

abaa 2026 building
enclosure
conference

**Critical Mass:
Scaling Passive House at Bunker Hill**

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AIA
Continuing
Education
Provider



Scaling Passive House at Bunker Hill



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Associate Principal
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Learning Objectives

1. **Analyze** the design considerations required to create a repeatable "kit of parts"
2. **Evaluate** the use of Performance Mock-Up (PMU) testing as a quality assurance tool
3. **Integrate** data-driven thermal modeling insights from initial to streamline performance and construction efficiency
4. **Apply** lessons learned to optimize cost and operational carbon reduction.

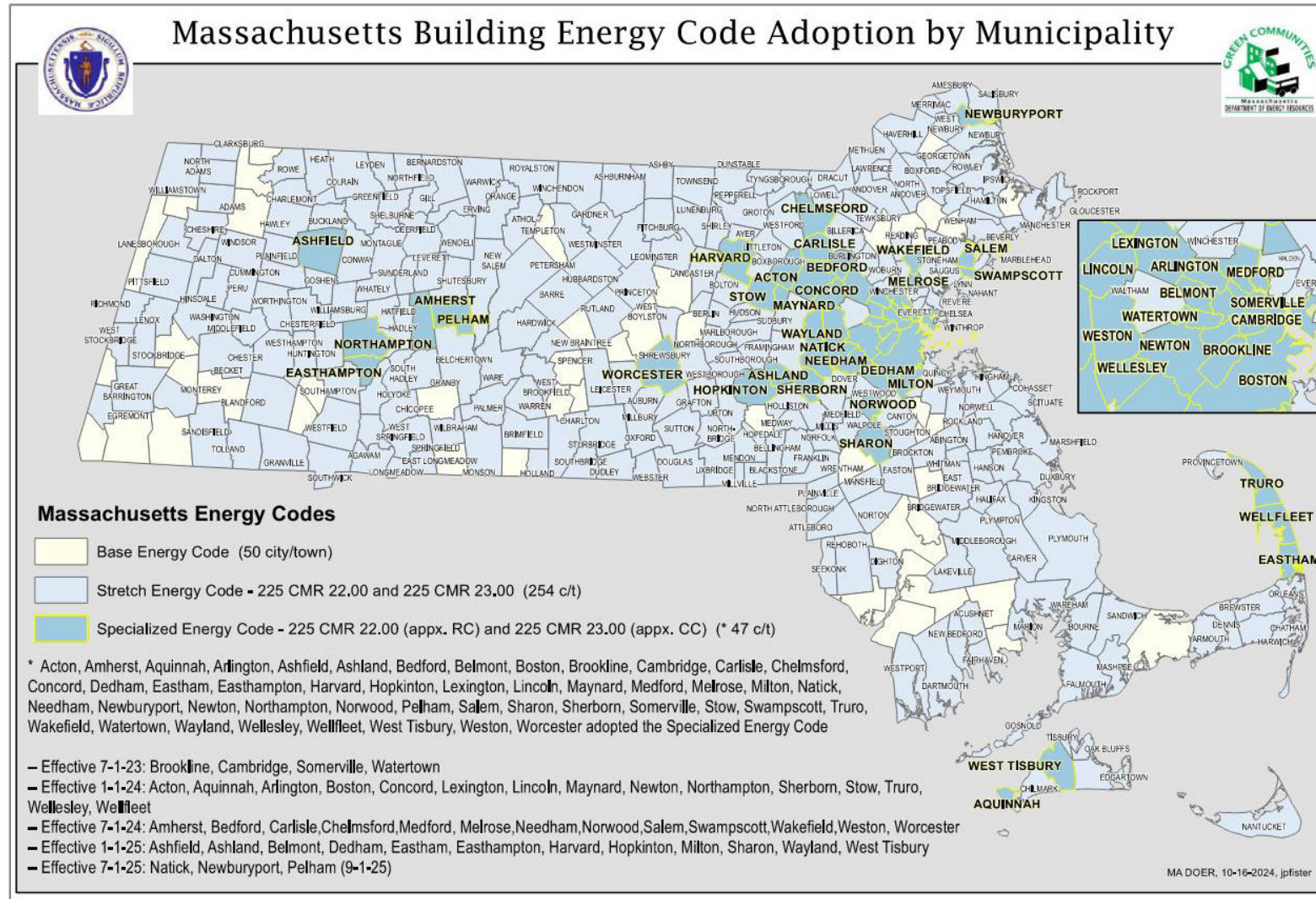
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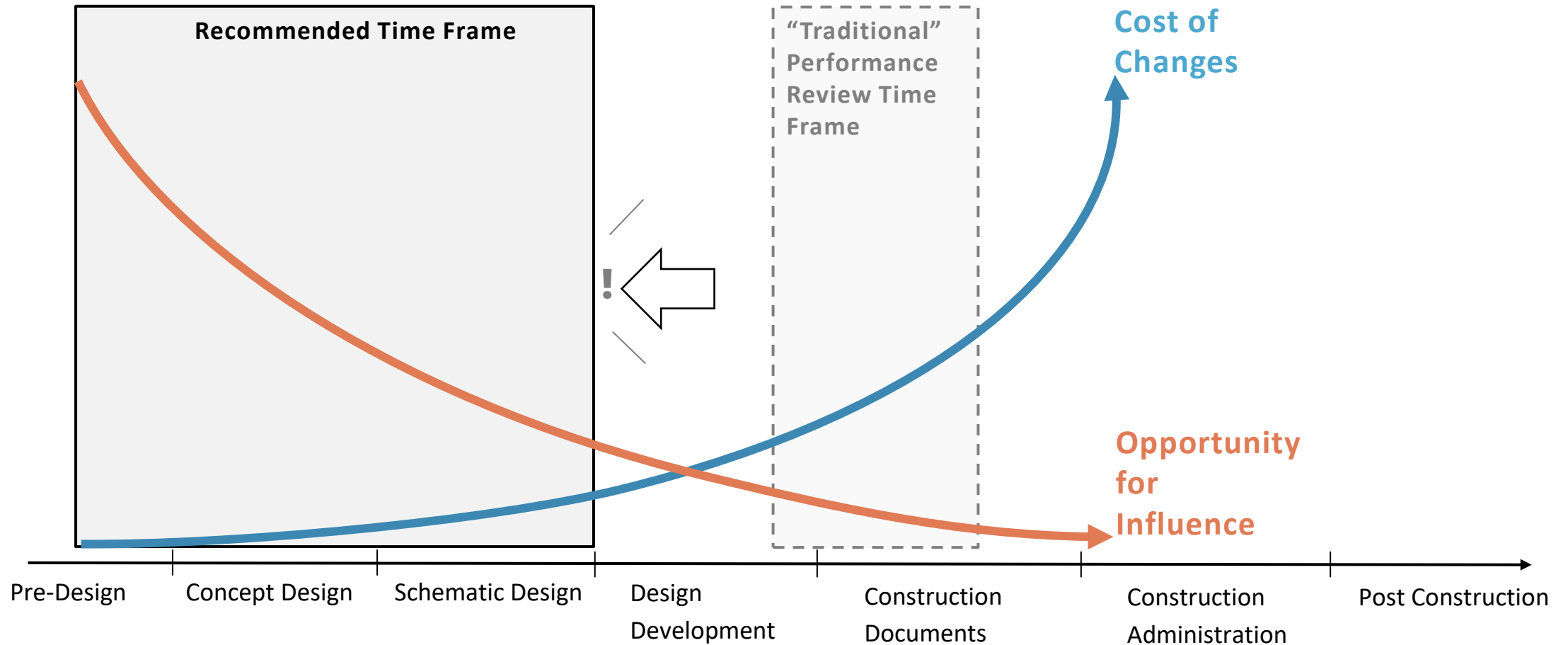
1

The Problem + The Mandate

Massachusetts Stretch + Opt-In Codes



“Traditional” vs. Passive House Early Phase Design Timeline



The Problem + The Mandate

- 15 Buildings
- 2,699 units
- 37% deeply affordable to replace 1,010 of the existing public housing units
- 4-10 stories
- 7 Acres of Open Space
- ~50,000 SF retail
- 14,000 SF Community Center

Approved Master Plan and Phase 1 Buildings



The Problem + The Mandate

- 15 Buildings
- 2,699 units
- 37% deeply affordable to replace 1,010 of the existing public housing units
- 4-10 stories
- 7 Acres of Open Space
- ~50,000 SF retail
- 14,000 SF Community Center





2 The Innovative Solution: A “Kit of Parts”

The Innovative Solution: A “Kit of Parts”

“The goal was to drive productivity as far as possible through an intelligent, value-packed set of components that can be put together in an infinite array of configurations, sizes, buildings, et cetera.”

– Nick Nigro, Leggat McCall



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The Innovative Solution: A “Kit of Parts”

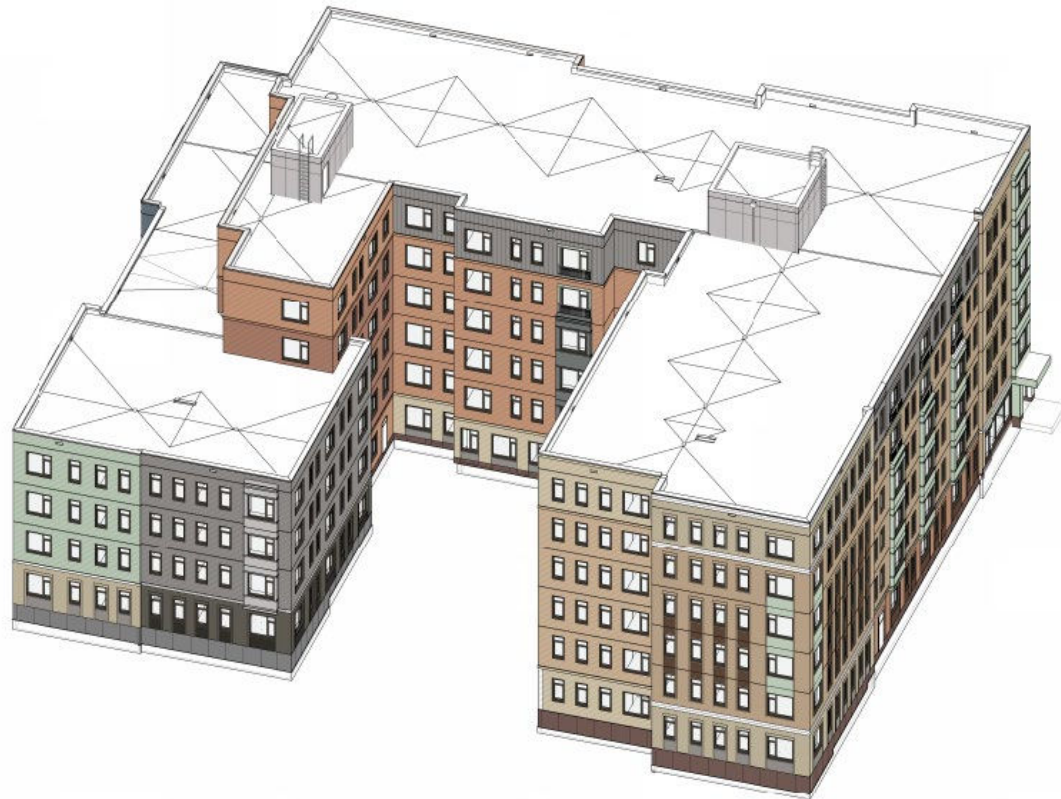
- Precast Cores
- 62’-0” Long 7-ply CLT
- Load Bearing Exterior Wall Panels



The More You Know

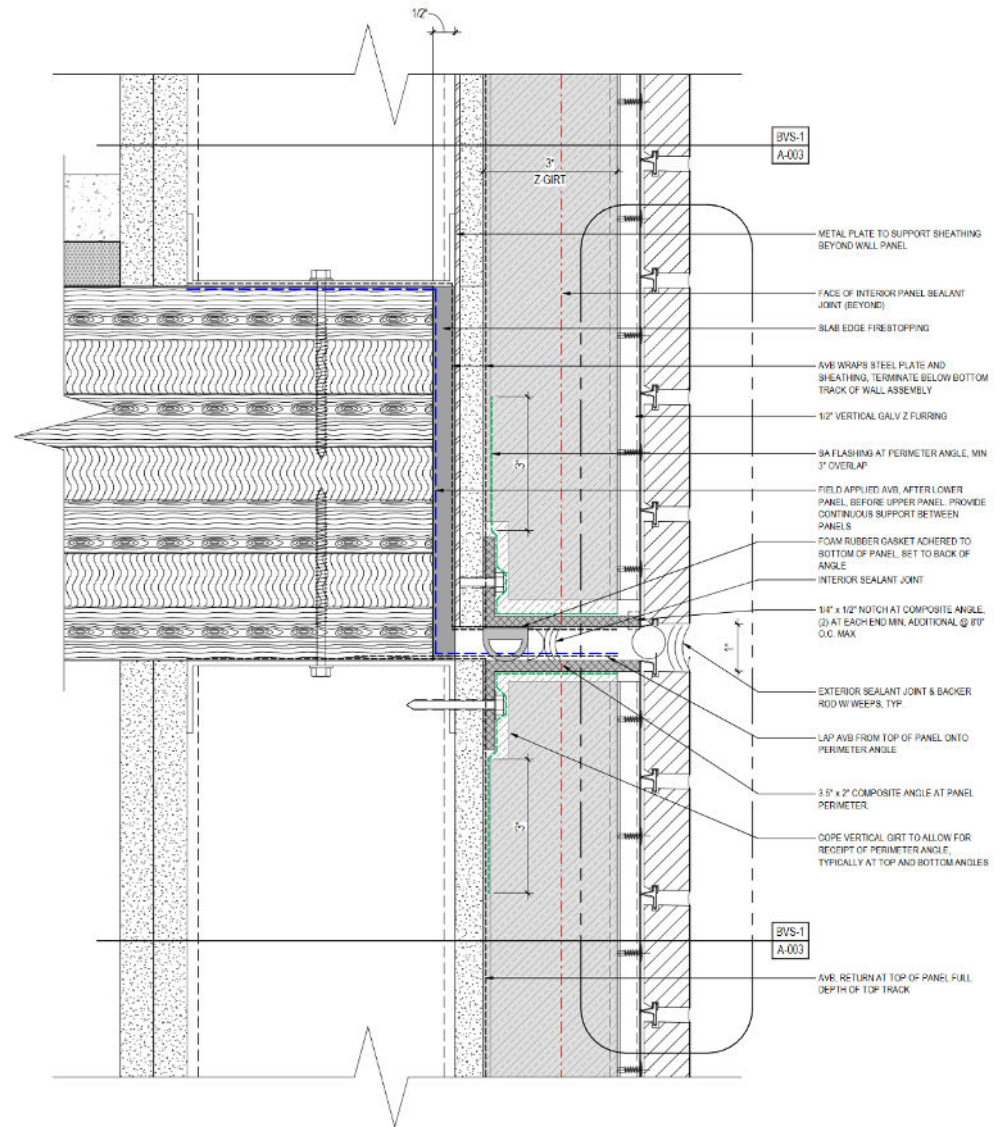
The image features the text "The More You Know" in a 3D, blocky font. The letters are colored with a gradient from purple on the left to blue on the right. To the right of the text is a large, bright yellow 3D star. Below the text and star is a colorful, glowing nebula or galaxy with red, orange, yellow, and green hues. The entire scene is set against a dark blue background with small white stars.

The Innovative Solution: A “Kit of Parts” – Building M



2
A-215

3D AXON - WEST - TUFTS STREET

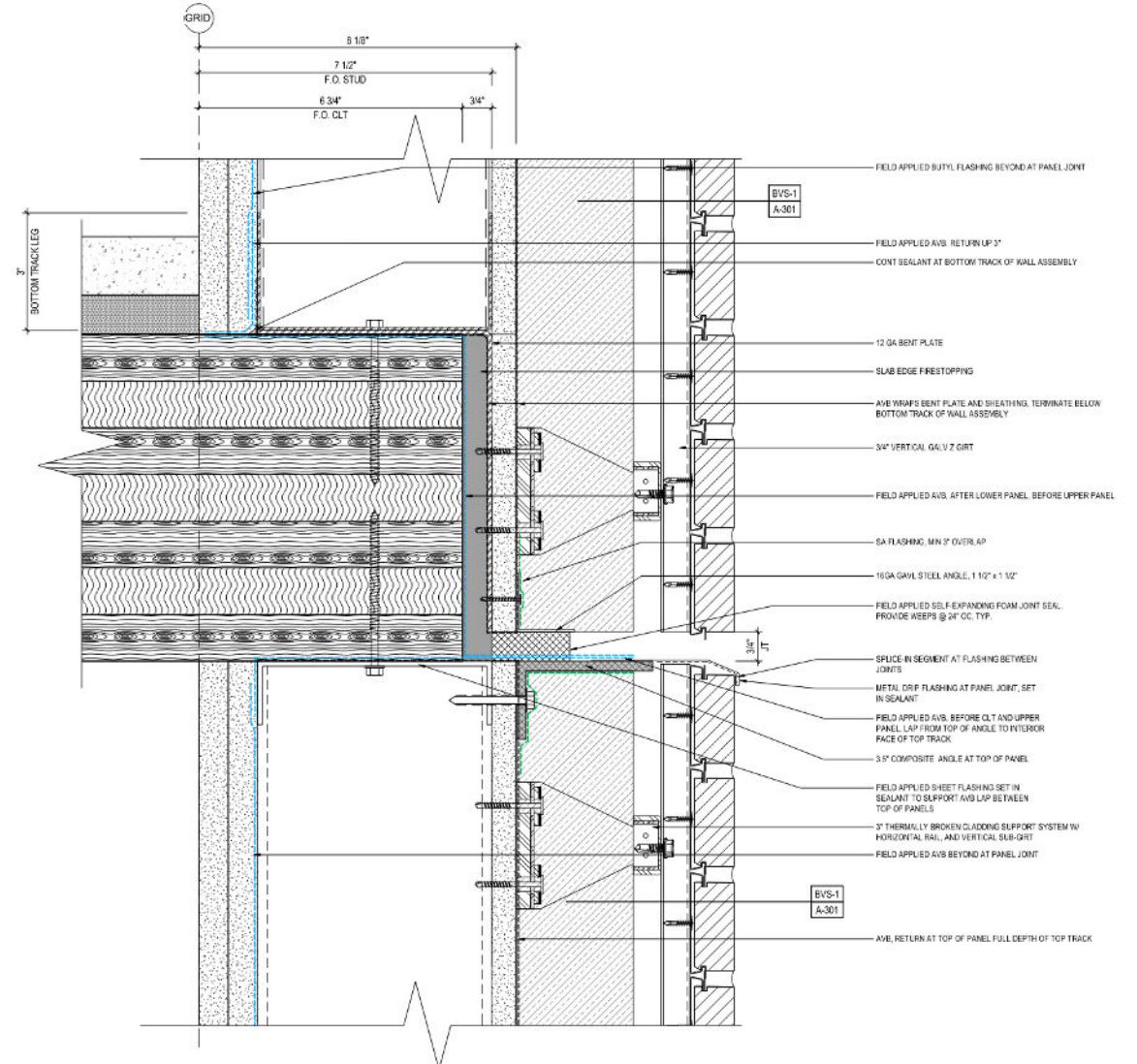
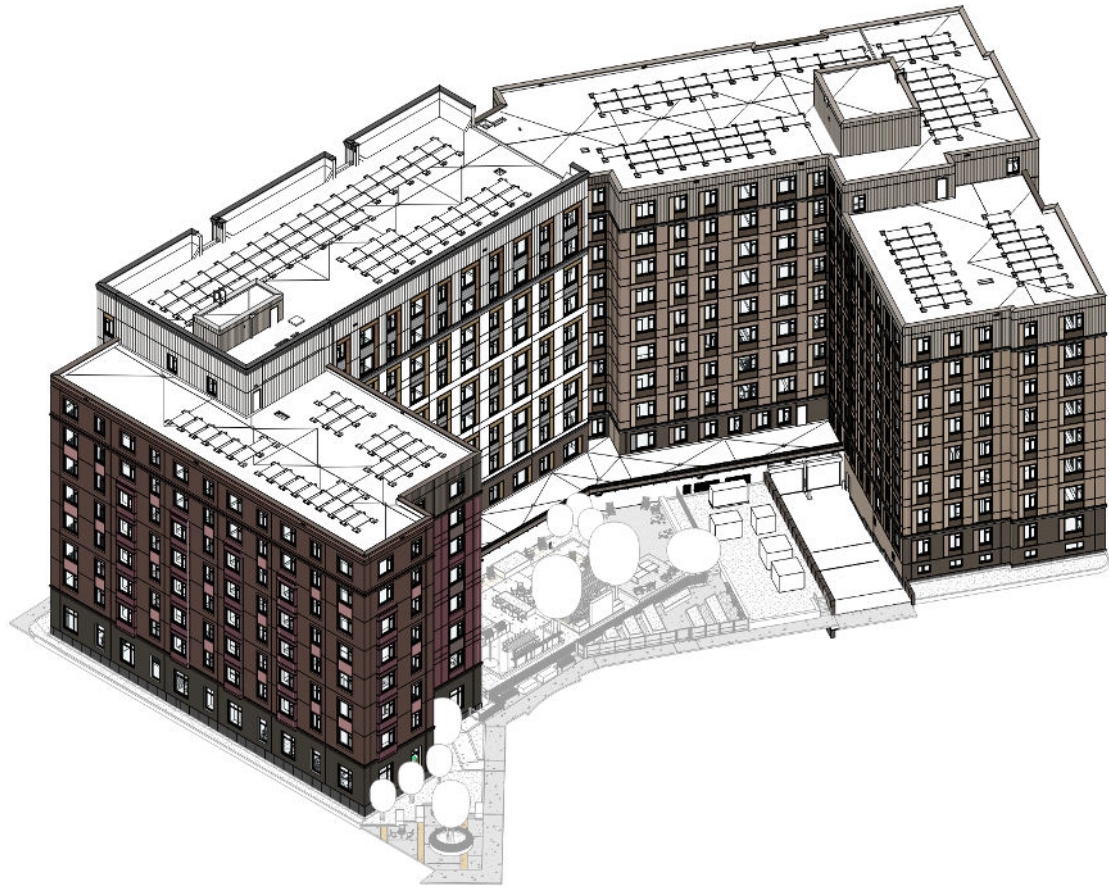


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FACADE PANEL JOINT - SECTION @ CLT SLAB (BVS SYSTEM SHOWN)

6" = 1'-0"

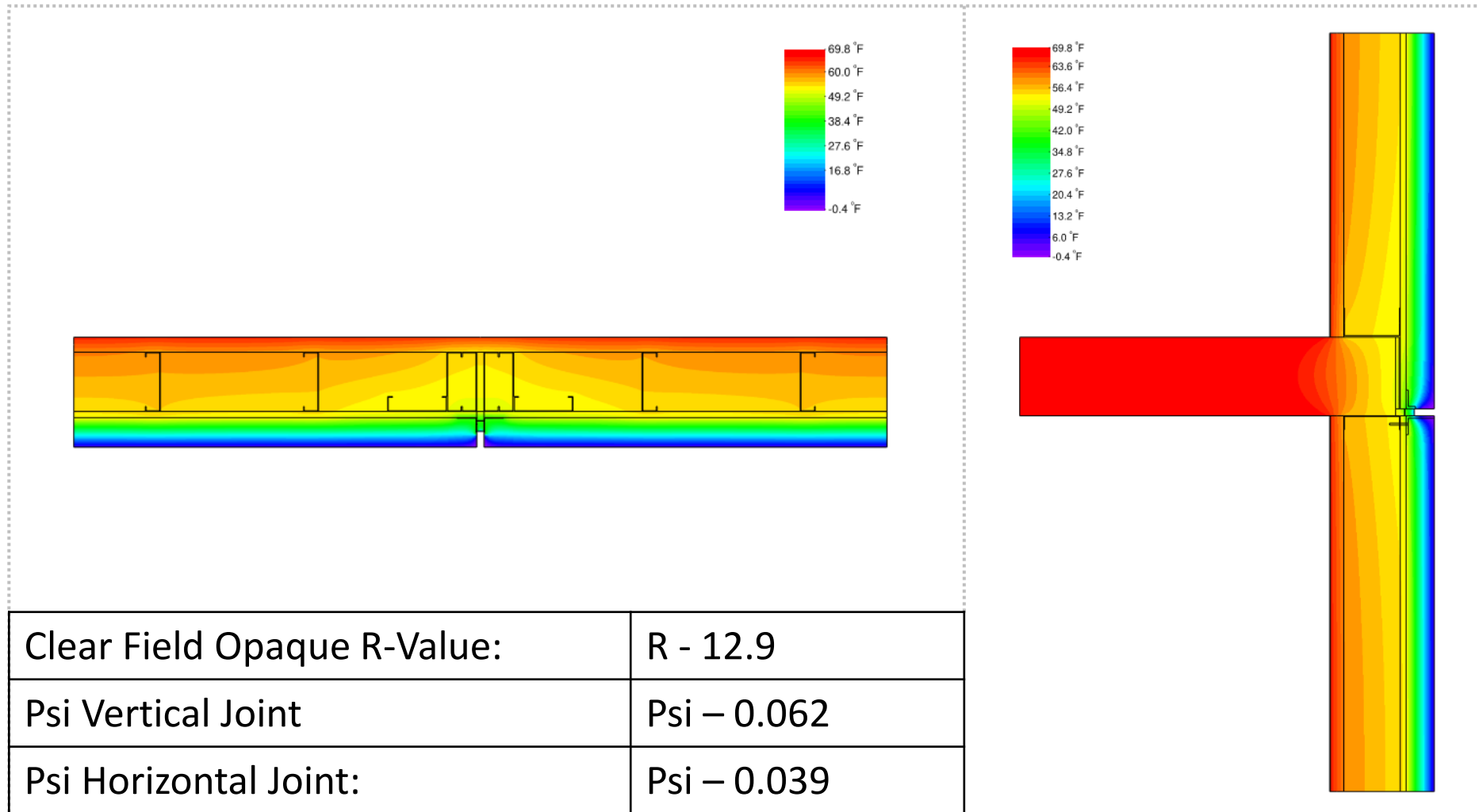
The Innovative Solution: A “Kit of Parts” – Building F



1
A-448
6" = 1'-0"

FACADE PANEL JOINT - SECTION @ BVS

The Innovative Solution: A “Kit of Parts” – The Next Iteration



3

Testing + Proving the Concept

Testing + Proving the Concept – PMU Test 1

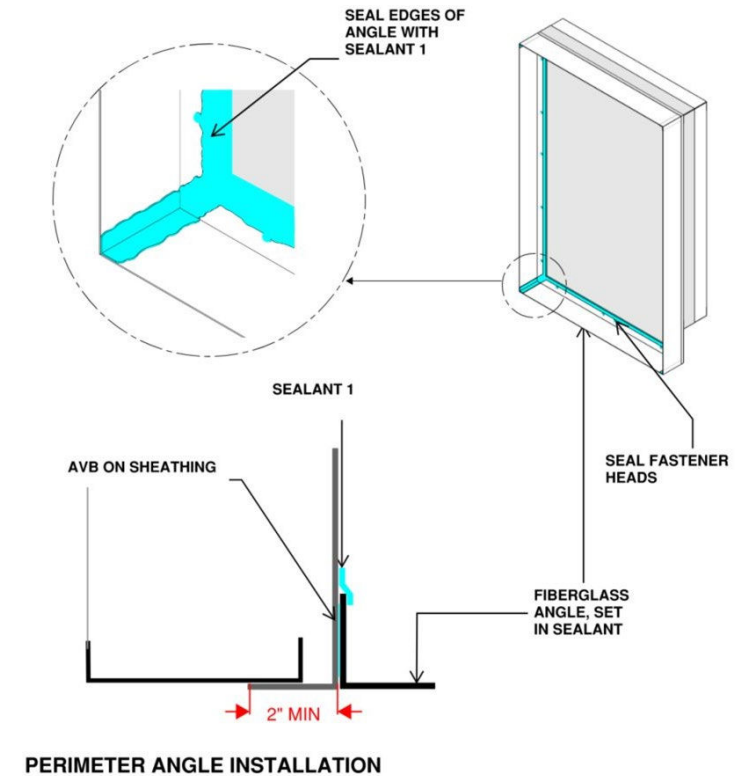
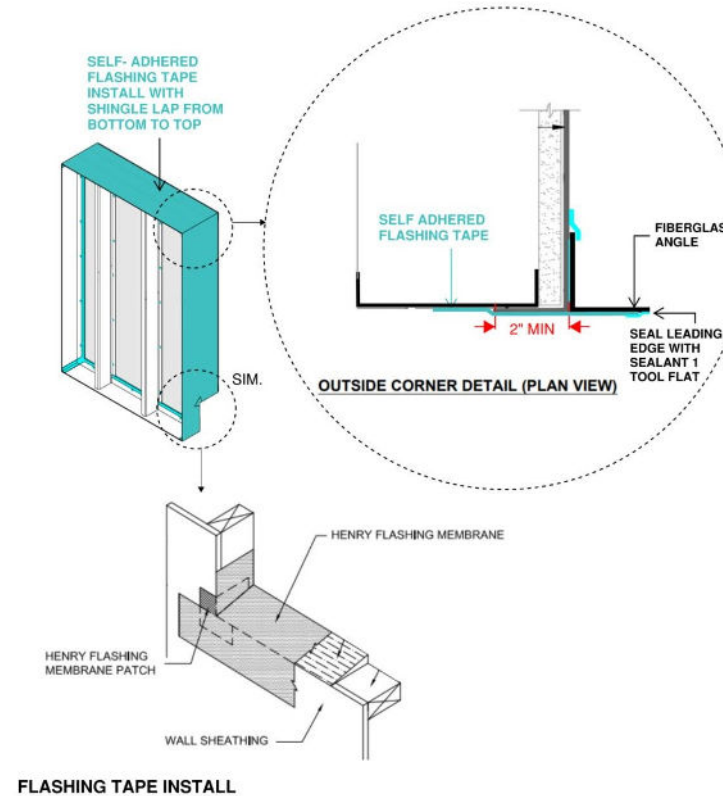


Testing + Proving the Concept – PMU Test 2



Testing + Proving the Concept – PMU 3

Quality assurance w/ explicit assembly instructions + Testing



Dynamic Water Testing (AAMA 501.1)

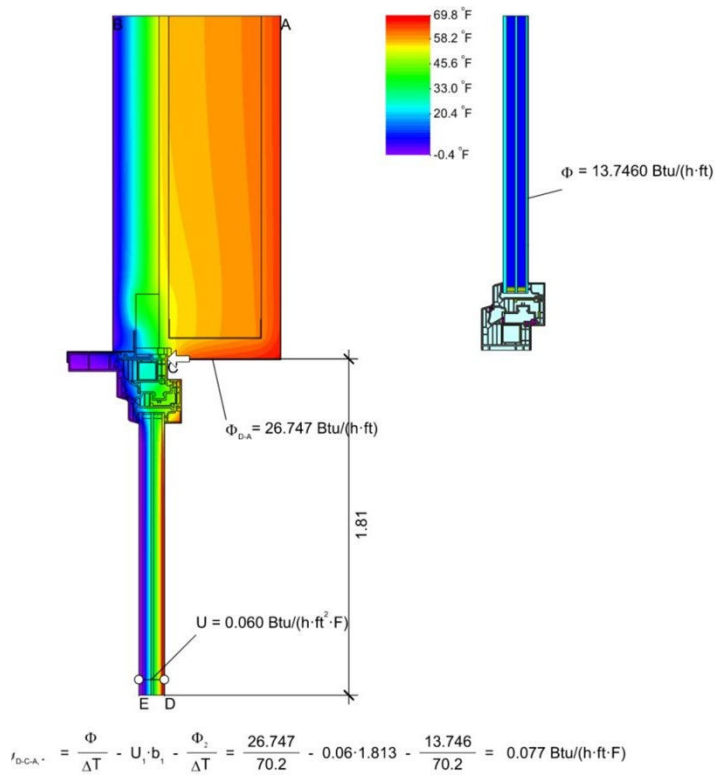
Testing + Proving the Concept, Building F



Dynamic Water Testing (AAMA 501.1)

Testing + Proving the Concept – PMU Test 2

Quality assurance w/ explicit assembly instructions + Testing



Thermal Modeling Verification



Factory Verification



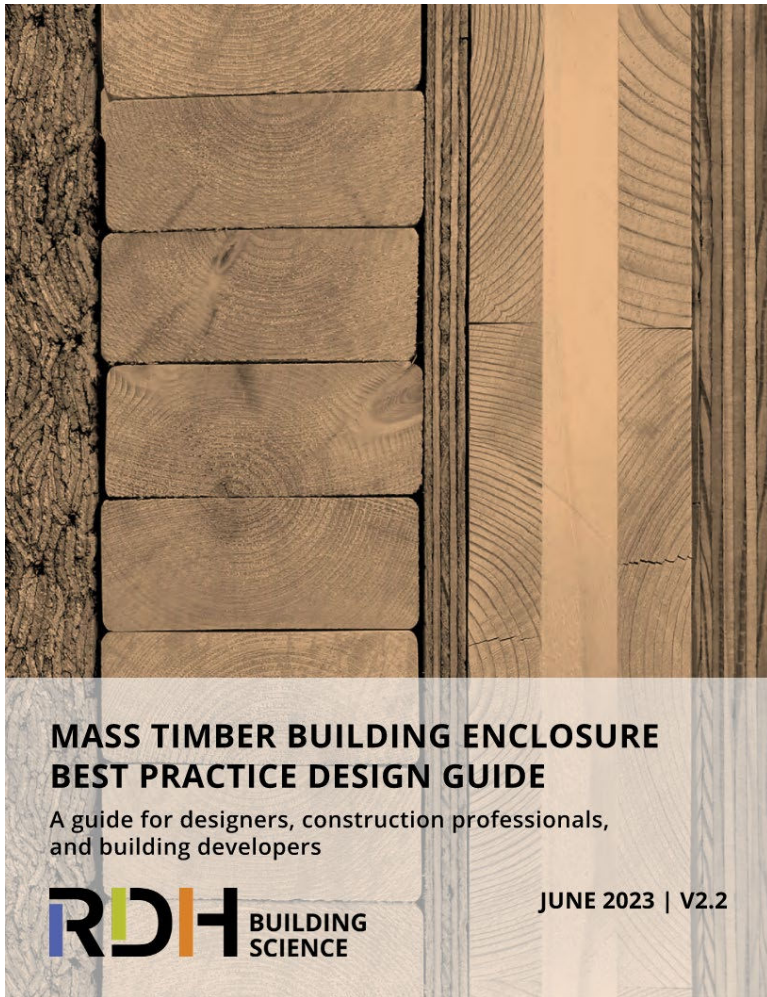
Testing + Proving the Concept









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Planning for Moisture Management

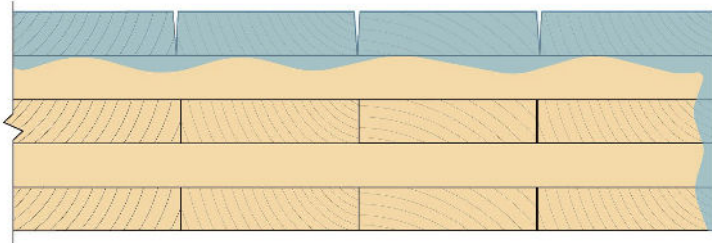
Planning for Moisture Management



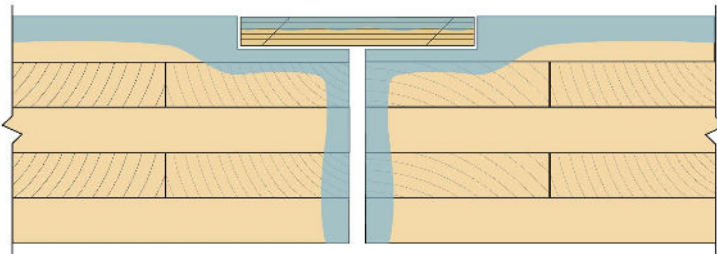
		MOSITURE EXPOSURE LEVEL		
		 HIGH or LONG	 MODERATE	 LOW
PROTECTION ROBUSTNESS	 LOW	X AVOID	? CAUTION	✓ OPTIMAL
	 MODERATE	? CAUTION	✓ OPTIMAL	✓
	 HIGH	✓ OPTIMAL	✓	✓

Planning for Moisture Management

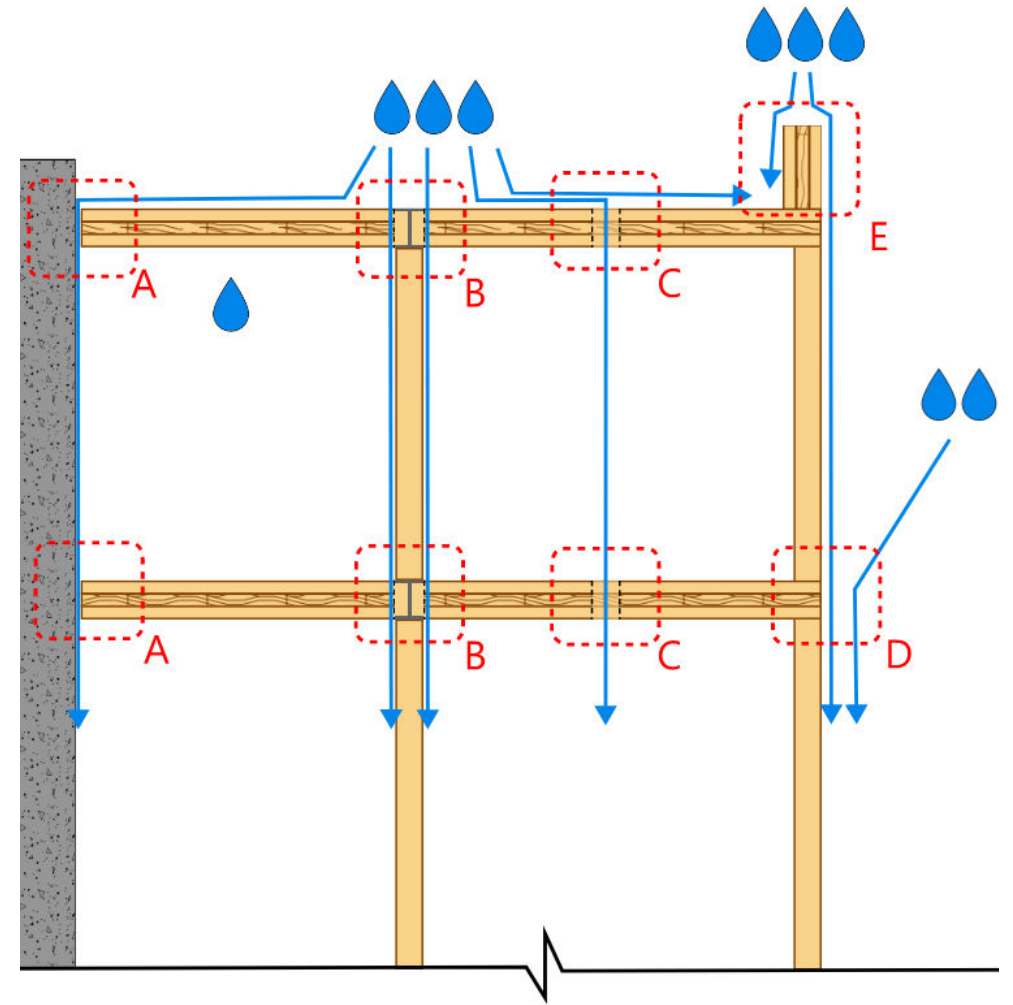
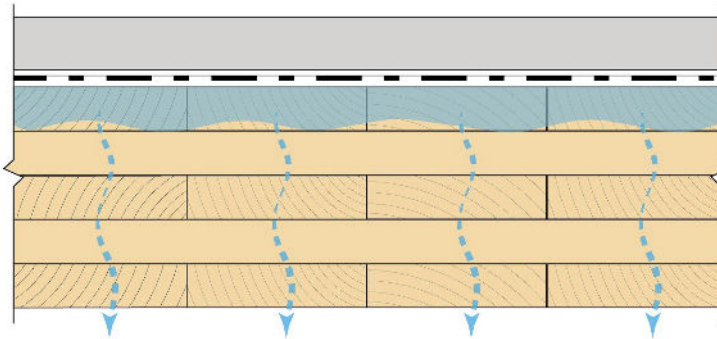
Mass timber components



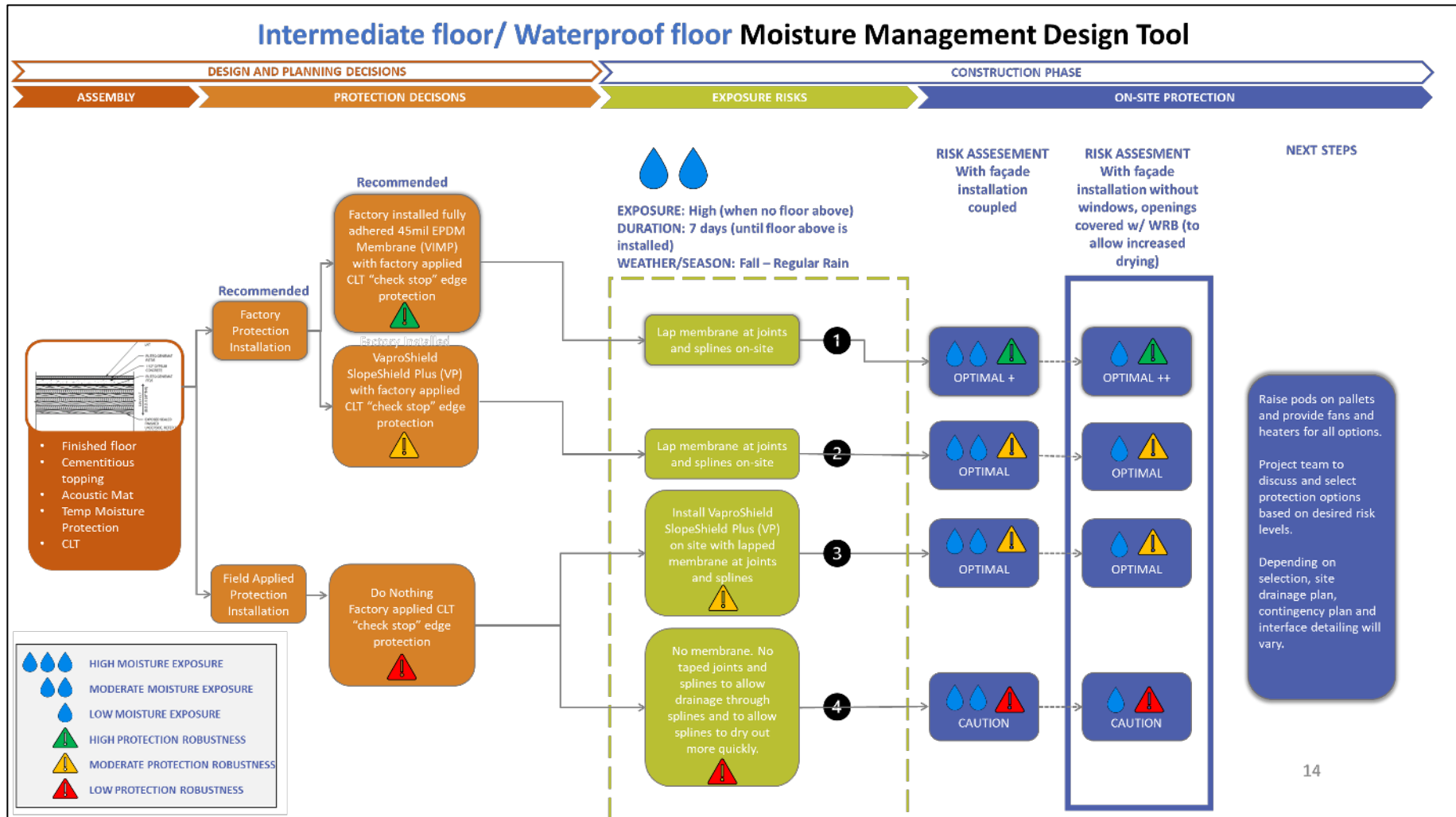
Mass timber connections




Mass timber assemblies



Planning for Moisture Management



Planning for Moisture Management



SUFFOLK

RDH Comments
Lucas Nahrgang, PE
3/25/2024

Moisture Mitigation Plan
March 19, 2024

To protect the cross laminated timber (CLT) product and as discussed with the design team and ownership in the past, Suffolk will be:

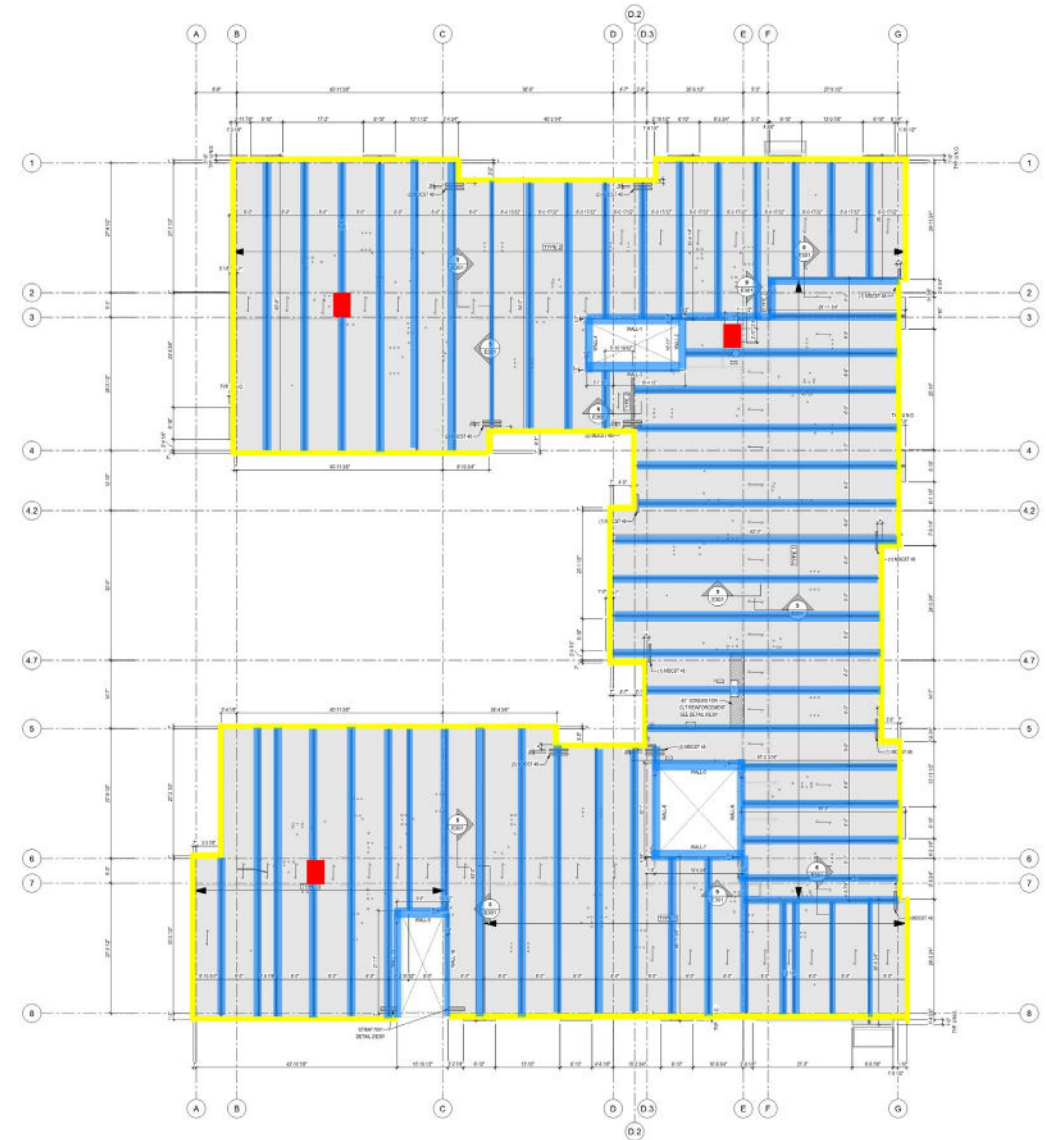
- 1) Temporary Roof Installation:
 - Installing a temporary roof on the 3rd and 5th floors. Protection (Air and Vapor Barrier – Henry VP-160) of all splines and slab penetrations on each of these floors. Detailed drawings have been attached documenting these measures (Drawings 1, 2 & 3).
 - Drying with leaf blower as needed.
 - Use of temp drains as needed. (3 locations ea on floors 3 & 5, see drawings)
- 2) Roof Vapor Barrier on Level 6:
 - Coordinating with the roofer, Greenwood Industries, to install the vapor barrier layer (GAF SA Vapor Retarder XL40) of the roof installation on level 6.
- 3) AVB Detail Installation:
 - Installing AVB (Henry VP-160) detail at the edge of CLT on each floor, as per the attached detail (Detail 1, below).

Additional Measures:

- 4) Setting a temporary drain at three locations on floor 5 to allow water to be squeegeed off the floor and out of the building window.
- 5) Absorbent blankets will be used at locations where an immediate concern for a water leak or water pooling is located.
- 6) Procuring a moisture meter gauge and performing intermittent testing on the CLT as it arrives and after it is set in place on the building. Suffolk will keep records of these tests. (RDH had noted that moisture content they would like to see is 19%)

These measures aim to protect the CLT product during the construction process, ensuring its integrity and longevity. It's a comprehensive approach that covers various aspects of moisture protection and quality control.

- AVB Detail at Edge of CLT
- Taping of splines at CLT
- AVB all MEP Penetrations
- Temp Drains locations



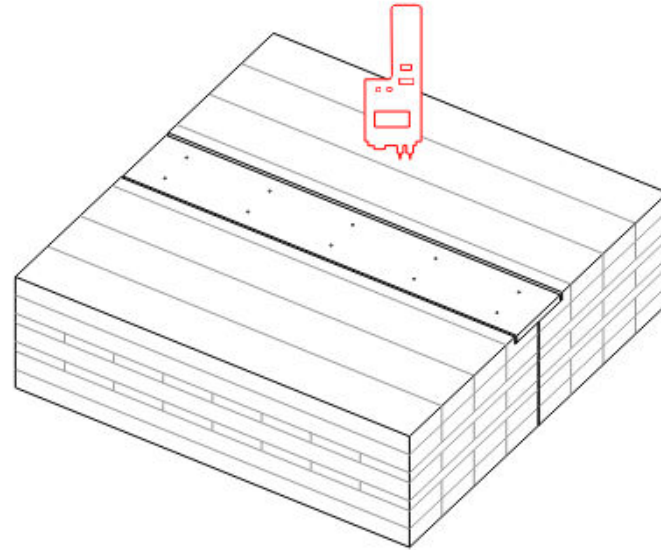
Mass Timber Moisture Management



Mass Timber Moisture Management

Weekly Spot Check:

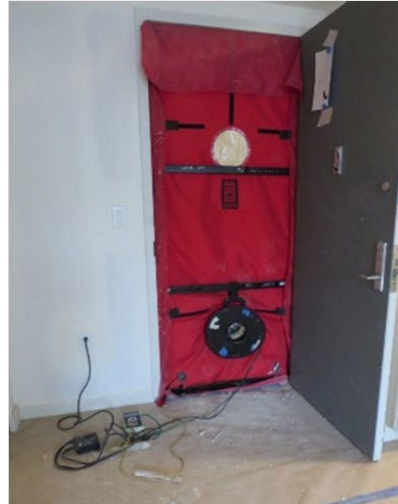
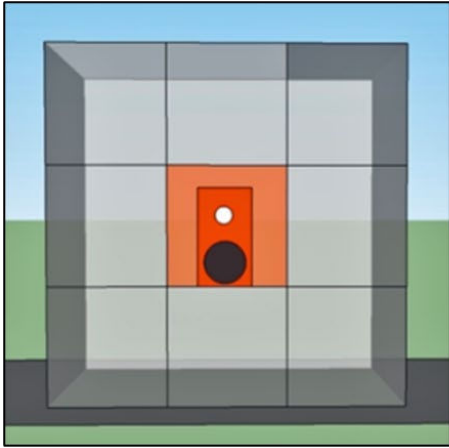
- If there is visual evidence of water, take steps to dry and move to Moisture Content/Drying Survey.
- Stick surface of CLT only (not spline) every 1,000-1,500 s.f.
- Make adjustments for wood species and temperature.
- Any readings over 16% triggers a discussion about Moisture Content/Drying Survey.
- Log readings.



5

**Success with Airtightness
Testing**

Success with Airtightness Testing

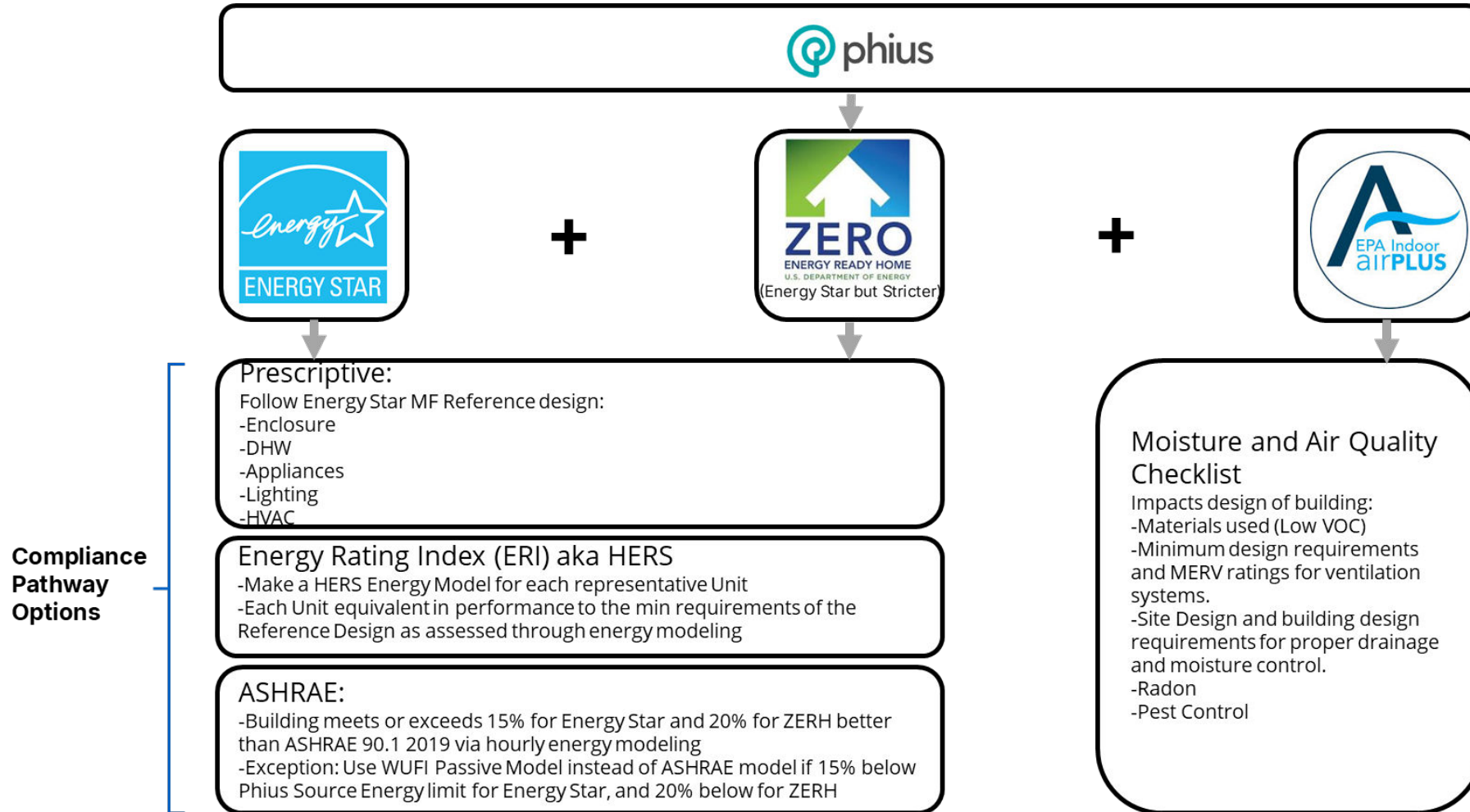


Compartmentalization Testing



Whole Building Airtightness Testing

Phius Co-Requisite Programs

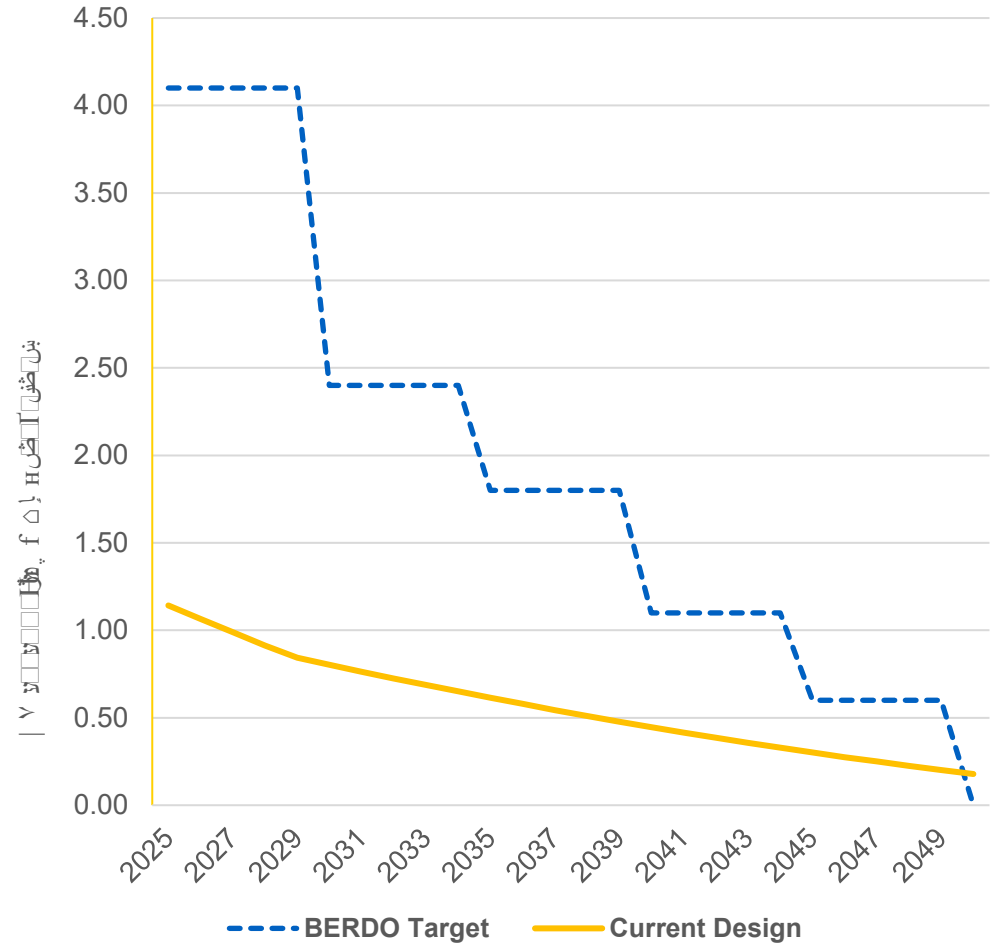
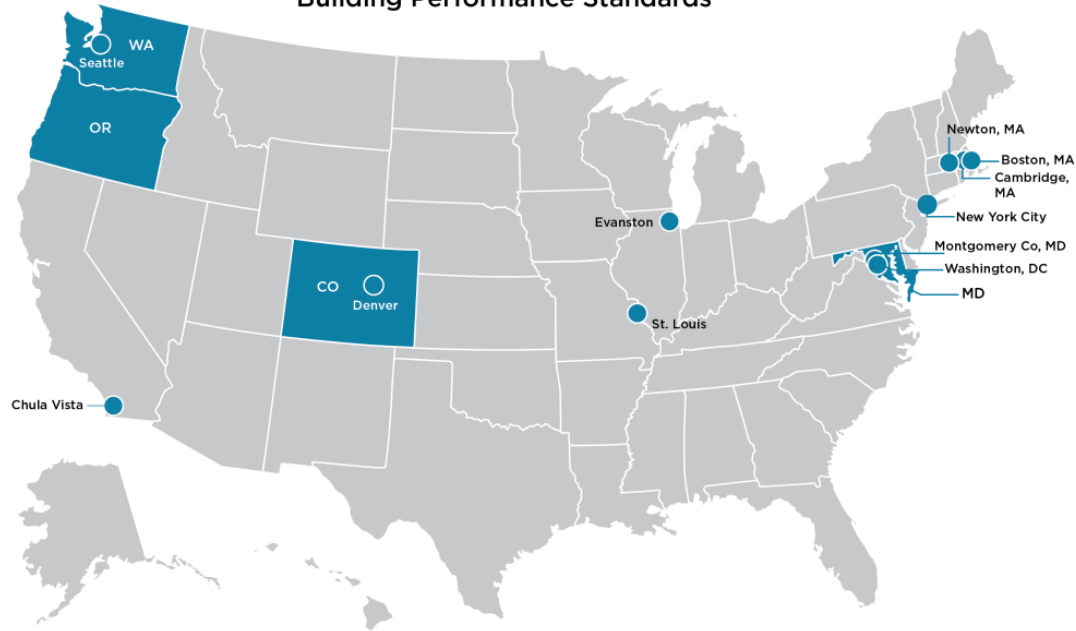


6

Critical Mass

Building Performance Standards

U.S. City and State Policies for Existing Buildings: Building Performance Standards



Broader Implications

We're trying to drive towards a way of achieving productivity and efficiency so we're getting to lower or stabilized construction costs without making these things lower quality, and without hurting the labor side of things. It makes the labor easier and less expensive so we can produce a whole lot more housing and put more people to work.

– Addie Grady, Leggat McCall



Thank You

asteingiser@rdh.com

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SCIENCE