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A Case Study on Moisture Problems and Building Defects

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Abstract

Hospital buildings are one of the complicated buildings that normally associate with a moisture problem. Besides environment factor, the different operation hour, poor workmanship and improper waterproofing installation also contributes to the moisture problems. Controlling the moisture problems seem to be vital in ensuring the building functionality. This study identifies the moisture problems and it's causes for the Hospital buildings in Malaysia. Based on various records obtained, this study discusses the defects according to four major building elements that are ceiling, wall, floor and roof. This paper concludes that the identified defects have great potential to affect the hospital building function.

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Keywords: Moisture problems; building defects; hospital

1. Introduction

Definition of moisture problem is “any visible, measurable or perceived outcome caused by excess moisture indication indoor climate problems or problems of durability in building assemblies caused by various leaks of water” (World Health Organization (WHO), 2009). However, WHO (2009) also had identified “moisture can be transported in both vapour and the liquid phase by diffusion, convection, capillary suction, wind pressure and gravity (water pressure)." Moisture problem commonly happens at every building. The issues of moisture that caused building defects are mainly recognised by many scholars such as Soronis (1992); Kian (2001); Chew (2005); Kubba (2008); WHO (2009); United States Environmental Protection Agency (EPA) (2013). According to Almas et al. (2011), moisture known as a

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major caused of building defect by 76 per cent and WHO (2009) identified that moisture caused 75-80 per cent of building envelopes defects.

Record shows billions of dollars have been spent to rectified defect due to moisture problems in the United States property (Kubba, 2008) and study done on 420 buildings in Sweden shows that a moisture cause in vivid microbial growth with 65% of the buildings (Wessén et al. 2002). Kubba (2008) has stated the "water is typically the main culprit" for microbial growth that lead to sick building syndrome. In addition, moisture is also known as a main source to poor indoor air quality, unhealthy buildings and mould growth (Kubba, 2008). There are many ways that moisture can enter to the buildings such as rainwater penetrating through leaks in walls, floors, roofs, windows and doors (Kubba, 2008).

Malaysia is a tropical country. The average temperature of Malaysia is constantly high around 26℃ throughout the year with humidity about 80% and high rate of evaporation. In addition, the rainfall is heavy with more than 2500mm (International Business Publication, USA, 2008). Compared to other western country, Malaysia is heavily exposed to moisture problems which lead to adverse on health effect, deteriorate the building faster and affect its functionality. The objective of this paper is to identify the moisture problems that occurred at the hospital building, the causes of moisture problem and the building defects.

2. Literature Review

There are ten (10) common moisture problems in buildings that were identified by WHO (2009); (1) rainwater or groundwater leaking into the enclosure (roof, wall, windows and foundation), (2) plumbing leaks and spill, (3) water wicking from capillary suction through porous building materials (concrete or wood), (4) rainwater, condensation or plumbing water, (5) infiltration of warm or moist outside air through cracks and holes in the enclosure during warm and humid weather, (6) exfiltration of warm or moist indoor air through cracks and holes in the enclosure during cold weather, (7) unvented or poorly vented sources such as swimming pools, (8) insufficient dehumidification by heating, ventilating and air-conditioning systems, (9) poor condensate drainage due to heating, ventilation and air-conditioning system deficiency and (10) enclosure of wet materials in building during construction.

The main building moisture problems are caused by leaking at building elements such as roof, wall and ceiling. For instance, a study done by Chew (2005) identified that among 14 major defects at walls and floors are water leakages through cracks, water leakages through pipe penetration, and water leakages through joints. According to Chew (2005) water leakage ranks as the highest (53 per cent) of presence defect at wall and floor. The issue of waterproofing is known as the main contributor to the failure of the building that leads to the moisture problems. For example, Kian (2001) identified that the flat roof leaky due to waterproofing that was not applied properly by the contractor (Kian, 2001). Waterproofing function is to preserve a structure of building through accepting of natural forces and their effect during life-cycle (Kubba, 2008). Besides that Kian (2001) added that the chosen of wrong type of tiles and failure to follow the standard roof gradient resulted in water leakage. In Malaysia, the problems of leakage at buildings are always happen due to tropical condition, improper design and poor workmanship. For instance, Ahzahar et al. (2011) revealed on the roof leakage at the Parliament building and few cases of pipes leakage and ceiling collapse at the government buildings.

Hassanain and Harkness (1998) identified that moisture can also travel from the wet area to dry area. Moisture and vapour can penetrate from the external wall to the internal wall then degrade the internal finishes due to lack of provision of air or vapour barrier. Besides that, moisture from outside or indoor air can go through the cracks and holes that caused condensation in wall and ceiling (WHO, 2009). However, the EPA (2013) has come out with two recommendations to control the moisture problems that are (1) preventing water intrusion and condensation and (2) limited the areas that routinely wet such as bathrooms, kitchen etc. and try to drying them out when it get wet. In order to control the moisture problem, EPA (2013) also recommended it is adequate that the vulnerable materials are in dry condition