



Heritage Implications in Egress and Modelling

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Introduction

Cultural Centers in Heritage Buildings

Delicate balance of protecting the building itself and the often valuable contents, as well as providing a safe environment for the occupants.



Heritage Buildings and Emergency Egress

Built before modern building
(and fire) codes



Changes in use and
occupancy



Limited intervention
recommendations

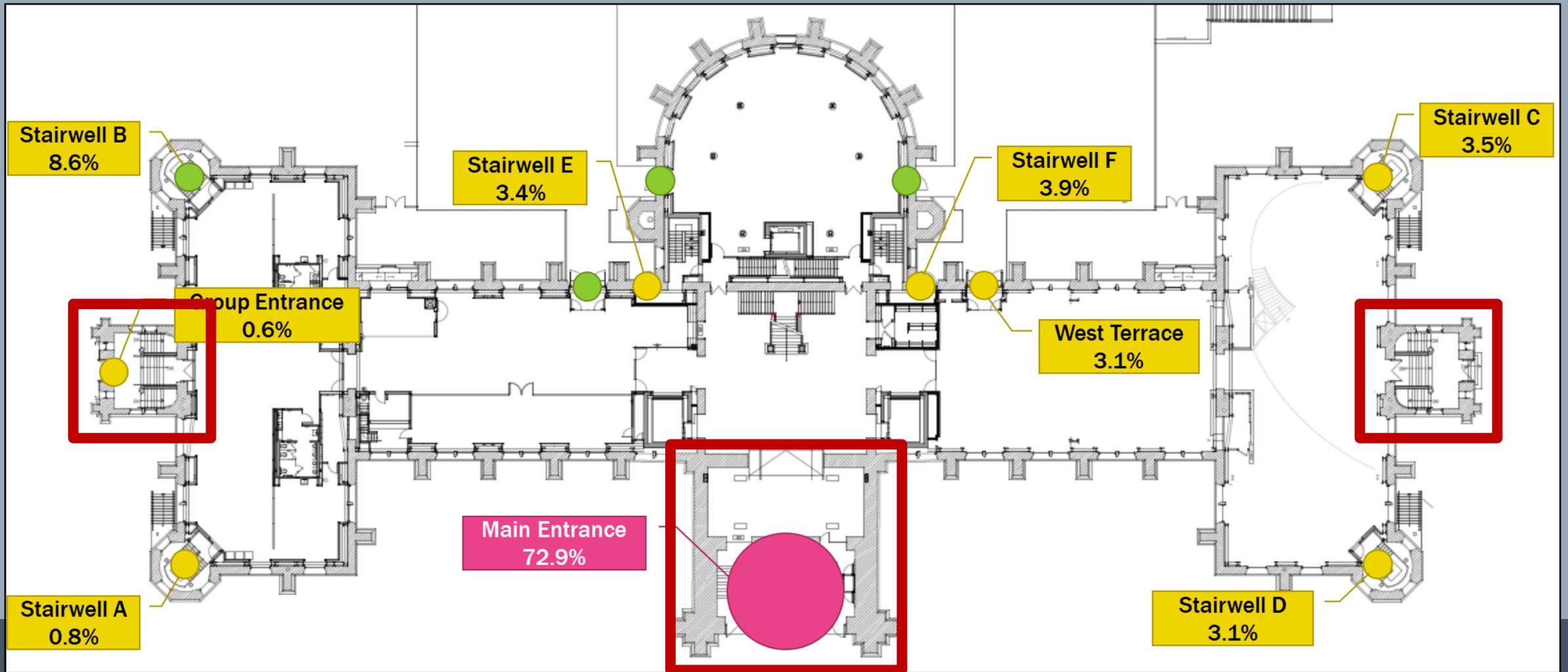
Data Collection

From a cultural center in a heritage building.



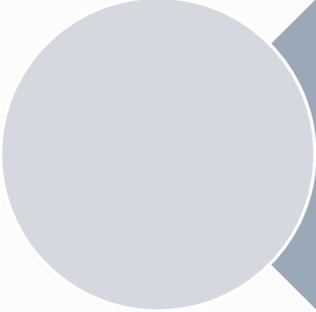
Evacuation data from two different events, named Scenario 1 and 2

Collected from 47 CCTV Cameras around the building

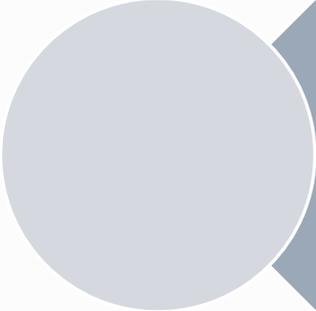


Example: scenario 1 Exit Usage

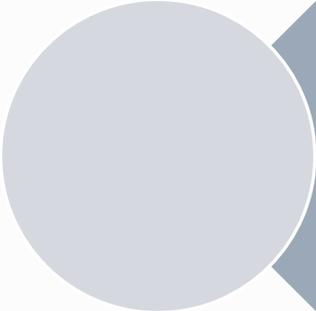
Research Goals



Verify Modelling
Tools



Validate
Movement Speeds



Analyse Heritage
Implications

Movement Profile Generation

For input into Software A and B.

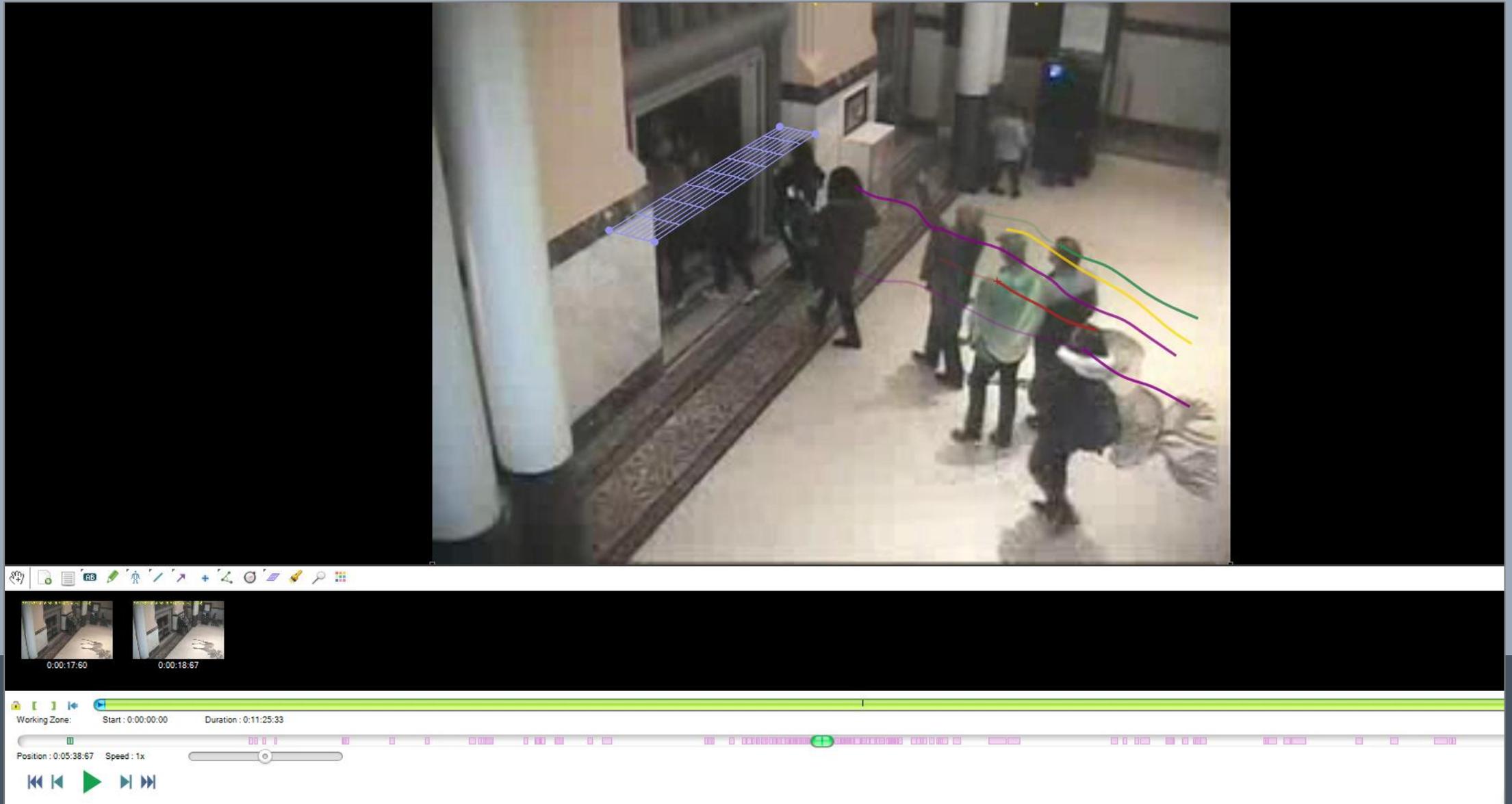
Movement Speeds



Pre-Evacuation Time



Exit Use Rates



Kinovea with tracking and perspective grid

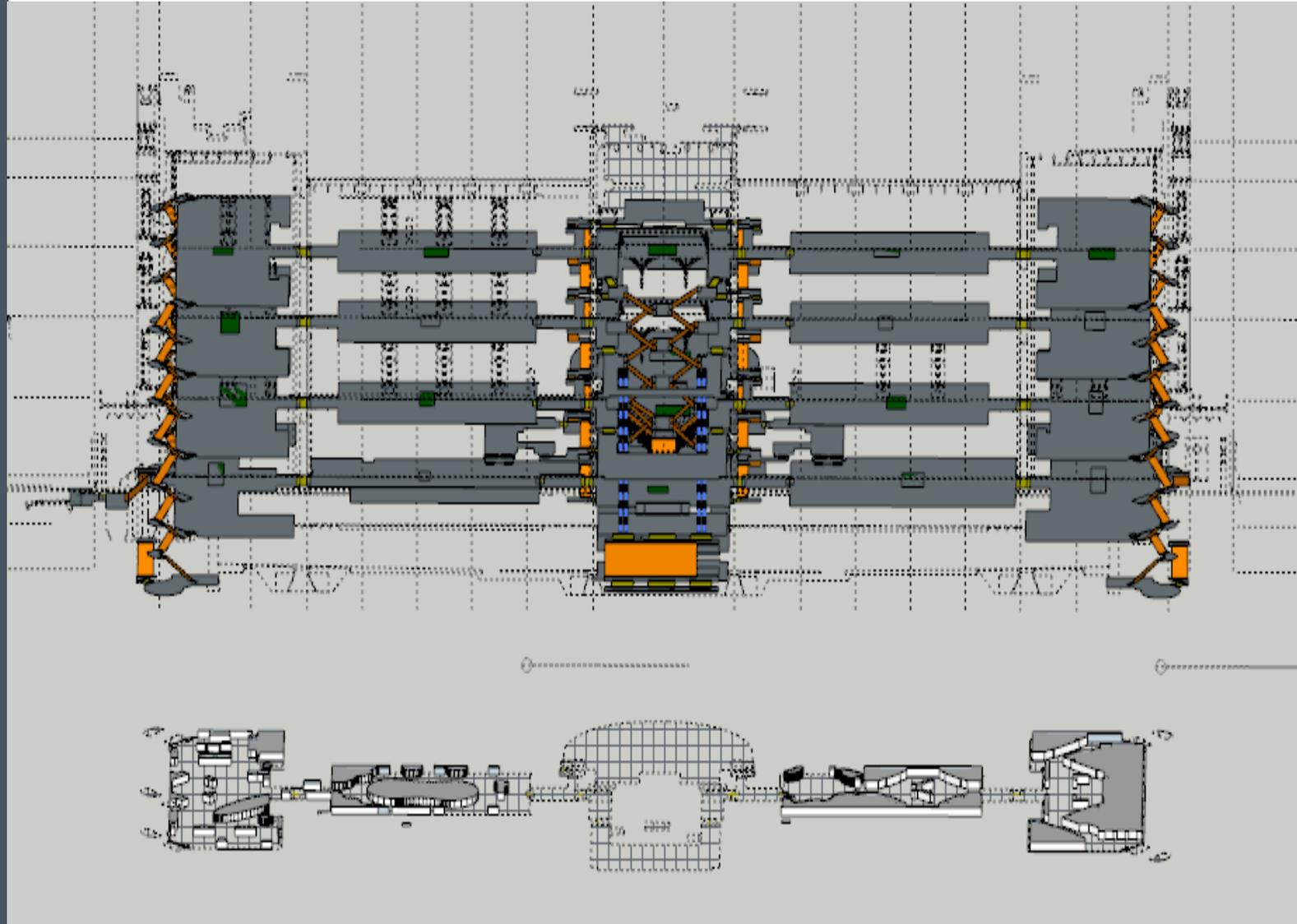
Generated Movement Profile

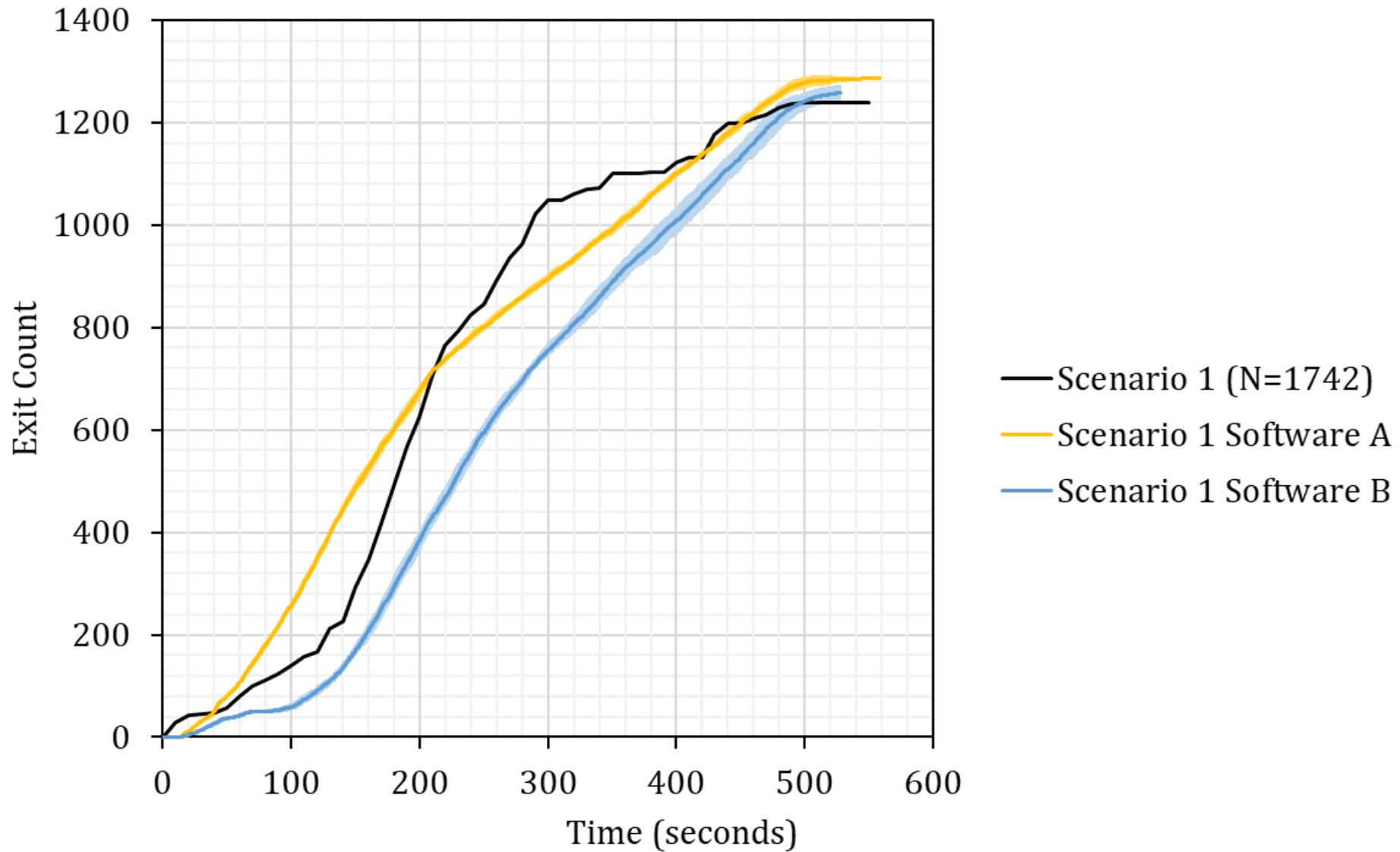
| Pre-Evacuation Time (Seconds) | Percentage of Occupants (%) |
|-------------------------------|-----------------------------|
| 0-5 | 17 |
| 6 - 10 | 18 |
| 11 - 20 | 15 |
| 21 - 30 | 19 |
| 31 - 60 | 20 |
| 61 - 120 | 9 |
| 121 - 210 | 3 |

| New Profile | Min Speed (m/s) | Max Speed | Mean | Std |
|-------------|-----------------|-----------|------|------|
| | 0.58 | 1.98 | 1.15 | 0.28 |

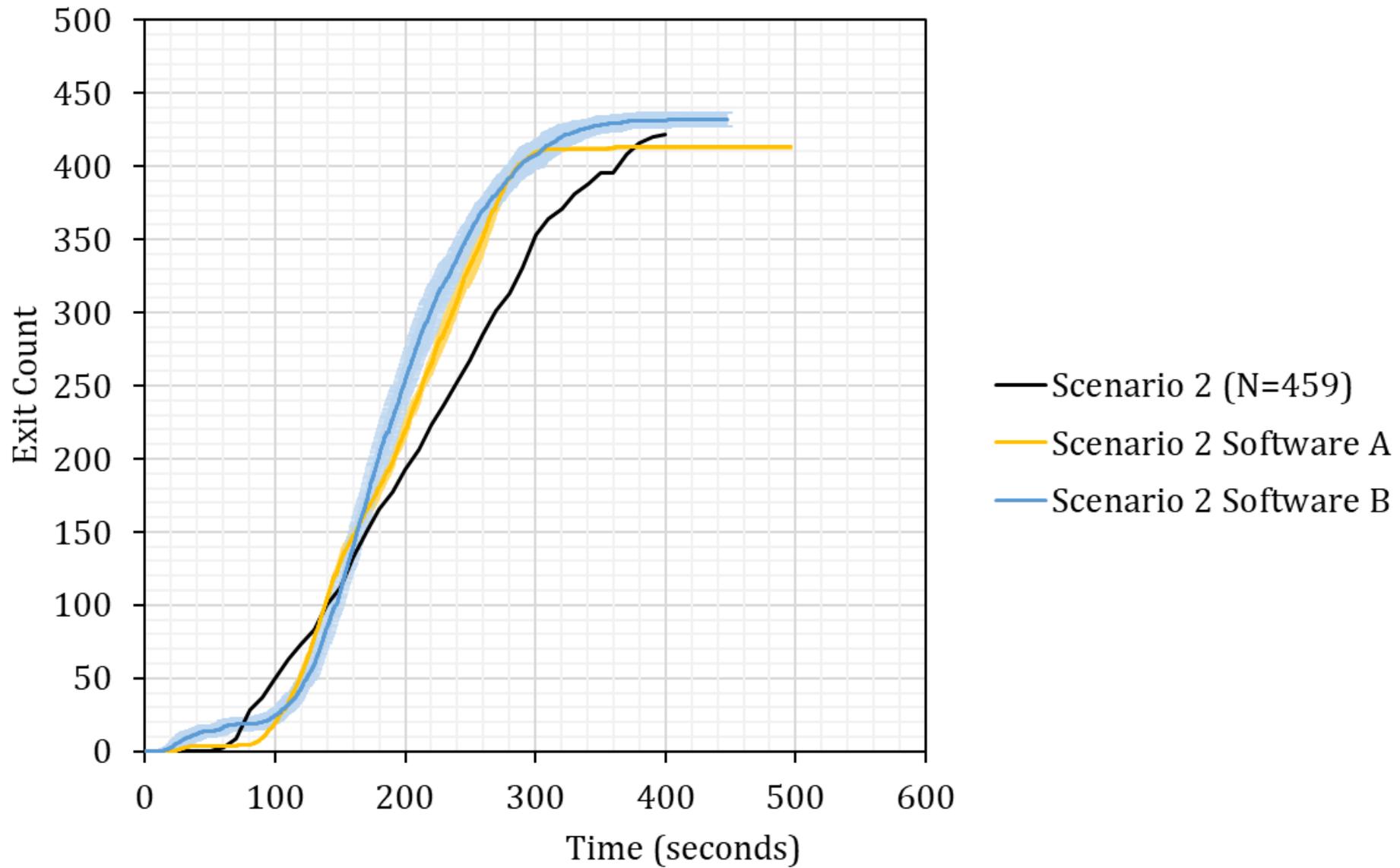
Modelling

In Software A and B for both Scenario 1 and 2, based on 2 recorded emergency egress events.





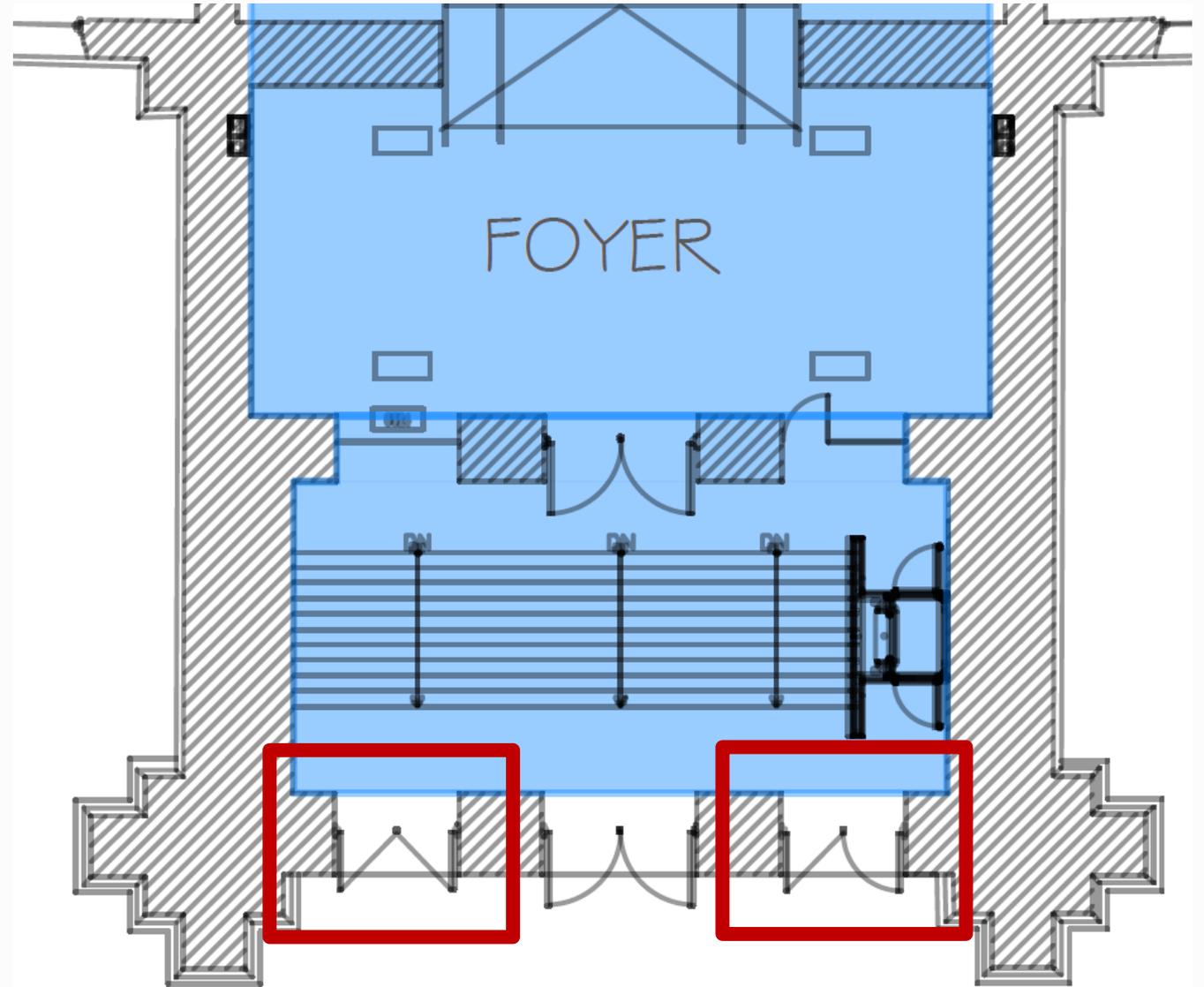
MOVEMENT SPEED VALIDATION – SCENARIO 1

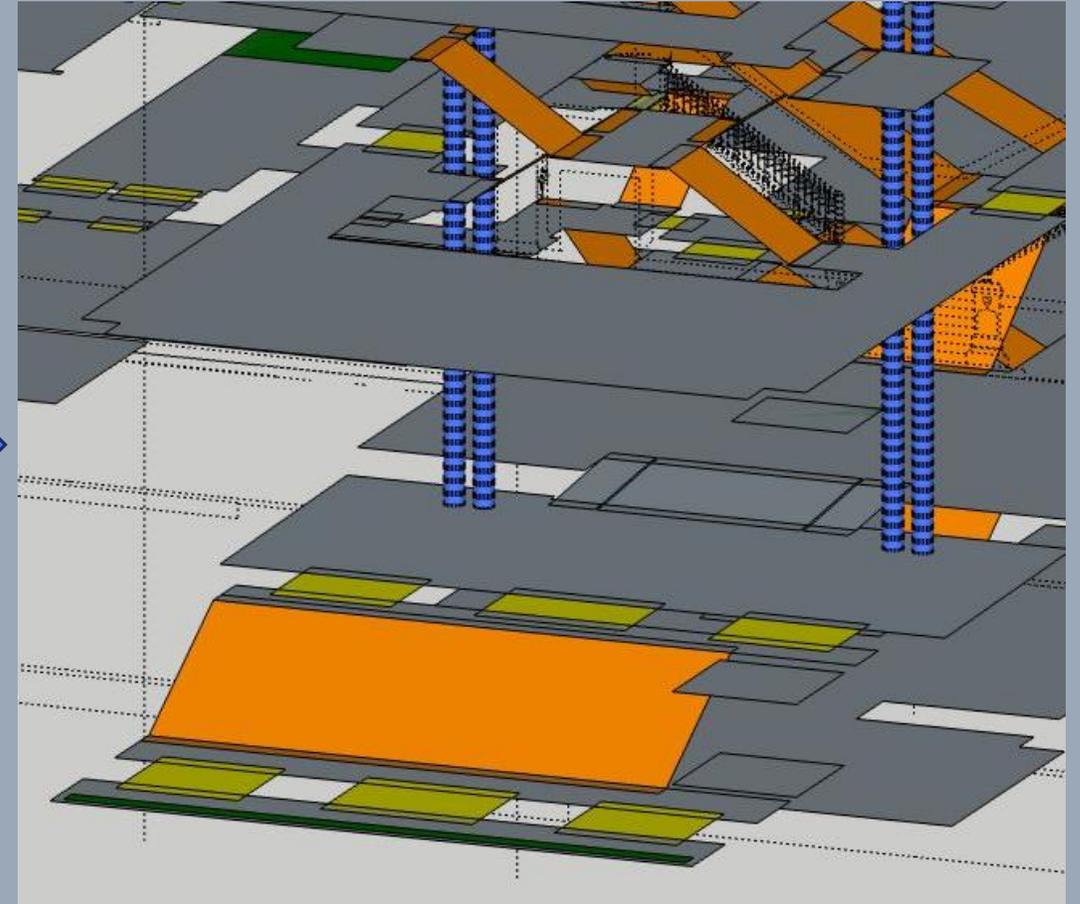
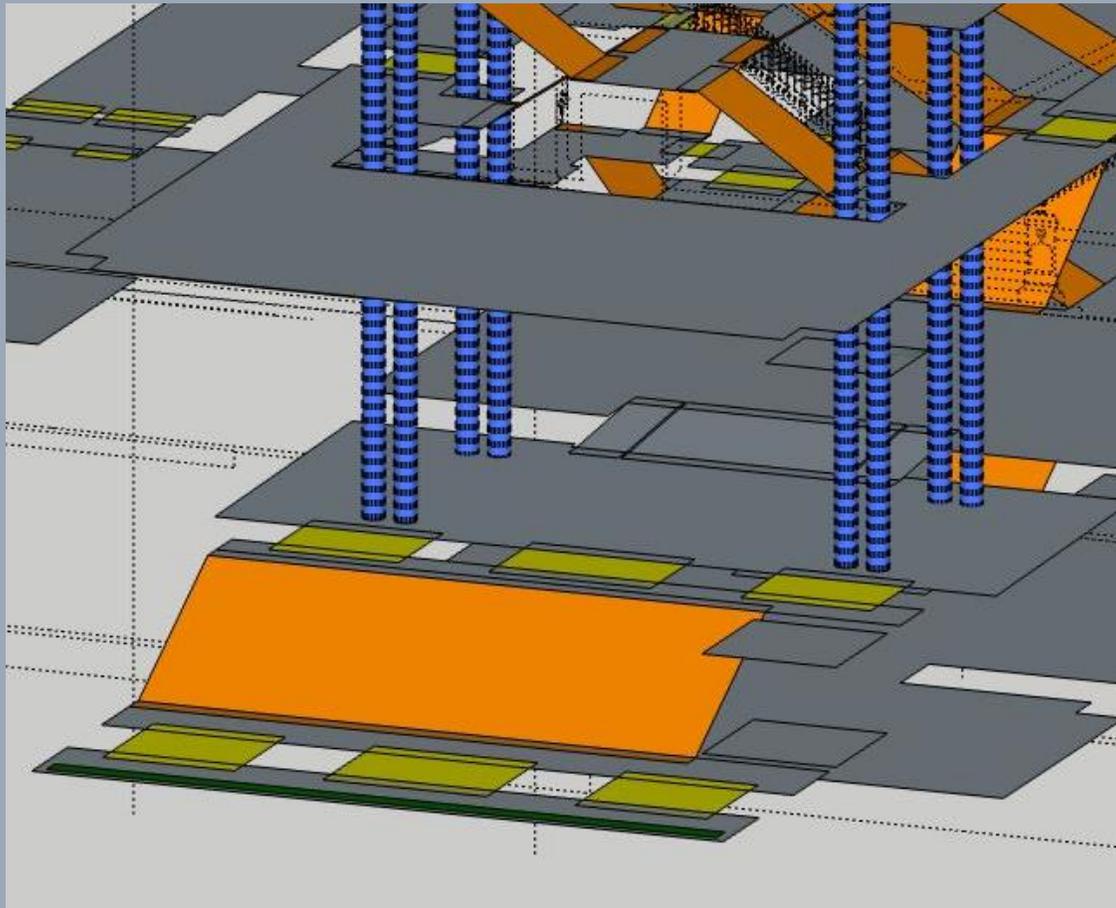


MOVEMENT SPEED VALIDATION – SCENARIO 2

Heritage Modelling

- New exits created during renovations
- Any elements that obstruct egress





Main Entrance Door Obstructions



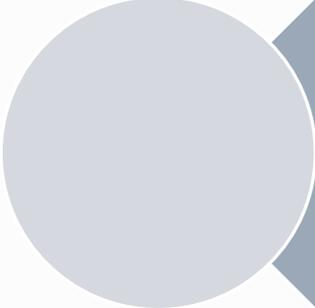
Additional Back Exits

Additional Considerations for Heritage Buildings

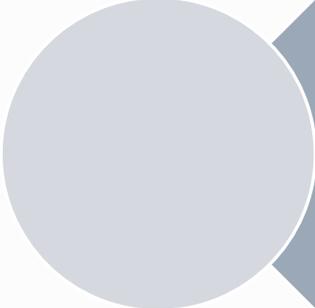
- Movement speeds and human behaviour changes over 100 years.



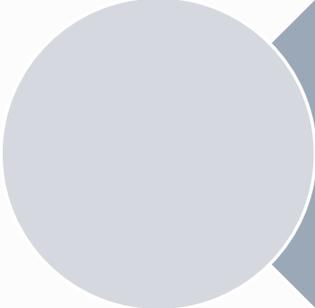
Future Work



Additional Scenario
Analysis



Parametric
Analyses



Continued Heritage
Investigation

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Learn more at the York University Fire Research Team website:

<https://yorkufire.com/research-areas/heritage-structures/>

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THANK YOU!

