Is it time to review Fire Engineering Research?

Eur Ing Dr Jim Marsden CEng, FIFireE, MEI
Greater Manchester Fire and Rescue Service

Fire Engineering Section
Manchester Central

Introduction

- Fire engineering in the past
- Fire safety engineering within buildings in the past
- Fire engineering in the present
- Operational engineering in the present
- Fire Engineering the Future
- Changes in Building design
- Modern Methods of Construction
- Timber frames some challenges
- The future of fire research
- Conclusions

Fire Engineering in the Past

- Very little guidance and support in both building design (fire engineering) and fire fighting techniques (operational engineering)
- Mainly based upon experience and passed from fire fighter to fire fighter.
- The practical elements of fire engineering and fire fighting were well understood, but the theory was not.

Fire Engineering in the Past

- Based upon the limits of the Equipment used by the Fire and Rescue Service to undertake rescues from the outside of the building for example.
  - More than one staircase over 11mtrs (the height of a standard fire service ladder.
  - Fire fighting shafts with fire fighting lift over 18mtrs (the height of a wheeled escape and first floor ladder)
  - Increased fire resistance over 30mtrs (the height of an aerial appliance)
- Fire dynamics and fire development poorly understood

Fire Engineering in the Present

- Greater advances in fire fighter protection and a greater understanding of fire behaviour within the built environment.
- Advances in fire engineering design mean that conditions within the building/enclosure can be accurately predicted and assessed.
- Greater use of zone and field models further our understanding of smoke, temperature and visibility within the building
- Advances in ‘gas cooling’ techniques and fire fighting equipment has benefited from fire science

Operational Engineering in the Present

- High level of fire fighter protection (PPE)
- The use of lightweight materials (Carbon Fibre) for breathing apparatus cylinders.
- Use of thermal imaging for temperature prediction.
- Use of lightweight alloys for fire fighting equipment.
- A greater understanding of fire dynamics, flash over and back draft

However

- There is still a greater reliance of using prescriptive fire fighter safety in complex buildings.
- Codes are generally some years behind building innovation.
- Is fire research keeping pace with the changing environment?
- Fire research must keep up with developments

However

- Are current fire testing standards reflective of modern construction
- Assumption that fires will ventilate early
- Assumptions in the stability of the building structural components such as supporting pillars, floors and walls
- CFD simulations will usually allow for the failure of the window at 200C to allow fire to develop.

Fire Engineering the Future

Changes in Building Design

Is Research keeping Pace with the Built Environment?

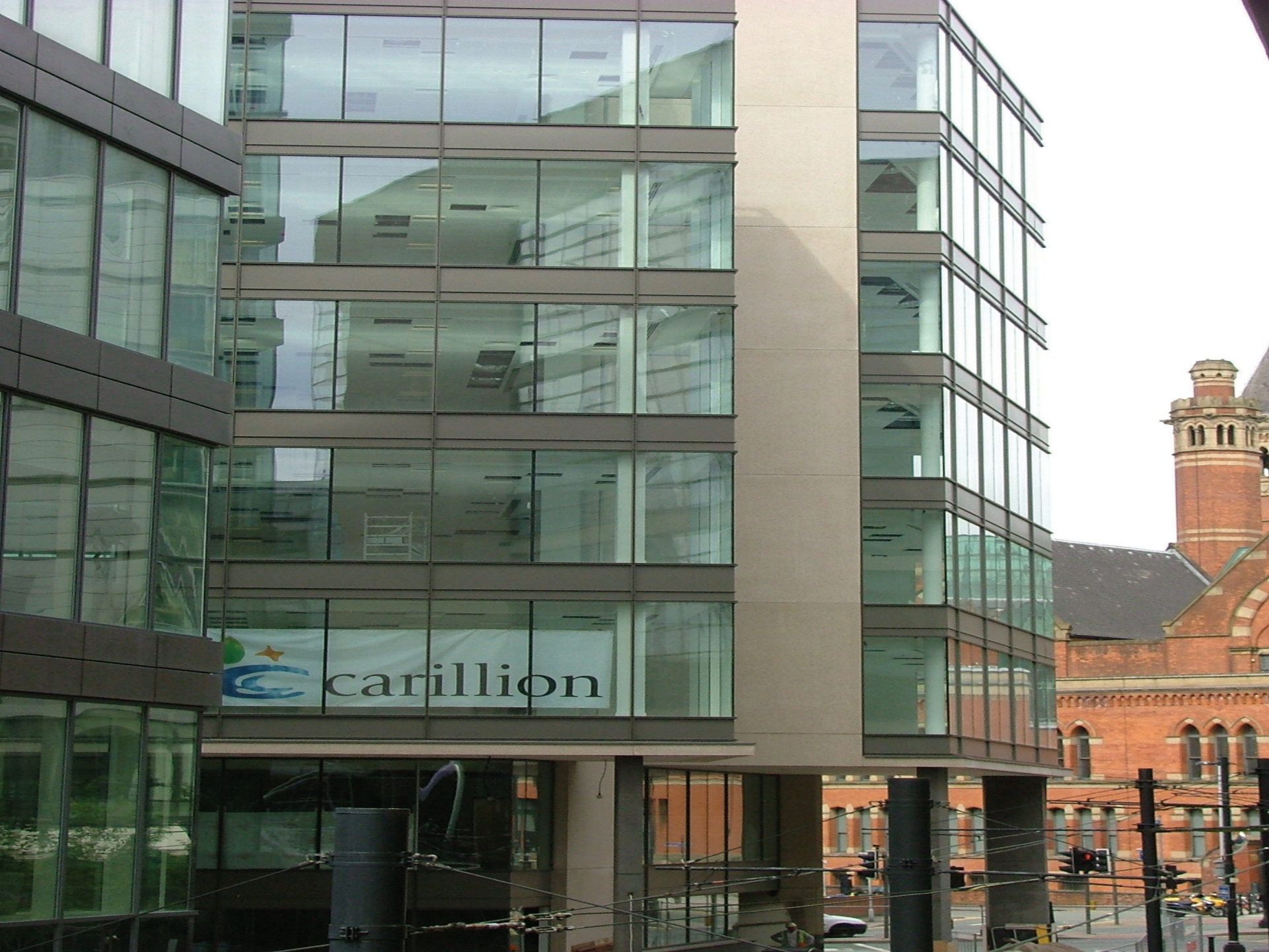
- Buildings are getting taller and more complex
- Greater use of sustainable and recycled materials such as plastic and rubber
- The development of green roofs
- Buildings have better insulation properties
- The greater effects of ventilation failure and fire development

Modern Methods of Construction

- Differs from that of traditional build.
- In timber frame the actual load bearing elements of structure are involved.
- Cavities are more susceptible to fire spread
- Load bearing elements of structural members easily affected by fire
- Greater strength and insulation within the facade design

Lightweight Steel Frame

Engineered Floor Joists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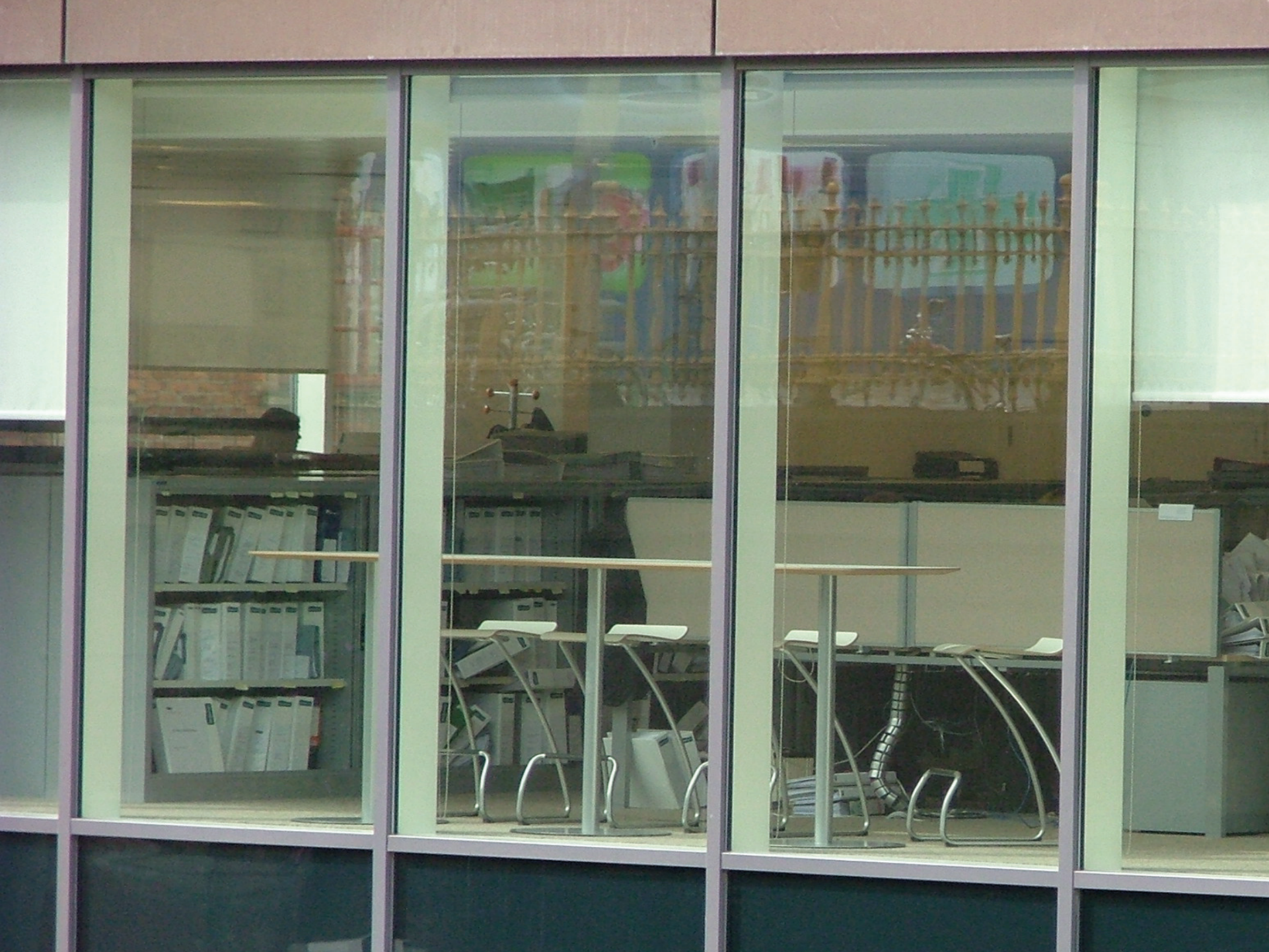


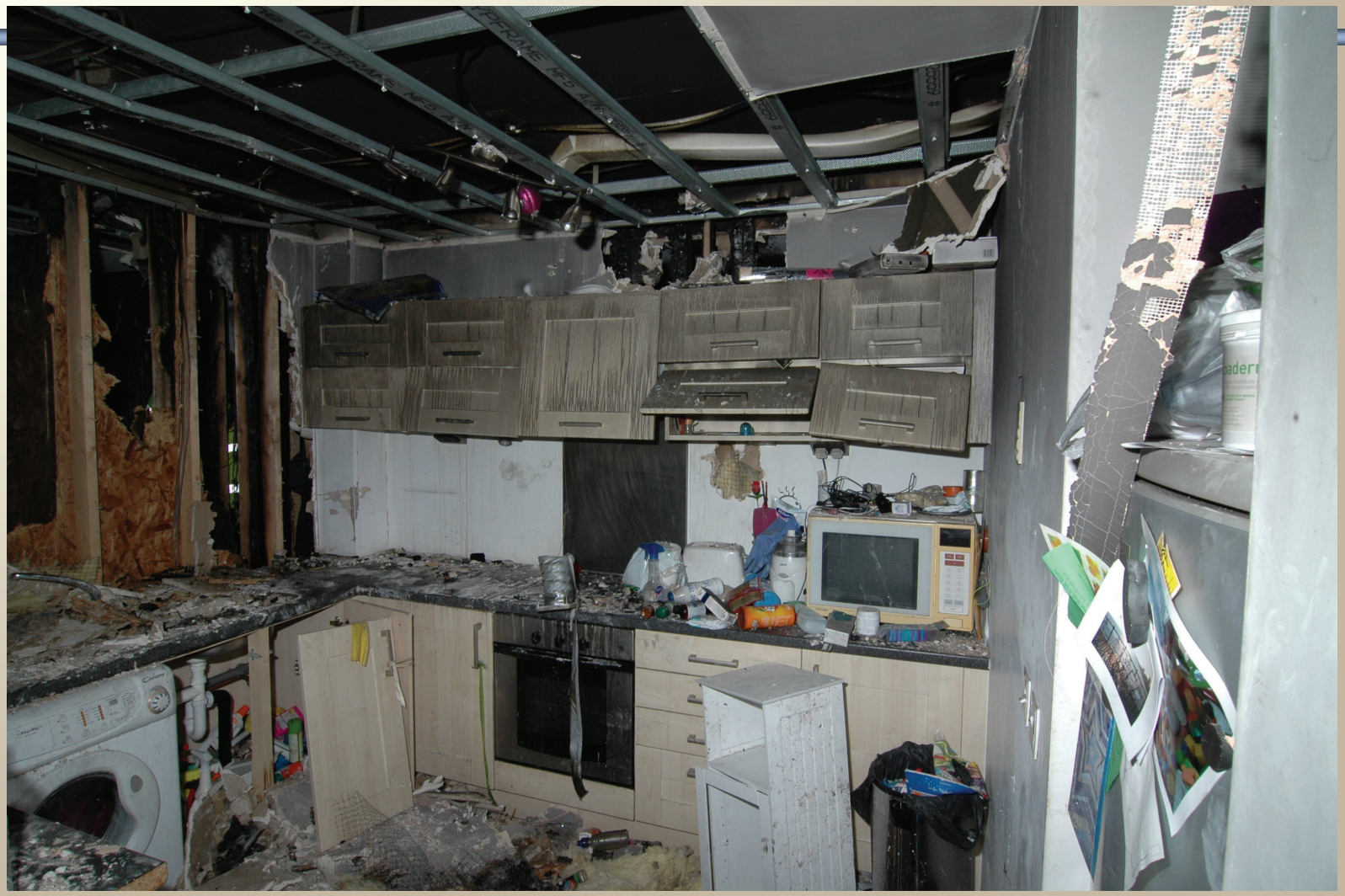
Timber Frame Fires

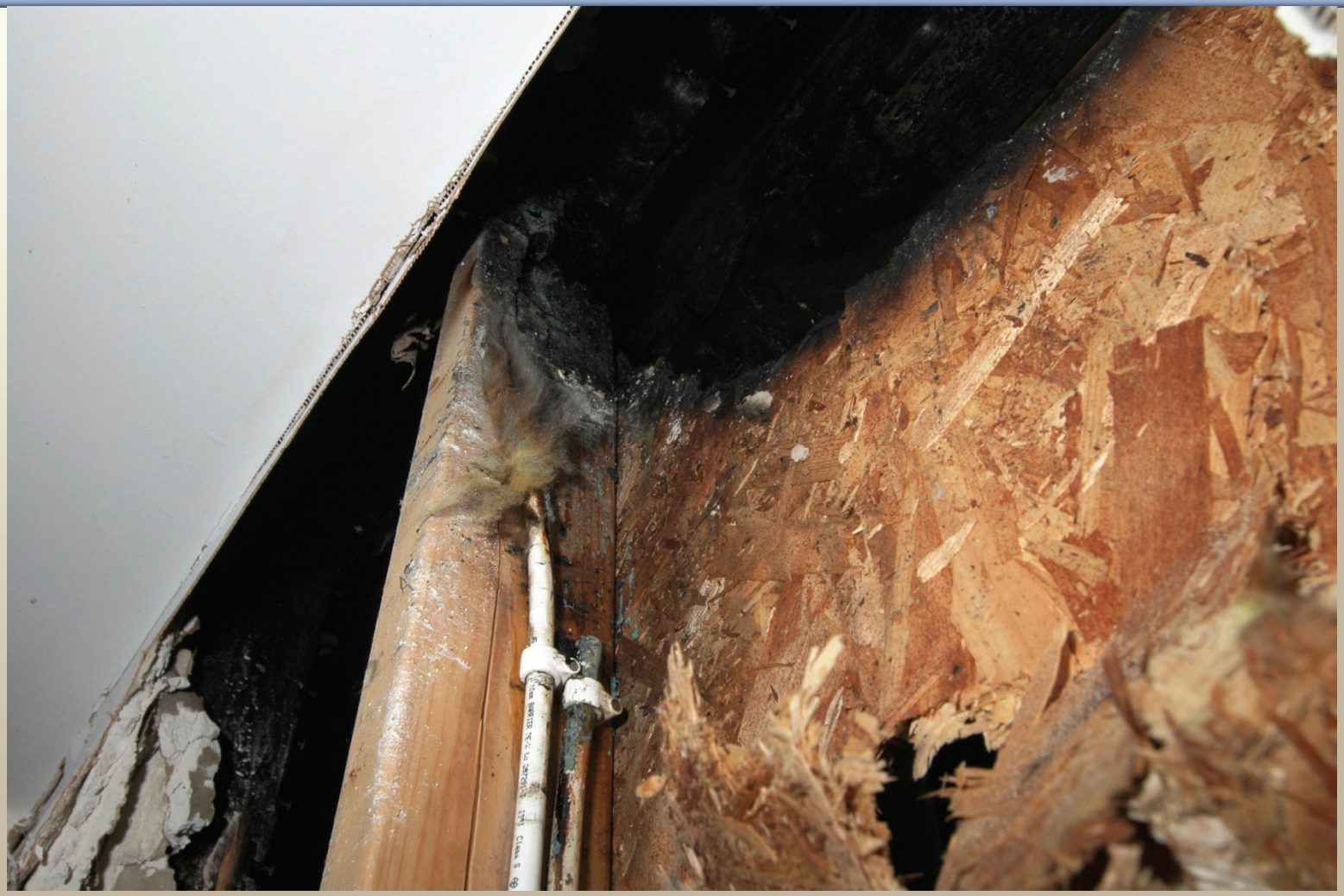
- Currently built up to 18mtrs tall
- Modular construction
- Very difficult to identify
- Fire fighting very difficult
- Combustible cavities
- No evacuation required in the case of residential

Timber Frame

- Fire started at the rear of a consumer unit
- Fire stopping was inadequate fire spread into combustible cavity
- Cavity barriers were installed as per code 30/15
- All 57 apartments had to be evacuated
- Anticipated that reconstruction will take 18 months at a cost of 1 million.


FIRE





The Future of Fire Research

- Due to improvements in sealing the air tightness of buildings greater use of the ventilation systems for fire fighting will have to be used.
- Greater reliance upon the skill of the fire fighter/incident commander to control smoke and heat movement within corridors and staircases
- The chances of back draft could greatly increase as the building envelope resists failure.
- The use of fire engineered solutions may mean that each building is bespoke and will require a different fire fighting approach.

The Future of Fire Research

- Greater research in respect to temperature and tenability after the escape phase.
- The effects of the non failure of the façade and subsequent fire behaviour.
- The potential of opening compartments in which there has been little or no ventilation of the outside envelope of the building.
- Storage/transmission of critical fire fighting information within fire engineered buildings.
- Fire development in modern methods of construction may require the application of different fire fighting extinguishing methods

Conclusions

- Current fire engineering approaches require review to take into account of the changing built environment.
- Façade designs are less liable to failure resulting in smaller ventilation openings.
- The likelihood of back draft will increase
- Buildings constructed of sustainable materials may require special consideration.
- Current code assumptions do not reflect current building design.
- Current fire tests require revision

Thank you

Any Questions