

## Research Trends and Results

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# Full-scale fire experiment of three-story wooden school building (preparatory experiment)

NARUSE Tomohiro(Ph.D., Engineering), Head

NII Daisaku(Ph.D., Engineering), Senior Researcher

Fire Standards Division, Building Department

FUKAI Atsuo, Head

YOKOTA Yoshihiro, Researcher

Standards and Accreditation System Division

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### 1. Introduction

The act concerning promotion of wood utilization in public buildings, etc. was enforced in October, 2010. Therefore, NILIM started to prepare a basic draft by collecting necessary data to review provisions related to fire protection of Building Standards Law regarding three-story wooden schools.

### 2. Purpose of preparatory experiment

Full-scale fire experiment of three-story wooden school building (preliminary experiment) was conducted in the premises of NILIM on February 22, 2012 and as a result, the following issues emerged.

- Early spread of fire to upper floors from the room on the first floor where a fire occurred through the external openings (about four minutes after setting fire to the second floor and about six minutes after setting fire to the third floor)
- Early spread of fire through fire walls (about 18 minutes after setting fire on the first floor)
- Fire walls collapsed without freestanding (96 minutes after setting fire)

In order to address these issues,

- to make interiors of the building except pillars, beams and floors resistant to fire,
- to place balconies and eaves to upper part of openings of outer wall and
- to separate fire walls structurally and change fire-proof doors and so forth

were worked out as countermeasures.

And it was intended to confirm their effectiveness and to gather data for evaluation of fire spread routes, impacts on surroundings of the building and impacts on main construction frames of the test body in case of long continuing fire, etc. and accordingly full-scale fire experiment (preparatory experiment) was conducted in Gero City, Gifu Prefecture on November 25, 2012. The constructed test building was a quasi-fire resistive construction for one hour duration with the building area of about 310m<sup>2</sup> and the total area of about 850m<sup>2</sup>.

### 3. Outline of the result of preparatory experiment

In the fire starting room, the fire source grew to limited part and did not spread in the whole room and as a result, combustibles stored in the fire starting room were reignited 50 minutes after setting fire. After that, the fire source gradually grew and the fire spread to the whole room about 89 minutes after setting fire and flames spouted from external openings.

The spread of fire from the fire starting floor (the first floor) to the second floor occurred about 129 minutes after setting fire through the floor of the second floor and the spread of fire to the third floor occurred about 139 minutes after setting fire through external openings. After confirmation of the spread of fire to the third floor, fire extinguishing started at the moment 142 minutes after setting fire.

The results indicate the following: firstly, the spread of fire from the fire starting room to staircase and the spread of fire through fire walls did not occur because early

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spread of fire to upper floors through external openings was prevented, and secondly, although pillars of the fire starting room carbonized 5~6 cm in-depth from the surface after completion of the experiment, both of the test body and fire walls did not collapse. Thereby, effects of the countermeasures against the issues of the preparatory experiment were confirmed and various data were gathered.

## 4. Conclusion

Based on the preliminary experiment and this preparatory experiment, after adjusting specifications and test methods, it is scheduled to conduct again full-scale fire experiment with building configuration which is supposed to be standardized and to prepare a basic draft in 2013.

[ Reference ]

As for the results of preliminary experiment and preparatory experiment and outline of video image, refer to the following URL.

<http://www.nilim.go.jp/lab/bbg/kasai/h23/top.htm>



Photo: The spread of fire to the second floor at the time of 137 minutes after setting fire