

Raising the Bar

SUSTAINABILITY
MAKES ITS CASE IN
A NEW UNIVERSITY
OF BALTIMORE LAW
SCHOOL BUILDING.

BY JOHN MORRIS, PE, CCS, LEED AP



The John and Frances Angelos Law Center is a distinctive new landmark in central Baltimore. The thermal mass of the concrete, 12-story structure is leveraged to reduce heating and cooling loads.

IMAGE BY BRAD FEINKNOFF



Mueller Associates, Inc.
Consulting Engineers

1401 S. Edgewood Street, Baltimore, Maryland 21227
410.646.4500 tel > 410.646.4738 fax
www.muellerassoc.com



The bright “Escheresque” interior multitasks as a gathering place, events hall and circulation hub.

IMAGE BY BRAD FEINKNOFF

When planning began for the new John and Frances Angelos Law Center at the University of Baltimore, campus administrators recognized the building’s potential to have a transformative impact on much more than the program itself—the sixth largest public law school program in the country. The corner site, adjacent to a prominent intersection in the Mt. Vernon neighborhood of central Baltimore, would enable the new law center to serve as a highly visible gateway to the campus and a landmark within the urban community.

“The site of the Angelos Law Center is consistent with a core educational value: innovation,” states university President Robert Bogomolny. “Free of any limiting or defining architectural context, and on a location that will be viewed on all sides, the building’s impact cannot be maximized by traditional approaches.”



A signal light informs occupants of the option to activate the window and shade-control systems manually. Beneath the control panel, custom millwork houses fin tube heating and wire management.

IMAGE BY ALAIN JARAMILLO

In a bold stroke, the university selected a design team consisting of the German firm Behnisch Architekten and Baltimore-based Ayers Saint Gross after sponsoring an international design competition. Concepts proposed by the team for a 12-story tower envisioned a striking composition of three interlocking forms clustered around a soaring, full-height atrium with airy, light-filled spaces for the law library, moot court, classrooms, offices and publicly accessible law clinics.

A SIGNATURE BUILDING

While reaching for maximum impact in the architectural design, administrators sought

a decidedly low-impact result for the building in terms of its energy use and sustainable profile. “As an educational institution, we envision a building whose design teaches critical lessons about how to create and sustain healthy urban environments...a signature building,” says President Bogomolny during the design phase. As a result, the LEED Platinum tower, which opened in 2013, showcases an array of sophisticated systems that optimize energy and water conservation and provide a comfortable environment for students and faculty.

The architects turned to Baltimore-based Mueller Associates to engineer the mechanical, electrical and plumbing

systems for the building, which has earned a Wintergreen Award from the U.S. Green Building Council’s Maryland chapter along with numerous other awards. Relying heavily on Revit for building information modeling and coordination, Mueller’s engineers helped the team meet the ambitious architectural objectives while incorporating cutting-edge systems such as thermo-active slabs that provide radiant heating and cooling, automated natural ventilation and automated shade control.

AN INTRICATE PUZZLE

Behnisch Architekten and Ayers Saint Gross devised an eye-catching design that

Perforated plenum walls and diffusers in raised floor steps provide displacement ventilation in the classrooms.

IMAGE BY ALAIN JARAMILLO



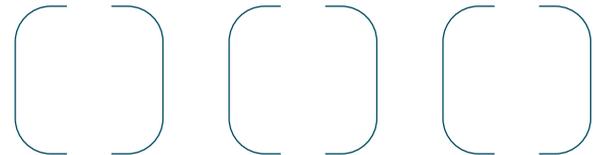
linked the center’s L-shaped, interlocking blocks to create “essentially three buildings in one,” according to architect Stefan Behnisch. The result resembles an artfully assembled puzzle, checkerboard or as Behnisch has described it: “a complex, three-dimensional chess game.” The bright, angular atrium, which rises to a rooftop skylight, matches the exterior in visual impact. Lawrence Biemiller, a longtime senior writer at *The Chronicle of Higher Education* who grew up in Baltimore, describes the design: “It’s the Escheresque interior that is the real prize. A bright—and brightly colored—atrium winds up through the middle, with bridges and staircases zigzagging and spiraling through the space in patterns as quirky as the law itself.”

Navigating the quirks of the design and maintaining the clean, contemporary aesthetic of the interiors kept Mueller’s engineers challenged as they worked to integrate the sys-

tems into the building. The 11-inch-thick slabs, for example, accommodate a cornucopia of infrastructure including the Uponor radiant system’s PEX hydronic tubing, power and lighting conduit, security conduit, and AV conduit. More common in Europe than in the U.S., the radiant system features sensors that detect the slab surface temperature, air temperature and humidity, with control valves in the building’s 177 custom-designed manifold boxes.

The majority of the manifold boxes are located on the underside of the ceiling slabs, requiring the engineers to design carefully around architectural details, building structure, ductwork and piping while maintaining accessibility for maintenance. Boxes located in the walls also required positioning around whiteboards and systems furniture.

On the lower floors, fin-tube heating elements were housed in custom millwork. On the upper floors of the law library, pedestal enclosures were designed to house the perimeter fin-tube heating in



ANGELOS LAW CENTER SUSTAINABLE HIGHLIGHTS

- Radiant heating and cooling that uses a thermo-active slab system with sensors to detect slab surface temperature, air temperature and humidity
- BAS sensors control air terminal units for temperature, humidity and ventilation air control
- Dedicated outdoor air system with a heat recovery wheel that uses exhaust air to preheat or pre-cool outside air, and a passive desiccant wheel that drives down humidity level
- Two magnetic-bearing, high-efficiency chillers in a garden-level mechanical room
- High-efficiency boilers in a penthouse boiler room
- Water-conserving plumbing fixtures
- Rainwater harvesting
- Automated natural ventilation system
- Automated shade-control system
- LED lights throughout the building
- Green roof



The full-height atrium serves as the ventilation pathway for the entire building. Five high-capacity exhaust fans at the top can supplement the automated natural ventilation system.

IMAGE BY AYERS SAINT GROSS

SUPPLIERS/SUBCONTRACTORS

STEEL CONSTRUCTION: Baltimore Steel Erectors

INTERIOR FITTINGS: Commercial Interiors Inc.

ELECTRICAL CONTRACTOR: Enterprise Electric

MECHANICAL CONTRACTOR: J.F. Fischer Inc.

INTEGRATION AND PROGRAMMING OF WINDOW CONTROLS: Schneider Electric (sub to JFF)

INSTALLER OF WINDOW CONTROLS: PCII (sub to SE)

MILLWORK: Mid Canada Millwork

FAÇADE: National Enclosure Company

INTERIOR GLAZING: Pioneer Cladding & Glazing Systems, LLC

GROUND EXCAVATION: Potts & Callahan Inc.

AUDIO/VISUAL: Signal Perfection Ltd

LED LIGHTING: Zumtobel

CONCRETE STRUCTURE: Schuster Concrete Construction

ELEVATORS: Kone

INSTALLING CONTRACTOR FOR WINDOWS AND ACTUATORS: National Enclosure Company

MANUFACTURER OF WINDOW ACTUATORS: WindowMasters

RADIANT FLOORING SYSTEM: Uponor

DEDICATED OUTDOOR AIR SYSTEM: Trane

CHILLERS: Daikin McQuay

PLUMBING FIXTURES: Sloan Valve Company

CURTAIN WALL: National Enclosure Company

CONTROLS: Embedia Technologies

DESIGN TEAM

OWNER: University of Baltimore

CONSTRUCTION MANAGER: Whiting-Turner

ARCHITECT OF RECORD: Ayers Saint Gross

DESIGN ARCHITECT: Behnisch Architekten

STRUCTURAL: Cagley & Associates

MECHANICAL: Mueller Associates

LANDSCAPE: Stephen Stimson Associates

CIVIL: RK&K

LIGHTING: MCLA Inc.

AV/ACOUSTICS: Shen Milsom & Wilke

IT/TELECOM/SECURITY: speXsys, LLC

GEOTECHNICAL: EBA Engineering

COMMISSIONING: Kibart Inc.

COST: Davis Langdon

CLIMATE/ENERGY MODELING: TransSolar

order to achieve a clean look. Here, the fin-tube heating and wiring for teledata and the windows controls are housed within insulated troughs of heavy-duty steel with aluminum grilles.

AUTOMATED SYSTEMS FOR COMFORT AND EFFICIENCY

An automated natural ventilation system, with window actuators and controls by WindowMaster, is another sustainable highlight. Windows in the curtain wall system open and close automatically depending on the outdoor ambient temperature and relative humidity. Occupants in private offices can open and close windows manually when they see a green light signal.

Custom bamboo diffusers match the flooring in the moot court. Extruded aluminum diffusers are positioned beneath the seating.

IMAGE BY ALAIN JARAMILLO



Displacement air diffusers provide ventilation air at the floor level in larger classrooms and the moot court. Also in the moot court, custom bamboo diffusers around the perimeter match the room's bamboo floors with extruded aluminum grilles under-seat diffusers also supplying a low-velocity air discharge. The design and location of the under-seat diffusers were also carefully addressed through BIM to position them around seating and floor supports. In the classrooms, perforated plenum air supply walls with ducts in the wall cavities provide supplemental displacement ventilation.

The Angelos Law Center also features an automated shade-control system. Operable shades within the façade, between the curtain wall and rainscreen system, are activated by rooftop solar sensors that track the sun's radiation. The shades minimize solar heat gain and reflect daylight into the building. The building's audio-visual system is also tied into the

shade-control system to allow for automatic adjustments as required for various presentation scenarios.

The law center is projected to achieve a 43 percent energy cost savings compared to an ASHRAE 90.1-2004 baseline building, with an annual site energy use intensity of 40 kBtu/sf (approximately 125 kWh/m²). Since its opening, the luminous, inviting building has not only

welcomed students but numerous tour groups as well: designers, educators and university administrators with an interest in the center's unique design and array of sophisticated systems. [edc](#)

JOHN MORRIS IS A VICE PRESIDENT AND MECHANICAL ENGINEER FOR MUELLER ASSOCIATES. HE SERVED AS PRINCIPAL-IN-CHARGE OF MEP ENGINEERING FOR THE ANGELOS LAW CENTER.

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