

The conservation and renovation of the timber constructions in the Palace Museum

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Abstract As the imperial palace of the Ming and Qing dynasty, the Palace Museum in Beijing is the most complete preserved timber architectural complex in the world. The paper aims at highlighting some of the main features of the timber structures of the Palace Museum as related to wooden structural forms, architectural mechanics, different types of mortise and tenon applied to the architecture, timber of different kinds, member sizes and traditional veneer constructions, in an attempt, with related case studies, to introduce the conservation and preservation of its timber constructions. The traditional and new methods of restoring or replacing the damaged members of the vertical and transversal constructions are also summarized. In addition, some materials used in preservation are also introduced and briefly reviewed.

Keywords the Palace Museum, timber construction, conservation, renovation

The Palace Museum, which was constructed in the 18th year (1420) of the reign of the Yingle emperor, is the largest and the most complete ancient palace complex existent in China as well as in the world. It has manifested traditional Chinese construction technology and revealed a remarkable achievement in art. By illustrating the main types of the ancient timber constructions and representing the construction features, the paper provides some useful references for the conservation and renovation of the northern palace-style buildings that were constructed during the Ming and Qing Dynasties.

The main structural forms of the palatial architectures, in terms of the buildings' cross section and the shape of the roof, are analyzed. The different aspects between the buildings are presented, including architectural mechanical, mortise and tenon joints, wood species, member dimensions and traditional veneering. The advantages and disadvantages of each typology are discussed.

The methods for protecting timber members are also presented, for example, the application of the *Toufeng* (the gaps between the walls and columns used to ventilation), Tong oil plaster, as well as *Dizhang* (layers covering the timber members).

The traditional and new methods used in the Palace Museum for restoring or replacing the damaged timber members are described. Some cases studies are presented, like the replacement of the column

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bases (named Dunjie), the strengthening of load-bearing beams, and the intervention in the Wu Gate (more than 40 years ago) with splints and additional trusses.

At last, some products used in the protection of the timber constructions are introduced. As those are relatively new materials in terms of China's conservation practices, the effect of those materials, such as some preservative treatments, need to be observed further.