Daylight-friendly design
10 tips for daylight optimization

What is daylighting?

Daylighting design leverages visible light from the sun to enhance a building's interior illumination through direct, diffused and reflected lighting approaches. It can be used to complement electrical lighting, create more visually stimulating environments and significantly reduce energy costs.

Why is it important?

Daylighting provides compelling benefits for human activities. The effective use of daylighting can improve productivity, enhance moods, boost morale, lower fatigue, reduce eyestrain and hasten healing in healthcare environments. In educational environments, daylighting has been proven to contribute to better student performance. Most importantly, the effective use of daylighting supports sustainability (LEED®) initiatives.

What are the financial implications?

The costs of daylighting design can be readily offset by the resulting energy efficiencies, reduced operating costs and increases to the overall building value.

Tips for daylighting design:

1. Start with the right design team. In addition to architectural expertise, this team should encompass mechanical, electrical lighting and HVAC experience. Effective daylighting in building design starts with schematics that take into consideration how the building spaces will be used, illumination requirements, building positioning and local climate patterns.

2. Leverage your region's sun path and climate. Your sun patterns should affect where you place your windows, what type of glazing you use, thermal insulation requirements and shading strategies. Design your

...continued

building around the light and sun patterns to mitigate glare from direct sunlight and maximize the distribution of indirect lighting.

3. Design your architectural spaces to optimize diffuse light. Daylighting is all about leveraging daylight without unwanted side effects. It is important to balance daylight availability with solar heat gain considerations and the ability to properly control the sun's glare through diffuse lighting approaches. Key design considerations should include window sizes and placement, solar shading devices, glass types, interior glazing and interior finishes.

4. Use daylighting as the primary source of illumination. Electric light should be designed to supplement daylight - not the other way around - and should employ dimming controls for optimal results. Increase the amount of brightness in a room by incorporating reflected daylight. For example, the use of light shelves - shelves that bounce light from the ceiling to reflect it down into the interior of a room - can enhance the amount of light in a room while decreasing the brightness of direct light from the windows.

5. Treat skylights or top lighting as light fixtures. Major retailers, including Walmart and Costco, have long employed skylight strategies to improve sales. By focusing daylight penetration at higher intervals in a space, you will deepen light penetration and reduce the risk for overly bright spaces. Skylight systems admit more light per unit area than windows, and can distribute it more evenly over a designated space.

6. Optimize interior design and finishes to underscore daylighting approaches. Use light colored surfaces throughout the building. Paint ceilings white to promote bounce and diffusion through spaces. When using light shelves, sloped ceilings can maximize the ability to bounce light deep into a space. Sloped ceilings can be designed to reflect light from the window areas to enhance interior illumination.

7. Use atriums to maximize daylight into deep interior spaces. Atriums offer both aesthetic and daylighting benefits. Effective daylighting strategies can significantly mitigate the costs of heating and lighting atriums when combined with shading solutions. For example, adjustable louvers encased in sealed glass can offer total control of the sun's rays and adapt the contribution of daylighting to both the atrium and adjacent spaces.

...continued

8. Use insulated glass units with integrated louvers to filter daylight. Operable, cord-free louvers typically deliver flexible heat and light control, and manage the quantity and quality of light transmission through fenestration. With a simple rotation, louvers can contribute to a better natural light distribution within the space, while still reflecting the light back outside. Integrated louvers are an ideal wall and fenestration application for art galleries, museums, libraries and other areas where optimal light control is an absolute necessity.

9. Use exterior shading and control devices in hot climates. Shading devices reduce heat gain and diffuse natural light before it enters the interior spaces. Examples of exterior shading and control devices include light shelves, overhangs, horizontal and vertical louvers, and dynamic reflecting systems. Motorized louvers or sunblades provide the maximum daylight control. They are usually made of extruded aluminum profiles that ensure control of solar heat gain and daylight performance, while adding aesthetic appeal to a building's design.

10. Test, test, test. Use simulation tools to help you make sure that you get your desired levels of illumination. Whether you use physical modeling or digital simulation tools, test your design ideas around sun and daylight patterns to ensure the desired results.

For more daylighting design tips, contact: unicel@unicelarchitectural.com

Daylighting Case Study
North Carolina Museum of Art

The North Carolina Museum of Art (NCMA) in Raleigh, NC, recently undertook a major expansion project to occupy 127,000 square feet (11,800 square meters) - enough space to host the permanent collection of over 5,000 art objects. The expansion was intended to transform the existing building into an exhibition center with administrative and educational offices, and combine these with gardens and outdoor galleries to create the nation's largest art museum park.

The challenge:

In order to enhance visitors' experience with art and help preserve the masterpieces hosted by the museum, the architect needed a system to filter UV rays and allow only a controlled amount of light to seep in. Architects Thomas Phifer & Partners were required to work within the artistic and educational guidelines of the project while maximizing the visual impact of the surrounding scenery. They approached Unicel Architectural for assistance in creating a vaulted roof that would match the neighbouring hills, while allowing controlled daylight into the buildings. The ultimate goal was to turn light into art with the help of technology.

Key parameters	
Location:	Raleigh, NC
Gross square footage:	127,000 square feet (11,800 m2)
Sunscreen:	45,000 square feet (4,180 m2)
Completion:	2009
Program:	Expansion, galleries, courtyards, public spaces

Team	
Owner:	North Carolina Museum of Art
Architect:	Thomas Phifer & Partners, NYC
Sub-Contractor:	Super Sky
Solar Shading Manufacturer:	Unicel Architectural

The daylighting solution:

For the NCMA sunscreen, Unicel developed a specially-designed blade to effectively control the amount of daylight that reaches inside the building. The blades were conceived to filter the UV radiations that could damage the exhibits and to allow only a reduced quantity of light to penetrate. Once it passes the sunshades, a system of vaulted ceiling coffers filters and softly diffuses the light into the galleries.

The result:

The resulting sunscreen comprises 376 curved panels of 20' x 6' (6m x 2m) made of clear anodized aluminum that filters daylight while creating a stunning visual complement to the building's exterior and surrounding landscape. Because of the number of panels, their shape and the daylight efficiency challenge, the NCMA daylighting project is an architectural milestone in terms of design and manufacturing.