New Public School in Googong

Gorman Drive, Googong NSW 2620

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Structural Schematic Design Report

Revision Schedule

Date	Revision	Issue	Prepared By	Approved By
07.05.21	A	Draft	J. Yu	J. Low
17.05.21	B	Schematic Design	J. Yu	J. Low
27.05.21	C	Schematic Design	J. Yu	J. Low

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1. Introduction

This Structural Schematic Design Report accompanies an Environmental Impact Statement (EIS) pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act) in support of an application for a State Significant Development (SSD-10326042).

The development is for a new primary school located on land bound by Gorman Drive, Aprasia Avenue, Wilkins Way and McPhail Way in Googong.

This report addresses the relevant Secretary's Environmental Assessment Requirements (SEARs), namely:

- Structural Report

1.1 The Proposal

The proposed development is for construction and operation of a new primary school in Googong that will accommodate up to 700 students.

The proposed development is a Core 35 school and includes:

- A collection of 1-2 storey buildings containing 30 home base units, 3 special education learning units, canteen, hall, library and administrative facilities.
- On-site carpark with 60 spaces and on-street kiss-and-ride facilities.
- Outdoor sports court and play area.
- Integrated landscaping, fencing and signage.

1.2 The Site

The site is located in the township of Googong NSW. The site is bound by Wilkins Way to the north east and east, Gorman Drive to the south and McPhail Way to the West and north west. The schools address will be on Gorman Drive.

The site is within a residential area.

Figure 1 – Draft SSDA site plan by Pedavoli Architects

2. Design Criteria

In this section we will outline the required design life, design parameters and loading criteria.

2.1 Design Life

The design life is nominated as follows:

- Structural elements including sub-structures 50 years
- Floor structures 50 years
- Roof structures 50 years
- Internal structural walls 50 years

2.2 Design Loads

The building will be designed with the loads determined from AS/NZS1170 parts 0 to 4 Structural Design Actions and the National Construction Code (NCC:2019) and the Department of Education *Educational Facilities Standards and Guidelines* (EFSG). The design loads are as follows:

2.2.1 Permanent Actions – Dead Load (DL)

Self-weight of the structure is considered Dead Load.

2.2.2 Permanent Actions – Superimposed Dead Loads (SDL)

Superimposed Dead Loads shall be considered for services, insulation, toppings, finishes, partitions and ceilings. As a minimum, the following SDL shall be considered in the design:

Area	Minimum SDL (kPa)
General Learning Spaces / Office / Libary	1.5kPa
Workshops / Plantrooms	2.2kPa
Balconies / Terraces / Walkways	2.0kPa
Lightweight roof areas	0.5kPa

2.2.3 Imposed Loads – Live Loads (LL)

Imposed loads on floor plates are to be compliant with AS/NZS1170.1. The building design is in development; however, we envisage the following uses and load requirements:

Area	Uniformly Distributed Load (UDL)	Concentrated Point Loads
Car park <2,500kg GVM	2.5kPa	13kN
General Learning Spaces	3.0kPa	2.7kPa
Office Areas	3.0kPa	2.7kPa
Auditorium/Hall	5.0kPa	4.5kN

Corridors / Stairs	4.0kPa	4.5kN
Plantrooms / Plant platforms	5.0kPa	4.5kN
Light weight roofs (non-trafficable)	0.25kPa	1.4kN
Balconies / Terraces	4.0kPa	1.8kN
Library / Bulk Stores	7.5kPa	4.5kN

2.2.4 Pattern Loading

Pattern loading shall be considered in accordance with AS/NZS1170.1.

2.2.5 Wind Loads

Wind loads shall be determined in accordance with AS/NZS1170.2 using the following site criteria:

Region:	A3
Importance Level (BCA Table B1.2a):	3
Annual Probability of Exceedance (BCA Table B1.2b):	1:1000 (ultimate)
	1:25 (serviceability)
Regional Wind Speed:	V_{1000} = 46m/s
	V_{25} = 37m/s
Terrain Category:	2.5

2.2.6 Snow Loads

Snow loads shall be determined in accordance with AS/NZ1170.3

Elevation:	750m
Importance Level (BCA Table B1.2a):	3
Annual Probability of Exceedance (BCA Table B1.2b):	1:200 (ultimate)
Probability Factor (k_p):	1.6

2.2.7 Earthquake Loads

Earthquake loads shall be in accordance with AS1170.4 using the following site criteria:

Hazard Factor (Z)	0.09
Site Sub-Soil Class:	(TBC)
Importance Level (BCA Table B1.2a):	3
Annual Probability of Exceedance (BCA Table B1.2b):	1:1000 (ultimate)
Probability Factor (k_p):	1.3
Earthquake Design Category:	II

2.3 Design Standards

The structural design will be in accordance with the latest revision of all relevant Australia Design Standards, Codes and other statutory requirements. The design shall be based on, but not limited to:

Reference	Edition	Title
AS/NZS1170.0	2002	Structural Design Actions Part 0: General Principles
AS/NZS1170.1	2002	Structural Design Actions Part 1: Permanent, imposed and other Actions
AS/NZS1170.2	2011	Structural Design Actions Part 2: Wind Actions
AS/NZS1170.3	2003	Structural Design Actions Part 3: Snow and Ice Actions
AS1170.4	2007	Structural Design Actions Part 4: Earthquake Actions
AS1720	2010	Timber Structures
AS3600	2018	Concrete Structures
AS3700	2018	Masonry Structures
AS4100	2020	Steel Structures
AS2159	2009	Piling – Design and Installation
EFSG	2021	Educational Facilities Standards and Guidelines

3. Serviceability

3.1 Deflection Limits

Deflection limits for the concrete and steel floors are generally as follows. These limits are to be reviewed as the design progresses:

Floor Type	Maximum Floor Deflection Limts			
	Dead Load (DL)	Incremental	Live Load (LL)	DL + LL
Floors supporting masonry walls	Span/360	Span/1000 Note 1	Span/500	Span/300 (25mm max.)
Compactus areas	NA	Span/750 Note 2	NA	25mm max.
General floor areas	Span/360 (20mm max.)	NA	Span/500	Span/300 (25mm max.)

Note 1 Areas supporting normal weight masonry partitions.
Note 2 Incremental deflection after compactus installed.

Deflection limits for the steel roof rafters are generally as follows. These limits are to be reviewed as the design progresses.

Roof Type	Maximum Roof Member Deflection Limts			
	Dead Load (DL)	Incremental	Live Load (LL)	DL + LL
General without ceilings. Roof pitch > 3	Span/360	Span/250 Note 1	Span/500	Span/150
General with ceilings. Roof pitch > 3	Span/500 Note 1	Span/250 Note 2	Span/150	Span/150
Commercial. Lightweight ceiling. Roof pitch > 3	Span/360 (25mm max.)	Span/300 Note 2	Span/250	Span/250
Commercial. Lightweight ceiling. Roof pitch < 3	Span/500 Note1 (25mm max.)	Span/300 Note 2	Span/250	Span/250
Commercial. Plasterboard and Acoustic ceiling treatments	Span/500 Note1 (25mm max.)	Span/600 Note 2	Span/600	

Note 1 Deflection Limits may require adjustment to prevent ponding of water and to ensure minimum roof slope achieved.
Note 2 Deflection Limit may require adjustment if gantry crane is present in workshop areas

3.2 Crack Control

Crack propagation in concrete elements due to shrinkage and temperature effects will be controlled by providing reinforcement quantities for a ‘strong degree of crack control’ where slabs or soffits are exposed, in accordance with Clause 12.7 of AS3600:2018-Concrete Structures. Other areas of the slab are to be designed for a ‘moderate degree of crack control’.

3.3 Fire Resistance Levels for Structural Elements

Fire resistance levels for structural elements will be in accordance with the structural requirements of the BCA and will be developed with the project BCA consultant. Design of individual structural elements to achieve the required FRL will be in accordance with the appropriate materials design code.

4. Site Conditions

4.1 Geotechnical Conditions

A site specific geotechnical investigation has been carried out by Douglas Partners and a report has been produced (refer 203634.00.R.001.Rev0).

In summary, the ground conditions at the subject site are typically:

Unit	Depth to top of Unit	Description
1.	0m	**TOPSOIL FILL**: Generally low plasticity, soft, moist, silty sandy Clay with a various mixture of sand and gravel.
2.	0.1m – 0.3m	**FILL**: Generally low to medium plasticity, stiff to hard, moist to dry, silty/silty sandy Clay.
3.	0.3m – 0.4m	**CLAYEY SAND & SILTY CLAY**: Generally medium dense to dense, dry to moist, clayey Sand and low to medium plasticity, hard, dry to moist, silty Clay with various mixture of gravel.
4.	0.3m – 1.4m	**DACITE**: Variably extremely low, extremely weathered dacite becoming low to medium strength, highly to moderately weathered with depth.

4.2 Site topography

A detailed survey of the site topography has been carried out by Steger & Associates (refer 20011_001_RevB) . The site generally has a ridge line running from the centre of the site across to the south east. The site falls from this ridge to the north and south west corner.

4.3 Retaining Walls

It is expected that some low-level retaining walls will be required around the footprint of the volumetric buildings to account for the falls across the site. Further detail on these walls will be developed as the civil earthworks design is developed.

4.4 Foundations

the buildings will be found on high level (pad and strip) footings bearing on a minimum 150kPa allowable bearing pressure material.

5. Structural Systems

The proposed structural system is described below:

Building	Description
Block A (Admin/Homebases)	Combination of site build (Admin) and volumetric offsite construction (Homebases). The volumetric solution will be an adaption of the module utilised at Catherine Field Public School. **Foundations**: Pad and strip footings. **Ground floor slab**: Reinforced concrete raft.
Block B (Library/SELU/Homebases)	Site build using reinforced concrete construction. **Foundations**: Pad and strip footings. **Ground floor slab**: Reinforced concrete raft. **Suspended floor:** Reinforced concrete. **Wall & Roof:** Steel framed
Block C (Homebases)	Volumetric offsite construction. The volumetric solution will be an adaption of the module utilised at Catherine Field Public School. **Foundations**: Pad and strip footings.
Block D (Hall/COLA/Canteen)	Site build using offsite prefabricated steel frames. Investigate the use of precast or masonry walling. TBC once architectural elevations are produced. **Foundations**: Pad and strip footings. **Ground floor slab**: Reinforced concrete raft. **Wall & Roof:** Structural steel framed
Walkways	Site build using RC. Investigate the use of kit-of parts approach. To be reviewed as architectural design is developed. **Foundations**: Pad footings.
Lift	Precast concrete shaft **Foundations**: Concrete base on screw piles or pad footing.
Stairs	Site build using RC. Investigate the use of a volumetric or kit-of-parts approach. To be reviewed as architectural design is developed. **Foundations**: Pad footings.

6. Structural Grid

The structural grid is driven by the spatial planning and room layout of the buildings. Some governing principles should be adopted by the architect when developing the concept design which are to have a regular repetitive spacing and eliminating structural transfer.

6.1 Regular Spacing

A regular spacing of grid has several benefits including:

- Simplicity of construction
- Flexibility to adapt the space (future proofing)
- Repeatability in construction elements (façade, wall panels, etc.)
- Opportunity to modularise building elements

Section 8 of this report discusses potential construction techniques and the optimum grid spacing in terms of structural efficiency.

6.2 Eliminate Transfer

Where possible, transfer (misalignment of load-bearing structure) should be avoided. Transfer structure is expensive and leads to larger structural depths. It also limits the future adaptability of the space, as transfer beams are highly sensitive to loading.