Structural Engineering Design Report

Moriah College Stage 1 and 2

Queens Park Rd

Queens Park NSW 1355

SSDA
REPORT

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Ref: SY191961
Rev: 1
Date: 18.09.2019

STRUCTURAL ENGINEERING SSDA DESIGN REPORT

Activity Schedule

Date	Revision	Issue	Prepared By	Approved By
17.09.2019	1	For Information	C Furness	
18.09.2019	2	Issued for SSDA	C Furness	

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1. MORIAH COLLEGE STAGE 1 AND 2

1.1 General

This structural engineering report has been prepared by Northrop Consulting Engineers Pty Ltd (Northrop) accompanies an Environmental Impact Statement (EIS) in support of State Significant Development Application (SSD-10352) for new school buildings on the existing campus of Moriah College, Queens Park (the site). The site is legally described as 101 York Road, Queens Park/ Lot 22 DP 879582, 1 Queens Park Road, Queens Park/ Lot 1 DP 701512 and 3 Queens Park Road, Queens Park/ Lot 3 DP 701512.

The proposal seeks consent for:

- Staged demolition of existing buildings A, B, C, D, J, E and removal of demountable buildings S, D, Z.
- Staged construction of new school buildings.
- **Stage 1** - Construction of a part 3 and part 4 storey STEAM building containing:
    - science, technology, engineering, art and maths rooms
    - technology and applied science rooms
    - administration offices
    - canteen and cafe
    - independent learning centre (library)
    - meeting rooms and auditorium
    - enhanced pedestrian entry at Gate 3A off Baronga Ave
    - basement parking for staff, waste management and storage rooms
    - modified vehicular circulation internal to the site
    - Redesign of the York Road Gate 4 parking area to create improved circulation and on site staff parking
- **Stage 2** - Construction of a 3 storey Early Learning Centre (ELC) building and administration offices.
- Student population increase from 1680 students on the site to 1970 students across ELC, primary and high school.
- Modification to internal traffic and parking on the site.
- Active and passive landscape upgrades to the site.
- Removal of trees.

1.2 Referenced Documents

This Design Report has been prepared with reference to the following documentation:

- Architectural Plans provided by FJMT, dated 10.09.2019.

1.2.1 Accompanying Drawings

Document Number	Document Title	Date
DA-200	Lower Ground – Work in Progress	10/09/19
DA-201	Upper Ground – Work in Progress	10/09/19
DA-202	First Floor Plan – Works in Progress	10/09/19

DA-203	Second Floor Plan – Works in Progress	10/09/19
DA-204	Third Floor Plan – Works in Progress	10/09/19
DA-205	Roof Plan	10/09/19

- Geotechnical report prepared by Douglas Partners Report No 86890.00 dated August 2019

1.3 Site conditions

1.3.1 Geotechnical

A geotechnical investigation has been completed by Douglas Partners in 2019. The investigation found relatively uniform conditions across the site with the bore and test pits generally finding shallow fill over sands increasing with density with depth. The sands extended for the full depth of the investigation.

Ground water monitoring was undertaken in 2 boreholes and measured ground water at depths of 6.55 and 8.0m which correspond to RL 41 and 41.3 respectively.

We recommend additional geotechnical investigation to be undertaken as part of the future detailed design phase to confirm these findings and recommendations.

1.4 Regulatory

1.4.1 National Construction Code

Northrop's engineering designs for this project will be prepared in accordance with the 2019 National Construction Code (NCC), in particular, NCC 2019 Volume One (The Building Code of Australia, Class 2 to Class 9 Buildings). With respect to the NCC, we understand the building classifications for this project are:

Building Area	NCC Classification
Teaching	Class 9b & 5

The effective height of the building is less than 25 metres.

1.4.2 Design Codes and Standards

Structural engineering services will be generally designed and developed in accordance with (but are not limited to) the following standards:

Standard	Description
NCC	National Construction Code of Australia
AS1170 Parts 0, 1, 2, 4	Structural Design Actions
AS2159	Piling – Design and Installation
AS3600	Concrete Structures
AS4100	Steel Structures
AS3700	Masonry Structures

1.5 Loading

The design is based on the following loading parameters.

1.5.1 Dead Loads

Material	Loading
Reinforced concrete generally	24kN/m³
Water (in Storage Tanks)	9.8kN/m³
Masonry (concrete block)	22kN/m³
Masonry (brick)	19kN/m³
Soil (in planters)	20kN/m³
Glazed panels (windows, doors)	30kN/m³
Structural Steel	77kN/m³
Timber	10kN/m³. minimum
Tiling and grout	To be determined but not less than 0.75kPa
Ceilings and miscellaneous dead load	0.25kPa minimum
Services Ducts, Lighting etc.	0.25kPa minimum
Lightweight Partitions	1.0kPa

1.5.2 Imposed loads

Use	Live Load	Superimposed Dead
Learning areas – General	3.0kPa	1.5kPa
Office	3.0kPa	1.5kPa
Corridors, hallways, lobbies	5.0kPa	1.5kPa
Library	5.0kPa	1.5kPa
Roof – non trafficable	0.25kPa	0.5kPa
Plant	5.0kPa	1.5kPa

Pattern live load is to be considered for both strength and deflection in accordance with the relevant Australian Standards.

1.5.3 Wind Loads

Criteria	Value
Location	Sydney
Region	A
Importance Level	3
Design Event for Safety (ULS)	1:500
Design Event for Serviceability	1:20
V_{1000}	45m/s
V_{20}	37m/s
M_s	1.0
M_t	1.0
Terrain Category	TC3
Design Wind Speed	38m/s

1.5.4 Earthquake loads

Criteria	Value
Location	Sydney NSW
BCA Importance Level	3
Design Event for Safety (ULS)	1:500
Probability Factor, K_p	1.0
Hazard Factor, Z	0.08
Subsoil	Deep soils
Site Subsoil Class	De
Earthquake Design Category	EDC II

1.5.5 Deflect Criteria

Element	Acceptance Criteria	Limit
Overall Building	Lateral deflection due serviceability to wind loads	Height/500
	Inter storey drift due to serviceability wind loading	Height/500
	Inter storey drift due to seismic loading	Height/100 Under Ultimate Load

Floor Elements Generally	Total Deflection	Span/300* Cantilevers Span/150*
Floor elements with masonry or brittle partitions	Incremental Deflection	Span/500* Cantilevers Span/250*
Transfer Elements	Incremental Deflection	Span/750**

* Limited to 25mm

**Limited to 15mm

1.5.6 Deisgn Life

The building has been designed and detailed for a minimum design life of 50 years.

1.5.7 Fire Design

Type A construction is required under the NCA. Typically the FRL for the concrete elements is 120/120/120.

1.5.8 Column Stiffness

The maximum allowable bending moments to be transferred into the columns is 20% of the gross column stiffness.

1.5.9 Shrinkage Crack Control

The floor slabs to the structure are to be designed for a “Moderate Degree of Crack Control” in accordance with AS3600. External balconies and roof slabs are to be designed for a “Strong Degree of Crack Control in accordance with AS3600.

1.6 Structural Framework

The Moriah College project will comprise of the structural system outlined below.

1.6.1 Foundations

All columns and walls are proposed to be supported by pile foundations which are founded in dense to very dense sand. These sands are generally encountered at 5-10m in depth. Due to the nature of the sands continuous flight auger (CFA) grouted piles will be required.

1.6.2 Lower Ground Floor

The lower ground floor slab is proposed to be 150mm thick slab supported on a prepared (compacted) sub base. The slab is to be adequately jointed to allow for movement and shrinkage. The joints are to be dowelled to prevent differential movements and potential trip hazards. The joints in the slab must be coordinated and reflected into brittle floor finishes and walls. Wet areas will be provided with a 50mm setdown.

1.6.3 Vertical Elements

All columns are reinforced concrete ranging in size from of 1000 x 300 for the, 500 dia, or 500SQ. The concrete strength of the columns ranges from 65MPa at the lower ground decreasing to 40MPa for the upper levels. The columns are typically positioned to allow future changes to the teaching spaces.

Lift and fire stair walls are typically 200mm thick reinforced concrete and designed to take the lateral earthquake and wind loads.

1.6.4 Suspended floors – Upper Ground, Level 1, 2, and 3

Post tensioned slabs and beams have been adopted for the upper level slabs. Post tensioning allows spans to be maximized while minimizing structural depths. Slabs are typically 200mm deep spanning between band beams. Band beams generally run in a east west direction and are typically 600mm deep by 2400mm wide.

1.6.5 Lateral Stability

Stability for lateral loading is achieved by utilisation of the lift and stair cores.

1.6.6 Roof Framing

A post tensioned concrete roof is proposed. The roof slab is a slab and beam structure with a similar configuration as the typical levels. The is to be designed with a residual stress from the post tensioning of 2.0MPa and is to be cast with falls to drainage outlets. Waterproofing for the roof is to be provided by an applied membrane.