

Abstract

This research is aim at investigating the effects of wall mass in controlling heat transfer through exterior wall using water as a thermal mass. The study is divided into 3 parts: 1) to study the thermal performance of water-wall in reducing the effect of radiation heat transfer. 2) to study efficiency of different mass wall in protecting heat transfer, and 3) to study the thermal property and mass effect of water-wall. The experiment was performed in controlled environment.

The propose of the research is to investigate the property of water-wall and determine suitable configurations of water wall for buildings in Thailand. The results of the study indicated that the heat capacity effects on the amount of heat transfer through wall. If the heat capacity of the wall is higher, the heat transfer rate as indicated in the inner surface temperature will be lower, resulting in longer time lag. In contrary, if the heat capacity is lower, the heat transfer rate will be higher resulting in a shorter time lag. Besides, it was found that reducing the effect of direct radiation heat transfer by adding external surface material will decrease wall-temperature changing rate and increase the time lag. When adding the direct radiation shield to the wall with high heat capacity, it has greater effect to reduce heat transfer and to increase time lag longer than the wall with low heat capacity.

In terms of designing the suitable water-wall for buildings in Thailand, the water-wall should have a direct radiation shield, an equipment to control the shield and mechanisms for draining off water from the wall at night. From 7: 00 am to 6: 00 pm, it is necessary to use the water-wall with direct radiation shield for reducing the heat transfer. From 7: 00 pm to 6: 00 am, it is necessary to use the water-wall without water and direct radiation shield. This is to increase the heat transfer rate of the wall and remove the heat that is stored in the wall during the daytime.