silka

The Environment & Calcium Silicate Blocks

Xella

Together, we can face any construction challenge

Calcium silicate products are the building material of the future. Certainly if they bear the signature of Xella, a firm with more than half a century of experience behind it.
Xella has a clear mission: to build reliably by using innovative products and services. Craftsmen who give of their best to achieve guaranteed quality and provide outstanding service. Xella possesses a large number of production locations and its own facilities for market research and product development.
The synergy within the concern enables Xella to convert the requirements in the building world rapidly and flexibly to specific, efficient and cost-saving building solutions.
Better building with fewer costs? Xella is ready for that!
Many in the building world know the slogan: "Building? With Silka blocks, naturally!" A slogan with a clear message: Silka blocks are an excellent building material with a particularly low environmental load. But exactly how "natural" are Silka blocks? And how do they relate to sustainable building? These are the important questions that will be addressed extensively in this brochure.

Contents

Chapter 1

Raw materials

Awareness of the environmental aspects of building materials continues to grow steadily. The starting point for this is that the developped environment creates optimum conditions for people's well-being and health. An important condition for a healthy and sustainable building is to use building products with the least possible environmental load and a favourable effect on the health and the quality of life.

This is summed up very well in the term "sustainable construction". Building products must not give off any harmful substances and must represent the smallest possible burden on the environment throughout the entire sequence, from extraction of raw materials up to and including processing of the waste. This brochure discusses various environmental and health aspects of calcium silicate blocks as a product, along with their applications. We start with the quarrying of the raw materials, followed by the production process and how they are used on the building site.
Then we examine specific aspects of the material and the applications of Silka blocks, particularly in relation to the themes of energy and the interior environment.

1.1 General

Calcium silicate blocks have been produced for more than 100 years. They are made of the raw materials sand, lime and water. No other substances are added. There is a sufficient availability of raw materials to ensure production of calcium silicate blocks through the long term.

1.2 Sand

Calcium silicate blocks are for their greatest part (approx. 93%) made of sand, which is obtained from sand pits and sand quarries that are usually situated in the vicinity of the factory. A fine-grained sand is used with a specific repartition of grain size.

The sand is washed, primarily to remove particles of wood and so to ensure the product quality.
The environmental aspects of extracting the sand mostly relate to changes in the landscape.
After the extraction period the sand pits are restored, giving rise to recreational areas or valuable natural areas where rare habitats sometimes develop.

1.3 Lime

Approximately 7% of the raw materials for the production of calcium silicate blocks consist of lime. Lime is prepared by burning calcium silicate and sand from the Meuse valley. It is quicklime (mostly CaO). Approximately 4.4 GJ (2nd order energy) is necessary to produce 1 ton of lime. Burning the lime releases CO2. This substance is largely taken up again into the product during the user phase of calcium silicate blocks. Rehabilitation of calcium silicate quarries is receiving much attention in most European countries.

1.4 Water

Water is necessary for mixing the lime and sand. Groundwater is usually used, which is employed as steam in the production process and as cooling water when sawing the calcium silicate products. The water that is formed by the condensation of steam, and that is released by sawing, gets partly reused and partly let off to surface water after treatment.

Chapter 2

The production process

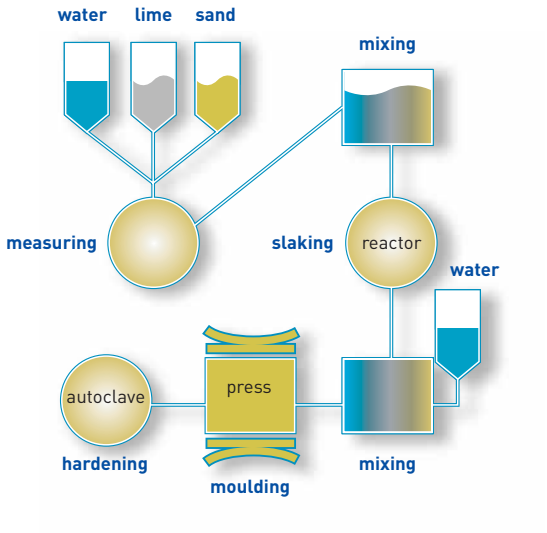
The production process

Lime, sand and a small quantity of water are weighed out and mixed in the correct quantities. This mixture is moved to what is called the reactor, in which the quicklime reacts with the water. From here the mixture finds its way to the presses where it is compressed into the desired shapes (blocks or large format blocks). After the presses the products are placed on a trolley and driven into an autoclave. Next, steam in the autoclave is brought to a pressure of approximately 15 Bar (approx. 200°C). At this temperature, a chemical reaction takes place between the lime and silicon-containing components of the sand and the hardening of the product is brought about. Next the small blocks are packed in recyclable shrink film and placed on consignment pallets (deposit principle). As soon as the products have cooled down, they can be transported to the building site and used. The steam is produced with natural gas, a relatively clean fuel.

It is only necessary to use steam at a temperature of 200°C to produce Silka blocks. This leads to a relatively low consumption of energy per unit of Silka blocks. Approximately 8 cubic metres of natural gas and 10 kilowatt hours of electrical energy are necessary per ton of calcium silicate products in typical production. Some waste is generated when calcium silicate blocks are produced. This consists of rejected products and offcuts from sawing.

Nowadays, the production waste is mostly re-used by breaking it up and bringing it back into the production process. The broken rubble serves as a replacement for sand. A smaller proportion is re-used as foundation material in road building and for strengthening the slopes of the sand pits.

One application of this broken rubble is to pave cycle paths in managed natural areas. Due to the natural appearance of the rubble and the very limited maintenance needed by the material, this application is much valued.



Chapter 3

Use

3.1 Types of mortar

Most Silka blocks are used with thin bed mortars. Only masonry blocks are still used with an ordinary masonry mortar. The thin bed mortar between the products is 2 to 3 mm thick. The composition of this type of mortar has nothing in common with other bonding agents such as ordinary household glue. It is a special sand-cement mortar of fine grained calibrated sand and white cement, to which a small quantity of additives (including cellulose binders) is added. Thin bed mortar in combination with Silka blocks contributes to a sustainable relationship with the environment. This is above all attributable to a lower consumption of materials when thin bed mortars are used. Thanks to the greater strength of a bonded wall, a slimmer design can be used in a number of situations, thus consuming less material.

3.2 Finishing

Handsize blocks, chamfered blocks and large format blocks have a very small size tolerance (approx. 1 mm). As a result it is possible to bond these products with a special thin bed mortar. With this building technique and the special profiling of the products, it is possible to build very flat walls and a thin wall finishing can be applied, usually a gypsum plaster. It is possible to re-use scrap of Silka blocks with a thin coating of plaster.

3.3 Building waste

When Silka blocks are used on the building site, building waste is produced in the form of rubble, remnants of mortar, left over anchors and the like. When large format Silka blocks are used for building, virtually no building waste ensues. The large format blocks are sawn exactly to size so exactly the right quantity is delivered to the building site. When hand size blocks are used, a little more rubble remains. This calcium silicate rubble can be deposited in a rubble container together with other remaining rubble. It is then used by rubble breakers to make mixed granulate, which is subsequently used as a foundation material in road building.

3.4 The use of Silka blocks

Blocks are sawn up on site to make connecting pieces. The blocks are sawn using a masonry circular saw. A wet sawing method is preferred to dry sawing, as it reduces dust formation.

Slots are cut or sawn for building in pipes for utilities. The Silka Light Block has the great advantage that, with its well defined pattern of holes, broaching is reduced to a minimum.

Chapter 4

Living comfort

4.1 The ability to breathe

When cooking, bathing, washing and breathing, liquid is released in the form of water vapour. A family of four people easily produces some ten litres of water per day. If this is not removed from the dwelling in the right way, a humidity overload can result. This is not only a nuisance, but is also bad for health. Ventilation is in principle a good solution for this problem. Modern energy-efficient dwellings are built to be almost airtight and are fitted with mechanical ventilation systems. Unfortunately it regularly happens that the occupants turn them off to save energy. They also try to save money on the maintenance (cleaning), so after a period of time the system only functions moderately. Then the dampness remains in the dwelling, rapidly causing the atmosphere to become unpleasant.
A dwelling that is constructed with Silka blocks has this problem to a far lesser extent. Calcium silicate is able to take up water vapour, until the degree of humidity in the dwelling has been reduced again. The capacity of the wall to absorb water vapour and release it again is determined by the variation over 24 hours of the relative humidity and by the type of material. Per m^2 Silka wall the damp absorption capacity amounts to 0,17 litres and the desorption capacity to 0,13 litres. The depth of penetration of the moisture in this process is 5 to 6 mm. For a dwelling with 130 m^2 Silka blocks this approximates to 17 litres of moisture per 24 hours.
The amount of water vapour produced depends very much on the behaviour of the inhabitants, but will seldom amount to more than 15 litres a day. The capacity of Silka blocks to regulate the water vapour is thus sufficient to keep the interior humidity in a dwelling manageable. This is often referred to as "the breathing of Silka blocks".
Because they breathe, humidity is regulated in a good and natural manner that encourages a healthy environment in which to live.

4.2 Heat accumulation

When a space is heated by central heating or incident solar radiation, Silka walls take up a part of the heat. When the air temperature drops, the heat is then given back to the environment.
This results in a heat-equalising effect contributing to the comfort of the room. Furthermore, thanks to this effect, extreme variations in temperature are minimised, which leads to another positive effect: energy savings. The extent to which heat can be taken up and released again is called the thermal inertia. This capacity is mostly determined by the specific surface temperature and the mass of the building material. The specific surface temperature of Silka blocks amounts to approximately 840 J/kgK. The density is approximately 1750 kg/m^2.
This results in a high thermal capacity to accumulate heat, which means that calcium silicate blocks remain cool longer in the summer and likewise warm longer in the winter. Due to the thermal inertia, variations in the outside temperature are not so quickly noticeable inside the home. The heating does not have to react so quickly, resulting in a more constant interior temperature.

4.3 Thermal insulation

In order to save energy, it is attractive to improve the thermal insulation of a building. Good insulation ensures that the heat is better retained within the building. Excess heat can be stored in the material mass of the building. This becomes available later, when the outside temperature drops again (see 4.2 heat accumulation). The thermal resistance of an outside wall (the Rc value) is the sum of the thermal resistances of the individual components of this construction.

4.4 Sound insulation

Good exclusion of noise increases the quality of life and consequently the sustainability of a dwelling. This applies both to noise from adjoining residences and noise from outside. The mass of the components used determines the noise-resisting properties of the construction to a large extent.
Another determining factor is the transfer of noise sideways through connecting parts of the building. Due to the product's mass, walls made with Silka blocks fea-

ture intrinsically good noise-resisting properties. However the detailed design of connecting parts of the house is important. During design and execution this aspect should be given special attention.
The sound insulation should satisfy two important requirements. First, there is the characteristic sound insulation index for airborne sound: the index reflects the airborne sound insulation between two spaces. Secondly, there is the requirement regarding the insulation index for structure-borne sound.
A popular method for limiting the transmission of sound is to make an unanchored cavity wall for separating two dwellings. In fact, it are two unconnected walls, with an air cavity between them. The dwellings then stand free of one another. The disconnection of the two walls usually ensures good sound insulation.

Chapter 5

Recycling

Construction and demolition waste is reused by breaking up the rubble from the Silka blocks, together with other types of rubble, to form mixed granulate. The mixed granulate is then used in the road construction business. The calcium silicate industry is also investigating the possibility of employing calcium silicate rubble from construction and demolition waste as a replacement for sand in the production of calcium silicate blocks. Another possible application of calcium silicate rubble is to use it for paving cycle paths in managed natural areas. This is already being done with part of the production rubble. Due to the natural appearance of the rubble and the very limited maintenance required by the material, this application is highly valued.

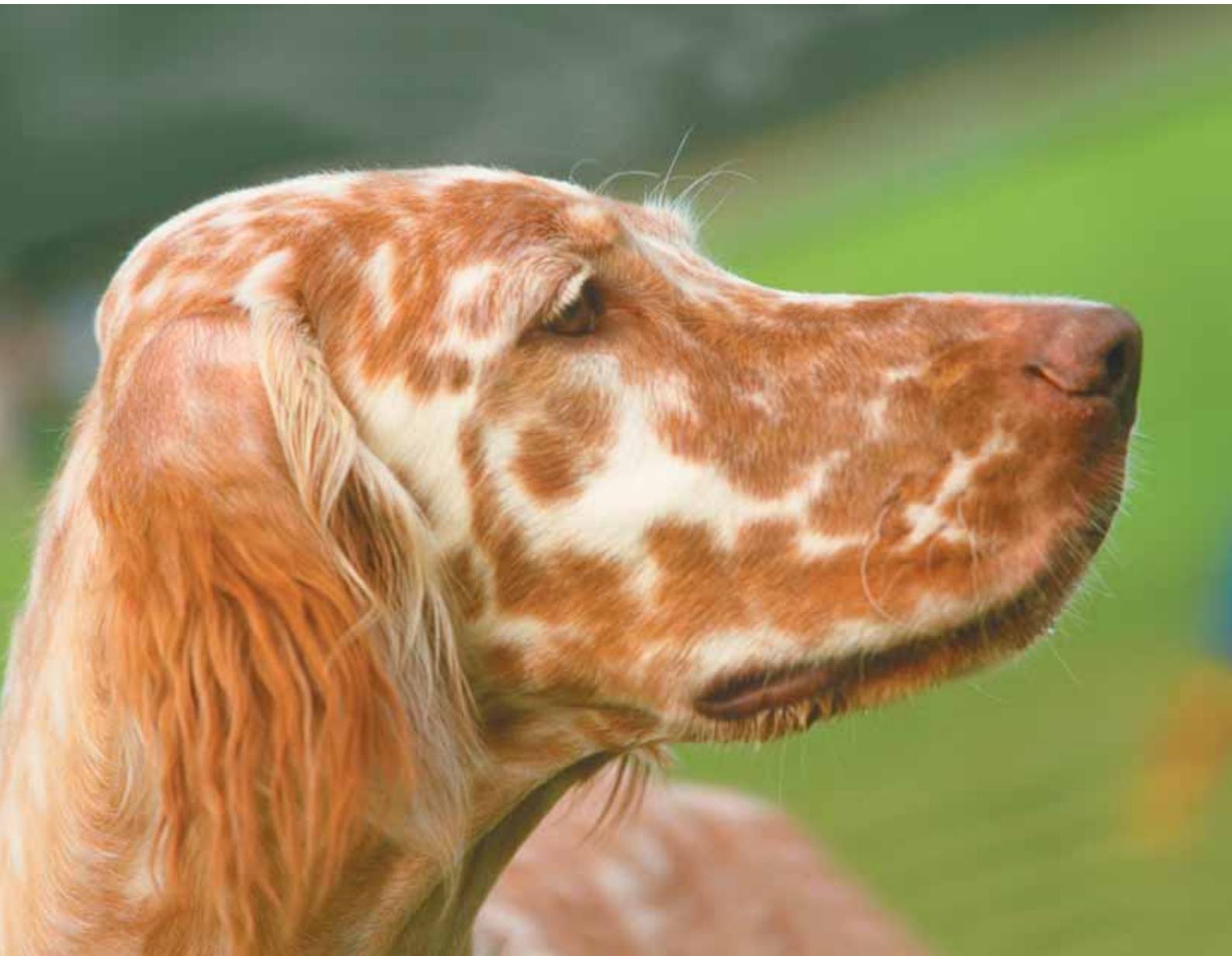
Chapter 6

The environmental performance

In recent years we have started to think differently about environmental performance. We are still looking at the environmental impact of the production of building products, but the accent has nowadays come to lie much more on the environmental effects from the extraction of raw materials right the way through to the scrapping phase ("from the cradle to the grave"). The methodology that is most used to assess the environmental performance is life cycle analysis (LCA).

A method has been developed by the members of the NVTB (Dutch Association of Building Suppliers) of using LCAs to arrive at unequivocal and reliable information about the environmental aspects of building materials and products, which is known as Environment Related Product Information (or by its Dutch abbreviation, MRPI). The calcium silicate industry has had MRPI sheets at its disposal since 1999 for all its products. These show for example that the consumption of energy for the production of 1000 kg Silka hand size blocks, including extraction, production and transport of the raw materials and including processing the waste, amounts to approximately 750 MJ. For large format Silka blocks the energy consumption amounts to approximately 830 MJ.

In the production of Silka blocks, no emissions are generated by the raw materials or the product. Emissions into the air are generated solely as the consequence of burning natural gas, mostly in the form of CO2. This relates particularly to the production of lime and the production of steam for hardening the Silka blocks.
According to the annual checks made by the supplier of the steam boilers, the NOx-emission remains below the legal limit of 75 mg per m^3 flue gas. The main result of all this is that the "Energy and Emissions" environmental measurements for calcium silicate are particularly low.



The Silka product range from Xella finds its way to all sectors in the building industry, finding use in dwellings, non-residential buildings and renovation.
In this connection, Silka blocks have the right properties for use in load-bearing and non load-bearing constructions.
In addition to sales and marketing activities, Xella supplies technical advice on construction and gives information to customers, builders, clients, architects and advisers.
If you have any questions about this brochure or the Silka-products and their applications and/or how they can be used in construction, please contact Xella.
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