Lismore Base Hospital Carpark

Structural Application Report

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Health Infrastructure

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Document Control

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1 Executive Summary

1.1 General Conditions

The proposed Lismore Base Hospital Car Park site is located to the south of the main Hospital campus and between Uralba and Dalziell Street. The proposed site falls approximately 14.0 metres from north to south. The existing site contains five cottages that are to be demolished and a section of vacant land. A multi-storey split level car park consisting of approximately 520 car spaces over five to six levels is proposed. It is proposed to construct the car park over two stages.

1.2 Geotechnical Conditions

Douglas Partners are preparing a geotechnical investigation and report on the proposed site and have provided the following summary of ground conditions encountered at the main Hospital campus across Uralba Street:

- Shallow filling and stiff gravelly residual soil to 045m depth
- Silt and/or sandy clays between 1.0 m to 2.8 m deep.
- High to very high strength basalt to 13.9m depth upper basalt layer.
- Medium strength slightly fractured tephra and some high strength agglomerate in some bores.

The conditions at the lower end of the site near Dalziell Street are expected to consist of greater weathered rock profile with weaker strength.

Deep excavations in the basalt layer are expected to require shoring or stabilising.

1.3 Proposed Structural System

The key structural elements for the proposed car park are as follows:

Bulk excavation and Shoring

Deep excavations which require shoring or stabilizing as battering appears to not be feasible due to the proximity to the adjacent boundaries and the requirement for the on-grade car park in Stage 1.

Foundations

Foundations are proposed to be single or double large diameter bored piers founded in the higher strength Basalt layer. If any rock daylights at bulk level, high level pad foundations will be employed.

Structural Framing

The structural system will typically consist of a banded one way post tensioned concrete slab and supporting beam system spanning between concrete columns and stair/lift shaft walls.

Building Phasing

The proposed car park is to be constructed in two stages with Stage 1 being the lower southern end.

2 Geotechnical Conditions

2.1 Existing Ground Conditions

A geotechnical investigation by Douglas Partners (Report 80760.01 dated November 2014) has been performed and they have provided the following summary of the expected subsurface conditions.

- Shallow filling and stiff gravelly residual soil to 0.45m depth
- Silt or sandy clay between 1.0 m to 2.8 m deep
- High to very high strength basalt to 13.9m depth – upper Basalt layer
- Medium strength slightly fractured tephra and some high strength agglomerate in some bores

The conditions at the lower end of the site near Dalziell Street are expected to consist of greater weathered rock profile with weaker strength.

Deep excavations in the basalt layer are expected to require shoring, stabilising or permanent safe batters

2.2 Ground Contamination

A preliminary report on site contamination has been performed by Douglas partners (report 80760.00 dated November 2014). The report concluded there is a moderate potential for contamination at the site and recommended that underground services such as pipes, Telstra pits be assessed for the presence of ACM following building demolition and that a waste Classification be undertaken to assess soils prior to off site export.

3 Structural System

3.1 Substructure

3.1.1 Shoring Structures

The lower end of the site, Stage 1 car park will require shoring and/or stabilisation to the eastern and western boundaries. It is proposed that temporary IH:IV batters be employed boundary setback permitting and reinforced block walls built supported by the structure and/or free standing cantilever walls. A permanent undercroft batter is at Grid F.

3.1.2 Proposed Foundations

It is proposed that the foundations for the new car park structure be constructed through single or double concrete bored piers that bear onto the lower basalt strata (medium or stronger fractured

basalt). It is anticipated that the pier sizes will vary between 900mm to 1500mm diameter depending on the building loading.

During design development, alternative high level foundations will also be assessed based on the extremity/or strength basalt layer located in Stage 1 between RL 25.5 and RL 22.

3.2 Superstructure

3.3 Design Principles

The structure has been designed to maximise car spaces and provide access and manoeuvring in accordance with the relevant Australian Standards.

3.3.1 Design Criteria

- **Building Structural Loading**

The general load design principles to comply with AS1170.0 wind, AS1170.1, AS1170.2, AS1170.3 and AS1170.4. Design wind loading to satisfy the minimum provisions of AS1170.20. Design Seismic loading to satisfy the minimum provisions of AS1170.4.

- **Flooring Live Loading**

Design floor live loadings are to generally satisfy the minimum provisions of AS 1170.1 for dedicated car usage up to 2.5 tonne gross mass

Carpark 2.5kPa Uniformly Distributed Load (UDL)

13.0kN Concentrated Point Load

Stairs 4.0kPa UDL

4.5kN Concentrated Point Load

No Live load reductions are to be applied to any floor system elements

- **Occupant Perceptions of Motion**

Floor vibration design response to occupant activity is to generally comply with the recommendations of AS2670.

- **Floor Deflection Criteria**

Design floor deflection in the short and long term is to generally comply with the recommendations of AS3600, but total slab and beam long term deflection must not exceed 25mm in any superimposed position.

Floor areas supporting the façade shall be designed for a maximum long term differential deflection under live load of 10mm nominal with appropriate detailing to accommodate any non moving façade supports with deflecting superstructure supports.

- **Cracking**

Post-tensioning steel and reinforcement shall be designed to provide at least a ‘moderate’ degree of crack control in accordance with Clause 9.4.3 of AS3600 with the roof level “moderate to strong degree” of crack control with an average prestress level of 2.0 MPa after losses.

- **Durability**

All concrete elements shall have a design durability which complies with the recommendations of AS3600 for a 50 year design life.

For painted elements refer to the structural steel section of this specification. A 10 to 15 year to first maintenance is required for the façade and all galvanizing will be to 650g/m2 such as guardrail and handrail.

- **Fire Rating**

The fire resistance of the structure is to be in accordance with BCA requirements. It is anticipated to be a 2 hour fire rated structure will be required.

3.4 System Description

3.4.1 Building Structure

3.4.1.1 General

The proposed multi-deck car park will have 5 to 6 split levels and be constructed in two stages. All suspended slabs shall be in-situ post-tensioned concrete supported by reinforced concrete columns on piered foundations unless approved otherwise at grade car park will be a flexible asphaltic concrete pavement.

3.4.1.2 Horizontal Design Loads

The horizontal design loads are to be in accordance with loading codes AS1170.2 (wind) AS1170.4 (earthquake) and AS1170.1 (braking and impact forces)

3.4.1.3 Lower Level On Grade Carpark (Stage 1)

All on grade car parking shall be an asphaltic concrete

3.4.1.4 Typical Floor Levels

The roof shall be f'_c – 40MPa with a minimum of 2.0MPa stress long term compression. The post-tensioning must be distributed in the band beams and edge beams and slabs to ensure that any differential tensile stresses are addressed due to exposure with an appropriate temperature differential considered.

The design must take into account the in-plane stresses and bending stresses due to thermal loading. A minimum of a 40^0 C temperature gradient must be allowed for in the design.

Integral falls shall be provided in the roof slab with minimum 1:200 falls to the gutter provided

- **GEOTECHNICAL**

Please refer to the Geotechnical report prepared by Douglas Partners report no. 80760.01 dated November 2014.

- **CAR BARRIERS**

Barriers shall be designed for the impact forces defined in AS1170.1. The barriers will be sufficiently rigid not to affect the façade when impacted but ingal type products are acceptable where deformation will not affect attachments on adjacent car spaces.

- **STRUCTURAL STEEL**

All structural steel shall have a protective coating for atmospheric category B to AS/NZS2312 to achieve 15 years to first maintenance.

3.5 Asphaltic Concrete Pavements and Ancillary Items

New flexible asphaltic concrete pavements will be designed in accordance with Ausroad Guide to Pavement Technology Part 2. Pavement structure design for a design traffic “equivalent standard axle” loading of $1x10^4$ and a 20 year design life. All construction material specifications will be submitted to the principal for approval.

Concrete kerb, gutters and footpaths will have a minimum F’c = 20MPa. Low height retaining wall systems and will be reinforced split block core filled on strip foundations. The blockwork will be jointed at 12m maximum and capping blocks will be used. Balustrade protection to be in accordance with AS 2890 and designed and certified for loads as specified in AS 1170. All retaining walls and landscape areas will have subsoil drainage wrapped in filter fabric linked to the main stormwater system with flushing points.