

Spanning 9m with various combinations of small and short lumber – Structural Design of Kindergarten in Date City

Ryoma MURATA*

*Ryoma Murata Building Studio Ltd.
#3 Komatsu Bldg. 3F, Sumiyoshicho 12-18, Shinjuku City, Tokyo JAPAN
murata@murataryoma.com

Abstract

Kindergarten in Date City (in Fukushima, Japan) was built with locally produced Japanese cedar lumber. In order to construct up to 9,1 m span using commonly distributed solid wood with standard small cross section, various timber frameworks such as truss, tree-shaped column, and reciprocal frame were utilized. In this paper, the key points of structural design and construction process of Kindergarten in Date City will be described.

In Japanese timber construction, solid wood, laminated wood and LVL (laminated veneer lumber) are usually used for the framework. Among them, solid or laminated wood with small cross section is widely distributed for housing use and easy to obtain with low cost. On the other hand, so far, laminated wood or LVL with large cross section has been used for building a long span such as, for example, a playroom of kindergarten, but since they are ‘made to order’ and relatively expensive, building a long span by using a combination of small and short lumber is effective in reducing construction costs. In addition, such kind of timber frameworks are suitable for expressing the fascination of wood as building material.

For this kindergarten, the following timber frameworks were designed: M-shaped trusses (120 mm square section @ 910 mm) with a span of 9,1 m for the playroom (Figure 1), tree-shaped column supporting 9,1 m square roof with one log column (250 mm in diameter) in the centre and eight radial brackets (120 mm square section) for the classroom of 0-2 year old children (Figure 2), and reciprocal frames supporting a roof of 6,4 m span with beams of 4,5 m in length (120 x 210 mm section @ 910 mm) for the classroom of 3-5 year old children (Figure 3).

Processing of wood was carried out efficiently by automated pre-cut machine for the most part. The roof by the reciprocal frames was erected with temporal supports at the centre of the span, and after the erection completed, the temporal supports were removed. Vertical displacements after support removal were measured and compared with the estimated values from analysis¹.

Conclusion: The key features of structural design of the Kindergarten in Date City were described. Various wooden spaces were created by small-section standard lumber that is inexpensive and easy to obtain, by devising M-shaped truss, tree-shaped column, and reciprocal structure.



Figure 1. M-shaped trusses



Figure 2. Tree-shaped column



Figure 3. Reciprocal frames

References

- [1] Architectural Institute of Japan, *Standards for Structural Design of Timber Structures*, Architectural Institute of Japan, 2006.