Project Documentation

Abstract

Betances Residence, 445 East 142nd Street, Bronx, NY

Data			
Year of construction	2019-2021	**Space heating**	**9 kWh/(m²a)**
U-value external wall	0.196 W/(m²K)		
U-value basement	0.294 W/(m²K)	Primary Energy Renewable (PER)	87 kWh/(m²a)
U-value roof	0.091 W/(m²K)	Generation of renewable Energy	See below
U-value window	1.04 W/(m²K)	Non-renewable Primary Energy (PE)	119 kWh/(m²a)
Heat recovery	84 %	Pressurization test n_{50}	0.5 h^{-1}
Special features	The ground floor is mixed use with healthcare offices, community room, library, computer room, fitness center, preschool (future tenant) and private outdoor space. The rooftop includes a photovoltaic array producing 35,417 kWh/yr.		

Brief Description

Betances Residence

Betances Residence was developed by Breaking Ground, New York's largest provider of street outreach and supportive housing. It is the group's first Passive House residence, which will house and support formerly homeless and low income seniors. The building is located between East 142nd Street and East 143rd Street in the Mott Haven neighborhood of the Bronx in New York City. The 8 story, 152-unit residence will dedicate 25% of units to New York City Housing Authority (NYCHA) seniors, 45 units to formerly homeless seniors, and remaining units to seniors with incomes of less than 50% of the area median income.

The project utilizes active design principles, such as making sure circulation spaces have access to daylight and views to green space, to encourage physical activity. Outdoor garden spaces, accessible accommodations (for mobility, vision and hearing impairments), and on-site social and medical services also support the overall well being of tenants. The building is organized into two residential towers, with a variety of shared spaces at the ground floor connecting the two towers that promote mental and physical well-being, independence and social connectedness for the residents. These shared spaces and services include on-site medical and psychiatric care, a garden, a library, a multi-purpose room, a computer room, a fitness room, bicycle storage and laundry as well as a separate Community Facility for the future community-based non-profit tenant (an early childcare center).

The design and construction of Betances Residence provides a superior living environment for residents. The high mass construction, continuous thermal envelope, and high-performance windows significantly reduces noise from outdoors. This translates to a quieter, more peaceful apartment setting. In addition, the thermal envelope and windows, coupled with the heating/cooling system allows residents to set and maintain their own consistent, comfortable temperature. Cold-surfaces and drafts have been eliminated with high-performance windows and thorough air-sealing and compartmentalization. The ERVs deliver a continuous flow of fresh, filtered air from outdoors and remove stale air from each apartment, resulting in excellent indoor air quality. The South Bronx is a known asthma corridor and the clean, filtered, outside air is especially important for the building residents.

Responsible Project Participants

Architect	COOKFOX Architects 250 W 57th St 10107 New York , United States of America
Client	BREAKING GROUND 505 8th Ave 10018 New York, United States of America
Building systems	DAGHER ENGINEERING 29 Broadway 10006 New York, United States of America
Structural engineering	WSP 1 Pennsylvania Plaza New York, NY 10119, United States of America
Building physics	STEVEN WINTER ASSOCIATES 307 Seventh Avenue New York, NY 10001, United States of America
Passive House project planning	STEVEN WINTER ASSOCIATES 307 Seventh Avenue New York, NY 10001, United States of America
Construction management	MONADNOCK CONSTRUCTION 155 3rd St Brooklyn, NY 11231, United States of America

Certifying Body

PASSIVE HOUSE ACADEMY
334 Douglass, Brooklyn, NY 11217, United States of America

Certification ID

6336	Project-ID (www.passivehouse-database.org) Projekt-ID (www.passivhausprojekte.de)

Author of Project Documentation

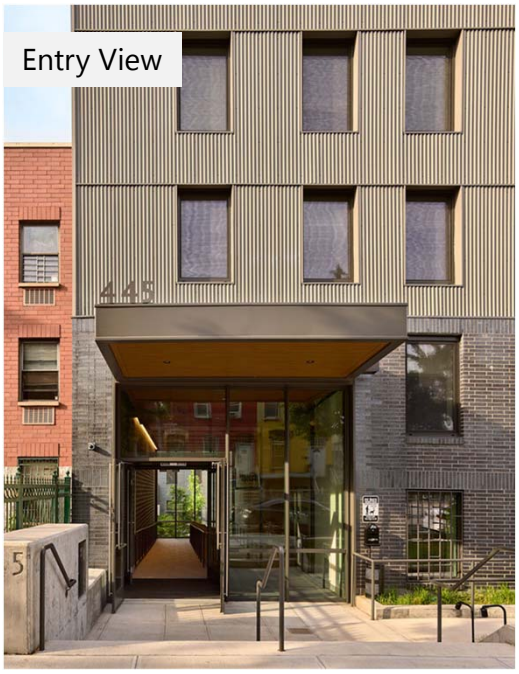
Adam Beaulieu, AIA
COOKFOX Architects

Date	Signature
11.02.2023	

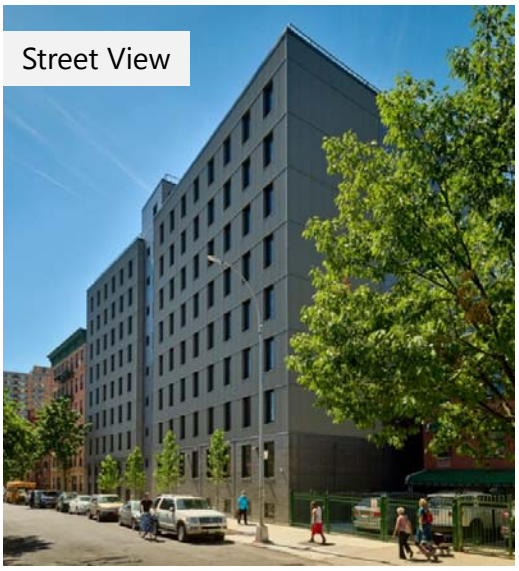
1. Exterior Photos

Street View

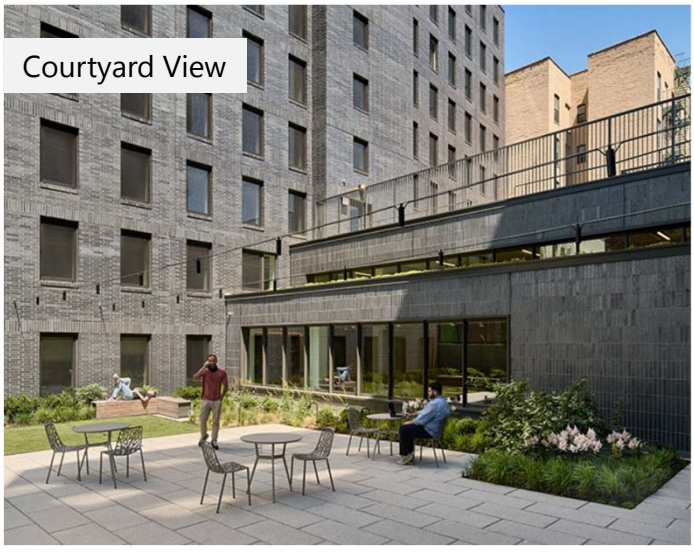
Entry View



Street View



Courtyard View



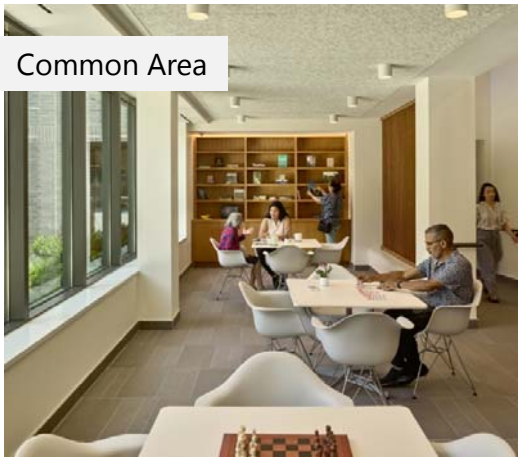
Facade View

2. Interior Photos

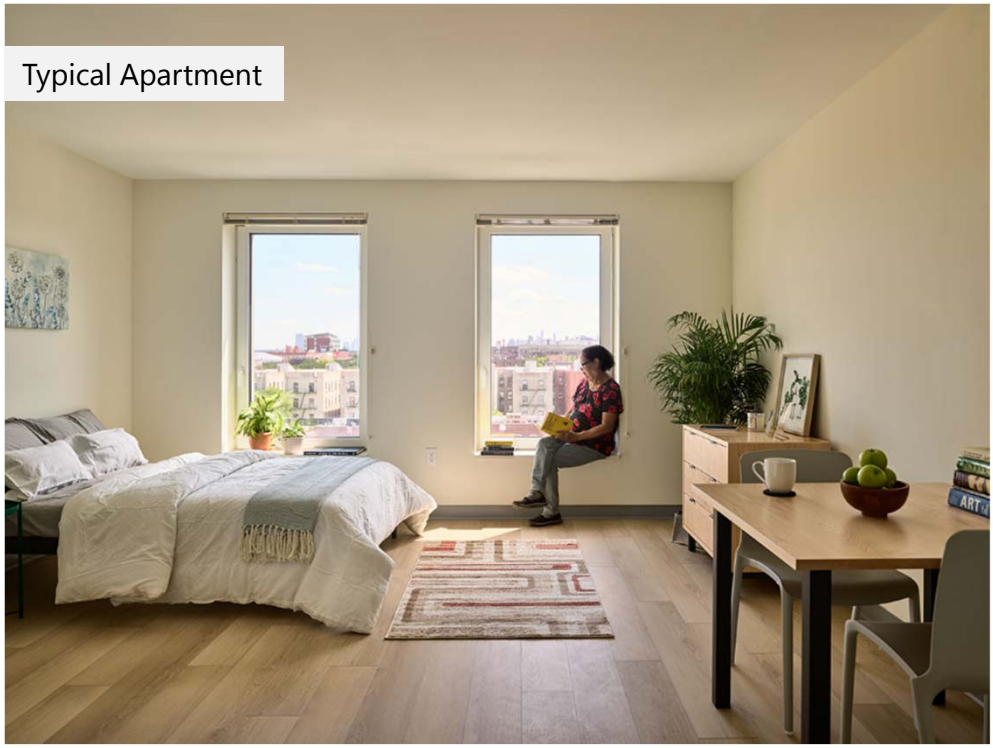
Interior Circulation

Interior Circulation

Common Area

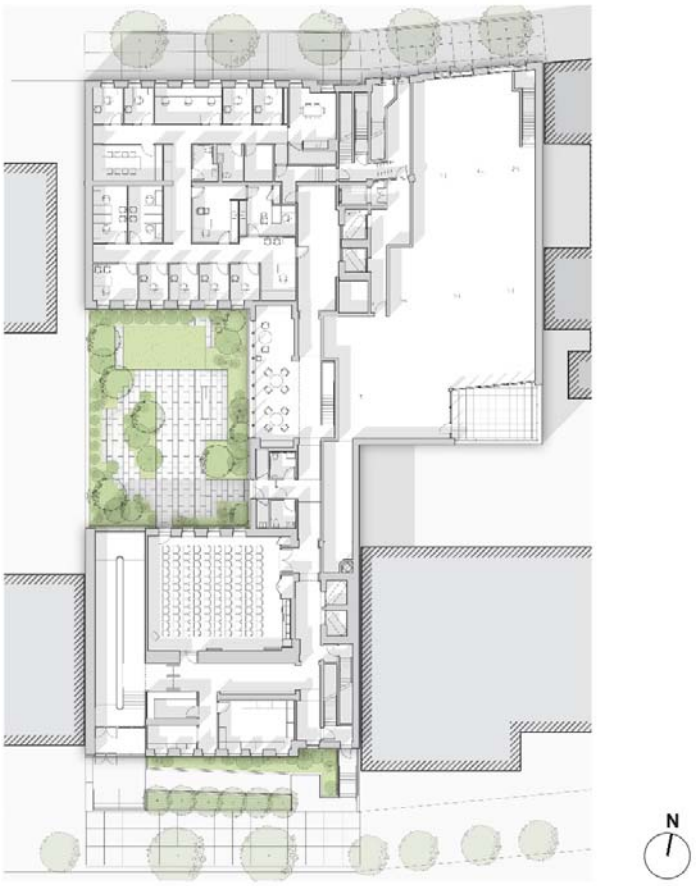


Typical Apartment

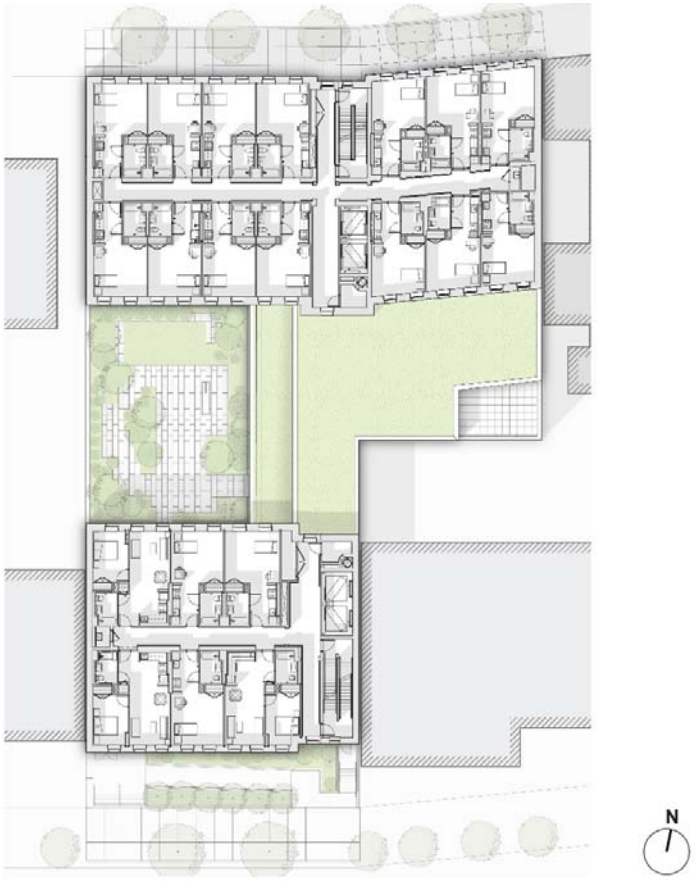


3. Floor Plans

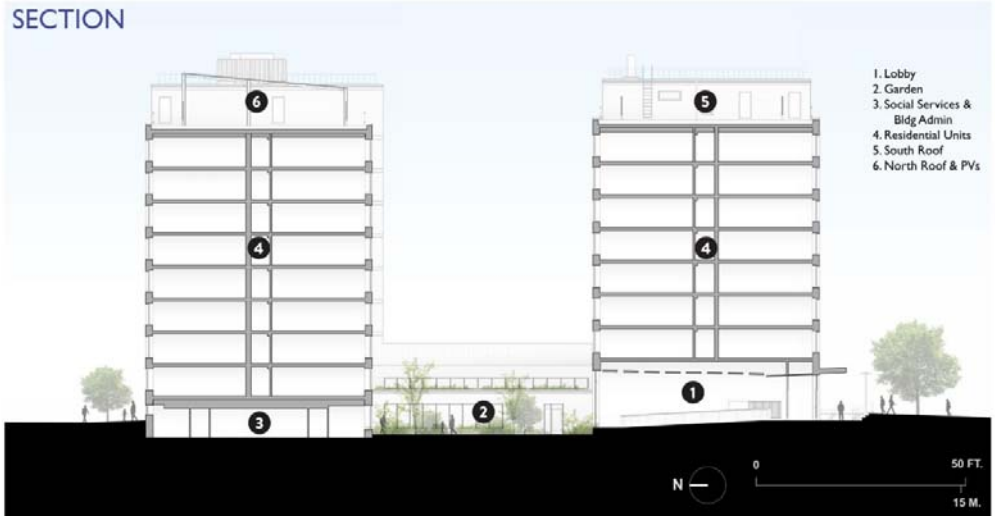
First Floor Plan



Typical Floor Plan



3. Building Elevations and Sections



BETANCES SENIOR HOUSING
PASSIVE HOUSE FEATURES

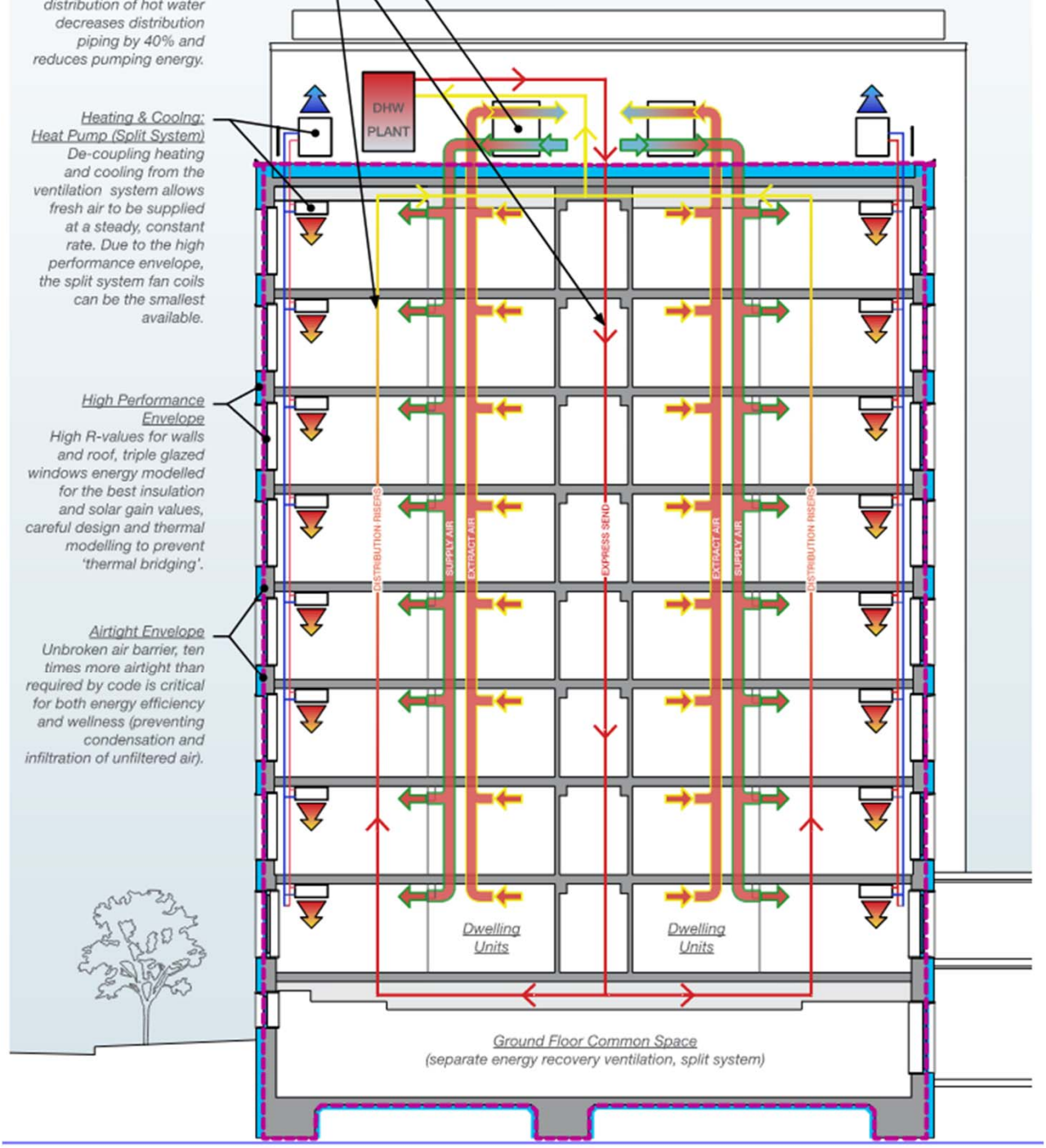
Energy Recovery Ventilation
Fresh air is heated (or cooled during warm weather) by exhaust air via energy transfer. All air passes through very high standard filters (MERV 13).

Optimized Central Recirculation for Domestic Hot Water
Carefully balanced vertical distribution of hot water decreases distribution piping by 40% and reduces pumping energy.

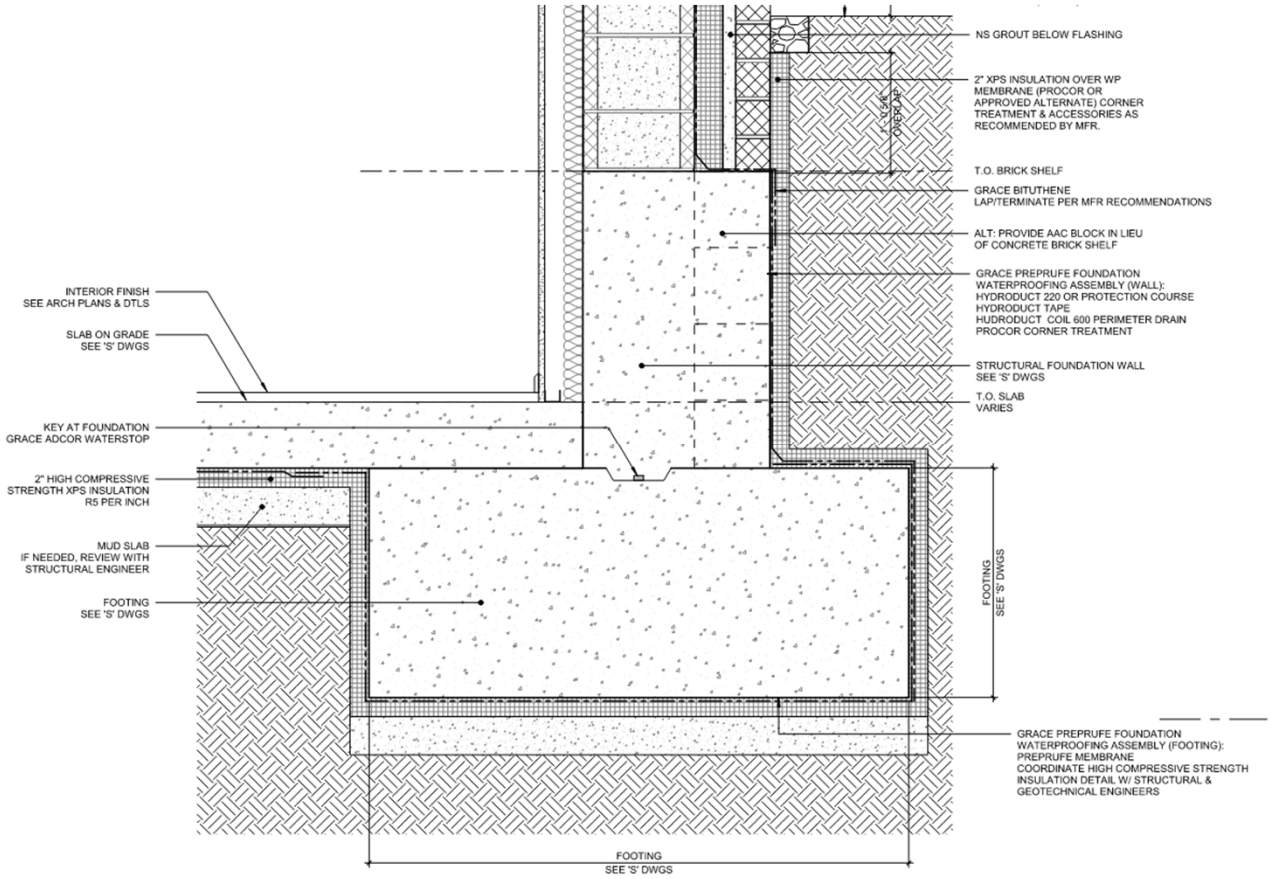
Heating & Coolng: Heat Pump (Split System)
De-coupling heating and cooling from the ventilation system allows fresh air to be supplied at a steady, constant rate. Due to the high performance envelope, the split system fan coils can be the smallest available.

High Performance Envelope
High R-values for walls and roof, triple glazed windows energy modelled for the best insulation and solar gain values, careful design and thermal modelling to prevent 'thermal bridging'.

Airtight Envelope
Unbroken air barrier, ten times more airtight than required by code is critical for both energy efficiency and wellness (preventing condensation and infiltration of unfiltered air).



5. Floor Construction



TYPICAL WALL BASE AT FOOTING
NOT TO SCALE

Assembly no.	Building assembly description					Interior insulation?
04ud	Slab					

Heat transmission resistance [m²K/W]

Orientation of building element: 3-Floor — interior Rsi: 0.13
Adjacent to: 2-Ground — exterior Rse: 0.00

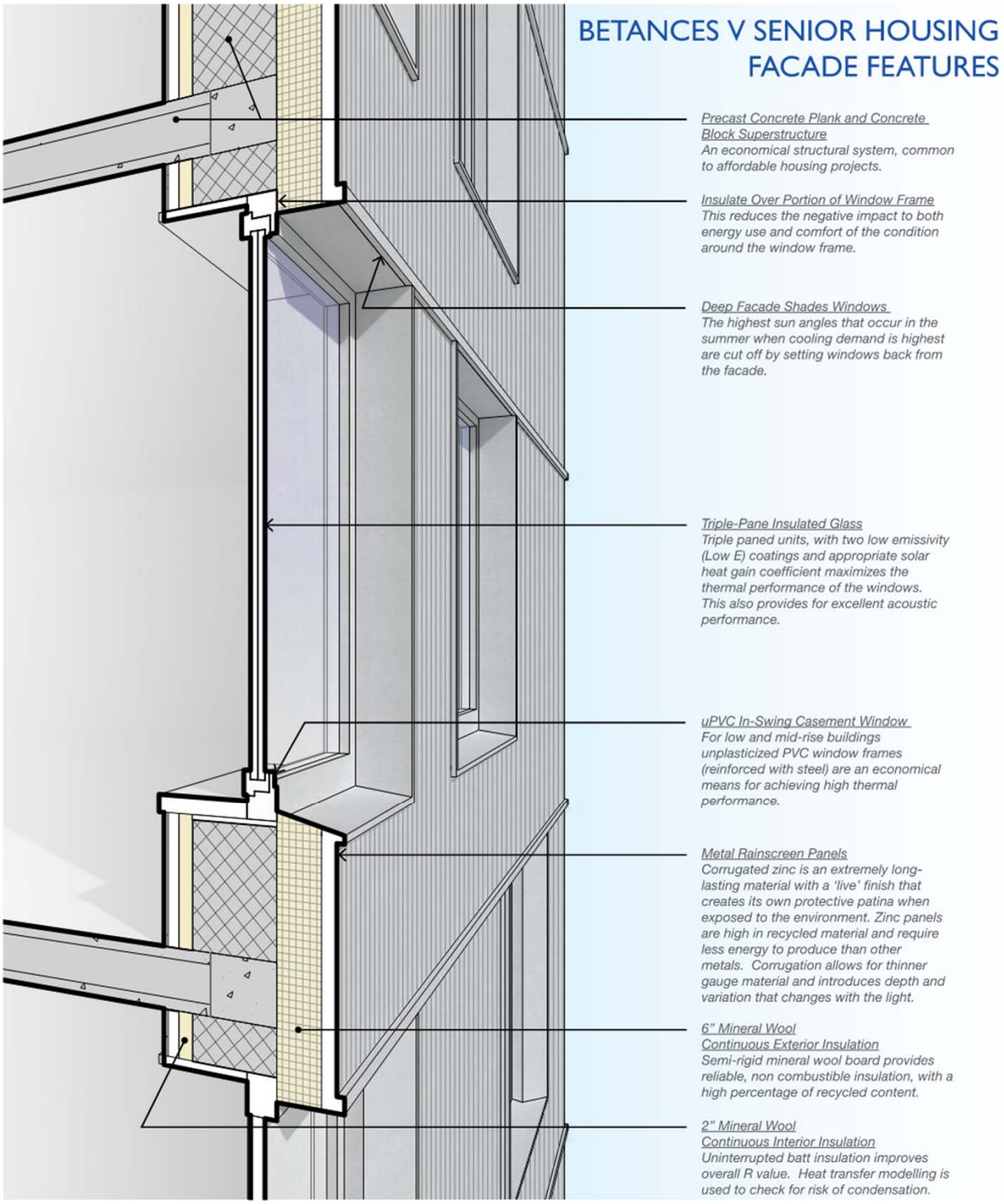
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Concrete Reinforced	1.442		0.000		0.000	203
XPS	0.029		0.000		0.000	51
	0.000		0.000		0.000	0
	0.000		0.000		0.000	0
	0.000		0.000		0.000	0
	0.000		0.000		0.000	0
	0.000		0.000		0.000	0
	0.000		0.000		0.000	0

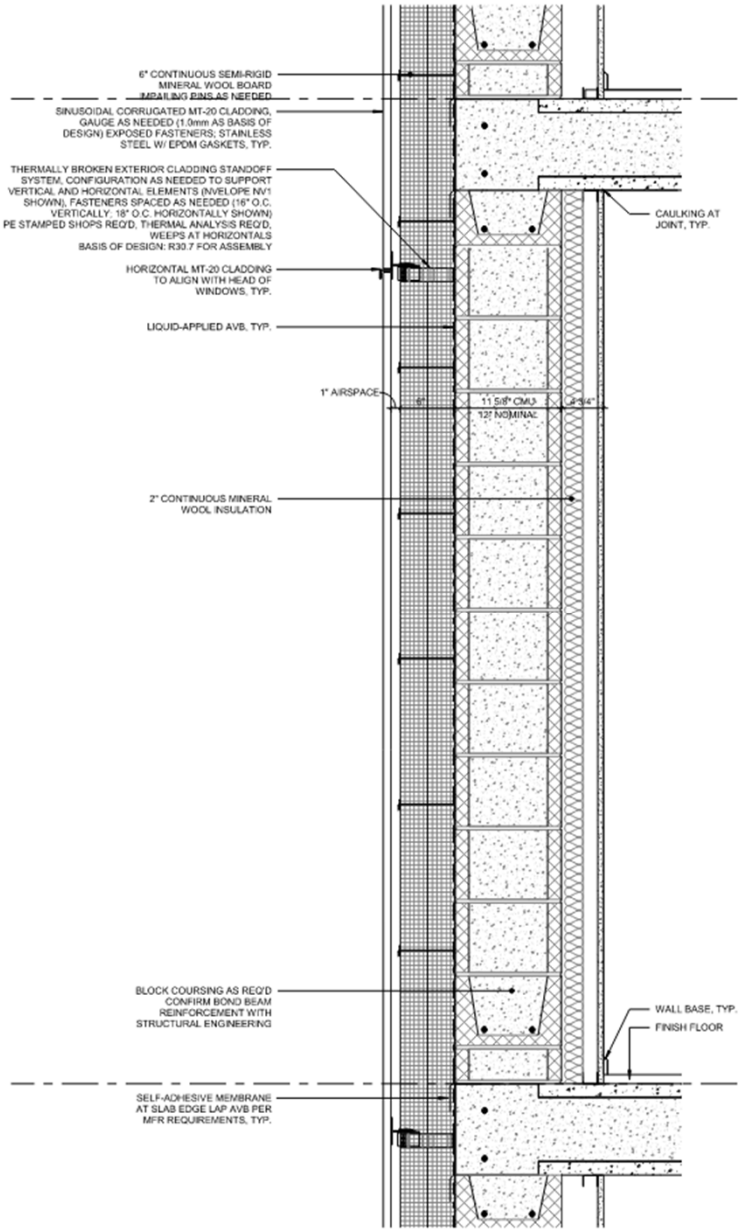
Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
100%	0.0%	0.0%	25.4 cm

U-value supplement: 0.00 W/(m²K)

U-value: 0.492 W/(m²K)

6. Exterior Wall Construction





TYPICAL METAL PANEL WALL ASSEMBLY

NOT TO SCALE

Assembly no.	Building assembly description
01ud	WT-1.0_Metal Rain Screen_6" Mineral Wool EXT

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall — interior R_{si}: 0.13

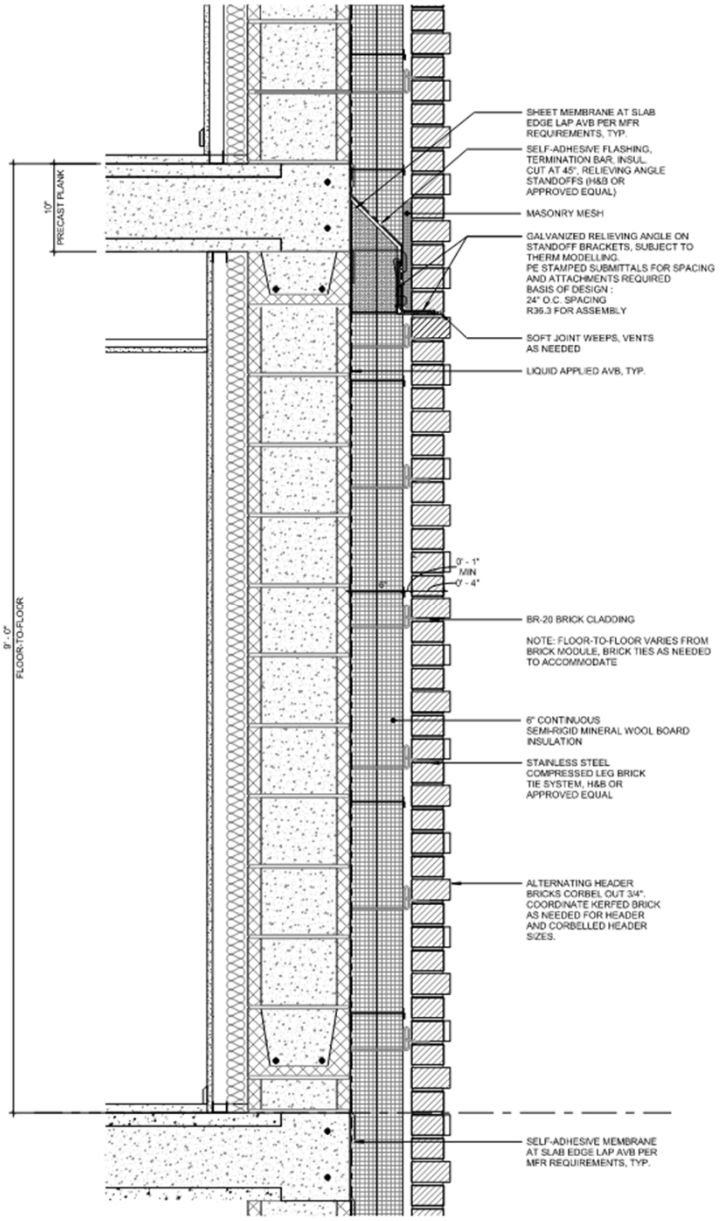
Adjacent to: 1-Outdoor air — exterior R_{se}: 0.04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]
Heat 3 Calculation (reference "WT1.0 HEAT3 Calculation")	0.005		0.000		0.000
	0.000		0.000		0.000

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3
100%	0.0%	0.0%

U-value supplement: 0.00 W/(m²K)

U-value: 0.196 W/(m²K)



TYPICAL BRICK VENEER WALL ASSEMBLY

NOT TO SCALE

Assembly no.	Building assembly description
02ud	WT-2.0_Brick w/ GALV Ties _3" KoolTherm K8 EXT

Heat transmission resistance [m²K/W]

Orientation of building element	2-Wall	interior Rsi	0.13
Adjacent to	1-Outdoor air	exterior Rse:	0.04

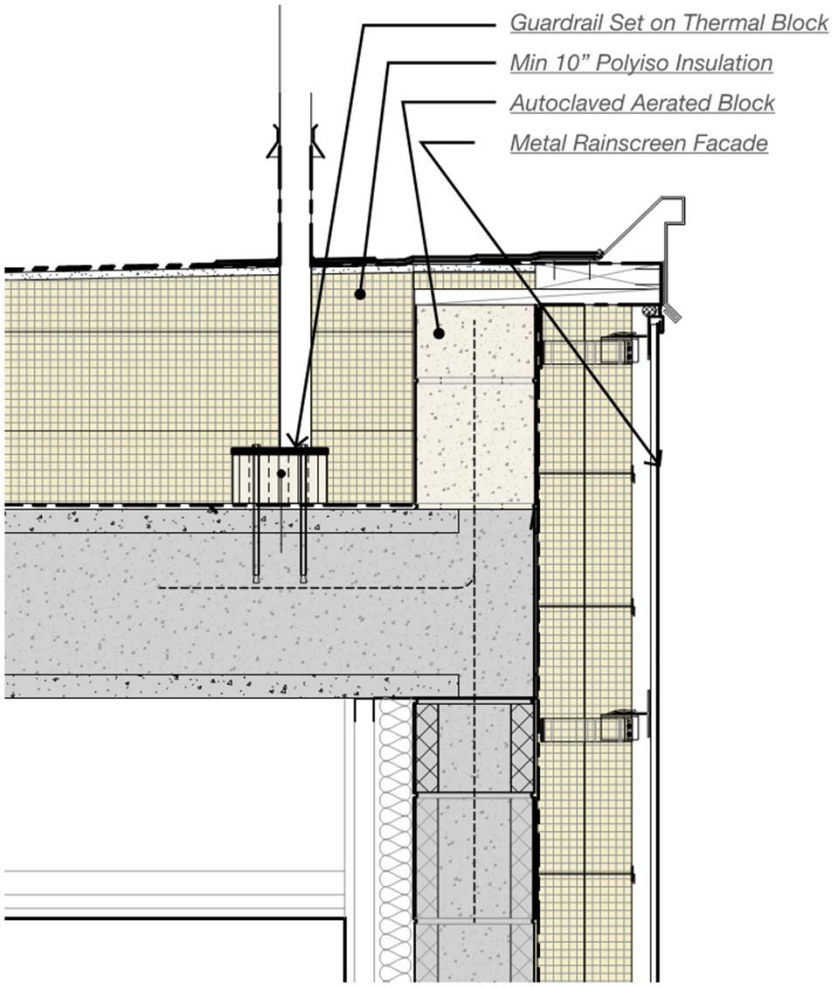
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]
Heat 3 Calculation (reference "WT2.0 HEAT3 Calculation")	0.005		0.000		0.000
	0.000		0.000		0.000

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3
100%	0.0%	0.0%

U-value supplement: 0.00 W/(m²K)

U-value: 0.187 W/(m²K)

7. Roof Construction



Section at Parapet/Roof Coping, Metal Rainscreen
Not to Scale

Assembly no.	Building assembly description					Interior insulation?
06ud	Roof					

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall — interior Rsi: 0.13
Adjacent to: 1-Outdoor air — exterior Rse: 0.04

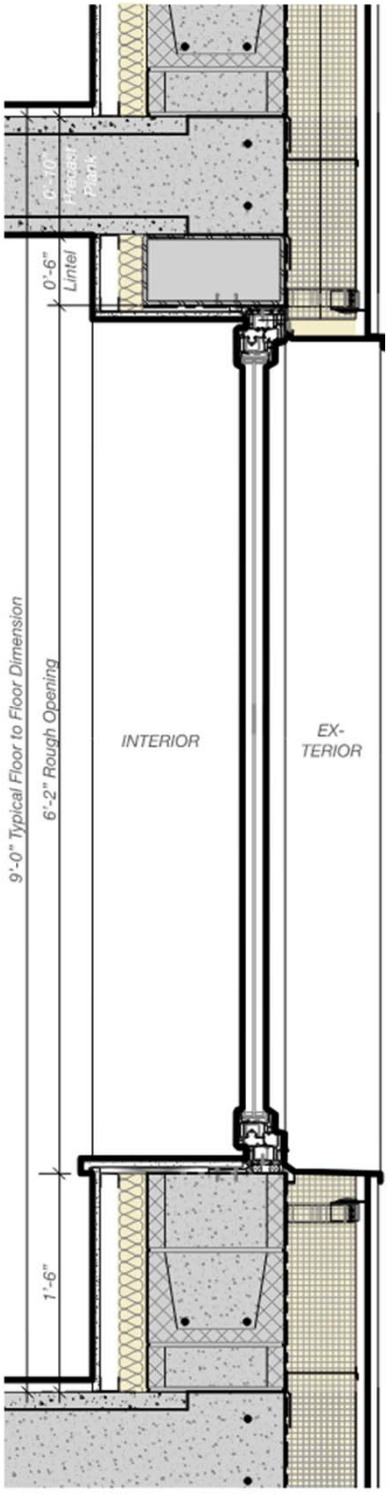
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Concrete Reinforced	1.442		0.000		0.000	305
Polyiso Insulation (10" min)	0.024		0.000		0.000	254
	0.000		0.000		0.000	0
	0.000		0.000		0.000	0
	0.000		0.000		0.000	0
	0.000		0.000		0.000	0
	0.000		0.000		0.000	0
	0.000		0.000		0.000	0

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
100%	0.0%	0.0%	55.9 cm

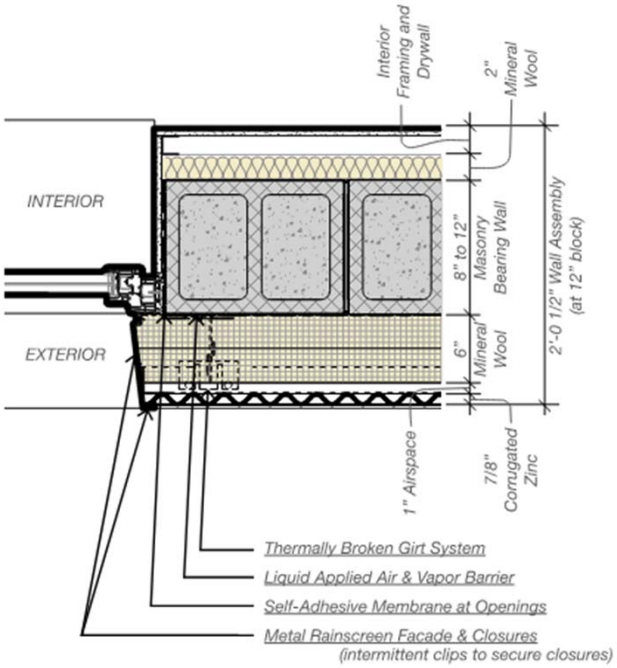
U-value supplement: 0.00 W/(m²K)

U-value: 0.091 W/(m²K)

8. Windows and Window Installation

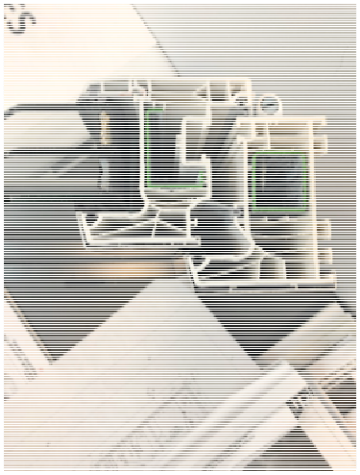


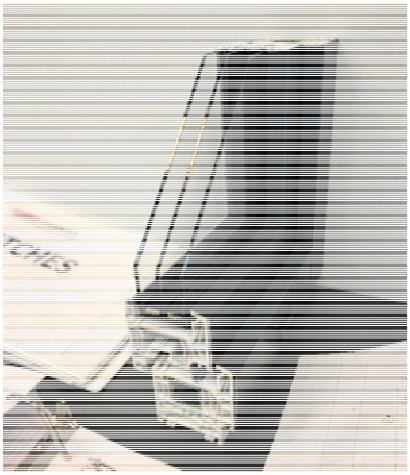
Section at Window, Metal Rainscreen
Not to Scale

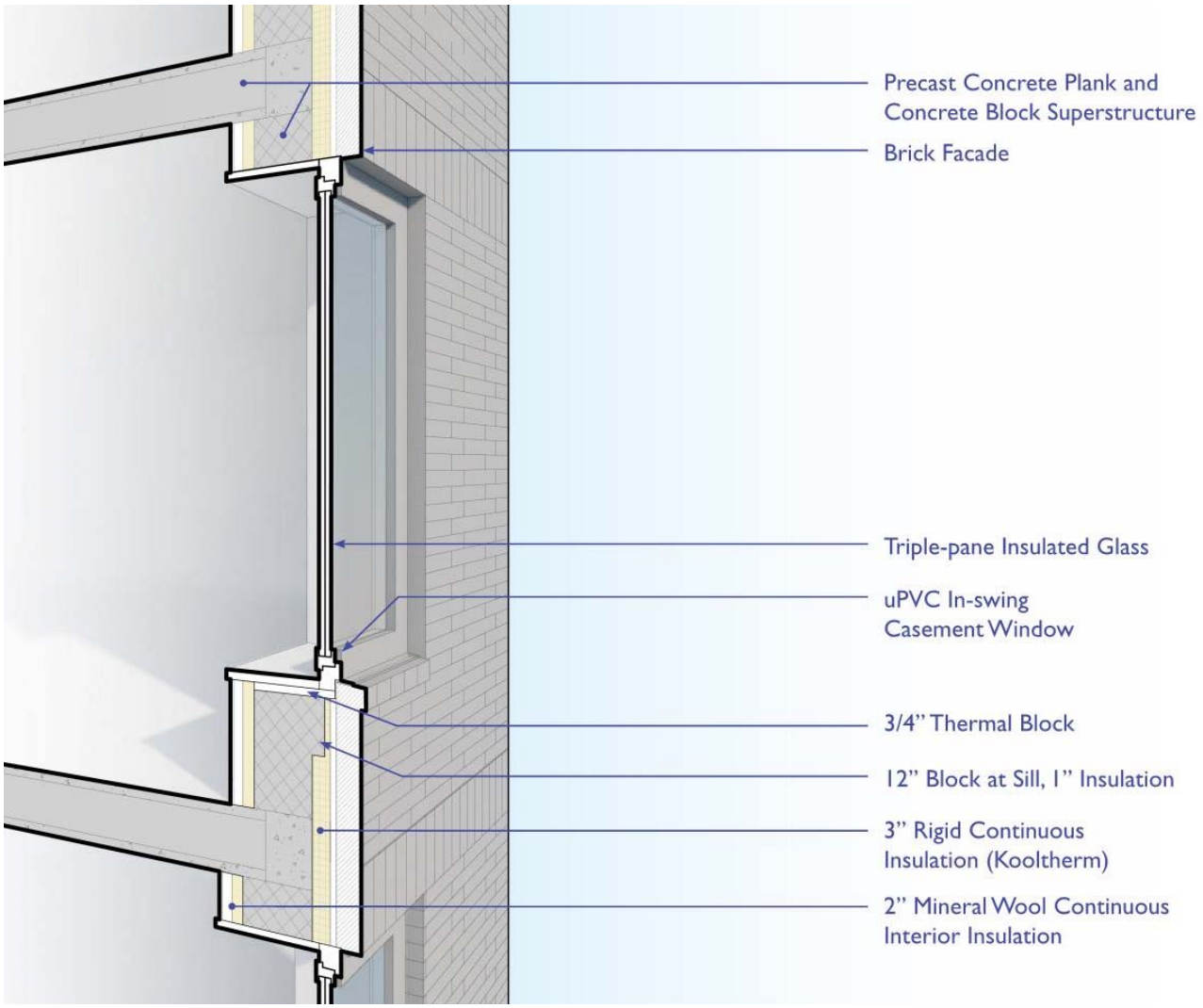


Window Jamb, Metal Rainscreen
Not to Scale

Window Frame Description:	**Schüco Living 82 MD TopAlu**
Manufacturer:	Schüco
Frame u-value:	0.96 W/(m²K)
Glazing	SGG CLIMATOP 6 | 18 ARGON 90 | 4 | 18 ARGON 90 | 4 ; PLANITHERM ONE F2, PLANITHERM ONE F5
Glass u-value:	0.48 W/(m²K)
SHGC	33%







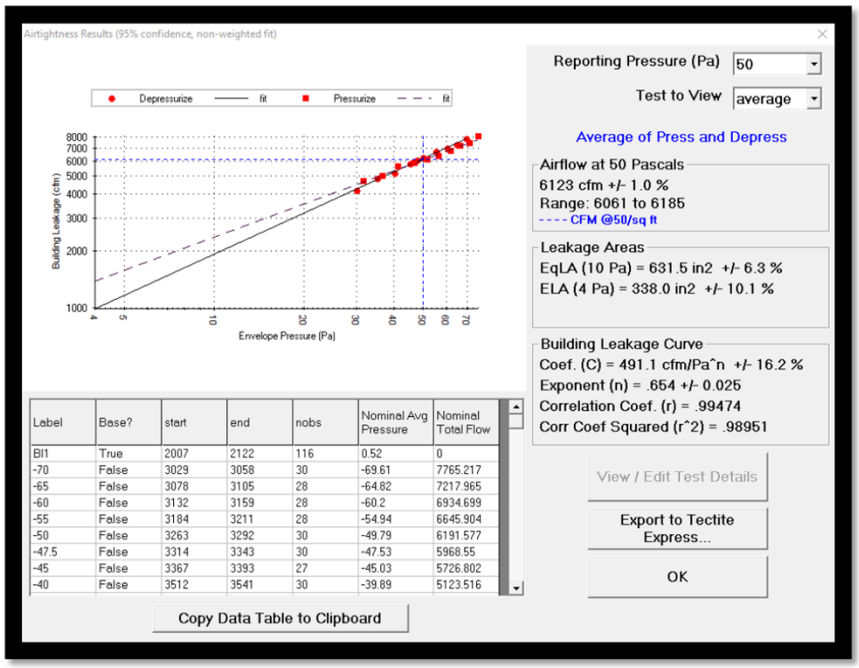
TYPICAL BRICK FACADE ASSEMBLY
DIAGRAM, PHOTOS


Air Barrier at Brick Facade


Mock-up Testing

9. Airtight Building Envelope

Photo 1:



Label	Base?	start	end	nobs	Nominal Avg Pressure	Nominal Total Flow
BI1	True	2007	2122	116	0.52	0
-70	False	3029	3058	30	-69.61	7765.217
-65	False	3078	3105	28	-64.82	7217.965
-60	False	3132	3159	28	-60.2	6934.699
-55	False	3184	3211	28	-54.94	6645.904
-50	False	3263	3292	30	-49.79	6191.577
-47.5	False	3314	3343	30	-47.53	5968.55
-45	False	3367	3393	27	-45.03	5726.802
-40	False	3512	3541	30	-39.89	5123.516

Whole Building:
- Net Int. Volume: **812,551 ft3**
- Treated Floor Area: 79,920 ft2

TOTAL: Average @ 50Pa: **6123**

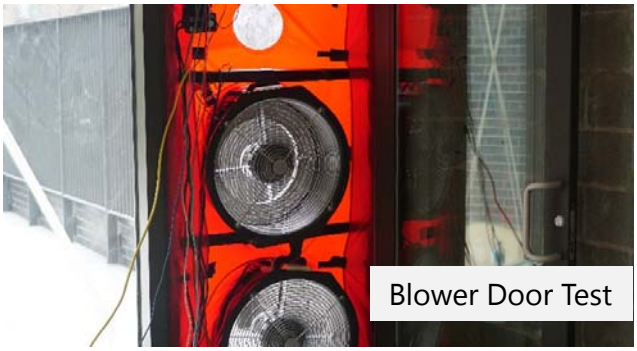
✓ The calculated 95% Confidence Interval is less than 8%; final CI was 1%

✓ The result meets the 0.6 ACH50 requirement; **final ACH was 0.45 ACH50**

✓ Determination = PASS

Air Barrier Installation

Blower Door Test



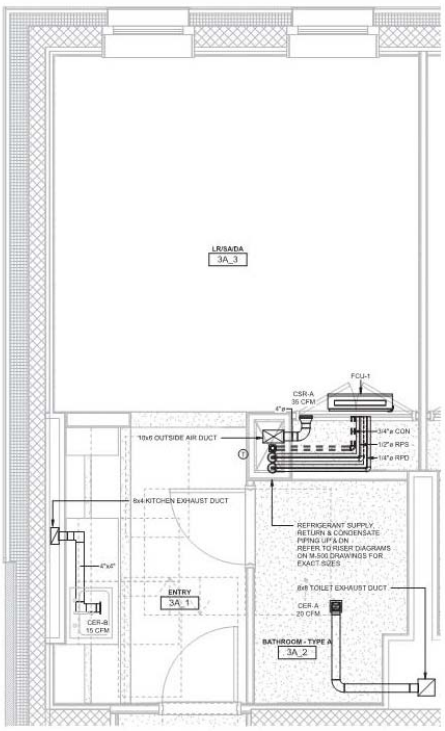
Blower Door Test

10. Ventilation and Mechanical Equipment

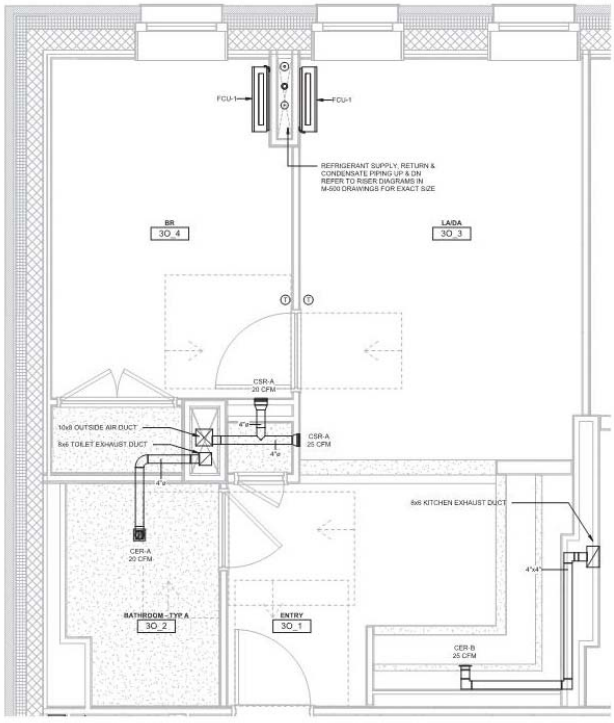
The project utilized highly efficient rotary heat exchangers.

“A rotary heat exchanger consists of an aluminum wheel with numerous small air passages. Energy is transferred between the supply air and extract air or vice versa when the wheel rotates. This is the most energy efficient heat recovery method with a temperature efficiency that always exceeds 80%.”

Manufacturer / Model	**Swegon Gold RX**
Overall Effective Heat Recovery Efficiency	84 %
Overall Spec Input Power	0.37 Wh/m³



TYPICAL STUDIO



TYPICAL ONE-BEDROOM

TYPICAL APARTMENT MECHANICAL AND VENTILATION LAYOUT
NOT TO SCALE

HEATING AND COOLING SYSTEM

The project utilized an electric Variable Refrigerant Flow (VRF) air source heat pump system for heating and cooling. Simple two-pipe systems, divided into different quadrants of the building (north tower/south tower, east wing/west wing, north façade/south façade) is utilized for apartments, and a more complex three-pipe system with heat recovery is used for shared common spaces. The air source condensing units are located on the roofs. Apartments use wall-mounted evaporators (fan coil units) and residents have individual thermostats for their own comfort.

"A Variable Refrigerant Flow (VRF, or Variable Refrigerant Volume) system is an air-conditioning system that varies the refrigerant flow rate using variable speed compressor(s) in the outdoor unit, and the electronic expansion valves (EEVs) located in each indoor unit."

Typical Apartment Evaporator Location Adjacent to Fresh Air Supply

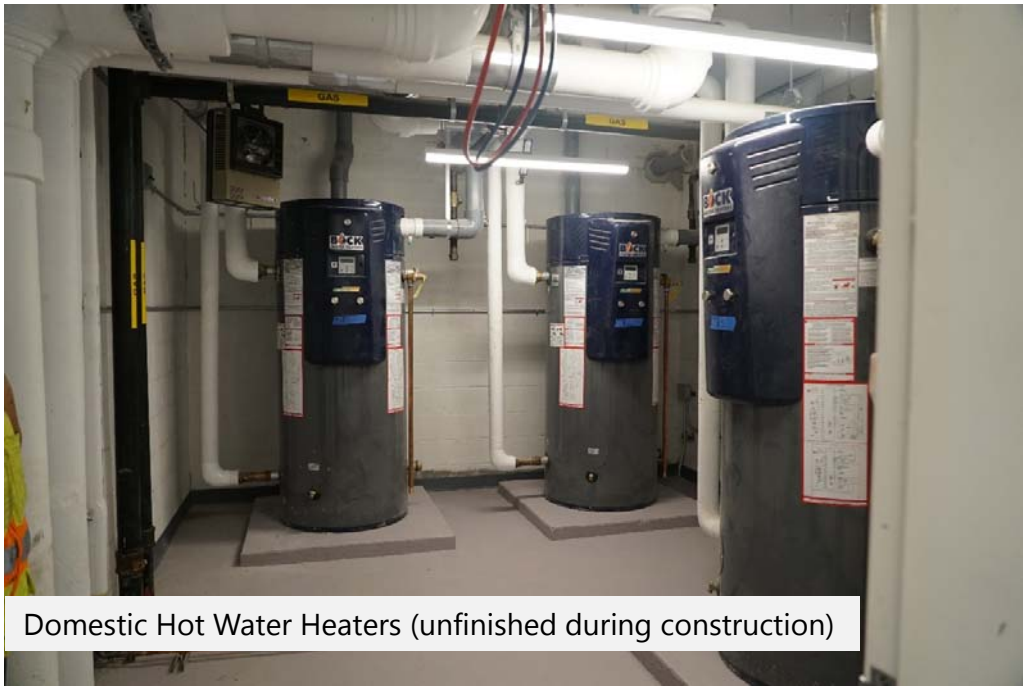
Rooftop Air Source Condensing Units, ERV, PV Structure (under construction)

11. Domestic Hot Water

The project utilized highly efficient condensing natural gas water heaters.

"Modulating condensing boilers (mod-con boilers) can increase combustion efficiency to about 96%, up from the 80% efficiency of non-condensing boilers. They provide a range of firing rates to match the variable heating load of the building.

Domestic Hot Water Heaters:	**OptiTherm Modulating Condensing Commercial Water Heater**
Manufacturer:	Bock
Source :	Natural Gas



Domestic Hot Water Heaters (unfinished during construction)

12. Short Documentation of PHPP-Results (verification sheet)

Passive House Verification

Building:	BETANCES_V		
Street:	455 East 142nd Street		
Postcode/City:	10454	Bronx	
Province/Country:	New York	US-United States of America	
Building type:	Residential		
Climate data set:	US0055c-New York		
Climate zone:	4: Warm-temperate	Altitude of location:	8.2296 m
Home owner / Client:	Breaking Ground		
Street:	505 8th Ave		
Postcode/City:	10018	New York	
Province/Country:	New York	US-United States of America	

Architecture:	Cookfox Architects		
Street:	250 W 57th St		
Postcode/City:	10107	New York	
Province/Country:	New York	US-United States of America	
Energy consultancy:	Steven Winter Associates		
Street:	307 7th Ave		
Postcode/City:	10010	New York	
Province/Country:	New York	US-United States of America	

Mechanical engineer:	Dagher Engineering		
Street:	29 Broadway		
Postcode/City:	10006	New York	
Province/Country:	New York	US-United States of America	
Certification:	Passive House Academy		
Street:	Wicklow County Campus		
Postcode/City:	A67 X566		
Province/Country:	County Wicklow	IE-Ireland	

Year of construction:	2019	Interior temperature winter [°C]:	20.0	Interior temp. summer [°C]:	25.0
No. of dwelling units:	152	Internal heat gains (IHG) heating case [W/m²]:	4.1	IHG cooling case [W/m²]:	4.1
No. of occupants:	174.0	Specific capacity [Wh/K per m² TFA]:	132	Mechanical cooling:	x

Specific building characteristics with reference to the treated floor area

					Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area	m²	7065.3				
Space heating	Heating demand	kWh/(m²a)	9	≤	15	-	yes
	Heating load	W/m²	12	≤	-	10	
Space cooling	Cooling & dehum. demand	kWh/(m²a)	12	≤	18	18	yes
	Cooling load	W/m²	10	≤	-	12	
	Frequency of overheating (> 25 °C)	%	-	≤	-		-
	Frequency excessively high humidity (> 12 g/kg)	%	0	≤	10		yes
Airtightness	Pressurization test result n_{50}	1/h	0.5	≤	0.6		yes
Non-renewable Primary Energy (PE)	PE demand	kWh/(m²a)	119	≤	120		yes
Primary Energy Renewable (PER)	PER demand	kWh/(m²a)	87	≤	-	-	-
	Generation of renewable energy (in relation to pro-jected building footprint area)	kWh/(m²a)	0	≥	-	-	

[2] Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

Passive House Classic? yes

Task:	First name:	Surname:	Signature:

Issued on:		City:

13. Occupancy

The project began occupancy in early 2022. The following films showcase the mission of the non-profit client Breaking Ground, some of the residents, and their initial impression of living at Betances Residence:

https://aiafilmchallenge.org/2022-aia-film-challenge/?contest=video-detail&video_id=3748

https://vimeo.com/761473535