BONACCI

Griffith Base Hospital Redevelopment

Structural SSDA Report

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Project Name: Griffith Base Hospital Redevelopment

BG Project No: 10616

Discipline: Structural

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Executive Summary

Structural Works

The proposed Griffith Base Hospital Redevelopment works include a new multi-storey concrete framed clinical services building. The main foundations have been designed as pad footings founded into highly weathered rock. The structural grid of the main building is 8.4m where possible in accordance with the Health Infrastructure (HI) guidelines.

The floors slabs are proposed to be post tensioned band beams. The floors have been designed to accommodate all the design requirements in the HI guidelines with respect to vibration performance and future flexibility (creation of set downs and additional risers adjacent to columns). No future vertical expansion has been allowed for in the design however horizontal expansion has been considered north of medical imaging and west of the lower ground floor administration area.

Lateral stability is to be (primarily) provided by lift and stair cores with a focus on minimising shear walls within the floor plate to allow future flexibility. The structure has been designed as having an Importance Level of 4 for the determination of design return periods. Three structural concepts have been considered including; flat plate, flat slab and banded slab. The banded slab option has been chosen as the most economical system for construction in Griffith.

Existing Conditions

Location

Griffith Base Hospital is located at 1 Noorebar Ave, Griffith NSW 2680. Warrambool Street, Noorebar and Animoo avenues encircle the hospital which is next to St. Vincent's Community Private Hospital.

Figure 1 – Aerial view of the existing Griffith Base Hospital site.

Geotechnical

Geology

A geotechnical survey has been carried out on site by JK Geotechnics - REF 30991L2rpt dated 15 November 2019. The report recommends that wherever possible excavation depths be limited due to the high strength of rock encountered at relatively shallow depths across the site. The report also outlines a maximum allowable bearing pressure of rock to be 1000 kPa with a 150 kPa allowable bearing pressure for the stiff clays above it. Given the shallow depths of rock on site, pad footings have been designed. Where rock is located greater than 1.0m below ground level, bored piers may be an alternative option.

Proposed Development

The proposed new development, includes the following;

- New three storey concrete framed structure, known as the Clinical Services Building
- Demolition of various existing buildings in north corner of site requiring services diversion
- Construction of new roads and carparks.

Structural Works

Demolition/ Staging

The proposed development involves the demolition of a number of existing buildings throughout the hospital. The hospital is required to remain operational during construction, as such, the building works will be staged with various departments relocating temporarily.

Clinical Services Building

Foundations

The foundations have been designed as pad footings founded on high strength bedrock. The following design parameters have been provided in the geotechnical report;

- Maximum allowable bearing pressure 1000kPa for footings founded in sandstone
- Maximum allowable bearing pressure 150kPa for shallow pad/strip footings founded on very stiff clay

Lower Ground Floor

The Lower Ground Floor will require a partial retention system. Reinforced blockwalls have been designed as retaining walls around the eastern portion of the floor.

Superstructure

The superstructure is to be a braced frame with columns placed on an 8.4m x 8.4m grid in accordance with the HI Design Guidelines. Lateral resistance is to be provided by in situ shear walls as well as stair cores and lift cores.

Floor Systems

A number of suspended floor systems have been investigated, including; flat plate, flat slab and banded slab. The banded slab has been selected as the preferred option for cost reasons. Typical slab and beam thicknesses are listed below. These thicknesses can be further rationalised during detailed design.

DESIGN PARAMETERS	STRUCTURAL SYSTEM	
RF = 2	BANDED SLAB	240mm thick slab (end bays) 240mm thick slab (int. bays) 2200W x 400D internal beams 1100W x 400D edge beams
RF = 1	BANDED SLAB	260mm thick slab (end bays) 260mm thick slab (int. bays) 2200W x 450D internal beams 1100W x 450D edge beams

Table 1 – Floor system summary

Spandrel Panels

The building is to be sprinklered, therefore spandrel panels which comply with Clause C2.6 of the NCC will not be required in the façade.

Roof

The roof of the Clinical Services Building is a banded post tensioned slab with membrane, with a similar beam configuration to the lower levels. At level 1 there are several steel framed roofs. Steel framing for these roofs will consist of conventional steel beams and purlins. The plant room structures on the roof top consist of conventional braced steel frames. Where the roof is required to support plant loads or point loads from pendants or similar, post tensioned concrete floors have typically been designed.

Future Flexibility

The floor slabs are to be provided with a 40mm sacrificial cover zone as per the HI Design Guidelines. Structural details are shown below in Figure 3.1-3.3. The reinforcement and post tensioning tendons are set down sufficiently so that they maintain the minimum cover when the 40mm sacrificial topping has been removed. This is in accordance with HI Design Guidelines.

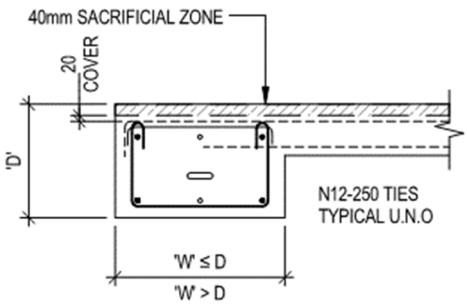

Figure 3.1 – Typical edge beam detail with sacrificial topping.

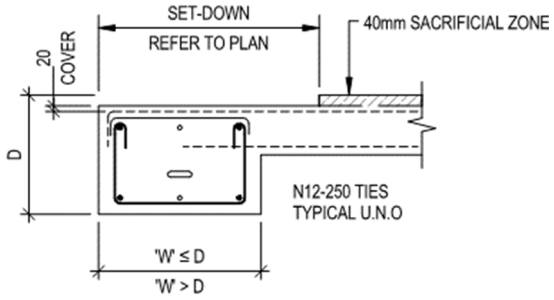

Figure 3.2 – Typical edge beam detail at set-down.

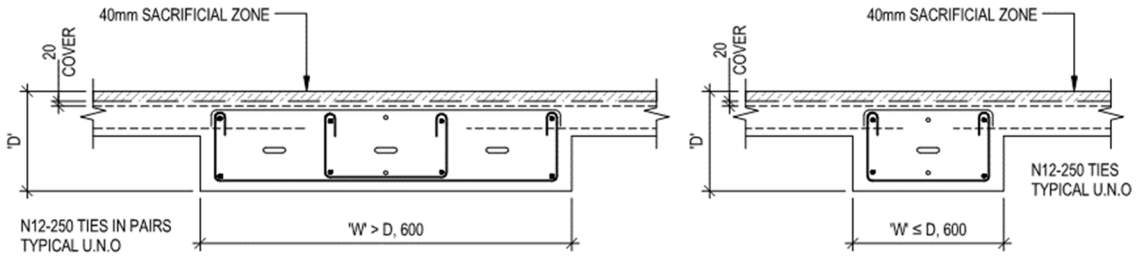

Figure 3.3 – Typical internal beam detail with sacrificial topping.

Allowance for additional service risers at each internal column is to be made in the design in accordance with HI Design Guidelines. This will require the reinforcement at the column lines to be displaced so that penetrations can be cut in the future and not require any associated strengthening works to the slab. Refer Figure 3.4 and Figure 3.5.

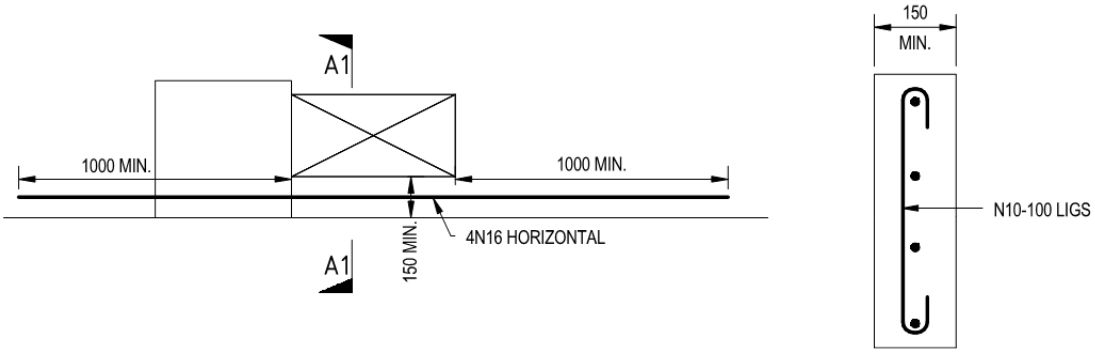

Figure 3.4 – Allowance for future service riser zone adjacent to column.

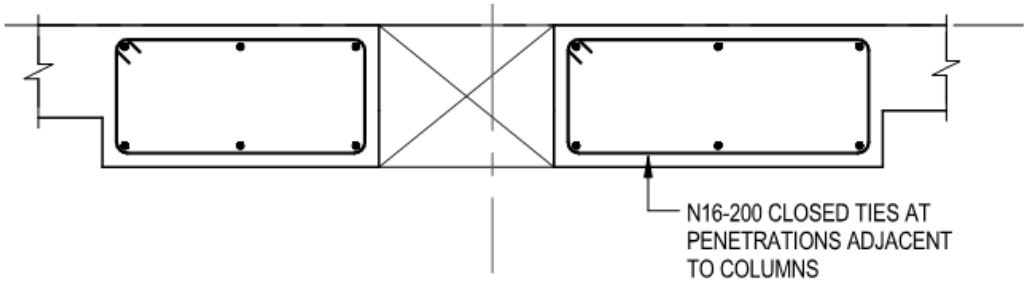

Figure 3.5 - Allowance for future service riser zone adjacent to column – Alternative detail.

Performance Parameters

Importance Factor

As the building is to accommodate medical emergency and surgical facilities, it has Importance Level 4 and is to be designed in accordance with NCC 2019 and the relevant Australian Codes & Standards. The structure is also to remain serviceable following an Importance Level 2 earthquake.

Design Loads

Table 3: Floor & Roof Loads

Floor Type	Uniform Imposed Load (kPa)	Imposed Point Load (kN)	Superimposed Dead Load (kPa)	40mm Sacrificial Topping (kPa)
Stairs, ramps	4.0	4.5	0.0	0.0
Corridors, circulation areas and foyer spaces	5.0	4.5	1.3	1.0
Wards typically	2.0	1.8	1.8	1.0
Clinical areas	3.0	4.5	1.8	1.0
Plant rooms	7.5	4.5	2.4	0.0
Roof typically	0.25	1.4	0.75	0.0
Shell space future expansion	4.0	4.5	3.0	0.0

Table 4: Wind Load Parameters

Item	Value
Location	Region A1
Importance Level	4
V_u	48m/s
V_s	37m/s
M_s	1.0
M_t	1.0
M_d	1.0
Terrain Category	3

Table 5: Earthquake Load Parameters

Item	Value
Importance Level	4
Probability Factor, K_p	1.5
Hazard Factor, Z	0.07
Earthquake Design Category	III
Structural Ductility Factor, μ	2
Structural Performance Factor, S_p	0.77

Floor Vibration

Footfall response will be calculated using the Concrete Centre Design Guide. The response will also be checked against the recommendations made within and Murray, Allen and Ungar in the AISC, 2003. The footfall frequencies and corresponding response factors defined within the NSW Health Design Guidance Note No. 1 (refer Table 4.3) will be checked for compliance with the Concrete Centre Design Guide.

Preliminary analysis has indicated 260mm slabs and 450mm deep band beams will be required in medical imaging zones based on the current proposed layout. The current response factors are shown in Table 5 below. As stipulated in the HI Design Guidelines, the response factor for a particular slab zone is required for the slab directly above and below.

Table 6: Footfall Response Factor Design Parameters – Concrete Centre Method

Facility/Equipment/Use	Design Response Factor	Footfall Frequency (Hz)
Generally procedure rooms, laboratories and general surgery	2	2.2
Corridors, circulation spaces, offices and other non-vibration sensitive areas	4	2.2
Imaging Suite and operating theatres	1	1.8
Plant areas	N/A	N/A
Roof areas	N/A	N/A

Fire Rating

Table 7: Health Infrastructure Design Guidelines

Building Element	FRL (Type 9a)
External Walls (Load Bearing)	120/60/30
External Columns	120/-/-
Load Bearing Fire Walls	120/120/120
Shafts (Non-load Bearing)	-/-/-
Other Load Bearing Walls, Beams, Trusses, Columns	120/-/-
Floors	120/120/120
Steel Framed and Metal Sheeted Roofs Not Providing Fire Separating Function	No FRL*
Steel Columns Supporting Steel Framed and Metal Sheeted Roofs Not Providing Fire Separating Function	120/-/- (TBC)

**This concession is gained as the building is to be fully sprinklered*

Durability

For concrete elements this will be achieved by specifying all elements in accordance with Section 4 of AS 3600 which sets out requirements for reinforced and post tensioned concrete structures with a design life of 40 to 60 years. Exposure classifications are as follows:
Columns – A2
Suspended slabs – A2

Protective coatings to structural steel elements shall comply with AS/NZS 2312 and ISO 2063 for the long-term protection category. Refer to architectural specifications for specialised paint systems. Where no architectural paint system has been nominated any external steel shall be hot dip galvanised.