HBRC Journal (2015) **xxx**, xxx–xxx

Housing and Building National Research Center

HBRC Journal

http://ees.elsevier.com/hbrcj

Evaluate the continuity of meeting items requirements when assessing buildings environmentally

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Received 18 December 2014; revised 6 May 2015; accepted 16 May 2015

KEYWORDS

Environmental assessment methods of buildings;
Human comfort;
Time variables;
Natural sequential and sudden variables;
Continuity

Abstract Green architecture emerged as a way to address environmental problems related to buildings. Various methods have been developed to assess environmental performance, such as LEED in the United States, BREEAM in the United Kingdom, and GPRS in Egypt. The accuracy of these methods is highly important, especially considering the global trend toward requiring proof of environmental efficiency for construction permits. However, obtaining accurate results requires taking into account the variables that affect the environmental assessment. These variables include the impact of natural and human changes that occur periodically (the repetition of certain events according to day, month, and year), sequentially (changes over time), and suddenly (disasters and other unexpected events). These relationships are not addressed in current assessment methods. Since assessment has several targets, including developing a system to compare buildings according to a specific, unified scale, designers must compete to meet environmental standards based on a fair comparison; thus, the treatment of several variable effects must be obtained to reach those goals. This study, therefore, proposes an approach for considering the effects of variables when assessing item requirements. By measuring the continuity of meeting the item requirements across different time periods, this approach can achieve higher accuracy and justice in evaluation results than afforded by current methods.

Introduction

Following the principles of green architecture, assessment methods have been developed to ensure that buildings meet environmental standards. Using these methods, many assessment certificates are issued for buildings, confirming the

Peer review under responsibility of Housing and Building National Research Center.

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http://dx.doi.org/10.1016/j.hbrcj.2015.05.003
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environmental commitment of designers and putting them into competition to meet established standards. Assessment methods reduce the negative impacts of buildings on the environment, create a system for comparing buildings with one another, and establish a specific scale for classifying buildings in terms of environmental performance [1,2]. Worldwide, relatively few environmental assessment methods for buildings have been developed. The Building Research Establishment Environmental Assessment Methodology (BREEAM), developed in England in 1990, is considered the first such method for assessing the environmental performance of office buildings. Other approaches appeared later [3,4], such as Leadership in Energy and Environmental Design (LEED), which appeared in 1998 in the United States and was applied in 2000 [5]; Green Star in Australia, which began in 2003 [6]; the Comprehensive Assessment System for Building Environmental Efficiency (CASBEE), established in Japan in 2004 [7]; and the Green Pyramid Rating System (GPRS) in Egypt, which was issued by the Egyptian Green Building Council (EGBC) and was proposed to be used in 2011 to evaluate residential buildings [8]. Current assessment methods did not include evaluating the continuity degree of achieving their different items requirements, Therefore, this research paper aims to Highlight the possibility of it and to suggest a proposed approach to apply it, due to the utmost importance that is resulted from considering the continuity of meeting items requirements to get a more accurate and credibility assessment, and to achieve justice when comparing the evaluation results of buildings to each other.

Variables affecting the environmental assessment of buildings

Environmental assessment methods of buildings assess the relationship of buildings with the environment. Since variation is an essential environmental characteristic, the assessment items in these methods need to be linked to this dynamic characteristic. There is a range of variables affecting the assessment which can be divided into the following:

- Variables affecting the formation of the environmental assessment methods of building components, including spatial variables (natural and human), temporal variables and types of buildings variables. Natural spatial variables include many variables such as climatic, hydrological, geological, ecological, available energy properties, and other variables. The natural spatial variables may vary at the district level in the same country. Human spatial variables include accustomed practice, prevailing culture, local laws, monetary, population density, and other variables. Differing site conditions may, for example, lead to fluctuate the importance of sustainability issues assessed; as in the difference between assessing the water consumption efficiency in rainy countries and dry ones. In Australia the importance of rationalization local water is high unlike the northern region of the United Kingdom which is low due its heavy rains. On the other hand, the population density is the highest in the United Kingdom, bringing attention to the importance of land use and ecology (Researcher using Refs. [1,5,9]). Changing the priority interest of global environmental issues is a time variable, such as global warming, scarcity of fresh water resources, and the degradation of biodiversity. Another important time variable is the level of technological development, as it affects building elements, components, and materials, and changes the importance and vision for different resources.
- Variables affecting the evaluation process itself and the awarded assessing grades of the items, where various effects of some natural and human variables appear on the continuity of meeting the item requirements at the achieved level, especially with the succession of different time periods and the repetition of some events during the day, month and year. That type of variables can be divided into periodical, sequential, and sudden variables. The periodical variables happen periodically as the daily day and night changes and the annual change of seasons. The sequential variables are constantly evolving with the passage of time, such as decaying buildings, dust accumulation, resource depletion, and urbanization changes. Sudden variables are unexpected changes such as earthquakes, volcanoes, floods, wars or sudden and lasting change to the function of a building (Researcher using Refs. [1,2]).

Possibility of achieving continuity of some items requirements in buildings

Continuity of some assessment items requirements can be achieved when the building can mutate temporally with the changing nature from a phase to another, for example, the change of air temperature during the hours of day and night and among different seasons can be adapted by buildings by changing the glass properties of the windows, while if the building factors on which depends the solar heating are fixed the designer will face a problem of maintaining the temperature inside the building within an appropriate range during the day, so it is better to get out of the building stability and use different possible mutation operations especially in the building facades to achieve consistency with environment variables. The mutation can be accomplished by controlling the parts and building components to change attributes of the building formalism. Continuity of some assessment items requirements can also be achieved where there is a potential of rotating or moving some building parts or the whole building. The process of opening and closing building openings is the simplest example of moving some elements in a building. It is possible to use simple moving parts on the inner or outer surface of the building to achieve adaptation with some environmental characteristics, such as curtains, blinds and shutters [10,11].

Continuity of some assessment items requirements may also be achieved when there is a possibility of adding or removing parts of the building according to the different variables affecting it, or when dealing with building spaces as a group of cells that can be changed in their number as needed, or when the spaces can be expanded to accommodate variety functions, or when some spaces can be decreased to allow the emergence of new spaces, those types of changes can represent the different needs of human social, functional and economic variables. This type of flexibility can be accomplished by separating spaces and elements into two types: First type with a fixed construction which can be established by durable materials and contains central mechanical building services, and the second