

DEVELOPMENT PROJECT OF P3, WOODEN POST AND BEAM BUILDING SYSTEM PRESTUDY Helsinki University of Technology 2009

SUMMARY

Although post-and-beam constructions are common in all buildings, including wooden buildings, there are surprisingly few comprehensive wooden construction systems on the market that are well-suited for industrial production and modern module fabrication. There is also a lack of generally applicable norms and standards for wood post-and-beam construction systems.

Wooden post-and-beam construction systems can be used for a large number of purposes: they are suitable for building small houses as well as for wooden residential buildings in general, including the frames of wooden apartment buildings. Wooden pillar-beam construction systems also can be applied to building business facilities, public buildings, sport facilities as well as industrial facilities and warehouses. They are also suitable for module building, e.g. frameworks of balconies and small-scale buildings like cottages, saunas, garages, storages and sheds.

Traditional wooden post-and-beam constructions include the timber framing and post-and-beam construction methods common in Great Britain and North America, and their Central European counterpart, Fachwerk. In these systems, the wooden columns and beams are connected by genuine wooden joints to form a construction frame that is stiffened by diagonal brackets. The traditional Japanese applications of post-and-beam systems typically use dimensionally accurate, elegant wooden joints. In Europe, North America and Japan, applications of the traditional post-and-beam construction method are still common. The method lends itself to applications suitable for all building forms, and producers can be found on the Internet. There are also modern patented or design protected wooden post-and-beam systems on the market outside Finland.

In the late 1960s and in 1970s, there was special interest in Finland in wooden post-and-beam and pillar-plate type of element systems. Development studies of common concrete element systems, titled BES and PLS-80, formed the basis for the emergence of these systems. At one point, the Finnish **Domino** and **Bungalow** systems became particularly popular for building small houses, semi-detached houses and small public buildings, such as nurseries. For a short while, an industrially prefabricated holiday home building system, **Moduli**, was popular for building holiday homes. Time has shown the vulnerability of these Finnish wooden construction systems. Their essential problems included scarce heat insulation, poor sealing of joints, the vulnerability of facades with no eaves, constructions that formed thermal bridges, and too optimistically constructed flat roofs.

The central elements of the modern post-and-beam system are prefabricated posts and beams and the standardized connection types or prefabricated joint components between them. A number of joint elements types are currently being used, from external metal grooves to dimensionally accurate wooden joints and elegant metal joint elements. Standard post-and-beam and metal joint elements have also been used to develop complete, modular construction systems. .

Building and wood product industries have moved away from handwork to computer-aided design and manufacturing. CAD (Computer-Aided Design), CAM (Computer-Aided Manufacturing) and CNC (Computer Numerical Control) are modern design and manufacturing tools. Post-and-beam systems give a natural opportunity for modular design work, for the utilization of building information modeling. An advanced planning system enables its users to apply for a building permit when only the most important features of the building have been defined, such as the main

dimensions, space arrangements, construction types, façade plans, and the main materials. All other more detailed planning work can be made by the supplier of the building modules.

3D-CAD planning programs suitable for post-and-beam building are nowadays available both for architecture design and for construction and product design. The most advanced programs are compatible with planning, component modeling and CNC manufacturing, which saves time and effort in the end-to-end production chain. The aim is the establishment of so-called BIM systems (Building Information Modeling) which can be utilized in all the phases of planning, production and construction. Advanced system applications help to improve the management of the building process, improves quality and gives better opportunities for making use of earlier related work and of the expertise of all the parties in the chain.

Since Finland has no open wood post-and-beam systems or standards, the construction solutions are always made case by case. We have a need for manufacturer-independent, open-to-all system. Wide-based application of such a system would enable the Finnish wood product industry to engage in major component production that would also be particularly suitable for export. Advanced construction systems enable the selling of either complete buildings, parts of them, mere building frameworks or individual building components. The system could be adjusted to meet the special requirements of each country it is exported to, even though the products themselves are produced in Finland.

New energy regulations will change the public attitude towards building frames, and the wooden post-and-beam construction will regain its popularity. As the heat insulation requirements tighten and the required insulation thickness increases, the traditional wooden frame construction is not the only natural building frame; the wooden post-and-beam frame is a logical alternative that allows the use of separate outer wall constructions and elements. Wooden post-and-beam building will lead to a high-tech-type, dimensionally accurate building method and to a high quality appearance. Simultaneously, it would also create new products for wood architecture, wood construction and wood product industry.

Yrjö Suonto, architect SAFA

Mika Leivo, student of construction technology HUT