Classical Solution

A new steel atrium added a distinctive element to New Zealand's leading natural and cultural history museum.

BY ROY KANE

SATISFYING THE AESTHETIC REQUIREMENTS ON A MAJOR PUBLIC BUILDING IS ALWAYS INTERESTING. But completing a massive, staged renovation project on a significant museum while keeping it operational is even more challenging.

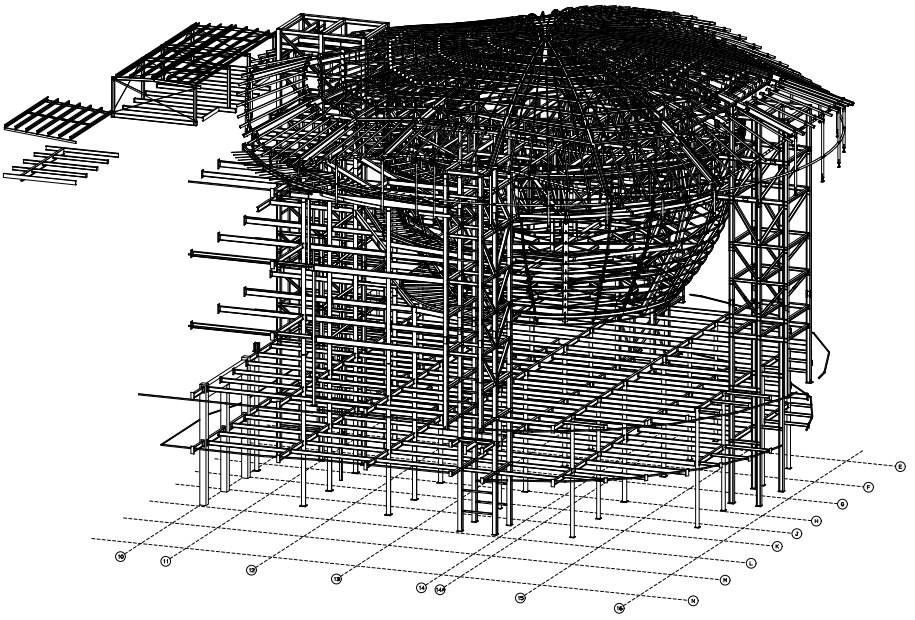
The first stage of the project took five years to complete and included the restoration of the existing building fabric, seismic strengthening, interior restoration, new building services and new permanent exhibitions. Stage Two, when completed this December, will increase the floor space by 60%, adding 3,000 m³ of safe and secure collection storage. It will also provide greatly enhanced access to New Zealand's leading collections of natural and cultural history.

According to Rodney Wilson, the director of the Auckland War Memorial Museum, the Grand Atrium addition is "an elegant, 'baroque' response to a neo-classical building."

The Grand Atrium project is an in-fill of the museum's southern courtyard. Architect Noel Lane's concept was to suspend a multi-story, kauri-clad bowl structure inside the atrium. This was just one of the many challenges to confront the engineers of Holmes Consulting Group.

The team, led by Project Design Engineer Karl Jones, determined that the primary structure to support the four-level, suspended bowl, would be structural steel box trusses, each one story deep. Arranged in a cruciform, these would in turn be supported by four structural steel truss towers that would house the main service shafts. The bowl was designed as an independent structure hanging from the trusses and structurally separated from the surrounding floor plates.

The floor plates maintain either physi-



Right, top: A 3-D drawing of the structural steel required, by Cadtec Draughting Ltd.

Right, center: The exterior of the copper-and-glass-clad dome during construction.

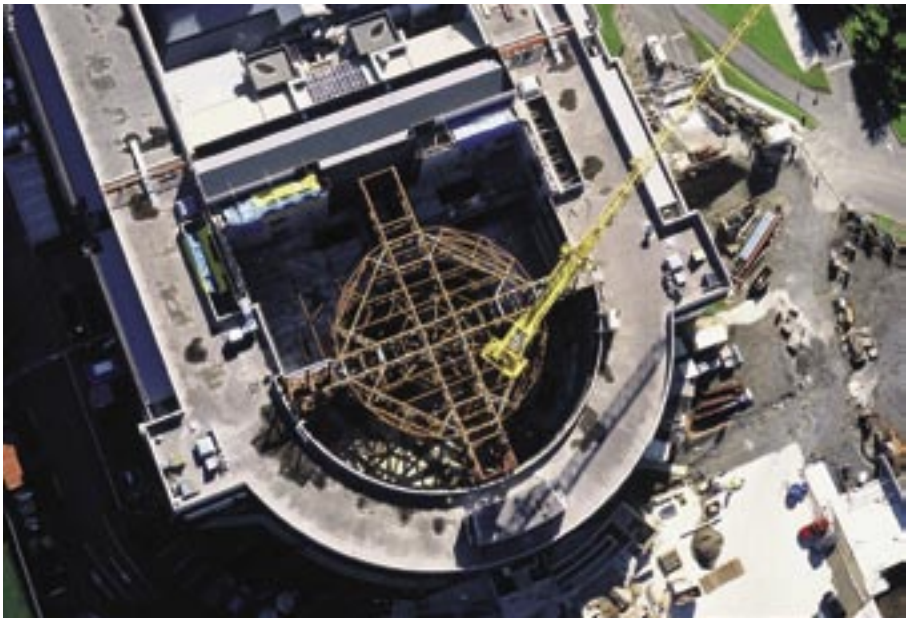
Right, bottom: An aerial view of the steel framing. The dome and bowl are supported on four steel towers.

cal or visual separation from the bowl. Where they do connect, the architect used glass floors. The structure supporting these floors is designed to touch the bowl lightly and preserve the visual separation.

One of the first tasks on site was to excavate down some 10 m (32.8 ft) inside the existing museum courtyard to create space for the two levels that would eventually provide the museum with space for storage and workshop functions. Access into the courtyard was created by digging a tunnel under the existing heritage building. The new truck dock and plant room will be constructed in this tunnel area.

Fabrication and erection of the steelwork was done by Grayson Engineering Ltd. The detailing was provided by Grayson subsidiary, Cadtec Draughting Ltd. Manager André Beets says their biggest challenge was the modification made to the roof design. It was originally simple concentric circles to support a copper and glass dome. Further into the design process, however, the architect introduced a wave, which he drew right around the roof perimeter.

Jones takes up the story: "A number of design iterations led to the development of the final geometry of the dome, which oscillates at the perimeter where the copper transitions to the glass cladding. Structural steel trusses radiate from the center of the dome and form the primary structure spanning 47 m (154.2 ft) across what was the museum courtyard. These trusses transition to a beam at the perimeter over the glass fringe—to reduce visual intrusion. The lateral support to the dome is provided by extending the four main mega-frame columns, thus ensuring that where the perimeter truss support columns interface



An artist's rendering of the suspended bowl, clad in kauri wood.

with the existing structure, the necessary seismic separation can be maintained."

The oscillating perimeter beam was constructed in steel pipe, which had to be curved in two planes, horizontal and vertical, to simulate the wave action. Beets says it wasn't complex to detail, but the geometry was tricky. "We had to take great care to be certain that we got the architectural intent correct, and then provide the set-out information that would be acceptable to the fabricators."

Grayson's managing director, David Moore, had his workshop staff construct a full-size jig to fabricate the structure. Once a pipe had been curved along the horizontal plane on a section-rolling machine, heat and force were used to curve it on the jig in the vertical plane. The sections were then transported to the site, fitted and erected.

Hawkins Construction Ltd.'s project engineer, Grant Thomas, in his third year on this project, says he still relishes its challenges. "The design has evolved, necessitating lots of meetings. And because this is a heritage building, its original look could not be altered. This meant modifying some upper floor levels to conceal the lift towers."

"We were acutely aware of the stress we were causing the museum staff. With more than 200 workers on-site, regular impact meetings were held to liaise about safety and ensure that any extreme noise occurred outside the museum's public hours. The work was exacting and very special. I doubt I'll ever have the privilege to build another one of these."

The official opening for the NZ $64.5 million (about U.S. $43.15 million) project is scheduled for December 8, 2006. By this date, the museum's many and rich collections, which have been kept in warehouses for the past 12 years, will have been brought home and once again made accessible. Among the world-class amenities will be a special exhibitions facility of international quality, a 196-seat theater for cultural performances, films and lectures, a new learning center for school education programs, a new workshop and truck dock, and at roof level, an events center for museum and public activities with panoramic views of Auckland and its harbor. MSC

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