

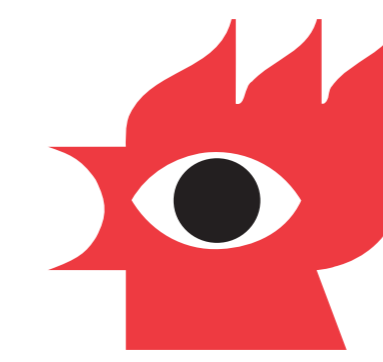


Validation of egress models

Simulation of Cinema Theatre Evacuations with Simulex, STEPS and buildingEXODUS



Nilsson, D. and Frantzich, H.
Department of Fire Safety Engineering
and Systems Safety
Lund University
Sweden



Husted, B. P. and Bygbjerg, H.
Danish Institute of Fire and
Security Technology
Denmark

Two unannounced evacuation experiments with almost identical conditions were performed in a cinema theatre [1,2]. The number of participants was 135 and a voice alarm was used. Results from the experiments were used to evaluate the ability of three egress models to simulate movement of people [3].

The pre-movement time for each person was determined and used as input in the simulations. An evaluation of the results at 50 seconds after activation of the alarm for one of the experiments is given in the present poster. The complete study contains a more in-depth analysis and additional scenarios [3].

Method

The following models were used in the study

- Simulex ver. 2007.2.0.0, June 2007 [4]
- STEPS ver. 2.1 (Build 0028), Oct 2006 [5]
- buildingEXODUS ver. 4.06, May 2006 [6]

Each model was run several times to ensure that the statistical variation implemented in the models did not influence the mean results. De-

fault values were used as much as possible in order not to manipulate the conditions. Data on pre-movement time and exit choice from the experiment were used in the simulations.

The results from the experiment and the egress models were compared at 50 seconds after activation of the alarm with respect to the

- number of persons still in rows 2 to 9
- location of the persons
- formation of queues

Results

The results of the comparison show that

- the location of persons varied significantly between experiments and simulations
- queues at exits formed quicker and were more compact in the simulations
- Simulex (continuous model) could predict more accurately the location of each person, compared to STEPS and buildingEXODUS (node based models)

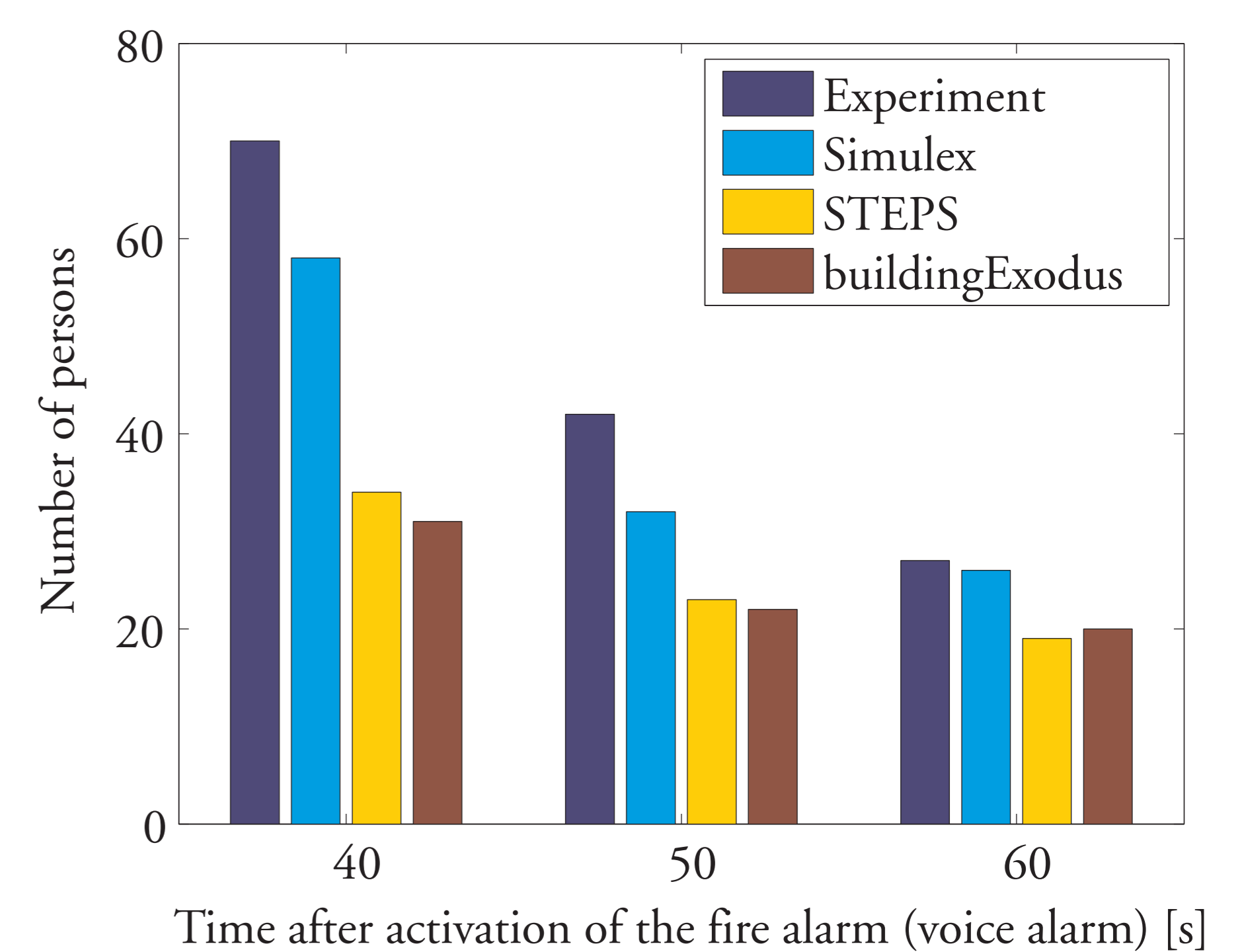
The results of the experiments and simulations are shown in the figures and the diagram.

More information

Information about the complete study [3] can be found at

http://www.brand.lth.se/english/research/fire_safety_engineering/evacuation

Diagram - Number of persons in rows 2 to 9 as a function of time



Empirical data

Experiment

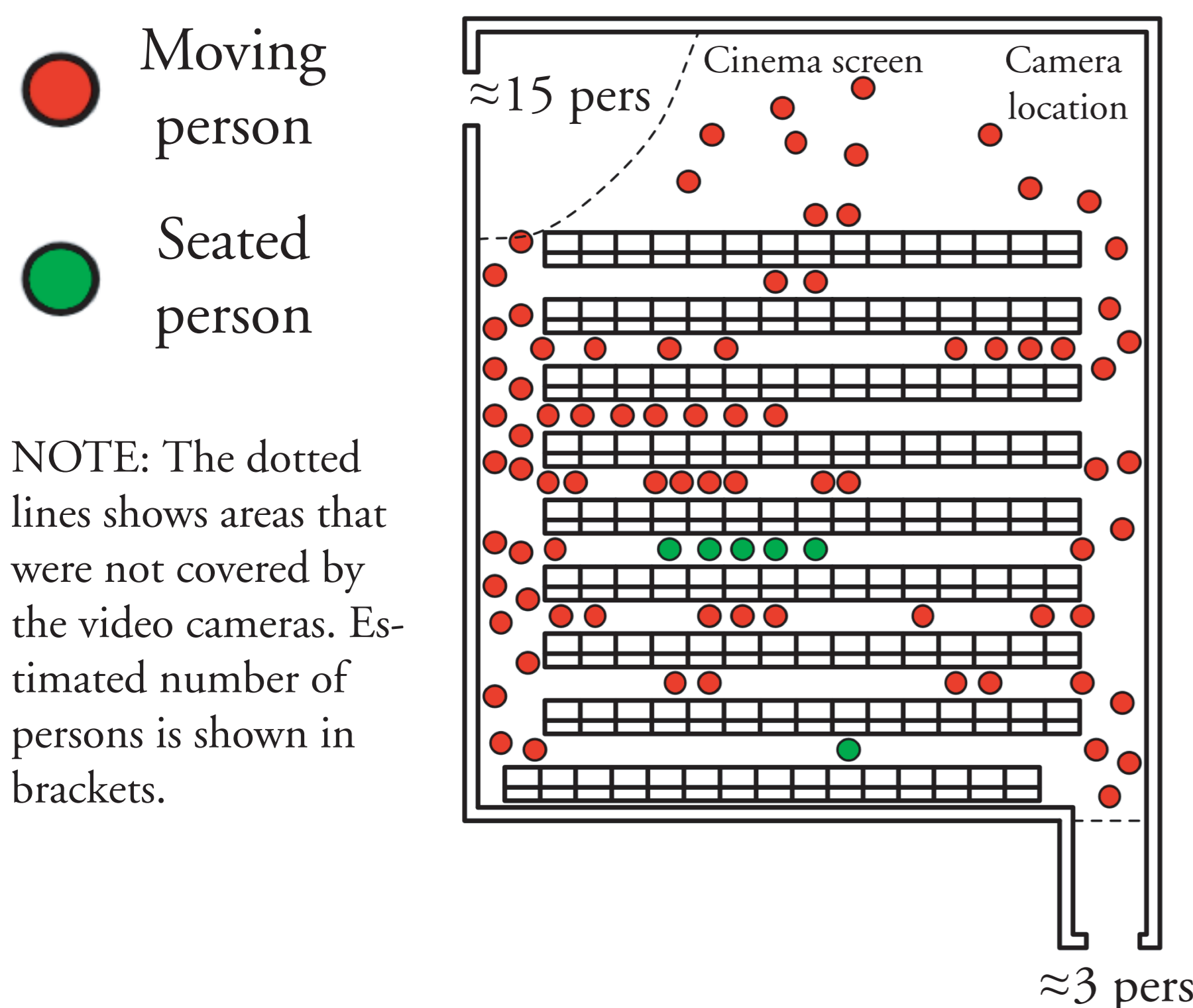


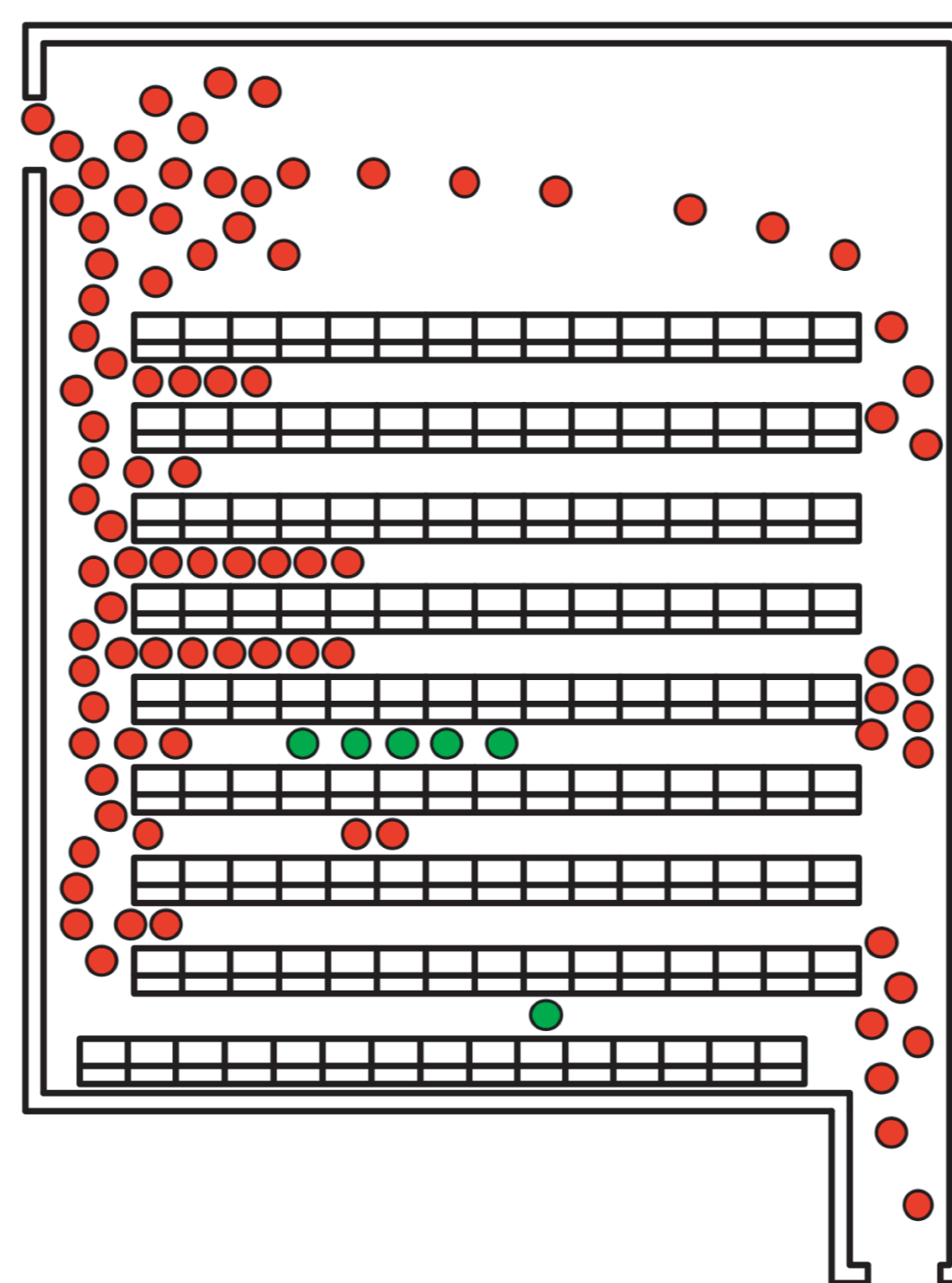
Photo from the experiment



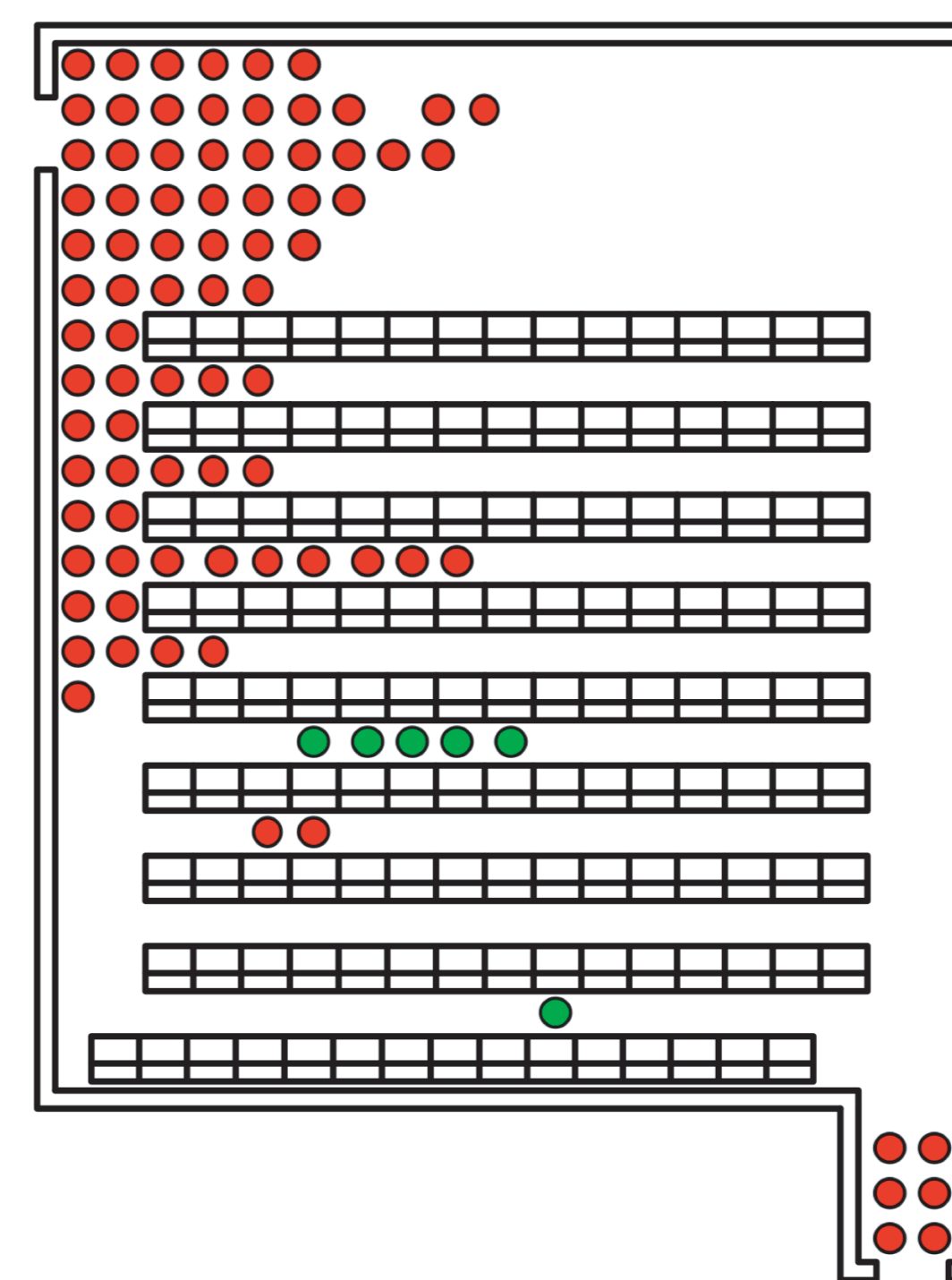
NOTE: A photo taken from the video camera footage

Egress models

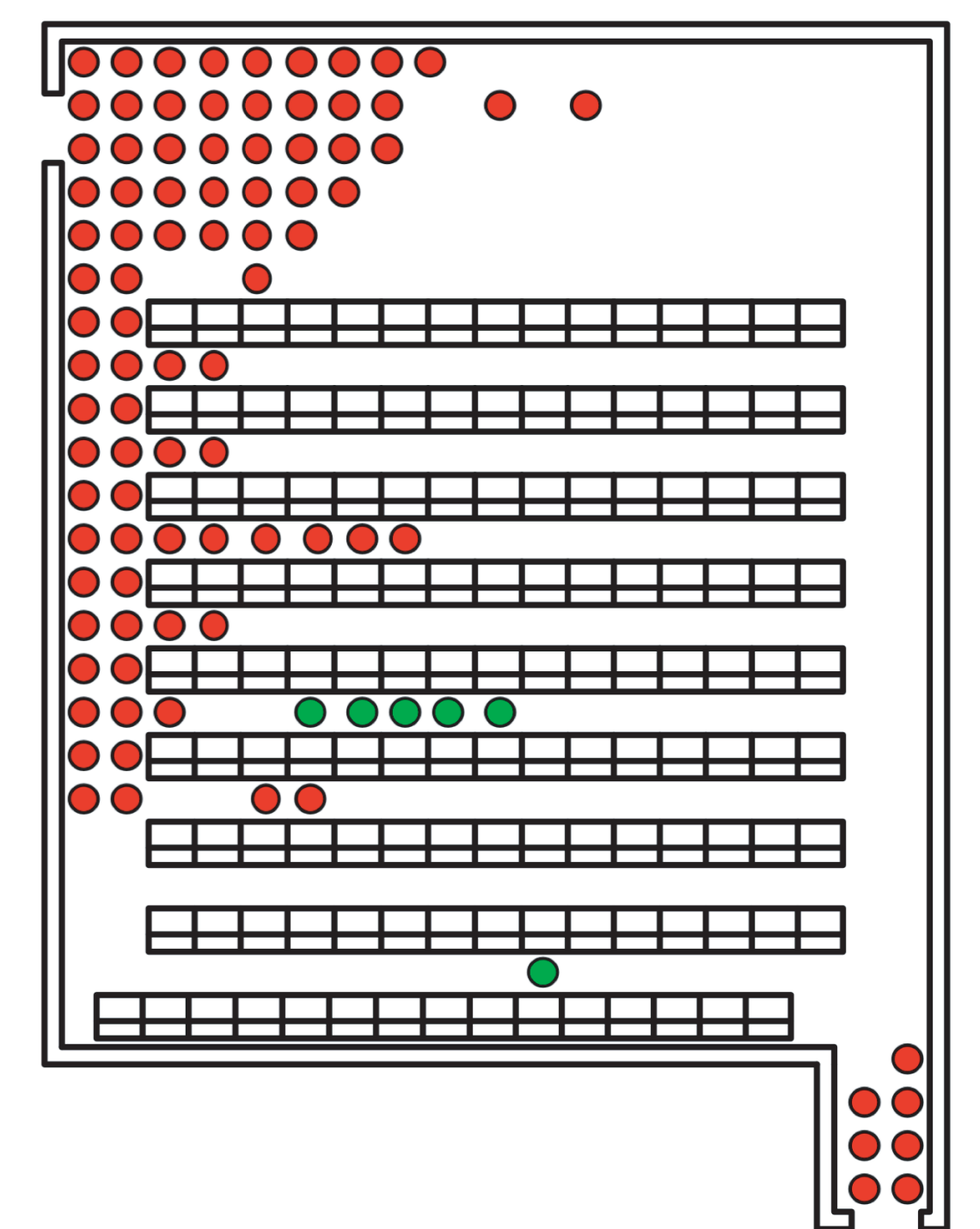
Simulex



STEPS



buildingEXODUS



Conclusions

In general, the programs are able to predict movement of people with **reasonable accuracy**. They can therefore be useful tools for estimating egress time. However, the models can **not accurately predict the exact movement patterns**. The models implicitly assume that the main goal of people is to escape as quickly as possible but ignore other possible motivations that also contribute to the observed patterns.

The study has shown that simulation results are highly sensitive to how the user defines the problems as models often contain numerous

parameters [3]. This vast number of parameters may easily confuse the user, since it may be unclear exactly how they influence the simulations.

References

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