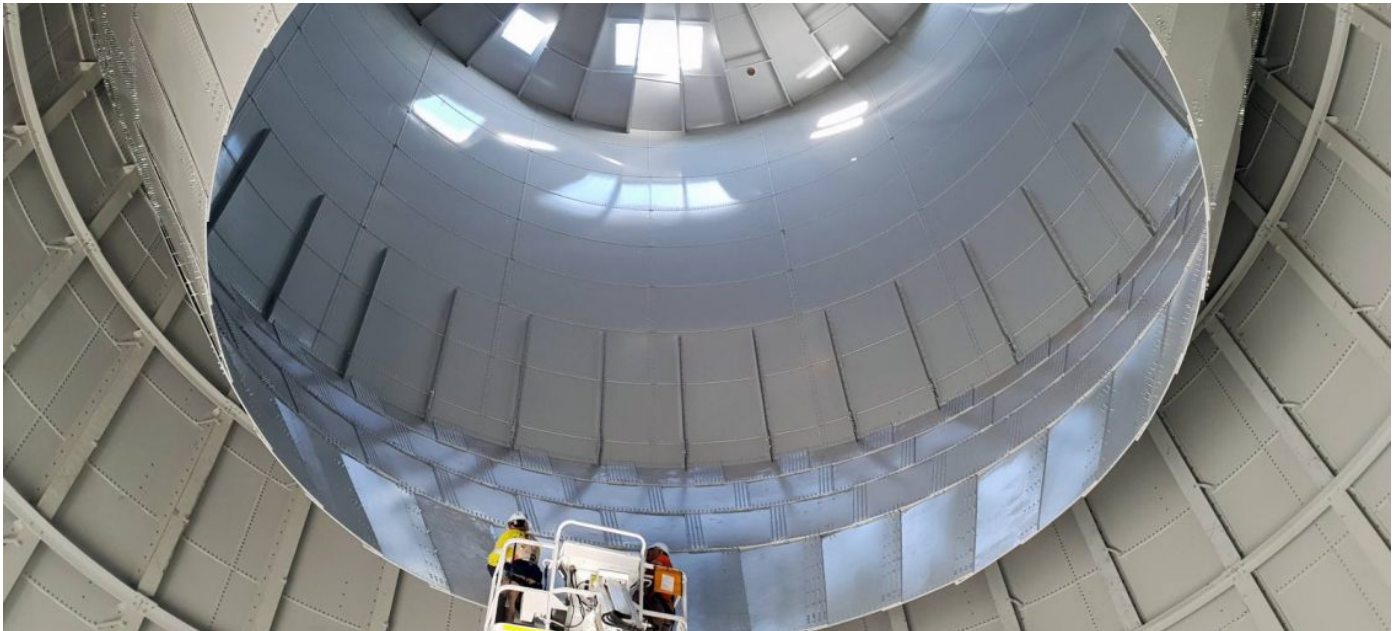


## Project Profile

# 3000t Steel Silo Design and Construct at Port Kembla



<b>Client</b>	Morgan Cement International
<b>Location</b>	Port Kembla, New South Wales
<b>Duration</b>	July 2017 to September 2018
<b>Contract</b>	Lump Sum Design and Construct
<b>Cost</b>	Confidential

## Project Overview

Adelaide Brighton Group produces and markets clinker, cement and lime products under the Adelaide Brighton Cement and Cockburn Cement brands, premixed concrete and aggregates under the Hy-Tec brand and concrete products under the Adbri Masonry brand. They employ 1,600 personnel in all states and territories of Australia and have a market capitalisation in excess of \$2 billion.

Morgan Cement International is a subsidiary of the Adelaide Brighton Group operating a cement clinker grinding facility in Port Kembla, New South Wales. The facility was first constructed in the 1920s and underwent major capital upgrades in the 1950s and the 1990s.

The original site had two cement storage silos which each held 400t of cement. Two additional storage silos, holding 1000t of cement each were constructed in 2008. An additional 400t silo was constructed in 2014 providing a total site storage capability of 3200t for both general purpose and shrinkage limited cements.

### McMahon Services

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Morgan Cement International was seeking to increase the productivity at their Port Kembla site and engaged McMahon Services to design and construct an additional 3000t silo to achieve this outcome.

## Scope of Work

McMahon Services led the design and construct project to deliver a 3000t fully bolted steel silo 26m in height and 14m in diameter, associated mechanical equipment including air slide conveyors and a 40m bucket elevator. The silo was erected using a synchronised jacking process that allowed it to be built from ground level. This process receives the highest safety ratings by significantly reducing working at heights and bringing cost savings to the overall project delivery.

Preliminary site works included asbestos removal and demolition on the existing slag shed where the silo was to be erected. All asbestos containing material was wrapped in double layer 200µm plastic and disposed of at EPA licenced stations. Other preliminary works included bulk excavation, backfilling and a piled foundation consisting of fourteen bored piles of 1.2m diameter socketed into 4m of hard rock into geotechnically challenging ground conditions.

Structural works included design and construction of the access tower, stairs, galleries for air slides and walkways amounting to over 180t of structural steel. The 200t silo was manufactured in Kansas, United States and transported in fourteen shipping containers to Australia. Logistics included trucking and rail from Kansas to Los Angeles, shipping across the Pacific Ocean to Sydney, then trucking to the project site in Port Kembla. McMahon Services managed the entire logistics process including customs and statutory requirements and clearance applications.

565 carbon steel plates and 72,882 bolts were used to construct the silo. 38,690 nuts on exposed surfaces were covered with plastic caps to eliminate corrosion in the harsh marine environment.

Water leak tests were performed during construction of the silo ensuring each section was leak proof prior to commencing to the succeeding section. A final leak test was conducted on completion using pressurised smoke to verify sealing design requirements.

Mechanical works included design and construction of the bucket elevator, air slide conveying systems including aeration fans, 11kW VSD controlled dust filter, silo pressure relief valve, mechanical and radar type level detection instruments, a 3.5m diameter live bottom discharge for silo, pneumatic flow control and isolation gates. A silo bottom access platform was also constructed for ease of access to mechanical equipment for their ongoing operation and maintenance requirements.

Piping works included PVC cement pipelines, electrical conduits, instrument air piping and all associated valves.

Electrical and instrumentation works included design and construction of the complete electrical and controls system for the entire plant, switch room, lighting, power supply, cabling, grounding, process control system, PLCs and SCADA including air controls and alarm systems.

Wallbridge Gilbert Aztec were engaged as the design consultants who prepared 3D design models of the silo and associated plant. All works were undertaken within a constrained site inside an operational industrial facility with shutdown works being minimised to perform tie ins to the existing plant. The plant was designed and constructed to simplify maintenance and serviceability of equipment including interchangeability of spare parts with existing plant material.

The silo design and construction was compliant to Australian and European standards, undergoing two independent third party design reviews as well as several reviews by specialist engineering consultants during construction.

Plant and equipment utilised on the project included 450t, 80t and 50t cranes, piling rig, 20t excavators, hydraulic jacks, telehandlers, elevated work platforms, welding equipment, 25kVA generators, 10t smooth drum roller, skid steer and a 15,000L water truck.

## Project Challenges

A major challenge on the project was lifting two double deck conveyor galleries each weighing 30t between the top of the new 40m access tower and the existing plant. McMahon Services worked closely with Morgan Cement International to ensure nil hold ups to plant operations and to reduce health and safety risks inherent in the lifting works.

Installation was achieved using a 450t crane in heavy lift configuration. Works were completed within a tight weekend shutdown window outside of cement trucking times resulting in nil impacts of plant logistics. Wind monitoring was conducted at all times to

ensure safety with all crane operations.

### Safety Performance

McMahon Services prepared a detailed construction methodology covering each stage of the jacking procedure. This included a comprehensive emergency response plan developed in consultation with McMahon Services Work, Health, Safety, Environmental and Quality (WHSEQ) division and Adelaide Brighton Cement safety representatives.

McMahon Services developed and wind and weight loading chart for the silo that took into account its changing weight as progressive sections were jacked up. The chart was used to determine the minimum jacks required for each lift factoring in wind speed limits to safely commence and complete each jacking process. A wireless anemometer was installed at the highest point on site to provide wind data in real time to ensure decisions were based on accurate and current information.

Over 27,000 work hours were completed on site without incurring a single lost time injury (LTI), medical treatment injury (MTI) or First Aid Incident. Over 1371 blood alcohol content tests were performed over the life of the project.

### Environmental Performance

A yellow striped frog sanctuary was situated in close proximity to the project. To protect these endangered frogs from construction traffic accidents, shade cloth bunting up to 600mm high were erected between the sanctuary and the construction. All works were planned around the sanctuary's exclusion zones.

Design of the silo also factored in dust mitigation. The final design detail included dust encapsulation to mitigate dust emissions with particularly emphasis on protecting the frog sanctuary and neighbouring residents.



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