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Review Article

Impact of indoor environmental quality on occupant well-being and comfort: A review of the literature

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Abstract

Indoor environmental quality (IEQ) and its effect on occupant well-being and comfort is an important area of study. This paper presents a state of the art study through extensive review of the literature, by establishing links between IEQs and occupant well-being and comfort. A range of issues such as sick building syndrome, indoor air quality thermal comfort, visual comfort and acoustic comfort are considered in this paper. The complexity of the relationship between occupant comfort and well-being parameters with IEQ are further exacerbated due to relationships that these parameters have with each other as well. Based on the review of literature in these areas it is established that design of buildings needs to consider occupant well-being parameters right at the beginning. Some good practices in all these different areas have also been highlighted and documented in this paper. The knowledge established as part of this paper would be helpful for researchers, designer, engineers and facilities maintenance engineers. This paper will also be of great benefit to researchers who endeavour to undertake research in this area and could act as a good starting point for them.

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1. Introduction

Human beings have endeavoured to create indoor environments in which they can feel comfortable. Human health is foremost when it comes to assessing the overall comfort of the environment. If for any reason the built environment is leading to sickness or negative impact on occupant health then it is a matter of concern and could point to some design or technical flaw in the building system. As ASHRAE guidelines stated (ASHRAE, 2010), since people spend about 80–90% of their time indoors and studies have indicated that a range of comfort and health related effects are linked to characteristics of the building, there has been a growth in interest in both academic and practitioner literature on occupant health and building design. There are studies to suggest that a few symptoms of discomfort from indoor environment lead to significant reduction in work performance of occupants (EPA, 2000). New building regulations/legislations and green building guidelines have highlighted the past idea of sustainability that often ignored psychological, cultural and sociological dimensions (ASHRAE, 2004). Research has clearly established that problems with indoor environmental quality (IEQ) (thermal, acoustic, visual and air quality) of a building has a direct effect on the comfort, health and productivity of the occupants (De Giuli et al., 2012). Performance of occupants in office buildings has also been a big area of focus for researchers and practitioners (Bluyssen et al., 1995).

Research indicates that the relationship between IEQ and wellbeing is complicated. A range of indoor factors such as thermal, visual, acoustic, and chemical can impact the wellbeing of the occupants (Apte et al., 2000; Jantunen et al., 1998; WHO, 2002). These relationships could often be very complex and can have both short-term and long-term impacts on individuals (Babisch, 2008; Fisk et al., 2007; Lewtas, 2007). Issues such as sick building syndrome (SBS), building related illness, and pollutants have an impact on the overall productivity of the occupants. Studies have linked, mental health and illnesses that are not easily noticeable in the short term but could be major problems in the long term (e.g. cardiovascular diseases, asthma-related issues and obesity) to IEQ (Houtman et al., 2008; Jaakkola et al., 2013). This paper presents a state of the art analysis of research in the area of health and wellbeing of occupants and their relationship to IEQs. The focus of the review of literature is commercial and

office buildings. The paper further discusses the major issues and thoughts emerging from research in this area to help researchers of the future, align their thought process, and help them establish a robust foundation for research in this area. The focus of this discussion is to establish a link between these IEQ parameters, health and well-being of occupants and implementation of green practices in building design. The methodology used to review the literature is presented in the next section and is followed by the review of state of the art literature in the area. The paper concludes with a discussion section that discusses major conclusions and the way forward.

2. Methodology

The purpose of this literature review was to document the state of the art literature and analyse the key threads of thought regarding health and well-being of occupants of office buildings. The eventual objective is to establish the state of the art in order to identify the way forward. For this study quite an extensive range of literature was reviewed. The literature included refereed journals, refereed conference proceedings, some reports available on the internet, and books. The study was conducted in a four stage cycle of identify, collect, classify and analyse.

The first step was the identification of the main keywords. Since the main focus of the study was to analyse the impact of the indoor environment quality on health and well-being of the office occupants, the keywords used for the search were: *occupant well-being, indoor environment quality, occupant comfort, well-being and green buildings*. Science direct and Google scholar engines were used to search the literature. After collecting the articles the bibliographies of the collected articles were scrutinised to identify any relevant articles that were missed in the first search results. The third step of classification was based on three criteria:

- Year of publication: The literature presented in this paper was published between 1970 and 2015. This gave us the opportunity to see if the thought process has evolved over time with the introduction of new technology. However, still the major focus of the review is 2000 onwards in order to analyse the current state of the art knowledge. Fig. 1 below documents the frequency of articles from different decades since 1970 s.

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