Rheological Approaches on Prediction of Time-dependent Behaviors for Concrete Used in FCM Bridges of Korea

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Summary

The primary objective of this study is to construct more simple and reasonable rheological model and to propose a methodology for predicting the time-dependent phenomena of concrete, especially for the FCM bridges of Korea. Deformations of concrete under sustaining stresses and drying environments can be expressed by the sum of immediately elastic deformation, creep deformation, shrinkage deformation, and thermal deformation, etc. To simulate these deformations, rheological models having five and six parameters were constructed. In composing of each parameter, existing theories and design model codes were incorporated with the numerical approach for the components which cannot be theoretically approached. Finally, actual test data from the FCM bridges of Korea were applied in the verification of the proposed models, and suitability of the models was confirmed by comparisons with existing predicting models and design codes.

Keywords: time-dependent behaviors; long-term creep; short-term creep; rheology; FCM bridges

1. Introduction

Creep influences the performance of concrete structures, causing an increase in deflection and affects stress distribution. In particular, for FCM concrete bridges, each segment undergoes various stress states. The effect of creep must therefore be considered carefully. In this study, two simple rheological creep prediction models are proposed. The proposed five and six parametric models were optimized and the recent studies on creep related to the separation of long-term and short-term deformation, respectively, were accommodated.

2. Rheological approach on creep

The most well-known rheological model that simulates visco-elastic material is Burgers' fluid model (Fig. 1), and creep compliance can be expressed by Eq (1) below [1].

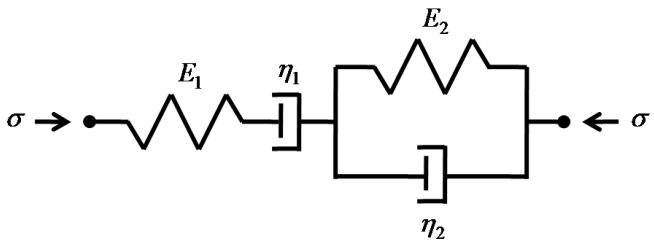

Fig. 1: Burgers' Fluid Model

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