

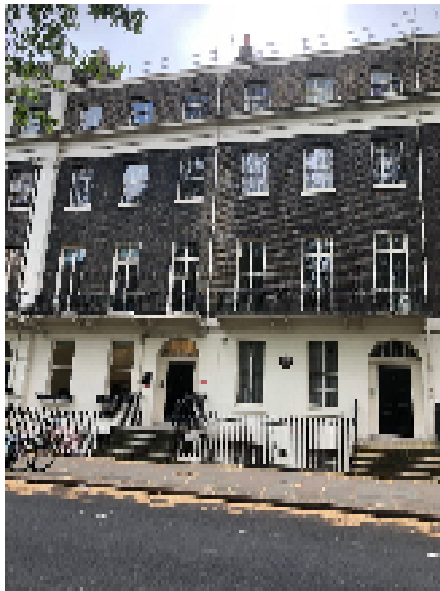


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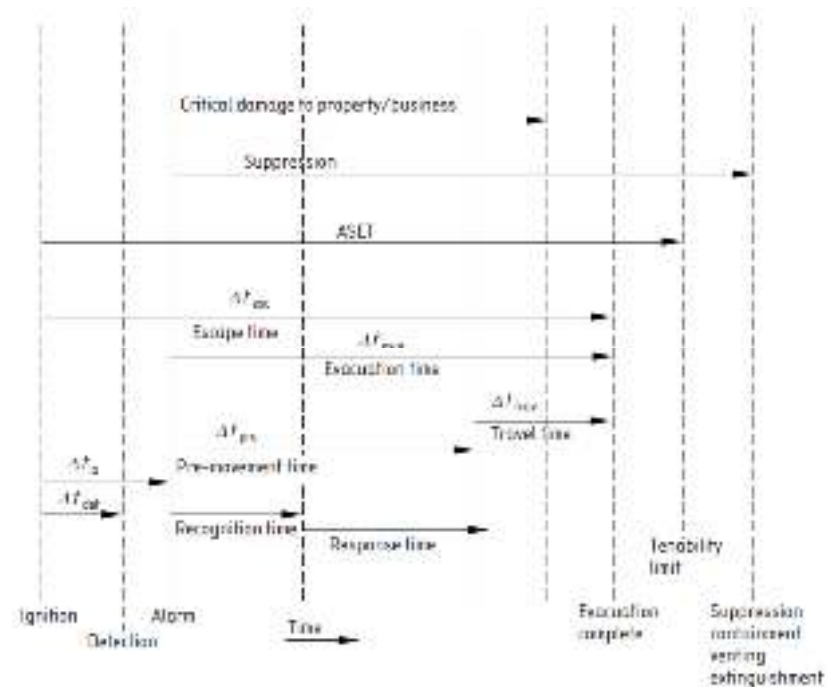
Pre-movement times in UCL Heritage buildings



Why explore this issue?



1. Fire risk associated with Heritage buildings.



2. Risk relating to delayed pre-movement times.





Approach to Research

- How the study was constructed.



Phases of research work



Phase 1

- egress drills
- surveys
- FSM review



Phase 2

- CFD model
- simulation training
- surveys
- further egress drill





Phase 1 research

- Sample analysis 10 buildings
- (actually ended up with eight buildings)



1 Monitored, unannounced egress drills

- Presentation times ranged from 2 – 620 seconds
- Most first presentation times were short (11, 13, 13, 12, 11, 16, 21, 17 seconds)
- Programme pre-movement time calculated as 169 seconds (between M1 and M2)

Building	$\Delta t_{pre (1st\ percentile)} + \Delta t_{pre (99th\ percentile)}$
22 Gordon Square	13 + 38 = 51 seconds
2 Taviton Street	13 + 65 = 78 seconds (discounting 2 sec time)
34 Tavistock Square	12 + 148 = 160 seconds
35 Tavistock Square	11 + 80 = 91 seconds
33 Bedford Place	16 + 62 = 78 seconds
11 Woburn Square	45 + 94 = 139 seconds
15 Woburn Square	21 + 40 = 61 seconds
19 Gordon Square	17 + 620 = 637 seconds



1 Survey results

- There were anomalies in risk perception when considering experience of fire
- Trust in fire alarm systems was very high
- On average, occupants found fire safety training to be relevant, and only 1/3rd occupants expressed interest in further training

Building	Percentage trust in fire alarm system
22 Gordon Square	90.9%
2 Taviton Street	94.7%
34 Tavistock Square	100%
35 Tavistock Square	80%
33 Bedford Place	100%
11 Woburn Square	100%
15 Woburn Square	100%
19 Gordon Square	43.5%



1

Survey results continued

- Somewhere between two and three minutes???

Building	Mean average anticipated ASET (minutes)
22 Gordon Square	3.125
2 Taviton Street	2.638
34 Tavistock Square	2.736
35 Tavistock Square	1.9
33 Bedford Place	3.81
11 Woburn Square	2
15 Woburn Square	2.25
19 Gordon Square	5.05
All	2.939



1

Fire safety management

Property	Number of fire marshals*	Floors checked by FEMs during egress drill
33 Bedford place	None recorded	2 nd , ground, lower ground
11 Woburn Square	One recorded	None
15 Woburn Square	Two recorded	3 rd , 2 nd , 1 st , ground
2 Taviton Street	Three recorded	Ground floor only
35 Tavistock Square	None recorded	All floors checked
34 Tavistock Square	Five recorded	4 th , 3 rd , 1 st , lower ground
22 Gordon Square	None recorded	Ground floor only
19 Gordon Square	One recorded	None

*Fire evacuation marshals as recorded on riskNET Responsible Persons Register



1 Fire detection and alarm systems

Property	Category of FDAS	Date of Installation	Number of Unwanted Fire Signals Between 01/09/2015 & 31/08/2018
33 Bedford place	L2	2014	None
11 Woburn Square	L2	1997	One (08/06/2016)
15 Woburn Square	L2	Mid-2017	Two (16/12/2016 & 10/01/2017)
2 Taviton Street	L2	2007	One (21/11/2017)
35 Tavistock Square	L2	1999	None
34 Tavistock Square	L2	1999	One (08/06/2016)
22 Gordon Square	L2	2010	None
19 Gordon Square	L2	2006	None





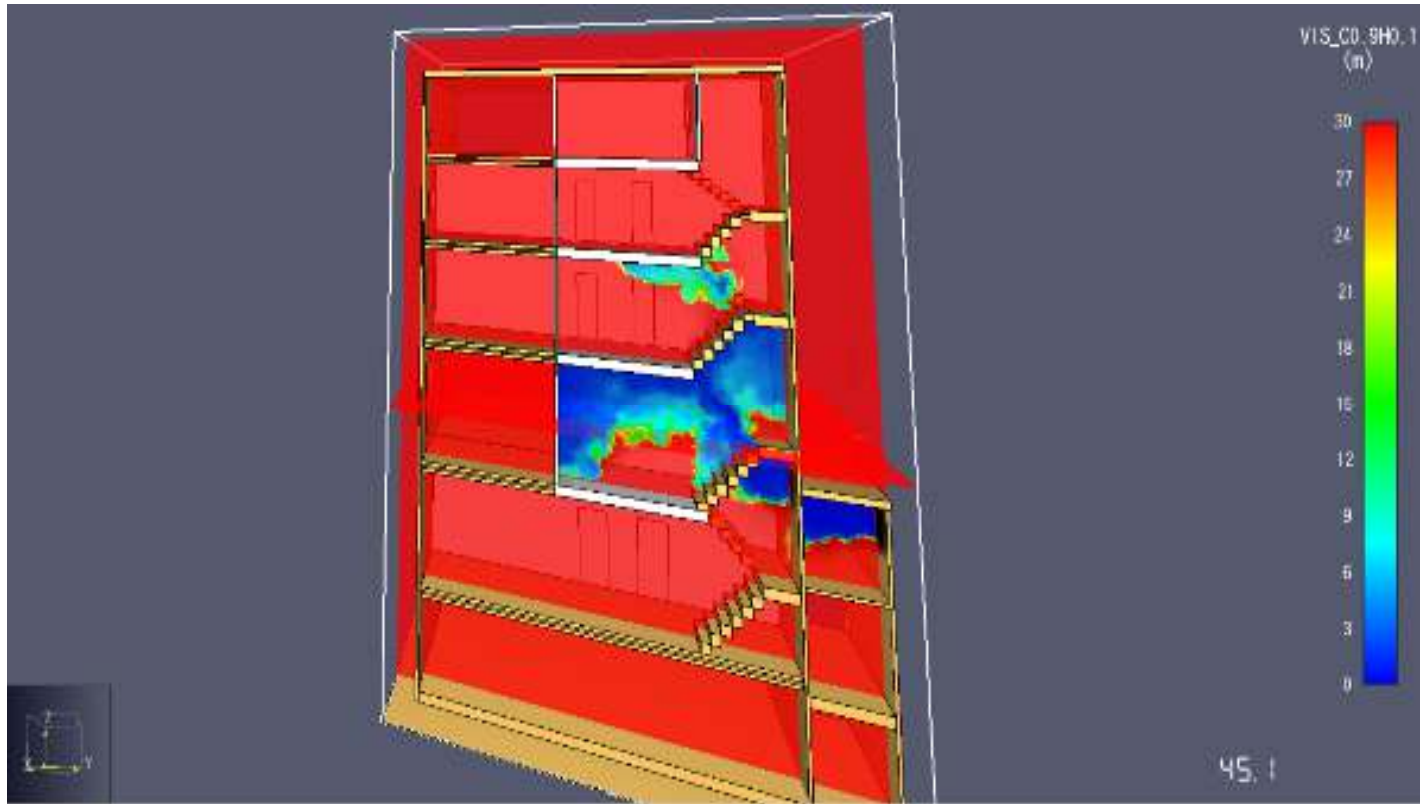
Phase 2 research

- Focus on single building (34 Tavistock Square)



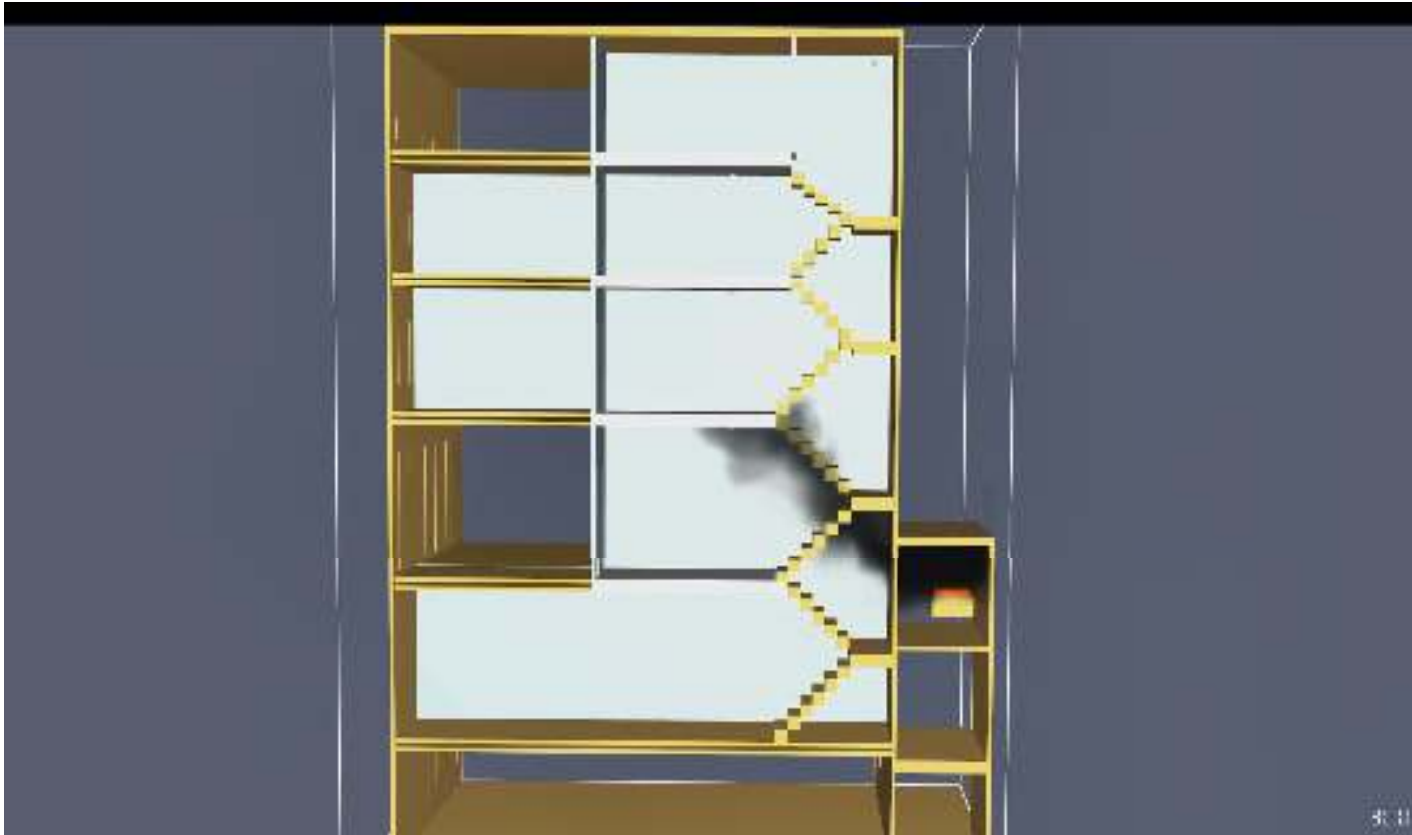
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CFD model



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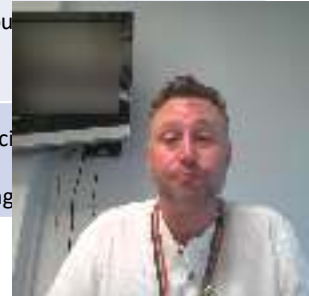
Simulation training



2 Surveys

- 12 – 1 thought CFD simulation changed their view on fire spread
- 9 – 1 less likely to wedge fire doors
- 11 – 2 more likely to remove wedges
- Usefulness of training = 4.69 / 5
- 10 / 13 delegates rated as 'extremely useful'

No.	Comments recorded by delegates following training
1	It was a great exercise and should be incorporated with online fire safety training modules.
2	Really quick + useful exercise.
3	Very useful information. Good to see the simulation & see how it affects our building.
4	Would be more useful having the fire exit by the window shown, differentiating escape time depending on fire development. Would be useful to not just see the smoke but heat too, to understand better what you were talking to us.
5	Use for future H&S planning / website.
6	Very useful to know how the fire travels and which areas would be affected. Good to see as visual representation.
7	Very interesting to note how quickly smoke spreads, especially in the scenario. Think it would be very useful to feature in a training



2

Further egress drill

Pre-movement time = 91 s (M1)

Floor	Room number	No. of persons	No. of persons that received training	$\Delta t_{pre (1st\ percentile)} + \Delta t_{pre (99th\ percentile)}$
4	401	1	1	40 s -
4	403	1	0	35 s -
2	201	2	1	27 s + 28 s = 55 s
1	102	2	2	24 s + 67 s = 91 s
G	G01	2	2	37 s + 40 s = 77 s
G	G04	1	1	Unknown – observer did not record occupants in this room



Evaluation of outcomes

What did the study show?

- Pre-movement times were generally quite short
- This was a slight surprise based on experience
- Fire safety management was mixed, although trust in alarms was high and false alarms were low
- Occupants found simulation training extremely useful
- Pre-movement times were down in second drill although this is challenging to correlate with accuracy due to size of dataset



Future work and collaborations



- Can we show more broadly that CFD simulation training is effective in reducing pre-movement times?
- What implications are there to using egress drills to evaluate training in the same sample group of buildings?
- Is it feasible to provide CFD-based training for other building types?
- Resources of engineers' time, computing power, drill observers, and buildings / occupants required?

QUESTIONS?





Pre-movement times in Heritage buildings

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