MPN
STRUCTURAL DESIGN & ENGINEERING

STRUCTURAL DESIGN REPORT

DA SUBMISSION

Vaucluse Senior Living
669-683 Old South Head Road
Vaucluse

For Vaucluse Holdings Pty Ltd
c/- Blare Management

December, 2023

MPN Group Pty Ltd
ABN. 20 001 568 878

PO Box 462
North Sydney
NSW 2059 Australia

T. +61 2 9929 7144
info@mpn.com.au

mpn.com.au

1.0 Introduction

MPN Group Pty Ltd has been engaged by Blare Management, on behalf of Meissen Properties, as the Structural Engineer Consultant for the proposed new development across 7 adjoining residential lots at 671-683 Old South Head Road, Vaucluse, and an additional retail/residential lot at 669 Old South Head Rd, Vaucluse. The existing 7 dwellings and the shop with shop-top residence will be demolished and the site amalgamated for the new high-end, mixed-use development incorporating seniors' living apartments, with a small component of retail space.
The proposed residential development is as described in new architectural plans by Bates Smart project ref. S12551, rev A, dated 15 December 2023.

The proposed structure also consists of 2 levels of basement amenities, plant space and car-parking, a ground floor of common uses (lobby, etc) and 3-4 levels of residential apartments for the seniors market.

2.0 Structural Philosophy

The structure is proposed to be designed predominantly as a conventionally reinforced concrete frame with reinforced concrete columns and walls. Post-tensions concrete will be used to minimise transfer beam depths where column positions cannot be aligned directly to a footing. The residential floors will be flat-plate insitu floor-slab construction, with concrete upstands for the support of slab edges, particularly at the large cantilevered balconies.

The column and wall structure will be founded on a combination of pad footings (internally) and CFA piles to the perimeter, bearing on sandstone bedrock.

The proposed building has a length of approximately 100m, and in order to control building shrinkage and temperature related movement, it is recommended to provide permanent movement joints across the building structure. Ideal locations for such joints appear to be at grid 08, wherein a double wall can effectively separate the building into 2 structural modules, which leaves the residential portions as separated blocks unaffected by the joint. Importantly, each structural module has stair and lift cores to provide lateral restraint for prescribed wind and earthquake loads.

2.1 Foundations

A Geotechnical Report has been prepared for the site by Geo-Environmental Engineering (ref. G21071VAU-R01F), which incorporates site investigation information from an earlier report done in 2018 by Crozier Geotechnical Consultants (ref. 2018-106). We also have to hand geotechnical investigation re. G20019VAU-R01F which describes geotechnical issues at 669 Old South Head Road.

In all, 9 borehole investigations have been carried out and reported on across the 8 lots. The report notes that the subsurface conditions are sand overlying sandstone bedrock at up to approx. 4-5 m depth below existing surface level. The nominated safe-bearing value for the rock mass is structurally adequate to support the proposed building.

The soil sampling indicates that the site contains non-aggressive soils in terms of the long-term durability impact on both concrete and steel elements which come into contact with the ground.

No permanent ground water was found within the site, although the well-draining sandy soils will allow rainwater to seep down and perch atop the sandstone bedrock. There may also be seeping seams in the bedrock not detected. These small volumes of ground water can readily be accommodated by the structural and civil design, via collection at the perimeter and a pump-out system.

The Geotechnical Report provides recommendations for further geotechnical testing and monitoring suggested for the site in the detailed design stage and construction stage. Refer to the various Geotechnical Report for details.

2.2 Groundwater Level

No permanent ground water was found within the site, although the well-draining sandy soils will allow rainwater to seep down and perch atop the sandstone bedrock. There may also be seeping seams in the bedrock not detected. These small volumes of ground water can readily be accommodated by the structural and civil design, via collection at the perimeter and a pump-out system.

2.3 Basement Excavation

The majority of the excavation will be in sand and weathered clayey-sandstone. Normal mechanical excavators will readily dig the upper layers, with ripping, hammering or sawing only needed at the lower depths of the basement excavation.

Vibration monitoring during excavation may be required, although very nominal vibrations are expected until the sandstone is reached near the bottom. One immediate neighbour to the south of the site is load bearing masonry, so vibration limits should probably be maintained below 5mm/sec.

These aspects are covered in more detail by the abovementioned geotechnical report.

2.4 Basement Retention

As previously mentioned, the site is overlain by sand for the most part of the proposed basement excavations, and as such a temporary and permanent retaining wall system will be required to retain the sands to the building perimeter.

The preferred structural wall retention system is a contiguous CFA pile wall, estimated at 450mm diam piles. Much of the wall can be designed as cantilevered in the temporary state for excavation, although some use of temporary ground anchors may be desirable where boundary distances allow; or larger diameter piles or dead-man piles may be employed. The general boundary off-sets of 4m+ gives rise to many options for retention support without affecting the design intent.

The sandstone bedrock is liable to be self-supporting at depth; however, this will need to be determined by geotechnical inspection, wherein some rock-bolting may be required. Given the second basement excavation is set well back from the street and other property boundaries, such rock-bolts or anchors would be housed within the development site's property boundary.

2.5 Superstructure

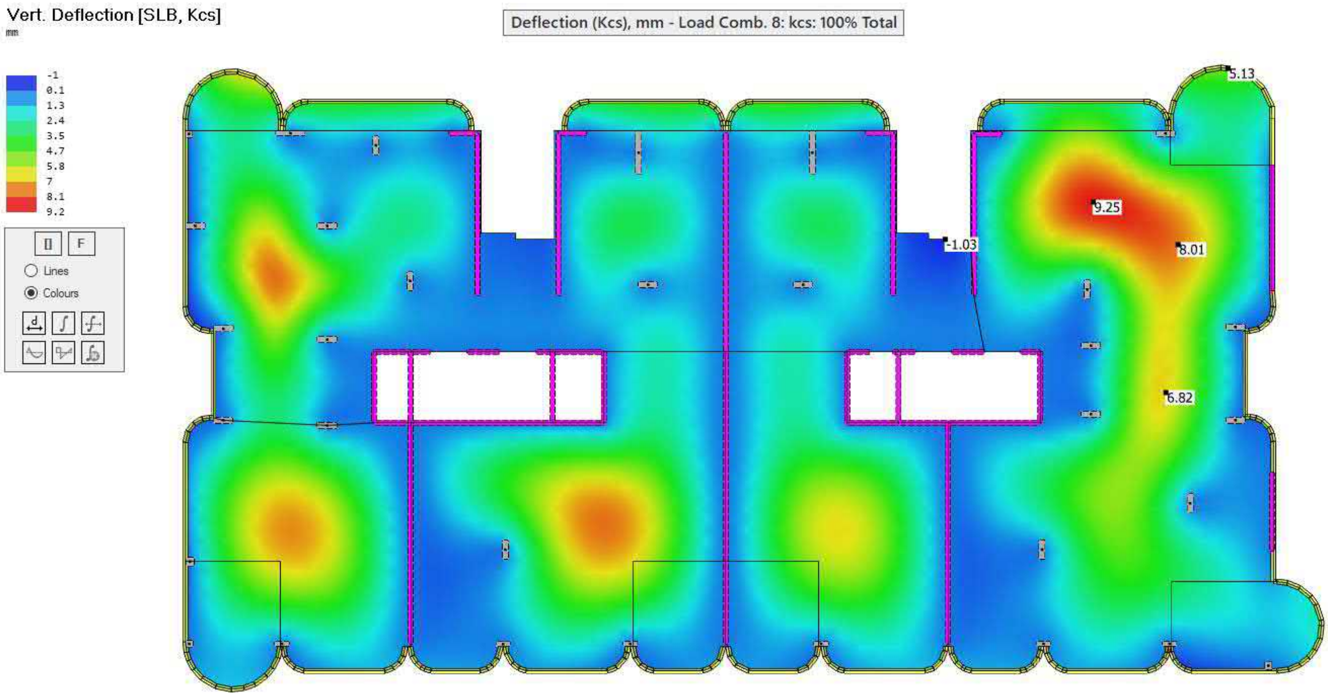
The building is designed as a reinforced and post-tensioned concrete structure.

Basement level B2, will be a slab-on-grade, expected to be cast onto the sandstone foundation material, with a thin blinding layer of sand.

All suspended levels will be constructed as reinforced floor slab, with specific transfer beams as post-tensioned. The retention system of CFA contiguous piles will be used as additional slab edge support to the interior formed columns.

The residential levels will use common walls of the room layouts for slab support, across spans of up to 8.9m. Slab thickness will vary between 200mm to 260mm. Large cantilevered balconies will make use of the thicker slabs as well as substantial stiffening provided by solid concrete upstand/balustrades, notionally 1000mm high x 200mm thick. Some intermediate internal columns will be required, as per the suggested layout below.

The diagram below indicates deflection contours based on the structure dimensions noted above, as modelled by preliminary design using Inducta SLABS modelling software.



2.6 Lateral Stability

Lateral stability of the building for wind and earthquake loads will be provided via the reinforced concrete stair and passenger-lift cores. Other load-bearing concrete walls being used for gravity loads will also greatly assist with the lateral loads.

Past experience advises that the stability of the building will be well catered for, but in detail design, this expectation will be checked by the use of RCB finite element software by Inducta.

2.7 Structural Vertical Deflection Limits

Structural deflections limits will follow AS 3600 (Concrete Structures), except the following more stringent limits are to be complied with for concrete floor slabs.

Building Type	Maximum Deflection Limit			
	Dead	Incremental	Live	DL + LL
Non-residential	Span/360 15mm max.	-	Span/800	Span/300 20mm max
Rendered &/or tiled masonry partitions	-	Span/1000	Span/500	
Transfer beams	-	Span/1000		

2.8 Lateral Deflection Limits

Wind Load

Inter-storey lateral drift = storey height/500
Total lateral drift = overall height/500

Earthquake Loads

Inter-story lateral drift <0.015h_s (h_s = height of storey)

3.0 Site Constraints

The site has no known site constraints that affect the structure or its construction, such as sewer or stormwater mains transecting the site.

4.0 Craneage

The site does not pose any apparent restrictions to the installation of a crane. While this will be dealt with in a Construction Management Plan, we expect that a suitable crane can be founded adjacent the structure, on a separate foundation pad.

5.0 Design Standards

The structural design will be performed using the current structural design standards nominated in NCC-2020 which may be relevant to the project, which at the time of writing are the following:

AS 3600 Concrete Structures (2018)
AS 3700 Masonry Structures (2018)
AS 4100 Steel Structures (2020)
AS 1170.0 Structural Design Actions General Principles (2002)
AS 1170.1 Structural Design Actions Permanent, Imposed and other actions (2002)
AS 1170.2 Structural Design Actions Wind actions (2021)
AS 1170.4 Minimum Design Loads on structures Earthquake loads (2007)
AS 2159 Piling- Design and Installation (2009)
AS 4678 Earth Retaining Structures (2002)

6.0 Design Loads

The structure will be designed for loads noted below.

Location	SDL	LL	Comment
Car Park	0.25kPa	2.5kPa	On grade at B2
Plant Rooms	2kPa	5kPa	Specific point loads to be confirmed
Loading Dock	-	12kPa	-
Entry Foyer	2kPa	5kPa	Finishes to be confirmed
Residential Units	2kPa + wall line loads	2kPa generally 2kPa on balconies	Internal non-structural walls to be plaster-finished rendered masonry or clad masonry

7.0 Durability

Internal areas of the structure will be designed for A2 exposure classification.

External areas of reinforced concrete will be designed for B2 exposure classification (coastal within 1km of ocean).

There are no other environmental conditions of concern for the building's durability.

8.0 Fire Rating

The structure will be designed for FRL's as given in the BCA Report in conjunction with requirements of the abovementioned Australian Standards. Generally, the FRL is expected to be 90/90/90 which can readily be achieved for this project.

MPN Group Pty Ltd

Viktor Mateffy
Director
BE(Hons) MEngSc, MIEAust, CPEng, NER(17240), DEP0000291