# Fire design methods for concrete columns embedded in walls

**Summary**

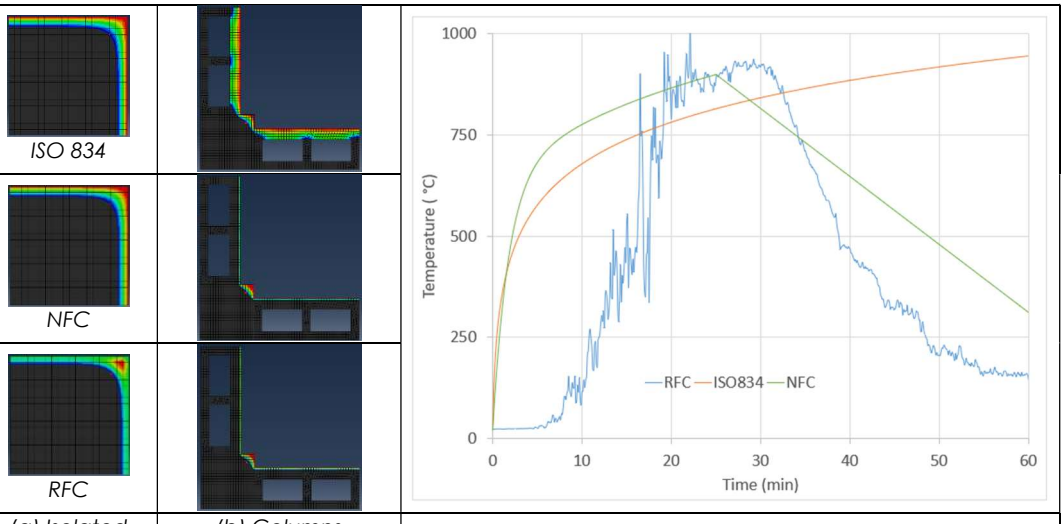
This PhD thesis studies the thermomechanical analysis of reinforced concrete columns embedded in walls under fire conditions. For the porpose, both numerical and experimental analyses are being carried out. In the numerical analyses, using the Abaqus software, the thermomechanical behavior of the columns subjected to three types of fire curves was compared: ISO 834, Natural Fire Curve (NFC), and a curve from a Real Fire Test (RFC). Additionally, the columns were exposed to high temperatures in various configurations: one side, two adjacent sides, two opposite sides, three and four sides. This analysis allowed a comparison of the thermomechanical behavior between columns embedded in walls an those isolated. The study considered the thermal influence of the walls on the columns.

Regarding the experimental part, a real-scale building model was carried out using wood cribs as fire load. This experiment provided data to feed a computational model using PyroSim/FDS to simulate a compartmentalized fire. The outcome of this experiment was a standardized cubic element for use in computional simulations of compartmentalized fires in buildings, with the main goal of understanding fire dynamics and identifying vulnerable areas within the structure. From the numerical modeling, a software for design columns in fire situations was developed, considering the presence or absence of walls (Fire Column Design - FCD). This software can assist in design of new columns and verifying existing columns based on the building's required fire resistance. Also, a new fire curve was proposed, derived from knowledge gained in numerical and experimental analyses, suggesting adjustments to the natural fire curve to bring it closer to the real fire curve.

Finally, a calculation methodology for reinforced concrete columns was proposed based on the analysis of fire dynamics in a building, using the standard wood crib as a fire load and with the assistance of the FCD program. This methodology aims to design columns in fire situation, whether embedded in walls or not, in a way that closely reflects reality.

**Keywords**

Column, compartment fire, thermomechanical analysis, reinforced concrete.




| (a) Isolated columns | (b) Columns embedded in walls | (c) Fire Curves |
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*Comparison between isolated and columns embedded in walls in case of fire.*

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**PhD student**
Bruno Carvalho Lima de Alencar Matos

**PhD program**
Fire Safety Engineering (FCT, University of Coimbra)

**Supervisor**
Fernando Ferreira (FCT, University of Coimbra)

**Co-supervisor**
João Paulo Rodrigues (FCT, University of Coimbra; CERIS, IST, University of Lisbon)

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