

A UK evacuation case study using Pathfinder questions the suitability of fire safety guidance

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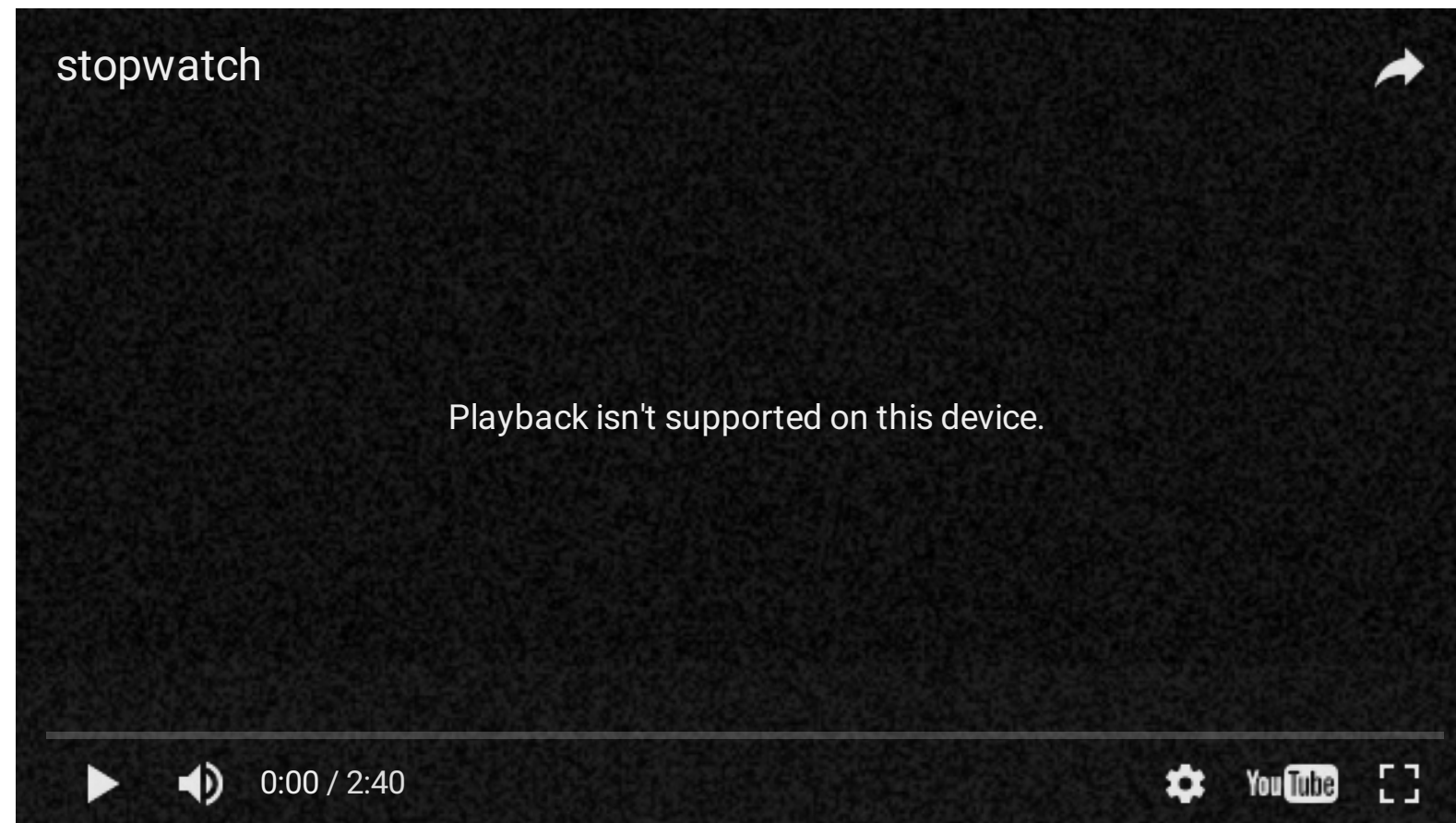
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Content

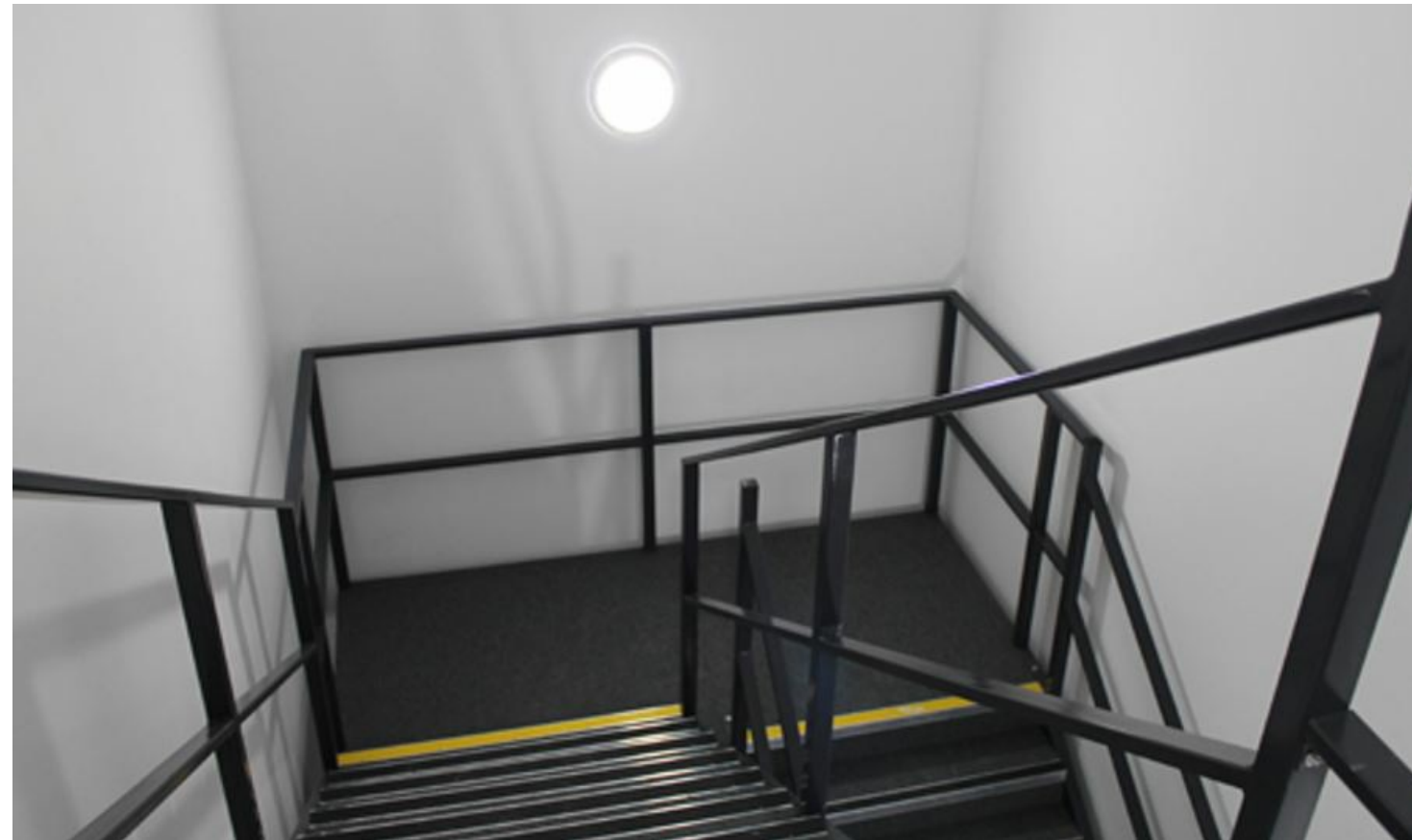
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UK Guidance for staircases



Sizing staircases

Flow rate and capacity to hold people taken into account when sizing staircases



Time to safety

When the last person enters the staircase people are safe



The starting point


	6 th floor – 88 people	
	5 th floor – 88 people	
	4 th floor – 88 people	
	3 rd floor – 40 people	
	2 nd floor – 88 people	
	1 st floor – 88 people	
	Ground – independent exits	

Total of 480 people

The latest code, British Standard 9999 states a maximum of 427 for this building

Guidance

ONLINE VERSION

 HM Government

The Building Regulations 2010

Fire safety


APPROVED DOCUMENT

B

VOLUME 2 – BUILDINGS OTHER THAN DWELLINGHOUSES

B1	Means of warning and escape
B2	Internal fire spread (linings)
B3	Internal fire spread (structure)
B4	External fire spread
B5	Access and facilities for the fire service

Came into effect April 2007



ONLINE VERSION

2006 edition
Incorporating 2007 and 2010 amendments

BS 9999:2008



BSI British Standards

**Code of practice for fire safety
in the design, management
and use of buildings**

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raising standards worldwide™

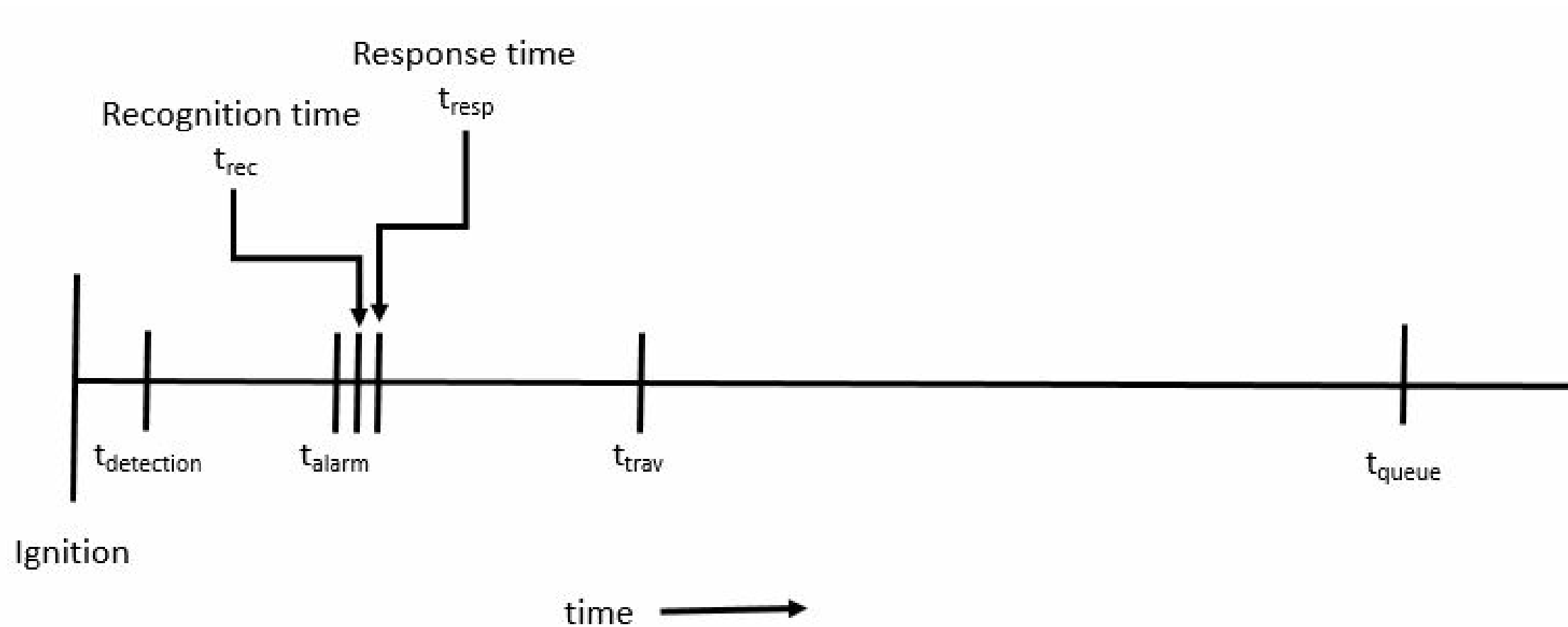
BSI
British Standards

Guidance

ADB says maximum of
350 people

BS 9999 says maximum of
427 people

The observed evacuation drill



Model



Times for each floor to evacuate

Floor	Time for the last person to leave
First	2 minutes 50 seconds
Second	3 minutes 48 seconds
Third	2 minutes 52 seconds
Fourth	4 minutes 41 seconds
Fifth	6 minutes 20 seconds
Sixth	5 minutes 52 seconds

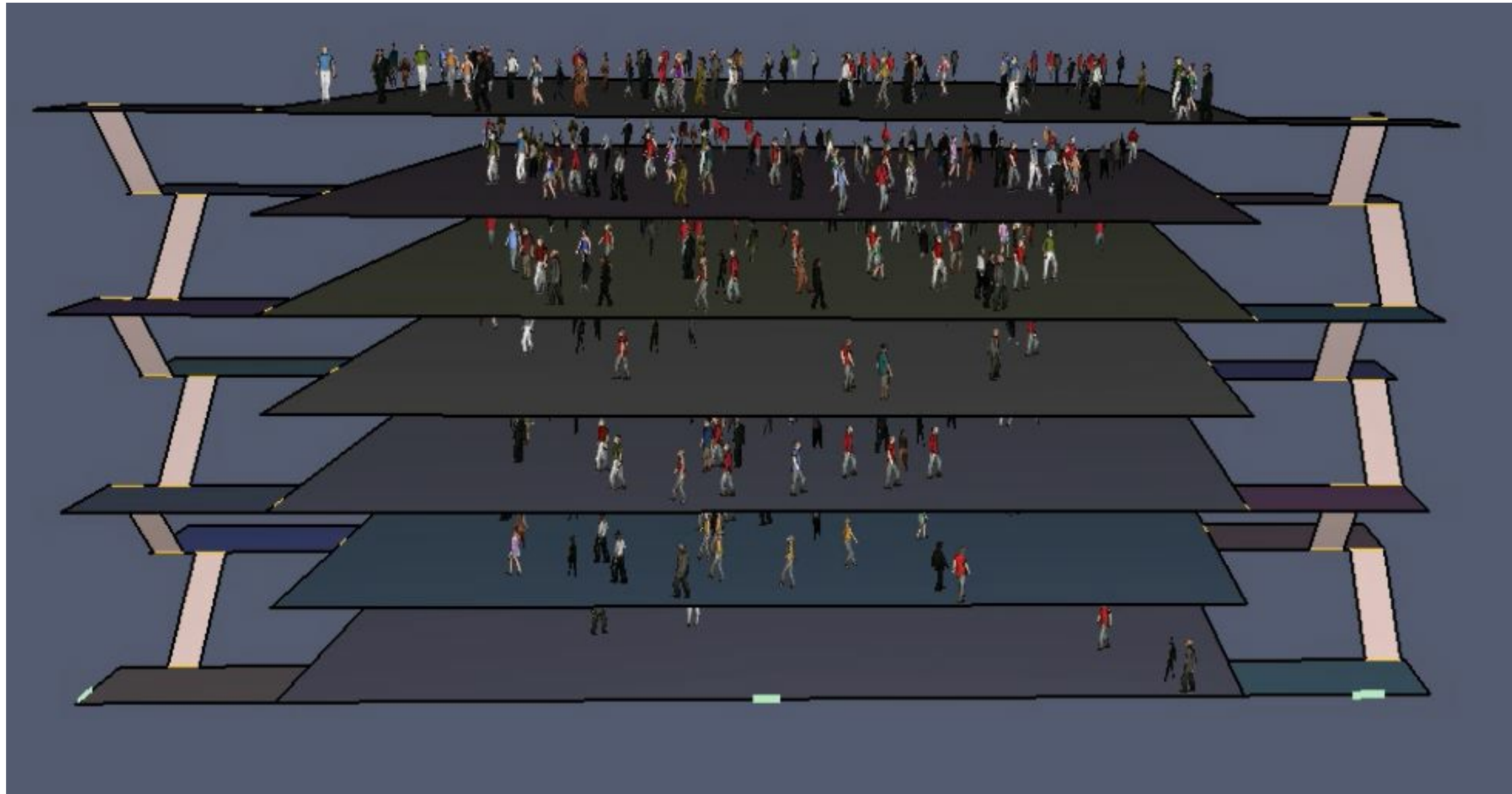
Safe?

Building not considered safe
Remedial works were undertaken

Remaining Question

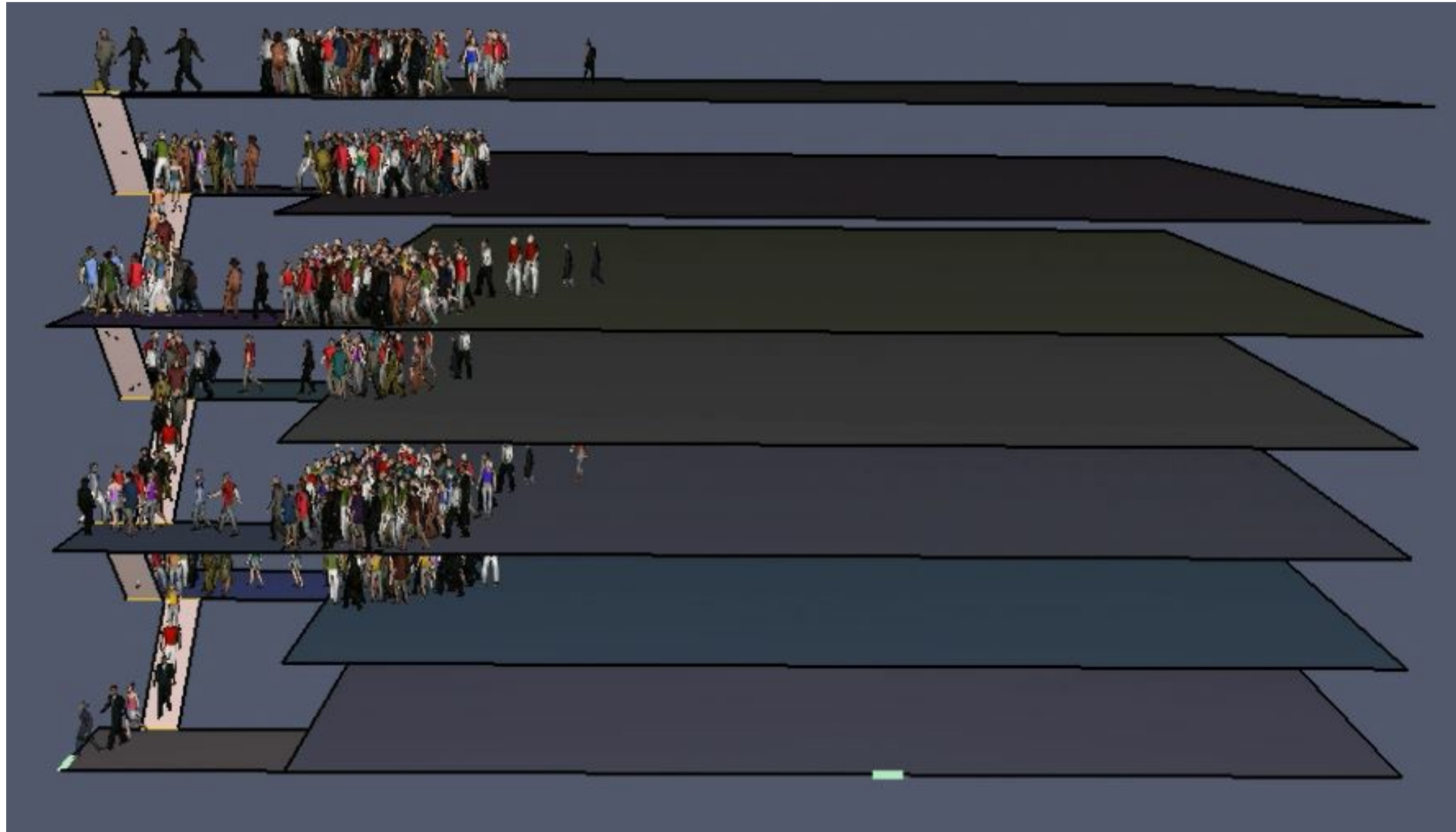
If the building had been code compliant
what would the evacuation times have been?

Pathfinder



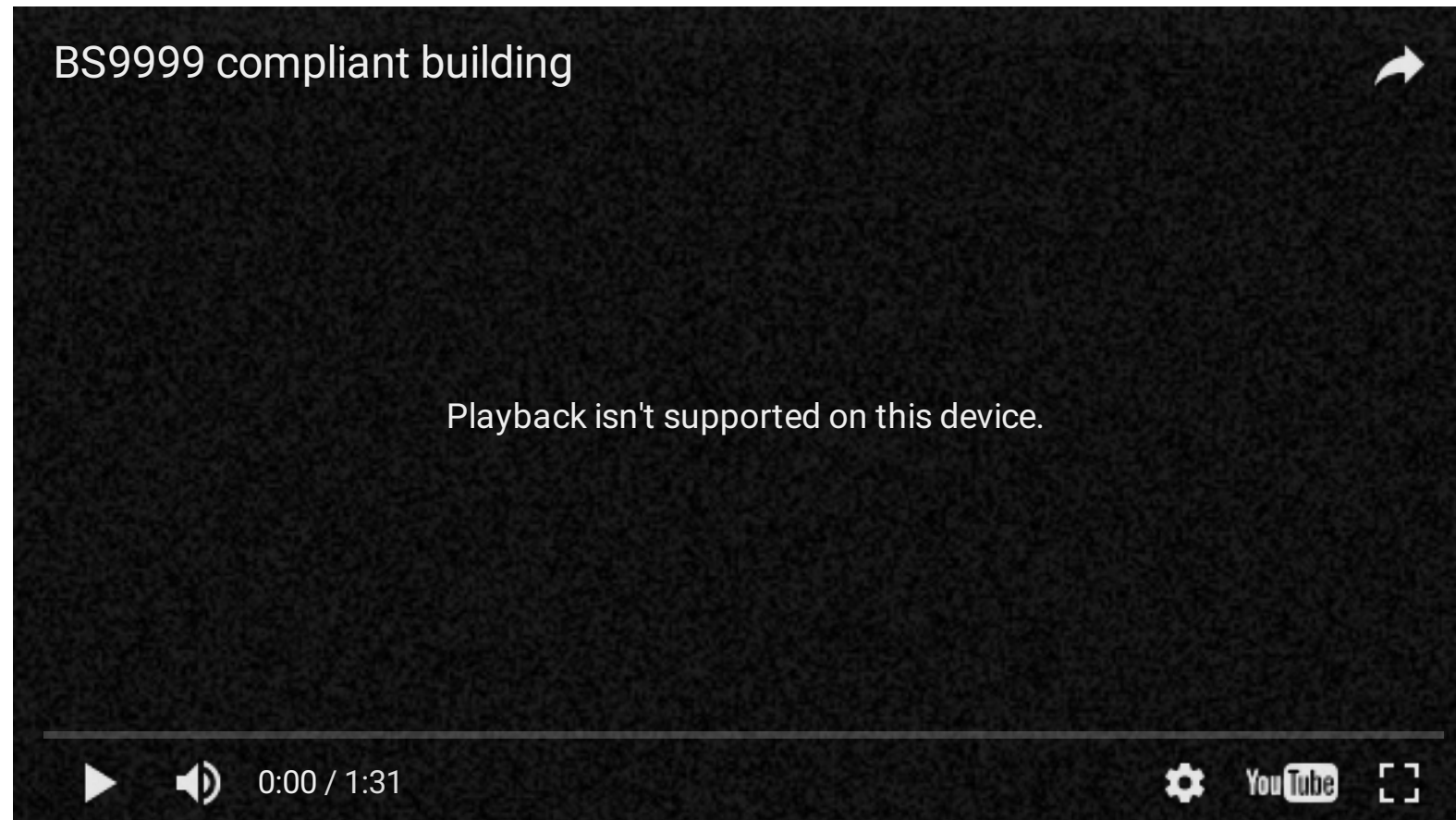
Evacuation reproduced in Pathfinder

Model adjustments



Priorities and speeds adjusted to closely match observed evacuation times.

Typical run



Evacuation times

Population reduced to
be code compliant
(BS 9999)

Floor	Time for the last person to leave
First	1 minute 40 seconds
Second	2 minutes 50 seconds
Third	1 minutes 35 seconds
Fourth	4 minutes 55 seconds
Fifth	6 minutes 00 seconds
Sixth	6 minutes 50 seconds
Average	3 minutes 58 seconds

Is there a problem?

There appears to be a problem as people are unlikely to survive on a fire floor for over 6 minutes.

And yet we have no history of deaths in office buildings

BS 9999

This is new code

It is less onerous than ADB

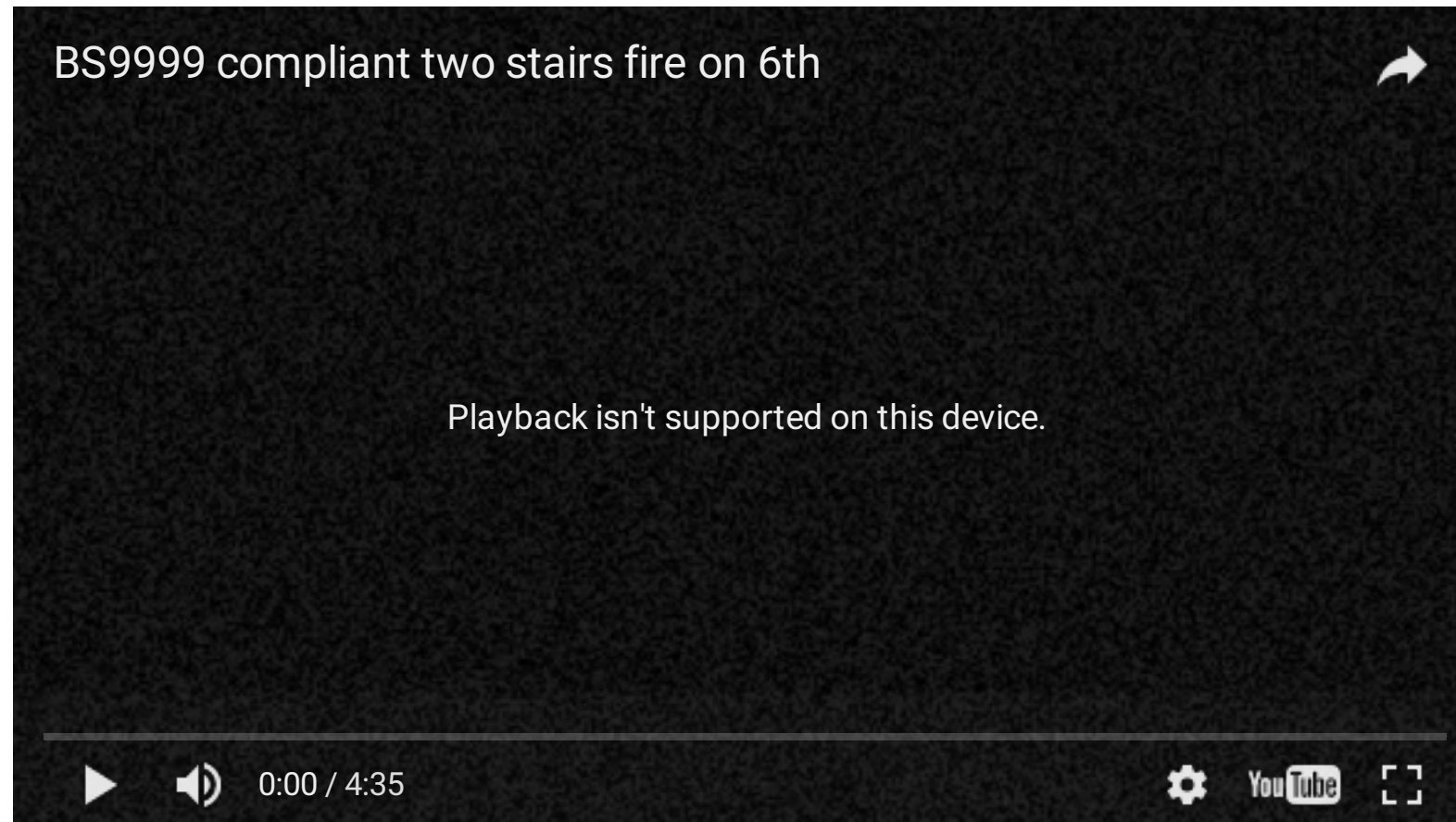
It has not stood the test of time as ADB has

ADB compliant building

Floor	Time for the last person to leave
First	1 minute 00 seconds
Second	1 minute 50 seconds
Third	2 minutes 30 seconds
Fourth	3 minutes 30 seconds
Fifth	4 minutes 00 seconds
Sixth	4 minutes 50 seconds
Average	2 minutes 57 seconds

Population reduced to ADB max. and model run again

Methodology



Summary

Pathfinder modeling shows that the assumed 2 and a half minutes is unachievable when populations at maximum, under current assumptions

But there is no history of fire deaths

New guidance (BS 9999) produces worse results than traditional approach (ADB)

But ADB results were not great

Maybe we are too pessimistic about the performance of staircases

As use of BS 9999 continues to grow time may reveal the answer