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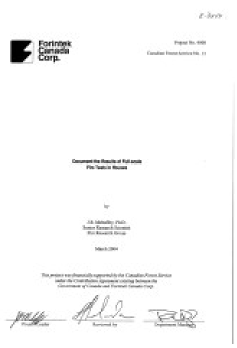

Document the results of full-scale fire tests in houses

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Résumé:

This report summarizes the results of a one-year project with the primary objective of documenting the results of six full-scale fire tests carried out on houses in Kemano BC in 2001. During the year, however, Forintek worked with a Ph.D. student at Carleton University to go beyond this objective and to compare the results of the experiments with the predictions of fire models.

These full-scale fire tests were conducted in order to assess the performance of wood-frame assemblies exposed to fire in furnished houses. The first item ignited in all tests was a waste-paper basket in contact with an item of upholstered furniture or a mattress. The fires were allowed to follow their natural course for a significant period of time without intervention by fire fighters so that the houses' wood-frame structures were challenged in a realistic fashion. Each experiment was instrumented to measure temperatures at up to 50 locations within rooms and building assemblies.

Observations taken onsite and a quick review of the raw data, allowed important conclusions to be drawn:

Fire spread quickly from the waste-paper basket to upholstered furniture or mattresses. Subsequent fire development was rapid with flashover occurring rather early. The temperature in the room of fire origin got much hotter than in standard fire-resistance tests.

Properly designed wood-frame walls and ceilings act as a significant barrier to fire spread.

The contents of a house (in particular, upholstered furniture and mattresses) are more of a fire-safety threat than the wood-frame structure. In all fires, untenable conditions developed before the structure was involved in fire.

was involved in fire.

In very large fires, a firewall provides a significant barrier to the spread of fire between two buildings of combustible construction.

A detailed analysis has also been undertaken whereby the fires were simulated using available fire models in order to assess whether the models give a good representation of real fires and of the performance of wood-frame assemblies. The results of this analysis, summarised below, were very encouraging.

The predictions of Forintek's computer model WALL2D for the temperature between 15.9 mm fire-rated gypsum and wood studs in walls agreed very well with the measured values. Both experiment and theory demonstrated that fire-rated gypsum delays the involvement of studs in fire for a very long period of time.

The predictions of BREAK1, a commercially available computer model, were very close to the times at which window glass was observed to crack.

Using measured fire temperatures and a simple model, the rate of burning during the early stages of the fires, in which it was primarily a couch that was burning, was similar to that of upholstered furniture observed in a comprehensive European furniture study.

A simple model for predicting the maximum temperature rise in a fire-room with closed doors and windows was found to give predictions in good agreement with the experiments.

This report summarises the findings of four of the six tests conducted in Kemano. Each of these four tests has, however, been studied in more detail than originally planned. Forintek scientists will continue to study the data from the Kemano fires. In particular, simulation of these fires using available computer models will continue. If fires in wood-frame structures can be modeled accurately, one can begin to assess the advantages and disadvantages of various design options. In the end, the computer models will be used to evolve recommendations on how to improve the fire-safety performance of housing.

Fires, Building - Tests

Documents

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