Inside Man

INVENTIVENESS AND A RESPECT FOR HISTORIC BUILDING FABRIC ARE THE HALLMARKS OF ROBERT SILMAN'S STRUCTURAL SOLUTIONS.

By Allen Freeman

A small photograph of Gustav Mahler hangs on the wall of Robert Silman's office in Greenwich Village. While describing the challenge of restoring Carnegie Hall, Silman, a structural engineer, mentions a family connection with the composer who conducted the New York Philharmonic in Carnegie Hall eighty-one years ago. Silman's maternal grandfather was Mahler's cousin, says Silman, whose slender face bears resemblance to the tempestuous maestro's. "I can't seem to replicate that impetuous streak. I would love to be able to put my adversaries down like he was able to do."

It is difficult to imagine Silman steering—his passive demeanor is the antithesis of the stormy Mahler—and it is improbable that Silman has formidable adversaries. The veteran structural engineer is widely admired among professional colleagues, and when more than 500 people gathered this March to help celebrate the twenty-fifth anniversary of Robert Silman Associates, Inc., a large percentage of them were preservationists and preservation architects.

"Tell my clients when I recommend that we engage Bob Silman that he is an engineer who is not afraid of old buildings," says architect Robert Meadows, who adds, "I don't think there is another engineer I have worked with who possesses his understanding."

Meadows and Silman worked for the National Park Service in the restoration of the William..."
Floyd house on Long Island, and part of the architect/engineer team's responsibility was to determine the second-floor load capacity of the 200-year-old house. Meadows remembers Silman smiling when reporting his initial analysis to the Park Service and saying that according to his calculations the house could not possibly be standing. Then, Meadows recalls, "he worked backward and offered the clients a series of alternatives. Ultimately he convinced them they should use the house the way it has been used for two centuries and limit tours. It was a nice solution—a gentle way of treating the house. Bob Silman is not afraid to leave things alone."

Nor does Silman shun solutions to structural problems others would fear. Architect Bruce Heyl of Notter Finegold + Alexander says that in situations in which "the majority of engineers would shake their heads in wonder and say, 'You can't do that,' Bob will find a way to work with the preservationists and make whatever is needed happen."

"He is very much interested in preserving historic fabric," says another architect, Vincent Benic of Beyer Blinder Belle, who, with Heyl, was a project manager for the restoration of the Main Building at Ellis Island. "Other structural engineers will tell you what they need, and you have to work around them or argue with them," Benic says. "Bob is sensitive to the opinions of restoration architects, and he is sensitive to history."

The history of structural engineering itself as a separate discipline is only little more than 100 years old. Prior to the technological advances of the late nineteenth century, any engineering required in a building's design and construction was part of the architect's function. If the design was structurally complicated, as Filippo Brunelleschi found it to be in the fifteenth century when designing the dome for the cathedral at Florence, the engineer became the architect. "The cleverness of the solution from the engineering point of view was the brilliance of the architecture," as Silman puts it.

Today's structural engineer deals solely with the things that make a building stand. He or she is responsible for the design of the foundations—the footings, the slabs, or the walls that bear the weight of the structure—and of the materials of the structure itself, whether they are metal, concrete, timber, masonry, or glass. Structural engineering is a narrow discipline, and structural engineering as applied to historic preservation occupies a very small niche within that discipline.

Engineering for historic preservation didn't exist by name twenty-five years ago when Silman began to practice on his own. Educated at Cornell and New York universities, Silman had worked for several large consulting engineering firms, including Ove Arup and Partners in London, before establishing his own firm—he was the sole employee—in 1966.

Today the firm has grown to thirty-three employees of whom two thirds are engineers. Roughly half of Silman Associates' work involves old buildings. One measure of his concern about historic preservation is the preservation pro bono consulting he and his staff have done for the New York City Landmarks Preservation Commission, the New York Landmarks Conservancy, the Municipal Arts Society, and other groups and individuals. Through his academic experience, currently as adjunct professor of architecture at Columbia University, where he teaches a course called Philosophy of Technology.

The firm's first exposure to structural engineering involving old buildings came in the 1970s in the so-called gut rehabs of derelict tenements in the South Bronx. Typically built in the first decade of this century—and in most cases six stories high—the utilitarian buildings were supported by load-bearing exterior brick walls, interior steel columns, and bearing walls, and the structure was stiffened by a forest of interior partitions.

Structural work in gut rehabs involves stripping a building to its essentials—the exterior walls, the interior columns and bearing walls, and the floor joists—and then bringing the structure up to standards that meet current building codes. The trick for the structural engineer is to devise with economy systems that do the job that the original interior partitions did in stabilizing and stiffening the floor joists. Silman's firm, which has completed 14,000 gut-rehab housing units in the Bronx, Harlem, and the Bedford-Stuyvesant section of Brooklyn, is currently working on another 712 units for the homeless in twenty-three South Bronx tenements.

Structural solutions for gut rehabs are not necessarily respectful of the original building fabric, so engineers approach restoration of historic buildings differently. What does transfer from one type of job to the other is consideration for saving as much of an old building as possible.

Carnegie Hall was one of the first historic structures on which Silman's firm worked, beginning with a building analysis in 1979, and construction based on Silman's structural calculations has continued until recently. Silman considers the managers of the 100-year-old midtown Manhattan concert hall among his most enlightened preservation clients, which must have eased the task of the massive restoration project. It was carried out—except for seven months in 1986 during work on the public spaces—while the building was in use.

"Most people think that Andrew Carnegie, the head of Carnegie Steel, built a magnificently solid concert hall," Silman says. "Of course he also was a Scot and very interested in getting maximum return for his dollar. Carnegie Hall was, in fact, a minimal building. I don't want to call it cheap, but it was not well-detailed for endurance."

The architect of the concert hall, which is ap-
preceeded more for its acoustics than for its beauty or functional design, was William B. Tuthill. More celebrated were Tuthill’s consultants: Richard Morris Hunt, the architect to millionaires, and Dankmar Adler, Louis Sullivan’s partner, who served as acoustician.

Carnegie Hall, with its maze of public spaces, performance and rehearsal rooms, and professional studios, is architecturally and structurally complex. It was built in three sections: the hall itself, completed in 1891 at the southeast corner of 57th Street and Seventh Avenue, followed by tower sections built in 1894 and 1896 that wrap around the east and south sides. One of the first buildings to employ a steel frame, it also incorporates masonry bearing walls. The exact structure—what holds up what—had become a mystery because the original construction documents, which were known to have existed in the 1950s during a renovation, were subsequently discarded. By testing and “poking around,” as Silman puts it, to find out where the structure is and what it is made of, his firm re-created the framing plans.

A major structural problem was the deterioration of the steel, which was positioned too close to the exterior of the building to protect it from the corrosive effects of water. On the 56th Street facade, I-beams were embedded in the brick facade’s horizontal mortar joints to support the brick.

When the engineers undertook the building survey, “every window sill at the seventh floor had a hump in it. It looked like the ocean,” Silman says. “We dropped a scaffold and very carefully took off a piece of sill and some brick to get to the steel spandrel, which had deteriorated to the point where you could poke a pencil right through the beam. We couldn’t believe that they built it this way. In other areas where we saw cracked and displaced brick we performed probes. Some of this damage was also due to corroding steel.” Silman’s solution for the spandrel deterioration was consistent with his philosophy of respect for original fabric. He abandoned the conventional remedy of removing the corroded girders and replacing them with new steel welded to the columns in favor of leaving the corroded beams in place, shoring the sill above with steel pipe stubs, and then restoring the integrity of the spandrel by casting a reinforced concrete beam that encased the original corroded steel as well as the pipe stub shores. This procedure was employed on 200 linear feet of corroded beam at the seventh-floor level.

On the 57th Street facade of the concert-hall section, which does not incorporate steel, loose and broken terracotta tiles had to be removed, repaired, and reanchored. Silman also engineered a handsome steel-and-glass entrance canopy that replicates the original, and, for the formerly awkward ticket foyer just inside the front door, helped devise a new scheme incorporating access for the disabled.

When it was decided to rebuild the curved ceiling of the stage’s acoustical shell, which had been removed in the 1940s and replaced with a curtain hanging from the proscenium arch, Silman’s firm had to execute for acoustical reasons a method of hanging the plaster shell from springs. Other work included renovating the recital hall and adapting space for a new rehearsal hall.

The New York-based architectural firm of James Stewart Polshek & Partners won a national American Institute of Architects Honor Award in 1988 for the Carnegie Hall restoration. From architect Tyler Donaldson, Polshek’s senior associate in charge of the Carnegie Hall project, Silman earns high marks for his willingness to do thorough investigative work and then to roll with the punches when the unexpected happens. The biggest surprise at Carnegie Hall, Donaldson says, involved a recent modification, the penetration of the party wall between the 1890s building into a new office building that is just being completed to the east. The 25,000-square-foot expansion into the adjacent building, which is to open May 5 for the hall’s centennial celebration, houses concert-hall support facilities that include intermission spaces, restrooms, and dining facilities for patrons and dressing rooms and storage spaces for performers and management.

Several years ago, in preparation for architect Cesar Pelli’s design for the new building, Silman’s firm drilled holes in Carnegie Hall’s side wall in line with a row of interior columns and determined that the wall was of masonry load-bearing construction. More recently, however, when the time came to link the two buildings, construction workers found out that for this point in the wall Tuthill had employed a widely spaced double steel column filled in with masonry. Silman’s probe had been misleading because it had penetrated the infilled section. “Steel columns were right where we wanted our openings,” Donaldson says. “And, since the openings in the new building were by this time literally cast in concrete, Bob had to devise some major load shifting between two floors of Carnegie Hall’s wall.”

There were no major surprises during the seven-year rehabilitation of the Main Building at Ellis Island, which opened last September. The building, completed in 1900, was intensely used and frequently modified during its first thirty years, little used for the next twenty-five, and neglected and vandalized over the course of the next twenty-five. Even so, investigation by Silman’s firm found it in good structural condition except for the railroad ticket-office addition, which showed deterioration in the walls and ceiling structure. Much of Silman’s work involved bringing the building up to standards as a climate-controlled destination for tourists and other users.

Adapting the former immigration station meant laying the structural framework... (Continued on Page 96)
The Search for the Cornerstone

When the bicentennial celebration is launched on October 13, 1992, in commemoration of the laying of the White House cornerstone, only one thing will be missing: the cornerstone. It seems it can't be found. It's not that no one has tried to locate it; they've tried. The subject of the search, however, is not actually a stone, but rather an engraved brass plate that was recessed into one of the stones as the walls began to emerge from the basement level.

On Saturday, October 13, 1979, the Freemasons who were constructing the stone walls ceremoniously spread moist mortar atop a stone in the northwest corner, according to news reports of the day. The brass plate was engraved with the inscription:

but I do think that at some point the president and his family may not live here—I can see that happening. I can see the family living elsewhere and the house being used for official entertaining and as a museum. Even today with the offices removed from here, with just the activity of the butlers and maids and electricians and engineers and everyone who has to do things, they really don't have any privacy. They have their bedroom and maybe one other room that is really theirs. . . .

In contrast to Silman's backstage contributions to the Ellis Island rehabilitation, the Main Building's front canopy and interior stairs—both engineered by Silman's firm—are quite evident to visitors. Each had been long demolished and required interpretive reconstruction in accordance with the Secretary of the Interior's design guidelines stipulating that new fabric in historic buildings appear new. The original canopy framework was constructed of metal sections strengthened by gusset plates and joined with rivets; Silman's detailing of the architects' design for a new canopy translates the original's footprint and outline into a flowing form of steel tubes and angles welded together as a seamless unit. The original had canopy sections of wire-reinforced glass; the reconstructed canopy is entirely transparent.

Similarly, the technology that informs the design of the new staircase was not a part of the structural vocabulary when the original was built. The architects wanted an organic form shaped as a monolithic whole. Silman engineered the new stair as a squared helix of reinforced, cast-in-place concrete supported only at the top, bottom, and—because it required four turns—at the third landing where there are connections to adjacent columns. Technical architect Sher- man Moss, Jr., a principal in the firm of Notter Finegold + Alexander, one of the partners in the joint-venture design team for Ellis Island, calls Silman's structural design for the stair the technical tour de force of the Ellis Island rehabilitation.

Perhaps the Silman firm's most fascinating current project is a job of forensic engineering. For the New York State Capitol in Albany, a Victorian eclectic building credited to three successive architects—Thomas Fuller, Leopold Eidlitz, and H.H. Richardson—Silman has been asked to re-create a sandstone ceiling in the Assembly Chamber. An Eidlitz design completed in 1878, the chamber was topped with what was, at the time, the largest stone groin vault in the world. (Groin construction, characteristic of the Gothic, employs two intersecting vaults.) Unfortunately, soon after the vault was in place the stone began to crack and chunks occasionally fell to the floor. Eidlitz defended his design and said that the stonework must have been faulty. Although none of the legislators was beamed, they became sufficiently alarmed to have the vault dismantled a decade after it was built and replaced with a flat, timber ceiling.

A century later, Silman was commissioned through the capitol restoration architects, Mesick-Colton-Waite, to analyze the Eidlitz vault, to determine why it apparently was failing, and to ascertain whether, if the state decided to rebuild the vault, it might again prove to fail. Silman's report was based on photographs of the chamber, the remains of the vault's anchorage, written descriptions (Eidlitz's drawings were destroyed in a fire), and computer analysis. The conclusion: the shape was wrong for this kind of stone vault, which, combined with the tremendous weight of the stone, created stresses that the masonry could not sustain. Therefore the state could not put back the same kind of vault, if it were to be self-supporting.

"We have designed a vault, which will probably be made of cast stone if the state ever gets the budget to do it," Silman says. "Since it will be suspended from a network of steel, it will be a visual restoration, not a structural restoration."

Caring about that kind of distinction has made for Robert Silman his reputation as the preservationist's engineer.