Construction Manager/ Subcontractor/Tradesperson Training Session 3: **QA/QC Techniques for Ensuring Success**

Since 1972, Steven Winter Associates, Inc. has been providing research, consulting, and advisory services to improve the built environment for private and public sector clients.

Our services include:

- Energy Conservation and Management
- Sustainability Consulting
- Green Building Certification
- Accessibility Consulting

We have over 125 staff across three office locations:
New York, NY | Washington, DC | Norwalk, CT

For more information, visit
www.swinter.com

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Upon Completion of Module

You will receive the following items via email:

- AIA Certificate of completion-can also be used for:
  - NYS PE CEUs
- PDF of final presentation
- Link to the webinar recording

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

Provider #: J827

CONTINUING EDUCATION AIA

CERTIFICATE OF COMPLETION

THIS CERTIFICATE IS TO CERTIFY THAT
Katie Zoppo

PARTICIPATED IN
Module 1: Overview of PH/Net Zero Building Concepts, Techniques and Benefits

COURSE NUMBER
M1OOPHNZBCTAB

ON
February 11th, 2020

LOCATION
New Paltz, NY

EARNING
4 AIA CES Learning Unit/HSW

Lois B. Arena, PE
Director, Passive House Services
Steven Winter Associates, Inc.

Steven Winter Associates, Inc.
61 Washington Street
Norwalk, CT 06854
203.857.0200
larena@swinter.com

Learning Objectives

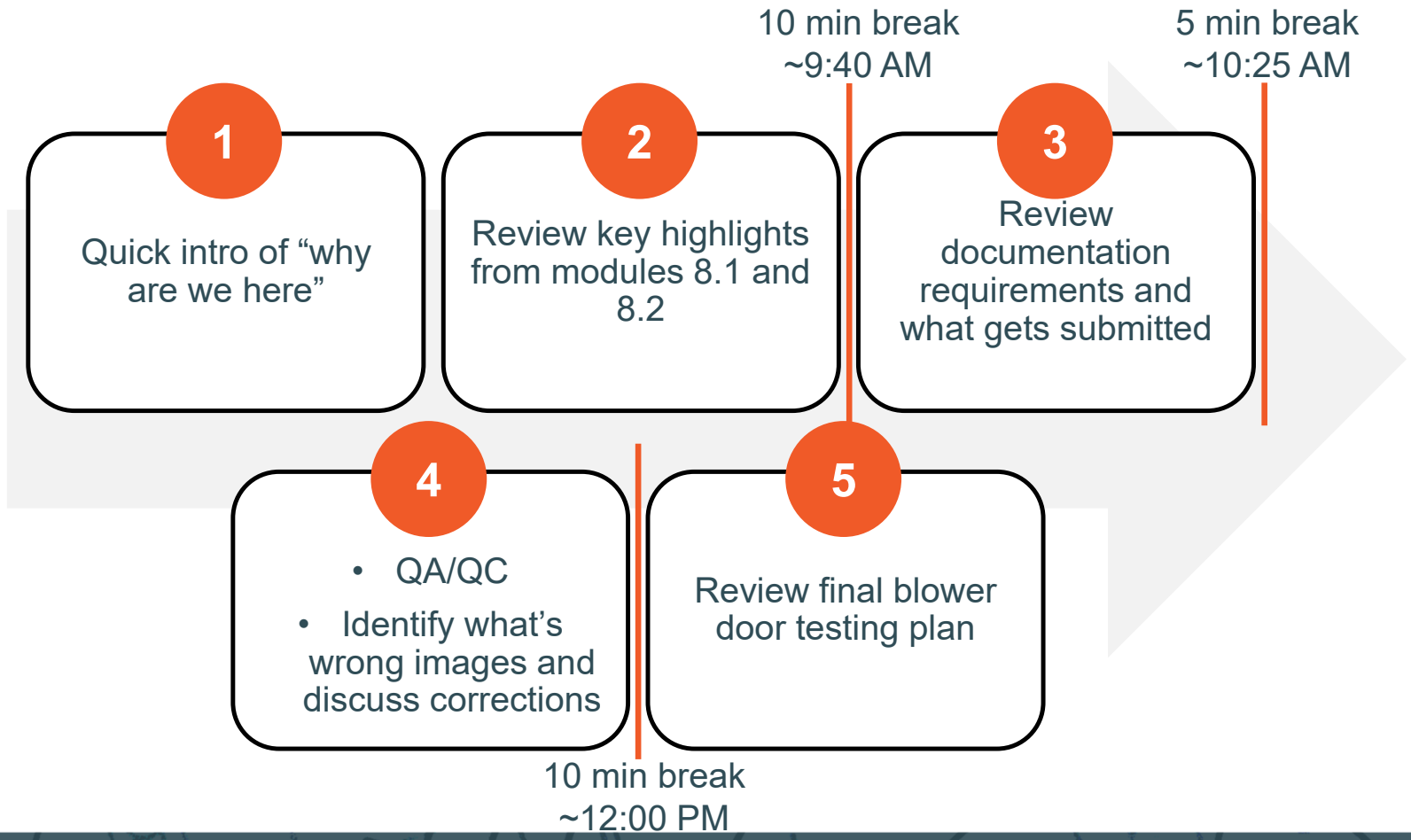
Understand net zero carbon goals for SUNY

Review key important concepts from modules 8.1 & 8.2

Examine suggested processes for project success

Look at issues, how to correct, & tracking corrections

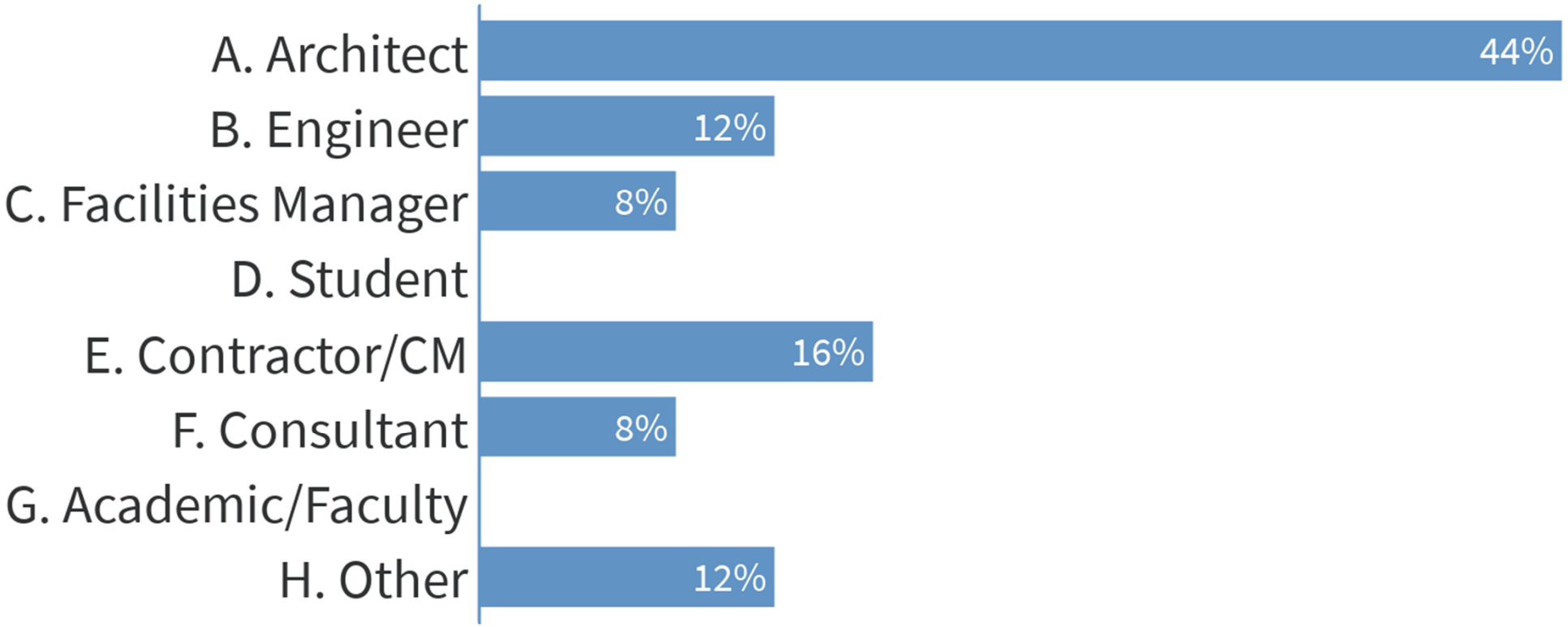
Overview of Presentation



When poll is active, respond at **PollEv.com/swa335**

Text **SWA335** to **22333** once to join

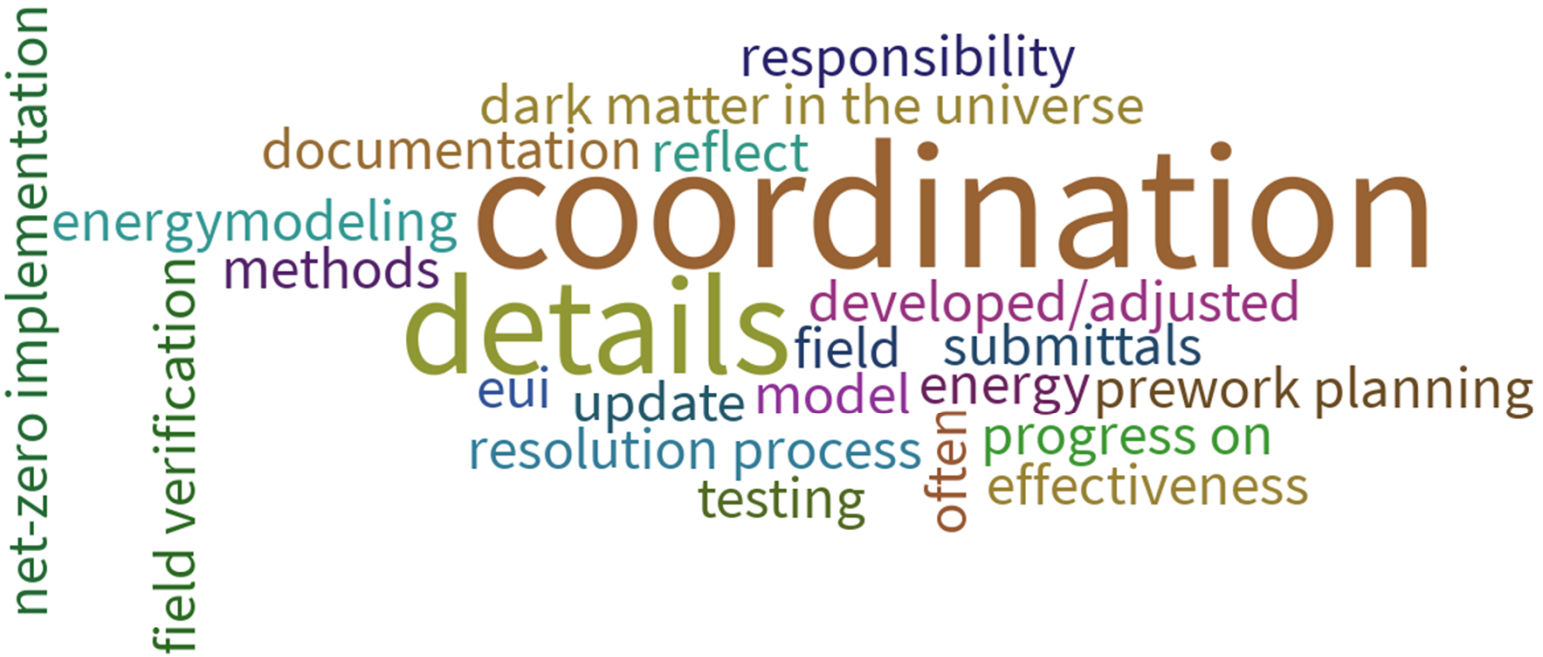
What is your profession?



When poll is active, respond at **PollEv.com/swa335**

Text **SWA335** to **22333** once to join

What is the one thing you were hoping to learn about today?



Coykendall Science Building

Why we are here: **Directive 1B-2**

- 2018 Chancellor calls for all new buildings to be zero-net-carbon & deep energy retrofits for existing buildings
- 2018 SUCF issued Directive 1B-2
  - Purpose: define and identify goals for Net Zero Carbon (NZC) new buildings and Deep Energy Retrofits (DER) of existing buildings.
  - Function: outlines the project target goals and provides direction for project designs.
  - Metrics: Site Energy as the measure of performance and energy consumption.

Why we are here: **Directive 1B-2**

- Design and construct highly energy efficient buildings which significantly reduce energy consumed below an energy code standard for new buildings or energy usage for an existing building.
- In the case of insufficient project funding, the design goal will be to design the building as NZC “capable” where: the design achieves the energy use intensity (EUI) limit using HVAC equipment and systems that can be electrically powered from renewable energy sources.

New Building Performance goals:
Site Energy Use Intensity (EUI) limits

Classroom building	50 kBTU/ft2/year
Office building	50 kBTU/ft2/year
Laboratory building	150 kBTU/ft2/year
Residence Hall	32 kBTU/ft2/year

These **Trainings**

- **Module 1:** Overview of PH and Net Zero
- **Module 2:** Construction Methods and High-Performance Products and Details
- **Module 3:** Air Barrier Development & Implementation
- **Module 4:** Net Zero HVAC Strategies and Controls + DHW
- **Module 5:** Construction Documents and Bidding
- **Module 6:** Deep Energy Retrofits
- **Module 7:** Refrigerant Management in Design, Construction, and Operations
- **Module 8.1:** Building Envelope
- **Module 8.2:** Net Zero Mechanical, Electrical, and Plumbing
- **Module 8.3:** QA/QC Techniques for Ensuring Success
- **Module 8.4:** Field Training & Mock-Up

Clarifications

We may use Passive House and Net-Zero interchangeably

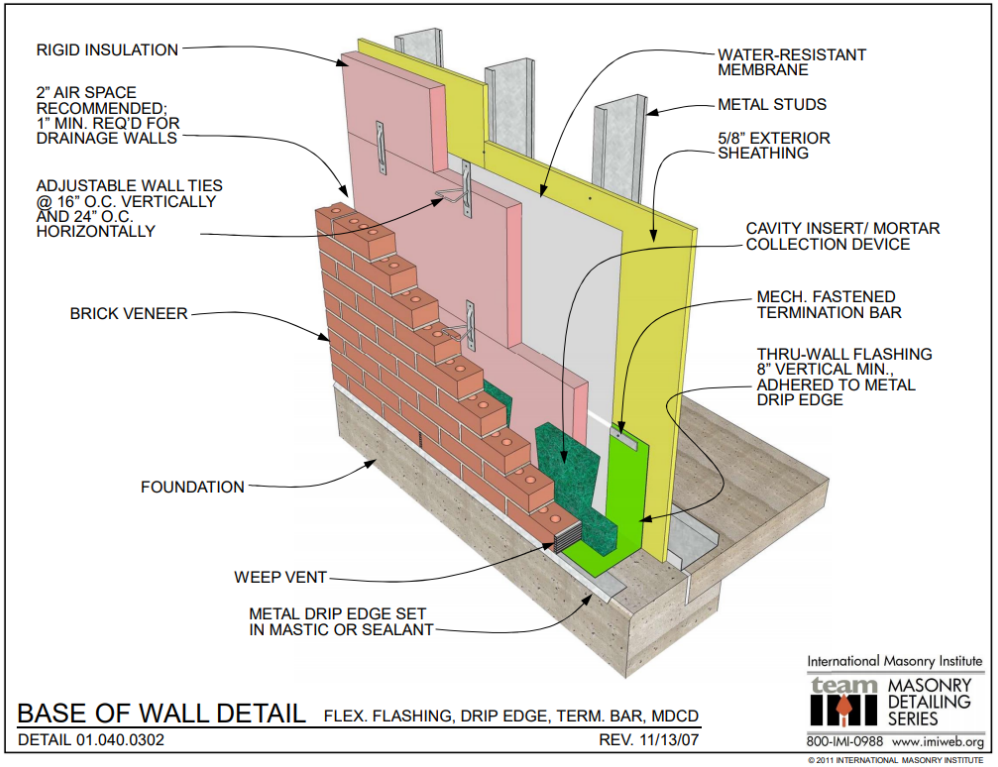
Passive House principles are a great pathway to achieving Net-Zero

Questions?

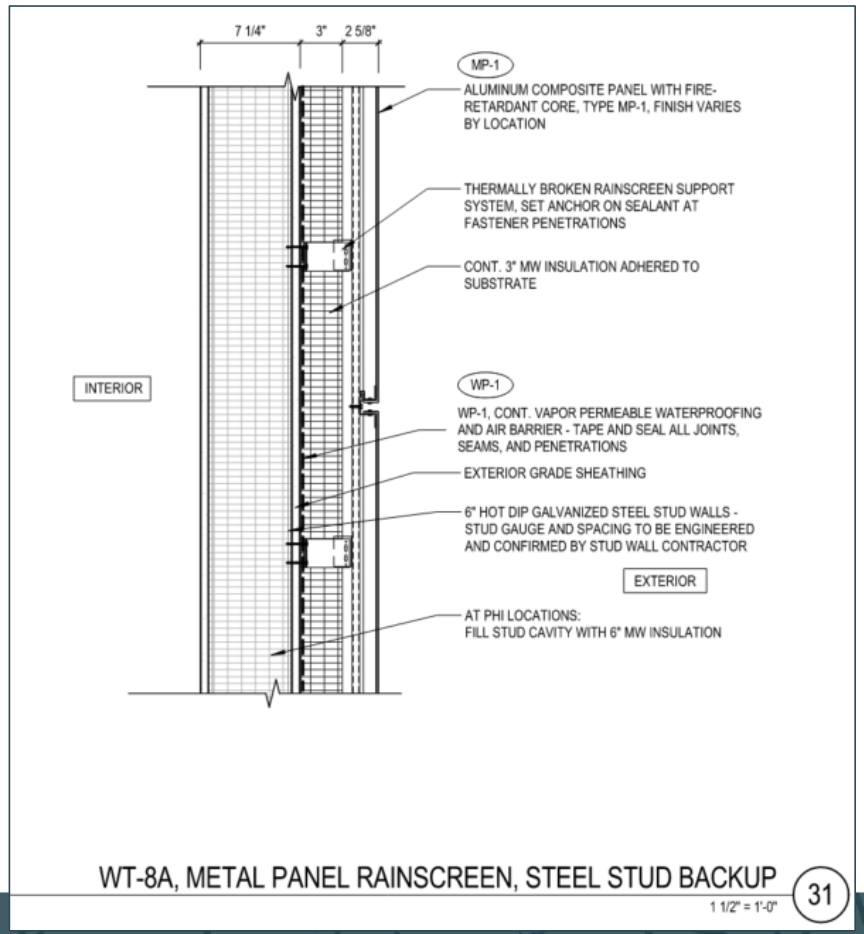
Modules 8.1 and 8.2 Highlights Review

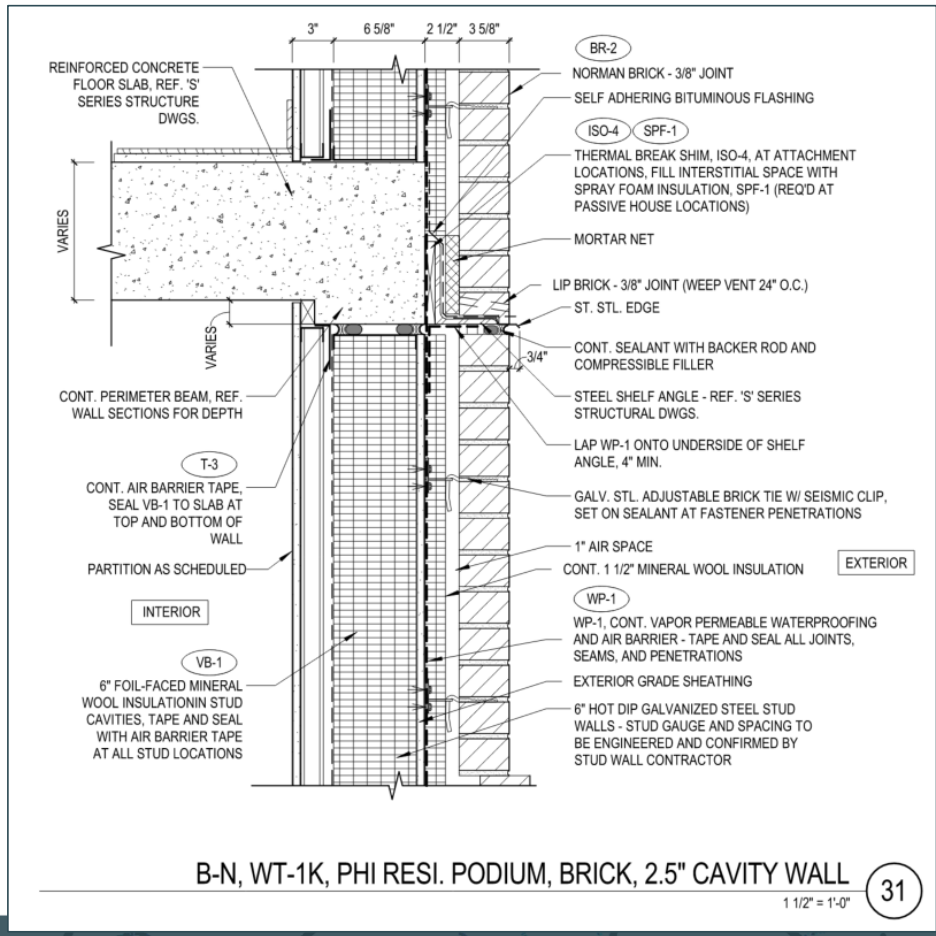
Typical Construction Types – **Steel Studs**

- Despite steel studs thermally conductive properties, they are still used on some high-performance buildings
- Steel studs are a back up wall alternative to CMU in large buildings
- It is possible to reach Passive House insulation levels with steel studs



Typical Construction Types – **Steel Studs**

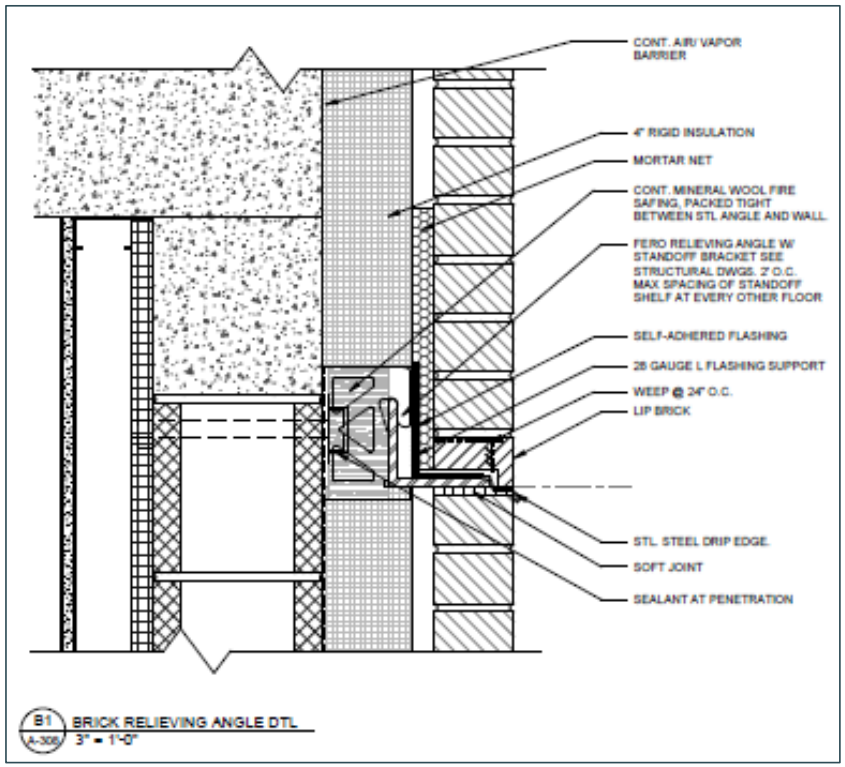


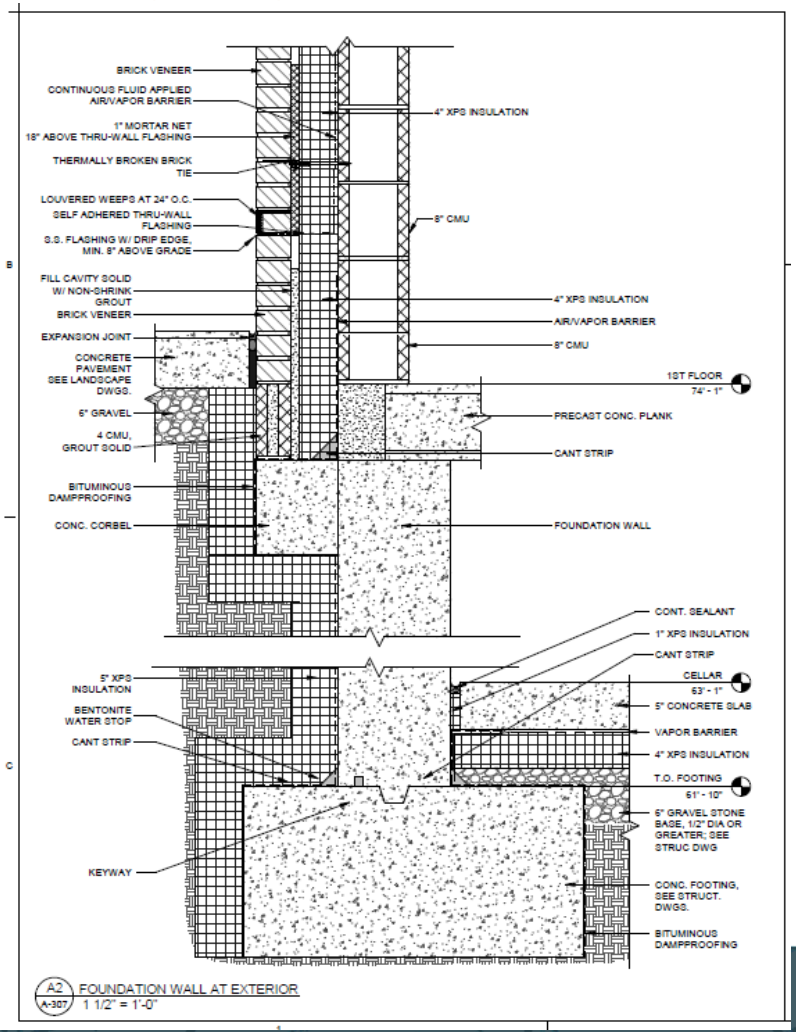


Typical Construction Types – **Steel Studs**

- Steel studs
- Exterior grade gypsum
- Fluid applied air barrier
- Sheet applied air barrier
- Exterior insulation
- Assumed finish of brick and EIFS
- PTACs

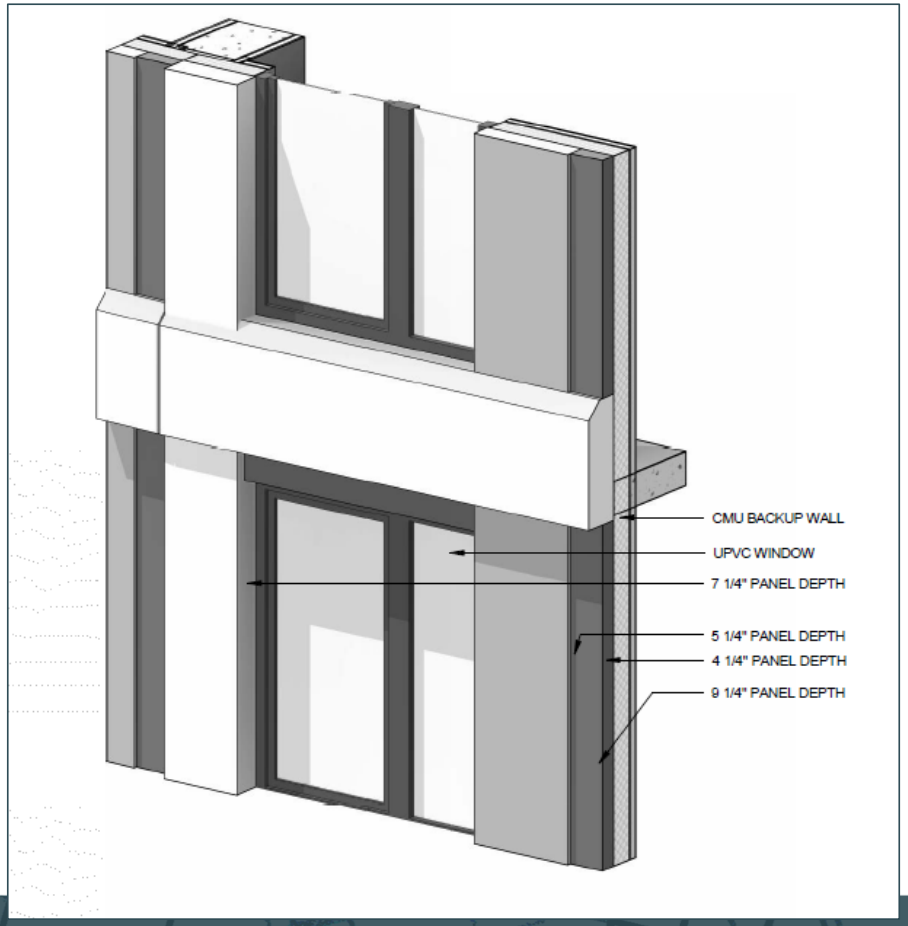
Typical Construction Types – **CMU**

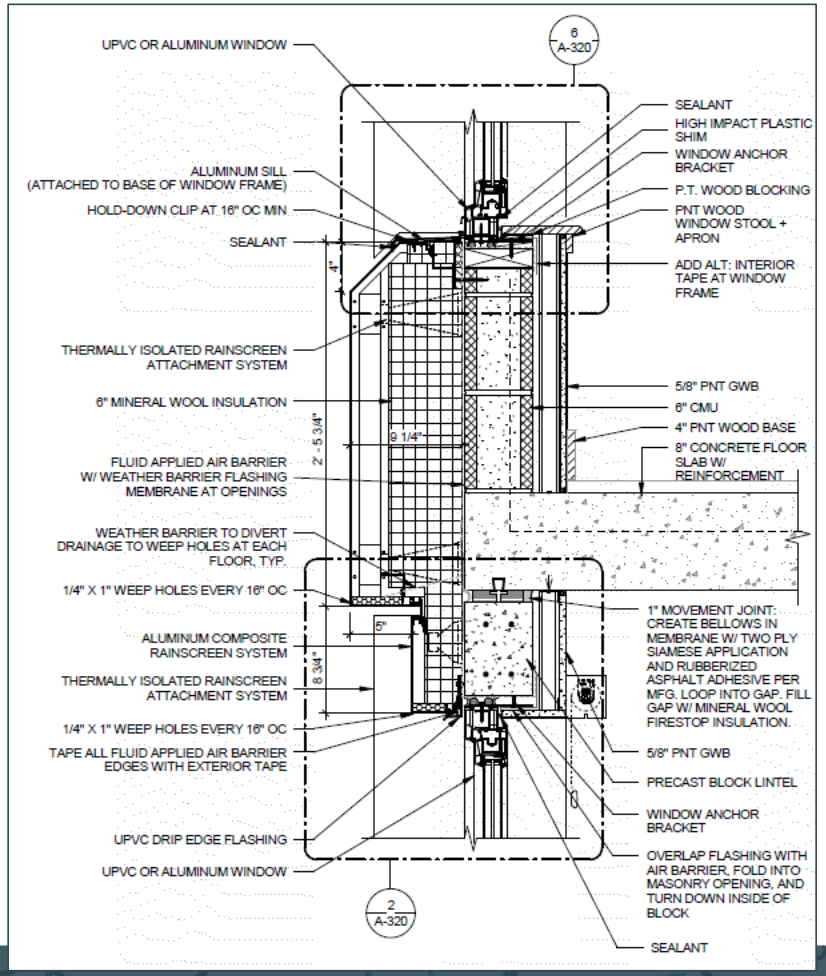




Typical Construction Types – **CMU**

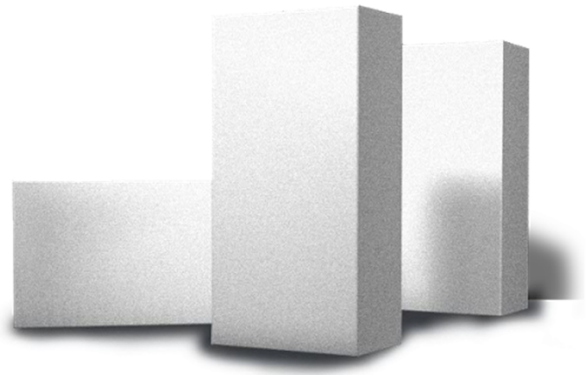
Typical Construction Types – **CMU**





Not So Typical Construction Type – **AAC Block**

- Autoclaved aerated concrete (AAC): a lightweight, precast, foam concrete building material suitable for producing concrete masonry unit (CMU) like blocks.
  - Composition: quartz sand, calcined gypsum, lime, cement, water and aluminum powder, cured under heat and pressure

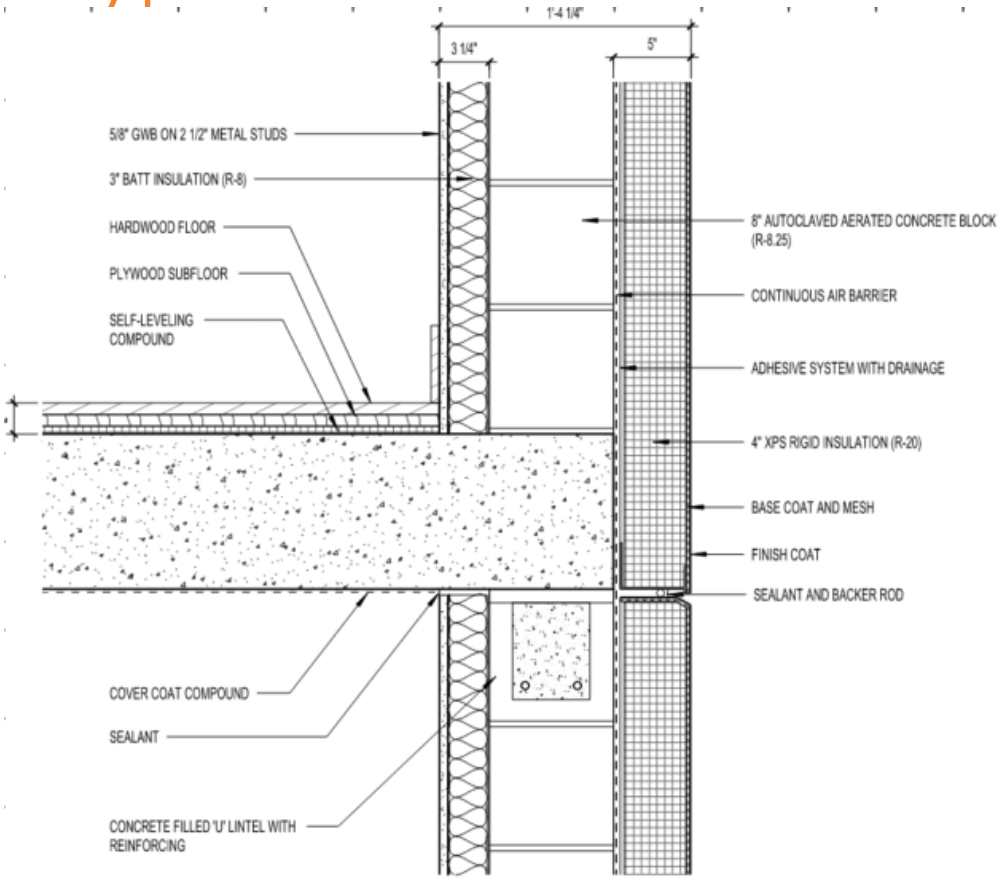


Not So Typical Construction Type – **AAC Block**

- **AAC Benefits** (to name a few)
  - Workable with hand tools, lightweight, fireproof, thermal insulation, less portland cement, noise reduction, moisture regulation

  AAC + PH = ✓
- **AAC Blocks** – Made by YTONG, Aercon Florida, etc

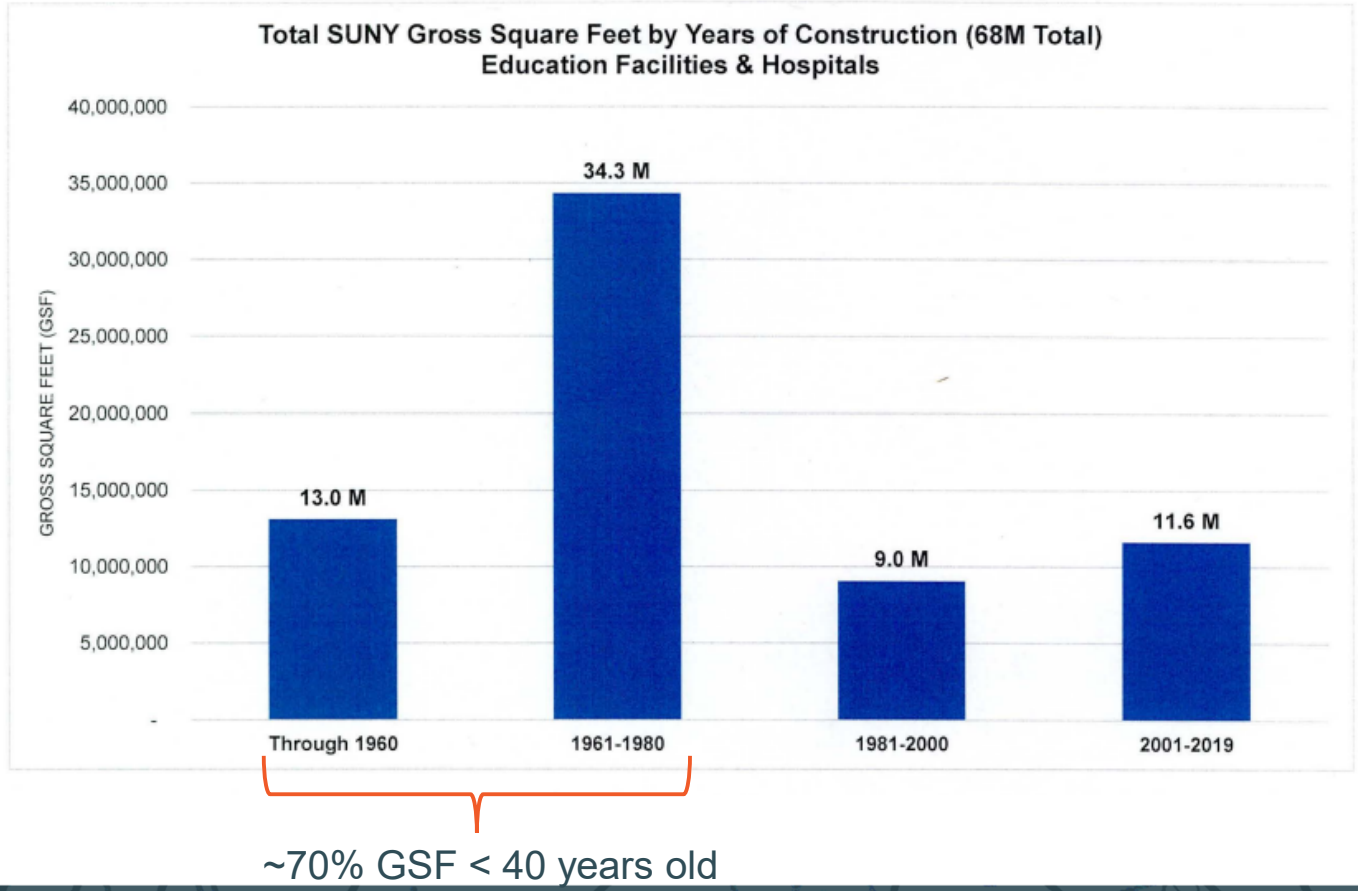
Not So Typical Construction Types – **AAC Block**



TYPICAL WALL SECTION WITH EIFS | 2 | A-420.00
1 1/2" = 1'-0"

Existing Buildings – Renovations and Retrofits

Existing buildings present a large opportunity to incorporate net-zero features in pending renovations and retrofits.



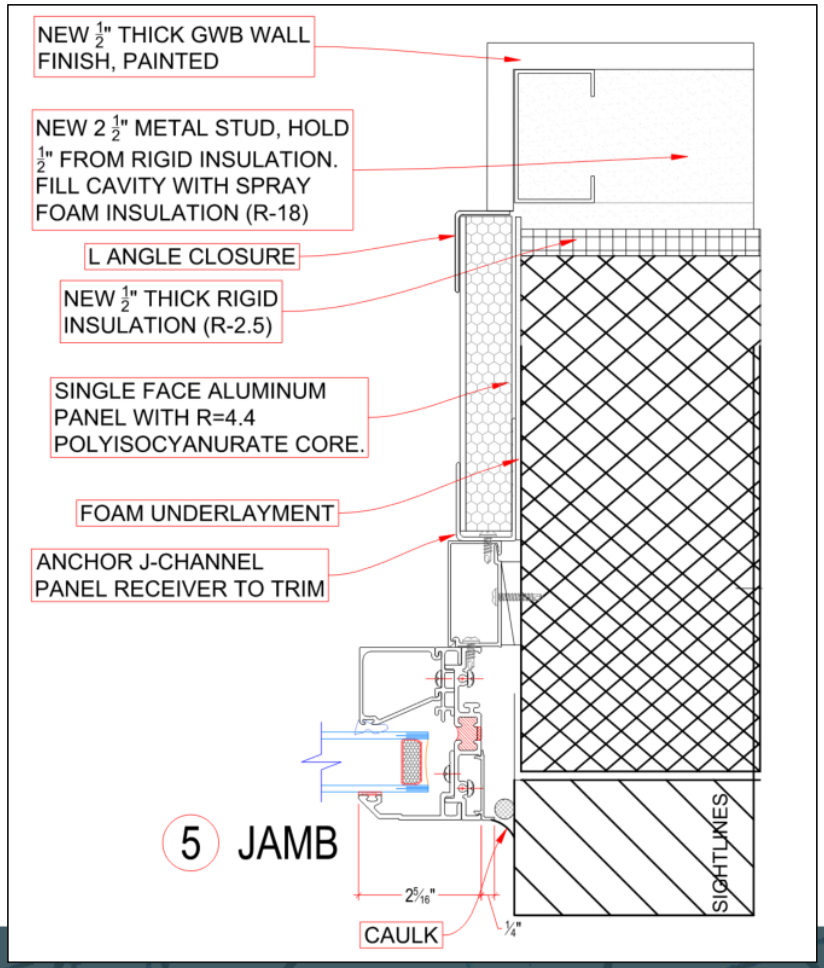
Existing Buildings

- Maintaining an airtight and well insulated building envelope is very challenging in existing structures
- Typically, interior application of both insulation and air barrier is required to preserve historic nature of the building

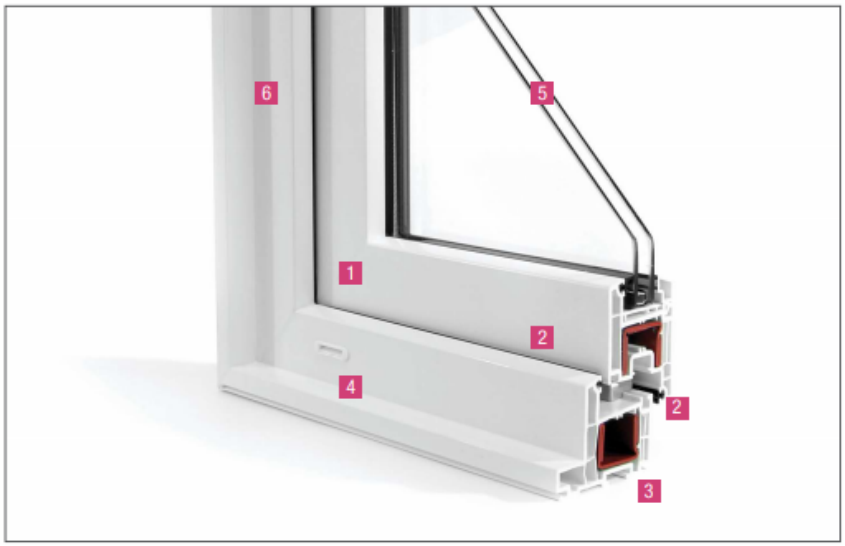
https://passivehouseplus.ie/magazine/insight/energiesprong

Existing Buildings – **The Good**

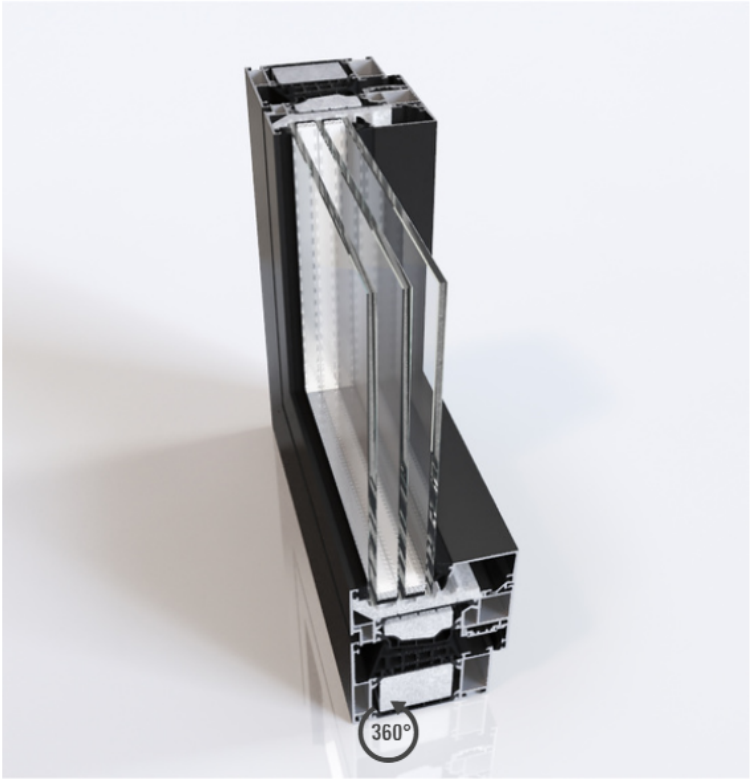
- Interior spray foam is a viable solution for insulating and air sealing from the interior
- Different iterations of shop drawings through out the design and implementation of this strategy



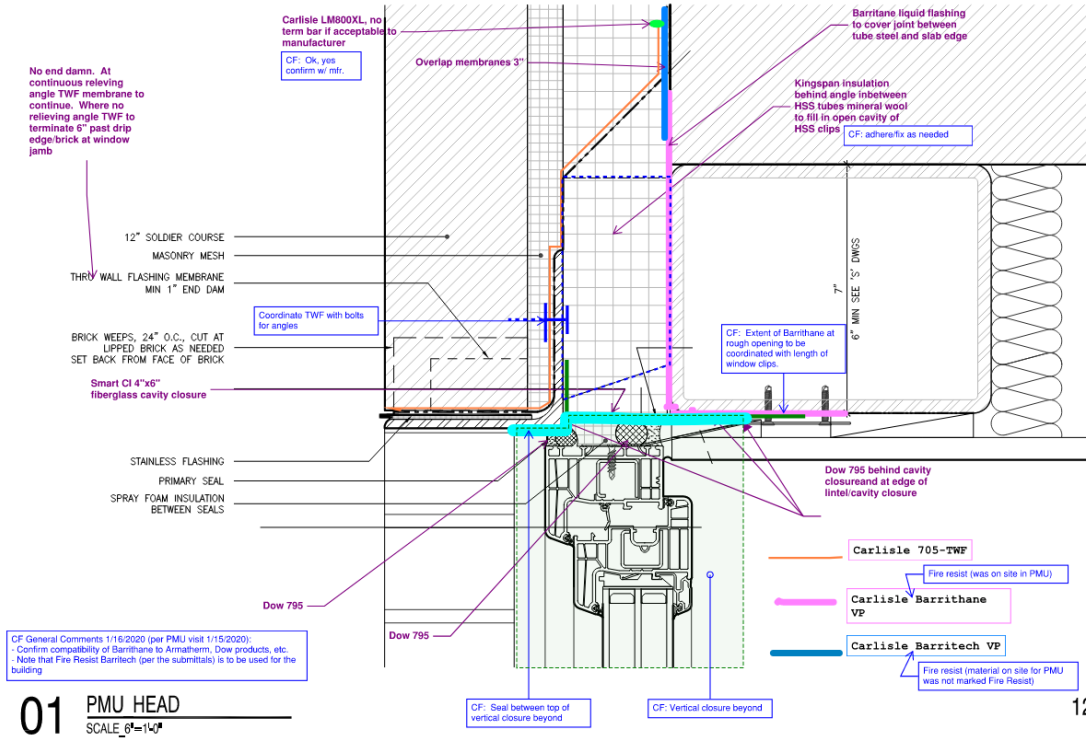
PH Windows



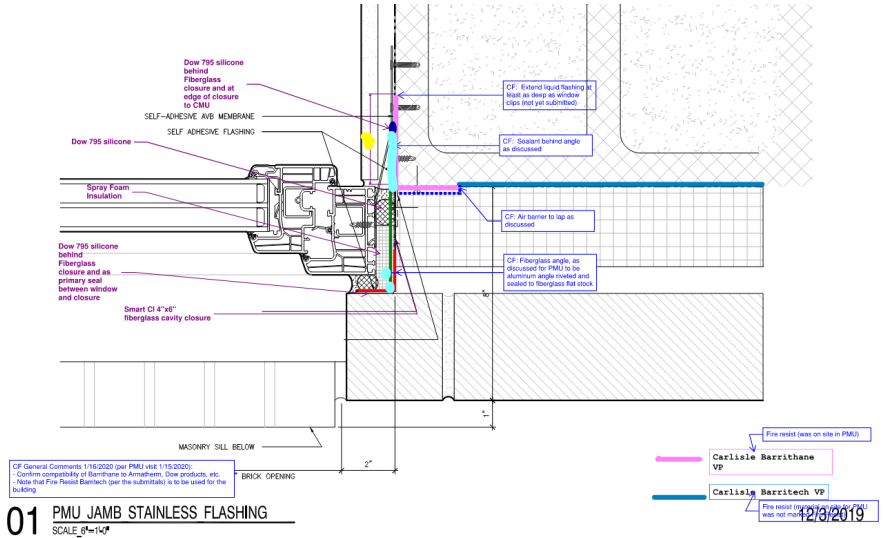
1. **Unique tilt-turn hardware** operates in both top-venting and inward-swinging positions
2. **Multiple locking points and dual weather seals** provide optimal air and water tightness
3. **Large chambers** accommodate reinforcements required for large openings in heavy commercial applications
4. **Accessory groove** accepts a variety of accessories such as brickmolds, extension jambs and for profiles to couple window elements
5. **Up to 1 3/8 in (35 mm) glass** increases energy efficiency and acoustical properties
6. **3 1/4 in (83 mm) North American frame depth** allows for hassle-free replacement installation; we also offer the 2 3/8 in (60 mm) European frame



Window Shop Drawings

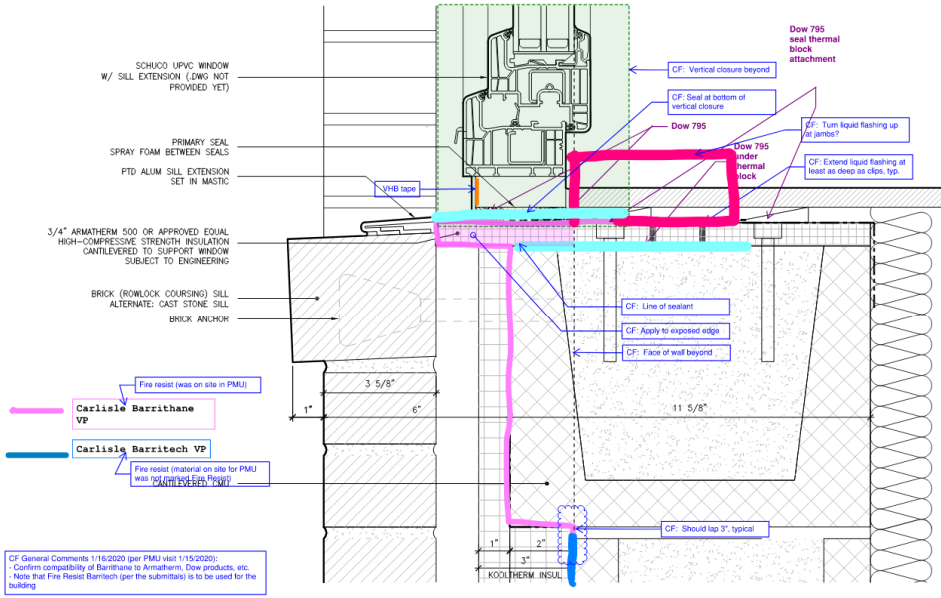


01 PMU HEAD
SCALE 6"=1'-0"



01 PMU JAMB STAINLESS FLASHING
SCALE 6"=1'-0"

12/3/2019

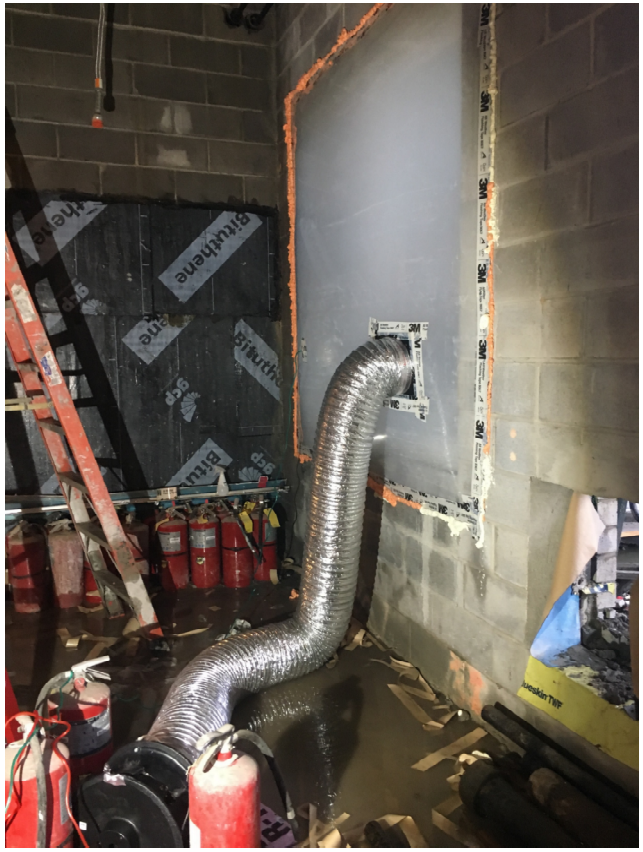


01 PMU SILL: THERMAL BLOCKING A

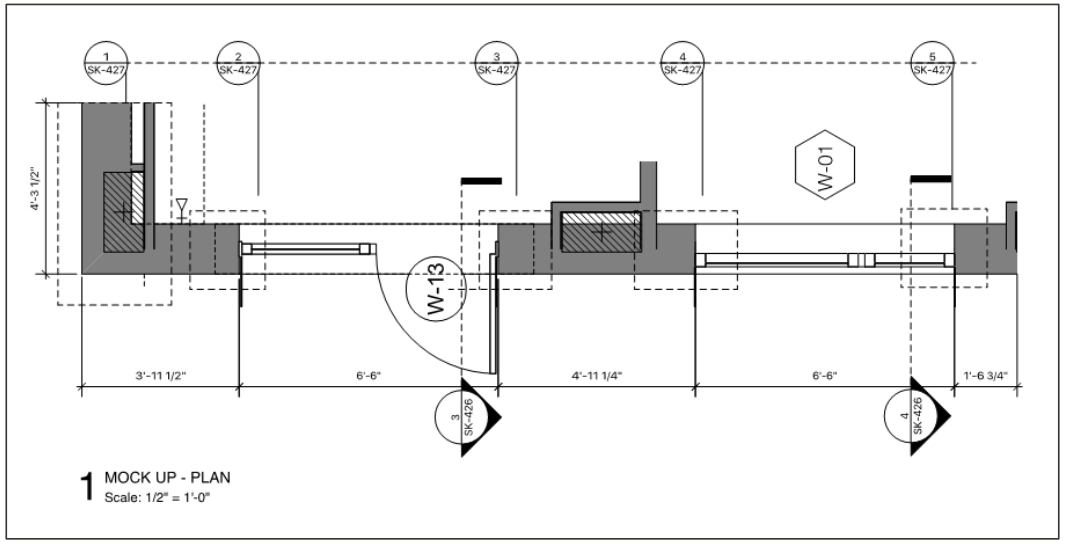
Window Installation

Windows – Mock Ups (AAC & CMU)

Windows – Testing and More Testing



Mock Ups are Critical



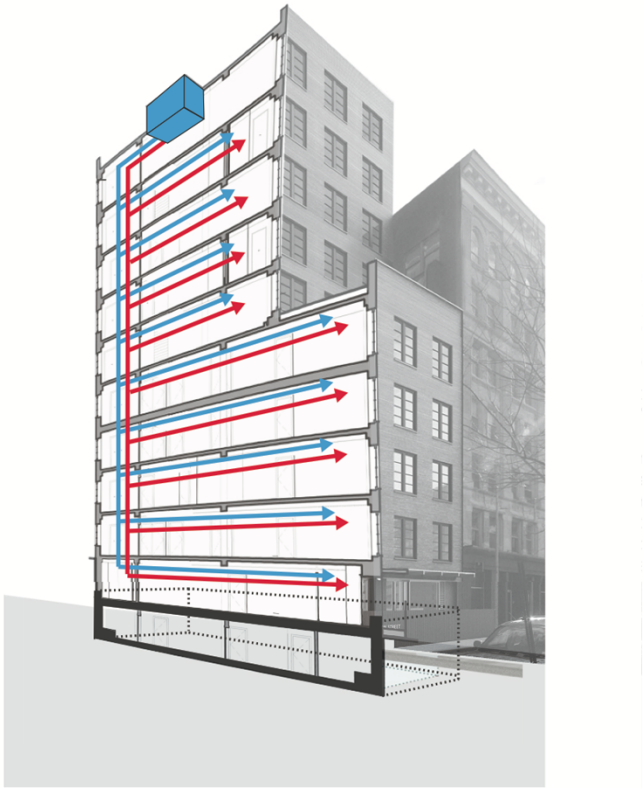
211 W 29th Street - Mockup Vendor Contact List

COMPONENT	CONTACT	NOTES
Cladding: Taktl Panels	Katherine Lynn Design + Applications Consultant, Northeast katherine.lynn@taktl-llc.com T 646·789·5626 | M 609·462·0173 175 Varick Street | New York, NY 10014 taktl-llc.com	Taktl Standard in Platinum - 2 textures, 2 finishes (4 types total)
Rainscreen Attachment: NVELOPE	Dave Sommer (206) 226-2311 cell international@nvelope.us dave@interra-facade.com	NV-1 System
Back Up Wall: Hebel AAC	Ricardo Gomez Director of Operations Telefon +1-2104023223 Mobil +1-2108658620 ricardo.gomez@xella.com Xella Aircrete North America, Inc Sales 900 Schneider Dr. US78108 Cibolo, Texas www.hebel-usa.com	6" Cored AAC and U Block
Sunshade: DAMS Inc	Shawn Bowman, CSI | National Director of Sales and Marketing DAMS Incorporated - D. Architectural Metal Solutions Incorporated 5919 W. 118th St. | Alsip, IL 60803 office: 708-224-4311 | fax: 708-388-9392 | mobile: 708-793-9107 shawn.bowman@damsinc.com | damsinc.com	Custom Extrusion and Flat Plate Aluminum
Windows & Doors: Fentrend	Sean Kennedy, CPHC Supplier/Client Manager sean@fentrend.com // 646.665.1478	One of Three options: Schuco AWS 90SI Zola Alu 90 Aluprof MB104
Door Sill: Alumat	Frank Hegan fhegan@ct-sol.com	Alumat MFAT
Insulation: Roxul (or Thermafiber)	SHAWN TORBERT, LEED AP, CPHD, CSI NY METRO SPECIFICATIONS MANAGER | ROXUL INC. Cell: (732) 887-4079 www.roxul.com	Cavity Rock DD and Comfort Batt

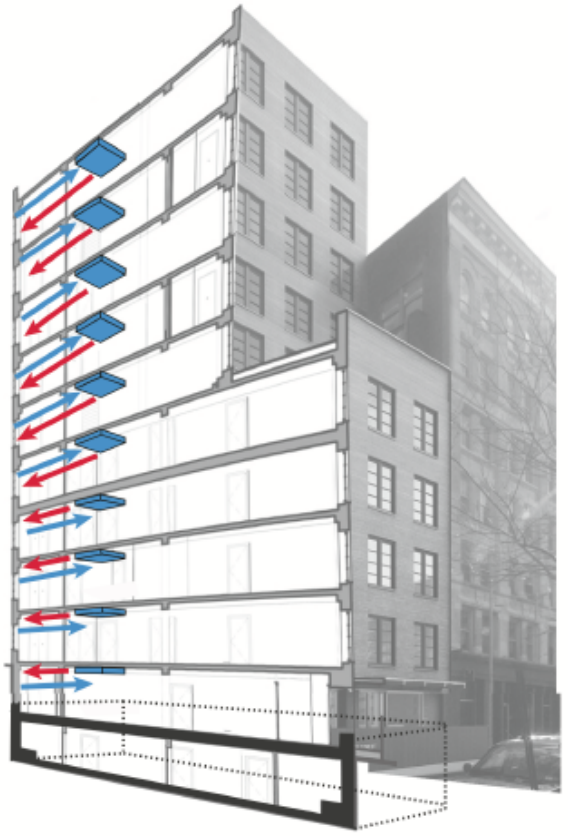
Thermally Improved Attachments

Products Applied – Armatherm 500

Ventilation – Balanced



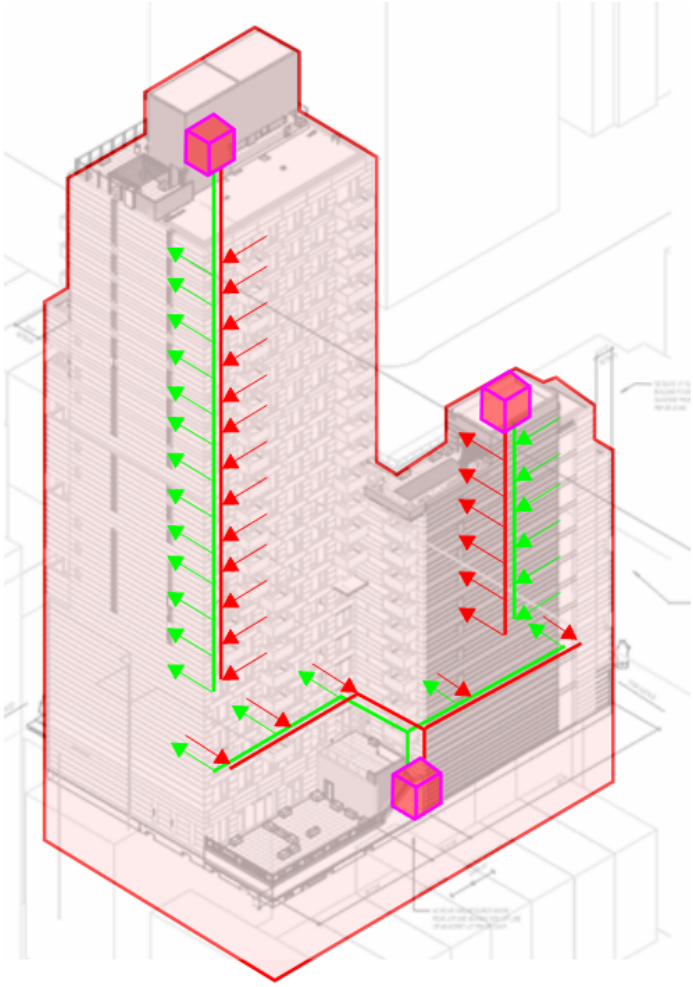
- Central ERV



- Individual ERVs

Ventilation (511)

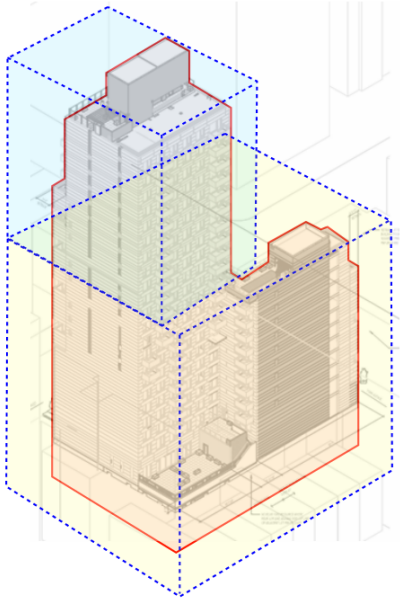
- Central Ventilation
  - Swegon Gold RX50 on main roof serving apartment spaces in main tower
  - 2x Ventacity VS1000 on roof of “sliver” building serving apartment spaces
  - Swegon Gold RX25 in cellar serving commercial space and lower amenities
  - DCV in main amenity spaces tied to occupancy sensors



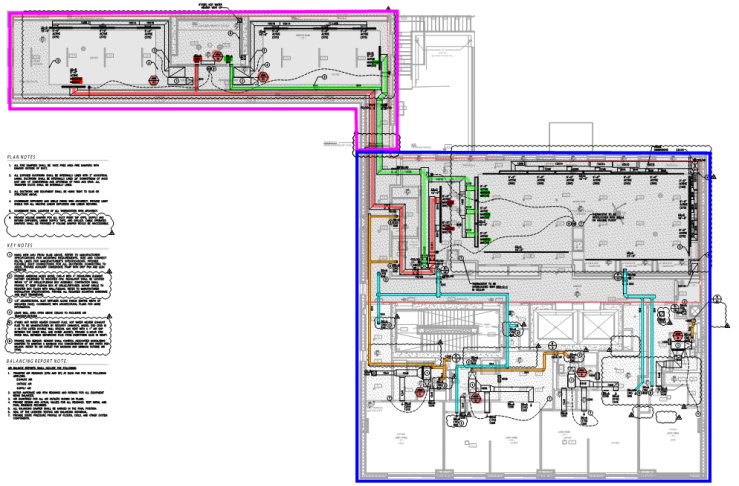
Ventilation

511 East 86th Street

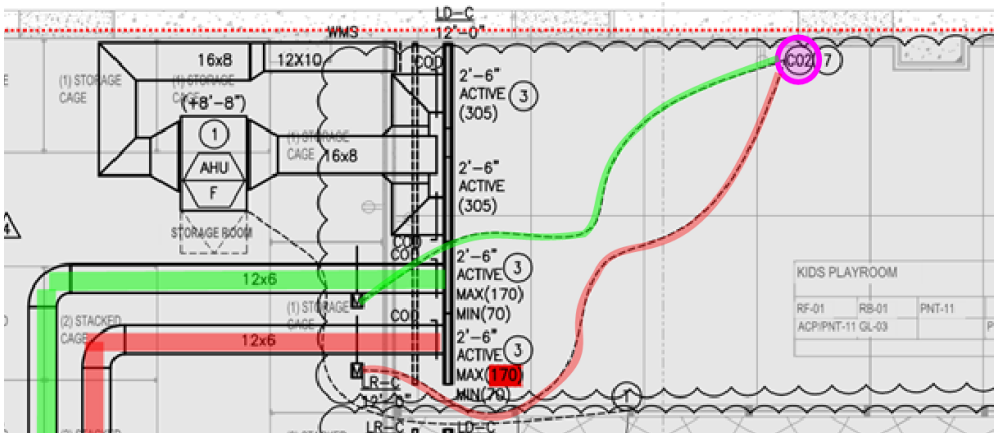
Obstacle 1: Building Form
Obstacle 2: Split TCO
Obstacle 3: Cost of CO2 Sensors



Obstacle 2: Allowing one part of the building to be occupied while construction is still happening in another will make balancing the system almost impossible. This is not advised.



Obstacle 1: The building is two large masses connected by a thin corridor. This results in long duct lengths on some floors and separation of systems on others.

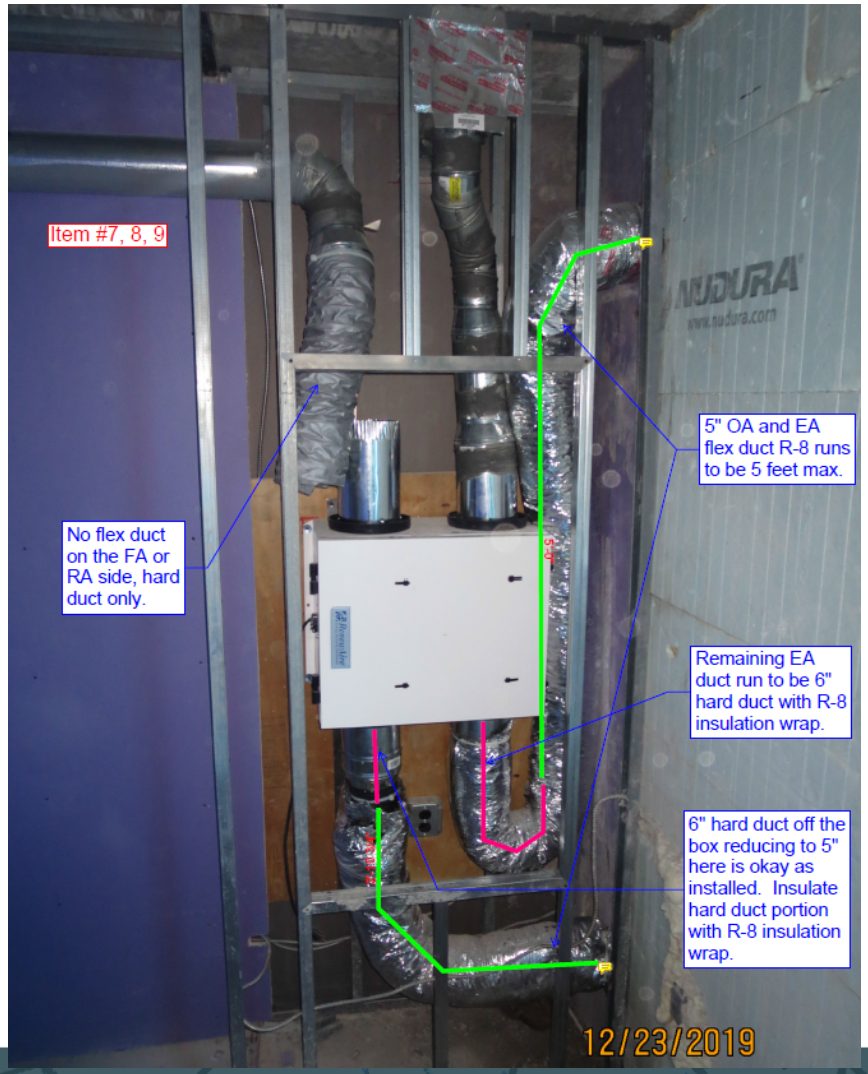


Obstacle 3: The cost of integrating CO2 sensors and the required controls can be significant. Consider using simple occupancy sensors when granular control is not needed.

Ventilation - Challenges

- Individual Ventilation
  - Cramped ERV closets
  - Difficulty in properly insulating and air sealing exterior wall connections
  - 2x wall penetrations per apartment
  - Future maintenance (filter changes)

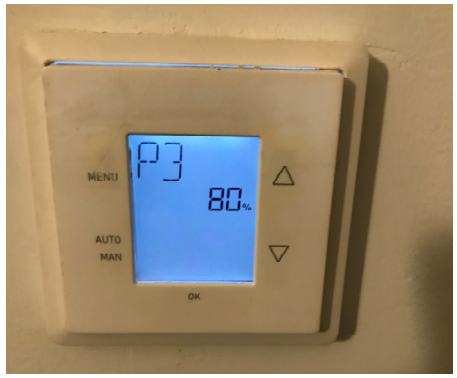
  - What do you see wrong in this photo?



Final Air Flow Rates & TAB

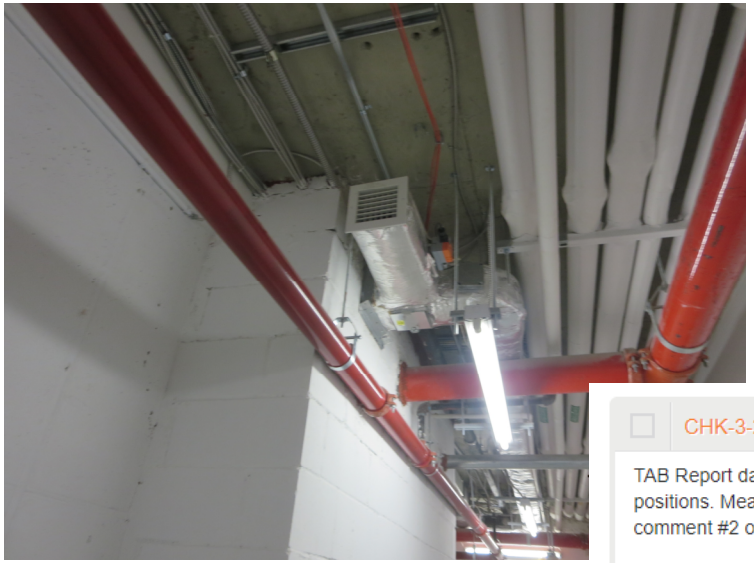
Manufacturer:	Zehnder
Model:	COMFOAIR 200
Location:	Apt 6C Closet

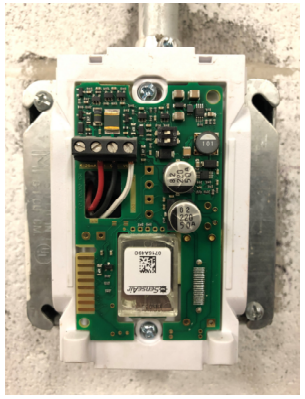
			Grille		CFM	
Drawing	Area Served	Supply/ Return	Type	Size	Design	Actual
27	Apt 6C	ERV Supply	SWR	6x4	15	15
28	Apt 6C	ERV Supply	SWR	6x4	15	15
30	Apt 6C	ERV Supply	SWR	6x4	15	15
32	Apt 6C	KX	SWG	6x6	25	25
33	Apt 6C	TX	CG	6x6	20	20



DCV Set Up

- Demand Controlled Ventilation (DCV) getting properly set up





CHK-3-2 PENDING VERIFICATION

Actions Watch

TAB Report dated 2019-09-27 does not include measurements with DCV dampers at their minimum/low positions. Measurements should be provided at both min and max positions. (See also EP Engineering comment #2 on their review)

Additionally, the actual programmed damper positions (i.e. % open) should be noted for each damper at min and max positions.

SOURCE Checklist 3, TAB Reports Received, Line 2

ERV-R-1

ASSIGNED TO Mechanical Contractor

ASSET ERV-R-1

DISCIPLINE Testing and Balancing

DRAWING TAB Report 2019-09-27

DUE DATE 10/29/2019

CREATED BY Chris Lyle

IDENTIFIED ON 10/15/2019 9:34 AM

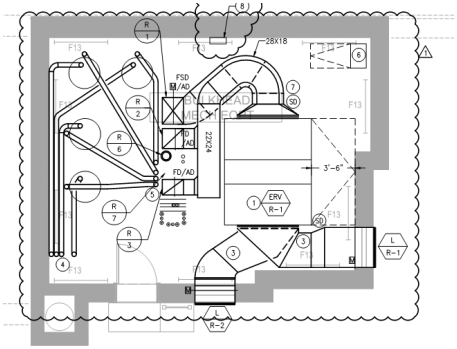
Comments 3 Files 0 View Details

Duct Sealing - Ventilation

211 West 29th Street

Obstacle 1: Timing of Aeroseal
Obstacle 2: Final balancing
Obstacle 3: Initial design much higher than mechanical code

Obstacle 1: Due to the sequencing of the project, it is very difficult to schedule Aeroseal at a time when all riser and branch ductwork has been installed. Scheduling of Aeroseal should be coordinated with HVAC contractor early in construction.



Obstacle 2: During balancing, the total CFM measured at the unit will likely be higher than the design CFM because of leakage in ductwork and higher static to overcome tight mechanical rooms. To minimize this, sharp turns in ductwork should be reduced when possible and extra fan power should be accounted for in energy models.

TABLE 403.3—continued
MINIMUM VENTILATION RATES

OCCUPANCY CLASSIFICATION	OCCUPANT DENSITY #/1000 FT²[a]	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_p CFM/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_a CFM/FT²[a]	EXHAUST AIRFLOW RATE CFM/FT²[a]
Private dwellings, single and multiple				
Garages, common for multiple units[b]	—	—	—	0.75
Garages, separate for each dwelling[b]	—	—	—	100 cfm per car
Kitchens[b]	—	—	—	25/100[f]
Living areas[c]	Based upon number of bedrooms. First bedroom, 2; each additional bedroom, 1	0.35 ACH but not less than 15 cfm/person	—	—
Toilet rooms and bathrooms[g]	—	—	—	20/50[f]
Public spaces				
Corridors	—	—	0.06	—
Elevator car	—	—	—	1.0
Shower room (per shower head)[g]	—	—	—	50/20[f]
Smoking lounges[h]	70	60	—	—
Toilet rooms — public[g]	—	—	—	50/70[f]

Obstacle 3: The initial ventilation design included rates in BOH and amenity spaces that were much higher than required by the IMC. This results in unnecessary fan energy use.

Ventilation

IF YOU REMEMBER ANYTHING, REMEMBER THIS LIST

- Ductwork must be Aerosealed in order to achieve balancing and ALL DUCTWORK SHOULD BE INSTALLED
- Constant airflow regulating (CAR) dampers must be used at all registers and must be ACCESSIBLE
- Ductwork behind registers must be CLEARLY connected to drywall
- Do not combine AHU and ERV ductwork
- Account for buffer on top of design flowrate in energy model

CAR Damper: CAR dampers must be used at all registers to achieve proper balancing. Make sure to use CAR dampers like the one pictured here, with a set screw to adjust the flap. https://eflowusa.net/product/constant-air-flow-regulators-3/

Well sealed ductwork to drywall: If ductwork is not properly sealed to drywall behind registers, air will dump into ceiling or wall cavities, drastically increasing total fan power required to achieve proper balancing.

Plumbing - DHW

- Follow P-001.00 for DHW, including crotons
- Insulation to be continuous at all hanger locations (kindorf & clevis)
- Runout piping

PLUMBING PIPING INSULATION

MATERIAL	MANUFACTURER	SERVICE	INSULATION THICKNESS	COMMENTS
FLEXIBLE ELASTOMERIC	AEROFLOX USA INC.; AEROCEL ARMACELL LLC; AP ARMAFLEX RBX CORPORATION; INSUL-SHEET 1800; INSUL-TUBE 180	DOMESTIC HOT & RE-CIRCULATED HOTWATER	1" FOR PIPES < 1.5" 1½" FOR PIPES ≥ 1.5"	1) FLAME SPREAD RATING INDEX SHALL BE 25 OR LESS. 2) SMOKE DEVELOPED INDEX SHALL BE 50 OR LESS. 3) PIPE INSULATION SHALL NOT BE INTERRUPTED BY PIPE SUPPORTS OR PIPE SERVICE.
		DOMESTIC COLD WATER (POTABLE)	1"
		STORMWATER & OVERFLOW	1"
		ROOF DRAIN AND OVERFLOW DRAIN BODIES	1"
		EXPOSED SANITARY DRAINS	1"
MINERAL-FIBER	FIBREX INSULATIONS INC.; COREPLUS 1200. JOHNS MANVILLE; MICRO-LOK. KNAUF INSULATION; 1000 PIPE INSULATION. OWENS CORNING; FIBERGLAS PIPE INSULATION	DOMESTIC HOT & RE-CIRCULATED HOTWATER	1" FOR PIPES < 1.5" 1½" FOR PIPES ≥ 1.5"	
		DOMESTIC COLD WATER (POTABLE)	1"	
		STORMWATER & OVERFLOW	1"	
		ROOF DRAIN AND OVERFLOW DRAIN BODIES	1"	
		EXPOSED SANITARY DRAINS	1"	
POLYOLEFIN	ARMACELL LLC; TUBOLIT NOMACO INC.; IMCOLOCK, IMCOSHEET, NOMALOCK & NOMAPLY RBX CORPORATION; THERMA-CELL	DOMESTIC HOT & RE-CIRCULATED HOTWATER	1" FOR PIPES < 1.5" 1½" FOR PIPES ≥ 1.5"	
		DOMESTIC COLD WATER (POTABLE)	1"	
		STORMWATER & OVERFLOW	1"	
		ROOF DRAIN AND OVERFLOW DRAIN BODIES	1"	
		EXPOSED SANITARY DRAINS	1"	

Pipe Insulation Sizes

- http://www.pi-piper.com/

1.5" diameter hot water piping observed with only 1.0" thick insulation, 9th floor

Light Fixtures – Verification

Lighting Controls - General

- Interior and exterior controls on the electrical plans

LIGHTING CONTROL LEGEND	
AREA	CONTROL DESCRIPTION
CORRIDOR	CEILING MOUNTED AUTOMATIC OCCUPANCY SENSOR (AUNTOMATICALLY TURN OFF LIGHTS WITHIN 20 MINUTES)
LAUNDRY, BIKE STORAGE & RETAIL SPACE COMMON BATHROOMS	VACANCY SENSOR MANUAL ON/AUTO OFF (AUNTOMATICALLY TURN OFF LIGHTS WITHIN 20 MINUTES)
EXTERIOR LIGHTING	PHOTOCELL TO TURN LIGHTS ON & TIME CLOCK TO TURN LIGHTS OFF
GARAGE	ASTRONOMICAL TIME CLOCK TO TURN LIGHTS ON & OFF
AREAS WITHIN 15' OF WINDOWS (LOBBY)	DAY LIGHT ZONE SENSOR

NOTES:

1. ALL FIXTURES IN DWELLING UNITS ARE HIGH EFFICACY FIXTURES.
2. EACH DWELLING UNIT IS SEPARATELY METERED THROUGH CON-EDISON. METER BANKS ARE LOCATED IN THE ELECTRICAL ROOM.
3. EACH SPACE INCLUDING INDIVIDUAL DWELLING UNITS ARE INDEPENDENTLY CONTROLLED VIA SWITCH OR OCCUPANCY SENSOR.
4. EXIT SIGNS WILL BE NOT MORE THEN 5 WATTS LED TYPE.
5. ELEVATOR CABS LIGHTING SYSTEM CONTROL SHALL BE PROVIDED BY ELEVATOR CONTRACTOR PER NYC ECC 2016 C405.9.1 REQUIREMENTS.

Questions?

10 Minute Break

Documentation Requirements for PH

Final Submissions – Field Documentation PHIUS

- Project Photos
- Contractor Declaration
- PHIUS+ Onsite Verification Folder
  - PHIUS+ Multifamily Quality Assurance Workbook.xlsx
  - Inspection Reports
- Final Energy Model

Note: This particular project was certifying under PHIUS+ 2015

Field Documentation PHIUS – Project Photos

- 0 1_ELEVATIONS
- 1 1_APPLIANCES
- 2 1_DHW
- 3 1_ABOVE_GRADE_WALL
- 3 1_BELOW_GRADE_WALL
- 3 1_EXTERIOR_AIR_BARRIER
- 3 2_ROOF
- 3 3_FLOORS
- 5 1_HVAC
- 6 1_IR
- 8 4_PV


IMG_6188.JPG


IMG_6189.JPG


IMG_6191.JPG


IMG_6192.JPG


IMG_6194.JPG


IMG_6210.JPG

Field Documentation PHIUS – Project Photos

- 0 1_ELEVATIONS
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Field Documentation PHIUS – Project Photos

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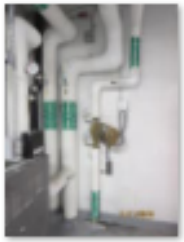
- 3 1_BELOW_GRADE_WALL
- 3 1_EXTERIOR_AIR_BARRIER
- 3 2_ROOF
- 3 3_FLOORS
- 5 1_HVAC
- 6 1_IR
- 8 4_PV


DHW 1.JPG


DHW 2.JPG


DHW 3.JPG


DHW 4.JPG


DHW 5.JPG


DHW 6.JPG


DHWP 1.JPG


DHWP 2.JPG


DHWP 3_VFD.JPG

Field Documentation PHIUS – Project Photos

- 0 1_ELEVATIONS
- 1 1_APPLIANCES
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- 3 1_ABOVE_GRADE_WALL
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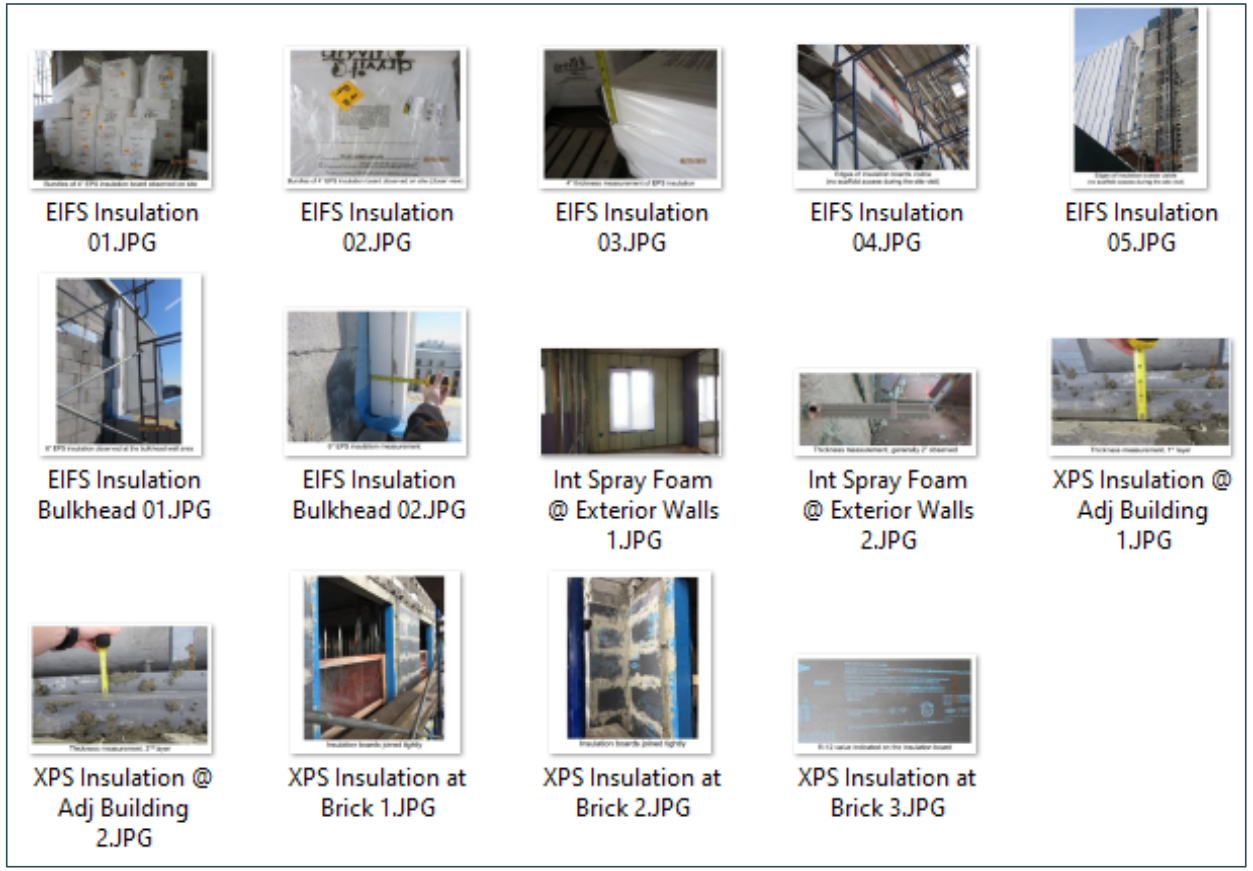
- 3 1_EXTERIOR_AIR_BARRIER
- 3 2_ROOF
- 3 3_FLOORS
- 5 1_HVAC
- 6 1_IR
- 8 4_PV



Field Documentation PHIUS – Project Photos

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- 2 1_DHW
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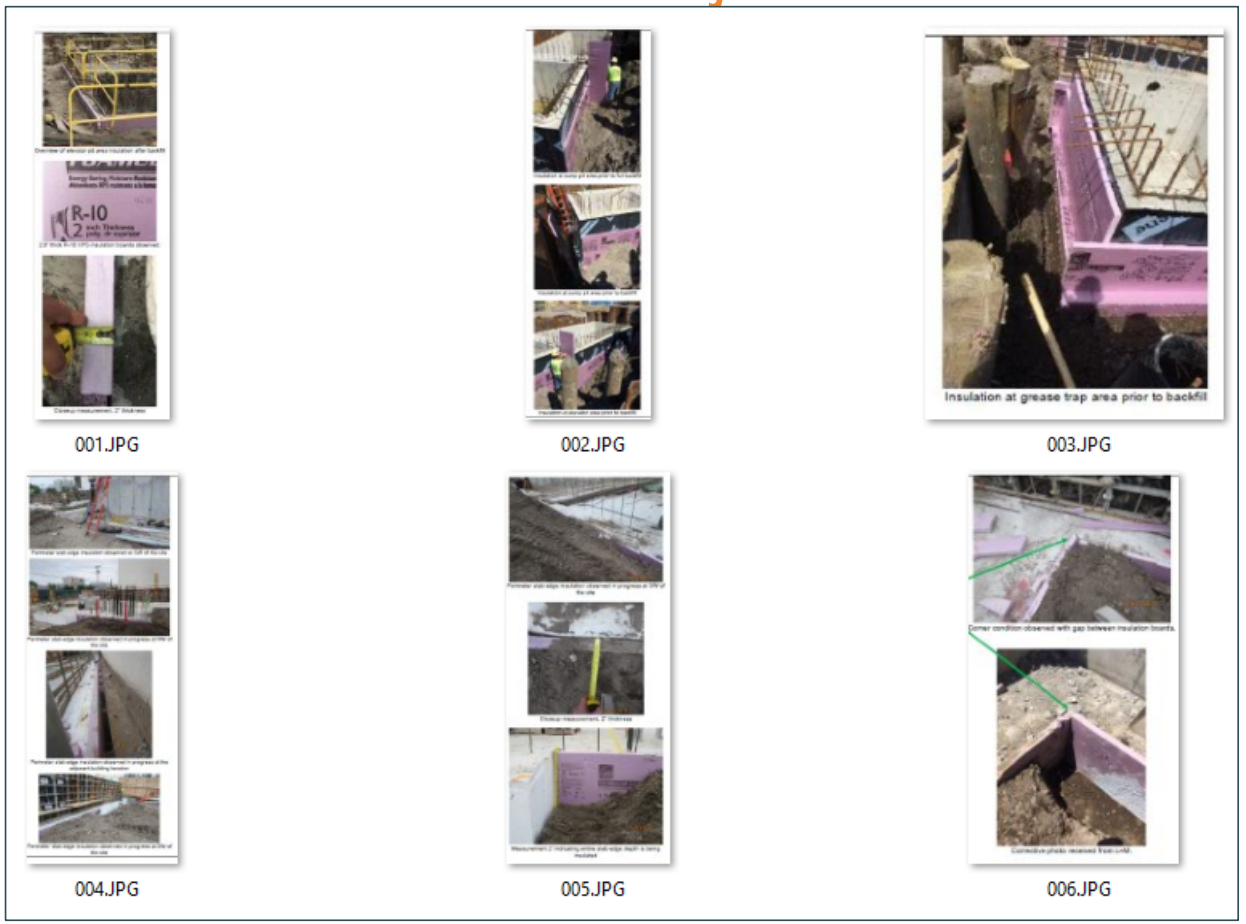
- 3 1_BELOW_GRADE_WALL
- 3 1_EXTERIOR_AIR_BARRIER
- 3 2_ROOF
- 3 3_FLOORS
- 5 1_HVAC
- 6 1_IR
- 8 4_PV



001.JPG 002.JPG 003.JPG

004.JPG 005.JPG 006.JPG

Field Documentation PHIUS – Project Photos

- 0 1_ELEVATIONS
- 1 1_APPLIANCES
- 2 1_DHW
- 3 1_ABOVE_GRADE_WALL
- 3 1_BELOW_GRADE_WALL
- 3 1_EXTERIOR_AIR_BARRIER
- 3 2_ROOF
- 3 3_FLOORS
- 5 1_HVAC
- 6 1_IR
- 8 4_PV


Air Barrier @ Brick 1.JPG


Air Barrier @ Brick 2.JPG


Air Barrier @ Brick 3.JPG


Air Barrier @ Brick 4.JPG


Air Barrier @ Brick 5.JPG


Air Barrier @ EIFS 1.JPG


Air Barrier @ EIFS 2.JPG


Air Barrier @ EIFS 3.JPG


Air Barrier @ EIFS 4.JPG

Field Documentation PHIUS – Project Photos

- 0 1_ELEVATIONS
- 1 1_APPLIANCES
- 2 1_DHW
- 3 1_ABOVE_GRADE_WALL
- 3 1_BELOW_GRADE_WALL
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- 3 2_ROOF
- 3 3_FLOORS
- 5 1_HVAC
- 6 1_IR
- 8 4_PV

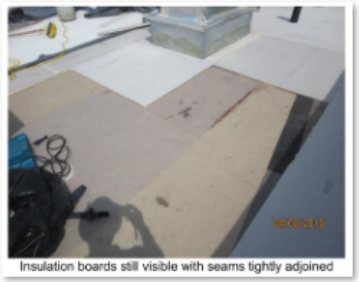
Roof - 01.JPG

Roof - 02.JPG

Roof - 03.JPG

Roof - 04.JPG

Roof Bulkhead - 01.JPG



Roof Bulkhead - 02.JPG

Roof Bulkhead - 03.JPG

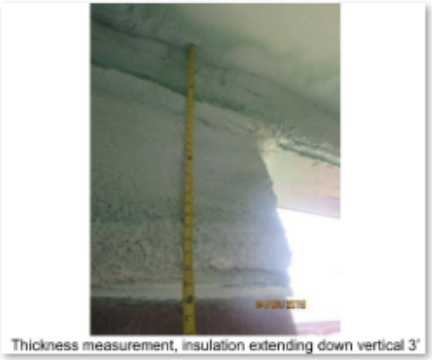
Field Documentation PHIUS – Project Photos

- 0 1_ELEVATIONS
- 1 1_APPLIANCES
- 2 1_DHW
- 3 1_ABOVE_GRADE_WALL
- 3 1_BELOW_GRADE_WALL
- 3 1_EXTERIOR_AIR_BARRIER
- 3 2_ROOF
- 3 3_FLOORS
- 5 1_HVAC
- 6 1_IR
- 8 4_PV

Garage Ceiling 01.JPG

Garage Ceiling 02.JPG

Garage Ceiling 03.JPG



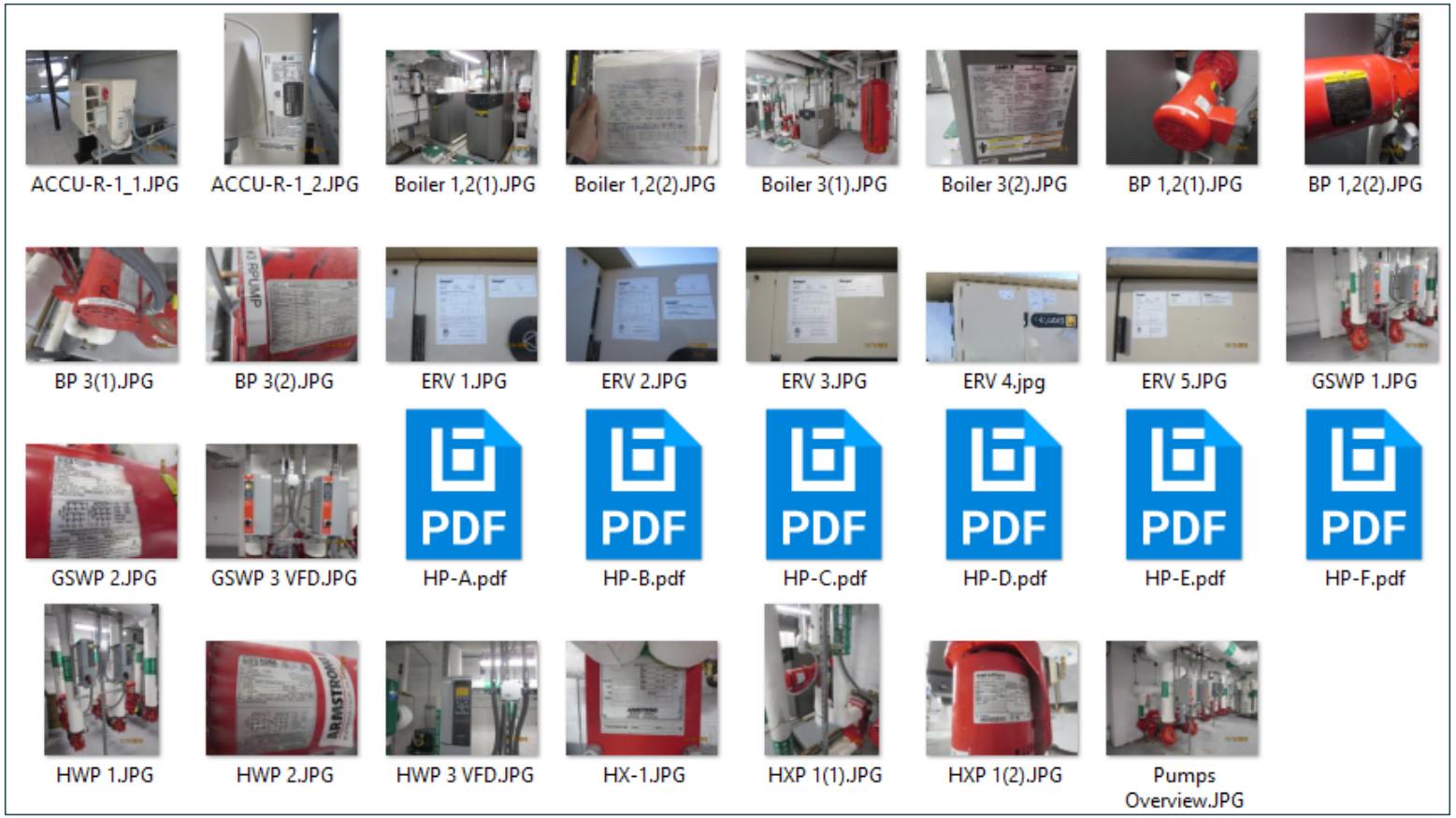
Garage Ceiling 04.JPG

Garage Ceiling 05.JPG

Garage Ceiling 06.JPG

Field Documentation PHIUS – Project Photos

- 0 1_ELEVATIONS
- 1 1_APPLIANCES
- 2 1_DHW
- 3 1_ABOVE_GRADE_WALL
- 3 1_BELOW_GRADE_WALL
- 3 1_EXTERIOR_AIR_BARRIER
- 3 2_ROOF
- 3 3_FLOORS
- 5 1_HVAC
- 6 1_IR
- 8 4_PV



Field Documentation PHIUS – Project Photos

- 0 1_ELEVATIONS
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- 2 1_DHW
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- 3 1_EXTERIOR_AIR_BARRIER
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- 3 3_FLOORS
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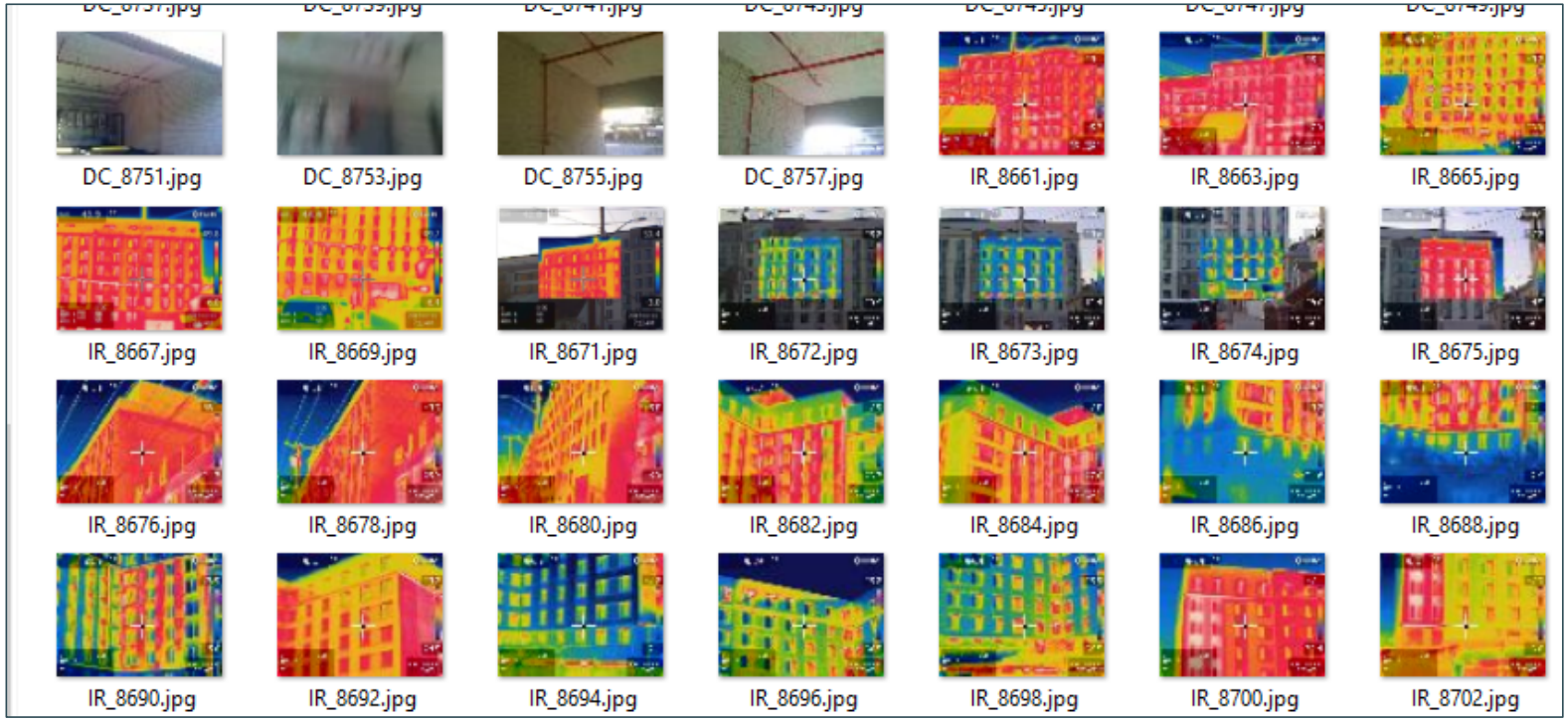
- 6 1_IR
- 8 4_PV



Field Documentation PHIUS – Project Photos

- 0 1_ELEVATIONS
- 1 1_APPLIANCES
- 2 1_DHW
- 3 1_ABOVE_GRADE_WALL
- 3 1_BELOW_GRADE_WALL
- 3 1_EXTERIOR_AIR_BARRIER
- 3 2_ROOF
- 3 3_FLOORS
- 5 1_HVAC
- 6 1_IR
- 8 4_PV


Carport PV 1.JPG


Carport PV 2.JPG


Carport PV 3.JPG


Carport PV 4.JPG

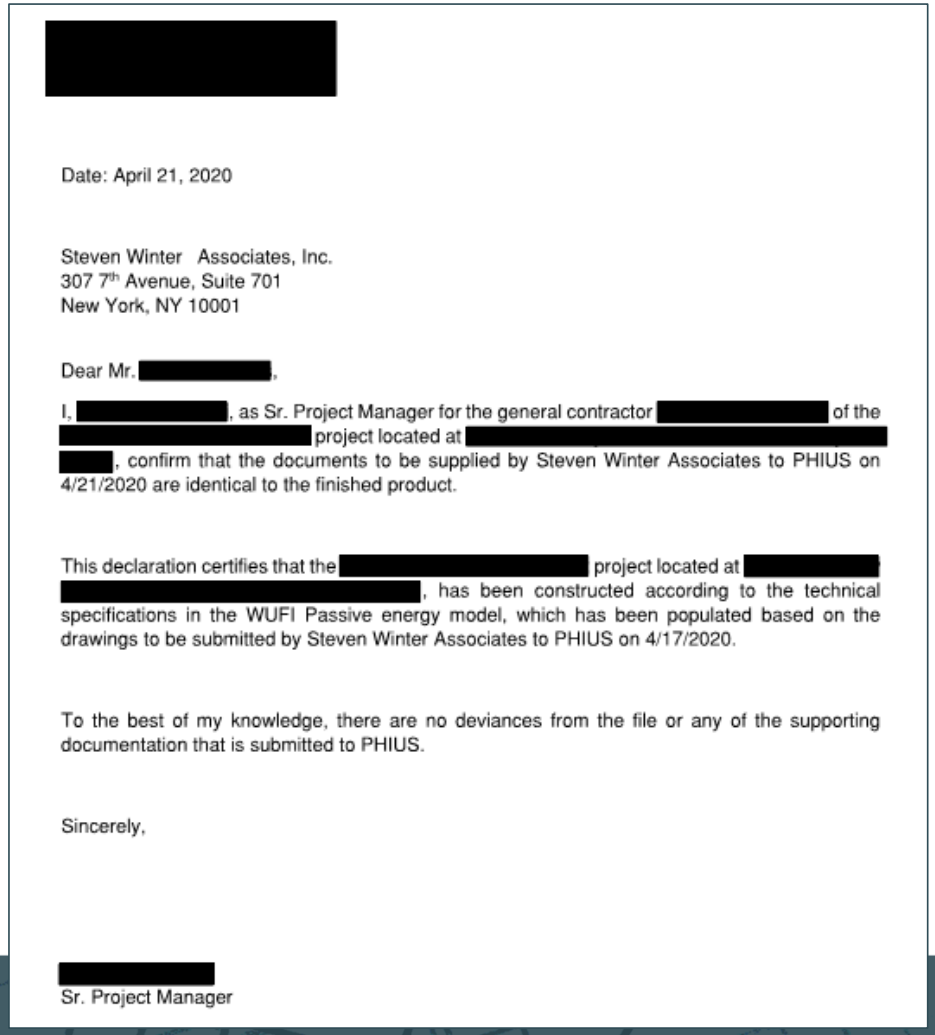

Roof PV 1.JPG


Roof PV 2.JPG


Roof PV 3.JPG

Roof PV 4.JPG

Field Documentation PHIUS – Contractor Declaration



[redacted]

Date: April 21, 2020

Steven Winter Associates, Inc.
307 7th Avenue, Suite 701
New York, NY 10001

Dear Mr. [redacted],

I, [redacted], as Sr. Project Manager for the general contractor [redacted] of the [redacted] project located at [redacted], confirm that the documents to be supplied by Steven Winter Associates to PHIUS on 4/21/2020 are identical to the finished product.

This declaration certifies that the [redacted] project located at [redacted], has been constructed according to the technical specifications in the WUFI Passive energy model, which has been populated based on the drawings to be submitted by Steven Winter Associates to PHIUS on 4/17/2020.

To the best of my knowledge, there are no deviances from the file or any of the supporting documentation that is submitted to PHIUS.

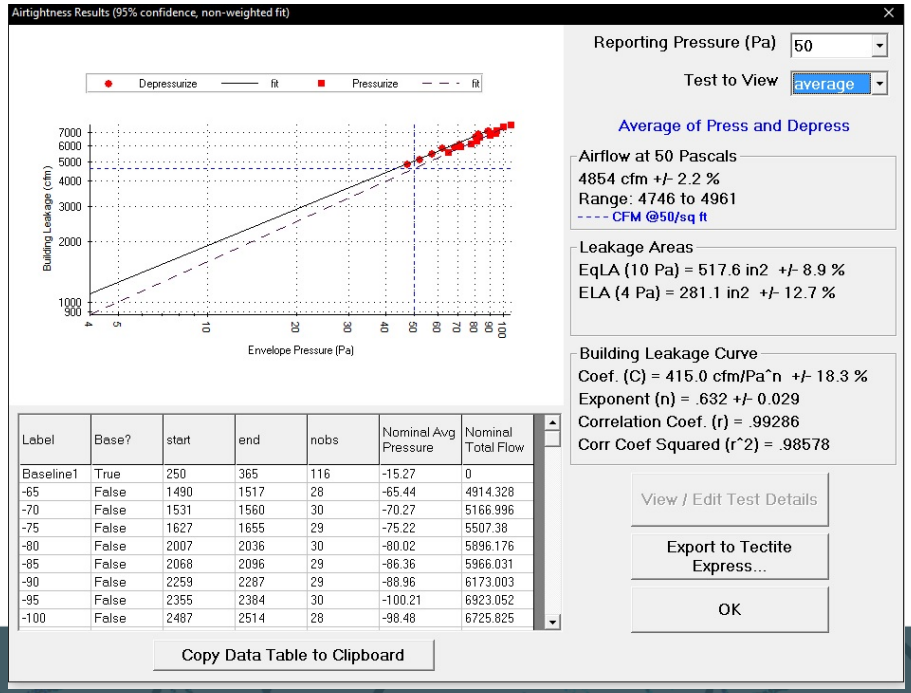
Sincerely,

[redacted]
Sr. Project Manager

PHIUS Onsite Verification Folder

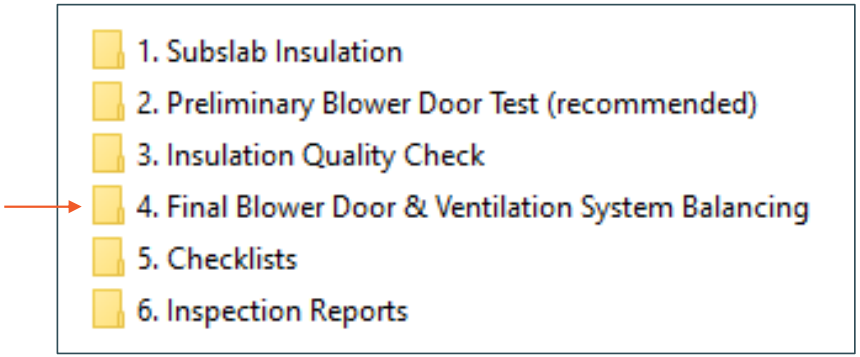
- 1. Subslab Insulation
- 2. Preliminary Blower Door Test (recommended)
- 3. Insulation Quality Check
- 4. Final Blower Door & Ventilation System Balancing
- 5. Checklists
- 6. Inspection Reports

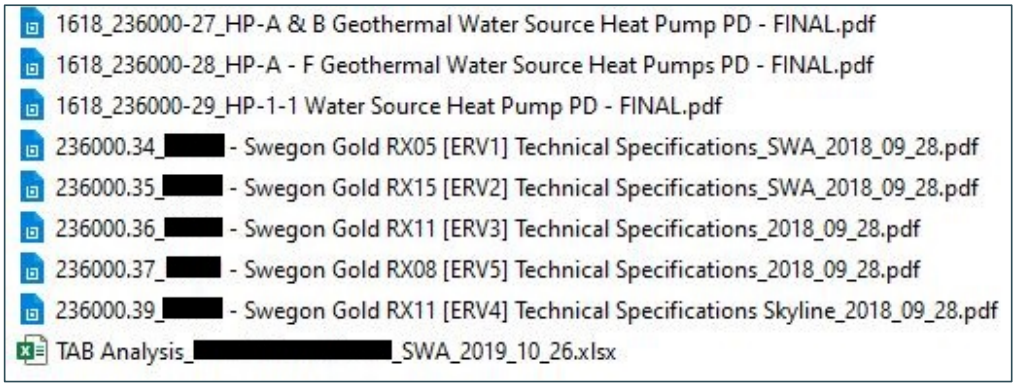
- 2019-10-18_[redacted]_Test 1 (Taped).TeclogData
- 2019-10-18_[redacted]_Test 2 (Untaped).TeclogData
- [redacted] - Whole Building Blower Door Test Report.pdf
- Taped Results Snip.jpg
- Untaped Results Snip.jpg



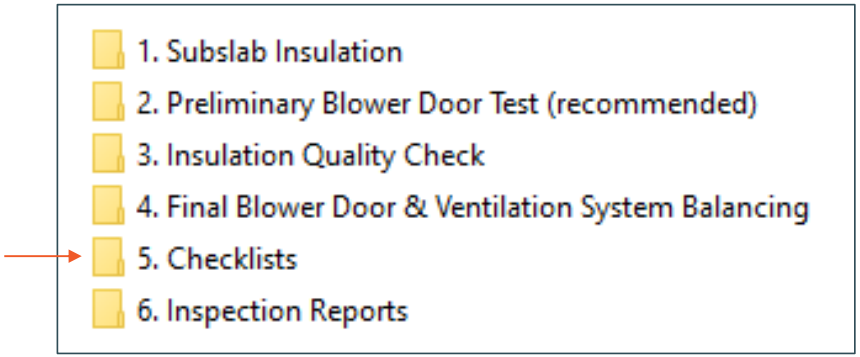
Label	Base?	start	end	nobs	Nominal Avg Pressure	Nominal Total Flow
Baseline1	True	250	365	116	-15.27	0
-65	False	1490	1517	28	-65.44	4914.328
-70	False	1531	1560	30	-70.27	5166.996
-75	False	1627	1655	29	-75.22	5507.38
-80	False	2007	2036	30	-80.02	5896.176
-85	False	2068	2096	29	-86.36	5966.031
-90	False	2259	2287	29	-88.96	6173.003
-95	False	2355	2384	30	-100.21	6923.052
-100	False	2487	2514	28	-98.48	6725.825

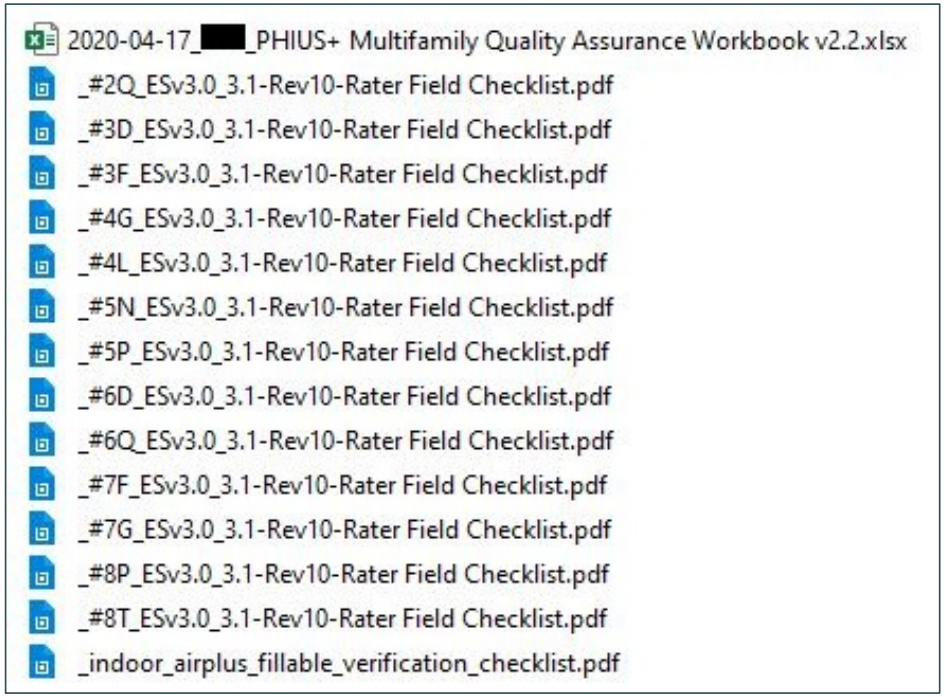
PHIUS Onsite Verification Folder





PHIUS Onsite Verification Folder





PHIUS Onsite Verification Folder

- 1. Subslab Insulation
- 2. Preliminary Blower Door Test (recor
- 3. Insulation Quality Check
- 4. Final Blower Door & Ventilation Sys
- 5. Checklists
- 6. Inspection Reports

PHIUS+ Quality Control Workbook for Multifamily Projects - v2.2 *(April 2019)*

Project Name			Project Permit Date	PHIUS+ Project Registration #	PHIUS+ Rater/MF Verifier Name	Rater/MF Verifier Company Name	CPHC Name	CPHC Company Name
				Yes	Mike O'Donnell	Steven Winter Associates	Thomas O. Moore	Steven Winter Associates
Street Address		City	State/Province	Zip Code	Country	Architect Company Name	General Contractor / Builder Company Name	General Contractor / Builder responsible Individual
			NY New York		United States			
Third-Party balancing firm hired by project?		Third-party balancing firm responsible Individual		HVAC Company	HVAC responsible Individual	Ducted heating/cooling systems in dwelling units?		HVAC Contractor must be ESTAR credentialed?
Yes						Yes		NO
Total # Buildings	Total # Dwelling Units	Total # Stories per Building	Do dwelling units occupy >80% of occupiable sqft of buildings?		Do dwelling units have individual heating, cooling, and water heating systems?		Does solar energy provide >50% of DWH load?	EPA ENERGY STAR / DOE ZERH Certification required?
1		8	Yes		No		No	NO

Welcome to the PHIUS+ Quality Control Workbook for Multifamily Projects!

Certification Criteria

The PHIUS+ Certification process for multifamily projects includes energy modeling and design consulting performed by a Certified Passive House Consultant (CPHC) to demonstrate compliance with PHIUS program energy performance metrics, as well as on-site verification of all critical project energy features by a Certified PHIUS+ Rater or PHIUS+ Verifier.

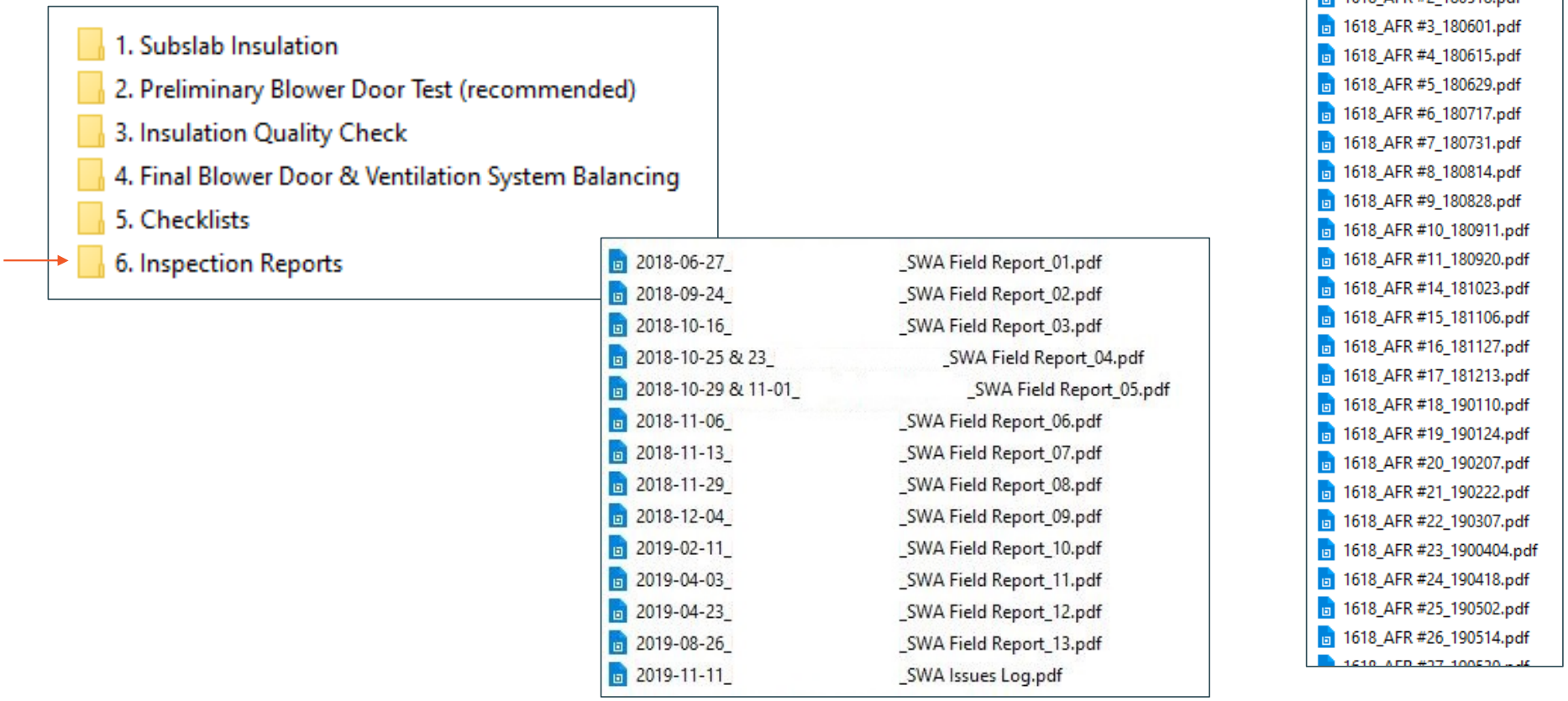
Additionally, multifamily projects that meet the eligibility criteria for the EPA ENERGY STAR Homes (ESTAR) or Energy Star Multi-family New Construction Program (MFNCP) and DOE Zero Energy Ready Homes (ZERH) programs shall be certified under those programs.**(1)(2)** Projects that do not meet eligibility criteria for certification under these programs shall be exempt from certification for both ESTAR and ZERH. However, the certification checklist criteria for these programs shall still be achieved in order to help ensure that multifamily projects seeking PHIUS+ Certification are not only energy efficient, but also a durable, comfortable and healthy buildings. For clarification on which ESTAR program your project is eleigble for, please consult the PHIUS+ 2018 Guidebook.

For full program requirements, please see *PHIUS+ Certification for Multifamily Performance Requirements (v2.2).*

Using This Workbook

Cover Sheet | Building Envelope | Compartmentalization | Ventilation (208) | Ventilation (304) | Ventilation (313) | Ventilation (419) | Ventilation (502) | Ventilation (507) | Ventilation (616)

PHIUS Onsite Verification Folder

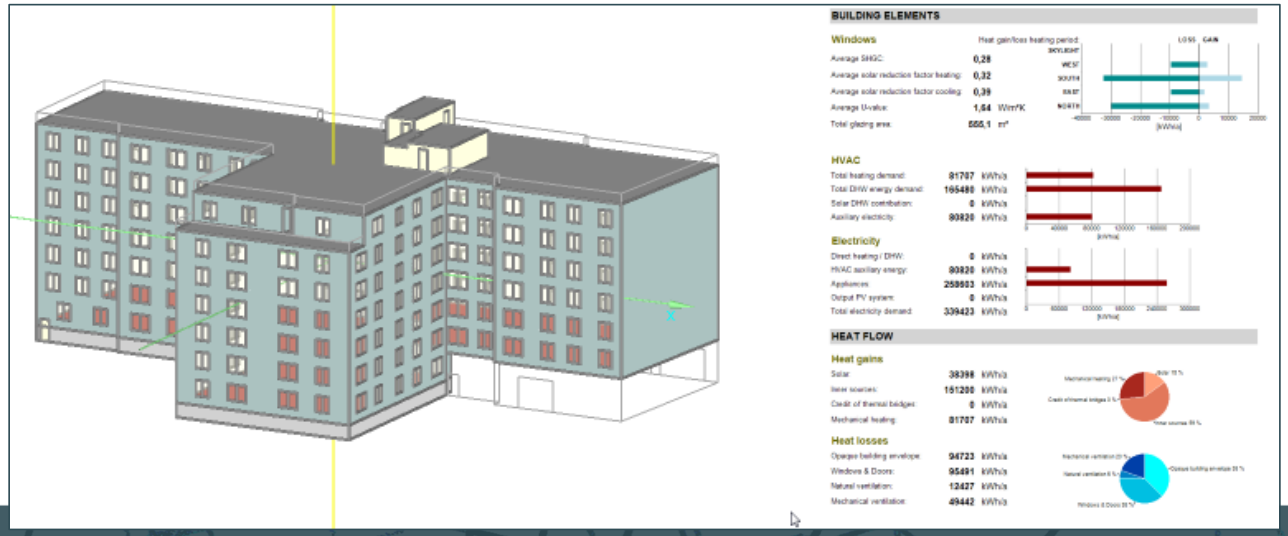


Final Submissions – Energy Model PHIUS

- 6. Project Photos
- 5. Contractor Declaration
- 4. PHIUS+ On-Site Verification
- 0. Energy Model

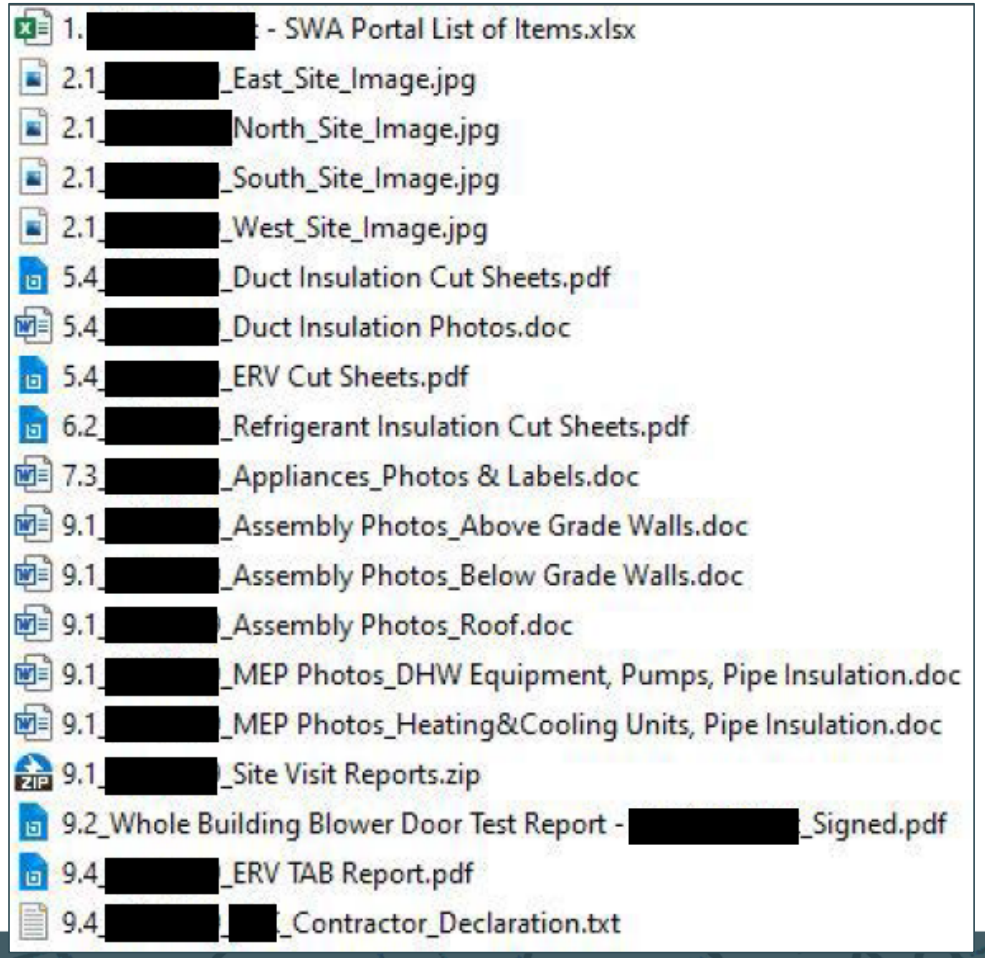
Final Model Items

- [redacted]_Pre-Certification Model V3.1.1.25_20181026_Certifier Comments.mwp
- [redacted]_Pre-Certification Model V3.1.1.25_20181026_PRE-CERT.mwp
- [redacted]_Pre-Certification Model V3.1.1.25_20181026_PRE-CERT.mwp.res
- [redacted]_Pre-Certification Model V3.2.0.1_20200415_Final Energy Model.mwp



Final Submissions – Field Documentation PHI

- Project Elevations
- Duct Insulation & ERVs Info
- Appliances
- Envelope Assemblies
- MEP Equipment, DHW Equipment
- Site Visit Reports
- Whole Building BD Test Report
- TAB Report
- Contractor Declaration



Field Documentation PHI – Elevations Images

Final Submissions – Field Documentation PHI

- Duct Insulation & ERVs Info, Refrigerant Insulation

SHOP DRAWING COMMENTS

PROJECT:

SUBMISSION: HVAC Insulation

DATE OF SUBMISSION: 01/19/18

DATE OF REVIEW: 01/31/18

ACTION TAKEN: AAN

BY: Robert McGee, PE

NOTES:

☐ NO EXCEPTION TAKEN
☒ APPROVED AS NOTED
☐ REVISE AND RESUBMIT
☐ RESUBMIT FOR RECORD
☐ REJECTED

Checking is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for Dimensions which shall be confirmed and correlated at the job site, fabrication processes and techniques of construction - coordination of his work with that of other trades and the satisfactory performance of his work.

EP ENGINEERING LLC

Date 01/31/2018

Reviewed By RM

PLEASE REFER TO ENGINEER'S COMMENTS IN THE SUBMITTAL PACKAGE FOR ADDITIONAL COMMENTS THAT MUST BE ADDRESSED PRIOR TO RELEASE.

PASSIVE HOUSE CONSULTANT AND ACOUSTICAL CONSULTANT SHALL REVIEW THIS SUBMITTAL PACKAGE PRIOR TO RELEASE.

Steven Winter Associates, Inc. 307 7th Ave, Suite 1701 New York, NY 10001

☐ No Exception Taken ☐ Rejected
☐ Approved As Noted ☐ Revised and Accepted
☒ Revise and Resubmit ☐ Checked

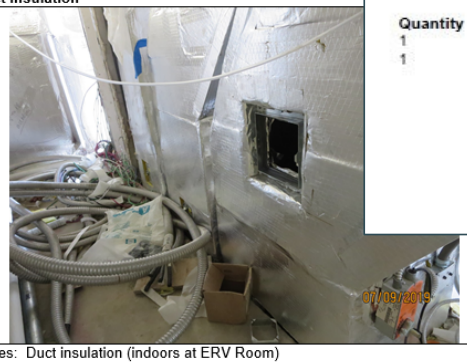
This review has been performed to verify general conformance with the design concept of the project and general compliance with the information provided in the contract documents. The contractor is responsible for confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating work with that of all other trades; and performing work in a safe and satisfactory manner. Corrections or comments made to submittal during this review do not relieve contractor from compliance with requirements of drawings and specifications.

By: Mike O'Donnell
Project: 211 W 29th
Date: 02/15/2018
Notes:

- R&R: Micro-Lok
- AAN: 800 Series & Microlite
- No comment: Duct Liner
- See comments throughout submittal

2/5/18
1" THICK JOHNS MANVILLE DUCTLINER IS APRPOVED FOR ACOUSTICAL PURPOSES.
ROB HANSEN
ROBERT A. HANSEN ASSOC.
(212) 687-2672

Duct Insulation



Notes: Duct insulation (indoors at ERV Room)

Notes: Duct insulation (indoors)

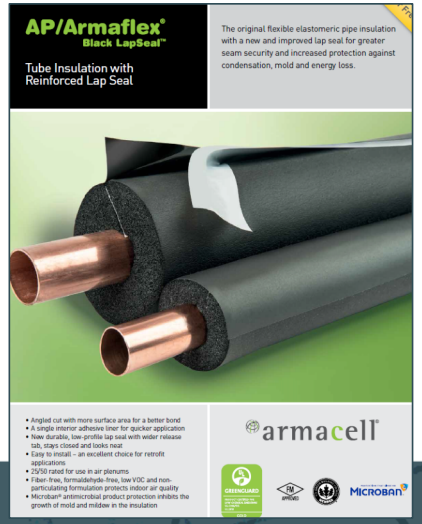
Project:
Customer
Engineer
Sales Office:
Date: 09.06.2018
Rev. Number: 2

Swegon

Quantity	Description	Tag	Model
1	Passive House certified ERV-Indoor Application	ERV-R-1	RX35
1	AHRI 1060 certified (Non-PHI certified) ERV-Indoor Application	ERV-M-1	RX05

ERV-R-1 and ERV-M-1 configured as "right handed" unit (when looking at the unit with door openings and pipe connections facing you, supply airflow is from left to right).

Contractor should confirm handing before releasing. Please refer to unit drawing page for handing confirmation.



Final Submissions – Field Documentation PHI

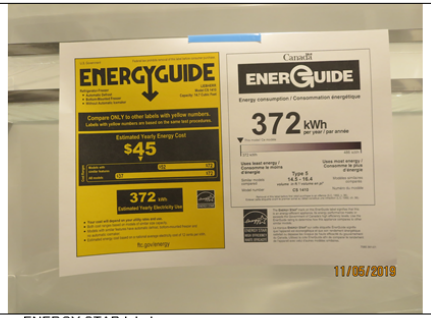
- Appliances – refrigerators, washers, dryers, dishwashers, induction cooktops

APPLIANCES

Refrigerators

Notes: Overview (Fridge)

Notes: Nameplate – Liebherr CS 1410



Notes: ENERGY STAR label

Notes:

Washers - Apartments

Notes: Overview (washer)

Notes: Nameplate – Blomberg WM98200SX2


ENERGY STAR CERTIFIED
Residential Clothes Washers

Blomberg : WM 98200 SX2

Specifications

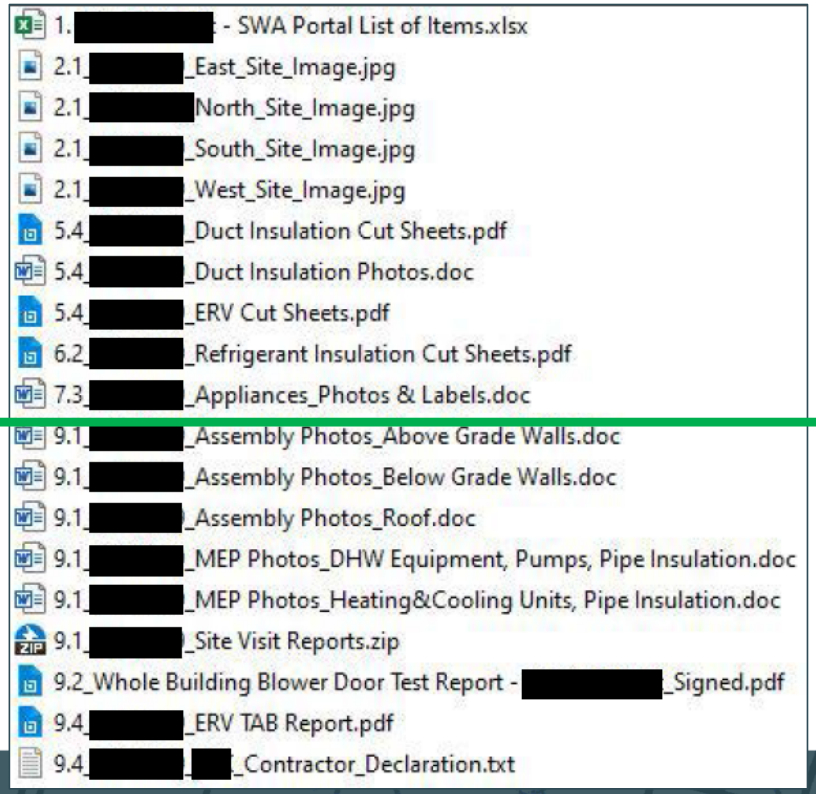
Brand Name:	Blomberg
Model Number:	WM 98200 SX2
Load Configuration:	Front Load
Volume (cu. ft.):	2.5
Integrated Modified Energy Factor (IMEF):	2.29
US Federal Standard (IMEF):	1.84
Annual Energy Use (kWh/yr):	82
Integrated Water Factor (IWF):	3.6
US Federal Standard (IWF):	4.7
Annual Water Use (gallons/yr):	2655
Connected:	No
Paired ENERGY STAR Clothes Dryer Available:	Yes
Paired ENERGY STAR Clothes Dryer ENERGY STAR Model Identifier:	ES_1036108_DHP24412W_01202017205610_5770588,ES_1036108_DHP2
Date Certified:	2015-04-13
Markets:	United States, Canada
ENERGY STAR Model Identifier:	ES_1036108_WM 98200 SX2_12192017095327_9271470
ENERGY STAR Certified:	Yes

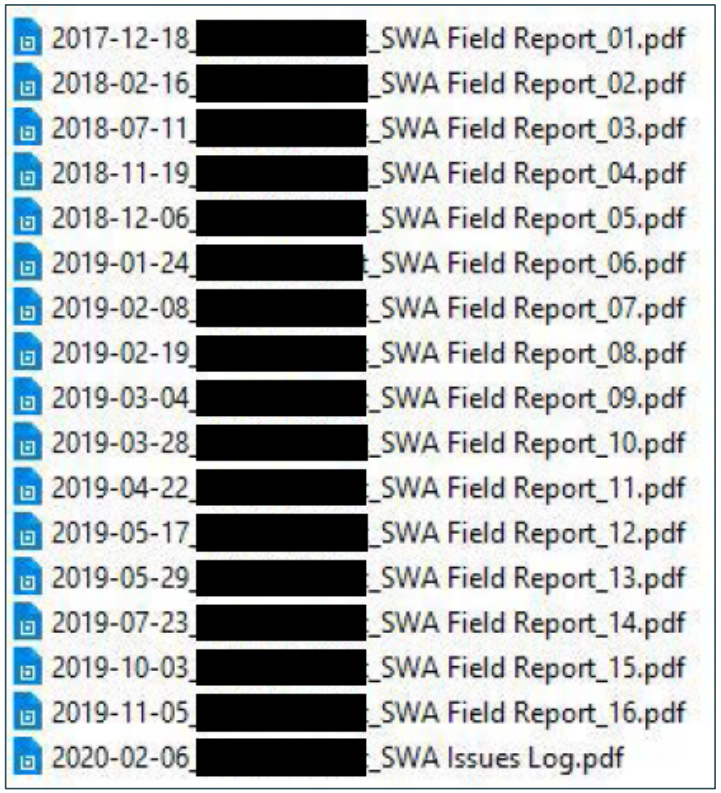
Notes: ENERGY STAR label

Notes:

Final Submissions – Field Documentation PHI

- Remaining Items – similar to PHIUS



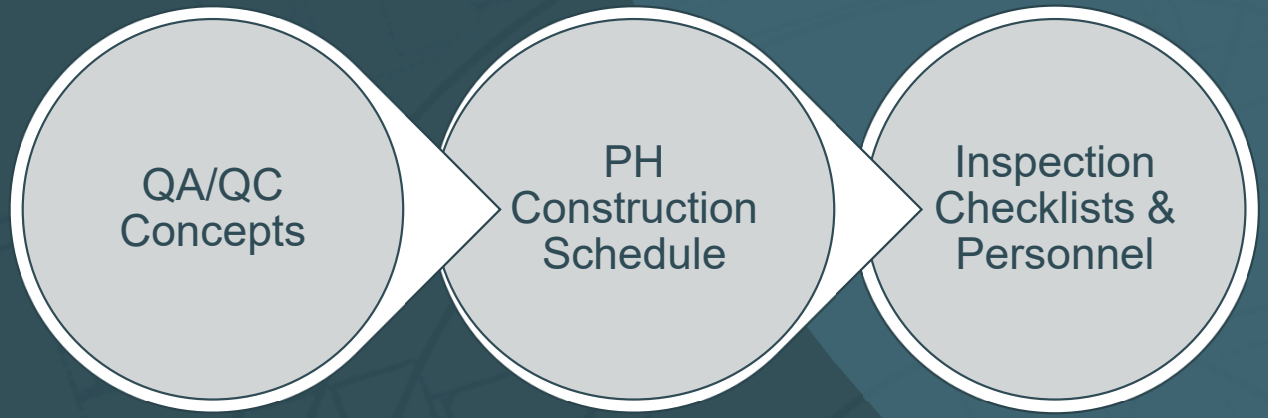


Questions?

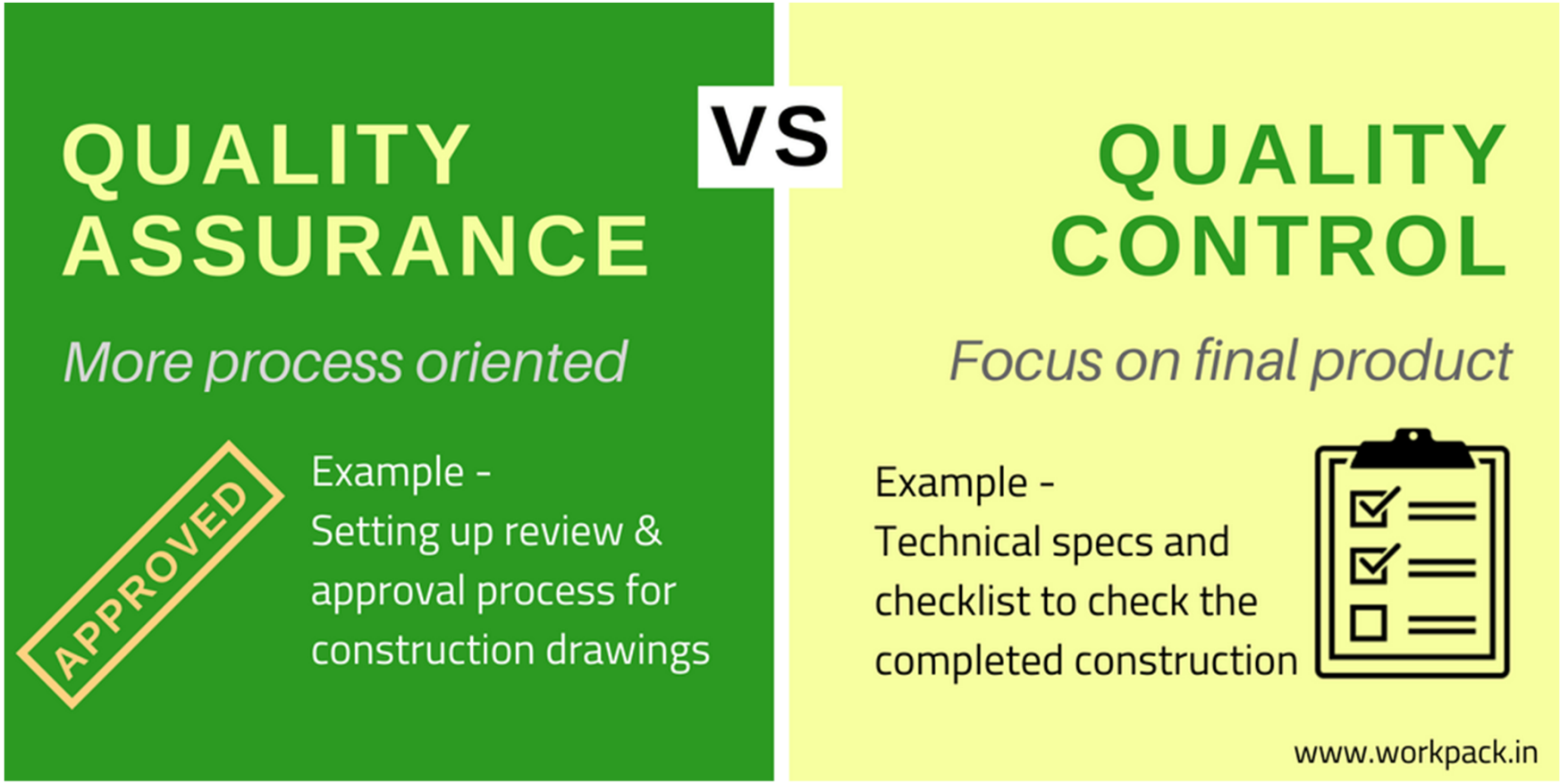
5 Minute Break

Process for Project Success

Quality Control & Quality Assurance



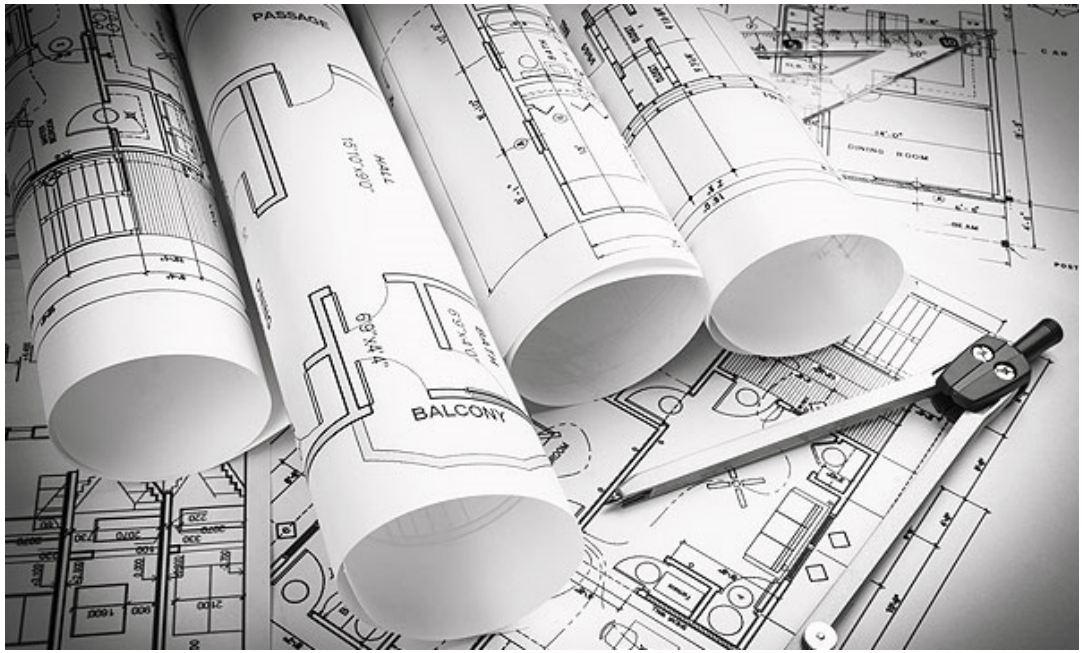
Quality Assurance vs Quality Control



https://www.workpack.in/2018/06/27/difference-quality-assurance-qa-quality-control-qc-construction/

Quality Assurance Defined

The planned and systematic activities implemented in a quality system so that quality requirements for a product or service will be fulfilled.



http://www.buildingprofessionals.com/quality-assurance/what-is-quality-assurance-2/

Quality Control Defined

Quality control is the part of quality management that ensures products and service comply with requirements.

It measures the quality characteristics of a unit, compares them with the established standards, and analyses the differences between the results obtained and the desired results to make decisions which will correct any differences.

https://www.designingbuildings.co.uk/wiki/Quality_control_for_construction_works

Quality Assurance vs Quality Control

QA	QC
A management tool	A corrective tool
Process-oriented	Product-oriented
Proactive strategy	Reactive strategy
Prevention of defects	Detection of defects
Everyone' responsibility	Testing & verifications team's responsibility
Planned then performed in parallel with a project	Preformed after final product is ready

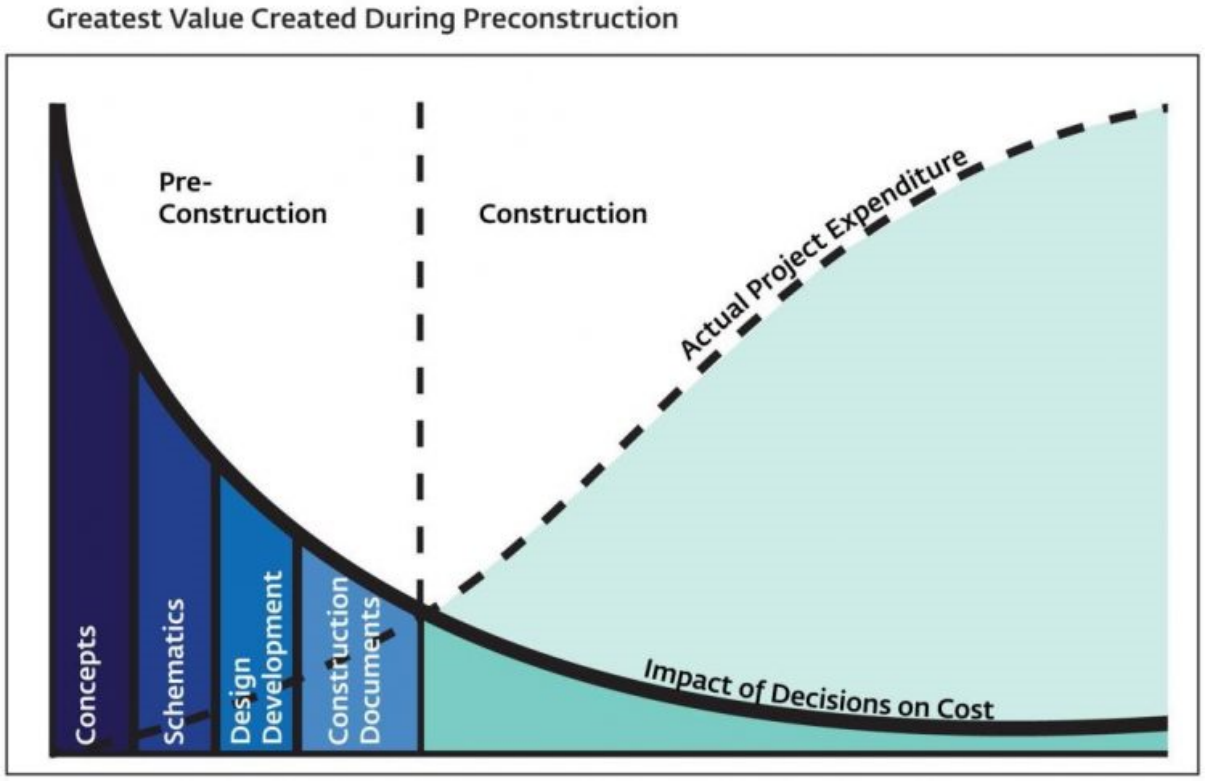
https://www.sam-solutions.com/blog/quality-assurance-vs-quality-control-the-difference-and-comparison/

Quality Assurance vs Quality Control

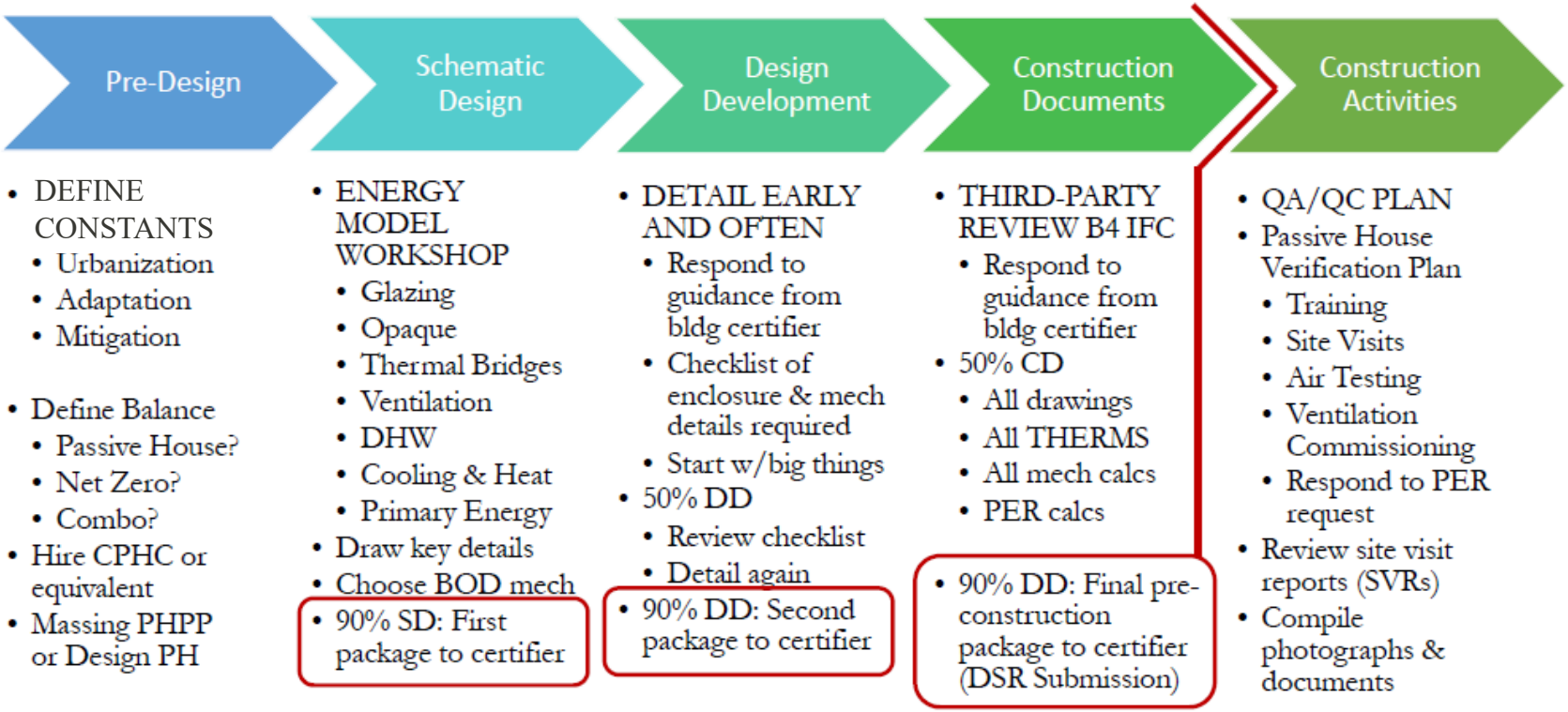
- To measure construction quality both QA and QC are essential to ensure the project is executed according to the standards
- It is critical to define quality with the owner
  - If Passive House certification or net zero is required by the owner a baseline of acceptable quality for high performance is required
- Factors include schedule, budget, fulfillment of specifications, ensuring final product preforms the intended purpose

Early Engagement

- Front loaded design
- Project team needs to work very closely together
- Design decision making during pre-construction
- Many projects succeed with first time PH team members if the owner & architect are committed



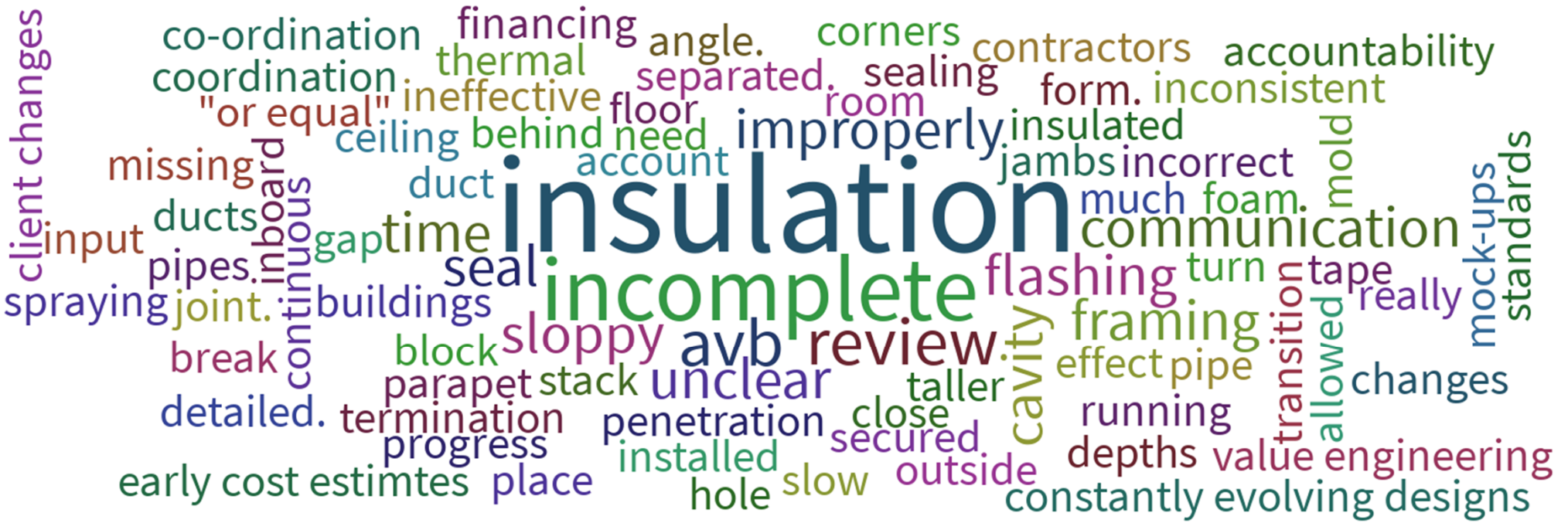
Integrating Net Zero



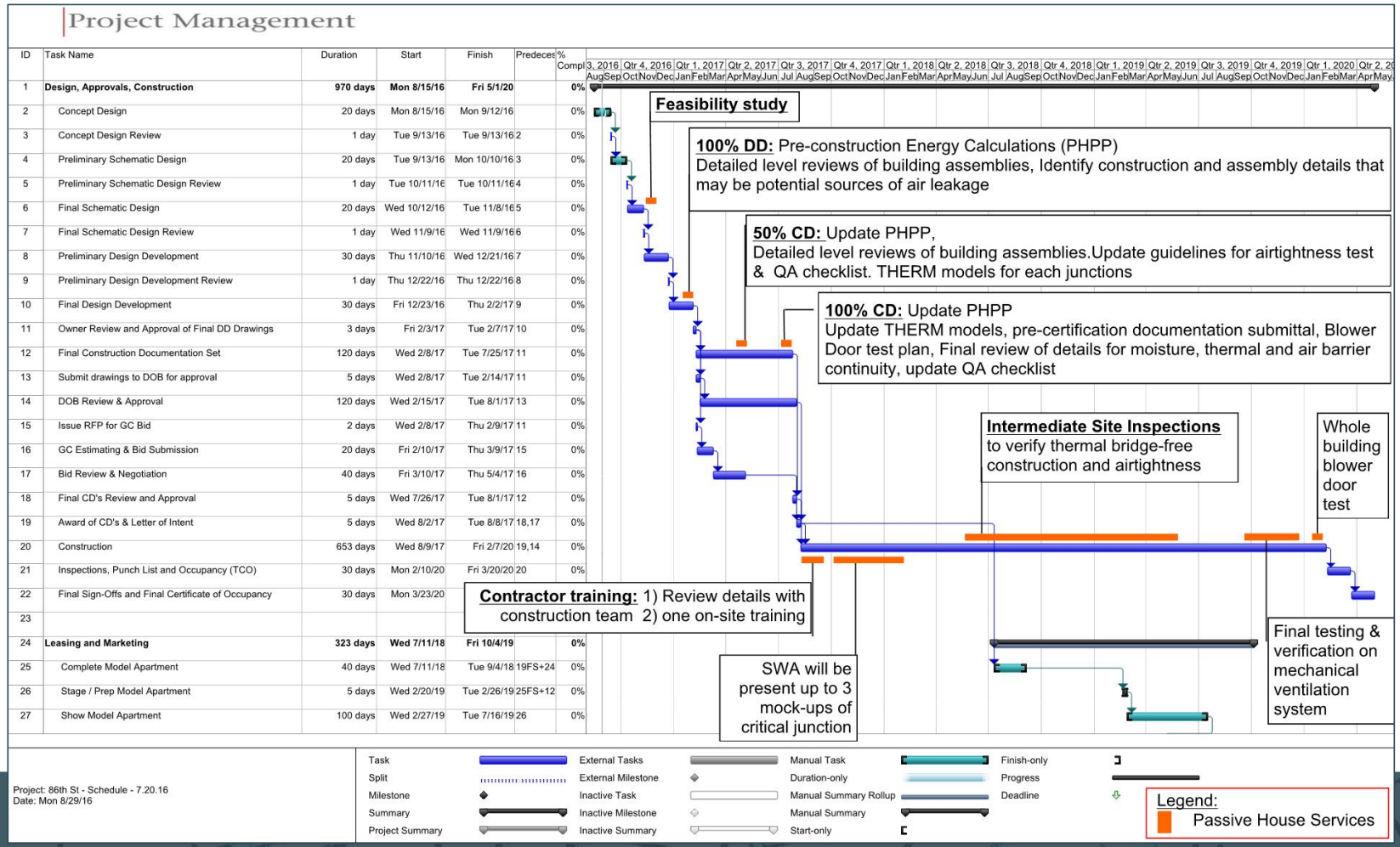
When poll is active, respond at **PollEv.com/swa335**

Text **SWA335** to **22333** once to join

What are some challenges of making sure all items get into the drawings & specs?

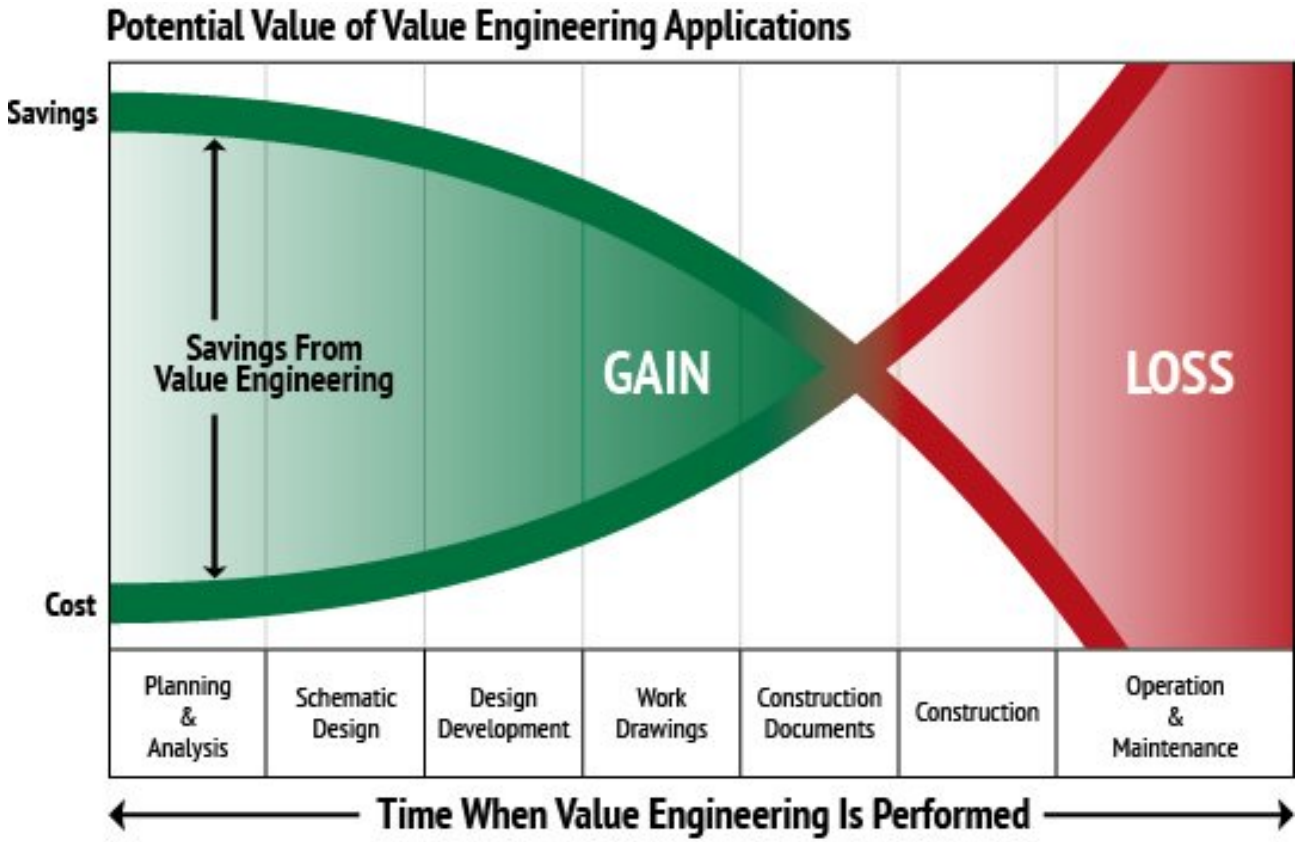


Integrating Net Zero

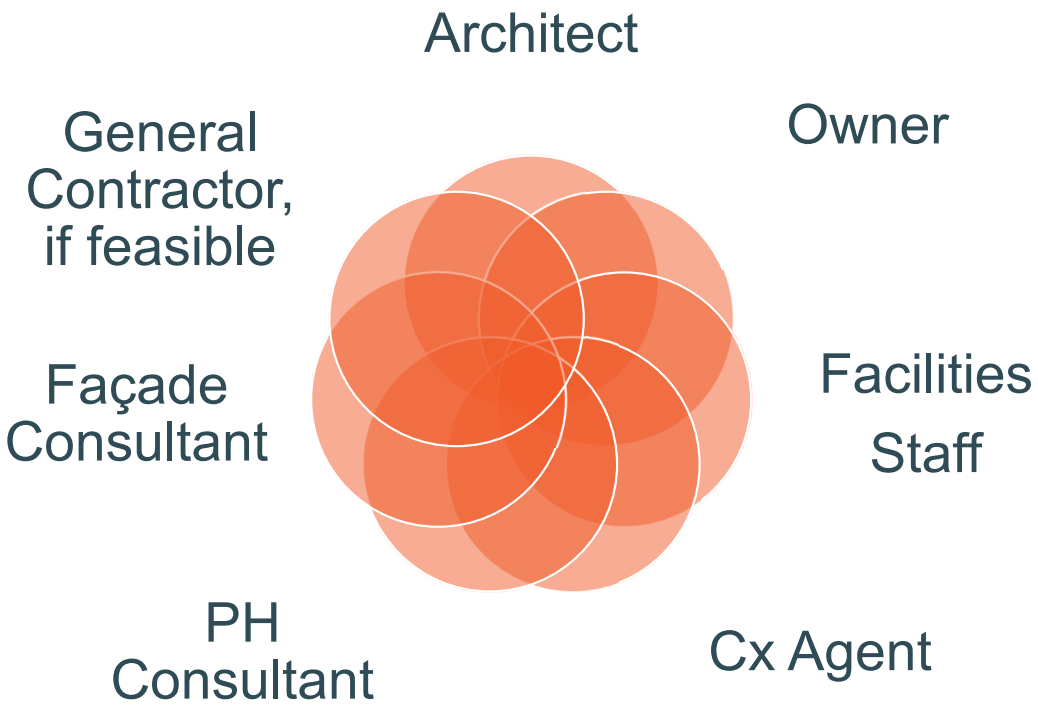


ID	Task Name	Duration	Start	Finish	Predeces	% Compl
1	**Design, Approvals, Construction**	**970 days**	**Mon 8/15/16**	**Fri 5/1/20**		0%
2	Concept Design	20 days	Mon 8/15/16	Mon 9/12/16		0%
3	Concept Design Review	1 day	Tue 9/13/16	Tue 9/13/16	2	0%
4	Preliminary Schematic Design	20 days	Tue 9/13/16	Mon 10/10/16	3	0%
5	Preliminary Schematic Design Review	1 day	Tue 10/11/16	Tue 10/11/16	4	0%
6	Final Schematic Design	20 days	Wed 10/12/16	Tue 11/8/16	5	0%
7	Final Schematic Design Review	1 day	Wed 11/9/16	Wed 11/9/16	6	0%
8	Preliminary Design Development	30 days	Thu 11/10/16	Wed 12/21/16	7	0%
9	Preliminary Design Development Review	1 day	Thu 12/22/16	Thu 12/22/16	8	0%
10	Final Design Development	30 days	Fri 12/23/16	Thu 2/2/17	9	0%
11	Owner Review and Approval of Final DD Drawings	3 days	Fri 2/3/17	Tue 2/7/17	10	0%
12	Final Construction Documentation Set	120 days	Wed 2/8/17	Tue 7/25/17	11	0%
13	Submit drawings to DOB for approval	5 days	Wed 2/8/17	Tue 2/14/17	11	0%
14	DOB Review & Approval	120 days	Wed 2/15/17	Tue 8/1/17	13	0%
15	Issue RFP for GC Bid	2 days	Wed 2/8/17	Thu 2/9/17	11	0%
16	GC Estimating & Bid Submission	20 days	Fri 2/10/17	Thu 3/9/17	15	0%
17	Bid Review & Negotiation	40 days	Fri 3/10/17	Thu 5/4/17	16	0%
18	Final CD's Review and Approval	5 days	Wed 7/26/17	Tue 8/1/17	12	0%
19	Award of CD's & Letter of Intent	5 days	Wed 8/2/17	Tue 8/8/17	18,17	0%
20	Construction	653 days	Wed 8/9/17	Fri 2/7/20	19,14	0%
21	Inspections, Punch List and Occupancy (TCO)	30 days	Mon 2/10/20	Fri 3/20/20	20	0%
22	Final Sign-Offs and Final Certificate of Occupancy	30 days	Mon 3/23/20			
23						
24	**Leasing and Marketing**	**323 days**	**Wed 7/11/18**	**Fri 10/4/19**		0%
25	Complete Model Apartment	40 days	Wed 7/11/18	Tue 9/4/18	19FS+24	0%
26	Stage / Prep Model Apartment	5 days	Wed 2/20/19	Tue 2/26/19	25FS+12	0%
27	Show Model Apartment	100 days	Wed 2/27/19	Tue 7/16/19	26	0%

Value Engineering – Be Careful



Who should be included from the beginning?



PH Overview Construction Timeline

14	DOB Review & Approval	120 days	Wed 2/15/17	Tue 8/1/17	13	0%
15	Issue RFP for GC Bid	2 days	Wed 2/8/17	Thu 2/9/17	11	0%
16	GC Estimating & Bid Submission	20 days	Fri 2/10/17	Thu 3/9/17	15	0%
17	Bid Review & Negotiation	40 days	Fri 3/10/17	Thu 5/4/17	16	0%
18	Final CD's Review and Approval	5 days	Wed 7/26/17	Tue 8/1/17	12	0%
19	Award of CD's & Letter of Intent	5 days	Wed 8/2/17	Tue 8/8/17	18,17	0%
20	Construction	653 days	Wed 8/9/17	Fri 2/7/20	19,14	0%
21	Inspections, Punch List and Occupancy (TCO)	30 days	Mon 2/10/20	Fri 3/20/20	20	0%
22	Final Sign-Offs and Final Certificate of Occupancy	30 days	Mon 3/23/20			
23						
24	**Leasing and Marketing**	**323 days**	**Wed 7/11/18**	**Fri 10/4/19**		**0%**
25	Complete Model Apartment	40 days	Wed 7/11/18	Tue 9/4/18	19FS+24	0%
26	Stage / Prep Model Apartment	5 days	Wed 2/20/19	Tue 2/26/19	25FS+12	0%
27	Show Model Apartment	100 days	Wed 2/27/19	Tue 7/16/19	26	0%

Intermediate Site Inspections to verify thermal bridge-free construction and airtightness

Whole building blower door test

Contractor training: 1) Review details with construction team 2) one on-site training

SWA will be present up to 3 mock-ups of critical junction

Final testing & verification on mechanical ventilation system

Project: 86th St - Schedule - 7.20.16
Date: Mon 8/29/16

Task	External Tasks	Manual Task	Finish-only		
Split	External Milestone	Duration-only	Progress		
Milestone	Inactive Task	Manual Summary Rollup	Deadline		
Summary	Inactive Milestone	Manual Summary			
Project Summary	Inactive Summary	Start-only			

Legend:
Passive House Services

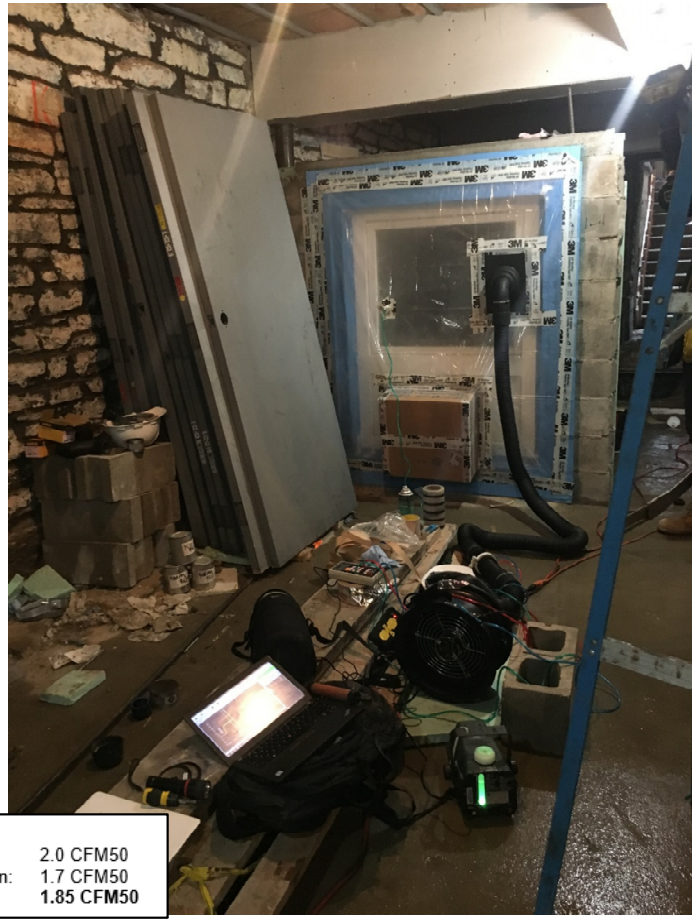
Page 1

Mock Up – PMU Testing

Why performance test a pre-construction mock-up?

- Great tool to verify design intent meets performance requirements
- Identify the logistics and sequencing of complex PH details
- Assist in working out sub-contractors responsibilities and provides hands on experience to subs responsible be fulfilling the design details
  - Used to QC sub contractor workmanship
  - Must use same contractors that will be on site
- Costs associated issues with details during construction mock up testing can out weigh the cost of the PMU

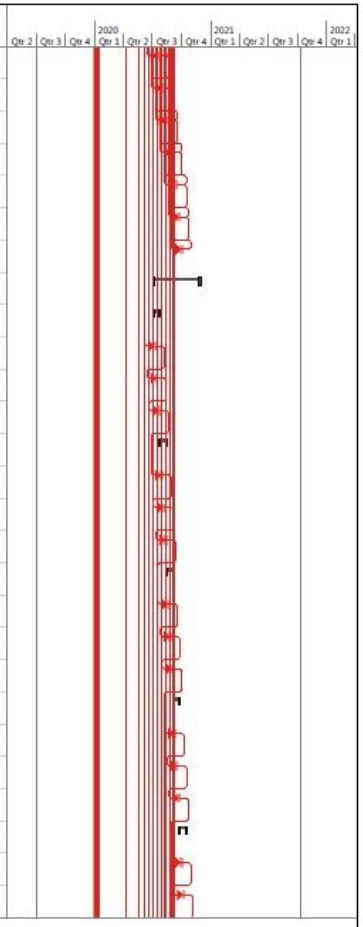
Pre-Construction Window mockup test



Final Airflow Rates:			
Rough Opening:	45" x 58"	Tested Pressurization:	2.0 CFM50
Air tightness metric:	0.08 CFM/sf	Tested Depressurization:	1.7 CFM50
Airflow Target:	**1.45 CFM50**	**Tested Average:**	**1.85 CFM50**

Construction Schedule

ID	Task Mode	Task Name	Baseline Duration	Baseline Start	Baseline Finish	% Complet	Actual Start	Actual Finish	Scheduled Start	Scheduled Finish
83		CMU Interior/Exterior Walls 6th floor (South)	10 days	Mon 6/15/20	Fri 6/26/20	0%	NA	NA	Fri 7/10/20	Fri 7/24/20
84		CMU Interior/Exterior Walls 7th floor (North)	10 days	Mon 6/29/20	Fri 7/10/20	0%	NA	NA	Fri 7/24/20	Fri 8/7/20
85		CMU Interior/Exterior Walls 7th floor (South)	10 days	Mon 7/13/20	Fri 7/24/20	0%	NA	NA	Fri 8/7/20	Fri 8/21/20
86		CMU Interior/Exterior Walls 8th floor (North)	10 days	Mon 7/27/20	Fri 8/7/20	0%	NA	NA	Fri 8/21/20	Fri 9/4/20
87		CMU Interior/Exterior Walls 8th floor (South)	10 days	Mon 8/10/20	Fri 8/21/20	0%	NA	NA	Fri 9/4/20	Fri 9/18/20
88		CMU Bulkhead North	5 days	Mon 8/24/20	Fri 8/28/20	0%	NA	NA	Fri 9/18/20	Fri 9/25/20
89		CMUC Bulkhead South	5 days	Mon 8/31/20	Fri 9/4/20	0%	NA	NA	Fri 9/25/20	Fri 10/2/20
90		**Brick**	**105 days**	**Mon 6/8/20**	**Fri 10/30/20**	**0%**	**NA**	**NA**	**Fri 7/3/20**	**Fri 11/27/20**
91		**2nd-3rd floor**	**15 days**	**Mon 6/8/20**	**Fri 6/26/20**	**0%**	**NA**	**NA**	**Fri 7/3/20**	**Fri 7/24/20**
92		Air/Vapor Barrier	5 days	Mon 6/8/20	Fri 6/12/20	0%	NA	NA	Fri 7/3/20	Fri 7/10/20
93		Insulation	5 days	Mon 6/15/20	Fri 6/19/20	0%	NA	NA	Fri 7/10/20	Fri 7/17/20
94		Brick	5 days	Mon 6/22/20	Fri 6/26/20	0%	NA	NA	Fri 7/17/20	Fri 7/24/20
95		**3rd-4th floor**	**15 days**	**Mon 6/29/20**	**Fri 7/17/20**	**0%**	**NA**	**NA**	**Fri 7/24/20**	**Fri 8/14/20**
96		Air/Vapor Barrier	5 days	Mon 6/29/20	Fri 7/3/20	0%	NA	NA	Fri 7/24/20	Fri 7/31/20
97		Insulation	5 days	Mon 7/6/20	Fri 7/10/20	0%	NA	NA	Fri 7/31/20	Fri 8/7/20
98		Brick	5 days	Mon 7/13/20	Fri 7/17/20	0%	NA	NA	Fri 8/7/20	Fri 8/14/20
99		**4th-5th floor**	**15 days**	**Mon 7/20/20**	**Fri 8/7/20**	**0%**	**NA**	**NA**	**Fri 8/14/20**	**Fri 9/4/20**
100		Air/Vapor Barrier	5 days	Mon 7/20/20	Fri 7/24/20	0%	NA	NA	Fri 8/14/20	Fri 8/21/20
101		Insulation	5 days	Mon 7/27/20	Fri 7/31/20	0%	NA	NA	Fri 8/21/20	Fri 8/28/20
102		Brick	5 days	Mon 8/3/20	Fri 8/7/20	0%	NA	NA	Fri 8/28/20	Fri 9/4/20
103		**5th-6th floor**	**15 days**	**Mon 8/10/20**	**Fri 8/28/20**	**0%**	**NA**	**NA**	**Fri 9/4/20**	**Fri 9/25/20**
104		Air/Vapor Barrier	5 days	Mon 8/10/20	Fri 8/14/20	0%	NA	NA	Fri 9/4/20	Fri 9/11/20
105		Insulation	5 days	Mon 8/17/20	Fri 8/21/20	0%	NA	NA	Fri 9/11/20	Fri 9/18/20
106		Brick	5 days	Mon 8/24/20	Fri 8/28/20	0%	NA	NA	Fri 9/18/20	Fri 9/25/20
107		**6th-7th floor**	**15 days**	**Mon 8/31/20**	**Fri 9/18/20**	**0%**	**NA**	**NA**	**Fri 9/25/20**	**Fri 10/16/20**
108		Air/Vapor Barrier	5 days	Mon 8/31/20	Fri 9/4/20	0%	NA	NA	Fri 9/25/20	Fri 10/2/20
109		Insulation	5 days	Mon 9/7/20	Fri 9/11/20	0%	NA	NA	Fri 10/2/20	Fri 10/9/20



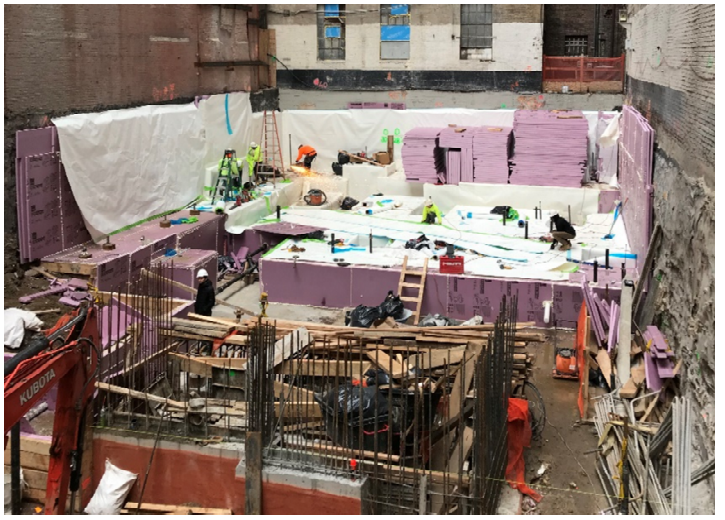
Project:
Date: Mon 12/30/19

Task
Split
Milestone
Summary
Project Summary
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
External Tasks
External Milestone
Deadline
Critical
Critical Split
Progress
Manual Progress

Page 4

Verification for Large Projects

- Foundations
  - Abutting neighbor(s)
  - Staging of foundation
  - Under slab / stem walls
- Above Grade Walls
  - Wall construction type: CMU, wood framed, etc.
  - Sequencing for hoistways, upper vs. lower floors
- Roof
  - Thermal breaks and roof membrane penetrations
  - Bulkheads, louvers & dampers



Verification for Large Projects

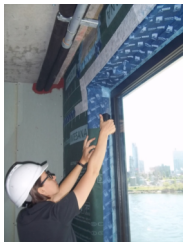
- Air Barrier
  - Window mockup testing
  - Interim guarded blower door testing
  - Compartmentalization (if applicable)
  - Unique component testing
  - Whole building blower door test
- MEP
  - In unit heat/cool duct testing
  - Ventilation
  - Fan power
  - TAB process
  - Pipe insulation
  - Lighting wattages & controls

PH Construction and QA/QC Process

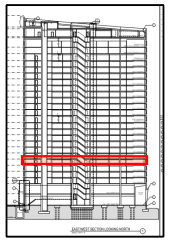
Project Team Kickoff (Review Checklists)

Below Grade Inspections

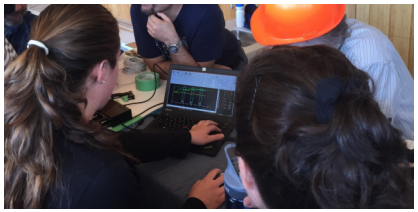
Mockup Testing and Contractor Training

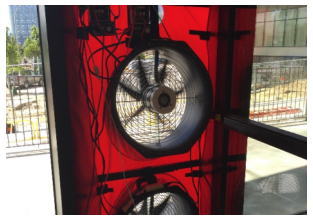


Interim Testing and Inspections



Guarded Blower Door Test

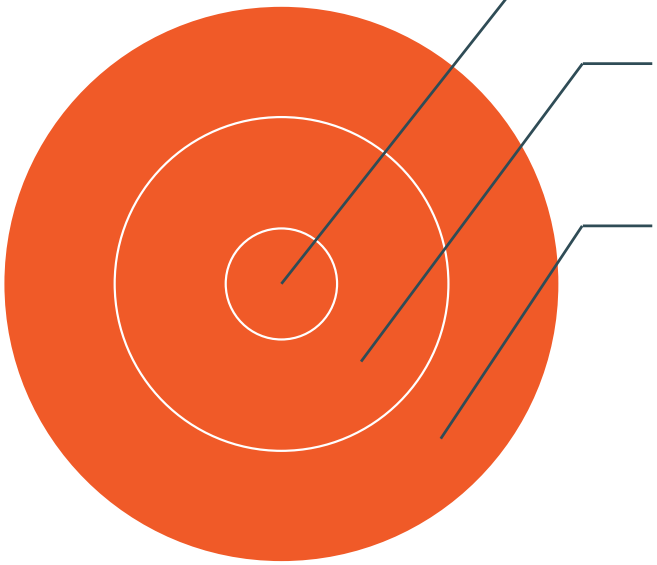




Final Blower Door Test

Airtightness

- Air barrier install
- Window details & installation
- Interim and spot testing
- Guarded BD Test
- Whole building BD Test



Planning during design and the integrated design approach

Training for contractors and subs

Inspections and testing

Contractor Trainings

- Typically two sessions: one for Envelope trades, one for MEP trades

Contractor Trainings

SWA Checklists for QA

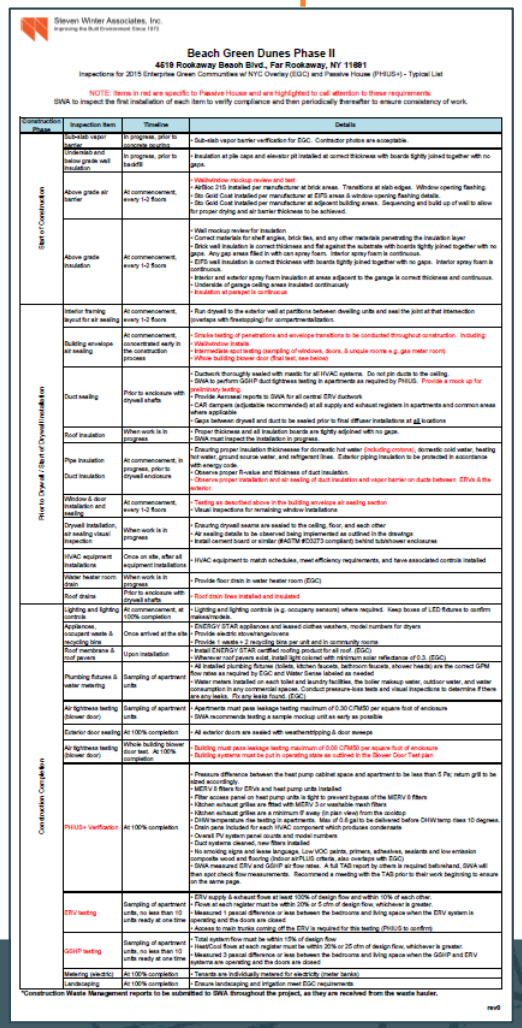
- To help both SWA and the contractors understand what is to be verified during the construction process and the quality expected, two checklists are developed and review with the construction team during kickoff (typically at foundation stages)
  - Typical Checklist – outlines repetitive items throughout construction
  - Unique Checklist – outlines “one-off” items but are important for PH

Typical & Unique Checklists

Start of Construction

Prior to Drywall / Start of Drywall Installation

Construction Completion



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

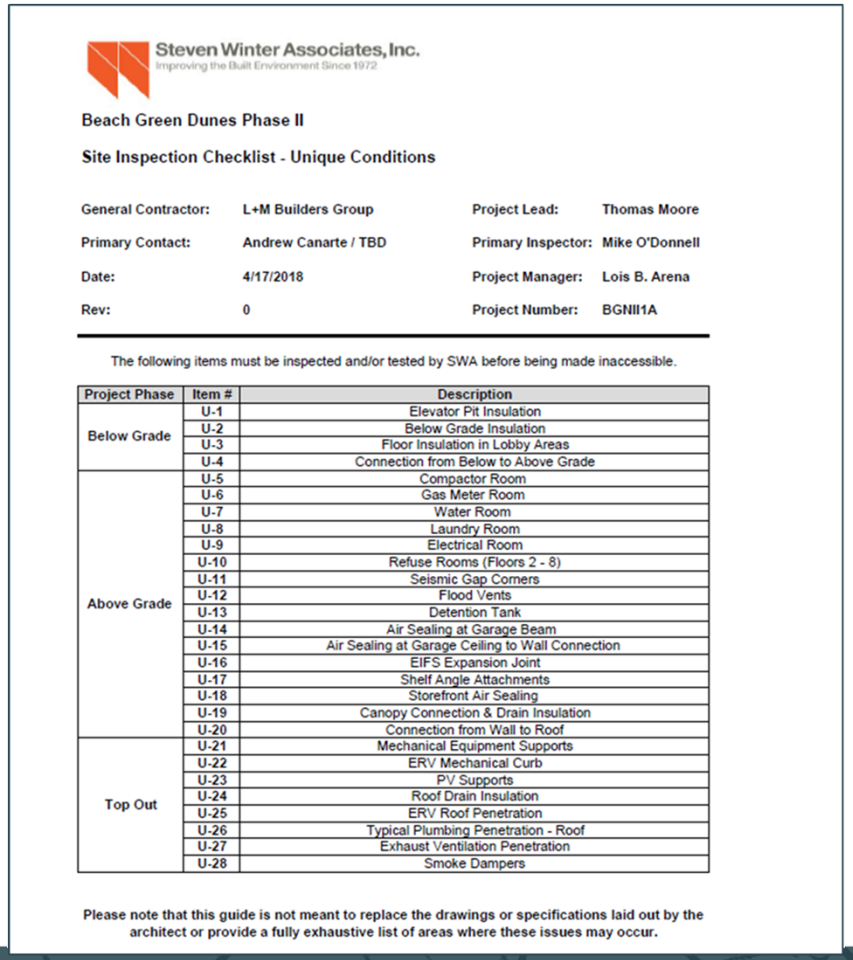
Beach Green Dunes Phase II
4619 Rockaway Beach Blvd., Far Rockaway, NY 11691
Inspections for 2015 Enterprise Green Communities w/ NYC Overlay (EGC) and Passive House (PHUS+) - Typical List

NOTE: Items in red are specific to Passive House and are highlighted to call attention to these requirements.
SWA to inspect the first installation of each item to verify compliance and then periodically thereafter to ensure consistency of work.

Construction Phase	Inspection Item	Timeline	Details
Start of Construction	Sub-slab vapor barrier	In progress, prior to concrete pouring	• Sub-slab vapor barrier verification for EGC. Contractor photos are acceptable.
	Underslab and below grade wall insulation	In progress, prior to backfill	• Insulation at pile caps and elevator pit installed at correct thickness with boards tightly joined together with no gaps.
	Above grade air barrier	At commencement, every 1-2 floors	• Wall/window mockup review and test • AirBloc 21S installed per manufacturer at brick areas. Transitions at slab edges. Window opening flashing. • Sto Gold Coat installed per manufacturer at EIFS areas & window opening flashing details. • Sto Gold Coat installed per manufacturer at adjacent building areas. Sequencing and build up of wall to allow for proper drying and air barrier thickness to be achieved.
	Above grade insulation	At commencement, every 1-2 floors	• Wall mockup review for insulation • Correct materials for shelf angles, brick ties, and any other materials penetrating the insulation layer • Brick wall insulation is correct thickness and flat against the substrate with boards tightly joined together with no gaps. Any gap areas filled in with can spray foam. Interior spray foam is continuous. • EIFS wall insulation is correct thickness with boards tightly joined together with no gaps. Interior spray foam is continuous. • Interior and exterior spray foam insulation at areas adjacent to the garage is correct thickness and continuous. • Underside of garage ceiling areas insulated continuously • Insulation at parapet is continuous
Prior to Drywall / Start of Drywall Installation	Interior framing layout for air sealing	At commencement, every 1-2 floors	• Run drywall to the exterior wall at partitions between dwelling units and seal the joint at that intersection (overlaps with firestopping) for compartmentalization.
	Building envelope air sealing	At commencement, concentrated early in the construction process	• Smoke testing of penetrations and envelope transitions to be conducted throughout construction. Including: • Wall/window installs • Intermediate spot testing (sampling of windows, doors, & unique rooms e.g. gas meter room) • Whole building blower door (final test, see below)
	Duct sealing	Prior to enclosure with drywall shafts	• Ductwork thoroughly sealed with mastic for all HVAC systems. Do not pin ducts to the ceiling. • SWA to perform DeltaQ duct tightness testing in apartments as required by PHIUS. Provide a mock up for preliminary testing. • Provide Aeroseal reports to SWA for all central ERV ductwork • CAR dampers (adjustable recommended) at all supply and exhaust registers in apartments and common areas where applicable • Gaps between drywall and duct to be sealed prior to final diffuser installations at all locations
	Roof insulation	When work is in progress	• Proper thickness and all insulation boards are tightly adjoined with no gaps. • SWA must inspect the installation in progress.
	Pipe insulation Duct insulation	At commencement, in progress, prior to drywall enclosure	• Ensuring proper insulation thicknesses for domestic hot water (including crotons), domestic cold water, heating hot water, ground source water, and refrigerant lines. Exterior piping insulation to be protected in accordance with energy code. • Observe proper R-value and thickness of duct insulation. • Observe proper installation and air sealing of duct insulation and vapor barrier on ducts between ERVs & the exterior.
	Window & door installation and sealing	At commencement, every 1-2 floors	• Testing as described above in the building envelope air sealing section • Visual inspections for remaining window installations
	Drywall installation, air sealing visual inspection	When work is in progress	• Ensuring drywall seams are sealed to the ceiling, floor, and each other • Air sealing details to be observed being implemented as outlined in the drawings • Install cement board or similar (ASTM #C3273 compliant) behind tub/shower enclosures
	HVAC equipment installations	Once on site, after all equipment installations	• HVAC equipment to match schedules, meet efficiency requirements, and have associated controls installed
	Water heater room drain	When work is in progress	• Provide floor drain in water heater room (EGC)
	Roof drains	Prior to enclosure with drywall shafts	• Roof drain lines installed and insulated
Construction Completion	Lighting and lighting controls	At commencement, at 100% completion	• Lighting and lighting controls (e.g. occupancy sensors) where required. Keep boxes of LED fixtures to confirm makes/models.
	Appliances, occupant waste & recycling bins	Once arrived at the site	• ENERGY STAR appliances and leased clothes washers, model numbers for dryers • Provide electric stoves/ranges/ovens • Provide 1 waste + 2 recycling bins per unit and in community rooms
	Roof membranes & roof pavers	Upon installation	• Install ENERGY STAR certified roofing product for all roof. (EGC) • Wherever roof pavers exist, install light colored with minimum solar reflectance of 0.3. (EGC)
	Plumbing fixtures & water metering	Sampling of apartment units	• All installed plumbing fixtures (toilets, kitchen faucets, bathroom faucets, shower heads) are the correct GPM flow rates as required by EGC and Water Sense labeled as needed • Water meters installed on each toilet and laundry facilities, the boiler makeup water, outdoor water, and water consumption in any commercial spaces. Conduct pressure-loss tests and visual inspections to determine if there are any leaks. Fix any leaks found. (EGC)
	Air tightness testing (blower door)	Sampling of apartment units	• Apartments must pass leakage testing maximum of 0.30 CFM50 per square foot of enclosure • SWA recommends testing a sample mockup unit as early as possible
	Exterior door sealing	At 100% completion	• All exterior doors are sealed with weatherstripping & door sweeps
	Air tightness testing (blower door)	Whole building blower door test. At 100% completion	• Building must pass leakage testing maximum of 0.06 CFM50 per square foot of enclosure • Building systems must be put in operating state as outlined in the Blower Door Test plan
	PHIUS+ Verification	At 100% completion	• Pressure difference between the heat pump cabinet space and apartment to be less than 5 Pa; return grill to be sized accordingly. • MERV 8 filters for ERVs and heat pump units installed • Filter access panel on heat pump units is tight to prevent bypass of the MERV 8 filters • Kitchen exhaust grilles are fitted with MERV 3 or washable mesh filters • Kitchen exhaust grilles are a minimum 6" away (in plan view) from the cooktop • DHW temperature rise testing in apartments. Max of 0.6 gal to be delivered before DHW temp rises 10 degrees. • Drain pans included for each HVAC component which produces condensate • Overall PV system panel counts and model numbers • Duct systems cleaned, new filters installed • No smoking signs and lease language, Low VOC paints, primers, adhesives, sealants and low emission composite wood and flooring (Indoor airPLUS criteria, also overlaps with EGC) • SWA measured ERV and GSHP air flow rates. A full TAB report by others is required beforehand. SWA will then spot check flow measurements. Recommend a meeting with the TAB prior to their work beginning to ensure on the same page.
	ERV testing	Sampling of apartment units, no less than 10 units ready at one time	• ERV supply & exhaust flows at least 100% of design flow and within 10% of each other. • Flows at each register must be within 20% or 5 cfm of design flow, whichever is greater. • Measured 1 pascal difference or less between the bedrooms and living space when the ERV system is operating and the doors are closed • Access to main trunks coming off the ERV is required for this testing (PHIUS to confirm)
	GSHP testing	Sampling of apartment units, no less than 10 units ready at one time	• Total system flow must be within 15% of design flow • Heat/Cool flows at each register must be within 20% or 25 cfm of design flow, whichever is greater. • Measured 3 pascal difference or less between the bedrooms and living space when the GSHP and ERV systems are operating and the doors are closed
	Metering (electric)	At 100% completion	• Tenants are individually metered for electricity (meter banks)
	Landscaping	At 100% completion	• Ensure landscaping and irrigation meet EGC requirements

*Construction Waste Management reports to be submitted to SWA throughout the project, as they are received from the waste hauler.

rev0



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

Beach Green Dunes Phase II

Site Inspection Checklist - Unique Conditions

General Contractor:	L+M Builders Group	Project Lead:	Thomas Moore
Primary Contact:	Andrew Canarte / TBD	Primary Inspector:	Mike O'Donnell
Date:	4/17/2018	Project Manager:	Lois B. Arena
Rev:	0	Project Number:	BGNII1A

The following items must be inspected and/or tested by SWA before being made inaccessible.

Project Phase	Item #	Description
Below Grade	U-1	Elevator Pit Insulation
	U-2	Below Grade Insulation
	U-3	Floor Insulation in Lobby Areas
	U-4	Connection from Below to Above Grade
Above Grade	U-5	Compactor Room
	U-6	Gas Meter Room
	U-7	Water Room
	U-8	Laundry Room
	U-9	Electrical Room
	U-10	Refuse Rooms (Floors 2 - 8)
	U-11	Seismic Gap Corners
	U-12	Flood Vents
	U-13	Detention Tank
	U-14	Air Sealing at Garage Beam
	U-15	Air Sealing at Garage Ceiling to Wall Connection
	U-16	EIFS Expansion Joint
	U-17	Shelf Angle Attachments
	U-18	Storefront Air Sealing
	U-19	Canopy Connection & Drain Insulation
	U-20	Connection from Wall to Roof
Top Out	U-21	Mechanical Equipment Supports
	U-22	ERV Mechanical Curb
	U-23	PV Supports
	U-24	Roof Drain Insulation
	U-25	ERV Roof Penetration
	U-26	Typical Plumbing Penetration - Roof
	U-27	Exhaust Ventilation Penetration
	U-28	Smoke Dampers

Please note that this guide is not meant to replace the drawings or specifications laid out by the architect or provide a fully exhaustive list of areas where these issues may occur.

Typical Checklist – Start of Construction

Inspections for 2015 Enterprise Green Communities w/ NYC Overlay (EGC) and Passive House (PHIUS+) - Typical List

NOTE: Items in red are specific to Passive House and are highlighted to call attention to these requirements.
SWA to inspect the first installation of each item to verify compliance and then periodically thereafter to ensure consistency of work.

Construction Phase	Inspection Item	Timeline	Details
Start of Construction	Sub-slab vapor barrier	In progress, prior to concrete pouring	• Sub-slab vapor barrier verification for EGC. Contractor photos are acceptable.
	Underslab and below grade wall insulation	In progress, prior to backfill	• Insulation at pile caps and elevator pit installed at correct thickness with boards tightly joined together with no gaps.
	Above grade air barrier	At commencement, every 1-2 floors	• Wall/window mockup review and test • AirBloc 21S installed per manufacturer at brick areas. Transitions at slab edges. Window opening flashing. • Sto Gold Coat installed per manufacturer at EIFS areas & window opening flashing details. • Sto Gold Coat installed per manufacturer at adjacent building areas. Sequencing and build up of wall to allow for proper drying and air barrier thickness to be achieved.
	Above grade insulation	At commencement, every 1-2 floors	• Wall mockup review for insulation • Correct materials for shelf angles, brick ties, and any other materials penetrating the insulation layer • Brick wall insulation is correct thickness and flat against the substrate with boards tightly joined together with no gaps. Any gap areas filled in with can spray foam. Interior spray foam is continuous. • EIFS wall insulation is correct thickness with boards tightly joined together with no gaps. Interior spray foam is continuous. • Interior and exterior spray foam insulation at areas adjacent to the garage is correct thickness and continuous. • Underside of garage ceiling areas insulated continuously • Insulation at parapet is continuous

Typical Checklist – Prior to Drywall

Prior to Drywall / Start of Drywall Installation	Interior framing layout for air sealing	At commencement, every 1-2 floors	• Run drywall to the exterior wall at partitions between dwelling units and seal the joint at that intersection (overlaps with firestopping) for compartmentalization.
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	Exterior door sealing	At 100% completion	• All exterior doors are sealed with weatherstripping & door sweeps
	Air tightness testing (blower door)	Whole building blower door test. At 100% completion	• Building must pass leakage testing maximum of 0.08 CFM50 per square foot of enclosure • Building systems must be put in operating state as outlined in the Blower Door Test plan
	PHIUS+ Verification	At 100% completion	• Pressure difference between the heat pump cabinet space and apartment to be less than 5 Pa; return grill to be sized accordingly. • MERV 8 filters for ERVs and heat pump units installed • Filter access panel on heat pump units is tight to prevent bypass of the MERV 8 filters • Kitchen exhaust grilles are fitted with MERV 3 or washable mesh filters • Kitchen exhaust grilles are a minimum 6' away (in plan view) from the cooktop • DHW temperature rise testing in apartments. Max of 0.6 gal to be delivered before DHW temp rises 10 degrees. • Drain pans included for each HVAC component which produces condensate • Overall PV system panel counts and model numbers • Duct systems cleaned, new filters installed • No smoking signs and lease language, Low VOC paints, primers, adhesives, sealants and low emission composite wood and flooring (Indoor airPLUS criteria, also overlaps with EGC) • SWA measured ERV and GSHP air flow rates. A full TAB report by others is required beforehand, SWA will then spot check flow measurements. Recommend a meeting with the TAB prior to their work beginning to ensure on the same page.
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***Construction Waste Management reports to be submitted to SWA throughout the project, as they are received from the waste hauler.**

Unique Checklist – TOC

The following items must be inspected and/or tested by SWA before being made inaccessible.

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	U-11	Seismic Gap Corners
	U-12	Flood Vents
	U-13	Detention Tank
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	U-16	EIFS Expansion Joint
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	U-18	Storefront Air Sealing
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	U-24	Roof Drain Insulation
	U-25	ERV Roof Penetration
	U-26	Typical Plumbing Penetration - Roof
	U-27	Exhaust Ventilation Penetration
	U-28	Smoke Dampers

Please note that this guide is not meant to replace the drawings or specifications laid out by the architect or provide a fully exhaustive list of areas where these issues may occur.

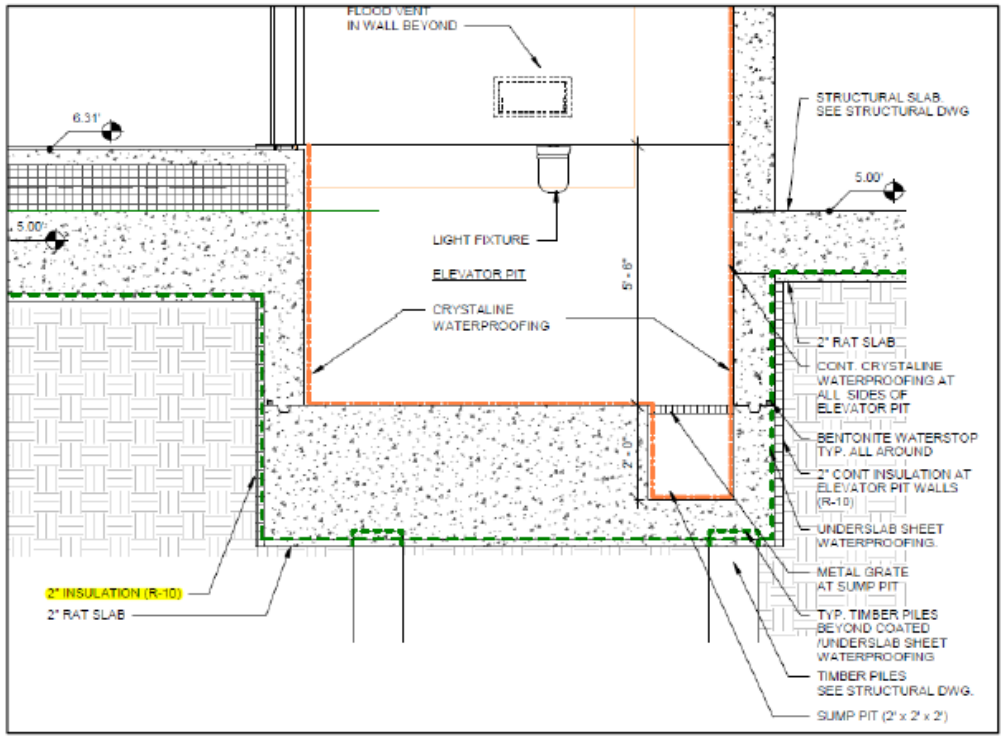
Unique Checklist – Example 1

Item #	Inspection	Detail Date
U - 1	Elevator Pit Insulation	Bulletin 1 - 01/24/2018

Description

2" rigid insulation installed as indicated at the elevator pit. Boards flat against the wall with no gaps / any gaps filled with spray foam.

Images



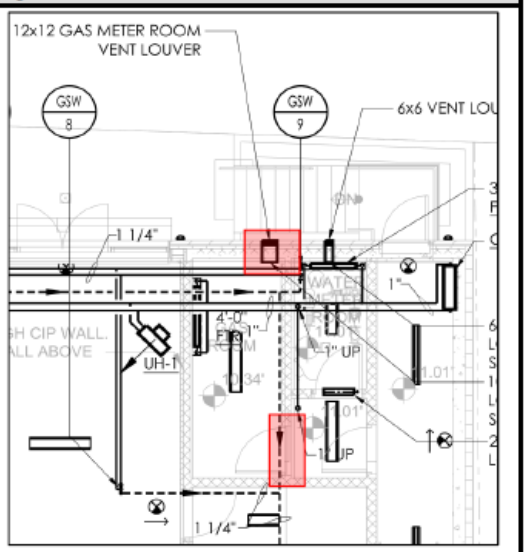
Unique Checklist – Example 2

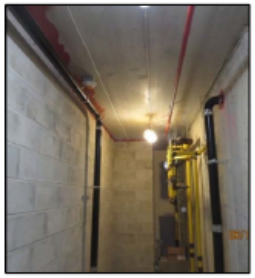
Item #	Inspection	Detail Date
U - 6	Gas Meter Room	Bulletin 1 - 01/24/2018

Description

Louver vent installed with continuous sealant around perimeter. Door to the room must fully be gasketed and weather stripped. Gas room penetrations must be air sealed.

Images





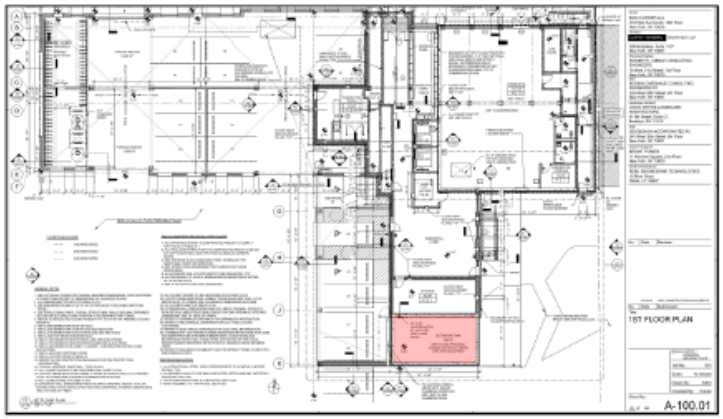
Unique Checklist – Example 3

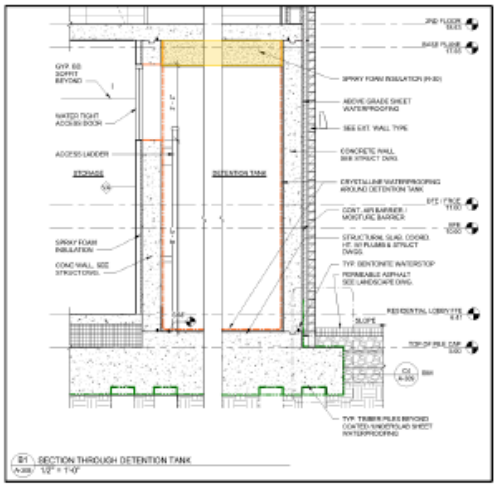
Item #	Inspection	Detail Date
U - 13	Detention Tank	Bulletin 1 - 01/24/2018

Description

Ensure continuous installation of spray foam insulation between the top of the detention tank and the underside of the apartment above; R-30 insulation indicated. Spray foam insulation between detention tank and Storage area.

Images





Notes

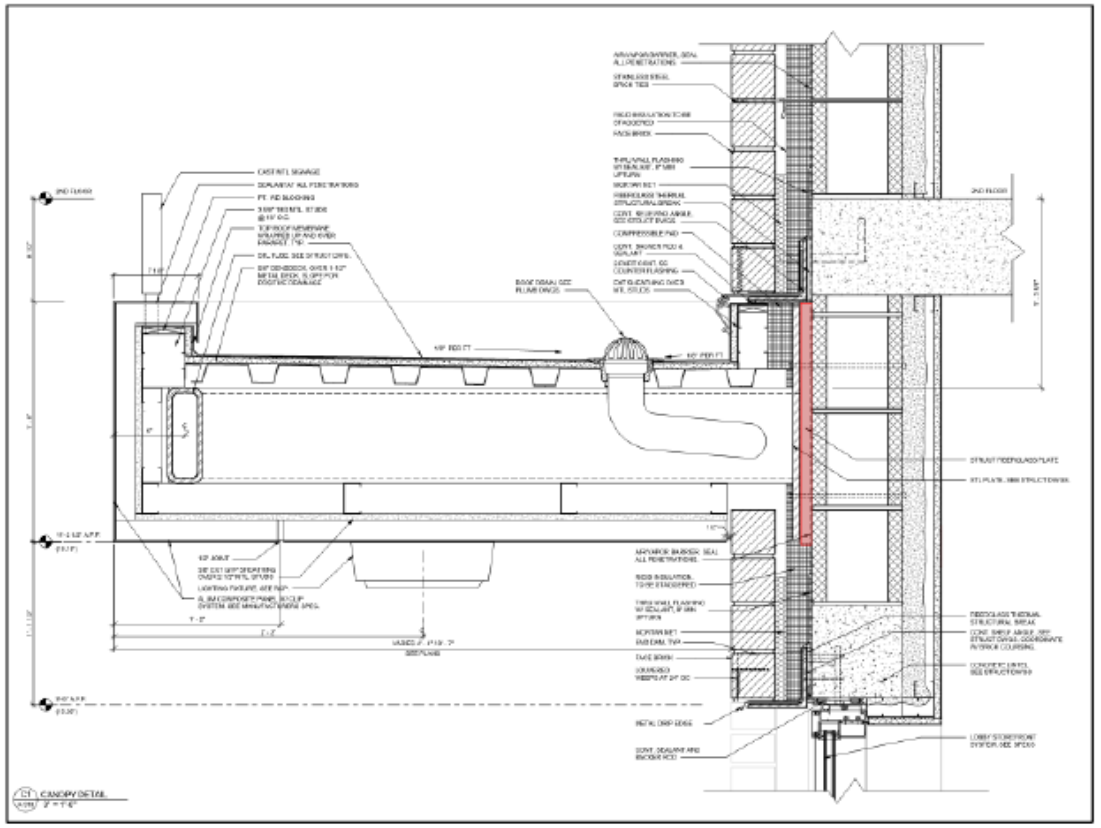
Unique Checklist – Example 4

Item #	Inspection	Detail Date
U - 19	Canopy Connection & Drain Insulation	Bulletin 1 - 01/24/2018

Description

Sturctural fiberglass plate is to be installed at canopy connection; refer to drawing A-318. Canopy drain line to be insulated (not currently indicated)

Images



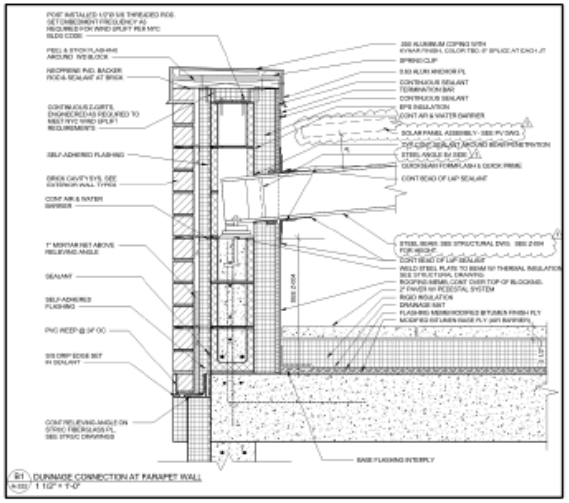
Unique Checklist – Example 5

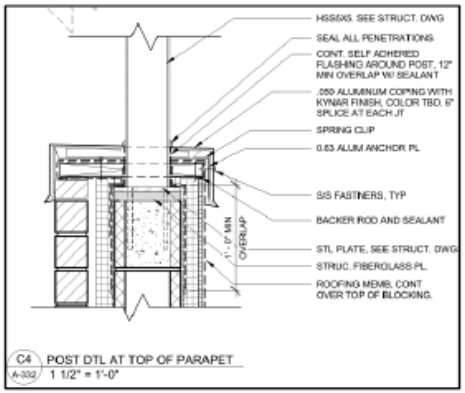
Item #	Inspection	Detail Date
U - 23	PV Supports	Bulletin 1 - 01/24/2018

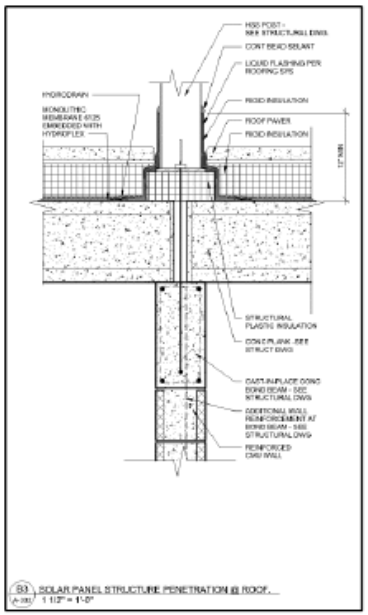
Description

All steel connections for PV penetrations must be installed with thermal breaks. Structural plastic thermal break underneath the horizontal parapet and roof penetrations. Vertical support connection at the top of the parapet must be installed with a fiberglass thermal break. Refer to details B1 - A332, B3 - A332, and C4 - A332.

Images







Notes

Dedicated Onsite Personnel

- Dedicated air barrier supervisor from CM team overseeing installation and continuity
- Dedicated air barrier contractors
- Supplemental air barrier consultant / tester hired by the GC for their own quality control

Dedicated Onsite Personnel

- The more eyes on the air barrier, the better.
- Don’t forget about the other trades though – although they won’t be “graded” with an air barrier test, their quality of work is important for achieving PH goals

Questions?

What's wrong with this photo?
(hint: there can be more than one thing)

What do you see wrong with this photo? Image 1

What do you see wrong with this photo? Image 2

What do you see wrong with this photo? Image 3

What do you see wrong with this photo? Image 4

What do you see wrong with this photo? Image 5

What do you see wrong with this photo? Image 6

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What do you see wrong with this photo? Image 8

What do you see wrong with this photo? Image 9

What do you see wrong with this photo? Image 10

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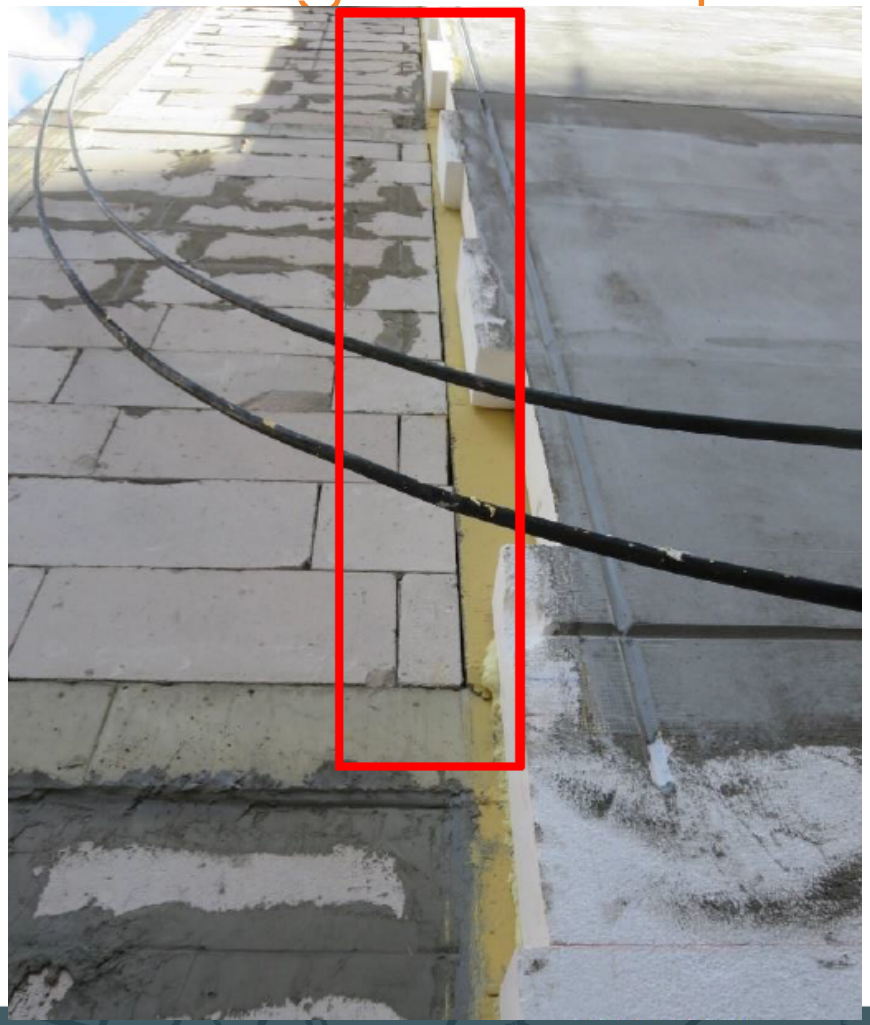
What do you see wrong with this photo? Image 13

What do you see wrong with this photo? Image 14



What do you see wrong with this photo? Image 15

Product observed on site does not match the submittal

What do you see wrong with this photo? Image 16

Seriously?

SWA Reports and Tracking

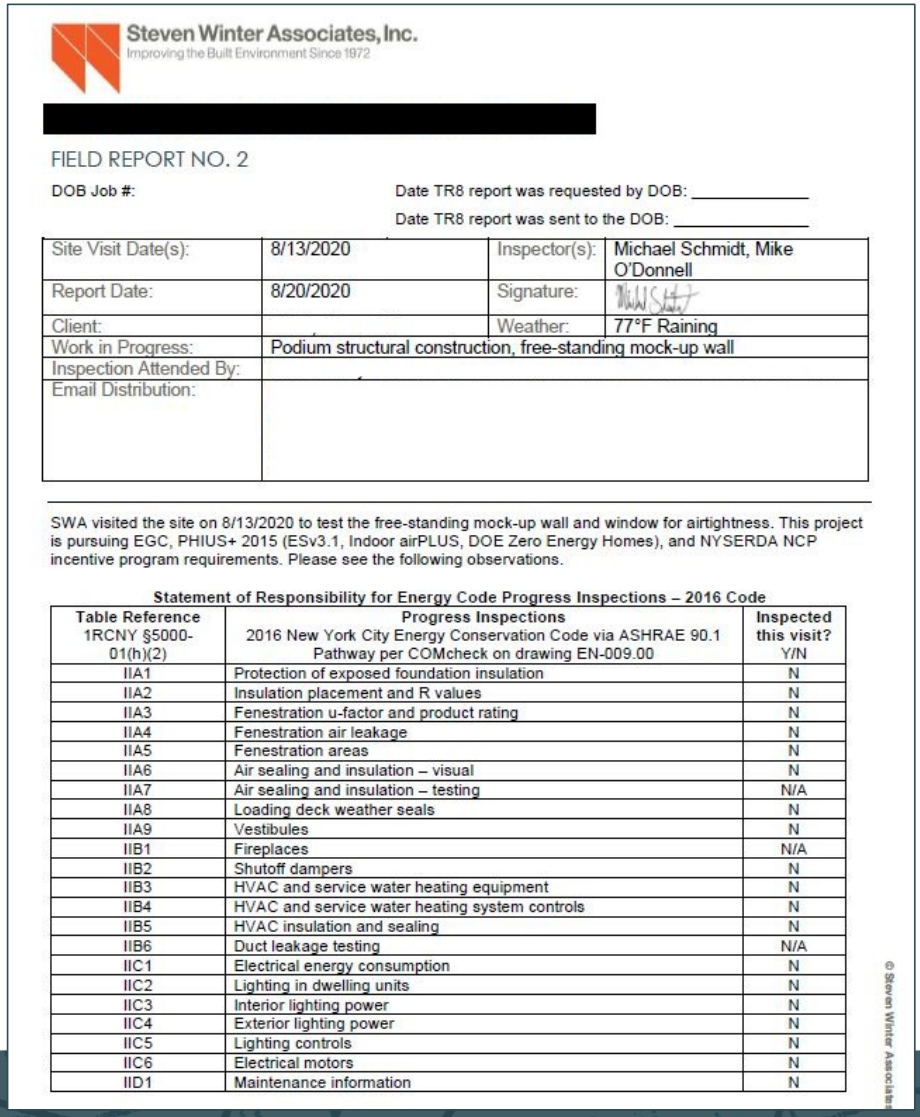
- Reporting Field Conditions
- Remedial Work
- Confirmation
- Issues Log

Photos & Sharing

- Take photos in 3 views
  - Overview photos to give context
  - Middle range photos to show more detail
  - Close up photos to show small details (e.g. air barrier around brick ties)

- Sharing photos on **Procore** or by **email**

Site Visit Reports



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

[redacted]

FIELD REPORT NO. 2

DOB Job #:

Date TR8 report was requested by DOB: _____

Date TR8 report was sent to the DOB: _____

Site Visit Date(s):	8/13/2020	Inspector(s):	Michael Schmidt, Mike O'Donnell
Report Date:	8/20/2020	Signature:	
Client:		Weather:	77°F Raining
Work in Progress:	Podium structural construction, free-standing mock-up wall		
Inspection Attended By:			
Email Distribution:			

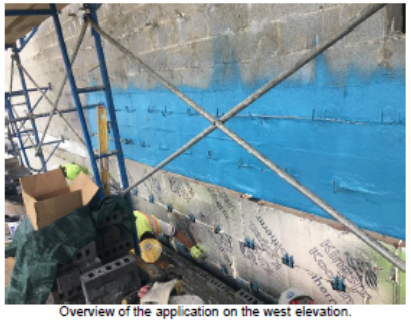
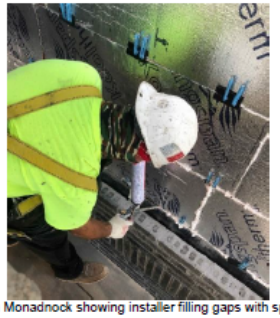
SWA visited the site on 8/13/2020 to test the free-standing mock-up wall and window for airtightness. This project is pursuing EGC, PHIUS+ 2015 (ESv3.1, Indoor airPLUS, DOE Zero Energy Homes), and NYSERDA NCP incentive program requirements. Please see the following observations.

Statement of Responsibility for Energy Code Progress Inspections – 2016 Code

Table Reference 1RCNY §5000-01(h)(2)	Progress Inspections 2016 New York City Energy Conservation Code via ASHRAE 90.1 Pathway per COMcheck on drawing EN-009.00	Inspected this visit? Y/N
IIA1	Protection of exposed foundation insulation	N
IIA2	Insulation placement and R values	N
IIA3	Fenestration u-factor and product rating	N
IIA4	Fenestration air leakage	N
IIA5	Fenestration areas	N
IIA6	Air sealing and insulation – visual	N
IIA7	Air sealing and insulation – testing	N/A
IIA8	Loading deck weather seals	N
IIA9	Vestibules	N
IIB1	Fireplaces	N/A
IIB2	Shutoff dampers	N
IIB3	HVAC and service water heating equipment	N
IIB4	HVAC and service water heating system controls	N
IIB5	HVAC insulation and sealing	N
IIB6	Duct leakage testing	N/A
IIC1	Electrical energy consumption	N
IIC2	Lighting in dwelling units	N
IIC3	Interior lighting power	N
IIC4	Exterior lighting power	N
IIC5	Lighting controls	N
IIC6	Electrical motors	N
IID1	Maintenance information	N

Site Visit Reports

ARCHITECTURAL & PASSIVE HOUSE (PHI)

Item #	Description and Action Required	Images
1	**Insulation placement and R values** **Drawing References:** A-313, A-312 **Submittal:** 072100-02.0 **Description:** SWA observed the installation of 3" Kingspan insulation on the above-grade walls in progress at the north tower, west and interior court north elevations floor 4-5. SWA requested progress photos to verify the gaps in insulation boards were being filled before being covered up with brick. Monadnock provided photos 8/10/2020, and these look good. Continue installing boards joined tightly without gaps and filling any gaps that do exist with spray foam. **Required Actions:** - None	 Overview of the application on the west elevation.  Photo from Monadnock showing installer filling gaps with spray foam.  Thickness measurement indicating 3".

Additional Support - When Needed

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

307 7TH AVENUE, SUITE 1701, NEW YORK, NY 10001

MEMO

Date: 12/23/2019

To: [redacted]

From: Mike O'Donnell (SWA)

Re: ERV and VRF Installation Practices for Project Success - [redacted]

ERV Systems

1. Seiho exterior vent cap hoods to have a short run of ductwork attached, with duct seam sealed and duct to vent cap connection sealed with mastic. These will be given to the EIFS contractor for installation from the outside. See photo, page 3.
2. Install spray foam in the entire gap space between the duct and the cored holes after hoods with duct are installed. Caulk the hood on the exterior (EIFS contractor).
3. **General duct sealing:** All joints, seams, branch connections, taps, screw heads, and duct connections to equipment are to be fully sealed with mastic at all locations.
4. Per clarification from the engineer, no backdraft dampers need to be installed.
5. Connect 5" flex duct, with R-8 insulation jacket, where the duct stubs through the cored wall hole at the OA and EA locations. Zip tie to hold in place, then seal with mastic at the seam between the flex duct and the hard duct. See example photo, page 4.
6. Pull the insulation silver jacket to drywall, and tape around the entire perimeter using short strips of tape. The tape needs to be fully flat against both the insulation jacket and drywall. See photo, page 5. https://www.energyconscious.com/3m-all-weather-flashing-tape-tan-slit-liner-3-in-x-75-ft-16266.html
7. Limit the 5" flex duct to 5 feet. For the OA connection, this should not be an issue as this is a short duct run. Come off the ERV unit with 6" hard duct, reduce down to 5" and then connect flex duct. Seal joint between the flex duct and the hard duct, similar to #4. See photo, page 6.
8. For the EA connection, make the section closest to the exterior wall 5" flex with the remaining duct run in hard duct. Utilize 6" hard duct for a long as possible. See photo, page 6.
9. Insulate the remaining portions of the OA and EA hard duct with R-8 foil faced insulation wrap, with all seams of the insulation taped. See photo, page 6.
10. At the ERV unit, pull the insulation jackets up and tape the connection between the plastic lip on the unit and the silver foil face of the insulation. See photo, page 7.
11. On the FA (supply side), each register box to get its own CAR damper. Utilize wye connections as needed to ensure each box is separate from any other boxes. See photo, page 8. All duct work to be hard duct on FA and RA sides (no flex).
12. On the RA (exhaust side), note the following:
    A. Kitchen register locations need to be 6' distance away from the center of the stove
    B. Kitchen registers are to have MERV 4 washable filters installed. Cut to size as needed. See photo, page 9. https://www.hardwareworld.com/prnh75m/True-Blue-Budget-Washable-Air-Filter-Approx-20-x-30-x-1
13. Duct to sheetrock connections to be sealed with caulking or tape prior to installation of final grilles. See photo, page 10.
14. Car dampers to go right inside the register box, typical for all locations. See photo, page 10.

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VRF Systems

1. The KoolDuct systems of ductwork look to be well sealed. However, note the following locations to be sealed as these were found to be leaky during preliminary duct testing:
    a. Connection from the KoolDuct to the flexible fabric connection (supply side)
    b. Connection from the flexible fabric connection to the air handler unit (supply side)
    c. Connection from the hard-ducted return to the air handler unit (return side)
2. It was noted in some apartments on 12/6/19 that the KoolDuct only had the main trunk and one branch but was missing one or more additional branch connections to bedrooms. It was discussed that these would be added with flex duct.
    a. Please ensure flex duct selections align with pressure drop and original duct size assumptions from the engineer.
3. All duct to sheetrock connections (supplies and return) to be sealed with caulking or tape prior to installation of final grilles.
4. SWA needs to test the duct work at rough-in stage for VRF systems, when all supply branches and returns installed as required by PHIUS.
5. MERV 8 filters and face grilles with balancing to be installed at final.

Addressing In-Field Conditions

- Check with PH consultant before doing anything which may impact the overall R-value

  Example: blind side conditions

  - excavation support lag wall to be used as foundation formwork

Remedial Work & Confirmation

- Inspector to reinspect, or GC to provide photos
- Judgment call – severity of issue
- Need to establish a good working relationship before being comfortable accepting photos

Issues Log

Issues Log - 1/25/2017

SVR #	SVR Item #	Issue Type	Location	Issue	Found by	Date Found	Action Required	Responsible Party	Reinspection Required?	Actions Taken/Updates	Date Verified/ updated	Open/ Closed
7	1	ENV	7th Floor	**Panel Insulation at Joints:** Insulation at the panel joints was found to be around 6 inches deep. Shop drawings indicate 9". (EEWS Shop Drawings Sheet 501, Detail 1, second image right). SWA notified Monadnock of the issue. Monadnock followed up with a photo on 5/11/16 and informed SWA that EEWS will continue to install insulation at 9 inch depth. All panels below the six floor will need to be inspected for insufficient insulation and corrected if needed via exterior scaffolding when exterior caulk is applied.	SWA	5/10/16	Photo documentation using a measuring device will be required to verify PH compliance. SWA & EEWS to agree on frequency of photos and method of depth verification.	Eastern	Y	On 9/22/16, Eastern issued photos of joint insulation being installed along two swing stage areas (Rig 3 Drop 2 and Rig 3 Drop 4). SWA will continue keeping track of Eastern's progress.		Ongoing
24	2	ENV	2nd Floor	Gap at the corner of storage room and condenser porch located behind the column is not air sealed at this time. Neither is the connection of Intesana to block. SWA to inspect when complete.	SWA	8/9/16	Monadnock to send photos of the area to SWA	Monadnock	N			Open
42	3	HVAC	All Floors	**Damaged Ductwork Covers:** SWA observed numerous instances of damaged ductwork opening covers damaged or loose throughout the first and second floors. SWA believes a significant amount of dust has likely accumulated in the ductwork. The project is now at risk of losing a LEED point needed for LEED Platinum certification.	SWA	11/21/16	Monadnock to make sure that all ductwork openings have been covered on floors 1, 2, 15-25. Monadnock to issue written confirmation to SWA once this work has been complete. SWA to spot check these areas in its next visit.	SWA	Y	On 11/30/16, SWA observed that much of previously noted loose and damaged ductwork opening covers were repaired. Issues still persist on the various floors. SWA performed spot checks on floors 1, 2, 15-25 and found issues in all floors. On 12/1/16, Monadnock emailed SWA notifying that floors 1,2, and 15-25 had been reinspected and damaged ductwork covers had been repaired. On 12/12/16, SWA observed issues on floors 1, 2, and 17.		Open
n/a	n/a	ENV	2nd Floor	**Insulation under 2nd floor condensor porch ballast** was covered before SWA could inspect. Images showing insulation depth and coverage must be provided.	SWA	5/24/16	Monadnock possesses photo documentation that shows depth and coverage. Provide images to SWA.	Monadnock	N	On 7/28/2016, Monadnock sent photos showing depth of insulation at condensor porch ballast.	7/28/2016	Closed
n/a	n/a	ENV	26th & 27th Floor	**Roof deck insulation inside AHU curb** was covered before SWA could inspect. Images showing insulation depth and coverage must be provided.	SWA	5/1/16	Monadnock possesses photo documentation that shows depth and coverage. Provide images to	Monadnock	N	On 10/1/2016, SWA received photos from Monadnock showing blurry tape measurements of insulation at the AHU curbs. On 10/24/2016, SWA	10/24/2016	Closed

Do NOT Do This

- **Be wary**
  - Assume if the GC has done a PH / Net-Zero project that the second will automatically pass
  - Keep going without passing the window mockup
  - Depend on subs understanding contract docs without communication
  - Allow the GC to exclude meeting PH requirements from the contract
- Ignore your PH Consultant!

Do This

- **Insist on**
  - Training for construction staff
  - Mockups & don't stop until the window mockup passes
  - Interim blower door testing if possible
- **Advanced Planning**
  - Typical and Unique checklists
  - Blower door testing plan
- **Quality Control**
  - Typical details readily available on site for all subs
  - Communication between GC and PH verifier
  - Panelized construction, if an option

Questions?

5 Minute Break

Blower Door Test Plan

Blower Door Testing

- Basic Components
  - Gauge (manometer)
  - Shroud
  - Frame
  - Fan

Whole Building Blower Door Test

Whole Building Blower Door Test

Air Tightness

- Requirement: < 0.6 ACH@50 or 0.08 CFM/SF enclosure (PHIUS large bldgs)
- What does this mean?
  - @50 refers to 50 pascals pressure difference between indoors and out during a blower door test, ≈ 20mph wind on all sides of house
  - 0.6 ACH50 = 5 times tighter than ENERGY STAR®
- Method A and Method B Testing
  - A: Configures building to operation during the heating and cooling seasons
  - B: Any intentional openings in the building envelope are sealed

Blower Door Test Conditions

Key: HVAC Contractor; Plumber; GC / Builder

Intentional Opening	Test Setting	Notes
Windows, doors, skylights in the building enclosure	Closed and latched	
Doors and operable windows inside the test enclosure	Open	Use stairways to connect all zones of the building
Fire dampers	Remain as found	
Dryer doors	Closed and latched	
Gas meter room	Door to gas meter room closed and weather stripped	
Waste handling system	Trash chute termination at roof taped off. Door to trash rooms closed.	
ERVs (apartments)	Fan off, any dampers closed. Ducts to the outside sealed inside the ERV cabinet in each apartment.	Ventilation is continuous, so can remain taped off
Motorized dampers: ERV-4 (cellar)	Fan off, dampers closed. Taped off from the exterior	Ventilation is continuous, so dampers closed and sealed off
Motorized dampers: ERV-5 (1st floor)	Fan off, dampers closed. Taped off from the exterior	Ventilation is continuous, so dampers closed and sealed off
Motorized dampers: ERV-2A (1st floor)	Fan off, dampers closed. Taped off from the exterior	Ventilation is continuous, so dampers closed and sealed off
Motorized damper: Laundry Room (2nd floor)	Fan off, dampers closed. Taped off from the exterior	Untaped for Method A test
Motorized damper: ERV-2 (2nd floor)	Fan off, dampers closed. Taped off from the exterior	Ventilation is continuous, so dampers closed and sealed
Motorized dampers: EMR (1st floor), Stair A, Star B, Elevator, Boiler Room (roof)	Taped off from the exterior	Untaped for Method A test
ERV-3 (roof)	Fan off, dampers closed	Ventilation is continuous, so

Whole Building Test Logistics

- Enough fans, cruise manometers, frames, shrouds, tubing, CAT5 cabling, people?
- Is building access limited to avoid people opening and closing doors, windows, etc.?
- Thorough walkthrough the day prior to test date to confirm prep has taken place?
- GC and appropriate subs on site to help with building prep and issues that come up on the test day?
- Saturday work permits active?
- COVID concerns?

Whole Building Prep Work

Central ERVs and Blower Door

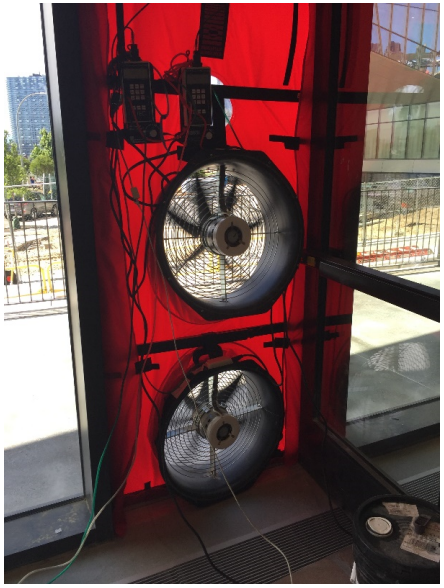
- Need to seal off ERVs for the test
- Wrap rooftop ERVs and/or seal exterior intake and exhaust louver ports

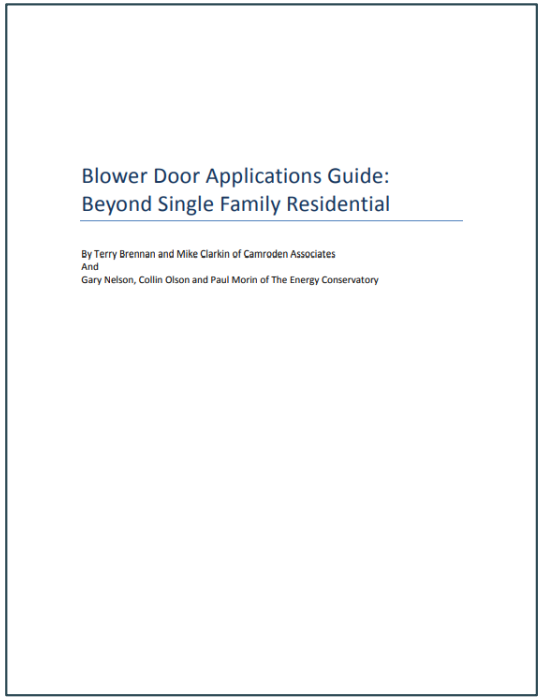
Individual ERVs and Blower Door

- Typically can't reach all vents to seal from outside
- Tape off both outdoor connection ports inside every ERV
- Some ERV's can't be sealed inside the cabinets

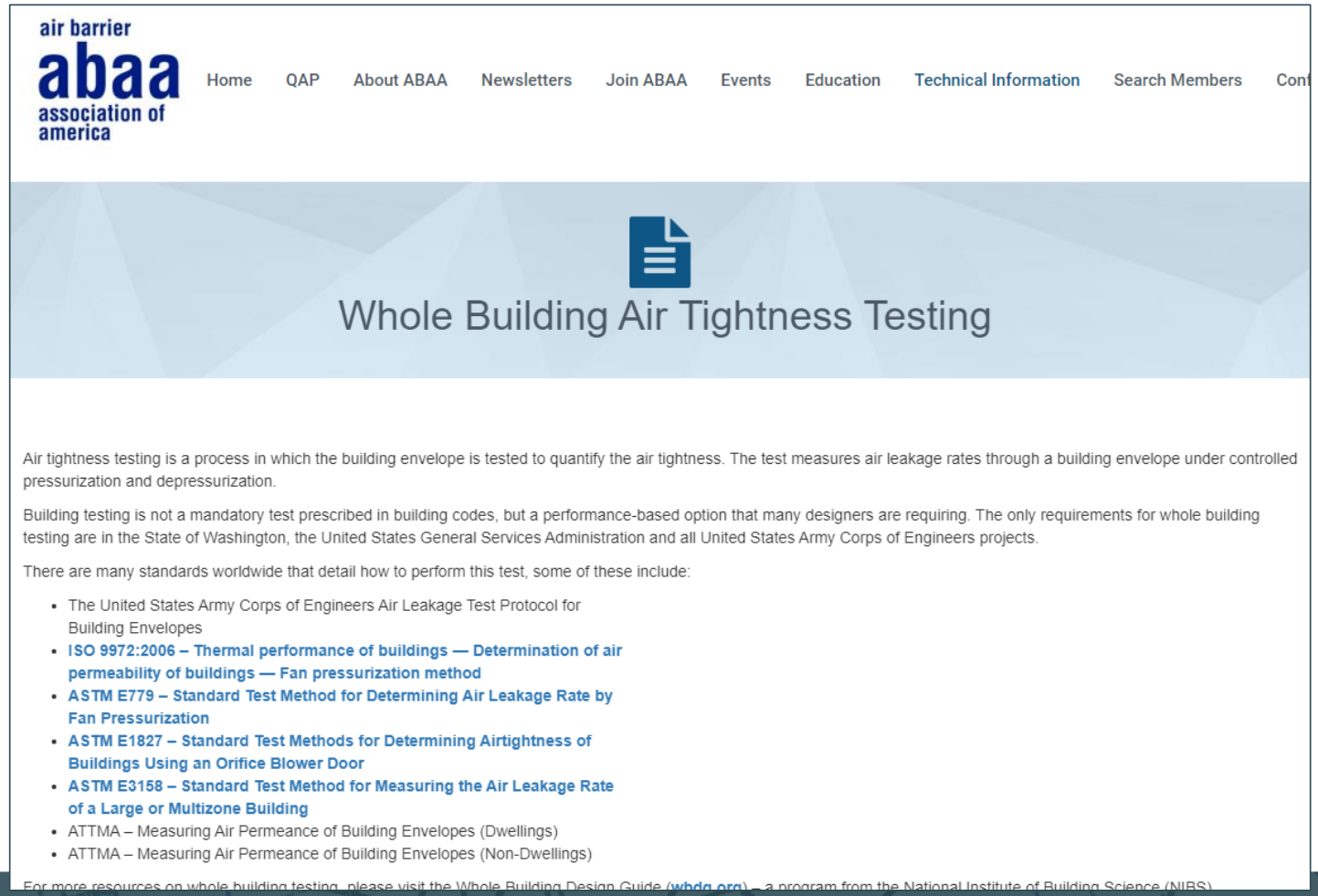
Whole Building Test Logistics and Execution

- A great resource is **Blower Door Applications Guide: Beyond Single Family Residential** PDF (Brennan, Clarkin, Nelson, Olson, Morin)





Whole Building Test Resources



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Whole Building Air Tightness Testing

Air tightness testing is a process in which the building envelope is tested to quantify the air tightness. The test measures air leakage rates through a building envelope under controlled pressurization and depressurization.

Building testing is not a mandatory test prescribed in building codes, but a performance-based option that many designers are requiring. The only requirements for whole building testing are in the State of Washington, the United States General Services Administration and all United States Army Corps of Engineers projects.

There are many standards worldwide that detail how to perform this test, some of these include:

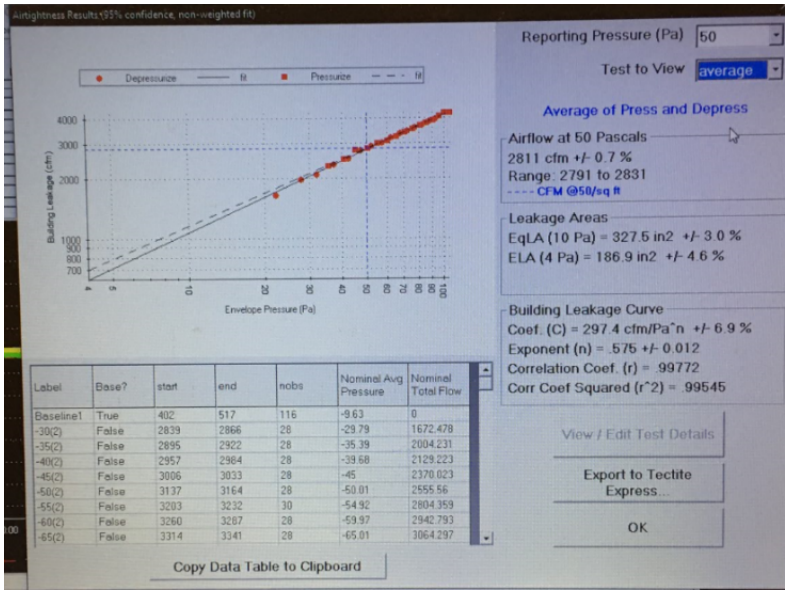
- The United States Army Corps of Engineers Air Leakage Test Protocol for Building Envelopes
- **ISO 9972:2006 – Thermal performance of buildings — Determination of air permeability of buildings — Fan pressurization method**
- **ASTM E779 – Standard Test Method for Determining Air Leakage Rate by Fan Pressurization**
- **ASTM E1827 – Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door**
- **ASTM E3158 – Standard Test Method for Measuring the Air Leakage Rate of a Large or Multizone Building**
- ATTMA – Measuring Air Permeance of Building Envelopes (Dwellings)
- ATTMA – Measuring Air Permeance of Building Envelopes (Non-Dwellings)

For more resources on whole building testing, please visit the Whole Building Design Guide (**wbdg.org**) – a program from the National Institute of Building Science (NIBS)

- https://www.airbarrier.org/technical-information/whole-building-air-tightness-testing-2/

Test Day

- Plan all equipment needed in advance
- Keep testing team small: 3-4 people
- Restrict building access for duration of test to essential people
- Have extra tape, caulk, foam on hand for any last minute air sealing efforts needed
- Construction crew on standby*



Some Successful Blower Door Tests

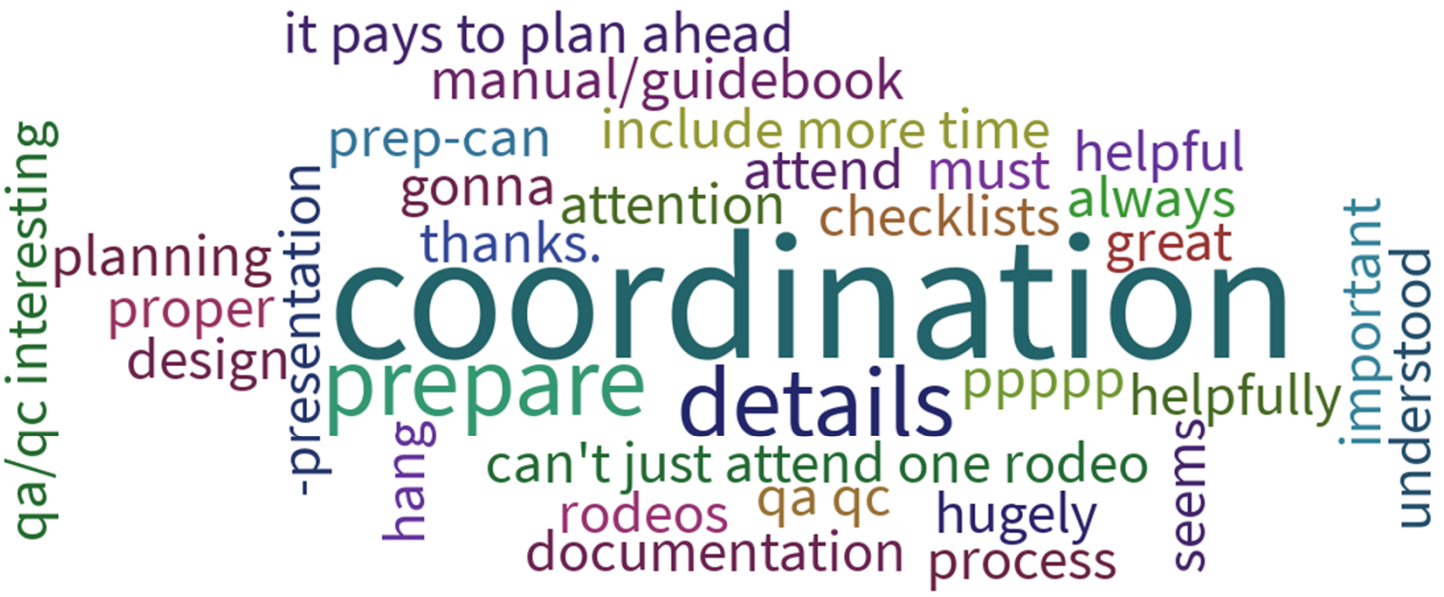
- Star Garments (Sri Lanka) passed on 5/1/2018
- 211 W 29th Street (NY, NY) passed on 10/12/2019
- Beach Green II (Far Rockaway, NY) passed on 10/18/2019
- 511 E 86th Street (NY, NY) passed on 08/31/2020

Questions?

When poll is active, respond at **PollEv.com/swa335**

Text **SWA335** to **22333** once to join

What are your final thoughts and takeaways from the presentation today?



Questions & Final Discussion

Join Us for More Trainings!

- **Module 8.4** - Field Training & Mock-Ups

Register here: https://www.newpaltz.edu/sustainability/view-programs-and-progress/zero-net-carbon-training/workshop-schedule-registration--details/

Contact Us

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Resources

- https://www.imiweb.org/masonry-detailing-series-3/masonry-detailing-series-main-list/
- https://www.workpack.in/2018/06/27/difference-quality-assurance-qa-quality-control-qc-construction/
- https://www.airbarrier.org/technical-information/whole-building-air-tightness-testing-2/