Mastering Prefabricated Rainscreen Walls

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SGH

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2

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3

Presenters Bio

Rebecca Herkes, P.E.

Senior Consulting Engineer

Experience:

- 10 years with SGH Chicago Office
- Expertise in new construction, contemporary cladding, glazing, roofing and waterproofing, and investinvestigating non-performing building enclosures

Peter Babaian, P.E., S.E.

Principal

Experience:

- 22 years with SGH (Chicago and Boston)
- Expertise in exterior enclosure consulting for new construction, rehabilitating existing structures and enclosures, historic preservation, building enclosure commissioning, investigating non-performing building enclosures, and providing expert services related to construction litigation

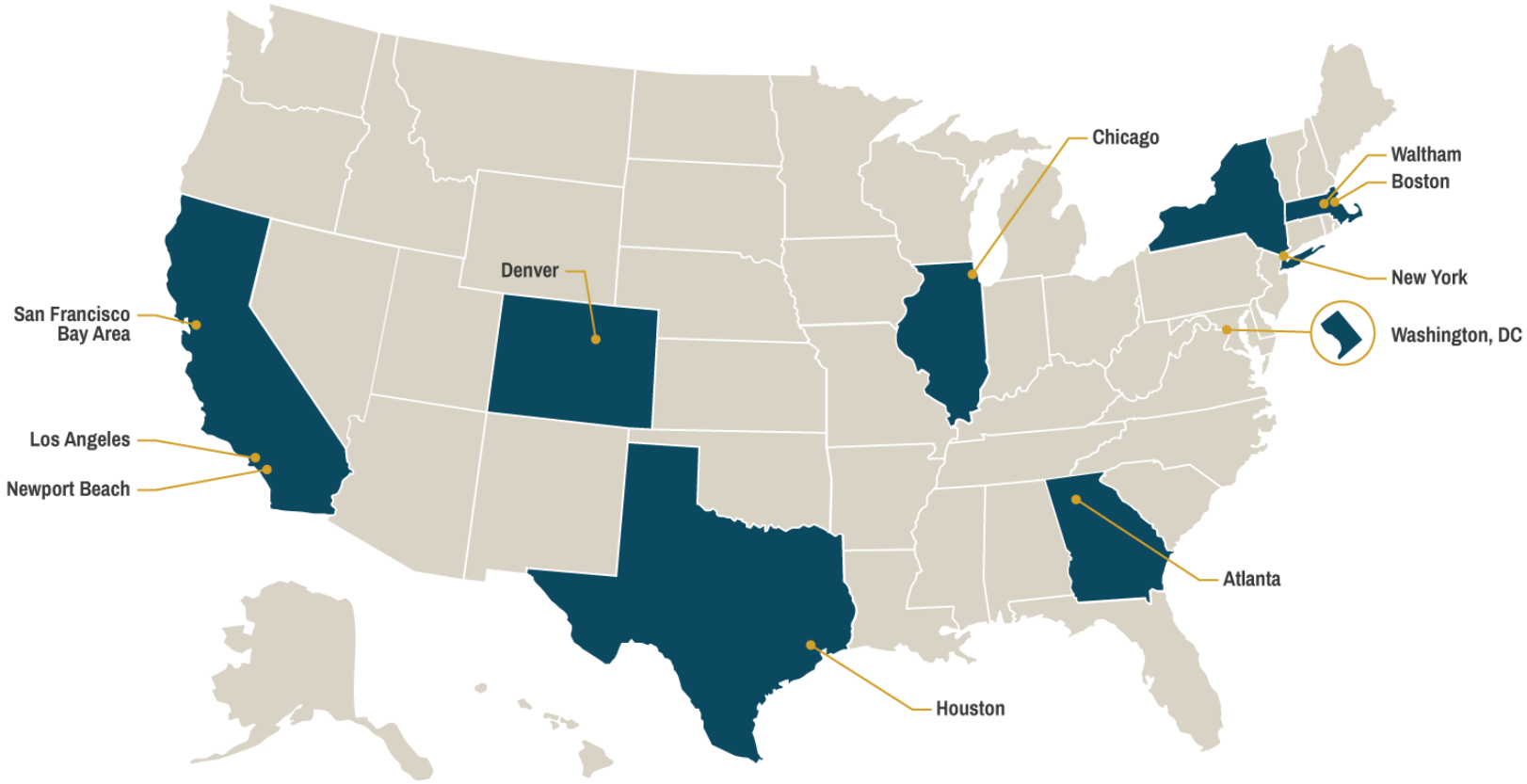
OUR FIRM

Simpson Gumpertz & Heger is a national engineering firm committed to delivering holistic advice for our clients' most complex challenges.

FACTS

YEAR FOUNDED	EMPLOYEES	TECHNICAL STAFF
1956	750	600+

LOCATIONS


Chicago
Waltham
Boston
New York
Washington, DC
Denver
San Francisco
Bay Area
Los Angeles
Newport Beach
Atlanta
Houston

LEARNING OBJECTIVES

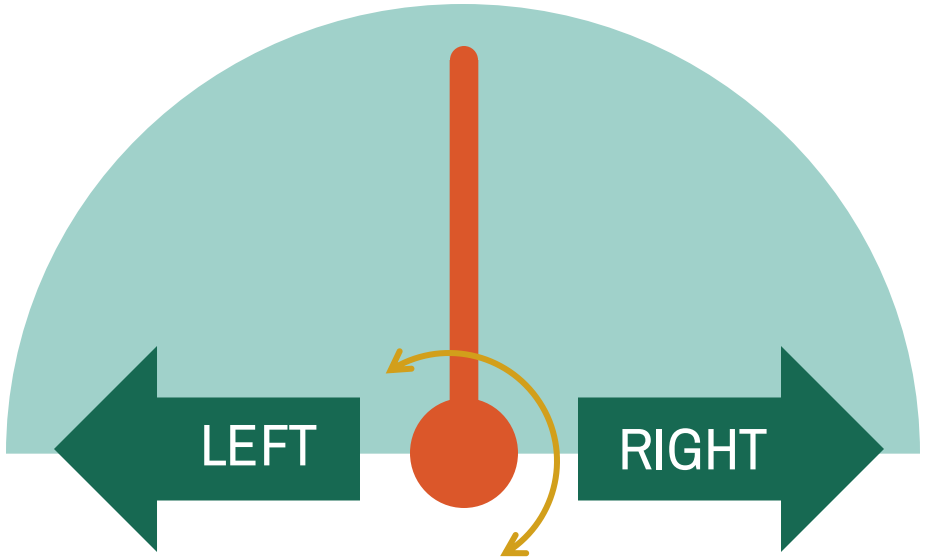
1. Evaluate the potential **advantages** and **challenges** of prefabricated construction.
2. Compare the three different **strategies** for prefabricated construction of rainscreen wall systems.
3. Coordinate **cladding selection** and **joint design** for a specific prefabrication strategy.
4. Optimize prefabrication through early **coordination** and appropriate **quality assurance** practices.

AGENDA

- Introductions and topic icebreaker – 10 minutes
- Prefabrication overview – 5 minutes
- Rainscreen system considerations – 20 minutes
  - Back-up wall panels only (cladding excluded)
  - Pre-clad wall panel (joints excluded)
  - Clad and gasketed panels (joints included)
- Cases study takeaways – 10 minutes
- Questions – 15 minutes

ICE BREAKER

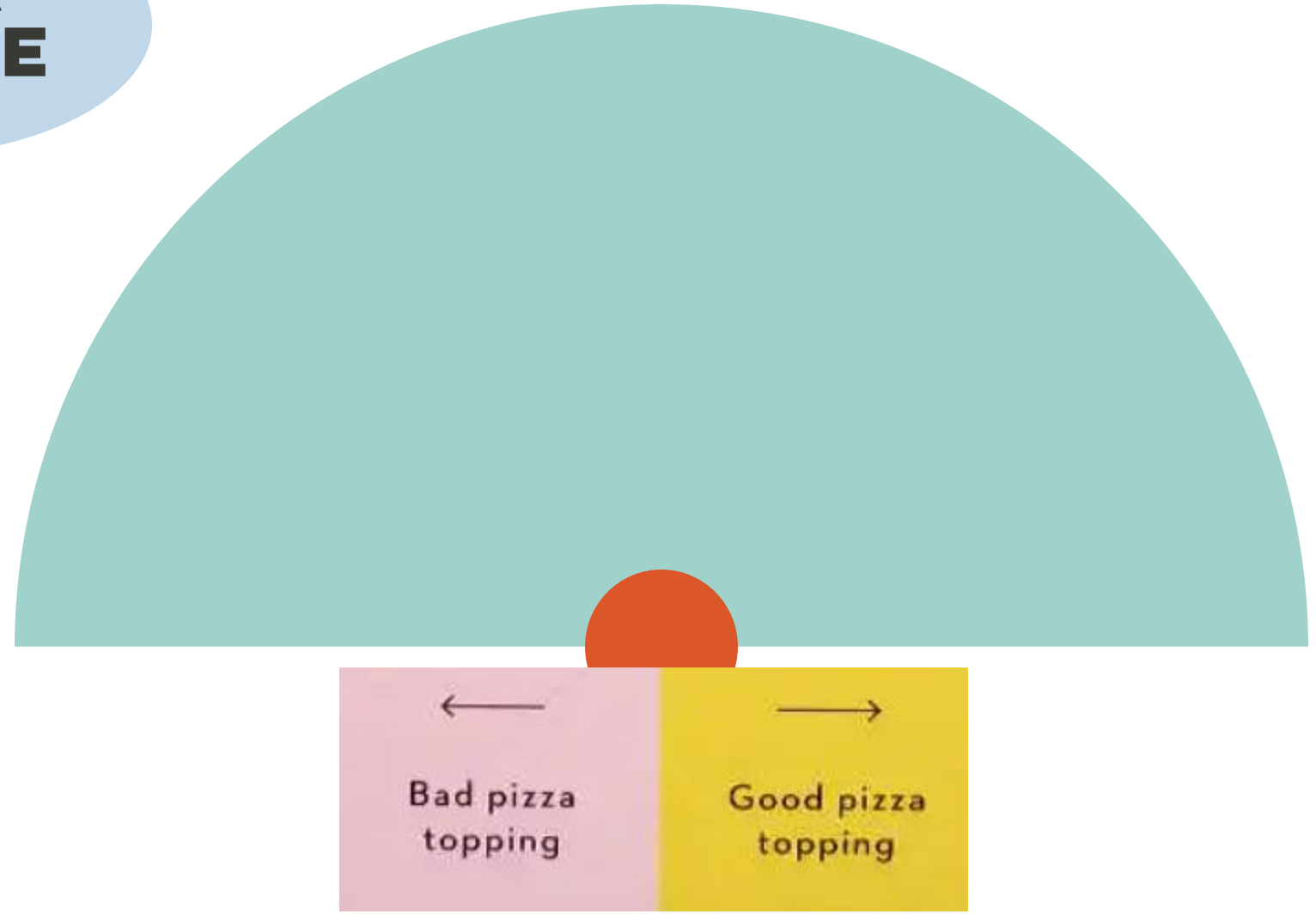
WAVELENGTH BY CMYK



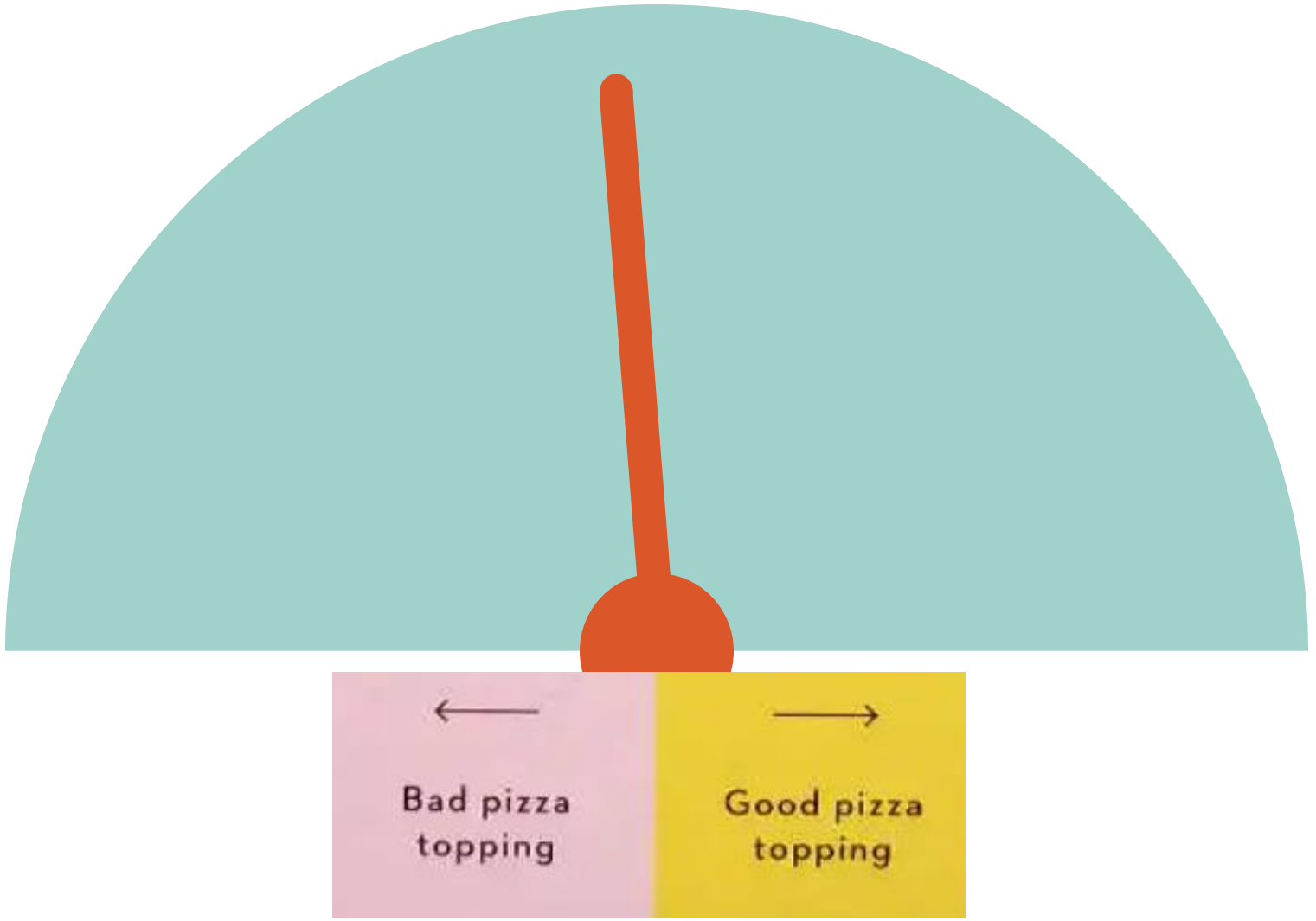
- 180° dial indicator
- Left extreme
- Right extreme
- Prompt: “On a scale from left extreme to right extreme, where would you place ____(clue)____?”

EXAMPLE

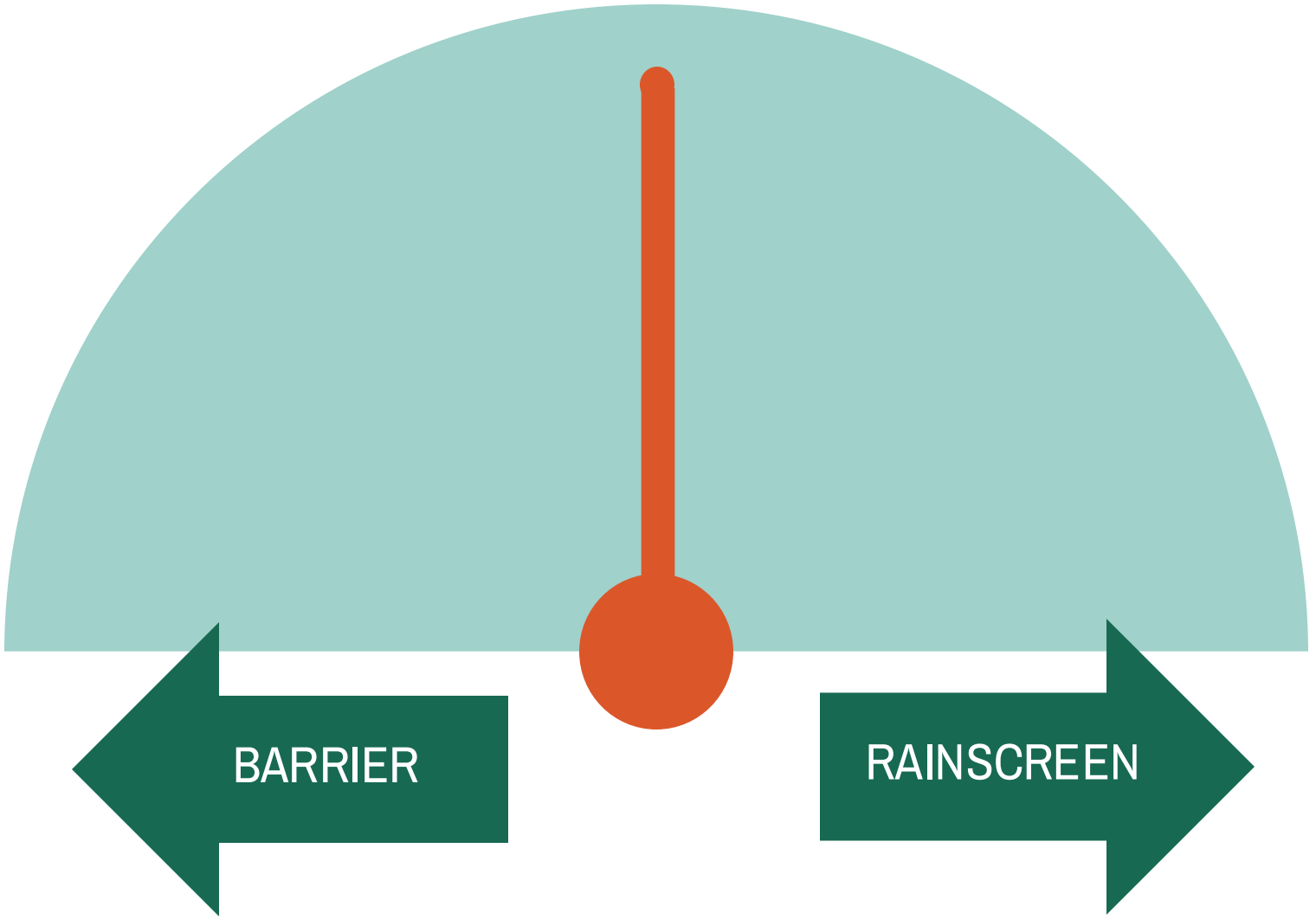
EXTRA CHEESE



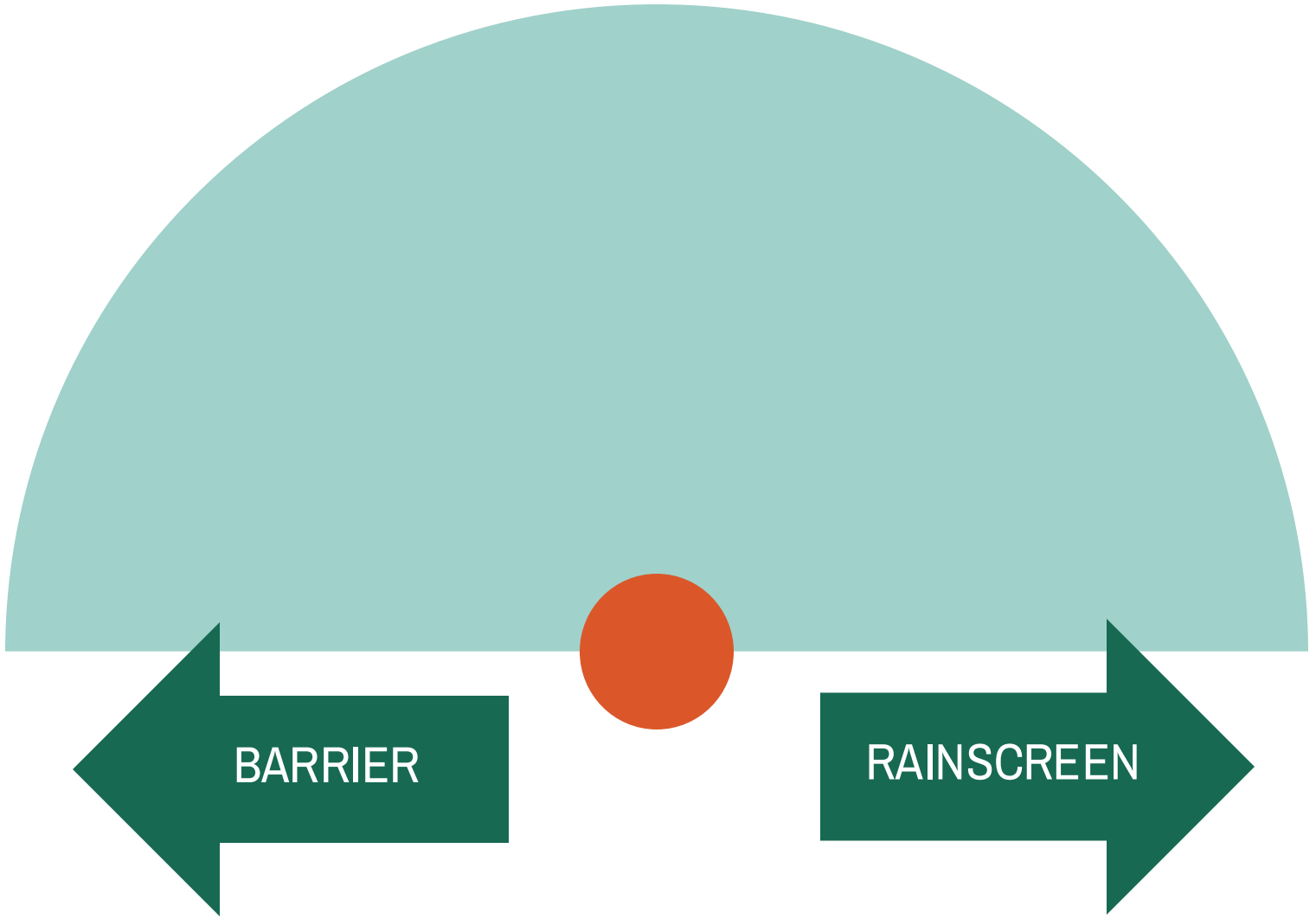
EXTRA CHEESE



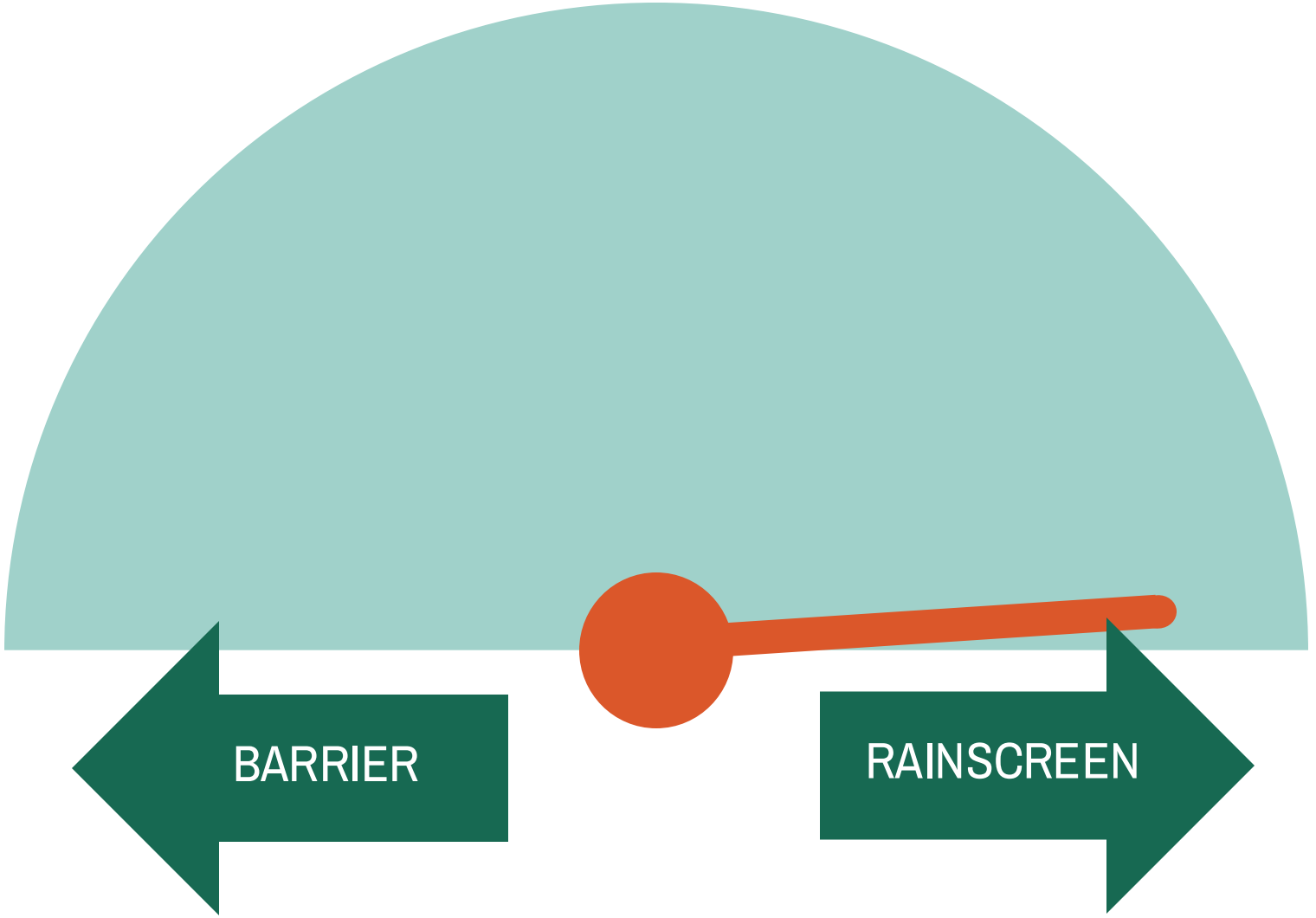
BARRIER SYSTEM VS. RAINSCREEN SYSTEM



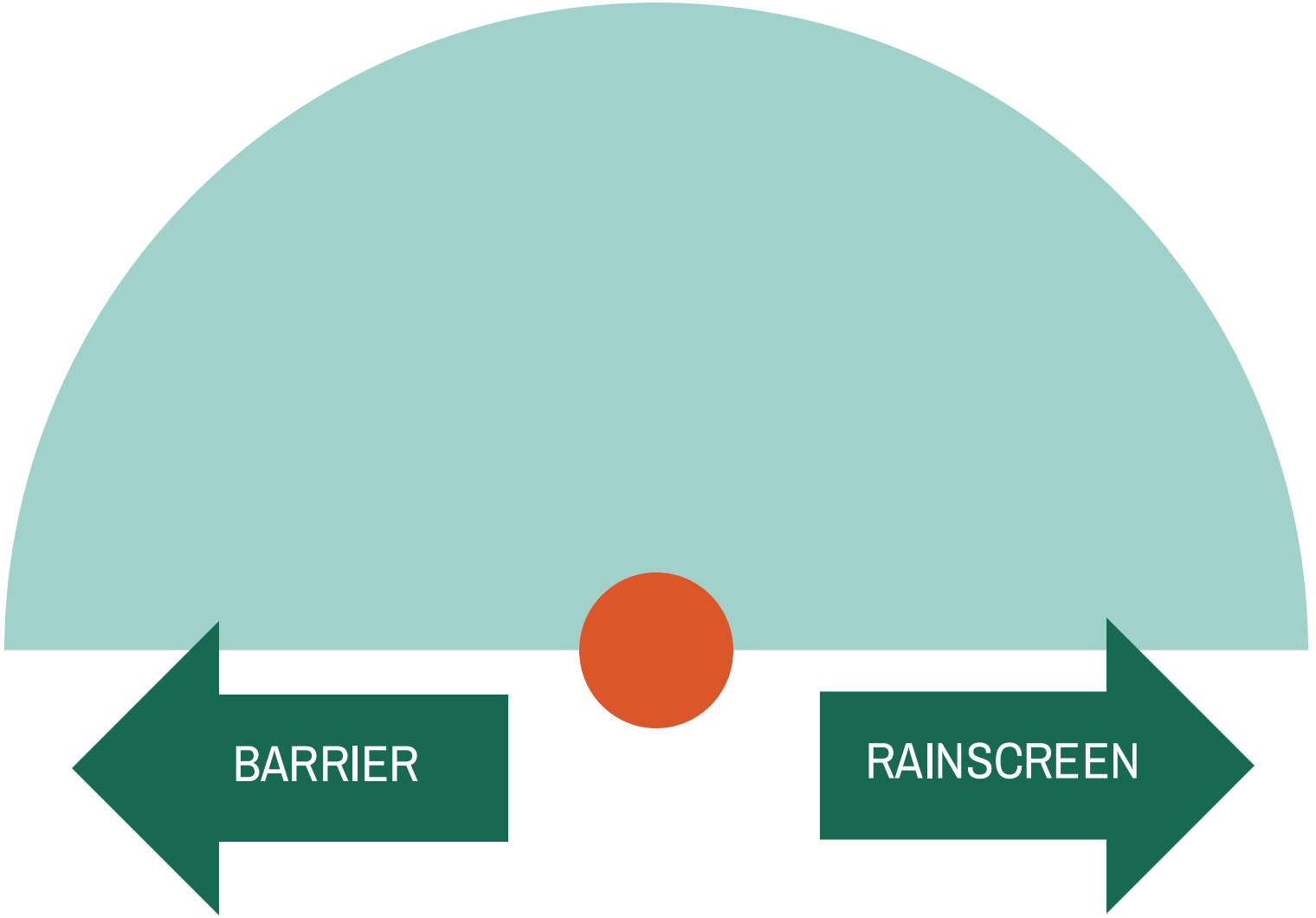
METAL PANEL CLADDING



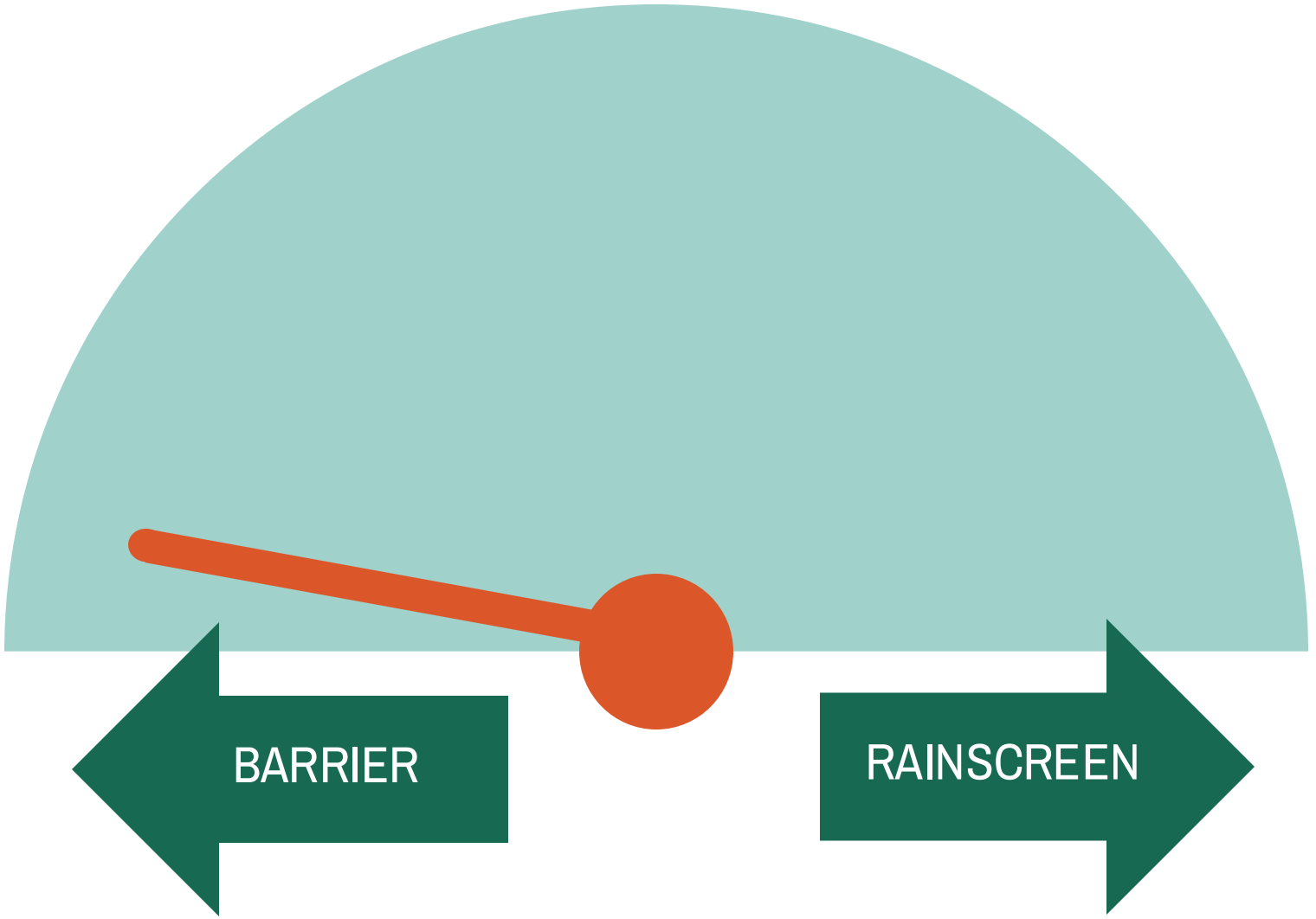
METAL PANEL CLADDING



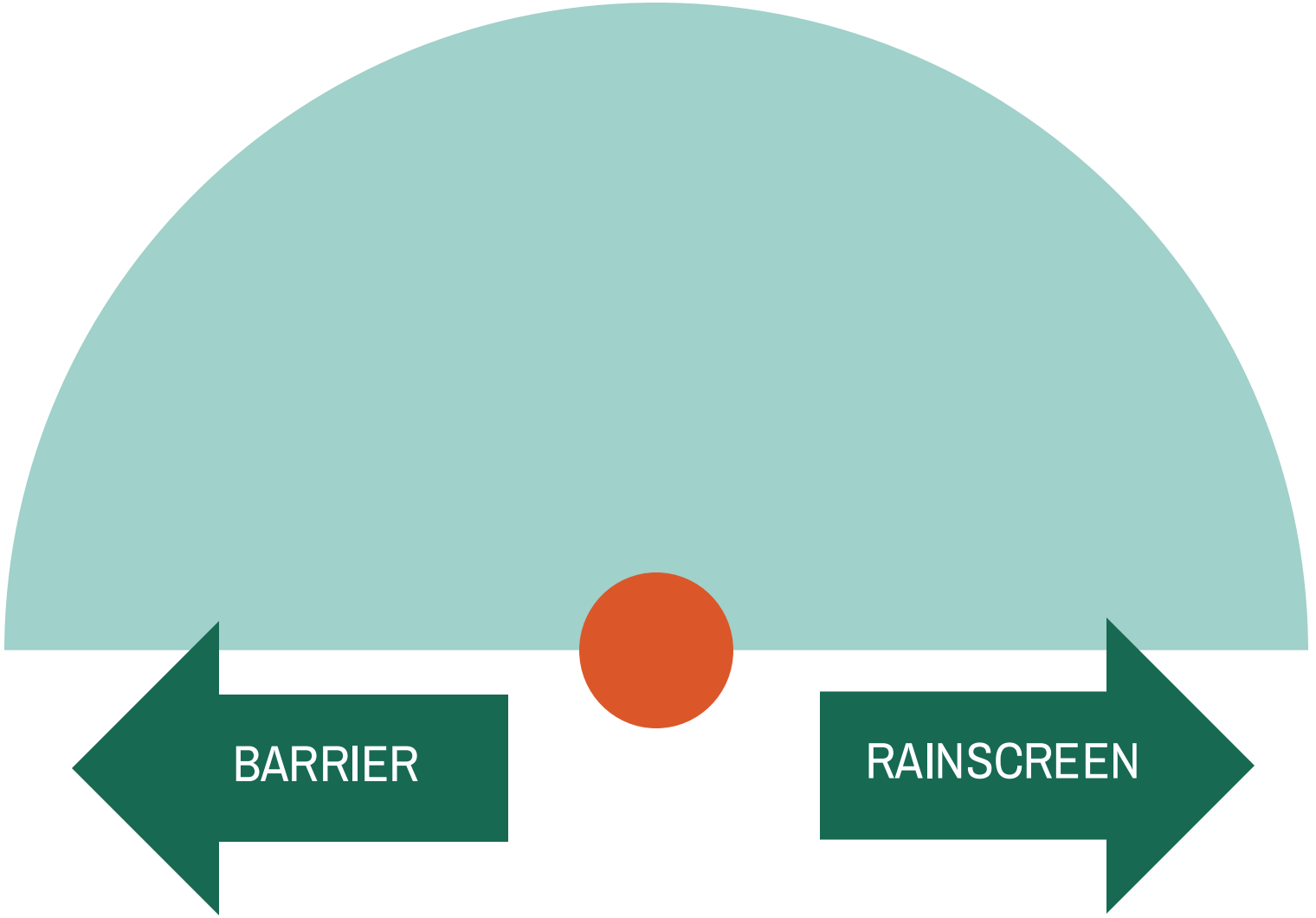
PRECAST CONCRETE PANELS



PRECAST CONCRETE PANELS



DRAINED EIFS



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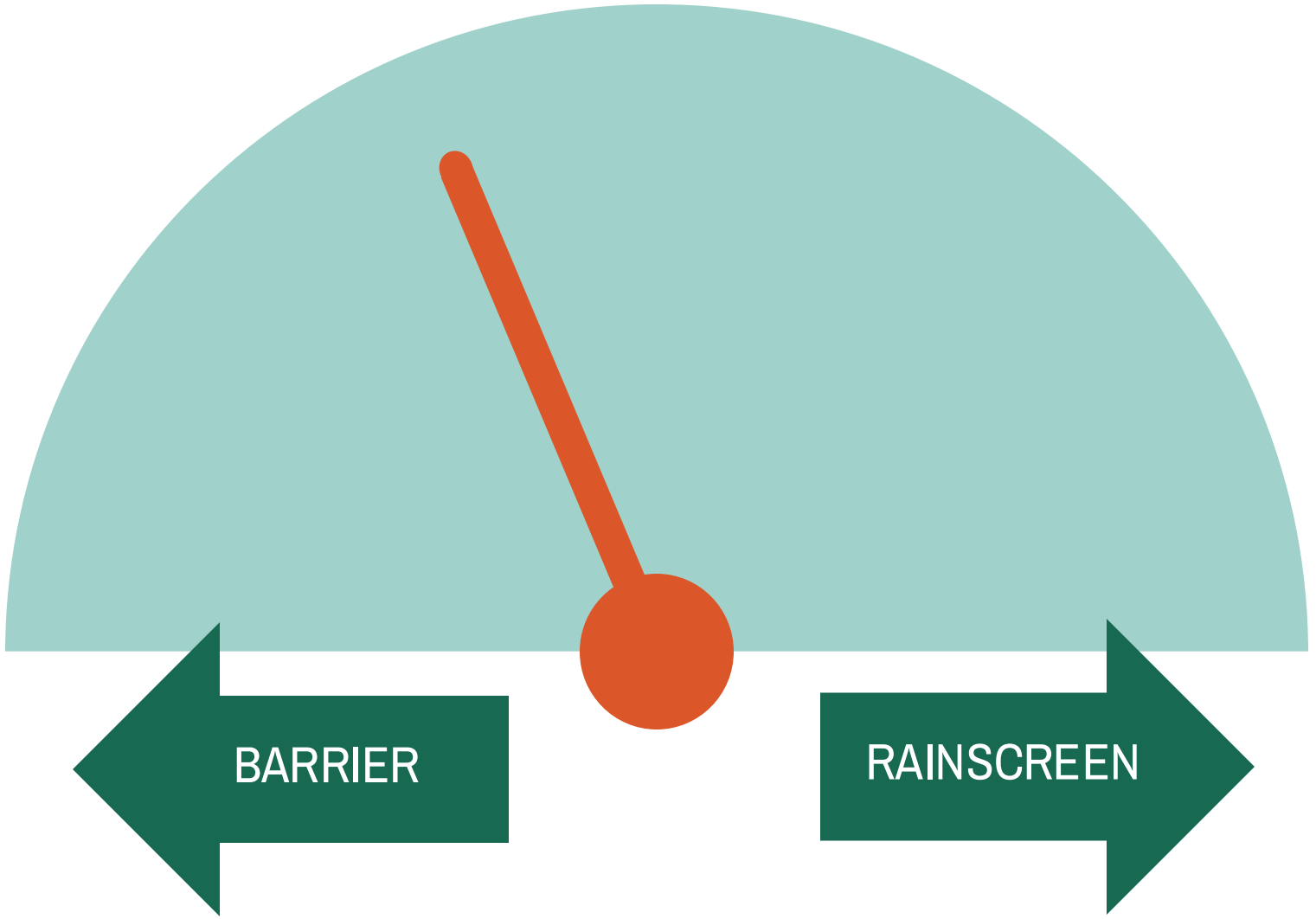
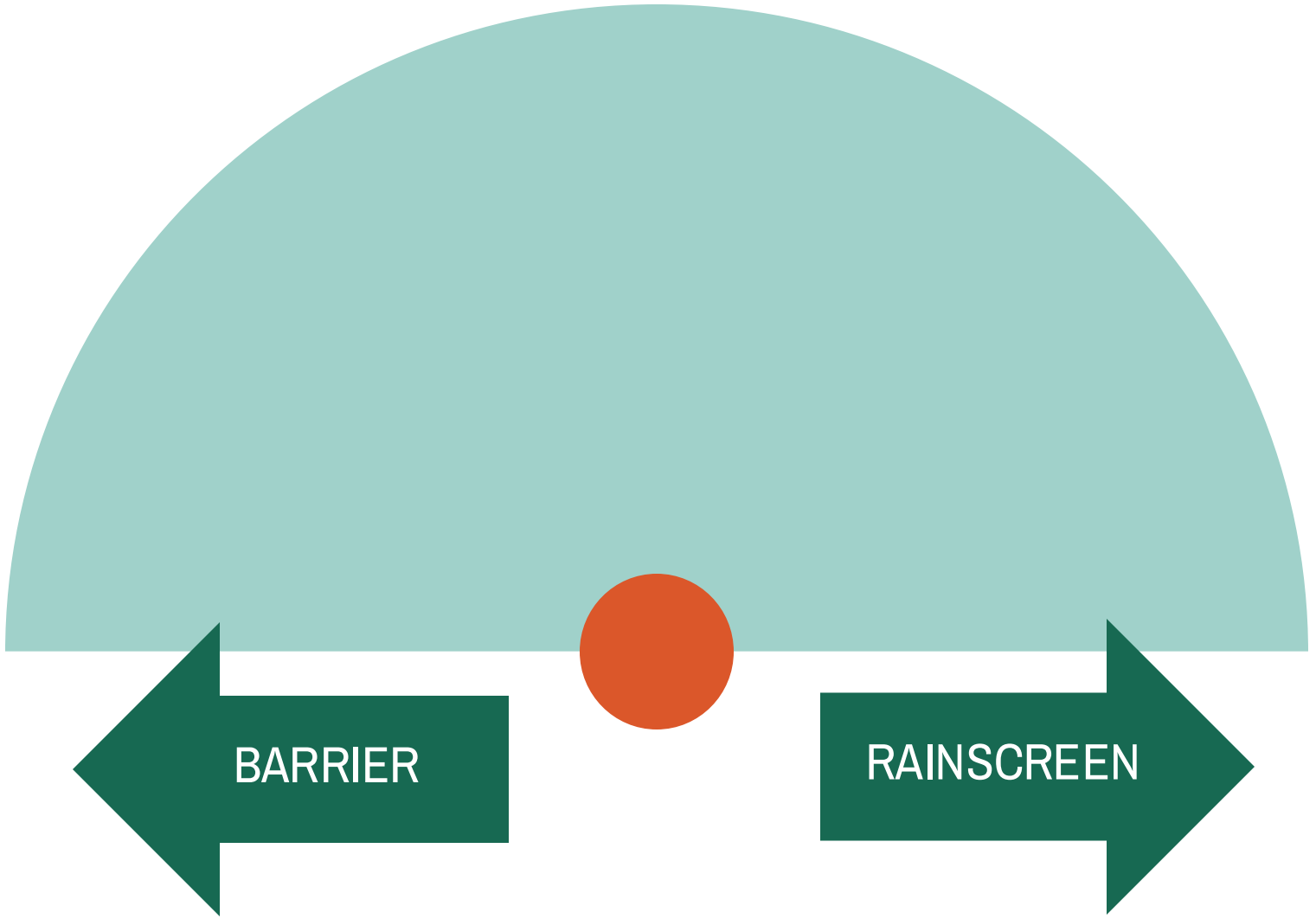
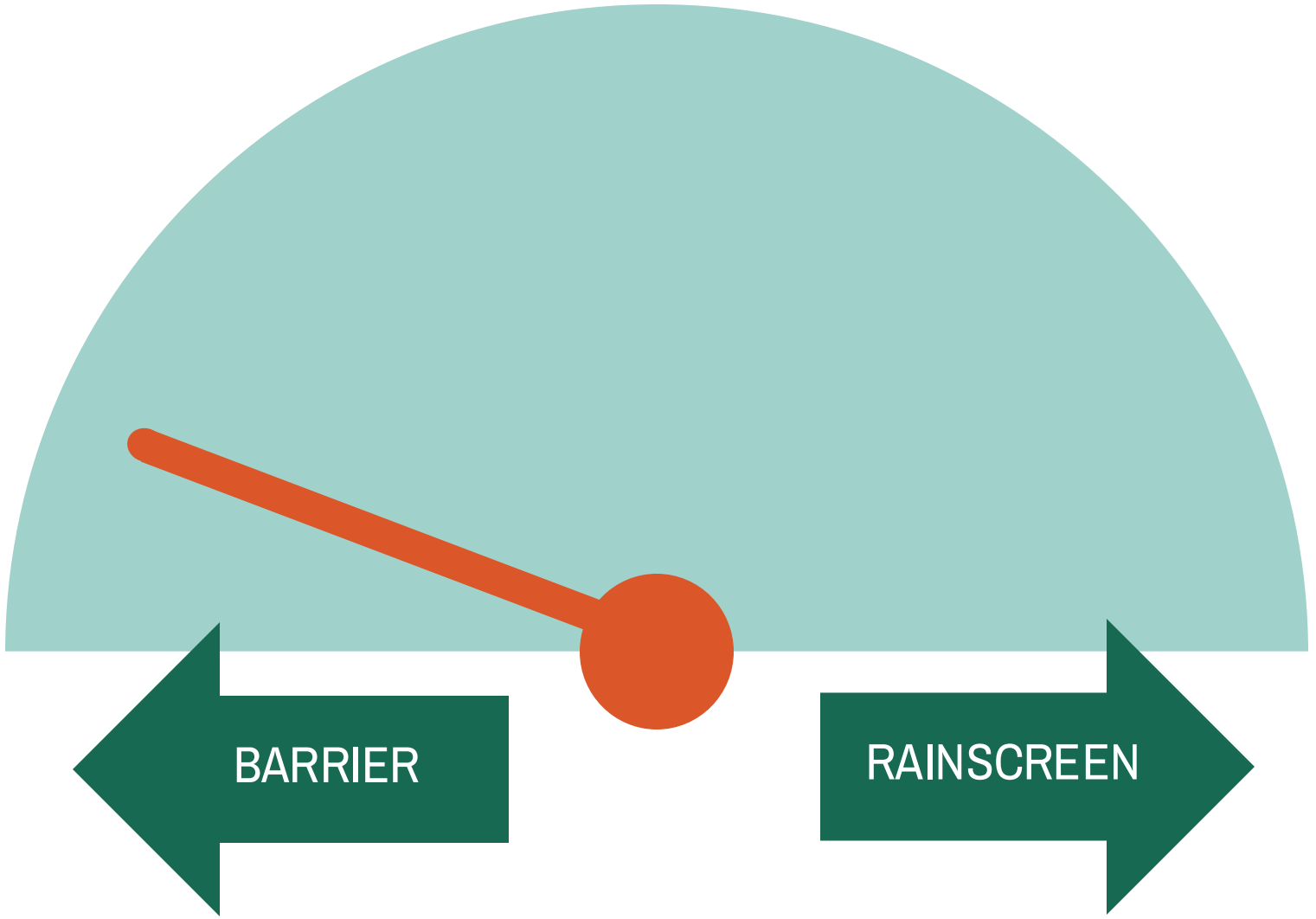


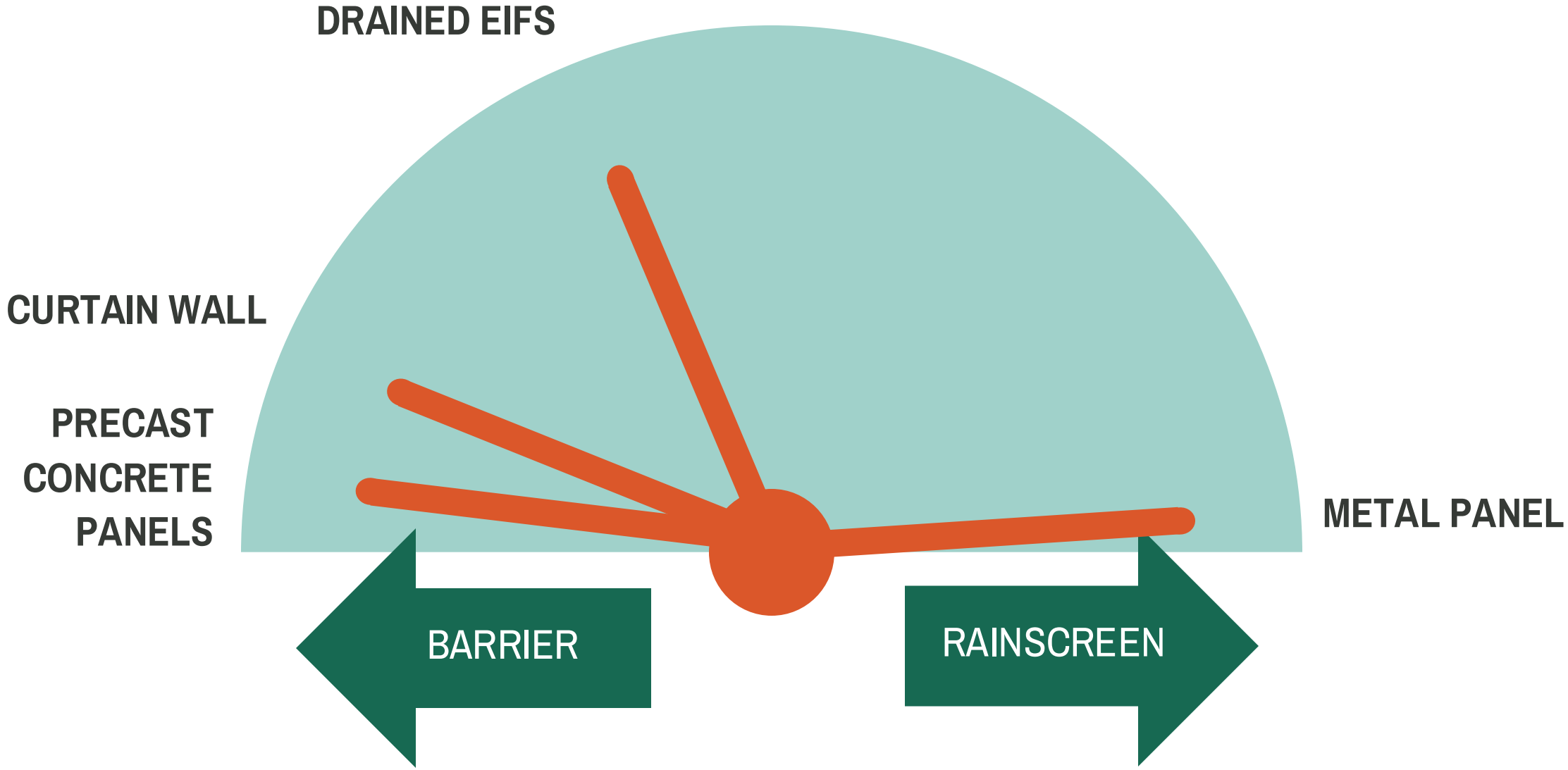
CURTAIN WALL



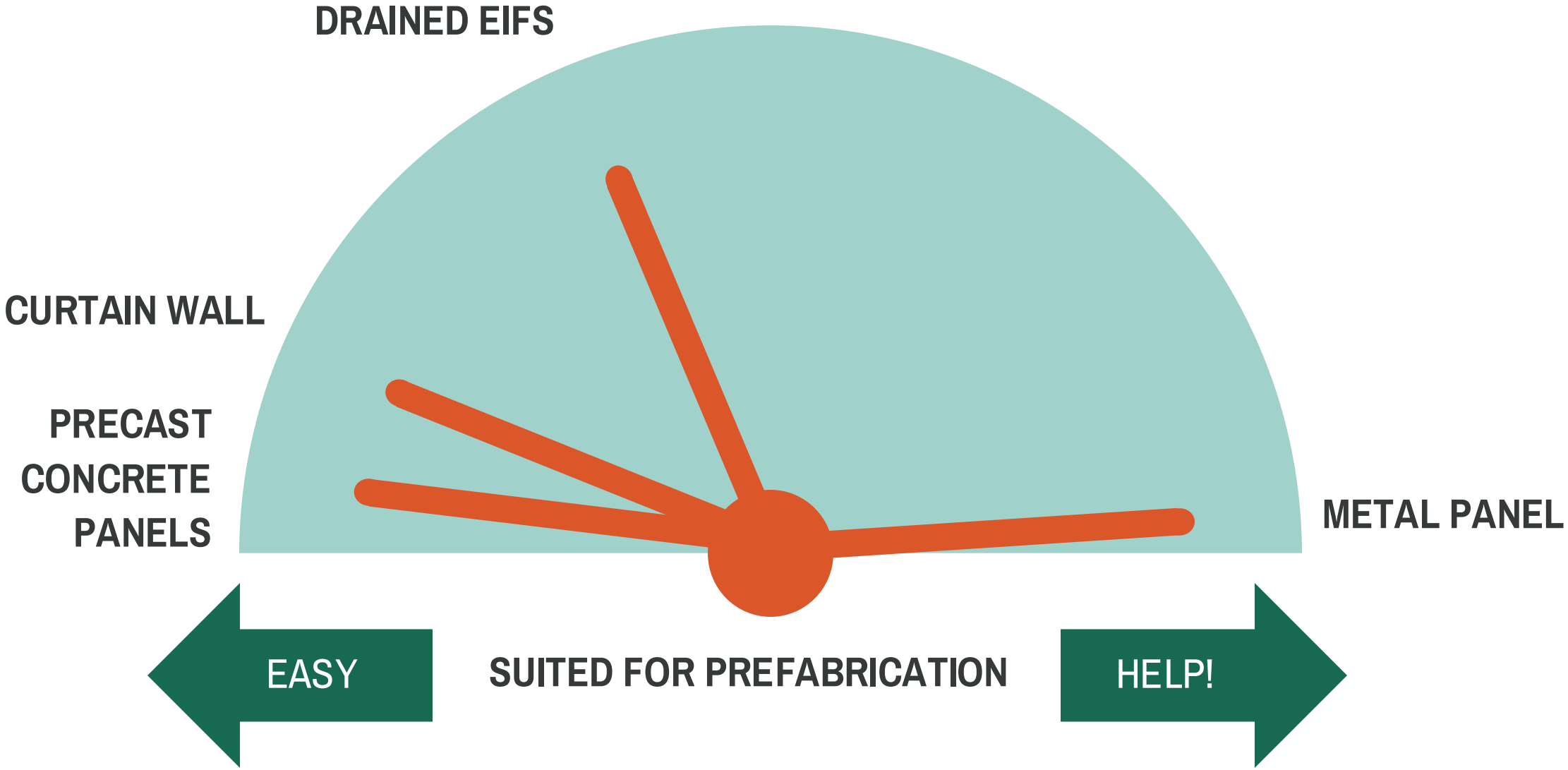
CURTAIN WALL



SUMMARY


DRAINED EIFS
CURTAIN WALL
PRECAST CONCRETE PANELS
METAL PANEL
BARRIER
RAINSCREEN

WHAT DOES THIS HAVE TO DO WITH PREFABRICATION?



OVERVIEW OF PREFABRICATION

EXTERIOR WALL PREFABRICATION

PRECAST CONCRETE

MODULAR HOMES

"MEGA PANELS"

UNITIZED CURTAIN WALL

WOOD AND METAL FRAMED WALL PANELS

EXTERIOR WALL PREFABRICATION

PRECAST CONCRETE

MODULAR HOMES

"MEGA PANELS"

UNITIZED CURTAIN WALL

WOOD AND METAL FRAMED WALL PANELS

STICK-BUILT OVERVIEW

Stick-Built Benefits:

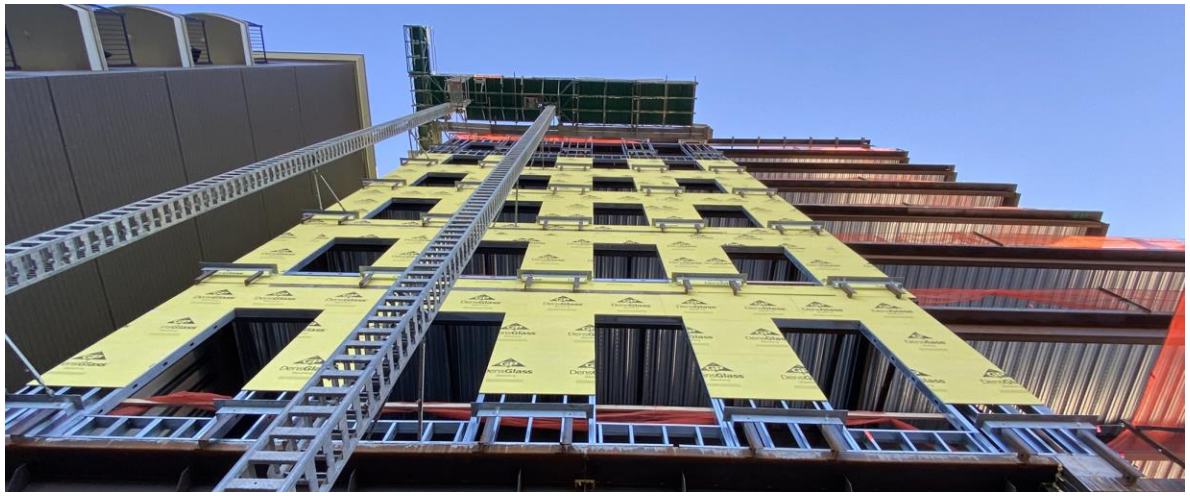
- Flexibility
- Detailing
- Shorter lead time
- Fewer materials limitations
- Layer-by-layer quality assurance

Stick-Built Drawbacks:

- Installation time
- Multiple access iterations
- Poor site conditions/weather
- Inconsistent quality
- Need for site space

Stick-Built Suitability:

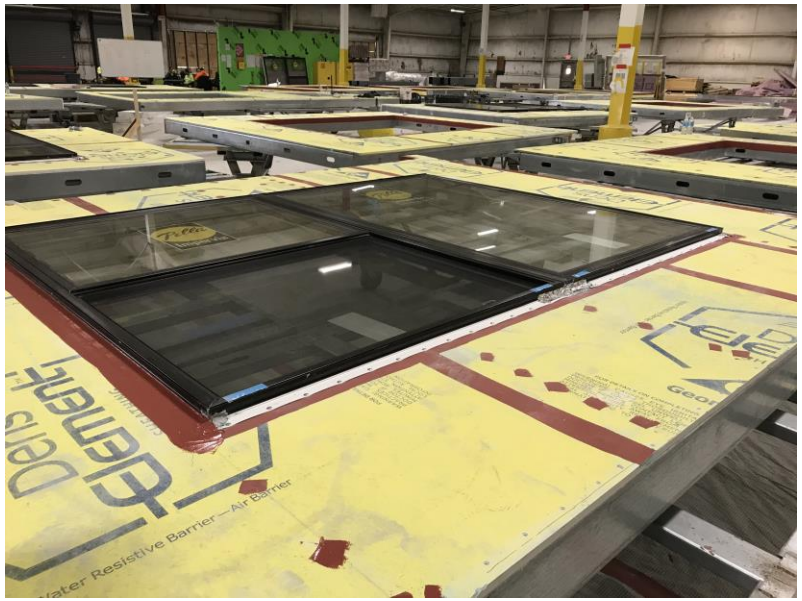
- Small projects; limited height
- Unique/complect façade
- Repair and rehab
- Unrestricted site footprint



PREFABRICATION OVERVIEW

Prefabrication Benefits:

- Flexibility
- Consistent quality
- Speed of installation
- Ideal construction environment

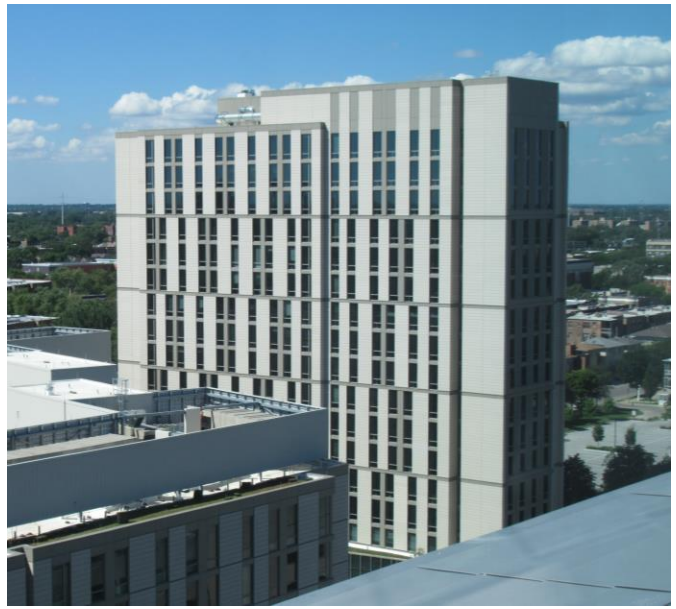


Prefabrication Drawbacks:

- Lead time
- Detailing
- Lack of system flexibility
- Lack of adaptability onsite
- Increased crane time
- Joint performance
- Potential aesthetic impact

Prefabrication Suitability:

- Contractor involvement early
- Repetitive façade
- Limited site footprint
- Aesthetic flexibility



BENEFITS AND DRAWBACKS

	STICK-BUILT	PREFABRICATED
BENEFITS	• Lead time ↓ • Detailing at joints ⊘ • Flexibility ↑ • Material options ↑	• Installation time ↓ • Crane/access iterations ↓ • Site footprint ↓ • Quality ↑
DRAWBACKS	• Installation time ↑ • Crane/access iterations ↑ • Site footprint ↑ • Quality ↓	• Lead time ↑ • Detailing at joints 👎 • Flexibility ↓ • Material options ↓

CONSIDERATIONS FOR PREFABRICATION

DESIGN	Project Fit Cost / GC Coordination Design Assist / Specialty Contractors Planning
ENCLOSURE SYSTEMS	Architectural Layout / Aesthetics Cladding Selection Thermal Performance Joint Design
CONSTRUCTION	Trade Coordination Perimeter Conditions Quality / Factory QC Transportation Testing

MOST TO LEAST WORK ON SITE

Maximum Work On Site			Minimum Work On Site
Strategy (Identified by Last Layer/Component on Panel)	**#1** Water Resisting Barrier	**#2** Cladding	**#3** Joints
Extent of Prefabrication	Framing Sheathing WRB	Framing Sheathing WRB Cont. Insulation Cladding	Framing Sheathing WRB Cont. Insulation Cladding Joints

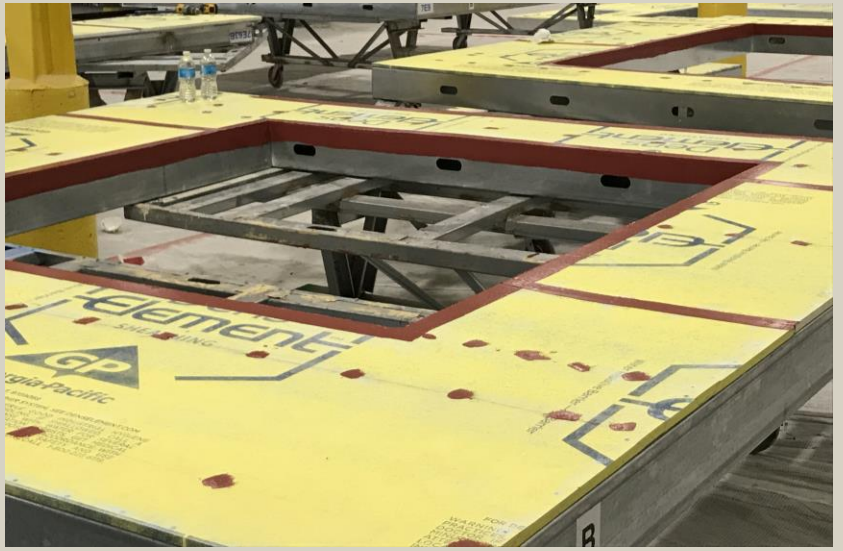
RAINSCREEN CONSIDERATIONS

STRATEGY #1: PREFAB INCLUDES WRB

FRAMING
SHEATHING
WATER RESISTING BARRIER

Big Picture

- Consider joint treatment
- Fewer access iterations
- Fewer trades onsite



STRATEGY #1: ADVANTAGES/DRAWBACKS

Advantages:

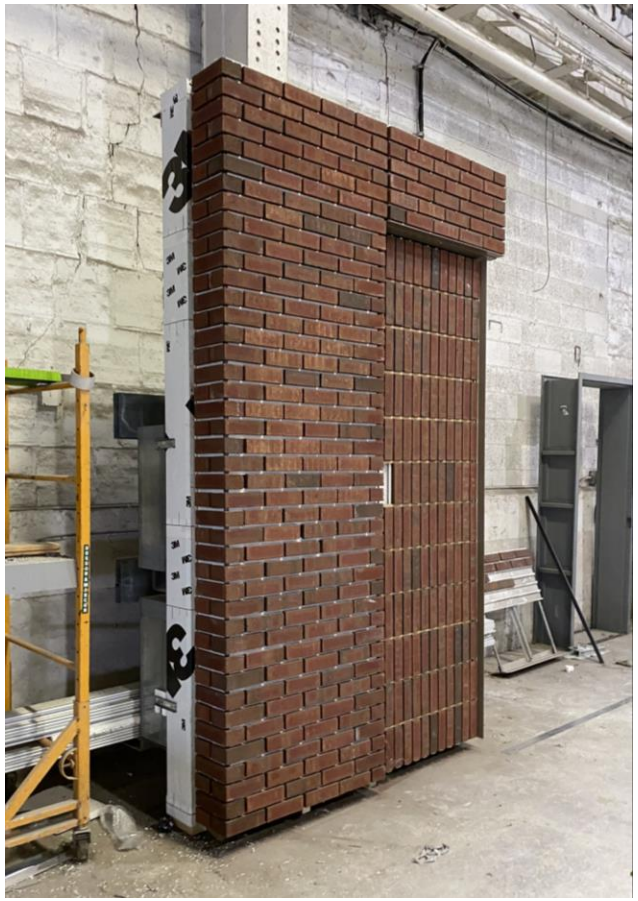
- Multiple options for joint treatment
- No gaps in insulation
- Cladding joints not required to align with the prefabricated panel joints
- Horizontal installation in climate-controlled environment
- Air barrier inspection onsite prior

Drawbacks:

- Potential for damage to the WRB during transportation
- Inspection/repairs (if needed) can significantly reduce prefab efficiencies

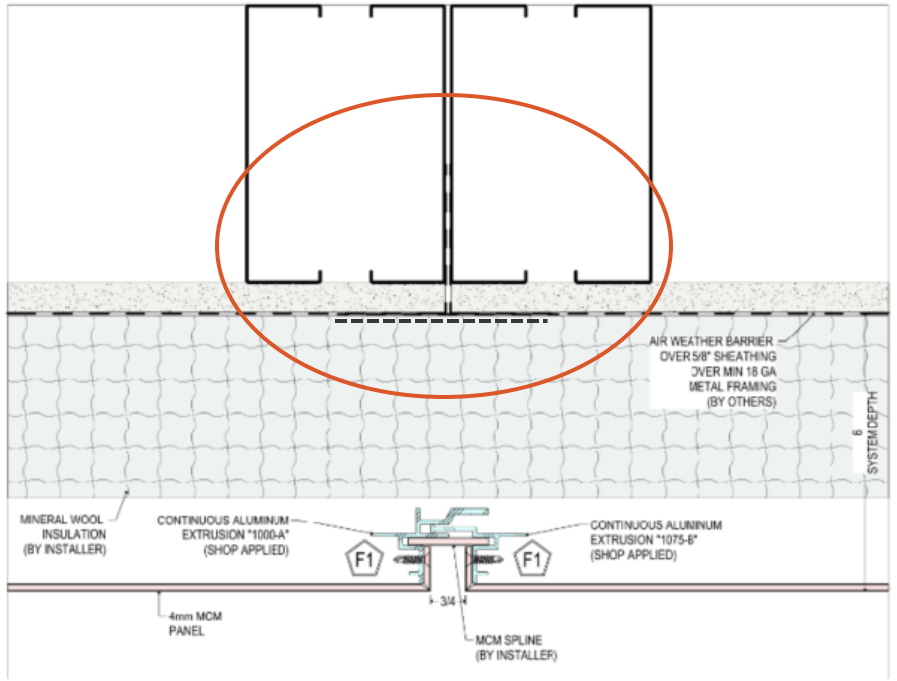
CONSIDERATIONS FOR RAINSCREEN SYSTEM

- Available cladding options: Unlimited*
  - *Full-depth brick masonry is not suited to most exterior wall panels



CONSIDERATIONS FOR RAINSCREEN SYSTEM

- Panel Joint Design:
  - Covering joints with self-adhering WRB offers best performance with no cladding impact
  - Post-installed cladding subframing systems allow cladding joints to vary from prefab panel joints
- Note increased importance of continuous insultation due to the thermal bridging at panel perimeters



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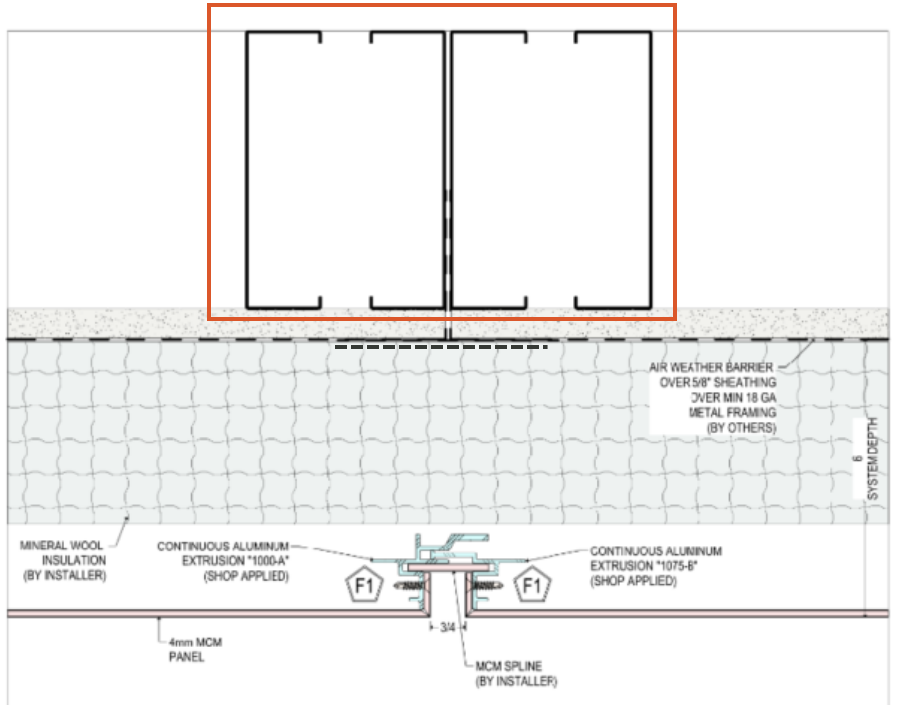


STRATEGY #2: PREFAB OUT TO CLADDING

FRAMING
SHEATHING
WATER RESISTING BARRIER
CONTINUOUS INSULATION
CLADDING

Big Picture

- Panel to panel joints will be visible on the building
- Access to joints will be limited
- Fewer trades on site
- Fewer access iterations

STRATEGY #2: ADVANTAGES/DRAWBACKS

Advantages:

- Significant time savings onsite
- Protection of the WRB after installation

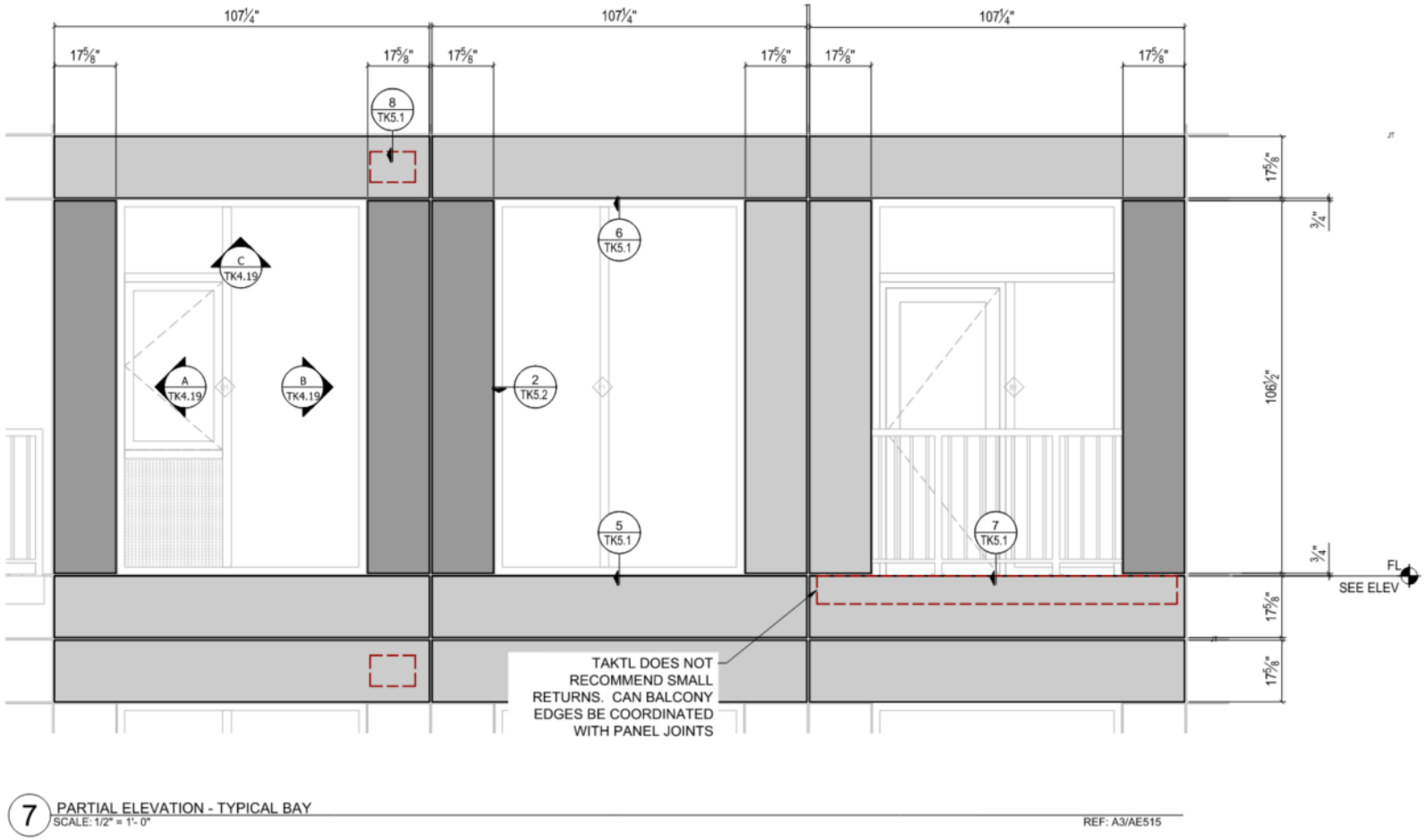
Drawbacks:

- Unable to inspect the WRB after installation onsite
- Limited cladding options (no full-depth masonry)
- Thermal bridging could be exacerbated since cladding and insulation gaps align with studs
- Less flexibility of joint detailing due to access
- Dual sealant joints are seen as sufficient, however more robust options could be considered (however uncommon)

CONSIDERATIONS FOR RAINSCREEN SYSTEM

Cladding Options

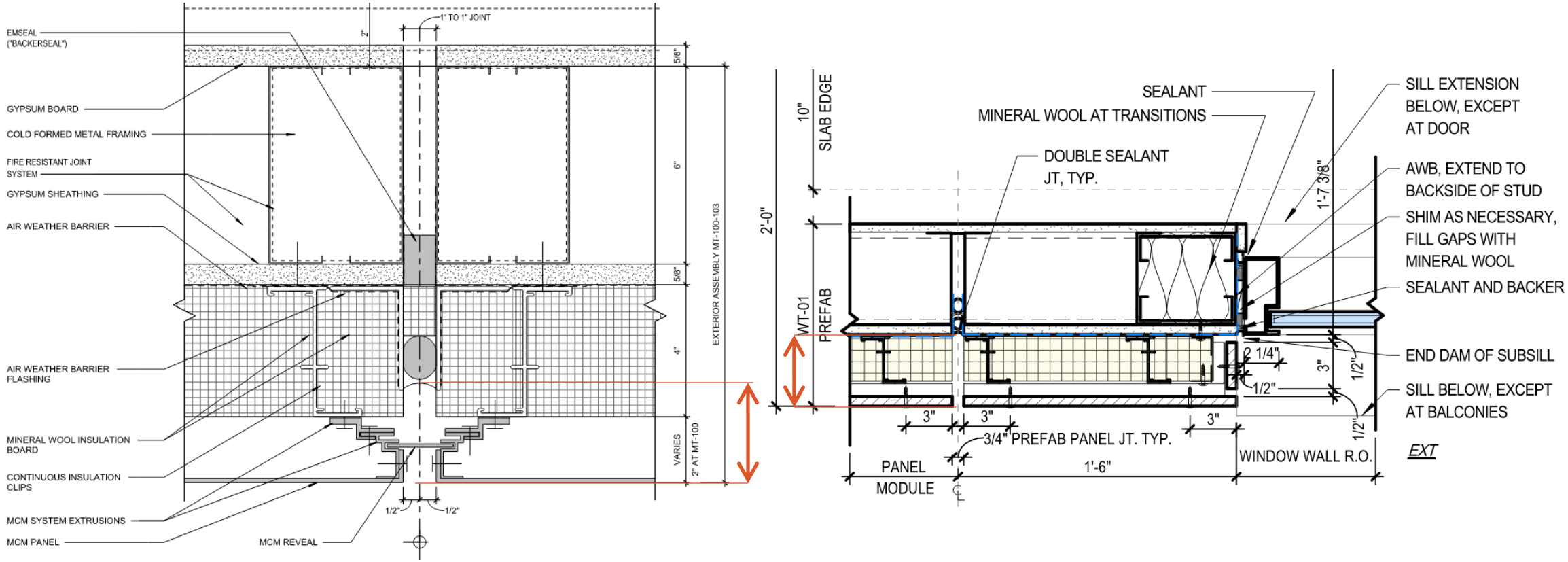
- Consider impact of using cladding that is not available in custom sizes.
  - Cost/waste
  - Durability



CONSIDERATIONS FOR RAINSCREEN SYSTEM

Panel Joint Design

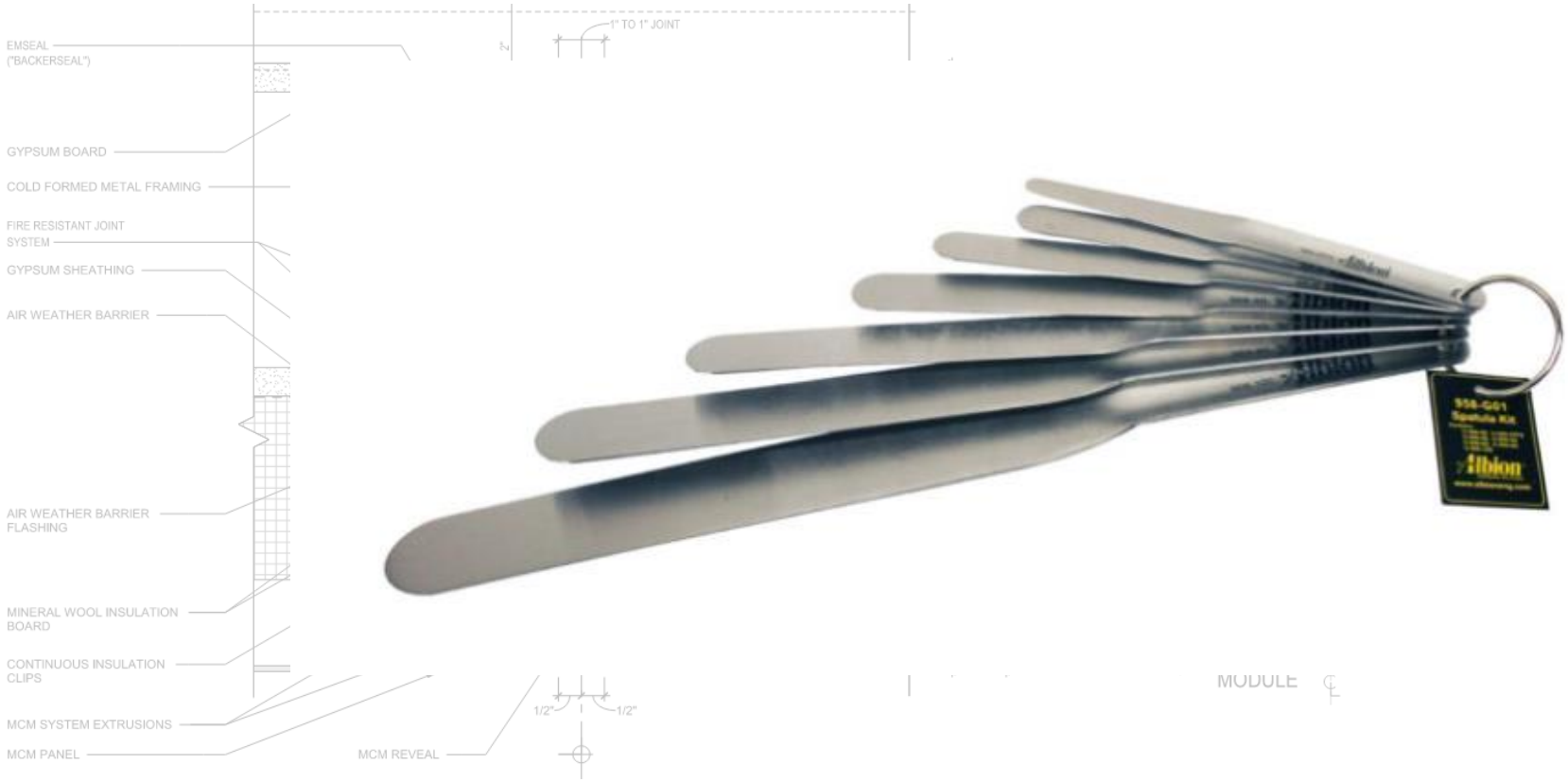
- Exterior sealant joint quality may improve with shallower cavity depth (<4”)

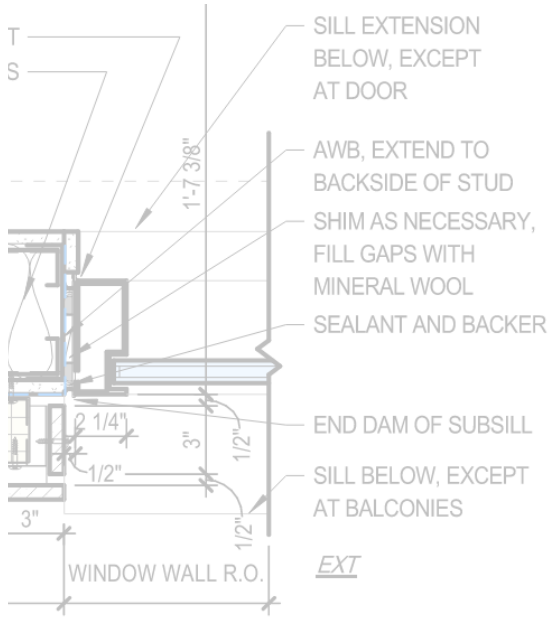


CONSIDERATIONS FOR RAINSCREEN SYSTEM

Panel Joint Design

- Exterior sealant joint quality may improve with shallower cavity depth **(12 in. maximum)**

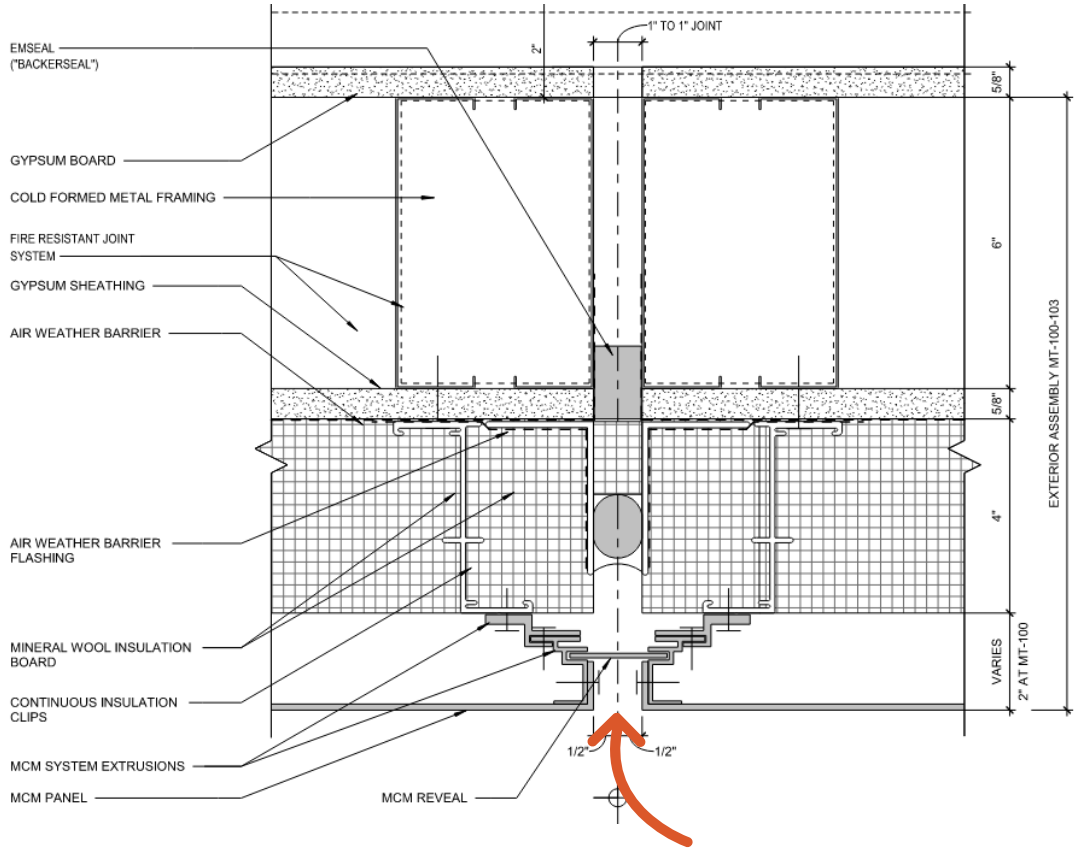


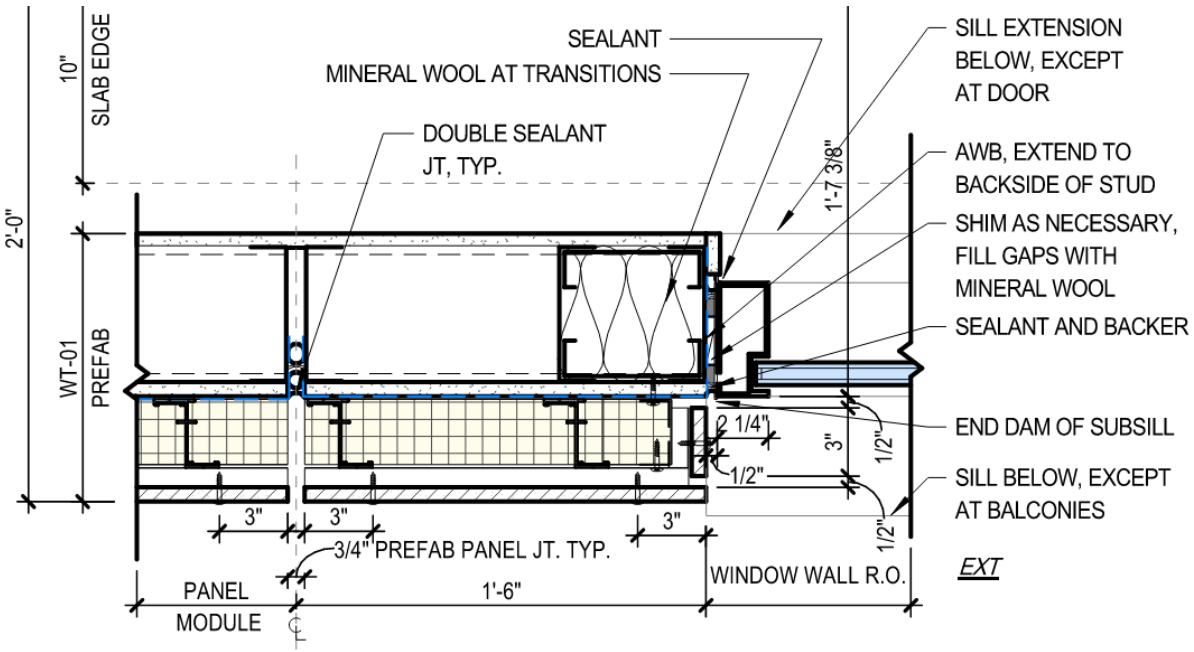


CONSIDERATIONS FOR RAINSCREEN SYSTEM

Panel Joint Design

- Vertical joints will give grid-like appearance; consider joint covers or post-installed cladding

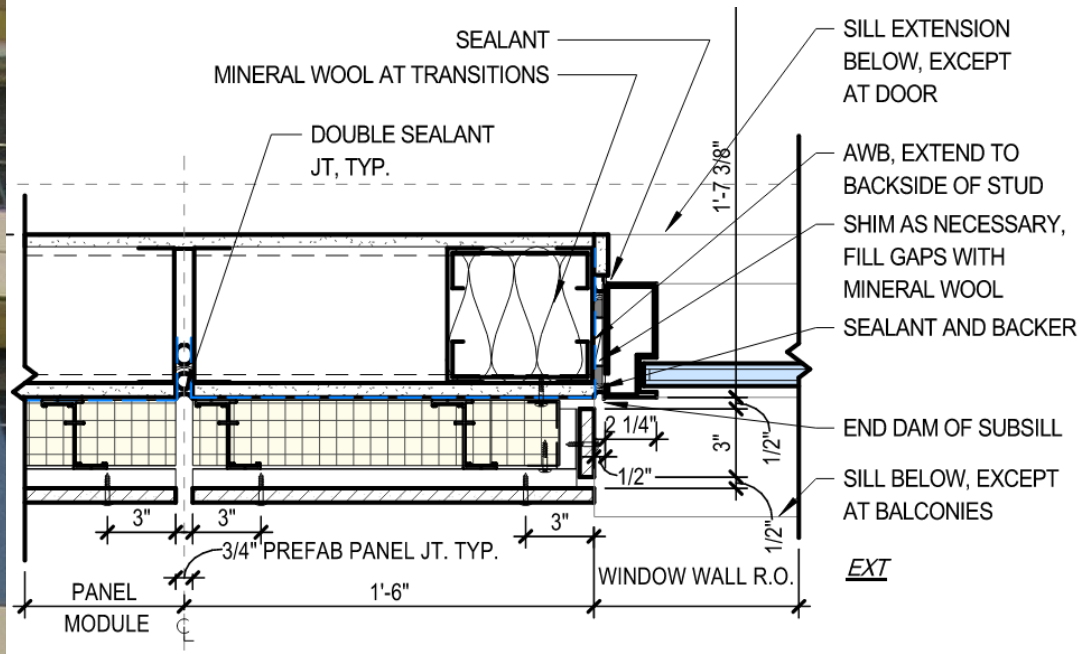




CONSIDERATIONS FOR RAINSCREEN SYSTEM

Panel Joint Design

- Panel joint tolerances may exceed cladding joint tolerances; plan for adjustments



CONSIDERATIONS FOR RAINSCREEN SYSTEM

Testing

- Perform WRB adhesion testing and inspection in the prefabrication shop

CONSIDERATIONS FOR RAINSCREEN SYSTEM

Testing

- Test panel-to-panel sealant joints (nozzle testing or destructive pull testing)
- Include panel-to-panel joints in performance mockup testing

STRATEGY #3: JOINTS INCLUDED IN PREFAB

FRAMING + SHEATHING
WATER RESISTING BARRIER
CONTINUOUS INSULATION
CLADDING
JOINTS

Big Picture

- Limited additional access iterations needed for opaque wall system
- Joint design and performance is critical

STRATEGY #3: ADVANTAGES/DRAWBACKS

Advantages:

- Maximum time savings onsite
- Fewer quality drawbacks
- Thermal bridging can be slightly mitigated

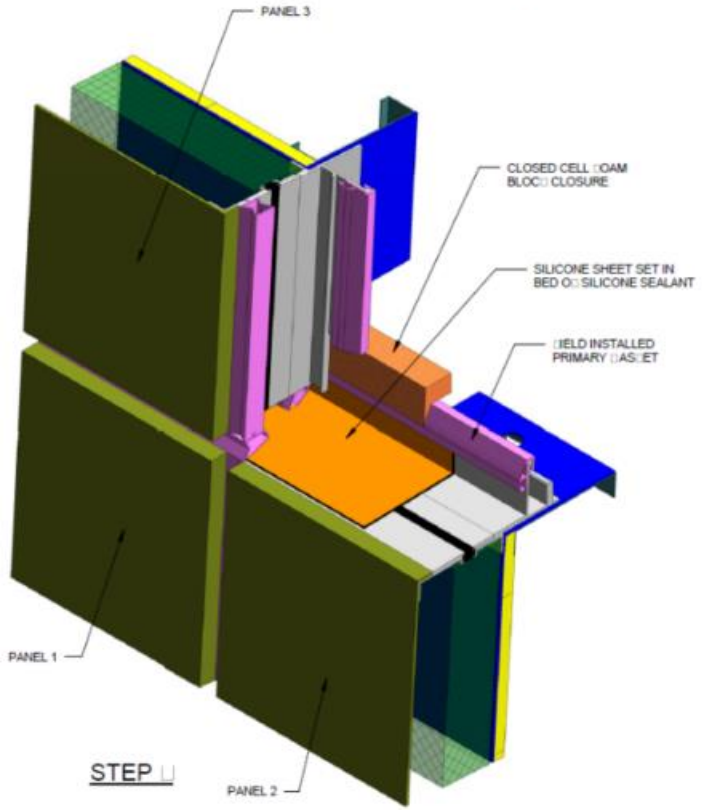
Drawbacks:

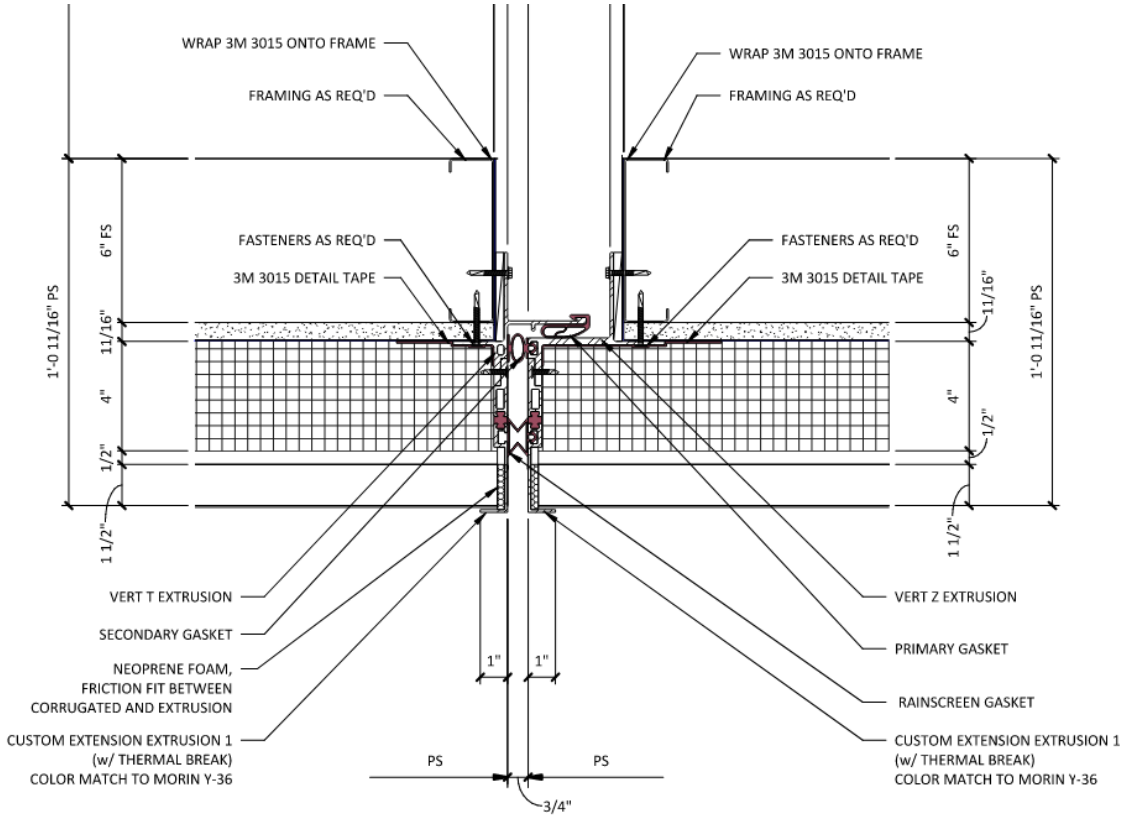
- Early coordination absolutely required
- Limited cladding options (no EIFS?)
- Transitions to other systems still require field detailing

CONSIDERATIONS FOR RAINSCREEN SYSTEM

Panel Joint Design

- Consists of multiple gaskets
- Delegated design (early design-assist project delivery recommended)





CONSIDERATIONS FOR RAINSCREEN SYSTEM

Cladding Options

- Not appropriate for EIFS (poor appearance, over design of a basic system)
- Best suited to metal panels to match metal perimeter extrusions

PROJECT EXAMPLES | LESSONS LEARNED

MULTI-USE TOWER | COLUMBUS, OH

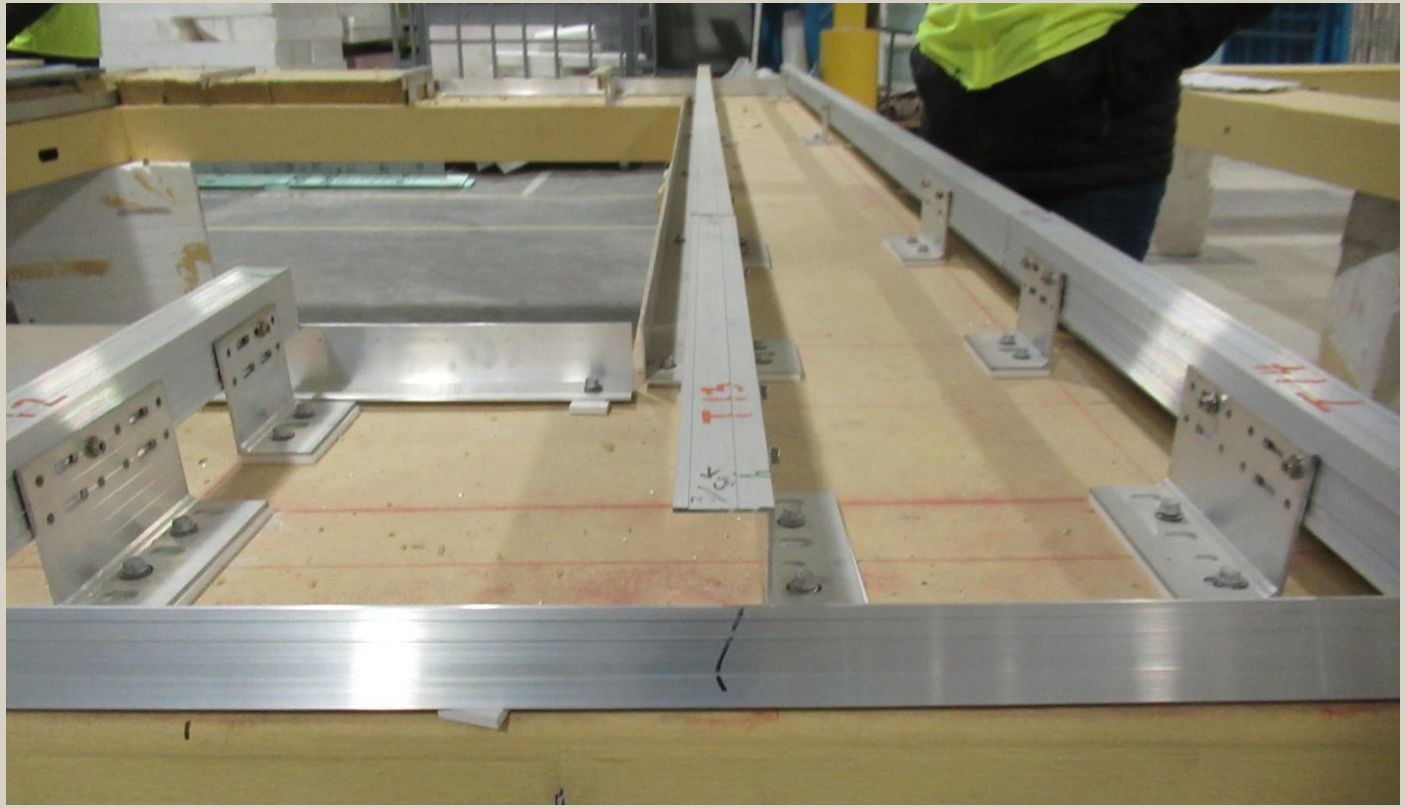
Strategy #2 (field-installed sealant joints)

- Uncoated metal girts visible at cladding joints

MULTI-USE TOWER | COLUMBUS, OH

Strategy #2 (field-installed sealant joints)

- Thermal bridging can be partially mitigated with discrete angle clips



STUDENT RESIDENCES | CHICAGO, IL

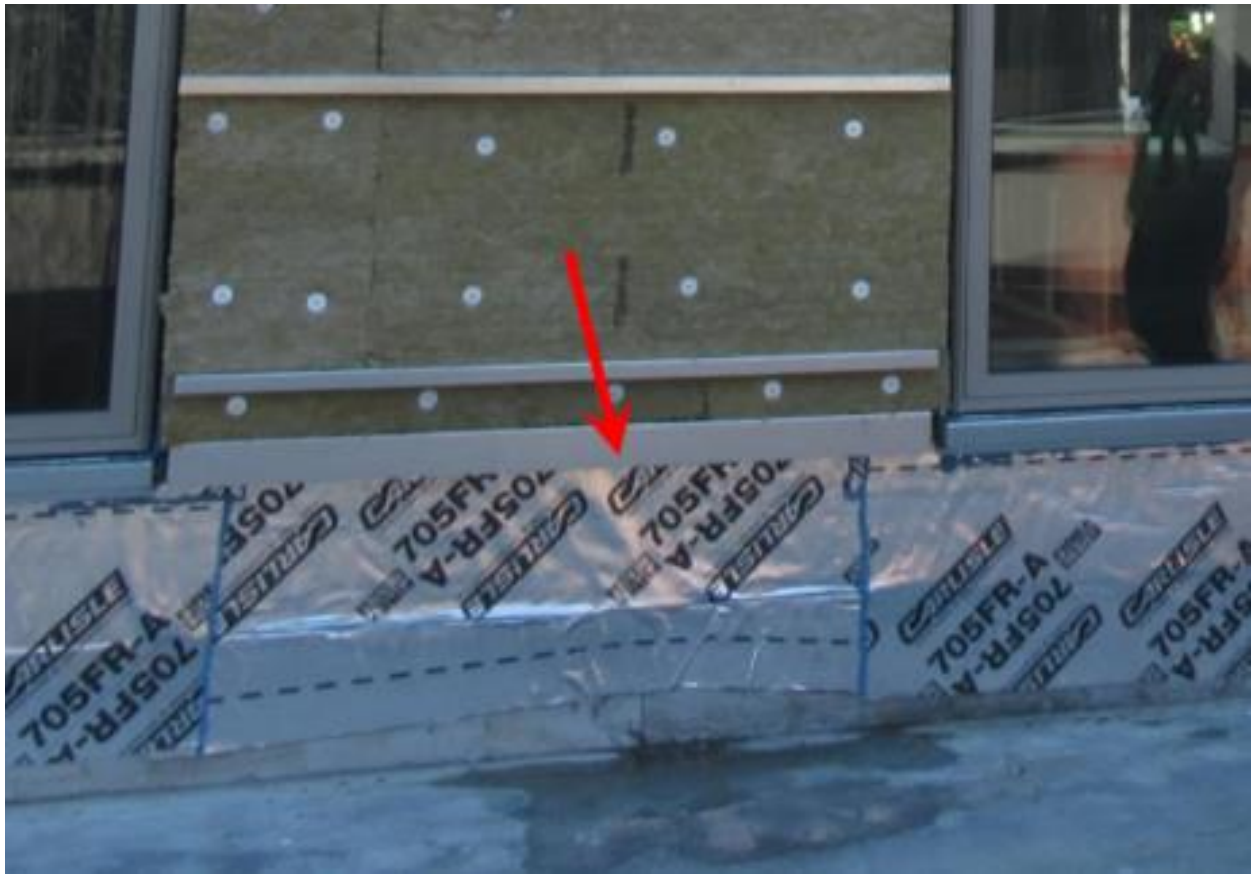
Strategy #2 → Strategy #1

- WRB was not promptly installed at prefab panel-to-panel joints

STUDENT RESIDENCES | CHICAGO, IL

Strategy #2 → Strategy #1

- Water trapped behind the WRB



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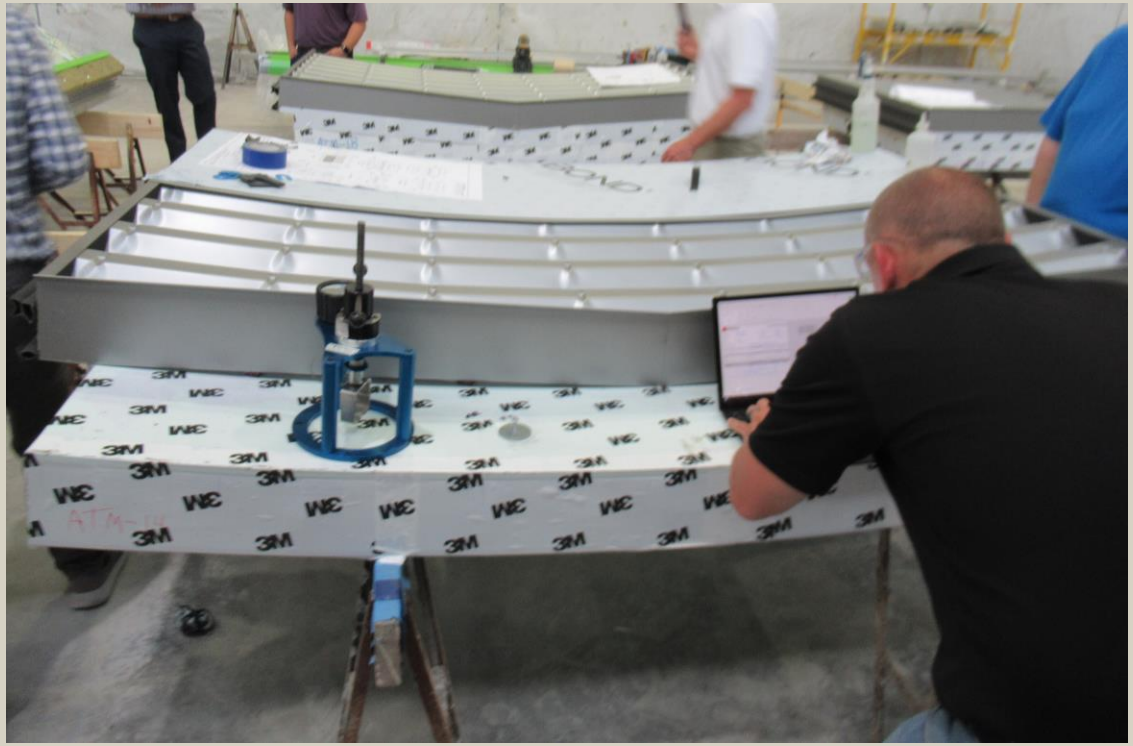
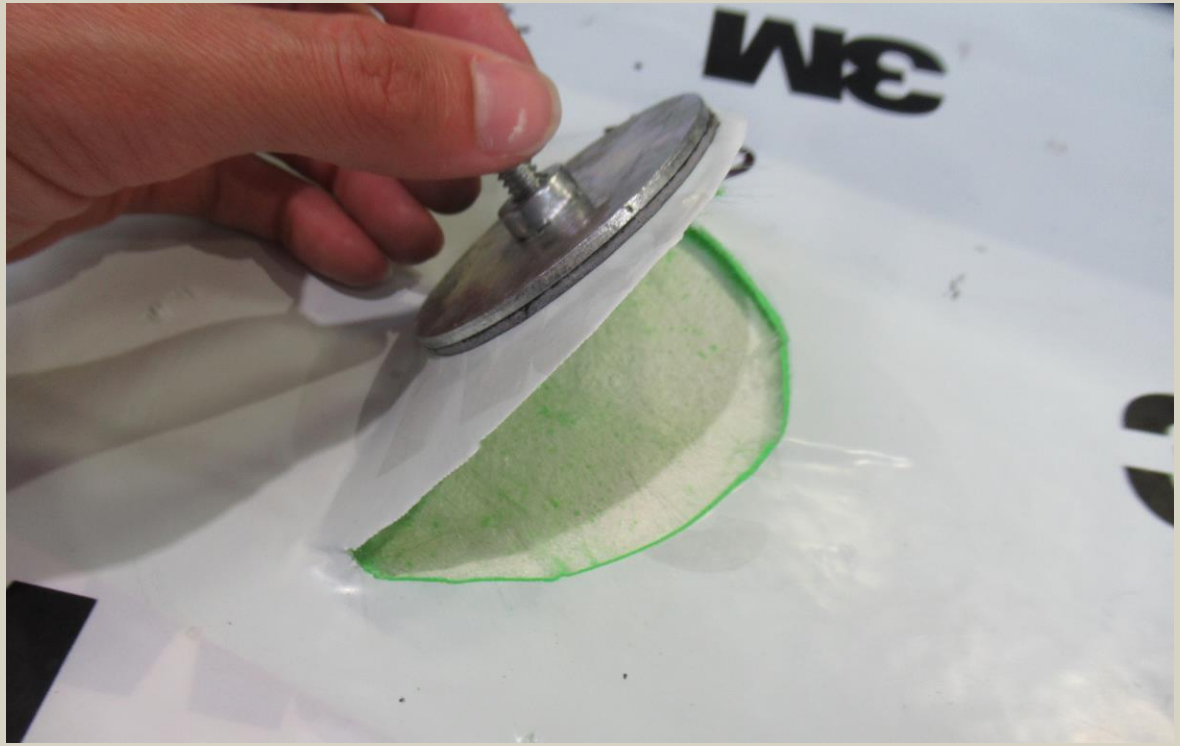
Strategy #3 Mockup Testing

- WRB adhesion testing (in prefabrication shop)





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Strategy #3 Mockup Testing

- Free-standing, fully-enclosed mockup construction

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Strategy #3 Mockup Testing

- Water penetration resistance testing (failure)

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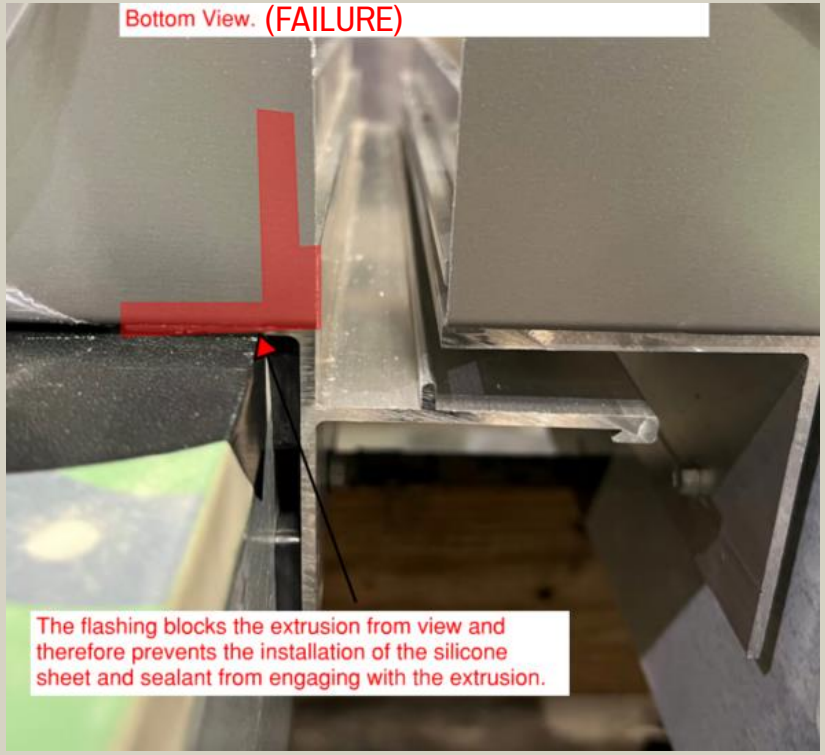
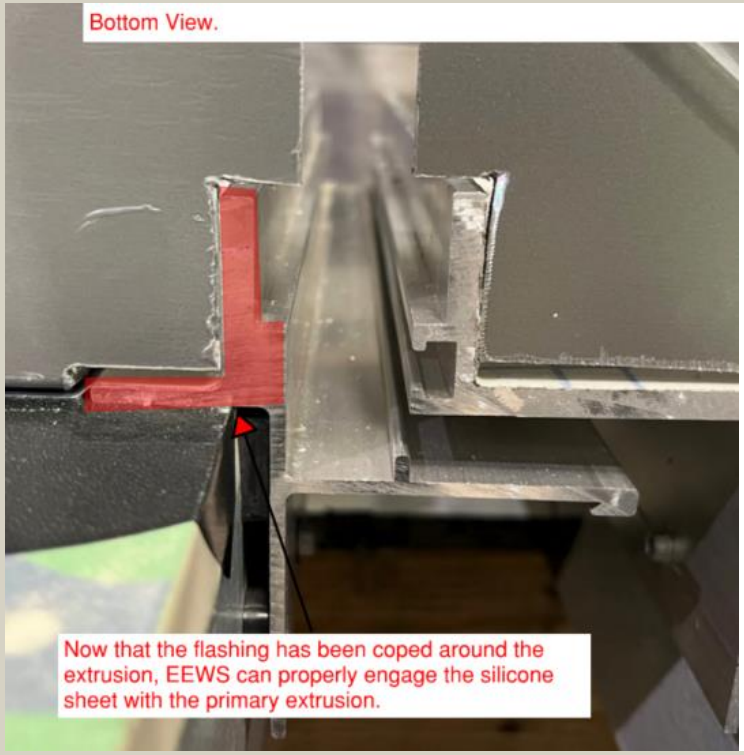
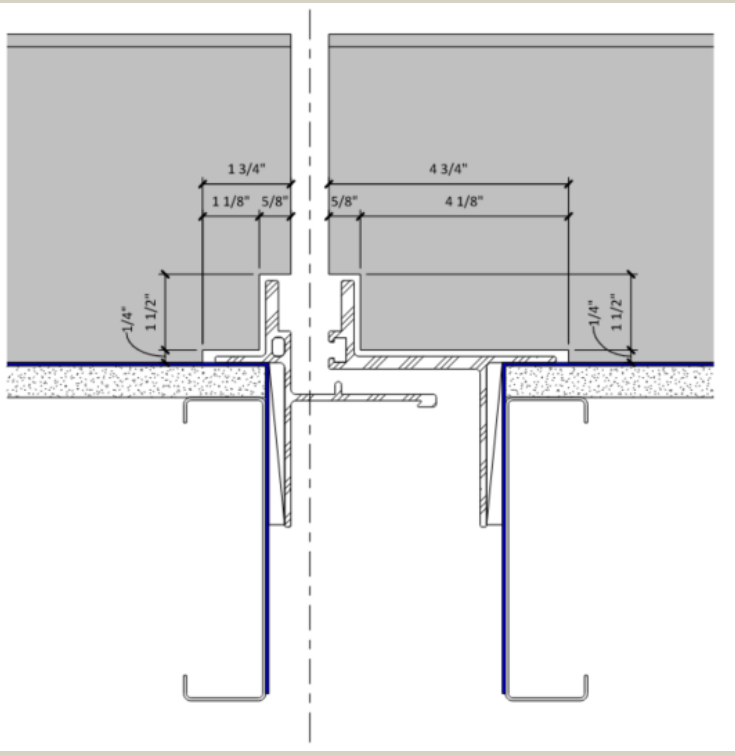
Strategy #3 Mockup Testing

- Leakage path diagnosis and modification







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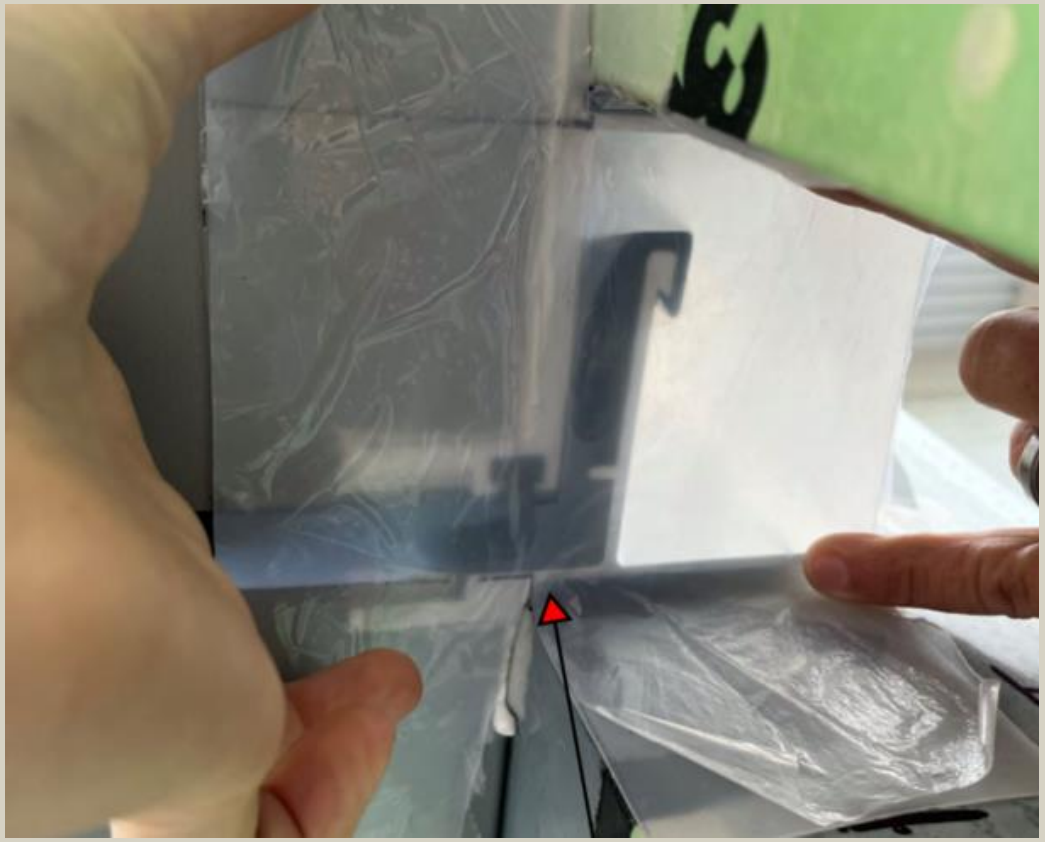
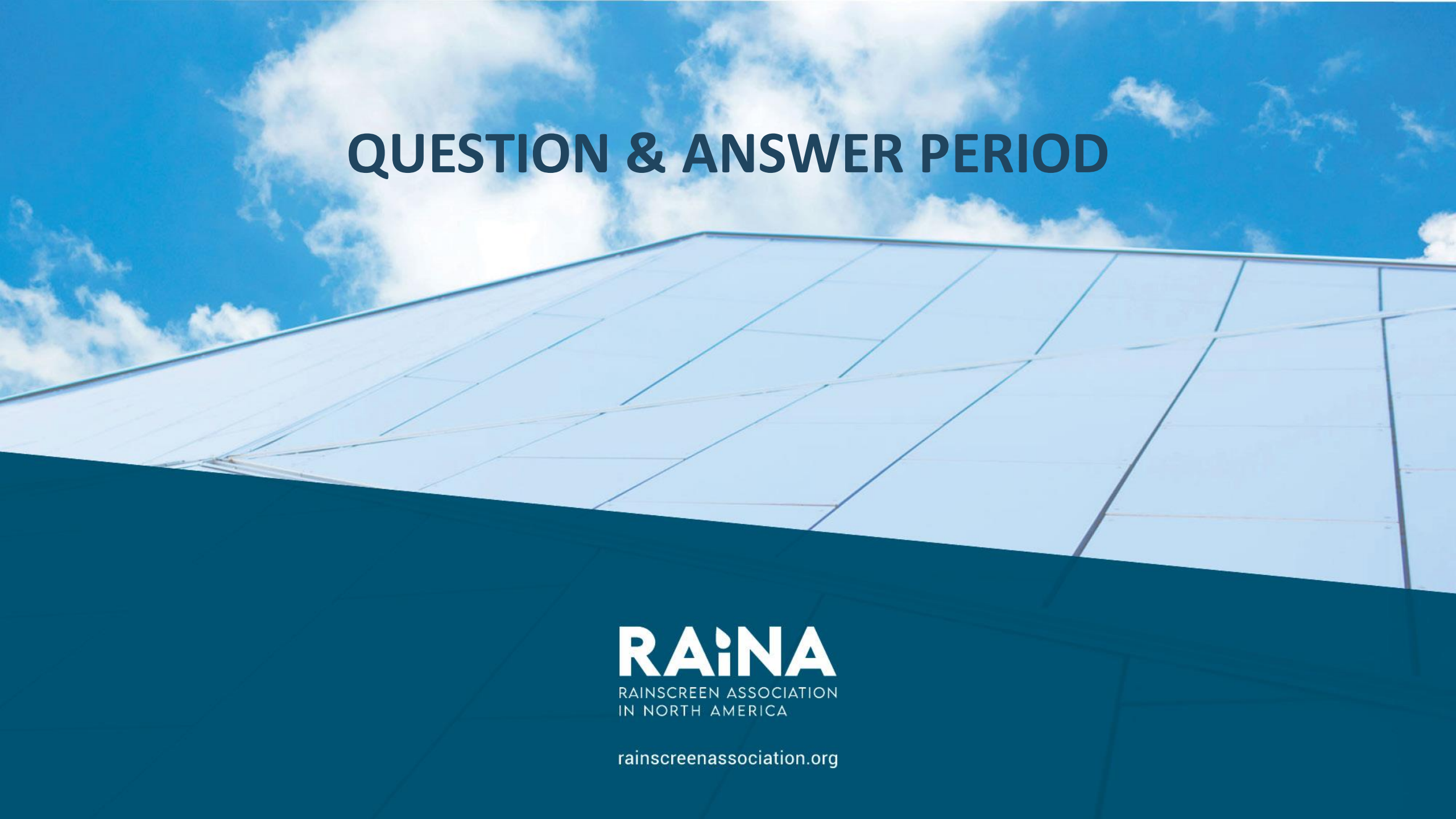
Strategy #3 Mockup Testing

- Miniature mockup retesting (pass!)



TAKEAWAYS

- **Rainscreen systems can be prefabricated!**
- There are numerous options for tailoring a prefabrication strategy to unique project conditions.
- Success depends on early coordination.
- Prefabrication is an investment; quality assurance remains critical after the panels are installed.



QUESTION & ANSWER PERIOD

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