

## Computer-Aided Gothic

*New tools help Kevin Roche replicate stone ornamentation with exacting detail.*



**ABOVE:** The newly reopened Jewish Museum is now entered on East 92nd Street, through the original front door of the Warburg Mansion.  
**TOP LEFT:** The 1963 List Building adjoining the Neo-Gothic Warburg Mansion added gallery space and a sculpture court on Fifth Avenue.  
**TOP RIGHT:** Roche Dinkeloo's addition fills in the sculpture court and seamlessly continues the mansion's weathered, 85-year-old limestone facade.



How could a self-avowed Modernist re-create Gothic Revival spires and gargoyles so faithful to those of a 1908 mansion that the visitor can scarcely tell the difference between the original and its addition? So asked architects and critics this summer, when New York City's Jewish Museum unveiled its \$36 million restoration and expansion by AIA Gold Medalist Kevin Roche. The skill with which Roche has reconstructed masonry ornament is a significant accomplishment, offering an inspiring reinvention of a centuries-old craft.

### Museum expansion

Roche Dinkeloo's addition to the Jewish Museum is the culmination of a long search for larger exhibition space, offices, and educational facilities. In 1945, Frieda Schiff Warburg, widow of noted philanthropist Felix Warburg, donated the family's 1908 Fifth Avenue mansion to house the museum. In 1963, the museum expanded into the Modern List Building, which also provided an auditorium. By the 1980s, the museum had outgrown both buildings. Anne Scher, the museum's director of public relations, recalls quarters so cramped that staff members shared desks on rotating schedules.

For its next expansion, the museum interviewed a number of architects before finally commissioning Kevin Roche John Dinkeloo and Associates of New Haven, Connecticut, in 1985. "Initially," explains Roche, "the museum was going to start afresh on a separate site, with a new building. We were retained with that in mind." After evaluating a number of sites, both architect and client recognized the importance of the mansion and chose not to relocate the museum.

Preliminary schemes called for the insertion of a new sliver building next to the orig-

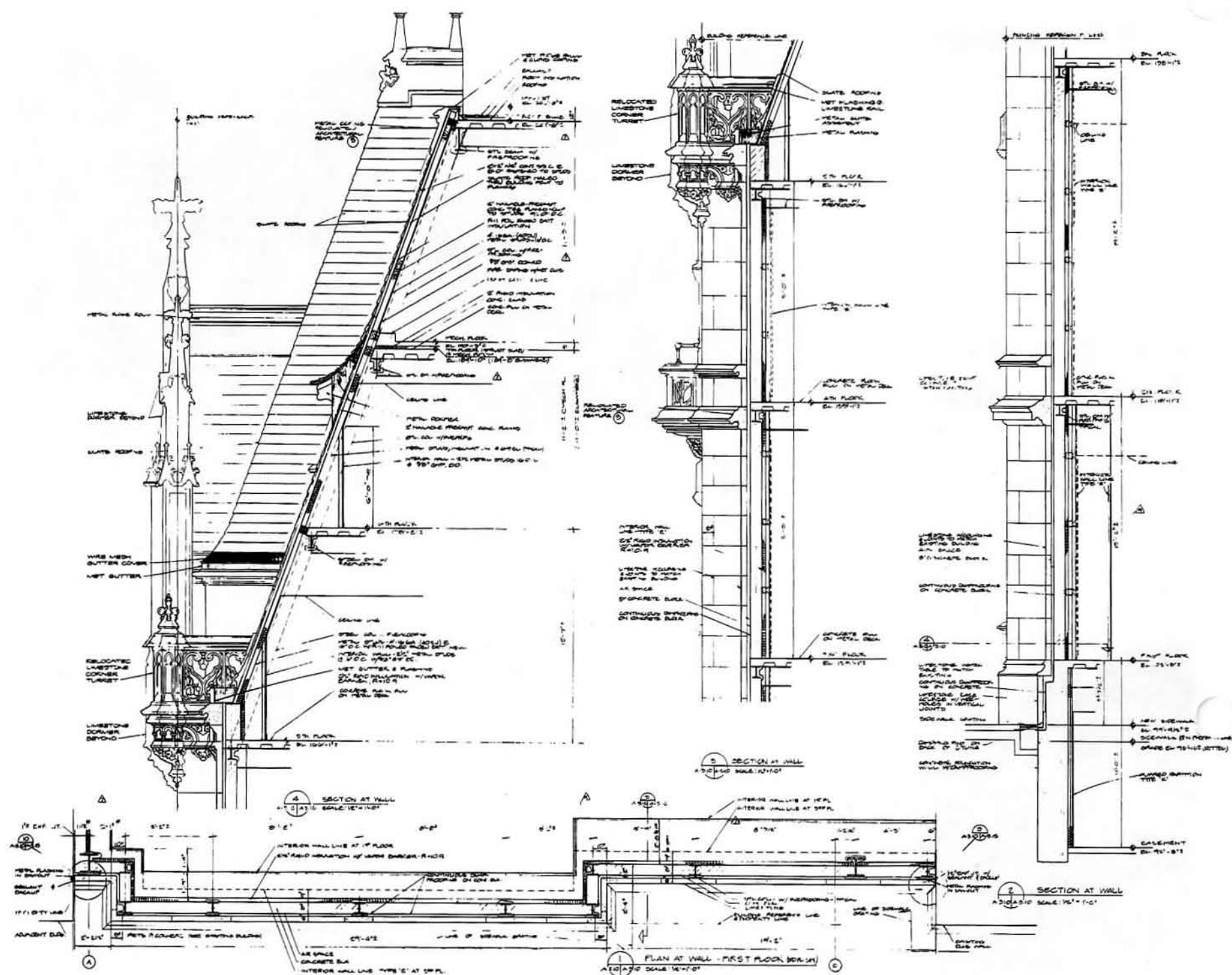
inal museum. Roche, however, chose to preserve the museum's identity, which was clearly tied to the mansion. Expanding the museum therefore meant expanding the Warburg building—quite literally. So Roche addressed the problem as if the original architect, Charles Prendergast H. Gilbert, had been asked to enlarge the mansion.

### Seamless integration

The new 30,000-square-foot infill structure occupies the former sculpture court to the north of the mansion. It is structurally connected to both the load-bearing masonry Warburg Mansion and the steel-and-concrete List Building. Roche carefully integrated his interior volumes to create a singular, unified building wrapped in a continuous facade. Both inside and out, seams between old and new are almost invisible. "We wanted to design the new structure as an extension of the whole building, not just of the facade," explains project architect James Owens.

The two new bays added to the west-facing Fifth Avenue elevation of the Warburg Mansion disrupt the original building's overall symmetry and emphasize the symmetrical south facade as the museum's main entrance. Roche recessed the first bay to the north of the mansion to establish subtly the edge between old and new construction. Architectural elements, from window moldings to crockets and spires, are literal, exact replicas of their counterparts in the existing building; some, including a large dormer and fragments of the cornice, were actually relocated from the Warburg Mansion's formerly freestanding north facade, following an agreement with the New York City Landmarks Preservation Commission. The commission mandated that details removed from the Warburg's facades during construction of

ARCHITECTURE / NOVEMBER 1993 123



the Roche addition be incorporated whenever possible in the new building. Roche also matched the surface texture of the new limestone elements to that of the 85-year-old originals. This painstaking process involved chiseling the finished stone to replicate the effects of weathering on the original; stone carvers labored for months to achieve the architect's exacting standards. The result is a seamless continuation of the Gothic-inspired building, where differences between new and old are difficult to discern.

### Computerized craft

Roche's toughest challenge was finding the technology and craftspeople to execute his design. While the client and the contractor sought the lowest bidder, the architect wanted the means to replicate exactly the original stone's color and texture; New York's Cathedral Stoneworks provided both. The company was retained to supply, fabricate, and engineer the facade stone and to

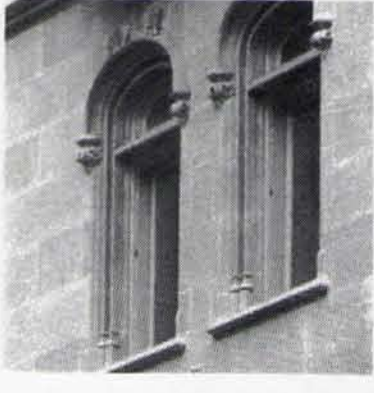
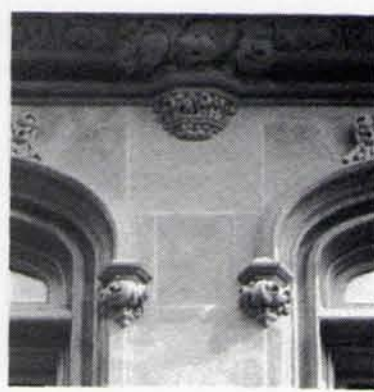
consult with the architect on construction methods. Under the direction of General Partner David Teitelbaum, Cathedral Stoneworks located the same Indiana quarry that supplied the limestone for the original mansion. Teitelbaum recalls scouring the site—where stone was quarried to clad such landmarks as the Empire State Building, Rockefeller Center, and the Cathedral of St. John the Divine—until he found the original excavation site for the Warburg Mansion. Such careful attention to materials ensured a close match between old and new.

To replicate the intricate detailing and ornament of the Warburg facade, workers typically molded cornices and figures on site to create plaster casts, which the stone carvers later used as models. Moreover, optical laser scanning was introduced to re-create some of the more elaborate details. With this method, digital cameras survey the surface of three-dimensional stone pieces, bouncing laser light from the objects back to a scanner. The com-

puterized data is then translated into exact measurements and relayed to a computer-aided manufacturing (CAM) system, which controls the precise maneuvers of automated saws. Guided by this information, stonecutting saws carve—in three dimensions—an exact replica of the original object from a block of rough-cut stone.

The system—a unique blend of new technology and ancient craft—makes stone carving a significantly faster and more affordable restoration process. To program the system, designers create CAD drawings for individual stone sections or details. The files, which may be sent from remote locations via modem, are then coded onto toolpath tapes that drive the robotic stonecutting saws. These automated, hydraulic machines profile raw stone blocks of up to 15 tons, completing approximately 80 percent of the carving; stoneworkers later embellish and refine the pieces by hand. What once took carvers two weeks to handcraft can now be finished in 30 minutes,

124 ARCHITECTURE / NOVEMBER 1993



**FACING PAGE:** The carved stone facade of the Roche addition is supported by a steel frame with concrete floor plates.  
**LEFT:** The bay of the new addition (left) is almost indistinguishable from the 85-year-old original (right).  
**TOP:** Workers hand-chiseled the surface of the new limestone to simulate the effects of weathering on the original.  
**CENTER:** As required by the New York City Landmarks Preservation Commission, a balcony removed from the Warburg Mansion's rear facade was reinstalled on the Fifth Avenue elevation of Roche Dinkeloo's addition.  
**ABOVE:** The preservation commission also required that new window moldings exactly match the originals.

ARCHITECTURE / NOVEMBER 1993 125