

The importance of ergonomics to sustainability throughout a building's life cycle

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Abstract. Protecting and conserving environmental resources is a global concern. Over the past decade, a number of certification processes have emerged to help designers and operators of buildings assess the potential impact of a building on the environment. Certifications such as the Leadership in Energy and Environmental Design (LEED) consider the environmental impact through the lifecycle of a building, but may not be considering the people that construct and utilize it. It is important to remember the human factor. Considering the human factor throughout the lifecycle is crucial to ensure individuals are protected during construction and in operation in the built environment. The paper highlights how ergonomics can be integrated into the life cycle of a building to promote sustainability goals for both the human factor and the environment. A case study approach will be used to illustrate how ergonomics was integrated into a LEED renovation and expanded into its daily operations on a large university campus..

Keywords: Ergonomics, Sustainability, LEED, Occupant Health

1. Introduction

The following paper highlights how ergonomics can be integrated into the life cycle of a building to promote sustainability goals for both the human factor and the environment. A case study approach will be used to illustrate how ergonomics was integrated into a LEED renovation and expanded into its daily operations on a large university campus.

Due to growing environmental concerns in recent years, there has been a dramatic rise in the demand for sustainable building practices, also called “green building” [14]. Sustainable design can be defined as development that meets the environmental, social, and economic demands of the current generation while also taking into account the needs of future generations [13].

Interest in “green building” continues to grow due to documented returns on investment (energy savings), overall occupant satisfaction, and the interest of the public to protect the environment [7]. Certifications such as the Leadership in Energy and Environmental Design (LEED) consider the environmental impact through the lifecycle of a building, but may not be considering the people that construct and utilize the certification program. Considering the human factor throughout the lifecycle is crucial to ensure individuals are protected in the design, construction, operation, and decommissioning of a building.

Integrating ergonomics into sustainable development enhances human performance, productivity, health and well-being, thereby promoting sustainability at both the individual and systems level [12, 9, 5].

Principles of ergonomics can be factored into how a building is constructed, which reduces potential risk for injury to construction workers. In the design and operation of a building, ergonomic analysis can identify the needs of the occupants and ensure work spaces are optimized for health, performance, and wellness. Finally, ergonomists can use their knowledge of motivation and change to promote behaviours that are environmentally responsible and meet the demands of sustainability [4, 15]. For example, in order to reduce the amount of hard copies when reviewing documents, new technologies, such as electronic reading devices, can be introduced to minimize waste. The challenge comes when workers resist technology due to usability concerns. Ergonomists have expertise in assisting with the integration of technology and minimizing usability concerns.

2. Need for Ergonomics

In LEED, ergonomics as an innovation in design credit is considered costly when it only receives one point in the certification process (K. Rodenberg, personal communication, May 31, 2011). However, when ergonomic principles are used proactively during the design phase of construction, environments are tailored to the needs of the occupants and the organization, thereby reducing the need for costly retrofits. Proactive ergonomics on the job site during construction benefits workers through improved safety and health. This also has a positive impact on the organization through fewer lost work days due to injuries or illnesses [2]. Considering ergonomics throughout the building lifecycle considers economic, social, and environmental factors thereby contributing to sustainability of the workforce, building occupants and ultimately of the organization and society. In order for ergonomics to be considered throughout the lifecycle of the building, ergonomists need to ensure organizations are fully aware of the benefits of the inclusion of ergonomics in sustainable development.

2.1 Design

A recent report issued by the Institute of Medicine cited the need for increased attention to the impact of green buildings on the health of occupants since people spend the majority of their time indoors [6]. To ensure that LEED buildings positively impact occupants, the Indoor Environmental Quality (IEQ)

category includes design criteria aimed to create healthy, comfortable, and productive environments for its occupants [7]. Concerns exist that design criteria under IEQ is narrow and primarily addresses the mechanical features of a building, not fully addressing the needs of the occupant [7]. Research shows that post-occupancy findings are mixed. Lee and Guerin (2008) found that when surveyed, occupants did report greater satisfaction with office furnishings and IEQ in LEED certified buildings as opposed to those in non-LEED certified buildings, but were less satisfied with office layout, lighting, and acoustics. Other studies have reported acoustical and thermal comfort concerns [5, 1]. Addressing ergonomics as a component of IEQ ensures that the human factor is considered in the design phase.

2.2 Construction/Renovation/Demolition

The Construction/Renovation/Demolition phases of a building are when most injuries and fatalities occur [3]. The evaluation of risks to workers needs to be considered in the sustainability assessment. With the development of new innovative designs and construction practices improving energy efficiency and reducing environmental impact, some green design features increase jobsite hazards. For example, the greater use of skylights and atria in buildings increase the risks for falls [3]. Additionally, due to the increased need to separate materials and manage waste leaving the site a requirement for LEED certified projects, increases in manual handling for workers potentially places them at a greater risk of a musculoskeletal discomfort or injury.

2.3 Operation

In the operation of a building, the goal is to continue green maintenance and operation practices. Green cleaning supplies/practices are encouraged and principles of reduce, reuse or recycle are encouraged for building occupants. If ergonomics is not considered in the regular performance of daily work activities, work practices once again may not support goals of sustainability. For example, in many LEED certified environments occupants are moved from private offices to smaller open office workspaces to reduce the overall footprint. With the assistance of an ergonomist, effective workspace layout and equipment selec-

tion can support both workflow needs and individual occupant needs for adjustability [10].

3. Case Study

3.1 Background Information

In the 2008-2009 academic year, Boston University created the Sustainability Committee commonly called Sustainability@BU. The University also established a \$1 million revolving loan fund that supported the hiring of the University's first Sustainability Director and Communications Specialist (Retrieved at <http://www.bu.edu/sustainability/what-were-doing/>). Sustainability@BU, housed within Facilities Management and Planning, is broad in scope with its fundamental goal to reduce the University's environmental footprint through campus infrastructure upgrades and by connecting students, faculty, and staff to participate in and support these efforts" (Retrieved at <http://www.bu.edu/sustainability/what-were-doing/>)

Renovated in 2009, the Boston University Sargent College Makechnie Study Center was awarded a silver Leadership in Energy and Environmental Design, Commercial Interiors (LEED-CI) certification. The 3,000 square foot Makechnie Study Center provides a broad range of media services for students, faculty, and staff. As part of the project, BU obtained one credit under the innovation in design category for an office ergonomics strategy.

In 2010, Boston University decided to continue their green practices by creating an in-house Green Office Certification (GOC) program related to daily operations within the participating facilities to minimize the impact on the environment. Ergonomics was incorporated into the GOC program, with points awarded for ergonomic practices and completion of a self-assessment tool.

3.2 Results

Presently, 34 offices have been voluntarily audited at Sargent College by Sustainability@BU. Of these offices, 17 were certified (lowest level), 11 were Silver and one Gold. Departments within the College were encouraged to participate. 60% (n=9) of the occupational therapy department participated, 43%

(n=9) of the administration participated; followed by 33% (n=2) for Sargent Choice, 25.9% (n=7) for physical therapy, 7% (n=2) for health science and 3.7% (n=1) for speech, language and hearing (M. Orr, personal communication, July 18, 2011). Each of these offices received a sticker on their door related to their level of certification.

Two occupational therapy graduate students assist in the Green Office Certification by conducting ergonomic jobsite analyses on some of the offices following an audit by a member of Sustainability@BU. Sustainability@BU has recently expanded the Green Office Certification beyond Sargent College due to its success in the pilot program. Presently, campus-wide 131 offices have been audited with 57 being certified, 54 as Silver and 14 as Gold.

4. Conclusion

There has been a dramatic rise in green initiatives over a relatively short period, leading to limited attention being given to factors outside of environmental concerns. The impact of green initiatives on people has been largely overlooked, and the literature suggests that this is of great concern. As recent report suggested by the Institute of Medicine cited the need for increased attention to the impact of green buildings on the health of occupants since people spend the majority of their time indoors, [6]. As more organizations adopt sustainability policies, an opportunity exists for ergonomists to support both occupant health and those that construct buildings.

In order for ergonomists to be positioned to act throughout the lifecycle of a building, it is important that ergonomists are aware of:

- How certifications such as LEED are obtained and how ergonomics can be factored into the process.
- A organization's sustainability (green building policies) pertaining to new construction and renovation, and
- How to act as champions to help support ergonomics as a proactive, rather than solely reactive, initiative.

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