

BUILD BETTER TOGETHER



PhiusCon 2026

The Future of Tall Multi-family Buildings

Breaking the Barriers to Phius at Scale

PRESENTED BY

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Speakers



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Associate Principal

Director of Technical Design

Sara works in partnership with SCB's technical leaders and sustainable to promote high performance design and quality across all SCB projects. Working domestically and internationally for over twenty years, Sara has extensive experience working with complex project requirements on challenging and unique sites. Her approach to design stems from a keen interest in livable urban environments, backed by a body of research on topics such as the decarbonization of cities, preservation and adaptive reuse of buildings, and high-performing building envelopes



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Passive Building Practice Lead

Prudence leads TT's passive building practice, as well as projects focused on campus and city scale energy resilience. She also partners with TT's forensics, façade engineering and existing building renewal groups to provide building science analytics for both new and existing buildings. Prudence has consulted on multiple high-rise and curtain wall passive building projects and helps inform emerging Phius Technical Committee thought on new methods of verification unique to the tower typology.

Learning Objectives

1

Learn how the newest energy codes are affecting the design and construction process for large-scale multifamily buildings.

2

Understand how applying the Phius standard to multifamily buildings can save energy and benefit human health.

3

Examine the exterior enclosure systems that can be applied to multifamily buildings, including those that can meet the Phius standard.

4

Understand the important role of energy modeling in the design process for multifamily buildings.

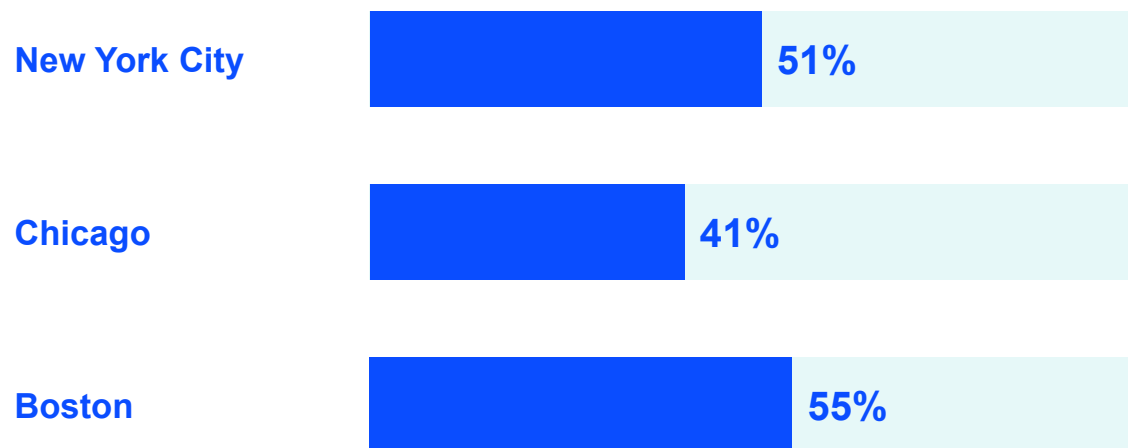
SECTION 01

Why This Matters Now

Density, decarbonization, and base code progression.

High-rise multifamily construction is concentrated in major urban cores

Share of buildings completed in 2010–2018 with more than 12 floors

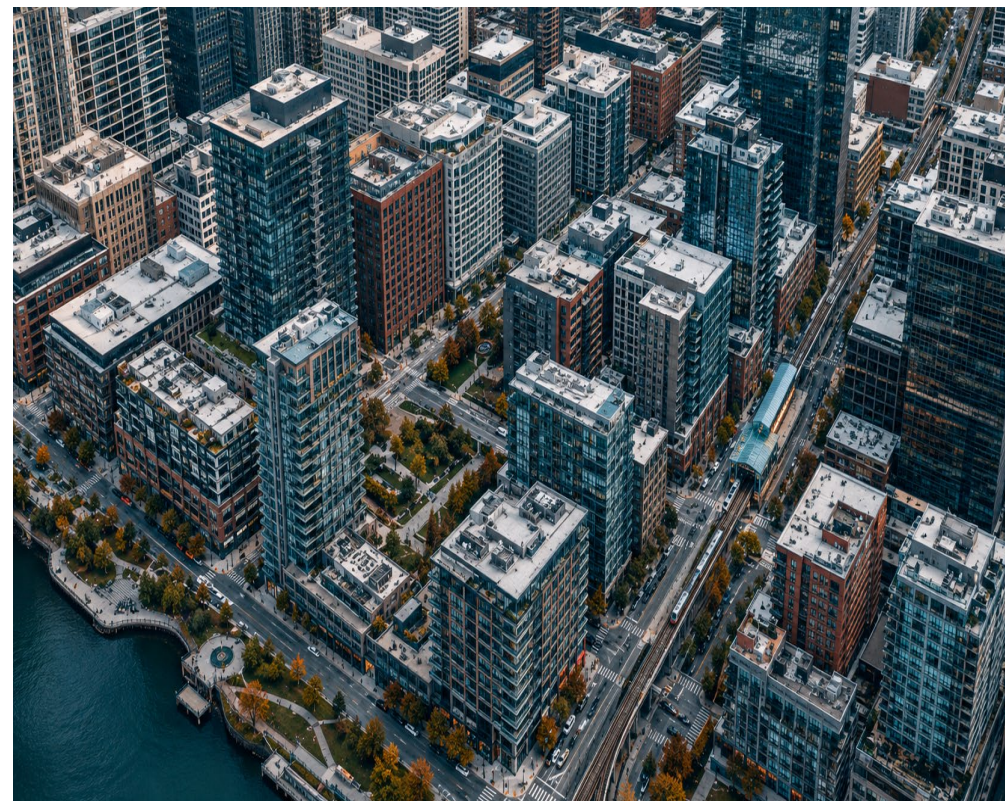


High-rise = >12 floors

Multifamily buildings with 50+ units; 2010–2018 completions.

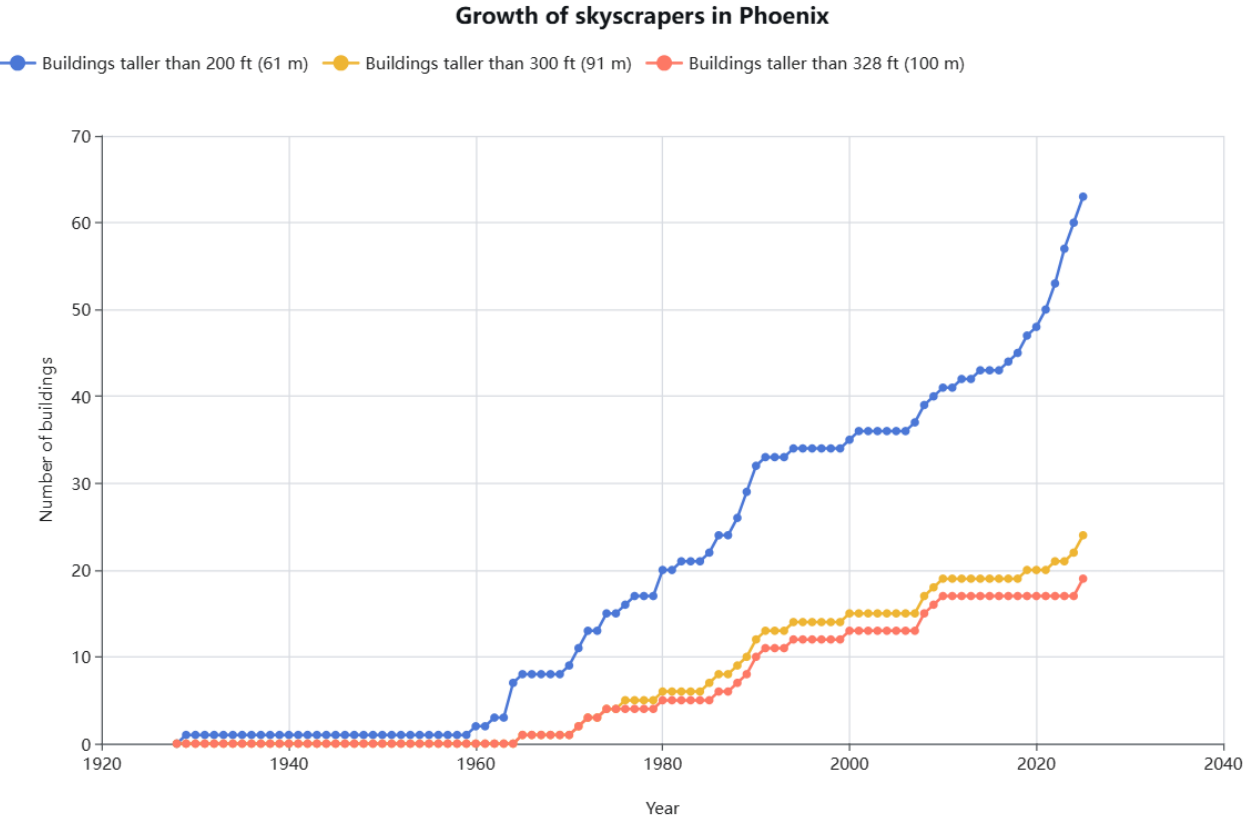
The increase in high-rise multi-family is also prevalent in Texas, Florida. Other mid-sized cities such as Boise, Idaho and Salt Lake City, Utah are seeing some of their first tall towers.

Source: RentCafe Research / Yardi Matrix, 2022; ~30,000 residential multifamily buildings with >50 units, built 1990–2018. High-rise defined as >12 floors.



Dense urban core: compact blocks, mixed-use density, vertical housing

High-rise Multifamily is growing in Phoenix

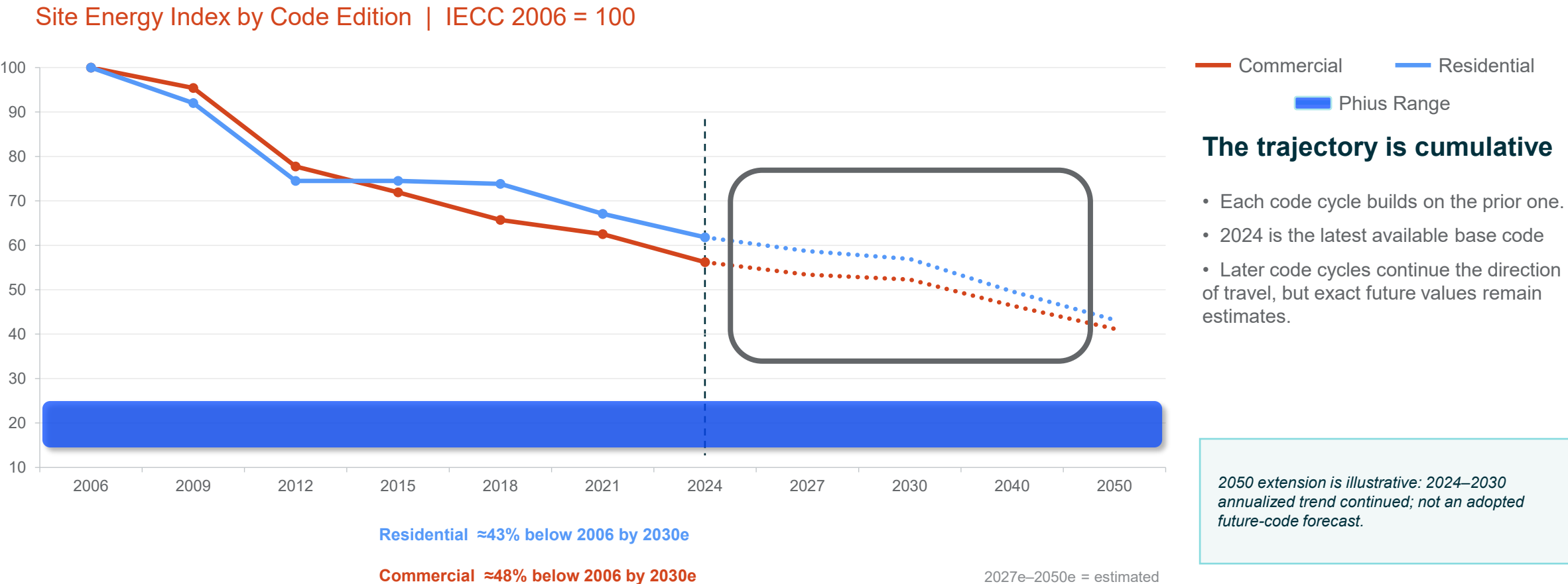


Phoenix has 63 buildings taller than 200' and 24 buildings taller than 300'. Most newer towers are residential.
Source: Wikipedia, 2026



The Ray, Phoenix is a 26-story multi-family tower completed in April, 2026.
Image © LJC, 2026

Turning Point: IECC code cycles continue to lower building energy use



Source references: supplied historical efficiency graphic and IECC savings table. Estimated values continue the observed 2024–2030 annualized trend by compounding stated savings; planning-level comparison only.

Turning Point: IECC code cycles continue to lower building energy use



Path 4 reductions come from the workbook's normalized prototype-emissions screen; readiness infrastructure is a policy overlay, not direct modeled savings.

Thermal bridging requirement matrix — overview

Code / standard	Thermal-bridge requirement	Continuous insulation	Compliance modeling
ASHRAE 90.1-2022	Partly explicit — via assembly U-factors	Prescriptive CI by assembly	ECB / PRM; bridges not fully isolated
IECC 2024	Not explicit — prescriptive envelope	Prescriptive R-value / U-factor	Performance path optional; bridges implicit
2022 CETC (Chicago)	Explicit — incl. balconies & parapets	CI required for assemblies	Mitigation shown in compliance path
Massachusetts Stretch Code	Path-dependent — perf. / Passive House path	Project / compliance-path dependent	Performance path can model bridges
NYCECC	Path-dependent — prescriptive + amendments	Prescriptive CI; local amendments	ASHRAE / IECC paths; bridges implicit
Passive House / Phius 2024	Explicit — models all linear & point bridges	Continuous insulation is central	Whole-building model includes bridges

 Explicit requirement

 Prescriptive / U-factor path

 Not explicit / project-dependent

 Passive House reference

Thermal bridging requirement matrix — detail

Aspect	ASHRAE 90.1-2022	IECC 2024	2022 CETC (Chicago)	Massachusetts Stretch Code	NYCECC	Passive House Plus 2024
Linear & point bridging	Addressed mainly via assembly U-factors; limited explicit linear/point provisions.	No explicit linear or point-bridge requirements in the prescriptive path.	Explicit mitigation for major bridges — balconies, parapets, slab edges.	Project / compliance-path dependent; performance & Passive House paths address bridges.	Not explicit; follows ASHRAE / IECC path with NYC amendments.	Explicitly accounts for all significant linear and point bridges.
Continuous insulation (CI)	Prescriptive CI by assembly type; adjustments in U-factor tables.	Prescriptive R-value / U-factor path; CI by assembly.	CI expected for assemblies; balconies/parapets need CI or thermal breaks.	Path-dependent; higher envelope performance favors CI.	Prescriptive CI by assembly; subject to local amendments.	Continuous insulation is central to meeting targets.
Compliance modeling	ECB / PRM account for the envelope; bridges not always isolated.	Performance path available; bridges usually implicit.	Compliance path expects thermal-bridge mitigation to be demonstrated.	Performance / Passive House path can model bridges explicitly.	ASHRAE / IECC modeling paths; bridges implicit unless added.	Whole-building energy model must include thermal bridges.
Emphasis on thermal breaks	Encouraged for significant penetrations of the thermal envelope.	Not explicitly required in the prescriptive path.	Required for balconies/parapets unless encapsulated with CI.	Path-dependent; stringent paths emphasize thermal breaks.	Handled indirectly through assembly U-factors.	Strong emphasis on breaks at all major penetrations.

Why Phius at Scale

Stringent codes make Phius a credible — and high-value — compliance path.

Once a daunting prospect

Designing mid- and high-rise buildings to the Phius standard is now within reach.

Codes are catching up

As base codes tighten, the gap to Phius narrows — it is a realistic route to compliance.

The payoff

Deep energy savings plus improved human health, comfort, and resilience.



$\geq 40\%$

Source-energy reduction vs.
code baseline



0.06

Airtightness target — CFM50 /
ft² enclosure

Illustrative targets — to confirm per project.

Barriers That Remain

01

Budget & Execution

Delivering these projects to an established budget without compromising performance.

02

Design Aspiration & Marketability

Achieving the architectural aesthetic needed to market and lease the building.

03

Constructability

Coordinating complex assemblies detailing and site verification without cost overruns.

The rest of this session addresses each barrier in turn.

SECTION 02

The Enclosure

From glass towers to calibrated, thermally-broken façades.

Then vs. Now: Façade Evolution

THEN · past 10–20 years

- Glass-heavy multifamily towers
- High window-to-wall ratio
- Non-thermally-broken framing
- Double-pane glazing

NOW · the PHIUS future

- Calibrated glazing ratios
- Triple-pane windows
- Thermally broken façade systems
- Detailed spandrels, balconies, parapets & roof transitions



All-glass tower vs. highly-insulated punched-window tower

Enclosure Systems – Towers of the (not so distant) Past

Not thermally broken

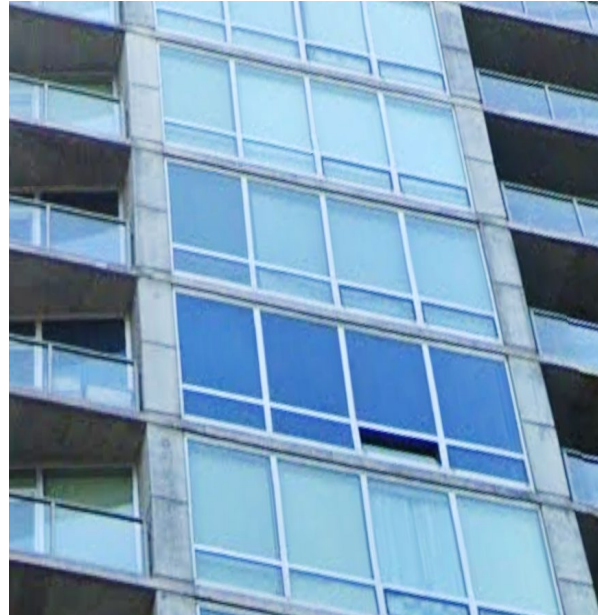
Even in northern climates, framing was left un-broken.

Slab-edge insulation optional

Rarely provided — a common weak point.

High glazing, weak glass

WWR ~70%; window U-value $\approx .38 \text{ Btu}\cdot\text{hr}^{-1}\cdot\text{ft}^{-2}\cdot^{\circ}\text{F}^{-1}$.



Vetro Condominiums, Climate Zone 5, 2008



Gateway Condominiums, Climate Zone 5, 2015

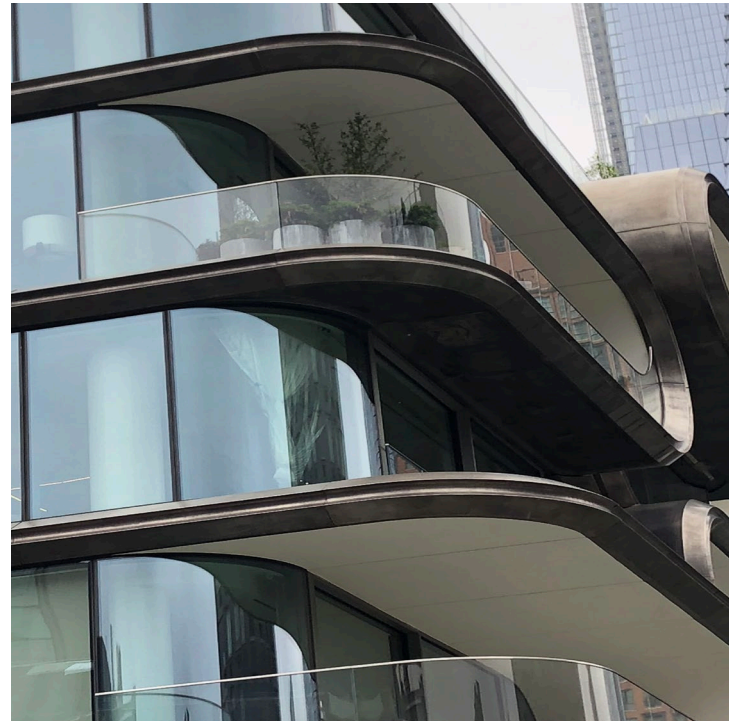
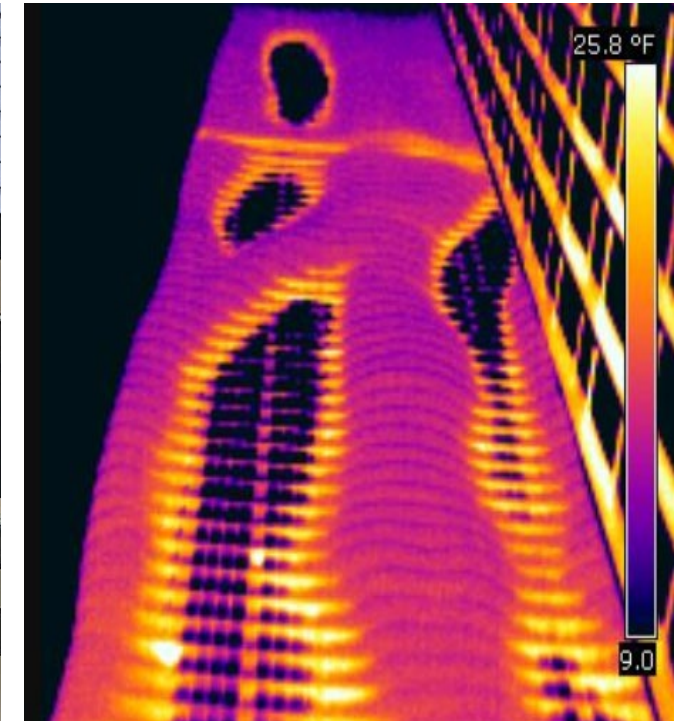
Enclosure Systems – Towers of the (not so distant) Past

Award-winning ≠ thermally sound

Even celebrated designs still struggle with thermal bridging.

Balconies: statement & liability

They create valuable outdoor space — but are a serious thermal challenge.



Zaha Hadid, 520 W 28th, NY, 2017 · Aqua, Chicago, 2009

Thermal image credit: Jim D'Aloisio

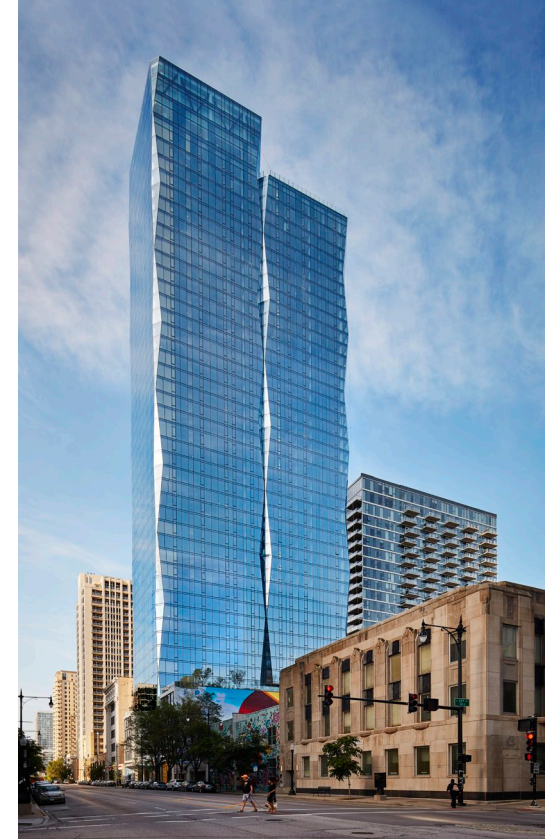
Enclosure Systems – Typical Glass Tower



East Stokes (SCB, 2026)



The Raye (SCB, 2025)



The Paragon (SCB, 2019)

Enclosure Systems – Typical Glass Tower



Window wall

Off the shelf double-pane aluminum window wall in the range of \$80-110 / sf . System U-Value 0.30 – 0.38 and ; 50–70% glazing.

1



Slab-edge cover

Metal or glass cover conceals the projecting slab edge.

2



Slab-edge / spandrel insulation

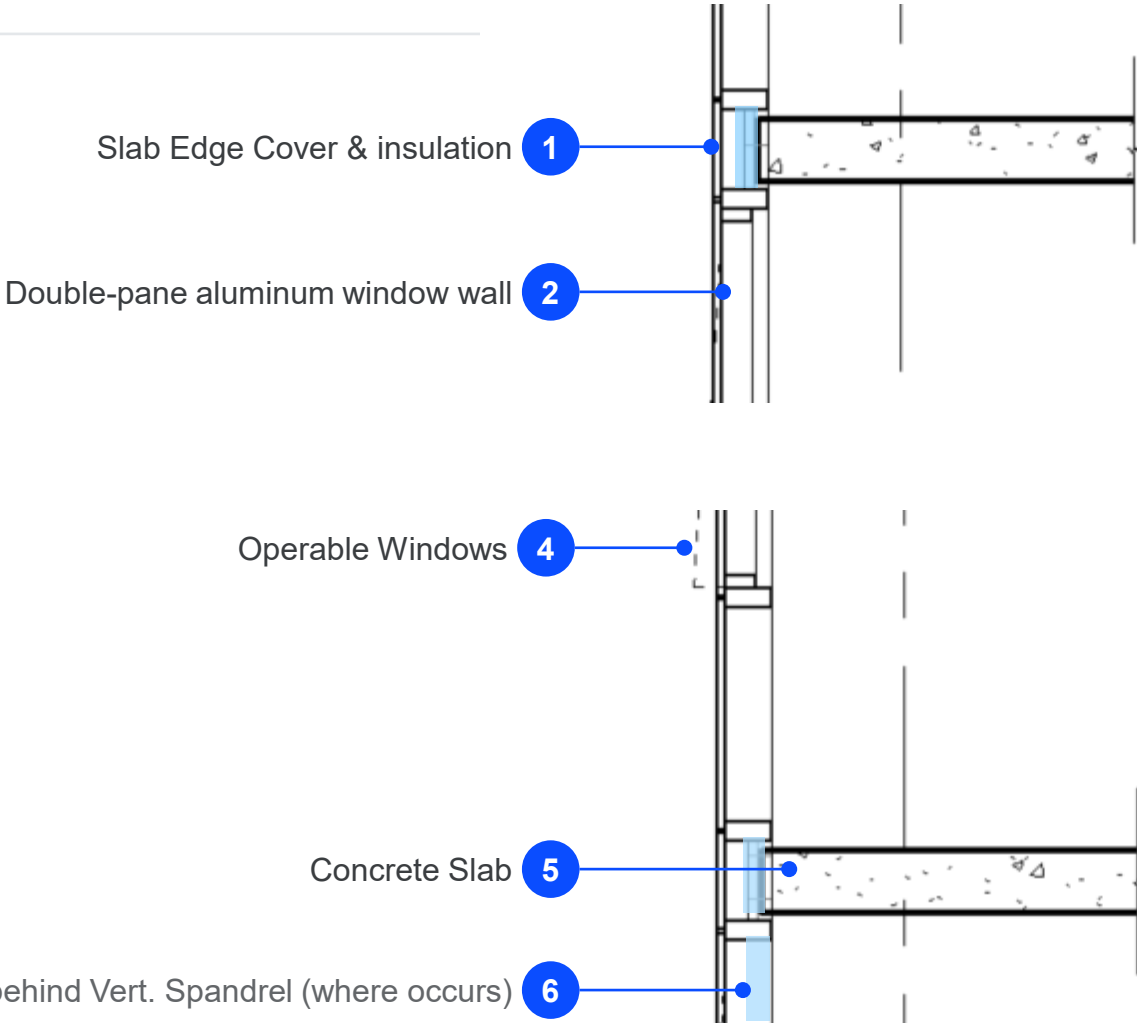
Limited insulation in front of slab and behind spandrels.

6



Thermal-bridge locations

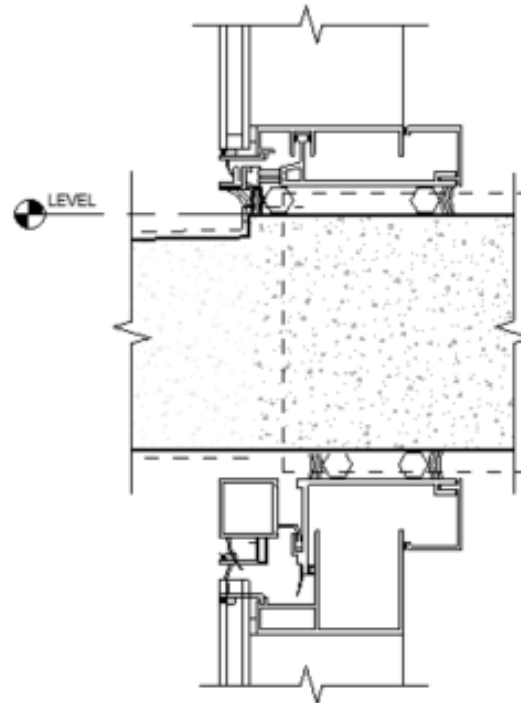
Slab-to-window-wall connection creates inherent bridging.



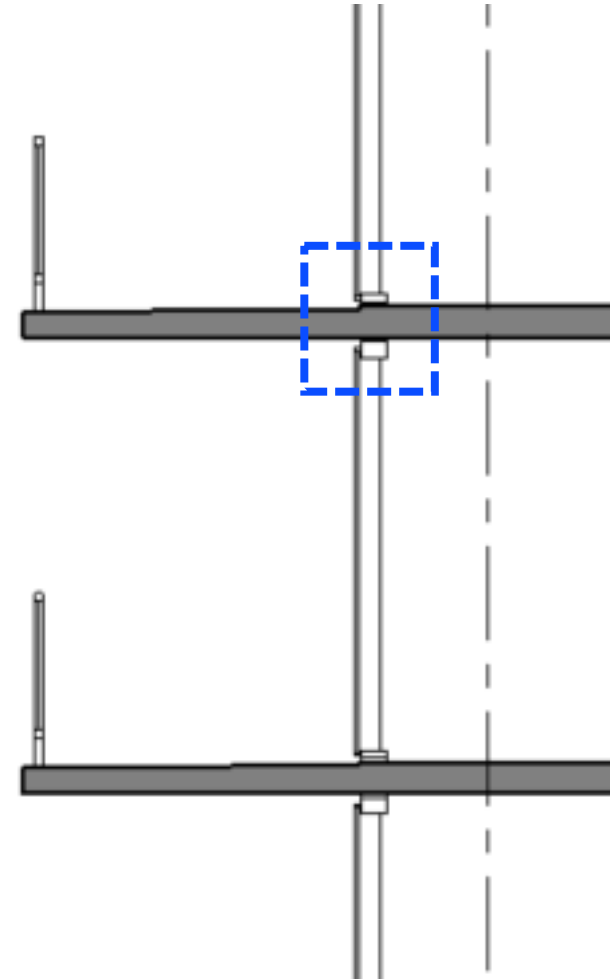
Wall section: Typical Window Wall

Enclosure Systems – Typical Glass Tower

- “Business as Usual” in residential buildings is to omit costly balcony thermal breaks, and it is still allowed, by Energy Code, to do this in virtually all southern climates, and most northern climates.



Detail – Balcony at Window Wall



Wall section: continuous insulation + thermal breaks

Enclosure Systems – Typical Glass Tower

“Business as usual”

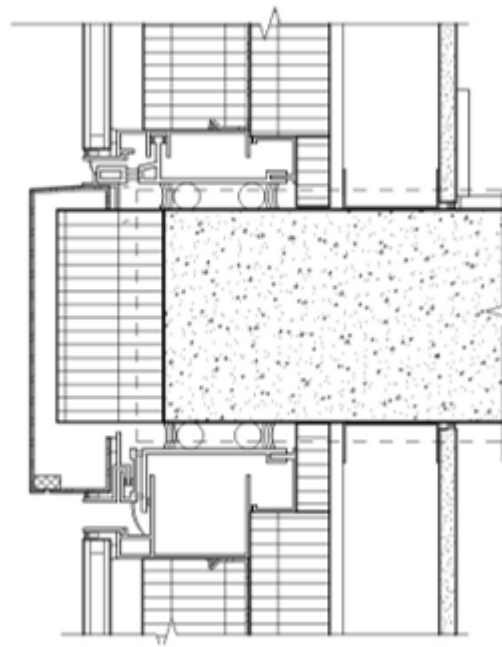
The economical high-rise enclosure is a glass-and-metal window wall with a “slab-edge cover.”

Economy vs. thermal cost

The slab-edge cover adds economy but creates inherent bridging; front-of-slab insulation can make the edge protrude.

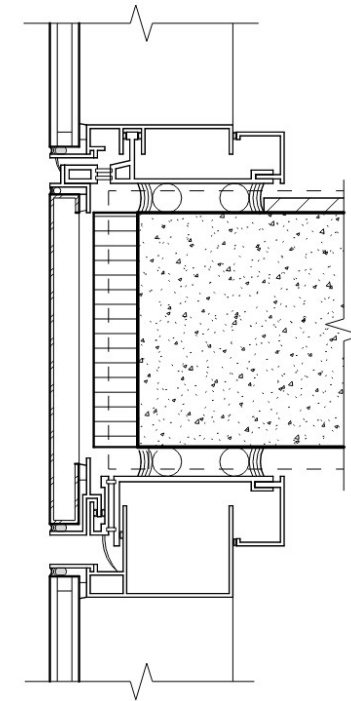
Climate-driven detailing

In warm zones (1 & 2) code may require little insulation or thermal breaks — and even skip the slab-edge cover.



Thermally Improved Window Wall (Vertical Spandrel)

This example has been upgraded to 3" in front of the slab and additional insulation behind the spandrels, for an average U.S. U-value of .20-.28 with 50% Vision Glass. But the slab cover protrudes and there are areas of increased thermal bridging.



Flush Slab Edge Cover (Vision Panel)

To achieve a smooth, all glass appearance with a "flush" metal or glass slab edge cover, only 1" of insulation can be achieved. U.S. system U value of about .30 to .34 with 50% Vision.

Enclosure Systems – Upgraded Glass Tower



605 Davis – Climate Zone 5 – 47% Glass



Proposed Tower – Climate Zone 5 – 50% Glass



JAX N7 – Climate Zone 2 – 45% Glass

Enclosure Systems – Upgraded Glass Tower



Additional insulation

1

Added CI behind the window wall raises U-value; confirm dew point to prevent condensation. Cost stays near typical.



Slab-edge cover & cavity insulation

2

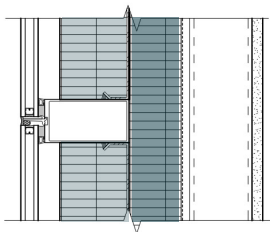
Metal slab-edge covers and vertical spandrel zones fit more CI than a 1" glazed cavity.



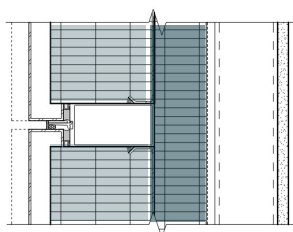
Moderate glazing ratio & U-value

3

40–50% WWR depending on climate; system $U \approx .25-.28$ $\text{Btu}\cdot\text{hr}^{-1}\cdot\text{ft}^{-2}\cdot^{\circ}\text{F}^{-1}$.



GLASS SPANDREL



METAL SPANDREL

©SCB, 2026

Continuous Insulation behind Vert. Spandrel (where occurs)

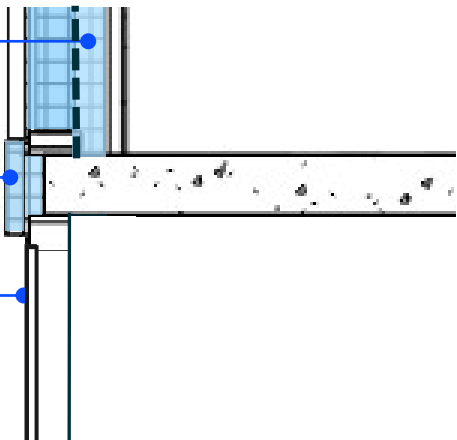
1

Slab Edge Cover & insulation

2

Double or triple-pane aluminum window wall

3



Concrete Slab

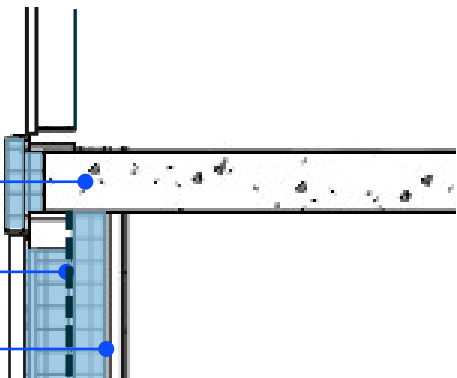
4

Continuous vapor barrier

5

Gyp Bd and Metal Stud wall

6



Wall section: Typical Window Wall and Balcony

Enclosure Systems – Upgraded Glass Tower

- **Where are the Balconies??**
Recently, many building owners have been choosing to omit balconies due to their cost, and to remove Thermal Bridging concerns that come with them
- Building codes allow common outdoor spaces
- These spaces can contain robust amenities like swimming pools and full-sized trees
- Removing (or reducing) balconies can improve thermal performance while savings cost and reducing complexity of construction



605 Davis St Tower, Evanston, IL



Outdoor Amenities – Paragon Tower (top), 605 Davis (bottom)

Enclosure Systems – Passive Facades



The House at Cornell Tech– Climate Zone 4 – 23% Glass



PHFA Headquarters – Climate Zone 4



Winthrop Center – Climate Zone 5

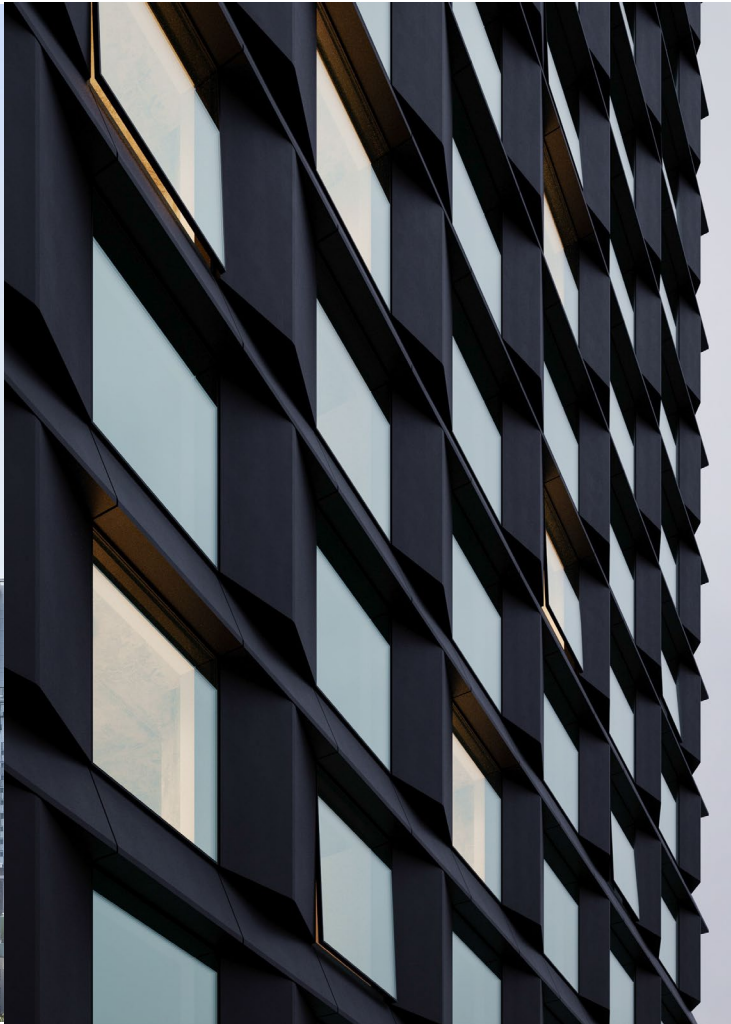
Enclosure Systems – Phius Facades



425 Grand Concourse – Climate Zone 4

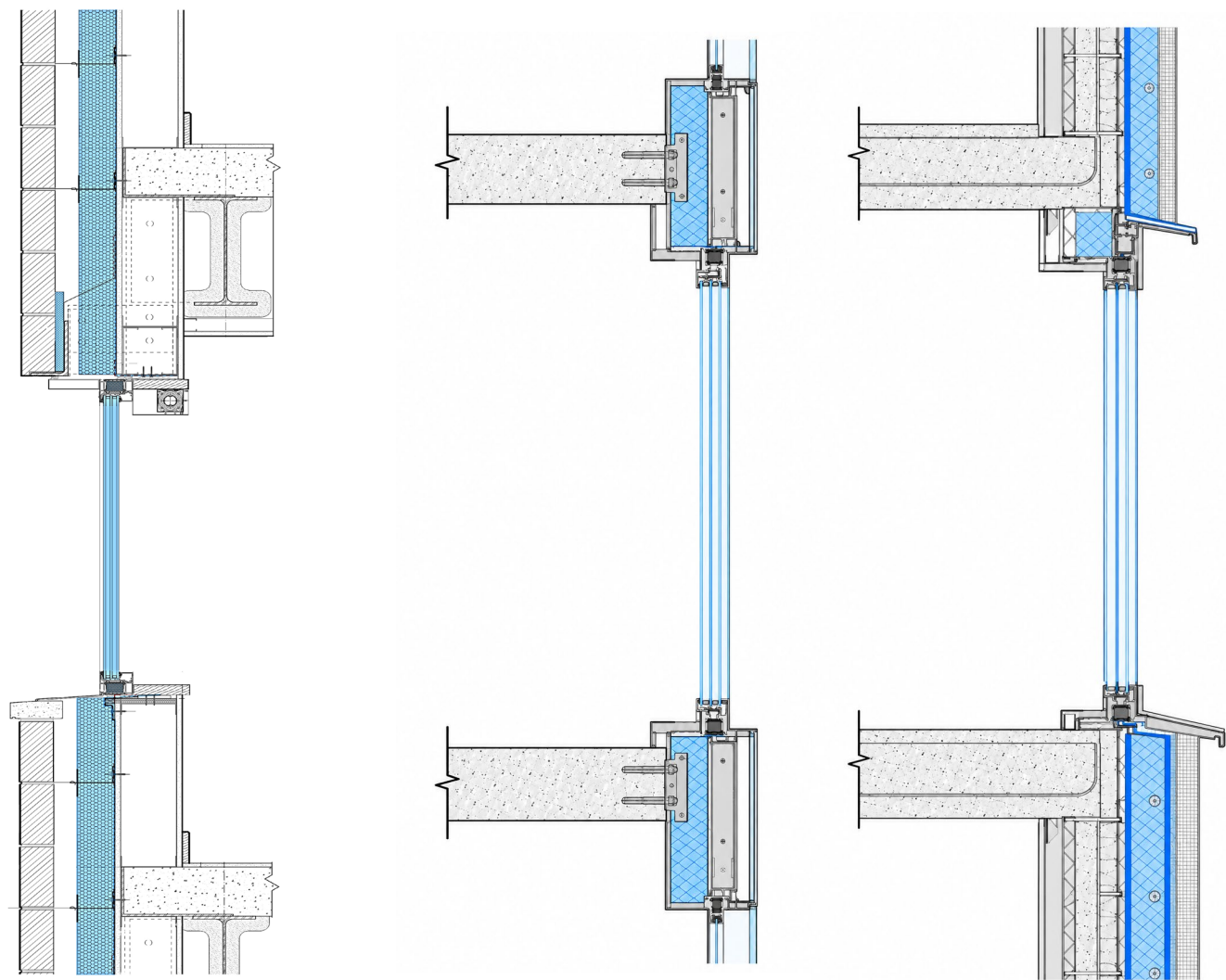


One Third Ave – Climate Zone 4



100 South Campus Drive – Climate Zone 5

Enclosure Systems – Phius-Capable



Enclosure Systems: Phius-Capable Masonry



Thermally broken brick ties

Minimize point-bridge losses through the continuous insulation. Coordinate tie type, spacing, and structural needs without short-circuiting the thermal layer.



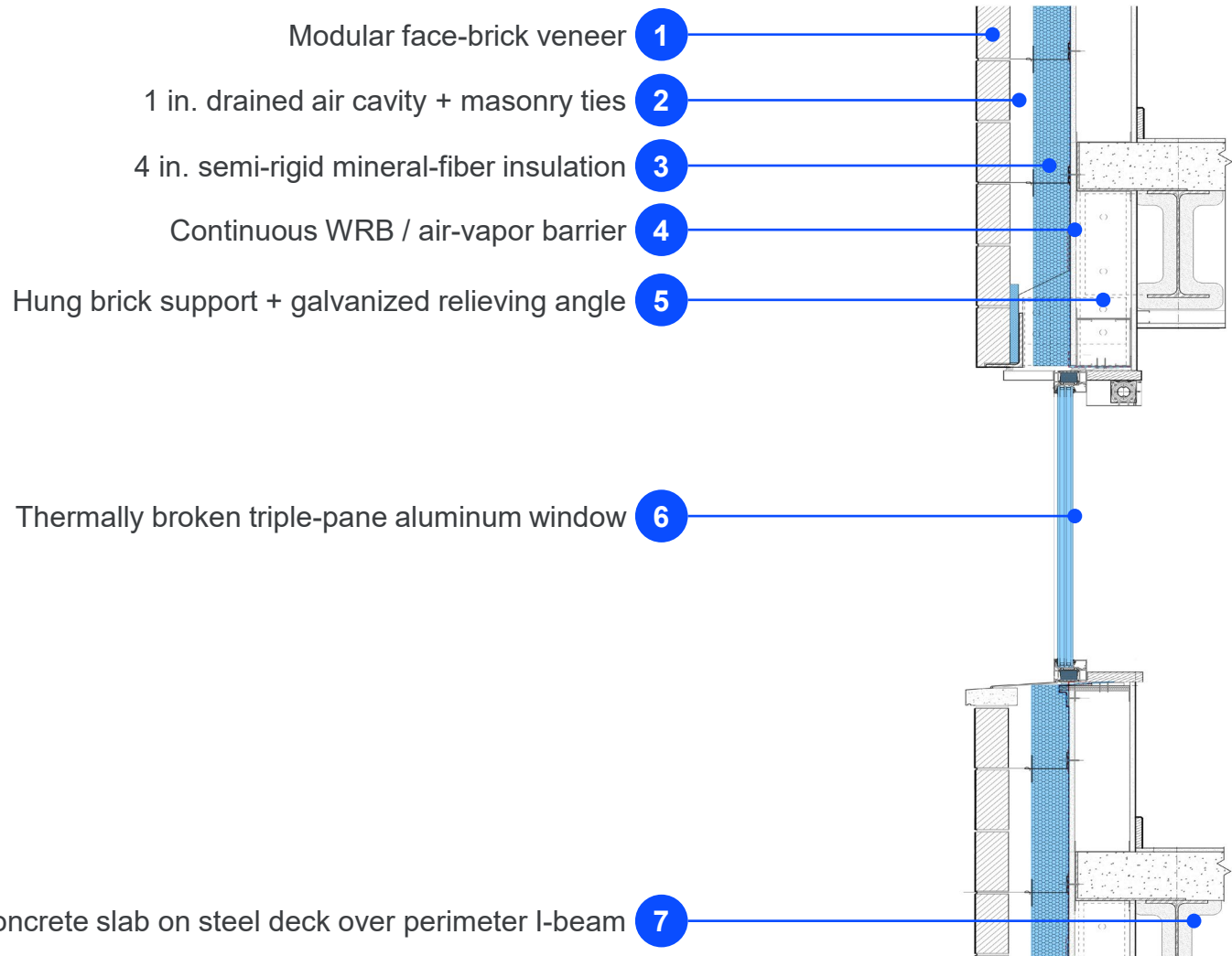
Structural steel + deck edge

Model the perimeter beam, welded plate, and fluted deck as a thermal bridge. Keep exterior insulation continuous and align delegated structural design with the Phius energy model.



Hung supports + relieving angles

Thermally isolate shelf angles and hung-brick supports where feasible. Coordinate early with structure while preserving cavity drainage, flashing, and air-barrier continuity.



Wall section: Phius-capable masonry

Enclosure Systems: Phius-Capable Rainscreen



Continuous exterior insulation

≥ 4 in. of continuous mineral-fiber insulation outboard of the structure keeps the thermal layer unbroken across every floor line.



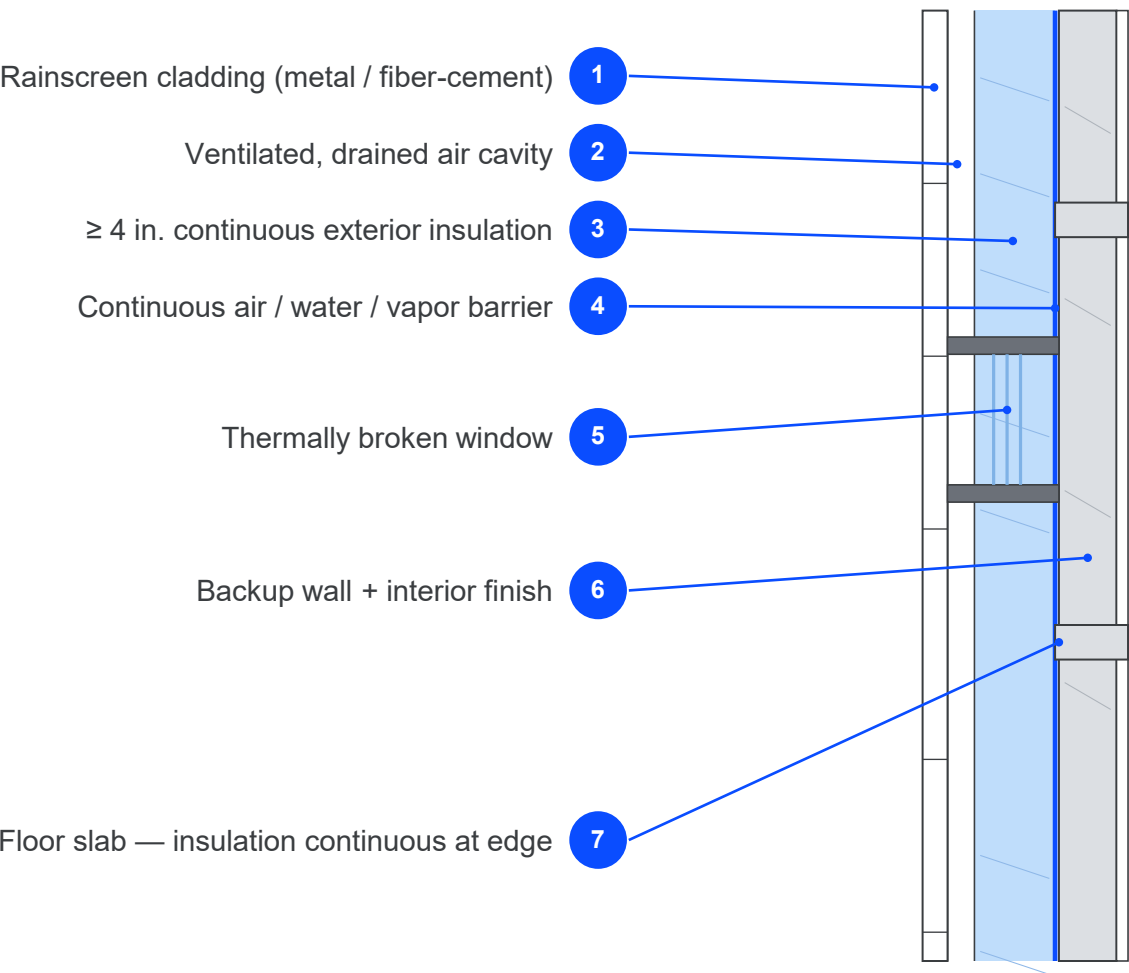
Ventilated rainscreen cavity

A drained, back-ventilated cavity behind the cladding sheds bulk water and lets the assembly dry outward.



Continuous control layers

The air, water, and vapor barrier stays continuous around slab edges and window openings to protect airtightness.



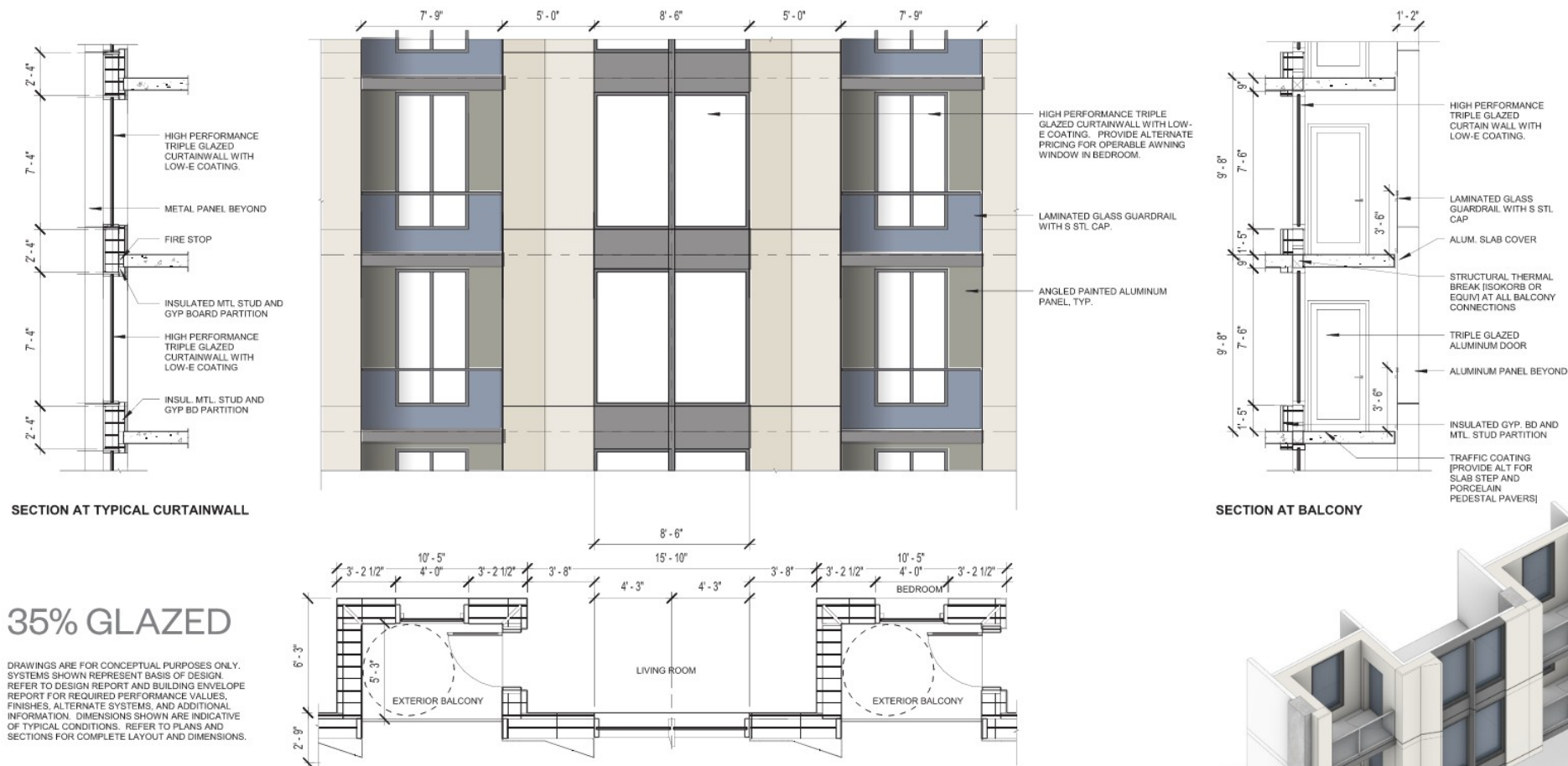
Wall section: Phius-capable rainscreen

Mega Panel at Cornell Tech

Prefabricated “mega-panel” enclosure — factory-built, thick continuous insulation



Enclosure Systems – Phius-Capable



Conceptual Design Example, Boston (SCB / TT)

Enclosure Systems - All Glass Appearance – Phius-Capable

Lower window-to-wall ratio

A Phius all-glass appearance typically runs a lower WWR than a conventional tower, with more spandrel area.

Spandrel zones

Opaque, insulated spandrel panels between the vision glass carry the added R-value the enclosure needs.

Shading & SHGC

External shading or very high-performance solar-control glazing resists cooling loads and summer gain.

Thermal breaks

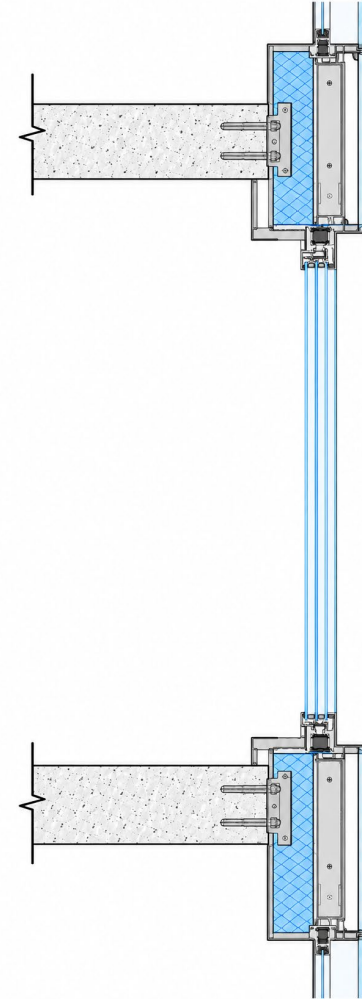
Thermally broken framing and slab edges control condensation and meet Phius comfort limits.

Triple glazing & U-value

Triple glazing brings the system U-value to roughly 0.18–0.22 Btu/hr·ft²·°F for cold climates.

Cost premium

Budget around \$250 / sf, depending on market and system selection.



Operable Windows?



Operable windows in a Phius unit — Alloy, Brooklyn



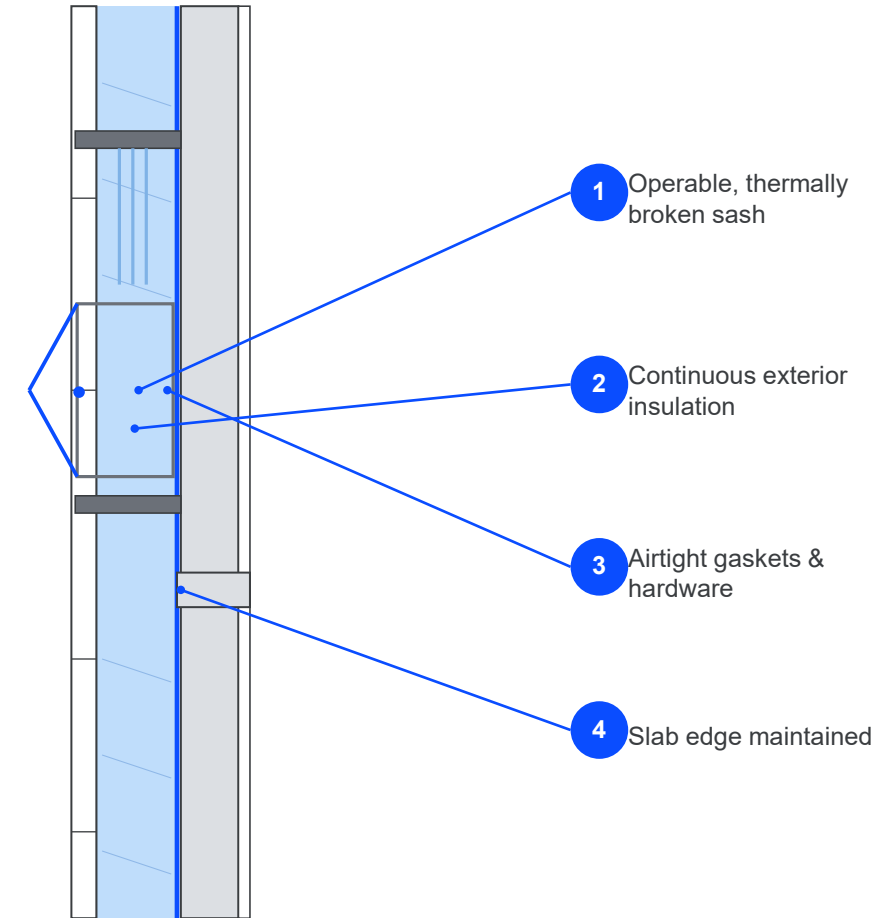
Not required by code

Modern IBC-based codes do not require operable windows — providing them is a value decision by the client.



A client value decision

Alloy chose operable windows for occupant comfort and control; each opening must still stay airtight and thermally broken.



Wall section: operable window in a continuous-insulation wall

Enclosure Systems: EIFS – Phius-Capable



Drainage

Detail EIFS as a drainable, back-wrapped system so incidental water behind the lamina can escape.



Attachment & support

Confirm fastening and any secondary support through thick continuous insulation back to structure.



Window & slab-edge transitions

Coordinate air- and water-barrier continuity at window perimeters and concealed slab edges.



Thermal continuity

Keep the continuous insulation unbroken; minimize clips and penetrations that bridge the layer.



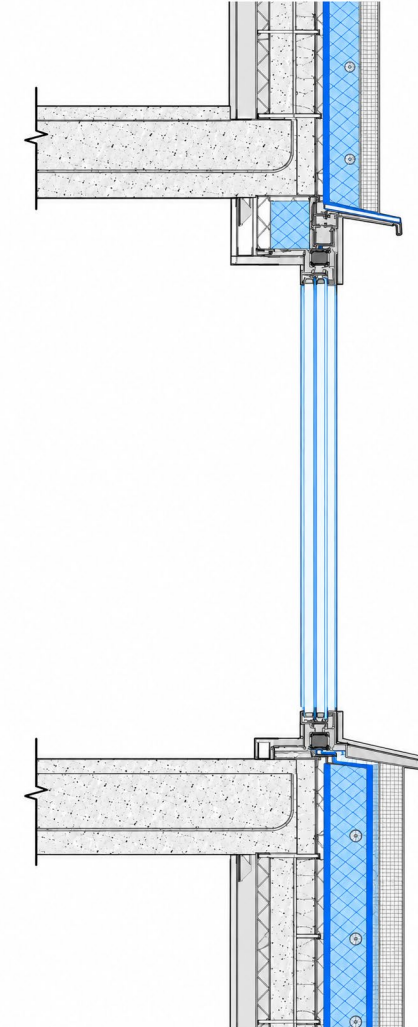
Fire / code coordination

Address NFPA 285 wall assemblies, joints, and fire-stopping early with the code consultant.



Verification

Plan mock-ups, adhesion tests, and inspection to verify the installed assembly.

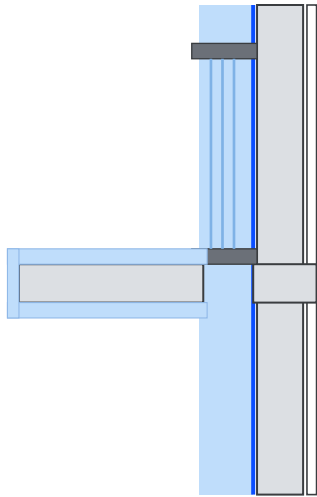


Wall section: Phius-capable EIFS

Phius-capable Balconies

Every balcony penetrates the thermal enclosure — three strategies reduce the bridge. The right choice depends on structural system, span, and budget.

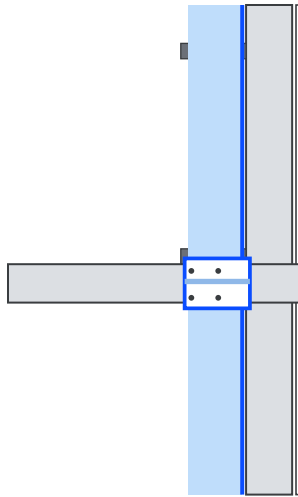
A



Fully insulated balcony

Wrap the balcony slab in continuous insulation so the thermal layer stays unbroken across the projection.

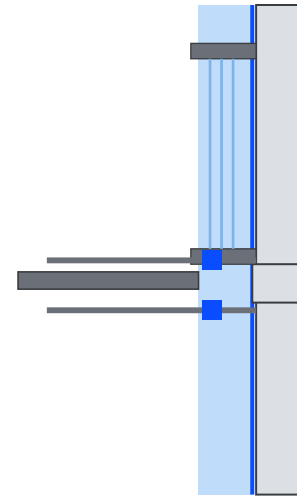
B



Thermal-break blocks (e.g. Isokorb)

Structural thermal-break modules carry load while interrupting the concrete thermal bridge at the slab edge.

C

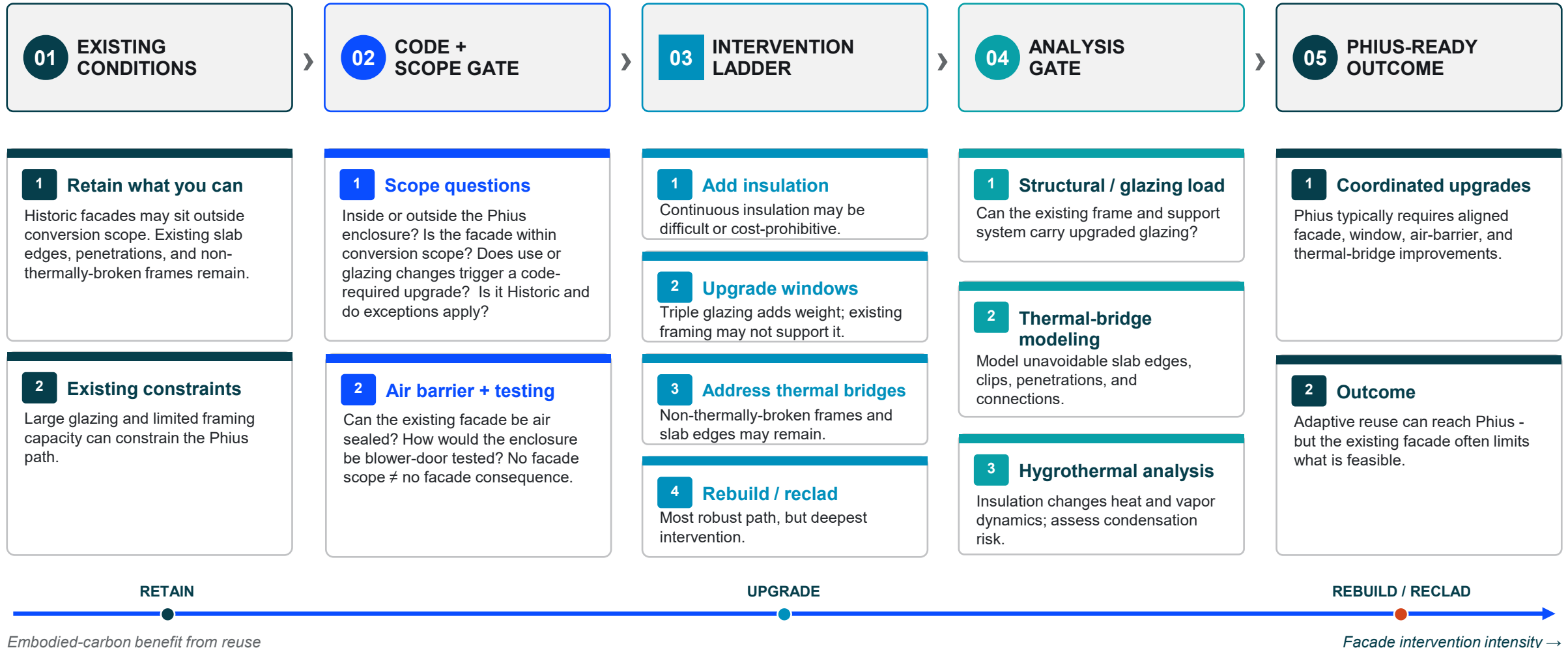


Local thermally broken attachments

Support a separate balcony on discrete steel / aluminum brackets with thermal-break pads at each penetration.

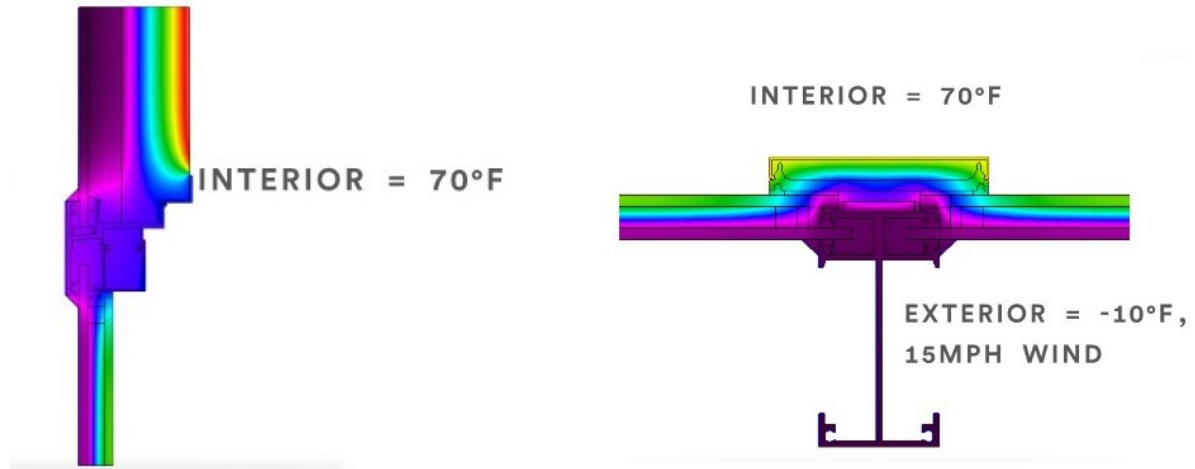
No single strategy is universally best — select per structural system, span, and budget.

Historic Facades & Adaptive Re-Use



Takeaway: Adaptive reuse can reach Phius -but the existing facade is often the limiting condition.

Historic Facades & Adaptive Re-Use



30 N. LaSalle – Re-Glaze and Thermal Improvement Studies (SCB)

- 30 N. LaSalle, a Historic landmark, is under design to be re-glazed and receive other thermal improvements
- This mid-century modern façade will have a significant U-value improvement (but not to Phius standards)
- Extensive studies were done regarding condensation and this was a primary reason for the choice to replace the glass with the raised humidity level of the conversion
- The upgrade allow it to meet modern Energy Code

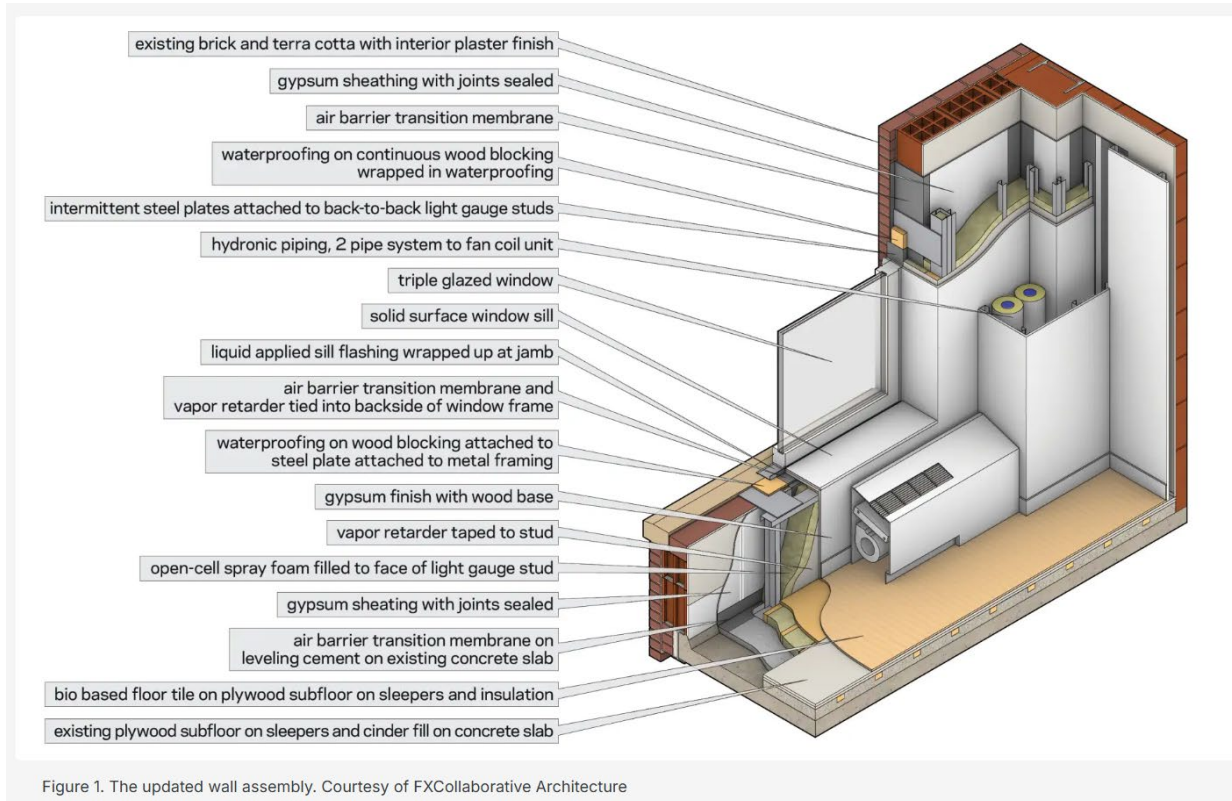
Historic Facades & Adaptive Re-Use



Tribune Tower (1930) – Receiving Spray Foam Insulation on the Interior

- The historic Tribune Tower was insulated and had its windows replaced
- The conversion was completed in 2024.
- It saved about 50% of energy after the retrofit (non-Phius), even though the historic window profiles limited their U-value

Historic Facades & Adaptive Re-Use – Phius Capable



Rubin Hall – FX Fowle / Steve Winters, 2024

- Rubin Hall, by FX Fowle, did reach Phius standards in 2024 as a historic retrofit
- Local Law 97 in NYC has encouraged more Phius retrofit projects
- The designers have published widely about the project to illustrate the possibility

Historic Facades & Adaptive Re-Use – More Phius-Capable Examples



PHFA — Pennsylvania Housing Finance Agency

Affordable-housing adaptive reuse

An affordable-housing conversion pursuing Phius performance by re-working the existing enclosure and upgrading building systems.

SCOPE ADDRESSED

-  Enclosure: added insulation, continuous air barrier, upgraded windows
-  Systems: heat pumps, DOAS ventilation, efficient domestic hot water



Alloy Tower — 505 State Street, Brooklyn

All-electric residential high-rise

Alloy's all-electric tower shows how a modern high-rise enclosure and systems scope can align with Phius goals.

SCOPE ADDRESSED

-  Enclosure: added insulation, continuous air barrier, upgraded windows
-  Systems: heat pumps, DOAS ventilation, efficient domestic hot water

Takeaway: adaptive reuse can be Phius-capable when the enclosure and systems scope are addressed together.

Hygrothermal Analysis

Insulating or upgrading a historic facade changes how heat and moisture move through the wall. A hygrothermal analysis models temperature, condensation, and drying over time to confirm the upgraded assembly stays durable.

! Condensation risk

Adding interior insulation cools the existing masonry, raising the risk of interior condensation and freeze-thaw.

💧 Moisture storage & drying

Assess the wall's capacity to store and release moisture, and preserve outward or inward drying paths.

🛡️ Interior-insulation limits

There is a practical limit to interior R-value before the assembly can no longer dry safely.

🔍 Evaluate existing + climate

Model the actual existing materials and local climate — not assumed layers — for each facade condition.



Historic facade receiving interior spray insulation (SCB). Hygrothermal analysis: Prudence.

Airtightness: Infiltration & Compartmentalization

Airtightness is verified by testing, not assumed. Plan the enclosure air barrier and unit compartmentalization from mock-up through phased occupancy.

Test timing

Test a mock-up early, then at enclosure completion — before finishes conceal the air barrier.

Mock-up & phasing

Iterative testing on mock-ups and representative units de-risks details before production.

Unit compartments

Test individual dwelling units to limit inter-unit air, odor, and sound transfer.

Phased occupancy

Coordinate testing with construction phasing and partial occupancy on tall buildings.

AIR-LEAKAGE TARGETS

$\leq 0.08 \text{ CFM50/ft}^2$ whole-building enclosure

$\leq 0.30 \text{ CFM50/ft}^2$ unit compartmentalization

Placeholder values — confirm per project & code.



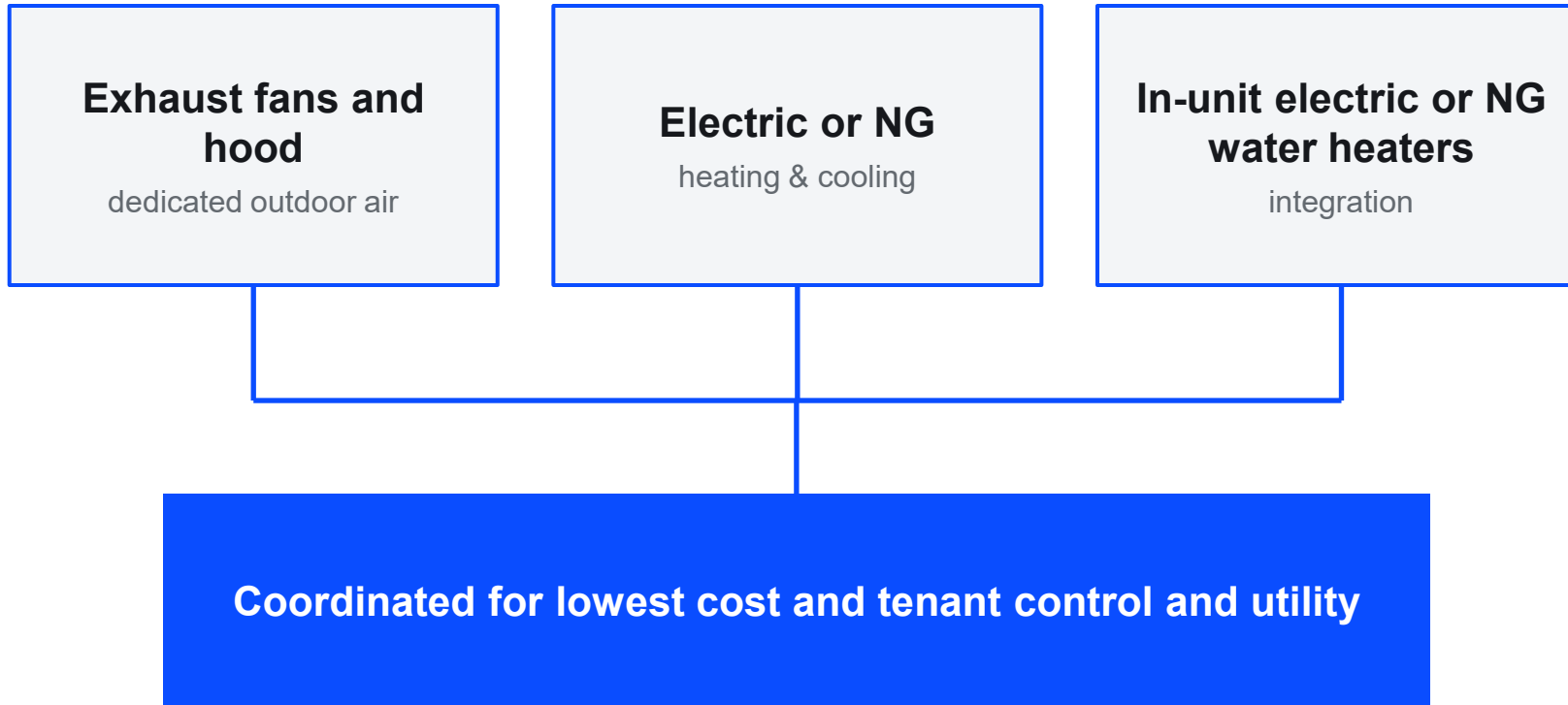
SECTION 03

Systems



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Business as Usual Systems (Market Rate)



Differences in Unit Design

- With the All-Electric mandates in many model codes, Residential Unit Design is changing
- Ventless dryers, convection cooking, electric water heaters - are becoming more common
- Gas fireplaces, which do not comply with Phius, are becoming less common
- These changes also reduce the amounts of shafts and shaft transfers
- Even in non Phius-compliant buildings, these trends remain prevalent



Unit Kitchen



HEAT PUMP
ELECTRIC DRYER

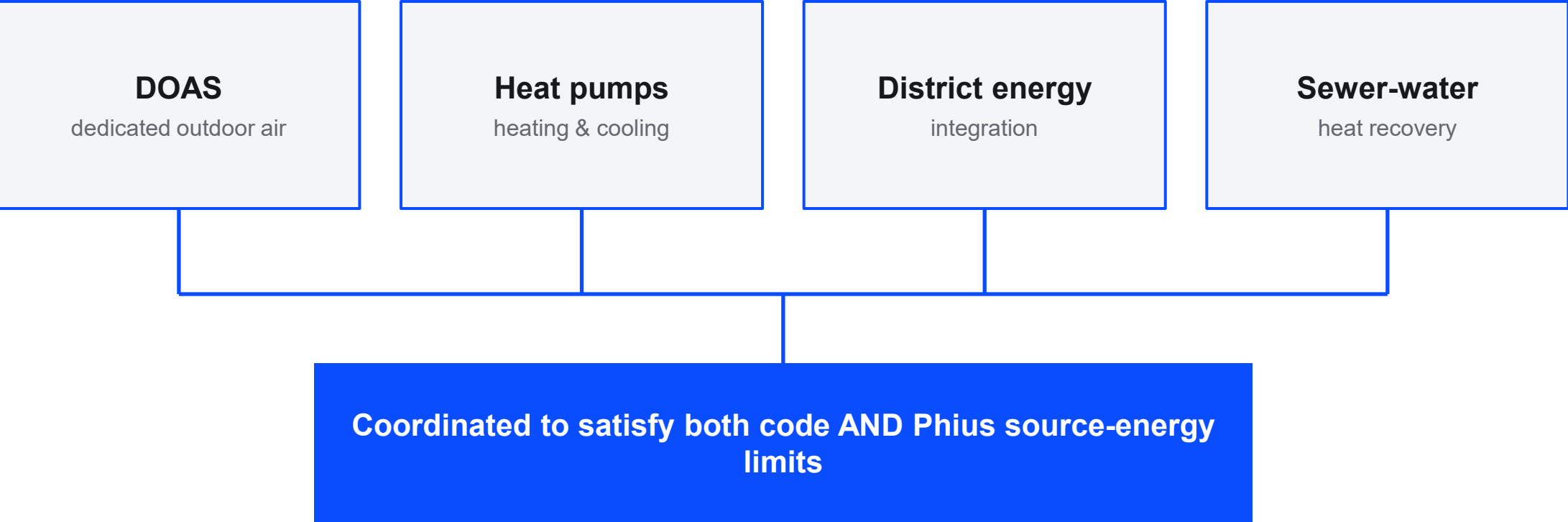


COMPACT WASHER



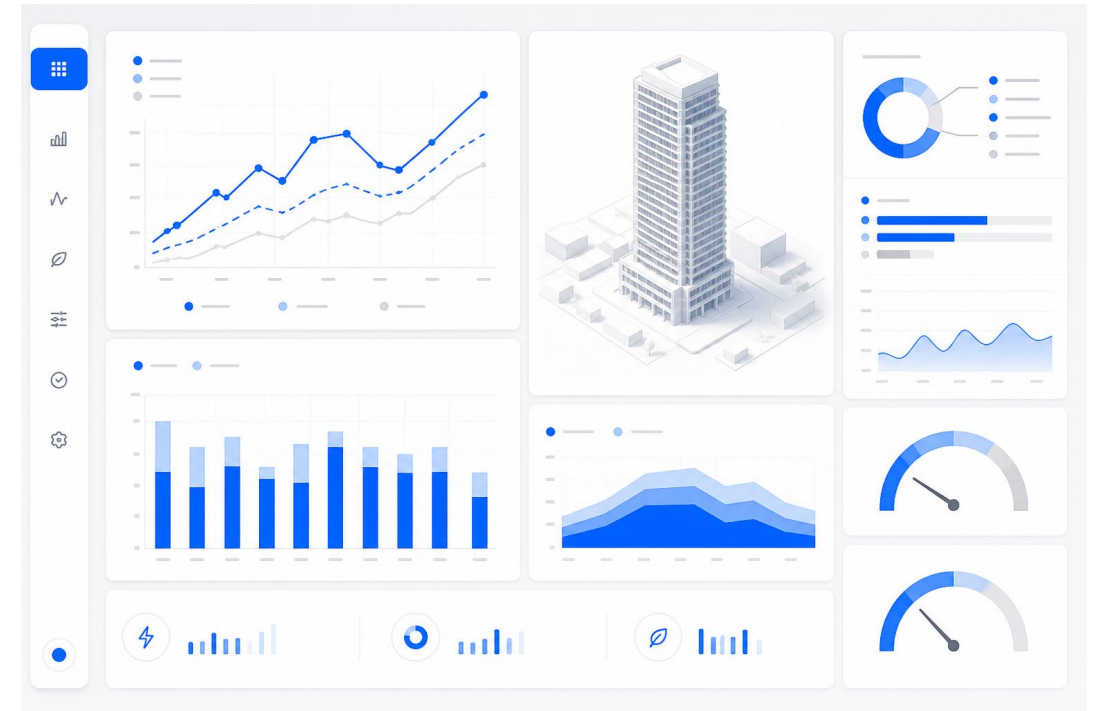
CONDENSING
ELECTRIC DRYER

Systems Integration



The Role of Energy Modeling

- Energy modeling is the backbone of the Phius design process.
- Informs glazing ratios, enclosure trade-offs, and systems selection.
- Enables “what-if” iteration from concept through realization.
- Supports Orange Path façade optimization decisions (introduced later).



SECTION 04

Case Studies

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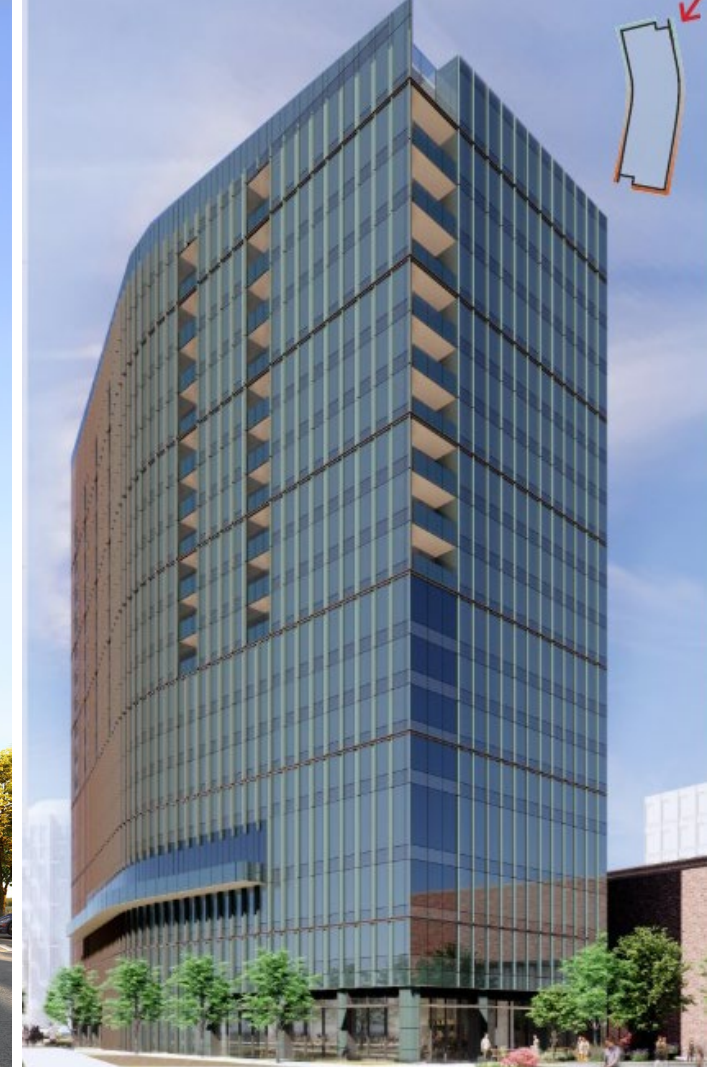
CASE STUDY 03

Building E, 776 Summer Street

Boston, MA · 18-story waterfront mixed-use tower

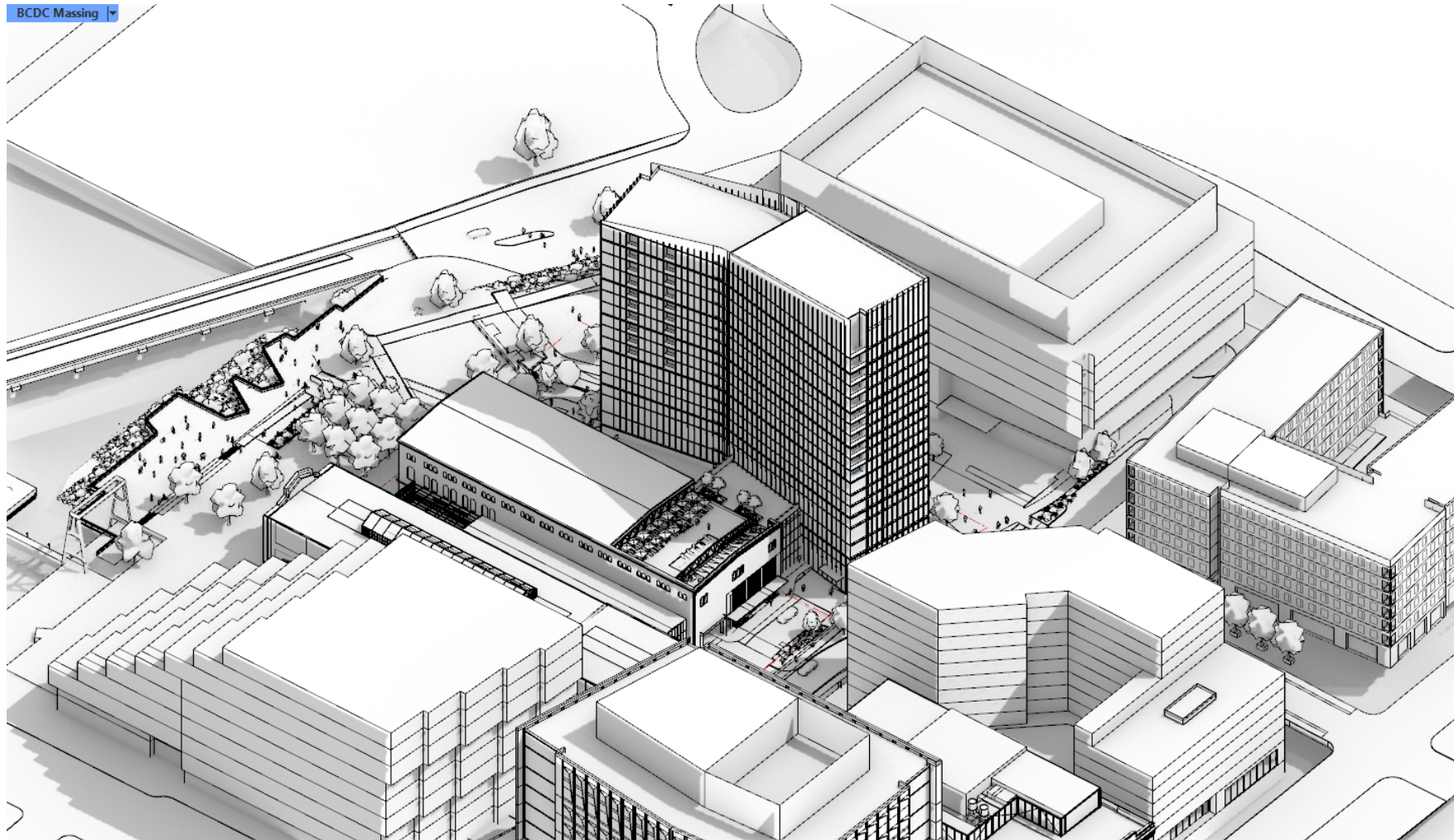
- Pursuing Phius 2024 ZERO for the residential program.
- Waterfront exposure and a mixed-use program under PHIUS.

KEY IDEA Waterfront exposure and a mixed-use program, delivered under PHIUS.



Block E (SCB, 2025)

Building E, 776 Summer St.





Building E, 776 Summer St.

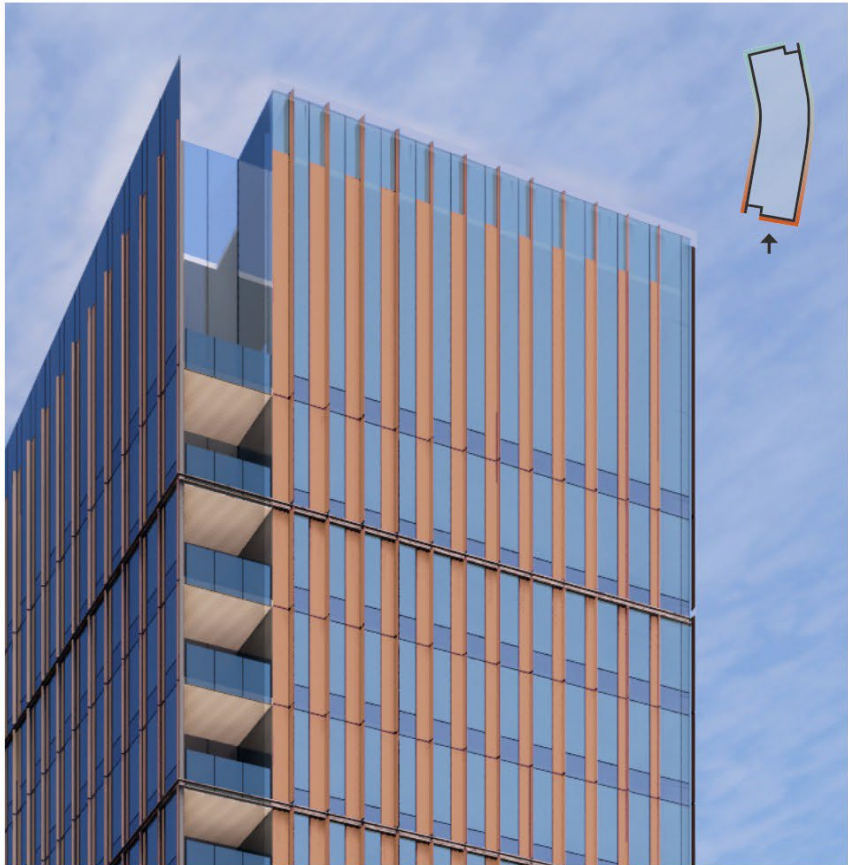
BLOCK E & 1898

NORTH & SOUTH FACADES

- ② Refine materiality and ensure it transitions appropriately within its context.
- ③ Study and evolve the balcony expression so it contributes positively to the massing and overall feel.



NORTH FACADE



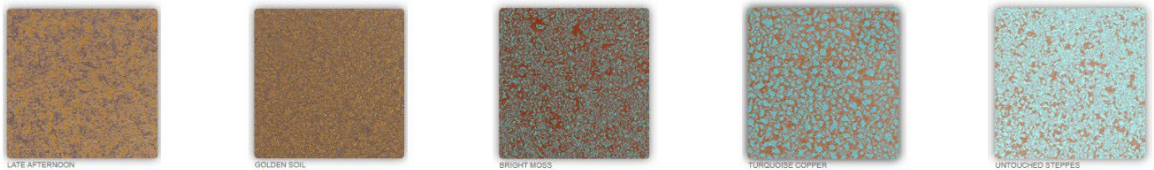
SOUTH FACADE

Building E, 776 Summer St.

BLOCK E & 1898 FACADE ARTICULATION



TRIPLE PANE GLAZING, METAL PANELS & FINS



TARNISHED PENNY ← → PATINA

- ① Improve the integration with surrounding development, both old and new.
- ② Refine materiality and ensure it transitions appropriately within its context.

WATERFRONT CHARACTER



NEIGHBORHOOD CHARACTER

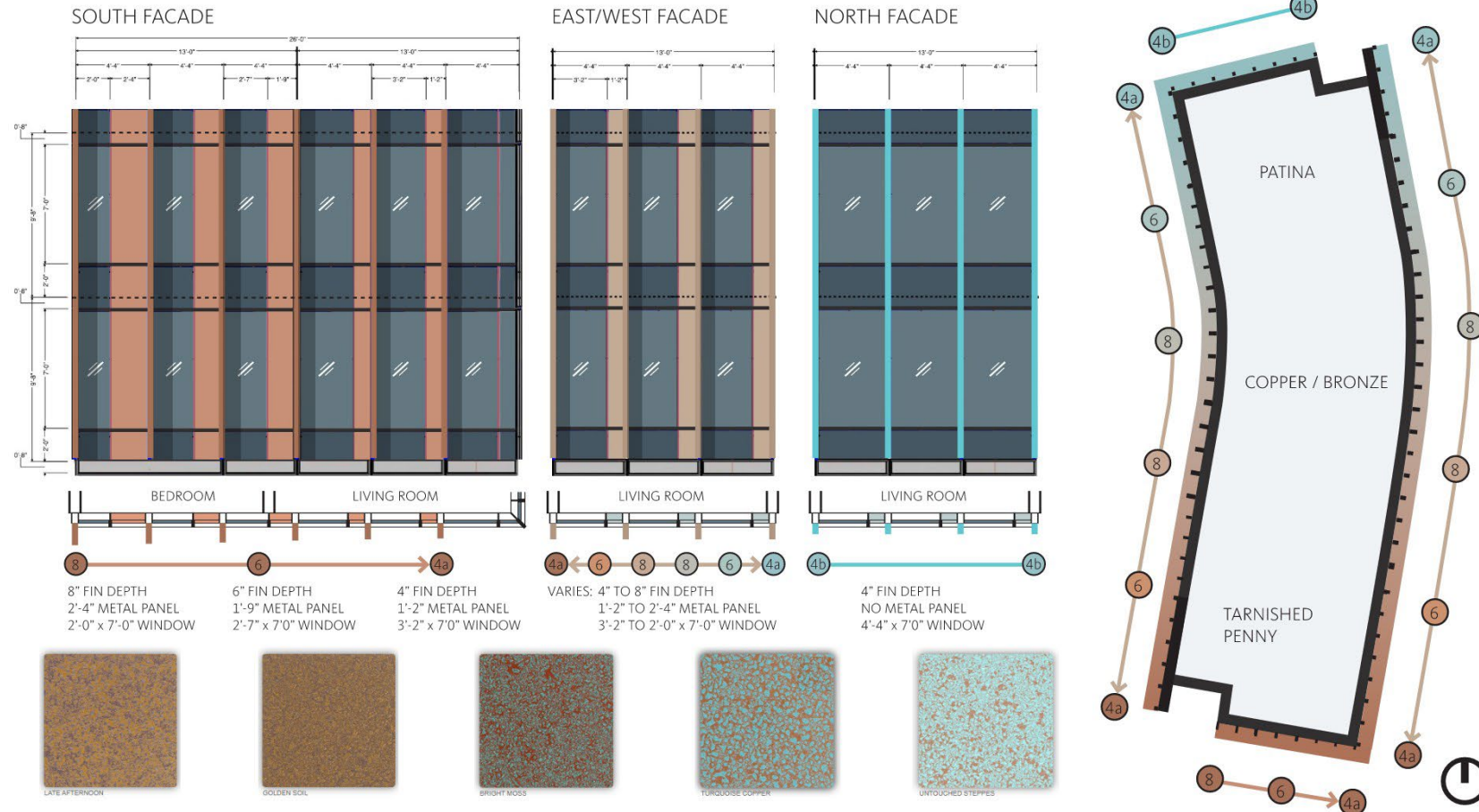


Building E, 776 Summer St.

BLOCK E & 1898

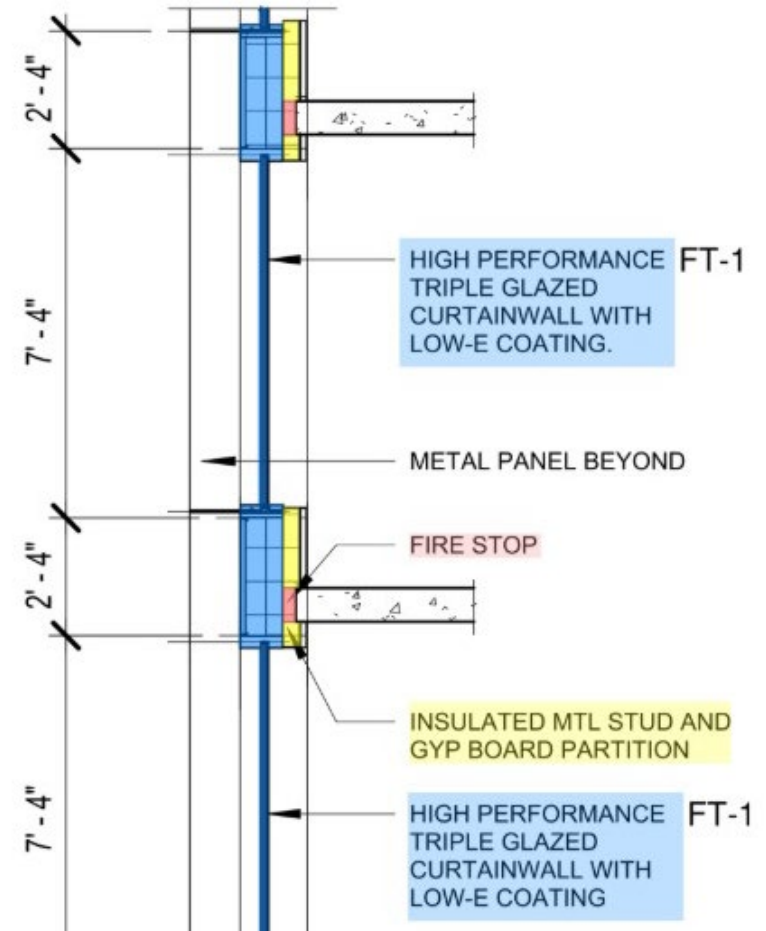
PANELIZATION & WWR ALIGNMENT (35%)

- 2 Refine materiality and ensure it transitions appropriately within its context.



776 Summer Street: Façade & Systems Detail

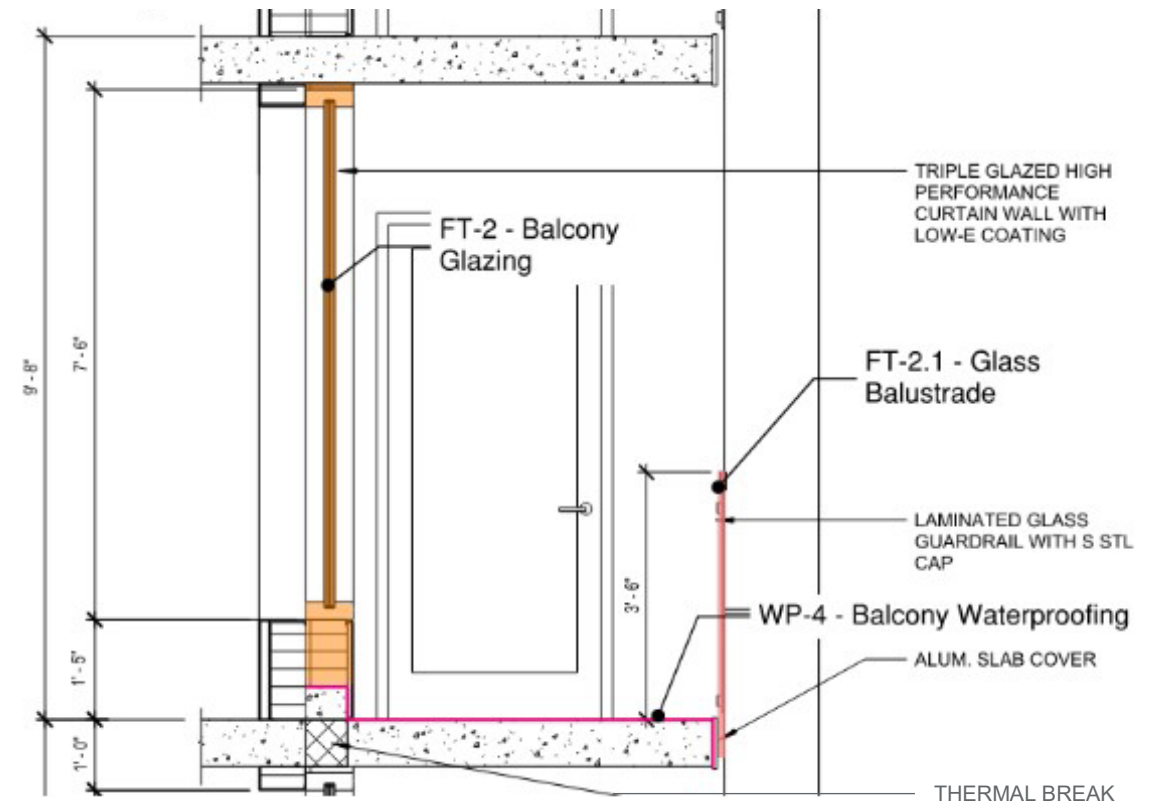
- Façade: durable, wind- and moisture-resilient waterfront enclosure.
- Thermally-broken assemblies throughout.
- Airtightness and compartmentalization approach for mixed-use stacking.
- Systems integration toward Phius 2024 ZERO residential.



Unitized Curtainwall

776 Summer Street: Façade & Systems Detail

- Façade: durable, wind- and moisture-resilient waterfront enclosure.
- Thermally-broken assemblies throughout.
- Airtightness and compartmentalization approach for mixed-use stacking.
- Systems integration toward Phius 2024 ZERO residential.



Detail at Balcony

Combined Lessons Learned

WHAT CONSISTENTLY WORKS

- Early enclosure decisions.
- Calibrated glazing ratios.
- Mock-ups plus blower-door discipline.
- Integrated mechanical systems.

RECURRING PITFALLS TO AVOID

- Late thermal-bridging fixes.
- Uncoordinated cost pressure.
- Over-glazing the façade.
- Deferring PHIUS-critical decisions.

Takeaways hold across typologies — masonry, curtain wall, waterfront, and mass timber — and across climates.

SECTION 05

Process & Delivery

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Phius Collaborative Design Process



PROJECT TEAM

Owners • Architects • CPHCs • Enclosure consultants • MEP engineers • Verifiers • Builders

- Structuring the “Phius-critical path” decisions.
- Managing Orange Path façade optimization.
- Navigating cost and constructability pressures without losing the physics.

Key Takeaways

- 1 Tall PHIUS multifamily can be code-compliant, financeable, and repeatable — across climates and market segments.
- 2 Newer energy codes (IECC 2024, envelope backstop) make PHIUS a viable compliance path.
- 3 The enclosure and integrated systems — not just glazing — determine success.
- 4 Collaboration and energy modeling de-risk the Phius-critical path.
- 5 The result: concrete, transferable strategies attendees can apply.

Thank You

Questions & Discussion

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