Two distinctive berms create a unique rooftop identity and allow visitors to appreciate green roof plants up close.

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RAISING THE BAR ON GREEN ROOF DESIGN

How does ASLA's unconventional green roof design perform?

By Theodore Eisenman

IN KEEPING WITH a rising tide of green roof design and construction across the country, the American Society of Landscape Architects (ASLA) has recently completed an innovative example of vegetated rooftop at its national headquarters in Washington, D.C. Unlike many conventional green roofs that clothe a building's existing profile with the requisite structure, soil, and plants, Michael Van Valkenburgh Associates took the green roof standard a step farther by redefining the three-dimensional character of the space.

A defining feature of ASLA's new rooftop is two symmetrical waves that rise from a central walkway. Finished with galvanized steel decking and a palette of grasses, succulents, and perennials, these geometric berms speak to the idiosyncrasy of green roofs: a naturalistic landscape typology re-created several stories in the air. Unlike many green roofs, however, this one does not conceal its architectonic nature.

"Many people might be surprised to know that Le Corbusier was exploring green roofs as early as the 1930s," says project manager Christopher Counts, ASLA, of the famed modernist architect. "We drew inspiration from his work and philosophy and made a fairly intentional effort to not hide the industrial character of the roof."

At first glance, plants share equal billing with wood and steel. But in an innovative gesture that sets this project apart from others, the metal grating that dominates the walking surface floats three inches above low-growing plants. As these sedums fill in, they are expected to peek through the grating, creating a novel interplay between contrasting materials. Over time, one can even envision the ground plane reflecting the movement pattern and desire lines of users.

"One of our partners on this project, Conservation Design Forum, proposed the idea of an open grating above the plant material," says Counts. "We really liked the idea but were initially concerned about how the plants would do in this type of growing condition, and we weren't aware of any precedents for this kind of treatment on a green roof. However, when we noticed that plants would sometimes grow through the square metal grids that protect street trees on sidewalks, it encouraged us to pursue the idea."

This rooftop retrofit, *above,* required a significant redesign of the roof surface, including the relocation of heating, ventilation, and air-conditioning units and a new stairwell to provide public access. The section drawing, *below,* shows how the berms create physical and visual enclosure.

From a functional perspective, this approach to the ground plane fulfills two of the most common goals of green roofs: accessibility and maximum vegetative cover providing environmental benefits such as stormwater retention, building insulation, and air-quality improvement. To enhance the aesthetic experience of plants and steel, sections of the metal grating are laid out in perpendicular patterns, creating subtle shifts in visual texture.

The prevailing aesthetic of this rooftop is more formal than many green roof precedents, which speaks in part to Van Valkenburgh Associates' design vocabulary, but also to the intentions and desires of the client. "We didn't go into the project with a predetermined aesthetic, but because this would be a highly visible expression of ASLA and the profession, we wanted something with a certain 'wow' factor," says Nancy Somerville, executive vice president of ASLA. "We wanted something that would not only represent our profession's commitment as stewards of the land but would also celebrate the design sensibilities of landscape architects."

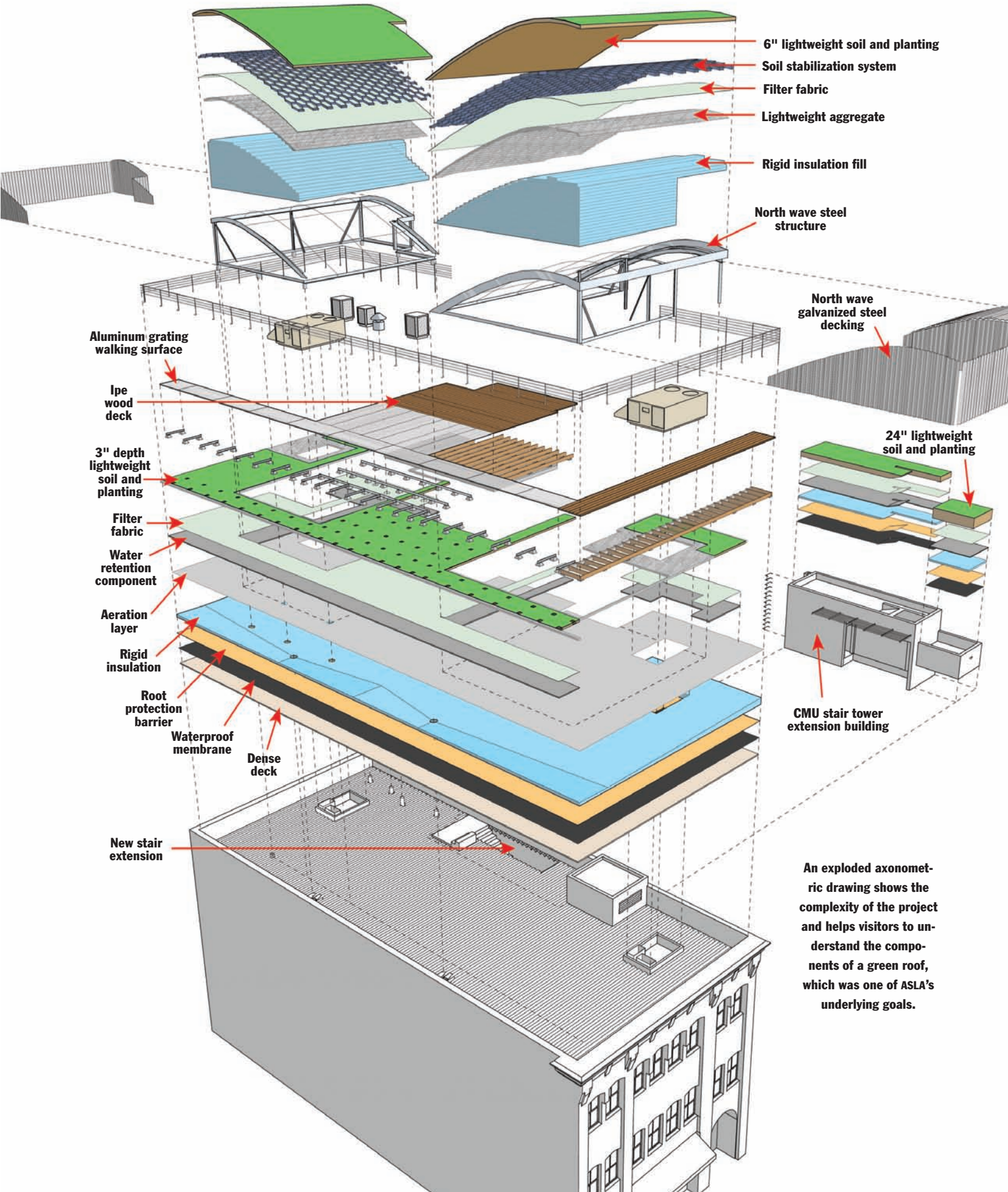
Somerville is particularly pleased with the two signature mounds that create a sense of outdoor enclosure while bringing the plants up to eye level. Indeed, the T-shaped walkway automatically leads up to either of these vegetated mounds, bringing your face within inches of these distinct plants. Up close, it is hard not to marvel at the adaptations—thick, waxy leaves that retain moisture, low stature to reduce exposure to dessicating sun and wind—that allow these plants to persist in some of the harshest environments, often clinging to a patch of rock and shallow, nutrient-poor soil in desert and alpine settings.

To provide visitors exposure to a wide range of green roof plant types and microclimatic growing conditions, the planting plan is organized in six discrete zones that generally reflect the roof's weight-bearing capacity: two "intensive" planting areas—a 24-inch profile with heavier plants such as trumpet vine *(Campsis radicans)* and flame sumac *(Rhus copallina)* planted above the elevator shaft (Zone F) and a 12-inch growing depth with middle-sized plants like New Jersey tea *(Ceonanthus americanus)* and sweet fern *(Comptonia peregrina)* sited above the stairwell (Zone E)—juxtaposed with four different "extensive" treatments, smaller plants in shallower and more lightweight growing media. To evaluate the effect of placing an open-grated walkway over plantings, a palette dominated by sedums is installed both under (Zone A) and outside (Zone D) the terrace grates.

Each of the berms was also planted differently to provide a broader demonstration of green roof plants and to enrich the visual experience. To strengthen visual perception of the north berm from street level, a combination of sedum and taller grasses and perennials was selected. The south berm, in turn, was planted with perennials and a palette of native sedums.

Installed in April 2006, the plantings have done well in their first growing season except for the native sedums on the south berm. According to Van Valkenburgh Associates, this was due to several factors, foremost being extremely hot weather. Indeed, this past July was the second hottest on record, and temperatures on the roof reached 136 degrees Fahrenheit. In addition to these torrid conditions, a lapse in availability of 400 native perennials exacerbated the ability to establish sedum cuttings and plugs. The perennials, for example, would have helped to provide shade, cool the surface, and retain moisture on the sloped, shallow growing medium of the berm. To increase vegetative coverage, tough sedums and

MICHAEL VAN VALKENBURGH ASSOCIATES, TOP LEFT, BOTTOM, AND OPPOSITE; SAM BROWN, TOP RIGHT

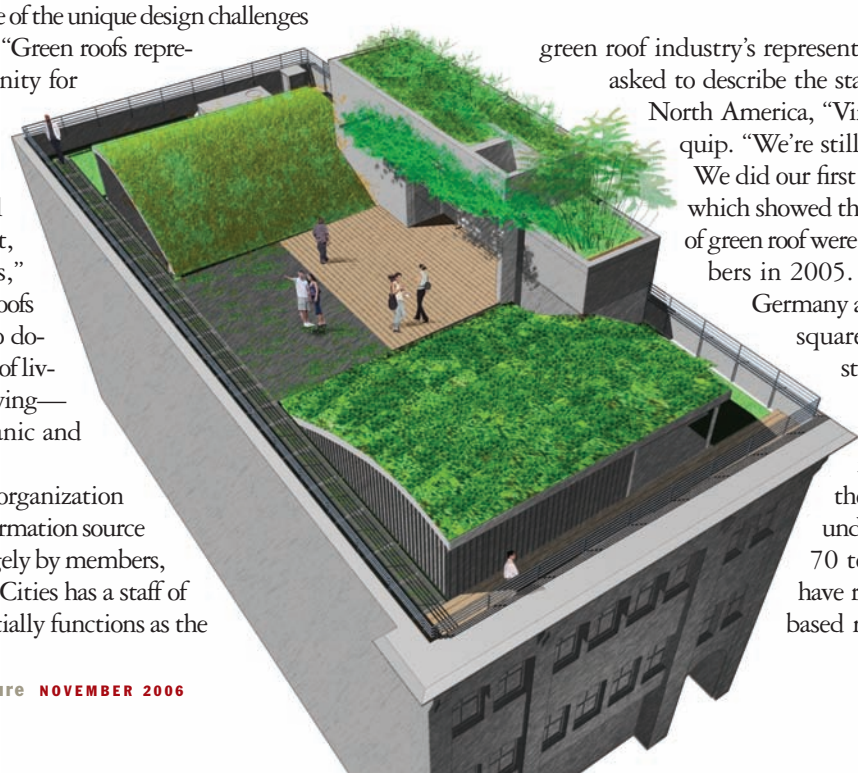


An exploded axonometric drawing shows the complexity of the project and helps visitors to understand the components of a green roof, which was one of ASLA's underlying goals.

succulents that colonize horizontally have since been installed. In the spring, these plantings will be supplemented with mature plantings to add diversity and coverage.

A metal grating, *above,* rests three inches above the planting surface, allowing for both pedestrian access and near total vegetative cover. The orientation of the grating varies to create visual interest through shifts in pattern. The rooftop surface incorporates a range of materials and textures, *below,* including wood, metal, and a diversity of plants.

THE RELATIONSHIP between green roof planting schemes and building structure is one of the unique design challenges of elevated landscapes. "Green roofs represent an exciting opportunity for landscape architects to become more involved in building systems, like internal drainage, lot level stormwater management, and mechanical systems," says Steve Peck of Green Roofs for Healthy Cities. "By so doing, you bring knowledge of living systems into the nonliving—the synthesis of the organic and inorganic."



Peck's Toronto-based organization is a leading green roof information source and advocate. Funded largely by members, Green Roofs for Healthy Cities has a staff of six led by Peck and essentially functions as the green roof industry's representative association. When asked to describe the state of green roofs here in North America, "Virginal," was Peck's ready quip. "We're still in the very early stages. We did our first industry survey last year, which showed that 2.5 million square feet of green roof were constructed by our members in 2005. By way of comparison, Germany averages 11 to 12 million square feet of green roof construction per year."

Consider that Germany's population is roughly one-third that of the United States, and you understand his point. "About 70 to 80 cities in Germany have regulatory and incentive-based mechanisms to promote

SAM BROWN, TOP; MICHAEL VAN VALKENBURGH ASSOCIATES, BOTTOM

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To provide visitors exposure to a broad range of green roof plant types, the planting plan includes six different zones. The north berm includes a range of sedums, grasses, and perennials.

green roofs," Peck says. "Their primary motivation is stormwater management, urban heat-island reduction, and provision of green space. In Germany, a builder must provide an equal square footage of green space to the amount it dislocates through construction. Often, a green roof is a viable green space alternative."

This is especially true on new construction, where costs can be significantly reduced by incorporating a green roof into the original building design. At ASLA headquarters, retrofitting the building to accommodate the green roof was a major expense. Like many green roofs that are constructed on existing buildings, ASLA's retrofit was timed to coincide with the need to replace the existing waterproofing. This helped to offset the cost of what came to be a rather expensive project: $950,000. It should be noted, however, that this project was intended as a demonstration site to increase awareness of green roofs. As such, it was essential to provide access to the roof, which required construction of a new interior stairwell and landing that consumed roughly $600,000 of the overall project budget. Another significant cost was moving two ventilation units to accommodate the design. Where a less high-profile project might simply incorporate these existing elements, ASLA wanted this to be a demonstration project that would show how standard building equipment can be artfully incorporated into a green roof design. As a result, the units were moved from the center of the roof to the edges, and one is actually tucked behind and within one of the berms, rendering it virtually invisible.

Major elements of the project such as the stairwell extension and relocation of the HVAC units would represent little additional cost if incorporated into the original design of a new building. According to Somerville, the cost of this project will be made up over time through the longer life of the roof, reductions in heating/cooling expenses, and the added value to the building of usable roof space.

Primary funding came from ASLA and its members, with support from sponsors and product donors. The Chesapeake Bay Small Watersheds Grant Program and the Chesapeake Bay Foundation also helped fund the project, in recognition of its demonstration potential and stormwater management benefits.

In keeping with this project's underpinning as a demonstration, ASLA and Van Valkenburgh Associates are undertaking monitoring and research to evaluate the functionality of the roof across a range of environmental metrics. Light meters have been placed in different areas and a number of plants have been tagged so that data on plant growth and growing conditions can be collected. A year-one report from Van Valkenburgh Associates will

Promoting Green Roofs Through Policy Incentives

TO PROMOTE WIDESPREAD GREEN ROOF implementation and encourage private sector participation, Green Roofs for Healthy Cities' Local Market Development Program works with municipalities to forge public–private partnerships. Incentives that policy makers can draw upon to offset initial costs and directly bolster green roof markets include such tools as a density bonus (a program that allows developers to increase the floor area of a structure beyond existing zoning limitations when they implement green roofs), fast-track permitting, green space allocation, grants, and tax credits.

Chicago leads the way with more than 3 million square feet of green roofs under development that can be attributed to a suite of comprehensive policy programs. Other cities such as Portland, Oregon, and San Diego use density bonus programs, while Toronto has opted to launch a pilot grant program that provides a $3 subsidy per square foot up to $20,000.

Incentives are not always direct—some programs with other goals promote green roofs via low-interest loans, energy-efficiency initiatives, and reductions in stormwater management fees. In some North American cities, stormwater utility agencies charge fees based on the percentage of impermeable surface on a given property. These cities recognize the ability of green roofs to reduce stormwater runoff and have adjusted their fee structures to reflect this capacity. Minneapolis, for example, awards up to 100 percent stormwater utility fee reduction to building owners who install features that improve stormwater quality or quantity. Gaz Metro, a forward-thinking energy provider in Montreal, contributes $5 per square foot to qualifying projects through its Energy Efficiency Fund.

Most local governments and related agencies have a number of tools at their disposal to create incentives for green roof development. To explore policies for advancing green roof implementation in your municipality, please contact Jennifer Sprout at Green Roofs for Healthy Cities, *jsprout@greenroofs.org*.

In addition to functional benefits such as stormwater retention, building insulation and energy efficiency, and air quality improvements, green roofs create a whole new elevated landscape aesthetic, as illustrated by this photo showing ASLA headquarters next to an adjacent building. The plants selected for this green roof are well adapted to dry, hot conditions, such as *Asclepia tuberosa* (butterfly milkweed), *bottom left,* and *Delosperma nubigenum* (ice plant), *bottom right.*

form the baseline for ongoing research conducted during each growing season.

To evaluate the roof's stormwater retention capacity, flow meters and rain gauges have been installed. Data collected in early September shows that the roof retained more than 72 percent of the 4.55 inches of rain that fell on it in the first few days of the month. Water quality, in turn, will be tested by collecting and comparing water samples from the roof and runoff from drains. The Chesapeake Bay Foundation is partially supporting this research, which will analyze the effect of the roof on water pH, temperature, suspended and dissolved solids, dissolved oxygen, chemical oxygen demand, nutrients, and heavy metals.

In addition, temperatures on the ASLA roof will be tracked against temperatures on the roof of an adjacent building. To determine the green roof's cooling potential for the building as well as for the city, temperature on the ASLA roof will be tracked at the ground plane, several inches above the roof surface, and six feet above the building.

These research tasks illustrate ASLA's commitment to stewardship, and as with any living landscape, time will be the true test of success. But barring unforeseen circumstances, this elevated site will likely grow into a distinct architectural precedent that is emblematic of the great potential that vegetated rooftops hold for an increasingly urbanizing world. LAM

Theodore Eisenman is a regular contributor to Landscape Architecture, *and this is his third article on green roofs for the magazine.*

PROJECT CREDITS **Client:** American Society of Landscape Architects, Washington, D.C. **Landscape architect:** Michael Van Valkenburgh Associates Inc., New York. **Consulting landscape architect:** Conservation Design Forum, Elmhurst, Illinois. **Architect:** DMJM Design, Arlington, Virginia. **Structural engineer:** Robert Silman Associates, Washington, D.C. **General contractor:** Forrester Construction Company, Rockville, Maryland.

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