Modeling of smoke control in underground parking-garage fires

Beline Alianto, author

Abstrak

Smoke is the real threat in a fire in an enclosed, underground parking garage, and is a significant issue and very critical for firefighters dealing with fire. Special attention should be paid to fire safety, especially for those with multiple floors underground. A model of the smoke movement in a basement was established using Fire Dynamics Simulator (FDS) 6.0 software. In this paper, the study undertaken used a basement model of 60 m (length) × 30 m (width) × 3 m (height) and has three typical floors. Smoke ventilation shafts were provided for the basement. A well-controlled liquid pool fire with a heat release rate (HRR) of 2 MW was used as an input parameter. The ventilation strategy was achieved through a mechanical exhaust fans and make-up air fans. The required ventilation was based on the air changing ten times per hour. The following parameters were varied: the location of the fire, the presence or absence of sprinklers, the presence or absence of a smoke-extraction system, the presence or absence of openings for incoming air, and the presence or absence of a jet fan and ducting. The impact of jet fans (induction type) was also addressed in several simulations. Smoke modeling was investigated under different fire scenarios. Simulations were conducted for smoke and heat control using forced, mechanical, horizontal ventilation. When the combination of a jet fan and ducting was applied, the fastest time for smoke removal was achieved compared to the other scenarios.