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Integrating Design, Construction and Logistics in Japan and Overseas CLT Building Projects

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Abstract: this paper describes optimization efforts throughout the process from design, delivery and construction to operations in two CLT (Cross Laminated Timber) building projects. CLT gives us an opportunity to change our mindset and examine issues concurrently instead of working separately by phase or by profession. The author, as project manager, led the interdisciplinary discussions.

Key words: off-site production, design integration, lean construction, CLT, remote communication

On the first project (PJ1), integrating the design team and the construction team was not initially planned, but it evolved as we learned the characteristics of CLT while determining every fabrication detail and responding to the owner's request to minimize construction time. The second case (PJ2) was a mass housing project overseas. How to deliver CLT panels from Japan was an additional challenge (Fig.1).

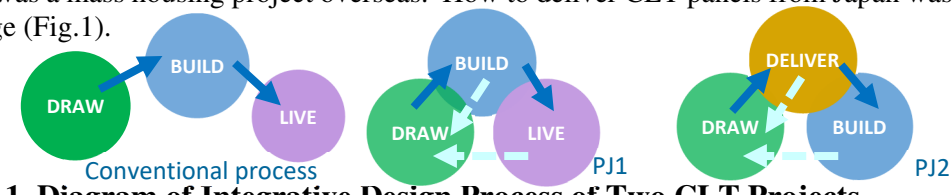

Figure 1. Diagram of Integrative Design Process of Two CLT Projects

PJ1 was a commercial office building project utilizing the large panel sizes of CLT (fig. 2-1). Fig. 2-2 shows one of the design integration achievements; fresh air intake ducts were pre-installed in V-shaped CLT beams at a CLT factory. This contributed to swift, safe construction with good quality.
The PJ2 project site is located on an island in the USA. Japanese team members with experience of PJ1 emphasized the importance of constructability being integrated into the design, in order to maximize the advantages of using CLT. This was welcomed by the US team, who were unfamiliar with CLT, as it helped to solve a labor shortage problem. In addition to US-Japan building code differences, the delivery-related issues were examined and the special conditions, such as CLT panel width limitations (they must fit in shipping containers), were reflected in the design. During test construction, a structural core unit, consisting of bedroom and bathroom, was assembled off-site (fig. 2-3). This approach was, however, discarded due to vehicle access difficulty. Instead, the erection work speed was significantly improved by repeating construction - over 100 houses (fig. 2-4).

Figure 2. 1)interior view, 2)duct in CLT beam, 3)test unit delivery, 4)housing construction site

PJ2 has moved on to its next phase and the continuous improvement (*kaizen*) discussions continue for a new design with module-size CLT panels. By meticulously bridging design and construction, good quality prefabricated CLT buildings can be provided regardless of the distance between site and factory.