UNIVERSITI TEKNOLOGI MARA

FLEXURAL PERFORMANCE OF RC BEAMS WITH NEAR SURFACE MOUNTED CFRP PLATE UNDER TROPICAL CLIMATE EFFECTS

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ABSTRACT

Environmental factors are one of the reasons for structural deterioration. Deteriorated structures are required to be strengthened and rehabilitated so that it can continue to stand strong throughout its service life. This study focuses on determining the flexural performance of RC beams longitudinally strengthened with CFRP plate using Near Surface Mounted (NSM) method with the effect of tropical climate. Tropical climate parameters such as the air and moisture will recommence the carbonation process. Through carbonation process, the carbon dioxide will gradually penetrates the concrete surface and react with moisture and calcium hydroxide forming calcium carbonate that leads to steel corrosion and weaken the structure. The utilization of CFRP composite materials using NSM method is an alternative to strengthen the structures as it is rust proof and stronger in term of stiffness compared to steel. The flexural performance of RC beams was observed experimentally and analytically. Eleven beam specimens sized 125mm x 300mm x 1800mm (width; height; length) were constructed and placed in both room temperature surrounding and exposed to the tropical climate for 6 and 12 months. The beam were tested under four point static loading once the exposure time has lapsed and finite element model were then developed to validate the experimental works. The results suggested that the concrete, steel, CFRP plate and epoxy adhesive were significantly affected by the environmental agents as the strength continues to decrease over time. Surface roughness and discoloration were also observed on the materials' surfaces with the longer exposure have the most negative influence. Both experimental and computational modelling display an agreement where there is reduction in flexural strength recorded in the strengthened beams exposed to the tropical climate when comparisons were made to its counterparts which are placed indoor. The exposed strengthened beams however display an enhancement in flexural strength compared to the control beam without any strengthening proving that NSM method is able to strengthen the beams even with the effects of the tropical climate.

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