Gensler

# Daylighting:
## Sustainability Considerations in Educational Facilities

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Sustainability increasingly is emerging as a primary consideration when designing contemporary educational spaces. With the assistance of 3-D modeling software, architects now have the ability to visualize not just how spaces will look, but also how they will perform.

Gensler is taking advantage of technology to engage in a performance-driven design process that allows for the real-time analysis of design decisions in-house. This approach allows for a quicker and more seamless iterative cycle of design decision-making, which in turn leads to more holistic and successful solutions.

An example of this design process is the recent design of state-of-the-art classrooms for the Los Angeles Community College District (LACCD). A prime challenge of the project was providing ample daylight while limiting solar heat load to strict energy efficiency targets required to achieve LEED Platinum certification. Vast window areas bring more natural light, but also unwanted heat. Conversely, minimal window areas reduce heat gain at the expense of natural light.

To be certified LEED Platinum, the classroom building had to prove its energy consumption was better by 42 percent than the already strict California Title 24 energy standard. Designers were limited to 35 percent glazing on the building perimeter. Within that limitation the team needed to maximize daylight penetration to reduce the need for artificial light, which generates heat and consumes energy. Daylight penetration also positively affects productivity, alertness and general wellness. The target: provide 25 foot candles of natural light over 75 percent of a 24-foot-deep classroom.

### Compressing the design-analysis cycle

In a traditional process, designers transfer drawings to engineering consultants for analysis. When the results of the analysis are returned, often days later, designers consider revisions to address identified issues. This cycle can be repeated multiple times.

Due to the accelerated schedule for the LACCD project, the design team turned to BIM and advanced analysis software to compress the design-analysis cycle. Software on the workstations of Gensler architects allows them to make balanced decisions earlier, be they planning choices, aesthetic choices or choices born from sustainable design principles, based on immediate feedback from an energy model. This model doesn't eliminate the essential work of engineering partners. It simply empowers architects to balance the multitude of different drivers on a project and deliver a comprehensive design solution, faster and smarter.

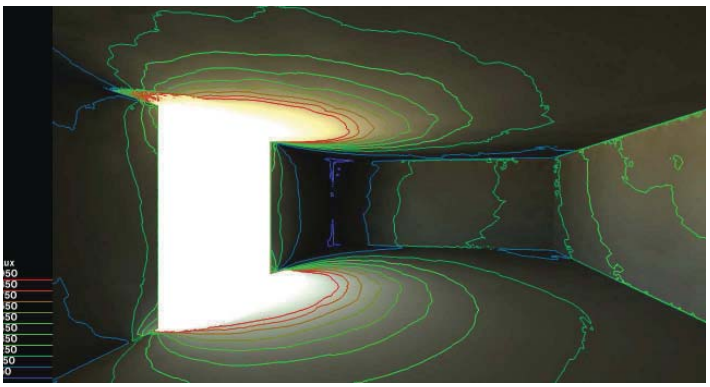
In house, through a quick series of iterative steps, the LACCD design team determined appropriate window shapes, sizes and positions that allowed the necessary light penetration and simultaneously limited heat gain. One piece of the solution was to place long, narrow windows near the top of the wall, and a limited number of conventional height windows spaced far apart beneath them. The team also designed a faceted ceiling plane that is higher at the window and slopes downward toward the center of the room. This approach improves light penetration further into the room.

The ceiling receives daylight from a light shelf outside the long narrow windows. The shelf's reflective surface bounces light back up into the room and, secondarily, serves as a shading device to block sun from hitting the lower windows, which would add to solar heat gain. The same computer simulation allowed designers to determine the appropriate glass types, as well. The upper, light-collecting windows are high VLT (visible light transmission) glass. The lower windows are low VLT glass, because they serve mostly to provide views.

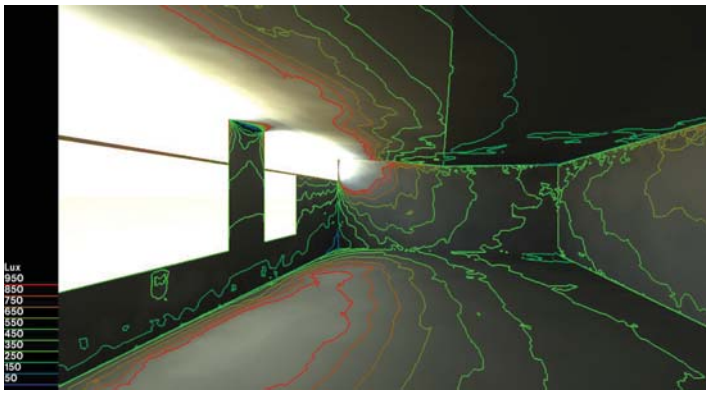
Starting with a base case, the design team created a 3-D model in Autodesk Revit and converted the geometric information into a gbXML (Green Building XML) file for use in Autodesk Ecotect, where the model was subjected to an array of analyses. The process included the assignment of various materials and sky conditions for radiance simulations that test how each variable affects light levels.

On this particular project, the process led to three significant design decisions:

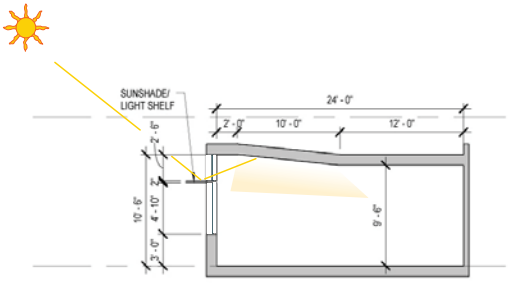
- The light shelf bouncing light onto the ceiling was placed outside the building, where it shaded the window below rather than inside where it would actually block some desirable light from penetrating into the room



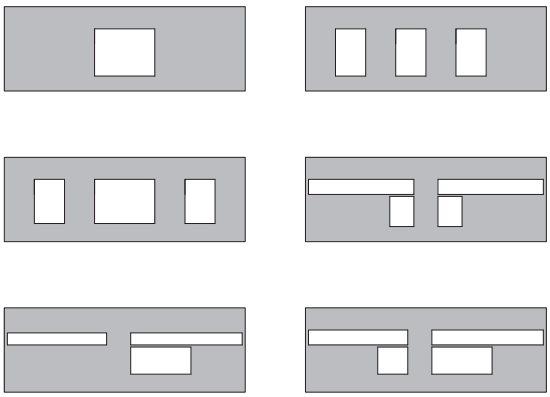
**Radiance Simulation:** Daylight penetration in the base case



**Radiance Simulation:** Daylight penetration in the final design




**Sectional diagram** of final design



**Elevations** of studied window arrangements

**A rendered view** of the daylit classroom

- Different glass types were assigned to specific windows to improve daylighting performance
- A second panel of vision glass was added to better distribute daylight

Gensler continues to increase its technological capabilities through investment in hardware and software for designers and project architects. The firm believes that staying current and expert with emerging technology benefits its clients in the education market. Gensler leads the design industry with more than 900 LEED-accredited professionals firmwide who continue to develop new ways to design sustainably. For its long-standing commitment to the advancement of sustainable design, Gensler received the leadership award from the U.S. Green Building Council in 2005.

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