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Case Report

Evacuation Modelling in New Zealand the Result of An Online Survey

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Introduction

Enhancing building fire safety is a fundamental task to reduce the impact of those disasters on occupants. This has been achieved around the word by introducing a performance-based approach which allow designer and building manager to assess how a building can respond from a fire and evacuation point of view.

This change has occurred also in New Zealand. In fact, fire engineering has experienced major changes in New Zealand in the last five years with the introduction of the 2012 edition of the Building Code [1]. The C/VM2 Verification Method [2] represents a compromise between a prescriptive approach and a novel performance-based approach by providing several prescriptive inputs for fire and evacuation modelling and provide a novel 'Framework for Fire Safety Design'. The performance approach relies on the comparison ASET and RSET, where ASET stands for Available Safe Egress Time while RSET stands for Required Safe Egress Time [3]. As such, fire engineers are asked to predict and model several fire and evacuation scenarios to ensure that the RSET is greater than the ASET.

To date, fire engineering can use several computational tools to simulate fire and smoke dynamics as well as the evacuation process. According to an existing survey [4], it was shown that FDS computational fluid dynamics program by NIST and BRANZ's B-RISK zone model were the most popular tools to estimate ASET in New Zealand. The commentary document of C/VM2 provided to support C/VM2 specifically describes the use of FDS and BRANZFIRE as the basis for a number of exemplar scenarios. In contrast, no computer evacuation model is discussed. Moreover, there is no available survey describing which evacuation model are used in New Zealand [5].

Through this short article we present the final results of a survey carried out in the 2017 to investigate the awareness and use of the existing computational evacuation models.

Survey

We developed a closed response survey to quantify which evacuation model's participants were familiar with and which model's participants have been using through their careers. This survey has been disseminated with the help of the Fire Protection Association NZ, the Institution of Fire Engineers New Zealand and social networks such as LinkedIn and Twitter since June 2017 and through FireNZ 2017 conference.

Results

To date 93 participants from the NZ fire engineering community have completed this survey. Most of them are fire engineers working as fire consultants or designers (71%) while the remaining ones are engineers, fire officers and academics. The average work experience in fire safety of those participants is ten years, while the average years of experience in performance-based design and evacuation models is six years and five years respectively.

According to this sample, the most known evacuation model in New Zealand is Pathfinder (67%) followed by FDS+Evac (63%), Exodus and STEPS (50%), Simulex (45%) and EvacuatioNZ (42%). While all the remaining models (i.e. Legion, Mass Motion, VISSIM, PedGo) are below 40%. In line with these statistics the most used model is Pathfinder (64%) followed by FDS+Evac (40%), EvacuatioNZ and Simulex (24%), STEPS (18%) and Exodus (16%). Finally, the results indicate that the most favourite model is still Pathfinder (58%) followed by FDS+Evac (20%) and EvacuatioNZ (10%). It is worth clarifying that those statistics do not add up to 100% as many participants stated to be aware and that they have used more than one model through their careers. A summary of these statistics is illustrated in Figure 1.

From the awareness viewpoint, the proposed results show many similarities with those from an international survey carried

out by Ronchi and Kinsey [6] in 2011, who identify many of the same models as the most known and used models around the world as illustrated in Figure 2. The only difference is the awareness and use of EvacuatioNZ which is not as popular internationally as it is in New Zealand. From the use point of view, the use of evacuation models in New Zealand differs from other countries.

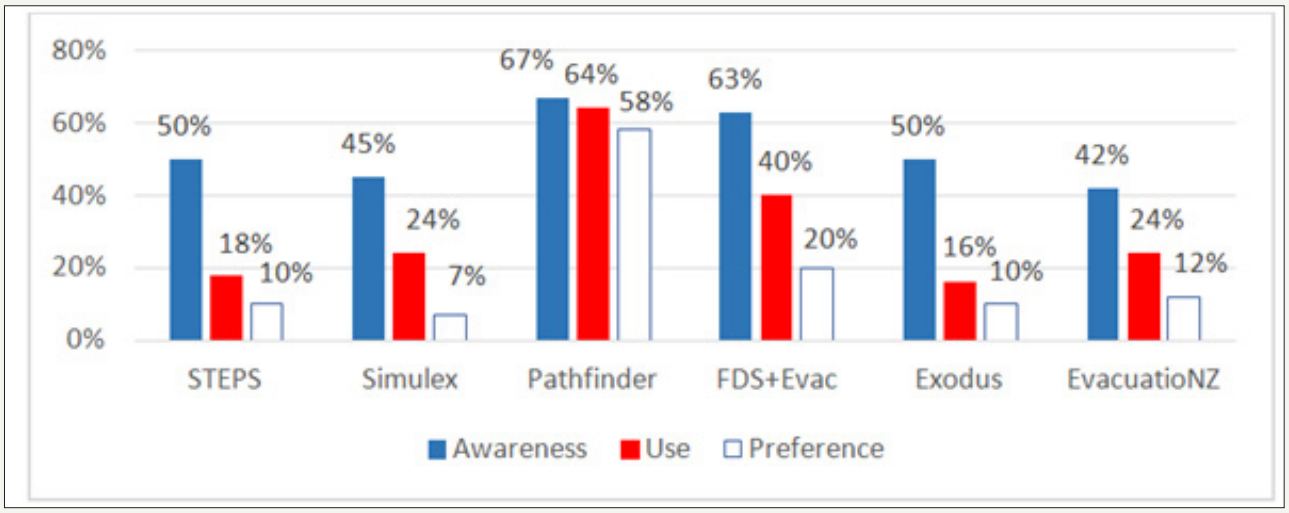

Figure 1: Percentages of the awareness, use and preference of evacuation models in New Zealand.

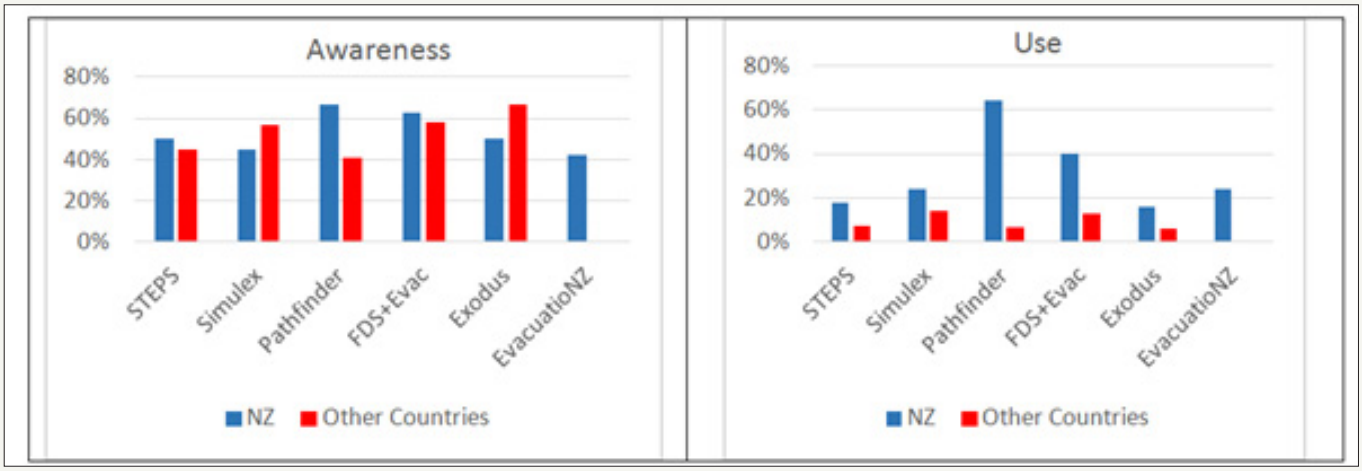

Figure 2: Comparison of the awareness and use of evacuation models in New Zealand and other countries.

Finally, these results indicate that the majority of the participants are not aware of many of the other computational evacuation models which have been developed by research groups and companies over the past 20 years but are not mentioned in this article. This lack of awareness could inhibit informed model selection as modellers are then not aware of the capabilities of all the available evacuation models [6]. Therefore, this survey identifies the need for a platform to provide updated information about all of the existing evacuation models, the behavioural assumptions or statements underpinning those models and the implemented behavioural sub-models for the pre-evacuation decision making, exit and route choices [10-17].

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