

Revival of an Icon

The United Nations renovation team brings back the long-faded luster of the Secretariat while satisfying ambitious performance goals.

By Joann Gonchar, AIA



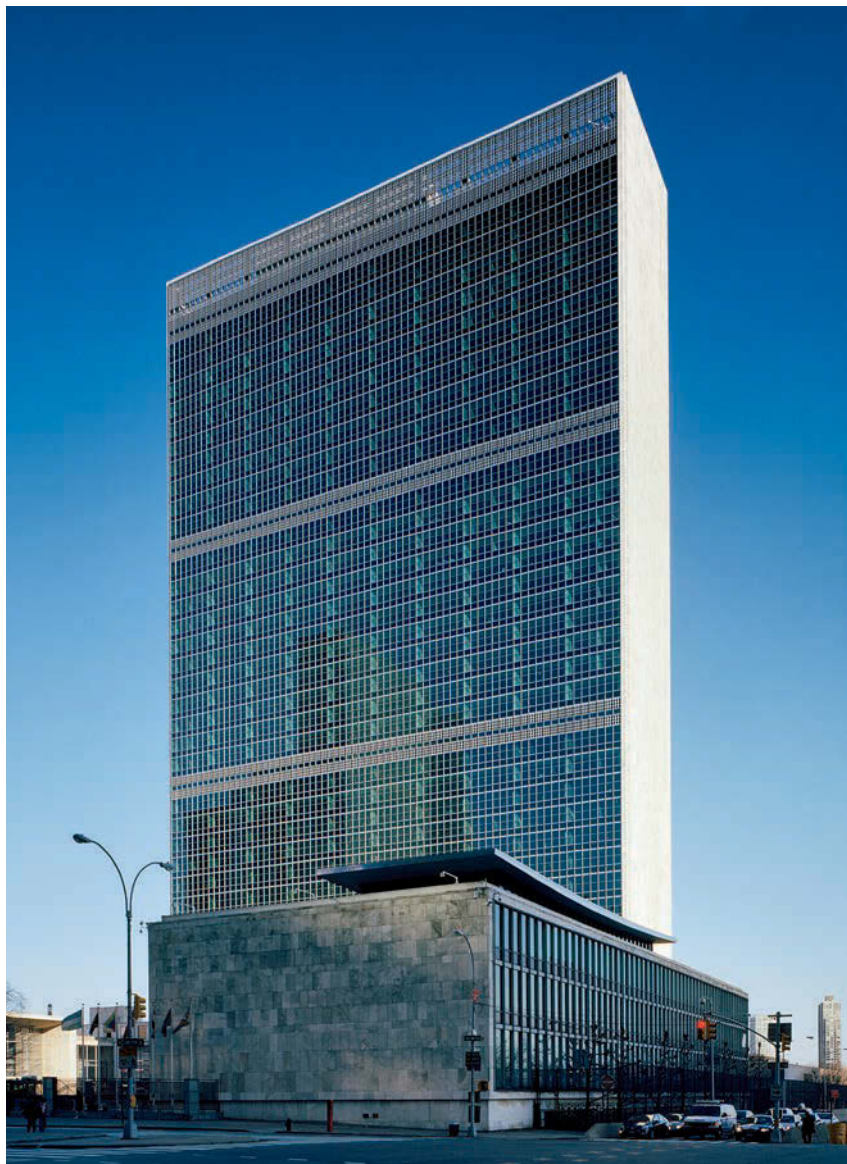
EARLY IN JULY, the first of more than 3,000 United Nations officials began to move back into the newly renovated Secretariat, the 39-story office tower that is the most visible element of the organization's 17-acre campus on the eastern edge of Midtown Manhattan. The high-rise is the first piece of a multiphase capital plan for the revamping of the U.N. slated for completion in 2014 and now projected to cost about \$2.3 billion, according to the U.S. Government Accountability Office.

The rational and prismatic Secretariat, with its billboard-thin profile and once-again-glittering skin, is the embodiment of post-World War II optimism. It represents the ideals of the age more succinctly than the sculptural

General Assembly or the low, rectangular conference building—the other components in the early-1950s trio of U.N. buildings designed by an international team that included Le Corbusier, Oscar Niemeyer, and Wallace Harrison.

In recent decades the Secretariat, along with the rest of the now six-building, 2.6 million-square-foot complex, had lost much of its luster and become increasingly outmoded: It was riddled with asbestos, had mechanical systems that were outdated and grossly inefficient, and lacked many of the most basic life-safety features, including sprinklers. Over the years, fixes intended to address numerous facade problems radically altered the appearance of the U.N. structures,

CENTERPIECE
The strikingly thin, 39-story Secretariat was the most prominent piece of the United Nations compound in the early 1950s (above), as it is today.

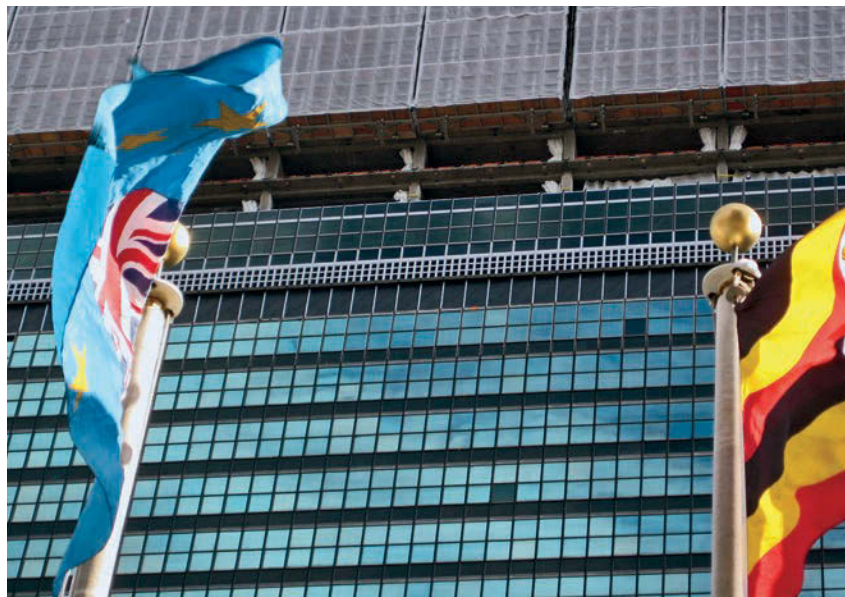


especially the Secretariat. John Gering, managing partner at HLW, design architect for many aspects of the renovation project, likes to compare the gradual deterioration and recent transformation of the U.N. centerpiece to a Grimm's fairy tale. "The building was a prince that turned into a frog," he says. "Our goal was to turn it back into a prince."

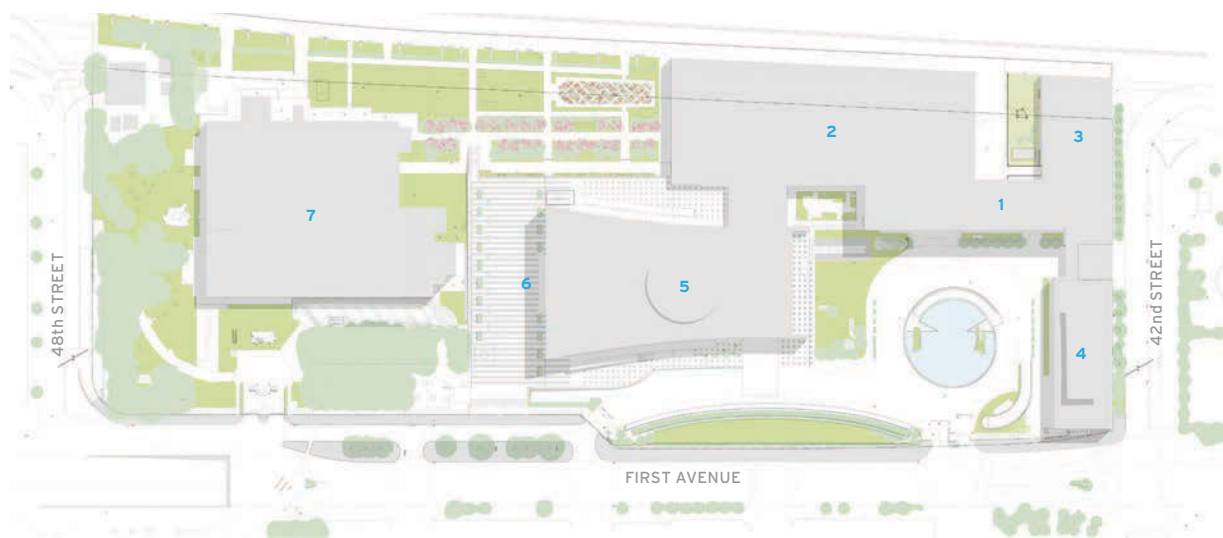
The Secretariat is among a handful of mid-century U.S. buildings that realized the ideal of the crystalline tower. Pietro Belluschi's Equitable Building in Portland, Oregon, completed in 1947, was the first glass-and-aluminum-clad high-rise. Its concrete structure is closely wrapped with aluminum panels that are filled in with aluminum-framed glazing. The envelope strategy contrasts with that of the Secretariat, finished in 1950, whose primary elevations are enclosed by free-hanging glazed facades. And although another Manhattan building—Skidmore, Owings & Merrill's Lever House, completed two years later—was the first tower to be *entirely* enclosed by a curtain wall, the Secretariat holds the distinction of being the first tall building to employ such a suspended system, explains Robert Heintges. His eponymous firm is the architect of record for the envelopes of all the buildings included in the U.N.'s renovation plan.

Judging from early-1950s photos, the glass walls on the east and west elevations of the newly completed Secretariat were sleek and taut, even though they were made up of many small components, including operable double-hung aluminum windows and glazed spandrel panels nested between aluminum-clad steel mullions. The resulting grid, which concealed rather than expressed the building's steel moment frame, ran vertically between louvered mechanical levels occurring roughly every 10 floors and stretched horizontally between Vermont-marble-clad walls on the north and south. The stone bookends emphasized the building's almost improbable thinness (its floor plate is 287 feet long but less than 74 feet wide) and provided a contrast to the two transparent facades.

But soon after occupancy, performance problems surfaced, especially due to heat gain and glare through the east- and west-facing facades and their blue-green-tinted,



FIRST BUT FLAWED
The Secretariat is the first skyscraper with a curtain-wall skin. However, the transparency of its original glazing (far left) was compromised by the installation of reflective film on both the east and west (near left) facades. The new curtain wall (above) re-creates the appearance of the building during the years just after completion, but with a state-of-the-art pressure-equalized system.



SITE PLAN

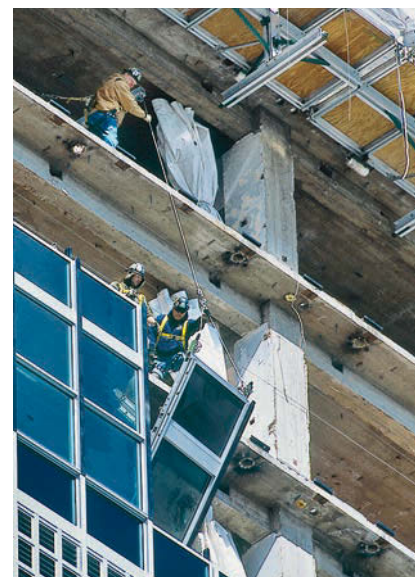


- 1 SECRETARIAT
- 2 CONFERENCE BUILDING
- 3 SOUTH ANNEX
- 4 LIBRARY
- 5 GENERAL ASSEMBLY
- 6 NORTH PODIUM
- 7 TEMPORARY NORTH LAWN BUILDING

single-pane vision glass. The complex's architects oriented the Secretariat parallel to Manhattan's street grid (29 degrees east of north) to take advantage of views of the skyline and the East River, rather than with an eye toward reducing solar loads, explains Michael Adlerstein, an architect and the U.N. assistant secretary-general in charge of the renovation.

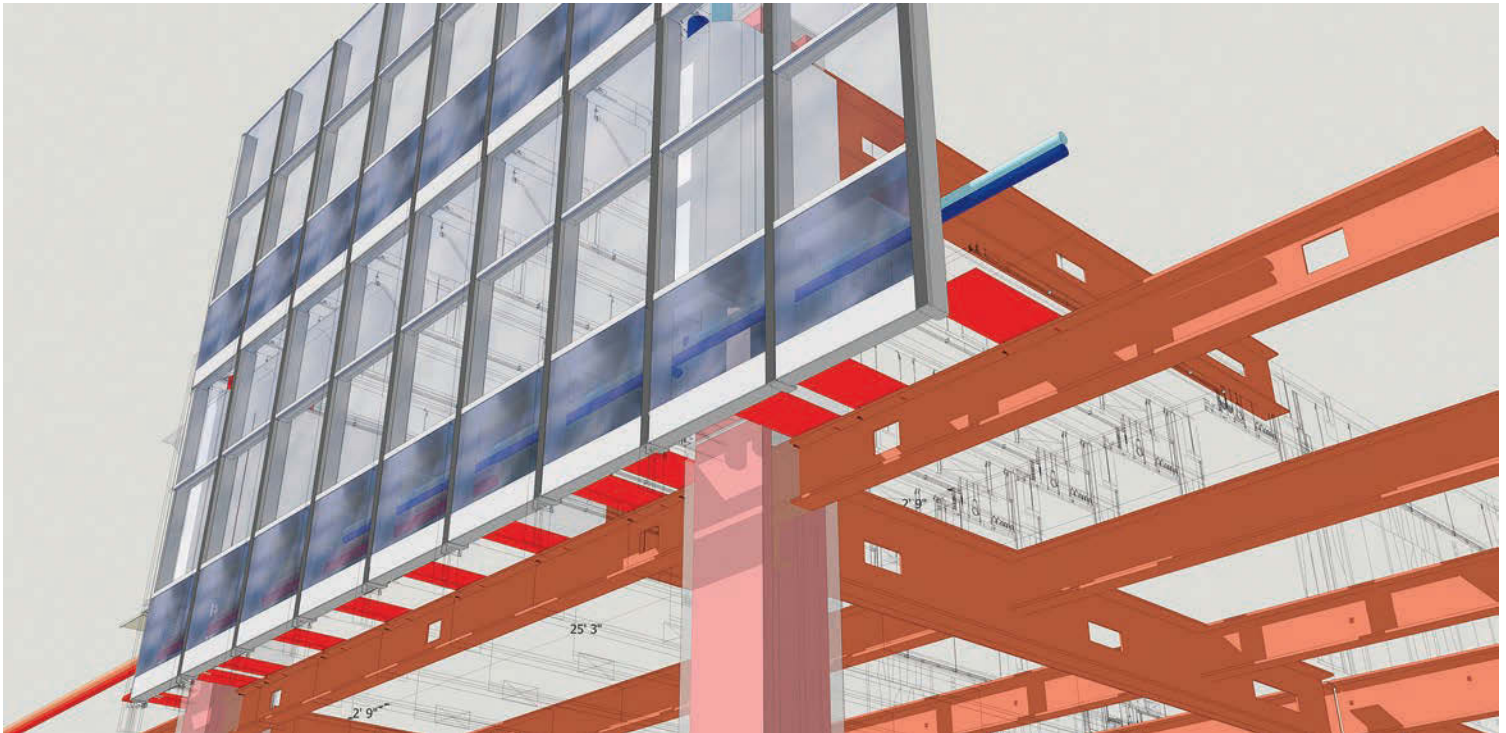
The original design-team members were not oblivious to the problems associated with their orientation choice, however. Le Corbusier argued for an envelope solution that included external shading devices, such as the brise-soleil that had been installed on his 1933 Salvation Army project in Paris several years after its completion. Harrison, meanwhile, advocated the use of insulated glazing, a new technology consisting of two layers of glass with a sealed air space in between. The U.N. originally chose insulated glazing based on a cost study by the mechanical-engineering firm Syska Hennessy (which, coincidentally, is also the mechanical engineer for the U.N. renovation). The study showed that the new glazing technology would be less expensive and easier to maintain than the combination of conventional glazing and an external shading system. However, the insulated glass was also eventually eliminated from the specifications, not only due to its cost premium over single glazing but also because the layered glass was too heavy for the double-hung sashes. Its international design team notwithstanding, the Secretariat "fell victim to that uniquely American practice affectionately known as 'value engineering,'" says Heintges.

The glare and heat-gain problems were most acute on the building's east side, which faces the East River. Here, almost immediately after the building's opening, the U.N. installed a reflective film to the inside of the vision glass. (A different type of adhesive film was applied to the Secretariat's west facade—which is partially shaded by Midtown Manhattan's mass of buildings—but not until after the 9/11 attacks in response to heightened security concerns.) The east facade's reflective film helped reduce the solar load, but it also radically altered the Secretariat's appearance, eventually bubbling, wrinkling, and peeling. And because the glazing was simply annealed (meaning it had not been heat-treated), the film also induced thermal stresses, causing the glass to



SEQUENCE

Demolition of the original curtain wall (above left) and installation of the new one (above right) proceeded from bottom to top in each of the roughly 10-story zones defined by the tower's louvered mechanical levels. The new cladding (left) incorporates numerous performance enhancements, including a low-E coating and blast resistance.



break. As the panels cracked, they were replaced with glazing of various types, creating a jumble of different hues and degrees of transparency.

The spandrel panels also suffered from occasional breakage. And although the originals were made of tinted wire glass, they were replaced in some places with clear glass and in others places with nonwire, laminated glass containing a blue-green PVB (polyvinyl butyral) interlayer intended to approximate the original tint. Behind the spandrels, paint began peeling from the concrete-block knee walls, revealing the masonry joints through the glass.

The glazed portions of the curtain wall were not the only sources of problems. The system as a whole suffered from air and water infiltration and condensation, resulting in energy loss and occupant discomfort, and creating ideal conditions for deterioration of the facade's structural components. And there were visible signs of such damage, like bulging mullion covers—an indication that the steel behind the aluminum was rusting. So in 2002, the U.N. authorized an inspection program that included borescopic investigation of the mullions performed from the building's interior and more extensive probes of the exterior conducted from a swing stage. The latter focused on areas deemed representative of the whole enclosure system and entailed the selective removal of spandrel panels, extrusions, and flashing. About 97 percent of the anchors inspected exhibited some form of corrosion, and 54 percent had significant corrosion.

The U.N. and its consultant team considered repairing the Secretariat curtain wall, restoring it to its original condition, and a strategy that Heintges calls "faithful reconstruction." The last option, which is the one they ultimately chose, involved complete replacement of the curtain wall with a state-of-the-art system that would closely match the look of the 1950s materials, replicate their profiles, and realize the

original design intent. Replacement, they concluded, would be the only way to meet heightened security standards, maintain comfortable interior environmental conditions, and conform to energy codes—codes the U.N. says it is voluntarily complying with, and in many cases exceeding, even though it is not bound by local zoning or building regulations. "We want to be good citizens and responsible owners, even though we are on sovereign territory," says Adlerstein. The U.N. predicts that the facade, along with features such as daylight dimming, demand-control ventilation, and a sophisticated building-management system, combined with campus-wide improvements like the revamp of the central plant, will cut the compound's energy use by 50 percent.

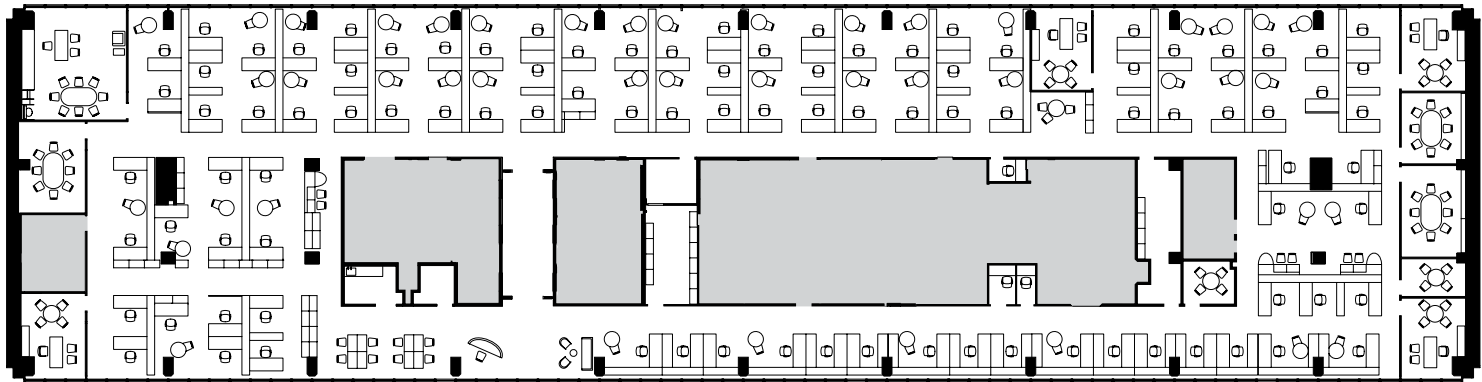
Due to security concerns, the U.N.'s consultants won't reveal all the details of the new curtain wall. However, they describe it as unitized, pressure-equalized, and thermally broken. Although the original had been anchored to the floor slabs, outrigger plates now tie the assembly to the building's frame, which has also been made more robust.

The profiles of the curtain wall's aluminum extrusions closely follow those of the original components, but project a few inches farther into the building's interior in order to accommodate the performance enhancements. Although all of the glazing is fixed, some extrusions are offset to mimic the appearance of the original double-hung windows. Designers decided against similarly offsetting the glazing to replicate upper and lower sashes because computer simulation showed that doing so would produce an almost imperceptible effect.

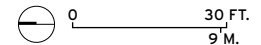
Simulation was also an important part of the glass specification process. Design-team members virtually re-created the early-1950s appearance of the building by measuring the spectral characteristics of an original glass sample. They then used the model as a benchmark for the new glazing. They combined this digital process with on-site testing of

NEW AND IMPROVED

Although the Secretariat's original curtain wall was anchored to the concrete floor slabs, the new curtain wall (above) is tied to the building's moment-frame structure with outrigger plates. As part of the curtain-wall replacement, the masonry knee walls at the spandrels, mandated by now-outmoded fire codes, have been eliminated.



TYPICAL FLOOR PLAN

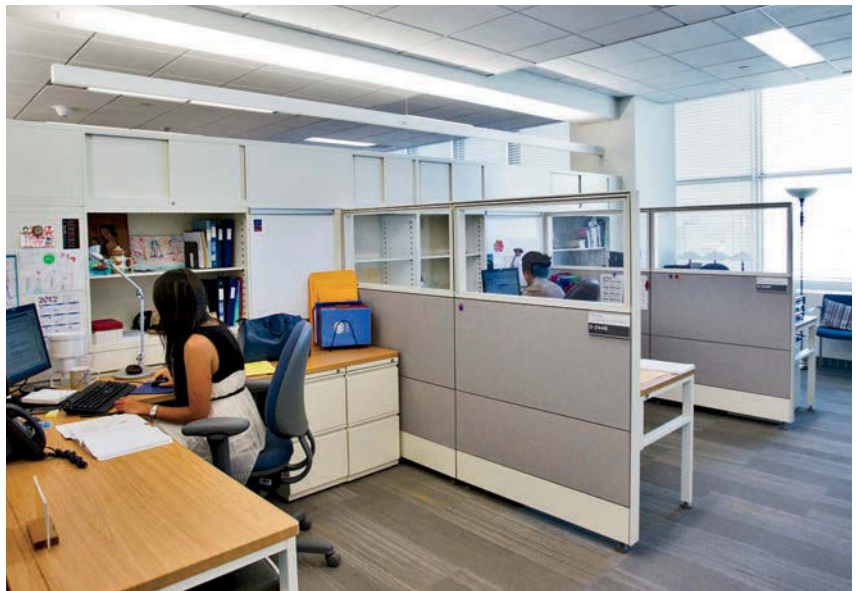


glass samples, under various atmospheric conditions and at different times of day, in order to select glazing without polarizing effects or undesirable color shifts. After narrowing the glazing options, contractors built a one-story-tall, four-unit-wide mock-up on the Secretariat's lawn. Ultimately, the team chose high-performance insulated vision panels of laminated glass that include a low-E coating and a blue-green-tinted substrate on the outer lite. The spandrels, which are also insulated, have painted aluminum back-panels to replicate the effect of the now-removed masonry knee walls.

Many more U.N. employees should be able to enjoy the daylight and views afforded by the new curtain wall, since the interior has been transformed from a warren of mostly private offices to floors devoted almost entirely to open and reconfigurable workspaces. These spaces are organized by 78-inch-tall modular "work walls" that extend from the perimeter columns and contain shelving, power, and data. The new Secretariat office floor layout also has a clearly defined circulation path around the perimeter of the core—a feature that was inexplicably lacking in the original building. "Way-finding was a nightmare," according to HLW's Gering. The ceiling in this new zone is 8 feet tall, gradually stepping up to 9 feet 6 inches at the windows, creating a configuration that reinforces the circulation path and aids in the distribution of mechanical services.

Each employee will have an average of 170 square feet of workspace, a number that is down from a pre-renovation average of 193 square feet. The figure includes new shared amenities such as "focus rooms" for sensitive phone calls or tasks requiring intense concentration; pantries; and spaces for small and impromptu meetings, distributed throughout the floor. More formal conference facilities, which are greatly expanded in the renovated Secretariat, and whose area is not part of the individual workspace totals, have been moved to dedicated floors below each mechanical level.

Adlerstein lobbied hard for the move to a largely open-office scheme. He, along with the rest of the renovation project team, won't know how well U.N. employees adapt to this "cultural change" until well after the last of them return from swing space in Midtown and Queens and quarters in a temporary building erected on the compound's north lawn—a process scheduled to be complete late this year. He compares the project's logistical challenges to those involved with moving an army. Now he just has to finish bringing the troops home. ■



MODULAR AND FLEXIBLE To facilitate future changes to office floor layouts, the Secretariat renovation team has created an open-plan system organized around 78-inch-tall furniture-like "work walls" that extend from each perimeter column and contain power, data, and storage.



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Learning Objectives

- 1 Outline the early history of curtain-wall cladding on tall buildings and explain the technological and historical significance of the Secretariat's curtain wall.
- 2 Describe the performance problems of the Secretariat's curtain wall and explain the causes of those problems.
- 3 Explain the renovation team's strategy for addressing those problems.
- 4 Explain the renovation team's strategy for complying with new codes and satisfying goals for energy conservation, security, and occupant comfort.

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