Verification Testing of Evacuationz, a Coarse Network Evacuation Model

Antariksh Gupta

Evacuation models are tools used by fire engineers to evaluate and check the suitability of evacuation design on the building layouts. The models are used to estimate the time required for people to escape from a building to a safe location in the event of an emergency. There are numerous models on the market to calculate the required time. It is difficult to judge whether the results of these models are accurate or not. Therefore, to establish the accuracy of the results the models must be tested. Verification is the process to check that the results of calculation methods match with the implementation of the conceptual representation – that the model does what was intended. Over a period of time, different verification test methods have been developed. At this time, there are four verification test procedures, and a document released by the International Organization for Standardization is the latest procedure for verification released (ISO:20414).

The focal point of the thesis is to implement the ISO verification test procedures in a coarse network model. This is the first time that the ISO test procedure has been applied to this type of model. A coarse network model uses a node system to represent simple and complex structures of buildings. People/occupants are considered as points in the node system (people representation does not have any real characteristics but it is shown as a dot), and the model user directs each movement of the occupant in the node.

Evacuationz software which is a coarse network model was chosen for this thesis. In this model there are six input files to run a simulation. The input files are named as Map, Populate, Agent type, Exit Behaviour, Simulation and Scenario. Every file has a unique attribute for the simulation.

In the ISO publication, there are a total of twenty-one verification tests. These tests are broken down into four categories: Basic components, Behavioural components, Fire-People Interaction components, and Building-Specific components. Basic components consist of 13 tests that primarily focus on the testing of basic features that most models possess, such as maintaining the walking speed of occupants in a corridor and stairs checking whether occupants can walk to specified exits when directed to them, and many more. The second component is the Behaviour component which consists of four tests and focuses on the behaviour of the building's occupants in the event of an emergency. The third component, Fire-People Interaction, consists of two verification tests. Its primary goal is to assess the impact of the fire and smoke on those who are trying to escape the premises. The effects include a decrease in the walking speed and the amount of smoke inhaled by people. The last component is the Building-Specific component whose goal is to determine whether the model has the capability of evacuation via lifts and escalators.

After running all the verification tests on the Evacuationz model, it was found that only seventeen out of twenty-one tests could even be performed. The remaining four tests were not performed given the absence of certain features. These tests will be successful if the specific features such as addition of ramp, lift, escalators, representation of Fractional Effective Dose (FED), and disabling an exit can be added to the model. A sub-set of the ISO:20414 tests are applicable given the nature of this type of network model. The outcome of performed tests were compared to the expected results specified in the ISO document and desirable results were obtained. Hence, it can be concluded that the ISO:20414 procedure for verification testing is applicable to coarse network models.