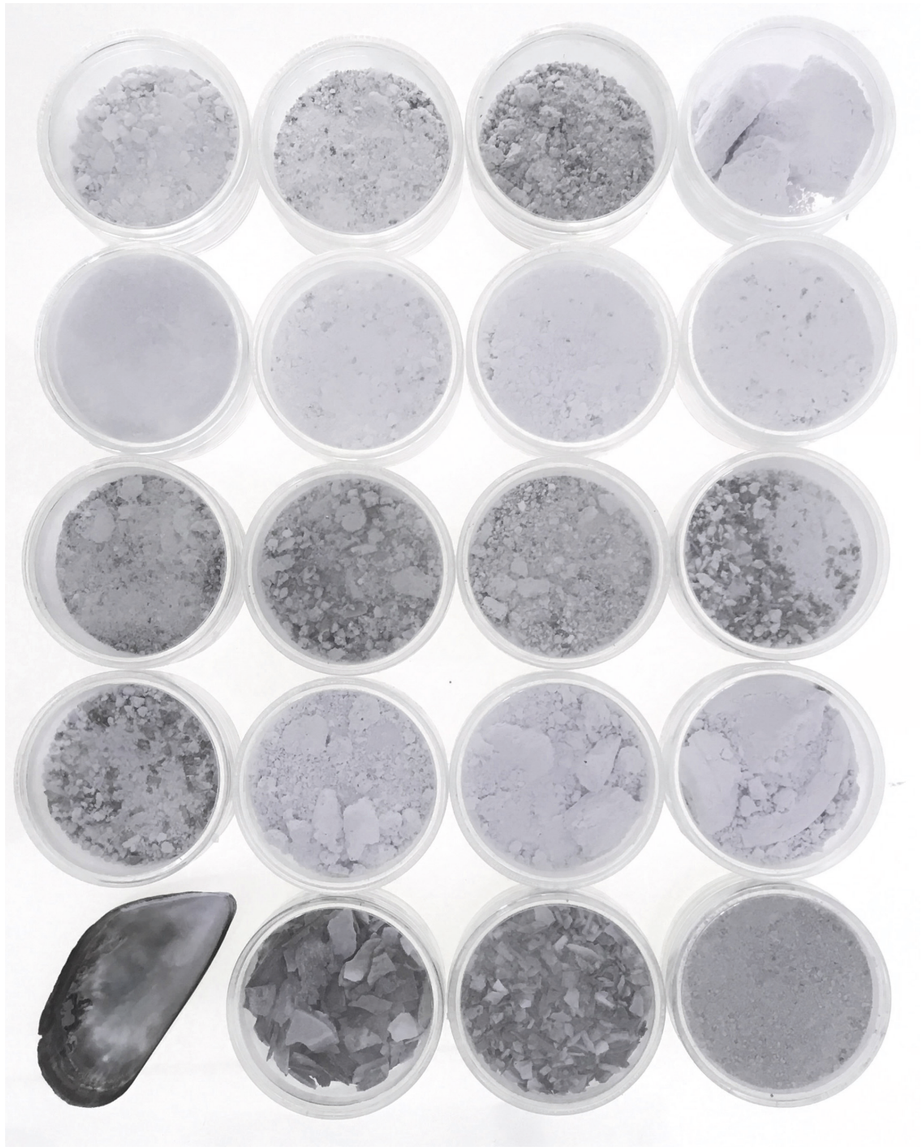
Material tests



Introduction

On the site today is huge piles of mussel shells left form the industry. We wanted to incorporate the shells in the building in casting as a nuance of the site in the building.
We took departure from a scientific report where they researched to replace the binder in concrete with crushed and burned mussels. Our interest was not primarily in the materials technical properties but rather its aesthetic qualities.
We did some initial test of crushed and burned mussels but shifted out focus to the materials own properties; the fragility and brittleness.
A big part of our material exploration was to find a material were the colour of the mussels, the light purple nuance, is visible and the mussels itself as the aggregate.

MATERIAL TESTS: BINDER

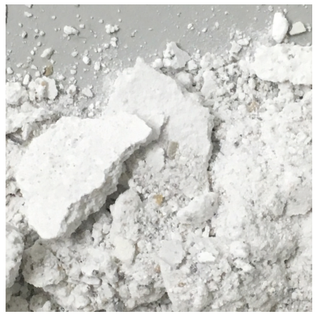
A
+
820°C
2 h

A1: BM 34% <1 32% W 34%

A2: BM 71% W 29%

A3: BM 48% <1 24% W 29%

B
-
820°C
2 h



B1: BM 71% W 29%

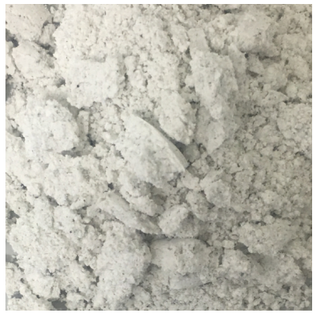
B2: BM 52% 1-4 28% W 20%

B3: BM 38% <1 21% 1-4 22 % W 19%

C
-
820°C
4 h

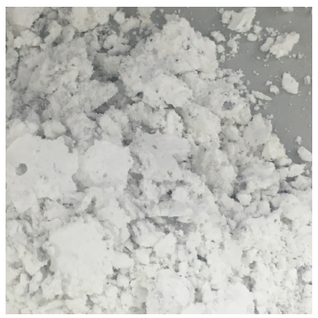
B4: BM 35% <1 40% W 25%

B5: BM 41% 1-4 42% W 17%

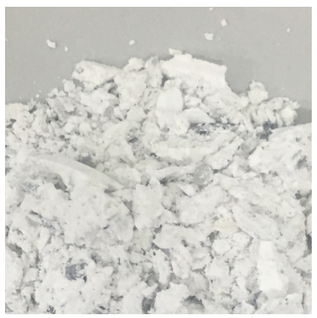


C1: BM 78% W 22%

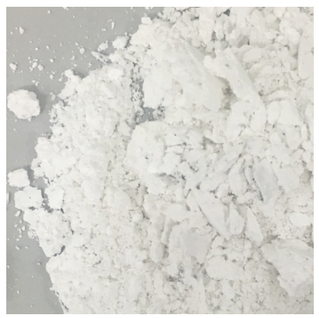
D
+
820°C
4 h



C2: BM 68% W 32%

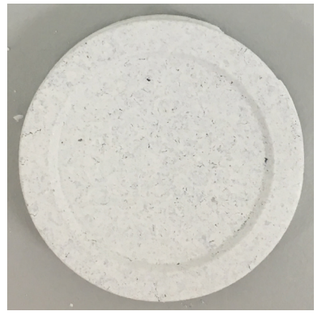


D1: BM 68% W 32%

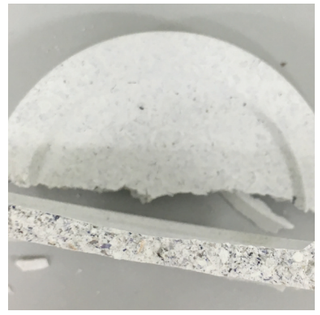


D2: BM 62% W 38%

*W C = White cement | B M = Burnt musel | <1 = Crushed musel < 1mm | 1-4 = Crushed musel 1-4 mm | >4 = Crushed musel >4 mm | W = Water | + = Grown musel | - = Wild musel

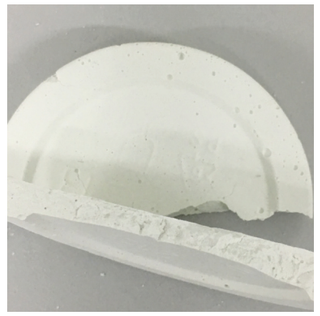


E1: WC 34% BM 32% W34%



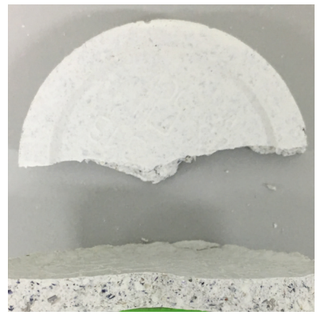
E1

E2: WC 71% W 29%

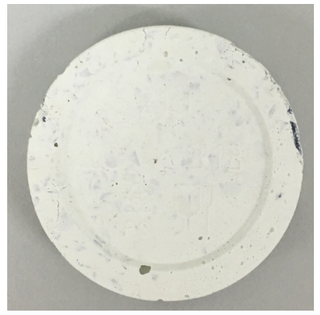


E2

E3: WC 48% BM 24% W 29%

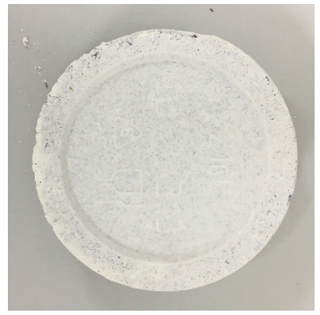


E3

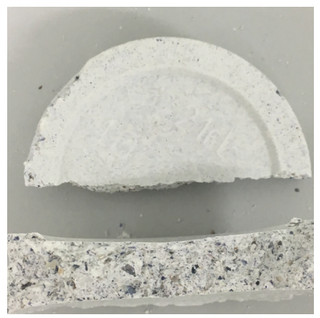


E4: WC 41% 1-4 42% W 17%

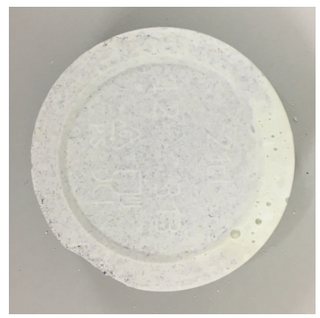
E4



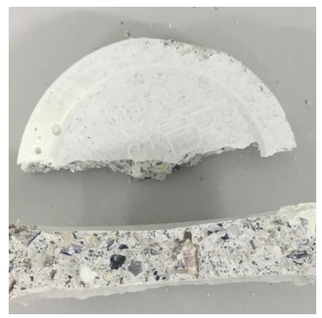
F1: WC 31% <1 47% W 22%



F1



F2: WC 45% 1-4 23% W 32%

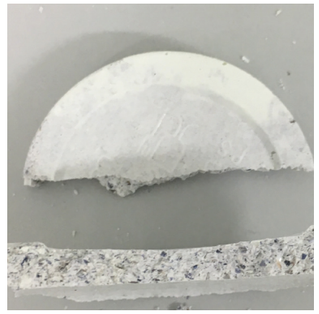


F2

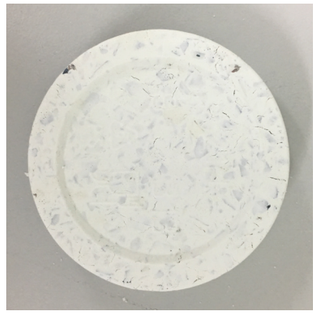
*W C = White cement | B M = Burnt musel | <1 = Crushed musel < 1mm | 1-4 = Crushed musel 1-4 mm | >4 = Crushed musel >4 mm | W = Water | + = Grown musel | - = Wild musel

MATERIAL TESTS: BINDER

F3: WC 26% <1 52% W 22%



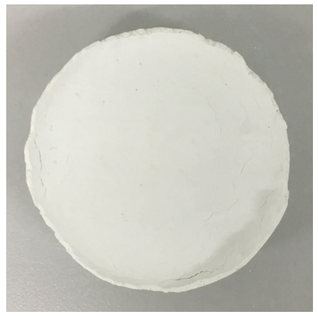
F3



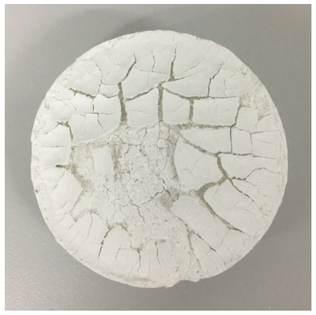
F4: WC 33% 1-4 50% W 17%

F4

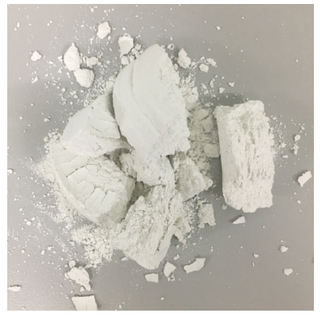
G1: WC 67% W 33%



G1

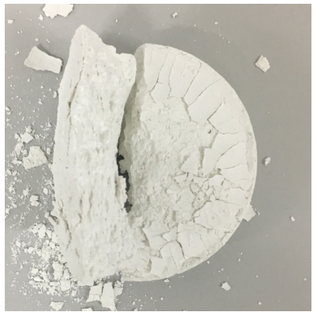


G2: WC 33% BM 33% W 33%



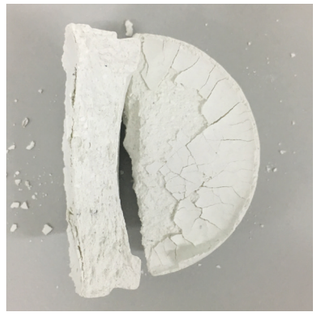
G2

G3: WC 40% BM 27% W 33%



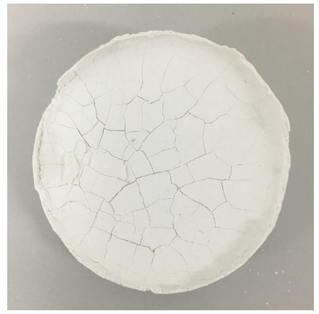
G3

G4: WC 47% BM 20% W 33%

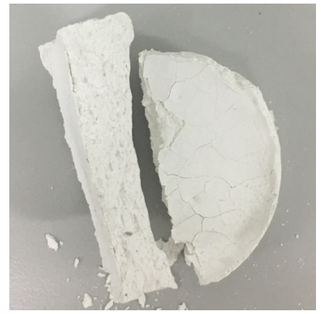


G4

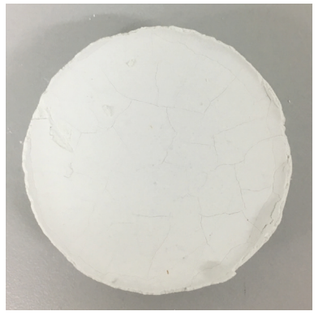
*W C = White cement | B M = Burnt musel | <1 = Crushed musel < 1mm | 1-4 = Crushed musel 1-4 mm | >4 = Crushed musel >4 mm | W = Water | + = Grown musel | - = Wild musel



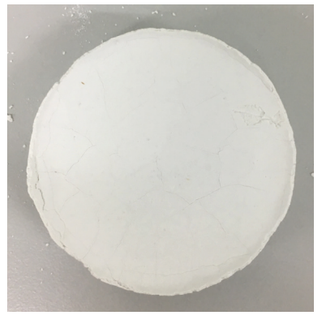
G5: WC 53% BM 13% W 33%



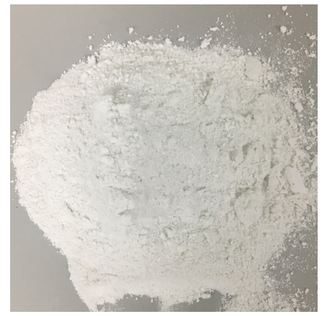
G5



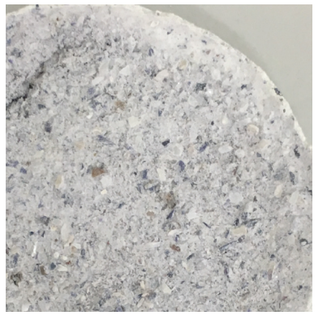
G6: WC 60% BM 7% W 33%



G6



G7: BM 90% W 10%



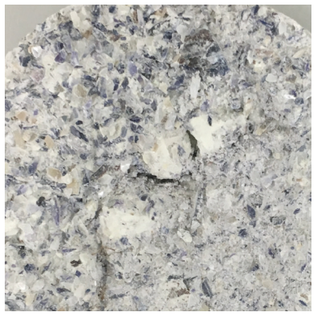
Ö1: WC 42% <1 16% 1-4 16% W 26%

About

We did initial experiments with different mixture of burnt mussels as the binder for concrete. The brunt concrete was heated up to 820°C for 2-6 hours to make it reactive. Though a complete replacement of cement wasn't successful a 10% replacement showed the most likeness to regular concrete.
We then went into exploration of the material with the intent of making a concrete where the mussels colour and texture is present.
To be able to control the colour nuance of the concrete we used a mussel powder (<1mm grains) mixed with white cement instead of traditional grey cement.

*W C = White cement | B M = Burnt musel | <1 = Crushed musel < 1mm | 1-4 = Crushed musel 1-4 mm | >4 = Crushed musel >4 mm | W = Water | + = Grown musel | - = Wild musel

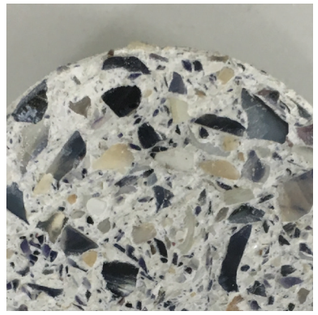
MATERIAL TESTS: EXPRESSION



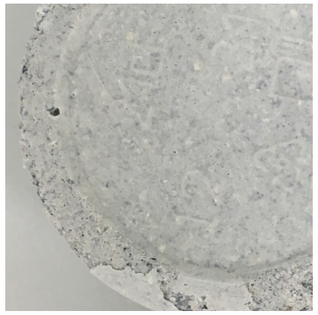
Ö2: WC 35% <1 24% 1-4 24% W 18%

Ö3: WC 35% <1 24% 1-4 24% W 18

Ö4:

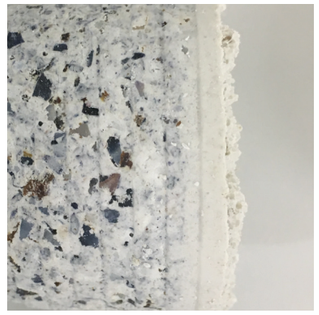


Ö5: WC 35% <1 24% 1-4 24% W18%

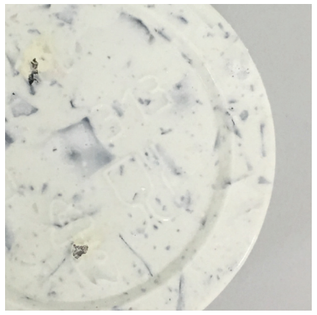


Ö6: WC 25% <1 33% 1-4 25% W 17%

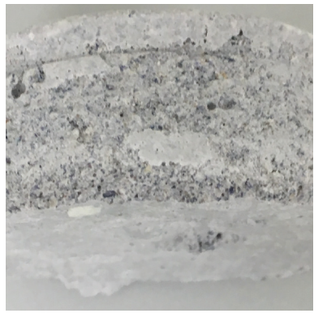
Ö7:



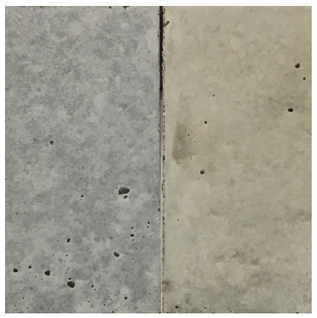
Ö8: WC 20% <1 20% 1-4 40% W 20%



Ö9: WC 27% 1-4 55% W 18%

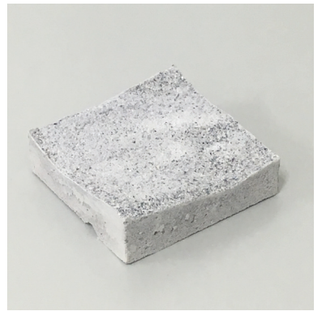


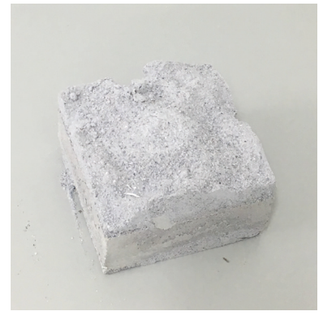
Ö10: WC 15% <1 62% W 23%

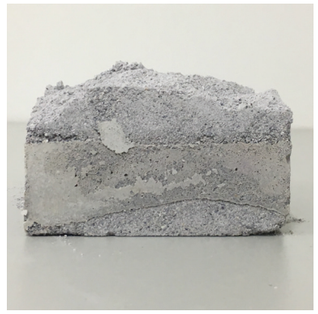


Concrete mixture using sand vs crushed mussel

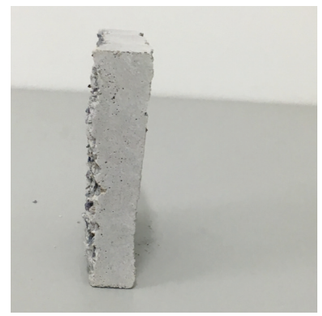
*W C = White cement | B M = Burnt musel | <1 = Crushed musel < 1mm | 1-4 = Crushed musel 1-4 mm | >4 = Crushed musel >4 mm | W = Water | + = Grown musel | - = Wild musel

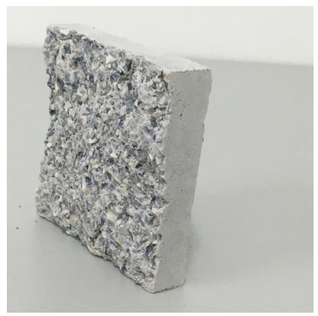




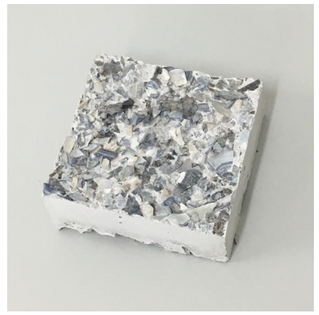


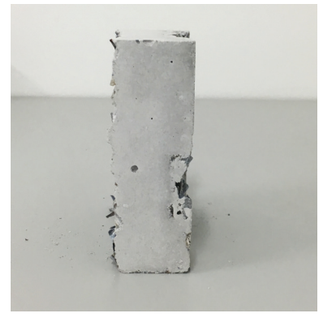
Casted against <1 powder, the result was a glittering, light lavender and fluent shape.



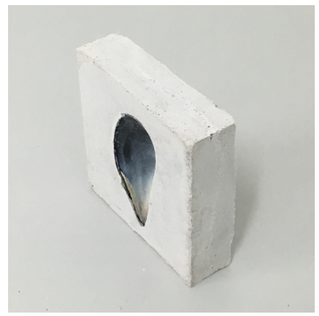


Casted against 1-4 powder.



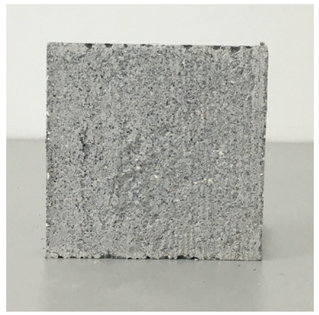


Casted against > 4.

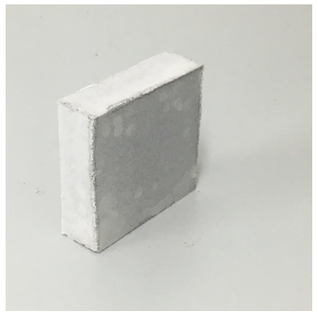
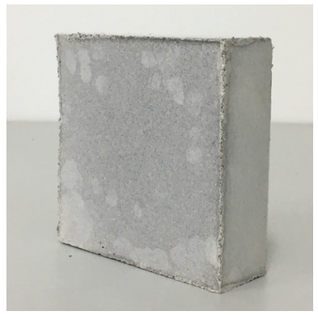


MATERIAL TESTS: EXPRESSION





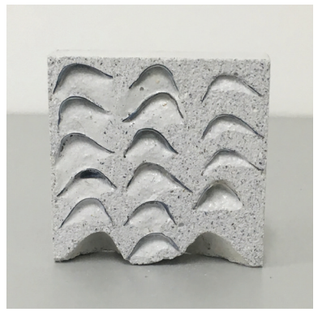
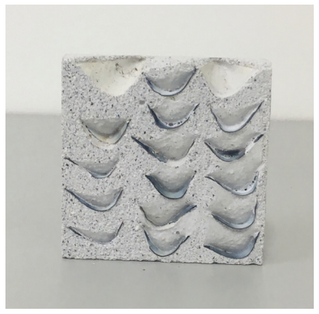
Casted against a rough birch, the result was a reliefed, light grey surface


Casted against acrylic sheets



Before: Shells in rows, later to be sanded

After: Shells in rows, broken shells and sanded with rough paper



Before: Uncrushed shells where placed in the mold, the result was uncontrolled holes in the cast



After: Sanded with rough paper



Before: Uncrushed shells where placed in the mold, the result was uncontrolled holes in the cast

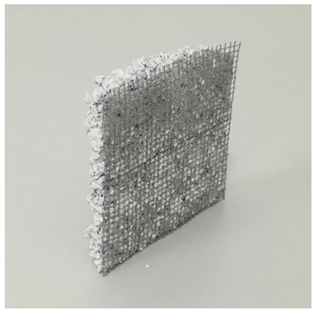


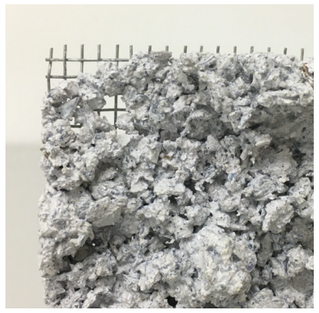
After: Sanded with rough paper

MATERIAL TESTS: EXPRESSION

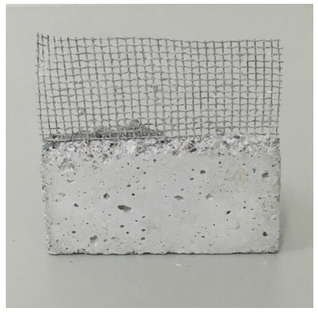
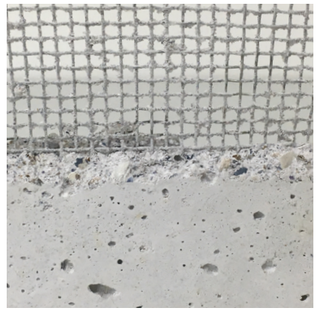
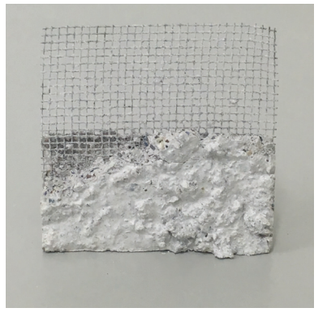


Sanded surfaces with different roughness





Casted against metall mesh, mix with less water

Break with a mesh inserted



Mesh still intact

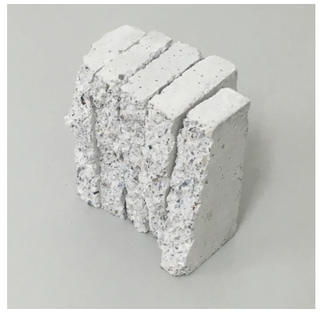


Sanded with rough paper



Sanded with rough paper





Broken pieces stacked

About

Through the initial material test with the material we found that its characteristic properties was its brittleness and its fragility. A feature of the material that, when broken, reveals its inner structure in a aesthetic pleasant way which is something we incorporated into the final design.

MATERIAL TESTS: POINT OF FAILURE

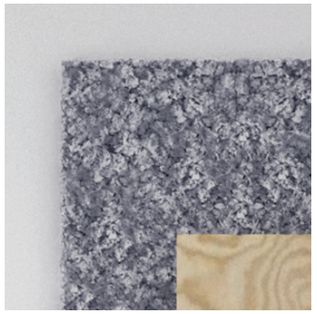
Cement + sand: 45 ton

Cement + mussel: 15 ton

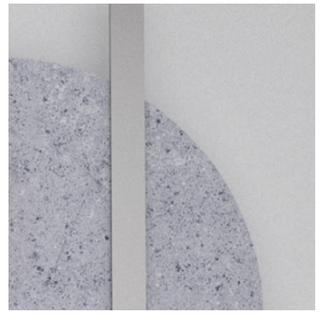
Test

When replacing sand and gravel with mussels of different sizes the point of failure for a cube (10x10x10cm) was 15 tonnes, which is the same as brick. The dimensions of the building is done according to that.

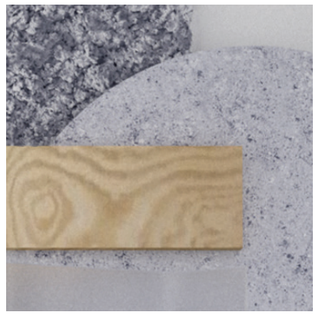
DIGITAL MATERIAL



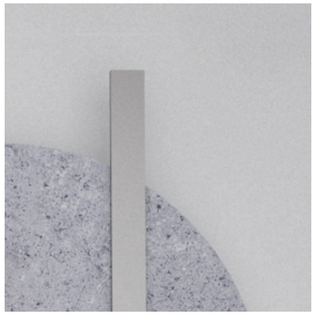
Sprayed mussel concrete



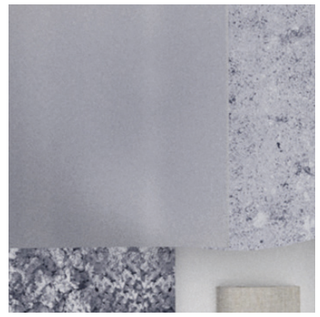
Smooth/gloss mussel concrete



Plywood, pine

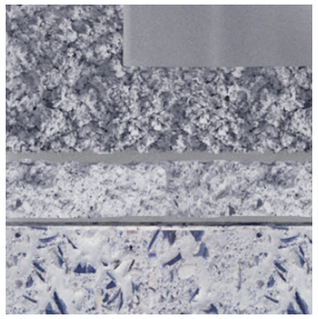


Stainless steel



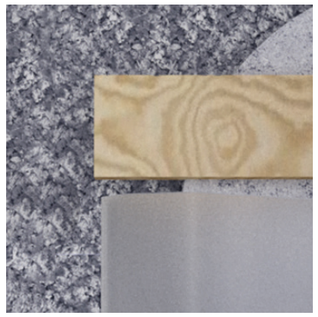
Plastic curtain

Linen fabric, nature



Cracked mussel concrete

Mussel concrete terrazzo



About

For the design proposal a digitalization of the material tests were made and a selection of different variation of the mussel-concrete with other coherent materials were added to get a good interior composition between the materials.

Reflection

The aim was to produce a material where both the binder and aggregate was mussel-based, where the binder would be crushed and then heated. Through experiments we can conclude that this will not be possible in this project and further experiments could be done in this subject.
Due to circumstances we didn't change the variables as much as originally intended, lower temperature for a longer time was mentioned in the report we read.
Our aim was to explore the aesthetic properties of the material rather than the technical. Some technical experiments was made for some basic knowledge of the material but the main focus remained central throughout the project.