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An Architect's Perspective on Rainscreens

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Presenter Bio

Eric Sassak, AIA
Senior Principal
SmithGroup

With his holistic and definitive approach, Eric Sassak is heavily involved in the design and development of contract documents for complex projects. As an enclosure specialist for SmithGroup's Building Technology Studio over the last fifteen years he is responsible for overseeing the production of a unified set of construction documents, integrating detailing to best accomplish both technical and aesthetic design goals, field analysis, and construction administration. Rainscreen systems, architectural metals, coatings, Contract Administration, and steep slope roofing are areas of his specialization. Eric is also keenly interested in bringing state-of-the-art building technology solutions to historic buildings.

Abstract

Architects face serious challenges when trying to specify rainscreens. They range from not fully understanding the technology, to specifying their design intent, to getting the intent built. All of this may seem like a problem that should not exist, but reality is more nuanced as are the answers to these issues.
Understanding the history and the components/function of rainscreens is vital, and yet it will be shown that many architects are performing all tasks in their practices, eliminating specialization as an option and seriously hindering meaningful continuing education. This is complicated by the modern rainscreen being a more recent development in the construction industry. It can feel like the options are ever changing.

Learning Objectives

1. **A Brief History.** Participants will discover how the rainscreen evolved over history giving them insight into their unique value in today's buildings.
2. **Rainscreen Definition.** Participants will be able to describe the components in a rainscreen and their function in the design of a building enclosure.
3. **Why is it Challenging.** Participants will be able to recognize challenges and pitfalls in specifying rainscreen systems in order to better optimize their designs..
4. **What Can be Improved.** Participants will learn how to collaborate with the design team and constructors in order to lay the foundation for project success.

How Can I Know Everything?

- I have heard it said that we speak the best on topics we know the most, so perhaps I am well suited to speak on a topic of asking questions.

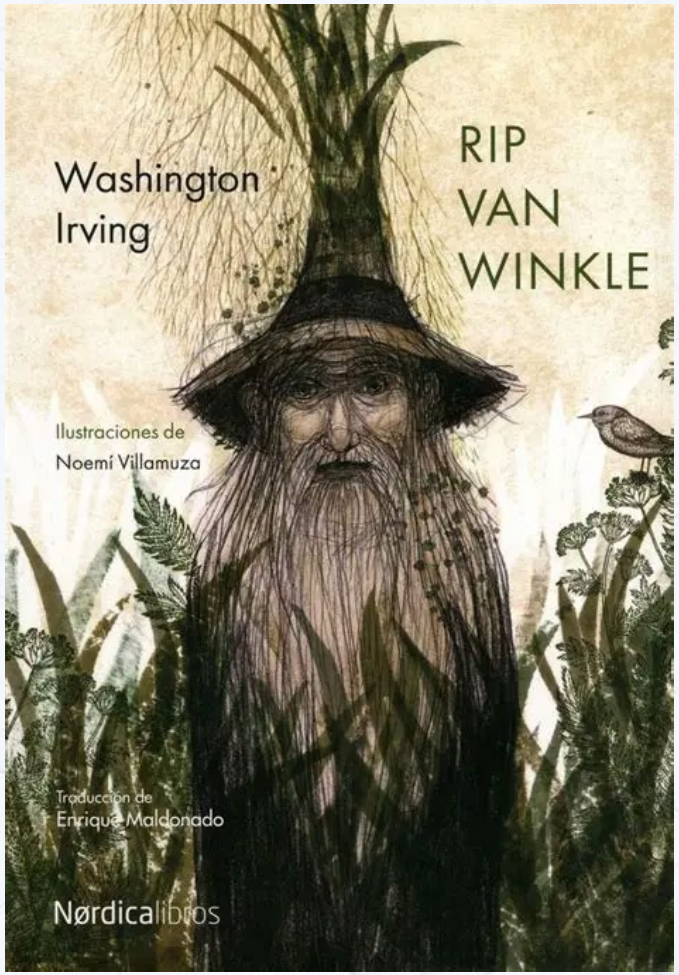
The Origin of the Rainscreen

"…if a wall is in a state of dampness all over, construct a second thin wall a little way from it….at a distance suited to the circumstances….with vents to the open air….when the wall is brought up to the top, leave air holes there. For if the moisture has no means of getting out by vents at the bottom and at the top, it will not fail to spread all over the new wall". -Vitruvius

Asleep for Two Thousand Years!

Our first formal modern revisiting of the concept comes in 1946 in a paper written by C.H. Johansson. Here he discussed the idea of positioning a water repelling screen in from of porous building materials like brick and concrete to keep water from infiltrating through the outer wall. In this paper he specifically uses the words “rain screen” and from there we see and ebbing and flowing evolution to where we are today.

It was only in the last five years, thanks to RAiNA, that we have an official definition for “rainscreen” as well as a host of other definitions, Building Codes updated and continuing research to strengthen rainscreen technology and knowledge.

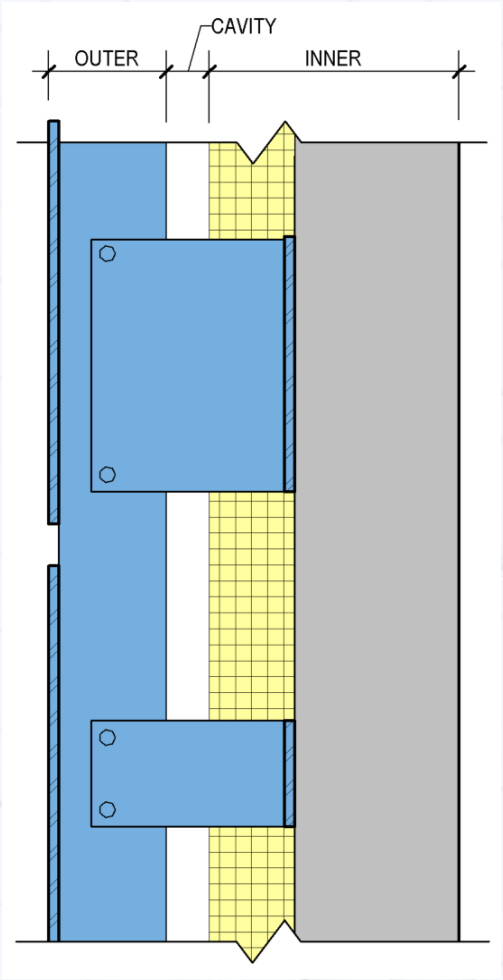


What is a Rainscreen? In Modern Terms…

RAiNA, understanding the growing use and confusion around raincreen wall assemblies was formed in 2020 and quickly developed this definition.

"Assembly applied to an exterior wall which consists of, at minimum, an outer layer, an inner layer, and a cavity between them sufficient for the passive removal of liquid water and water vapor."

This was included in the International Building Code in the 2024 edition.



What makes a Rainscreen Better?

There are three main categories of building enclosure:
-Barrier Wall
-Mass Storage
-Rainscreen

Mass Storage

Barrier Wall

Rainscreen

A Perfect Wall in Imperfect Construction?

While somewhat hyperbolic, the “Perfect Wall” created important elemental concepts to articulate the most foundational functions of an exterior wall. Here is what Joseph Lstiburek published in July of 2010:

“The perfect wall is an environmental separator—it has to keep the outside out and the inside in. In order to do this the wall assembly has to control rain, air, vapor and heat. In the old days we had one material to do this: rocks. We would pile a bunch or rocks up and have the rocks do it all. But over time rocks lost their appeal. They were heavy and fell down a lot. Heavy means expensive and falling down is annoying. So construction evolved. Today walls need four principal control layers—especially if we don’t build out of rocks.

A Division of Labor

They are presented in order of importance:

-a rain control layer

-an air control layer

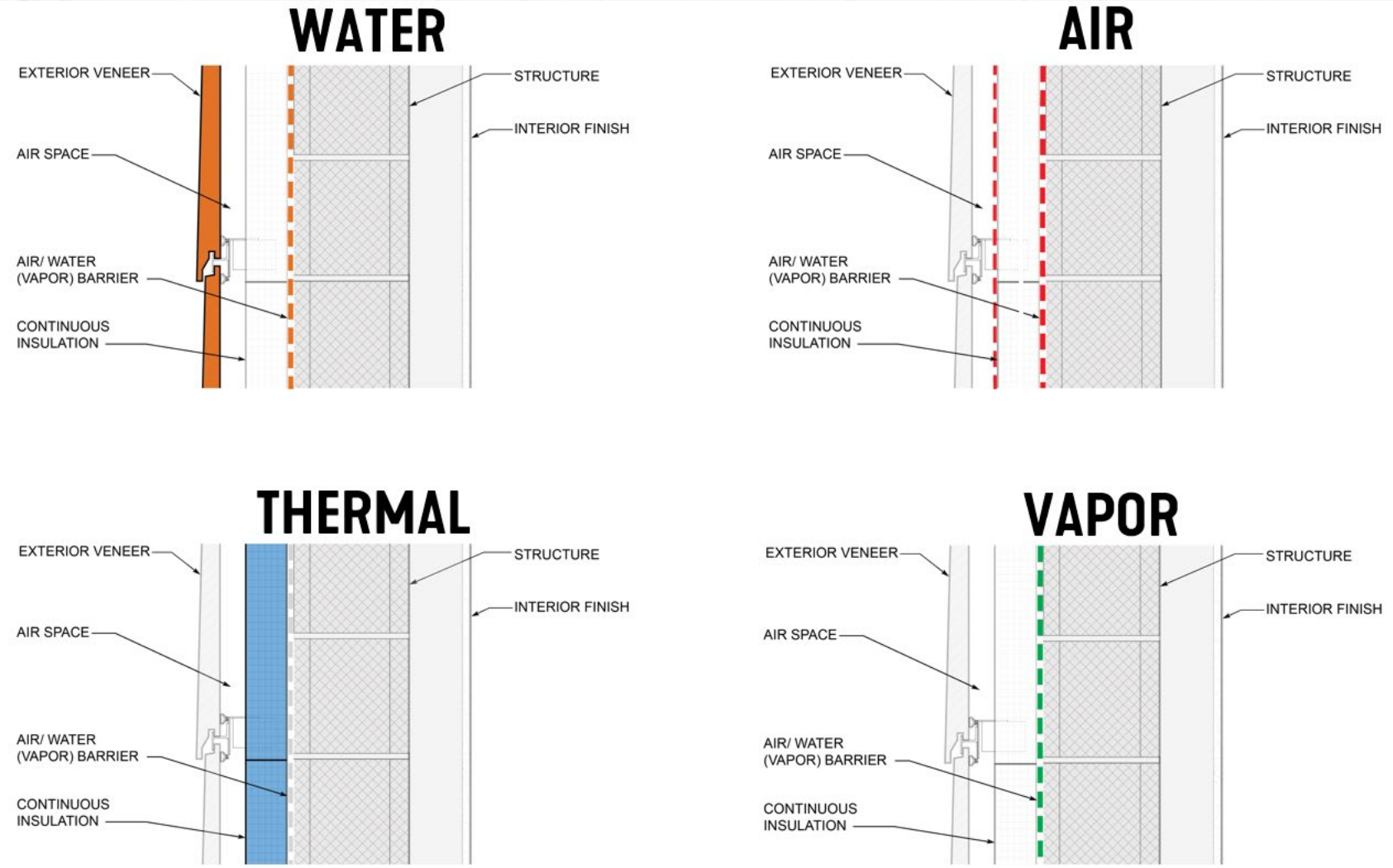
-a vapor control layer

-a thermal control layer

Layers of Protection

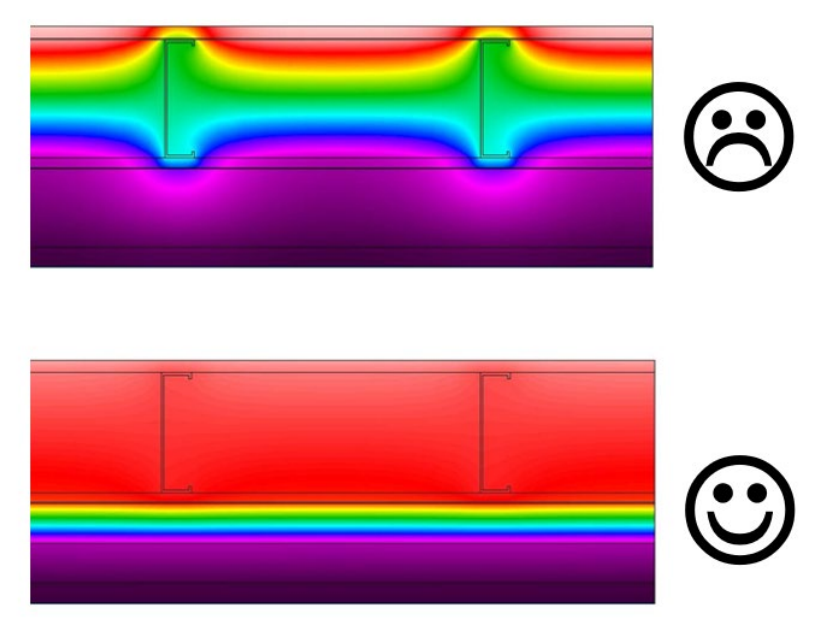
A point to this importance thing here, if you can't keep the rain out don't waste your time on the air. If you can't keep the air out don't waste your time on the vapor.
The best place for the control layers is to locate them on the outside of the structure in order to protect the structure (Figure 1). When we built out of rocks the rocks didn't need much protection. When we build out of steel and wood we need to protect the steel and wood. And since most of the bad stuff comes from outside the best place to control the bad stuff is on the outside of the structure before it gets to the structure."

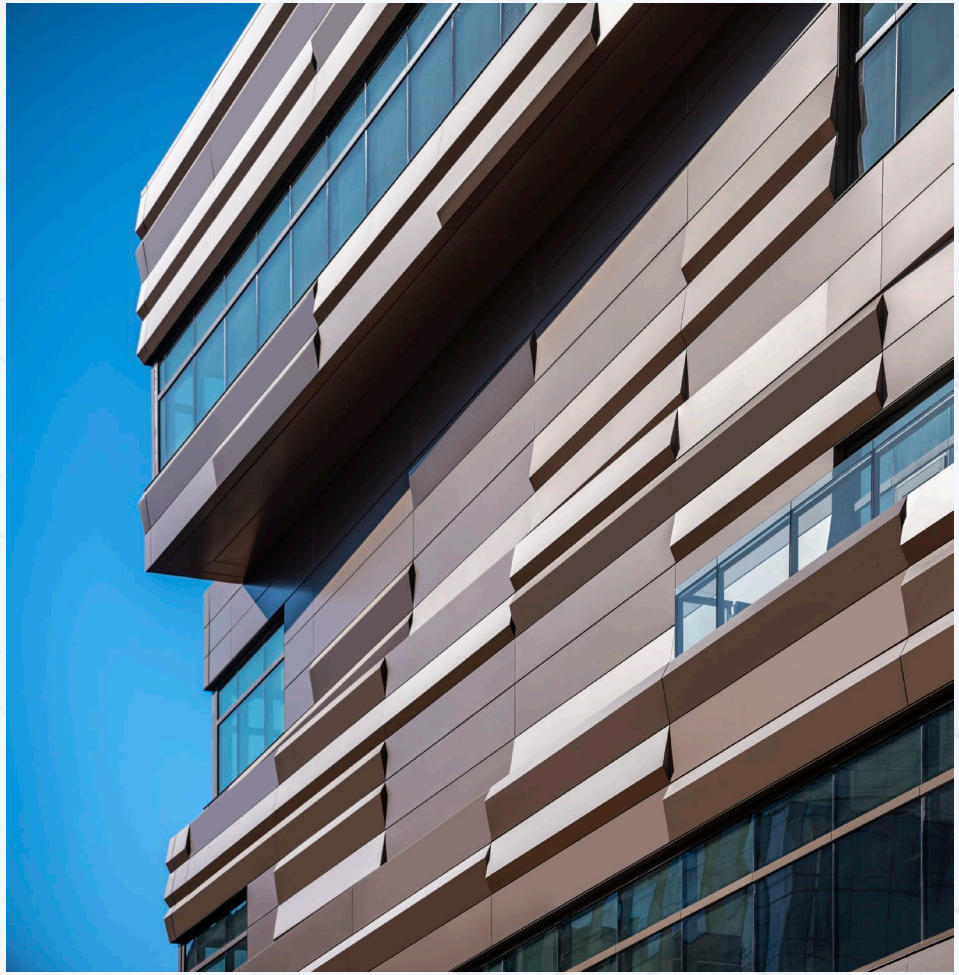
Let’s Look at How this Comes Together



c.i. – at the Core of it All

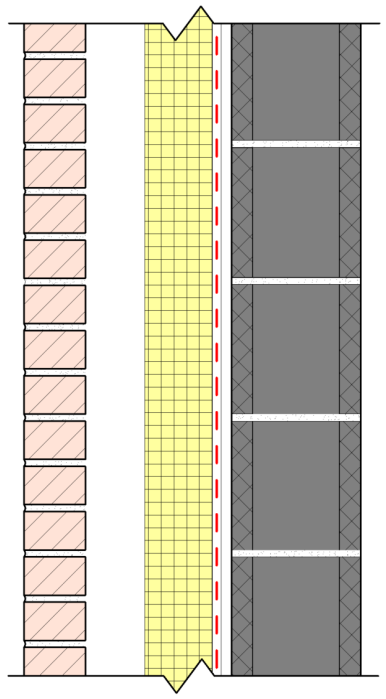
Rainscreens can take many forms. There are Code requirements that can shape them. Perhaps the most important is continuous insulation. RAiNA's mission is to provide standards and definitions that help owners, architects, constructors and manufactures understand and achieve their goals.





The Old Reliable

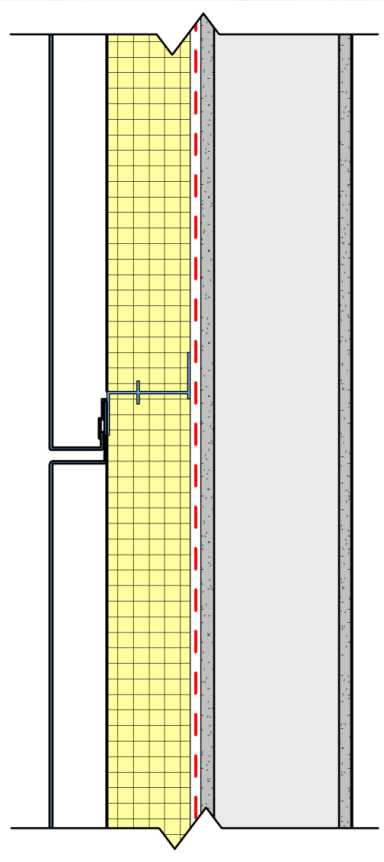
Let’s go through some common examples. Masonry, one of the most ubiquitous building claddings. Relatively simple to make and simple to install, masonry has been around for thousands of years.



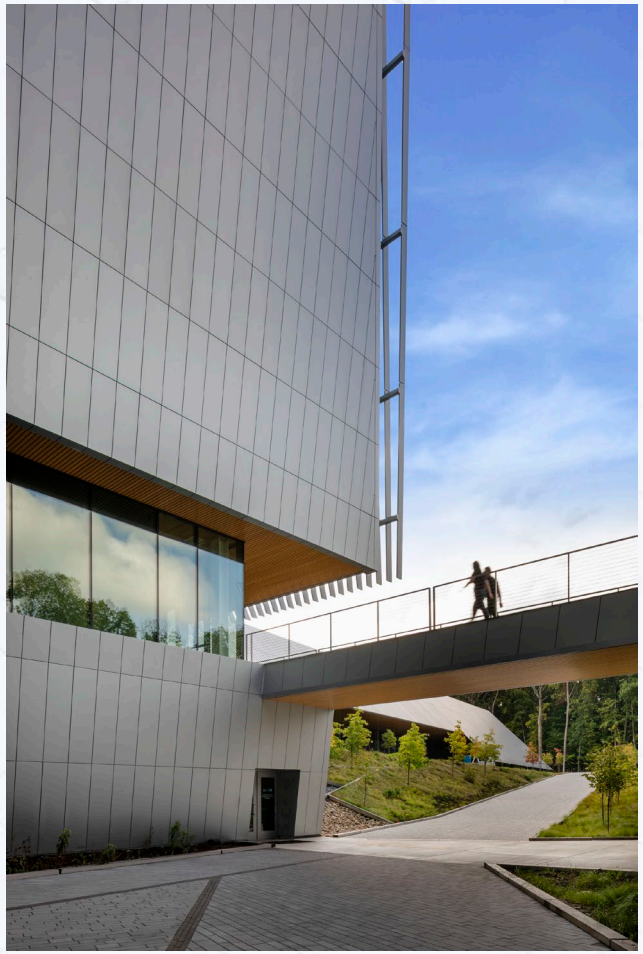
Masonry Examples

Metal Cladding

Lighter than masonry with seemingly endless possible variations.

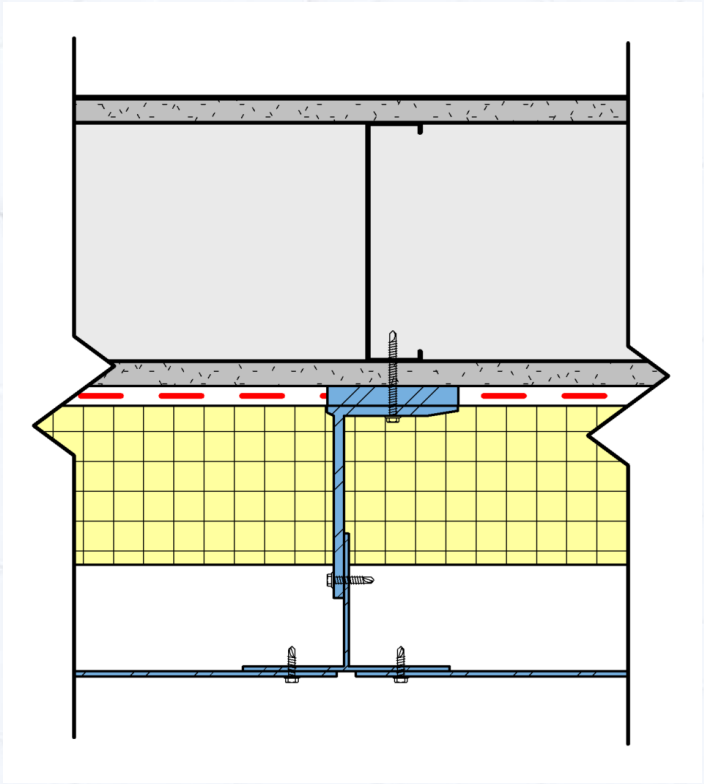


Metal Cladding Examples

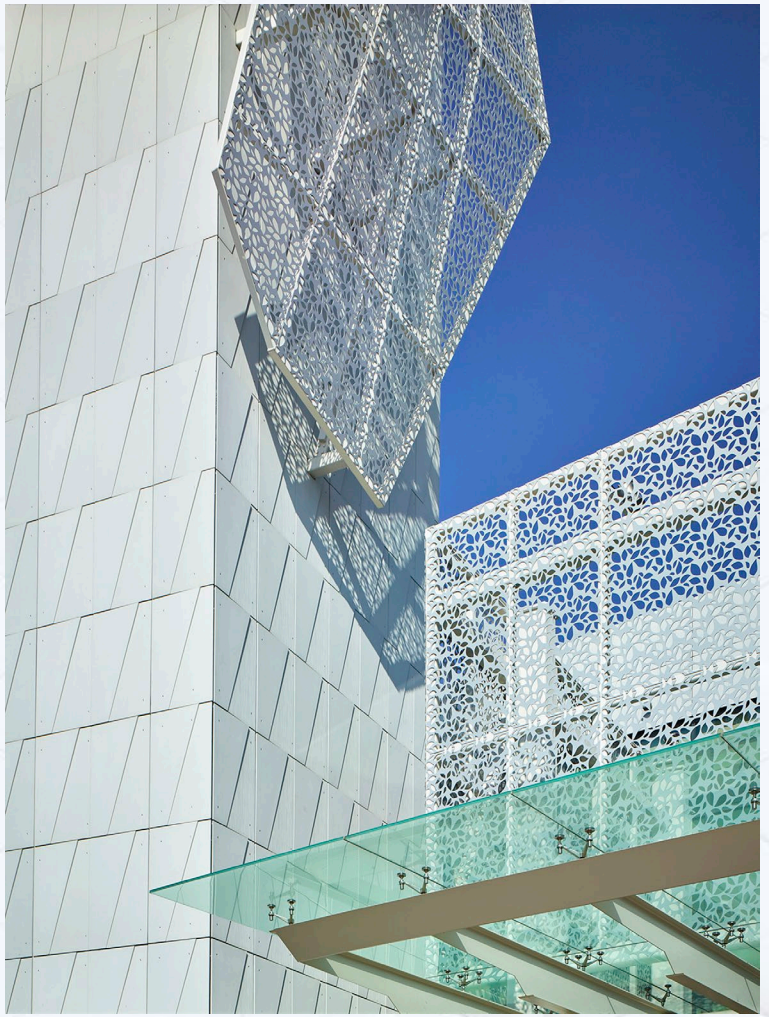


Thin Panel Cladding

Flat panels from a variety of materials with similar attachment strategies.

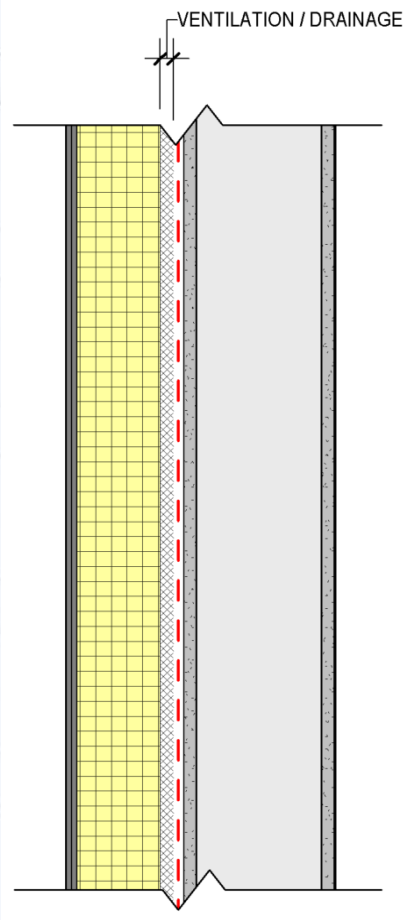


Thin Panel Cladding Examples



Options you might not Associate with Rainscreen

Stucco, Exterior Insulation Finish Systems and other applied material can be designed as a rainscreen.



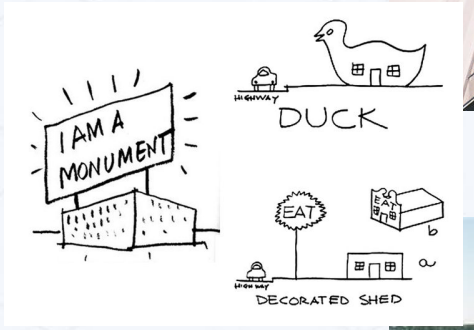
Adhered Cladding Examples

Torn between Beauty and Science

Modernism in Architecture was born over 100 years ago. With Form follows function being its rally cry, it was the predominant style through the mid Twentieth Century.

Post-modernism followed which embraced more eclectic expressions.

At the end of the Twentieth Century, having gone through an energy crisis, economic turbulence and the growing concern over climate change Sustainability emerged as a driver in Architecture.



Sustainability and Rainscreens

We have made great strides with our sustainability efforts. A big part of this is verification. Commissioning and whole building air testing are going to be an important part of the conversation later in this presentation.

Photo 4 – Bank of Fans Installed in the Penthouse Door

Like it or not…Ringmasters

The non-architects in the room might make “know-it-all” jokes about architects, after all we are tasked to be Circus Ringmasters to some extent. Architects would probably prefer orchestra conductors… I will argue Ringmaster is most apropos.

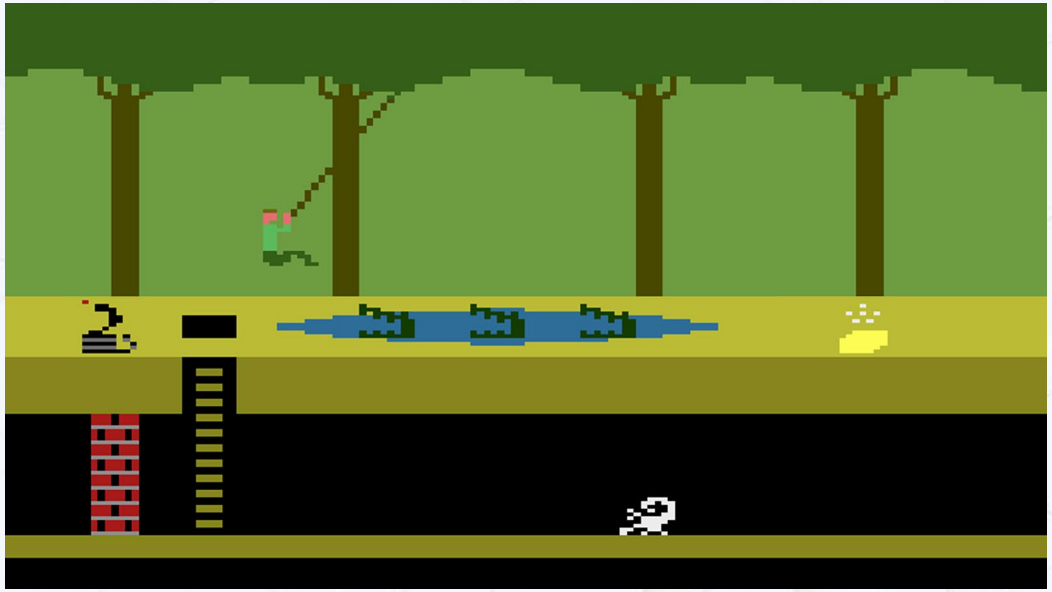
The reality is we are far from know-it-alls, and our knowledge gaps lead to some of our biggest challenges.

The Rest of the Circus

The complete design/construction team.

Examples of Pitfalls

We love to think of things in the ideal, but the real world has different plans for us.



Potentially Misleading

Sometimes it is an outright falsehood, but more commonly it is a reductive simplification. Various claims and statements from around the internet.

Acoustical Surfaces
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LEED Certified Soundproofing | Solve Any Noise Problem

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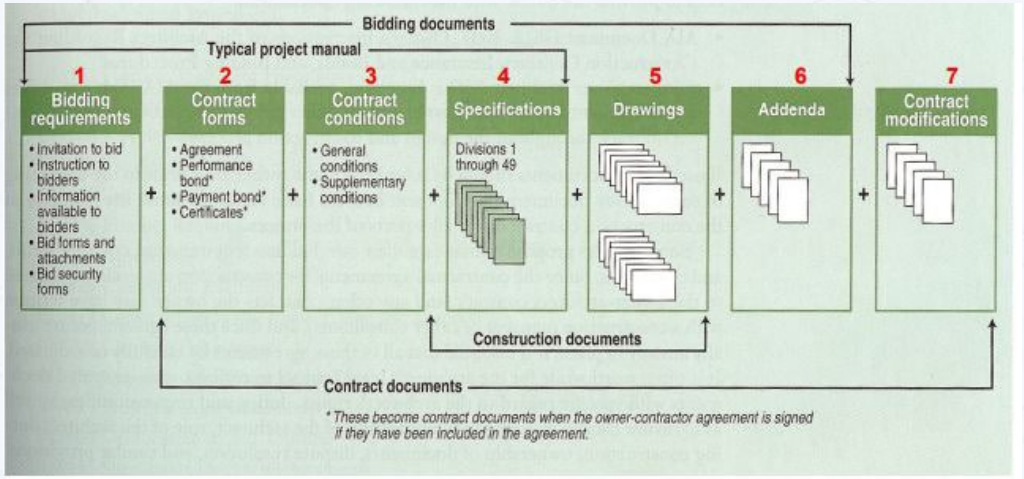
LEED Certified Building Materials — What is LEED®? The LEED green building certification program encourages and accelerates global adoption of sustainable green building and ...

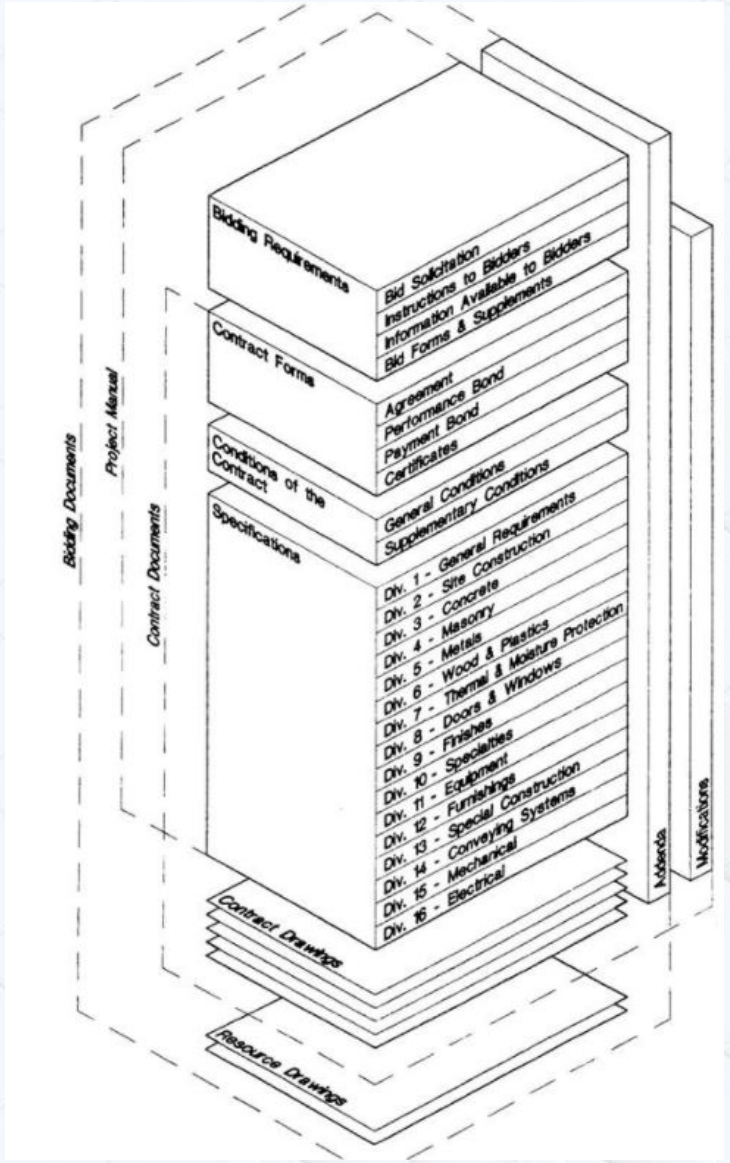
ALPOLIC Technical Summary

	Property	Standard	Alpolic					unit
			PE			fr		
			3 mm	4 mm	6 mm	4 mm	6 mm	
Physical Properties	Aluminum Skin Thickness				0.02			inch
					0.5			mm
	Weight		0.93	1.12	1.5	1.56	2.23	lb/ft^2
			4.54	5.47	7.32	7.62	10.89	kg/m^2
	Sound Transmission Coefficient	ASTM E90	25	26	26	—	—	dB
	Coefficient of Thermal Expansion				0.000013			in/in-°F
					0.0000234			mm/mm-°C
	Drum Peel	ASTM D1781	33.6	33.6	33.6	27.6	—	lb-in/in
			150	150	123	110	—	N-mm/mm
Fire Resistance Properties	Smoke Developed Index	ASTM E84	15	0	10	10	0	—
	Flame Spread Index	ASTM E84	5	0	0	0	0	—
	Flash Ignition Temperature	ASTM D1929	—	716	716	811	811	°F
			—	380	380	432.8	432.8	°C
	Self Ignition Temperature	ASTM D1929	—	752	752	837	837	°F
			—	400	400	447.2	447.2	°C
	Rate of Burning	ASTM D635	—	CC1	—	—	—	—
	ISMA Test	UBC 26-9	—	—	—	Pass	Pass	—
	Potential Heat Release	UBC 17-2	—	—	—	<6000	—	BTU/ft^2
	Other Fire Tests	ASTM E162	—	0	—	0	—	—
		ASTM E108	Pass	Pass	Pass	Pass	Pass	—
		ASTM E119	—	—	—	Pass	—	—
		UL-94	V-O rating	V-O rating	—	—	—	—
		UL-879	Pass	Pass	—	—	—	—
		NFPA-285	—	—	—	Pass*	Pass*	—
rances	Width				0.08			inches
					2			mm

Getting to the Goal

So how does a rainscreen assembly come into being? The architect and owner determines the aesthetic and functional requirements of the exterior enclosure. This is informed by Codes and other regulatory requirements along with the financial constraints of the project.





Working Together on a Common Goal

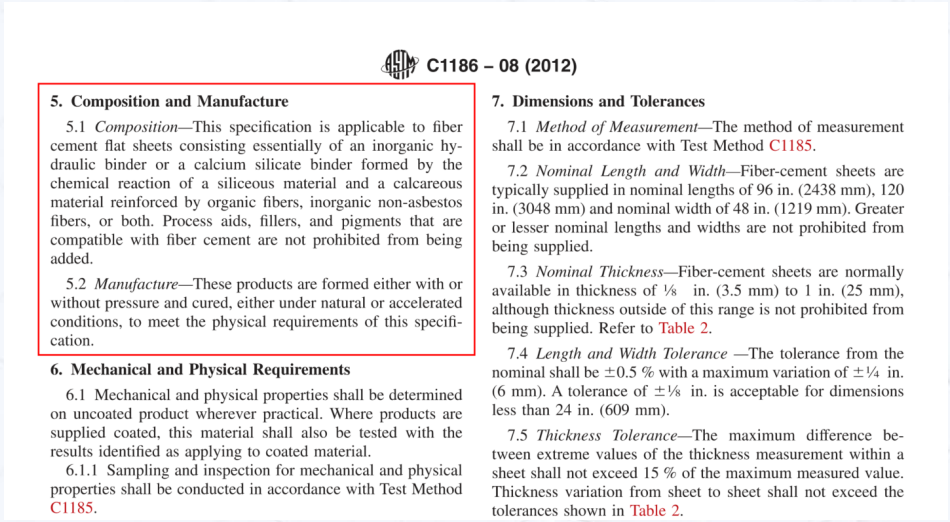
We are caught between fantasy and reality, we think we should all be pulling together in a grand kumbaya moment. The nuanced reality is that we have different interests, even if the architect's goal and the constructor's goal are both a happy client.

Navigating the Same but Different

Some product categories contain wildly different options even though they are considered as equals by ASTM, MasterSpec, etc. They are not the same but equal…

The Conundrum of Making Everything Equal

The whole point of a specification is to have some control on the outcome. On rare occasions the Standards undermine this effort. Architects who are aware of that issue frequently avoid the associated products. We can have strong reasons for our choices and get waylaid after the bidding process with nominal savings to the owner and a bunch of "just as good-isms."



C1186 – 08 (2012)

5. Composition and Manufacture

5.1 *Composition*—This specification is applicable to fiber cement flat sheets consisting essentially of an inorganic hydraulic binder or a calcium silicate binder formed by the chemical reaction of a siliceous material and a calcareous material reinforced by organic fibers, inorganic non-asbestos fibers, or both. Process aids, fillers, and pigments that are compatible with fiber cement are not prohibited from being added.

5.2 *Manufacture*—These products are formed either with or without pressure and cured, either under natural or accelerated conditions, to meet the physical requirements of this specification.

6. Mechanical and Physical Requirements

6.1 Mechanical and physical properties shall be determined on uncoated product wherever practical. Where products are supplied coated, this material shall also be tested with the results identified as applying to coated material.

6.1.1 Sampling and inspection for mechanical and physical properties shall be conducted in accordance with Test Method C1185.

7. Dimensions and Tolerances

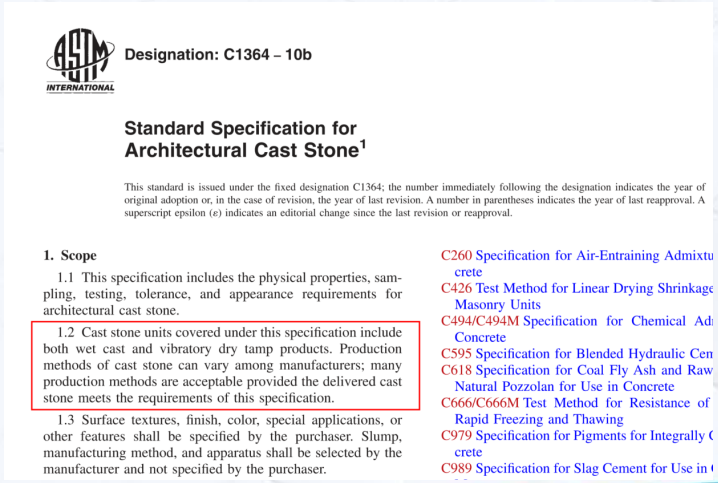
7.1 *Method of Measurement*—The method of measurement shall be in accordance with Test Method C1185.

7.2 *Nominal Length and Width*—Fiber-cement sheets are typically supplied in nominal lengths of 96 in. (2438 mm), 120 in. (3048 mm) and nominal width of 48 in. (1219 mm). Greater or lesser nominal lengths and widths are not prohibited from being supplied.

7.3 *Nominal Thickness*—Fiber-cement sheets are normally available in thickness of ⅛ in. (3.5 mm) to 1 in. (25 mm), although thickness outside of this range is not prohibited from being supplied. Refer to Table 2.

7.4 *Length and Width Tolerance* —The tolerance from the nominal shall be ±0.5 % with a maximum variation of ±¼ in. (6 mm). A tolerance of ±⅛ in. is acceptable for dimensions less than 24 in. (609 mm).

7.5 *Thickness Tolerance*—The maximum difference between extreme values of the thickness measurement within a sheet shall not exceed 15 % of the maximum measured value. Thickness variation from sheet to sheet shall not exceed the tolerances shown in Table 2.



Designation: C1364 – 10b

Standard Specification for Architectural Cast Stone[1]

This standard is issued under the fixed designation C1364; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification includes the physical properties, sampling, testing, tolerance, and appearance requirements for architectural cast stone.

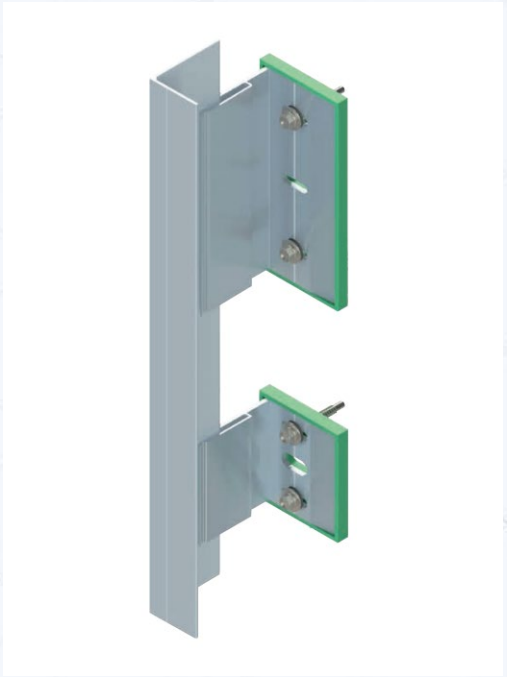
1.2 Cast stone units covered under this specification include both wet cast and vibratory dry tamp products. Production methods of cast stone can vary among manufacturers; many production methods are acceptable provided the delivered cast stone meets the requirements of this specification.

1.3 Surface textures, finish, color, special applications, or other features shall be specified by the purchaser. Slump, manufacturing method, and apparatus shall be selected by the manufacturer and not specified by the purchaser.

C260 Specification for Air-Entraining Admixtu
crete
C426 Test Method for Linear Drying Shrinkage
Masonry Units
C494/C494M Specification for Chemical Ad
Concrete
C595 Specification for Blended Hydraulic Cem
C618 Specification for Coal Fly Ash and Raw
Natural Pozzolan for Use in Concrete
C666/C666M Test Method for Resistance of
Rapid Freezing and Thawing
C979 Specification for Pigments for Integrally
crete
C989 Specification for Slag Cement for Use in

The Wake of the Razor's Edge

We have gone from cold formed metal Z's and hats to much more sophisticated systems. One system we specified in the early to mid 10's until we realized in the field installing insulation was problematic.

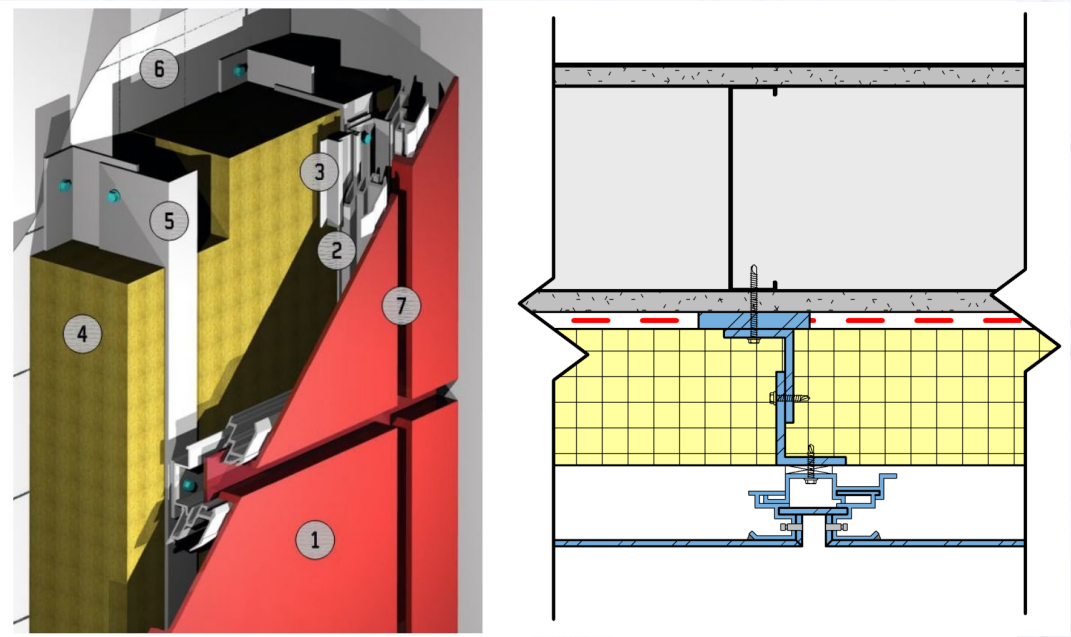


So why are Architects Delegating Design?

“Delegated design is a collaborative approach where a contractor assumes responsibility for designing a specific portion of a construction project. While it offers significant advantages, contractors new to this type of service should understand the associated risks. Below are key features of delegated design services and practical tips to help contractors navigate potential challenges.” AIA 2022

Delegated Design and MCM Rainscreens

This is an example rainscreen system form an unnamed fabricator. They can provide turnkey rainscreen installations. Most MCM fabricators will offer a back ventilated route and return systems with splines in the reveals, but they all do not all accomplish it the same way.



How Does the Industry Move Forward

The easy answer is more of the same tweaking and adjusting as we go. Doing the same and expecting different…

Rainscreen Contractors? Enclosure Contractors?

They already exist, but there needs to be more. This is not necessarily about folding manufacturers into conglomerates but creating contracting companies with the capability to install the different components of the complete rainscreen system and be responsible for it all.

Rainscreen Contractor Reality

The cost of construction keep going up and moving in this direction will continue that trend.

Rainscreen Contractors

Ultimately it is in the best interest of the Owner and the Architect to have a rainscreen contractor.

What Could Go Wrong

Centralizing the assembly to a single contractor solves some potential issues but leaves others same as they ever were.

The architect still has to know what they are designing and specifying. The contractor and it’s trades still has to perform.

What Will Go Right

From an Owner perspective an overarching rainscreen/enclosure contractor brings one enormous advantage, a single point of responsibility when something goes wrong. Admittedly this is a huge benefit to the architect too.

Let’s Discuss

In this realm there are more questions than answers, and we need lively discourse if we are going to discover any new treasure.

QUESTION & ANSWER PERIOD

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