

APPLICATION OF THE CAD-EMBEDDED CFD CODE FOR THE INVESTIGATION OF THE LONDON SKYSCRAPER'S DAMAGING EFFECT

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ABSTRACT

CFD simulations are generally used at the design stage for the analysis of the operational behavior of built environment constructions. Such calculations provide architects and engineers with the complete information about geometrical and physical features of the model developed to guarantee its safe and stable performance. Such results are relied upon to understand the risks and failure possibilities associated with different design options. Unfortunately, the real life is more complicated, particularly when plans depart from convention, as new and unforeseen issues can arise. The presented research was aimed at investigation of the real-life incident happened in the center of London on the 29th of August 2013 when a car parked on Fenchurch Street has been damaged due to sunlight focused by the skyscraper's parabolic surface. The investigation was performed with FloEFD – CAD-embedded CFD-software developed by Mentor Graphics.

The full-scale CAD-model of 20 Fenchurch Street skyscraper and the surrounding city block was built with the maximum geometrical similarity to the original objects. The dynamics of solar flux distribution around the date of the incident have been calculated. Based on these results which appeared to be in good compliance with official information the exact position of the damaged car on the southern side of the Fenchurch Street was detected. Further calculations were then aimed to estimate the impact of solar radiation on the car surface using the basic CAD-model complemented with the car. From the simulation, the location and temperature of the sunlight focus spot on the car's side-view mirror as well as the approximate temperature of the pavement around the car at the moment of melting were reproduced. To complete the picture, two further extreme cases were simulated: First, the most intensive sun exposure was calculated on the assumption of full mirror reflection and second, the opposite situation without any solar reflection, were calculated. Such calculations are representative in relation to existing objects for the estimation of the scales of focused sunlight impact.

The results obtained demonstrate the effectiveness of CFD for investigations of actual incidents and emphasize the need for simulation early in design, with

simulations repeated for each design iteration, a paradigm that CAD-embedded CFD is designed to facilitate.