

Design Revolution

The Glasgow Wing Tower provided unique construction challenges. Rosie Gordon investigates.

This is the soaring, elegant new structure which has won the hearts of the Glaswegians below it and accolades from architects all over the world.

Part of the new Glasgow Science centre complex, which includes an exhibition centre and IMAX cinema, the wing tower is the tallest building in Scotland at over 125 metres. With the width to height ratio of 1:13 it is 60% more slender than most buildings. The design, by

give you a good idea of the challenges faced by contractors during construction.

Providing primary structure support, the tower has two outriggers and a stair shaft nose which form a triangle. The building's torso is strengthened and stiffened by a fully braced stair shaft and diagonal 'K' bracing linking the outriggers.

There is a glass fibre-reinforced polymer viewing cabin 100 metres high, and aerodynamic effects could have caused vibrations at an uncomfortable level for visitors. Engineers adopted 0.5 metres per second as a suitable level. To allow this, the tower was built upon a turntable, which rotates to face mean wind direction. Airfoil shaped outriggers control airflow around the 520 step stairwell shaft, preventing vortex shedding and steadying the tower.



Baldwin's Liebherr LTM-11000D mobile crane was deployed, after dismissing the use of helicopters or barge mounted cranes

Richard Horden Associates and the Building Design Partnership, has also earned a place in the Guinness Book of Records as the only building in the world that rotates 360 degrees in the wind.

A description of the building should



The Science Centre is clad in titanium





Bespoke access platforms were built into the structure as shown here and inset

The tower's performance also depends upon the triangulated tubular steel stair shaft, which forms a precise aerodynamic shape. Outriggers are curved plates with internal webs and the tail section is formed from a primary tube surrounded by curved aluminium cladding, which balances the tower. The structure demands that the tower's centre of rotation is located too far back, meaning that the centre of lift is forward of the centre of rotation, so the tower must be driven to align with the wind. Without power or brakes it would feather at about 40 degrees to the prevailing wind.

The solution

Carillion plc was among the contracted companies. Muir Smith, its Building Project Manager, explains that the major challenge was safety. "We had operatives over 120 metres above ground, and the potential risk to those on the ground was also a major concern. The structure is also only 20 metres from the tidal river Clyde on three sides, as well as being just

120 metres from the city heliport and less than four miles from a busy international airport."

Because of the tower's location a number of lifting solutions were considered. "We looked into barge mounted cranes and helicopters for different aspects of the tower", says Smith, "but in the end the Liebherr mobile supplied by Baldwins was able to handle everything up to hook heights in excess of 120 metres for lifts over 10 tonnes. For the major lifting the 1000 tonne LTM11000D was ideal, assisted throughout by a 50 tonne LTM1050."

The superstructure was contracted to Mero of Wurzburg, Germany. They made a series of 12 metre long sections, to be stacked up. Each one weighed about 23 tonnes. The crane used a specially constructed hoist to lift these sections into place.

Providing safe access to this uniquely shaped building, from which tower sections could be secured once lifted into place, was one of the project's major tri-



umphs. K&M Baum Management of Hanover won the contract. Alois Kitte, the managing director of K&M explains the solution. "The difficulty we faced was accessing each external connection point during the erection of the tower. We decided that, at each 12 metre level, bespoke platforms should be positioned between the spiral stair and the structure's shell. There were also platforms around the inner part of the cladded nose and others from the outrigger to the tail fin. This allowed workers to walk safely to the very external point on the tail fin - which is an extremely dangerous point."

After a year of close team work between the various contractors, the tower was officially opened in July 2001 and, as yet, is a complete success. ■