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## TIMBER FRAMED BUILDINGS IN FIRE SITUATIONS: THE ROLE OF THE DESIGNER

### ***Key to nomenclature used***

Timber Frame – a term used in this document to refer to panelised structural walls and floors using small section timber studs and board products for the walls. The term does not in this document refer to timber post and beam structures or timber engineered structural frames.

Designer - this term is used differently by different groups. It is understood that in the timber frame industry 'Designer' is a term that refers to the persons who produce the fabrication drawings. In this note 'Designer' is afforded the definition used by the CDM Regulations i.e. it is any party which makes decisions regarding the selection, type, layout, compartmentation or other aspect of the timber frame, which may have a bearing on fire safety during construction. These decisions may be made by more than one party and at various stages of the project.

### **1. Introduction**

There have been a number of severe fires in timber framed buildings during construction which has put that form of construction under the spotlight for designers whilst carrying out their initial feasibility studies into new projects. The cause of these fires has been noted to be almost universally caused by arson and have occurred on timber frame buildings where the structural frame elements have not been protected by the in service fire protection finishes.

During a designer's initial risk analysis, fire during construction must be taken into account as an influencing factor in the choice of timber frame system and as a debit compared with the positives that timber provides as a construction method. Those risks will be site specific and so will need to be closely assessed on a project by project basis.

The UK Timber Frame Association has produced a useful document "Fire Safety On Timber Frame Construction Sites" ([www.uktfa.com/#/uktfa-literature-downloads/4538897734](http://www.uktfa.com/#/uktfa-literature-downloads/4538897734)) which gives procedures for contractors to follow to reduce potential risks. The recently updated HSG 168 'Guidance on fire safety on construction sites' is also relevant and contains advice for Designers (see para. 30 and Appendix 4 for example).

It has long been acknowledged that a timber framed building is safe for service when completed due to the fire protection given to the frame by the boarding and fire stops installed during the construction activities following frame erection. However, recent fires have shown that prior to completion, for exposed timber frame elements, there are very real risks, of the highest severity, albeit with a low probability. It is these high severity/low probability risks that specifically require careful management.

HSE has confirmed that timber framed construction is an acceptable form of construction providing it is assessed appropriately. It is expected that more effort should be put into high risk buildings e.g. high rise in urban situations, and for Designers to give thought to the specification of appropriate

fire retardants, closed panels, compartmentation and/or safe build sequences if considered as necessary from the risk analysis.

## 2. Design actions

Although responsibility for safety on site falls to the Contractor, the Designer can, and is required to play a role at the design stage.

In the course of discharging actions under Regulation 11 of CDM 2007<sup>1</sup>, Designers should consider the following:

### *Eliminating hazards*

- i) Consideration must be given to determine whether this is the appropriate form of construction having regard to adjacent buildings, their occupancy, and how they might be affected should a fire occur. This should consider recent experiences in terms of ignition of adjacent property through radiated heat and, as a consequence of the heat, the means of escape from these adjacent structures should the subject building catch fire. These scenarios are 'major hazards' with multiple fatality potential and must receive commensurate consideration. Designers should be aware of the position statement issued by the Chief Fire Officers' Association on the use of timber framed construction (September 2010). In some cases it may be concluded that an alternative choice of material is necessary.  
Note: UKTFA are producing guidelines on boundary distances for storey height of exposed panelised timber frame elements. In addition options to reduce the fire load in an arson attack are being produced for March 2011.

### *Mitigating risk:*

If, having considered the above, a timber framed solution is chosen, the following should be part of the risk mitigation exercise at the planning and design stage:

- ii) Fire engineered solutions must give consideration to the construction phase in addition to the in-use phase. The assumptions should be made known to the contractor since they often only relate to the final condition thereby leaving residual risks during the construction phase.
- iii) Anticipated partial occupancy should be considered to ensure that a sensible construction sequence can be achieved whilst maintaining fire safety. The assumptions should be made known to the contractor.
- iv) In refurbishment projects build sequences e.g. removal of fire stops and doors may need to be specified in order to maintain a minimum level of fire safety.
- v) Limitations of the fire service, for example in terms of equipment reach.
- vi) The likelihood of spread of a construction phase fire to adjacent buildings based on recent real fire experiences.
- vii) The use of additional protective measures e.g. fire retardants, intumescent, fire compartmentation etc. solely to cater for the build phase.
- viii) Consideration as to the site security that can reasonably be assumed to be in place balanced against the knowledge of the area in which the building is being constructed.
- ix) Checking the design against the UKTFA guidance to make sure the guide advice is not compromised and where possible is assisted.

Specific projects may require other items to be considered.

A possible solution might be treating the timber in advance for fire protection. Treatments would have the additional benefit of reducing the potential risks which occur during later modifications.

1. See [http://www.cskills.org/supportbusiness/healthsafety/cdmregs/guidance/Copy\\_5\\_of\\_index.aspx](http://www.cskills.org/supportbusiness/healthsafety/cdmregs/guidance/Copy_5_of_index.aspx)

The suggestions made above should be considered within the framework of 'eliminating hazards and mitigating any remaining risk' (i.e. the ERIC approach<sup>2</sup>). There is benefit in discussing this subject overall with the Client and HSG168 gives useful guidance in this respect.

#### *Passing-on information for the construction process*

As in all forms of construction final completion compliance relies on compartmentation and the (varying) fire resisting properties of various walls. It is incumbent on the Designers to identify for the Contractor any special requirements that a reasonable contractor, experienced in the field of construction being considered, may not be aware of, so that:

- A building can be sequentially constructed in a form to ensure the structure is safe in itself.
- Dependent on the scale of the project that there are adequate and optional routes for egress for personnel working on the project. Consideration of the routes utilising temporary works e.g. scaffolding and usable parts of the building should be considered.
- During construction it does not generate an undue risk for adjacent properties. Recent fires have shown this to be an important aspect.

Engineers are used to providing statements and loadings for the temporary condition of structural elements to ensure stability is maintained during the construction process. Designers should also get used to providing data to contractors on fire safety to highlight the residual risks present until the frame is encapsulated.

#### *Multiple designers*

On many projects there will be more than one party inputting into the design of a timber framed structure. Each individual designer has a responsibility to:

- i) consider the consequences of their decisions on the work of other designers (maybe not appointed at that time) and on the build sequence as noted above.
- ii) co-ordinate their design with other designers
- iii) communicate and co-operate with other parties as necessary
- iv) pass on information relating to their design to other designers and others.

All the above are independent of, and superior in law to any contractual linkages.

#### *CDM Co-ordinators*

CDM Co-ordinators, whilst not directly responsible, do have a duty to ensure that Designers are discharging their duties and that adequate co-ordination and communication is occurring.

### **3. The Building Control process**

As with all forms of construction it is necessary to distinguish between the aims of the Building Control process and other legislation.

In broad terms the Building Regulations are not concerned with issue of safety during the construction phase unless these will directly lead to non-compliance in the completed state. It is also noted that third party approvals such as NHBC timber frame certification do not refer to the construction process. However (health and) safety legislation is concerned with safety during the construction phase (and over the life of the structure) and places obligations on all parties.

2. See section 2 CDM Designers' Guidance at

[http://www.cskills.org/supportbusiness/healthsafety/cdmregs/guidance/Copy\\_5\\_of\\_index.aspx](http://www.cskills.org/supportbusiness/healthsafety/cdmregs/guidance/Copy_5_of_index.aspx)

In Scotland, the Certifier of Design will have a responsibility to ensure that the building design overall is compliant with the Building Regulations for Scotland. No such equivalent formal oversight occurs in England and Wales.

However, in neither case is there a responsibility under Building Regulations for ensuring construction phase safety.

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