Cement Association of Canada
Association Canadienne du Ciment

July 21, 2025

Feedback on Phase 1: Embodied GHG Draft Policy Positions

To: CBHCC Secretary, CBHCCSecretary-SecretaireCCHCC@nrc-cnrc.gc.ca

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On behalf of the Cement Association of Canada (CAC), we thank you for the opportunity to respond to the Canadian Board for Harmonized Construction Codes' (CBHCC) draft policy direction regarding embodied greenhouse gas (GHG) emissions in the National Model Codes.

We commend the Canadian Table for Harmonized Construction Codes Policy (CTHCCP) and the CBHCC for considering embodied carbon in the 2030 code cycle. Our sector leads in disclosing and reducing embodied carbon emissions and has developed a comprehensive industry Action Plan, Concrete Zero. Our Action Plan supports policies for disclosure and reduction of embodied carbon, particularly the Treasury Board Secretariat's (TBS) Standard on Embodied Carbon in Construction (the Standard), specifically, Appendix B – Structural Material Embodied Carbon Disclosures and Reductions, Table B.1 - Concrete. Both the cement and concrete sectors have developed regionally specific, industry-wide average type III Environmental Product Declarations (EPDs) to quantify and confirm our industry's progress in reducing carbon emissions. All cement facilities in Canada have also published facility-specific EPDs, and an increasing number of concrete producers have done the same.

We see alignment between our efforts, the Standard, and the CBHCC's direction, and we are pleased to present the following summary recommendations along with more detailed feedback in this document. The CAC recommends that the codes' approach to embodied carbon be material- and technology-agnostic, focusing on performance outcomes across all materials rather than on prescriptive metrics that could impose market-distorting restrictions on building designs and material choices. The CAC encourages CBHCC to establish early clarity and consistency in their policy and technical guidance to support the timely development of codes and planning for provincial and territorial adoption. To ensure the necessary clarity and consistency, the CAC recommends that the CBHCC:

1. Facilitate the development of a whole building life cycle assessment (WBLCA) CSA National Standard of Canada that incorporates best practices from the NRC National WBLCA Guidelines, the NRC National WBLCA Practitioner Guide, and the ASHRAE 240p draft, to serve as a reference for consistent development of WBLCAs.
2. Define the scope of the WBLCA to include life cycle stages A1 through C4, or at a minimum, A1 through A5. The CAC recommends that the code process facilitate the development of standard data and module assumptions for

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stages A4 through C4. The results from modules A4 through C4 should not be used to demonstrate compliance with embodied carbon reductions until these modules are fully developed in **collaboration** with industry. The CAC recommends conducting a construction industry-wide study to support the development of these modules. The cement and concrete industry is ready and willing to collaborate on creating industry-specific data and module assumptions.

3. Establish tiered performance benchmarks based on percentage reductions from a baseline building. Using percentage reductions to select a performance benchmark allows project owners, architects, engineers, consultants, and builders to retain the freedom to choose materials and design solutions that meet their technical and functional requirements, while being motivated to improve specifications, sourcing, and design efficiency to reduce embodied emissions. This approach has been adopted across Canada and is a well-documented, industry-supported method as demonstrated by the Standard. Currently, there is insufficient and inconsistent data and information to set intensity limits and absolute targets. The performance evaluation metric for WBLCA should be the total kg CO_2e for the building, and the intensity metric should be the kg CO_2e per m^2 of built floor area (as defined by NRC WBLCA practitioner's Guide, including underground structures and parking).
4. Allow carbon impacts associated with biogenic carbon and concrete carbonation to be calculated, but the results shall be reported separately and shall not be included in the demonstration of compliance with the embodied carbon limit (tiered limits/percent reductions), as per the NRC WBLCA practitioner's Guide section 4.4, Treatment of Special Topics, pages 30 and 31.

The CAC appreciates the opportunity to submit this document and has included detailed comments on specific sections of CBHCC's policy paper, which follow the signature block below. We are available to discuss our recommendations in more detail.

Sincerely,

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CAC's Detailed Comments

CAC Comments:

5. The disclosure and reduction of embodied carbon are increasingly common, as shown by the rise in government policies and green building certification programs like LEED, CAGBC Zero Carbon Standard, and BOMA BEST that require it. It can be measured effectively with minimal impact on cost or construction schedule. Reports and case studies demonstrate that reducing embodied carbon is achievable without increasing costs or causing delays, especially around the 10% reduction target, as highlighted in the recent Clean Energy Canada report. When targets are set at a more ambitious level, such as 30%, there is a more noticeable impact on cost and schedule. A deliberate design approach focused on reducing embodied carbon through material optimization and minimization can significantly lower project budgets and support housing affordability. Please refer to the following sections in this document for more details on strategies to minimize impacts when disclosing and reducing embodied carbon in construction projects.
    - Strategies for Reducing Carbon in Structures
    - Material Based Reductions

6. The Phase 1: Embodied GHG draft policy positions provided by the CBHCC provided general descriptions of how it planned to address embodied GHG emissions. The CAC sees alignment between our efforts, the Standard, and the CBHCC's direction, but would like to be a collaborative partner in developing the clarity and consistency needed to make this policy effective and implementable. The following are CAC's detailed comments on specific excerpts from the CBHCC's policy paper.

Definitions (excerpt from CBHCC policy paper)

The following definitions are used in this document: Embodied GHG emissions refer to the greenhouse gas emissions associated with materials and construction processes throughout the life cycle of a building excluding emissions from building energy use. This can include emissions from material extraction, manufacture, transportation, construction, replacement, refurbishment, demolition, removal. Life cycle is a term used in the context of assessing the overall environmental impact of buildings from the extraction of raw materials all the way to the disposal of waste at the end of their useful life. In the context of a building, it includes the product stage, construction stage, use stage and end-of-life stage. For the purpose of this policy position, operational impact and the Beyond the Building Life Cycle Stage D, is not in scope. The operational impact is addressed in the CBHCC's policy paper on operational GHG emissions.

CAC Comments:

7. The CAC recommends that the CBHCC should reference existing definitions for embodied carbon terms that are found in either:
   - NRC National WBLCA Practitioner's Guide
   - Ashrae 240p Draft
   - UK Net Zero Carbon Buildings Standard
8. The CAC agrees with not including Life Cycle Stage D.
9. Before the CBHCC finalizes their policy position of excluding operational GHG emissions from this code the CAC recommends that the CBHCC consider how solutions targeting either operational or embodied GHG emissions could influence each other and contribute to a single "whole-life carbon" metric. There are software tools that specialize in calculating either operational or embodied carbon. WBLCA tools focused on calculating embodied carbon typically can integrate operational carbon estimates from energy modelling tools, providing a comprehensive understanding of all GHG emissions, whole-life carbon, related to constructing and operating a building.

Draft policy direction for code development (excerpt from CBHCC policy paper)

Unless otherwise specified, the following are applicable to new construction only.

CAC Comments:

10. The CAC agrees that the code should apply only to new construction.

Tiered framework (excerpt from CBHCC policy paper)

Embodied GHG emissions National Model Code requirements should be developed in a tiered framework that allows jurisdictions to adopt changes at a pace that suits their needs while aligning on the overall approach and objectives. The tiered framework should incorporate progressively improved embodied GHG emissions performance targets within the parameters described below. In addition to the life cycle stages and building elements included below, the tiered framework should be able to accommodate the future addition of other life cycle stages and building elements and should provide options for a range of available construction materials. The parameters described below are based on the current state of knowledge and research in the subject area and reflects the availability of data that is suitable for development of National Model Code requirements in the 2030 code cycle. The CBHCC will continue ongoing policy discussions, which could inform future code development, on expanding the tiered framework described in this document to include a broader scope of life cycle stages, building elements, and/or GHG emissions metrics. The baseline level of the tiered framework should represent the minimum performance level that is attainable using construction materials and practices that are consistent with building elements associated with the lowest performing energy efficiency and operational GHG emissions tiers in the 2025 National Model Codes. Higher tiers of performance should include incremental improvements in performance over the baseline requirements. Where practical, the framework should leverage existing standards and guides.

CAC Comments:

11. Many jurisdictions have set intensity metric targets; however, to CAC's knowledge, no comprehensive research study has produced a statistically representative sample of WBLCA's that follow the same WBLCA guidelines, data, and modelling assumptions for A1 through C4 to establish statistically representative intensity metrics for different building archetypes and across different geographic areas.
12. The CAC recommends that tiered performance be based on percentage reductions from a baseline building until a comprehensive study has been completed to establish intensity benchmarks for various building archetypes across Canada's different geographic areas. The NRC WBLCA Practitioner's Guide, Section 5, Determining the Baseline, provides an appropriate methodology for this approach.
13. The CAC recommends that CBHCC consider applying Part 3 building requirements based on built floor area for new constructions. For example, the TBS Standard, Appendix A, indicates the standard's relevance for buildings exceeding 2,000 m2 of built floor area for new developments.

Building elements and life cycle stages (excerpt from CBHCC policy paper)

When considering the impact of embodied GHG emissions on buildings elements, the National Model Codes should as a starting point have performance requirements for life cycle stages A1-A3 for the structural elements (including foundations and substructure), and, if practical within the code cycle, for the building envelope.

CAC Comments:

14. Define the scope of the WBLCA to include life cycle stages A1 through C4, or a minimum of A1 through A5. The CAC recommends that the code process facilitate the development of standard data and module assumptions for stages A4 through C4. The results from modules A4 through C4 should not be used to demonstrate compliance with embodied carbon reductions until these modules are fully developed in **collaboration** with industry. The CAC recommends

conducting a construction industry-wide study to support the development of these modules. The cement and concrete industry is prepared and willing to collaborate on creating industry-specific data and module assumptions. Project teams should be free to override the default data with project-specific data.

15. The CAC recommends that performance requirements be defined for the entire building or its load-resisting system, rather than for individual structural elements. CAC's rationale is best conveyed through the following examples: Not all floor systems span the same distance—some may allow for reduced column spacing or require fewer supporting beams. Similarly, not all envelope systems are load-bearing. Therefore, applying the same limits to both a concrete load-bearing wall and, for example, an insulated metal panel system is not appropriate. While both systems provide enclosure for the building, the concrete wall also supports gravity loads and is part of the load-resisting system. In contrast, the insulated metal panel system relies on a supporting frame and does not contribute to the building's structural resistance.
16. The CAC recommends that the WBLCA should be calculated at the end of the project design phase, not as built. The process of designing and constructing Part 3 buildings can take five years or longer. The complexity of tracking and managing data on building materials and designs throughout an entire project life cycle could involve multiple architecture, engineering, and construction firms, which would be too burdensome to accomplish at this stage of the policy. The requirement to provide as-built data could be a future tier.
17. The CAC recommends that carbon impacts related to biogenic carbon and concrete carbonation can be calculated, but the results must be reported separately and not included in the demonstration of compliance with the embodied carbon limit, as specified in the NRC WBLCA practitioner's Guide section 4.4, Treatment of Special Topics, pages 30 and 31.

Performance evaluation metrics (excerpt from CBHCC policy paper)

Performance evaluation of embodied GHG emissions in the National Model Codes for the 2030 code cycle should include the percent-improvement (i.e. reference approach). The CBHCC will continue ongoing policy discussions, which could inform future code development, on expanding the performance evaluation to include both intensity (kg CO2 e/m2 of gross floor area) and absolute metrics (metric tons of carbon dioxide equivalent, MT CO2 e) and will provide further direction at a later date.

CAC Comments:

18. The CAC agrees that a percent-improvement approach (i.e. reference approach) is appropriate. A percentage reduction approach is the most suitable method to

demonstrate the disclosure and reduction of embodied carbon in building construction. This approach offers the greatest flexibility for project owners, designers, architects, engineers, and builders to address the diverse demands and requirements of different building types while providing clear, measurable, and attainable embodied carbon metrics. In contrast, intensity-based targets may force decisions about material substitution and design that could conflict with other project needs, budgets, design choices, or operational requirements. Furthermore, intensity metrics rely on data disclosure tools, such as environmental product declarations, which are explicitly not intended for inter-material comparisons (as per ISO 21930, Section 5.5), but are primarily focused on intra-material decision-making.

A percent reduction approach allows project teams to retain the freedom to choose materials that meet their technical and functional requirements, while being motivated to improve specifications, sourcing, and design efficiency to reduce embodied emissions. This offers a practical and achievable path to decarbonisation without compromising the design intent or project feasibility. This method also prevents market-distorting competition between materials, encouraging innovation and better outcomes for all types of buildings and construction materials. Additionally, it provides a predictable, long-term signal to material manufacturers to invest in carbon reductions, supporting a smoother and more economically resilient transition aligned with realistic capital investment cycles. In short, the percent reduction approach enables freedom of design and material choice, emphasising optimisation over substitution, and aligns with real-world project delivery requirements.

This method has been implemented and validated over the past three years by the Federal Government through the Standard.

19. The CAC recommends maintaining consistent percentage reductions for both Part 9 and Part 3 buildings. Suggested reduction targets are 10%, 20%, or 30%, representing modest, intermediate, and high performance levels. For instance, a 10% reduction is the current goal for ready-mix concrete in the TBS Standard.

20. The CAC recommends that the WBLCA performance evaluation metric be measured as the total kg CO_2e for the building.

21. The CAC recommends that the WBLCA intensity metric be kg CO_2e per m^2 of built floor area (as defined by NRC WBLCA practitioner's Guide).

Prescriptive options (excerpt from CBHCC policy paper)

The scope of work should include prescriptive options for housing and small buildings (Part 9 of the National Building Code) that are available in the same edition of the National Model Codes as the tiered framework.

CAC Comments:

22. The CAC agrees with having both performance-based and prescriptive options for housing and small buildings (Part 9 of the National Building Code).

Geographical flexibility (excerpt from CBHCC policy paper)

The tiered framework should allow for flexibility to account for the unique circumstances of rural and remote areas.

CAC Comments:

23. The CAC agrees that the tiered framework should provide flexibility to accommodate the specific circumstances of rural and remote areas. The CAC

24. The CAC recommends that the CBHCC require disclosure of embodied GHG emissions in all regions across Canada and consider how to implement reductions based on geographic availability. The CAC also suggests that the CBHCC review the Standard's approach to geographic flexibility for relevant projects.

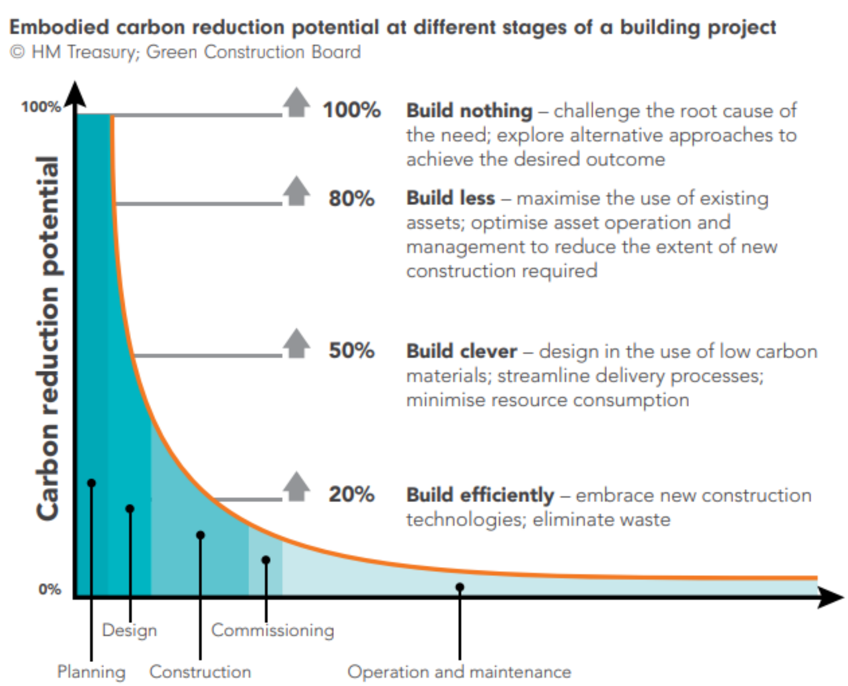
Excerpts from CAC's Concrete Design Handbook v5 (set to be released in September 2025)

Strategies for Reducing Carbon in Structures

Much of the focus on reducing a structure's embodied carbon often centres on more efficient designs or advanced materials with lower carbon impacts, which are considered expensive. In reality, the greatest potential for reducing material use happens much earlier in the design process, where a sustainable design is usually less costly. Any design aiming to lower its carbon footprint should prioritize reducing material use first, as this also reduces costs.

Several common methods for reducing embodied carbon in a project throughout the construction life cycle are illustrated in the figure below. Engineers play a crucial role in advising projects on their use case or on building less of it. Although final decisions on the project scope are often not made by engineers, they can support the team with overall planning, which can lead to the greatest carbon reduction impacts.

[1]



Decisions such as reducing transfers by planning a grid and maneuvering around project requirements, adjusting massing, reducing balconies, and changing parking requirements will lead to the greatest reductions in carbon. In the case study from the previous section, much of the transfer slab is placed over a retail and parking grid, which, if removed or better aligned, would result in the largest single decrease in

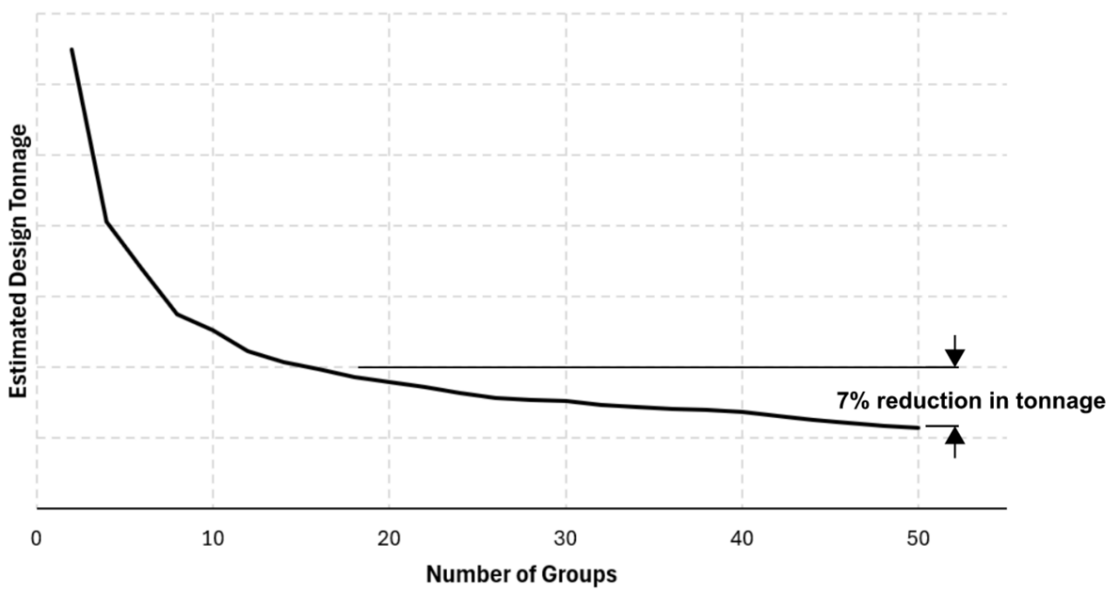
[1] HM Treasury. (2013). Infrastructure Carbon Review. London: HM Treasury. https://assets.publishing.service.gov.uk/media/5a7c9803ed915d12ab4bbd33/infrastructure_carbon_review_251113.pdf

embodied carbon. Challenging other client specifications, such as deflection limits, vibrations, and loading criteria, will have a more significant impact than design refinements.

Building clever has the next best potential for impact and is the true domain of the Engineer. Engineering involves the careful application of the best design to meet project requirements. Engineers are well-suited to determine efficient systems, such as slab layouts, lateral and core configurations, and optimize for new materials. They can also expand testing of material properties, such as Modulus of Elasticity, or combine competing project requirements.

Finally, is build efficiently. This can involve extra refined designs or use of high performance materials. The carbon goals of society can't be met without this final step, and many great advancements in materials engineering are required, and are underway.

As stated above, there is often an oversized focus on high-performance materials or 'over-design'. The practice of engineering is a careful balance of providing for aesthetics, societal safety and economy. Economy of structure, however, includes working within a provided budget and constructable designs. For example, the graph below illustrates the optimization of numerous reinforcement 'mats'—the top bars over the columns in a slab. This slab is quite large, with 76 columns on the floor plate. The columns are frequently grouped together for easier design and construction.



Balancing the ability to refine a design with the practicality of constructing such a precise design.

In this case, the approximate reduction of reinforcement in just the top mats is about 6% if the total number of column groups increases from 16 to 50 (roughly from groups of 5 to fewer than 2). Additional top reinforcement may only account for about half of the slab reinforcement, so the overall impact per slab would be less than 3%. Usually, the cost or carbon savings of such a design do not justify the effort to achieve a very precise but inappropriate solution. Unlike manufactured goods, buildings are typically unique designs and are generally constructed once, which requires balancing Quality Assurance and Control with these efforts' costs. If every element is also unique, the cost and time needed to design and build each as a separate piece are often prohibitive. A single mistake in the field can cause significant cost and schedule delays. Limited full-scale testing and refinements of systems occur more in the building industry compared to sectors like aerospace. Therefore, engineering always involves balancing these various pressures.

Material Based Reductions

Lower-carbon concrete refers to concrete produced with a lower carbon footprint than traditional mix designs using baseline technology, while meeting all relevant performance requirements. That said, there is not yet an agreed-upon specific definition of what these baseline values are.

Achieving low-carbon concrete outcomes requires early collaboration among specifiers, contractors, and concrete producers. Clear specifications, informed by performance requirements rather than prescriptive mix constraints, are essential. Rather than mandating fixed mix designs, project teams should aim for overall project-based carbon reduction targets, allowing flexibility and innovation in material selection.

The following strategies, summarized from work by Mantle Developments and the National Research Council of Canada, Strategies for low carbon concrete: primer for federal government procurement: low carbon assets through life-cycle assessment (LCA)[2] initiative, outline practical ways to reduce embodied carbon in concrete.[2]

Consider Performance-based design: Performance-based design requirements provide flexibility for specifying the required strength and durability of concrete, while considering low-carbon options. This can be achieved by employing concrete constituent materials in the most carbon-efficient manner when meeting the project requirements. For example, concrete is typically designed to achieve a strength target within 28 days, but if the structural element is not being put into service within that time, the design strength at age can be delayed to 56 days or even 91 days. As a result, the cement content may be reduced and the use of supplementary cementitious materials, such as slag can be maximized. It, in turn, creates a more sustainable and lower-carbon concrete overall. Similarly, paying attention to the required durability criteria, including the classes of exposure defined in CSA A23.1 may avoid over-specifying durability requirements, reducing the embodied carbon content and ensuring the use of the most applicable classes of exposure.

Use Portland limestone cement: In 2008, the CSA A3001 standard introduced a new category of general-use cement known as Portland-limestone cement (PLC), also referred to as general-use limestone (GUL) cement. By incorporating limestone to replace a portion of the cement, PLC reduces the amount of clinker needed—a significant source of CO_2 emissions in cement production. The following year, the CSA A23.1 concrete standard recognized PLC as an approved cement type, and it has since been incorporated into both national and provincial building codes across Canada.

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[2] Zizzo, Ryan, Masoudi, Rana, Cooney, Rob. 2021. Strategies for low carbon concrete: primer for federal government procurement: low carbon assets through life-cycle assessment (LCA)[2] initiative. National Research Council of Canada. https://nrc-publications.canada.ca/eng/view/object/?id=d15ccce0-277b-4eed-80ac-d0462b17de57

Maximize the use of supplementary cementitious materials, alternative cementitious materials or blended cements: Partial replacement of cement with supplementary cementitious materials (SCMs)—including blast furnace slag, silica fume, ground glass, fly ash, and natural pozzolans enhances concrete's quality and durability while also helping to reduce CO_2 emissions. The adoption of these materials is influenced by their regional availability. In Canada, while the use of blended cements is gradually gaining traction, the incorporation of slag or fly ash—typically at replacement levels of 10% to 40%—remains a common and well-established practice.

Maximize recycled content in reinforcing steel: Most re-bars in Canada contain recycled content. Recycle rates of 95% and above are possible for typical reinforcing steel and above 75% for specialty steels like high-strength or stainless steel. However, specifying a specific supplier can often be challenging due to the global nature of rebar procurement.

Recycled Concrete Aggregate (RCA): With the release of the updated CSA A23.1/.2:2024 standard, the construction industry in Canada has taken a significant step forward in promoting sustainability. The new provisions now allow the use of **Returned Hardened Concrete (RHC)** and **Reclaimed Concrete Material (RCM)** as **normal-density coarse aggregate**, permitting up to **30%** inclusion in blended coarse aggregate mixes. This advancement not only offers a practical solution for reducing construction and demolition waste but also helps lower the environmental impact of concrete production by conserving natural aggregate resources and reducing landfill use. By embracing **RCA**, producers and specifiers can contribute to a more circular economy in construction while maintaining performance standards and meeting sustainability goals. As the industry continues to seek low-carbon alternatives, the adoption of RCA represents a valuable and now fully codified strategy for improving the environmental footprint of concrete.

Use of chemical admixtures: Chemical admixtures such as water reducers and superplasticizers allow concrete to maintain its strength and workability while reducing the water-to-cement ratio. This enables designers to lower the overall cement content—directly reducing the embodied carbon—without compromising performance.

One challenge with low-carbon concrete mixes, especially those using increased percentages of SCMs, is **slower strength development**. **Accelerating admixtures** help overcome this by speeding up early-age strength gain, making these mixes more viable for projects with tight schedules.

Several of the strategies outlined above can contribute to the development of lower-carbon concrete, promoting sustainable design within the construction sector. While some low-carbon materials may incur a higher cost, many options are cost-neutral. For example, GUL cements have achieved near-universal use with minimal economic impact. One consistent consideration, however, is that many lower-carbon concrete mix designs tend to require longer curing times, which can influence project schedules. Given these factors, a collaborative design process—engaging all stakeholders early on—is vital to effectively balance sustainability objectives with performance, cost, and scheduling concerns.