The College of Graduate Studies and the College of Engineering Cordially Invite You to a

Master Thesis Defense

Entitled

STRENGTHENING OF CONCRETE DEEP BEAMS USING CARBON FABRIC REINFORCED CEMENTITIOUS/GEOPOLYMERIC MATRIX

by

Nour Khir Allah

Faculty Advisor

Prof. Tamer El Maaddawy, Department of Civil and Environmental Engineering

College of Engineering

Date & Venue

10:00 AM

Thursday, 11 November 2021

F1-1117

Abstract

This research aimed to examine the effectiveness of using carbon fabric-reinforced matrix (C-FRM) composites to improve the shear response of reinforced concrete (RC) deep beams. Ten RC deep beams with a shear span-to-depth ratio (a/h) of 1.6 were tested. Test parameters included the presence of internal shear reinforcement (no shear reinforcement and minimum shear reinforcement), number of C-FRM composite layers (one and two layers), angle of inclination of the second layer of CFRM (90o and 0o with respect to the longitudinal direction of the beam), and type of matrix (cementitious and geopolymeric). In the absence of internal shear reinforcement, the use of one layer of C-FRM with cementitious and geopolymeric matrices resulted in 95 and 77% increases in the shear capacity, respectively. The shear capacity of the specimens strengthened with two layers of C-FRM composites were insignificantly higher than that of their counterparts strengthened with one layer of C-FRM. Positioning the second layer of CFRM in the vertical direction (i.e. at angle of inclination of 90o) tended to be more effective than placing it in the horizontal direction (i.e. at angle of inclination of 0o). The gain in shear capacity was less pronounced in the presence of internal shear reinforcement where a maximum shear strength gain of 18% was recorded. Three-dimensional numerical simulation models were developed to predict the shear response of the tested specimens. The shear capacities predicted numerically were in good agreement with those obtained from the tests. The ratio of the predicted-to-measured shear capacity was on average 0.90 with a corresponding standard deviation of 0.09 and a coefficient of variation of 10%.

Keywords: deep beams, shear, strengthening, carbon, fabrics, composites, cementitious, geopolymeric.