

## Daylighting

### Introduction

Daylighting is the controlled admission of daylight into a building to reduce artificial lighting and energy consumption. Daylighting is compelling for aesthetic improvements, health benefits and energy saving opportunities. Since natural lighting creates a visually stimulating and productive environment, people have an innate attraction for daylighting. Impact of daylighting on productivity improvement and health benefit are now well established by many scientific studies. A recent study shows a physiological basis for the claims for increased student productivity and health.

### Benefits and Challenges

Daylighting enhances living/working environment and sets body's circadian rhythm/biological clock. Daylighting provides high illuminance and permits excellent color rendering, creating good visual environment. However, daylighting can also create uncomfortable solar glare and very high luminance reflections on display screens, both of which negatively impacts visual quality. Thus, the effect of daylighting on the performance of a task depends on how the natural lighting is delivered. Challenges to daylighting also include damaging ultraviolet ray and solar heat gain. All of these factors need to be considered in daylighting design for buildings.

### Daylighting Planning

Daylighting design starts with the selection of building site and continues from construction phase to occupancy phase. Daylighting planning has different objectives at each stage of building design and construction:

- **Conceptual Design:** As the building scheme is being created, daylighting design influences and/or is influenced by basic decisions about the siting of the building, orientation of the facades / fenestration, seasonal effects / sun path, building's shape, proportions, and apertures, as well as about the integration and the role of building systems.
- **Design Phase:** As the building design evolves, daylighting strategies must be developed for different parts of the building. The design of facades and interior finishing, and the selection and integration of systems and services (including artificial lighting), are all related to the building's daylighting plan.
- **Final/Construction Planning:** The selection of materials and products is affected by the building's daylighting strategy; final details of the daylighting scheme must be worked out when construction plans are created.
- **Commissioning and Post-Occupancy:** Once the building is constructed, lighting controls must be calibrated and ongoing operation and maintenance of the system begins.

### Key Aspects for Design

For successful implementation of daylighting, the following design aspects should be considered.

- Provide daylighting into all occupied zones adjacent to an exterior wall or ceiling
- Select appropriate glazing
- Provide for integral glare mitigation techniques in the initial design

- Provide balanced luminous environment while meeting the illuminance requirements
- Provide automatic, continuously dimming, reliable daylighting controls for all daylight zones
- Design interiors to maximize daylighting distribution
- Integrate the artificial lighting with the daylighting system
- Integrate with Heating Ventilating and Air Conditioning system
- Commission and verify post-occupancy energy savings

### Lessons Learned

Case studies of eight representative daylighting project examples reveal the following common issues<sup>1</sup>.

- Commissioning of lighting control system was not completed prior to occupancy
- The problems revealed through the commissioning exercise are not easily corrected
- Lack of coordination between architectural, interior and space planning, mechanical and lighting/ electrical disciplines to provide an effective daylighting system
- Lack of clear understanding on the part of the disciplines as to how the decisions they make can affect the performance of a daylighting control system
- Location of daylighting controls and windows not properly coordinated
- Detailed shop drawing review was not performed to ensure a functional system
- Daylighting system that does not save energy goes unnoticed (under dimming)
- Daylighting system that saves energy more aggressively gets disabled

### Operations and Maintenance

The success of a daylighting design depends completely on commissioning and continuous evaluation of the lighting system. During regular building operation, maintenance needs to periodically check the functionality of the daylight-responsive lighting controls to ensure that the system is saving energy as planned and has not been overridden. Maintenance also should ensure that areas designed to admit daylight are not shaded by growth of landscaping or other obstructions. As part of any routine building cleaning regimen, any daylight redirection devices should be cleaned on a regular basis to ensure the optimal performance of the reflecting surfaces.

### References

1. [http://www.daylighting.org/WeidtGroup-SS04\\_Panel7\\_Paper30.pdf](http://www.daylighting.org/WeidtGroup-SS04_Panel7_Paper30.pdf)
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