

FEM ANALYSIS OF FRCM STRENGTHENED RC COLUMNS EXPOSED TO FIRE

ReemTalo¹, Salem Khalaf¹, Muhammad Kyaure¹ and Farid Abed^{1*}

¹Department of Civil Engineering, American University of Sharjah, POBox 26666, UAE,
*fabled@aus.edu

Key Words: *FE, Reinforced Concrete, FRCM, Fire.*

Reinforced Concrete deteriorates over time and therefore needs to be strengthened. Despite the fact that RC has a decent fire rating, the performance of the strengthening system under fire exposure needs to be evaluated. One of the main restrictions associated with Fiber Reinforced Polymer (FRP) systems is poor resistance to high temperature, which originates from the combustible polymer matrix [1]. Therefore, Fiber Reinforced Cementitious Matrix (FRCM) has been introduced due to its improved performance under fire exposure [2]. The potential of Poly-paraphenylene-benzobisoxazole (PBO) Fiber Reinforced Cementitious Matrix (FRCM) to strengthen circular RC columns is evaluated using nonlinear Finite Element (FE) Analysis [3]. ABAQUS is used to develop 3D FE models to investigate the axial performance of the strengthening system. The modeling approach is split into two: first model is a thermal analysis that incorporates temperature dependent material properties for concrete, steel and FRCM; second model includes a displacement-controlled loading condition with imported nodal temperatures from the first model with FRCM layers to strengthen the columns. Material nonlinearities are accounted for in the FE model. The models are validated against published literature and a comprehensive parametric study is conducted on the basis of three parameters: FRCM layers (1, 2 and 4), longitudinal reinforcement ratio (2% and 4%), and column length (800 mm and 1200 mm for short and slender columns respectively) for a 170 mm diameter cross section. The potential of PBO-FRCM to strengthen circular RC columns exposed to elevated temperature is evaluated and results are presented and discussed.

REFERENCES

- [1] F. Abed, C.Oucif, Y.Awera, H.Mhanna and H.Alkhraisha, FE modeling of concrete beams and columns reinforced with FRP composites. *Defence Technology*, Vol. **17**, pp. 1-14, 2021.
- [2] N. Tello, Y.Alhoubi, F. Abed, A. El Refai and T. El-Maaddawy, Circular and square columns strengthened with FRCM under concentric load. *Composite Structures*, Vol. **255**, pp. 113000, 2021.
- [3] M. Kyaure and F. Abed, Finite element parametric analysis of RC columns strengthened with FRCM. *Composite Structures*, Vol. **275**, pp. 114498, 2021.