

CEMENT

# Powercrete *plus*



**PREMIUM**  
Technical Cement



bringing materials to *life*™

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## Designed for high performance

- Excellent strength at all ages
- Improved workability for better placing
- Can be extended to give extra value and customised mixes
- Lower heat of hydration
- Better off-shutter finishes
- Lower carbon formulation for environmental tender specifications

## Introducing Powercrete Plus

Powercrete Plus is a Premium Technical cement that combines excellent strength performance at all ages with versatility and enhanced durability benefits.

The characteristics of superior workability and good early strength, in particular, make Powercrete Plus the effective solution to the productivity demands of large construction projects while also satisfying the needs of homeowner building projects.

Powercrete Plus is produced at our **Lichtenburg Cement Works** in the North West Province, **Randfontein Grinding Station** on the west side of Johannesburg and at our **Richards Bay grinding plant** in KwaZulu-Natal. While having similar essential characteristics, the product formulations differ between the sites, to optimise the use of the available raw materials. They conform to the SANS 50197 (EN 197) specification, in accordance with SANS 50196 (EN 196) test requirements.

### LICHTENBURG WORKS

#### Composition

Our Lichtenburg Works produces **Powercrete Plus** as a **CEM II/A-M(V-L) 42,5N Portland-composite cement** formulated from Portland cement clinker together with a selected type of limestone, quality siliceous fly ash and a strength-enhancing additive.

### RICHARDS BAY & RANDFONTEIN PLANTS

#### Composition

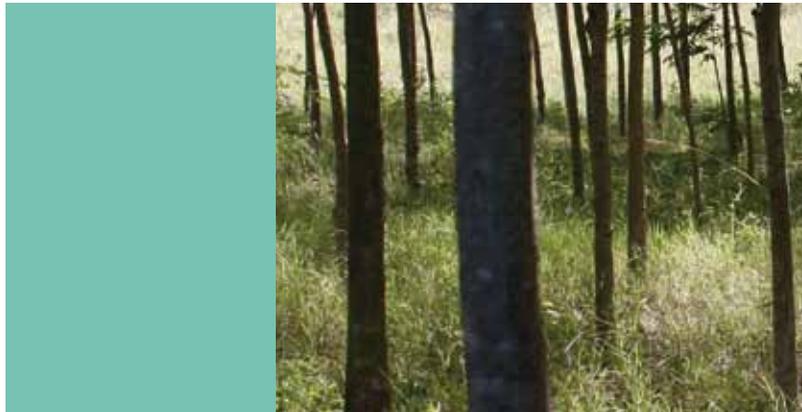
The formulation for **Powercrete Plus** produced at Randfontein and our Richards Bay plant is based on Portland cement clinker and 15% of quality siliceous fly ash, together with a strength enhancer to achieve a **CEM II/A-V 42,5N Portland-fly ash cement**.

## Environmental responsibility

For many years, Lafarge has led the industry in a programme of action plans to push the boundaries of sustainable development. This stems from the Group's belief that a responsible corporation must leave a legacy of good resources management for our children.

Our aim is to be the most innovative and the most responsible in the industry for providing solutions to environmental issues:

- The South African Cement Business Unit has won a Group annual award for the Highest Reduction in CO<sub>2</sub> emissions. A major contribution to this achievement was the development of our innovative fly ash extended cements
- Lafarge Cement is the only company in South Africa with a full range of extended products based on quality siliceous fly ash
- Our innovative Powercrete Plus formulation reduces CO<sub>2</sub> emissions from the processing plants by 120kg/ton of cement compared with traditional Ordinary Portland cement



#### FLY ASH AND THE ENVIRONMENT:

Fly ash is an environmentally-friendly product. Lafarge Cement's increasing use of fly ash as a component of building materials is making a significant contribution to sustainable development by:

- Reducing the use of non-renewable resources such as limestone and coal
- Reducing carbon dioxide emissions from cement plants
- Recycling a waste-product of coal burning power stations which cuts back on the landfill sites



### GREEN BUILDING COUNCIL

Lafarge Cement was the first member of the building materials industry to join the Green Building Council of South Africa (GBCSA). It is a commitment to assist the Council in leading the transformation of the South African property industry to ensure that all buildings are designed, built and operated in an environmentally sustainable way. The aim is to allow all people in our country to work and live in healthy, efficient and productive environments.

## The 'Plus' value

The innovative formulation of Powercrete Plus retains the early strength gain characteristics of a CEM I cement while producing concrete mixes with better workability and higher ultimate strength.

### SCOPE FOR EXTENSION

Another key benefit of Powercrete Plus is the capability of being extended further. Trials with our two Powercrete Plus formulations have demonstrated the potential for further cement replacement with an additional 15% up to 30% DuraPozz® or 30% up to 50% Slag (GGBS).

With Powercrete Plus, contractors have the scope to produce on site a wide range of specific, cost-effective mix formulations which provide solutions to requirements for strength, durability and workability. The specially developed strength enhancer, which is interground with the clinker, optimises strength development in cement containing fly ash and/or slag.

### REDUCED WATER DEMAND

The inclusion of quality siliceous fly ash in the formulations results in a reduced water requirement for concrete mixes. The spherical shape of the fly ash particles and their ability to disperse into cement particle voids creates a workable mix using less water.

Tight control of water addition will realise the benefits of extra strength, reduced bleeding and shrinkage cracking. Typically, the water demand of a concrete mix made with Powercrete Plus is reduced by between 2% and 5% compared with a CEM I class cement. (The reduction depends on a number of factors in addition to the amount of fly ash in the cement.)



## The name that inspires confidence

At Lafarge Cement, we believe that a customer needs total confidence in their cement.

### Confidence that the product will:

- Have consistent high quality performance
- Deliver beyond normal expectations
- Enhance on-site productivity
- Help to produce superior finished concrete work
- Have effective back up service and technical assistance

Powercrete Plus offers customers everything they expect from Lafarge, the world's leading cement producer.



## Applications

Powercrete Plus offers effective solutions to the requirements of a wide range of applications:

### WHERE HIGH STRENGTH AND EARLY AGE STRENGTH ARE NEEDED FOR:

- Post-tensioning and prestressed slabs and beams
- Spun pipe manufacturing
- Precast manufacturing

### WHERE LARGE PROJECTS REQUIRE SPECIALISED CUSTOM BLENDS FOR:

- Dam/reservoir construction
- Structural concrete applications
- Tunnel lining

### WHERE THE VERSATILE POWERCRETE PLUS CAN BE USED FOR:

- Home concrete work such as foundations and garden paths
- Medium strength concrete for driveways, unreinforced light industrial floors and mass concrete
- High strength concrete for columns, suspended slabs, heavy duty industrial floors and water retaining structures
- Masonry work: mortar and plaster
- Brick and block making



## The advantages of using Powercrete Plus

Powercrete Plus is able to create concrete with a wide range of strengths. It may be further blended on site with additional fly ash or slag, producing effective solutions to different design requirements. As well as providing good early strength, the composite formulations have the benefit of:

- Improved workability: for easier placing, better response to vibration, more efficient filling of formwork and finishing of concrete
- Good early strength for better productivity
- Reduced water requirement: results in less cracking and more strength
- Better cohesion: the ingredients in the concrete stay uniformly mixed, instead of segregating before the concrete can set
- Lower heat of hydration: lower temperatures result in lower temperature differentials and lower tensile stresses. Peak temperatures are also at a later age, resulting in more mature concrete.

A typical value for Heat of Hydration determined in accordance with EN 196-9 is 227J/g at 41h, making Powercrete Plus a low heat common cement (< 270J/g)

### Using Powercrete Plus concrete work has:

- Higher long-term strength and durability
- Better off-shutter finishes to meet aesthetic requirements

The high, good early strength capability of Powercrete Plus provides for the needs of specialist technical applications, in particular construction techniques such as post-tensioning of prestressed beams.



*Powercrete Plus combines high technical performance for large projects with all-round versatility for the smaller user.*

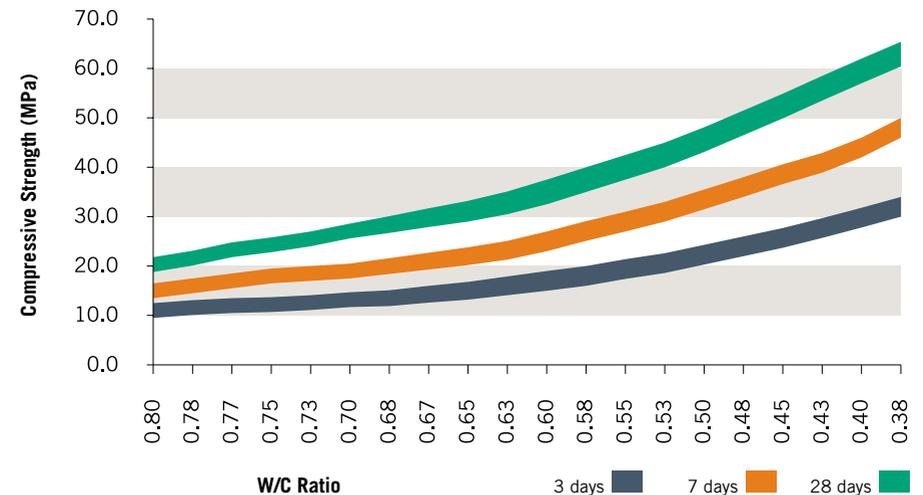
## Deciding on a mix

### Mix proportions by MASS using bulk Powercrete Plus:

Powercrete Plus is especially suitable for large projects, which will normally require the cement to be delivered in bulk to on-site silos. Increasingly, batch plants are equipped with computerised mass flow control systems and mix designs can be optimised using the performance curves below. The basic design procedure is:

1. Decide on the 28-day target strength of the concrete based on the specification design strength plus an appropriate margin based on site control. From the vertical strength axis of the graph, move horizontally to intercept the specified age curve – in this case, 28-day. Read the Water/Cement (W/C) ratio off the horizontal axis
2. Determine the water content of the mix based on the water demand of the aggregate to be used and the desired workability – typically established by making a trial mix
3. Calculate the cement content required by dividing the water content by the W/C ratio
4. Using an established mix design model formula, the stone content can be calculated
5. Based on the relative densities of the constituents, the sand content can then be determined to yield 1m<sup>3</sup> of concrete
6. If the design specification uses a 3-day or 7-day strength criterion, follow the same steps but use the appropriate performance curve

### Powercrete Plus: Performance envelopes



## Properties

Powercrete Plus complies with the chemical and physical requirements of SANS 50197 (EN197) for a Class II 42,5N cement.

PHYSICAL PROPERTIES		
Property	Powercrete Plus*	EN Spec. requirement
2 day Compressive strength	22,5 MPa	≥ 10,0 MPa
28 day Compressive strength	56,5 MPa	≥ 42,5 MPa ≤ 62,5 MPa
Initial set	200 minutes	≥ 60,0 minutes
Soundness	1,0 mm	≤ 10,0 mm
Relative Density	3,04	n/a

\*Typical results

CHEMICAL PROPERTIES		
Property	Powercrete Plus*	EN Spec. requirement
SO <sub>3</sub>	2,10%	≤ 3,5% m/m
Cl <sup>-</sup>	0,051%	≤ 0,10% m/m

### Recommended mix proportions by VOLUME using bagged Powercrete Plus:

The good early strength of the Powercrete Plus formulation is designed to be especially effective in meeting the needs of fast-track large projects. However, for convenience and ease of handling, Powercrete Plus in 50kg bags can be used in a wide range of smaller jobs. Use the mix guidelines below to avoid wastage with unnecessary amounts of cement.

Generally, a standard builder's wheelbarrow that holds 65 litres of material is used to measure out the correct volumes of cement, stone and sand required to make a batch of concrete. Since cement is sold by weight not volume, please note that 2 x 50kg bags (often referred to as 'pockets') are equivalent to one wheelbarrow load.



**Note: If you want to make a smaller batch of concrete, remember to use the same size container to measure all the ingredients. (e.g. a 10litre household bucket)**

USES	POWERCRETE PLUS	SAND	STONE
Low strength 10-15MPa Home concrete foundations, footings, unreinforced domestic floors	1	4	4
Mid strength 20-25MPa Driveways, unreinforced light industrial floors	1	3	3
High strength 30-35MPa Reinforced concrete structural applications: suspended slabs, heavy duty industrial floors	1	2,5	2,5
Watertight concrete reservoirs, ponds	1 	2 	2 
Mortar for bricklaying and plastering	1	6	-
Brick and block making	1	8	-

*Have confidence in strength and quality with Lafarge Powercrete Plus 42,5N*



## A major South African cement producer

Lafarge Cement is one of the major cement producers in Southern Africa. We have:

- A production capacity in excess of 3million tons per year
- A flagship cement facility at Lichtenburg in the North West Province, which is one of the largest and most technically advanced cement works in the country
- A recently commissioned world-class grinding station, with packaging and distribution facilities, at Randfontein on the west side of Johannesburg
- A grinding station and distribution facility at Richards Bay on the north coast of KwaZulu-Natal

## Quality assurance

Our Lichtenburg Cement Works and Richards Bay plant are SABS/ISO 9001-2000 listed. The new Randfontein Grinding Station is currently involved in the procedure for obtaining its listing. While the Lafarge name is a worldwide assurance of quality, our Powercrete Plus bag also displays the following locally regulated quality symbols:

- LOA number

**LOA no: AZ/9085/2008/0028**

The Letter of Authority number shows that Lafarge is authorised to sell Powercrete Plus in the South African market. In terms of recent legislation it is now mandatory to display a Letter of Authority (LOA) number on a bag of cement and on the sale transaction documentation. The LOA number indicates that Powercrete Plus complies with the compulsory standard SANS 50197-1

- SABS mark

Although displaying the SABS mark is no longer mandatory, Lafarge Cement voluntarily displays it

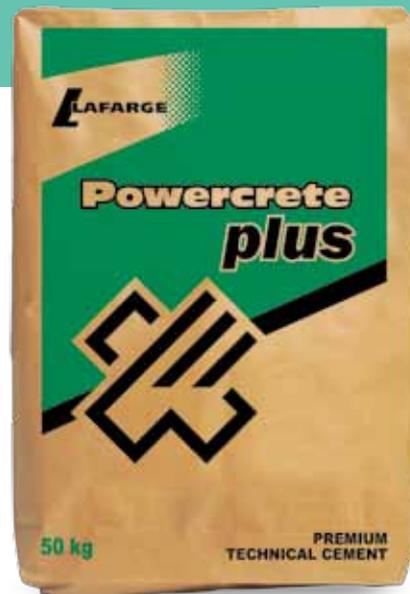
### Changes in the regulation of cement in South Africa:

*Cement now falls under the Compulsory Specification Act of South Africa. It is regulated by an independent government body called the NRCS, National Regulator for Compulsory Specifications, which is part of the Department of Trade and Industry. NRCS is a public entity responsible to the Minister of Trade and Industries for administration of technical regulations including Compulsory Specifications based on Standards that protect human health and safety, and the environment. The only major change is that it is no longer mandatory to show the SABS mark on cement bags. Instead, a Letter of Authority number (LOA number) must be displayed: it is strictly illegal to sell cement without the LOA number reflected on the delivery note and the bag.*



- e-mark

Indicates that the packaging equipment and systems at our Lichtenburg Cement Works have been audited and approved by the NRCS and comply with the SANS 1841 standard. Our customers are assured of receiving the quantity they have paid for



## Technical service

### LOCAL

Powercrete Plus is fully supported by the unique technical and laboratory resources of Quality Department Southern Africa (QDSA) at Industria, Gauteng. QDSA operates one of the largest and most respected SANAS (South African National Accreditation System) Accredited Civil Engineering testing facilities in South Africa. Complying with ISO/IEC 17025, the facility has a proud fifteen-year track record of continuous accreditation.

### Scope of QDSA's Accreditation

The SANAS accreditation covers thirty-four test methods, including most of the SANS EN tests for Common and Masonry cements, other relevant SANS, EN and DIN test methods for aggregates and concrete, as well as an in-house method for Dense Medium Separation. Within the framework of this accreditation, QDSA can add another 200 tests to the above methods.



### UNEQUALLED INTERNATIONAL RESOURCES:

One of Lafarge Cement's strengths is having access to the experience and technical resources of the international Lafarge Group.

- Every year a budget of €170 million (over R2 billion) is devoted to research and to the development of new solutions
- 1 300 scientists, engineers and technicians from all over the world work on the optimisation of production processes and the creation of tomorrow's materials
- Lafarge also operates the world's largest building materials research laboratory

This research and development, together with the exchange of information and benchmarking between the international Group's 160 cement and clinker facilities, ensures the world-class quality of Lafarge's products.

### PROCESS QUALITY CONTROL

The strength development and performance of Powercrete Plus is continually monitored for compliance with Lafarge's stringent in-house standards (referred to as "Usage Quality Testing").



## The International Lafarge Group

Lafarge is the world-leader in building materials, with top-ranking positions in all of its businesses: Cement, Aggregates, Concrete and Gypsum. The Group has 78 000 employees in 78 countries and, in 2009, achieved sales of Euros 15,8 billion.

### A LEADER IN SUSTAINABLE DEVELOPMENT

Lafarge combines its skills and technical resources with the expertise of others for greater effectiveness in the environmental control field:

- Lafarge was the first industrial group to enter into a worldwide 'Conservation Partnership' with the environmental protection organisation, WWF International
- Lafarge is a founding member of CSI (Cement Sustainability Initiative) which actively promotes responsible management and the worldwide reduction of carbon dioxide emissions by the industry
- Lafarge is co-chair of the "Energy Efficiency in Buildings" Project, which works towards the objective of zero net energy use in buildings

## Concern for people

**Our people are the heart of our company:**

- Health & Safety is our No. 1 priority
- Our HIV/AIDS prevention and care programme is used as a model in other developing countries
- Our training centre and sponsorship schemes help develop our own employees to their full potential and also offer advancement opportunities for persons from local disadvantaged communities

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*In 2009, for the sixth consecutive year, Lafarge was listed in the '100 Global Most Sustainable Corporations in the World'*

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