In Fairbanks, Alaska temperatures can range as much as 160°F during the course of a year (-60° to +100°F). Winter temperatures can stay at 40-below zero for weeks at a time. Accommodating issues related to such extreme cold puts considerable emphasis on design and specification of the building envelope. At the College of Engineering facility at University of Alaska Fairbanks (UAF), completed in 2016, building performance issues were seamlessly woven into an insightful design that not only facilitates and showcases advanced engineering studies, it offers the building itself as a basis for student research and analysis.

**Project:** College of Engineering & Mines, University Of Alaska Fairbanks  
**Design Architect:** NBBJ Seattle  
**Executive Architect:** ECI/Hyer  
**Construction Manager:** Davis Constructors  
**Curtain Wall Fabricator & Erector:** Bucher Glass  
**Curtain Wall Design & Engineering:** Overgaard, Ltd.  
**Cladding Panels:** TAKTL® Architectural Ultra High Performance Concrete Facade Panels  
**Texture:** Standard Smooth and Crinkle Textures, Media-Blast Finish
ENGINEERING EDUCATION

Designed by NBBJ and ECI/Hyer, the College of Engineering facility represents a sizable leap forward in the university’s instructional capabilities in the field of engineering.

Constructed adjacent to the university’s existing engineering building, the facility incorporates advanced engineering features including a 4-foot thick steel-reinforced floor in a central high bay space that joins the older building with the new. This specially engineered floor will facilitate testing and analysis of large-scale structural elements in seismic and other high-stress conditions.

Large glass panels at ground level will showcase activity within the central high bay to the surrounding campus. Mechanical, electrical, and plumbing systems, and much of the structure will be exposed to reveal the underlying building infrastructure.

Sensors throughout the facility will enable continuous analysis of building performance factors: e.g., structural loads, environmental conditions, and energy, providing insight about how a wall performs behind a vacuum insulated glass panel versus standard block wall insulation or opaque curtain wall. Not only are the sensors valuable teaching tools, the data will help assess post-occupancy performance issues and allow students and university personnel to monitor the results of any remediation.

BUILDING ENVELOPE

Building performance issues in Fairbanks go far beyond what is generally encountered in the Lower 48. Extreme temperature differentials from outside to inside, with a 100˚ differential not uncommon, can create pressure issues: a stack effect where the cold air is pulled inward with a high degree of force. Within the existing engineering facility, a pencil-sized hole once created a high-pressure jet of extremely cold air strong enough to cause a basement water pipe to burst. The pipe was a full 8 feet from the exterior wall.

With such acute climate considerations, every aspect of the building envelope is important. In addition to a tight thermal seal and protection from air and moisture, the new engineering facility needed a cladding solution capable of withstanding extended freeze-thaw conditions, dramatic annual temperature swings, material degradation via absorption and exposure, and corrosive factors such as salt spray from de-icing of the surrounding roads and walkways.

Many materials may become brittle and crack in persistent subzero temperatures. Expansion and contraction issues from metal cladding can harm the building’s vapor seal over time. Moisture penetration in freeze-thaw conditions can also create degradation in many porous materials.
UNITIZED ULTRA HIGH PERFORMANCE CLADDING

Searching for a cladding material that could hold up in such demanding conditions, the design team began looking closely at TAKTL Ultra High Performance Concrete (UHPC) facade panels.

“When it comes to product selection, we look at the product performance at extreme temperatures to make sure it performs,” said architect Sean Carlson of ECI/Hyer. “We avoid any system that we can’t get information about how it performs at 40-below.”

TAKTL panels had several key attributes:

**Strength**  TAKTL is a proprietary UHPC product over four times as strong as traditional precast with excellent flexural and compressive strength

**Durability**  Tight material bonds virtually eliminate the capillary pores that can cause freeze-thaw degradation in other concrete products

**Aesthetics**  Surface textures, color, and panel size can all be customized to achieve desired appearance

**Sustainability**  TAKTL’s reduced material usage, low emissions, energy impact, and projected lifecycle performance supported university and design team sustainability goals
The design flexibility of the TAKTL panel, combined with its ability to address the full range of performance criteria, made it an ideal cladding choice for the UAF College of Engineering. NBBJ and ECI/Hyer collaborated with TAKTL to explore different design options, eventually opting for an open joint, ventilated and back drained (BVDC) unitized curtainwall to address weather conditions and thermal performance. The unitized assemblies would incorporate a complete wall enclosure system with approximately 11” of mineral fiber insulation (+/- R=40), weatherproofing, vapor sealing, and 5/8” thick TAKTL UHPC Facade Panels.

Overgaard, Ltd. engineered the curtain wall, collaborating closely with Fairbanks-based, Bucher glass and TAKTL to detail the unit assemblies. TAKTL produced and delivered the facade panels, cut, finished, and drilled for concealed anchors. Bucher assembled the unitized panel in its own facility during the winter to be ready for the start of the Alaska construction calendar. When it came time to install the curtainwall, the wall units were transported from Bucher’s facility to the site and craned into place.

Because the unitized panels represent a complete wall system, the install was not only highly efficient, it also allowed for increased control over the aggregate tolerances that can occur with multiple trade contracts (primary wall, glazing, waterproofing, cladding). Field adjustments to fit the wall assemblies to the structure were handled by a single, expert installer, resulting in a streamlined installation.
The UAF project represents the first of many building enclosure projects in which TAKTL panels have been integrated into pre-fabricated wall systems. These unitized or panelized wall systems combine mineral materiality, durability, and strength-to-weight ratio of TAKTL with the performance, quality, predictability, and schedule compression of factory pre-fabricated curtain walls to deliver a new range of facade design options.

According to Sean Carlson at ECI/Hyer, the comparative lightness of the TAKTL panels meant the design team could afford to specify more concrete, due to significantly lower shipping rates. It further allowed the units to be assembled off-site, whereas a heavier concrete option would have had to be shipped in separately and unitized on site. That same lightness enabled them to articulate large spans of the facade with fields of concrete. The result was a curtain wall both visually and functionally light. Supporting a concrete aesthetic with standard precast would have required considerably more structural investment to carry the dead load of the material.

An easy comparison of precast to thin A|UHPC for the 8 foot by 16 foot units is 8960 pounds versus 883 pounds – or 1/10 the weight. In addition, with A|UHPC at 5/8” thick compared to precast concrete at 6” thick there is a trade off in floor space and/or insulation layer thickness. For a project that has restricted floor plate size and tight budgets for primary building structure this can have a significant impact on performance and return on investment.

Together with structural advantages and high performance, the media-blasted Crinkle finish adds textural and visual interest to the facade. The panels appear equally at home within the aesthetics of the articulated facade and as a backdrop for the pine trees and surrounding landscape of the UAF campus. Not only does the cladding accommodate the extreme environmental conditions of the location, it does so while integrating harmoniously within the material context of the facade and the beautiful, natural environs of central Alaska.

For more information on TAKTL and prefabricated wall systems please visit www.taktl-llc.com.