

# Development of design and construction technologies for mixed-structure buildings that use new wooden materials

## Building Department

Technologies are now under development to contribute to the establishment of design and construction technologies for mixed-structure buildings that mix wooden structures using large wooden panels, such as cross-laminated timber (CLT), and other structural types or other wooden structural types to respond to the need to promote the use of wooden materials, expand usability by effectively using the characteristics of wooden materials, shorten the construction period, and respond to the need to effectively use the designability of wooden materials.

## Social background and issues

- The Basic Policy on Regional Empowerment for Japan's Growth (reached Cabinet Decision in June 2015) stipulates that the development of CLT and other wooden materials and building wooden public buildings shall be further promoted to increase the number of wooden buildings.
- The policy calls for the increased use of wooden materials, such as CLT, in mid-to-high-rise buildings. Combining wooden materials with fireproof members, such as an RC structure (= mixed wooden structure), is considered effective in increasing the use of wooden materials. Yet, actual experience in constructing such buildings or technical references are rarely available.
- To spread mixed wooden structures, it requires the development of structural design and fireproof design methods and the establishment of standard specifications for joint sections and other parts so that anyone can build such buildings. It is necessary to present standard designs and construction methods from the perspective of ensuring durability as well.

## Study contents

### Examination of structures, fireproofing, and durability performance needed to materialize prototypes

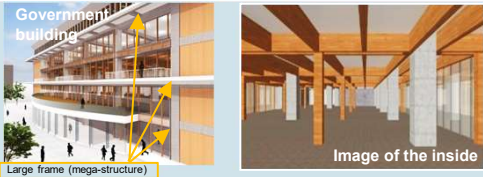


The main technological development concerning structural performance, fireproofing performance, and durability performance that are necessary to materialize the main variations (prototypes) of expected mixed-structure buildings are examined.

○ Main issues related to each type

Type I: Examination of how to control fire on the upper floors

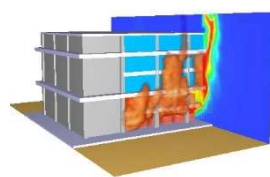
Type II: Investigation of the characteristics of mixed-structure buildings

Type III: Cases when different types of wooden materials are used

Type	Image of frames	Benefits
<b>Type I</b> Two-layer RC structure Wooden frame is freely arranged inside the large frame	 <p>Government building Large frame (mega-structure) Image of the inside</p>	- Flexibility - Visible arrangement of wooden materials is possible on the fourth floor and up. - Fire safety section with the floor and core of the mega-structure
<b>Type II</b> Use wooden materials on the walls and floors of each level using RC structure and S-structure frames	 <p>RC+CLT wing walls (apartment building) S+CLT walls (office building) S+CLT walls (apartment building)</p>	- Flexibility - Realization of building higher than four floors by arranging wooden materials in visible parts of indoor spaces - Fireproof design can be relatively easily created (section at each floor)
<b>Type III</b> Realizes free spaces with large spans with wooden materials	Mixed construction using CLT walls + beams made of integrated woods 	- Free spatial structure - More efficient construction by reducing the number of parts to use



Partial structure test using RC framework + CLT wing walls



Examination of the risk of fire propagation during a fire in multi-story buildings



Fire in wooden section



Air blowing and water spraying test on outer walls of ventilation structure

Expansion of new demand for wooden materials and promotion of uses through highly flexible designs and construction using the proper materials in the proper places

### Relevant articles

- Development of design and construction technologies for mixed-structure buildings that use new wooden materials (P.88)

\*General Technological Development Project: A system to comprehensively and systematically implement researches through cooperation among the industry, academia, and the government under the initiative of the administration section by selecting especially urgent themes that are also applicable to a wide range of fields among important research themes related to construction technologies