Towns Fund Delivery Partner

TOP 10 FIRE SAFETY ISSUES IN BUILDING DESIGN AND SPECIFICATION

This guide provides an overview of the top 10 fire safety issues to consider and address during design and specification stages of building projects.

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Introduction

In the wake of several high profile fire events around the world, fire safety has become a more important aspect of building design than ever.

It is critical that the industry implements lessons learnt from these incidences and experience on previous projects to improve building safety in the future.

This guidance will provide an opportunity for Towns to learn from the top 10 issues experienced by our fire experts during design and specification stages of building projects.

We hope these slides enable discussion, help you avoid such issues in investments proposed as part of the Towns Fund work, and encourage safe and resilient development in your town.

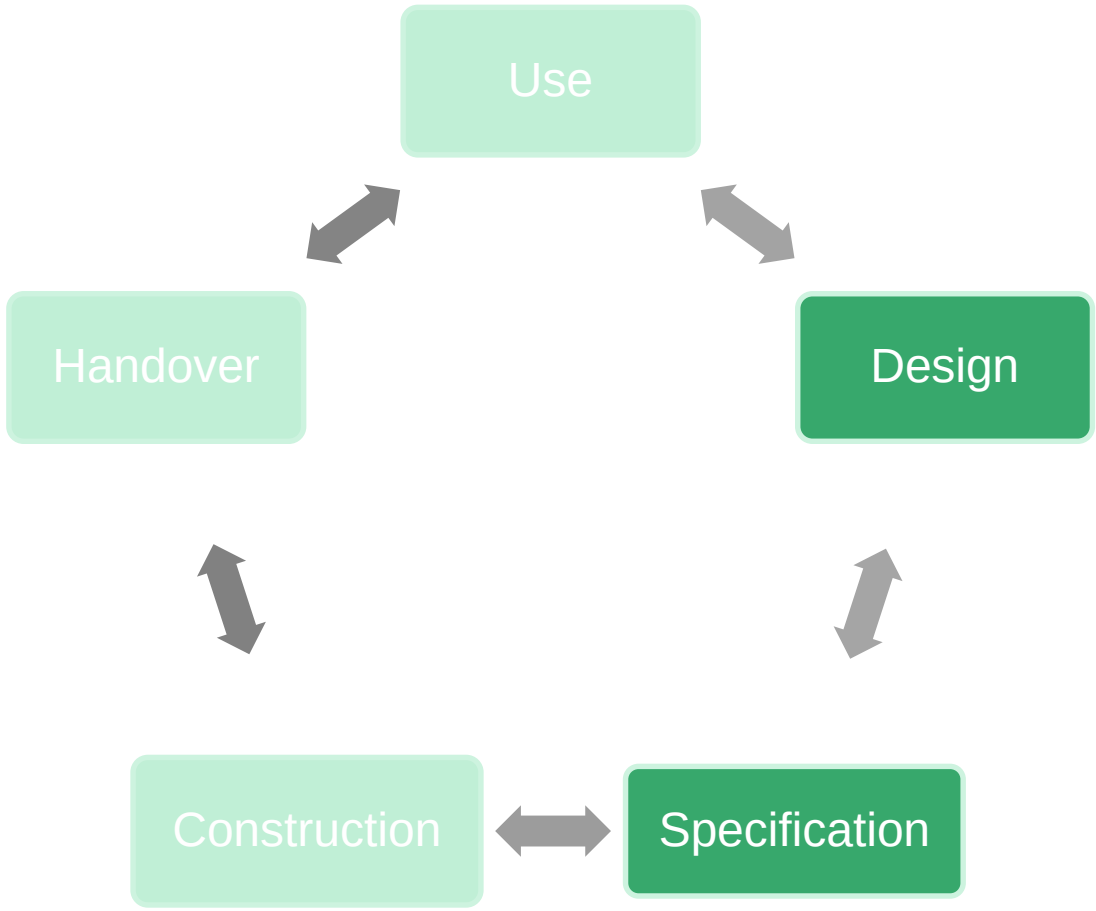

Sourced online at Wikipedia, accessed 10/08/2020


Sourced online at Wikipedia, accessed 10/08/2020.


Sourced online at manchesterfire.gov.uk, accessed 10/08/2020

Purpose of this guidance

The purpose of this guidance is to share TFDP's top 10 concerns in relation to fire safety provisions in buildings at the design and specification stage of the full asset cycle.



1. Performance requirements of products and materials are not understood

Understanding Material Performance in Fire

Combustibility - Reaction to fire classifications;

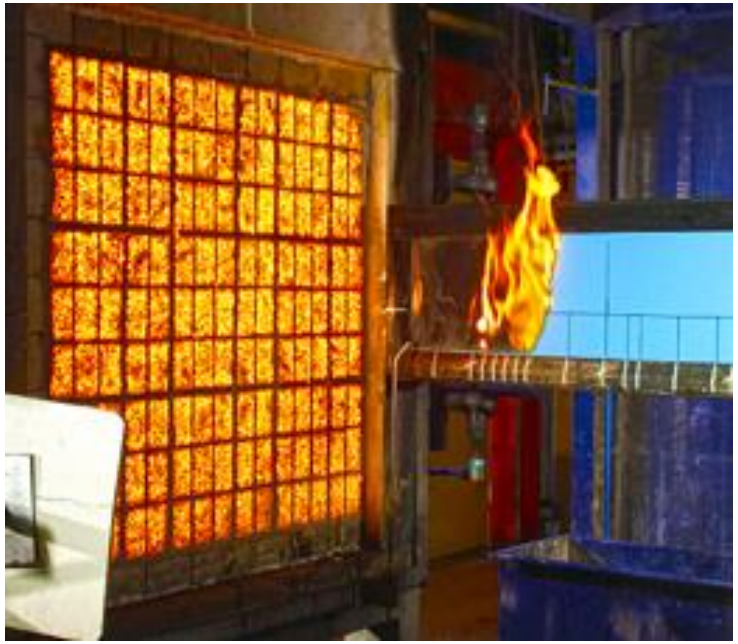
- A1, A2, B, C, D, E, F

Surface spread of flame;

- Class 0, Class 1, Class 2, Class 3

England for example still allows the National way of classifying combustibility in parallel to the European way of classifying this.

This leads to confusion, and mistakes in product specification and selection.



Class 0 → Limited Combustibility ✗

Class 0 ← Limited Combustibility ✓

1. Performance requirements of products and materials are not understood

Example of issue 1

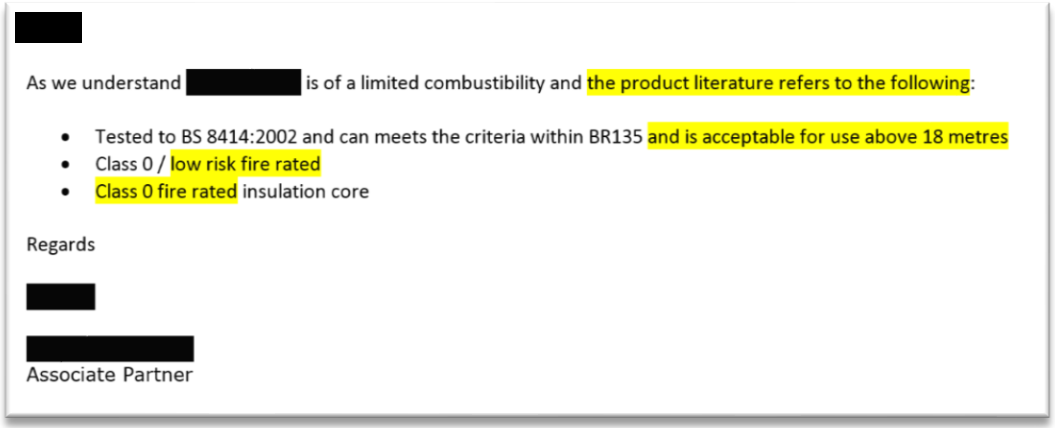
Context:

A residential project which exceeds 18m in height and is associated with sleeping risk. A performance requirement was outlined for the façade insulation to be of limited combustibility, prior to the recent change to the Regulations regarding externa wall construction.

Issue:

Following the performance requirement specification, the architect selected a product based on information provided by the supplier, believing the product complied with the fire requirements.
Although the insulation product was classified as ‘acceptable’ for buildings over 18m in height, product specification also stated:

- **The insulation product was stated as achieving Class 0, despite Class 0 not considered a combustibility test**
- **The insulation product was stated as being ‘low risk fire rated’.** This arbitrary ranking has no basis in UK testing or certification.



[redacted]

As we understand [redacted] is of a limited combustibility and the product literature refers to the following:

- Tested to BS 8414:2002 and can meets the criteria within BR135 and is acceptable for use above 18 metres
- Class 0 / low risk fire rated
- Class 0 fire rated insulation core

Regards

[redacted]

[redacted]
Associate Partner

2. Insufficient Knowledge of New Methods of Construction

Modern construction methods often don't align with the assumptions inhered to the solutions provided in ADB

This lack of detailed consideration regarding the Specific risks is a significant concern. The construction industry continues to innovate and change construction methodology, due to, for example shortage of *skilled labour, increased output requirement (especially in residential), controls on waste, energy performance and financial pressures*. This is resulting in new methods of construction being introduced to the market.

There is a concern that insufficient research is undertaken, leading to a lack of knowledge regarding how these systems perform in fire, and what inherent weaknesses may exist.

For example **Mass Timber** and **Volumetric Modular Construction** involve issues such as:

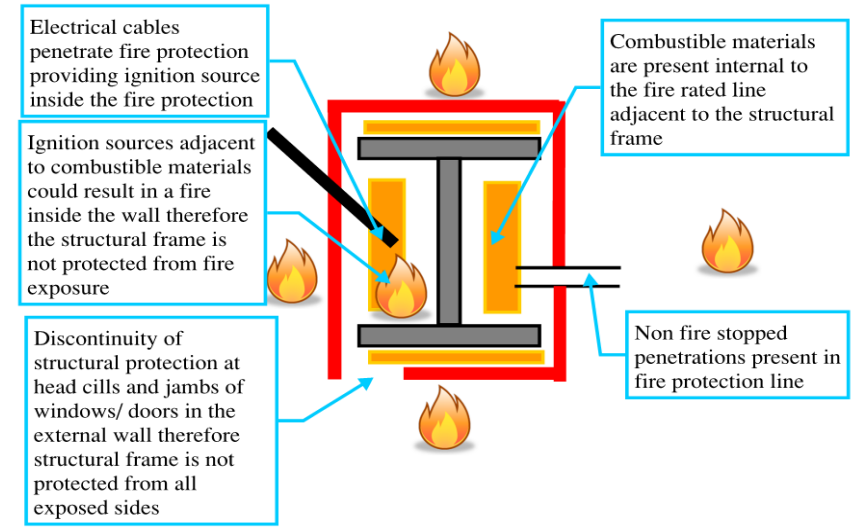
- Details often not sufficiently tested;
- Lack of appreciation of the risks inherent in using certain methods of protection;
- High quality assurance is required on site during construction; and
- More onerous fire safety management requirements in use.

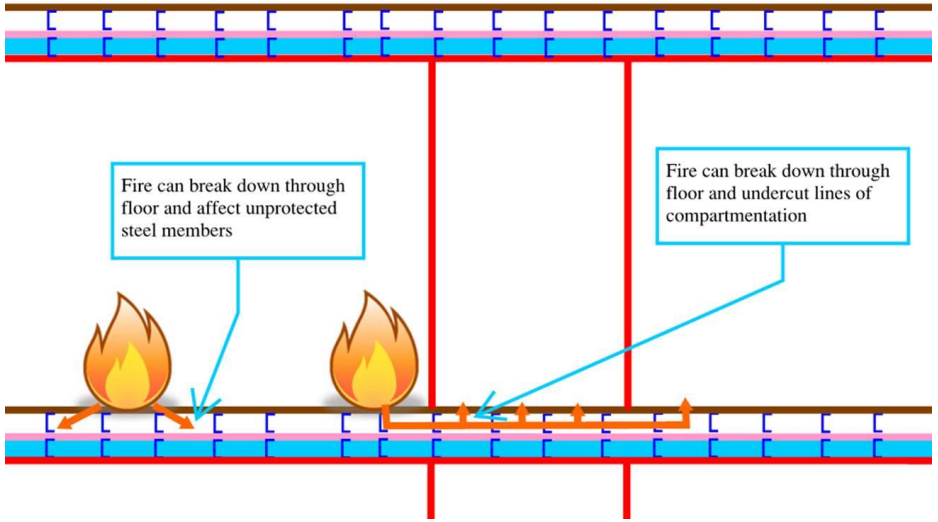
2. Insufficient Knowledge of New Methods of Construction

Volumetric Modular Construction

Concerns that we have found often are addressed by the design include:

- **Fire protection not applied directly to the face of structural elements** – resulting in combustible materials on the wrong side of the applied fire protection;
- **No monolithic floor slab** – complexity regarding where fire stopping, and cavity barriers should be located to present a continuous fire resisting line of construction. May lead to continuous voids around modules and floors;
- **Higher reliance placed on board protection,** requiring higher performance, hence greater consequence should that protection fail in fire - insufficient consideration of 'layers of safety' principles;
- **Exponentially more fire stopping needed** - as very single penetration in the internal linings is a potential route for extensive fire spread compared to traditional builds;
- **Voids that exist between modules** are difficult to fire stop, often leading to continuous voids around all modules within building;
- **More onerous ongoing fire safety management** – fire stopping are often installed in factories during early stage of construction and it is very difficult to install fire stopping once modules placed together;
- **Burn down** not considered but impact of loss is significant – ADB does not consider this risk.





3. System Interactions Not Clear

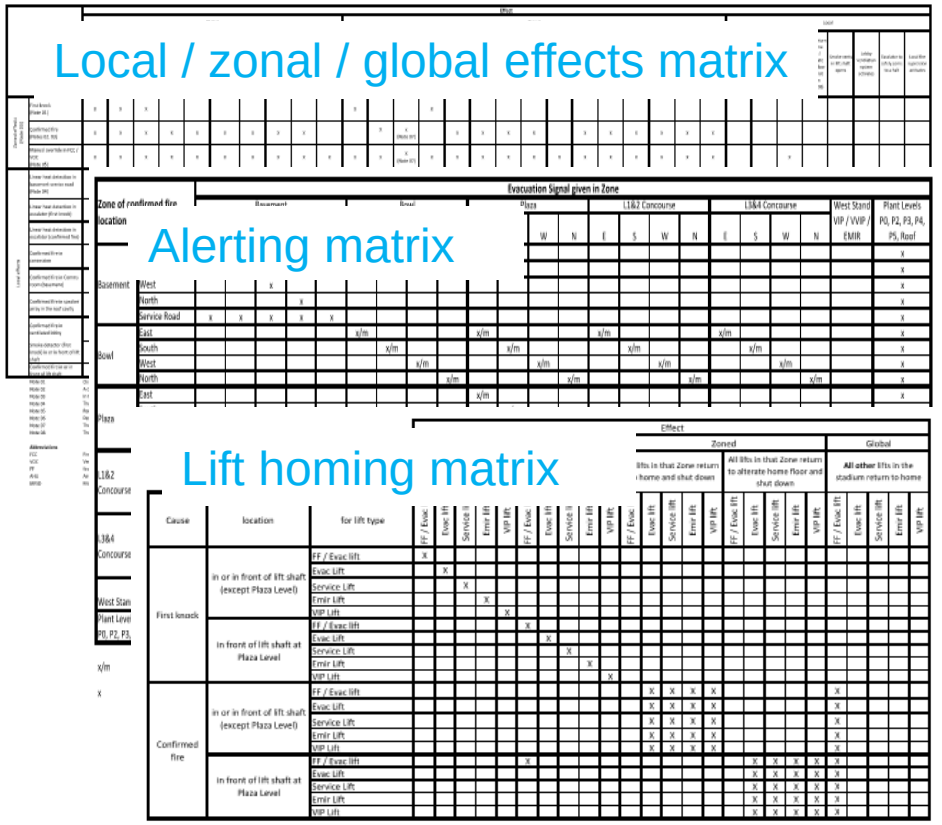
Cause and Effect setting out interaction of active and passive systems interactions not written down properly

Complex buildings require many different parts to interact to ensure the entire system work. In fire safety, there are often a considerable number of systems that need to work together properly. For example:

- Fire alarm and detection system;
- Access control system;
- Lifts (to ground them to a safe floor);
- Fire and smoke dampers - to close potential routes for fire and smoke spread via ventilation systems;
- Smoke control system - to aid firefighting and clear smoke;
- Two-way communication systems in refuges; and
- Local suppression systems that are to discharge.

These system interactions need to be recorded and documented in the design stage, so they are then carried through the specification, construction and commissioning stages.

Otherwise, it is very difficult for a building owner to operate their building properly if they do not know what the system interactions are meant to be in the event of a fire. For example, how many floors are meant to evacuate, and in which order.



4. Reliance on Building Management

Reliance on specific building management controls to support fire safety solutions in increasingly prevalent

Do these meet the requirement of the Building Regulations?

Approved Document B, Clause 0.6 – *'A design that realises on an unrealistic or unsuitable management regime cannot be considered to have meet the requirements of the Building Regulations.'*

How often does the design team have the opportunity to discuss with the building management team the requirements the strategy being developed places on them?

This varies significantly between projects. Items that need to be considered include:

- What capacity will they have to respond to an incident?
- Will someone be available 24hrs a day over the lifetime of the building?
- What training is in place?
- Does the information provided in fire strategy actually mean something to the building management staff -what does *'fire load sterile*' mean?

We would recommend early dialogue between the building management team (or supplier) during the design phase such that they can provide input.

5. Lack of Clarity in Guidance

Approved Document B – Fire Safety of External Walls

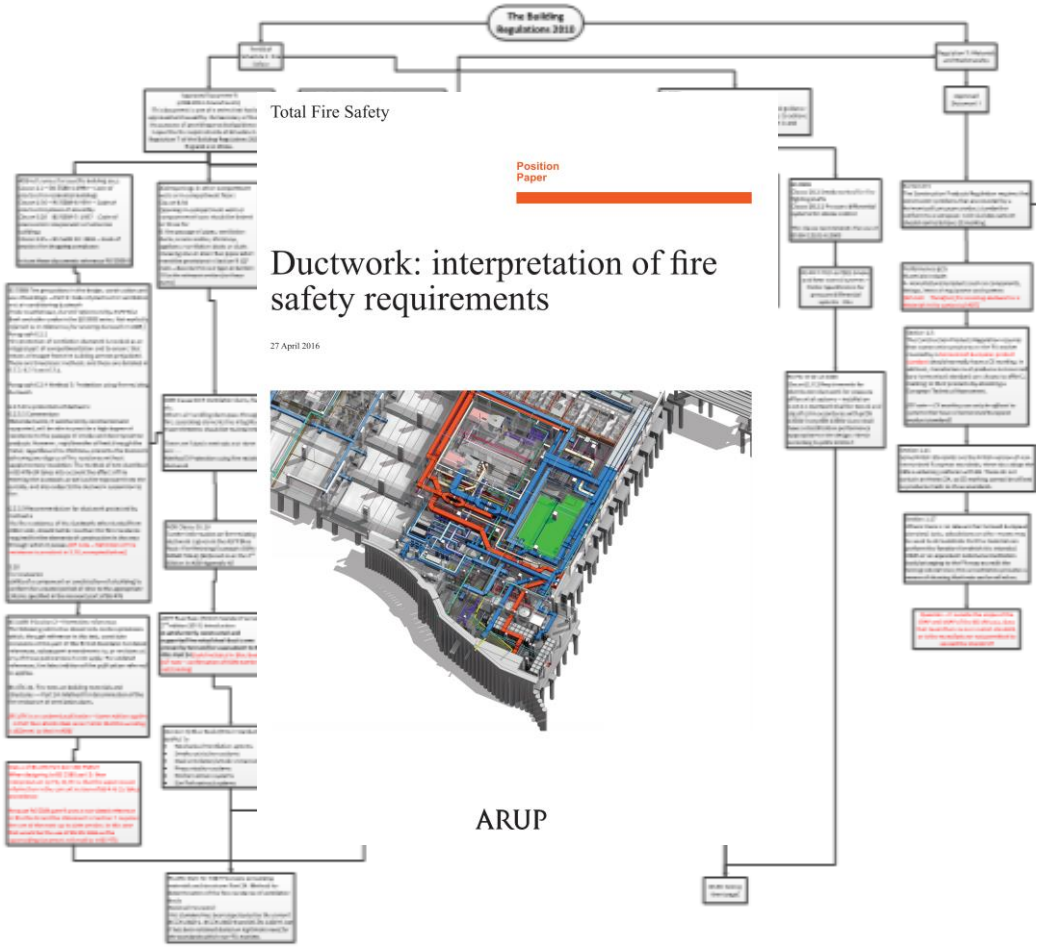
- Why use different definitions of ‘height’?
  - Height of building → External surfaces;
  - Height of top storey → Insulation materials.
- Underlying assumptions and limitations not clear;
  - e.g. BS8414 test and BR 135 acceptance criteria:
    - Fire in test will be extinguished after 30 minutes;
    - ‘Pass’ relates to 600 degrees celsius threshold not being exceeded within first 15 minutes of the test;
    - Does this assume the fire service are there after 15 minutes to fight the fire? Is that reasonable?
- Lack of clear guidance for buildings under 18m;
  - No guidance available for balconies;
  - Implications of phased evacuation, high degree of internal; compartmentation on required performance of external walls.
- No suitable test for fire performance of loadbearing external walls.

6. Ducts & Dampers – Myriad of Test Standards

The number of test standards available leads to confusion.
Product classification is complex.

Using ductwork as an example

- Ductwork can be tested to a withdrawn over 30-year-old British Standard, or the more recent BS EN series of standards, to comply with Part B of the Building Regulations
- The flow chart follows what is stated in various fire safety guidance and associated standards
- The current BS EN standards (considered more complex standards) is recommended to be applied
- The classification of ductwork under the BS EN standards is more detailed



7. Penetrations and Fire Stopping

Fire strategies generally rely on fire compartmentation

Appropriate fire stopping to these compartment walls and floors is critical to maintaining the required level of safety. A concern to consider during the design and specification phase is twofold:

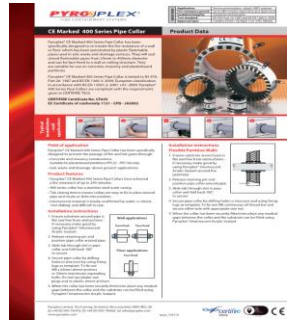
1. Insufficient considerations of fire stopping requirements during the design phase.

- Tasks such as production of installation drawings that are based on fire stopping limitations (space between services, number and diameter of ducts) provide the opportunity for appropriate setting out.

2. Products being used outside their tested arrangement.

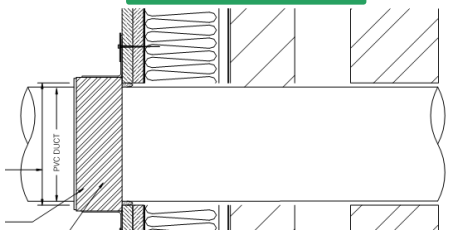
- The installation requirements and limitations of fire stopping products is, based on experience, severely limited. Fire stopping details tests undertaken in anything other than plasterboard or blockwork are rare.

Manufacturer Installation Instructions



Product specification

Installation drawings



8. Specification of Fire Resistance

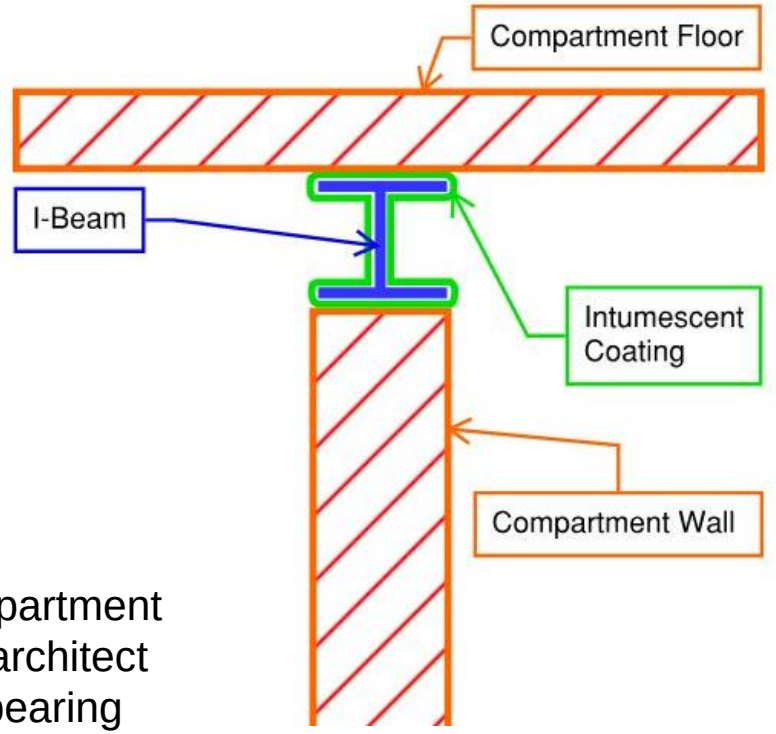
Poor specification of fire resistance leads to issues when interpreted by others in the team.

Specifications often include statements such that as: ***'The plantroom must achieve 60 minutes fire resistance…'***

Issues with this statement include:

- Are the performance requirements clear from this?
- Does the fire resistance need to enclose the whole room?
- What standard should it be tested to?
- Is the fire resistance for load bearing capacity, Integrity, Insulation?
- Does it apply for fire exposure from both sides or one side only?

Performance requirements are occasionally neglected to reduce costs.



The diagram on the right illustrates an example; the I-Beam sits in line with the compartment wall and should achieve **load bearing capacity**, **integrity** and **insulation**. Will the architect understand and detail this accordingly? Intumescent paint would maintain the load bearing capacity, integrity is likely to be achieved, however insulation criterion will definitely not be met.

9. ‘Received Wisdom’

Modifications to specifications without understanding consequences

Systems modifications are often made without understanding the consequences and impact on resilience and compliance of the safety provisions, such as:

- Smoke control systems
  - Insulated ductwork – removing insulation;
  - Motorized fire and smoke dampers – switched for fusible link dampers;
  - Cold smoke tested ductwork – instead of ducts tested with hot smoke; and
  - Make up air provisions – reduced in size, moved or removed.
- Fire curtains
  - Reduction of fire performance; and
  - Change in operation in cause and effect matrix.

People too often simply follow what they did on the last job

The fire strategy should be the single point of reference that sets out how each active fire safety system is to perform in the event of a fire.
This must then translated into a detailed cause and effect matrix.

10. No ‘Golden Thread’ of Fire Safety Information Management

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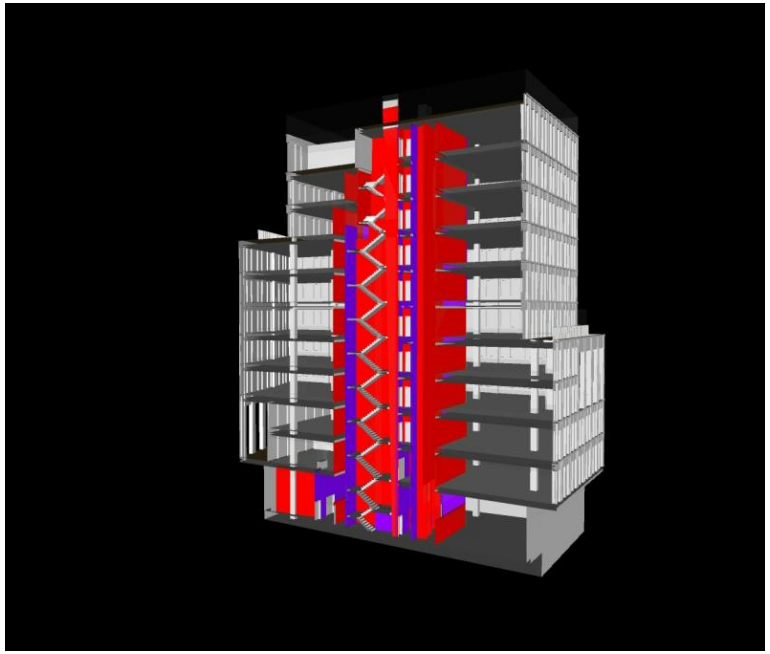
Information transfer and translation across the project cycle needs to be effective and clear, such as:

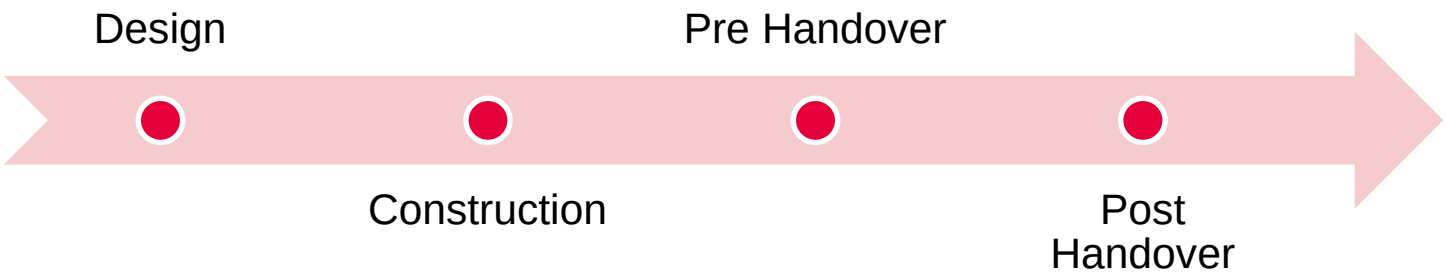
- Fire strategy is for building control approval – it is not very helpful for end users;
- Integration of fire properties into models;
- Enabling fire safety coordination to take place in 3D;
- Regulation 38 compliance requires clarity on:
  - who provides what ‘fire safety information’ for handover under Regulation 38 ‘fire safety information’ of the Building Regulations to the owner / operator;
  - making sure handover strategy has sufficient info to help with redesign / specification for future changes;
  - what format is it required in (pdf, dwg, etc);
  - who checks for accuracy; and
  - what should be provided is defined in statutory fire safety standards.



Top 10 Design and Specification Concerns

To summarise, the top 10 design and specification concerns are:

1. Performance requirements of products and materials are not understood
2. Insufficient Knowledge of New Methods of Construction
3. System interactions not clear
4. Reliance on building management
5. Lack of clarity in guidance
6. Ducts and dampers – myriad of test standards
7. Penetrations and fire stopping
8. Fire resistance specification
9. ‘Received wisdom’
10. No ‘golden thread’ of fire safety information



Top 10 Design and Specification Concerns

The key themes that we see relate to:

1. **Competence** - We need to focus on competence in all the professions involved – everyone needs to understand fire safety, the layers of safety, and the detailing of those layers.

2. **Quality** - There is quality and specifically quality assurance, at every single stage of the project - explicit milestones where full compliance is rigorously checked, before the next stage commences. An evidenced based approach.

3. **Materials** - There is the whole issue of material performance in fire – a major overhaul is needed here. From publishing fire test data, including testing to failure, limiting the reliance on extension beyond reasonable test boundaries, focusing on the system performance, the solution - not the product alone, demand an increased focus on testing, moving away from judgement. Working on the safe installation of materials and systems.

4. **Regulation** - How about we try to comply with the ones we have and focus on an entirely refreshed approach to investing in enforcement – deregulation does not appear to us to be working. Compliance and rigour is not cheap.

Basic elements of compliance

Design Compliance

The proposed fire safety measures comply with the regulatory requirements.

(e.g. REI 60 fire resisting wall, classified to BS EN 13501-2 for exposure from each side, is the right design proposal for the location in question)

Product Compliance

Adequate and proper materials shall be used in the building work.

(e.g. the selected plasterboard product does achieve REI 60 for exposure from each side evidenced by a classification report that suits the proposed application)

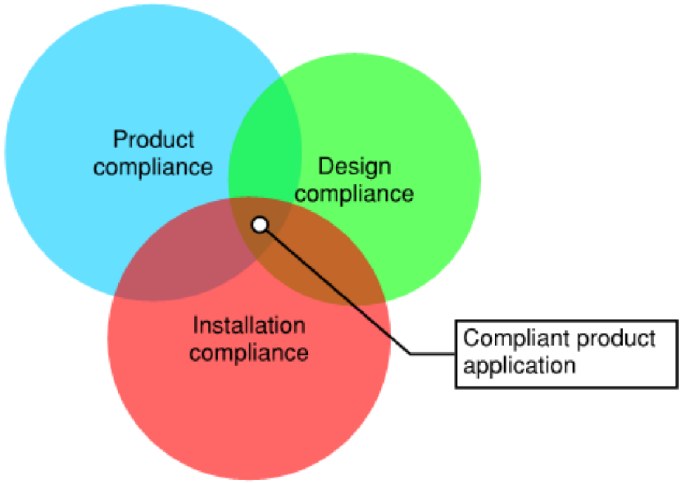
Installation Compliance

The adequate and proper materials are [..] fixed so as adequately to perform the function for which they are designed.

(e.g. the correct type, thickness, number of boards, studs, screws are used in the right arrangements to achieve REI60)

Compliant Outcome

These elements of compliance interact with one another and only when all three are met the building work shall satisfy the Building Regulations requirements.



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