STOP COMPROMISING YOUR ENVELOPE: KEEP YOUR EXTERIOR WALL UNCOMPLICATED

The evolution of how exterior walls insulate and protect,
and how to select the best system for your next building project.

genwall® Enhanced Substrate System™

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Introduction

Architects face many challenges in the design and detailing of a successful building project. A critical element of a building's design is the exterior envelope. The building's envelope presents challenges and opportunities—for both aesthetics and performance.

The complications come from many factors:

- The growing number of finish materials
- More stringent energy and building codes
- The many options for the envelope's backup wall
- A shortage of skilled laborers in the construction field

Today's architects need to be more demanding, knowledgeable and adaptable when designing the building envelope. They can't copy and paste the same details and specifications they've used for years. Traditional backup wall construction no longer meets the changing performance requirements and expectations. The rules have changed.

Traditional envelope construction required several passes of different trades to install the various components on top of one another. This process led to coordination issues, added costs, reduced reliability, and longer construction schedules. Also, the exterior façade installation required compromising the air and water barrier with each screw to provide positive attachment to the building framing.

To meet today's codes, the architect has to keep a constant eye on energy and building requirements, as well as the technologies that manufacturers are developing to help them be code compliant.

These technologies must come from the combined efforts of the entire building industry, working together to meet this growing need. Architects, builders, building scientists, code officials, and building material manufacturers must continue to learn from past successes and failures to develop a "perfect" wall system.

The Perfect Wall

Industry experts may never create the perfect wall that meets everyone's needs and requirements. There are too many variables to meet every obstacle with a universal solution. Material cost fluctuations, construction methods, and designer preferences all play a part in a building's final design and construction.

"Compared to traditional wall construction, we eliminated numerous joints, seams, exterior gyp board taping issues...another phase of subcontractors to run that work, and then another sub to come in and insulate.

Traditional becomes a coordination challenge – you have several different trades to phase in. Then you have to integrate your MEPs into this work.

Genwall® is a one-and-done approach."

- Bill Bowman

Project Manager, Story Construction
Project: Workiva - Ames, Iowa
Previously known as Webfilings

However, with the right technologies and the right product, we may be able to inch closer to perfecting at least a part of the wall.

For the purposes of this paper, today's exterior wall is broken down into two basic parts:

- **Exterior Façade** - face brick, metal panel system, limestone or whatever finished material the designer decides on; essentially, the material that the rest of the world sees.

- **Exterior Backup Wall** - the workhorse behind the scenes supporting the façade, ensuring the building performs both structurally and thermally, protecting the interior and the building's occupants.

This paper discusses how material manufacturers have developed products to improve the **exterior backup wall**; to help architects, designers, builders and building owners determine the best backup wall system for their next project.

An effective exterior backup wall needs to serve the following functions:

- Provide structural support (as a load-bearing member for the building, or as a support for the exterior façade)

- Deliver thermal efficiency (insulated and detailed to meet and/or exceed code requirements)

- Keep out the rain, wind, snow and ice

- Control the flow of air and vapor from captured within the wall

- Provide a drainage plane (as part of a rainscreen system)

In the following pages, we look at how the industry's view of the exterior backup wall has evolved...
… the challenges architects face designing a backup wall that meets the many requirements it needs to serve...
… and the system solutions the industry is developing to meet those needs.

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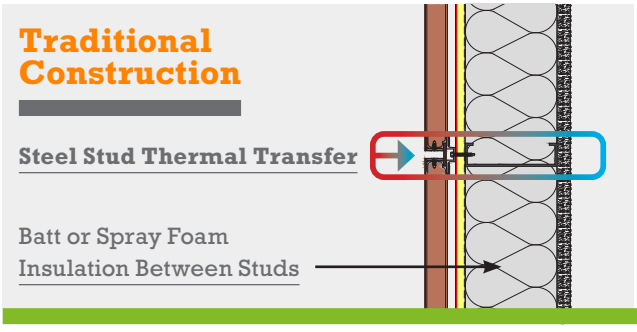
Evolution: How did we get here and where are we going?

In the early 2000s, a shift occurred that changed how our industry viewed the building envelope's performance. The building and energy codes began changing to address these new findings.

Thermal Bridging and Effective R-Values

In 2004, the American Society of Heating, Refrigerating and Air-Conditioning Engineers ("ASHRAE") developed new thermal standards for building wall systems. The new standards looked at the R-value of an entire wall assembly as opposed to just the insulation.

Using American Society of Testing and Materials ("ASTM") methods, ASHRAE discovered the steel studs were transferring thermal energy at a rate greater than previously understood.



Plan view of the thermal bridge in traditional wall construction reduces the system's R-value by up to 0.52. Image courtesy of SHG, Inc.

With these new findings, ASHRAE corrected the traditional construction wall system's R-values by factors up to 0.52. Insulation R-Value alone is no longer the indicator to determine wall system thermal performance. Building designers are now required to shift their thinking from **nominal** insulation R-values to **effective** wall system R-values.

The following table contains data from Table A9.2-2 of the ANSI/ASHRAE/IES Standard 90.1-2013. The numbers illustrate how adding thicker insulation or increasing stud depth, or stud spacing still won't significantly improve thermal performance. It's impossible to design a steel stud wall with batt insulation in the stud cavity and achieve a system R-value over R-10.

Other Issues with Traditional Building Envelope Design

For building envelope design and construction, maintaining the air and water barrier is critical. These barriers are part of the backup wall system—making them vulnerable to penetrations during the exterior façade installation.

Traditional building envelope design requires "multi-pass" installation to achieve thermal and moisture protection. This means separate trade groups apply or attach several components on top of one another. These processes add to the complication, cost, reliability and time needed to construct a building.

The "Multi-Pass" System

- **Pass 1** - A first trade attaches exterior sheathing to the outside face of the steel studs.
- **Pass 2** - A second trade group applies a building wrap to the sheathing.
- **Pass 3** - A third trade group installs the exterior insulation panels & façade support.
- **Pass 4** - A fourth trade group installs the façade.

Façade anchors then compromise the air, water, vapor and thermal barriers as they extend through the wrap and sheathing.

This creates an increased concern when a façade anchor misses a stud during pass 4, is removed, and leaves a hole in the barrier that an anchor doesn't fill.

The following table contains data from Table A9.2-2 of the ANSI/ ASHRAE/IES Standard 90.1-2013. The numbers illustrate how adding thicker insulation or increasing stud depth, or stud spacing still won't significantly improve thermal performance. It's impossible to design a steel stud wall with batt insulation in the stud cavity and achieve a system R-value over R-10.

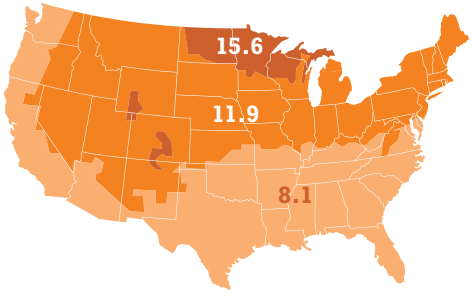
Effective R-Value by Increasing Stud Depth

Nominal Framing Depth	Nominal Insulation R-Value	X	Correction Factor	=	Effective R-Value
4" @ 16" O.C.	R-15	X	0.43	=	R-6.4
4" @ 24" O.C.	R-15	X	0.52	=	R-7.8
6" @ 16" O.C.	**R-21**	**X**	**0.35**	**=**	**R-7.4**
6" @ 24" O.C.	R-21	X	0.43	=	R-9.0

65% Reduction

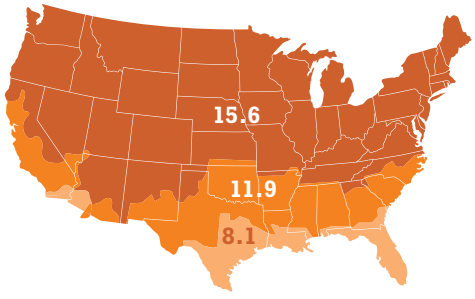
Staying Ahead of Increasingly Stringent Energy Codes

In 2006, the International Building Code ("IBC") adopted ASHRAE standards and created regions with specific R-value standards for exterior building wall envelopes.



ASHRAE 2004

R=15.6 R=11.9 R=8.1



ASHRAE 2007

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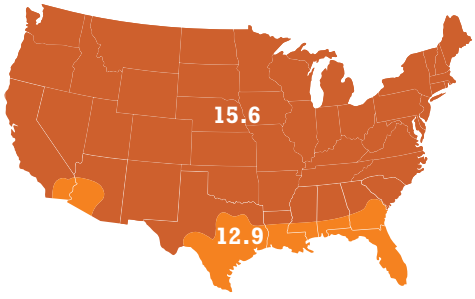

ASHRAE 2012

R=15.6 R=12.9

The 2012 International Energy Conservation Code (IECC) later built on these standards and greatly expanded the regions requiring an R-value of 15.6.

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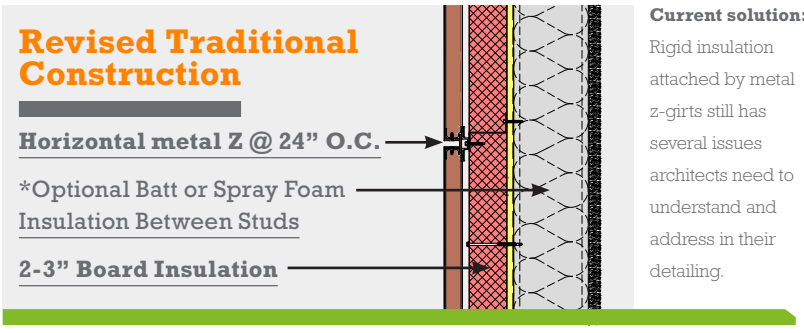
As each state or agency adopts new building or energy codes, the energy performance requirements increase. This led to increasingly higher R-values that require better exterior wall detailing and improved wall construction systems.

The First Solution

The industry's first solution has been to **"remove the steel studs from the equation."** Since the studs were causing such a dramatic drop in the effective R-value, the first step was to move the insulation outside the stud cavity to the exterior of the building. This introduced the term "continuous insulation" into the building envelope vocabulary.

Many "continuous" exterior insulation options used by architects include rigid board insulation held in place by metal z-girts, either as the only insulation source or paired with batt insulation or spray foam insulation in the metal stud spaces. While this option is a move in the right direction, the architect still needs to address several issues.

ASHRAE 2010 defines "continuous insulation" as "…insulation that is continuous across all structural members ***without thermal bridges*** other than fasteners and service openings. It is insulated on the interior or exterior or is integral to any opaque surface of the building envelope."



Current solution: Rigid insulation attached by metal z-girts still has several issues architects need to understand and address in their detailing.

**Caution is needed if batt insulation is used in the cavity so the dew point does not fall there & create moisture problems.*

Challenges Facing Some Exterior Continuous Insulation (C.I.) Solutions

Despite best intentions, most C.I. designs still have similar issues to traditional envelope designs. Many of these issues are leading the industry away from traditional "multi-component" wall construction, as well as the current "alternative" of continuous insulation.

R-Value Performance

The first issue is the extra points of thermal bridging continuing the concern for wasted energy. According to the 2011 report, *Thermal Performance of Building Envelope Details for Mid- and High-Rise Buildings (1365-RP)*, completed by the firm Morrison Hershfield, on behalf of ASHRAE, the use of horizontal or vertical metal z-girts to support rigid insulation panels dramatically reduces the effective R-value of the C.I. system.

When vertical metal girts are used, the thermal resistance is between 43-78% effective compared to the nominal R-values for C.I. systems between R-5 to R-25. For horizontal metal girts, the effective R-values improved slightly to 52-83% effective compared to the nominal R-values.

The research also found there were diminishing returns in adding more insulation to counter this:

> "For example, going from an R-5 to an R-10 exterior insulation with the horizontal z-girt system, the thermal resistance is increased by R-2.6. If another R-5 of insulation is added, from R-10 to R-15, the thermal resistance this time is only increased by R-1.9."
>
> **– ASHRAE Research Project 1365-RP Morrison Hershfield**

Coordination of Trades in Multi-Component System

The installation of a multi-component C.I. system often requires a similar "multi-pass" system to traditional multi-component exterior wall construction:

- **Pass 1** - A first trade attaches exterior sheathing to the outside face of the steel studs.
- **Pass 2** - A second trade group applies a building wrap to the sheathing.
- **Pass 3** - A third trade group installs the exterior insulation panels & façade support.
- **Pass 4** - A fourth trade group installs the buildings façade materials.

Water Infiltration Issues

Anchors (screws) for the façade and insulation support compromise the air, water, vapor and thermal barriers as they extend through the building wrap and exterior sheathing.

Inadequate Structural Support for Outer Skin

Support systems for anchoring the facade cantilever through the insulation thickness before attaching to the metal stud framing. This can often lead to inadequate support for heavier façade materials, or facades subjected to higher lateral and gravity design loads.

Shortage of Experience and Skills

Another factor that's played a part in the industry's look at how to construct an effective backup wall is the number of skilled tradesmen available in the construction field.

It's no secret the building industry has a shortage of skilled tradesmen both entering and staying in the field. With the huge loss of construction jobs between 2006 and 2011, many of the skilled tradesmen left the field for other opportunities. This shortage has left a gap that construction companies are trying to fill.

With this gap come concerns for proper installation of the multiple components a traditional exterior wall requires. This gap calls for a simplification of both the composition and installation of the backup wall.

continued

A Simpler Solution: Insulated Composite Backup Panels (I.C.B.P.)

Enter the insulated composite backup panel (I.C.B.P.). To meet the building industry's growing need for a simple backup wall system, several companies have taken a traditional façade material and reimagined it as a backup panel to other façade systems. For decades, building designers have used insulated composite panels as a finish material.

Insulated Composite Backup Panels

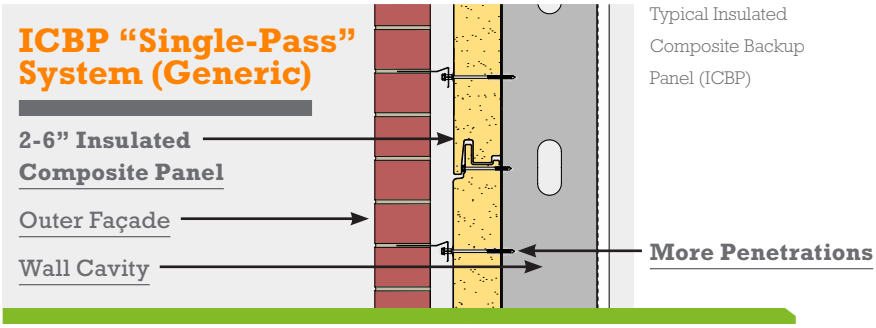
Insulated composite panels are foam-insulated, steel-skinned sandwich panels, interconnected together with tongue-and-groove connections. When used as ICBPs, the manufacturers can reduce the panel's cost by using a lighter gauge steel to wrap the insulation and a less-expensive coating system.

Insulated composite panels provide the air, water, vapor and thermal barriers in a single component. When used as backup panels, the panels are attached to the building framing and provide the facade's structural support.

ICBPs provide the required R-values to meet the newest and strictest energy codes. This leaves the wall cavity free of batts or spray foam insulation. All trades are able to work more efficiently to run their conduits, plumbing and other utilities without worrying about damaging the vapor barrier or creating "cold-spots."

An ICBP system is considered a "single-pass" system in that a single trade typically installs the insulated composite panels and façade. While this system overcomes many of the multi-pass designs' problems, there are still some issues. For one, the subframe's attachment to support the façade to the barrier panels limits the facade's structural support. This attachment also exposes the foam core of the barrier panels to moisture through the holes created by the many screws required to attach the façade supports.

The better solution is to provide a system that allows the framing support for the façade panels to be attached without penetrating the ICBPs and air and water barrier.



Typical Insulated Composite Backup Panel (ICBP)

Making It All Work: Genwall®

What do you need to take advantage of the benefits provided by ICBPs and provide a backup wall system that's as close to "perfect" as you can get?

Genwall® (ICBP) single-pass system installed over steel studs leaving open wall cavity inside the building with ACM panel façade system installed over vertical hat-channels.

Simple-to-Install, Single-Pass System

A single subcontractor providing faster weather-in, a more efficient construction schedule and less construction waste.

In our work with architects and contractors, the most desirable benefit is the ***simplicity*** of the Genwall® system, and how quickly this backup wall system goes up.

With today's increasingly tight construction schedules, it makes a huge difference if your product can help the contractor get the building weathertight sooner. Then the contractor is free to begin the interior work in any weather conditions.

Depending on when you break ground, quicker installation can be the difference between meeting schedule and a two-month delay. It can also help reduce temporary "weathering in" costs. Genwall's® simplicity means a small, two-man installation crew can install a relatively large quantity in a very short time.

At the WebFilings/Workiva project in Ames, Iowa, SGH installed 12,500 square feet of Genwall® in three weeks. That allowed the contractor, Story Construction, to get weathered-in just before winter hit—***eliminating a two- or three-month delay and the added heating costs.***

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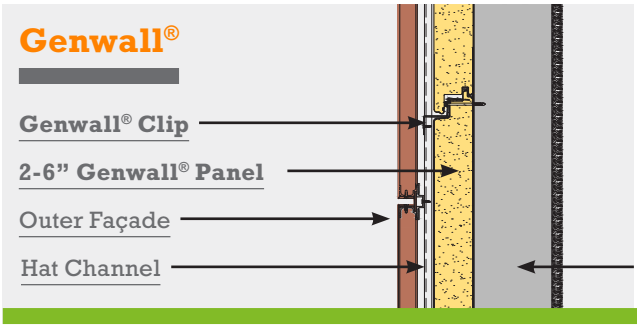
Unique Façade Fastening System

A system that attaches the outer-skin of your choice with minimal penetrations of the drain plane.

What makes the Genwall® system truly unique and sets it apart from other ICBP systems is the patented mounting clip and sub-girt fastening system for attaching and supporting the exterior façade—with minimal penetration of the barrier to the studs. The only full penetrations are at the top and bottom perimeter and they are sealed with butyl.

That means when your outer skin is ready to be installed, you can install your façade without piercing the drain plane or degrading the air barrier.



Genwall® Insulated Enhanced Substrate System

Genwall's® fastening clip, part of the patented enhanced substrate system.

Hidden Cost Savings

A system that provides not-so-obvious cost savings across the board for the contractor and, ultimately, the building owner. Throughout the construction process, the Genwall® system provides the contractor with opportunities to save money.

With the opportunity to get the envelope weathertight faster and more efficiently, Genwall® significantly reduces the temporary heat requirements for getting started on the interior work.

Genwall® also saves on the expense of having exterior facade crews working in unfavorable weather conditions to close up the building (i.e. winter). They can wait until spring to install the façade, if needed.

On at least one project, the mason reduced his bid substantially since he was able to avoid cold-weather installation procedures.

The Genwall® substrate system quickly went up in late fall, protecting the interior from the winter weather. The mason completed the brickwork in the spring without constructing and maintaining a temporary heated enclosure.

Can you find cost savings in headache reductions? We think so. For example:

- In traditional backup wall construction, the general contractor has to devote project management time to coordinating multiple trades to enclose the building. Genwall® dramatically drops this time commitment with only one subcontractor needed… Time = Money, Less time = Internal cost savings.
- Or how about this one… Mold remediation can be a huge time- and money-draining process if mold creeps into your building project. The Genwall® system takes mold issues out of the equation since the dew point can't condensate within the insulation.
- And, finally, with Genwall's® inherent ability to shorten the construction schedule, the system helps the contractor provide a completed building faster, getting the building open for business—a clear benefit for any business or building owner.

About Genwall® Enhanced Substrate System™

Genwall® Enhanced Substrate System™ is a complete weather-tight wall system that can accommodate a variety of facades.

Genwall® can be exposed to weather for up to 12-months. This air and moisture barrier has a unique outer-skin fastening system that attaches outer facades of your choice ***without penetrating the drain plane***.

Genwall® eliminates the need for separate batt, spray foam or board insulation, exterior gypsum board sheathing, air barriers, vapor retarders and building wraps while providing better thermal efficiency and moisture control.

Additional information about SGH or their Genwall® Enhanced Substrate System is available at Genwall.com, sghinc.com or by calling 844-255-9393. Contact us today to find out how Genwall® can simplify your building envelope.

About SGH - A Division of SGH Redglaze Holdings Inc.

With roots back to 1949, SGH [a division of SGH Redglaze Holdings Inc.] has provided premium products and innovative solutions to architectural design challenges with unmatched support for architects and general contractors, from project creation to completion. SGH strives to be the industry's most trusted resource for architects and contractors by providing premium products and comprehensive services for efficient, innovative structures that improve our communities.

SGH is headquartered in Omaha, Neb., with additional locations in Des Moines, Iowa, Kansas City, Mo., Minneapolis, Minn., Denver, Colo., and Billings, Mont. Partnering with associated companies—HGI Resources, and Riverside Technologies—we've completed projects with clients in many cities throughout the United States.