New Maitland Hospital

State Significant Infrastructure – Stage 2 – Structural Statement

Prepared for Multiplex

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Rev 02

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Table of Context

1 Background

Health Infrastructure has committed to undertaking a Staged planning application process in accordance with Section 115ZD (1) of the Environmental Planning and Assessment Act 1979 (EP&A Act) for the following works:

- Stage 1: Site clearance and preparatory works (approved under SSI9022)
- Stage 2: Design and construction of the hospital Main Works. (this application SSI9775)

Stage 2 includes the design and construction work generally comprising:

- A new seven storey Acute Services Building, including:
  - Emergency services
  - Medical, surgical, paediatric and maternity services
  - Critical care services for adults and babies, including a special care nursery
  - Operating theatres, delivery suites and assessment rooms
  - Palliative care and rehabilitation services
  - Mental health services
  - Satellite renal dialysis
  - New chemotherapy services
  - Oral health service
  - A range of ambulatory care and outpatient clinics.
- Internal road network and car parking for staff, patients and visitors
- Signage
- Site landscaping and open space improvements
- Tree removal
- Utility and services connection and amplifications works.

1.1 The Site

The New Maitland Hospital sits on the former PGH brick quarry site along Metford Rd, Metford. It is bound by bushland to the south west, and a dam to the east. There are new roads to the north, west and south boundaries of the hospital site.

Figure 1. Final Site Plan.

1.2 Site Constraints

The major constraints identified include –

- Bushland to the South and West of the building site.
- Water body to the east of the building site
- Exposed coal within some of the existing cut.

2 Geotechnical Conditions

2.1 Geotechnical Investigations and Reports

The following site investigation reports provided by Douglas Partners summarise numerous historical reports carried out for the site:

- Document No. 81719.01.R.001.Rev 0, Report on Geotechnical Investigation, 14 Dec 2015
- Document No. 81719.01.R.001.Rev 1, Report on Geotechnical Investigation, 18 Aug 2017

- Document No. 81719.01.R.001.Rev 2, Report on Geotechnical Investigation, 9 May 2018
- Project 81719.07.R.001.Rev1, Assessment of Existing Capping over Carbonaceous Material stockpile Proposed New Maitland Hospital (Chitter Pile), 12 July 2018
- Project 81719.09.R.001.DftA, Report on Detailed Geotechnical Investigation, Proposed New Hospital, Metford Rd, Metford, January 2019
- RPT-000082, Rev 1, Proposed Carpark, New Maitland Hospital Preliminary Geotechnical Investigation, 6 February 2019.

2.2 Geotechnical Conditions

A geotechnical investigation for the site has been carried out by Douglas Partners (report Project 81719.01, Rev 2, May 2018).

The report indicates the building site typically comprises residual soil over weathered rock, grading to low strength sandstone/ siltstone at depth. It also indicates that there are coal seams throughout the site.

The previous remediation works have resulted in some reshaping of the site since the report was carried out, but not modified the subsoil conditions.

Depths to weathered rock vary from 0.5m – 3.8m across the site. In this case, a mixture of pad footings and bored pile footings founded on the rock is anticipated. Alternately all footings may be piled to the low strength rock.

The geotechnical report notes that slope stability, groundwater, acid sulphate soils and soil aggressivity to buried structures are not an issue for this site.

2.3 Typical Ground Conditions

Previous geotechnical investigations provide some indication on the foundation materials present on site and their depths below ground level. The site ranges in surface level and is generally comprised of areas of fill above ground level, rock outcrops, water bodies, unsealed access roads, areas of dense bush and stripped areas. The depth to bedrock (low strength siltstone or sandstone is between 0.4m – 8m below the surface at the time of the geotechnical investigation. There were also areas detected where the low strength siltstone was overlying fractions of coal and carbonaceous siltstone.

The bulk excavation level for the basement is expected to be at RL14.9 and this means there are areas of significant cut within the site.

No issues have been identified in relation to slope stability, or items that would affect the proposed development.

2.4 Mine Subsidence

The Douglas Partners report states that “the site is not within a mine subsidence district and hence proposed developments do not require the approval of the Mine Subsidence Board.”

3 New Maitland Hospital Building

3.1 Suspended Slab Options

An 8.4 x 8.4m column grid has been adopted to provide flexibility to floor layouts. A post tensioned structural system has been proposed. This is a combination of Post- tensioned banded slab with a post tensioned flat plate for the internal spans.

Option 1 - Post Tensioned Concrete Banded Slab

The post-tensioned banded slab consists of 2200 wide band beams which are 400 deep with slabs 200 deep for the typical floors. The bands would run on grid, primarily in the North-south direction.

Option 2 – Post Tensioned flat plate

With its flat soffit, this option has the advantage of the simplest formwork of the options considered. The flat soffit also has advantages for services reticulation by minimising obstructions. The disadvantages of this system include the requirement for a significantly thicker slab. The flat plate option is also post-tensioned in both orthogonal directions.

This option will require studrails at every column to maintain the slab integrity in punching shear.

The vertical penetration arrangement for interior columns and a zone for future penetrations has also been checked for the flat plate slab option. Refer to sketch below for the penetration arrangement at internal columns.

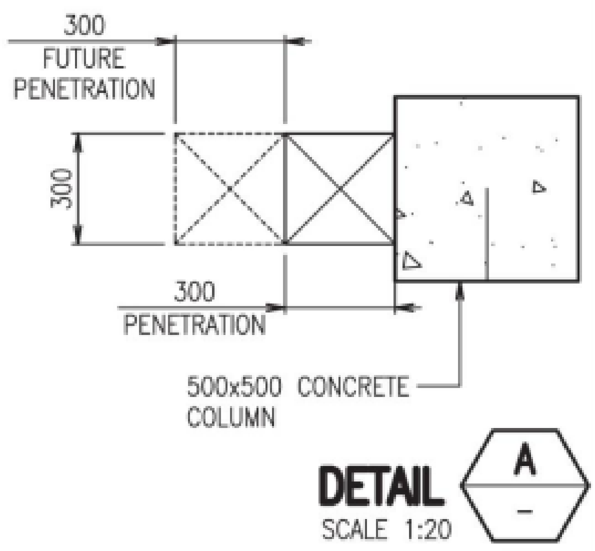

Figure 2: Typical penetration arrangement adjacent to columns and zone for future penetrations (DGN 01)

3.2 Slab on Ground

The Basement 01 level slab will be constructed on grade with a free draining subbase.

3.3 Roof Structure

The building is to be designed with a post-tensioned concrete roof as Level 06. This level houses various plant equipment which is to be contained within a steel framed enclosure.

The level 06 slab will contain falls which will need to be topped in the future in order for it to act as a future IPU level. The new IPU level will have a steel roof over and columns aligning with the concrete columns below.

Part of the Level 2 slab also acts as a roof slab to Level 1 and this slab will contain falls to drains and overflows.

3.4 Foundations

Foundations below columns at basement level are to be pads on the low strength rock. While, foundations for the columns which stop at Ground floor level are to be large diameter piles (1200mm dia) also socketed into the low strength rock. There are some larger loads experienced under the central corridor columns for the towers and these will require two piles and a pile cap. Note, these designs are currently based on assumed levels to rock.

Piles located under the lift cores and stair wells will be tied together with a base to transfer loads from columns through to piles. Piles are socketed into Class IV Sandstone with larger socket lengths for piles in tension. The Geotechnical Investigation conducted by Douglas Partners notes an Ultimate bearing pressure of 5000kPa for pads on the low strength rock and an Ultimate end bearing pressure of 10000kPa for piles on the Class IV rock.

3.5 Vertical Structure and Stability

Floor to floor height in the new build varies between 5m (in the basement) to 4.2m (for the typical upper floors).

Transfer structures have been minimised by the use of a simple grid. The new building has a stair core at the end of each wing on the higher levels, and a number of lift cores and one stair core central to the building. The central core has also been extended to include the large service risers adjacent. These cores provide the primary stability to the building against lateral loads. Additional concrete shear walls have been added in the basement, to assist the building with resisting lateral load.

3.6 Vibration

The vibration criteria being adopted is similar to that being used in the design of other major NSW public hospitals (as per Design Guidance Note 1 Rev A). New building areas which are required to support operating theatres and other sensitive areas such as medical imaging equipment are to comply with RF1 (Response Factor 1). This is a British Standards term that relates to a multiplying factor of 1 on the vibration base curve in AS 2670.2-1990 and ISO 10137-2007.
Other areas of the building not containing medical imaging equipment or Intensive Care Units have been designed for RF2 (Response Factor 2).

3.7 Fire strategy

The fire protection strategy is being developed in coordination with the BCA consultant, architect and fire engineer. A number of options utilise a combination of fire walls, drenching sprinklers and design of structural members to comply with the required FRL of 120/120/120.

4 Safety in Design

Safety in design reviews on all aspects of the structure will be undertaken using a structural risks and solutions register. This will be completed at the following millstones during the New Maitland Hospital project:

- Prior to structural trade packages for tender
- Prior to issue of structural drawings 'for Construction

5 Design Parameters

5.1 Loads

In general all loads and load combinations shall comply with AS/NZS 1170 Parts 0 to 4 structural Design Actions. Live load reductions will be applied as permitted by AS/NZS 1170.1. Generally the design loads are:

5.1.1 Permanent Actions – Dead Loads

Dead load shall be considered as the self-weight of the structure plus an allowance for services, toppings, walls and ceilings which vary significantly throughout the site.
The additional dead loads should not be less than the following:

Area	Services, ceilings, partitions etc.
Hospital floors and office areas	1.8 kPa (excludes 40mm sacrificial topping)
Car Park Areas	0.5 kPa
Concrete roof areas	4.9 kPa (Includes 70mm ave falls +60mm pebbles+ services under)
Northern courtyard Level 1	2.8 kPa (Includes 70mm ave falls + services under)

No façade or masonry wall loading is included in the above loads. We will allow for a façade loading of 1 kPa which equates to approximately 5 kN/m depending on the floor to floor heights. This will need to be confirmed once the façade type and extent is developed.

It is assumed that all internal partitions will be of lightweight stud construction and specific allowance will be made for masonry partitions if required. In particular, masonry walls will most likely be required around services risers and additional band beams will be required around the major risers.

5.1.2 Imposed Actions – Live Loads

Area	Uniformly Distributed Actions	Concentrated Actions
General Hospital Floors	3.0 kPa	2.7 kN
Theatres / X-Ray Rooms / Laboratories	3.0 kPa	4.5 kN
Stair and Corridors	4.0 kPa	4.5 kN
Office Areas	3.0 kPa	2.7 kN
Car Parking	2.5 kPa	13 kN
Ambulance Parking	15 kPa	-
Plant and Utility Areas	Plant loads or 5.0 kPa (minimum)	4.5 kN (minimum)
General Store Rooms	2.4 kPa for each metre of storage height (max 2.1m)	7.0 kN
Compactus	4.0 kPa for each metre of storage height. Locations to be confirmed	To be calculated

Area	Uniformly Distributed Actions	Concentrated Actions
Trafficable Roof/ Courtyard	4 kPa	1.8 kN
Non-trafficable Concrete Roof	1.5 kPa	1.4 kN

Pattern loading will be considered when determining worst case scenarios for strength and serviceability where required by AS1170. Live load reductions will be considered for columns, walls and footing design in accordance with AS1170.1. No live load reductions are to be applied to any floor system elements.

Loads in plant areas are to be confirmed by services engineers once layouts are known. Higher loading will be required for large pieces of plant or tanks.

5.1.3 Wind Loads

Wind loads are in accordance with AS1170.2 and based on the following parameters:

New Maitland Hospital:

Region:	A2
Importance Level (BCA Table B1.2a):	4
Annual probability of exceeding (BCA Table B1.2b):	1:2000 (ultimate)
	1:25 (serviceability)
Regional Wind Speed: Ultimate limit states -	V_{2000} = 48 m/s
Serviceability limit states -	V_{25} = 37 m/s
Terrain Category (all directions):	2

5.1.4 Earthquake Loads

Earthquake loadings shall be in accordance with AS1170.4 – 2007 (Earthquake actions in Australia) and AS/NZS1170.0 – 2002.

Hazard Factor (Z):	0.1
Site Sub-Soil Class:	Ce (Shallow Soil)
Importance Level (BCA Table B1.2a):	4
Annual probability of exceeding	1:1500
(BCA Table B1.2b):	
Earthquake Design Category:	III

5.1.5 Barriers

Barriers including parapets, balustrades and railings are to be designed in accordance with Table 3.3 of AS/NZS 1170.1.

5.2 Serviceability

5.2.1 Deflection Limits

Deflection limits for the concrete structures are generally as follows;

	Maximum floor deflection			
	Dead	Incremental	Live	DL + LL
Floors supporting masonry walls	Span/360	Span/1000[1]	Span/500	Span/300 (25mm max)
Compactus areas	N/A	Span/750[2]	N/A	25mm max
Other floor areas	Span/360 (20mm max)	N/A	Span/500	Span/300 (25mm max)

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

5.2.2 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 plain, reinforced and post tensioned concrete structures and members with a design life of 40 to 60 years. Exposure classifications are as follows;

Exposure Classification	Elements
A2	Internal
B1	External
A2 – To be confirmed by Geotechnical Engineer	In Ground

Protective coatings to structural steel elements shall comply with AS/NZS 2312 and ISO 2063 for the long-term protection category.

5.2.3 Occupant Perception of Motion

As outlined in section 3.6, the new building will be designed to an RF2 response factor where there are no operating theatres and other sensitive areas.
Areas that contain sensitive imaging equipment or pendants which require a greater restriction on vibrations experienced by the occupants will be designed for an RF1 response factor.

5.2.4 Fire Resistance Levels

The BCA type of construction required for this building will be type A. Fire Resistance Levels (FRL) for the structural elements will need to be in accordance with Specification C1.1 of the BCA. Typically, the FRL (minutes) for concrete structural elements is 120/120/120.

5.2.5 Design Standards

The structural design will be in accordance with the latest revision of all relevant Australian Design Standards, the Building Code of Australia and other statutory requirements. As a minimum requirement, the design shall be based on, but not limited to;

Number	Edition	Title
AS/NZS 1170.0	2002	Structural design actions Part 0: General Principles
AS/NZS 1170.1	2002	Structural design actions Part 1: Permanent, imposed and other actions
AS/NZS 1170.2	2011	Structural design actions Part 2: Wind Actions
AS 1170.4	2007	Structural design actions Part 4: Earthquake loads
AS 2159	2009	Piling – Design and installation
AS 3600	2009	Concrete Structures
AS 3700	2001	Masonry Structures
AS 4100	1998	Steel Structures
HI Design Guidance Note 1	Rev A 22 Oct 2012	Structural Design Criteria Guidelines
HI Design Guidance Note 24	Rev B 30 May 2018	Building Importance Levels for NSW Health Projects

6 Certification

Design certification will be issued on completion of the detailed design and documentation.

A Site Inspection Certificate will be issued after construction.

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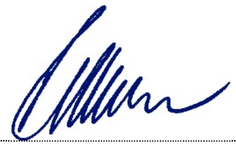

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