



FIRE SAFETY

A Wood-Frame Building Performance Fact Sheet



Fire safety in buildings is a blend of personal and public responsibility. Everybody has a role to play in minimizing fire risk and maximizing fire safety: building regulators, building officials, manufacturers of building components, building designers, builders, and most importantly, the occupants of the buildings. Canadian fire-loss statistics demonstrate that wood-frame buildings are as safe as any.

Lifestyle: the key to fire safety

Fires are usually accidents, but they don't start all by themselves. Something allowed a spark, flame or heat access to the many sources of fuel in a building like paper, cardboard boxes, upholstered furniture, mattresses and bedding, curtains and drapes, carpets, and other household furnishings. Too often the cause was human error. Common mistakes include overloading wiring circuits, being careless with matches and improperly using appliances.

Most fire deaths and injuries occur in homes, where we spend about two-thirds of our time and engage in many of those activities posing the highest fire risk such as cooking, smoking, and using candles. Homes are also where we sleep – it takes us longer to respond to a fire if we're asleep when it starts. Occupants can minimize fire risk in their houses by regular inspections of their premises and by a fire-safe lifestyle. This involves common-sense precautions such as not smoking in bed, keeping combustible materials away from furnaces, water heaters and clothes dryers, paying careful attention while cooking foods, keeping a fire extinguisher in the kitchen, taking special care around open flames such as fireplaces and candles, and making certain that all smoke alarms are in good working condition.

These lessons are being well learned. In Canada, for example, fire deaths have been cut by nearly 50% in the last twenty years, thanks to several events over that time that together have increased the safety of our homes. Smoke detectors are now mandated by code to be installed in all homes. Fewer Canadians are smoking and those that still do are smoking less. Mattresses and some upholstered furniture are now ignition-resistant. Household electrical systems and appliances have improved. And educational programs by local schools and fire departments have successfully raised public knowledge about fire safety.



Firewalls are masonry or concrete walls designed to withstand prolonged fire exposure so that fire will not spread from one building to the next. In this case, the masonry firewall is used to subdivide a large wood-frame building into two smaller areas, allowing the building to meet Canada's building codes. While the entire building exceeds the size allowed for wood-frame construction, each of the smaller areas is considered a separate unit and meets the code's requirements.



Wood-frame buildings are safe



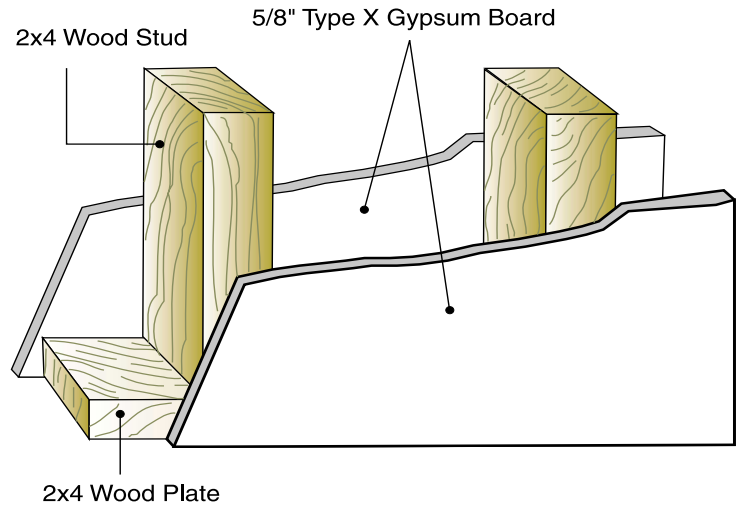
Wood is combustible — it can burn. Does this mean it's unsafe as a structural material? Hundreds of laboratory fire tests have shown that wood-frame assemblies perform very well. But actual fire data tells the story more convincingly.

North American fire-loss statistics reveal a crucial fact: *When it comes to fire protection, people are just as safe in a wood-frame house as they are in one built of light-frame steel, concrete or masonry materials.* Fire safety in a house, apartment, or other building has little to do with the combustibility of the structural materials used in its construction. Most fire fatalities are caused by the inhalation of smoke from burning household furnishings and contents, and most of those people succumb to the smoke long before the structural materials in the house are even involved in a fire.

More than 50% of house fires begin in furniture and other building contents, or occur during the preparation of meals. The structural components are rarely the first items ignited — less than 9% of the time. It's the nature of the materials within the occupied space that are most important for life safety. The fire and thermal properties of building contents and surface finishes greatly influence how fast a fire will grow and spread within a structure and how much heat, smoke and toxic gases are generated. These are important factors that determine whether or not occupants have enough time to get out. However, building contents are not as strictly regulated as building designs and construction materials. This puts some burden on occupants to be participants in fire safety.

Few burning buildings actually collapse – the fire is usually extinguished before it spreads from the building contents to the structural material. Less than 0.25% of all fire fatalities are caused by the collapse of walls or floors in burning buildings.

Fire resistance of a structural assembly is not so much dependent on the individual material properties of its components as it is on the *performance of the entire system* to resist fire. Although wood may ignite on exposure to heat or flame, almost all wood in modern Canadian homes is isolated behind fire-resistant gypsum wallboard (drywall). This wall assembly usually proves highly resistant to fire. The drywall shields wood from the thermal effects of the



Building codes may require specific levels of fire resistance for various assemblies. The fire resistance rating for a construction assembly is determined by full-scale laboratory fire tests following standardized procedures. This is an example of a wood-frame wall with a one hour fire rating, which means it can keep a standard fire contained on one side or the other for at least one hour in the standard test.

fire and also reduces its access to oxygen, which is a necessary ingredient for fire. Similarly, steel achieves good fire resistance with a systems approach. Steel softens in the heat of a fire and is typically protected by another material such as gypsum board.

Larger structures may contain *heavy timbers*, or large-dimension beams and columns, which perform differently than light-frame wood assemblies. Heavy timbers inherently have good resistance to fire. This is because wood has low thermal conductivity; as well, the “char” or burned surface of heavy timbers insulates and protects the unburned wood below. This allows large pieces of wood to burn for long periods before they become structurally unsound. Heavy timbers have even been pulled from fire-destroyed buildings, planed down, and re-used. For these reasons, heavy timber construction is given specific fire-resistance ratings in the codes.

Designing for fire safety



Building designers can't prevent people from being careless with fire, but they can ensure that at least the building will contribute to occupant safety. The primary purpose of building codes is to protect life safety. North American buildings, regardless of structural material, are safe, thanks in large part to the strict design rules established by the codes.

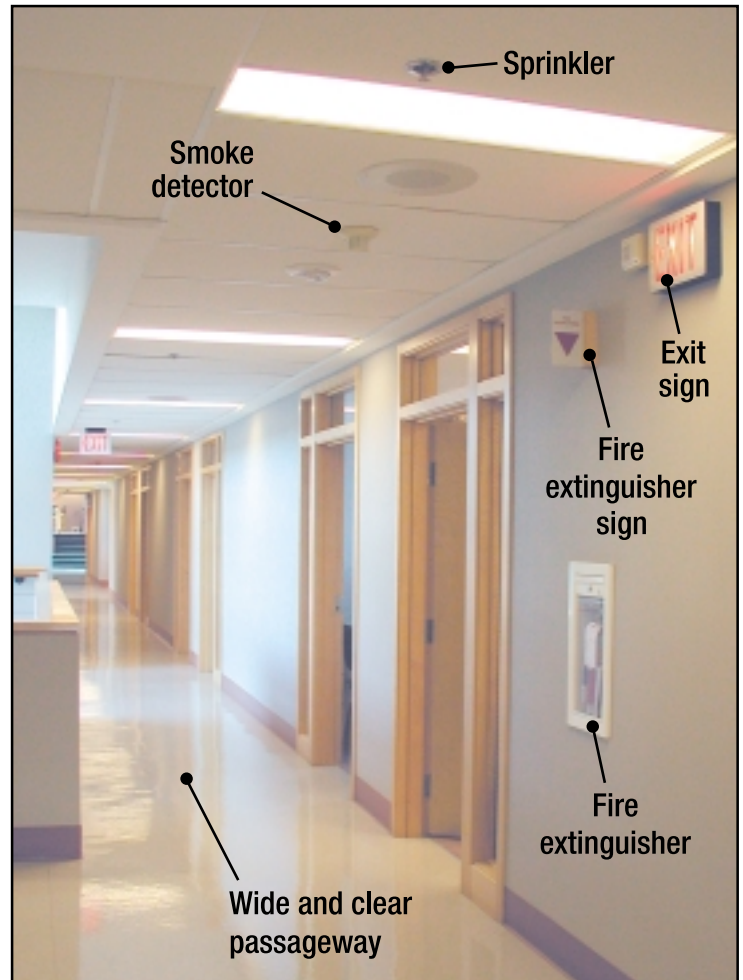
Codes contain many requirements, for example, size and location of exits, that are geared towards getting people out of buildings quickly and safely in various emergencies, including fire. Codes are also intended to ensure that buildings will hold together long enough, and resist the spread of fire and smoke long enough, to maintain the integrity of the escape routes.

There's no such thing as a "fireproof" building — there are only degrees of fire resistance. Depending on a building's use, codes specify the length of time its walls, floors and ceilings must resist fire in standard fire tests. Construction features that separate components of the building ensure that a fire and its smoke can be kept isolated, or *compartmentalized*.

Exit routes are the most important part of a building to protect from fire and smoke. These are subject to the strictest regulations, so that people can safely move from buildings as quickly as possible. The location, width, finish materials, and distance-to-escape of exit routes are all governed by codes.

Fire and smoke can travel through concealed voids that are normal in light-frame construction. *Fire stops* are blocks of solid construction, installed to close off potential transportation routes for fire. Heat and smoke may also travel through ducts that supply air throughout a building, a fire risk generally of concern only in larger buildings. In those cases, designers will call for *fire dampers*, which are barriers that move into place within ducts when fire is detected.

Fire-spread between adjacent buildings can be controlled through adequate spatial separation between buildings, and/or the use of fire-resistant barriers called firewalls. Codes limit the numbers and sizes of openings in exterior walls and firewalls.



Many elements in this corridor are required by code to ensure fire safety for the occupants of this large wood-frame office building.

Many fire safety professionals advocate installation of *sprinkler systems* in buildings to counter the many fire safety risks we take in our lifestyles. During a fire, sprinklers are automatically triggered to spray cold water over the burning area. Sprinklers keep a fire under control until the firefighters arrive. Fire insurance companies may offer reduced premiums for sprinklered buildings. And because they provide an additional level of fire safety, sprinklers allow designers a bit more flexibility with building code restrictions such as building area and height limits. For example, Canadian codes permit construction of larger and taller buildings of combustible construction when buildings are protected by sprinkler systems. Also, installation of sprinkler systems has been mandated for many larger commercial, industrial and public buildings typically of non-combustible

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Designing for fire safety

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construction. Sprinklers are not required in Canadian homes due to costs and other practical concerns.

Detection/alarm systems are vital to initiate movement of people out of the building as *early* as possible. Having detectors installed and in good working order is by far the most effective measure to keep people safe in building fires. Smoke detectors are now mandatory in all Canadian homes as a first line of warning in the event of fire.

For more information

Fire Safety Design in Buildings is a reference for applying the fire safety requirements of the National Building Code of Canada to building design. This publication is available in French and English from the Canadian Wood Council: Tel: 1-800-463-5091. Web: www.cwc.ca

Fire Losses in Canada Annual Report is prepared by the Occupational Safety and Health and Fire Prevention Division of Human Resources Development Canada and published by the Council of Canadian Fire Marshals and Fire Commissioners. The report is compiled from information supplied by the Council of Canadian Fire Marshals and Fire Commissioners, Indian and Northern Affairs Canada and Statistics Canada. A summary of the data is available on-line; the full report can be ordered for a small fee. Web: info.load-otea.hrhc-drhc.gc.ca/fire_prevention/fire_losses/annual.shtml

Fire Loss in the United States is published annually by the National Fire Protection Association and contains statistics from the NFPA survey of fire departments on fires, civilian deaths and injuries, and property damage. Includes patterns by major property class, region, and community size, and includes major trends. Available on-line; bound version can be ordered for a small fee. Many other statistical documents are also available. Web: www.nfpa.org/Research/OneStopDataShop/Reports/FireStats/FireStats.asp#free



Forintek is Canada's wood products research institute. Established as a private not-for-profit corporation in 1979, Forintek is an amalgamation of two former public laboratories whose history dates back to 1913. To this day, Forintek continues to provide leading-edge technical support to the solid wood products industry. As part of its broad program, Forintek is North America's foremost industry-funded fire research organisation for wood construction systems. For more information, visit www.forintek.ca.



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