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Fire Safety in Timber Framed Buildings – *Part 1... Fire spread in cavities*

By Martin Edwards

First Published June 2011

In my experience of investigating fires in timber-framed buildings, common ignition sources are both external (blowtorch, burning cigarette, lightning strike) and internal (electrical faults). In each case, regardless of ignition source, the route of fire spread has been through concealed spaces: wall cavities, floor and roof voids. Fires can spread within concealed spaces without the occupants realising. Even when the fire service arrives, the firefighters may be unaware that the building is timber-framed and contains concealed voids.

Locating a cavity fire, and its full extent, takes up time before fire fighting begins. New technology may help, but in tests fire crews took 27 and 34 minutes to locate the seat of a fire in an external cavity using thermal imaging cameras/infrared thermometers after searching fruitlessly inside the building. [1] Under the UK building regulations cavity barriers are only required to have a fire resistance of 30 minutes integrity and 15 minutes insulation. By the time that fire fighting takes place, the nearest cavity barriers to the fire source may already have failed and the fires spread to the next flat or compartment.

It may also be difficult to get fire-fighting water to the seat of the fire. Getting access to wall cavities may involve smashing through plasterboard and OSB (oriented strand board or Sterling board) or plywood panels, and may damage the timber studs. Firefighters must exercise caution when opening-up, as the timber framework also constitutes the structure, so damage and/or removals must be limited to avoid collapse.

Fire stopping is necessary at every service penetration of compartment walls and floors. Tests undertaken for TRADA (the UK Timber Research and Development Association) have indicated that timber stud walls containing duct penetrations, light switches and socket outlets can achieve 30 or 60 minutes fire resistance, as can ceilings with recessed light fittings. [2] TRADA publishes details of fire-resistant recessed cableways and socket outlets formed in timber stud walls. [3] Some timber frame fabricators prefer not to penetrate compartment walls and will install plasterboard linings inside the compartment walls and below ceilings, in order to recess sockets and to conceal cabling without compromising the fire resistant construction. This additional lining is also more robust in the event of DIY alterations by occupants, which can compromise compartment walls.

The UK Building Regulations state "*The external envelope of a building should not provide a medium for fire spread if it is likely to be a risk to health or safety.*" [4] In my experience, there is always combustible material present in the cavities of timber framed constructions. Either the timber studs/joists are exposed, or they are lined with a sheathing or 'racking' board, most commonly OSB board or plywood. There may be other combustible materials in external wall cavities: PVC retaining mesh, polypropylene breather membranes, PVC cavity trays and airbricks. Most commonly, the insulation material is incombustible mineral fibre, but I have reported on one fire where polystyrene insulation was ignited by a blow torch on the roof. The fire spread was rapid and the damage very extensive. This may be an area where changes in regulations could limit the fire risk. The cavity faces of timber stud walls could be required to be faced with incombustible boards, and plastic materials could be prohibited from cavities.

The most common external wall cladding is brickwork, but the architectural trend for timber external cladding now extends to timber framed buildings. In North America, PVC '*siding*' may be substituted for timber cladding and this was a factor in a major fire in Canada in 2007. [5] Modern methods of construction are introducing further combustible material to the walls of timber framed buildings, such as SIPS panels (structural insulated panels) composed of a combustible polymeric foam core sandwiched between two sheets of OSB board.

In my opinion, the major risk in timber framed buildings arises from open, but concealed, cavities containing combustible materials.mConnected clear voids within internal and external walls allow any fire which has penetrated the cavity to burn and spread. Alternatively, if the voids were fully filled, the fire would tend to be stifled. A fire in Manchester England was started by a faulty consumer unit fixed on a double stud compartment wall containing OSB board and a clear void. Fire spread was extensive. However, there was a fire in a similar consumer unit in a similar flat on the estate, fixed on a single stud internal wall, consisting only of timber stud, plasterboard linings and the void filled with mineral fibre insulation. The fire did not spread at all, as it had no oxygen source within the wall voids. For the future development of timber-framed construction, the construction industry and insurers should be considering full-fill incombustible insulation as the rule.

[1] "Understanding Fire Risks In Combustible Cavities" Chiltern International Fire, Table 5, page 38.

[2] "Timber frame walls and floors: Fire resistance of service penetrations" TRADA Technology Report 1/2001.

[3] TRADA Timber Frame Construction 4th Ed 2008, Figs. 10.6 and 10.9.

[4] The Building Regulations 2000, Approved Document B 2006 ("ADB"), External Wall Construction 12.5.

[5] Edmonton, Alberta, 21 July 2007: 149-unit condominium and 9 duplexes destroyed, 68 other duplexes damaged.

Fire Safety in Timber Framed Buildings – *Part 2... UK Building Regulations: past, present and future*

By Martin Edwards

First Published October 2011

Following the Great Fire of London in 1666, the London Rebuilding Act of 1667 decreed " *…That all the outsides of buildings be henceforth made of brick or stone.*" Party walls and external walls were to be 1-2 bricks thick. Timber buildings were effectively excluded from the capital. Over subsequent centuries, the London Building Acts, and then the national Building Regulations, were developed on the basis of masonry buildings.

Search for "*timber frame*" in ADB 2006 [1] and you will find only with a reference to the Building Research Establishment (BRE) "*Multi-storey timber frame buildings: a design guide*". [2] This document is derived from the TF 2000 tests conducted by BRE/TRADA (the UK Timber Research and Development Association) in 1999, a full-scale fire test in a 6-storey block of 24 flats erected in the vast hanger at BRE Cardington. The fire test was terminated after 64 minutes, when the ceiling plasterboard had failed and the floor joists above directly exposed to fire for 8 minutes. It was demonstrated that the fire conditions were 10% more severe than a standard test so the report was able to conclude " *The test demonstrated that timber frame construction can meet the functional requirements of the Building Regulations … in terms of limiting internal fire spread and maintaining structural integrity.*" [3] (60 minutes fire resistance is recommended for compartment walls and floors of flats up to 18m above ground.)

The TF 2000 tests demonstrated that timber frame construction could withstand fire originating within the rooms of a flat. However subsequent events also demonstrated one of timber frame's vulnerabilities. 2½ hours after the test terminated, the fire brigade had to return. For over five hours they fought a fire which spread up through concealed cavities on the fire test floor and the storeys above. The test fire had burned into the corner structural studs just below the kitchen ceiling, charring through the timber studs and OSB (oriented strand board) sheathing to reach the cavity. [4]

The re-ignition experienced after the TF 2000 test is not unique. Smouldering can continue unseen in hidden voids and break out hours later. In December 2009 a fire occurred after a soldering operation in an external wall of a block of flats in Salford and spread to the roof. The fire was believed extinguished, but it burst into flames in the evening. It was again extinguished. Fire broke out on three further consecutive days and eventually complete demolition was necessary.

The provision of cavity barriers within timber frame construction is a critical detail for reducing the spread of fire in open cavities. The effectiveness of cavity barriers depends heavily on good workmanship to achieve a tight fit, and on good supervision to ensure no barriers are missed out or are inadequate. BRE/TRADA states: [5] " *Workmanship in relation to the success of fire safety provisions in any building is of vital importance …*" The required standard of workmanship is not easy to achieve in timber framed buildings. Cavity locations become progressively inaccessible as construction proceeds, so cavity barriers must be installed as each wall, floor or prefabricated unit is installed. Following trades, such as bricklaying and roofing, can disturb cavity barriers fixed by the timber frame installer.

Multiple defects were discovered in the TF 2000 construction which would have permitted fire spread: gaps between cavity barriers; dislodged horizontal cavity barriers (some by mortar droppings); and no cavity closers around the window apertures. [6] Even under the scrutiny of BRE / TRADA, there were significant workmanship defects. This indicates the magnitude of the challenge facing contractors and those inspecting the works. One way of providing a construction which would be more robust and less susceptible to poor workmanship than the practice of inserting cavity barriers in the open cavities containing combustible materials, would be for timber framed buildings to include incombustible boards facing cavities and full-fill incombustible insulation in cavities. This could be a matter for consideration under future UK Building Regulations.

[1] Building Regulations 2000, Approved Document B ("ADB") Fire Safety (2006), Volumes 1 & 2.

[2] Building Regulations 2000, ADB 2006, Note 1 in Appendix A.

[3] BRE 454 "Multi-storey timber frame buildings: a design guide" 2003, chapter 3 Fire Safety, 3.2 TF2000

[4] "Understanding Fire Risks in Combustible Cavities" Chiltern International Fire, Fig. 3.

[5] "Multi-storey timber frame buildings: a design guide" BRE 2003, chapter 3 Fire Safety, 3.1 Introduction.

[6] "Understanding Fire Risks in Combustible Cavities" Chiltern International Fire, pp. 15-17.

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Contractual Responsibility for Specialist Design

By Bart Kavanagh

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In the UK the liability of specialist subcontractors for the design of those elements of work which they are contracted to provide is often a grey area for contractors, employers and architects alike. In full design and build contracts the issue is usually considered and addressed. Where the contractor has no formal design responsibility, however, or undertakes design responsibility only for a portion of the works, there is often a lack of clarity regarding design responsibility and liability for defects if things go wrong. The resulting difficulties in obtaining satisfactory remedies in law have been highlighted vividly by the recent judgement in Walter Lilly v MacKay [1].

Contractual relationships

In order to sue for breach of contract under the law of England and Wales the potential claimant must be a party to a contract with the person whom he wishes to sue. It follows that an Employer wishing to instigate such a suit in relation to a design defect in a construction project must have a contract in place which imposes liability on the relevant designer. Where that designer was the contractor or one of his subcontractors, the relevant contract will be the construction contract between the Employer and the Contractor and the success of any such action by the Employer under it will depend upon the presence and effectiveness of any terms relating to design liability.

Establishing contractual design liability

In order to ensure that design liability is properly identified and apportioned it is essential to select a form of contract that is expressly intended to accommodate some design by the contractor. In the UK there are a number to choose from. JCT SBC 05, JCT MP 05, GC/Works/1 (1998) and NEC3, are among those suitable for major works and JCT ICD 05, JCT MWD 05, ACA Form of Building Agreement 1982 and NEC3 (Short Contract) [2] are suitable for a range of less complex, undertakings. Forms with no option for any design by the contractor, such as CIOB forms, should be avoided for this purpose.

Once a suitable form of contract has been selected, the appropriate contract documentation must be put in place. For example JCT SBC 05 stipulates that Employer's Requirements, Contractor's Proposals and a Contractor's Design Portion (CDP) Analysis must be prepared for the relevant portions of the work.

Where a bespoke contract has been developed, or where standard forms have been amended, it is essential that any terms relating to the design liability of the contractor are clear with regard not only to their intent but also the formalities that are required to bring them into operation. The parties, and their agents who will be responsible for administering the contract, must be made aware of these formalities and must ensure that they are properly observed and carried out.

In Walter Lilly it was a requirement of the (amended) contract that the Employer must notify the contractor of any work that was to be the subject of contractor design. Several areas of work exhibited significant design defects but no notification had been issued to the contractor regarding his responsibility for their design. Instead, reliance was placed on, the wording of specification clauses, the active participation by specialist subcontractors with the architect in the design of certain elements, references in subcontracts to the 'completion' of design and on the production by subcontractors of detail and shop drawings.

In finding for the contractor Mr Justice Akenhead was unequivocal in his dismissal of this reliance, saying:

"The need for a clear CDP notification should not be considered if one has to try to scrabble around for it in documents issued …" paragraph 203(d) and "(The architect) … ignoring of a series of letters from (The contractor) seeking clarification as to design responsibility … points strongly by inference to (the architect) taking a conscious decision not to provide any such notification." paragraph 203(e).

Conclusion

To be confident of obtaining remedies at law, in contract, for defective specialist design work it is essential to have a contract with an appropriate Contractor's Design Portion in place and to ensure that its requirements and formalities are properly adhered to. Peripheral documents and actions might appear to infer liability but, almost certainly, they will not.

[1] This article is based on lectures given to the Society of Construction Law (Gulf) in Abu Dhabi and Dubai.

[2] This article is based on lectures given to the Society of Construction Law (Gulf) in Abu Dhabi and Dubai.

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RIBA Work Stages – Getting the paperwork in order

By Gerard Mclean

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The appointment of many British architects proceeds on the basis of the Standard Conditions of Appointment ("SCA") published by the RIBA; within the Schedules to the SCA, a Plan of Work sets out stages of work over the course of the project. The RIBA altered the definition of work stages in 2013, but the former Plan of Work – setting out stages from "*A – Appraisal*" to "*L – Post Practical Completion*" – is long established and remains widely used; even when an RIBA form is not used, an architect's services are likely to be defined by reference to roughly (sometimes exactly) these stages.

The SCA appears to assume that the architect is appointed for the entirety of a project and may proceed from one work stage to the next at his/her own discretion, without having to seek a separate instruction for each stage. However, it is obvious that not all clients will want all of the services listed in the Plan of Work. Omitting early stages from the architect's work is common: for example, an architect is often brought into a project after all of the work to stage "*D – Design Development*" (usually culminating in a Planning Application) has been completed, possibly by another architect better suited to the early work stages. Similarly, many clients will not require (or at least will not want to pay an architect to provide) the services at stages "*L2 – Assisting building user during initial occupation period*" and "*L3 – Post occupation evaluation*". It is a straightforward matter to strike out from the agreement the services that are not required but, if not amended in this way, the SCA would suggest that the full range of services is required.

It is also clear that a client may wish to have control over the rate of progress through the stages, and such client control of the programme is more difficult to define within an SCA type of contract than control over the scope of services. However, such control may be necessary to suit specific technical, legal or regulatory requirements of the project, funding or cashflow constraints, or for other reasons. There is therefore an expectation among many (but not all) architects and some clients (usually experienced or governmental clients) that architects will seek a new express instruction before starting each work stage. The SCA does not require such a separate instruction, but the Architect's Job Book advises the architect – for every stage from "*C – Concept*" to "*L1 – Administration of the building contract ....*" – to "*Check that the client's instruction to proceed has been given and confirmed in writing*" or words to that effect. In this context it is surprising that the Job Book does not provide this advice for stages A, B, L2 and L3, which list the services most often not required of the architect.

Despite some obvious benefits to both architects and their clients, in terms of certainty as to what the client requires, architects in fact rarely seek, and even more rarely receive, a full set of instructions to proceed through the stages of a project. Often, this is uncontroversial: the parties work closely together and it is obvious, for example, that stage "*E – Technical Design*" should be put on hold pending the outcome of a planning application, or that stage "*H – Tender Action*" (issuing invitations to tender) might be delayed and some re-design required if a cost estimate at stage "*G – Tender Documentation*" indicates that the cost is likely to exceed the budget available.

However, disputes about these matters frequently arise, most often if the architect's engagement is terminated before a project is completed, because the architect has claimed fees for stages of work that s/he was not expressly instructed to carry out. This as an issue separate from the question of whether the work stage in question was properly completed, but it is likely to be raised by clients when such a dispute is already in progress. Given how straightforward it should be to prevent such arguments – in most cases, all that would be required would be for the architect to confirm in writing that s/he is proceeding to the next stage of the work covered by the appointment, giving the client sufficient opportunity to instruct otherwise – it is surprising how often architects fail to take the necessary precautions.

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Experts in Low Value Disputes

By Robin Orme

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In any dispute, costs often equal or exceed the sums in dispute. In low-value disputes, this is even more of a risk and it more important for the expert to take every opportunity to maximise value and minimise cost. Whatever the value of the dispute, the construction expert in the UK usually has a dual role: as expert adviser, to assist the appointing party to understand its case and that of its opponent,

and as expert giving evidence in court, to assist the court to decide the dispute. In both roles and especially in low-value disputes, it is essential for the expert to be impartial and independent. Independence is not an end in itself but is part of the expert's service to the parties, to enable the dispute to be resolved as quickly and economically as possible. An independent expert tells the truth, the whole truth and nothing but the truth. That includes truths which may be unpalatable, but those are the ones which save the most costs in the long run.

The first priority is to clarify as early as possible the issues dividing the parties. This will enable time to be focussed on those parts of the dispute which really matter, avoiding unnecessary cost. Clarification of the issues leads to the issues in dispute being narrowed, enabling the dispute to be resolved more quickly and economically. Often the initial complaint from the claimant is not the real issue. For instance, a client may complain about defective design, when the real cause of the problem is a failure to tender a specialist contract early enough in the design process.

Experts are usually asked for a preliminary view of the dispute, but it may be more cost-effective to confine this to a preliminary view of the defendant's obligations relevant to the matters in dispute. This is often the most straightforward and least time-consuming part of the expert's work. It can, however, reap dividends in clarifying the real issues, or sometimes can demonstrate that no duty is owed and that the claimant has identified the wrong prospective defendant.

Whenever possible, the expert should work from documents only. Site visits are time-consuming and expensive and they should be undertaken only when other evidence is required but is not available. In disputes concerning construction defects, a site visit is likely to be essential. But in most other construction disputes, the evidence will be in contemporaneous documents recording the facts which will eventually decide the dispute.

Time and cost can be saved by encouraging cooperation between experts. This is rarely easy, either because the other side's expert has not yet been instructed, or because one side is not sure of its case and fears that it has more to lose than gain from cooperation.

An early meeting of both side's experts will be helpful. The purpose of the meeting should be to identify and discuss relevant issues and facts and to identify areas of agreement and disagreement. The meeting should help each side to understand the dispute better from the other side's viewpoint. That is often the most effective step to a resolution of the dispute, or at least to a narrowing of the disputed facts and issues.

If the site is to be visited to inspect defects, this should be done jointly by both sides' experts with an agreed record (even if this records disagreement). Similarly, any testing should only be carried out after agreement on the purpose of the tests, on samples, on the tests required and on the testing laboratory to be used.

For low-value disputes, appointment of a single joint expert is often suggested. This was proposed in the 1996 Woolf report [1] and commented on favourably by Lord Jackson in his recent civil costs report. [2] This should save costs, but the single joint expert is not available to the parties separately to perform the role of expert adviser, thus depriving the parties of the benefit of this advice.

Finally, expert reports should be disclosed, on a without prejudice basis, as soon as possible. This is essential for communication between the parties and narrowing of the issues and facts in dispute. If reports are disclosed early, it is usually appropriate for the claimant's expert's report to be disclosed first, as it is for the claimant to make the positive case. Early exchange of experts' reports is not always an option - the defendant will not wish to disclose its expert's report if the expert's advice is that the defendant is vulnerable.

These suggestions are known to experts and legal advisers, but they are not easy to put into practice both sides want to win, or at least to lose as least badly as possible. Ultimately it is for the parties to decide how to pursue their cases, but experts should always be ready to offer ways of reducing costs, particularly in low-value disputes.

[1] Woolf LJ Access to Justice, London 1996, Chapter 13

[2] Jackson LJ: Review of Civil Litigation Costs, London: The Stationery Office, December 2009, Chapter 38, paragraph 3.19.

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