A Study on the Classification and Evaluation of Loads Acting on Driftwood Trapping Structures Based on Flow Process of Driftwood Groups

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In Japan, it has been revealed that driftwood-related disasters are on the rise each year, and the amount of driftwood reaching downstream areas is increasing. Due to buoyant effects, driftwood is carried by shallow currents, allowing it to easily travel to downstream regions where residential areas and infrastructure are located, resulting in bridge blockages and loss of life. Furthermore, it has been reported that groups of driftwood collide with driftwood trapping structures such as erosion control dams causing damage to their crests and side sections. Currently, driftwood trapping countermeasures are being constructed to prevent driftwood from flowing downstream, and large amounts of driftwood are trapped. However, in current designs of driftwood trapping structures, only the static water pressure load is considered, and the impact loads produced by driftwood groups have not been considered. This study evaluates the impact loads exerted by driftwood groups on driftwood trapping structures. First, an evaluation of loads with and without the formation of driftwood groups was conducted, demonstrating that driftwood group can influence impact loads. Subsequently, the experimental results were organized to clarify how changes in the number and length of driftwoods affect the acting loads. The time dependent characteristics of these loads are examined, and their defining features are clarified. In addition, because driftwood trapping countermeasures are installed in the downstream area, experiments were conducted to examine the effects on the acting load by changing the gradient and flow rate, which are parameters of the downstream environment, and the results were compiled. The results showed that the loads exerted by driftwood groups on driftwood-trapping structures can be divided into three categories (collision interval, transition interval, and accumulation interval) based on their temporal progression. Additionally, it was found that the maximum collision load depends strongly on the total mass, flow velocity, and accumulation height of the driftwood group. Furthermore, the maximum collision load clearly exceeds the static water pressure load, suggesting the necessity of accounting for dynamic impact forces in design of driftwood trapping structures.