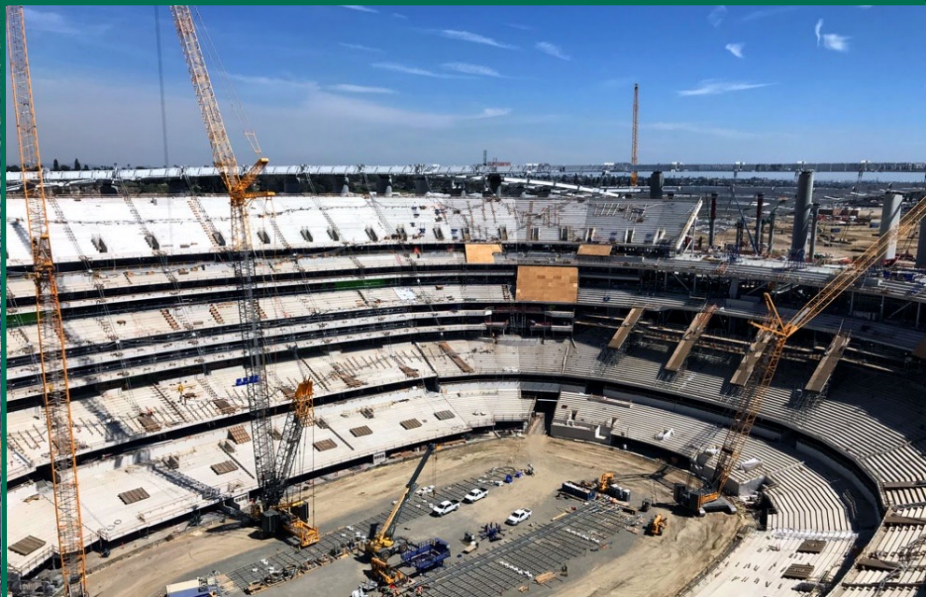
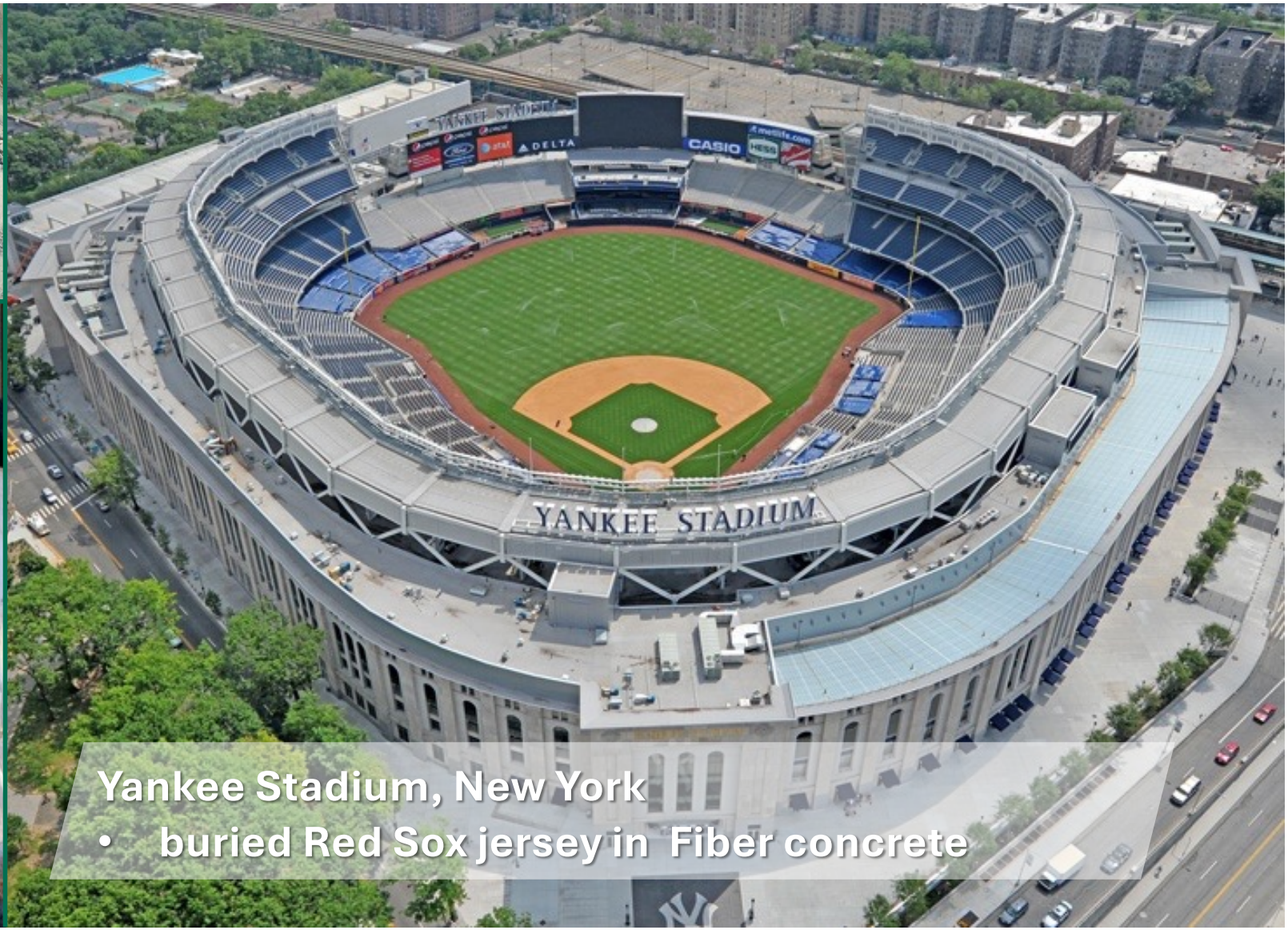
Inglewood, CA
Tuf-Strand SF @ SoFi Stadium





Yankee Stadium, New York

- buried Red Sox jersey in Fiber concrete

Fiber Reinforcement Products for Concrete

Calculator for Measuring Carbon Footprint

Quantify the savings in GWP of using fiber versus steel.

Environmental Product Declaration

(EPD) is a report that documents the environmental impact of a product throughout its life cycle.

Fiber Calculator to determine dosage rate of macro fibers in lieu of WWF

Fiber-Reinforced Concrete

TUF-STRAND SF

Environment Product Declaration - GWP Workbook calculator - US UNITS

EUCLID CHEMICAL

Project Name:

This worksheet calculates the approximate total Global Warming Potential (GWP) of TUF-STRAND SF concrete in comparison to conventionally reinforced c

input required data	
calculated data	
output	

These calculations are only provided for the manufacturing of the reinforcing materials and do not include any site transport to the project site. Note that fiber will generally be included with delivery of the concrete while steel would need to arrive separately and require additional handling, storage and fabrication.

Concrete Volume Calculations

Length, ft	400	ft			
Width, ft	500	ft	Area of concrete	200,000	ft^2
Thickness, in	8	in	Volume of concrete	4,938	yd^3

Steel Reinforcement Details

Bar diameter	0.5	in	Length of steel required	400,000	ft
Bar Spacing	12.0	in	Length of steel to order	412,000	ft
Double mat layer?	No		Weight of steel required	275,271	lb
Percentage for laps	3	%	**GWP Value for steel**	106,162	kg

Fiber Reinforcement Details - provided by engineering analysis

Fiber Dosage	5.0	lb/yd^3	Weight of fiber required	24,691	lb
			GWP Value for fiber	34,505	kg

GWP Comparisons

GWP Savings of fiber from steel	-71656	kg
GWP Reduction of steel to fiber	-67%	

Cost Comparisons

Steel - Raw material	800.0	$/ton	Total Cost of Steel	$ 206,453	
Steel - Labor / Install	700.0	$/ton	Cost of Steel per area	1.03	$/ft^2
Fiber	7.00	$/lb	Total Cost of Fiber	$ 172,840	
			Cost of Fiber per area	0.86	$/ft^2
Cost saving for TUF-STRAND SF:				$ 33,614	
				0.17	$/ft^2

GWP for steel rebar (CRSI) provided by CRSI EPD 362	0.85	kg CO2eq/kg steel
GWP TUF-STRAND SF provided by NRMCA EPD:20080	3.08	kg CO2eq/kg fiber

NRMCA

The University of Akron

TUF-STRAND SF

TUF-STRAND SF Slab-on-Ground Carbon Footprint Calculator

Developed by
Dr. A. Patnaik and Dr. T. Cutright
The University of Akron

Contact: Mr. Michael Mahoney
Email: info@euclidchemical.com Phone: (800) 321-7623

EUCLID CHEMICAL
An RPM Company

This Calculator Provides Project Specific Carbon Footprint for Slab-on-Ground Floor.
Comparison Can be Made between Fiber Reinforced and Steel Reinforced Slab-on-Ground Floor.
Password: Euclid

For New Project, Press: Ctrl + N
Caution: Will Delete All Existing Input

INPUT DATA — Please Input Your Data in Yellow Cells Only. — May 20, 2012

Project Title — Baltimore Industrial Floor Example Project

Click Here for System Boundary

ISO 14040 Compliant

Floor Dimensions	Input Units	US Customary
Length		387.30 ft
Width		387.30 ft
Floor Area		150000 Sq. feet

Steel Reinforced Concrete Floor Data		
Floor thickness		8 inches
Concrete Type		4,000 psi Concrete 15% FA
Steel Reinforcement Input Type		US Bar # & Spacing
Bar Size - US Bar #	Enter Data	#4 Bar
Bar Area		0.2 $inch^2$
Bar Spacing	Enter Data	12.00 inches
Steel Percentage (steel ratio)		%
Steel Area per unit width		0.2000 $inch^2$
Allowance for Laps and Splices		2.00 %
Distance from Rolling Mill to Fabricator		160 miles
Mode of Transport		Truck
Distance from Fabricator to Site		20 miles
Mode of Transport		Truck
Quantity of Concrete		3703.7 yd^3
Quantity of Steel		199920 lb

PP Fiber Reinforced Concrete Floor Data	
Floor thickness	8 inches
Concrete Type	4,000 psi Concrete 15% FA
Dosage	4.5 lb/yd^3
Distance from Pellet Plant to Extrusion Plant	2422 miles
Mode of Transport	Rail
Distance from Extrusion Plant to Warehouse	1890 miles
Mode of Transport	Truck
Distance from Warehouse to Batching Plant	650 miles
Mode of Transport	Truck
Quantity of Concrete	3703.7 yd^3
PP Fiber Quantity	16667 lb

Carbon Footprint (CFP) Summary Including the Effects of Concrete

Click Here for Carbon Footprint Summary for Materials

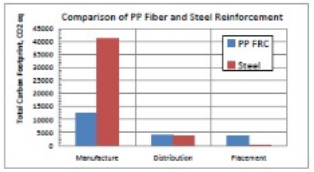
Carbon Footprint (CFP) Comparison of TufStrand-SF Fiber Reinforced Concrete Floor with Steel Reinforced Floor including Concrete

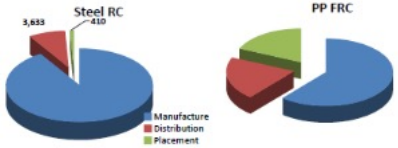
	PP FRC Floor	Steel RC Floor	
Floor Area	150000	150000	ft^2
CFP of Concrete Alone	908534	908534	kg of CO_2 eq
TufStrand-SF Fiber or Reinforcement Alone	20543	45054	kg of CO_2 eq
CFP of Concrete with Fiber or Reinforcement	929077	953588	kg of CO2 eq
Carbon Footprint per Square Foot Area	6.19	6.36	kg of CO_2 eq/ft^2
Percent Increase due to Fiber or Steel Rebar	2.21%	4.72%	
Carbon Footprint Savings for the Floor	24511		kg of CO_2 eq
Carbon Footprint Savings for the Floor	2.6%		

Carbon Footprint Savings from TufStrand-SF Fiber Reinforced Concrete Floor for the Project

Carbon Footprint Direct Comparison Between TufStrand-SF Fiber and Steel Reinforcing Bars

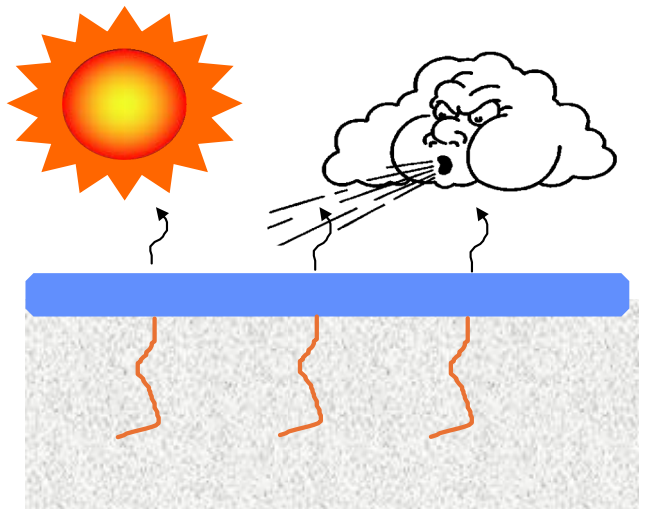
Total Savings of CO_2 eq for the Project	24511	kg CO_2 eq total
Percent Savings of CO_2 eq for the Project by Using TufStrand-SF	54.4%	Relative to Steel Reinforcement





Disclaimer: To be inserted

Reducing the potential for plastic shrinkage cracking



Plastic Shrinkage Cracks

- Caused when the surface evaporates faster than bleed water rises to the surface
- Effects increase with low humidity, high winds, sun, temp increase

AS THE WATER CONTENT INCREASES, THE AMOUNT OF SHRINKAGE INCREASES

DON'T ADD WATER!

- **Synthetic microfibers**: “secondary” reinforcement; finer strands and short cut length (1/8”-3/4”), plastic shrinkage crack control only. They can be monofilament or fibrillated, dosage: 0.5-1.5 pcy

Movie 1967 – The Graduate

Dustin Hoffman - Benjamin
Anne Bancroft – Mrs Robinson
Simon Garfunkel
Oscar Best Director Mike Nichols
ELAINE ELAINE ELAINE

Movie 1967 –
The Graduate

“I am going to tell you one word. Are you listening Benjamin?"
"Yes, I am."
"Plastics."

New Fiber Development

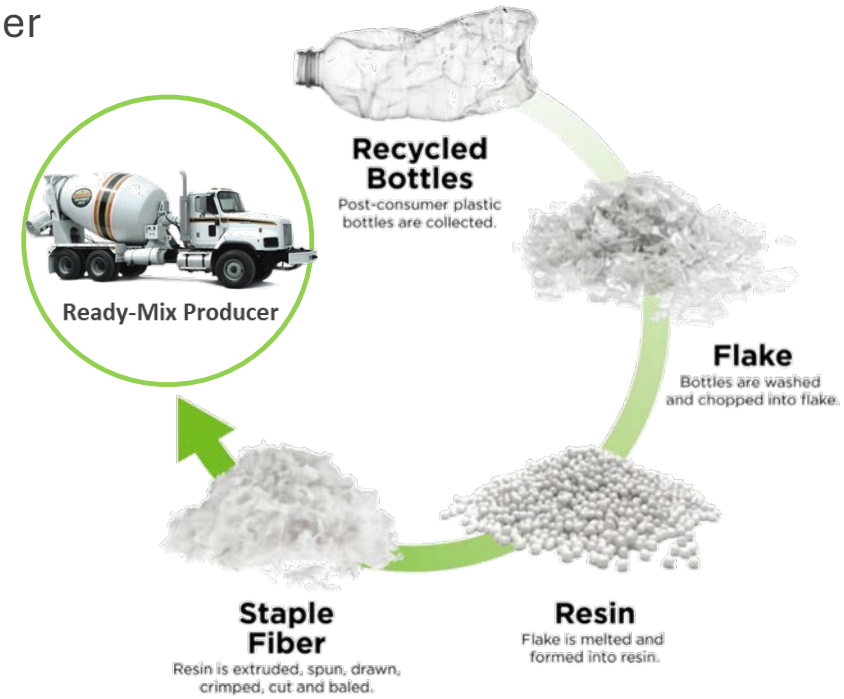
Introducing……

A sustainably resourced microfiber for concrete reinforcement

- Manufactured from polyester fiber developed from a recycling process with “plastic” water bottles as its source
- Provides concrete with enhanced durability and plastic shrinkage protection while being easier to finish

New Fiber for Plastic Shrinkage Cracking

- fine denier monofilament polyester synthetic microfiber
- recommended 0.5 lbs/yd3 (0.3 kg/m3) dosage
- 2.25 denier monofilament, ¼” (6 mm) length
- over 300 million fibers per lb (667 million fibers/kg)



Target Markets:

Plastic Shrinkage Cracking Concerns
Colored, stamped applications with aesthetic concerns
Projects requiring sustainable or **“green”** needs

Additional Information

One 20 lb box of R 225 is manufactured from 190 plastic bottles.

Each yard of concrete dosed at 0.5 lbs/yd^3 diverts nearly 5 bottles from landfill operations

We look forward to working together in the future to create Value Added Opportunities.

Thank You

NESMEA

wlyons@euclidchemical.com

www.euclidchemical.com

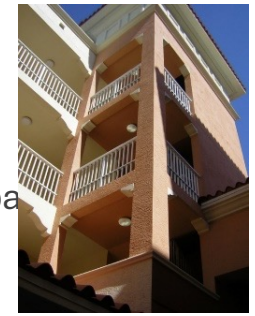
Bill Lyons cell – 201-401-3391

EUCLID CHEMICAL

EUCLID CHEMICAL

Broad Product Line – Concrete Products

- Admixtures for concrete/masonry – ready-mix, precast, block, pipe, shotcrete
- Cement based - structural grouts, repair mortars, hardeners
- Liquid sealers – curing, penetrating, protection, architectural
- Joint fillers – epoxy, polyurea, urethane
- Coatings – acrylic, epoxy, urethane
- Structural epoxies – grouts, mortars, bonding agents, crack repa
- Fibers – macro and micro synthetic
- Decorative – complete line, integral, topical, in-house tool manufacturin





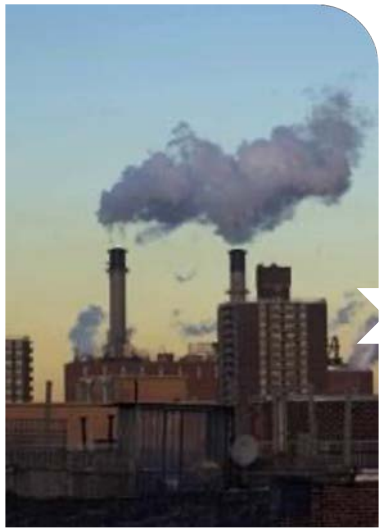


CO_2 Technology

Carbon injection is a technology for the concrete industry that introduces recycled CO_2 into fresh concrete to reduce its carbon footprint without compromising performance.

Once injected, the CO_2 undergoes a mineralization process and becomes permanently embedded. This results in economic and climate benefits for concrete producers—truly a win-win.

CO_2 Supply



CO_2 is collected from large emitters.

The gas is purified by industrial suppliers.

The CO_2 is delivered to concrete plants by industrial gas suppliers.

The CO_2 is stored at concrete plants in pressurized tanks.

How it Works: for Concrete Operations

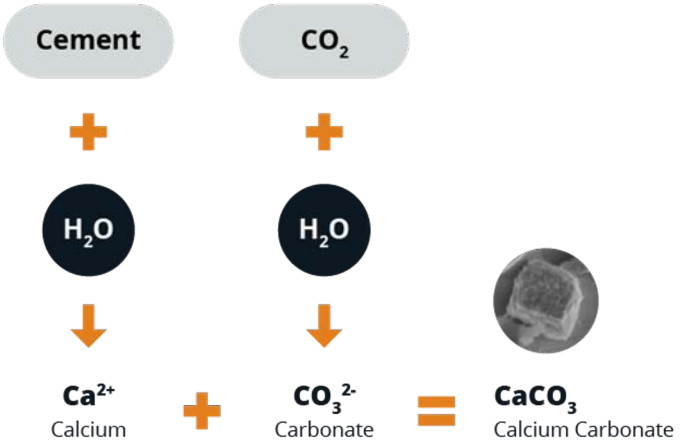
Carbon Co installs its proprietary retrofit equipment (1 day)
CarbonCo optimizes the CO_2 injection rate

Central mix: CO_2 snow injected into mixer during batching sequence
Dry batch: CO_2 snow injected into mouth of truck near the end of the load

Batching integrated with batch operations system
Automated CO_2 dosage

Remote telemetry for customer support
Real-time system monitoring
Toll-free technical support line

What Happens When CO_2 is Injected?



- CO_2 mineralization reaction occurs
- CO_2 converts into **$CaCO_3$ (solid limestone)**

CO_2 has a Neutral Impact on...

Fresh Properties

- Setting time
- Workability/slump
- Concrete pumping
- Air content
- Temperature
- Finishing

Hardened Properties

- Freeze-thaw
- pH
- Density
- Durability
- Color
- Texture

Note: Peer reviewed papers are available to support the above information at carboncure.com.

Durability Validation

Extensive durability testing has verified that there are no adverse impacts, including:

- Academic studies by University of Toronto & University of New Brunswick
- US State Depts of Transportation
- Concrete producer verification
- Third party concrete consultants

"The durability testing showed that the CO_2 injection process had a neutral to positive effect on concrete durability."

Source: Properties and durability of concrete produced using CO_2 as an accelerating admixture (Journal of Cement and Concrete Composites)

CO_2 Saved

20-35 lbs per yd^3

15-20 kg per m^3

Reference Projects

Halifax, NS – RBC Centre
Concrete Producer: Quality Concrete
CO_2 Saved: 90.7 tonnes

Austin, TX – UT Seay Expansion
Concrete Producer: Lauren Concrete
CO_2 Saved: 21.5 tonnes

Indianapolis, IN – Infosys Innovation Hub
Concrete Producer: Irving Materials
CO_2 Saved: 109 tonnes

Calgary, AB – East Deicing Apron
Owner: YYC Calgary International Airport
CO_2 Saved: 160 tonnes

Chicago, IL - McDonald's Flagship
Concrete Producer: Ozinga
CO_2 Saved: 13.6 tonnes

Kapolei, HI – Kapolei Interchange.
Concrete Producer: Island Ready-Mix
CO_2 Saved: 1,500 lbs

Atlanta, GA – Georgia Aquarium
Concrete Producer: Thomas Concrete
CO_2 Saved: 150 tonnes

Arlington, VA – Amazon HQ2
Concrete Producers: Miller & Long, Vulcan Materials
CO_2 Savings Estimate: 1,043 tonnes

Reference Project:

Amazon HQ2 - Arlington, VA

“We are excited to invest in Carbon Injection, a company producing stronger, more sustainable concrete, which will help Amazon and other companies meet The Climate Pledge, a commitment to be net-zero carbon by 2040. We are looking forward to lowering the carbon footprint of many of our buildings by using Carbon Injected concrete, including in Amazon’s HQ2 building in Virginia.”

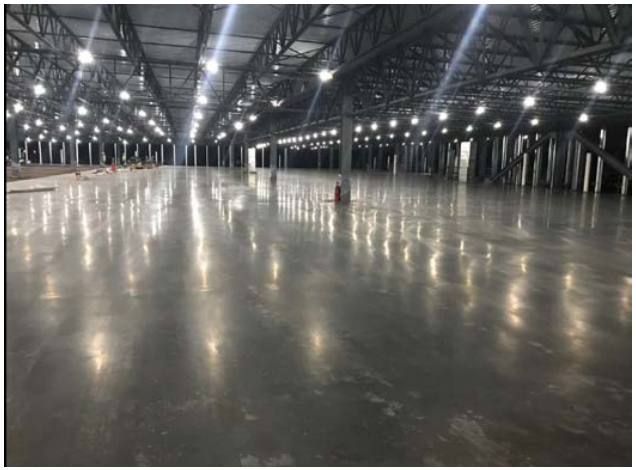
Kara Hurst
Vice President of Sustainability at Amazon

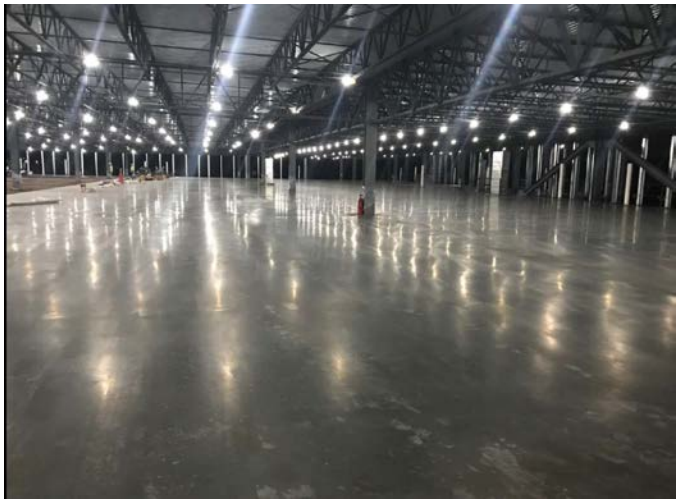
Concrete Suppliers:
Miller & Long, Vulcan Materials Company

Estimated CO_2 savings:
1,043 tonnes

Structural Engineer:
Thornton Tomassetti

Estimated Completion:
2022





Amazon Fulfillment Centers

Bill Lyons

- ACI Fellow
- Recent Past Chair of ACI 306 “Cold Weather Concreting”
- Current chair of Hot Topic Committee
- Member ACI 232 “Fly Ash in Concrete”
- Member ACI 207 “Mass Concrete”
- Former President of Three ACI Chapters, VP of EPA ACI
- Award winner of ACI Chapter Activities 2018
- Member of three PCI Committees including Parking Structure and Total Precast Systems
- Speaker at many associations meetings including ACI, ICRI, PCI and Structural Engineering Associations

EUCLID CHEMICAL

Euclid Chemical's Core Business

Additives for Concrete

Construction Products &Materials

Concrete Admixtures

Construction Materials

Reinforcing Fibers

Integral Colors

Concrete Repair

Stamps & Overlays

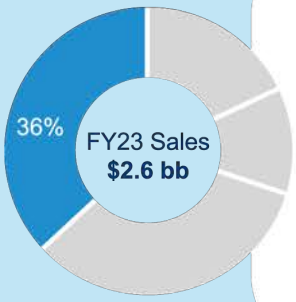
Waterproofing Materials

Admixture & Fibers Categories

- Macro-Synthetic Fibers
- Micro-Synthetic Fibers
- Steel Fibers
- Accelerators
- Retarders
- Air Entrainers
- Water Reducers
- Mid-Range Water Reducers
- High-Range Water Reducers (Superplasticizers)
- Integral Color
- Micro-Silica
- Shrinkage Compensating
- Shrinkage Reducing
- Waterproofing
- Powdered Admixtures
- Mortar Admixtures
- Corrosion Inhibitors
- Flowable Fill

Construction Products Categories

- Bonding Agents
- Architectural Wall Coatings
- Decorative Floor Coatings
- Industrial Coatings
- Traffic Deck Coatings
- Curing & Sealing Compounds
- Dry Shake Floor Hardeners
- Color
- Retarders
- Form releases
- Rebar Coating
- Grouts
- Joint Fillers & Sealants
- Densifiers & Penetrating Sealers
- Horizontal Repair Mortars
- Vertical & Overhead Repair Mortars
- Underwater
- Cathodic Protection
- Coating Primers
- Waterproofing & Dampproofing



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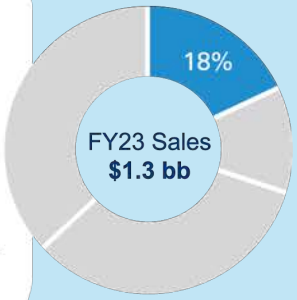
Create and drive unique systems for the construction, restoration and maintenance of the building envelope and infrastructure

TREMCO · Dryvit · Nudura · NewBrick · EUCLID CHEMICAL · illbruck · Flowcrete · Nullifire · Vandex · Viapol · KB

PERFORMANCE COATINGS GROUP

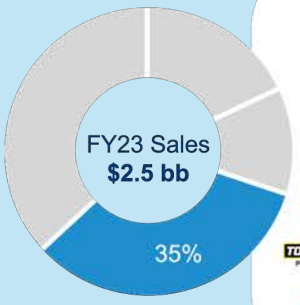
Protecting, enhancing and extending the useful life of concrete, steel and structural alternatives

STONHARD · carboline · Fibergrate Structures · PRIME RESINS · STRATHMORE · KEMTILE · INFRASTRUCTURE · FIBREGRID · ARNETTE POLYMERS, LLC · Dudick · HUMMERVOLL INDUSTRIBELEGG · amt. · BESON Innovative Products · PLASITE · api · SPC · GRUPO PV · AD FIRE PROTECTION SYSTEMS



RPM

FY23 SALES:
$7.3 BILLION



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Create, innovate and lead consumer product category platforms

RUST-OLEUM · DAP · Varathane · ZINSSER · RUST-OLEUM STOPS RUST · TESTORS · Kwik Seal · ALEX · GATOR · XIM · TOR · WATCO · TOUCH'N FOAM PROFESSIONAL · DRYDEX · KRUD KUTTER · MATHYS Paints Waterproofing · MM MODERN MASTERS · Weldwood · MIRACLE SEALANTS · PAINTER'S TOUCH · ROCKSOLID · EPOXYSHIELD · Plastic Wood · TREMCLAD · DYNAFLEX

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