SSDA STRUCTURAL REPORT

SCEGGS Darlinghurst Wilkinson House

215 Forbes Street, Darlinghurst NSW 2010

PREPARED FOR
Sandrick Project Directions
Suite 412, 4 Columbia Court
Baulkham Hills
NSW 2153
Tel: 02 8860 9494

Ref: SY211000-SR01
Rev: C
Date: 05.11.2021

SSDA Structural Report

Revision Schedule

Date	Revision	Issue	Prepared By	Approved By
25.08.2021	A	SSDA Structural Report	T.Myers	T.Myers
01.09.2021	B	SSDA Structural Report	T.Myers	T.Myers
05.11.2021	C	SSDA Structural Report	T.Myers	T.Myers

Northrop Consulting Engineers Pty Ltd

ACN 064 775 088 | ABN 81 094 433 100

Level 11, 345 George Street, Sydney NSW 2000

02 9241 4188 | sydney@northrop.com.au | www.northrop.com.au

Table of Contents

1. Introduction

Northrop Engineers have been engaged by Sandrick Project Directions to provide structural engineering services for Wilkinson House at SCEGGS Darlinghurst.

This report has been prepared to discuss the structural engineering works associated with the adaptive reuse of Wilkinson House, including alterations and additions.

This report establishes the structural framework for the proposed redevelopment works outlining the structural design principles adopted for the project.

Refer Site Plan below:

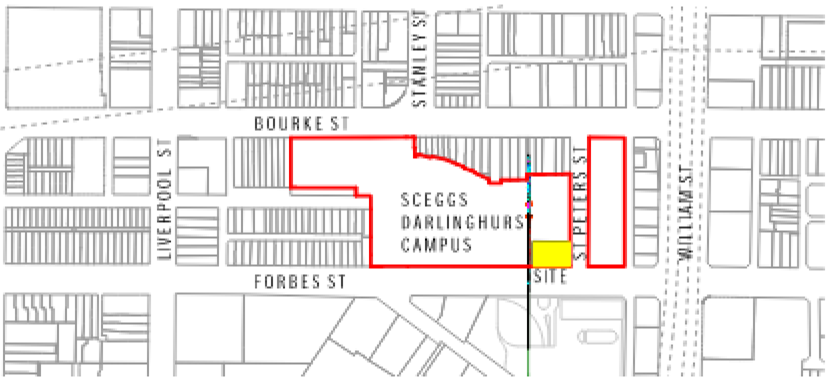

Figure 1 - Site plan

2. Existing Structure

The existing structure of Wilkinson House was constructed in 1901. The structure consists of timber floorboards supported by loadbearing masonry walls. The masonry walls provide lateral stability to the structure. We note that very little information exists of the existing structure at Wilkinson House. Our design team have undertaken a site inspection to understand the existing structure, and how it has been constructed. Due to existing finishes and ceiling, not a lot of the actual structure was accessible or visible. More detailed site investigation will be undertaken in subsequent phases, with organised access to gain better visibility of key structural areas.

The existing façade is a double brick masonry structure, supporting the internal floor joists. The existing façade is restrained laterally by the floor joists at floor level, and take the load back to the internal masonry walls. The existing façade is founded on high level rock, on what appears to be a brick footing.

3. Proposed Development

The proposed Wilkinson House development includes the removal of most of the internal walls and floors inside Wilkinson House. The existing façade of the building will be maintained, to protect the heritage significance of these walls. The existing foyer at Ground level on Forbes Street has also been earmarked to be maintained.

The internal structure will be replaced with concrete slabs supported on concrete columns. Concrete shear walls will be introduced to provide lateral stability to the building. The existing façade will not be relied upon to provide lateral stability or to take vertical load for the new structure, to avoid compromising the integrity and overloading the existing walls.

The new structural design will allow for larger floor to floor heights and provide a flexible floor layout to improve the learning spaces for the students and teachers.

The new structural floor plates will be installed at the same or similar level as the existing floor levels, with an additional level proposed to the top floor, Level 3. The existing LG slab RL is proposed to be dropped 700mm from its current level, and the extent of LG will continue for the full length of the building, excluding the zone below the existing GF foyer. Currently LG only occupies one third of the building footprint, on the northern part of the building.

4. Structural Engineering

In this section we outline the anticipated ground conditions, required design life, structural design parameters, proposed footing solutions, proposed superstructure solutions.

4.1 Geotechnical Conditions

A geotechnical assessment has been undertaken on the site as part of the previous Masterplan Redevelopment. The Geotechnical Investigation for the Wilkinson House Redevelopment was undertaken by Douglas Partners, and the findings of this assessment can be found in their Report 86514.03.R.001 Rev 0 dated 14th October 2021. This report makes reference to previous site investigations undertaken at SCEGGS Darlinghurst on two of the nearby buildings (The Sports Hall undertaken in June 1994, and the Science and Technology Building undertaken in April 2008). At the time of writing this report, the previous geotechnical investigation reports were not available to review.

The geotechnical report states that the existing basement of Wilkinson House is founded on sandstone. The sandstone is generally of medium to high strength with a preliminary allowable bearing pressure of 3.5MPa. The use of pad and strip footings have been recommended as suitable foundations for this material. It is noted that a weak zone of rock was identified along Forbes Street in previous investigations. The report notes there is a possibility that a weak zone could also existing in the Wilkinson House footprint. If this is the case, the foundations will need to be designed for a lower bearing pressure, or to bridge the dyke.

Where the existing footings to the façade walls are bearing on medium strength rock, the geotechnical report notes there is unlikely a need to underpin the existing foundations. This will need to be monitored on site during excavation to ensure all footings are indeed sitting on suitable rock. From high level conversations with the geotechnical engineer, it is expected the rock face can be cut vertically a distance 300 – 500mm off the face of the existing wall. Rock bolts or pins may be required to stabilise any areas that are jointed or fractured. Where rock bolts cannot be use (such as the eastern façade as the bolts will cross the boundary into Forbes Lane) a concrete retaining wall can be introduced retain the vertical cut face. If any low or very low strength bands of rock are encountered in the vertical face, localised shotcreting is recommended to prevent weathering and deterioration of the rock face.

On the western boundary, a vertical rock face exists which forms the basement of the Joan Freeman Building. The proposed excavation to the Wilkinson House LG level (of up to 2.5m) will result in a slither of rock being left under the existing western brick wall and its footing. The geotechnical report notes this remaining wedge of rock will be unstable, and will require strengthening. To stabilise this footing and brick wall, underpinning will be required to take the load down to the BEL of Wilkinson House, with a cantilevered footing to rectify any lateral loads or over turning that may be induced on the wall.

Natural groundwater is estimated to be many meters below the existing site RL, and thus should have no impact on the development. It is noted that some seepage will occur along the sandstone bedrock after periods of heavy rain. This will not be significant, but provision will need to be allowed to collect and dispose of this water.

Due to the required excavation into the bedrock material, and the sensitivity of the existing masonry façade, the geotechnical report outlines the risks associated due to vibrations that will occur when excavating the rock. The report outlines the required construction and excavation methodology to minimise in ground vibrations to acceptable levels and to minimise the risk of damaging the existing heritage façade. It is recommended for vibration monitoring to be undertaking during excavation works.

4.2 Structural Systems

The proposed building comprises of three suspended post-tensioned slabs supported on concrete columns, a concrete slab on ground, and a steel roof.

As noted above, all new foundations will be designed as concrete pad and strip footings and designed for an allowable bearing capacity of 3500kPa.

The lateral stability of the structure will be provided by two concrete shear walls and the concrete lift shaft.

The floor plates have been designed as a one way post tensioned slab support on a combination of upturn and downturn beams to suit the architectural planning of the floor plates. The floors are then supported vertically on concrete columns and walls. Where the concrete columns are located hard up against the existing façade, it is proposed to use a steel sheet form work system to enable the columns to be located as close to the existing façade as possible, without loading the façade. This will allow for the columns to be set back and avoid them from protrude too far into the learning spaces and impact the spatial set out of the rooms.

Where conventional formwork and back propping cannot be utilized for the floor slabs (such as over the existing foyer) a deep trapezoidal deck profile has been adopted to avoid any back propping requirements. The metal deck will be supported by the bottom flange of the steel beams, which assists in reducing the overall depth of the structure (which would traditionally involve the metal deck formwork sitting on top of the steel beam). The overall structural depth of this system is 305mm. The steel beam will be encased in concrete which will provide the necessary fire protection to the beam, however the bottom flange of the steel beam will remain exposed, and will require fire protection.

The floor plates will require a positive connection into the existing façade to provide permanent lateral support to the façade. The current thought process on this is to adopt a toothing detail of the concrete into the existing façade, which would already exist at the existing floor joist locations. Alternatively, a steel angle with masonry anchors at regular centres could be considered, or a sleeved dowel that is grout filled after post-tensioing the floor plates.

The steel roof is a pitched roof, that falls to a box gutter on the eastern and western façade. A steel roof was selected due to its light weight, which will avoid the need for any deep transfer beams at Level 3 where the planning did not allow for the columns grid to continue up. The lightweight roof will also have the added benefit of keeping column sizes to a minimum due to a smaller load than if a concrete roof was adopted. The steel columns supporting the roof have been designed as cantilevered columns, to avoid the need to provide cross bracing in the walls, which was limiting the flexibility of the spaces on L03 and compromised on the aesthetics. An added benefit of the steel roof, it will be an easier and safer construction methodology for the builders, as a concrete roof would bring with it complexities around scaffolding and fall protection to the top level which would need to be built out and over the existing façade.

4.3 Design Parameters

4.3.1 Design Life

The design life of the structure is a minimum 50 years.

4.3.2 Design Loads

All buildings and structures will be designed with the loads determined from Australian Standards, and will be in NCC:2019.

4.3.2.1 Permanent Actions – Dead Load (DL)

Self-weight of the structure is considered Dead Load.

4.3.2.2 Permanent Actions – Superimposed Dead Loads (SDL)

Superimposed Dead Loads shall be considered for services, insulation, toppings, finishes, partitions, and ceilings. As a minimum, the following SDL shall be considered in the design:

Area	Minimum SDL (kPa)
General Learning Spaces / Office / Foyer	1.5kPa
External Terraces	2.5kPa
Stairs	0.5kPa
Lightweight roof areas	0.5kPa
Concrete Roof areas	2.5kPa
Landscaping L03 Terrace (450 soil depth)	9.0kPa

4.3.2.3 Imposed Loads – Live Loads (LL)

Imposed loads on floor plates are to be compliant with AS/NZS1170.1. The building design is in development; however, we envisage the following uses and load requirements:

Area	Uniformly Distributed Load (UDL)	Concentrated Point Loads
General Learning Spaces	3.0kPa	2.7kPa
Office Areas	3.0kPa	2.7kPa
Common Room	4.0kPa	4.5kN
Breakout Space	4.0kPa	4.5kN
Corridors / Stairs/ Foyer	4.0kPa	4.5kN
Plantrooms	5.0kPa	4.5kN

Light weight roofs (non-trafficable)	0.25kPa	1.4kN
Concrete Roof	2.5kPa	2.7kN
Balconies / Terraces	4.0kPa	1.8 kN

4.3.2.4 Pattern Loading

Pattern loading shall be considered in accordance with AS/NZS1170.1.

4.3.2.5 Live Load Reduction

Live load reduction shall be considered in accordance with AS/NZS1170.1.

4.3.2.6 Wind Loads

Wind loads shall be determined in accordance with AS/NZS1170.2 using the following site criteria:

Region:	A2
Importance Level (BCA Table B1.2a):	3
Annual Probability of Exceedance (BCA Table B1.2b):	1:1000 (ultimate)
	1:25 (serviceability)
Regional Wind Speed:	V_{1000} = 46m/s
	V_{25} = 37m/s
Terrain Category:	4

4.3.2.7 Snow Loads

Snow loads are not applicable for this site.

4.3.3 Earthquake Loads

Earthquake loads shall be in accordance with AS1170.4 using the following site criteria:

Hazard Factor (Z)	0.08 (Sydney)
Site Sub-Soil Class:	Be
Importance Level (BCA Table B1.2a):	3
Annual Probability of Exceedance (BCA Table B1.2b):	1:1000 (ultimate)
Probability Factor (k_p):	1.3
Earthquake Design Category:	II

4.3.4 Deflection of Structural Elements

For the design life of the structure, the maximum deflections of structural members and their effect on finishes will comply with the serviceability requirements of the structure.

4.3.4.1 Deflection limits

Maximum deflections shall be in accordance with Table 2.3.2 of AS 3600 – 2009, and as per the below table.

Structural Element	Deflection Limit
Floors (not supporting brittle elements)	Total Long Term: Span/300 (max 25mm)
	Live Load: Span/500
	Dead Load: Span/360
Floors supporting masonry walls	Incremental: Span/750
Stud Walls under lateral loading	Span/500
Roof Members	Dead Load: Span/360
	Live Load: Span/250
	Wind: Span/150

4.4 Temporary Works

In order to maintain stability to the existing masonry façade after the existing timber floors and loadbearing masonry walls are removed inside the building, a temporary structure will need to be installed prior to any demolition. As noted above, the intent it to retain the majority of the existing building facade, and the existing Ground Floor Foyer at the entry off Forbes Street.

The temporary structure will consist of a structural steel frame that will have horizontal elements installed above the existing floor level. These horizontal members will clamp the existing façade, through the existing windows that will be removed. The horizontal members will span back to vertical trusses that will provide the lateral stability to the façade.

To be able to install the vertical trusses, localise holes will need to be made through the existing floors to allow the steel work through. Provided these steel elements do not clash with any primary structural elements, there should be minimal impact on the integrity of the existing floor. Alternatively, if the location of the steel work is not favourable, localised temporary propping may be required.

Careful planning and coordination will be required when setting out the temporary retention structure, to ensure that it does not compromise or conflict with the new concrete structure. The new concrete structure will need to be installed, prior to the removal of the temporary steel retention structure.

New foundations will be required to support the temporary retention structure. It is likely the new foundation will have to be installed at the existing natural ground level, and to be socketed below the proposed bulk excavation level.

To provide construction access into the existing Wilkinson house building to facilitate demolition of the structure and removal of waste, an existing column on the Northern Façade will need to be temporarily removed. A steel frame has been proposed to temporarily support the vertical weight of the wall over. Once the new building has been constructed, the existing column will be rebuilt, and the temporary steel frame will be removed.