

Difference in Deterioration Rates Based on Location in Wooden Crib Dams

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INTRODUCTION

Wood has received significant attention as an environmentally friendly material. Particularly, the efficient utilization of thinned wood in construction and its carbon dioxide (CO₂) emission reduction potential have drawn attention as a countermeasure to global warming. As a result, small-scale dams have recently been constructed with wood instead of conventionally used concrete. There are not many studies on the actual conditions of deterioration of the wood parts of the wooden crib dams because the construction of modern types of the wooden crib dams have started in 2000 in Japan. In addition, lack of information has caused several challenges in the design, inspection, and maintenance of the dam.

This study aims to investigate the yearly changes in deterioration rates of wooden crib dams and also to determine the differences in deterioration rates based on the location in the dams.

METHODS

Four wooden crib dams constructed between 1998 and 2000 in Kyoto Prefecture (**Table 1**) were investigated. A resistograph (drill resistance testing equipment) was used to measure the thickness of the deteriorated part of the wood. The test has been conducted almost every year for a period of more than 10 years since the construction and the deterioration rates (the thickness of deteriorated part which proceed in a year) were recorded. The yearly change in the deterioration rates of each dam was analyzed, and the difference in deterioration rates based on the location in each dam was examined.

RESULTS

Yearly change in the thickness of deteriorated parts of Keihokucho 2 dam is shown in **Figure 1**, where the locations above and below the dam spillway are indicated as wing and main body, respectively. The thickness of the deteriorated parts of the other three dams also increased at a constant rate as the number of years after dam establishment increased. Hence, there is no sudden change in deterioration rates of wooden crib dams over time. In addition, the dispersion of the deterioration rates in a single dam were significantly wide. The deterioration rates of the wing were higher than those of the main body in Keihokucho 1 and 2 dams, both of which have running water during normal times. On the other hand, the difference in deterioration rates between the wing and main body was minimal when data from Kuta and Ooe dams where there is almost no running water during the normal period of time were compared.

Tab. 1 Overview of each dam investigated in the study

Name of dam	Kuta	Ooe	Keihokucho 1	Keihokucho 2
Year of establishment	1998	1999	1999	2000
Hight of dam (m)	1.5	1.3	1.87	2.89
Length of dam (m)	5.15	5.8	18.5	16
Wood used	Japanese cedar and <i>Hinoki</i> cypress	Japanese cedar	Japanese cedar	Japanese cedar

Deterioration rates of each part of the Keihokucho 2 dam are shown in **Figure 2**. Deterioration rates are largely different depending on where the wood is located even within a single dam. Wooden parts located near running water (spillway, right under the spillway, and dam base) during normal conditions tend to have lower deterioration rates and the longer the distance from those locations, the higher the deterioration rates tend to become. The distributions of the deterioration rates of other three dams were similar to those of the Keihokucho 2 dam.

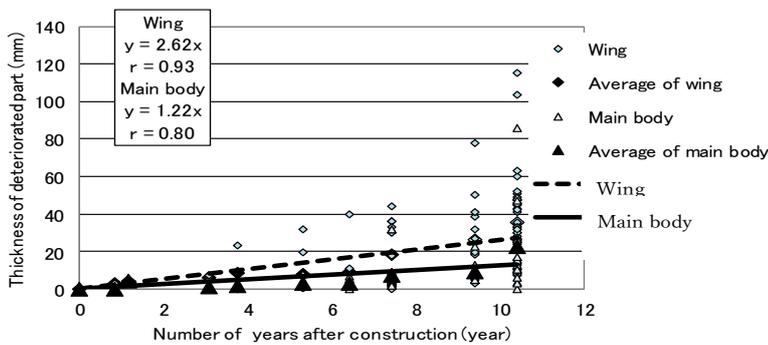


Fig. 1 The relationship between the number of years after establishment and the thickness of deteriorate part of Keihokucho 2 dam

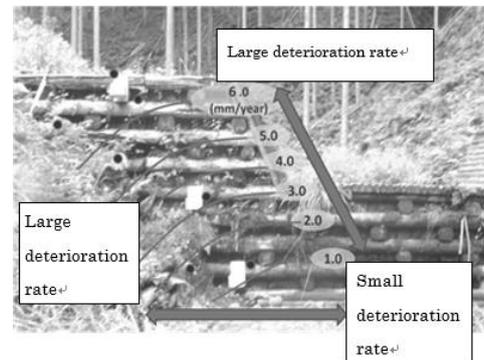


Fig. 2 Distribution of main deterioration rates which represent each part of Keihokucho 2 dam

CONCLUSION

The average deterioration rates of wooden crib dams do not change over time. On the other hand, the longer the distance from where the running water exist, the higher the deterioration rates are. During the design of a wooden crib dam, the difference in the degree of deterioration based on the location of the wooden parts in the dam should be considered. It is also important to consider the difference in the deterioration rates based on location and investigate different parts of the dam during inspection.

Keywords: detereoration rate, wooden crib dam, spillway, running water, location