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Marsden Park Public School

Structural Feasibility Report for Building on Marsden Park Site

Rev B

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Project No. 43722
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Revision

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A	17/07/2019	Final	**FTS**
B	26/07/2019	Final-Revised	**FTS**

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Yours faithfully,

Francis Toledo Silva – Structural Project Engineer, Associate
for **Wood & Grieve Engineers now part of Stantec**

Contents

1. Introduction

This report has been prepared by Wood & Grieve Engineers on behalf Schools Infrastructure NSW (SINSW) (the Applicant). It accompanies an Environmental Impact Statement (EIS) in support of State Significant Development Application (SSD-9809) for the Marsden Park New Primary School at the corner of Northbourne Drive (to the east) and a proposed future road (to the north) within the Elara Estate, Marsden Park (the site). The site is legally described as Lot 2889 in Deposited Plan 1230906. The development footprint does not include a portion of the site to the west as this is reserved for a future alternative use.

The Marsden Park New Primary School will cater for 1,000 primary school students at completion. The proposal seeks consent for:

- Construction Stage 1 (Temporary School): a temporary school facility constructed within the western portion of the development site located on the future sports grounds. This temporary school facility is to accommodate a maximum of 500 students at any given time. Should the permanent school progress as per the program, the temporary school will not be required.
- Construction Stage 2 (Construction of Permanent School Facility): a permanent consolidated two storey courtyard building with capacity to accommodate a maximum of 1,000 students. This new school building is to comprise
  - 40 teaching spaces;
  - A canteen;
  - Library;
  - Multipurpose hall;
  - Office and administration space;
  - Staff and student amenities; and
  - Out of school hours care accommodation.
- Multi-purpose sporting facilities and outdoor play spaces;
- Associated site landscaping and public domain improvements;
- An on-site car park for 48 parking spaces and a drop-off and pick-up area; and
- Construction of ancillary infrastructure and utilities as required.

The purpose of this structural report is to make a feasibility assessment on building the proposed new primary school structure on the Marsden Park site.

2. Background

2.1 Marsden Park Public School Proposed Structural Scheme

The proposed new school is a two-storey concrete framed building consisting of a Level 1 suspended slab on ground, a Level 2 concrete slab and a Level 3 steel framed roof.

Based on the proposed design of a project of similar size and layout, an assessment is made of a structural scheme comprising of 400x400 internal columns spaced at 8.1mx8.1m grids typically, with a banded slab system on L2 and a L1 slab suspended on piles socketed into sandstone. The columns support the L2 slab and L3 steel roof and transfers load directly onto larger piles.

The L2 slab is assessed as 200 thick with 1800Wx700D bands in the north-south direction. The slab essentially behaves as a one-way spanning between the bands with a clear span of around 6200mm from band edge to band edge. This can be seen in the figure below:

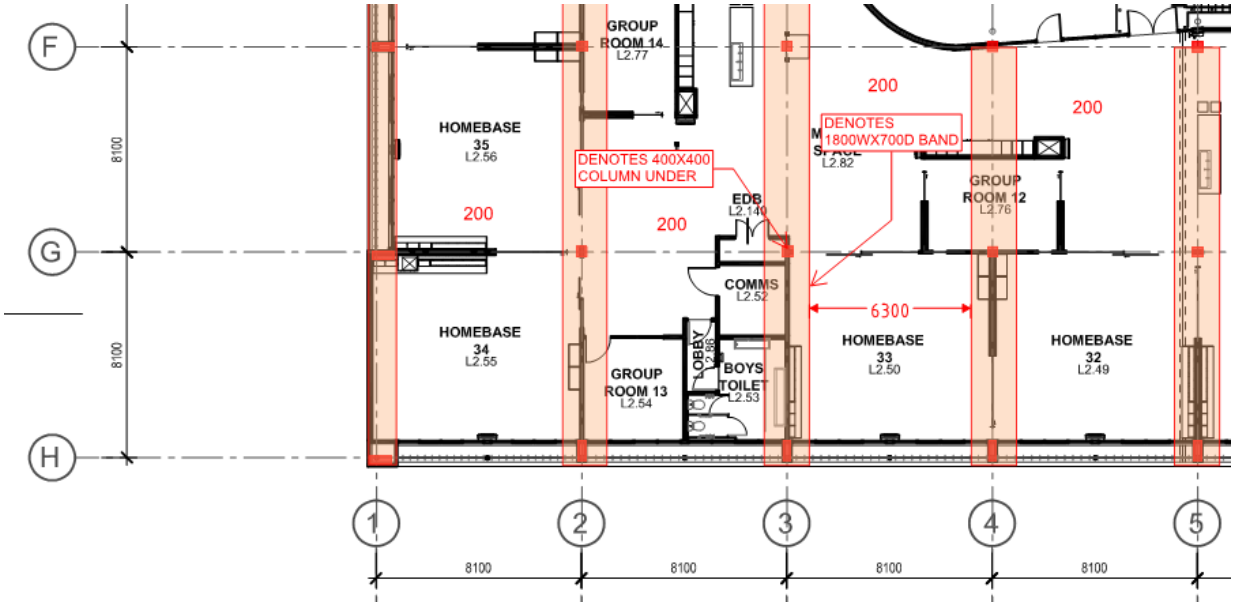

Figure 1: Part Plan of L2 Slab with proposed structural elements

The L1 slab which is founded on natural ground is designed to be suspended between piles spaced at 2.7m centres. This comprises of the larger piles supporting the columns above and a grid of smaller piles in between these. All piles are founded with a 1.5m socket into weathered shale. Part plan of the L1 slab with structural markups are shown below:

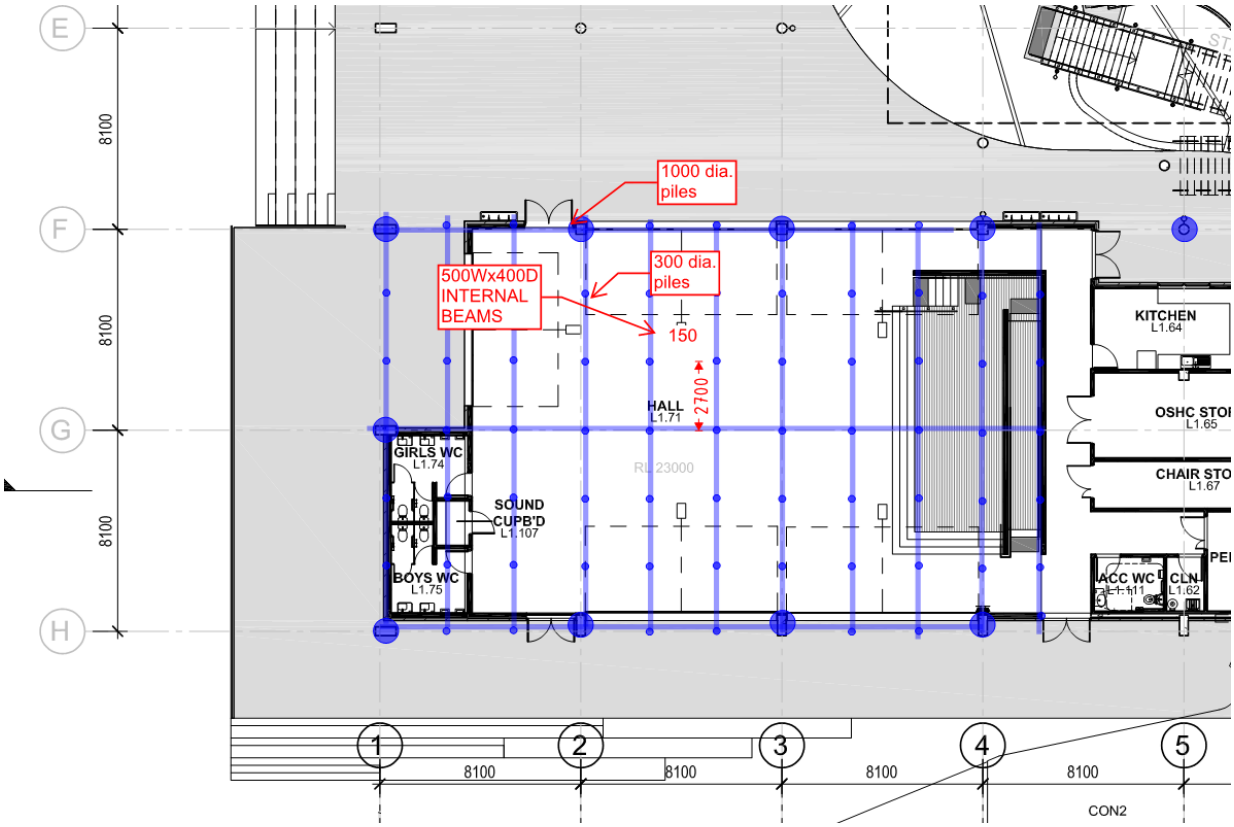

Figure 2: Part plan of L1 Slab on Ground

The L1 and L2 slabs are assessed as reinforced concrete only with no post-tensioning.

2.2 Marsden Park Site Analysis

The proposed site for the new school development is located at the northern end of Northbourne Drive, Marsden Park. The site slopes down to the north west with a fall of approximately 6m.

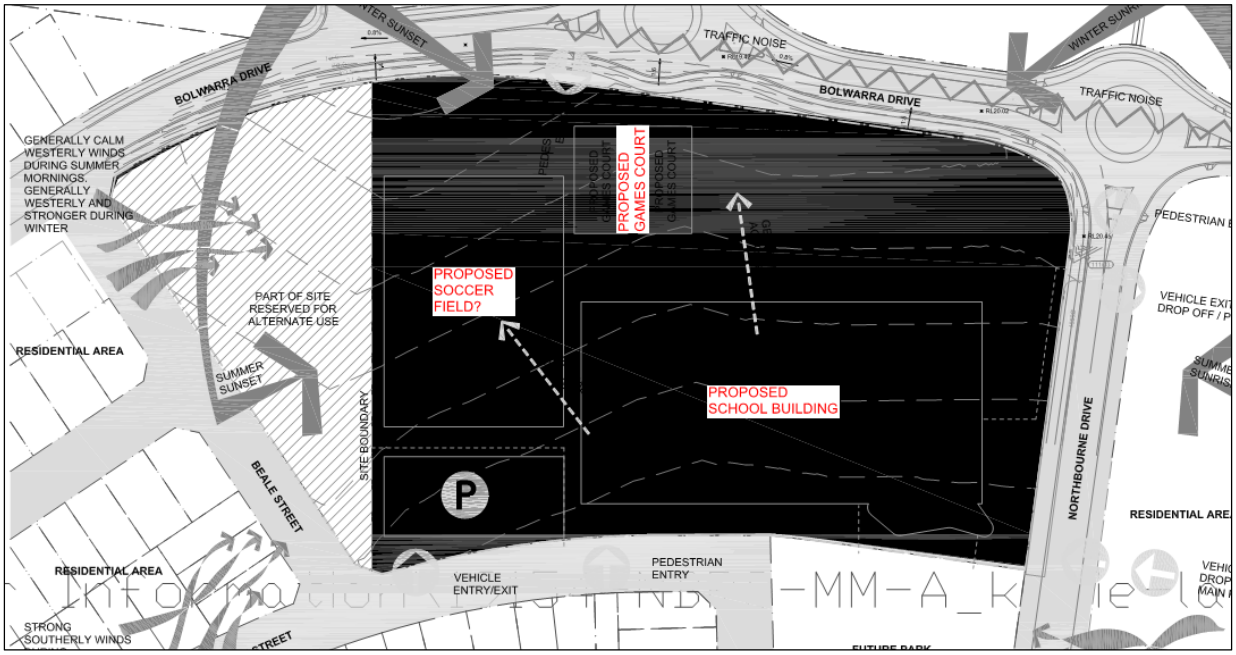

Figure 3: Site Analysis Plan

Based on the draft geotechnical report from Douglas Partners (Project Number: 94522.01), the site is generally underlain by a deep layer of fill of up to 3.5m, under which lies a thin layer of natural clay and very low strength shale at depth of between 5.5m and 7.0m. The fill material is considered to be uncontrolled and it is suggested that all building loads be supported by piles founded on the shale bedrock to avoid potential differential settlement and differential movement across the building.

On this site, weathered shale is suggested to provide the following capacities:

- Allowable end bearing pressure: 1000kPa
- Allowable shaft adhesion: 100kPa

3. Feasibility Assessment

3.1 Preliminary pile design

The following drawings and documents are used in the preparation of this assessment:

- Marsden Park NBRS Preliminary Architectural drawings dated 190702 (plans, elevations and sections)
- Marsden Park_Geo_94522.01.R.001.Dft1, draft report received July 2019

Pile loading is determined by a simple area load takedown based on the architectural plans and the preliminary structural scheme as outline in section 2.1, plus the following assumptions:

- Roof SDL to comprise of 0.5kPa (1.0BMT steel sheeting, 0.05kPa for purlins, 0.12kPa for solar panels, 0.025kPa for services and 0.08kPa for a 10mm plasterboard ceiling plus a 20% overall tolerance)
- Roof LL of 0.25kPa
- Blanket loading of SDL 1kPa and LL3kPa on level 2
- Blanket loading of SDL 1kPa and LL 4kPa on level 1
- L1 slab on ground to be designed as suspended between piles, with internal ground beams

Based on the above loading assumptions, the load takedown on the larger 1000 diameter pile supporting L2 and L3 column loads in addition to the L1 slab is G=700kN and Q=240kN. The typical 300 diameter piles supporting L1 slab on ground are expected to sustain a loading of 80kN.

Based on the conditions at the Marsden Park site and suggested geotechnical parameters in the draft geotechnical report, the corresponding preliminary pile design is listed in Table 1 below:

Type	Pile Diameter (mm)	Socket Length into weathered shale (mm)	Approx. total pile length (mm)
Larger pile	900	1500	7500
Smaller pile	300	1500	7500

It is possible to reduce the pile diameter by increasing the socket length and vice-versa.

The pile design is based on the geotechnical report and bore hole data, which indicates an anticipated depth of approximately 6m to shale bedrock. This is to be confirmed onsite.

3.2 Assessment of L1 slab

The 150 thick L1 slab is checked as two-way reinforced and suspended between the 300 diameter piles at 2700 centres with SDL of 1kPa and LL of 4kPa. Reinforcement is SL82 top and bottom is found to be satisfactory for strength considerations. The long-term deflection of the slabs under service loads of 3mm is also acceptable.

As the proposed site on Marsden Park is underlain by a deep layer of uncontrolled fill, it is suggested to design the slab as suspended between piles to minimize cracking resulting from differential settlement of the slab.

3.3 Constructability Issues

As mentioned in the geotechnical report, care needs to be given in casting the L1 slab on ground as the effects of ground drying and swelling may impact the poured slab. It is recommended that a vapour barrier be placed between the slab and ground prior to the concrete pour.

4. Conclusion

It is feasible to construct the proposed Marsden Park Public School on the proposed site by using a simple concrete frame with driven piles founded in shale bedrock, underlying the fill/clay topsoil. It is noted from the geotechnical report that the fill layer on this site is relatively deep, which results the need for deep driven piles engaging bedrock.

Reactivity of the subsurface soil is mitigated in the design of the L1 slab by designing it to be suspended between piles.