



TAKTL KORSA™: AIUHPC® Exposed Aggregate Facade Elements

The KORSA collection from TAKTL utilizes innovative manufacturing methods to combine the time-tested performance of AIUHPC concrete facade elements with the depth and richness of exposed decorative aggregates. By incorporating aggregates of varying color and size into the face layer of the material, KORSA panels offer a wide palette of design options for large thin facade panels that far exceed the pound for pound strength and durability of stone or precast concrete. TAKTL KORSA panels are an ideal solution for rainscreens, prefabricated wall assemblies and interior cladding applications, offering versatility in size, fabrication, and assembly while minimizing additional weight and wall thickness.



KORSA™ Panel Description TAKTL has developed a technique for incorporating aggregates of varying color and size into the face layer of TAKTL panels without compromising the strength or long-term performance of its AIUHPC base matrix. Aggregates are selected and reviewed for integrity through a battery of tests and petrographic analysis, ensuring perfect integration into the surface layer of the TAKTL panel.

Features + Advantages of TAKTL KORSA Panels

- KORSA Panels are just 5/8" thick, but much higher in strength and long-term performance in comparison to the 4" profile of traditional precast concrete and 2-3" profiles of stone.
- KORSA Panels, like all TAKTL panels, can be manufactured in the size of curtainwall glazing and integrated seamlessly into unitized applications.
- Thinner profiles mean less concrete material and less sub-structure, potentially resulting in lower costs and lower environmental impacts.
- During the casting of KORSA Panels, aggregates are applied to the surface of TAKTL panels, not throughout the mix, in order to retain the full strength and durability advantages of AIUHPC.
- Recycled stone and masonry cladding can be crushed and re-purposed, provided petrographic analysis and quality review demonstrate a successful KORSA Design Mix.
- KORSA Design Mix can be applied to most flat and raised textures in TAKTL's product line, as well as many custom textures, providing designers with opportunities to re-envision concrete surfaces and create customized designs from our preapproved range of sizes, shapes, and colors.

Health & Safety TAKTL AIUHPC has been formulated to specifically exclude ingredients harmful to the environment or workplace health and safety. Unlike many cementitious materials, TAKTL has extremely low (trace) levels of respirable crystalline silica (RCS). We are committed to using aggregates that do not introduce crystalline silica content into the base matrix, as represented in Tier 1 of the chart below.

| RCS Content | Type of Stone or Recycled Aggregate |
|------------------------|--|
| Tier 1 <1.0% | Marble, Glass, Slag, Limestone (TAKTL KORSA Approved) |
| Tier 2 1.0%–20% | Clay, Porcelain, Granite (certain types) |
| Tier 3 >20% | Sandstone, Riverstone, Quartz, Natural Sand |

Material/Panel Characteristics

| | |
|---|--|
| Material Density | 137lbs/ft ³ |
| Coefficient of Thermal Expansion | 6.41 E-06 in/in/°F |
| Compressive Strength | 12,000 psi – 18,000 psi (95Mpa – 120Mpa) |
| Flexural Strength (Panel) | 3,916 psi – 4,786 psi (27Mpa – 33Mpa) |
| Undercut Anchor Load Values (10mm)* | 520 lbf Tension 890 lbf Shear |
| Standard Base Panel Thickness** | 5/8 in (16mm) (1½ in/38mm Max.) |
| Panel Weight 5/8" (16mm) Thickness min. | 6.9 lb/ft ² (33.7kg/m ²) |
| Standard Nominal Panel Size | 48 in (1220mm) X 120 in (3050mm) 48 in (1220mm) X 144 in (3656mm) |
| Min. Standard Panel Size | 6 in (150mm) X 48 in (1220mm) |
| Max. Standard Panel Size | 60 in (1500mm) X 144 in (3656mm) |

* Recommended minimum design values

** Custom textures/profiles available up to 1 ½" (38mm) overall thickness upon request
Test reports available upon request

Aggregate Size Allowance by Panel Thickness

| Standard Panel Thickness | Available Aggregate Size (US) | | | | | |
|-------------------------------|-------------------------------|--------------------|-------------------|-------------------|-------------------|---------------------|
| | #00 ≤ 1/16" | #0 1/8" – 1/16" | #1 1/4" – 1/8" | #2 3/8" – 1/4" | #3 1/2" – 3/8" | #3-5 5/8" – 1/2" |
| 5/8" (15.875mm) | ● | ● | ● | | | |
| 3/4" (19.050mm) | ● | ● | ● | ● | | |
| Custom Panel Thickness | | | | | | |
| 1"* (25.400mm) | ● | ● | ● | ● | ● | |
| 1 1/2"* (38.100mm) | ● | ● | ● | ● | ● | ● |

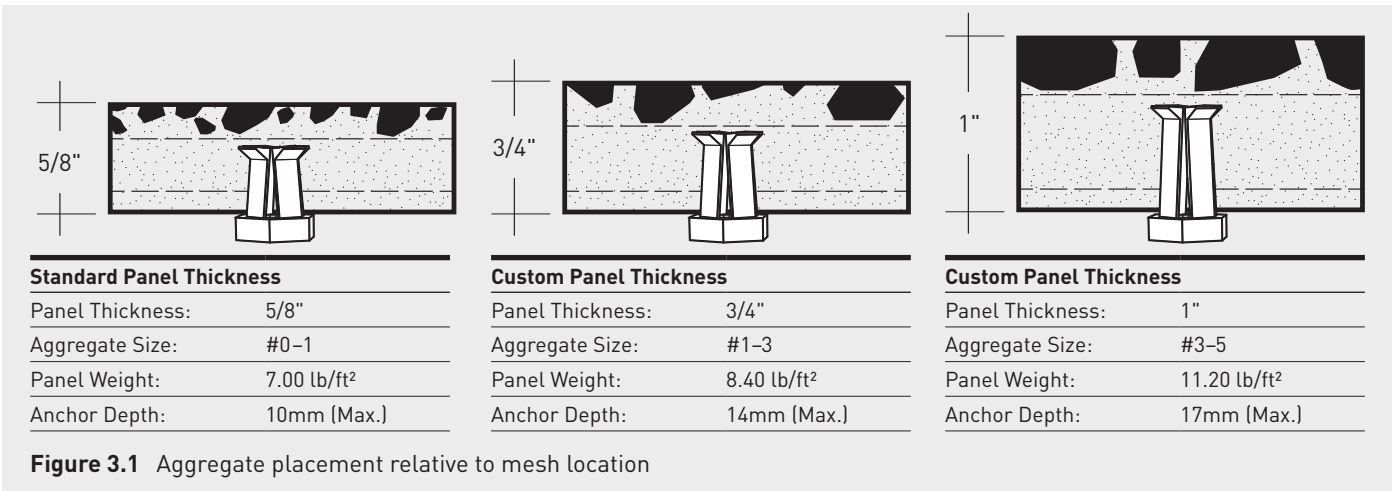
* Custom texture and profile thicknesses may accommodate larger aggregates but require more material and increase production and shipping costs. Please consult TAKTL Technical Support with questions about aggregate sizing for custom thicknesses and textures.



Environment & Economy

- Manufactured with 90% raw materials sourced within 500 miles of the factory.
- Made in the USA (Pittsburgh PA) by a company wholly-owned by US Citizens
- Fully complies with the Buy America and Buy American acts

For more information regarding potential LEED credit contribution or to discuss recycled or re-purposed stone or masonry options, contact TAKTL Technical Support.



Aggregate Placement and Limitations

Aggregate Size and Placement Integrated textile reinforcement differentiates TAKTL A|UHPC panels from GFRC or other UHPC products. Each panel has two layers of continuous AR glass fiber mesh to provide increased flexural strength, improved handleability and increased safety in the event of severe impact during installation or over the life of the building. Mesh placement is one of two factors determining aggregate size limitations.

The second factor is the composition of the A|UHPC base matrix. A primary characteristic of A|UHPC is the micro-scale and nano-scale ingredients comprising the base matrix selected to achieve a high "packing" density and to create extremely strong chemical and mechanical bonds in the final product. The aggregates added to the face layer for visual purposes are limited in size and quantity to prevent them from interfering with the mechanical properties and behavior of the A|UHPC matrix and panel performance.

Together, the placement of mesh and integration of surface aggregates with the A|UHPC base matrix determine size limitations or thickness requirements for the panel. Larger aggregates may require the accommodation of an increased panel thickness to prevent interference with the properties of the base matrix or the mesh interlayer. (Figure 3.1)

Geometry and Chemistry TAKTL strongly recommends the selection of stone or byproduct material that is 'crushed' (not rounded) to ensure the development of interlocking mechanical bonds between the surface aggregates and the base matrix. 'Rounded' stone may be used, but requires special evaluation to determine long-term strength and durability in addition to standard chemical and petrographic analysis to determine compatibility of the aggregate with the A|UHPC mix. (Figure 3.2)



Crushed Stone (Preferred) Rounded Stone
Figure 3.2 Aggregate Geometry

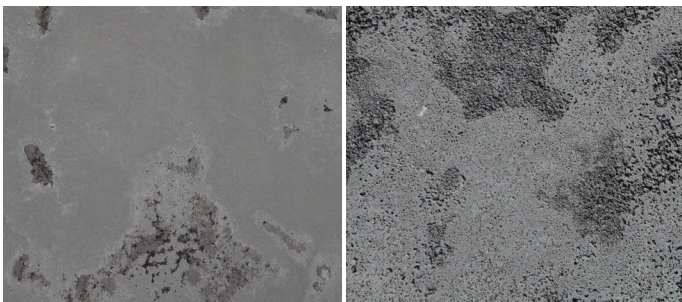
Aggregate Distribution + Density Aggregate is distributed across the entire surface of the panel following density limits that have achieved the best results for each KORSA Design Mix. KORSA Standard Panels A01, A02, A04, and A05 (page 4) are examples of even distribution with medium to high density per square foot. Alternative options include processes that create variations similar to naturally occurring surfaces:

Organic Dispersion Irregular distribution of surface aggregate within control limits create an organic dispersion on the panel surface. KORSA Standard Panel A03 was created through distribution of a very fine aggregate to achieve a natural veining effect similar to limestone. (Figure 3.3)

Overloaded Density The surface of a KORSA Panel may be distressed with fine to small aggregate. This process creates random marbling effects and is available in both the cast and mediablast finish on a custom basis. (Figure 3.4)



Cast Finish Mediablast Finish
Figure 3.3 Organic Dispersion



Cast Finish Mediablast Finish
Figure 3.4 Overloaded Density

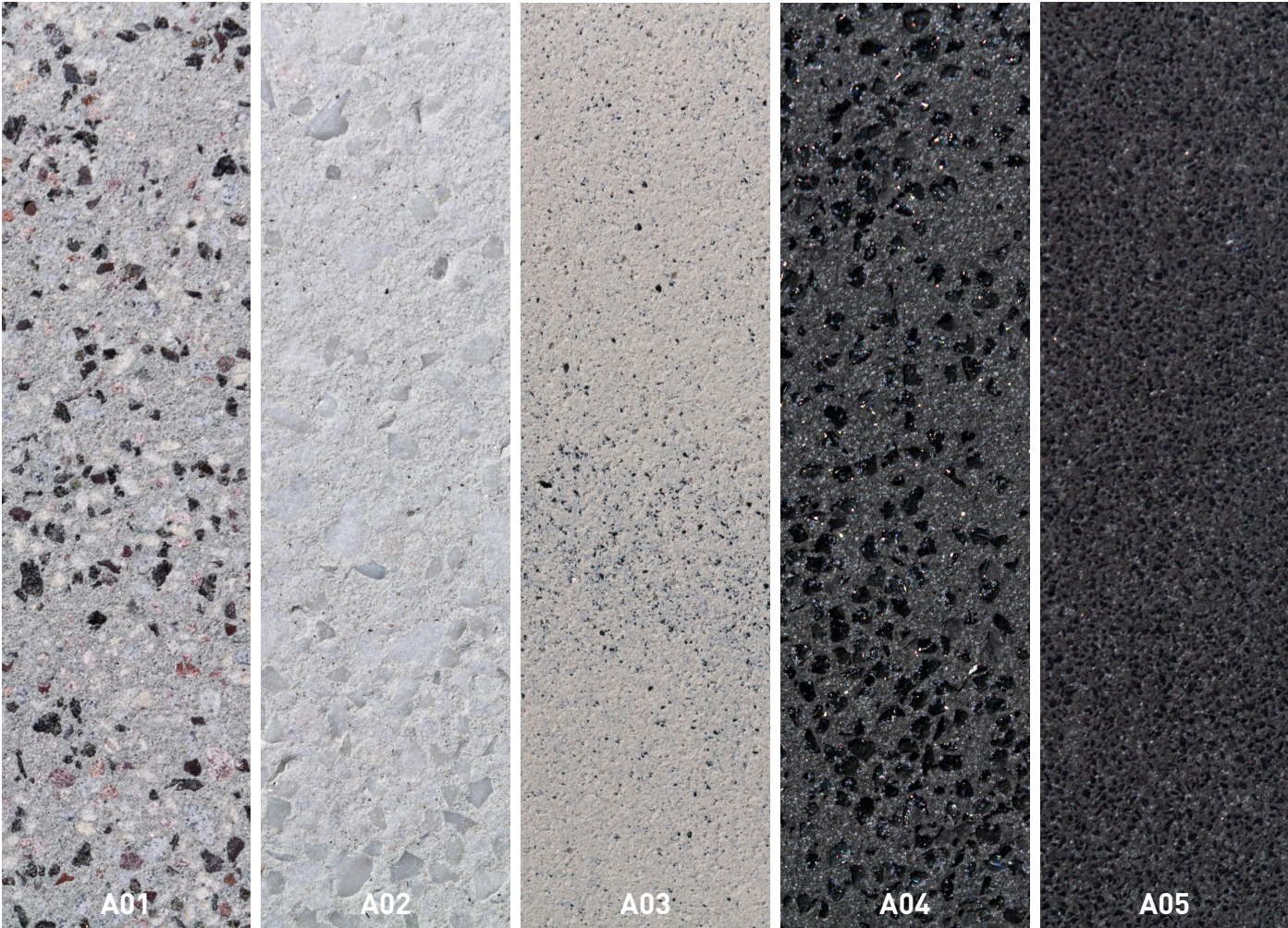
KORSA Standard A collection of approved and readily available aggregates, design mixes, and panels.

Aggregate KORSA Standard Design Aggregates include a wide range of aggregate size, shape, mineral type, and color that are available in sizes that fit within our standard 5/8" thickness, have consistent supply sources, and have the lowest health and safety risks possible.

Design Mixes KORSA Standard Design Mixes provide design-minded combinations of aggregates that have been tested and approved to maintain structural integrity and strength when applied as a surface layer to the AIUHPC base matrix.

Panels KORSA Standard Panels A01, A02, A03, A04, and A05 (shown below) are applicable in a variety of design settings, featuring curated design mix and base color combinations.

Base Colors KORSA Standard Panels are cast in the TAKTL colors of Titanium 63, White 87, Bone 78, and Graphite 40, as reflected in the table below. KORSA Standard Design Mixes may be cast in any base color, either another TAKTL standard color or a custom color. Casting in a custom base color requires a lead time of 6-8 weeks.



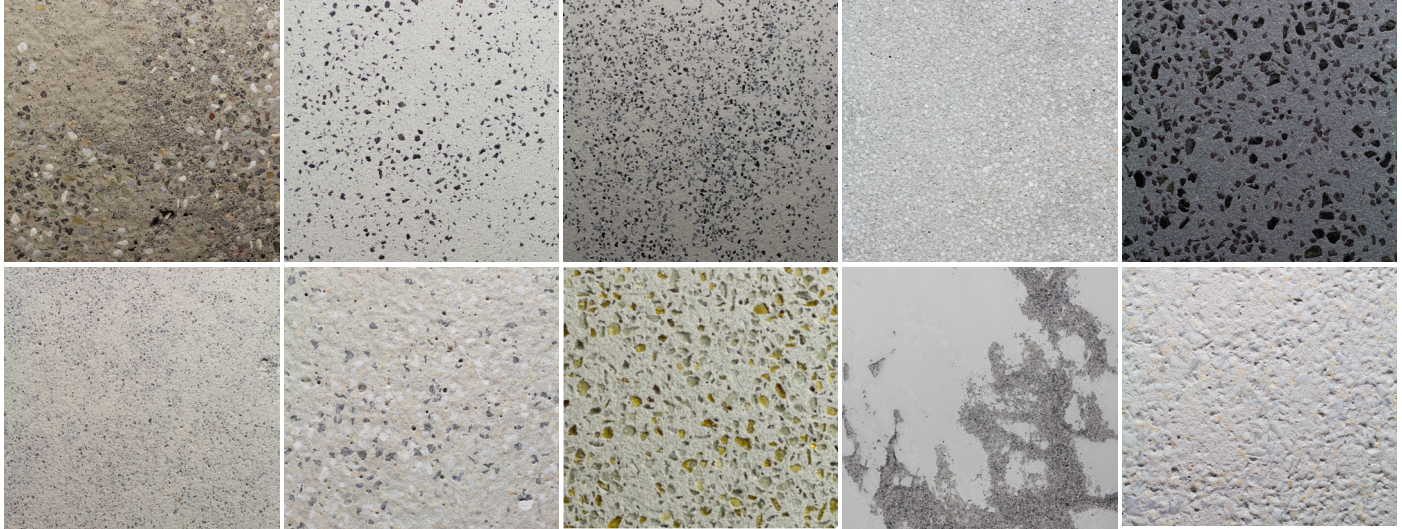
KORSA Standard Panel Specifications

| ID | Base Color | KORSA Standard Design Mix | | | |
|-----|-------------|---------------------------|--------------------------|------------------------------|----------------|
| | | Size | Visual Description | Mineral Type | Spread Density |
| A01 | Titanium 63 | #0 | Black, White, Gray, Rose | Marble, Gabbro | High |
| A02 | White 87 | #0-1 | White, Light Gray | Glass, Marble | High |
| A03 | Bone 78 | ≤#00 | Tan, Gray | Syenite, Hematite, Magnetite | Medium |
| A04 | Graphite 40 | #0 | Translucent, Smokey | Recycled Glass | Medium |
| A05 | Graphite 40 | ≤#0 | Black | Bauxite | High |

KORSA Custom Combine custom aggregates, design mixes, and base colors to create endless possibilities that meet project design needs.

Custom Aggregate Designs TAKTL's Materials Lab develops KORSA Custom Panels for projects requiring a non-standard aggregate, base color, or combination. KORSA Custom Panel orders require a 5,000 ft² minimum material order and a 6-8 week lead-time for samples. Additional time is required for strength testing. All KORSA Custom Panels require in-house performance testing and may require laboratory-certified testing for an additional charge.

Texture Limitations KORSA Custom Panels are most commonly achieved with our standard Smooth texture but may be cast in any of our standard flat textures (Smooth, Rough 1, and Rough 2). KORSA Custom Panels are also possible with raised, three-dimensional textures, based upon several factors such as thickness, surface geometry, and size/shape of the aggregates. Panel thickness may be increased to accommodate aggregates with a diameter of 1/4" or larger.



Please contact TAKTL Technical Support to discuss KORSA Custom Panel opportunities.

Matching Natural Materials The durability and versatility of TAKTL KORSA provides exceptional possibilities for matching stone, precast concrete, and cast-in-place concretes with exposed aggregate. For the best outcome, physical samples are required for our lab technicians to most accurately determine the appropriate base color and the type and size of aggregates to introduce into the mix. KORSA Custom Panel matches may require a lead time of 7-8 weeks for delivery due to procurement, casting iterations, evaluation, and testing for compatibility.

Advantages A|UHPC is stronger and thinner than natural stone cladding with a very low coefficient of variation in testing, providing consistent mechanical behavior panel to panel. The exceptional durability of TAKTL A|UHPC allows for thinner, lighter, and stronger panels that can be cast in larger sizes than natural stone, resulting in less expensive attachment systems. TAKTL A|UHPC builds upon the history of UHPC for outstanding strength and durability, water tightness, and excellent resistance to freeze-thaw and chemical degradation.



Left: 5/8" KORSA Custom Panel | Right: 3/4" Sandstone Slab



Left: 5/8" KORSA Custom Panel | Right: 1-3/8" Tennessee Marble



Left: 5/8" KORSA Custom Panel | Right: 2" Custom Precast

Performance Properties

| Material | Thickness (in) | Weight (lb/sf) | Flexural Strength (Psi) |
|-----------------------|----------------|----------------|-------------------------|
| A UHPC | 5/8" | 6.90 | 4641 – 6526 |
| Face Brick | 3 5/8" | 29 – 32 | N/A |
| Terracotta (Hollow) | 1 1/2" | 11.50 | 2494 |
| GFRC (Spray-In) | 1 1/2" | 8.58 | 1740 – 2320 |
| Precast Concrete | 4" – 6" | 40 – 70 | 520 – 725 |
| Limestone (Dim. Slab) | 2" | 22.00 | 435 – 1015 |
| Granite (Dim. Slab) | 1 1/2" | 20.00 | 1203 – 1499 |

KORSA Panel Acceptance Criteria The criteria for evaluating KORSA Panels will be established within the context of a specific project and panel design. The contributing factors for visual evaluation of KORSA Panels include: panel size, size of contiguous cladding area on the facade, panel color, aggregate size, and color relative to the base color. Below is a set of guidelines to use in formulating the acceptance criteria with the design team, owner representatives, and contractors:

Viewing Conditions Often the call for acceptance or rejection of a panel is subjective. Mock-ups will be used to establish expectations and reference acceptable conditions.

- Panels are to be viewed under normal daylight conditions perpendicular to the cladding surface from a distance of no less than 15 feet.
- Panels should be judged in a group of not less than 3 panels typical of the size and orientation of the project. A panel by itself may be viewed as problematic; however, when in the context of other panels, it may be acceptable.

Air Voids Small air voids (1/4" or less and not creating a discernible pattern) resulting from the aggregate distribution do not represent a durability or performance defect and there is no technical reason for rejection of this panel. Aesthetically small imperfections such as this would be acceptable under TAKTL's QC procedures given a reasonable viewing distance (Figure 6.1).

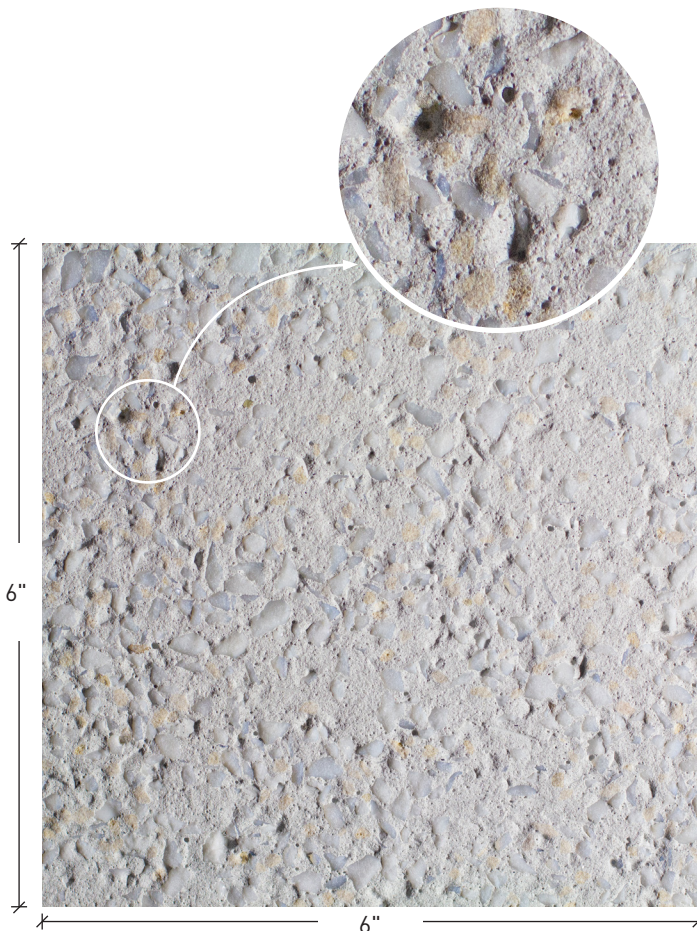


Figure 6.1 Typical air voids, aggregate density and spread

Aggregate Density and Spread Variation in the density of surface aggregate within a panel is inherent to KORSA Panels and application methods (Figure 6.2) and are considered normal. Panels are rejected only when heavier and lighter areas are acutely contrasting and result in a discernible pattern. The contrast between the base matrix and the color of the aggregate can shift what is acceptable or rejected. Uneven distribution will be less noticeable when the aggregate and base color are similar, and the reverse is true for panels where the aggregate is a contrasting hue or value relative to the base matrix. Panels with a "large" contiguous area lacking visible aggregate should be rejected prior to shipment; the definition of 'large area' is relative to the panel size and the size of the field of panels for which it is a part.

Example 1: 5' x 10' panels missing contiguous aggregate in an area greater than approximately 18" to 20" in diameter should be rejected.

Example 2: 2' x 4' panels missing contiguous aggregate in an area greater than approximately 6" to 10" should be rejected.

In each case, as noted above, the panel base color, the aggregate size and color, the surface texture, and the panel size will all have a role in establishing KORSA Panel Acceptance Criteria for a project.

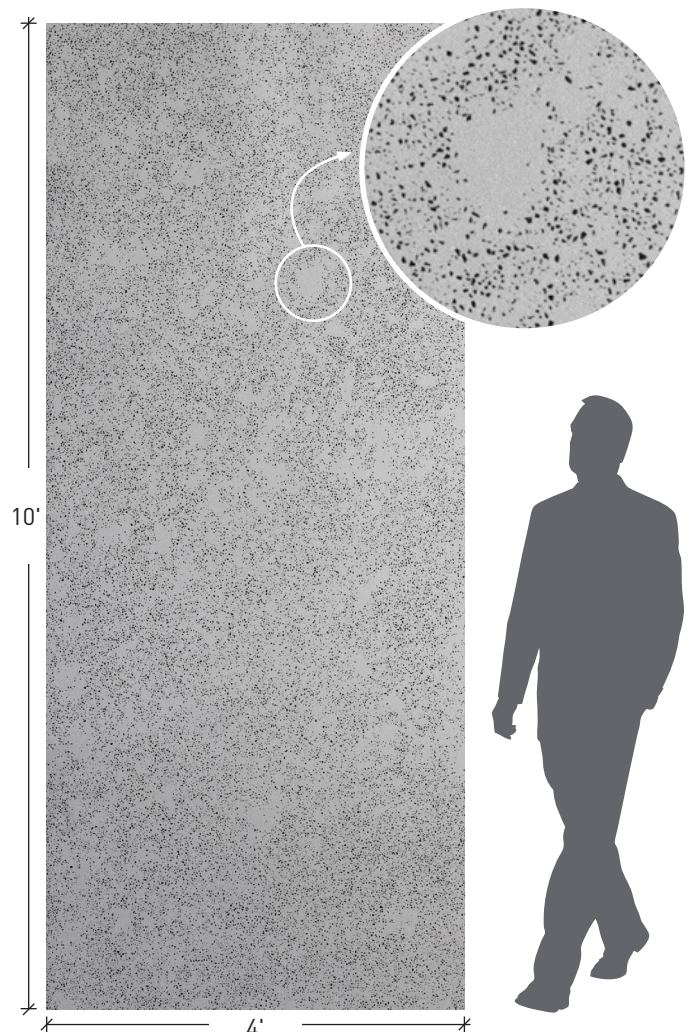
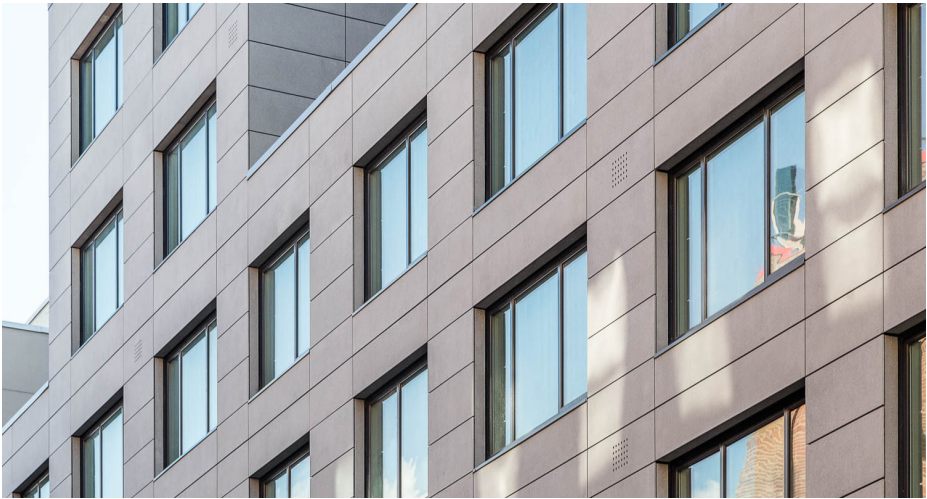


Figure 6.2 Typical acceptable aggregate density and spread

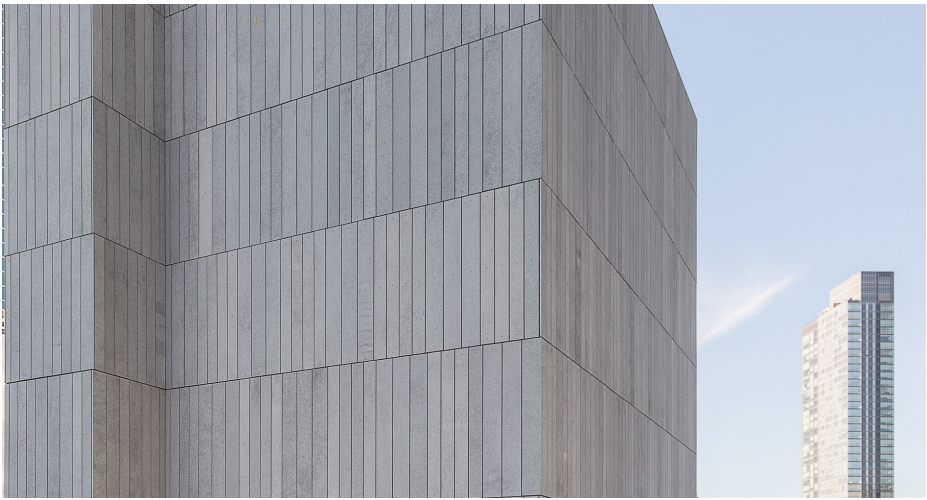
Project Examples



Rainscreen Installation | KORSA Standard Panel (Design Mix: A01, Base: Natural)



Rainscreen Installation | KORSA Custom Panel (Base: Dune)



Interior/Exterior Cladding | KORSA Custom Panel (Base: Custom Gray)



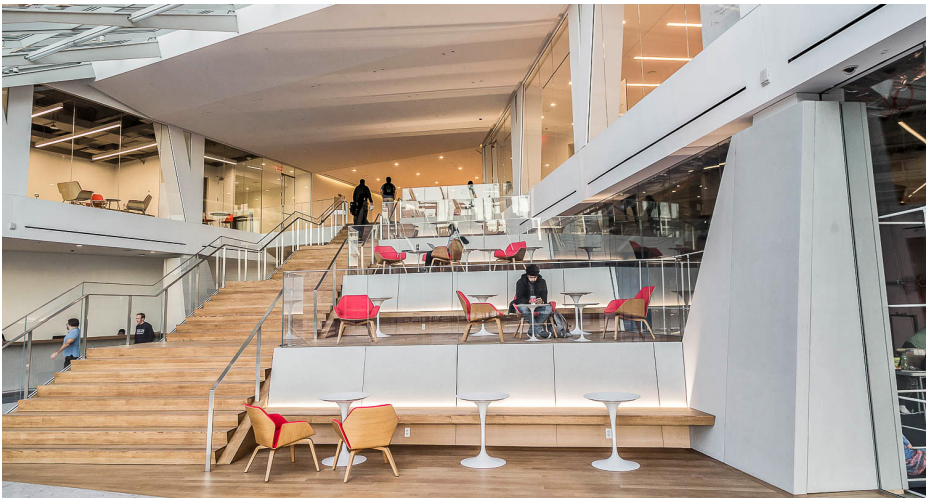
Project Examples



Rainscreen Installation | KORSA Custom Panel, Dual Texture (Base: Titanium)



Unitized Curtainwall | KORSA Standard Panel (Design Mix: A01, Base: Titanium Classic)



Interior Cladding | KORSA Custom Panel (Base: Custom White)