World Academy of Science, Engineering and Technology
International Journal of Structural and Construction Engineering
Vol:19, No:08, 2025

Structural Testing and the Finite Element Modelling of Anchors Loaded Against Partially Confined Surfaces

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Abstract : This paper summarises the laboratory tests, numerical models and statistical approach developed to investigate the behaviour of concrete blocks loaded in shear through metallic anchors. This research is proposed to bridge a gap in the state of the art and practice related to anchors loaded against partially confined concrete surfaces. Eight concrete blocks (420 mm x 500 mm x 1000 mm) with 150 and/or 250 deep anchors were tested. The stainless-steel anchors of diameter 16 mm were bonded with HIT-RE 500 V4 injection epoxy resin and were subjected to shear loading against partially supported edges. In addition, finite element models were constructed to validate the laboratory tests and explore the influence of key parameters such as anchor depth, anchor distance from the edge, and compressive strength on the stability of the block. Upon their validation experimentally, the numerical results were used to populate, develop and interpret a systematic parametric study based on the Design of Experiment approach through the Box-Behnken design and Response Surface Methodology. An empirical model has been derived based on this approach, which predicts the load capacity with the desirable intervals of confidence.

Keywords : finite element modelling, design of experiment, response surface methodology, Box-Behnken design, empirical model, interval of confidence, load capacity
Conference Title : ICSE 2025 : International Conference on Structural Engineering
Conference Location : Venice, Italy
Conference Dates : August 12-13, 2025