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Innovative Daylighting Scheme Premiered in New Middle School

A new school is opening in Greensboro, North Carolina, that will be the state's most environmentally sustainable school yet. Northern Guilford Middle School's most striking feature is the high quality natural daylighting. Using a new, breakthrough technique invented by the architects and showcased here for the first time, the school promises to be not only one of the most energy efficient schools in the US, but also a healthy school. The school was designed by Innovative Design, Inc. of Raleigh, NC, a nationally recognized leader in sustainable design.



Carefully designed lightshelves make a striking vision from the exterior and provide beautiful light inside the classrooms without glare. The unique daylighting design incorporates curved, white, translucent lightshelves located just below south-facing clerestory windows. The sunlight entering through the high windows either reflects to the back of the classrooms or filters through the translucent panels to the work surfaces. Outside the clerestory windows is a second set of lightshelves that bounces additional sunlight into the clerestory areas and helps shade the lower window glass in the classrooms. Through the use of the lightshelves and highly reflective ceilings that slope down from the heads of the clerestory windows to the opposite side of the room, the glass area that provides natural lighting is reduced by 40% over typical daylighting strategies. This results in both energy savings as well as initial cost savings. More important, it creates a more uniform light distribution within the space as compared to traditional means of naturally lighting spaces from one side.

In the other key spaces, different daylighting strategies are employed. In the gymnasium, multi-purpose room and cafeteria, south-facing roof monitors are used in conjunction with translucent fabric baffles to create natural lighting without glare. No direct beam radiation enters through any of the daylighting components, helping to ensure that the daylighting apertures will remain open and utilized. Precisely designed overhangs at the monitor windows protect the spaces from excessive direct light during peak cooling periods.

In the administrative areas and the media center, both located on the north side of the school, high north-facing clerestories provide the opportunity for additional daylighting. All totaled, the daylighting strategies will provide superior light within the spaces for over two-thirds of the school day. By reducing the lighting load, the daylighting also cuts the peak cooling load by 20%. The combination of daylighting, roof assembly, and under-floor air distribution system reduces the initially installed air conditioning tonnage by 82 tons and cost by over \$160,000.

In addition to the practical nature of the daylighting design, it adds a striking visual component to the school. It is highly visible on the approach to the school with the many monitors on the roof and a soaring rounded monitor over the entry. Inside, the quality of light is exceptional. Since studies have proven over and over that student performance is significantly enhanced in schools with natural rather than electric lighting, there are high expectations for this school on every level.

Interior architectural shading is another innovative strategy used in these classrooms. An interior dropped soffit slopes up from the windows towards the back of the space. Its placement intentionally shades the projection screen and TV monitor areas within the classrooms without blocking view. This architectural element eliminates the need for movable shading devices that often end up being left closed, eliminating the benefits of daylighting.



A daylight-responsive electrical lighting scheme complements the natural lighting. Indirect fluorescent lighting is installed throughout the school building. This lighting is dimmable and controlled by occupancy sensors and photocell sensors that work in concert to minimize unnecessary artificial light usage.

This school is one story, but project architect, Bae-Won Koh states “The breakthrough design will be valuable in single-story and multi-story buildings. This new strategy is a very economical way of getting controlled, glare-free sunlight into buildings.”

In addition to the high quality natural daylighting throughout, there is a long list of green techniques and products incorporated into the school’s design. A unique rainwater catchment system collects rain on the roof, uses it for toilet flushing, then sends it through an environmentally friendly, on-site, waste treatment system called the *The Living Machine*[™], and then to athletic fields for sub-surface irrigation. Water returned to the aquifer is clean and nitrogen-free. Rainwater that falls on the driveways and parking areas is directed through bioswales to one of three constructed wetlands where the water is cleansed and nitrogen reduced before seeping into the aquifer or being discharged to local streams. The school also features a solar water heating system providing 75% of the school’s hot water needs, an eighteen foot sundial, a solar greenhouse attached to science classrooms, and several photovoltaic systems that provide electricity including one that lights the school’s sign at the campus entrance.

Principal Dr. Misher says “All the green features of the school are linked to the curriculum and intended to enhance experiential learning. The students will clearly benefit in that everyday they will be able to see the impact and importance of sustainable design strategies that can be implemented now.” Not only are constructed wetlands incorporated on the site, but careful access is provided so students can learn first hand, how wetlands help our natural environment. The rainwater harvesting, solar systems and daylighting will be real-time monitored and accessible on the school’s computer system. Attending this school will give students and teachers hands-on experience with these sustainable technologies that are working and available now. It will provide lessons on energy, ecology, and their impact on the land and environment.

According to Innovative Design’s president Mike Nicklas, “Daylighting is unique in school design because it is the only thing that you can implement that improves student performance, enhances health, saves energy, helps our environment and pays for itself in less than one or two years. The daylighting strategy that we implemented for the first time in the classrooms at Northern Guilford Middle School is important because it will provide designers with an improved means of integrating controlled, glare-free daylighting, cost-effectively into schools and offices.”



Joe Hill, Facility Planning Consultant for the school system says that “Guilford County Schools teamed with Innovative Design to design a high performance school that incorporates many environmentally friendly features. Northern Guilford Middle School could very well be a benchmark for future schools in Guilford County. In addition to minimizing the impact on earth’s natural resources, this facility is very energy efficient and will result in significant savings in terms of operating costs. Many learning opportunities are afforded students as they study the “green” features of this facility such as energy saved through the use of daylighting, solar water heating panels and photovoltaics. This is truly an example of how school facilities can maximize use of limited resources and protect the environment at the same time.”

For more detail on Northern Guilford Middle School, see attached printed material, www.innovativedesign.net or www.gcsnc.com (click on School Directory). The school will be open to the media on January 24. Please coordinate with Dr. Sam Misher, the principal, if you would like to visit the school.

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