

## Abstract (English)

An experimental investigation supported by numerical analysis was carried out to study the effect of horizontal ceiling openings in an informal settlement dwelling in reducing fire spread between dwellings. FDS was later used to analyze these experimental data.

The experimental part included a quarter scale ISO-9705 compartment of dimensions 0.6x0.9x0.6 m (Length×Width×Height) with a vertical door opening of dimensions 0.2 x 0.5m (W ×H) and variable areas of horizontal openings. The study investigated different shapes of horizontal openings, the first one being four-square corner openings with dimensions of 0.025x0.025, 0.05x0.05, 0.1x0.1, 0.15x0.15 and 0.2x0.2 m while the second shape was one rectangular central opening with dimensions of 0.6x0.02 ,0.6x0.07 ,0.6x0.15 and 0.6x0.27 m. The compartment had a thermally-thin steel sheet boundary materials, while polypropylene was used as a fuel source with a fuel load of 80 MJ/m<sup>2</sup>.

The study showed that the horizontal opening size had an insignificant effect on the gas layer temperatures with a horizontal opening size of 0.04 m<sup>2</sup> or less. Beyond that size there was a considerable reduction in temperatures of about 40% with the 0.16 m<sup>2</sup> ceiling opening leading to no flashover. The radiative heat flux to the surrounding decreased significantly by about 50% with the increase of the size of the horizontal opening until 0.16 m<sup>2</sup>. With a horizontal opening area of 0.04 m<sup>2</sup> or more the time to flashover increased and the neutral plane almost vanished, in addition to the vanishing of the ventilation pulsation phenomenon (Oscillating flames) that occurred with 0.01 m<sup>2</sup> or less of horizontal openings.

The validation process indicated the ability of FDS to model these under-ventilated dwellings with horizontal opening sizes of 0.04 m<sup>2</sup> or less with high accuracy except for the ventilation pulsation phenomenon (oscillating flames) which struggled to model. However, with a horizontal opening size of 0.09 m<sup>2</sup> or more indicating over-ventilated compartments, FDS failed to capture the flow fields through the openings , the heat balance within the compartment and the combustion efficiency which could require using finer meshes and test its accuracy.