Limiting fire spread

Fire research led by BRANZ is studying the best design approach for stopping fire spread in buildings. It's part of a project to keep people safe and to reduce property damage.

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THE MAJOR FIRE research programme under way at BRANZ will provide technical input into the Building Code clause C *Protection from fire* requirements, so a look at the relevant clauses is useful.

Setting the scene

Building Code clauses C1-C6 have three objectives that deal with safeguarding people, protecting other property and assisting with fire-fighting and rescue.

Protecting other property can mean another building across the boundary or an apartment owned by someone else in the same building.

One requirement to meet these Code objectives is that there is a low chance of a fire affecting areas beyond where the fire starts (clause C3). This means the fire safety systems in the building must be designed and installed to prevent a fire spreading to other parts of the building or to adjacent buildings. Rapid or unexpected fire spread can cause major safety problems for people in a building.

A fire can spread either horizontally through walls or vertically through floors within a building. The most likely path for this fire spread is where pipes and cables pass through the wall and floor. A fire on one floor of a building can also break out through windows - the flames billow out of the windows - and spread to floors above. A fire can also spread to adjacent buildings in a similar way.

Getting the right fire rating

The most common way to prevent fire spread is to have fire-rated walls, floors, doors, fire stopping and the like.

It is easy to determine what level of fire resistance rating a product or system will achieve by doing a fire resistance test. But the problem is that real fires in actual buildings are different to the standard lab test.

In order to work out what level of fire rating is required, the designer must do a

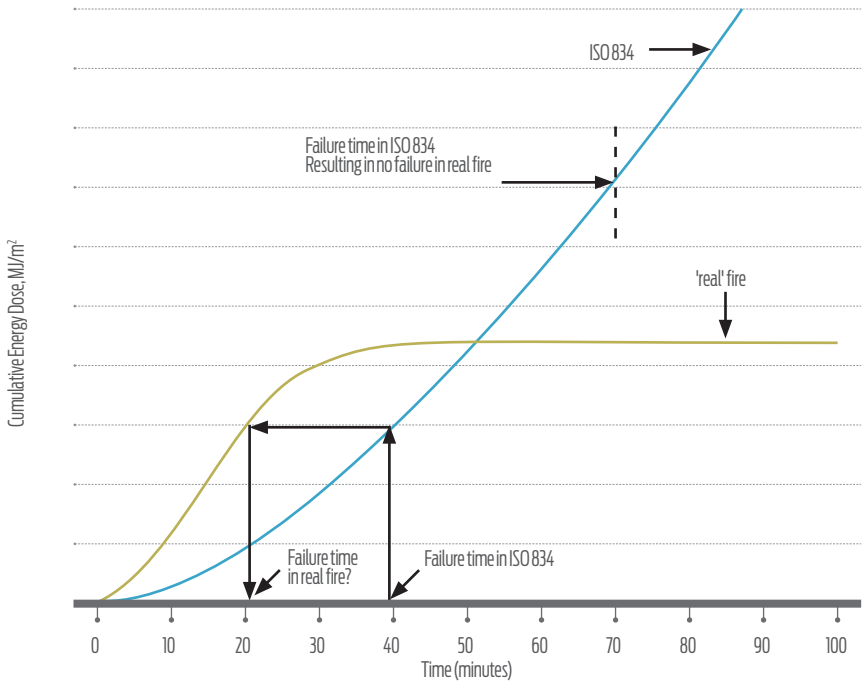

Figure 1: Cumulative energy dose approach – an alternative to time-equivalence calculations. The cumulative energy that the fire-rated element would receive in the 'real' fire is compared to the energy received in the standard lab test (ISO 834) to determine the failure time.

time-equivalence calculation. This is where an estimate is made of how the real building fire equates to the standard lab test.

Where does BRANZ research fit?

Because of the importance of fire spread, BRANZ is currently conducting a major fire research programme looking into this. The limiting fire spread by design (LFSD) programme brings together a team of experts from New Zealand and overseas contributors.

The LFSD programme is made up of four projects, each dealing with a different part of the fire spread issue:

- Fire resistance ratings.
- Characterisation of external fire plumes.
- Preventing horizontal fire spread.
- Preventing vertical fire spread.

Fire resistance ratings

The first project deals with fire resistance ratings, particularly the time-equivalence calculation method that dates back to European research from the 1970s in limited types of buildings.

Time-equivalence calculations are being done every day in New Zealand in applications well beyond what the original method was ever intended to cover.

Is this a safety concern? At this point in the research, BRANZ cannot say, but it's possible. Therefore, the first LFSD project is all about ensuring we have the right fire ratings for buildings in New Zealand, delivering what the Building Code expects.

Characterising fire plumes

The second LFSD project deals with what researchers call characterisation of external fire plumes.

The project is looking at fires where the flames billow out of a window, and the fire can spread up the outside of the building or between buildings.

At BRANZ, we are trying to determine the things that are known when a building is being designed that will affect the fire plume. Then the relevant calculations can be done at the design stage.

To be able to carry out the engineering calculation for this, it's first necessary to know how big the plume of flames will be, the shape of the plume and also how much heat radiation will occur.

This might sound simple but, as the saying goes, not all fire plumes are the same. There is also very little useful research internationally on this subject.

The current approach is that one size fits all, but it is unclear if this fit is safe or unsafe.

Preventing fire spread

Using input from the second project in the LFSD programme, the third and fourth projects deal with what features can actually be used to prevent both horizontal and vertical fire spread in buildings.

Currently, methods used to achieve this include window area limits, separation distances, spandrel panels, aprons, window-to-window separation distances between floors, flammability limits for external claddings and the like.

However, this approach is piecemeal, and a comprehensive review of how all these features work together is overdue, as well as new ideas on how to limit fire spread.

A clearer picture

The LFSD programme will provide a much better picture of fire spread in buildings, how to design for this and how to effectively prevent fire spread occurring.

Ultimately, it's about ensuring people can get out of buildings safely in a fire, that firefighters can do their job in relative safety and that the fire doesn't affect adjacent owners.