STSM Scientific Report
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Visiting researcher: Maja Ban, PhD student
The University of Split
Faculty of Civil Engineering, Architecture and Geodesy
Split, Croatia

Host: Dr. Shrikant B. Sharma
Buro Happold
BATH BA2 3DQ
United Kingdom

- **Purpose of the STSM**

The purpose of the STSM was to study about crowd flow and evacuation modelling as part of my PhD research. The mission included the education in basic modelling capabilities of SMART Move software, developed by SMART team at Buro Happold's Office. The idea was to learn about basic rules of modelling people's interaction and behaviour in evacuation, in order to help the researcher to improve own model.

- **Description of the work carried out during the STSM**

Dr. Shrikant Sharma and his SMART team explained to the researcher basic modelling capabilities of their SMART Move software with a brief overview of the code structure. Verification and validation of SMART Move software was made by the researcher, in order to test software's capability of realistic modelling of people and their behaviour in actual situations, since that is the most difficult modelling assignment.
Advices and experience from experiments conducted by SMART team will be very useful to the researcher.

- **Description of the main results obtained**

These parameters were verified in SMART Move: walking speed on horizontal walkways, down stair and up stair, pre – movement time, discharge rate, limiting flow rate through door, on stair and corridor, holding capacity, service time, density and speed – density relation. All parameteres passed verification test. Testing started from simple ones (walking speed) and finished with people's interaction model which follows Fruin's data and rules. Tested parameters were defined clearly in software and the advantage is that designer decides which value to assign for each parameter, except for the last one, speed – density relation, which is integrated in software. Since software showed correct output for isolated models in verification test, validation test of more complicated space and process was made.
Three experiments were conducted in Buro Happold Office (Bath), on one stair with different combinations of floor entry points. The focus of the study was the merging behaviour on the specified landing. Results obtained from experiments were evacuation times for first and last person of each entry point and merge ratio between people from different entry points measured on specified landing. These three scenarios were simulated in SMART Move by the researcher. Simulations showed similar results to those from experiments. Merge ratios and

evacuation times for first occupants in each scenario matched very good, but there were bigger differences for those who came last to destination point. Main reason was that velocities were calculated based on first (the fastest) person, and each occupant with same entry point had same profile characteristics. Despite that, there were similarities in occupant's behaviours, such as queuing, slowing down because of high density, giving priority to other occupants in front etc. Software SMART Move showed realistic results in simulating people merging on stair with single and with two entry points on the same floor. Also, it can be used for calculating evacuation times, but occupant's input profile should be different for each type of person to get accurate total values.
Validation of software against an external experiment was planned and preliminary work was done. The case study was total time needed for students to exit a classroom depending on density around exit doors with different width.

- **Future collaboration with host institution**

Collaboration with the SMART team at Buro Happold Office in Bath is planned in the future, since they're very supportive and helpful to people with common areas of research.

I would like to express my sincere thanks to the COST Action and my hosts for giving me this opportunity to learn and share experience.

Maja Ban

Split, 02. 04. 2013.