

Reliability of Fire Barriers

This study investigates the reliability of the fire barriers as an effective mean of protection.

Fire resisting constructions, used in passive fire protection, are built according to specifications taken from manufacturers after full-scale tests done in furnaces. The objective of this study was to investigate the effect of increased air leakage and reduced thermal insulation of walls on the fire resistance rating. This was done using numerical tools namely FDS and ABAQUS.

Fire safety engineers usually rely on the given fire resistance rating obtained from the manufacturer after full scale furnace test. However, there is always a chance that these fire-rated barriers are in practice less air-tight or that parts of insulation material might be missing compare to the similar structure which was tested in the furnace. This raises concerns about the reliability of fire barrier as an effective mean of protection. Indeed a change in those two parameters could have a direct effect on the rating of the fire-rated barriers and thus could reduce its performance in case of fire. Little research has been done with respect to those parameters on the reliability of fire walls. Simulation of fire resistance test is something that is currently being studied in different countries around the world as it is less expensive than the cost of full scale furnace test performance. This study shows how fire resistance tests can be simulated with the use of numerical tools. For that, the attempt was made to simulate the furnace in FDS and investigate the impact of leakage inside the barrier on its fire resistance rating. Additionally, walls, different in their configuration, were modelled in ABAQUS in order to study the heat transfer through them and see which configurations lead to the failure. Validation of the created models were performed by comparing obtained results with experimental ones from different past studies.

The results showed clearly that in order to stay reliable, a fire-rated partition must be built and maintained as specified by the manufacturer. It was also discovered that using stone wool insulation inside the cavity could help improving the reliability. This study provided a method to simulate fire resistance tests with the help of numerical tools. It showed also how a reduction of the insulation or an increase of air leakage affected the fire rating of walls. The findings of this work gave a general idea of the safety factor inherent in fire barriers and showed how the reliability could be improved.