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The Sponsors of Energize Connecticut, and in partnership with Connecticut Passive House, are pleased to offer *Passive House & All-Electric Homes Initiative* to support workforce development and help transform the energy efficiency and building construction industries in Connecticut.



For more information, please visit [EnergizeCT.com/passive-house](https://EnergizeCT.com/passive-house)  
or email [PassiveHouseTrainingCT@icf.com](mailto:PassiveHouseTrainingCT@icf.com)

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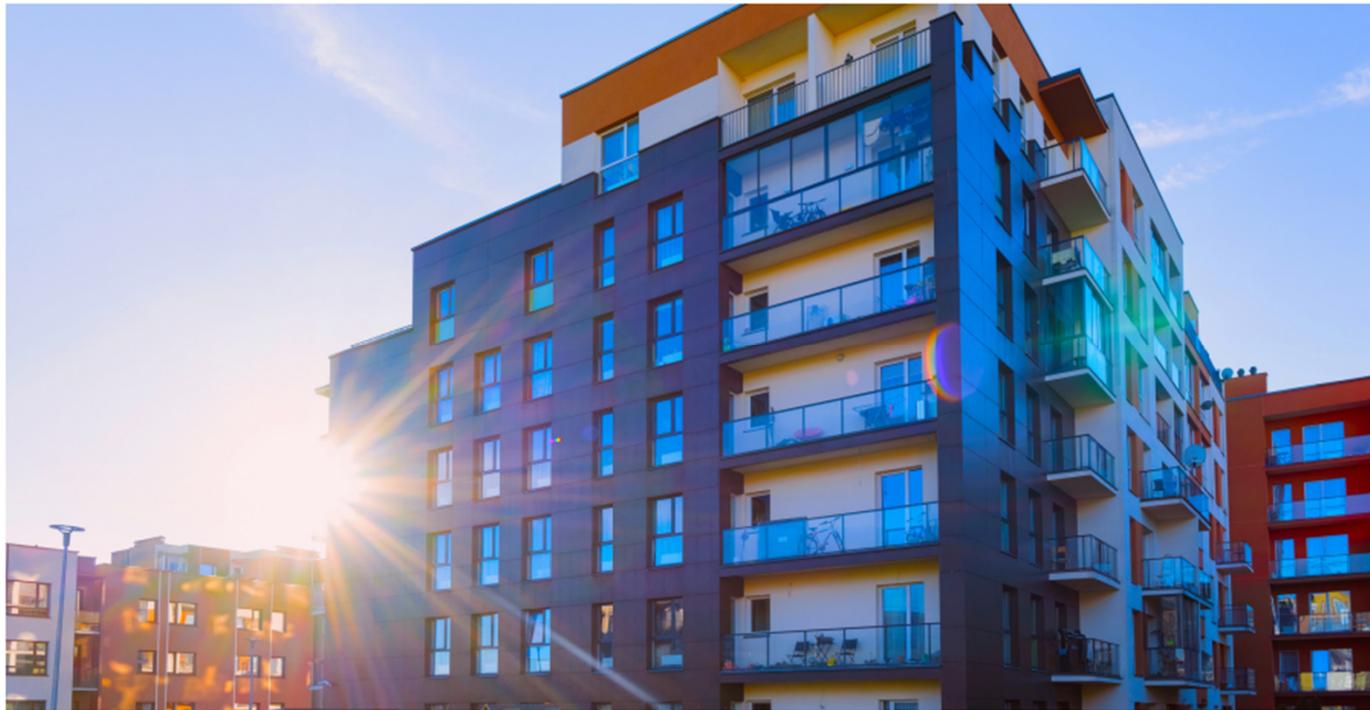


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# Take energy efficiency to a new level

Residential New Construction Passive House Multi-family buildings with five units or more



PASSIVE HOUSE INCENTIVE STRUCTURE FOR MULTI-FAMILY (5 UNITS OR MORE)				
Incentive Timing	Activity	Incentive Amount	Max Incentive (Per Unit)	Max Incentive (Per Project)
Pre-Construction	Feasibility Study <sup>1</sup>	Up to 100% of Feasibility Study Costs	N/A	\$5,000.00
	Energy Modeling <sup>2</sup>	75% of Energy Modeling Costs (Before 90% Design Drawings)	\$500.00	\$30,000.00
		50% of Energy Modeling Costs (90% Design/50% Construction)	\$250.00	\$15,000.00
Post Construction	Certification <sup>3</sup>	Up to 100% of Certification Costs	\$1,500.00	\$60,000.00

1. Feasibility Study will require documentation in the form of a Feasibility Study report and invoice from the Passive House Consultant
2. Incentives will only be awarded prior to 50% Construction Drawings for Passive House projects. No incentives will be granted after 50% Construction Drawing set.
3. Certification may be either through PHIUS, PHI, or EnerPHit certification offerings.

Next steps you can take...  
Contact your Energy Efficiency Representative or

Go to [EnergizeCT.com](https://www.energizeCT.com) or call 1-877-WISE USE for more details.

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The future of high-performance,  
all-electric homes starts here.



	LEVEL 1		LEVEL 2	
	Single Family (Detached Dwellings)	Multifamily (Attached Dwellings)	Single Family (Detached Dwellings)	Multifamily (Attached Dwellings)
Total UA Alternative Compliance or HERS Index Score <sup>†</sup>	Total UA ≥ 7.5% better than 2021 IECC or HERS Index Score ≤ 55		Total UA ≥ 15% better than 2021 IECC or HERS Index Score ≤ 45	
Heat pump for space heating <sup>††</sup>	Required		Required	
Space Conditioning Connectivity & Controls <sup>†††</sup>	Optional		Required	
Heat pump for water heating	Required	Optional	Required <sup>††††</sup>	
Hot Water Distribution <sup>††††</sup>	Required		Required	
Envelope Infiltration Rate (ACH)	ACH50 ≤ 2.5	CFA > 850ft <sup>2</sup> : ACH50 ≤ 4.0 CFA < 850ft <sup>2</sup> : ACH50 ≤ 5.0	ACH50 ≤ 2.0	CFA > 850ft <sup>2</sup> : ACH50 ≤ 3.0 CFA < 850ft <sup>2</sup> : ACH50 ≤ 4.0
Duct Leakage Rate (CFM)	2021 IECC code minimum requirements		All ductwork must be located in conditioned space	
Balanced Ventilation Systems	Optional		Required HRV/ERV (≥70% SRE / ≥40% TRE)	
Induction Cooking	Optional		Required <sup>†††††</sup>	Optional
Electric Vehicle Readiness <sup>††††††</sup>	Required		Required	

ALL-ELECTRIC HOME INCENTIVE STRUCTURE		
	Level 1	Level 2
Single Family	\$7,500	\$10,000
Single Family Attached	\$3,000	\$5,000
Multifamily	\$1,500	\$2,500

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# The Tyler: An Adaptive Reuse & Passive House Collab Between Developer and CPHD

*Kate Doherty, Steven Winter Associates &*

*Christina McPike, WinnCompanies*

# Learning Objectives

AIA credits pending

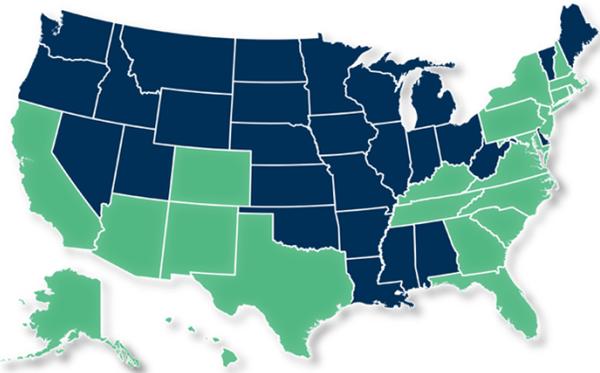


1. Understand how reaching for Passive House is beneficial to developers and why it's worth the challenge
2. Identify the intricacies of the EnerPHit program compared to new construction Passive House
3. Understand how Passive House accommodates historic projects through possible exemptions and special considerations
4. Learn how the developer can work in synergy with their CPHD to simplify the certification process

# WinnCompanies Overview

## WinnCompanies:

- Largest affordable housing manager in US;
- Completed over 30 historic adaptive reuse projects in Northeast;
- Long term commitment to sustainability.



**We manage 615 communities nationwide and own 107 of those, totaling 13,709 units**



# Industry Drivers

## The American Jobs Plan:

President Biden is calling on Congress to:

- Produce, preserve, and retrofit more than a million affordable, resilient, accessible, energy efficient, and electrified housing units. Through targeted tax credits, formula funding, grants, and p

## Electrification:

### Natural Gas Moratorium

In January 2019, HG&E was forced to impose a natural gas moratorium natural gas service. Regionally, demand for natural gas is outpacing sup

## State & Municipal Zoning:

### BOSTON ZONING ARTICLE 37 - INTER AGENCY GREEN BUILDING COMMITTEE ZERO CARBON BUILDING ASSESSMENT

In support of the City of Boston's Resiliency and GHG emissions reduction goals, including Carbon Neutral Boston 2050, the IGBC requests the project team include a project-specific Zero Carbon Building Assessment by modeling a Low Energy Building with an enhanced envelope and optimized

## State LIHTC QAPs:

### 4 Point Options:

- \_\_\_\_\_ EGC + 35 pts
- \_\_\_\_\_ LEED v4 Silver or Higher
- \_\_\_\_\_ ICC/ASHRAE 700 - NGBS 2015 (Silver or higher)
- \_\_\_\_\_ NJ ZERH Tier 3
- \_\_\_\_\_ Passive House V2.0
- \_\_\_\_\_ LBC 3.1

# CHFA: Preservation Pathway



## Exhibit A-1

### Sustainable Design Measures: Preservation

LIHTC applications for preservation will require a scope of work, including recommendations from the Energy consultant for the highest energy efficiency and sustainability design measures appropriate for the development. CHFA will expect the proposal to contain the following items to the extent appropriate and practical for the property.

- Benchmarking – EPA’s Energy Star Portfolio Manager
- • Energy Conservation
  - Average HERS Index  $\leq 70$ ; OR
  - $\geq 30\%$  reduction in pre-rehab energy use
- • Green Building
  - Enterprise Green Communities 2020 (EGC 2020); OR
  - National Green Building Standard (NGBS ); OR
  - Leadership in Energy and Environmental Design (LEED)
- PV system to offset annual energy demand for site interior common area lighting (onsite or offsite renewables) - Complete feasibility study and analysis of return on investment in consultation with CT Green Bank
- Backup power to provide resiliency to Critical Systems, Emergency Lighting, and Access to Potable Water
- Commissioning
- High-speed Broadband access to units

# CHFA: New Construction Sustainability



Exhibit A-2

## Sustainability Design Measures: New Construction

*Benchmarking with EPA's Energy Star Portfolio Manager is a prerequisite for all Sustainability points*

### Energy Conservation

Prerequisites:

- DOE Zero Energy Ready Home Certification
- Balanced ventilation

Criteria	Points
<b>Tier 1</b> Average HERS Index $\leq 50$ ; OR Average % below ENERGY STAR Target Index $\geq 15\%$	2
<b>Tier 2</b> Average HERS Index $\leq 46$ ; OR Average % below ENERGY STAR Target Index $\geq 25\%$	3
<b>Tier 3</b> Average HERS Index $\leq 42$ ; OR Average % below ENERGY STAR Target Index $\geq 35\%$ ; OR Passive House; OR International Living Future Institute (ILFI) Zero Energy Ready	4





# EnerPhit:

Passive House Institute's retrofit pathway

# EnerPHit vs. New Construction



- Component vs. Performance pathways (200 Tyler: Component)
  - Opportunity for a more prescriptive list of requirements.
- Airtightness requirement 1.0 ACH50 vs. 0.6ACH50
- Relaxed Source Energy (component path)
  - \*historic\*

EnerPHit (retrofit): Component characteristics					
Building envelope to exterior air <sup>1</sup> (R-value)	hr.ft <sup>2</sup> .°F/BTU	41.88	≥	37.86	
Building envelope to ground <sup>1</sup> (R-value)	hr.ft <sup>2</sup> .°F/BTU	21.91	≥	12.08	
Wall w/int. insulation in contact w/external air (R-value)	hr.ft <sup>2</sup> .°F/BTU	17.98	≥	16.22	
Wall w/interior insulation in contact w/ground (R-value)	hr.ft <sup>2</sup> .°F/BTU	21.38	≥	6.38	
Flat roof (SRI)	-	45.20	≥	-	
Inclined and vertical external surface (SRI)	-	45	≥	-	
Windows/Entrance doors ( $U_{W/D, installed}$ )	BTU/hr.ft <sup>2</sup> .°F	0.50	≤	0.16	
Windows ( $U_{W, installed}$ )	BTU/hr.ft <sup>2</sup> .°F	-	≤	0.19	
Windows ( $U_{W, installed}$ )	BTU/hr.ft <sup>2</sup> .°F	-	≤	0.20	
Glazing (SHGC)	-	0.40	≥	0.76	
Glazing/sun protection (max. solar load)	kBTU/(ft <sup>2</sup> .yr)	104.8	≤	-	
Ventilation (effective heat recovery efficiency)	%	72	≥	75	
Ventilation (humidity recovery efficiency)	%	45	≥	-	

<sup>1</sup> With

# Exemptions for EnerPHit



The limit values in Table 2 for the heat transfer coefficients of the exterior envelope building components may be exceeded if absolutely necessary based on one or more of the following compelling reasons:

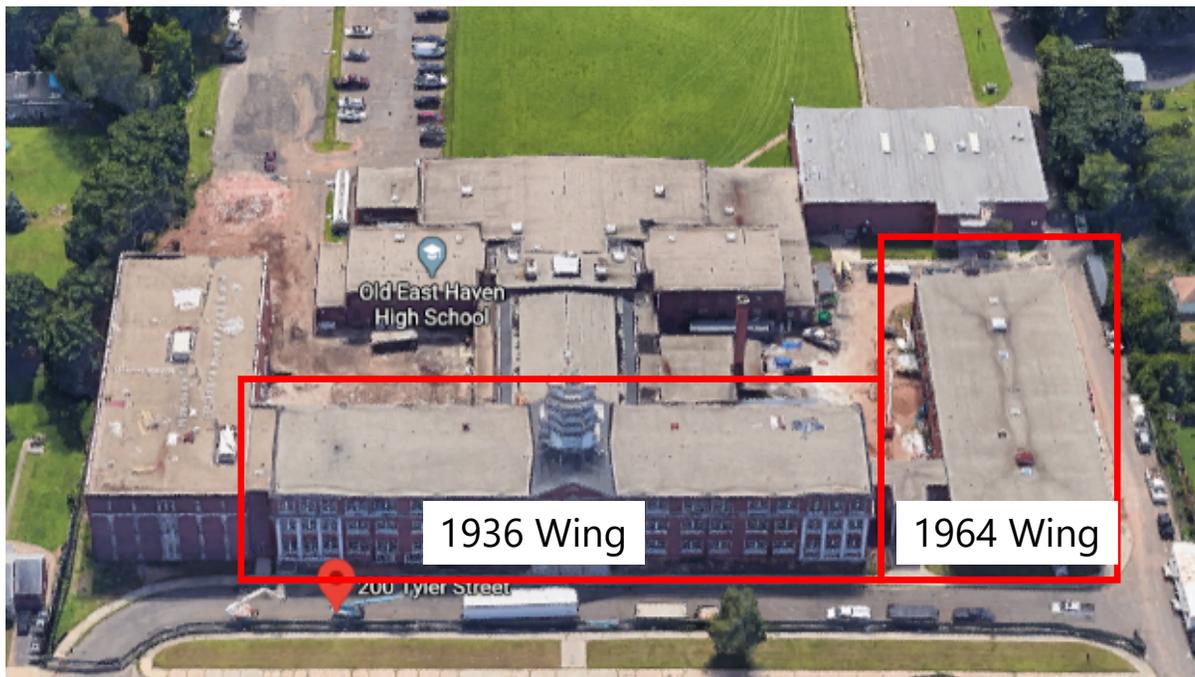
- ★ *If required by the historical building preservation authorities*
  - If the cost-effectiveness of a required measure is no longer assured due to exceptional circumstances or additional requirements
  - Due to legal requirements
  - If implementation of the required standard of thermal insulation would result in unacceptable restriction of the use of the building or adjacent outer areas
- ★ *If special, additional requirements (e.g. fire safety) exist and there are no components available on the market that also comply with the EnerPHit criteria*
- ★ *If the heat transfer coefficient (U-value) of windows is increased due to a high thermal transmittance (psi value) of the window installation offset to the insulation layer in a wall that has interior insulation*
  - If reliably damage-free construction is only possible with a smaller insulation thickness in the case of interior insulation
  - If other compelling reasons relating to construction are present

## The Tyler, East Haven, CT



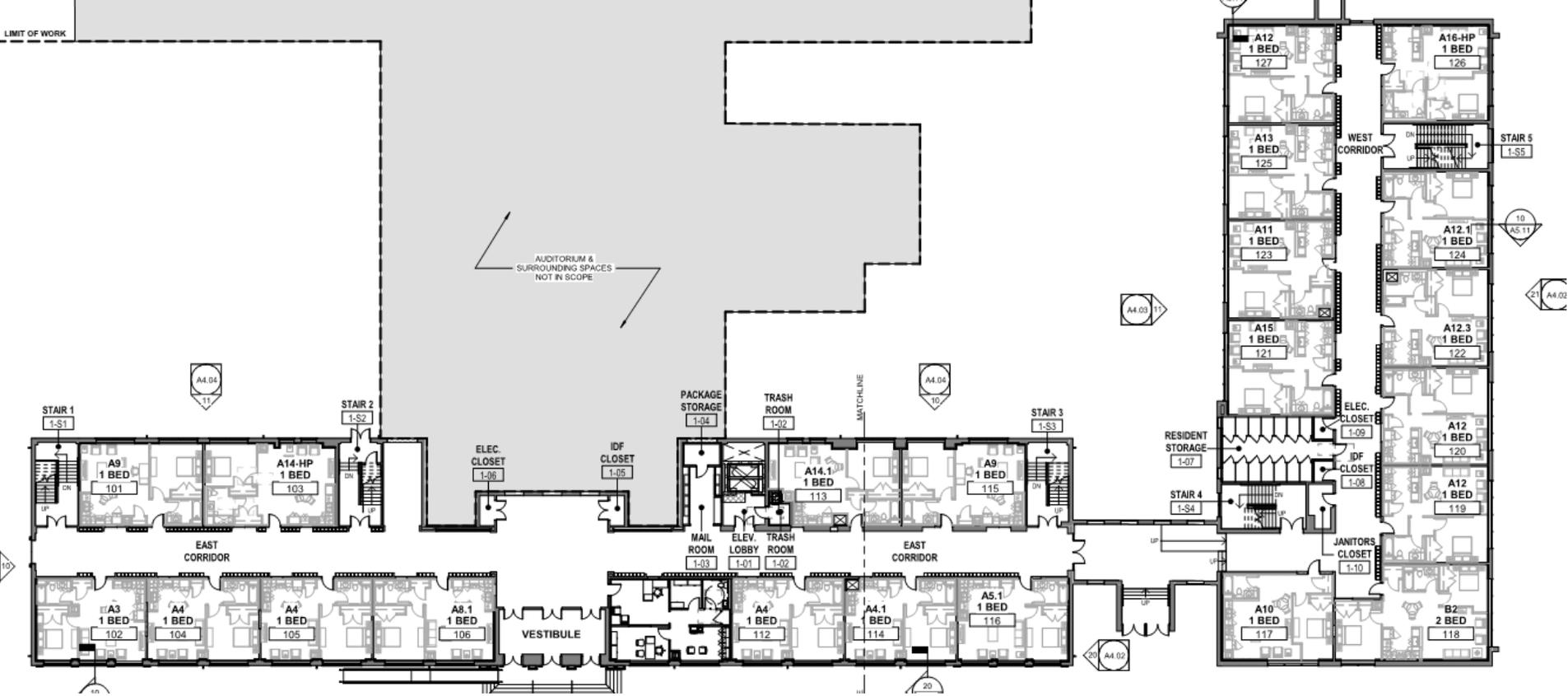
- Mostly vacant city owned building.
- Acquisition of three wings – 1936, 1964, 1972 original construction
- Conversion of 1936 and 1964 wings to 70 apartments
- Estimated completion August 2020

# The Tyler, East Haven, CT



- Multi-phased campus;
- 70 new mixed income units located in 1936 and 1964 wings.
- Fully demolished the 1972 wing (far left).

# Typical Floor



# Project Goals

- Create 70 new units of affordable housing
- Historic preservation and compliance with NPS and SHPO
- EnerPhit certification through PHI
- EnergizeCT utility incentives
- Solar PV

# Project Financing

- Connecticut Housing Finance Authority 9% LIHTC award, \$15m
- Federal HTC: ~\$5m
- State HTC: ~\$4m
- TDC = \$32m
- Construction cost ~300k/unit

**QAP scoring for Sustainable Design critical for LIHTC funding**



**e. Sustainable Design**  
Points will be awarded based upon the Sustainable Design Measures (SDM) provided and indicated in the plans, specifications, Energy Conservation Plan, third-party Energy Consultant's / Professional Engineer's report, and/or other supporting documents as outlined in the Standards.

Points for Sustainable Design Measures described below are additive. Maximum points available in this category: 6

Measure	Description	Points
Passive House Design	Points may be awarded for projects designed to meet Passive House standards. Submit plans and specifications at a level of 40% or higher with detailed wall sections, a detailed scope of Passive House design measures prepared by a third-party Certified Passive House Consultant or Designer in coordination with the Project Architect, and a preliminary modeling analysis/output report through the Passive House Planning Package (PHPP) as developed by the Passive House Institute (PHI) <a href="http://passiv.de">http://passiv.de</a> or WUFI Passive as developed by the Passive House Institute United States	3

*Connecticut Housing Finance Authority  
2017 Qualified Allocation Plan*

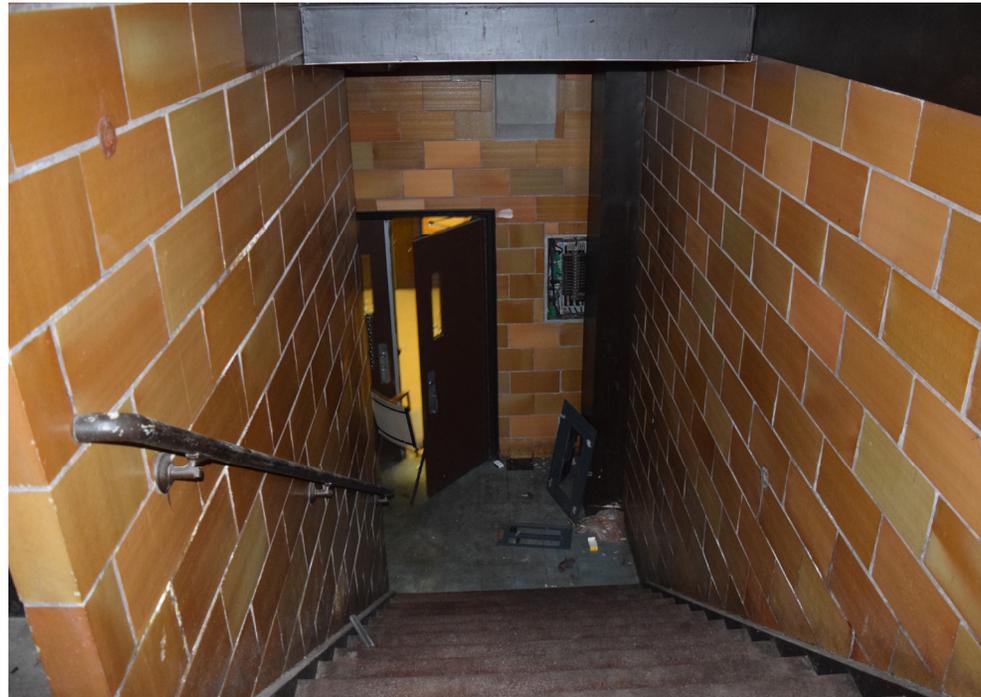
# Historic Conditions – 1936 Steel Windows



# Historic Conditions – 1964 Curtain Wall



# Historic Conditions



# EnerPHit Scope Impacts

Hard Cost Premium: \$1,200,000, or 6% total construction costs

Baseline	EnerPHit (6% added cost)
2" foam, or 1" rigid only. Exposed plaster and block preferred/required.	Max of 4" thickness, R-17 effective, 1/2" rigid with 2.5" foam. Glazed block must be exposed.
Central gas boilers, cooling tower, hybrid water source heat pumps.	Central Mitsubishi VRF for heating & cooling, central gas fired DHW plant, dehumidification
65% efficient ERV, living room supply only	80% efficient, bedroom supply (soffits), Aero seal
Historic compliant windows, drywall returns	Equal window, custom made insulated trim/sill
R-30 roof	R-49 , spray foam underside of decking
R-0 slab	R-20, slab of '64 wing & crawlspace ceiling
Concrete floors, no thermal break	1" thick, 1' perimeter spray foam around exterior
Compartmentalization only, 5 ACH50	Whole building infiltration, 1 ACH50

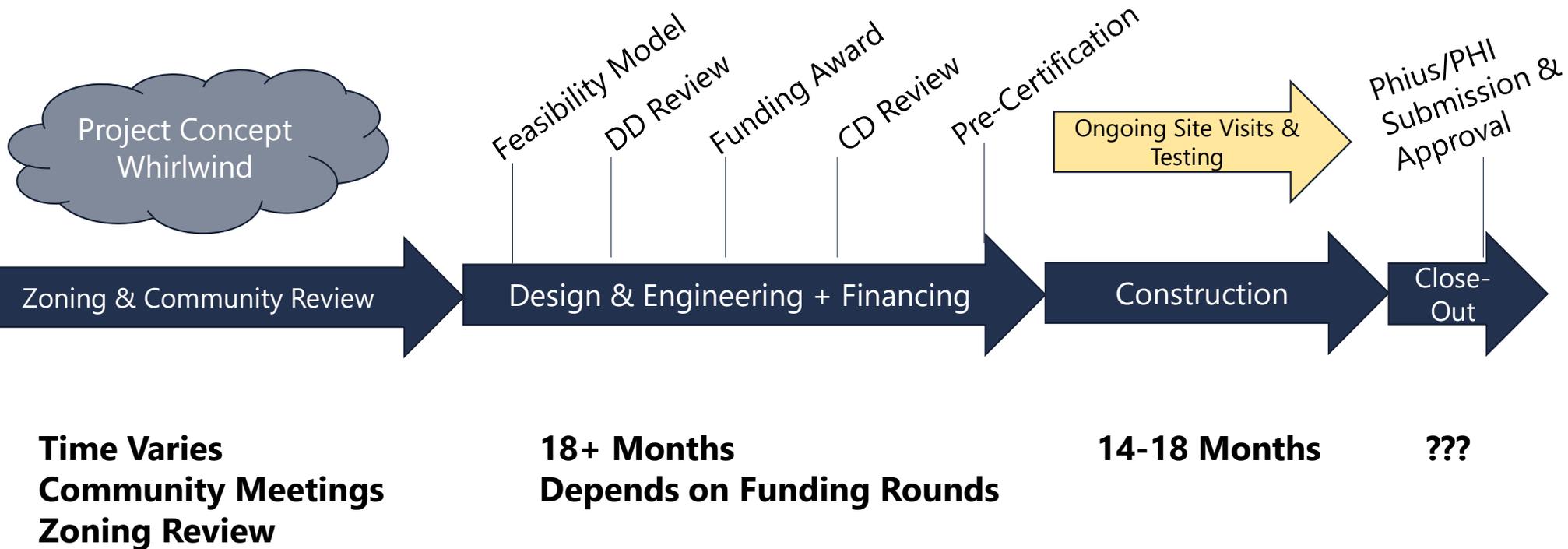
# Going EnerPHit: Synergy between Developer & CPHD



## Design Collaboration:

**Integrated design** with Architect, MEP Engineer, Sustainability consultant – Steven Winter Associates – and GC **critical** to project success.

# Passive House Timeline





# Historic Requirements: What We CAN'T Do

- Triple pane windows
- PH frames
- Change the exterior
- Change some of the interior surfaces not in the apartments
- Eliminate any doors

# Behind the Scenes with a CPHD

## Schematic Design

- Walk through of existing building
- Preliminary energy model

## 100 % DD: Two weeks

- Detailed update to energy model
  - Critical/typical TB model(s)
  - Building geometry and shading
  - MEP systems
- **Needed from Team:**
  1. DHW distribution pipe lengths
  2. Ventilation rates in individual rooms
  3. Lighting energy calculations
- PHPP Model Update Report
- Sign on with a Certifier

## 50% CD: Two weeks for review

- **Needed from Team:** updated calcs
- TB Modeling
- Air Barrier Review
  - **Plan and section** details
  - Continuous air barrier strategy
- MEP Plan Review
- Spec Review
- QA/QC Inspection Checklists
- Blower Door Test Plan
- PHPP Model Update Report
- 1<sup>st</sup> Full Model Submission to PH certifier

## 100% CD: Two weeks for review

- Finalize Tasks listed under 50% CDs



# Construction Collaboration

# PH Construction Phase

## Construction Phase:

- **Contractor Training**
- **Site Inspections**
- **Interim Testing**
- Submittal Review
- Shop Drawing Review
- RFI review

## Construction Completion:

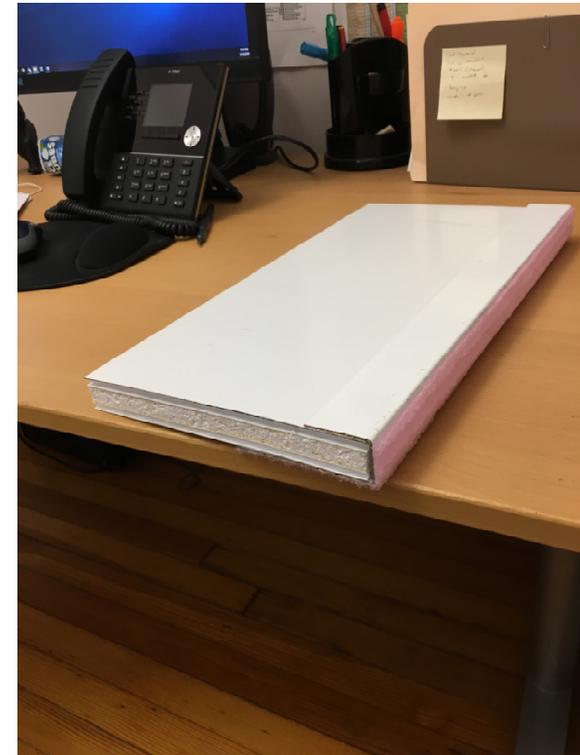
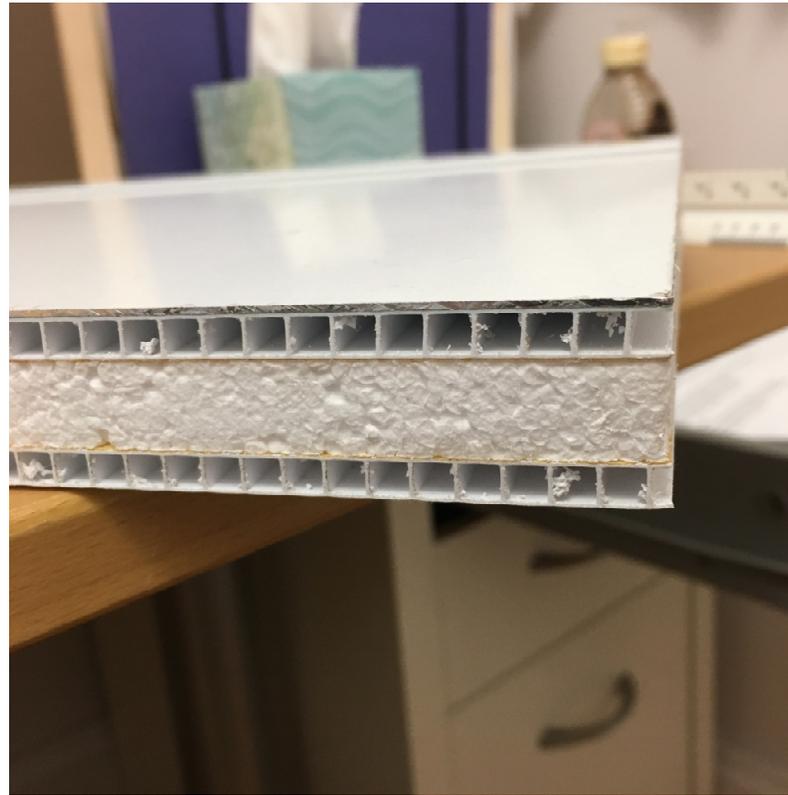
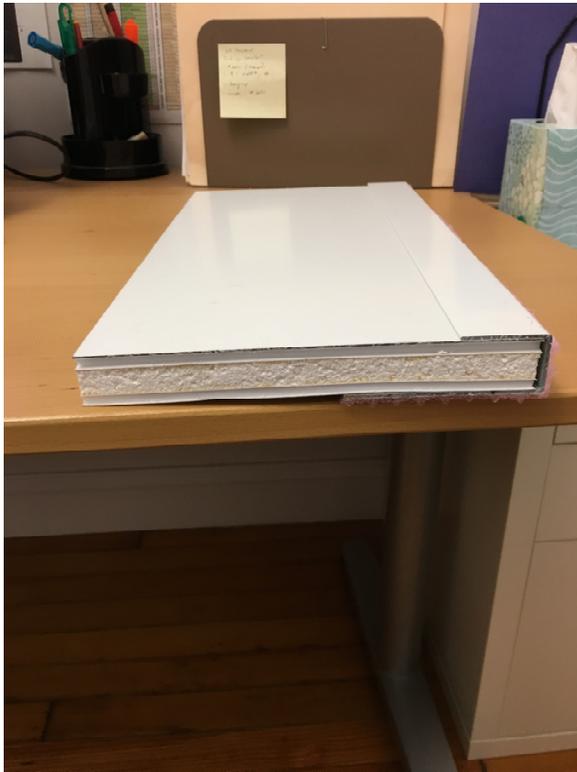
- **Whole building blower door tests**
- **Measurement and balancing of the ventilation system**
- **Verification of proper installation of the mechanical system**
- Verification of fixtures & appliances
- Documentation & submission to certifying body



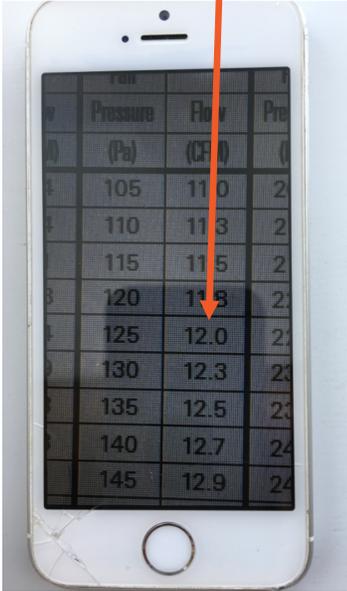
# Punched Window Conditions



# Custom Window Surround

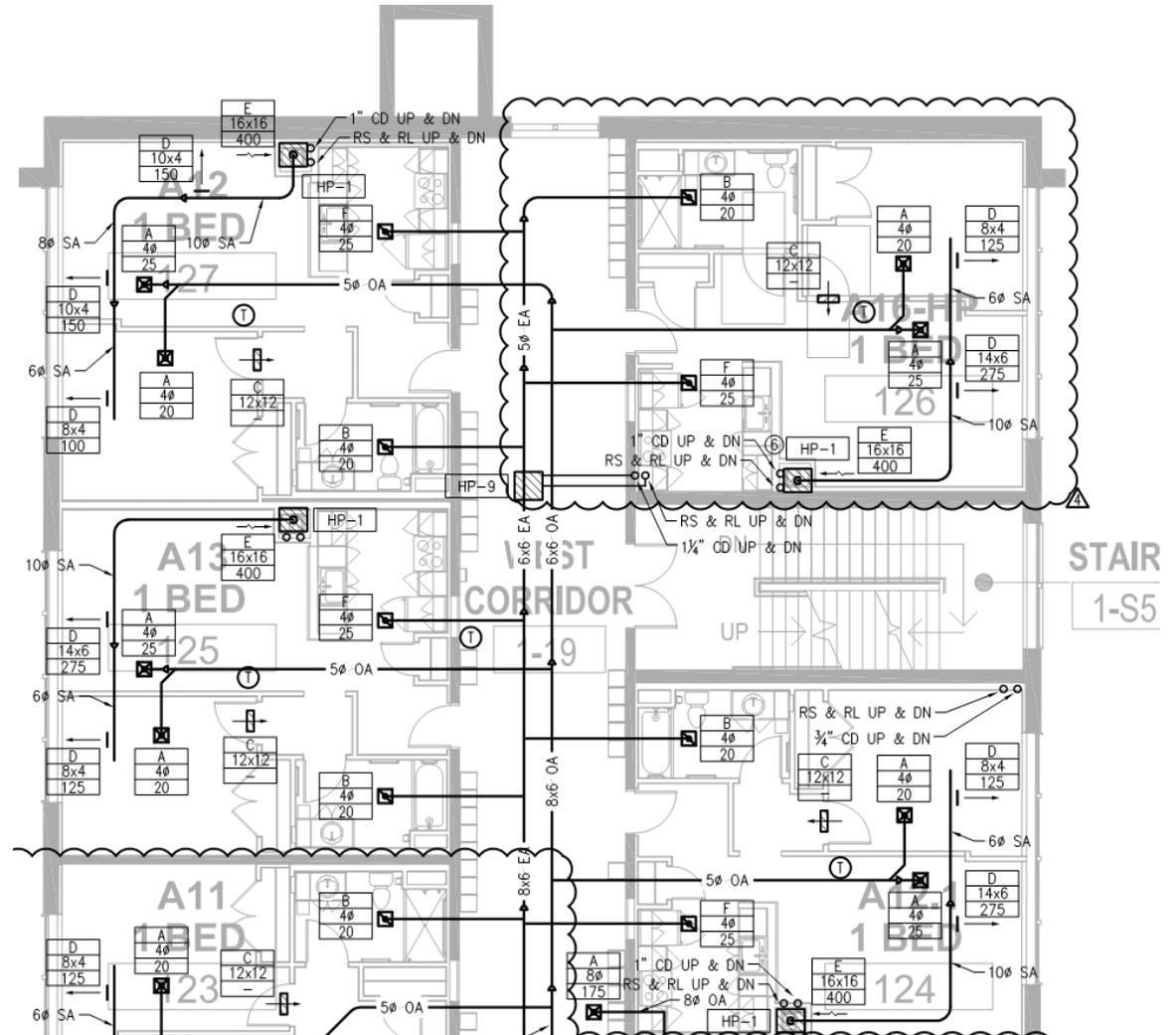


# Punched Window Mock-up



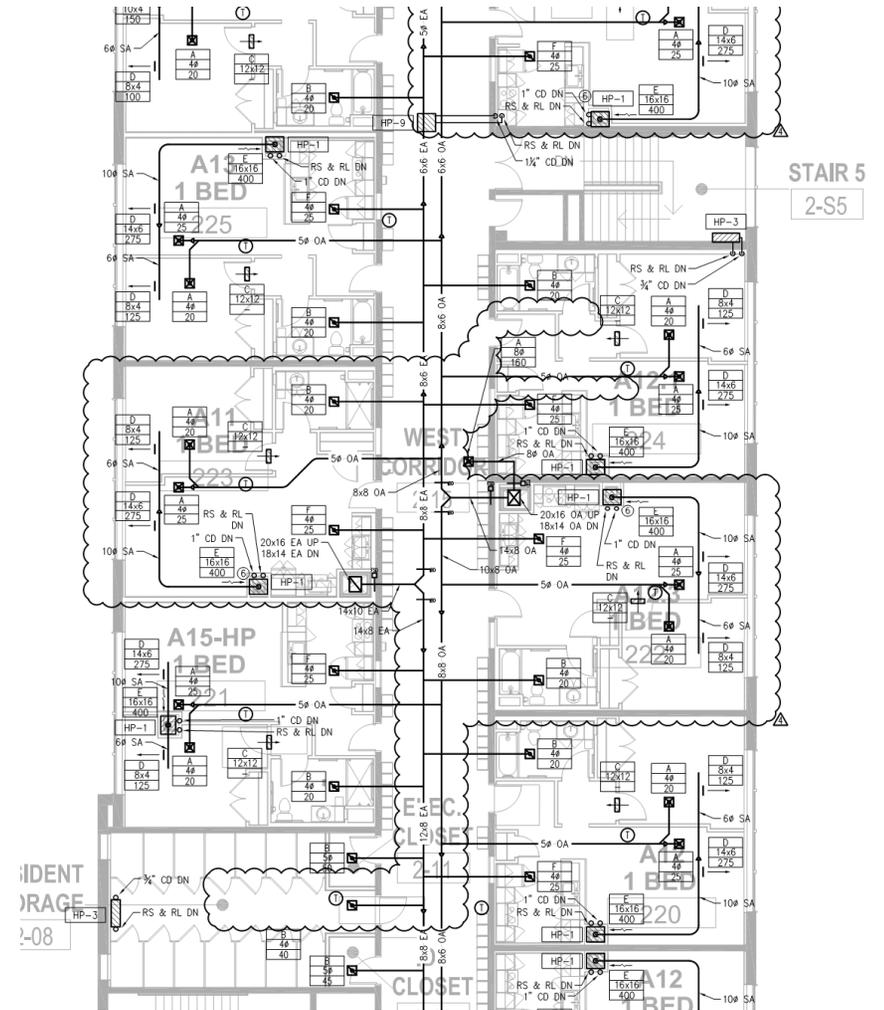
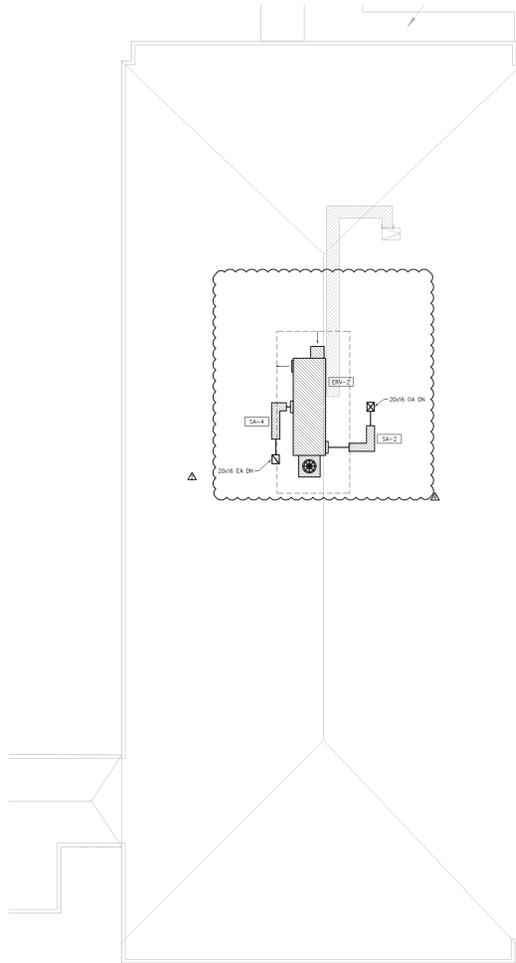
# Heating & Cooling

- Mini-splits & VRF
- Concealed, vertical ducted units in apartments
- Registers aimed at windows
- Wall or ceiling mounted in corridors, stairs, back of house spaces



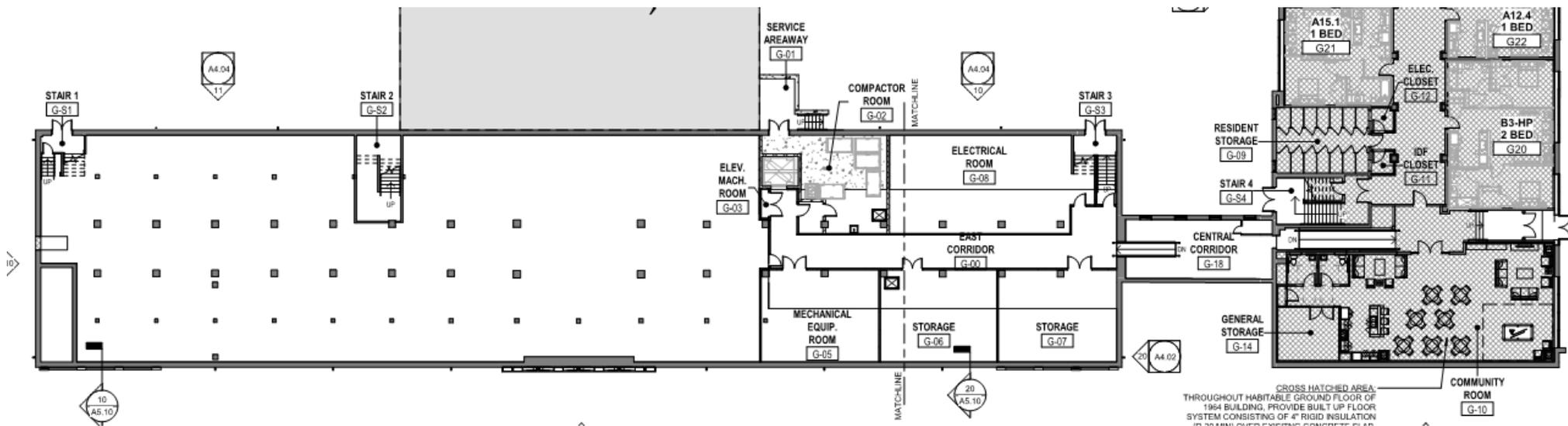
# Ventilation

- 2 Central ERVs
- Ducts run in corridors
- CAR dampers
- Aeroseal



# Misc. Mechanical

- Central, gas DHW
- Dehumidifier in crawl
- Stairs heated w/ wall mounted mini-splits





# Post Construction Takeaways

- How did 200 Tyler inform future projects?
  - Wood studs
  - Triple glazed windows
  - VRF & All Electric
- VRF Zoning
- Solar Heat Gain
- Tenant feedback

# Post Construction Operations and Maintenance



# Operations and Maintenance



- Ongoing communication- SWA wants to know how the building ACTUALLY performs!
- The Tyler-best performing in SWA's portfolio
  - Senior housing- less overall cooking, clothes washing
  - Less occupants/unit
  - Larger units
- Staff Development trainings upcoming (SWA Academy)

SWA Academy is a user-paced learning platform that guides practitioners through the quickly evolving topics of building science and accessibility.

Trainings focus on practical design and construction techniques, efficient building operations and maintenance practices, and current programs and requirements.

**SWA Academy is for:**

Staff Development | Onboarding | Project Teams

- Architects
- Engineers
- Researchers
- Consultants
- Operations & Maintenance Staff
- Students
- Contractors
- Policy Professionals
- Developers

For more information, visit  
[www.swinter.com/training](http://www.swinter.com/training)



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