



# THE WORLD'S LARGEST PASSIVE HOUSE BUILDING

Cornell Tech NYC Campus  
Residential Building



# PARTNERSHIP: HUDSON COMPANIES AND RELATED COMPANIES



Seven Buildings on Roosevelt Island



**Riverwalk 7:**  
25.5% better than ASHRAE 90.1–2007  
LEED Silver and NYSERDA ENERGY STAR anticipated

# THE HUDSON COMPANIES: GREEN LEADERSHIP



## Third + Bond

LEED Platinum and ENERGY STAR labels  
Completed 2011



## Gateway Elton Street Phases I, II, III

Largest Residential PV Installation in NYS  
3 phase multi-building mid-rise development  
LEED for Homes Gold or better expected  
Plan to exceed NYSERDA's energy-efficiency standard



# RELATED: SINCE 2008 BUILDS GREEN EXCLUSIVELY

LEED Silver or Better

## Completed:

14 projects, 6.4M SF, \$3.7B

1 LEED Platinum

5 LEED Gold

8 LEED Silver

## Underway:

32 projects, 14.5M SF, \$10B

3 LEED Neighborhood Developments



Tribeca Green, NYC

Completed: 2004

LEED NC Gold



# HANDEL ARCHITECTS: MIXED-USE HIGH-RISE DESIGNERS





# APPLIED SCIENCES NYC

For centuries, American innovation and technology have helped to reinvent and reinvigorate our economy and improve the way we live. Applied Sciences NYC seeks to again reinvigorate New York City's economy by spurring innovation, attracting investments and creating jobs.

**\$6 BILLION OVER THE COMING DECADES**

The benefits of the Applied Sciences NYC initiative for New York City and New Yorkers will be substantial and dramatic, generating \$6 billion in economic activity over the coming decades.

## THE CAMPUS

More than \$1 billion in private capital investment on site

With nearly 8,000 construction jobs.

And hundreds of other employment opportunities in diverse fields.

Building Workers, Faculty & Researchers, Education Administrators, Accountants & Auditors

## SPIN-OFF COMPANIES

This endeavour is estimated to produce more than 400 new companies and 22,000 well paying jobs.

Many within 5 miles of the site.

## APPLIED SCIENCE → STARTUPS

Just how can applied sciences lead to new jobs and a reinvigorated economy?

Research in applied sciences is conducted in an academic setting. The talent pipeline is boosted by training students and further attracting science, engineering and tech talent to the City.

This spins out research and development that can be commercialized. This is then fueled by funding from angel investors and VC firms.

The result is a strengthened entrepreneurial and startup ecosystem in New York City.

If companies founded by graduates of MIT were an independent nation, it would have the 17th largest economy in the world.

## INVESTING IN INNOVATION FOR A STRONGER ECONOMY



**December 2010**  
City launches "Applied Sciences NYC."

**October 2011**  
Responses received from universities around the world.





Technion - Israel Institute of Technology President Peretz Lavie, Cornell President David Skorton, Mayor Michael Bloomberg

# Bloomberg hands over 12-acre plot for Cornell campus on Roosevelt Island

The Cornell Tech 'Genius School' under the Queensboro Bridge will 'ensure that New York City businesses play a major role in determining how technology shapes our future,' the outgoing New York City mayor says.

BY JENNIFER FERMINO [Follow](#) / NEW YORK DAILY NEWS / Friday, December 20, 2013, 1:13 AM

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BART MICHIELS

Outgoing Mayor Bloomberg handed over a 12-acre plot to Cornell at a City Hall ceremony Thursday that will pave the way for a Cornell Tech 'Genius School' on Roosevelt Island.

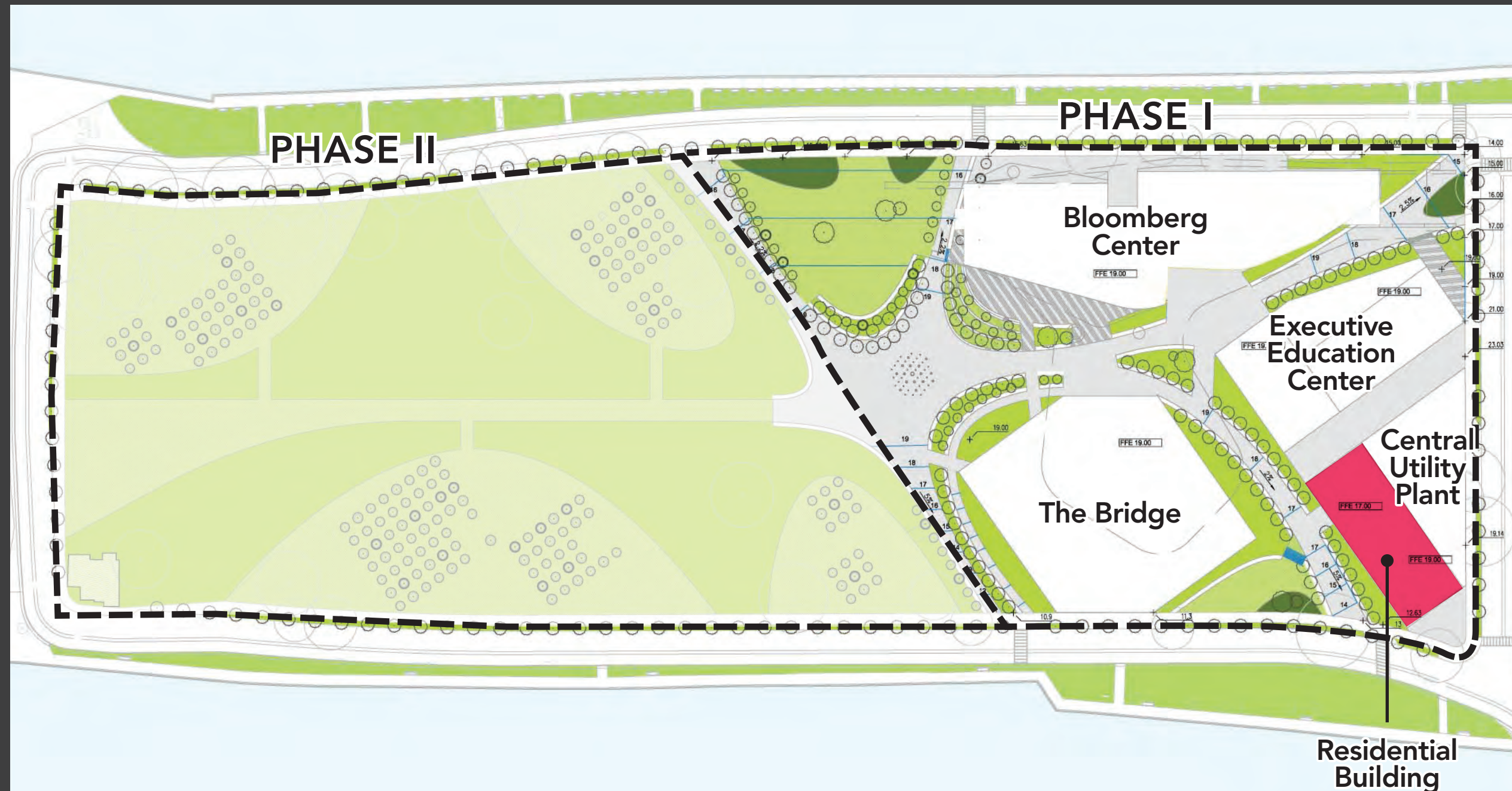
- RELATED STORIES**
- [Cornell tech campus takes shape](#)
  - [Mike charts the future](#)
  - [Engineering NYC's future](#)
- It was a finishing touch on one of [Mayor Bloomberg's](#) signature legacy projects — the Cornell Tech "Genius School."
- Bloomberg on Thursday formally handed over 12 acres of city land to Cornell at a City Hall ceremony, paving the way for construction of the 2 million-square-foot campus on Roosevelt Island.



# NOVEMBER 2012

Cornell issues an RFP for the Phase 1 Residential Tower.

- Sustainable design
- Competitive rents
- Design Excellence





# PROJECT GOALS



## 1 Better Living Quality

- Improve indoor air quality and comfort
- Provide acoustic separation from the surrounding environment
- Allow individual control of heating & cooling



## 2 Save the Planet

- Reduce energy consumption
- Reduce Greenhouse Gas (GHG) emissions
- Reduce dependance on fossil fuels



## 3 Elevate the University

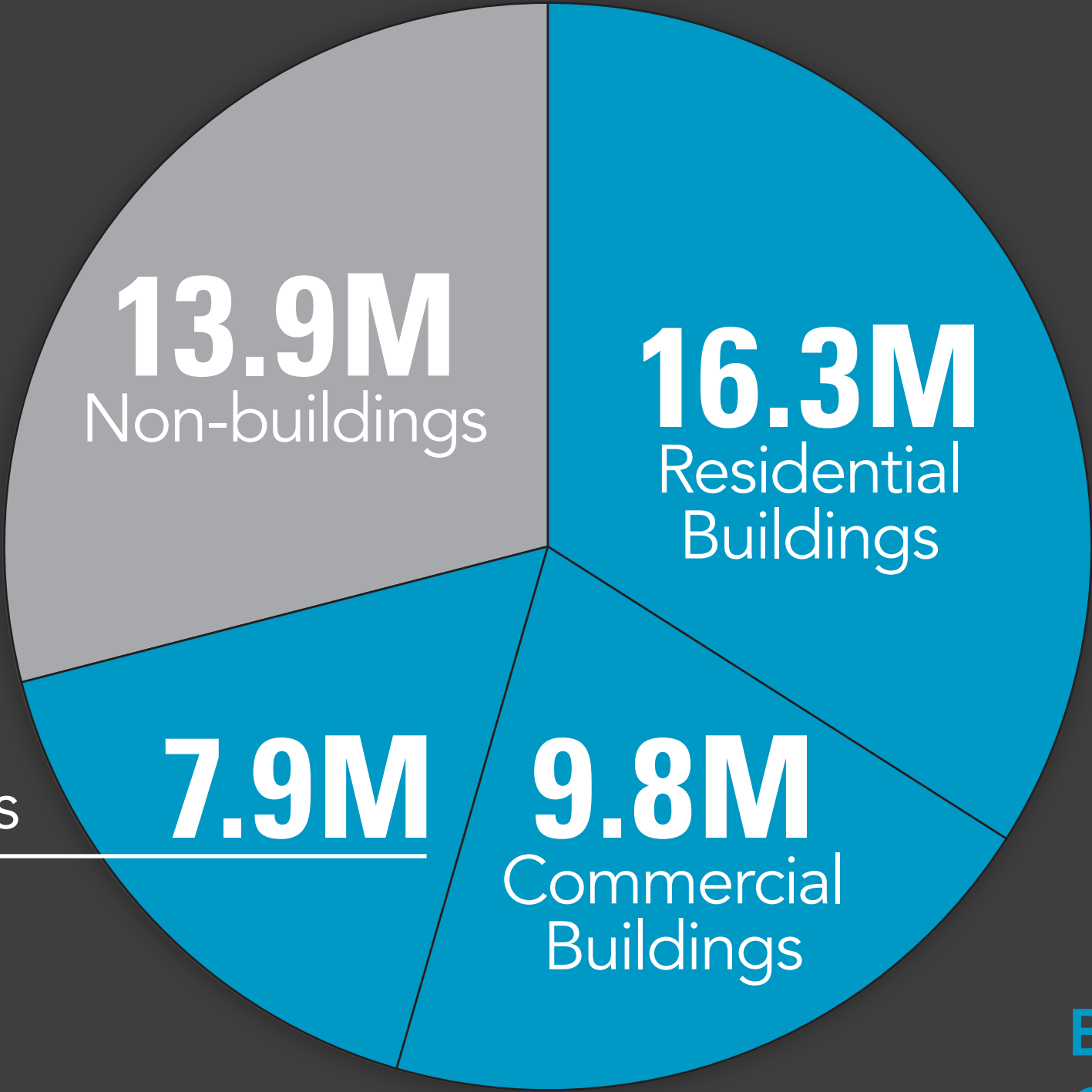
- Position University at the forefront of innovation



## 4 Save Money

- Provide housing that is affordable to the community
- Reduce energy costs for users

# GREENHOUSE GAS EMISSIONS IN NEW YORK CITY (2014 = 47.9 MILLION TONS CO2)

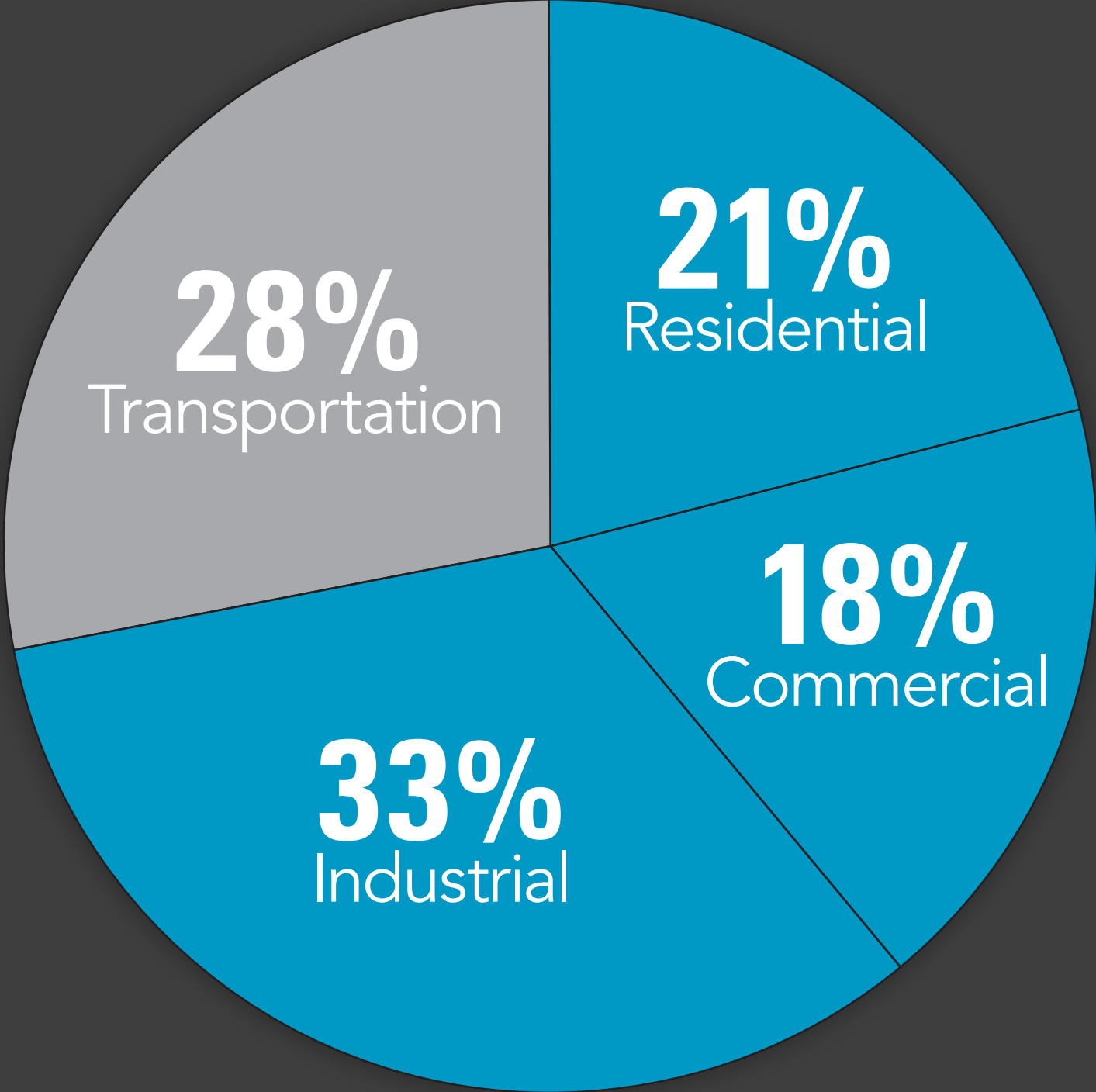


Industrial & Institutional Buildings

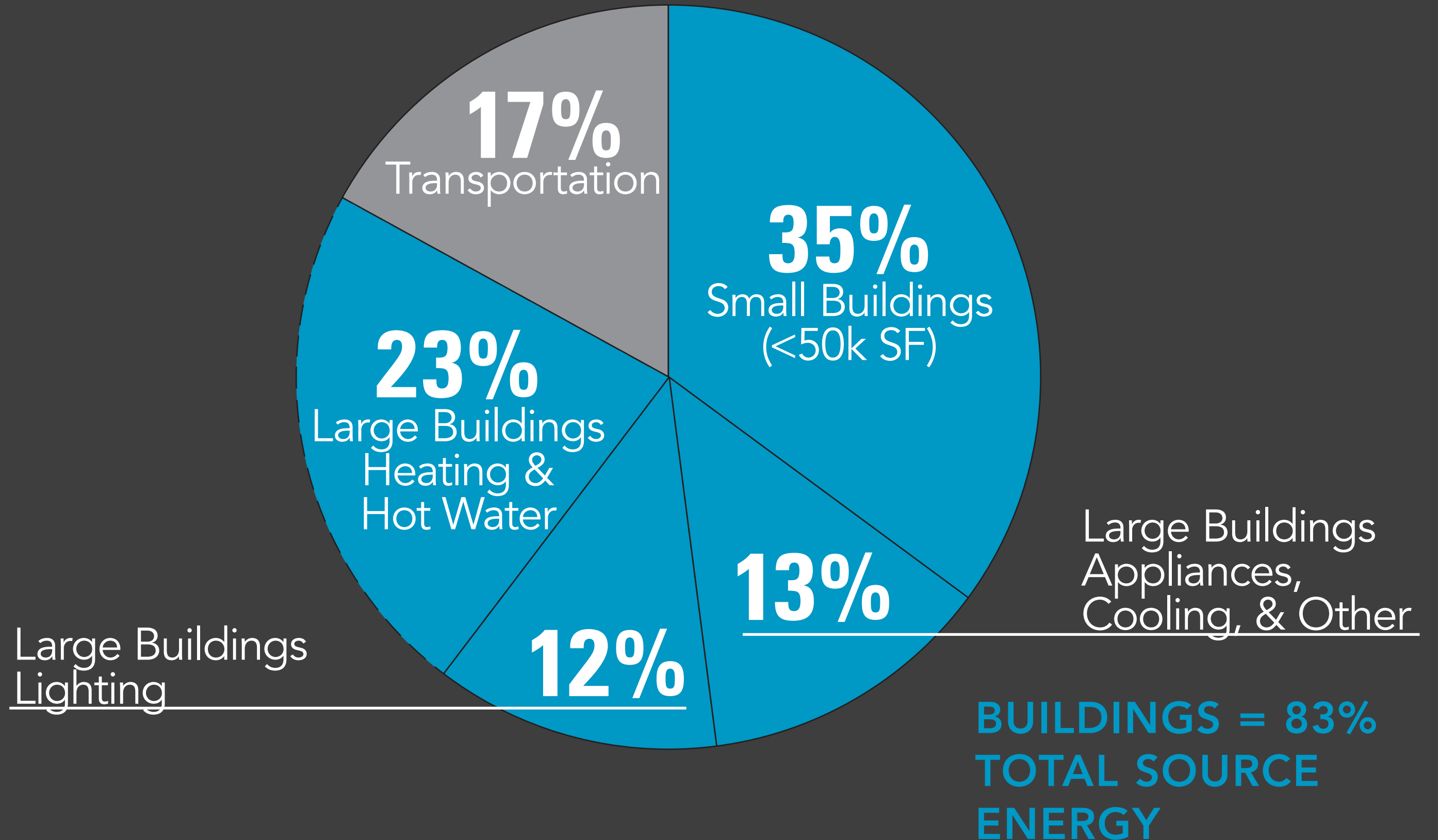
**BUILDINGS = 71%  
GREENHOUSE GAS  
EMISSIONS**



# SHARES OF U.S. PRIMARY ENERGY CONSUMPTION (2006)



# ENERGY CONSUMPTION IN NEW YORK CITY (2011)



# DOING RADICALLY MORE WITH RADICALLY LESS



Median Energy Use of All NYC Buildings over 200,000 sq. ft.:  
140.8 pEUI kBTU/SF per year



Energy Use of Passive House Buildings:  
38.1 pEUI kBTU/SF per year  
**370% Improvement**

**Buildings = 83% Total Source Energy in New York City**  
**Designing to Passive House = 775.9 MMBtu (77.5 %) reduction**



# DOING RADICALLY MORE WITH RADICALLY LESS



Greenhouse Gas Emissions of  
All NYC Buildings:  
38 Million Tons per year



Designing to Passive House:  
24.8 Million Tons CO2 reduction  
**52% reduction**

# WHAT IS PASSIVE HOUSE?

Maximize your gains, minimize your losses

- 1 The most rigorous energy efficiency standard in the world
- 2 Based on absolute energy use, not enhancement over code
- 3 Focus attention on enclosure - insulation continuity and elimination of thermal bridging and air leakage
- 4 An emphasis on balanced filtered fresh air
- 5 Building maintains constant temperature allowing for a drastically reduced heating and/or cooling load





# THE BIRTH OF PASSIVE HOUSE

- 1 European response to climate change
- 2 First introduced in Darmstadt, Germany over 25 years ago
- 3 Born from a need for an energy independent strategy
- 4 Intended to change the face of low energy developments and architecture
- 5 Direct response to stopping global warming and reducing Green House Gas (GHG) emissions

# PASSIVE HOUSE AT A DIFFERENT SCALE

## Allgemeine Angaben, Germany - Current Tallest Residential Passive House Building



- 16-Stories
- 140 units
- 91,200 sq.ft.

## Cornell Tech Residential



- 26 Stories
- 352 Units
- 272,500 sq.ft.
- 10,600 GSF/Floor
- 270' to Roof



# NEW YORK STATE CLIMATE ACTION PLAN 2050



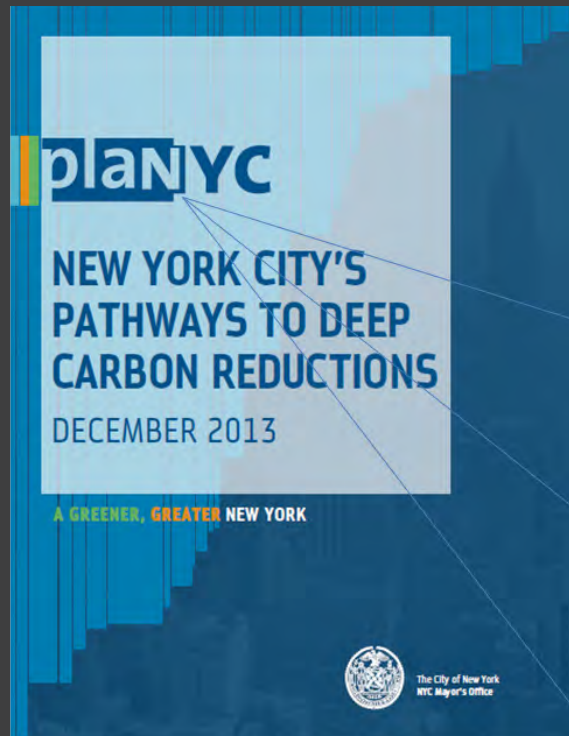
In Million Metric Tons of CO2/yr

Sector	Case 1	Case 2	Case 3	Baseline	Notes
Residential	0	0	7.5	37.6/45.0	
Commercial	0	0	4.5	27.2/39.1	
Industrial	12.7	12.7	14.1	19.0/24.1	
Transport	20.1	20.1	51	88.3/126	
Electricity	10	13	24	49.2/83.3	
Other	12.3	12.3	12.3	28.8/43.0	
<b>Total</b>	<b>55.1</b>	<b>58.1</b>	<b>113.4</b>	<b>250.2/360.5</b>	<b>Goal – 55.4</b>

Source: Stokes, Gerald M., Brookhaven National Lab

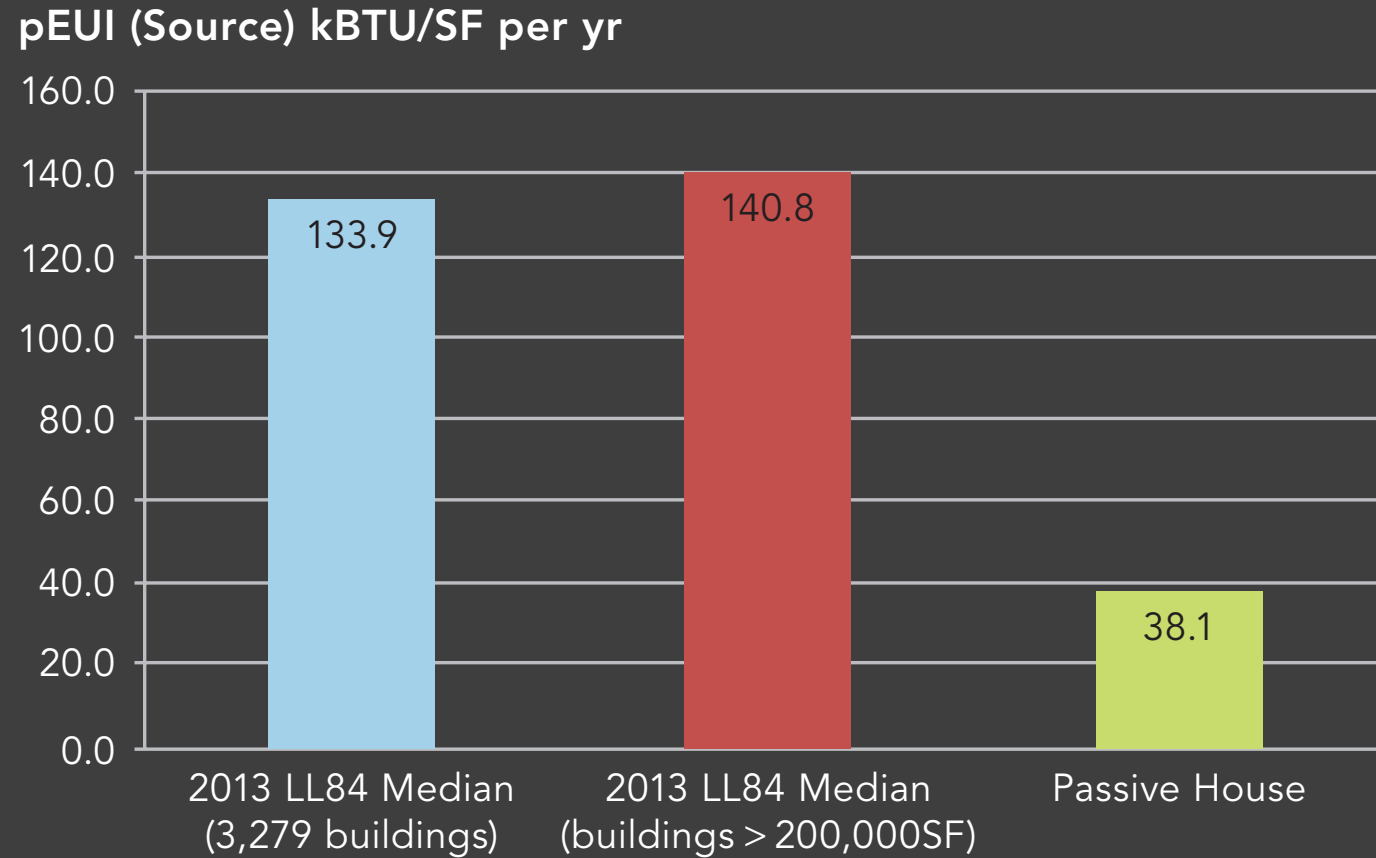
# INCREASING ENERGY STANDARDS

- To achieve 80% reduction in emissions by 2050, New York City must retrofit a large majority of today's existing buildings
- Convert onsite combustion of fossil fuels to renewable or low-carbon energy
- Construct new buildings 75% more efficiently than existing construction standards; and greatly improve the efficiency of appliances & electronics.





# PASSIVE HOUSE PERFORMANCE CRITERIA



- **Overall Source Energy Used** 38 kBtu/ft<sup>2</sup> per year
- **Heating Energy Used** Max 4.75 kBtu/ft<sup>2</sup> per year
- **Cooling Energy Used** Max 5.39 kBtu/ft<sup>2</sup> per year
- **Air Changes per Hour (ACH) Through the Facade @ 50 Pascals of Pressure** 0.6 ACH - Very Tight Facade
- **Ventilation** Balanced supply and exhaust mechanical ventilation with energy recovery

# INTEGRATION WITH OTHER CERTIFICATIONS

Many Passive House projects also pursue:



## LEED Certification

- Green building certification program
- Save money and resources, have positive impact on health, and promote renewable, clean energy

## ENERGY STAR v3

- Meet strict energy performance standards set by EPA
- Less expensive to operate and causes fewer greenhouse gas emissions

## DOE Zero Energy Home Program

- Based on Energy Star
- Incorporates indoor air quality and moisture management principles



# STRATEGIES TO ACHIEVE PASSIVE HOUSE CERTIFICATION

## 1 Siting: Solar Orientation and Shading

Maximize solar gains for winter, minimize gains for the summer.

## 2 Compact Building Shape

Low surface-to-volume ratio (<1)

## 3 Enclosure

### Continuous Insulation

Create steady indoor temperatures that won't drop below 50 degrees without heating source

### Thermal Bridge Free Construction

Minimize heat transfer/condensation/building deterioration

### Airtightness

Tightly air seal building - limit air leakage.

Minimize moisture diffusion into wall assembly.

## 4 Balanced Ventilation with Heat Recovery

Provide exceptional efficiency, indoor-air quality & comfort.

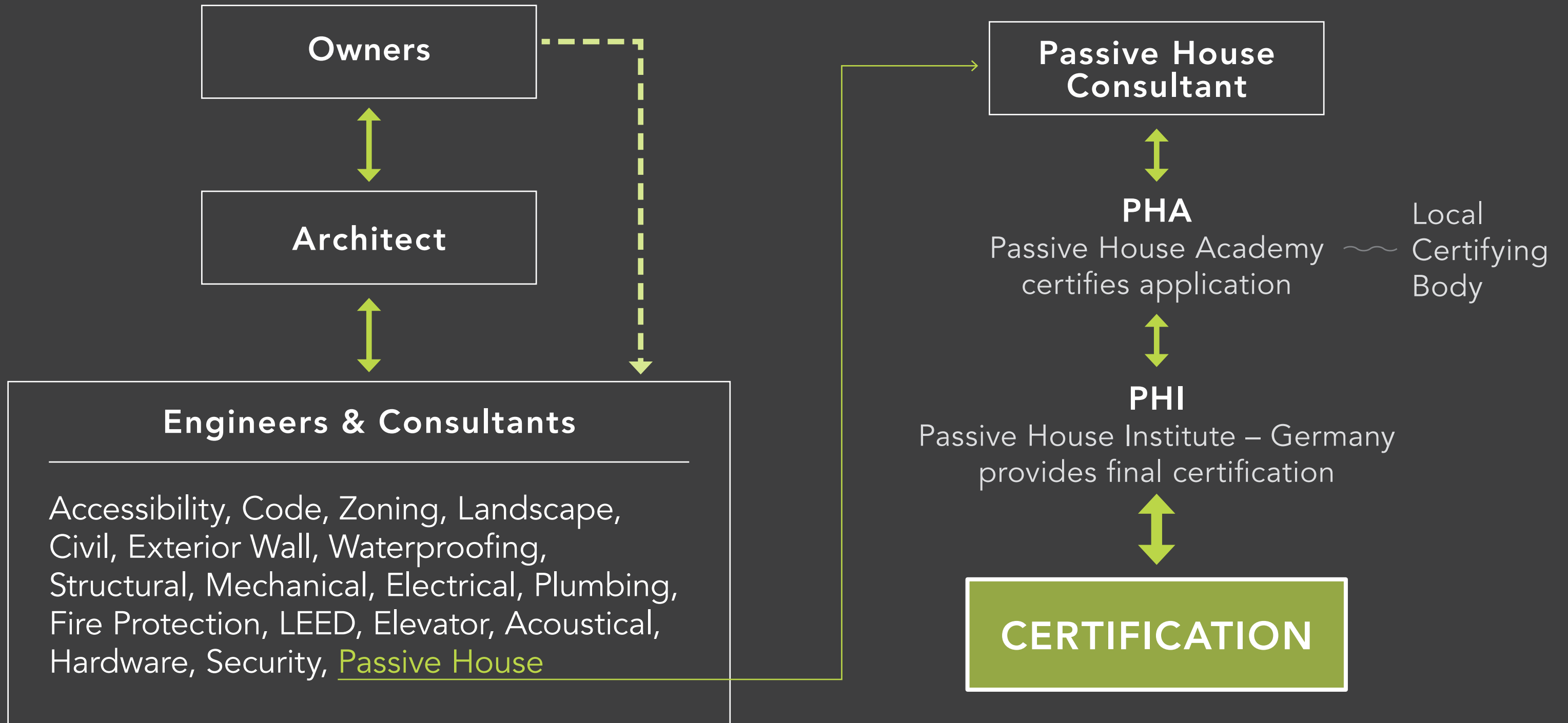
## 5 Energy Efficient Appliances and Lighting

Use energy efficient equipment, appliances and lighting.

## 6 User Friendliness

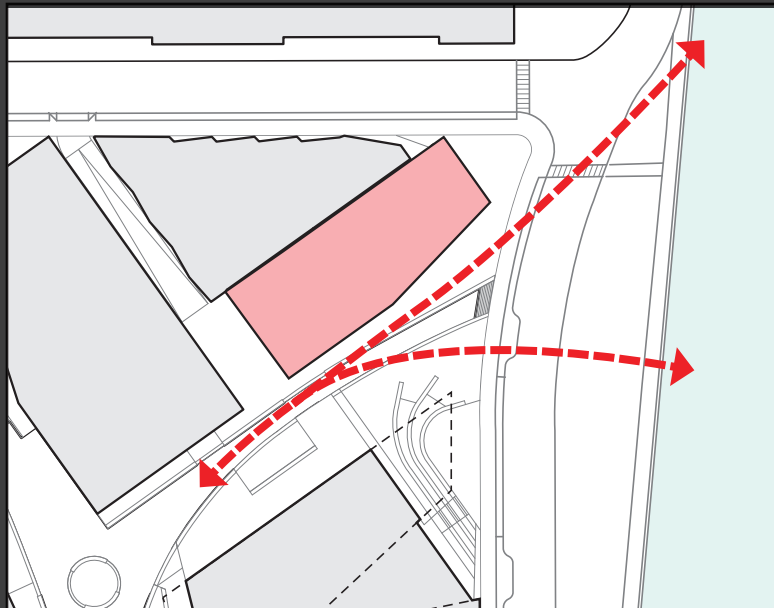
Manuals are given to residents, but operational use should be very similar to typical buildings

# IMPLEMENTATION PROCESS





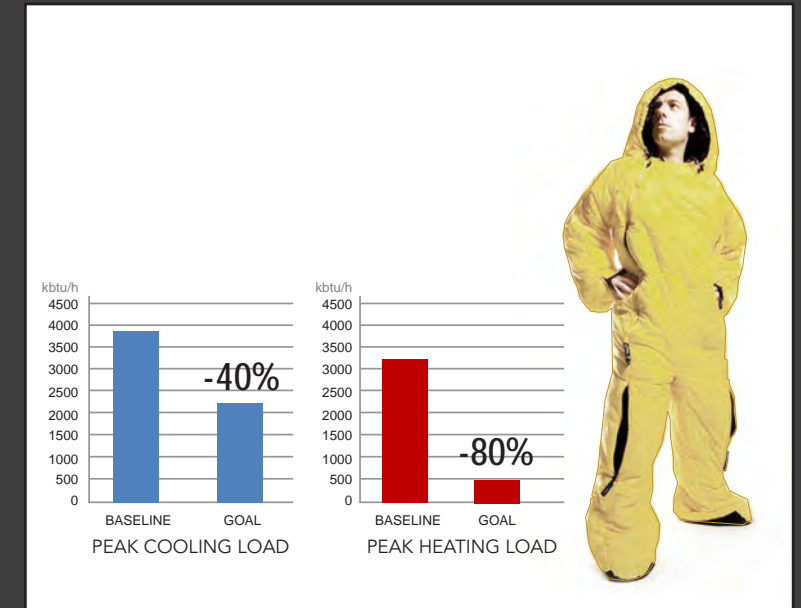
# SHAPING OUR APPROACH: MASTER PLAN PRINCIPLES



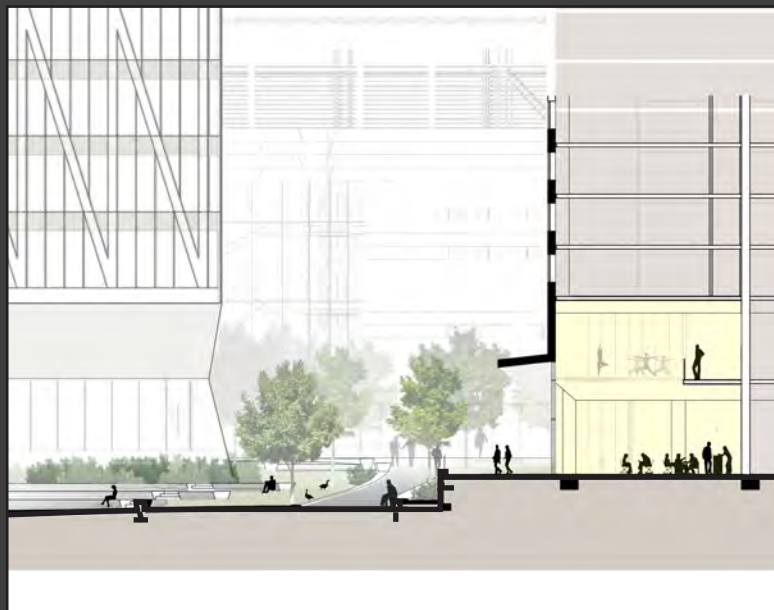
RIVER TO RIVER  
EXPERIENCE



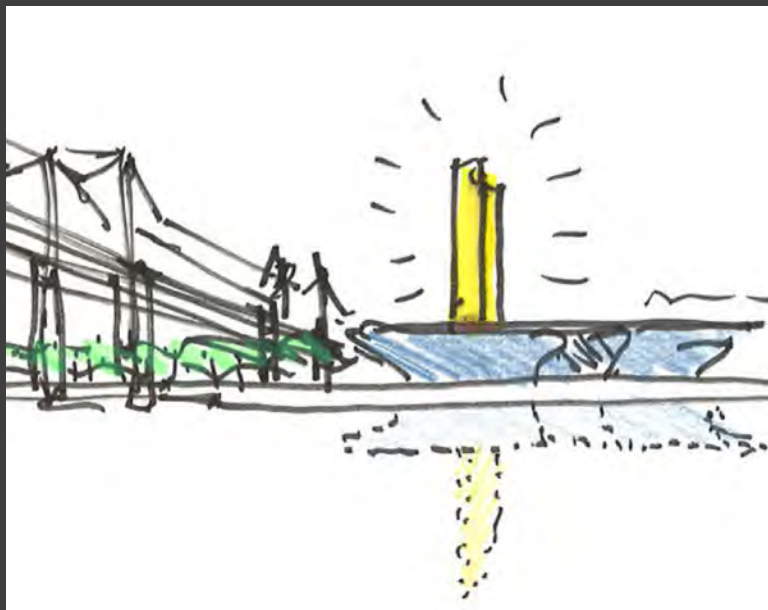
INDOORS AND  
OUTDOORS



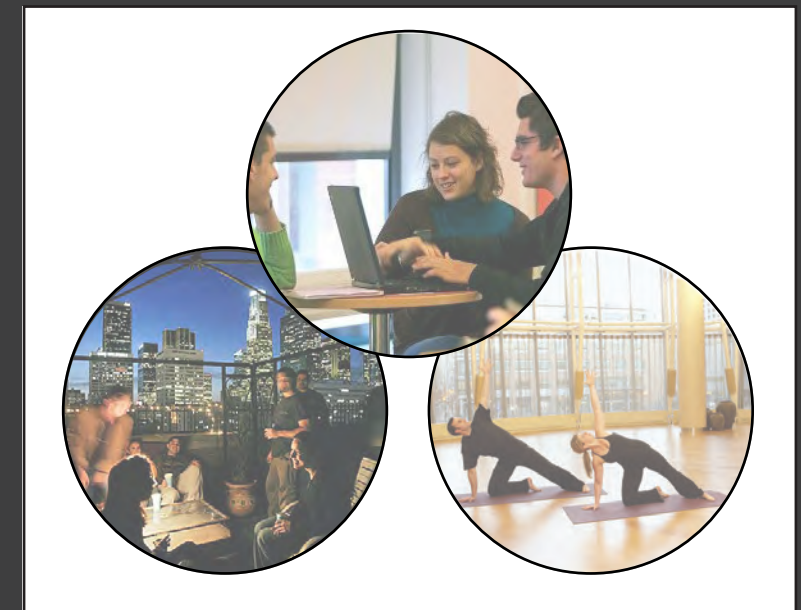
OPTIMIZED  
PERFORMANCE



DIVERSE + ACTIVE OPEN  
SPACES



CAMPUS MARKER



LIVABLE + SUSTAINABLE  
CAMPUS

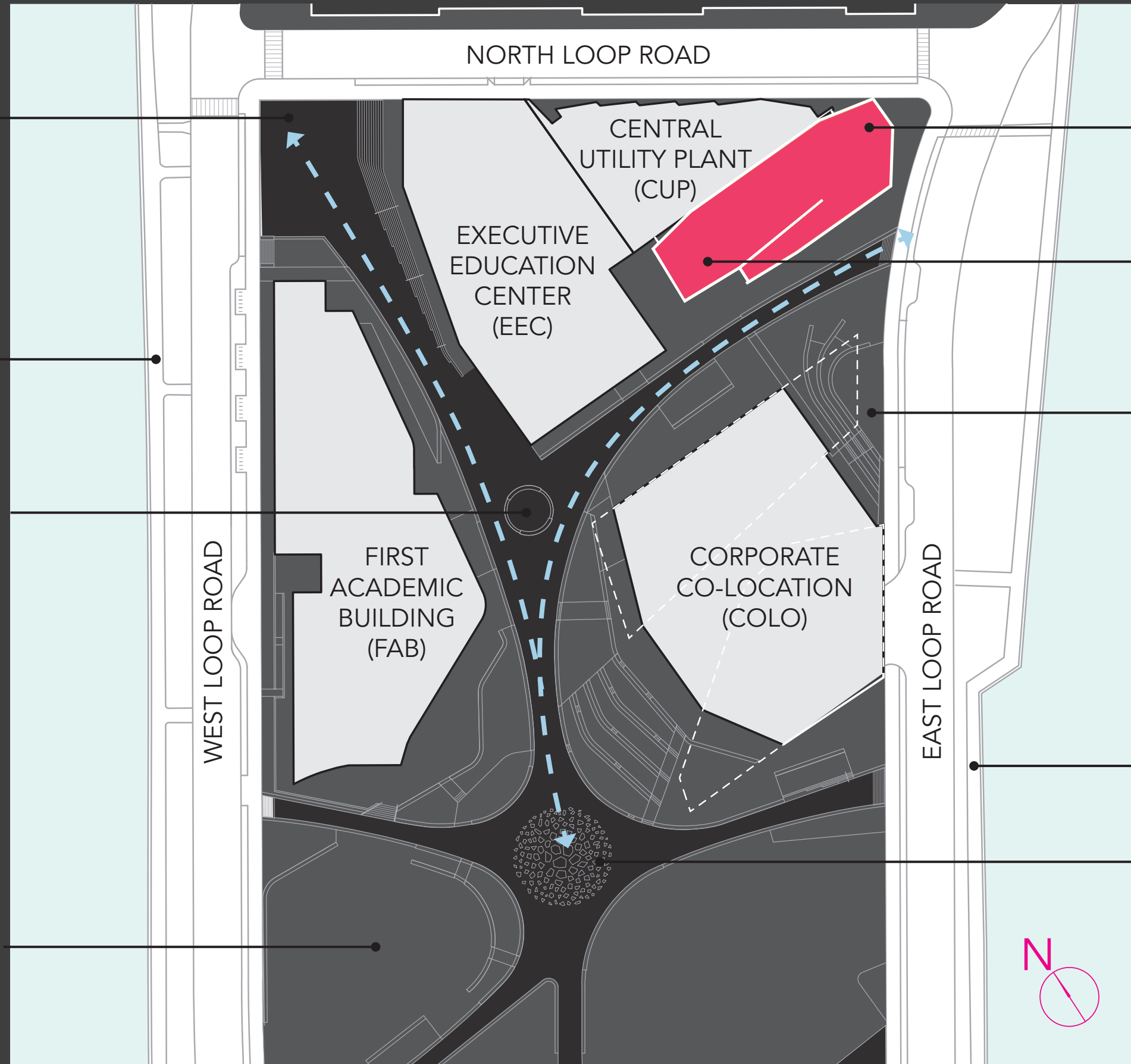
# SITING

MAIN CAMPUS ENTRY

RIVERFRONT WALK

ENTRY COURT/  
HIGHEST POINT

CAMPUS LAWN



NORTH LOOP ROAD

CENTRAL  
UTILITY PLANT  
(CUP)

EXECUTIVE  
EDUCATION  
CENTER  
(EEC)

FIRST  
ACADEMIC  
BUILDING  
(FAB)

CORPORATE  
CO-LOCATION  
(COLO)

WEST LOOP ROAD

EAST LOOP ROAD

NORTH/SOUTH AXIS  
BROAD SOUTHERN  
EXPOSURE.  
SHORT SIDES FACE  
EAST AND WEST

SITE

OUTDOOR  
CLASSROOM

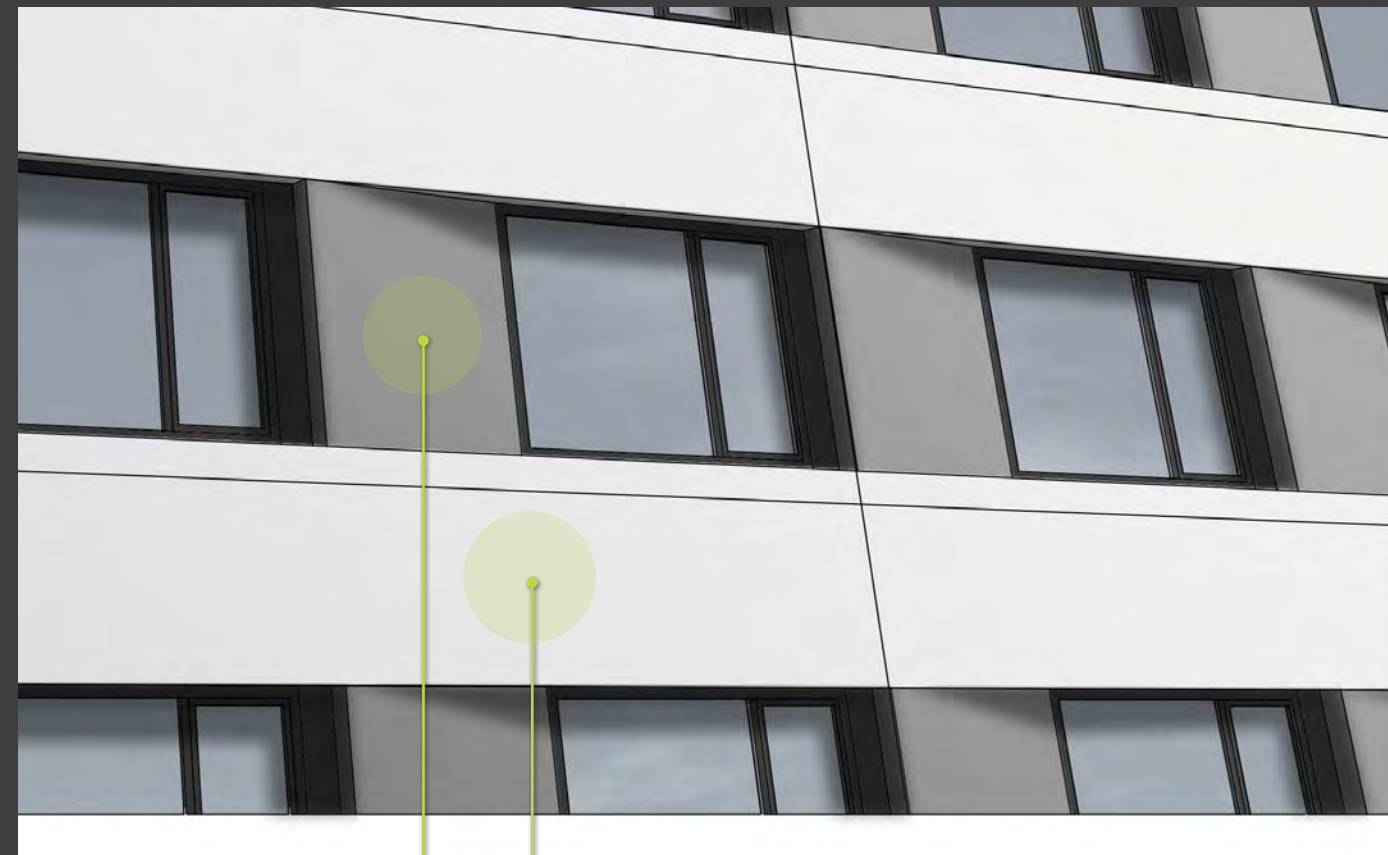
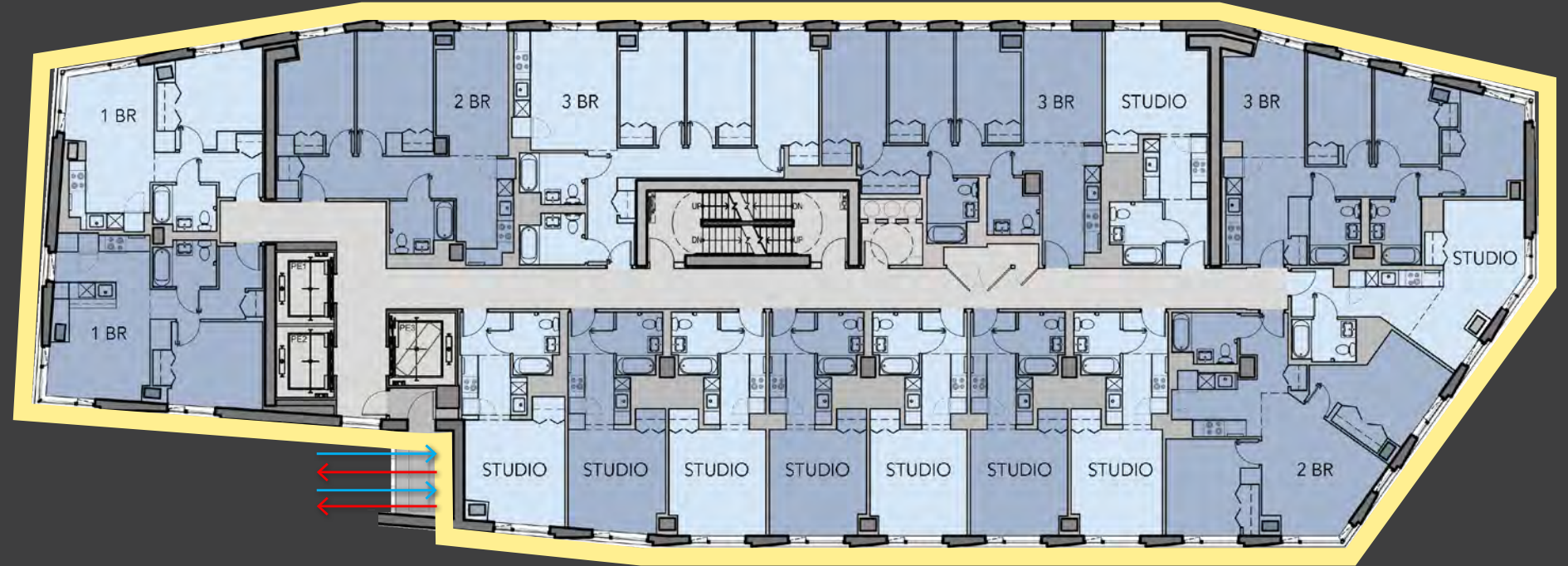
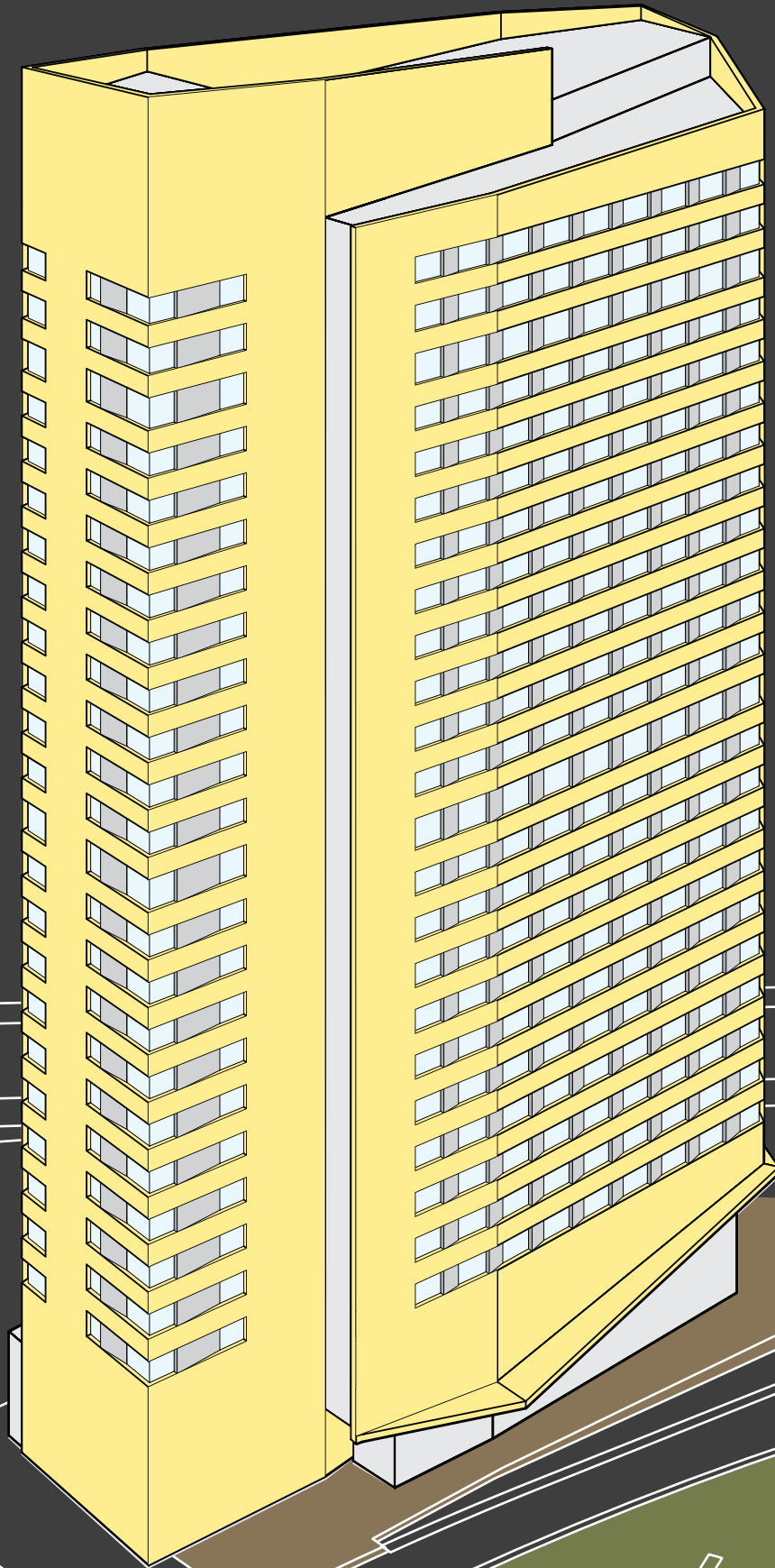
RIVERFRONT  
WALK

CAMPUS PLAZA





# ENCLOSURE: THERMAL WRAP

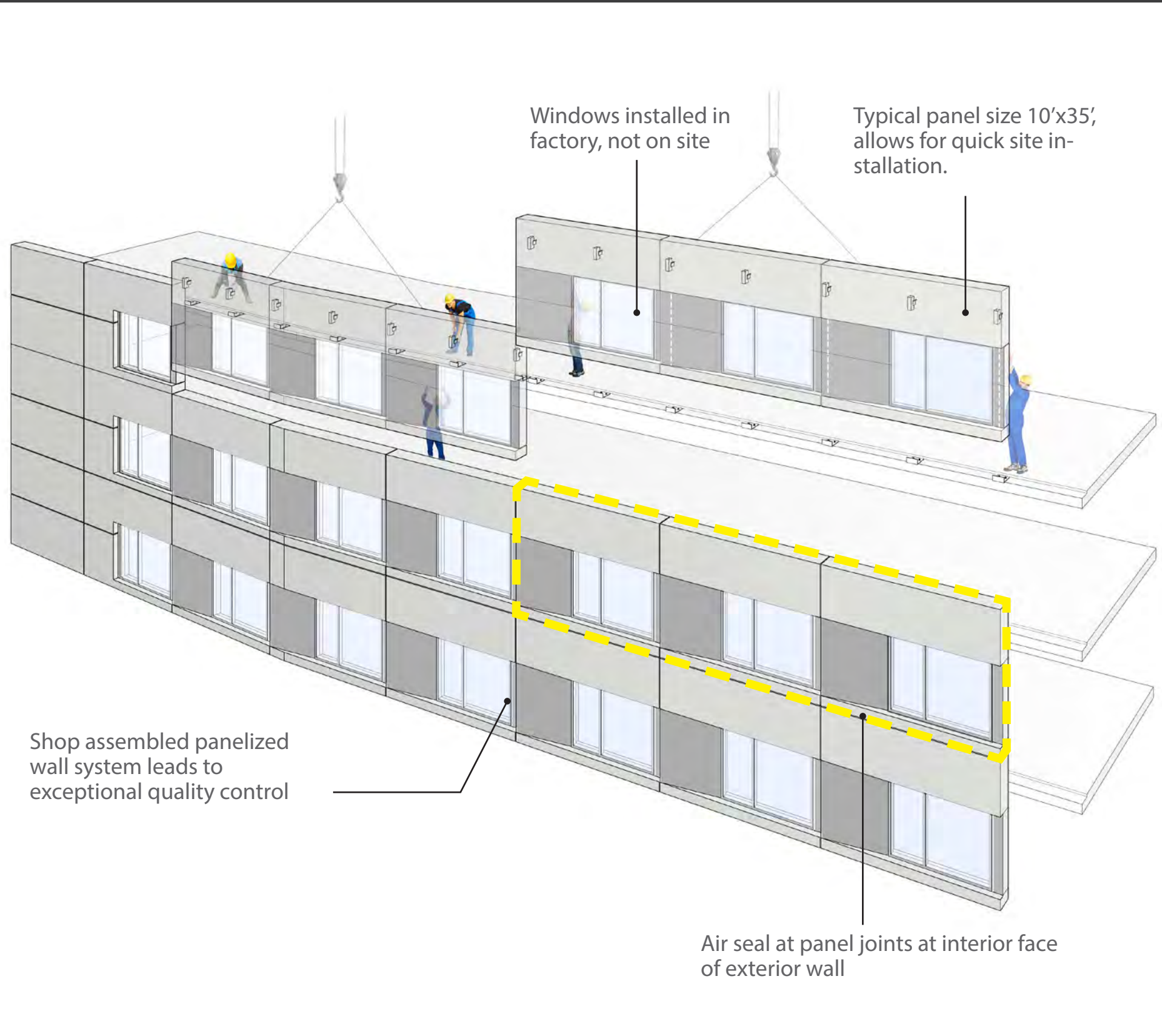


Rainscreen Cladding System

Angled Metal Spandrel



# PANEL SYSTEM

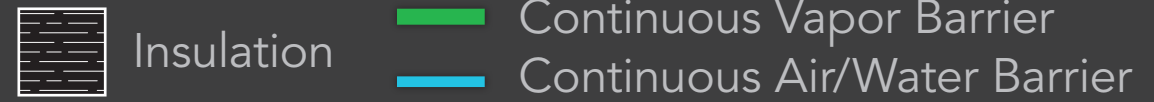
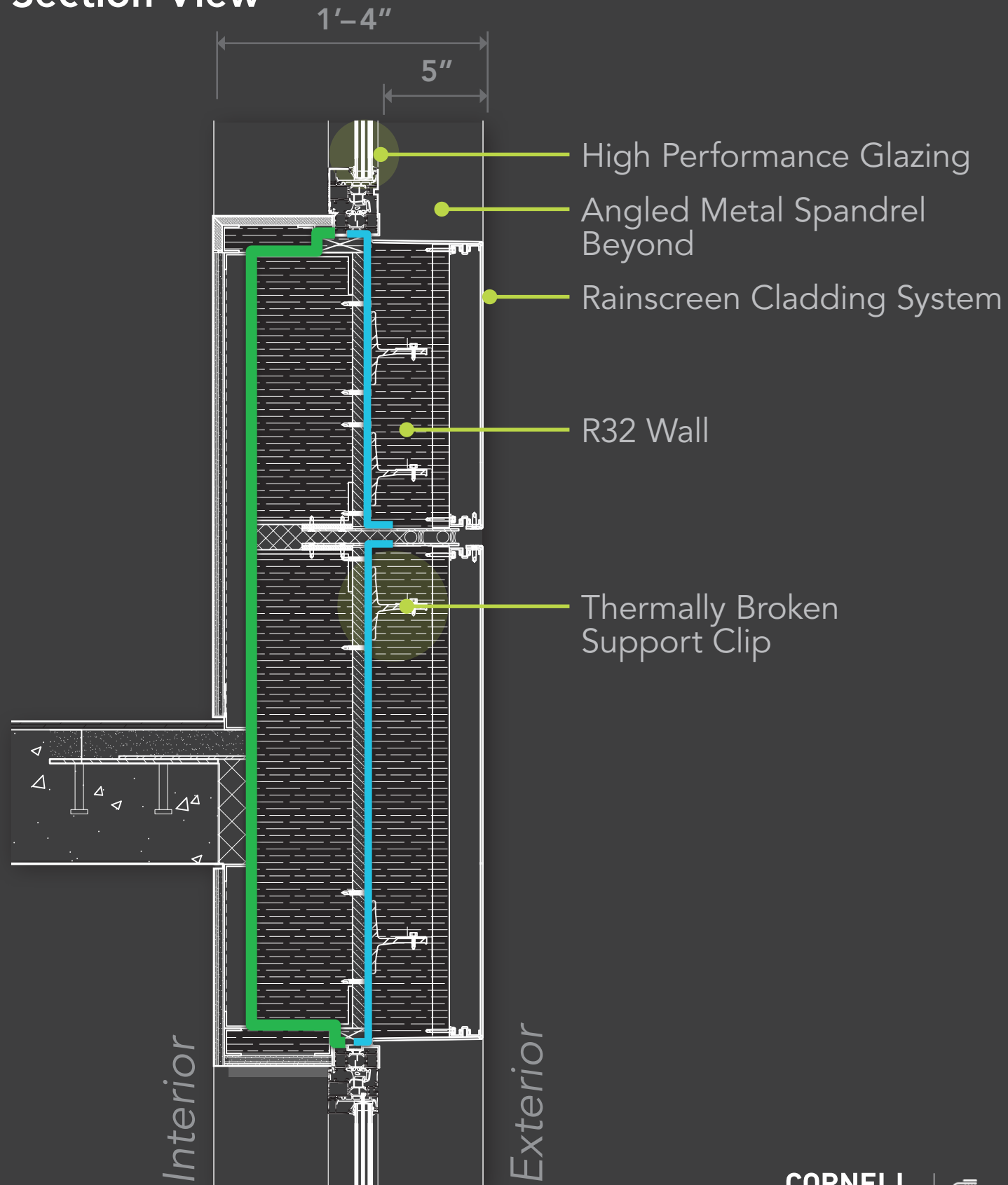


Prefabricated metal wall panel installation

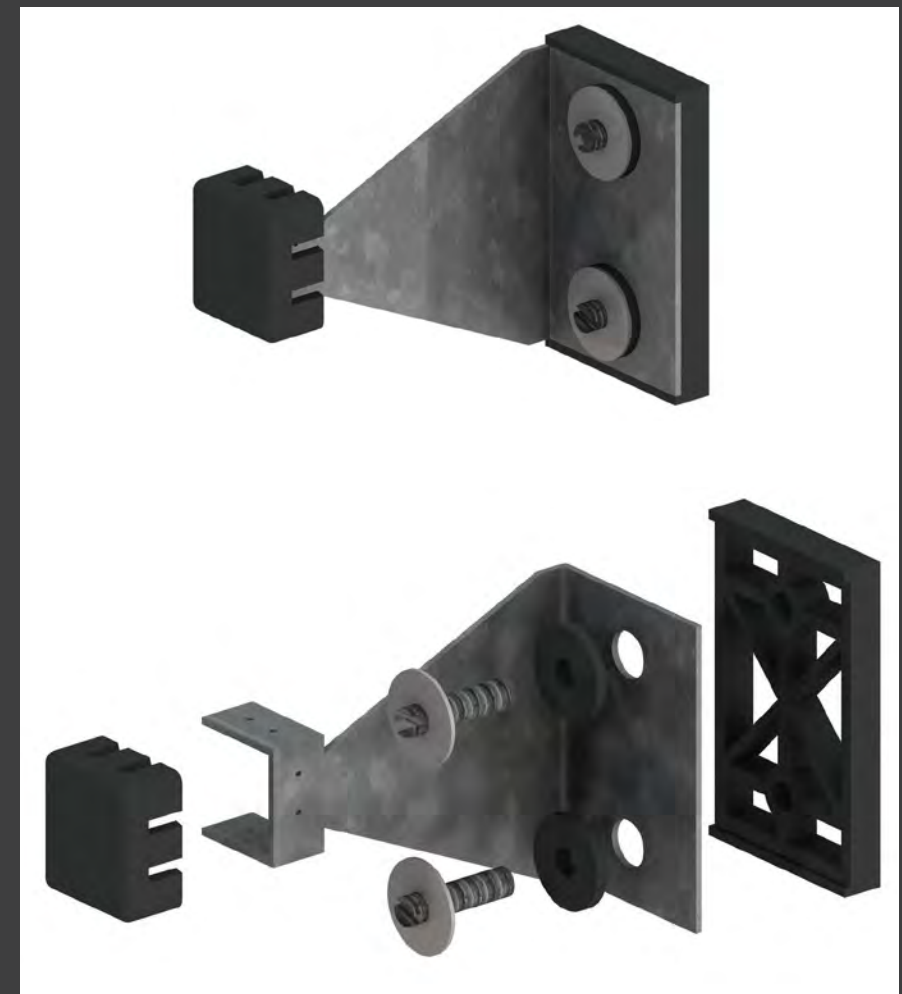


# EXTERIOR WALL DETAIL

## Section View

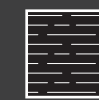


- Thermally broken construction
- Airtight envelope: 0.6 ACH@50pa
- Window-to-wall ratio calibrated to maximize performance



ThermaBracket Assembly with Isolators

# BUILDING BALCONY DETAIL - CONCRETE TO CONCRETE THERMAL SEPARATION



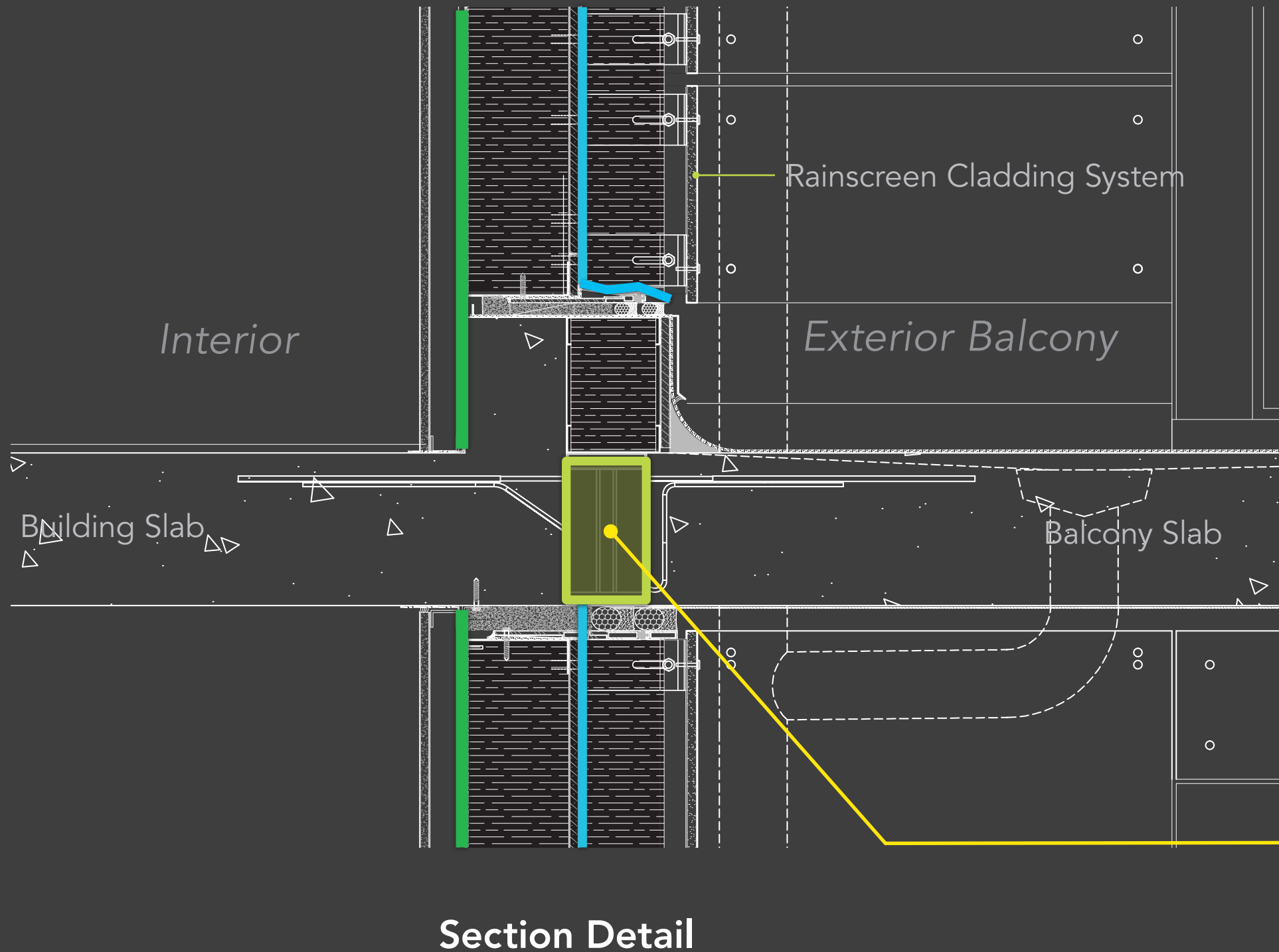
Insulation



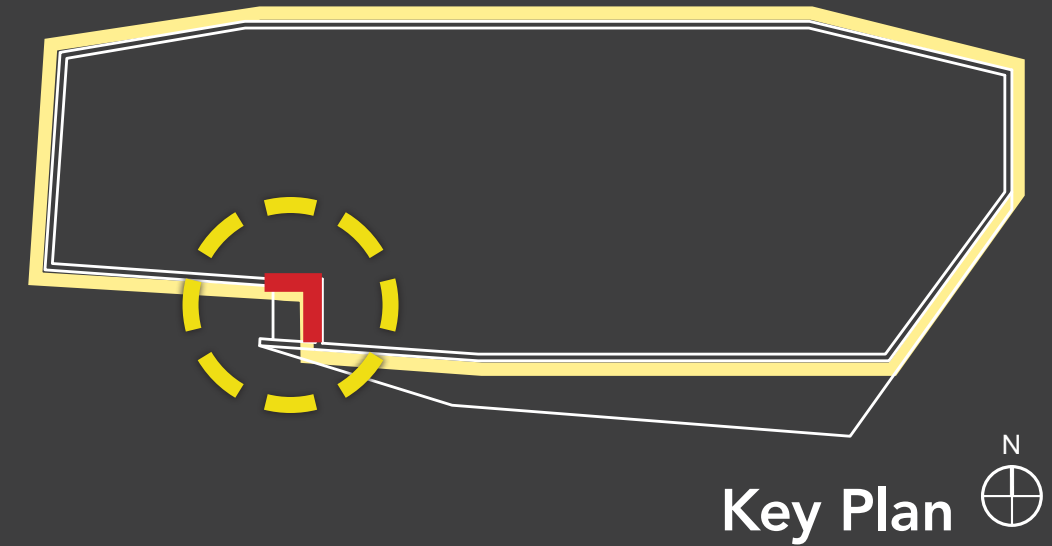
Continuous Air/Water Barrier



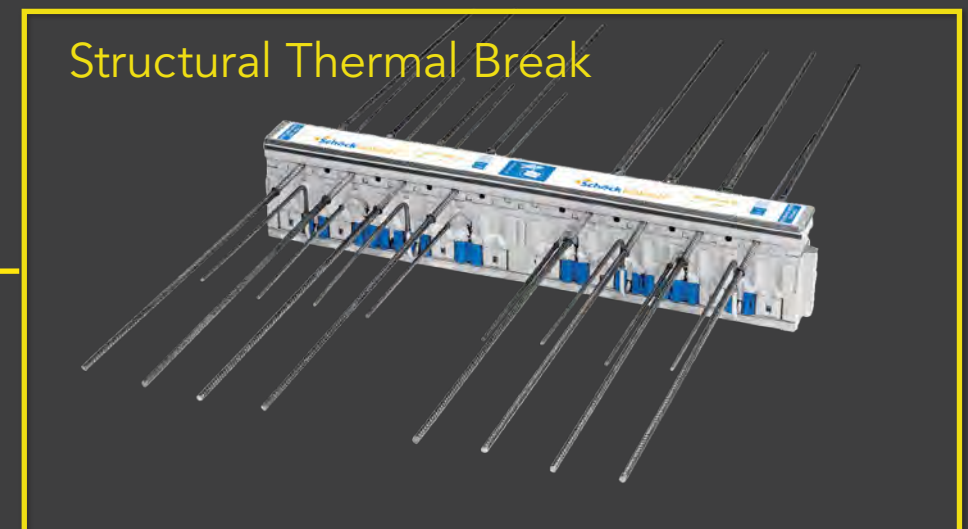
Continuous Vapor Barrier



Section Detail

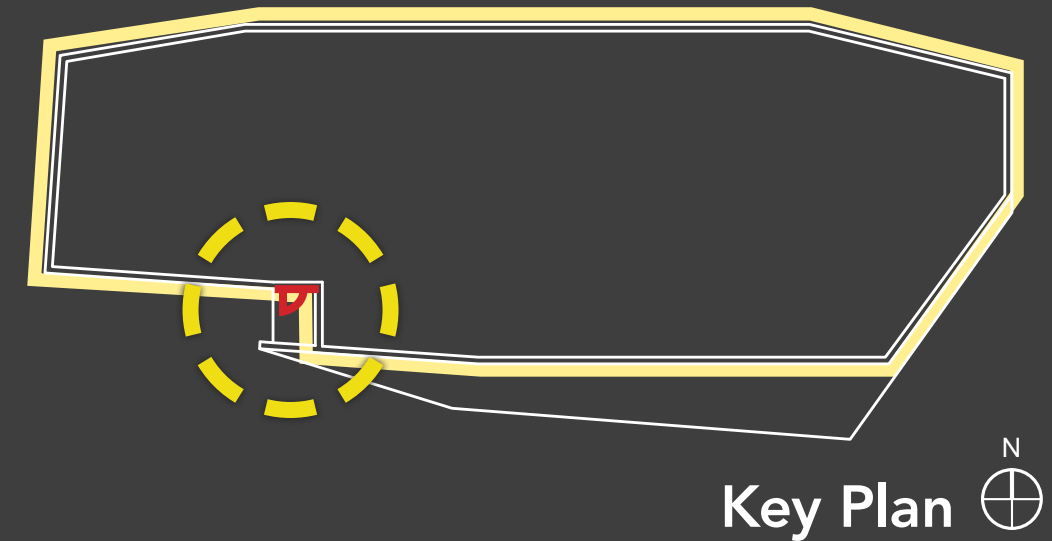


Structural Thermal Break

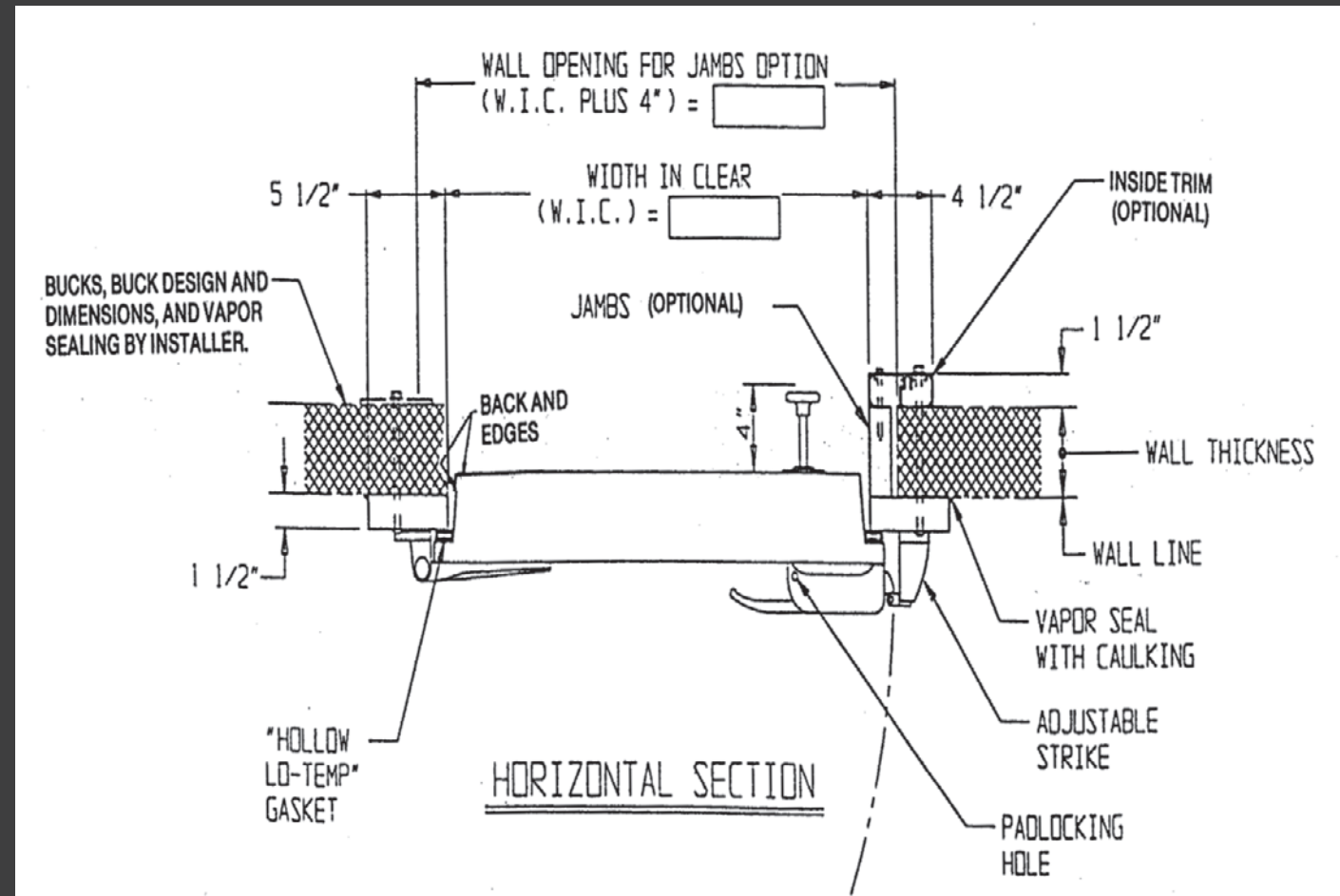




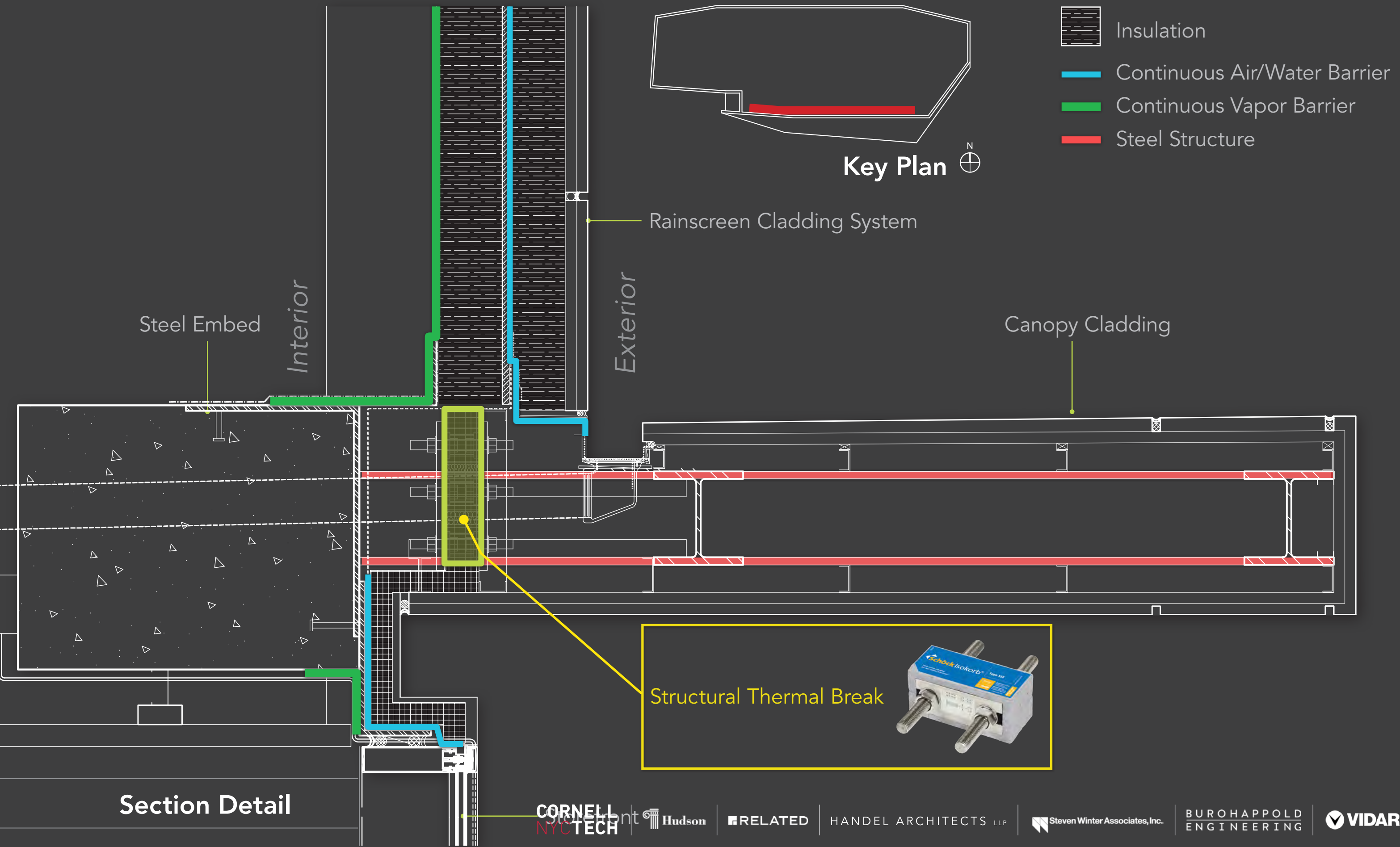
# BUILDING BALCONY - THERMALLY INSULATED DOOR



Insulation R value is 32 at 40°F.



# BUILDING CANOPY DETAIL - STEEL TO STEEL THERMAL SEPARATION



Section Detail

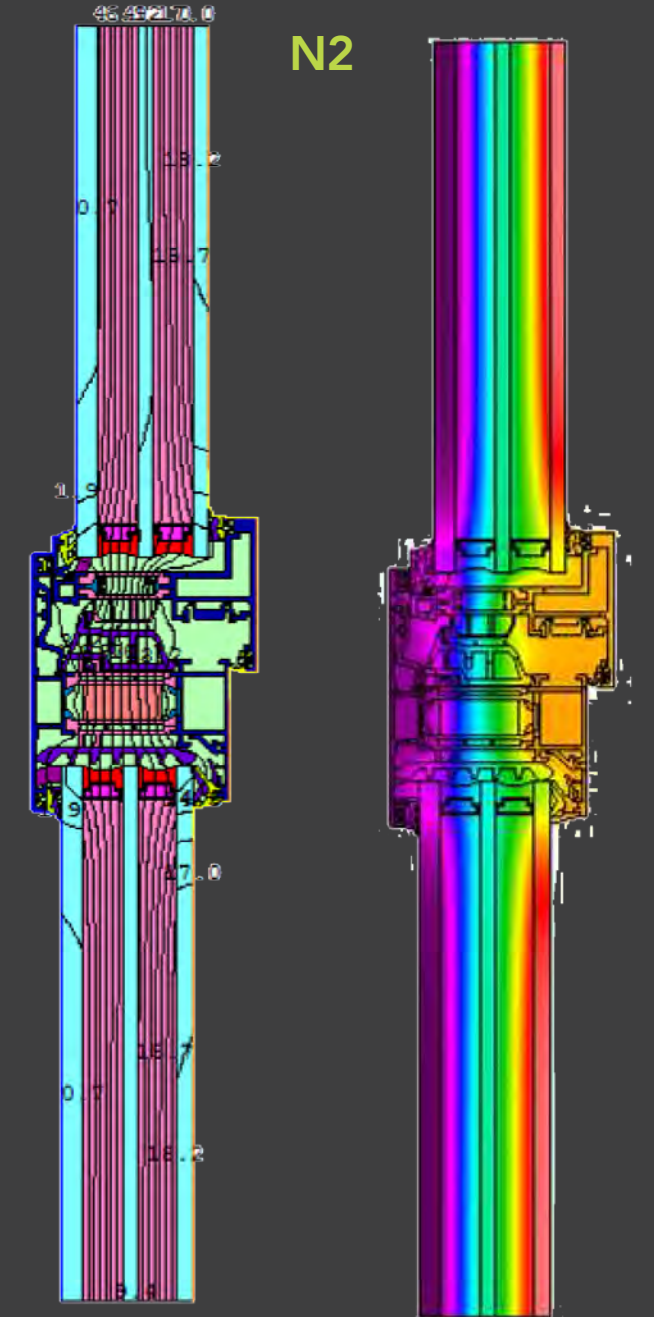
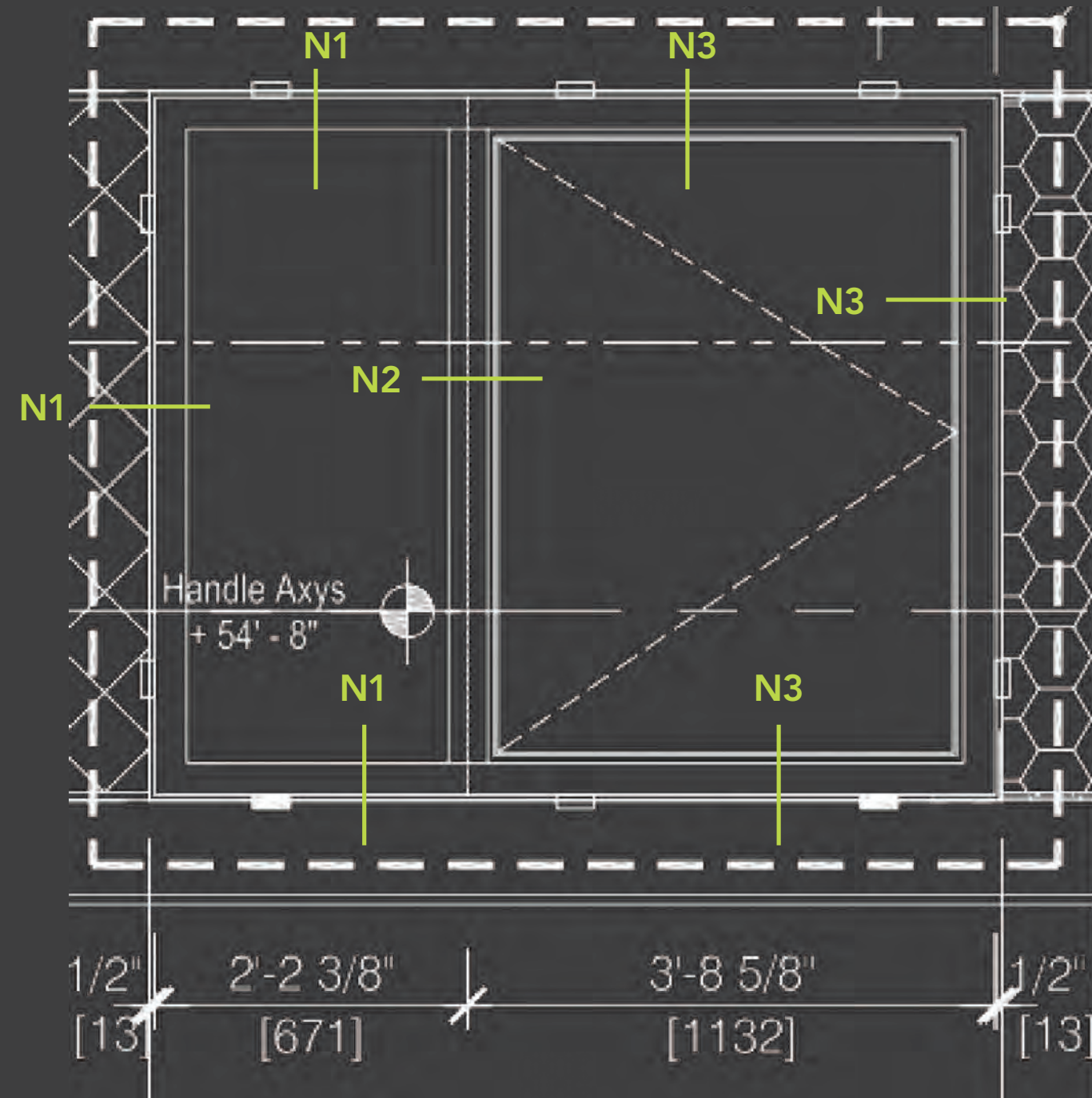


# WINDOWS

- **EN vs. NFRC**

- » The centre-of-glazing U-value ( $U_g$ ), according to standard EN 673.
- » The frame U-value ( $U_f$ ), calculated with THERM, according EN ISO 10077-2
- » The linear thermal transmittance through the glass edge ( $\Psi$ -value)

- **Unit conversion US to Metric**
- **Condensation analysis**
- **Third party analysis**



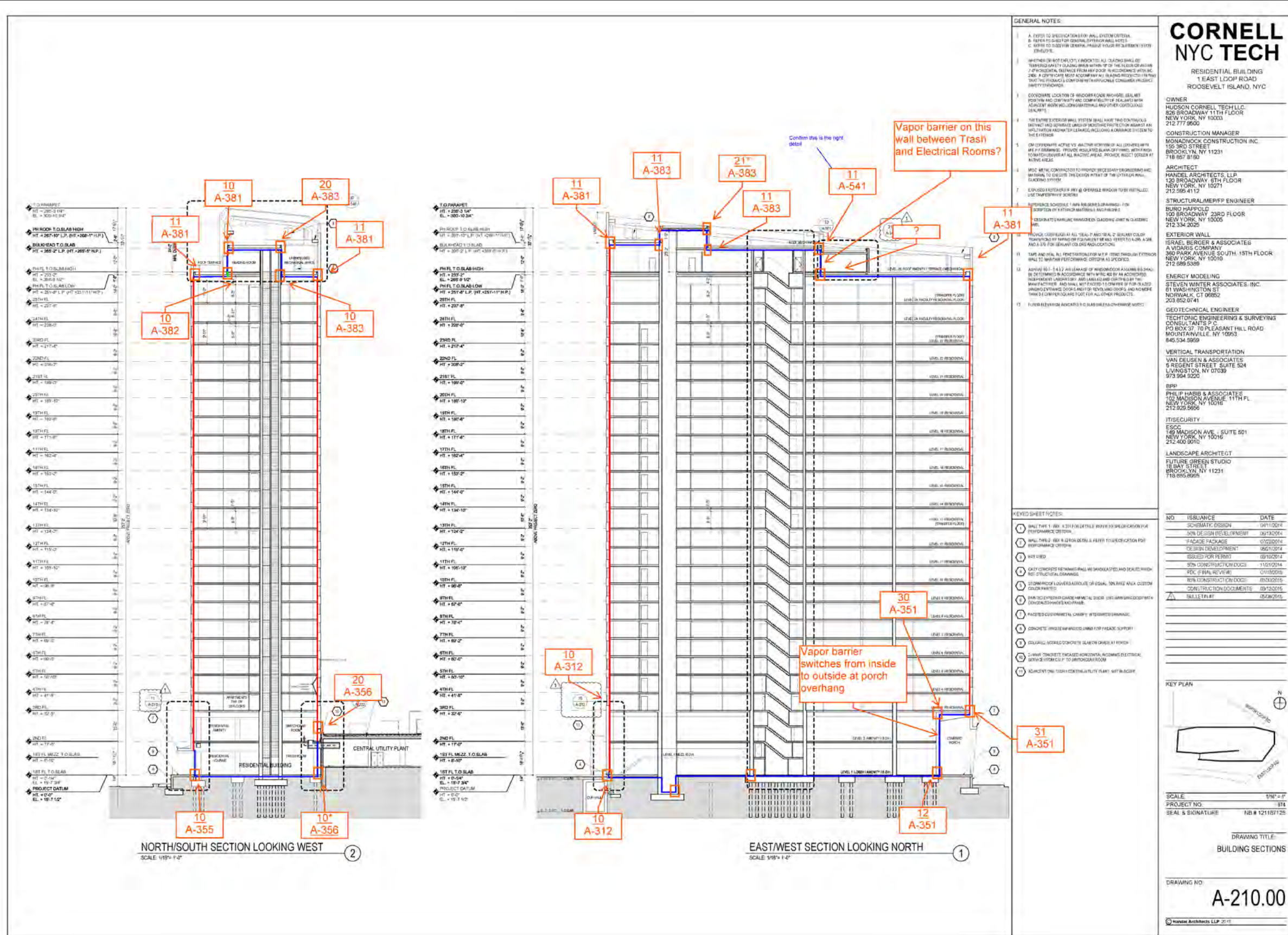
# WINDOW + FRAME

Standard metal frame and window is .45

	Frame U-Value		Average Overall U-Value	
	Calculated Value (Average)	Target Value	Calculated Value (Average)	Target Value
<b>Window Type A</b>	0.28 Btu/h·ft <sup>2</sup> ·F (1.59 W/m <sup>2</sup> K)	0.28 Btu/h·ft <sup>2</sup> ·F (1.59 W/m <sup>2</sup> K)	0.18 Btu/h·ft <sup>2</sup> ·F (1.05 W/m <sup>2</sup> K)	0.20 Btu/h·ft <sup>2</sup> ·F (1.14 W/m <sup>2</sup> K)
<b>Window Type B</b>	0.27 Btu/h·ft <sup>2</sup> ·F (1.51 W/m <sup>2</sup> K)	0.28 Btu/h·ft <sup>2</sup> ·F (1.59 W/m <sup>2</sup> K)	0.16 Btu/h·ft <sup>2</sup> ·F (0.93 W/m <sup>2</sup> K)	0.20 Btu/h·ft <sup>2</sup> ·F (1.14 W/m <sup>2</sup> K)
<b>Window Type C</b>	0.26 Btu/h·ft <sup>2</sup> ·F (1.50 W/m <sup>2</sup> K)	0.28 Btu/h·ft <sup>2</sup> ·F (1.59 W/m <sup>2</sup> K)	0.17 Btu/h·ft <sup>2</sup> ·F (0.96 W/m <sup>2</sup> K)	0.20 Btu/h·ft <sup>2</sup> ·F (1.14 W/m <sup>2</sup> K)
<b>Condensation Risk (Te=0°F; Ti=70°F; R.H.=30%)</b>			$T_{s, \min} = 50.2^{\circ}\text{F} (10.1^{\circ}\text{C})$	$T_{dp} = 37.0^{\circ}\text{F} (2.8^{\circ}\text{C})$
<b>Condensation Risk (Te=18°F; Ti=68°F; R.H.=50%)</b>			$T_{s, \min} = 54.0^{\circ}\text{F} (12.2^{\circ}\text{C})$	$T_{dp} = 48.7^{\circ}\text{F} (9.3^{\circ}\text{C})$



# AIR SEALING - CONTINUITY OF AIR BARRIER





# AIR SEALING - CONTINUITY OF AIR BARRIER

## CORNELL NYC TECH

RESIDENTIAL BUILDING  
1 EAST LOOP ROAD  
ROOSEVELT ISLAND, NYC

### OWNER

THE HUDSON COMPANIES, INC.  
826 BROADWAY 11TH FLOOR  
NEW YORK, NY 10003  
212.777.9500

### CONSTRUCTION MANAGER

MONADNOCK CONSTRUCTION INC.  
155 3RD STREET  
BROOKLYN, NY 11231  
718.857.8190

### ARCHITECT

HANDEL ARCHITECTS, LLP  
120 BROADWAY 8TH FLOOR  
NEW YORK, NY 10271  
212.555.4112

### STRUCTURAL/MEPFP ENGINEER

BURO HAPPOLD  
100 BROADWAY 23RD FLOOR  
NEW YORK, NY 10005  
212.334.2025

### EXTERIOR WALL

ISRAEL BERGER & ASSOCIATES  
A VIDARIS COMPANY  
380 PARK AVENUE SOUTH, 15TH FLOOR  
NEW YORK, NY 10010  
212.693.5383

### ENERGY MODELING

STEVEN WINTER ASSOCIATES, INC.  
61 WASHINGTON ST  
NORWALK, CT 06852  
203.852.0741

### GEOTECHNICAL ENGINEER

TECHTOMIC ENGINEERING & SURVEYING  
CONSULTANTS P.C.  
PO BOX 37, 70 PLEASANT HILL ROAD  
MOUNTAINVILLE, NY 10953  
845.534.5959

### VERTICAL TRANSPORTATION

VAN DEUSEN & ASSOCIATES  
5 REGENT STREET SUITE 524  
LIVINGSTON, NY 07039  
973.994.9220

### BPP

PHILIP HABIB & ASSOCIATES  
102 MADISON AVENUE, 11TH FL.  
NEW YORK, NY 10016  
212.858.5656

### IT/SECURITY

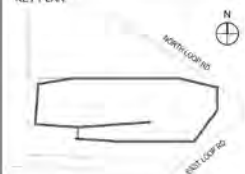
ESCC  
149 MADISON AVE., SUITE 501  
NEW YORK, NY 10016  
212.400.9010

### LANDSCAPE ARCHITECT

FUTURE GREEN STUDIO  
18 BAY STREET  
BROOKLYN, NY 11231  
718.855.8995

NO.	ISSUANCE	DATE
1	SCHEMATIC DESIGN	06/11/2014
2	50% DESIGN DEVELOPMENT	06/13/2014
3	DESIGN DEVELOPMENT	06/21/2014
4	ISSUED FOR PERMIT	09/16/2014
5	50% CONSTRUCTION DOCS	11/21/2014
6	PDC (FINAL REVIEW)	01/13/2015
7	85% CONSTRUCTION DOCS	01/30/2015
8	CONSTRUCTION DOCUMENTS	03/12/2015

### KEY PLAN

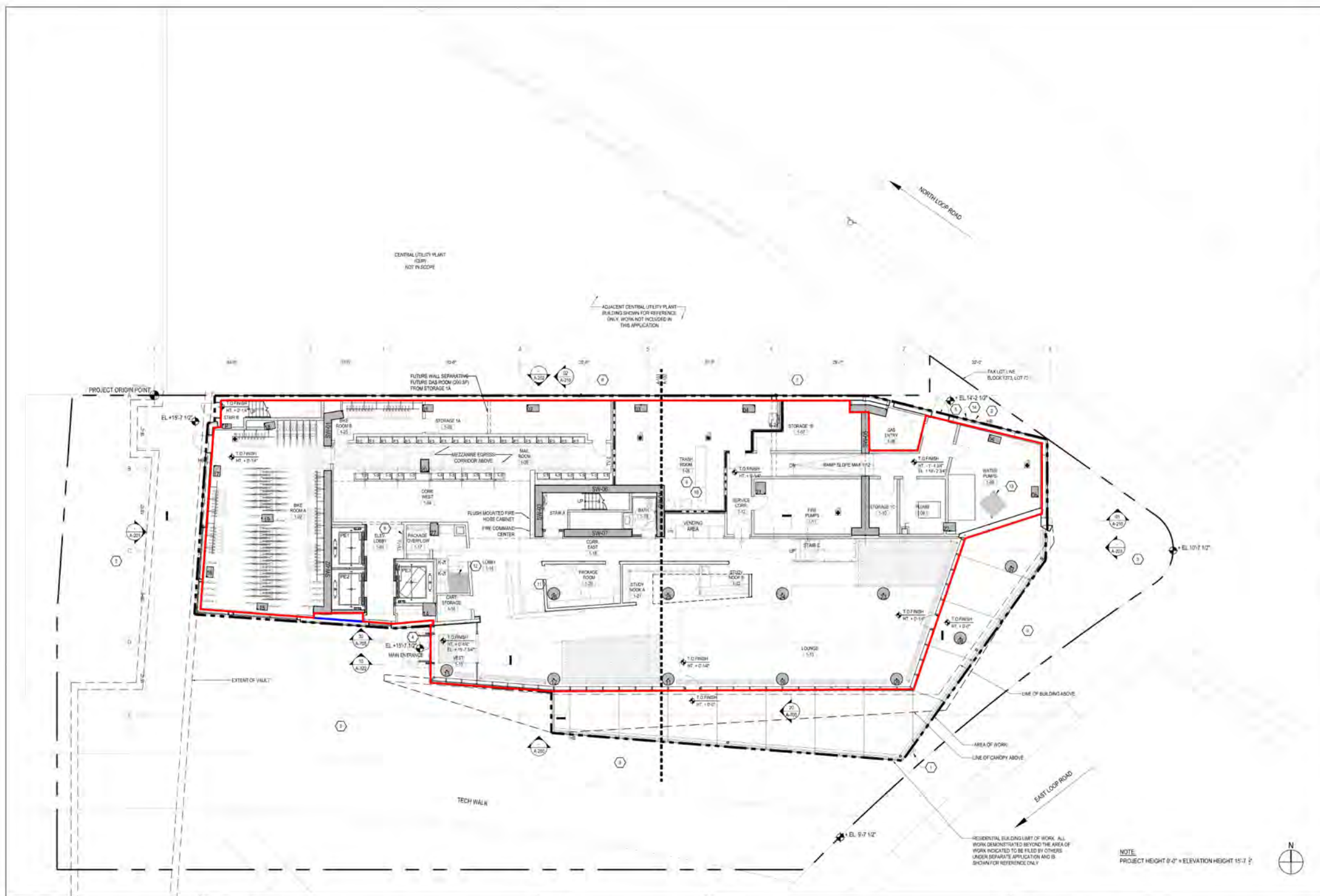


SCALE: 1/8" = 1'  
PROJECT NO: 874  
SEAL & SIGNATURE: NB # 121187125

DRAWING TITLE:  
1ST FLOOR PLAN

DRAWING NO:  
A-101.00

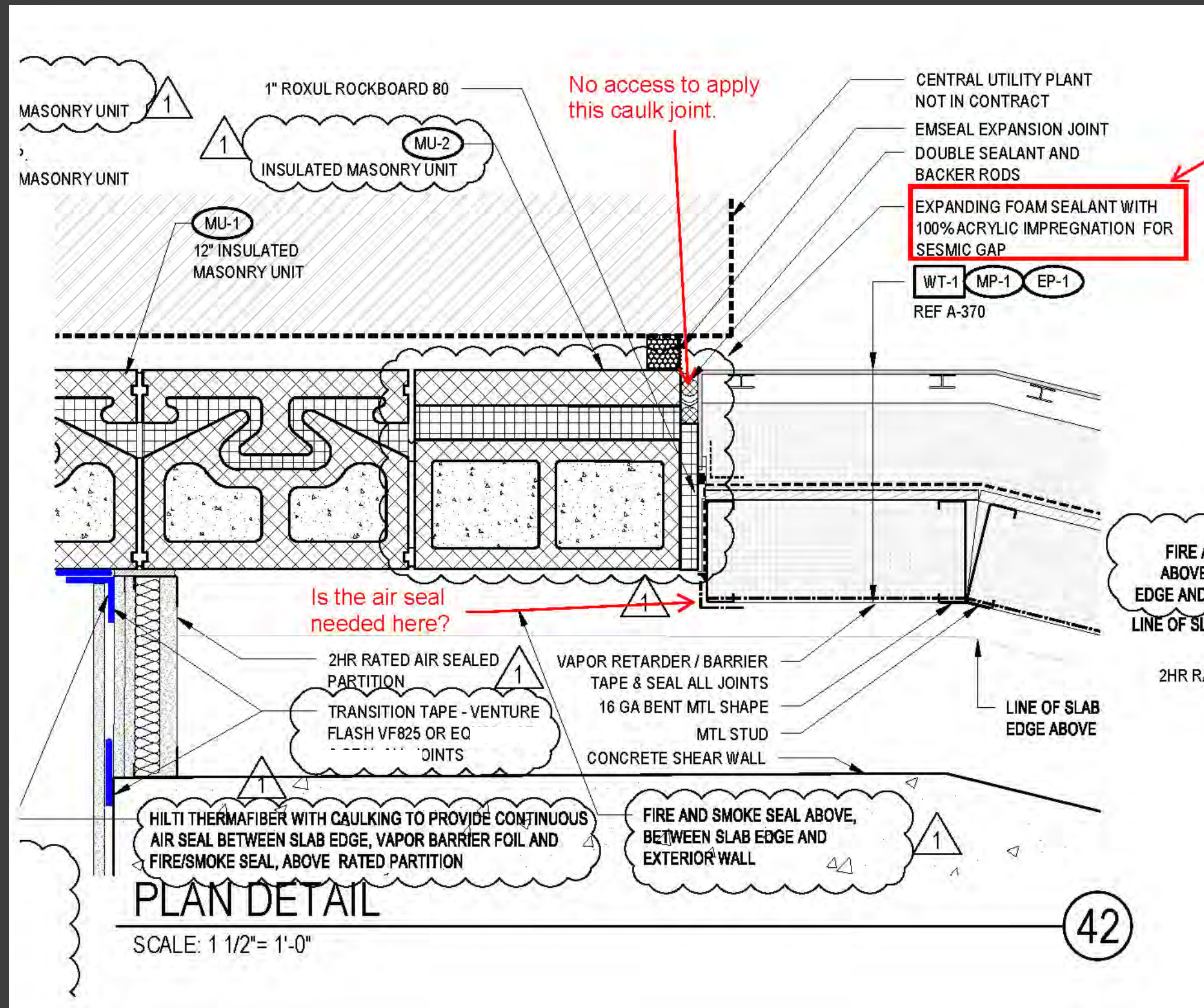
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GENERAL FLOOR PLAN NOTES	PARTITION NOTES	DOOR NOTES	SHEET NOTES	LEGEND
<p>1. REFERENCE G-002 TO G-003 FOR GENERAL INFORMATION</p> <p>2. ALL DIMENSIONS ARE FROM FACE OF SYSTEM UNLESS NOTED OTHERWISE</p> <p>3. REFER TO MEY, PE, TEL SECURITY DRAWINGS FOR ADDITIONAL INFORMATION</p> <p>4. REFER TO STRUCTURAL DRAWINGS FOR ADDITIONAL INFORMATION</p> <p>5. FIRESTOP ALL PLUMBING, ELECTRICAL, ETC., SLAB AND WALL PENETRATIONS</p> <p>6. ALL FLOOR DRAINS ARE TO BE FLUSH WITH THE FINISHED FLOOR O.N.</p> <p>7. REFERENCE ALSO SERIES FOR PLUMB AND SECTIONS AT CONDO STAIRS/ELEVATOR</p> <p>8. REFERENCE ARCHITECTURAL SCHEDULES</p>	<p>1. ALL WALLS SURROUNDING STAIRS, MECHANICAL SHAFTS, MECH/ELEC/STAIRS ARE TO BE 2 HOUR RATED</p> <p>2. TRASH ROOM WALLS @ GROUND FLOOR ARE TO BE 3 HOUR RATED CMU WALLS</p> <p>3. ALL ELEVATOR SHAFT WALLS ARE TO BE 2 HOUR RATED</p> <p>4. CEILING SCAND</p> <p>5. IF WALL TYPE IS NOT SPECIFIED PROVIDE WATER RESISTANT OVER AN AREA AROUND A WATER SOURCE INCLUDING BUT NOT LIMITED TO BATHROOM, KITCHEN, WASHROOMS, CLOSET, LOCKER ROOMS AND JANITORY CLOSET</p> <p>6. IF WALL TYPE IS SPECIFIED PROVIDE (CEMENTITIOUS BACKER BOARD)</p> <p>7. IN ALL OTHER AREAS PROVIDE MASON RESISTANT WALL BRICK (PIPER, SHARD)</p> <p>8. PROVIDE 1/2" GA METAL BRACKETS FOR ATTACHMENT OF MULLION, GYM BARS, BATHROOM ACCESSORIES, AND OTHER SIMILAR ITEMS REQUIRE SUPPORT. REF G-004 FOR TYPICAL LOCATIONS AND MOUNTING HEIGHTS</p>	<p>1. ALL DOORS ARE 4' FROM FACE OF CURTAIN WALLS UNLESS OTHERWISE DIMENSIONED</p>	<p>1. BARRIER CONNECTION: HEAT TRACE</p> <p>2. BARRIER CONNECTION</p> <p>3. LARGEST PENETRATIONS TO BE FILLED BY OTHERS UNDER SEPARATE APPLICATION AND SHOWN FOR REFERENCING ONLY</p> <p>4. INTERCOM TO MAIN PHONE LINES</p> <p>5. VIDEO INTERCOM TIED TO FRONT DESK</p> <p>6. BUILDING ENERGY CONSUMPTION DIGITAL INFORMATION DISPLAY</p> <p>7. DRINKING WATER FOUNTAIN (RAMP FOUNTAIN)</p> <p>8. DRINKING WATER FOUNTAIN (REAR COURTYARD)</p> <p>9. REFER TO ELECTRICAL DRAWINGS</p> <p>10. TRASH COMPACTOR</p> <p>11. RECYCLING BAR BELOW CHUTE</p> <p>12. METER ANNUNCIATOR</p> <p>13. STORMWATER HOUSE TRAP WITH 1/2" DEEP GALV STEEL GRATING ON EMBEDDED 1 1/2" x 1 1/2" GALV STEEL ANGLE AND INDOOR FINISHER</p> <p>14. SHOWERHOUSE TRAP WITH 1/2" DEEP GALV STEEL GRATING ON EMBEDDED 1 1/2" x 1 1/2" GALV STEEL ANGLE AND INDOOR FINISHER</p> <p>15. TEST TEE</p>	<p>REFER TO G-003 FOR ADDITIONAL SYMBOLS</p> <p>1 HOUR RATED WALL</p> <p>2 HOUR RATED WALL</p> <p>3 HOUR RATED WALL</p> <p>3 HOUR RATED SHFT WALL</p> <p>3 HOUR RATED WALL</p> <p>WOOD FLOORING AND DIRECTION</p> <p>CARPET</p> <p>TILE</p> <p>WALL</p> <p>FRONTIUM TILE - REFER TO MEY</p> <p>W/C WASHING CRYER</p> <p>PD FLOOR DRAIN</p> <p>HOSE BIB</p> <p>AMENITY PANEL</p> <p>FIRE CONTROL PANEL</p> <p>EXTERIOR RECESSED LIGHT FIXTURE</p> <p>EXTERIOR FLOOR MOUNTED LIGHT</p> <p>CONDENSED LED STRIP LIGHT FIXTURE</p> <p>1" DIAMETER CONDENSATE DRAIN</p> <p>RO FLOOR DRAIN</p> <p>OUTLET DRAIN</p>

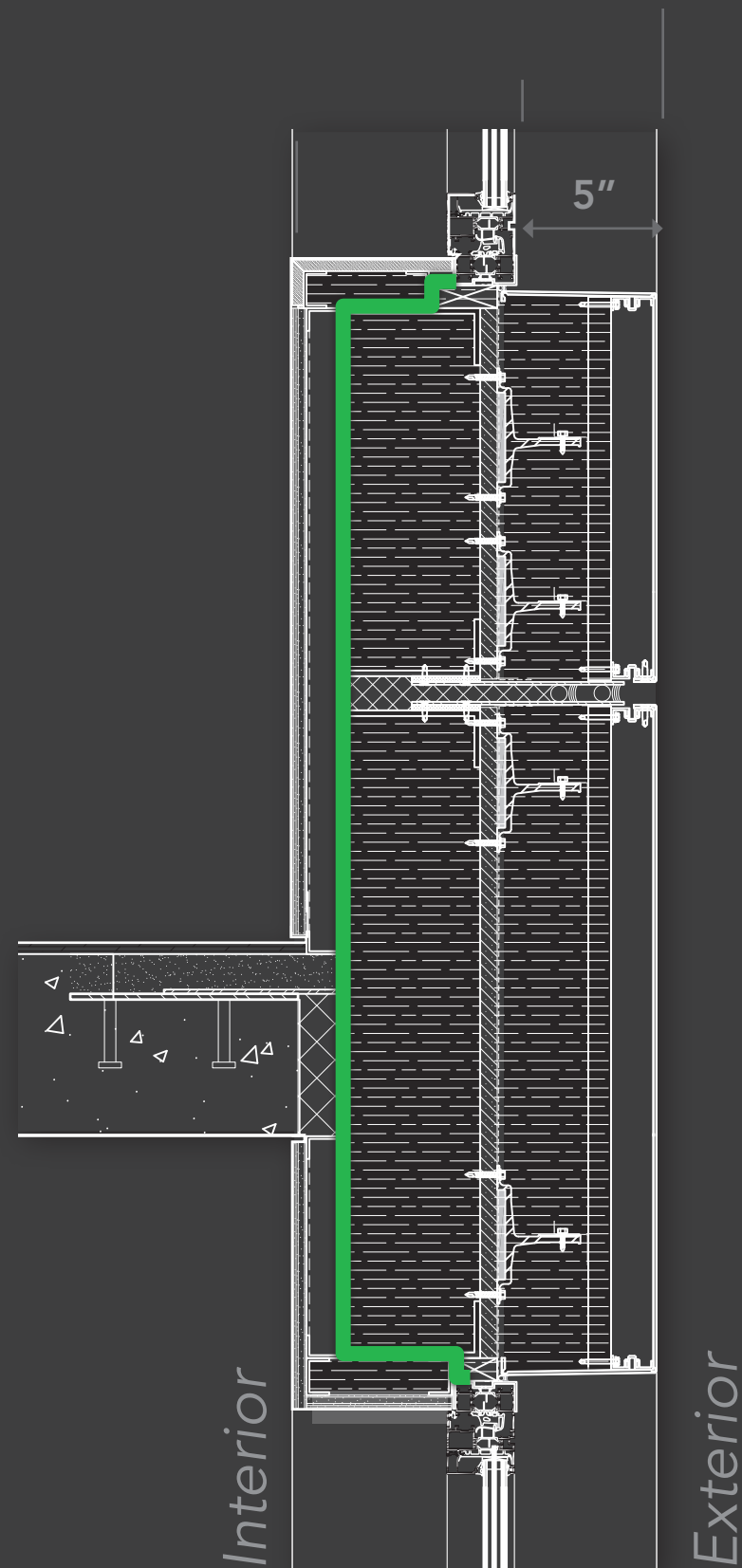


# AIR SEALING - ITERATIVE PROCESS





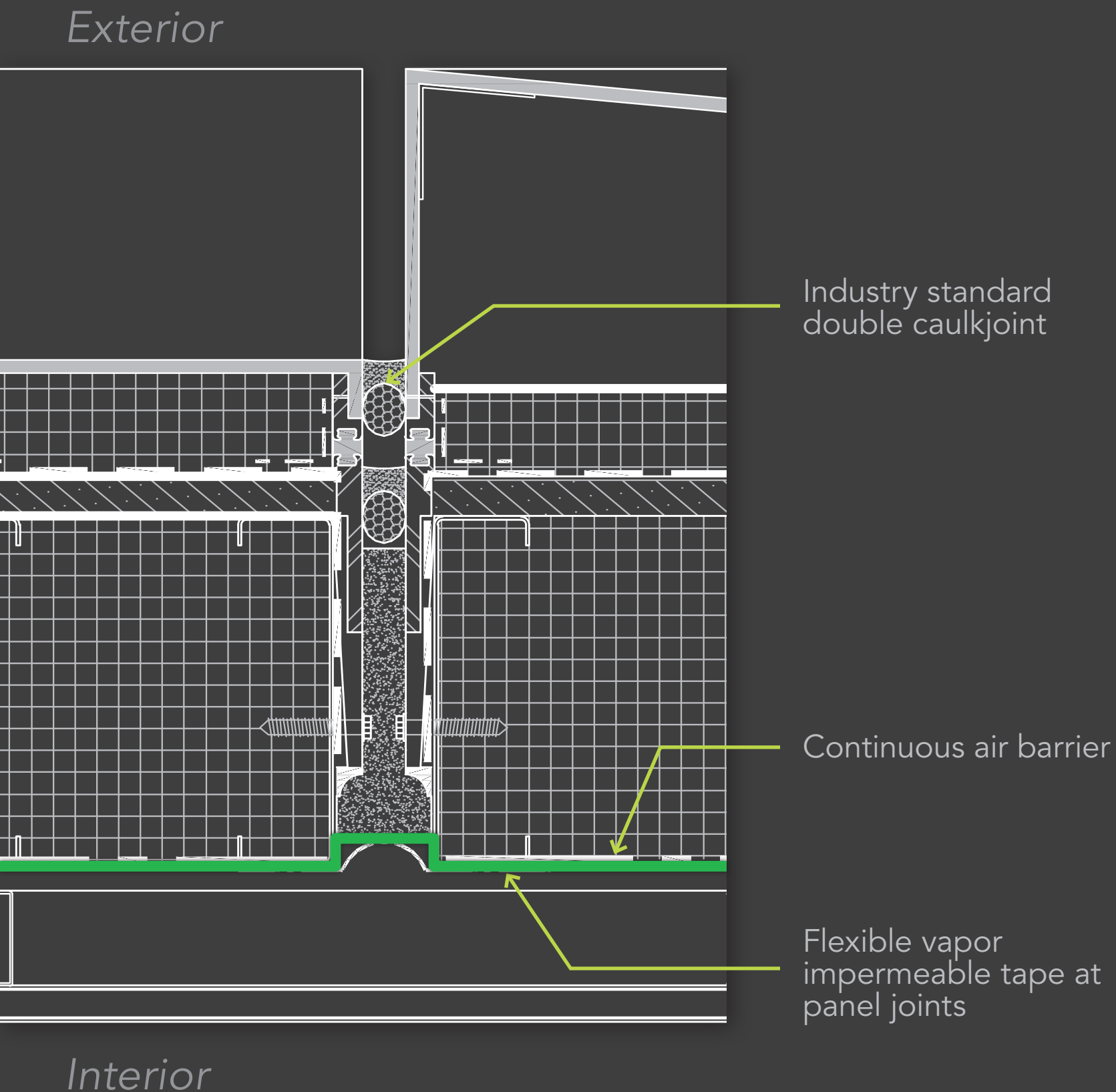
# AIR SEALING - AT INSIDE FACE OF EXTERIOR WALL



- Smart vapor retarder on interior installed in the shop
- Taped to interior face of window and studs
- Overlaps at panel joints - held back at factory and connected in field
- Panel joints taped in the field - bypassing slab edge



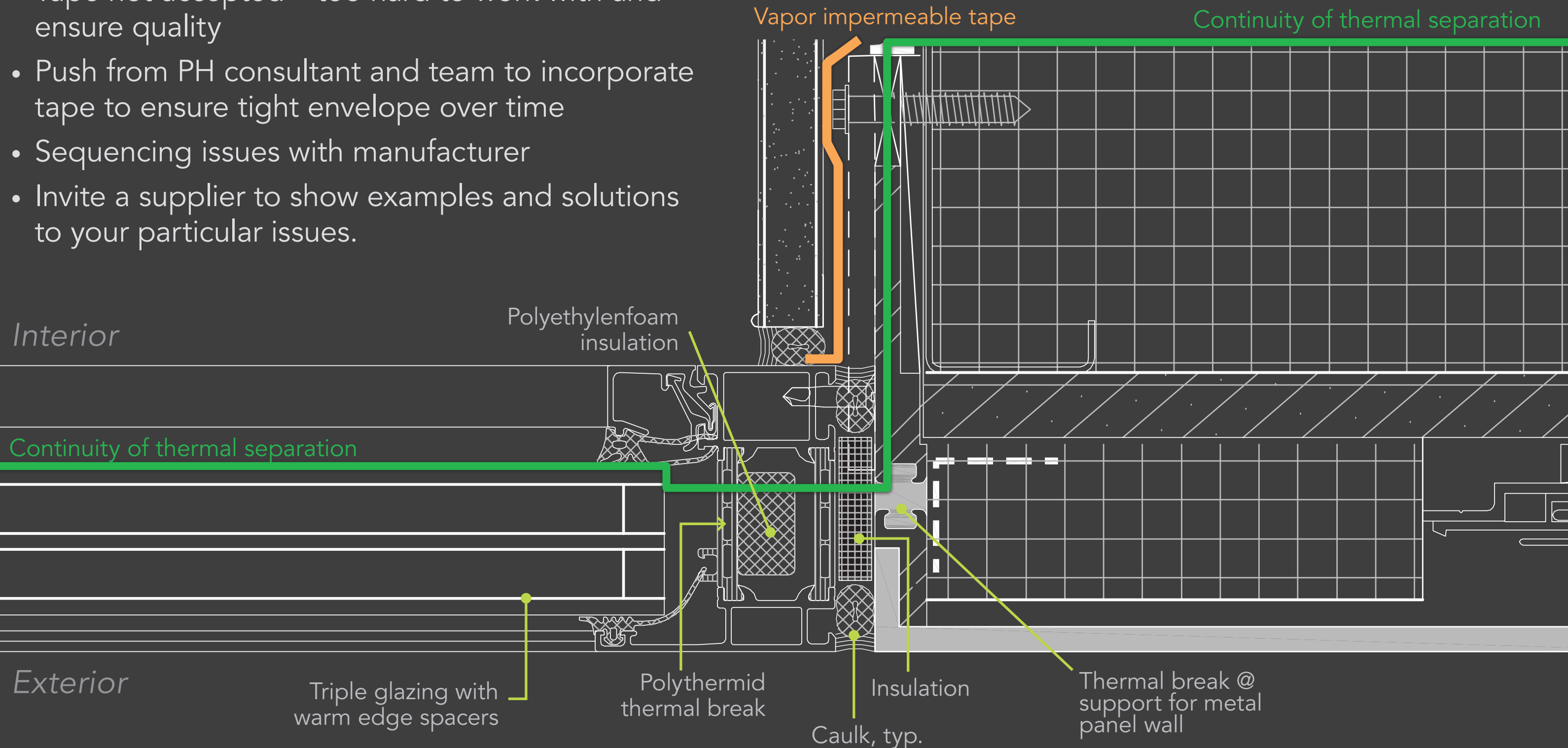
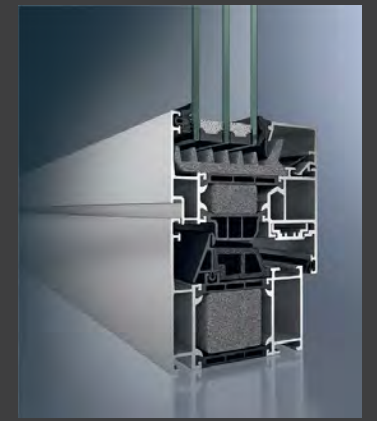
# AIR SEALING - ENLARGED PANEL JOINT DETAIL



- Problem for Passive House blower door testing: caulking not complete until façade is completely installed. Therefore, there is no way to verify tightness during construction.
- Interior vapor retarder will be used to determine compliance for air sealing during construction, therefore, continuity is critical.

# AIR SEALING - TYPICAL WINDOW

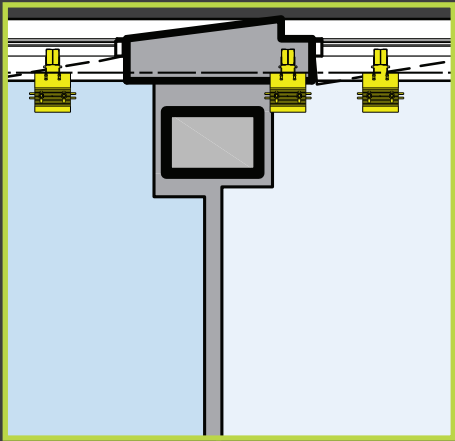
- Façade consultant and contractor – caulk is what was proven and usually done.
- Tape not accepted – too hard to work with and ensure quality
- Push from PH consultant and team to incorporate tape to ensure tight envelope over time
- Sequencing issues with manufacturer
- Invite a supplier to show examples and solutions to your particular issues.



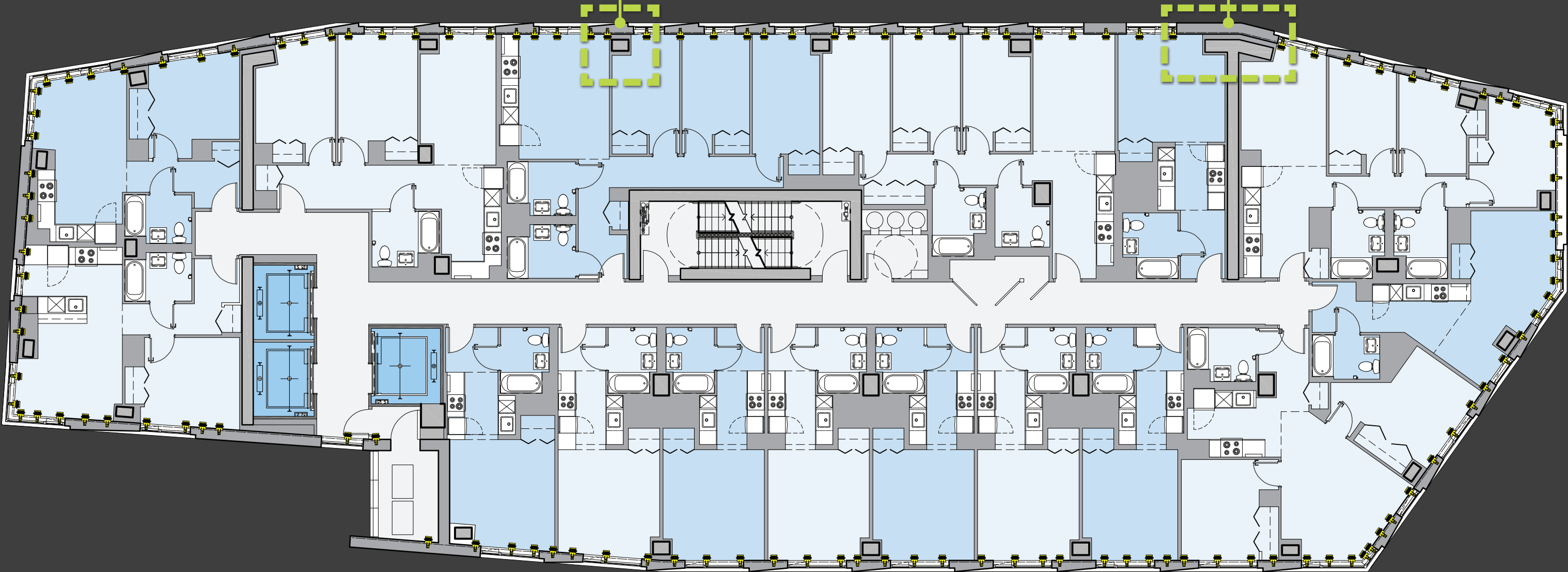
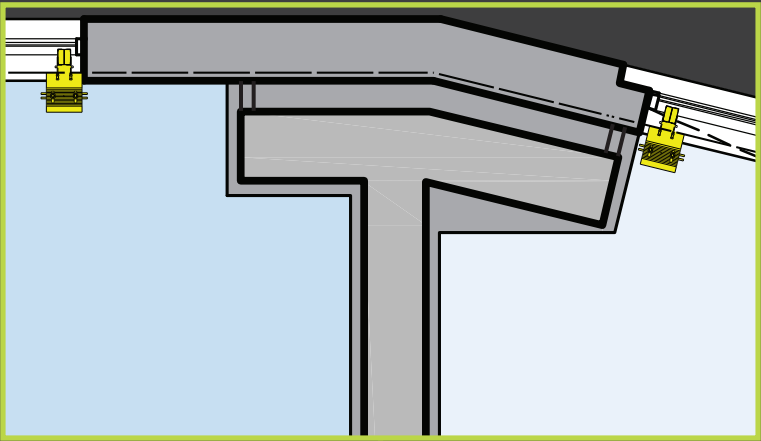


# AIR SEALING - ACCESS AT FACADE COLUMNS AND SHEAR WALLS

TYPICAL COLUMN DETAIL  
17 PER FLOOR



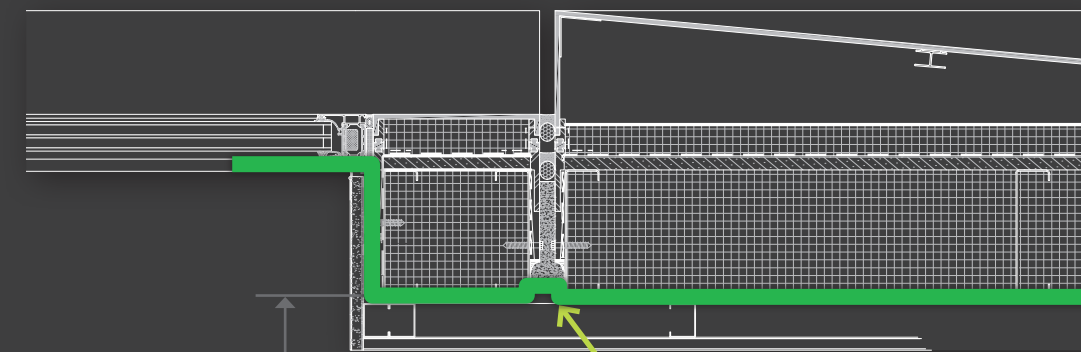
SHEAR WALL  
CONDITION



# AIR SEALING - ACCESS AT FACADE COLUMNS

- Allow for access at columns
- Columns set back 10"
- Max horizontal distance to panel joint = 8"
- Coordinate with facade design

*Exterior*

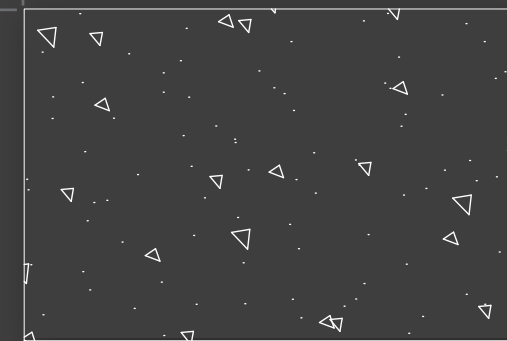


10"

8"

Panel joint

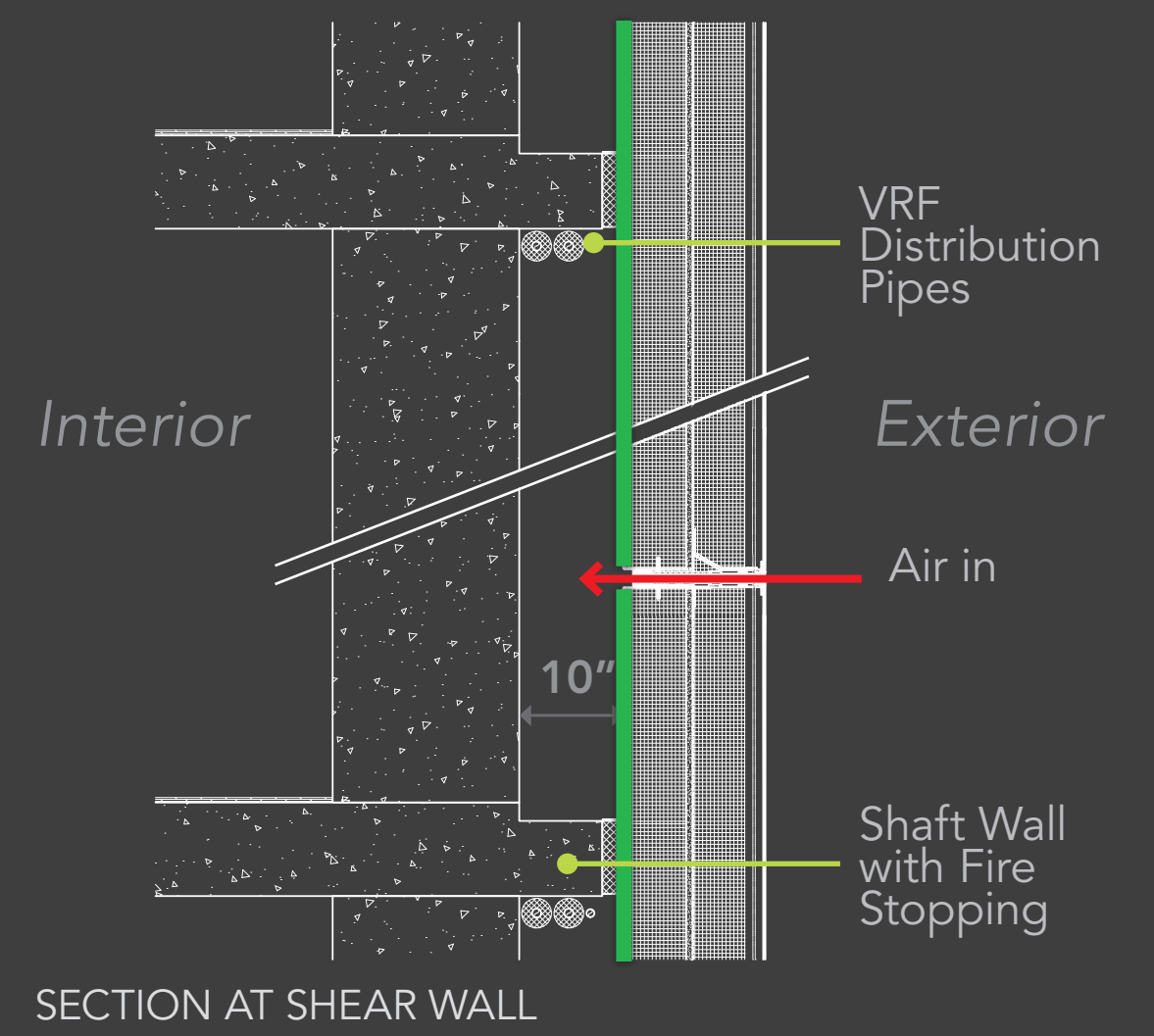
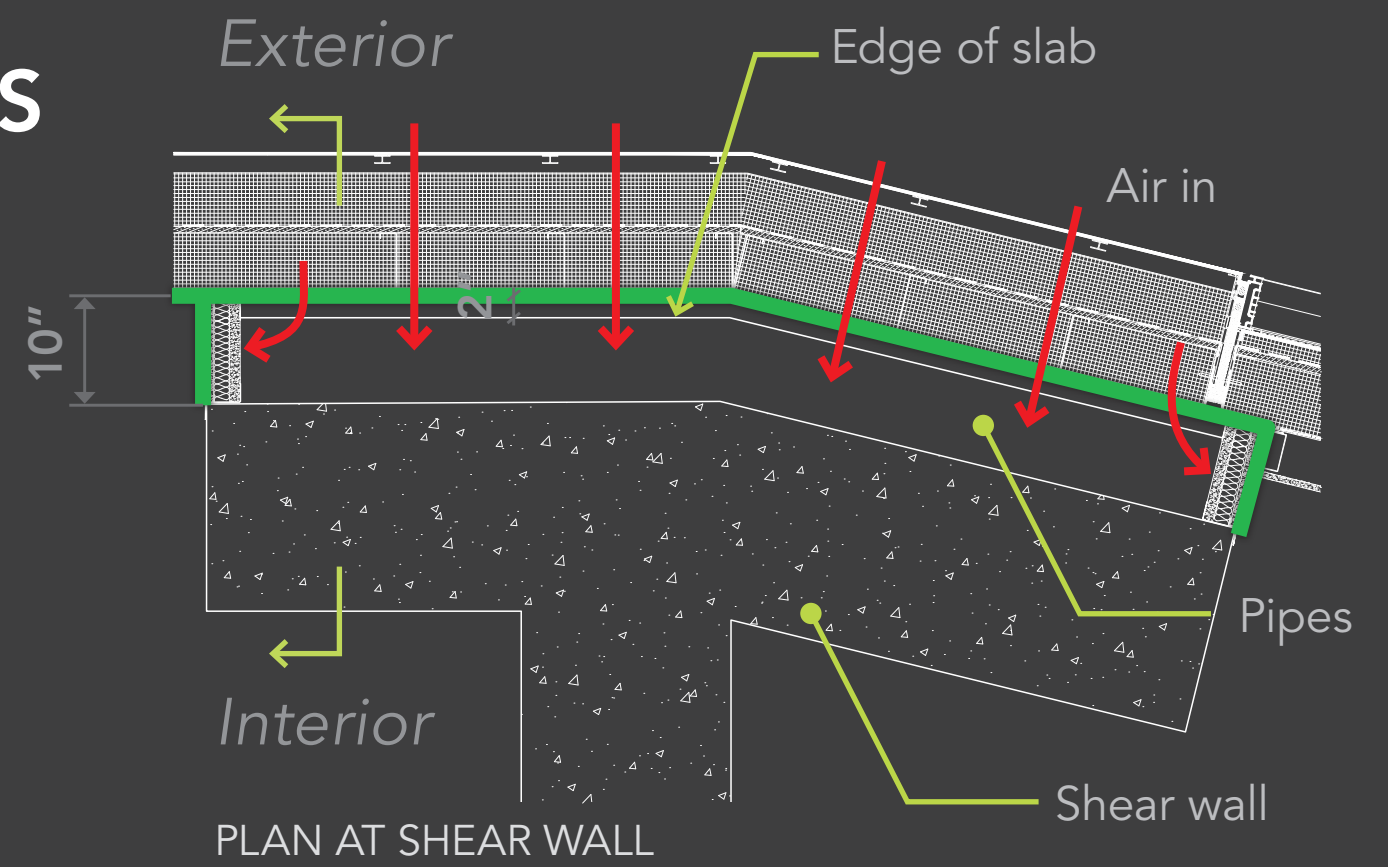
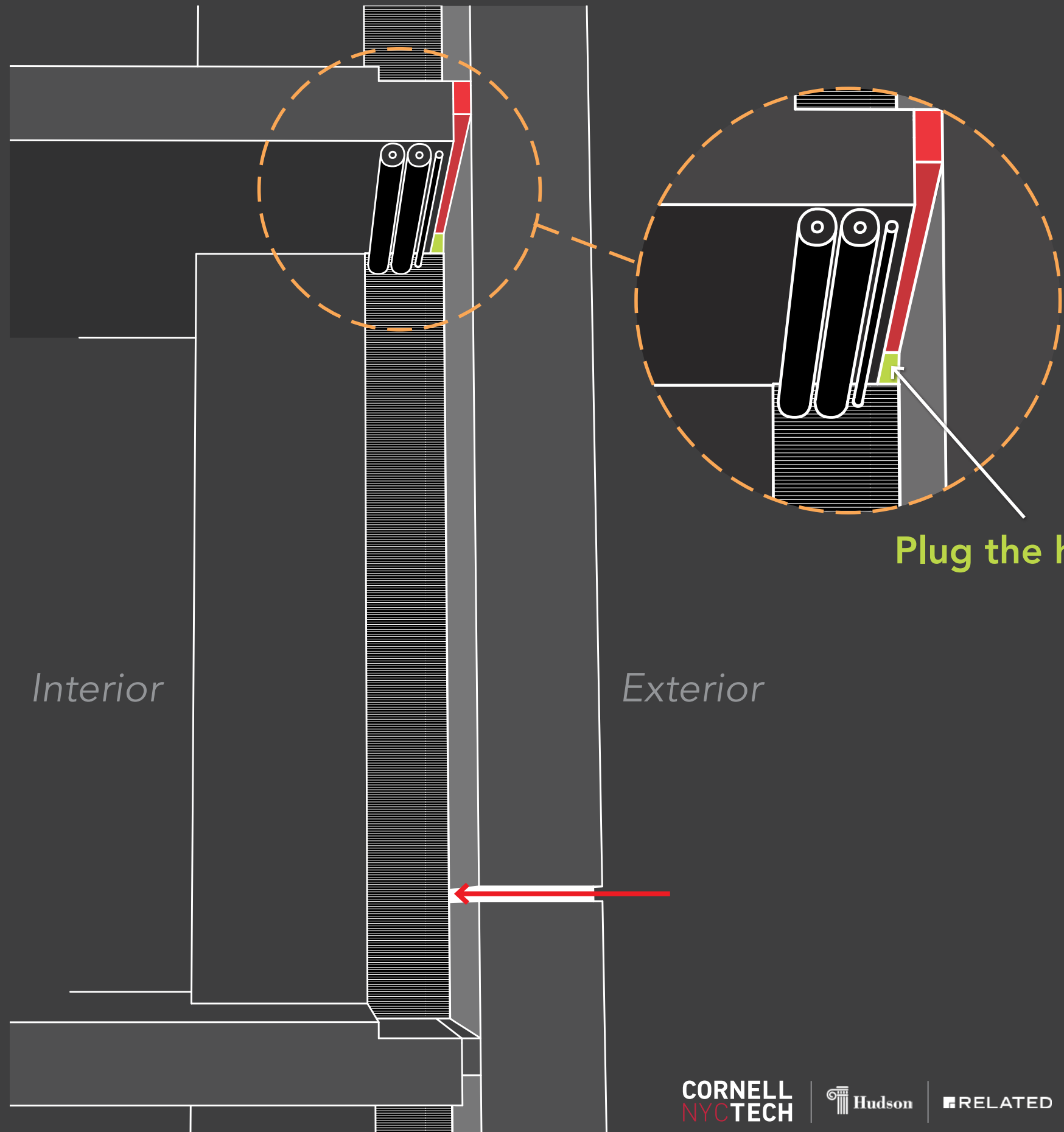
*Interior*



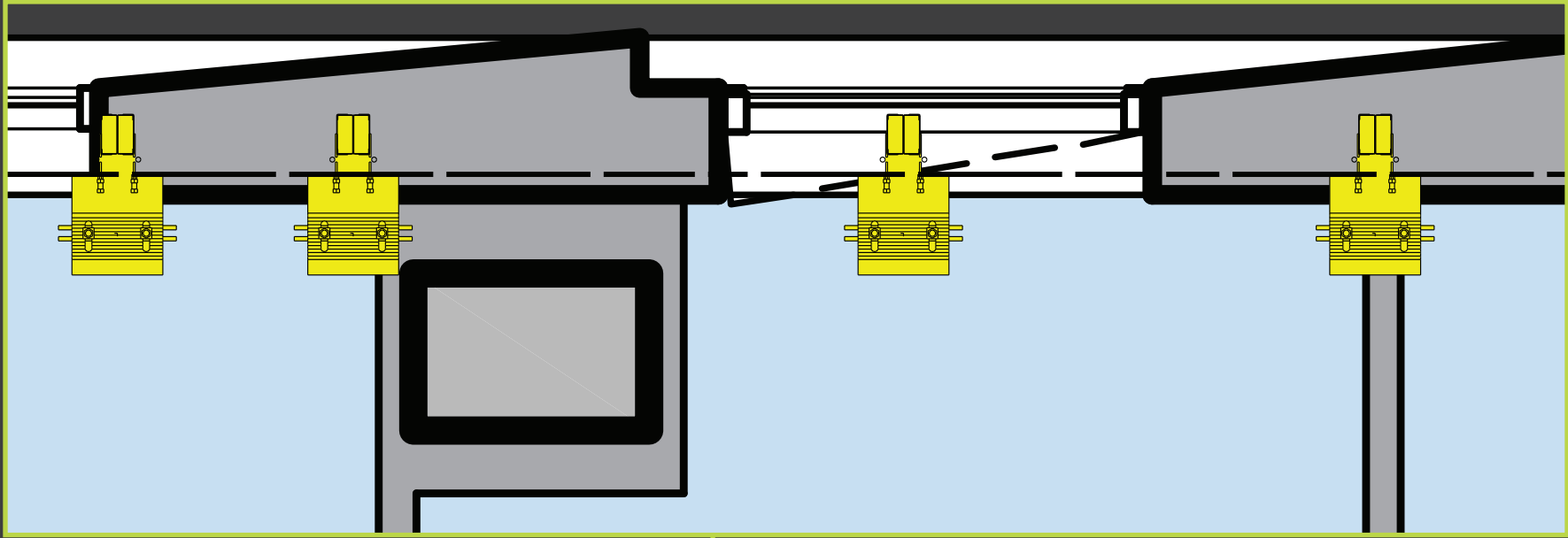
Column



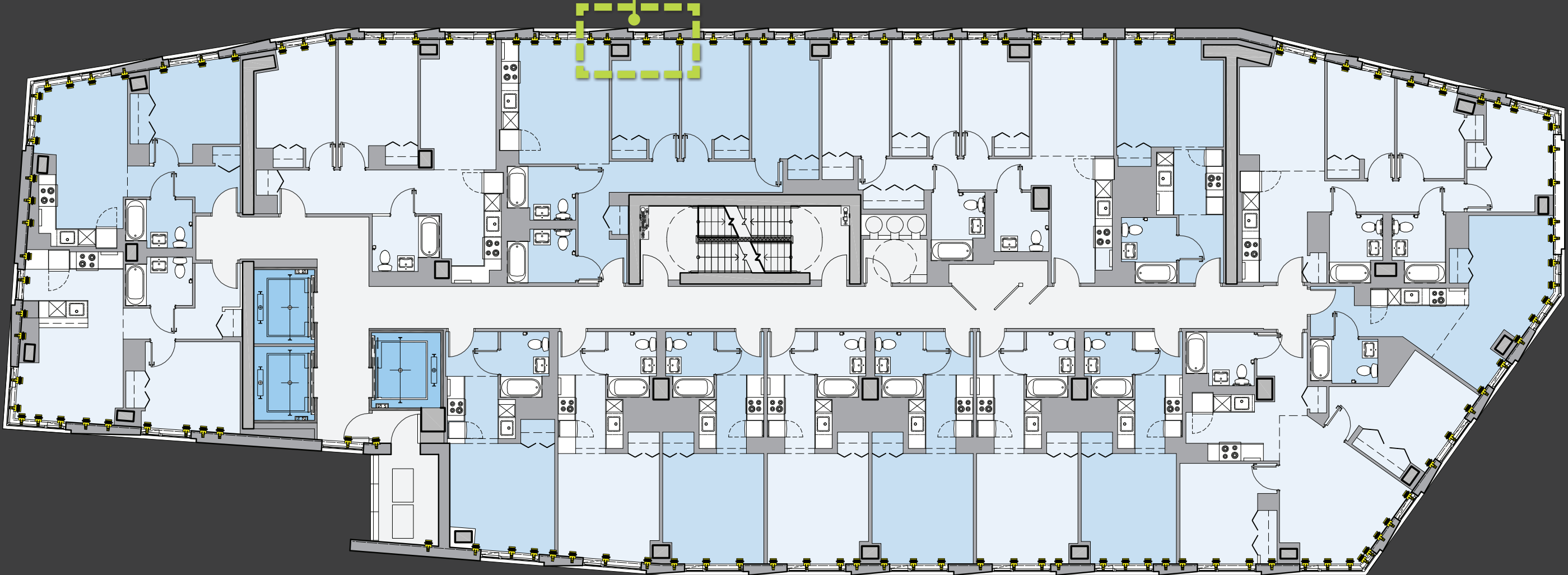
# AIR SEALING - ACCESS AT SHEAR WALLS



# AIR SEALING - AT FACADE ANCHORS



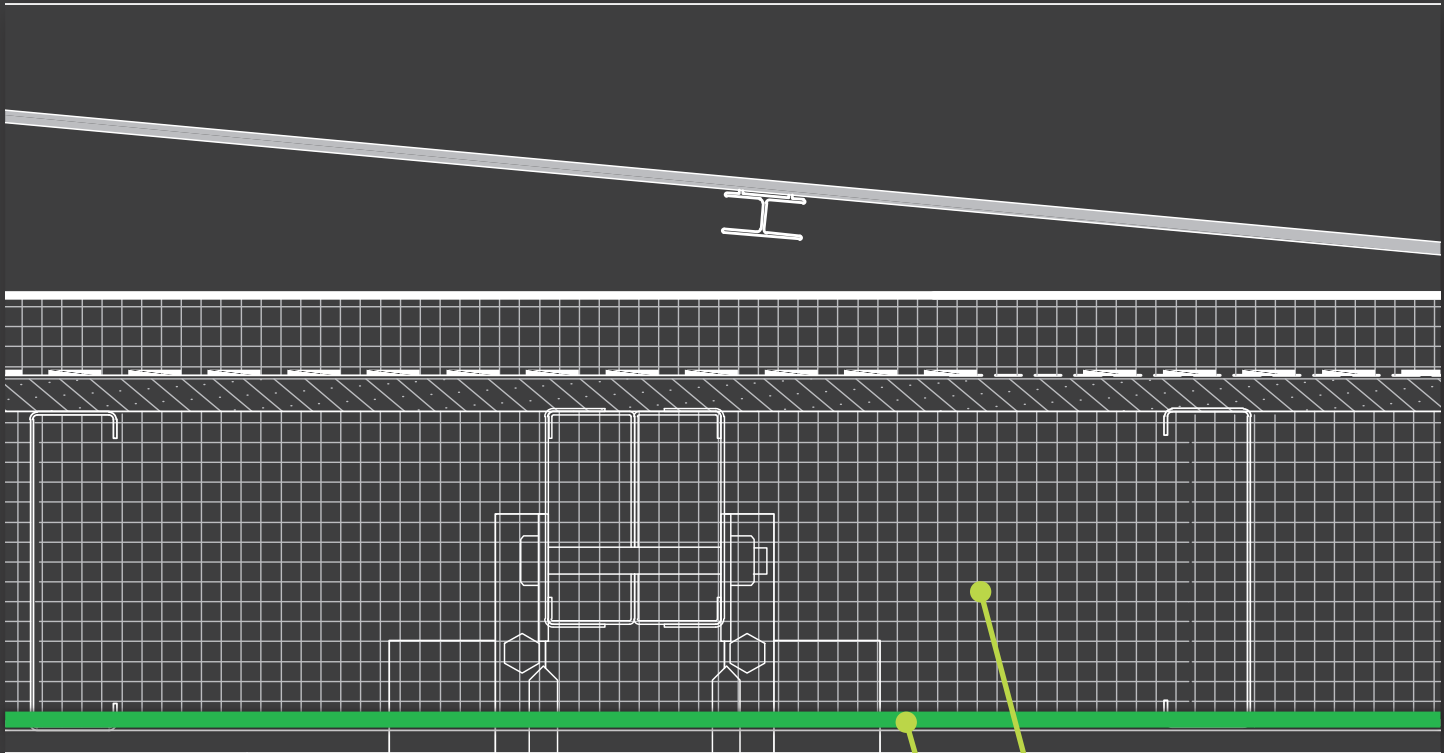
- 123 Anchors Per Floor
- Over 3,000 Anchors Total



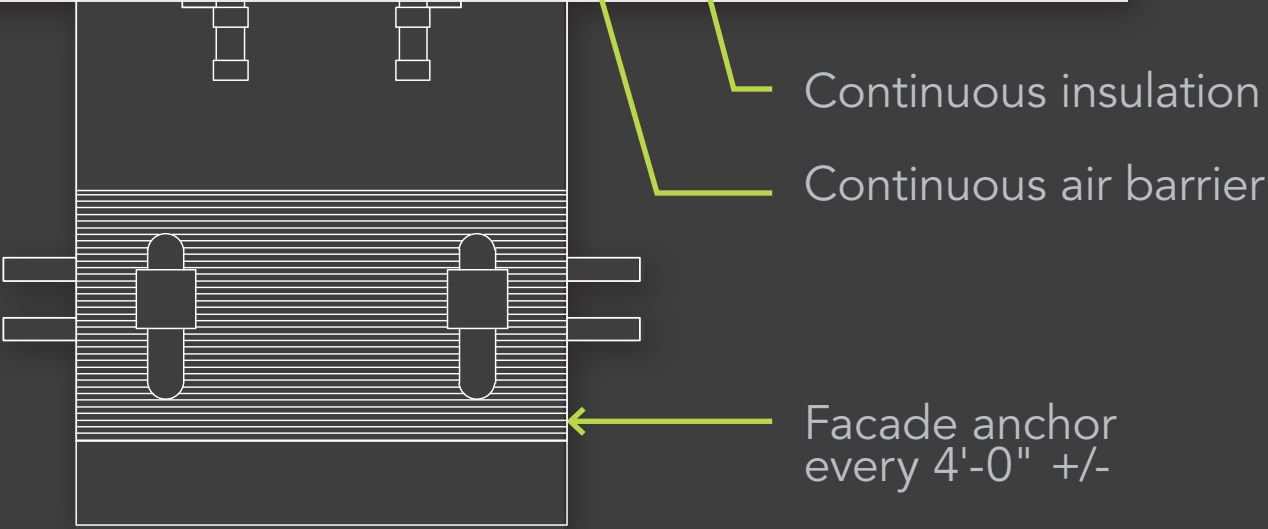


# AIR SEALING - AT FACADE ANCHORS

Exterior



Interior



PLAN AT FACADE ANCHOR



# AIR SEALING - AT FACADE ANCHORS

## SEQUENCE

1. FABRICATE LOOSE FLAPS IN BULK.
2. PREPARE TOP FLAP IN SHOP.
3. INSTALL BOTTOM FLAP ON LOWER BRACKET IN FIELD JUST BEFORE PANEL INSTALLATION.
4. AFTER PANEL INSTALLATION & ADJUSTMENTS, INSTALL MINERAL WOOL INSULATION, FILLING VOID AROUND BRACKET.
5. LOWER FLAPS AND SEAL TO INTELLO PLUS, THE BRACKET AND TO EACH OTHER, SANDWICHING THE TOP AND BOTTOM TAPES TOGETHER.

Mineral wool pressing

1 DETAIL @ FLOOR SLAB  
3" = 1'-0"

**475 High Performance Building Supply**  
This sketch is modified 8/24/2015 to reflect discussions at mock-up in ATI testing facility, York PA.

vapor impermeable tape short strip on membrane. Retain release backing until it is time to seal the membrane.

Sandwich the top and bottom tapes together on each side of bottom bracket. Seal to top, bottom and sides of bracket.

Flap of vapor barrier taped to underside of Halfen bottom bracket just prior to panel installation (no earlier than same day). Hold out of the way with releasable-adhesive tape.

vapor impermeable tape adhered to flap on 4 sides (short strip on membrane). Retain release backing on remainder of tape until it is time to seal the membrane.

PROJECT NUMBER	14621	DATE	5/22/15
ORIGINAL PAPER SIZE	11 x 17	DWG NO	501
D/T STAMP	6/8/2015 11:32:59 AM	ARCHITECT	HANDEL ARCHITECTS, LLP 120 BROADWAY, 6TH FLOOR NEW YORK, NY 10271
DRAWN BY	PD	CONSTRUCTION MANAGER	MONADNOCK CONSTRUCTION INC. 155 3RD STREET BROOKLYN, NY 11231
CORNELL NYC TECH PMU MOCKUP		DRAWING ISSUES	DATE
1 EAST LOOP ROAD, ROOSEVELT ISLAND, NYC		ISSUE	5



- Construction method challenges
  - » Caulk: 20 years. Industry standard for keeping water out of buildings
  - » Tape: 100 years. Not yet proven in industry.
  - » Site Monitoring. QA/QC



# AIR SEALING - MATERIALS



## Schedule 4 | Tape Schedule

Tag	Description	Location
T-1	Vapor impermeable tape	<ol style="list-style-type: none"> <li>1. Windows &amp; Door openings</li> <li>2. Inside face of exterior wall in contact with vapor barrier</li> <li>3. Inside face of exterior wall in contact with vapor barrier</li> <li>4. Interior walls adjacent to hammerhead shear walls</li> </ol>
T-2	Vapor impermeable tape	<ol style="list-style-type: none"> <li>1. CMU block (Where no liquid applied membrane is present)</li> <li>2. Inside face of exterior wall to 1st floor slab &amp; 3rd floor slab in rooms over porch and unenclosed mechanical</li> <li>3. Inside face of exterior wall to underside of roof slab (25th &amp; 26th floors)</li> </ol>
T-3	Vapor impermeable tape	<ol style="list-style-type: none"> <li>1. CMU Block where the masonry has an liquid applied air barrier.               <ol style="list-style-type: none"> <li>A. Floor, ceiling and corner connections @ 1st and 2nd floor north wall.</li> <li>B. Transitions in the components around the porch area</li> <li>C. Transitions in the unenclosed mechanical area at the 2nd Floor</li> </ol> </li> </ol>

# AIR SEALING - CONSTRUCTION MANAGEMENT COORDINATION

## Trades Affected by PH Requirements

- **Exterior Sealing**
  - Exterior Panel Fabricator
  - Window Supplier
  - Carpenter
  - Mason
  - Caulker
- **Interior Sealing**
  - Mechanical
  - Electrical
  - Plumbing
- **Heating / Ventilation / Airside Contractor**

## Control of Scope of Work

- Bid/Buy documents need to be sure to cover passive house requirements
- Not enough to say "follow spec"
- Contractors will exclude certain details/requirements

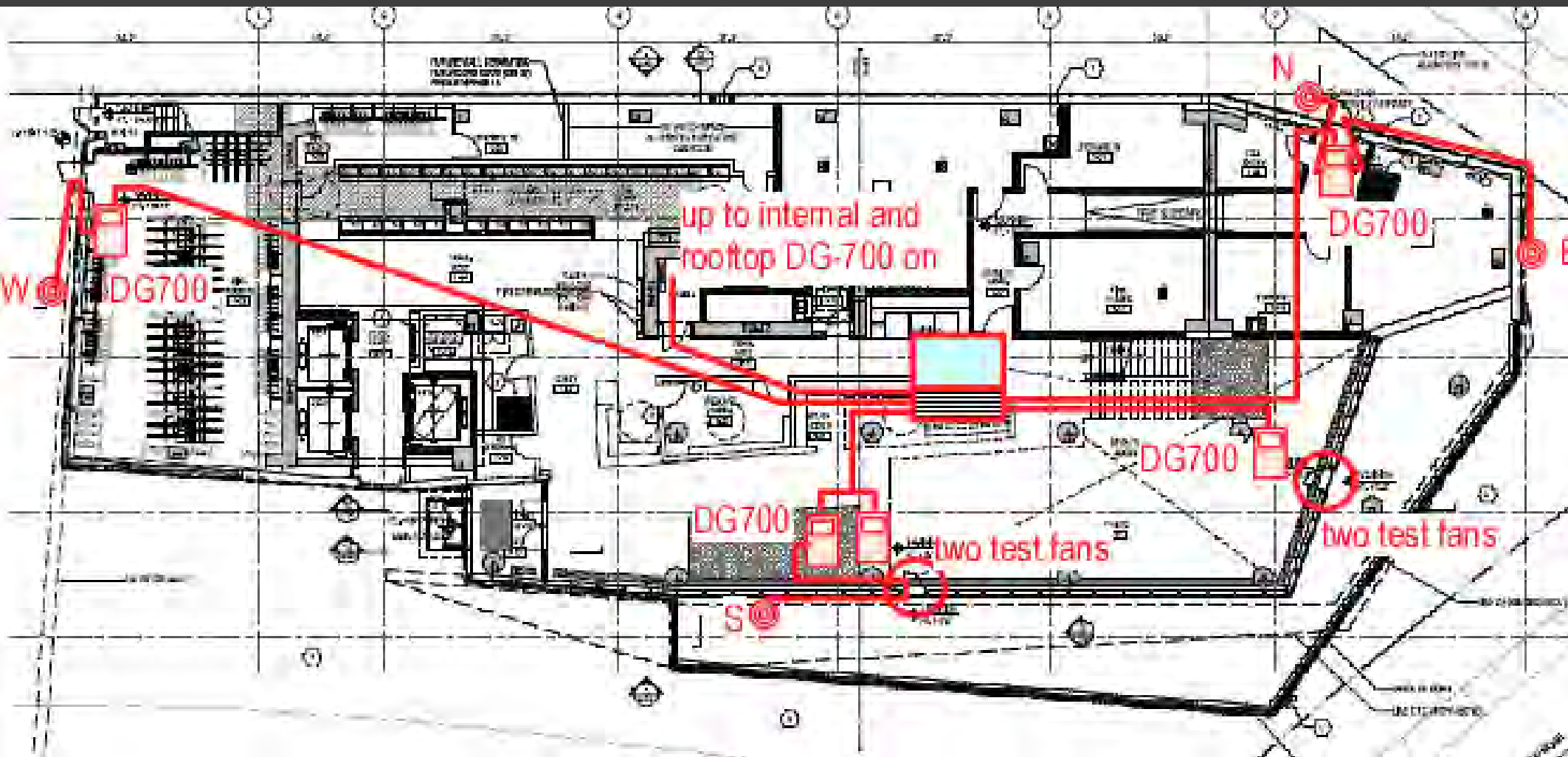


# AIR SEALING - AIR LEAKAGE TESTING



- On-going
- Various components to be tested along the way
- Full blower door tests not possible
- Mock-up indicates very tight façade
- Components that should be spot checked throughout construction
  - Slab/wall connection
  - Windows & store front
  - Doors to rooms outside the air barrier
  - Roof/Wall connections
  - Penetrations through the facade

# AIR SEALING - BLOWER DOOR TEST



- Air Tightness Testing requirements for Passive House
- Large Building Test Procedures from RetroTec
- Ultimately need to create a plan for your particular building – can show Single family house vs. Cornell Resi images to make the point.

## Test Configuration of Intentional Openings

### Intentional Openings

Windows, doors, skylights and hatches in the bounding enclosure

Doors, hatches and operable windows inside the test enclosure

Fire Dampers

Dryer Doors

AHU-1 (ERV OA)  
Penthouse roof 26th Floor

### Test Status

Closed and latched

Open

Remain as found

Closed and latched

Fan off, dampers closed, sealed

### Notes

Ventilation units run continuously, so dampers closed and sealed.



# MOCK-UP TESTS

Pressure Sensor



Blower Door Test Set-up



# HVAC SYSTEMS



## Evaporator

Indoor unit for heating and cooling;  
individual control

## Condenser

Outdoor unit

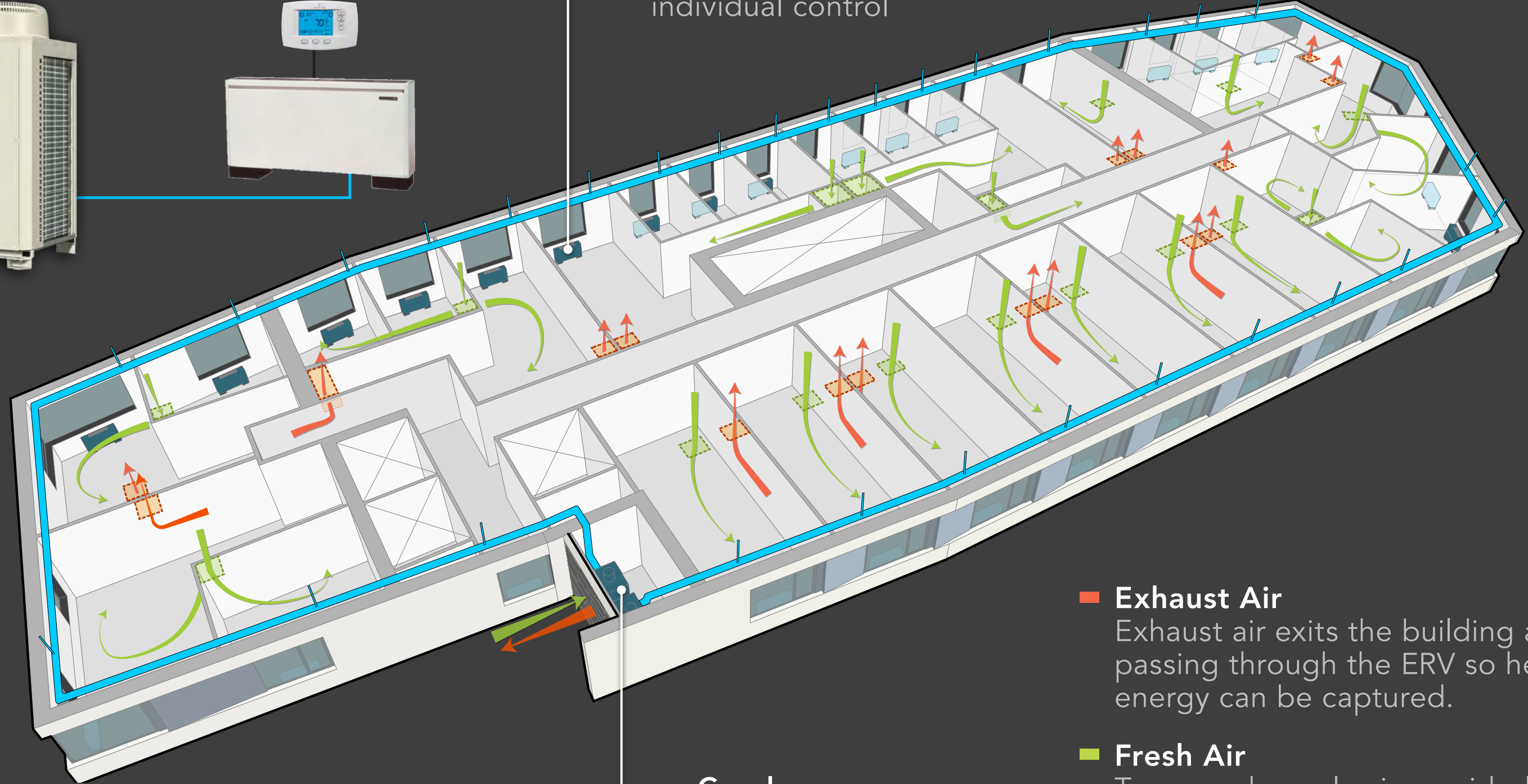
## Exhaust Air

Exhaust air exits the building after passing through the ERV so heat energy can be captured.

## Fresh Air

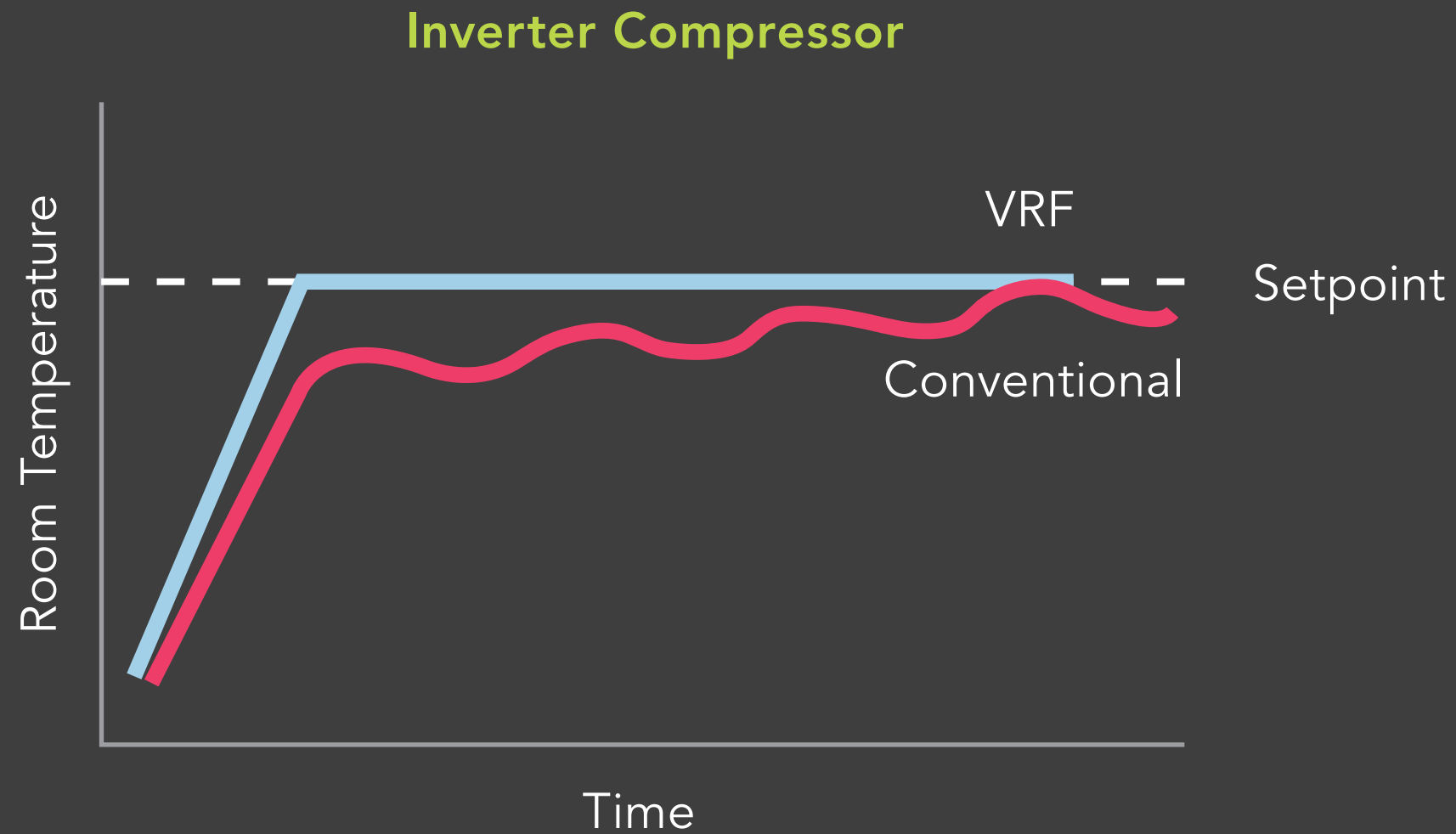
Tempered supply air provided to all units in separate supply risers.

## Refrigerant





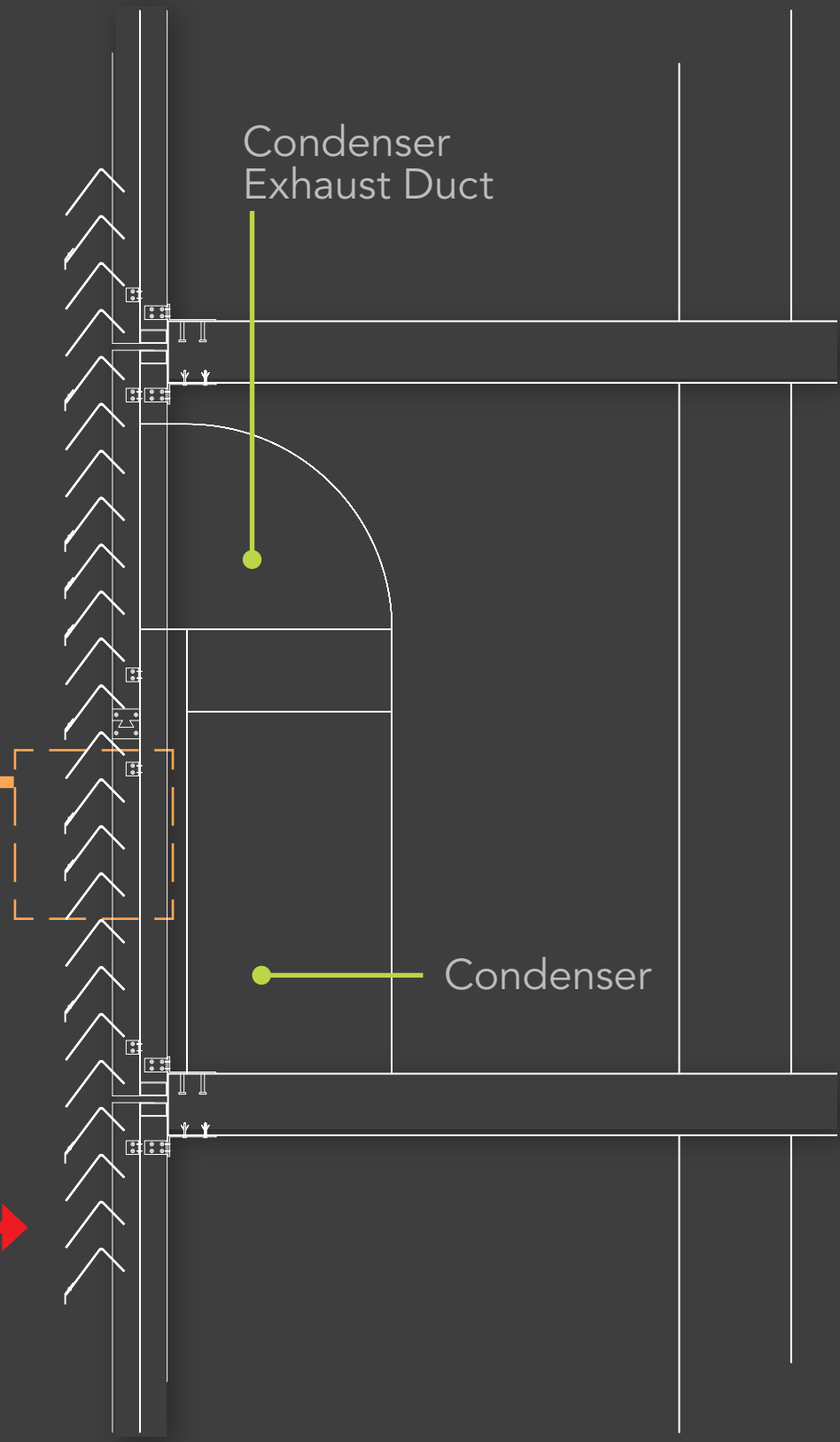
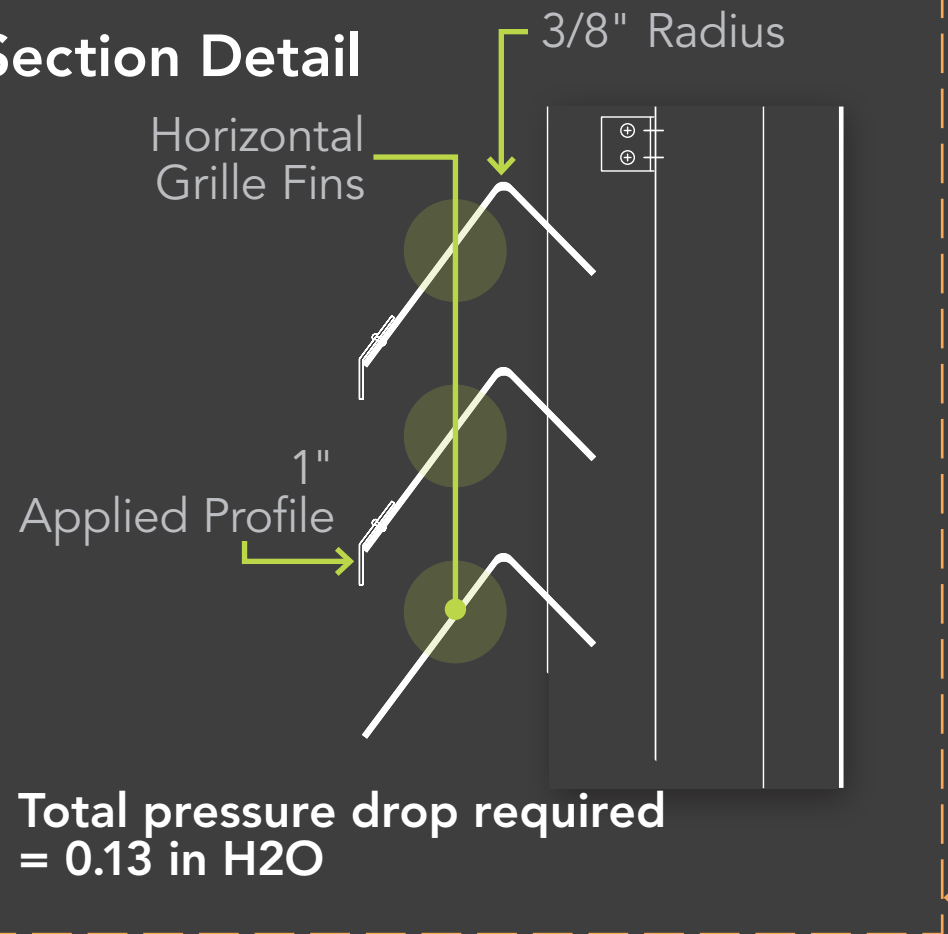
# VRF TECHNOLOGY



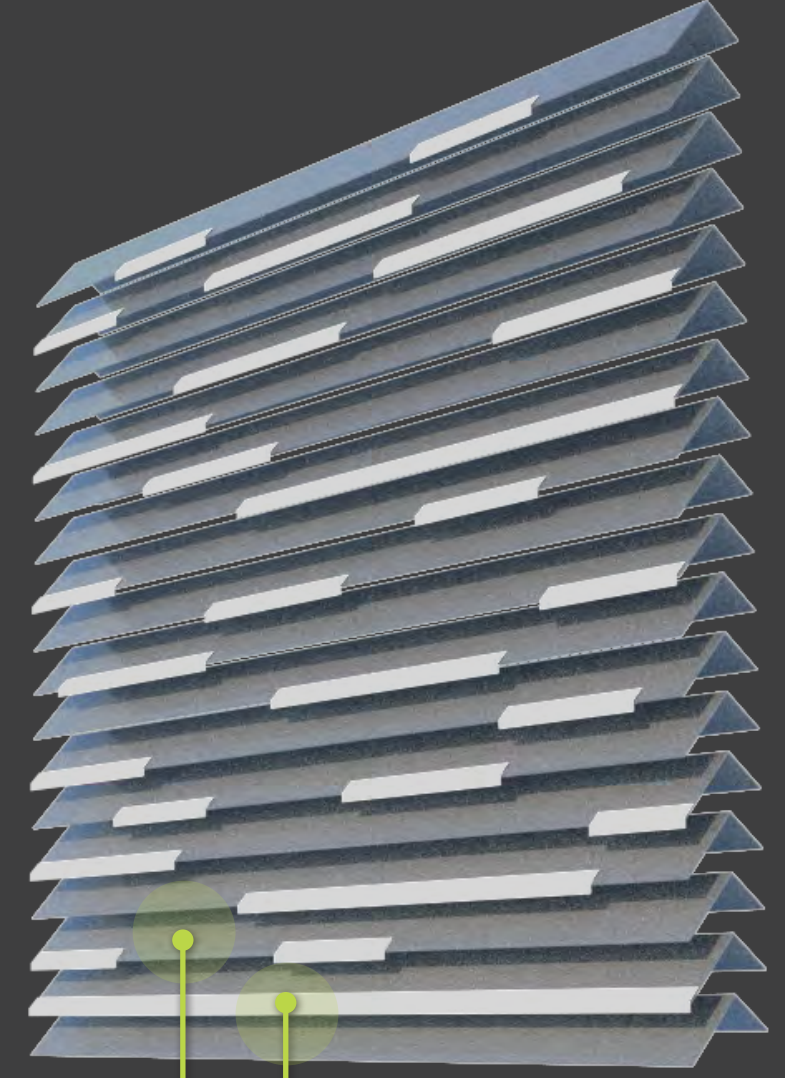
- Super efficient, highly variable, and very responsive
- Electric system: best energy efficiencies in the industry

# VERTICAL REVEAL GRILLE

## Section Detail



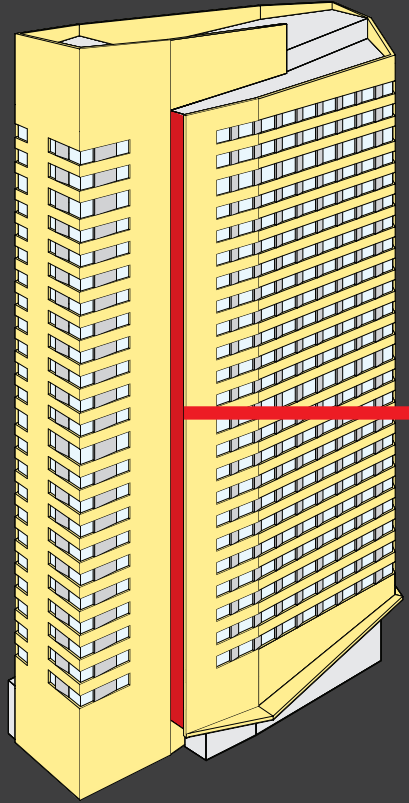
Section Diagram



**Applied Profile Paint**  
Warm champagne with metallic sparkle to match main wrap cladding material

**Horizontal Grille Fins Paint**  
Flat warm dark grey to match window frame color

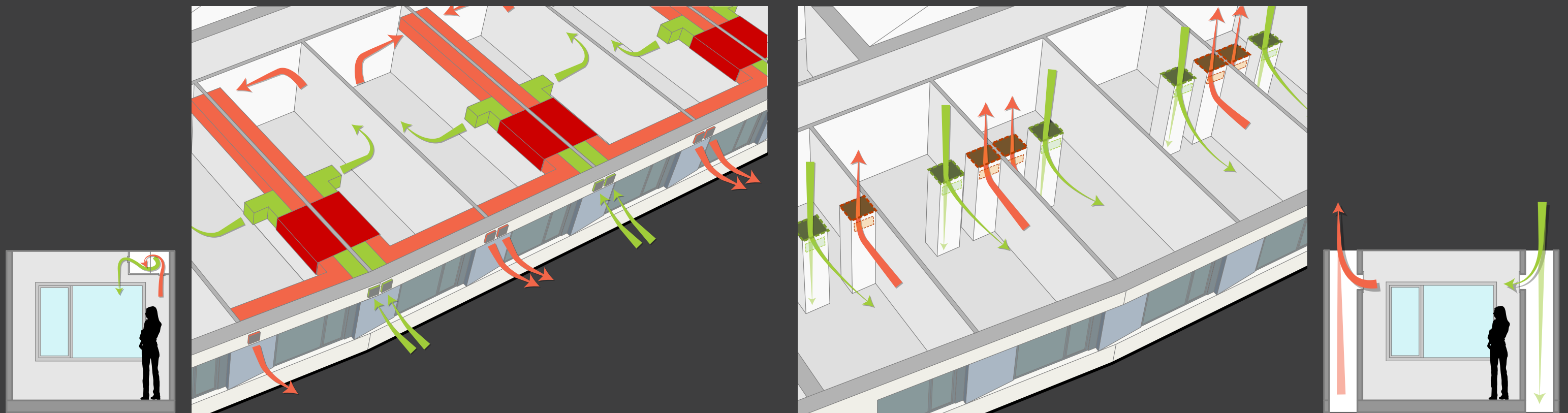
Grille Assembly



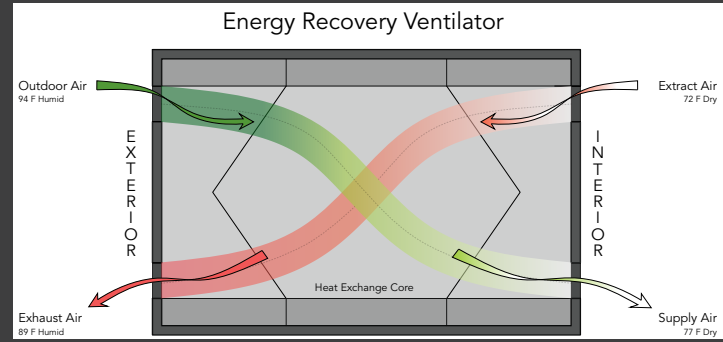


# UNITIZED VS. CENTRAL VENTILATION SYSTEMS

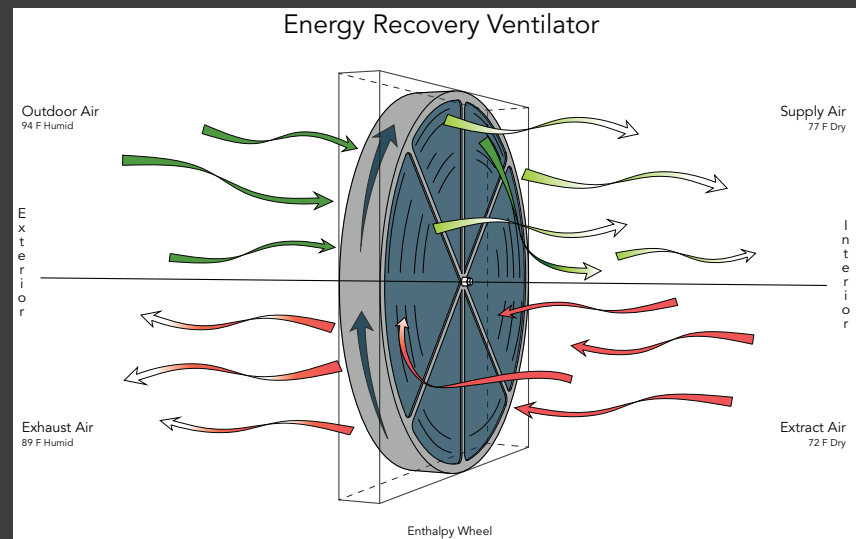
- Exhaust Air
- Fresh Air
- ERV



# VENTILATION SYSTEM



- ERV Unit to be air tight/Passive House Certified
  - Min 75% heat recovery efficiency
  - Include frost protection and humidity control
  - $\leq 35$  decibels
- Utilize constant air regulating dampers to balance supply/exhaust flows to within 10% of one another
- Provide Average of 0.35 air changes/hour
- Flow rates approved by EPA and LEED for Homes
- Provide boost flow for localized humidity or pollutants
- System on emergency generator to provide fresh air in emergencies
- Timed options acceptable



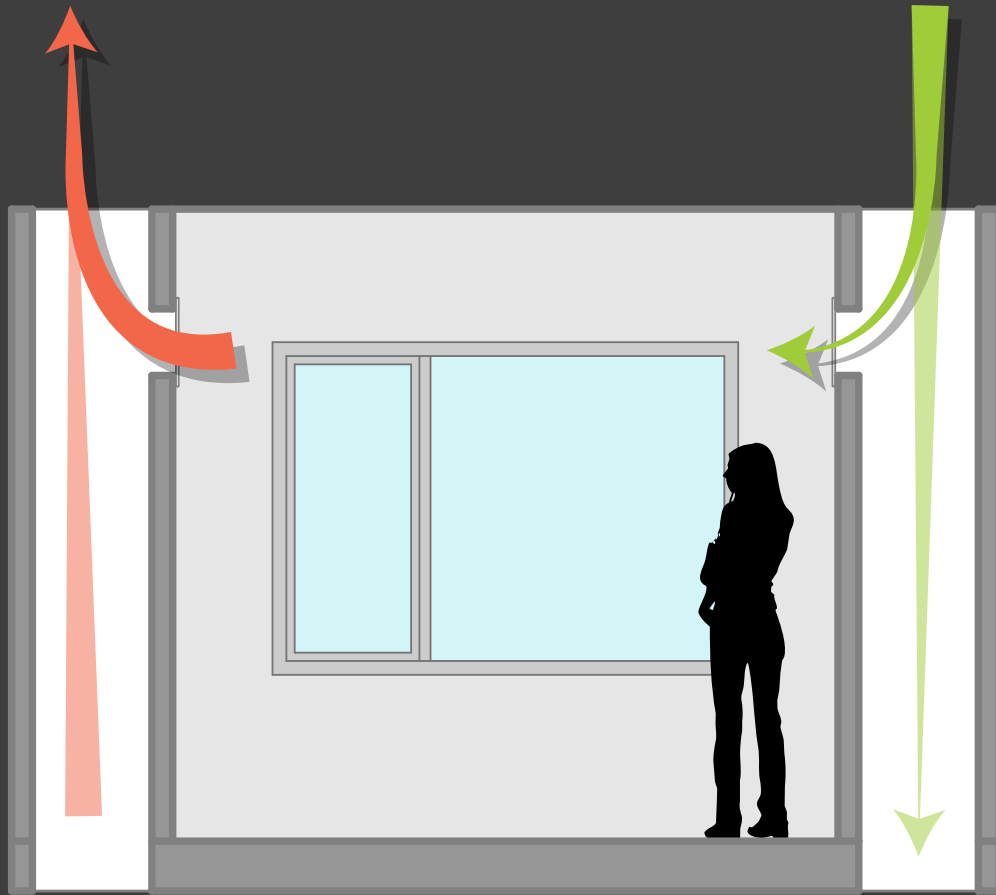
Energy Recovery  
Ventilation Unit (ERV)

Exhaust Air  
Fresh Air

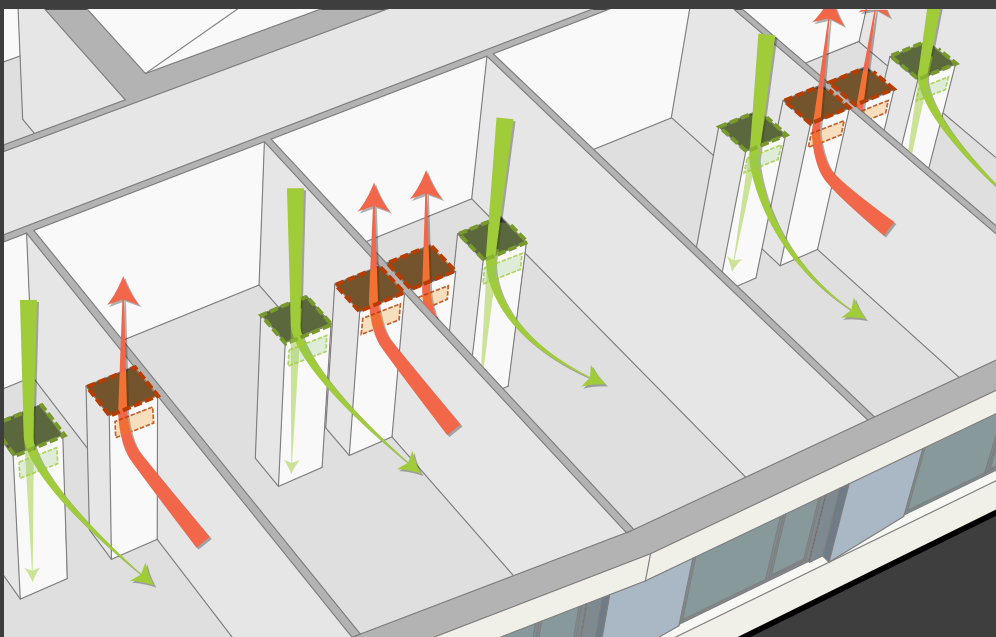




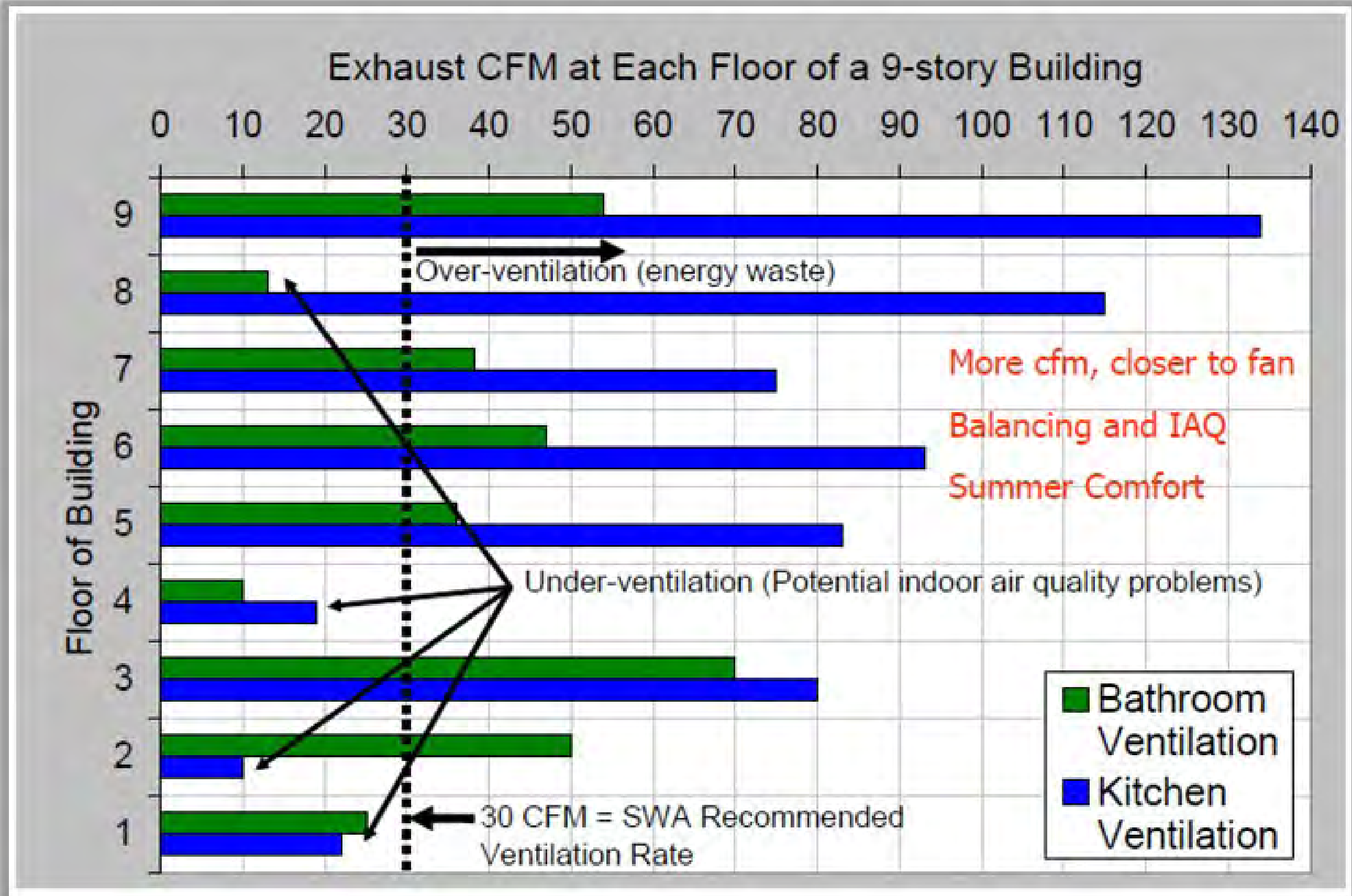
# VENTILATION SYSTEMS



- As the building gets bigger ventilation has a bigger impact on energy
- As apartment size decreases ACH increases
- Central systems are easier to maintain, but less able to deal with variability
- This project:
  - Uses continuous ventilation
    - Average of 0.35 ACH
    - Kitchenettes = 10 CFM
    - Baths = 25 CFM
    - Supply = 10-20 CFM
  - Flow rates approved by EPA and LEED for Homes
  - ERVs connected to emergency generator

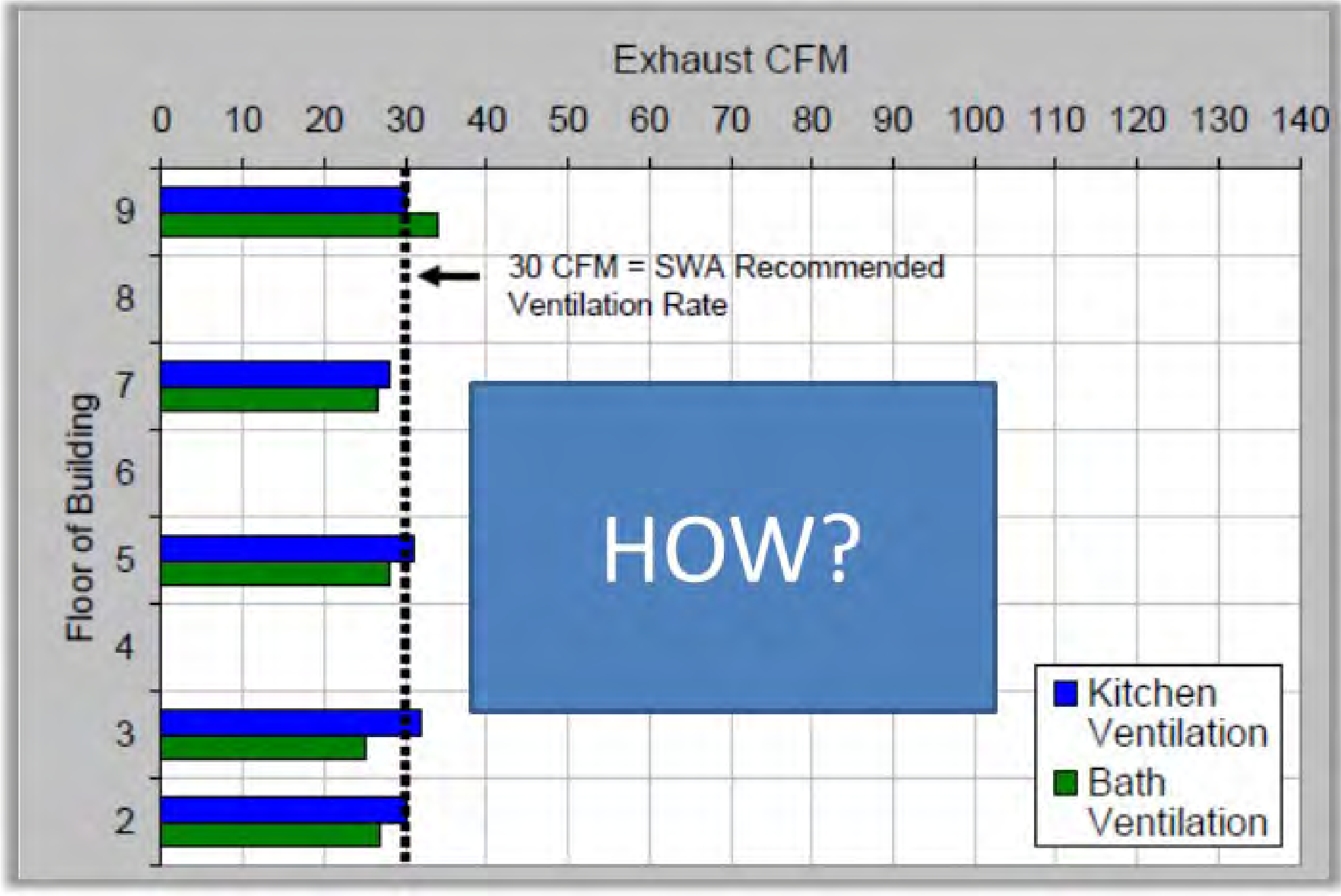


# TYPICAL OVER-VENTILATED MULTIFAMILY BUILDING





# SOLUTION: BALANCED SYSTEM WITH MINIMAL FLOW



# AIR SEALING - DUCT SEALING

## Certificate of Completion

### Overall Sealing Results

When we arrived,  
**YOUR DUCTS HAD:**

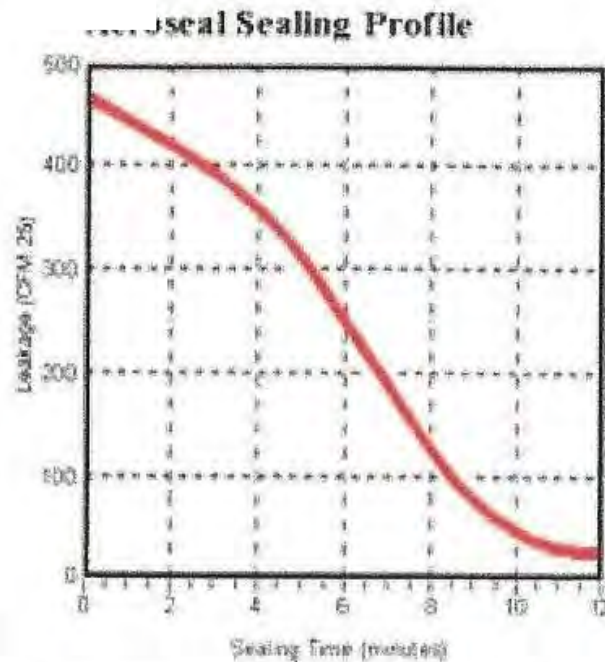
**471 CFM** of Leakage, equivalent to a  
**89.5 Square Inch Hole**

After we finished,  
**YOUR DUCTS HAVE:**

**36 CFM** of Leakage, equivalent to a  
**4.0 Square Inch Hole**

This corresponds to a **92% Reduction** in Duct Leakage.

Note: Duct leakage results are calculated in cubic feet per minute (CFM) measured at a standard reference pressure of 25 ps (0.15 in. water).



Your Heating and Cooling Capacity Improvement for Duct Sealing is **25%** based upon measured leakage reduction and original register flow

### Automatic Balancing Dampers:

- Provide restriction in size of opening (increase static pressure)
- Dynamically self-adjust to changes in the system (automatic balancing)

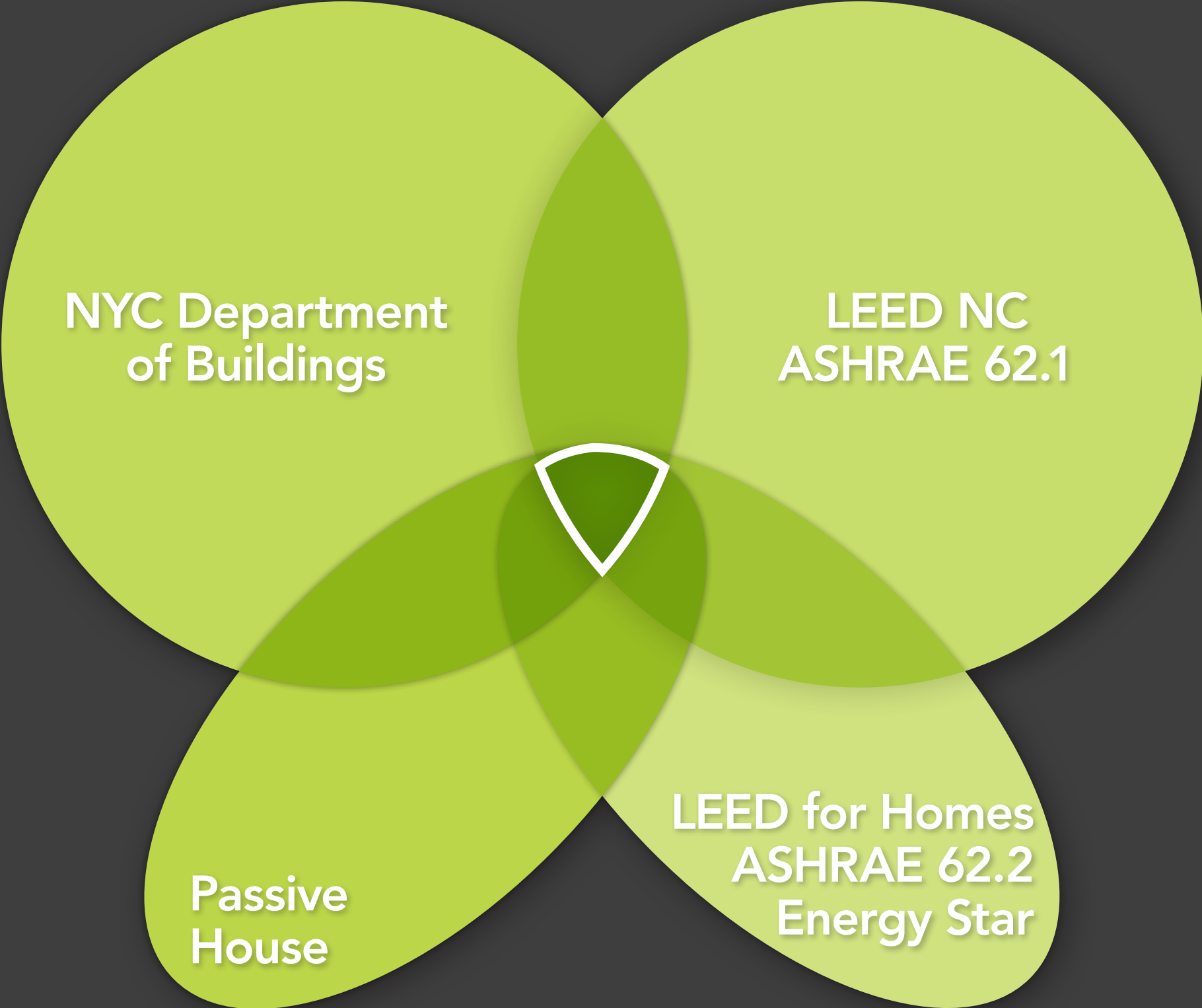
### Benefits:

- Improves comfort
- Improves indoor air quality
- Increases life span of HVAC units
- Save money
- Reduces noise
- Protect the environment





# OVERLAPPING OF CERTIFYING AGENCIES

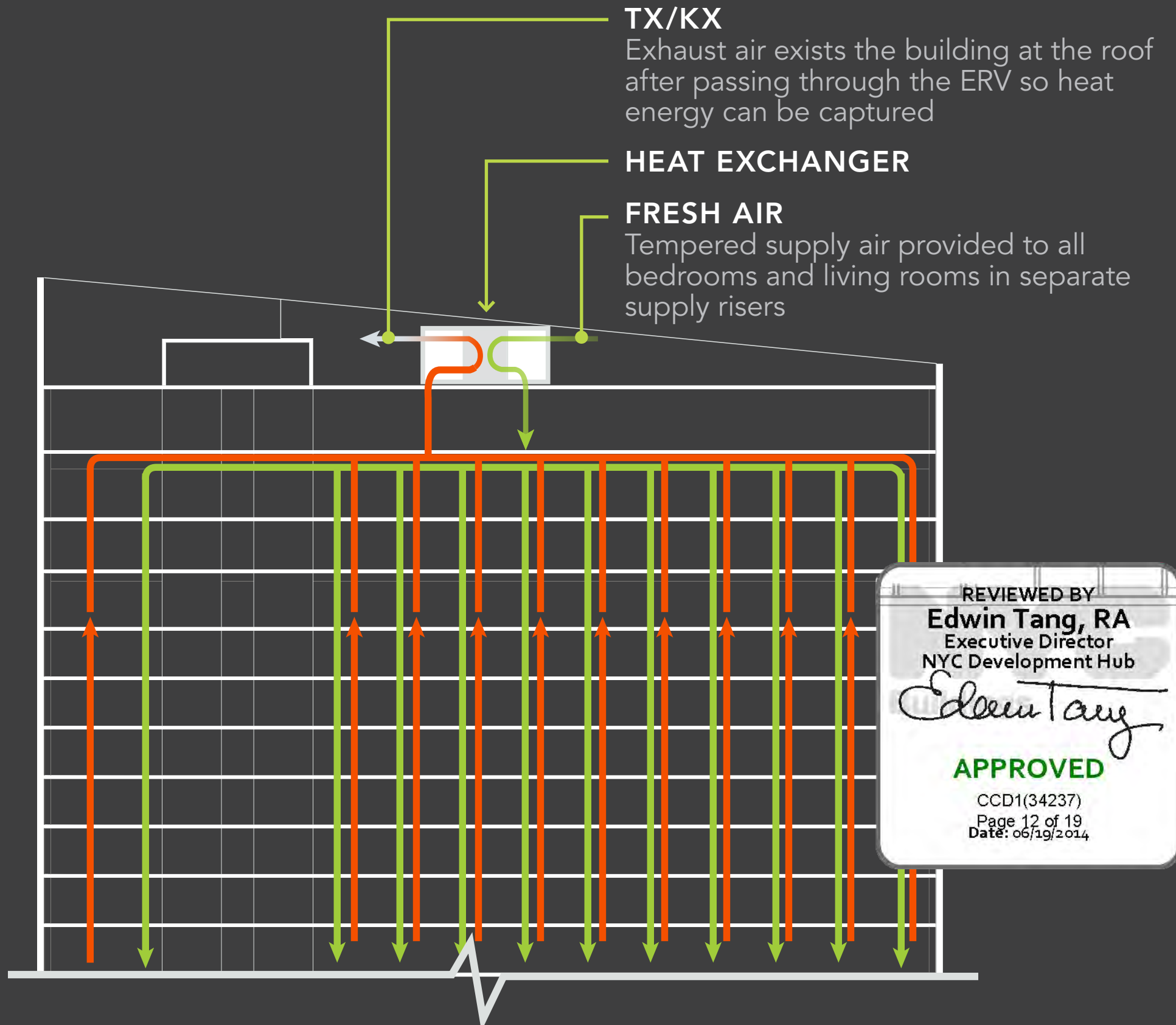


# CHANGE TO THE BUILDING CODE: MECHANICAL EXHAUST SYSTEM

- Permission by DOB to combine toilet and kitchen exhaust from multiple apartments in vertical shafts, which is not typically allowed by NYC code.
- Necessary for proper balancing and operation of ERV

Section of the Code:

501.5.1. Single or combined mechanical exhaust systems from bath, toilet, urinal, locker, service sink closets and similar rooms shall be independent of all other exhaust systems, except as permitted in Section 401.5.2.



REVIEWED BY  
**Edwin Tang, RA**  
Executive Director  
NYC Development Hub

*Edwin Tang*

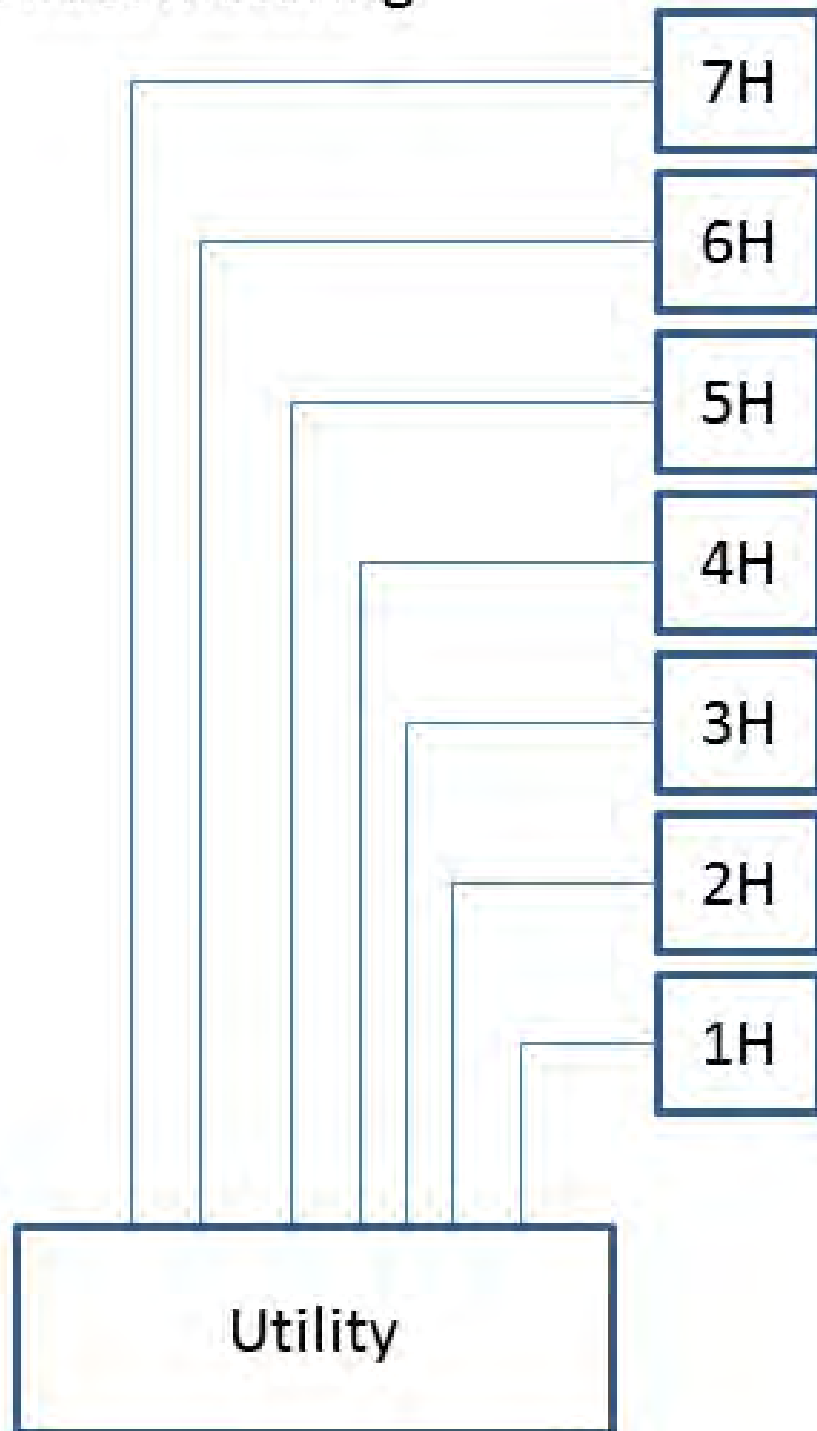
**APPROVED**

CCD1(34237)  
Page 12 of 19  
Date: 06/19/2014

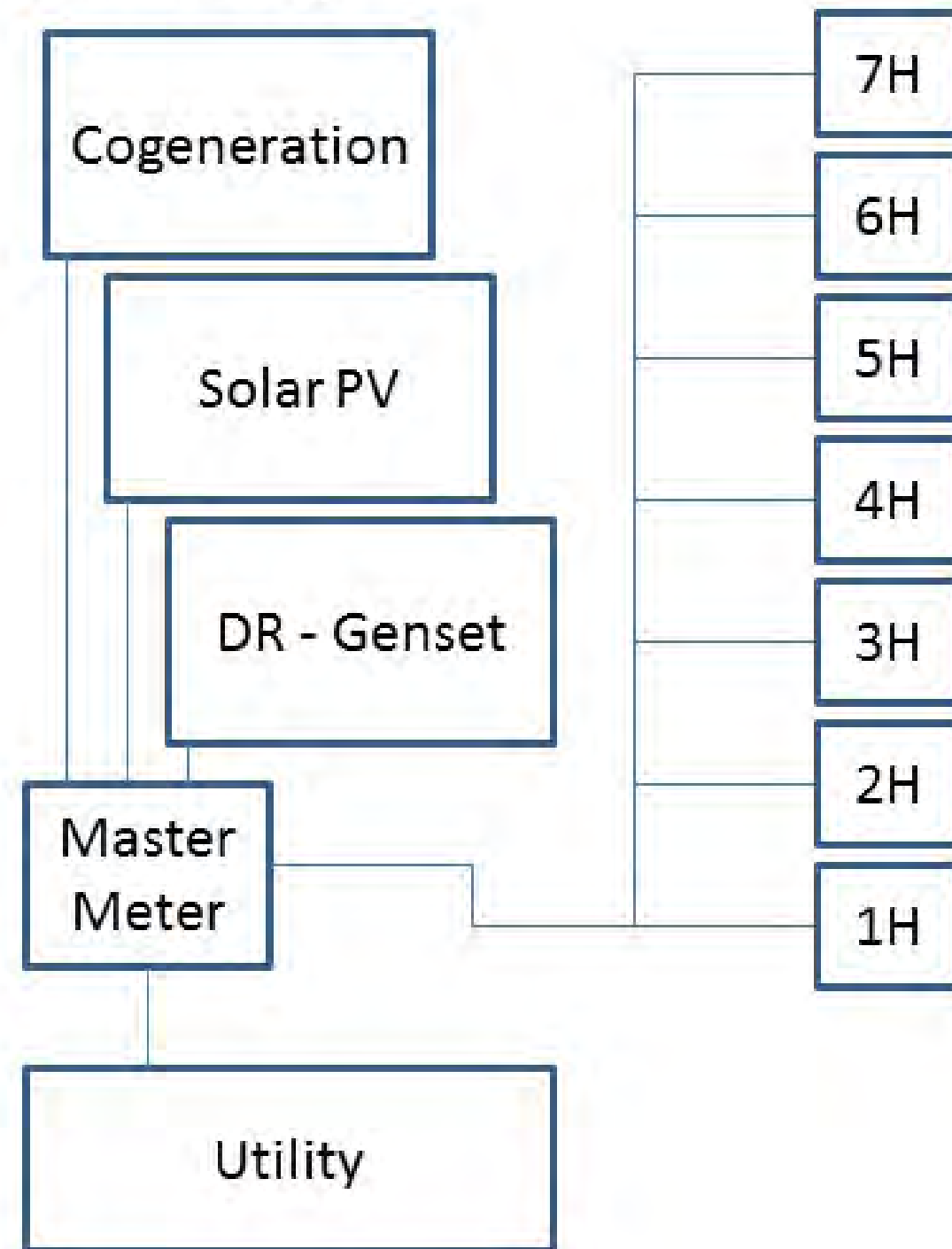


# ELECTRIC SUBMETERING

Direct metering



Submetering



# RESIDENT INTEGRATION AND UTILITY TRANSPARENCY



We Offer an Entire Suite of Advanced, Enterprise-Class Solutions

Proprietary & Confidential



Visibility  
& Reporting



Utility Bill  
Management



Measurement &  
Verification



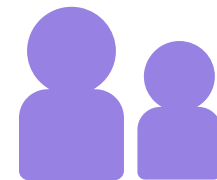
Budgeting &  
Planning



Building Efficiency



Benchmarking



Occupant  
Engagement

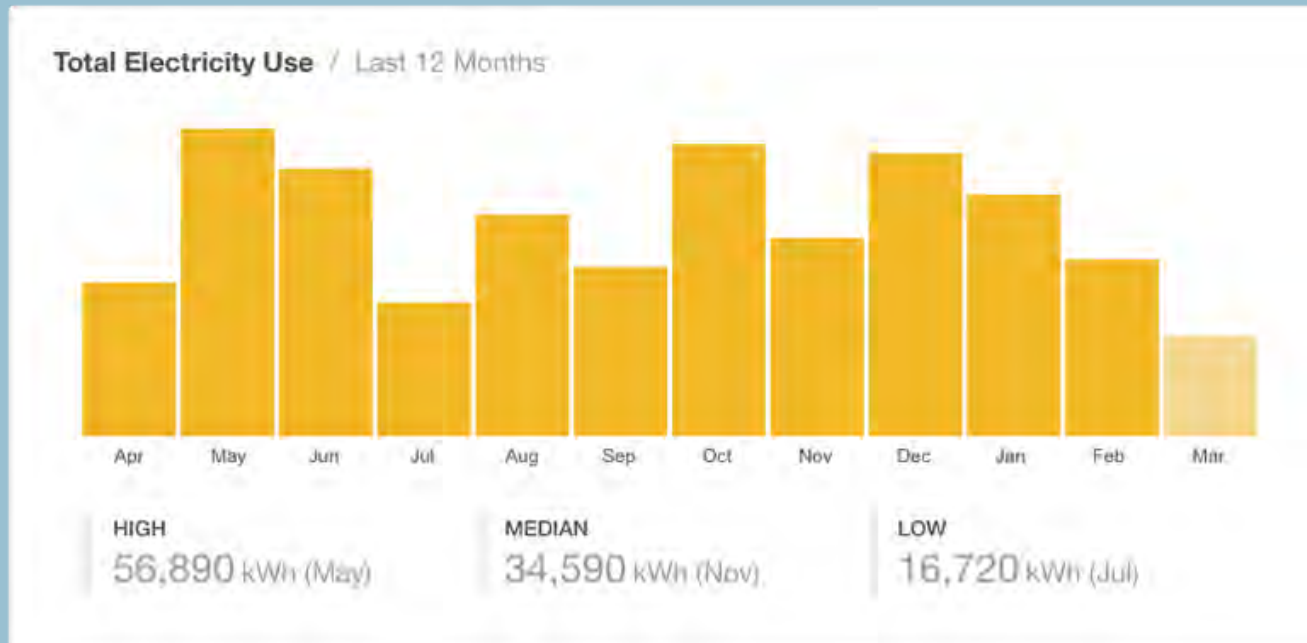
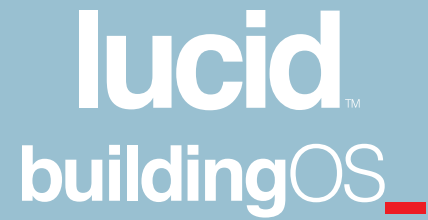


Tenant  
Billing

**buildingOS**



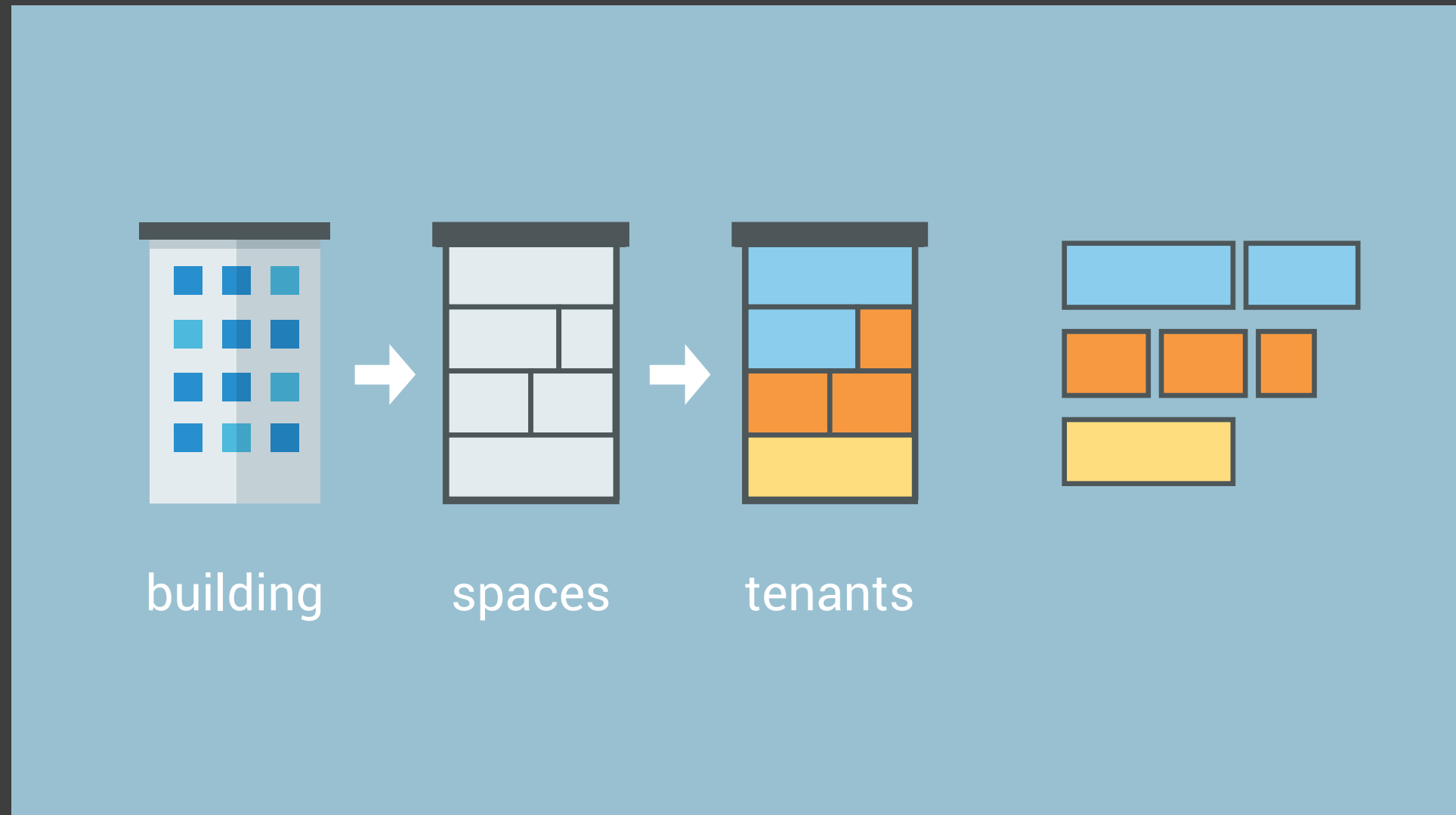
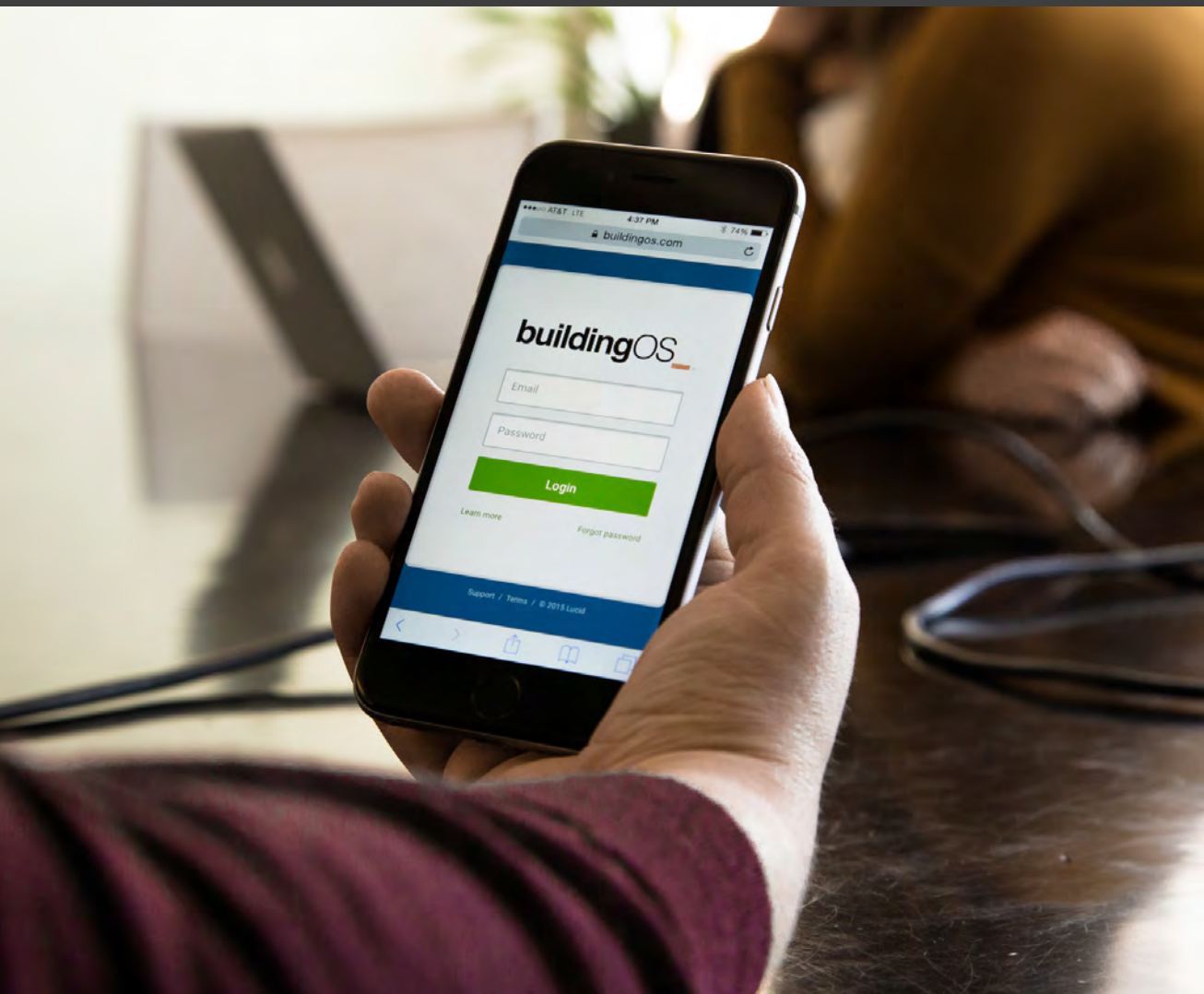
# RESIDENT INTEGRATION AND UTILITY TRANSPARENCY



### Summary / 2015

- TOTAL UTILITY COSTS**  
\$125,780
- TOTAL ELECTRICITY USE**  
361,800 kWh
- TOTAL WATER USE**  
267,350 gallons
- TOTAL SOLAR PV PRODUCTION**  
35,710 kWh
- TOTAL CO2 EMISSIONS**  
160,140 lbs CO<sub>2</sub>

# RESIDENT INTEGRATION AND UTILITY TRANSPARENCY





# PASSIVE HOUSE MODEL REQUIREMENTS MET

## Cornell

Specific building demands with reference to the treated floor area

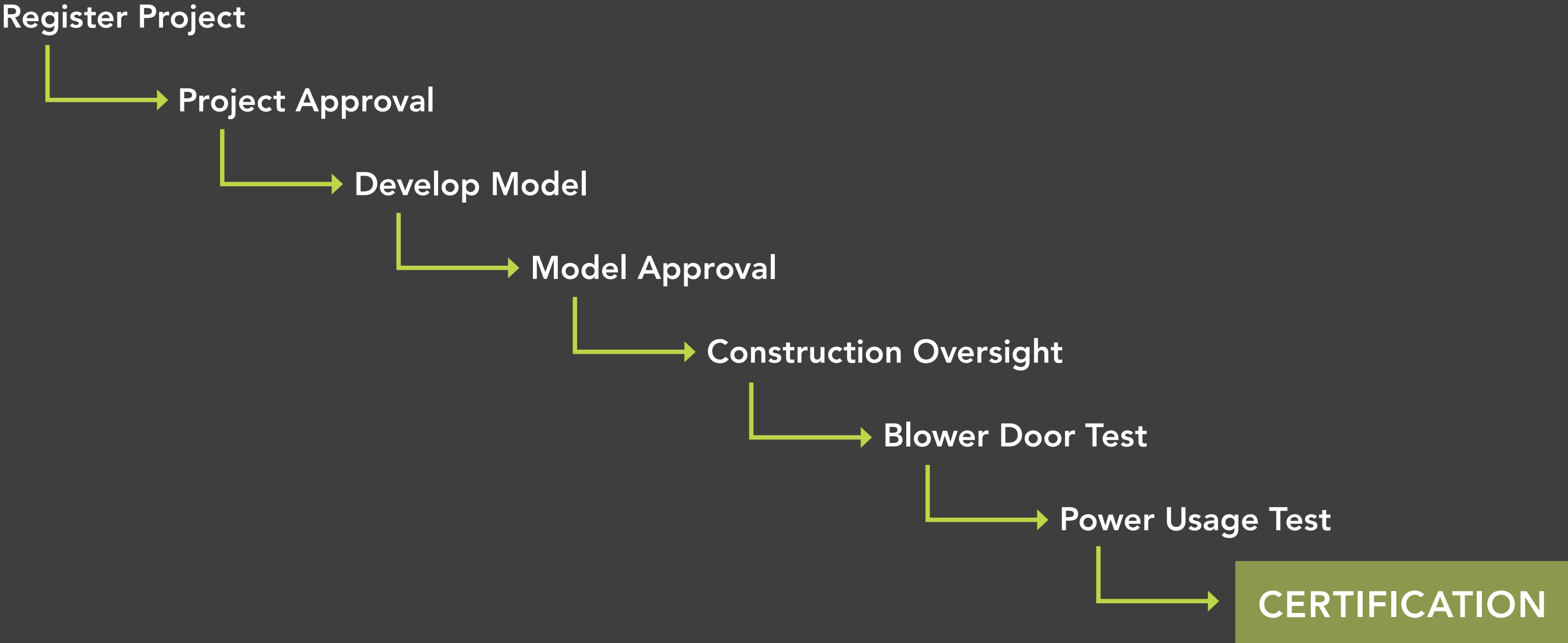
	Treated floor area	189012 ft <sup>2</sup>		Requirements	Fulfilled?*
<b>Space heating</b>	Heating demand	3.69 kBTU/(ft <sup>2</sup> yr)	78% of	4.75 kBTU/(ft <sup>2</sup> yr)	yes
	Heating load	4.13 BTU/(hr.ft <sup>2</sup> )	130% of	3.17 BTU/(hr.ft <sup>2</sup> )	-
<b>Space cooling</b>	Overall specif. space cooling demand	4.87 kBTU/(ft <sup>2</sup> yr)	90% of	5.39 kBTU/(ft <sup>2</sup> yr)	yes
	Cooling load	2.97 BTU/(hr.ft <sup>2</sup> )		-	-
	Frequency of overheating (> 77 °F)	%		-	-
<b>Primary energy</b>	Heating, cooling, dehumidification, DHW, auxiliary electricity, lighting, electrical appliances	37.4 kBTU/(ft <sup>2</sup> yr)	98% of	38.0 kBTU/(ft <sup>2</sup> yr)	yes
	DHW, space heating and auxiliary electricity	15.9 kBTU/(ft <sup>2</sup> yr)		-	-
	Specific primary energy reduction through solar electricity	kBTU/(ft <sup>2</sup> yr)		-	-
<b>Airtightness</b>	Pressurization test result n <sub>50</sub>	0.6 1/h		0.6 1/h	yes

\* empty field: data missing; '-': no requirement

Passive House?

yes

# TIMELINE TO CERTIFICATION















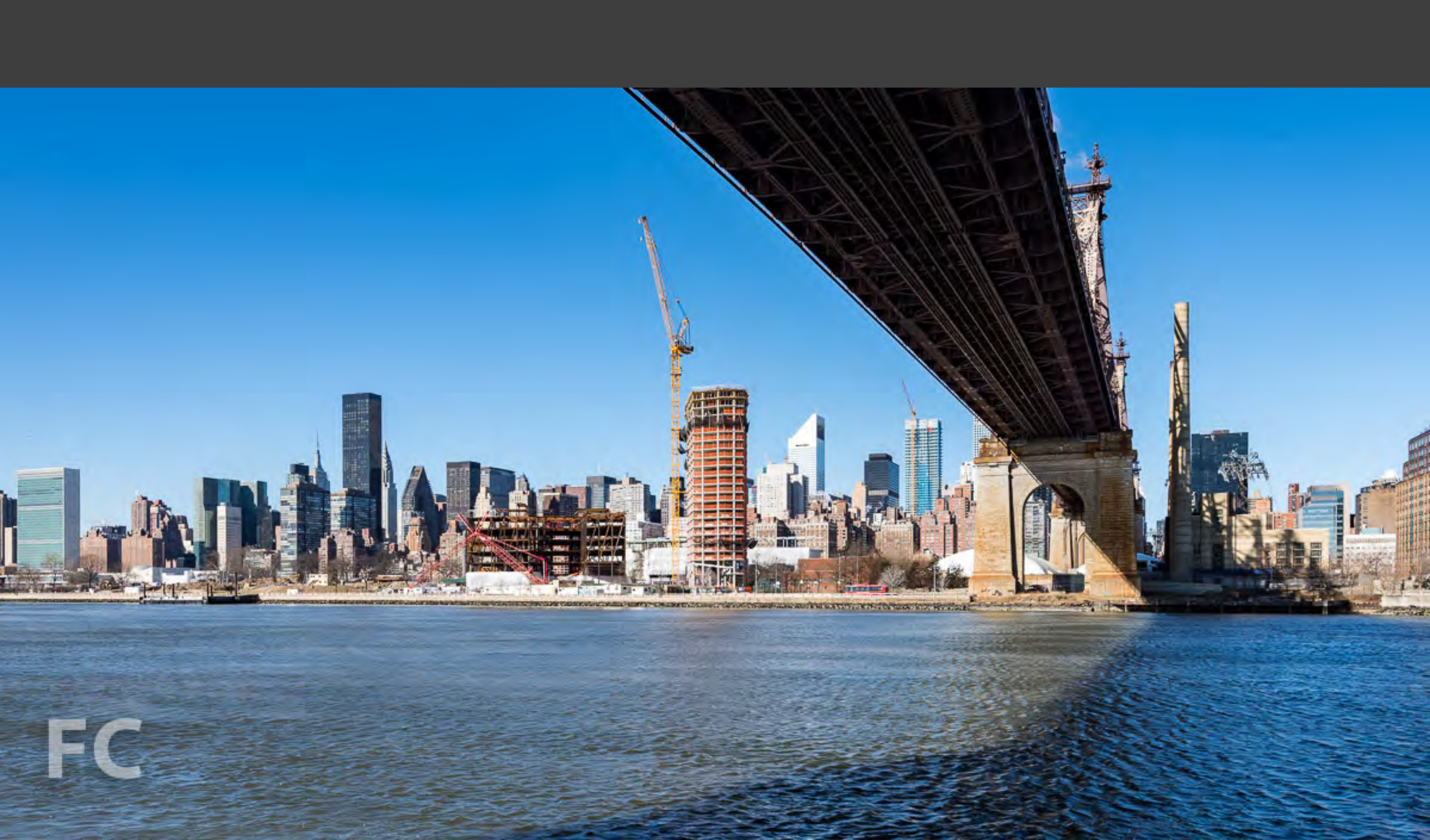












FC







THANK YOU

