction. Where required by the *code official*, an *approved* third party shall inspect all components and verify compliance.

R402.4.1.2 Testing. The building or dwelling unit shall be tested and verified as having an air leakage rate not exceeding five air changes per hour in Climate Zones 1 and 2, and three air changes per hour in Climate Zones 3 through 8. Testing shall be conducted in accordance with ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

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Occupancy

Vacancy

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.

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.

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 following:

1. Areas designated as security or emergency areas that are required to be continuously lighted.
2. Interior exit stairways, interior exit ramps and exit passageways.
3. Emergency egress lighting that is normally off.

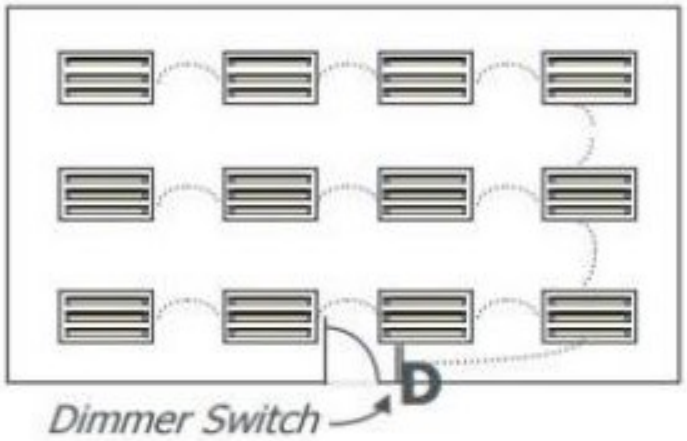
C405.2.1 Occupant sensor controls. Occupant *sensor controls* shall be installed to control lights in the following space types:

1. Classrooms/lecture/training rooms.
2. Conference/meeting/multipurpose rooms.
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) or less that are enclosed by floor-to-ceiling height partitions.
12. Warehouses.

2015 IBC/IECC, NFPA 101

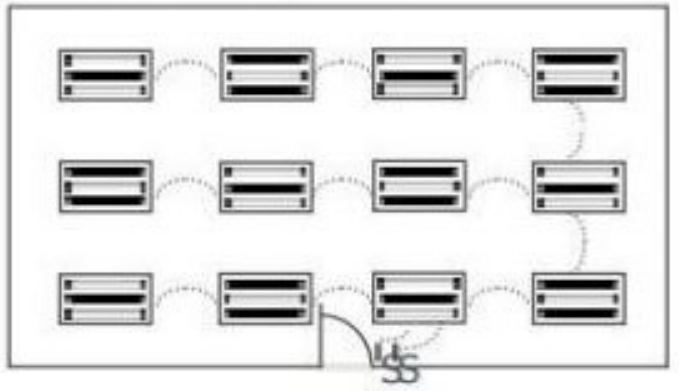
EEBA

Dimming



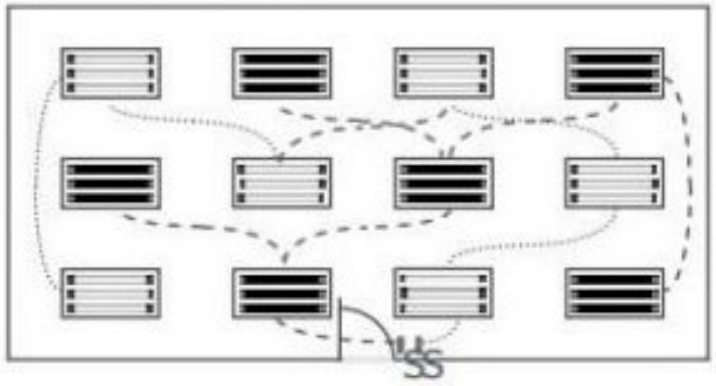
a) Control of all lamps/luminaires

Alternating Lamps



c) Switching middle lamp luminaires independently

Alternating Luminaires



b) Dual switching of alternate rows of luminaries

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

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SHORT-CYCLING

SHORT-CYCLING

= QUICK ON/OFF

= BAD!

DECREASES:

Efficiency

Durability

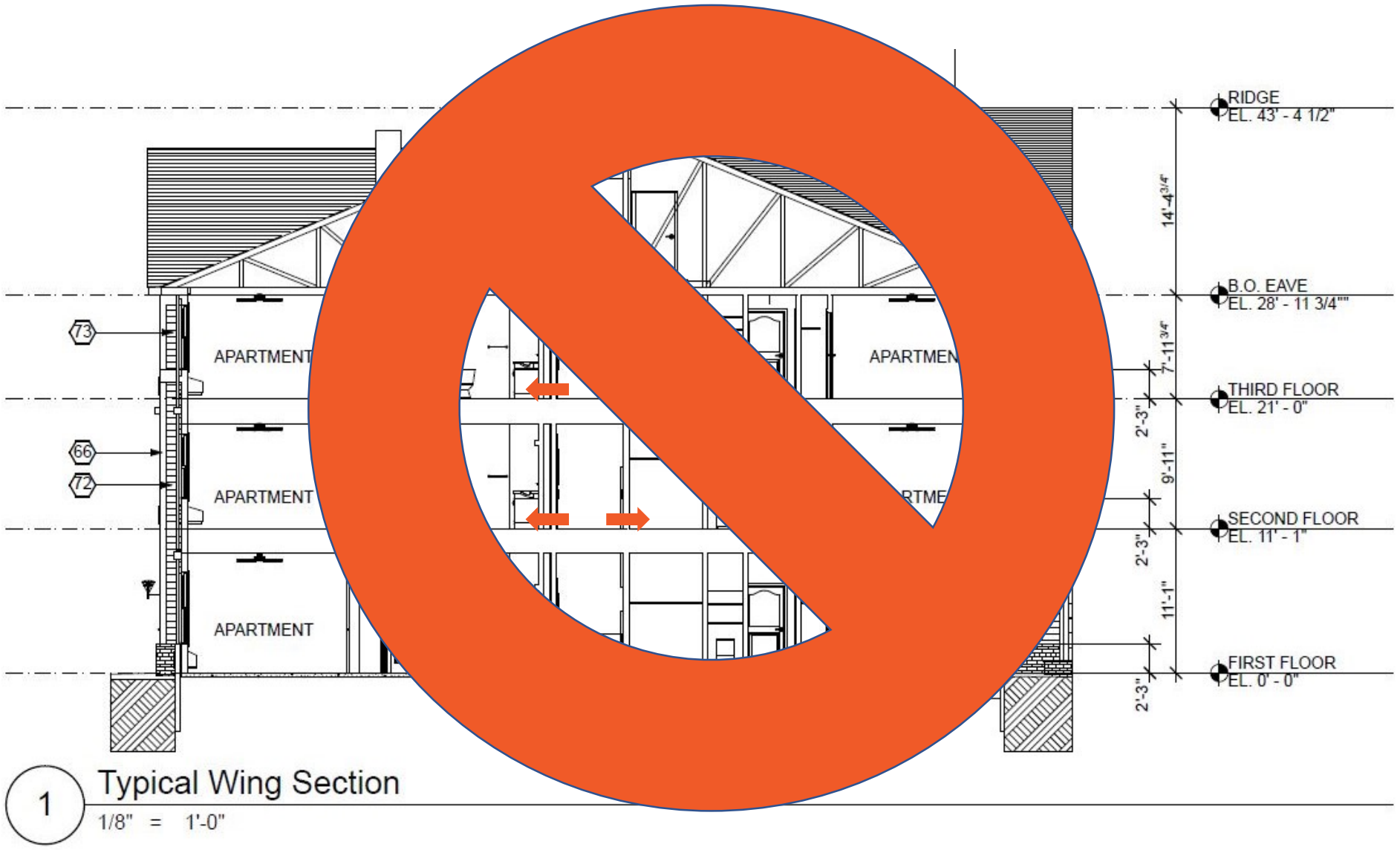
Indoor Air Quality

Comfort

1. Overcomplicated Geometry
2. Design Irregularities
3. Thermal Bridging: Roofs & Walls
4. Thermal Bridging: Slabs
5. Poorly Detailed Air Barrier
6. No Lighting Controls
7. Improperly Sized HVAC
8. Antiquated Ventilation
9. Oversized DHW Distribution
10. Poor Communication

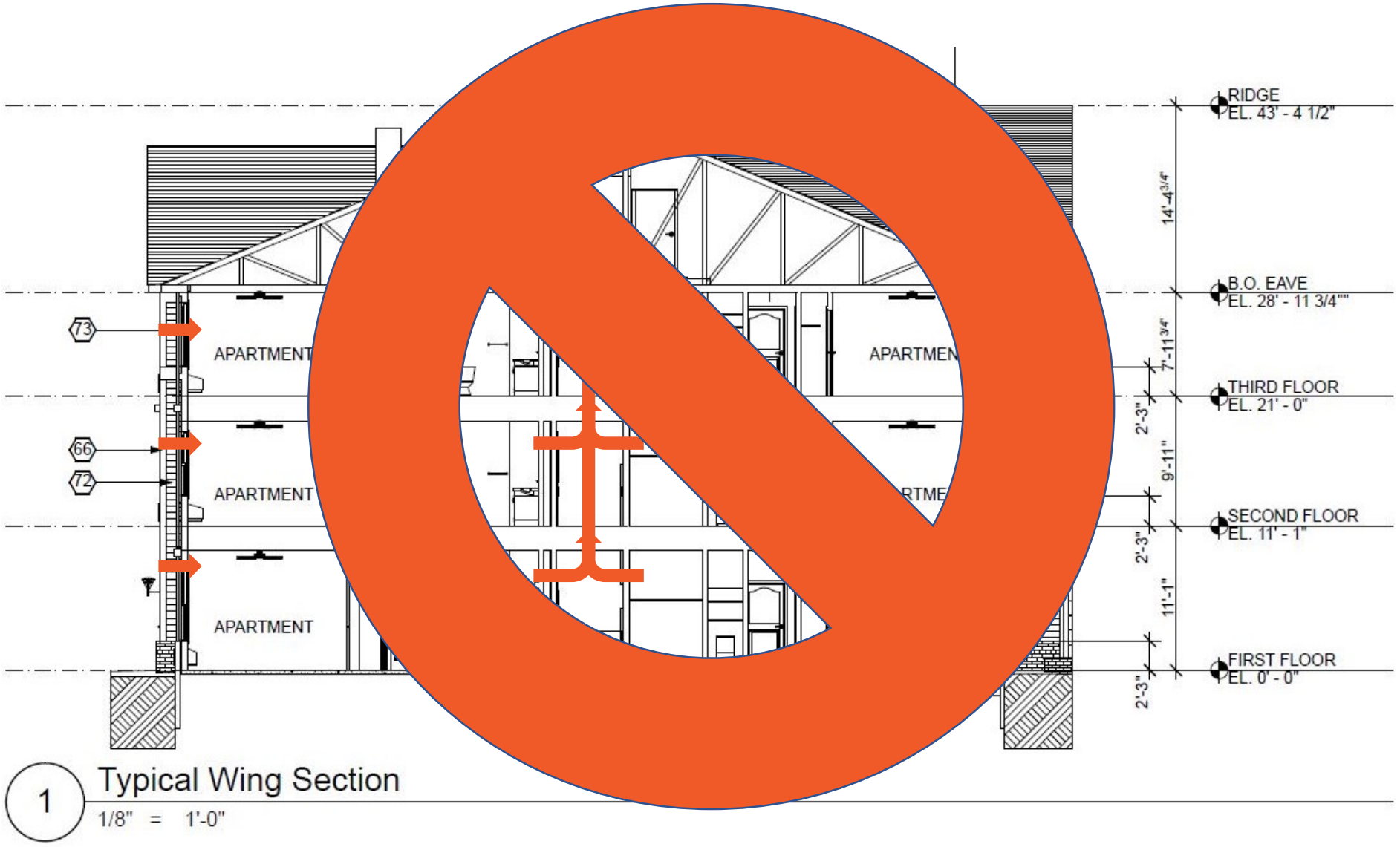
We Should Know Better

Top 10 Multifamily Design Mistakes



1 Typical Wing Section

1/8" = 1'-0"



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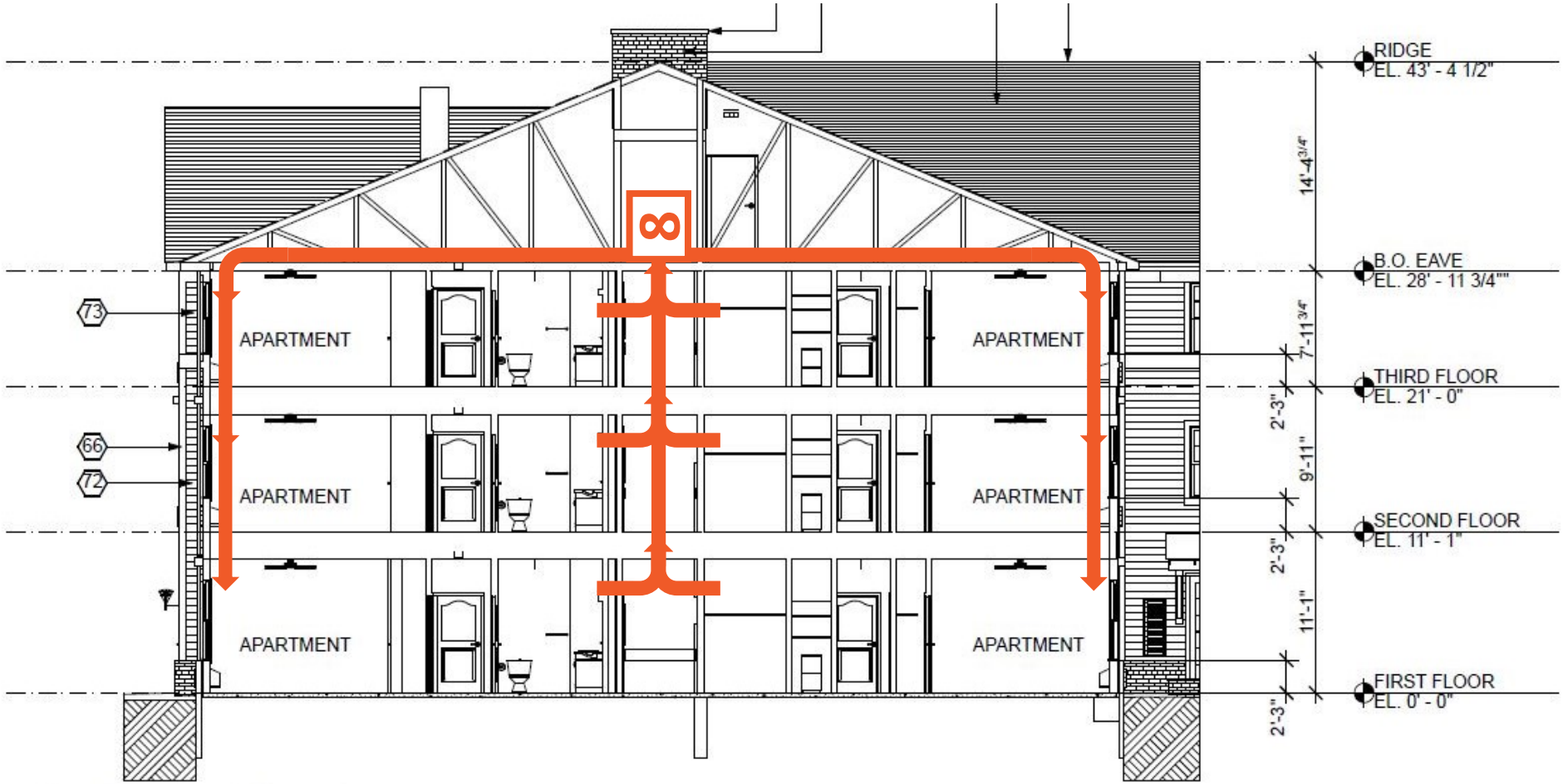

1 Typical Wing Section

1/8" = 1'-0"

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NEWS CENTER

Hidden Dangers in the Ai

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

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

The Berkeley Lab scientists are now working
based solutions, including better standards f
the hazardous pollutants. These efforts are t
Health Perspectives in 2012 that described a n
of indoor air pollutants. That research uncov
recognized as a cause for concern—fine part

http://newscenter.lbl.gov/20

EHP Environmental Health Perspectives

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Research

Pollutant Exposures from
Simulation-Based Assessr

Jennifer M. Logue, Neil E. Klepeis, Agnes B. Lobsche

First Published: 5 November 2013 | Cited by: 4

Sections | View Article

Abstract

Background: Residential natural gas cooking b
they are typically used without venting range h

Objective: We quantified pollutant concentrati
homes.

Methods: A mass-balance model was applied t
homes in Southern California and the exposur
nitrogen dioxide (NO_2), carbon monoxide (CO
summer and winter for a representative sampl
emissions from NGCBs as well as NO_2 and CO
ventilation and deposition. Residence characte
from available databases. We inferred ventilat
characteristics. We also explored proximity to
model executions using independently generat
concentration distributions with geometric me

https://ehp.n

Well

DEPT. OF PUBLIC HEALTH

HEALTHY CONSUMER

The Kitchen as a

BY PETER ANDREY SMITH JULY

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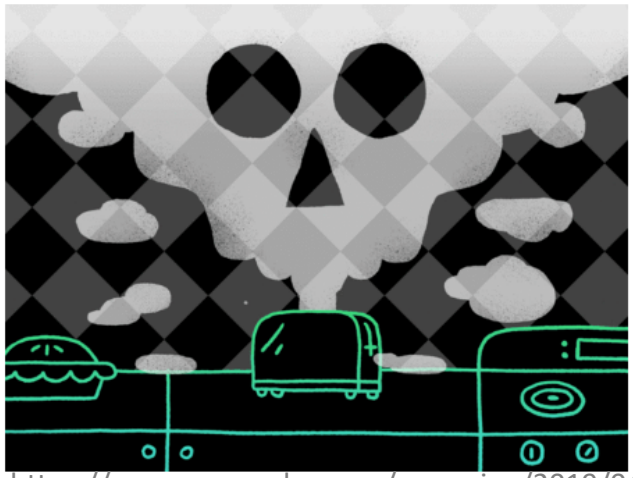
THE HIDDEN AIR POLLUTION IN OUR HOMES

Outdoor air has been regulated for decades, but emissions from daily domestic activities may be more dangerous than anyone imagined.

By Nicola Twilley April 1, 2019



https://www.newyorker.com/magazine/2019/04/08/the-hidden-air-pollution-in-our-homes

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EEBA

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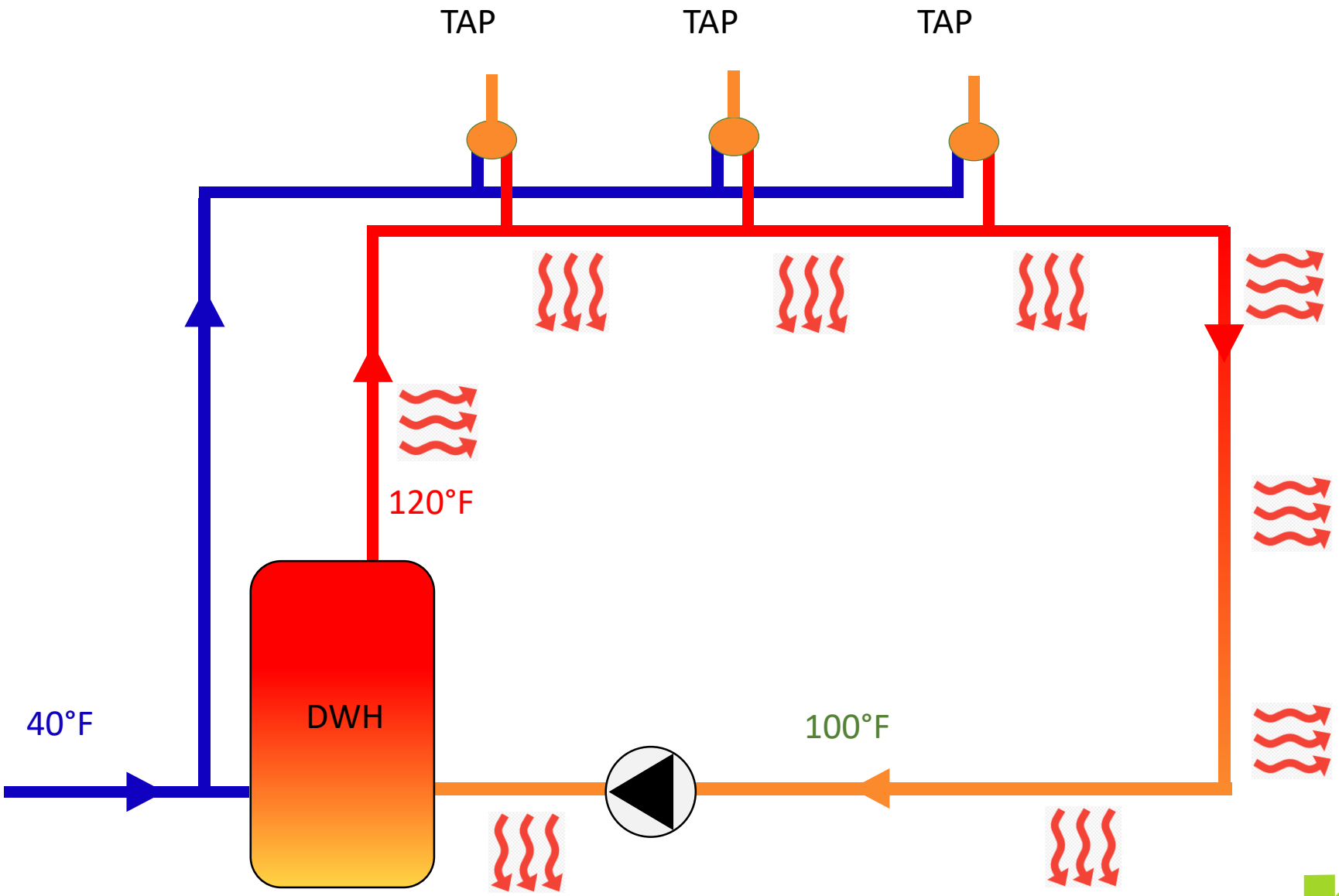
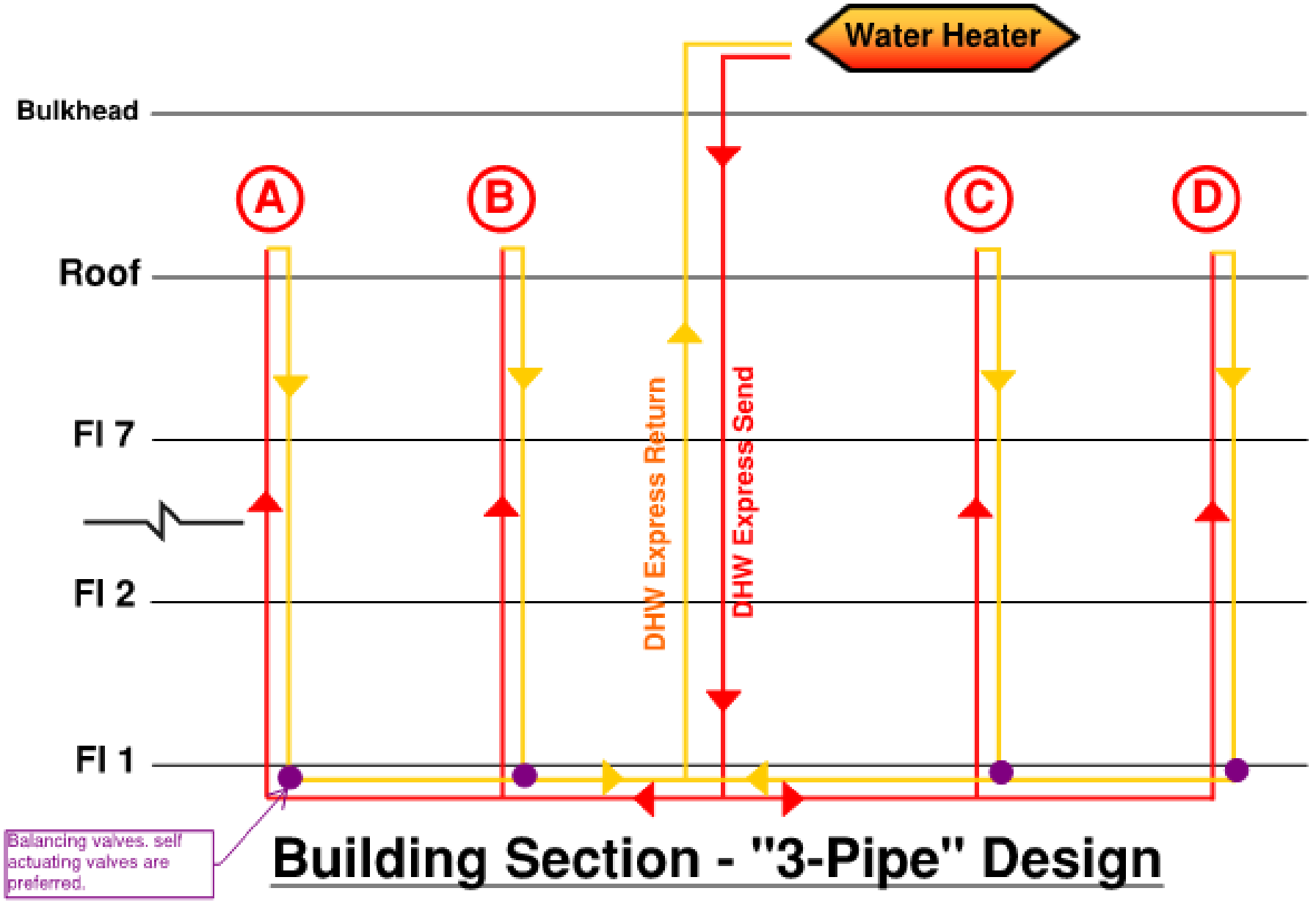
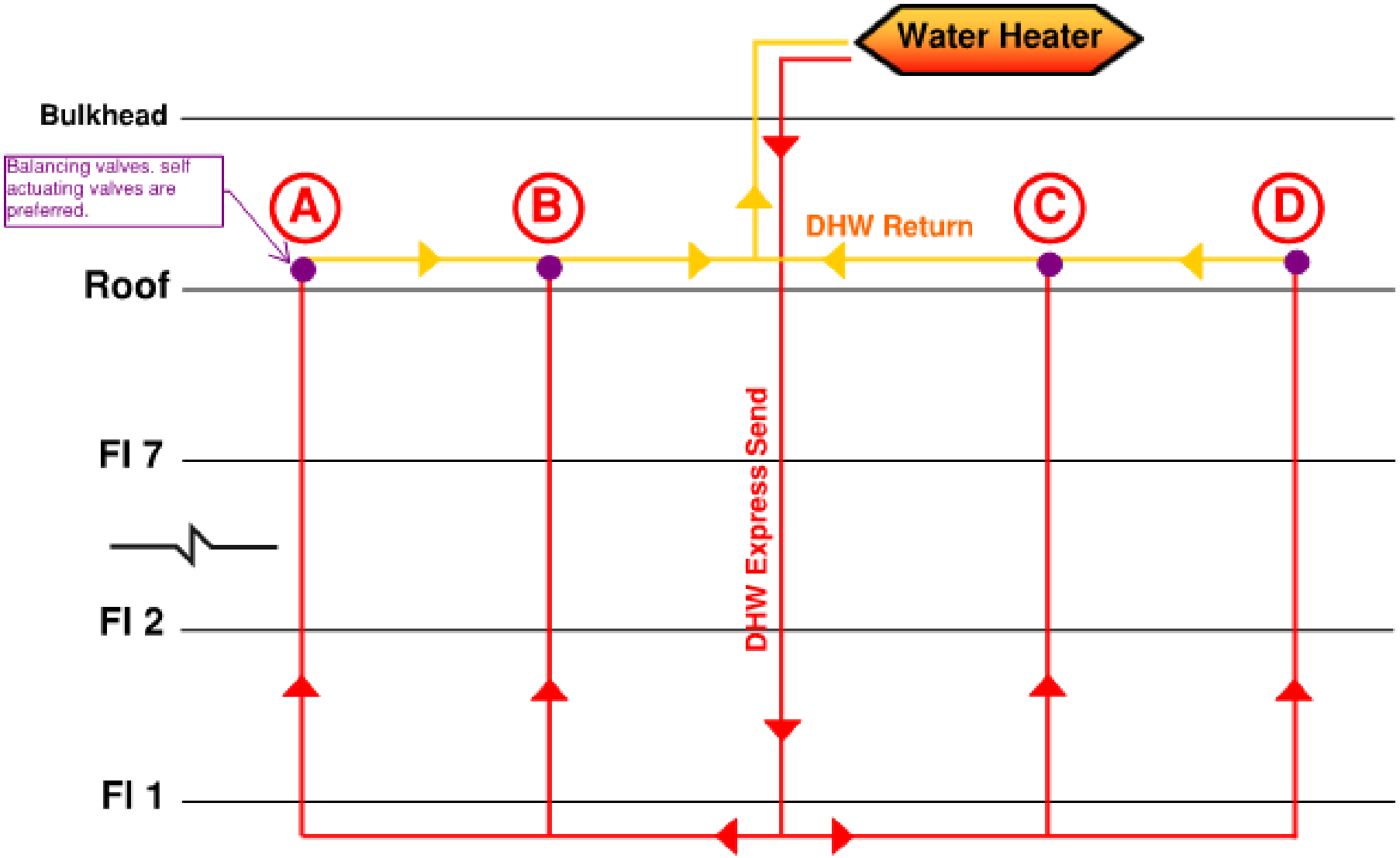
Top 10 Multifamily Design Mistakes


TAP
TAP
TAP
120°F
40°F
DWH
100°F



Building Section - "3-Pipe" Design

EEBA



Building Section - "Box" Design

EEBA

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

Guideline	Peak Minutes 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

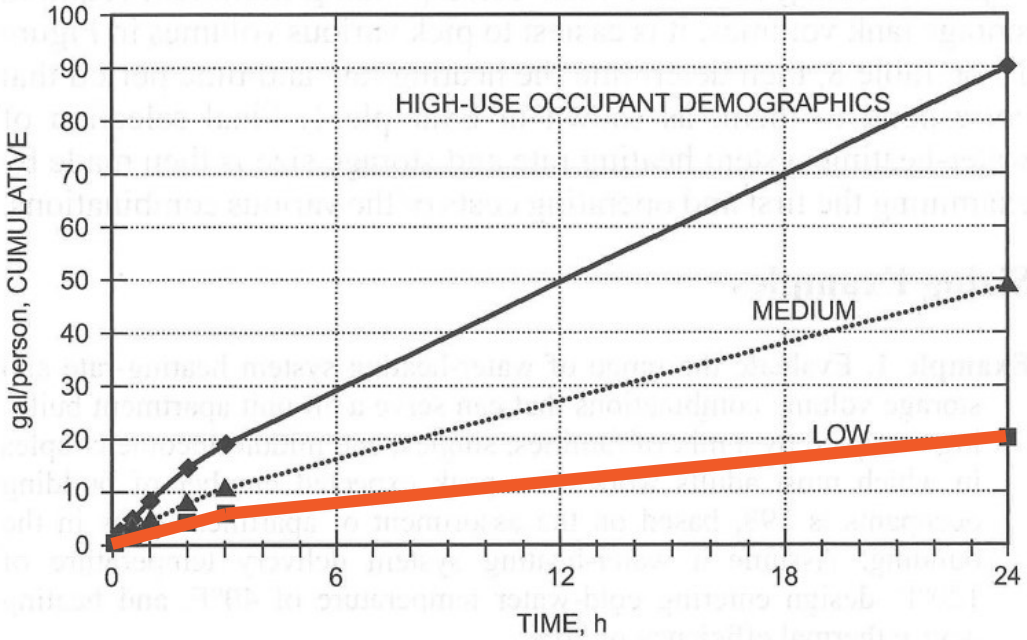


Fig. 15 Apartment Building Cumulative Hot-Water Use Versus Time (from Table 8)

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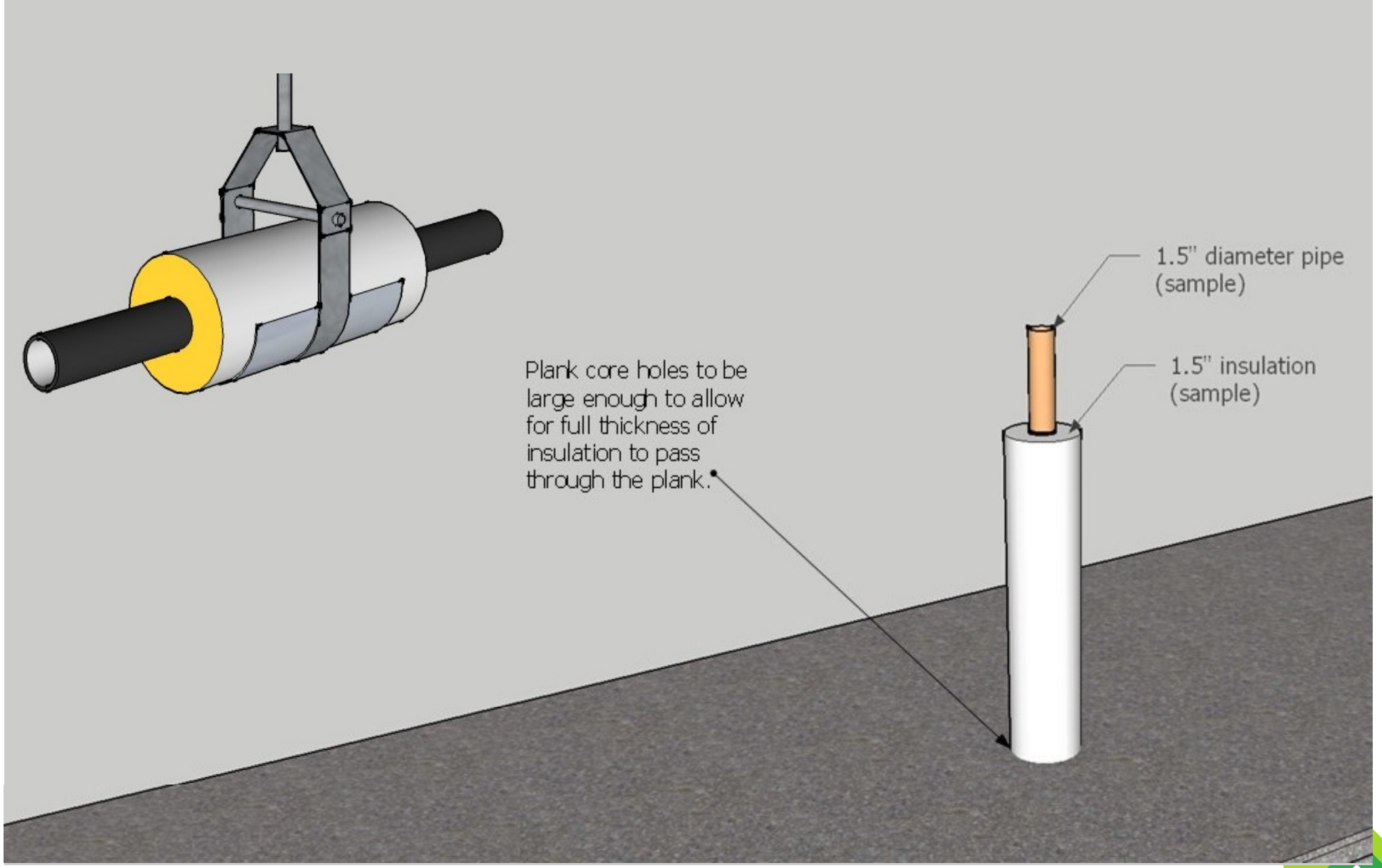
1.5" diameter pipe
(sample)
1.5" insulation
(sample)
Plank core holes to be
large enough to allow
for full thickness of
insulation to pass
through the plank.

1. Overcomplicated Geometry
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We Should Know Better

Top 10 Multifamily Design Mistakes


DETAIL
SCALE: 3" = 1'-0"
GUSSET PLATE
STEEL COLUMN SEE PLAN
S310
GENERAL NOTES
SEE GENERAL NOTES FOR CONNECTION CRITERIA
3/4"DIA BOLT
DOOR
NO
TYPE
WIDTH
HEIGHT
THICK

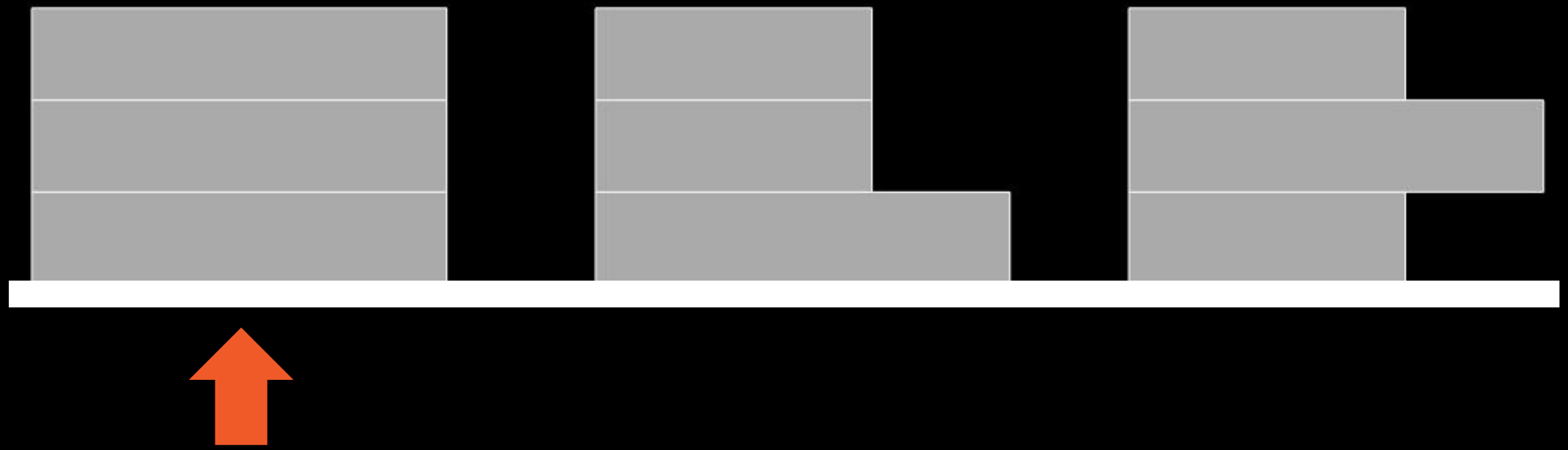
Questions?

We Should Know Better

Top 10 Multifamily Design Mistakes

Question #1

Which building shape is easier to build?

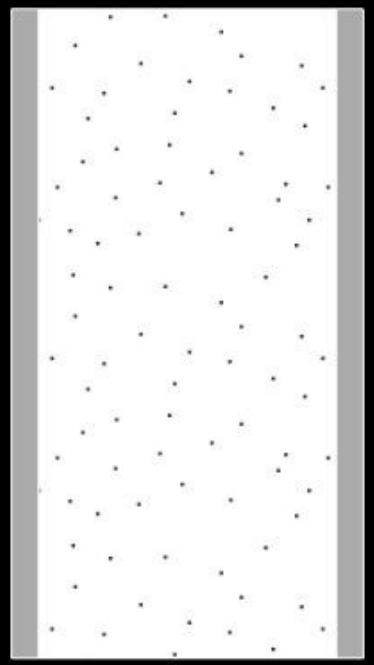


Question #2

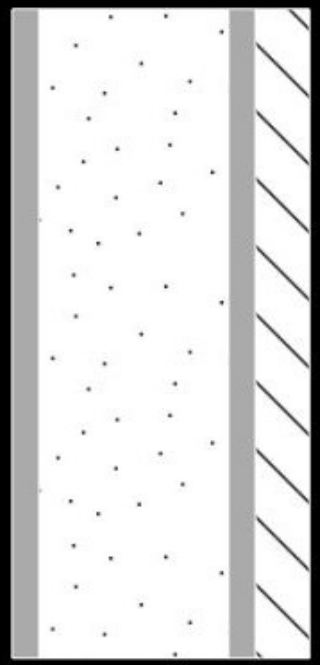
Which unit layout will result in the fewest mistakes?

Question #3

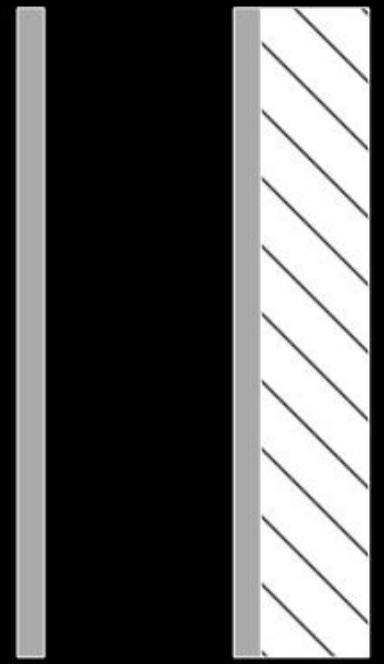
Which wall assembly has the highest R-value?



R-20 cavity



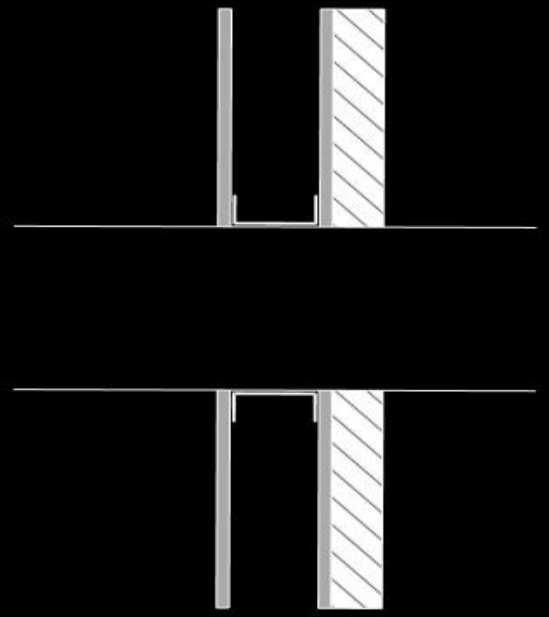
R-13 cavity + R-5 continuous



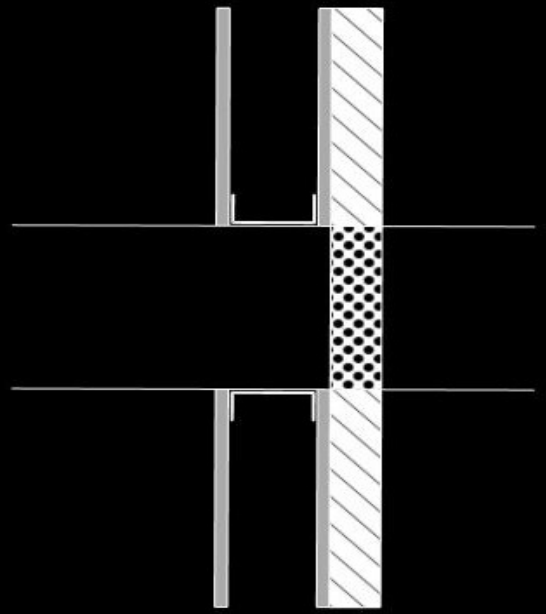
R-0 cavity + R-10 continuous

Question #4

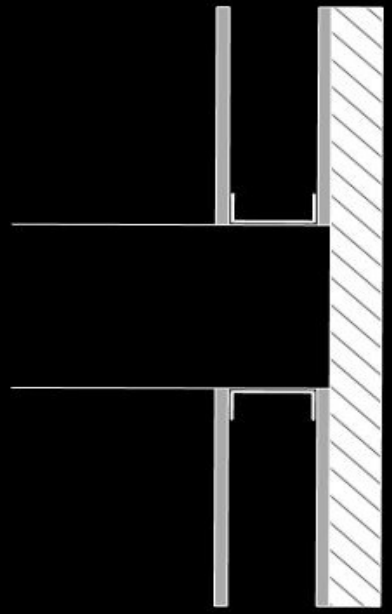
Which balcony assembly has the least thermal bridging?



Continuous concrete slab



Structural thermal break



No balcony

Question #5

Where is the best place to include infiltration requirements in your documents?

A. Drawings
B. Specifications
C. Both

Question #6

Which lighting control method is best?

A. None
B. Wall switches
C. Remote vacancy sensors
D. Occupancy sensors on fixtures
E. It depends on the situation!

Question #7

Which approach to cooling equipment sizing is best?

A. Assume 1 ton per 600 square feet
B. Block load calculation with safety factor
C. Room-by-room calculation; equipment sized to meet load (and no larger)

Question #8

Which is the best ventilation strategy for indoor air quality?

A. Operable windows
B. Exhaust + trickle vents
C. Central make-up air unit
D. Balanced (HRV/ERV)

Question #9

Which factors affect
DHW distribution efficiency?

A. Pipe length
B. Insulation thickness
C. Pump sizing
D. Fixture flow rates
E. All of the above

Question #10

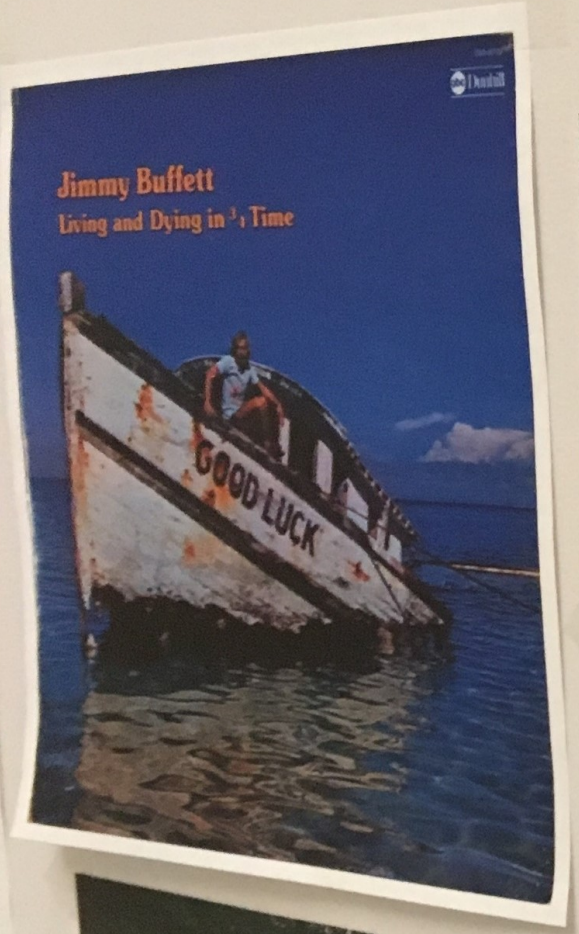
What is the difference between
a successful project and a failure?

COMMUNICATION

Moving forward

We Should Know Better

Top 10 Multifamily Design Mistakes



COMPANY PRINCIPLES

Be Visionary

Lead the industry forward.

- Identify and respond quickly to trends that are anticipated to shape our industry.
- Be proactive and develop the expertise that will position SWA at the forefront of the industry.
- Pursue opportunities to share expertise both internally and outside the organization.
- Don't accept industry standard practice as the only solution. Develop and propose innovative solutions.

Take Ownership

Pursue opportunities for building lasting success.

- Bring new thoughts, solutions, and ideas to the table in an effort to change and/or improve a process or procedure, develop an initiative, or grow an idea.
- Hold yourself and one another accountable for following through on expectations.

Think Holistically

Collaborate to optimize whole building and community solutions.

- Collaborate strategically whenever possible to add value; drive collective results above all else.
- Promote the whole building approach to creating high performing buildings; recognize that our value is in our unique skill set and variety of service offerings.
- Share knowledge and information. There is extreme value in learning and teaching; do so whenever possible.

Foster Comradery

Engage with one another to build community.

- Spread positivity by being SUPER (supportive, understanding, polite, encouraging, and respectful).
- Celebrate successes and milestones.
- Bring laughter to the office. And dogs. And baked goo

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 designed in three dimensions?

What did we do right last time?

What did we do wrong last time?

Steve Klocke

sklocke@swinter.com

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Thank you!

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Save the dates for next year:

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