

Heavy timber construction

It is important to consider the following aspects when designing wood structural systems for fire safety under the NBC:

- the size of the wood members,
- the methods of assembly, and
- the degree to which wood products and assemblies must be combined with other materials to achieve fire-safe conditions.

The type of construction currently permitted by the NBC depends on building size (height and area) and use (occupancy classification).

Though the structure of a modern wood-frame building may be made entirely of wood, protective finishes such as gypsum board can be applied to the framing to provide structural fire resistance where required.

Wood-frame assemblies can economically and easily be made to resist the effects of a fire for up to two hours through the use of appropriate materials and construction methods. Various configurations of wood-frame floor and wall assemblies have been tested and based on the test results, have been assigned varying degrees of fire resistance from 45 minutes to two hours.

Large dimension wood sections have an inherent resistance to fire. Wood burns slowly at approximately 0.6 mm/minute. The char created on the wood surface as it burns helps protect and insulate the unburnt wood that remains below the charred layer. The unburnt portion of a thick member retains at least 85 to 90 percent of its strength.

Hence, a wood member with a large cross-section can burn for a significant amount of time before its size is reduced to the point where it can no longer carry its load.

Heavy timber construction is defined in the NBC as: “a type of combustible construction in which a degree of fire safety is attained by placing limitations on the sizes of wood structural members and on thickness and composition of wood floors and roofs and by the avoidance of concealed spaces under floors and roofs.” Both solid sawn lumber and glued-laminated timber (glulam) members qualify under this definition, provided they have the minimum cross-sectional sizes given in the NBC. Of course, they must also be designed to resist the expected loads in conformance with the NBC and CSA O86.

To satisfy heavy timber requirements wood elements must be arranged in solid masses with essentially smooth, flat surfaces to avoid thin sections and sharp projections. This is to reduce to a minimum the surfaces which can be exposed to fire.

For the same reason, when roof arches, trusses, beams or girders are made from several pieces, the connection elements must be a minimum of 64 mm (2-1/2 in) thick and be protected by sprinklers. Where not protected by sprinklers, they must be built so that they constitute a solid mass or have the voids blocked off on the underside by a continuous wood cover plate at least 38 mm (1-1/2 in) thick. The NBC also includes specific requirements related to floor and roof assemblies in heavy timber construction.

The NBC recognizes the inherent fire resistance of heavy timber construction, and allows the unprotected wood members, including floor and roof decks, that meet the minimum size requirements to be used both where a 45-minute fire-resistance rating is required and in many noncombustible buildings.