CONCRETE BRIDGE STEWARDSHIP

Joining Forces

Concrete and steel bridge champions collaborate to develop thorough life-cycle assessments and lower embodied-carbon material procurement requirements for bridges

by John Cross and Emily Lorenz

On the surface, two recent federal initiatives—one to increase infrastructure spending and the other to reduce carbon emissions—seem mutually exclusive, which raises the question of whether more bridges can be built while simultaneously lowering the carbon emissions associated with their construction. The answer is that these two objectives can coexist, but only if a consistent and robust technical framework is in place for evaluating the embodied-carbon impacts of the materials used in bridge construction.

To address this challenge, the steel and concrete industries have joined together to develop fair and technically robust life-cycle assessment (LCA) requirements for the bridge market. The National Concrete Bridge Council (NCBC) and the National Steel Bridge Alliance (NSBA) are working together to craft a guidance document for properly conducting an LCA that is specifically applicable to bridges. The guidance will also address the procurement of materials with less embodied carbon.

The guidance document will be especially valuable to state departments of transportation (DOTs) that are increasing their infrastructure investments but must adhere to laws and regulations designed to reduce the embodied-carbon impact of construction materials.

The following are among the recent federal, state, and local initiatives that are driving this push toward more-sustainable solutions:

- The Federal Highway Administration issued a vision for pavements: "To advance the knowledge and practice of designing, constructing, and maintaining more-sustainable pavements through stakeholder engagement, education, and development of guidance and tools."[1]
- The White House has set economy-wide greenhouse gas emission targets: 50% reduction by 2030 and 100% reduction by 2050 (based on 2005 baseline).[2]
- A federal Buy Clean initiative was announced in September 2022.[3]
- A carbon-reduction program was created through the Infrastructure Investment and Jobs Act of 2021.[4]
- California, New York, Colorado, Minnesota, and Oregon are among the states to enact Buy Clean laws that establish embodied-carbon thresholds for purchasing construction materials for buildings and infrastructure projects.[5]

These initiatives can only be successful if the embodied-carbon impacts they seek to reduce can be accurately and consistently measured and quantified.

Design decisions need to be based on numerous analytical factors, including the environmental impacts of alternative scenarios. Today, properly evaluating the embodied-carbon impacts of a project in terms of its global warming potential (GWP) is critical. A bridge LCA is a necessary component of measuring GWP and must be based on a consistent and sound technical methodology.

But the effort to reduce embodied carbon must not end there. Identical products from different producers will have different embodied-carbon impacts associated with differences in the producers' manufacturing and production processes. Procurement guidelines are necessary to ensure that any differences in manufacturing processes from company to company do not impede the production of low-embodied-carbon products.

Today's bridge market lacks comprehensive tools to quantify and reduce negative environmental impacts. The first step in developing the tools is the LCA guidance document.

Why a Consistent LCA Framework Is Needed

Current Buy Clean laws and embodied-carbon-reduction specifications for steel and concrete materials used in bridges are technically insufficient and were developed without industry input. Laws, reguations, and specifications sometimes disagree with ISO standard requirements that have established the methods for measuring, evaluating, and reporting environmental impacts. Without technically accurate requirements, DOTs cannot know if they are truly accomplishing the mandated goal of reducing the environmental impact of concrete and steel bridges.

What Will Be Developed

The steel and concrete industries have been conducting LCAs for more than 20 years and have the longest history of evaluating and reporting the environmental impacts associated with structural materials. Representatives of these industries are well versed in the ISO standards that are used during assessments, and they frequently serve on the committees that develop these standards. The joint effort of the steel and concrete industries will provide the best opportunity for crafting technically sound language that can be used to accurately determine real reductions in environmental impacts, including embodied carbon. By joining together to develop resources, the concrete and steel bridge industries

can ensure that the requirements that will be implemented are equitable and technically correct.

The steel-concrete collaboration aims to develop a guidance document on how to properly conduct LCAs for bridge projects and address the procurement of materials. This guidance document will:

- maintain technical accuracy and adherence to ISO standards;
- emphasize the importance of performance in conjunction with reducing environmental impacts;
- frame decision-making from a whole-life-cycle context and evaluate a full set of environmental impacts;
- be mindful of existing DOT requirements and the Envision rating system (a system similar to LEED but for infrastructure projects) to harmonize with current industry practices, where possible;
- solicit feedback from bridge engineers, DOTs, and other agencies during work-product development.

It is anticipated that draft guidelines will be available for review in mid-2024.

Gregg Freeby, chair of NCBC, states, "NCBC looks forward to the collective efforts between the concrete and steel industry groups on a scientific-based approach to aid bridge practitioners in assessing and reducing the embodied carbon in the design and execution of their projects."

Chris Garrell, NSBA chief bridge engineer, states, "NSBA is thrilled to work on this collaborative effort to standardize the environmental assessment of steel and concrete bridges, and we're confident that the marketplace will benefit from this unified approach."

References

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3. The White House. 2022. "Fact Sheet: Biden-Harris Administration Announces New Buy Clean Actions to Ensure American Manufacturing Leads in the 21st Century." https://www.whitehouse.gov/briefing-room/statements-releases/2022/09/15/fact-sheet-biden-harris-administration-announces-new-buy-clean-actions-to-ensure-american-manufacturing-leads-in-the-21st-century/.
4. FHWA. 2023. "Fact Sheets: Carbon Reduction Program (CRP)." https://www.fhwa.dot.gov/bipartisan-infrastructure-law/crp_fact_sheet.cfm.
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EDITOR'S NOTE

It is unusual for organizations representing competing materials to join forces. However, the consequences of allowing other parties—unfamiliar with the materials, processes, and existing requirements, or lacking the technical background—to create LCA requirements for the bridge industry would have long-term adverse effects for all, including the general public. NCBC and NSBA are knocking down the traditional barrier to join in the development of guidance, based on science, on properly conducting whole-life-cycle assessments for bridge projects. Look to ASPIRE® for future updates on the progress of this historic effort.