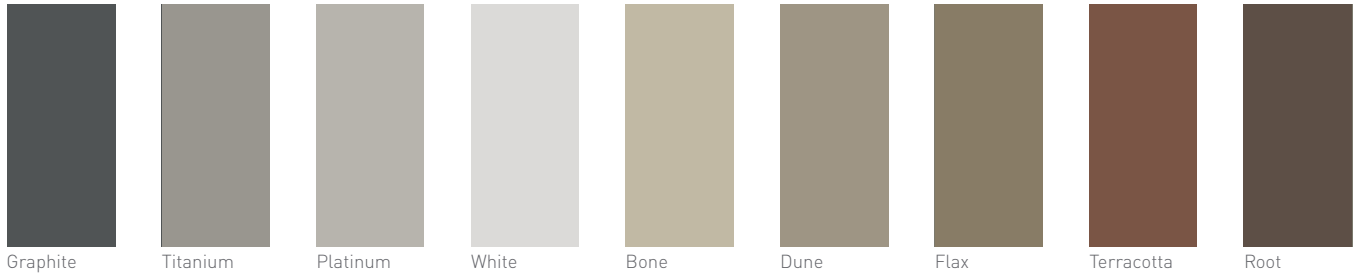




TAKTL® is an advanced Ultra High Performance Concrete (UHPC) that is over four times as strong as traditional precast concrete and performs exceptionally well in demanding conditions. The key to TAKTL's strength is the carefully calibrated ratio of engineered ingredients and a mixing sequence that tightly packs molecules together and creates very strong bonds. This high packing density yields excellent flexural and compressive strength and virtually eliminates the capillary pores that cause freeze-thaw degradation in precast concrete and GFRC panels.

VECTR® Panels are comprised of TAKTL reinforced with Alkali Resistant (AR) Glass Fiber and two layers of AR Glass Fiber Mesh. Panels are cast utilizing a proprietary, automated production process into molds that yield an intrinsic pattern and finish. Additionally, special surface effects can be created with aggregates and/or a variety of media-blasting techniques in an automated, enclosed blasting booth. TAKTL is the first company to fully integrate UHPC formulation, design, mold making, and automated manufacturing.

Standard Colors



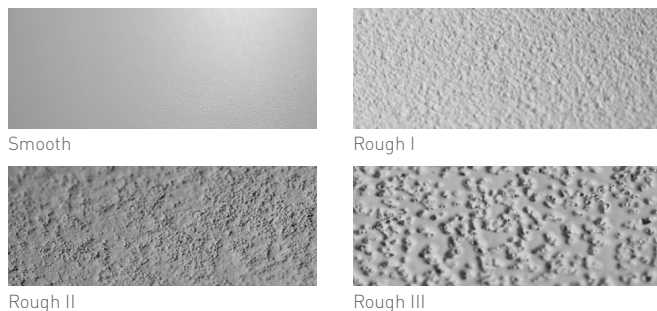
Colors TAKTL has developed standard colors for the building industry and is able to match custom colors. Pigments are added during mixing, resulting in integral color that is consistent throughout the panel. The TAKTL color Platinum is formulated without pigment. All other standard and custom colors contain high performance pigments that are UV-stable and specifically engineered for use in concrete. Custom colors are possible for projects over 4,000 square feet (370 square meters) and are evaluated on an individual basis.

Color Variation + Weathering Raw materials, particularly cement and sand, can vary from delivery to delivery, resulting in slight batch-to-batch color variations characteristic of a natural, mineral-based material. In addition, variables such as temperature and humidity can affect cure time and color consistency. TAKTL minimizes this color variation by carefully controlling raw material specifications, temperature, and humidity during cast-

ing and curing. To help control color fluctuations arising from raw material variations over time, project-specific batch production and planning for safety stock are tightly coordinated with the installation schedule to span the shortest time possible.

Finishing Options MicroSeal/T™, a hydrophobic, breathable finish, is applied to all panels before shipment to help regulate the flow of moisture between the material surface and the environment during the more sensitive early stages of the curing process. MicroSeal/T is invisible and does not affect the rich, natural appearance of the panel. An alternative factory applied finish, ColorSeal/T™, is recommended for projects in which the natural qualities of TAKTL's subtle color variation and weathering over time are not desired. The ColorSeal/T process affords tighter control of the surface color characteristics, virtually eliminating the subtle batch-to-batch color variation that results from using mineral raw materials.

Flat Textures

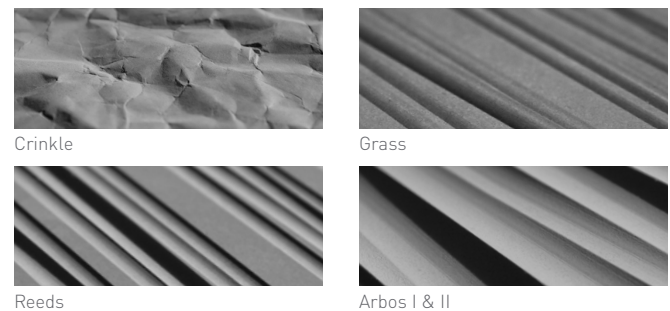


Specialty Aggregates

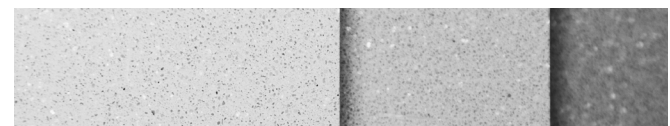


Specialty Aggregates TAKTL has perfected a technique for incorporating aggregates of varying color and size into the face layer of flat panels without compromising strength or long term performance. Two specialty aggregate color/texture combinations have been added to the VECTR standard lineup: SPA01 and SPA02. Custom aggregate colors/textures will be considered for projects exceeding 5,000 square feet.

Raised Textures

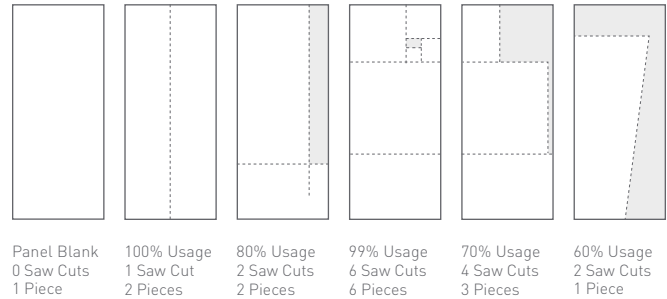


Media Blasted Finish



Media Blasted Surface Texture Available as a standard option with any color or texture, media blasting creates a subtly lighter and more visually varied surface of exposed matrix. TAKTL's media blaster was purpose designed and built for TAKTL with automated feed and articulating multi-head nozzles to create an even surface texture that is not possible with fixed head or hand blasting. Media is cleaned and re-circulated in a dust-free and resource efficient cycle.

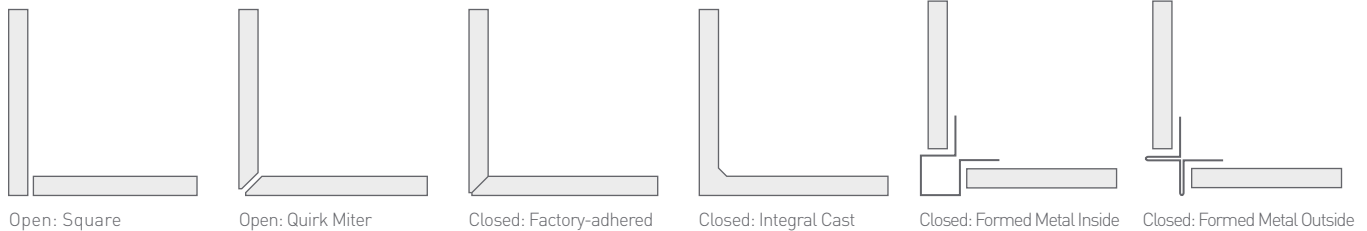
Standard Dimensions	
Length Maximum	120 in (3,050mm)
Width Maximum	48 in (1,120mm)
Thickness Flat Textures	0.5 in (12.7mm)
Thickness Raised Textures	0.5 in at <i>thinnest point</i>
Weight Flat Textures	5.7 lb/ft ² (29.3kg/m ²)
Weight Raised Textures	5.7 lb/ft ² – x.x lb/ft ²



Panel Sizes VECTR panels are cut to finished size per approved panel layout and manufacturing shop drawings in our factory. Panels are cast on a continuous production line into molds that yield standard sizes up to 4' in width and 10' in length. The line is designed to operate at several different widths in order to minimize material waste. Panel size, orientation and layout directly influence installation costs by impacting number and placement of anchors, cost of substructure, weight of the panel and material handling challenges at the job site.

Material Optimization To minimize waste and also realize the lowest material cost, we recommend designing panel layouts that maximize material use. Our standard program efficiency target is 80% panel blank utilization. Please contact our Technical Support Team for assistance with panel sizes, material optimization, and related pricing parameters.

Joint + Corner Options



Corners A variety of closed and open corner options are possible within the standard VECTR program. Our CNC bridge saws precisely create straight and mitered edges as the finished panels are cut to size. Factory Adhered corners have been fully tested, with the strength of the joint matching (or exceeding) that of reinforced cast corners. The dimension guidelines for Integral Cast corners at 1/2" thickness are: length ≤ 6' (1.8m); width of each face ≥ 4" (101 mm) and ≤ 32" (812mm) with the total combined face width ≤ to 36" (914mm). Formed Metal corners can be incorporated in a variety of ways, with the metal components supplied by others.

Joints Thermal movement is negligible in VECTR panels and does not affect joint size. The coefficient of linear expansion for a 36" (914mm) VECTR panel over a 68°F (38°C) temperature swing is 0.016" (0.4mm). Although a 3/16" joint is possible, a typical joint dimension is 3/8". The coefficient of linear expansion does not determine joint size. Designer preference, building movement and installation tolerances drive joint size.

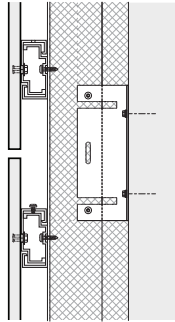
The structural engineer of the project should review criteria to determine minimum joint sizes based on building movement values.



Application Examples



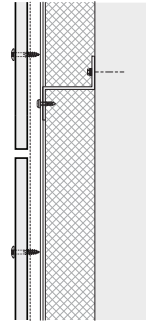
Rain-screen | Undercut Anchors



See Fig. 1.1



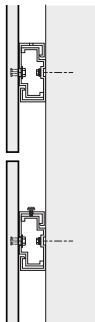
Rain-screen | Exposed Direct Fastener



See Figure 1.2



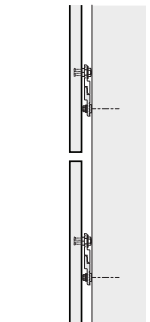
Close Cladding | Undercut Anchors



See Fig. 1.1



Z-Clip Interior Cladding | Undercut Anchors



See Fig. 1.1

Applications VECTR panels are compatible with a wide range of facade applications and cladding support systems, from rainscreens to interior lobby elevations. We've developed sample architectural details, available on our website, with some of the most common substructures and clips illustrated (*above*).

Anchoring VECTR panels can be affixed with concealed undercut anchors or exposed fasteners through the face of the panel. Undercut anchors are compatible with textured surfaces and install with a fast, adhesive-free process. VECTR panels can also be attached to substructure framing with screws or rivets. All panels are factory-drilled for ease of installation (*below*).

Anchor Spacing For a standard 1/2" (12.7mm) panel, the spacing between anchors should not exceed 39" (990mm) under typical design load conditions. The edge of the undercut anchor or the hole for face fastening shall be a minimum of 3" (76.2mm) from panel edge and not greater than 9" (228mm). For adequate support, panels must have a minimum of four anchors. The thickness of the panel, the depth of the anchor, and the engineer's stamped calculations incorporating windloads, seismic loads, and other project specific design criteria determine anchor spacing and quantity. *Reference VECTR Doc. SP20.1 for complete anchor and anchor spacing information.*

Attachment Examples

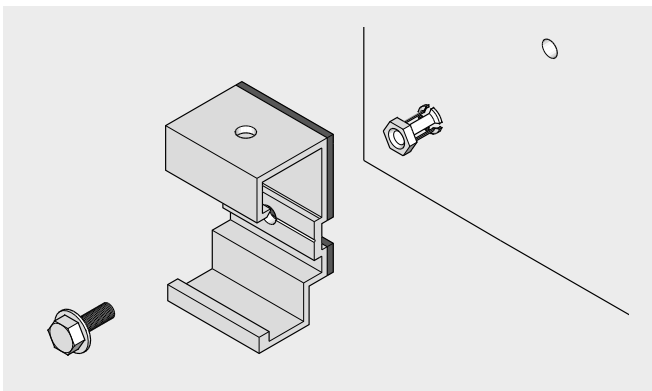


Fig. 1.1 | Concealed Fastener | Undercut Anchors | Into Panel Back

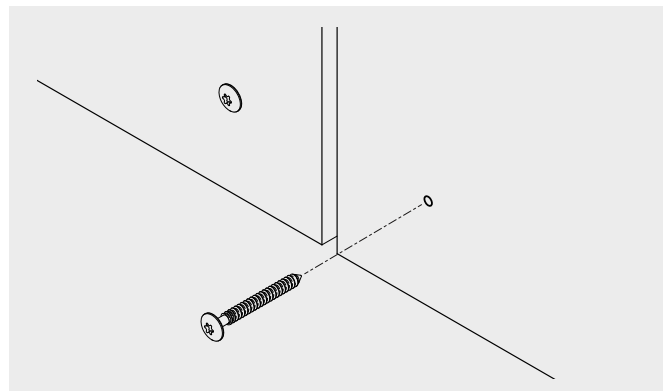


Fig. 1.2 | Exposed Direct Fastener | Through Panel Face



Technical Support + Project Management Every aspect of a project is coordinated by a Technical Support Specialist and Project Manager. Our Technical Support Specialists are able to provide expert assistance throughout the design, budgeting, sampling, specification writing, and quoting process. TAKTL Project Managers work closely with contractors and installers from the finalization of order details through project completion, overseeing drawings, approvals, scheduling, shipments, and problem resolution. Their expertise enables them to anticipate issues, collaborate with all team members, and support architects and contractors through a successful installation.

TAKTL does not offer engineering services. However, we work frequently with structural engineers and will be pleased to refer structural engineers who specialize in UHPC and/or facades.

Pricing Each project is unique, with a variety of factors influencing ultimate cost. These factors include: square footage requirement, number of color/texture combinations, project timeline, anchoring system, edge/corner style, panel size, and sheet utilization are among the most important. Custom colors, custom textures, and panel size can also impact both cost and delivery schedule. Please contact our Technical Support team to discuss budget pricing and how panel specifications impact manufacturing, shipping, and cost.

Specifications As an Ultra High Performance Concrete existing within the broader category of Glass-Fiber Reinforced Concrete, VECTR panels are generally specified within Division 07 or 08. Please contact our Technical Support Team for assistance with specification placement and language.

Project Scheduling Lead Time

From receipt of deposit, approved drawings and approved color sample(s)

Standard Project	12 Weeks
Custom Project	16 Weeks
Custom Samples	7 Weeks

Storage + Handling Panels are shipped in custom crates, designed to protect the panel faces and minimize damage in transit. We have created detailed instructions to make sure unloading, on-site storage, handling, field cutting/drilling and installation of our panels is as straightforward and efficient as possible. Panels must be protected from moisture (rain/snow and condensation) during storage to prevent uneven hydration that can cause surface discoloration. Careful handling of panels is required to maintain product quality. Handling instructions are similar to those for glass – handlers should hold panels on edge with the finish face and edges protected at all times.

Reference VECTR Doc. H2.1 for complete handling and storage instructions.

Field Cutting + Drilling VECTR panels are typically cut and drilled per approved drawings prior to shipment. However, situations may arise in which field cutting is required, and we have created detailed instructions to make field cutting, drilling, and installation of our panels as easy and efficient as possible. VECTR panels can be cut with standard equipment in the field - we recommend a wet saw with a continuous rim blade, keeping the panel surface uniformly wet during cutting, rinsing it thoroughly, and drying with compressed air. For field drilling, we recommend wet drilling with glass or diamond bits, keeping the panel surface uniformly wet during drilling, rinsing it thoroughly, and drying with compressed air.

Reference VECTR Doc.: P2.1, P4.1, P6.1 for complete field processing instructions.

Installation Depending upon the type of project, panel size, and substructure, our panels can be successfully installed by a variety of specialized façade contractors and trades, including carpenters, ironworkers and glazers. Working with the installing contractor and the production team, the TAKTL Project Manager creates a detailed shipment schedule and panel packing sequence that balances installation strategy with drawing release dates and production efficiencies.

REFERENCE DOCUMENTS	
SP20.1	VECTR Technical Data Document
H2.1	VECTR Un-Crating, Storage + Handling Instructions
P2.1	VECTR Field Processing Field Cutting Instructions
P4.1	VECTR Field Processing Field Drilling Instruction
P6.1	VECTR Field Processing Field Grinding Instructions
Q2.1	VECTR Quality Management Tolerances + Acceptance Criteria

Certified Test Results VECTR® panels are tested according to the methods for ASTM C1185 without sealer or coating. The products have been certified to meet the standards of ASTM C1186. All test results exceed the requirements for classification of Type A, Grade IV (highest grade). ASTM C 1186 is the International Building Code referenced standard for exterior fiber cement panels (1405.16).

Except as noted, the following results reflect testing completed by Architectural Testing, Inc. (York, PA) on 0.5” panels cast at the TAKTL production plant in Pittsburgh, PA and selected at random by ATI during certification. CAN/ULC S114-05 testing was conducted by Intertek (Coquitlam, BC).

Quality Management + Certification TAKTL’s Quality Management System monitors parameters such as product dimensions, physical properties, flexural strength, anchor pullout strength, color and curing conditions, and provides full traceability for each panel back to raw materials. Under the independent quality certification program, ATI conducts unannounced audits of TAKTL operations at least four times annually, verifying procedures, reviewing QMS records, and selecting panels at random for laboratory testing and verification. TAKTL employs a full-time Quality Administrator, who monitors procedures, testing, training and reporting.

Reference VECTR Doc. Q2.1 for complete quality and acceptance criteria.

ASTM C 1186 CERTIFICATION - GRADE IV		RESULTS (US)	RESULTS (SI)	CERTIFICATION REQUIREMENTS (MINIMUM STANDARD)
ASTM C 1185-08	Tolerance - Length	0.00 in	0.00 mm	1/4 inch maximum variation from nominal dimension
ASTM C 1185-08	Tolerance - Width	0.00 in	0.00 mm	1/4 inch maximum variation from nominal dimension
ASTM C 1185-08	Tolerance - Thickness (within Sheets)	3.65 %	3.65 %	≤ 15% variation between extreme measure of max measured value
ASTM C 1185-08	Tolerance - Thickness (between Sheets)	0.022 in	0.559 mm	≤ 0.05 in. variation between sheets
ASTM C 1185-08	Tolerance - Squareness (Diagonal)	0.00 in	0.00 mm	length variation ≤ 1/32in/ft of sheet length
ASTM C 1185-08	Tolerance - Squareness (Width Edge)	0.00 in	0.00 mm	variation between opposite edges of sheet ≤ 1/32in/ft
ASTM C 1185-08	Tolerance - Squareness (Length Edge)	0.00 in	0.00 mm	variation between opposite edges of sheet ≤ 1/32in/ft
ASTM C 1185-08	Tolerance - Straightness (Length)	0.00 in	0.00 mm	Edge dimensions within 1/32in/ft of length
ASTM C 1185-08	Tolerance - Straightness (Width)	0.00 in	0.00 mm	Edge dimensions within 1/32in/ft of width
ASTM C 1185-08	Density	137.1 lb/ft ³	2,196.1 kg/m ³	Reporting Requirement Only
ASTM C 1185-08	Modulus of Elasticity - Equilibrium	3,685,222 psi	25,408.7 MPa	Reporting Requirement Only
ASTM C 1185-08	Modulus of Rupture - Equilibrium	6,895 psi	47.5 MPa	Flexural strength must be ≥ 3190 psi
ASTM C 1185-08	Modulus of Rupture - Wet	6,176 psi	42.6 MPa	Flexural Strength > 2,610 psi and > 50% of Equilibrium Flexural Strength
ASTM C 1185-08	Freeze/Thaw - Flexural Strength Retention	97.3 %	97.3 %	No visible cracks and ≥ 80% strength retention
ASTM C 1185-08	Heat/Rain Exposure - Rainscreen Assy	No Defects	No Defects	No visible cracks/structural alteration of the sheets and frame assembly
ASTM C 1185-08	Moisture Content	0.9 %	0.9 %	Reporting Requirement Only
ASTM C 1185-08	Moisture Movement	0.00 %	0.00 %	Reporting Requirement Only
ASTM C 1185-08	Water Absorption	3.9 %	3.9 %	Reporting Requirement Only
ASTM C 1185-08	Penetration & Water Droplet Formation	0/0	0/0	Moisture penetration permitted, but no droplet formation
FIRE TESTING / SURFACE BURN CHARACTERISTICS		RESULTS (US)	RESULTS (SI)	CERTIFICATION REQUIREMENTS
ASTM E 84-09	Flame Spread Index	0 (Class A)	0 (Class A)	Class A: Flame spread 0-25 / ASTM C 1186: Flame spread 0
ASTM E 84-09	Smoke Development Index	5 (Class A)	5 (Class A)	Class A: Development 0-450 / ASTM C 1186: Development ≤ 5
ASTM E 136-09	Combustibility	Non Combustible (6.9% loss, < 0°C)	Non Combustible (6.9% loss, < 0°C)	Max loss of mass during the test ≤ 50%; Surface and interior temp rise ≤ 30°C above furnace temp; No flaming after first 30 seconds
CAN/ULC S114-05	Combustibility	Non Combustible (6.6% loss, < 0°C)	Non Combustible (6.9% loss, < 0°C)	Max loss of mass during the test ≤ 20%; Temp rise of specimens ≤ 36°C. No flaming of any of the specimens during the last 14.5 minutes
ANCHOR STRENGTH - KEIL UNDERCUT ANCHORS		RESULTS (US)	RESULTS (SI)	
ASTM E 488-10/E 488M-10	Anchor Shear Strength	839.9 lbf	3.7 kN	1/2" (12.7mm) thick panels; 8.5mm anchors
ASTM E 488-10/E 488M-10	Anchor Tensile Strength (Pullout)	456.3 lbf	2.0 kN	1/2" (12.7mm) thick panels; 8.5mm anchors
ASTM E 488-10	Anchor Shear Strength	1,118.3 lbf	5.0 kN	5/8" (15.9mm) thick panels; 11.5mm anchors
ASTM E 488-10	Anchor Tensile Strength (Pullout)	602.1 lbf	2.7 kN	5/8" (15.9mm) thick panels; 11.5mm anchors
ASTM E 488-10/E 488M-10	Anchor Shear Strength	1691.7 lbf	7.5 kN	3/4" (19.0mm) thick panels; 15 mm anchors
ASTM E 488-10/E 488M-10	Anchor Tensile Strength (Pullout)	807.4 lbf	3.6 kN	3/4" (19.0mm) thick panels; 15 mm anchors
ASTM E 488-10/C 666M-03	Anchor Shear Strength - Freeze/Thaw	117.3 %	117.3 %	1/2" (12.7mm) thick panels; 8.5mm anchors
ASTM E 488-10/C 666M-03	Anchor Tensile Strength - Freeze/Thaw	111.0 %	111.0 %	1/2" (12.7mm) thick panels; 8.5mm anchors
ACCELERATED WEATHER TESTING / COLOR CHANGE		RESULTS (US)	RESULTS (SI)	
ASTM G-155-05a/D2244-09a	ColorSeal/T (2000 hrs)	1.69 ΔE	1.69 ΔE	
ASTM G-155-05a/D2244-09a	MicroSeal/T (500 hrs)	0.37 ΔE	0.37 ΔE	