BENEFITS OF WOOD

FACT SHEET 10

TIMBER QUEENSLAND
We build Queensland

Construction Benefits – Fire

Fire safety is essential in all building design and construction. There is a perceived risk by the general public that the combustible nature of timber makes it an unsafe building material. In fact, timber has several properties that make it safer in a fire than other building materials. For example, timber is a good insulator (does not easily allow heat to pass through it) and burns in a predictable fashion.

Fire Risk

Regardless of materials of construction, all buildings are capable of burning or being destroyed by fire. Timber is combustible; steel conducts heat and can buckle and concrete can crumble (spall). The design of buildings and choice of building material is an important consideration so that in the event of fire the building remains standing and the fire contained.

The NCC establishes a performance level for all buildings in Australia. All construction systems, whether they be concrete, steel or timber, have to deliver the same performance level. Concerns about fire safety and timber buildings were addressed by changes to the NCC in 2016. These changes provided "deemed to satisfy" solutions for timber mid-rise buildings, and outline the standard practices for how to construct and protect these buildings. The provisions include the installation of automatic sprinkler systems, protective layers for load bearing walls and other essential components such as fire stairs, installation of non-combustible insulation, and cavity barriers (Wood Solutions, 2016). These regulations aim to prevent the spread of fire within a timber building as well as ensuring the structural integrity is maintained. These factors, when combined with the way that timber behaves during a fire, make timber just as safe and in some cases safer than other construction materials.

Behaviour of Timber in a Fire

Although timber is combustible, its behaviour during a fire is very predictable. Timber burns slowly due to its ability to form a charred outer layer, shown in Figure 1, that protects the core of the material. This allows the inner core of the timber to stay cool and maintain integrity and as more of the wood is converted to char, this process provides more insulation to the core. Softwood timber burns at a rate of around 0.7 mm a minute which means that after an hour of combustion a large timber beam will only have the outer 40 mm burned.

Quick Facts

1. All building and construction systems have fire risks which must be mitigated. Irrespective of the construction material, all buildings have to provide the fire performance required by the Building Code of Australia.
2. The National Construction Code (NCC) provides deemed to satisfy provisions for the protection of mid-rise timber buildings.
3. Timber is combustible and performs predictably once it is alight. Timber does not expand and distort in the heat of a fire like steel.
4. The outer burned layers of a piece of timber form an insulating layer of charcoal that protects the inner core of the timber allowing it to maintain integrity.

Figure 1 CLT that survived a complete burnout of a structure showing the protective char layer from (XLam, 2017)

This process makes the burning rates of timber very predictable, which can be incorporated into the fire engineering of the building design. The slow combustion can be enhanced through the use of structurally oversized timber sections to allow for a larger core and the use of denser, naturally slower-burning, timbers. Coating timber in fire resistant chemicals provides extra insulation and prolongs exposure without combustion. The deemed to satisfy provisions also require load bearing walls and floors to be oversized and to be protected by technology such as fire resistant gypsum boards to prevent fire from reaching these important structural components.

Further Reading

Wood Solutions, 2013. *Forte Living*. [Online] Available at: www.woodsolutions.com.au/Inspiration-Case-Study/forte-living

Wood Solutions, 2016. *Mid-rise Timber Buildings*. [Online] Available at: www.woodsolutions.com.au/system/files/WS_TDG_37_16_11_2016.pdf

Wood Solutions, 2017. *Fire design*. [Online]
Available at: www.woodsolutions.com.au/articles/design-fire

XLam, 2017. XLam Panel Specifications. [Online] Available at: www.xlam.co.nz/technical.html

Case Study — 25 King St, Brisbane, Queensland

The 25 King St building, opened November 2018, is Australia's largest commercial timber building. The building is a column and beam construction with a concrete basement and ground level. Engineered timber is used extensively for Level 1 to 10 including cross laminated timber, Glulam and Laminated Veneer Lumber.

The design and construction meets the Performance Requirements of the National Construction Code Series – Volume One, Building Code of Australia. This has been achieved by conducting an analysis of the fundamental principles of fire safety in combination with analysis of the risks associated with use of engineered massive timber as structural element, and the use of specific scientific experimental data. It also utilised and followed European principles relative to structural robustness and analysis as part of the fire safety analysis to support the explicit wholistic performance based design of the building.

Fire safety measures include specific lamella configuration of CLT elements, open plan office plate, sprinkler systems, smoke detection, pressurisation system and hydrant systems.

An early engagement with stakeholders (i.e. fire brigade, certifiers, designers, etc) and agreed continued engagement throughout the design process assisted in achieving approval from relevant authorities.

Figure 2 25 King St, Brisbane. Image courtesy of Lendlease.