



Innovating the way to a resilient and sustainable supply of sand for concrete

 **KAYASAND**
engineering sand for construction



Kayasand plant & equipment offers a viable solution to New Zealand's growing demand for concrete sand

New Zealand still relies on a diminishing supply of natural sand to make concrete.

Technological innovation means there is a better way of obtaining sand and Kayasand is committed to making this technology available for the long-term benefit of New Zealanders, our environment and our construction industry.

There is a commercially viable, economical and sustainable alternative available to natural sand

Engineered sand. However, the biggest barrier to its widespread use is the belief natural sand is essential to make concrete and that it can't be replaced entirely with sand manufactured in quarries.

The reality is it can and our quarries already generate the raw materials needed to meet the growing demand for quality concrete, asphalt and construction sand. Our dependence on natural sand is now unnecessary.

Internationally, manufactured sand is already an accepted economical and commercially viable replacement for natural sand in construction. Good quality manufactured sand, like that engineered using Kayasand's innovative crushing and screening technology, is often better and costs less than some natural sand. It uses aggregate sourced from quarries such as crusher dust that can be made readily available.

Concrete is the world's most widely used building material. It's durable, versatile, fire-resistant, waterproof, and strong.

How the economics of engineered sand stack up

As an example, our sand plant in Waikato — one of our smaller V7 plants — is capable of processing 100,000 tonnes p.a. depending on the quarry. Our medium-sized plant produces about 300,000 tonnes per year and our biggest one is capable of producing 600,000 tonnes p.a. or more.

As a comparison, natural sand sales to the Auckland construction market are estimated to be a total of 720,000 tonnes p.a.

Assuming natural sand is blended with crusher dust at a 50 – 60% ratio, the total volume of crusher dust that needs to be processed into engineered sand to supply Auckland's construction industry is 1.2–1.4m tonnes per year.

Three Kayasand V7-120s and three V7-60s can produce enough engineered sand to replace all the concrete sand in Auckland at current concrete manufacturing rates. By 2030, we plan to have 30 of these plants operating in Australia and NZ.

There are some limitations on the availability of crusher dust. However, this is the case with many different aggregate sizes. In fact, quarries are already expanding production so more crusher dust becomes available to meet the growing demand for concrete sand. With this increased production there can be more than enough engineered sand made to supply the NZ construction industry.

Why engineered sand made using Kayasand equipment is so good

Concrete made using sand with our innovative crushing and screening technology flows better, finishes better and binds better with cement than natural sand. The result is stronger concrete with less cement compared to natural sand. For example, independent trials show that replacing the sand in a typical 40MPa concrete mix in Auckland with sand engineered on our equipment results in a 10% reduction in cement to achieve the same strength.

We achieve this by precisely controlling the four main characteristics of sand:



Shape



Size



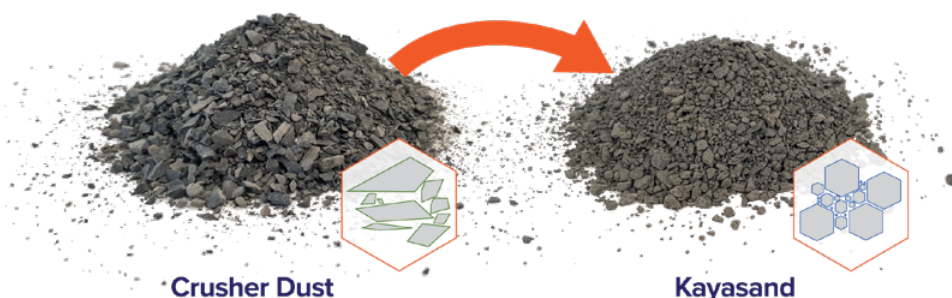
Contaminants



Consistency

Our one step process produces sand that is cuboidal in shape and graded to desired specifications first and every time. The levels of contaminants and fines in the finished product are controlled or removed, and there's no need to blend it afterwards.

Kayasand's engineering process provides superior results and contributes to the preservation of our precious natural resources for generations to come.





Kayasand technology is proven

The technology in our plants was developed 20 years ago because of a ban on dredging that severely disrupted concrete sand supply in Japan. Engineered sand from V7 plants is now routinely used in Japan as the only sand in concrete. As a result, dredging in Japan has dropped from 40 million m³ in 2000 to less than 7 million today. China now has over 240 of these V7 plants.

Australia has also started using the technology in NSW as growing restrictions on coastal sand mining have encouraged industry to look at, and adopt, alternatives.

Kayasand plants are a prudent financial investment

The payback period from commissioning a Kayasand plant can be between 2 to 3 years. This depends on variables like the amount of crusher dust being processed, filler byproduct made into saleable product, the local price of sand and how much we lower operating costs.

Our plants are low maintenance, self monitoring and able to operate unmanned with minimal oversight. We use of electronic reporting tools, advanced sensors and high-speed electronic control systems for diagnostics and early fault detection.

Quality componentry is used, spare parts are designed to be interchangeable, and long term support contracts are available.

Our plants are also designed for use in urban areas where noise and dust must be suppressed, and for quarries and processing facilities where space is limited.

Additionally, the traditional processing of sand for concrete often requires massive volumes of water that are expensive to clean up and generate huge amounts of sludge. Our process uses no water for washing aggregate, emits no dust and is typically lower cost to run. No tailings or sediment ponds to maintain, or depositing clays and silts back into environment.

Concrete sand engineered by Kayasand plant & equipment is more sustainable for the construction industry

The V7 sand plant was designed from the ground up to be economically and environmentally sustainable.

Every tonne of cement takes about 700-900kg of CO₂ to produce. Our goal is to engineer sand of such quality that it reduces these emissions by 20% for every cubic metre of concrete that cement is used in. For a typical 30MPa concrete mix design, that's about 60kg of cement saved per cubic meter of concrete.

For example, if all of Auckland's concrete was manufactured this way, concrete producers could save more than 50,000 tonnes carbon emissions each year.

Plus, our plants also turn waste into saleable products, creating a truly circular economy and further thereby reducing the industry's carbon footprint. Waste glass is recycled into premium concrete sand, old concrete is recycled into new concrete, and cement substitutes are created from limestone filler and waste slag.



High quality manufactured sands are proven to produce concrete of the highest quality, with higher strengths, durability, and consistency, enabling significant reductions in cementitious contents, costs, and carbon emissions. Kayasand V7 plants have been proven to engineer the highest quality manufactured sand with full control over particle shape, particle size distribution and consistency.



Mark Mackenzie,
Managing Director of Technicrete Pty Ltd

Mark is an accomplished concrete and aggregate technologist. Based in Australia for the last 23 years, he helps global construction companies enhance product quality and optimise processes.

In South Africa, he successfully developed processes for high-quality manufactured sands, leading to the replacement of 80-90% of natural sand in approximately 3 million m³ of concrete. This achievement was shared and implemented in various Holcim group companies. After relocating to Australia, he held the position of National Functional Manager — Technical at Hanson Australia and chaired the CCAA National Technical Committee. He made significant contributions to the review of AS1379-2007 and focused on enhancing industry skills. He also played a pivotal role in driving the development of standardised and structured training courses on concrete technology. Currently, his company Technicrete provides specialised technical consulting and advisory services.

The future
is here



Engineered sand facts

Engineered sand has been designed specifically for concrete.

- replaces natural sand
- reduces cement content
- increases strength

It is made with precision. Its shape, grading, contamination, moisture content and consistency tightly controlled to ensure a quality product every time.



Engineered sand vs manufactured sand

Engineered sand is a type of manufactured sand made to precise specifications. Its cuboidal shape, precise grading and consistency means it has less voids and is of better quality than manufactured sand.

The level of contaminants and fines in engineered sand is tightly controlled during the crushing process. As a result, it does not need blending with other sands before it can be used to make concrete.

It should not be confused with manufactured sand, and/or crusher dusts which often contain a high variability of waste products.

Common applications of engineered sand in the construction industry

Engineered sand can be used to replace all natural sands in almost all concrete mixes and products.

- **Ready mix.** Reduces the cost and improves the consistency and workability of the concrete in house slabs and foundations..
- **Precast.** Improves the flow and homogeneous particle distribution of the concrete in slabs and pipes, provides faster setting times and produces a better finish.
- **Asphalt.** Ensure consistency, predictability and performance of roading mixes. The impact of engineered sand on the environment

Engineered sand turns crusher dust, which in many areas is a waste byproduct, into valuable and value-added products to replace natural sands in concrete.

It makes a superior concrete from both a performance and durability perspective and reduces the cement content — a good thing as cement accounts for 8% of global emissions.

It also reduces our reliance on natural sand, preserving natural ecosystems for future generations.

Guidelines and standards for using engineered sand in construction in New Zealand

In New Zealand, the use of sand in construction is governed by various industry standards and guidelines. The primary organisation responsible for setting standards in construction is Standards New Zealand, a division of the Ministry of Business, Innovation and Employment.

Although there is no standard specifically for either manufactured or engineered sand, one important standard that might be applicable is NZS 3104:2003 "Concrete Production." This standard provides guidelines for concrete production, including aggregates such as sand. It specifies requirements for the quality and grading of aggregates used in concrete, including manufactured sand.

In addition to NZS 3104, other relevant standards or guidelines may include:

- NZS 3121:2005 "Specification for Aggregates from Natural Sources for Concrete."
- NZS 4407:2015 "Methods of Sampling and Testing Road Aggregates."
- NZS 3122:2009 "Specification for Aggregates from Natural Sources for Asphalt"

These standards provide specifications and testing methods for various types of aggregates, which may include engineered sand used in construction.

We design for the customer and build on the foundations of simplicity and durability in form, function and user experience.



The largest obstacle to replacing natural sand in concrete with engineered sand — the belief that man-made sand isn't as good quality as natural sand. This is a myth.

A new era in sand manufacturing

Plant & technology from specialists in fine aggregate crushing and screening

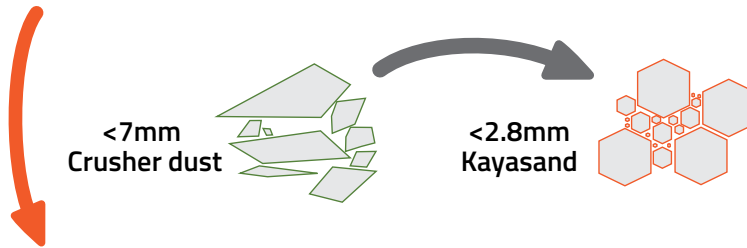
Innovation in crushing and screening that enables quarries to engineer a resilient supply of sand for construction.

A sand that binds better with cement, and flows and finishes better than natural sand in concrete.

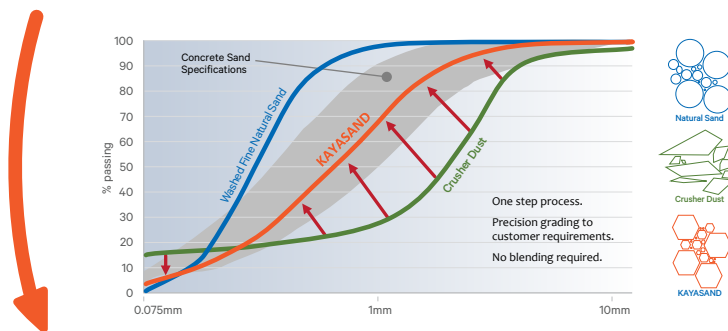
A process that conserves natural resources and makes the most of what's taken out of the ground: crusher dust, particles all passing, recycled glass and concrete, and slag.

The characteristics of sand are precisely controlled during processing

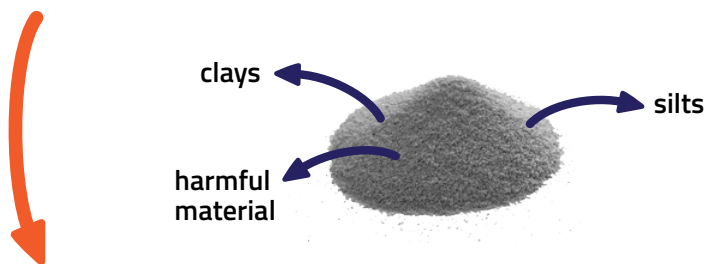
1 Shape



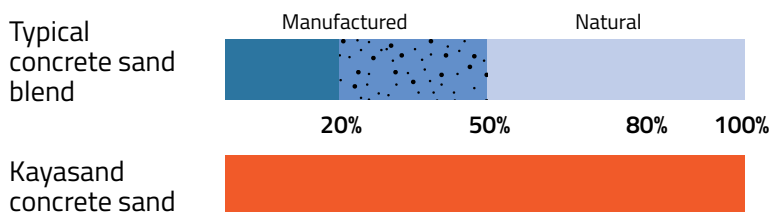
2 Grading



3 Contaminate removal




4 Consistency



Typical manufactured sand replaces up to 60% of natural sand.
Kayasand replaces 80-100% of natural sand.



A profitable one-step process for converting low value crusher dust into high value concrete sand.

 <p>Washes without water</p>	 <p>Dust free</p>	 <p>Accurate</p>
 <p>No operator required</p>	 <p>Compact footprint</p>	 <p>Low noise</p>
 <p>Low operating cost</p>	 <p>Versatile</p>	 <p>High throughput</p>

Make the ideal sand for any construction job from crusher dust and PAP.

V7 sand engineering plants

Precision engineering of high quality concrete sand

How they work

Crushing

The crusher's grinding impact action mimics natural erosion to create a cuboidal particle that is ideally shaped for strength and workability in concrete.

Screening

The combination of high accuracy screens with high throughput air classification ensures product is made to specification every time.

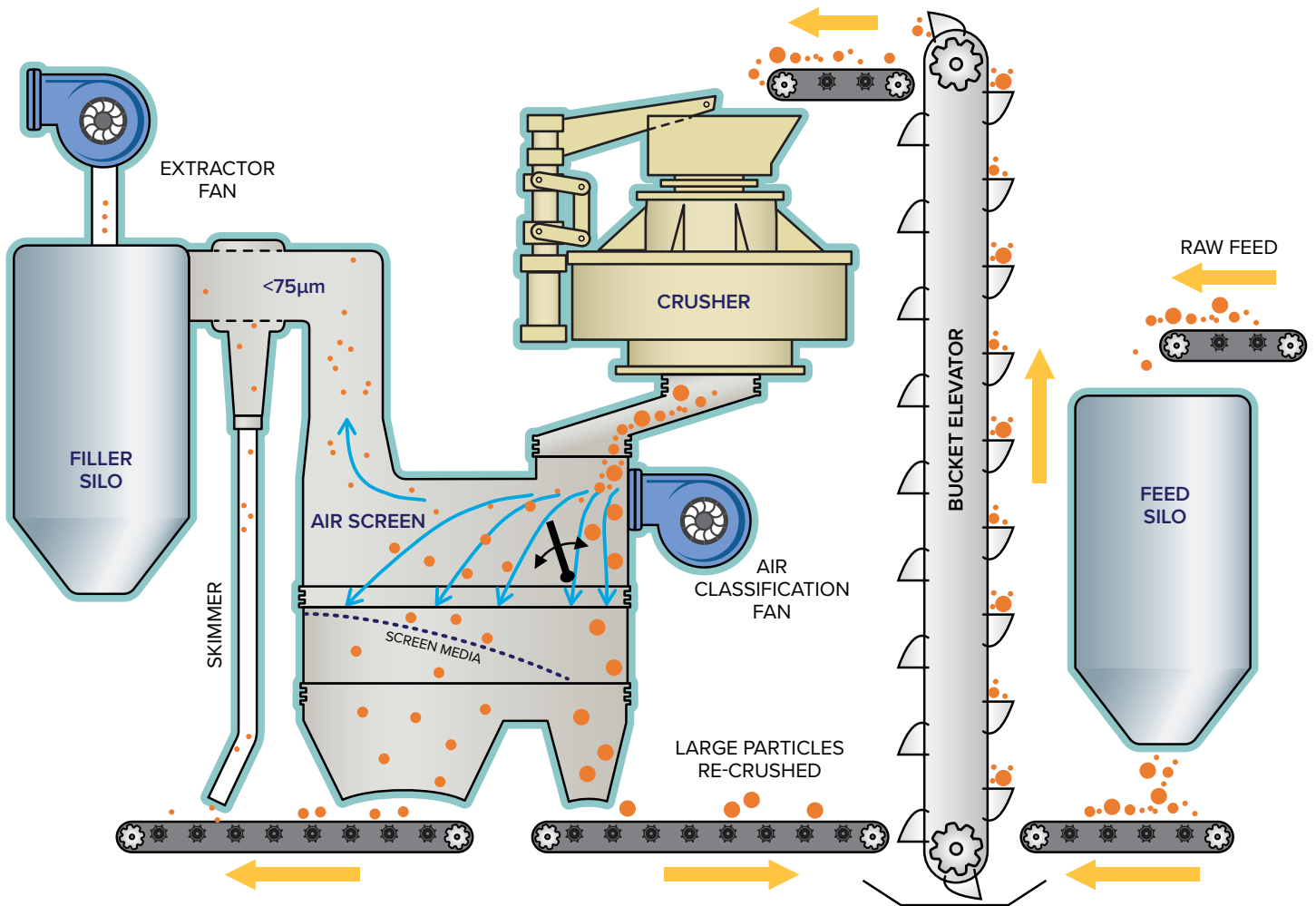
Conditioning

Water and skimmer material is blended into the final product to meet customer specifications, maximise concrete performance and to suppress dust on the stockpile.

Ultrafines collection & storage

Ultrafines are extracted and stored dry until they are needed to dose other quarry products or loaded out into trucks or tankers.





- Produces cuboidal particles right down to $75\mu\text{m}$ grain size
- The grading curve shape required, including at the ultrafine level (% passing $75\mu\text{m}$) is configurable through plant settings
- Produces a very consistent product, even with variations in the raw feed grading. A FM accuracy of ± 0.1 is typically achievable
- Less than 10mm feed size
- Maximises yield of 0.15mm to 0.6mm particles

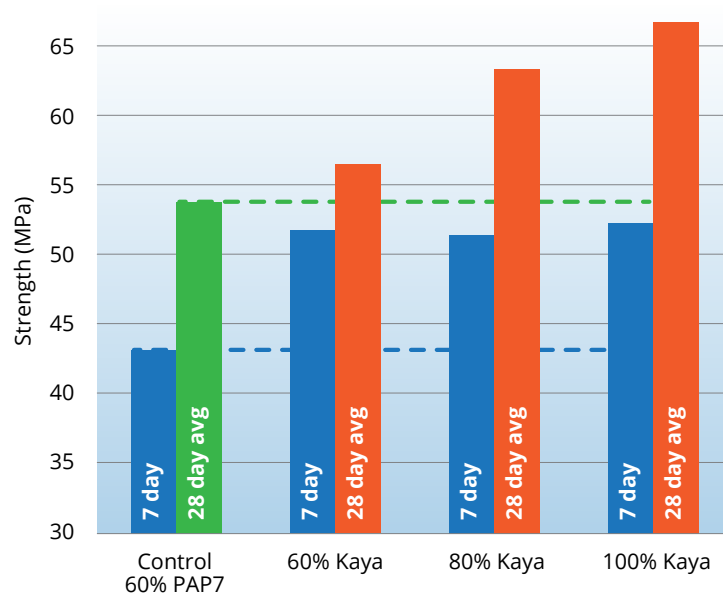


The evidence

A range of independent concrete experts across New Zealand and Australia have demonstrated Kayasands ability to increase concrete strength, reduce cement and replace natural sand.

Concrete trials by concrete experts in New Zealand using Kayasand in a normal Auckland mix design showed:

- 100% replacement of natural sand while maintaining workability.
- 24% strength increase using Kayasand.
- 10% cement savings still making stronger concrete than the control.

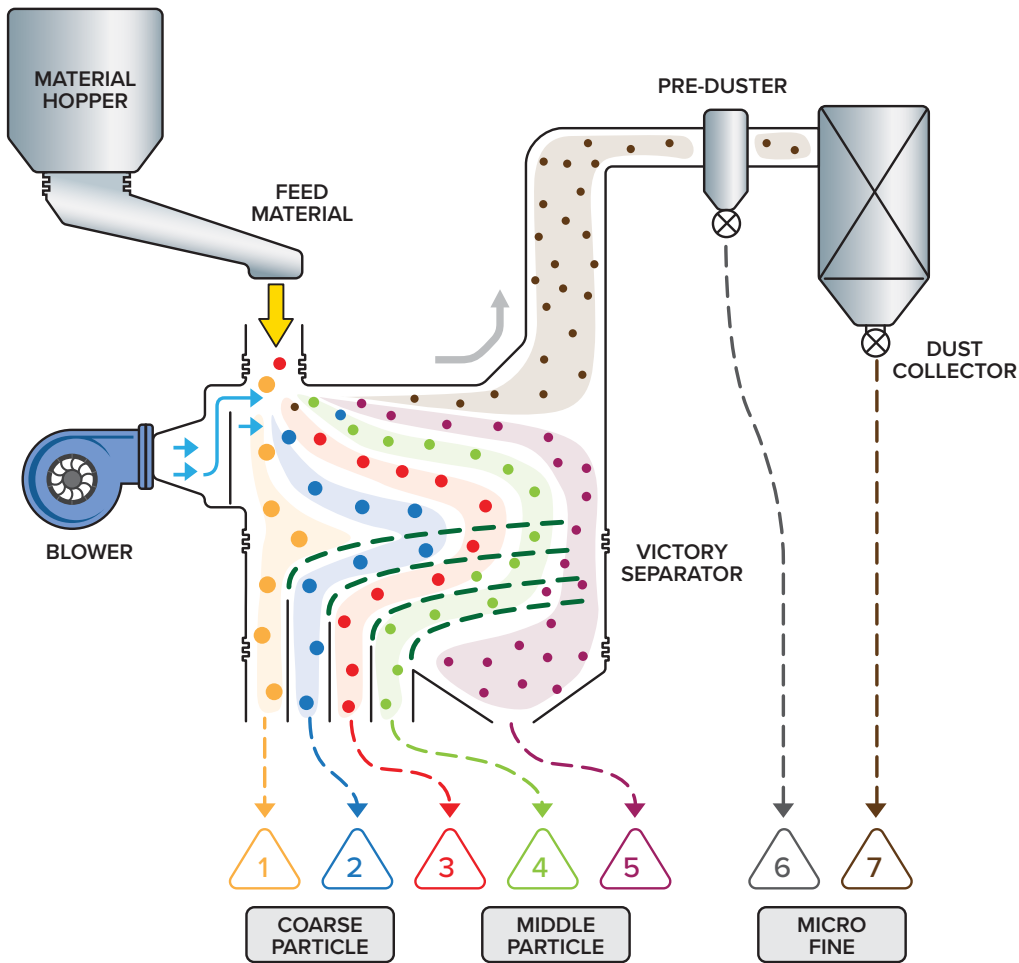


*Example using Kayasand in a normal Auckland mix design (Control)
by James Mackechnie.*

Independent concrete experts in Australia are also seeing excellent results replacing traditional manufactured sands with Kayasand in normal mix designs from Melbourne and Sydney.

- 9% strength increase using Kayasand made with Basalt rock replacing 100% of natural sand.
- 18% strength increase using Kayasand made from Hornfels rock replacing 80% of natural sand.

“Indications from 20-day strength results are that replacement of standard PAP7 with Kayasand products can produce a cementitious saving of at least 10% without compromising strength. The improved strength performance of concrete made with Kayasand appears to be a combination of reduced water demand and improved packing resulting in higher density.” — James Mackechnie, New Zealand concrete expert



RCAS quad-deck air screen systems

High throughput, precision screening of coarse and fine aggregates

Particle separation

Quad-deck air screens product accurately and consistently every time. Their unique design is the best of both worlds by combining the high accuracy of vibrating screens with the high throughput of dual-airflow classification systems. No Blinding.

Dry process

Uses no water for removing ultrafines, ideal for dedusting coarse aggregates and manufactured sand for use in concrete and asphalt.

Ultrafine collection & storage

Ultrafines are extracted and stored dry until they are needed to dose other quarry products or loaded out into trucks or tankers.



- Ultrafine levels in finished product are precisely controlled with a high degree of accuracy down to 0.075mm
- Options for up to 7 different product fractions simultaneously, ranging from 40mm to <0.075mm
- 2x – 10x the processing rate of conventional screens, especially in high ultrafines product, and without blinding



20mm



10mm



2.4-1.2mm



0.6-0.3mm

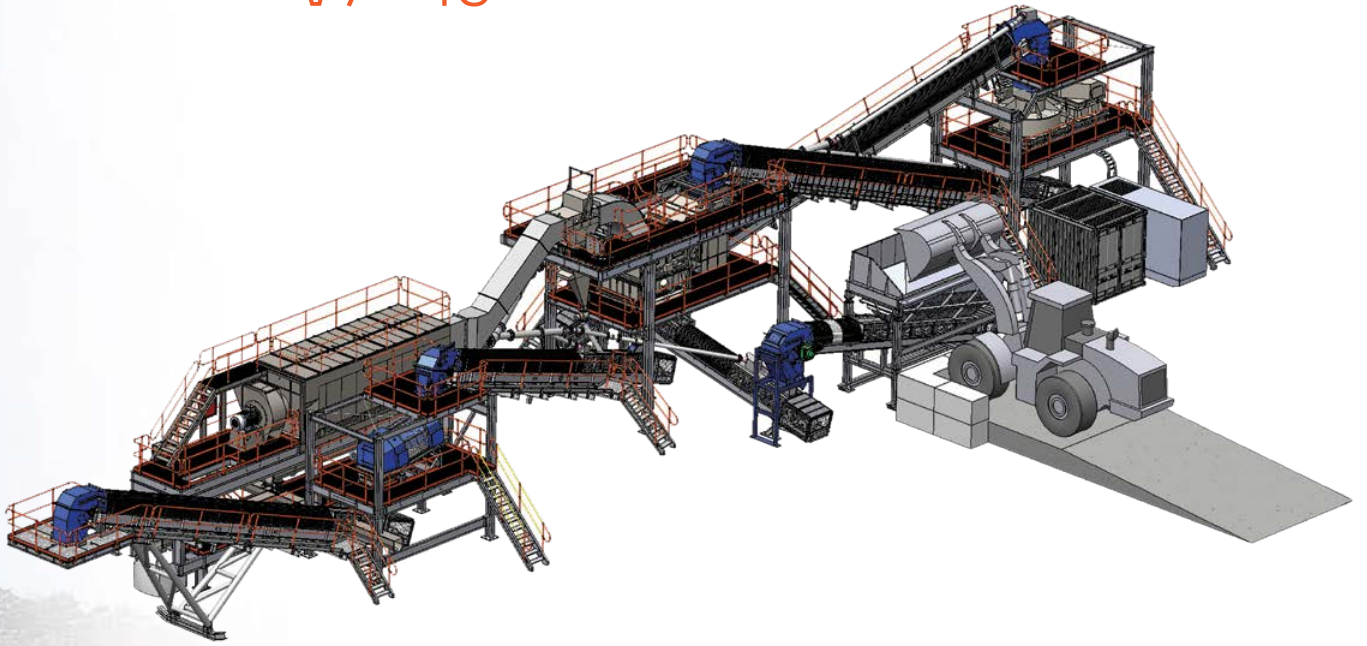


0.15-0.075mm

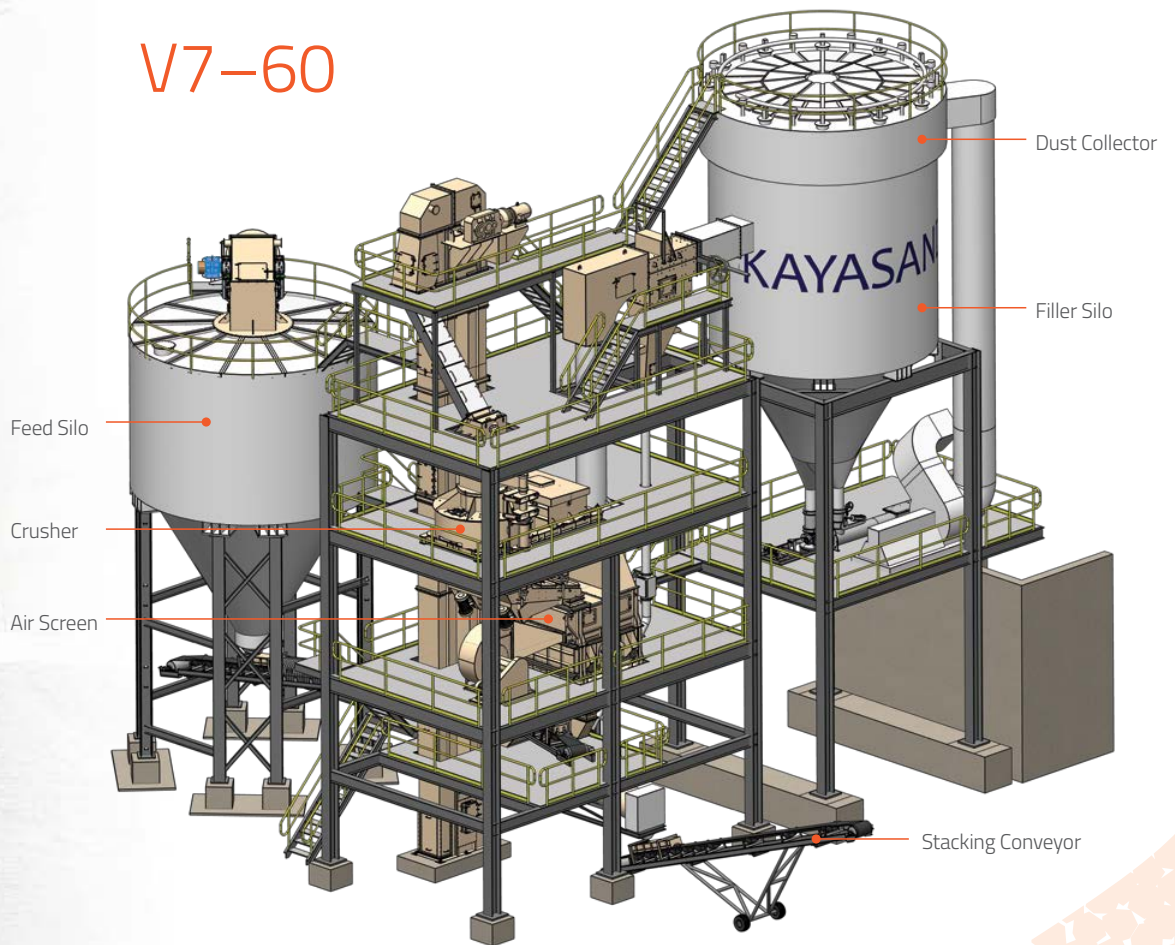
Plant configurations



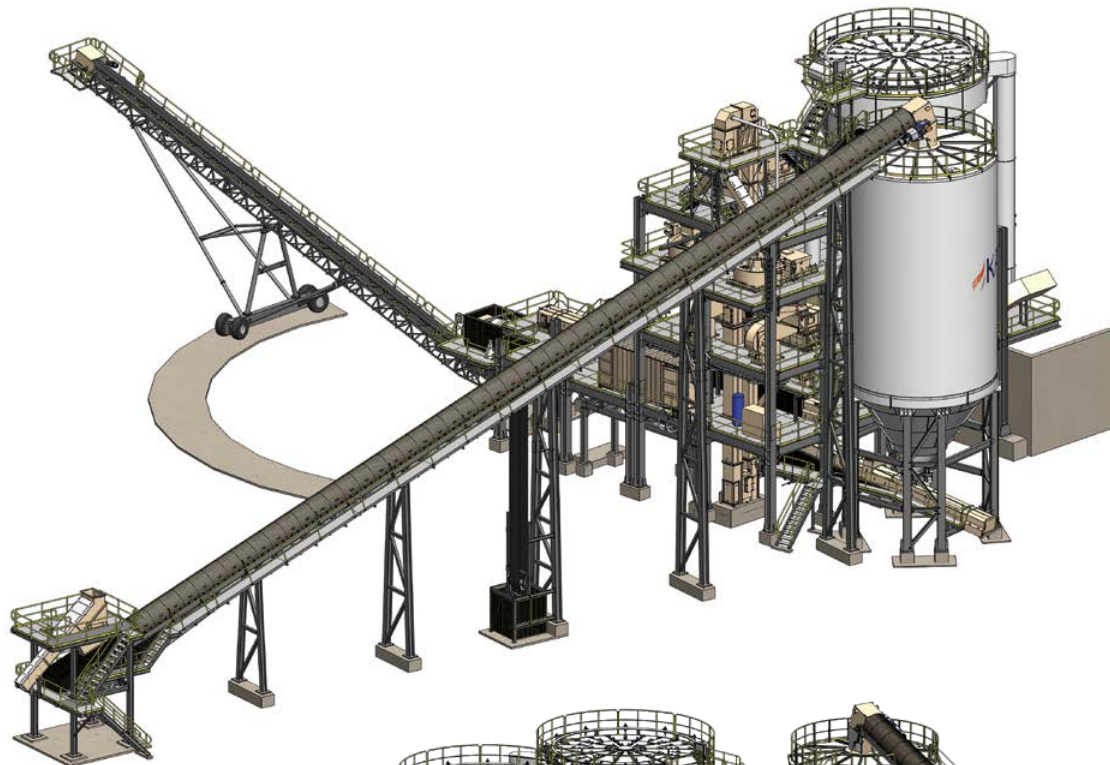
V7-40



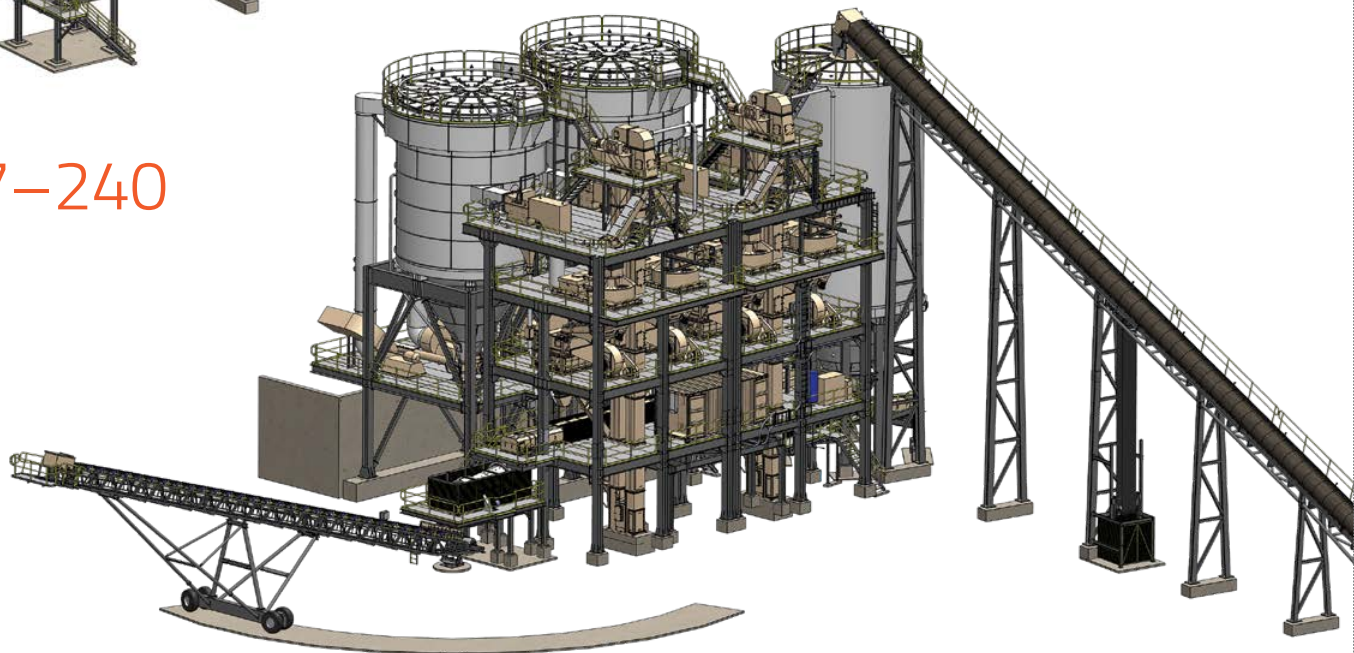
V7-60



V7-120



V7-240



V7 Sand plant specifications	V7-40	V7-60	V7-120	V7-240
Processing capacity (TPH)	40	60	120	240
Power usage (kW normal)	290	380	760	1520
Power usage (kW peak)	450	550	1000	1900

V'Sepa screen specifications	RCAS 900	RCAS 1200	RCAS 1900	RCAS 2500
Power (kw)	40	55	65	95
Capacity (tph)	90	120	190	250
Height (m)	4.5	4.8	5.0	5.4
Width (m)	1.1	1.4	1.8	2.7

AU/NZ standards compliant for structural, mechanical & electrical design.
Australian Mines Department compliant.

About Kayasand

Kayasand are designers and builders of specialist plant for fine aggregate processing.

Our unique and innovative technology maximises quarry yields, reduces the construction industry's dependence on natural sand and provides sand supply chain resiliency.

Sand engineered using our plants makes stronger, more durable concrete. Our goal is to use manufactured sand to reduce cement in concrete by 20% while maintaining good workability and finish.



Engineered sand has the potential to save concrete producers 6,000 tonnes of carbon emissions each year and significantly contributes to the industry achieving their carbon emissions targets by 2050.

A history of innovation

New Zealand has a history of developing world leading technologies for fine aggregate production. In the 1970s the Barmac VSI crusher was invented by New Zealanders Jim MacDonald and Brian Bartley. These are now commonplace in quarries around the world.

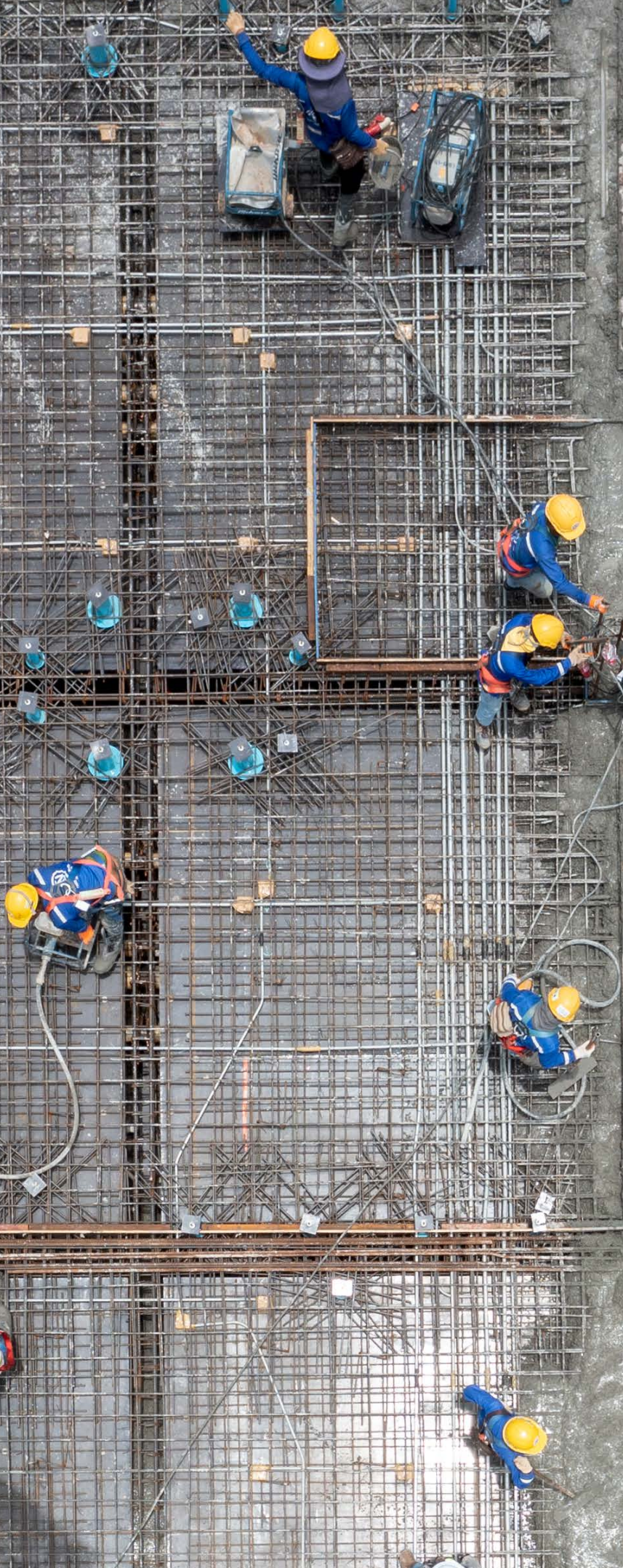
In the early 2000s, Kayasand's founder, Andi Lusty became aware of V7 crushing technology developed by Kemco in Japan. Andi immediately understood the impact it would have — he had been the managing director of companies selling Barmac VSIs for over 30 years.

Seeing the growing need for an alternative to natural sand and inspired by what he had witnessed, he founded Kayasand, named in honour of Kemco's chief engineer, Doctor Kaya.

Andi raised capital and was joined on the board by experienced investors Andrew Turnbull and Chris Sattler. Together, they set out to change the face of engineered sand in Australia and New Zealand and create a more environmentally sustainable construction industry.

In 2023, Kayasand received \$3.5 million backing from New Zealand Green Investment Finance (NZGIF) and a further \$1.8 million of private investment, to help deliver its services to the construction sector and to support its environmental and commercial aspirations. NZGIF is a Crown-owned green investment bank established to accelerate investment that helps reduce greenhouse gas emissions in New Zealand.





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