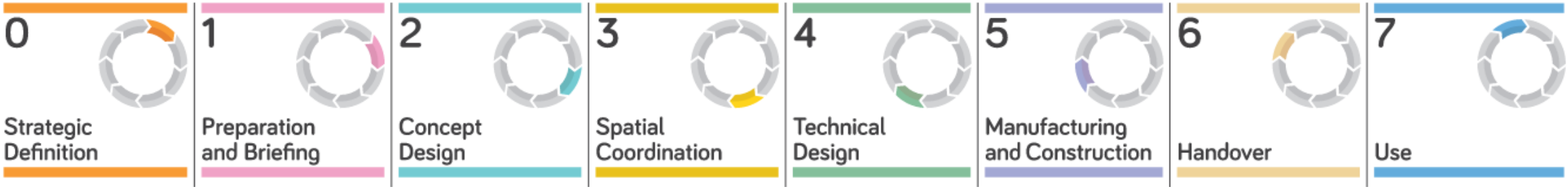
Firefighters and Evacuation Lifts

Farrokh Azad – SWECO Fire Engineering

Fire Safety in Buildings

Governing Regulations:

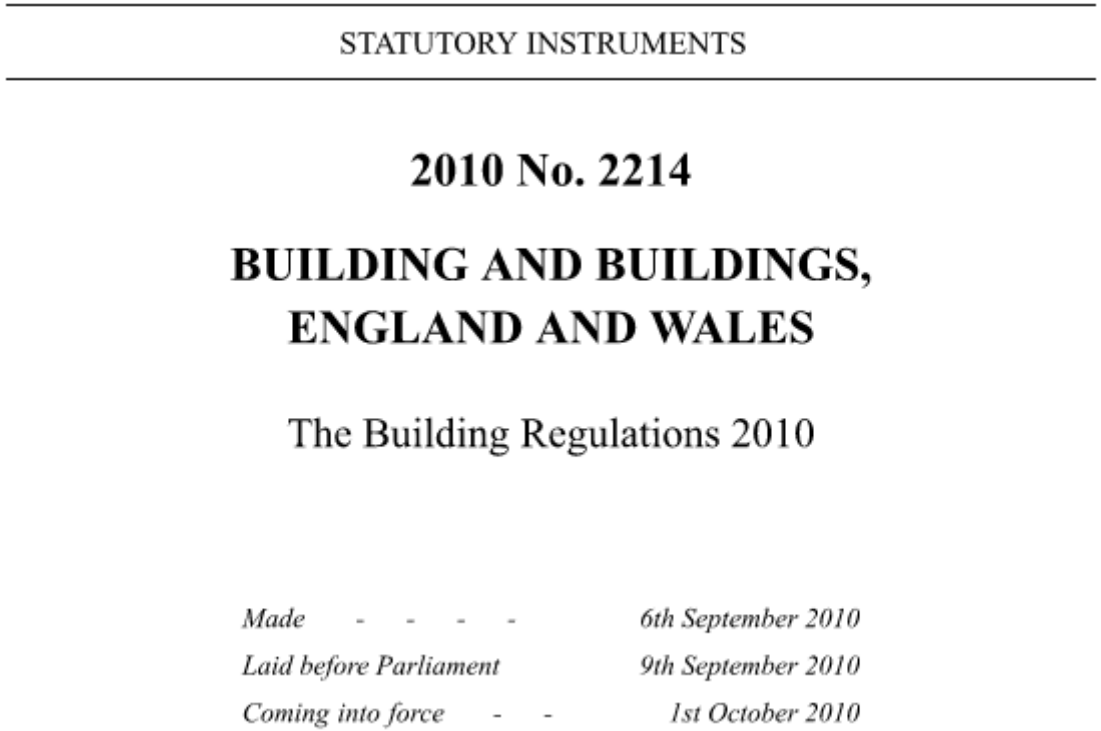
- Town and Country Planning Order 2015 – Planning Application (Gateway 1)
- Building Regulations 2010, Part B – Part B Certification
- Fire Safety Order 2005 – Building in Use



Fire Safety in Buildings

Building Regulations 2010, Part B

- B1 – Means of Warning and Escape
- B2 – Internal Fire Spread – Linings
- B3 – Compartmentation and Structure Fire Resistance
- B4 – External Fire Spread
- B5 – Fire Brigade Access and Facilities



STATUTORY INSTRUMENTS

2010 No. 2214

BUILDING AND BUILDINGS,
ENGLAND AND WALES

The Building Regulations 2010

Made - - - - 6th September 2010
Laid before Parliament 9th September 2010
Coming into force - - 1st October 2010

Routes of Compliance with Part B (Fire Safety)

- Prescriptive Fire Safety Design
  - Approved Document B
  - BS 9999 – non-residential
  - BS 9991 – residential
  - BB100 – schools
  - HTM 02-05 – hospitals

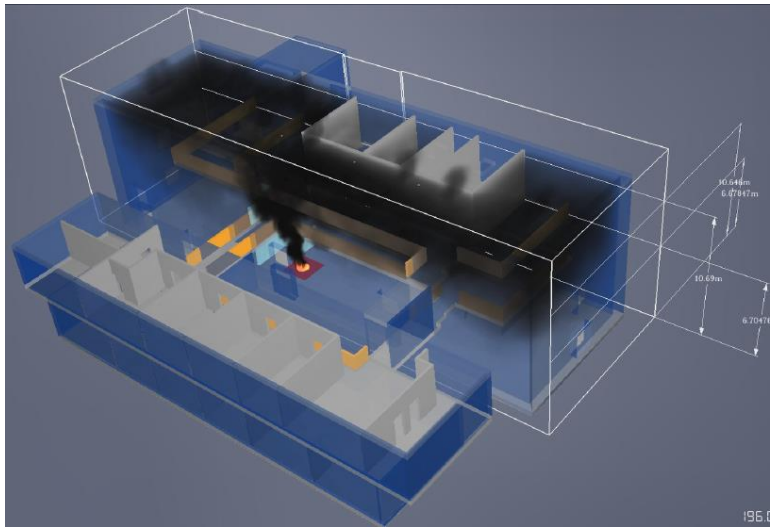
- Performance-based Fire Safety Design
  - BS 7974: Application of Fire Safety Engineering

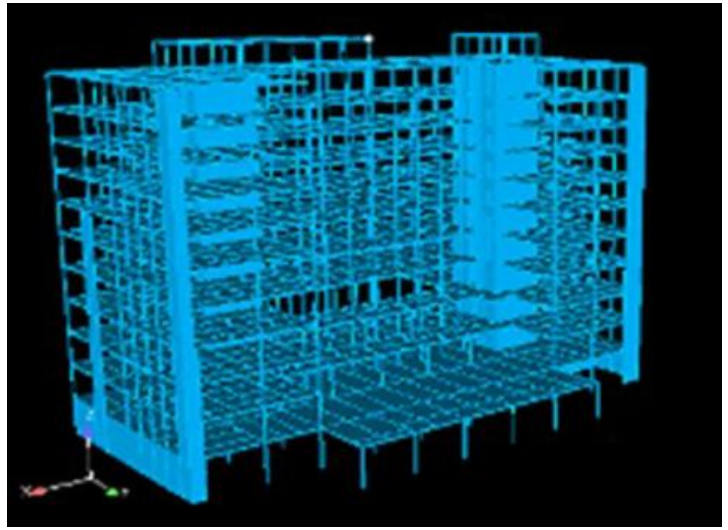
    Not necessarily following the parameters set in the guidance documents, proposing **Fire Engineering** bespoke solutions considering the **Fire Safety** and **Human Tenability Criteria** supported through a **Comparative** or **Deterministic Study**.

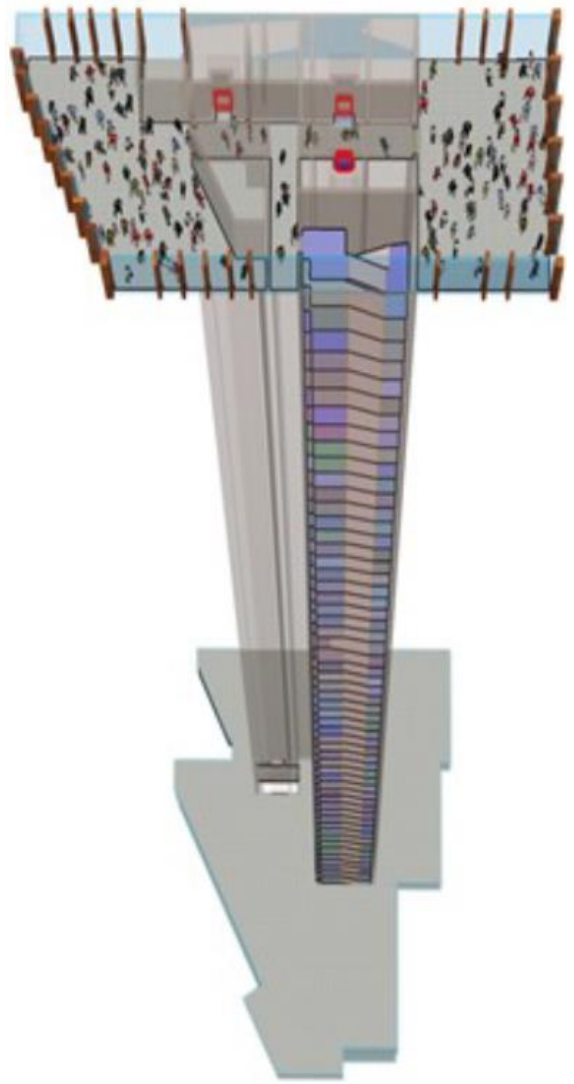
Fire Safety Engineering

What is Fire Engineering?

- **Code Consultation:** Providing Fire Safety advice following the guidance documents; and
- **Fire Engineering Design:** Utilising application of science and engineering principles to protect People, Property, and their Environments from the harmful and destructive effects of fire and smoke.







Latest Updates in Fire Safety Industry

Firefighters Lift

- Lift with protection measures, controls and signals that enable it to be used under the direct control of the fire and rescue service in fighting a fire installed as per BS EN 81-20 and BS EN 81-72 (BS 9999)

- Firefighters Lift is required as part of a Firefighting Shaft arrangement where:
  - The height of the building is >18m
  - The depth if >10m

Note: It is not necessary for floors above and below fire and rescue service access level to be served by the same lift.

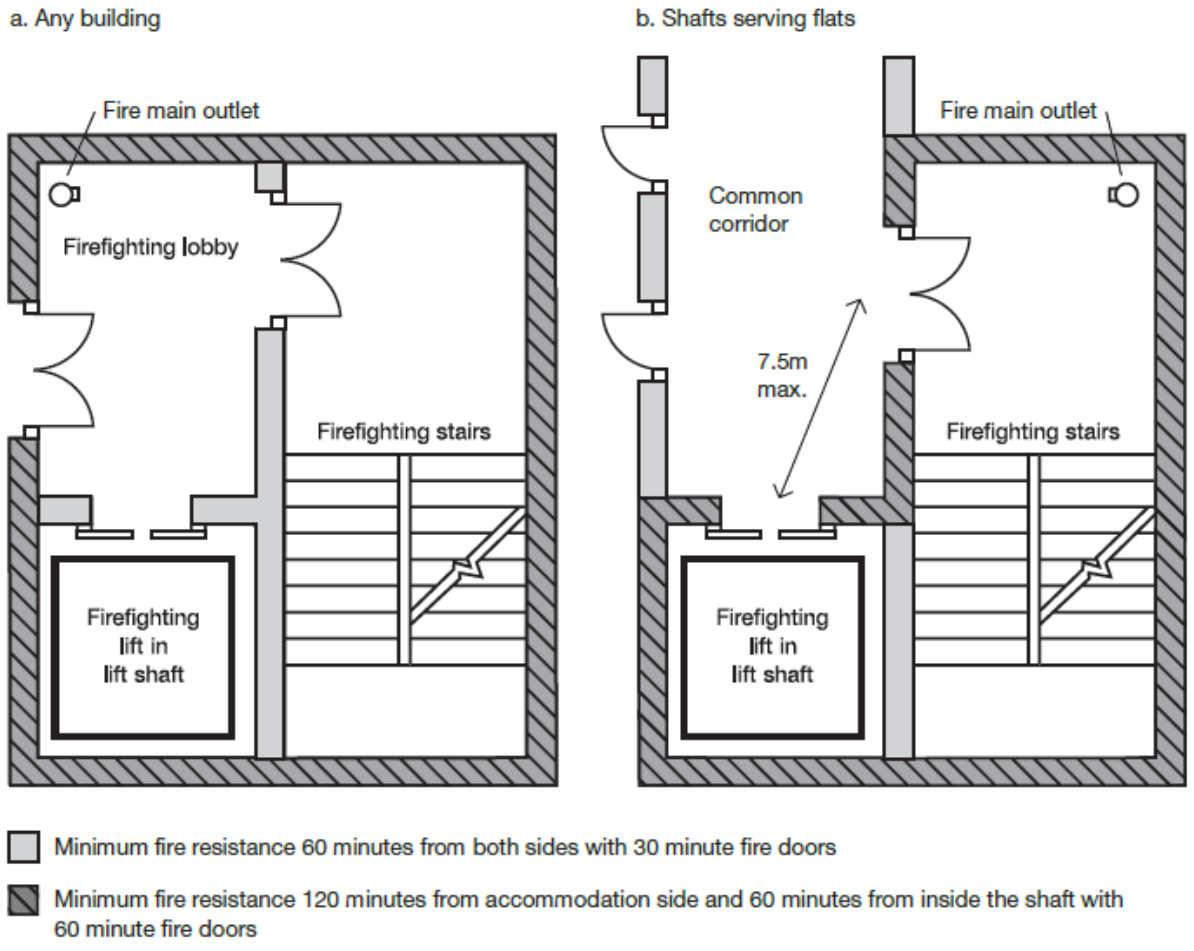
Table 17 **Provision of fire-fighting facilities**

Type of building (qualifying storeys)	Facilities to be provided
Any building in occupancy risk category A or B and with a height of 11 m or more, but less than 18 m	Escape stair [A)] Unvented protected lobby provided with a fire main [B)]
Buildings or parts of buildings with a risk category of A3, B3 or B2 [C)], factories or for assembly and recreation where the height of the topmost storey exceeds 7.5 m, with the floor area of any storey above the ground storey not less than 900 m²	Fire-fighting shaft, comprising: Fire-fighting stair Fire-fighting lobbies provided with a fire main
Any buildings or parts of buildings [D)] where the height of the topmost storey (excluding any storey consisting entirely of plant rooms) exceeds 18 m	Fire-fighting shaft, comprising: Fire-fighting stair Fire-fighting lobbies provided with a fire main Firefighters lift installation
Any buildings where the depth of the lowermost storey exceeds 10 m	Fire-fighting shaft, comprising: Fire-fighting stair Fire-fighting lobbies provided with a fire main Firefighters lift installation
Any buildings where there are two or more basement levels, each with a floor area exceeding 900 m²	Fire-fighting shaft, comprising: Fire-fighting stair Fire-fighting lobbies provided with a fire main

Firefighters Lift

Design Considerations:

- Lift shaft fire resistance enclosure of 120mins
- Minimum required dimension
- Signage
- Back up power supply
- Lobby protection (enclosure and ventilation)
- Shaft smoke ventilation (pressurised)
- Control system and interface with alarm system
- Grounding cause/effect
- Communication system
- Water protection
- Maintenance



Approved Document B

Evacuation Lift

- Where a lift is part of the evacuation sequence for people, it should be an evacuation lift installed as per BS EN 81-20 and BS EN 81-70 (BS 9999)

Design Considerations:

- Evacuation lifts should not be considered as the only means of escape
- The overall evacuation regime of the building i.e. simultaneous, phased, stay put
- Over crowding and queueing
- Operation requires assistance i.e. management, fire marshal or fire service (during firefighting)
- A lobby protection (refuge space) is required
- Should be provided with a protected route to final exit
- Appropriate signage
- Back up power supply
- Maintenance

Combined Firefighters and Evacuation Lift

- **Single Firefighting Shaft:**

- In some cases, firefighters lifts (which are provided principally for the use of the fire and rescue service in fighting fires) may be installed at locations within the building that enable them to augment the evacuation strategy for **disabled people**. If so located, these lifts may be used for evacuation of those occupants prior to the arrival of the fire and rescue service. **Where this is planned, the relevant local fire authority should be consulted before implementation** (BS 9999).

- **Two Firefighting Shaft:**

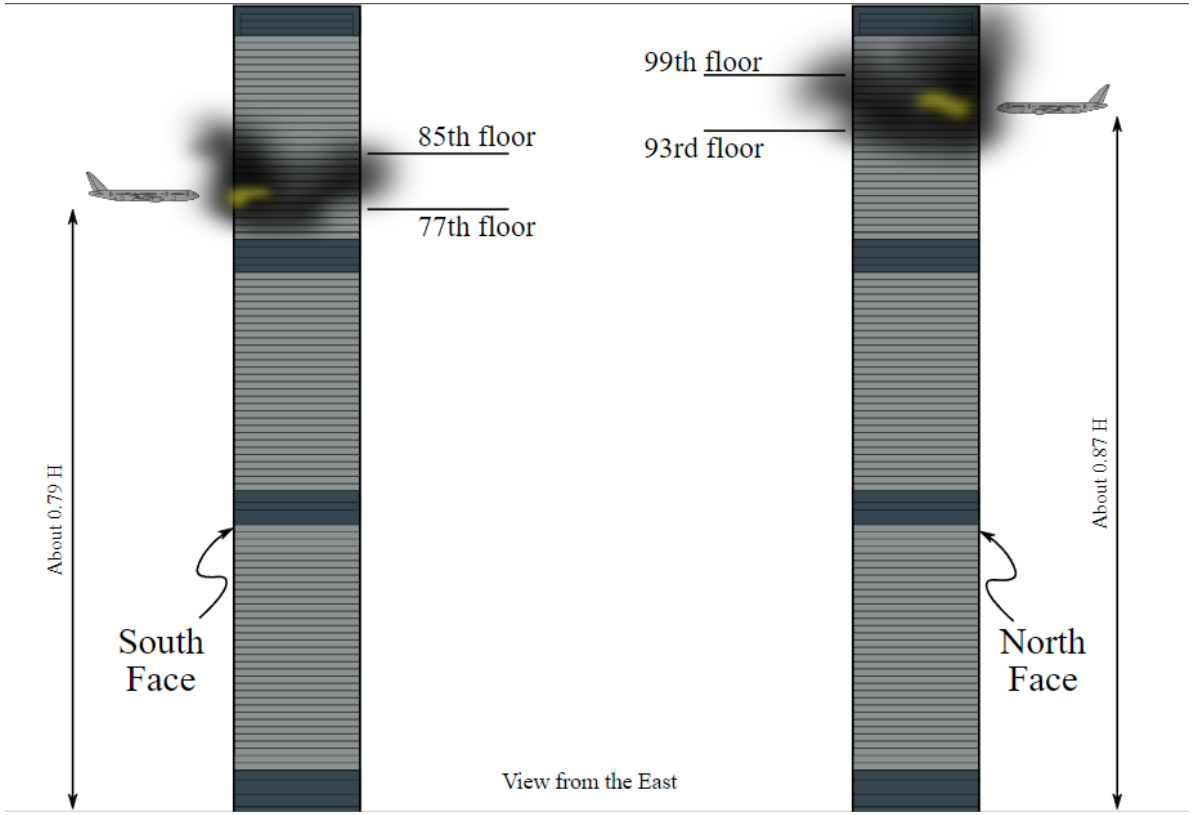
- Storeys are provided with two (or more) firefighting shafts (lifts), a fire engineering case can be made to justify utilising one of the firefighters lift as evacuation lift for all occupants (not only disabled). This is a fire engineered solution and needs coordination with Fire Safety Management of the building and presence of trained Fire Marshalls. **Where this is planned, the relevant local fire authority should be consulted before implementation.**

BRE Research by Prof David Charters

Background

In the Investigation into the World Trade Centre collapse:

- In the 16 minutes before the impact of the second aircraft, 27% of those who evacuated WTC2 used the elevators for part of their escape route.
- The flow rate from WTC2 during this 16 minutes was approximately twice that for WTC1 (where only stairs were available for evacuation).
- There is some evidence that stair flow rates were approximately 50% of those measured during evacuation drills.
- Potential difficulties during the evacuation of the WTC towers included; obstructions, mobility impairment, illness, fatigue, counter-flow and footwear.
- Approximately 1,000 surviving occupants of WTC had a limitation that impacted their ability to evacuate, including recent surgery or injury, obesity, heart condition, asthma, advanced age and pregnancy.
- The most frequently reported disabilities were recent injuries and chronic illnesses.



BRE Research

Current practice

- Lifts and escalators main form of normal access/egress in many non-domestic buildings (CIBSE Guide D)
- High rise buildings/basements:
  - Evacuation for people whose mobility is impaired
  - Fire Service Access
- LU Underground stations: escalators and lifts
- Hospitals: escape bed lifts eg Chelsea and Westminster
- Air Traffic Control towers (Klote)
- Specific buildings:
  - HSBC Canary Wharf (non-fire)
  - BT tower, London
  - Stratosphere, Las Vegas
  - Petronas towers, Kuala Lumpur

BRE Research

Research findings (examples)

- World Trade Centre (Averill):
  - 27% of WTC 2 used elevators
  - WTC 2 evacuation flow rate: ~2 x WTC1
- '…not possible to conclude that…elevators played a significant positive role…(WTC 2)' (Galea)
- Hong Kong super high rise evacuation analysis (Wong):
  - 36% reduction in time to evacuate
  - 58% reduction in time to evacuate first 25%
- Lifts reduce risk beneficial above 8 storeys (Nakahama)
- Lift capacity, not arrangement, most important (Ebihara)

BRE Research

Concerns

- Change to existing evacuation doctrine/culture
- Long waiting times in lift lobbies
- Exposure to fire and smoke:
  - Lift opening onto fire floor
  - Failure of refuge protection
  - Smoke ingress into lift shaft (stack/piston effect)
- Overloading of lift preventing door closure/descent
- Power failure to lift
  - Unavailability
  - Trapped between floors
- Lift pressurisation – door jamming/arrangement
- Egress complexity (Donegan et al)
- Learned irrelevance for stairs (McLintock et al)
- Feasibility of upgrade/inconsistency between buildings

BRE Research

Summary of background research

- 40% of WTC 2 survivors evacuated when elevators used
- Evacuation analysis shows significant reductions in time to evacuate building occupants
- Some buildings already use lifts as part of their evacuation strategy.
- Concerns identified including:
  - Human Factors
  - Reliability, availability and protection of lifts/lobbies
  - Feasibility of retro-fit
  - Inconsistency between buildings
- Evacuation using lifts and/or escalators is feasible, but involves significant organisational and engineering challenges

Thank you!