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Wood Points

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Wood Construction and Fire Safety

The Canadian Wood Council (www.cwc.ca) has assembled these key facts in response to questions about six-storey residential wood buildings permitted under the British Columbia Building Code.

- Fire is a threat to all buildings. Canada's National Building Code and the Provincial and Territorial regulations based upon it require that, regardless of what materials they are made of, buildings be designed to minimize the risk of unacceptable loss by including fire protection features to contain a fire, limit its effect on the supporting structure, and control the spread of smoke and gases.

- Wood walls, floors and roofs must be designed to provide fire resistance ratings of up to two hours, a level of fire performance also required for non-combustible building materials - contributing to the time needed for occupants to escape and emergency responders to perform their duties.

- In all construction types for six-storey mid-rise buildings, openings and doorways must be designed to provide up to 1.5 hours of fire protection and limit the spread of fire and smoke into exit stairways.

- In all construction types for six-storey mid-rise residential buildings, automatic fire sprinkler systems must be installed throughout the building to limit fire growth and the spread of fire and smoke.

- The fire resistance of wood-frame walls or floors depends primarily on the gypsum board used to shield the structural wood members from the effects of heat. Gypsum board has a non-combustible core and, when exposed to fire, it absorbs large amounts of heat as its water content is released.

- Steel is a noncombustible material but can quickly lose its strength when exposed to the high temperatures of a fire. Similar to wood-frame assemblies, light-frame steel assemblies must also be protected from direct exposure to fire, usually by gypsum board, to prolong the time before collapse occurs in a fire.

- Newer insulated concrete form (ICF) systems use combustible foam. These concrete form systems also need gypsum board or some other form of fire protection to limit involvement

of the foam in a fire and to retard the spread of fire when such walls are used in multi-family residential buildings.

- The fire safety of a completed building must consider the whole system, including the building contents and its use. For completed buildings, research shows that the size and severity of the majority of fires are related to the contents of a building and the living and working habits of its occupants.

- In multi-family residential buildings, close to 80 per cent of fires are contained to the compartment of fire origin, regardless of construction type. In the few cases when fire does spread to the entire structure, such spread usually occurs at a time after the occupants have left the building.

- No structure can ever be completely fireproof, and all construction materials can be affected by fire. Concrete and steel may not burn, but they can degrade and fail when exposed to a typical building fire, which could lead to a complete structural failure.

- Heavy timber resists fire very well - when heavy timber burns, a layer of char is created, which helps to maintain the strength and structural integrity of the wood inside, reducing the potential for complete collapse.

Remy Project Fire in Richmond

- The May 3, 2011, Remy fire in Richmond occurred during construction of a six-storey wood-frame building – before fire safety features such as sprinklers, gypsum board protection and fire doors were required to be in place. The firewalls in the structure were made of steel framing and two layers of one-inch-thick gypsum liner panels. Even firewalls built with concrete or concrete block likely would not have stopped the fire under these circumstances.

Earthquake Safety

- Fire is a major hazard and risk to buildings and infrastructures after major earthquakes. Concrete and masonry buildings historically have not performed as well as wood buildings in earthquakes, and thus are likely to be more prone to the loss of both active and passive fire protection systems, such as sprinklers.

- A 2010 study by the National Research Council noted that structure deformation from an earthquake could damage a building’s fire protection systems, possibly resulting in a full fire load and failure of the structure in a post-earthquake fire. In reinforced concrete and masonry

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structures, cracking and spalling of the concrete cover used to protect reinforcing steel could result in penetration of the flame and rapid elevation of the steel temperatures.[1]

- Research into recent earthquakes around the world shows that modern wood structures are better able to resist seismic forces than other building materials. Wood's flexibility, its high strength-to-weight ratio and its high energy-absorption capacity and ductile behaviour make it a safe choice.

- A unique earthquake simulation confirmed taller wood-frame buildings can be designed to perform safely in a major earthquake. Earthquake engineering researchers tested the seismic performance of a full-size, six-storey wood building on the world's largest shake table at a facility in Miki City, Japan.[2]

More information about wood performance and fire safety is available from the Canadian Wood Council at www.cwc.ca/DesignWithWood/FireSafety/?Language=EN.

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[1] *Performance of a six-story reinforced concrete structure in post-earthquake fire* July 2010 NRCC-52689 http://www.nrc-cnrc.gc.ca/obj/irc/doc/pubs/nrcc52689.pdf

[2] British Columbia government 6 Storey Wood Shake Test July 2009 www.hsd.gov.bc.ca/video/wood_shake.html