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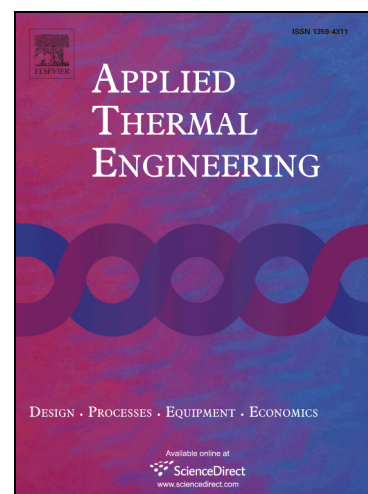
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Improvement in smoke extraction efficiency by natural ventilation through a board-coupled shaft during tunnel fires

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Abstract

This study investigated the smoke extraction process by natural ventilation through a vertical shaft. In addition, the factors restricting smoke exhaust, such as plug-holing and boundary layer separation are discussed. Accordingly, a new concept (board-coupled shaft) is introduced to solve the dilemma. By installing a thin board under the shaft, the negative effect of plug-holing can be eliminated, leading to higher smoke-extraction efficiency in the shaft. Numerical simulations were performed using the Fire Dynamic Simulation (Version 6.1.2). The influences of board location and fire heat release rate on smoke extraction were investigated. Furthermore, the validity of this model was proved, and the results indicate that the distance between the board and shaft should be properly selected. In addition, a new empirical model was deduced to predict the mass flow rate inside the shaft, which agrees well with the experimental data.

Keywords: Tunnel fire; Natural ventilation; Shaft; Smoke extraction efficiency

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