National Institute of BUILDING SCIENCES™

**Innovations and Operations: Developments in Sustainable Precast Concrete**

December 12, 2023 | Session Overview

**Speaker**

Jim Schneider, Executive Director, PCI Mountain States, a chapter of the Precast/Prestressed Concrete Institute (PCI)

**Moderator**

Sarah Swango, Vice President, Corporate & Foundation Relations, National Institute of Building Sciences

## Developments in Sustainable Precast Concrete Overview

Precast concrete is a durable and resilient material that provides many benefits to efficient, sustainable structures in the long term. While precast concrete has an upfront CO2 impact, the industry is working to reduce greenhouse gas emissions and increase the efficiency of its products.

On December 12, 2023, the National Institute of Building Sciences hosted a webinar on developments in sustainable precast concrete with Jim Schneider, Executive Director of PCI Mountain States. The webinar is part of the Building Innovation Webinar Series.

In his presentation, Schneider discussed technical innovations to reduce the carbon footprint of precast concrete and examined current process improvements that are pushing the industry forward to a more sustainable future.

Sarah Swango, Vice President, Corporate & Foundation Relations with NIBS, served as moderator.

## Preparing for Inevitable Change

PCI's Schneider opened his presentation with a definition of sustainable design, taken from the U.S. General Services Administration: "Sustainable design seeks to reduce negative impacts on the environment and the health and comfort of building occupants, thereby improving building performance. The basic objectives of sustainability are to reduce consumption of non-renewable resources, minimize waste, and create healthy, productive environments."

According to the U.S. Green Building Council, buildings account for 13.6 percent of potable water use in the United States. That is the third-largest category behind thermoelectric power and irrigation.

Additionally, the building industry consumes 40 percent of the raw materials flow of the global economy every year.

This type of building impact means one thing, Schneider said.

"We have to build with both sustainability and resilience in mind," he said. "Any difference we can make in decreasing our part of the pie will make a difference worldwide."

## What is Embodied Carbon?

The concrete industry recognizes the need for immediate reductions in greenhouse gas emissions.

When it comes to embodied carbon, the definitions differ.

Some view the embodied carbon of a building as including the entire lifecycle of materials, even the operational phase of the building. A full lifecycle view of embodied carbon would account for impacts of landfilling or recycling materials as well.

Others focus on initial embodied carbon, which are the impacts associated with extracting, manufacturing, and transporting materials to the jobsite.

All building materials contribute to the carbon footprint of a building in different ways, and the materials matter:

- Concrete contributes 6 to 11 percent of global carbon dioxide emissions.
- Manufacturing virgin steel from iron ore is very energy intensive.
- Wood produces fewer emissions than concrete and steel, but there's much debate about the overall impact.

When it comes to precast concrete, there's an upfront carbon impact, but this is mitigated through the delivery of a high level of performance over a building's long lifecycle.

## The World of Concrete

Schneider shared some information about concrete. This includes:

- Concrete is the most abundant manmade material in the world.
- Estimates range between 4 and 10 billion tons of concrete are produced annually.
- Concrete provides durability, resilience, and quality.
- We need it.
- We need to make it better and less impactful on the environment.

A UN Environment Global Status Report from 2017 found that we will have 3.4 trillion square feet of buildings built by 2060. This is 1.4 times the existing building stock.

Building designers and owners are encouraged to design for resilience and zero energy.

Among the goals to achieve these goals – reduce the use of traditional Portland cement and instead use more Portland-limestone cement (PLC), which is a blended cement with a higher limestone content, and boost the use of limestone calcinated clay cement (LC3).

## Supplementary Cementitious Material

Supplementary cementitious material can be used to reduce cement content.

There are many approaches to replacing cement, using other cementitious materials like fly ash, slag cement, or silica fume. Other innovative materials to replace cement include biochar, calcium carbonate aggregates, recycled glass, microalgae, and cellulose nanomaterials, among others.

Schneider shared a case study in sustainability with the Missoula Federal Credit Union Russell Street Branch in Missoula, Montana.

The project utilized concrete made of recycled content. A big component of the structure utilized recycled glass, he said.

The building pioneered the use of a concrete product that eliminated Portland cement from the building, drastically lowering embodied carbon. It was the first building in Montana to be awarded a LEED Platinum certification.

Site references and concrete industry resources:

- Precast/Prestressed Concrete Institute
- Build With Strength
- National Ready Mixed Concrete Association
- NEU Concrete – American Concrete Institute

## Building Innovation Webinar Series

As part of our mission to continue conference education, NIBS launched a new webinar series to reach even more professionals on new technology, trends, groundbreaking tools, best practices, and workforce solutions.

It's our way of extending the Building Innovation annual conference beyond the in-person meeting.

The next webinar – Unlocking the Metaverse: The Cyber-Physical Relationship – takes place January 16, 2024.