

AMMONIA STORAGE TANK

STONE COLUMNS



Developer: Wesfarmers CSBP
Main Contractor: Transfield

Specialist Contractor: GFWA

THE PROJECT

In 1988, Wesfarmers CSBP Ltd commenced engineering investigations for the design and construction of a new ammonia storage tank at their Kwinana Nitrogen Facility in Kwinana, WA. The tank was to store a cryogenic product and consisted of an inner steel shell and an outer reinforced concrete bund wall that was founded on a ring beam. The tank diameter was 48 m to the outer edge of the foundation slab supporting the steel shell and 52 m to the outer toe of the ring beam. The design storage height for the liquid product was 28.5 m.

The geotechnical investigation revealed that a loose layer of sand, 1 m thick was recorded at the depth of about 5 m below ground surface and additional more localised loose sand layers were also present from 5 to 9 m below ground level. Groundwater was recorded at the depth of 4 m.

Initial calculations indicated that the tank would settle excessively without implementation of specific foundation measures. Ground improvement by Stone Columns was determined as the most advantageous solution.

THE ROLE OF GFWA

GFWA was awarded the contract for Stone Columns over an area with a diameter of 60 m. Depth of treatment was defined as 10 m. Column diameters were about 1.1 to 1.2 m.

Material used in the stone columns was crushed limestone rubble passing 75 mm sieve. The working triangular grid of 2.5 m was established after performing a calibration on site.

Modulus of deformation for stone columns was assessed using plate load testing. The soil modulus was estimated using CPT tests.

The success of the ground improvement works was confirmed during the hydro-testing of the tank. Tank surface settlement recorded after 4 days under full hydrotest load averaged 70 mm which was about one third the predicted settlement in the event that ground improvement was not implemented.