Regulatory guidance for timber buildings in the UK and results from full-scale tests

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TF 2000
Project Partners and Objectives

PARTNERS

• United Kingdom Government
• BRE
• TRADA Technology
• UK Timber Industry

OBJECTIVES

• Data to assist in harmonisation of UK building codes
• Demonstrate the fire performance of timber frame construction
• Investigate the relevance of standard fire resistance tests compared to real fire exposure
Building Regulations before TF 2000

- Different Regulations for different parts of the UK
  - England and Wales – Approved Document B
  - Northern Ireland- Technical Booklet E
  - Scotland- Technical Standard D

- Requirements for timber frame generally more onerous in Scottish regulations

- Importance of England and Wales as future market for timber frame

- Great need for harmonisation of regulations
Main fire related barriers to using timber in building regulations before TF 2000

- Scottish regulations:
  - separating floor-greater than 11m to be of non-combustible construction, precluding timber frame above 5 storeys
  - stair shaft and protected lobbies to be of non-combustible construction
  - stairs to be non-combustible

- Rest of UK - stairs to be non-combustible where single means of escape for flats of four or more levels
Compartment Fire Test

- Fire load provided by timber cribs
- Floor loading equal to one third of the design imposed load
- Investigate
  - compartmentation,
  - integrity of means of escape,
  - structural stability and
  - tenability criteria
- Termination criteria based on period of exposure of timber elements
Compartment fire test - project objectives

- To obtain valuable data on the performance of a complete building subject to a real fire
- To provide a quantitative appraisal of the performance of forms of construction tested to the standard fire resistance test
- To demonstrate that a medium-rise building of timber frame construction can meet the functional requirements of the UK Building Regulations
Instrumentation

- Fire atmosphere temperature
- Heat flux
- Oxygen concentration
- Charring depths
- Differential pressure
- Fire/Smoke detector response times
- Carbon Monoxide concentration
- Smoke density
- Video record
Plan view of test compartment

Fire flat
Fully developed fire
Compartment fire test - air temperatures

Oxygen concentration and atmosphere temperature at 200mm below ceiling in living area of fire flat

- Fire Brigade break kitchen window
- First brigade water into flat
- Engineer cleaning O2 system
- Brigade water into living room

Graph showing oxygen concentration (%) and temperature (deg C) over time (mins).
Post-test fire damage
Time equivalence

Average ceiling void temperature - measured on back of plasterboard

- Temperature (deg C)
- Time (mins)

- TF2000 test
- Furnace
Conclusions from compartment test

- Common areas remained tenable for means of escape
- Importance of workmanship in terms of fire performance
- Exposure equivalent to 66 minutes exposure in a BS476: Part 20-22 fire resistance test
- Integrity between compartments maintained
- Load bearing capacity maintained
Impact of TF 2000 on regulations

- Harmonisation of UK regulations

- Changes to Scottish technical standards- 6th Amendment March/April 2002

- Removal of non-combustibility requirement for separating floors between 11m and 18m
Stair test: Functional fire safety objectives

• Access for fire brigade
  – remove persons immediately at risk
  – access to fight fire

• Evacuation of other occupants after the fire event
Fire performance requirements for stair

If fire is in the stair,
the staircase

- **must retain** its load bearing capacity
- **must not contribute** significantly to the fire development
Generic Features

- Scissors type stair geometry
- Whitewood timber
- Thermosetting type glue (Cascamite)
- No stair coverings
- Pressure impregnated treatment (Hickson Dricon)
  - Notional Class 1 Reaction- to-Fire performance
Trial tests
Impact on stair
Underside of stair
Stair performance
Conclusions from stair fire test

- The test has demonstrated the ability of an appropriately treated timber stair to meet the functional fire safety objectives for the UK
- Benchmarking tests required
- Stair Coverings not currently included
Other TF 2000 Research

Reinstatement of fire damaged timber frame structures