CARBON CURE™

3 Ways to Gain a Competitive Advantage in Concrete Production

Guide to investing in new technologies and business practices to meet new market demands and boost profits

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Introduction

Concrete is the most abundant human-made material in the world and one of the oldest industries still thriving today. Its prevalence and endurance are testaments to its efficacy. Concrete is simply the most resilient building material on earth.

One reason for the industry's longevity is its ability to continuously innovate to meet the demands of modern society. Today, several forces in the global construction industry are driving innovation in concrete:

- Rising costs and limited availability of raw materials
- Digital transformation of processes and practices
- Global climate policies driving demand for sustainable building materials

These forces are so powerful and immediate, they are accelerating the speed of change at an unprecedented rate. Producers that don't keep up risk being left behind.

Concrete producers around the world are adopting new processes and technologies and investing in talent and training to rise to these challenges while maintaining — and even increasing — profit margins.

This guide describes three ways that producers are modernizing their businesses while unlocking more opportunities to boost their bottom lines:

1. Investing in New Technologies
2. Collaborating with Specification Writers
3. Gaining Profits from Carbon Removal

Forces Driving Change

Rising costs and limited availability of raw materials

Globally, the price of cement is increasing at an annualized 2.9% to USD $128.2 per metric tonne in 2021.

Digital transformation of processes and practices

Digital transformation in construction can result in productivity gains of 14 to 15% and cost reductions of 4 to 6%.

Global climate policies driving demand for sustainable building materials

The global market for green building materials is projected to reach USD $425.4 Billion by 2027.

1. Investing in New Technologies

In the past few years, rising costs have pushed concrete producers to seek out ways to create efficiencies and digitize manual tasks and processes. The challenges created by the pandemic — maintaining safe workplaces and reducing physical touchpoints — accelerated these attempts to transform concrete operations with technology.

Some easy-to-implement technologies that can demonstrate an immediate return on investment include:

Digital Collaboration, Quality, and Dispatch Optimization

Customers want the right product at the right time, according to their schedule. Delivery and quality control process improvements can significantly impact a producer's bottom line while maximizing customer satisfaction and loyalty.

Command Alkon's CONNEX platform, for example, helps concrete producers, contractors, and project owners manage material and transport costs and capture real-time visibility into orders and deliveries by digitizing concrete tickets and invoices — eliminating paper and streamlining orders and deliveries. Novamix and Ultracem are just two producers using Command Alkon's CommandBatch to ensure better quality and consistency of their mix designs.

Other digital solutions for concrete include Jonel, Marcotte, or MPAQ. Each of these technologies unites data from the quotation phase to job scheduling, order entry, resource planning, material planning, mixing software, dispatch, and delivery.

This allows producers to control costs and reduce waste by centralizing dispatch processes and performing batching from the plant closest to the delivery site. For example, on a large project, there could be up to 50 trucks per day delivering concrete. With the right technology in place, dispatchers can evaluate trucks, plants, and other variables like traffic and weather to use resources more efficiently. They can also give their contractors access to the trucks' GPS location and estimated arrival time so that there is no wastage created from trucks arriving when the site is not ready.

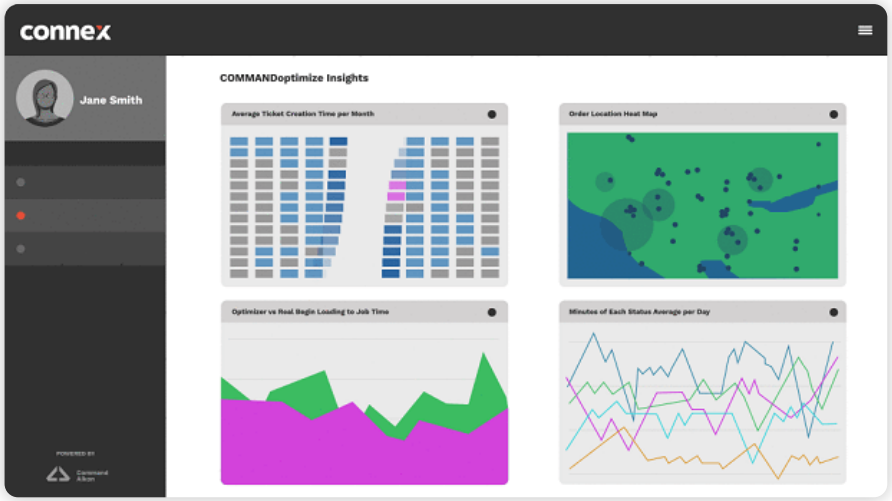


Image source: Concrete Construction

Smart Concrete Testing and Data Collection

Using smart sensors when placing concrete can help concrete producers monitor properties like temperature, humidity, maturity, and strength either on-site or remotely.

For example, Giatec Scientific's smart testing technology and sensors capture data in the field in real-time to help producers create efficiencies and address problems before they arise. Giatec has also created a new web-based dashboard called SmartMix that uses AI algorithms to help concrete producers calculate the ideal amount of water, cement, and admixtures in their mixes to reduce material costs and environmental impacts.

These advanced technologies unlock insights quickly and enable producers to enhance performance and create efficiencies in their mix designs.

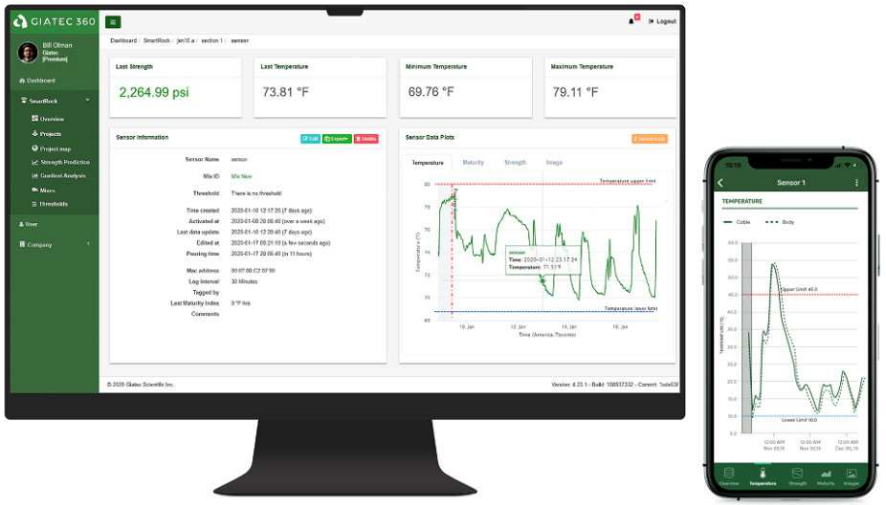


Image source: Giatec

Digital EPD Generation

Today, producers have to optimize mix designs for key performance requirements like strength. They also face an increasing number of requests from contractors to do that at the lowest embodied carbon footprint.

GWP or Global Warming Potential is a new performance metric in construction, and it is changing the way we think about concrete. Climate Earth is an organization that creates innovative applications to enable concrete producers to create a competitive advantage in the emerging market for low-carbon construction and sustainable supply chains.

The company's CarbonCLARITY applications are engineered to ensure the construction industry can save millions of pounds of embodied carbon and enable concrete producers to accelerate the rate of low-carbon concrete innovation.

Climate Earth's Environmental Product Declaration (EPD) Generator is the first of its kind in the concrete industry and enables concrete manufacturers (ready mix, block, aggregate, and cement) to instantly generate EPDs and connect them to other digital tools.

What is Embodied Carbon?

Embodied carbon is the carbon dioxide (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. It also refers to the CO_2 produced by maintaining the building and eventually demolishing it, transporting the waste, and recycling it.

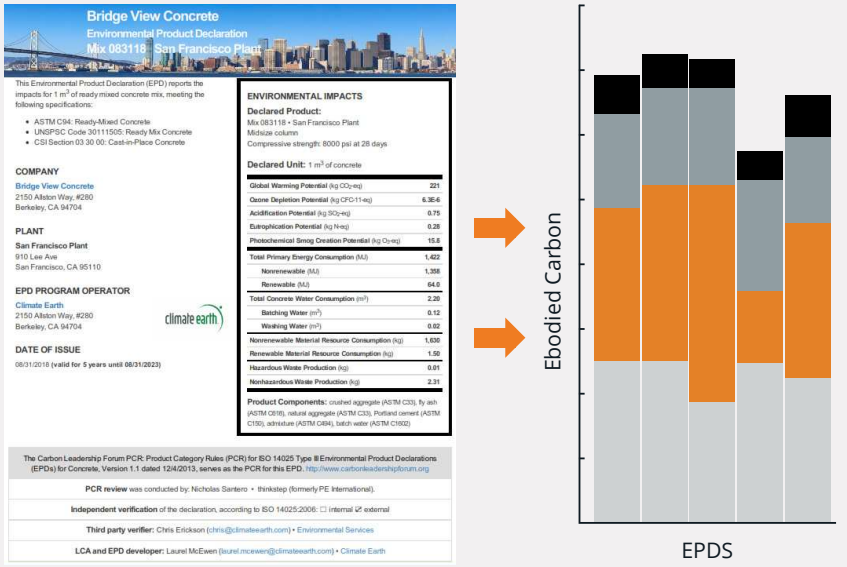


Image source: Climate Earth

An Environmental Product Declaration (EPD) is an independently verified document, defined by the International Organization for Standardization (ISO) 14025 as a declaration that "quantifies environmental information on the lifecycle of a product to enable comparisons between products fulfilling the same function."

In the same way that nutritional labels report the measured nutrition facts for food products, EPDs report the measured lifecycle environmental impact of a product so designers and builders can make more informed decisions.

Carbon Utilization

Carbon utilization innovation such as CarbonCure helps producers beneficially repurpose CO_2 to reduce the carbon footprint of concrete without compromising concrete performance.

CarbonCure injects a precise dosage of captured CO_2 into concrete, where the CO_2 becomes chemically converted into a mineral, which becomes embedded in the concrete.

This makes the concrete stronger, enabling mix optimization while permanently eliminating the CO_2. Ultimately, concrete created with CarbonCure meets the same strength and performance requirements, but with an optimized mix.

The technology is currently implemented in over 300 concrete plants around the world. More than 10 million cubic yards (7,645,549 cubic metres) of CarbonCure concrete have been supplied to sustainable construction projects around the world by producers like Thomas Concrete, imi, and many others.

Creating a Competitive Advantage by Investing in Technology

One of the key benefits of adopting new technology is the ability to harness the power of data to improve communication, efficiency, productivity, and safety. In addition to these benefits, concrete producers have discovered another benefit to digitization: sustainability.

New technologies help concrete producers gain a greater understanding of the true impact of sustainability on their business. Since sustainability specifications are being requested more frequently by construction clients — especially if the end clients are hoping to receive green designations like LEED or special tax credits — having the data at hand to show concrete is sustainable will be a competitive advantage.

2. Collaborating with Specification Writers

In Europe, specifications can include actual work quantities like a bill of materials and are often a collaboration between producers and designers. Generally, by collaborating with local specification writers like structural engineers and architects, producers can influence spec design to encourage concrete mix innovation. In North America and some other markets, however, the construction community traditionally relied on prescriptive-based specifications for concrete mix designs. Many commercial projects — and nearly all public building and infrastructure projects — still use prescriptive specs today.

The Cost of Prescriptive Specs

Prescriptive specs outline criteria for **how concrete is made**. They include clauses for the methods of construction and impose restrictions on the compositional parameters of concrete mix. In some cases, prescriptive specifications may entirely disallow certain ingredients.

Examples of prescriptive requirements included in these specifications include:

- Limitations on source and composition of materials
- Minimum cement factors
- Limitations on supplementary cementitious materials (e.g., quality, type, composition)
- Water to cement ratio limits (when durability doesn't apply)
- Aggregate grading requirements
- Requirement to use potable water
- Limitations on the composition of mixtures
- Restrictive requirements for slump or air content
- Restrictions on the concrete temperature outside standards

Prescriptive specifications are often overly conservative, which can lead to higher costs, negative results, and poorer sustainability results. In a recent webinar, concrete expert Dr. Mike Thomas described how the National Ready Mixed Concrete Association (NRMCA) in the U.S found prescriptive water to cement ratios were applied in 73% of specifications where the limitations were not even applicable. Other restrictions of prescriptive specifications included:

Prescription	% of specs	Where Applicable?
Restriction on SCM quantity	85%	ACI 318 - for F3 only
Max w/cm (when not applicable)	73%	ACI 381 - for durability only
Minimum cementitious content	46%	ACI 301 - for floors
Restriction on SCM type, characteristics	27%	None
Restriction on aggregate grading	25%	Suggested for floors

Boosting Performance and Profitability with Modern Specs

Performance-based specs outline criteria for **how concrete needs to perform**.

Performance specifications make more sense in the modern construction landscape as they do not put parameters around the components or proportions of the mixture. Instead, performance specifications 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 e.g., chloride permeability no greater than 1,500 Coulombs at 56 days.

Performance specifications empower the concrete producers — the experts in concrete mix design — to propose the best concrete mix to meet the performance needs of the required application.

Studies have shown that performance-based concrete specs are more likely to result in better-performing concrete, with better sustainability profiles — and often with lower costs — than prescriptive specs. They also represent one of the most significant embodied carbon reduction strategies available that can be implemented today.

CASE STUDY:

imi Wins New Business with CarbonCure

Irving Materials, Inc. (imi) has been delivering quality concrete throughout the midwestern and southern U.S. for almost 75 years. Other than the quality and reliability of its concrete, imi's innovative approach to adopting new technologies sets it apart from the competition.

When imi implemented CarbonCure, it immediately began to secure projects because of CarbonCure's value to end-users: reducing the carbon footprint of concrete without compromising performance.

Today, imi has implemented CarbonCure at 48 plants and has produced over 574,000 cubic yards (438,855 cubic meters) of concrete or over 71,000 truckloads. And the demand keeps growing.

> "Once we decided to go all-in [on CarbonCure], the enthusiasm level in the marketplace was surprising. It was phenomenal."

Jeff McPherson, Vice President of Customer Development, imi

Read the Case Study

Creating a Competitive Advantage through Collaboration

Thanks to initiatives like SE2050 and Architecture2030, engineers and architects are motivated to reduce embodied carbon in their projects and are eager to partner with experts who can help them do that.

Concrete producers that open dialogue with specification writers can position themselves as innovators in the space and gain a competitive advantage with sustainable concrete mix designs.

The NRMCA's Prescriptive to Performance (P2P) Initiative provides a suite of resources to support producers who choose to engage with local engineers and specifiers on concrete specification best practices.

3. Gaining Profits from Carbon Removal

There are several ways concrete producers can monetize sustainability initiatives including through participation in carbon removal programs, gaining competitive advantage in green building markets, and reducing waste.

Carbon Removal Programs

Firstly, some sustainability initiatives enable producers to earn money from carbon reduction and removal. For example, if a producer uses carbon utilization technology like CarbonCure to reduce and remove carbon emissions from its production process, the producer could effectively "sell" its carbon removal efforts to another company that can't effectively reduce or remove emissions from its own business.

Similar to carbon offset programs, carbon removal programs enable producers to unlock more value from sustainability initiatives.

CASE STUDY:

Thomas Concrete Monetizes Carbon Removal

Thomas Concrete was established in Sweden in 1955 and now has over 150 concrete plants and over 2,000 employees in the U.S. and Europe. Thomas Concrete is still a family-owned company and it places environmental policy at the heart of its identity.

The U.S. operation has been serving customers for more than 30 years and has earned the reputation of being progressive, innovative, and sustainable. In 2016, Thomas Concrete installed CarbonCure in their first plant located in Doraville, Georgia; and shortly after, they became the first company to use CarbonCure operationally. Immediately, Thomas Concrete began realizing savings from using less cement in their mixes. Lazenby was also impressed by CarbonCure's performance and reliability.

In 2021, Thomas Concrete had another first with CarbonCure as the pilot producer involved in CarbonCure's Carbon Removal Program. The program enabled Thomas Concrete to unlock hundreds of thousands of dollars in incremental profit by selling verified Carbon Removal Certificates to CarbonCure's marketplace.

Read the Case Study

Waste Reduction

New technologies can also lead to waste reduction and savings from recycling. For example, CarbonCure's Carbon XPRIZE-winning technology CarbonCure for Reclaimed Water and new Recycled Concrete Aggregates innovation can help producers reduce and remove even more carbon from their operations, while maximizing the use of recycled materials like cement, water, and aggregate.

CASE STUDY:

Trio Unlocks Profit from Reclaimed Water

TRIO Ready-Mix's concrete plant in Victoria, British Columbia is the first plant using CarbonCure for Reclaimed Water — the new solution that spun out of CarbonCure's Carbon XPRIZE win.

Dealing with slurry or concrete wash water is costly, inconvenient, and damaging to the environment — even for producers with reclaimers in place. Reclaimers can help you get some value from waste material — but the materials are generally downcycled for use in lower quality products.

When integrated with a reclaimer, CarbonCure uses CO_2 to separate the cementitious fines and water from the reclaimer to reuse as virgin materials.

How It Works

Suspended solids in reclaimed water are created through a reaction with CO_2. The presence of these solids enhances concrete strength when present in new mixes.

The cementitious fines are CO_2-stabilised and can be recycled for equal use as binder material in new concrete mixes, replacing the need for virgin cement.

CarbonCure for Reclaimed Water reduces variability in fresh properties that occur unpredictably when using untreated reclaimed water slurry in new concrete production.

Creating a Competitive Advantage with Carbon Removal

New innovations in concrete production present a great opportunity for producers to build market share and win new business in the green building space.

CarbonCure offers one such innovation. CarbonCure pioneered the utilization of captured CO_2 by injecting it into concrete during the mixing process. Once injected, the CO_2 chemically converts into a mineral and becomes permanently eliminated.

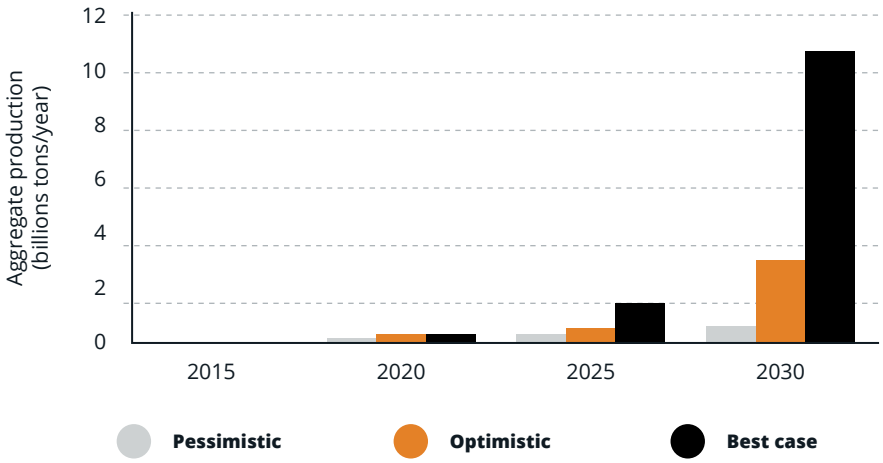
The mineralized CO_2 also increases the concrete's strength, which enables producers to reduce the amount of cement content in their mixes while still maintaining concrete strength and performance. This is a win-win solution as it permanently eliminates the CO_2 that has been captured while also reducing the amount of carbon-intensive cement needed in concrete production.

This CO_2 utilization in concrete is not only sustainable — it makes good business sense. Analysts say it has the potential to become a USD $800 billion global industry by the year 2030.

Producers that are not thinking about developing sustainable concrete mixes will miss out on this business opportunity *and* lose significant market share to competitors, as more industry associations and government bodies set standards for carbon-reducing building practices.

In Australia, Boral, Holcim, and other larger producers are also adopting carbon-reduction strategies —and have received good press as a result.

In the U.S., companies like Irving Materials Inc. (imi), Ozinga, and Thomas Concrete have also taken proactive sustainability steps. They've tapped into new innovations like CarbonCure to create a competitive advantage in their markets.



Source: Global Roadmap for Implementing CO_2 Utilization, CO_2 Sciences and the Global CO_2 Initiative

Key Takeaways

Investing in new technologies, collaborating with specification writers, and gaining Incremental profits from carbon removal are just a few of the ways concrete producers can prepare their organizations to meet the demands of a changing market and maintain and increase profit.

When embarking on any of these initiatives, keep the following considerations in mind:

Further Reading

Webinar: The Next-Gen Concrete Producer: 4 Tech Innovations to Boost Productivity

Guide: Solving Embodied Carbon Challenges with Concrete Specifications

Case Study: Irving Materials Inc. (imi)

Case Study: Ozinga

Case Study: Thomas Concrete

Case Study: Conewago Manufacturing

Change Management

The main barrier to innovation in a concrete organization is often adapting engrained processes and shifting the status quo. Investing in new technologies will only be beneficial if processes support them and people are trained in how to use them. People, process, and technology are the three pillars of successful change management.

The Power of Data

One of the key benefits of digital transformation and innovation is data. Data, when connected across a business and analyzed correctly, can unlock incredible insights that inform business strategy. It can connect the dots between seemingly disparate scenarios and help business leaders make changes that will drive efficiencies, meet new market demands, and increase profits.

Link Between Profitability and Sustainability

A subtle theme in each of the sections outlined in this guide is that profitability and sustainability are inextricably linked. Research by Oxford University and others confirms that good sustainability practices correlate with lower operating costs, better profitability, and higher share price performance.

The cement and concrete industries are aware of this link, hence the recent shift toward greener practices. Driven by demand and new government policies, concrete producers are looking for ways to future-proof their plants to remain competitive in this new landscape.

Doing the Right Thing

While most of the initiatives detailed in this guide will help producers gain a competitive advantage in their market and/or boost the profitability of their business, there's another reason to modernize and adopt sustainable practices: doing the right thing by the communities they operate in.

> "When it comes to sustainability, we all have to think about what we're doing and the impact that it has on the environment. It's not about the dollars and cents, it's about doing the right thing. With every load of concrete that leaves our plant, we're essentially giving back to the community from a sustainability perspective."

Collin Bender
Quality Control Manager at Conewago Manufacturing

CARBON CURE

Build for the Future.
Build with CarbonCure.

CarbonCure has been used on thousands of projects ranging from healthcare to higher education, residential developments, and corporate campuses.

For more information about building with CarbonCure concrete, visit **carboncure.com**. To get in touch with a CarbonCure representative, send us an email at **info@carboncure.com** or give us a call at **+1 (902) 448-4100** (Worldwide) or **+1 (844) 407-0032** (North America).