Available online at www.sciencedirect.com
ScienceDirect
Renewable Energy 32 (2007) 1033–1044
RENEWABLE ENERGY
www.elsevier.com/locate/renene

Data Bank

Testing glare in universal space design studios in Al-Ain, UAE desert climate and proposed improvements

Khaled A. Al-Sallal*

Department of Architectural Engineering, UAE University, P.O. Box 17555, Al-Ain, UAE

Received 9 March 2006; accepted 9 August 2006
Available online 7 November 2006

Abstract

Previous studies by the author revealed several issues with regard to daylighting levels and glare problems in the new building of the architectural engineering department at UAE University and proposed solutions. This study investigates mainly the use of reflective light shelf to reduce glare problems and redistribute daylight in the ground floor studio space of the case study. Several slopes of light shelf along with other design parameters were tested on March 21 at 10:00AM using serial testing improvement approach, based on comparisons between pretest and posttest results. Other parameters were also tested, as ways to improving the performance of the light shelf, such as the height of the light shelf, the slope of the ceiling, and the type/existence of the front north partition. Both Radiance and Ecotect programs were used to simulate the required design configurations. The 5°-sloped roof performed better than the horizontal roof and improved the performance of the light shelf. Removing the north partition has the potential to improve glare on the rear space, yet it creates glare problems on the front side. Future testing is needed to investigate this problem.

Keywords: Light shelf; Daylighting; Glare; Desert climate; Universal space; Design studios

1. Introduction

The new building of the architectural engineering department at the UAE University is an example of a new building form in the UAE and probably in the Arab Gulf region. The

*Tel.: +971 3 7622318; fax: +971 3 7636925.
E-mail address: k.sallal@uaeu.ac.ae.

0960-1481/$ - see front matter © 2006 Elsevier Ltd. All rights reserved.
doi:10.1016/j.renene.2006.08.010

Fig. 1. Pictures of the case study building; north façade (left), south façade (right).

building has a curved roof with skylights covering a large universal space that includes three levels of studio spaces. The use of such form typology in architectural studios is very rare worldwide and perhaps it is used for the first time in desert climate. This created an incentive to study and improve it.

The case study building is designed by KEO International Consultants. It includes three main sections: the architectural engineering department (i.e., the focus of this study), the teaching facilities section, and the students' activities section. The pictures of the architectural engineering department building are shown in Fig. 1. In previous studies by Al-Sallal et al. [1] and Al-Sallal and Fikry [2], the authors investigated the daylight factors levels inside the studios located in the first and second floors of the same building used in the current research. The purpose of the study was to evaluate the performance of such a new building form with regard to daylighting, under the conditions of Al-Ain desert climate and to propose solutions for future investigation. The purpose of the current study is to investigate some potential solutions for improving daylight levels and visual comfort of the occupants. The ultimate goal is to improve the occupants' thermal and visual comfort and to save energy through means of controlling solar radiation and maximizing the use of daylighting.

2. Background

Daylight is receiving increased consideration as a light source for buildings given the current interest in peak demand reduction and green building design (LEED rated buildings). Design for daylighting in hot dry climates requires an integrated design approach toward energy performance of the building envelope and illumination of the interiors. Architectural morphology must respond to passive heating, cooling, and ventilation requirements, and be properly configured to capture and distribute natural illumination effectively and efficiently to the interior spaces. While many studies on the effect of sky lighting and atrium design on natural day lighting are widely available in the literature, very few studies can be found on natural lighting issues in architectural studios, especially in desert climates.

Littlefair [3] defined four key aims for the innovative daylighting systems: to increase daylight levels deep within rooms, to improve daylight uniformity, to control direct