BUILDINGENERGY BOSTON

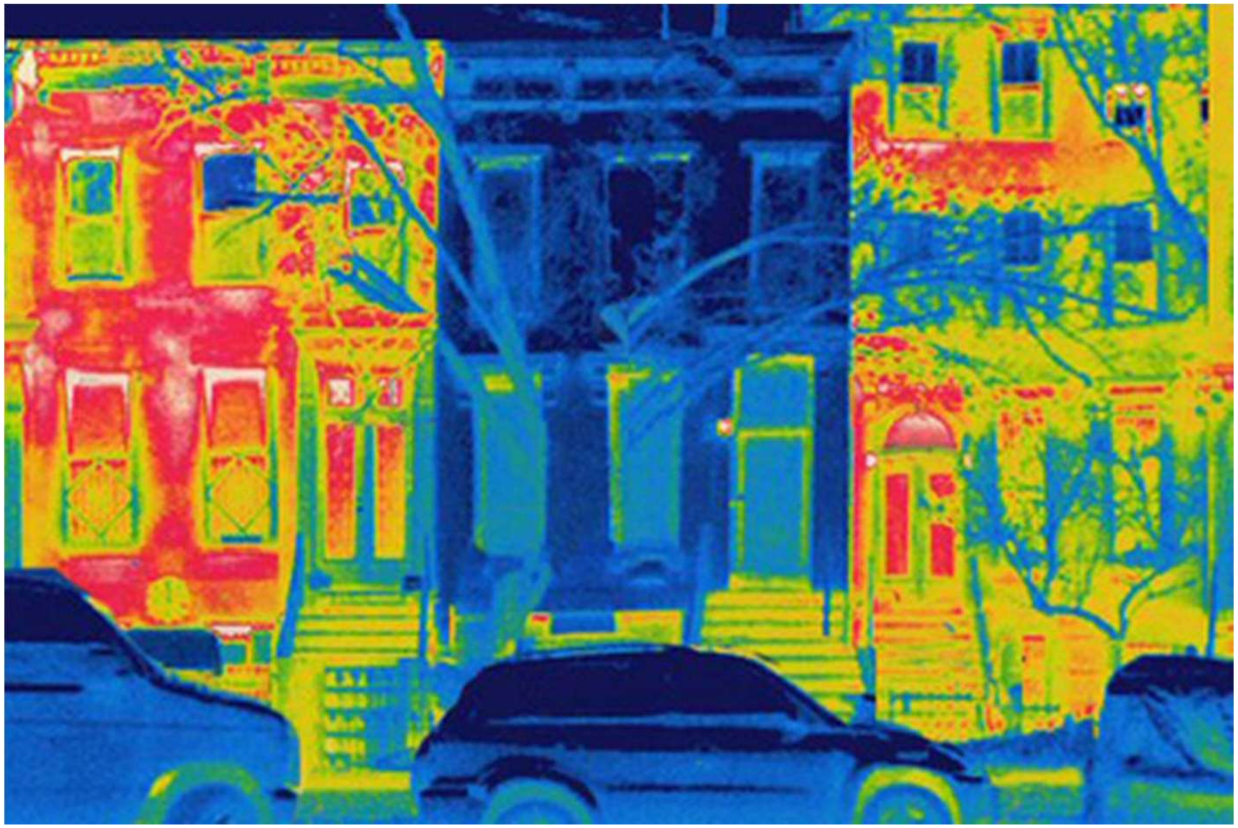
Getting a Phius Project to the Phinish Line: What You Need to Know

Mike Browne, Advanced Building Analysis
Greg Downing, Bald Hill Builders
Jeff Geisinger, Utile

Curated by Greg Smith

Northeast Sustainable Energy Association (NESEA) | March 20, 2025

Which One is the Phius Building?



What is Phius?

The Phius standard is a set of design principles for creating ultra energy efficient buildings with comfortable indoor living spaces. These principles can be applied to all buildings, including single-family homes, multifamily apartment buildings, schools, skyscrapers and more.

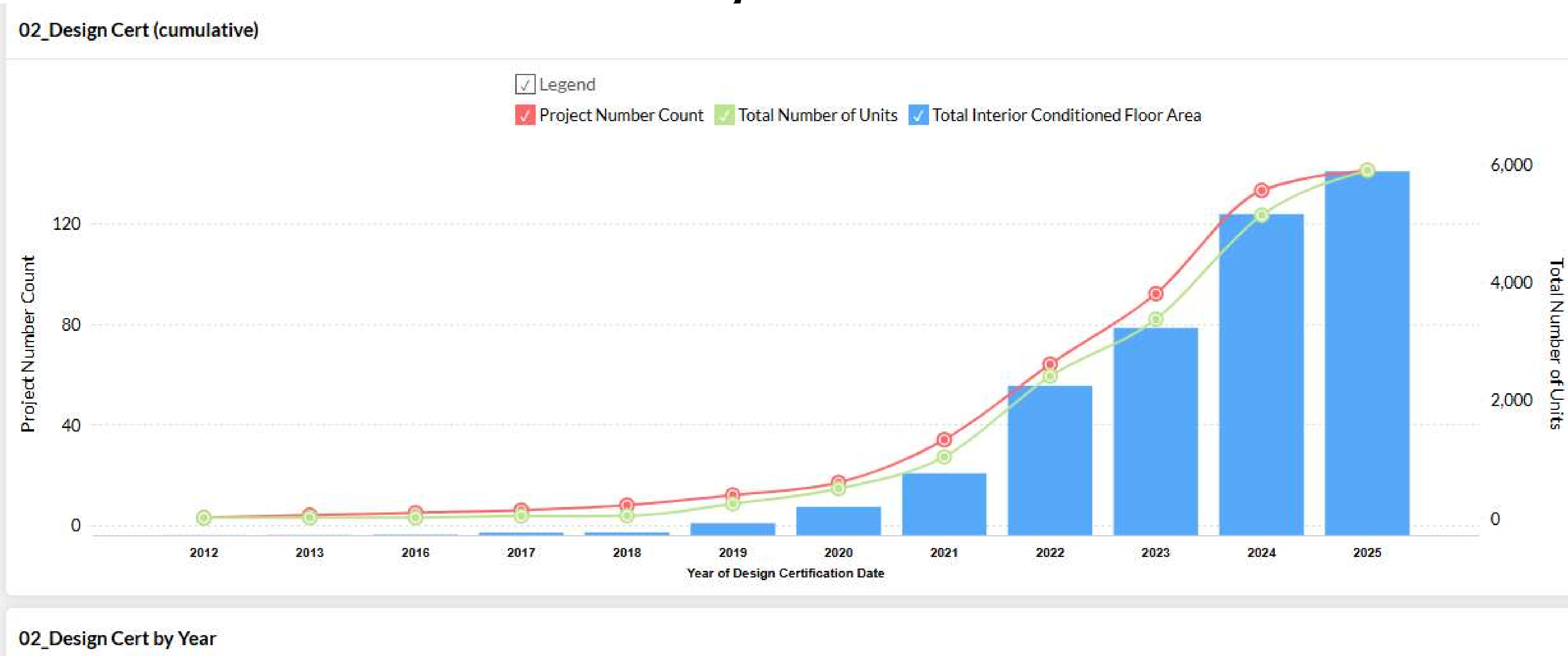
Rise in Phius Projects

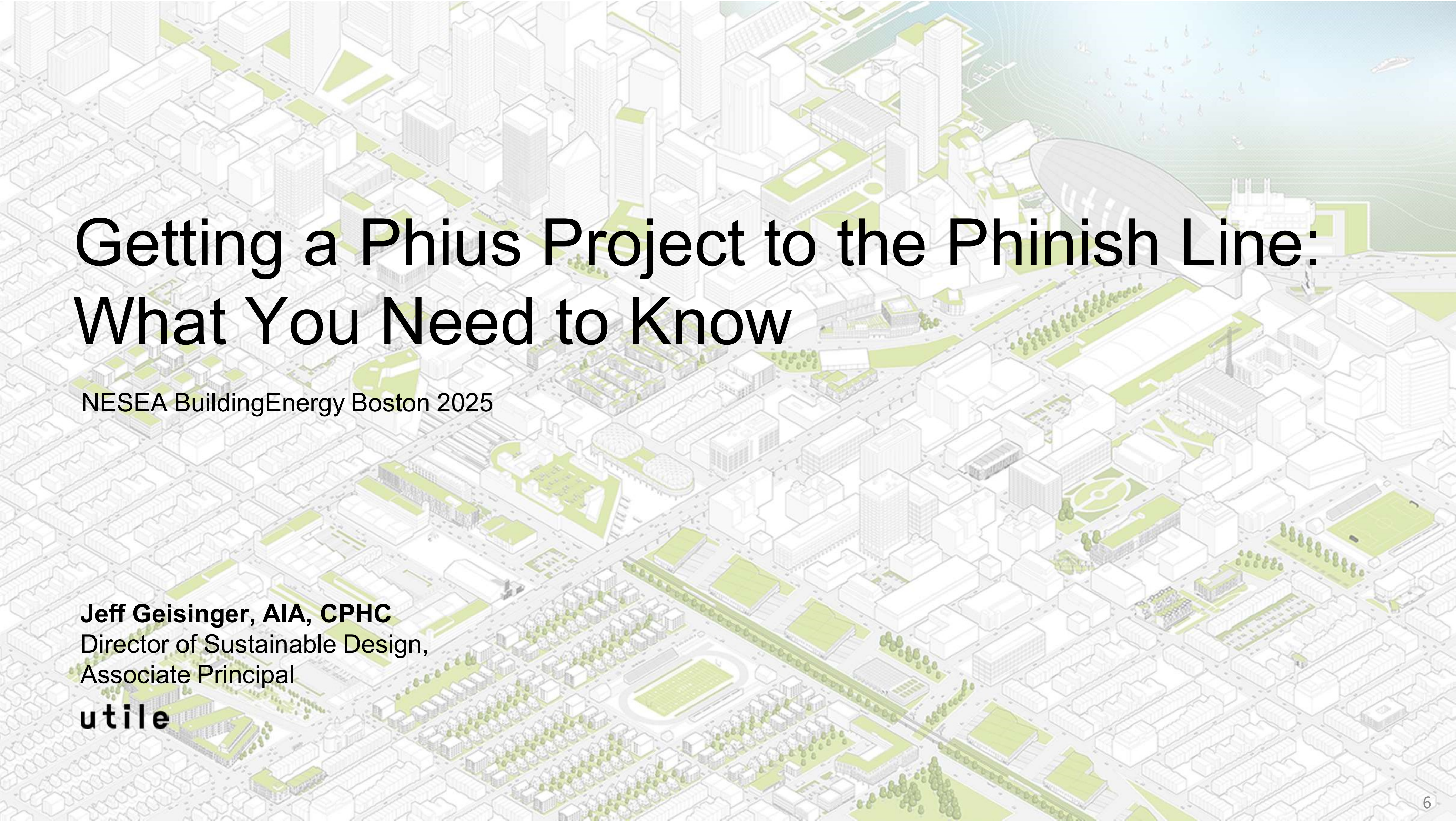
- Opt in Specialized Code Requires that Residential Buildings over 12,000 square feet meet the Passive House Standard (either Phius or PHI).

- 48 municipalities have adopted the Opt in Specialized Code covering 30% of the population in the state including Boston.

- Massachusetts incentivizes Passive House through the MassSave Program and through the Qualified Allocation Plan (QAP) for Low Income Housing.

Increase in Phius Projects Since 2012



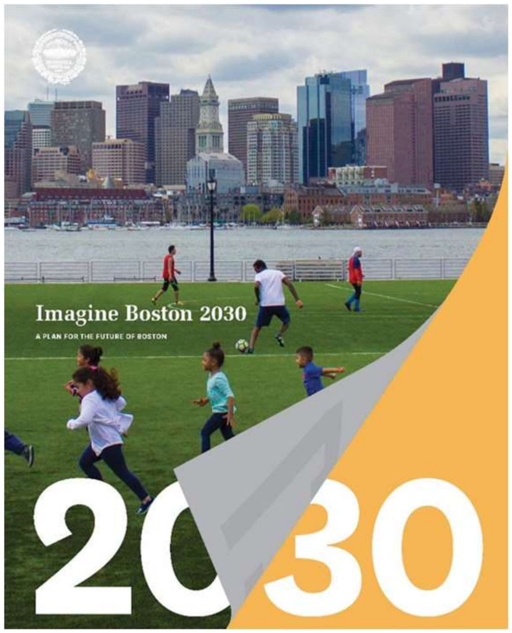


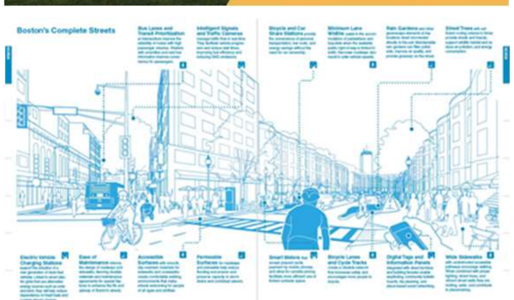
Getting a Phius Project to the Phinish Line: What You Need to Know

NESEA BuildingEnergy Boston 2025

Jeff Geisinger, AIA, CPHC
Director of Sustainable Design,
Associate Principal
utile

utile


Imagine Boston 2030
A PLAN FOR THE FUTURE OF BOSTON
2030


Boston's Complete Streets


Teen
Children


THE BOSTON CONSERVATORY
THE BOSTON CONSERVATORY

A Passive Building can be any size/type

Front St.
Portland, ME | 100 Units
Phius Certified (Buildings 2 + 5)

3371 Washington St.
Boston, MA | 39 Units
Phius Design Certified, In Construction

152-158 Broadway
Somerville, MA | 45 Units
Phius Certified

1200 Montello
Brockton, MA | 94 Units
Phius Design Certified, In Construction

Scape Charlesgate
Boston, MA | 400 Units
In Design

Walnut St. Housing
Foxborough, MA | 200 Units
Phius Design Certified, In Construction

1005 Broadway
Chelsea, MA | 38 Units
Phius Certified

25 Sixth St.
Chelsea, MA | 62 Units
Phius Design Certified, In Construction

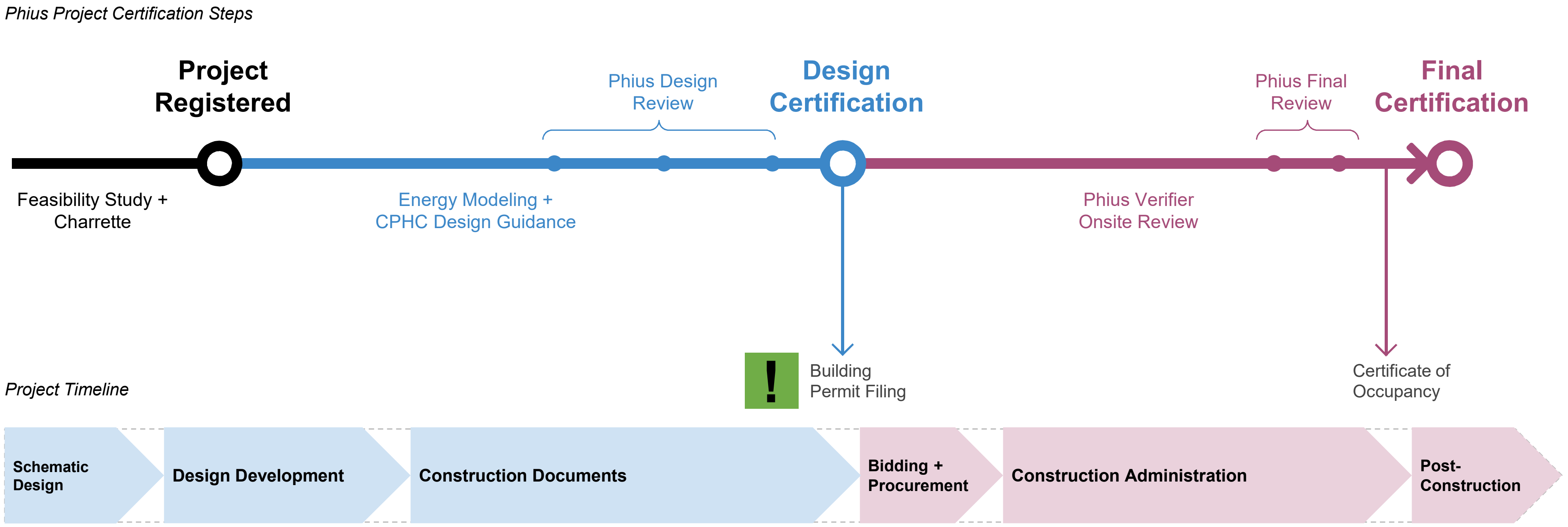
1599 Columbus Ave.
Boston, MA | 65 Units
Phius Design Certified, In Construction

495 On the Dot
Boston, MA | 331 Units
Phius Design Certified

Recommendations from a CPHC

- Set a **road map** for achieving Design Certification
- Conduct a **feasibility study** and **design charrette** as early as possible in the process
- Use **energy modeling for design guidance** and refine for Design Certification
- Utilize **checklists to track program requirements** by phase for design team, consultants
- Integrate **Revit outputs** to facilitate the Design Cert process
- **Coordinate with Verifier** and track changes **proactively during construction**

Set a road map for achieving Design Certification

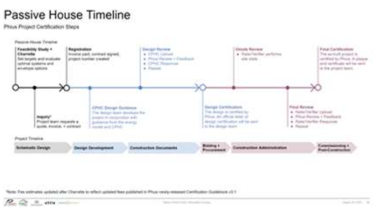


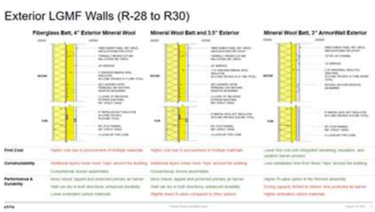
Conduct a feasibility study as early as possible in the process

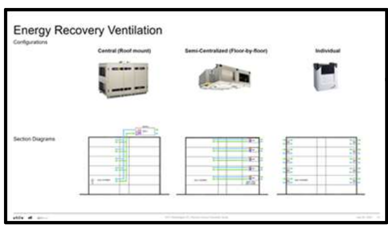
Goal: Reach consensus around Phius criteria, assemblies, and systems configurations to achieve Phius certification with the integrated team:

- Owner
- Designer/ architect
- Phius Certified Consultant (CPHC)
- Engineering Consultants: MEP Engineer, Structural Engineer
- CM or Pre-construction Advisor
- Phius Certified Verifier

Feasibility Study







Energy Recovery Ventilation

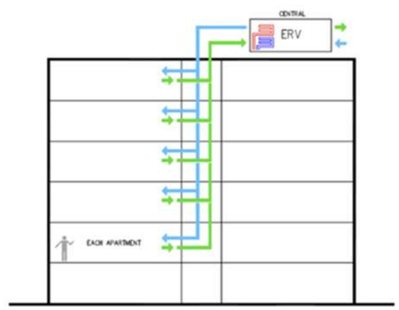
Configurations

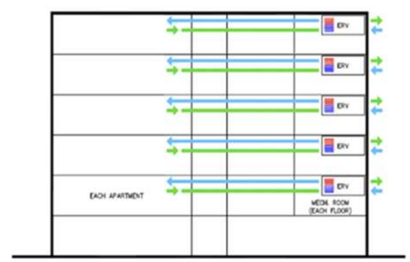
Central (Roof mount)

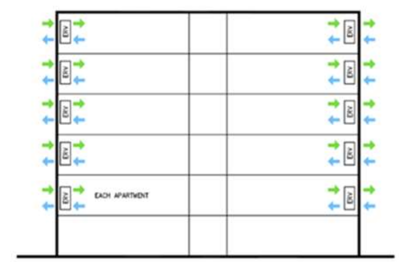
Semi-Centralized (Floor-by-floor)

Individual

Section Diagrams

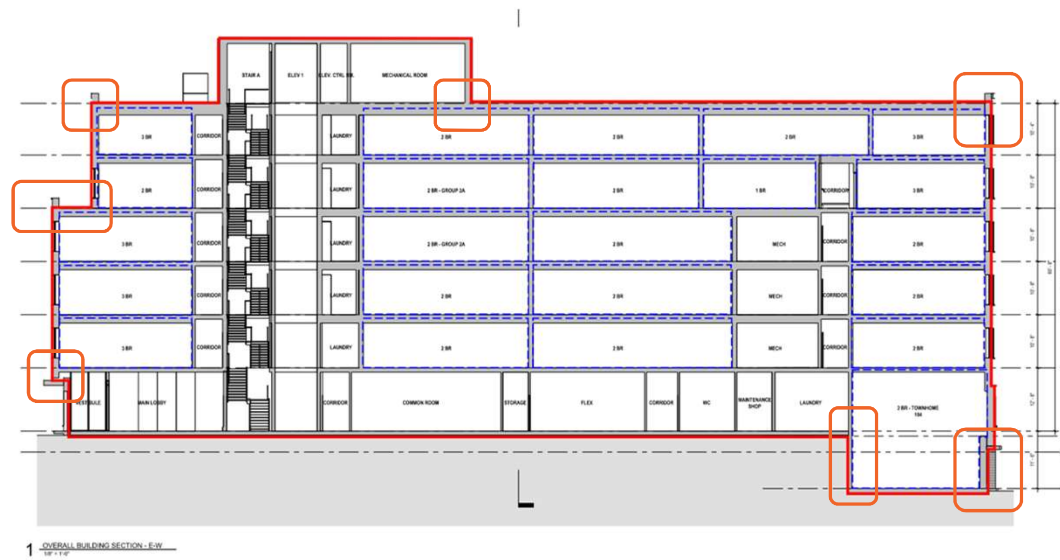






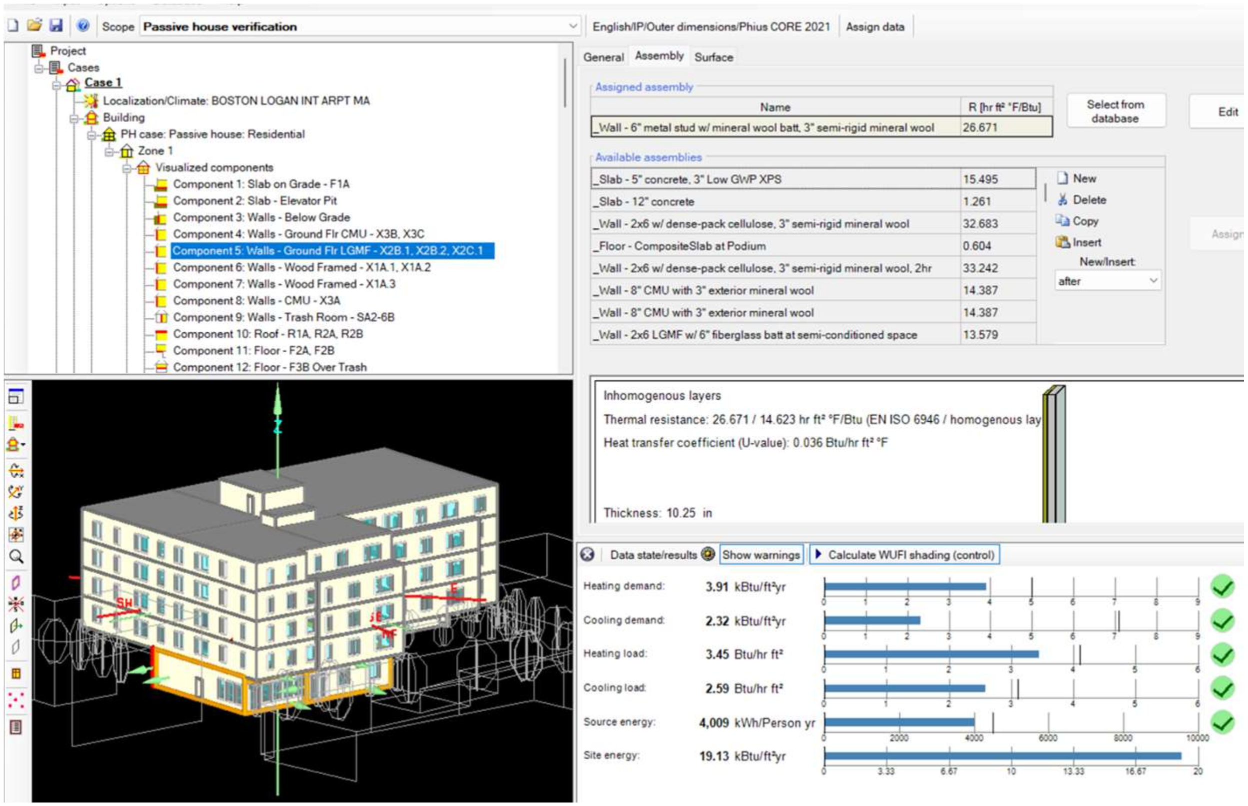
Feasibility Study - Early Identification of Challenges

Ground Floor Plan

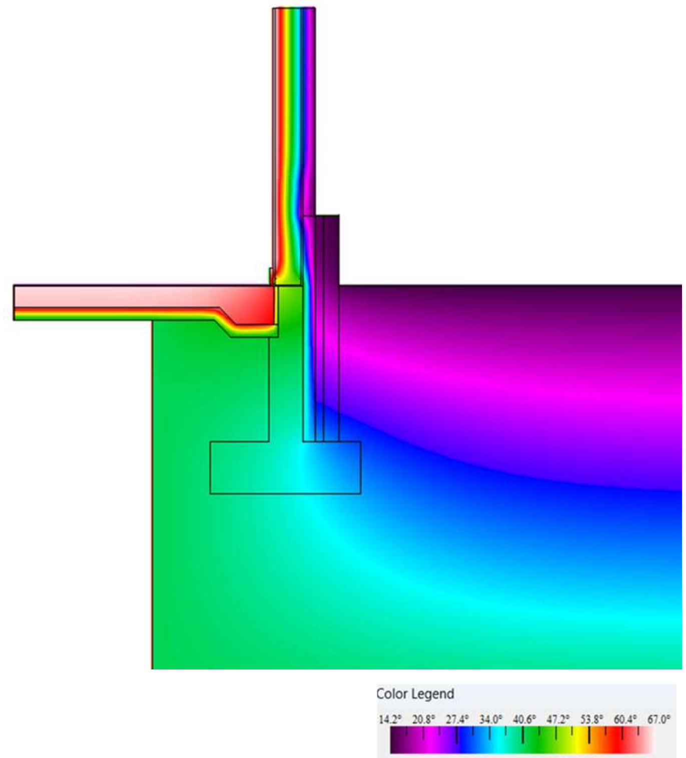


Use energy modeling for design guidance - Feasibility study

Use energy modeling for design guidance - Design Certification

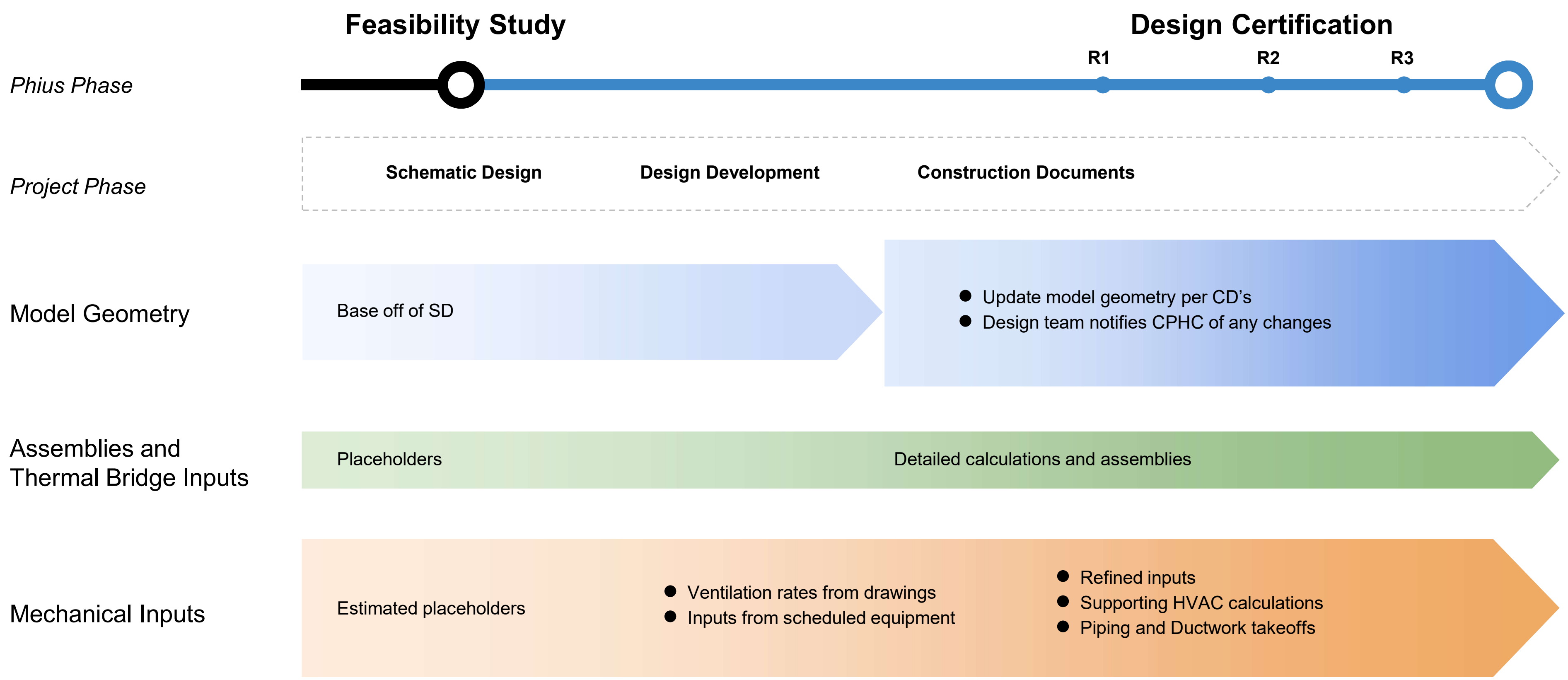


WUFI Passive energy model

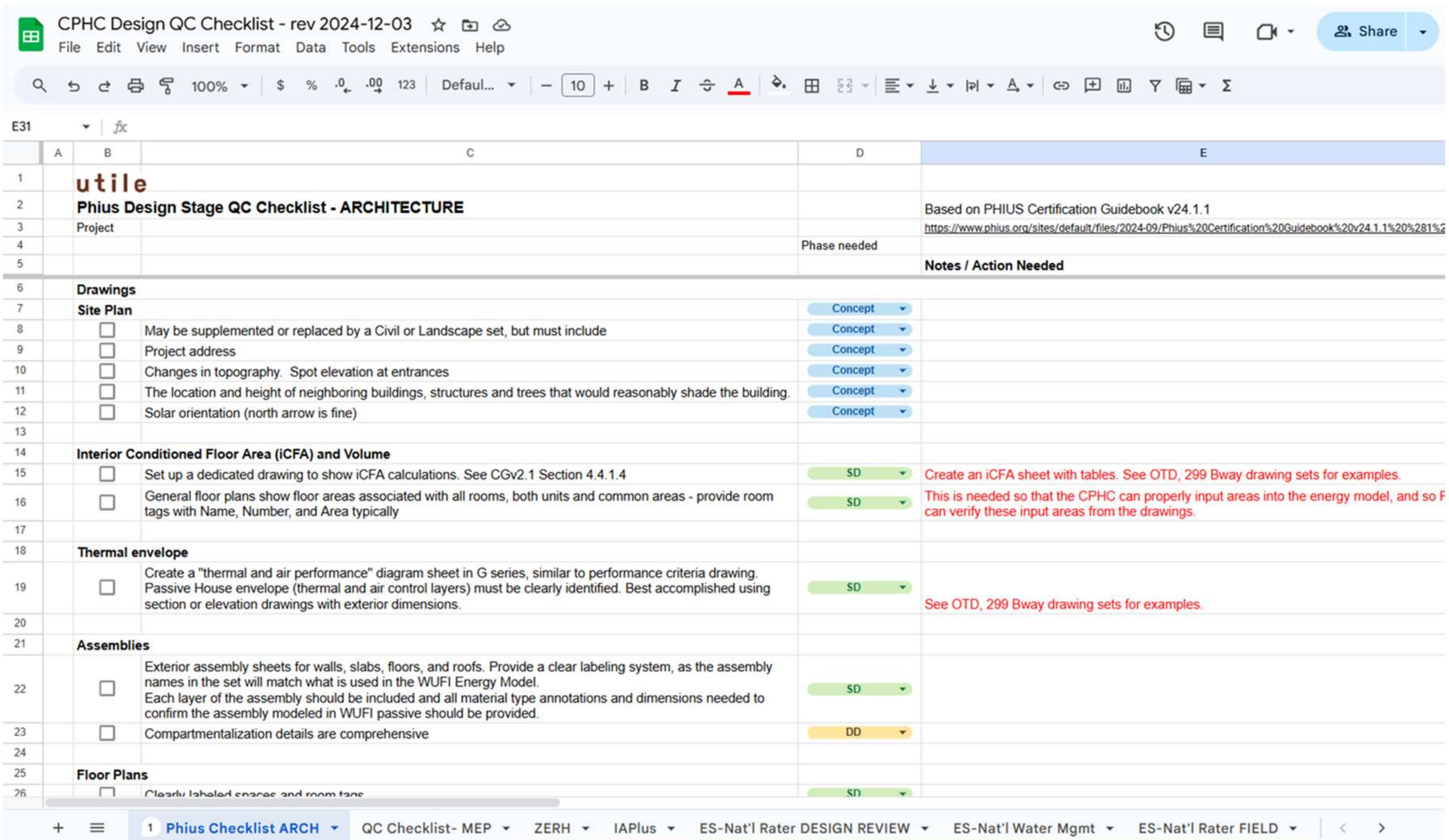


Thermal bridging analysis of a typical foundation detail

Energy modeling through the process



Utilize checklists to track program requirements

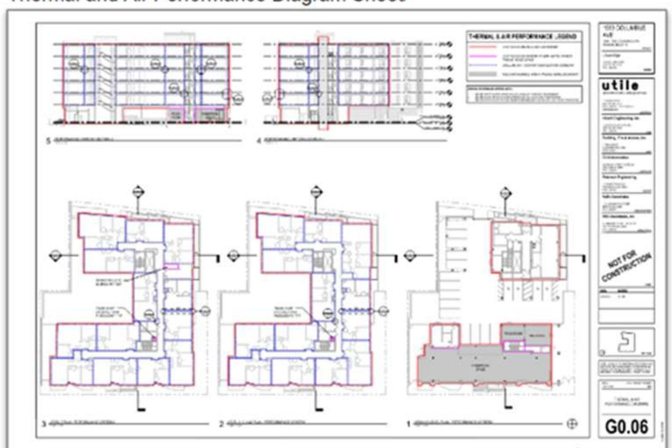


	A	B	C	D	E
1		utile			
2		**Phius Design Stage QC Checklist - ARCHITECTURE**			Based on PHIUS Certification Guidebook v24.1.1
3		Project			https://www.phius.org/sites/default/files/2024-09/Phius%20Certification%20Guidebook%20v24.1.1%20%281%2
4				Phase needed	
5					**Notes / Action Needed**
6		**Drawings**			
7		**Site Plan**		Concept	
8		☐	May be supplemented or replaced by a Civil or Landscape set, but must include	Concept	
9		☐	Project address	Concept	
10		☐	Changes in topography. Spot elevation at entrances	Concept	
11		☐	The location and height of neighboring buildings, structures and trees that would reasonably shade the building.	Concept	
12		☐	Solar orientation (north arrow is fine)	Concept	
13					
14		**Interior Conditioned Floor Area (iCFA) and Volume**			
15		☐	Set up a dedicated drawing to show iCFA calculations. See CGv2.1 Section 4.4.1.4	SD	Create an iCFA sheet with tables. See OTD, 299 Bway drawing sets for examples.
16		☐	General floor plans show floor areas associated with all rooms, both units and common areas - provide room tags with Name, Number, and Area typically	SD	This is needed so that the CPHC can properly input areas into the energy model, and so F can verify these input areas from the drawings.
17					
18		**Thermal envelope**			
19		☐	Create a "thermal and air performance" diagram sheet in G series, similar to performance criteria drawing. Passive House envelope (thermal and air control layers) must be clearly identified. Best accomplished using section or elevation drawings with exterior dimensions.	SD	See OTD, 299 Bway drawing sets for examples.
20					
21		**Assemblies**			
22		☐	Exterior assembly sheets for walls, slabs, floors, and roofs. Provide a clear labeling system, as the assembly names in the set will match what is used in the WUFI Energy Model. Each layer of the assembly should be included and all material type annotations and dimensions needed to confirm the assembly modeled in WUFI passive should be provided.	SD	
23		☐	Compartmentalization details are comprehensive	DD	
24					
25		**Floor Plans**			
26		☐	Clearly labeled spaces and room tags	SD	

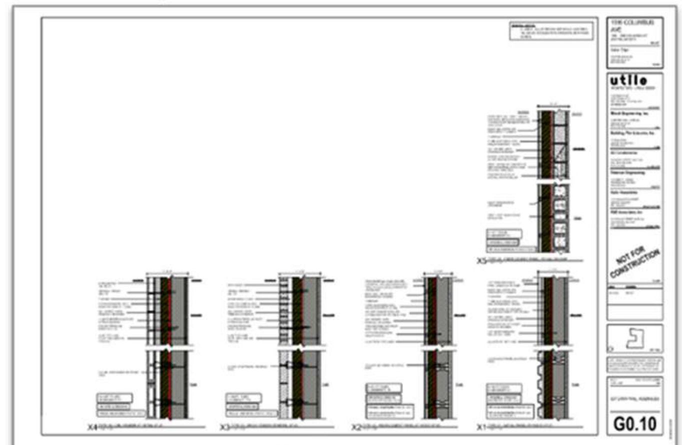
Integrate Revit and Phius Documentation

iCFA and Volume

Thermal and Air Performance Diagram Sheet/



Exterior Assembly Sheets



Inputs in WUFI

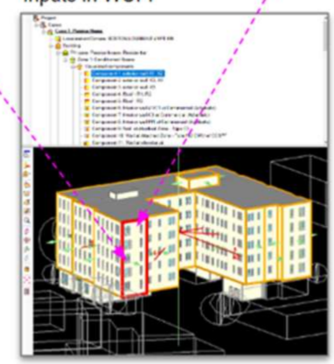
Geometry / Specific heat capacity

Setting	Setting way	Value
Visualized volume [ft³]	From visualized geometry	813185.56
Gross volume [ft³]	From visualized volume and components	813185.56
Net volume [ft³]	User defined	518414
Interior conditioned floor area [ft²]	User defined	66996
Specific heat capacity [Btu/ft²F]	Lightweight	11

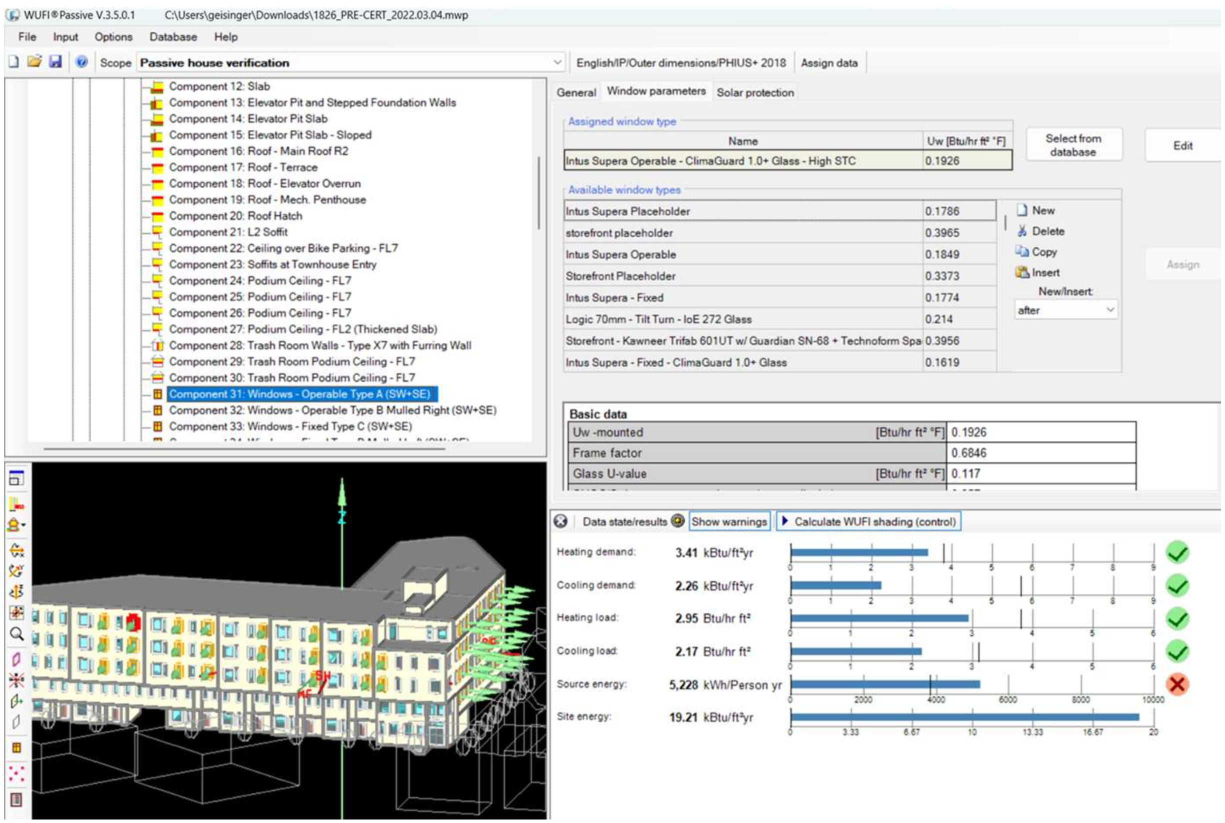
Additional data

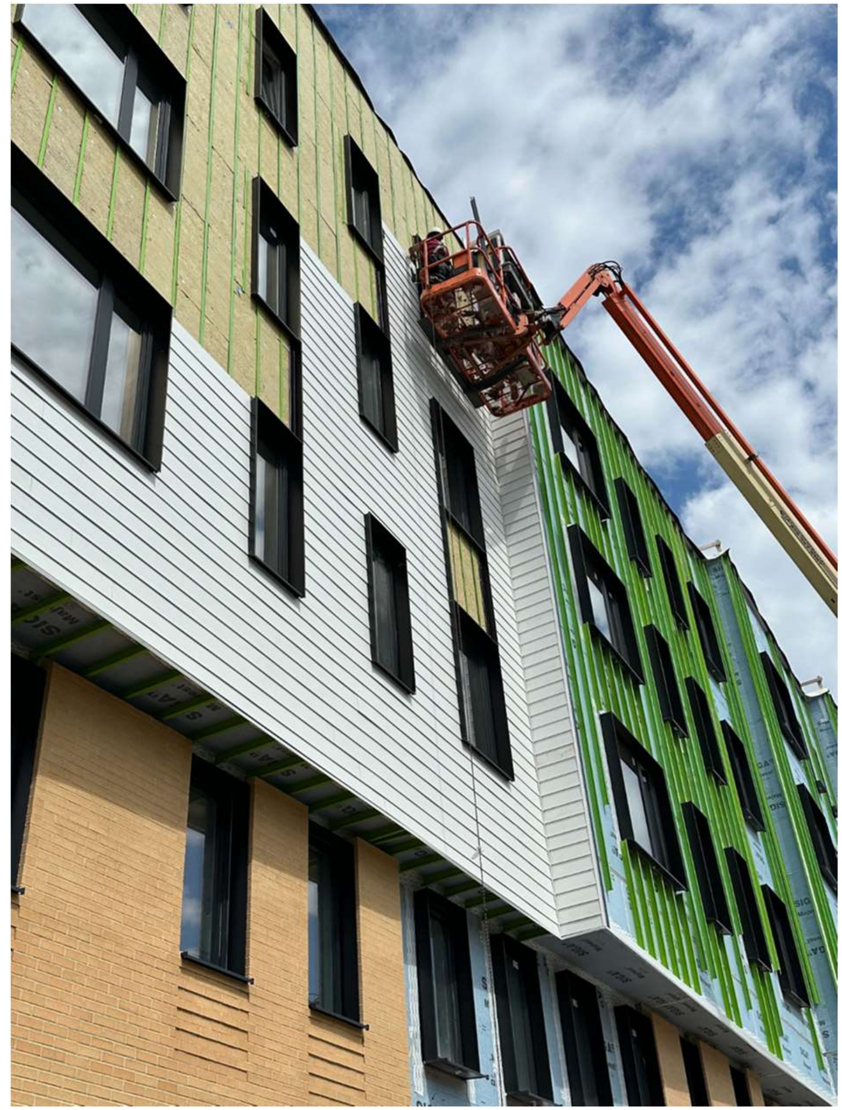
Humidity capacity [lb/(lbw/lbda) ft²]	143.3713

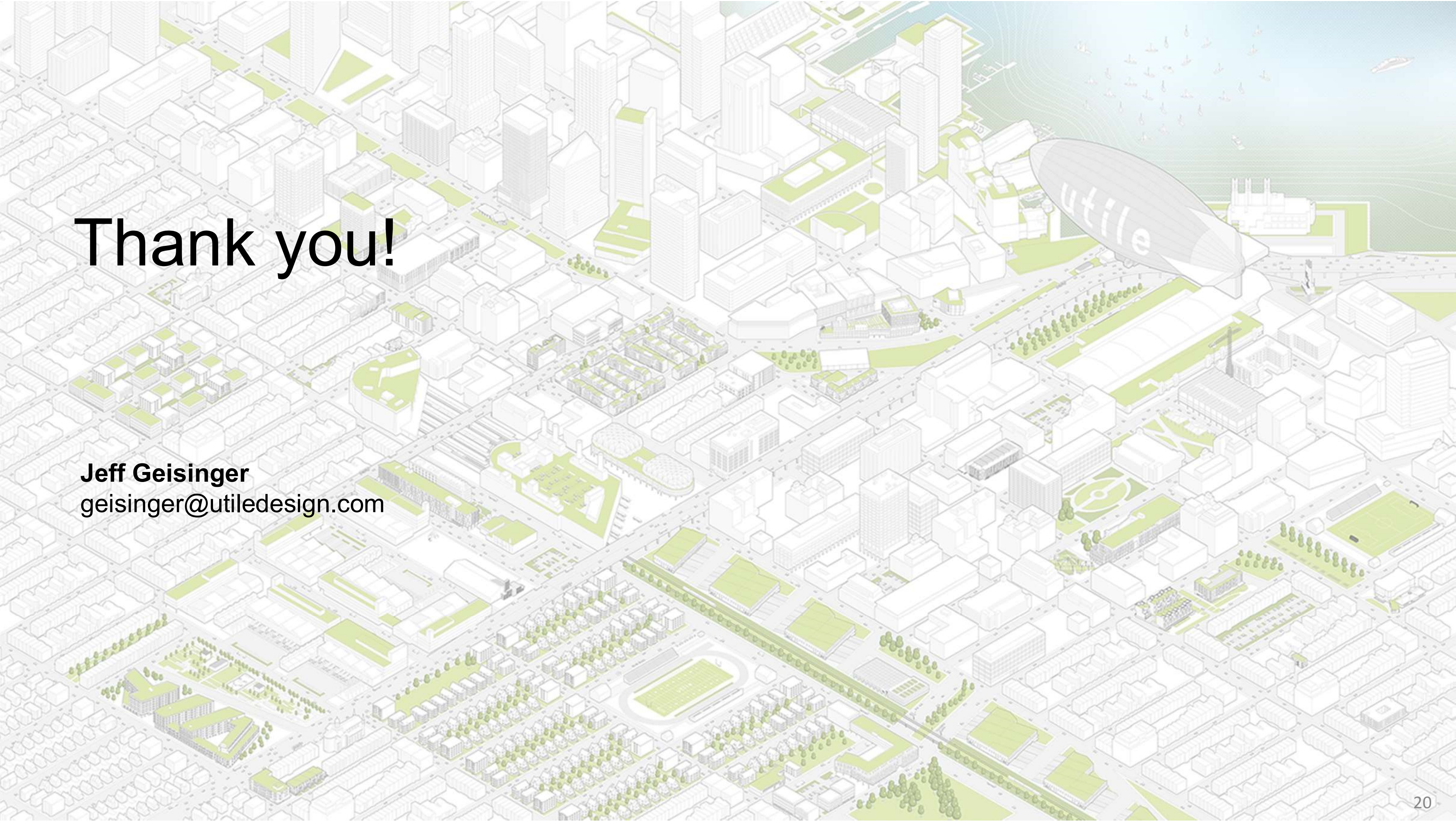
Inputs in WUFI



Coordinate with Verifier +
Track changes during construction



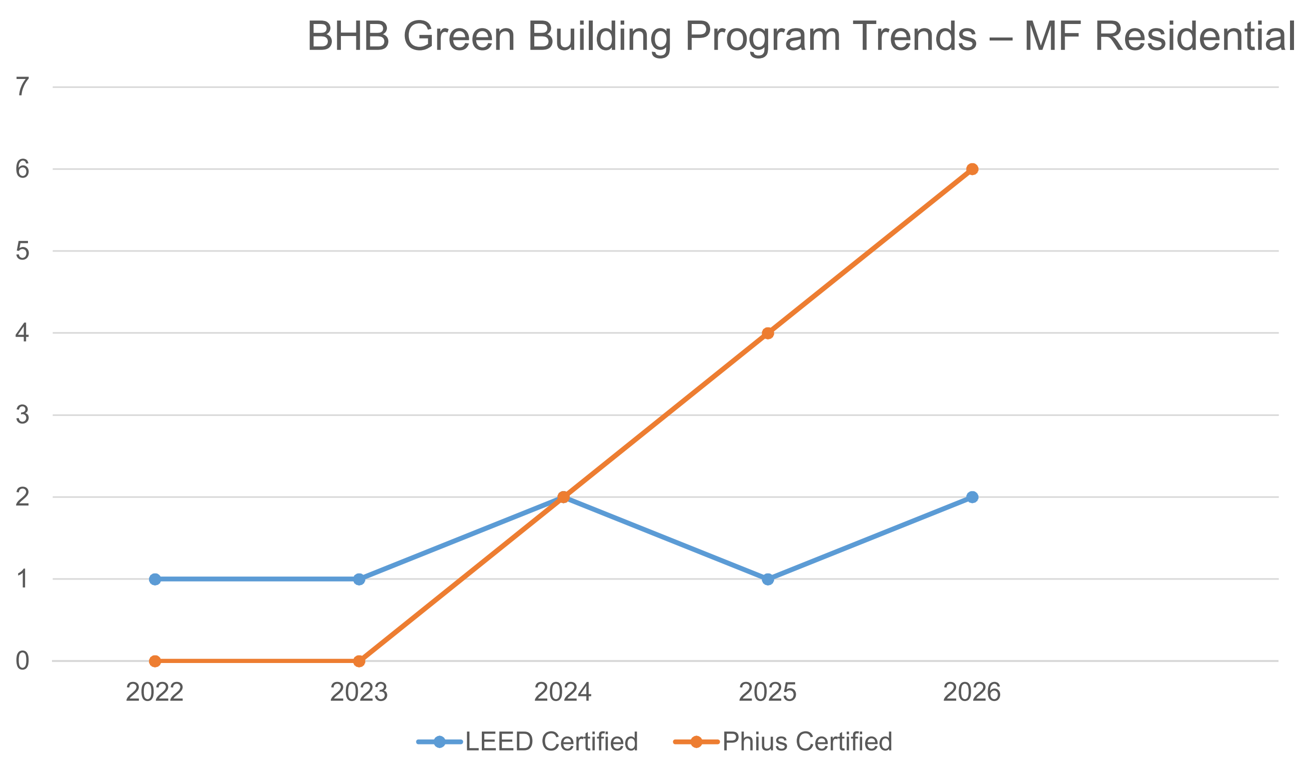




Thank you!

Jeff Geisinger
geisinger@utiledesign.com

BHB's MF Residential Green Building Program Trends



Building a Better Experience

Proactive vs Reactive

Reactive:

- **Reliance on Others**
  - Verifiers to visit the site and provide guidance
  - Not reviewing details and questioning constructability in advance
- **Assumption of Understanding**
  - Not coordinating critical details with Subcontractors prior to mobilization and specific activities in their scope
  - Trusting our subcontractors are familiar with Passive House and our project goals
  - Trusting the installers have reviewed details and understand the manufacturers specifications of the product they are installing
- **Utilizing Typical Construction Schedule**
  - Not allowing for adequate time for QAQC and corrections
    - Examples: VB before Slab pour, AVB prior to Insulation
- **Completing critical performance tests when convenient**
  - Need to prioritize getting these tests done in sequence so there is adequate time to make corrections
    - Exampled: VB and AVB install

Proactive:

- **Exhibit B's**
  - Refining scopes to ensure Passive House requirements or best practices are within subcontractor's scopes
- **PH Activities Integrated into Construction Schedule**
  - Work through sequencing issues (ie. Midpoint BD, TAB)
  - Overcommunicate site activities with 3rd party Verifiers
- **Internal and Subcontractor Trainings**
  - Internal trainings for Site Superintendents, PMs, and Field Support Staff
  - Product representatives Lunch and Learns for internal teams
  - On-site trainings with product reps for installing subcontractors and site superintendents
- **Pre-task Coordination / Phius Coordination Meetings**
  - Review expectations and explain the WHY.
  - Assess plan details with Installing contractor and 2nd Tier Subs
  - Ensure they are following manufacturers specifications
  - Set the tone for communication through issues that may arise during installation
- **Internal Performance Testing / Field Observations**
  - Data tracking of performance metrics
  - Diagnostic tools – Blower Door, Fogger, IR Camera
  - Internal Phius Tracker / Field Observation Reports

Proactive vs Reactive

Reactive:

Proactive:

Comments from the Field

Mistakes Made:

1. Lack of understanding the product compatibility / manufacturers specifications
   - Tapes, primers, rollers, etc.
   - Installation conditions – temperature, substrate, etc.
2. Failure to review details and expectations with subcontractors before work begins
   - Not the subcontractor's fault
   - 2nd Tier subs not involved in detail reviews
3. Covering critical areas before testing
   - Primary AVB, Ductwork, Material Transitions, Phius Boundary Penetrations, etc.
4. Overlooking importance of QAQC
5. Incorrect sequencing
   - Exterior pens not complete prior to AVB install
   - Air sealing around steel fireproofing

Biggest Challenges:

1. Subcontractor QAQC for entirety of project – *Winner by a landslide*
   - Subcontractor education and acceptance
   - Becomes more of a challenge as buildings get larger with more "zones"
   - WHY are doing it like this?
2. Sequencing
   - Adequately mid-point testing a large building
   - Adjusting typical construction schedule
3. Coordination with Trades
   - Ex. –MEPs complete all exterior penetrations prior to AVB installer's QA Sign off
4. Planning for issues with product availability
   - Ex. - Europe to US export for window repairs
5. Whole Building Test
   - Full understanding and buy in from everyone on-site
   - Useful mid-point testing to ensure project is on track

Lessons Learned:

1. Site superintendent and executing subcontractor need to fully understand constructability of critical air sealing details
   - Why is this being done?
   - When? – Proper Sequencing
   - What materials will be used?
   - How is this step being executed?
2. Strict QAQC is essential – Develop a system
3. Significant value in proactive discussions
   - Functional Mock-Ups
   - Building Enclosure / Pre-Task Meetings
     - Confirm proper materials, sequence, trades, etc.
4. Be in constant contact with the Verifier
   - Regularly take and share photos
5. Know your Passive House Boundary
   - Phius boundary is not always at your exterior walls/ floors
   - Building types matter
     - Slab on Grade, Podium Slab, Additions
6. Test early and often

Integrating PH into Construction Schedule

Pre-Mobilization / Pre-Task Coordination Meetings – Review Overall Plan and Specific Details

- Incorporating Passive House requirements, project goals, all details relative to the trade discussed in Pre-Mobilization meetings

- Good time to answer questions and ensure trades have all the proper materials, and they understand manufacturers specifications

- Slab Pours
    - VB Terminations at Interior / Exterior columns
    - How are we handling penetration clusters
- AVB Install
    - Transition Details
    - Include AVB Rep
- Mid-point blower door testing
    - Include Verifier in discussion on how to properly sequence
    - Building Prep Checklist
- TAB process
    - Ensure TAB Agent is aware of Phius ventilation thresholds
    - TAB Agent and Verifier must communicate and ideally meet on-site together
- Assembly testing
    - At what stage, Installer present

Meeting Involvement
- OAC Phius Updates
- Phius Break Out Meetings
    - Separate meeting with the sole focus on Passive House activities if team is inclined
- Weekly project updates with General Superintendent

BALD HILL BUILDERS

Why…How…What If’s

Mo… f and … eri… il…

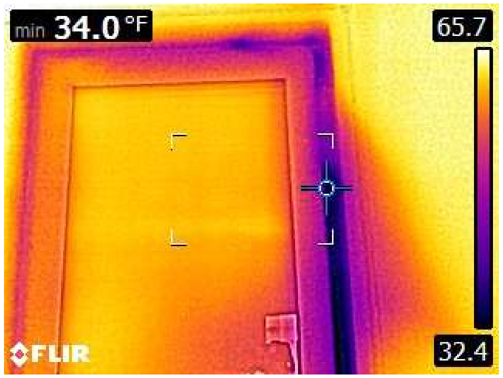
ncin…

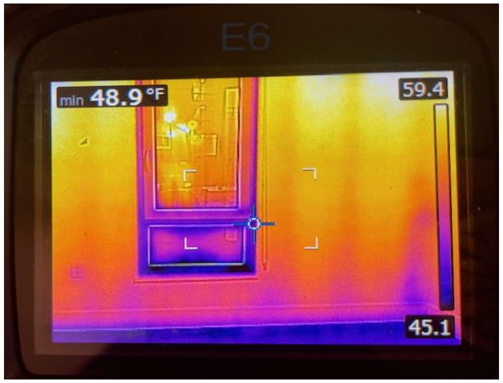
- Foreman and entire team completing installations including any 2nd Tier Subs
- Document all installation steps
- Include applicable product reps if possible
- 3rd party envelope consultant present (if applicable)
- Utilize performance Mock-Ups
    - Iron out and test installation details

Integrating PH into Construction Schedule

Inspections:

- **3rd Party Verifier Inspections and Performance Testing**
  - Understanding Verifier scope and implement their visits into schedule
  - Including 3rd Party Verifier on all 3-week look ahead
- **Internal Inspections / Performance Testing**
  - Duct Testing as needed
  - Visual Inspections
    - Pre-Rock Inspections prior to production drywall
    - Phius Boundary inspections prior to covering
  - Prelim and Final Compartmentalization Testing
    - Sampling of Units
    - Record data for post project reviews
    - Do not waste our Verifier visits with failing units
  - Assembly testing
    - Testing assemblies and penetrations through assemblies with Blower Door + Fog Machine prior to covering





Integrating PH into Construction Schedule

Close-Out Process

- TAB Coordination – sometimes harder than it should be
  - TAB Agent and Verifier should be on-site together
  - Ensure TAB contractor thresholds match green building program thresholds
- Final Performance Testing
  - Whole Building – BEFORE OCCUPANCY
  - Compartmentalization
  - Duct Testing
  - Ventilation
- Document Control
  - BHB
    - IAP Checklist Items
    - ES Rater Field Checklist Sign Offs
    - ES Water Management Checklist
  - HVAC Contractor
    - Energy Star Functional Testing Checklist Sections 1-5
    - GET AHEAD OF SECTION 6
      - FT Agent needed if shared VRFs

ERV-1 Overview: Serves dwelling units 71, 73-83 on floors 1-3.

North Tower (ERV #1) airflow testing verification:	Design (cfm)	Verified (cfm)	% +/- Design	+/- cfm Design	OK?	Room pressure difference	OK?	Room pressure difference	OK?
SUPPLY									
Unit 171 - hall	30	23	-23%	-7	NO				
Unit 171 - bed	30	23	-23%	-7	NO				
Unit 173 - hall	30	25	-17%	-5	YES				
Unit 173 - bed	30	26.4	-12%	-3.6	YES				
Unit 174 - hall	30	26	-13%	-4	YES				
Unit 174 - bed	30	27	-10%	-3	YES				
Unit 175 - hall	30	24.3	-19%	-5.7	YES				
Unit 175 - bed	30	25.2	-16%	-4.8	YES				
Unit 176 - hall	30	24	-20%	-6	YES				
Unit 176 - bed	30	24	-20%	-6	YES				
Unit 177 - hall	30	25.9	-14%	-4.1	YES				
Unit 177 - bed	30	24	-20%	-6	YES				
Unit 178 - hall	30	30	0%	0	YES				
Unit 178 - bed	30	26.8	-11%	-3.2	YES				
Unit 179 - hall	30	27	-10%	-3	YES				
Unit 179 - bed	30	25.8	-14%	-4.2	YES				
Unit 180 - hall	30	26	-13%	-4	YES				
Unit 180 - bed	30	25.8	-14%	-4.2	YES				
Unit 181 - hall	30	27.6	-8%	-2.4	YES				
Unit 181 - bed	30	25.5	-15%	-4.5	YES				
Unit 182 - hall	30	27	-10%	-3	YES				
Unit 182 - bed	30	27.2	-9%	-2.8	YES				
Unit 183 - hall	30	26	-13%	-4	YES	0.4	YES		
Unit 183 - bed	30	26.6	-11%	-3.4	YES				
Unit 271 - hall	30	20	-33%	-10	NO				
Unit 271 - bed	30	24.8	-17%	-5.2	YES				
Unit 273 - hall	30	24.1	-20%	-5.9	YES				
Unit 273 - bed	30	25.3	-16%	-4.7	YES				
Unit 274 - hall	30	24	-20%	-6	YES				
Unit 274 - bed	30	25	-17%	-5	YES				
Unit 275 - hall	30	25	-17%	-5	YES				
Unit 275 - bed	30	24.6	-18%	-5.4	YES				
Unit 276 - hall	30	25.9	-14%	-4.1	YES				
Unit 276 - bed	30	24	-20%	-6	YES				
Unit 277 - hall	30	24	-20%	-6	YES				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				

Additional QAQC Measures

Internal Tracking:

- Performance Testing Tracking
  - For compartmentalization and duct testing in dwelling units and shared ventilation systems
  - Helpful to understand where we should be testing at different stages based on historical data
- Internal Sustainability Field Observation Reports
  - Useful tool for site superintendents to communicate correction items with trades
  - Site team responsible for responding to Field Observation reports like they would for the architect, engineer, or Verifier
- Internal Phius Progress Tracker
  - Purpose is to help ensure no critical items are missed and understand what the Verifier may still need to test, inspect, or collect photographs of

Phase 3 - Mid-point Testing	Status	Inspection Date	Notes
Mid-point blower door testing plan complete and communicated with project team	In Progress	6/28/2024	- Diagnostic midpoint test completed - Discussion with NEI about next Midpoint needed
Dwelling unit mid-point duct testing complete (Minimum 20% tested)	Completed	5/24/2024	- NEI has completed all dwelling unit duct testing
Central ERV ductwork Aerosealed (if required)	Issue Present	6/28/2024	- Mid-point testing indicated there was some duct leakage on the roof which will affect our whole building blower door results
Duct insulation installed properly and layout matches design	Completed		
ERV Duct testing passed by Verifier	Completed	7/31/2024	- NEI's confirmed via e-mail on July 30th
Mid-point Blower Door Scheduled	In Progress	7/31/2024	- E-mail sent 7/30 regarding scheduling for week of
Mid-point Blower Door Test Completed	Future Work		- Final mid-point can be scheduled soon. Need to check: - Doors - Trash chute windows - Loading windows - Amory tower
Fog test / IR Test remediations addressed	Issue Present	6/28/2024	- Fog testing on slab on deck connection completed and idicated issues - through deck penetrations has occurred multiple times, most recently 6/28/2024
All exterior insulation inspected and approved by Verifier prior to covering	In Progress	8/15/2024	- Amory tower needs insulation inspection - ready week of 8/26-8/30 - Need to confirm spray foam under deck has been signed off - Exterior mineral wool installation almost complete as of 8/15
Plumbing insulation installed properly and layout matches design. Obtain Phius Verifier sign off	Completed	7/31/2024	- NEI confirmed via e-mail on July 30th
TAB and FT Checklist Process communicated, acknowledged / understood by responsbile parties and agreed on by Verifier and TAB agent	Completed	8/15/2024	- Internal meeting held with TAB Agent, CAC, and SES on 06/06/2024 - E-mail sent to coordinate with NEI and SES on 06/07/2024 - Follow up e-mail sent [illegible] parties confirmed on 7/31/[illegible]

Bald Hill Builders, LLC
25 Walpole Park South Dr. #10
Walpole, MA 02081
Tel:781-806-5951
Fax:781-806-5952

Field Observation Report #23: Compartmentalization Testing

Project Name:	1599 Columbus Avenue
BHB Job Number:	01-21-049
Inspection Date:	August 20, 2024
Present on Site:	BHB: David Perez, Nicole Raymond, Matt D'Errico, Greg Downing
Energy and Green Programs:	PHIUS 2018+ | DOE Net Zero Energy Ready Homes | EPA Indoor airPLUS | Energy Star MFNCP
Site Conditions:	Cloudy, Hot | ~ 80 degrees
General Comments:	The purpose of this report is to update the project team with results from our final round of preliminary compartmentalization testing.

Getting a PHIUS Project to the Phinish Line:

NESEA Building Energy Boston 2025

Michael Browne, PHIUS Rater/Verifier

Advanced Building Analysis, LLC

Collaboration

- **Early Planning and Design**
  - Important to involve everyone particularly including the Functional Testing Agent and MEP in design decisions
  - Airtightness testing plan
- **Construction**
  - GC needs to Coordinate Passive House Work and Inspections
  - Who is the AIR BOSS?
  - Early Testing
- **Phinishing**
  - Ventilation, Ventilation, Ventilation, Ventilation, Ventilation, Ventilation ….

Top 10 items that go wrong at the end

1. Air tightness
2. Ventilation
3. Ventilation
4. Ventilation
5. Ventilation
6. Ventilation
7. Ventilation
8. Ventilation
9. Ventilation
10. Ventilation

How they go wrong ….

1. Air tightness - No early testing
2. Ventilation - Choice of Overall System type
3. Ventilation - Choice of Equipment
4. Ventilation - Choice of Ventilation Flow Rates
5. Ventilation - Duct design
6. Ventilation - Choice of Balancing Damper
7. Ventilation - Installation of Balancing Dampers
8. Ventilation - Duct leakage and Aeroseal
9. Ventilation - Choice of Air Flow measurement equipment
10. Ventilation - Not understanding Passive House limits for airflow

Recommendations for Successful Verification

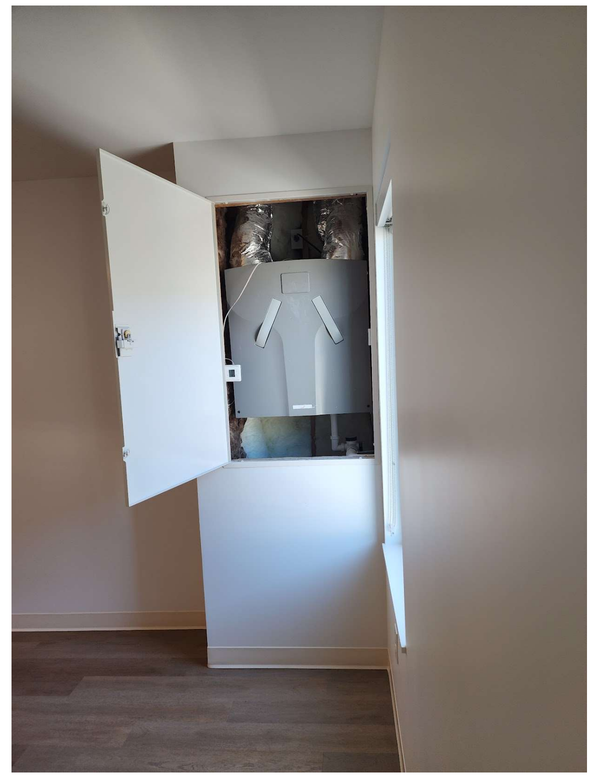
1.	Air tightness	+ Early Test when primary air barrier is still accessible
2.	Ventilation	+ Choose dwelling unit ERV's for best ventilation
3.	Ventilation	+ Choose ERV with excellent controls
4.	Ventilation	+ Choose design rates 5 cfm above minimum allowed
5.	Ventilation	+ Duct design and ductwork with smooth turns
6.	Ventilation	+ Tight ductwork – and don't seal your dampers…
7.	Ventilation	+ Dampers adjustable by Balancer – NOT by the occupant
8.	Ventilation	+ Make dampers easily accessible to the Balancer
9.	Ventilation	+ ANSI/RESNET/ICC Standard 380 Measurement Devices
10.	Ventilation	+ Early communication of PHIUS Balancing limits

1. Air tightness - Test early when primary air barrier is still accessible

1. Air tightness - Test early when primary air barrier is still accessible

2. Dwelling unit ERV's for best ventilation

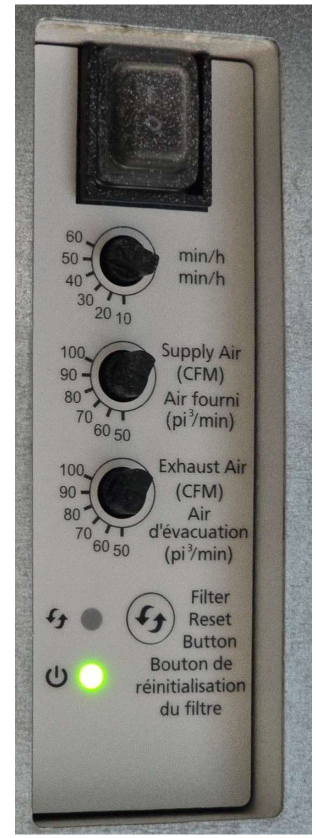
1. Low quiet continuous speed
2. Boost Speed for local exhaust needs
3. Simple to balance
4. Keep it simple by keeping ventilation distribution completely separate from heating and cooling distribution.
5. Exhaust bathrooms, Supply Bedrooms



3. ERV with excellent controls

3 ERV models we recommend for smart controls plus recovery and fan efficiency:

1. Panasonic FV+10VEC2
2. Broan BLP150
3. Any Zehnder Q Series ERV



4. Design flows 5 cfm above minimum req.

DON'T design for the absolute minimum allowed by ASHRAE 62.2.

Give yourself a buffer of +5 cfm at each register

This will eliminate many verification failures which happen when the verifiers measurements fail to meet minimum ASHRAE Ventilation and provide better ventilation overall.

5. Smoooooooth Duct design

DON'T make air turn around sharp edges.

This causes erratic flow and noise.

Instead design duct distribution with angled take+offs and smooth turns

6. Tight ductwork – but don’t seal your dampers…

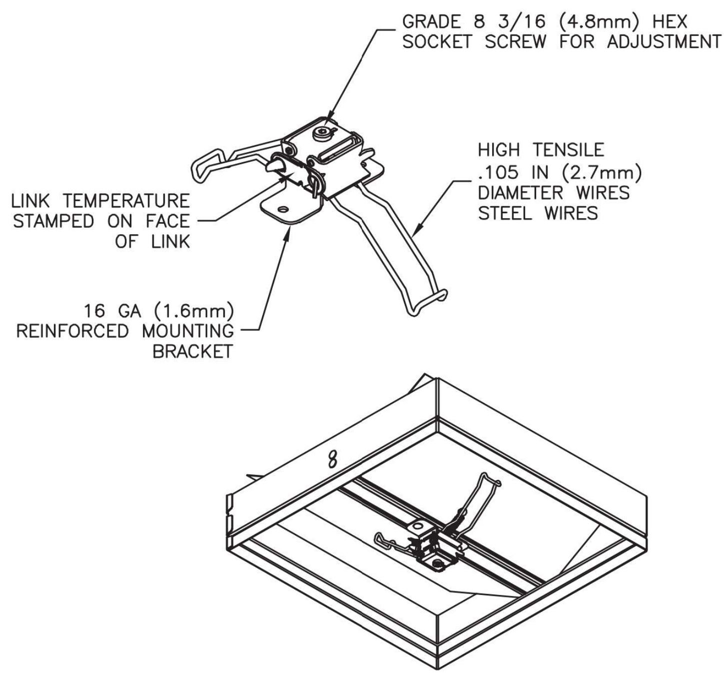
Do seal all of the ducts including the joints of the boots to the sheetrock or flooring.

Also seal the exterior duct penetrations to the outer louvers or caps to avoid allowing moisture behind siding.

7. Dampers should be easily used by Balancer – NOT by the occupant

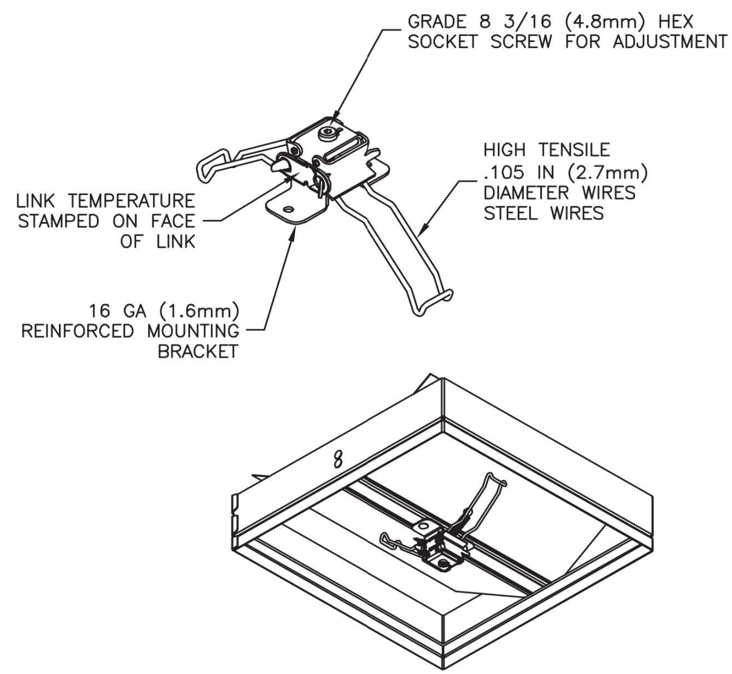
DON'T use grilles with adjustable louvers that occupants could easily change.

Use a damper that can be marked with the final position of the damper after Balancing.



8. Make dampers accessible to the Balancer

This type can be adjusted with a long+handled Allen wrench without removing the register or diffuser and without the need for ceiling access panels



9. ANSI/RESNET/ICC Standard 380 Airflow Measurement Devices

Powered Flow Hoods

+ RetroTec Flowfinder MK2

Passive Flow Hoods

+ Testo 417 with Flow Straightener and Capture Hood

Inline Pressure Measurements

+ Traverse measurements or measurements on taps at ERV’s

10. Early communication of PHIUS Balancing limits

Limits should be expressed 3 ways:

1. Per Register
2. Per Dwelling Unit
3. Per ERV

These vary slightly by Passive House Program and Version, but they all require more accuracy than is called for by TAB Standards that will be used if the Balancer is not informed.

Recommendations for Successful Verification

1.	Air tightness	+ Early Test when primary air barrier is still accessible
2.	Ventilation	+ Choose dwelling unit ERV's for best ventilation
3.	Ventilation	+ Choose ERV with excellent controls
4.	Ventilation	+ Choose design rates 5 cfm above minimum allowed
5.	Ventilation	+ Duct design and ductwork with smooth turns
6.	Ventilation	+ Tight ductwork – and don't seal your dampers…
7.	Ventilation	+ Dampers adjustable by Balancer – NOT by the occupant
8.	Ventilation	+ Make dampers easily accessible to the Balancer
9.	Ventilation	+ ANSI/RESNET/ICC Standard 380 Measurement Devices
10.	Ventilation	+ Early communication of PHIUS Balancing limits