Study of diffused light levels in an institutional common eating area in New Delhi

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Abstract

Buildings with adequate daylighting experience a variety of physiological and psychological advantages, particularly in terms of increased visual comfort. How much daylight can enter a space depends on a number of factors, including setbacks and window sizes. However, many interior areas frequently encounter insufficient daylighting because of incorrect setbacks, a lack of windows, and their sizes. By measuring the lux levels in various locations and comparing them to the necessary lux levels specified in the NBC and Unified Building Byelaws, this paper will analyze a case study of a school in New Delhi.

Keywords: Daylighting, Lux level, institutions.

Introduction

This paper discusses the daylighting laws given in the Unified Building By-laws and NBC and conducts a case study for a educational institute in New Delhi.

Aim

The aim of this paper is to study daylighting by measuring lux levels inside a common eating area in educational institute.

Objectives

to measure the light levels inside the common eating area at various locations.to review daylighting regulations and learn about the different rooms' lighting needs in a space. Using the data gathered, determine whether the specified number of openings and windows is sufficient to meet the required lux levels.

Literature Review

Tregenza (1999) has conducted a daylight calculation study on a room based on a Standard school classroom having depth of 7m from the window (Figure 2.3b). The room has reflectance of 80% for the ceiling, 50% for the walls and 20% for the floor. The north-facing window provided a daylight factor of 2% in the centre of the room (4.5m) and a mean of approximately 4 % on the working plane as a whole. He describes the illuminance on the horizontal working plane at the back of the room is contributed mainly by the sky above horizon. The study was done to indicate the sensitivity of illuminance in a room to variation in the luminance of the sky.

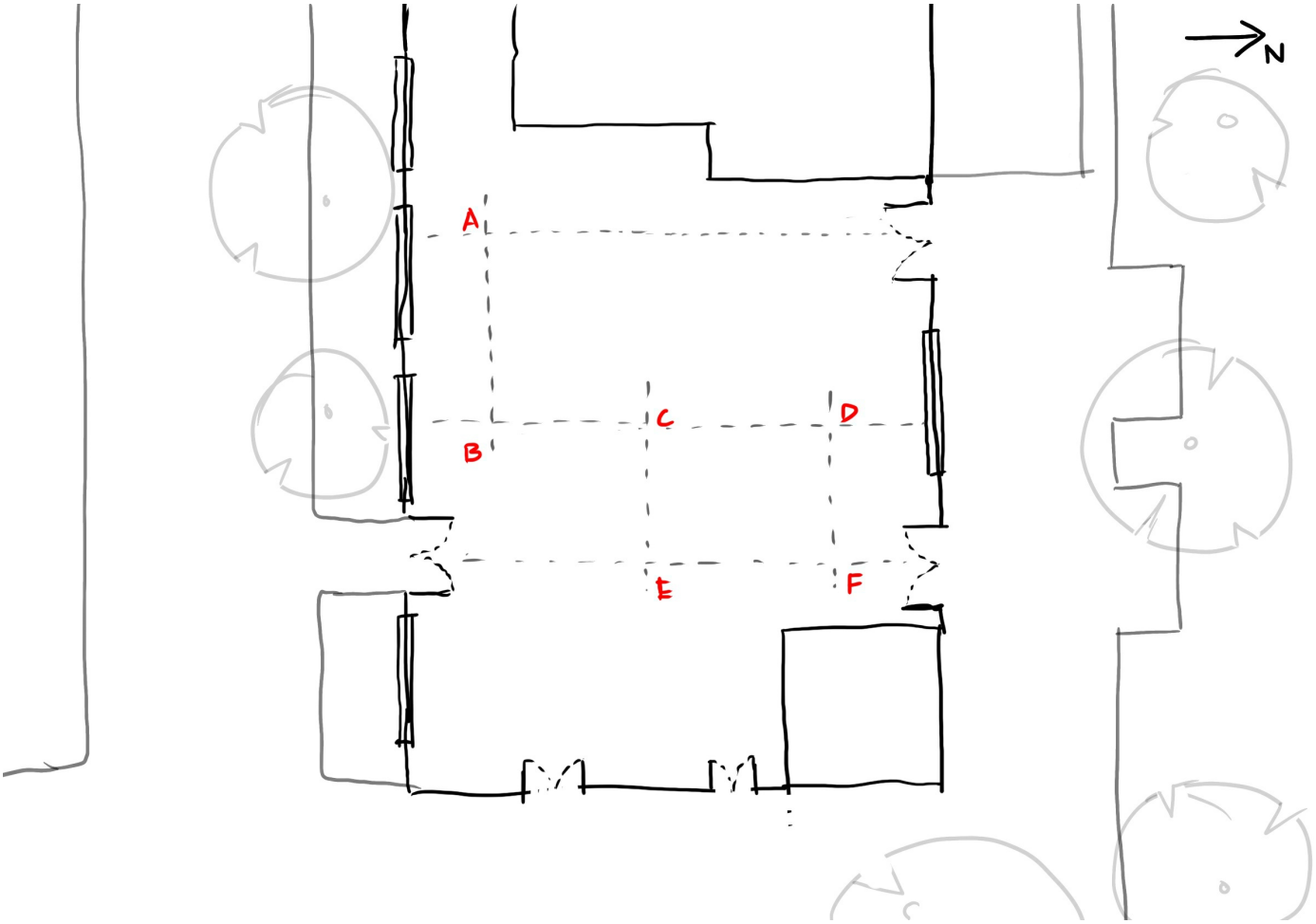
Penetration of natural lighting into a classroom depends on many parameters of design, which includes ceiling height, internal reflectance's, depth of room, shape and size of glazing area (Capeluto, 2003). The relation of Window area to Floor area (WFR) in a classroom was also studied which confirms that provision of visual comfort for students decrease the energy consumption in a tropical area such as Malaysia (Seyedehzahra Mirrahimi, 2012)

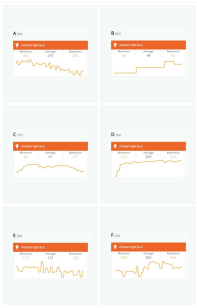
A school with insufficient light can also reduce a student's ability to learn due to the effect lighting has on physiology. Poor spectral light can create strain on students' eyes, leading to a decrease in information processing and learning ability, causing higher stress levels (Liberman 1991). Dr. Walker (1998) found that stress impacts certain growth hormones. He determined that "persistent stress stunts bodily growth in children" because the activity of the growth-inhibiting hormones cortisol and ACTH increase under stress. Students in the Canadian full-spectrum fluorescent schools grew 2.1 cm more in two years (Hathaway, et al. 1992) compared to students who attended traditional fluorescent-lit schools. The increased activity of these hormones supports researchers' observations that children under electric lights all day have decreased mental capabilities, agitated physical behaviour, and fatigue.

Michael Rosenfeld (2010) discussed that, everything from the school's placement and orientation on the site, the shape of its unique footprint, the development of the building's cross sections, the educational programming for each space, the building's mechanic / electrical systems and the architectural details / aesthetics were all about light, ambient light levels and light controls.

Methodology

The objective of this research is to evaluate the daylight condition in common eating area and to identify the parameters which provide adequate daylight illuminance in that space. The research was done by collecting the data from the actual site of the common eating space and then drawing inferences. The lux reading was taken in the common space using the android app 'Arduino Science Journal' on the working surface to measure the natural light illumination from 10:30 AM to 11 AM on a working day. It is obtained from the side of the wall of the windows until to the other side which is the opposite side of the windows.





Inferences

Based on these readings we can infer that Table F receives the maximum daylight around 11 AM. This is mainly contributed due to the glass door right next to the table which allows more natural light to directly hit the table from the North-East direction. Tables next to the windows don't receive as much light from either sides due to the high height of the windows. Table D also receives ample light despite being besides a window due to its position being closer to the North wall allowing more light in during the first half of the day. Tables towards the southern side of the space don't receive as much light.

Conclusion

The size of the opening and the orientation of the opening greatly influences the amount of light falling on a surface. During the first half of the day, north-eastern side of the room receives more light while the opposite may or may not be true.

Way Forward

Further readings at different times of the day should be taken along with accurate dimensions of the openings to gain more insight in the effect of light on working/eating surfaces.

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