A BUILDER'S GUIDE TO
OPEN-JOINT CLADDING SYSTEMS

From the effects of wind-washing to proper installation, this resource book will help you tackle your next open-joint cladding project with confidence

DÖRKEN
DELTA®

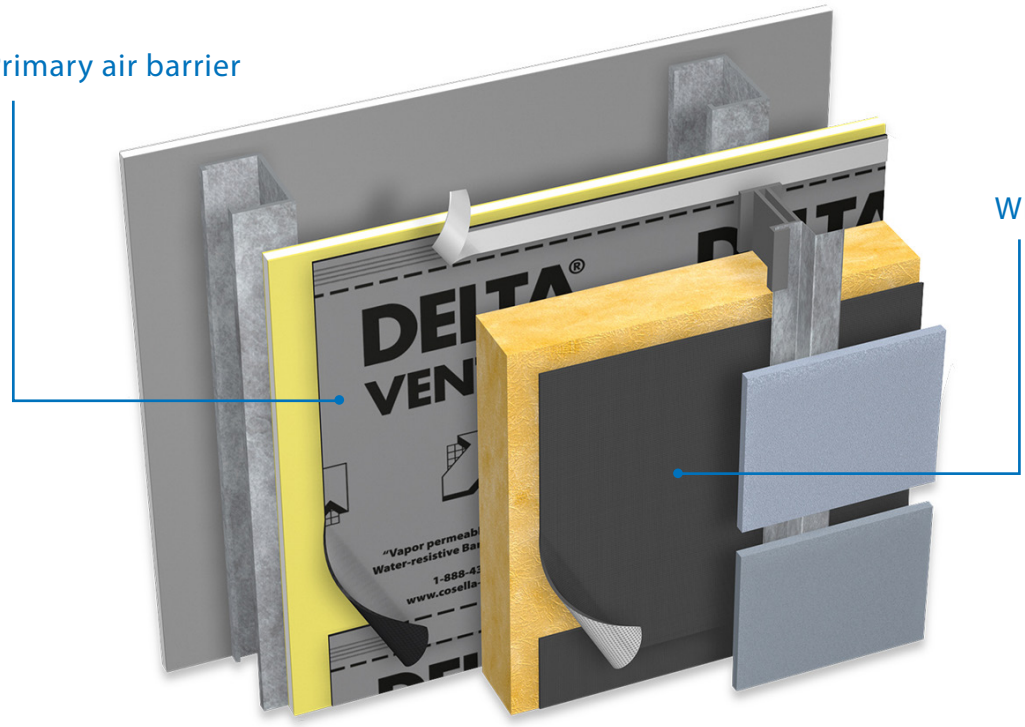
INTRODUCTION:
A BUILDER'S GUIDE TO OPEN-JOINT CLADDING SYSTEMS

Open-joint cladding enhances the visual appeal of buildings. However, it exposes the exterior wall to wind, water, and ultraviolet (UV) rays, thereby risking havoc to building performance and causing the growth of mold and rot within the wall cavity. Applying the right barrier in the right place can help building professionals protect their designs well into the future and improve the overall performance as well as the appearance of a structure.

Water-resistive barriers (WRB) specifically meant for open-joint cladding designs are intended to be installed in front of the continuous insulation (ci) and behind the cladding itself. At this location, it does not replace the primary air barrier/WRB—these membranes are located in front of the structural sheathing and behind the ci.

Project Name | SPA BALNEA
Architect | BLOUIN TARDIF ARCHITECTURE - ENVIRONNEMENT
General Contractor | CONSTRUCTION DES SOMMETS

Project Name | SCIENCE PYRAMID — DENVER BOTANIC GARDENS
Architect | BURKETT DESIGN
General Contractor | GH PHIPPS CONSTRUCTION COMPANIES



This illustration shows that water-resistive barriers (WRBs) for open-joint cladding systems are installed in front of the continuous insulation (ci) and do not replace the primary air barrier/WRB, located in front of the structural sheathing.

INSULATION **PROTECTION**

The primary role of a WRB designed for open-joint cladding systems is to channel bulk water from wind-driven rain (and snow) to the outside of the structure to keep it dry and maintain the insulation system's performance. In effect, the WRB functions as part of the primary cladding. It will also protect the insulation from the R-value-lowering effects of wind-washing, a phenomenon of air movement driven by wind pressures passing through the insulation, causing significant loss of energy.

This movement of air can also cause condensation and greater energy consumption. However, several contributing factors can alter the severity of these effects, including insulation type, thickness, and building height. So, while there is still some discussion in the industry regarding the overall effects of wind-washing on insulation, the fact of the matter is the membrane behind the cladding protects the insulation from elements like wind when installed correctly.

PROPER
INSTALLATION

To ensure the effectiveness of the WRB in an open-joint cladding system, it is essential to install the membrane and its components in a manner that seals all potential leakage points, including:

- Connections of the walls to the roof's air barrier and the foundation
- Seismic and expansion joints
- Piping, conduit, duct, screws, bolts, and similar penetrations
- Changes in plane
- All other potential water leakage pathways in the building enclosure

Along with being water-resistive, the right membrane should also be highly vapor permeable, allowing moisture within the cavity to escape swiftly through diffusion, while protecting the insulation from possible damage by moisture infiltration. Regardless of the type of membrane used, it is critical the moisture throttle should not be at this location to allow all interior moisture to diffuse freely to the exterior.

Project Name | SPA BALNEA
Architect | BLOUIN TARDIF ARCHITECTURE - ENVIRONNEMENT
General Contractor | CONSTRUCTION DES SOMMETS

Project Name | 380 EAST MAIN STREET
Architect | TPG ARCHITECTURE
General Contractor | VRD CONTRACTING

THE IMPORTANCE OF **UV STABILITY**

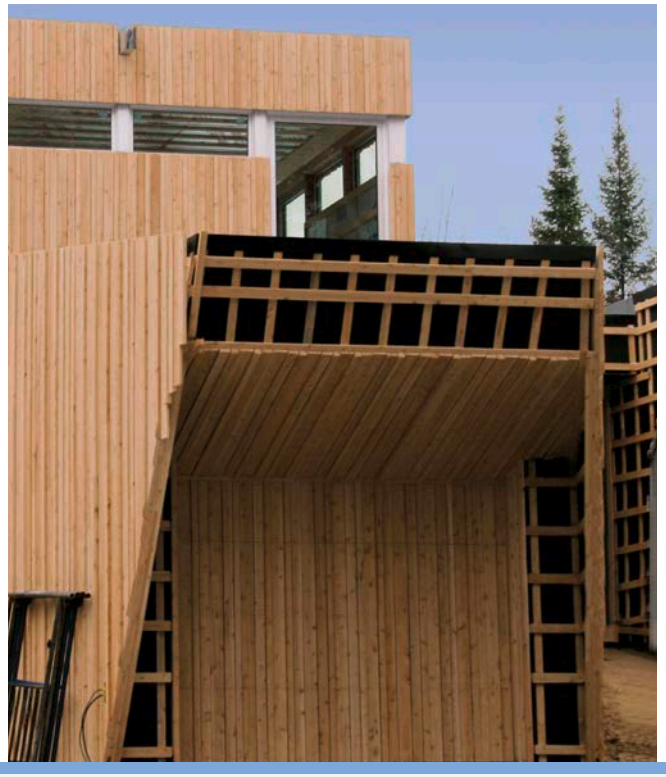
If wind, rain, and snow can get through the open joints, it goes without saying UV light can also do so, as the wall assemblies are exposed. This increases the risk of degradation of wall components by UV light. It is important to note regular house-wraps and even building paper might provide the desired water holdout, but the aging process will accelerate due to excessive UV exposure. The assembly may only perform as expected for a few years, resulting in significant loss of performance over the life of a new building. However, design professionals can protect the exterior wall assembly by employing materials with UV-stabilized properties.

Project Name | CLARK UNIVERSITY
Architect | ARCHITERRA INC.
General Contractor | VRD CONTRACTING

Project Name | SCIENCE PYRAMID — DENVER BOTANIC GARDENS
Architect | BURKETT DESIGN
General Contractor | GH PHIPPS CONSTRUCTION COMPANIES

In the case of long-term UV exposure, there is no ASTM standard on which a manufacturer may base their claim of acceptable exposure time. There is a durability component to the International Code Council-Evaluation Services (ICC-ES) Acceptance Criteria (AC) 38, "Water-resistive Barriers," but sinceit was designed to test any regular WRB's, it is not a meaningful measurement tool for membranes specifically designed for long-term open-joint exposure.

However, using a UV-stabilized membrane, along with best practices in understanding and preventing excessive UV exposure, will help to prevent negative impact on performance. DELTA®-FASSADE S is manufactured with a special acrylic coating to make it UV resistant. It may be used in systems with up to 50-mm (2-in.) openings comprising up to 40 percent of the overall façade.



Project Name | MAISON DU LAC GRENIER
Architect | PAUL BERNIER ARCHITECTE
General Contractor | LEONALD GOYETTE, CHERTSEY, QUEBEC

DURABILITY AND **TEAR RESISTANCE**

The ideal barrier for open-joint cladding is resistant to tears and able to withstand the day-to-day environment of a construction site because the WRB is left uncovered prior to the installation of the cladding material. The durability is also a critical consideration for open-joint designs because some elements of the barrier will be left exposed even after the cladding is applied, as previously discussed.

The WRB is a part of the wall system but its location makes it quite vulnerable and exposed. Therefore, it is a poor idea to designate the membrane at this location as the primary air barrier. Though both the air- and water-resistive barriers are expected to be durable and tear resistant, it is important to note their location is also critical to their long-term performance.

As industry experts Dr. John Straube and Dr. Joe Lstiburek recommend in the *Perfect Wall* concept, critical performance layers, such as the air barrier, should be placed in a protected location to prevent damage. Barriers—exposed or actually performing as cladding—such as those seen in an open-joint design would not be considered protected in the Perfect Wall concept. Therefore, the designated air barrier should be placed inboard of the continuous insulation, to prevent damage.

Project Name | GROTTO SAUNA
Architect | PARTISANS
General Contractor | JORDAN CONSTRUCTION

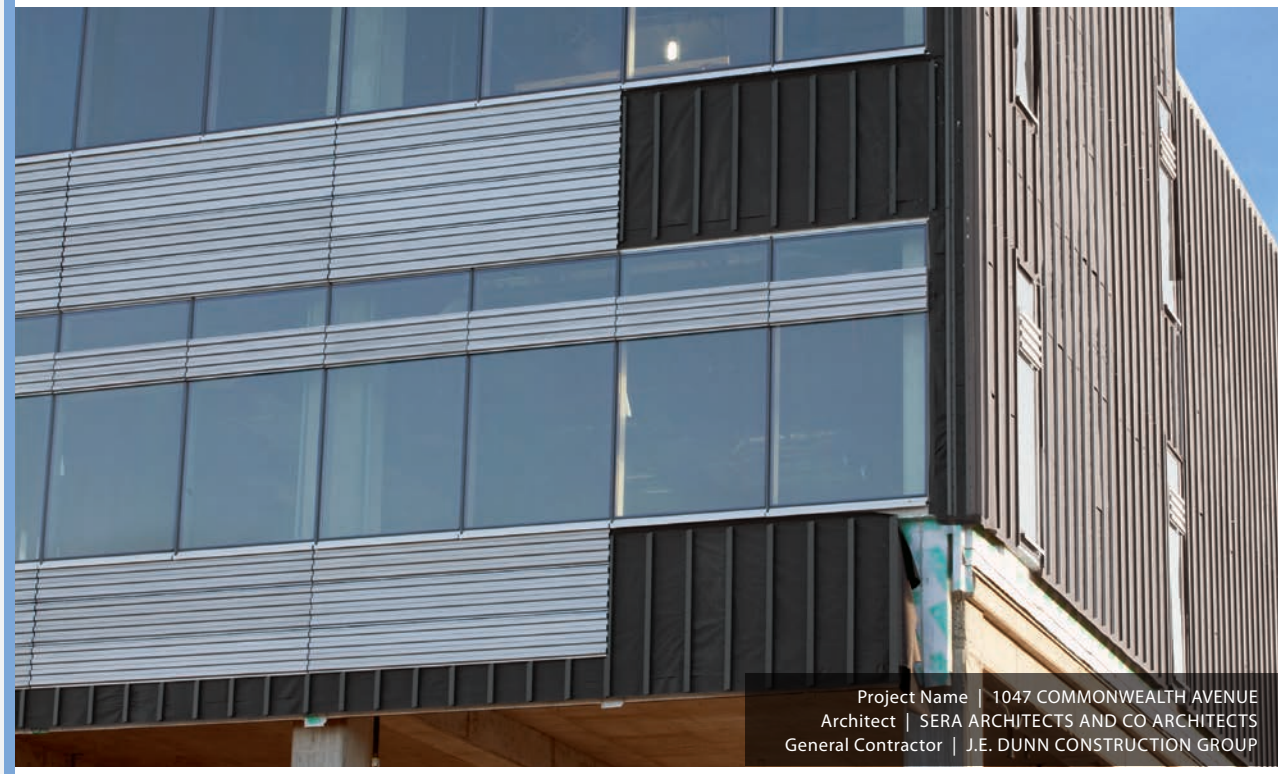
ADDS TO **INNOVATIVE DESIGN**

Most architects and designers choose open-joint cladding to enhance the overall visual appeal of their buildings. When not using a WRB directly behind the cladding, there can be concerns around the appearance of the wall elements. For example, if the uncovered insulation shows through in such designs, a beautiful concept might miss the mark.

However, when the right barrier is employed in the proper manner, it can provide a 3D effect to enhance the visual appearance of the building. This concept is applied by some of the world's most advanced building professionals designing some of the most cutting-edge buildings. In 2015, the Grotto Sauna won the Design Excellence Award from OAA and the Architizer+ Award.

BRINGING THE **CONCEPT TO LIFE**

Recognizing the need for protection and getting ahead of building challenges were the drivers behind the development of the Collaborative Life Sciences Building (CLSB) in Portland. The project brought together three of the state's top universities to create a landmark facility. The project combined the resources of the Oregon Health & Science University (OHSU), Oregon State University (OSU), and Portland State University (PSU) to provide 46,452 m^2 (500,000 sf) of instructional and research space for life sciences, pharmacy, medical, and dental programs.



Project Name | 1047 COMMONWEALTH AVENUE
Architect | SERA ARCHITECTS AND CO ARCHITECTS
General Contractor | J.E. DUNN CONSTRUCTION GROUP

Project Name | COLLABORATIVE LIFE SCIENCES BUILDING
Architect | SERA ARCHITECTS AND CO ARCHITECTS
General Contractor | J.E. DUNN CONSTRUCTION GROUP

One of the unique features of this new build was the enclosure design. The exterior of the CLSB is made up of prefinished perforated panels of aluminum, engineered in a corrugated profile. While this specific feature provided the building with enhanced visual interest, one technical challenge was wind and water intrusion. It was important the design meets the project's stringent water intrusion goals. Open-joint cladding systems specifically require extreme water and wind protection.

If the WRB is not durable enough to withstand extreme weather conditions or stable when exposed to prolonged periods of UV light, the system will fail. With the CLSB building exposed to strong winds off Puget Sound, the concern was that the constant positive and negative pressure of blowing wind could damage the membrane, particularly at fastening points.

DESIGNING
THE ASSEMBLY

When determining what would go underneath the panels, it was critical to choose a water-shedding membrane suitable for the conditions in Oregon, as CLSB is situated in an area where high winds and wet weather are common. The team considered using a black sheet metal for the weather barrier, but then looked to a WRB solution that could provide strong weather protection and UV resistance. The neutral black color of the product also provided a suitable background to give the perforated panels the desired visual depth. However, questions arose about durability because of building height and local weather conditions.

Project Name | COLLABORATIVE LIFE SCIENCES BUILDING
Architect | SERA ARCHITECTS AND CO ARCHITECTS
General Contractor | J.E. DUNN CONSTRUCTION GROUP

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Architect | SERA ARCHITECTS AND CO ARCHITECTS
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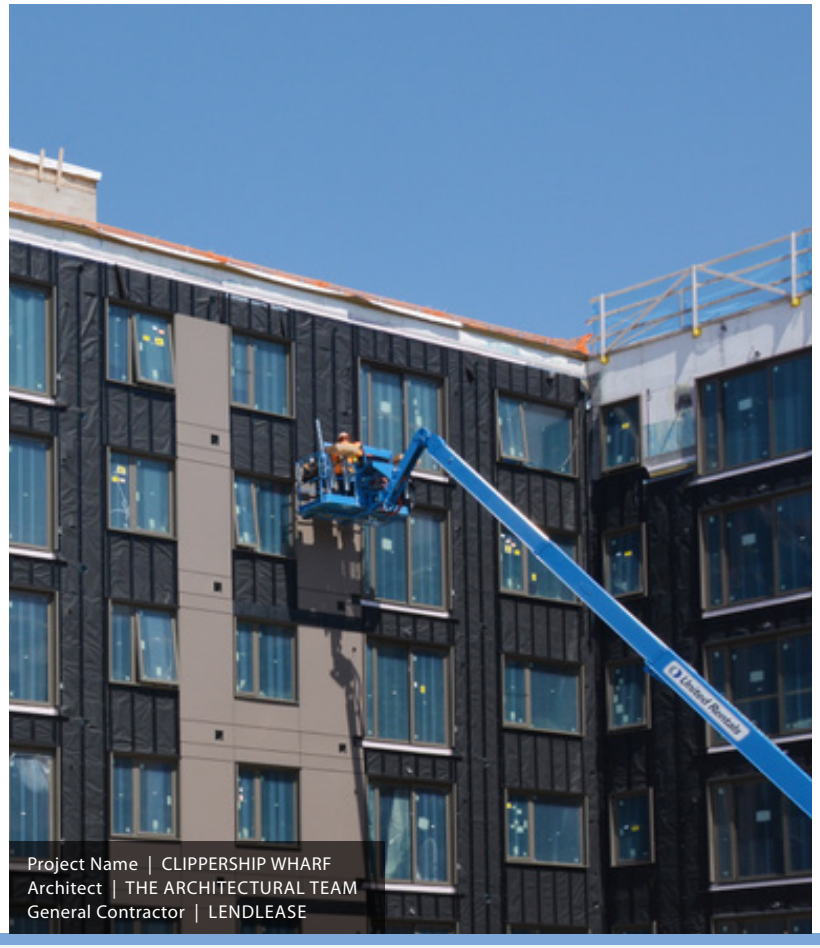
TESTING

Special testing was required for the application, as the building is subject to extraordinary wind conditions. The concern was the durability of the membrane, particularly at fastening points, since it would be subject to the cyclic action of wind pressures. The testing was a collaborative effort and was critical to measure the WRB's structural strength and durability. The testing was done over the span of two days, where the lab put the membrane through 9,000 cycles of pressure differential, each consisting of three seconds of pressure followed by three seconds of rest.



Project Name | CLIPPERSHIP WHARF
Architect | THE ARCHITECTURAL TEAM
General Contractor | LENDLEASE

Project Name | COMMONWEALTH AVENUE
Architect | NESHAMKIN FRENCH
General Contractor | METRIC CORPORATION

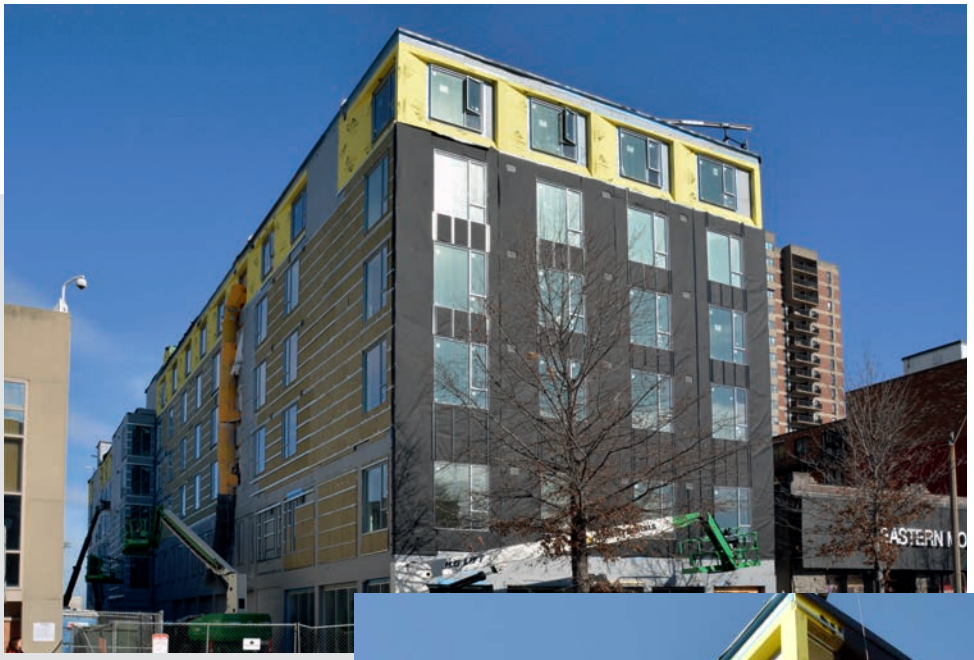
To fully observe the condition and performance of the membrane, testing was done in increments—7,000 cycles with a positive pressure differential of 575 Pa (12 psf), followed by 2,000 cycles of negative pressure differential at 575 Pa. Given that no test existed for this kind of design previously, the laboratory created a test based on ASTM E1233, *Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Cyclic Air Pressure Differential.*

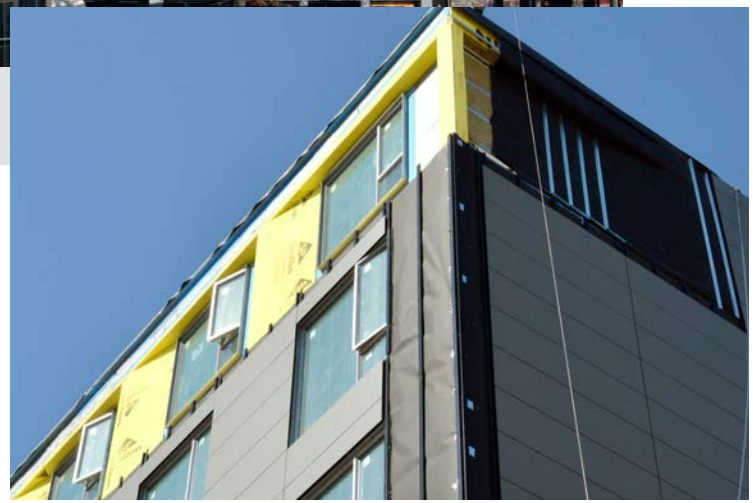
The results of the test showed no measurable wear, indicating the WRB was quite durable. However, given the severity of the weather in Oregon, the team wanted to dig further. Therefore, after the initial testing, the team tried a five-minute cycle at higher wind velocity pressures, up to 193 km/h (120 mph) and performed destructive testing on the wall system. No rips or tears were seen on the membrane, but the z-girts gave out before the membrane did.

For a building with an exterior cladding full of holes, using a suitable WRB proved to be the best solution to preserve the structure's performance and enhance its aesthetics.

CASE **STUDIES**

1047 COMMONWEALTH AVE
BOSTON, MASSACHUSETTS





Architect | NESHAMKIN FRENCH
General Contractor | METRIC CORPORATION

1047 Commonwealth Avenue was originally a two-story building that the developer, Urban Spaces LLC, planned to expand to six stories. The plan was to create 180 studio apartments for graduate students and young professionals.

Nearby Boston University was in the market for temporary student housing while the dorms were being remodeled. They reached an agreement with Urban Spaces to lease the apartments for the next two years.

While it normally would take a year to fill a new apartment building, 1047 Commonwealth was filled as soon as it was completed. The building will return to market rate housing when the university agreement ends.

The architectural firm, Neshamkin French, needed to design a building with an attractive exterior, both to make it a welcome addition to the neighborhood as well as to make the building more desirable to tenants in a competitive market.

The owners also wanted an energy-efficient building that could help control the operating costs, especially during the bitter cold Boston winters. They also plan on this building having a long service life, so they looked for materials that would provide a long, trouble-free service life.

CACTUS CLUB
TORONTO, CANADA

Architect | ASSEMBLEDGE+
Sub-contractor for DELTA® Product | BOTHWELL-ACCURATE

The award-winning Cactus Club Café fine-dining flagship is described by Architizer as having a rough, muscular exterior featuring textured concrete plank paired with a warm and inviting atmosphere, even in the face of fierce Ontario weather.

The 20,000-square-foot restaurant designed by Assembledge+ is protected by DELTA®-FASSADE S, a water-resistive barrier that acts as a durable drainage plane, channeling water from wind-driven rain and snow to the outside of the structure – performance is maximized without compromising aesthetics in open-joint cladding applications.

SPA BALNEA
QUEBEC, CANADA

Architect | BLOUIN TARDIF ARCHITECTURE - ENVIRONNEMENT
General Contractor | CONSTRUCTION DES SOMMETS

The Spa Balnea is located about an hour away from busy Montreal, perched on a hillside in a private nature reserve overlooking Lake Gale. The spa facilities are housed in the original, old-fashioned building with thick stone walls that was built in the 1970s and the principal spa building, which was built in 2005. The owner was looking for a functional, inviting new building to be a complement to the immersive spa experience as well as a connection between the two existing structures. And at the same time, it should meld with the surrounding forest.

The architect's answer was a centrally located minimalist pavilion on stilts. The open-joint wood cladding and wooden walkways integrate the building into the landscape in a contemporary style. It houses the reception area of the spa as well as the offices, creating more space for the spa and treatments in the principal building.

DELTA®-FASSADE S was used by BLOUIN TARDIF Architecture – Environnement to add depth of beauty and superior performance to the building enclosure.

EAST MAIN BAY SHORE
BAY SHORE, NEW YORK

Architect | TPG Architecture
General Contractor | VRD Contracting

TPG Architecture designed an 18,000-square-foot, two-story, Class-A office building and was retained afterwards by the tenant to design a multi-practice space out of the building's interior. Built using durable, lightly textured fiber cement, the exterior cladding is fire resistant, provides durability, and maintains a sought-after look with minimal signs of aging.

Although offering many architectural design benefits, fiber cement is not well equipped to protect a building against moisture, which is why DELTA®-FASSADE S was installed to enhance the building envelope's overall performance.

ABOUT **DÖRKEN SYSTEMS INC.**

Dörken is the North American division of Ewald Dörken AG in Germany. Ewald Dörken AG has been in business since 1892, longer than almost any building materials company.

For more than 125 years, Dörken has been delivering innovative, high-performance air and moisture barriers for both commercial and residential construction, protecting all types of buildings from around the world in the most extreme weather conditions.

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