CARBON CURE™

The 3 Big Tech Construction Opportunities for Concrete Producers

The tech industry's sustainability mandate is driving demand for low-carbon construction materials.

Tech Industry Construction Growth

In 2021, non-residential construction is expected to continue its decline in most regions due to the decrease in demand for office and retail space, and a delay in public sector projects—but the technology industry is an outlier.

As the world continues to embrace digital habits in all areas of life, tech companies are building technology campuses, eCommerce fulfillment centers, and data centers and to keep up with their seemingly endless growth trajectory.

CNBC Retail asserted in July 2020 that the "U.S. may need another 1 billion square feet (92,903 square metres) of warehouse space by 2025 as e-commerce booms."

Similarly, according to the Australian Construction Industry Forum, the pandemic "has accelerated surging e-commerce and supply chains are being reconfigured and rebuilt.

The tech sector represents a massive growth opportunity for concrete producers around the world—particularly producers that can deliver low-carbon concrete mixes.

Tech's Green Agenda

Tech companies are the vanguard of the sustainability movement. Most have published ambitious carbon reduction and removal commitments to meet their climate action targets.

Today, carbon reduction and removal are standard business practices in the tech industry and are considered in all areas of operation from the supply chain to the construction of new buildings.

Microsoft committed to being carbon neutral by 2030 and to remove all carbon created directly or indirectly by its products since the company was founded in 1975 by the year 2050.

Amazon co-founded The Climate Pledge and Climate Pledge Fund and is investing $2 billion to support the development of technologies and services that reduce carbon emissions and help preserve the natural world.

Salesforce considers the environment a key stakeholder and publishes a Stakeholder Impact Report annually that holds the company accountable to its environmental initiatives including its green building practices in design, construction, and operations.

A Focus on Embodied Carbon

Most tech companies have already reduced operational carbon dioxide (CO_2) emissions sufficiently to meet sustainability goals. To move the needle on ambitious climate goals, the tech industry is turning its focus to embodied carbon.

> **Operational carbon:** The emissions from a building's energy consumption.

Embodied carbon is the CO_2 emissions associated with materials and construction processes throughout the whole lifecycle of a building or infrastructure.

It includes any CO_2 created during the manufacturing of building materials (material extraction, transport to manufacturer, manufacturing), the transport of those materials to the job site, and the construction practices used. Put simply, embodied carbon is the carbon footprint of a building or infrastructure project before it becomes operational.

> **Embodied carbon:** The emissions from manufacturing, transportation, and installation of building materials through the construction of the building.

Cement—the key ingredient that gives concrete its strength—is also one of the largest emitters of CO_2 in the built environment. It also represents the largest opportunity for embodied carbon reduction and has become a hot topic among tech construction project owners.

The Big Tech Opportunity for Concrete Producers

Concrete producers can create a competitive advantage by offering sustainable concrete products to meet the demands of the tech industry in three significant growth areas:

1. **Tech campus projects**
2. **eCommerce fulfillment or distribution centers**
3. **Data centers**

It's difficult to break out tech construction project numbers from other commercial projects but it's certainly a growth area. In the data center category alone last year, Europe saw the expansion of over 70 small data center projects, registering over USD $1.5 billion in investments, North America had over 50 projects and the Asia Pacific region had more than 35 small projects, which contributed over USD $600 million in revenue.

The Green Tech Campus Opportunity

Most tech companies have impressive campuses that reflect their core company values—innovation and sustainability. Recently, tech companies are bringing these values into the construction process of new projects.

In a recent webinar, LinkedIn's Senior Manager of Design Build Workplace, Jennifer Mitchell shared her experience building LinkedIn's Middlefield Campus, where sustainability was a must-have requirement throughout the project.

Microsoft, LinkedIn's parent company, recently announced aggressive climate change initiatives and LinkedIn adopted similar sustainability commitments. Of those commitments, Jennifer's team sought out carbon-negative technologies, specifically related to the reduction of embodied carbon.

Within its Carbon Negative commitment, LinkedIn aims to:

1. Reduce Scope 3 emissions by 55% by 2030 (e.g. carbon emissions from procurement, business travel, employee commutes)
2. Support efforts by suppliers and customers to improve their carbon impact
3. Offset all historical emissions by 2050
4. Invest in carbon removal and sequestration innovation (this is where the concrete opportunity lies)

LinkedIn began its low-carbon concrete journey at its LinkedIn Middlefield Campus in Mountain View, California. Through clever design, performance-based specifications, and great partnerships with the architects, engineers, general contractors, and concrete producers, the project saved 4.8 million lbs (2.18 million kg) of CO_2 through innovation in concrete mix design.

LinkedIn's Corporate Sustainability Commitments

Aligned with Microsoft and Leveraging LinkedIn's Unique Assets

Carbon Negative
Reduce and offset operational carbon by 2030; remove historic carbon by 2050.

Zero Waste
Drive to Zero Waste certification on LinkedIn campuses by 2030.

Water Positive
Reduce water use intensity and replenish watersheds by 2030.

Engaged Employees
Empower and mobilize employees in healthy workplaces.

Green Economy
Support equitable growth of green skills, green jobs, and green economic data insights.

The Green Fulfillment and Distribution Center Opportunity

According to McKinsey and Co., the eCommerce industry experienced 10 years of growth in just three months from March to June 2020 due to the changing consumer behavior as a result of the global pandemic. This surge in eCommerce created a 51% increase in large fulfillment, or distribution, center demand.

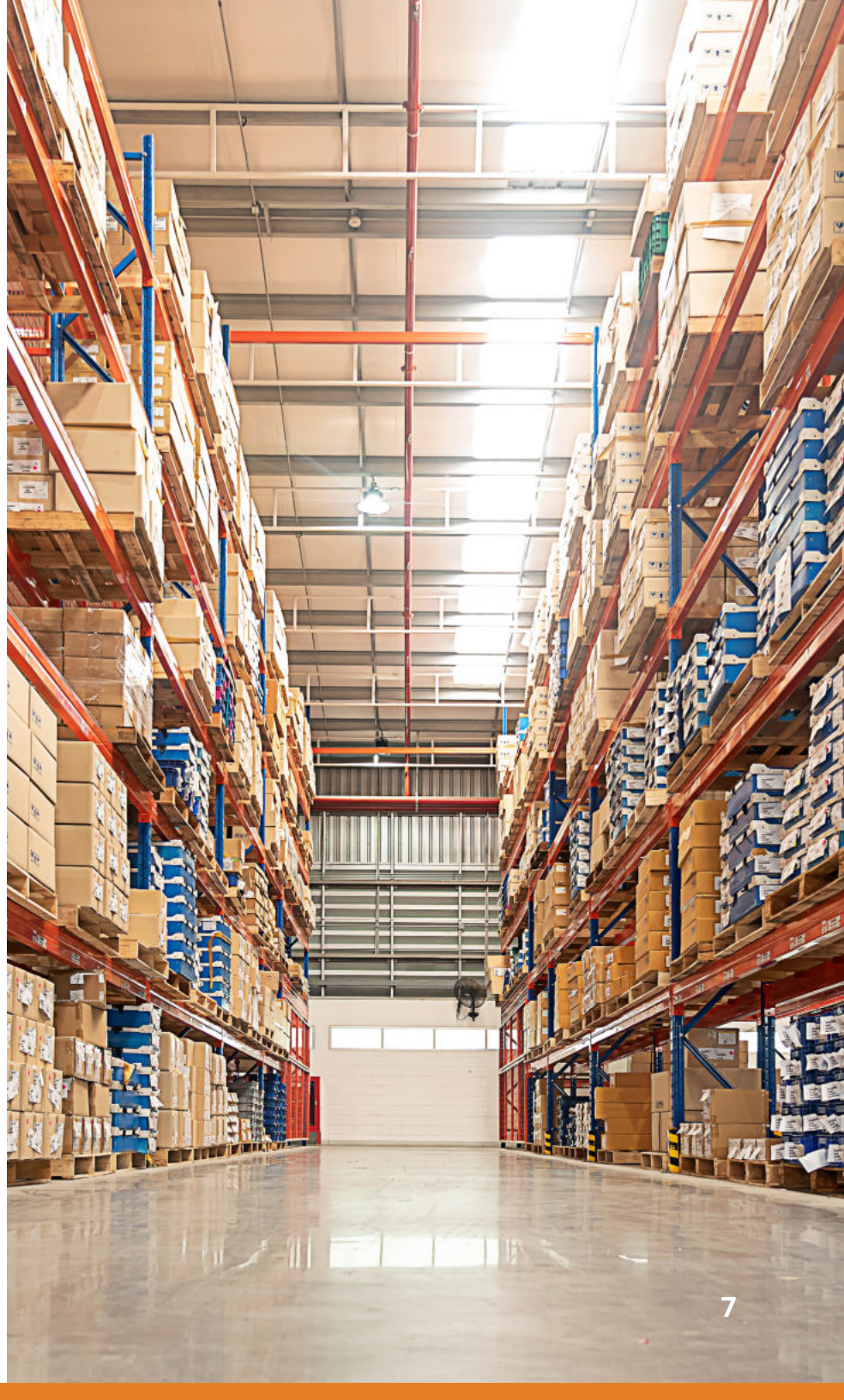
For eCommerce businesses, order fulfillment is one of the most costly line items. The best way to make fulfillment cheaper is to place inventory closer to the customer which is driving demand for more regional distribution centers across the world.

Distribution Center Concrete Requirements

In fulfillment and distribution centers the concrete slab and flooring are critical to the functioning of the operations. For example, abrasion and abrasion resistance are key since the floor slabs are put through so much wear and tear with heavy machinery traffic.

Curling and shrinkage are also critical requirements due to the sheer quantity of joints required in a large floor space. If the joints curl up, the machinery will hit them, creating a maintenance nightmare—not just related to the floor slab but also to the machinery. A large distribution center could face routine maintenance costs of up to USD $100,000 per year as a result of poor flooring.

Finally, and most importantly, the floor slabs in distribution centers must also be incredibly flat and level to enable the efficient operation of the heavy machines that utilize them.



A concrete slab's flatness and levelness are expressed by the so-called F-numbers (Face floor profile numbers): FF and FL. Flatness (FF) is how close to geometric planarity a slab is. Levelness (FL) is the amount of slope (or pitch or tilt) in a slab. This is the degree to which the surface of the slab approaches true horizontal perfection.

Usually, FF tells you how well the finisher worked the surface and FL tells you how skillfully the contractor set the side forms and struck off the concrete. To put that into perspective, a typical retail store requires FF 20 / FL 17; a gymnasium requires FF 40 / FL 30, and a TV studio requires FF 100 / FL 50. The specification for a typical fulfillment center is FF 50 / FL 35.

Sunbeam Builds Sustainability into its New Construction Project

Sunbeam Development Corporation recently constructed a new distribution center in Indianapolis using low-carbon concrete to meet its sustainability goals.

Sunbeam's construction manager, Shiel Sexton, introduced Sunbeam to CarbonCure via Shiel Sexton's trusted concrete producer, Irving Materials Inc., who had used CarbonCure on similar distribution center projects. CarbonCure's technology reduced the carbon footprint and global warming potential of Sunbeam while making no discernible difference to the quality or performance of the concrete itself.

Sunbeam Building 3 project had flexural strength requirements for 400 psi (2.76 MPa) in 28 days and 700 psi (4.8 MPa) in 56 days. The concrete made with CarbonCure hit the flexural numbers in just 28 days, so the team was very comfortable with it. The FF/FL numbers were also impressive on the Sunbeam project at FF 69 and FL 51, exceeding the project specification for FF 50 / FL 35.

In total, 15,295 cubic yards (11,694 cubic metres) of concrete applied to Slab On Grade applications saved 428,260 pounds (194,256 kilograms) of CO_2; which is equivalent to 254 acres (103 hectares) of forest absorbing CO_2 for a year.

The Green Data Center Opportunity

Tech companies—and most organizations that run applications in the cloud—rely heavily upon the services and data contained within a data center.

According to a 2020 IDC study, the world will create more data over the next three years than it created over the past 30 years. That means more and more data centers are required to meet the insatiable demand for data.

A data center is a purpose-built structure that houses IT equipment like servers, storage subsystems, networking switches, firewalls, routers, and the cables and racks used to organize and connect all the equipment. The expensive computing equipment requires an uninterruptible power supply, excellent ventilation, and high-tech cooling systems. As such, the structure of a data center must be secure, resilient, and have sufficient square footage to house the equipment required.

Data centers, for the most part, always aim to be green. The cost of powering and cooling computing machines is high, so energy efficiency is critical. The core key performance indicator for most data centers is power usage effectiveness (PUE). PUE describes how effectively the data center uses energy, specifically how much energy is used by servers versus the consumption of the power from the utility. The goal is always to stay below the industry average and continue to improve.

To meet the tech industry's demand for more sustainable business practices, data centers reduce operational carbon emissions by installing catalytic converters on backup generators and using alternative energy technologies such as photovoltaics, heat pumps, and evaporative cooling.

Recently, however, the focus of the tech industry has shifted from operational carbon efficiency to embodied carbon efficiency. As a result, new data center designers strive to minimize the embodied carbon footprint of new buildings by using low-carbon building materials. One of the simplest ways to make an impact on the embodied carbon is to specify low-carbon concrete for their new construction projects.

Data Center Concrete Requirements

Data centers offer concrete producers a tremendous market opportunity—a typical data center is approximately 165,141 square feet (15,342 square meters) and uses tens of thousands of cubic yards or meters of concrete. Producers that have proven low-carbon concrete mix designs in their portfolio have a distinct competitive advantage when it comes to pursuing these projects.

Data center architecture is designed with their unique mechanical and electrical infrastructure requirements in mind. Concrete is the perfect construction material to house the expensive machines stored in data centers. It doesn't rust or rot and it's resistant to fire, wind, water, and earthquakes.

Another key advantage of concrete is speed to market. In a recent webinar, Compass Datacenters' Chief Innovation Officer, Nancy Novak said, "For us, concrete is the most resilient, safest, and fastest way to erect the facilities that our clients desperately need in order to keep expanding...we love the fact that we can be dried in a month [to deliver] six megawatts worth of space."

There is another reason tech companies turn to concrete. Low-carbon concrete is a proven way to significantly reduce the carbon footprint of the building.

Compass Datacenters builds the construction and technology infrastructure to serve its market of data-hungry tech clients—clients that have very ambitious sustainability goals. Compass partnered with CarbonCure and committed to performance-based specs for ready mix and precast suppliers. All their suppliers today must be able to meet their requirements for low-carbon concrete.

"The exciting part for us now is making concrete a more environmentally-friendly product to go along with all of its other benefits," said Nancy.

Compass anticipates saving an average of 3.97 million pounds (1,800 tonnes) of CO_2 per campus, which is equal to 2,100 acres (850 hectares) of U.S. forest sequestering CO_2 for a year, or driving 4 million miles (6.4 million kilometers).

Partnering for Performance

With big tech's increased focus on embodied carbon, low-carbon concrete offers an excellent opportunity for producers to respond to the growing demand and gain a competitive advantage. Tech campuses, distribution centers, and data center projects are influencing other owners and property developers to set sustainability goals. As a result, projects such as corporate campuses, post-secondary warehouses, and commercial office parks are ideal opportunities for concrete producers. In parallel, these shifts are paving the way for policies rewarding construction solutions that reduce embodied carbon.

From the top down, tech companies are encouraging suppliers to adopt more sustainable business practices. Tech construction is no exception. Construction project managers in the tech industry are actively seeking sustainable solutions for their building projects and they're taking a partnership approach.

Concrete producers don't have to be the test labs for new solutions—the project owners are often happy to invest in the mix designs. For example, Compass Datacenters incentivizes its contracting community by rewarding partners for hitting or exceeding certain sustainability or diversity goals on its project sites.

Partnership across the construction team—from owner to the designer and engineer to the contractor and concrete producer—are key to meeting sustainability requirements. LinkedIn's Jennifer Mitchell said, "I think project owners have a huge responsibility here. They also have a great opportunity to help drive the change that the industry needs. We want to stop talking about the problem of cement. The industry is really doing a great job developing solutions to address that. Once people fully understand it, we can stop talking about concrete as the problem and start talking about concrete as the solution."

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Jennifer Mitchell,
Senior Manager of Design Build Workplace, LinkedIn

Mitchell at the LinkedIn Middlefield Campus construction site. Image courtesy of American Builders Quarterly

The Push for Performance-Based Specs

The tech industry wants a seat at the table to push for performance-based specifications so they can implement the innovative new technologies that will help them meet their sustainability goals.

Prescriptive specifications hinder innovation as they include clauses for methods of construction and impose restrictions on the compositional parameters of concrete mix. For example, prescriptive specifications may prescribe a minimum cement content of 700 lb/yd^3 (415 kg/m^3), a maximum fly ash content of 25%. In some cases, prescriptive specifications may entirely disallow certain ingredients or new technologies.

Performance specifications, on the other hand, are based on performance indicators like strength, permeability, shrinkage, sulfate resistance, resistance to alkali silica reaction, etc. These indicators are measured by standard test methods with defined acceptance criteria.

Compass Datacenters exclusively uses performance specs for its projects. “I’ve always wondered why we have prescriptive specs…I thought it was a kind of a lazy way of designing concrete to assure you’re going to get a certain amount of strength, but it was wasteful because it required way more cement than was really needed. Performance specs allow the suppliers to fine-tune mix designs to get the desired strengths while also meeting sustainability goals,” said Nancy.

Similarly, LinkedIn partnered from the pre-construction stage with the design and engineering team to set the priorities for the project and push for sustainability requirements in the performance specifications.

The tech industry disrupts the status quo—and it is disrupting prescriptive specification practices in its construction projects.

Conclusion

Tech industry construction—from tech campuses to fulfillment centers and data centers—is arguably the most high-growth sub-vertical in non-residential construction.

Tech companies, guided by clear sustainability goals across their business, are creating demand for low-carbon, carbon removal, and carbon-negative solutions all along their supply chains.

Low-carbon concrete represents the largest opportunity for tech companies to move the needle on embodied carbon in their construction projects and they're actively looking to engage concrete producers early in the construction process to find solutions to meet their needs.

Concrete producers that have low-carbon concrete mixes stand to win big in the tech industry construction vertical.

About CarbonCure

Architects, structural engineers, owners and developers are seeking proven ways to reduce the embodied carbon of their building projects. Recognizing concrete as a solution, CarbonCure Technologies, a fast-growing, clean tech company, has developed an easy-to-adopt carbon removal technology that enables concrete producers to use captured carbon dioxide to produce reliable, low-carbon concrete mixes and achieve market differentiation.

CarbonCure's Technology: A Closer Look

CarbonCure offers a concrete solution to reducing embodied carbon. CarbonCure's technology works by injecting recycled carbon dioxide (CO_2) into fresh concrete during mixing.

Once injected, the CO_2 undergoes a chemical reaction known as CO_2 mineralization, where the CO_2 converts into a nano-sized mineral. What was once CO_2 is now eliminated, never to be re-released into the atmosphere.

Mineralized CO_2 improves the concrete's compressive strength, which then enables the reduction of cement content in mix designs without impacting strength or performance.

Every cubic metre of concrete produced with CarbonCure's technology saves an average of 25 pounds (17 kilograms) of CO_2 emissions from entering the atmosphere, and provides a 4-6% reduction to Global Warming Potential.

An average building built with CO_2 mineralized concrete would save approximately 1.5 million pounds (680,000 kilograms) of embodied carbon, which is equivalent to the carbon absorbed by 888 acres (360 hectares) of US forest in a year!

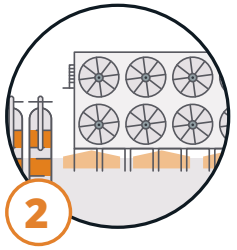
If you'd like to chat about how you can win new business from the technology industry with CarbonCure, please call +1 (844) 407-0032 or get in touch with a CarbonCure representative .

Further Reading

Webinar:	The Big Tech Construction Opportunity for Concrete Producers
Blog:	Performance-Based Specs
Case Study:	Central Concrete & CarbonCure Success Story

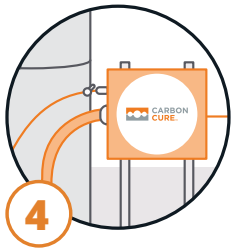
How it Works

CarbonCure's technology is retrofitted to an existing concrete plant.



Carbon dioxide (CO_2) gas is primarily sourced as a by-product from industrial processes.

The purified CO_2 gas is delivered in pressurized vessels by commercial gas suppliers.



CarbonCure's proprietary delivery system precisely injects the CO_2 into the concrete mix.

Batching is controlled by a simple interface integrated with the batch computer.

Once injected, CO_2 reacts with cement to form a nano sized mineral that becomes permanently embedded in concrete.