Accuracy of Concrete Creep Predictions Based on Extrapolation of Short-Time Data

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Abstract

Concrete exhibits creep already at low stress levels and normal temperatures, and long-time measurements on laboratory samples as well as on concrete structures indicate that the growth of strain at constant stress continues even after many decades, see Brooks (2005) and Bažant et el. (2010). Problems with excessive deflections caused by creep have been reported for many large-span prestressed concrete bridges, and comparative numerical simulations based on design codes and advanced models have revealed the essential role played by a good predictive creep model, see Bažant et el. (2010). Unfortunately, empirical formulae for determination of creep model parameters based exclusively on the fundamental properties (such as compressive strength, concrete mix composition and curing) have a very limited accuracy and often lead to gross errors. It is essential to update the model parameters based on laboratory tests or measurements of the early response of the real structure.

The present paper will assess the accuracy of predictions obtained with various creep models after updating of their parameters based on short-time data. The models considered in this comparative study will include relatively simple formulae recommended by major design codes (ACI, fib) as well as more sophisticated models developed by researchers (B3,GL). Appropriate error measures will be defined and several updating strategies will be examined. Predictions of the models will be checked against data from a comprehensive creep database, see Bažant and Li (2008). Finally, conclusions and recommendations regarding the choice of the model and updating strategy will be formulated, and the dependence of the error on the load duration after which the update is performed will be described.

References

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