

Abstract

Design of reinforced concrete structural elements under concentrated loading with consideration of cracking

Different model approaches and recommendations for the design and reinforcement detailing of concrete structural elements under concentrated loadings are given in technical literature. These are mainly based on results of investigations of uncracked respectively unreinforced elements.

A detailed investigation of reinforced concrete structural elements under concentrated loadings requires the consideration of cracked conditions. Thus the carried-out investigation concentrates on the influence of cracking and reinforcement detailing on the splitting stresses and the obtainable load-bearing capacity. Within the analysis plane and spatial cases of concentrated loadings for structural members made of reinforced normal strength concrete are considered.

For this purpose results of experimental testing from technical literature are summarized in a database and analyzed. After that detailed investigations concerning the first crack state in structural elements under concentrated loadings are carried out and an approach for the minimum splitting reinforcement is derived.

For the analysis of the influence of split cracking on the splitting stresses in cracked structural members numerical calculations are used. Herein finite-element models are applied which consider different stiffness states in the force transmission zone. With the results approaches for the determination of the stiffness depending splitting stresses are derived.

For the evaluation of different reinforcement detailings nonlinear numerical calculations are applied. After summarization of basics and calibration of model parameters studies on plates and prisms with different reinforcement detailings are carried out. The results lead to a proposal for an improved reinforcement arrangement in the force transmission zone.

Concluding, the results of the investigation are combined in proposals for design calculations and reinforcement detailings.