Skanska USA easily justified the higher construction cost of its LEED-Platinum office space in the Empire State Building by emphasizing daylight and slashing energy costs

ANOTHER LEVEL

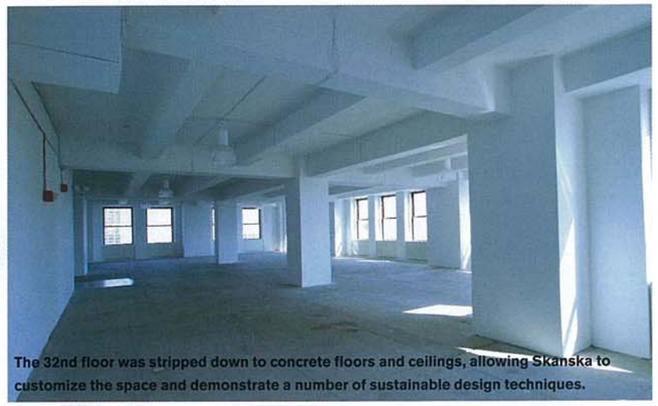
It only makes sense to aim high when designing office space in the Empire State Building. The project team for Skanska USA's New York City headquarters did just that by targeting LEED-Platinum status for the space; meeting a demanding project timeline; and delivering a finished product that now enables this Fortune 500 construction company to showcase its own use of sustainable design when meeting with clients.

From the outset, sustainability was a primary factor in Skanska's renovation of the 32nd floor of the Empire State Building. Terrapin Bright Green, a sustainable consulting and strategic planning firm affiliated with the design architect, Cook + Fox, organized a workshop to develop a strategy for incorporating Skanska's sustainable ideals into the design of its new space. Participants in the workshop included representatives from Skanska, the Empire State Building and Cook + Fox, as well as Swanke Hayden Connell Architects, the architect of record, the MEP engineer Cosentini Associates, and specialist lighting and acoustics consultants from Arup. The ideas on sustainability were wide-ranging, encompassing everything from mechanical distribution to space planning, electric lighting and daylighting.

Given the Empire State Building's high profile, the design team felt that the project could push the limits of sustainable design and energy efficiency. Though it was completed in 1931 during the Great Depression, much of the building's office space remained unrented until late 1940s. Over the years, most of the floors have been divided among multiple tenants, leaving very few full floors available. The 32nd floor, however, was stripped down to concrete floors and ceilings, allowing Skanska to customize the entire 24,400 sq ft floor.

Photos: Bilyana Dimitrova

Private offices are positioned near the core of the building rather than at the perimeter windows. The front walls of the offices were glazed, which maintains the view out and lets in useable daylight.



The 32nd floor was stripped down to concrete floors and ceilings, allowing Skanska to customize the space and demonstrate a number of sustainable design techniques.

Skanska set a goal of a LEED Platinum for Commercial Interiors. In addition, the project, which resulted in 16,600 sq ft of useable space, would need to be designed and constructed in under six months. That's an aggressive goal for any modern office retrofit; however, the historic nature of the Empire State Building, the LEED Platinum target and the logistical challenges of construction in New York City made the schedule even more demanding.

LEVERAGING DAYLIGHT

There are not many buildings that reach the height of the Empire State Building's 32nd floor in the immediate surrounding area. This resulted in virtually endless 360-deg views out and an abundance of daylight permeating the space. Fully realizing the potential of daylight in the space, however, required an unusual commitment from Skanska. The company decided early on to position private offices near the central core of the building rather than at the perimeter windows. This, in turn, placed the open-plan workspaces at the four corners of the building; enabled the daylight coming through the many large windows to be the primary light source in these spaces; and gave every employee access to daylight and a view outside from their workspace. All totaled, there are roughly 19 private offices, 66 workstations, seven small conference/meeting rooms, two large conference/training rooms and a board room.

The private offices were arranged along the north and south sides of the core, separated from the façade by a circulation path that connects the open workspaces on the four corners of the floor plan. To take advantage of daylight, the front walls of the offices were glazed, which maintains the view out and lets in useable daylight for both the north- and south-facing offices. While the north-facing private offices have very little exposure to glare from direct sunlight, the distance of the south-facing private offices from the façade helps shield them from high-angle direct sunlight in the summer.

While the installed power was 35 percent less than 90.1 limits, a digitally addressable networked lighting control system provides further savings by dimming the electric lighting when sufficient daylight is available.

Photo: Biliana Dimitrova

Sun-diffusing roller shades were installed to mitigate direct sunlight when needed but still allow diffuse light into the space when drawn. The shades on the south façade are motorized and automated because they are outside of the private offices and not within reach. The other three façades have manually operated shades because they are either easily within reach (for the east/west façades) or they are not likely to be drawn frequently (the north façade outside private offices).

INDIRECT SOLUTION

The predominance of daylight informed the electric lighting design. Since the amount of daylight in the space would allow for electric lighting to be dimmed or turned off for a majority of working hours, a reduced illuminance target for general ambient lighting was set for the electric lighting. The remaining lighting is provided locally at each workstation, since it is more efficient to light work surfaces with task lighting if it is appropriately sized.

The decision to use an underfloor air distribution system in the major-

The existing structural grid of columns with beams between them became an ideal reference for a pattern of indirect luminaires, which light the open office areas in combination with natural light.

Photo: Bilyana Dimitrova

ity of the floor meant that architectural ceilings weren't necessary in most of the space to house ductwork and other mechanical devices. The existing structural grid of columns with beams between them became an ideal reference for a pattern of indirect luminaires, which light the open office areas. The frequency of the column and beam lines in the grid dictated the quantity and spacing of the fixtures.

The spacing varied according to the exact beam locations, but the rows of fixtures were generally about 6 ft apart. On average there was a 12-ft run of fixtures in every coffer, and the coffers are approximately 5-ft wide by 20-ft long. The density of fixtures is greater than if coffers had not existed; however, each fixture uses only one lamp.

The fixtures were sized and lamped to provide an average of about 20 to 25 footcandles of ambient light in the space. By providing a fixture within every beam pocket, the resulting pattern appears uniform and provides a level of quality diffuse ambient light while taking advantage of the architectural expression of the coffered ceiling.

After looking at several fixture types and mounting conditions–including linear fluorescent pendant fixtures hung from the center of the beam pockets and uplights mounted on the sides of the beams–the design team chose an indirect uplight (a one-lamp 28-W 4-ft T5 from Focal Point) that lighted the space efficiently without drawing too much attention to the fixture itself. For the private offices, wall-mounted fixtures from the same family were chosen to uplight the ceiling. The lighting design is completed by LED task lighting both in the open office area and private offices.

By sizing the ambient and task lighting appropriately and using efficient sources, the installed lighting load was reduced to 35 percent below the load allowance calculated for ASHRAE/IESNA 90.1-2004 compliance, even with task lighting included in the load calculation. This reduction led to three LEED CI points under Energy and Atmosphere Credit 1.1.

CONTROLS CONTRIBUTION

A digitally addressable networked lighting control system (Lutron Ecosystem) provides further energy savings by dimming the electric lighting when sufficient daylight is available. Occupancy sensors in each space turn off lighting when spaces are unoccupied, and local controls allow occupants to raise and lower ambient light levels in each area of the floor.

By using a distributed networked system rather than a centralized panel-based dimming system, the number of photocells needed to control each zone of lights was reduced. The control system helped the electrical contractor meet the aggressive construction schedule by simplifying wiring connections. Photocells, occupancy sensors and switches could be wired using low-voltage cabling to the nearest fluorescent fixture ballast, rather than back to a panel or electrical closet. The completed system provides the energy savings from daylight harvesting expected in a sustainable lighting system, while giving occupants control to adjust light levels in their workspaces.

Between the energy efficiency of the lighting system, the availability of daylight and views out, and the presence of daylight responsive and local controls for occupants in the space, the project gained eight points out of the 44 it achieved for the LEED CI Platinum rating from daylighting and electric lighting systems. More importantly, the design and operation of these systems and the other sustainable aspects of the project contribute to a 57 percent savings in electrical costs compared Skanska's to previous office space, when adjusted for electricity rates and square footage. This should translate to a savings of more than $650,000 during the course of Skanska's 15-year lease on the space. While the construction cost was roughly 4.7 percent more than a typical Class A office space, this extra capital cost is quickly offset by the energy savings.

A year's worth of ROI is now in the books, as the space was completed in January 2009.

The LEED logo is proudly displayed on a glass wall in the Skanska reception area. The project is Platinum-certified and earned eight points for its daylighting and electric lighting systems.

Photo: Bilyana Dimitrova

METRICS THAT MATTER

Skanska USA New York City Headquarters

Watts per sq ft: .69 (includes task lighting at workstations); complies with ASHRAE/IESNA 90.1-2004

Illuminance Levels: Open office areas = 20-25 fc, supplemented by task lighting at desks to raise work-plane levels to 40-plus fc; private offices = 30 fc, supplemented by task lighting at desks to raise work-plane levels to 40-plus fc; training/conference rooms = 40-50 fc

Lamp Types: 7

Fixture Types: 15

LEED Certified: LEED Platinum (Commercial Interiors)

About the Designer: Matt Franks, PE, Member IES (2002), LEED AP, is a senior lighting consultant in Arup's New York office. Since joining Arup in 2000, he has been involved in a variety of projects doing daylighting and electric lighting design and analysis, and has developed extensive experience in the computer simulation of electric lighting and daylighting. Recent projects include the Darwin D. Martin House Visitor's Center in Buffalo, NY, the Morgan Library and Museum in New York, NY, and the rehabilitation of the exterior plaza of the Central Branch of the Brooklyn Public Library in Brooklyn, NY, which was the recipient of a Lumen Award of Merit in 2008. Mr. Franks is also a Board Member of the Designer's Lighting Forum of New York.