Building One Canadian Economy

Accelerating adoption of lower-carbon concrete in Ontario and Alberta

December 2025

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These acknowledgements are part of the start of a journey of several generations. We share them in the spirit of truth, justice and reconciliation, and to contribute to a more equitable and inclusive future for all.

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Why lower-carbon concrete matters

Canada is in the midst of a critical nation-building moment — one defined by affordability, sovereignty and economic competitiveness. Investments in housing, transit, water systems, transportation corridors and energy infrastructure will shape communities and economies for decades to come. Concrete is central to this work; it underpins nearly every public asset, supports over 166,000 jobs and contributes $76 billion annually to Canada's economy. At the same time, concrete is a significant source of carbon emissions over its life cycle, with cement production accounting for 7% of global CO_2 emissions and 1.5% of Canadian emissions. This means that today's procurement decisions will lock in emissions and material choices far into the future, making the shift to lower-carbon solutions critical.

Current progress

Canada is already home to producers that are global leaders in lower-carbon concrete technologies. Portland-limestone cement, which is about 10% less carbon intensive than conventional cement, is becoming the preferred choice for Canadian infrastructure projects. Scaling lower-carbon concrete is the next step for the Canadian cement and concrete industry. The provinces of Alberta and Ontario have adopted two distinct but complementary pathways to do this. Alberta is advancing carbon capture, utilization and storage, as well as innovations in near-zero-emissions cement. Meanwhile, Ontario is piloting the use of advanced supplementary cementitious materials and using lower-carbon energy sources for kilns.

Barriers

Despite this momentum, widespread adoption faces several challenges:

- fragmented and prescriptive codes and standards
- inconsistent public and private procurement practices
- a lack of clear, accessible guidance and tools for engineers, architects and municipalities

Recommendations

To accelerate innovation and scale up the use of lower-carbon concrete across Canada:

- **Modernize codes and standards:** Shift from prescriptive to performance-based requirements and align across provinces and municipalities.
- **Leverage public procurement:** Apply the federal Standard on Embodied Carbon in Construction to provincial procurement, sending a clear, technology-agnostic demand signal.

- **Align private-sector procurement:** Use targeted incentives to reduce cost barriers and accelerate commercialization of lower-carbon concrete technologies.
- **Strengthen workforce readiness:** Consolidate guidance, expand training and develop a lower-carbon concrete toolkit for workers across the decision-making chain.

1. Introduction

Concrete plays a central role in Canada's economy and built environment. The cement and concrete industry contribute $76 billion to the nation's economy every year while supporting 166,000 jobs across the concrete value chain.[1] From concrete production to procurement to construction, thousands of Canadian families directly or indirectly rely on the sector. Canada is home to global leaders in lower-carbon concrete manufacturing. The role concrete plays in Canada's infrastructure and economy makes it key to Canada's climate competitiveness.

While the country boasts strong technical capacity and substantial innovation across the cement and concrete value chain, inconsistent market conditions limit made-in-Canada solutions. To support innovation and ambition in Canada's concrete sector, industry and government must create clear, stable demand for lower-carbon concrete.

Today, uptake of lower-carbon concrete remains uneven across Canada because of prescriptive standards, fragmented procurement approaches, and gaps in workforce awareness. Without an enabling regulatory context and consistent market signals, innovative products struggle to reach commercial scale, even when technical performance is proven. When regulations and procurement requirements are aligned, they send a long-term signal that enables manufacturers to invest confidently, expand production, reduce costs and accelerate adoption of lower-carbon concrete.

1.1 Nation-building and one Canadian economy

Now is the time to act, as Canada enters a significant era of nation building, driven by the need to strengthen economic competitiveness countrywide. Major public investments in transportation, housing, roads and highways, and energy infrastructure — guided by the One Canadian Economy Act — will rely heavily on concrete, the most widely used construction material in the country. These projects present a once-in-a-generation opportunity to align investment, scale Canadian innovation and strengthen domestic manufacturing, while accelerating the shift to lower-carbon construction materials. With predictable demand, Canadian producers would be able to expand production and deliver emerging, climate-competitive concrete solutions.

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[1] Cement Association of Canada, "Industry Overview." https://cement.ca/the-cement-and-concrete-industry/industry-overview/

Alberta and Ontario are two of Canada's largest concrete markets and together account for a major portion of national infrastructure investment. They also represent two distinct pathways for decarbonizing concrete. Examining these two provinces together offers cross-provincial lessons that can help shape a consistent, national approach to lower-carbon concrete.

Alberta and Ontario also sit at the centre of broader national efforts to reduce interprovincial trade barriers. Both provinces have committed to improving the movement of goods and construction materials across Canada,[2] recognizing that inconsistent codes, standards, and specifications increase project costs and limit market access for innovative products. Modernizing and harmonizing infrastructure requirements while shifting from prescriptive to performance-based approaches can reduce these barriers and create clearer pathways for deploying lower-carbon concrete.

1.2 Purpose and methodology

This report presents a roadmap for enabling broader use of lower-carbon concrete in Alberta and Ontario. It outlines regulatory, procurement and workforce strategies that can strengthen domestic manufacturing, support climate competitiveness, and prepare Canada's construction ecosystem for the next generation of nation-building projects. Recommendations based on these strategies are provided, aimed at creating the market conditions needed to unlock Canadian innovation and deploy lower-carbon concrete at scale.

In order to understand the opportunities and barriers to adopting lower-carbon concrete, we partnered with Introba — a global engineering and consultancy firm that specializes in building decarbonization and lower-carbon design — which did a technical analysis for the report. We also engaged with more than 30 stakeholders across leading concrete design, construction, manufacturing, procurement and industry organizations. What we learned from Introba's analysis and these stakeholders helped form the foundation of our recommendations.

[2] Government of Ontario, *Economic cooperation memorandum of understanding: Ontario and Alberta* (2025). https://www.ontario.ca/page/economic-cooperation-memorandum-understanding-ontario-and-alberta

2. About concrete and carbon emissions

Concrete is the most widely used construction material in the world and the backbone of Canada's built environment.[3] It is essential for buildings, transit systems, bridges, roads, water and wastewater systems and major energy infrastructure. Its durability, fire resistance and performance in diverse climates makes it a dependable material for both public and private development.

Concrete is also a major source of emissions. Cement production is responsible for 7% of global CO_2 emissions,[4] driven largely by the cement used in concrete mixes. Cement is the binding ingredient in concrete and accounts for about 88% of its total footprint (Figure 1).[5] Most of the emissions in cement come from clinker, the solid material formed when limestone and other minerals are heated to around 1,450°C in a kiln.[6] Clinker emissions come from two main sources:[7]

- Combustion emissions: Clinker is produced at very high temperatures. Maintaining the temperature of the kiln requires a considerable amount of carbon-intensive fuels.
- Process emissions: The chemical transformation of limestone into clinker releases large amounts of carbon dioxide. This process accounts for more than 60% of cement's emissions.[8]

Other sources of emissions from concrete include the transportation of both raw and finished materials and the energy used in concrete manufacturing.[9] Because concrete-related emissions occur across the entire material chain, reducing concrete's carbon footprint requires multiple strategies and levers rather than a single solution.

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[3] Global Cement and Concrete Association, *The Cement and Concrete Industry Net Zero Action and Progress Report* (2025). https://gccassociation.org/cement-and-concrete-industry-net-zero-action-and-progress-report/

[4] *The Cement and Concrete Industry Net Zero Action and Progress Report*.

[5] Mitchell Greenis, Galal Fares, Davoud Heidari, and Jieying Zhang, *Low-carbon concrete materials: current and emerging technologies* (National Research Council Canada, 2025). https://doi.org/10.4224/40003529

[6] Lisa Hanle, Pedro Maldonado, Eiichi Onuma, Milos Tichy, and Hendrick G. van Oss, *Volume 3: Industrial Processes and Product Use* (IPCC, 2006). https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/3_Volume3/V3_2_Ch2_Mineral_Industry.pdf

[7] Cement Association of Canada, *Concrete Zero: Canada's cement and concrete industry action plan to net-zero* (2023). https://cement.ca/wp-content/uploads/2023/05/ConcreteZero-Report-FINAL-reduced.pdf

[8] Government of Canada, "Roadmap to Net-Zero Carbon Concrete by 2050." https://ised-isde.canada.ca/site/clean-growth-hub/en/cement-and-concrete-canada/roadmap-net-zero-carbon-concrete-2050

[9] *Concrete Zero: Canada's cement and concrete industry action plan to net-zero*.

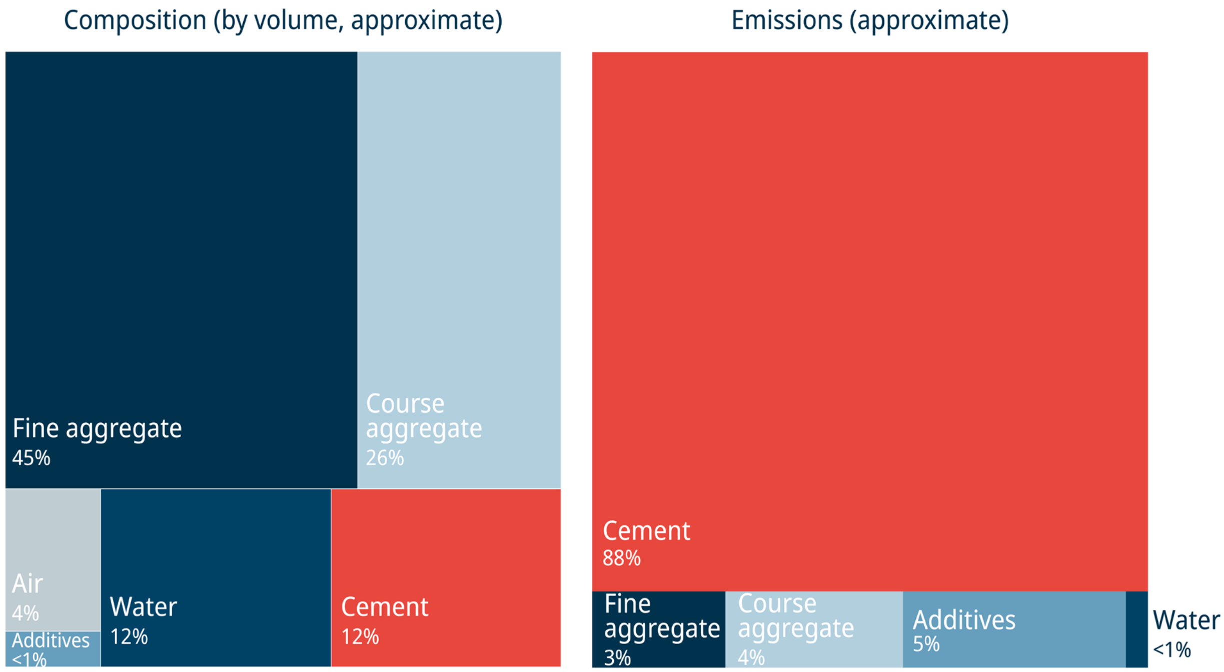

Figure 1. Composition of concrete and emissions breakdown

Data sources: Canada Green Building Council, National Research Council Canada[10]

2.1 Concrete and emissions intensity

Concrete is produced by mixing cement, sand, gravel, water and small amounts of air and a minute quantity of other additives.[11] While aggregates and water contribute relatively little to its carbon footprint, cement is highly emissions intensive, as noted above. Producing a cubic metre of standard concrete today results in roughly 325 kg of carbon dioxide equivalent, driven largely by the production of clinker.[12]

Canadian cement and concrete producers have made significant progress in reducing emissions. Since 2017, the emissions of standard mixes have dropped 13–20% depending on region.[13]

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[10] Canada Green Building Council, *Carbon Capture and Utilization in Cementitious Building Materials: Market Primer* (2025) https://www.cagbc.org/wp-content/uploads/2025/03/Market-Primer-Carbon-Capture-and-Utilization-in-Cementitious-Building-Materials.pdf

Low-carbon concrete materials: current and emerging technologies.

[11] Canada Green Building Council, *Carbon Capture and Utilization in Cementitious Building Materials* (2025). https://www.cagbc.org/wp-content/uploads/2025/03/Market-Primer-Carbon-Capture-and-Utilization-in-Cementitious-Building-Materials.pdf

[12] Mitchell Greenis, Galal Fares, Davoud Heidari, and Jieying Zhang, *Low-carbon concrete materials: current and emerging technologies* (National Research Council Canada, 2025). https://doi.org/10.4224/40003529

[13] According to the 2017 Canadian Ready Mix Concrete Association's science-based Environmental Product Declaration (EPD), the manufacturing process emits 417 kg CO_2 per cubic metre of 35 megapascals of concrete. That number varies depending on the structural strength of the concrete. (Stronger concrete usually emits more, as there's

These improvements reflect early adoption of Portland-limestone cement (PLC), greater use of supplementary cementitious materials (SCMs), improved mix optimization practices, and increased industrial and thermal efficiency.

Despite this progress, achieving Canada's climate goals will require deeper emissions reductions and widespread adoption of lower-carbon concrete across all regions.

2.2 Pathways to lower-carbon concrete

Canada's concrete sector is already a global sustainability leader. The Cement Association of Canada has committed to reducing emissions 40% by 2030 from 2020 levels and reaching net-zero by 2050.[14] Because of this leadership, several lower-carbon concrete products are commercially available and widely supported. PLC, for example, is roughly 10% less carbon-intensive than conventional cement and is quickly becoming the preferred choice for many Canadian construction projects.[15]

Achieving net-zero in cement and concrete will require deep emissions reductions across all regions. The three most viable pathways based on existing technologies are:

- **Decarbonize conventional cement** using promising technologies like fuel-switching to further cut combustion and process emissions.
- **Invest in SCMs** to reduce the volume of traditional cement in concrete. This includes stretching sources of conventional SCMs like slag and fly ash, scaling SCMs such as calcined clays, ground glass and recovered cement feedstocks, and exploring emerging materials such as geopolymers, magnesium oxide binder and calcium silicate system, which can further reduce reliance on Portland-limestone cement. These alternatives show strong potential and can advance rapidly with continued research and development, field demonstrations and standardization support. Supplies of some traditional SCMs, particularly fly ash, are declining as coal-fired electricity is phased out and steelmaking transitions to lower-carbon production methods. This makes it even more important to invest in novel SCMs.[16]

more cement per cubic metre.) Based on the latest EPDs from Concrete Ontario and Concrete Alberta, published in 2022, producing a cubic metre of concrete emits 334 kg CO_2 in Ontario and 363 kg CO_2 in Alberta.

[14] *Concrete Zero: Canada's cement and concrete industry action plan to net-zero.*

[15] Concrete Ontario, "Portland-Limestone Cement." https://www.concretealberta.ca/concrete-101/portland-limestone-cement

[16] *Concrete Zero: Canada's cement and concrete industry action plan to net-zero.*

- **Maximize the carbon capture and storage potential of concrete**[17] by focusing on two strategies. First, capture the largest share of emissions by taking advantage of the magnitude and point-source nature of process emissions from clinker production. Second, enable greater storage directly in our built environment by using new materials and methods, such as synthetic aggregates made from captured carbon dioxide or bio-based aggregates.

The maturity, availability and cost-effectiveness of the practices and technologies within these pathways vary across provinces. Material supply chains, geology, regulatory environments and industrial capacity all shape which approaches can scale most efficiently in a given region.

Because of these differences, **Canada's transition to lower-carbon concrete must remain technology-agnostic. Flexible, performance-based standards and coordinated procurement can support regional choice, reduce project costs and encourage ongoing innovation.**

[17] *Carbon Capture and Utilization in Cementitious Building Materials*

3. Cement and concrete in Alberta and Ontario

As hosts to major manufacturing hubs and two of the country's largest construction markets, Alberta and Ontario play a major role in shaping national supply chains, promoting climate and market competitiveness, and supporting Canada's ability to scale lower-carbon construction.

This section highlights the economic importance of cement and concrete manufacturing in Alberta and Ontario, as well as the innovations that position each province to support a cleaner, more cohesive Canadian market.

Both cement and concrete manufacturing are a core part of Alberta's and Ontario's economy. However, cement and concrete manufacturing facilities operate differently. Cement plants are large, capital-intensive industrial facilities located near key raw materials and major transportation corridors. There are only 14 cement production facilities across Canada.[18] In contrast, since concrete must be delivered to construction sites within hours of being mixed, there are thousands of concrete production facilities distributed across Canada's urban centres and regional markets.

3.1 Alberta: Sector's economic contribution and innovation

In Alberta, the cement and concrete industry contributes $16 billion annually to the economy and supports 39,000 jobs in manufacturing, construction, transportation and engineering.[18] Concrete plays a significant role in Alberta's large-scale industrial and municipal infrastructure projects. The province is home to two major cement plants — Amrize's plant in Exshaw, near Calgary, and Heidelberg Materials' plant in Edmonton — along with dozens of concrete production facilities distributed across Alberta's urban and communities.

Alberta is poised to become a global leader in the use of carbon capture, utilization and storage (CCUS) in the cement industry. Heidelberg, in partnership with the governments of Canada and Alberta, is establishing at its Edmonton plant the world's first full-scale CCUS facility at a cement plant, designed to capture more than 1 million tonnes of carbon dioxide annually.[19]

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[18] Cement Association of Canada, "Industry Overview."

[19] Heidelberg Materials, "Edmonton CCS." https://www.heidelbergmaterials.us/home/edmonton

Alberta is well positioned to deliver additional CCUS projects due to its favourable geological formations,[20] as well as an established regulatory system and trained workforce for sequestration hubs. Maintaining industry support for CCUS across the cement and concrete value chain will help secure long-term industrial competitiveness, create high-quality jobs for Albertans and ensure that the province's manufacturing base remains strong for decades to come.

Beyond CCUS, Alberta's producers are advancing a range of additional lower-carbon innovations, including using lower-carbon fuels for kilns, integrating carbon-utilization technologies in concrete production, and developing new SCMs.[21] Manufacturers in Alberta are also advancing near-zero-emissions cement that could replace Portland-limestone cement.[22] These advancements reinforce Alberta's leadership in delivering lower-carbon construction materials and strengthen the province's competitive advantage as the market evolves.

3.2 Ontario: Sector's economic contribution and innovation

In Ontario, the cement and concrete industry contribute $26 billion annually to the economy and support 62,000 jobs in mining, manufacturing, construction and engineering.[23] Concrete is essential for Ontario's housing, municipal infrastructure, and commercial buildings, as well as for major transit expansions across the Greater Toronto and Hamilton Area. The province is

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Heidelberg Materials "Heidelberg Materials North America Announces Funding Commitment from Government of Canada in Support of its Groundbreaking Edmonton CCUS Project," media release, March 7, 2025. https://www.heidelbergmaterials.us/home/news/news/2025/03/07/heidelberg-materials-north-america-announces-funding-commitment-from-government-of-canada-in-support-of-its-groundbreaking-edmonton-ccus-project

[20] Stefan Bachu, Michel Brulotte, Matthias Grobe and Sheila Stewart, *Suitable of the Alberta Subsurface for Carbon-Dioxide Sequestration in Geological Media* (Alberta Energy Regulator, 2000). https://ags.aer.ca/publications/all-publications/esr-2000-11

[21] Cement Association of Canada and Emissions Reductions Alberta, *Scaling Innovation in Alberta Heavy Industry* (2023). https://www.eralberta.ca/wp-content/uploads/2023/10/Cement_White-Paper_V5.pdf.

Emissions Reductions Alberta, "Project Industry: Cement and Concrete." https://www.eralberta.ca/?taxonomy=project_industry&term=cement-concrete

LAFARGE Canada Inc. "Lafarge and Carbon Upcycling Technologies Sign MOU to Reduce Carbon," media release, July 6, 2021. https://www.businesswire.com/news/home/20210706005167/en/Lafarge-and-Carbon-Upcycling-Technologies-Sign-MOU-to-Reduce-Carbon

Robert Lewis, "Carbon Upcycling Working with BURNCO to Install Low-Carbon Concrete in Calgary," *Calgary.tech*, April 22, 2024. https://calgary.tech/2024/04/22/carbon-upcycling-low-carbon-concrete-in-calgary/

[22] Cement Association of Canada and Emissions Reduction Alberta, *Scaling Innovation in Alberta Heavy Industry* (2023). https://www.eralberta.ca/wp-content/uploads/2023/10/Cement_White-Paper_V5.pdf

[23] Cement Association of Canada, "Industry Overview."

home to nearly 100 concrete batching plants and 6 major cement plants to meet the province's significant construction demand.[24]

Ontario is already a national leader in adopting conventional SCMs like slag.[25] The province also has innovative manufacturers that are deploying a wide range of technologies to scale lower-carbon concrete manufacturing. The Ash Grove cement plant in Mississauga recently partnered with Carbon Upcycling to manufacture a CO_2-enhanced SCM that sequesters emissions while reducing the share of clinker in cement.[26] St Mary's Cement is advancing the use of alternative fuels to cut combustion emissions in cement.[27] The latter project was supported by the federal government's Decarbonization Incentive Program, which is funded by the industrial carbon price.

Industrial carbon pricing reinvestment has been instrumental in advancing lower-carbon concrete innovations. Ontario recently transitioned to the Emissions Performance Standard (EPS) for industrial carbon pricing, which functions as an output-based pricing system for large emitters. Compliance proceeds collected under EPS are reinvested by the province into industrial decarbonization projects, providing support for Canadian manufacturers looking to scale lower-carbon technologies.

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[24] Concrete Ontario, "Active Plants." https://www.rmcao.org/certifications/active-plant/

Cement Association of Canada, "Our Members." https://cement.ca/about-cac/our-members/

[25] Concrete Ontario, *Concrete Carbon* (2023). https://www.rmcao.org/wp-content/uploads/2022/11/Concrete-Carbon-Guide_October_13_2023.pdf

[26] Carbon Upcycling, "Ash Grove Mississauga Cement Plant." https://carbonupcycling.com/crh/

[27] Environment and Climate Change Canada, "Pollution pricing at work: re-investing $2.2 million into new low-carbon cement in Ontario," media release, July 15, 2024. https://www.canada.ca/en/environment-climate-change/news/2024/07/pollution-pricing-at-work-re-investing-22-million-into-new-low-carbon-cement-in-ontario.html

4. Modernizing codes and standards

Concrete use in Canada is governed through a combination of building codes, technical standards, and procurement specifications that vary across infrastructure types and jurisdictions. For buildings, each province adopts its own building codes, which are based on the National Model Building Code of Canada and reference CSA standards for concrete materials, structural design, durability and testing.[28] For horizontal infrastructure — including highways, bridges, water and wastewater systems, and transit networks — requirements are set by project owners through procurement documents. See Appendix A for further details.

Modernizing technical standards and material specifications is critical in the pursuit of lower-carbon concrete. These rules shape how concrete is designed, tested and used across the country, ensuring that it is safe and durable. However, as lower-carbon concrete technologies advance, many of these frameworks — developed for an earlier era — can unintentionally slow the adoption of proven novel solutions.

4.1 The case for harmonization and performance-based standards

Two core issues with the current regulatory approach are hindering the roll-out of market-ready innovations:

- **Prescriptive standards:** Many standards and specifications dictate *which* materials can be used and *how* they must be incorporated. Updating these prescriptive requirements can take years to implement.
- **Fragmentation:** Standards and specifications can vary from province to province and sometimes between municipalities. This inconsistency about how, when and where materials can be used creates uncertainty for decision-makers, including engineers and architects working across multiple jurisdictions.

These factors also present barriers to interprovincial trade, add red tape and increase project costs. Prescriptive and inconsistent standards require manufacturers and builders to redesign, retest or recertify concrete mixes for different jurisdictions. This duplication increases administration, delays project timelines, limits economies of scale, and prevents producers from

[28] Canadian Commission on Building and Fire Codes and National Research Council of Canada, *National Building Code of Canada* (2020). https://publications.gc.ca/collections/collection_2022/cnrc-nrc/NR24-28-2020-eng.pdf

distributing the same lower-carbon products nationally — all of which drives up costs across the value chain.

Fortunately, these barriers can be overcome by adopting performance-based approaches and improving alignment across jurisdictions. Performance-based approaches, instead of dictating which materials can be used, focus on the *outcomes* lower-carbon concrete must achieve, such as strength and durability.

Harmonized, performance-based approaches are a proven way to reduce costs, foster innovation, and improve market certainty. In Canada, provinces have demonstrated this success through decades of collaboration on harmonized, performance-based building codes.

4.1.1 From prescriptive to performance-based standards

As with other jurisdictions, both Ontario's and Alberta's infrastructure standards and specifications still rely on rigid prescriptive requirements that lack flexibility. Take for example OPSS.PROV 1350, one of the specifications that outlines material requirements for concrete in Ontario. It defines what SCMs may be used and imposes fixed limits on their percentage of the total cementing material. In Alberta, the Standard Specifications for Highway Construction takes a similar approach, imposing fixed SCM caps and establishing minimum cement-content requirements, limiting the use of alternative materials.[29] These specifications are explored in greater detail in Appendix B.

As both provinces invest research and development dollars into expanding the use of SCMs and other lower-carbon technologies, shifting to performance-based approaches is necessary to enable their commercialization.

4.1.2 From fragmentation to harmonization

Requirements for concrete use vary widely across Canada, with some specifications set provincially and others municipally. The result is a patchwork of requirements for similar types of projects. For example, each province maintains its own set of requirements for roads and bridges. Adding to this complexity is that municipalities often define their own standards for the same infrastructure.

In Ontario, requirements for buildings can vary across municipalities. For instance, Ontario municipalities can differ in their concrete performance specifications or mix design criteria for

[29] Alberta Transportation, *Standard Specifications for Highway Construction* (2019). https://open.alberta.ca/dataset/9b29fb0b-e413-4ef6-a856-f33bc961177c/resource/7cbaea1c-6291-4543-a37f-bc3c405d27e7/download/trans-standard-specifications-for-highway-construction-edition-16.pdf

similar type buildings. Toronto's Green Standard includes embodied-carbon expectations and references performance-based concrete requirements for new buildings,[30] while neighbouring municipalities such as Mississauga and Hamilton rely solely on the Ontario Building Code.[31] Because the provincial building code does not set embodied carbon objectives, the result is uneven adoption of lower-carbon concrete. As a result, it may be possible to use SCM-rich mixes for a building constructed in Toronto, while the same approach may not be possible just a few kilometres away. This underscores the need for greater harmonization to provide consistent expectations for industry and accelerate embodied carbon reductions across the province.

Greater alignment across provinces and municipalities would reduce duplication, lower design and testing costs, and give manufacturers enhanced clarity and predictability for product development. Referencing the same specifications across jurisdictions is one way to harmonize infrastructure requirements. OPSS.MUNI 1350, referenced by municipalities in Ontario for their projects, is one example of harmonization given its close alignment with CSA A23.1.

National estimates suggest that harmonizing the building codes across provinces will save up to $1 billion each year by 2028.[32] Extending this effort to other specifications would provide even further savings, among other benefits.

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[30] City of Toronto, "Toronto Green Standard." https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/toronto-green-standard/

[31] Government of Ontario, "Building regulation." https://www.ontario.ca/document/ontario-municipal-councillors-guide/12-building-regulation

[32] Regulatory Reconciliation and Cooperation Round Table, *Reconciliation Agreement on Construction Codes*. https://rct-tccr.ca/wp-content/uploads/2023/07/Construction-Codes-RA-2019.pdf

5. Standardizing procurement approach

Governments are among the largest purchasers of concrete in Canada, accounting for roughly one-third of total demand.[33] As a major buyer, they have a unique ability to:

- shape markets
- set expectations for industry
- send a clear, stable signal that de-risks investment and enables Canadian firms to scale manufacturing[34]

Having a consistent procurement approach across jurisdictions for concrete and other lower-carbon construction materials can help achieve that. And there already exists a standard that could be used.

5.1 Standard on Embodied Carbon in Construction

The federal government developed and adopted the Standard on Embodied Carbon in Construction to drive consistent embodied-carbon reductions in public projects. The procurement standard requires that total project emissions from ready-mix concrete be reduced by at least 10% for projects that use at least 100 m^3 of concrete and have budgets that exceed $5 million.[35] These reductions can be achieved with products that are readily available today while laying the foundation for emerging lower-carbon concrete materials and other solutions.

The federal standard applies to federal construction projects and to some federally funded projects across Canada. Provinces like Alberta and Ontario can accelerate market transformation by voluntarily adopting it. The timing to do so is also particularly good given the federal government's commitment to nation-building projects.

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[33] Rachel Sutton, "B.C. can seize huge economic, environmental opportunity with clean concrete" (Pembina Institute, 2024). https://www.pembina.org/media-release/bc-can-seize-huge-economic-environmental-opportunity-clean-concrete

[34] *Concrete Zero: Canada's cement and concrete industry action plan to net-zero.*

[35] Government of Canada, "Standard on Embodied Carbon in Construction," March 20, 2025. https://www.tbs-sct.canada.ca/pol/doc-eng.aspx?id=32814

5.2 Lower-carbon concrete for nation-building projects

Nation-building projects are a once-in-a-generation opportunity for coordinated investment in Canadian industry and innovation. Since concrete is an essential material for any major construction initiative, procurement decisions today will shape markets for years to come.

By applying the federal Standard on Embodied Carbon in Construction uniformly across these projects, provinces can unlock economies of scale unavailable to individual municipalities or private developers. This coordinated approach would strengthen industry confidence, lower costs over time, and speed up the deployment of lower-carbon concrete.

6. Incentivizing demand growth and streamlined development

The private sector is responsible for most of Canada's concrete purchases. Aligning private-sector procurement approaches with public investment would create stronger conditions for lower-carbon concrete innovation than coordinated public investment alone. Incentives like tax credits and expedited permitting are strategic tools to scale private-sector demand for new technologies in Canada. These incentives have been used to reward early adopters and expand market use for innovations like carbon capture and storage.

Introducing incentives to encourage private-sector projects to align with the federal Standard on Embodied Carbon in Construction would promote wider use of lower-carbon concrete and reduce the risks associated with adopting new materials. These incentives would also reward builders and developers, which can help advance infrastructure and housing projects more efficiently.

Public procurement can set out clear expectations for embodied-carbon performance, but private-sector participation is essential to achieving market-wide transformation. Incentives help connect these two levers by supporting adoption beyond government-funded projects.

6.1 Why incentives matter for Alberta and Ontario

In Alberta and Ontario, incentives are especially important because most construction activity is led by the private sector and much of each province's infrastructure pipeline relies on market-driven development. Alberta has a more decentralized procurement landscape and relies heavily on private developers for commercial and residential construction. Ontario's planning environment, with strong municipal autonomy and varied local requirements, means developers face different expectations across jurisdictions. In both provinces, incentives provide a practical way to complement public procurement and enable developers to adopt lower-carbon materials without facing higher upfront costs or added approval risks.

Financial incentives for lower-carbon concrete should be funded through provincial or federal output-based pricing systems (OBPS). In Alberta, supports are delivered through the Technology Innovation and Emissions Reduction (TIER) fund, and in Ontario through the Emissions Performance Standards (EPS). Both systems generate revenues from industrial carbon pricing. Reinvesting a portion of these funds into materials-related incentives would directly support the adoption of lower-carbon construction products, aligning with the intent of the OBPS — to reduce emissions from industrial activity while supporting industries that manufacture and use lower-carbon materials.

Where provincial carbon pricing systems have been repealed or no longer meet federal benchmarks, the federal Output-based Pricing system applies. In these cases, proceeds returned to the province or territory through the federal OBPS Proceeds Fund should also be earmarked to support the use of lower-carbon concrete so that builders are not disadvantaged by jurisdictional differences in carbon pricing policy.

6.2 Types of incentives

There are several types of incentives that can be used to encourage private sector procurement to align with the Standard on Embodied Carbon in Construction. Incentives can be financial or non-financial, and each plays a different role in supporting private sector adoption. Financial incentives help offset upfront costs for developers and builders, making it more feasible to choose lower-carbon materials. These tools can be delivered at the provincial or municipal level and are summarized in Table 1.

Non-financial incentives complement financial tools by reducing administrative barriers and providing clearer pathways for adopting lower-carbon concrete. These incentives can include planning tools that allow developers to build more usable floor area on a site than would normally be allowed — such as floor-space-ratio (FSR) or floor-area-ratio (FAR) bonuses — along with expedited permitting, standardized embodied carbon reporting templates, or simplified permitting rules.

Table 1. Potential financial incentives to promote made-in-Canada, lower-carbon concrete in construction projects

Incentive	Description
Investment tax credits	Federal ITCs reduce the cost of eligible emissions-reducing technologies like CCUS and clean technology manufacturing equipment.[36] They do not apply to the procurement of low-carbon construction materials. The federal government could introduce a low-carbon materials procurement ITC to reward private sector projects that meet the federal embodied carbon standard.
Development charge rebate	Development charge rebates are offered to developers by Canadian municipalities for higher building performance.[37] These rebates could be given to developers who meet the federal standard on embodied carbon.
Permit or application fee reductions	Municipalities and provinces sometimes reduce or waive permit or application fees to encourage project-level outcomes such as affordability, resilience, or higher-performance buildings.[38] While these incentives do not apply to the procurement of specific materials, they could be adapted to reward projects that demonstrate lower embodied carbon or align with the federal standard.
Bid discounts	Bid discounts adjust the evaluated bid price for contractors who procure lower-embodied carbon materials, effectively giving a competitive advantage in the procurement process.[39] Such a mechanism could be implemented in Canada to strengthen demand for lower-carbon concrete by make lower-carbon bids more competitive in the private sector.

[36] Government of Canada, “Clean Economy Investment Tax Credits (ITCs),” December 1, 2025. https://www.canada.ca/en/revenue-agency/services/tax/businesses/topics/corporations/business-tax-credits/clean-economy-itc.html

[37] City of Toronto, “Development Charge Refund Program.” https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/toronto-green-standard/development-charge-refund-program/

[38] City of Toronto, "Rental Housing Supply Program.” https://www.toronto.ca/community-people/community-partners/housing-partners/housing-initiatives/rental-housing-supply-program/

[39] New York State, *Scoping Plan* (2022), Chapter 14. https://climate.ny.gov/Resources/Scoping-Plan

7. Equipping the workforce for lower-carbon concrete

Equipping the workforce with skills relevant to lower-carbon concrete is essential to scaling its application across Canada. Even with strong technical backgrounds, many design and construction decision-makers are unsure about how to specify, implement, or evaluate lower-carbon concrete in practice.

Workers across the decision chain, particularly engineers, architects and procurement officers, need clearer guidance, better coordination and accessible technical information to confidently adopt lower-carbon concrete. Concerns about liability, limited hands-on experience and prescriptive standards continue to influence decisions and slow the adoption of new materials.

To better understand these workforce needs, professionals across the concrete decision chain were interviewed.

7.1 Insights from industry interviews

Industry interviews highlighted a strong need for better coordination across the concrete decision-making process. Lower-carbon concrete can generally replace traditional mixes by meeting the same structural performance standards, but differences in cure times, material availability, or chemical properties can affect design choices, scheduling and logistics. Interviewees emphasized that without early and sustained coordination among designers, engineers, manufacturers and contractors, lower-carbon options are harder to integrate into project workflows. These perspectives, along with other insights from our research, point to several workforce gaps that must be addressed to support broader adoption of lower-carbon concrete.

- **Confidence and liability concerns remain widespread:** Engineers, architects, project clients and other decision-makers raised concerns about liability when specifying unfamiliar materials. Many practitioners want access to trusted evidence — such as lab tests, case studies, and pilot projects demonstrating lower carbon concrete's safety and structural integrity — before approving lower-carbon mixes. Even when solutions meet CSA technical and performance requirements, limited familiarity with the existing body of research and a lack of experience using lower-carbon concrete can make them appear risky. This creates hesitation driven by liability concerns and change management challenges rather than a lack of validated data.

- **Limited coordination across roles creates barriers:** Lower-carbon concrete can influence design sequencing, procurement timelines and on-site scheduling. Interviewees noted that without early coordination across project teams, it becomes difficult to adapt workflows to accommodate new mixes. The "early lock-in" effect, where design decisions are fixed before material options are fully explored, was identified as a recurring challenge.
- **Access to expertise varies significantly across organisations:** Larger design and construction firms often employ sustainability specialists or have in-house knowledge of lower-carbon mixes. Smaller firms, rural contractors, and under-resourced municipalities do not. This uneven distribution of knowledge means some teams are well-equipped to work with lower-carbon concrete, while others lack the capacity to evaluate or specify them.
- **Embodied-carbon literacy is increasingly important:** As performance-based standards and embodied carbon requirements become more common, project teams will need stronger skills in life-cycle assessment (LCA) and basic embodied carbon evaluation. Interviewees stressed that a foundational understanding of carbon drivers is needed across roles, not just among LCA specialists. This would ensure that teams can collaborate effectively and understand how mix choices affect overall project emissions.

7.2 The concrete decision chain

Choices about concrete are shaped by multiple actors — clients, architects, engineers, manufacturers, contractors, and trades — working within a framework of building standards, procurement requirements, other regulations, and project timelines. Construction projects are started by public or private clients, whose procurement officers source contractors (architects, engineers, construction firms).

Architects are the primary decision-makers on vertical infrastructure projects (buildings), leading the design process, coordinating engineering subconsultants, and serving as the client's main point of contact. When clients set sustainability or embodied-carbon goals, architects are usually the first to propose lower-carbon concrete solutions or identify opportunities to use lower-carbon concrete to meet those targets. For horizontal infrastructure such as roads and bridges, engineers are generally the lead consultants.

On both vertical and horizontal projects, engineers specify the concrete's performance requirements — strength, durability and permeability. These specifications are passed to mix designers at concrete manufacturing companies, who determine the combination of cement, aggregate, SCMs, admixtures, and additives needed to meet performance requirements. If the regional standard does not prescribe a certain mix, manufacturers have some latitude to choose lower-carbon options. Finally, labourers and trade crews pour and finish concrete on-site, ensuring that mixes perform as intended under real-world construction conditions.

The roles involved in concrete decision-making are summarized in Figure 2. Understanding how these decision-makers interact is important context for the tools, training, and guidance needed to support wider adoption of lower-carbon concrete.

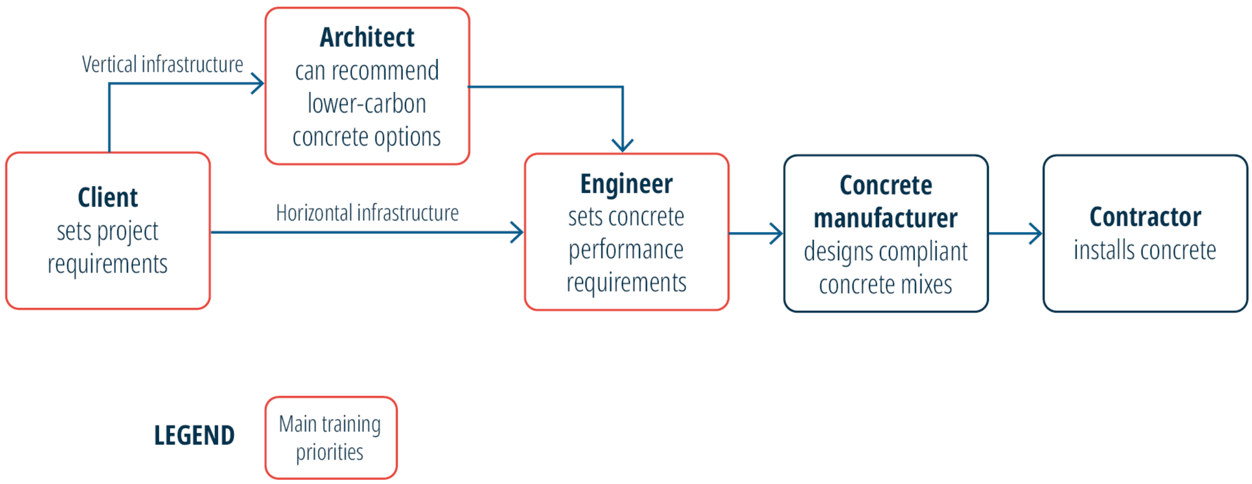

Figure 2. Concrete decision-making chain

7.3 Tools and training needed to support lower-carbon concrete adoption

Capacity-building resources are needed for less-resourced stakeholders to help them understand new standards, access technical information, and develop low-carbon procurement policies. While a number of high-quality resources already exist across industry, government, and academia, they are not consolidated or easy to navigate. An accessible, centralized, and comprehensive toolkit for workers, industry stakeholders, and municipalities would help. And industry leaders like the Cement Association of Canada could spearhead its development. The toolkit should include performance-based guidance, mix specification templates, carbon-budgeting tools and case studies to help engineers and architects gain knowledge and confidence about lower-carbon mixes. A peer learning network should also be included so that well-resourced lower-carbon concrete leaders can share best practices and technical support with smaller firms and municipalities.

In addition to providing information, the toolkit should offer hands-on training to relevant professionals to familiarize them with life-cycle assessment (LCA) techniques. Industry and professional associations are well-positioned to develop such training and validate them for professional development credits to further encourage participation. Incorporating embodied carbon literacy into mainstream professional training and offering upskilling workshops would help ensure designers and procurement officers can effectively interpret performance-based requirements and evaluate lower-carbon options.

Finally, the toolkit should be paired with broader outreach to create a shared baseline understanding of embodied carbon across the construction ecosystem. Unlike formal training or technical upskilling, this outreach is about raising general awareness across all the occupations about what embodied carbon is, why it matters and how performance-based approaches support reduced carbon emissions. This outreach could be done by creating simple, accessible opportunities for cross-occupation dialogue that fosters understanding of concrete decision-making roles and helps surface any misconceptions and coordination challenges affecting the design and delivery process.

8. Recommendations

In Canada, innovative firms are looking to become global leaders in lower-carbon concrete manufacturing. To unleash investment in Canadian innovation, governments must unlock demand for these materials. Investments made to date by leading producers position Alberta and Ontario to drive the economic growth in Canada's lower-carbon concrete industry. To expand the use of lower-carbon concrete across the country, support Canadian innovation, build local jobs, and boost economic growth, we recommend that all provinces work together to:

1. **Modernize codes, standards, and specifications through a harmonized, performance-based framework** to enable technology-agnostic approaches to infrastructure. This will create a consistent framework across jurisdictions to unlock Canadian innovation and lift barriers to interprovincial trade.
2. **Adopt the federal Standard on Embodied Carbon in Construction** for provincial procurement to set measurable benchmarks for infrastructure projects. Coordinated procurement will derisk investment in lower-carbon concrete for Canadian leaders and scale made-in-Canada innovation.
3. **Introduce incentives to reward private sector projects that reduce embodied carbon** to support Canadian developers, expedite infrastructure investment, and grow a unified, climate competitive manufacturing base. These measures may include Investment Tax Credits, application fee rebates, and expedited permitting.
4. **Introduce a lower-carbon concrete toolkit** to enable workers across the decision-making chain to use lower-carbon concrete. This toolkit should provide a comprehensive collection of resources that will support consistent implementation of lower-carbon concrete products across Alberta, Ontario and the rest of Canada.

Appendix A. Regulatory framework for concrete use in Alberta and Ontario

Table 2. Regulatory framework for concrete use in Alberta

Governance layer	Vertical structures	Horizontal structures		
	Buildings	Highways & bridges	Water & wastewater infrastructure	Airports
Legal foundation	The Safety Codes Act gives the Province authority over building design and construction through the Alberta Building Code.	The Highways Development and Protection Act gives Alberta Transportation authority over planning, design, and construction of provincial highways and bridges. Municipalities have authority over local roads and structures under the Municipal Government Act.	The Municipal Government Act establishes municipal authority to plan, design, construct, and operate water and wastewater infrastructure.	The Aeronautics Act gives Transport Canada authority over aerodromes, airports, and aviation safety in Canada. Under this act, the Canadian Aviation Regulations incorporate by reference Transport Canada TP312 Aerodrome Standards and Recommended Practices.
How authority works	Every building must comply with the Alberta Building Code. Permits are required prior to construction.	Compliance is enforced through contract documents, with Alberta Transportation or municipalities selecting the standards and specifications used in tenders.	Municipalities function as asset owners and issue tenders for water and wastewater projects, with the procurement documents governing compliance.	Airport authorities (e.g., Edmonton Airports, Calgary Airport Authority) act as asset owners and must ensure that all construction meets TP312 performance requirements to maintain federal certification and operational approval.

Governance layer	Vertical structures	Horizontal structures		
	Buildings	Highways & bridges	Water & wastewater infrastructure	Airports
Technical standards/ specifications	The code references CSA standards for concrete materials, structural design, durability, and testing.	The Standard Specifications for Highway Construction are mandated for all provincial contracts, setting the requirements for concrete. Municipalities may adopt these specifications directly or adapt them for local road and bridge projects to suit local conditions such as climate, material availability, and budget.	Municipalities rely on their own municipal engineering standards, which vary across jurisdictions. Based on these standards, project-specific amendments are also commonly applied to address individual project requirements.	Airport authorities reference CSA, ASTM or FAA specifications, or other technical requirements and may develop supplementary design manuals to demonstrate compliance with TP312.

Table 3. Regulatory framework for concrete use in Ontario

	Vertical structures	Horizontal structures		
Governance layer	**Buildings**	**Highways & bridges**	**Water & wastewater infrastructure**	**Airports**
Legal foundation	The Building Code Act grants the Province (and delegated enforcement authorities) the regulatory power to govern materials and design through the Ontario Building Code.	The Public Transportation and Highway Improvement Act gives the Ministry of Transportation authority to plan, design, and construct works under its jurisdiction. The Municipal Act grants municipalities authority over roads, bridges, and related infrastructure within their boundaries. Separately, the City of Toronto exercises this authority under the City of Toronto Act.	The Municipal Act enables municipalities to plan, design, construct, and operate local water and wastewater infrastructure within their boundaries.	The Aeronautics Act gives Transport Canada authority over aerodromes, airports, and aviation safety in Canada. Under this act, the Canadian Aviation Regulations incorporate by reference Transport Canada TP312 Aerodrome Standards and Recommended Practices.
How authority works	Every building must comply with the building code to obtain a permit.	Compliance is enforced through contracts. Each infrastructure owner (Transportation ministry or municipality) determines which standards are referenced in tender documents.	Municipalities act as asset and project owners, issuing tenders and managing construction.	Airport authorities in Ontario (e.g., Greater Toronto Airports Authority) act as asset owners and contracting entities responsible for planning, design, and construction. They must ensure that the project meets TP312 performance requirements to obtain and maintain federal certification and operational approval.

Governance layer	Vertical structures	Horizontal structures		
	Buildings	Highways & bridges	Water & wastewater infrastructure	Airports
Technical standards/ specifications	The Ontario Building Code references CSA standards for concrete design and performance.	The Ontario Provincial Standards Specifications (OPSS) and Ontario Provincial Standard Drawings (OPSD) form the basis for concrete materials, testing, and construction practices. The Transportation ministry develops and updates OPSS.PROV, while OPSS.MUNI is maintained jointly by the Municipal Engineers Association and the ministry. OPSS.MUNI specifications may be identical to or adapted from OPSS.PROV. In addition, local governments may issue local amendments or supplementary standards to address local needs.		Airport authorities reference CSA, American Society for Testing and Materials (ASTM), Federal Aviation Administration (FAA) specifications, or other technical specifications to demonstrate compliance.

Appendix B. Prescriptive standards across Alberta and Ontario

Table 4. Examples of prescriptive clauses limiting lower-carbon concrete (Alberta Standard Specifications for Highway Construction, 16th ed., 2020)

Section (#)	Clauses	How it limits lower-carbon concrete options
Class and Composition of Concrete (5.5.1.2)	Defines six classes of Portland cement concrete with **prescribed 28-day strength, aggregate size, slump, air content, and maximum w/cm ratio.**	These fixed parameters limit flexibility in the composition of concrete.
Fly Ash (5.5.2.2)	"**Fly ash shall not exceed 30%** by mass of cementing materials. All fly ash shall conform to the requirements of CSA-A3001 Cementitious Material Compendium for Type "F" fly ash, with a maximum calcium oxide (CaO) content of 12%."	Fixed caps prevent the adoption of alternative binders and additional usage of supplementary cementing materials (SCMs).
Aggregate Tests and Concrete Mix Design (5.5.3.2)	"For all concrete mixes **the minimum cement content**, excluding supplementary cementing materials, **shall be 300 kg/m^3.**"	The mandated minimum cement content restricts optimized mix designs and usage of higher SCMs.

Table 5. Examples of prescriptive clauses limiting lower-carbon concrete (Ontario Provincial Standard Specification (Provincial) 1350, 2025)

Section (#)	Clauses	How it limits lower-carbon concrete options
Cementing Materials (1350.05.03)	"**Portland limestone cement (PLC) shall not be used** in concrete in combination with limestone filler."	Explicit prohibition in combining PLC with limestone filler.
Cementing Materials (1350.05.03)	"Ground granulated blast furnace slag (slag) or fly ash or a combination of the two materials shall be **restricted to the following proportions by mass** of the total cementing material: **a. Slag up to 25%.** **b. Fly ash up to 10%.** **c. A mixture of slag and fly ash up to 25%."**	Fixed caps prevent the adoption of alternative binders and additional usage of supplementary cementing materials.
Acceptance of Concrete Compressive Strength (1350.08.01)	"When any individual strength test result falls below the specified minimum **28-Day compressive strength** by more than 4.0 MPa, the Contract Administrator may require the Contractor to take and test 100 mm diameter concrete cores to determine whether individual sections of concrete are structurally adequate and whether remedial work or removal is required."	The prescriptive 28-day strength criterion disadvantages binders or curing processes with slower strength development.
Acceptance of Rapid Chloride Permeability (1350.08.03)	"Acceptance testing shall be carried out at **28 to 32 Days**."	Durability acceptance is limited to short-term testing, which may penalize materials whose performance continues to improve with longer curing periods.
Test Cylinders (1350.07.05.09.04)	"Concrete test cylinders for early strength determination shall be cast, cured, and transported as specified in the Contract Documents."	Inconsistent collection and handling of test cylinders may lead to overdesigning of MPa to avoid test failures.

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