



## Design Innovations using Fiber Cement in Commercial Construction

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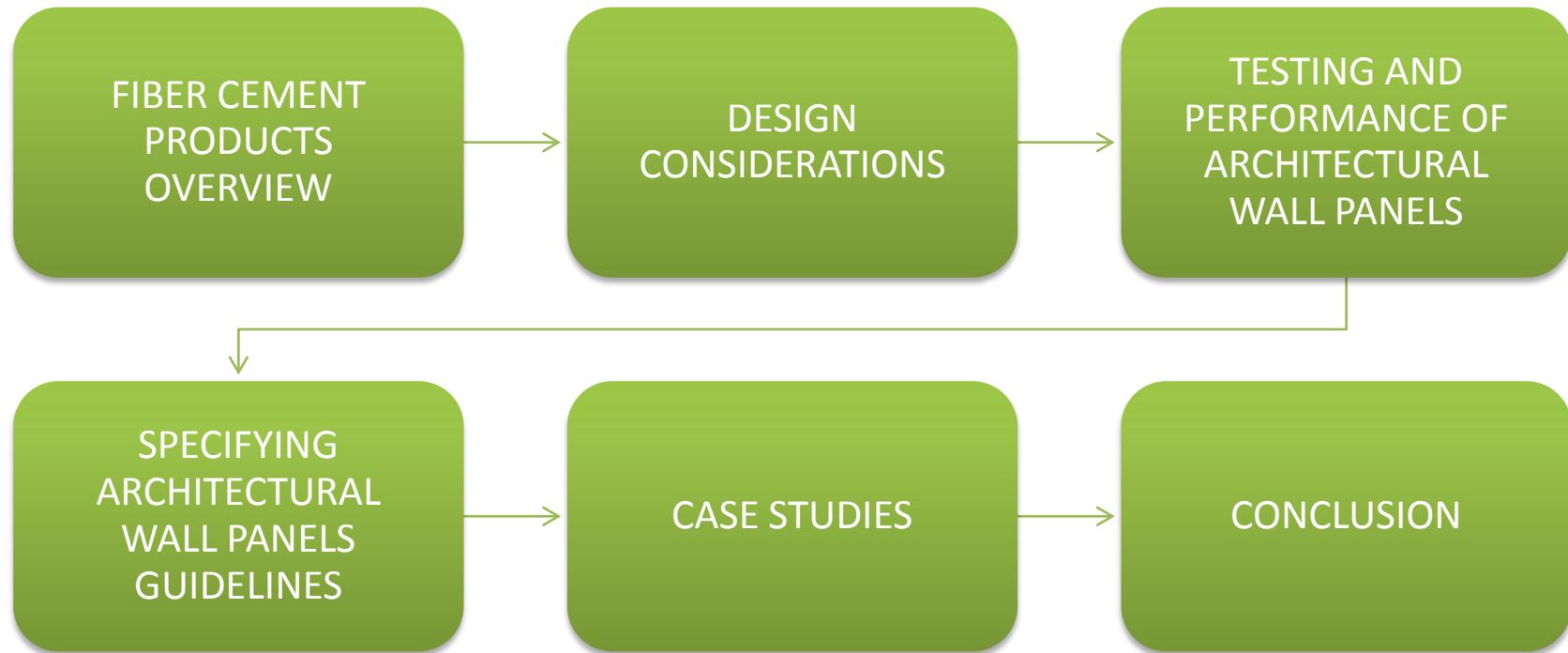
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# Learning Objectives

- After completing this presentation you will be able to:
  - Identify and recognize the innovative characteristics of fiber cement products used in commercial buildings
  - Compare and contrast the differences between residential fiber cement siding and commercial architectural wall panels
  - Assess the performance of commercial fiber cement products as they relate to code and testing requirements
  - Specify fiber cement products in a variety of building situations and make appropriate selections related to specific building types

# Course Outline





## Section 1:

# FIBER CEMENT PRODUCTS OVERVIEW

MANUFACTURING PROCESS

RESIDENTIAL PRODUCTS

COMMERCIAL PRODUCTS



# Fiber Cement Overview



- Composite material combining fibrous material with Portland cement binder
- In early 1900s European products developed as an alternative to roofing tile
- In 1970s Japanese products developed as siding material
- Today products in the US are recognized as safe, innovative, and sustainable



# Manufacturing Process – Basic Ingredients

Standard process is to combine:

**Wood fiber sources:** Wood chips, raw wood fibers, etc.

- Recycled and virgin sources
- Turned into wood pulp
- Provide resiliency and flexibility

**Portland cement:** Acts as binder

- Creates a tight, secure bond

**Silica filler:** An inert filler

- Silica is a component of sand
- Reduces weight or other characteristics
- Avoid airborne dust



# Manufacturing Process – Alternative Ingredient

**Alternative Fly Ash filler:** Some products use fly ash as an alternate inert filler material.

- Fly ash is a by-product of burning coal in electric power plants
- It is an extremely fine, lightweight powder captured in filters
- The majority (55%) of the 72 million annual tons of fly ash is landfilled
- The remaining 45% is diverted from landfills through beneficial reuse (recycling)
- US EPA, NRDC and USGBC all agree that recycling fly ash in building materials is beneficial
- Fiber cement manufacturers are helping while finding it improves performance

# Manufacturing Process - Water



- **Water:** some water may need to be added to the other ingredients to activate the bonding effect
- **Dry System:** Certain formulations simply use moisture already present in the other ingredients giving rise to the term “dry system”
- Either way, amount of moisture is measured and controlled



# Manufacturing Process - Result

Once ingredients are proportioned and combined, the resulting material is processed into final shape and length.

Stamping processes or molds can be used to create the appearance of wood grain, stone, brick, or other patterns.

Final step is to apply protective coatings over the fiber cement products.





# Residential Products



Residential fiber cement products are:

- A replacement for traditional wood, vinyl siding or board products
- Applied in a direct nailed manner just like other traditional residential siding
- Installed requiring only basic carpentry skills
- Commonly unfinished ready for standard painting or finish in the field



# Residential Products



- Residential fiber cement products are durable and often an excellent choice
- Relies on traditional moisture management and flashing to create a weathering barrier for the building
- There is no commercial grade moisture management system, engineered into these products

# Commercial Building Products



Commercial fiber cement products are:

- Architectural Wall Panels
- More suited to the rigorous and demanding conditions of commercial buildings
- Offered with fully engineered installation systems
- Designed for appropriate moisture and air flow management on substrate wall

# Commercial Building Products



## Appearance:

- Commonly fully pre-finished in a range of standard or custom colors
- Range of textures available
- Warranty available for the total finish
- Hidden fasteners are used to create a clean, uncluttered look desired in many commercial buildings



## Section 2: DESIGN CONSIDERATIONS

SUBSTRATE DESIGN

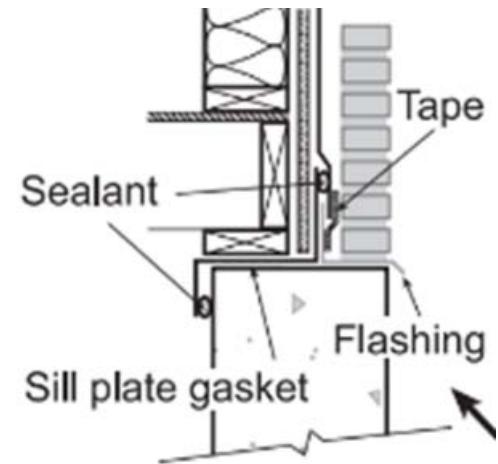
PANEL JOINT TYPES

PANEL DESIGN OPTIONS



# Substrate Design

- Fiber Cement wall panels and the substrate need to work together.
- Attention needs to be paid to:
  - Air barriers
  - Vapor barriers
  - Weather /water resistive barriers (WRB)
- In all cases, a barrier is required when installing fiber cement Architectural Wall Panels.



# Definitions for Exterior Wall Assembly Elements

**Air Barriers:** Materials used anywhere in a building assembly to stop the movement of air into or out of the conditioned space (water vapor also transported by air). Any material that has an air permeance that is not greater than  $0.02 \text{ L}/(\text{s}\cdot\text{m}^2)$  at a pressure difference of 75 Pa ( $0.004 \text{ cfm}/\text{ft}^2$ ) at a pressure difference of 1.56 lb./ft<sup>2</sup>) when tested in accordance with ASTM E 21 is considered an air barrier material.

**Vapor Barriers:** Materials used to slow or reduce the movement of water vapor through a material. Vapor barrier materials are installed on the warm side of the insulation in a building assembly. The position of the vapor barrier in a building assembly will be determined climatic conditions. In warm climates, it will be on the exterior while in cold climates it will be on the interior.

# Definitions for Exterior Wall Assembly Elements



## **Water Resistive Barriers/Weather Resistive**

**Barriers:** Materials on the exterior of a building which are intended to resist bulk liquid that has leaked, penetrated or seeped past the exterior cladding from absorbing into the exterior sheathing or concrete wall (depending on the application) and further into the wall assembly.



# Barrier Choices

## Traditional Sheet Goods/Building Wraps

- Bonded or fused paper or fabric based materials
- “Wrap” the structure



## Fully-Adhered Sheet Goods

- Multi-laminated layers or bonded fibrous materials bonded together to form a sheet backed with an adhesive and easy-release film



## Fluid Applied

- Seamless offered in spray , trowel and roll on formulations
- Wall joints are well sealed and reinforced at panel joints & sill areas

# Panel Joint Types



Manufacturers of fiber cement  
Architectural Wall Panels offer two  
fundamental choices:

- Open joint assemblies
- Closed joint assemblies



# Open Joint Systems



Open Joint systems create a ventilated, rainscreen type of exterior cladding system.

- Emerged from need to hold panels away from the substrate
- Literally provides a permeable screen to rain and other weather
- The water and air barriers are the true exterior skin barriers and require significant attention
- Open joint systems allow for air and water to both penetrate and drain out from behind the panels



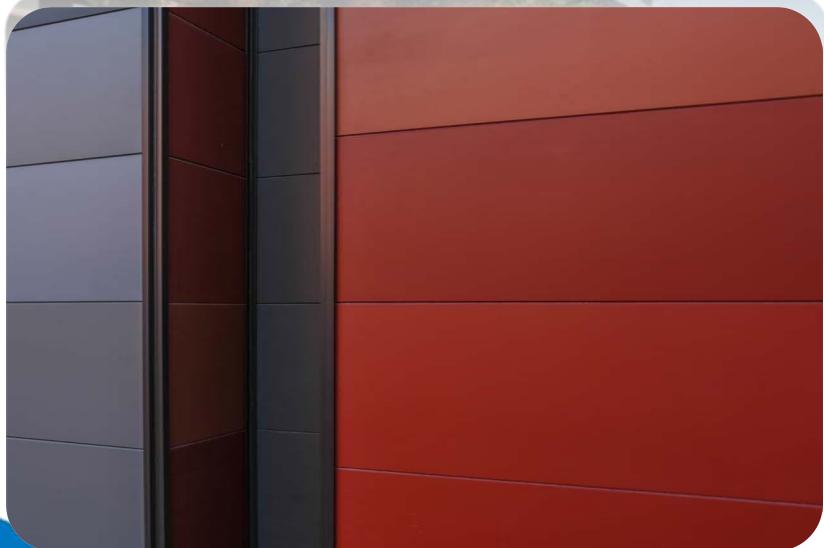
# Open Joint Systems

Open joint details:

- Panels installed on a system of metal hat and J-channels
- WRB is penetrated by fasteners
- WRB needs to be UV stabilized since it is partly exposed
- Installation based on slipping points instead of fixed points for adjustment and expansion
- Corners need to be detailed - if cut, edges of the panels need field finish to protect integrity



# Closed Joint Systems



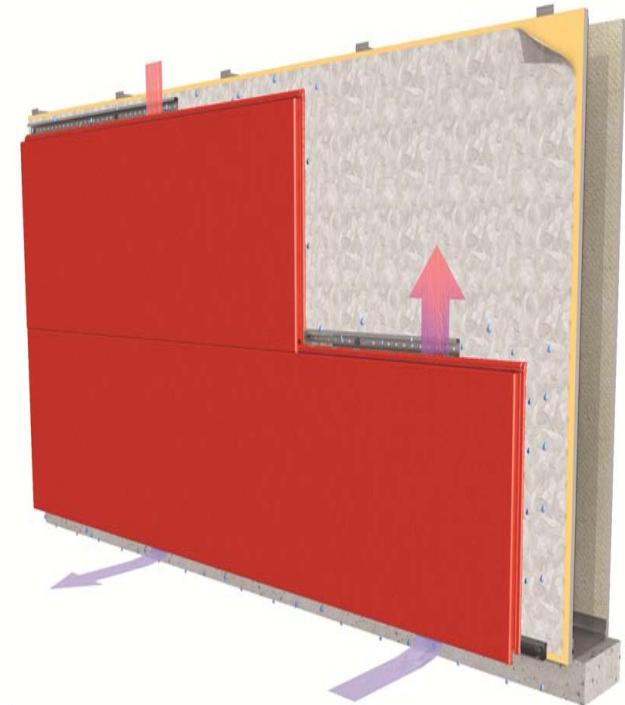
Closed Joint system eliminates open joints between panels.

- Creates a smooth, continuous exterior surface
- Closely resembles metal or composite exterior wall panels
- Fiber cement panels are generally less expensive and easier to install than metal panels

# Closed Joint Systems

Closed Joint details:

- Closed joints don't allow bulk water to penetrate
- Are inherently simpler to design and install than open joints
- Panels still function as a back draining, ventilated rainscreen but in a much smaller depth
- Attachment of panels rely on a concealed, narrow, clip system
- Less material, less time, less cost



# Closed Joint Systems



- Panel joints are factory formed to lap or join fairly tightly
- Some use factory applied foam gaskets along edges
- Substrate barriers are not exposed to weather or UV
- Corners can be overlapped or butt joined
- Long facades require expansion joints
- Can be modified in the field

# Panel Design Options



Size of fiber cement architectural wall panels:

- Height and length of the panels can range from small to very large
- Multiple sizes on a single project are possible
- Can meet design needs while minimizing field modifications
- Consult with manufacturers during design phase



# Panel Design Options



## Texture and Finish:

- Smooth surfaces
- Wood textured look
- Range of standard and custom colors
  - Common to see mixed colors intentionally used on a particular façade
- Brick and stone textures are also available
  - Appropriate colors
  - Less weight
  - Less depth

## Section 3:

# TESTING AND PERFORMANCE OF FIBER CEMENT ARCHITECTURAL WALL PANELS

**ASTM TESTS**

**AAMA TESTS**

**NFPA 285**



# ASTM E283



- “Standard Test Method For Determining Rate Of Air Leakage”
- Covers a standard laboratory procedure for determining the air leakage rates of exterior windows, curtain walls, and doors under specified differential pressure conditions
- Intended to measure only such leakage associated with the assembly sample and not the field installation
- Often referenced for rainscreen type of walls, but the cavity depth can alter the results



# ASTM E330



- “Standard Test Method for Structural Performance by Uniform Static Air Pressure Difference”
- Describes determination of the structural performance of exterior windows, doors, skylights, and curtain walls under uniform static air pressure differences
- Applicable to curtain wall assemblies
- Intended to represent the effects of a wind load on exterior building surface elements, actual loading on building surfaces will vary
- Useful but not necessarily applicable or accurate for all rainscreen types



# ASTM E331



- “Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference”
- Procedures to determine the water penetration resistance of windows, curtain walls, skylights, and doors
- Performed by applying 5.0 gal/ft<sup>2</sup>-h of water at of 6.24 psf of pressure to exterior while lowering pressure inside
- Can be useful to determine the extent to which the wall assembly behind Architectural Wall Panels is resistant to water penetration



# AAMA 501-1



- “Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure”
- Similar to ASTM test this AAMA standard establishes the equipment, procedures and requirements for optional laboratory testing of exterior windows, curtain wall and door systems for water penetration
- However test is based on using dynamic pressure instead of static pressure to see the range of performance at different pressures
- Intended to simulate real world conditions of wind driven rain against a building



# AAMA 509-9



- “Voluntary Test and Classification Method of Drained and Back Ventilated Rain Screen Wall Cladding Systems”
- AAMA recognized the need to develop testing specific to rainscreens hence, AAMA 509-9 developed for purpose of quantifying
  - Volume of rain water contacting an imperfect Air and Water Barrier (AWB)
  - The system’s ability to allow for ventilation/drying as measured by air flow through the system
- Understood that water will reach the AWB
- Not a “pass/fail” rather is how much water penetration and drainage and drying



# AAMA 509-9



Under this test, there are four (4) essential design requirements that must be demonstrated:

- Water entry must not penetrate into or through the entire wall system (i.e. penetrating the AWB)
- The AWB & WRB shall be designed to provide the primary weather protection
- The wall system must manage and drain any water entering the cavity behind the cladding plus be sufficiently vented to allow the cavity to dry
- In the event that water vapor diffuses through the wall assembly from building interior and into wall panel cavity, that water vapor shall be vented and/or drained out to the exterior



# NFPA 285



- “Standard Fire Test Method For Evaluation Of Fire Propagation Characteristics Of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components”
- Standardized fire test procedure for evaluating of exterior, non-load bearing wall assemblies that are constructed using combustible materials or components where the exterior walls are required to be non-combustible
- Most fiber cement products are not rated as combustible, however portions of the rest of the wall assembly might be
- This fire safety standard does not test individual materials, rather it tests full assemblies



## Section 4:

# SPECIFYING FIBER CEMENT ARCHITECTURAL WALL PANELS GUIDELINES



# Specification Guidelines - General



Contact manufacturers during the design process to determine specific capabilities, options, and system coordination items

- Particularly important for taller buildings subject to greater weathering stresses and specific installation requirements

Request manufacturer samples and submittals

- Include product lead times to be sure that construction schedules are being met

Identify the appropriate testing requirements such as  
AAMA 509-9



# Specification Guidelines - Products



All options and details will need to be listed:

- Panel size(s)
- Color
- Texture
- Installation system
- If open joint system, then the channel system needs to be called out in detail and indicated on the drawings
- If closed joint system then clip system specified as part of manufacturer's standard installation system
- Other third party components such as sealants, flashings, trims, fasteners, etc.



# Specification Guidelines - Installation



Each manufacturer will have particular requirements especially since the installation system is likely made by them along with the panels.

Manufacturer requirements should be consulted and referenced to be sure that the installation is done correctly and the integrity of the substrate wall is maintained.

Manufacturer trained installers are generally preferred as a matter of construction quality control.

# Section 5:

## CASE STUDIES

# Case Study #1: Berkshire Terminus, Atlanta, GA



## Architect

- Lord Aeck Sargent

## Product

- VintageWood

## General Contractor

- Living Stone Construction

## Location

- Atlanta



## Project Features

- Low Maintenance
- Cost Savings
- Rich Finish
- Durability

## CHALLENGE

The building had to complement neighboring structures—but still stand on its own. Mixing façade materials was an ideal solution, but required careful thought into transitioning from one look to another.

## SOLUTION

The use of gray and white colors enhance the warmth of the Nichiba wood-look panels and the building's contemporary design.

## RESULTS

The apartment building features a contemporary high-end design that meshes well with neighboring buildings and the community as a whole. At the same time, its unique approach sets it apart while capturing the attention of other building owners and architects in the Atlanta area.



# Case Study #2: Ford Ice Center, TN



## Architect

- HBM Architects

## Installer

- Dixie ICF

## Location

- Nashville

## Product

- Illumination Series

## Project Features

- Modern Aesthetics
- Simple Installation
- Drained and Back Ventilated Rainscreen System
- Color Xpressions System
- Durability

## CHALLENGE

Rehab an old mall into three different spaces that are unique to themselves while complementing each other.

## SOLUTION

The use of different color panels for each area allowed the three spaces to become their own with the use of blue pulling them all together.

## RESULTS

A hockey arena, library, and community center work in concert visually, while leaving behind any appearance of an old mall.

# Case Study #3: Third North Apartments, Minneapolis, MN



## General Contractor

- Kraus-Anderson  
Construction Company

## Product

- Illumination Series



## Location

- Minneapolis

## Project Type

- Multifamily

## Project Features

- Smooth, satin finish
- Virtually limitless color palette
- Easy installation
- Low maintenance
- 40% recycled content

## Challenge:

Create a modern-feeling façade without contrasting with the surrounding neighborhood.

## Solution:

Fiber cement panels used in a blend of six colors offers shape and pattern reminiscent of nearby historic brick buildings.

## Results:

Third North Apartments complements the varying elevations and facades of the neighborhood while bringing a fresh look to the streetscape.



## Section 6: CONCLUSION



# Conclusion



Commercial products are different from residential products:

- They meet the demands and rigors of commercial installations
- They are available in a variety of system types
- As a rainscreen product they can meet a range of tests in conjunction with a properly designed substrate or supporting construction wall





# Conclusion



Fiber Cement Architectural Wall Panels are a worthy choice for consideration on current and future commercial building projects where aesthetics, quality, and cost-effectiveness are needed.

# Thank you!



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