

A photograph of the interior of St. Patrick's Cathedral in New York City. The image shows the high, vaulted Gothic architecture with stone columns and stained glass windows. A modern glass walkway with a dark metal frame is installed across the lower level, allowing visitors to view the interior from a different perspective. The lighting is warm, highlighting the textures of the stone and the colors of the glass.

Glass Structures in Historic Milieux

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FOR ARCHITECTS AND BUILDING TEAMS WORKING IN HISTORIC CONTEXTS, STRUCTURAL GLASS SYSTEMS CAN OFFER COMPELLING DESIGN SOLUTIONS THAT CAN IMPROVE FUNCTIONALITY WHILE SIMULTANEOUSLY HIGHLIGHTING AND CONTRASTING WITH THE SPACES' ORIGINAL FABRIC AND CHARACTER. HOWEVER, CHALLENGES WITH THE INTEGRATION OF GLASS SYSTEMS THAT RELATE TO DESIGN DEVELOPMENT, SPECIFICATION, FABRICATION, AND INSTALLATION DO RAISE A HOST OF CONSIDERATIONS THAT MAY NOT BE IMMEDIATELY APPARENT. EXAMINING A RECENT RENOVATION PROGRAM AT A NEW YORK CITY LANDMARK, THE ST. PATRICK'S CATHEDRAL, PROVIDES A USEFUL CASE STUDY OF EFFECTIVE DESIGN STRATEGIES FOR MELDING MODERN GLASS EXPRESSION WITH HISTORIC PRESERVATION AND ALSO RENOVATION SCOPES. EXPLORING THESE SOLUTIONS WOULD OFFER INSIGHT INTO THE BENEFITS AND THE CHALLENGES THAT ARE INHERENT IN THIS APPROACH.

Led by Murphy Burnham & Buttrick Architects (MBB), the conservation and renovation of the St. Patrick's Cathedral was a multifaceted undertaking spanning 10 years and \$175 million of construction and improvements on a campus occupying an entire city block. Designed by American architect

James Renwick, Jr., in the Gothic Revival style and constructed between 1858 and 1888, the cathedral is a designated city, state, and federal landmark and one of New York's most-visited destinations. The architecture and preservation team at MBB helped develop a comprehensive project approach focused on stabilizing the cathedral structure and also providing a better experience for clergy, visitors, and worshippers—all while preserving the character of this sacred and iconic building.

In addition to completing exacting preservation work—including conservation of exterior and interior stone, wood, and plaster, as well as stabilization and conservation of stained glass—MBB worked with a multidisciplinary team to incorporate several new glass elements. Along with Silman and Eckersley O'Callaghan Engineers, construction manager Structure Tone, and two glass fabricators, the design team developed two major insertions:

- sliding glass doors for the main entry allowing the church to keep its bronze portals open without loss of conditioned air; and
- an 82-m² (880-sf), 14-m (48-ft) tall glass wall providing acoustic isolation for the Lady Chapel worship space.

Contemporary approach to preservation and facility goals

When designing for historic preservation work, why would an architect consider the use of modern glass systems? In the case of the St. Patrick's Cathedral renovation, glass structures presented a means of turning several of the cathedral's facility operations challenges into opportunities for improving functionality, increasing community connections, and enhancing appreciation of an iconic landmark. Just as importantly, glass both maximizes transparency and minimizes the impact of interventions on the original historic fabric. For the Archdiocese of New York's leadership, using glass in the St. Patrick's Cathedral renovation presented an opportunity to develop architectural elements that also improve the building's expression of the congregation's core values: openness, a welcoming atmosphere, and a sense of sanctuary and refuge.

The cathedral entrance, for example, is symbolic of those principles. Throwing open the large, 4082-kg (9000-lb) bronze doors serves as a



The extensive recent restoration of New York City's landmark St. Patrick's Cathedral, led by Murphy Burnham & Buttrick Architects (MBB), focused on stabilizing the structure and creating a better experience for clergy, visitors, and worshippers. Photo © Chris La Pute



The interface between new interventions and the cathedral's historic elements required a series of carefully considered design decisions about alignments, priorities, and the preservation of the existing architecture, among other factors. Photo © Whitney Cox

welcoming gesture, signifying to visitors and passersby alike this centrally located complex is open and available as a physical and spiritual resource. However, keeping the doors open would compromise energy efficiency. The archdiocese

In order to achieve acoustic isolation for the intimate Lady Chapel worship space, MBB's design solution centers on a glass enclosure filling the 14-m (48-ft) high arch.



also create a transparent barrier affording views down the nave when in the closed position. This minimal glass entry creates a sustainable and sensitive solution, allowing the original doors to remain open year round while minimizing heat and air-conditioning loss. The discreet glass panels also work to emphasize the original architecture.

Given the historical importance and complexity of the project, a sensitive touch was necessary. The motorized glass pocket doors sit on a series of bearings allowing them to slide into the wall with the push of a button. This sliding-door hardware system is engineered for large structural glass panels. To create a pocket for the doors to slide into the existing structure, the project team shifted the interior wall by 101 mm (4 in.) and removed some of the stone entirely.

This design solution, which could be considered for a range of historic settings, required careful planning and significant consideration of preservation logistics. In this case, the doorframe's limestone surround was removed, cut down 127 mm (5 in.), and reinstalled to accommodate the channels.

The work of setting the glass entry doors into place was made even more complicated by the need to keep the cathedral open to visitors and worshippers throughout the process. Intelligent and precise coordination and scheduling was instrumental to success. The project team conducted preparation work during the day by simply cordoning off the area around the entry doorframe, maintaining public access to the cathedral's interior. Installation work took place at night and in the early morning. Working with an architectural metal and glass fabricator and installer, Structure Tone orchestrated closing off a portion of Fifth Avenue so the glass assemblies could be delivered and set into their pockets.

A minimalist enclosure and technical challenges encountered

In addition to improving the cathedral entry, archdiocese leaders sought to enhance the functionality of interior worship spaces. Over time, the popularity of St. Patrick's Cathedral and the sheer number of daily visitors had acutely impacted the ability of its Lady Chapel, an addition on the east side of the cathedral built in the early 1900s, to serve as a quiet, intimate space. Responding to the changing needs of worshippers and the visiting public required creating an enclosure that could provide acoustic separation between the main cathedral areas and the chapel



New motorized sliding glass pocket doors welcome visitors to the cathedral entrance, allowing the original bronze doors to remain open while minimizing heat and air-conditioning loss.

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leaders sought a solution with a level of functionality that was also in keeping with how the building is used.

Since the scope of restoration work included significant upgrades to St. Patrick's Cathedral's mechanical plant, MBB suggested creating sliding glass pocket doors that could be hidden, but would