

Manufactured Sand For a Low Carbon Era

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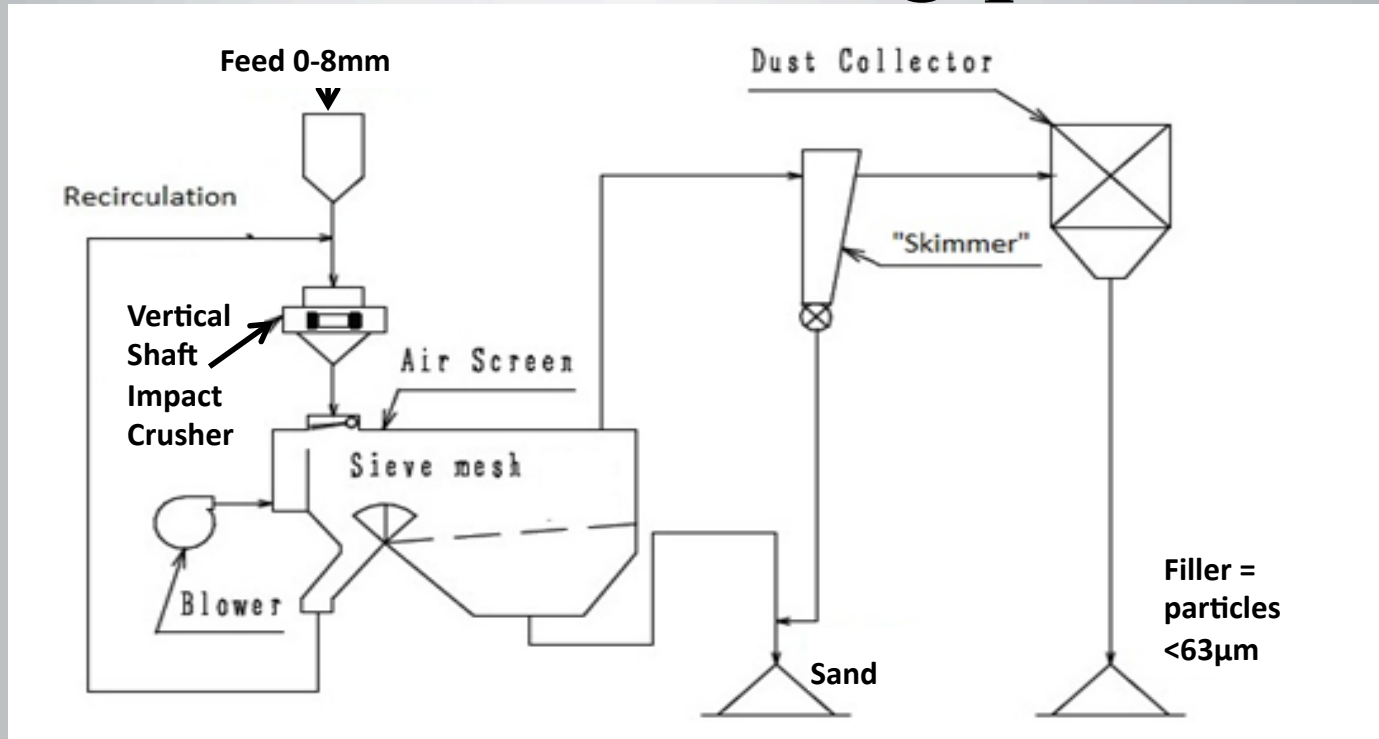
Introduction

- Background to project – WAG document: Crushed Rock Sand In South Wales, A Reconnaissance Survey, 2000.
- Current practice in UK
 - Blend crusher dust with natural sand.
 - Excess of sub-63 micron particles in dust
 - Flaky and very angular
 - Lack of 0.3 to 1 mm particles

Aims

- Replace natural sand and sand blends in concrete with 100% manufactured sand
- Investigate fine aggregate test applicability to manufactured sands

Sand Manufacturing process

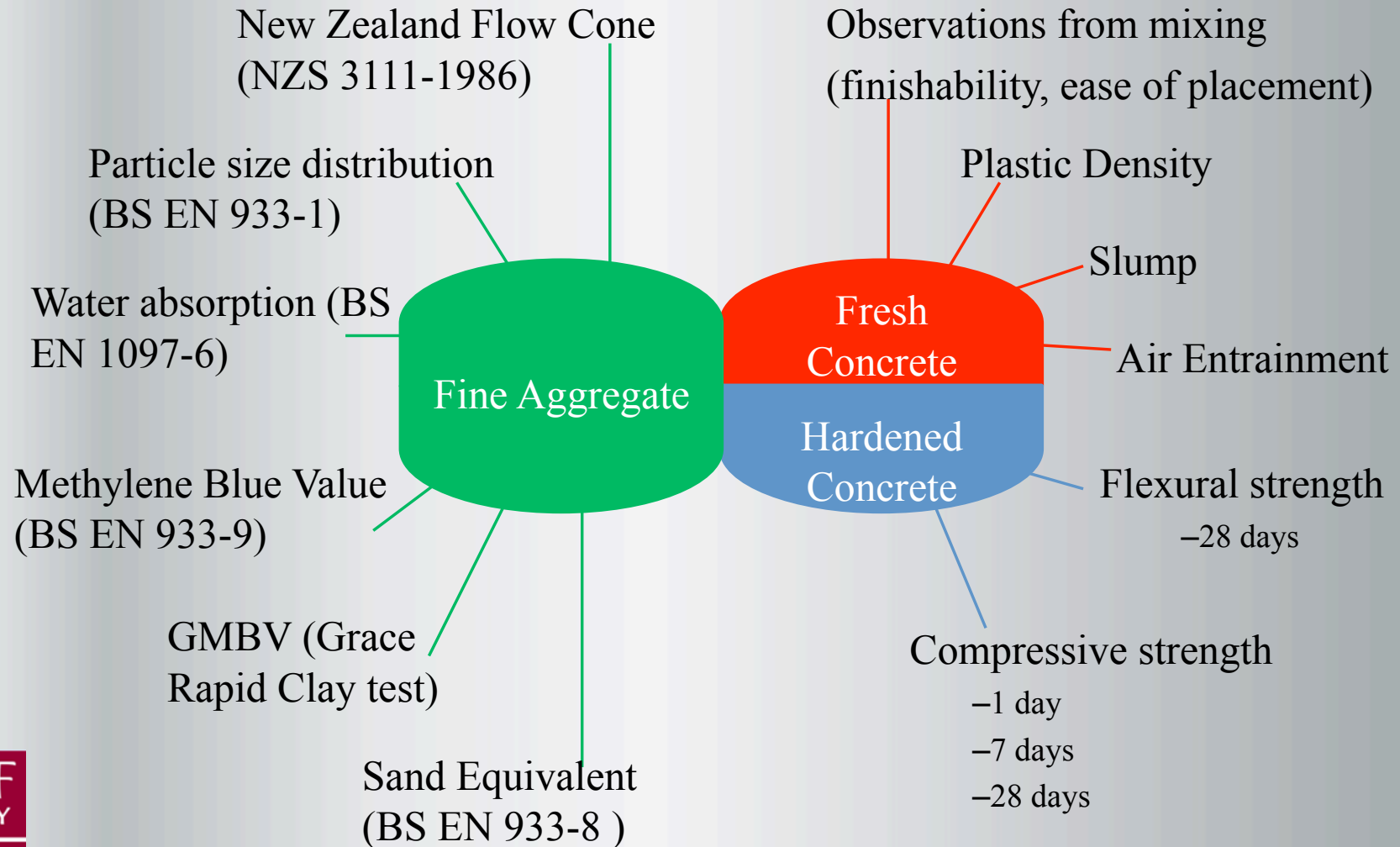


- Integrated in the quarry crusher system
- Dry process – the product is not washed
- Water added to the final product to avoid segregation (3%)
- “Skimmer” particles added back in the produced sand, therefore creating different gradings (-A,-B,-C,-D) with different sub 63 micron content and increasing yield

Materials

- CEM I 52.5 N
- Crushed limestone 4/20 mm (CA)
- Sea dredged natural sand control (N)
- Crusher dusts (..-FEED)
- Manufactured sands from crusher dusts with at least 4 gradings for each quarry
 - Basalt (B)
 - Granite (G)
 - Limestone (L)
 - Sandstone (Gritstone) (S)
- Mid range plasticizer WRDA 90

Characterisation tests



Concrete mixes

➤ Two stages

- Stage 1: without plasticizer, aiming for S2 slump, fixed w/c ratio for particular quarry sands which provides S2 slump.

Cement	FA	CA	Water
350	753	1040	varies

- Stage 2: Varying plasticizer dosage to achieve S2 slump, fixed w/c ratio at 0.55 for all sands.

Cement	FA	CA	Water	Plasticizer
350	753	1040	193	varies

- Accounted for absorption capacity and water content of aggregates and admixtures

Results – Fine aggregate tests

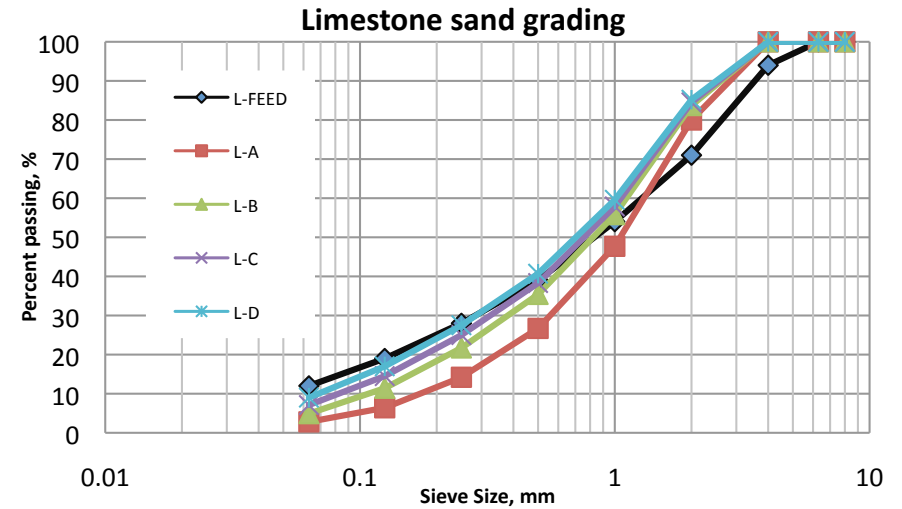
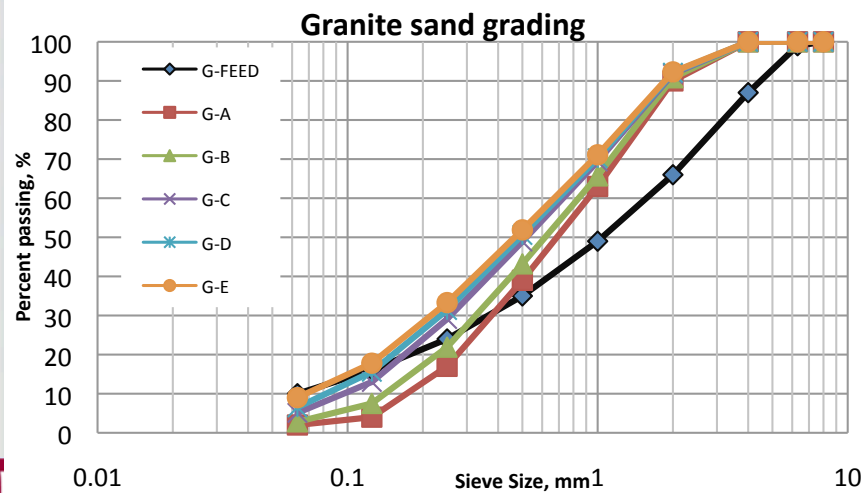
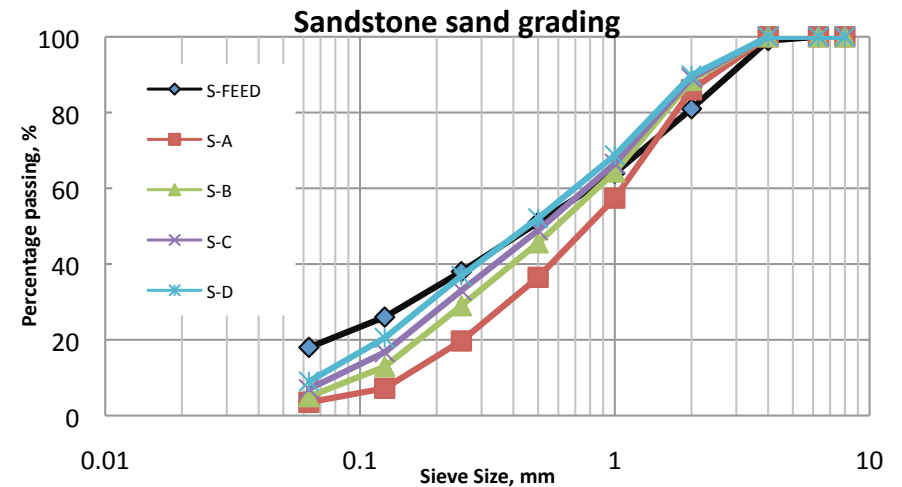
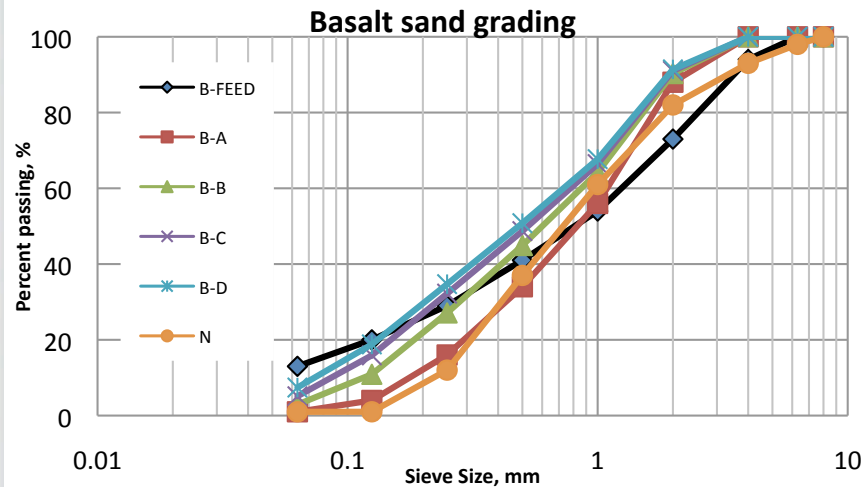
Crusher dust
Feed (0-4)

Manufactured sand (0-4)

Sea dredged sand (0-4)

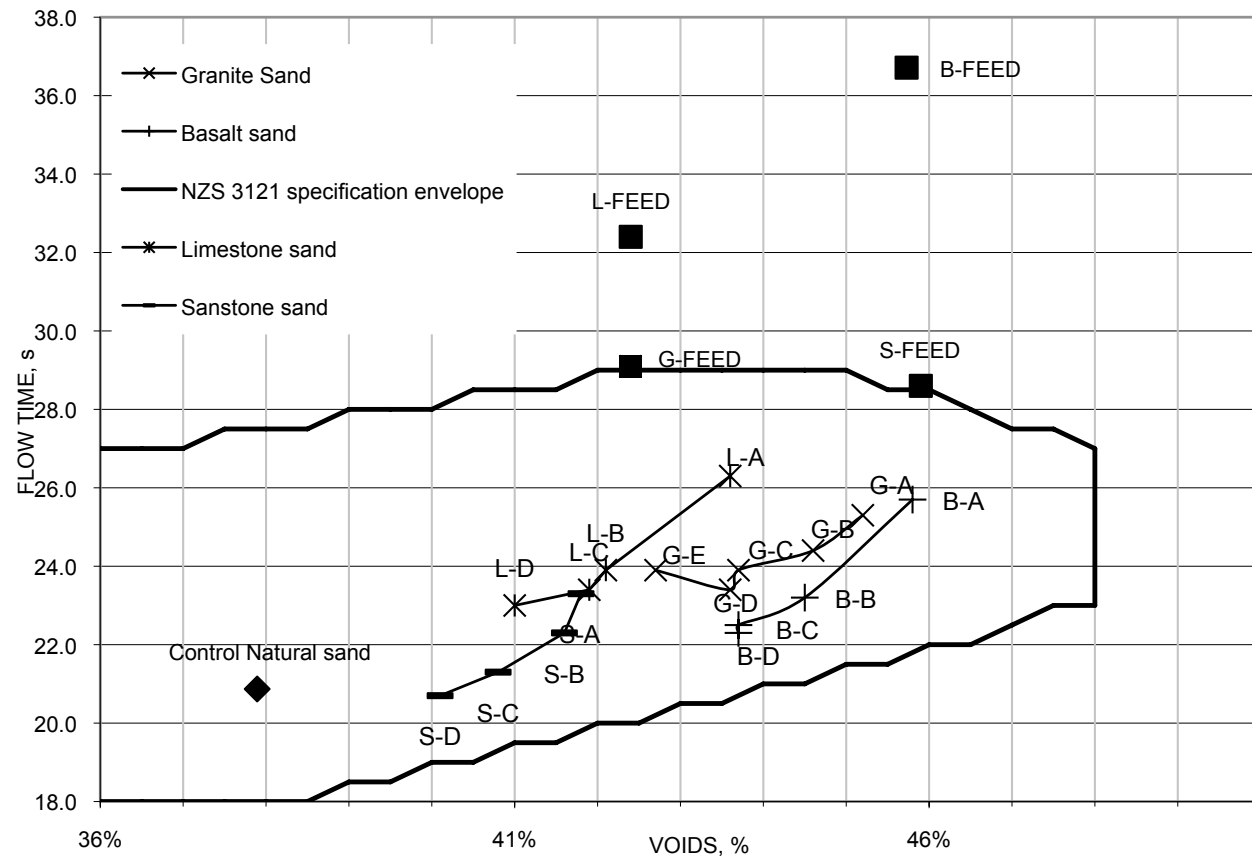


Results – Particle Size Distribution

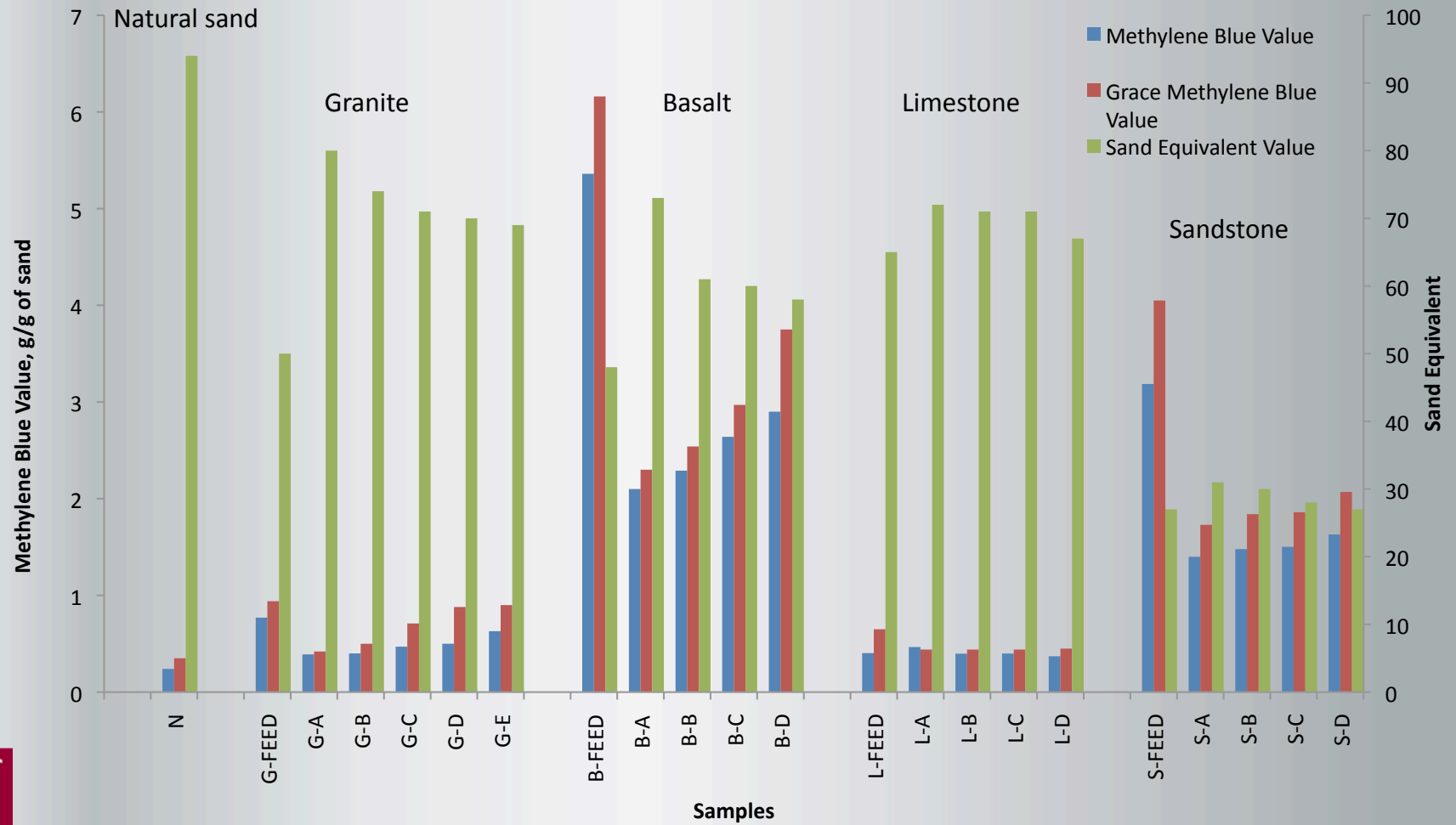


Results – New Zealand Flow Cone

- Simple indirect test indicating shape, grading and surface texture

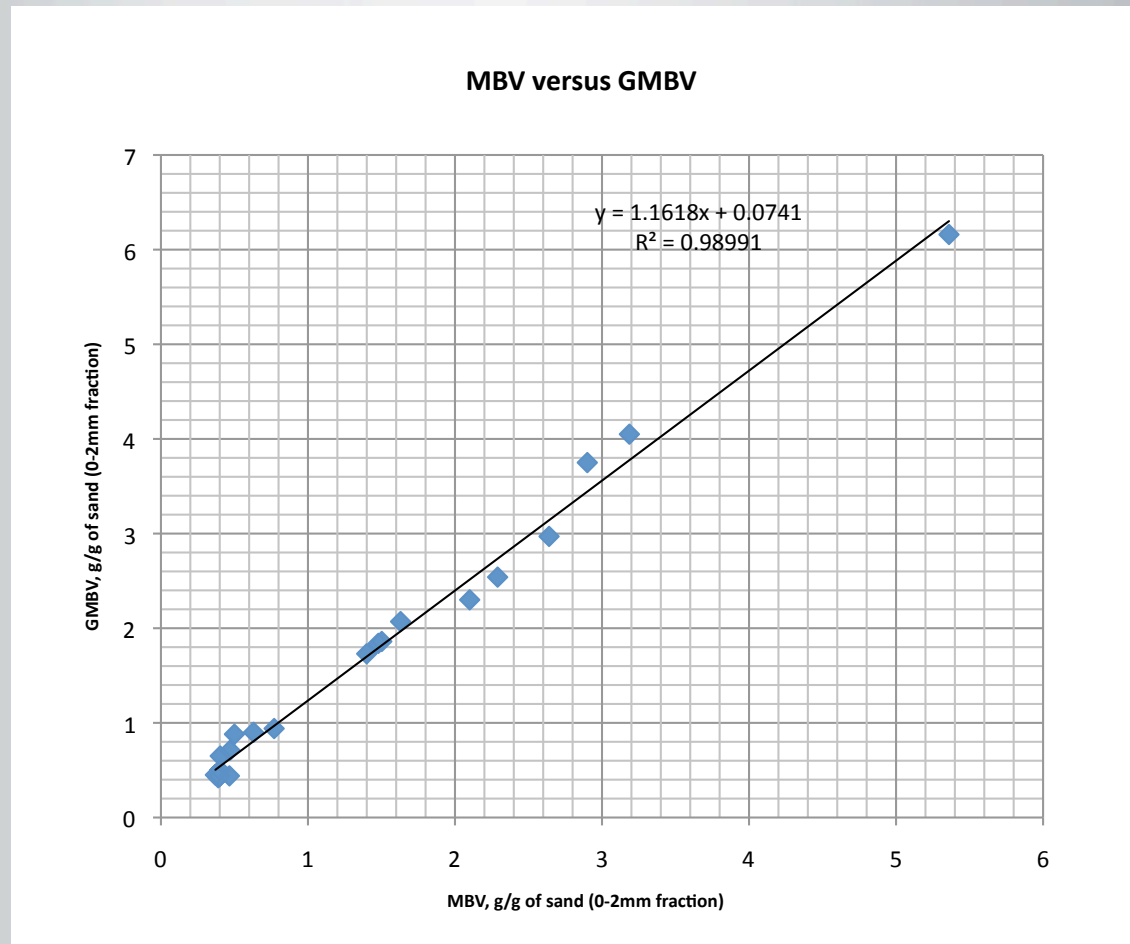


Results – MBV, GMBV, SE



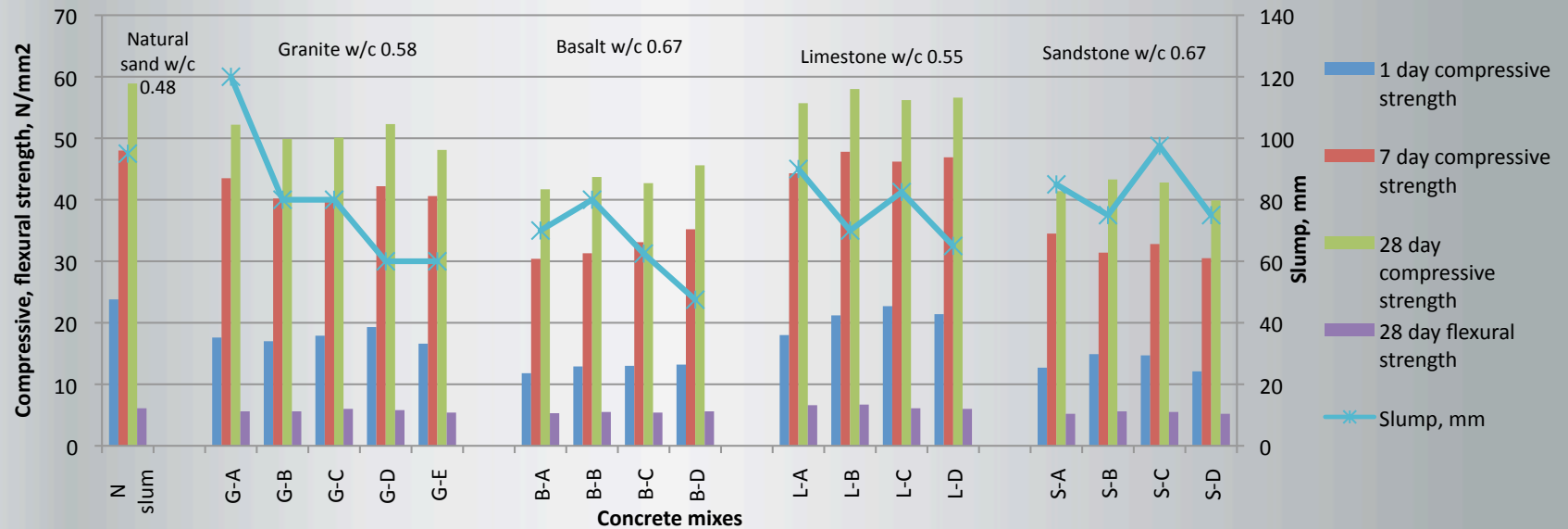
Results – MBV, GMBV

➤ Comparing two methods for MBV testing

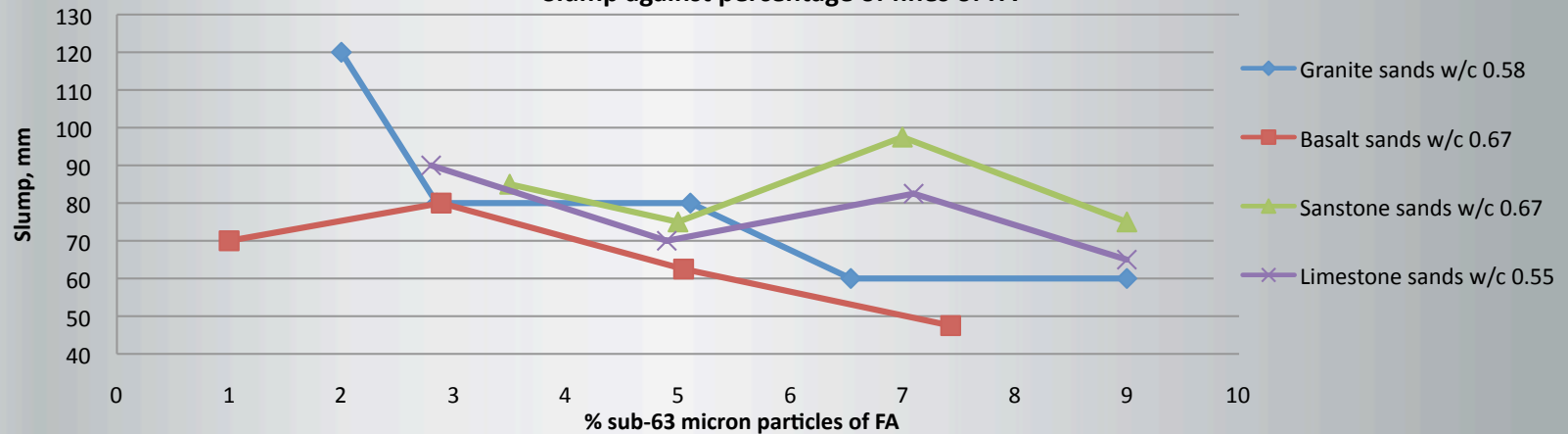


Results-Concrete, Stage 1

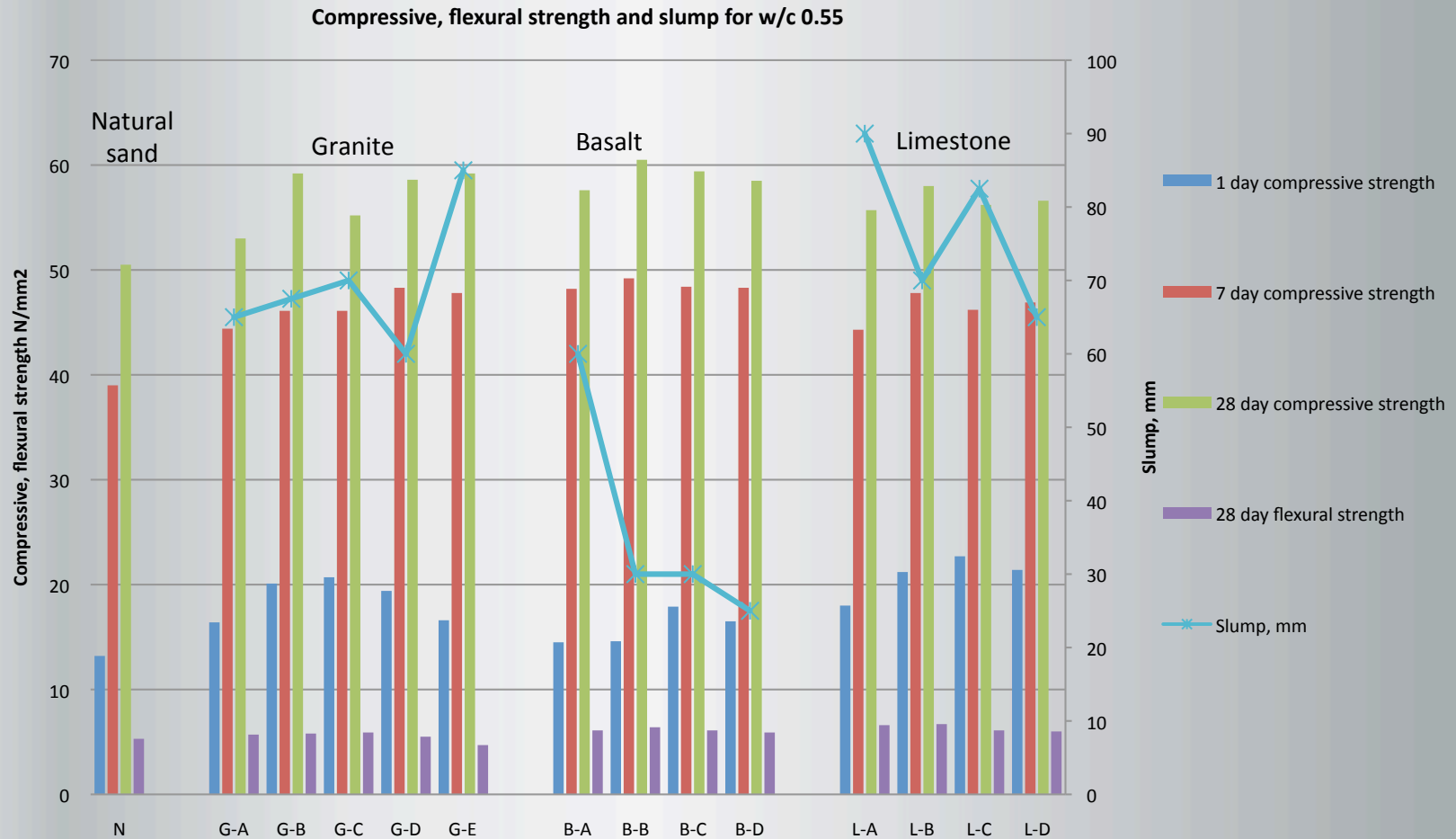
Compressive, flexural strength and slump



Slump against percentage of fines of FA



Results – Concrete, Stage 2



Conclusions

- It has been demonstrated that viable concretes can be produced using 100% manufactured sands
- Good strength and workability can be achieved regardless of rock mineralogy by appropriate manipulation of w/c ratio and particle size distribution.
- Caution must be exercised when using manufactured sands which contain clays
- MBV tests are good indicators of the presence of clays
- Sustainability and environmental benefits

Thank you for your attention!
Any questions?

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