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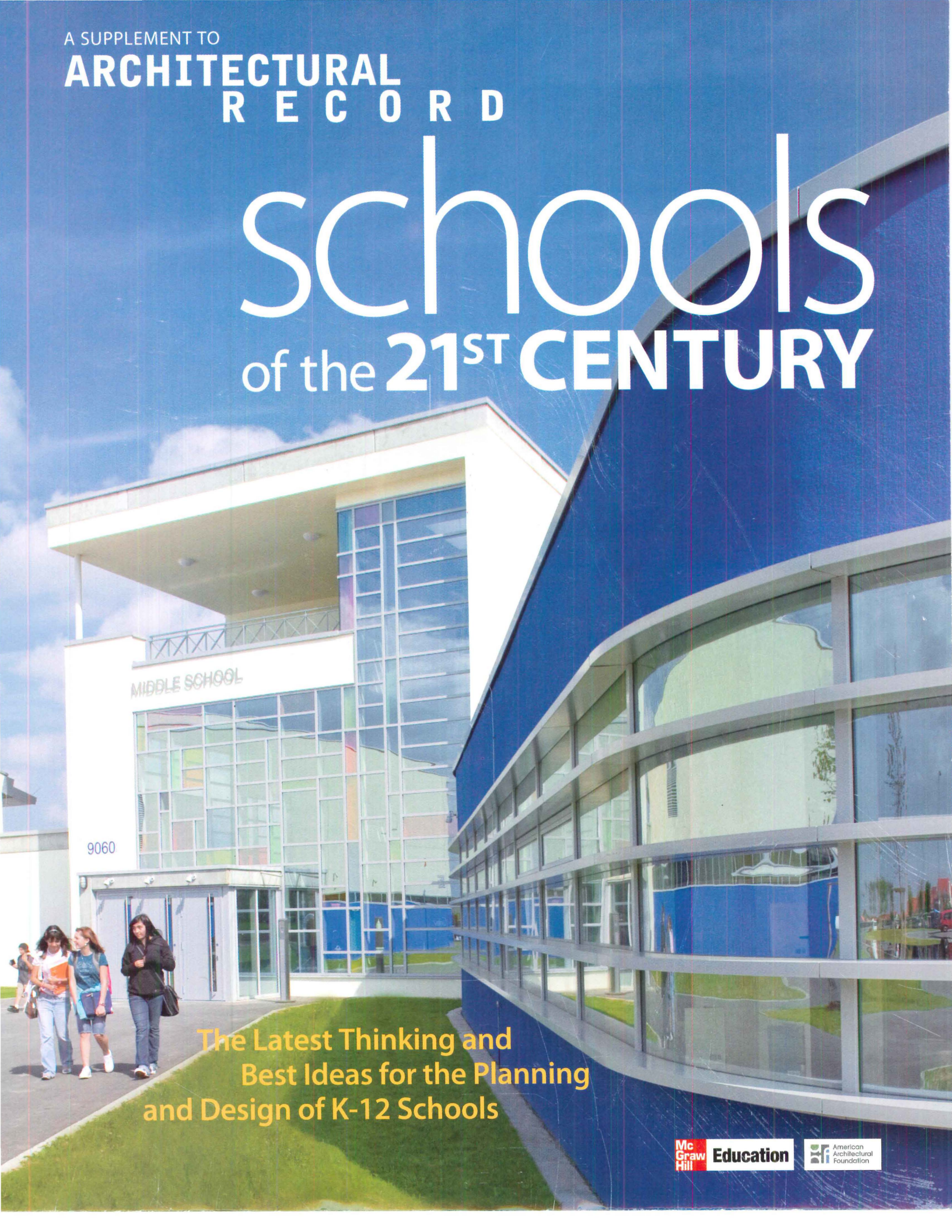
schools of the 21ST CENTURY



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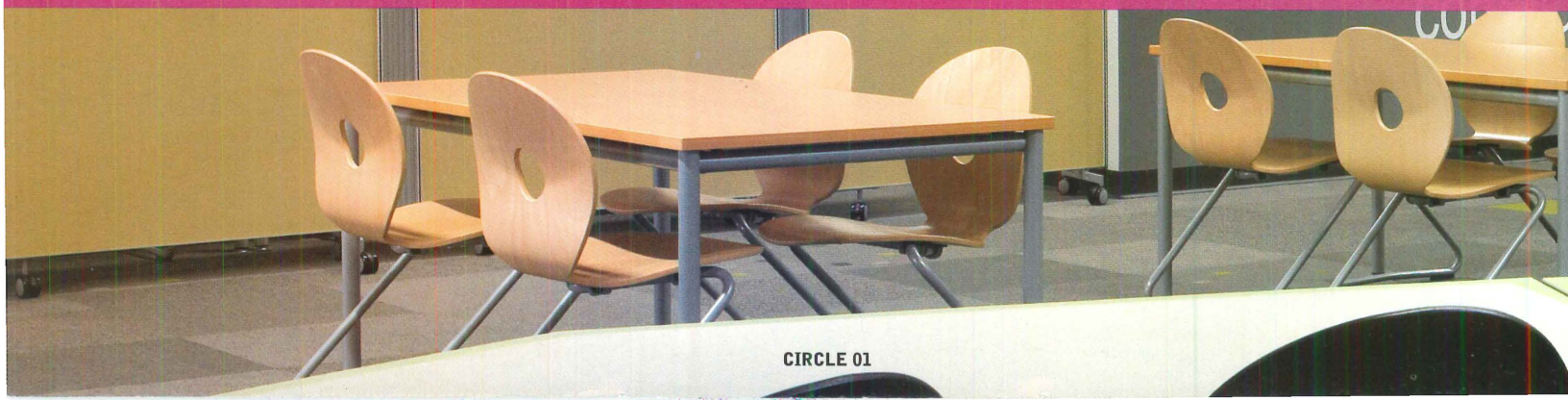

CIRCLE 01

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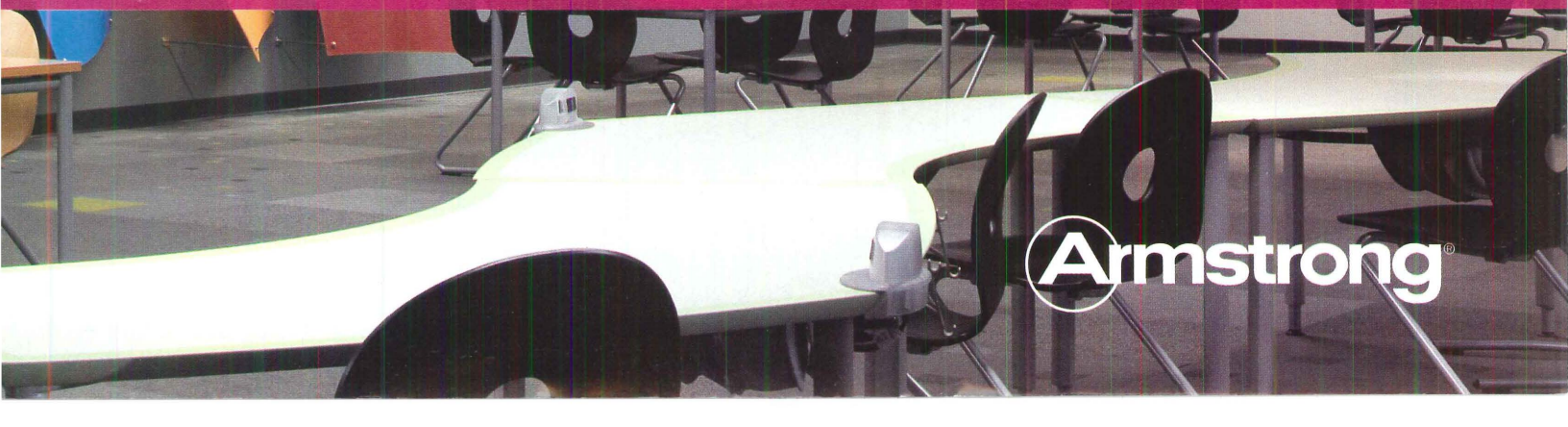

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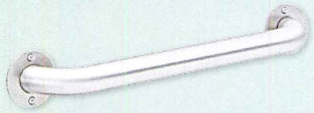
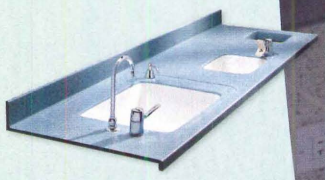
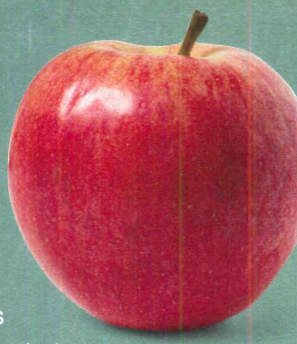




A Better Choice



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CIRCLE 02

Greening America's School Restrooms

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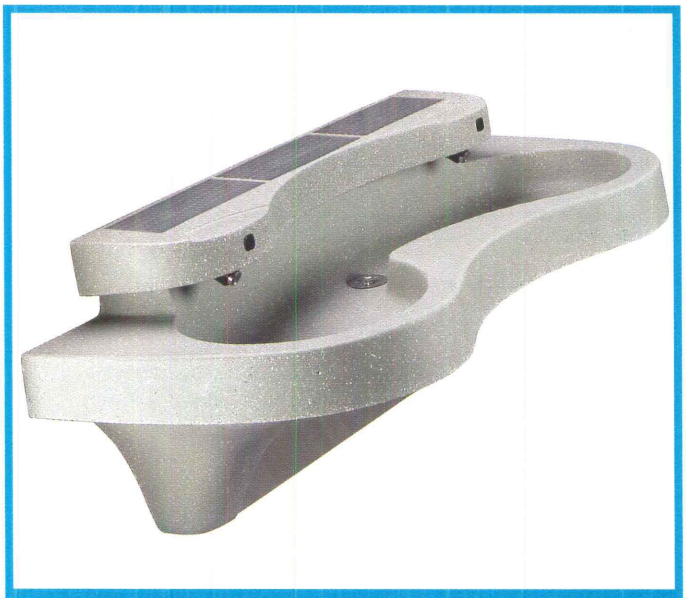

With TerreonRE solid surface, combined with ndite light-powered technology and a 0.5 GPM sprayhead, the Express MG is one of the greenest handwashing fixtures on the market.

ARCHITECTS AND DESIGNERS GREENING AMERICA'S SCHOOLS know that restrooms and locker rooms are notorious for consuming large amounts of water and energy. Albeit only one part of a building, the fixtures in schools' restrooms can significantly impact the "greenness" of the overall facility.

Clients jumping on the green bandwagon are looking for innovative restroom design choices. These products not only should conserve water and energy and utilize environmentally sound building materials, they need to address vandalism, traffic flow and ADA compliance. When you add contemporary styling and durability, working with an industry leader like Bradley is key.

For 85 years, Bradley has provided high-quality restroom solutions for schools – from multi-height lavatory systems, juvenile-height washfountains and classroom sinks to commercial showers and lockers – ideal for green restroom design. A number of Bradley products help earn LEED credits.

Here are some ways Bradley is helping to "green" schools' restrooms and locker rooms:

>>> RECYCLED MATERIALS

The leader in solid surface, Bradley recently introduced a recycled solid surface material, Terreon®RE. Composed of an eco-friendly bio-based resin, pre-consumer recycled granule fillers and other natural materials, TerreonRE looks as beautiful as it is gentle to the environment. TerreonRE is one of the greenest and most durable product materials available.

Bradley's Lenox™ Lockers and Bradmar® solid plastic partitions – made from 100 percent post-consumer recycled High Density Polyethylene (HDPE) plastic (i.e., recycled milk jugs) – are another green choice. This material stands up to heavy usage and moist environments like locker rooms.

>>> WATER CONSERVATION

In 1921 Bradley's invention of the washfountain, which can save 80% in water consumption, set the industry standard for conserving water. For corridor-concept washrooms, Express® Lavatory Systems, MG and SS-Series, made from Terreon solid surface material, curb water flow to 0.5 GPM. These fixtures employ touch-free handwashing technology that also saves energy because the faucet automatically shuts off after a user's hands leave the sensor area.

>>> ENERGY MANAGEMENT TECHNOLOGY

The first light-powered handwashing fixture, ndite® technology, uses photovoltaic cells integrated into the top of Bradley's Express Lavatory System to capture and store solar or normal room-level lighting. The light is then converted into energy, which activates the flow of water.

Bradley has built a solid history of manufacturing innovative restroom and locker room products that conserve natural resources, water and energy. With continued focus on green design, Bradley will help build high-quality and environmentally sound school washrooms fit for the future. ■

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schools of the 21ST CENTURY

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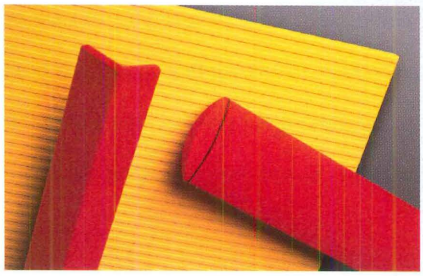

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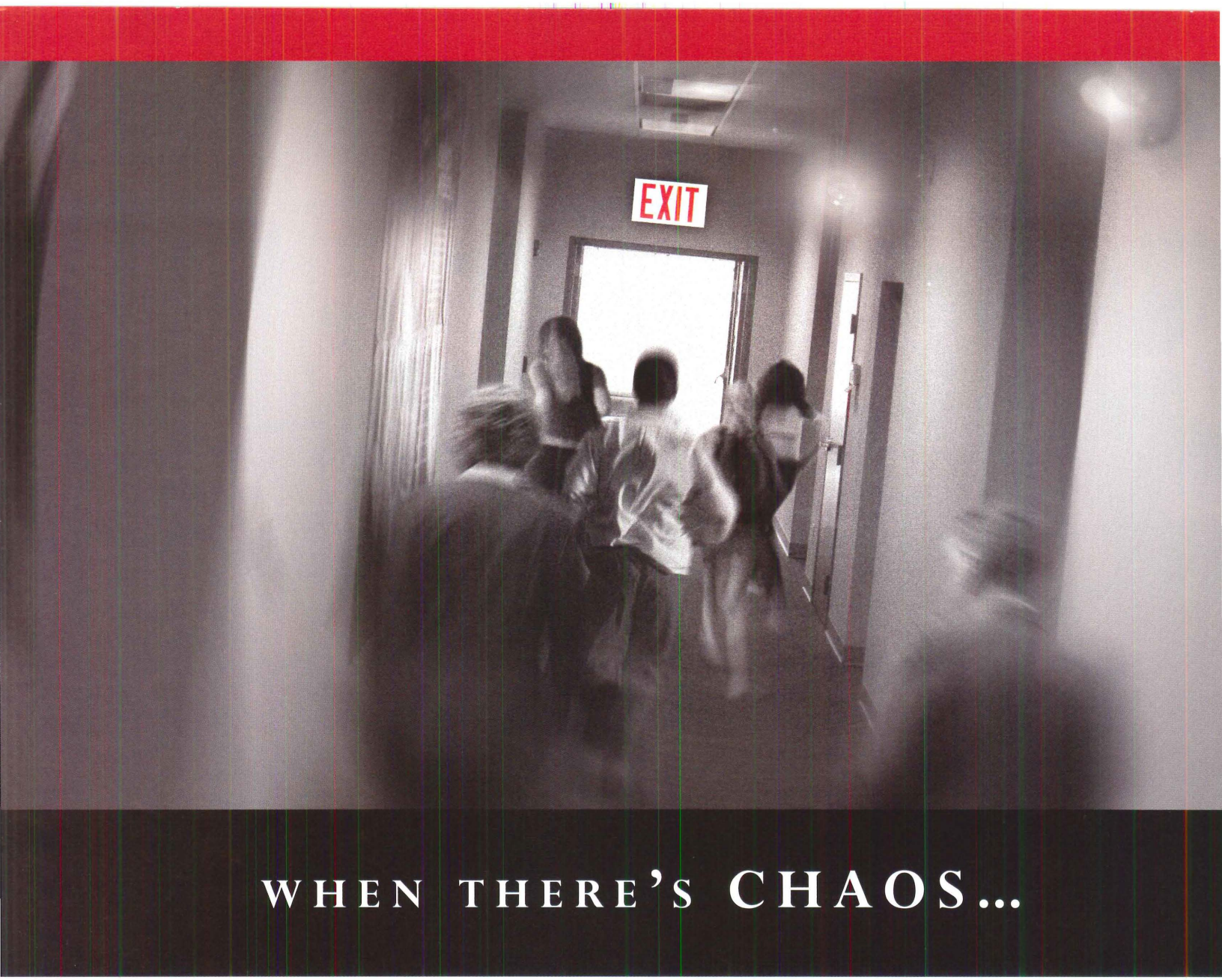

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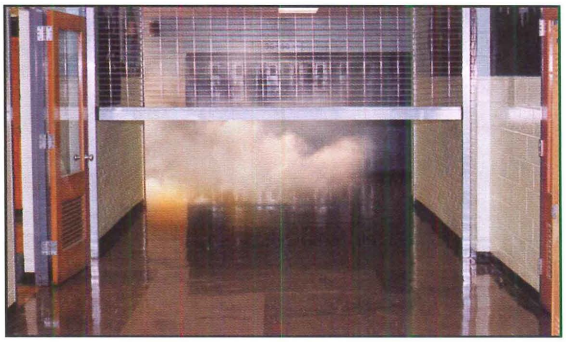

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CONTENTS 01.09

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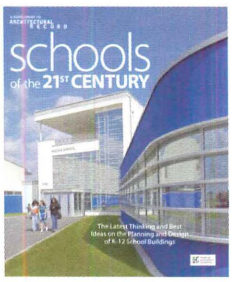

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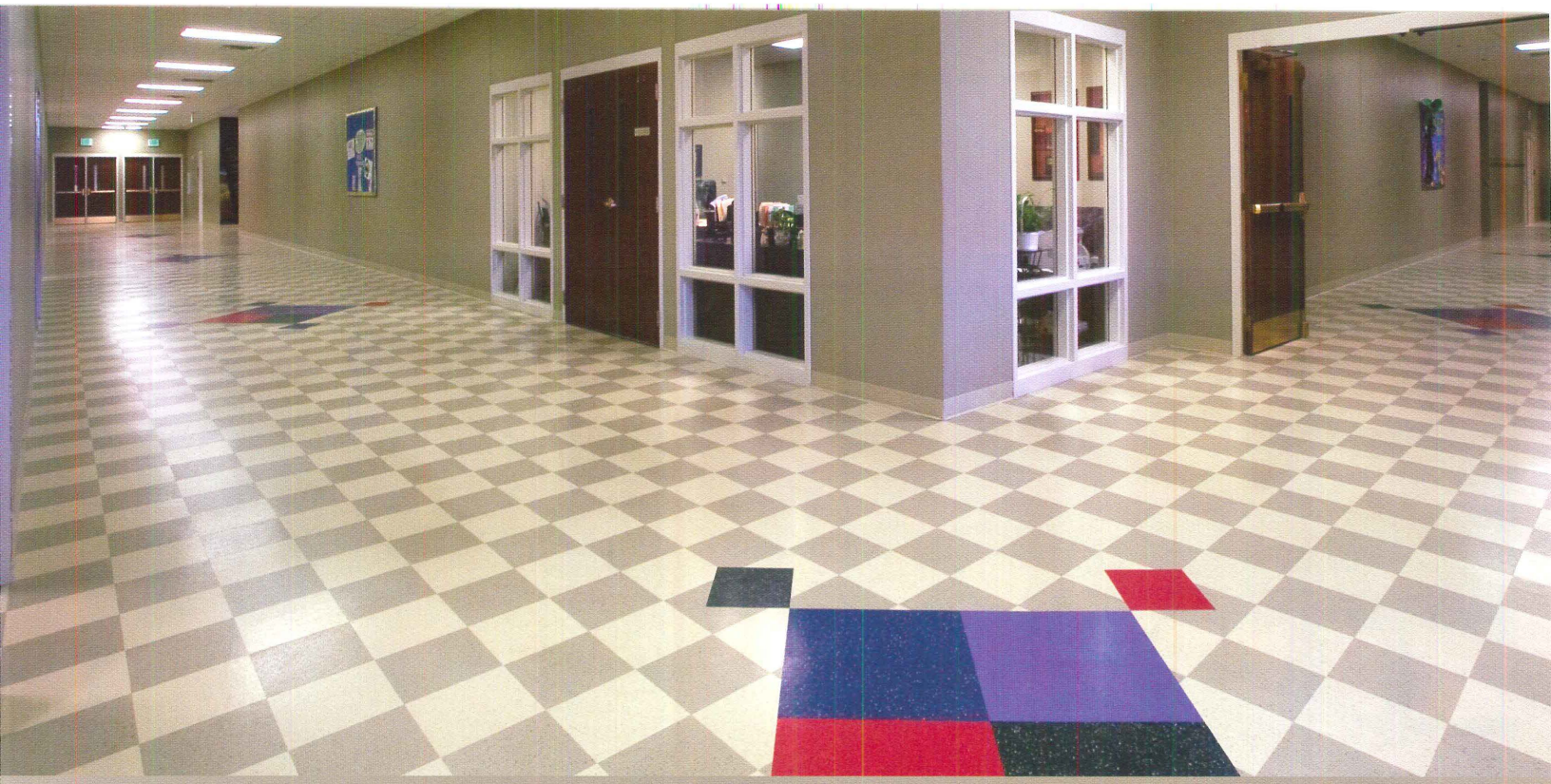

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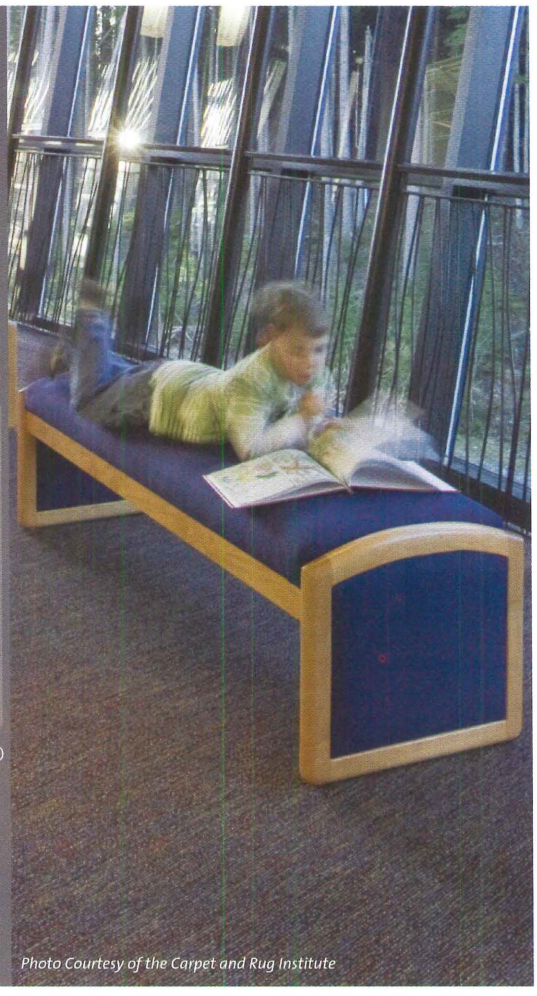

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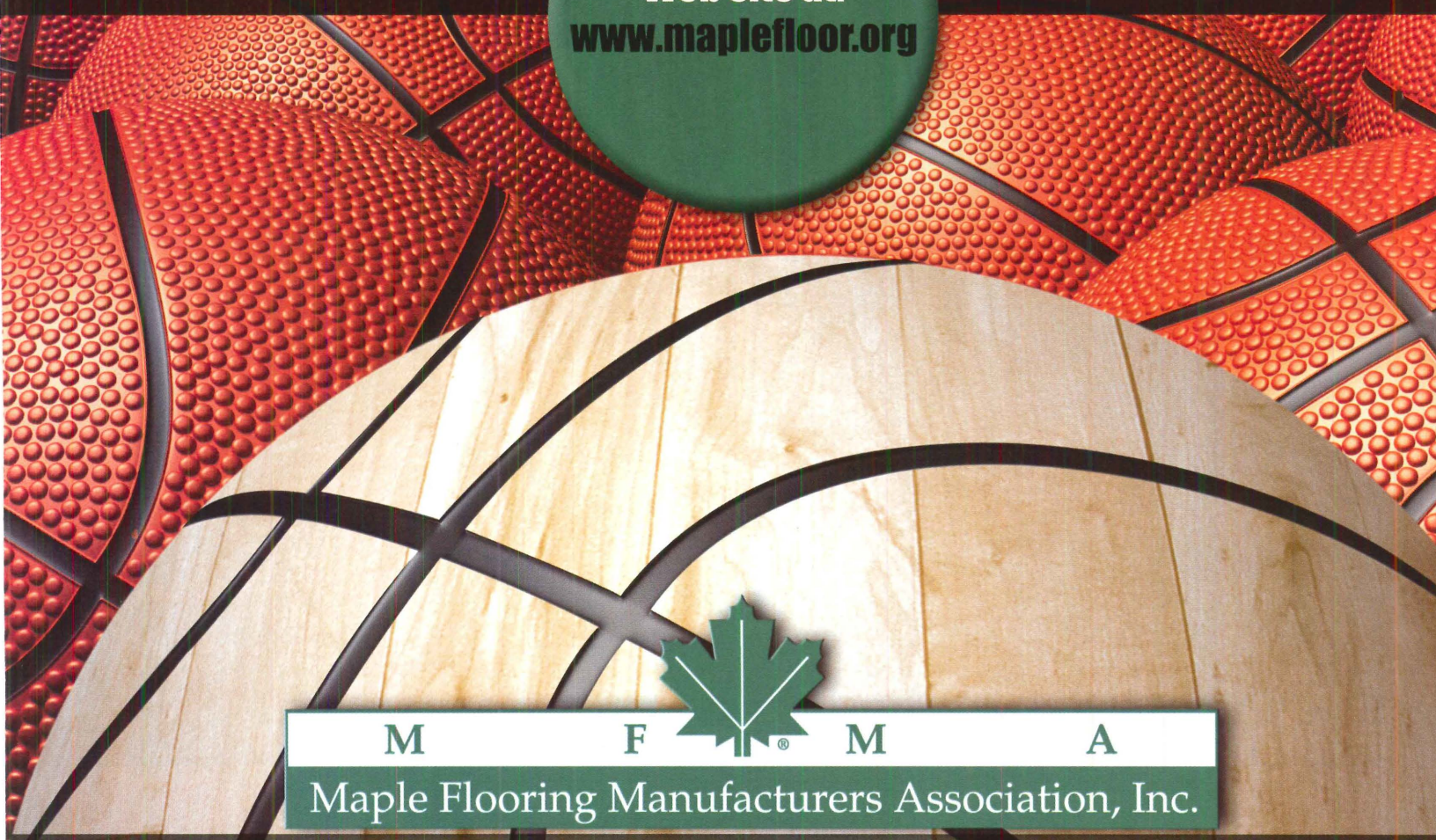

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CIRCLE 07

There is no "right" answer

FOR THE RATIONAL CHILD WHO PREFERS ABSOLUTES TO AMBIGUITY, "There is no right answer" is probably one of the most frustrating phrases a teacher can utter. Architects and school officials who are involved in the design and construction of schools sometimes find themselves in a position of saying something similar when parents or other members of the public ask why most school buildings are unique. Why can't they all be alike? Wouldn't that be cheaper? Better? Not necessarily. No two sites are alike. Each district's needs are different from any other's, and what works for a grade school seldom works for a high school. In other words, there is no "right" answer.

But one thing that is universally true is that the senses of a child are nearly always more acute than those of an adult. Poor air quality, bad lighting, extraneous noise, and rooms that are too hot or cold are enormously distracting, especially if one is struggling to learn. In 2006, the editors of ARCHITECTURAL RECORD magazine decided that we could help those who are charged with making decisions about the future of our schools do a better job by publishing some of the best school-design work in the United States. As a result of our decision, you are holding the third annual issue of SCHOOLS OF THE 21ST CENTURY. In previous editions we wrote about green schools, integrating IT into existing school buildings, and several programs put on by the American Architectural Foundation (AAF). This year's issue includes six more case studies, feature stories on schools for special-needs children, and school building additions. And, we have coverage of a special design charrette sponsored last year by the AAF and Target. This exciting program, called "The Voice of the Student Design Charrette," brought together four teams of architects and educators to put shape and form to student design ideas that have been collected by the Foundation over the past two years.

On April 3, 2009, please join us for the third annual SCHOOLS OF THE 21ST CENTURY design symposium. We'll have presentations—and great conversations—with some of the nation's leading experts on school design (along with continuing-education credits for architects). It will be collocated with the National School Boards Association's annual conference and, best of all, it is free of charge. Visit schoolsofthe21stcentury.com to register. We will offer attendees many answers, if not the "right" one.

Laura Viscusi, Publisher, and Charles Linn, FAIA, Editor

On April 3, 2009,
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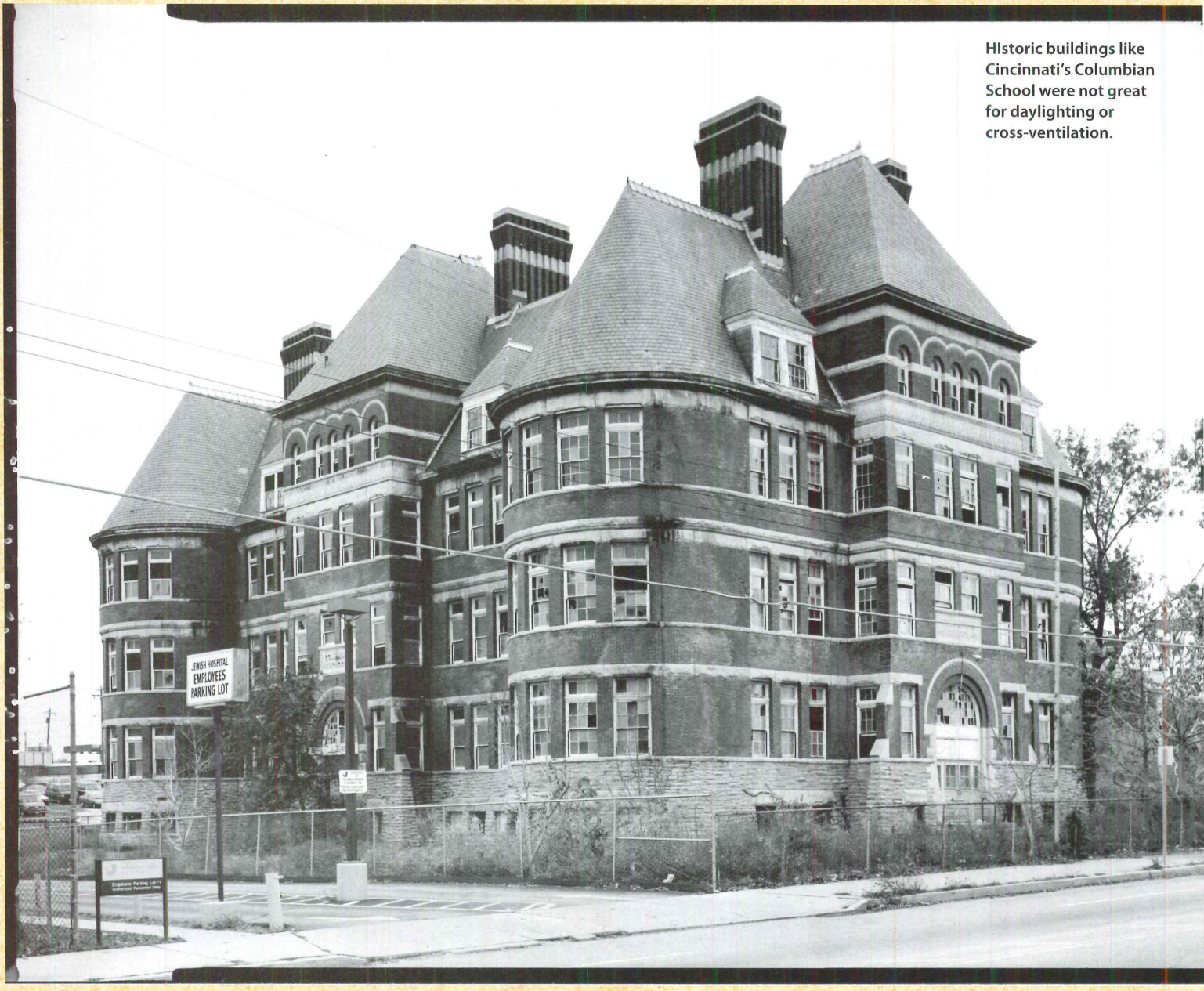
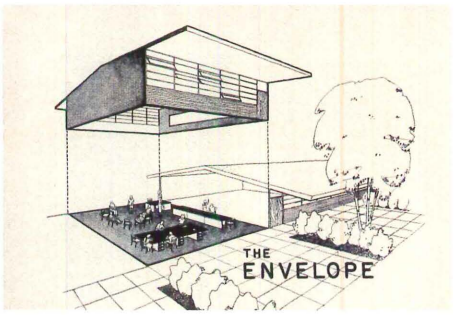


HIstoric buildings like Cincinnati's Columbian School were not great for daylighting or cross-ventilation.

History Lesson

Anyone concerned about greening schools can learn from William Caudill's 1954 book, *Toward Better School Design*. It extolled the virtues of daylighting and natural ventilation seeing a resurgence today.

BY CHARLES LINN, FAIA



In 1954 the number of births of American children exceeded four million for the first time. This was just the beginning of the baby boom and the school construction explosion that would follow. The nation's need for schools was acute, and knowledge so scarce that ARCHITECTURAL RECORD devoted not one but two issues to the subject that year. We also published a wonderful book called *Toward Better School Design*. Its author was a gregarious Texan named William Caudill, who had been running a practice and doing research on school design at Texas A&M since the late 1940s. His firm, Caudill Rowlett Scott (CRS), was well on its way to becoming one of the largest architectural firms in the United States, in part because of its innovative approach to the planning, design, and construction of schools.

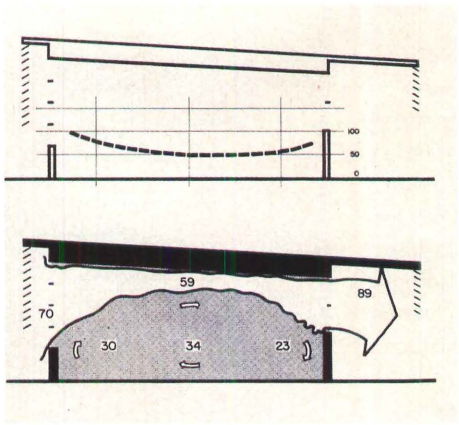
By 1950 architects all over the country had already abandoned the idea that schools must look like grand mansions for learning. This quaint notion was being swept away by one of the core tenets of Modern architecture—that function dictated form, and buildings could be stripped of ostentatious ornamentation without apology. Out went brick palaces, and in came flat-roofed schools with tall expanses of glass. This dovetailed nicely with the need to build quickly and cheaply on vast suburban greenfield sites.

Caudill organized his book into three parts: Education, Environment, and Economy. Many theories of child psychology and education were going mainstream at the time, and architects were eager to contribute to the theorizing. He spent a great many pages discussing ideas for making school buildings stimulate students and make learning interesting. He was well ahead of his time when he wrote, "In all grades provide nooks in classrooms for individual instruction and guidance." In recent years these ideas have been recast somewhat; now we say that such classrooms "accommodate different learning styles."

Most schools built prior to World War II had daylighting and natural ventilation in common with these new schools. But Caudill's research took these ideas much farther. His book showed how combinations of windows, overhangs, and skylights could provide generous amounts of daylight without adding more heat or creating glare on desks and chalkboards. Other diagrams showed ways in which strategically located windows and vents could allow classrooms to be naturally ventilated with cool breezes.

The benefits of daylighting and natural ventilation on the quality of classroom spaces seem to have been forgotten in the 1960s, perhaps due to the widespread introduction of air conditioning and fluorescent lighting in schools. Some school architects in this period even reduced their windows to vertical ribbons barely a foot wide, reasoning that views to the outside were distracting. Today, Caudill's ideas about daylighting and natural ventilation are experiencing a vigorous renaissance. The U.S. Green Building Council's LEED for Schools program, the American Society of Heating and Refrigeration Engineers' Advanced Energy Design Guide for K–12 School Buildings, and several publications put out by the Collaborative for High Performance Schools (the ASHRAE and CHPS documents can be downloaded free of charge from their Web sites) all utilize these concepts. Their energy conservation and indoor air quality benefits are indisputable, although some expertise is required to apply these principles without causing other problems.

Caudill's exploration of Economy, the means by which construction dollars could be made to go as far as possible, has never become irrelevant. McGraw-Hill Construction's Outlook Report, issued in October of 2008, noted that while the number of square feet of primary and middle schools constructed in 2008 was down only 2 percent over the prior year, the number of square feet built for high schools was up 13 percent. The years ahead will bring great challenges: The number of schoolchildren increases by about 300,000 each year, but unlike the mid-1950s, our economy is not booming. ■



Back to the future
The influence of Caudill's book (drawing, upper left) could be seen in America's schools almost immediately (top). Many pages were devoted to daylighting and cross-ventilation diagrams.

"Mansions for learning" fell out of favor.

Contrast and Context

School expansions are opportunities to teach students about different expressions of design.

BY DAVID SOKOL

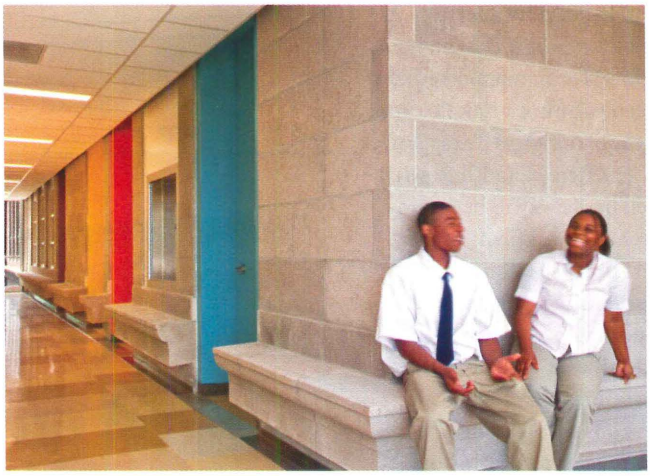
As America's cities go, so go its schools. With people streaming into cities, school districts from Los Angeles to New Haven are renovating and expanding their existing building stocks to serve the growing student base. These ambitious programs are also helping urban school districts shed reputations once predicated on crumbling environments and poor academic performance. "Traditional settings have failed some kids, especially in larger urban systems," says Trung Le, AIA, design director of the education group at OWP/P in Chicago. "Interestingly enough, these urban areas are pulling ahead of well-to-do suburban districts in experimenting with new teaching methodologies and new environments."

Thanks to a lack of large, vacant sites in many cities, urban projects require adding onto existing buildings, rather than starting from scratch. Not only are the results innovative pedagogically, but these expansions also spark an architectural dialogue with the urban fabric—and, perhaps, serve as an introduction to design for the next generation.

OWP/P's design for Chicago's charter facility Ralph Ellison High School serves as an object lesson in appending new to old. A glazed volume containing science and multimedia labs as well as administration workspace attaches to one side of a 1926 limestone building originally constructed as a Catholic elementary school. The old interior was renovated, too. The design team preserved such original features as wood-framed clerestory windows and added accents of bold color.

That color palette is echoed in the addition, although its distinguishing feature is its curtain wall in which an excerpt from Ellison's Invisible Man is etched in the glass. "The contrast was very conscious," Le says of the disparate exteriors, which are meant to symbolize Ellison's break from the African-American literary tradition begun by author Richard Wright. Le also calls the glass inscription a teaching tool, enticing students to read Ellison's novel.

Alice Kimm of Los Angeles's John Friedman Alice Kimm Architects also thinks of her studio's two-year-old Aragon Avenue Elementary School expansion project in Los Angeles as a medium for educating students. The $6.2 million Aragon expansion, comprising a 16-classroom building with freestanding kitchen and cafeteria spaces, pragmatically responded to site conditions. The original faux Spanish colonial offered little respite from the surrounding Cypress Park neighborhood, Kimm says, and so the new classroom structure now defines a central upper courtyard. The building provides contrast as much as resolution. Its stucco surface features giant blocks of paint whose colors evoke neighboring bungalow houses and the landscape, which give the illusion that the building has a much more complex, faceted geometry. "We like to set up a dialogue. It allows you to interpret the old and new in a more interesting way," Kimm says, adding, "The

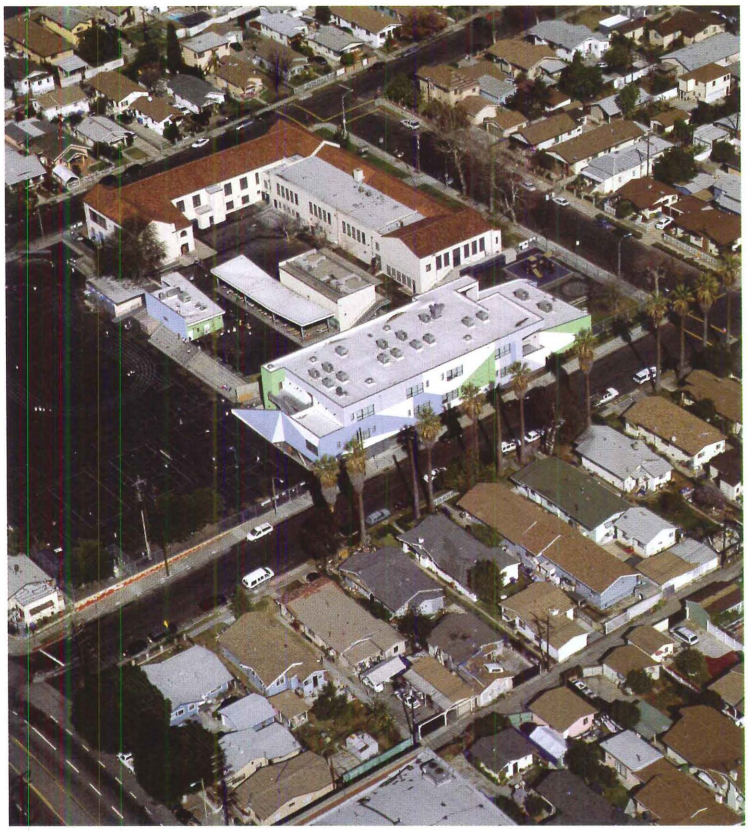


Ralph Ellison High School A glassy addition features an Ellison excerpt (right), while the historic building's interior got a colorful update (above).

"Dialogue allows you to interpret the old and new in a more interesting way."

PHOTOGRAPHY: © JAMES STEINKAMP (LEFT AND BOTTOM RIGHT); WAYNE SOVERNS, JR. (TOP TWO)

Beaver Country Day School
To house a new black box theater (left) at Beaver Country Day School, HMFH Architects created visual interest on its exterior by designing an intensely textured brick skin (far left), since windows were out of the question. It is surrounded by a new classroom wing that's more aesthetically similar to the original school building. The theater connects to that older building by a pedestrian bridge.

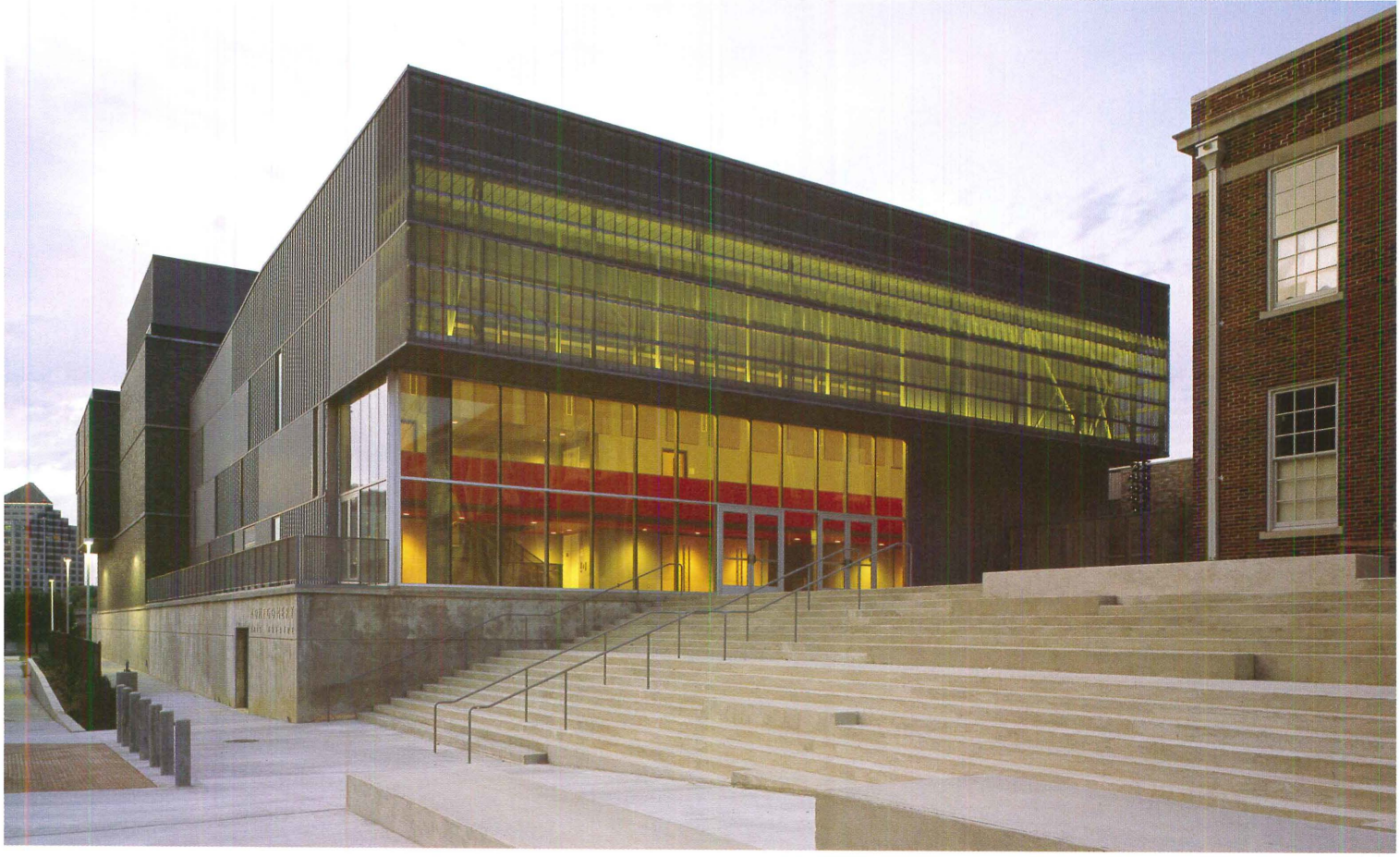


Aragon Avenue Elementary School
John Friedman Alice Kimm Architects designed an inexpensive addition that wrestles the once-open site into a courtyard-campus configuration (left). Exterior paint creates the impression of a faceted facade (below).

arts are so underfunded in these schools that we wanted to give students a physical environment that could provide the inspiration they may not be getting in the classroom."

In Dallas, an addition to a school dedicated specifically to the arts still expresses the difference between old and new. The Portland, Oregon-based Allied Works Architecture won a 2001 competition to design a 170,000-square-foot expansion to Booker T. Washington High School's 1922 landmark building. Firm founder Brad Cloepfil, AIA, calls the new building "just an industrial space" reminiscent of the lofts where contemporary artists work. Cloepfil used a masonry structure to achieve some consistency with the 86-year-old building, and also opted to arrange the campus in a courtyard so students feel sheltered in the city's vibrant Arts District.

Despite his modesty, Cloepfil did design the expansion of Booker T. Washington to prompt a "visceral" response in students and visitors alike. The new building's brick is manganese-flashed to give it the appearance of igneous stone, standing out from the red brick of yesteryear. And the interwoven public spaces, such as the central courtyard and interior corridors



stacked to create an atrium, are configured to accommodate students' Fame-like bursts of energy. Cloepfil views the students as an element of this animated design, and as collaborators—he even proposes that students enliven the building with their own graffiti.

Despite this trend of urban-school additions in which architectural contrast trumps context, Kimm says that not all clients are willing to catch the wave. "Upper-level establishments," she says, "are fairly resistant to contemporary design. Tradition and its icons are harder to uproot."

In a sign suggesting that the phenomenon is emerging from nascence, some of those institutions are embracing Modernism. At the venerable Beaver Country Day School, in Brookline, Massachusetts, for example, HMFH Architects of nearby Cambridge, created a pearl within an oyster when it wrapped a new black box theater featuring an intensely textured brick pattern in a classroom wing whose exterior looks more like the original 1920s campus. "Because [the theater] is such a different and creative, creature we thought it should reflect that," HMFH principal Pip Lewis, AIA, says of the unique brick-clad structure. To be sure, circumstances may not always permit an expressive architectural response. But clients and designers are clearly recognizing an opportunity to elevate a common building type to an inspirational art form. ■

Booker T. Washington High School
Portland, Oregon-based Allied Works Architecture designed the expansion to Booker T. Washington High School in Dallas. The new building's brick exterior (above) complements the masonry of the 1922 building, although its fiery gray color is meant to convey the rawness of an industrial space. Inside (right), the daylit circulation core encourages students' impromptu performances.

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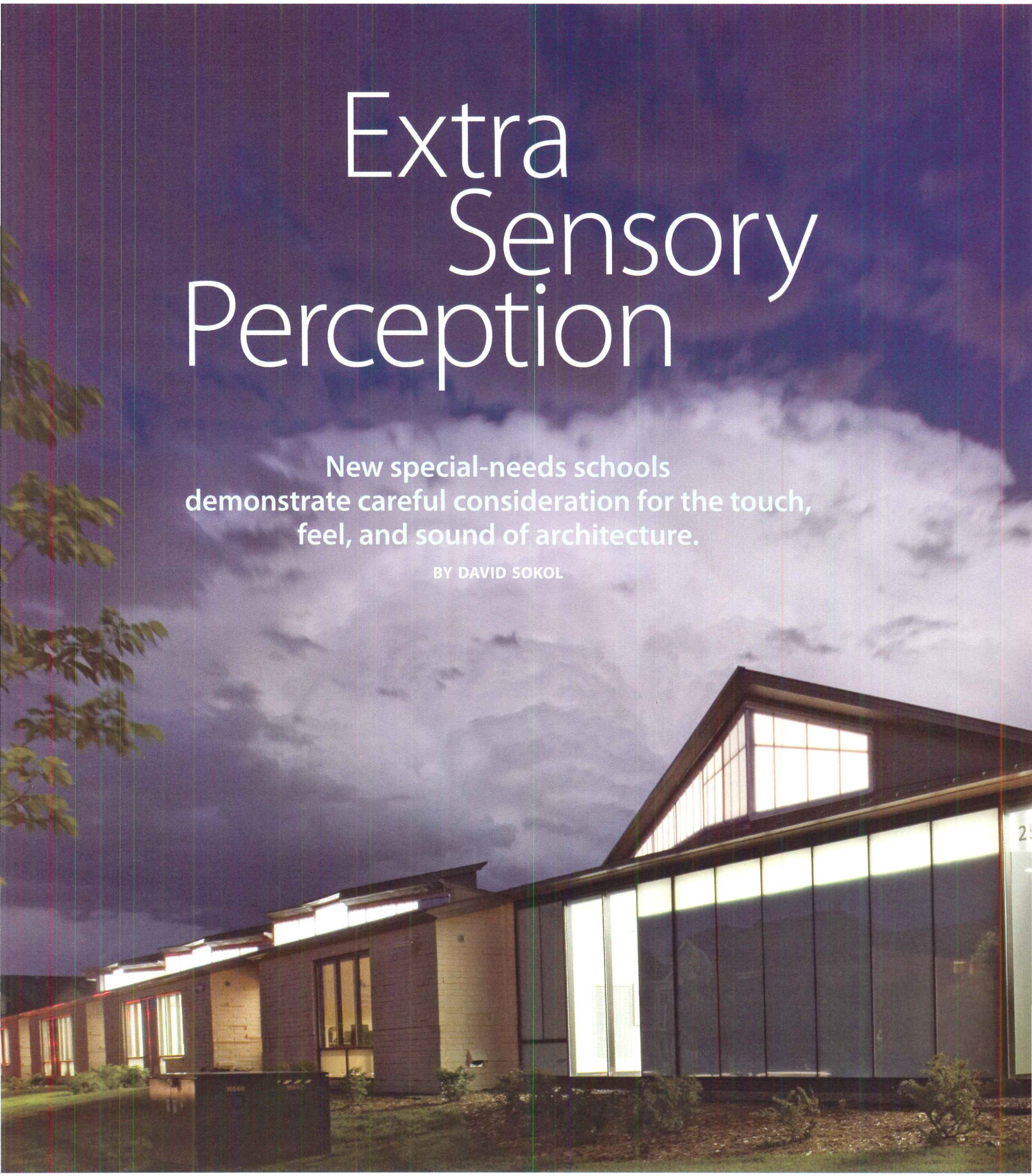
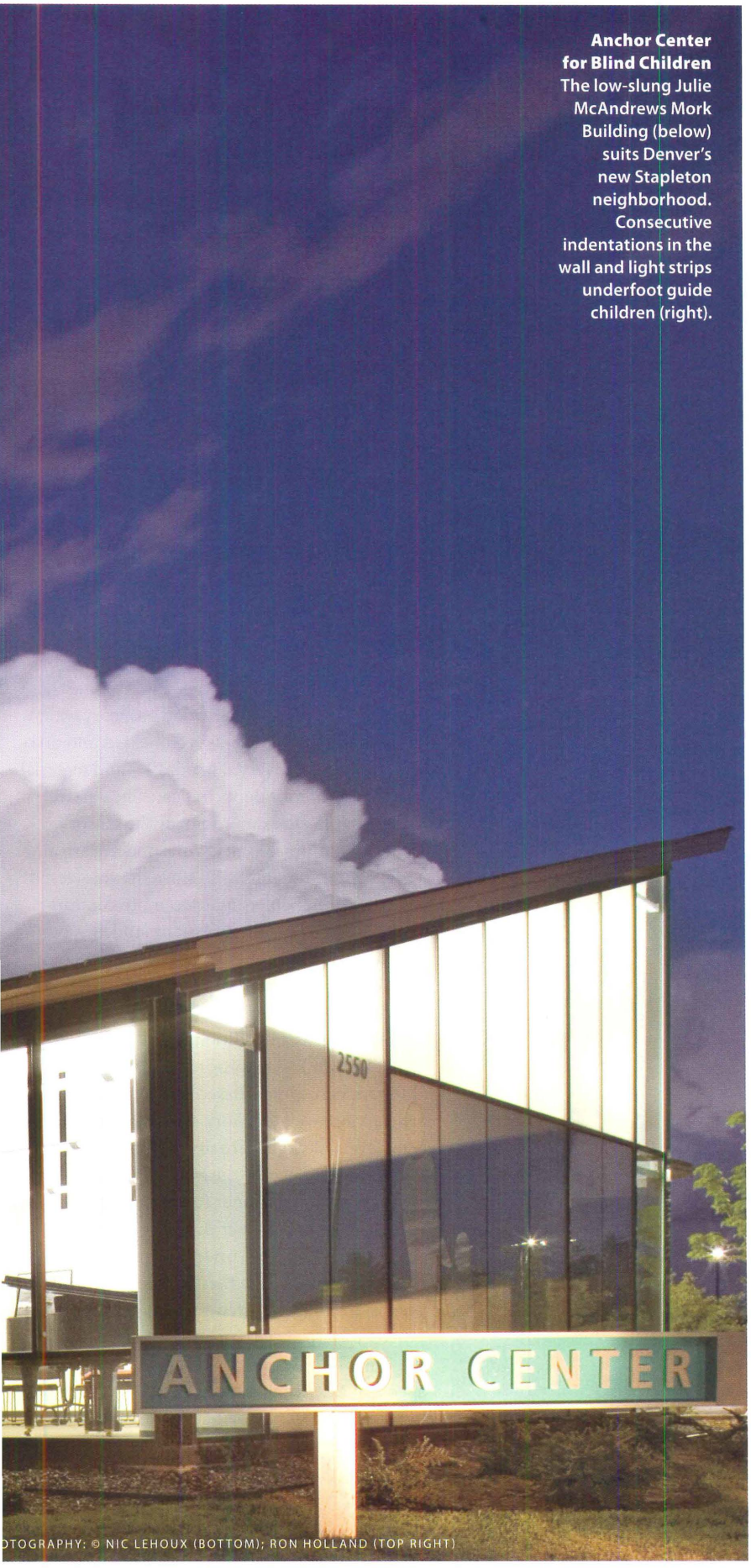
CIRCLE 11

Extra Sensory Perception

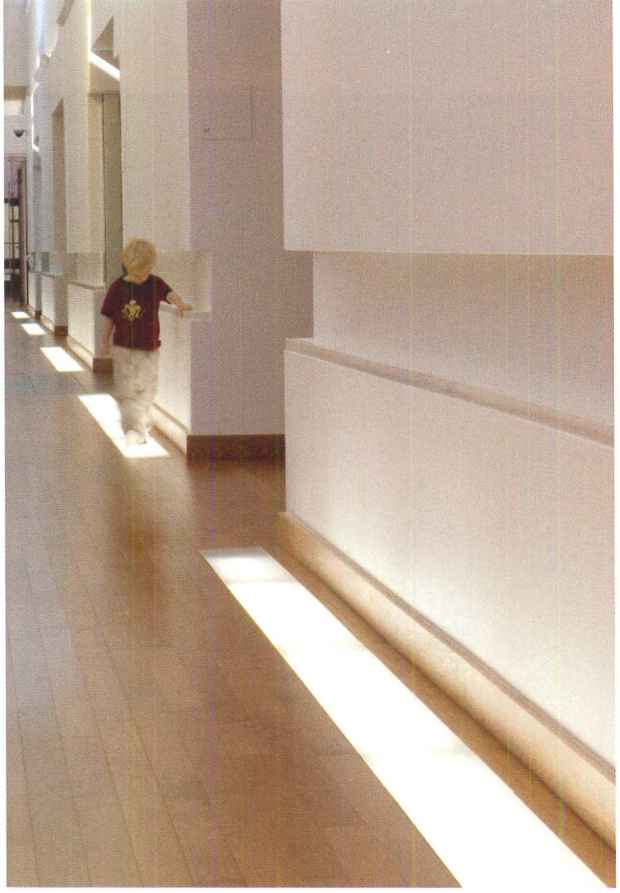
New special-needs schools demonstrate careful consideration for the touch, feel, and sound of architecture.

BY DAVID SOKOL





Anchor Center for Blind Children The low-slung Julie McAndrews Mork Building (below) suits Denver's new Stapleton neighborhood. Consecutive indentations in the wall and light strips underfoot guide children (right).



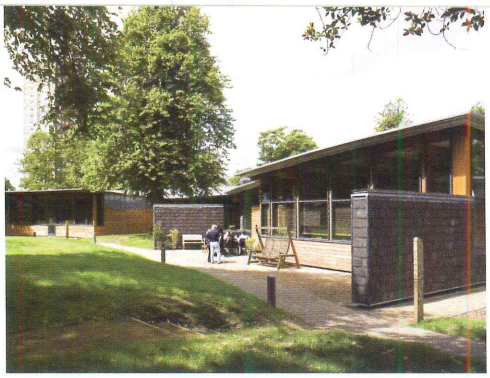
PHOTOGRAPHY: © NIC LEHOUX (BOTTOM); RON HOLLAND (TOP RIGHT)

We won the project through a competition, which was a complete surprise because we didn't have previous school experience," Alan Dunlop of Glasgow-based Gordon Murray + Alan Dunlop Architects says of Hazelwood School (featured on page 56). The year-old Glasgow facility serves a small group of children with dual sensory impairment and, Dunlop's inexperience notwithstanding, Hazelwood has racked up a series of accolades—a DesignShare Honor Award, the Civic Trust Award, placement on the World Architecture Awards shortlist, and the Andrew Doolan Award for the best building in Scotland. Tellingly, the juries of these prizes make their selections from a wide range of building types for diverse sets of users.

In other words, Hazelwood is an award winner not just for the ways it serves its unique student population. It exemplifies design excellence in general.

One could rightly assume, then, that there is very little to differentiate a carefully considered school for special-needs children from another well-designed work of education architecture. Yet, as a series of recently completed facilities for special-needs students demonstrates, designing for disability requires dedicating extra attention to the experiential aspects of architecture.

Though thousands of miles apart, Hazelwood and the Julie McAndrews Mork Building—part of the Anchor Center for Blind Children located in Denver's Stapleton neighborhood—have analogous features. At Hazelwood, for example, the central corridor boasts a so-called sensory wall which appears like unfurled origami. Students trace the folds of the



Hazelwood School
The Glasgow-based school teaches life skills to pupils between the ages of 2 and 9. The interior's "sensory wall" (left) as well as exterior material selections (above) provide cues for students as they move between activities.

Brewster Hall
The new building at the Governor Baxter School for the Deaf in Falmouth, Maine (above), deploys multiple strategies for infusing the interior spaces such as the library (right) with daylight without glare, thereby optimizing the environment for K–8 students who learn primarily by visual engagement.

wall and the channels in its cork-covered surface to guide themselves between destinations. The building's exterior materials are varied, too, so that children can navigate gardens.

The main hallway of the Mork building, by the local studio Davis Partnership Architects, is home to a cousin of Hazelwood's sensory wall. A generously scaled recess is embossed into one side—a kind of inverted handrail—and material changes at interior doors indicate one's arrival at a class, the eye exam room, or the sensory gym. An illuminated strip runs underneath and parallel to this "Trail Rail," since the youngest of Anchor's preschoolers may feel more comfortable crawling, and because many students, possessing limited sight, can perceive brightness.

The pair of schools deploys other wayfinding concepts. Children wielding canes may use echolocation as an additional guide through the hallways: The tapping of the cane produces different perceptions based on the volume of the space. Moreover, for Mork students who sense light levels, skylights are situated in the ceiling of the hallway "where the kids stop or turn to go into a classroom or other function spaces," says Davis managing partner Brit Probst, AIA.

Both design teams undertook empathetic research to determine these elements. Dunlop recalls hours spent listening to teachers and parents, while at the Anchor Center's old facility, Davis's architects outfitted themselves with special glasses that "help re-create the different kinds of sight impairments that are common in the blind population," explains Probst, who also notes that all other senses were heightened by the experience. "You begin to understand the importance of sound, or whether you were walking on a hard or soft surface."

PHOTOGRAPHY: © ANDREW LEE (TOP LEFT); KEITH HUNTER (TOP RIGHT); BRIAN VANDEN BRINK (BOTTOM TWO); DAVID SUNDERBERG/ESTO (OPPOSITE TWO)

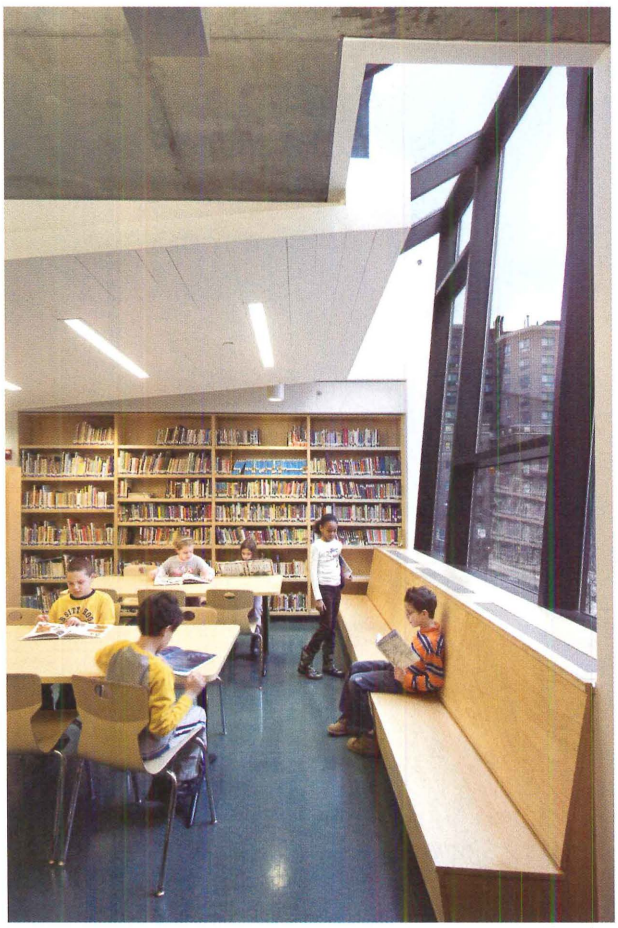
Stephen Gaynor School
Stephen Gaynor School shares its new multistory home on Manhattan's Upper West Side with the Ballet Hispanico. A muscular stairwell (left) connects the school's floors, providing students with a consistent wayfinding landmark. While the library (below) enjoys extensive glazing, classrooms feature clerestory windows to minimize distractions.

"You begin to understand the importance of sound, or whether you were walking on a hard or soft surface."

Paying special attention to compensatory senses also characterizes schools for special-needs students. At Brewster Hall, a new K–8 building at the Governor Baxter School for the Deaf in Falmouth, Maine, Portland-based architect Barba+Wheelock deftly balanced daylighting and lamp illumination. The resulting system of light shelves and roof monitors allows daylight into deep interior spaces like the library and minimizes glare in order to facilitate hearing-impaired students' reliance on visual information. (The design also reduces lighting and cooling demands, helping the building secure LEED Silver certification.) In a slightly different take on this principle, Mork's classrooms include tapered vertical surfaces, corrugated wall panels, and scalloped drywall to minimize noise distraction for students whose precise hearing counteracts lack of sight.

Regardless of where children lie on the spectrum of special needs, the new buildings serving them exemplify such sensitivity. Take Manhattan's Stephen Gaynor School, where high-functioning children cope with attention deficit, dyslexia, or low muscle tone: The Rogers Marvel design features a colorful central stairwell that expedites wayfinding; small classrooms' clerestory windows provide daylight without the distracting views of the city.

These tactics should sound familiar. So how does an architect design a school where a deaf, blind child learns to navigate the world with dignity? Not much differently from how she designs any school where students are conquering learning disabilities. "There's no reason that it couldn't be a mainstream school," Dunlop says of Hazelwood. Which suggests that what a student experiences in any school should be conceived so carefully. ■



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On any given school day, thousands of students across the country are unable to understand 25 to 30 percent of what's said in their classroom.

The reason: excessive noise and reverberation within the classroom interferes with their ability to clearly hear their teacher.

The result: a decreased level of concentration, an increased level of stress, and an overall reduction in the level of learning.

Considering that the primary mode of teaching involves speech and listening, is it any wonder that good speech intelligibility is required in classrooms?

Acoustic environment

The quality of the acoustic environment in a classroom is vital to all students because all need to understand the teacher, but it is of particular importance to students who have hearing impairments or learning disorders; to very young students with limited vocabularies; to students for whom English is a second language; and to students with a temporary hearing loss due to illness such as a head cold.

To help remedy problems caused by inadequate acoustic design, the American National Standards Institute (ANSI) approved ANSI Standard S12.60 for Classroom Acoustics.

Titled "Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools," the standard provides an enhanced learning environment for students and teachers alike by improving the conditions for good speech intelligibility.

ANSI Standard S12.60

ANSI Standard S12.60 addresses both the issues of reverberation time and of background noise as they affect speech intelligibility by setting maximum permissible levels on each.

Under the standard, the maximum acceptable reverberation time in unoccupied but furnished classrooms with volumes up to 10,000 cubic feet is 0.6 seconds, and 0.7 seconds for classrooms between 10,000 and 20,000 cubic feet. Reverberation time is the time required for sound reflections within a room, such as from a loud hand clap, to become inaudible.

The maximum acceptable background noise allowed in these classrooms is 35 decibels (dBA). By comparison, the loudness of a normal face-to-face conversation is about 60 dBA.

These acoustical performance requirements apply to the design and construction of new classrooms of small-to-moderate size, and, as far as is practical, to the renovation of existing classrooms.

At the present time, the ANSI standard is voluntary unless referenced by a code, ordinance or regulation. Individual school districts, for example, may require compliance with the standard as part of their construction documents for new schools.

New classrooms

ANSI Standard S12.60 is a performance specification in that it states desired results but not how to attain them. However, it does include a number of appendices that are prescriptive in nature, with specific design suggestions, including choice of materials.

Designing a classroom to meet the acoustical requirements of the standard is neither difficult nor costly. The key is to include acoustic concerns early in the planning and design stages. With this in mind, general guidelines are described below.

Reverberation time. For any given room, reverberation time decreases as additional sound absorptive materials are added in the space. Both the amount of sound absorptive materials and its location in the space are important considerations that affect the quality of sound within the room.

- For classrooms with ceiling heights of approximately 10 feet, place most, if not all, of the sound-absorbing material on the ceiling. This is usually the easiest and lowest cost solution. For best results, choose an acoustical ceiling panel that has a Noise Reduction Coefficient (NRC) rating of at least 0.70.
- For rooms with ceilings between 12 and 14 feet high, it may be advantageous to place some of the absorptive material on the walls as well as on the ceiling.
- For ceiling heights 15 feet or over, it is usually necessary to utilize wall absorption. Acoustical wall treatments usually consist of 3/4" to 1" thick mineral fiber or fiberglass backer board with a vinyl or fabric covering.
- If there is no possibility of acoustical wall treatment, try to ensure that three-dimensional furnishings such as bookshelves are distributed around the room to diffuse sound reflections, thereby reducing the possibility of echoes.

Carpeting may also help reduce reverberation, but not as much as a good acoustical ceiling because most commercial carpeting is generally a poor absorber (NRC of 0.25 or lower). However, carpeting can help reduce background noise caused by the sound of people walking, and desk and chair shuffling.

Figures #1 and #2 show the difference in sound paths in a classroom that is not acoustically treated compared to one that is.

Background Noise. There are many sources of background noise that may intrude into a room. How these are handled depends of the path the noise takes in entering the room. The primary contributors to background noise are described below.

Noise Traveling Through the Plenum. Some rooms are constructed with walls that are only as high as the suspended ceiling, rather than extending all the way up to the roof or floor deck above. As a result, noise from an adjacent room can

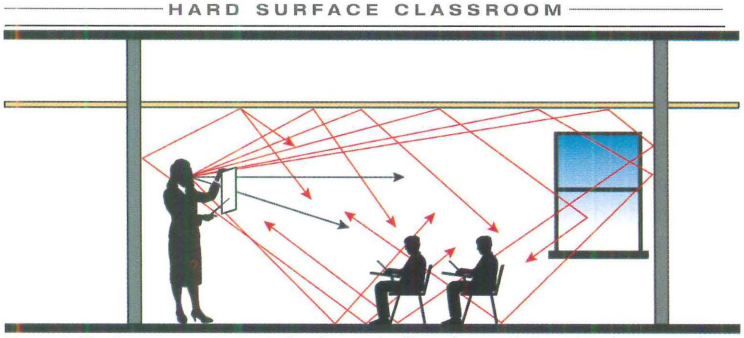


Figure 1: Black arrows represent direct sound with a clear path from teacher to student. Red arrows represent reflected sound. Note the many red arrows which indicate the longer, more indirect path taken to reach the student.

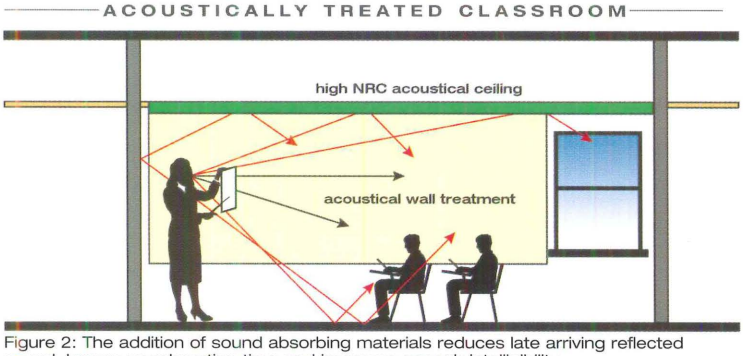


Figure 2: The addition of sound absorbing materials reduces late arriving reflected sound, lowers reverberation time and improves speech intelligibility.

penetrate the ceiling plane and move unimpeded throughout the ceiling plenum. Some portion of this plenum noise will pass back down through the ceiling into adjoining rooms, thereby adding to the background noise in each room. To help reduce plenum noise intrusion:

- Choose an acoustical ceiling panel that has a Ceiling Attenuation Class (CAC) rating of 35 or higher.
- Backload the suspended ceiling with R-11 fiberglass building insulation batts.
- Install a gypsum board plenum barrier between adjacent rooms, being sure to seal all penetrations such as pipes, ducts, cable runs, etc.

Noise Traveling Through the Walls. Years ago, interior school walls were built of brick or concrete block, so intrusion of sound through a partition wall was not much of a problem. Today, noise intrusion must be addressed because most walls are constructed using metal studs with a layer of gypsum wallboard on each side.

According to the ANSI standard, the minimum Sound Transmission Class (STC) rating of a wall separating two adjacent classrooms is 50. To achieve this rating and reduce noise transmission between rooms:

- Add R-11 fiberglass insulation in the cavity between the gypsum board layers.
- Add a second layer of gypsum board to each side.
- Seal all gaps between the walls and the floor and ceiling.
- Seal any openings in the wall such as piping, electrical outlets, and HVAC registers.

HVAC Noise. The main source of background noise in classrooms is usually the heating, ventilation and cooling (HVAC) system. A centralized system is usually much quieter than window or room units which usually contain high velocity fans that are very loud and difficult to treat with sound absorbing materials in the room. To help reduce HVAC noise:

- Locate air handlers and rooftop mechanical equipment away from critical listening spaces such as classrooms.
- Locate the equipment over spaces that are inherently noisy, such as corridors, cafeterias and gymnasiums.
- Position units over hallways and then run ducts to nearby classrooms.

Existing classrooms

A classroom designed without regard to good acoustics will often include a high ceiling of plaster or gypsum board; masonry or gypsum board walls; and a hardwood or tile floor.

Unfortunately, numerous classrooms fitting this description were built in the days before sensitivity to acoustical needs. In such a classroom, long reverberation times tend to destroy speech intelligibility, especially for younger children.

Acoustical problems in existing classrooms can be solved, but the options are often limited. This is because little can be done to change the architectural infrastructure or HVAC system without great expense. Consequently, the most common and affordable solution is to control reverberation through the addition of sound absorptive materials. To improve the acoustical environment of an existing classroom:

- Install a suspended acoustical ceiling in a classroom that does not have one.
- If an acoustical ceiling is already in the room, replace panels that have a low NRC (0.50 or lower) with panels that have a higher NRC (0.70 or higher).
- Add acoustical wall treatments and "space absorbers" (baffles).
- Add carpeting.
- Seal as many openings in the common walls as possible.
- Add a second pane of glass with an air gap to the windows, if possible, to help block exterior noise.
- Install vibration isolators under HVAC equipment, and silencers in the ductwork.

Solutions such as these do not add significantly to the construction cost of a new building. It is when they are included as part of a retrofit that additive costs usually apply.

Quiet classrooms

The need for good classroom acoustics and the methods for attaining them have been known for decades. However, in the absence of a standard, far too many schools have been built with little or no concern for good hearing.

The establishment of ANSI S12.60 fills that void by providing clear design goals for both school planners and administrators. It also raises awareness of the learning problems associated with poor acoustics and, hopefully, eventually eliminates design problems from being repeated as new schools are built.

Resources

The information on classroom acoustics and ANSI Standard S12.60 has been provided by Armstrong Ceiling Systems. There are additional resources available to you to meet your needs. They include:

- Classroom Acoustics CEU course at armstrong.com/ceu
- Online Reverberation Tool at armstrong.com/schools
- Reverberation Calculations through TechLine™ at 1-877-ARMSTRONG
- Reverberation Calculation Form at armstrong.com/schools
- "Classroom Acoustics, a resource for creating learning environments with desirable listening conditions;" Acoustical Society of America, asa@aip.org
- Your Armstrong Ceiling Systems representative at 1-877-ARMSTRONG

Case Study

An evaluation conducted by Dr. Kenneth Roy, senior principal research scientist for Armstrong Building Products, demonstrates the difference a high performance acoustical ceiling can make in a classroom renovation.

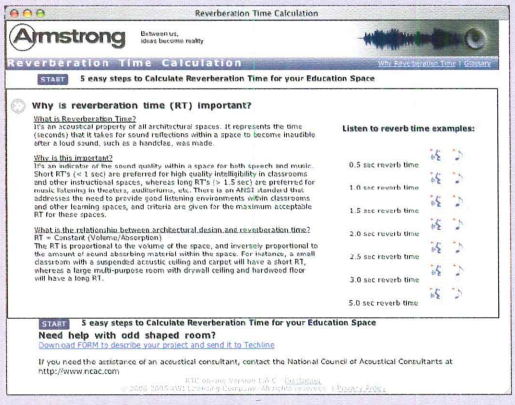
The acoustic test took place in a sixth grade classroom at the Robert E. Lamberton Public School in Philadelphia, PA. Built in 1949, the 24'x44'x11' classroom had a spray-applied 1/2" fiber-on-plaster ceiling, concrete block walls, and a vinyl tile floor. The NRC of the existing ceiling was estimated to be approximately 0.25.

The reverberation time in the existing room was 1.1 seconds averaged over the frequency range specified by ANSI S12.60, far exceeding the maximum acceptable reverberation time of 0.6 seconds.

An Armstrong School Zone™ Fine Fissured suspended ceiling with an NRC of 0.70 was then installed. This ceiling is designed specifically for educational facilities and features more uniform sound absorption than most conventional ceiling panels commonly used in these applications. Following the change in ceilings, measurements were re-taken and the average reverberation time was now 0.56 seconds, within the acceptable limit.

Reverberation Calculator

To help demonstrate the beneficial effect of acoustical treatment in a classroom, Armstrong Ceilings has developed a web-based, interactive Reverberation Calculator that allows users to hear the difference in sound quality both before and after treatment. It will even provide recommendations for a new space or an upgrade to an existing space.



To access the calculator, simply log on to armstrong.com/schools and follow the prompts regarding a description of the space and its surface materials. The program will first calculate the current reverberation time and allow users to hear the quality of the sound. Following selection of acoustical treatment options, the program will then allow users to hear the difference in sound quality with lowered reverberation time.

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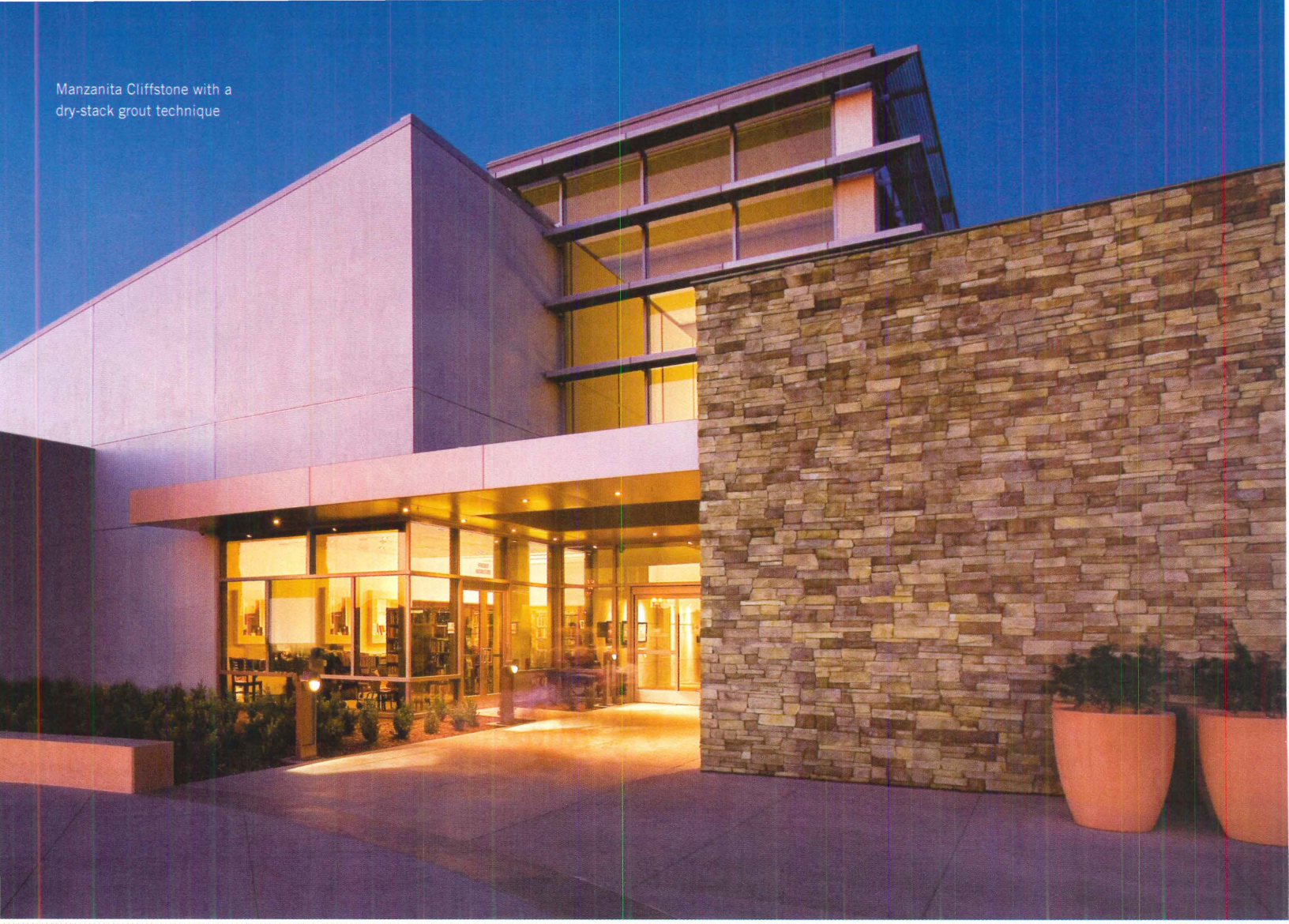

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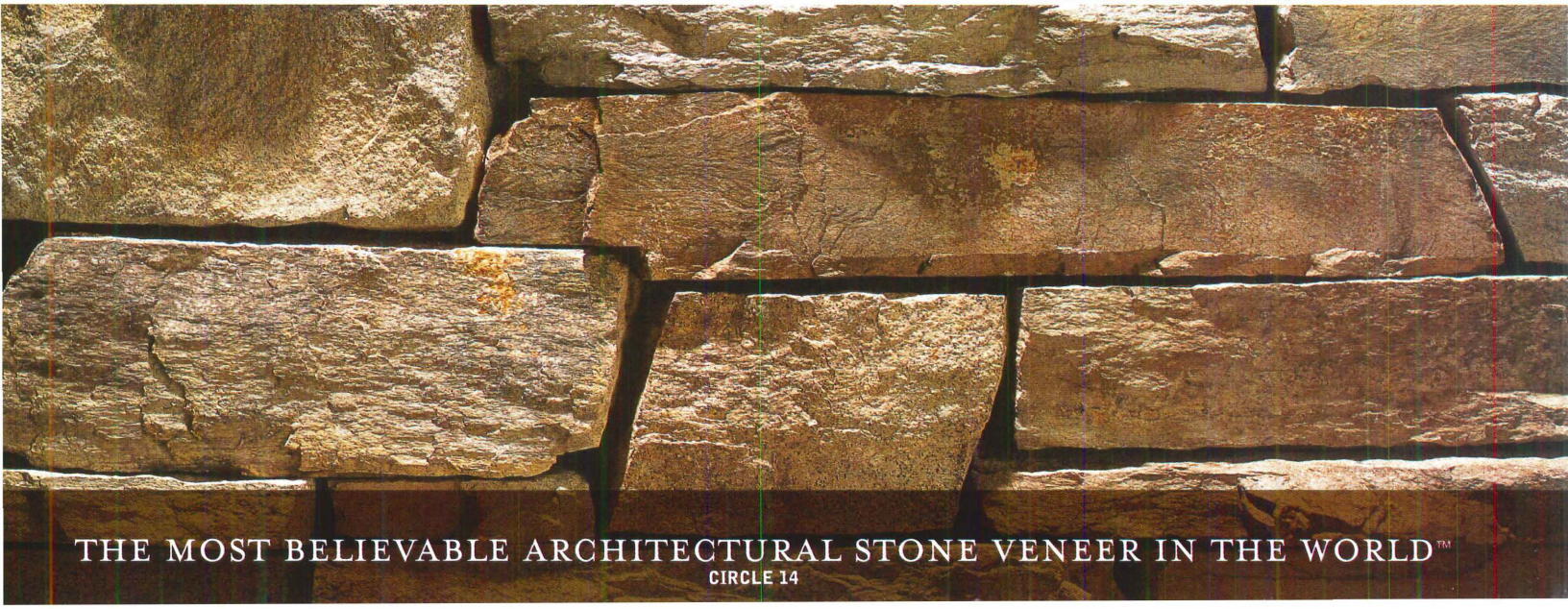

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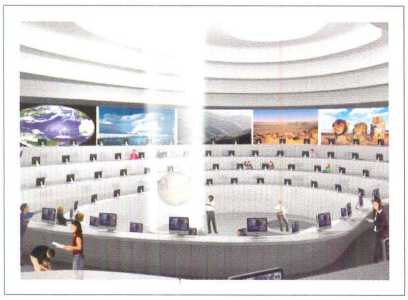
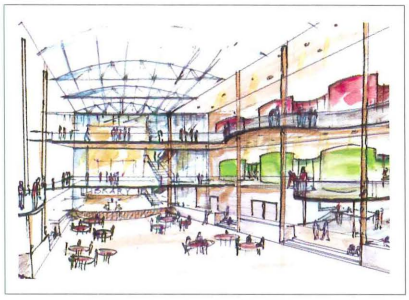
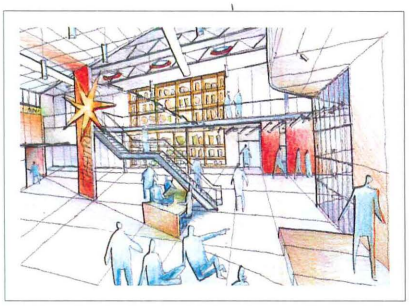
34 Connection to the Outdoors



36 Nontraditional Schools



39 Spaces for Social Learning



41 Physical and Emotional Comfort

Now Hear This

Architects and educators interpret design ideas submitted by students across the U.S.

BY CHARLES LINN, FAIA

When conversations turn to what schools should be like, ironically the unfiltered, uncensored voice of the student often goes unheard. In fact, says Ron Bogle, president and CEO of the American Architectural Foundation (AAF), "In the history of our nation, there has never been any serious research into what kids themselves say they really want in their schools."

The gathering of the raw material that could fuel that research was part of the purpose of last year's "Redesign Your School" competition sponsored by the AAF and Target. Five thousand students registered for the competition, and 250 entries were completed. Bogle says, "We quickly realized that although many of the students were not sophisticated in the way that they expressed their ideas graphically, the written essays they submitted were quite rich in ideas." Story Bellows, the director of research for the architecture firm OWP/P, has been studying the entries for the AAF. She said at a recent AAF conference, "Some unexpected themes popped out. Some of these were: connection to the outdoors; safety and security; the shape of a learning unit; feelings and emotions. These things were not inherent in the entry materials they were given."

Here are some others. Students want their school's spaces to be connected to the outdoors and the community. They want them to be refuges of emotional safety and security. They'd like alternative kinds of learning spaces that take advantage of multimedia offerings and accommodate many different learning styles. And, they want their schools to provide fun places for relaxation and socializing.

"One of the objectives of looking at the entries is to find ways of reinterpreting them into more practical, more direct useful ideas, that could be built in communities today," says Bogle. And to do that, last September the AAF convened a gathering of architects, architecture students, and educators. The groups worked for 24 hours to conceptualize new kinds of environments for schools. On the following pages you will see some of the ideas they came up with. ■

VOICE OF THE STUDENT DESIGN CHARRETTE

Connection to Outdoors

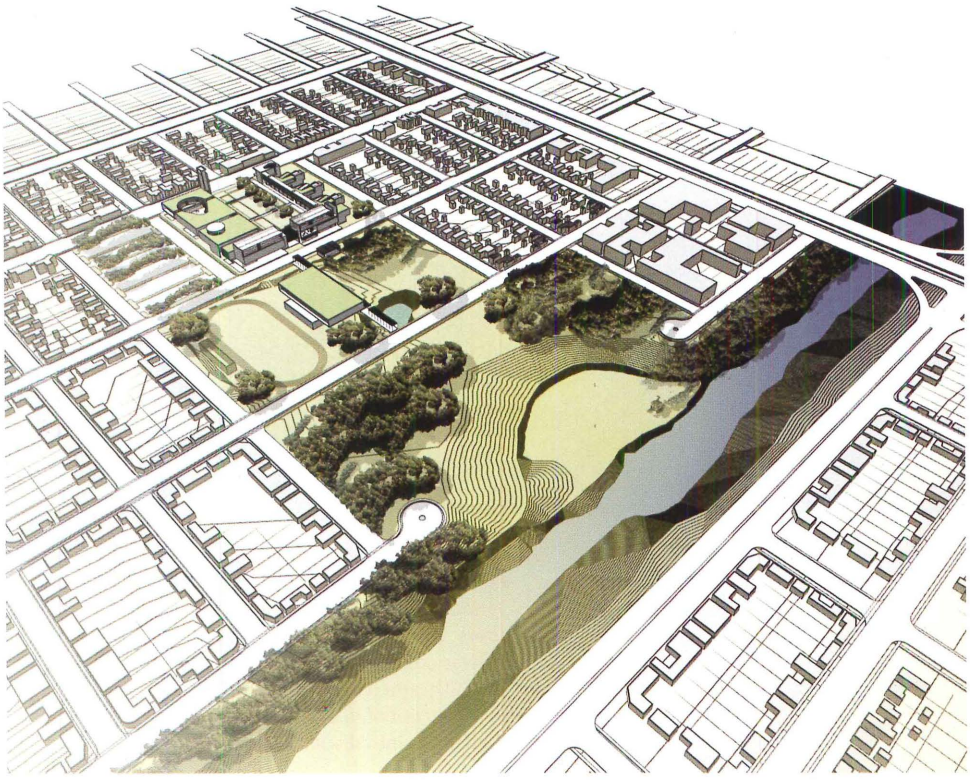
"If students are taught in a box, they will always think in a box. I am reminded of Galileo, who always taught his students outside."

ONE OF THE THEMES THAT CAME UP REPEATEDLY IN THE STUDENT DESIGN competition essays is their desire for schools to do a better job of connecting with the outdoors. We were struck by how intimate that connection was for many of them: Nature was seen as a nonjudgmental, personal friend—something they can relate to in a safe way. Schools connected to nature are refuges: calm, stimulating, but invigorating.

We also saw that students want to use the school complex to connect to the community and the larger world. We decided to expand on the connection to the outdoors theme, and to develop a hypothetical school that would illustrate several additional ideas. The village green is the heart of the school. This large outdoor gathering space welcomes the students and community by functioning as the entrance to the campus, and the traffic drop-off loop. It could be multifunctional and accommodate, for example, a farmer's market on weekends. The school itself comprises a series of small learning communities, or "habitats" organized around the village green. The kindergarten-through eighth grade habitats would be located on one side of the green, and the high school opposite it. Shared facilities, such as a performing arts building and library would close the gap at one end. We also envisioned adding a preschool and a senior citizen center, so the learning campus could embody cycles of life, continuous learning, and transitions from one generation to another. Finally, it would also be ideal if the school could reclaim a brownfield or take advantage of an underutilized site, and in this way might stimulate the revitalization of a neighborhood. ■

Students think of school as a refuge, so the team provided calm outdoor spaces (above). Like the small learning academy (right), buildings in the complex utilize sustainable elements such as photovoltaics, rainwater collection, and green roofs.

Above, the school is organized around a village green, with kindergarten through eighth grade learning academies on one side and a high school on the other, joined at one end by shared facilities like an auditorium. Below right, the team felt it would be ideal if their school could reclaim a brownfield. This would possibly help stimulate revitalization of the surrounding neighborhood. Team members from left: David Lee, FAIA, Stull and Lee; Kas Kinkead, Cascade Design Collaborative; Helen Avery, Howard University; Steve Turckes, AIA, Perkins + Will.



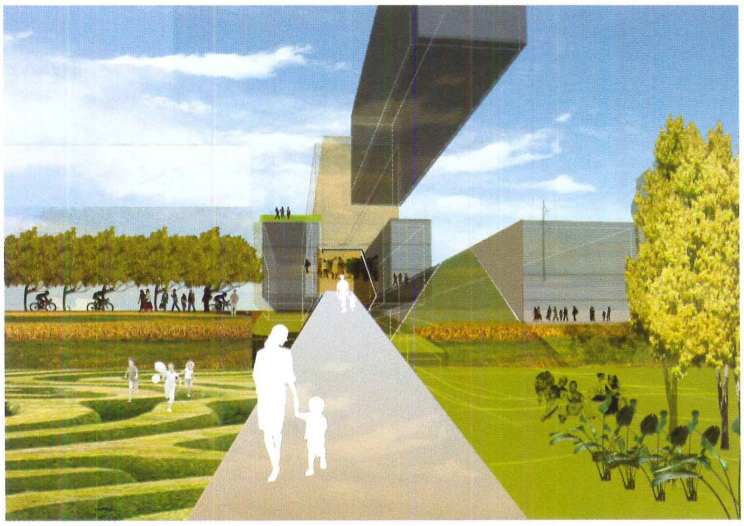
VOICE OF THE STUDENT
DESIGN CHARRETTE

Nontraditional Schools

"No one wants to learn in sterile institutional spaces. Give us beauty, real life projects, choice, opportunity and ownership, and we'll show you what we can do."

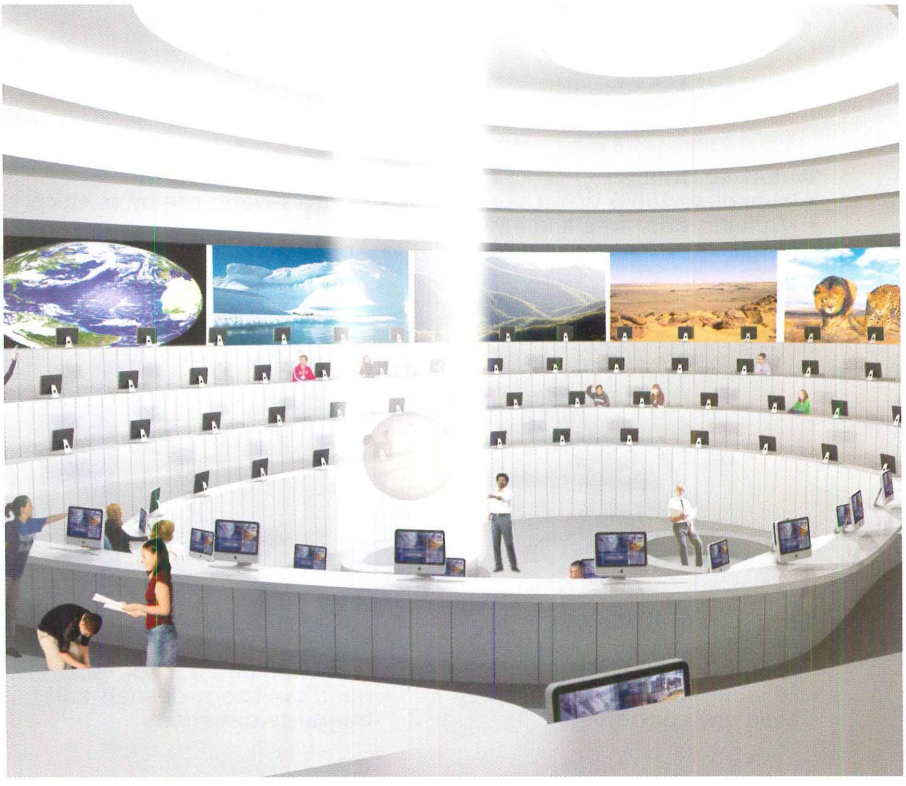
STUDENTS WHO PARTICIPATED IN THE "REDESIGN YOUR SCHOOL" COMPETITION had the opportunity to wipe the slate clean and start over from scratch. And, in an iPod-obsessed culture, we expected most would simply junk the traditional school building structure in favor of computer-based virtual learning that could take place anywhere.

This was true, but only to a limited extent. We were surprised to learn that few students wanted to give up interacting with their peers or learning from teachers; most wanted more opportunities for engagement. In fact, in our analysis of the student essays, we saw that there is a perception among the students that many traditional school spaces do not provide adequate opportunities for the informal exchange of ideas and chance encounters between students and teachers. We responded by creating "nexus points" that act as living room, library, cafeteria, gallery and performance space. The students' visions of nontraditional school design also incorporate many landscape elements that allow learning to be extended outside the classroom and into the environment and community. Spaces that have multiple uses and possibilities were also embraced by these young designers—who see themselves as busy learners who want to use the time they spend moving from space to space to accomplish both their assigned and their self-imposed learning goals. To that end, buildings could function as didactic tools. Why, asked one, couldn't a hallway be shaped like strands of DNA? We agree with the students that the traditional grid of desks does not take advantage of the many wireless and multimedia tools available to teachers and students today, but we believe the traditional components of the school environment can be updated while preserving the valuable traditions of teaching and learning. ■

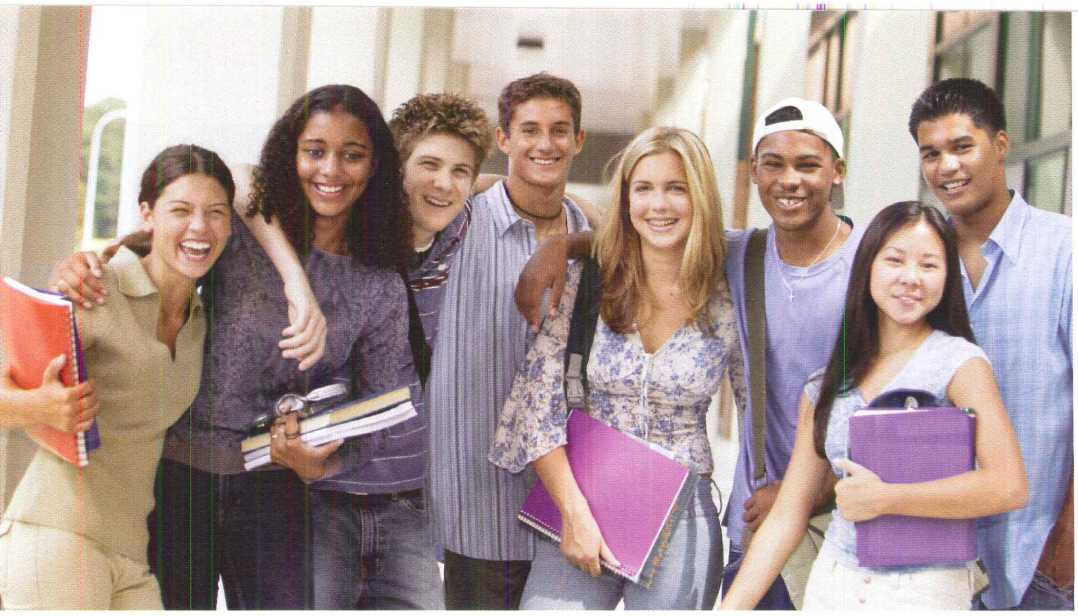


Students' vision of nontraditional school design (above) uses the landscape to extend learning outdoors. One student's idea that a hallway could be shaped like a strand of DNA (right) converges with another's concept of buildings that can be made into didactic tools.

Nexus points allow all sorts of interaction and activities (above). Classrooms (right) make use of the latest technology. Team members from left: Darrell Puffer, AIA, SOM; Beth Hebert, Crow Island School (retired); Lisa LaCharité-Lostritto, University of Maryland; Don Carlson, FAIA, Mithun Architects.



DRAWINGS BOTH PAGES: HA PHAM, SOM



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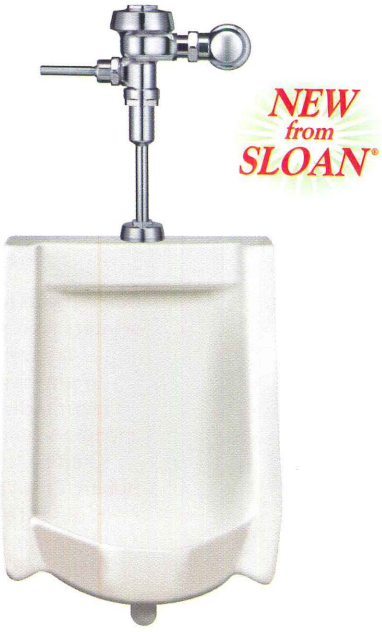

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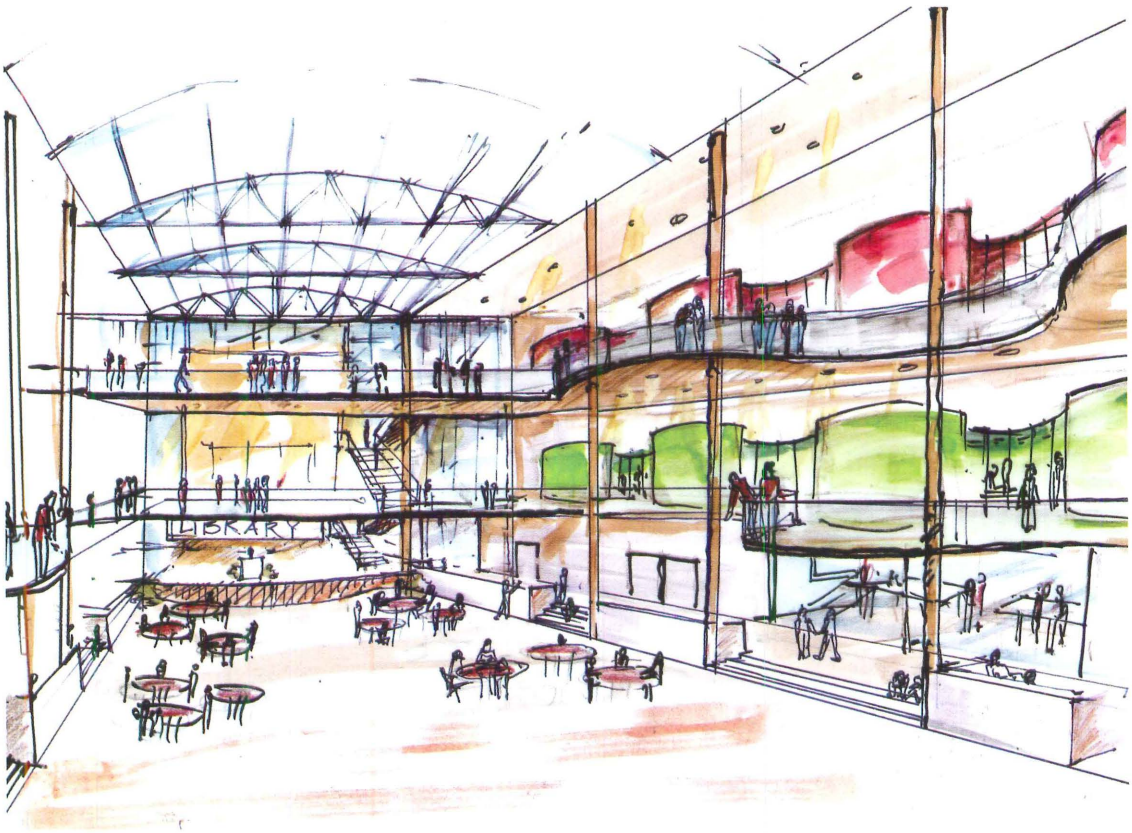
CIRCLE 16



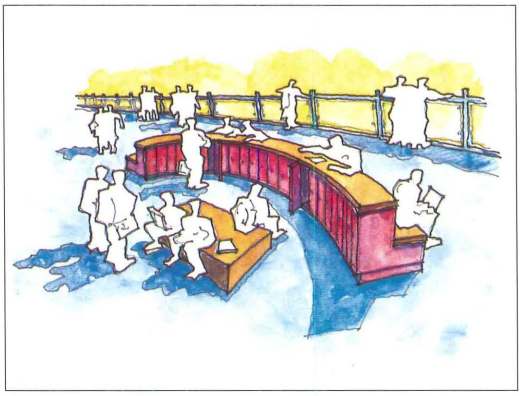
VOICE OF THE STUDENT DESIGN CHARRETTE

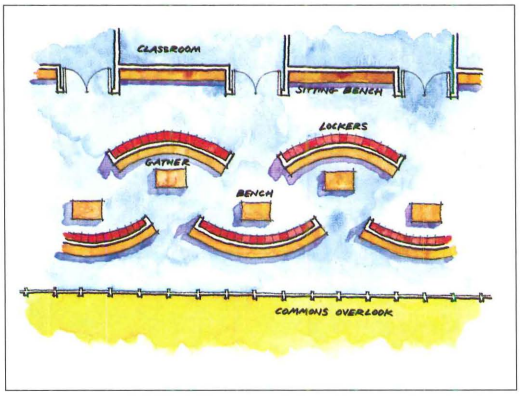
"I like spaces where there is lots going on, but sometimes I just need a quiet place to study and hang out with my friends."

Spaces for Social Learning

Team from left: Cliff Hardison, Thomas Jefferson High School; Ruth Coates, AIA, Miller Hull Partnership; Liselle Coker, Howard University; Kerry Leonard, AIA, OWP/P.

WE BEGAN BY ESTABLISHING PRINCIPLES THAT CAN GUIDE ANY KIND OF enlightened school design. One is that the built environment facilitates discovery through active participation. Another is that growth occurs when students are allowed personal responsibility. Finally, opportunities for one-on-one interaction foster social awareness of other cultures' perspectives and ideas. We confined our discussions and design concepts to finding ways to encourage the kind of learning that occurs when students are socializing with each other informally. We already knew that multi-story atria found in shopping malls are successful in attracting kids and encouraging interaction. This idea is as old as the Greek agora. And yet, the controlled chaos and excitement of centralized spaces is not conducive to the social learning of all types of students. We designed arc-shaped seating pods built around lockers, which are, in most schools, the only form of personal space, where students can gather for peer-to-peer and small group study. To maintain the connection to the atrium, we substituted balconies for typical double-loaded corridors in the levels above the main floor. Schools should provide a flexible framework that allows students the freedom to achieve common educational goals in individual ways. Providing spaces—large and small—for groups gives them the freedom they need to develop personal responsibility skills. ■





A central atrium (top) offers a big space where students can gather to eat, play games, or watch a performance. Seating and workspaces at lockers (lower left and right) provide more-intimate places to socialize and study.

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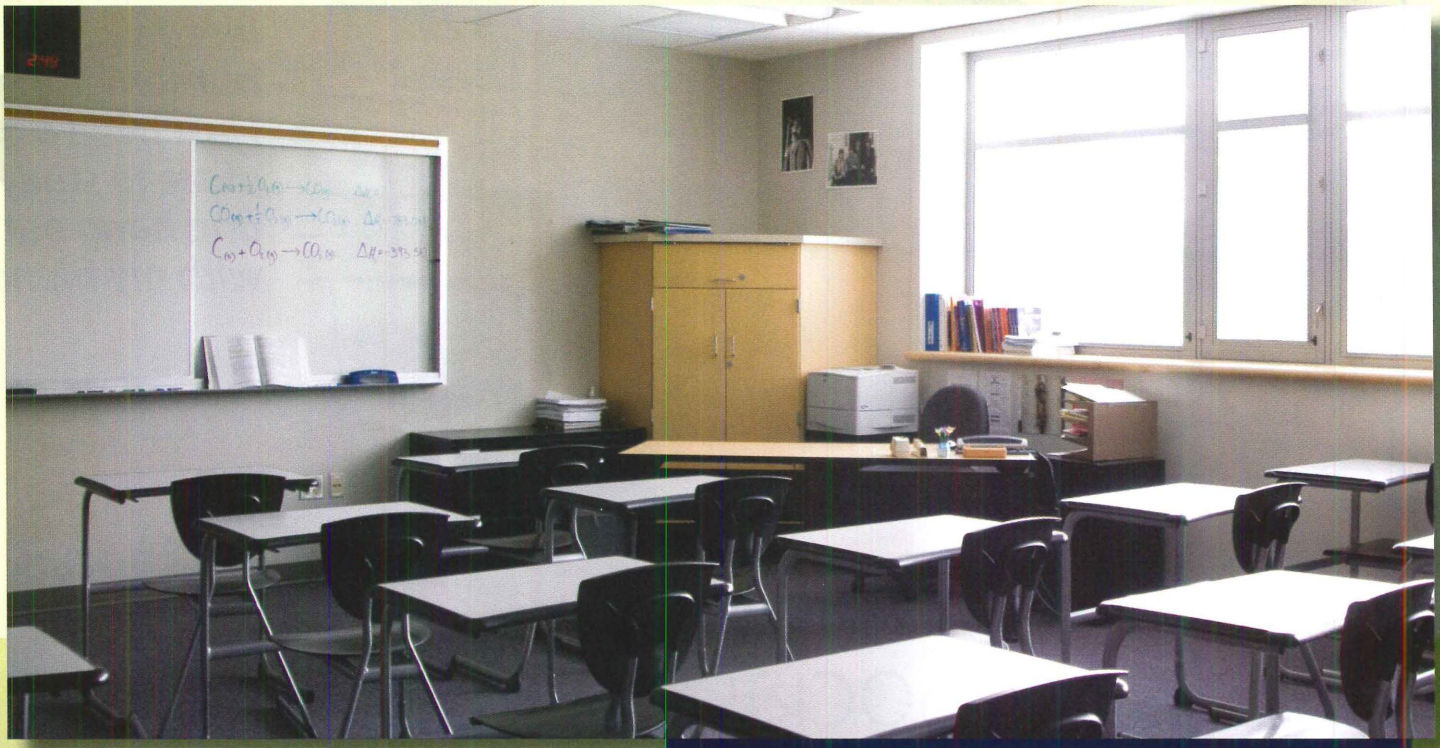

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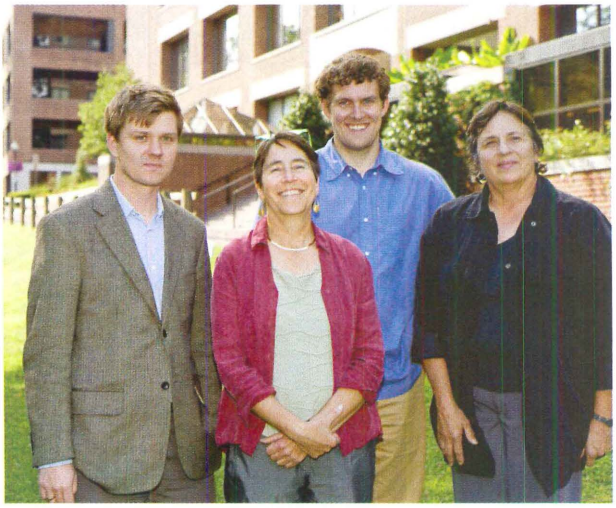
CIRCLE 17

Physical and Emotional Comfort

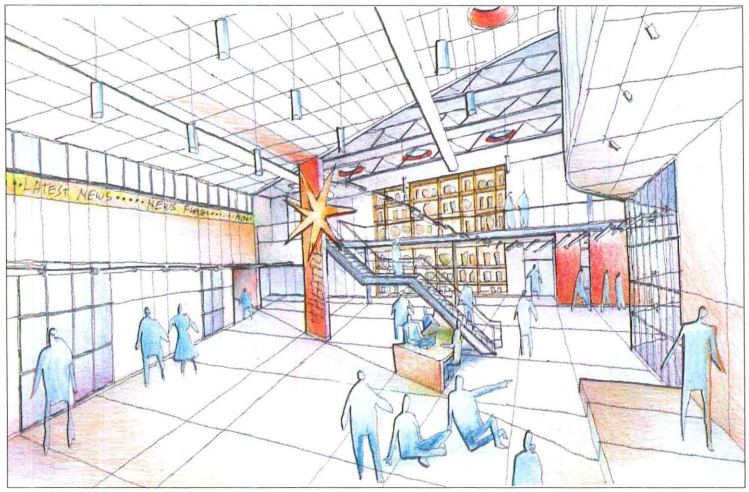
THINKING ABOUT PHYSICAL AND EMOTIONAL COMFORT AS A COMPONENT of learning provided us with a wonderful lens for considering how to manipulate the qualities of space in schools and to maximize their effectiveness as places to learn. We found that the student entries provided a range of places that were stimulating, inviting, exciting, often highly personal, but fostered both creativity and academic rigor.

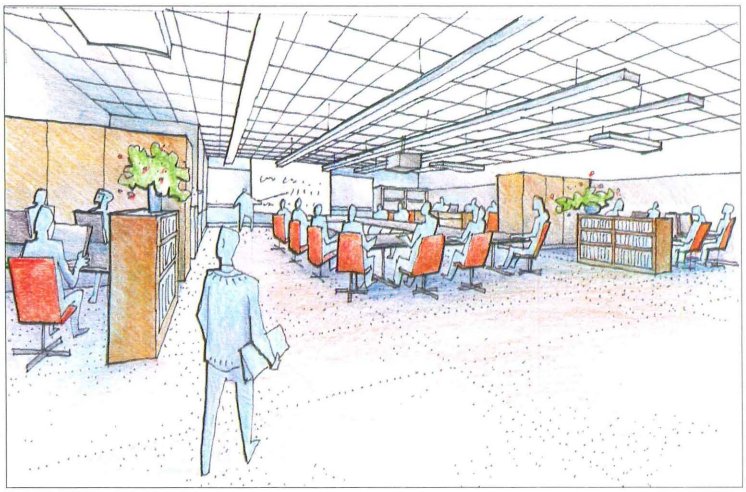
"I learn best in classrooms with comfortable seating, large windows, and colorful surroundings."

We also noted that the students say that transition, study, and gathering spaces have become more important as places to learn, so we explored how variables like lighting, acoustics, size, and shape can be enhanced to help us design supportive, and ultimately, more "comfortable" space. A few themes emerged. We know students want to feel safe and secure within the learning environment, and several things help accomplish that: provide a clear and controlled school entrance, roomy corridors, and clear visual connections throughout the building. We found a strong school identity can also help students feel connected to their community and ease isolation they may feel. This can be achieved by introducing landmarks and thematic motifs throughout a building. Finally, we learned that flexibility within study and gathering spaces is paramount. While one student might need a quiet, isolated place for individual study, the same student might find comfort in a project-based learning space that is loud and stimulating. Giving students a greater sense of control over their space may also contribute to giving a them sense of comfort. This means making schools less institutional: provide more open space, plenty of areas where student work can be displayed, and individual study areas that students can personalize by being able to move partitions and furniture. ■



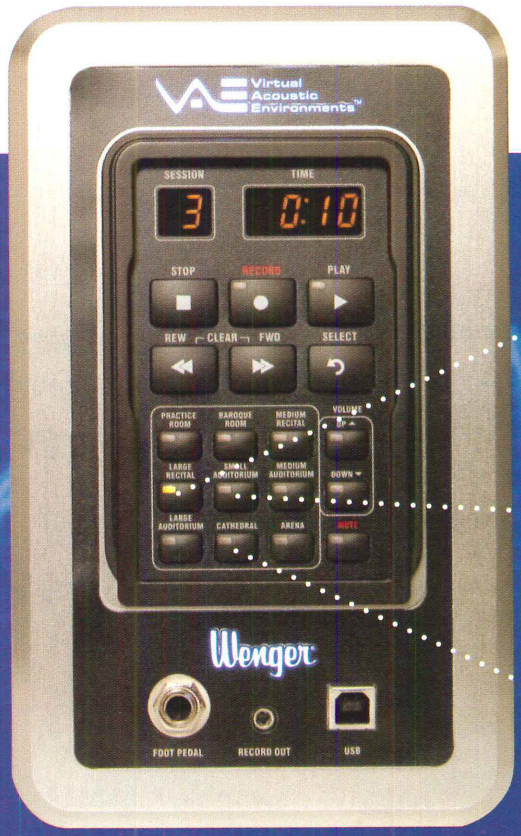
Team members from left: Graham Stroh, American Architectural Foundation; Laura Wernick, AIA, HMFH Architects; Beret Dickson, University of Maryland; Carol Ross Barney, FAIA, Ross Barney Architects. Transition and gathering spaces (below left) using thematic motifs enhancing school identity help break down the isolation kids can feel. Flexibility is important in study spaces (below right) to accommodate a multitude of learning styles and project types.

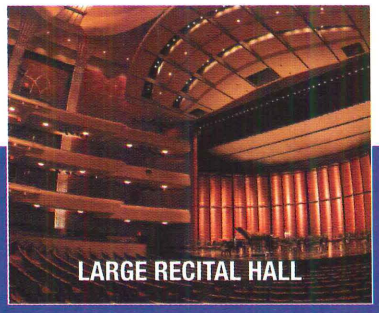


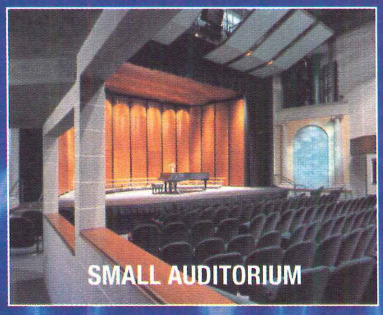


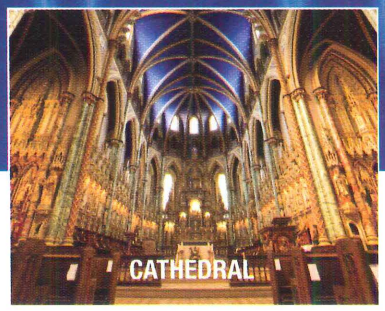
AND COLIN DOCKRILL, AIGA, HMFH ARCHITECTS

MUSIC EDUCATION JUST GOT **A WHOLE LOT SMARTER**









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CIRCLE 18

Teaching by Example

Project teams for six schools tackle diverse design problems, creating high-performing buildings for high-performing students.

BY JOANN GONCHAR, AIA

Schools, like other buildings, are the outcome of innumerable and complex factors, such as the demands of clients and occupants, the particulars of site and climate, and practical concerns like budgets and codes. And the six schools on the pages that follow are no exception: They are each the unique product of fulfilling the needs of the students and educators they house, their institutions' curricula and philosophies, and their surroundings.

For example, the design concept behind a magnet school for the performing arts in Trumbull, Connecticut, was born of the need for acoustic separation between classrooms and the desire for a shared space where students could socialize and work together informally. And the scheme for a school for deaf and blind children in Glasgow, Scotland, is a response to its setting among massive beech trees in a city park. The resulting serpentine plan allowed for a curvilinear inner street that serves both as the connection between programmatic elements and as a wayfinding device.

Some of the schools featured here have dramatic settings, like a middle school in Aspen, organized to make the most of spectacular views of the Colorado Rockies, or a performing arts center on the campus of an international school in Shanghai, with a rooftop terrace that looks out over the city's dynamic skyline.

Designers for a few of these schools were motivated by a desire to foster a sense of community within large institutions. One of these is at the edge of Phoenix, where architects created a mini-college campus, dividing the 2,000-student facility into more intimate learning environments and multiple buildings. Architects for an elementary and middle school in the Bavaria region of Germany took a similar approach by breaking up the single "megastructure" originally called for in a master plan into three bar-shaped structures. That arrangement provides children of each age group with a building they can call their own.

Despite the diversity displayed in these case studies, the six buildings share, to a greater or lesser extent, a commitment to sustainability. All the schools included here strive to maximize the use of daylighting, and most include other resource-conserving strategies, like radiant heating and cooling, well-designed exterior envelopes, and natural ventilation. Such features are not only earth-friendly, but occupant-friendly as well. They help create environments that are comfortable and conducive to teaching and learning. In short, sustainability is not only a strategy for better-performing buildings, but one for better-performing students as well. ■

CREDITS

OWNER: Concordia International School Shanghai

ARCHITECT: Perkins Eastman—*Ron Vitale, AIA, principal-in-charge; Pam Loeffelman, FAIA, Aaron Schwarz, FAIA, design principals; Mark Markiewicz, AIA, John Neary, AIA, John Dias, Paul Chen, Mary Ye, design team*

CONSULTANTS: Edwards & Zuck *(MEP and fire protection)*; Theatre Projects *(lighting)*; Jaffe Holden *(acoustical)*; The PAC Group *(project management)*; Shanghai Yangzijiang *(general contractor)*

SOURCES

EXTERIOR MASONRY: YTong

EXTERIOR METAL: Shanghai Huayuan New Composite

ROOFING: Beijing Kalairuiyu Waterproofing Materials

GLAZING: Pilkington

Making Connections

Despite space and budget constraints, Concordia International School Shanghai embraces a community feeling.

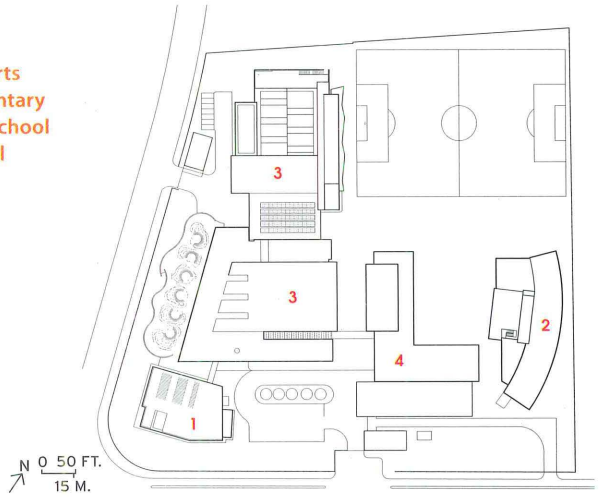
BY JAMES MURDOCK

Only in China, perhaps, is it possible for a private academy serving grades pre-kindergarten through 12 to construct an innovative 64,600-square-foot elementary school and a richly appointed 24,000-square-foot performing arts center in 18 months and for a scant $15 million.

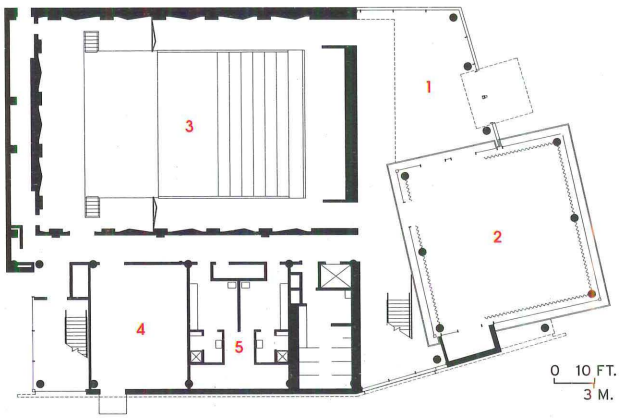
The Concordia International School Shanghai opened these facilities, in 2007, as the first phase of a new campus master plan designed by the New York City-based firm Perkins Eastman. China's inexpensive labor pool helped the school maximize its construction budget, but the design still underwent value engineering to cut costs. During this process a different sense of the word "value" guided Concordia: what Louise Schini Weber, a cofounder and principal of the elementary school, describes as a commitment to nurturing "cooperation and collaboration."

Indeed, administrators refused to skimp on a performing arts center. Located in the southwest corner of the 10-acre campus, the trapezoidal-building connects to the high school to the east via a skybridge. Movable platforms and seating, as well as variable acoustics, enable its main volume to function as a 400-seat recital hall as well as a 335- or 300-seat thrust-stage theater. A rooftop studio opens onto a terrace for art classes whose aluminum-slatted canopy echoes the look of aluminum sunscreens throughout the campus's south- and west-facing elevations.

"The terrace would have never survived the typical value engineering process in the U.S.," observes Ron Vitale, AIA, managing principal of Perkins Eastman's



Site Plan
1 Performing arts center **2** Elementary school **3** High school **4** Middle school



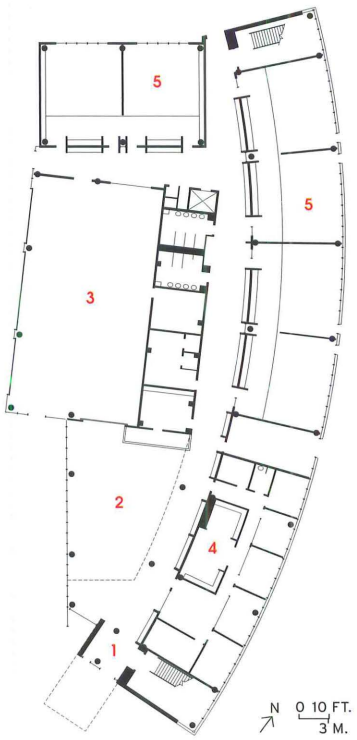
Performing Arts Center, First Floor Plan
1 Lobby **2** Band room **3** Black box theater **4** Scene shop **5** Dressing room

Concordia's expansion included construction of a new performing arts center, which contains a 400-seat recital hall.

Shanghai office. "But the school's board decided it was as important a space for teachers and students as it was for the community."

Concordia's commitment to community building is manifested strongly in the design of the elementary school, a D-shaped structure located at the campus's southeast corner, opposite the performing arts center. The first and second grades, as well as the third and fourth grades, occupy the four-story building's top floors in "paired" classrooms separated only by a partial wall. "In a classroom with four walls and a door, other teachers don't know what you're doing," Weber explains, "but in a paired classroom, collaboration is unavoidable."

There's another, prosaic reason the elementary school feels so intimate. Wetlands surrounded Concordia when it opened in 1998. But just as enrollment grew from 22 students to more than 1,000—nearly three-quarters of whom are the children of U.S. and Canadian citizens—foreign business executives moved to the vicinity and the swampland was developed into a residential enclave. Only half the 20 acres that Concordia initially wanted were still available when it began



Elementary School, First Floor Plan

1 Entrance **2** Commons
3 Motor skills **4** Administration
5 Classroom

master planning in 2006. It was further constrained by municipal building codes requiring plenty of open space.

To maximize available real estate, Perkins Eastman went vertical, replacing a previous low-rise structure with the four-story school. Vitale's team also pushed unexpected uses of routine spaces. In addition to the rooftop arts terrace, for instance, Concordia features two playgrounds on the roof of the elementary school. Corridors, meanwhile, do double duty as social hubs and extra instruction areas: At wider points, these pathways contain tables, chairs, and whiteboards.

Generous fenestration maintains a sense of connectivity to the outdoors and interior spaces. Glass walls and windows enclose the elementary school's ground-floor cafeteria. A large opening connects this dining and assembly space to a gymnasium, where glass garage doors along the west elevation open during pleasant weather. Daylighting is the design's primary sustainable strategy, Vitale says, although phase two of the master plan includes adding a partial green roof during renovations to the high school.

Teachers say that having access to a variety of sun-filled rooms is critical. "Shanghai's weather and air quality are terrible, and it is dreary and yellow a lot of the time," explains

The exterior of the performing arts center (above) takes material cues from the adjacent high school, to which it connects by a skybridge. The generous use of glass in common spaces like the cafeteria enhance daylighting, as well as students' sense of being outdoors (right). A wide swath of terra-cotta brick differentiates the four-story elementary school (below, right) from the existing high school.

Stephanie Herdrich, an instructional coach. "Moving kids from space to space inside, with so much daylight everywhere, almost feels like going outdoors. It has a huge effect on students and teachers." The building's material palette also lifts spirits.

Mostly clad in glass and zinc panels to match the existing high school (designed by Perkins Eastman's predecessor on campus, Perkins+Will), the exteriors of the new elementary school and performing arts center feature warmer accents, such as horizontal wood-louver screens and terra-cotta bricks. "When the sun hits the terra-cotta in the morning, it gives you a feeling like, 'Please come inside, you're going to be loved when you walk in the door,'" Weber says—an important message for every school to convey. ■

James Murdock is a Manhattan-based writer and broadcast journalist specializing in architecture and real estate.

Fine-arts students attend class at the rooftop studio and terrace of the performing arts center—an amenity school officials insisted upon (above). Wood louvers mounted on the exterior of the performing arts center protect young musicians from excessive sunlight or glare (right).

CREDITS

OWNER: **Cooperative Educational Services**

ARCHITECT: **JCJ Architecture**—*James E. LaPosta, Jr., AIA, principal-in-charge; Gregory J. Smolley, AIA, project manager; Peter Rader, AIA, design team leader; Julie Norris, interior designer; Ronald N. Paolillo, Assoc. AIA, senior designer*

CONSULTANTS: **CES** *(MEP & fire protection);* **Michael Horton Associates** *(structural);* **Stantec** *(civil);* **Fisher Dachs Associates** *(theatrical);* **LaRosa Building Group** *(general contractor)*

SOURCES

CURTAIN WALL: **Vistawall**

WINDOWS: **Peerless Products**

UPSWINGING DOORS: **Marshfield**

Creative Community

A high school for the performing arts makes the most of students' energy without taming their spirits.

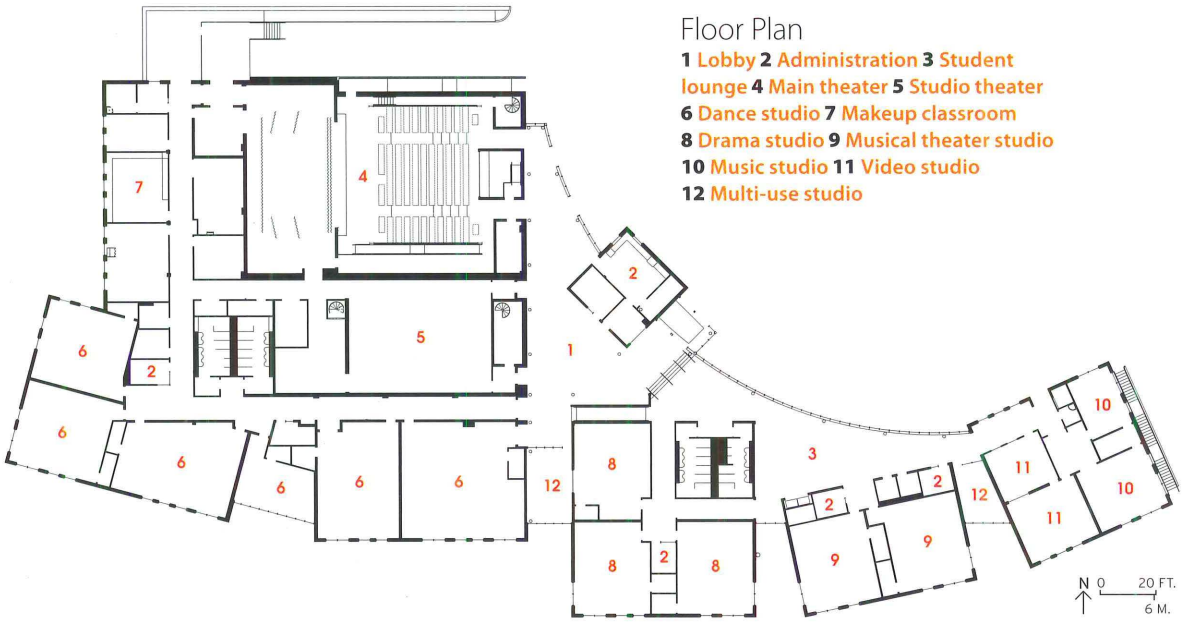
BY SEBASTIAN HOWARD

The Regional Center for the Arts (RCA) is a magnet high school in Trumbull, Connecticut. Most of its faculty commutes from nearby New York City, and 250 students from 15 districts attend the school part-time, in the afternoon. In RCA's new facility, JCJ Architecture made sense of what can be—and has been—a frenetic environment.

Connecticut has no county governments, so state-funded organizations like Cooperative Education Services (CES) have been created to raise the standard of public education. Dianne Wheeler, principal of RCA and a CES coordinator, explains that CES is "charged with bringing cutting-edge technology and school-based academics to our district." RCA is the most recent of four schools the group has built since its inception more than 40 years ago, and it is the only performing arts school in southwest Connecticut. Construction of the 47,700-square-foot, $16 million facility, which opened in November 2007, was funded entirely by the state.

The school has shuffled through several buildings since its 1998 founding. Until RCA moved into its new home, classes were held in a repurposed warehouse. To save money for the construction of its new facility, RCA partitioned the warehouse with half-walls.

It would have been a challenging situation for any organization, but in a performing arts school it was



Floor Plan

1 Lobby **2** Administration **3** Student lounge **4** Main theater **5** Studio theater **6** Dance studio **7** Makeup classroom **8** Drama studio **9** Musical theater studio **10** Music studio **11** Video studio **12** Multi-use studio

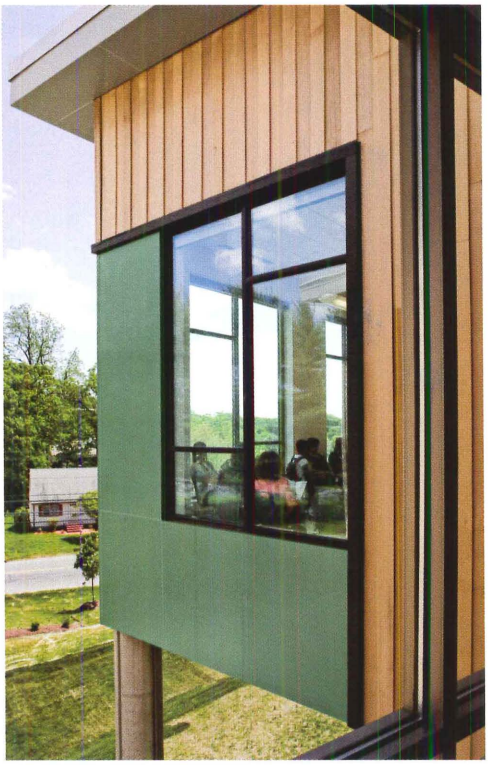
sheer bedlam. For the three years they spent in that building, students had trouble concentrating. "The musical theater department had to drown out the band, which had to drown out the dance music and the acting department," Wheeler says. JCJ design director James LaPosta, AIA, remembers, "It was like a maze."

The school's leadership invited JCJ to spend time on-site with students and faculty to learn what it would take for programs to succeed. LaPosta's team ended up shadowing Wheeler for several days, interviewing teachers, and spending time in classes.

Perhaps not so surprisingly, the process revealed that acoustic separation was a top priority for RCA. In response, the design team

PHOTOGRAPHY: © ROBERT BENSON

The articulated southern elevation of the Regional Center for the Arts reflects the pod scheme of its interior, and complements surrounding houses.



A dramatic circulation corridor arcs from one end of the RCA building to the other, tapering at either terminus.

proposed a single-story building with the school's departments isolated in discrete pods that splay out from a panhandle shape; double walls and doors between classrooms further combat noise leakage.

The pods, each of which contains two, three, or four classrooms, open onto a lobby and common space. "The whole building was designed to promote community—instead of a hallway, you have this flowing area that connects the pods together," LaPosta says of the public space, which also adjoins a main theater large enough to fit the entire student body. "There are all of these nooks and crannies where students can hang out and work on scenes."

RCA sits on a slope between an existing

The crescent-shaped, north-facing entry elevation is finished almost entirely in low-emissivity glass, which welcomes daylight but mitigates heat gain.

RCA's free-form hallway links pods containing separate curriculum programs, such as music (left) and dance (right). The pods, as well as the theater (below) located in the northwest corner of the building, are acoustically separated so that one student group's artistic expression does not interrupt another's deep thought.

special-needs school and a residential neighborhood, and in a nod to the larger community, LaPosta wanted the building "to mediate between these two contextual responses." Pods are visually separated on RCA's south elevation to echo the rhythm of homes across the street, and plank-cedar cladding helps the facility meld with the surroundings. On the north side of the building, a crescent-shaped facade of low-emissivity glass frames the entrance, filling the interior with daylight but not excessive heat. "We almost never have to put the lights on," says Wheeler. "We're operating on daylight 90 percent of the time."

Just as Wheeler cites JCJ's on-site presence as a reason for the building's success, LaPosta praises Wheeler's involvement in the design process. "One of the things she said to us was that it was all about the kids." Her actions confirm the claim: One of Wheeler's unorthodox requests was to put her modest office—among the few rooms with no windows—immediately adjacent to the common area, without the customary secretarial antechamber buffering her from the students.

Wheeler, who will retire in the spring after 39 years as an educator, gives the building high marks. JCJ's thorough research made all the difference, she says. The firm "really did resolve all of the challenges that we presented. They obviously heard us." ■

Sebastian Howard is a writer and video editor based in New York City.

College Prep

A small-school approach to education yields a campus plan for a quickly growing district.

BY TED SMALLEY BOWEN

CREDITS

OWNER: **Phoenix Union High School District #210**

ARCHITECT: **DLR Group**—*Tom O'Neil, AIA, principal in charge; Karl Derrah, AIA, design principal; Ted Wright, architectural designer; Jim Copeland, AIA, construction administration*

CONSULTANTS: **DLR Group** *(MEP);* **Atherton Engineering** *(civil);* **Design Tech** *(food service);* **Adolfson & Peterson Construction** *(general contractor)*

SOURCES

STEEL: **Quincy Joist**

CONCRETE MASONRY: **Master Bloc**

CURTAIN WALL: **Vistawall**

DOWNLIGHTS: **Lithonia**

CONVEYANCE: **Thyssen-Krupp**

CARPET: **Shaw**

AUDITORIUM SEATING: **Hussey**

After-school activity at Betty H. Fairfax High School, located in Laveen Village on the southwest edge of Phoenix, includes the usual practice sessions and tutoring. But there's also a good deal of hanging out.

"I'm sitting here in a common area, it's more than an hour after school's let out, and kids want to be here," says lead English teacher Kate Mullen. "It's warm and inviting."

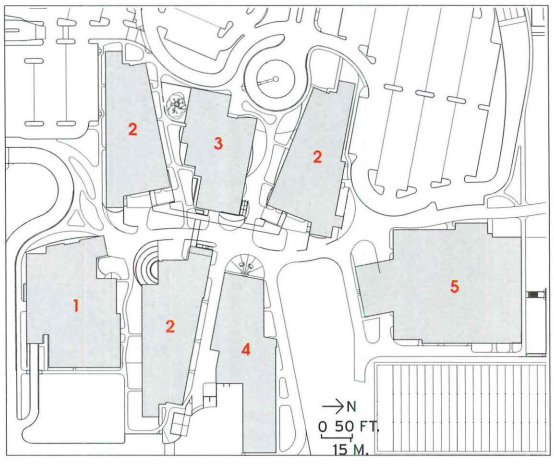
Phoenix Union High School District #210 authorized the school in 2003 as this hyper-growth city absorbed the former agricultural community of Laveen. It was completed for $63 million, in time for the 2007–2008 academic year. The campus, which is expected to accommodate a four-year enrollment of more than 2,000, was designed by DLR Group following a decentralized model known in education and policy circles as small learning communities (SLCs).

"It's basically breaking down a large school population into more relationship-oriented units," explains Karl Derrah, AIA, DLR design principal. Although average class size is around 29, the schools-within-a-school model allows for more individual attention, continuity, and tracking of students, according to principal Zach Muñoz. The 51-acre campus includes three two-story SLC buildings, each of which comprises classrooms, labs, a faculty room, administrative offices, and common space. Separate structures house performing arts facilities, the gymnasium, and food services and student services. The centrally located student services building includes the dining hall and main library.

For a multi-building campus, the scheme makes relatively efficient use of space, according to the architects. In addition to the seven buildings, landscaping, and parking, they managed to work in a full complement of ball fields, courts, and a track. "It's a tight site, but ultimately that was a great benefit," Derrah says. "The smaller footprint is more sustainable, and it brings the buildings and students closer, so it's easier to supervise and socialize."

The buildings are oriented along an east-west axis to maximize daylighting. Overhangs shade windows and cool outdoor spaces in the summer without interfering with solar gain in winter. For materials, the designers opted for painted concrete masonry, corrugated steel cladding, and ample glass. The exterior and interior palettes of gray, green, purple, and yellow reflect the Sonoran Desert and nearby South Mountains and Sierra Estrella range.

Within the campus, generous fenestration and second-floor walkways connecting buildings provide sightlines that foster a sense of community and allow teachers and administrators to keep an eye on things. That openness, in combination with the density of the layout, addressed some students' unease with the small-schools approach, according to Derrah. "In the planning meetings, students were concerned about being isolated from their friends," he says.



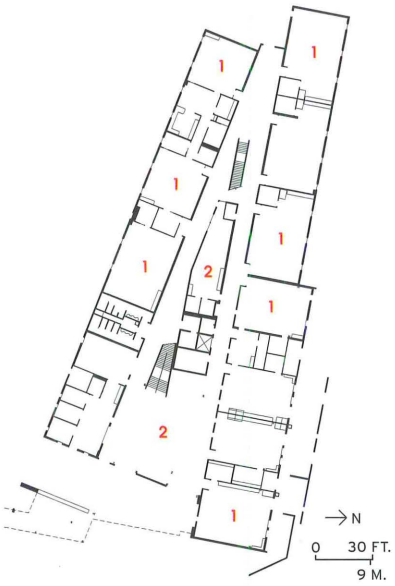
Partial Site Plan
1 Performing arts **2** Small learning community **3** Student services **4** Food services **5** Gymnasium

DLR Group designed Betty H. Fairfax High School as a series of small learning communities, distributing the 2,000-student school among less imposing buildings devoted to different functions like academics, arts, and athletics.

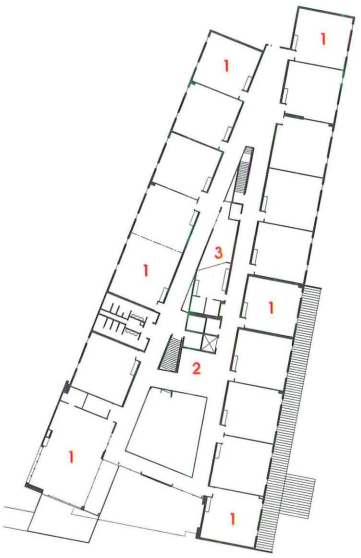
CASE STUDY *Betty H. Fairfax High School*

The auditorium and gymnasium flank the complex, permitting off-hours use for community programs without requiring the rest of the campus to be open.

The designers followed a checklist based on LEED, but to keep costs down, they didn't register the project, according to Tom O'Neill, DLR's principal-in-charge. "We wanted to put all our resources toward design and construction," he says, adding that the decentralized plan doesn't compromise energy efficiency, as the campus is served by a central plant chiller system. Occupancy sensors reduce HVAC and lighting demand, and energy-efficient lamps complement the extensive daylighting scheme. "We plan to look at the real energy use and compare that to our models," says DLR managing principal Bryce Pearsall, FAIA. The project



Small Learning Community, First Floor Plan
1 Classrooms **2** Commons
3 Faculty office



Small Learning Community, Second Floor Plan

Students lounge in a space between buildings planted with native species and a carpet of drought-resistant sod.

An auditorium is located on one end of the campus, easing off-hours operation. Elevated walkways connect the upper floors of academic buildings (below).

also used locally-sourced products, low-VOC, and recycled materials. The landscaping mostly uses drought-tolerant native plantings, as well as drought- and heat-tolerant hybrid sod.

Eating up agricultural land may not seem like the most sustainable choice, but DLR officials say the district chose the location over urban infill sites because it serves the burgeoning neighborhoods at the city's southwestern edge. Public transportation still lags, though. As of press time the city bus line hadn't extended to the school.

Filling that transit gap would make Betty H. Fairfax High an even more sustainable alternative to the school-as-warehouse approach. Mullen, who moved from Chicago to teach there, says the campus sets the tone for the small-school model of pedagogy. "It feels like we want it to, like a college," she says. "After all, they are college students in training." ■

Boston-based Ted Smalley Bowen writes about design, the environment, and business.

Pavilion in a Park

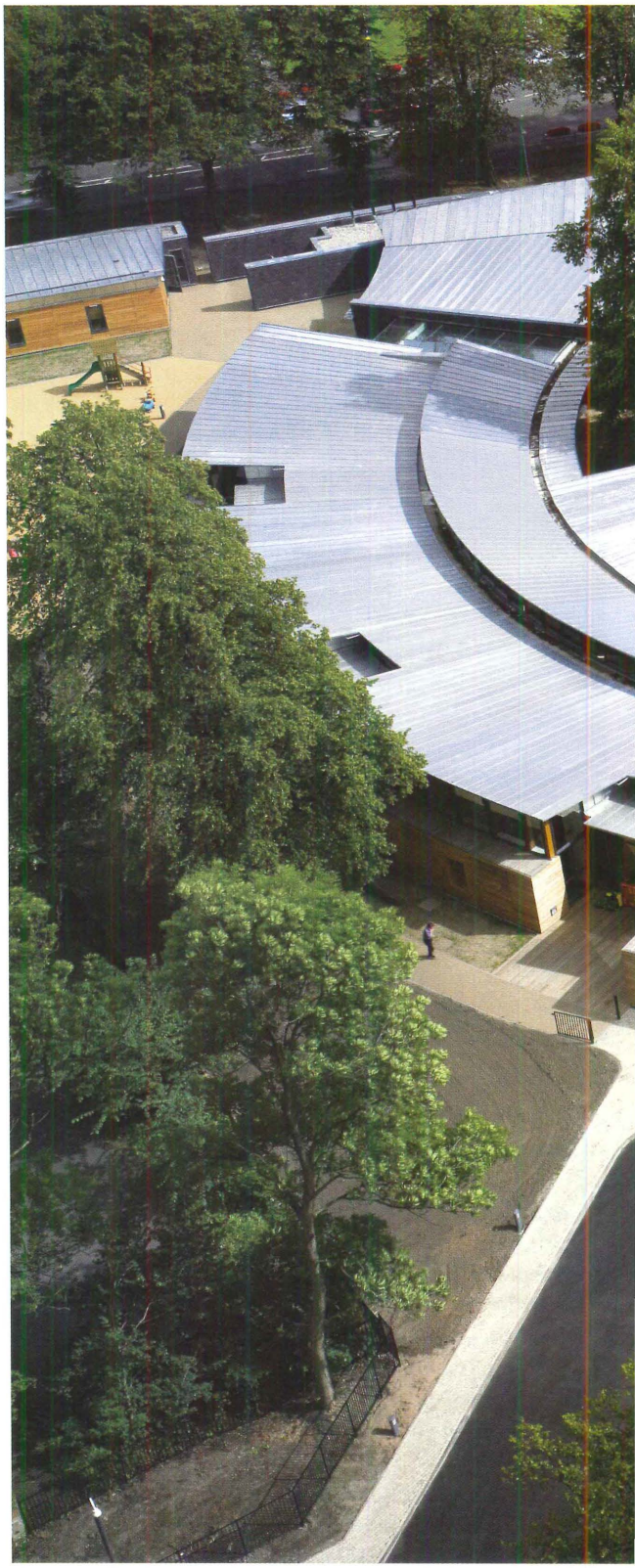
Hazelwood School connects sensory-impaired students to the landscape.

BY DAVID SOKOL

The 46 youngsters attending Hazelwood School in Glasgow, Scotland, have met stringent admissions criteria, but these are not qualifications most parents would wish for their children. Hazelwood's students, who range in age from 2 to 19, endure dual-sensory impairment. In addition to deafness and blindness, "they all have learning difficulties, many are in wheelchairs, and some display challenging behavior," head teacher Monica McGeever explains. Hazelwood focuses on teaching life skills.

"They may never be able to live completely independent lives," notes Alan Dunlop, who has run Gordon Murray + Alan Dunlop Architects (GM+AD) with partner Gordon Murray since 1997. In 2004 the Glasgow-based studio won the competition to design a new building for Hazelwood. In the year that the $9 million building has been in operation, the students have been thriving, demonstrating greater independence and marked improvement in their communication skills, says McGeever.

Previously, Hazelwood's student population was divided between two schools: a 25-year-old former military facility that suffered from disrepair, and an Edwardian villa whose traditional layout restricted children's movement. Upon reviewing maintenance costs for both facilities, Glasgow City Council determined to build a single venue. Due to the complex student profile, the municipality also decided to sponsor a design competition for the building.



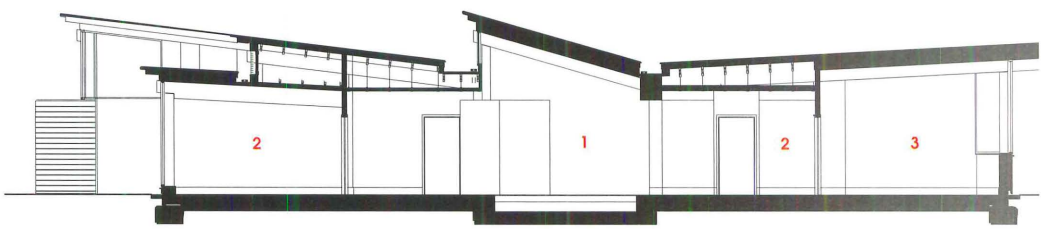
PHOTOGRAPHY: © ANDREW LEE, EXCEPT AS NOTED

Site Plan
1 Administration
2 Hydrotherapy pool/gym
3 Lobby **4** Dining/assembly
5 Nursery **6** General classroom **7** Focus-learning classroom **8** Life-skills home
9 Subject-specific classrooms

Sitting on the edge of Glasgow's Bellahouston Park, Hazelwood School wraps around old trees and follows the contours of the topography.

Section A-A

1 Central circulation spine
2 Focus-learning classroom
3 Subject-specific classroom



SECTION A-A

Hazelwood School's 10 classrooms feature generous storage space. Clerestory windows provide plentiful ambient daylight, without the glare, or views to the outdoors that could distract partially sighted children.

GM+AD won the competition without any prior school buildings in its portfolio, and Dunlop admits that the look and feel of Hazelwood evolved dramatically over the course of design development. In the earliest schemes, "classrooms, music room, and clinician rooms were like stepping-stones along a linear route," he says. "Now there is still a clear route with well-defined elements along it, but it's much more sensual."

Hazelwood's plan resembles a sea horse with its long axis running roughly east–west. Ten classrooms occupy half as many volumes protruding gently from the sinuous north elevation, while additional functions, such as the music room and library, dot the opposite side of the building; the two sets of spaces face an internal street. A gymnasium, hydrotherapy pool, and kitchen are nestled into the western terminus of the structure, and a wedge-shaped multi-use cafeteria and entrance area sit immediately adjacent to this cluster.

The design responds to several constituencies at once. Hazelwood is located on the site of a dairy near Glasgow's Bellahouston Park. Since that building's demolition in 1926, "the community had considered the site to be part of the park itself," Dunlop explains. The school's plan is in part a response to neighbors' concerns about the construction of the building. The curvilinear form follows the contours of the site and accommodates three massive beech trees. Richard East, director of local landscape consultant City Design Co-operative, says only two trees were removed. A low-slung zinc roof melds with the topography, while its Siberian larch cladding will weather to a soft gray similar to slate shingles applied to other walls. Soon Hazelwood should appear more like a landscape feature than architecture.

"Bringing the trees into the design helps form external classroom spaces," Dunlop also notes. Indeed, garden spaces where teachers can calm children one-on-one are appended to each classroom. The weaving of landscape into the architectural design soothes teachers, too. "It's an incredibly intense job these guys do," says Dunlop. "The building is designed as much to relieve that kind of pressure as to support the children."

Hazelwood's bucolic setting suffuses the 29,000-square-foot interior. Louver-protected glazing and clerestory windows surround the internal street, showering it with daylight. Clerestories dominate the classrooms, since expansive full-height windows could distract those students who have partial sight. "We wanted to make students aware of the change of the seasons, the falling of rain, different smells," Dunlop says. GM+AD never wavered from its intention of building with timber, which the architect calls "warm and good to touch—it creates a non-institutional feeling."

Institutional is exactly what Hazelwood isn't. There are few handrails; instead blind students follow a "sensory wall"—a folded cork plane lining one side of the internal street—to guide themselves between rooms. "We were asked to not make everything too safe," Dunlop says. Outside, students feel the sun-warmed slate or larch slats for wayfinding cues, and East's landscape design is punctuated by unprotected steps. "There are corners in this building, there are challenges," McGeever says of Hazelwood's non-risk-averse design, "the world is not built like a school environment." She adds, "Plus, safe buildings sometimes equate to boring buildings. With some students here for as long as 15 years, we didn't want a building that was boring." ■

PHOTOGRAPHY: © KEITH HUNTER (TOP)

Volumes as well as slim walls project from the sinuous building in order to effectively partition the outdoor space for different functions (above). A cork-wrapped "sensory wall" helps students find their way through Hazelwood's main corridor (right).

CREDITS

OWNER: **Glasgow City Council**

ARCHITECT: **Gordon Murray + Alan Dunlop Architects**—*Alan Dunlop, Partner; Stacey Phillips, project director; Fergal Feeney, architect*

CONSULTANTS: **Buro Happold** *(engineering and lighting);* **City Design Co-operative** *(landscape);* **Buro; RMP Acoustic Consultants** *(acoustical);* **Sir Robert McAlpine** *(general contractor)*

SOURCES

METAL ROOFING: **VM Zinc**

ROOF LIGHTS: **Brett Martin Daylight Systems**

WINDOWS: **Scandinavian Window Systems**

CEILING SYSTEM: **British Gypsum**

CREDITS

OWNER: The Aspen School District

ARCHITECT: Studio B Architects—*Scott Lindenau, AIA, design principal; Gilbert Sanchez, AIA, managing principal; Michael Piché, Kevin Heath, project team;* Hutton Architecture Studio, né Hutton Ford Architects *(architect of record)*

CONSULTANTS: Redwine Engineers *(structural);* Beaudin Ganze *(lighting and mechanical);* Design Concepts *(landscape);* DL Adams *(acoustical);* GE Johnson *(general contractor)*

SOURCES

CURTAIN WALL: Kawneer

ARCHITECTURAL PANELS: Mapes

MASONRY: Interstate Brick

ROOFING: Firestone

SKYLIGHTS: Solatube

PANELING: Smith & Fong Plyboo

Mountain Do

Aspen Middle School takes cues from its picturesque setting, and relieves some stress on the planet.

BY B. J. NOVITSKI

It should come as no surprise that a school in Colorado's Rocky Mountains ranks sustainability high on its teaching agenda. The small town of Aspen, an upscale winter ski resort and summer hiker's paradise, takes civic pride in its ecological awareness. The newest of its three public schools, the year-old, 113,000-square-foot Aspen Middle School by local Studio B Architects and Denver-based Hutton Ford Architects, is designed to support environmental education and to foster a sense of stewardship among students.

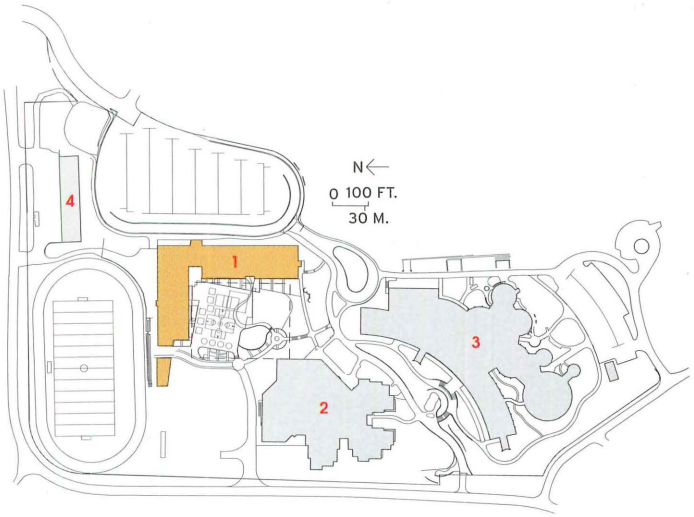
As a symbol of the school's place in the landscape, its exterior materials echo the surrounding mountains. Regionally manufactured brick and metal panels evoke the snowy peaks of the photogenic Maroon Bells. "Our educational concept was to connect the students to the landscape and to the environment," says Studio B principal Gilbert Sanchez, AIA.

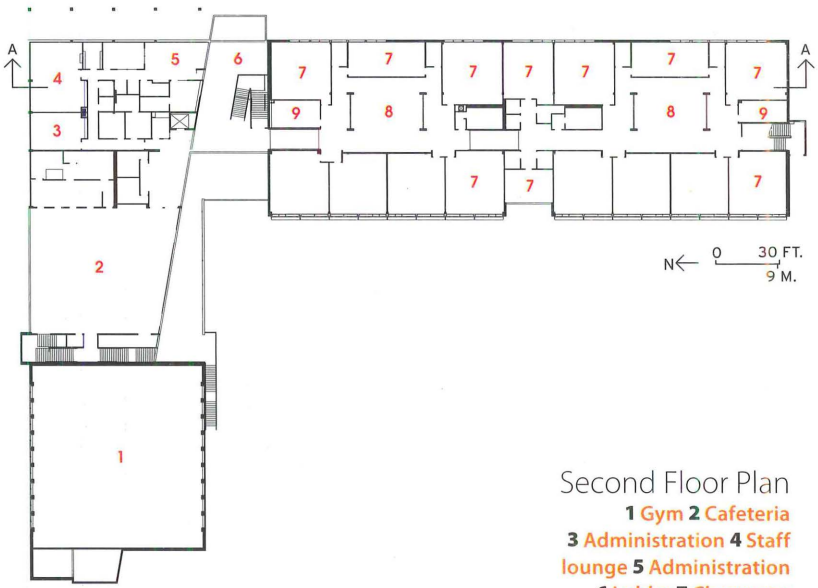
The building's angular form also reminds users of the spectacular surroundings. Studio B principal Scott Lindenau, AIA, explains, "The L-shaped plan bifurcates the classroom wing from the specialty wing and opens the entry toward the view. And as you walk from parking lot into lobby, the major view is oriented toward Buttermilk Mountain; the lobby roof is butterfly-shaped to open up that view."

Unlike its nearly windowless predecessor, the new middle school boasts views of the mountains from every classroom. Operable, double-glazed, low-E glazing controls the flow of heat and light so the

Site Plan

1 Middle school **2** Elementary school
3 High school **4** Bus barn





Second Floor Plan

1 Gym **2** Cafeteria
3 Administration **4** Staff lounge **5** Administration
6 Lobby **7** Classroom
8 Classroom core **9** Office

The butterfly-roofed entrance to the school is located in the elbow of an L-shaped plan, dividing classes from aspecial-purpose spaces like the gym.

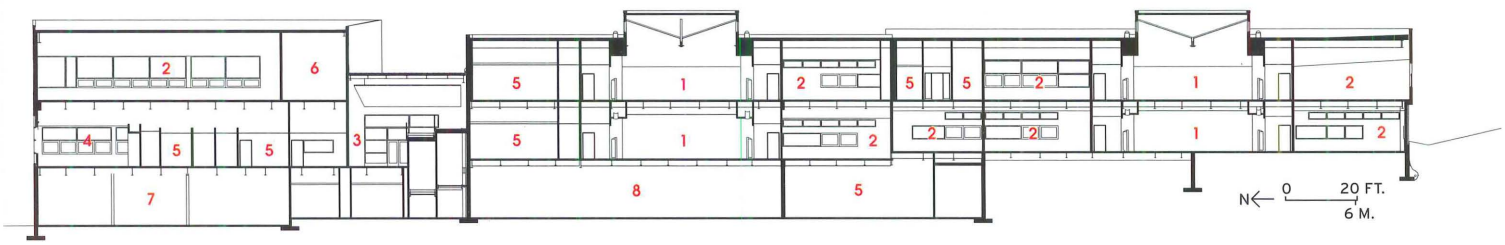
new building is comfortable, fuel-conserving, and filled with daylight. Aluminum louvers on the exterior of the west-facing windows are fixed at a 25-degree angle off horizontal to maximize their shading effectiveness throughout the year. Fixed aluminum louvers on the interiors of east- and south-facing classroom windows help with daylight distribution. On mild winter days, many students eat lunch on the south-facing, wind-protected balcony outside the second-floor cafeteria. Teaching about the building's orientation to the sun and other sustainability features is integrated into science coursework.

All subjects are taught in what school superintendent Diana Sirko calls an "educational teaming approach." Each of the four grades' classrooms clusters around a common area where students of that grade meet for group activities. For the core areas on the lower level, a raised ceiling differentiates the space from the adjacent corridor; the upper-level cores have roof monitors with north- and south-facing clerestories. The rectilinear cores are further differentiated by their carpet designs.

Small-group classrooms that can be outfitted with movable partitions are adjacent to each core. "We feel it's important to meet the individual needs of students," Sirko says. "So these mini-classrooms are for math or reading

Section A-A

1 Classroom core **2** Classroom **3** Lobby
4 Staff lounge **5** Office **6** Conference
7 Industrial arts **8** Future classroom



CASE STUDY *Aspen Middle School*

A balcony (right) adjacent to the cafeteria and the lobby offers students a wind-protected spot to eat lunch oudoors. The library (below), at the northwest corner of the building, commands spectacular views of the surrounding landscape.

The bamboo-clad lobby ceiling follows the contours of the butterfly roof (right). Its form maximizes the view west to Buttermilk Mountain (bottom), a spiritual and aesthetic lodestar for the project.

specialists to work with individual students for enrichment or remediation."

Another key part of the curriculum is the outdoor educational program. Classes learn recreational skills by taking camping and rafting trips. In addition to the large storage rooms needed for the school-owned equipment, the program called for open spaces, where students learn to set up rafts and tents. The central core areas serve this purpose well.

But environmentalism at Aspen Middle School is more than views and camping trips. The building offers object lessons in sustainability. Bamboo, a rapidly regrown material frequently substituted for wood, clads the ceilings and walls in the lobby. The flooring is natural linoleum and the carpet has recycled content. New cabinets are formaldehyde-free, while some from the previous building are reused.

"Reduce, recycle, reuse" applied to the old school's deconstruction in general. To provide continuous service, it stayed in session while the new building was being erected just a few feet away on the 25-acre site. Later, in plain view of the students, crews painstakingly dismantled the structure to reclaim reusable materials. Rather than compete for attention, some teachers asked curious students to write about the process.

That recycling helped push the school toward LEED Gold territory, a rating granted by the U.S. Green Building Council in late October. Other contributing aspects include energy-saving features, solar air heating, waterless urinals, and sensors that turn lights down when daylight is sufficient and off in unoccupied rooms. Sirko reports the electric lights in the classrooms are largely unnecessary during the day. "This building is saving us about 50 percent in energy costs over the building it replaced," she says. Aside from a few features deleted for budgetary reasons, "mostly we achieved what we set out to accomplish." ■

B. J. Novitski, an ARCHITECTURAL RECORD *contributing editor, writes about professional practice and sustainability.*

CREDITS

OWNER: Confidential

ARCHITECT: Mitchell/Giurgola Architects—*Jan Keane, FAIA, partner in charge; Steven Goldberg, FAIA, design partner; Susan Stando, AIA, interior design architect; You-Chang Jeon, AIA, project architect/designer;* Baurconsult, Architekten + Ingenieure *(architect of record)*

CONSULTANTS: HPS Haustechnikplanung Schreiber *(building services);* SHL Architekten *(landscape);* Brandston Partnership *(lighting)*

SOURCES

GREEN ROOF: Benkert and Zinco

EXTERIOR SOLAR SHADES: Warema

COLORED GLASS: Vanceva

LAB CABINETRY: Waldner

RUBBER FLOORING: Nora

CORRIDOR LIGHTING: Zumtobel

At Home, Abroad

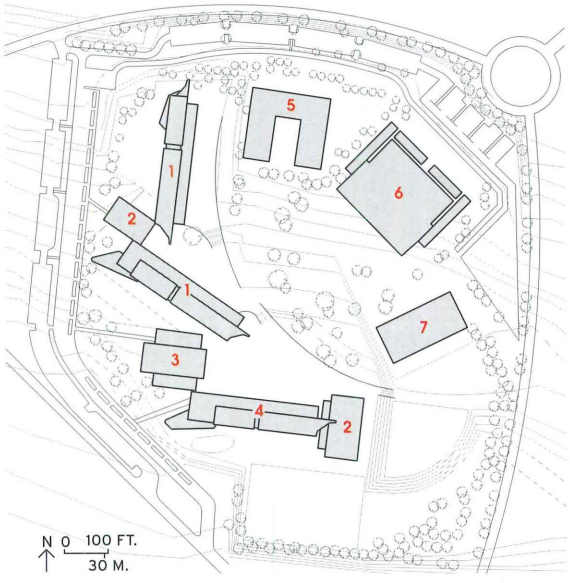
Mitchell/Giurgola infuses an American school in Germany with a taste of the States.

BY MICHAEL DUMIAK

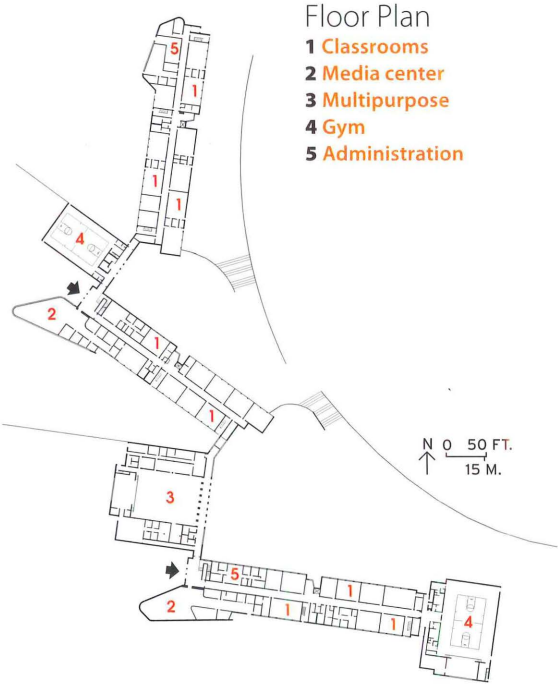
An American elementary and middle school designed by Mitchell/Giurgola in Bavaria forges form with specific purpose. The $36 million, 1,500-student project reflects educators' requests: There are gathering spaces in the hallways and between the long classroom buildings for impromptu breakout groups, for example, and larger classroom sizes handle computer equipment or "national" sessions for German-language lessons or sampling local cuisine. Long, gently rising green roofs complement the steep slopes of the 17-acre site, and natural ventilation and abundant daylighting courtesy of clerestory windows breathe life into the halls. In doing so the New York-based architects had to successfully negotiate many significant differences in both culture and curricula.

The project required skillful coordination among multiple partners, too. The client's project architect says that while it helps to have a local architect who understands local building codes and construction methods, it was necessary to hire an American architect who understands what American students and teachers expect and need.

Indeed, students residing in foreign countries often rotate schools every few years, so it's important to keep a level of consistency in curriculum between schools. The same idea applies to architecture, which should feel approachable to a student body that may move through multiple schools both Stateside and abroad, and which should take 21st-century American



Site Plan
1 Elementary school
2 Gym
3 Multipurpose
4 Middle school
5 Administration
6 Planned chapel
7 Youth activity center



Floor Plan
1 Classrooms
2 Media center
3 Multipurpose
4 Gym
5 Administration

Blue exterior surfaces characterize the middle school, which is located uphill from the elementary school.

teaching approaches into consideration.

Mitchell/Giurgola partners Jan Keane, FAIA, and Steven Goldberg, FAIA, started work from a community master plan done by a local landscape architect. The school suggested in that scheme showed a much more German approach to pedagogy and its architecture. "It was a giant, curving megastructure," Keane says of the sober vision, which distinguished little between grades.

The site's 24-foot overall grade change was a challenge, as was seamlessly situating the playing fields and creating identities for elementary and middle schools, Goldberg says. Their reworked design broke down the school components and resulted in a series of buildings placed along one side of the slope in 12-foot terraces—three bar-shaped structures set like falling dominoes. This splintered the megastructure, bringing in breathing and play space. Students work their way up the hill over time. Primary-grade buildings are accented in yellow, and higher grades feature cerulean blue. Other entrances and administrative buildings are white.

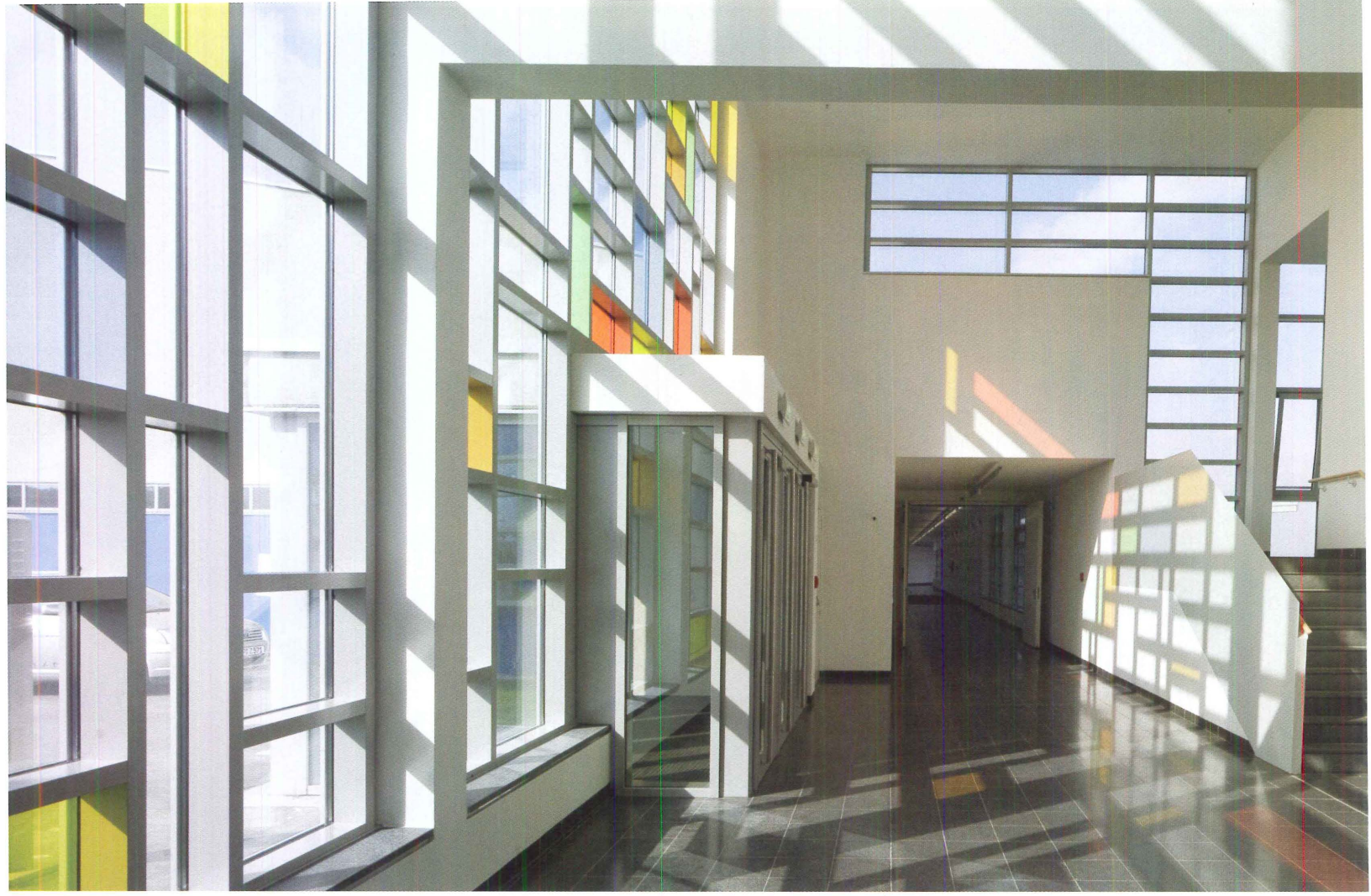
Two rounded, boomerang-shaped multimedia

Like the middle school, the elementary school entrance (above) is defined by lozenge-shaped volumes. Clerestory windows enhance interior daylighting and natural ventilation (right). The wedge-shaped building (below, foreground), which has a companion at the middle school, houses a multimedia library.

library rooms in yellow and blue emerge from two of these three wings. Meanwhile, nearby multipurpose rooms are used for both remedial and advanced students—there's no shoving the remedial kids into substandard space. Keane also says that on the weekends or after hours, both sets of rooms host meetings and activities because they can be isolated from the rest of the school.

With their bright colors and strip windows these spaces suggest something of the International style instead of Americana. Another building signature is the large, prow-shaped canopy identifying one entrance, as well as other overhanging roofs that shield the school from the elements during the long European winter. These climate-sensitive weather buffers would be commended anywhere, just like the eco-friendly details that include photo sensor–controlled exterior blinds, radiant floors, and a pond and science garden fed by stormwater runoff in, addition to the natural ventilation and daylighting strategies. So would modern conveniences, like a central utility tunnel that winds underneath all the buildings so that repairs don't disrupt classes. Overall results are measured pretty quickly. "Kids are in it," says the client's project architect. "And they love it." ■

Michael Dumiak writes on architecture, design, and science from Berlin.



Clockwise from top: Glass panes featuring inlaid color film evoke a Mondrian painting. These colors accent particular building surfaces, including each school's entry elevation. Mitchell/Giurgola's daylighting strategies are on display in the corridor of the middle school, and in the school's generously scaled, wood-paneled gymnasium.

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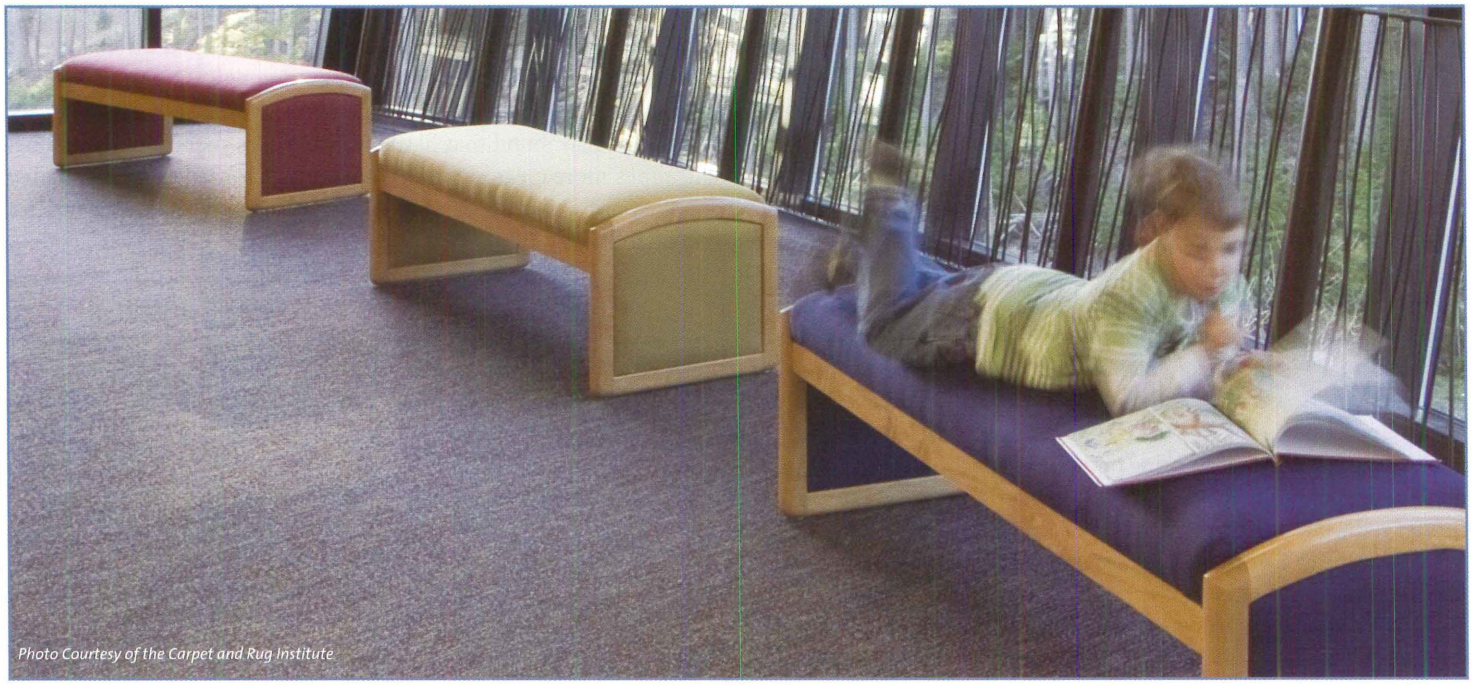


Photo Courtesy of the Carpet and Rug Institute

Provided by the Carpet and Rug Institute

From kindergartners to postgraduate students, a pleasing school environment is a plus that can add up to superior performance. Over the past several decades, school design has been widely recognized as a factor in creating a good learning environment that strongly affects student achievement, social development and attendance, as well as teacher retention and satisfaction. In a 2001 study by the Atlanta-based research firm, Beth Schapiro & Associates, more than 92 percent of teachers surveyed believe general classroom design has a strong impact on students' learning and achievement. In the same study, teachers identified the top five design elements that promote the best learning environment: comfort, safety, lighting, temperature control and good acoustics.

Carpet helps achieve several of these design goals, and is a factor in the creation of welcoming, friendly and less institutional classrooms that can contribute to a better educational environment for students, teachers and school personnel. In fact, more than 70 percent of teachers surveyed in the Schapiro study prefer carpet on their classroom floor.

This article will cover the safety and health issues related to carpeting in schools, as well as guidelines to selecting the right carpet and keeping it a sustainable choice for the life of the product. The proper way to clean and maintain carpets will be explored, as well.

CONTINUING EDUCATION

Use the learning objectives below to focus your study as you read **Carpet Scores Good Marks in Schools: A Smart, Sustainable Solution in Floor Coverings.** To earn one AIA/CES Learning Unit, including one hour of health safety welfare/sustainable design (HSW/SD) credit, answer the questions on page 73, then follow the reporting instructions or go to **ce.ArchitecturalRecord.com** and follow the reporting instructions.

Learning Objectives
After reading this article, you should be able to:

- Discuss the benefits of carpets in schools
- Specify the right carpet for high, medium and low traffic areas
- Recommend a Carpet Maintenance Plan

BENEFITS OF CARPETS

Carpet is a foundation for the look and feel of a room. It can provide a casual simplicity to reinforce a soft, livable ambiance or it can lend vibrancy to a room through strong colors and heavier textures. One of the easiest methods of personalizing an environment, carpet also offers a host of health and safety benefits.

Improved Safety. Because it affords more traction, carpet helps prevent falls. According to the above-mentioned Schapiro study, 77 percent of teachers agree that carpet helps prevent falls and injuries and makes a classroom safer. Not only do fewer slips and falls occur with carpeting, but when they do happen the chances of injury are greatly diminished on a soft floorcovering. Further, carpet provides a non-glare surface that reduces reflection and eyestrain.

Reduced Noise. With carpet, less acoustic protection is needed on the ceiling and elsewhere. This provides a better learning atmosphere with fewer distractions. According to the Technical Committee on Architectural Acoustics of the Acoustical Society of America, the speech intelligibility rating is 75 percent or even less in many classrooms, meaning that those with normal hearing can understand only 75 percent of the words read from a list. Research shows that background noise from inside and outside the classroom negatively affects learning. Excessive noise and reverberation interfere with speech audibility, leading to diminished understanding, learning and ability to focus on the lessons at hand.

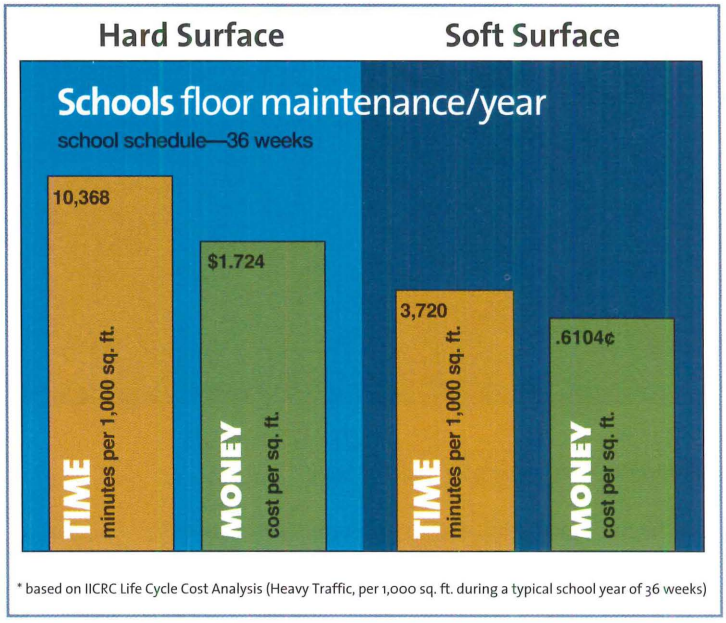
Flooring is a major component of comprehensive noise management. Based on a study by the American Society of Interior Designers, carpet is deemed to be 10 times more efficient in reducing noise compared to other flooring options. When a cushioned backing made with polyurethane technology is added, noise levels can be further reduced.

Increased Comfort. For teachers and other staff, a cushioned walking and standing surface reduces leg fatigue. Several studies have investigated the influence of floor surfaces on the body during long-term standing, and results show that softer floor materials usually result in less postural discomfort than standing on hard floor surfaces (Redfern & Cham, 2000). According to Rys and Konz (1988), heart rate was higher after two hours of standing on a concrete floor compared to carpet, and perceived comfort was higher when standing on carpet. Similarly, In 1997, Madeleine et al. found that after two hours of standing, the comfort level was greater for a soft surface. Standing on a hard surface increased parameters, such as shank swelling and muscle fatigue. It also detrimentally changed subjects' standing posture.

Better Insulation. Carpet is warmer to sit on or work on, extending the learning areas to space on the floor. Thermal comfort exists because carpet retains inside ambient temperatures for longer periods. Because of its fibrous construction, carpet traps a layer of air close to the floor. Air is an excellent thermal insulator and consequently carpet acts to increase the thermal insulation of a surface. Additionally, a pad beneath carpet can further increase this thermal insulation effect.

Research conducted at the Georgia Institute of Technology School of Textile Engineering tested the thermal insulation values (R-Values) of carpet and cushion and found that the total R-value was more dependent on the total thickness of the carpet than the type of fiber content. The research indicated that a carpet system comprising carpet and pad can increase the R-value of the floor to somewhere in the range of 2 to 4.

Lower Life-cycle Costs. Carpet that is properly selected, installed and maintained lasts up to 10 years or longer. When product, installation and maintenance supplies and labor costs are considered over a 15- to 20-year period, carpet showed lower life cycle costs than other flooring options. A 2002 report, "Life-cycle Cost Analysis for Floor Covering in School Facilities," prepared by the Institute of Inspection, Cleaning and Restoration Certification (IICRC), found that carpet could be 65 percent less expensive to maintain than hard surface flooring. In the study, buying and installing the hard surface flooring was less expensive than carpet. But when labor, supplies and equipment costs were calculated over a 22-year life cycle, carpet proved to be more cost effective. The life expectancy of the hard surface flooring was 22 years. The cost of replacing carpet after 11 years was factored into the analysis. The study also found that hard surface floors require two and one-half times more cleaning than carpet and that hard surface cleaning supplies are about seven times more expensive than supplies for carpeted floors.



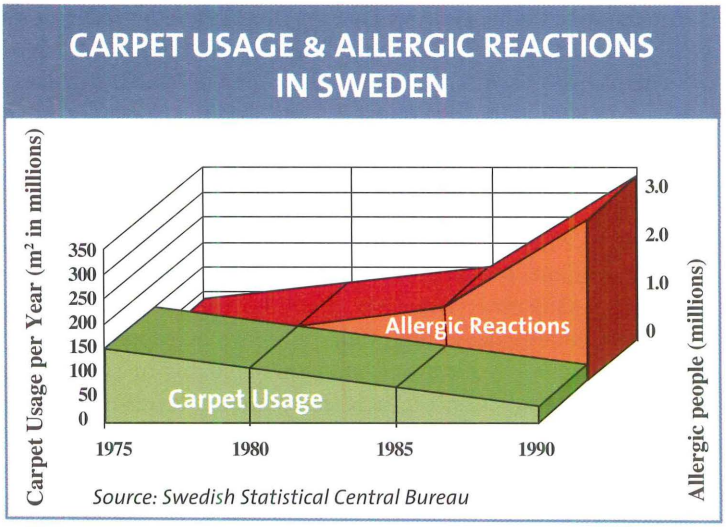
Source: The Carpet and Rug Institute

The carpet industry is working to make carpet even longer lasting in schools by creating more durable fibers and fabrication methods, improving primary and secondary backings and increasing the number of different design and performance options. Modular carpets, the fastest growing segment of the industry, provide the option of replacing parts of a carpeted surface, instead of the entire carpet.

Improved Indoor Air Quality. Allergies are usually affected by airborne particles. Carpet traps allergens in its fiber and does not allow them to circulate in the air, even with the activity of children. The allergens trapped in the carpet then can be easily removed by adhering to a regular cleaning and maintenance schedule that includes vacuuming and periodic extraction cleaning using Seal of Approval-certified products. Studies have compared the distribution of airborne dust associated with normal activities on hard and soft flooring surfaces. In 2002, research by G. Asbury titled, "Cleaning and Foot Traffic Emissions Analysis," for the Professional Testing

Laboratory, Inc., in Dalton, Georgia, showed that walking on hard surfaces disturbed more particles. These particles became airborne and entered the breathing zone. In contrast, carpeted surfaces trapped more particles so that walking disturbed fewer particles. The result was less dust in the breathing zone over carpeted floors.

In a government study in Sweden, when carpet was banned from public buildings and replaced with smooth surfaces, the allergic reactions of people actually increased as carpet use decreased. There were intensive discussions and reports in Sweden in the 1970s claiming that carpet was the source of harmful contaminants, resulting in allergic reactions. As a result, Swedish consumers and public building officials severely reduced their use of carpet. Carpet's share of the total floorcovering market in Sweden dropped from 40 percent in the mid-70s to only 2 percent in 1992. Based on historical figures published by the Swedish Statistical Central Bureau in the early nineties, Professors Roshan L. Shishoo and Alf Börjesson, Swedish Institute of Fibre and Polymer Research, published an article for *Carpet & Floorcovering Review*, pointing out that while the use of carpet in Sweden had steadily decreased since 1975, the occurrences of allergic reactions in the general population had increased. Professors Shishoo and Börjesson contend that the removal and decline of carpet usage did not mean improved conditions for allergic patients, who in fact missed the advantages of carpet such as comfort, insulation, and noise reduction.



Another indoor air quality issue is that of carpet and mold. Clean carpet does not support mold growth even at prolonged and elevated temperatures. However, left unresolved, leaks and spills, heavy condensation and localized flooding, especially when followed by prolonged high humidity, can lead to mold growth in many areas of a school. For mold to grow, it needs water, oxygen, a warm temperature and something that contains nutrients to feed on, such as dirt, wood or paper. Moisture trapped below a carpet can result in mold growth and the release of mold spores and mold metabolic products (microbial VOCs or MVOCs) into indoor air. Effective moisture control is critical to protect all building systems from the potential for mold growth. That said, studies have shown that the biggest source of mold spores is actually an improperly operated and maintained HVAC system. Shutting the HVAC system off at night or during downtime creates the perfect incubator for mold spores, which are then flushed into the breathing zone.

Indoor air quality also involves the emissions of volatile organic compound (VOC) levels from building materials. Carpet may be the lowest VOC emitter of common flooring choices and one of the lowest emitting products used in new construction and renovation, much lower than products such as paint. The already low VOC emission of new carpet drops significantly after 24 hours, even sooner with fresh air ventilation. According to Werner Braun of the Carpet and Rug Institute, the industry has developed a program known as the Indoor Air Quality Green Label Program to determine the level of VOC emissions from carpet, floor adhesives, and cushion products. Attached to a carpet, floor adhesive or cushion, the label signifies that a representative sample of the product type has been tested by an independent laboratory. The recent Green Label Plus is an enhancement that incorporates additional requirements to meet California's Collaborative for High Performance Schools (CHPS) low-emitting materials criteria. Products listed as CHPS-compliant materials have been chamber tested to meet the indoor air quality guidelines outlined in California's specification section 01350.

SELECTING THE RIGHT CARPET

In many instances, new schools have incorporated a mix of floor coverings, with carpet in entrances and corridors to minimize dirt brought in and spread throughout the facility. Carpeting in these areas also provides extra traction for school children entering the building, particularly when it's wet or snowy outside. In elementary school classrooms carpeting is increasingly being used around teachers' and students' desks, with smooth surfaces reserved for around sinks and water fountains and in bathrooms and cafeterias.

Choosing the right carpet to stand up to the heavy traffic expected in a school is critical. Industry guidelines are geared to choosing an appropriate carpet for any area, from corridor to classroom to school office, classifying carpet's use according to expected traffic, determining the performance required for the location and for determining the carpet's desired physical characteristics. Compromising any specification recommendation can dramatically affect the way a carpet looks and its ease of cleaning.

Experience has taught that a low profile, densely tufted, tight loop construction is very functional in a school. Color selection is a prime factor in long-term appearance retention and facility managers and maintenance supervisors who understand this can increase the longevity of the carpet and save on future capital replacement. While a light color cut pile can make rooms and hallways look brighter, they are a poor choice in heavy traffic areas and can make successful maintenance more difficult. A darker color loop pile will retain its appearance longer and is a better choice in heavy traffic areas. Tweeds or patterns in the carpet are also a good choice as they add interest to the floor and hide soil.

"Carpet is a cost-effective way to bring color and texture into a project and has the flexibility to transition between areas within a school," says Lisa Pinyan, ASID, IIDA, LEED® AP, Director of Interior Design for Greenline Architecture in Savannah, Georgia.

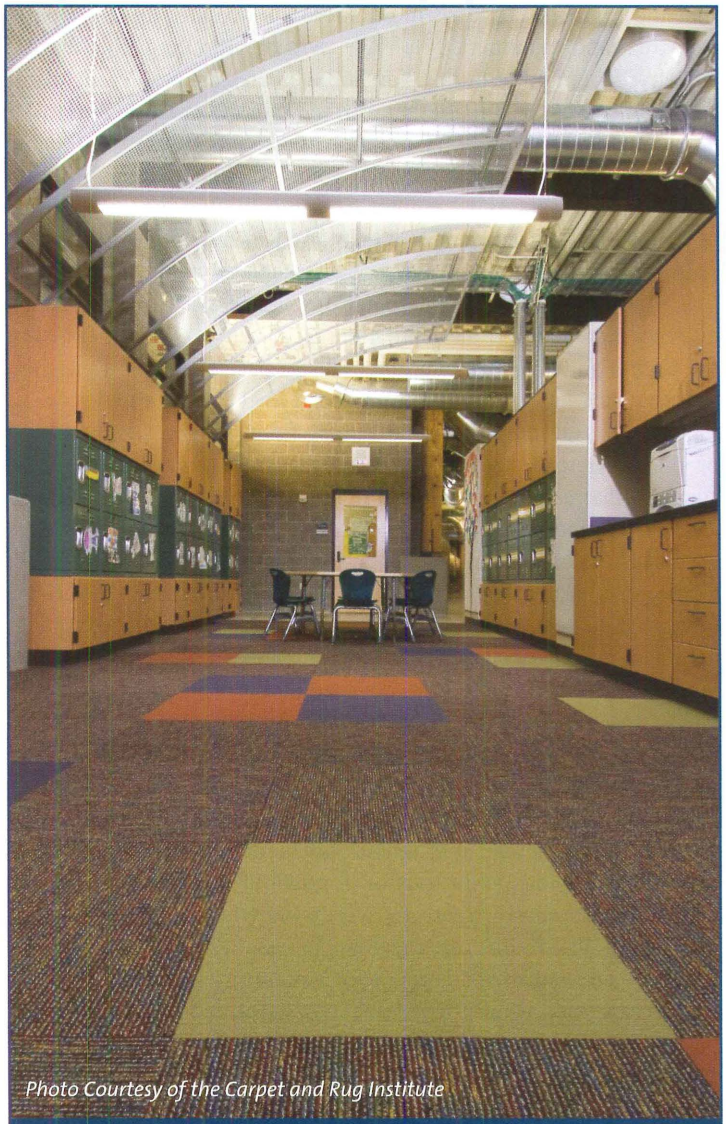


Photo Courtesy of the Carpet and Rug Institute

Variation in color and pattern can mask the effects of traffic in school settings.

Pinyan favors some variation in color and pattern to mask the effects of traffic. "Darker colors and solid colors don't perform as well. They show the dirt and lint and all other debris," says Pinyan, noting that the construction method — preferably loop — and dye methods are two key factors in her specifying decisions. "When budgets allow, we go with solution-dyed carpets." Pinyan also notes that carpet tiles, the fastest growing component of the carpet industry, have their place. She specified them for Georgia Southern University's new College of Information Technology, where computer access flooring was used throughout much of the building. "They're more expensive initially, but they are easier to replace as individual carpet tiles become damaged. If the school has the budget for them, carpet tiles can have a longer life cycle," she says. Carpet tiles ranged from a modern pattern in common areas to those with color and warmth in the professional development area to classrooms where less pattern and stain hiding ability were considerations.

Carpet performance ratings, found on the carpet label, are a tool used by some manufacturers to help specifiers select the most appropriate carpet for various areas of a facility. Rated from 1 to 5, the scale represents the carpet's ability to withstand extended wear. A carpet with a higher performance rating such as 5 or 4 is one that will maintain its new appearance longer in various traffic conditions than one with a lower rating. A rating of 4.0 is considered outstanding. These carpets are recommended for a school's heavy traffic locations, which would include such areas as entrances, corridors, student break areas and classrooms. A rating of 3 or higher is predicted to provide normal durability and would be appropriate for libraries, conference rooms, media centers or classrooms with limited use. A rating of 2.5 or higher is predicted to be appropriate for teacher or administrative offices.

These ratings do not take into account soiling, poor maintenance or other factors of use; just the change of texture related to matting and crushing that might occur from walking on it. For these reasons, it is not practical to associate years of wear with the performance ratings. To obtain the projected appearance retention performance, the carpet must be correctly installed following the manufacturer's instructions and in accordance with industry installation guidelines and must be in accordance with the carpet manufacturer's recommendations.

The Texture Retention Rating value is determined by grading the appearance change of a carpet subjected to simulated traffic exposure either from actual walkers or from laboratory drum tests such as Hexapod or Vettermann Drum testers. Carpet is tested without underlay cushion material. After simulated traffic exposure, the exposure-conditioned carpet is rated according to an assessment of carpet surface change using industry grading scales.

Sustainability. With the plethora of carpet types available in the marketplace, selecting the most sustainable carpet can be a challenge. NSF 140-2007, certified by the American National Standards Institute (ANSI), is the prevailing standard for sustainable carpet. The standard is voluntary, based on life-cycle assessment principles, and provides a single rating system that recognizes levels of achievement — mandatory minimum standards of sustainable performance as well as silver, gold and platinum levels that define a more sustainable carpet. It establishes performance requirements and quantifiable metrics throughout the supply chain for public health and environment; energy and energy efficiency; bio-based, recycled content materials; manufacturing; and reclamation and end of life management. While the standard can be used to evaluate any carpet product, it is primarily intended for commercial carpets as its evaluation methodology is complementary to emerging commercial green building standards.

Continues at ce.ArchitecturalRecord.com.

See Quiz on the Next Page

or

Take the Quiz Free Online

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Program title: **"Carpet Scores Good Marks in Schools: A Smart, Sustainable Solution in Floor Coverings" (1/09, page 69).** AIA/CES Credit: This article will earn you one AIA/CES LU hour of health, safety, and welfare /sustainable design (HSW/SD) credit. (Valid for credit through January 2011.) **Directions:** Refer to the Learning Objectives for this program. Select one answer for each question in the exam and fill in the box by the appropriate letter. A minimum score of 80% is required to earn credit. **To take this test online and avoid handling charge, go to ce.ArchitecturalRecord.com**

1. The percentage of teachers surveyed that prefer carpet on their classroom floor is :
- ❑ **a.** 70 percent.
- ❑ **b.** 50 percent.
- ❑ **c.** 30 percent.
- ❑ **d.** 15 percent.

2. The effectiveness of carpet in reducing noise compared to other flooring options is:
- ❑ **a.** roughly the same.
- ❑ **b.** 50 times more efficient.
- ❑ **c.** 10 times more efficient.
- ❑ **d.** 10 times less efficient.

3. Carpet's thermal insulation effect can be increased by:
- ❑ **a.** regular cleaning.
- ❑ **b.** a pad beneath the carpet.
- ❑ **c.** a denser pile.
- ❑ **d.** a warmer color.

4. Carpet that is properly selected, installed and maintained:
- ❑ **a.** lasts up to 2 years or longer.
- ❑ **b.** will serve its design life.
- ❑ **c.** requires less vacuuming.
- ❑ **d.** lasts up to 10 years or longer.

5. Studies have shown that the biggest source of mold spores is:
- ❑ **a.** water trapped under carpet.
- ❑ **b.** carpet installed over uncured concrete.
- ❑ **c.** an improperly operated and maintained HVAC system.
- ❑ **d.** wet construction materials.

6. Experience has taught that a low profile, densely tufted, tight loop construction:
- ❑ **a.** is very functional in a school.
- ❑ **b.** should only be used around a school entrance .
- ❑ **c.** should not be used in any area of a school.
- ❑ **d.** is not appropriate for schools.

7. A carpet retention rating of 4.0 is considered:
- ❑ **a.** average.
- ❑ **b.** poor.
- ❑ **c.** outstanding.
- ❑ **d.** not appropriate for schools.

8. Most school carpet is installed using:
- ❑ **a.** the direct glue method.
- ❑ **b.** staples.
- ❑ **c.** nails.
- ❑ **d.** a combination of glue and nails.

9. The single most effective and economical means of keeping carpet in schools clean is:
- ❑ **a.** shampooing.
- ❑ **b.** spot removal.
- ❑ **c.** vacuuming.
- ❑ **d.** extraction cleaning.

10. Wrinkles, ripples and buckles in carpet are most often caused by:
- ❑ **a.** improper glue.
- ❑ **b.** failure to stretch the carpet correctly.
- ❑ **c.** faulty measuring.
- ❑ **d.** imperfections in the carpet.

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Material resources used: This article addresses issues concerning health and safety and sustainable design.

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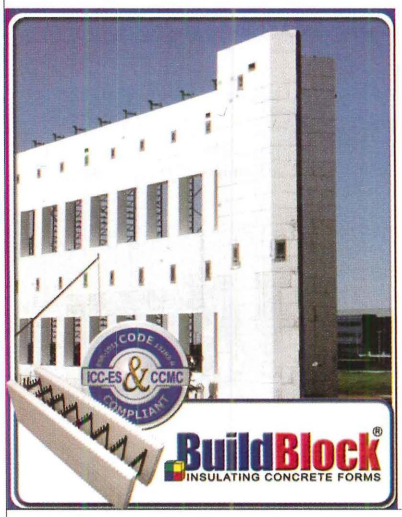

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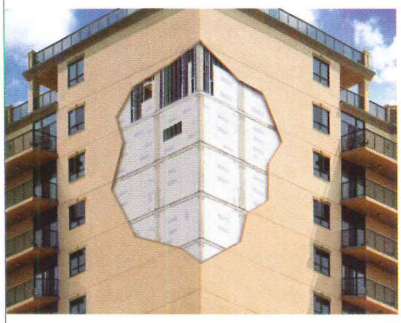
Sheathing



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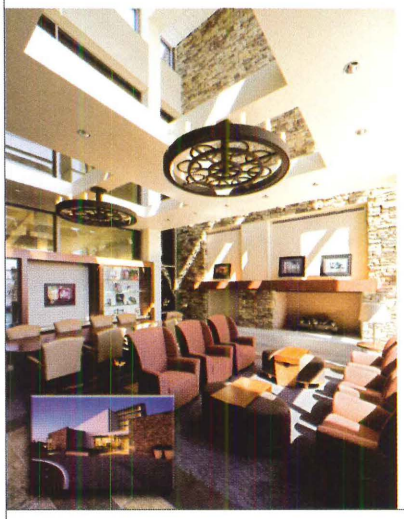

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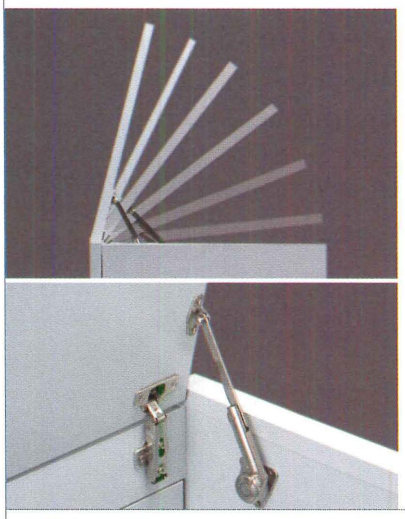

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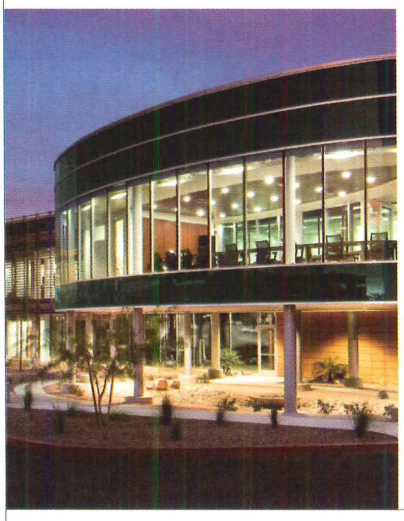

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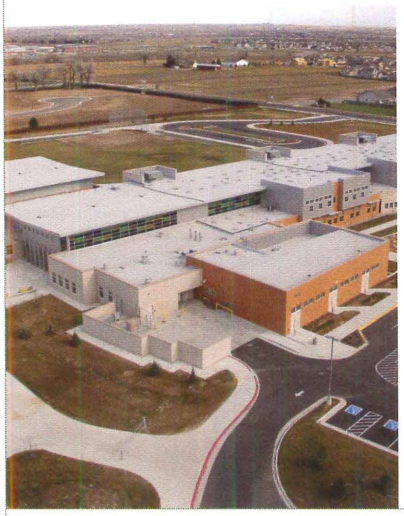
High Performing Roofs for Schools



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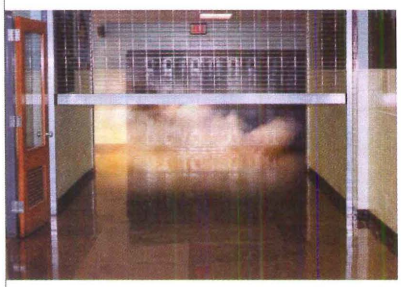

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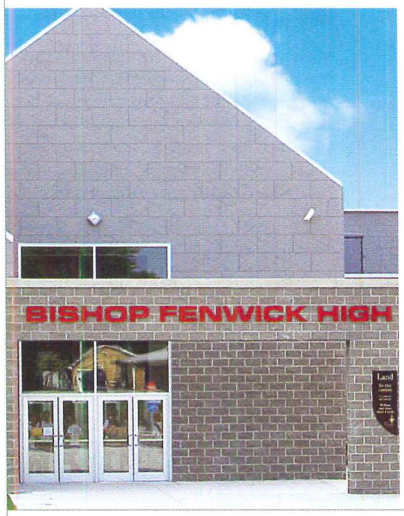
An Economic Opportunity for Education



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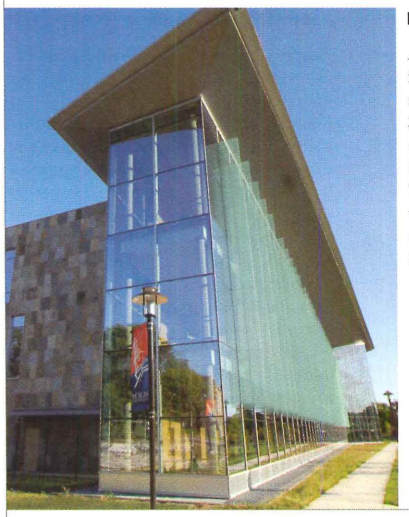
An Educational Landmark



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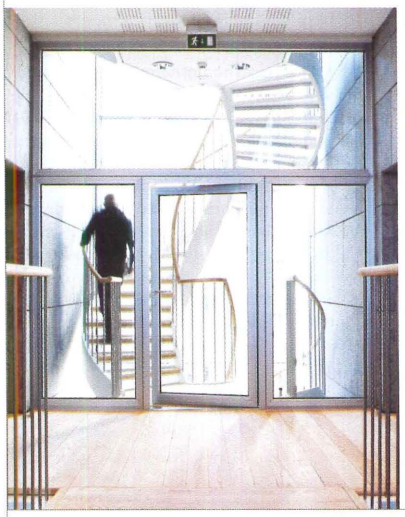

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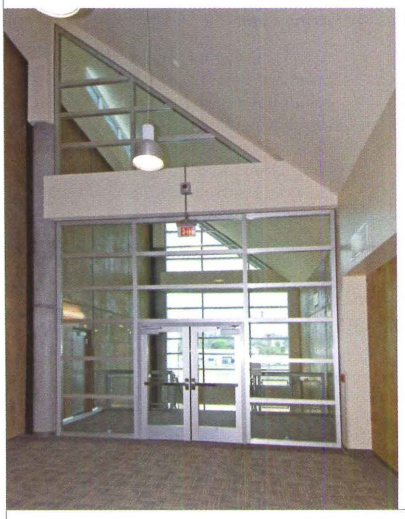

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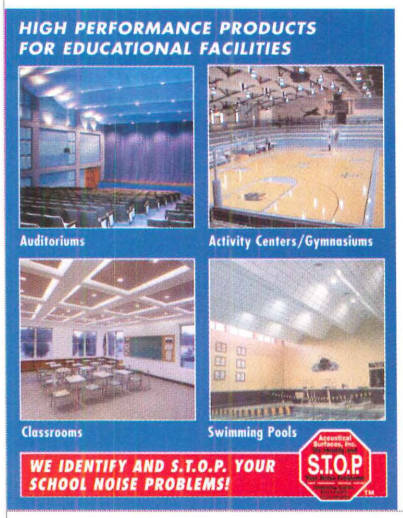
Better Acoustics = Better Schools

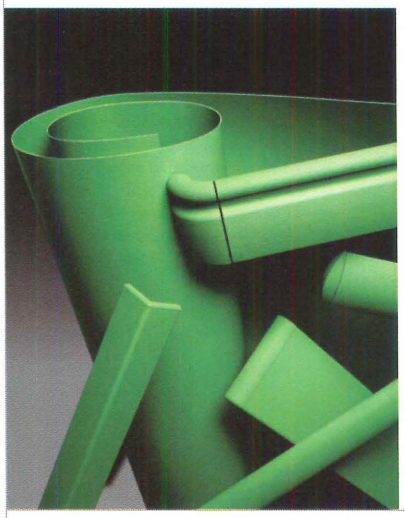


Acoustical Surfaces, Inc.

Acoustical Surfaces, Inc. is a company with over 25 years of experience and carries over 200 specialty soundproofing, noise control, vibration control and acoustical products for schools. Their products help schools meet the ANSI S12.60-2002 American National Standard Acoustical Performance Criteria, and are class A fire retardant. Ask their knowledgeable acoustical and soundproofing professionals to explain their cost effective solutions. They have hundreds of products in stock including their complete line of eco friendly "Green" products. 800-626-7868 Fax number 952-448-2613 Email sales@acousticalsurfaces.com www.acousticalsurfaces.com

Circle 162

Wall Protection



Construction Specialties

PVC-Free Acrovyn® 3000 from Construction Specialties performs as well as traditional Acrovyn Wall Protection and it is MBDC Cradle to Cradle Certified. It has the same outstanding impact resistance and a Class 1 fire rating without the use of halogens. This revolutionary line of wall protection is available in 55 corner guard, handrail and crash rail profiles as well as wall covering. Acrovyn 3000 is currently available in 25 of the most popular Acrovyn colors. 888-621-3344 www.c-sgroup.com/3000

Circle 165

Choice of "Toppings"

Action Floor Systems

Action Floor Systems, a leading manufacturer of athletic floors provides an option for facilities to combine both a premium American hard maple court surface and water-based, seamless synthetic surface for a surrounding running track. Stunning white maple grown in the north woods of Wisconsin & Michigan tops a selection of engineered subfloor systems to match specific performance requirements. Action Herculan® polyurethane poured floors feature environmentally friendly solvent-free materials throughout. For more information, visit their web site or contact their toll-free number or e-mail. 800-746-3512 Email info@actionfloors.com www.actionfloors.com

Circle 163

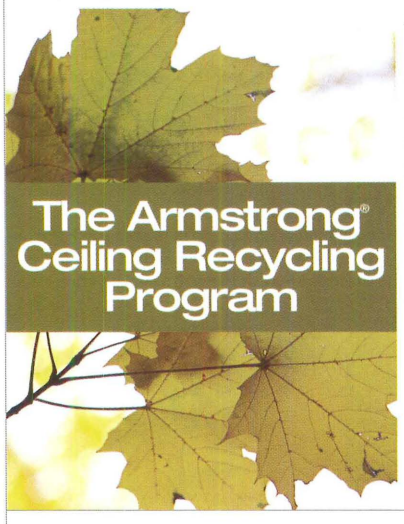
Sports Flooring

Flexco

Make style and endurance an everday practice. With its patented vulcanization process using predominantly recycled rubber, Tuflex® Force™ Resilient Rubber Flooring tiles have been keeping sports and commercial facilities in peak condition since 1957. 800-633-3151 www.flexcofloors.com

Circle 166

Recycling Program

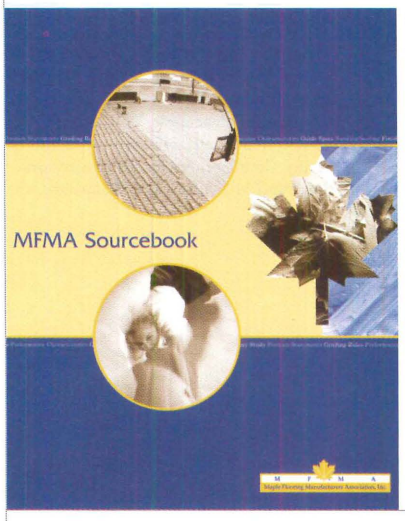


Armstrong

Armstrong Ceilings has a long history of diverting post-industrial and post-consumer waste from landfills. As part of this commitment, Armstrong offers the Ceiling Recycling Program, a first-of-its-kind, closed-loop program that diverts used ceilings from landfills to Armstrong plants where they are recycled into new ceilings. More than 65 million sq. ft. of old material has been recycled since the program began in 1999. 877-ARMSTRONG www.armstrong.com/ceilings/recycling

Circle 164

Technical Information for Maple & Sports Flooring



Maple Flooring Manufacturers Association

MFMA is an authoritative source of innovative technical information for maple and sports flooring systems. MFMA establishes product quality, performance, installation guidelines and maintenance issues. Additionally, it promotes the use of maple flooring products worldwide. MFMA has combined all their information in one place, the MFMA Sourcebook. Request a free copy through e-mail. 888-480-9138 Email mfma@maplefloor.org www.maplefloor.org

Circle 167

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Custom Capabilities

Roppe Corporation

Custom capabilities in floor designs allow the creativity of the classroom to extend itself into play areas, lunchrooms and hallways to encourage school spirit or just to add interest to the space. Roppe welcomes your designs or can create a design for you based on your desired impact. 800-537-9527 Fax number 419-435-8546 www.roppe.com

Circle 168

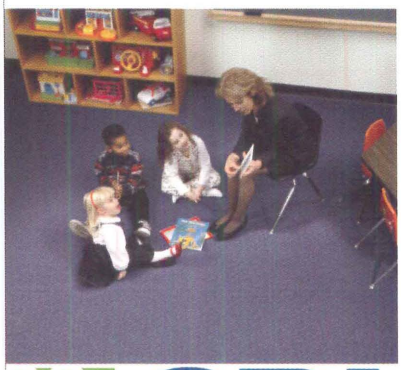
Versatile Table Solutions

Virco Mfg.

Virco's GREENGUARD® certified TEXT™ tables for technology-based learning environments and offices combine proven Virco construction with elliptical legs, swooping yokes and arched feet for exceptional elegance. Designed by the award-winning team of Peter Glass and Bob Mills, the TEXT line includes dozens of adjustable-height and fixed-height models. An array of TEXT tilt-top tables are also available for multi-purpose facilities requiring variable furniture set-ups. For versatile table solutions, TEXT gets the message. 800-448-4726 www.virco.com

Circle 171

Carpet Makes the Grade



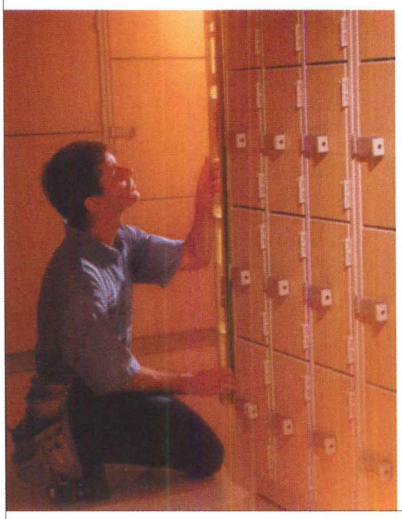
The Carpet & Rug Institute

The Carpet and Rug Institute (CRI) is a source for science-based information and insight into how carpet and rugs can create a better environment—for living, working, learning and healing. CRI's membership consists of manufacturers representing over 90% of all carpet produced in the United States, and suppliers of raw materials and services to the industry. 706-278-3176 www.carpet-rug.org

CRI™
THE CARPET AND RUG INSTITUTE

Circle 169

Products & Solutions for Classrooms & More



Wenger Corporation

Wenger Corporation provides innovative, high-quality products and solutions for customers across various markets: elementary, secondary and higher education; performing arts centers, theatres and places of worship; parks and recreation venues; rental companies; and athletic facilities. Wenger products include sound-isolating practice rooms, storage cabinets, staging, risers, seating and acoustical solutions, including portable and full-stage acoustical shells. Along with superior customer service, Wenger delivers outstanding value with a beautiful blend of form and function. 800-4WENGER (493-6437) www.wengercorp.com

Circle 172

Toilet Partitions

Weis/Robart Partitions, Inc.

Since 1876, Weis/Robart Partitions, Inc. has been providing quality toilet partitions for the building industry. Weis/Robart stocks a large inventory of toilet partitions in stainless steel, phenolic, plastic laminate and polyethylene. Weis/Robart Partitions is concerned about the environment. They now provide materials that are recyclable and materials that contain post consumer content. Coming this summer, they will introduce their new line of toilet accessories. 734-467-8711 www.weisrobart.com

Circle 170

Green Spin on Solid Surface Material

Bradley Corp.

Bradley Corp. has combined eco-friendly recycled materials and nearly unmatched durability with its new Terreon®RE solid surface material for handwashing fixtures. Composed of an eco-friendly bio-based resin, pre-consumer recycled granule fillers and other natural materials, Terreon®RE is one of the greenest product materials on the market. Call their toll-free number or visit their web site. 800-Bradley www.bradleycorp.com

Circle 173

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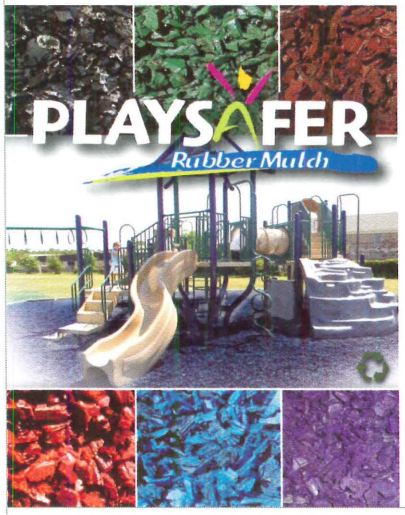
High-Efficiency Toilets

Sloan Valve Company

The Efficiency Series by Sloan® includes High-Efficiency Toilet Systems, which package water-efficient Flushometers with vitreous china floor- or wall-mount toilets. Choose from single- or dual-flush Flushometers in manual and sensor-operated models. Sloan also offers High-Efficiency Urinal Systems that flush with as little as a pint of water. Call their toll-free number or visit their web site. 800-9-VALVE-9 (982-5839) www.sloanvalve.com

Circle 174

Rubber Mulch



Playsafer Rubber Mulch

Playsafer rubber mulch is the ideal surface for resilience and durability in playgrounds, landscaping and equestrian facilities. It also provides the highest quality fill for ropes courses, obstacle courses, training pits for hand to hand combat training and backstops / bullet traps for shooting ranges, both for public and military applications. Ipema Certified. ADA Accessible F1951-99. Exceeds ASTM F1292-99. Guaranteed to last a lifetime. For more information, please contact Rubberecycle at their toll-free number or visit their web site. 888-436-6846 Email info@rubbermulch.com www.rubbermulch.com

Circle 177

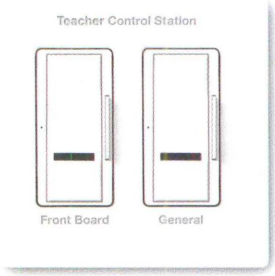
Water-Source Heat Pumps

Climate Master

Tranquility 16™ Compact (TC) Series water-source heat pumps with EarthPure® HFC-410A zero-ozone-depletion refrigerant is extremely environmentally-friendly. With one of the smallest cabinets in the industry, it's compatible with thousands of older water-source heat pumps, and utilizes scroll compressors to exceed ASHRAE 90.1 efficiency requirements; available in sizes from 1 to 5 tons and geothermal capable. 405-745-6000 www.climatemaster.com

Circle 175

Classroom Lighting Control Fixture Solution



Lutron Electronics Co., Inc.

Balance LC from Lutron is the first educational light control solution to combine individually controllable fixtures, high-performance manual control, and automatic sensors into one simple package that enhances the learning environment, saves energy and contributes to sustainable classrooms, and supports the community. 888-LUTRON1 www.lutron.com/k-12

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