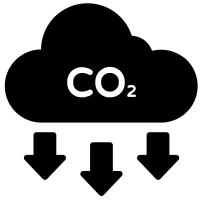
Lets Talk About PLC Implementation

A simple change making a monumental impact

What is PLC?

Portland-limestone cement (PLC) is a blended cement with a higher limestone content, which results in a product that works, measures, and performs the same as OPC, but with a reduction in carbon footprint up to 10%. [1]

"...a reduction in carbon footprint up to 10%"



In short, PLC is a type of cement with lower CO2. It performs just like the cement you're used to using, resulting in the same concrete you're used to producing.

How is it Made?

Cement is made by grinding clinker to a fine powder, which is the main energy intensive ingredient. The same clinker is used to make OPC and PLC—there's just less of it in PLC.

Why Use PLC?

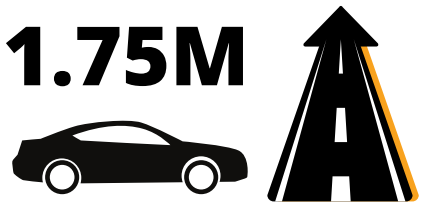
Society places so much concrete each year, even small enhancements to its formulation can have dramatic effects on the construction industry's annual carbon footprint, benefiting everyone globally.

"Approximately 5% of CO2 emissions are from the production of concrete." [2] Enhancing a concrete mixture design to replace higher carbon materials is an effective strategy to to reduce its environmental footprint.

With optimization by a cement plant, up to 15% limestone can be used in a PLC, with performance assured by ASTM C595 (and AASHTO M 240). Using up to 15% limestone can reduce the CO2 footprint by up to 15%.

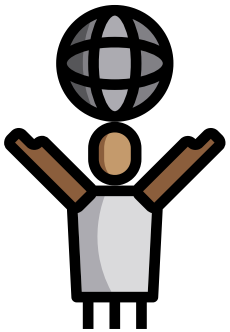
Concrete mixtures designed with PLC are compatible with all supplementary cementitious materials (SCMs). So when you substitute PLC for OPC, you can continue to use all the other materials you use to make concrete for an even greater reduction in carbon footprint.

"For instance, if all cement used in the U.S. in 2019 had been converted to PLC (Type IL), it would have reduced CO2 emissions by 8.1 million metric tons, which the U.S. EPA says is the equivalent of taking 1.75 million cars off the road for an entire year." [1]



Has it Been Used?

PLC and concrete mixtures containing PLC have been used around the world for decades. It has been subjected to extensive research and testing by industry, both in the United States and elsewhere. Researchers have studied fresh properties related to placing and finishing, as well as hardened properties that relate to durability. Many states have been placing PLC concrete pavements for more than a decade with good results.



"...concrete mixtures containing PLC have been used around the world for decades"

How Do I Specify PLC?

PLC is recognized by the International Code Council, the Federal Aviation Administration, and the American Institute of Architects. PLC containing 5 to 15% limestone is included in the current blended cement Type IL specifications of ASTM C595 and AASHTO M240.

ASTM C595 and the use of Type IL are accepted in the following specifications:

- ACI 318 – Building Code Requirements for Structural Concrete
- ASTM C94 – Standard Specification for Ready-Mixed Concrete
- ASTM C270 – Standard Specification for Mortar for Unit Masonry
- ASTM C476 – Standard Specification for Grout for Masonry
- ASTM C1713 – Standard Specification for Mortars for the Repair of Historic Masonry
- FAA Airport Construction Standards, P-501 – Cement Concrete Pavement
- AIA MasterSpec®

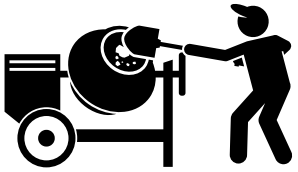
Making the Switch

A switch to PLC (Type IL) is handled the same way as a switch to any other new material, with an investigation of fresh mixture behavior and hardened properties.

Once a baseline performance is established, minor adjustments can be made as needed to accommodate any material combination.

Typically, PLC mixtures require little or no adjustment to concrete mixture designs to achieve the same strength, durability, and resilience as mixtures with the same amounts of OPC. PLC can be swapped in for OPC at a 1:1 replacement level, allowing minimal disruption to operations.

"...PLC mixtures require little or no adjustment to concrete mixture designs..."



As the industry moves toward this new, more sustainable product, working with your cement producers is more important now than ever.

Discuss the timeline of implementation with your producers to map out when making the switch makes the most sense for you.

Resources

www.greenercement.com
https://climate.mit.edu/explainers/concrete

References

1. www.cement.org/sustainability/portland-limestone-cement
2. www.youtube.com/watch?v=dizQpwTMPEo
3. www.greenercement.com
4. https://fcpa.org/wp-content/uploads/2020_PCA_PLC_FCPA_Presentation.pdf
5. https://www.lehighhanson.com/products/cement/EcoCemPLC

Tools

- PCA CO2 Calculator
- SCA Calculator
- GCCA Calculator

Great Lakes Cement Promotion Council
248.848.3710
dburns@glcement.org
www.glcement.org

Scan to access more resources

Case Study: Tennessee DOT Selects PLC Mixtures for Bridge Deck Replacement

Courtesy of www.greenercement.com

Henry County, Tennessee is home to an important automotive corridor in the southeastern United States. On a well-trafficked stretch of road there, TDOT identified a number of bridges for deck replacement as part of a statewide infrastructure plan. The DOT actively monitors bridge repair and replacement needs while seeking methods to reduce environmental impact of construction projects. Working closely with their cement suppliers, ready mixed concrete producers began testing PLC mixtures for compressive strength, setting time, air content, slump, and bleed potential. They used a mixture containing 620 lbs/ft3 of PLC with a 25% fly ash replacement. The fly ash provided better consistency for the mixture. After running some 450 trial batches, producers were confident in the compressive strength results of 4000 psi at 28 days, noting little to no difference between the PLC mixtures and their typical Type I/II mixtures. Ready mixed employees commented that it was easy to make the change. With this information in hand, the ready mixed producer approached TDOT about using PLC concrete for its bridge decks. TDOT agreed to use the PLC/fly ash mixtures. As a result of the 1:1 replacement level for ordinary portland cement and the additional 25% fly ash content, TDOT was able to use PLC to reduce the carbon footprint for several bridge decks while obtaining concrete with the required properties.