

Summary

The capacity of Fire tools to simulate crowd modelling in large-scale scenarios

The thesis presented has proved that Fire tools can be used to simulate Crowd in large-scale evacuation scenarios such as, an outdoor festival.

The project has been focused on a realistic outdoor music festival scenario. Two main areas have been studied: Partial evacuation of a sector and crush barriers design in a stadium area. Results have given an understanding of the capability of fire evacuation tools to manage with crowd evacuation in areas where a high amount of people is expected to be. Three different scenarios were considered and interesting results have showed up about the improvements that can be made by modifying the pre-evacuation times or the door's availability in case of a partial evacuation procedure. Moreover, the influence of their size, position and number has pointed out the importance of these factors. In the second part, crush barriers designs, the thesis has been able to provide the design characteristics of these elements that would be able to optimize their number and position while, ensuring a safe environment for the people standing there. All these, based on maximum values provided by authorities.

The main need phased was to obtain more research on the possibility to use fire evacuation tools to simulate crowd evacuation in large-scale scenarios and obtain realistic results. The densities expected in each area was bigger than the usual density in regular building were less people are placed in a same area at a time. From the point of view of the crush barriers design, the need to improve these kind of set up and see how they can be used in a safe way in stand by stadiums.

Results obtained have demonstrated that fire tools can be used for this kind of situations. Crowd evacuation scenarios can be modelled and this will impact the safety of music festivals. During the last years different incidents have end up killing thousands of people and the use of this tools will provide better knowledge of human behaviour in risky situations as well as, improving the environment. For example, providing better exits' design, locating them in specific places or changing the way in which people are organised during evacuation procedures. In case of crush barriers, they can be design to both reduce costs and apply enough safety for attendees.

Finally, pre-movement time influence has been an interesting aspect. Increasing it in some areas could reduce the total evacuation time if well combined with the total walking distance and the number of people using at the time. This fact might go against what most people may think, which is that making people to wait more before evacuation will increase the total evacuation time.