Welcome to NEU's Webinar!

NEU's monthly webinars are part of our commitment to education on sustainable practices and climate adaptive strategies.

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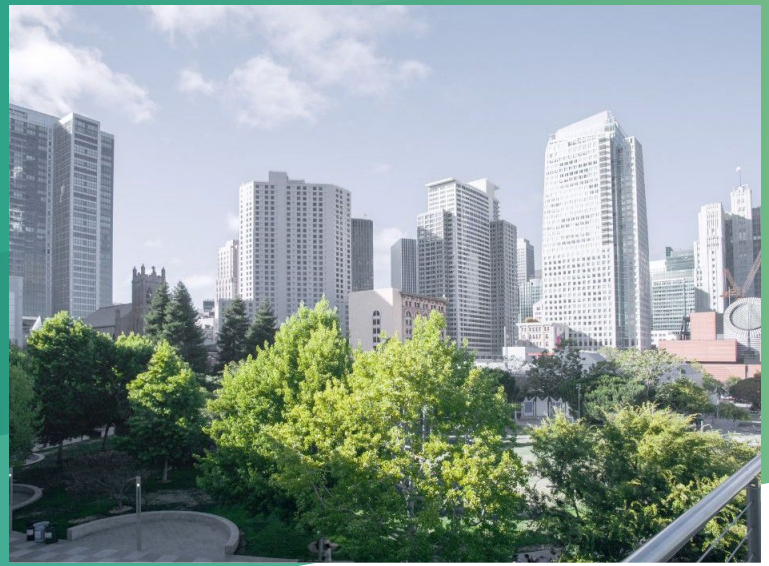
Are you part of the Concrete Roadmap journey or a speed bump



Shawn Kalyn B.Eng. Leed AP bd+c
Votorantim Cementos
VCNA St Marys Cement

August 26, 2026

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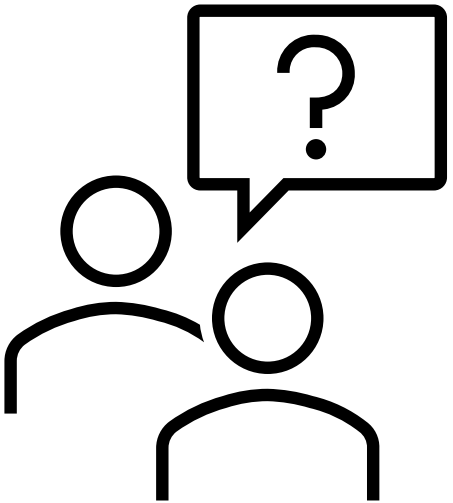
Presentation Notes

- Find presentation slides and post-event recording at:
  - https://www.neuconcrete.org/events-and-education
- Attendees are in listen-only mode.
- Ask questions via the Q&A dialog box in the zoom platform.



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Today's Speaker

Speaker bio

Shawn Kalyn B.Eng, LEED AP bd+c , Sustainability & Technical Marketing Manager, VCNA St Marys Cement, A Votorantim Cimentos Company. Team focuses on performance and lower carbon cementitious products like blended cements and slag cement.

Shawn has a Bachelor of Civil Engineering from Ryerson University in Toronto Ontario Canada. Also has a Civil Engineering Technologist diploma from Mohawk College in Hamilton Ontario Canada. Has had the privilege of working with both American and Canadian concrete industry partners. He is involved with ACA Sustainability committee as a co chair, SCA chair of Marketing Technical Committee, and is involved with the Global Cement and Concrete Association EPD task group and Cement Association of Canada climate action committee.

VOTORANTIM cimentos · st marys cement · cbm · prairie materials · superior materials · united materials

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Presentation Overview

- Concrete Road maps a goal 2030 to 2050
- Cement where does carbon come from?
- The 5 Cs with focus on clinker and cement
- Blended cements
- How can environmental product declarations (EPDs) and life cycle analysis (LCAs) do the tracking
- Are you the speed bump?

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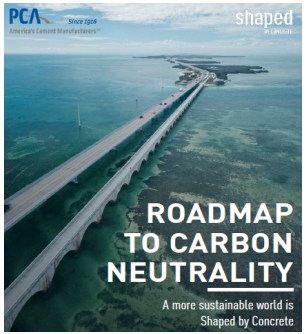
Concrete road maps are global with local lens

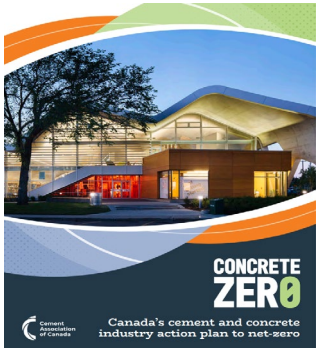
2013 Europe

2018 World

2021 United States



2022 Canada



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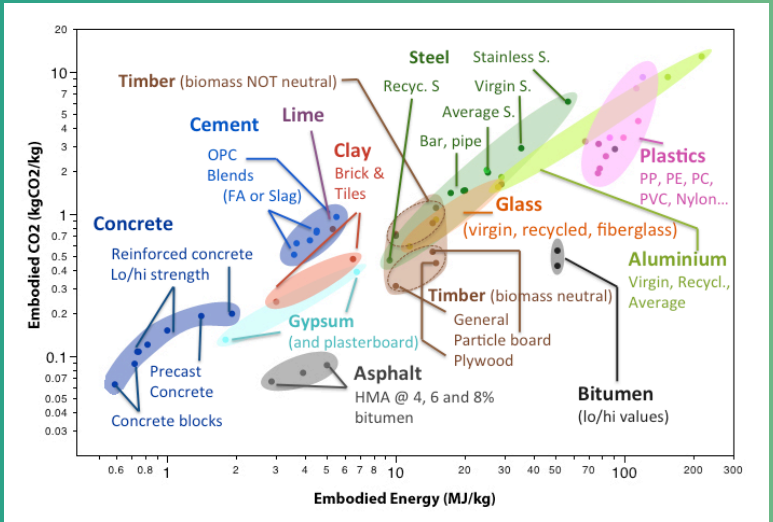
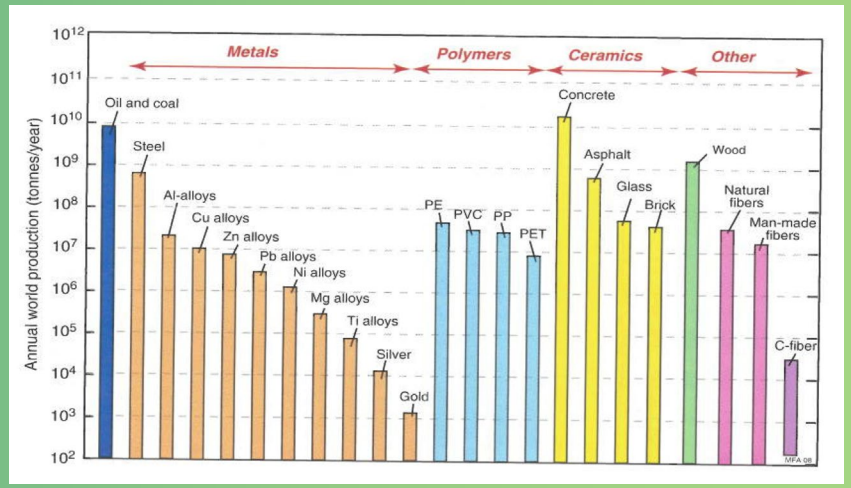
Why Large CO_2 Footprint for Concrete? All Materials Have CO_2 & Energy Impacts



Barcelo, Kline, Walenta (2012)

Low CO_2 footprint per unit mass (t CO_2/t)



Ashby (2009)

Worldwide annual production (t/year)

Results in worldwide annual CO_2 footprint for concrete (t CO_2/year)

Slide: Courtesy of American Concrete Cement Association

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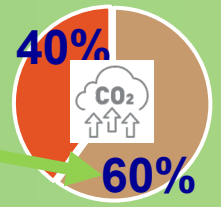
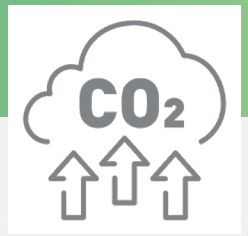
Where Does the CO_2 Come From?

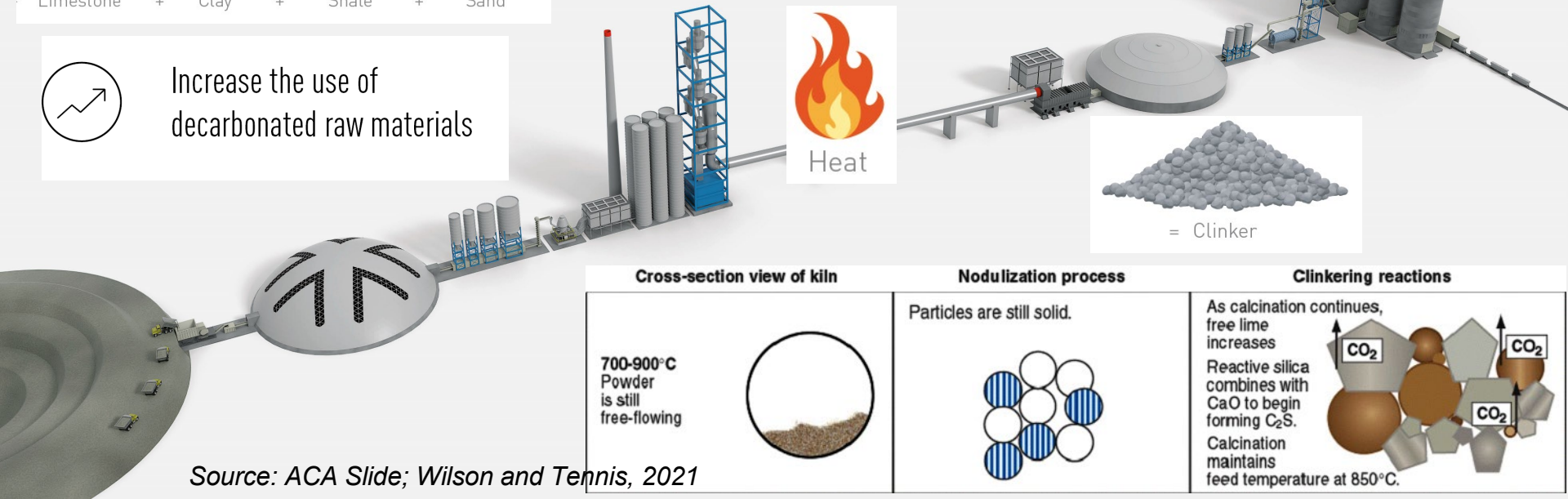
700-900°C: Starting at 1100°F - Calcining, decomposition of $CaCO_3$ (endothermic)

Calcination: $CaCO_3 \rightarrow CaO + CO_2\uparrow$





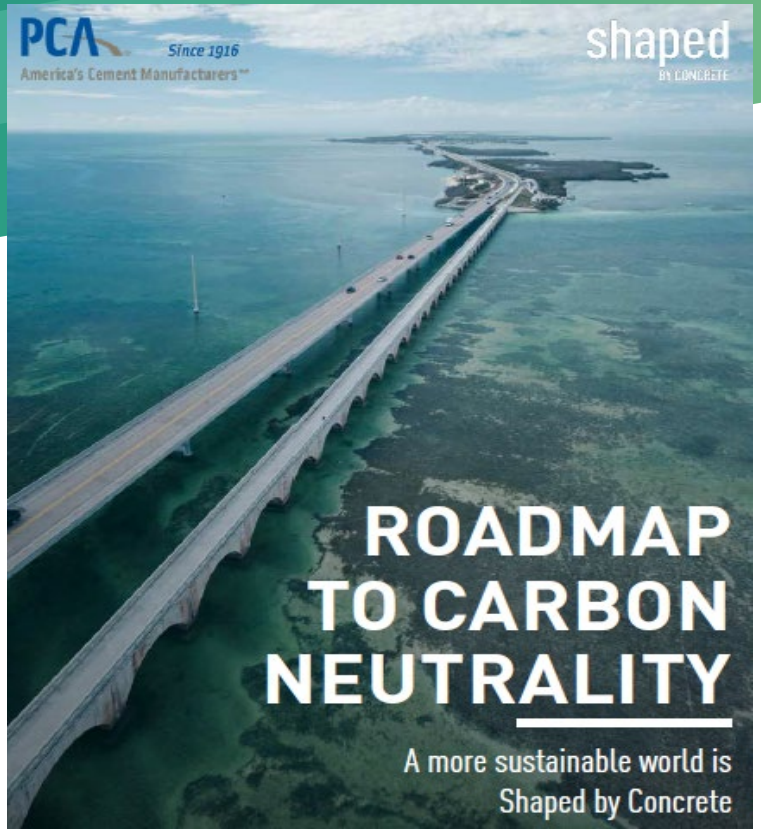
Increase the use of decarbonated raw materials



Cross-section view of kiln	Nodulization process	Clinkering reactions
700-900°C Powder is still free-flowing	Particles are still solid.	As calcination continues, free lime increases Reactive silica combines with CaO to begin forming C_2S. Calcination maintains feed temperature at 850°C.

Source: ACA Slide; Wilson and Tennis, 2021

Concrete road maps are global with local lens



THE INDUSTRY'S MISSION Carbon neutrality Carbon neutrality is achieving net-zero CO2. This can be done by balancing emissions of CO2 with removal or elimination of emissions from society. The reality is that the cement and concrete industry will still be emitting CO2 in 2050. However, through direct reductions and avoidance measures, the industry can offset its remaining CO2 emissions.

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Concrete Solutions with the 5 Cs

Big Challenge, incremental impact

• Thermal (40% kiln emissions)
  • Alt Fuels
• Calcination: (60% kiln emissions
  • Decarbonated alternative raw materials, carbon capture
	• Reduced clinker factor-PLC (5% to 15%)
	• Transition to blended cements
	• Modelling & reporting embodied $C0_2$ (EPDs)
		• Increased SCM use (Slag cement, coal ashes, calcined clay and others)
		• Decreased cement content, admixtures and optimized aggregates
			• Less concrete, less overdesign, improved quality assurance, whole building life cycle inventory
			• Recycling concrete, C&D waste
				• Concrete is a CO_2 sink
				• Calcium hydroxide in concrete reacts with atmosphere $C0_2$ to form calcium carbonate

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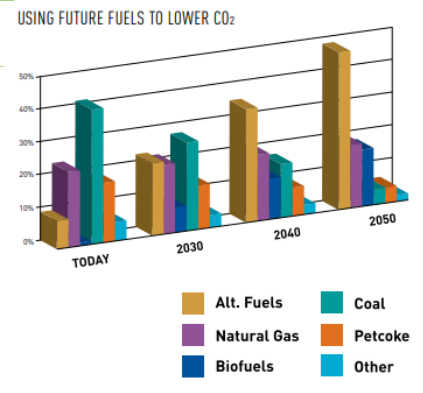
Clinker
Portland Binder

Near Term
today

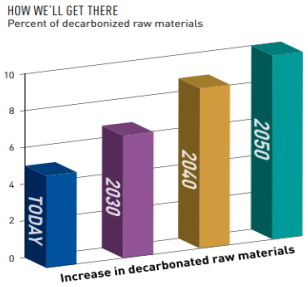
Source: ACA Roadmap_Jan2024



Alternative Raw Materials

L.I.S.A limestone Iron Silica Alumina

- Use of recovered materials using fewer virgin materials
  - Promotion of circularity
  - Using of materials destine to landfill
    - Mill scale (Fe)
  - Pre calcined from previous industries
    - Bottom Ash from power plants (Si, Al)



Source: ACA Roadmap_Jan2024

Alternative Fuels
–Thermal Substitution Rates increasing

Reduction in traditional fossil fuels like coal

- Use of recovered materials with fuel benefits
  - Secondary Materials
    - Single use plastics
      - Water bottles, shopping bags
    - Tires –nylon, rubber, steel
  - Bio based materials both primary and secondary
    - Primary
      - Harvested wood
      - Saw grass
    - Secondary
      - Wood construction demolition

Energy Management

Energy consumption monitoring

- Capex improvement on plant to improve energy efficiency
- Use of energy management like ISO 50001 and EPA energy star
- Power generation selection from renewable energy and non-carbon-based sources

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Cement

Near Term
today

Blended Cement Materials

- **Domestic cement is decarbonizing with the transition from portland cement to portland limestone cements**
- **Introduction of other blended cement with other hydraulic binders of pozzolans**

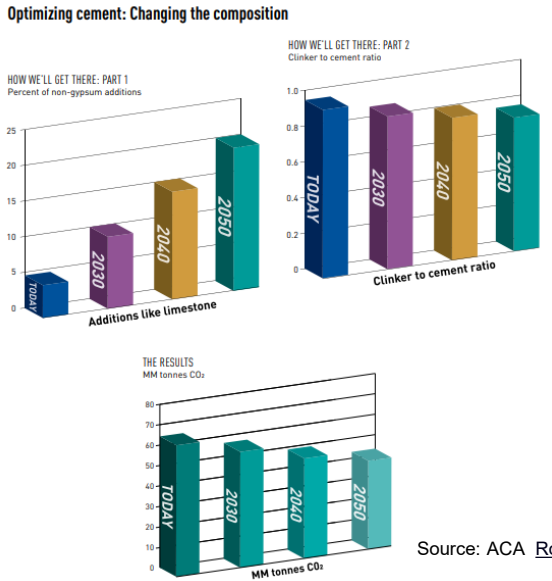
Supplementary Cementitious Materials

- **Added in the concrete mix either as one ingredient as a cement replacement or increase SCM concrete with the blended cement**

Energy Management

Energy consumption monitoring

- **Improvements in mill efficiencies**
- **Use of energy management like ISO 50001 and EPA energy star**
- **Power generation selection from renewable energy and non-carbon-based sources**



Source: ACA Roadmap_Jan2024

Clinker to cement ratio

Lowering clinker amount in a ton of cement

- **Increasing the fineness of the clinker**
- **More reactive clinker**
- **Cement grinding additives to increase performance**
  - **Strength enhancers**
  - **Water reduction**
- **Process additions under 5%**
  - **Example 3% slag cement in PLC**

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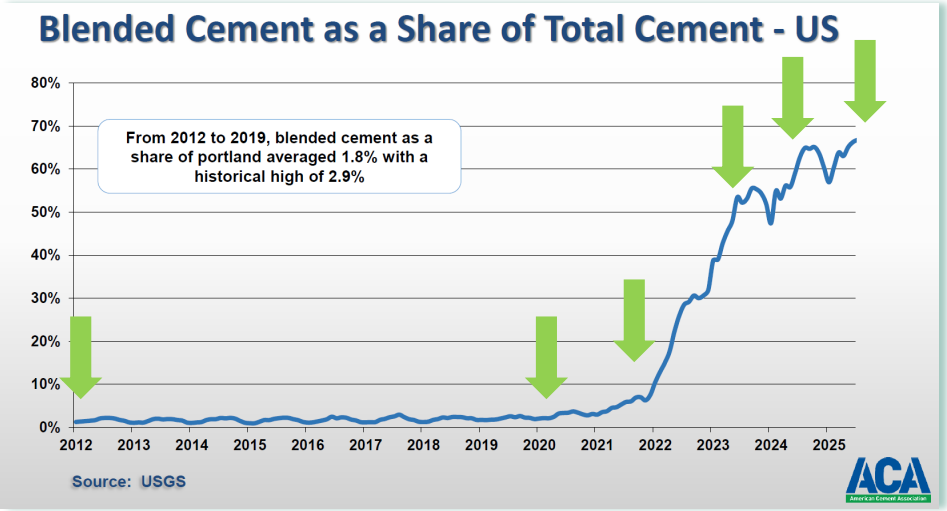
United States evolution of Blended Cement share of total cement



Timeline North America acceptance of limestone addition into cement

- 1983 CSA allows 5% limestone in general use cements
- 2004 ASTM C150 allows 5% limestone in cements
- 2008 CSA allows portland limestone cement (PLC) with 5% to 15% limestone
- 2010 National building code of Canada references PLC

Timeline USA evolution from 2012 till 2025

1) 2012 ASTM C595 & AASHTO M240 defines Type IL with up to 15% limestone
2) 2020 PLC awareness campaign
3) 2021 PCA now ACA roadmap was published in October 2021
4) 2023 Blended cements pass 50% of cement used
5) 2023 ASTM C595 & AASHTO M240 establish IL (HE) for high early cement
6) 2024 US Geological Survey now tracks PLC Type IL as separate category
7) 2025 Blended cement at nearly 70% of cement used

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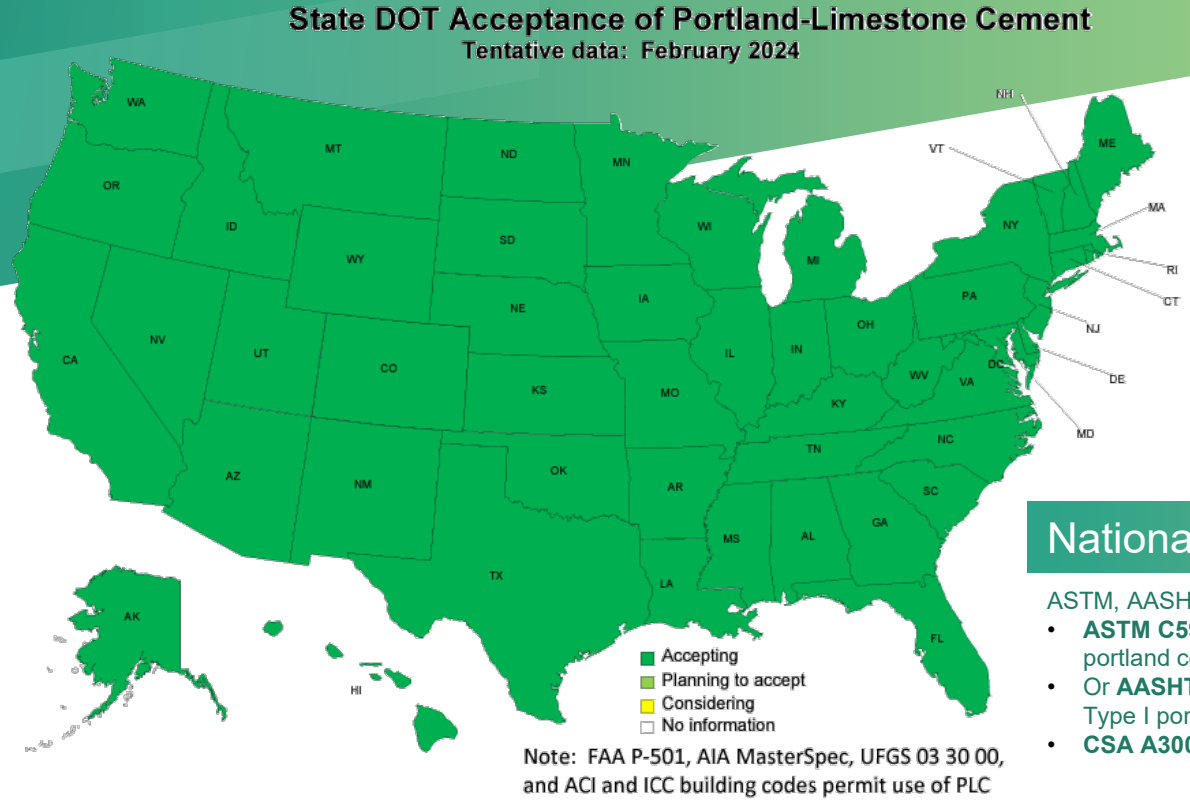
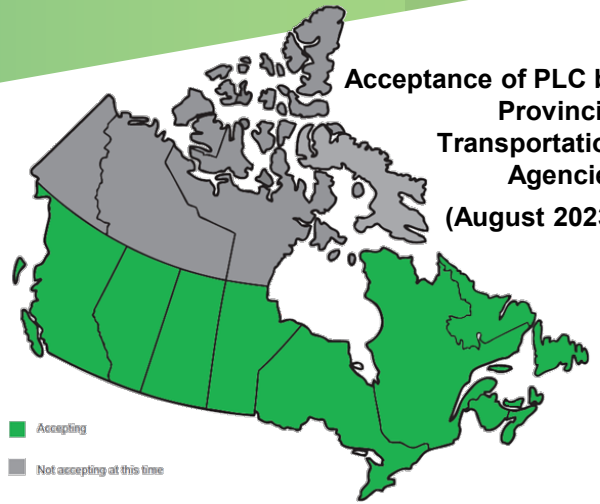
PLC North America Acceptance



Note: FAA P-501, AIA MasterSpec, UFGS 03 30 00, and ACI and ICC building codes permit use of PLC



National Standards Specifications

ASTM, AASHTO, CSA specifications

- **ASTM C595 Type IL cement** as an alternative to ASTM C150 Type I portland cement
- Or **AASHTO M 240 Type IL cement** as an alternative to AASHTO M 85 Type I portland cement
- **CSA A3001 Type GUL, Type HEL, Type GULbS, etc.**

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Next in the journey of blended cements

More adoption of ASTM C595 and AASHTO M240 blended cements beyond just PLC

Contains base of portland cement clinker or portland cement

Type IS

Slag Blended Cement

- Contains ground granulated or
- Blast furnace slag cement

Type IP

Pozzolan Blended Cement

- One pozzolan
  - Coal Ash
  - Silica Fume
  - Ground glass
  - Natural pozzolan

Type IT

Ternary Blended Cement

1. Slag & pozzolan
2. Slag & limestone
3. Two pozzolans
4. Pozzolan & limestone

Previous verson ASTM C595 -2025

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Next in the journey of blended cements

Just published this week ASTM C595 -2026

More adoption of ASTM C595 and AASHTO M240 blended cements beyond just PLC

Base cement is portland cement or portland limestone cement

Type IS

Slag Blended Cement

- Contains ground granulated or
- Blast furnace slag cement

Type IP

Pozzolan Blended Cement

- One pozzolan
  - Coal Ash
  - Silica Fume
  - Ground glass
  - Natural pozzolan

Type IT

Ternary Blended Cement

1. Slag & pozzolan
2. ~~Slag & limestone~~
3. Two pozzolans
4. ~~Pozzolan & limestone~~

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Disclaimer

As with all concrete mixtures, trial batches should be performed to verify concrete properties. Results may vary due to a variety of circumstances, including temperature and mixture components, among other things.

You should consult your materials, cement, and concrete professionals for design assistance. Nothing contained herein shall be considered or construed as a warranty or guarantee, either expressed or implied, including any warranty of fitness for a particular purpose.

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Benefits of using blended cement with slag cement or certain pozzolans compared to ordinary portland cement or PLC

- Improved workability in concrete plastic state
- Less water demand
- Improved resistivity and permeability
- Improved sulfate resistance
- Lower heat of hydration depending on the % of SCM in the blend
- Lower the dependence on virgin material use

All these factors can support the durability and improve the EPD reporting of GWP reduction

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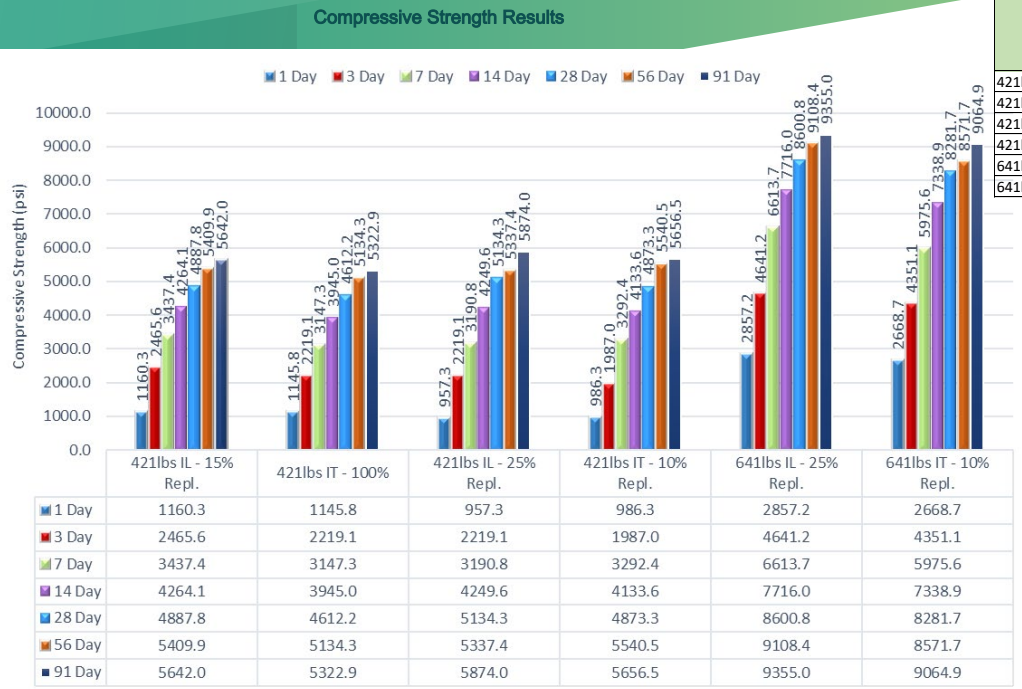
Portland Limestone and Blended slag cement in concrete



	421lbs IL - 15% Repl.	421lbs IT - 100%	421lbs IL - 25% Repl.	421lbs IT - 10% Repl.	641lbs IL - 25% Repl.	641lbs IT - 10% Repl.
1 Day	1160.3	1145.8	957.3	986.3	2857.2	2668.7
3 Day	2465.6	2219.1	2219.1	1987.0	4641.2	4351.1
7 Day	3437.4	3147.3	3190.8	3292.4	6613.7	5975.6
14 Day	4264.1	3945.0	4249.6	4133.6	7716.0	7338.9
28 Day	4887.8	4612.2	5134.3	4873.3	8600.8	8281.7
56 Day	5409.9	5134.3	5337.4	5540.5	9108.4	8571.7
91 Day	5642.0	5322.9	5874.0	5656.5	9355.0	9064.9

Mix Identification	w/c Ratio m	ADVA 190 Dose (oz/100lbs)	Slump (in)	Air Content (%)	Plastic Density (lbs/ft³)	Temperature (°F)	
						Conc	Amb
421lbs IL - 15% Repl.	0.67	-	5	2.2	149	69.8	71.1
421lbs IT - 100%	0.67	-	5	2.3	151	70.0	71.1
421lbs IL - 25% Repl.	0.67	-	5	2.2	150	70.5	71.2
421lbs IT - 10% Repl.	0.67	-	5	2.2	150	70.7	70.9
641lbs IL - 25% Repl.	0.45	5.46	7	2.4	152	72.3	71.2
641lbs IT - 10% Repl.	0.45	5.46	8	2.3	152	72.1	69.3

- Using blended cement on it own or with additional SCM like slag cement
- Two mixes shown
  - 421 lbs @ w/cm 0.67
  - 641 lbs @ w/cm 0.45
- Four cement combinations tested
  - PLC @ 13% limestone
  - IS (15S)(10L)
  - Same mix with 25% slag combination

Source of information from: Leaside Lab. Testing program report 23-09-A, St Marys plant products. Report date: June 8th, 2025.
Note testing was done prior to August 2026 and referenced as type IT for ASTM C595-25 standard.

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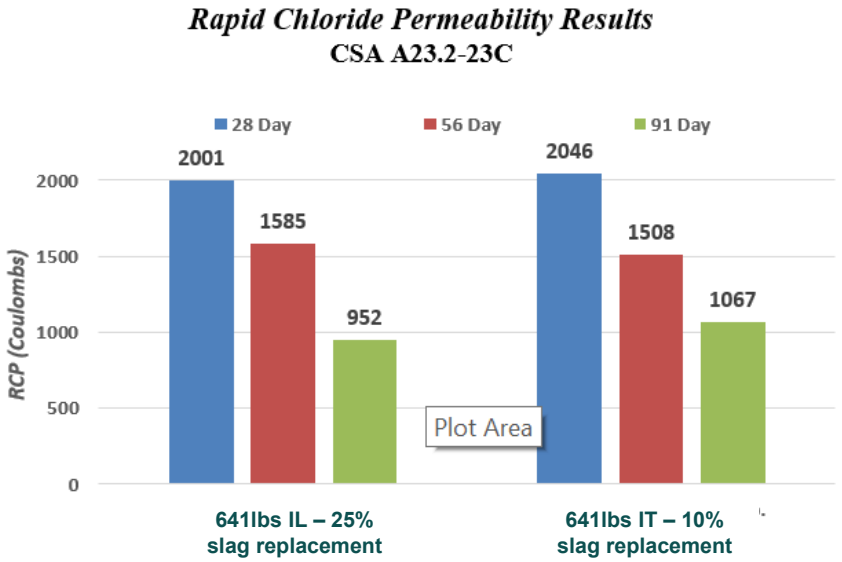
IL vs. IS*(IT) in concrete



Source of information: Leaside Lab. Testing program report 23-09-A, St Marys plant products. Report date: June 8th, 2025.

* ASTM C595-26 type IS will include portland or portland limestone as base cement published August 2026. Past ASTM C595-25 and older versions, IT was the nomenclature for blended slag cement with 5 to 15% limestone

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Measuring and Tracking:

Environmental Product Declarations (EPDs) Process

The process to create

1. Life Cycle Assessment (LCA)
2. Product Category Rule (PCR)
3. Life Cycle Analyis of product under PCR guidance
4. Development of “executive summary” Environmental product declaration (EPD)
5. Hire a program operator who hires a verifier to verify LCA, LCA software and EPD meets the requirements of PCR
6. Once acceptable by program operator the third party EPD is published

There are different PCRs and EPDs for cement, ready mix concrete, precast and concrete masonry products most EPD are only product stage (embodied) cradle to gate (A1 to A3), however for circular economy concrete, in the future could strive to be cradle to cradle or at least into construction assembly (A4 to A5)

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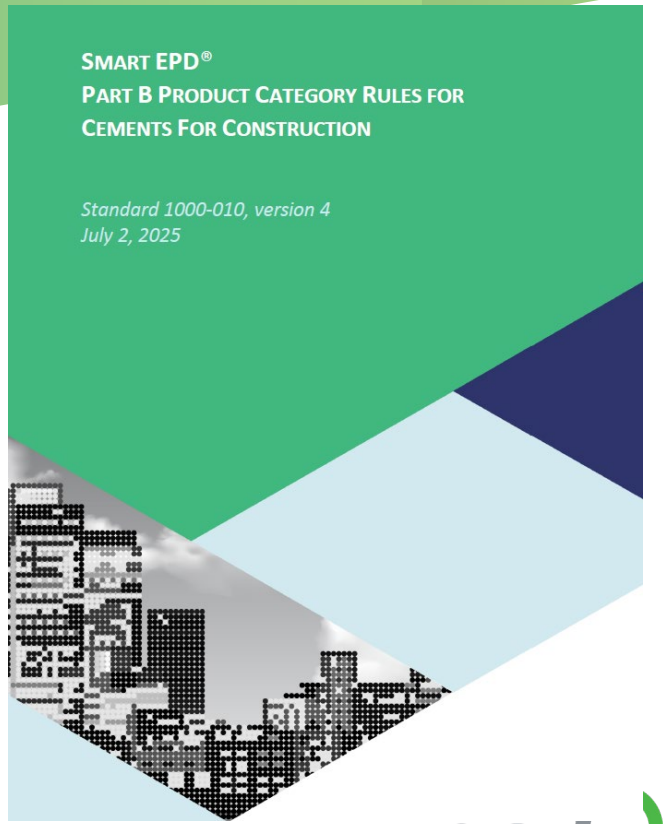
New Cement PCR

Newest Cement PCR was published July 2025

- PCR Library - Smart EPD listed as Part B PCR for Cement for Construction 1000-010, V4.0
  - Like previous EPD still just cradle to gate (A1 to A3) but with guidance on A4 (*downstream products A2 cement transport*):
    - A1 Raw Materials
    - A2 Transportation
    - A3 Manufacturing
  - Three new guidance annex sections
    - ANNEX A: Carbon Capture, Utilization, and Storage (CCUS)
      - First PCR for EPDs to address the use of CCUS
    - ANNEX B: Combustion and Calcination Emissions
      - Guidance help on calculations and reporting for raw materials and kiln fuels
    - ANNEX C: Additional information for reporting transport from cement plant gate
      - Helps with accurate reporting from gate of cement plant to gate of concrete manufacturing plant



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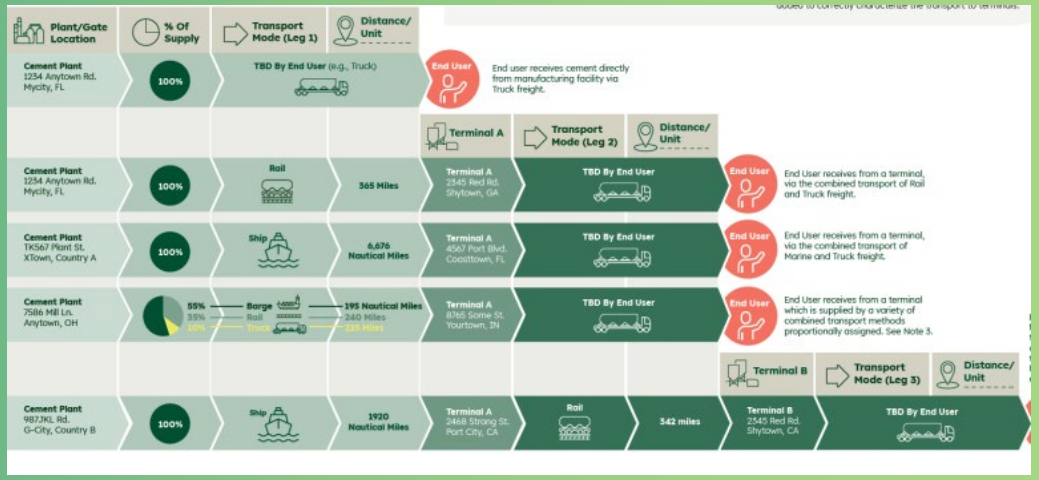
New PCR Updates

- Requirements for report transport to terminal within cement distribution and transport legs



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Measuring and Tracking:

Embodied CO2 assessment in the project environment

The process to track and measure

- Carbon budget on concrete material category is a good option
  - High strength column less concrete but high GWP per yd^3
  - Mass concrete with high blended slag cement low GWP but high volume
- Concrete manufacture when using cement EPD make sure to account for travel when making selections of product from gate of cement manufacturer

Materials should not be compared directly but used in whole building LCA that look at the functional unit of the material in the project application. Functional unit defined as a quantified performance of a product system. Most concrete product EPDs are shown in the declared unit like tons of cement or cubic yards of concrete.

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Local Cement Plant Product Specific EPDs

ASTM C150 cements and ASTM C595 PLC and other Blended cements

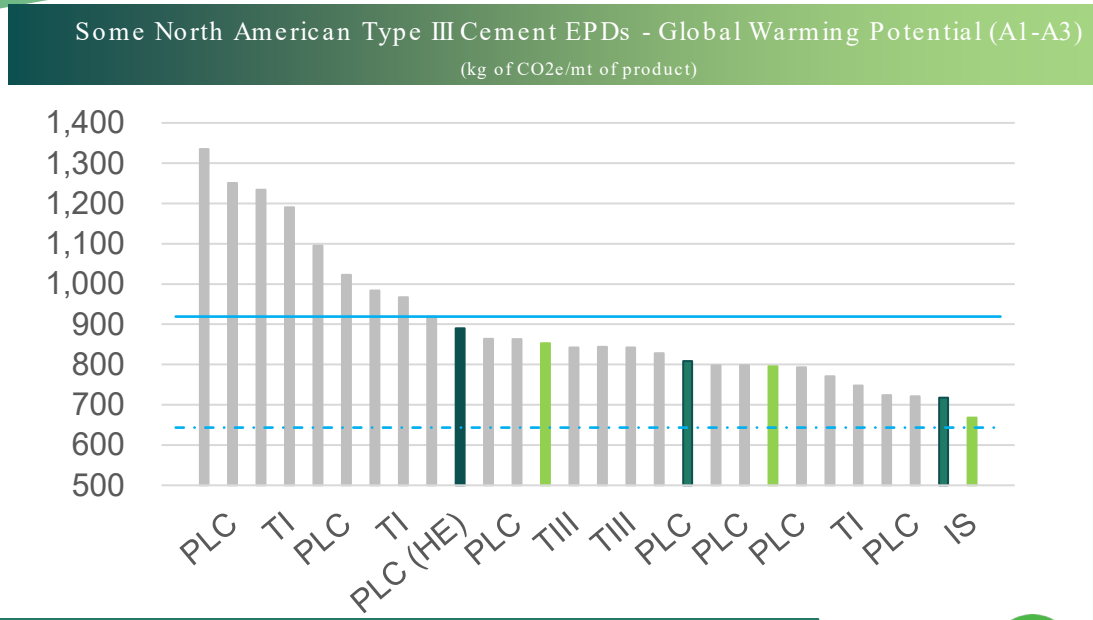
Cement Plant A

Cement Plant B

Other Cement plants

ACA Industry Average (919)rev 2023

30% below ACA (643) rev 2023



Notes:

1. Graph is a single snapshot in time so as industry and energy sectors decarbonizes, products shown above may change as EPDs are updated or retire.
2. As cementitious standards evolve so will the concrete performance.
3. Graph is only showing EPDs to gate of cement plant., transportation travel modes and distances traveled can have big influence on GWP impacts for downstream user.

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Cements and SCM's have its part in society

Concrete's GWP and its performance in the built environment can be positive

New York Example:
communication is key for success:

- **Procurement** NYS OGS limit for GWP verified by concrete EPD's
- **Building industry associations and agency** like NYSDOT educational efforts
- **Ready Mix producer** validating concrete mix options and what is need for a particular concrete application to support performance, durability and end user needs
- **Cement producer** suppling performance and lower carbon options meeting specification approvals and requirements
- **SCM producer** suppling performance and lower carbon options meeting specification approvals and requirements
- **Concrete Contractors** providing feed back on performance both during application and final acceptance
- **Specifiers and Designers** if the don't update or not will to accept ASTM C595 cements they can be the speed bump
- **Academia and others** providing quality assurance and future referrals to support concrete's use
- **Finaly the end users that operate and use concrete structures** successful durability and life cycle longevity referrals for future concrete use in society

Cements used t from a single cement plant source:

- Mix 1 -PLC Type IL
- Mix 2 -Blended Type IS (IT)
- Mix 3 -PLC Type IL with 30% slag cement
- Mix 4 -Blended Type IS (IT) with 18% additional slag cement

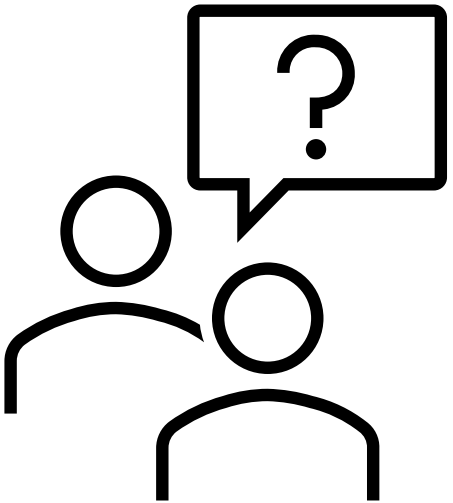
Source: Page 22 on this link - Material Matters (NCMB) - Fall 2025 - Cover

Learning Objectives Revisited

- To reduce carbon In the atmosphere we all need to communicate
- Cement used, local, blended cement aspects and the amount of additional scm can lower and improve the concrete durability
- EPD can be used as a measuring tool and when used in carbon budgets can support the need of a project schedule while reducing carbon.
  - Concrete EPDs the travel of the cement and aggregates can impact the A2 transportation depending on the original source location and travel modes.
  - Cement EPD's can help make designer and contractor decisions, prescriptive choices can limit designer and or contractor requests

Questions?

- Ask questions via the Q&A dialog box in the zoom platform



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Please join us for the next NEU Webinar

October 1, 2026, 2:00 PM EDT

No Capture, No Clinker, Just binder

Thomas Atkinson, Head of International Affairs, Hoffmann Green Cement

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NEU is Here to Help You!

Ask us about:

NEU's *The Low-Carbon Concrete Guide: Materials.* Strategies for reducing the carbon emissions of concrete with an emphasis on material/mixture decisions made at the project level. Available for purchase at the ACI Store. Scan the QR code!

NEU's Validation and Verification program. Provides third-party validation or verification of the environmental claims of both existing and innovative new products/technologies associated with low-carbon cement, concrete, and concrete products, following the requirements of international standards.
www.neuconcrete.org/validation-verification

NEU's Second Low-Carbon Concrete Certificate Program. A new certificate program, *Low-Carbon Concrete: Fundamentals, Materials, and Innovations*, is now available from NEU. This program is a complement to NEU's first certificate, *Low-Carbon Concrete: Qualification, Design, and Compliance*.

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Thank you!

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