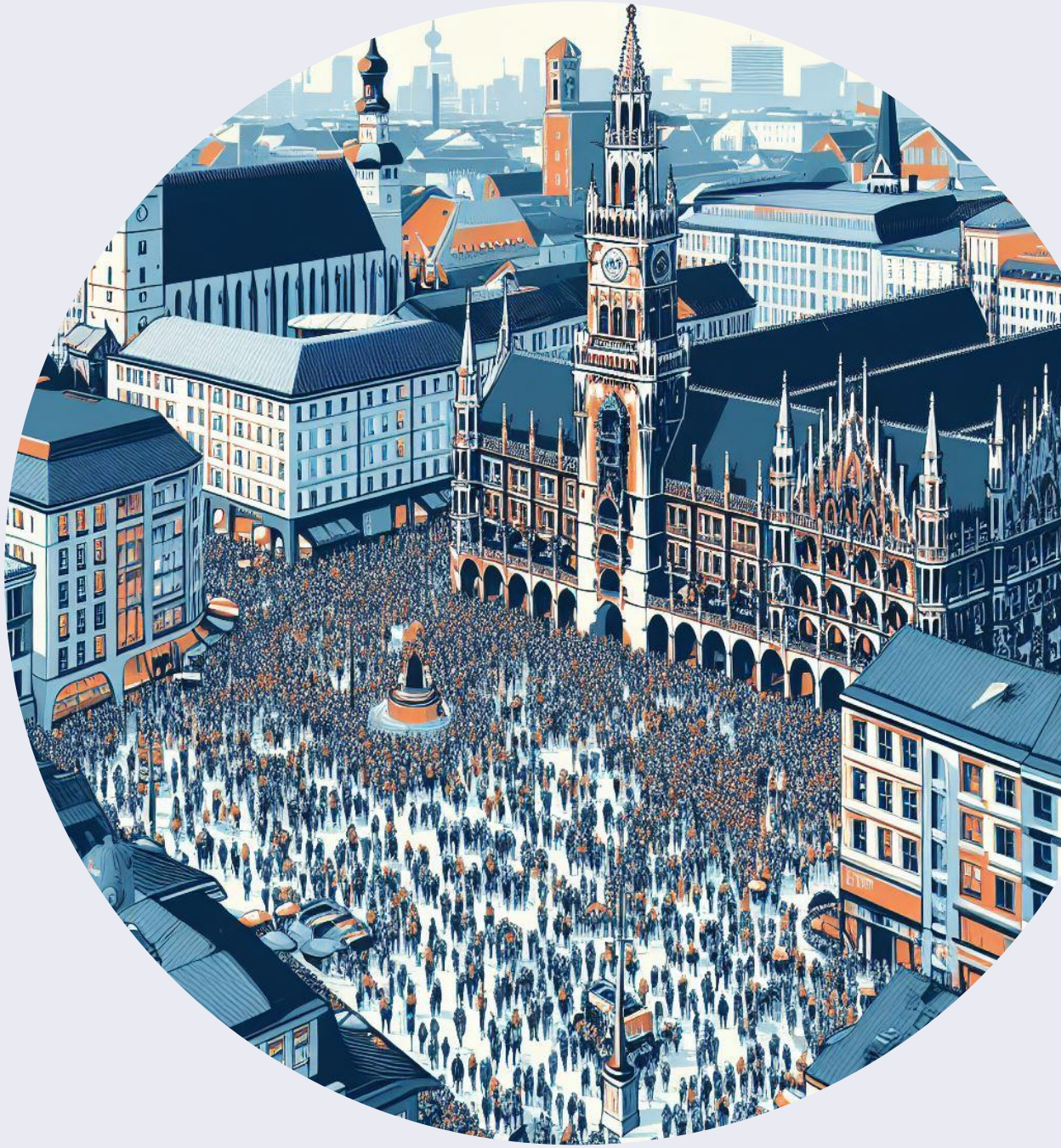
accu rate
INSTITUTE FOR CROWD SIMULATION

RiMEA



The Lecture Hall Example as a Reference for Evacuation Simulations –

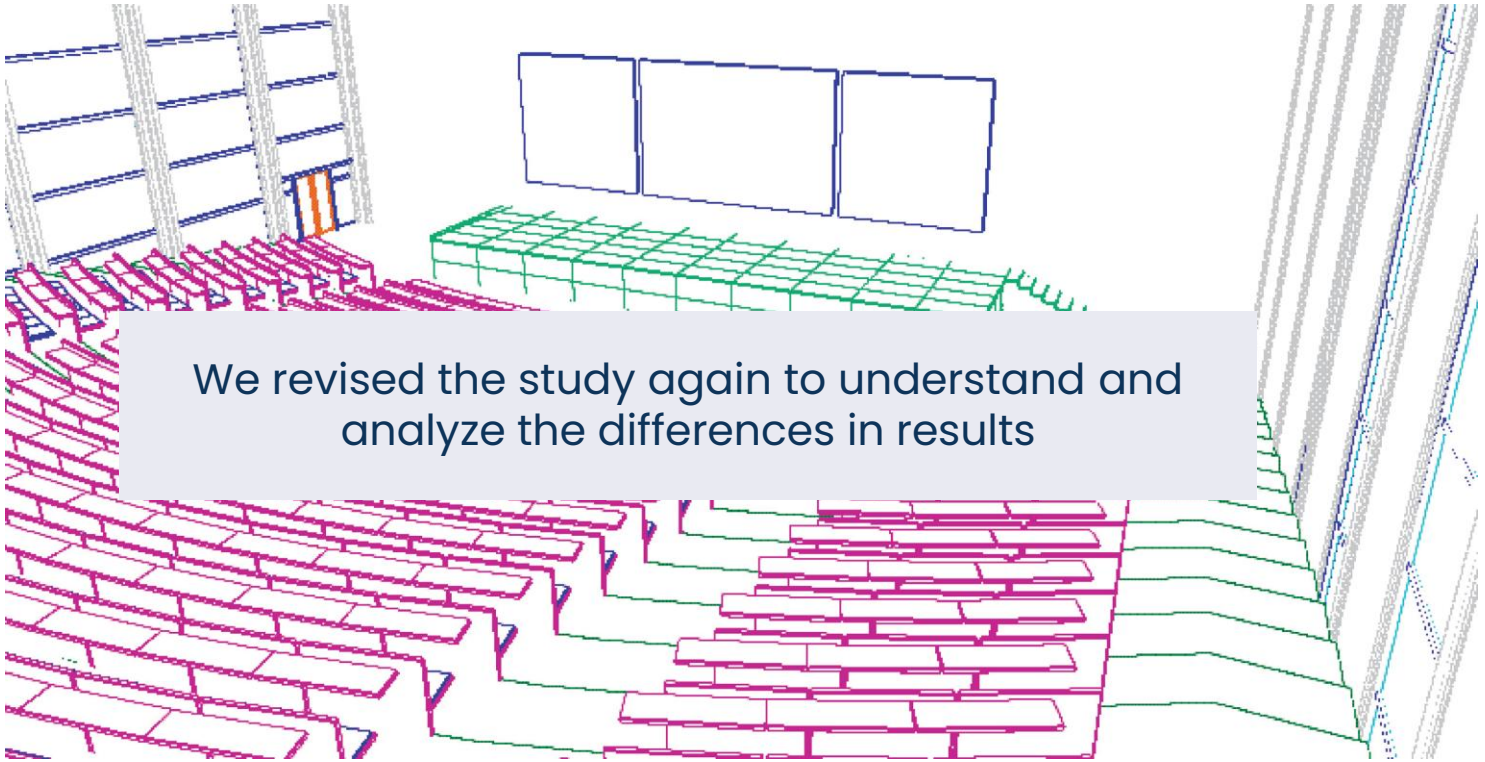
An Updated Study

RiMEA Workshop, Göttingen
12. Oktober 2025

Arbeitsgruppe RiMEA:
Angelika Kneidl, Burkhard Forell, Gerald Grewolls, Rainer Könnecke, Tim Meyer-König, and Andreas Winkens

The Lecture Hall example - History

- The lecture hall example was taken as a characteristic example to compare different evacuation models.
- The results were first published in 2015, with an updated version in 2021 [1].
- In total, 8 different models were used to model the evacuation of this lecture hall and to compare their results.
- **The results have shown up to 30% deviation in evacuation time**



We revised the study again to understand and analyze the differences in results

Picture: View of the lecture hall building(A. Weilert)

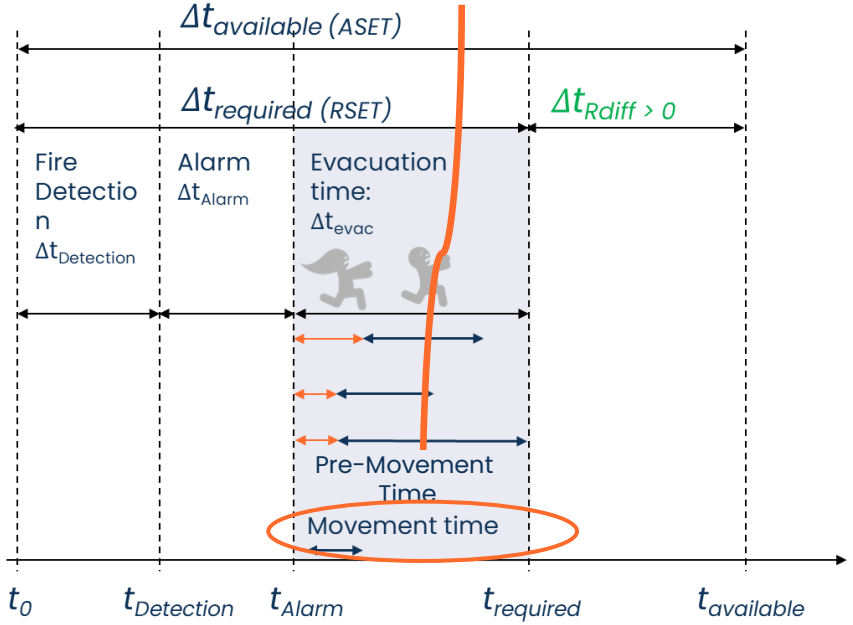
[1] Schneider, Volker & Forell, Burkhard. (2021). Personenstromsimulationen und Evakuierungsberechnungen. Bauphysik-Kalender 2021, Ernst & Sohn 10.1002/978343361057.ch7.

The Lecture Hall example – Setup (First Study – 2021)

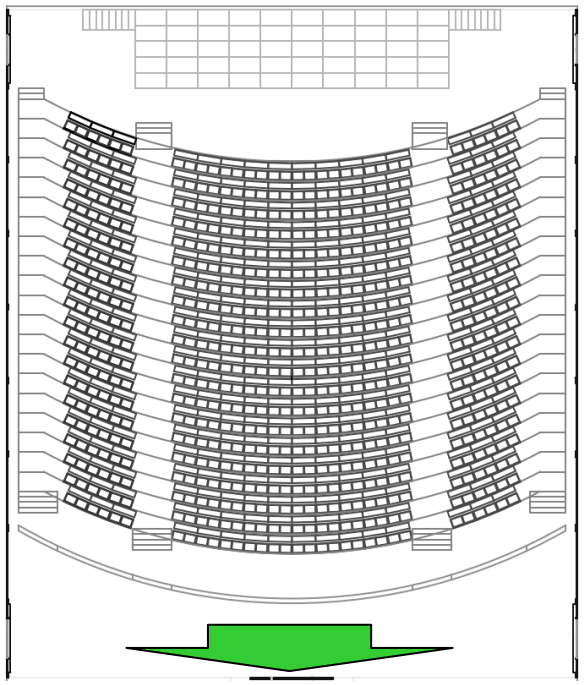
People simulated:

- 640 seats
- 360 standing places

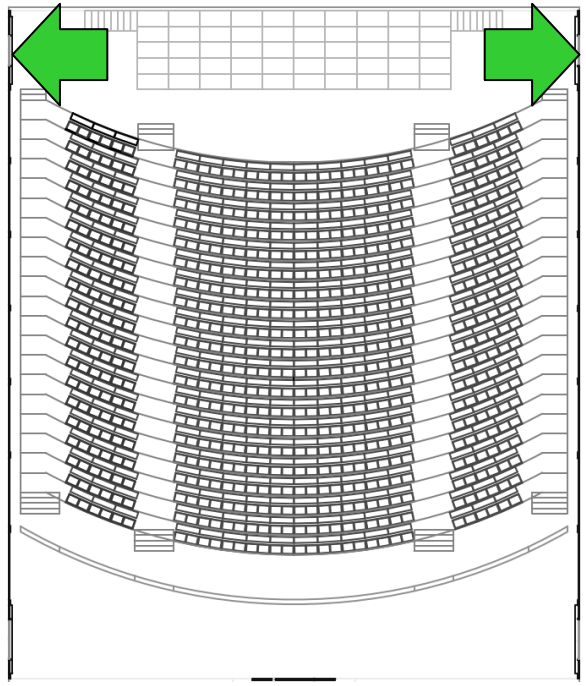
Time compared: Movement time



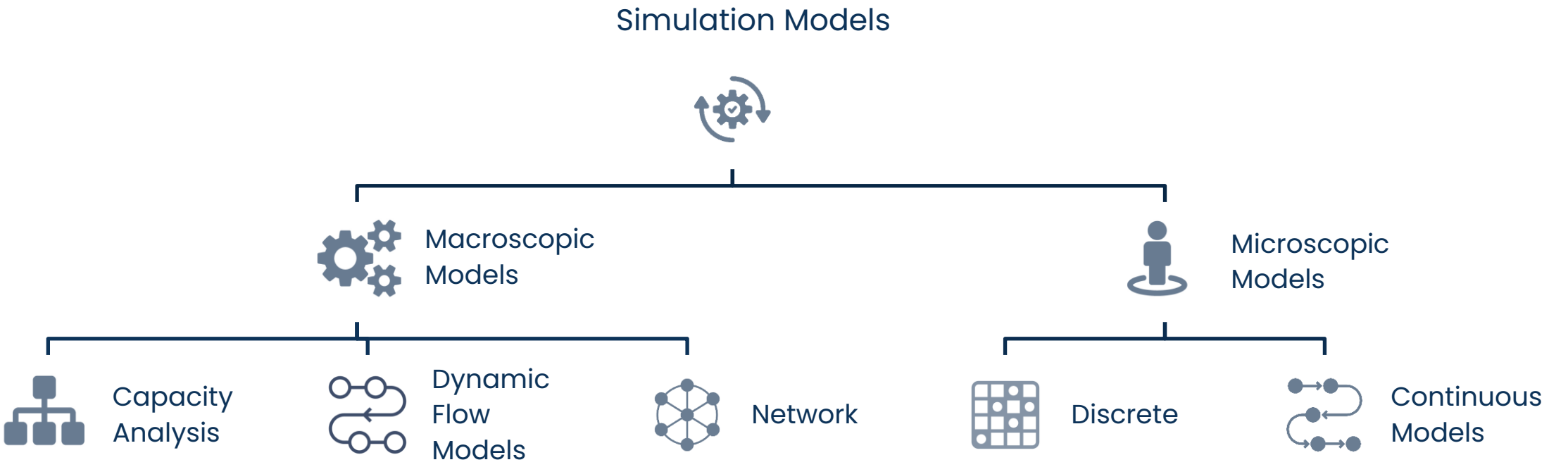
Scenario 1
1st escape route with one exit at the back



Scenario 2
2nd escape route with 2 exits at the front right and front left



Models used in the study



acc. to vfdb Guideline[1]

Predtetschenski & Milinski

buildingExodus

PedGO

Aseri

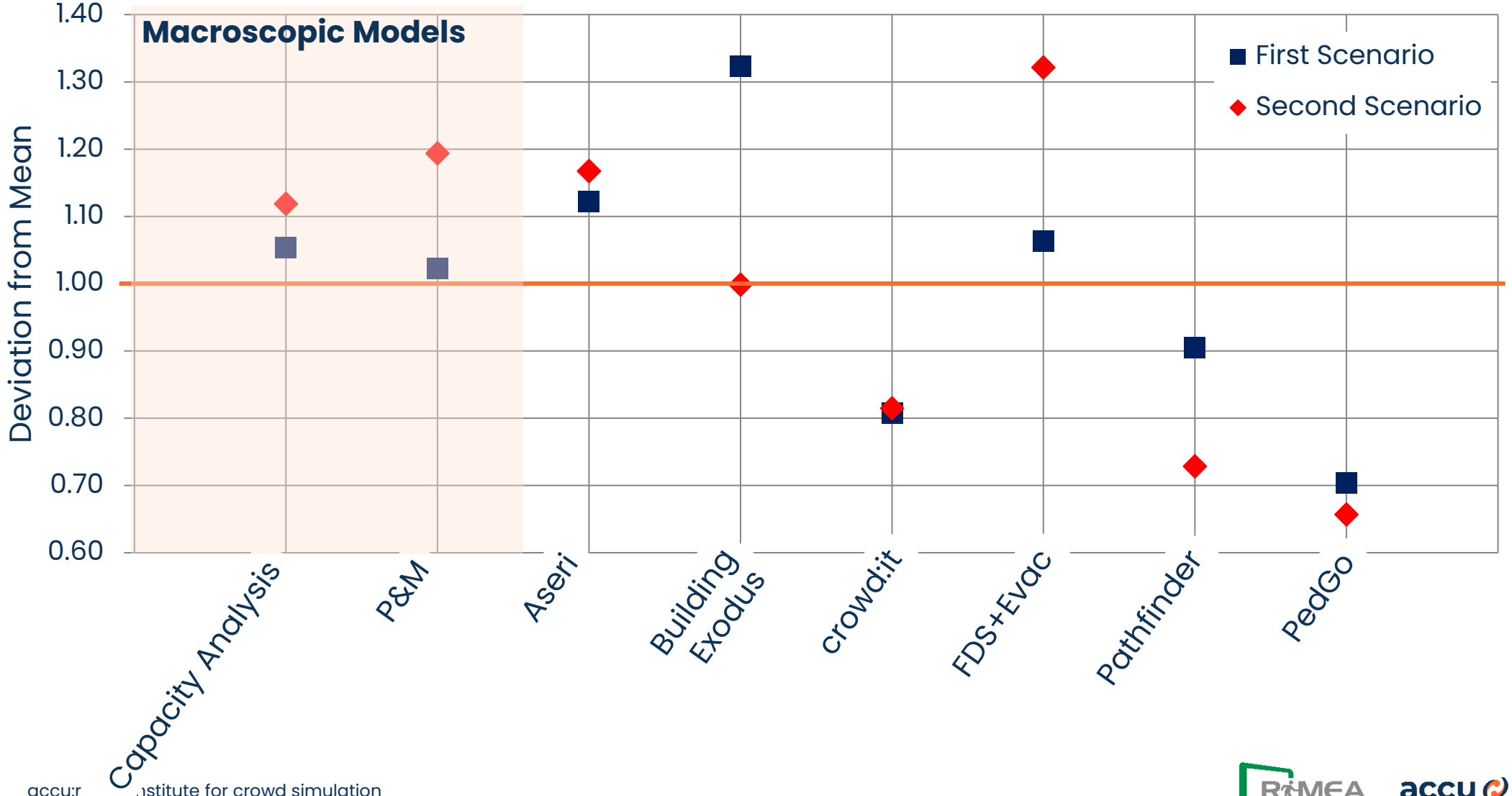
crowd:it

FDS + Evac

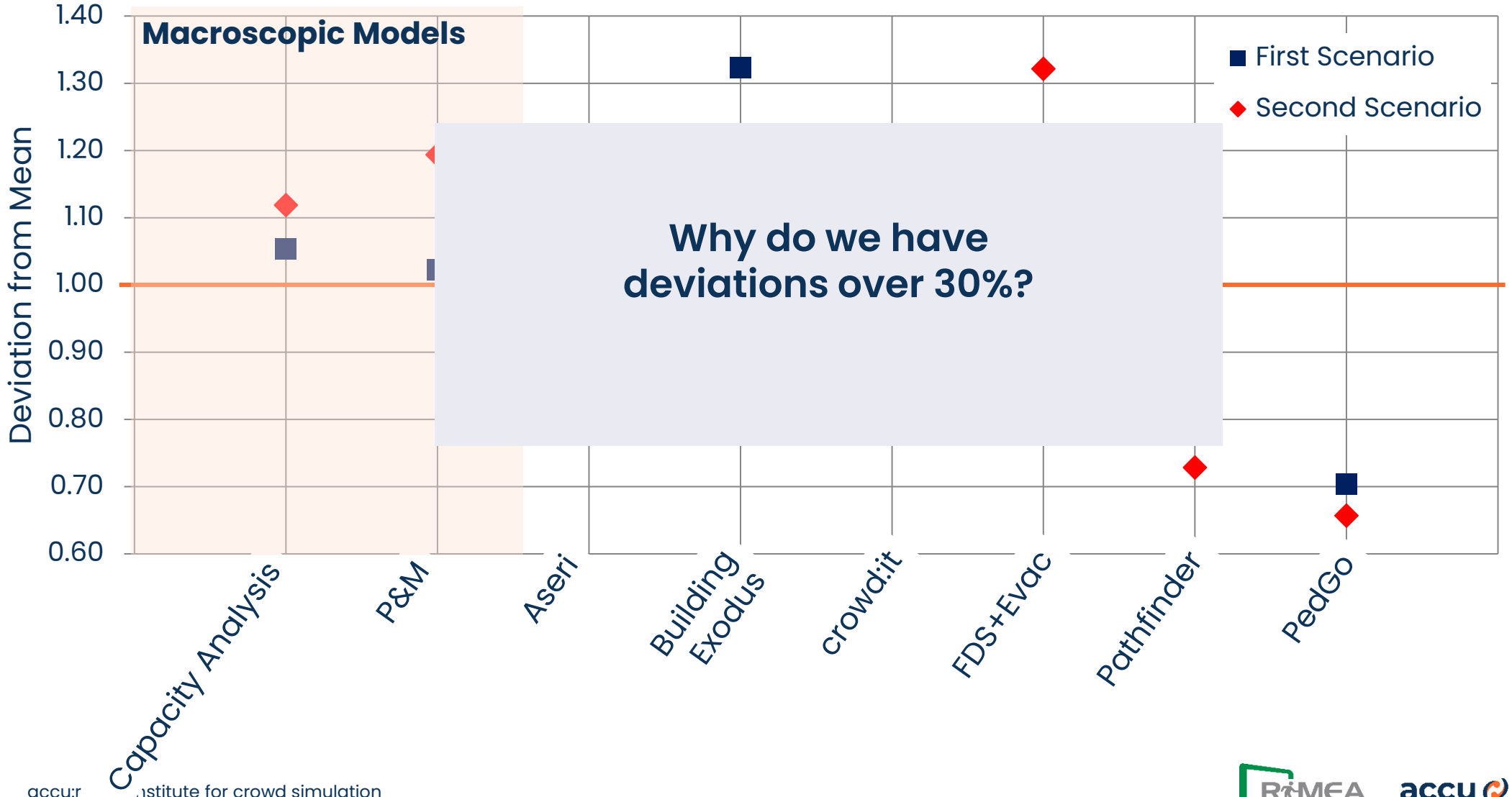
Pathfinder

[1] Vereinigung zur Förderung des Deutschen Brandschutzes e.V. (vfdb) / Zehfuss, Jochen (Hrsg.): Leitfaden Ingenieurmethoden des Brandschutzes; Technischer Bericht vfdb TB 04-01, 3. Auflage März 2020.

First Study | Results



First Study | Results

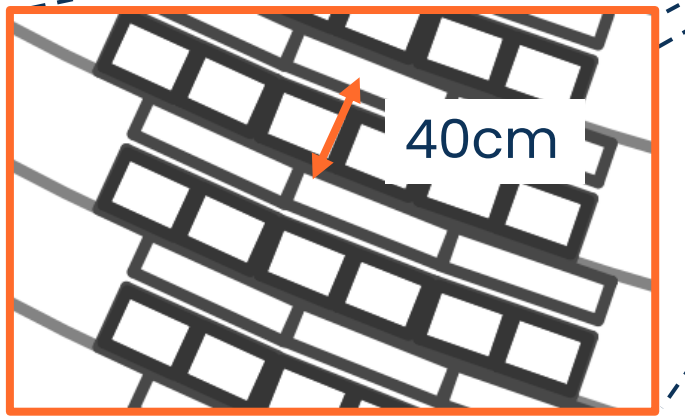


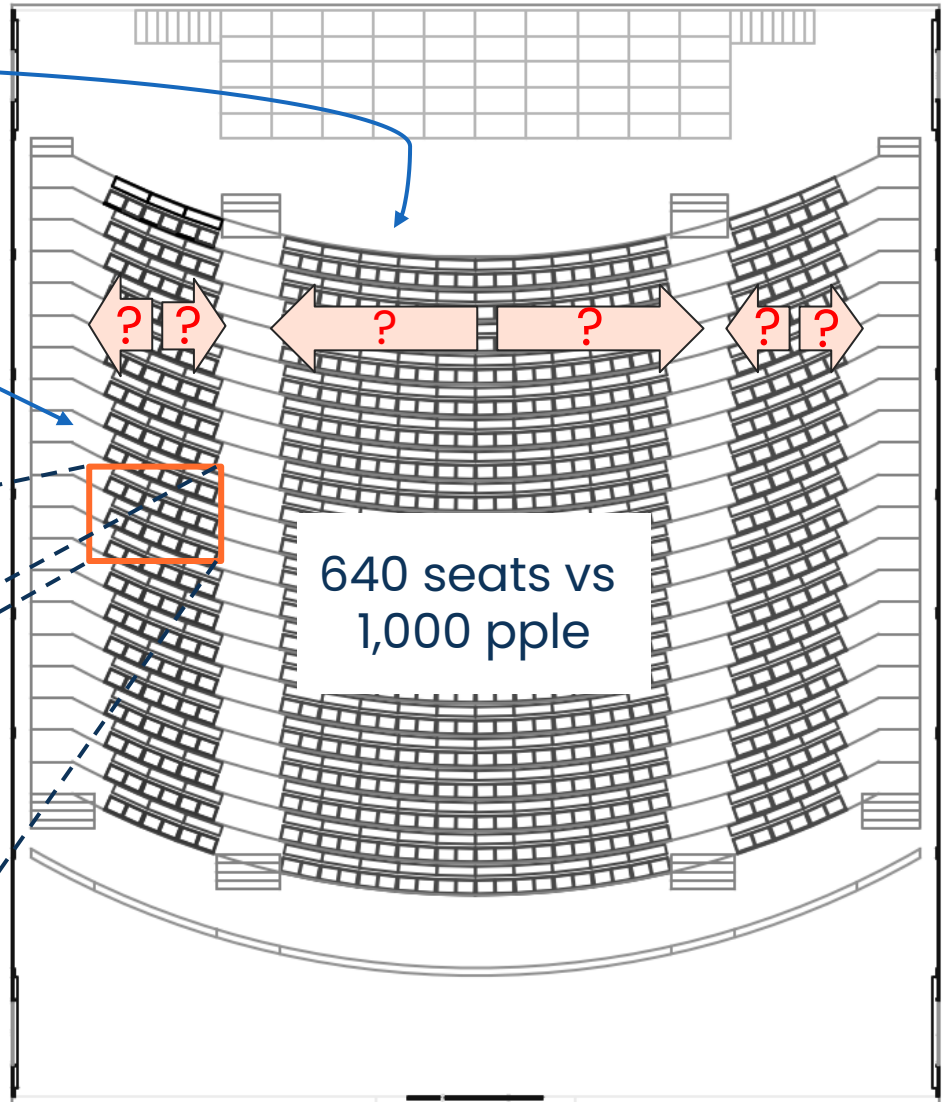
First Study | Input Analysis

Different modelling of curved geometry

Different interpretation of the geometry and steps

Rows are too narrow to fit agents





Different distribution on escape routes

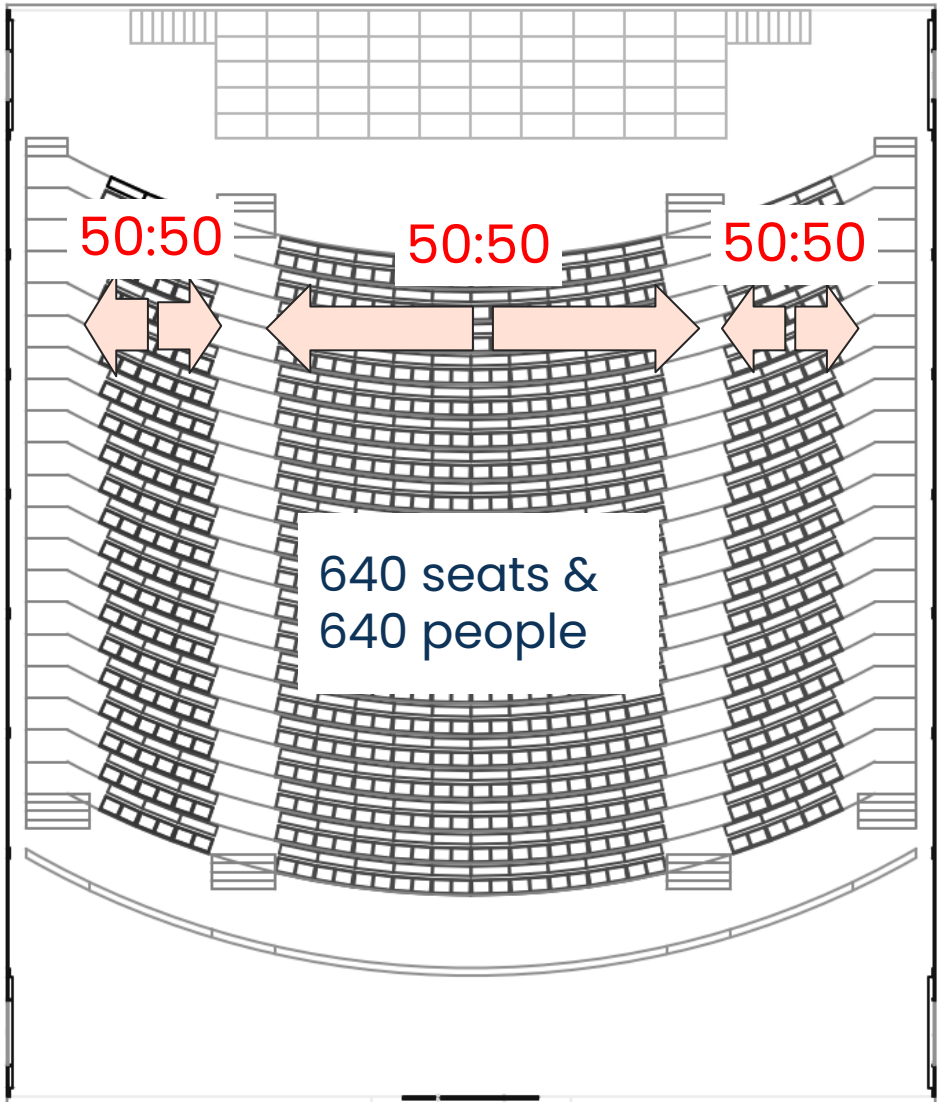
Different distribution of the "remaining" people

Second Study | Harmonization of parameters

Re-evaluation of all escape route width

Documentation of modeling approach

Explicit definition of how results are produced (e.g. how flowrates are measured, where to measure etc.)

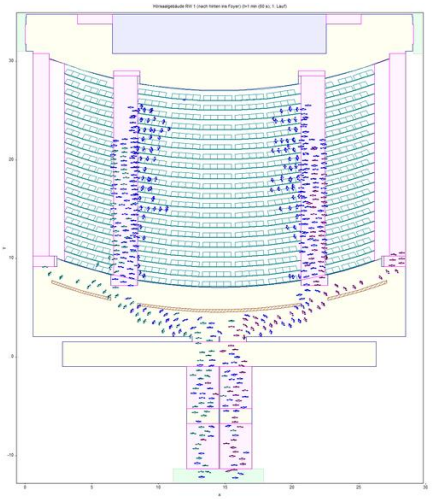


Fixed distribution for route choice

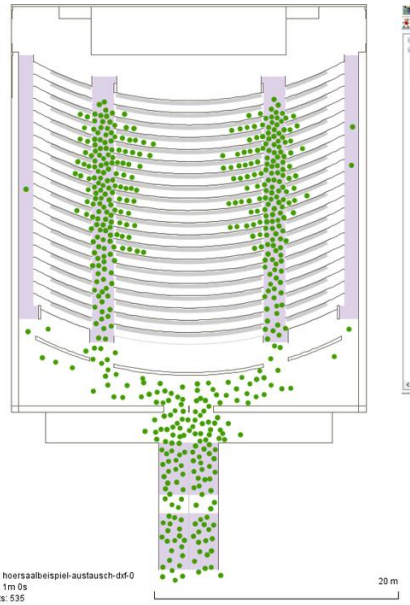
Number of people reduced to 640

Results First Scenario

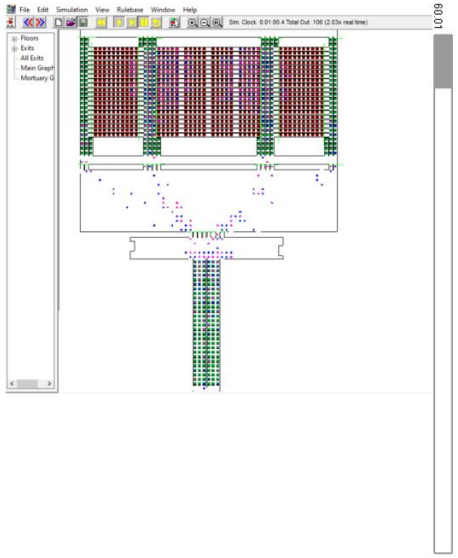
Aseri



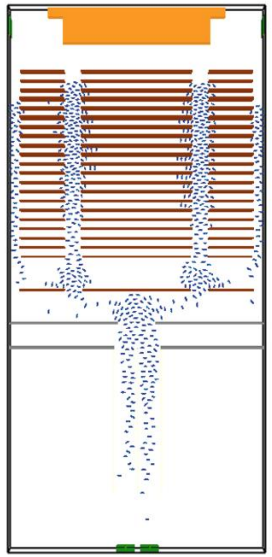
crowd:it



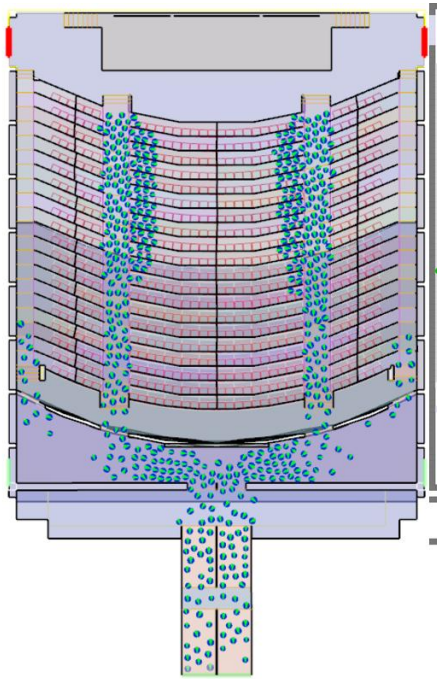
BuildingExodus



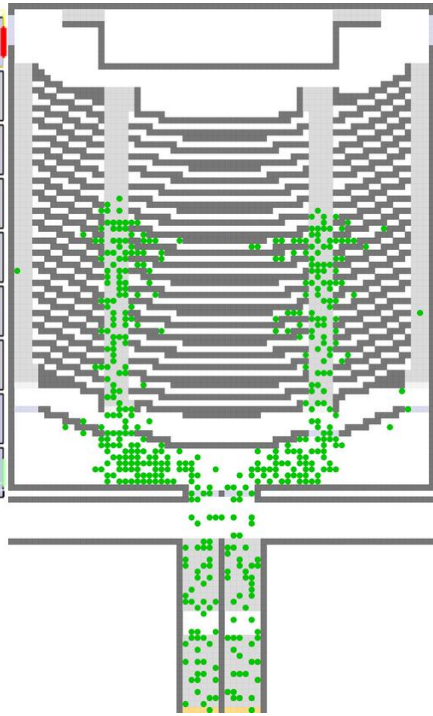
FDS+Evac



Pathfinder



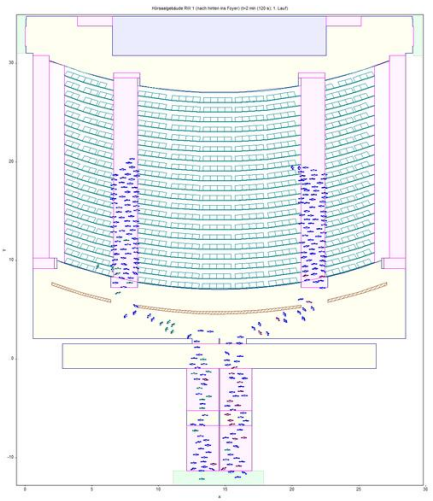
PedGo



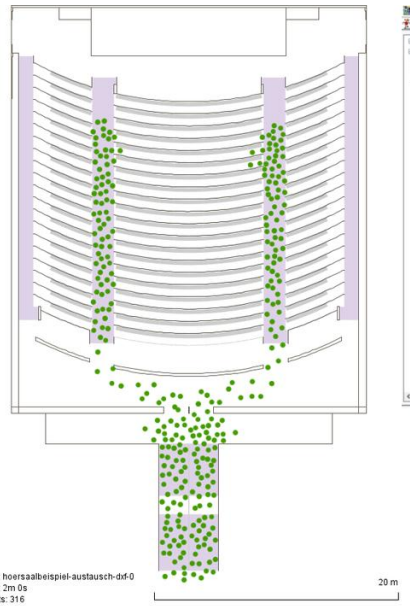
After 60 seconds

Results First Scenario

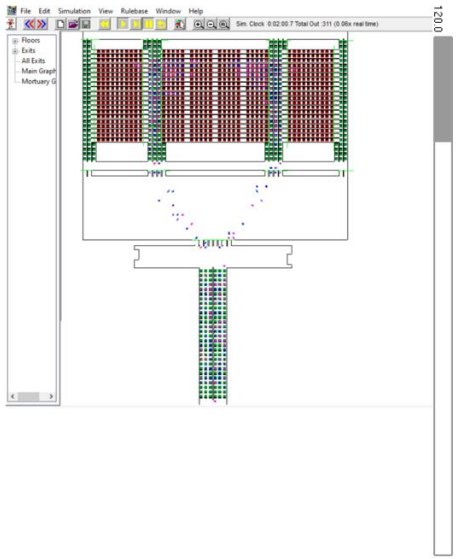
Aseri



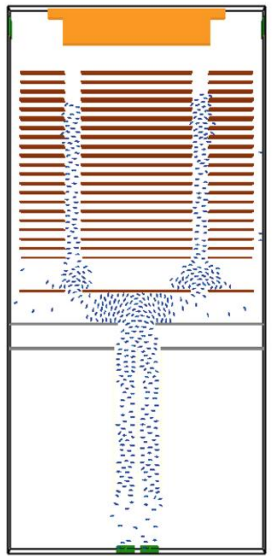
crowd:it



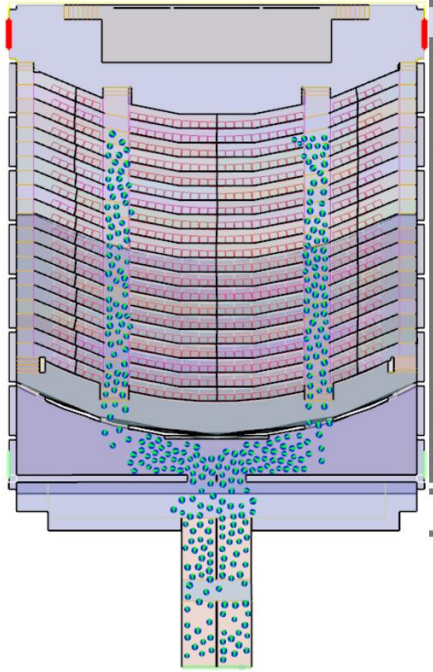
BuildingExodus



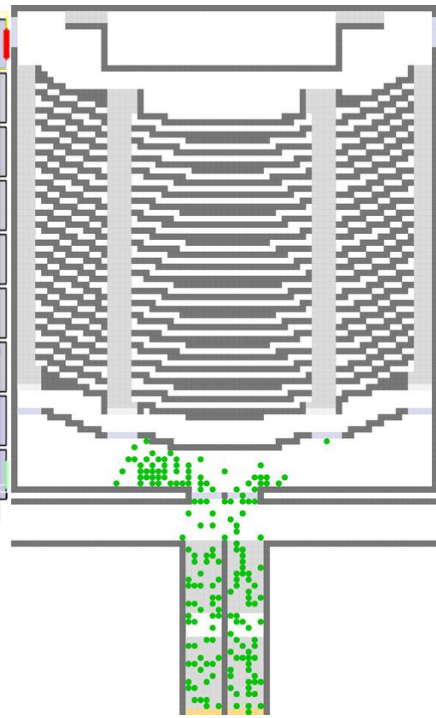
FDS+Evac



Pathfinder



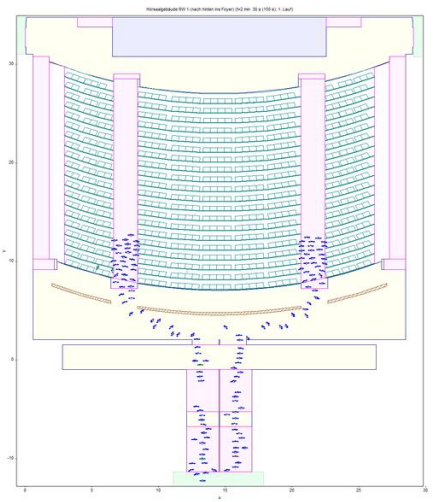
PedGo



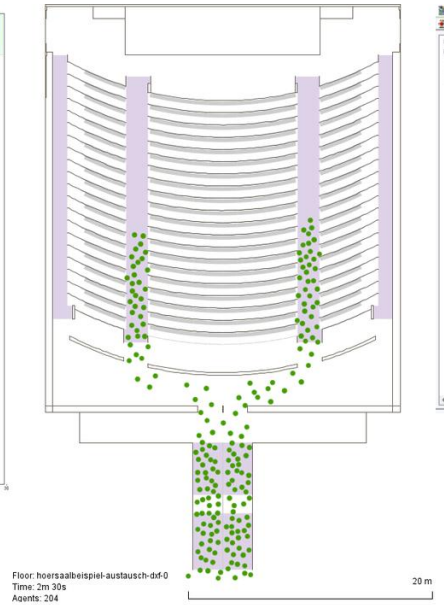
After 120 seconds

Results First Scenario

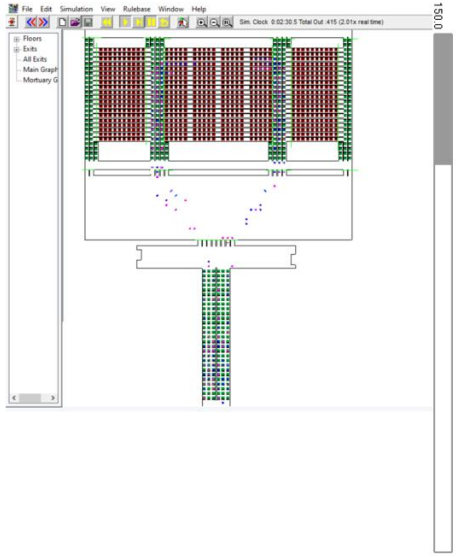
Aseri



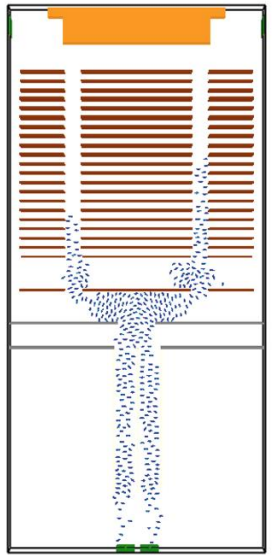
crowd:it



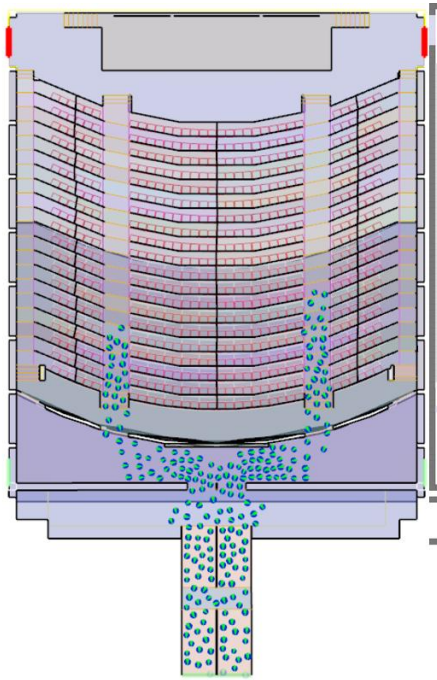
BuildingExodus



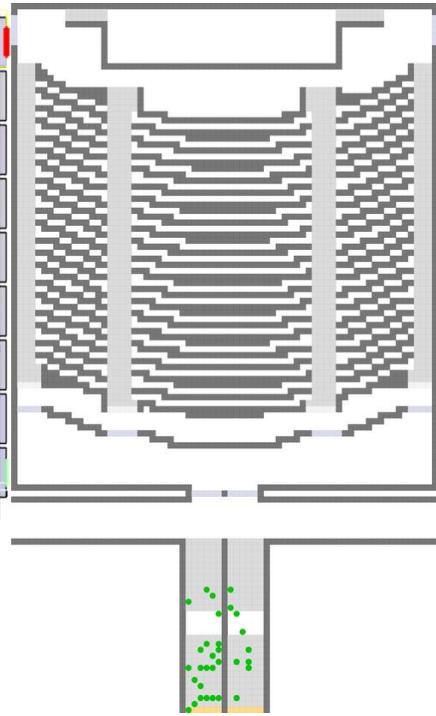
FDS+Evac



Pathfinder



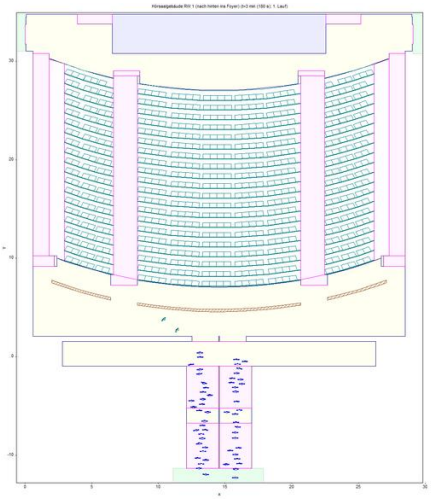
PedGo



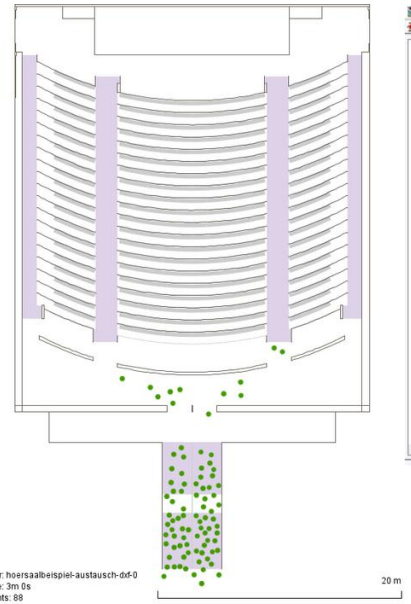
After 150 seconds

Results First Scenario

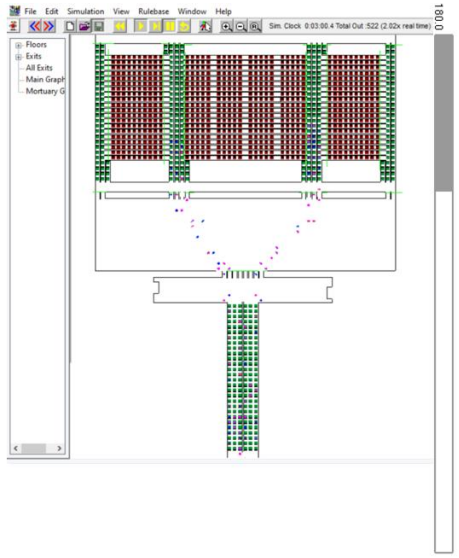
Aseri



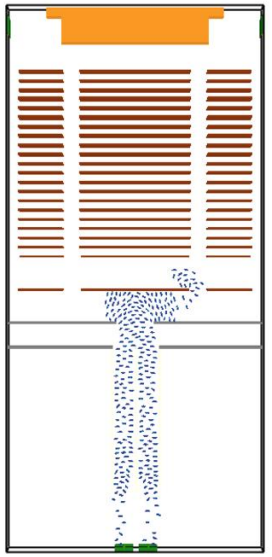
crowd:it



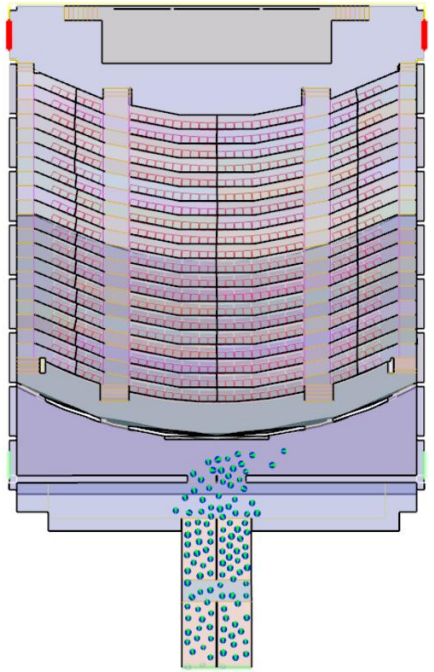
BuildingExodus



FDS+Evac



Pathfinder

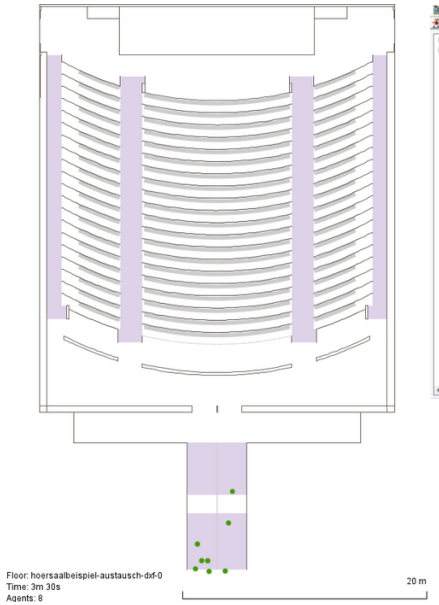


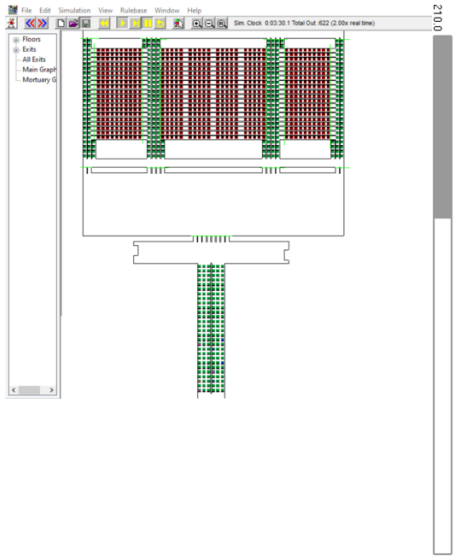
PedGo

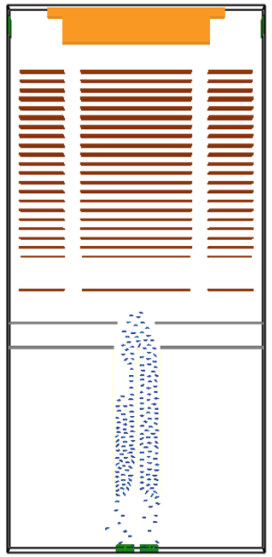
After 180 seconds

Results First Scenario

Aseri | crowd:it | BuildingExodus | FDS+Evac | Pathfinder | PedGo

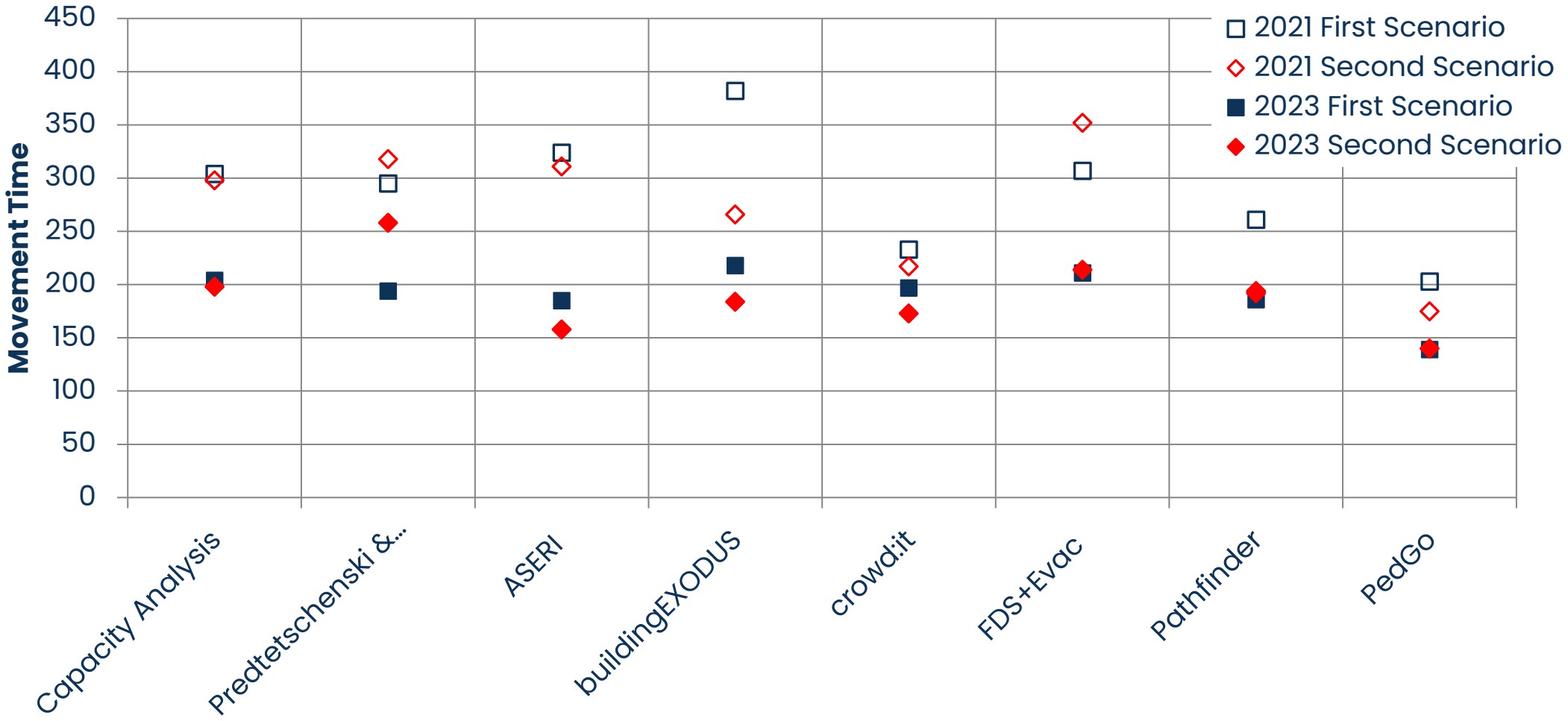




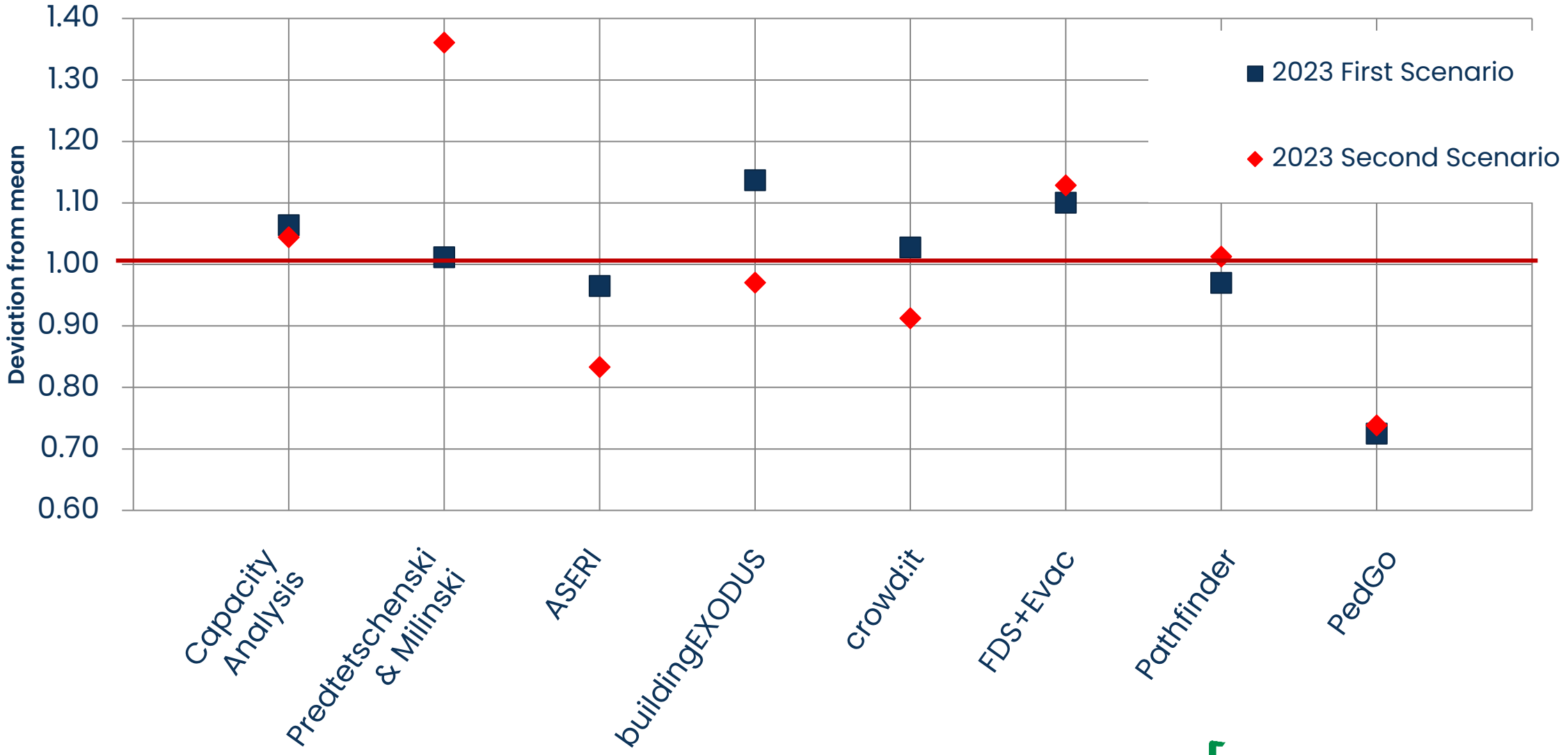


After 210 seconds

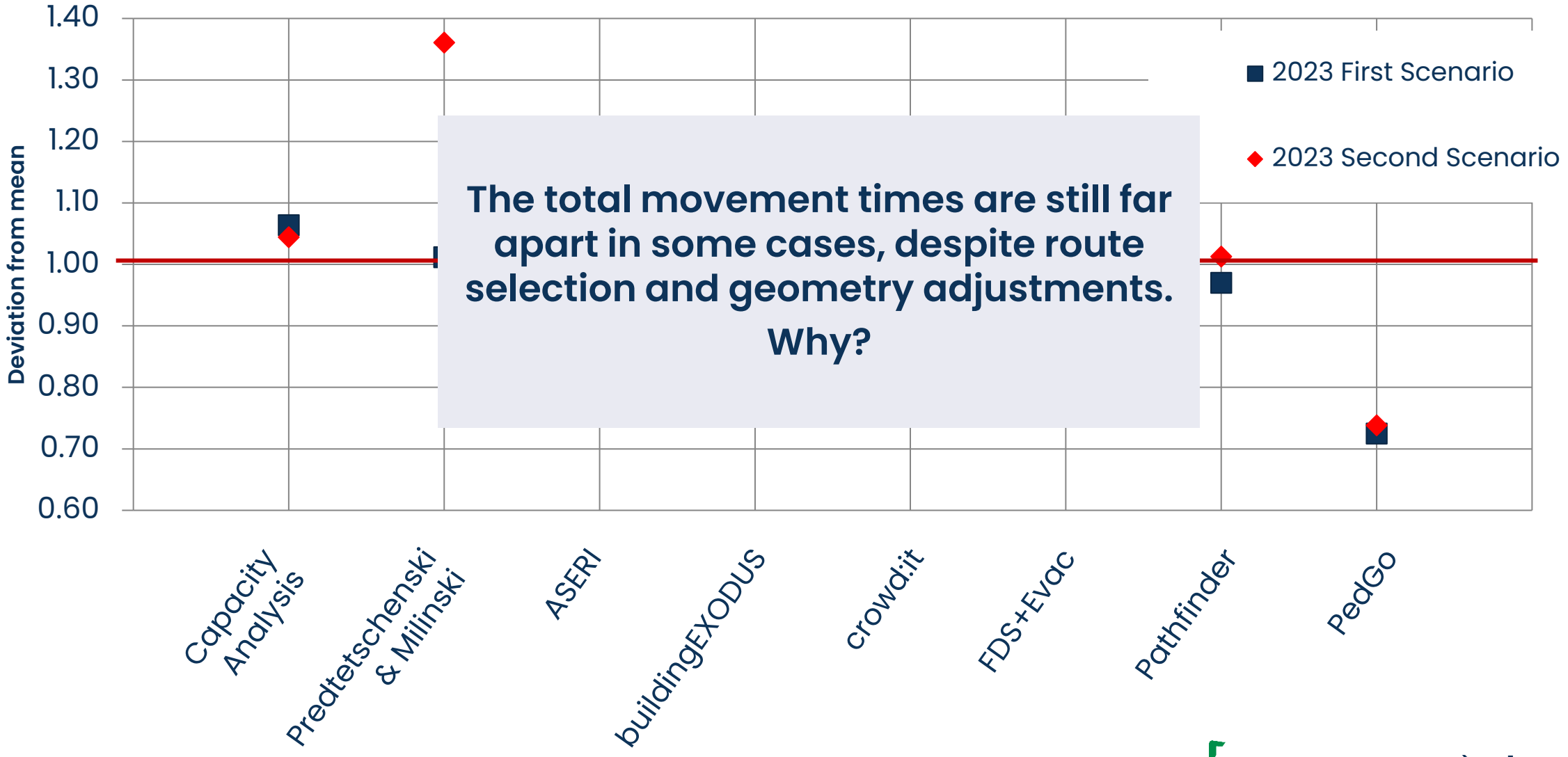
Movement Times



Second Study | Results

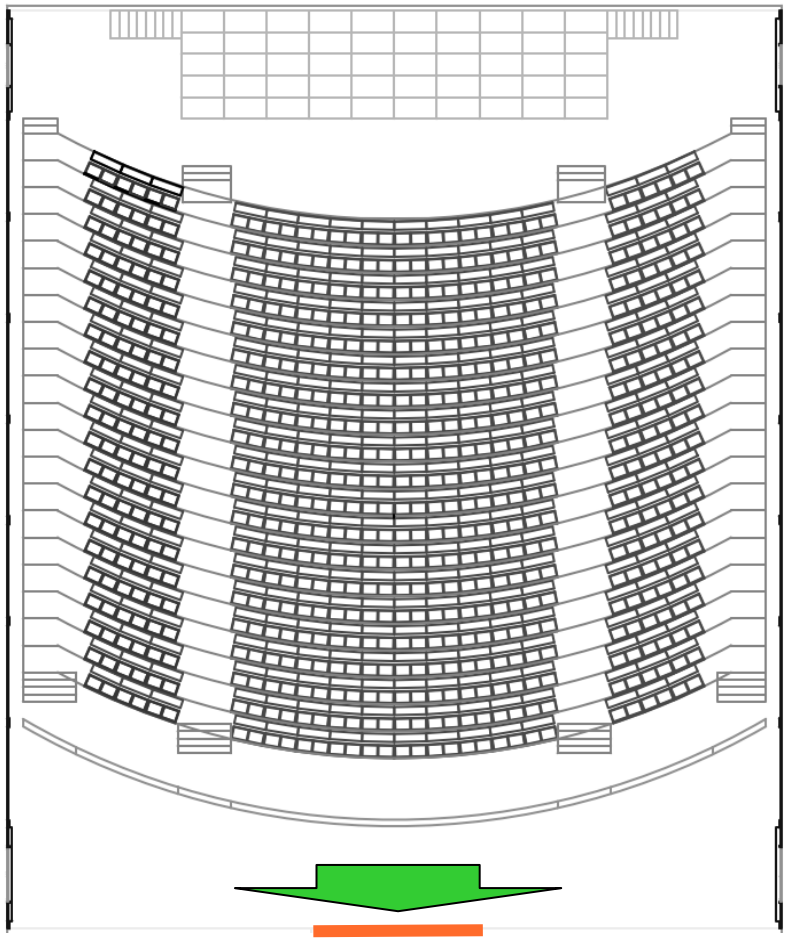


Second Study | Results

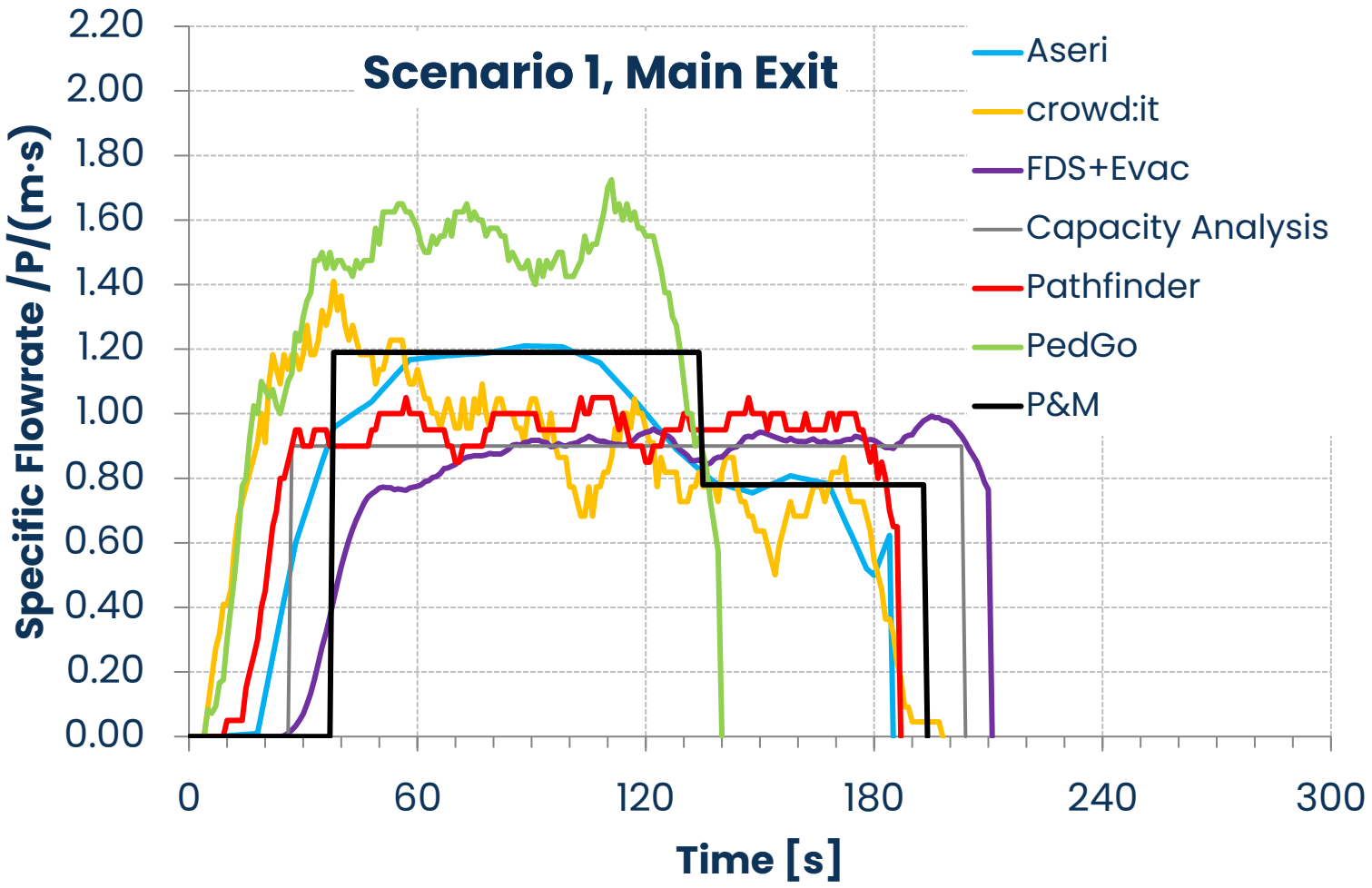


The total movement times are still far apart in some cases, despite route selection and geometry adjustments. Why?

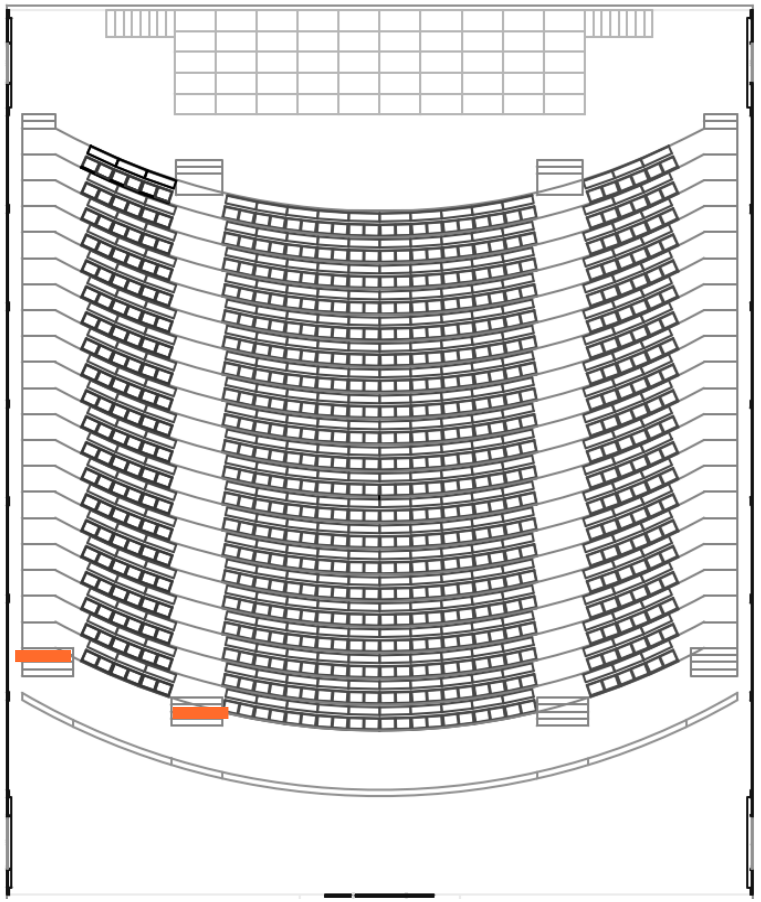
Comparison of specific flow rates



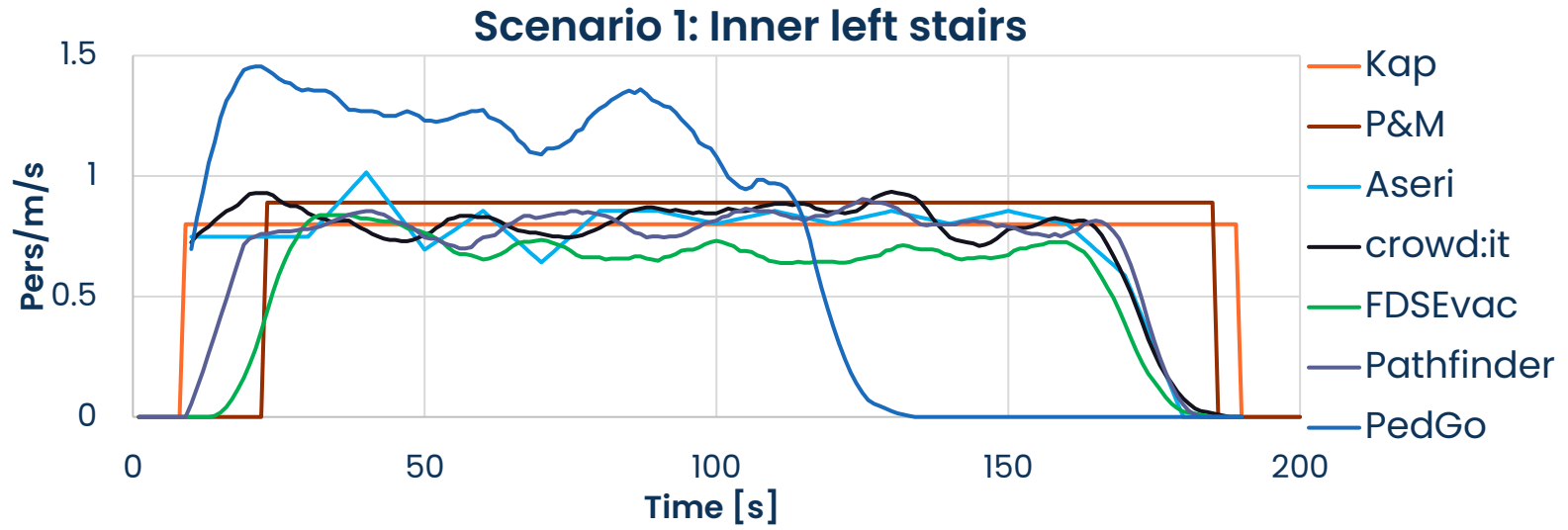
Measurement line for flow rates

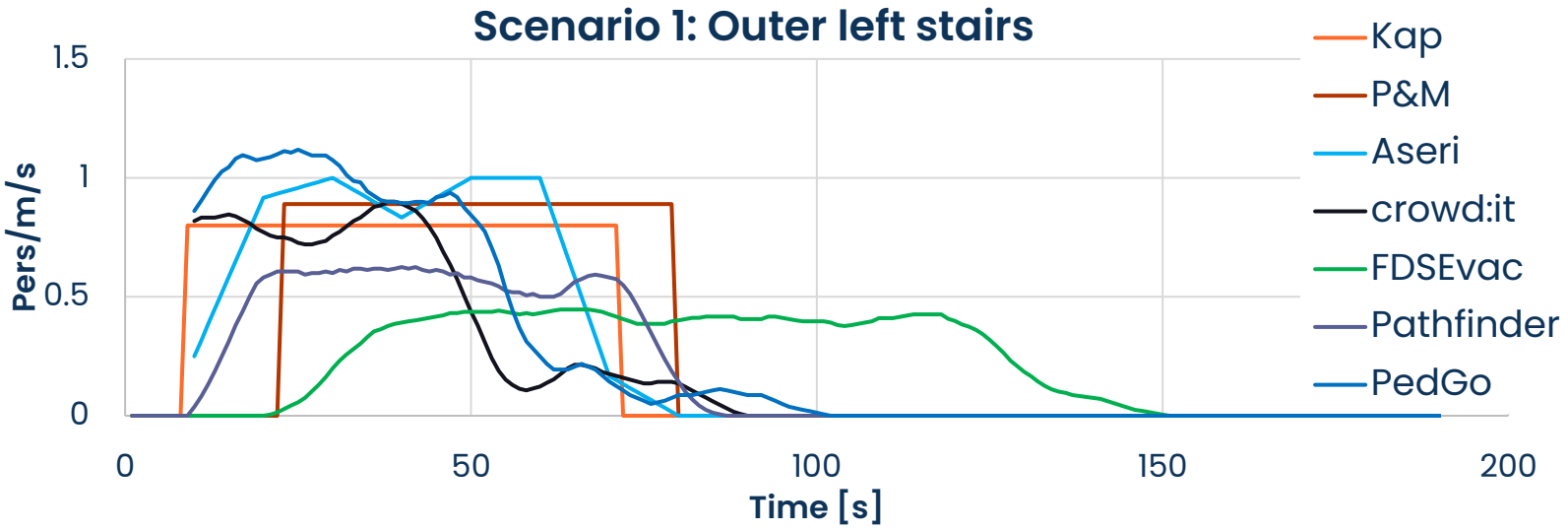


Comparison of specific flow rates on stairs



Measurement lines



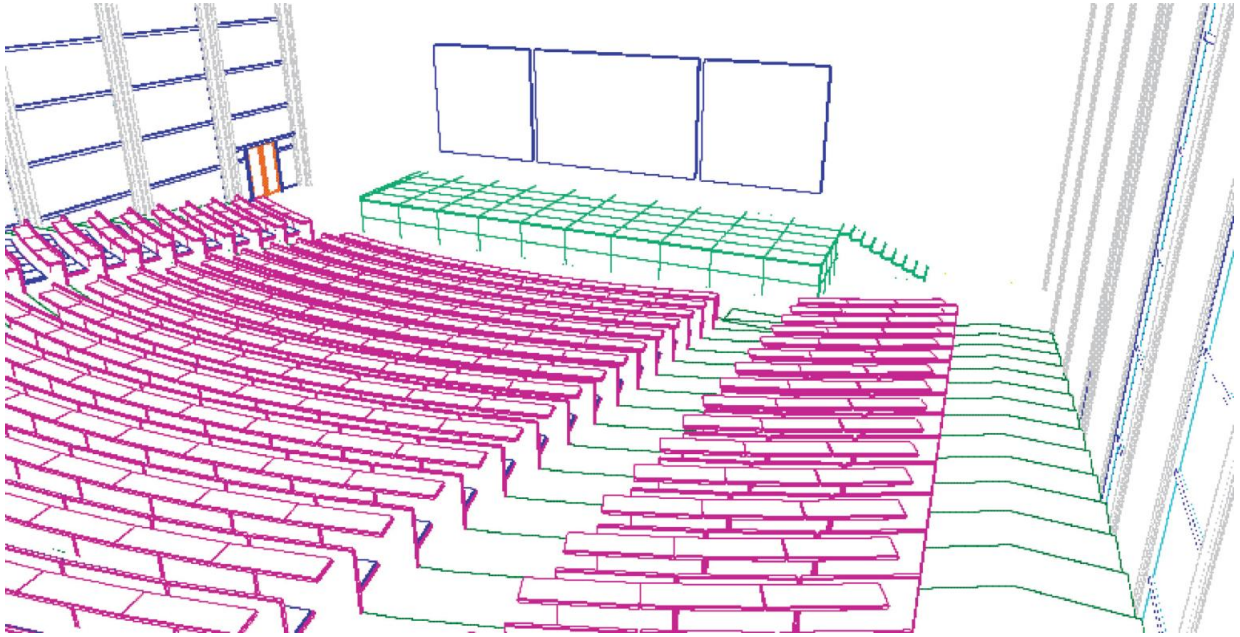


Summary and Outlook

Model-induced fluctuations up to ~30% in movement times observed

Main Reasons:

- Flow rates on stairs influence movement times
- Route choice strongly affects results
- No symmetry between scenarios → influenced by exit layout & flow rates
- Modeling decisions (geometry, parameters, simplifications) influence results and must be documented!



Weakness:

- No comparison to real-world data

Next step:

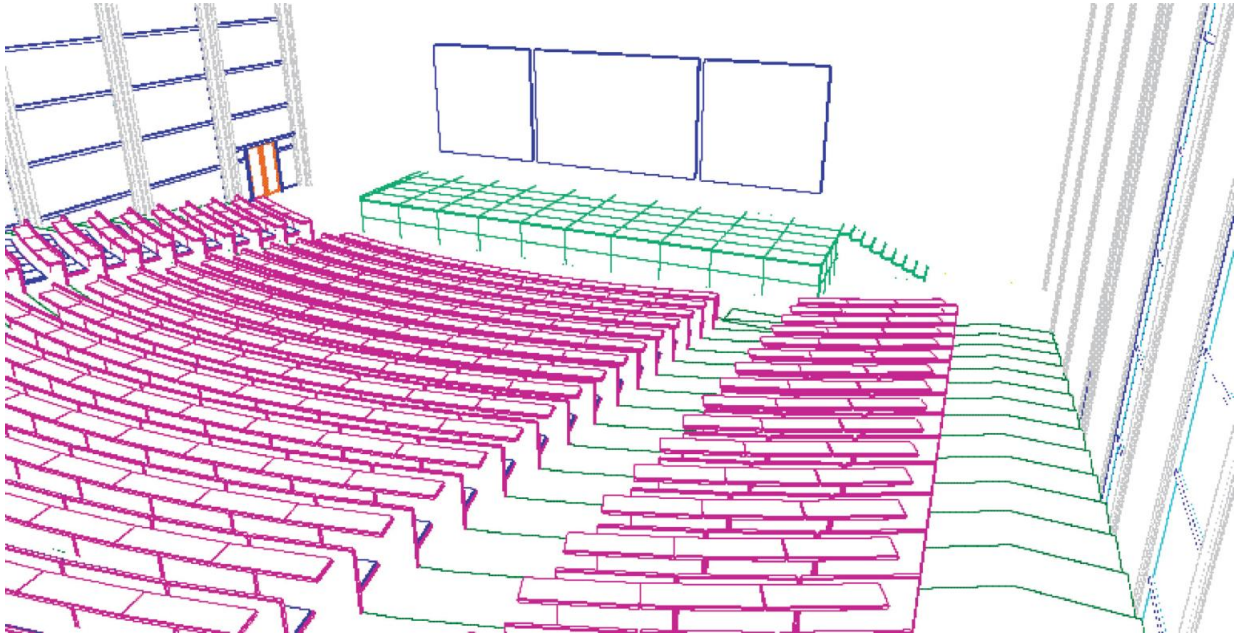
- Create a study with real data for a comprehensive picture

Take-Away Message

- Models will always deviate to some extent.
- The German DIN 18009-2 standard considers these model differences and recommends a sensitivity analysis.
- RiMEA and ISO 20414 tests provide a solid foundation for in-depth understanding of the model and for adding safety margins, respectively.

Tips for practitioners:

- Be aware of your model choice!
- Comparative studies instead of absolute values!
- Check tests of your chosen model to understand the sensitivity to input parameters!



simulate.visualize.improve

Contact me:
angelika.kneidl@accu-rate.de