



KAYASAND
Quality sand made sustainable

**Washing
without water**

**A new era in sand
manufacturing**

19 July 2024



Washing aggregates with water – Is it the only way?

- Large volumes of water
- Lots of space for ponds
- Treatment costs
- Difficult waste disposal



Innovative dry screening technology



Over 300 plants across Japan and China

- **Washing without water**
Cleaning aggregates without using water.
- **Precise quality control**
Accurate control of 75-300 μ m product size fractions.
- **Utilisation of byproduct**
Ultrafines collected dry & blended into other products for precise 75 μ m targets.
- **No dust emissions**
Operates under a negative pressure giving off no dust.



Developed by
Kemco in Japan

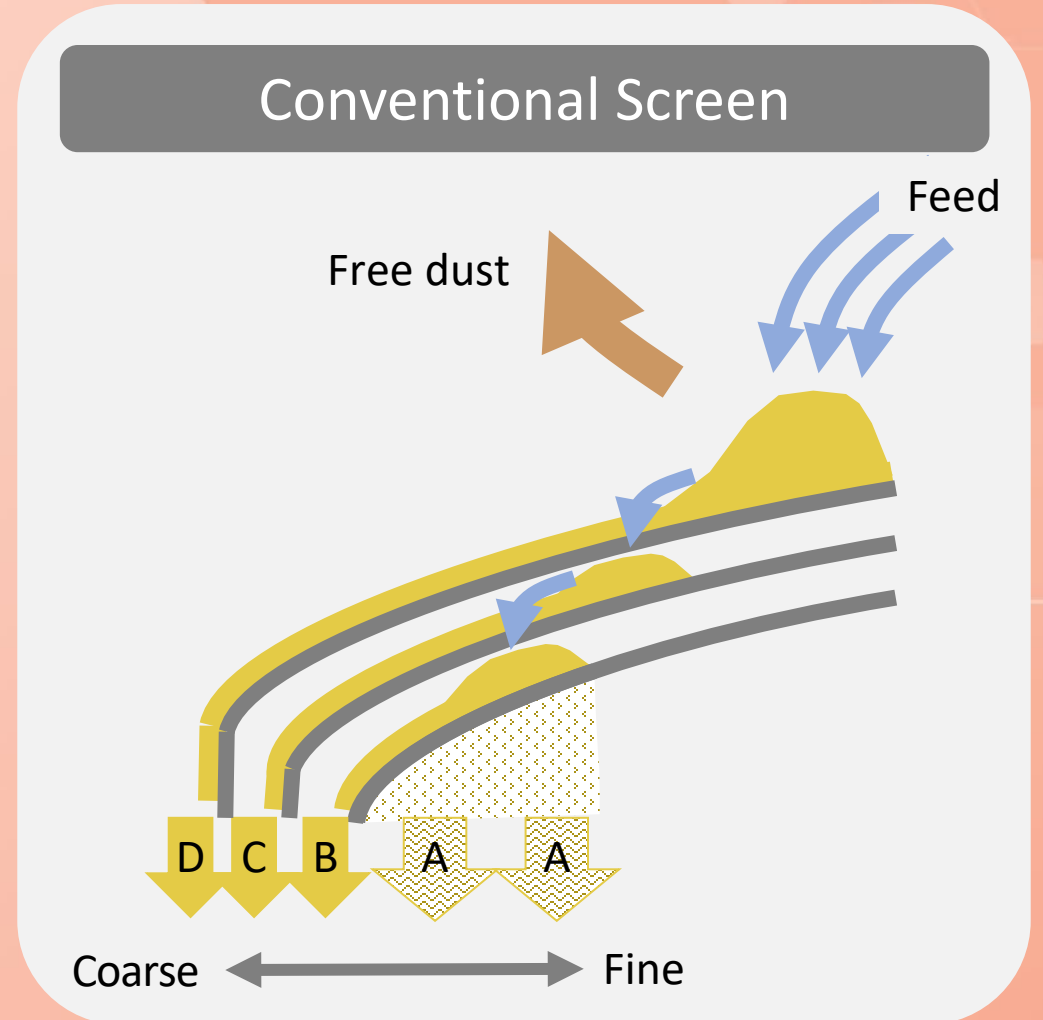
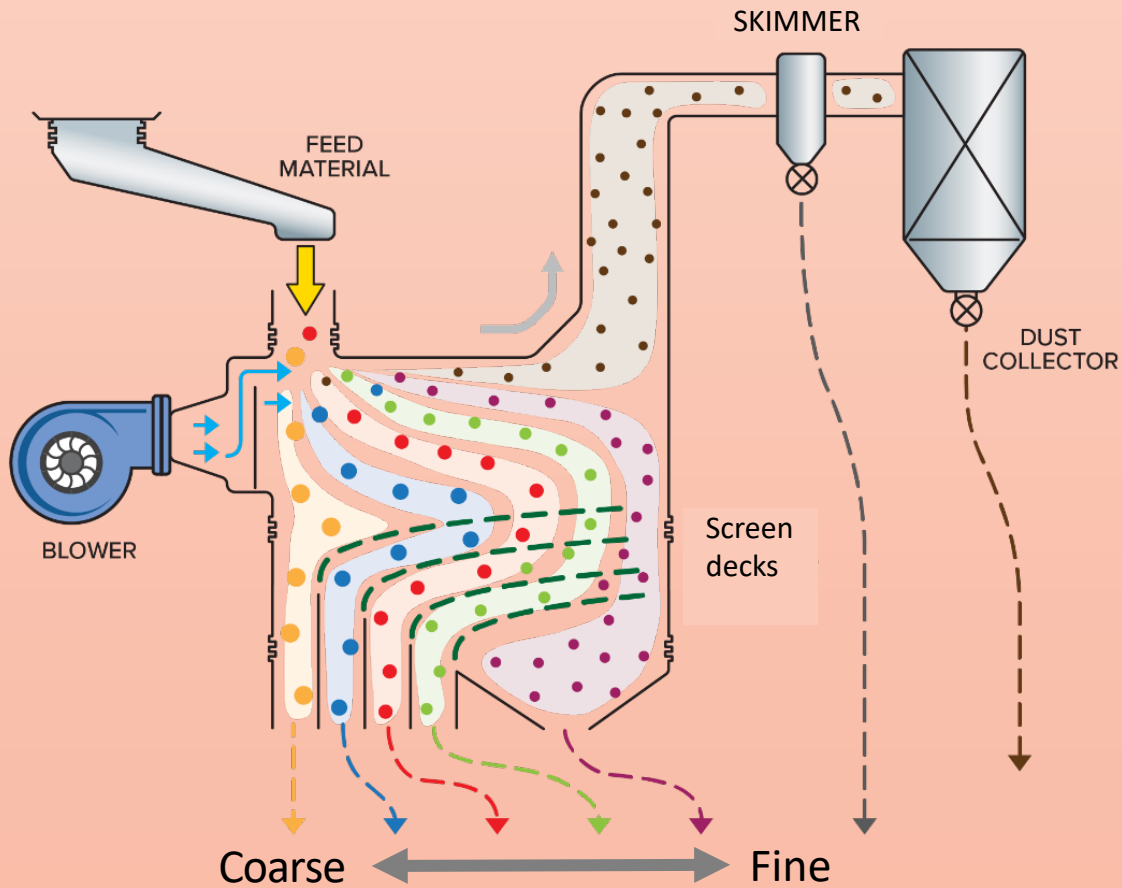


Combines the benefits of two technologies



The **throughput** of an air classification

The **accuracy** of screening

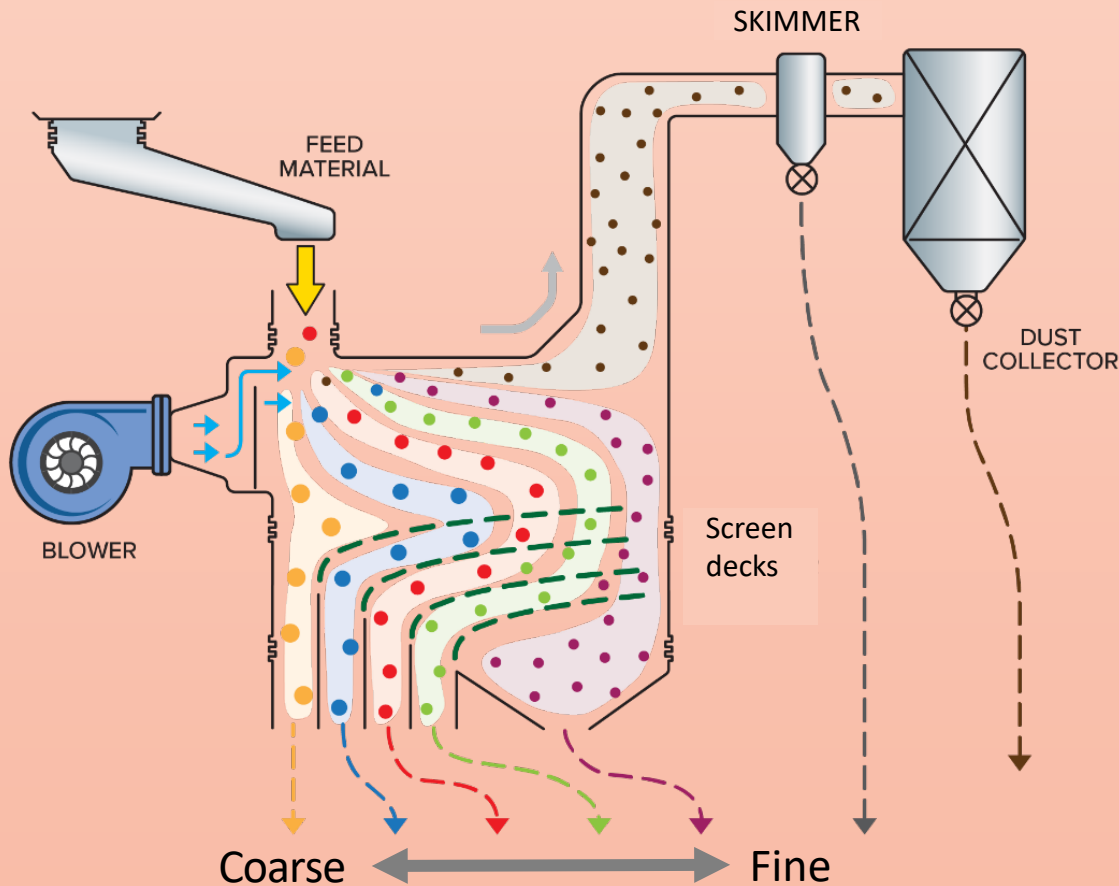


Combines the benefits of two technologies

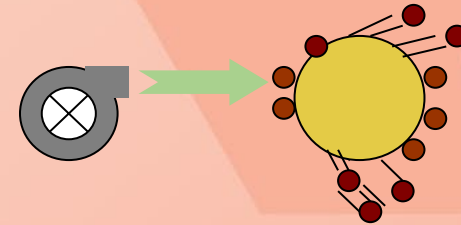


The **throughput** of an air classification

The **accuracy** of screening



- Aggregate passes through an “air-curtain”, liberating ultrafines.



- Ultrafines extracted to dust collector before hitting the screen mesh.
- Skimmer extracts 150-300 μ m particles from ultrafines.
- Benefits

Throughput – Accuracy - Control

Two dry screening technology applications



- Engineered sand for concrete
- Dry screening of coarse aggregates

Enabling quality aggregate production without water.



Problem - Global demand for concrete is growing... so is the environmental impact

Substantial
carbon
emissions

8% of the world's emissions from
cement production.

Sand supply
challenges

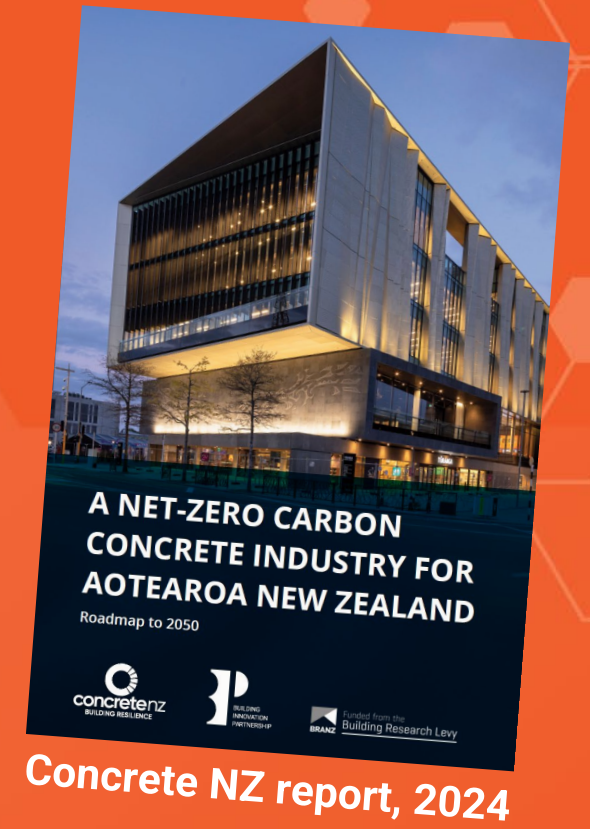
20b tonnes p.a. of sand used globally.

High water
demand

Washing aggregates & sand requires
high volume water supply & processing



*Sand is the second most consumed natural
resource in the world behind water.*



Our goal: Precision Engineered Sand for concrete



Concrete without natural sand

Quality engineered sand alternative to natural sand in building materials.



Decarbonising concrete

Stronger concrete with less cement.



Washing without water

Dry process that does not produce sludge or give off dust.



Utilisation of byproducts

Maximising utilisation of crusher dust and filler.



Increase profitability

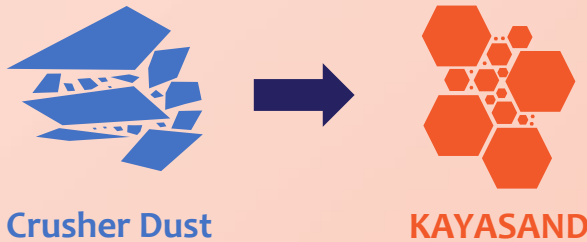
Premium product with reduced operating costs, reduced cement costs and higher product utilisation.



What makes quality Engineered Sand?



1) Shape optimisation

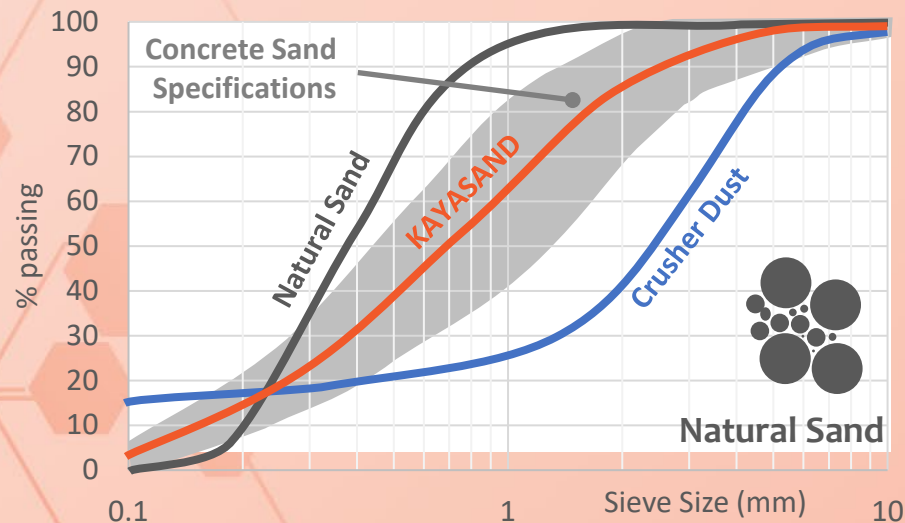


3) Contamination removed



Deleterious material, clays & silts removed dry

2) Sizing precision



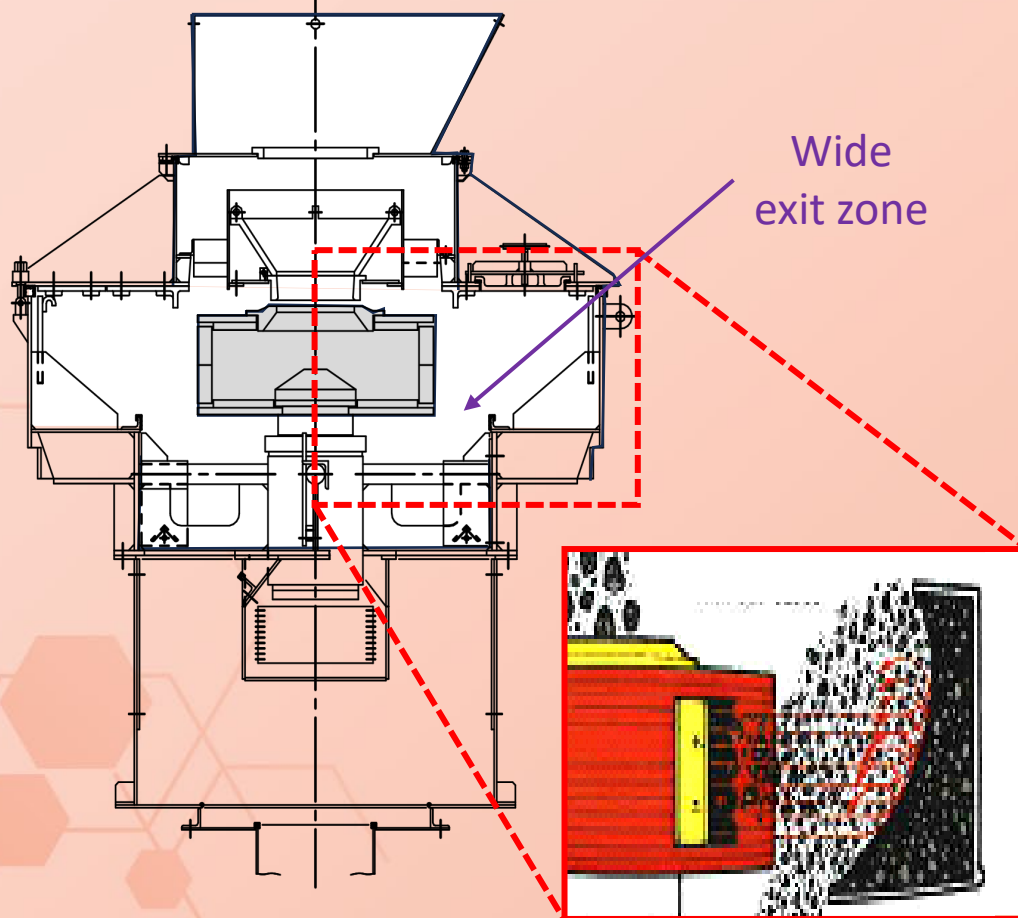
4) Consistent product

Our goals:

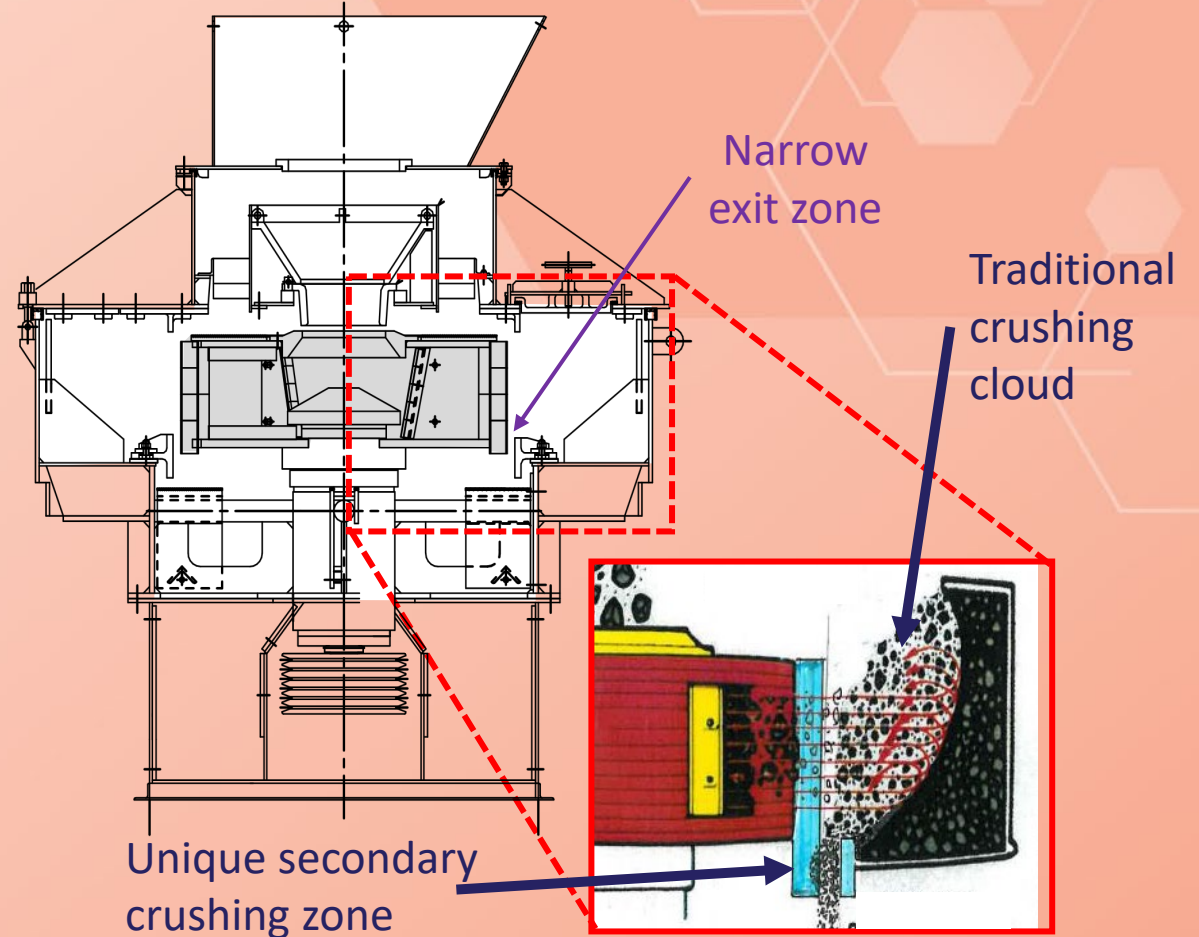
- Enable replacement of all natural sand in concrete.
- 20% cement savings

Kemco VSI versus Traditional VSI

Traditional VSI
<55mm feed



Kemco VSI
<10mm feed

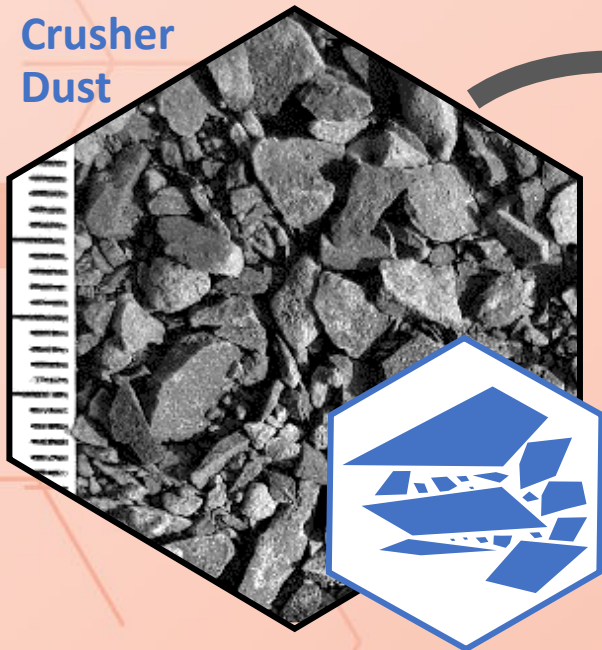


Kemco VSI – Specialist fine aggregate crusher KAYASAND

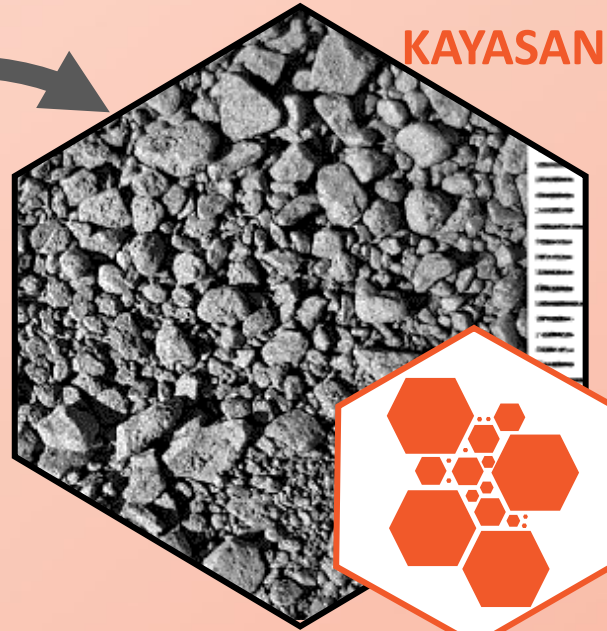
Unique secondary impact zone:

- Twice the reduction ratio
- Much lower wear
- Significantly lifts 300µm particles for better concrete packing & strength.
- Excellent shaping to maximise workability.

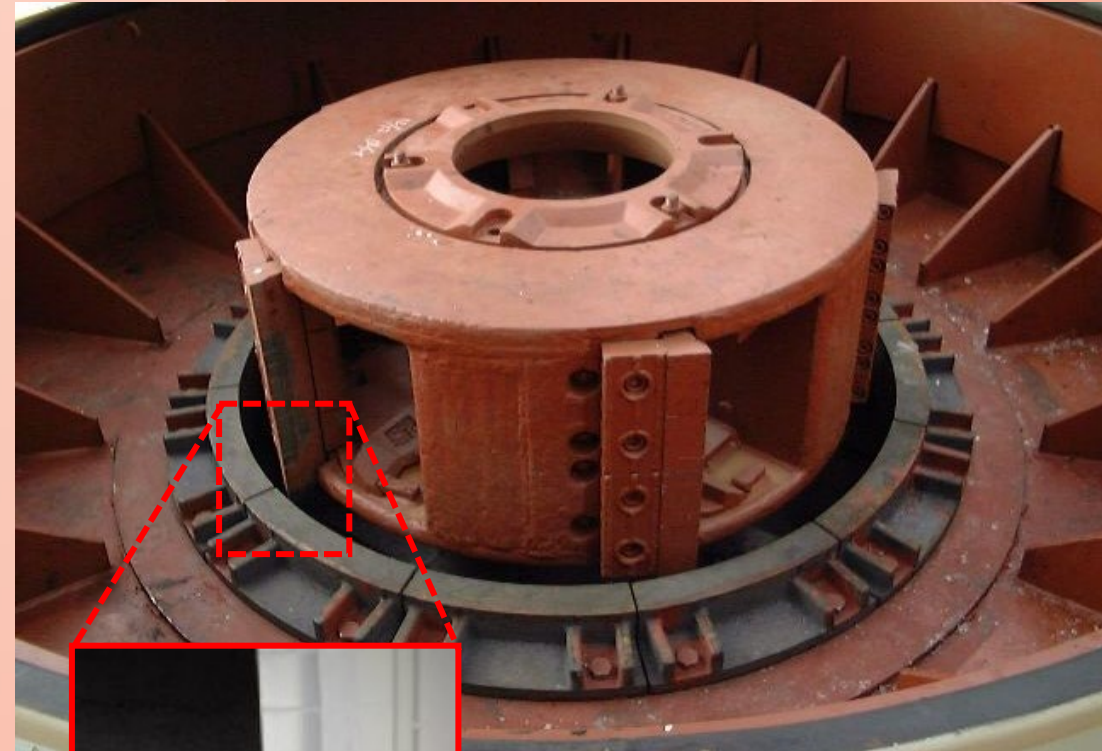
Crusher
Dust



KAYASAND

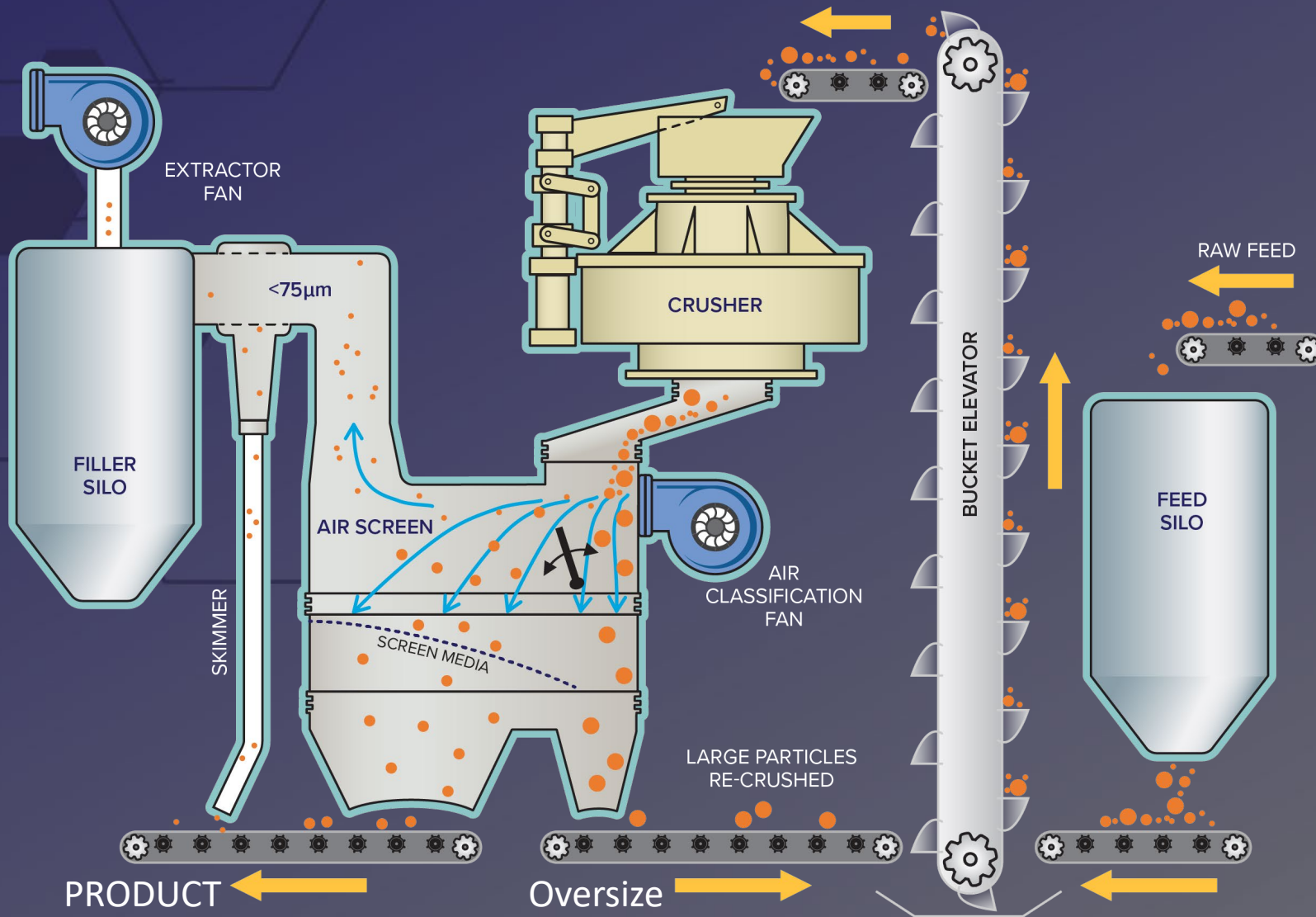


CONFIDENTIAL



Unique secondary
crushing zone

V7 engineered sand plant configuration



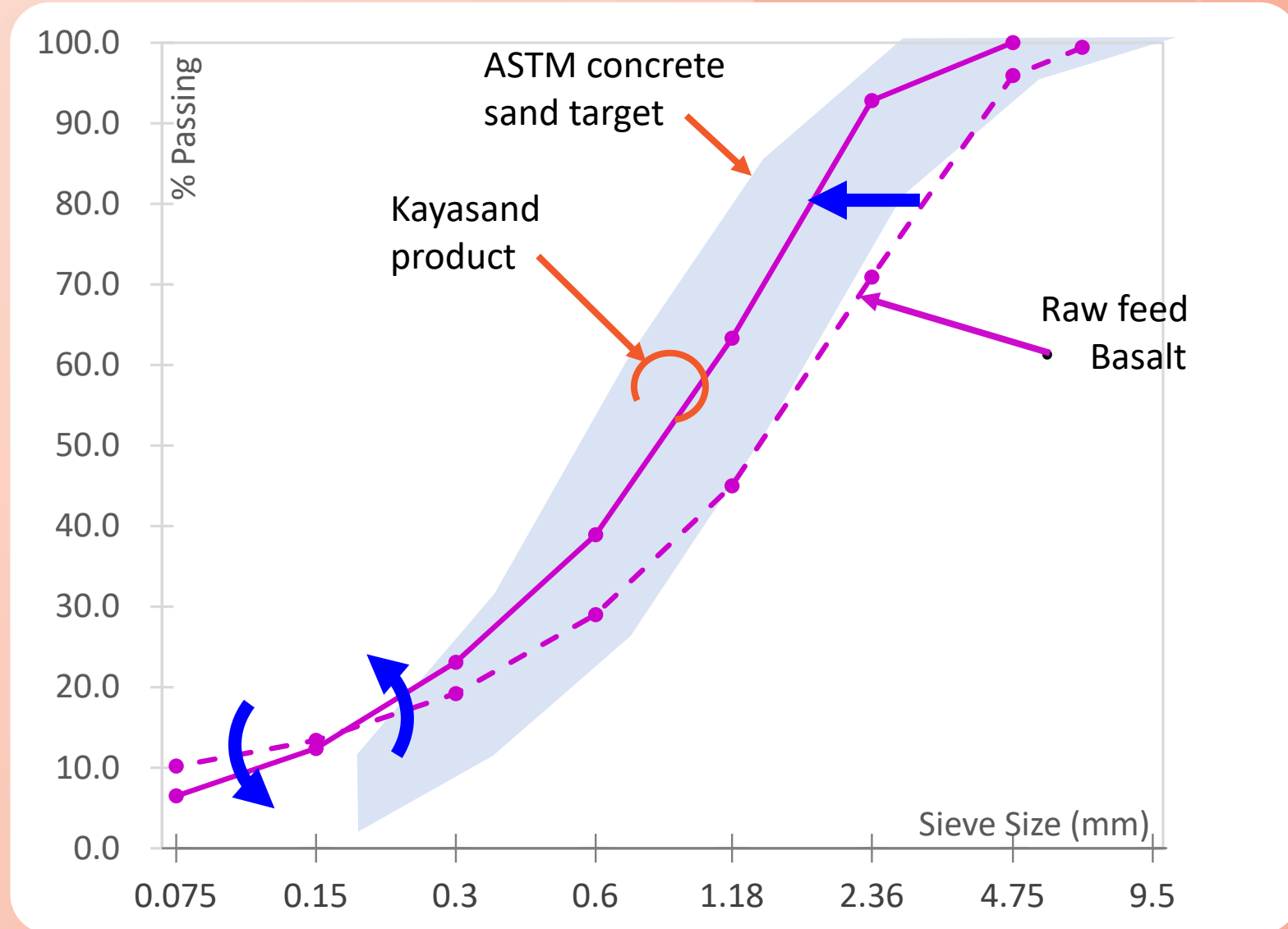
- **Blower and deflector plate** control recirculation to optimise crusher load.
- **Dust collector** extracts ultrafines to control contamination.
- **Skimmer controls** 150-300µm particles in the product.
- **Single deck screen** controls fineness modulus (FM).

Product grading optimised for concrete



Typical objectives:

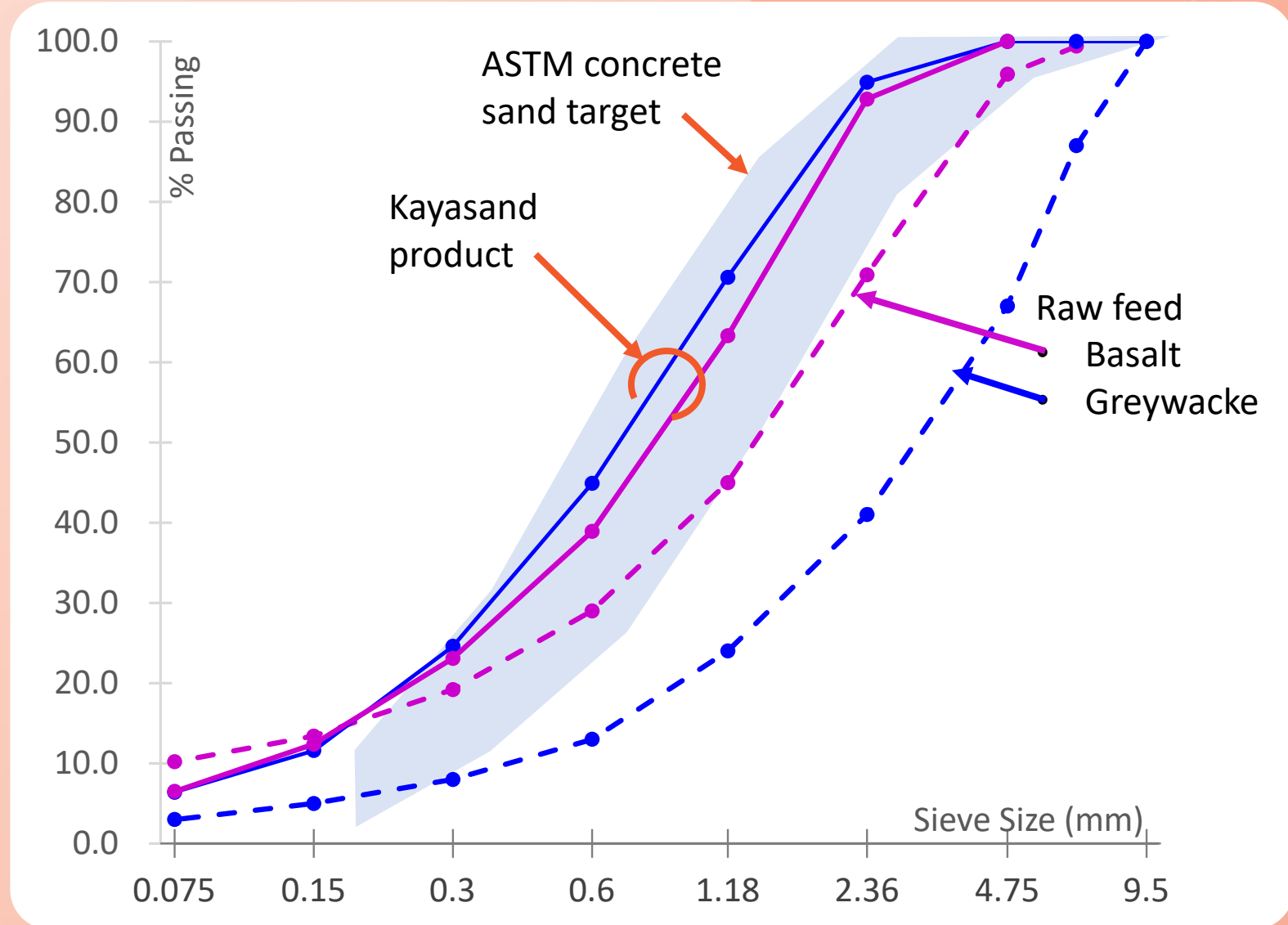
- Reduce toptsize.
- Increase passing 0.3mm
- Control passing 0.075mm



Works on a range of raw materials



Feed size
($<10\text{mm}$)
doesn't matter



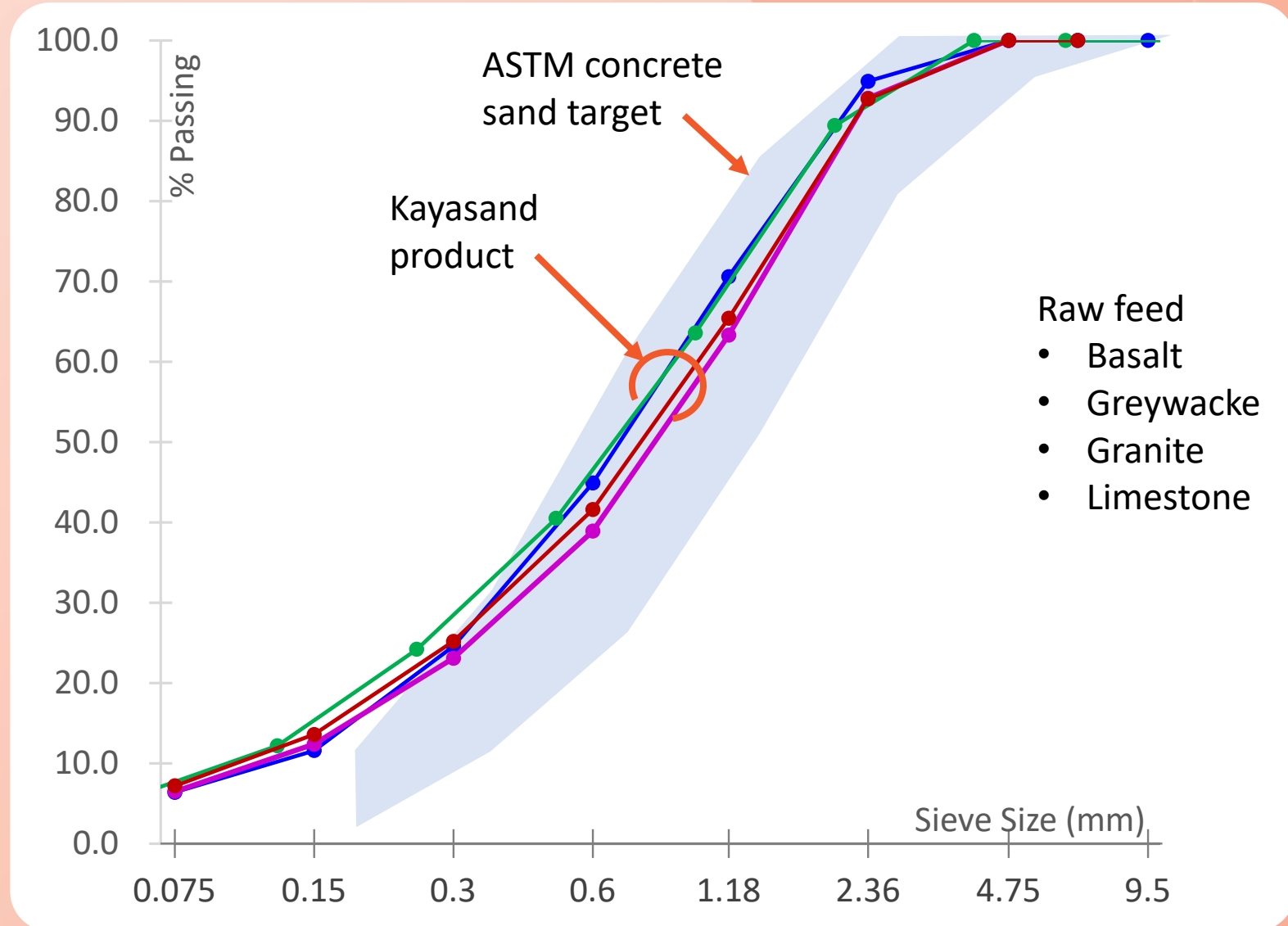
Works on a range of raw materials



Feed size
($<10\text{mm}$)
doesn't matter

Feed filler level
doesn't matter

Rock type
doesn't matter

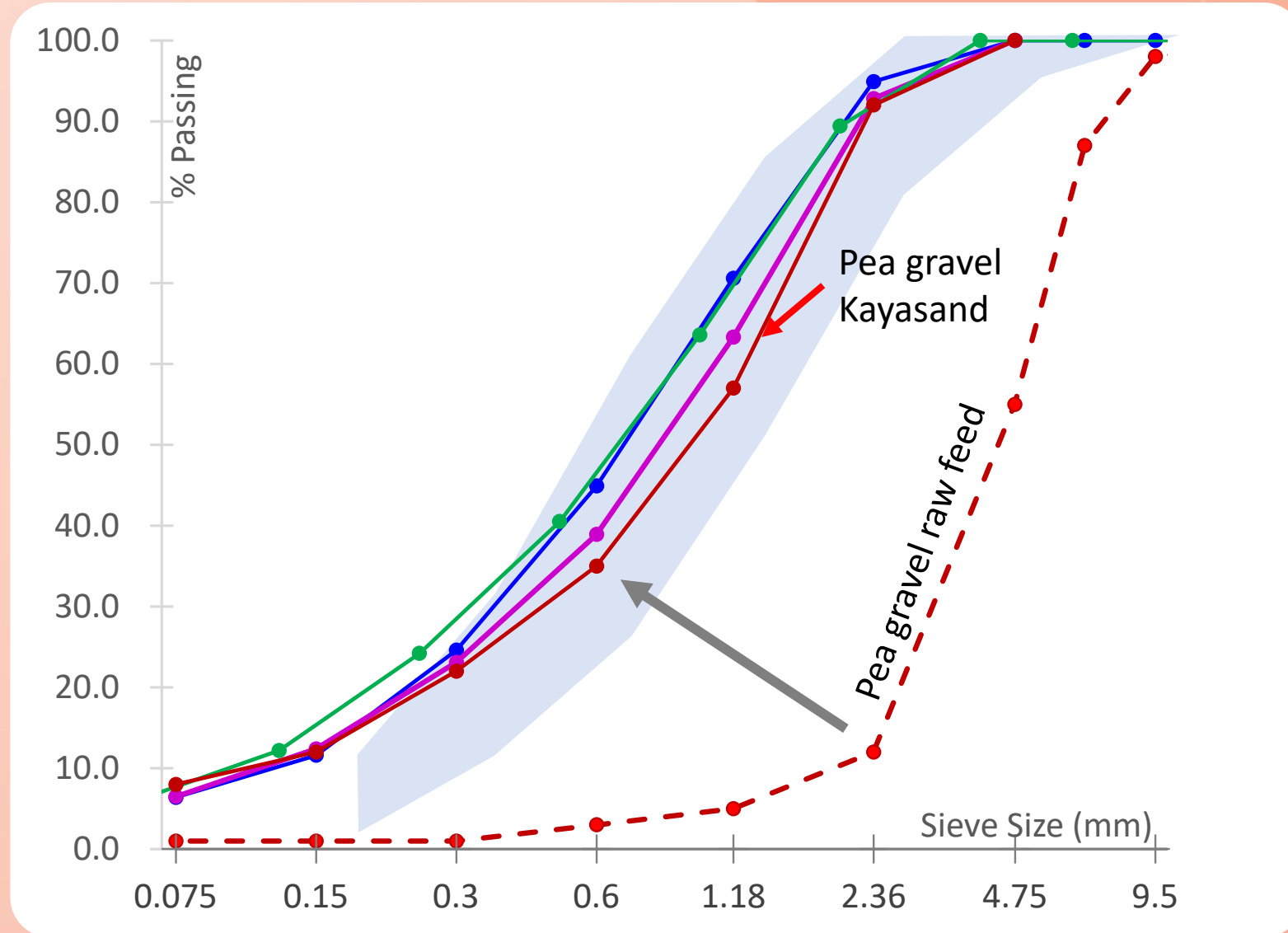


- Raw feed
- Basalt
 - Greywacke
 - Granite
 - Limestone

We've even "cracked" Pea Gravel



Pea gravel
raw feed



V7-60 plant at Holcim Albion Park Quarry (NSW)

Bucket
elevator

Dust
collector

Crusher

Filler silo

Air
screen

Product stacker

Feed
silo

Sand
conditioner



Air screen with no dust emissions

Dust extracted, no emissions.

Material blown onto screen mesh



Skimmer returns 0.15-0.6mm particles

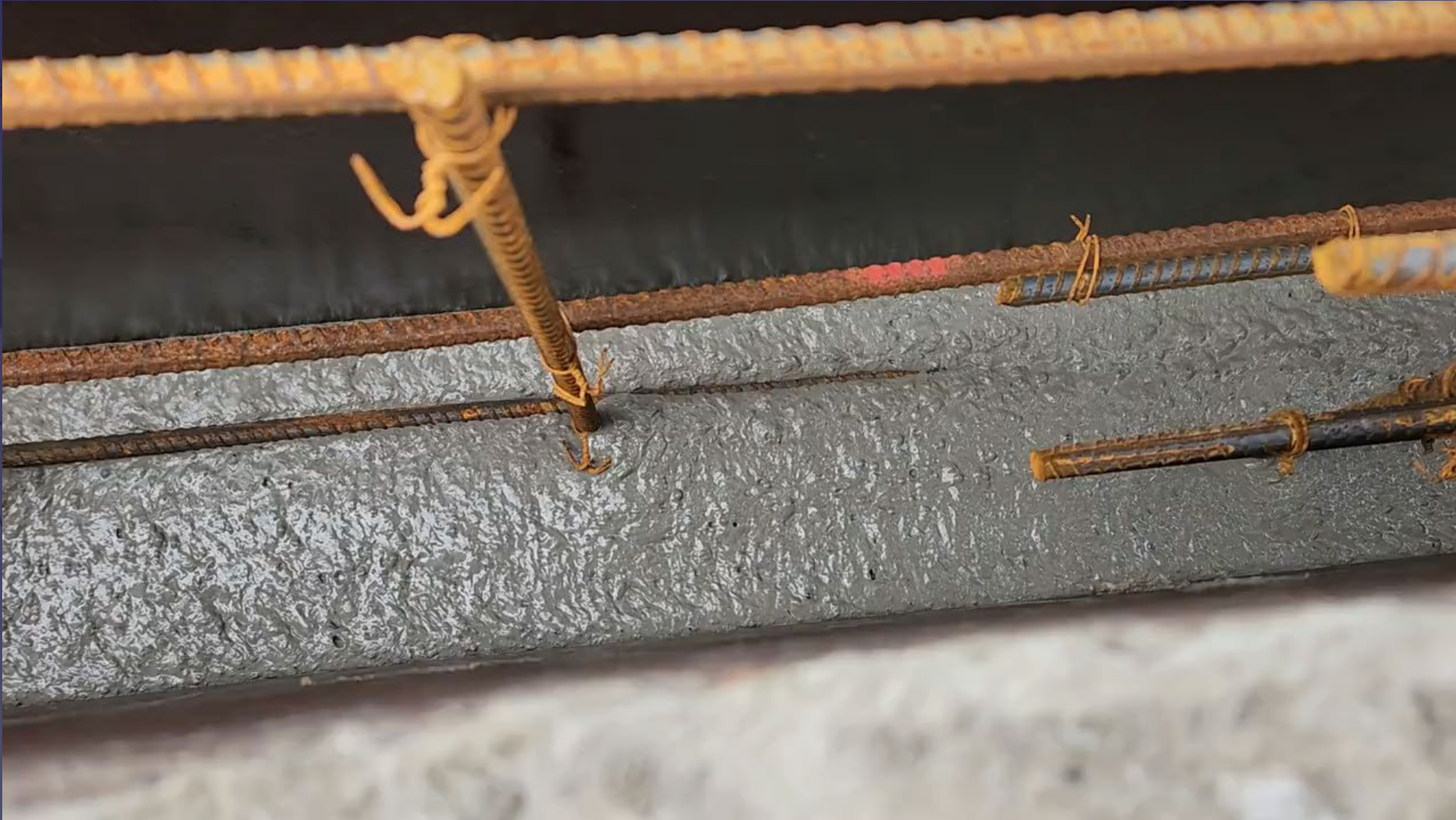


Concrete guys
love this stuff!

Makes concrete
creamy, finish
well.

Increases
compaction to
maximise
strength.

Excellent flow (precast example)



Entrainment

Flow

Past

Engineered Sand concrete trial success

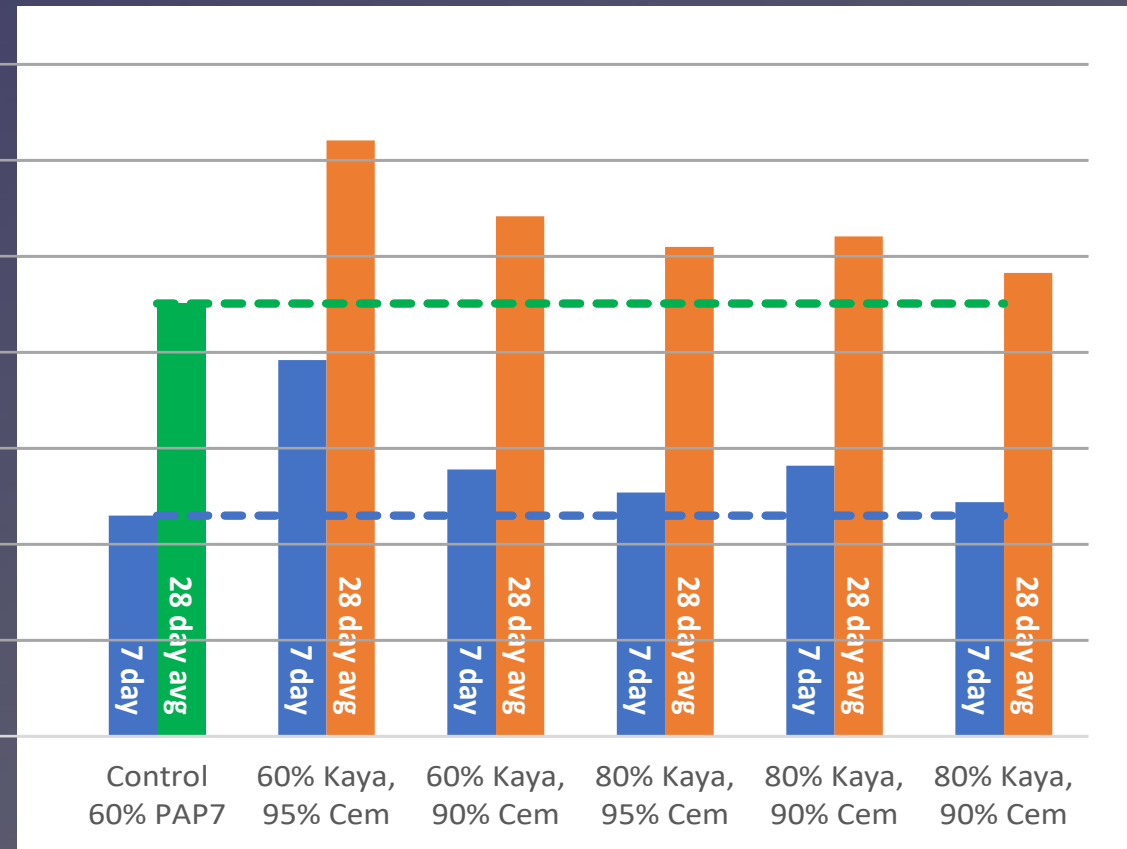
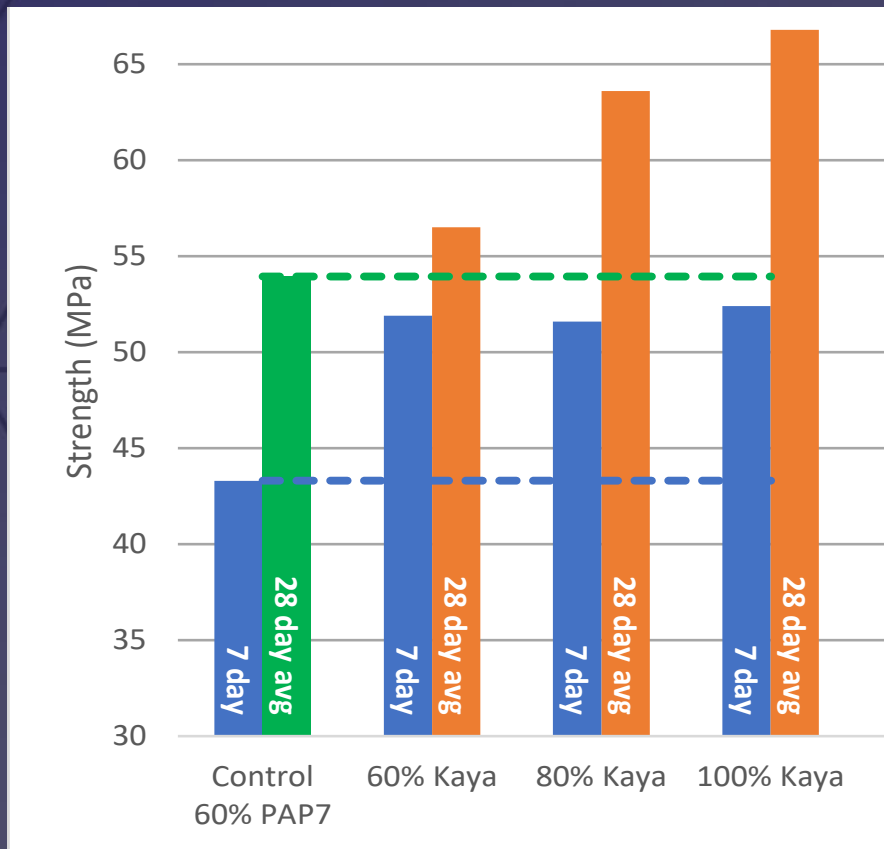


100% natural sand replacement

10% cement savings

24% strength increase

Still stronger



Independent concrete trials by James Mackechnie using typical Auckland mix design as control

Kayasand V7 sand plant – Benefits

For Quarries

Higher crusher dust sales	2-3x more sales for same concrete volume
Washing without water	No cleaning settling ponds & sludge disposal.
Byproduct utilisation	Dry filler can be blended & sold.
No dust emissions	Plant operates under negative pressure.
Autonomous operation	24hr/day operation potential, no operator.
Low operating cost	Cheaper to run the washing system

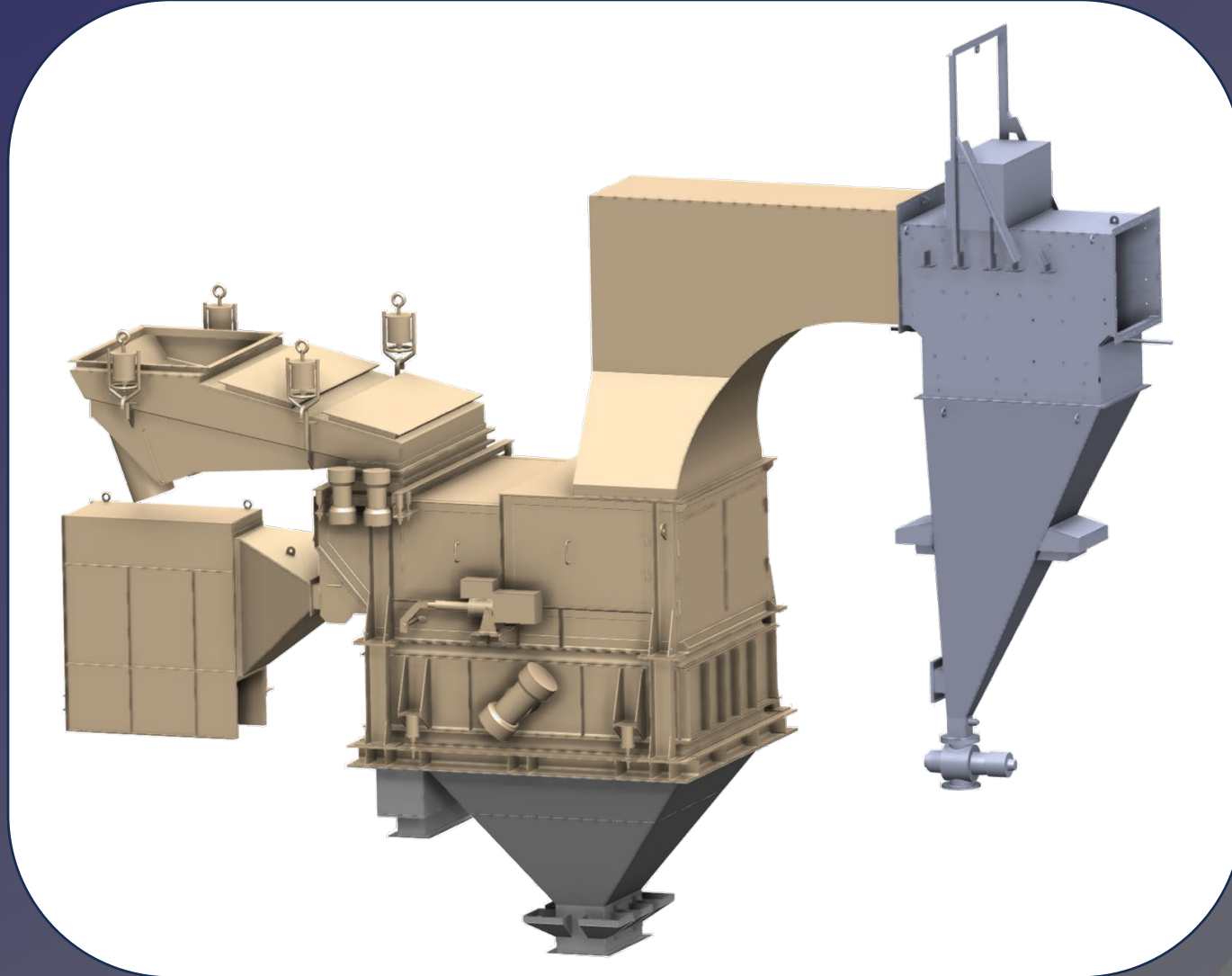
Typically 2-3 year payback.

For Concrete

Replace natural sand	Reduce or eliminate natural sand.
Reduced cement	Over 10% cement savings (20-40kg/m ³ , \$5-\$10/m³)
Reduced emissions	36 kgCO ₂ e/m ³ emissions savings (12,000tCO₂e/yr)
Reduced freight	Quarries often closer to concrete plants.



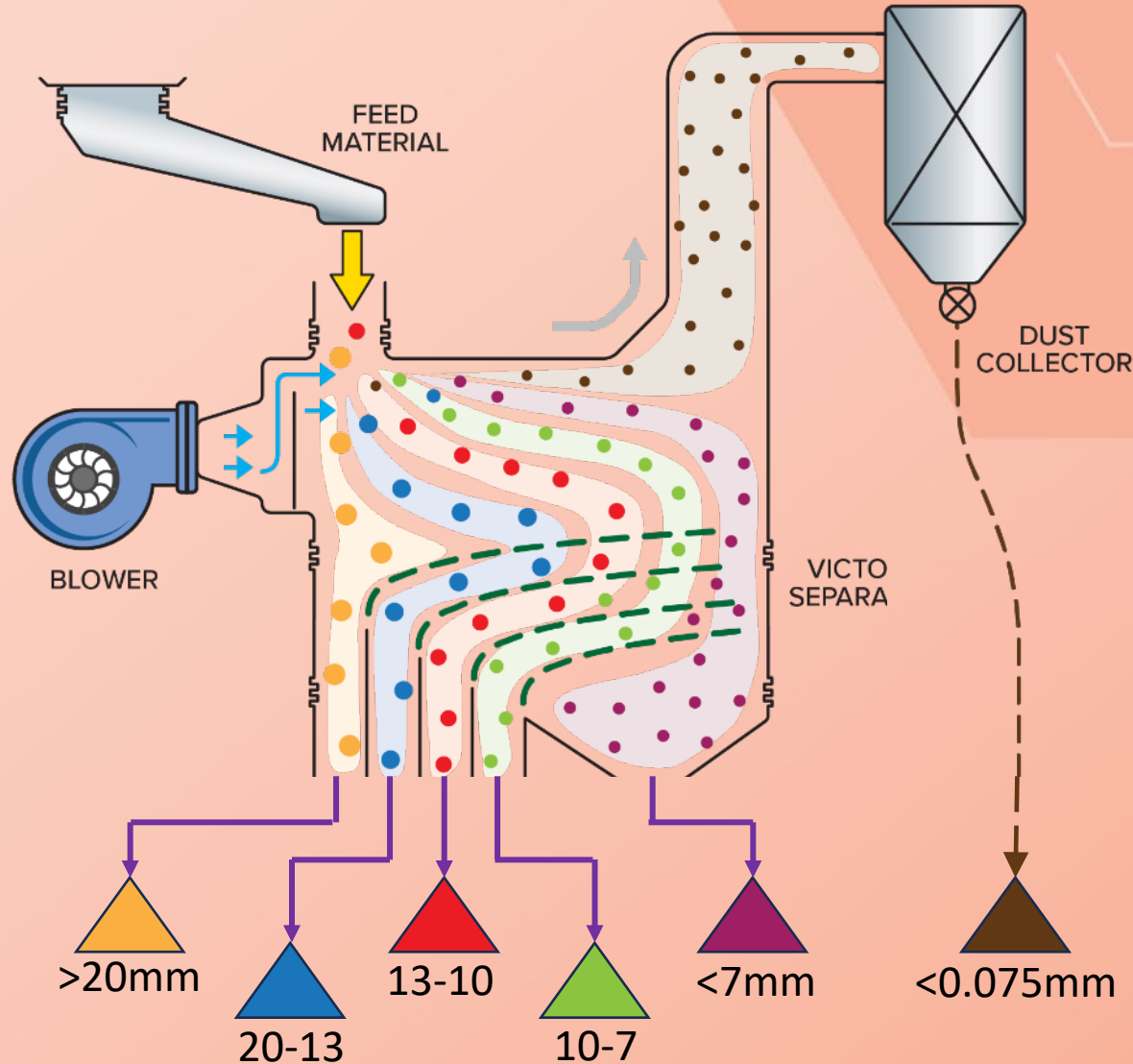
Coarse aggregate dry screening



RCAS coarse aggregate screening



- Dry screening of coarse aggregate products (e.g. concrete & asphalt aggs).
- Achieving cleanliness targets without using water.
- De-dusting PAP5 or PAP7 products.
- Ultrafines collected dry.



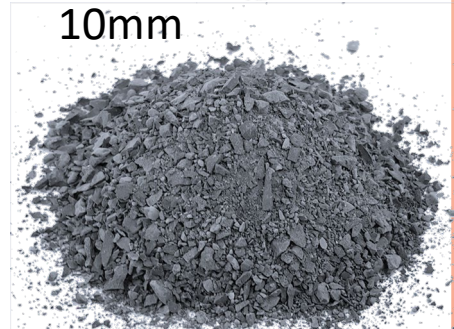
Example products



20mm



10mm



PAP7 dedusted

Coarse aggregate product grading example



Sieve Size (mm)	% Passing					
	Raw material	20-13mm	13-5mm	5-2.5mm	Sand	Dust collector
30	100	100				
20	99	95	100			
13	86	29	93			
10	73	5	64	100		
7	63	1.4	36	99		
5	54	0.4	14	90	100	
2.5	36	0.2	3.5	28	93	
1.2	25		1.1	11	64	100
0.6	18		0.5	5.3	39	99
0.3	13		0.3	3.1	20	97
0.15	10		0.3	2.2	8.0	91
0.075	8.2		0.2	1.8	3.9	79
Yield	100.0	15.5	33.9	19.9	22.0	8.7

- High cleanliness of coarse aggregate for roading applications.
- De-dusting of sand at the same time with precise control of filler (<0.075mm) levels

<2% passing 75µm in coarse agg

Plant can be tuned to adjust 0.075mm in sand.

84% of <0.075mm extracted

High quality cleaned products without water

Operational improvements:

- Dry process
- Greater product utilisation
- Lower operating costs
- No dust

Product quality improvements:



Outcomes:

Quality coarse aggregates.

Engineered Sand for sustainable concrete

- Replacement all natural sand
- 10-20% cement savings.



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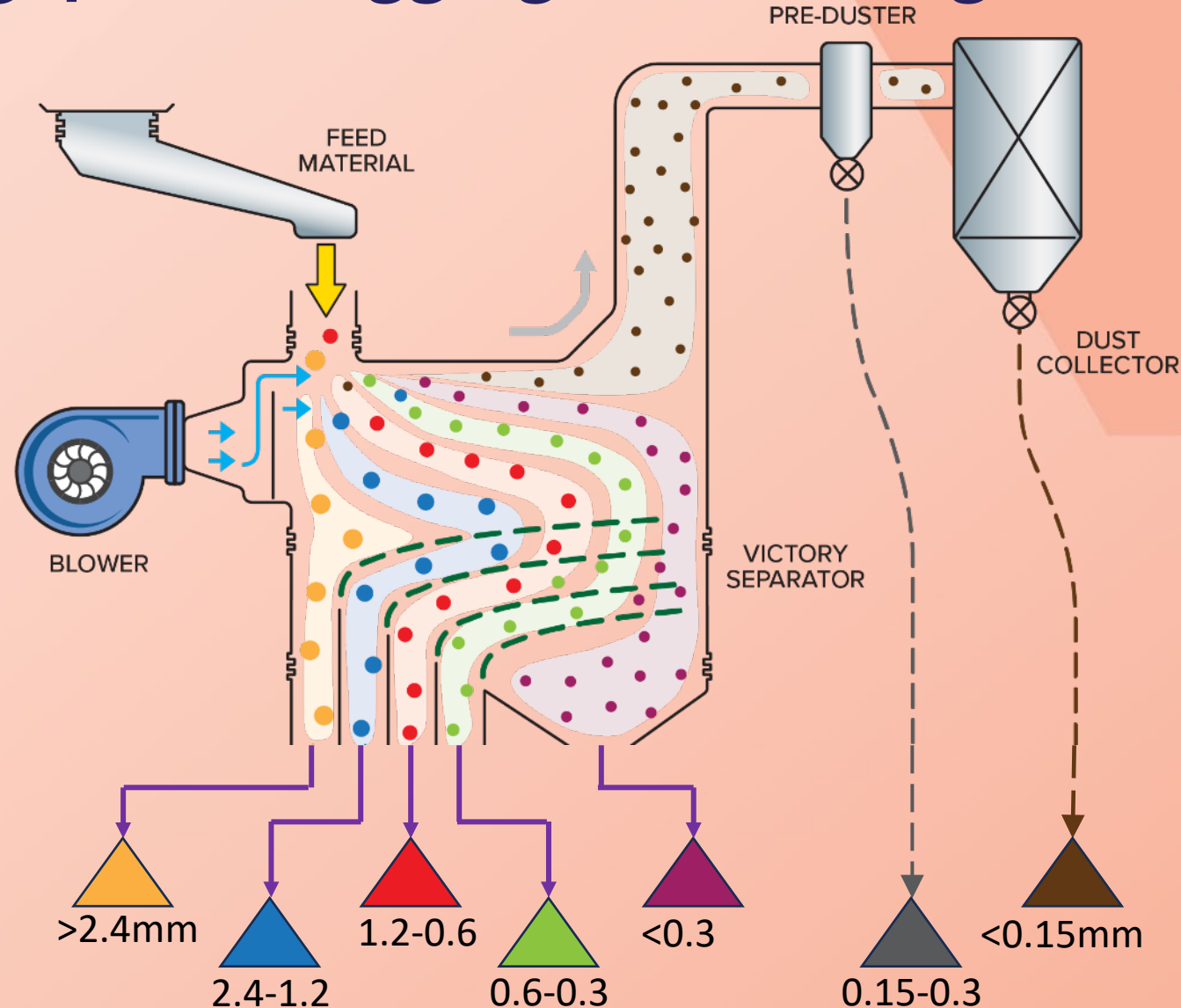
High throughput fine aggregate screening -



Up to 7 different products from one process.

Application examples:

- Recycled glass
- Limestone
- Slag



Example products from glass



2.4-1.2 (Pool filtration)



1.2-0.6mm (Bead blasting)



0.6-0.3mm (Bead blasting)

High accuracy fine screening product gradings

Crushed glass example

High accuracy screening cuts.

Ultrafines removed before screening to avoid carryover.

Sieve size (mm)	% passing							
	Raw material	>3.88	3.88-1.7	1.7-1	1-0.5	<0.5	Skimmer	Dust collector
13.2	100	100						
9.5	100	99.4						
6.7	99.5	93.7						
4.75	97.7	72.3	100					
4	95.9	52	99.6					
2.36	83.2		65.5	100				
1.7	73.4		25.8	99.6	100			
1.2	61.5			30.2	98			
1	56.1			7.7	86.9			
0.6	41.8	0.7			42.2			
0.5	36.6		1		25.5	100	100	100
0.3	25.3			1.3		75	96.1	99.7
0.15	14.9				2.7	23.6	63.2	94.3
0.075	8					3.4	13.5	69.4