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Pull-Out Analysis of Composite Loops Embedded in Steel Reinforced Concrete Retaining Wall Panels

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Abstract : Modular concrete elements are used for retaining walls to provide lateral support. Depending on the retaining wall layout, these precast panels may be interlocking and may be tied into the soil backfill via geosynthetic strips. This study investigates the ultimate pull-out load increase, which is possible by adding varied diameter supplementary reinforcement through embedded anchor loops within concrete retaining wall panels. Full-scale panels used in practice have four embedded anchor points. However, only one anchor loop was embedded in the center of the experimental panels. The experimental panels had the same thickness but a smaller footprint (600mm x 600mm x 140mm) area than the full-sized panels to accommodate the space limitations of the laboratory and experimental setup. The experimental panels were also cast without any bending reinforcement as would typically be obtained in the full-scale panels. The exclusion of these reinforcements was purposefully neglected to evaluate the impact of a single bar reinforcement through the center of the anchor loops. The reinforcement bars had of 8 mm, 10 mm, 12 mm, and 12 mm. 30 samples of concrete panels with embedded anchor loops were tested. The panels were supported on the edges and the anchor loops were subjected to an increasing tensile force using an Instron piston. Failures that occurred were loop failures and panel failures and a mixture thereof. There was an increase in ultimate load vs. increasing diameter as expected, but this relationship persisted until the reinforcement diameter exceeded 10 mm. For diameters larger than 10 mm, the ultimate failure load starts to decrease due to the dependency of the reinforcement bond strength to the concrete matrix. Overall, the reinforced panels showed a 14 to 23% increase in the factor of safety. Using anchor loops of 66kN ultimate load together with Y10 steel reinforcement with bent ends had shown the most promising results in reducing concrete panel pull-out failure. The Y10 reinforcement had shown, on average, a 24% increase in ultimate load achieved. Previous research has investigated supplementary reinforcement around the anchor loops. This paper extends this investigation by evaluating supplementary reinforcement placed through the panel anchor loops.

Keywords : supplementary reinforcement, anchor loops, retaining panels, reinforced concrete, pull-out failure
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