Ultimate Loading Capacity of RC Columns under Fire: Comparison of ACI and Eurocode Models

H. Barros*, C. Ferreira* and V. D. Silva*

*Institute for Systems Engineering and Computers at Coimbra (INESC Coimbra)
Dep. of Civil Engineering, Faculty of Sciences and Technology, University of Coimbra, Portugal
hbarros;carla;vdsilva@dec.uc.pt and http://www.uc.pt/fctuc/dec

ABSTRACT

The reinforced concrete structures undergo a loss of capacity when submitted to the high temperatures due to a fire. The mechanical properties namely the strength of concrete and steel are predicted in different ways in the European codes (EC2) [1] and in the American Concrete Institute (ACI) code [2]. The EC2 considers different rules for siliceous and calcareous aggregates in function of the temperature, as shown in the figure, where the relative strength is plotted in function of the temperature. The ACI code [2] besides this distinction also considers three different situations, defining the relative strength with the temperature for: 1-specimens stressed during the heating; 2-unstressed during the heating; 3-stressed after attaining ambient temperature, termed residual, as seen in the figure.

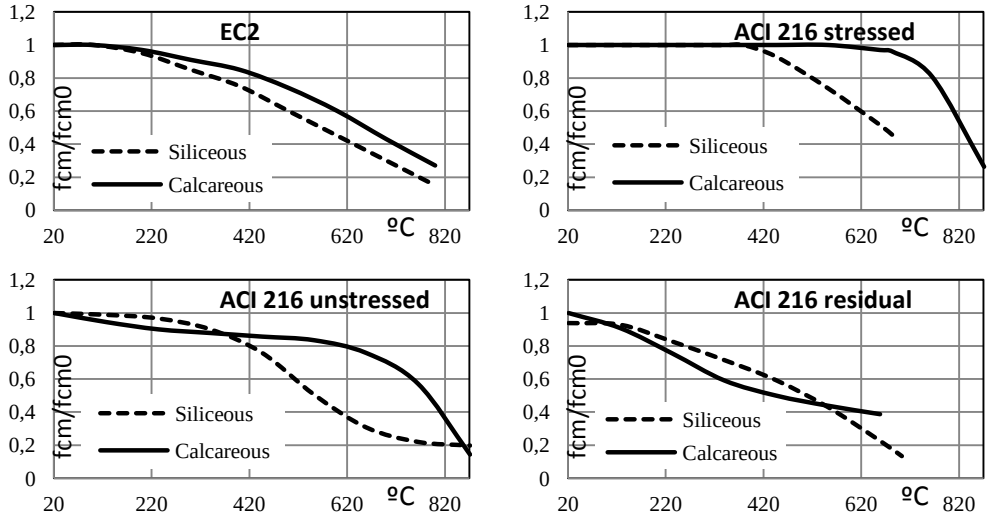

Figure: EC 2 and ACI temperature-dependent compressive strength models.

In the present work the temperature after 30 minutes and 60 minutes of fire is obtained in column with rectangular sections. The software implemented considers geometric and material nonlinearities, obtaining the load displacement curves to compare the different models of the codes. The columns of the numerical examples presented are made of siliceous aggregates exposed to standard fire exposure ISO 834. The thermal analysis considers the lower limit of the conductivity indicated in EC2 for this kind of aggregates.

REFERENCES

[1] Eurocode 2, "Eurocode 2 – Design of composite steel and concrete structures – Part 1-2: General rules –Structural fire design"; EN 1992-1-2; December (2004).

[2] ACI 216R, Guide for Determining the Fire Endurance of Concrete Elements, Farmington Hills, MI, American Concrete Institute, (2007).