

Case Study

Southern Cross University

Coolangatta QLD

Market Sector

INFRASTRUCTURE



Application

DEEP IMPACT COMPACTION



Site Conditions

UN-ENGINEERED GRANULAR FILL



Project

The development comprised the construction of a 10-story building, and a 4-storey building within stage 1 for the proposed Southern Cross University Campus in Coolangatta. Landpac carried out the Impact Compaction Works and Verification for upper level footings on variable un-engineered fill down to 5m or so for the 4 storey concrete framed building and provided sufficient compaction for the underground services underlying the 10-storey building. Pile layout and footing plan required Column loadings of 50 tonne, 100 tonne, 150 tonne, 200 tonne and 350 tonne. The 4 story-Building area is about 60m x 27.5m.

Soil Conditions

Pre CPT's indicated that the fill included a slimes layer varying from 100mm to 1,200mm in thickness with an average of 600mm, and a standard deviation of 400mm. One test indicated a 2,300mm slimes layer. The site consisted predominantly of sandy fill with depths ranging from 0.8m to 5.2m of sand above the slimes layer. Below the slimes layer fill ranged from 0.1m to 6m but typically an average of 2m was encountered. The fill was extremely inconsistent showing the sand above the slimes layer had variable densities ranging from relative density $I_d=30\%$ (loose) and in excess of $I_d=100\%$ (very dense).

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Geotechnical Solution

The site consisted of extreme variability so Impact Compaction was applied over the entire site for the in-situ fill as an economical alternative to Dynamic Compaction or removal and replacement to provide a uniform sub-grade and reduce post construction settlements to acceptable levels. The purpose of the geotechnical testing was to determine the post ground improvement sub-surface conditions and to provide geotechnical recommendations for the proposed building to be constructed on the site.

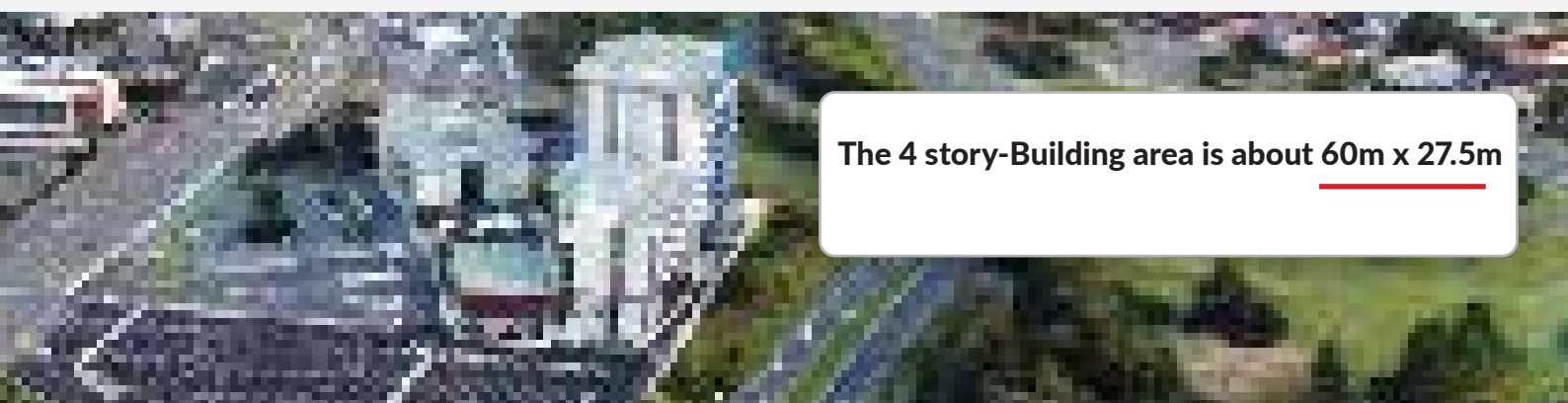
CPT No	Cohesionless soil				Cohesive soil	
	Loose	medium dense	dense	very dense	soft	firm to hard
1		3.6-4.8m		0-3.6m, 4.8->4.2m		
2			2.8-4.5m	0.7-2.6m 4.5->7.2m		0-0.7m 2.6-2.8m
3			3.3-4.5m	0-3.3m 4.5->6.4m		
4	3.75-4.5m	3.6-3.75m	4.5-4.8m	0-3.6m 4.8-6.2m		
5			2.4-4.2m	0-2.4m 4.2->4.5m		
6		5.2-5.75m	3.1-4.75m	0-3.1m 4.75-5.2m 5.75->5.65m		
7		3.0-4.0m	2.7-3.0m	0-2.7m 4.0->5.6m		
8		3.6-3.8m		0-3.6m 4.0-4.9m		3.8-4.0m
9	3.8-4.2m	2.7-3.1m		0-2.7m 4.2->4.4m	3.1-3.8m	
10		3.8-4.3m	2.6-2.9m 4.45->4.8m	0-0.2m 0.6-2.6m 3.0-3.8m		0.2-0.6m 2.9-3.0m 4.4-4.45m

Discussion/Recommendations

The soil penetrated by the cone penetration tests is judged to have virtually zero potential for volume change with variation in moisture content. The Site Classification in accordance with AS 2870-1996, Residential Slabs & Footings, Section 2, which refers to the reactivity or shrink swell potential of the site soils, is CLASS A. There were thin layers of clay type soil that were encountered in 4 of the 10 CPT's. Potentially these layers are reactive, however, they were mostly encountered below the regional groundwater level (1-2m) and would not be subject to moisture variation.

High level pad footings with an allowable bearing pressure of 250 kPa was adopted for the HEIC treated sub-grade below the proposed 4-storey building. The table above shows the test results summarised. The table below shows estimated settlements for an isolated pad footing proportioned for an allowable bearing pressure of 250 kPa at each of the 10 cone penetration tests for a 350 tonne (3.75 x 3.75m footing size) and a 50 tonne (1.5m x 1.5m footing size) column load. The estimates assumes that the footings are founded at a depth of 0.75m below the existing surface level. Maximum total footing settlements and differential settlements of 20mm were determined.

CPT No	Estimated Footing Deflection, mm	
	3500 kN Column Load	500 kN Column Load
1	7	3
2	8	3
3	7	3
4	10	3
5	6	3
6	7	3
7	7	3
8	7	3
9	35	15
10	10	4



The 4 story-Building area is about **60m x 27.5m**

Monitoring & Verification/QA

The Impact Compaction works were monitored with Landpac's Intelligent Compaction Measurement (ICM) System. The ICM analysis provided engineers with accurate GPS locations for Soft Spot removal. The ICM systems also indicated localised areas with higher potential settlements and identified when a uniform sub-grade had been achieved. 10 cone penetration tests were pushed to effective cone refusal at depths of about 4.2m to 7.2m below the existing surface level. DCP's were also carried out throughout the Impact Compaction process.

Construction

Proposed 4-Storey steel or concrete framed with glass/precast panel/block work/light weight panel in fills and reinforced concrete floors. Proposed 10-storey building constructed on piles.

Client: SCU

Engineering Consultant: Bradlees Consultants

Main Contractor: Fulton Hogan

Ground Engineering Contractor: Landpac



Summary

- ✓ Site Classification in accordance with AS 2870-1996
- ✓ Impact Compaction was applied over the entire site
- ✓ Thin layers of clay were encountered in 4 of the 10 CPT's

Get in touch

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