Evacuation Modeling – Issues and Challenges

Panel: Weiguo Song (USTC, China), Daniel Nilsson (Lund University, Sweden), Rita Fahy (NFPA, USA), Arturo Cuesta (University of Cantabria, Spain)

This workshop, moderated by Ed Galea (University of Greenwich, UK), featured short presentations by the panelists on several broad themes, which were then discussed by the participants. These themes were:

- How do we build and validate evacuation models, as they include increasingly complex behaviors and choices?
- How and when should a model be used?
- How do we deal with uncertainty in data?
- What should be the focus of future model development, and what are the challenges?

Weiguo Song led off the discussion on the first theme. The group discussed the mechanism of evacuation models, quantification of personal characteristics, consideration of human behaviors and fire enviroment, validation of evacuation models and reliability of model validation. During the discussion, the panelists and participants summarized the following outcomes:

1. The decision-making process of occupants is important in evacuation modeling.
2. Parameters of real scenarios should be further considered.
3. Consideration of the fire environment is necessary, especially in the near-fire area.
4. Both verification and validation of models are needed.
5. Both simple models for fast estimation and complex models for accurate prediction are useful.

Daniel Nilsson followed with a discussion on the use of models. He pointed out that certain phenomena that are too complex for hand calculations can be better handled by computer models. These phenomena include complex occupant flow (e.g., influx of people into a metro station from trains), interaction between different occupant flows, and crowding. The participants discussed when and why they would and would not use a model – depending on complexity of the design and resources of the client – as well as how they would use the results.

Next, Rita Fahy presented some issues concerning the data to be used in evacuation model and the group addressed questions related to their specific issues, how the issues of model developers might differ from those for model users and what steps the modeling community needs to take to address these issues and reduce data uncertainty (e.g., safety margins or sensitivity analyses).

Although Arturo Cuesta was not able to attend, he did provide discussion points on the last theme that were presented by Ed Galea. In addition to future developments suggested by others, including a comprehensive database, inclusion of a more comprehensive theory of human behavior and more integration with fire models, he pointed out two other challenges for model development – the misuse of models and the need for a protocol for the verification and validation of evacuation models. He also proposed development of more models focused on other environments (such as hospitals and schools), as well as the use of models for decision support in real-time during emergencies. He posed a set of questions for discussion in these areas.

The workshop then opened up for general discussion, led by Ed Galea. Much of the discussion focused on the practitioner's perspective of what should be done in the area of evacuation modeling. Some of the points made included:

- Model output could include suggestions for optimizing results (such as making doors wider).
- Model output could include advice, for example on effect of low staffing in health-care facilities.
- There could be better resolution in modeling behaviour. For example, even a well-trained homogeneous group has some variability, but what about a less homogeneous group?
- We need more information about the effect of false alarms on occupant response.
- Models should address exit choice, recognizing that people tend to head to the main entrance.