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# Extending BIM to achieve Fire Safety Code Compliance

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Overview

- Personal Background
- Rationale and Mitigating Fire Risk
- Best practice guidance
- Existing workflow
- Importance of Fire Safety Code Compliance
- Vision
- BIM FireStop app (*work in progress*)

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Background
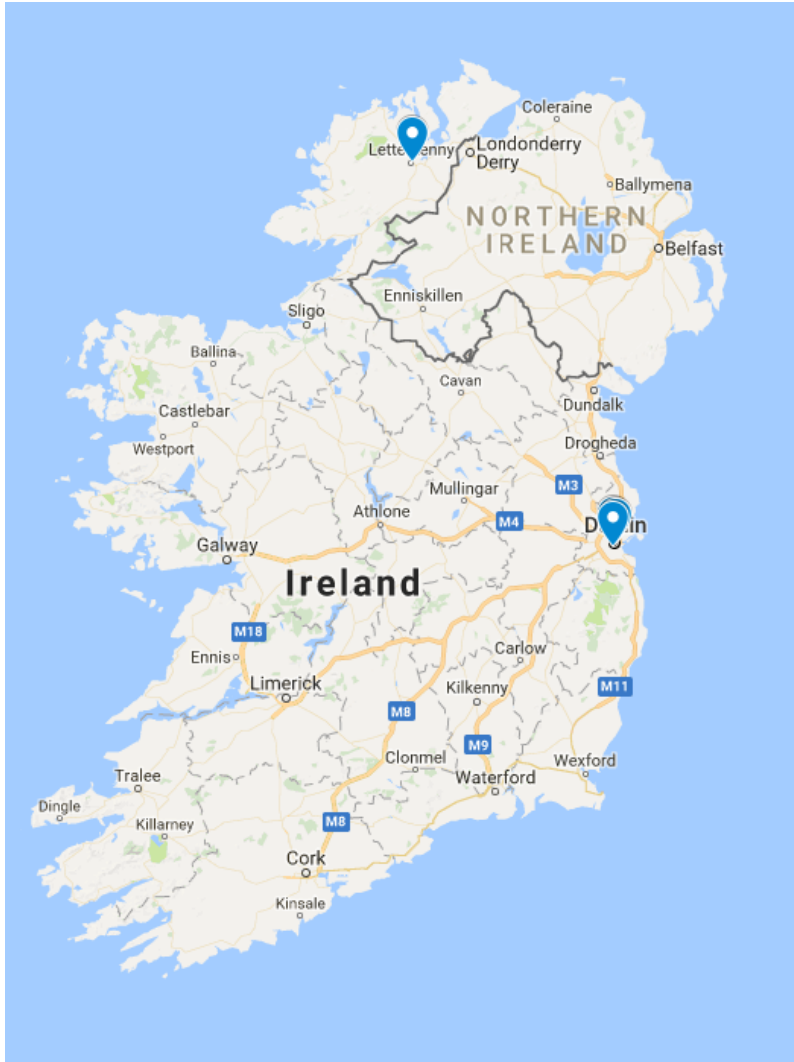
Department of Civil Engineering and Construction
- Civil Engineering
- Building Services Engineering
- Quantity Surveying
- Architectural Technology
- Fire Safety Engineering

Rationale

- Fire safety staff resourcing issue
- "Approximately 95% of fire stopping in North America is not installed correctly or has no documented classified system drawings to provide any evidence or proof of being code compliant." [1]
- Health & Safety is taken seriously, why not Building Code Compliance?
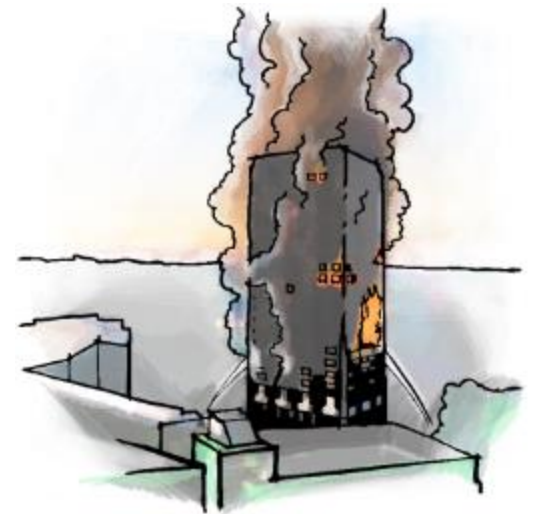

Torch Tower, Dubai [4]

Marco Pollo Apts, Honolulu [4]
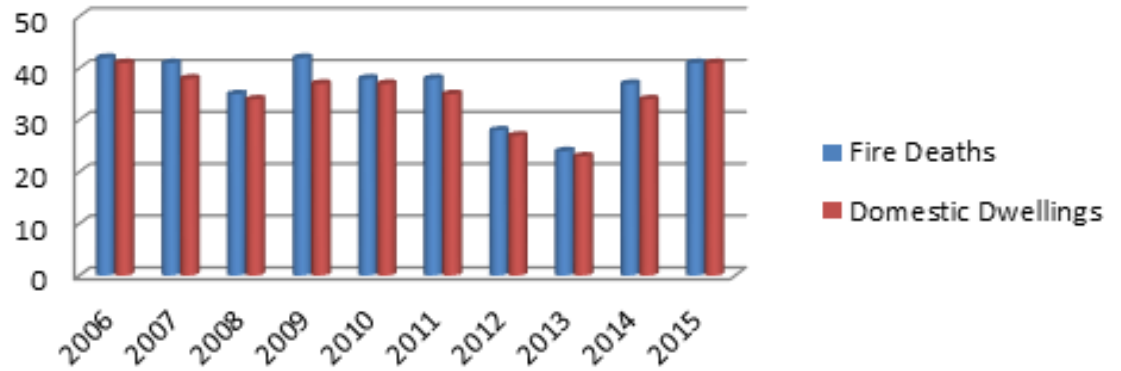

Grenfell Tower, London [4]

Millfield Manor [5]

Windsor Tower [6]

Fire Risk

- Perpetual risk
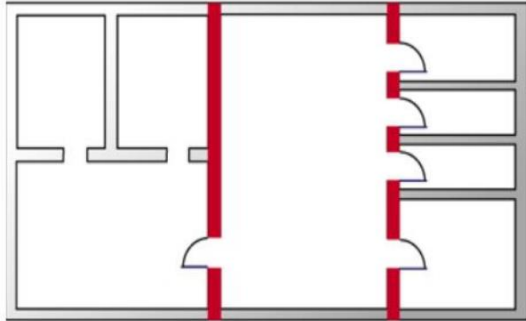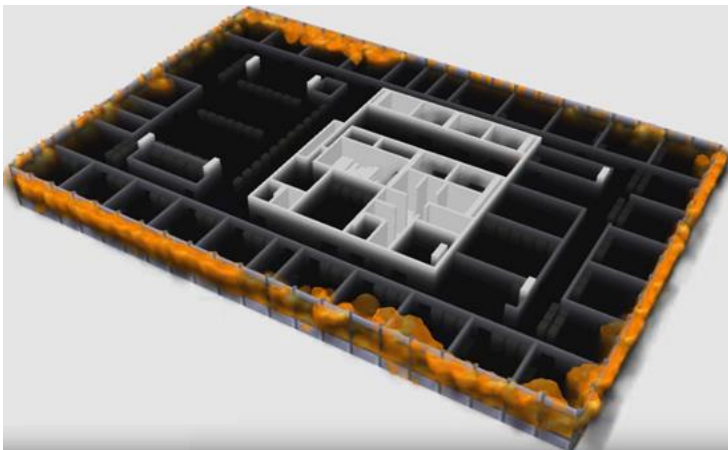- Ageing population
- Urbanisation
- Vertical cities

[2]

[3]

Mitigating Fire Risk
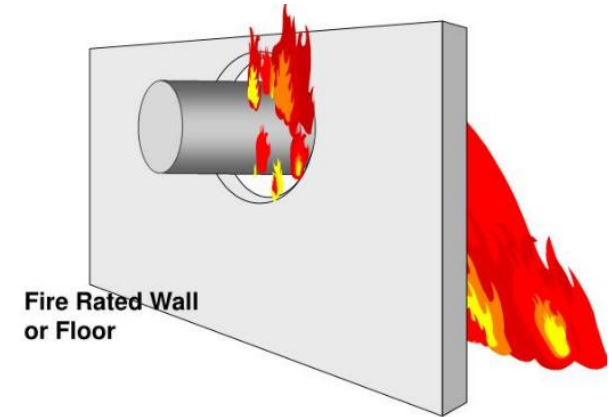
Windsor Tower, Madrid [6]
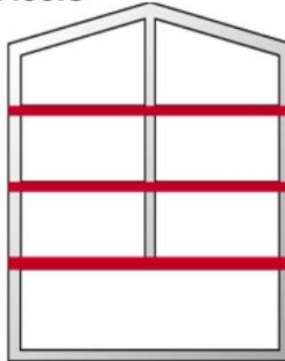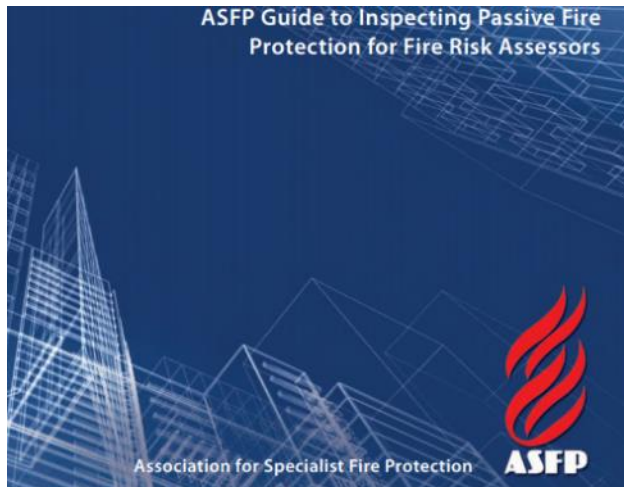
Guidance

ASFP On-site guide to installing fire-stopping

6. After installation

Dos

▶ Do ensure a complete record is made of all installations and referred to in the labelling. This will be needed for the certificate of completion and as part of the inspection process.
See ASFP TGD 17 ***Code of practice for the installation and inspection of fire-stopping***.

▶ Do apply labels as part of the certification process and for traceability for future remedial work.

▶ Do take photographs of the completed installation to assist verification of the work.

ASFP Guide to Inspecting Passive Fire Protection for Fire Risk Assessors

Association for Specialist Fire Protection

Annex G: Fire-stopping and penetration seals

Mechanical and electrical services, by necessity, breach fire-resisting construction on escape routes and compartment walls and floors will allow the passage of smoke and flame if not adequately fire-stopped.

There is a wide range of products that are designed for use as fire-stopping and penetration seals. These include products based upon mineral wool; high and low pressure intumescents, mortars, pillows filled with fire-resisting materials, plugs and blocks, elastomers, putties, foams and mastics.

Evaluation of the fire resistance of fire-stopping and penetration seals has traditionally been undertaken by using ad-hoc procedures based on BS 476: Part 22: 1987 as there was no dedicated British Standard for these. Increasingly, manufacturers are using the European standard EN 1366-3 for penetration seals and EN 1366-4 for linear gap seals. The European standards are more rigorous and contain a wealth of guidance on how to test these products.

The crucial issues for fire-stopping are poor installation and/or the breaching of fire-resisting construction on escape routes and fire compartmentation after installation and handover. Unlike e.g. a fire door where any defective remedial work will normally be readily apparent and easily inspected, defects in fire-stopping and penetration sealing often remain out of sight and consequently often out of mind. The fire risk assessor in checking for the presence and condition of penetration seals in walls forming escape routes will be able to at least perform a 'first-aid' check on service penetrations. However, to evaluate the condition of fire-stopping, inspection other than in areas that are readily accessible, is unlikely to be an option and/or too invasive.

The best solution for ensuring that fire-stopping is installed properly is to use third party certified contractors. These are required to use trained staff, whose competence has been evaluated and whose records are subject to audit by the certification body and whose work is subject to random inspection by qualified inspectors. However, if in the course of his 'first-aid' inspection if fire-stopping, the assessor discovers significant failings, he should ask for an appropriate survey from an independent third party inspection organisation.

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Fire Stopping

Existing Workflow
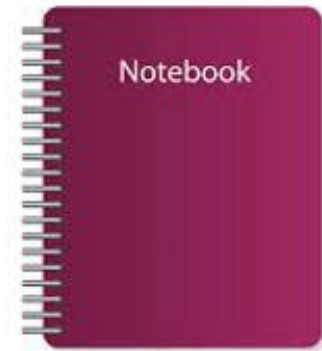
- Wasteful
- Paper based
- Error prone
- Laborious
- Static
- Primed for a digital revolution
- Capable of meeting the building/housing need?

Code Compliance and Accountability
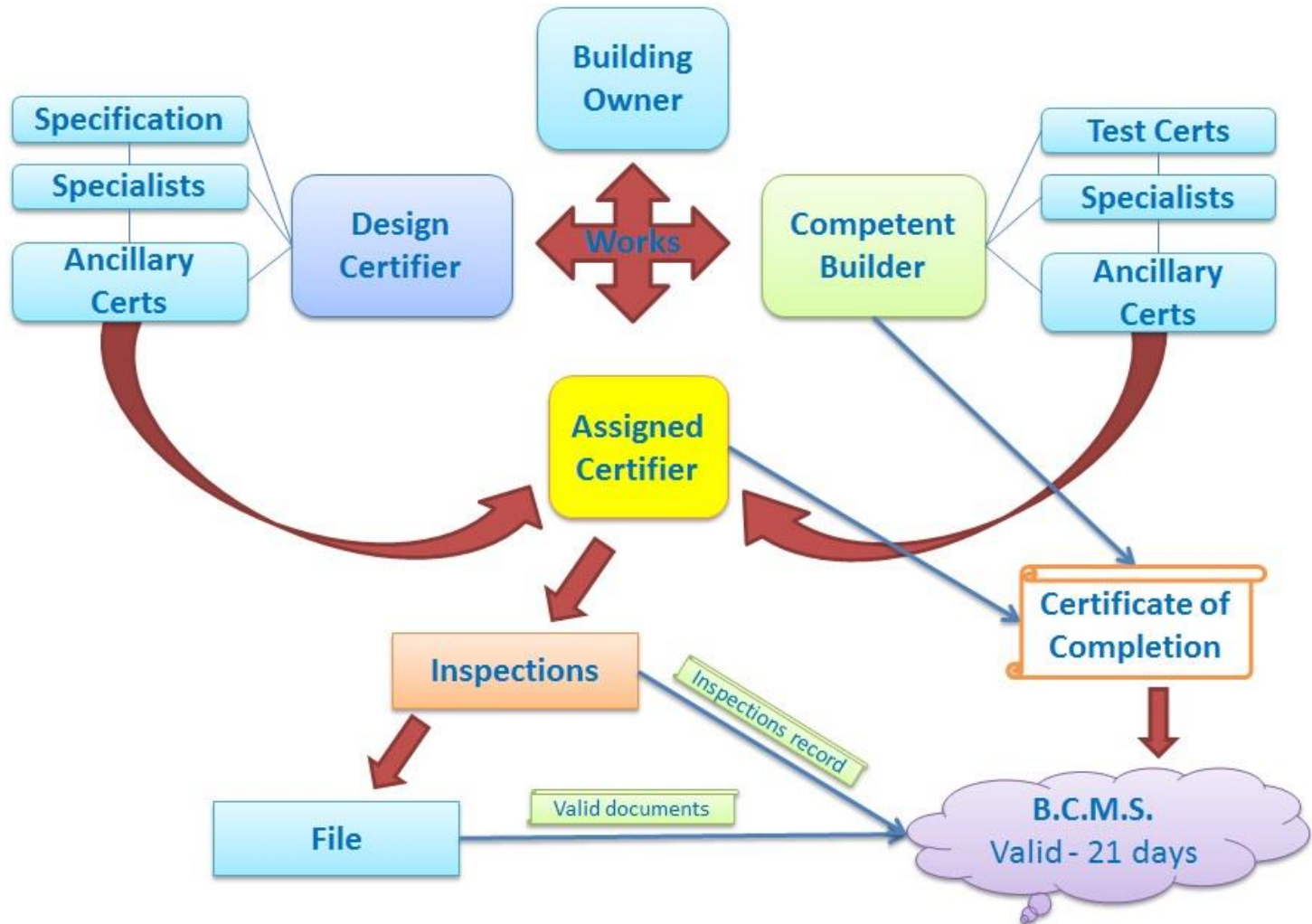
- Priory Hall
- Longboat Quay

- Building Control Amendment Regulations (BCAR)
- Building Control Management System (BCMS)
- Construction Industry Register Ireland

- Is code compliance strictly an Irish problem?
- Building Control inspections

BCAR

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BCAR

- Preliminary Inspection Plan

- Number of site visits

- Fire safety compliance equates to approximately 10~15 hours of site work for the Fire Safety Consultant.

- Fire stopping is usually carried out in awkward locations with difficult access.

- Potential for delays waiting for fire stopping to be inspected
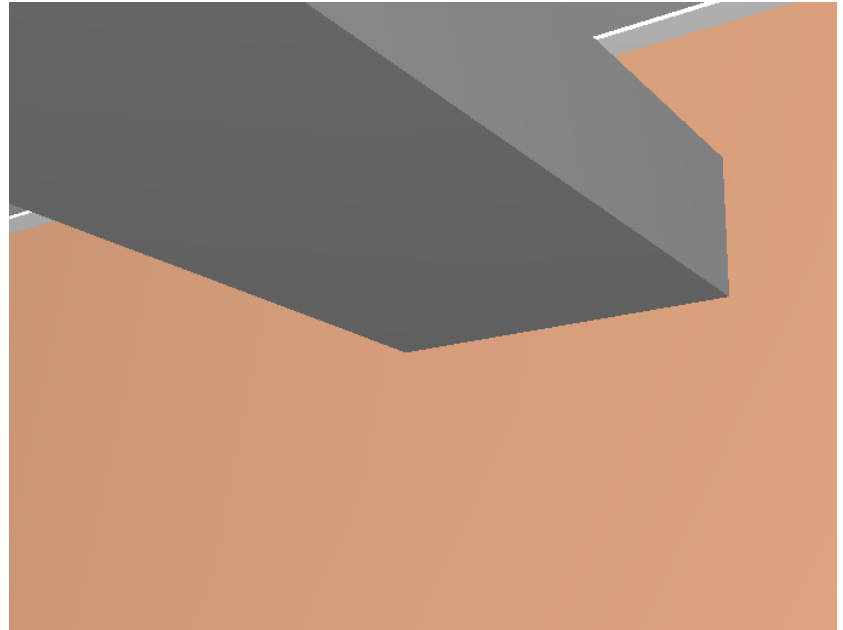
Vision

- Design digitally, construct manually, data capture?

- AIM
  - Project documentation tool
  - Single source of truth
  - Time capsule
  - Photo log
  - Leverage existing hardware

BIM FireStop app

- BIM middleware – proof of concept
- Record fire stopping through 'lens of place'

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BIM FireStop app Benefits

- intuitive
- democratizing
- no need for new equipment
- reality capture – fast, easy, cost-effective
- quality assurance
- irrefutable evidence – time and date stamped
- brings site to the BIM model
- collaborative digital workflow
- seamless integration of field data
- scalable
- the whole process is efficient and seamless
- it builds trust between the builder, fire stopping installer, Assigned Certifier and client
- it reduces the number of site inspections which reduces costs for the client
- it reduces the time spent in the office
- it produces an indisputable audit trail of photographic evidence
- the photos contribute to the overall digital safety file
- it has the potential to significantly increase revenue and profitability
- it reduces errors and improves quality of the exchange of information.
- it could be used as an inter-organisational coordination and collaboration tool
- it makes use of the BIM model and is easy to query

Conclusion

- Importance of Fire Safety
- Compliance
- Traditional workflow inefficient, laborious and error prone
- Proposed digital workflow outlined
- Proof of concept developed
- Advocate a bottom up revolution

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References

[1]   AECON (2016) *Firestopping*. [online], available: http://www.aecon.com/What_We_Do/Multi-sector_Services/Firestopping [accessed 6 July 2017].

[2]   DoHPCLG (2016) *Fire Authorities*. [online], available: http://www.housing.gov.ie/community/fire-and-emergency-management/fire-authorities/fire-authorities [accessed 8 August 2016].

[3]   UL (2013) *Comparison of Modern and Legacy Home Furnishings*. [online], available: https://www.youtube.com/watch?v=LsReYgKpHbE [accessed 12 February 2017].

[4]   Meyer Fire (2017) *Worldwide reach: 8 major fire events this year*. [online], available: http://www.meyerfire.com/blog/worldwide-reach-8-major-fire-events-this-year [accessed 31 Jul 2017].

[5]   RTE (2015) *Incident room set up in wake of Kildare fire*. [online], available: https://www.rte.ie/news/2015/0401/691265-millfield-manor-kildare/ [accessed 16 May 2017].

[6]   Blanch, E. L.-O. (2012) *Simulation of the Windsor Tower fire Madrid February 12, 2005*.

[7]   McDermott, A. (2015) *Building Control*.