Insulation Shrinkage Issues

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Session Outline

- Background
- Benefits
- Trouble Signs
- ccSPF Shrinkage
- Potential Remedies
- Future Actions

Growth of ccSPF in Commercial Projects

- ccSPF provides:
  - Insulation
  - Air Barrier
  - Water Barrier
- All in one material
- Designers LIKE it!

Trouble Signs

- SGH
  - Forensic engineering firm
  - Boston area
  - December 2011: “Cavity Wall SPF Considerations,” by Sean O’Brian
  - May 2013: “SPF Uses in Modern Building Construction Applications and Limitations,” by Vince Cammalleri
  - August 2013: Meeting with SPFA members

SGH Issues

- Increasing rate of SPF failures
- Behind wall cladding
- Shrinkage related
- Problems at terminations on peel & stick / adhered membranes

SGH Issues (2)

- ccSPF shrinkage can be GREATER at 100 F vs 158 F
  - Both at 97± % RH
  - ASTM C1029 specifies 158 F only (7 days)

SCH Issues (3)

- ccSPF shrinkage at 100 F can be up to 30-40%
- Shrinkage can lead to transition membrane failure

Masonry Institute of Michigan

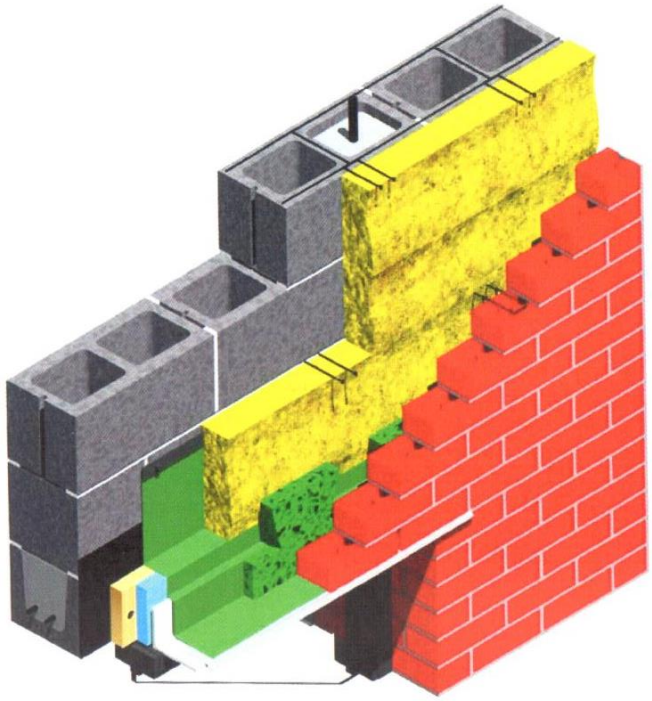
- April 2015: SPF Insulation Bulletin
  - Referenced: “Dimensional Stability Considerations in SPF Air Barriers” by Wagner & Peterson (WDP & Assoc.)
  - SPF shrinks
  - Shrinkage potentially affects interfaces with other materials
  - Repair / correction guidance lacking

Masonry Institute of Michigan (2)

- **“Guidance for design, detailing, and application of SPF to address the considerations and concerns raised have not been developed by the spray foam industry. Until the time when such guidance is available, the … masonry cavity wall details that incorporate SPF will not be finalized by MIM.”**

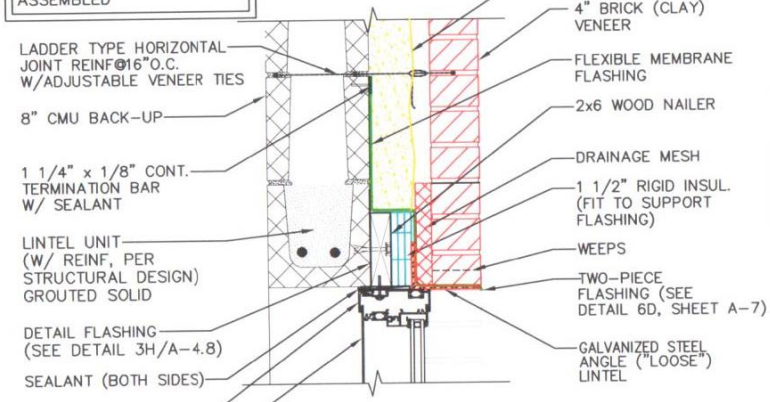
NOTE:

UNPROTECTED ALUMINUM DOOR AND WINDOW FRAMES CAN INTERACT WITH CEMENT-BASED MATERIALS AND INCUR DAMAGE. SEE PCA "MASONRY TODAY" VOLUME II, No. 1 FOR RECOMMENDATIONS.
www.cement.org/masonry/cc_al_frames.asp



ISOMETRIC VIEW

NOTE: MASONRY LINTEL MAY BE PRECAST OR FIELD ASSEMBLED



SECTION VIEW

3A / A-1 MASONRY LINTEL (PREFERED) (SHORT SPAN) FOR WINDOW OPENING (USING RECEPTORS)

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MASONRY Institute of Michigan

GENERIC WALL DESIGN - 3" SPRAY FOAM CAVITY WALL

IN CHARGE:	MIM
DRAWN:	M.W.F.
APPROVED:	T.A.D.
DATE:	04/01/2013
TITLE:	MASONRY LINTEL - RECEPTOR WINDOW
SHEET:	A-4.1

WDP & Assoc.

- Forensic engineering firm
- Virginia area
- December 2013: “Dimensional Stability Considerations in SPF Air Barriers” by Wagner & Peterson

WDP & Assoc. (2)

- Shrinkage problems: Short & long term
- Damage to:
  - Flashings
  - Closures
  - Terminations

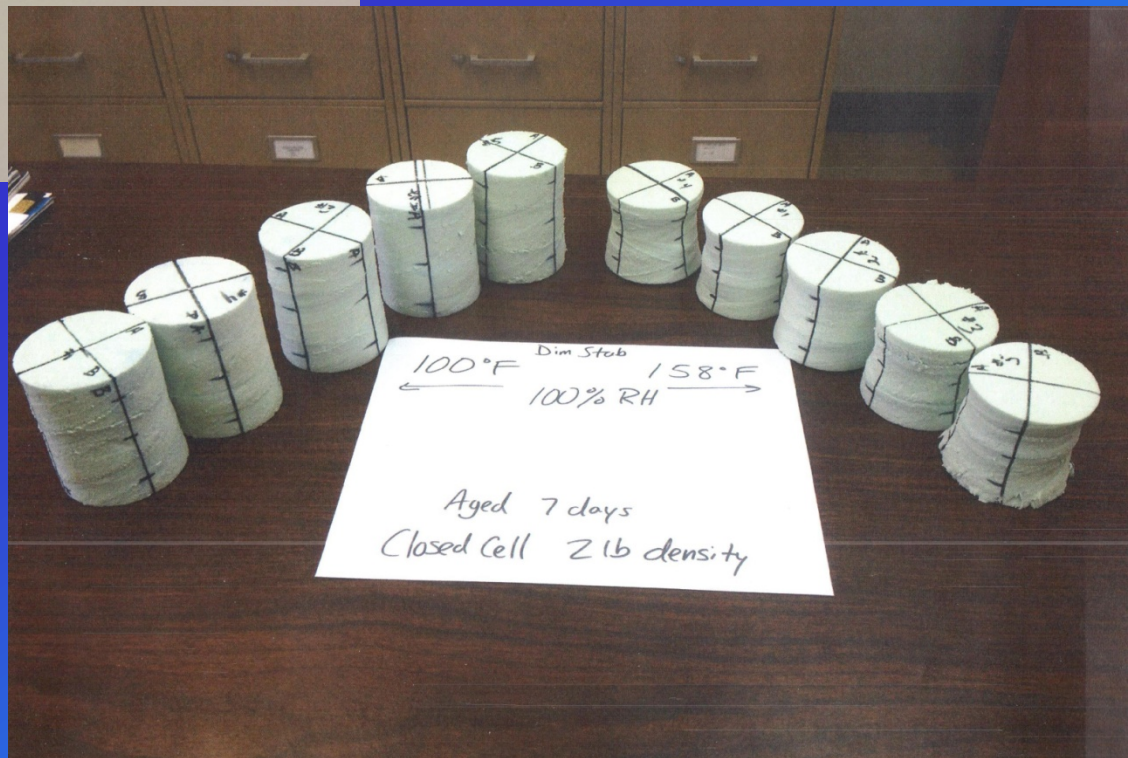
WDP & Assoc. (3)

- "… designers must give additional consideration to the properties of SPF which may be detrimental to the performance of the exterior envelope … until such time that industry resources are developed to assist designers with the proper detailing of SPF systems to limit the impacts of dimensional stability issues."

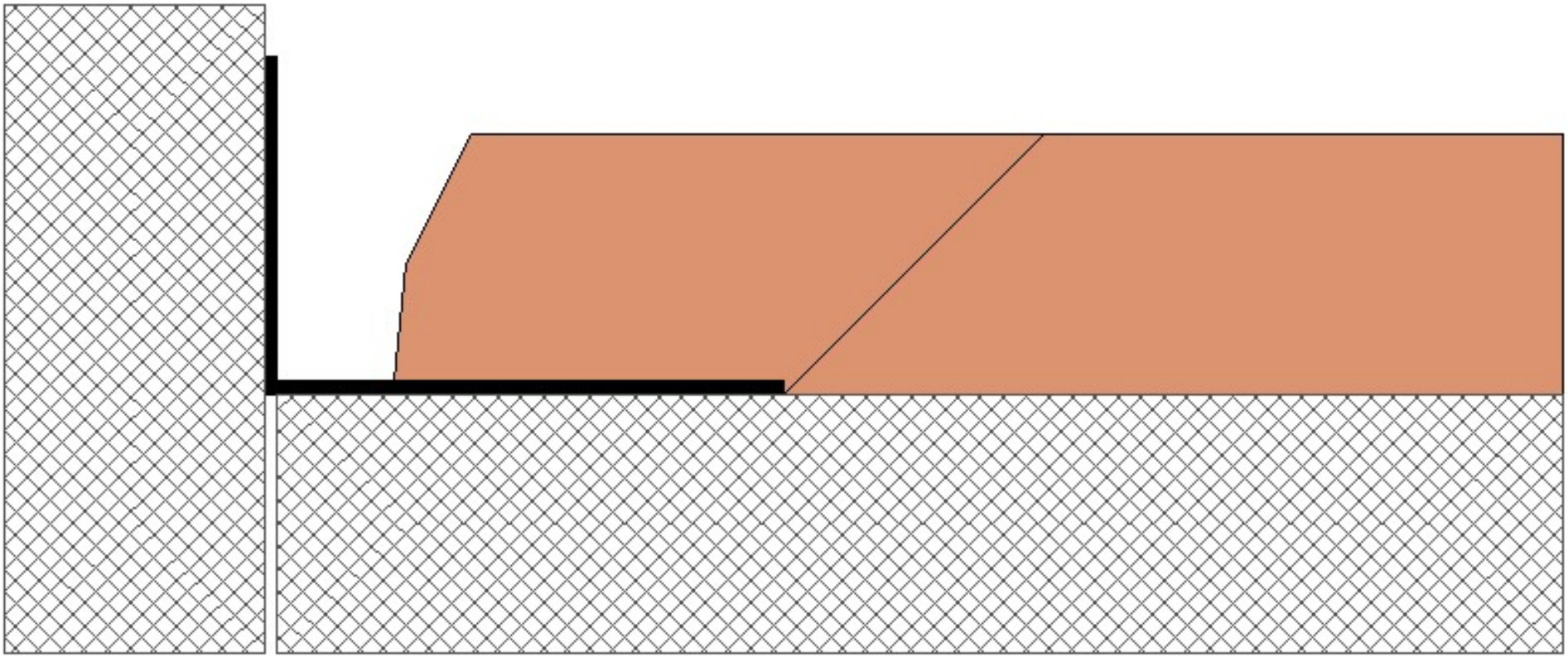
Flexible flashing membrane debonded from the substrate at the horizontal leg of the flashing after SPF application.

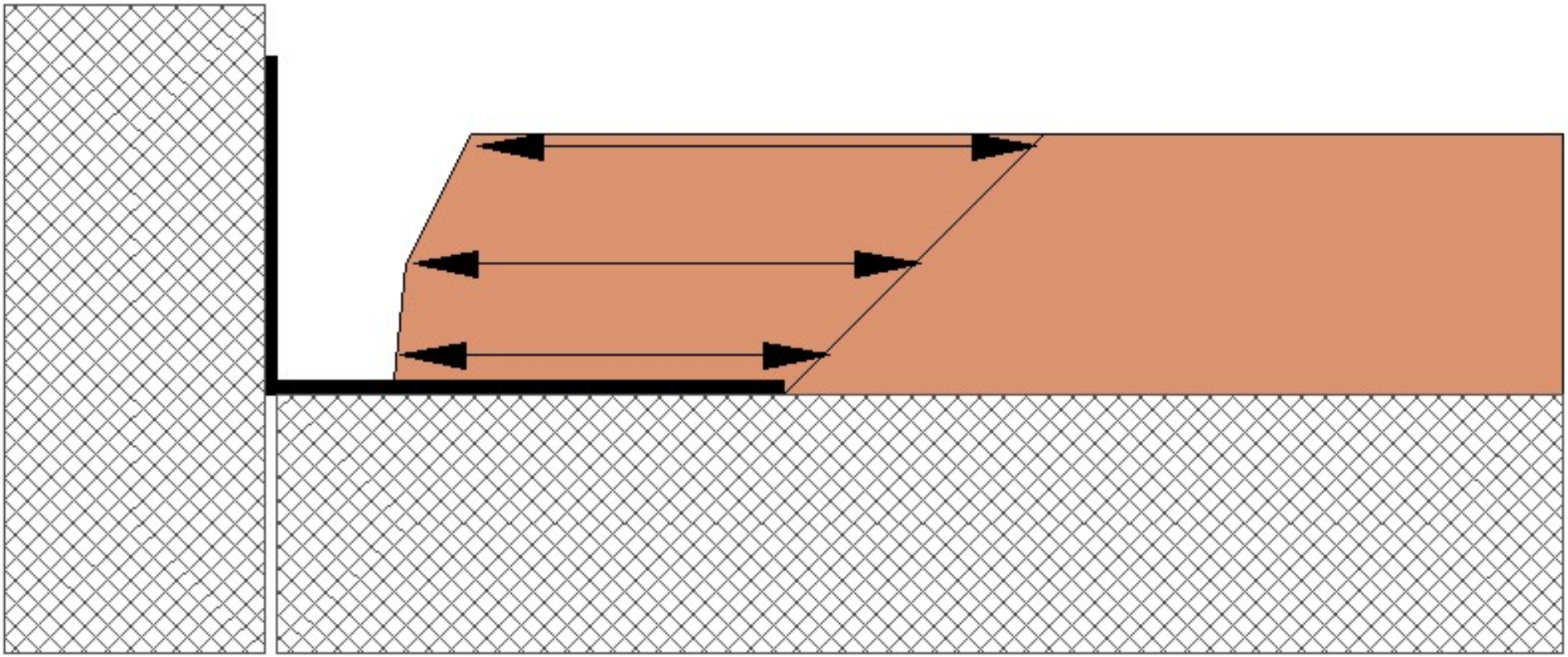
Why does ccSPF shrink?

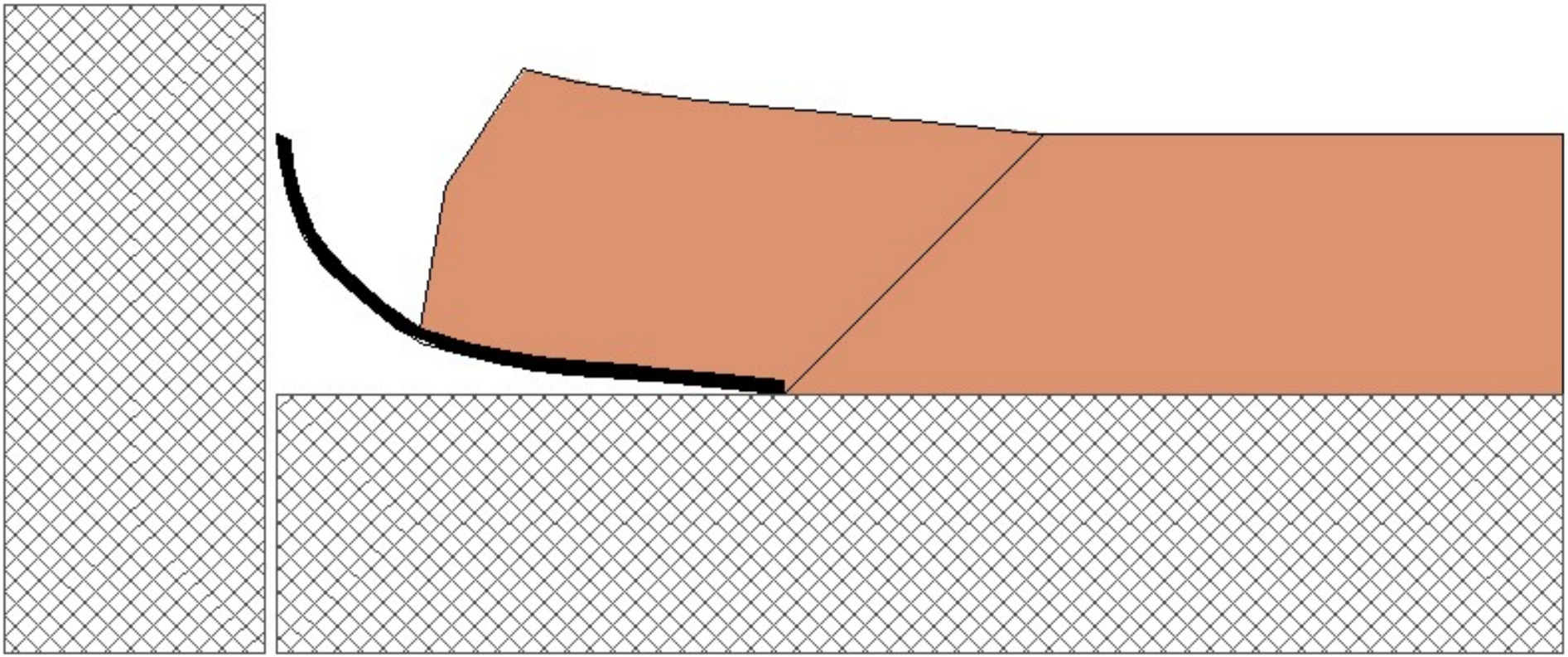
- Cooling of blowing agent
  - Ideal gas law: PV = nRT
- Absorption of blowing agent into polymer
- SPF can expand
- ASTM D2126 (per ASTM C1029)
  - Typically 15% limit (158 F, 97 RH, 7 days)
- No test or standard for initial shrinkage or at different temperatures


Dim Stab
100°F
158°F
100% RH
Aged 7 days
Closed Cell 2 lb density

SPF Shrinkage & Transition Membranes







Potential Remedies

- Termination Membrane Specs
- SPF Specs
- Details
  - Mechanical Attachment
  - Spray Technique
  - Hybrids

Termination Membrane Types

- Self-Adhered (peel & stick)
- Fluid-Applied

ABAA Requirements for Self-Adhered Membranes

- ABAA Process for Approval of Air Barrier Materials, Accessories and Assemblies (D-115-010 Rev 14)
- Material Specs for both self-adhered and fluid-applied
- Pull Adhesion: 16 psi

Transition Membranes

- Are some Transition Membranes heat sensitive?
  - SPF exotherm
- SPF Industry Experience

SPF Specs

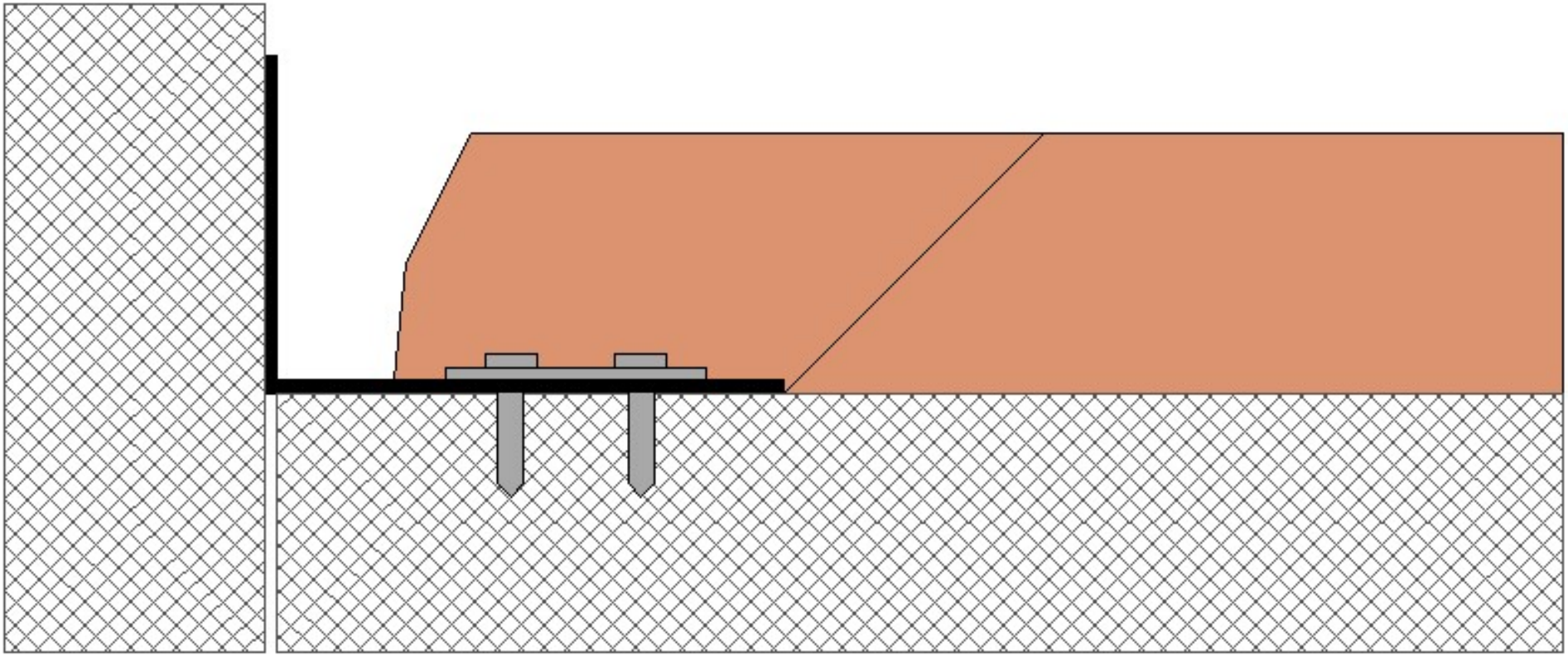
- ASTM D2126 (dimensional stability)
- Tested at 157 F and 97 % RH for 7 days (per ASTM C1029)
- Does not address initial shrinkage
- Does not address SPF response at temperatures typically found in commercial insulation applications

SPF Specs (2)

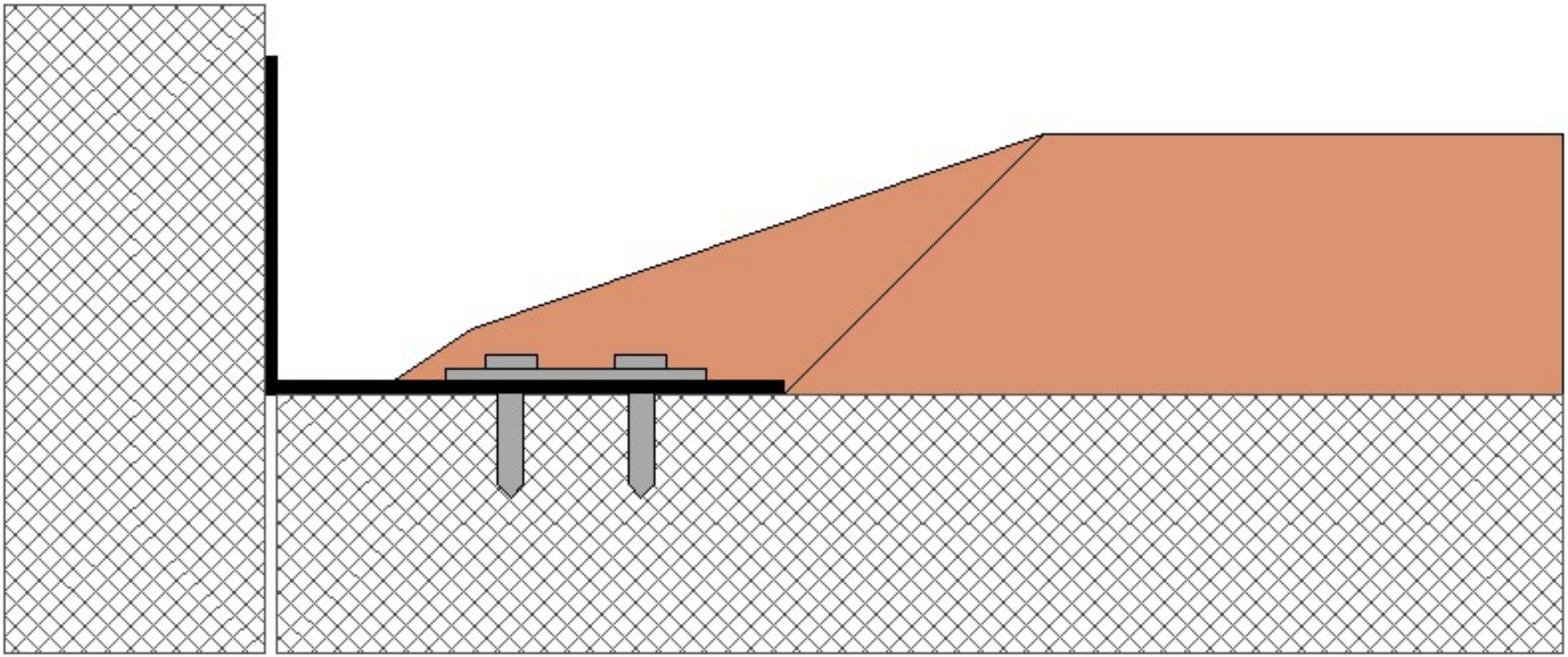
- Are some SPFs better than others?
- SGH work suggests this

Details

Mechanical Attachment

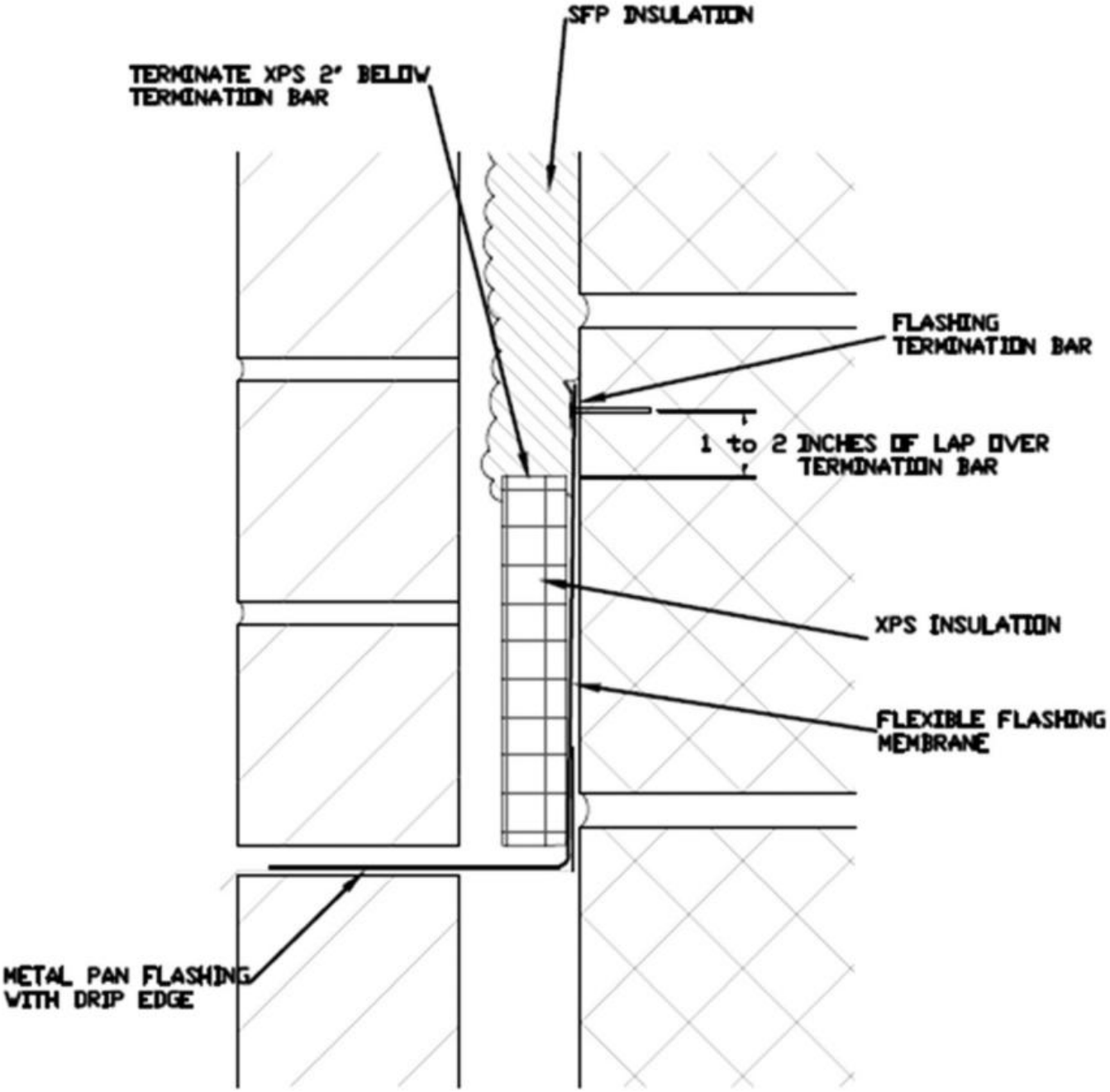


Spray Technique



Wagner-Peterson Detail

Hybrid using XPS as a foam stop



Recap

- Field problems at SPF – Transition Membrane junctures
- Due to:
  - SPF shrinkage (short and long term)
  - Transition membrane adhesion failure
- Potential Remedies
  - Material specs
  - Details
- SPF industry needs to provide guidance

QUESTIONS?