Fire Alarm (From July 2002 edition of Building Magazine U.K.)

Concrete Today is re-printing in full a report in the July 2002 edition of 'Building Magazine' on the dramatic failure of the TF 2000 Cardington fire test, where a 6 storey timber framed building was purpose built, virtually under laboratory conditions, to test the performance of multi-storey timber frame in fire. The failure of the test is a clear warning as to what can happen when less favourable conditions prevail.

The TF 2000 Cardington Fire Test is the main support material in the Timber Frame Housing 2002 Consortium Report which proposes two major changes to the Irish Building and Fire Regulations to make way for 4 storey timber framed dwellings.

Almost 20 years after the devastating World in Action Exposé, the timber frame industry is back under the microscope. This time government-backed research has found that poor workmanship is exposing occupants of timber frame buildings.

Shoddy workmanship is leaving timber frame buildings exposed to heightened risk of fire, potentially endangering the lives of thousands of people. Thomas Lane and Andy Pearson Reports.

The risk to homes, nurses' homes, old people's homes and student flats was revealed at a private seminar last week organised by the DTI and industry researchers. The experts who gathered at BRE's headquarters in Watford have uncovered alarming evidence that badly installed plasterboard drylining and fire protection measures mean a fire can spread uncontrolled through cavity walls.

And the problem may affect more than just timber frame buildings. Mark Van Scalwyck, an insurance inspector for Zurich Municipal, says: "Most of the defects we find relate to cavity construction. 'About one in four properties have problems with fire stopping." However, timber frame buildings are most at risk because their cavities are lined with combustible materials.

These revelations are a potential disaster for an industry that took years to recover from a World in Action Exposé in 1983. The programme showed examples of poor site practice on timber frame housing sites and listed 30 types of recurrent defects. Recently, however, it seemed that this had all been forgotten: the government has been promoting timber frame construction because of its environmental credentials and also because it uses factory-made wall frames and roof trusses - useful given the shortage of skilled site operatives. Last year, the industry turned over £247m and produced more than 23,000 units.

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Mostyn Bullock, principal engineer at research body Chiltern International Fire, says: "There is another World in Action programme waiting to happen. What if one of these student blocks went up and people died? These places are deathtraps."

While the occupants of the buildings are clearly in most danger, there are potential financial risks for owners. Insurers are warning that they may refuse to pay for fire damage where poor workmanship has allowed a blaze to spread. They may also demand that only approved timber frame contractors are used. Industry experts have in turn responded to the development by calling for building control officers, or other independent consultants, to sign off the correct installation of fire stops in cavities.

These workmanship problems are compounded by fears that fires can reignite in the cavity of a timber frame building because the timbers smoulder undetected for hours. Oxfordshire Fire Brigade has changed its procedures so that fire officers must return to the scene of a timber frame building blaze after four hours, to check the fire has not reignited in the cavity. For other types of construction, this is at the discretion of the fire fighters.

The fears of fire experts like Bullock were first aroused on 15 September 2000, when BRE carried out a test on a specially constructed, six-storey, timber frame building in an old airship hangar at its Cardington Research Centre.

A fire was deliberately started in the living room of one of the second-floor flats in the south-west corner of the block. The fire spread through the flat and raged for an hour before the fire brigade put it out. But two-and-a-half hours later, after the fire fighters had left, smoke was seen coming out through joints in the external brickwork. It seemed the fire had reignited in the wall cavity.

The fire brigade was called back, and immediately evacuated the building. They found the heat of the fire was causing the brickwork to crack, and decided to fight the fire from the outside. However, because the fire was in the cavity, they were unable to locate its source and were pointing their hoses wherever they saw smoke coming from the building. In order to reach the cavity, fire fighters took out some of the window frames and removed the eaves protection; they even had to resort to taking out sections of the brickwork. The blaze was eventually extinguished five-and-a-half hours after the fire brigade was recalled. The destruction was extensive. When the fire reignited in the cavity, it caused severe damage to three flats above the one in which the fire started.

So what went wrong? Fire investigators revealed at the seminar that after the initial fire was thought to have been extinguished, a section of the timber frame in the cavity smouldered undetected for an hour-and-a-half before bursting into flames. The fire then ripped through the wall cavity to the three flats above. These suffered extensive damage because the fire-protection measures, which should have stopped the blaze spreading, were ineffective. The horizontal cavity closers had become dislodged by mortar dropping on them during the construction of the wall and some were actually missing.

Even more alarmingly, this discovery was the second example of how poor workmanship is exacerbating the fire risk to timber frame buildings. The first emerged

before the test was even carried out. Plasterboard in the test flat had to be taken out and reinstalled. "The linings were not put up properly and the joints weren't staggered," said Bullock. If the original plasterboard had remained, he added, "we wouldn't have got 60 minutes [fire resistance], it would have been more like 20". This is because the fire could have breached the plasterboard drylining and broken into the cavity.

The results of the Cardington test raised fears that the risks of fire spreading through wall cavities in timber frame buildings could be much more extensive. Timber frame is thought to be more vulnerable than masonry constructions because the cavity is lined with combustible materials. It is not an intrinsic fault in the design, but it does mean the workmanship has to be accurate in order for a fire to be localised.

A spokesperson for the Timber Industry Research Association said the solution was training, education and policing: "The industry needs to police itself or the Building Regulations need to include third-party certification." In a statement to Building, the UK Timber Frame Association said: "UKTFA recognises that poor workmanship in the installation of cavity barriers for fire protection is a problem throughout the construction industry. Where barriers are missing, not installed correctly or not properly overlapped, there is an increased risk of fire occurring. This is an industry-wide problem and not specific to timber frame."

Following the Cardington test in 2000, the government launched a research project headed "Understanding Fire Risks in Combustible Cavities". The project is being carried out by BRE and Chiltern Fire under a DTI-sponsored Partners in Innovation programme. Their report is due to be published in September.

In an attempt to gauge the scale of the problem, the researchers commissioned BRE's fire and risk sciences division to study cavity fires. The division looked at a 20% sample of all fires that have occurred over the past five years. The study revealed most cavity fires occurred in timber framed buildings, with domestic dwellings the highest risk group. It also highlights the considerable amount of damage caused both as a result of the fire and of the fire brigade destroying walls to get to the seat of the blaze.

Last week's seminar was organised to determine the extent of the problem in the industry and to gain anecdotal evidence from those attending the seminar. It is now apparent that shoddy workmanship is a serious concern that will be highlighted in September's report.

As part of the project, the researchers also visited three sites where timber frame was being used - a social housing project and two private developments. To their horror, they found the cavity closers in each were installed incorrectly. In some instances, they were pulled tight round corners exposing gaps, and in others bricklayers were ripping them out when they got in the way. "The brickies find cavity barriers get in the way and remove them," says James Lavender, a Chiltern fire engineer. "They also think you don't need them if the cavity is small."

The researchers believe that timber frame homes are at most risk. Fires in domestic buildings have been caused by faulty electrical wiring in wall cavities, and even the heat generated by drilling holes in a wall to install a satellite dish, which could lead the timber frame to start smouldering. One senior building control officer told Building: "The only reason these fires have not received wider publicity is that nobody has been killed yet."

Another part of the investigation has focused on the conditions under which fire reignites in a cavity. The researchers set up a test in which a fire was started in a cavity through a hole in the brickwork. The fire was allowed to burn through the timber cavity lining before being extinguished. But the fire carried on smouldering, and after an hour-and-a-half it had charred three sets of structural timber studs. After three hours, the timber burst into flames. "We thought it had all died down," says Lavender, "It reignited in a matter of seconds without us noticing."

The researchers also tested the cavity closers themselves to prove that they do in fact stop fire spreading. This was found to be the case when the closers are correctly installed, but when a gap of two or three fingers' width is left, and it is pulled tight round a corner, the fire reached temperatures of 250°C above the closers after just two minutes. Flames also burst through the closers and reached sections of the timber frame above. Lavender points out this suggested that in such instances, the building would be in breach of Part B of the Building Regulations, which covers fire safety.

The publication of the research report in September is likely to presage widespread changes in the way timber frame buildings are constructed and regulated, although a government spokesperson emphasised that "the issues [in the report] are relevant to all construction types". Apart from the threats from insurers, there may be calls for the design of timber frame cavity walls to be changed to make them less vulnerable to the spread of fire. This could include changing their construction to keep flammable material out of the cavity, and cavity closers may have to be redesigned to make them easier to install correctly.

But this crisis isn't primarily about design - it's yet another construction disaster. And for the proponents of timber frame, it has terrible echoes of that cataclysmic moment nearly 20 years ago when World in Action's cameras rolled.

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