

FIBRE CEMENT PANELS AS PERMANENT FORMWORK FOR REINFORCED CONCRETE ELEMENTS – EFFECTS ON CARBONATION

Research Leads: Hans Beushausen, Civil Engineering Professor and Joanitta Ndawula, Civil Engineering PhD student
Location: Concrete Materials and Structural Integrity Research Unit (CoMSIRU), University of Cape Town, South Africa

This research aimed to assess the improved durability of RC elements constructed with permanent formwork made of fibre cement panels. To this aim, composite specimens consisting of concrete with fibre cement boards as permanent formwork were investigated for their resistance to carbonation.

Carbonation occurs when carbon dioxide gas from the atmosphere diffuses into concrete and reacts with the hydrated cement paste in the presence of moisture. The reactions in this process reduce the pH of the pore solution from a value greater than 12 to a value of about 9 for fully carbonated concrete. This reduction in pH causes depassivation of the steel reinforcement and may initiate corrosion in the presence of moisture and oxygen.

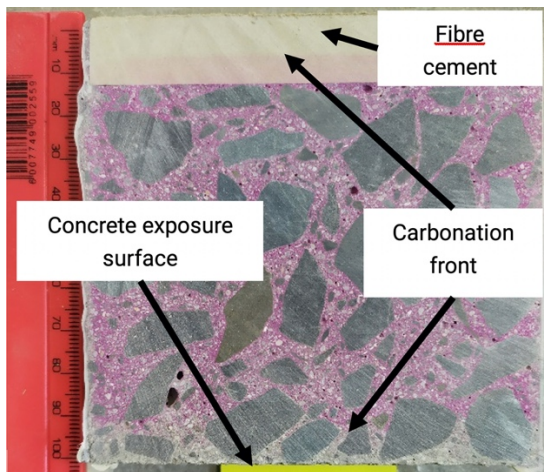


Figure 1: Carbonation fronts on cut surface of specimen

The composite specimens were subjected to accelerated carbonation for a period of 23 weeks, after which they were split perpendicular to the exposure surfaces. Phenolphthalein indicator was then sprayed on the freshly cut surface as shown in Figure 1. The carbonation depth is the distance from the external surface to the pink/purple line, also referred to as the carbonation front.

From the experimental results, the estimated service life extension for concrete elements provided by fibre cement panels of various thicknesses was calculated. For these calculations, it was assumed that carbonation of the protected concrete would only initiate when the carbonation depth was equal to, or greater than the thickness of the fibre cement panel and that the rate of carbonation remained constant over time. The additional service life provided by the fibre cement panels was therefore equivalent to the time required for the panels to completely carbonate. The results are presented in Figure 2.

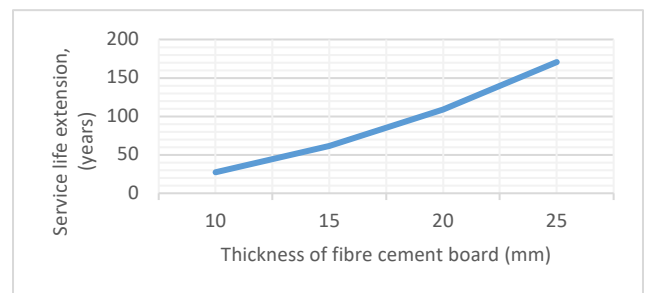


Figure 2: Estimated service life extension of concrete elements

Based on the results, using fibre cement panels of 15 mm thickness could provide a service life extension of up to 60 years, while using a panel of 20 mm thickness could provide a service life extension of up to 100 years, provided the panels remain in good condition.

Published 2nd Nov 2020. For more information on IIBCC's research projects, visit iibcc.biz/features/projects/

