

INSPIRED BY NATURE, PROTECTED BY SCIENCE.
**BUILDING SCIENCE ON THE OUTSIDE,
BIOLOGICAL SCIENCE ON THE INSIDE**



This project is a perfect example of balancing aesthetics and performance. DELTA® products check all the boxes in terms of performance and aesthetics.

BUILDING FOR SCIENCE

It started out as a competition for the design of the new focal point in the Denver Botanic Gardens; a science building meant to showcase the world-renowned research that was previously inaccessible to the public. The competition included a very specific design requirement of elemental biomimicry. The client wanted to push the boundaries in so many directions. The biomimicry was important in that the building needed to showcase all of the worldwide research it would eventually house. In essence, the science of the building needed to be as innovative as the science found within it. The winning design came from a pragmatic reference: the location within which it would be situated.

The winning design for the science building was to be a pyramid – a 34-foot-high pyramid. In order to incorporate contextual regionalism, the building's massing mimicked local mountain formations. Its form was inspired by a seedling breaking its way through the soil's surface. And influenced by the bees, which are so critical in the botanical process, Swisspearl® fiber cement rain screen panels were used to represent the honeycomb of a beehive.



NOT YOUR EVERYDAY PYRAMID

Typically, a pyramid as a 3D lean-to, or three-pin arch, is quite structurally efficient. However, with this specific form, offsets were created vertically, horizontally, and laterally. Also, a pyramid doesn't include a distinction between wall and roof – it is something of a hybrid, and for this particular pyramid, the faceted sides meet at the spine, where a glazed ribbon of skylights cuts diagonally through the building's footprint. These elements created quite a few structural and enclosure-related challenges. Fortunately, Studio NYL, structural engineers of record and façade designers of the Science Pyramid, love a good challenge.

The structure was to remain a lean-to, keeping the spatial requirements below void of any columns, in order to use as much of the already conservatively sized space as possible. But when the forces were transferred slightly lower to accommodate the spine and the striking gap between the two halves of the pyramid, a force-transfer for bending needed to be created. This created another challenge, as the resulting force-transfer was much less efficient than forces found in a typical pyramid, and needed to have bigger members to accommodate it.

THE RIPPLE EFFECT

The 5,258-square-foot structure was to include 16 sides, with painted steel tubes and angular windows. The shape, usage, types of cladding, and climate all had to be factored in when searching for the right materials. These materials needed to simultaneously maintain a watertight exterior and the appropriate interior environmental conditions.

The biggest challenge was in the transitions. The design created many more transitions than found in a traditional pyramid; not just from opaque plane to opaque plane, but from opaque plane to the ribbon of skylights. Moving across one plane to the next, they might appear vertical and seem simple enough, but there are actually slight bends in the sheathing there, requiring some laps and having it closed off with flashing to maintain the continuity. This continuity is critical because whenever there is a failure in the envelope, or any leaks or breaches in the air barrier, they are almost always at the transition points.

The building challenges had a ripple effect across the design of the whole building, including the envelope.

SPOTLIGHT ON DELTA®



PERFORMANCE VS. AESTHETICS

While many enclosure firms serve as problem solvers, focusing solely on performance, Studio NYL takes it a step further, collaborating on the designs themselves with the architects in addition to requisite performance variables. The relationship with the architects meant that from the beginning, they looked into which materials made the most sense for the needs of the building. This project is a perfect example of balancing aesthetics and performance.

They initially looked into standard commercial roofing solutions, but issues primarily surrounding constructability and the overall look of the design made those unviable options. There was also a need for a product with a redundancy, a barrier that would stop the initial rainfall as well as the UV. Using redundant systems is important because if a small component of that system fails or is installed incorrectly, it will not make the entire project performance fall apart. In this design, redundancy came in the form of a rain screen system combined with two barrier membranes in the building envelope assembly. The fiber-reinforced concrete (FRC) cladding, due to its open-joint design, has a primarily

aesthetic function, as it does not shed rainwater like a conventional cladding. The primary water-resistive barrier (WRB) is provided by DELTA®-FASSADE S, which manages virtually all rainwater that hits the exterior of the building. The membrane acts as a permanent UV barrier at the same time.

A redundant WRB and air barrier is provided by DELTA®-VENT SA deeper inside the building enclosure assembly below the insulation. Compatibility and a shared manufacturer helped make this decision, but it was ultimately the proven performance and benefits of the self-adhered membrane's exclusive edge-lap that made DELTA®-VENT SA the obvious choice.

Factoring in all of that, as well as the best wall assembly for handling this specific type of orientation and design in terms of aesthetic and functional performance and constructability, the decision was made to use the combination of Swisspearl panels and DELTA® products. The building required an underlayment that would suit the wall system, which is technically a mix of wall and roof panels.

The extremes of Denver's winter and summer climate as well as the high UV index made the performance requirements even more stringent. That, combined with the fact that there is a large gap between panels, one inch throughout, increases the UV exposure, so a resilient product was needed.

The product would have to balance many variables to connect everything and achieve the aesthetic form that the architect had intended from the beginning. It was also important to avoid the creation of a thermal bridge, which would pose energy loss and condensation problems. However, should condensation form, the high permeability of DELTA®-FASSADE S would allow it to dry outward.

In many designs, architects want to create reveals or depth between panels, and that often comes in the form of open-joint rain screens or open-joint cladding which, in turn, brings about the need for UV resistance.

"There aren't many products on the market that compare to the testing and track record that Dörken has – especially with DELTA®-FASSADE S and DELTA®-VENT SA.

We have a few projects going on right now that are using DELTA® products for that very reason. We have used DELTA® products in many climate zones."

*William Babbington,
AIA PE LEED® AP BD+C, Principal
and Façade Design Director at
Studio NYL, and Secretary -
Building Enclosure Council
National Board*





PROOF IS IN THE CREDENTIALS

Working with a consultant from the manufacturer on the product details is also wise. Especially for a roof application but, really, any time, running the details by a consultant is beneficial because nobody knows the product's strengths and limitations better. While manuals and catalogs are informative, you simply cannot anticipate all the details that might come about with unique projects, especially if using the materials in non-standard ways. Even if the consultant was confident that the product was going to perform the way it should, including them in your project ensures that you don't jeopardize the warranty you and your clients both want and need. For the Science Pyramid, Babbington consulted with Dörken Product Manager Peter Barrett to ensure the water-resistive barrier (WRB) would provide all the performance criteria of a regular WRB along with long-term resistance to UV light and the impact of wind, rain, and snow.

"With this project, we really needed materials that were tried and true, as the time frame from the competition entry to the opening of the building was just nine months. The sequencing was critical."

William Babbington

"DELTA®-FASSADE S meets the most important qualities I look for in a WRB in open-joint rain screen systems: UV resistance – so very critical. The product's origins are in European roofing, meaning it's going to be quite a bit more resilient under the construction foot traffic – very strong and pliable. And last, it doesn't compromise on performance or aesthetics – it delivers on both."

William Babbington

SO, WHY CHOOSE DELTA® AIR AND MOISTURE BARRIERS?

DELTA®-FASSADE S is the WRB ideal for open cladding. The watertight membrane is highly vapor permeable and extremely tear resistant. Highly stabilized against damage from UV exposure, the barrier is designed for use in cladding systems that have open joints up to 2" (50 mm) wide, which expose up to 40% of the entire façade surface. It is also the only UV-stable WRB that is tested to and has passed ICC-AC308.

DELTA®-VENT SA is a high-performance, three-layer water-resistive barrier and air barrier. Highly vapor permeable, watertight, and aggressively self-adhering, the product ensures energy efficiency and protection from wind-driven rain. It exceeds the most stringent air tightness requirements of the ABAA (Air Barrier Association of America) when tested as per ASTM E2357-11 Standard Test method for Determining Air Leakage of Air Barrier Assemblies, surpasses the requirements of a 60-minute Grade D building paper, and passes ASTM D1970 Nail Sealability test.

STUDIO NYL

Studio NYL, a Boulder, Colorado-based structural engineering and façade design firm known for its exemplary skills, has earned the trust and respect of architects around the world for delivering truly innovative design-led solutions that exceed the conventional. www.studionyl.com