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An Evaluation of Daylight Illuminance Performance for Visual comfort and Determination of the Environmental Impact of Artificial Lighting Energy Consumption

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ABSTRACT

The sun provides free and renewable energy in the form of daylight. It is a valuable natural resource that can be harvested and turned into various energy sources. However, we do not make good use of this energy. Buildings become utilitarian and lose visual comfort due to the neglect of many building design practitioners and their failure to follow the building code. These artificial lighting systems contribute significantly to CO_2 emissions and global warming. The goal of this study is to look at day lighting illumination levels and calculate the artificial lighting energy consumption and carbon emissions of a typical residential building in hot and humid places like Dhaka. These artificial lights contribute to the final consumption of fossil fuels and global warming. The researcher intended to look into the visual comfort and energy consumption of a building as a result of this improper fenestration design. Furthermore, the study intends to concentrate on the solution to this problem. Buildings contribute to a significant portion of energy consumption and greenhouse gas emissions. Architects and building professionals may lower the environmental impact of buildings and contribute to climate change mitigation by focusing on energy-efficient design and technologies. Perhaps this study will help architects, engineers, researchers, and designers utilize day lighting as a way to lower building energy use and save money. The research aims to calculate the Carbon emissions per year due to the improper design of daylight in the case study building. The visual comfort has been calculated using light Lux meter and daylight software. In addition, manual calculations were employed to determine the artificial energy consumption. The study was discovered to have a significant impact on the energy savings caused by natural lighting.

1. Introduction

The construction of permanent or temporary structures for housing, which is the second necessity of existence, is an attribute of every expanding society *(George, 2002)*. Environmental impacts caused by structures can range from energy-related to ecological to aesthetically pleasing. Materials have also helped to create an indoor environment that has negative consequences on man's activities, comfort, and well-being, according to the International Association for Environmental Impact Assessment Act (EIA). The building sector consumes the most energy and has the most negative environmental effects, including air and water pollution, harm to public health, wildlife extinction, water and land use, and emissions that contribute to global warming. The Sun is the primary source of light and energy on Earth. The Sun provided humans with light in two ways: direct sunlight and diffuse skylight from the atmosphere. In order to produce a more sustainable living environment, daylighting design has become a significant topic in the context of modern structures. Perhaps daylighting is an important source of illumination and a unique component in enhancing building design. Recent architectural

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endeavors by building owners and architects to increase illumination, on the other hand, have resulted in a greater use of daylight.

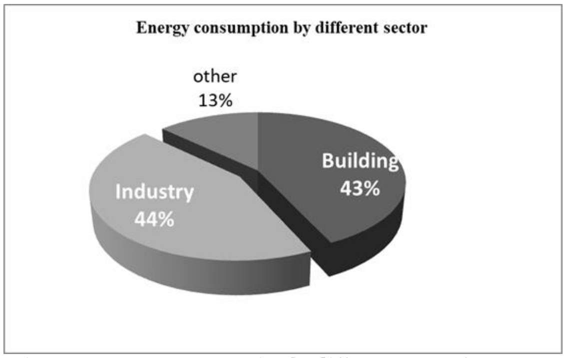


Figure 1: Energy consumption by different sectors (energy 2020)

(Source: https://www.iea.org/reports/world-energy-outlook-2020)

However, the artificial lighting we employed in our building interior has a number of detrimental health impacts, including an increased risk of obesity, depression, sleep disorders, diabetes, breast cancer, and other diseases ***(Larry, 2006***). Natural light contributes to healthy health. It has biological and physiological ramifications for all living creatures on Earth. Natural light aids the human body in the production of vitamin D and hormones ***(Muller, 2013).*** Using sunshine to produce energy-efficient, visually comfortable, and ecologically friendly structures is a successful and sustainable development approach. Natural light is a cost-effective technique to illuminate a building. Using energy-efficient fixtures, lighting controls, and a day lighting system may help reduce power use while boosting visual efficiency. However, the purpose of this article is to explore general subjects like as day lighting, visual comfort, and energy consumption reduction. Because natural gas and coal are the primary means of creating electricity in Bangladesh, the country's energy sector is significantly reliant on these sources of energy. In Bangladesh, natural gas provides about 62.9% of the country's electricity, followed by diesel (10%), coal (5%) heavy oil (3%) and renewable energy (3.3***%) (Taheruzzaman, M. & Janik, P, 2016).***

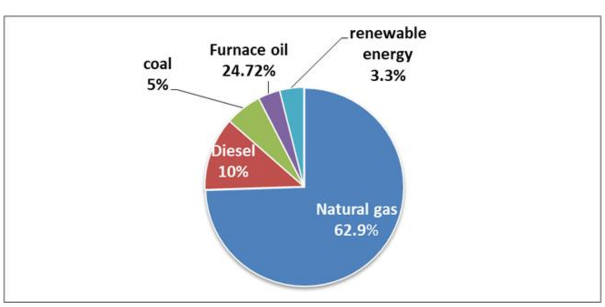


Figure 2: Electricity generation from different energy sources (Pie chart generated by Author)
(Source:https://energypedia.info/wiki/Bangladesh_Energy_Situation)

Although electricity, petroleum products, natural gas, coal, biomass, and solar energy are all used in Bangladesh, regulators and decision-makers prioritize electricity as the most extensively used source of energy globally ***(Chowdhury et al. 2014).***

Only if visual needs and comfort requirements are carefully taken into account during building design can the benefits of day lighting be fulfilled. (***Anderson et al. 2013)***. The problem of poor quality of the indoor environment (IEQ) has been an important concern in the world with its enormous influence on occupant health and productivity, in addition, the deterioration of the interior environment would increase stress, and there might be a cause of the hazardous building syndrome ***(Asadi et al. 2017).***

In the context of this energy crisis, attention to the sustainable development of our society has become a priority worldwide. Sustainable and eco-friendly architecture and urban design are the central concerns of all participants involved in urban manufacturing in Bangladesh as well. Among them, architects play an important role in the design of the form, space, enclosure structure, and living environment. Because of this, architects must choose wisely in order to enhance the standard of living, create high-performance, sustainable structures, and preserve harmony with surrounding and distant environments. The study's overarching goal is to calculate the annual carbon emission percentage, in particular as a result of incorrect day lighting design. The specific aim is to improve day lighting performance with the help of National building code standards and determine the result with computer simulation software. This study would be beneficial for Architects, engineers, researchers, and designers to incorporate Day lighting as a means to reduce energy use in buildings and thus assist in cost saving. Following the energy performance legislation and the building environment assessment plan, a series of this kind of research on building design optimization studies should have been carried out. This study aims to determine the illumination level of a residential building in Dhaka that will have an effect on occupants' visual comfort and carbon emission to the environment. This will overall reduce the carbon footprint and greenhouse gas emissions. By the energy efficiency regulations and the building environment assessment plan, a series of this kind of research on studies on optimizing building designs should have been carried out.

2. Materials and Methods

The study uses a quantitative research approach and is based on secondary and primary data. The investigation was conducted by looking at a sample of a building in the Mohammadpur district of Dhaka. The study started in January 2021 and will be finished in June 2021. This study employed an exploratory hypothesis testing design. Several research instruments are used in this investigation. A light lux meter is used to measure the lighting intensity in the building's various rooms. Utilizing computer-based software called Dialux, the illumination level is also calculated. A quantitative analysis was used to determine the level of carbon emissions attributable to energy use. In addition to BNBC regulations and standards, a range of published periodicals were used to collect secondary data. The sample design for the study made use of purposeful sampling. Researchers were compelled to choose a sample that was both accessible and practical for data collection due to the pandemic situation at hand. two-bedroom apartment measuring 1150 square feet served as the model building.

Study area and Data collection

- **Study Area Selection**: For the purpose of this study, the researcher chose a residential construction in Mohammadpur, Dhaka. The chosen building surroundings are in better condition than any other congested building structure in that location. The structure is exposed to receive adequate sunlight within the apartment because it is placed in the corner of a huge 20/40-foot road junction. For example, the researcher chose this much better-located study building to examine the current state of the residential building's overall visual illumination level.

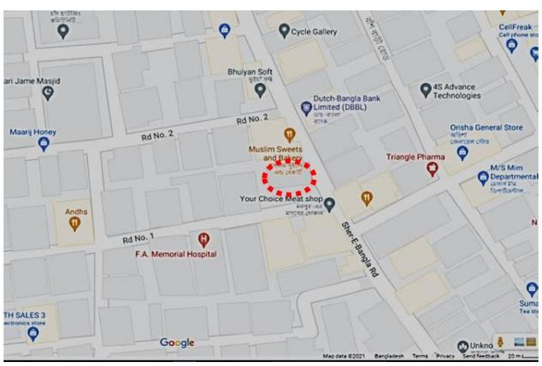


Figure 3: Study Area in Google Map

- **Primary Data:** As the primary data source for achieving the study's aims, the daylighting illumination level was collected from the various rooms of the sample building. The key data for the software simulation was the sample building layout plan. In addition, various artificial lighting components were a significant data source for calculating energy use.
- **Secondary Data:** Keywords "visual comfort", "standard illumination level", "daylighting design strategies", "energy consumption" etc. were used to search for research articles published between 2010-2020.

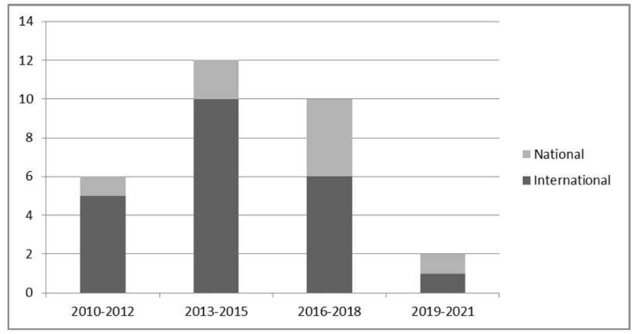


Figure 4: Number of publications related to the topic (Bar chart generated by Author)

Instrument

In order to collect primary data for this study, two instruments were used. The digital lux meter was the first tool used to measure the degree of illumination in various locations. The Dialux lighting design tool will be utilized as the second instrument in this research for the software simulation daylight computation. A mathematical analysis will be obtained as a research tool to estimate the environmental influence of artificial lighting in buildings.

DiALux:

To strengthen the investigation, research carried out the numerical method to determine the daylight illuminance of different simulation scenes. Using the well-known DIALux evo9.2 software from the open source, a numerical simulation is used to create the daylight factor regression model. DIALux evo 9.2 is a complete and expandable simulation environment for the most well-known sky brightness calculation model's daylight modelling of structures and urban complexes.

Figure 5: Light Lux Meter

Light Meter

To determine the illumination level of the individual room of the case study building light lux meter has been used.

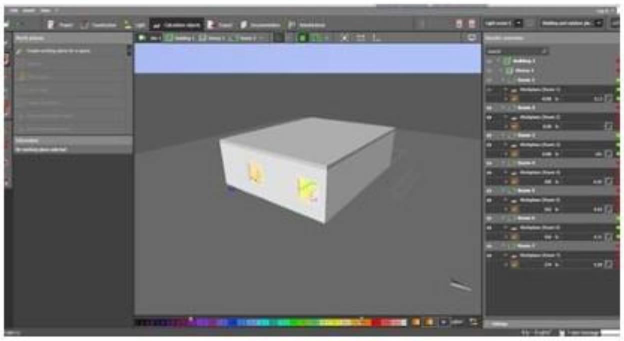


Figure6. Dialux Lighting Design Softwar

Procedure

The research was conducted on a typical six-story rectangle residential building of 1140 square feet. It should be noted that the suggested research in this paper does not address the impact on the heating and cooling system and instead focuses on daylighting illuminance levels to diminish electricity savings produced by artificial lighting. Data were collected in June 2021 from a number of rooms in the sample building under typical clear sky (direct sunlight) conditions. Data was gathered using the light meter. It is a tool for measuring light intensity or the amount of illumination produced by sunlight. The illumination level of the accompanying chart was measured with this light lux meter. The apartment complex depicted in Figure 09 was chosen for analysis in this study. This structure has four flats of varying proportions on each floor and stretches east-west. This analysis takes into account a master bedroom located on the first level in the southwest corner of the structure. The entire building's wall is thought to be built using local brick. And the inner and outer sides of the wall are considered white. The room height is set at 3.00m, and the wall thickness is set at 125mm. The ceiling is thought to have been built by RCC with a thickness of 125mm. Ground area: 13.06 m² | Reflection factors: Ceiling: 70.0 %, Walls: 50.0 %, Floor: 20.0 % | Light loss factor: 0.80 (fixed) | Clearance height: 2.800 m.

- **Daylight calculation process**

The systematic method was used to conduct the daylight analysis. Figure 07 depicts the overall day lighting calculating method. In day lighting computation, various influential factors contribute to the growth or decrease of illuminance level utilizing various forms. The most important aspects are divided into three categories: sky condition, specified standards, and design. The DiALux program collected all climatic and occupant information based on the location provided.

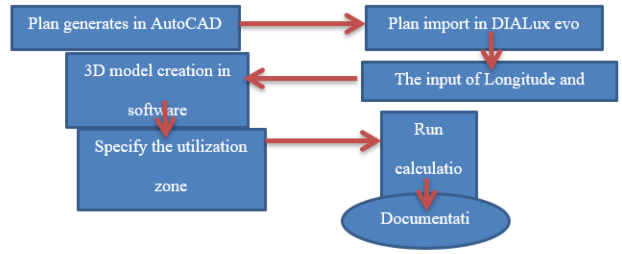


Figure7. Flow Diagram of Day lighting simulation (Flow chart generated by Author)

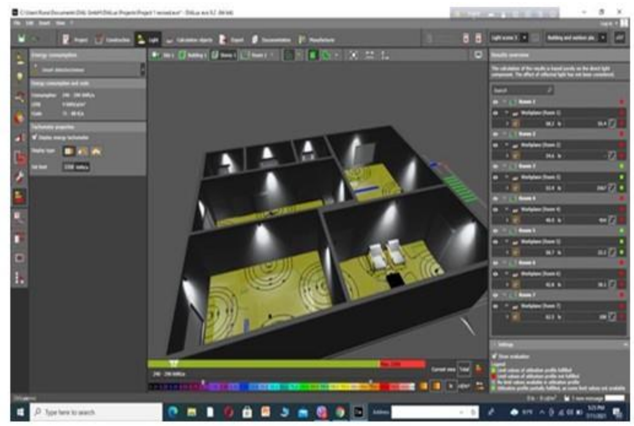


Figure 8. Main Screen of Dialux Software

The picture above the primary screen of the day lighting software and the typical floor plan of the case study building are shown in Figure 8.

- ***Modeling Data with Software Simulation***

In the computer simulation "Dialux," the amount of daylight lighting was calculated using software. DIALux is the name of the software with professional lighting design. Lighting should be planned, calculated, and displayed for both interior and outdoor areas. Everything from entire buildings and individual rooms to parking lots or street illumination can be calculated. In this investigation, the Dialux evo 9.2 has been used.

Table 1. Simulation months, hours, and time schedule.

Simulation Month	July 2020
Simulation Date	07
Time	12 pm

The modelling procedure has been generated from DIALux simulation software for July noon under the consideration of local climate.

3. Result:

The rigorous daylight illuminance analysis process produced the following findings. Analysing data from the Dialux daylight design software evo 9.2 yielded all of the findings are stated below.

Table 2. The illumination level of case study building

Work planes Properties	Ē (Target)
Workplace (Room 1/Bed room) Perpendicular illuminance	138 lx (≥ 250 lx) ✗
Workplace (Room 2/Living room) Perpendicular illuminance	0.00 lx (≥ 100 lx) ✗
Workplace (Room 3/dining room) Perpendicular illuminance	59 lx (≥ 100 lx) ✗
Workplace (Room 4/Bed room) Perpendicular illuminance	198 lx (≥ 250 lx) ✗
Workplace (Room 5/bathroom) Perpendicular illuminance ✓	155 lx (≥ 100 lx)
Work plane (Room 6/kitchen) Perpendicular illuminance	276 lx (≥ 200 lx) ✓
Work plane (Room 7/bathroom) Perpendicular illuminance	382 lx (≥ 100 lx) ✓

The Perpendicular illuminance levels of case study building rooms 1–7 in the case study building are shown in Table 2. The Red Cross mark was produced by software calculation since the recommended lux level was not met by the illuminance target of rooms 1-4. In rooms 5-7, the lighting level has been attained. The projected minimum and maximum illuminance levels vary for each room.

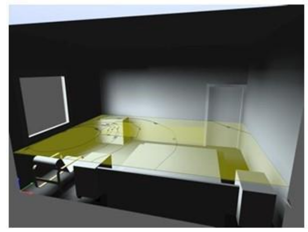
Table 3: Illumination level determination in sample building with a light meter

Area	Recommended Illuminance (Lux)	Measured Illuminance (Lux)
Bedroom		
General	70	39-45
Bed-head	250	55
Kitchen	200	145
Dining room	150	55-59
Bathroom		
General	100	79-85
Shaving/Makeup	300	89
Lounge/Living area	150	00

In order to assess the illumination intensity in each room of the dwelling under typical clear sky conditions, Table 3 shows the results of separate room illumination levels obtained by a light lux meter. As this was one of the main goals to achieve, the overall conclusion of Tables 2 and 3 demonstrates the poor illumination level inside the case study building.

Figure 9. Simulated floor plan in three dimensions (3D)

Floor plan simulation Figure 9 clearly shows that the undesirable lighting intensity is the result of bad wall design. As a result, the artificial illumination uses the alternatives of building inhabitants.



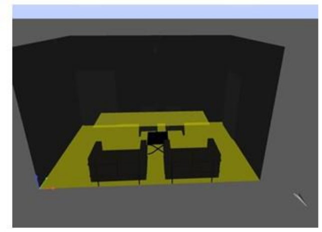
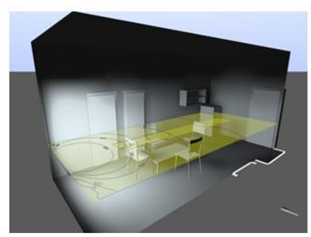


Figure 10. Simulation environment of room 1

Figure 11. Simulation environment of room 2



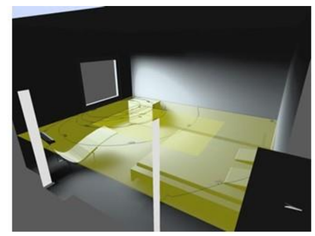


Figure 12. Simulation environment of room 3

Figure 13. Simulation environment of room 4

These photos above illustrate the software-generated simulation environment of various rooms of the case study building. Figure 11 demonstrate that no sunlight can enter the room, which is highly undesirable. The work plane is represented by the yellow horizontal plane. In this plane, the available Lux level is computed.

Some ISO curve displays of simulation results are shown below for further investigation.

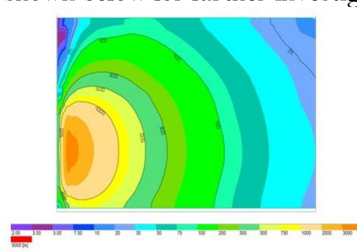
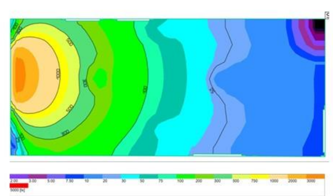


Figure 14. ISO illuminance curve display of room 1

Figure 15. ISO illuminance curve display of room 2



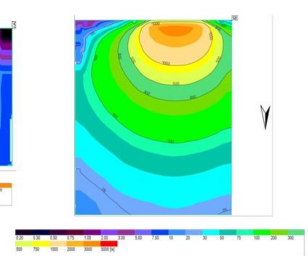


Figure 16. ISO illuminance curve display of room 3

Figure 17. ISO illuminance curve display of room 4

The images shown above are Iso illuminance curve displays made by DiaLux software for the day lighting illuminance levels of rooms 1, 2, 3, and 4. The curve line displays the lux ratings in numeric form. Furthermore, the varied colours represent the various lux levels specified in the legend. As the green colour curve line represents the 100lx in that specific area of the room. The sap green area displaying 200lx is then available in that region of the room.

Energy consumption by artificial lighting

Daytime inhabitants employ artificial light in the building to attain the desired illuminance level or visual comfort. This section of the study depicts the energy usage of artificial lighting. The energy consumption is calculated using the same program that calculates the daylighting level.

Room1				
Light Fixture used	**Manufacturer Article No.**	**Article name**	**Φ efficacy**	**luminous**
4	FLOS 07.9466 B Portal 29.6 W	TUBULAR BELLS PRO Suspension PH LED FL IN	7.4 W 394 lm	53.2 lm/W Total Φ 1576 lm
Room2				
Light Fixture used	FLOS 07.9466 B	TUBULAR BELLS PRO Suspension PH LED FL IN	7.4 W 394 lm	53.2 lm/W Total Φ 1576 lm
4				
Room3				
Light Fixture used	FLOS 07.9466B	TUBULAR BELLS PRO Suspension PH LED FL IN	7.4 W 394 lm	7.4 W 394 lm 53.2 lm/W Total Φ 1576 lm
4				
Room4				
Light Fixture used	FLOS 07.9466B	TUBULAR BELLS PRO Suspension PH LED FL IN	7.4 W 394 lm	7.4 W 394 lm 53.2 lm/W Total Φ 1576 lm
4				

The results sheet of Dialux evo 9.2 along with manual calculation revealed that the case study building's poor daylight design resulted in 7380 kWh of power being used annually. The analysis of the data showed that the annual carbon dioxide emissions from the residential building were 5.23 metric tons. The indirect number includes the carbon dioxide emissions produced as a result of generating the electricity used by the building's occupants. Electricity cannot be produced without fuel, which results in an increase in carbon dioxide emissions. The nation's national weighted average CO_2 marginal emission rate for 2019 was 7.09 10-4 metric tons CO_2/kWh, according to the US Environmental Protection Agency, or EPA (2020), in Washington, DCAs a result, the fuel required to produce one kWh of energy results in the release of 7.09 10-4 metric tons of carbon, or (7.09/10000) = 0.000709 metric tons, of carbon. As a result, the 7380 KW of electricity used by the building under study resulted in annual emissions of 5.23242 metric tons (7.09/10000) 7380 metric tons. According to B.K. Hoque et al. (2017), there are 640 g of carbon emissions per kWh. Accordingly, the fuel used to generate one kWh of energy results in the release of 640g of carbon into the environment. For the building under consideration, the power 7380 KW emits (640g X 7380)/1000 kg = 4723.2 kg CO_2 yearly.

4. Discussion:

The required average clear sky condition led to the creation of the computer simulation that was utilized in the case study building research. Field studies of daylighting in sample structures revealed that the majority of internal illumination was insufficient. During the day, artificial lighting is used to improve visual performance and occupant enjoyment, consuming needless electrical resources. However, this energy demand might be reduced if day lighting was carefully planned from the start. The article also noted how day lighting control can save a lot of energy when it comes to lights. Given that it helps cut down on the amount of electricity used, day lighting should take into account the aesthetics of the architecture and design standards. An efficient lighting plan makes the best use of daylight, employs lights in the best possible ways, and regulates how much light gets into the building. Natural lighting increases user performance and contributes to human vitality. It is a passive method for reducing the electricity burden of lighting. The overall findings lead to the conclusion that using natural lighting improves user performance and supports human vitality. It is a passive technique for lessening the need for electricity for lighting. According to general observations, using day lighting design strategies in the building can reduce the use of electric energy. When fossil fuels are used to produce energy, carbon dioxide is released; this gas is bad for the environment and accelerates global warming. The end result illustrates the CO_2 emission parameters associated with energy generation and resource usage. This might have been avoided if the building had been properly lighted by sunshine. Coal, natural gas, and oil are the main fuels utilized to generate energy in the country. To secure power production, the security of fundamental energy must be ensured. Bangladesh's CO_2 emissions per capita in 2019 were 0.66 tons, according to the world statistics atlas. According to the World Statistics Atlas, Bangladesh's CO_2 emissions per person in 2019 were 0.66 tons. According to Sarkar et al. (2015), Bangladesh's CO_2 emissions increased at an average annual rate of 5.48% from 0.05 tons in 1970 to 0.66 tons in 2019 (per capita). The world's energy infrastructure may be seriously strained by this rising demand because of the emissions of CO, CO_2, SO_2, and NOx as well as the potential for global warming. Actions for sustainable development that could take a while to complete are needed to address the environmental issues we currently confront. Population growth and economic development have resulted in an increased demand for energy, which is mainly obtained from fossil fuels ***(Alrubaih et al.,2013).*** According to ***Mavromatidis et al. (2014),*** natural and artificial interior lighting design is closely related to visual comfort and building energy usage as part of the overall environmental quality process. In terms of visual comfort, the global study survey includes the following points:

- The availability of adequate lighting levels for artificial lighting is generally specified according to the minimum level related to international standards and recommendations, depending on the type of activity.
- Colour rendering index and colour temperature (ambient, hot, or cold) are two indicators of light quality.
- The existence of dazzling light source and brightness balance: avoid contrast glare and excessive brightness in the field of occupants (lower brightness lamps, sun protection, etc.). In addition, research on energy consumption in lighting matters is mainly focused on the following points:

▪ The building should design with proper day lighting analysing to achieve the indoor illuminance level described by BNBC.
▪ Lighting control techniques should be incorporated into the building.
▪ Day lighting design strategies should be considered while designing the building exterior at the initial stage.
▪ Strictly maintain the rules and regulations of BNBC.
▪ Building design should be done by professionals Architects.
▪ Methods of investigating day lighting in buildings should be incorporated.
▪ Energy-efficient electric fixtures should use to reduce energy consumption.
▪ Renewable energy sources should be used in the building.
▪ The occupant's behaviour should be changed to reduce electricity consumption.

5. Conclusion

The research presented a comprehensive investigation of energy use, visual comfort, and daylight in urban settings. The data analysis and hypothesis suggest that day lighting design is vital in the building to reduce inefficient electrical energy use. The best way to incorporate natural day lighting into the design is through passive design principles or sustainable architecture. The study showed the importance of interior design in allowing light to enter a facility. This is a common "design gap" in the industry, in which architects produce the architectural characteristics but the client selects the interior decoration. The study's findings may help architects and engineers implement appropriate day lighting strategies, as well as promote sustainable development and energy efficiency in buildings. This article provides a complete review of the literature, taking into account the most recent discoveries in the field of improving the energy efficiency of residential structures. It was determined to have a significant impact on the energy savings brought about by natural lighting. Increased daylight opening improves the transmittance of the glass or window area, resulting in increased daylight benefits. Residential building energy efficiency enhancement applications will undoubtedly be critical to meeting energy efficiency and carbon reduction targets. Researchers should pay more attention to the societal implications of climate change on new building design, construction, and renovation projects. It will also be fascinating to map the most recommended passive design solutions for each climate zone and determine the best design for all imaginable climatic scenarios. Finally, selecting an effective energy efficiency solution necessitates considering the specific trade-offs between winter and summer energy demand.

Cost Analysis for Proposed Amendments

The researcher's recommended modifications for the current case study building can be implemented in small steps, leading to progress over time. Ample day lighting will enter the building's interior if the advice is followed, as has been decisively shown by computer modelling of the suggested design. Tenants of the building may, in fact, alter the fenestration of the structure, counsels the researcher. The cost estimation for the whole rectification has been looked at and is given below as support for the study paper. The rating was chosen by a local contractor's vendor.

Break down the estimation of the restoration cost of one window

➢ Measurement of older window = 4' x 5' = 20 ft
➢ Selling price of old window raw material = 20sft x 200 =4000 tk
➢ New modified window measurement =8' x 6' = 48 ft

➢ ***Costing of restoration of a new wall (one wall)***

Labour cost = 700 tk
Cement cost =550tk
Mason worker =500 tk
Sand =40 tk
Transportation cost =200 tk

Costing of a New Thai aluminium panel per window=(48 x350) =16800 tk

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Total Cost = (16800+700+550+500+40+500)tk
=18590 tk

The total cost required per window (after selling old window material) = (18590-4000)tk =14590

Total Restoration Cost of the Apartment

The researcher suggested four window restorations to enter adequate day lighting in the apartment therefore, among them one wall of the living room does not have any window. Hence, for the sunlight during the daytime, a window must be incorporated inside the wall.

The installation cost of a new window in the living room = is 18590 tk
Rectification cost of the window in dining room = 14590 tk
Rectification cost of window in two Bedrooms = (14590 x 2) = 29180tk

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Total Rectification Cost of the whole Apartment = 62,360 tk

Recommendation from Literature Review

A light pipe system is another option for achieving desired day lighting in structures that cannot be repaired or modified. When windows or skylights are not available, a light pipe system serves as a basic day lighting device, allowing natural light to enter interior or underground regions. Without the use of artificial lighting, a light pipe system can boost illumination while saving a significant amount of energy. After accounting for the various artificial lighting control methods (on/off control, two-step control, dimming control), the energy savings potential of implementing a light pipe system was calculated, revealing a potential reduction in lighting energy use of up to 30% on average. ***(Shin et al. 2013***). Natural light is distributed by light pipes and day lighting, which may also be utilized to disperse artificial light. Light pipes are used to carry light with little light loss to areas far distant from the source. Light pipes can be transparent and diffuse light along their length, or they can be built such that light is conveyed but leakage is regulated at the place of application. The Egyptians were the first to conceive the notion of light pipes in ancient times. Light pipes boost natural daily light exposure, which can be beneficial to those suffering from seasonal affective disorder. Over-illumination, which can be caused by direct sunlight, is also avoided by using light pipes. The energy savings from reducing the usage of artificial lighting is a no-brainer. In hybrid setups that employ both types of light, light pipes and day lighting can be used, and automation can be built to maintain the amount of illumination consistent. Because light pipes and day lighting do not require electricity or other types of energy, they are most suited for usage in wet spaces such as baths and pools, where electrical fittings might pose a risk. The notion of light pipes and day lighting has given architects a lot more leeway in designing buildings that don't rely on windows for light and ventilation. The light pipes may also be used for ventilation, and they come in a variety of colours. According to the research of ***Sabrina (2015***) in Dhaka light pipes can contribute necessary day lighting to the fairly simple office work one of many that examines the usage of light pipes in office buildings with deep floor layouts in a tropical Asian metropolis. When the outcomes from the two case studies are compared, it is clear that the light pipe system is an excellent resource for enhancing the lighting environment. It has a light output of up to 300 lux. Light pipes are functional for roughly 6 hours in both circumstances, which eliminates the need to turn on the electric light during those times. Even though the produced illumination levels are insufficient for a moderately tough visual job (500 lux), the study also demonstrated the practicality of the proposed technique, and a comparison was made between the current and retrofitted conditions. The study also reveals that this technique is most efficient when the sky is sunny and that it is ineffective when the sky is cloudy. Because side reflectors are built for equinoxes and summer solstice, a yearly observation is required to analyse their output and the contribution of oblique angles.

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Conflict of Interest

Manuscript title***: "An Evaluation of Daylight Illuminance Performance for Visual Comfort and Determination of the Environmental Impact of Artificial Lighting Energy Consumption"***

I affirm that this work is unique and has not been previously published or is currently being considered for publication anywhere.

In this study, I demonstrated the environmental effects of poor residential building design in the setting of Dhaka, Bangladesh. We consider that this work is eligible for publishing in "The Journal of Architecture Science Review" because it seeks advanced empirical knowledge and theoretical understanding of architecture and design in light of global challenges. Illegitimate architectural design is fairly common in Bangladesh. As a result, massive amounts of carbon are released into the atmosphere. To identify a comparable fact, a study was conducted on a typical residential construction in Dhaka, Bangladesh. As a result, huge carbon emissions are released into the atmosphere. The investigation was carried out on a typical residential structure in Dhaka, Bangladesh, to discover a similar fact. The research study parameter was solely focused on the case study building's insufficient day lighting availability. The readership would profit from the daylighting basics' study to promote effectively passive architecture and minimize energy consumption in the context of the local high energy crisis.

There are no conflicts of interest to disclose. Please address all correspondence concerning this manuscript to me at [runa.sharmin87@gmail.com].

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