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CONCRETE SOLUTIONS GUIDE

Know Your Numbers

Performance-Oriented Specifications



Performance-oriented specifications are an alternative to existing standards that dictate the mix proportions of concrete. Instead of stipulating the ratio or types of inputs to a concrete mix like prescriptive requirements, performance-oriented standards require that the concrete product meet certain thresholds (e.g., for strength), without specifying how those standards must be achieved. Moving toward more performance-oriented specifications can diffuse the perceived tension between embodied carbon and performance.

Key Takeaways

Some limitations to using low-carbon concrete are policy-based (e.g., building codes and concrete mix specifications), but communication and coordination between designers and concrete producers early in the design process can offer avenues to navigate these constraints.

Polymakers should work closely with industry stakeholders and support performance-oriented specifications in building codes wherever possible.

When developers or designers orient specifications around performance, they allow concrete producers to innovate, inviting low-embodied-carbon products to replace traditional mixes.

Opportunity

Concrete producers have continued to innovate specialized blends, developed in partnership with clients seeking to improve environmental performance. These projects succeed where performance-oriented specifications allow experts to apply creative solutions, while minimizing unnecessarily prescriptive requirements that constrain the concrete space. Developers have the opportunity to expand the benefits of performance, cost savings, and sustainability that innovative concrete blends can bring to projects by encouraging the use of performance-oriented specifications in the early stages of project development.


Concrete specifications often focus on mixture composition, restricting the ability of producers to create innovative mixes with lower embodied carbon and high performance. The National Ready Mix Concrete Association (NRMCA), a peer-to-peer initiative, also supports the transition toward more performance-oriented specifications. A survey conducted by the NRMCA found that prescriptive specifications are often characterized by a combination of the following requirements: 1) restrictions on supplementary cementitious material (SCM) quantity, 2) maximum water-to-cement ratio, 3) minimum cementitious content, 4) restrictions on SCM type, and 5) restrictions on aggregate grading.¹


But high-quality concrete does not require rigorous specifications on mix type. The American Concrete Institute's standards, for instance, do not feature many of the input-based specifications used today. These prescriptive specifications unintentionally limit the ability of manufacturers to provide low-carbon concrete by narrowing the solution space and discouraging innovation.

Although concrete producers cannot prevent the use of prescriptive specifications, they can take steps to accelerate the transition to performance-oriented specifications. For instance, producers can provide customers with examples of alternative mixes with lower carbon footprints that meet the performance requirements of a particular project. Educating consumers will help expand market reach while improving the visibility of a product and delivering greater value to customers who are eager to reduce embodied carbon.


Designers in turn have a responsibility to remove stringent and unnecessary prescriptive requirements where possible, though prescriptive requirements can still play an important role in project development. Leveraging lived experience through understanding local material supply or particular site conditions can direct concrete producers to the most fertile ground for mix innovation.

Related Solutions

 2. Mix It Up:
Supplementary
Cementitious
Materials (SCMs)

 3. Plug and Play:
Sensors Can Save Time,
Money, and Materials

 4. Embrace Circularity:
Concrete Recycling

 5. Carbon as a Service:
Sequestering CO₂ in
Concrete

Considerations

Specifications in building design always prioritize safety. This is a sizable challenge, as procedural changes in government procurement can take years. Designers will often specify a concrete blend based on familiarity, potentially resulting in an overreliance on traditional blends with higher embodied carbon content. In turn, developers want to mitigate risk, and they often follow the specification of designers without question. Finally, concrete producers, who have the most sophisticated understanding of the science and performance of concrete, are often excluded from this process and are only involved to deliver a specified product. Addressing this systemic issue requires improving communication across the value chain, with an emphasis on early engagement about the potential of using performance-oriented specifications to reduce embodied carbon.

State of the Market

Several resources for specifying performance characteristics have been developed in recent years. *The Guide to Improving Specifications for Ready Mixed Concrete* by the National Ready Mixed Concrete Association is one such resource. This guide and other references for developing performance-oriented specifications can be found in the [resources section](#) at the end of this guide.

Public agencies and departments of transportation can also encourage uptake of performance-oriented specifications. This is a sizable challenge, as procedural changes in government procurement can take years. Even so, several large government agencies are already deploying performance-oriented specifications, including the Federal Highway Administration and the Port Authority of New York and New Jersey.²



Endnotes

1. "Performance Based Specifications State of the Industry and Way Forward," video, <https://www.youtube.com/watch?v=jscs6V-qVGA>.
2. Tom Yu et al., "From Research to Reality: Can We Implement Performance-Based Specifications for Durability and Longevity of Concrete? Will They Work?" *Concrete International*, vol. 39 (2017): 39–46.

Charles Cannon, Valentina Guido, and Lachlan Wright, *Concrete Solutions Guide: Six Actions to Lower the Embodied Carbon of Concrete*, RMI, 2021, <http://www.rmi.org/concrete-solutions-guide/>.

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