Verification of Serviceability Limit States of Reinforced Concrete Hinges

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ABSTRACT

Concrete hinges are monolithic necks in reinforced concrete structures. As regards the verification of serviceability limit states, it is an unsolved question how to define tolerable relative rotation angles, based on the compressive normal force transmitted across the neck [1]. This open issue is tackled in the present contribution, based on Hooke's law and a kinematic assumption concerning the region of the neck. This leads to analytical formulae, describing serviceability limit states of reinforced concrete hinges for different operating conditions. Corresponding dimensionless design diagrams are assessed based on experimental data from structural testing of reinforced concrete hinges. This way, it is exemplarily shown that the described mechanical model is suitable for describing serviceability limit states. Related design recommendations are discussed and applied to the verification of serviceability limit states of the reinforced concrete hinges of an existing integral bridge. Because the reinforcement is explicitly accounted for, the tolerable relative rotation angles are larger than those according to the guidelines of Leonhardt and Reimann [2]. Bending-induced tensile cracking beyond half of the width of the neck is acceptable, because the tensile forces carried by the reinforcement provide the required position stability of the hinges.

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