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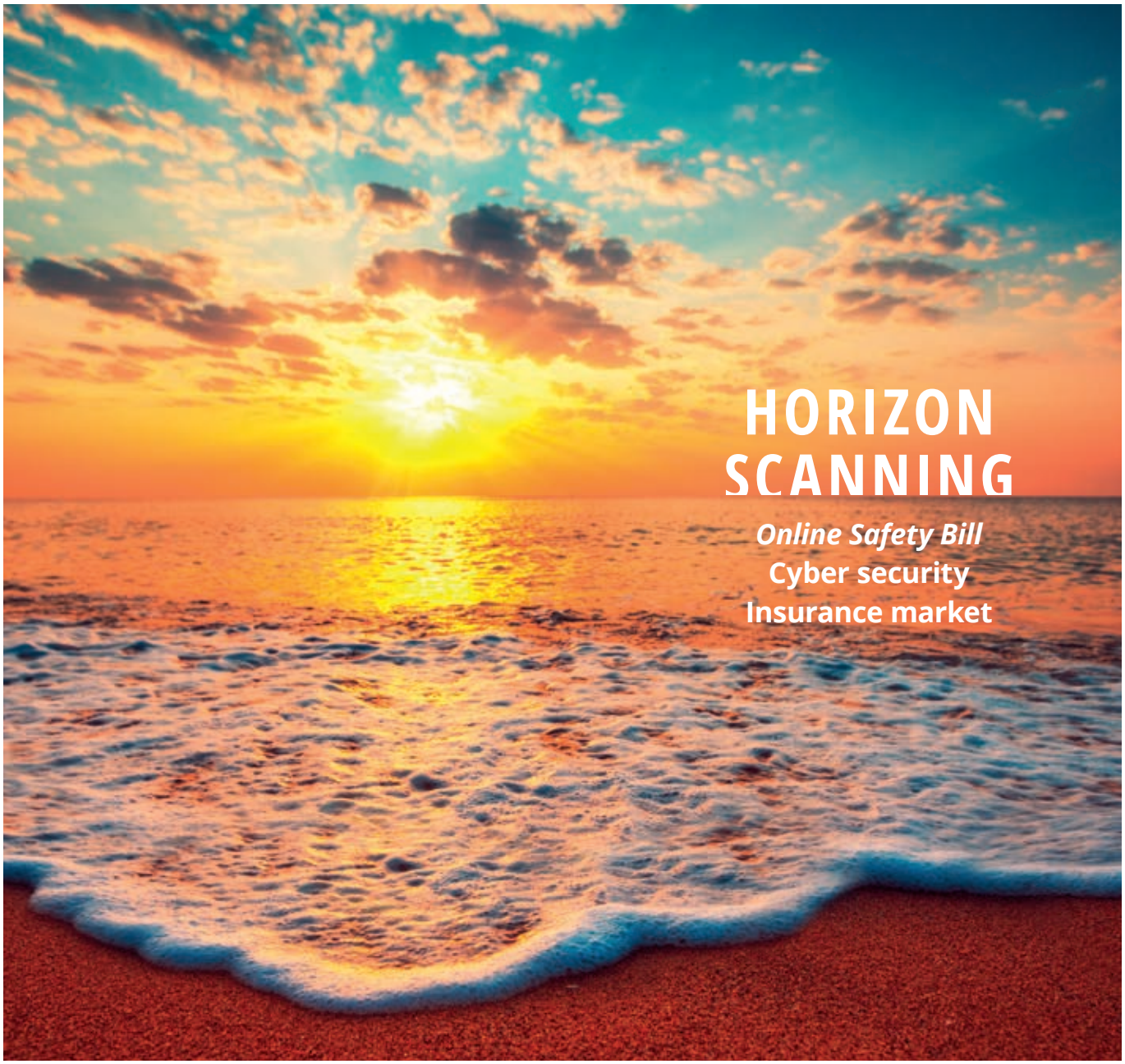

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Risks of modern methods of CONSTRUCTION

As the various types of modern methods of construction are more commonly used, the risks associated with new materials and systems become better known.

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Modern methods of construction (MMC) encompass a range of constructions, many of which are now widely used in refurbishments, conversions and retrofits, as well as new build developments.

As forensic investigators of fires, explosions, water escapes and other incidents, Burgoynes often encounter MMC in our investigations. Below are some of the more common risk issues with MMC, with comments on addressing these risks and references for further reading.

Timber framed buildings

During construction, timber frames are vulnerable to fire until the timber has been clad with non-combustible or limited-combustibility materials, such as plasterboard. Fires during construction can become very large, causing total destruction of the building and damage to neighbouring buildings.

Ignition risks during construction are substantial, including arson by intruders; hot work; cigarettes discarded into waste (resulting from poor housekeeping); site lighting; and electrical faults. Considerable guidance exists to address fire risks in this situation[1].

In occupied buildings risk of fire remains. Generally, the incidence of fires has been reducing, but some factors tend to increase fire risk or resulting damage. An example is increased use of battery-powered devices such as e-scooters. Batteries can give rise to fires, particularly during charging when the charger is mismatched with the battery, or sub-standard after-market batteries are used.

Completed timber framed buildings can be vulnerable to extensive spread of fire via timber-faced voids that are naturally part of the construction. These voids should be properly fire-stopped, but in practice this may not happen due to a combination of design issues; difficulties with the initial installation of the fire stopping; disturbance of installed fire-stops by following trades; and lack of effective supervision and/or inspection. Damage to room-lining plasterboard during occupancy can also allow fire to spread too easily into timber-lined voids. In these cases, resulting damage may be extensive, even if the initial fire is not particularly large or severe.

Considerable published guidance exists on timber frame construction[2], but fundamentally timber frame remains more vulnerable to loss, compared with traditional construction using largely non-combustible materials.

Completed timber framed buildings can be vulnerable to extensive spread of fire via timber-faced voids that are naturally part of the construction.

Water ingress and water escapes may cause relatively severe damage in timber framed buildings. This is partly because water can penetrate downwards more readily than with some traditional constructions such as concrete floors. Also, timber frame construction may require more remedial work than traditional construction.

Aftermath of a fire in a five-storey timber framed building under construction, which damaged neighbouring buildings.

Insulation and cladding

Increasing focus on energy saving has led to additional insulation within new-build construction, and insulation applied retrospectively outside buildings as over-cladding.

Use of combustible polymer foam insulation has increased, partly because of lower weight and improved insulation performance for a given thickness compared with mineral wool. Combustible foam insulation can contribute to the severity or extent of fires, but the contribution varies widely, depending on the foam and how it is arranged and encapsulated.

Over-cladding and combustible foam insulation have received a lot of attention following the Grenfell Tower fire, so are not discussed further in this article.

It has been suggested that lightweight construction such as timber framed buildings with well-insulated, plasterboard-lined rooms can produce unusually rapid fire development. This is because the room envelope heats up quickly so that a fire reaches flashover earlier than with traditional heavy masonry construction. Addressing this issue is likely to include ensuring proper fire stopping as mentioned elsewhere in this article, maintaining good fire detection, and installing sprinklers.

Solar photovoltaic (PV) panels

These are increasingly installed on roofs of new-builds, as well as retrospectively. Depending on the arrangement of the panels and the adjacent construction, they can lead to extensive and rapid spread of fire.

Fire service responses may be limited by electrical risks from the PV panels, their wiring and the system's connection to the mains electricity distribution network. Published guidance on this issue has so far been relatively limited, but there are some references to fire behaviour of roofs with PV panels[3], and on fire service approaches[4]. Addressing the risks of severe fires is likely to involve steps to ensure high quality installation of PV systems, as well as avoiding nearby combustible construction that can facilitate fire spread.

Example of fire spread within voids of a timber framed building, extending to floors beyond the initial fire origin.

Extensive fire spread at PV panels on a new-build roof.

Plumbing installations and water leaks

Typically, plumbing and wet heating installations have become more extensive and complex, leading to more leaks. Plumbing now frequently uses systems that don't require hot work, which addresses ignition risks, but cold plumbing systems may increase the risk of leaks, particularly ones that appear long after installation.

Leaks are most often due to installation faults, particularly with more complex and extensive systems, but manufacturing defects also produce leaks, as does freezing.

Water leaks are most often due to installation faults, particularly with more complex and extensive systems.

Modern buildings often have floor build-ups where layers of insulation, screed and floor coverings rest on structural concrete. Concealed leaks tend to migrate horizontally above the concrete, leading to widespread damage before discovery.

Water leak risks can be addressed via proper design; installation; supervision; and correct pressure testing during installation, but some risks will remain. Installing automatic leak detection may reduce the extent of damage resulting from leaks, particularly with built-up floor constructions on concrete.

Fire stopping of services

Modern, more complex plumbing, heating, electrical and data installations in new-builds and refurbishments tend to increase the need for services to penetrate compartment walls and floors. The penetrations need fire stopping, which can suffer from similar issues as those with timber-framed buildings (above). This issue can be addressed via proper design, installation, supervision and inspection but again the nature of such construction means that it is difficult to ensure full compliance. ●

References

[1]*16 steps to fire safety*, Structural Timber Association
[2]*Structural timber buildings fire safety in use guidance*, Structural Timber Association
[3]*The Solar PV Standard*, MCS
[4]*Fire and Solar PV Systems – Recommendations for the Fire and Rescue Services*, BRE National Solar Centre

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Founded in 1968, Burgoynes is an international partnership providing specialist forensic services to a wide range of clients, including loss adjusters, insurers, reinsurers, law firms and businesses. With more than 60 investigators, Burgoynes investigates around 3,000 incidents a year involving fire, explosion and other engineering failures, which include electrical failures and electrical related incidents. **burgoynes.com**