

Shear Strengthening of Reinforced Concrete Flat Slabs Using Prestressing Bars

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Abstract : The effectiveness of using pre-stressing steel bars for shear strengthening of high strength reinforced concrete (RC) slabs was assessed. Two large-scale RC slabs were tested, one without shear reinforcement and the second strengthened against punching shear failure using pre-stressing steel bars. The two slabs had the same dimensions, flexural reinforcement ratio, loading and support arrangements. The experimental program including the method of strengthening, set up and instrumentation are described in this paper. The experimental results are analyzed and discussed in terms of the structural behavior of the RC slabs, the performance of pre-stressing steel bolts and failure modes. The results confirmed that the shear strengthening technique increased the shear capacity, ductility and yield capacity of the slab by up to 15%, 44%, and 22%, respectively compared to the unstrengthened slab. The strengthening technique also successfully contributed to changing the failure mode from a brittle punching shear mode to ductile flexural failure mode. Vic3D digital image correlation system (photogrammetry) was also used in this research. This technique holds several advantages over traditional contact instrumentations including that it is inexpensive, it produces results that are simple to analyze and it is remote visualization technique. The displacement profile along the span of the slab and rotation has been found and compared with the results obtained from traditional sensors. The performance of the photogrammetry technique was very good and the results of both measurements were in very close agreement.

Keywords : flat slab, photogrammetry, punching shear, strengthening

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