

# CALUMEX®

## Advanced Calcium Aluminate Technology

Calcium Sulfoaluminate (C.S.A.)  
Amorphous Calcium Aluminate (A.C.A.)  
Calcium Aluminate (C.A.C.)  
Calcium Sulphate ( $\text{CaSO}_4$ )  
Metakaolin  
Lightweight Fillers and Fibres



# **CALTRA**

## **SPECIAL BINDERS**

Our production and storage facilities are strategically and conveniently located in the Netherlands, the center of Europe.

A stone's throw from the Major port of Rotterdam, we ship our products globally.



# CALUMEX®

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# CALTRA

## Introduction

Caltra Nederland B.V. has been the leading force of C.S.A. and A.C.A. cements in the dry-mix industry. Established in 1985, Caltra Nederland B.V. now has three manufacturing locations and continues to expand each year.

As an expert in the field of C.S.A. cement, Caltra is now also focussed on the new generation of high alumina cement namely amorphous calcium aluminate – A.C.A. This is the most reactive and effective additive to Portland cement. Taking care of manufacturing, a strict quality control, logistics and technical consultancy, Caltra is able to provide the total package. Our aim is to work closely together with product formulators and share our knowledge and experience in order to create new and innovative products.

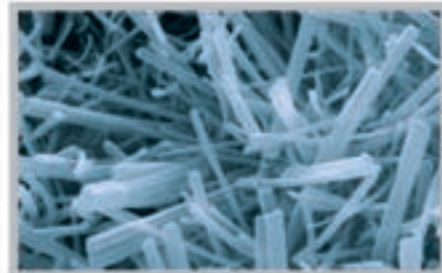
From the heart of Europe we are able to supply our customers worldwide. With our flexibility in mixing and packaging we are able to comply to nearly all of our customer's demands. PE and paper bags, coated big bags and bulk loads are the different options shipped in containers, bulk-tankers or trucks on rail- and motorway.

Through the reduction of our carbon footprint and the maximization of industrial efficiency, together with our partners, we continuously strive toward beneficial cooperation within a healthy environment.

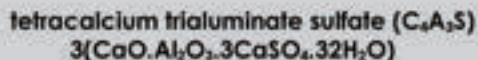


# CALTRA

## The Ternary System



Our Calumex products are based on the ternary system, where alumina, sulphate and calcium are combined to form Hydrated Calcium Aluminum Sulfate Hydroxide or Ettringite crystals.



The possible sources of Alumina we provide:

- Calumex C.S.A.
- Calumex A.C.A.
- Calight C.A.C.

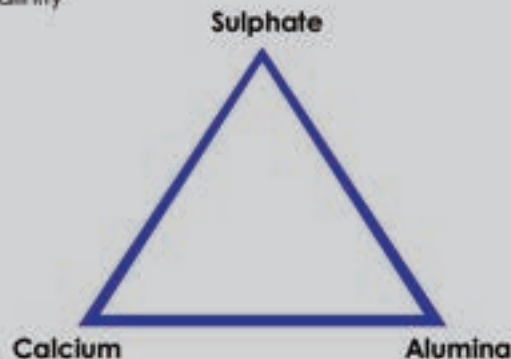
Several sources of sulphate can be used in the system:

- Anhydrite Super : synthetic anhydrite
- Calcast 200 :  $\beta$ -hemihydrate
- Calcast 400 :  $\alpha$ -hemihydrate

Portlandcement will be the main source for the necessary calcium.

Main advantages of the Ternary System:

- Significantly improved early strength
- No loss of strength over time
- Rapid drying
- Excess water is bound
- Shrinkage compensation through positive expansion
- Increased resistance to sulphates and acids
- Elimination of efflorescence
- Improved density
- Lower alkalinity





# CALTRA

## The Ternary System

Aside from the physical disadvantages of Portland cement when compared to alternatives like C.S.A. or A.C.A., such as slow strength development, shrinkage and its high alkalinity, there are also some major issues with regard to its carbon footprint.

### *Early ettringite and how it works:*

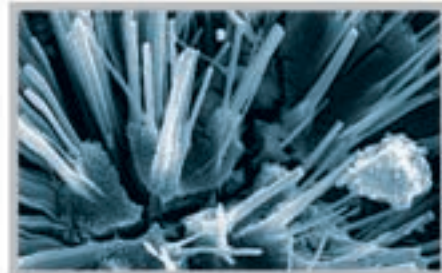
The use of Ordinary Portland Cement has a few well-known disadvantages for the dry-mix industry namely: significant strength development starts after more than twenty-four hours, there is a significant risk of shrinkage which causes cracking and curling, and both drying and setting times are relatively slow. Using a ternary system can minimize or eliminate these issues. Due to the early ettringite formation setting times are vastly increased, the expansion of the ettringite crystal compensates the shrinkage of the OPC, and the amount of water added to the mix is predominantly bound by the ettringite crystal, which requires thirty-two water molecules. The needle-shaped structure of the crystal also increases the density filling up pores and cavities.

Lastly the sulphate resistance of the end-product is improved upon due to the quick binding of alumina phases, this prevents sulphoaluminates from reacting with external sulphates.



# CALUMEX®

## Calcium Sulfoaluminate



We offer several types of Calcium Sulfoaluminate (C.S.A.) Cements:

### **Calumex® QUICK**

A ye'elimite based C.S.A.

Main phases:  $C_4A_3S + CA$

Calumex® Quick is a pure ye'elimite cement and the most reactive C.S.A. additive to Portland cement. It contains no reactive silicates or free lime.

The unique system of Calumex® QUICK is built around the ye'elimite phase, where the ettringite crystal is formed. It accelerates setting times, has the highest early strength development, and yields rapid drying. Due to the positive expansion of the ettringite crystal, the shrinkage of the Portland cement is compensated.

Furthermore, the addition of Calumex® Quick will improve the resistance to sulphate, alkali or other aggressive substances.

When using Calumex® Quick the alkalinity of the mortar will be reduced making it suitable for glass fibre reinforced concrete (GRC) application. The pH level will remain sufficiently high in order to protect steel rebar or fibres.

### **Calumex® Belicem**

A Belite based C.S.A.

Main phases:  $C_4A_3S + C_2S$

Calumex® Belicem can be used as a straight binder or as an additive to Portland cement. Due to the presence of the Belite compound, lime is released upon hydration which is needed for a reaction to take place and for (late) strength to develop. Calumex Belicem combines a fast set, high early strengths, and rapid drying.

Setting times and strength development can be easily adjusted by altering the C.S.A. - Portland cement ratio, which makes the Belicem an extremely flexible product.

The cement is stable and consistent over time. Due to the high solubility it allows for working under lower temperatures.



# CALUMEX®

## Calcium Sulfoaluminate

### Calumex® WHITE

A white C.S.A.

Main Phases:  $C_4A_3S + CS$

The whiteness of the Calumex® WHITE is achieved by a meticulous production process and very specific sourcing of raw materials where only low iron bauxite and high purity limestone and gypsum are selected. This is done to ensure the iron content is kept to a minimum. Calumex® WHITE combines all the advantages of C.S.A. cement with a high whiteness, perfect for aesthetic applications such as:

- Grouts
- Decorative plasters
- Micro cement
- Terrazzo
- Tile adhesives for white marble etc.

Due to the lower pH Calumex® WHITE is perfectly suitable for GFRG (glass fibre reinforced concrete) applications or in combination with decorative fillers such as glass beads and marble. Sufficient alkali remains in order to protect steel rebar or fibres.





# CALUMEX®

## Expanding Agents



### Calumex® QX-P:

Calumex® QX-P is an additive to Portland cement mainly focused on the shrinkage compensation at both the early and later stage. In the early stages of hydration hard burnt lime (CaO) will compensate the shrinkage, while ettringite formation will take over at a later stage.

The free lime will react with water and converts to Portlandite. When free lime remains in the matrix it will react at a later stage with water or carbon-dioxide (CO<sub>2</sub>) and will form CH and carbonate.

The volume of the hydration expands by a factor 1,98 compared to the original volume of the CaO and thus giving the expansion that compensates the shrinkage of the Portland cement.

Be aware that careful testing is required to establish the optimum dosage. In combination with a CEM I 52.5R a maximum of 8% replacement of Portland cement is advised.

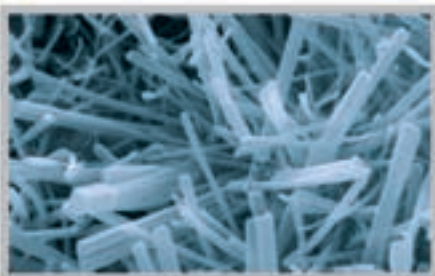
Main applications are:

- Dry-mix mortars
- Technical mortars
- Non-shrink mortars
- Prefab / precast concrete
- Anchoring mortars etc.

### Calumex® E.A.:

Calumex® E.A. is specially developed to increase the amount of ettringite formed thereby compensating the shrinkage of the Portland cement. Depending on the amount added it can achieve shrinkage compensation or positive expansion. The rise in temperature during hydration will further add to the strength development. Careful testing is advised as an excess can disrupt the mortar or concrete.

According to Caltra laboratory tests a 12% maximum replacement of Portland cement is advised.



# CALUMEX®

## Amorphous Calcium Aluminate

The introduction of Amorphous Calcium Aluminates (A.C.A.) presents the new generation of cement accelerators. The main phase of A.C.A. is  $C_{12}A_7$  or Mayenite, the most reactive phase of cement hydration. Applied as an additive to Portlandcement at relatively low dosages, a significant acceleration of setting times, increased strength development as well as shrinkage compensation are achieved. A.C.A. does not only contribute to early strength development but will also improve strength development over time.

A.C.A. cements are produced through fusion, where the molten clinker is cooled extremely fast to prevent the formation of crystalline phases, resulting in its amorphous properties.

In order to facilitate product formulators, Caltra provides two types of A.C.A.: Calumex® SC-A and Calumex® XT-20.

**Calumex® SC-A** stands for an A-class Super Cement. It is the most reactive additive on the market. At a 10% substitution of OPC setting times of 20-40 seconds are easily achieved, making it a perfect solution for applications such as:

- Shotcrete
- Post-fix
- Waterplug

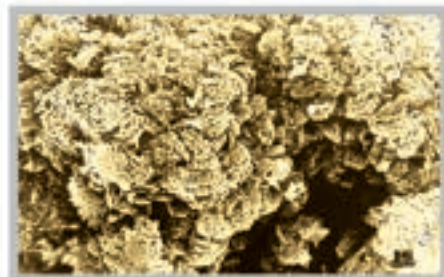
For products that require a longer workability the use of **Calumex® XT-20** is advised. Calumex® XT-20 stands for Extended Time. Using Calumex® XT-20 provides the same benefits as Calumex® SC-A but with a longer open time. A 10% substitution would result in 2-6 minutes initial and final set making it ideal for the following applications:

- Self-levelling flooring products
- Fast-set tile adhesives
- Grouts
- Road or airfield repair

For the purpose of retarding A.C.A. based products, Caltra has developed a specialized retarder named **Delta 20**. Using Delta 20 setting times can be easily adjusted without the loss of reactivity over time, meaning that an extended "open time" can be combined with a very short time between initial and final set.

# CALUMEX®

## Amorphous Calcium Aluminate



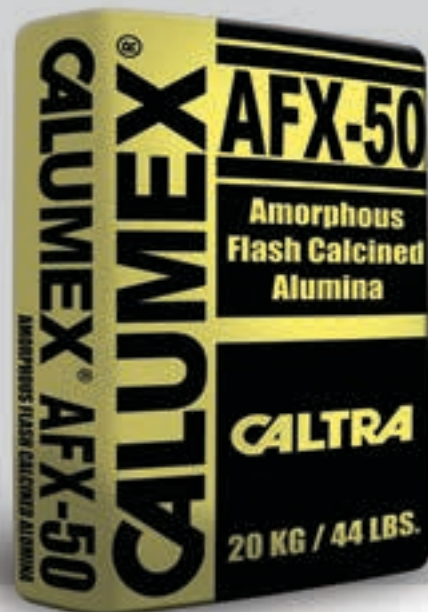
The latest amorphous technology that has been added to our product range is **Calumex® AFX-50**.

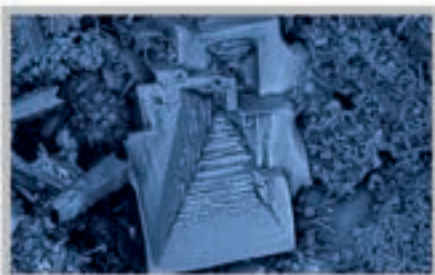
Calumex® AFX-50 is an amorphous flash calcined alumina, it is used as an additive to Portland cement predominantly focused on:

- Shrinkage compensation
- Accelerator
- High initial and final strength
- Increased durability
- Low alkalinity
- White

Depending on the required characteristics of the end formulation, Calumex® AFX-50 can be dosed at a 1-5% replacement of the Portland cement content.

Calumex® AFX-50 will allow for longer working times than some of the more reactive formulations described in this booklet without the need of retarders.





# CALCAST®

## Calcium Sulphates

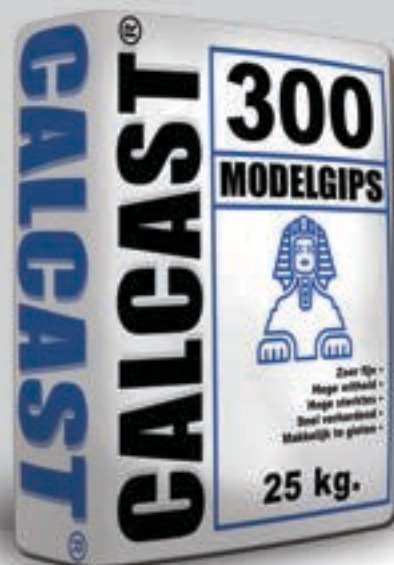
The type and amount of calcium sulphate selected for use in the ternary system can influence setting times and compressive strength development. Therefore, choosing the right sulphate source is of the utmost importance and can impact the characteristics of the final product.

The following types of calcium sulphate can be used within a Calumex system:

- **Anhydrite Super®**: an anhydrous calcium sulphate –  $\text{CaSO}_4$
- **Calcast® 200**: A  $\beta$ -hemihydrate with a limited water demand –  $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$
- **Calcast® 400**: An  $\alpha$ -hemihydrate with a low water demand –  $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$

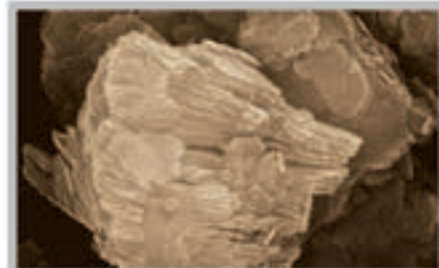
Besides using calcium sulphate in a ternary system, Anhydrite Super and Calcast 400 can also be used as a straight binder in self-levelling screeds or other sulphate based compounds. Calcast 200 is mainly used as a fast setting casting plaster.

All calcium sulphates are carefully selected and monitored by the Caltra QC-department ensuring both a stable and reactive source for the ternary system. Thorough study has been carried out on the use of the different types of sulphate within the system in order to provide a high quality final product.



# METACAL®

## Metakaolin



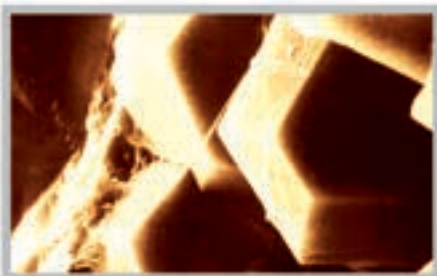
An unpopular byproduct of Portland cement is lime, which can result in efflorescence, increase porosity and reduce colour durability and strength development. Metakaolin will reduce this risk by binding the lime, increasing the density and it forms additional silicate and aluminate phases, which will contribute to better strength development. Metakaolin is one of the most effective ways to increase the pozzolanic activity within the system.

The main effects of metakaolin in a cementitious system are:

- Reduces the risk of efflorescence by binding the calcium oxides
- Increases the density of the matrix and thus increases compressive strength
- Accelerates the hydration of silicates and aluminates
- Reduces the pH
- Improves colour durability

There are two production methods for metakaolin. The kaolinite is traditionally calcined on a rotary kiln or it can be flash calcined. The traditional method will result in a plate structure but through flash calcination a round-shaped structure is created. A round structure benefits the flowability and workability of the product and requires a lower water uptake. In addition, flash calcination is easier to control, which results in a consistent quality.

	Metacal 2000	Metacal 3000
Pozzolanic index (Chapelle test)	1000mg Ca(OH) <sub>2</sub> /g	1300mg Ca(OH) <sub>2</sub> /g
Specific area BET	17 m <sup>2</sup> /g	20 m <sup>2</sup> /g
Iron content - Fe <sub>2</sub> O <sub>3</sub>	1,4 %	0,8 %
Whiteness	N/A	>80%
Structure	Plate structure	Round structure



# CALUMEX®

## Special Binders and Additives

**Calumex® G.R.C.:** a C.S.A. based additive to Portland cement, which will reduce the alkalinity of the mortar making it extremely suitable for glass fibre reinforced concrete.

**Calumex® Extra Rapid:** a formulated binder with a rapid set and high early strength. Depending on the application sand and/or gravel can be added. Depending on the filler-cement ratio it will achieve a compressive strength of 12Mpa after 4 hours. Applications mainly consist of:

- Fast setting screeds
- Road repair
- Fast set concrete
- Sewage maintenance
- Marine work etc.

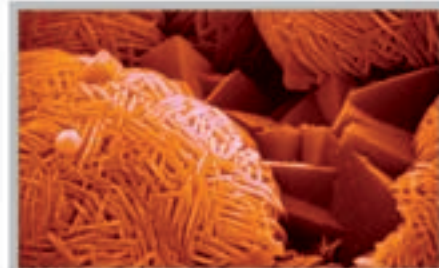
**Calumex® UPC:** a white or grey ultrahigh performance binder or additive, which in pure form achieves a compressive strength of up to 30 Mpa after only one hour. After 72 hours a compressive strength of 83Mpa is reached. The main applications are:

- Decorative concrete
- Terrazzo
- Glass fibre reinforced concrete – GFRC
- Dry-mix mortars
- Architectal precast etc.
- Road- and runway repair
- Pothole repair etc.



# CALIGHT®

## Calcium Aluminate Cements



A more traditional alumina source in a ternary system is the use of Calcium Aluminate Cements C.A.C. Though outperformed by C.S.A. and A.C.A. additives, C.A.C. has the advantage of a resistance to high temperatures making it perfectly suitable for refractory cement.

Calcium Aluminate Cements can be used as straight binders or as an additive to Portland Cement in combination with calcium sulphate.

The Calight system offers three different types:

The main applications are:

- Self levelling underlayment
- Tile adhesives
- Tile grouts
- Repair mortars
- Floor screeds

	Calight 40	Calight 50	Calight 70
$Al_2O_3$	40%	50%	70%
Colour	Dark brown/grey	Crème	White



# Eco-Perla®

Synthetic C.S.A. Binder for Paints and Pastes

**Eco Perla®** is a synthetic C.S.A., a hydrous calcium aluminum sulphate salt. It forms ettringite through a chemical reaction of soluble aluminum, calcium, and sulphate. The result is a product with very high whiteness, filling capacity and insulation properties. All without the use of preservatives or titanium dioxide (TiO<sub>2</sub>).

The Eco Perla has the following features:

- High whiteness 95-98%
- Environmentally friendly
- Non-irritating
- Low odour
- Easy dispersion for fillers and pigments
- Sand, limestone, or marble may be added
- Hypoallergenic

The main applications are:

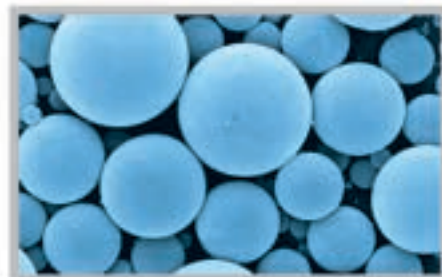
- Paints
- Putties
- Ready mixed plaster
- Repair pastes etc.

The logo for Eco Perla. The word 'eco' is in a large, green, rounded font with a leaf-like shape inside the 'e'. The word 'perla' is in a smaller, blue, lowercase font with a slight shadow effect.



# BOROLITE®

Lightweight Fillers and Fibres



## BOROLITE GB20 MICRO GLASS BUBBLES

Caltra is always looking for new innovative solutions to modern-day problems. One of the trends that can be noticed is the increase in liquid and paste products in combination with light-weight fillers. A high-quality lightweight filler is the Borrolite GB, a sodium-lime, borosilicate glass microsphere, that will not affect the rheology or workability of the end product. Due to the hollow spheres with a high whiteness it can be applied to light-weight products including decorative applications.

Applications include:

- Light weight paints
- Specialty coatings
- Spackling
- Caulks
- Adhesives
- Roof coating etc.

	GB20	GB32	GB40	GB60
Size - $\mu\text{m}$	2-120	2-92	2-75	2-65
D50	70	47	38	30
True density - $\text{g}/\text{cm}^3$	0,2	0,32	0,4	0,6
Crush resistance - MPa	4	14	28	96

### Artex® glass fibres:

Due to the low alkalinity of C.S.A. cements, it is extremely suitable to use in combination with glass fibres. The high alkalinity in Ordinary Portlandcement will result in regular glass fibres being dissolved, at the cost of all the advantageous characteristics they bring. Artex are alkali resistant glass fibres, specifically designed for application in Glass Fibre Reinforced Cement (G.R.C.). The fibres will not be dissolved in the cement matrix and will bring improved tensile and flexural strengths.

**ARTEX**  
ALKALI RESISTANT GLASS FIBRE

# QUALITY ASSURANCE

In house Quality Control



We continuously monitor the quality of our raw materials as well as our daily produced products, enabling us to guarantee a stable quality and supply. Through XRF and XRD analysis, we assure the highest quality and consistency in our cements.

At our in house laboratory, every individual produced batch is subjected to thorough testing in compliance with the relevant European Standards, before the product is released for dispatch. We are proud that our Quality Assurance System has been certified under ISO:9001 for many years.

Furthermore, we cooperate closely with external, independent laboratories and universities who regularly examine our cements and raw materials.

Through working closely with our clients, we constantly identify new applications for our products. To further facilitate usage for our clients, it is always possible for us to further optimize our products through the addition of organic or inorganic additives. We are even able to blend tailor made products to clients' specification.

Lastly, our laboratory staff is always available for any technical support needed by our clients.



# CALUMEX®

## Sustainability



As a family-owned company Caltra Nederland is always thinking of the next generation. Working green is an important element for this. Great steps have been taken on all levels: manufacturing, logistics, and product innovation.

It is widely known that the production of Portland cement is responsible for 10% of the global CO<sub>2</sub> output. Firstly, the rotary kiln in which Portlandcement is produced is heated up to 1550°C, as opposed to ca. 1250°C in the case of C.S.A. cements. Furthermore, the chemical conversion of limestone during the production of Portlandcement releases an extreme amount of carbon dioxide, counting for up to 90% of the total CO<sub>2</sub> emitted during Portlandcement production. As a large percentage of the limestone is replaced by bauxite in the production of C.S.A. and A.C.A., CO<sub>2</sub> emission is much lower. Lastly, C.S.A. clinker is much less tough than is the case with Portlandcement clinker, meaning the costs and energy expenditure during grinding are much lower. Additionally the use of metakaolin, slags and fly ash are increasingly significant.

- Less limestone reduces release of CO<sub>2</sub>
- Lower calcination temperature required
- Clinker is more friable -> energy reduction during grinding
- Acceleration of industrial by-products

To further reduce our carbon footprint, all our manufacturing and storage locations are LED lit, operated using electronic forklifts and the application of solar panels on all roofs will be finalized by the end of this year. Waste material is mostly recycled and we are critical in choosing the most sustainable logistical partners.

	OPC	CSA
CO <sub>2</sub> emission	73,7%	36,7%
Calcination temperature	1600°C	1250°C



# CALUMEX®

## Conclusion

Caltra Nederland B.V. stands for quality, agility, consistency and innovation. Serving customers worldwide from the green heart in the Netherlands. Located near the Europe's largest container port Rotterdam, we are able to deliver in paper and PE bags, big bags, and bulk-loads. With a broad knowledge of global logistics we are able to reach all continents. We are currently present in Europe, United States, Australia, South America, Middle East, and South East Asia.

With close to forty years of experience in the special cement industry we pride ourselves with our high quality laboratory and research center from where we work closely together with other product formulators. With a tight quality control we carry out all physical tests on each batch as well as an XRD and XRF analysis, in order to guarantee quality and consistency. Furthermore, we are closely linked with several technical universities in Germany, Switzerland and the Netherlands and this way remain a frontrunner in the industry.

Four storage facilities and two manufacturing locations provide four mixing facilities, more than 1000t of silo storage and two quality control labs as well as an R&D center. Both manufacturing locations have received CE certification based on mechanical and electronical properties as well as OHS (Occupational Health and Safety). In addition, we have been ISO 9001:2015 certified and are currently working on the ISO 14001:2015 certification. The way in which both plants are designed does not only offer consistent quality but also offers the opportunity to add organic and/or inorganic additives or produce premixes. This way we can minimize storage availability for our customers, eliminate the risk of fluctuation in product quality, and blend tailor-made.

Sustainability is an important topic for Caltra and also in our manufacturing.

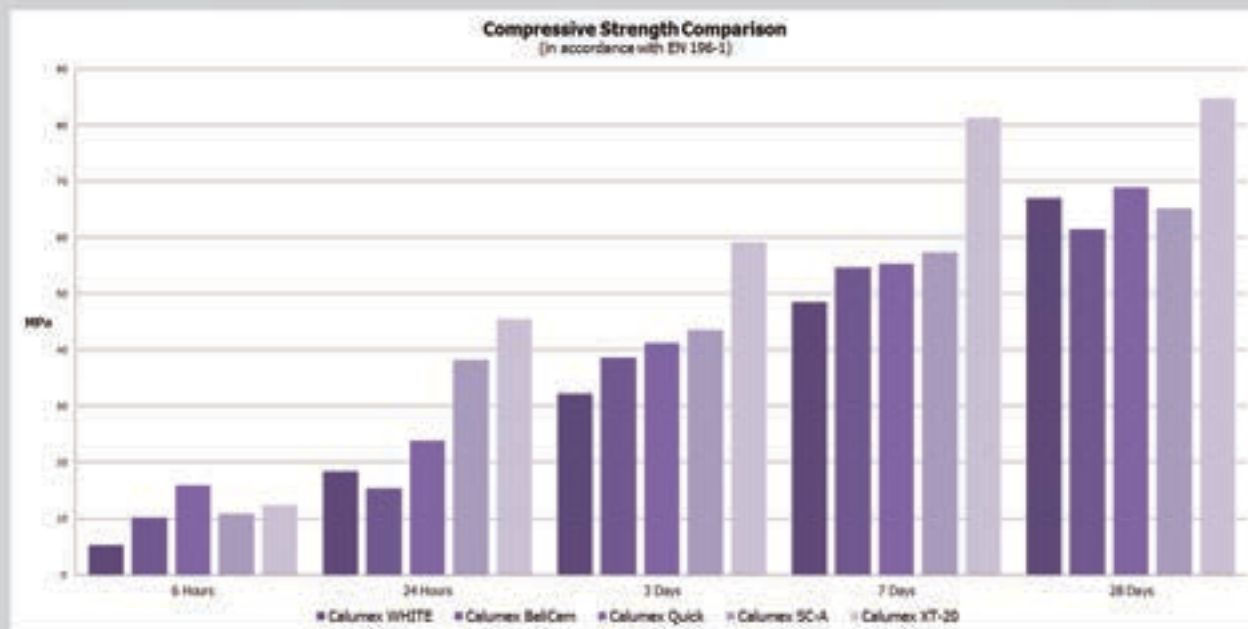
All the above mentioned aspects lead to a full-service platform

# CALUMEX®

## Compressive Strength Analysis



In the graph below, a comparison is shown between the compressive strength development of our main Calumex products:





# CALUMEX®

Starting Formulations

## C2FT Tile Adhesive

Based on: **Calumex White**

Calumex WHITE	15,00%
White OPC CEM I 52,5R	25,00%
Sand	56,00%
Polymer Powder	3,50%
Accelerator	0,10%
Cellulose ether	0,40%

## Rapid Set Tile Grout

Based on: **Calumex XT-20**

Calumex XT-20	3,00%
White OPC CEM I 52,5R	34,00%
Limestone filler	7,50%
Sand	40,80%
Metacal 4000	5,00%
Fine filler	8,40%
Hydrophobic additive	0,30%
Polymer Powder	0,80%
Retarder	0,20%

## Self levelling Floor screed

(< 50 mm)

Based on: **Calumex Quick**

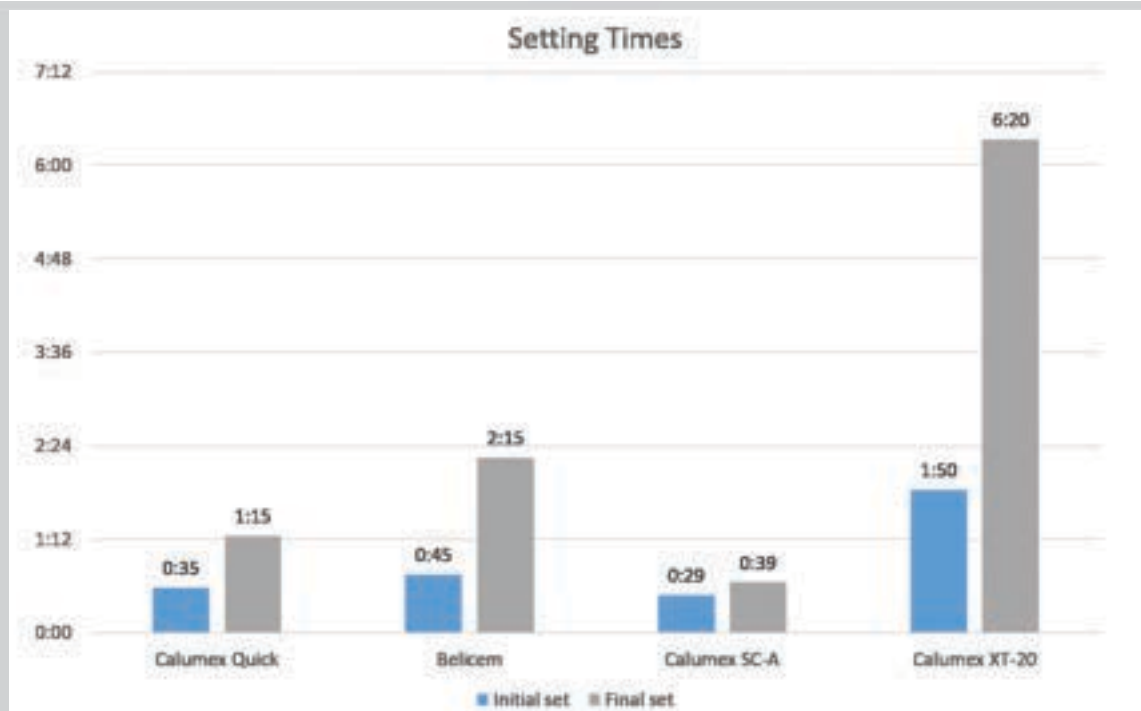
Calumex Quick	17,50%
OPC CEM I 52,5R	25,00%
Retarder	0,20%
Sand (max. 4 mm)	45,50%
Fillers	8,00%
Plasticizer	0,45%
Defoamer	0,25%
Polymer Powder	3,00%
Cellulose Ether	0,10%

Please note that the end result of any formulation depends on a multitude of factors, not the least of which is the selected source of raw materials. Take care to carefully test any formulation before taking anything into production. The formulations given above are indicative, as is the case with the further information in this booklet. The data does not provide any guarantee of the end result. Caltra Nederland B.V. cannot be held responsible for any damage resulting from the (incorrect) use of its products.



# CALUMEX®

## Setting Times



# CALUMEX®

## Advanced Calcium Aluminate Technology

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