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SSD STRUCTURAL ENGINEERING DESIGN REPORT

Sutherland Hospital

Operating Theatre Upgrade Project

Prepared for: *Health Infrastructure* NSW

Document no: ACR-ST-SSD Structural Design Report

Issue no: Rev 2

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REVISIONS

Revision	Date	Purpose	Prepared By	Approved By
1	13/11/2020	Issue for SSD	B. Martin	D. Lenden
2	22/01/2021	Reissue for SSD	B. Martin	D. Lenden

Review Panel	
Division/Office	**Name**
St Leonards	D. Lenden

Unless otherwise advised, the parties who have undertaken the Review and Endorsement confirm that the information contained in this document adequately describes the conditions of the site located at Sutherland Hospital.

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1 Introduction

ACOR Consultants have been engaged by *Health Infrastructure* NSW as the Structural and Civil engineering consultants on The Sutherland Hospital – Operating Theatre Upgrade Project (TSHOTUP).

This report has been prepared to support the SSDA submission.

The scope of the proposed works the subject of this SSD application includes the following:

- Alterations and additions to the existing South Wing building west towards the Ambulance Station, including:
  - Additional operating theatres;
  - Additional endoscopy suites;
  - New Magnetic Resonance Imaging (MRI) space;
  - New Central Sterilising Services Department (CSSD);
  - Surgical short stay unit;
  - Post- Anaesthesia Care Unit (PACU), recovery and other perioperative clinical and supporting spaces;
  - Facilities for admission and discharge;
  - Refurbishment of Level 3;
  - Associated Staff Amenities.
- Earthworks and demolition;
- Tree removal and landscaping works.

1.1 Site Context

The proposed development works is located in the western side of the main hospital near the Kareena Road site access and the topography generally falls in a north to south direction. The area is heavily built up and is constrained by existing facilities on all sides including, the ED building to the north, South Wing building to the East and the Ambulance Station and Carpark to the west. The new building extension is proposed to be built within the existing building constraints and limit the disturbance of the surrounding area.

The site area can be currently accessed from both a north and south direction with a road providing a link between the two site accesses off Kareena Road as well a ring road that provides connection to the entire Hospital perimeter. This road was partially upgrade to a rigid concrete pavement as part of the Stage 1 - ED & IPU Redevelopment works and is regularly used by Ambulances as it provides easy access between the ED and Ambulance Station.

The road also contains multiple inground services and acts as service corridor for the surrounding buildings. Existing services within the road include stormwater drainage, sewer, watermains, electrical and communication services.

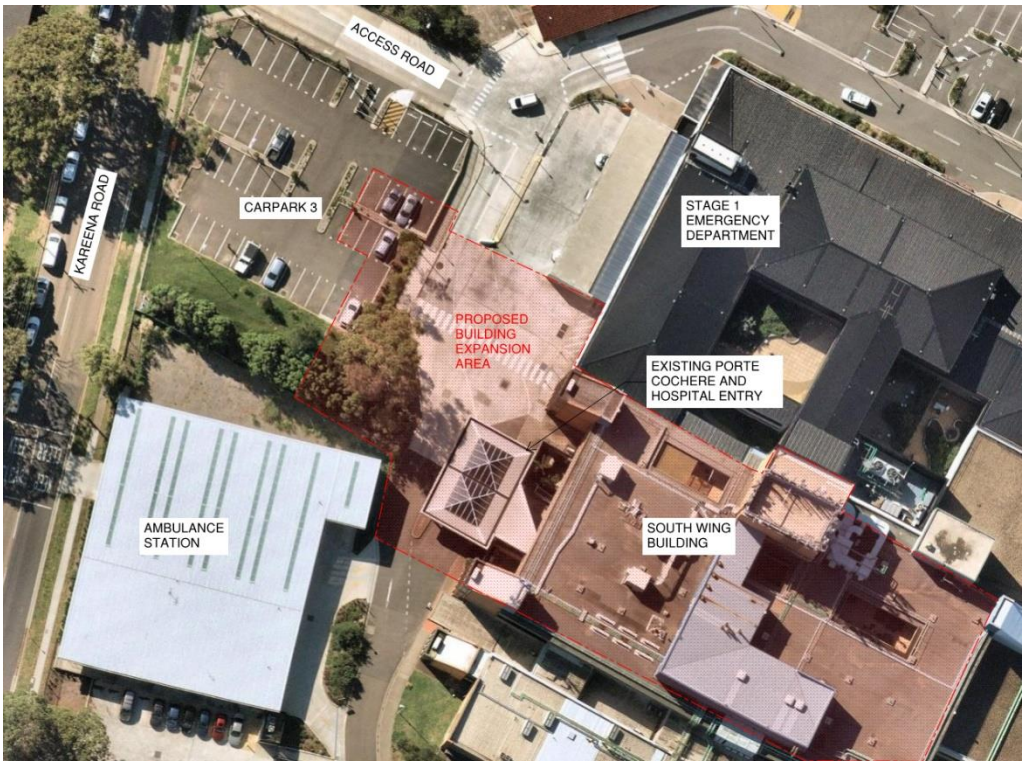

Figure 2 – Existing Site Conditions (Source Nearmaps)

1.2 Site Survey

A detailed topographical survey and inground service location survey of the existing site has been completed on 08/05/2020 by Total Survey Solutions. This survey has been used to the determine the existing topography and site features that will be impacted due to the site development.
The details of this survey are listed below:

Surveyor Contact Details: Total Surveying Solutions

Suite 8, 448 Pacific Highway, Lane Cove .Tel: 1300 877 000

Job Reference: 200599

Survey Date: 08/05/2020

Drawing Number: 0003

1.3 Geotechnical Investigation & Site Geology

HI have commissioned JK Geotechnics to undertake detailed site investigations of geotechnical, groundwater, soil contamination and hazardous materials on the project site.

The details of this report are listed below;

Name: Sutherland Hospital Theatre Upgrade

Contact Details: *JK Geotechnics*

115 Wicks Rd, Macquarie Park Tel: (02) 9888 5000

Job Reference: 33141LXrpt

Report Revision and Date: Rev 0 – 09/07/2020

The report references previous geotechnical investigations on the site, namely the Douglas Partners report Job No. 84311, Rev 0, 17/04/2014, and has utilised the previous bore hole logs from these previous investigations.

The boreholes disclosed a generalised subsurface profile comprising shallow to moderately deep fill overlying residual clays, with weathered siltstone and then sandstone at depth.

Existing pavements encountered on site vary from 150mm thick concrete pavements on 200mm thick road base, and 60mm thick asphalt pavements underlain road base of varying thickness.

Silty clay fill was encountered in bore holes BH1 – BH4 and varied in depth between 0.8m to 1.4m in parts. Residual soils consisting of silty clay of varying plasticity (medium to high) and strength (very stiff to hard) was encountered beneath the fill in each borehole.

Bedrock comprised siltstone overlying sandstone. The underlying sandstone encountered in BH1 to BH4 bedrock ranged from low to medium strength on first contact improving to medium or high strength with depth. The rock encountered as part of these investigations has been classified as Class V (Shale) and Class IV/III (Sandstone), the geotechnical parameters for footing design is given as below;

Geotechnical Design Parameters

Rock Unit (Class)	Allowable End Bearing Pressure (kPa)	Allowable Shaft Friction (kPa) Compression	Ultimate End Bearing Pressure (kPa)	Ultimate Shaft Friction (kPa) Compression	Elastic Modulus (MPa)
Class V Siltstone	700	50	3,000	100	150
Class IV/III Sandstone	3,500	350	15,000	800	700

Indicative borehole locations are shown on the plan below.

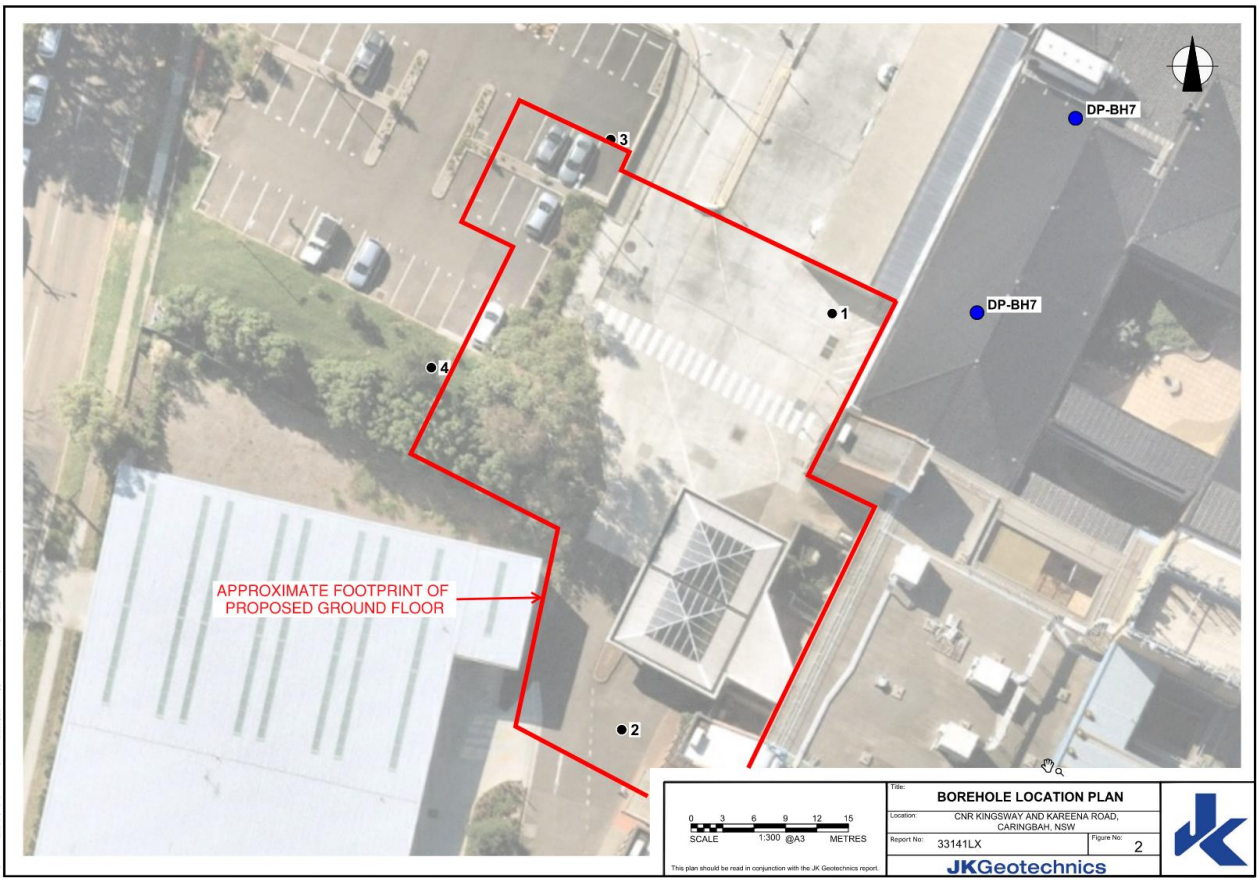

Figure 3 – Borehole locations *(Source: JK Geotechnics)*

1.4 Structural System for the New Build

The new building construction will typically follow a standard 8.4m grid (HI system design) for the main section of the structure. The structure will be supported on piled foundations and will typically consist of post tensioned band beams and slabs.

The new building will provide its own stability system, without reliance on the existing buildings. Overall lateral stability will be provided by reinforced concrete stair and lift core walls. Future levels are to be incorporated into the design with the vertical structure designed for additional load including construction load-case.

1.5 Refurbishment Works

The refurbishment of the existing building operating theatres is also included in the project. The scope of structural works for the refurbishment is limited to minor service penetrations and new fire walls. No change in use of the existing building is proposed.

1.6 Excavation

Deep excavation is to be limited to the foundations under the lift and stair cores. Based on the geotechnical investigations, we understand that the natural soils will be readily excavated using standard earth moving equipment. Temporary batters for excavation purposes are advised as being a minimum of 1H to 1V.

1.7 Disruption and Staging

Noise/dust/vibration issues are a significant construction risk. It is intended that the staging of works and isolation of disruptive activities will be coordinated with the hospital to control these risks. The New Build Works and refurbishment works are to be constructed over numerous stages to minimise the potential disruption to the hospital operations. Refer to the architectural report for details of this staging.

Existing services that may be impact by the building works are to be divert and relocated into a common services trench.

Construction traffic can disrupt hospital operations. The provision of construction access to the site will need to be carefully considered by the contractor.

1.8 Future Proofing

The structural design of the building is to provide capacity for the Future levels are considered in the design, with the vertical structure designed for additional load including construction load-case. The new building will be designed for an additional two levels of IPU wards to be added at a later date, with an allowance for a design imposed uniformly distributed load-case of 3kPa.

2 Design Parameters

2.1 Design standards

The structural design shall be in accordance with the latest revision of all relevant structural Australian Standards, relevant structural sections of the BCA and other statutory requirements.

In particular, the structural design will be in accordance with the following relevant Australian Standards:

- 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 Loads
- AS 1170.4 (2007) – Structural Design Actions Part 4 Earthquake Actions in Australia
- AS 2159 (2009) – Piling – Design and Installation
- AS 3600 (2018) – Concrete Structures
- AS 3700 (2018) – Masonry Code
- AS 4100(1998) – Steel Structures
- AS 4678 (2002) – Earth Retaining Structures

2.2 Loading

2.2.1 Vertical

- General Floor Areas & Ward Areas:
  - SDL = 1.8kPa (Excluding sacrificial topping);
  - LL = 3.0kPa;
- Operating Theatres:
  - SDL = 1.8kPa (Excluding sacrificial topping);
  - LL = 3.0kPa;
- Corridors:
  - SDL = 1.8kPa (excluding sacrificial topping);
  - LL = 4.0kPa;
- Offices:
  - SDL = 1.8kPa (excluding sacrificial topping).
  - LL = 3.0kPa;
- Medical Imaging Areas:
  - SDL = 1.8kPa (Excluding sacrificial topping);
  - LL = 3.0kPa;
  - Additional loads from equipment.
- Plantrooms:
  - SDL = 2.5kPa;
  - LL = 7.5kPa;

- Stairs:
  - SDL = 0kPa;
  - LL = 4.0kPa;
- Toilets/Bathrooms/Kitchens:
  - SDL = 1.8kPa (excluding sacrificial topping);
  - LL = 2.0kPa;
- Non-Trafficable Metal Deck Roof Areas:
  - SDL = 0.5kPa;
  - LL = 0.25kPa;
- Trafficable Concrete Roof Areas:
  - SDL = 2.5kPa;
  - LL = 4.0kPa;

Live load reduction in accordance with AS/NZS1170.1 Clause 3.4.2 will be applied.

2.2.2 Wind

Wind loading is in accordance with AS/NZS 1170.2 – Structural Design Actions – Wind Actions with the following parameters:

- Buildings with post disaster functionality requirements:
  - Annual probability of exceedance – 1:2000;
  - Region A2;
  - V2000 – 48m/s;
  - Terrain Category TC3.
- All other buildings:
  - Annual probability of exceedance – 1:1000;
  - Region A2;
  - V1000 – 46m/s;
  - Terrain Category TC3.

2.2.3 Earthquake

Earthquake loading in accordance with AS 1170.4 – Structural Design Actions – Earthquake Actions for Australia with the following parameters:

- Buildings with post disaster functionality requirements:
  - Annual probability of exceedance – 1:1500;
  - kp = 1.5;
  - Z = 0.08;
  - Class Ce (to be confirmed by detailed geotechnical investigation);
  - Earthquake Design Category III;
    - Dynamic Analysis;

- All other buildings:
  - Annual probability of exceedance – 1:1000;
  - kp = 1.3;
  - Z = 0.08;
  - Class Ce (to be confirmed by detailed geotechnical investigation);
  - Earthquake Design Category III;
    - Dynamic Analysis;

2.3 Serviceability and durability

2.3.1 Deflection limits

Structural element	Maximum deflection
Supporting face masonry walls	Span / 1000
Supporting rendered masonry walls	Span / 1800
Floors not supporting brittle elements	Span / 500
Floors supporting brittle elements	Limit to provide adequate serviceability of brittle elements
Stud walls under lateral loading	Span / 500
Roof members:	
Dead load	Span / 360
Live load	Span / 250
Wind Service load	Span / 300
Relative horizontal deflection between adjacent frames at eaves levels	Less than the smaller of floor to eaves height / 250 and frame spacing / 200

2.3.2 Lateral movement

The lateral drift of the building will be limited to the following:

- Under Serviceability Wind Actions – Height / 500
- Under Earthquake Actions (AS 1170.4 clause 7.5) – Height / 67

2.3.3 Vibration

The design of the floor structure will ensure that vibration due to footfall excitation is kept within acceptable limits. These limits will be based on *Health Infrastructure* Design Guidance Note 1 – Structural Design Criteria Guidelines (refer extract below) :

Vibration Criteria

Area	Dampening	Footfall Frequency	Sacrificial Topping Considered Structurally	Targeted Response Factor
Operating Theatres, Corridors and General areas	3.5%	2.1 Hz	Yes	1.0
Plantrooms (located over OT's)	3.0%	2.1 Hz	T.B.C.	1.0
Future Expansion Assumptions	3.5%	2.1 Hz	Yes	2.0

Steel serviceability posts may be considered to improve the response factor of the existing concrete floor plates if they are deemed to be less than RF=1.0.

All equipment which may be a possible source of vibration will be isolated from the structure through the provision of isolation mounts. Special attention to this will need to be given for the plant and equipment directly over the operating theatres.

2.4 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 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.

Upgrading of the existing structure to meet the current required FRL is to be confirmed by the BCA consultant and fire engineer.