Kingscliff Public School

SSDA Report - Structural

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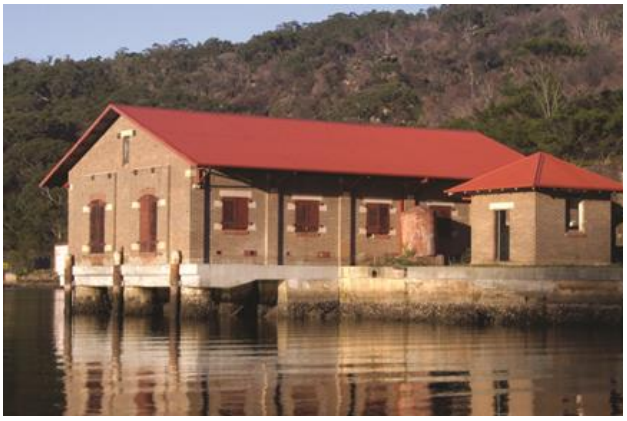

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Unless otherwise advised, the parties who have undertaken the Review and Endorsement confirm that the information contained in this document adequately describes the conditions of the site located at 80 Ann Street, Brisbane City.

Prepared By:	**Matthew Powell** Project Engineer - Structural	Reviewed By:	**Jarrod Novosel** – Principal Engineer, Structures Lead QLD

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Executive Summary

The purpose of this report is to define the structural design parameters for the new buildings proposed as part of the Kingscliff Public School Master Plan and to highlight potential design risks across the project.

Kingscliff Public School is located between Orient and Sutherland Streets, Kingscliff NSW. The site is situated within a predominantly residential zone approximately 500mm west of Cudgen Creek and Cudgen Headland. Existing permanent and demountable structures, except for the existing amenities (Block D) and the existing hall and canteen (Block G), are proposed to be demolished as part of the project scope.

The scope of works covered by this report includes:

- Retaining existing amenities (Block D), hall and canteen buildings (Block G) and staff carpark.
- New two-storey building (Building 1) at northern end of the site to house a library, general purpose learning areas and outdoor learning spaces.
- New COLA structure located at the southern end of Building 1.
- New two-storey building (Building 3) on the eastern side of the site to house an integrated COLA, general learning spaces and a special programs unit.
- New two-storey building (Building 4) at south western corner of the site to house general purpose learning areas and outdoor learning spaces. The southern end of Building 4 is proposed to be single storey only to suit view impact requirements.
- New concrete tiered seating and stairs between Buildings 3 and 4.
- New bike store and entry pavilion adjacent to pedestrian and maintenance vehicle access point off Sutherland Street.
- New playing court at northern end of the site and general landscaping throughout.
- New electrical substation kiosk adjacent to new bike store and entry pavilion off Sutherland Street.

1 Introduction

1.1 General

This report has been prepared by ACOR Consultants (QLD) and outlines proposed structural design parameters and highlights potential design risks which should be managed during the project.

1.2 Site Description

Kingscliff Public School is located between Orient and Sutherland Street, Kingscliff NSW. The site is situated within a predominantly residential zone approximately 500mm west of Cudgen Creek and Cudgen Headland.

Several permanent buildings and demountable structures are located at the northern end of the site. These existing structures, except for the existing amenities (Block D) and the existing hall and canteen (Block G), are proposed to be demolished as part of the project scope. The existing oval is located at the southern end of the site, bordered by a blockwork retaining wall forming a staff carpark along the western side adjacent to Orient Street.

Figure 1. Satellite Image of Site with Kingscliff Public School Highlighted

1.3 Project Description

A masterplan concept has been developed by SJB Architects to outline the proposed scope of works and includes the following:

- Retain existing amenities (Block D), hall and canteen building (Block G) and staff carpark.
- New two-storey building (Building 1) at northern end of the site to house a library, general purpose learning areas and outdoor learning spaces.

- New COLA structure located at the southern end of Building 1.
- New two-storey building (Building 3) on the eastern side of the site to house an internal COLA, general learning spaces and a special programs unit.
- New two-storey building (Building 4) at south western corner of the site to house general purpose learning areas and outdoor learning spaces. The southern end of the building is proposed to be single storey only to suit view impact requirements.
- New concrete tiered seating and stairs between Buildings 3 and 4.
- New bike store and entry pavilion adjacent to pedestrian and maintenance vehicle access point off Sutherland Street.
- New playing court at northern end of the site and general landscaping throughout.
- New electrical substation kiosk adjacent to new bike store and entry pavilion off Sutherland Street.

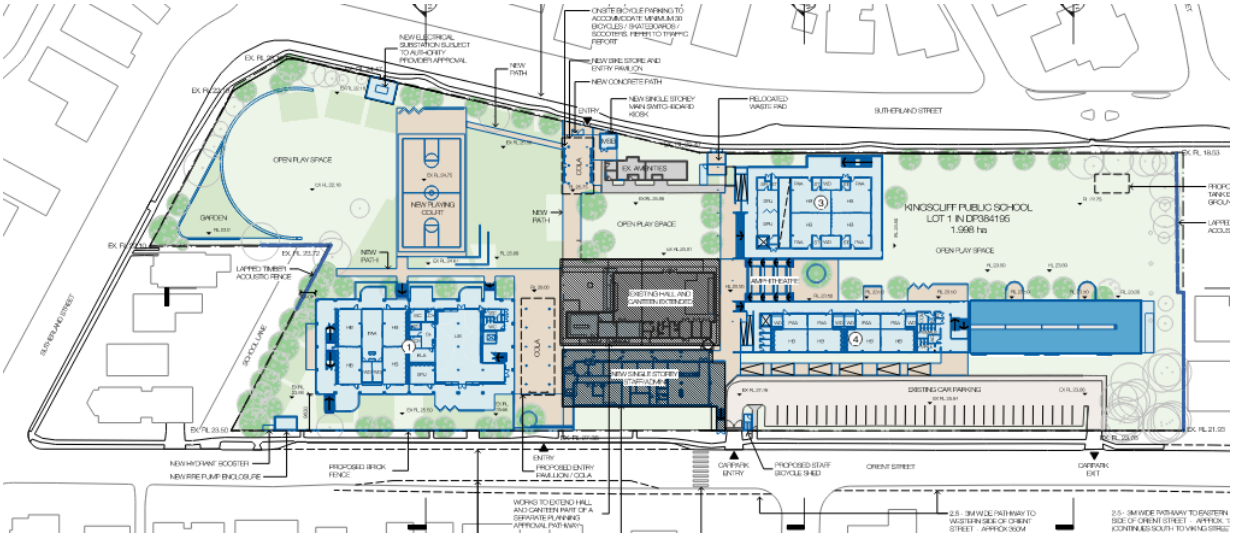

Figure 2. Proposed Site Plan by SJB Architects

1.4 Reference Documents

This report has been prepared in accordance with the following State Significant Development Application (SSDA) reference drawings by SJB Architects dated 3rd May 2021:

Table 1. Reference Drawings

Sheet No	Sheet Name	Rev
1-X-0000	TITLE PAGE	2
1-X-0101	EXISTING LOCATION PLAN	2
1-X-0102	PROPOSED LOCATION PLAN	2
1-X-0103	SITE ANALYSIS	2
1-X-0104	PLANNING APPROVAL DIAGRAM	1
1-X-0111	SITE PLAN - EXISTING AND DEMOLITION	1
1-X-0121	SITE PLAN - PROPOSED LOWER GROUND LEVEL	2
1-X-0122	SITE PLAN - PROPOSED GROUND LEVEL	2
1-X-0123	SITE PLAN - PROPOSED LEVEL 01	2
1-X-0124	SITE PLAN - PROPOSED ROOF LEVEL	2
1-1-0201	BUILDING 1 - LIBRARY & HOME BASES - FLOOR PLANS AND ROOF PLAN	2
1-3-0201	BUILDING 3 - HOME BASES - FLOOR PLANS AND ROOF PLAN	2
1-4-0201	BUILDING 4 - CLASSROOMS - FLOOR PLANS	2
1-6-0201	SUTHERLAND STREET ENTRY - COLA AND MSB - FLOOR PLANS AND ROOF PLAN	2
1-1-0501	BUILDING 1 - LIBRARY & HOME BASES - ELEVATIONS, SECTIONS AND AXO	2
1-3-0501	BUILDING 3 - HOME BASES - SECTIONS, ELEVATIONS AND AXO	2
1-4-0501	BUILDING 4 - HOME BASES - SECTIONS, ELEVATIONS AND AXO	2
1-X-0501	STREET ELEVATIONS - PROPOSED	2
1-X-0601	SITE SECTIONS - PROPOSED	2
1-X-3101	SHADOW DIAGRAMS - 9AM WINTER SOLSTICE	2
1-X-3102	SHADOW DIAGRAMS - 12PM WINTER SOLSTICE	2
1-X-3103	SHADOW DIAGRAMS - 3PM WINTER SOLSTICE	2
1-X-3201	GFA PLAN - PROPOSED - LOWER GROUND LEVEL	1
1-X-3202	GFA PLAN - PROPOSED - GROUND LEVEL	1
1-X-3203	GFA PLAN - PROPOSED - LEVEL 01	1
1-X-3211	STAGING DIAGRAMS	1
1-X-3221	MATERIALS	1

1.5 Reference Standards and Guidelines

1.5.1 General

The following reference Standards and guidelines have been used for the design of new buildings and structural elements forming the project scope:

Reference Standard / Guidelines	Description
NCC 2019	National Construction Code 2019
EFSG	Educational Facilities Standards and Guidelines – NSW Department of Education

1.5.2 Structural Engineering

The following structural engineering references have been used for the design of new buildings and structural elements forming the project scope:

Reference Standard / Guidelines	Description
NCC 2019 Volume 1 Amendment 1	National Construction Code 2019
EFSG Design Guide - Structure	Educational Facilities Standards and Guidelines – NSW Department of Education

2 Site Conditions

2.1 Geotechnical Investigation

Geotechnical investigations at the site have been undertaken by Douglas Partners Pty Ltd, with results provided in the following reports:

- Report No. 98084.00 dated April 2020
- Report No. 200062.00, dated 1st April 2021

The geotechnical investigation consisted of the drilling of twelve boreholes across the site to provide commentary and advice on the following:

- Subsurface conditions.
- Site classification in accordance with AS2870-2011.
- Suitability of both high level and deep foundation systems, including allowable bearing capacities, skin friction and anticipated characteristic surface movements.
- Recommendations for subgrade preparation and fill placement or re-compaction.
- Likely potential for contaminants based on laboratory test results.

2.2 Summary of Geotechnical Conditions

Refer the following summary of geotechnical conditions at the Kingscliff Public School site:

- The site is located within an area of Coastal deposits, with subsurface conditions comprising localised fill underlain by silty sand and silty clay.
- The subsurface conditions encountered in the various boreholes are summarised in Table 2, Table 3 and Figure 3.
- Fill material is generally poorly compacted across the site with DCP < 5 blows per 100mm. In the absence of documentation to confirm that fill was engineered and placed under 'controlled' conditions, it must be deemed 'uncontrolled'.
- Groundwater was encountered within Bore 5 at a depth of 2.4m during auger drilling.
- The site in its present state is given a 'Class P' classification due to presence of 'uncontrolled' sandy fill in excess of 0.8m depth. Based on laboratory analysis, characteristic surface movement values for a full depth cohesive profile (y_s) are consistent with 'Class M' classification if it were not for existing 'Class P'.
- Indicative site classification is based on materials encountered at test locations only and final classification assessment should be undertaken following bulk earthworks at the site.
- Excavated silty sand fill or natural sand and clay material are expected to be suitable for re-use as structural fill material.
- High level footings may be adopted where relatively shallow 'uncontrolled' fill material is present. High level footings should be founded below the existing 'uncontrolled' fill strata that extends to depths of between 0.2-1.9m across the site.
- Allowable bearing pressures for high level footings are summarised in Table 4.
- Bored pier, CFA piles, driven piles or steel screw piles have been identified as alternative options to high level footings.
- Douglas Partners recommends that an experienced piling contractor is engaged to advise on choice of pile installation.
- Allowable pile design pressures and parameters are summarised in Table 5.

Table 2. Summary of Subsurface Conditions

Bore	Strata/Depth Range (m)[(i)]					
	Topsoil and Fill (Silty Sand)	Silty Sand		Silty Clay/Sandy Clay		
		loose	medium dense (or denser)	soft to firm	firm	stiff (or stronger)
1	0.0 – 0.3	0.3 – 1.8	1.8 – 2.0[(ii)]	–	–	–
2	0.0 – 0.8	0.8 – 2.1	–	–	–	2.1 – 3.0[(ii)]
3	0.0 – 0.2	–	–	–	–	0.2 – 3.0[(ii)]
4	0.0 – 0.2	–	–	–	–	0.2 – 3.0[(ii)]
5	0.0 – 1.9	–	–	2.4 – 2.7	1.9 – 2.4	2.7 – 3.0[(ii)]

Notes (i) All depths were measured from existing site level at the time of the investigation.
(ii) Limit of investigation.

Table 3. Summary of Subsurface Conditions

Bore	Strata/Depth Range (m)[i]					
	Topsoil and Fill (Silty Sand/Sandy Clay)	Silty Sand/Clayey Sand		Silty Clay/Sandy Clay		
		loose	medium dense (or denser)	soft to firm	firm	stiff (or stronger)
9	0.0 – 1.8	–	–	1.8 – 2.1	2.1 – 4.4[ii]	–
10	0.0 – 0.8	–	0.9 -1.9	–	–	1.9 – 3.0[ii]
11	0.0 – 0.1	–	–	–	–	0.1 – 3.0[ii]
12	0.0 – 0.3	–	–	0.5 – 1.5	0.3 – 0.5	1.5 – 3.0[ii]
13	0.0 – 0.1	0.1 – 1.2	1.2 – 1.8	–	1.8 – 2.1[iii]	2.1 – 4.0[ii]
14	0.0 – 0.3	0.3 – 2.0[ii]	–	–	–	–
15	0.0 – 0.3	0.3 – 1.3	1.3 – 2.0[ii]	–	–	–

Notes (i) All depths were measured from existing site level at the time of the investigation. (ii) Limit of investigation.
(iii) firm to stiff consistency

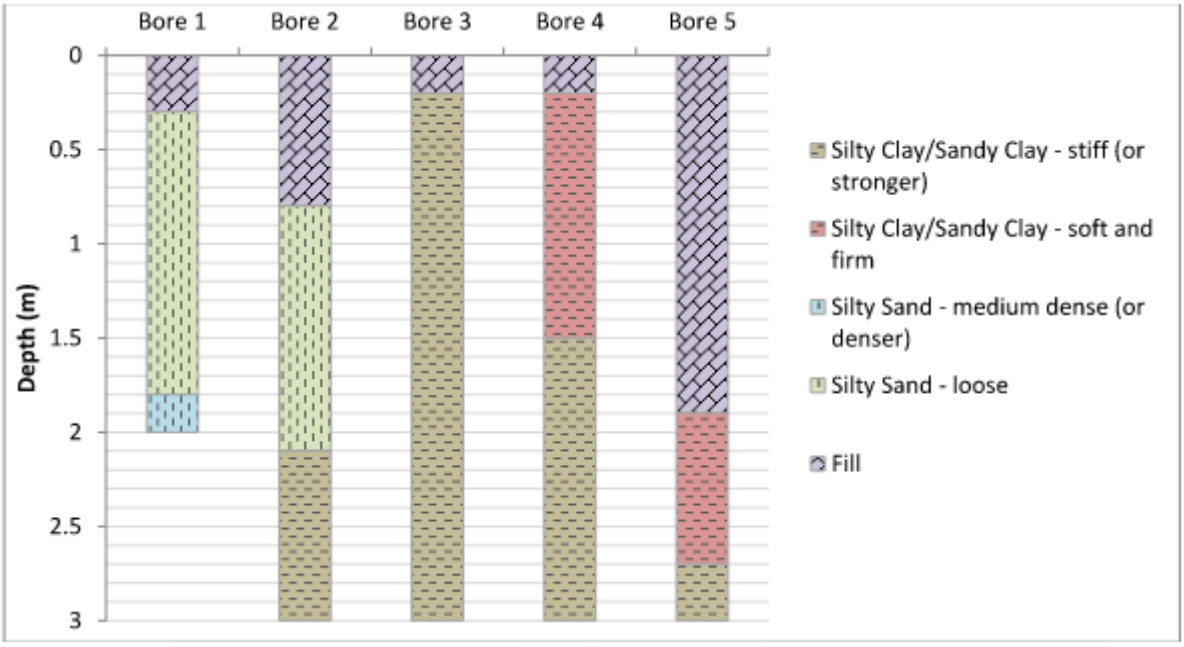

Figure 3. Graphical Summary of Subsurface Conditions

Table 4. High Level Footing Design Allowable Bearing Pressures

Material Description	Allowable Bearing Pressure (kPa)
'Uncontrolled' Fill	Not recommended
'Controlled' Fill(i)	100
Silty Clay/Sandy Clay – stiff (or stronger)	100
Silty Sand – loose(ii)	50 (strip footing) 100 (pad footing)
Silty Sand – medium dense (or denser)(ii)	125 (strip footing) 250 (pad footing)

Note (i) Assuming 'controlled' fill is placed under 'Level 1' inspection and testing by DP in accordance with the recommendations of this report AS3798 and good practice guidelines.

(ii) Founded at a minimum 1 m depth.

Table 5. Allowable Bored and CFA Pile Design Pressures

Material Description	Allowable Shaft Adhesion (kPa)(i)(ii)	Allowable End Bearing (kPa)
'Uncontrolled' and 'Controlled' Fill	not recommended	
Silty Sand – loose	not recommended	
Silty Sand – medium dense (or denser) (min 2 m founding depth)	not recommended	250
Silty Clay/Sandy Clay – stiff (or stronger)	15(i)(ii)	170

Notes (i) It is recommended that the upper 0.75 m or 1.5 times pile diameter, whichever is greater, of shaft be ignored in pile shaft adhesion calculations due to the effects of load development and seasonal moisture variation.

(ii) Ignore if temporary or sacrificial liners are used during construction.

3 Design Criteria

3.1 National Construction Code

The structural design for the new buildings and miscellaneous items at Kingscliff Public School will be prepared in accordance with the National Construction Code 2019 Amendment 1 Volume 1 (Class 2 to 9 Buildings) and Volume 2 (Class 1 and 10 Buildings). With respect to the National Construction Code, we understand the building classifications to be as follows:

Table 6. Design Criteria - NCC Classification

Building / Structural Element	Part of Building	NCC Classification
Building 1 – Ground Level	Library and Classrooms	9b
Building 1 – Level 1	Classrooms	9b
Building 1 – COLA	Assembly – Outdoor	10a
Building 3 – Lower Ground	Classrooms	9b
Building 3 – Ground Level	Classrooms	9b
Building 4 – Ground Level	Classrooms	9b
Building 4 – Level 1	Classrooms	9b
Bike Store, Entry Pavilion, Electrical Substation Kiosk	Non-Habitable	10a
Miscellaneous Items	Fences, Concrete Tiered Seating, Landscape Retaining Walls etc.	10a / 10b

3.2 Design Codes and Standards

The structural design for the new buildings and miscellaneous items at Kingscliff Public School will be prepared in accordance with the following Australian Standards and design codes:

Table 7. Design Codes and Reference Standards

Australian Standard / Design Code	Description
NCC	National Construction Code 2019 Amendment 1 Volumes 1 and 2
AS 1170.0-2002 (incl. Amdt 1,3 & 4)	Structural Design Actions, Part 0: General Principals
AS 1170.1-2002 (incl. Amdt 1 & 2)	Structural Design Actions, Part 1: Permanent, Imposed and Other Actions
AS 1170.2-2002 (incl. Amdt 1,2,3,4 & 5)	Structural Design Actions, Part 2: Wind Loading
AS 1170.4-2002 (incl. Amdt 1 & 2)	Structural Design Actions, Part 4: Earthquake Actions in Australia
AS 2159-2009 (incl. Amdt 1)	Piling – Design and Installation
AS 2870-2011	Residential Slabs and Footings

AS 3600-2018 (incl. Amdt 1)	Concrete Structures
AS 3700-2018	Masonry Structures
AS 4100-1998 (incl. Amdt 1)	Steel Structures
AS 4678-2002	Earth-Retaining Structures

3.3 Design Loading

3.3.1 Dead Loads

The structural design for the new buildings and miscellaneous items at Kingscliff Public School will be prepared using the following imposed loads:

Table 8. Design Loading - Dead Load

Material	**Loading**
Reinforced Concrete	24 kN/m^3
Water (in Storage Tanks)	9.8 kN/m^3
Masonry (Core Filled Reinforced Block)	22 kN/m^3
Masonry (Brick)	19 kN/m^3
Soil (Planter Box)	20 kN/m^3
Glazed Panels (Windows, Internal Doors etc.)	30 kN/m^3
Structural Steel	77 kN/m^3
Timber	10 kN/m^3 minimum
Tiling and Grout	To be determined but not less than 0.75 kPa
Suspended Ceilings	0.25 kPa minimum
Services, Ductwork, Lighting etc.	0.3 kPa minimum
Lightweight Internal Partitions	To be determined but not less than 0.5 kPa

3.3.2 Imposed Loads

The structural design for the new buildings and miscellaneous items at Kingscliff Public School will be prepared using the following imposed loads:

Table 9. Design Loading - Imposed Loads

Usage	Live Load	Superimposed Dead Load
General Purpose Learning Areas (GLPA)	3.0 kPa	1.5 kPa
Corridors, Hallways, Lobbies etc. **not** subject to wheeled vehicles	4.0 kPa	1.5 kPa
Office	3.0 kPa	1.5 kPa
Library	7.5 kPa	1.5 kPa
Roof (Maintenance Access Only)	1.8/A + 0.12 but not less than 0.25 kPa	0.5 kPa minimum
Balustrades [1]	Top Edge = 0.75 kN/m Vertical = 0.75 kN/m Inward/outward/downward = 0.6 kN Horizontal Infill = 1.0 kPa Infill Point Load = 0.5 kN	N/A

[1] Note – Balustrades are to be designed for imposed loading in accordance with AS 1170.1-2002 Table 3.3 Activity Type C3 – Areas without obstacles for moving people and not susceptible to over-crowding.

3.3.3 Wind Load

The structural design for the new buildings at Kingscliff Public School will be prepared using the following wind loads:

Table 10. Design Loading - Wind Loads

Criteria	Value
Location	Kingscliff, New South Wales
Region	B
Importance Level	3
Annual Probability of Exceedance - ULS	1/1000
Annual Probability of Exceedance - SLS	1/25
Regional Wind Speed, ULS (V_{1000})	60 m/s
Regional Wind Speed, SLS (V_{20})	39 m/s

Shielding Multiplier, Ms	1.0
Topographic Multiplier, Mt	1.0
Terrain Category	2.5
Design Wind Speed	57.8 m/s

3.3.4 Earthquake Load

The structural design for the new buildings at Kingscliff Public School will be prepared using the following earthquakes loads:

Table 11. Design Loading - Earthquake Loads

Criteria	**Value**
Location	Kingscliff, New South Wales
Importance Level	3
Annual Probability of Exceedance - ULS	1/1000
Probability Factor	1.3
Hazard Factor, Z	0.09
Site Subsoil Class	Ce – Shallow Soil Site
Earthquake Design Category, EDC	2

3.4 Deflection Limits

The structural design for the new buildings at Kingscliff Public School will be prepared using the following deflection limits under serviceability load conditions in accordance with EFSG Design Guidelines for Structure:

Table 12. Design Loading - Deflection Limits

Structural Element	Maximum Deflection
Supporting face masonry wall	Span/1000
Supporting rendered masonry wall	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 under dead load	Span/360
Roof members under live load	Span/250
Roof members under wind load	Span/150
Relative deflection between adjacent frames at eaves level	Less than the smaller of floor to eaves height/250 and frame spacing/200

Unless noted otherwise, structural elements will be designed in accordance with AS 1170.0-2002 Table C1 - Suggested Serviceability Limit State Criteria.

3.5 Design Life

The structural elements forming the four new buildings at Kingscliff Public School are to be designed for a minimum design life of 50 years unless noted otherwise.

3.6 Fire Design

All structural elements have been designed to achieve a Fire Resistance Period (FRP) in accordance with the National Construction Code 2019 Amendment 1 based on the Type of Construction as follows:

Table 13. Fire Design – Fire Resistance Period

Building	**Rise in Storeys**	**Type of Construction**	**Minimum FRL for Structural Elements**
Building 1	2	B	120 mins
Building 1 - COLA	Zero	C	N/A
Building 3	2	B	120 mins
Building 4	2	B	120 mins
Bike Store, Entry Pavilion, Electrical Substation Kiosk	Zero	C	N/A

4 Structural System

4.1 Building 1

4.1.1 General

Refer ACOR KPS-S-1 series for 100% Design Development drawings for proposed structural scheme for Building 1.

4.1.2 Foundation System

The borehole logs suggest varying depth of uncontrolled fill at the northern end of the site. Borehole log 2 (located at southern end of proposed Building 1 footprint) indicates uncontrolled fill material down to depth of 0.8m below NGL with a DCP value less than 5 blows per 100mm down to a depth of 2.1m, suggesting poorly compacted subgrade material. The existing subsoil conditions have been deemed unsuitable for high level footings, resulting in a steel screw piled solution being proposed as the foundation system for Building 1. Screw piles should penetrate the existing fill material and be founded into native stiff material and at a minimum founding depth to be determined by a specialist piling contractor in conjunction with the geotechnical engineer.

4.1.3 Ground Level Slab

The ground level slab has been designed as a 200mm thick 32 MPa concrete suspended flat slab formed on existing and imported uncontrolled fill material supported by a grillage of steel screw piles spaced at approximately 3m centres. Drop panels are to be provided at screw pile locations where required to resist punching shear forces. The slab is to be poured on a 0.2mm polythene damp proof membrane over a nominal 50mm sand blinding layer. A 400mm deep x 600mm wide edge thickening is proposed around the perimeter of the structural ground floor slab to minimise vertical deflection.

4.1.4 Vertical Elements

The ground floor slab is supported by steel screw piles and a block work retaining wall around the perimeter of the structural ground floor slab at the northern end of the building to suit the existing grade of the site. The suspended level 1 slab is supported by 300x450mm in-situ reinforced concrete columns and 200mm thick in-situ reinforced concrete walls which also form the lateral stability elements. All in-situ concrete columns and walls are proposed to have a minimum characteristic compressive strength of 40 MPa.

The roof structure will be supported by 300x450 in-situ reinforced concrete columns cantilevering off the level 1 suspended slab.

4.1.5 Suspended Floors

The level 1 slab has been designed as a 32 MPa concrete suspended flat plate slab. Slab thickness varies between 220-240mm thick with additional local thickenings to form drop panels at some column locations, typically along Grid Line 1.3. In-situ concrete columns supporting the level 1 slab are proposed to be spaced on grid lines at roughly 6m centres. A 400mm deep x 600mm wide edge thickening is proposed around the perimeter of the level 1 slab to minimise vertical deflection.

4.1.6 Roof Structure

The roof structure predominantly consists of light-gauge steel (LGS) prefabricated roof trusses, designed and certified by a specialist sub-contractor. LGS trusses are proposed to be supported by LGS hip trusses and structural steel roof beams spanning between in-situ reinforced concrete columns.

4.1.7 Lateral Stability

Lateral stability is provided by in-situ reinforced concrete shear walls forming the stair and lift cores. The perimeter blockwork retaining wall between lower ground and ground level at the northern end of the building also provides shear resistance for lateral loads. Lateral wind and earthquake loading at roof level is transferred to level 1 via cantilevering in-situ reinforced concrete column.

4.1.8 Outdoor Learning Spaces

The outdoor learning spaces consist of 200mm thick 32 MPa concrete suspended flat slab formed on existing or imported uncontrolled fill material. The slab is to be poured on a 0.2mm polythene damp proof membrane over a nominal 50mm sand blinding layer. The suspended slabs to the outdoor learning spaces are proposed to span between the perimeter of the ground level slab and retaining walls around the perimeter of the outdoor learning spaces. The suspended slab is to be constructed with voids and set downs to suit planters as per the landscape architect's drawings.

4.1.9 COLA

The Building 1 COLA is proposed to consist of 450 diameter in-situ concrete columns founded on concrete pile caps over 600 diameter bored pier footings. The concrete columns are proposed to support structural steel roof beams and purlins to form the roof structure. The concrete columns and steel rafters will be designed to form portal frames to provide lateral stability under wind loading. A civil pavement slab will be constructed at ground level and tied into the southern end of the Building 1 structural slab.

4.1.10 Balustrades

Balustrades are located at the northern end of Building 1, around the perimeter of the outdoor learning areas and the perimeter of the level 1 slab. Balustrade types include galvanised steel frames consisting of welded mild steel plate and brick. Brick balustrades are proposed to consist of two-skins with a central grout-filled and reinforced cavity. Cast-in starter bars and a steel plate with locking nut is proposed to achieve structural capacity to resist the imposed loads detailed in Section 3.3.2.

4.2 Building 3

4.2.1 General

Drawings denoting the proposed structural scheme for Building 3 were not available at the time of writing this report.

4.2.2 Foundation System

The borehole logs suggest a relatively shallow depth of fill material (up to 0.2m) within the proposed Building 3 footprint, however, DCP test results suggest a varying degree of compaction of the existing subgrade, with values between 3 and 10 blows per 100mm recorded down to a depth of 2.3m. It should also be noted that site is graded from north to south under the proposed Building 3 footprint and that the proposed FFL is up to 0.8m above the existing NGL at the south eastern corner of the proposed building.

To avoid the requirement for extensive subgrade preparation and to mitigate the risk of differential settlement caused by variability in existing subgrade compaction, a steel screw piled solution is the preferred foundation system for Building 3. Screw piles should penetration existing fill material and be founded into native stiff material and at a minimum depth to be determined by a specialist piling contractor in conjunction with the geotechnical engineer.

4.2.3 Ground Level Slab

The ground level slab is expected to consist of a 200mm thick 32 MPa concrete suspended flat slab formed on existing and imported uncontrolled fill material supported by a grillage of steel screw piles spaced at approximately 3m centres. Drop panels are to be provided at screw pile locations where required to resist punching shear forces. The slab is to be poured on a 0.2mm polythene damp proof membrane over a nominal 50mm sand blinding layer. A 400mm deep x 600mm wide edge thickening is proposed around the perimeter of the structural ground floor slab to limit vertical deflection.

4.2.4 Vertical Elements

A core-filled reinforced blockwork retaining wall is proposed to be constructed at the northern end of the building to suit the existing grade of the site and the lower ground floor spaces. The suspended level 1 slab is proposed to be supported by in-situ reinforced concrete columns (column size TBC) and 200mm thick in-situ reinforced concrete walls which also form the lateral stability elements. All in-situ concrete columns and walls are proposed to have a minimum characteristic compressive strength of 40 MPa.

The roof structure will be supported by in-situ reinforced concrete columns (column size TBC) cantilevering off the level 1 suspended slab.

4.2.5 Suspended Floors

The level 1 slab is proposed to be designed as a 32 MPa concrete suspended slab with a thickness of up to 240mm. Band beams or slab thickenings may be required to suit the proposed open-plan design to the centrally located home base areas. Local thickenings to form drop panels may also be required at certain column locations to resist punching shear forces. A 400mm deep x 600mm wide edge thickening is proposed around the perimeter of the level 1 slab to minimise vertical deflection.

In-situ concrete columns and walls supporting the level 1 slab are not expected to be located at regular centres, instead aligning with proposed internal walls.

4.2.6 Roof Structure

The roof structure predominantly consists of light-gauge steel (LGS) prefabricated roof trusses, designed and certified by a specialist sub-contractor. LGS trusses are proposed to be supported by LGS hip trusses and structural steel roof beams spanning between in-situ reinforced concrete columns.

4.2.7 Lateral Stability

Lateral stability is provided by in-situ reinforced concrete shear walls forming the stair and lift cores and storerooms. The blockwork retaining wall at the northern end of the building also provides shear resistance for lateral loads. Lateral wind and earthquake loading at roof level is transferred to level 1 via cantilevering in-situ reinforced concrete column.

4.2.8 Entry Ramps

New reinforced concrete entry ramps are proposed to be supported on screw piles to mitigate the risk of differential settlement and the development of trip hazards. Minimising differential settlement is also a design consideration to prevent cracking to the proposed masonry veneer and balustrades.

4.2.9 Tiered Seating and Stairs

New reinforced concrete tiered seating and stairs are proposed to be supported on screw piles to mitigate the risk of differential settlement and the development of trip hazards due to the varying degree of compaction of the existing subgrade as noted in Section 4.2.2.

Tiered seating and stairs are expected to consist of a 200mm thick suspended flat plate slab with drop panels at screw pile locations to resist punching shear forces.

4.2.10 Balustrades

Brick balustrades are to be located around the perimeter of the level 1 concourse and are proposed to consist of two-skins with a central grout-filled and reinforced cavity. Cast-in starter bars and a steel plate with locking nut is proposed to achieve structural capacity to resist the imposed loads detailed in Section 3.3.2.

4.3 Building 4

4.3.1 General

Drawings denoting the proposed structural scheme for Building 4 were not available at the time of writing this report.

4.3.2 Foundation System

The borehole logs suggest varying depth of uncontrolled fill at the southern end of the site. Borehole log 5 (located at southern end of proposed Building 4 footprint) indicates uncontrolled fill material down to depth of 1.9m below NGL. Existing subgrade material generally appears to have a consistent degree of compaction with a DCP value of approximately 5 blows per 100mm. Due to the depth of existing uncontrolled fill material, the subsoil conditions are deemed unsuitable for high level footings, so a steel screw piled solution is proposed as the foundation system for Building 4. Screw piles should penetration existing fill material and be founded into native stiff material and at a minimum depth to be determined by a specialist piling contractor in conjunction with the geotechnical engineer.

4.3.3 Ground Level Slab

The ground level slab is expected to consist of a 200mm thick 32 MPa concrete suspended flat slab formed on existing and imported uncontrolled fill material supported by a grillage of steel screw piles spaced at approximately 3m centres. Drop panels are to be provided at screw pile locations where required to resist punching shear forces. The slab is to be poured on a 0.2mm polythene damp proof membrane over a nominal 50mm sand blinding layer. A 400mm deep x 600mm wide edge thickening is proposed around the perimeter of the structural ground floor slab to limit vertical deflection.

4.3.4 Vertical Elements

The suspended level 1 slab is proposed to be supported by both reinforced concrete columns and 200mm thick in-situ concrete walls which also form the lateral stability elements. All in-situ concrete columns and walls are proposed to have a minimum characteristic compressive strength of 40 MPa.

The roof structure is expected to be supported by 300x450 in-situ reinforced concrete columns cantilevering off the level 1 suspended slab. Structural steel columns may be utilised to support the lower level roof structure at the southern end of the building where an FRP is not applicable.

4.3.5 Suspended Floors

The level 1 slab is proposed to consist of 32 MPa traditionally reinforced concrete band beams at approximately 4800mm centres supported by in-situ reinforced concrete columns. 180mm thick infill slabs are proposed to span one-way between the reinforced concrete band beams. Areas of up to 240mm thick flat slab may be documented at the northern and southern ends of Building 4 at level 1 around the stair and lift cores. A 400mm deep x 600mm wide edge thickening is proposed around the perimeter of the level 1 slab to minimise vertical deflection.

4.3.6 Roof Structure

The roof structure predominantly consists of light-gauge steel (LGS) prefabricated roof trusses, designed and certified by a specialist sub-contractor. LGS trusses are proposed to be supported by LGS hip trusses and structural steel roof beams spanning between in-situ reinforced concrete columns.

4.3.7 Lateral Stability

Lateral stability is provided by in-situ reinforced concrete shear walls forming the stair and lift cores. Lateral wind and earthquake loading at roof level is transferred to level 1 via cantilevering in-situ reinforced concrete column.

4.3.8 Outdoor Learning Spaces

The outdoor learning spaces consist of 200mm thick 32 MPa concrete suspended flat slab formed on existing uncontrolled fill material. The slab is to be poured on a 0.2mm polythene damp proof membrane over a nominal 50mm sand blinding layer. The suspended slabs to the outdoor learning spaces are proposed to span between the perimeter of the ground level slab and perimeter edge beams.

4.3.9 Entry Ramps

New reinforced concrete entry ramps are proposed to be supported on screw piles to mitigate the risk of differential settlement and the development of trip hazards. Minimising differential settlement is also a design consideration to prevent cracking to the proposed masonry veneer and balustrades.

4.4 Miscellaneous Items

4.4.1 Bike Store and Entry Pavilion

The bike store and entry pavilion are proposed to consist of 450 diameter in-situ concrete columns founded on concrete pile caps over 600 diameter bored pier footings. The concrete columns are proposed to support structural steel roof beams and purlins to form the roof structure. The concrete columns and steel rafters will be designed to form portal frames to provide lateral stability under wind loading. A civil pavement slab will be constructed at ground level to the entry pavilion and bike store, with local strip footings to suit the bike store racks.

4.4.2 Sports Court

Refer civil drawings and civil SSDA report for proposed new sport court design.

4.4.3 Electrical Substation Kiosk

Electrical substation kiosk is proposed to consist of a civil pavement slab with perimeter strip footings founded into native stiff material to support core-filled reinforced blockwork walls. It is understood that the perimeter block walls are to be designed to withstand blast loading. A lightweight LGS or timber-framed roof supported by the perimeter blockwork walls is proposed to enclose the new electrical substation kiosk.

Should any aspect of this report remain unclear or if further clarification is required, please do not hesitate to contact this office.

Yours faithfully,

Matthew Powell
Project Engineer – Structural
ACOR Consultants (QLD) Pty Ltd