The Benefits of Daylight Modeling:

a site-specific simulation that aids the process of intelligent daylighting design.

By Amy Keller

Daylighting can make a building's design and use come to life. But if not skillfully planned and well implemented, daylight can negatively affect both building and occupants, and be costly to fix.

Daylighting creates the mood of a space, affecting the comfort, productivity, performance, health, and well being of occupants. And with measures of building performance such as LEED® becoming more important than ever, it boosts total energy efficiency and potential savings in electrical lighting and HVAC climate control costs. Too often, unfortunately, the end result is not realized until construction is complete. This is not the time to discover glare, overly bright areas, shadows, dark spaces, or poorly balanced light levels. Effective daylighting happens in the design phase.

Climate-based daylight modeling clearly demonstrates the impact of the size, type, and placement of skylights, windows, or translucent wall systems. Computer-generated charts and light-level schematics can measure daylighting effects, enabling designers to analyze the behavior of light within their space and make changes early.

Grayscale renderings such as this are excellent indications of light distribution within a space. This image shows an atrium topped with a translucent skylight and daylight being driven deep into the space.

Beyond the building itself, well-planned daylighting considers a number of issues. How will the structure be positioned relative to the topography or the points of the compass? What is the effect of local climate and the sun's path? Might any proximate structures create an urban canyon at certain times? Are there mountains or trees nearby, or reflections off the surfaces of buildings or bodies of water?

A daylighting design that is effective in one location simply may not be in another. How much daylight is needed? What about harsh glare and shadows? Too often, bright sunlight blinds occupants, overheats the space, or overworks the HVAC system. Using daylight modeling, "what if" scenarios can eliminate any negatives. Alternate design solutions are studied and planned, revealing better ways to daylight any space. A good first step is to evaluate the impact of direct sunlight. Balanced daylighting is essential.

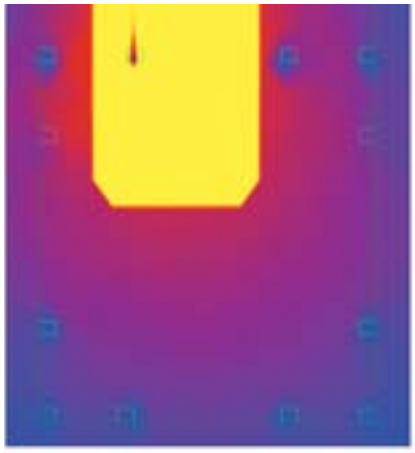
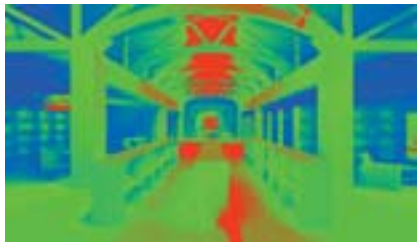


Fig. 1

In this example, an architect wanted to select light transmittance. First, a skylight was assessed at noon on the fall equinox; the sun, directly overhead, is at its strongest and gives a good indication of typical midday light levels for most of the year. Using 30% glass (Fig. 1), this falsecolor plan view reveals excessive areas of direct sun (bright yellow); light levels are not balanced within the space, indicating glare. Next up were translucent sandwich panels (Fig. 2), based on 8% light transmittance. Given the same sky condition, the panels diffuse direct sunlight, evenly filling the entire space with controlled, balanced daylight.



False color modeling reveals the light level in the same space below a skylight.

Clearly, the original plans would have left students and staff dealing with imbalanced light levels and glare. Using daylight simulation, alternatives were considered, yielding a more effective design as well as operational savings through reduced energy consumption.

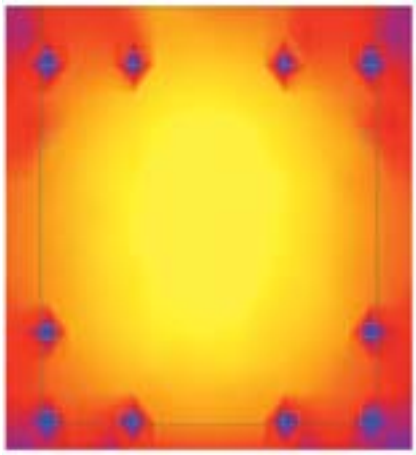


Fig. 2

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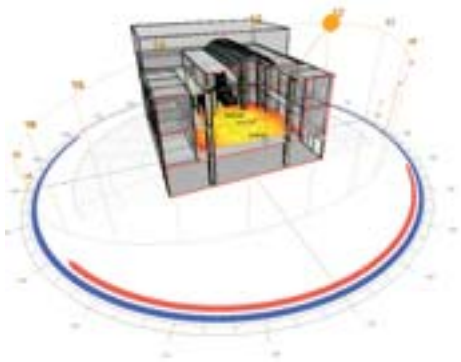

The sun's path during the various months of the year and times of day can be site-specific simulated.