UNIVERSITI TEKNOLOGI MARA

TROPICAL GREEN ROOF MAINTENANCE BEST PRACTICE FOR HIGH-RISE RESIDENTIAL BUILDINGS

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ABSTRACT

Numerous approaches towards sustainable development exist in order to overcome crucial environmental issues, including urban heat island, air pollution and lack of green spaces. One of the sustainable approaches to help minimizing this problem is by using the means of vegetation or plant material on rooftops or known as the green roof. Among the benefits of the green roof includes a good stormwater management, improves air quality, reduces the consumption of energy in the building, and provides new amenity spaces for the occupants. Regardless of the benefits of green roof's implementation, challenges in terms of its maintenance should also be taken into account and given attention. Moreover, the Eleventh Malaysia Plan (2016-2020) is moving towards the green growth for sustainability and resilience to develop a green environment and culture. Unfortunately, the maintenance management of green roof is often being neglected and unprioritised during the planning stage of its implementation. Among the major problems of maintaining green roof in residential are higher maintenance cost, involves a complicated and tedious process, and there is no standard maintenance system established for the green roof in the Malaysian context. Hence, the research is aimed to establish maintenance best practice of green roof for high-rise residential, with criteria identification and ranking. The objectives of this study are to identify the criteria of green roof maintenance, to rank the maintenance criteria of green roof practice, and lastly to establish the best practice of maintenance for the green roof in high-rise residential buildings. A mixed-method approach was used in this study, where both quantitative and qualitative data was utilised in the methodology phases. A questionnaire survey was carried out in the first phase of this study. The purposive sampling method is used to distribute the questionnaire to the respondents, comprise of 30 maintenance operators from 15 high-rise residential of green roof projects. The survey has revealed that there are 16 criteria that should be prioritised towards the green roof maintenance. Drainage is ranked as the most significant criteria, followed by waterproofing, irrigation, water retention and roof slab. In the next phase, a semi-structured interview was carried out via focus group discussion workshop, involving 8 industry practitioners and relevant stakeholders from various agencies. The interview was carried out to determine the best practice of maintenance for all 16 criteria that has been confirmed through the quantitative result. In the final stage, the best practice maintenance framework was successfully developed based on the result of both quantitative and qualitative analysis. The experts' validation interview has concluded that the proposed best practice maintenance framework is applicable and beneficial to be used by the relevant bodies in performing a better maintenance management practice.

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CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

Green and sustainability are connected. According to Samari *et al.* (2013) Green Building is described as the foundation of the sustainable construction development, or even referred as "environmentally sound" building or "sustainable building". Meanwhile, sustainability refers to the capacity to endure (Malica, 2011). This word explains how biological systems remain diverse and productive over time, such as healthy long-lived wetlands and forest. For humans, sustainability is the potential for long-term maintenance of well-being, which includes three main dimensions of society, environment, and economy (Malica, 2011). Some may be buying green building not for the reason it saves energy and money, but for their altruistic belief that climate change and its effects on man and the environment are real, and their action can diminish these effects (Uche *et al.,* 2013). Therefore, green and sustainability are connected to one another as green building is one of the agenda where cities and constructed environment can achieve sustainability.

Towards achieving an advanced Malaysian economy by 2020, the country has come out with a momentous milestone of the Eleventh Malaysia Plan (2016-2020). The Eleventh Plan has developed six strategic thrusts and six game-changers, where one of them is focusing on pursuing green growth for sustainability and resilience. This is where the country will embark on green growth and it will be a way of Malaysians' life. Not only the public and government sectors who are trying to take the initiatives in developing the green environment and culture, but also the private companies and non-government organisations. For instance, Ministry of Energy, Green Technology and Water (KeTTHA) prime objective is to enhance the green technology and environment. Meanwhile, the Institute of Architect Malaysia or also known as Pertubuhan Arkitek Malaysia (PAM) and the Association of Consulting Engineers Malaysia (ACEM) has developed The Green Building Index (GBI) as a rating tool for evaluating and valuing the green status of a building (Ting, 2012). Malaysia Green Technology Corporation (MGTC) is established in order to enact the legal mechanisms to regulate and enforce