UNIVERSITI TEKNOLOGI MARA

STRENGTH CHARACTERIZATION OF THE CFRP CONFINED CIRCULAR REINFORCED CONCRETE COLUMN UNDER HIGH TEMPERATURE

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ABSTRACT

High temperatures can do severe harm to reinforced concrete buildings, resulting in strength losses and damaging the mechanical and physical properties of the construction. Strengthened column structures are exposed to the risk of fire occurrence subjecting the structure to high temperatures. There are still limited studies on full and partial CFRP confined RC circular columns under high temperature and on validation of experimental result with Abaqus software. There are three main objectives are outlined in this study; i.e. to investigate the effect of high temperature exposure of the fully and partially of CFRP confinement of the columns, to determine the strength and failure mode of the CFRP confined circular reinforced concrete column under static loading and fire exposure and to validate the CFRP confined circular column using Abaqus software. A total of 21 samples of circular RC columns were fabricated for this study. 15 samples with 3 unconfined and 12 CFRP confined of 3 full 2-layers, 3 full 1-layer, 3 partial 2-layers and 3 partial 1-layer for unheated samples and 6 samples with 2 unconfined and 4 CFRP confined of 1 full 2-layers, 1 full 1-layer, 1 partial 2-layers and 1 partial 1-layer for heated samples. The heated samples were heated up to 500ºC – 600°C in range. All columns were tested under axial load to find out the compressive strength of each column's configurations. Based on the result, the CFRP confined samples obtained higher stress results than the unconfined results for both unheated and heated samples. CFRP full 2-layers RC column obtained the highest maximum axial compressive load which was 65.73% and 78.96% for unheated and heated in comparison with unconfined (control) samples respectively for experimental results. CFRP full 2-layers RC column model also obtained the highest stress which was 65.73% and 69.33% for unheated and heated compared to unconfined model respectively for FEA results. The validation of the FE models using Abaqus software showed higher stress-strain values than the experimental results with acceptable maximum percentage difference from 3.27% and 8.33% of the ultimate axial compressive stress. The implementation of CFRP was very good in supporting the stiffness of RC columns, thus increased the compressive strength of the RC columns. Both full and partial CFRP confinement showed promising results with a potential for application due to high temperature and under axial load. Full 2-layers CFRP confinement was the best configuration in this research.

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