

FIRE AND EVACUATION SIMULATIONS WITH HPC TO DESIGN SAFE BUILDINGS

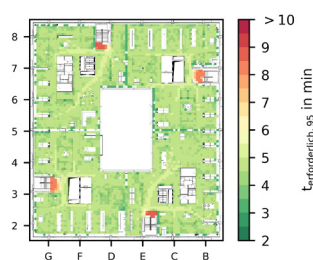
A SUCCESS STORY BY GÖRTZEN INGENIEURE



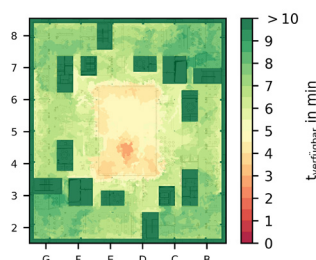
To assess the fire safety of modern office concepts with connected spaces of multiple thousands of square meters and interconnected levels is a challenging task. Many of the common building code requirements cannot be applied. Using High-Performance Computing (HPC), a more sophisticated performance-based approach can be pursued to satisfy the legal protection goals.

In this approach, the smoke spread and heat propagation are computed using fire simulations based on Computational Fluid Dynamics (CFD). Then, the building evacuation is predicted using agent-based pedestrian simulation tools. The fire simulations allow to determine the available safe egress time (ASET), during which fire effects such as smoke and heat are acceptable, while the pedestrian simulations are used to predict the required safe egress time (RSET). The safety margin, given by the difference of ASET and RSET, should be sufficiently large to ensure a fire-safe building design. That is, the time available until parts of the building become inaccessible due to smoke or heat should be sufficiently larger than the time needed for a safe evacuation.

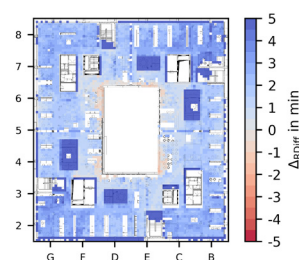
The proof that the legal protection requirements are met must be robust. Therefore, numerical accuracy and multivariate approaches are inevitable, and many different scenarios have to be considered. Moreover, the performance-based analyses are carried out in early stages of a construction project, where the architect's drafts and the user's premises change frequently. A short time to solution is essential for quick assessments and binding decisions. The use of HPC allows to conjunct robustness, variability, and a short time to solution. HPC thereby creates added value for the design process of modern and safe buildings.



Map displaying the required egress time (RSET)



Map displaying the time available for safe egress (ASET)



The difference map (ASET-RSET) showing the safety margin