Date: 1 May 2019
Ref: 32377Z SR

Site Report

Richard Doyle
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NORTH BALGOWLAH NSW 2093

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Dear Sir

GEOTECHNICAL ASSESSMENT
RETAINING WALL
20 DAISY STREET, NORTH BALGOWLAH, NSW

The undersigned visited the above site on 29 April 2019 to inspect the retaining wall along the front boundary, in the presence of the owner, Mr Richard Doyle. Mr Doyle reported that a section of the retaining wall had moved (bulged and tilted) and cracked since January 2019. Mr Doyle also reported that the wall is Heritage listed.

SITE OBSERVATIONS

The site is located in undulating topography which slopes locally down to the south-east and has an eastern frontage onto Daisy Street.

At the time of our inspection, the site was occupied by a single storey sandstone house with rendered extensions on either side. The house was situated about 3m above street level and the front yard was supported above the adjacent nature strip by a mortared sandstone block wall. This wall extended along the entire eastern site boundary, except for a gap near its centre, which divided the wall into a northern section and a southern section. The gap allowed pedestrian access to the property and the two returns to the wall supported the front yard above a set of steps which led to the front door.

Southern Section of Wall

The southern section of the wall was a maximum of 2m high. The northern end of the wall appeared to have been a more recent rebuild and a concrete footing was evident. Over its central portion, the wall was bulging and tilting (towards the east) and a stepped diagonal crack had formed. The bulge and tilt resulted in the top of the wall being about 200mm off its apparent original alignment and the crack was a maximum of 10mm wide at the top of the wall reducing to hairline at its base. The crack extended along mortar joints, through

an individual sandstone block and into the concrete footing. A hairline crack was also evident at the northern return.

A gas and water main extended up the face of the wall near the centre. Two buried rainwater storage tanks were located between the wall and house with their access pits set back about 5m from the wall. Mr Doyle reported that he had never recycled the rainwater and did not have details of the tank overflow arrangements. A garden bed, with sprinklers, was located immediately behind the crest of the entire section of wall and a water meter and inspection eye were evident in the garden bed behind the central portion of the wall.

Beyond the toe of the wall was a grass covered nature strip which included a tree near the southern end. Two manholes (considered to be gas and sewer) were also evident, as were two adjacent stormwater outlets, which were located in the kerb opposite the central portion of this section of wall.

Northern Section of Wall

The northern section of the wall was about 2m high at its southern end reducing to about 1m at its northern end. A sub-vertical hairline crack was evident near the central portion of this section of wall. Beyond the toe of the wall adjacent to the crack was a sandstone outcrop with roots over its surface. A garden bed with sprinklers was located behind the crest of the wall and a large tree was present beyond the crest near the central portion of the wall.

GEOTECHNICAL EVALUATION

We consider the movement which has occurred over the central portion of the southern section of wall to be significant, particularly given that it has appeared recently over a relatively short period of time. The deformed shape of the wall indicates that the problem is related to excessive pressure being applied to the back of the wall rather than issues with the founding. The cause of the movement is not evident but may be related to leaking rainwater tanks and/or associated plumbing. The fact that the movement occurred to a section of the wall which had been rebuilt may be an indication that there has been a history of problems. We are not aware if the concrete footing has tilted with the wall or it was constructed with a sloping front face.

Nevertheless, we consider that the southern section of the wall could rapidly become unstable and, therefore, immediate attention is required.

The hairline crack in the northern section of wall is considered to be the result of ‘root jacking’. Roots, presumably from the tree behind the crest of the wall, have extended between the base of the wall and the surface of the rock outcrop. As the roots have grown in thickness, they have forced the wall up locally, causing it to crack. Mr Doyle has reported that he has not noticed any deterioration of the crack.

COMMENTS AND RECOMMENDATIONS

Southern Section of Wall

As stated above, the central portion of the southern section of wall requires immediate attention. The movement which has been reported has occurred over a relatively short period of time is of concern and, if it continues, the wall will topple over.

Given the poor condition of the wall, we recommend that the damaged portion be demolished and rebuilt to an engineered design and specification. It is possible to improve the stability of the wall (for example, by installing tie rods or similar) but as the deformation of the wall will remain, this option is not favoured.

The proposed new wall should be designed using the following parameters:

- The proposed cantilever wall should be designed using a triangular lateral earth pressure distribution with an 'active' earth pressure coefficient, K_a = 0.3, assuming a horizontal backfill surface.
- A bulk unit weight of 20kN/m^3 should be adopted for the backfill.
- All surcharge loads affecting the wall (construction loads, live loads, etc) should be taken into account using the earth pressure coefficient from above.
- The wall must be designed as drained and measures taken to provide permanent and effective drainage of the ground behind the wall. Subsurface drains must incorporate a non-woven geotextile fabric (eg. Bidim A34) to act as a filter against subsoils erosion.
- Lateral toe restraint may be achieved by the passive pressure of the soil in front of the wall. Adopt a triangular lateral earth pressure distribution with a 'passive' earth pressure coefficient, K_p = 3, assuming horizontal ground in front of the wall.
- An allowable bearing pressure of 150kPa may be adopted for stiff or better clayey soil, subject to inspection by a geotechnical engineer.

We recommend proceeding as follows:

1 Appoint a plumber to check the rainwater tanks and all buried water bearing services for leaks, and repair as appropriate.

2 Reroute all existing services which will be impacted by the proposed demolition.

3 Carefully demolish the deformed section of wall (say, the northern two thirds) taking care to avoid destabilising the section of wall which will remain. Being a Heritage listed wall, the sandstone blocks will need to be numbered, photographed and carefully stockpiled. The existing concrete footing should be inspected by the structural engineer (and if necessary, the geotechnical engineer) to assess whether it can remain or should also be demolished).

4 The existing backfill to the wall must be battered to a slope no steeper than 1V:1H and the excavated material stockpiled.

5 A geotechnical engineer must inspect the founding conditions to confirm the footing design.

6 The proposed new wall should be rebuilt. The stockpiled sandstone blocks will need to be reinstated in their original location, possibly as a facing to the new wall.

Northern Section of Wall

We are not concerned with the stability of this section of wall at this stage. However, the wall should be regularly visually monitored by the owners and should any evidence of deterioration be noted (eg. tilting, bulging, increase in crack width or extent, etc), further geotechnical advice must be sought.

Should you require any further information regarding the above, please do not hesitate to contact the undersigned.

Yours faithfully
For and on behalf of
JK GEOTECHNICS

Agi Zenon
Principal Consultant I Geotechnical Engineer.