



American Concrete Institute
Always advancing



UHPC2.0: Addressing the problems of the construction industry



Peter Weber, MACI

President/CEO
ceEntek

Industry Talks Theatre Sponsor



Organised by





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Addressing the Problems of the Construction Industry

Building with less CO₂ Emissions



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Building with less CO₂ Emissions

Agenda

- Concrete problems
- Technology to overcome problems
- Project examples
- Further developments
- The Future of Construction

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Construction related CO₂ sources

Direct sources

- cement
- steel
- ad-mixtures
- aggregates



**Mass
Energy**

Indirect sources

- Construction traffic
- Traffic delays/re-routing



Time

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Concrete Impacts



Concrete's Carbon Footprint

Concrete accounts for 8% of global greenhouse emissions. (nearly 30x that of plastic)

If concrete were a nation, it would be the 3rd largest emitter of CO₂ globally.

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Decaying Infrastructure

The world is challenged by rapidly decaying & increasingly inadequate infrastructure₁.

The US has recognized this risk and will invest USD\$1T in infrastructure; USD\$110B will go towards roads and bridges. Other countries to follow.



Growing Demand

In the next 40 years app. 2.5 trillion square feet of infrastructure will be built.

It's the equivalent of putting up another New York City every month for the next 40 years₂.

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The Solution: UHPC2.0™

ceEntek's solution to worldwide construction challenges are less mass, less steel, less time to completion, extended durability based on leading edge Nano technology with unmatched sustainability.



Less Mass

Structures can be up to 5x lighter, reducing mass and increasing load to mass ratio.



Sustainable

Less cement, less steel, use of waste products, extremely durable, fully recyclable.



Time

Structures can be repaired or assembled in days versus months.



Durable

UHPC2.0™ is at least 3 to 4 times more durable than normal concrete reducing repair.

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The Technology: ceEntek's UHPC2.0™

ceEntek's proprietary CNFs are mixed into concrete to increase the strength at the molecular level - creating the most sustainable, strongest, and safest solution.



Simple

CNF technology reduces the number of ingredients to five and eliminates the need for chemicals and additives.



Stable

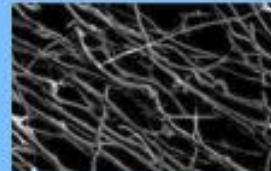
UHPC2.0™ guarantees excellent workability and strength under all climate conditions.

UHPC2.0™

Proprietary CNF Paste



Plasticizer



CNF



Safe

Elimination of harmful silica fume and silica flour protects workers and the environment.



Sustainable

Less material, less steel, use of waste products, extremely durable, fully recyclable.



Sand



Cement



Water

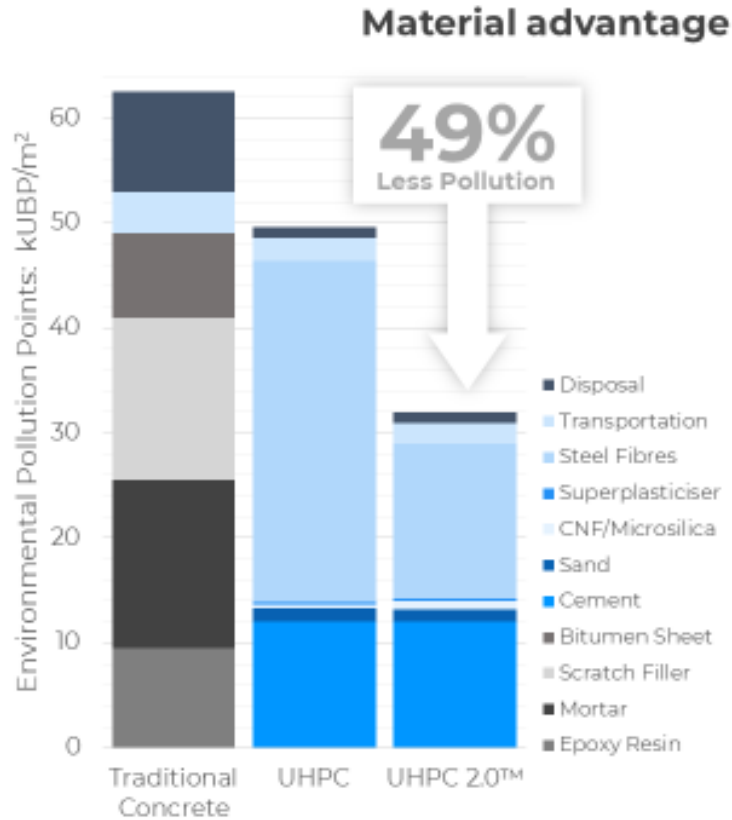
Locally sourced ingredients

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Sustainability Advantages



Transport advantage

- + At the ceEntek factory in Singapore, **CNF** are blended with superplasticizer into a paste representing <1% of the overall UHPC2.0™ system to be transported long distance
- + The bulk of the material is made within 250 miles of the project site

92%

Transport savings in CO₂ emissions

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Accelerated Bridge Construction

ceEntek's Project: I-52, Indiana USA



Precast piers, UHPC2.0™ connections



Precast bridge decks, UHPC2.0™ connections

Bridge completed in **35 days**, instead of **180 days** with conventional approach

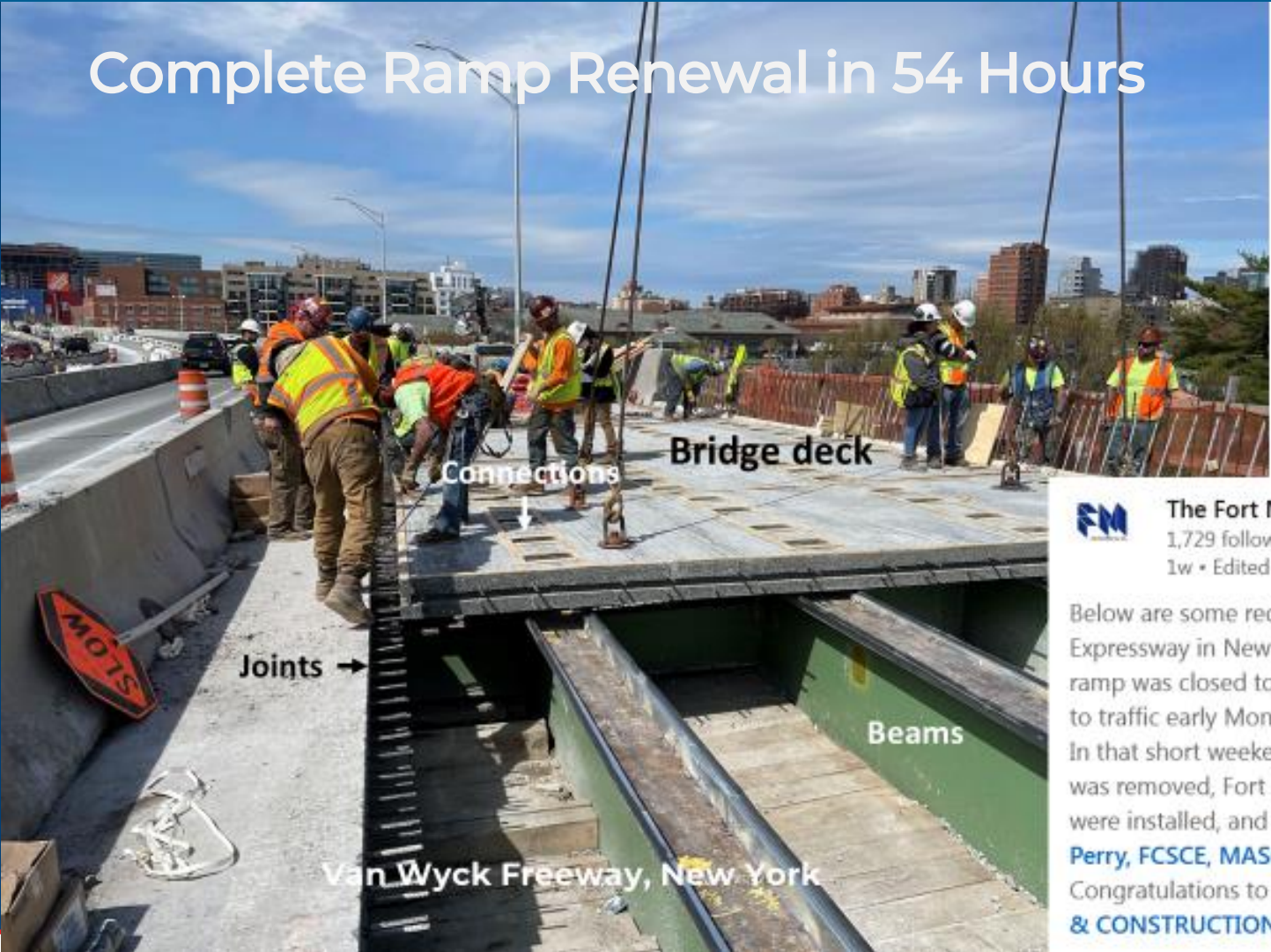
80% less CO₂ for Traffic disruptions only!

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Complete Ramp Renewal in 54 Hours



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- Step 1: Joints, connections, link-slabs
- Step 2: complete bridge decks
- Step 3: Beams + columns



The Fort Miller Co., Inc.
1,729 followers
1w • Edited •

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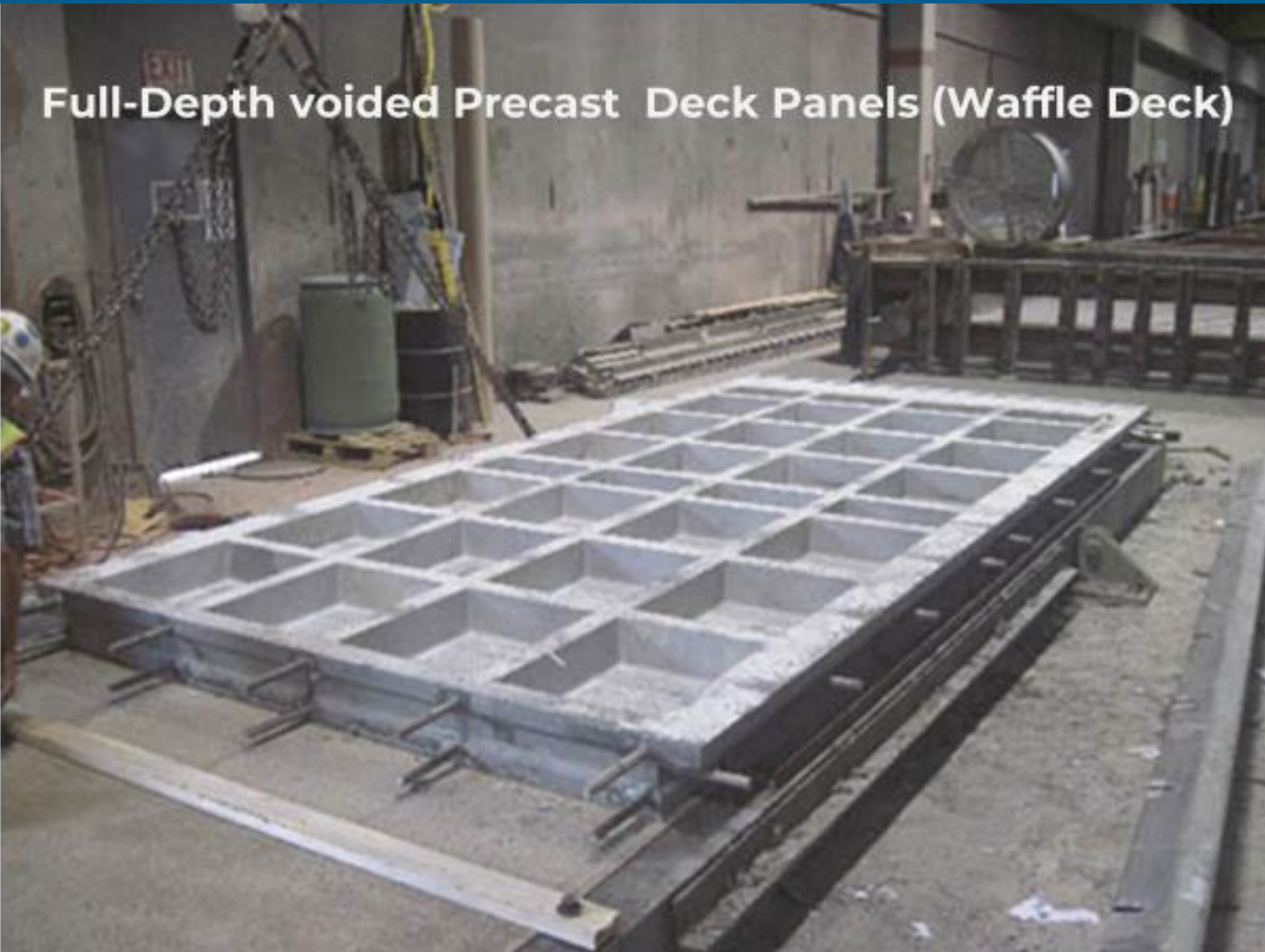
Below are some recent photos of the Van Wyck Expressway in New York City. This bridge structure / ramp was closed to traffic on Friday night and reopened to traffic early Monday morning! In that short weekend closure, the existing bridge deck was removed, Fort Miller precast bridge deck panels were installed, and UHPC joints by **ceEntek Pte Ltd Vic Perry, FCSCE, MASc., P.Eng.** were cast and cured. Congratulations to the team at **EL SOL CONTRACTING & CONSTRUCTION CORP** for making this happen!



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52%
Of the concrete₆

Less than
42%
Of the steel

22%
Of the CO₂

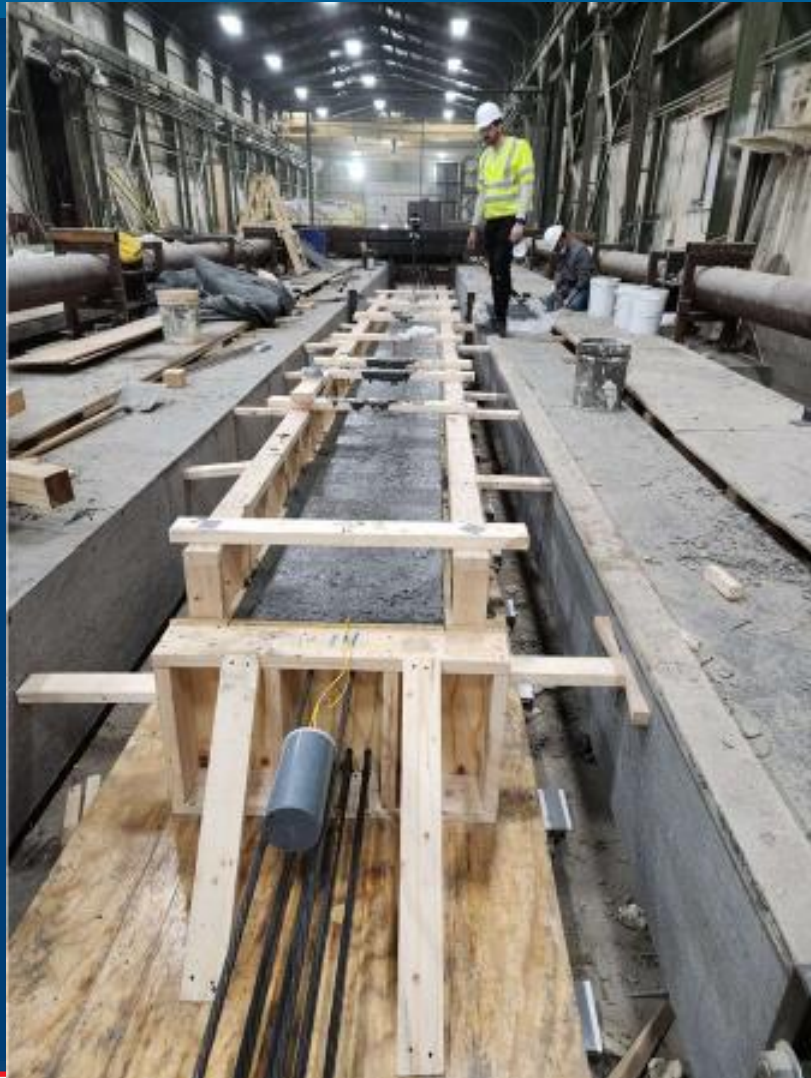
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Casting of pre-stressed girders

Pre-stressed girders casted with UHPC2.0™ replace Steel girders or massive concrete structures.

- **Less material**
- **Less steel**
- **Extended lifetime**
- **Lower cost**

Resulting in short- and long term CO₂ reductions.

Casting at Fort Miller, NY

ceEntek Confidential

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Lusail Towers – Innovative design by Foster + Partners .

- + Lusail Towers will be the tallest in the state and will be featured in the opening & closing ceremonies of the 2022 World Cup
- + The towers will host the headquarters for the Qatar National Bank, Qatar Central Bank, and Qatar Investment Authority alongside several other global organizations including Qatari Diar
- + Environmental design was a key driver in the project's design
- + Targeting 4 stars in the regional Global Sustainability Assessment System (GSAS), the design includes centralized thermal storage using innovative phase change materials, high-pressure hydronic systems, demand-controlled ventilation, and efficient LED lighting
- + The molded concrete panels give the buildings a high thermal mass, with minimal punched windows that reduce the amount of solar heat to the interior space

**Less material – less time
extended durability**

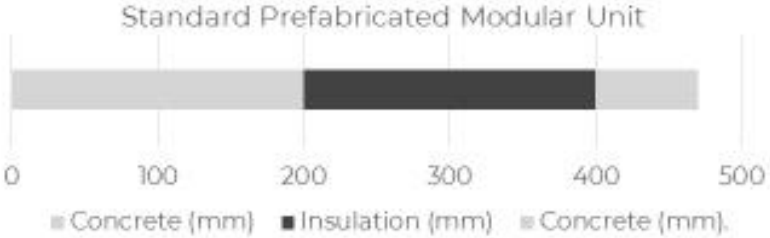
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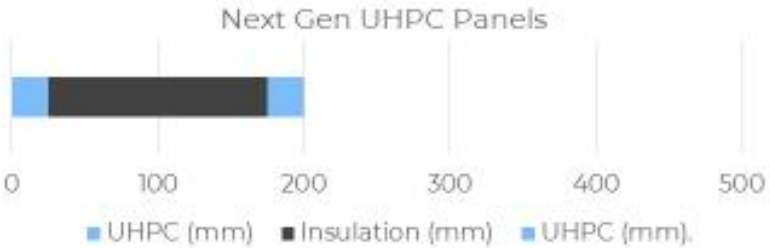
**Three dimensional, hollow castings
UHPC strength 20mm**

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Increasing efficiency through Innovation



Thinner, lighter, energy efficient Insulated Sandwich Panels provide access to a larger geographic market area due to better transportability. Higher production volumes allow additional cost savings due to efficiencies of scale.



23%
Of transportation

80%
Weight reduction

18.5%
Of the concrete

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ceEntek Approach



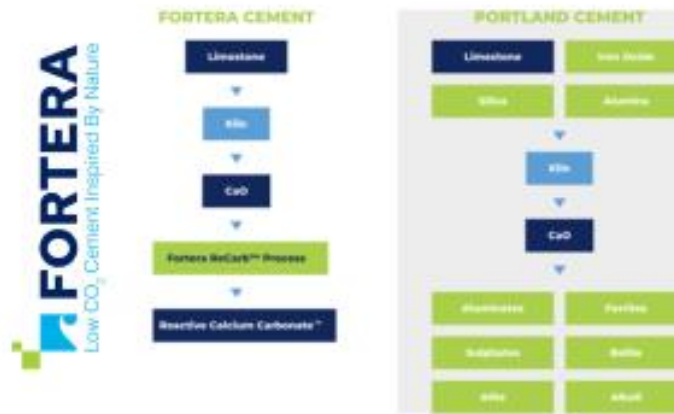
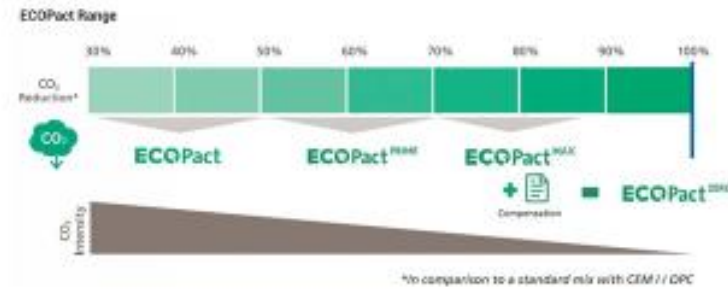
Innovating the curing process



Embedded CO₂ is chemically converted into solid calcium carbonate which improves concrete's compressive strength.

Producers using CarbonCure for Ready Mix reduce cement content by 3-6% with no compromise on concrete quality or performance.

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Material
System
Mass
Time
Carbonation

UHPC2.0™

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Low CO₂ and Clean Air

Clean Air:

- Elimination of hazardous dust at the construction site
- No Silica Fume – No Quartz Four – Nano materials in Paste
- Dry blend: Binder (cement/GGBS/CaO₃) plus sand

Low CO₂*

- + 50% replacement of cement with GGBS or Fly-Ash
→ CO₂ reduction from 415kg/ton to 212kg/ton UHPC
- + GGBS carbonation
→ CO₂ reduction from 415kg/ton to 163kg/ton UHPC
- + Recycled glass as sand replacement
→ CO₂ reduction from 415kg/ton to 83kg/ton UHPC
- + Carbonated recycled concrete
→ Total potential sequester of CO₂ in 1 ton of recycled concrete: 500kg
250kg recycled concrete in 1 ton UHPC, 125kg CO₂ sequestered
→ **UHPC2.0™ is carbon negative**

* All data based on Stevens Institute of Technology, USA

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UHPC2.0™: Low CO₂ and Clean Air



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Image Credit: Vincent Callebaut

**UHPC2.0™ is
changing the way
structures are built
towards a greener
& lasting future**

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KAUST Spins-in Five Cutting-Edge International Startups and Brings New Tech to Saudi Arabia



THUWAL, Saudi Arabia--
([BUSINESS WIRE](#))--[King Abdullah University of Science and Technology \(KAUST\)](#) has recently wrapped up 'Destination Deep Tech,' a Saudi-first program that spins in leading-edge global startups to the Kingdom to develop deep tech innovations. The international startups - [CeEntek](#), [Hopu](#), [Insignes-Labs](#), [Pasgal](#), and [Proteinea](#) - were chosen to experience the three-month program as a result of their highly advanced technology expansion into the MENA region.



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