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Transforming Construction

Through Decarbonization, Circular Economy, and Material Innovation

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June 18, 2025

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Agenda

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Presentation Overview

02 Returned Concrete
Convert C

03 Challenging Materials
Quad

04 Sustainable Solutions
SCMs, Strength Enhancers & LC3 Cements

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Paving the Way for Sustainable Construction

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How Can We Help?

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Sustainability at Chryso – Saint-Gobain

MAKING THE WORLD A BETTER HOME

- Decarbonizing Construction
- Building Resiliency
- Circularity Solutions
- Transparency & Performance

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02

Returned Concrete Solutions

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The pain points for the management of returned concrete are increasing.

Plant and Jobsites Space

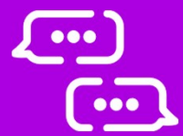
Current “solutions” have limited space to store returned concrete and jobsites will not keep the concrete leftover

Environmental Regulations

Difficulty to adapt to growing environmental regulations and find cost effective solutions quickly

Complex RM Management

Scarcity of quality Raw Materials and complexity to manage quality x price and logistics



Practicality & Decision making

Making the optimal decision for your surplus concrete at the speed of business

Returned Concrete Management

Most used market solutions

Hauling Offsite

- High cost
- Regulations changing
- Not “sustainability friendly”
- Challenge managing space at the plants

Producing Blocks

- Cost beneficial producing and selling blocks
- Labor dependable
- Practice decreasing for use at concrete plants

Crushing Concrete

- Dependable on equipment, investment and space
- Cost beneficial if reselling crushed concrete

Reuse of Fresh Returned Concrete

- Increasing practice
- Cost beneficial
- Granulizing and reselling/reusing
- Stabilize and reusing
- More sustainable

**Additional solutions should be considered for different markets and customers.*

The volume of returned concrete is typically between 2% to 5% of total production with a 3% in average

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Case Study Circular Solutions: Convert C

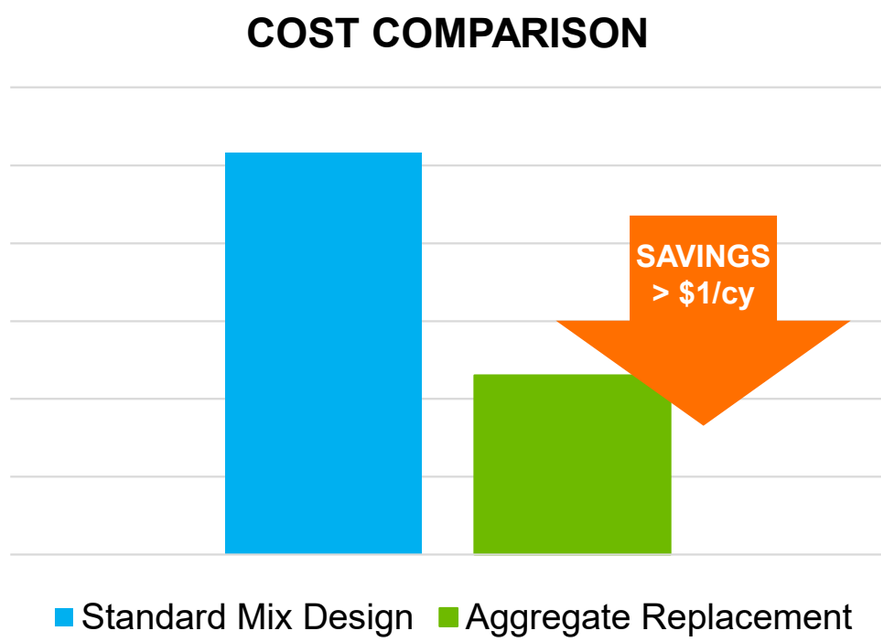
Concrete Waste Reduction

COST SAVINGS: > $1/cy from aggregate replacement

Circular economy in practice: waste reduction & recycled aggregate

Target: replacing aggregate using recycled aggregate treated with Convert C

- Replacing **5 % of total aggregate**, equally distributed for gravel and sand (estimated materials costs)
- > **$1 per cubic yard** in cost savings.
- If using in **20% of the volume** in a plant producing 100k cy per year, total savings per year is **~$30k.**



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03

Quad and Challenging Materials

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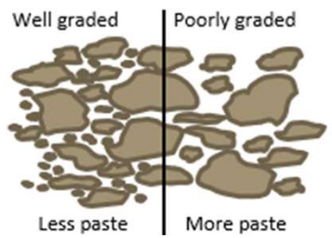
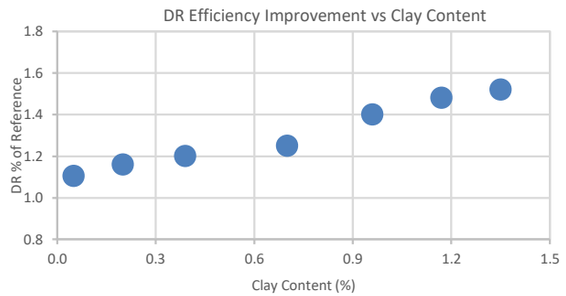
Aggregates material characteristics with negative impact in concrete performance: characteristics and challenges

- Scarcity of good quality aggregates and the impact of transport on concrete embodied carbon make lower quality sands locally available of high value.
- However, the quality of sands has a direct impact on concrete performance, placeability and finishability.

Aggregates material characteristics with negative impact in concrete performance





Specific and shapes

- Increase friction between particles
- Reduces rheology and flow
- Affects pumpability and workability

Lack of fines

- Compactness – porosity
- Slump retention – bleeding, pumpability issues
- Reduces strength

Swelling clay/Excess of fines

- Higher water and/or admixture consumption
- Slump retention – pumpability and workability

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Quad Lab and Clear Test

Chryso has developed an innovative and fast service to analyze sands and provide our customers with the right solution according to specific requirements.

Unique characterization method for swelling clay which is a real alternative to the methylene blue test with higher accuracy and reproducibility, and very easy-to-use testing in the lab and on site.

Step 1: Identification of swelling clay

A leading-edge tool for analyzing sand containing swelling clay

Step 2: Sand characterization data

Fineness modulus, type of sand, absorption rate, etc.

Step 3: data analysis

We use collected data to determine the best Quad solutions to meet specific requirements.

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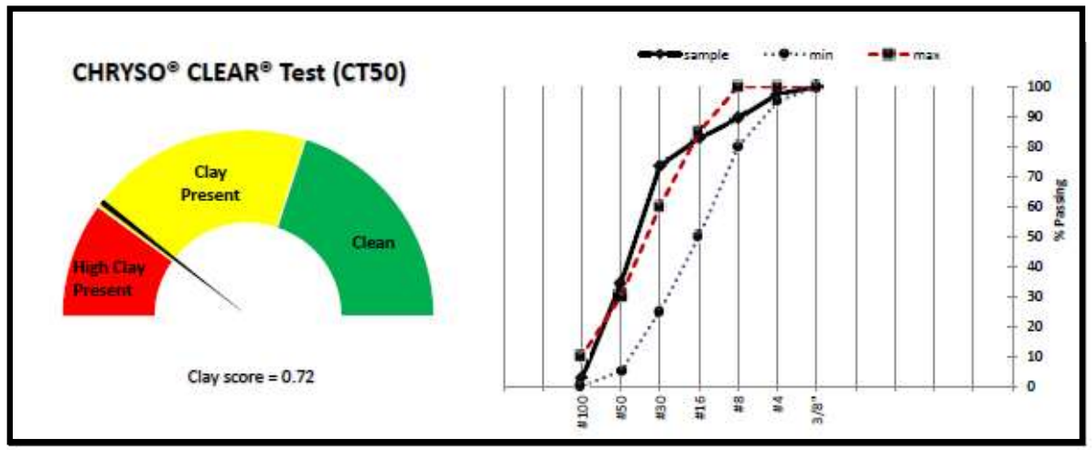
Case Study: Material Optimization, Quad 520 EMx

Low Quality Aggregate: Reduce CO_2 using available low-quality natural sand due to clay contamination

Initial objective: solve clay contamination issues and reduce cost by using locally available natural sand. *Customer achieved its initial objective and reduced its concrete embodied carbon by 3.5%.*

Target: Maintain the use of poor-quality natural sand and find the best admix solution to achieve cost reduction and potential CO_2 reduction

- **Quad Clear Test** was a crucial tool to help identify the best product to use. High clay score of 0.72, failed gradation and low FM.
- **Targeted performance obtained** higher slump, better air control, good slump retention and higher compressive strengths compared to the competition product.
- **Enhanced finishability** noted by the finishing crew.
- Allowed to achieve significant **embodied carbon reduction.**



Comments: Very low FM high with amount on #100. Clay Score "0.72" indicates high level of potentially harmful Clays.

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Case Study: Material Optimization SW USA, Quad series

Increase SCM use: Natural Pozzolan with potential for CO_2 reduction

Initial objective: increase SCM, maintain same or higher concrete performance and reduce cost.
*Customer achieved the objective, reduced concrete embodied carbon by **24%** and **~$3 savings/cy** from mix optimization.*

Target: Optimize concrete mixture to leverage availability of local natural pozzolan source to deliver cost savings and CO_2 reduction for the concrete.

Customer aimed to maximize use of internal natural pozzolan sources.

- Achieved comparable slump, air control, slump retention, and compressive strength to the control mix.
- Improved finishability with Quad®.
- Supported potential carbon reduction by optimizing the mix design through increased SCM replacement.

	Control Mix	Quad (30% SCM)	**Quad (40% SCM*)**
CO_2 Impact kg CO_{2eq}/m^3	342	293	**259**
Reduction vs Control	-	-14%	**-24%**

***Mix Optimization**: SCM usage increased maintaining same strength levels. Use of Natural pozzolan.*

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04

Building a Sustainable Portfolio of Solutions

Driving sustainable product ranges

Quad Unique Water Reducers for Challenging Materials	EnviroMx Water Reducers & Strength Enhancers	EnviroMx Impact App	EnviroMx New Range for C-Clay	EnviroAdd Next Gen Activators
Circular Economy Solutions for Aggregates	**Water Reducers Enabling SCM Use; Cement Reduction with Strength Gain**	**Proprietary Embodied Carbon App to Pre-quantify Mix GWP Results**	**Admix for Calcined Clay Cements**	**Customized Cement Additives**
Circularity solutions Transparency – EPDs available	Decarbonizing construction Building resiliency Transparency – EPDs available	Decarbonizing construction	Decarbonizing construction Transparency – EPDs available	Decarbonizing construction Circularity solutions

Decarbonizing Construction

Circularity Solutions

Building Resiliency

Transparency & Performance

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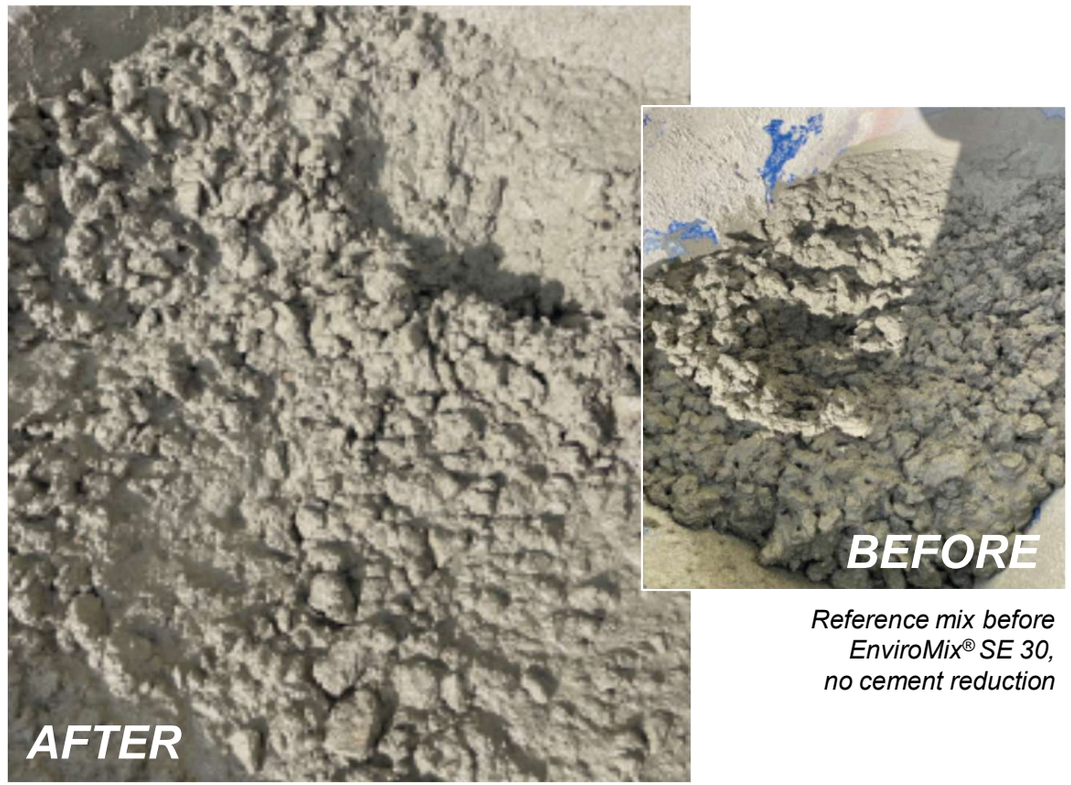
Case Study: Decarbonization SEs, Midwest USA

EnviroMix® SE 30 in this region demonstrates its effectiveness in achieving cement reductions of 18 to 30 kg/m³ (30 to 50 pcy), while maintaining or exceeding strength requirements.

- Concrete mixes incorporating EnviroMix® SE 30 have shown **superior workability and finishability** as noted in direct contractor feedback.



Reference after EnviroMix® SE 30, minus 22.7kg (50lb) of cement

Reference mix before EnviroMix® SE 30, no cement reduction

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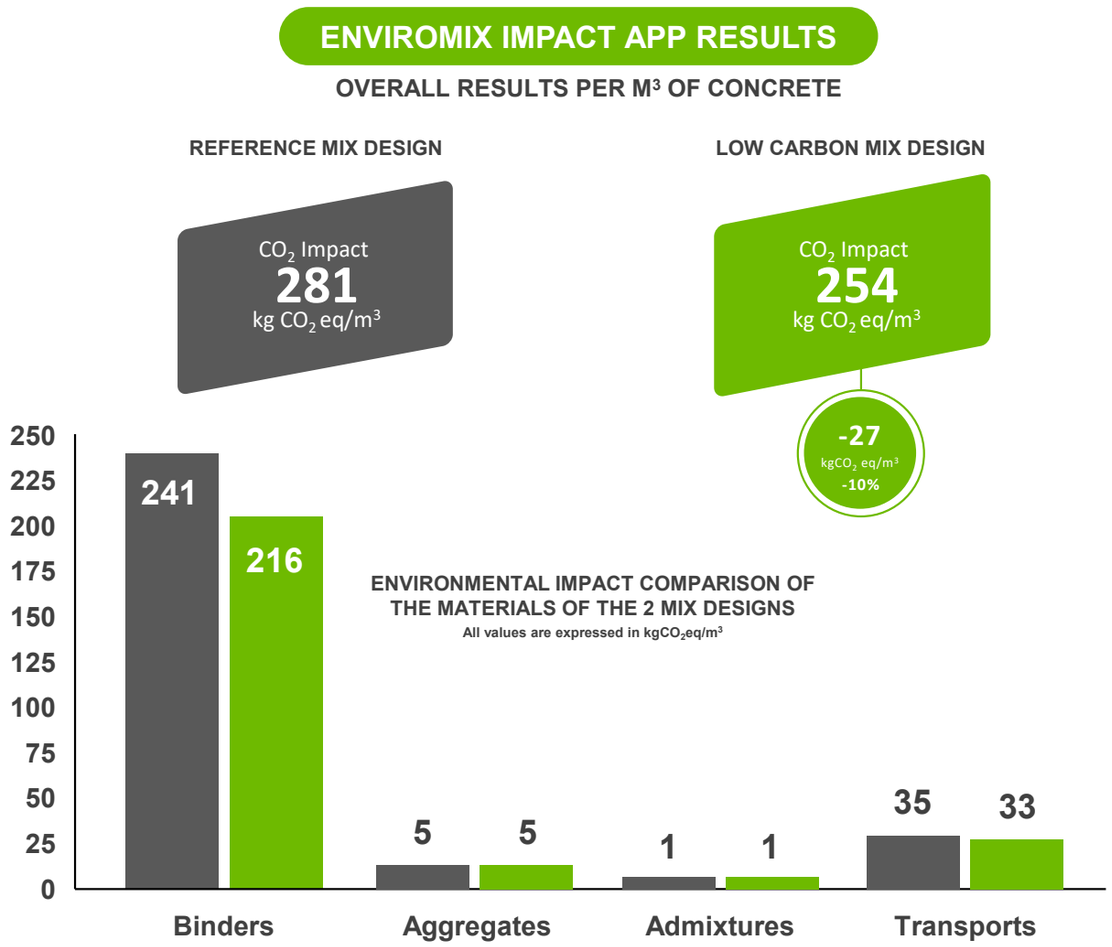
Case Study: Midwest USA, CO_2 and strength impact

EMx SE 30: 10% enhanced strength with Type IL cement

EMx SE 30: Up to 50lb cement reduction in mix design

Customer	Mix Design	Cementitious lb/y³ Reference Mix	Cementitious lb/y³ EMX SE 30	Cement Reduction lb/y³
A	4000 psi (Type 1L + Fly Ash)	560	510	50 (Cement)
B	3500 psi (Type 1L + Fly Ash)	440	390	50 (Cement)
C	4000 psi (Avg Portland Cement)	500	470	30 (Cement)
D	4000 psi (Type 1L + Fly Ash	564	514	50 (Cement + Fly Ash)



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Admixtures for calcined clay-based cement

Cement expertise and anticipated work on the topic for industrial scale since 2019 with various co-development projects on concrete and cement side.

Characterization of numerous calcined clays from worldwide origins with in-house and patented methodologies to determine the optimal formulation for each potential configuration.

Optimization of our solutions, building of a large Calcined Clay database to be able to provide tailor-made solutions.

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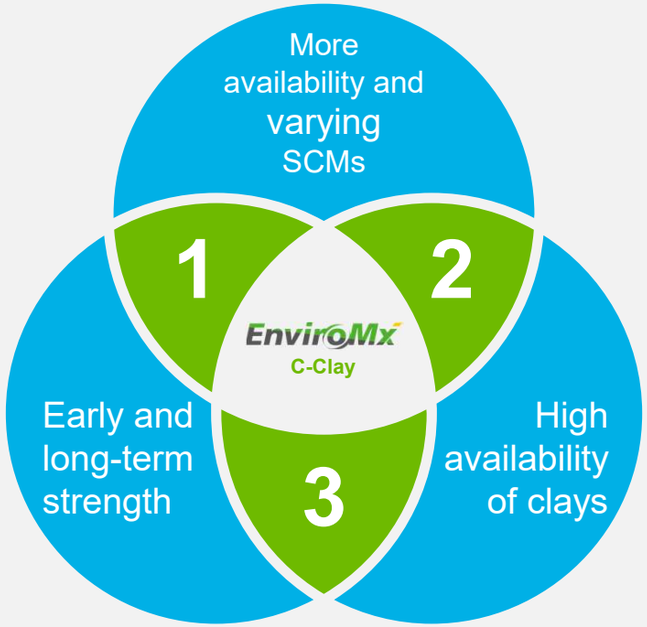
Creation of EnviroMix C-clay range

Admixtures and Additives for Use with Calcined Clay Cements



CO_2 of calcined clay is ~60% that of portland cement; 490 $kgCO_{2eq}$/ton vs 810 $kgCO_{2eq}$/ton, respectively

01

↑ SCM USE WITH ↓ AVAILABILITY

Need for SCMs with high availability to pursue global decrease of CO_2

02

HIGH AVAILABILITY OF CLAYS

Wide availability of suitable clays throughout the world; cement focused on the subject

03

CONCRETE PERFORMANCE

Depends on quality and quantity of calcined clay used in cement

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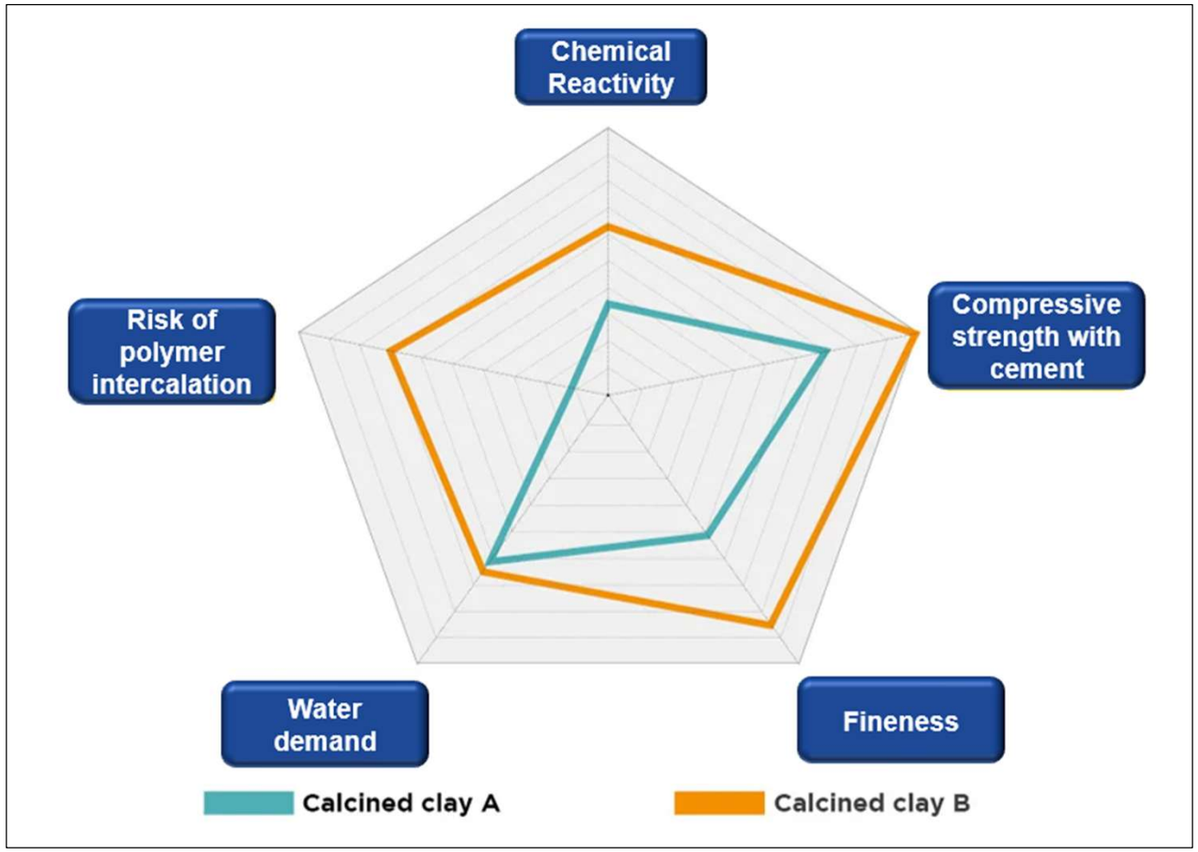
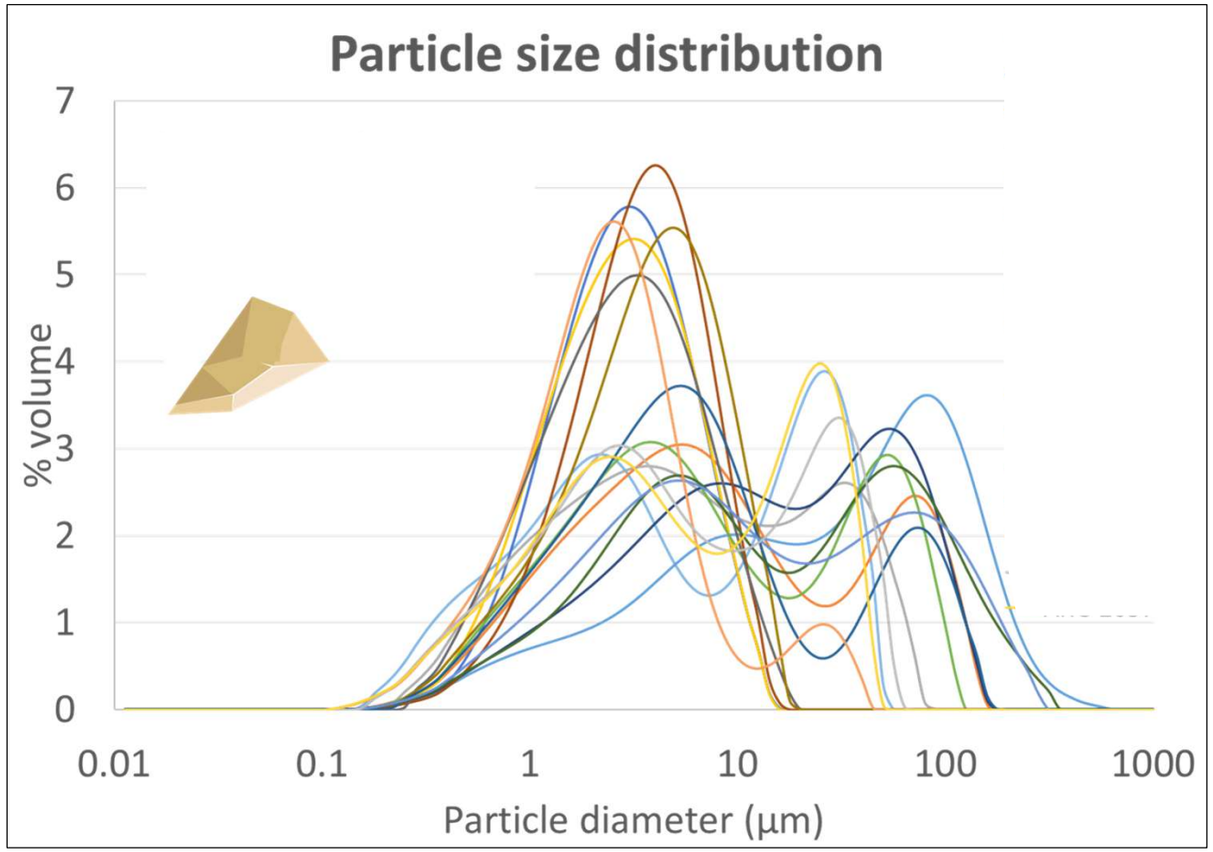
Concrete performances challenges

Wide variety of calcined clays





Necessity to develop specific admixture solutions

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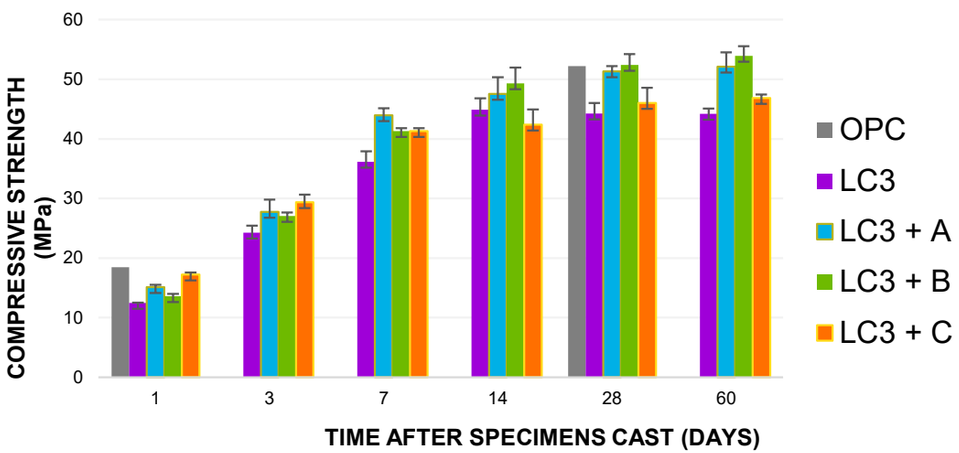
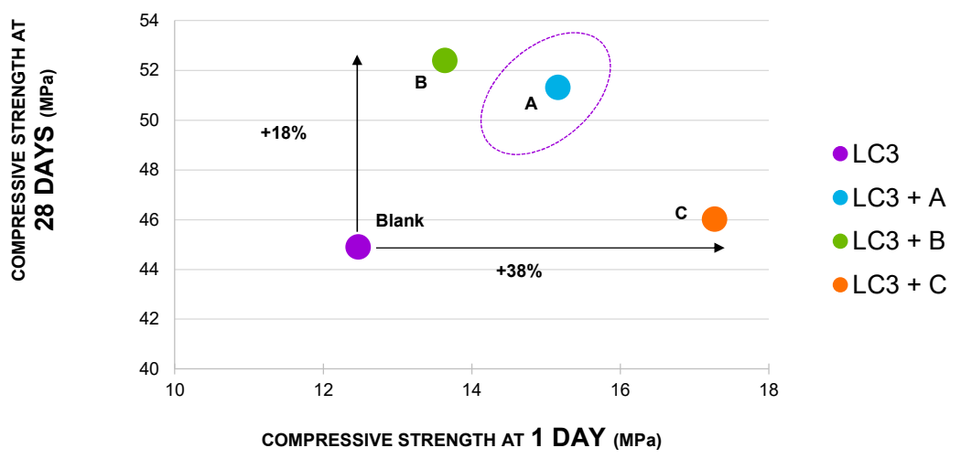
Case Study: EnviroAdd LC3 Activator

Industrial trial with LC3-50 Cement (30% calcined clay, 15% limestone)

Achieved robust increase of compressive strengths

- 1 day (+38%) with EnviroAdd® “C”
- 28 days (+18%) with EnviroAdd® “B”.
- Customized Additive EnviroAdd® “A” met cement plant’s target performance at all ages.





***CUSTOMIZED* EnviroAdd® ACTIVATORS ALLOW TO MEET THE SPECIFIC NEEDS OF LOW-CLINKER CEMENTS**

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05

Paving the Way for a Sustainable Future

Key Takeaways

Crossroads

Pioneer advancements in sustainable construction by addressing the crossroads of material innovation, circularity, resiliency and environmental responsibility

Circular Economy

Drive the transformation of construction through the adoption of circular economy practices, setting new standards for sustainability

Collaboration

Foster teamwork and shared knowledge to overcome industry challenges and drive progress

Unite diverse expertise and perspectives to create a collaborative environment that fuels innovation and growth

Innovation

Utilize advanced tools to accelerate analysis and quantify goals, paving the path for a sustainable future

Innovate continuously to push the boundaries of construction, embracing cutting-edge solutions for a greener tomorrow

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Thank you!
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