Aluminum Composite Material (ACM): Sustainable Materials & Processes



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Aluminum Composite Material (ACM): Sustainable Materials & Processes

Presented by: 3A Composites USA
Two Harbour Place, 721 Jetton St., Ste. 325
Davidson, NC 28036

Description: Provides an overview of the versatility, sustainability, and functionality of aluminum composite material (ACM) and discusses why it is selected for architectural cladding, interiors, and signage applications in new and existing buildings around the world.

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Purpose and Learning Objectives

Purpose: Provides an overview of the versatility, sustainability, and functionality of aluminum composite material (ACM) and discusses why it is selected for architectural cladding, interiors, and signage applications in new and existing buildings around the world.

Learning Objectives:

At the end of this program, participants will be able to:

- Summarize the fundamentals of ACM including its brief history, materials, and environmental aspects
- Evaluate the significance of environmental product declarations (EPDs) and describe how ACM products are manufactured in an environmentally responsible manner
- Differentiate between the common types of ACM systems, finishes, and coatings
- Discuss how ACM enhances a building's energy performance while reducing its environmental footprint
- Explain how ACM is installed and identify different applications citing case studies

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Click on title to view

Introduction to ACM

Rush University Medical Center, Chicago, Illinois
Image: Robert R. Gigliotti

Aluminum Composite Material (ACM)

Aluminum composite material (ACM) is used for exterior as well as interior applications including cladding for exterior canopies, soffits, fascias, interior columns, graphic displays, and decorative elements.

From building an innovative and modern façade or one that's decidedly more subtle, to giving existing structures a fresh look, ACM offers architects flexibility in design.

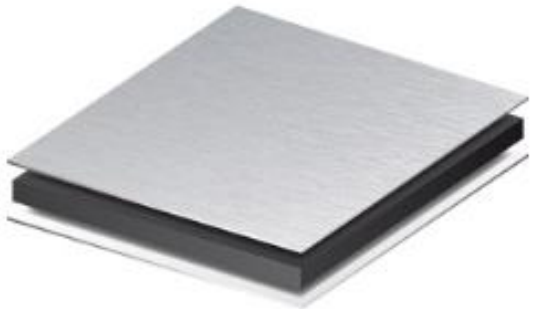
ACM provides functional and decorative surfaces that offer long-term color consistency, weather resistance, excellent flatness, rigidity and formability, and ease of maintenance.

Hamburg Bus Station, Poppenbüttel
Hamberg, Germany

Brief History

In 1968, the first aluminum composite material was created in Europe by Alusuisse of Zurich. Even though it was being commercially produced in Germany in 1969, production of ACM was not introduced to North America until 1977. The first ACM was produced domestically in Benton, Kentucky in 1978 and the first building project—Spaceship Earth—utilizing ACM in the United States had its grand opening in 1982.

While aluminum was the first and remains the predominant skin for metal composite panels, the product category metal composite material (MCM) reflects the use of new skin metals such as zinc, copper, titanium, and stainless steel.* Today, ACM is used worldwide since it provides a sustainable solution for building design in a variety of climatic and environmental conditions.



*Source: Metal Construction Association (MCA). “Metal Composite Panels”. www.metalconstruction.org/index.php/applications/metal-composite-panels. Accessed January 2015

Modern Architecture, Sustainability & Aluminum

Aluminum has been used to clad components of buildings or entire structures since the late 1800s and today it plays a key role in enhancing the sustainability of modern architecture or the renovation of existing buildings.

This course focuses on the design, testing and manufacturing techniques of ACM for exterior and interior applications. In doing so it highlights the infinite lifecycle of aluminum and its role in improving the safety, comfort, and energy performance of buildings. Included are a few details from an industry environmental product declaration (EPD) held by the Metal Construction Association (MCA) and a lifecycle assessment (LCA) of metal building products. The documents are based on procedures used by several product manufacturers. A list of resources at the end of the course provides more information.

Georges-Freche School of Hotel Management
Montpellier, France
Images: Massimiliano and Doriana Fuksas,
Moreno Maggi and Ramon Pratt

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Environmental Product Declaration (EPD)

An environmental product declaration (EPD) is a standardized, internationally recognized report that contains verified information about the environmental performance of a building product across its complete or a portion of its lifecycle. An EPD offers a way to evaluate and specify a product with a low environmental footprint. An EPD can be produced for one specific manufacturer's product (proprietary EPD) or for a specific group of manufacturers' product type (industry wide or generic EPD).

EPDs are created using Life Cycle Assessment (LCA) data as specified by the product category rules (PCRs) and are based on ISO 14025 standards. PCRs determine the type of product information collected and define the type of LCA data to be evaluated.

EPDs are included under the U.S. Green Building Council's (USGBC's) Leadership in Energy and Environmental Design (LEED®) program, LEED v4, in new criteria for the Materials and Resources category - Building product disclosure and optimization - environmental product declarations.

Source: U.S. Environmental Protection Agency. "EPD Fact Sheet". www.epa.gov/region10/pdf/greenbuilding/mindclicksgm-epd-fs.pdf. Accessed January 2015

How To Use An EPD

Aluminum composite material (ACM) manufacturers that hold EPDs have invested time and money in gathering LCA information. This information is useful for identifying processes and ingredients that negatively impact the environment and human health. Architects can use this information to look for evidence of improvement in the environmental impact of a product across its life span. The LCA information identifies what the company acted upon, and what positive changes an ACM manufacturer has made or is making.

Using an EPD to compare the environmental impacts between same or similar products can be difficult since not many are available and the same PCR has been used, with the same life-cycle phases evaluated. However, they can be used to start a discussion about the sustainability goals of a company.

ACM: Environmental Impact

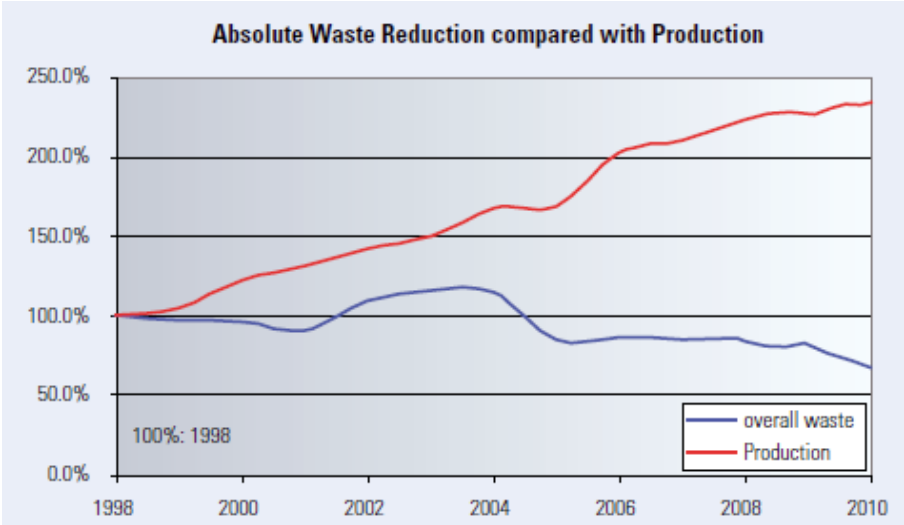
It is important to note that EPDs generally do not include environmental impacts of a product during its use, and that a cradle-to-gate LCA excludes the reference service life of a product and all impacts beyond the manufacturing facility.

A cradle-to-gate LCA of ACM includes: raw material extraction and transport of raw materials to a manufacturing facility, transportation of the materials between ACM manufacturing facilities, waste and emissions, and energy and water input at ACM coating facilities. The Interpretation section of an EPD and an EPD's Transparency Brief summarize a product's environmental impact, within the boundaries of the LCA, in prescribed Lifecycle Impact Categories.

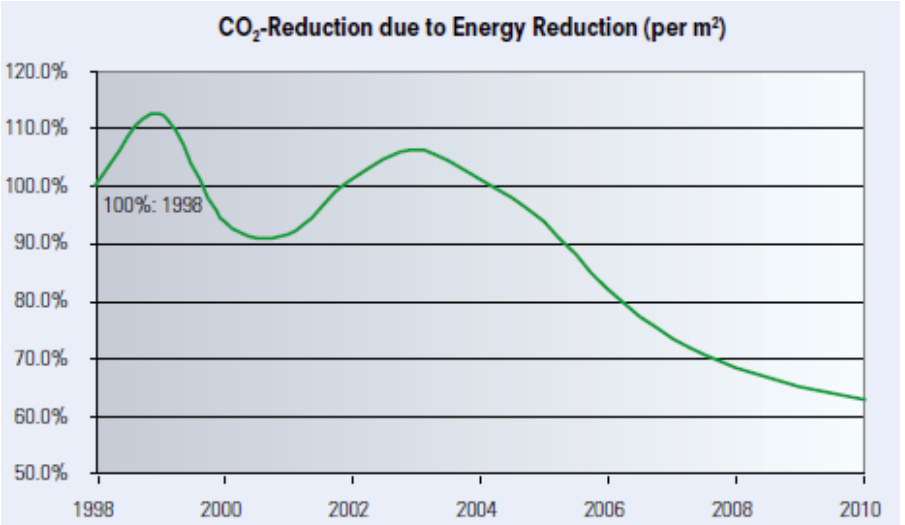
The EPD for ACM shows that the global warming potential impact for this product is dominated by the raw material stage (69%) and manufacturing stage (31%). While the demand for ACM production increases, many manufacturers have taken steps to minimise CO_2 emissions in the supply of the core material, panel production, and mode of transportation used. Reducing production waste and wastewater has been another priority. The industry's overall carbon footprint has fallen dramatically, declining 19% since 2005 and 37% percent since 1995.

ACM: Environmental Impact

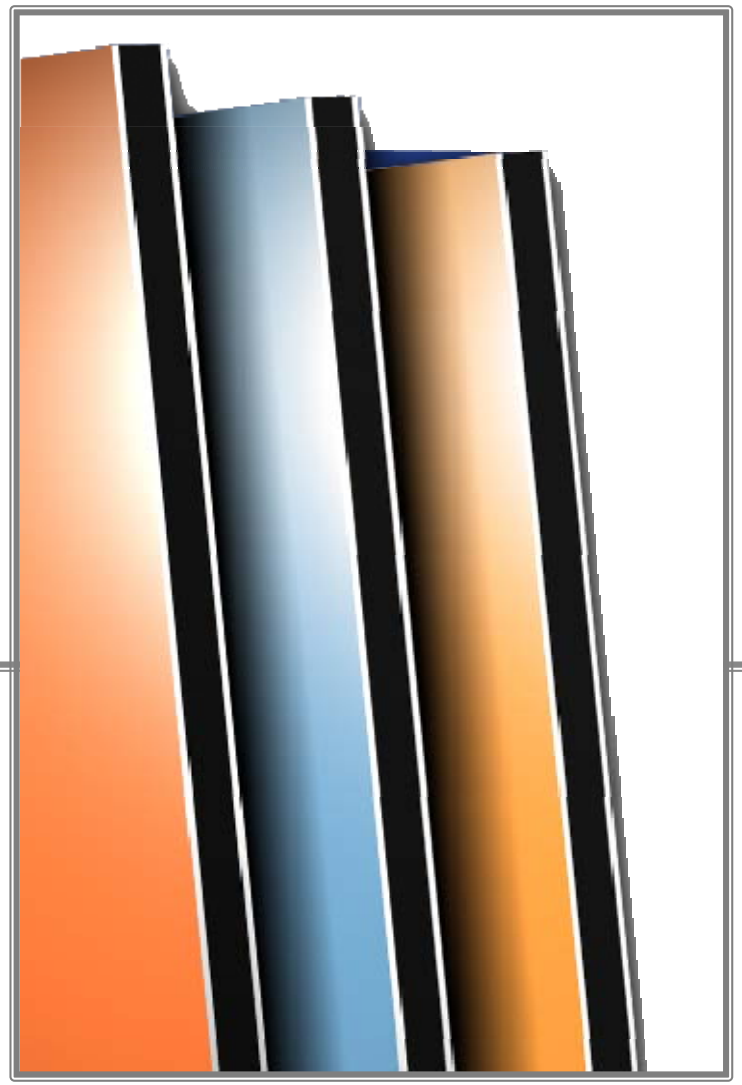
Over the past decade, some in the industry have moved towards a more environment-friendly approach to manufacturing ACM.



The past 10 years have seen a 50% reduction in waste water and a 14% reduction in waste. Both these figures come to fruition with a 114% increase in production.



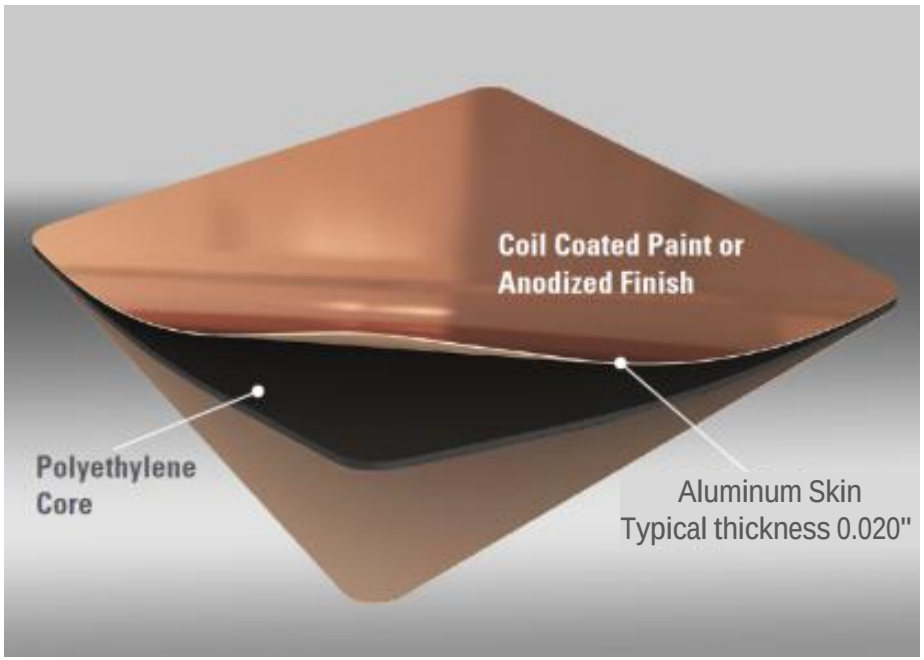
The past 10 years have seen a 32% reduction of CO_2 emissions per m^2 in the production process.

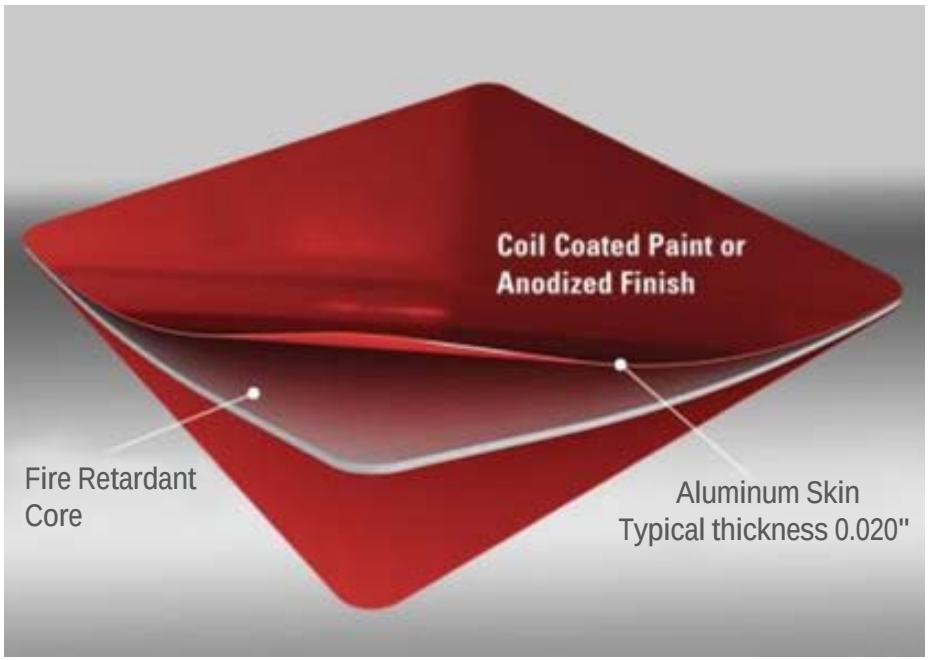


Materials & Processes

What Is ACM?

ACM is a lightweight composite material consisting of two sheets of aluminum (3000 or 5000 series alloy) facings thermobonded to a polyethylene core or to a fire retardant core. ACM may be available in an anodized finish or a premium coil coating in a full spectrum of appealing standard colors or any custom color a project demands. Consult individual manufacturers for their technical specifications.





Example: Typical Technical Specification

Materials:
- Aluminum interior and exterior skins in smooth, non-embossed, 0.020" (0.5 mm) nominal thickness to ensure flatness
- Polyethylene (PE) core available in 3 mm, 4 mm, and 6 mm nominal thickness
- Fire retardant core in 4 mm thickness

Sheet widths:
- Standard coil coated widths include 40", 50", and 62"
- Standard anodized width 62"

Sheet lengths:
- Standard length 196"
- Custom sheet lengths from 48" to 360"
- Standard anodized length 198"

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Example: Technical Specifications

Minimum bending radius:

- The minimum bending radius of a panel with a PE core without routing the interior skin is 15 times the thickness of the material

Temperature resistance:

- Withstands environmental temperature changes from -55˚F to +175˚F (-50°C to +80°C)
- Coefficient of linear expansion is governed by the aluminum sheet

The Materials: Aluminum

Aluminum, the most abundant metal and the third most abundant element in the earth's crust, was successfully extracted from boxite ore in 1825. Due to its inherent performance properties, it is used by the building industry around the world.

Aluminum is:

- **Lightweight** (places a reduced load on the wall framing and foundation; the building components use less material; construction cost savings)
- **Malleable** (can be shaped into tight radiuses and sweeping curves)
- **Corrosion resistant** (generates its own protective oxide coating that is corrosion resistant, and surface treatment and finishes enhance this property)
- **Non-toxic**, **impermeable**, and **releases no odors**
- **Reflective** (of both heat and light)
- **Durable** (resistant to breakage or cracking, and harsh environments)
- **Recyclable** (100%, with no loss of its inherent properties)

Environmental Impact

The main uses of aluminum in the building industry often have a lifecycle of several decades through which a vast material storage bank is being created for future recycling use. There is a clear incentive to bring the scrap of aluminum products back into the supply chain after its useful life.

- This offers an economic value and high CO_2 savings
- Due to aluminum's longevity millions of tonnes of aluminum remain in use—approximately 75% of all aluminum ever produced is still in use
- Over 95% of aluminum used in building applications is collected and undergoes further recycling
- Today's aluminum comprises up to 40% of recycled aluminum
- Approximately 70% of an ACM by weight is recycled content

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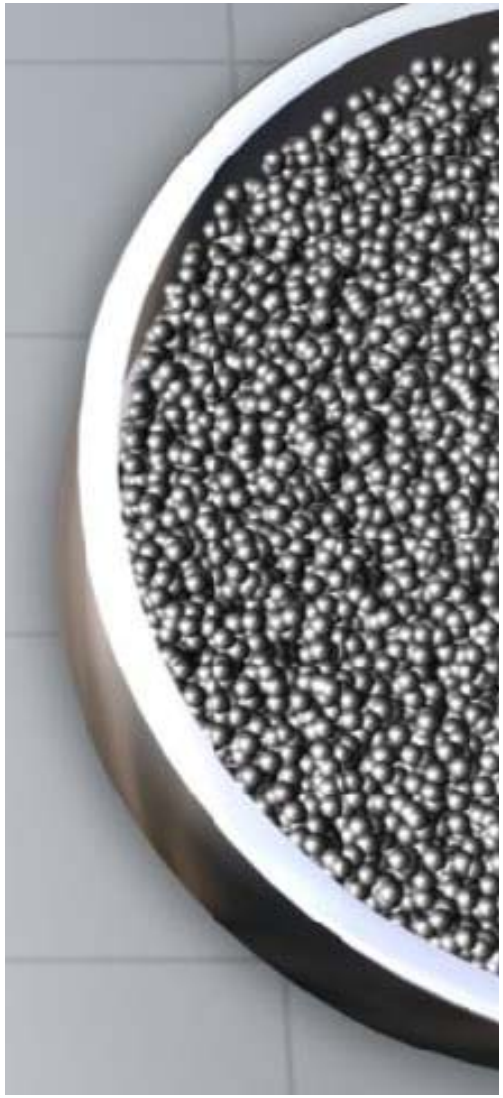
The Materials: Polyethylene (PE)

Polyethylene (PE) is the most widely used plastic in the United States. Its applications include household items such as grocery bags, housewares and toys, to commercially used goods such as pipes, drums, tanks and coatings.

The core of ACM comprises virgin polyethylene pellets and recycled polyethylene pellets, the specific chemistry of which is usually proprietary to each manufacturer. The polyethylene core is designed to enhance the ACM's strength and rigidity. Depending on a building's design needs the ACM's thickness can be 3 mm, 4 mm, or 6 mm (98% of all ACM has a thickness of 4 mm). Consult individual manufacturers for available options.



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The Materials: Fire Retardant (FR)

Where required the core formulation contains the additives necessary to meet the fire performance of the given product geometry for building code compliance on multi-story construction and applications. In the United States, ACM is tested to meet fire classifications, including NFPA 285 and ASTM E84.

NFPA 285 - Standard Fire Test Method For Evaluation of Fire Propagation Characteristics of Exterior Non-load bearing Wall Assemblies Containing Combustible Components

- This standard provides a standardized fire test procedure for evaluating the suitability of exterior, non-load bearing wall assemblies and panels used as components of curtain wall assemblies that are constructed using combustible materials or that incorporate combustible components for installation on buildings where the exterior walls are required to be non-combustible.
  What does NFPA 285 address? Fire propagation characteristics are determined for post-flashover fires of interior origin. NFPA 285 requires both visual observations made by laboratory personnel conducting the test and temperature data recorded during the test. It is important to note that NFPA 285 is an assembly test.

The Materials: Fire Retardant (FR)

ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

- This fire-test-response standard for the comparative surface burning behavior of building materials is applicable to exposed surfaces such as walls and ceilings. The purpose of this test method is to determine the relative burning behavior of a material by observing the flame spread along the specimen. The surface burning characteristics obtained are the Flame Spread Index and Smoke Developed Index values. The Flame Spread Index is a relative indication of the flammability of the test material with respect to a red oak standard. The Smoke Development Index is a classification indicating a comparative measure derived from smoke obscuration. However, there is not necessarily a relationship between these two Indices.

Environmental Impact

Core material:

- The polyethylene core in ACM is fully recyclable.
- Polyethylene is a thermoplastic which means it can be remelted, retreated, and reused.
- The fire retardant core is recyclable.

Manufacture

ACM is formed by bonding two metal skins to the engineered plastic core under very controlled conditions of pressure, tension, and temperature. Rolling ingots (large aluminum blocks) are usually cast from the application specific aluminium alloy via a continuous casting process. These rolling ingots are slid between two rotating steel rollers which are spaced a little less than the thickness of the rolling pieces. Friction causes entrainment by the rollers and compression to the space between the rollers. This reshaping is primarily lengthwise causing the rolled pieces to elongate.

Several rolling processes are usually required in order to obtain the final thickness. Thermal treatment is performed in order to achieve the required material properties in terms of formability and strength. The aluminium coils are coated in a continuous coil coating process. Solvents used during this process are collected and thermally utilised for drying the varnishes.

The coated aluminum coil is thermally bonded to the core and cut to length in a further process involving a continuously manufactured plank.

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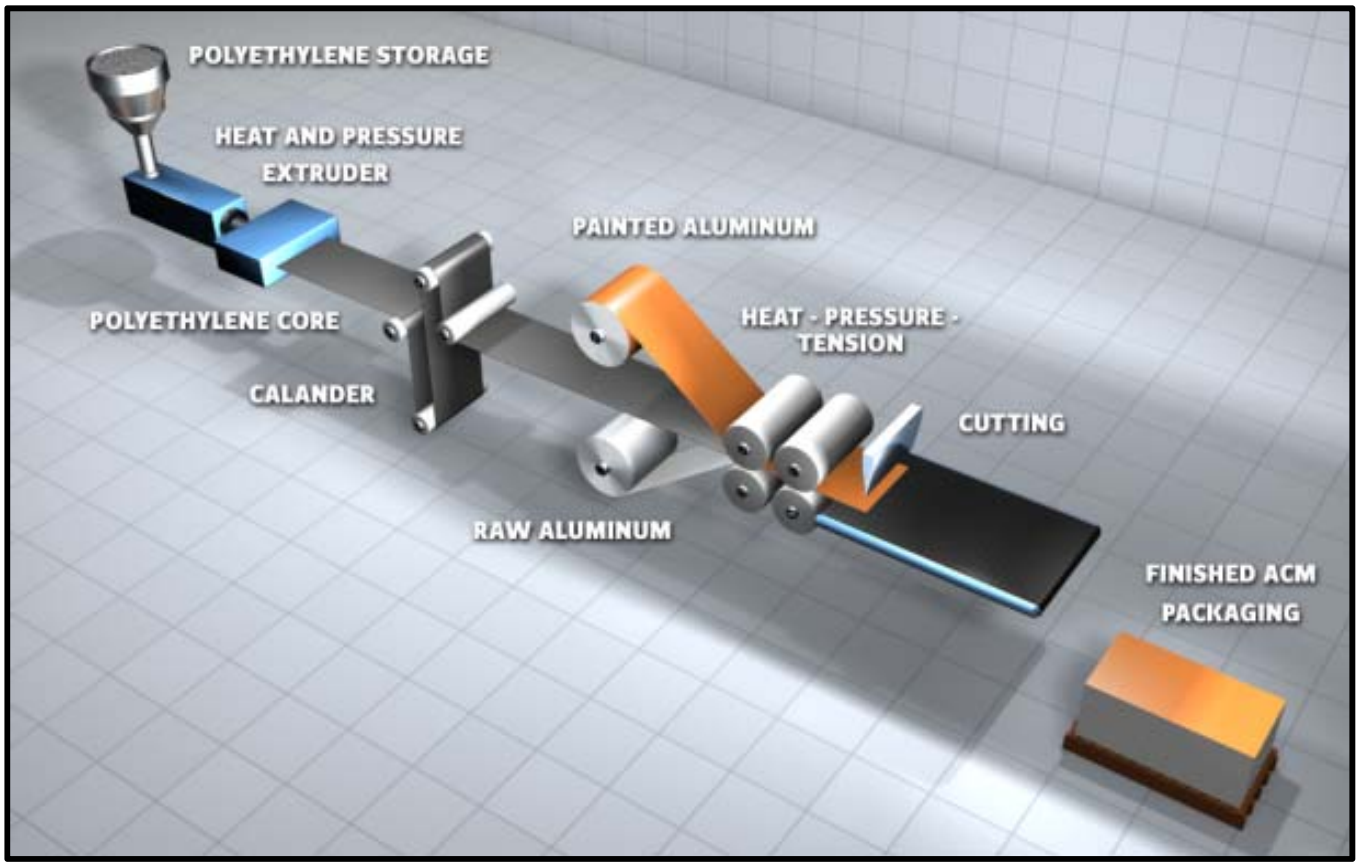
Manufacture: Video



To view this YouTube video an internet connection is required. Click on the image above to start the video. Click on Adobe PDF icon in the taskbar to return to the course.

Environmental Impact

Manufacturing:

- During the manufacturing process, all excess polyethylene is recycled back into the manufacturing process and all scrap aluminium is sent back to aluminium processing plants for recycling.

Sandwich concept:

- The “sandwich concept” reduces energy input. Given the fact that aluminium requires large amounts of energy to be produced, the portion of aluminium to manufacture ACM is by far less compared to flat sheet aluminium. Therefore energy consumption is significantly less whilst keeping equal rigidity properties.

Continuous Coil Coating Process

The continuous coil coating process is a controlled, automated process, as shown in the graphic and video on the next slide:

- The accumulator rises and falls, to adjust to the speed of the coil
- The degreaser removes the oil used to lubricate the rollers that squeeze the large ingots (aluminum blocks) into thin coils of aluminum
- Chemicals used in the degreasing process are then rinsed off
- The application process, known as “reverse coil coating,” begins when paint is transferred from the pan to a partially submerged roller to another roller that is in contact with the surface of the coil
- The oven bakes the paint onto the coil at +/- 450°F, a process known as “curing”
- The paint/coating cools before the aluminum sheet is rewound into another coil

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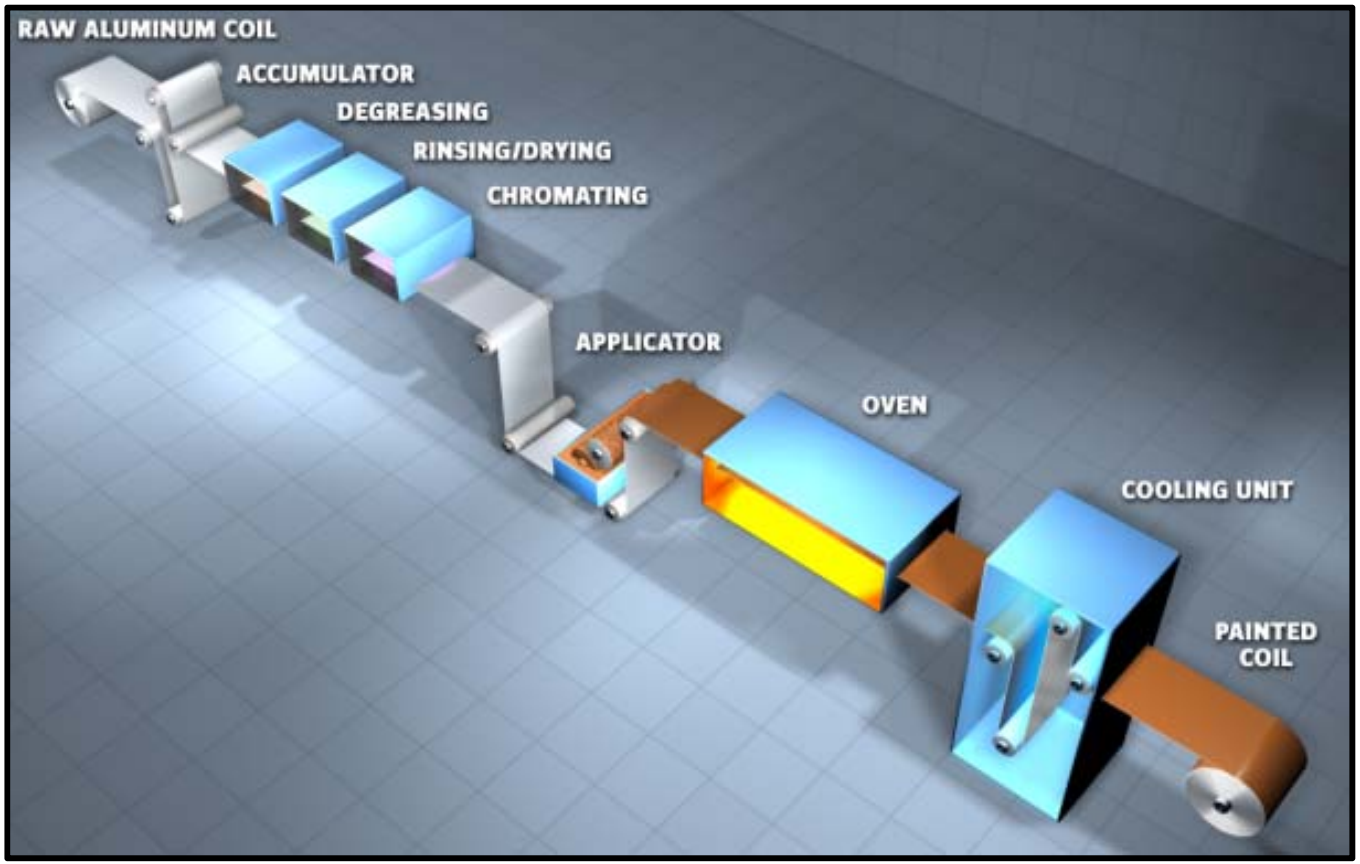
Coil Coating Process: Video



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Environmental Impact

Coil coating:

- During the coil coating process, 99.9% of all volatile organic compounds (VOCs) are captured.
- Excess paint is recovered and used to cover the non-visible side of ACM, so no excess paint is burned as waste.
- All solvents used to clean the machinery are collected and used again.

Paints & Finishes

Paints & Coatings

The continuous coil coating process provides ACM with a protective coating available in a wide range of paint colors and finishes.

The resin in a paint is the source of a coating's durability and physical properties. Due to its durability to withstand harsh climatic conditions, 70% PVDF (Polyvinylidene fluoride) resin-based coatings are used around the world on the exteriors of numerous architectural projects.

Paint containing 70% PVDF is able to resist chalk and fade, and withstand lengthy exposure to UV rays, temperature, humidity, water, and atmospheric pollutants (smog).

Gustavo House, Berlin, Germany

This was a coil coated retrofit project. What was once an East German concrete block apartment building was transformed into a five building complex of modern art with coil coated ACM.

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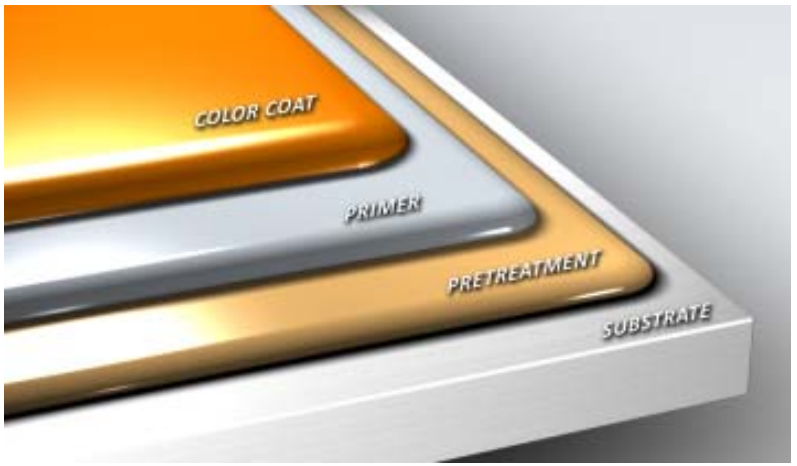
Two and Three Coat PVDF

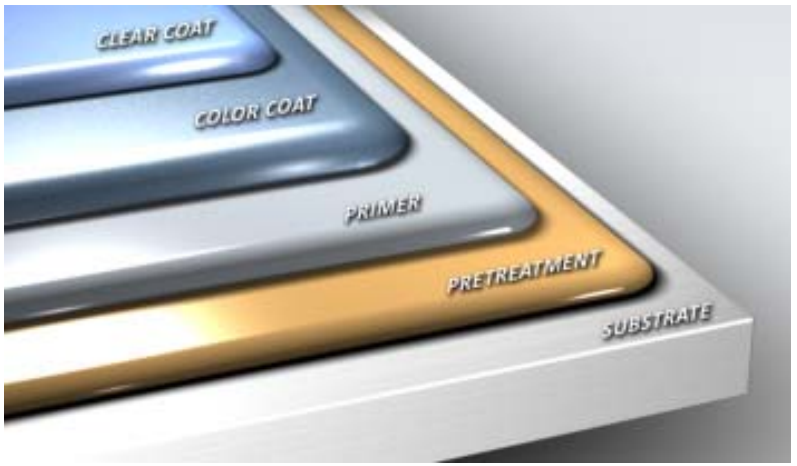
Two coat PVDF paint systems are solid and mica finishes which are coil coated over a pre-treated aluminum substrate with a primer and color coat at a nominal 1.0 mil thickness.

When a two coat PVDF system is used, the primer allows bonding and color consistency in the color coat to show, in lieu of having the underlying metal affect color consistency. Note, the pretreatment is not considered one of the paint “coats.”

Three coat systems are solid and metallic finishes which are coil coated over a pre-treated aluminum substrate with a primer, color coat, and clear coat at a nominal 1.0 mil thickness. The clear coat protects the aluminum flake from oxidizing.



Two Coat PVDF,
70% KYNAR 500® / HYLAR® 5000 RESIN



Three Coat PVDF, Metallic

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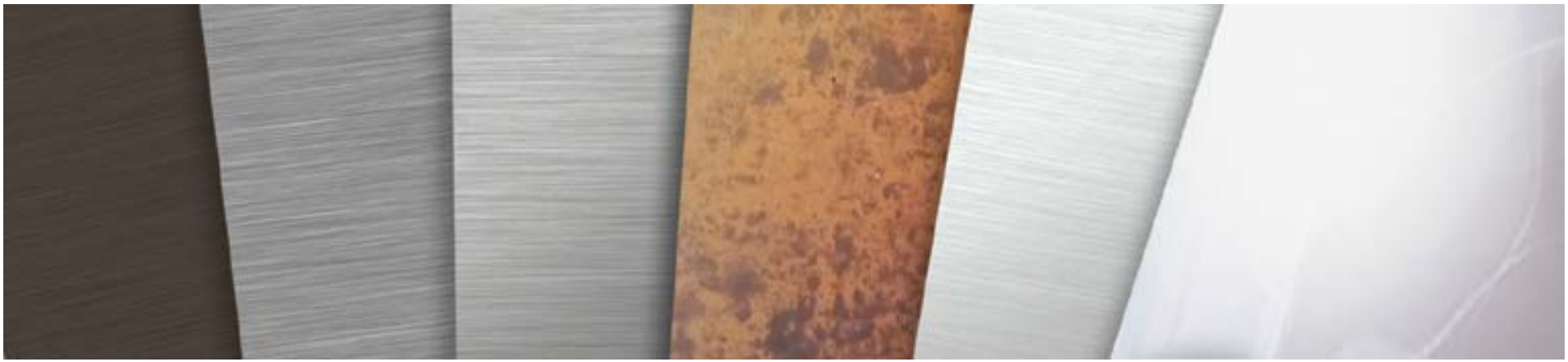
Additional Finish Options: Natural Surfaces

Color and patterns that mimic metals such as graphite, stainless, zinc, or rusted can be rolled directly onto a coil at the aluminum mill. These colors amplify the natural beauty and character of many natural elements to enhance the design of the architectural project while maintaining the durability and lightweight properties of aluminum.



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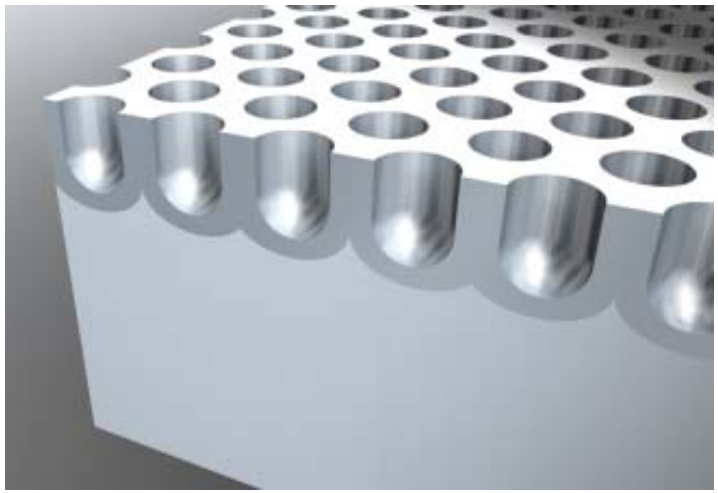
Additional Finish Options: Color Shifting Paints

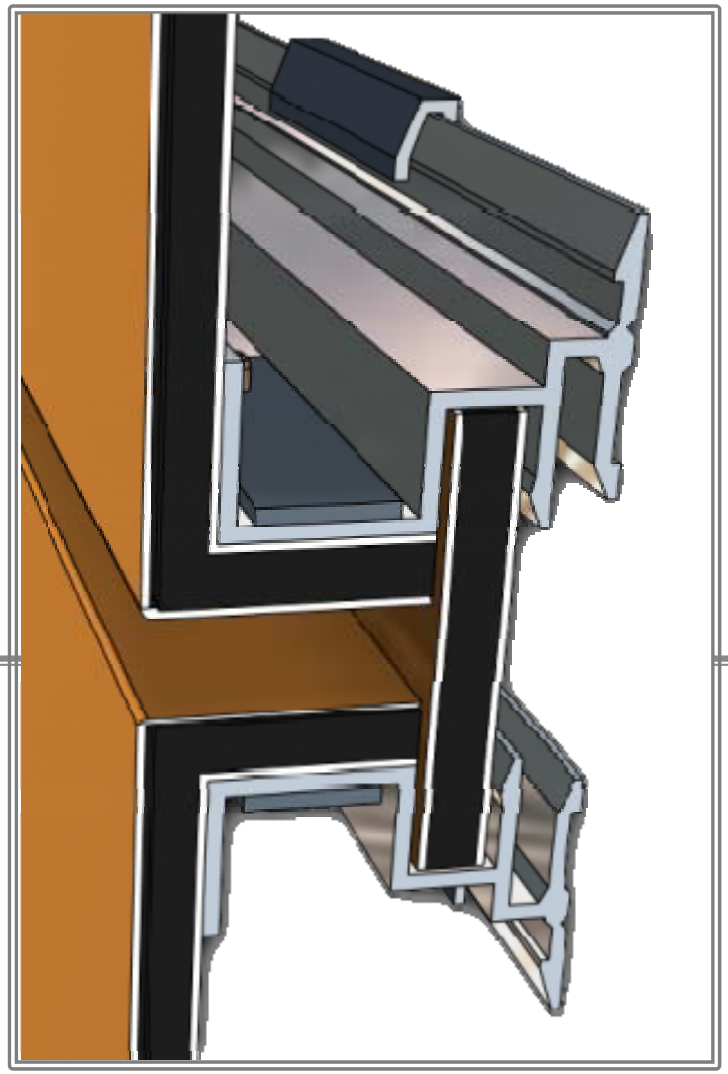
Transitional color finishes that change color as different wavelengths of light are reflected back to the audience, depending upon the viewing angle, offer ever-changing color gradients with iridescent highlights. As the light is broken up and refracted by the individual surface layers the color effects are enhanced.

Additional Finish Options: Anodizing

Anodizing is an electrochemical process that thickens and toughens the naturally occurring protective oxide on aluminum. The anodic coating is part of the metal, and its porous structure allows for coloring and sealing.

The aluminum oxide coating is 30% thicker than the metal it replaces—aluminum oxide is the second hardest substance known to man, after the diamond.





ACM Cladding Systems

ACM Systems

A building's design, aesthetics, and performance requirements (control of wind driven rain etc.) will determine the type of ACM cladding system and attachment method selected.

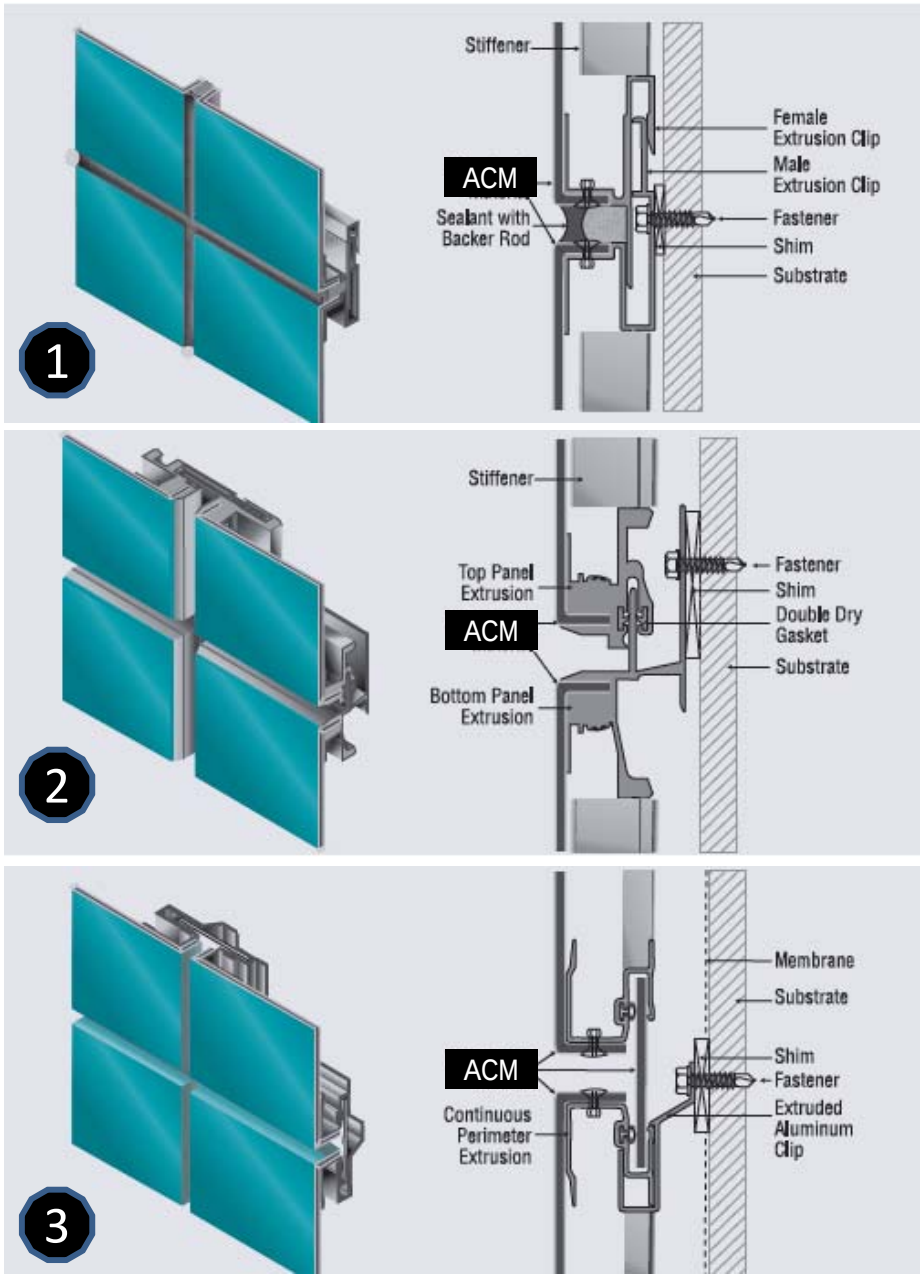
Systems requiring the prevention of air and water infiltration must utilize a different attachment method to those that, by design, allow water and air infiltration.

Painted Rock Estate Winery Tasting Room,
Penticton, BC, Canada
Image: Photos © Carey Tarr courtesy of Painted Rock Estate Winery Ltd.

Attachment Methods

Three common attachment methods are:

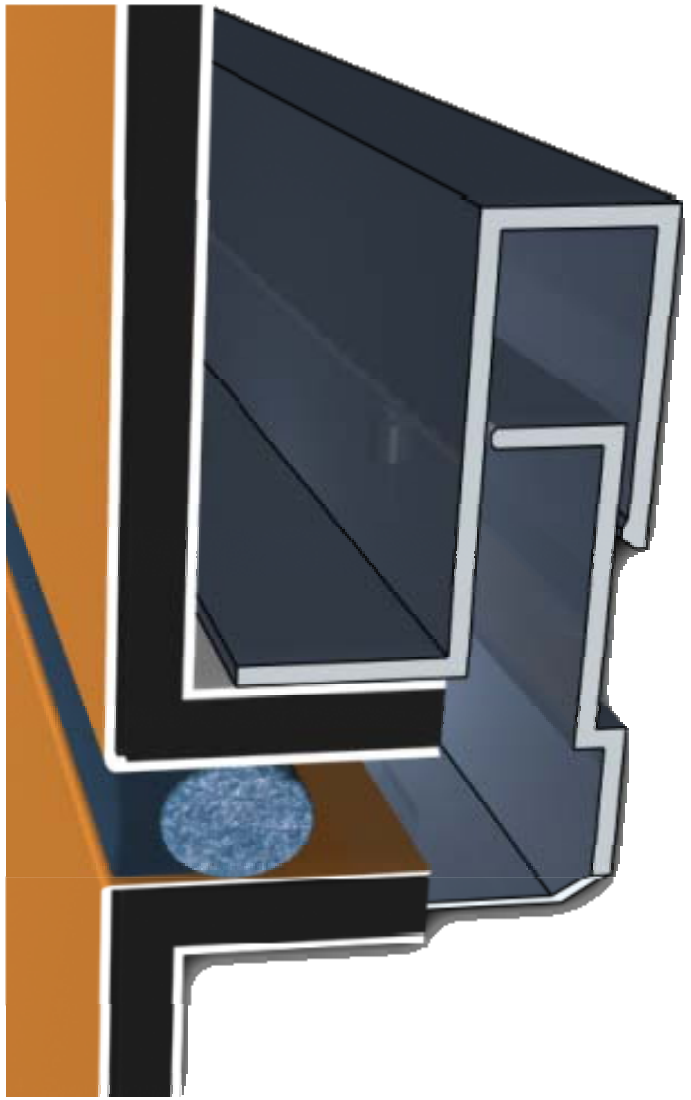
1. Rout and return wet systems
2. Rout and return dry systems
3. Rainscreen systems



Rout and Return Wet Systems

Rout and return wet systems:

- Primary silicone sealant for air and water barrier
- Utilize a simple male/female clip design
- Are economical
- Accommodate simple to complex panel designs
- Recommended for use on sloping walls



Rout and Return Wet Systems: Video

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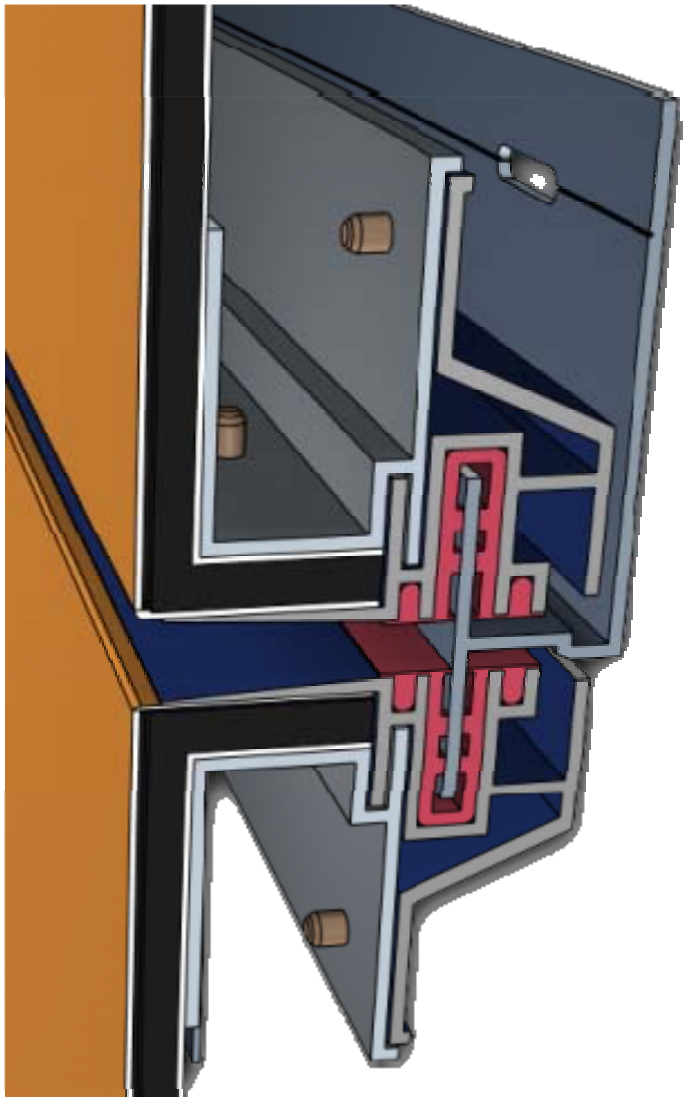
Rout and Return Dry Systems

Rout and return dry systems:

- Utilize concealed gaskets for air and water barrier
- Have a clean appearance and dry joint design
- Are high-performance, low-maintenance
- Use continuous perimeter extrusions to eliminate exposed cut edges
- Have secondary gutters that ensure water tight performance



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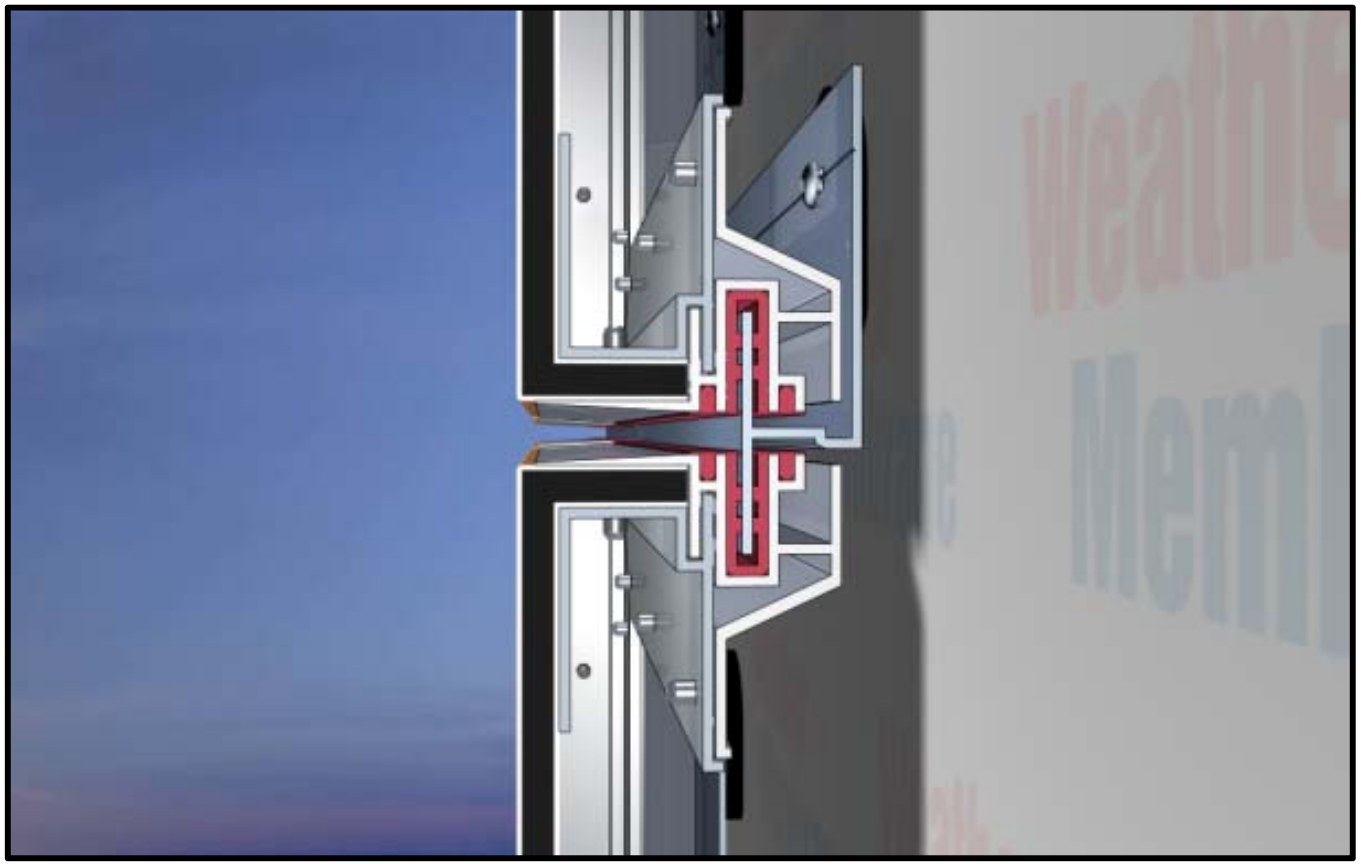
Rout and Return Dry Systems: Video



To view this YouTube video an internet connection is required. Click on the image above to start the video. Click on Adobe PDF icon in the taskbar to return to the course.

Rainscreen Systems

Rainscreen systems:

- Use concealed air and water membranes that provide improved weather resistance
- Are available in different design variations including pressure equalized and drained-back ventilated
- Use joint filler that allows for variable color and reveal size
- Are not recommended for sloping walls
- Are high-performance and flexible
- Are low-maintenance and cost-effective

Testing of Rainscreen Systems

American Architectural Manufacturers Association (AAMA)

AAMA-508 Voluntary Test Method and Specification for Pressure Equalized Rainscreen Wall Cladding System

- AAMA-508 is a test method based on the results of testing a pressure equalized rain screen wall cladding systems. This test method addresses water infiltration through the entire wall system, pressure equalized behavior, and the maximum differential between the cyclic wind pressure and cavity pressure in the system.

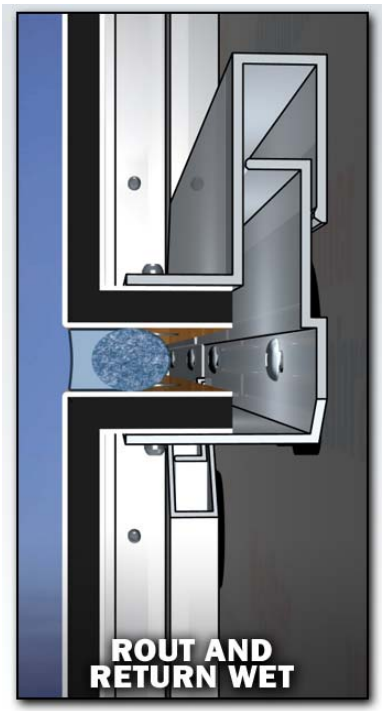
AAMA-509 Voluntary Test and Classification Method of Drained and Back Ventilated Rainscreen Wall Cladding System

- AAMA-509 is a test and classification method based on the results of testing a representative sampling of drained and back ventilated rain screen wall cladding systems. This test method addresses air leakage of the air/water barrier, air flow/cavity ventilation, and water management. The primary purpose of this test method is to quantify the volume of rainwater contacting an imperfect air/water barrier and the system's ability to allow for ventilation/drying as measured by airflow through the cladding.

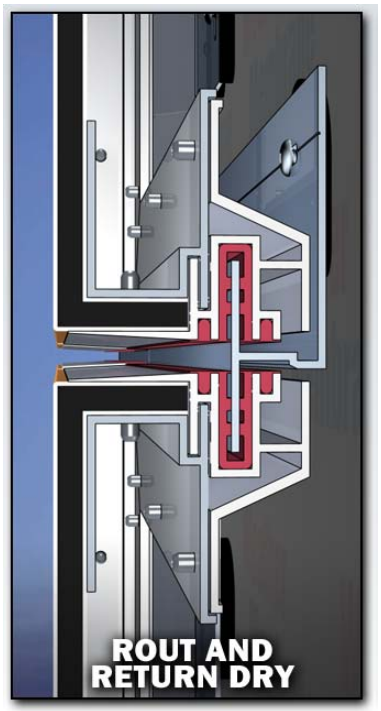
Rainscreen Systems: Video

To view this YouTube video an internet connection is required. Click on the image above to start the video. Click on Adobe PDF icon in the taskbar to return to the course.

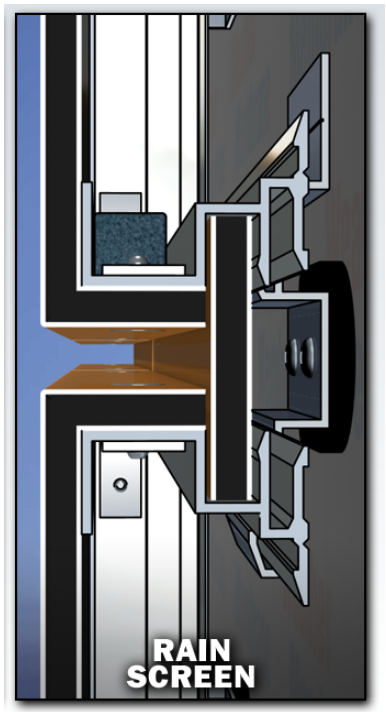
System Comparison



- Silicone sealant for air and water barrier
- Simple male/female clip design
- Economical system
- Simple to complex panel designs



- Concealed gaskets for air and water barrier
- Clean appearance and dry-joint design
- Perimeter extrusions eliminate exposed cut edges
- High-performance, low-maintenance



- Concealed membrane for air and water barrier
- Pressure equalized system
- Ventilated cavity allows wall to breathe
- Joint filler allows for variable color and reveal size
- High-performance, low-maintenance
- Cost-effective and flexible
- Not advised on sloping walls

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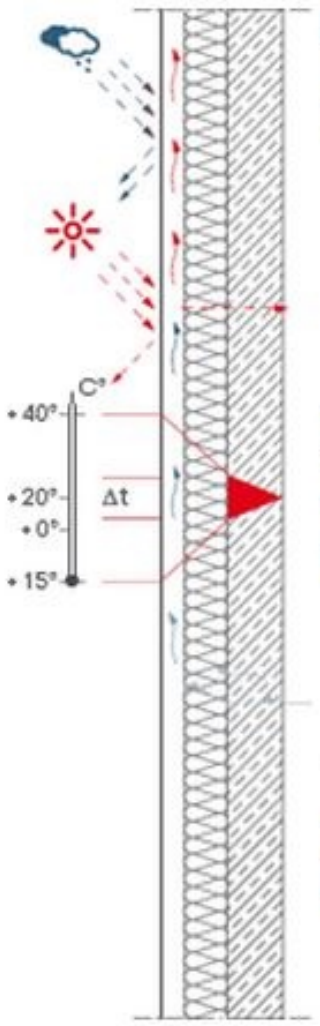
Benefits Of An ACM Cladding System



During decades of use in a drain-back ventilated cladding system, ACM protects the building from weathering and the harmful effects caused by industrial and environmental pollution.

An external cladding system using ACM acts as a barrier against solar radiation. The ventilated space between the ACM panels and the wall or the thermal insulation reduces the heat transmission.

The drain-back ventilated cladding system using ACM protects the wall of the building from high and rapid temperature changes. Moisture can pass through the wall. The building structure keeps dry.

Advantages

- Lower maintenance costs
- Long-term preservation of building structure

- In winter: savings in heating cost
- In summer: savings in air-conditioning cost

- Reduction of thermal expansion
- Reduction in crack formation

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ACM Benefits & Attributes

Why Choose ACM?

There are many cladding materials available in today's market…why choose ACM?
This section of the course provides an overview of the attributes and benefits of ACM

wood stone brick solid sheet EIFS

ACM Attributes

Formable and versatile:

- Able to achieve sweeping curves and tight radiuses; perfectly adapts to a building's contours (unable to shape brick, stone, and wood with the same ease)
- Encourages innovative architectural design

Aesthetics:

- Endless palette of coil coated colors and finishes
- Natural material surface appearances

Lightweight:

- Less material is utilized in wall framing members and foundation (brick, stone, and solid sheet weigh more)
- Easy to transport and handle in the factory and onsite

Seven Clans Casino Red Lake
Red Lake, Minnesota

ACM Attributes

High rigidity:
- Due to its composite structure, ACM achieves a high strength-to-weight ratio, even when comparing large panel sizes
- Durable and stable; can be perfectly formed without any loss to its rigidity
- Panels keep their shape and remain flat, even when exposed to extreme temperature changes

Vibration-damping:
- No additional sound-damping needed

Weather and corrosion resistance:
- ACM does not weaken or corrode in harsh environments
- Paint finishes provide long term exterior durability

Affordable:
- Many ACM systems are available to meet any budget
- Large panel sizes, pre-fabricated panels
- Fast installation, low cost

ACM Attributes

Energy efficiency:

- Protects building interior from heat in the summer
- Very good vapor diffusion properties (no formation of condensation)
- ACM systems designed with ASHRAE 90.1 construction may achieve certain LEED energy code goals
- Paint finishes with SRI (solar reflective index) values help achieve energy savings (the lighter the color of paint the higher the SRI value—lighter paints tend to "reflect" more heat during the summer reducing cooling costs)

Please remember the **exam password ENERGY.** You will be required to enter it in order to proceed with the online examination.

ACM Attributes

Sustainability:

- ACM remains unchanged during its life cycle (when the product is used as designated, no changes in material composition are anticipated during processing or use)
- Long façade service life; low service life costs as very little maintenance and repair work is needed
- ACM is fully recyclable; both the PE core material and the aluminium cover skins can be utilized in the production of new material

The next section includes a few case studies of innovative sustainable design building projects that have utilized ACM and achieved LEED certification.

Applications & Building Types

Paul F. Cullum Tower, North Bergen, New Jersey
Image: Daniel Lunghi

Green Building: LEED Certification

Project name: VanDusen Botanical Garden Visitor Centre
Project location: Vancouver, British Columbia
Architect: Perkins+Will Canada
Year of installation: 2011

This one-story 19,000 square-foot Visitor Centre which houses a café, library, volunteer facilities, a garden shop, office space, and flexible classroom spaces, utilizes an iconic design reflective of the organic forms and natural systems of a native orchid. Completed in 2011, the Visitor Centre, a LEED certified project, achieved Platinum level certification in 2014. The project was also submitted to the International Future Living Institute's Living Building Challenge—the most stringent measurement of sustainability in the built environment. The Visitor Centre serves as a public face for the City of Vancouver's initiative to be the "Greenest City in the World" by 2020.

Images: Raymond Chan, Photomedia Canada and Keith Panel Systems

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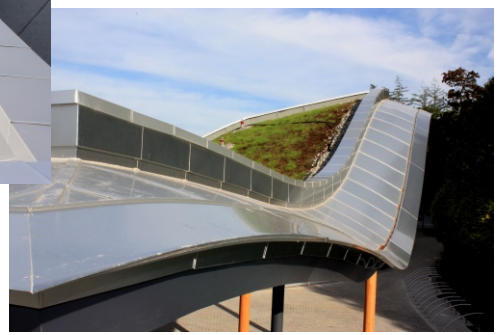
Green Building: LEED Certification

Project name: VanDusen Botanical Garden Visitor Centre

To meet Living Building Challenge standards, only building products that did not contain “Red List” chemicals were utilized. Materials included fully recyclable ACM, wood, glass and rammed earth. Approximately 12,000 sq. ft. of ACM in a custom plain mill finish and 4 mm thickness was used on the roof. ACM was considered the best material to achieve this three-dimensional design challenge—it had to go up and down and sideways at the same time to achieve the undulating roof lines and the positive and negative curves.



Images: Raymond Chan, Photomedia Canada and Keith Panel Systems

Green Building: LEED Certification

Project name: Rush University Medical Center
Project location: Chicago, Illinois
Architect: Perkins+Will Canada
Year of installation: 2011

The 14-story building at Rush University Medical Center in Chicago, which is referred to as The Tower, stands out on the city's skyline with a unique butterfly design and striking white exterior—both visual symbols of the medical center's goal to transform healthcare delivery. ACM in a custom white color was selected to realize the hospital's shining, clean exterior image and its unique butterfly design. The 840,000 square-foot LEED® Certified™ Gold Tower stands out in the market not only by offering state-of-the-art healthcare technology but by the medical center's overriding goal to re-orient its facilities around patients and their families.

Image: Robert R. Gigliotti

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Green Building: LEED Certification

Project name: Rush University Medical Center

A total of 267,000 square feet of ACM with a fire retardant core was installed on the Tower, including approximately 250,000 square feet of ACM with a fire retardant core in the white color and 4 mm thickness as exterior wall cladding. Approximately 17,000 square feet of ACM with a fire retardant core in a pewter color and 4 mm thickness was installed as a recessive color accent on column covers and on interior mullions.

Images: Robert R. Gigliotti

Green Building: LEED Certification

The University of North Texas' Apogee Stadium, the first newly constructed collegiate football stadium in the United States to be LEED® certified to the Platinum level, opened in Denton, Texas, in September 2011.

To create a cohesive look with other campus buildings, brick was utilized to construct stadium walls. Recyclable ACM was installed as a unifying design element throughout the stadium. A total of 49,754 square feet of ACM panels in the 4 mm thickness was installed in two colors on the stadium, including: 48,320 square feet of a silver metallic color and 1,334 square feet of a custom green.

University of North Texas' (UNT) Apogee Stadium, Denton, Texas
Images: Daryl Shields – HKS

Exterior Cladding: LEED Certification

Project name: Stony Brook University Residence Halls
Project location: Stony Brook, New York
Architect: Goshow Architects of New York
Year of installation: 2010

ACM was ordered in bold colors and installed as exterior cladding on an interconnected series of three buildings totaling 173,000 square feet with varying heights of two to six stories to create architectural interest. This project was unique in that the thermal insulation was mounted to the exterior of the metal studs rather than in between the studs to achieve better thermal efficiency.

This LEED-certified project was required to achieve the Silver level but has since achieved Gold level certification.

Images: Taylor Crothers Photography

Curtainwall

Project name: 1600 Broadway Tower
Project location: New York City, New York
Architect: SLCE Architects, LLP
Year of installation: 2006

The 195,000 square-foot tower features two floors of retail space above which are 137 condominiums—many of which feature balconies overlooking Times Square.

ACM was chosen as exterior cladding for the building as well as for the signage. Approximately 68,000 square feet of ACM in 4 mm thickness and custom color was fabricated and installed with a rout and return system. Engineering the building panels to resist high winds and support upper-level signage that extended 30 feet off the building was achieved by using more panel stiffeners and heavy-gauge framing.

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Interior

Project name: U.S. Xpress
Project location: Chattanooga, Tennessee
Architect: SSOE, Inc.
Year of installation: 2006

ACM helped this interior achieve a “high-tech” image. To enhance the material’s reflectivity, the metallic flake and gloss of a standard color was increased as high as possible.

Interior

Project name: Children's Atrium at Oklahoma University Medical Center
Project location: Oklahoma City, Oklahoma
Architect: Miles Associates, Oklahoma City
Year of installation: 2011

The whimsically designed six-story Children's Atrium at Oklahoma University Medical Center never lets viewers forget who it is there to serve—the youngest of patients who might just as well prefer to be playing with toys outdoors.

Image: Courtesy of University Hospitals Authority & Trust

Interior

Project name: Children's Atrium at Oklahoma University Medical Center

In addition to cladding the curved roof, ACM was installed throughout the building, including on the exterior columns, soffits, entryway canopy, and glazed-in curtainwall as well as on interior wall columns and beam wraps, and as revolving-door trim. The fabricator also created custom coverings for everything from lights in the terrazzo floors to recessed lighting, mechanical boxes, and return-air enclosures. A total of 46,739 square feet of ACM in a silver metallic color and 6 mm thickness was fabricated for the atrium.

Images: Courtesy of University Hospitals Authority & Trust

Column Covers

Project name: Minnetonka Schools
Project location: Minnetonka, Minnesota
Architect: ATS&R Planners/Architects/Engineers, Minneapolis
Year of installation: 2009

ACM's ability to be bent into curved shapes was greatly utilized in the high school entryway. In addition to wrapping 32 exterior columns located beneath the school's canopies, ACM covered six round cylindrical interior columns that stretch floor-to-ceiling in the two-story entryway as well as four upper-level interior columns.

Canopies

Project name: Warren, MI Civic Center
Project location: Warren, Michigan
Architect: Neumann/Smith Architecture
Year of installation: 2006

Traditional exterior materials were chosen to construct the civic center including brick, stone, and glass, but the striking cantilevered canopy was fabricated from ACM with a fire-rated core in a custom silver color and 4 mm thickness. Measuring 140 feet at its widest point and 100 feet in length, the canopy is comprised of multiple geometrically shaped panels. All of the framing for the canopy was manufactured from 16-gauge metal framing. The soffit panels were attached from structural steel and five support columns (26" diameter tubes) fabricated from ¼" steel and painted were positioned beneath the canopy.

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Walkways

Project name: Georgia Aquarium
Project location: Atlanta, Georgia
Architect: Thompson, Ventulett, Stainback, Atlanta, GA
Year of installation: 2005

The Georgia Aquarium utilized approximately 50,000 square feet of ACM material in 3,600 panels of 4 mm thickness to clad the entire aquarium and the walkway.

Color Accents

Project name: Paul F. Cullum Tower
Project location: North Bergen, New Jersey
Architect: Lothrop Associates LLP, White Plains, N.Y.
Year of installation: 2013

Before the exterior retrofit, this 200,000 square-foot tower's exterior façade was constructed of a blue-and-white aluminum curtain-wall system set over reinforced concrete walls. The exposed gray concrete columns had faded and looked utilitarian at best. Approximately 117,000 square feet of ACM in nine different colors, including eight transitional color finishes, was installed. The three major goals—improving the building's thermal performance, eliminating air and water infiltration, and improving building aesthetics—were achieved with the use of ACM.

Image: Daniel Lunghi

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Corporate Identity & Signage

Conveying corporate identity internally and externally is multi-faceted: ranging from façades, canopies, and totems to interior design, store fittings, and signage.

ACM offers long-lasting color fidelity and brilliance, décor surface options, excellent dimensional stability, easy processing, and cost effectiveness.

Corporate Identity

Project name: Jiffy Lube Suds Express
Project location: Cambridge, Ontario, Canada
Designer: M.C.G.W. Properties Group, Ontario, Canada
Year of installation: 2006

This building features ACM in the 4 mm thickness—5,000 square feet of silver metallic panels, 2,140 square feet in a bright red and 1,250 square feet in a custom blue. ACM was selected for its extraordinary flatness and rigidity, excellent formability, low weight, low-maintenance, and outstanding weather resistance.

Building Types: Office & Government

BFFT Headquarters
Gaimersheim, Germany

Norm Dicks Government Center
Bremerton, Washington

TORO Company World
Headquarters
Bloomington, MN

Building Types: Hospitality & Public Venues

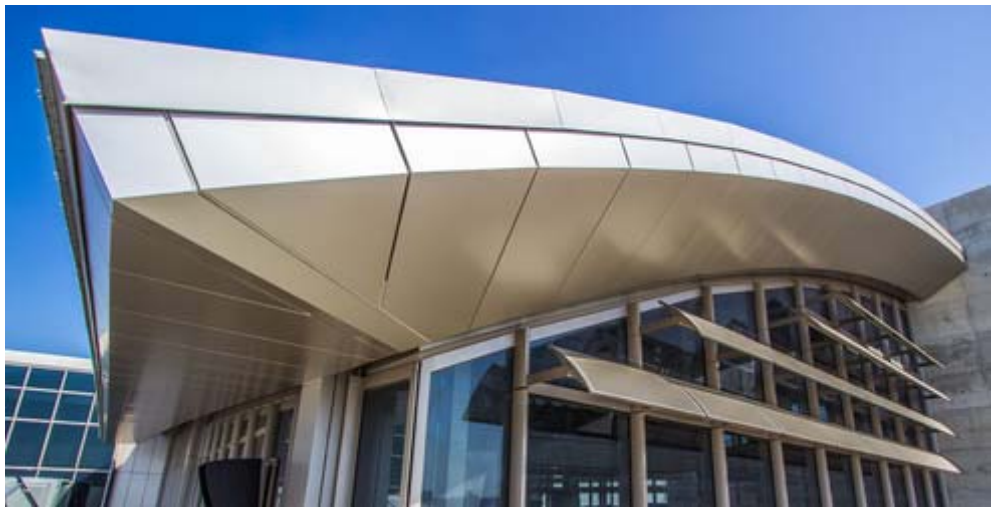
Clarion Hotel, Winnipeg,
Manitoba Canada

Regal Cinemas, Crocker Park, Ohio

Seven Clans Casino Red Lake
Red Lake, Minnesota

Building Types: Airports & Transportation Centers

Tempe, Arizona Transportation Center,
Tempe, Arizona

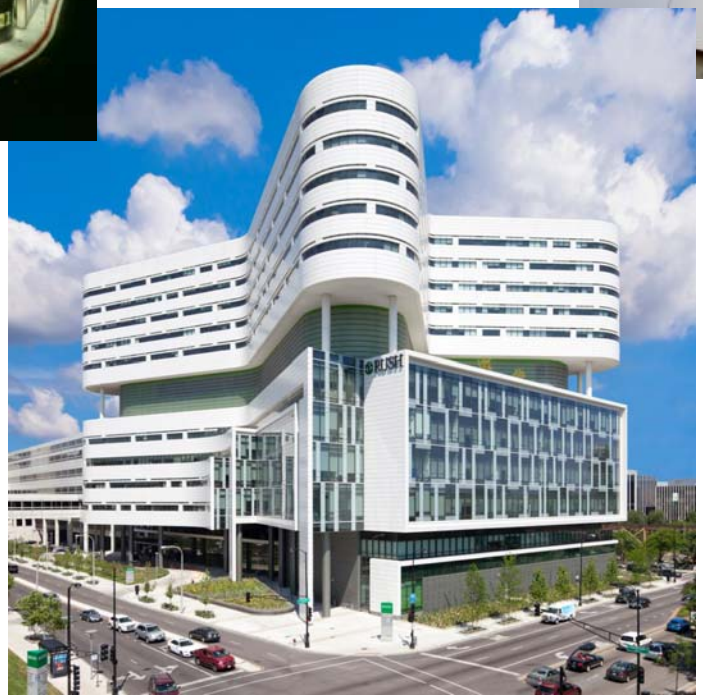


Tom Bradley International Terminal (TBIT) at LAX
Los Angeles, California
Images: David Ford of Crown Corr

Building Types: Healthcare & Education

Sharp-Grossmont Hospital,
La Mesa, California

Northern Kentucky University,
Highland Heights, Kentucky



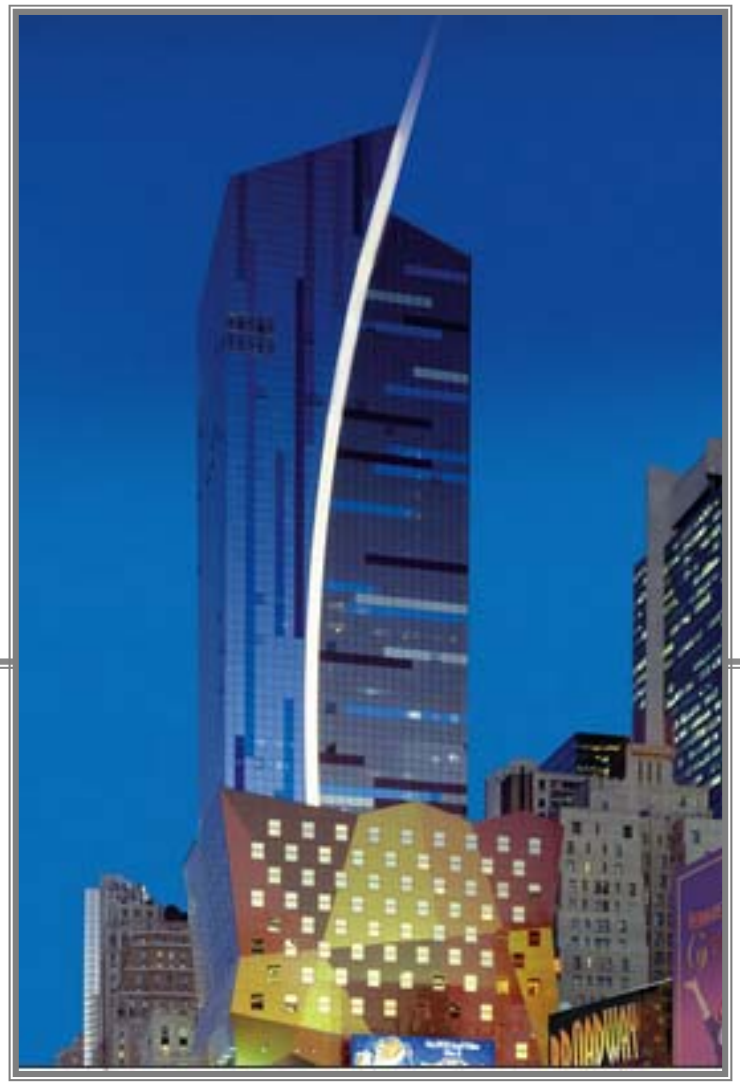
Rush University Medical Center,
Chicago, Illinois
Image: Robert R. Gigliotti

Building Types: Restaurants & Auto Dealerships

A&W Express

New Country Motor Cars, Mercedes-Benz, Hartford, Connecticut

Clark Knapp Honda Automotive Dealership, Pharr, Texas
Image: Bob Simpson courtesy of Boultinghouse Simpson Gates Architects



Resources

Westin New York, New York, New York
Image: Robert R. Gigliotti

Resources

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Resources: Applications

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- **Exterior Cladding:** Stony Brook University Residence Halls http://www.alucobondusa.com/blog/stony-brook-university-residence-halls-student-center-focused-on-future-with-modern-alucobond-plus-cladding/#.VL_Ai0fF98E (accessed January 2015)
- **Curtainwall:** 1600 Broadway Tower http://www.alucobondusa.com/blog/1600-broadway-tower/#.VL_HJEfF98E (accessed January 2015)
- **Interior:** U.S. Xpress. http://www.alucobondusa.com/blog/u-s-xpress-chattanooga/#.VL_UcUfF98H (accessed January 2015)
- **Interior:** Children's Atrium at Oklahoma University Medical Center http://www.alucobondusa.com/blog/formable-alucobond-acm-clads-whimsical-childrens-atrium-at-oklahoma-university-medical-center/#more-192 (accessed January 2015)
- **Column Covers:** Minnetonka Schools http://www.alucobondusa.com/blog/minnetonka-schools/#more-383 (accessed 2015)
- **Canopies:** Warren, MI Civic Center http://www.alucobondusa.com/blog/warren-mi-civic-center/#.VL_ei0fF98E (accessed January 2015)
- **Walkways:** Georgia Aquarium http://www.alucobondusa.com/blog/georgia-aquarium/#.VL_kr0fF98F (accessed January 2015)
- **Color Accents:** Paul F. Cullum Tower http://www.alucobondusa.com/blog/category/case-histories/page/3/ (accessed January 2015)
- **Corporate Identity:** Jiffy Lube Suds Express http://www.alucobondusa.com/blog/jiffy-lube-suds-express/#.VL_sxEfF98G (accessed January 2015)

Conclusion

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