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CSIRO

Report on durability assessment of Benex blocks against salt attack
CSIRO job number: JK13ATS3468

Testing for durability to salt attack has been completed on Benex Technologies' solid 100mm and hollow 200mm Benex blocks.

Background

As per AS 3700-2001 (Clause 5.3) masonry units must satisfy the slat attack resistance grade given in Table 5.1. AS/NZS 4456.10:2003 details the requirements for testing masonry units for resistance to salt attack. Durability grades for masonry units are given in AS/NZS 4456.10:1997 but not in the 2003 version.

Test procedure

Specimens of 50 mm long, 25 mm wide and 20 mm high were taken from two separate solid Benex blocks (S1 and S2) and 50 mm long, 25 mm wide and 40 mm high taken from three Benex hollow blocks (H1, H2 and H3) were subjected to cycles of soaking in salt solution (14% NaCl), oven drying and cooling as recommended by method B of AS/NZS 4456.10:2003.

The weather exposed surface of the Benex block is quite different to its interior, unlike for common masonry units. Therefore, in addition, a separate series of specimens, from both solid and hollow samples, were prepared by applying Vaseline to cover the interior cut surfaces before subjected to salt exposure. Hence, only the exterior face of the masonry unit of the test sample would be exposed to salt solution.

All the specimens were exposed to a total of 40 cycles and the weight changes of the specimens after each cycle was recorded.

Results

Figure 1 shows the change of weight of the test specimens obtained from the solid Benex block during the salt exposure cycles. The specimens without Vaseline (S1-3, S1 -4, S1- 5, S2 -3, S2 -4 & S2-5) show a gradual increase in weight up to about 30 cycles and reaching constant thereafter. In contrast, the Vaseline treated samples (S1-1V, S2-1V and S2-2V) shows little or no change in weight throughout the testing cycles. Apart from the salt deposits on the surface of these samples, no cracks or any other deterioration signs were observed. Furthermore, there were no solid deposits found in the solutions.

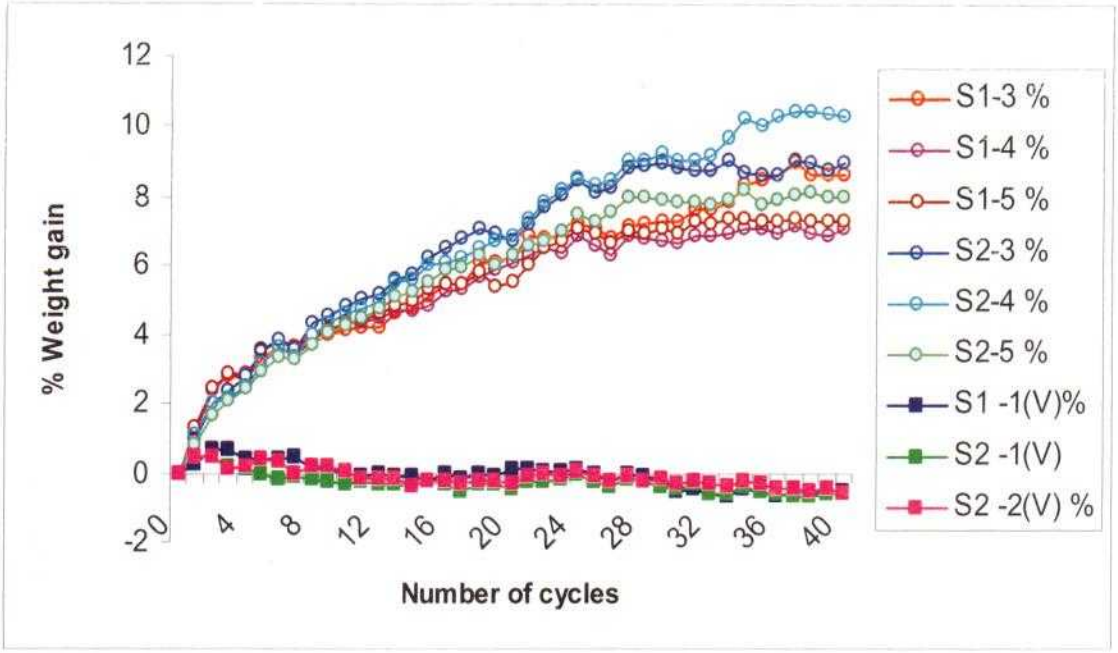


Figure 1. Percentage weight change of specimens taken from solid blocks (Vaseline treated samples contain "V" in the name)

Figure 2 shows the change of weight of the specimens prepared from hollow Benex block during the salt exposure cycles. As with the solid specimens, these specimens also showed a gradual increase in weight with the exposure up to about 35 cycles. No significant change in weight was observed with Vaseline treated specimens (H1 V and H2 V). Also, no solid deposits were found in the solutions.

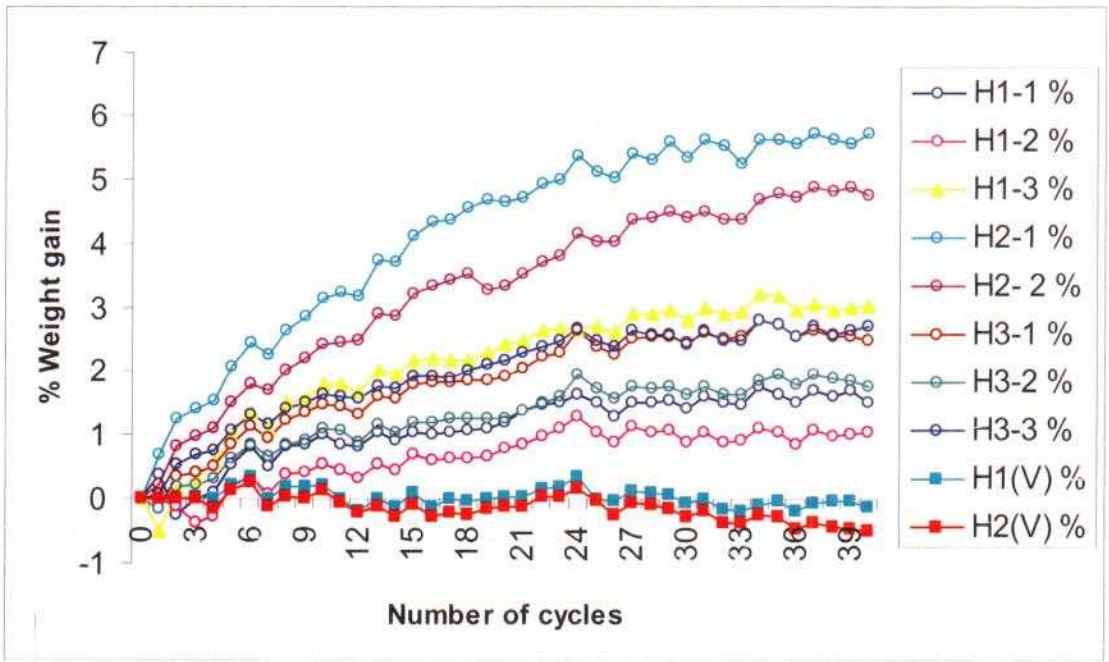


Figure 2. Percentage weight change of specimens taken from hollow blocks (Vaseline treated samples contain "V" in the name)

Discussion

The procedure used in this work is the recommended standard method to determine the resistance to salt attack of materials other than stone (method B). The gradual increase in weight of the non-Vaseline treated samples indicates absorption and diffusion of salt through the specimens. This was also clearly visible by the salt deposits found on the surface, towards the end of the treatment cycles. It is normally believed that salt depositions (crystallization) within the cement phase can lead to expansions and crack formations. However, there was no visible deterioration signs/cracks with any of the specimens studied. Therefore, it is possible that the polystyrene embedded medium in the tested specimens can withstand against any resistance/expansion created by salt deposits. A detailed analysis of the microstructure may help in establishing the mechanism that takes place in these samples.

The results of the Vaseline applied specimens also show that salt absorption does not occur or is minimal through the external surfaces of solid and hollow Benex units, which is the case in real life applications.

As per AS/NZS 4456.10:1997, both solid and hollow Benex blocks can be graded as "exposure" type.

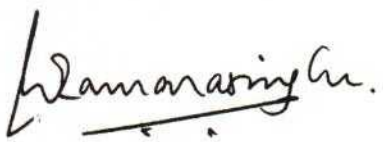
Conclusions

1. As per AS/NZS 4456.10:2003 method B, both solid and hollow samples of Benex blocks seem to be resistant to salt attack.

2. Salt diffusion occurs only through open (cut) surfaces of the specimens. Capped surfaces seem to be impermeable towards salt movement.

3. Both solid and hollow Benex blocks can be categorized as "Exposure Grade" as per AS/NZS 4456.10.1977. Hence, they can be used in aggressive environments such as severe marine environments and aggressive soils; as per Clause 5.2.5 of AS 3700-2001.

Yours sincerely.



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