



What matters more than the choice of facades? The facade defines your building for decades. Based on the life-cycle criteria for product selection, you have many choices in a wood aesthetic material selection.

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# Course Overview

The look of “wood” provides warmth in a building design that cannot be achieved by masonry, metals, or other building materials. Natural wood is a traditional option, but newer composite and synthetic products replicate the look of natural wood but offer superior color retention and life-cycle performance while requiring little to no maintenance. This learning unit will provide an in-depth overview of current “wood” design technologies, both natural and synthetic.

The warmth of wood in architectural elevations is very popular in many designs, from traditional to modern, whether as a complete facade or just an accent. It is difficult to replicate wood with masonry and metals.

# Learning Objectives

Upon completing this course, the participant should be able to:



- Identify the current market “wood aesthetic” technologies.
- Define the core materials of each technology.
- Discuss the sustainable features and life-cycle benefits for each technology based on the following criteria: color retention, maintenance, and warranty.
- Describe the surface-burning characteristics, and explain which construction type is appropriate.
- Review the installation details and budgetary information.



We will cover eight wood and natural wood technologies in depth.

## What Technologies Can I Specify for a "Wood Aesthetic"?



**Natural/  
treated  
wood**



**WPC  
hybrid**



**Fiber  
cement**



**Solid and  
capped  
WPC**



**Rice  
hull/PVC**



**Phenolics  
film and  
wood  
veneer**



**Bamboo**



**Aluminum**



Natural wood cannot be excluded in any program about “wood aesthetic” technologies. Natural wood has been a construction technology since man sharpened stones.

## Natural Wood – Basic Technology

Cedar  
Ipe  
Redwood  
etc.

- Wood
- Wood
- More wood

Our basic technology source material for natural wood is of course wood, such as cedar, redwood, ipe, etc.

## Natural Wood – Life-Cycle Performance



Color retention for natural wood is poor. Unless the wood is allowed to simply patina, wood is a high-maintenance choice. As a specifier, wood does provide an unlimited color palette for selection. Proper installation is critical to control moisture and termite/insect. Sustainability is based on the source of the wood; if the wood is from a Forest Stewardship Council (FSC) managed forest, sustainability is good. However, if a rain forest is being destroyed, this would not provide a sustainable source. Natural wood at end of life is recyclable and can be used to produce several of the technologies in this program.



Due to the performance issues with natural wood, additional “treatments” to improve life-cycle performance have entered the market.

## Treated Natural Wood – Basic Technology



Chemical treatments alter the cell structure of wood, improving its technical properties and performance. Unmodified wood contains 'free hydroxyl groups' that absorb and release water as weather conditions change. These wood species are from overseas.

# Treated Natural Wood – Life-Cycle Performance



The chemical treatment provides some improvement in life-cycle performance. Color retention is still poor, the same as natural wood. Unless the wood is allowed to simply patina, treated natural wood is a high-maintenance choice. As a specifier, wood does provide an unlimited color palette for selection. Proper installation is critical to control moisture and termite/insect. Sustainability is based on the source of the wood; if the wood is from an FSC managed forest, sustainability is good. Prorated warranties are available for material only, not finish and do have a rapid proration schedule: 30 percent coverage for years 10–15 and only 10 percent for years 16–20 based on original purchase price.

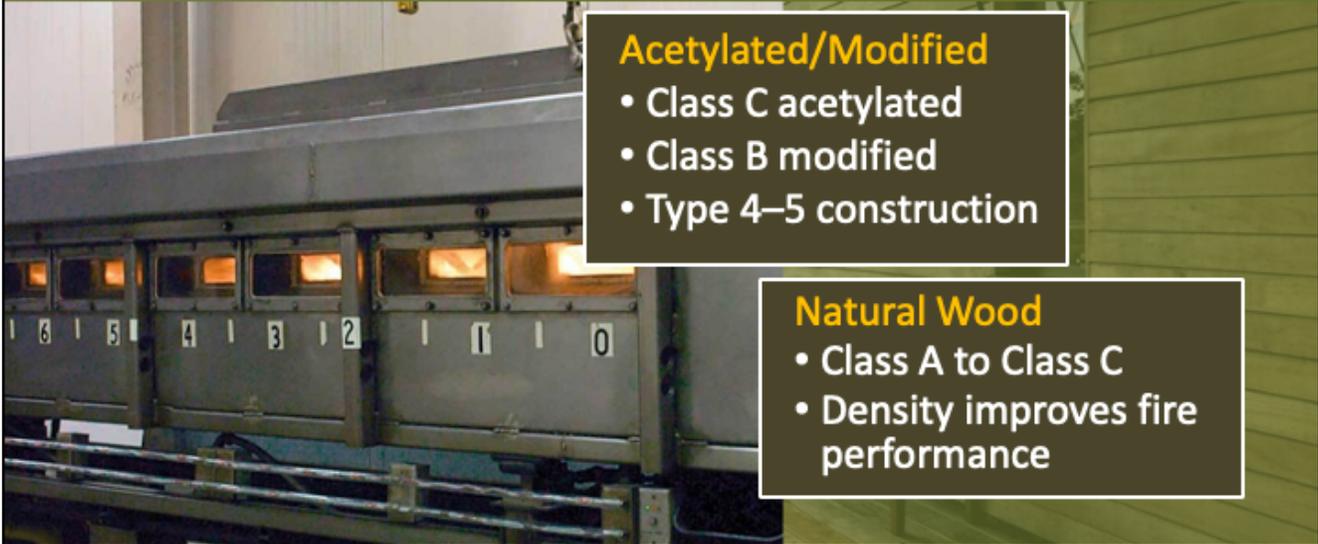
## Treated/Natural Wood - Installation

- Wood or metal studs minimum 16 inches OC (Stainless Steel for treated)
- Airspace
- AVB
- Field or factory finishes
- Insect screening
- Soffit or cladding



Installation is important for performance. 16-inch OC furring strips are needed to provide airspace, and a properly installed air, water, and vapor barrier is required. It is recommended to use stainless steel fasteners with treated material. Treatment chemicals may be corrosive. Insect screening is needed. Natural or treated wood work well for cladding or soffit installations.

## Treated/Natural Wood – Fire Performance



Natural/treated wood can provide Class A–C performance based on ASTM E-84. Chemical treatment improves fire performance in less-dense wood, and Class A and B are available. Most natural wood (cedar, spruce, etc.) will only be Class C. However, some natural wood like ipe can provide Class A due to density of the species.



# Hybrid Technologies

# Hybrid – Basic Technology



Hybrid products are the co-extrusion of:

- ALU/wood plastic composite (WPC)
  - 70–80 percent recycled
    - Recycled wood (mix of six different species)
    - Polypropylene
- Adhesive

Hybrids are the newest technology in this program. Hybrid technology is a three-part coextrusion of aluminum, wood plastic composite, and adhesive that allows the combination of dissimilar materials for expansion and contraction to perform together without delamination, etc.

The technology is 70–80 percent recycled material based on color, and 90 percent of the recycled material is post consumer.

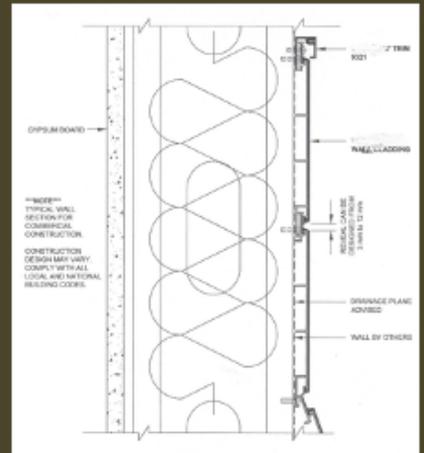
# Hybrid – Life-Cycle Performance



Hybrid technologies perform well in life-cycle performance. The color is inherent in the extrusion and provides excellent long-term color retention even in dark colors. Maintenance is virtually zero, there is no future refinishing, and the aluminum substrate provides protection against moisture and insects. Recycling is challenging because the WPC and adhesive must be separated. The warranty is 10 years labor and material and is not prorated.

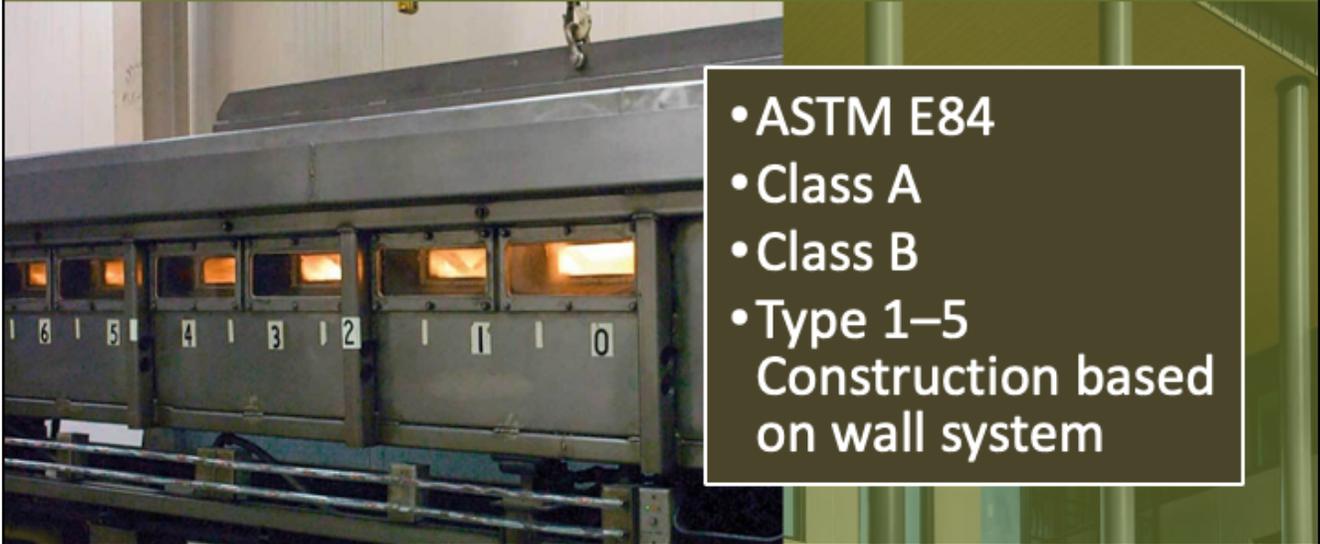
# Hybrid – Installation

- Wood or metal studs 24 inches OC or less; 32 inches OC for soffit
- No furring or clips
- Tight or 1/8-inch butt joints
- AVB
- Lightweight 0.86# plf
- No finishing needed
- Soffit or cladding
- Great for continuous insulation systems; no additional furring needed



Hybrids provide simple and foolproof installation. Spans up to 24 inches OC for sidewall applications and 32 inches OC for soffits. No furring or clips are required; the only requirement is that it screws into solid substrate or stud. Lightweight, easy to handle, and no special care at butt joints. Hybrids are very lightweight, as a standard 12-foot panel weighs less than 10#. The butt joints can be installed with a 1/8-inch gap or tight based on screw pattern. The butt joints remain as installed and do not open and close based on temperature variation. Hybrids work well for siding or soffits. The aluminum substrate is a positive for soffits in case of leakage since moisture will not affect the technology. Hybrids perform well with exterior continuous insulation systems for several reasons: lightweight, no additional furring or airspace is required, and the butt joints minimize the potential to see insulation or sub-framing.

## Hybrid – Fire Performance



Hybrid technology is not noncombustible; however, Class A or B formulations are available with no change in aesthetics.

Class A may be acceptable for Type 1–3 construction dependent on specific local code restrictions.



## Fiber Cement Technologies

# Fiber Cement – Basic Technology



The basic components for all fiber cement are the same regardless of density. The lower the density, the lighter weight and susceptibility to moisture. Denser materials perform better in all categories. Fiber cement (FC) can be installed as primed and field finished or painted as a faux wood aesthetic.

## Fiber Cement – Life-Cycle Performance

### COLOR RETENTION



**Varies by  
finish**

### MAINTENANCE



**Future  
refinishing  
required**

### MOISTURE/ TERMITES



**Non-  
permeable;  
cannot trap  
moisture**

### SUSTAINABILITY



**Not rot  
impervious  
to termites  
Not  
Recyclable**

### WARRANTY

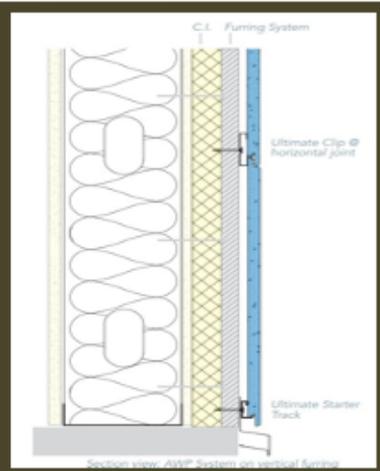


**Average  
15 years  
Finish  
Prorated**

Fiber cement is a porous technology and finishes perform well; however, painted surfaces will require future maintenance. The challenge in refinishing a “faux wood” will be replication with field application. FC is a non-permeable technology, and breathability is a necessity. Regarding sustainability, FC will never rot, but at end of life, it is not recyclable into new product. The average warranty is 15 years for material only; finish warranties typically prorate quickly in as early as the third year. Due diligence and caution are warranted for finish and proration.

# Fiber Cement - Installation

- Heavy, which may be an issue for CI systems due to cantilever
- Difficult to cut (dust control mandated)
- Furring required
- Primed or prefinished
- Not soffit friendly



Installation of FC is challenging primarily due to the weight. It is typically not feasible to install as a continuous insulation system without sub-framing due to concern with cantilever.

FC is difficult to cut, and proper tools are required to control silica dust, which is a known carcinogen.

FC is available in primed or prefinished, but "faux wood" is commonly manufacturer factory finished.

Due to the weight of FC, it is not typically used for soffits, and manufacturers may not warrant soffit applications.

# Fiber Cement – Fire Performance



FC is a noncombustible technology that can be used in any construction type.



We are going to address two types of phenolic technologies for wood aesthetics.

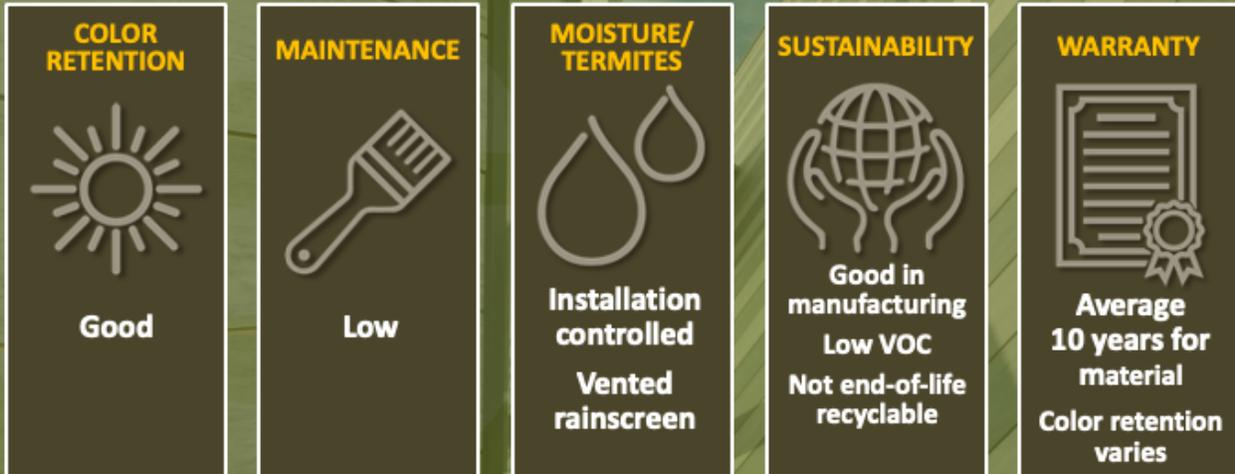
## Phenolic – Basic Technology



Basic technology for all phenolic is kraft paper, phenolic resin, and a decorative layer. The technology is a paper sandwich that is created under heat and pressure. The difference is how the wood aesthetic is created. Some manufacturers use a film, while others use a thin layer of wood veneer.

The challenge is to provide the wood aesthetic without any grain effect and pattern repetition. Typically phenolic are manufactured as a sheet good and fabricated to specified sizing. Several manufacturers are now offering cladding profiles that eliminate additional fabrication.

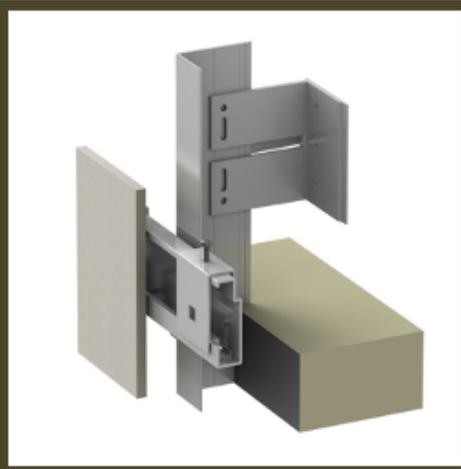
## Phenolic – Life-Cycle Performance



Phenolics are an overall solid life-cycle performer. No additional finishing is required at installation or in the future, which ensures low maintenance. Due to the amount of “kraft paper” in the material, moisture control is critical. Related to sustainability, initial manufacturing may include recycled content, but at end of life in general, the material is essentially composed of a thermosetting resin that is not molten or fused by heat, so it is difficult to recover or recycle it into a raw material. Average material warranty is 10 years. Confirm color warranty by manufacturer.

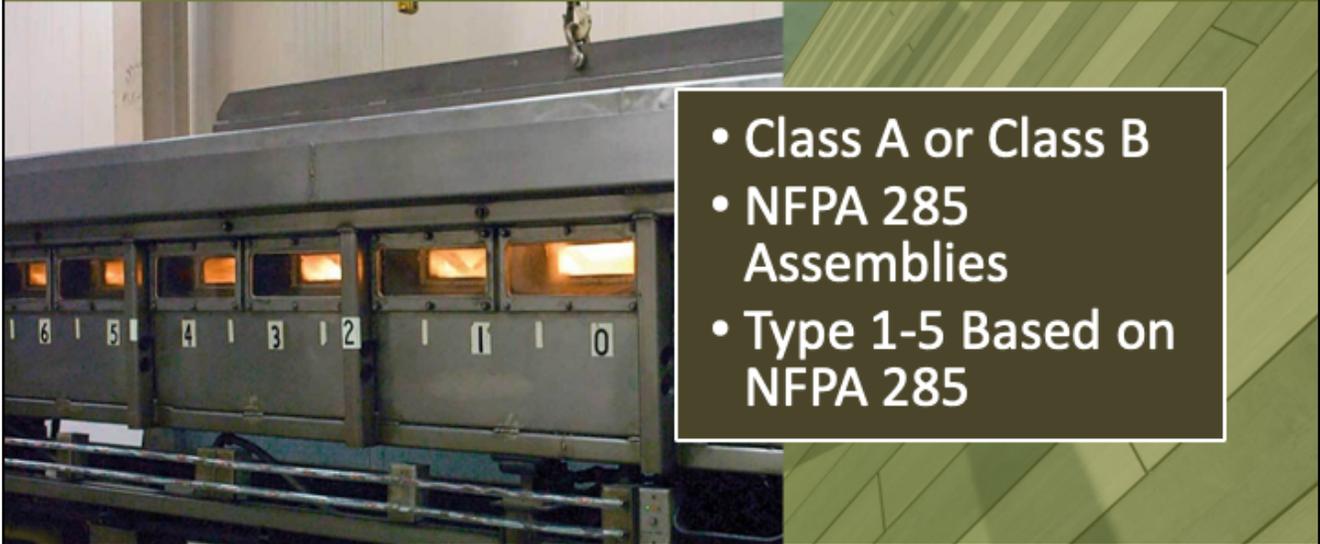
## Phenolic – Installation

- ¼-inch joint spacing
- Open joints may be CI issue
- Sub-framing or clips
- Airspace/AVB-vented rainscreen
- Hidden or exposed fasteners
- Finished surfaces
- Soffits or cladding



All phenolic technologies require an airspace for moisture control. Moisture control is critical to performance. Phenolic technologies typically require sub-framing systems to ensure this airspace and proper spacing to address expansion and contraction. Phenolics install as an open-joint rainscreen with spacing of ¼ inch or 3/8 inch. With an open butt joint, the potential to see continuous insulation sub-framing or insulation may be an concern. This is often addressed with an additional black weather barrier.

## Phenolic – Fire Performance



Phenolics are available as Class A or B per ASTM E84. Most phenolic manufacturers have a tested NFPA 285 assembly for specification with mineral wool insulation. Based on the NFPA 285 assembly, some Type 1–3 applications may be applicable.

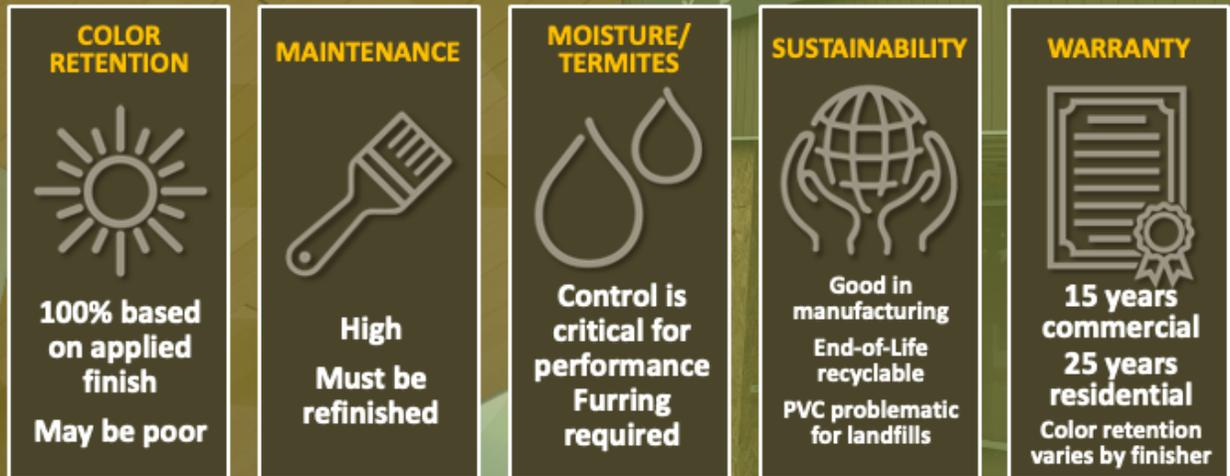


## Rice Hulls/PVC – Basic Technology



This technology uses the rice hulls that remain after the grains are harvested. This biofiber represents approximately 50 percent of the material, and 40 percent is virgin-grade polyvinyl chloride (PVC). PVC is a thermoplastic that emits a toxic gas when burning and may be an issue at end of life in landfills due to potential leaching of PVC into water sources.

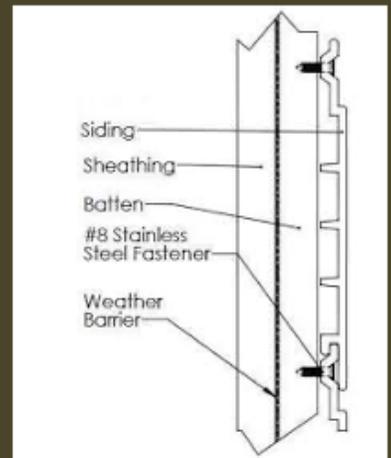
## Rice Hulls/PVC - Life-Cycle Performance



This technology is extruded without finish and requires post manufacturing finishing. The specifier has an unlimited color palette and can select the finisher. The manufacturer can finish, or the finish can be field applied. UV performance and color retention is 100 percent based on finish quality. This technology is similar to natural wood in color retention and requires regular finishing to maintain color or stain. Moisture can be an issue if not addressed with correct installation. Mold/mildew can occur if airspace is restricted. Routine maintenance technology; moisture is problematic for performance and potential deterioration. The sustainability is good for the rice hulls biofiber but may be questionable for the PVC as mentioned earlier. Warranty is material only, 15 years commercial and 25 residential. Limited to original purchase price, color retention warranty is dependent on the finisher.

# Rice Hulls/PVC – Installation

- Challenging installation
- Expansion/contraction up to 5/8 inch
- May be CI system issue
- Airspace required/AVB/furring
- Must be prefinished and refinished
- Soffits or cladding

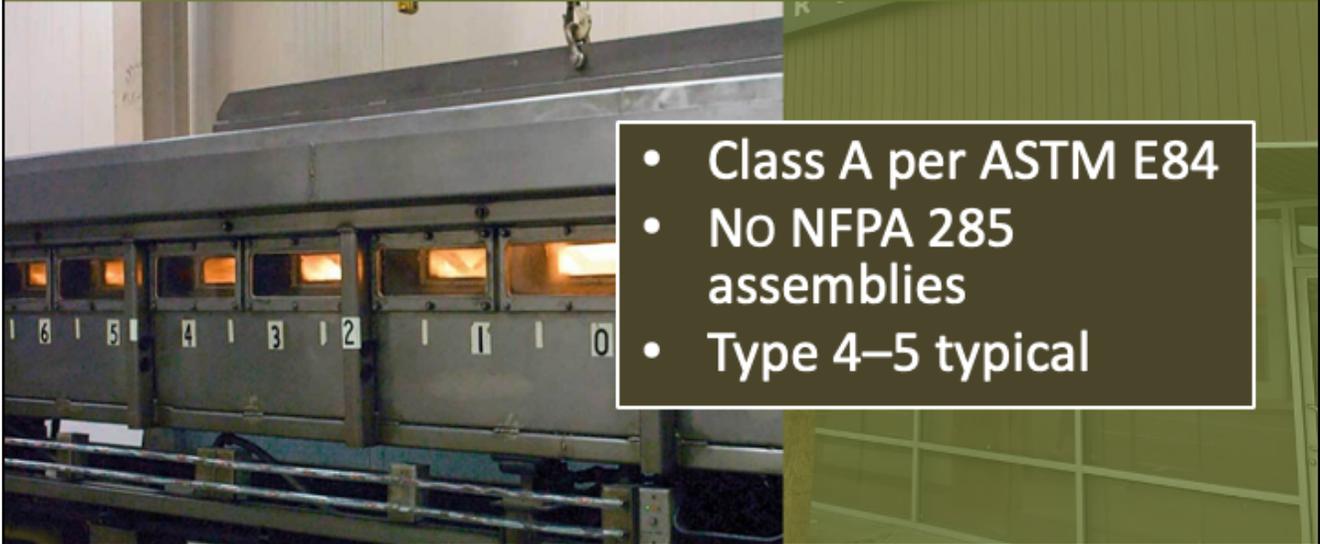


The expansion and contraction of rice hulls/PVC technology makes installation challenging. Expansion and contraction must be addressed perfectly. These panels have elongated nailing slots like vinyl siding to address the movement with temperature variance. Even properly installed, the panels may have up to a 5/8-inch open butt joint during cold weather. With an exterior sub-framing continuous insulation system, this 5/8-inch gap may be an issue, and additional black water barriers may be needed to hide the continuous insulation sub-framing and insulation.

This technology installs as a vented rainscreen and must have an airspace for moisture management and a properly installed air, water, and vapor barrier.

Unless the boards are allowed to patina, routine maintenance will be required. This technology is commonly used for cladding and soffits.

## Rice Hulls/PVC – Fire Performance



Rice hulls and PVC provide a Class A rating per ASTM E 84. No NFPA 285 assemblies are available. Type 4 and 5 construction is common.



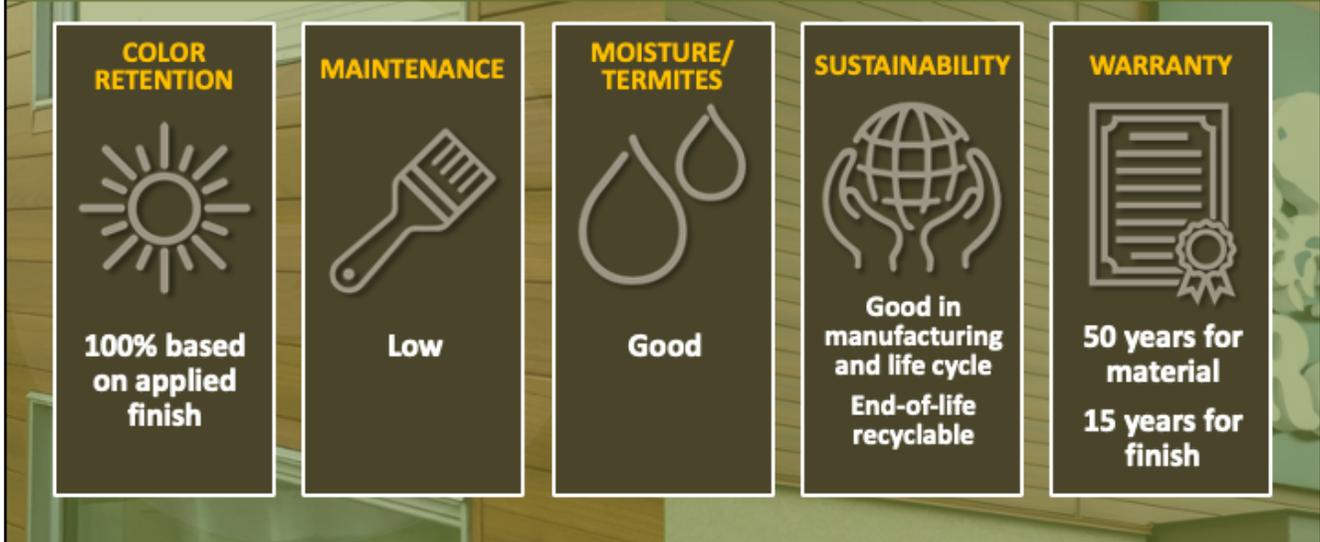
## Aluminum Replica Wood Technologies

# Aluminum Wood – Basic Technology



Basic core technology is recycled aluminum. Finishes are wet paint, film, or powder coat. The aesthetic challenge is to replicate real wood with paint or film.

# Aluminum Wood – Life-Cycle Performance



This technology is an overall solid life-cycle performer. The color retention is good, and the maintenance is low. Moisture and insects are not a concern. The sustainability is a positive. The aluminum has some recycled content in manufacturing, and it can be recycled again at end of life. Warranty for material is 50 years, and the average finish warranty is 15 years.

# Aluminum Wood – Installation

- Clips needed
- Long lengths available
- Works well with CI system
- AVB
- Soffits or cladding
- Touch-up paint provided



The installation of replica wood aluminum is similar to hybrid, but clips are used versus direct hard screws. Long lengths up to 24 feet are available. Works well with sub-framing continuous insulation systems. Works well for cladding or soffits. May scratch during installation; touch-up paint is provided for repairs.

# Aluminum Wood – Fire Performance



100 percent noncombustible and can be used in any construction type.



## Solid WPC – Basic Technology



These are extruded wood plastic composites with color through technology. All manufacturers are overseas: Italy, Turkey, and China.

Basic technology is wood and virgin PVC thermoplastic. The source of the wood is unknown and may or not be from recycled material.

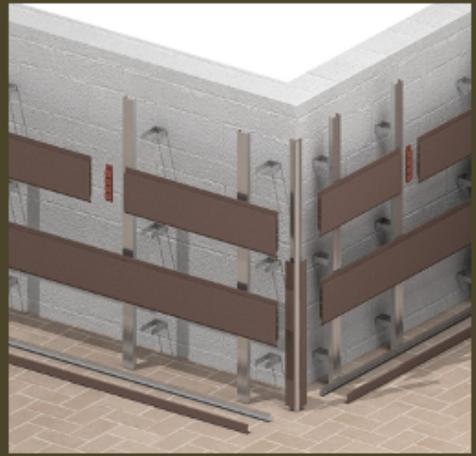
## Solid WPC – Life-Cycle Performance



Solid WPC is an overall good life-cycle performer. The color is inherent in the extrusions and throughout the entire product. Good color retention and no future refinishing provide low maintenance. Moisture control is critical to prevent mold and mildew growth and uneven drying. Sustainability is a question due to the questionable wood source and virgin PVC thermoplastic. The warranties are vague and varied from 5-50 for material coverage and 3-15 for color retention. Due diligence is needed when specifying this technology.

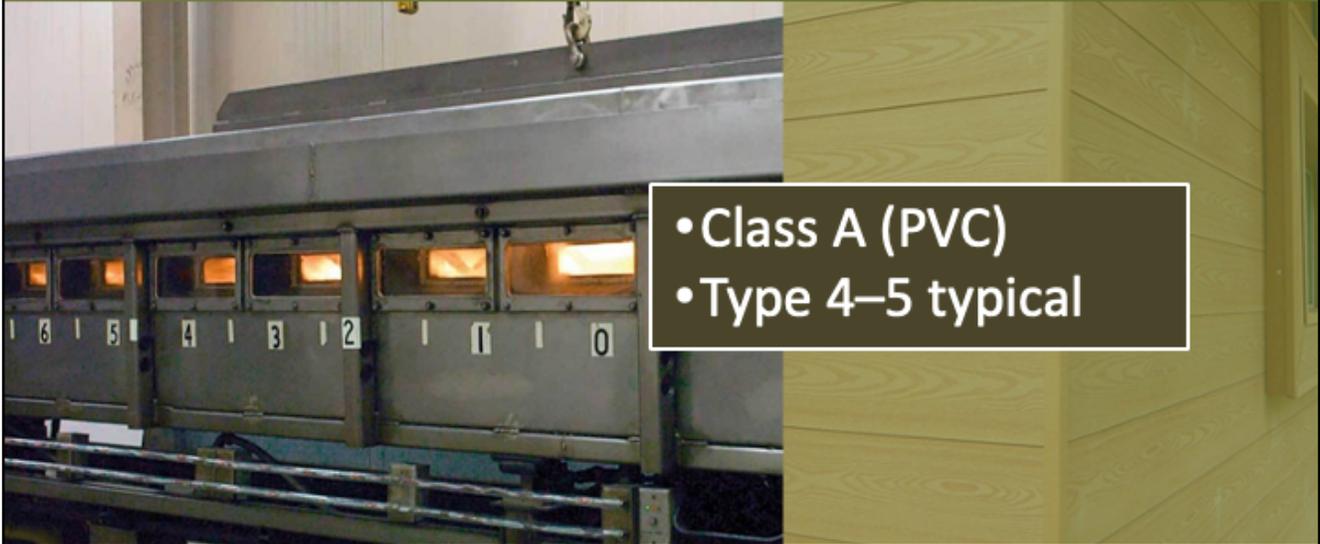
# Solid WPC – Installation

- Exposed fasteners and plugs
- AVB
- Furring
- Challenging installation
- Expansion and contraction
- Extra furring with CI system
- Soffits or cladding



Expansion and contraction of this technology makes for installation challenges. The extensive movement is addressed with an elongated screw hole, butt joint spacing, and plugs. Installation over CI systems may need black barrier to hide insulation or sub-framing. May be used for cladding or soffit.

## Solid WPC – Fire Performance



Solid WPC technologies offer a Class A rating, but without NFPA 285, they are typically used for Class 4 and 5 construction.



First-generation deck technology with plastic (PVC) capping.

## Solid WPC/Capped – Basic Technology



This is decking applied as rainscreen cladding. The basic technology is recycled wood and polyethylene thermoplastic. The PVC cap is simulated wood texture and protects the core from moisture intrusion.

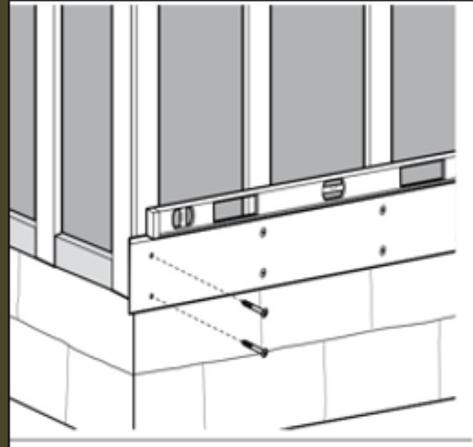
## Solid WPC/Capped - Life-Cycle Performance



Capped WPC is an overall good life-cycle performer. The color is inherent in the PVC. Good color retention and no future refinishing provide low maintenance. Sustainability is good in manufacturing due to recycled content up to 90 percent; however, end of life is a question due to the challenge of separating the PVC from the wood plastic composite. The aesthetic challenge is, does PVC look like wood? The warranties are 10 years in average for commercial applications and 20 for residential.

# Solid WPC/Capped – Installation

- Challenging install for expansion and contraction
- Open butt joints
- 3/16-inch gap between panels
- Exposed fasteners
- Vented rainscreen
- AVB
- Extra furring with CI system
- Soffits or cladding
- Cut ends must be sealed or swelling will occur



Expansion and contraction of this technology makes for installation challenges. The extensive movement is addressed with an elongated screw hole, butt joint spacing, and plugs. Installation over CI systems may need black barrier to hide insulation or sub-framing. Cut ends must be sealed to prevent moisture absorption into wood and swelling at butt joints. May be used for cladding or soffit.

## Solid WPC/Capped – Fire Performance



Polyethylene thermoplastic performs poorly in the ASTM E84 standard. Solid/capped wood plastic composites will be Class C and limited to Class 4 and 5 construction.



# Bamboo

# Bamboo – Basic Technology



The largest supplier of bamboo is China with 1½ m acres in production. Basic technology is bamboo.

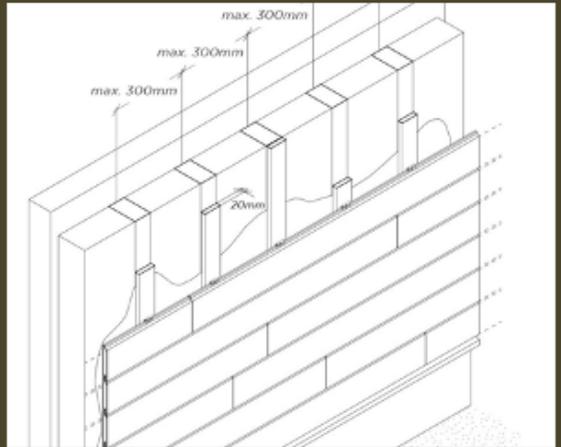
# Bamboo – Life-Cycle Performance



Life-cycle performance for bamboo is similar to natural wood. Color retention for bamboo is poor. Unless the bamboo is allowed to simply patina, bamboo is a high-maintenance choice. As a specifier, bamboo does provide an unlimited color palette for selection. Proper installation is critical to control moisture and termite/insect. Sustainability is good for the biofiber, but poor at end of life. The amount of glue makes bamboo non-recyclable. Warranty for material is based on the original purchase price and averages 30 years, with a rapid proration schedule and zero finish warranty.

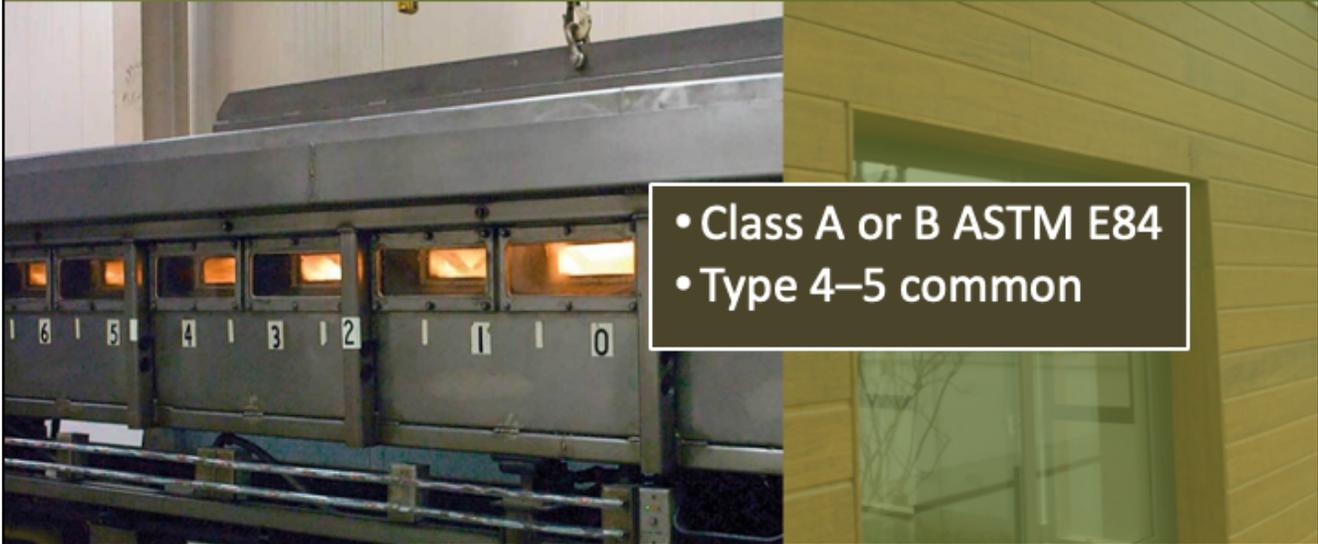
# Bamboo – Installation

- Short 6-foot boards (heavy)
- Vented rainscreen
- AVB
- Extra furring with CI system
- Soffits or cladding



Bamboo is heavy and supplied in short 6-foot lengths. Installation is important for performance. 16-inch OC furring strips are needed to provide airspace, and a properly installed air, water, and vapor barrier is required. Moisture must be controlled to prevent mold and mildew. With a sub-framing continuous insulation system, additional furring is needed. Insect screening is needed. Bamboo may be installed for cladding or soffit installations.

## Bamboo – Fire Performance



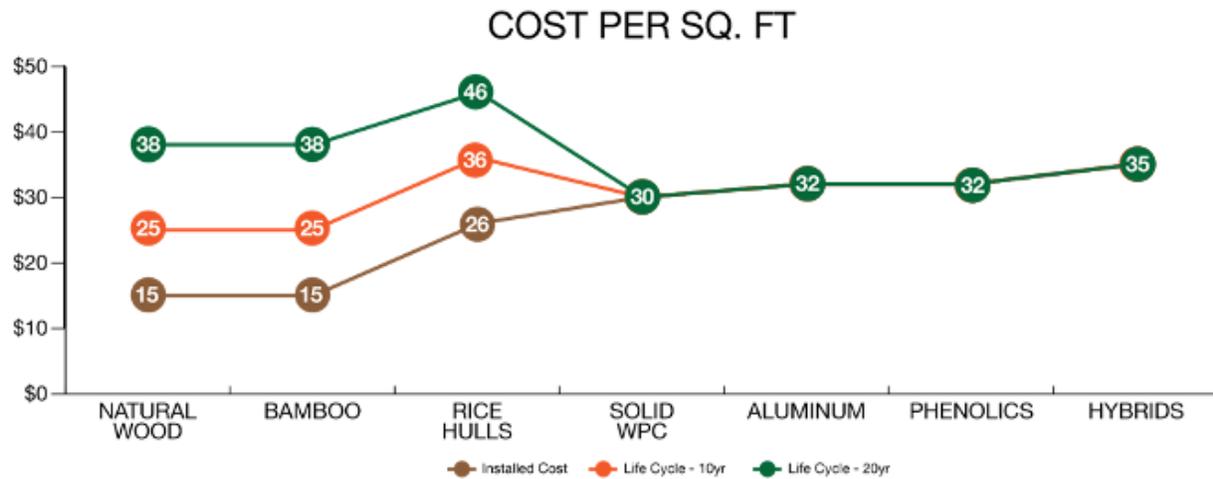
Class A or B is available per ASTM E84, no NFPA 285 assemblies. Bamboo is most used in Type 4 and 5 construction.

## Comparison Chart

Product	Color Retention	Maintenance	Moisture/ Termites	Recyclable	Warranty	Cost Installed
Natural/Treated	Poor	High	Poor	Yes	None	\$15
Bamboo	Poor	High	Poor	No	30 years	\$15
Rice Hulls/PVC	Poor	High	Poor	No	15 years	\$26
Fiber Cement	Average	Medium	Good	No	15 years	\$26
Solid WPC	Good	Low	Good	No	10 years	\$30
Aluminum	Good	Low	Good	Yes	15 years	\$32
Phenolics	Good	Low	Great	No	10 years	\$35
Hybrids	Excellent	Virtually Zero	Great	Yes	10 years	\$35

This chart provides a quick overview of the technologies presented in this program. As a designer and specifier, you have a lot of choices in the wood aesthetic category. Low initial investment cost may be quickly offset by maintenance expenses; however, based on the project budget and client expectations, there are products that provide great life cycle performance if upfront budgets allow.

## Installed Budgets Year 1, 10, and 20



This chart shows costs at 10 and 20 years. The initial low cost is quickly offset by maintenance within the first 7–10 years and at 20 years, the cost exceeds the superior life-cycle technologies.

# Product Comparison

Phenolic	Phenolic	Hybrid	Aluminum	Rice Hulls/PVC	Fiber Cement
					
 GOOD  LOW  GOOD  YES  10-YEARS	 GOOD  LOW  GOOD  YES  10-YEARS	 EXCELLENT  VIRTUALLY NONE  BRIGHT  YES  10-YEARS	 AVERAGE  LOW  GOOD  YES  10-YEARS	 POOR  HIGH  POOR  NO  10-YEARS	 AVERAGE  YES  GOOD  NO  10-YEARS
INITIAL COST: \$\$\$ LIFE CYCLE COST: \$	INITIAL COST: \$\$\$\$ LIFE CYCLE COST: \$	INITIAL COST: \$\$\$ LIFE CYCLE COST: \$	INITIAL COST: \$\$\$ LIFE CYCLE COST: \$	INITIAL COST: \$\$ LIFE CYCLE COST: \$\$\$	INITIAL COST: \$\$ LIFE CYCLE COST: \$\$

In lieu of physical samples, this visual slide provides each of the technologies except natural wood. The only two that have any real wood in the technology is the phenolic and hybrid. Only the hybrids have any “grain” effect that provides natural color variation.





McDonalds has used the hybrid technology on several restaurants, vertically and horizontally applied.



Corporate headquarters in South Carolina. Hybrids for cladding and soffits, selected for aesthetics and life-cycle performance.

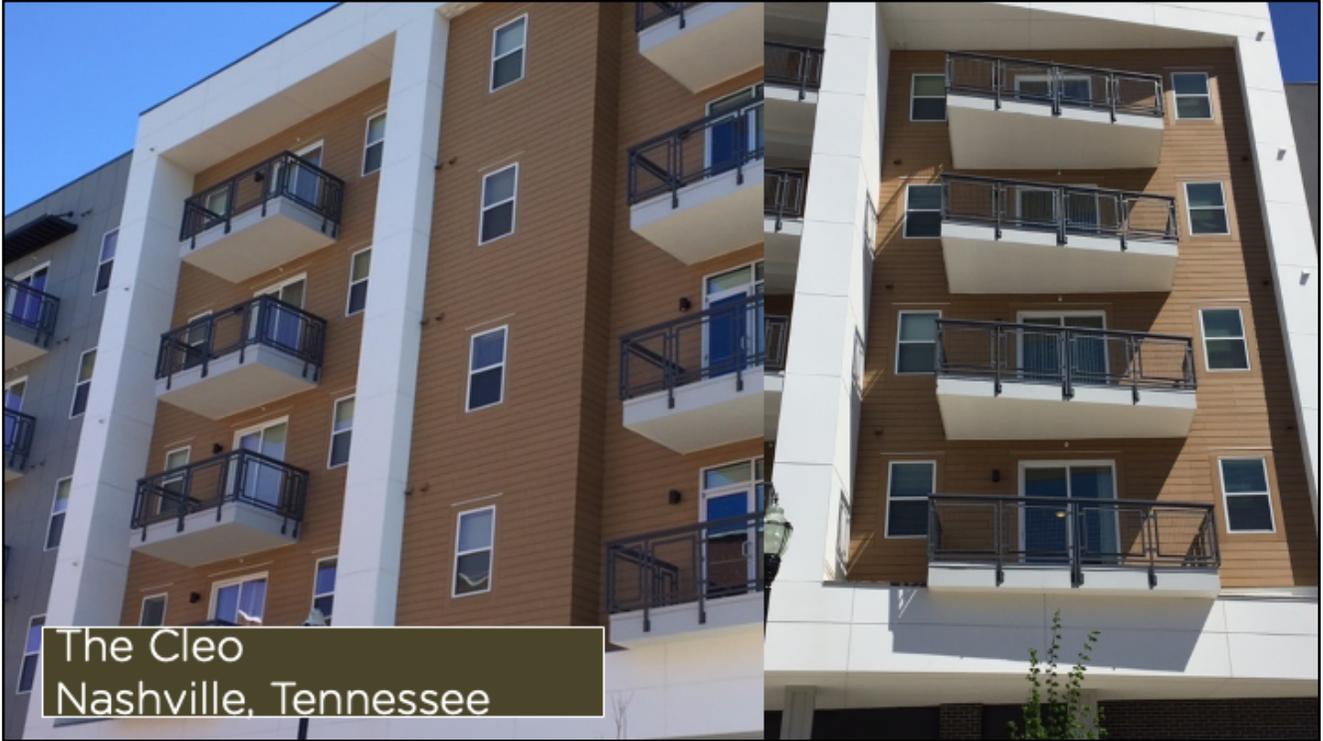
Hybrids are very popular for soffit applications due to the ease of installation, light weight, and no furring strips needed. Also, if they ever get moisture on the back due to leaks, etc. the hybrid technology will not be damaged or require replacement.



Hybrid soffit at East Alabama Medical Center. Natural stone and metal panels create a maintenance-free facade with great life-cycle performance.



Solid WPC at Brookfield Zoo outside of Chicago.



Solid WPC technology on a mixed-use project in Nashville called the Cleo.



Condominiums  
Fort Worth, Texas

Solid WPC in 8-year-old dark gray in Texas. Great color retention.



State Farm Building  
Richardson, Texas

Solid WPC soffit on a State Farm building in Texas.



Cici & Hyatt Brown Art Museum Daytona Beach, Florida

This is a solid WPC on a museum in Daytona Beach, Florida. It is 8 years old with excellent color retention.



Solid WPC soffit and canopy in Nebraska.



Solid WPC on a Texas school. Note the wider joint spacing on the solid WPC.



Public Library Columbus,  
Ohio

Solid WPC on a library in Columbus, Ohio.

# Thank You

Thank you for your interest in the performance and sustainability of advanced WPC and WPC hybrid products. This concludes the American Institute of Architects Continuing Education Systems Course.

Please contact Geolam directly to request samples, budgets, and answer any questions about the material presented here.

**Geolam**<sup>®</sup>

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