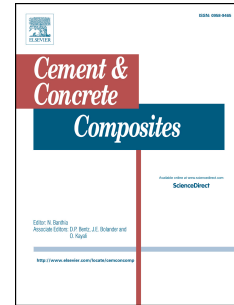


Accepted Manuscript

An analytical solution for hydraulic conductivity of concrete considering properties of the Interfacial Transition Zone (ITZ)

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PII: S0958-9465(17)31001-6

DOI: [10.1016/j.cemconcomp.2018.04.008](https://doi.org/10.1016/j.cemconcomp.2018.04.008)

Reference: CECO 3044

To appear in: *Cement and Concrete Composites*

Received Date: 6 November 2017

Revised Date: 11 April 2018

Accepted Date: 13 April 2018

Please cite this article as: H. Baji, C.-Q. Li, An analytical solution for hydraulic conductivity of concrete considering properties of the Interfacial Transition Zone (ITZ), *Cement and Concrete Composites* (2018), doi: 10.1016/j.cemconcomp.2018.04.008.

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1 **An Analytical Solution for Hydraulic Conductivity of Concrete Considering** 2 **Properties of the Interfacial Transition Zone (ITZ)**

3
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8 **ABSTRACT**

9 As a composite material, hydraulic conductivity of concrete depends on conductivity of its
10 components that are the mortar, aggregates and the Interfacial Transition Zone (ITZ). Since
11 hydraulic conduction is analogous to heat and electrical conduction, analytical models from these
12 analogous areas relating effective conductivity of composite to conductivity of its components can
13 be used to find the effective hydraulic conductivity of concrete as a function of properties of its
14 components, i.e., aggregate, mortar and the ITZ. However, effect of the conduction in the ITZ has
15 not been considered in these models. This paper presents an analytical solution for the hydraulic
16 conductivity of concrete as a three-phase composite material. The solution is an extension to the
17 model originally proposed for conduction of composite media with randomly suspended spheres.
18 Results of the proposed model compare well against the experimental results and those obtained
19 from rigorous numerical analysis using the Finite Element (FE) method. The principal significance
20 of this study lies in the development of a versatile analytical model that can be employed as a quick
21 tool for assessment of hydraulic conductivity of concrete without the need for sophisticated FE
22 models at the meso-scale level. It offers more insight into effect of different components of concrete
23 on its overall conductivity.

24 **KEYWORDS**

25 Hydraulic Conductivity; Analytical; Concrete; Interfacial Transition Zone (ITZ)
26

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