Report prepared on behalf of
Unisearch Limited

on

TESTING OF "BEADCRETE"

By

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COMMERCIAL-IN-CONFIDENCE

METHOD

Shrinkage: As required by the procedure of ASTM C596, four mortar prisms each measuring 285 x 25 x 25mm were cast using the Beadcrete supplied by the company and mixed by the BRC to the company's specifications. Targets were incorporated in the ends of the prisms allowing their change of length to be measured using a comparator. The prisms were moist cured in (he moulds for one day and water cured for 2 days before being placed in a controlled environment for drying at 23 ± 1 °C and 50 ± 5 % RH. As specified in the Standard, the changes in length of the specimens were monitored at regular intervals over a 28 day period to arrive at a result

Adhesion to Substrate: Beadcrete staff applied the reflective mortar to a depth of 20mm over concrete substrates, 250 x 250 x 40mm thick prepared by the BRC. Two of the substrates were several years old - their top surfaces were prepared for the application of the mortar by light wire brushing. The other four substrates had been prepared three weeks before - their top surfaces were finished with a wooden float to aid adhesion of the mortar. The surface preparations are representative of Beadcrete's current practice.

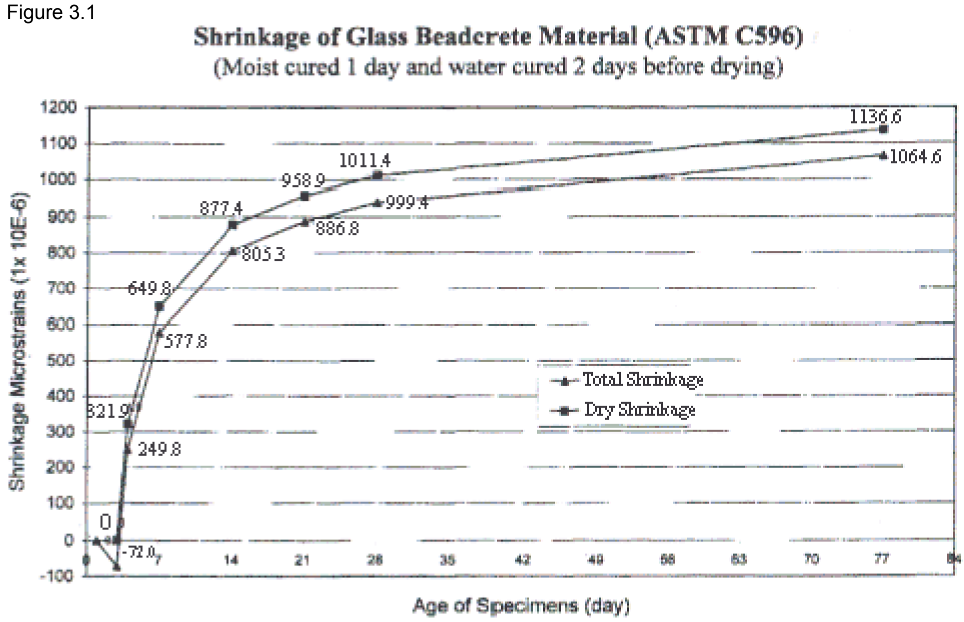
After having been mixed to a cake mix-like consistency and trowelled into place, the material was allowed to set for 30 minutes before the top layer of the mortar was washed off using a sprinkle head nozzle to expose the glass beads. The mortar was applied on the 7th of October 1998 after which the specimens were dry cured at 23°C and 50% RH. until the 20th when they were placed in an accelerated weathering apparatus. The accelerated weathering regime consisted of six cycles per day of immersion in 10% salt solution followed by drying under heat lamps to 60°C. A control specimen of new and old substrate was left un-exposed to weathering.

After exposure to each of 30, 60 and W) cycles of weathering, the adhesion strength of the bond between Beadcrete and the substrates was assessed by a pull-away test. A 60mm diameter core cutter is passed through the topping into the substrate creating a circular island of topping 60.5mm in diameter. A steel plate is epoxy bonded to the (op face and the disc of mortar pulled away from the substrate. The force required to separate the mortar disc from the substrate is assessed by an electronic load cell and the calculated ultimate tensile stress over the circular area is a measure of the bond strength attained.

RESULTS

Shrinkage: Figure 3.1 is a curve of shrinkage strain (average of four prisms) plotted against time. The dry shrinkage is corrected to allow for the small expansion that occurred during the water curing period. The average 28-day shrinkage of 1011 microstrain observed is not considered excessive for a mortar.

Figure 3.1



Adhesion strength: The results of testing of the strength of the bond be-tween Beadcrete and (he concrete substrates arc summarised in Table 3.1. The results suggest slight decrease in bond strength with exposure to repeated cycles of and immersion in salt water and drying with heat. The bond strengths recorded are all significantly over one Megapascal, an often-quoted level for acceptable adhesion of renders and mortars. Some exposed specimens failed prematurely due to shortcomings in the epoxy bond to the salt affected top surface.

Table 3.1

Date No. of Cycles	Specimen	Substrate	Maximum Force (N)	Maximum Stress (Mpa)	Grp. Mean Strength (Mpa)	Comments
(04.11.98)	Control1	New	3148	1.09		Adhesion failure against substrate
	Control2		5320	1.85		Cohesion failure within mortar
	Control3		6620	2.30	1.75	Cohesion failure within mortar
	Control4		4970	1.73		Cohesion failure within mortar
	Control5		540	1.73		Adhesion failure against substrate
30	Ex1	New	4618	1.61		Epoxy to steel failure
30	Ex2		4930	1.71	1.59	Epoxy to steel failure
30	Ex3		4130	1.44		Epoxy to steel failure
(17.11.98)	Control1	New	6775	2.36		Adhesion failure against substrate
	Control2		6943	2.41	2.27	Adhesion failure against substrate
	Control3		5837	2.03		Adhesion failure against substrate
90	Ex1	New	4251	1.48		Adhesion failure against substrate
90	Ex2		5912	2.06	1.95	Cohesion failure within mortar
90	Ex3		6692	2.33		Cohesion failure within mortar
(04.12.98)	Control1	New	6319	2.20		Adhesion failure against substrate
	Control2		5836	2.00	1.80	Cohesion failure within mortar
	Control3		3461	1.20		Part cohesion part adhesion failure
180	Ex1	New	3167	1.10		Epoxy failure
180	Ex2		7428	2.60	2.10	Out of range
180	Ex3		7682	2.70		Out of range
(04.11.98)	Control1	New	5809	2.00		Out of range
	Control2		5931	2.10	2.10	Out of range
	Control3		6141	2.10		Out of range
180	Ex1	New	5697	2.00		Out of range
180	Ex2		6227	2.20	2.10	Out of range
180	Ex3		5931	2.10		Out of range

CONCLUSIONS

When mixed and applied according to the suppliers instructions, the glass bead impregnated polymer modified mortar "Beadcrete", made to the formula tested by the Building Research Centre in late 1998, shows an acceptable level of shrinkage for use in the rendering of swimming pools.

When applied over wood float finished concrete, "Beadcrete" shows a high adhesion strength to the substrate which is not greatly affected by repeated changes of temperature and moisture. A similar strong adhesive bond was observed when the substrate was older concrete whose surface was prepared by wire brushing.

The results suggest that the adhesion of "Beadcrete" to the wood floated concrete substrate is not affected by later contact with salt water.