WHAT IS ULTRA-HIGH PERFORMANCE CONCRETE?

Ultra-high performance concrete (UHPC) is an advanced construction material that affords new opportunities for the future of the highway infrastructure.

Ultra-high performance concrete (UHPC) is cementitions-based composite materials with high compressive strength and enhanced durability, Castable and Self-Consolidating.


Portland Cement-Based


Castable


Self-Consolidating

MATERIAL

UHPC production was mainly caused by the production of the steel fibers, portland cement, and high-range water-reducing admixtures.


Fiber Reinforcement

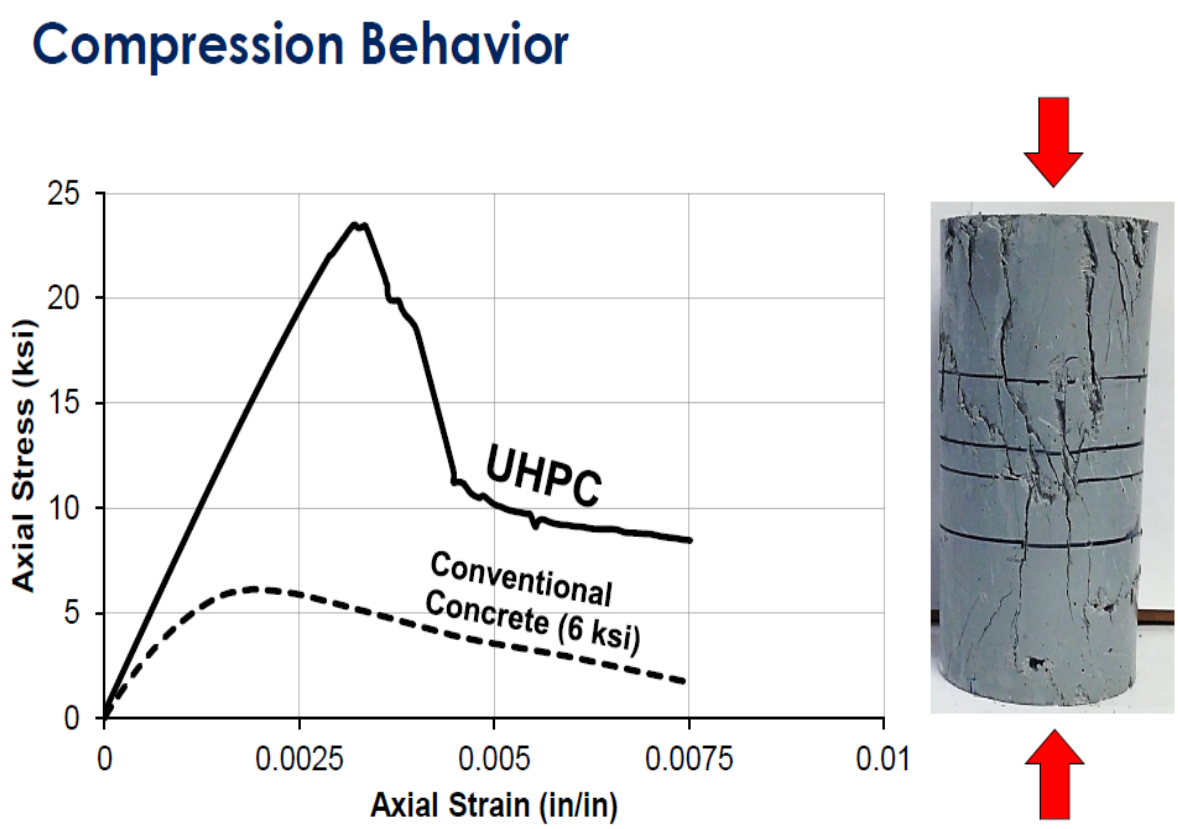
Superplasticizers


Portland Cement

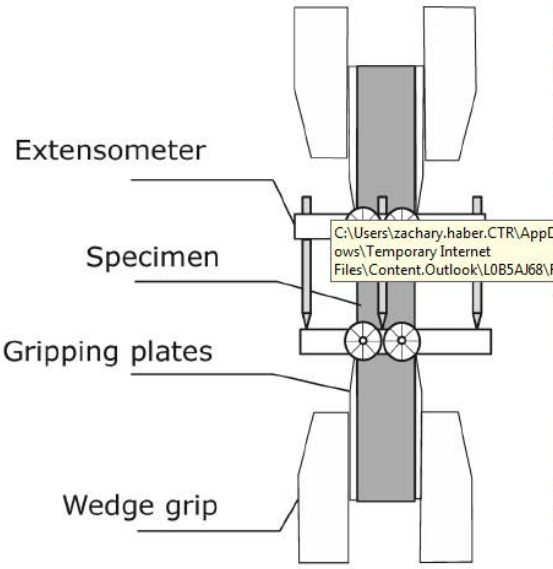
UHPC PROPERTIES: VALUES

BIL	PROPERTIES	VALUE
	Compressive Strength	18 to 35 ksi
	Modulus of Elasticity	6000 to 8000 ksi
	Sustained Tensile Capacity	0.75 to 1.5 ksi
	Rapid Chloride Test	20 to 360 Coulombs
	Permeability (Chloride Ion Diffusion Coefficient)	2 x 10-13m2/s
	Freeze/Thaw Resistance	RDM > 95%

BEHAVIOR OF UHPC



Tensile Behavior



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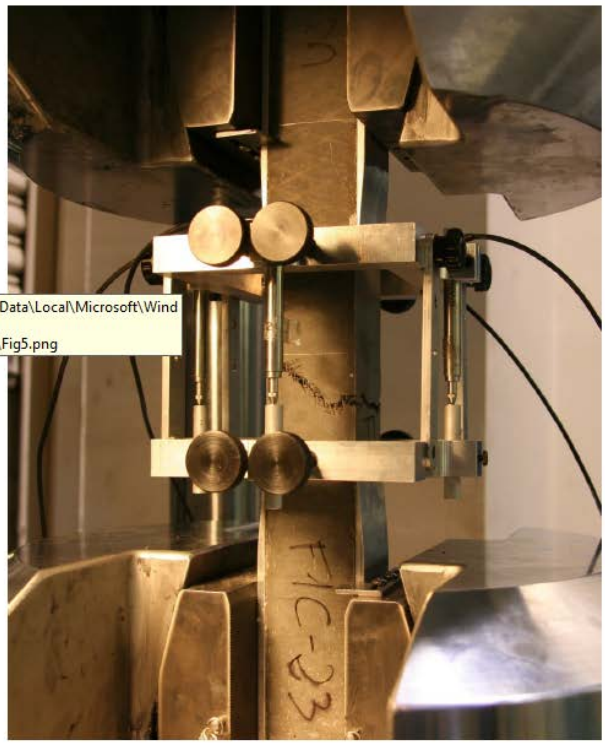
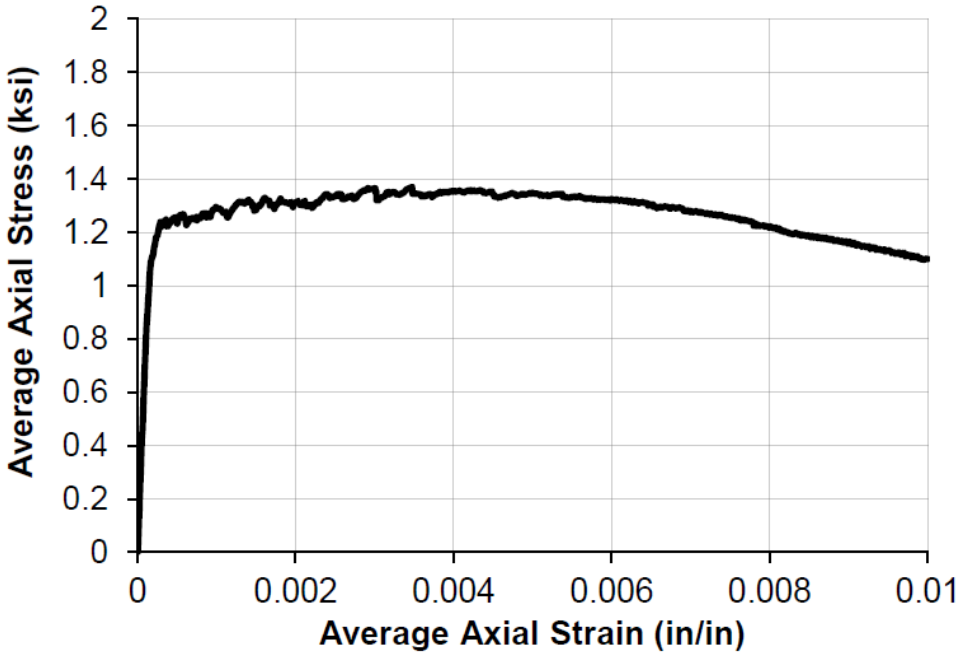


Specimen: 2” x 2” x 17”

Tensile Behavior



TERMINOLOGY

Various terms are used to refer to cementitious-based composite materials with high compressive strength and enhanced durability. These include the following:

- Compact reinforced composite (CRC).
- Densified small-particle (DSP) concrete.
- Fiber-reinforced high-performance concrete (FRHPC).
- High-performance fiber reinforced cement composite (HPFRCC).
- Macro defect free (MDF) concrete.
- Multi-scale fiber-reinforced concrete (MSFRC).
- Reactive powder concrete (RPC).
- Steel fibrous cement-based composite (SFCBC).
- Ultra-high performance concrete (UHPC).
- Ultra-high performance fiber-reinforced cementitious composite (UHPFRCC).
- Ultra-high performance fiber-reinforced concrete (UHPFRC).
- Ultra-high strength concrete (UHSC).
- Ultra-high strength cement-based composite.
- Ultra-high strength cementitious material.
- Ultra-high strength fiber-reinforced cementitious composite.

Based HWA researches, UHPC had greater frost and deicing salt resistance, a lower rate of carbonation, and greater chloride resistance than conventional concretes. Consequently, highway structures made with UHPC will have lower maintenance and repair costs in the future compared with conventional concrete bridges.

However, sufficient data were lacking to perform realistic life cycle cost analyses.

COSTS

The initial unit quantity cost of UHPC far exceeds that of conventional concrete. Consequently, applications have focused on optimizing its use by reducing concrete member thickness, changing concrete structural shapes, or developing solutions that address shortcomings with existing non-concrete structural materials.

UHPC is a very durable product, and structures that use it are expected to have a longer service life and require less maintenance than structures built with conventional concrete.

BENEFIT FOR HIGHWAY COMMUNITY (BRIDGE CONSTRUCTION)

1.0 UHPC have 4 times material strength from conventional concrete and higher durability.
2.0 As a green concrete and environmental friendly product.
3.0 Known as light weight component
4.0 Standardized and control quality product (factory production).
5.0 Easy construction.
6.0 Short duration for construction.