WOOD BUILDINGS AND FIRE IN HISTORICAL URBAN CONTEXT, IN EDO (FORMER TOKYO) AND VIENNA

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ABSTRACT: This paper provides analysis on the historical priority of city structure and usage of wood in Tokyo (Edo) and Vienna through social scientific approach about conversion to middle- and high-rise, cost of materials, and social countermeasures against fire. Wood is one of the most primitive materials, and each domestic area has own traditional use of the material in the period of formation of the cities. The aim of this historical analysis is to deepen comprehension of various utilization of wood through (1) political priorities on physical urban structures and (2) orders of establishments of social countermeasures.

KEYWORDS: Tokyo, Vienna, Use of Wood, Fire, Fire Fighting, Urban Structure

1 INTRODUCTION

1.1 CONTEXT OF WOOD BUILDINGS

1.1.1 Social Demands for Wood
From the social point of view, wood is expected to use in urban building in recent years as a sustainable construction material because of low CO2 emission during production. Wood had been used as workable material in various domestic areas from ancient days, but also had been limited to use to large urban buildings because of its combustion or depletion of material by reckless deforestation during the period of the Industrial Revolution. And then we had not been using wood on large urban buildings as the main construction material for a long time.

1.1.2 Reluctances of Individuals against Wood
Since 1990's many countries revised their former prescriptive building codes witch excluded the use of combustible materials for large buildings to performance-based codes. And then after 2000’s, several multi-story wood-based buildings have been built. Performance based codes require equivalent fire resistance between wood and non-combustible materials. The costs of fire-resistance wood constructions tend to be more expensive than other structures with non-combustible materials because of the requirements of “equivalence”. Currently, it is difficult to offer the cost benefit of wood-based buildings for individual building owners.

As wood is a traditional material, each individual knows a lot about the character and has fixed image and silent understanding from the domestic way of use. Sometimes the knowledge tends to cause certain prejudice about use of material, even with contemporary solutions.

1.1.3 Potential Trade Off
Actually the requirements of "equivalence" are not fair to wood construction. Non-combustible materials are already burnt by fossil fuels and wood can be used as fuel in the future. That is why wood is recognized as a sustainable material. Usually fire resistance of wood-based structures is realized by coverage of non-combustible materials. The solutions are technically reasonable, but these are not the best for sustainability or cost efficiency. The reasonable trade off of fire safety and cost efficiency of wood-based buildings should be discussed from comprehensive viewpoints. Comparative study of various histories of contexts of wood will give us objective viewpoints on our way of thinking.

1.2 METHODOLOGY

1.2.1 Aim
The aim of this paper is to analyse various historical urban contexts of utilization of wood and to recognize different priorities and cost optimizations with contexts of these.

1.2.2 Target
Japan and Austria are two of the countries, which have similar strict technical requirements on wood-based buildings concerning equivalent fire resistance. Research targets are the historical contexts of wood in the capitals of the countries, Tokyo and Vienna.

1.2.3 Method
Change of physical urban structures and societal activities on wood buildings in the long term in Edo (former name of Tokyo, till 1868) and Vienna are analysed. An illustration of “levels of decision making” (Figure 1) is used for a map of the analysis. The illustration shows the relationships between “structure” (physical area) and “wholes” (human group) with time spans as frequency of change. Upper physical area and human levels are more stable and effective to design priority of lower levels. Characteristics of upper physical and human levels of “base building” are analysed by (1) design priority of urban structure and blocks and (2) orders of establishments of social countermeasures against fire.

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In Edo, all the buildings were constructed of wood, and more than two-story housings were prohibited to build for the common people by political reason. More than two-story buildings were recognized as displays of high social class.

### 3.2 MATERIAL SUPPLY

The selection of material was not only because of technical reason, but also cost of materials. Vienna is rich in clay soils and coal from nearby Bohemia for brick production. As a result, brick was cheaper than wood as construction materials at that time. Low-rise housings in Edo were built by wood which supplied by water transportation and inner city canal systems.

### 3.3 FIRE FIGHTING

Vienna used wet (water based), and Edo used dry (demolition) fire-fighting system.

By Edo system, fire fighters (for each social class) were ruled in 1600’s, and after the main reformation of the city to Tokyo (by Meiji Restoration), new fire-fighting system and the fire insurance system were ruled, and then the city was converted to middle to high-rise after World War Two. City center of Vienna keeps similar volume of buildings from the end of 1800’s, but that of Tokyo has been fairly changed.

### 4 CONCLUSIONS

Contrasts of technical solutions in histories show various priorities of city design and cost optimizations against fire and materials. The recognitions of various backgrounds deepen understanding both international and domestic situations of fire resistant wood-based buildings.

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### REFERENCES


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Notes:
As word definitions of this paper, “wood” means material or traditional (solid wood or pure wood) products or structure, and “wood-based” means contemporary (hybrid or chemically treated) products or structure.