

Silo Condition Assessment

Menangle Park

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SMEC Company Details

Greg Moore

178-180 Queen St, Campbelltown NSW 2560			
Tel:	+61 2 4640 8222	Fax:	+61 2 4628 1056
Email:	greg.moore@smec.com	Website:	www.smec.com

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1. Introduction

SMEC was engaged by APP, on behalf of Dahua Group, to conduct a condition assessment of the existing concrete silos in the Menangle Park South site. The site is located approximately 60km south-west of the Sydney CBD, in the City of Campbelltown local government area.

Menangle Park South consists of approximately 134 hectares of cattle grazing rural-residential land which is proposed for low density residential development. The silo is located on the eastern side of the site, approximately 300 m west of the Hume Motorway (see Photograph 1).



Photograph 1: The site known as Menangle Park South, with the silo location shown in red.

2. Silo Description

The structure consists of two freestanding concrete silos, set approximately 1.5 m apart. The silos have a diameter of 4.5 m and their height is estimated to be approximately 8 m. The wall thickness of the silos is approximately 110 mm with the outer face formed using corrugated iron. It appears that reinforcement in the wall consists of 12 mm vertical and 8 mm horizontal bars. Each silo has 3 access openings which have been cut out of the walls at various heights.

A timber-framed structure between the silos houses an access ladder to the top of the silos. This is clad with a corrugated iron façade to provide weather protection. A grain chute protrudes through the metal façade on the southern face of the silos.

A timber-framed, gable roof spans across the top of both silos. Corrugated iron clads the top of the roof and the frame connections are reinforced with bolted steel plates. Bolt size and plate thickness are unknown.

No drawings of the silo were available so the details of the footings and foundations are unknown. The structure is estimated to have been constructed circa 1930's.



Photograph 2: South elevation of the silos.



Photograph 3: North elevation of the silos.

3. Site Inspection

A site inspection was undertaken by two SMEC engineers, Tom Kopecny, a structural engineer, and Dean Oliver, a remedial engineer, on 22 February 2018, with the purpose of visually assessing the current condition of the silos.

The silos were inspected from ground level, with defects and the general condition noted and photographically recorded. A camera with a large telephoto lens was used to photograph the upper structure. Dimensional measurements were taken with a tape measure and a surveyor's wheel. A steel hammer was used to sound out concrete at all accessible locations of the external faces and identify areas of delaminating concrete.

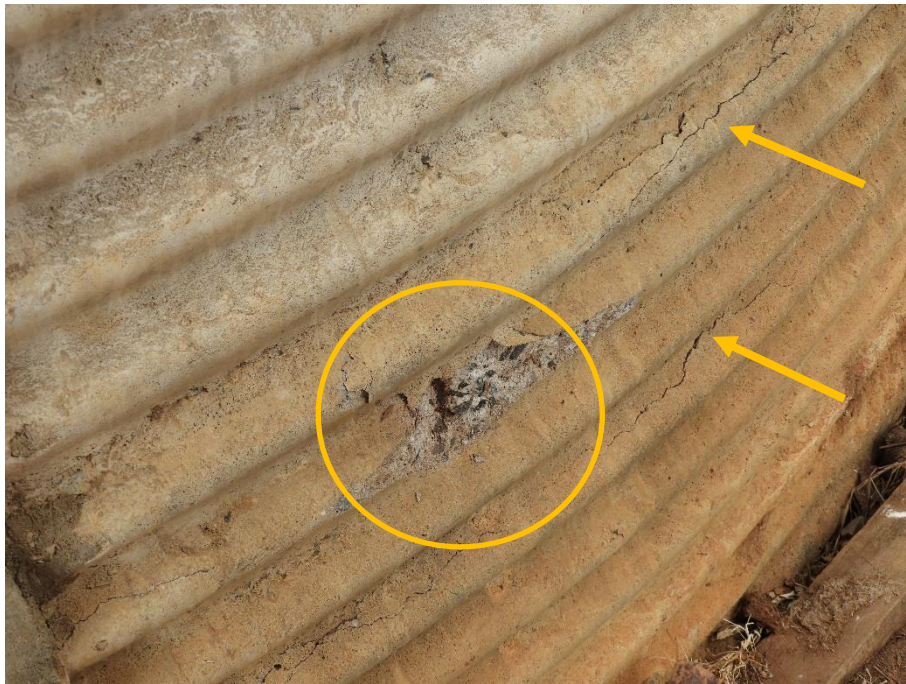
No destructive testing or specialised inspection techniques or equipment were used in the assessment. No attempt to climb the central access ladder was made due to safety concerns

It was overcast at the time of the inspection.

4. Condition Assessment

4.1. Concrete Silos

Without the benefit of chemical testing, the concrete elements appear to be in poor condition. Several areas of spalling on the external faces is apparent, particularly on the lower sections of the silos. Photograph 4 and Photograph 5 show spalled sections of concrete, and surrounding cracking indicating the commencement of spalling. Cover over the reinforcement, as seen from spalls and exposed reinforcement, appears to be minimal throughout the structure and as low as 4 mm in some locations, but up to 25 mm in others. Furthermore, some honeycombing was noted on the surface of the concrete which is potentially allowing an easy path for water to penetrate to the steel and initiate corrosion.



Photograph 4: Spalled section of concrete, and surrounding cracking indicating the commencement of spalling.



Photograph 5: Spalled section of concrete, with exposed reinforcement.

The internal faces of both concrete silos are in fair . Minor vertical shrinkage cracks up to 0.75 mm wide were noted in 2 locations.

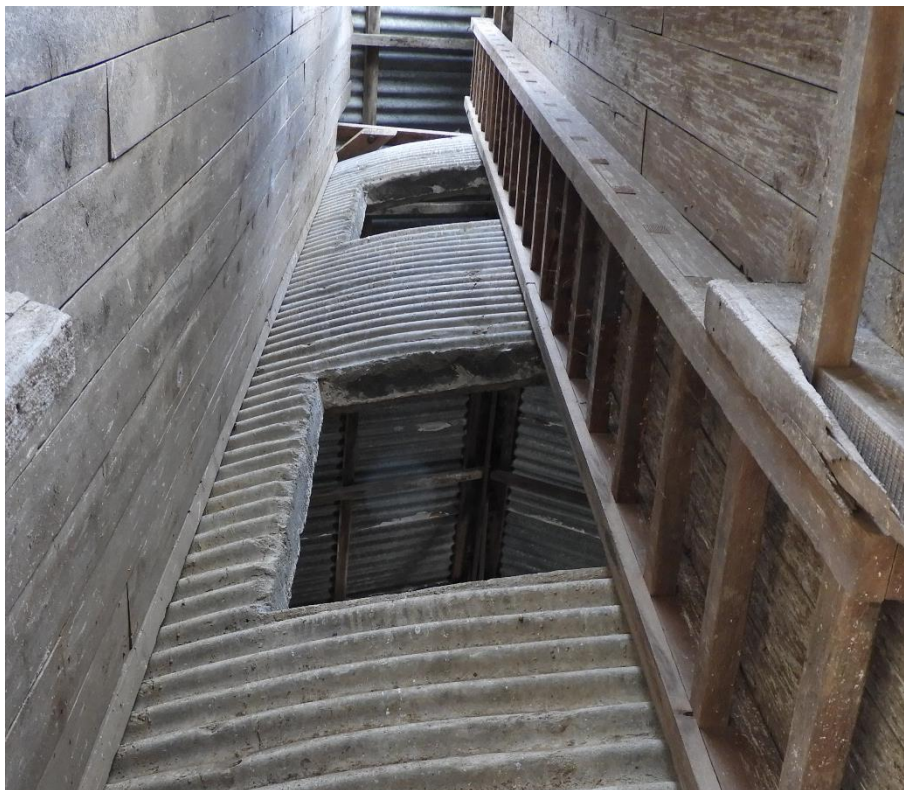


Figure 6: Inside of western silo. Concrete is in fair to good condition.

Concrete spalling and exposed and corroding reinforcement was noted around the edges of the lowest access opening of both silos. Refer Photograph 7. The openings for the upper levels did not show similar signs of deterioration. Refer Photograph 8.



Photograph 7: Spalling and exposed reinforcement around lowest opening of western silo.



*Photograph 8: Upper openings did not show the same signs of deterioration as lowest openings.
Image of eastern silo.*

4.2. Roof Structure

The corrugated iron roof cladding has been completely displaced from the western side of the roof which appears to be a result of failure of the battens (refer Photograph 9). Consequently, significant weathering and deterioration of the roof frame has occurred in this location (refer Photograph 10).



Photograph 9: Missing roof cladding on western side of silos.



Photograph 10: Extensive weathering of exposed timber beams and rafters.

The remaining metal roof cladding is in poor condition with widespread corrosion. Refer to Photograph 9 and Photograph 11. The structural timber sections of the roof that have remained sheltered by the cladding are in fair condition – refer to Photograph 11, Photograph 12 and Photograph 13. The steel plates at the connections are also in acceptable condition, with surface corrosion noted only – refer to Photograph 12 and Photograph 13.



Photograph 11: Steel cladding and timber structural members are in good condition on eastern side of silos. Photo looking up through east silo.



Photograph 12: Steel plates at connections are in acceptable condition. The timber beams and rafters undercover have remained in good condition.



Photograph 13: Steel plates at connections are in acceptable condition. The timber beams and rafters under cover have remained in good condition. Corrosion on the underside of the roof cladding.

The gutters show significant corrosion throughout, and is perforated as a result. A section of gutter on the south-western side is missing (refer to Photograph 14).



Photograph 14: Corrosion of gutter on north western side (left), and gutter missing on south western side (right).

The downpipe is missing on the north face of the silos, and the downpipe on the south face is not connected to the gutter. Significant corrosion of the downpipe is occurring (refer to Photograph 15).



Photograph 15: Downpipe missing on north face (left), and downpipe not connected on south face (right).

4.3. Metal Façade and Timber Access Structure

The corrugated iron façade is deteriorated, deformed and displaced on both the north and south elevations (refer to Photograph 16 and Photograph 17). However, the sheeting still provides some level of protection to the timber access structure.



Photograph 16: Façade on southern elevation.



Photograph 17: Façade on northern elevation.

The façade is supported by a timber frame spanning between the silos which also supports a timber ladder providing access to the top of the silos. The timber structure appears to be affected by termites or borers which has compromised the structural integrity of the frame (refer Photograph 20). For this reason, access was not possible to undertake a thorough assessment and determine the extent of the infestation.



Photograph 18: Internal ladder on north side of silo. Deterioration of the lowest section can be seen at the bottom left of the image.



Photograph 19: Internal structure on south side of silos.

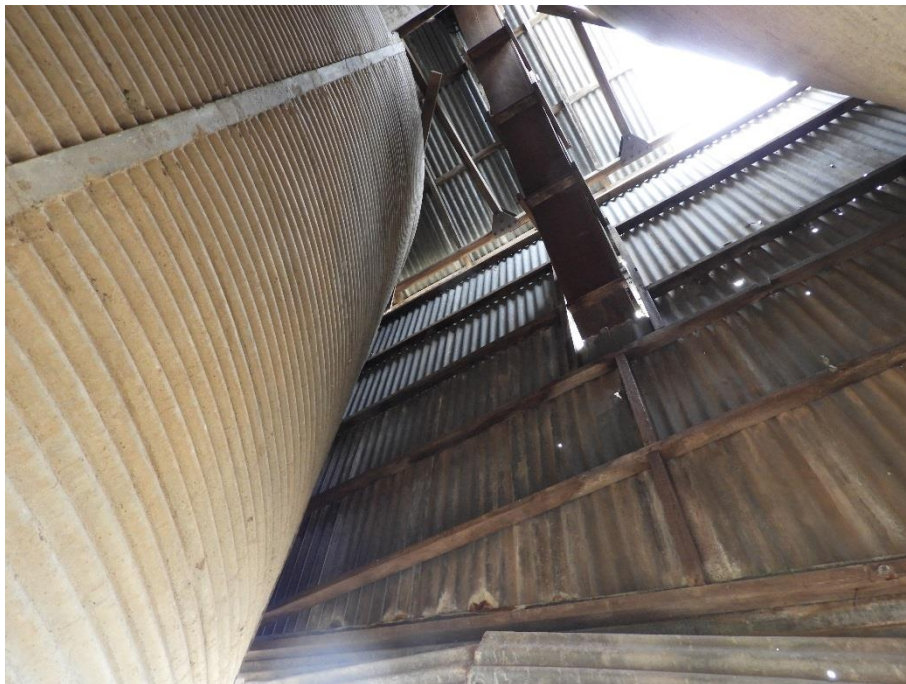


Photograph 20: Evidence of termites or borers in timber frame.

A grain chute extends through the southern face of the façade and is in a state of disrepair. The exposed structure has failed and splintered sections hang through the opening (refer to Photograph 21).



Photograph 21: Exposed section of grain chute on southern elevation has failed.



Photograph 22: Internal section of grain chute.

4.4. Miscellaneous

Ground subsidence in the clay foundations was evident around the footings of the silos (refer to *Photograph 23: Ground subsidence evident around the base of the silos.*). This does not appear to be having any consequence on the structure at this stage but will undermine the structure in future if unaddressed.



Photograph 23: Ground subsidence evident around the base of the silos.

Both silos currently have a large amount of rubbish inside which is holding moisture and will impact on the durability of the silos (refer to Photograph 24).



Photograph 24: Large amount of rubbish can be found inside both silos

Overgrown vegetation is present around both silos, particularly on the south face of the silos (refer to Photograph 25).



Photograph 25: Overgrown vegetation on south side of silos

5. Conclusion and Recommendations

Generally, the structures are in are in poor condition, consisting of the following:

- concrete spalling;
- corroding reinforcement;
- failed roof timbers;
- displaced roof and wall cladding;
- termite infestation;

The silo is located in Menangle Park, which is about 40 km from the coast. This environment may be classified as a B1 exposure environment in accordance with AS 3600 (Concrete Structures). Based on the provisions of AS 3600, a concrete structure constructed from 25 MPa concrete requires a minimum cover of 60 mm to achieve a 50-year design life. Given that the observed concrete cover of the silo is significantly lower than 60 mm and the silo is over 80 years old, it would appear that the silo has exceeded its design life.

In its current state, the silo is not considered to be safe and suitable for a residential environment. There is a substantial amount of rubbish that has accumulated within the silos that is required to be tipped.

The structures condition is such that extensive work would be required to remediate. Based on our observations it is our recommendation that the structure be demolished.



Member of the Surbana Jurong Group

SMEC Australia Pty Ltd

Level 5, 20 Berry Street
North Sydney, NSW, 2060

T +61 2 9925 5555

F +61 2 9925 5566

www.smec.com