Available online at www.sciencedirect.com

ScienceDirect

Procedia Environmental Sciences 38 (2017) 522 – 529

Procedia Environmental Sciences

International Conference on Sustainable Synergies from Buildings to the Urban Scale, SBE16

Daylighting and Visual Comfort in Buildings' Environmental Performance Assessment Tools: a Critical Review

Christina Giarma[a,*] , Katerina Tsikaloudaki[a], Dimitris Aravantinos[a]

[a]*Laboratory of Building Construction and Building Physics, Department of Civil Engineering, Aristotle University of Thessaloniki, P.O. Box: 429, Gr-54124 Thessaloniki, Greece*

Abstract

In this paper, some well-known buildings' environmental performance assessment tools and methods are reviewed with regard to the consideration of visual comfort in their structure and assessment process. Specifically, the parameters used for visual comfort's assessment in widely used tools (BREEAM, LEED, SBTool and CASBEE - versions for office buildings) are examined; the type and the kind of criteria used for the assessment, the weightings applied and references to relative standards are reviewed and comparatively assessed. Although the presented results cover the issue of visual comfort as a whole, emphasis is given on daylighting–related factors.

Peer-review under responsibility of the organizing committee of SBE16.

Keywords: daylighting; visual comfort; illumination; glare; buildings environmental performance assessment tools

1. Introduction

The provision of a safe and comfortable indoor environment is one of the principal demands that have to be met by buildings; indeed, the quality of the indoor environment, defined by its main axes, i.e. thermal, acoustic and visual comfort, as well as the quality of indoor air, is a critical factor for reasons related not only to health issues but also to the well-being and the productivity of building occupants[1]. As such, the quality of indoor environment is taken into consideration in the context of all widely used methods and tools for the assessment of buildings environmental performance. The study presented in this paper focuses on the way visual comfort is dealt within the

* Corresponding author. Tel.: +302310995412; fax: +302310995603.
E-mail address: chgiarma@civil.auth.gr

Peer-review under responsibility of the organizing committee of SBE16.
doi:10.1016/j.proenv.2017.03.116

context and the process of the assessment conducted by well-known methods and systems rating the environmental performance of buildings. Emphasis is put on daylight-related parameters.

Specifically, in this paper the parameters used for visual comfort's assessment in four widely used tools (BREEAM, LEED, SBTool, CASBEE) are examined; the analysis is based on the versions of the methods dealing with buildings of the tertiary sector, and specifically with office buildings. This choice was based on the hypothesis that office buildings are characterized by certain features, which are common or similar around the world (this is not the case e.g. for residential occupancies, in the design, construction and operation of which regional conditions, tradition and local mentality are much more pronounced); as a result, the comparative review and assessment attempted in this paper would have a sound basis. In the context of the analysis presented in this paper, the type and the kind of criteria used for the assessment of visual comfort-related parametres, the weightings applied and references to relative standards are reviewed and comparatively assessed.

2. Visual comfort parameters in buildings' environmental performance assessment tools

2.1. Background

The tools examined in this paper (BREEAM, LEED, CASBEE and SBTool) vary in their philosophy, approach and structure. Therefore, the presentation of their main features is an inseparable part of the analysis regarding the consideration of visual comfort related parameters in the assessments they conduct. These features are presented in the following subsections.

2.1.1. BREEAM

BREEAM (Building Research Establishment Environmental Assessment Methodology), the oldest method for the assessment of buildings' environmental performance, was initially published in 1990 by Building Research Establishment, UK. Currently BREEAM can be used for the assessment of buildings of various uses (residential, office buildings, hospitals, schools, etc.) at various stages of their lifecycles. In fact, there are available several schemes, each one of which can be used for different cases. Also, a scheme has been developed for the assessment of projects of bigger scales (BREEAM Communities). With regard to the method's applicability in different regions, BREEAM International, which includes a set of assessment methods for all the stages of the building's lifecycle, can be employed in any part of the world, with its adjustment to the local conditions and standards being feasible. Furthermore, versions of BREEAM for application in specific countries (e.g. Germany, The Netherlands, Norway, etc.) have been developed. In BREEAM, the performance of a building is quantified with the consideration of several criteria extending across a range of environmental issues, which, in the scheme under consideration in this paper (BREEAM UK New Construction - Non Domestic Buildings UK[2]), are organized into the following sections: "Management", "Health and Wellbeing", "Energy", "Transport", "Water", "Materials", "Pollution", "Waste", "Land Use and Ecology" (an additional section, "Innovation", is introduced to provide additional credits). Depending on whether the assessed building meets the performance levels set for each criterion, it is awarded or not the credits assigned to it, with the achievement of minimum accepted levels in some key areas being prescribed as compulsory for the achievement of various BREEAM ratings. The aggregated sum of the ratio of the number of the awarded credits and the number of the available credits corresponding to each one of the first 9 environmental sections and the addition of the contribution of the credits awarded for the issues covered by Innovation section are resulting to the final rating of the building. The categories, under which the buildings assessed with the use of BREEAM method are classified according to the achieved score, are: Unclassified, Pass, Good, Very Good, Excellent, Outstanding.

2.1.2. LEED

LEED (Leadership in Energy and Environmental Design) has been developed in U.S.A. by U.S. Green Building Council (USGBC). It is a very widely used system for the rating of buildings environmental performance. The different LEED schemes can be used for the assessment of buildings of various uses at all phases of development. Furthermore, a LEED rating system (LEED Neighborhood development) has been developed for the assessment at a larger scale (neighborhood level, land development projects, etc.). LEED can be applied, with the appropriate adjustments, in various regions of the world. It is noted that in the previous years there have been developed some