AN Media Group

fiberon®
Composite Cladding

Resiliency White Paper

Shown Above: Office building render featuring Wildwood™ Palo from the Sahara Collection.

The Role of Wood-Plastic Composite Cladding in Resilient Design

November 1, 2023

The Role of Wood-Plastic Composite Cladding in Resilient Design

Presented by Fiberon

Table of Contents

Executive Summary

This white paper will cover the principles of resilient design, the importance of material durability and performance when specifying resilient materials, and how wood-plastic composite cladding contributes to a building's resiliency.

Introduction

Buildings must be designed to stand up to their natural environment, including high winds, heavy rain events, and freeze/thaw cycles. Increasingly, building systems must also be able to withstand catastrophic events, such as fire and potential natural disasters. This, in essence, is what defines resilient building design—and wood-plastic composite cladding (WPC) has emerged as an exciting alternative to traditional carbon-intensive building materials that stands up against the elements, and the test of time.

Resilient Design Strategies

Resiliency is the ability to adapt to changing conditions and maintain or regain functionality and vitality in the face of stress or disturbance. In the case of buildings and communities, this stress or disturbance is often caused by extreme weather events that threaten safety, with effects that can last years. Regional and local impacts expected with climate change include greater intensities of storms, higher volumes of precipitation, more frequent coastal and valley flood events, and wider-reaching wildfires.

In buildings, an integrated design approach is key to maintaining performance under exposure to the elements, and in making sure the structure can bounce back from catastrophic events. Through resilience, we can maintain livable conditions in the event of natural disasters, power loss, or other interruptions to normally available services.

The Four Rs of Resilience

The National Infrastructure Advisory Council (NIAC), which advises the White House on how to improve the security and resilience of the nation's critical infrastructure, breaks resilience down into four Rs:

Shown Above: University campus render featuring Wildwood™ Sumac from the Sahara Collection.

Robustness

The ability to maintain critical operations and functions in the face of crisis. Every building does not have to remain functional during a crisis, but it's vital that specific buildings—such as police departments, fire departments, hospitals, and schools—can continue to perform and offer emergency services in the event of disaster.

Resourcefulness

The ability to skillfully prepare for, respond to, and manage a crisis or disruption as it unfolds. Building design should minimize dependency on external resources and enable flexibility. Buildings must first and foremost remain structurally sound so they can safely shelter response teams and displaced people, with power and communications maintained.

Rapid recovery

The ability to return to normal operations, as quickly and efficiently as possible after a disruption.

Redundancy

The ability to have backup resources to support the originals in case of failure. Strategies to provide redundant systems could include backup power generators, alternate water sources, and in the case of building envelope design, rainscreen systems that mitigate moisture to ensure the continuity of wall systems.

In building design, robustness, resourcefulness, rapid recovery and redundancy can be achieved by carefully considering the materials specified, including how they will provide moisture management and thermal control, and how well they can handle wind, seismic, and freeze/thaw loads. Specifying highly durable materials with minimal maintenance will contribute significantly to resilient design.

Shown Above: Mixed-use property - 2530 Junction Place, Boulder, CO 80301, featuring Wildwood™ Mulga from the Sahara Collection.

Designing Above Code

Building and energy codes are becoming increasingly stringent to ensure buildings and the materials they're constructed with can withstand the forces of moisture, wind, fire, and seismic events—but even these are not enough. Buildings should ideally be designed above code, with strong and durable materials, even in regions that aren't typically threatened by extreme weather, wildfires or earthquakes. Recent events have shown that with the rapid acceleration of these events, everyone is vulnerable, and it's likely that regions will experience new climate patterns that they must prepare for.

In fact, the University of Maryland has released an interactive web application called the Future Urban Climates tool that "aims to help the public understand how climate change may impact the lives of a large portion of the population of the United States by matching the expected future climate in each city with the current climate of another location, providing a relatable picture of what is likely in store." Scientists analyzed 540 urban areas in the U.S. and Canada, then mapped what each city's future climate is expected to be in 2080, including minimum and maximum temperatures and precipitation in each season. In general, cities should look to locations 500 miles south to determine what their climate may be like approximately 60 years from now. A tool such as this can help architects and engineers design above code to future-proof buildings for the expected climate changes to come.

In addition to having superior durability to contribute to resilient design in the short-term, materials must also be manufactured efficiently and with a lower carbon footprint. Taking these steps and designing with sustainability and resiliency in mind will improve the quality of life for building occupants and communities by mitigating the impacts of extreme weather events, lowering energy, operational and maintenance costs, and ultimately leaving future generations with

Shown Above: Mixed-use building render featuring Bamboo from the Wildwood™ Sahara Collection, installed diagonally.

a safer, cleaner and healthier environment.

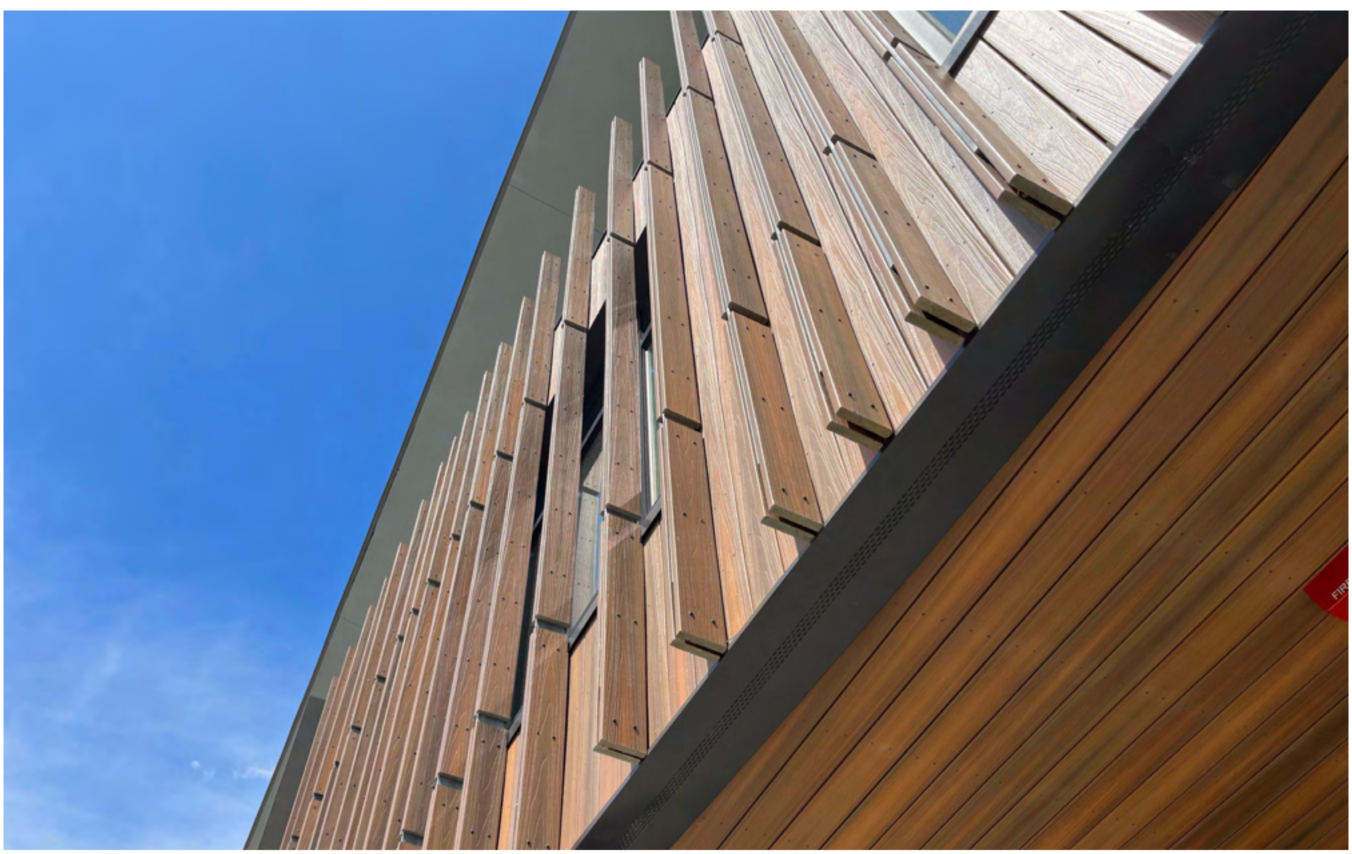
Diving into Durability—Why Material Selection Matters

Ultimately, the performance of the built environment is directly related to material selection. The key to material selection is understanding the performance of various construction materials and engineered systems. It's crucial that designers understand both acute performance metrics in the face of abnormal weather conditions as well as their long-term performance subject to the routine, yet relentless forces of nature. Durable materials and technical design considerations allow buildings to withstand damage related to a variety of conditions, including extreme heat, bulk water, wind-blown projectiles, hurricane-force winds, and fire.

The ability to predict the service life of different materials and systems with reasonable certainty enables decision-makers to compare various materials, and how their differences will ultimately impact costs. An outstanding design is easily compromised if inferior construction materials are specified, as they will fail prematurely and necessitate replacement or repair. This compromises both the service life and resiliency of a building. Conversely, specifying materials that are appropriate for the local environment, including typical weathering and acute weather events, will result in a more resilient and sustainable building.

Life Cycles of Wood-Plastic Composite Cladding

Life cycle analysis considers the full lifetime costs and benefits of a product, from its initial cost to maintenance and repair costs, as well as disposal at the end of the product's life. Doubling the life of a building essentially halves the environmental impacts



Shown Above: Mixed-use property - 2530 Junction Place, Boulder, CO 80301, featuring Wildwood™ Mulga from the Sahara Collection.

of its construction, which is why a material's durability and performance are crucial when considering its sustainability and resiliency.

Wood-plastic composites (WPCs) combine the best qualities of recycled wood with the low-cost and long-lasting resilience of recycled plastic, which is less prone to water absorption and insect infestation. Blending these two materials together is the reason why WPC lasts so long, and why it's sustainable from start to finish.

WPCs are manufactured using a co-extrusion process, combining wood fiber and polyethylene (PE) into the board core, and a high-density polyethylene (HDPE) capstock for superior stain-, fade-, and scratch-resistance. Both the core and capstock are manufactured with several additives that increase the resiliency of the product, including additives for color, resistance to weathering, and other performance characteristics. For example, coupling agents are added to improve the bond between the hydrophilic wood and hydrophobic plastic, allowing the formation of single-phase composite, and resulting in a product with better dimensional stability than solid wood. Fillers are used to further improve stiffness and durability. Biocides protect the wood components from insect and fungal attack, while fire-retardant chemicals, UV stabilizers, and pigments can also be added to improve resilience against the elements.

When taking the maintenance, repair and replacement of materials into account, wood-plastic composite cladding has quite a few life cycle benefits compared to alternative cladding materials, such as wood, fiber cement, stucco, brick and masonry. Traditional wood siding is prone to fading, chipping and staining and can also develop mold and mildew stains. The siding will need to be refinished (and sometimes repaired) every few years—which is a very time-consuming process that can entail scraping, sanding, pressure-washing and re-staining. When it comes to durability, wood splits and splinters and is particularly affected by freeze/thaw cycles. Water absorption is dependent on the quality and age of the finish; so, if the siding is not maintained, the durability will be compromised.

Likewise, engineered cladding products such as fiber cement must be painted, and they are prone to fading and cracking. Because engineered cladding releases silica when cut, the Occupational Safety and Health Administration (OSHA) requires exposure controls and protective equipment for all installers. In addition, the material can break under its own weight, so it requires careful handling to avoid product loss.

Stucco is resistant to rot, mold, fire and insects, but is porous and will absorb water more readily than other materials, causing it to develop dark spots. Therefore, stucco is typically more suitable for drier climates. Also, stucco is very labor-intensive to install, requiring a multi-step application (dash coat, scratch coat, brown coat, and finish coat)—plus painting by a concrete contractor. Improper installation can result in extensive interior wall and structural damage. In addition, stucco is prone to cracking due to its brittle nature, particularly if the foundation of the building settles. The material is also sometimes affected by freeze/thaw cycles.

Both brick and stone have an authentic look that often pairs well with more traditional homes. Brick and stone are both highly durable products, but do absorb water and can spall (flake or break off) when exposed to excess moisture. Depending on the material's water absorption rate and saturated coefficient, it can be affected by freeze/thaw cycles. Brick and stone are also subject to efflorescence—crystalline deposits of water-soluble salt on the surface.

Unlike these other cladding materials, the durable composite core of wood-plastic composite cladding ensures exceptional resistance to rotting, cracking, insects and decay. A three-sided cap layer protects against fading and staining common with solid wood cladding, and it has a finished surface on both the top and bottom to further prevent water absorption. Composite cladding also never needs sanding, staining, painting or sealing.

Aside from the obvious labor and cost involved with continual maintenance, there are also environmental dangers associated with volatile organic compounds (VOCs) released from stain and paint. VOCs are the leading cause of ground-level air pollution and indoor air pollution, which can adversely impact the health of building occupants. When solid wood, fiber cement, or stucco are stained or painted to maintain their durability, they will then need to be refinished with more stain or paint every few years, which creates a continual cycle of chemical emissions.

The chemicals used in treated wood are generally not good for humans, either. Because composite cladding is highly durable and never needs to be stained or painted, it is free of these toxic chemicals and preservatives. Furthermore, when the WPC is finished being used as cladding, the material can be recycled into something new. Wood treated with chemicals, on the other hand, cannot be burned or recycled when its use as cladding is complete.

How Wood-Plastic Composite Cladding Contributes to Resilient Building Design

The resiliency of a building product or material is closely tied to its performance. If a high-performance material is designed and tested to withstand rain, snow, hail, wind and fire, among other forces, it will be inherently resilient. Aside from its durability, sustainability, and ease of maintenance, wood-plastic composite cladding contributes to resilient building design through moisture management, wind-borne debris impact resistance, and fire performance.

Moisture Management

One important performance measure of resiliency is a product's moisture-resistance. Designing and building resilient wall systems, with rainscreen details that can help deflect, diffuse, drain and dry when moisture presents itself, is a vital component of moisture management. This is important because the American Society for Testing and Materials (ASTM) reports that roughly 90 percent of all wall failures are the result of moisture-related issues.

Rainscreen systems are one of the most effective methods to manage moisture and mitigate its damage to residential and commercial structures. As the outermost component of the rainscreen system, exterior cladding absorbs the greatest velocity and volume of moisture. Depending on the material and construction details, some moisture may pass through this layer, but in much lower volumes and at a reduced velocity. A highly durable exterior cladding can withstand periodic wetting without deterioration over the service life of the enclosure.

Wood-plastic composite is gaining popularity among construction teams as a high-performance rainscreen cladding because it deflects rather than absorbs water. Fiberon® Wildwood™, for example, is the first wood-alternative to be issued both a Florida Product Approval Number and a Texas Department of Insurance Product Evaluation for use in rainscreen cladding applications. WPC facilitates better management of bulk water infiltration, capillary water intrusion, and water vapor exfiltration than other cladding products, providing long-lasting performance. Also, WPC cladding is used in commercial rainscreen applications to provide a rear-ventilated facade system (RVFS) in continuous insulation rainscreen assemblies, including polyiso, mineral wool, and multipurpose, nonstructural rigid board insulation systems.

To read more about the benefits of wood-plastic composite cladding in high-performance rainscreen applications, download our white paper "Protecting the Building Envelope: Bridging Form and Function with Modern Rainscreens."

Rainscreen systems are one of the most effective methods to manage moisture and mitigate its damage to residential and commercial structures. Wood-plastic composite is gaining popularity among construction teams as a high-performance rainscreen cladding because it deflects rather than absorbs water. It also facilitates better management of bulk water infiltration, capillary water intrusion, and water vapor exfiltration than other cladding products, providing long-lasting performance.

Wind-Borne Debris Impact-Resistance

Another key component of resilient building design is limiting damage from high winds, especially in wind-prone regions and those in a High-Velocity Hurricane Zone (HVHZ). The HVHZs of South Florida are designated by the state as more prone to severe weather and hurricanes, and therefore must adhere to stricter codes. Design considerations for wind include ensuring the roof is properly tied to walls and framing so it cannot detach, specifying materials with impact-resistance to wind-borne debris, and designing buildings to limit moisture intrusion.

When specifying wood-plastic composite cladding, it's vital that panels are designed to withstand the wind load based on the local building code, and that the composite siding system is tested in accordance with ASTM E330/E330M, the Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

Wood-plastic composite cladding can meet Florida Building Code test protocols for HVHZs based on the following test procedures:

- TAS 201-94 - Impact Test Procedures for Large and Small Missiles
- TAS 202-94 - Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components Using Uniform Static Air Pressure
- TAS 203-94 - Criteria for Testing Products Subject to Cyclic Wind Pressure Loading

In these tests, composite cladding surpasses the capabilities of fiber cement and engineered wood claddings. Products with a Florida Product Approval Number designation—set by the state of Florida for all construction trades—have been approved for use throughout Florida, including in Hurricane Zones. Specifiers should request the Product Approval page as evidence of approval. Once a product has been awarded a Florida Product Approval Number, no state building commission can require additional testing,

Shown above: Corporate building featuring a mixed color application of the Fiberon Wildwood™ collection.

Shown above: Fiberon Wildwood™ collection cladding application.

Shown Above: University render featuring Wildwood™ Tupelo from the Eden Collection.

evaluation, or documentation.

Also, WPC cladding with a Texas Department of Insurance Product Evaluation, such as Fiberon Wildwood, means the product has been evaluated for compliance with the wind loads specified in Chapter 3 of the International Residential Code (IRC) and Section 1609 of the International Building Code (IBC).

Fire Performance

Building products are tested for surface burning characteristics and given a rating classification depending upon how well they resist ignition and spread of flame across the surface. The flame spread classification has three levels: Class A, B, or C, with Class A having the best performance at resisting flame spread. Most natural wood products have a Class C rating unless treated for ignition resistance. Wood-plastic composite siding has a Class B fire rating in accordance with ASTM E84, the Standard Test Method for Surface Burning Characteristics of Building Materials.

To further comply with fire code regulations, be sure to specify WPC cladding that meets NFPA 268, the Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source. Conducted under controlled laboratory conditions, this is a testing methodology to measure and describe the ignitability characteristics of exterior wall assemblies, and their potential to contribute to fire growth.

Although WPC cladding products may have a Class B fire rating and meet the NFPA 268 standard, they are still combustible and must only be used where combustible materials are permitted by the building code, within the limits of IBC Section 1405.

Shown Above: Residential building render featuring Wildwood™ Koa from the Eden Collection.

Conclusion

Building owners and communities are coming to the realization that climate change and extreme weather events are here to stay and will only be exacerbated by a warming planet in the coming years. Luckily, the benefits of wood-plastic composite cladding in resilient building design are only growing. Wood-plastic composite is highly durable with performance attributes that equate to a longer-lasting, more resilient, and sustainable product than alternative cladding materials such as solid wood, fiber cement, stucco, brick and masonry. This is because it combines the best qualities of recycled wood, such as strength and low cost, with the long-lasting resilience of recycled plastic, which is less prone to water absorption and insect infestation. Blending these two materials together is the reason why WPCs last so long, and why they're sustainable—and resilient—from start to finish.

Shown Above: Multi-family building - 901 Wilkes Blvd, Columbia, MO 65201, featuring Concordia by Fiberon.

Composite Cladding

181 Random Drive
New London, NC 28127

P 1.877.775.2523 (CLAD)

E info@fiberoncladding.com

fiberoncladding.com/future