A model which includes compressive membrane action

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ABSTRACT

Tests on both full scale and small scale reinforced concrete slabs showed that, if the edges of the slabs where laterally restrained, the bearing capacity was significantly higher than the slabs that did not have laterally restrained edges. After these tests, performed in the 1960's various people did research on this phenomenon. They generally came to the same conclusion: after cracking of the slabs a compressive force is introduced which enhances both the shear and bending capacity of the slabs. This phenomenon is called compressive membrane action. The theories however consisted of long and difficult derivations, ending up in big and hard to read formulas, which are of no use in practice. Furthermore, different derivations where made for bending and punching failure, making things even more complex. With the introduction of faster computers and especially better finite element programs like DIANA, which can include non-linear material behaviour, it can be checked if models can be made which takes into account this compressive membrane action. Consequently, laterally restrained structures can be designed in a more economical way. These models can also be used to demonstrate if certain repairs or replacement are necessary, or that the structure has enough extra bearing capacity to postpone the maintenance. It is tried to include this compression membrane action in a finite element analysis and the results are compared to a theory for both bending and punching shear that includes compressive membrane action. The results are also compared to experimental data, which is presented in various articles. The results of the finite element models look very promising.