GeoEnvironmental Pty Ltd
Geotechnical and Environmental Solutions

GEOTECHNICAL DESK TOP STUDY

FOR

URBAN LINK PTY LTD

1188-1200 Canterbury Road, Roselands, New South Wales

Report No: 15/0873

Project No: 20226/5479C

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Table of Contents

1. INTRODUCTION

This report presents the results of a preliminary geotechnical assessment (Desk Top Study) carried out by STS GeoEnvironmental Pty Limited (STS) for a proposed new mixed use development which is to be constructed at 1188-1200 Canterbury Road, Roselands. We understand site development comprises six (6) above ground storeys and two (2) basement levels which will require excavating to a depth of about 6 metres below the existing groundsurface.

The purpose of the assessment was to:

- Review available literature and past projects for the general area
- Make an assessment of the subsurface conditions at the site,
- Classify the site in accordance with AS2870,
- Make recommendations regarding the temporary and permanent support of the excavation,
- Recommend foundation design parameters, and
- Make recommendations regarding vibration control during rock excavation.

The assessment was undertaken at the request of Lujie Jiang of Urban Link Pty Limited.

Our scope of work does not include a contamination assessment of the site.

It should be noted that the report was prepared using information from other sites in the area and our experience in this geological environment. No subsurface drilling has been carried out.

2. SITE CONDITIONS AND GEOLOGY

The site is located on the south eastern side of Canterbury Road between Pentland and Fairview Avenues. The site is approximately 4200 m^2 in area. Reference to available aerial imagery indicates that the site is currently occupied by commercial premises.

The Sydney geological series sheet at a scale of 1:100,000 shows the site is underlain by Triassic Age Ashfield Shale of the Wianamatta Group. Rocks within this formation typically comprise shale, claystone and laminite.

3. SUBSURFACE CONDITIONS

Based on our experience, it is our expectation that the subsurface conditions will comprise some minor fill and topsoil overlying silty clays and weathered shale. The fill, topsoil and natural silty clays are expected to be 2 to 3 metres deep. Weathered shale likely underlies the silty clays.

Groundwater is not expected to be encountered.

4. DISCUSSION

4.1. Site Classification to AS2870

The classification has been prepared in accordance with the guidelines set out in the "Residential Slabs and Footings" Code, AS2870 – 2011.

Because there are buildings present, abnormal moisture conditions (AMC) prevail at the site (Refer to Section 1.3.3 of AS2870).

Because of the AMC, the site will likely be classified *a problem site (P).* Provided the recommendations given below are adopted, the site may be reclassified *highly reactive (H1).*

4.2. Excavation Conditions and Support

The construction of the basement may involve excavating close to the property boundaries. It is of course important that the excavation is adequately supported at all times and that it does not endanger the adjacent properties.

Conventional earth moving equipment, such as excavators, should be capable of removing the soils and possibly the rock to the proposed excavation depth. It is possible medium and high strength shale or ironstone bands may be encountered during the excavation. Removal of medium or high strength rock and ironstone bands will probably necessitate the use of other rock excavation equipment.

If rock breaking is required, particular care will be required to ensure that buildings or other developments on adjacent properties are not damaged when excavating the rock. At their closest point some buildings will be within a few metres of the excavation. The structures on the adjacent properties may be founded directly on the weathered rock. Buildings founded directly on rock can often be very susceptible to damage from vibrations transmitted directly through competent rock.

Excavation methods should be adopted which limit ground vibrations at the adjoining developments to not more than 10 mm/sec. Vibration monitoring will be required to verify that this is achieved. However, if the contractor adopts methods and/or equipment in accordance with the recommendations in Table 1 for a ground vibration limit of 5 mm/sec, vibration monitoring may not be required.

TABLE 1 – RECOMMENDATIONS FOR ROCK BREAKING EQUIPMENT

Distance from adjoining structure (m)	**Maximum Peak Particle Velocity 5 mm/sec**		**Maximum Peak Particle Velocity 10 mm/sec**	
	Equipment	Operating Limit (% of Maximum Capacity)	Equipment	Operating Limit (% of Maximum Capacity)
1.5 to 2.5	Hand operated jackhammer only	100	300 kg rock hammer	50
2.5 to 5.0	300 kg rock hammer	50	300 kg rock hammer or 600 kg rock hammer	100 50
5.0 to 10.0	300 kg rock hammer or 600 kg rock hammer	100 50	600 kg rock hammer or 900 kg rock hammer	100 50

* Vibration monitoring is recommended for 10 mm/sec vibration limit.

The limits of 5 mm/sec and 10 mm/sec are expected to be achievable if rock breaker equipment or other excavation methods are restricted as indicated in Table 1.

At all times, the excavation equipment must be operated by experienced personnel, according to the manufacturers' instructions and in a manner consistent with minimising vibration effects.

Use of other techniques (eg. ripping, grinding, rock sawing), although less productive, would reduce or possibly eliminate risks of damage to property through vibration effects transmitted via the ground. Such techniques may be considered if an alternative to rock breaking is necessary.

If rock sawing is carried out around excavation boundaries in not less than 1 metre deep lifts, a 900kg rock hammer could be used at up to 100% maximum operating capacity with an assessed peak particle velocity not exceeding 5 mm/sec, subject to observation and confirmation by a geotechnical engineer at the commencement of excavation.

It should be noted that vibrations that are below threshold levels for building damage may be experienced at adjoining developments.

Saw cutting should be carried out around the perimeter of the excavation before any rock breaking is commenced. It would be appropriate before commencing excavation to undertake a dilapidation survey of any adjacent structures that may potentially be damaged. This will provide a reasonable basis for assessing any future claims.

Because of the proximity of the excavation to some of the property boundaries, temporary support will be required for the soils. Reinforced concrete piles with shotcrete infill are probably the most cost-effective option for providing this support. The piles may be drilled and fixed into the material below the base of the excavation.

When considering the design of the supports, it will be necessary to allow for the groundsurface slope, loading from adjacent structures and water pressure. Where the nearby structures are within the zone of influence of the excavation, it will be necessary to adopt K_o conditions when designing the temporary support. If the buildings are sensitive to movements, the top of the support must be prevented from deflecting. Anchors or props can be used to provide the required support. If anchors extend into adjoining properties, it will be necessary to obtain the permission of the property owners. When props or anchors are used for support, a rectangular earth pressure distribution should be adopted on the active side of the support. The permanent basement support should be designed assuming K_o conditions.

Where there is level groundsurface, the following parameters are suggested for the design of the temporary and permanent retaining wall system:

Active Earth Pressure Coefficient (K_a)	=	0.4
Passive Earth Pressure Coefficient (k_p)	=	4.5 (shale only)
At Rest Pressure Coefficient (K_o)	=	0.6
Total (Bulk) Density	=	20 kN/m^3

Based on our experience, minimal if any, groundwater seepage is expected to flow into the excavation. A sump and a pump should be sufficient to control the seepage.

4.3. Foundation Design

At the base of the proposed excavation very stiff silty clays or weathered shale will likely be present. Footings founded in very stiff silty clays may be proportioned using an allowable bearing pressure of 300 kPa. Those founded in weathered shale can be proportioned using an allowable bearing pressure of 700 kPa.

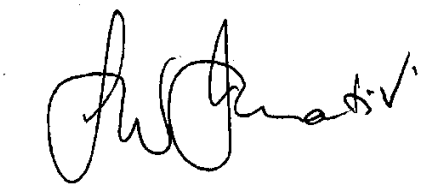
In order to ensure the bearing values given can be achieved, care should be taken to ensure that the base of excavations are free of all loose material prior to concreting. It is recommended that all footing excavations be protected with a layer of blinding concrete as soon as possible, preferably immediately after excavating, cleaning, inspection and approval. The possible presence of groundwater needs to be considered when pouring concrete.

5. FINAL COMMENTS

This report has been prepared using our experience in this local area. Prior to commencing construction it is essential that subsurface drilling is undertaken to ensure that the design reflects the actual subsurface conditions on the site. Because the site has a common boundary with Canterbury Road, the RMS will require cored boreholes. A minimum of three (3) cored boreholes will be required to a depth of 3 metres below the proposed excavation level.

During construction should the subsurface conditions vary from those inferred above we should be contacted to determine if any changes should be made to our recommendations.

The exposed bearing surfaces should be inspected by a geotechnical engineer to ensure the bearing values given have been achieved.



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NOTES RELATING TO GEOTECHNICAL REPORTS

Introduction

These notes have been provided to outline the methodology and limitations inherent in geotechnical reporting. The issues discussed are not relevant to all reports and further advice should be sought if there are any queries regarding any advice or report.

When copies of reports are made, they should be reproduced in full.

Geotechnical Reports

Geotechnical reports are prepared by qualified personnel on the information supplied or obtained and are based on current engineering standards of interpretation and analysis.

Information may be gained from limited subsurface testing, surface observations, previous work and is supplemented by knowledge of the local geology and experience of the range of properties that may be exhibited by the materials present. For this reason, geotechnical reports should be regarded as interpretative rather than factual documents, limited to some extent by the scope of information on which they rely.

Where the report has been prepared for a specific purpose (eg. design of a three-storey building), the information and interpretation may not be appropriate if the design is changed (eg. a twenty storey building). In such cases, the report and the sufficiency of the existing work should be reviewed by SMEC Testing Services Pty Limited in the light of the new proposal.

Every care is taken with the report content, however, it is not always possible to anticipate or assume responsibility for the following conditions:

- Unexpected variations in ground conditions. The potential for this depends on the amount of investigative work undertaken.
- Changes in policy or interpretation by statutory authorities.
- The actions of contractors responding to commercial pressures.

If these occur, SMEC Testing Services Pty Limited would be pleased to resolve the matter through further investigation, analysis or advice.

Unforeseen Conditions

Should conditions encountered on site differ markedly from those anticipated from the information contained in the report, SMEC Testing Services Pty Limited should be notified immediately. Early identification of site anomalies generally results in any problems being more readily resolved and allows re-interpretation and assessment of the implications for future work.

Subsurface Information

Logs of a borehole, recovered core, test pit, excavated face or cone penetration test are an engineering and/or geological interpretation of the subsurface conditions. The reliability of the logged information depends on the drilling/testing method, sampling and/or observation spacings and the ground conditions. It is not always possible or economic to obtain continuous high quality data. It should also be recognised that the volume or material observed or tested is only a fraction of the total subsurface profile.

Interpretation of subsurface information and application to design and construction must take into consideration the spacing of the test locations, the frequency of observations and testing, and the possibility that geological boundaries may vary between observation points.

Groundwater observations and measurements outside of specially designed and constructed piezometers should be treated with care for the following reasons:

- In low permeability soils groundwater may not seep into an excavation or bore in the short time it is left open.
- A localised perched water table may not represent the true water table.
- Groundwater levels vary according to rainfall events or season.
- Some drilling and testing procedures mask or prevent groundwater inflow.

The installation of piezometers and long term monitoring of groundwater levels may be required to adequately identify groundwater conditions.

Supply of Geotechnical Information or Tendering Purposes

It is recommended tenderers are provided with as much geological and geotechnical information that is available and that where there are uncertainties regarding the ground conditions, prospective tenders should be provided with comments discussing the range of likely conditions in addition to the investigation data.