Nonlinear Finite Element Analysis of Reinforced Concrete Corbels

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Abstract

The research investigates the behavior and ultimate load of reinforced concrete corbels or brackets for **HSC** and **NSC**. The theoretical study uses **FEM** via computer program ANSYS 16.1 to present three-dimension models for forty six specimens that are divided into four case studies based on experimental studies. Case study No.1 includes fourteen specimens of **HSC** divided into five series and considers main reinforcement ratio, shear reinforcement stress, compressive strength of concrete and the ratio of outside depth to the total depth of the corbels (k/h) as variables. Case study No.2 involves six specimens made from **HSC** divided into two series and the variables considered are compressive strength of concrete, and the amount of main and secondary reinforcement. Case study No.3 includes twenty specimens of **NSC** divided into seven series, the variables are shear span to effective depth, amount of the shear reinforcement (stirrups), the ratio of outside depth to the total depth of the corbels (k/h), the compressive strength of the concrete and the main reinforcement ratio. The last case study No.4 includes six specimens of **NSC** divided into two series and the only variable considered is the amount of stirrup reinforcement.

The results show that the agreement between the **FEM** and experiments was good for results of ultimate load, where the maximum difference ratio was 7% and observed that the **HSC** behaviour is like the **NSC** behavior, and that increasing the compressive strength of concrete, amount of main and secondary (stirrups) reinforcement and the ratio of out site to the total depth (k/h) causes the increase of the ultimate load, and found that decreasing the shear span ratio to the effective depth (a/d) causes increasing the ultimate load.

The results arrived at in this study also show that the crack patterns started as flexural cracks and with increasing the applied load diagonal cracks appeared to lead the corbels to fail by Beam Shear Failure for the specimens with stirrups reinforcement and Diagonal Tension Failure for the specimens without stirrups.