BONACCI

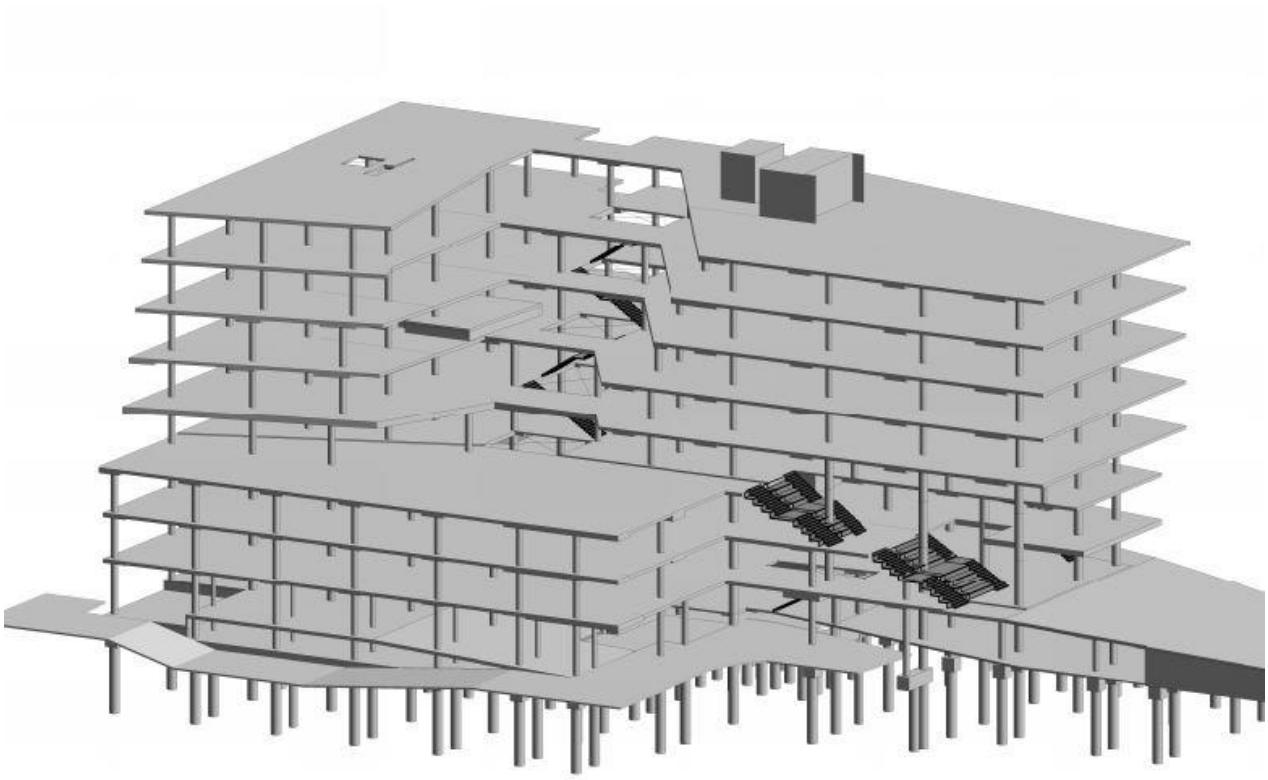
The University of Sydney

Health Precinct Stage 1

Structural Design Report

Prepared for The University of Sydney

THE UNIVERSITY OF SYDNEY



Report Amendment Register

Rev. No.	Page No.	Issue/Amendment	Author/Initials		Reviewer/Initials		Date
1	9	Structural Design	Ben Ip	B.I	John Williams	J.W	26/06/17
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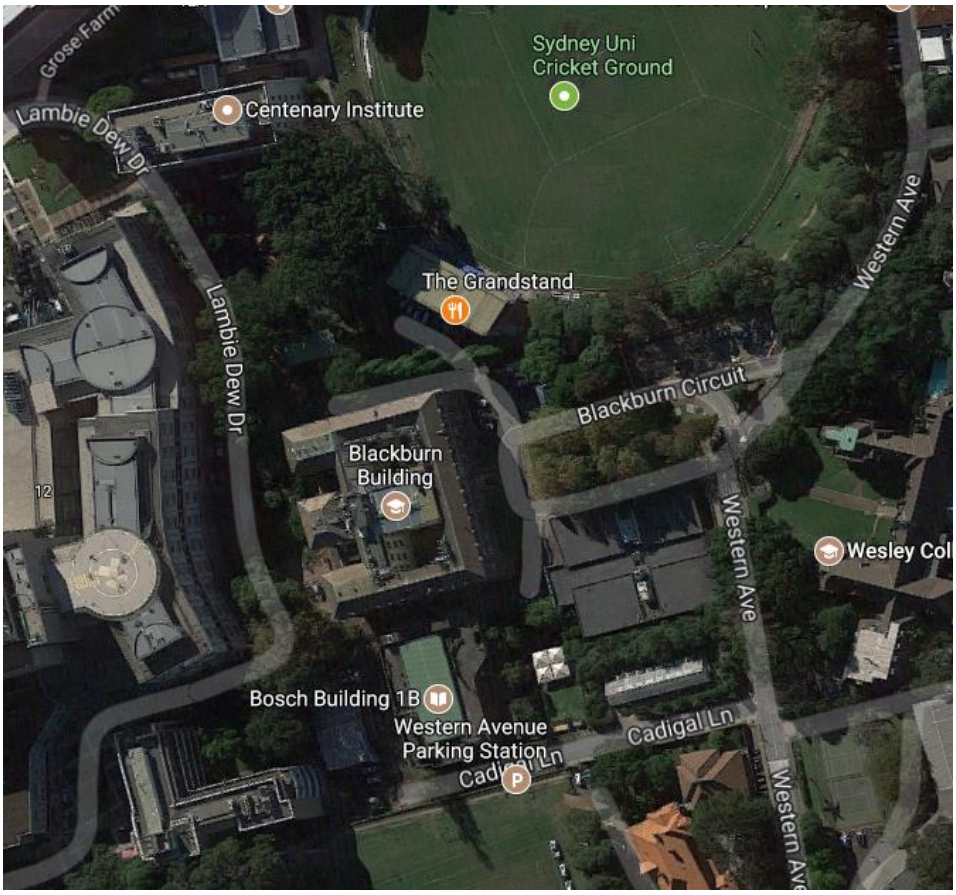
1. EXISTING CONDITIONS

1.1. Existing Building

- The proposed redevelopment of the Blackburn building is located within the Health Precinct of the University of Sydney –Camperdown Campus, which is at the western part of the campus. The existing Blackburn Building is a 5-storey building with an approximate floor plate area of 60x60m square.



1.2. Geotechnical Survey

Referring to the geotechnical investigation report (GEOTLCOV25283AF-AD Rev 1) carried out by Coffery, six boreholes around the existing Blackburn building were drilled to depth ranging from 10m to 12.5m. The site is generally underlain by fill, residual soil and shale bedrock. The ground surface of the site rises gradually in all directions away from the existing building. Below table shows a summary of the geotechnical conditions encountered in the borehole).

Unit	Material	Description	Depth of Top of Unit (m)
1	Fill	50mm thick Asphalt	Surface
2	Residual Soil	Clay	0.7 to 2.2
3	Bedrock	Class V/IV shale	4 to 6.0
4	Bedrock	Class III Shale	6.0 to 8.9

Information extracted from Geotechnical Report

1.3. Existing Structures

- RPA Hospital is located to the west,
- No.1 Oval to the north,
- Bosch building to the south,
- Blackburn circuit to the east,
- A single storey Dangerous good store (About 25m2) is located near the north eastern corner of the Blackburn building,

2. PROPOSED DEVELOPMENT

2.1. General Description

The proposed development comprises the construction of a new 8-storey building with potentially basement levels up to about 6m below existing ground. The generally floor plate area is approximately 70x70 m square.

2.2. Geotechnical Conditions

As recommended by the geotechnical engineer, the proposed building should be founded on Unit 4 shale, in order to reduce the risk of differential settlement and deterioration of Unit 3 shale due of exposure during construction.

Parameters used for the preliminary design of the foundations were recommended in the geotechnical report as below:

Unit 2 - Allowable End Bearing Pressure of residual soil	– N/A
Unit 3 - Allowable End Bearing Pressure of Class VI/ V shale	– 700 kPa
Unit 4 - Allowable End Bearing Pressure of Class III shale	– 3000 kPa

Work example of the ultimate capacity of a 1.2m Diameter Pile with 5m rock socket:

Pile Dia. (m)	Socket Length (m)	Ultimate End Bearing (MPa)	Ultimate Shaft Adesion (kPa)	ϕg	Factored Ultimate end Bearing Capacity (kN)	Factored Ultimate Adhesion Capacity (kN) per 2m
1.2	5	20	500	0.4	9000	3700

2.2.1. Sub-ground structures

Lateral support system will be required for all vertical excavation in units 1, 2 and 3. It is recommended that internal bracing system or ground anchors to be provided to ensure the lateral stability of the excavation and lateral support system.

2.2.2. Superstructure

The superstructure is to be a braced frame with columns placed generally to 8.1, 8.4m and 9.6m spaced grid. Lateral resistance is to be provided by stair walls and the lift shaft located within the building.

2.2.3. Floor Systems

We have provided a few feasible options for comparison, in which the post-tensioned one-way slab on band beams option is considered as the most economical solution at this stage. Footfall induced vibration will also be considered to ensure the slab satisfies serviceability limits.

3. DESIGN CRITERIA

3.1. BCA Classification

- Type of Construction: A

- Classes of Building:

  - Class 5 Office Building
  - Class 6 Café
  - Class 7a Car Park
  - Class 8 a laboratory
  - Class 9 a building of a public nature
  - Class 9b laboratory or the like in a primary or secondary school

Building Matrix		
Levels	**BCA Class**	**Use**
Level 0	9b Public Building 7a Car parking	Labs, learning spaces, Entry / reception, Car parking, ancillary plant and delivery area.
Level 1	9b Public Building	Labs, library collections, learning spaces, lecture theatres, Entry foyer, ancillary plant.
Level 2	9b Public Building	Labs, library collections, learning spaces, lecture theatres, circulation space, ancillary plant.
Level 3	9b Public Building 5 Offices	Labs, research areas, Offices / meeting
Level 4	9b Public Building 5 Offices	Teaching and learning spaces, Offices
Level 5	9b Public Building 5 Offices	Teaching and learning spaces, Offices
Level 6	9b Public Building 5 Offices	Teaching and learning spaces, Offices, ancillary plant.
Level 7	9b Public Building	Future Laboratory Use, Teaching and Learning Space
Rooftop	9b Public building	Student use (possibly)

3.2. Design Codes

The structural design of the project will be carried out in accordance with the following Australian Standard Codes of Practice.

- Building Code of Australia
- AS1170 Part 0 General Principles
- AS1170 Part 1 Permanent imposed and other actions
- AS1170 Part 2 Wind actions
- AS1170 Part 4 Earthquake Actions in Australia
- AS3600 Concrete Structures
- AS3700 Masonry Structures
- AS4100 Steel Structures Code
- AS4600 Cold-formed Steel Structures

3.3. Design Loads

Table 1: Floor Loads

Floor Type	Uniform Imposed Load (kPa)	Super Imposed Dead Load (kPa)
Stairs, ramps	4.0	0.75
Corridors, circulation areas and foyer spaces	5.0	1.5
Offices, lecture spaces	4.0	0.75
Plant rooms	5.0	0.75
Construction Loading	T.B.C	-
Library	5.0	1.5
Compactus	10.0	1.5
Truck Dock	10.0	0.25
Carpark	2.5	0.25
Store Rooms	5	0.25
Staff Areas, design studio	4.0	1.5
Steel Roof	0.25	0.5

3.4. Wind Loads

Wind Load will be assessed in accordance with AS1170 Part 2, using following parameters:

Item	Value
Location	Region A2
Importance Level	3
Vu	46m/s
Vs	37m/s
Ms	1.0
Mt	1.0
Md	1.0
Terrain Category	3.0

3.5. Earthquake Loads

Earthquake loads will be assessed in accordance with AS1170.4-2007, and the design parameters are as follow:

Item	Value
Importance Level	3
Probability Factor, Kp	1.3
Hazard Factor, Z	0.08
Sub-Soil Class	Ce
Earthquake Design Category	ii
Structural Ductility Factor, μ	3*
Structural Performance Factor, Sp	0.67

**This assumes that ductile shear walls are to be utilised.*

3.6. Deflection Criteria

3.6.1. Vertical Deflection

- Incremental slab deflection less than span/500
- Total long-term deflection less than span/250
- Cantilever slab – Total long term deflection - span/150

3.6.2. Lateral Deflection

- Interstorey drift due to wind – Storey height/ 500 (serviceability)
- Interstorey drift due to earthquake actions – 1.5% storey height(serviceability)