GHL CONSULTANTS LTD

Heavy Timber Construction
Building Code and Fire Engineering Opportunities

Heavy timber construction has a long history of use in buildings up to and including 8 storey buildings still in use in both Vancouver and Toronto. Although heavy timber has been the preferred material for construction of large buildings at the turn of the last century, it fell out of use in the middle of the last century due to building codes that were introduced to the country with strict requirements for combustible construction. However, there is now a renewed interest for wood in large buildings due to the material's benefits to the environment, ease of workmanship, and the warm and inviting aesthetics.

Photo of the Earth Science Building north wing, a 5 storey heavy timber structure, under construction.

Wood construction has traditionally been perceived to have a greater risk of fire than noncombustible construction such as of steel or concrete. However, much of this perception is based on light wood-frame construction, which behaves quite differently from heavy timber construction; unfortunately, because building codes generically classifies buildings as 'noncombustible' or 'combustible', the superior performance of heavy timber in fire is not realized. In fact, heavy timber construction is arguably more similar to steel or concrete construction than wood-frame as heavy timber structural members have significant capacity to support large spans like steel framework. This characteristic coupled with the formation of char layers in fire give heavy timber construction significant advantages in fire safety not seen in light wood frame or steel construction.

Rendering of the Earth Science Building interior featuring a wood stair in a tall atrium.
(Courtesy of Perkins + Will Canada)

When exposed to fire, wood undergoes a thermal decomposition process known as pyrolysis; because of the nature of the combustion process, not all wood cellulose undergoes combustion; wood that is not consumed by the fire forms a zero-strength char layer, which exhibits significant thermal insulation properties, which in turn provides heavy timber with an inherent fire-resistance rating. In contrast, both light wood frame and steel construction require the protection of gypsum board as unprotected dimensional lumber can quickly fail in fire and steel loses significant capacity at elevated temperatures. Although prescriptive building codes have yet to recognize the advantages of heavy timber construction, they are now possible through the use of alternative solutions, and many municipal governments in Metro Vancouver are open to well-developed alternative solutions with good fire engineering analysis.

In recent years, a number of new heavy timber products have emerged, initially in the form of glued-laminated timber, and more recently in the form of laminated veneer lumber (LVL), parallel strand lumber (PSL) and cross-laminated timber (CLT). These new products are offering the design community a wide variety of possibilities in terms of design options. Our recent work at UBC's Earth Science Building (ESB) is an example of using the alternative solution / fire engineering approach to permit the use of exposed glue-laminated and LVL heavy timbers as the building structure and interior finish.

The information in this letter is for guidance only. Refer to applicable Building Codes and Fire Codes for actual requirements. The designer should always check with the AHJ for local policies and interpretations regarding the foregoing. Earth Science Building: Owner – UBC Properties Trust; Architect – Perkins + Will Canada; Structural Engineer – Equilibrium Consulting Inc