

SIKA AT WORK PASTE VOLUME OPTIMIZED CONCRETE WITH Sika® Viscocrete®

LIFE CYCLE IMPACT ASSESSMENT



BUILDING TRUST

PASTE VOLUME OPTIMIZED CONCRETE WITH Sika® Viscocrete®

PROJECTS

Argos is the first cement and concrete producer in Colombia and the fourth largest concrete producer in USA. Argos Quality Control and Concrete Technical Development areas with Sika Technical Department worked together to go further reducing water and cement (paste content) in the high volume concrete.

The core philosophy of this strategy was concentrated to use the latest aggregates compressible packing model but also using a less viscous cement paste including a Viscocrete.

Viscocrete technology allowed to reduce the cement paste contents in the conventional concrete, breaking the traditional limits to obtain a better concrete (in fresh and hardened states) with a lower cost. The durability aspects related with a cement paste reduction (for a constant w/c ratio) were studied in detail. In this sense lower paste cement content will decrease the drying shrinkage, creep, abrasion erosion and liquid penetration (chlorides and sulphate penetration). To take advantage of the mathematical tools but above all the use of new admixtures technologies allowed to make a better concrete with less water and cement, maintaining or improving his properties. A part from economic benefit a smarter and more sustainable concrete is produced by this company which colour is at first, green.

Paste volume optimization program was introduced in all the main cities of Argos operation in Colombia as Bogotá, Medellín, Barranquilla, Cartagena, Cali to optimize concrete concept. Based on extensive laboratory trials the field testing phase was initiated and successfully completed.

Fines content

32 mm

16 mm

> 375 kg/m³ with max. grain

> 500 kg/m³ with max. grain

280 to 1

320 to .

REQUIREMENTS

Placing method

Pumped concrete

Crane & Bucket Concrete

Self-compacting concrete (SCC)

Based on existing concrete recipes for all type of Argos concrete types the target was to:

- To optimize costs of concrete recipes
- No negative influence of fresh concrete properties
- To improve quality of hardened concrete
- Increase concrete recipe sustainability

SPECIAL REQUIREMENTS

For every type of concrete placing the requirements vary regarding the fine fraction portion of the design mix. Along with this of course the larger components play a role, but this is of considerably lesser significance. The coarse grains form primarily the scaffolding and serve as filling material.

On the basis of innumerable concrete mix designs over many decades, ranges of fines content and mortar quantities can be indicated for various types of installation which lead to a correct result also with differing aggregate components, or respectively take these fluctuations into consideration.

SIKA SOLUTIONS

By using the Sika paste volume optimization approach it is possible to improve hardened concrete properties in line with reducing costs of the recipe and improving life cycle aspects of the concept. Under this consideration, customer ends up with significant reduction of cement content.

Fresh concrete properties:

As soon as the paste volume with constant w/c-ratio is reduced in the meantime we reduce the fine content in the mix. This is possible as long the fresh concrete properties will not be influenced negatively.

Hardened concrete properties:

the reduction of cement content with constant w/c-ratio will end in improved concrete durability behaviours as long as there the required workability behaviour will be achieved.



Sieve curve with high sand content

LIFE CYCLE IMPACT ASSESSMENT

Life Cycle Impact Assessment of two concrete systems to compare the impact of the use of Sika® ViscoCrete®

Concrete Systems		Components				
		Cement	Additive	Sand / Gravel	Water	Concrete Admixture
Cement paste	290 liter	Cement Type I	_	798 kg/m³	w/c-ratio = 0.57	0.56% traditional
Fina paste	321 liter	327 kg/m³		916 kg/m³	187 liter	Plasticizer
Cement paste	242 liter	Cement Type I	_	845 kg/m³	w/c-ratio = 0.57	0.38% Plastiment°
Fine paste	275 liter	273 kg/m³		952 kg/m³	155 liter	0.45% Sika° ViscoCrete

DEFINITION LIFE CYCLE IMPACT ASSESSMENT

- Cradle-to-Gate, including packaging of the Concrete Admixtures (IBC container)
- Functional Unit: 1 m³ concrete
- Modeled in the software GaBi, from PE-International accorfing to the ISO 14040 series

Fine mortar paste	Remarks	
250 to 280 L/m ³	The fine mortar paste contains:	And the second se
280 to 320 L/m ³	cement, powder additives, fines from sand ≤ 0.125 mm + water	
320 to 380 L/m ³	_	
		-

575	

Binder content [kg/m³]					
🗕 200 — 250					
🛨 300 — 350					
 400 450					
- 500 - 550					
- 600 - 650					
— 700 — 750					
- 700 - 750					

Cement mortar paste includes all binders, powder additives and the free water (not absorbed by the aggregates). Fine mortar paste includes in addition also all fine parts of the aggregates \leq 0.125 mm.

PASTE VOLUME OPTIMIZED CONCRETE Concrete Volume per 10,000 m³ Energy savings equivalent to 31,000 liter oil Carbon savings equivalent to driving 450,000 km (truck 15 ton)



LIFE CYCLE IMPACT ASSESSMENT

Environmental impacts and resource inputs





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