Precast Concrete Drive to Decarbonization

William's Court, Kanata, Ontario

Years of Data Collection

The Canadian precast concrete industry, through CPCI, has been tracking and reporting the environmental impacts of its products and operations since 2015. In 2023, CPCI published its third round of Environmental Product Declarations (EPDs) for various precast product categories with regionalized breakdowns and introduced the 2050 Roadmap to Net-Zero, demonstrating our commitment to decarbonizing the Canadian Precast Concrete industry.

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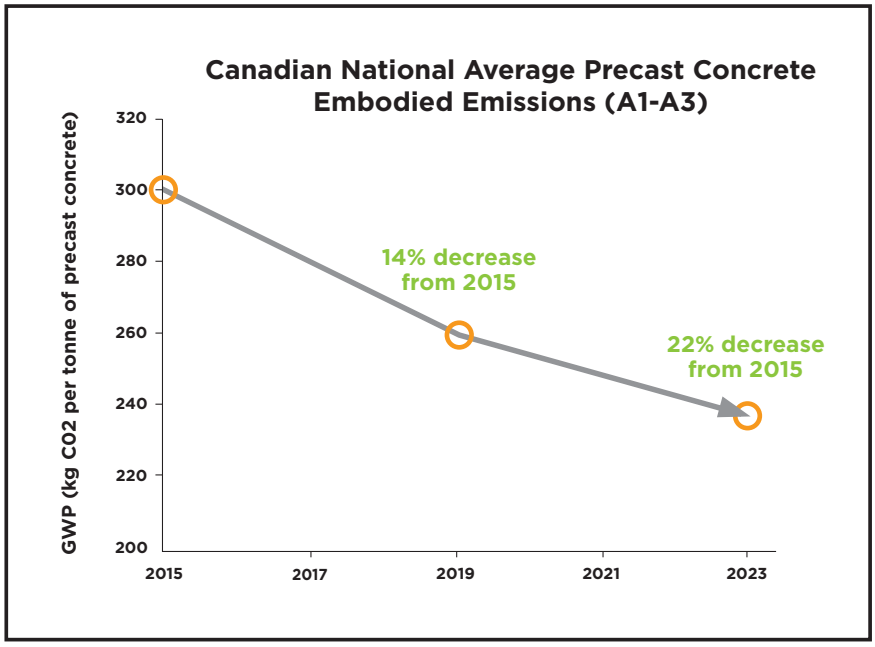
In 2015, ASTM published the first industry average Type III Environmental Product Declaration (EPD) for the Canadian precast concrete industry, a significant milestone within the wider construction industry. Since then, the Canadian precast concrete EPDs have undergone two more rounds of updates in 2019 and 2023 to capture the latest emissions data from the industry. The newest round of EPDs from 2023 introduced a more detailed regional emissions breakdown than just a national average. Four product categories were reported on: architectural precast products; insulated wall panels; structural precast products; and underground precast products.

Since the publication of our first industry-average EPD in 2015, the Canadian precast industry has seen a 22% reduction in our A1-A3 embodied carbon.



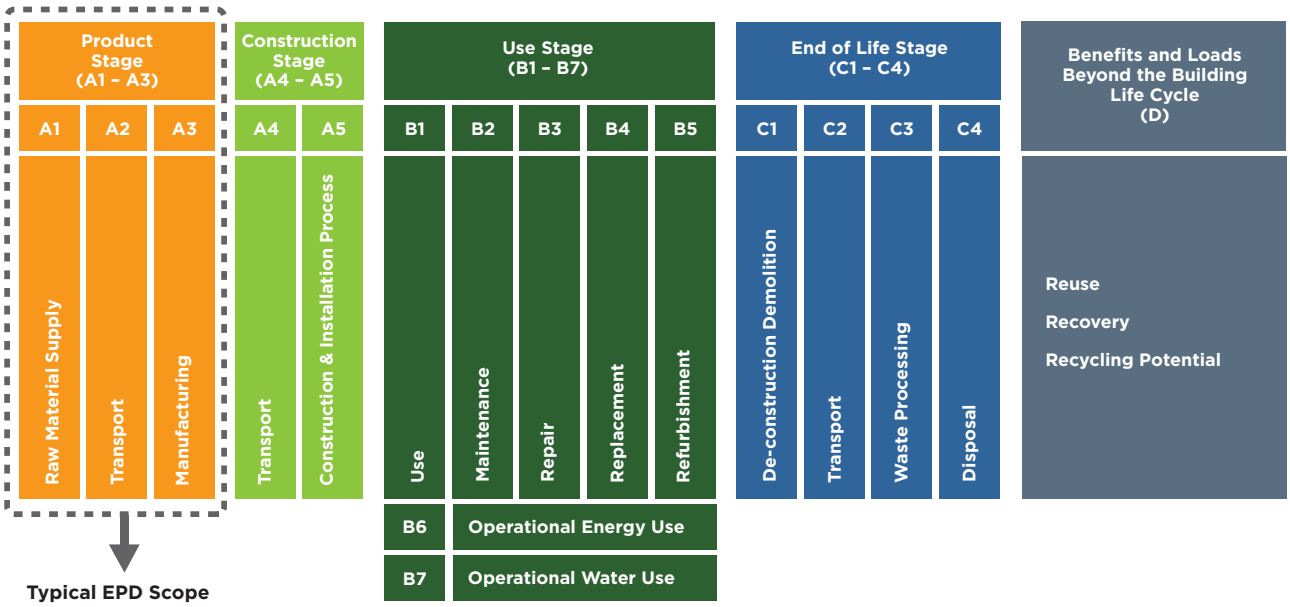
Why This Matters?

A 22% reduction in A1-A3 embodied carbon among our main product categories is an impressive achievement in the construction industry. This further reinforces our concrete commitment to full transparency in reporting our embodied emissions and tracking our progress to net zero. We are on track to our 2030 targets and will continue to push the limits as an industry to reduce our environmental impact. We are continuously innovating and introducing new technologies to make more sustainable products.

EPDs Should Not be Compared

The AEC community must understand the limitations of EPDs and the differences between EPDs and whole-life whole-building life cycle assessment (wbLCA). Most people focus on just the Global Warming Potential (GWP) reported in the EPDs, but what does this number mean? Can you compare two different building materials' EPDs and choose the lowest GWP?

EPDs are intended to be used as reference input data for consultants conducting whole-life whole-building life cycle assessments (wbLCA). The figure below shows all the life cycle stages that are present in a whole building life cycle assessment. The scope of EPDs for most construction materials, including precast concrete, only covers stages A1 to A3 (also known as cradle-to-gate emissions). Therefore, EPDs only represent a fraction of the emissions emitted throughout the entire life cycle of a building or project.



Complete life cycle stages in a whole-life, whole-building life cycle assessment (wbLCA). The scope of EPDs for most construction materials, including precast concrete, only covers stages A1-A3, which is also known as cradle-to-gate.

For prefabricated systems like precast, the A1-A3 GWP can be misleading when compared against in-situ materials such as cast-in-place concrete. Precast concrete may seem to have higher A1-A3 emissions at first glance, but it has greatly reduced A4-A5 emissions during the construction stage because it is a prefabricated system.

Consider a situation where a design team is choosing a material for the structure of a building. Different materials would demand different structural designs to comply with building code requirements. Thus, the amount of material used would be very different due to the differences in strength and weight. It is possible to produce a lower embodied carbon building by using more carbon-intensive materials if it is more structurally efficient and can create longer spans (such as with precast hollow-core flooring systems). Prefabricated systems also greatly reduce A4-A5 construction emissions because the product is ready to be installed when delivered to the job site. Climate-resilient and durable materials like precast concrete offer much longer service life, which saves the emissions due to repairs or having to rebuild sooner. In summary, each project must be assessed in its entire design (with an engineer-reviewed bill of materials) for its entire life cycle to get an accurate comparison of different materials.

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"We should look at a whole-life, whole-building life cycle assessment (LCA). That is the only way to determine the full impact of our decisions at all life cycle stages, considering all material and system interactions. Design decisions should never be made on a cradle-to-gate scope without considering the whole life of the structure. Once the structure has been optimized, systems are chosen, and material quantities have been finalized, a designer should look for the "best" within a material category that meets the performance requirements."

– Emily Lorenz, an independent sustainable consultant and former editor-in-chief of PCI Journal.

Design for Disassembly and Reuse

Prefabricated precast systems can be easily designed with disassembly and reuse in mind, recovering emissions during stage D of life cycle. Precast panels can be dissembled easily from old buildings to be reused in new buildings. Precast concrete can also be crushed at the end of its life cycle to obtain recycled aggregates to be used in road construction or to mix new concrete.

It is important to note that the North American PCRs for precast concrete EPDs do not capture the environmental benefits of disassembly and reuse. It is also important to define the scope of your whole building life cycle assessments to include reuse, recovery and recycling.

We invite you to join us in our journey to decarbonize the Canadian precast concrete industry by 2050. By working together, we can build a sustainable future for generations to come.

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