Case Study: Navigating the Complexities of Expansion Joint Installation for Stadium Construction

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AIA Continuing Education Provider

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Learning Objectives

1. How expansion joint systems can restore the attributes of adjacent building components.
2. The role we **ALL** play.
3. Product technologies.
4. Ensuring continuity of seal throughout the entire structure.

Navigating the Complexities of Expansion Joint Installation for Stadium Construction

What’s the deal with Expansion Joints?

- They, flat out, don’t perform as intended.
- Joints leak!
  - Dissimilar substrates
  - Connections
  - Transitions (roof to wall, foundation to above grade wall, etc.)
- Mechanical anchors/fasteners will damage the substrate.
- Don’t handle variations in width well (or at all…)
- These things are ugly!
- Can they handle the necessary movement?
- Impossible to install at certain conditions.
- Trap dirt and debris.
- Cause a break in the fire rating.
- Flanking path for sound, heat/cold, etc.

- OVERLOOKED and UNDERESTIMATED cost… Often… A lot… Most of the time.

Types of Joints

Small (sealant) Joints

Through wall penetrations (windows, doors, vents, HVAC, etc.)

Panel to Panel

Concrete Joints

Types of Joints

Large (expansion or movement) Joints

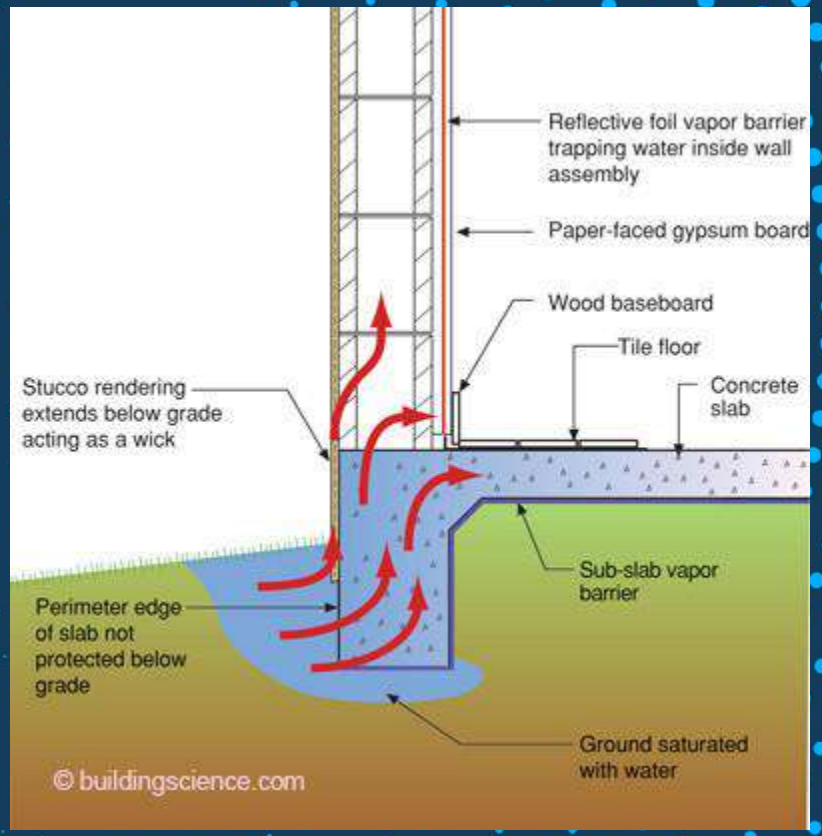
Gap or break designed to accommodate the expansion and contraction of a structure's components due to temperature changes or other factors.

Failed Joints…

…make stadiums sick

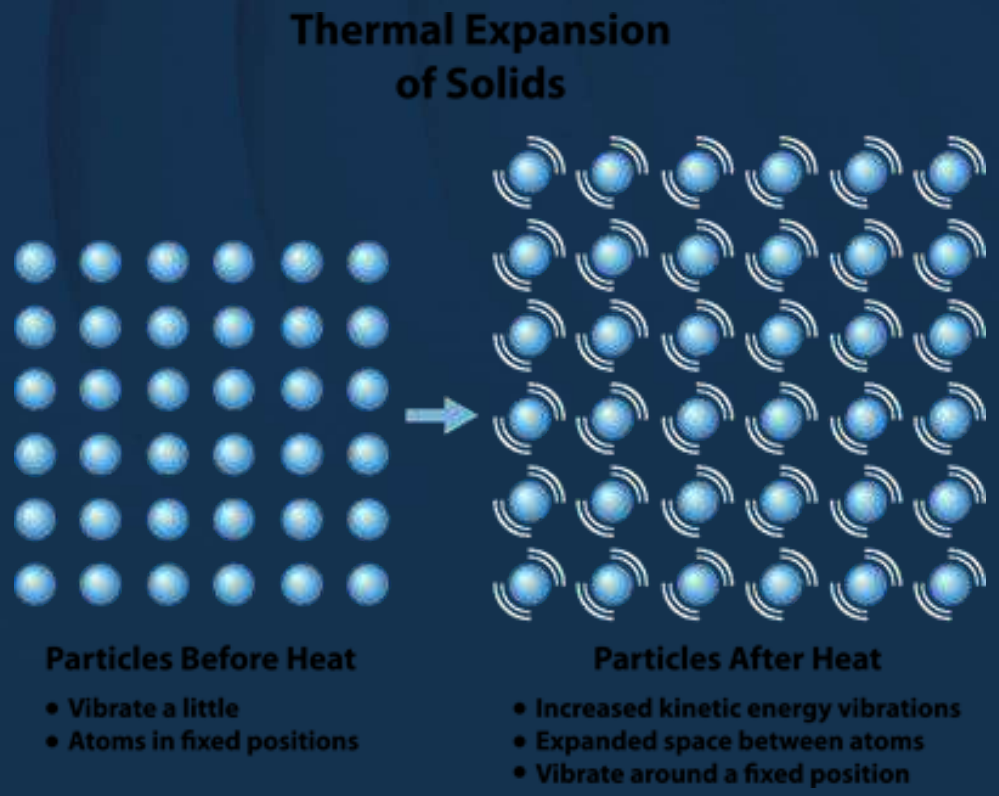
How does water get past failed sealant?

Wind Driven Rain
Gravity
Capillary Action
Air Pressure Differential (water being sucked in)
Stack Effect
HVAC
Bernoulli Principle



Building Movement

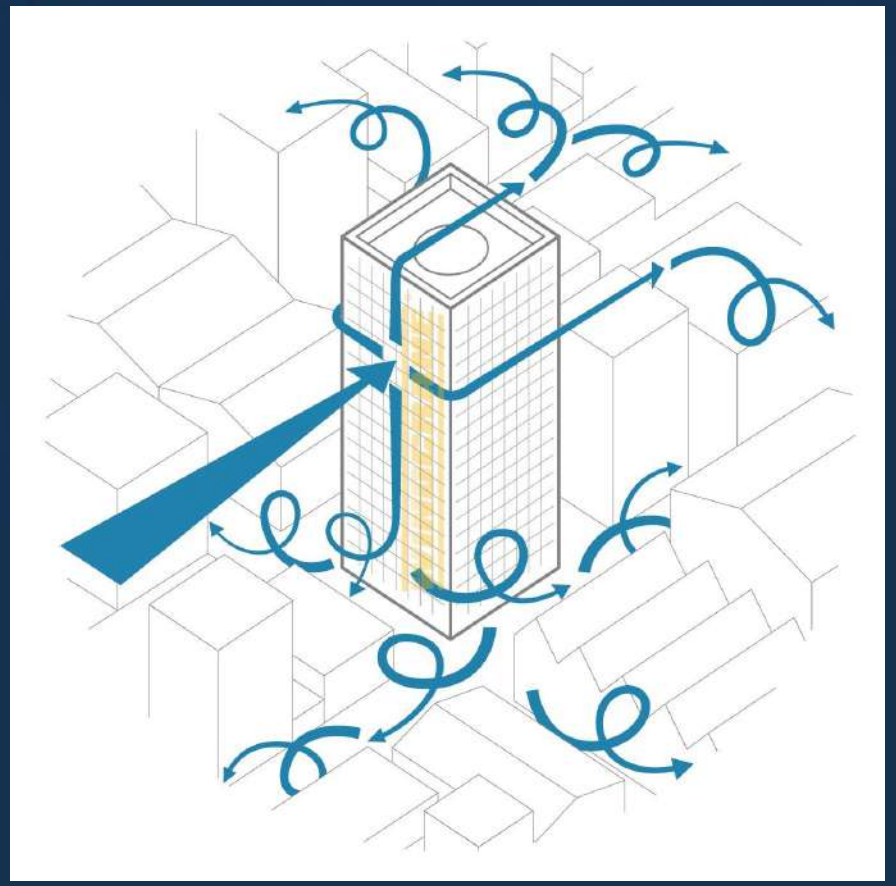
Thermal

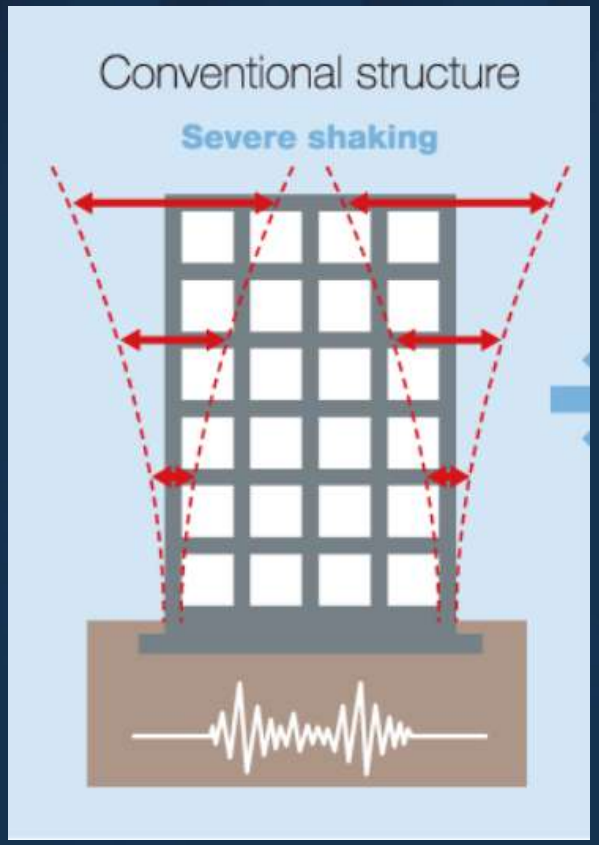


Building Movement

Thermal

Wind (sway)



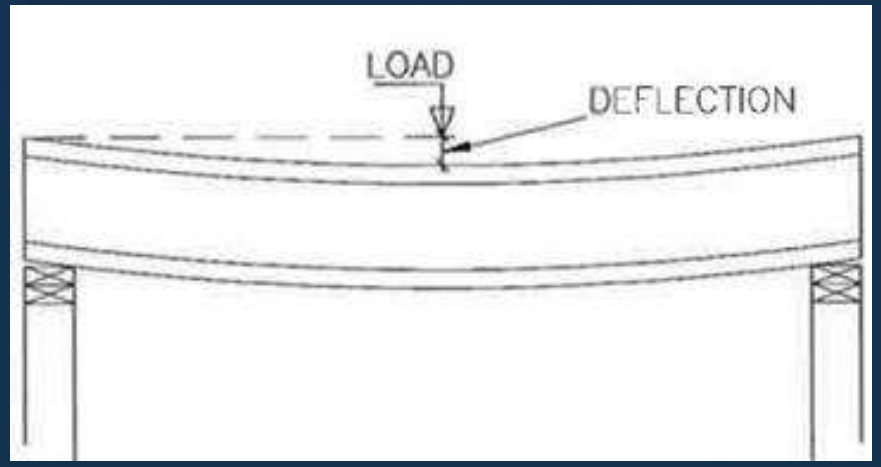


Building Movement

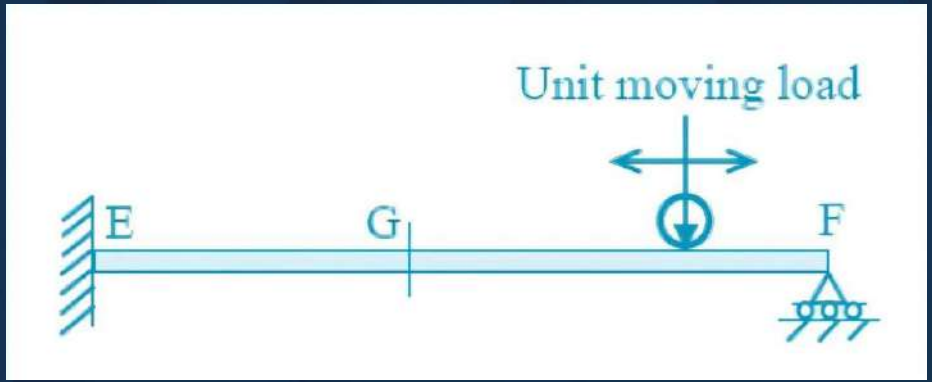
Thermal
Wind (sway)
Seismic

Building Movement

Thermal
Wind (sway)
Seismic
Static load deflection



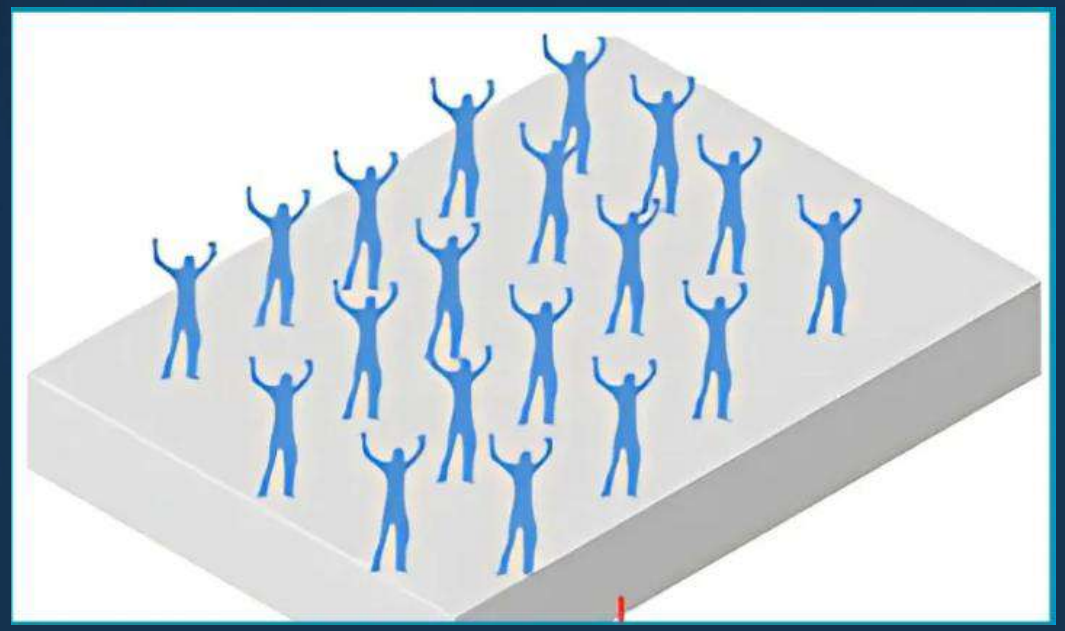
Building Movement



Thermal
Wind (sway)
Seismic
Static load deflection
Live load deflection

Building Movement

Thermal
Wind (sway)
Seismic
Static load deflection
Live load deflection
Dynamic crowd deflection



Choice and Selection

Although sealant joints and expansion joints are a minor component of the overall building envelope, these systems will account for over 75% of the water intrusion into the structure.

The importance of designing and installing these systems correctly, can have major impacts on the overall health of the building.

Acknowledging the Need

Mother nature will be sure to add joints in, if we don’t…

Tell everyone where these occur

Joints go through the entire structure.

Be sure to show them on all drawing sets

- Architectural
- Structural
- Mechanical
- Landscape

Design considerations and early communication will help alleviate extension RFIs and change orders.

Substrates will help determine system

Ensure that the designed substrate can accommodate the designed system.

Substrates should be solid and smooth, especially if fire-rated

“Measure twice, cut once”

Size matters

The width of the system and the systems movement capability should be determined by a structural engineer.

The anticipated movement at these isolated locations are designed and need to be communicated

The chosen system needs to accommodate the necessary movement needs

Movement Rating: 50% ±

Thermal Exterior Seismic ADA Compliant

Nominal Joint Width Install Range		H1 Seal Height	
US	mm	US	mm
1 5/8"-2 3/8"	41-60	2 3/16"	56
2 1/2"-3 3/8"	63-86	3 5/16"	84
3 1/2"-4 3/8"	89-111	3 5/16"	84

A meeting of the minds

Gather and share information early

Call out specifics early to ensure clarity from design team

Require a preconstruction meeting with ALL subs present

Think, design, and plan in 3D

Joints, like many systems, are easy to install in straight runs. Issues arise at transitions.

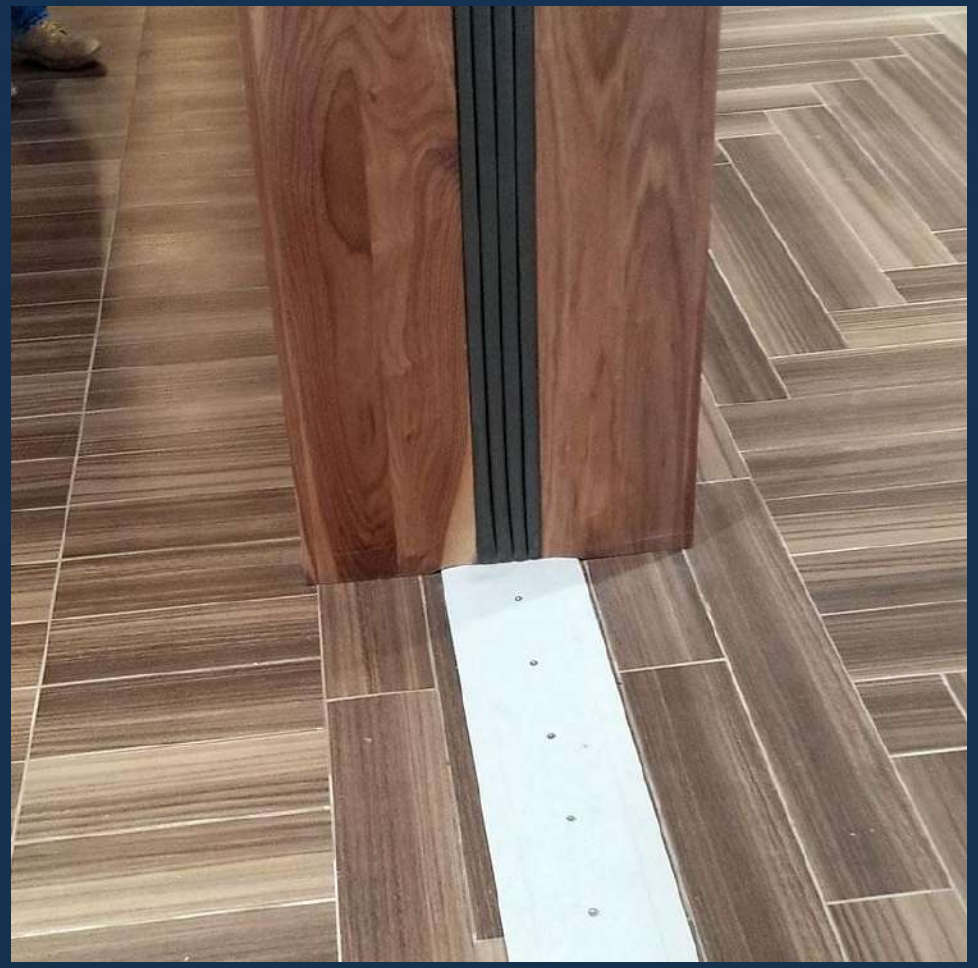
What happens when:

Foundation meetings above grade wall?
Above grade wall meets plaza deck?
Above grade wall meets roof?

Transitions

Ask:

How will we transition from floor to wall in an executive suite?



Transitions

Ask:

How will we transition from floor to wall in the main concourse?

Do we need to maintain any life safety aspects (fire-rating) through the joint opening?

Do these systems need to be watertight?

Transitions

Ask:

How will we transition from tread to riser through the entire stadia?

Do these joints need to be watertight? Fire-rated?

If you don’t…

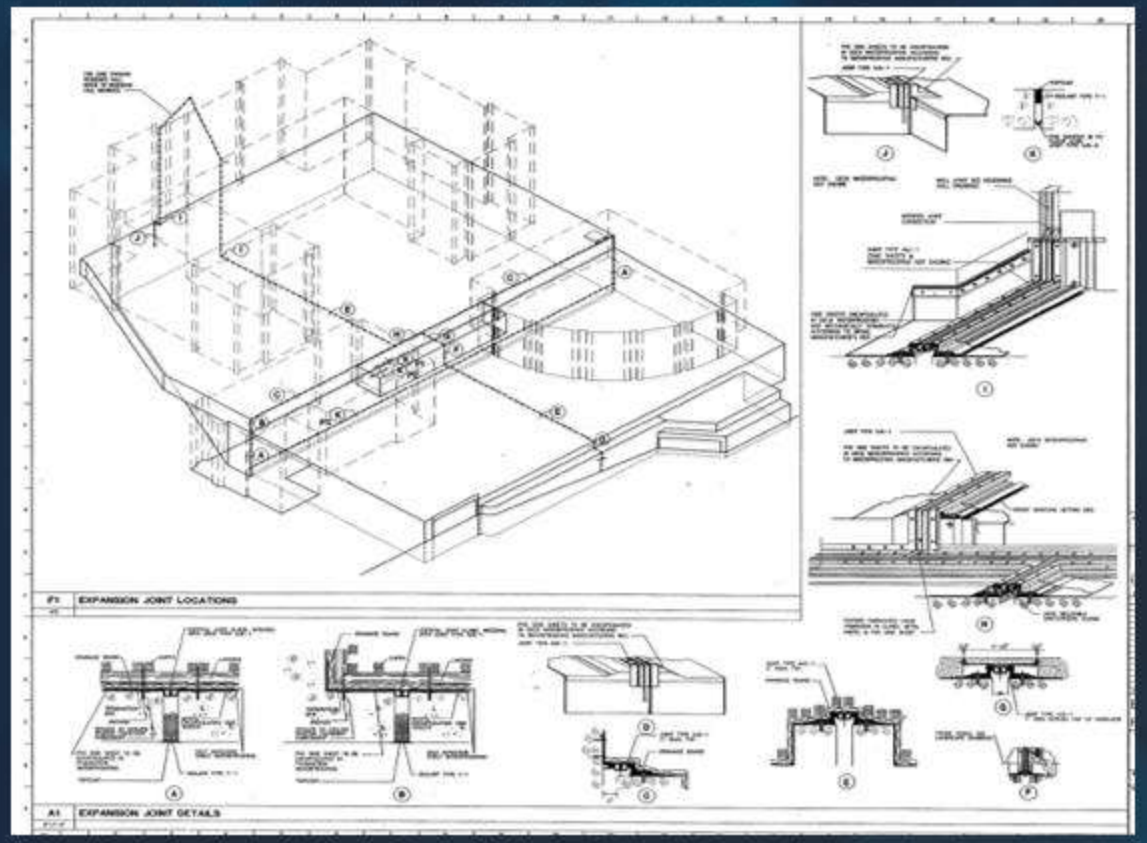
Joints will be misaligned

There will be gaps in your fireproofing and waterproofing

Your building WILL leak

Your project becomes a retrofit before you even turn it over to ownership

Design, Detail, and Specify in 3D



Interpreting an expansion joint run can be one of the most daunting tasks. Request specific details to ensure transitions in changes of plane and direction are accounted for.

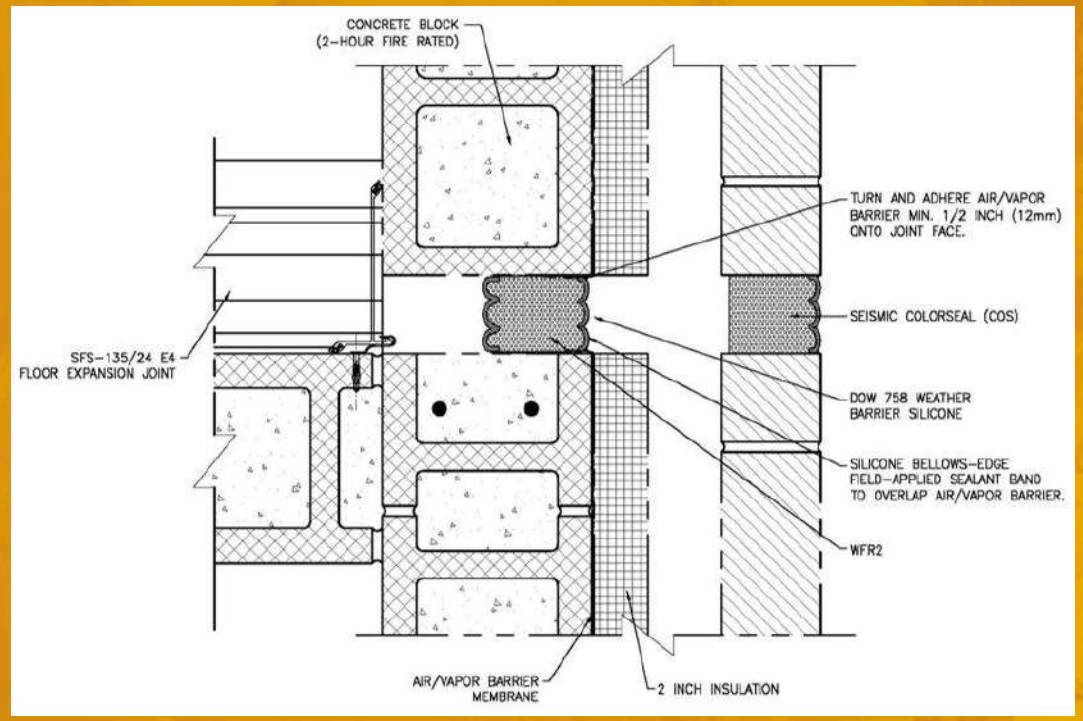
If you don’t, missed costs may fall on you.

Change order nightmare.

Remember – Joints are a hole through the

Entire structure
Waterproofing
Roofing
Air Barrier
Insulation
Soundproofing
Interior floors
Interior walls
Interior ceilings
Fireproofing

Must restore the function of the

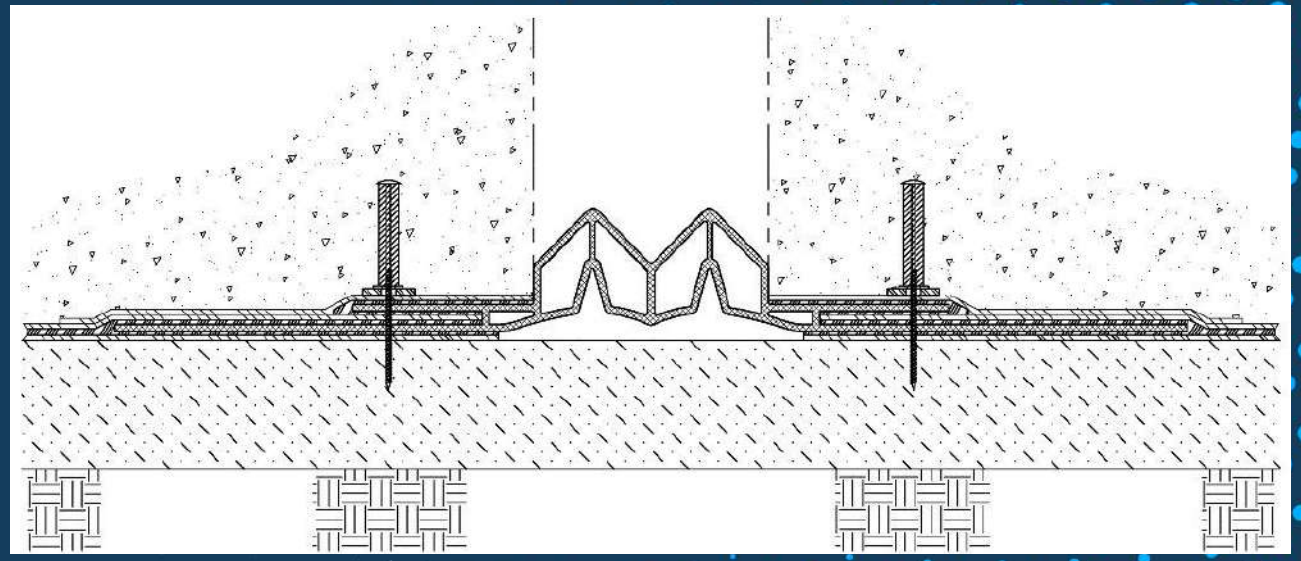


Entire structure
Waterproofing
Roofing
Air Barrier
Insulation
Soundproofing
Interior floors
Interior walls
Interior ceilings
Fireproofing

Below-Grade Systems

Must integrate and maintain waterproof capabilities of the adjacent waterproofing system(s)

Wrap the entire foundation (pre-applied slab, to pre/post-applied foundation walls)



How to transition from below-grade to above-grade wall

Specify one manufacture and require continuity through the transition

Transitions should be factory fabricated NOT field fabricated

Vertical Walls

Wall expansion joints must:

Move

Bridge the gap between dissimilar materials

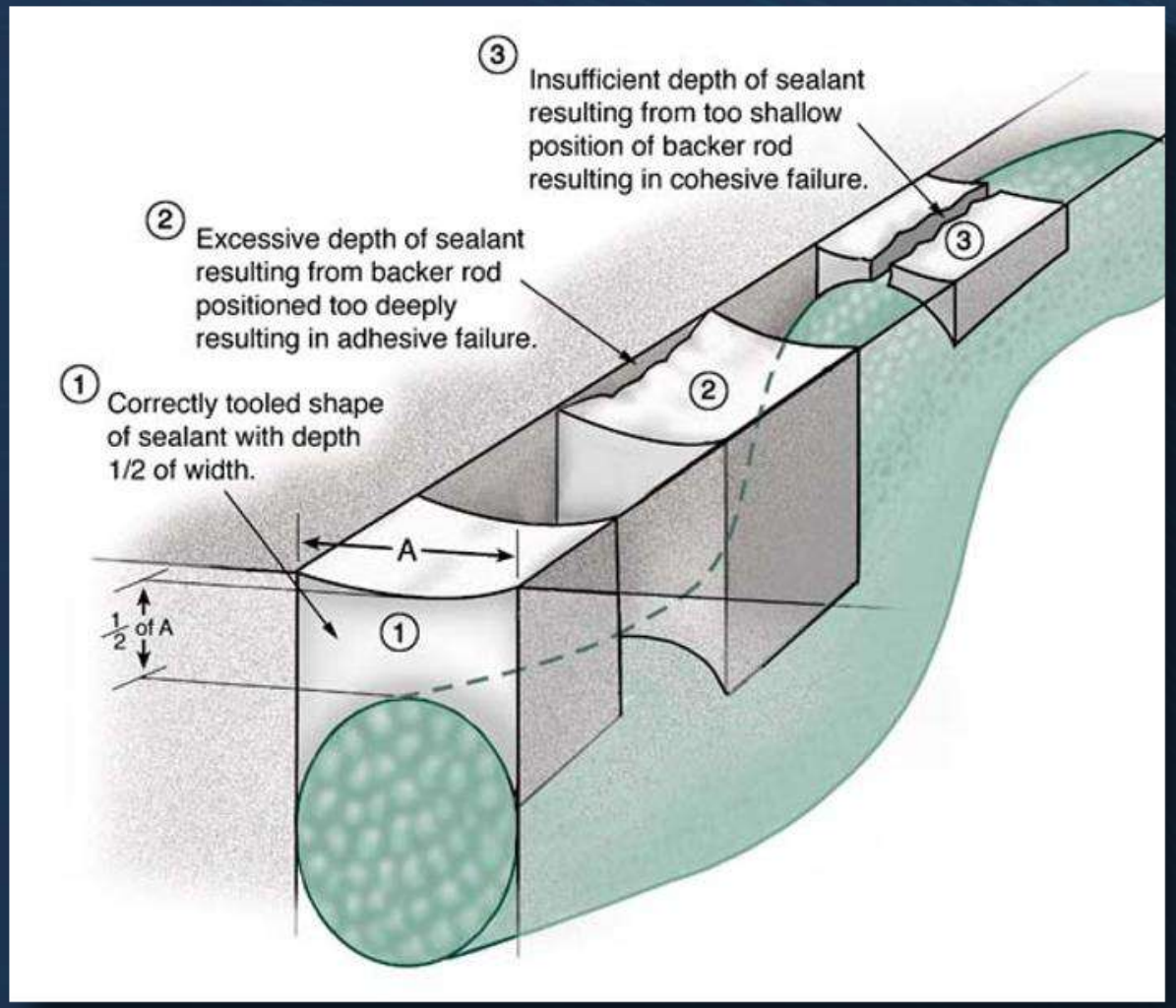
Provide/maintain R-value

Block sound

Keep out water

In some cases, maintain the fireproofing

Caulk (liquid sealant) and backer rod



Common system used to seal small joints ranging from ¼” to 1” in width

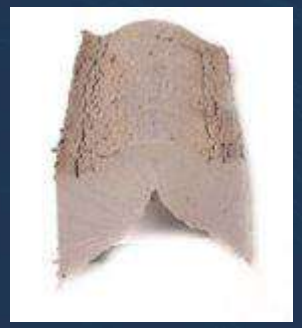
Relatively inexpensive

Variety of colors

Versatile (can be manipulated in field)

BUT…

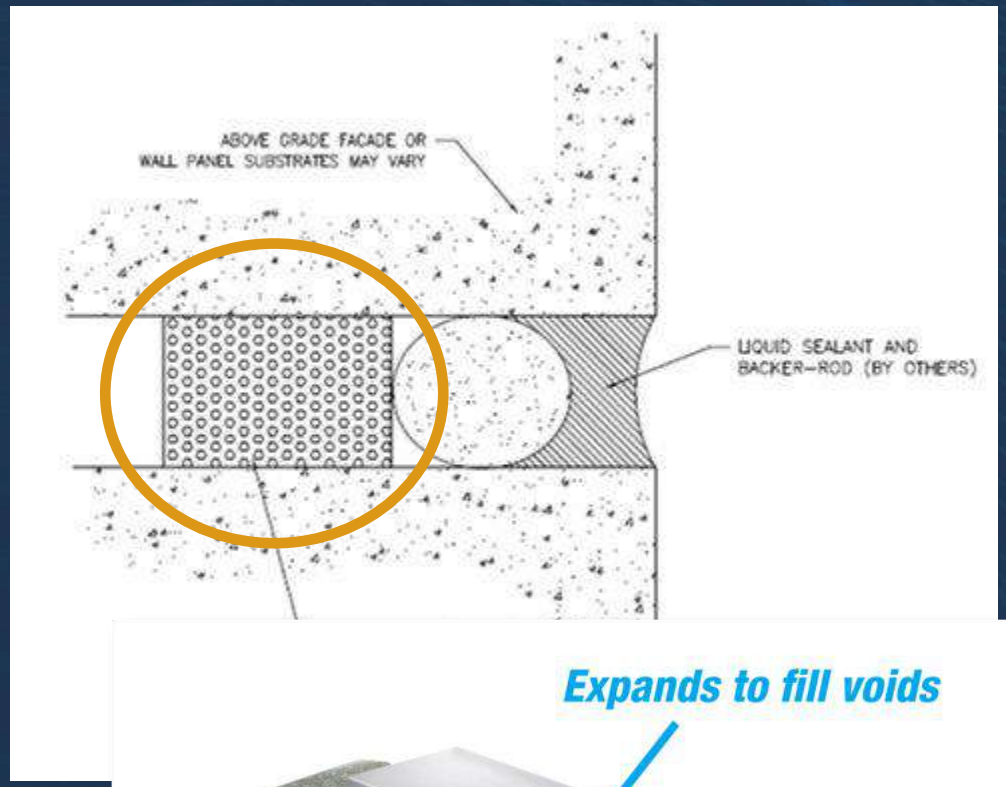
Relies on “hour-glass” shape

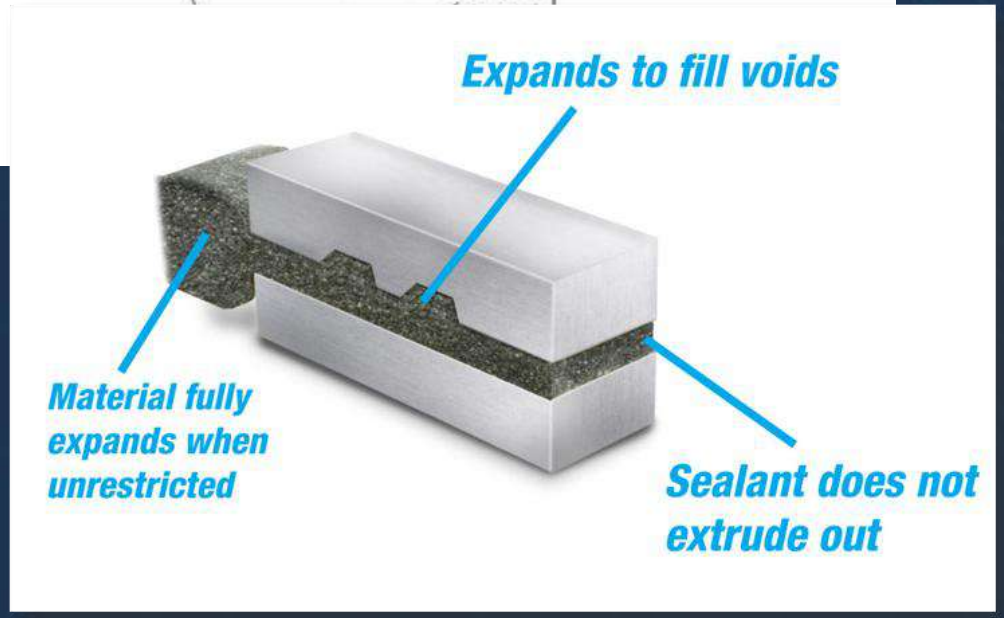


Caulk (liquid sealant) and backer rod

Relying on the “hour-glass” shape is imperative to meet a sealants documented movement capabilities

If installed incorrectly, they will not perform as noted





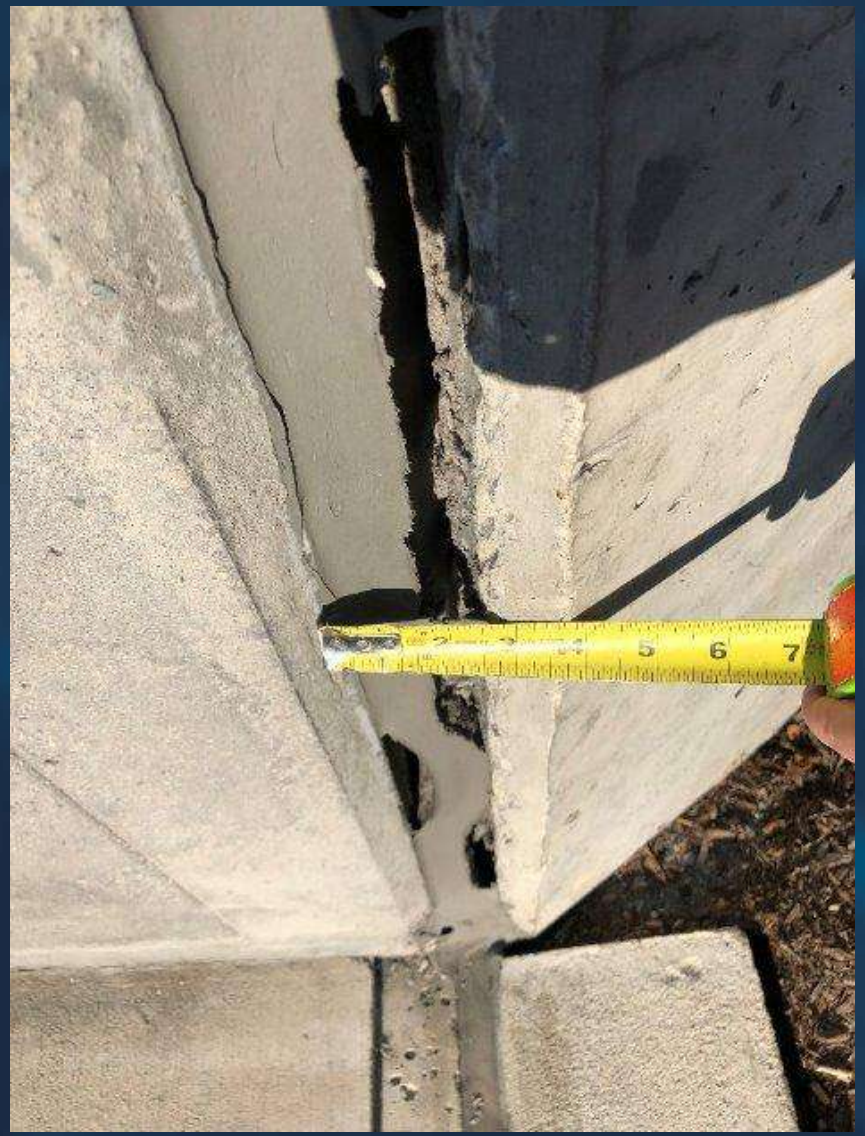
Get the most out of Caulk (liquid sealant) and backer rod

Maintain R-value

Watertight secondary seal

Resists air pressure differential

Fills voids/irregularities through the substrate



Large (Vertical) Expansion Joints

True expansion joints should NEVER be treated using liquid sealant

A solid rule of thumb, no greater than 1.25” wide

Technologies: Compression Seals

Not watertight
Not airtight
Doesn’t fill voids
Suffers compression set
Mounting adhesive doesn’t bond
Fails in tension

Technologies have come a long way
Well known as a value option, but not recommended

Technologies : Closed-Cell “Economy” seals

Uncompressed – installer must physically compress this system

Also suffer compression set – width-wise

Fail in tension

Suffer longitudinal shrinkage

Value option (don’t really exist)

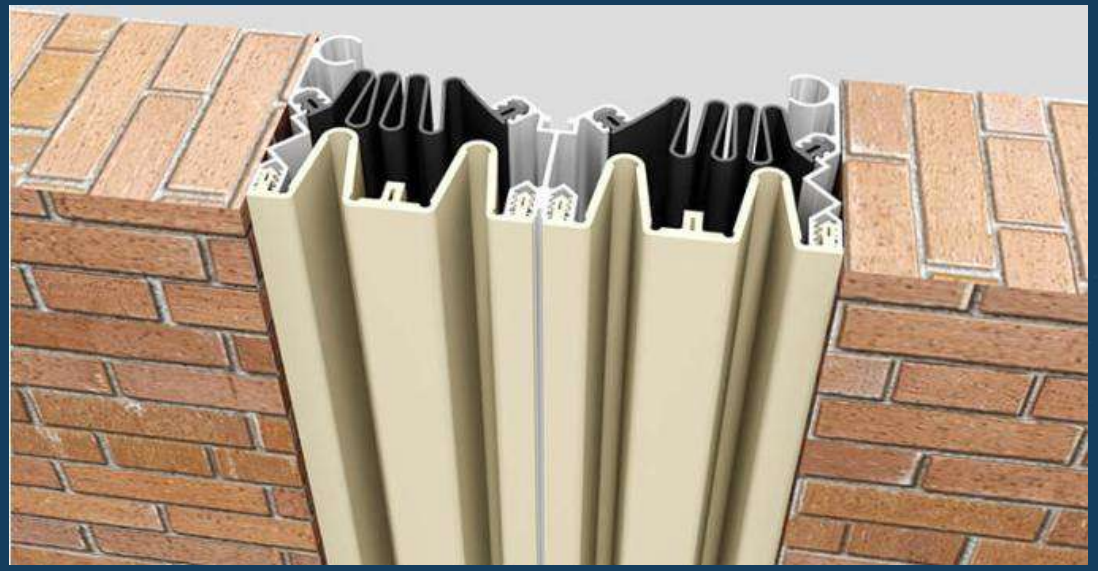
Technologies: Strip Seals – “rail and rubber”

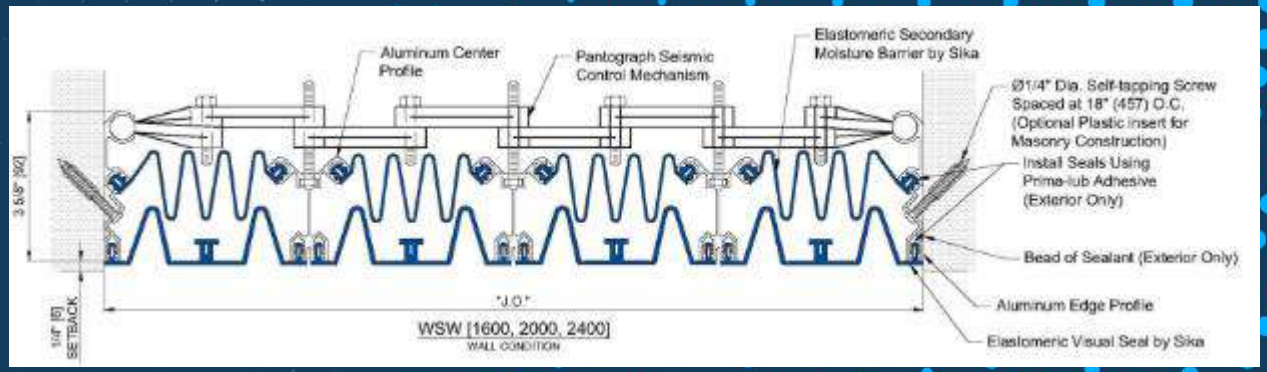
Evolved from interior products
Not watertight
Not airtight
No insulation properties
Does not conform to any variances
Invasive anchors
Tricky/impossible installs at inside corners

Technologies: Strip Seals – “rail and rubber”

System of choice for LARGE openings

Up to 24” wide

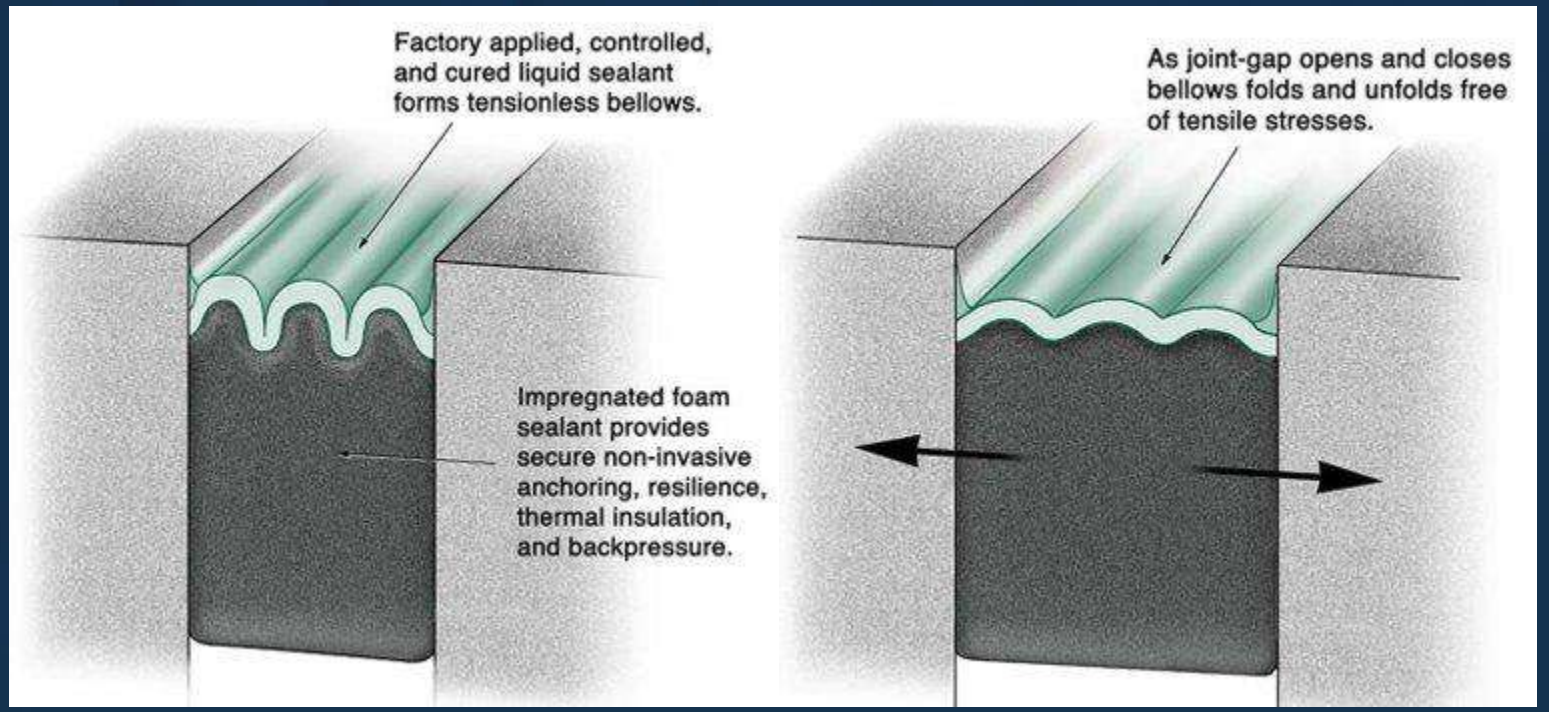




Technologies: Pre-compressed Foam

Hybrid of foam and liquid sealant

Optimizes the **best** features of both technologies



Technologies: Pre-compressed Foam

Acrylic infused foam sealant with factory coated sealant (silicone and hybrid)

These systems are watertight

Maintain R-value

Sound attenuating

No mechanical fasteners into the substrate (important in freeze/thaw climates)

Form to substrate irregularities

Technologies: Pre-compressed Foam

Stadiums lend themselves to large sealant joints that are constantly getting “beat up”

Pre-compressed foams are a great solution to replace habitually failed joint sealant(s)

Technologies: Pre-compressed Foam

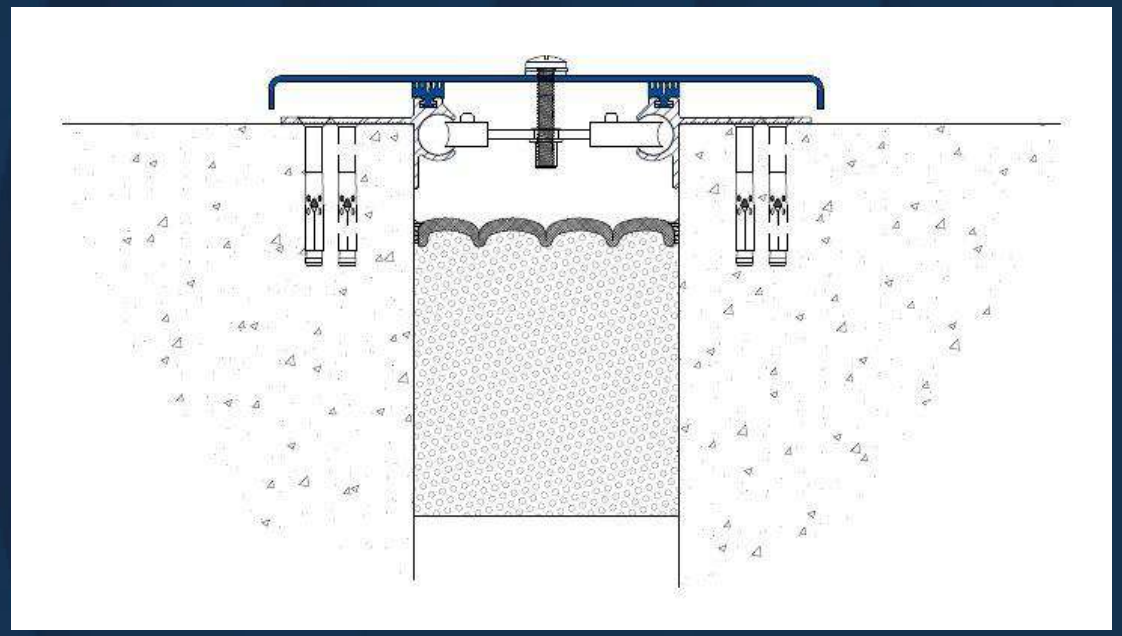
Great at making directional changes and are easy to field fabricate these changes

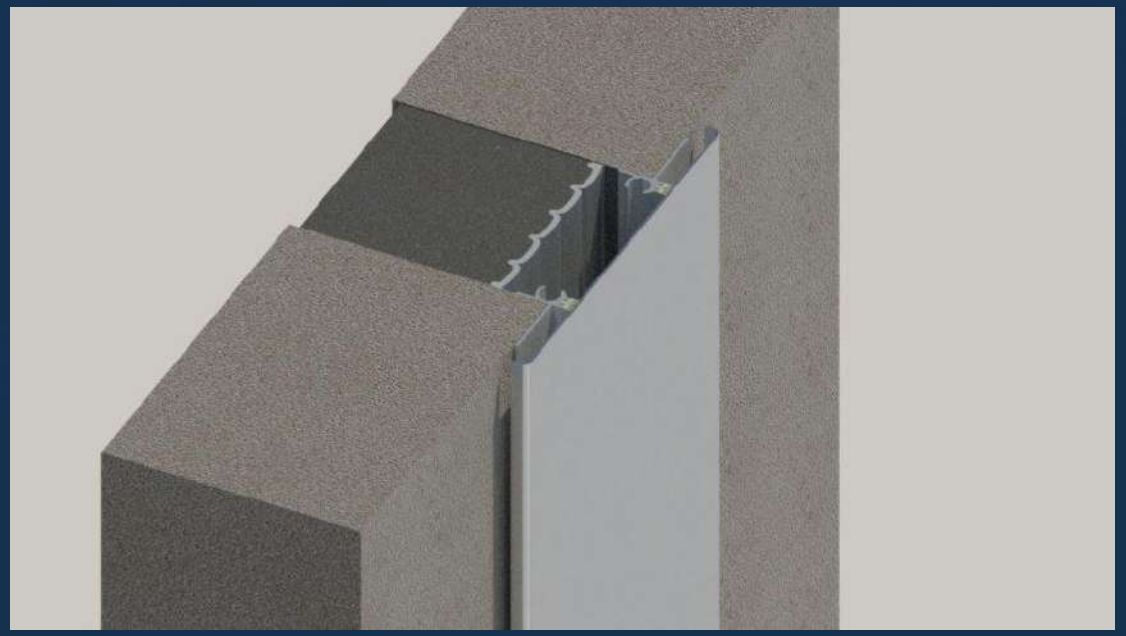
Technologies: Pre-compressed Foam

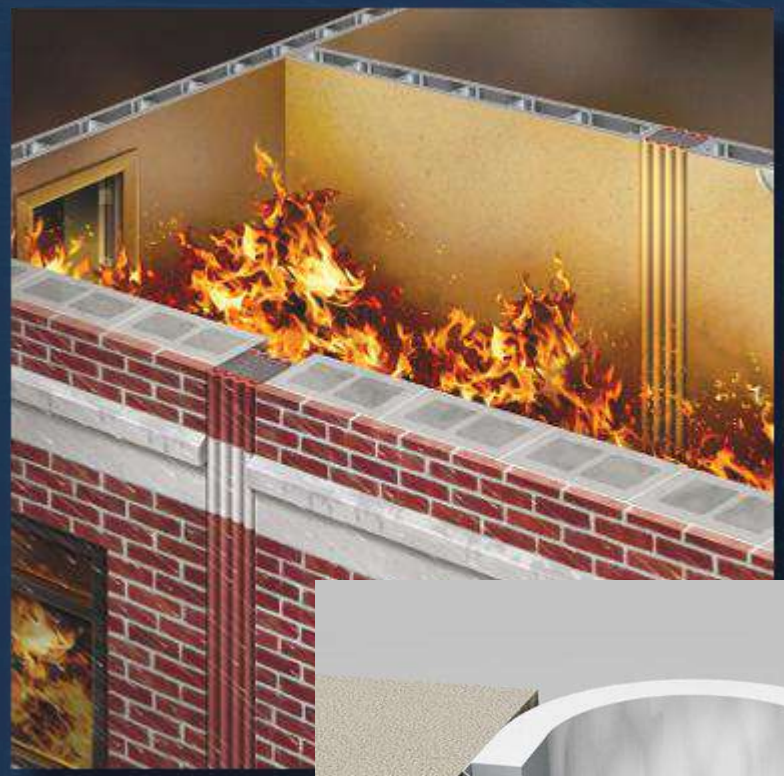
Wide variety of colors to handle a variety of aesthetic designs

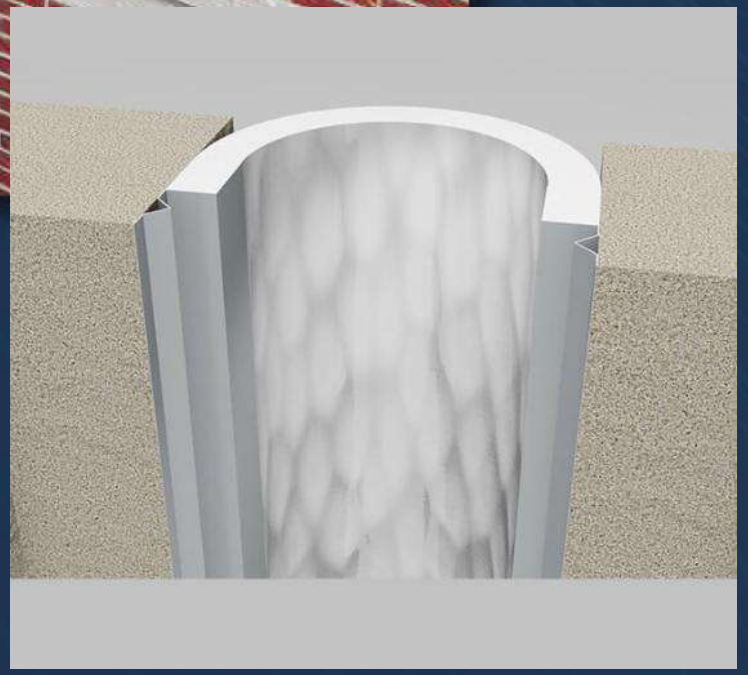
Technologies: Pre-compressed Foam

Or in behind a metal cover for a more industrial look







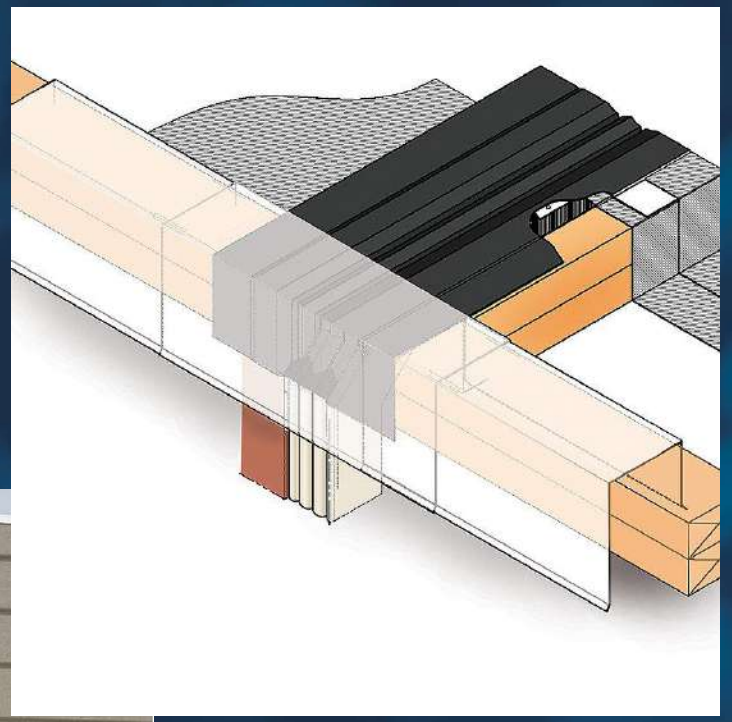


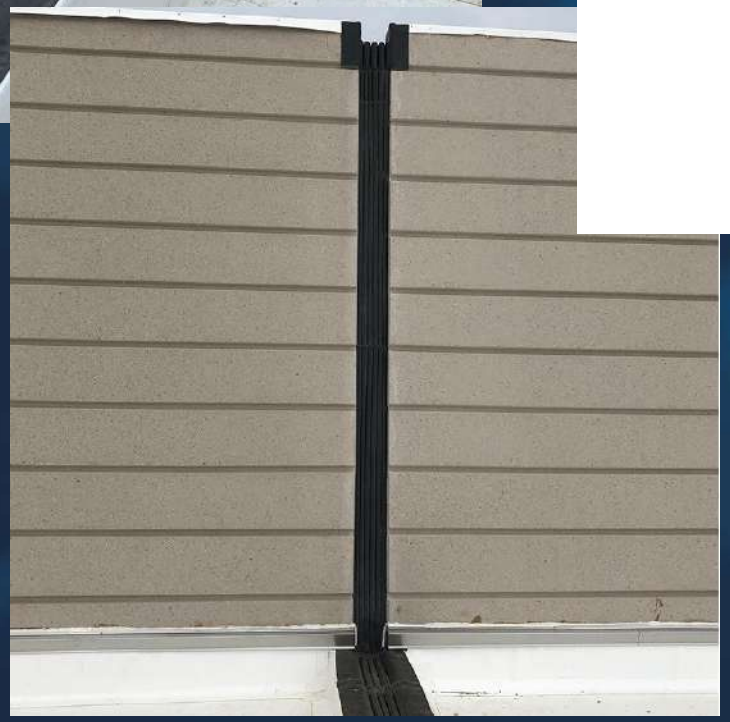
What if I need a fire-rating?

Pre-compressed foams also come in fire-rated systems

These systems maintain all the same features, but with a 1-, 2-, 3-, or 4-hour fire-rating

There are also fire blankets that can be used in behind metal covers. NOTE: these should NOT get wet… ever!





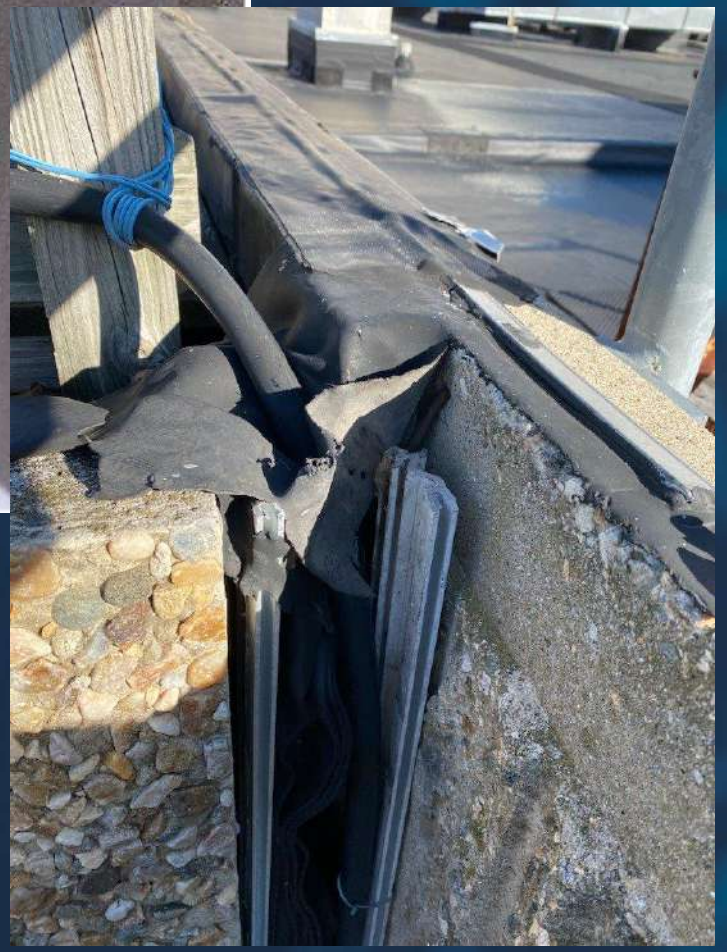
Roof Expansion Joint Systems – Solution!

Arguably the most important expansion joint on your building

Avoid the “pool noodle” and membrane

Thought designed system to handle changes in direction and plane/elevation

Consider the wall to roof transition



Roof Expansion Joint Systems – Problem!

“Pool noodle” system

How can/will that transition to vertical wall?

Field fabricated…

Split-Slab Expansion Systems

True expansion joint solution for split-slab conditions

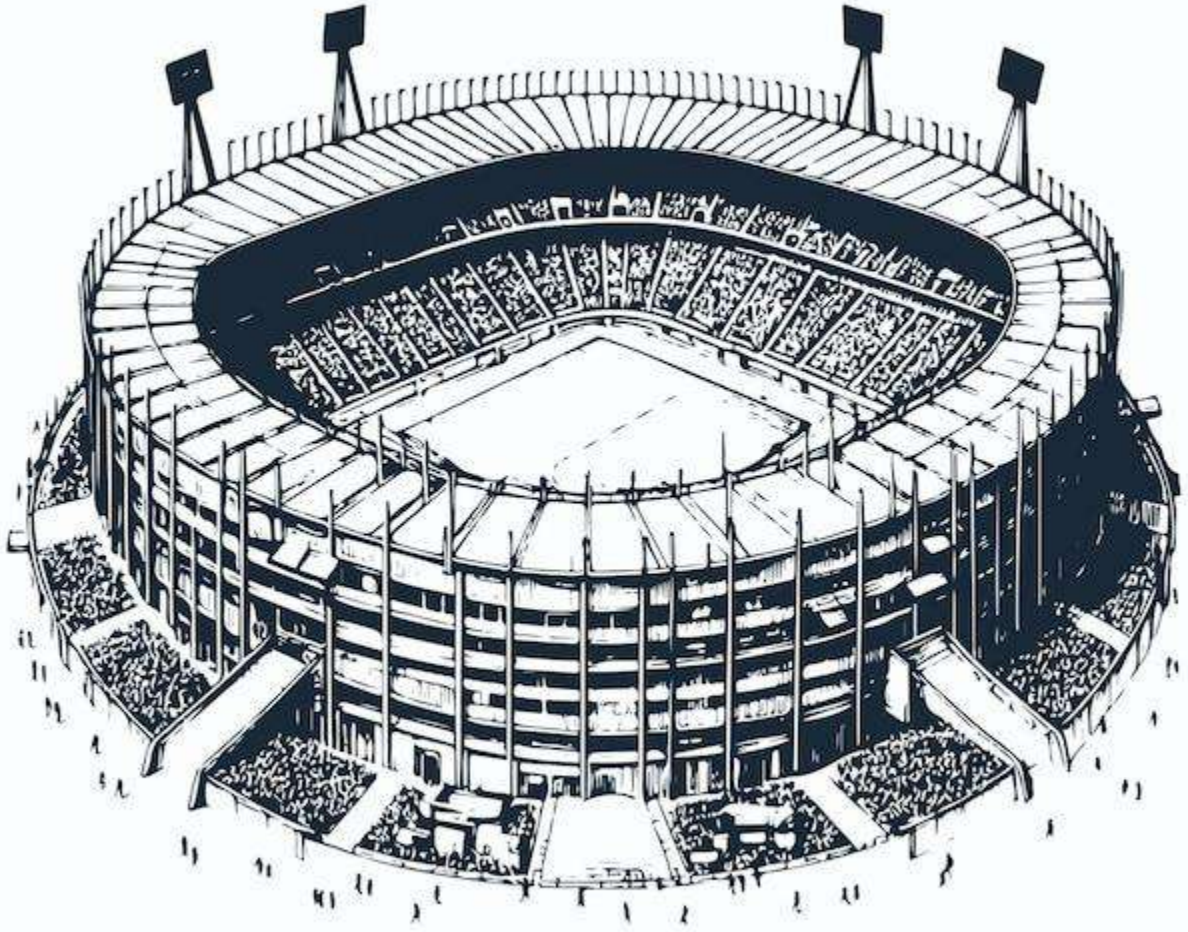
Watertight

Maintains fire-rating and R-value (if needed)

Continuity of seal

Soft and hard-scape configurations

Transitions from one system to another



Main objective

Maintain the continuity of seal throughout the entire structure

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Questions?

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