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Influence of Structural Cracks on Transport Performance of Reinforced Concrete

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Abstract : Concrete structures in service are constantly under the influence of load. Microstructural cracks often develop in them and considering those in the marine environment; these microcracks often serve as a means for transportation of harmful fluids into the concrete. This paper studies the influence of flexural tensile stress that structural elements undergo on the transport properties of such concrete in the tensile zone of the structural member. Reinforced concrete beams of 1200mm 230mm 150mm in dimension in a four-point bending set up were subjected to various levels of the loading required to cause a microcrack width of 100µm. The use of Autoclam permeability tests, sorptivity tests as well as the Permit chloride ion migration tests were employed, and results showed that air permeability, sorptivity and water permeability all increased as the load increased in the concrete tensile zone. For air permeability, an increase in stress levels led to more permeability, and the addition of steel macrofibers had no significant effect until at 75% of stress level where it decreased air permeability. For sorptivity, there was no absorption into concrete when no load was added, but water sorptivity index was high at 75% stress levels and higher in steel fiber reinforced concrete (SFRC). Steel macrofibers produced more water permeability into the concrete at 75% stress level under the 100µm crack width considered while steel macrofibers helped in slightly reducing the migration of chloride into concrete by 8.8% reduction, compared to control samples at 75% stress level. It is clear from this research that load-induced cracking leads to an increase in fluid permeability into concrete and the effect of the addition of steel macrofiber to concrete for durability is not significant under 100µm crack width.

Keywords : durability, microcracks, SFRC, stress Level, transport properties
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