Formulation of The Theory of Critical Distance For Fatigue Characteristics in Concrete Incorporating Various Water-Cement Ratios: Unified Relationship For Static And Fatigue Properties (Part A)

Ahmad Shah Mohamad Shazwan¹, Sarehati Umar¹, Shahrum Abdullah², Beng Hong Ahmad³, Mohd Nasir Tamin⁴, Kim Jang-Ho Jay⁵, Yahaya Nordin¹, and Md. Noor Norhazilan¹

¹Universiti Teknologi Malaysia School of Civil Engineering
²Universiti Kebangsaan Malaysia Fakulti Kejuruteraan dan Alam Bina
³Universiti Malaysia Sarawak Fakulti Kejuruteraan
⁴Universiti Teknologi Malaysia School of Mechanical Engineering
⁵Yonsei University

October 20, 2023

Abstract

The research into fatigue fracture formulations for the Theory of Critical Distances (TCD) in concrete is advancing, with a focus on reducing the occurrence of fatigue failures in concrete structures. Despite design safety factors, concrete fatigue failures persist, and the associated fatigue tests are resource intensive. While TCD is known for its accuracy, it exhibits instability concerning variations in water-cement ratios in concrete mixes. The absence of standardized procedures further complicates fatigue testing, hindering research progress. This paper proposes a unified relationship between static and fatigue properties, streamlining fatigue characterizations through less laborious static tests. This research paves the way for Part B, which explores mathematical enhancements to this formulation. Together, Parts A and B aim to bridge knowledge gaps, offering a foundation for safer and more efficient concrete structures.

Hosted file