Sustainability and How the Industry is Reducing it’s Environmental Impact

By Lori Tiefenthaler and Jay Whitt
Leading the Way to Carbon Neutrality

Evolution of Sustainability – Developing Expertise

Products and Technology

Discussion
Why do we collectively care about Sustainability?

Figure 1. GHG emissions by economic sector in the U.S. (EPA 2013).
Lehigh Hanson is part of the HeidelbergCement Group, one of the worldwide market leaders in the building materials sector.

World leader in the vertical integration

#1 worldwide in aggregates:
• 600 production sites for sand, gravel and crushed rock (200+ Lehigh Hanson)

#2 worldwide in cement
• 160 cement plants/grinding mills (20+ Lehigh Hanson)

#3 worldwide in ready-mixed concrete
• 1,700 ready mixed concrete plants (200 Lehigh Hanson)
Products and Technology: Developing Sustainable Solutions in Our Markets

Cement’s environmental impacts are typically at least 80% of Concrete’s carbon footprint.

It is difficult to have the same offering in each market; however, we strive to serve all of our areas with at least one sustainable cement.

User of recycled materials (Circular Economy):
- Slag
- Fly Ash

Blended Cements – EcoCem
Low-carbon cement types:
- Portland Limestone Cement (IL) - EcoCemPLC
- Composite Cements (IT) - EcoCemPLUS
- Slag and Portland (IS)
- Fly Ash and Portland (IP)
Leading the Way to Carbon Neutrality

Science Based Targets Initiative

Science Based Targets Initiative

Our goal is to realize the vision of carbon-neutral concrete at the latest by 2050

-30% reduction 1990 baseline
HeidelbergCement 2030 Commitments

“We are committed to fulfilling our share of the global responsibility to keep temperature rise below 2°C, and we will continue to reduce our impacts on air, land and water.”

Ensuring Compliance and Creating Transparency
“We adhere to international human rights, anti-corruption and labour standards and co-operate pro-actively in an open and transparent manner with all our stakeholders.”

Being a Good Neighbour
“We are committed to supporting the social and economic development of our neighbouring communities and ensure transparent communication to all our stakeholders.”

Enabling the Circular Economy
“We conserve our natural reserves by continuously increasing the use of alternative resources as substitutes for natural raw materials.”

Reducing our Environmental Footprint
“We are committed to fulfilling our share of the global responsibility to keep temperature rise below 2°C, and we will continue to reduce our impacts on air, land and water.”

Achieving Excellence in Occupational Health and Safety
“We are committed to continuously enhancing the occupational health and safety conditions of our employees, contractors, and third parties.”

Driving Economic Strength and Innovation
“We will ensure sustainable profitability through the effective management of all processes and resources and the continuing innovation of products and services.”
Our Industry is developing a roadmap

**Carbon Neutrality by 2050...!**

- Cement and concrete sector (led by PCA) is developing a roadmap by the end of 2021 to facilitate achieving *carbon neutrality* across the concrete value chain by 2050...

[www.cement.org/newsroom](http://www.cement.org/newsroom)
Lehigh Wants to Be A Leader in Sustainability

We have aligned our Sustainability Commitments with the UN Sustainable Development Goals (SDG) enacted in 2015 by the UN General Assembly, which have been adopted by all 193 member states. Their aim is to end extreme poverty, fight injustice and to protect our planet with 17 goals set out for 2030.

- For Lehigh: 30% Reduction in Carbon Emissions by 2030

PLC is an immediate strategy that can be implemented to tackle carbon emissions; it's something that we can do NOW.

- Increasing CO2 efficiencies at cement plants (Mitchell's K4, etc.)

Production and use of PLC is a proactive step that can be taken to promote GREEN BUILDING.

- Lower "Global Warming Potential" value for use in EPD's (Environmental Product Declaration) with PLC
Cement/Concrete Products and Technology: Sustainable Solutions

At least 80% of HeidelbergCement’s Research and Development Investments are Sustainability Driven

**ALTERNATIVE RAW MATERIALS**
- Reduction of clinker content in cement and concrete
- Alternative cementitious systems
- Levers for Lower Carbon Concrete

**ALTERNATIVE FUELS**
- Biomass (zero emissions)
  - Sewage sludge
  - Wood, paper, carton
  - Animal meal, animal fat
  - Animal bone meal
- Other fuels
  - Waste oil, tires
  - RDF
- Use of SCMs: slag cement for basements and massive construction pours
- Use of fly ash other recycled fines in cement production

**AIR CLEANING**
- TioCem® reduces NOx in cities

**ENERGY STORAGE & TRANSMISSION**
- Heatcrete® is a special concrete with high thermal conductivity for energy storage.
- Powercrete® increases the efficiency of underground power cables with its high thermal conductivity.
Sustainability Evolution – Developing Expertise

Operational Carbon Emissions

LEED (1998-present)
- Rating system
- Credit driven
- 75% Operational (water/Energy efficiency)
- Materials (10%)

Embodied Carbon Emissions

Environmental Product Declaration (2015)
- Product/Plant EPD
- Embodied Carbon Accounting
- Reducing GWP kg of CO2
- Low Carbon Concrete
- Setting Baselines

Global Warming
- Climate Change
- Paris Agreement (2016)
- GHG emissions
- GWP in kg of CO2 eq
- Cement Industry 5-8% global emissions – due to resilience necessity

Transparency

Global Warming

- Climate Change
- Paris Agreement (2016)
- GHG emissions
- GWP in kg of CO2 eq
- Cement Industry 5-8% global emissions – due to resilience necessity
Environmental Product Declaration (EPD)

“a transparent, verified report used to communicate the environmental impact (e.g., resource use, energy, emissions) associated with the manufacture or production of construction materials…”

What are the Benefits of EPD’s

- Provide verifiable and transparent information on life-cycle environmental impact data for materials or products
- Allow meaningful comparisons of the environmental performance of materials
- Identify areas for environmental performance improvement, encouraging industry efficiency

Source: FHWA
Environmental Product Declarations (EPD) – What’s Included to Make Them

TRANSPARENT REPORTING OF ENVIRONMENTAL IMPACTS - EPD

Updated Cement Industry average in Q1 2021 will have a PLC

Includes 72 mixes; 6 categories; 2500-8000 PSI

2019 <13% GWP than 2014
What is on an EPD

TRANSPARENT REPORTING OF ENVIRONMENTAL IMPACTS - EPD

ICPA – CP Tech Center Webinar Sustainability by Lehigh Hanson | 2.19.2021 | Lori Tiefenthaler and Jay Whitt
Products and Technology: Using Portland Limestone Cement (PLC or Type IL)

EcoCem® PLC is a blended portland cement with up to 15% limestone and as much as 10% less embodied carbon.

Benefits of Using Type IL

<table>
<thead>
<tr>
<th>Concrete Producers</th>
<th>Contractors/Customer</th>
<th>Public</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced Energy impact from cement</td>
<td>Improved Consistency and workability</td>
<td>Fewer CO2 Emissions</td>
</tr>
<tr>
<td>Lower Global Warming Potential (GWP)</td>
<td>&gt; Durability</td>
<td>More Durable Concrete with SCMs</td>
</tr>
<tr>
<td>Better Chemical Control</td>
<td>Particle packing optimized</td>
<td>Cleaner Air</td>
</tr>
<tr>
<td>Synergies with SCMs</td>
<td>Lower Carbon Concrete</td>
<td>Concrete has Lifetime CO2 Uptake</td>
</tr>
</tbody>
</table>

Link: [www.concretejustgotgreener.com](http://www.concretejustgotgreener.com)
Advantages of PLC

What does PLC do for me?

- The primary advantage is that it allows for a reduction in CO2, typically up to 10%
- PLC is a simple, straight forward switch in your operation; essentially “plug n play”
- Pull OPC powder out of your mix, and replace it with PLC
- PLC provides you an opportunity to “Go Green” and increase your sustainability without spending money on capital investments for specialized systems at your ready mixed concrete plants

https://www.greenercement.com/
PLC or Type IL: Current Status

- Lehigh Cement - Seattle market reaching 100% conversion to PLC
- Department of Transportation in 32+ States have now approved the use of PLC or Type IL cement.
  - IDOT 2013-14
  - FAA
  - US Army Corps of Engineers
- Many Cities and Counties are adopting PLC into their local specifications
- Engineers and Architects have begun adding ASTM C 595 to their specifications
- PLC is being used on many high profile projects, where reducing carbon footprint is part of their goal
- Performance concrete rather than specified concrete is bringing additional value to the owner and contractor
- Combining PLC with recycled products is leading the way in sustainable design.

https://www.greenercement.com/
Portland Cement Association: [https://www.greenercement.com/](https://www.greenercement.com/)

Links to PLC fact sheets, Research Reports and for the Architects, Engineers and Specifiers, there is a link to “How to Specify PLC”.

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**Reduce Your Carbon Footprint With PLC**

The same durable, resilient concrete you depend on can now reduce your carbon footprint by 10%.

Easy. Proven. Readily available.

**Why PLC**

Same durability. Same resilience. 10% carbon footprint reduction.

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**Get All the Facts**

About Portland-Limestone Cement

- Download Fact Sheet
- How to Specify PLC

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**Partners**

- ACPA
- NRMCA
- PCA
- PCI
- CRSI
- NCMCA
- NAHB
- ASCE
- USEPA
- DOE
- NAICS
- BNP
- Duralock
- PCI

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To understand how PLC works, we need to look at how it’s made.

- **What is a PLC?**
  - Type IL blended cement in ASTM C595/AASHTO M240
    - Allowed 5% to 15% limestone by mass
    - Typically made from the same clinker as C150 cement; PLC just has ~6% more limestone.
    - Designed for equivalent performance.
  - ~5-10% additional limestone added to the Finish Mill, replacing clinker at 1:1.
  - Ground Finer for equivalent performance
  - Optimized Sulfate for Set Control
The LS occupies the finest part of the cement Particle Size Distribution (PSD) spectrum.

Keys to PLC Performance
Products and Technology:

**Re-Carbonation Ready** - Embodied Carbon Emission Reduction Accounting Soon

**RE-Carbonation benefits quantifiable through EPDs**

- HeidelberCement: significant carbonation R & D
- HeidlbergCement Research Labs:

**EPD Calculations a concrete product (EN 16757, Annex BB)**

The CO₂ uptake in kg for each application during t years can be calculated as:

\[
\text{CO}_2 \text{ uptake} = \left( \frac{k_l \times DOC_p \times A_j}{V(t)/1000} \right) \times \frac{U_{sc}}{C}
\]

\[
\text{CO}_2 \text{ uptake} = f(\text{concrete properties}), (\text{geometry}), (\text{time}), (\text{Cement parameters})
\]

**Global Cement and Concrete Association** good source on this topic
SUSTAINABILITY

Sustainable Concrete Pavements – Whole Life Carbon Accounting

Life Cycle Assessment (LCA) – Use-phase impacts are often dominant (energy, CO₂ etc.)

- Pavement Vehicle Interaction (PVI) – roughness, texture and deflection (stiffness)
  - Useful tool for agencies to reduce GHG emission. Increasing the stiffness using 10% resurfacing in the network per year → 18% reduction of GHG emissions from the pavement network, or 440 Mt CO₂ eq, over a 50-years. (AzariJafari et al.)

- Albedo – Mitigating Urban Heat Island and Climate Change
  - Reflective pavements could lower air temperatures by more than 2.5°F, and offset CO₂ equivalent of 4 million cars per year

- Carbon Uptake – can offset 5.4% of GHG emissions associated with clinker production!
  - 5.8 Million metric tons CO₂ can be sequestered by US pavement network (AzariJafari et al.)
PORTLAND LIMESTONE CEMENT PROJECTS

Lehigh Project and Case Studies using EcoCem\textsuperscript{TM} PLC$^\text{TM}$
First Iowa DOT PLC Pavement Project - 2013

Concrete was a Ternary Mixture:

- Iowa DOT QMC Mix Design
- Type IL(10) Cement and 20% Class C Fly Ash
- 19,270 yd³ Concrete
- 4,274 Tons Type IL(10) Cement

Pavement:
- 10 ½ inch Doweled Pavement
- 4 Miles, 2 East Bound Lanes w/ Turn Lanes
- Placed in 12 days: May 24-June 19, 2013
PLC PROJECTS

Central Iowa Expo Center: Boone IA

Concrete Mix Information:
- Iowa DOT QMC Mix Design
- Type IL(10) and 20% Class C Fly Ash
- 2,536 yd³ Concrete
- 553 Tons Type IL(10) Cement

Pavement:
- 6 inch Plain Pavement
- 19 Mile Haul from Concrete Plant!
- Placed: June 21-28, 2013
PLC PROJECTS

Lehigh Plant – Leeds, Alabama

2009-10 Creek Relocation
- 26,800 CY
  Soil Stabilization, Creek Lining, Tunnel Under Plant
2010 New Cement Silo – 5,100 CY
  Slip Formed – 5100 CY (40% Slag)
  Intricate Structural Design
PLC PROJECTS

City of Leeds, AL Streets

2013 & 15 Streets – 500 CY (20% F-ash)
City of Leeds Paving – 400 CY
PLC PROJECTS

Indiana First PLC Pavement Project - Patching

Project: completed Sept. 2020
Project location: I-65 Columbus, IN

Comments from the project:

Plastic properties of the concrete were very consistent and stable

Expected project duration was 5-6 Saturdays; due to the performance of the PLC concrete, the project was completed in 3 Saturdays.
PLC PROJECTS

Indiana First PLC Pavement Project - Patching

Project: completed Sept. 2020
Project location: I-65 Columbus, IN

Patch Concrete: 284 Cubic Yards
Concrete Patch Mix design - typically patching mix
  Replaced ordinary cement with PLC (like for like)

Specs: 625psi flex in 3 days (typically 550psi)

Concrete Test Results:
425 flex psi spec to open to traffic; with maturity, this was attained in 12-15 hrs.
The 3d flex spec was 625 psi; the average for the project was 730 psi in 3 days.
Indiana First PLC Pavement Project - Patching

Flowable fill: 68 yards
First time DOT was using a higher performance flowable mixture
Flowable Fill: 8 hour DCP blow count (typically a 3 day spec – 30 blows). New mix met in ~2.5 hrs
Resources for You
Portland Cement Association: [https://www.greenercement.com/](https://www.greenercement.com/)

The Site Contains a CO2 Calculator – How much CO2 can you save by using PLC on a project?

![CO2 Savings Chart]

BY VOLUME
(Buildings, Ready Mix Producers, Geotechnical)

<table>
<thead>
<tr>
<th>Total volume of concrete (cu. yd.)</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement factor (lb/cu. yd.)</td>
<td>564</td>
</tr>
</tbody>
</table>

**CO2 Savings with PLC**

- = 23 Tons
- = 45,910 lbs
- = 21 Metric Tons
- = 20,824 kg

Basic calculator assumptions:
- 0.045 cu. yd. of concrete are used per sq. ft. of building floor space
- one cu. yd. of concrete contains 450 lbs of cement.

For advanced calculation, input your total concrete volume and cement factor.
PORTLAND LIMESTONE CEMENT RESOURCES

Introduction
Portland-limestone cement (PLC) is an innovative cement that contains at least 95% and 99% finely ground limedite. PLC is a relatively new cement in the United States—the first application for paving took place in Colorado in 2007. This MAP Brief is intended to review experience with this product over the past 10 years regarding the following:

1. Acceptance of the product by specifying agencies
2. Growth in production
3. Performance in the field

To date, over 900 lane miles of highway paving has been completed with PLC in Colorado, Utah, and Oklahoma. The focus of this paper is the performance of these pavements in service.

The cement industry is a significant producer of CO2; for every ton of Portland cement produced approximately 1,400 pounds of CO2 are released. Growing concerns over the environmental impacts of building materials has been one of the driving forces for the development of PLC. PLC cements containing up to 15% limestone can reduce carbon footprints up to 30% compared to ordinary Portland cements (OPC).

Limestone, often considered a tier 2 ingredient, when added to Portland cement, is not completely chemically inert and consists in the development of the cement's microstructure (ITMA 2011). Limestone is softer than cement and has a finer particle size when ground, thus producing an improved particle size distribution. The first limestone particle acts as nucleation site increasing the hydration rate of the calcium silicate at early ages. Finally, limestone reacts with the alumina phases to form water needing hydrates. The rates of this reaction can increase with the fineness of the limestone and when PLC are combined with fly ash or slag.

Specifically, the physical mechanisms include enhanced partial packing and paste density due to the enhanced overall cement particle size distribution and the "nucleation site" phenomenon—when small limestone particles are dispersed in pozzolanic clinker grains and become interparticle sites for calcium silicate hydration, growth, which improves efficiency. The chemical mechanisms include limestone, which contributes calcium compounds to the solution for hydration interactions, and calcium carbonate, which reacts with aluminum compounds to produce durable water- and heat-cemented hydrates over time.

Numerous research has shown that certain properties of the concrete could be negatively impacted with above 15% limestone addition.

Although somewhat new in the United States, some European countries have been using PLC since the 1960s. According to Cemento (2012) PLC concrete was 25% of the cements produced in Europe. In 2005, the first commercial production of PLC in the United States was completed and under the AASHTO T335 performance-based specifications for hydraulic cement.

History of Performance
PLC has been used by the ready mix and precast concrete industries. PLC is used in thousands of cubic yards of concrete for commercial and industrial projects.

"Moving Advancements into Practice" MAP Brief, October 2018
Best practices and promising technologies that can be used to enhance concrete paving

ICPA – CP Tech Center Webinar Sustainability by Lehigh Hanson | 2.19.2021 | Lori Tiefenthaler and Jay Whitt

July 2020: ENR mag

Reducing the Carbon Footprint of Cement in the United States
Continuing its move to reduce the carbon footprint generated by the cement sector, Lehigh Hanson is expanding its market into the Midwest for EcoCem PLC, the company’s Portland-limestone cement (PLC). The company connotes that use of EcoCem PLC releases less carbon while deflecting climate change. Strengths of these cements in ordinary Portland cement (OPC)

Lehigh Hanson and European manufacturers, PLC accounts for about 10% of the United States does not use a lot of it. However, in Europe, particularly in regions where testing in labs and field trials, the depth method, CO2 emissions, use of cement, strength, and resistance.

For the past decade, Lehigh Hanson completed its supply of EcoCem PLC of its Detroit, Buckskin, cement plant in Canada. And for many years, it has demonstrated PLC potential for construction projects in its Leeds, Ala., Phoenix, Ontario, and Nanaimo, Pa., cement plants. Lehigh Cement supplied PLC for the $1.9 billion concrete storm sewer in Idaho and also had an open house to help educate agencies on all the benefits of specifying new cement product, which the Alabama DOT now uses. After 2 years ago in Iowa, Lehigh Cement supplied the first concrete pavements for the Iowa DOT in 2004. Last year, in 2005, Lehigh Cement built a pavements in Speed, Ind. This project has made it creates the list of products approved by both the Iowa and Kentucky Transportation Cabinet. Lehigh has been the independent of cement sales for Lehigh Cement says, "Over the past few years, we have worked with multiple agencies, producing this size and supplying projects from our Midwest plant in Iowa and Indiana to produce cementitious products that will challenge the sector to reduce its environmental impact. "Lehigh Cement has also been testing the product for a more widespread use across all product segments where cement is used. That means that the company can help reduce the carbon footprint of the performance concrete systems.

EcoCem PLC is a hydraulic interground Portland-limestone cement that contains about 15% limestone that complies with ASTM C 150, C 151, and ASABE M 420 as a Type II PLC. Lehigh Cement has modified the cement to produce EcoCem PLC compared to ASTM C 150, M 420, and ASABE M 420 Type I Portland cement, EcoCem PLC meets all ASTM C 150, M 420, and ASABE M 420 Type II requirements. The Portland Cement Association (CPA) recommends using this product to cementitious materials in concrete and asphalt pavement. The PCA recommends the product for use in concrete and asphalt pavement.
A Green Cement | PLC | Portland Limestone Cement

3,823 views • Oct 7, 2020

Tyler Ley
60.5K subscribers

The concrete industry has made great strides to create green cements. They do this by adding limestone during the final grinding. These cements are called Portland-Limestone Cements or PLCs. These cements have lower carbon footprints but similar performance to traditional portland cements. This video is sponsored by the Portland Cement Association to promote its new website www.greencement.com.
PORTLAND LIMESTONE CEMENT RESOURCES

WHAT IS THE IMPACT OF PLC ON CONCRETE DURABILITY?

Enforcement durability testing has been conducted by Lehigh Cement and many other cement companies in the US and Europe, with very favorable results for PLC.

PLC performance in concrete is essentially equivalent to that of OPC made at the same cement/placement ratio and water/binder ratio. The results are comparable to OPC with slightly lower chloride permeability, sulfide resistance, freeze-thaw resistance, and resistance to salt scaling, with some slight enhancement in some cases. Similar to concrete made with OPC, concrete with PLC often requires supplemental air-entraining admixtures (SEA) to meet these requirements.

HOW DO CONTRACTORS LIKE WORKING WITH LEHIGH ECCOCEM PLC?

Contractors made with Lehigh ECCOCEM™ PLC exhibit an excellent record of performance and dependability. Many contractors report that Lehigh ECCOEM™ PLC concrete is stronger and more dimensionally stable than concrete made with Type I/II Portland cement. This is a result of the unique cement composition that reduces the amount of free lime in the cement. The result is a more uniform and consistent product that performs better in a variety of applications.

WHAT CEMENT SPECIFICATIONS COVER PLC?

PLC (EcoGenPLC™) is a Type I/II cement that meets or exceeds the current (interim) (Type I, Type II) ASTM specifications of ASTM C150 and AASHO M75, and the use of PLC is accepted in the following Specifications and State DOTs:

- NA (Not Accepted)
- All others

The key restrictions to the use of Type I/II cement relate to specifications for green projects that have not yet updated their specifications to current interim standards. For assistance on specifications and additional information, contact the Portland Cement Association at www.pcgemember.com.

CAN PLC BE USED IN THE SAME CONCRETE MIX DESIGNS AS TYPE I-IL PORTLAND CEMENT?

Yes, the affinity for water and air in cement in concrete may even be superior. No special concrete admixtures or storage changes are necessary, and there are no operational restrictions. Enhanced environmental management characteristics are negligible and easily addressed.

HOW DO PVC IMPROVE THE SUSTAINABILITY OF CONCRETE?

PLC substitution for Portland cement provides a significant improvement in concrete sustainability without an investment in specialized equipment or production processes. When OPC with up to 15% lower internal hydration and higher chloride resistance, the result is that PLC reduces the carbon footprint of cement manufacturing by up to 10% due to the production of less CO2. While the concrete is made to have a similar impact on a cement’s Environmental Product Declaration (EPD), PLC will allow for a measured reduction in the Global Warming Potential.

CONCLUSIONS ABOUT USING LEHIGH ECCOCEM PLC IN CONCRETE

Lehigh EcoGenPLC™ has the potential to significantly improve concrete sustainability, while delivering performance in concrete that is equal to, or better than, concrete made with OPC.

Lehigh EcoGenPLC™ is a Type I/II cement that meets or exceeds the current (interim) (Type I, Type II) ASTM specifications of ASTM C150 and AASHO M75, and the use of PLC is accepted in the following Specifications and State DOTs:

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# Specifying PLC

## WHAT CEMENT SPECIFICATIONS COVER PLC?

PLC containing from 5% to 15% limestone is now included in the current blended cement Type IL specifications of ASTM C595 and AASHTO M240. ASTM C595 and the use of Type IL is accepted in the following Specifications and State DOT's:

### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
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<tbody>
<tr>
<td>ACI 318</td>
<td>Building code for structural concrete</td>
</tr>
<tr>
<td>ACI 301</td>
<td>Specification for structural concrete</td>
</tr>
<tr>
<td>ASTM C94</td>
<td>Specification for ready mix concrete</td>
</tr>
<tr>
<td>ASTM C270</td>
<td>Specification for mortar for unit masonry</td>
</tr>
<tr>
<td>ASTM C476</td>
<td>Grout for masonry</td>
</tr>
<tr>
<td>ASTM C1496</td>
<td>Packaged, pre-blended, dry combined materials for use in wet or dry shotcrete (gunite) application</td>
</tr>
<tr>
<td>ASTM C1713</td>
<td>Historic Masonry Mortar</td>
</tr>
</tbody>
</table>

The only restriction on the use of Type IL cement may be in specifications of private design firms that have not updated their specifications to current industry standards. For assistance on specifications and additional data, reference the Portland Cement Association at www.greencement.com.

### STATE DOT'S

<table>
<thead>
<tr>
<th>State DOT</th>
<th>Acceptance</th>
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<tbody>
<tr>
<td>Illinois</td>
<td>All concrete</td>
</tr>
<tr>
<td>Indiana DOT</td>
<td>All concrete; Stabilization pending field trials</td>
</tr>
<tr>
<td>Iowa DOT</td>
<td>All concrete</td>
</tr>
<tr>
<td>Kentucky Transportation Cabinet</td>
<td>All concrete; Stabilization request pre-bid</td>
</tr>
<tr>
<td>Minnesota DOT</td>
<td>All concrete</td>
</tr>
<tr>
<td>Ohio DOT</td>
<td>All concrete</td>
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### OTHER SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
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<tbody>
<tr>
<td>FAA P501</td>
<td>Concrete Paving Specification</td>
</tr>
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<td></td>
<td>Included in AIA MasterSpec</td>
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</tbody>
</table>
increase your knowledge

resources for information and learning on concrete sustainability and transparency

https://www fhwa dot gov/pavement/sustainability/

Greenercement com – Portland Limestone Cement

CShubMIT – YouTube – MIT Concrete Sustainability Hub Public Videos

Home | Concrete Sustainability Hub (mit edu) – Website with research Briefs

https://www fhwa dot gov/pavement/sustainability/hif19087.pdf

https://buildwithstrength com/education/ - National Ready Mix Concrete Association Educations – On demand videos

carbonleadershipforum org – Carbon Leadership Forum

buildingtransparency org – CLF’s tool for viewing EPDs

gccassociation org – Global Cement and Concrete Association

nrmca org/association-resources/sustainability/epd-program - NRMCA

Home - Build With Strength : A Coalition of the National Ready Mixed Concrete Association

https://www linkedin com/groups/1807540/ - Women in Concrete Alliance

Lehigh Hanson Linked In - #knowledgeIsStrength

Environmental Product Declarations (EPDs) - Lehigh Hanson, Inc. - Lehigh Hanson and Industry Wide EPDs
Thank You!

Questions?

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