Material Data Sheet

SMART^{UP} Structural

1. General characteristics

Ultra-high performance concrete material produced by combining a premix of cement, aggregates, and other fine minerals with water, liquid admixtures, and metallic fibers.

Packaging:
The premix is delivered in 50lb (23kg) bags or 1800lb (815kg) big bags. The admixtures are delivered in can, barrel, or bulk depending on project size. Metallic fibers are delivered in 50lb (23kg) bags.

Storage:
Premix and metallic fibers should be kept dry before use. Admixtures should be stored above freezing temperatures.

Premix	Premix of cement, sands, and other fine minerals
Color	Gray
Fiber Reinforcement	Steel microfibers L : 0.5 inch (12.7mm) d : 0.008 inch (0.175mm)
Thermal treatment	None
Efficient water-binder ratio	0.14 to 0.17
Maximum aggregate size, D_{MAX}	0.05 inch (1.25mm)

2. Composition

Component proportions indicated below yield 1 yd^3 (0.76m^3) of **SMART^{UP} Structural** with 2.5% (by volume) of metallic fibers.

Component	Weight (lb/yd^3)	Weight (kg/m^3)
Premix	3545	2102
Admixture 1	47.2 – 53.9	28.0 – 32.0
Admixture 2	13.5 – 27.0	8.0 – 16.0
Water	303.4 – 328.7	180.0 – 195.0
Steel fibers	332.9	197.5

3. Mixing and pouring protocol

Mixing **SMART^{UP} Structural** takes approximately 15 minutes per batch when performed in a high-shear concrete mixer. Mixing takes approximately 50 minutes per batch when performed in a ready mix truck.

For best results, the following mixing procedure is advised:

- Add half of dry premix into mixer.
- Add all batch water and admixtures. Wait for the mixture to "turn fluid". The UHPC will be very overwatered at this time.
- Add the remaining half of dry premix gradually, allowing the mixture to re-achieve fluidity after each addition.
- Add the metal fibers. Be careful to avoid large clumps of fibers falling into the mixer to ensure good dispersion in the UHPC.
- Continue mixing for several minutes after fiber addition.
- If air content is a concern, allow concrete to sit without mixing for a few minutes before pouring to reduce air pockets.

SMART^{UP} Structural is a self-leveling concrete that does not require vibration or other consolidation methods. *Typical concrete consolidation methods are harmful to fiber suspension in UHPC and should be avoided.*

4. Fresh concrete properties

Static flow test *Per ASTM C1347*	7 to 10 inches (178 to 254 mm)
Workability time	60 minutes
Set time (initial/final)	9 hours / 17 hours
Density	150 – 156 lb/ft^3 (2400 – 2490 kg/m^3)
Air content	2 to 5%
Mix temperature *Ambient temperature**	70 - 90 °F (21 – 32°C) *50 - 85 °F (10 – 30°C)*

**Ice should be used when ambient temperature is above 85°F (30°C).*

United States Sales Department
Robert Taylor, 334.750.9648 / Hannah Tzabari, 205.329.1527
www.smartupuhpc.com
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5. Mechanical characteristics

Mechanical characteristics	Value	
24-hr Compressive Strength *ASTM C1856/C39*	12.9 ksi	89 MPa
4-day Compressive Strength *ASTM C1856/C39*	17.8 ksi	123 MPa
28-day Compressive Strength *ASTM C1856/C39*	23.8 ksi	164 Mpa
Direct Tension First Crack Stress *FHWA-HRT-17-053*	0.95 ksi	6.5 Mpa
Direct Tension Peak Stress *FHWA-HRT-17-053*	1.11 ksi	7.6 Mpa
Modulus of Elasticity *ASTM C1856/C469*	7500 ksi	51.7 GPa
Poisson's ratio	0.2	

6. Durability properties

Material property	Value
Chloride Ion Permeability *ASTM C1856/C1202*	55 coulombs
Freeze-Thaw Durability *ASTM C1856/C666*	RDM 100%
Abrasion Resistance *ASTM C1856/C944*	0.021 oz lost
Alkali-Silica Resistance *ASTM C1856/C1260*	0.01% change (Innocuous)
Scaling Resistance *ASTM C1856/C672*	Visual Rating y < 1

7. Other properties

Material Property	Value
Drying Shrinkage *ASTM C1856/C157*	280 microstrain
Direct Tension Bond Strength *ASTM C1856/C1583*	0.385 ksi
Rebar Pullout Testing *ASTM E488 - #4 @ 4 in depth*	18.9 ksi (Steel Failure)
Rebar Pullout Testing *ASTM E488 - #5 @ 5 in depth*	29.2 ksi (Steel Failure)
Rebar Pullout Testing *ASTM E488 - #6 @ 6 in depth*	42.6 ksi (Steel Failure)

8. Curing and finishing

Heat curing is not required for this product. Final set occurs between 12 and 20 hours depending on ambient temperatures.

Exposed faces of items made of **SMART^{UP} Structural** require protection to avoid damage due to evaporation as the concrete sets. Examples include plywood formwork, plastic sheeting, or curing compounds, though other arrangements can be discussed based on site conditions.

The fineness of the granular composition of **SMART^{UP} Structural** allows the product to retain intricate, high-quality surface textures if desired. The high fluidity and small aggregate size also allow finely detailed items to be produced.

The values presented in this product data sheet are based on laboratory testing conducted in an AASHTO-accredited concrete testing facility. They do not guarantee that performance is achieved for any type of work considered. The product must be used following current recommendations of the manufacturer regarding the mix design, raw materials, mixing procedure, equipment used, and method of casting such that the properties are not compromised. It is common to require additional studies at the proposed job site.

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