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Fire experiments and simulations in a full-scale atrium under transient and asymmetric venting conditions

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Abstract-

An experimental and numerical comparison of new full-scale atrium fire tests in the 20 m cubic atrium with four different heat release rates (1.7 MW, 2.3 MW, 3.9 MW and 5.3 MW) is presented. Different exhaust conditions (steady and transient extraction rates) and different make-up air configurations (symmetric and asymmetric) are assessed. Temperature measurements in the near (fire plume) and far field (close to the walls) have been recorded by means of 59 thermocouples. The smoke layer interface is also estimated by means of a thermocouple tree with 28 measurements using the least-square and the n-percent methods. The simulations have been conducted using FDS (version 6, Release Candidate 3). The comparison with the simulations shows average discrepancies lower than 32% and 11%, for the near and far field temperatures, respectively. A discrepancy lower than 5% (1 m) is obtained by both methods for the smoke layer height when the steady state is reached. Finally, a slower response to an increment on the exhaust rate is predicted on the smoke layer, being more perceptible for high heat release rates.

Index Terms- Atrium, Full-scale fire tests, FDSv6, Smoke layer, CFD simulation

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