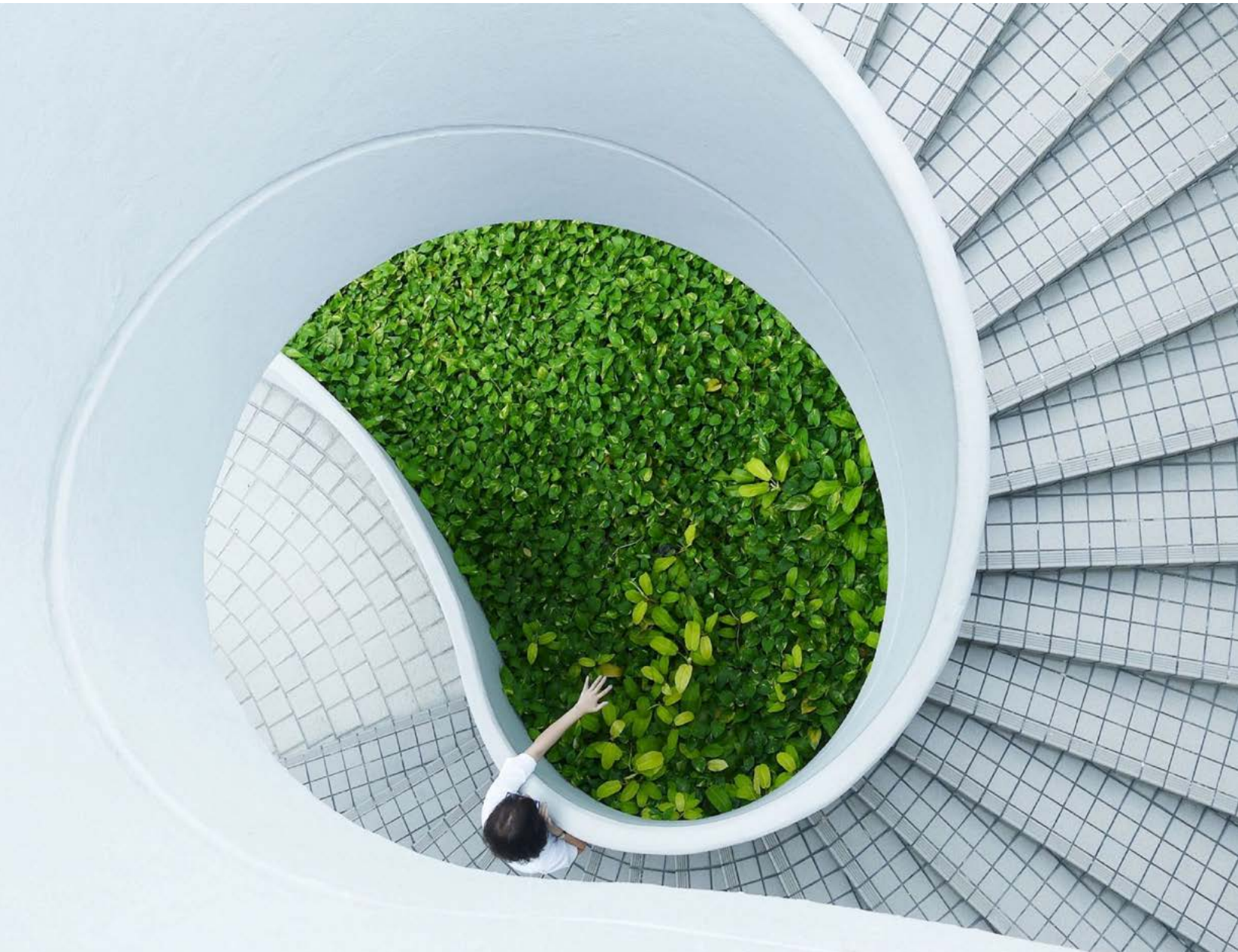


Green Cement





PozzoSlag in Interstate 45 - Conroe, TX

GREEN CEMENT

Eco Material Technologies' "Green Cement" line of products is so named because they can be substituted for portland cement in the production of ready-mixed concrete and precast concrete production, reducing the carbon emissions associated with traditional cement production (decomposition of CaCO_3) by up to 99 percent.

PozzoSlag® was first developed to increase the portland cement replacement ratio and overcome the prolonged setting times that have historically hindered the use of higher volumes of fly ash and ground granulated blast furnace slag in concrete applications. Green Cement's PozzoSlag chemistry and specialized manufacturing system and methods allow for the replacement of higher percentages of cement—up to 60 percent, but more typically 40-50 percent. Most replacement rates are in the 20 percent range for other supplementary cementitious materials in general concrete mix designs.



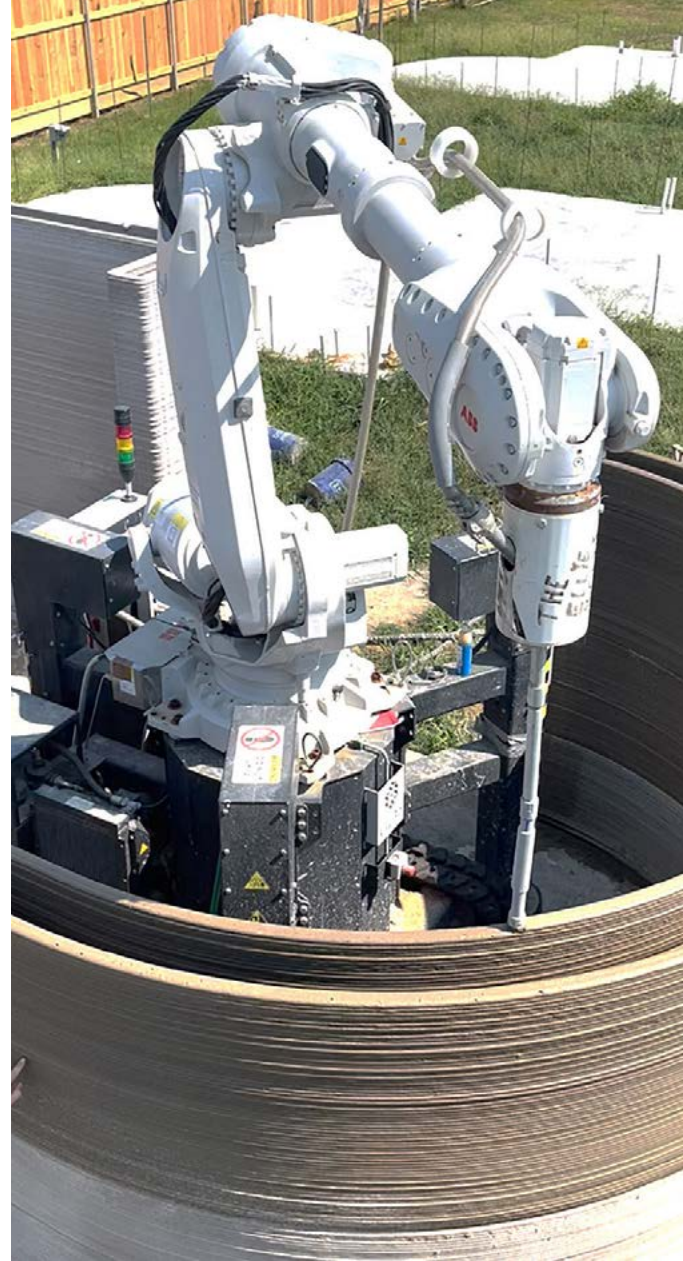
PozzoSlag Precast Products

OUR PRODUCTS

PozzoSlag® 1.0 & 2.0 are highly reactive modified pozzolans that, unlike ground granulated blast furnace slag, meet both ASTM C989 performance specifications and ASTM C618 performance specifications for Class F fly ash. Comprised primarily of Class C and F fly ash, PozzoSlag is approved by the Texas Department of Transportation and the Federal Highway Administration under a Special Provision as a Modified Fly Ash allowing for up to 50 percent portland cement replacement. PozzoSlag 1.0 & 2.0 are typically utilized in ready-mixed concrete as a replacement for portland cement in projects including highways, bridges, and concrete products such as pipe.

PozzoSlag® 3.0J is a special-purpose SCM product that is designed for fast-setting controlled low-strength material (“flowable fill”) and similar applications. Comprised of Class C fly ash, PozzoSlag 3.0J takes as little as 15 minutes to meet 100-250 psi strength requirements. When used in 3- to 4-sack mix designs, PozzoSlag 3.0J attains 50-80 psi compressive strength (ASTM C109) in one day and 150-250 psi in 28 days, depending on sand quality. PozzoSlag 3.0J can be designed and formulated to meet the target strengths for specific project needs.

PozzoCem® and **PozzoCem® Vite**, Eco’s 3D printer cements, achieve 3,000 psi in 7 days and 5,000-plus psi in 28 days. These products can replace up to 100 percent of the portland cement that traditionally would be used to manufacture concrete while saving approximately 90 percent of the carbon emissions associated with portland cement production.



PozzoCem Vite 3D printing of a home

FORMULATION

Although our Green Cement products are manufactured using fly ash from multiple sources, Eco utilizes a reactor system to process the raw materials and ensure a consistent product. It is truly a manufactured product, compared to coal combustion products fresh from a power plant, which can have slight variations in quality. Our proprietary chemical additive mixture improves the product's strength and performance characteristics, which can be formulated for specific use.

Unlike the portland cement manufacturing process, our Green Cement production process does not rely on an energy-intensive kiln, eliminating inefficiencies and extreme energy requirements. Because Green Cement requires significantly less electricity per ton produced compared with portland cement, it reduces the carbon emissions associated with production and, again unlike cement manufacturing, does not generate and release CO₂ via the decomposition of calcium carbonate (CaCO₃).

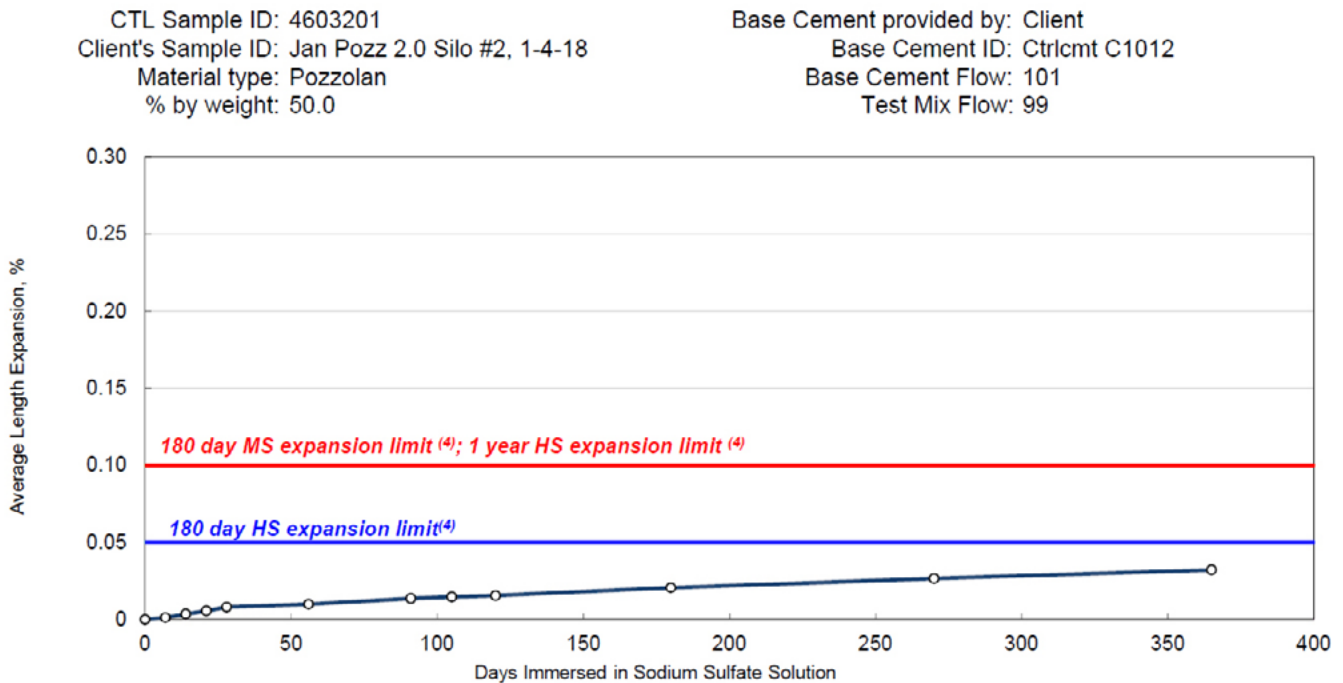
PERFORMANCE

Concrete made with PozzoSlag and its derivative products offers numerous performance benefits compared with that made from portland cement, including the following.

Less porosity, which improves durability because of:

- Better particle size distribution/density from improved packing factors
- Improved chemistry and stoichiometric balance of the concrete binder
- Reduced alkali-silica reactivity because of its chemistry and densification due to reduction of pore structures
- Mitigated delayed ettringite formation
- Decreased exposure to moisture intrusion due to impervious surface (pore structure) from high pozzolan content and chemistry
- Reduced chloride intrusion, reducing Cl attack of rebar and other metallic components due to density and reduced pore structure eliminating chloride intrusion

Figure 1
Report of Sulfate Resistance (ASTM C1012)



Improved sulfate-resistant performance because of:

- The chemistry of pozzolan and high pozzolan replacement of cement, as seen in Figure 1
- Reduced alkali-silica reactivity/improved durability, as seen in Figure 2
- Improved ASR mitigation because of PozzoSlag’s high pozzolanic reactivity and reduced chemical elements and alkalis that contribute to ASR
- Reduced water-cement ratio and densification, which prevents water intrusion to help mitigate ASR reactions

Reduced shrinkage cracks because of:

- Reduced bleed channels that trap water and slow shrinkage (slow curing)
- Improved early strength
- Reduction in calcium hydroxide
- Lower water demand

Improved workability, pumpability, and finishing because of:

- Spherical shape of fly ash
- Decreased water demand

Lower set times and improved long-term strength because of:

- Smaller particle size/increased BET surface area for reactivity
- Greater contact between reactive materials
- Faster rate of cement hydration and pozzolanic reactions, which increase long-term strength, as seen in Figures 3 and 4 found on the next page

Fewer surface problems in concrete, such as dusting and delaminating, because of:

- Reduced bleed water

Figure 2

ASTM C1567-22 Testing for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)

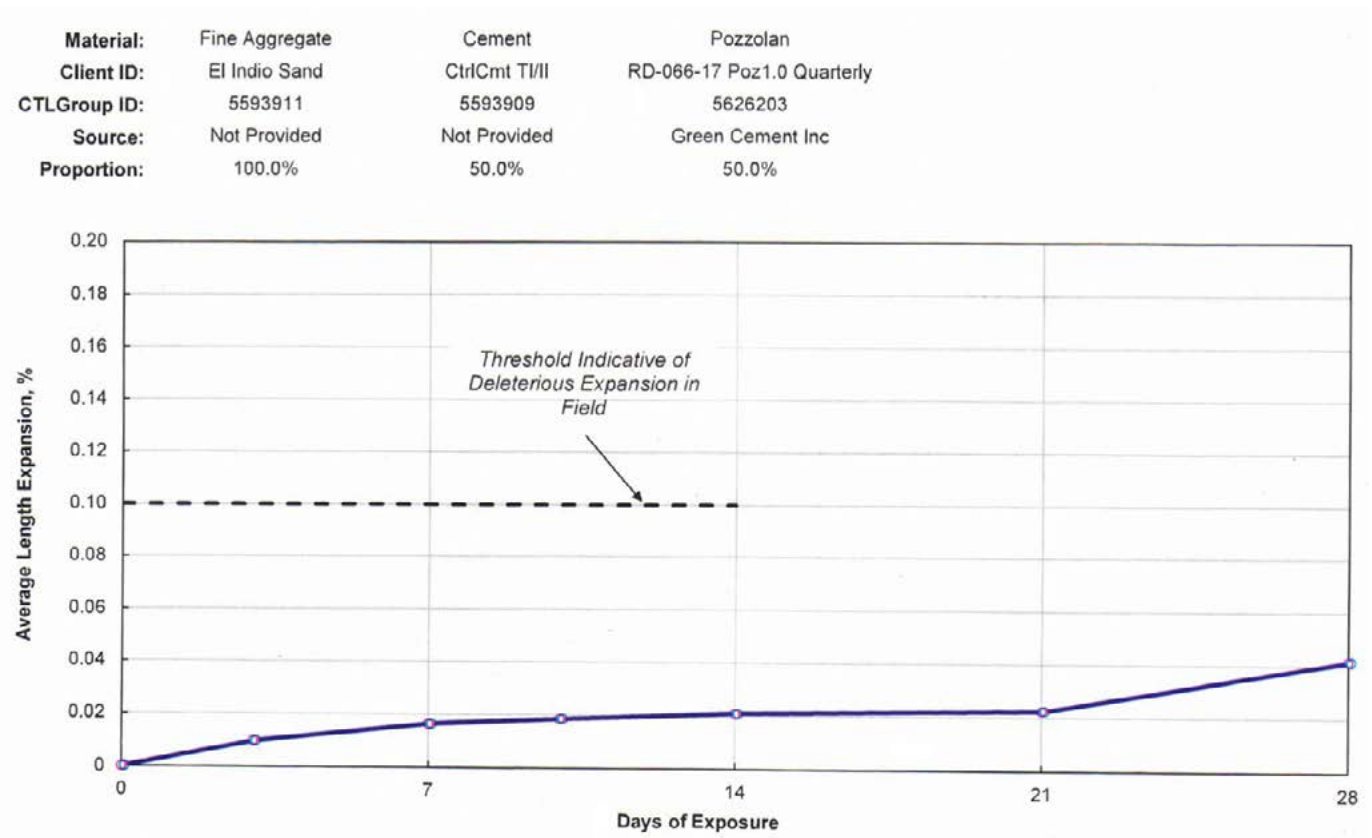


Figure 3
 PozzoSlag® vs Control Average SAI-PSI 2023 Testing

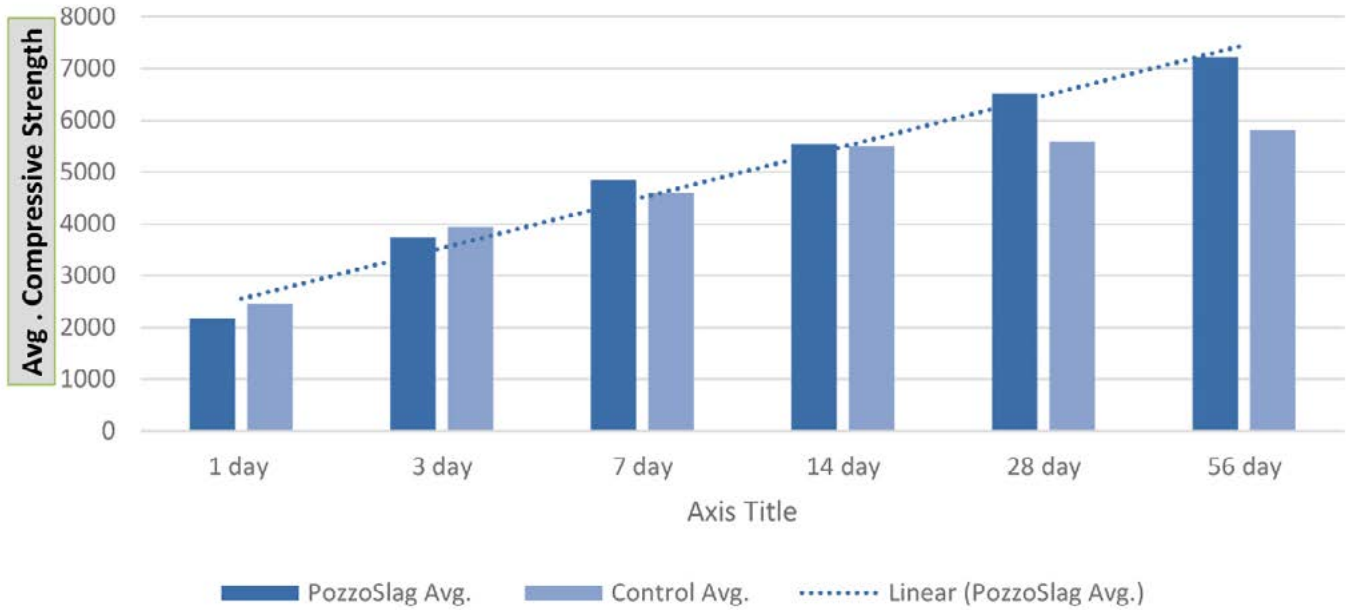
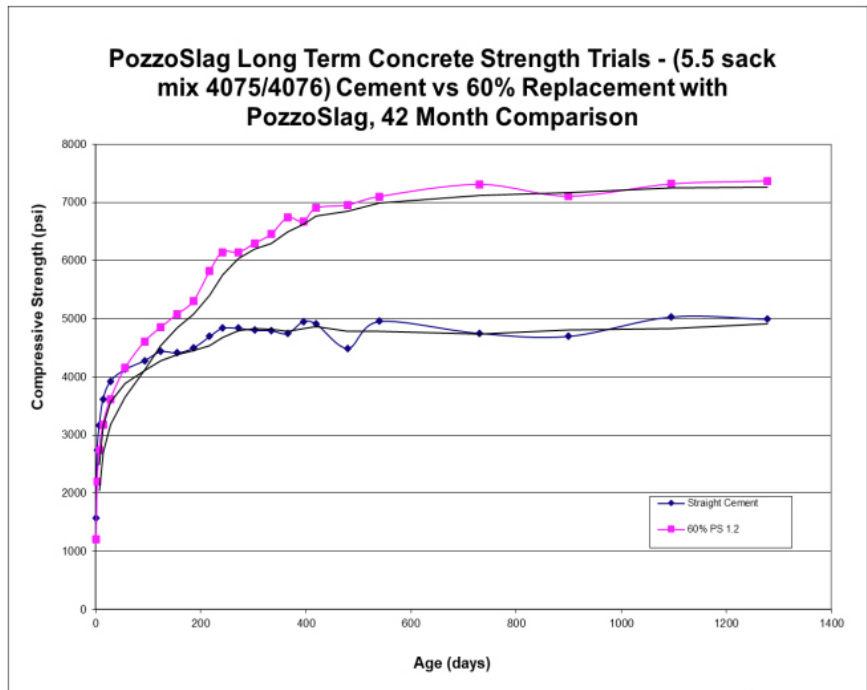


Figure 4
 Long Term Strength Gain Curve PozzoSlag® vs Control Cement at 60% Replacement

	Straight Cement	60% PS 1.2	Days	Pct Increase	Percent of Control
1 Day	1570	1210	1	-29.8%	77.1%
3 Day	2745	2200	3	-24.8%	80.2%
7 Day	3165	2742	7	-15.4%	86.6%
14 Day	3611	3180	14	-13.6%	88.1%
28 Day	3926	3619	28	-8.5%	92.2%
2 MONTH	4130	4155	56	0.6%	100.6%
3 MONTH	4280	4607	93	7.1%	107.6%
4 MONTH	4438	4854	124	8.6%	109.4%
5 MONTH	4415	5080	155	13.1%	115.1%
6 MONTH	4500	5305	186	15.2%	117.9%
7 MONTH	4697	5821	217	19.3%	123.9%
8 MONTH	4839	6146	241	21.3%	127.0%
9 MONTH	4839	6146	272	21.3%	127.0%
10 MONTH	4805	6300	303	23.7%	131.1%
11 MONTH	4800	6455	334	25.6%	134.5%
12 MONTH	4751	6738	365	29.5%	141.8%
13 MONTH	4955	6671	395	25.7%	134.6%
14 MONTH	4913	6905	420	28.8%	140.5%
16 MONTH	4495	6958	480	35.4%	154.8%
18 MONTH	4957	7102	540	30.2%	143.3%
24 MONTH	4752	7312	730	35.0%	153.9%
30 MONTH	4701	7108	900	33.9%	151.2%
36 MONTH	5036	7319	1095	31.2%	145.3%
42 MONTH	4996	7368	1278	32.2%	147.5%



COST BENEFITS

Concrete made from Eco Material's Green Cement products will typically cost less to produce compared to a typical blended cement concrete because of their ability to be used in higher replacement ratios compared with Class C or F fly ash. Further, concrete made from Green Cement will typically save on contractor labor costs because the concrete will be easier to work at lower slumps and set faster, allowing reduced hours for finishing. PozzoSlag cementitious products are typically manufactured at smaller plants that are located closer to the end user than portland cement plants, thus the shipping radius to deliver the PozzoSlag cements is frequently less than that associated with portland cement. These shipping cost savings, plus the lower PozzoSlag pricing versus portland cements, result in improved economics for the end user and their concrete products.

A PROVEN PRODUCT

In just over a decade since its introduction, more than 1 million tons of low-carbon Green Cement has been used on over 1,000 miles of highways and multiple runways throughout the U.S. To learn how Eco's Green Cement products can benefit your project, contact Eco Material at:

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