



Sustainable Concrete: A QC Perspective

Combined perspectives from concrete experts on sustainability best practices and how quality control teams can play a pivotal role in the project design stage.

Vulcan
Materials Company

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CONCRETE **imi**

CHANEY
ENTERPRISES **OZINGA**[®]

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CENTRAL
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Introduction

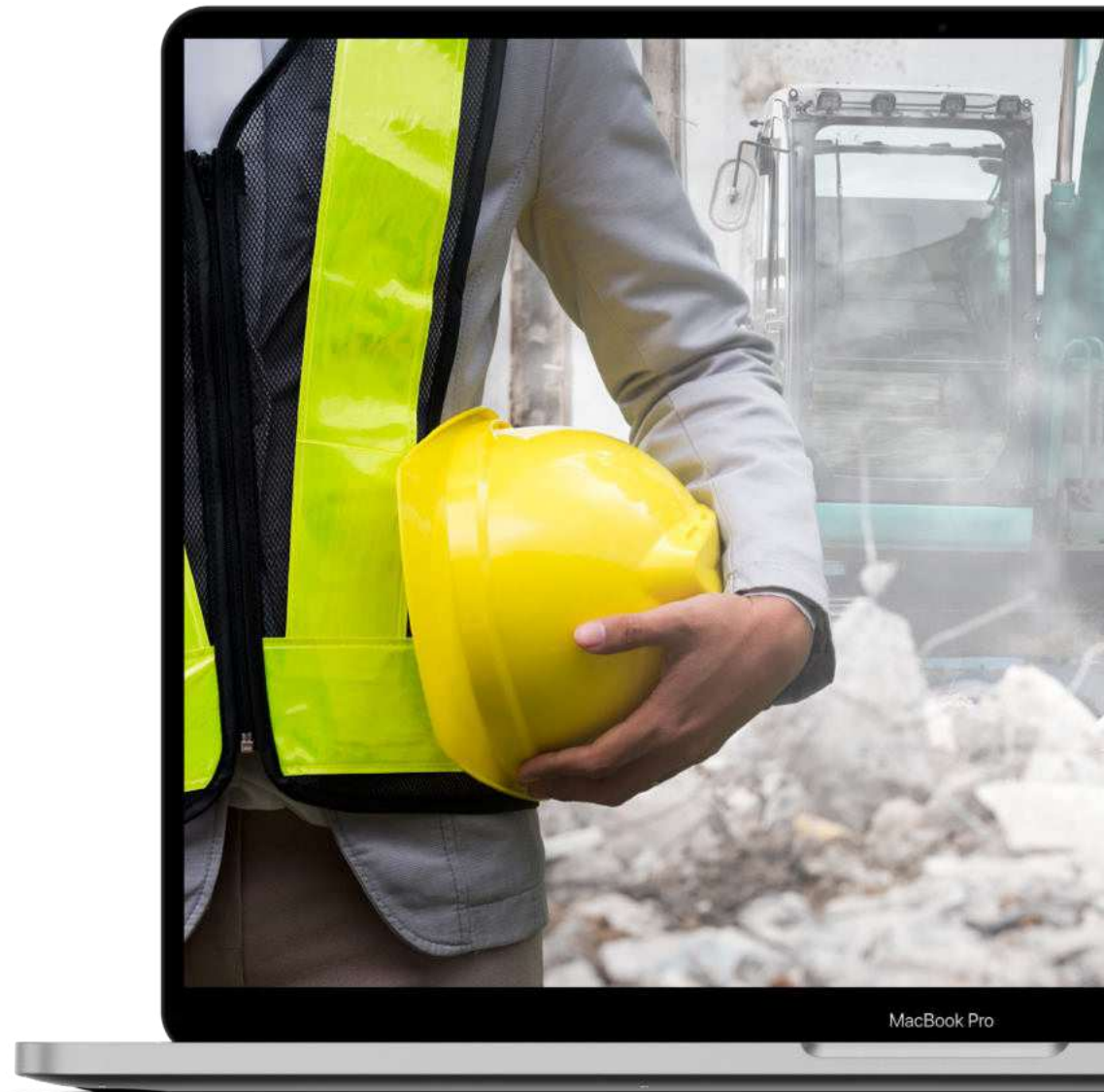
Quality control (QC) experts play an integral role in concrete production. From designing mixes based on the specification criteria to ensuring the quality of the finished product, QC teams are involved in every stage of concrete production.

QC professionals can also play an impactful role earlier in the design process. They have a wealth of knowledge about concrete mix design that can help architects, structural engineers, and general contractors (AECs) meet their desired performance requirements in a cost-effective way. They can also advise on specifications that will contribute to the successful design of greener buildings with lower embodied carbon emissions.

This eBook summarizes data collected from several in-depth exploratory interviews and webinar panels with QC experts from [Irving Materials Inc.](#), [Chaney Enterprises](#), [Lauren Concrete](#), [Bay Ready Mix](#), [Central Concrete](#), [Vulcan Materials](#), [Thomas Concrete](#), and [Ozinga Ready Mix](#).

In this eBook, we explore the trends and best practices that are having a significant impact on sustainability — and on producers' bottom lines.

If you're interested in hearing directly from some of these producers, check out the two QC panel webinars in CarbonCure's [resource library](#).



The Evolving Role of the QC Manager

According to Darrin Litteral, QC Manager at Irving Materials Inc. (imi), on any given day, a QC manager may be conducting field tests on concrete-making cylinders or running an entire project and controlling the quality and quantity of material being used. QC teams also play a key role in the research and development of new concrete technologies.

“From an additive standpoint, new technologies are always presenting themselves. Whether it’s a new water reducer, a new accelerator, a new finishing product, or whatever,” said Darrin. “While these technologies are new, they’re not too different from what we were doing in the 1960s and 70s. The basics of concrete haven’t changed — you still need cement or cementitious material, water, and aggregates. It’s the mix designs that have changed.”

As the trend toward performance-based specification continues to gain traction, the role of QC is becoming increasingly important. Research and development (R&D) enable progressive producers to develop mix designs that meet performance requirements while using materials more efficiently.

“With R&D, we can make concrete that will give you all the strength you want without even adding Portland cement,” said Justin Lazenby, Director of Georgia Technical Services at Thomas Concrete. “We’re not big risk-takers. But we are technology-driven and we like to show what we can do when we’re given an opportunity to be innovative.”

Too often, concrete producers are consulted too late in the design process to have a great impact on concrete mix design and innovation. However, QC teams are a valuable resource for the AEC community as they are at the forefront of new technologies that can help deliver on performance, sustainability, and cost-efficiency goals.

“The most successful conversations I’ve had have been at the beginning of a project. Too often, producers are only engaged after the project has progressed and the specs have been written. It requires a twofold approach,” said Nate Tarbox, Manager at Bay Ready Mix of Maryland. “Firstly, producers need to understand why designers have specified something for a reason and, secondly, designers need to be willing to bring in the concrete experts earlier so we can recommend solutions that can impact sustainability.”

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Darrin Litteral, QC Manager at Irving Materials Inc.

A QC Perspective on Sustainability Best Practices

As a key construction material, concrete has everything going for it — except its carbon footprint. “We’re always seeking out opportunities to be more sustainable. We feel like this is a competitive advantage for us,” added Matthew Jetmore, General Manager, Central Region at Lauren Concrete.

“We’re all members of the same community. We all want the world to be the way it is today when our grandkids’ grandkids are living here,” said Jeff Slagle, Concrete Operations Officer, Chaney Enterprises. “We want to do the right things for these communities now.”

Concrete producers can adopt a variety of best practices to achieve more sustainable operations and low-carbon, high-performance mix designs — all while creating efficiencies and driving value across the business.

“Sustainability of concrete is the number one thing that we have to accomplish because it’s the number one threat to our industry,” said Nate (Bay Ready Mix).

The concrete experts consulted for this eBook listed the following sustainability best practices:





1. Truck Optimization

Concrete producers optimize their concrete truck fleets in a variety of ways to create efficiencies and contribute to sustainable operations.

Many producers make a conscious effort to run newer mixer trucks that have lower particulate emissions. Newer trucks are also typically lighter and have better fuel efficiency. In essence, a new, lighter truck carrying 12 cubic yards (9 cubic metres) of concrete uses the same amount of fuel as an older, heavier truck carrying just 10 cubic yards (7.6 cubic metres).

Other producers are implementing policies for more efficient use of the trucks. "Idling creates a tremendous waste of energy so our drivers follow a no-idling policy, said Teck Chua, Director of Technical Services at Vulcan Materials.

"Our mixer trucks also have tire pressure indicators," said Teck. With proper tire inflation, safety is ensured, trucks gain better fuel efficiency, and producers can actually extend the life of the tires.





2. Renewable Energy

As part of their sustainability efforts, many producers choose to purchase energy from renewable sources like wind and solar farms and all of them are paying close attention to energy efficiency.

Ryan Cialdella, VP of Research and Development at Ozinga Ready Mix described how his team monitors how much energy is required to produce a cubic yard or metre of concrete. “We do a lot of energy audits and monitor equipment to make sure things are operating properly,” said Ryan. “We also look at transportation methods such as rail, barge, and evaluate the use of compressed natural gas (CNG) or renewable natural gas (RNG) in the delivery vehicles that haul materials into the plants. We do everything possible to stay away from diesel and its high CO₂ impact.”

Other producers, like Bay Ready Mix, are actually installing wind turbines or solar panels at their concrete plants in an effort to be more efficient.

Some producers are testing out renewable fuels and biodiesel. For example, Central Concrete Supply Co.’s trucks have been running on renewable diesel since 2015.

“We even tried to make some of our fleet cars run on cooking oil,” said Nate (Bay Ready Mix). “The initiative wasn’t a success but the fact that we’re willing to try stuff like this is testament to the attitude we have about sustainability and innovation at Bay Ready Mix.”





3. Delivery Efficiency

Delivery process improvements can significantly impact sustainability as well as improving a producer's bottom line.

In the past, the standard operating procedure was to use paper for order and delivery sign-offs. Today, producers are moving toward e-ticketing orders. "Most other industries have been paperless for a while but the concrete industry is old school — some of our customers still pay with cash," said Darrin (imi). "Overall it's trending towards digital. We're putting technology in our customer's hands, so they actually have the ability to track their trucks as they come to the job now. It helps them utilize their labor better."

In the move toward digital processes, producers are adopting dispatch and quality software like Command Alkon, Jonel, Marcotte, or MPAQ to connect data from the quotation phase to job scheduling, order entry, resource planning, material planning, mixing software, dispatch, and delivery.

These technologies enable producers to control costs by centralizing dispatch processes and performing batching from the plant closest or most convenient to the delivery site. With the right technology in place, producers can give their

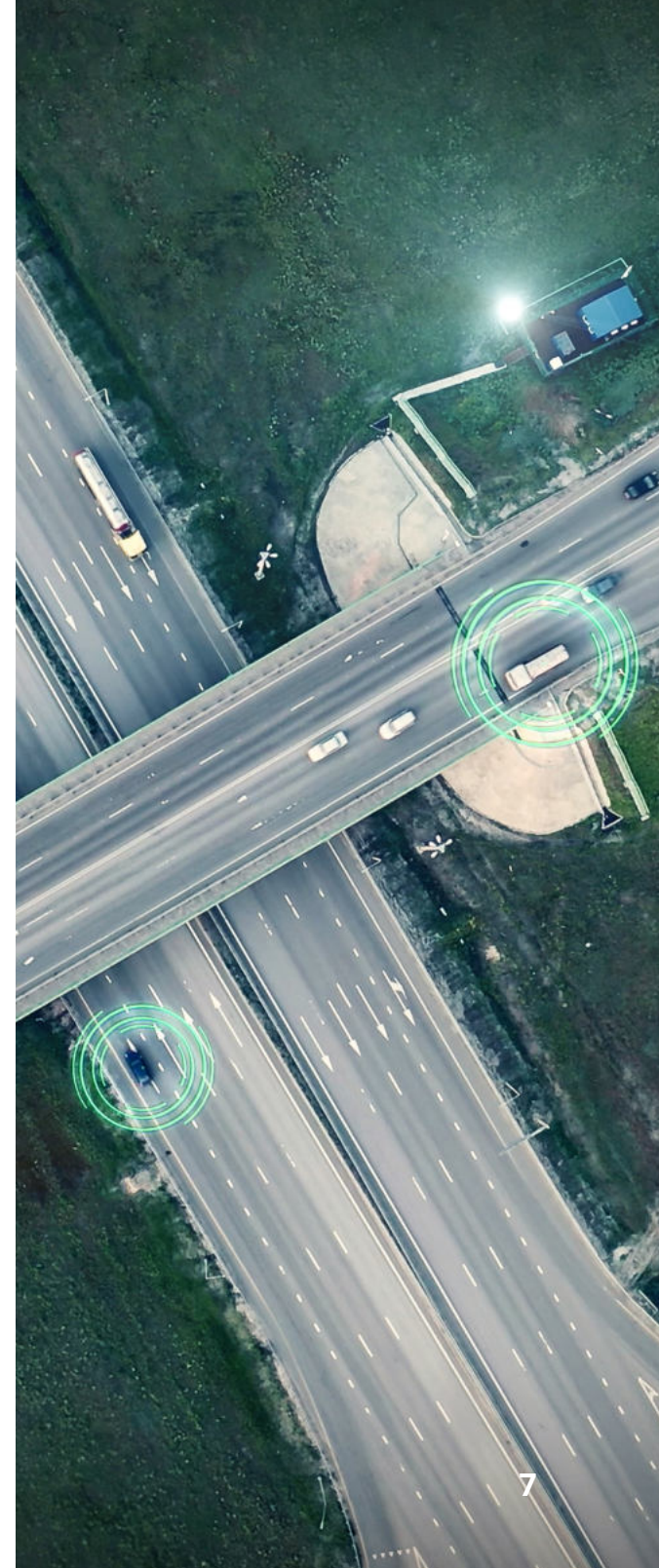
contractors access to the trucks' GPS location and estimated arrival time so that there is no wastage created from trucks arriving when the site is not ready.

"GPS in our mixer trucks has had such a tremendous impact," said Teck (Vulcan Materials). "Our business is mostly in Northern Virginia where we have some of the worst traffic in the country. GPS, along with improvements in central dispatch, has created huge efficiencies for us."

For the most part, producers do not undertake delivery optimization for the sole purpose of sustainability. "We did it to increase our productivity," said Matthew (Lauren Concrete).

"However, we've done a study that has shown our emissions per yard of concrete produced has dropped significantly just because of more efficient truck routing."

*Matthew Jetmore,
General Manager, Central Region at Lauren Concrete*





4. Waste Reduction

“We are looking at our water usage and trying to use as much recycled water as possible,” said Justin (Thomas Concrete). “We’re really pushing the limits on grey water.”

Water Waste

To reduce water waste, producers are employing truck washout systems like **EnviroGuard** as innovative and environmentally sound disposal methods for waste water and concrete slurry. This reduces waste and improves truck turnaround times and efficiencies. It collects all waste water and concrete slurry, removing the risk of penalties and fines from regional authorities, and enabling reuse of the waste material.

“We’ve started configuring plants, especially greenfield plants with sustainability in mind,” added Matthew (Lauren Concrete). “We’re putting in reclaimers and we’re aiming for 100% water capture.”

Recycled Concrete Aggregates

“We bring returned or rejected concrete back to a centralized location and crush it into a couple of different sizes to resell as base material,” said Teck (Vulcan Materials). “At some point, we may consider putting some of it back into the concrete to replace some of the virgin aggregates that we use. It’s good for the bottom line and it’s good for the environment so there’s a win-win all around.”

Other producers use returned concrete to make precast blocks to reduce waste. Some are going one step further and looking at newer solutions like CarbonCure for Reclaimed Water to manage costly slurry or concrete wash water.

How It Works

CarbonCure injects a precise dosage of CO₂ into the waste water from concrete production. The CO₂ reacts with the calcium ions in the waste solution to produce a nano-scale suspended solid with strength-enhancing properties.

The new nano-solid material can then be incorporated back into new concrete mixes — along with chemically stabilized cement particles — to reduce the amount of required freshwater and carbon-intensive cement required as virgin products.

[Learn More](#)





5. Slump Management

Rather than measuring concrete slump with the traditional metal cone, producers are adopting technology to measure and adjust slump and monitor the water content of concrete as it travels from the plant to the job site.

VERIFI[®] is one technology that allows ready mix concrete producers to shave off priceless minutes from the process of measuring and testing concrete on site.

“We utilize VERIFI on our trucks to track slump and temperature. It means our drivers aren't having to add water as slump is adjusted with admixture dosing,” said Alana Guzzetta, Manager, U.S. Concrete's National Research Lab at Central Concrete Supply Co.

With VERIFI, all loads are measured for slump and temperature, so producers can catch bad loads before they pour. Low strength concrete can be mitigated, as well as the risk of having to repair or replace concrete after the pour.





6. Supplementary Cementitious Materials

Supplementary Cementitious Materials (SCMs) are a common feature in mix designs today and greatly help move the needle on sustainability by reducing the need for cement. The most common SCMs are fly ash, a by-product of the coal industry; slag, a by-product of steel production; and silica fume, a by-product of ferrosilicon metal industry.

Since their introduction, [studies](#) and industry testing have proven that SCMs actually increase the strength of concrete over time to levels greater than that of traditional concrete mixes. SCMs have a secondary environmental benefit too since they also take post-industrial waste from coal and steel and sequester it for the lifetime of the concrete structure.

However, as these industries evolve, the supply and demand of their by-products change. For example, according to [a recent report](#), there are several factors affecting the fly ash market today:

- Declining quality due to no NOx control
- Strong demand is affecting supply
- Fly ash is consumed and marketed regionally as it is expensive to move

Many power plants are shutting down in the US which is further adding to supply issues. “We need something to replace fly ash at an economical scale,” said Ryan (Ozinga Ready Mix). That’s where emerging technologies like carbon utilization can play a role.





7. Carbon Utilization

Carbon utilization solutions include processes to convert CO₂ into chemicals, fuels, plastics, and concrete. Today, there are only a few utilization solutions that offer permanent storage of CO₂. For example, if CO₂ is utilized for fuel, it is released back to the atmosphere when the fuel is burned.

Converting CO₂ to a solid mineral in concrete offers permanent storage of carbon — it will never be released into the atmosphere. **CarbonCure Technologies** has developed one such technology: CarbonCure for Ready Mix. It works by injecting recycled CO₂ into fresh ready mix concrete during mixing.

Once injected, the CO₂ undergoes a chemical reaction where it transforms into a mineral, improving the compressive strength of the concrete, which enables the reduction of carbon-intensive cement content in mix designs.



Sustainable Concrete: A QC Perspective

CarbonCure is gaining traction in the concrete industry and is already installed at nearly 300 plants around the world.

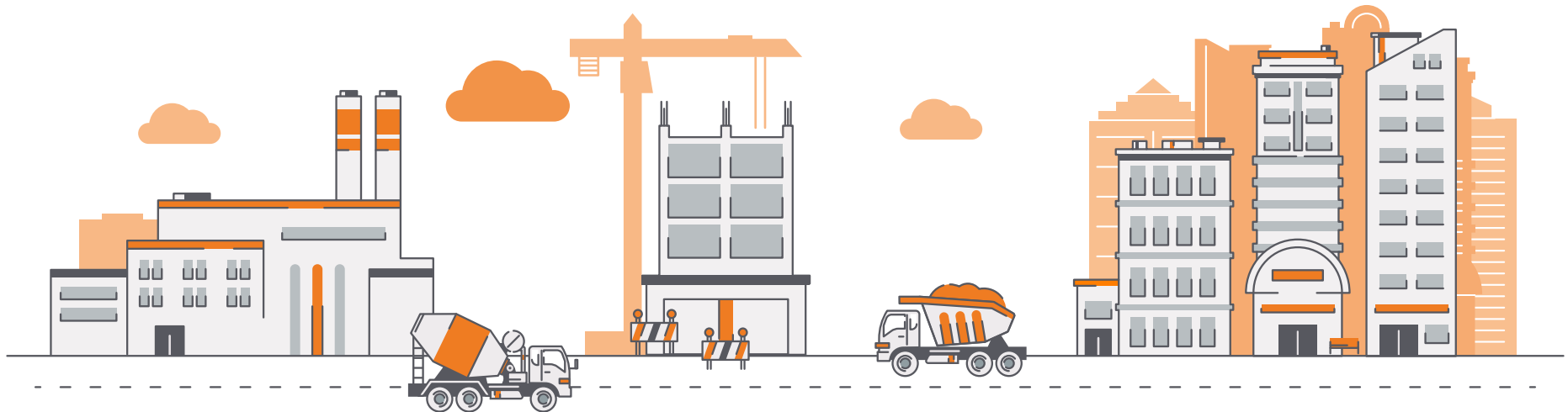
Irving Materials Inc. (imi) was the first producer in the midwest to install CarbonCure. “With CarbonCure, we can speak to two motivations. Number one, it strengthens concrete. So from a business perspective, I can reduce my material costs and achieve the same performance,” said Darrin (imi). “Number two, it is sustainable. This is a huge industry that has a huge carbon footprint and people are worried about climate change.”

Lauren Concrete installed CarbonCure in two production plants that supply the entire greater Austin area. Austin is a progressive city with a young population. As such, it is very receptive to sustainable products.

“Concrete can be a slow-moving industry. We have one big innovation every ten years. CarbonCure is it for this decade,” said Matthew (Lauren Concrete). “For Lauren, the first draw to CarbonCure was that it made business sense. It reduces material costs so it’s a no-brainer. The second draw is the sustainability piece. This is setting us up well for future growth in sustainable concrete.”

Lauren moved to CarbonCure to gain a competitive advantage. “Ten years from now, CarbonCure’s technology will be industry standard so it won’t be a point of differentiation. We want to capitalize on the first-mover advantage and make a name for ourselves as a sustainable concrete supplier today.”

How CarbonCure Works



1. Waste CO₂ emissions are collected from local industrial emitters by gas companies and then purified.

2. The purified CO₂ is stored onsite at the concrete plant and connected to the CarbonCure Technology.

3. The CarbonCure Technology injects CO₂ into the concrete during mixing to produce stronger, greener concrete.

4. Private and public projects are built with CarbonCure concrete, reducing embodied carbon in new buildings.

Getting a Seat at the Design Table

Concrete producers (and other materials providers) have long struggled to secure a seat at the design table despite the value they can offer the AEC community.

To address this, Central Concrete has taken the approach of hosting a variety of remote and in-person “Lunch-and-Learn” sessions for architects, engineers, and contractors.

When concrete producers engage with architects, engineers, and contractors before the RFP process even begins, they can advise on the right materials and specifications to meet design goals in the most cost-efficient and sustainable way.

“We’ve gained some good momentum by bringing our perspective to the design community,” said Alana (Central Concrete). “Traditionally there has been a big gap between the ready mix producer and the AEC stakeholders in project situations. By bridging these gaps, we can provide proactive insights on materials, performance requirements, and sustainability.”

Central Concrete even developed a **specification guide** offering advice on minimum cement content, maximum water to cement ratios, and maximum SCM contents based on the use case and required performance.

“We’re hoping to show what is possible with concrete materials and how people on the technical side in the ready mix industry have a unique ability to help with performance specs,” said Alana.

Most producers prefer to engage with the AEC community earlier in the process because it is much easier to make changes before the job is specified. “Once the bids are out, making changes to them is difficult and creates a lot of extra work for the design team that is usually already working to a tight schedule,” said Ryan (Ozinga Ready Mix). “Getting involved as early as possible is the best way to give them the most sustainable product we can.”

Producers are more than happy to engage and offer advice before the job is specified. “Producers like to talk about their product and what it can do,” said Matthew (Lauren Concrete). “They’re more than happy to walk you through how this works, what the test results are, what the possibilities are so get informed and reach out to the producers around you.”



Central Concrete's Specification Guide

Moving to Performance-Based Specifications

Prescriptive specifications include clauses for the methods of construction and impose restrictions on the compositional parameters of concrete mix. Generally, concrete producers prefer [performance-based specifications](#) as they allow for more flexibility and innovation.

“Prescriptive-based specifications are a big barrier to innovation,” said Matthew (Lauren Concrete). “We are master mixers so it’s always a disappointment to be prescribed a mix design that’s been embedded in the industry for decades and doesn’t consider new technologies or innovations. It’s like asking a top baker to bake a cake following your exact recipe — you miss out on a much better cake that could have been made if you’d trusted in the baker’s initiative and expertise.”

Many prescriptive specs exist simply due to legacy, and engineering firms and government bodies are actively working to remove these unnecessary barriers.

“Some of these recycled specs have been around for 30 years,” said Justin (Thomas Concrete). “We don’t do anything the same today as we did it 30 years ago! Technology is our friend. It allows us to push our mixes to a certain level without compromising performance.”

Other firms are unaware of the cost and environmental impact created by their outdated specifications. By engaging in dialogue and sharing expertise, concrete producers can support the engineering and concrete procurement community in its objectives to build more sustainably, while maintaining high-quality standards.

“There is a skepticism that producers are trying to cheapen up the mix but that’s not the case. Producers are the experts. We’re trying to give you as much performance and the best bang for your buck,” said Justin (Thomas Concrete).

The NRMCA’s [Specification in Practice](#) initiative provides a suite of resources to support concrete producers who choose to engage in dialogue with local engineers and specifiers on concrete specification best practices.



Shaping Sustainability Programs

The original [Leadership in Energy and Environmental Design \(LEED\)](#) program gained a lot of criticism from the industry when it first launched. One of the main faults with it was that it was designed without representation from the entire building community. As such, [some industry groups](#) dismissed the system as burdensome, arbitrary, and expensive. Many developers today forgo LEED certification in favor of additional eco-friendly features.

The program could have been more successful if it had involved more stakeholders in the building process. “Ideally there’d be more diversity in environmental boards,” said Darrin (imi). “Ready mix and contractor representation would result in more realistic solutions that would work in practice. However, engineers and architects typically make up 100% of these boards.”

More recent initiatives are seeing more success as they are more diversified. For example, Central Concrete was one of the founding members of the [Carbon Leadership Forum](#). “We collaborate with the forum on initiatives like the [EC3 tool](#) or the [Bay Area Low-Carbon Code](#) to provide the ready mix industry perspective,” said Alana (Central Concrete). “We offer a practical perspective on the realistic way to introduce some of these things.”



What's Next for Sustainability in Concrete?

As technology continues to progress, QC experts are already considering how advances in other industries can be applied to the concrete industry.

“Data has come a long way — we’re always looking at how we can better utilize all the data that we have out there, said Alana (Central Concrete). “On the research side, we’re examining how we can apply machine learning to make mix performance more predictable and change things in real-time, as required.”

One other area that’s expected to gain traction is Environmental Product Declarations (EPDs). It is predicted that these will become the standard across the concrete industry.

“As the market moves towards EPDs, you have to make a business decision whether or not you're going to start doing it for individual mixes,” said Ron Terrelonge, Technical Services Manager at Chaney Enterprises. “It gives you a competitive edge I would think, and you may get the payback from that.”

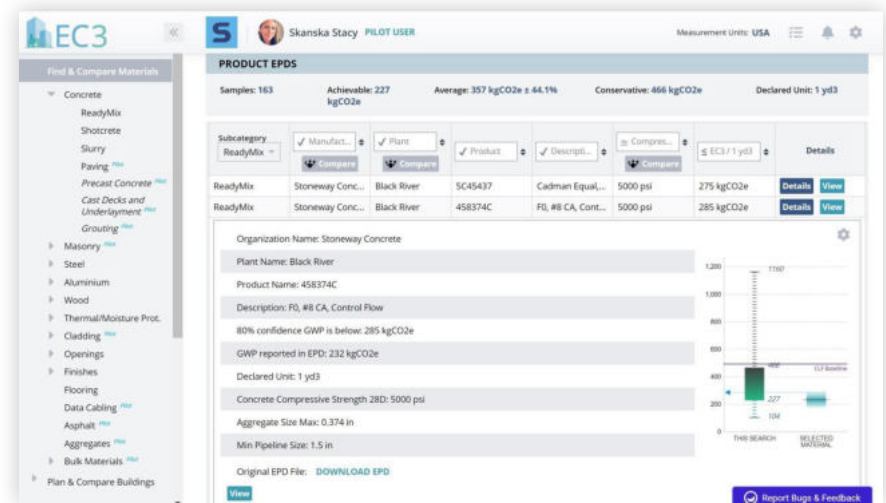
The first approach for ready mix suppliers is to participate in the [NRMCA's EPD program](#). “There's a generic, industry-wide EPD that I've utilized when it's required for certain government projects,” said Nate (Bay Ready Mix). “I will typically get a set of forms to complete and send back. We're working on our own EPDs as well — it's the natural progression of things.”

Once producers have published EPDs for low-carbon concrete, they will appear in searches within the [EC3 tool](#) for consideration by specifiers. The EC3 already contains 24,000 EPDs for concrete products manufactured in the USA and Canada. The EPDs are searchable and sortable by strength, location, manufacturer, plant, mix ID, and unique properties such as “CO₂ Cured” concrete (in which concrete mixes made with CarbonCure’s CO₂ mineralization technology apply).

EPDs, data usage, and advances in technology will continue to increase efficiencies in concrete production while also decreasing concrete’s carbon footprint.

Sustainability hasn't been a linear progression in the concrete industry. “I've been doing this for 35 years and it seems like 90 percent of the progress in that time has happened in the past five years,” said Matthew (Lauren Concrete).

The [decarbonization of the concrete industry](#) is an incredibly important mission. It's clear from this eBook that QC leaders have the experience and knowledge required to play a key role in influencing positive change in a safe, efficient way.



Search Criteria Within EC3

Appendix

CarbonCure would like to thank the following concrete quality control professionals who took the time to participate in our webinar panels and contribute to thoughtful discussions related to specifying low-carbon concrete and sustainable design and building practices. Without them, this ebook would not be possible.

Quality Control Webinar Panelists

The following participants took part in a CarbonCure webinar, [Specifying Low-Carbon Concrete: A QC Perspective Panel 1](#), on June 16, 2020:

Teck Chua

Director of Technical Services, [Vulcan Materials](#)

Teck has 36 years' experience in the concrete industry. He is currently responsible for product research and development, concrete troubleshooting, and QC/QA at Vulcan Materials. A graduate of Purdue University, Teck holds both a bachelor's and a master's degree in Civil Engineering.

Justin Lazenby

Director of Georgia Technical Services, [Thomas Concrete](#)

Justin has been in the Concrete Industry for 19 plus years all with Thomas Concrete in Technical Services. Justin is involved with several industry associations and was the 2019 President of the Georgia chapter of ACI and has served on the board of Directors.

Ryan Cialdella

VP of Research and Development, [Ozinga Ready Mix](#)

Ryan has held various roles in his 17 years at Ozinga. Most recently, Ryan is responsible for exploring innovative materials and technologies to help Ozinga stay at the forefront of the ready mix industry. Ryan earned his bachelor's degree in Aerospace Engineering and an MBA from the University of Illinois.

Ron Terrelonge

Technical Services Manager, [Chaney Enterprises](#)

Ron spent 23 of his 30 years in the concrete quality control field working in the ready mix industry. At Chaney Enterprises, he is responsible for the quality of concrete and aggregates. Ron has a B.S. and M.S. in Civil engineering from the University of South Florida.

The following participants took part in a CarbonCure webinar, [Specifying Low-Carbon Concrete: A QC Perspective Panel 2](#), on June 18, 2020:

Darren Litteral

Quality Control Manager, [Irving Materials Inc. \(imi\)](#)

Darrin has been working for imi for 17 years and in his current role as Quality Control Manager for 7 years in the Central Indiana market. Darren worked as a Technical Services Field Representative for 10 years.

Nate Tarbox

Manager, [Bay Ready Mix of Maryland](#)

Nate joined Bay Ready Mix of Maryland, LLC in 2016. He has 20 years' experience in the design and production of concrete. Nate is an NRMCA Concrete Technologist, Certified Concrete Sales Professional, former Chairman of the MRMCA Technical Committee, and former President of the National Capital Chapter of the American Concrete Institute.

Alana Guzzetta

Manager, U.S. Concrete's National Research Lab, [Central Concrete Supply Co.](#)

Alana has worked for U.S. Concrete for 9 years. She has a Masters Degree in Civil Engineering from San Jose State and is a licensed civil engineer in CA. She is currently the President of the American Society of Civil Engineers (ASCE) San Jose Branch and is a member of the ACI 318 sustainability committee.

Matthew Jetmore

General Manager, Central Region, [Lauren Concrete](#)

Matthew has over 35 years' experience in the ready mix industry. He has an extensive background in operations and sales in a variety of markets including IN, IL, FL, TX and Brazil. Matt holds a BA in Latin American Studies from Carleton College and an MBA from Ball State University.

In-Depth Interviews

Interviews with the following participants were completed by Sterling Communications on behalf of CarbonCure on May 15, 2020:

Jeff Slagle

Concrete Operations Officer, [Chaney Enterprises](#)

Jeff has been working for Chaney Enterprises since 1995 where he started as a sales trainee. Since then he has engaged in the ready-mixed concrete industry as a board member for the Maryland Ready Mixed Concrete Association, Chairman for the Virginia Ready Mixed Concrete Association, Northern Virginia Concrete Council, Virginia Ready Mixed Concrete Association board of directors and VRMCA Secretary/Treasurer.

Matthew Jetmore

General Manager, [Lauren Concrete](#)

Darren Litteral

Quality Control Manager, [Irving Materials Inc. \(imi\)](#)