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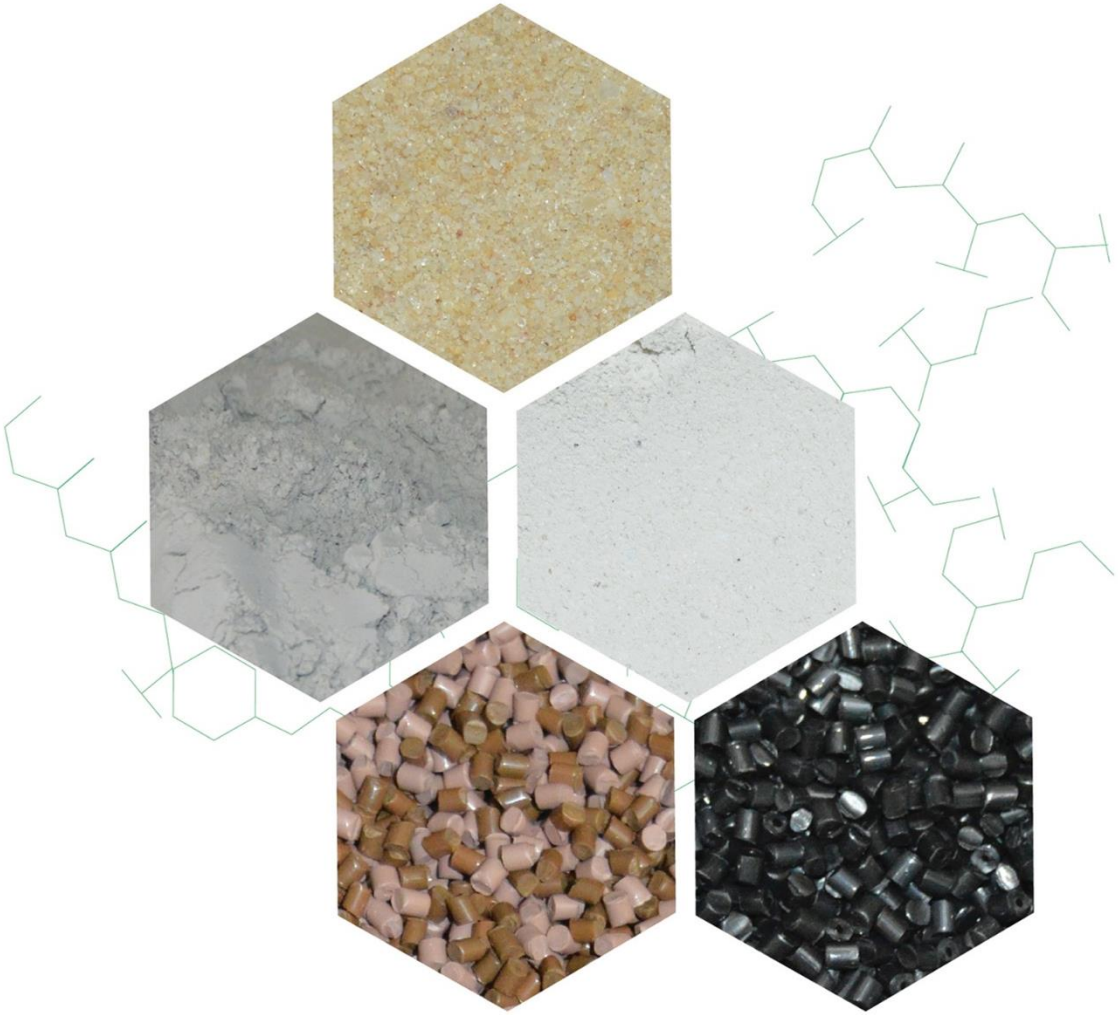

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Kaolin Group is more than merely a mining house. We not only mine and upgrade raw kaolin, a very common and environmentally friendly mineral, for commodity sales.

Kaolin Group also beneficiates the kaolin in various ways to make it uniquely suitable for applications in various industries ...

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LOCAL KAOLIN FOR LC3 CEMENT

The Opportunity:

To realise sustainable and commercially viable local production of **LC3 CEMENT AND CONCRETE** using **LOCALLY MANUFACTURED METAKAOLIN** in **SOUTH AFRICA.**

The Prospects:

- **Be the first to introduce LC3 cement and concrete;**
- **fill the deficit in slag availability in SA;**
- **use dry-separation technology to unlock local kaolin sources.**

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INTRODUCTION & BACKGROUND

Kaolin Group was formed in late 2011.

The motivation of its founders was twofold.

Their aim was for successful development and significantly improved quality of a vast range of materials on the one hand, and greater cost effectiveness as well as sustainability on the other, all the while maximising commercial viability.

Today, reducing our carbon footprint is as much a priority in realising our vision as increasing energy efficiency is, which is why we chose raw kaolin as a material: it is both sustainable and readily available.

After the initial investment in an extensive **kaolin mine** in South Africa**,** we pursued further beneficiation of our kaolin for use in various industries. Selection of those industries took into account both the most urgent need to reduce the carbon footprint and the importance of maintaining the highest quality standards.

Beyond simply upgrading raw kaolin into a marketable commodity, our unique approach to this extraordinary resource and its capabilities is both creative and multi-faceted.

ISO 9001:2015
BUREAU VERITAS
Certification

UKAS MANAGEMENT SYSTEMS
0008

TEAM & SHAREHOLDERS

Shared motivation, drive and vision brought our team together.
From the most junior staff members to the senior operators and production crews, our workforce on the ground is well-rounded and exceptionally dynamic. Our diverse group of shareholders, all of whom offer immense and multi-focal expertise, capital, business experience and determination, as well as many years of success in their original businesses, steer Kaolin Group's concerted efforts towards achieving our goals.

KG & KG-PC Shareholders:

Loanhead is a member of **UAL Alliance** and its globally operating shipping line, **UAL Ltd.**. **UAL Alliance** has serviced the oil and gas industry in Europe, America and Africa for over four decades, offering complete logistics solutions (both break bulk and containers), technical expertise, commercial awareness, international management and local knowledge in Africa.

Notably, **UAL** is one of the first shipping lines worldwide operating 5 ECOTRADER vessels, which offer greater safety and speed while requiring 25% less fuel. **Loanhead/UAL Alliance** are shareholders both in **KG** and in **KG-PC**, tendering both companies – and their clients – a solid financial base, global expertise and cost-effective logistics solutions.

Jacki van Rensburg is an established entrepreneur and civil engineer with an extensive background in both mining and property development. Having successfully owned and run his businesses for decades, Jacki first instigated our interest in kaolin. He is a director of **KG** and a shareholder of **KG-PC**.

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TEAM & SHAREHOLDERS

PP, owned by Petra Wiese & Piet Schreuder, is a shareholder in both **KG** and **KG-PC**.
Petra is a highly successful business woman with 30 years of experience both locally and overseas in the fields of design, manufacturing, construction, project management and entrepreneurial consultancy. Piet, with decades of experience in accounting and financial mangament is the CFO of both companies. Petra is an executive director of **KG** and of **KG-PC**.

Savio Hagemann, with over 20 years of business and project management experience, manages the day-to-day technical and operational tasks of the beneficiation plant and drives both **Kaolin Group**'s business planning process and project focus. Savio is a shareholder and director of **KG-PC**.

Further key team members include:

Harry Coetzee, an engineering graduate with an MBA, who has more than 30 years' experience as an executive and CEO with South African and international companies. These companies procure, add value to and distribute industrial and consumer durable products. Amongst others, he was the managing director of Bosal SA, Toyota Manufacturing SA, and Group CEO of Powertech and Aberdare Cables. Harry is the lead consultant to KG and KGPC.

Our senior operators, our laboratory technicians and our mechanics, all of whom are wholly committed to stringent quality controls and ISO-certified production standards. Together, they combine well over 40 years of experience in their respective fields with resolute leadership and their staff's skills development.

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LOCATION OF MINE

Our kaolin mine is located on the West coast, in the Western Cape province of South Africa, 125 km from Cape Town's CBD, where the joint registered office of KG and KG-PC is located.

The deposit's close proximity to the commercial port of Saldanha Bay reduces logistics costs for the exporting of products directly from the mine.

Our plant is strategically positioned halfway between the mine itself on the one hand and Cape Town harbour, Cape Town International Airport and Cape Town's CBD on the other hand. On-site handling at the plant, and subsequently, transport and shipping in containers, break-bulk and/or air freight is optimised.

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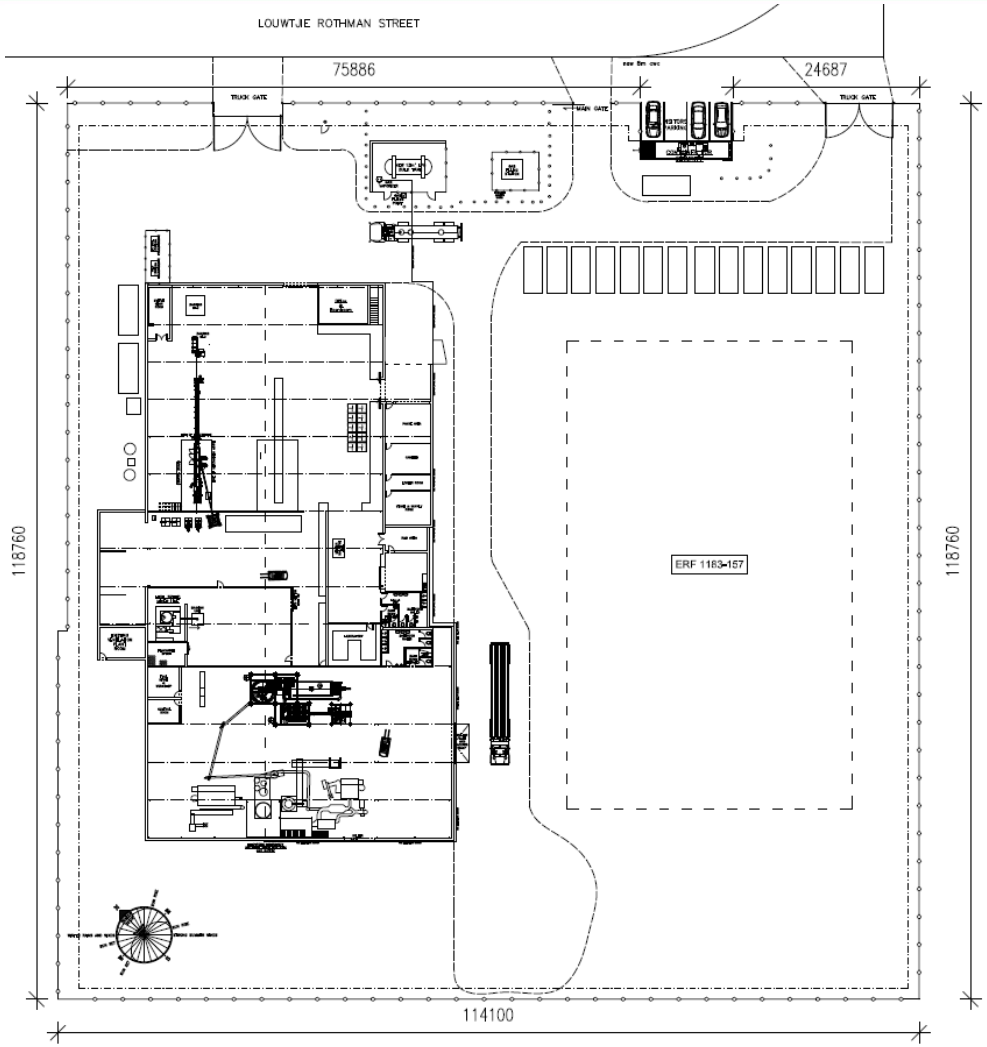
BENEFICIATION PLANT



The beneficiation plant was built on 15.000m² of industrial land, with the current factory building housing the various beneficiation streams and processes:
3000m² fully insulated factory building divided into various sections including R&D spaces, offices, workshops and
2 main production areas for:

KG products/flash calcination and **KG-PC** compounding line;

plans for further extension of the factory are in progress.

The entire plant has got 100% backup generator supply available for uninterrupted production capability.

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CALCINATION FACILITIES

KG - Calcination Facilities:

Kaolin Group's patented flash calcination method was developed over the past 4 years specifically with the highest possible level of metakaolin reactivity in mind.

- Our pre-drying, micronising and flash-calcination cluster set-up produces highly reactive metakaolin in one process.
- Our current pilot flash-calcination plant has a capacity of 350t of metakaolin per month.
- Our flash-calcination method results in the highest reactivity of metakaolin, due to the increase of reactive surface area by 300-400% over conventional rotary kiln calcination.

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LABORATORY

Laboratory

Testing and/or evaluation of our various products takes place in our high-tech laboratory equipped with/for:

- light microscopy; polarised light analysis;
- particle size analysis (0,05µm - 2000µm range);
- moisture content analysis;
- micro scales up to 0,000g;
- flammability testing (glow wire testing);
- absolute moisture metering through Karl Fischer titrator;
- filler-content test/ash-content test;
- tensile testing (tensile strength & flexural modulus);
- charpy testing (impact strength/izod);
- hardness testing (shore d&a);
- colorimetry (colour analysis);
- vicat softening/heat deflection tests;
- heat agency test.

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MINE FACTS

The mining extent covers :

- 2 adjacent kaolin deposits of approximately 500 million tons each.
  Each is a surface deposit starting from about 500mm below a layer of surface grit and extending to a depth of about 80m.
- A deposit of salt-free, fine silica sand with an extent of about 4 million tons.
  The sand is defined by its very fine particle size, ranging from **±100-350µm** in size.
  The particles are naturally smooth, round and of a high purity.

A railway line runs directly past the mining area and discussions with Transnet are underway to provide a **siding for bulk loading the mining products.**

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THE NEED FOR DRY SEPARATION OF KAOLIN

CHEMICAL COMPOSITION

		ex Mine
Silica	SiO_2	71,00%
Aluminium	Al_2O_3	18,20%
Potassium	K_2O	2,95%
Iron	Fe_2O_3	1,37%
Titanium	TiO_2	1,20%

MINERALOGICAL COMPOSITION

	ex Mine
Quartz	43,20%
Kaolinite	37,80%
Muscovite	19,00%

International standard practise for kaolin beneficiation is through **wet separation**, by which quartz and other impurities are largely removed from the **kaolinite** portion of the raw clay.

This method is highly effective, but **costly and, as regards water resources, wasteful.**

South Africa is classified a **water scarce country** and water licences for washing raw clay **can not easily be obtained.**

Currently **no clay deposits in South Africa are water-washed** and hence no “waste” grades are available.

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THE NEED FOR DRY SEPARATION OF KAOLIN

CHEMICAL COMPOSITION

		ex Mine	Dry Separated
Silica	SiO_2	71,00%	61,20%
Aluminium	Al_2O_3	18,20%	25,32%
Potassium	K_2O	2,95%	2,51%
Iron	Fe_2O_3	1,37%	1,13%
Titanium	TiO_2	1,20%	0,91%

MINERALOGICAL COMPOSITION

	ex Mine	Dry Separated
Quartz	43,20%	< 28%
Kaolinite	37,80%	**> 50%**
Muscovite	19,00%	± 20%

Our **patented dry separation** adds **minimal cost** to the raw clay, hence making it an attractive tool for beneficiating kaolin for low-cost applications, such as **cement and concrete products.**

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SILICA SAND

KG's high-grade silica sand consists mainly of silicon dioxide (SiO_2, also known as silica). Higher silica content leads to better quality for applications in various industries, including:

- glass;
- electronics;
- glass fiber;
- chemicals;
- construction;
- oil & gas.

Critical components of our silica sand are the percentages of aluminium oxide (Al_2O_3) and iron oxide (Fe_2O_3), both of which need to be as low as possible to ensure high-grade silica sand. The chemical analysis of our sand is as follows:

Unwashed Silica Sand Ex Mine

silica sand		
name	formula	Kaolin group
Silicon Dioxide (silica)	SiO_2	99,80%
Aluminium Oxide	Al_2O_3	0,248%
Iron oxide (rust)	Fe_2O_3	0,049%

Washed and Dried Sample

silica sand		
name	formula	Kaolin group
Silicon Dioxide (silica)	SiO_2	99,80%
Aluminium Oxide	Al_2O_3	0,265%
Iron oxide (rust)	Fe_2O_3	0,065%

Above results from **Nedlab** (a leading certified Dutch Lab).

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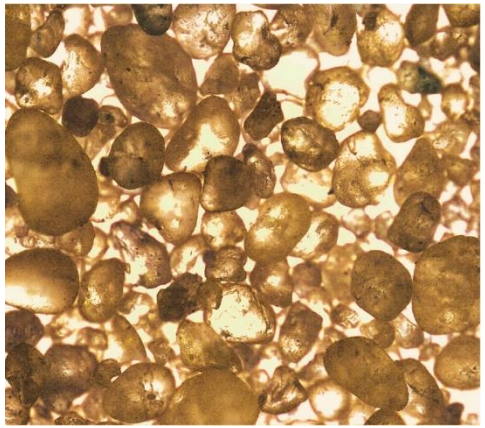
SILICA SAND

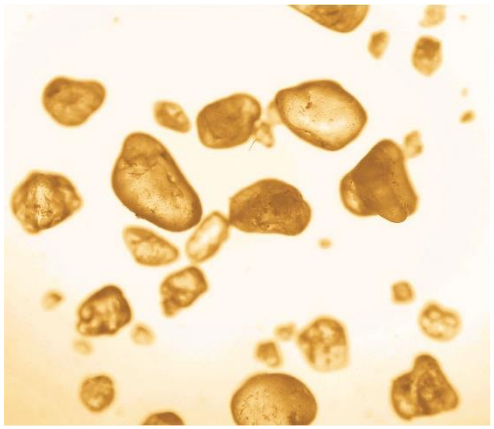
Because our silica sand is salt-free and has a rounded particle structure, another of its potential applications is its use as a proppant for hydraulic fracturing in oil- and gas-well stimulation. The particle size matters – as can be seen in the lab report made by Fritsch (see below).

Fracking sand is a relatively scarce commodity, so it needs to be transported in large quantities as cost-effectively as possible. With our mine being so near the coastline, and UAL's (i.e. KG shareholder's) break-bulk vessel's regular monthly service along the African coast from and to the US (Houston) and Europe, we can offer highly cost-effective supply and logistics.

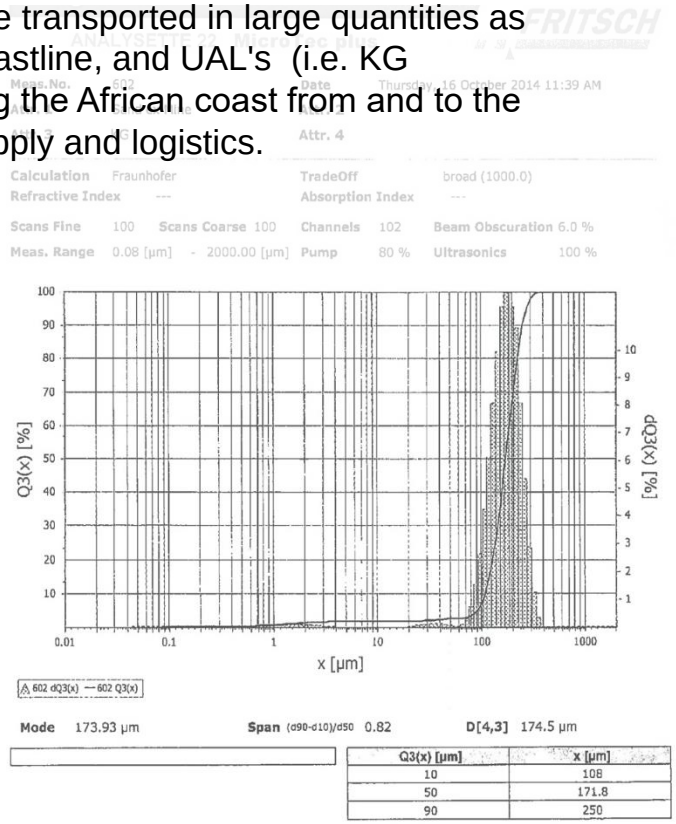
Silica Sand (Unwashed) ex. Kaolin Group Mine.



Dense particle arrangement
(individual grains).
Light microscope (light from below)
40x magnification



Loose particle arrangement
(individual grains).
Light microscope (light from below)
40x magnification



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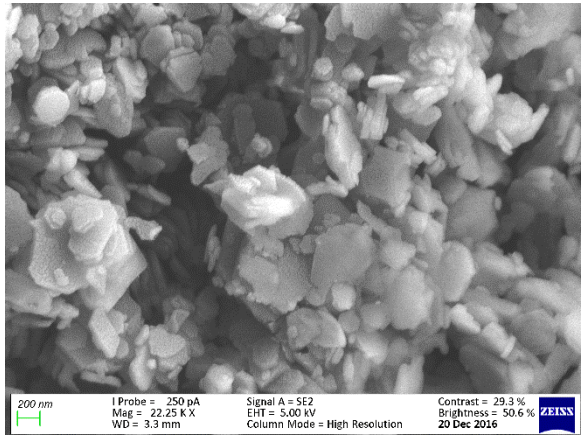
METAKAOLIN – CASE STUDIES

Due to the unique properties of concrete containing metakaolin, we contributed to a number of projects in which the performance of this remarkable pozzolan was put to the test.

Metakaolin's remarkable potential to optimise various concrete properties made many projects a long-term success. These features include:

- outstanding durability;
- fast curing;
- high strength;
- excellent resistance to chemical attack;
- high density and consequent surface hardness;
- ability to suppress ASR.



There are several projects in which specific design criteria could not be met, except with the addition of metakaolin. Two key examples are:

- repairs to a concrete jetty at the **K5 International Oil and Gas Freeport** in Equatorial Guinea;
- structural screed application for **200 residential units at Melville Place**, Ottery, Cape Town.

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METAKAOLIN CASE STUDY: K5

In 2013, we were called in to assist our main shareholder, UAL Africa, to carry out emergency repairs at the K5 International Oil and Gas Freeport in Malabo, Equatorial Guinea.

A large part of the concrete jetty beam had collapsed and needed urgent repairs and replacement.

In order to operate on a normal day-to-day basis,180-ton steel caterpillar cranes need to be able to move on the concrete slab and edge-beam of the jetty, 365 days a year, to load and off-load cargo.

METAKAOLIN CASE STUDY: K5

Much of the existing broken concrete and sub-base were removed, and **new concrete, containing 15%** (cement-replacement value) of our **locally produced metakaolin**, was poured into the space between the existing steel shuttering and remaining structure.

As the steel shuttering was damaged, the existing void was filled with **sea water**. The concrete mix was poured directly into the sea water and left **to cure for 12 hours**. The following day, the edge of the concrete slab was prepared and poured in sections.

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METAKAOLIN CASE STUDY: K5

48 hours after completing pouring of the main surface slab of the jetty, and a total of **1 week** after the start of the repair work, the jetty operations resumed as normal.

The 180-ton steel cranes drove on the concrete surfaces and edge beam to load and off-load cargo as required.

To date, no repairs were required for any of the metakaolin-enriched concrete replacements.

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METAKAOLIN CASE STUDY: MELVILLE PLACE

200 residential units were built, which required a **100mm structural screed**, able to cure to **>30MPa strength**, with a **moisture content of below 2% in 48 hours**, so that vinyl-laminate flooring could be glued down.

These challenging design criteria were met with the replacement of **10% of our metakaolin** in the screed design. The **cement-to-sand ratio was set at 1:2**, and the final strength was determined at **33 MPa**.

All units were **completed with metakaolin** as part of the mixes.

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CONTACT US

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beautifull life building, 70-74 bree street
cape town, 8001, south africa
tel +27 (0) 21 424 5958
fax +27 (0) 86 612 4536
email enquiries@kaolin-group.com
web www.kaolin-group.com

kg-polymer compounds

7 louwtjie rothman street
atlantis industria, 7349, south africa
tel +27 (0) 21 424 5958
plant +27 (0) 21 577 2776
fax +27 (0) 86 612 4536
email enquiries@kg-polymercompounds.com
lab@kg-polymercompounds.com
web www.kg-polymercompounds.com

savio hagemann – managing director

cell +27 (0) 82 375 3349
email savio@kaolin-group.com
savio@kg-polymercompounds.com

petra wiese – director

cell +27 (0) 83 5000 800
email petra@kaolin-group.com
petra@kg-polymercompounds.com

piet schreuder – CFO

cell +27 (0) 72 216 2859
email piet@kaolin-group.com
piet@kg-polymercompounds.com

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THANK-YOU !