



CALCINED CLAY IN CEMENT PRODUCTION BASED ON FACTORY TRIALS

JULY 2022, SIKA SERVICES AG / CEMENTOS ARGOS

IN COOPERATION WITH



BUILDING TRUST



PRESENTATION – SUPPORTERS



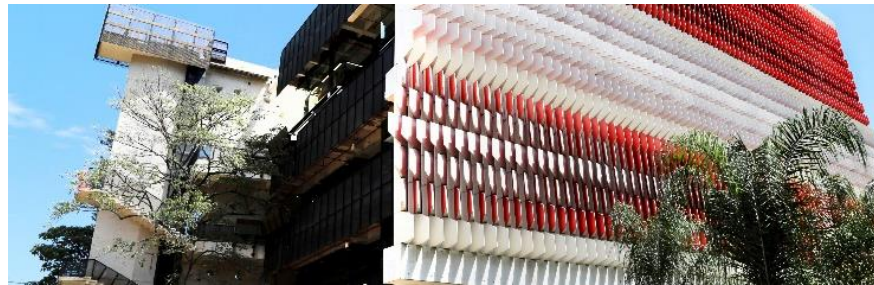
Sika Headquarters, Zurich

Sika Team:

- » Oscar Ferney Garzon
 - Responsible Cementitious - Concrete Sika Colombia

- » Dario Martinez
 - Specialist in R&D - Technology Sika Colombia

- » Alejandro Velez
 - Corporate Product Engineer Infra - Corporate Construction



Argos Center for Innovation, Medellín

Argos Team:

- » Carlos Augusto Orozco
 - R&D Manager- Cementos Argos S.A

- » Ana Gomez
 - R&D Leader -Cementos Argos S.A

- » Claudia Rodriguez
 - R&D Leader -Cementos Argos S.A

CALCINED CLAY – CONTENT

Sika / Cementos Argos



Rotary kiln for clay calcination-Rioclaro Plant

Calcined Clay
introduction



SikaGrind® CC
description



Field test description

- Rioclaro plant & pozzolanic mix



Results

- Mortar and concrete



Conclusions

SIKA – ABOUT THE COMPANY...



Sika is a specialty chemicals company with a leading position in the development and production of systems and products for ***bonding, sealing, damping, reinforcing and protecting*** in the building sector and motor vehicle industry.

1,240

EMPLOYEES ARE DEDICATED TO RESEARCH AND DEVELOPMENT

150

INVENTION DISCLOSURES REGISTERED IN 2021

99

NEW PATENTS WERE FILED IN 2021

SIKA AT A GLANCE

27,000+ EMPLOYEES

99 NEW PATENTS IN 2021

100 COUNTRIES

+7 ACQUISITION IN 2021

300+ PLANTS WORLDWIDE

9.2BN CHF NET SALES IN 2021

4 NEW FACTORIES IN 2021

WE ARE THERE



Our products might not always be visible but the results they achieve are clear to see.

CALCINED CLAY – INTRODUCTION



In 2021, there were about **4,000** cement plants in the world



Around **7%** of the world's CO₂ emissions are due to cement production



The clinker production process produces over **650 kg of CO₂** per ton of cement



Today's cement industry faces challenges in terms of sustainability, such as reduction of carbon emissions and use of alternative raw materials. Calcined clay (CC) is one of the alternatives to pursue this goal.

CHALLENGES



Reduce:
Water demand



Improve:
Workability



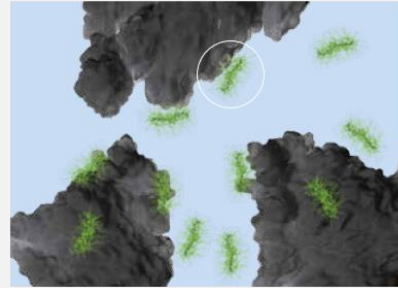
Increase:
Early strength



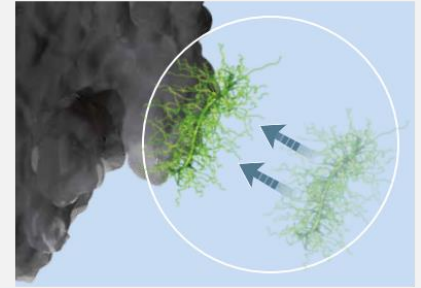
SIKAGRIND® CC – DESCRIPTION OF THE TECHNOLOGY

SikaGrind® CC are liquid grinding aids specifically developed to enable the production of Calcined Clay Cements.

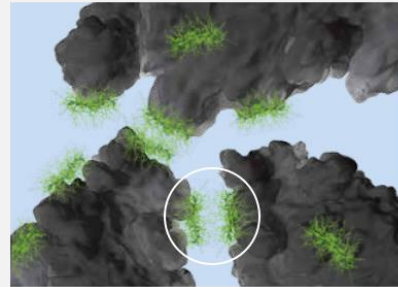
- » Reducing water consumption.
- » Increasing strength at all ages while maintaining workability, hardening and extending durability of concrete.
- » SikaGrind® CC optimizes the efficiency of modern separators and cement mills.
- » The liquid formulation is easily added during cement production.
- » Does not cause discolorations at the surface of concrete.



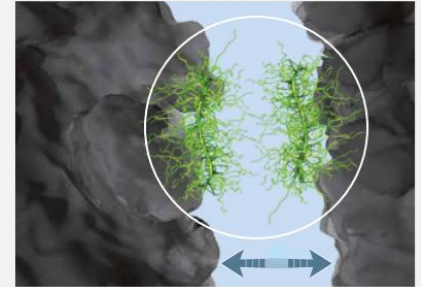
Adsorption of the polymer (backbone) on the cement grain.



Detail of the adsorption of the polymer (backbone) on the cement grain.



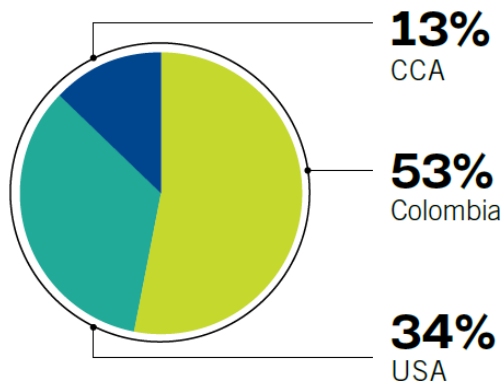
Improved workability due to steric hindrance.



Detail of improved workability due to steric hindrance.

CEMENTOS ARGOS – ABOUT THE COMPANY...

TALENT



7.050
employees

85%
Men

15%
Women

9 / 7
Granted / Pending
Patents

12
cement plants

31
ports and terminals

+1,600
railway wagons

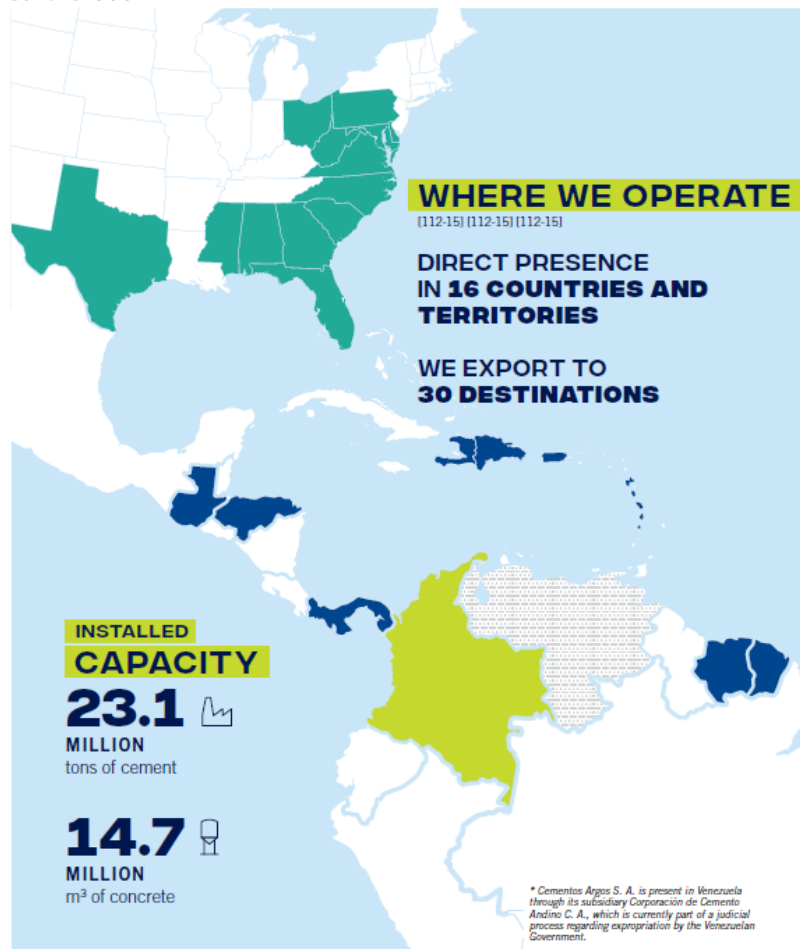
248
concrete plants

56
dispatch centers

4
own boats
2 leased permanently

9
clinker grinding mills

+1,905
Mixer trucks



FIELD TEST – RIOCLARO PLANT

Location

Antioquia, Col

Calcined clay
produced up to 2021
131.000 t

Installed Capacity
1400 tpd

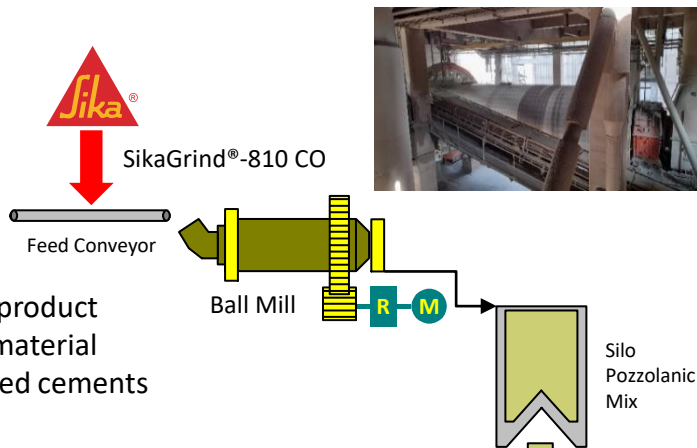
Blended cements
**GU: Hydraulic cement for
general construction.
HE: High Early-Strength.**



FIELD TEST - POZZOLANIC MIX

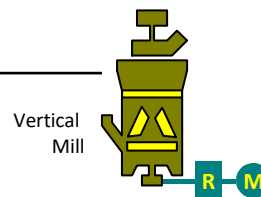
Pozzolanic Mix

- Calcined Clay
- Others



- Intermediate product
- Fine powder material
- Used in blended cements

Base Cement



- Clinker
- Gypsum
- Others



Emax (High Early Strength, HE):
50-90% Base Cement
10-50% Pozzolanic Mix
Aditive: (800-2000ppm)

FIELD TEST – DESCRIPTION OF THE PROCESS



Blank Pozzolanic mix

- 3 hours of steady production
- Standard flow measurement
- Sampling



SikaGrind®-810 CO

- 3 hours of stabilization



Pozzolanic Mix + SikaGrind®-810 CO

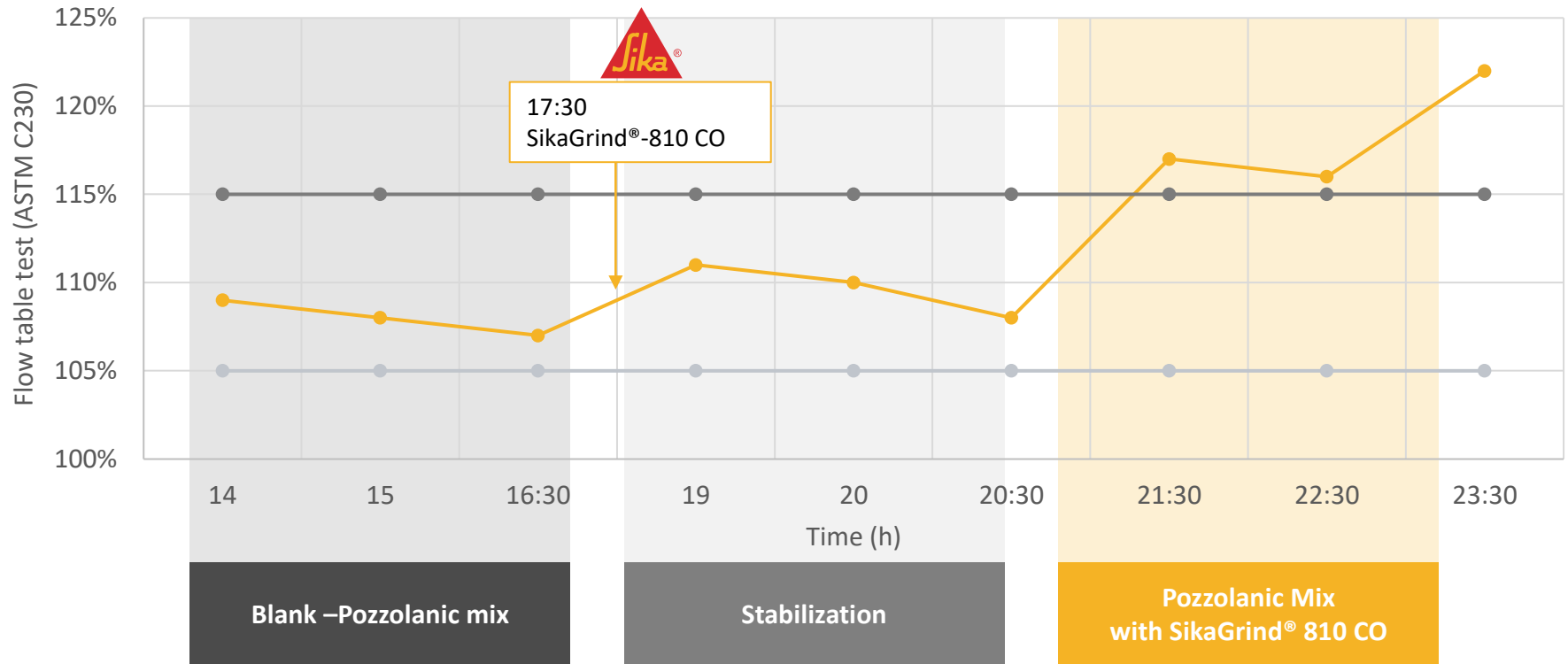
- 3 hours of steady production
- Standard flow measurement
- Sampling



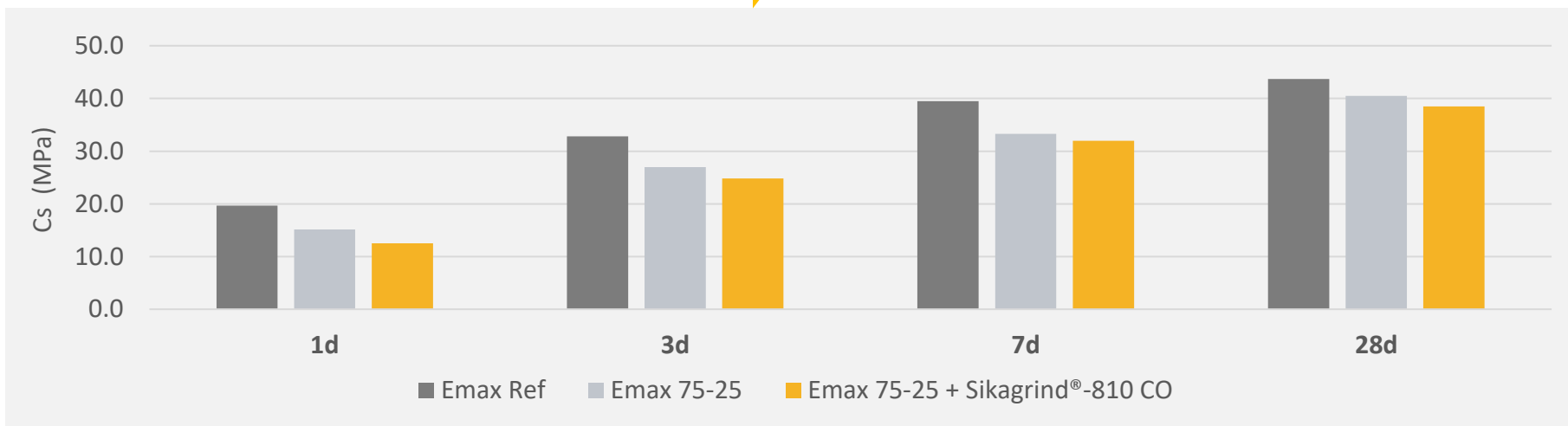
Considerations:


- Steady mill production rate (Fixed)
- Continuous and steady flow rate (SikaGrind®-810 CO)
- No variation on weight feeders
- No variation on bucket elevator

FIELD TEST – PROCESS MONITORING

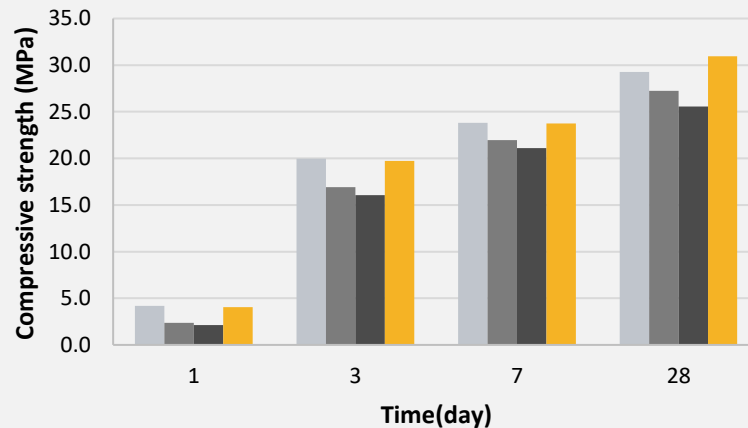
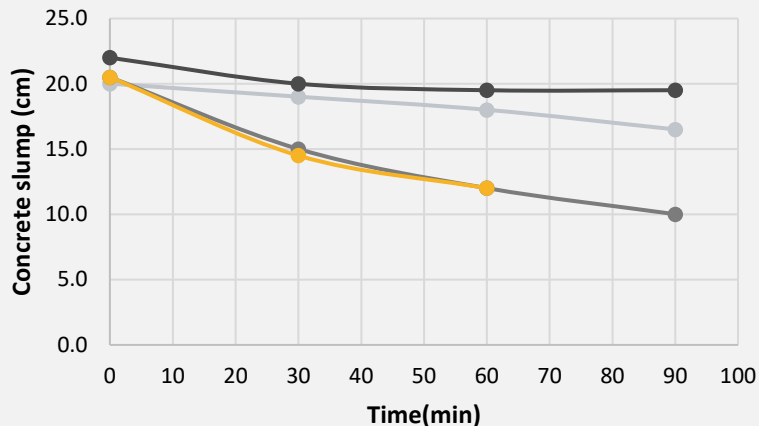


RESULTS – MORTAR PERFORMANCE TEST



	Compressive strength (ASTM C109)						Setting time (ASTM C191)		
	w/b	Flow (%)	1d	3d	7d	28d	Consistency	IS (min)	FS (min)
Emax Ref	0.485	114	19.7	32.8	39.5	43.7	26.7	136	255
Emax 75-25	0.495	114	15.2	27.0	33.3	40.5	28.2	163	240
Emax 75-25 + SikaGrind®-810 CO	0.475	113	12.5	24.8	32.0	38.5	27.8	189	270

RESULTS – CONCRETE PERFORMANCE TEST



Mix design
target 28 MPa

- Ref: Binder mix 88% cement + 12% FA (Fly Ash)
- w/b 0.48 -> 0.45
- 0.46 % SikaPlast® AD-85
- 0.65% Sika ViscoFlow®-8300



Emax Ref



Emax 75-25+ SikaGrind®-810 CO



Emax 75-25



Emax 75-25+ SikaGrind®-810 CO,
low w/c

CALCINED CLAY – TRIAL CONCLUSIONS



The **water/cement ratio of calcined clay cements (mortar test) was reduced** by using SikaGrind®-810 CO. Concrete using cement treated with SikaGrind®-810 CO showed a slight **increase in the slump**.



Concrete containing calcined clays and SikaGrind®-810 CO exhibited **similar workability retention** than concrete with plain cement at the same w/c.



SikaGrind®-810 CO (and its used dosage) did not have a negative impact on the cement milling process using the regular standard equipment.



The development of additional products from the SikaGrind® CC range must increase the compressive strength.



Alto Rico: Clay quarry.

CALCINED CLAY – INDUSTRY CHALLENGES



Calcined clay cements are promising technologies that will help the cement industry reduce emissions and work towards a more sustainable environment.



Low carbon

CC can save 30-40% of CO₂ compared to OPC.



Resource saving

CC use abundantly available materials and can save scarce resources.



Durability

Performance can be adapted to specific requirements.



Globally scalable

Suitable clays for CC are sufficiently available all over the world.



Cost effective

CC technologies reduce cement production costs.



Ready to be implemented

CC are used similar to OPC, yet they can be better in performance.



GRACIAS POR LA ATENCION



BUILDING TRUST

