



Technical BULLETIN

► Report on: Fire Performance Volume 1, Number 2

“...new fire-resistance ratings for floor assemblies using cold formed c-section joists...”



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Fire Endurance of Floor Assemblies

The National Building Code of Canada (NBCC) is the model code that specifies the structural and fire protection requirements for buildings constructed across Canada. These requirements prescribe the minimum levels of occupant safety to be achieved.

Steel construction has a long history of implementing standards and conducting tests to meet these codes. The latest series of tests have produced new fire-resistance ratings for floor assemblies using cold formed c-section joists, suitable for constructing houses and small commercial and industrial buildings.

Steel construction has sometimes been unjustly perceived as offering reduced fire safety. Testing conducted by the National Research Council of Canada (NRC) - Institute for Research in Construction (IRC) in Ottawa, provides an indisputable third party endorsement that cold-formed steel framed floor assemblies can meet and exceed the building code requirements, and in fact out-perform the more traditional framing materials.

Testing Program

The fire testing conducted by NRC-IRC was part of a three year joint government and industry program. The project participants included representatives from the steel, wood and concrete industries, gypsum board and insulation manufacturers, home builders and related government agencies. Thirty-two fire tests were conducted on full scale floor assemblies framed using dimensional lumber, wood-I joists, concrete and cold-formed steel joists. Testing was done in accordance with fire endurance testing standards CAN/ULC-S101-M89 and ASTM E119.

The time temperature curve that is specified in the CAN/ULC and ASTM standards was adhered to in all tests. The test standards also called for the floors to be loaded to 100% of strength. This was the case for all the steel framed floors and some of the wood & wood-I floors.

Results

In the following table, the test results show that the steel framed floors achieve a higher fire resistance than either of the wooden counterparts. For the same floor assembly construction (see Figure 1), and switching only the floor joists, the cold-formed steel joists achieved a fire resistance of **74 minutes** while the dimensional wood joist achieved a rating of 69 minutes under the same loading conditions. The wood-I framed floors reached 72 minutes and the fire resistance was found to depend on the type of wood-I joist used. The effect of imposed test load was found to be significant. For the solid wood joist increasing the load from 75-100% decreased the fire resistance by 14%. The failure mode for all the floors in this comparison was structural.

The data, published by the NRC/IRC in an internal report (IRC-IR-764), will form the basis for fire resistance ratings for floor assemblies to be listed in the NBCC. The tests outlined in the following table are baseline tests from which the various effects of insulation and resilient channel can be extrapolated. The data will eventually enable derivation of fire resistance ratings for unlisted assemblies according to the component method found in Appendix D of

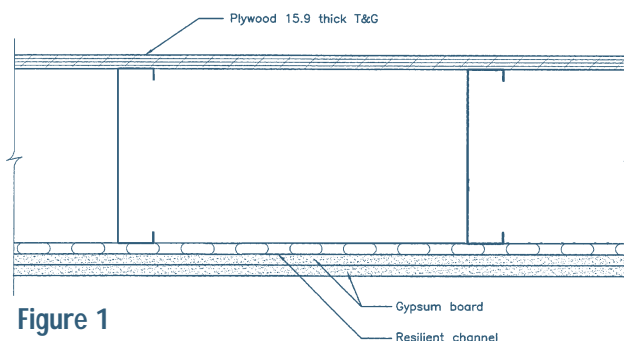

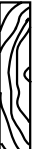



Figure 1

► *Report on:*
Fire Performance

the NBCC. The steel industry, through the Canadian Sheet Steel Building Institute, has already developed a large series of non-loadbearing cold-formed steel framed wall

assemblies that achieve the required fire-resistance and acoustic ratings and these are listed in the NBCC Part 9- Table A-9.10.3.1.A.

Comparison of Fire Resistance Ratings of Steel and Wood Framed Floor Systems		
Floor Assembly	Floor Assembly Detail	Fire Resistance (minutes)
Steel Load=100% of design load 	Nominal 2 x 8 framing 16" o.c. spacing No insulation Two layers 1/2" Type X drywall with resilient channel One layer 5/8" plywood	74
Dimensional Wood Load=100% of design load 	Nominal 2 x 10 framing 16" o.c. spacing No insulation Two layers 1/2" Type X drywall with resilient channel One layer 5/8" plywood	69
Wood I Load=100% of design load 	Nominal 2 x 10 framing 16" o.c. spacing No insulation Two layers 1/2" Type X drywall with resilient channel One layer 5/8" plywood	72

Source: M.A. Sultan, et.al.; Results of Fire Resistance Tests on Full-Scale Floor Assemblies, IRC-IR-764, May 1998

