4 April 2025
Ss Michael and John's Primary School, Horsham

DESIGN REPORT
Structural and Civil Engineering

PROJECT No. 10048
FOR Morton + Co, Attn: Jim Wilmot

BALANCE CONSULT.

Revision History

Revision	Description	Prepared By	Approved By	Date
0	Schematic Design Deliverable	T Mansfield	T Mansfield	2025.04.04

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1. Introduction

Balance Consult has been engaged by Morton + Co to provide structural and civil engineering consultancy services for the proposed new building works at the existing Ss Michael and John's Primary School in Horsham, Vic. The new works will include extension to the existing learning building to deliver classroom pods and construction of a new STEAM building on site. In addition, external works will be undertaken to create a landscaped link between the existing building and the new STEM building.

1.1. Purpose

This design report is provided as a summary of the design criteria and decisions made in developing the structural and civil design solutions.

As design and coordination progresses, this report may be updated if necessary but irrespective changes to design logic will be recorded in drawings issued for the various stages of the project.

Should significant changes to the design approach or client requirements be required, then this report would be updated to reflect those as required by the project team or client.

1.2. Site

The existing structure is located at 7 McLachlan Street, Horsham. The site is located in the middle of Horsham and is surrounded by residential, and community buildings. The geographical area of the site appears to be relatively flat with a gentle fall from east to west along the length of the site.

Existing Site (Google Maps)

1.3. Existing Conditions

The existing primary building on the site was constructed around 2010 with original structural and civil engineering undertaken by Aurecon for Nairn Architecture.

Based on existing structural and civil engineering drawings made available as part the current project, it is possible to confirm that the existing features include:

- Stiffened raft ground level structure proportioned consistent with Class H conditions to AS2870
- Braced structural steel frame above slab level

- Structural steel framed roof structure to suit a conventional pitched roof arrangement with central ridge
- External screens fabricated from structural steel are fixed to the primary structure but are not part of the primary load bearing path of the existing structure
- An at grade carpark with rigid concrete pavement occurs at the west end of the site immediately adjacent to the existing building
- External surfaces beyond the existing building footprint generally consists of artificial turf and sports courts.
- A covered outdoor area occurs at the south-east corner of the existing building
- Stormwater drainage is dealt with via sub-surface drainage which appears to discharge to two points of discharge (council stormwater) in McLachlan Street.
- The west point of discharge appears to capture roof drainage and the existing carparking, while the east point of discharge captures surface drainage east of the existing building.

2. Structural Engineering – Basis of Design

2.1. Objectives

The existing building is to be modified with additional classroom pods added to existing classroom building. The modifications will be made by additions to the existing structure with a desire to maintain the existing building façade line as for as long as possible so as to minimise disruption of the school due to building works.

The classroom pods will require modification and, in some cases, deletion of existing structural elements.

The proposed STEAM building will deliver a range of new rooms and facilities to suit the needs of the school. The STEAM building will be a standalone building located at the north-east corner of the existing site.

In each case, an economical and robust structural solution will be developed to deliver the project requirements.

2.2. Design Strategy

The proposed structure will feature the following key structural elements.

Existing Conditions:

Building Component	Type	Description
Existing Structure	Steel framed over concrete slab and foundations	The existing structure will be maintained in its current condition to the extent possible given the new works. In principle, all existing structural bracing elements constructed as part of the original building will be maintained and as such, the new building elements will require only sufficient bracing to remain self-supporting. If possible, and subject to detailed analysis and verification, the existing structure will be used to brace new building elements where economical. Some modifications to the existing floor structure, and associated integral beams, will be required to suit set downs and internal modifications. Changes will be detailed so as to maintain the function and integrity of the existing structure in the long term.
Existing Floor	Stiffened raft construction	Based on existing drawings, the ground level structure to the existing building is a stiffened raft concrete construction proportioned to the requirements of AS2870 to suit the site classification for the site.
Existing Walls	Non-structural partitions concealing the steel framed superstructure	Internal partitions conceal the structure above slab level which supports the roof structure. Wall bracing occurs as part of the structural steel frame and is concealed within the internal partitions. Façades frame from slab to structure over using conventional 'window wall' type construction.
Existing Roof	Structural steel frame with purlins to suit roof pitch from central ridge	Regularly spaced steel rafters span from north and south facades to ridge with an intermediate support on the building line each side of internal courtyards. Rafters support purlins which are aligned over rafters to provide support to the roof sheeting.
Internal Modifications	Set down for new wet areas	Existing internal amenity areas on each side of the building (east and west) are to be reconfigured to suit new internal layouts. Resulting changes to toilet and associated wet areas will likely require a significant reconfiguration of in-ground sewer infrastructure. As such, it is most likely that demo and reconstruction of the existing floor will be most effective.
Building Extension – Ground Level	New stiffened raft	A new stiffened raft slab to match the existing conditions and site geotechnical conditions will be required for each of the three

		building extensions. To account for potential future movement and/or settlement, new slab will be dowelled to the existing.
	Foundations	Where required, pad footings will be constructed integral with stiffened raft construction.
Building Extension – Superstructure	Steel frame	Using the existing structural grid, new rafters will be constructed to suit the required roof profile and pitch. Some modification to existing structure will be required to accommodate deletion of alternate columns to open up the internal spaces.
Building Extension – Bracing	Conventional bracing tied back to the original structure	Given the extent of the existing structure, additional lateral loading on the building extensions will be relatively minor (virtually zero in the north-south direction). As such, existing bracing will be assessed to determine spare capacity to brace the new structures.

Existing Building Modifications:

Building Component	Type	Description
Ground Level	New stiffened raft	A new stiffened raft slab to match the existing conditions and site geotechnical conditions will be required for each of the three building extensions. To account for potential future movement and/or settlement, new slab will be dowelled to the existing.
	Foundations	Where required, pad footings will be constructed integral with stiffened raft construction.
Superstructure	Steel frame	Using the existing structural grid, new rafters will be constructed to suit the required roof profile and pitch. Some modification to existing structure will be required to accommodate deletion of alternate columns to open up the internal spaces.
Bracing	Conventional bracing tied back to the original structure	Given the extent of the existing structure, additional lateral loading on the building extensions will be relatively minor (virtually zero in the north-south direction). As such, existing bracing will be assessed to determine spare capacity to brace the new structures.

STEAM Building:

Building Component	Type	Description
Ground level structure and foundations	New stiffened raft	The footprint of the proposed STEAM building lends itself to a stiffened raft solution consistent with reactive natural soil conditions. While the provisions of AS2870 do not apply for a structure such as the STEAM building, it serves as a useful reference and basis for construction.
	Foundations	Given the building superstructure above ground level, foundation elements under isolated columns or braced wall elements will include strip and pad footings. These foundations will generally be constructed integrally with the ground level stiffened raft structure.
Superstructure	Steel frame, braced	Given the nature of the internal spaces and required large clear spans, a structural steel frame for primary structure is most suitable to achieve efficiency and project requirements.

		Stability of the frame will be achieved by in-plane bracing at roof level and wall bracing to located around the building layout to achieve stability to foundation level.
Secondary Framing	Internal Partitions	Metal or timber stud construction will be appropriate for this building subject to the building Type requirements of the NCC (to be confirmed by the building surveyor). Given the nature of the structure, partitions will potentially be quite tall and so consideration will be given to secondary steel framing to ensure that a conventional metal stud can be adopted throughout.
	Façade	Facades will be generally constructed with head and bottom restraint from structure as conventional. Wall headers and the like will be documented as part of the structural steel construction for the superstructure.

3. Design Criteria

3.1. Regulatory

NCC - National Construction Code of Australia

CRITERIA		
NCC Edition		2022
Classification		TBA by RBS
Type of Construction		TBA by RBS
Building Importance Level		2 (TBA by RBS)

3.2. Loading

AS1170.1 – Dead and Live Loading

CRITERIA	Uniformly Dist. Load (kPa)	Concentrated Load (kN)
Dead Load – Superimposed – (Hospital Floors)	0.5	-
Live Load – Floor – (Public Areas, Corridors)	4.0	4.5
Live Load – Floor – (Classroom)	3.0	2.7
Live Load – Roof – (Non-Trafficable)	0.25 (minimum)	1.4
Live Load – Plant – (TBD by Consultants)	TBD	TBD
Live Load – Plant – (General Plant)	2.5	4.5

AS1170.2 – Wind Loads

CRITERIA		
Building Height (h m) above NGL		3.95
Region		A5
Terrain Category (TC)		3
Importance Level (I)		2
Annual Probability of Exceedance P		1/500
Regional Wind Speed, V_R		45 ms^{-1}
Shielding Multiplier (M_s)		1.0
Topographic Multiplier (M_t)		1.0
$M_{z.cat}$ for Building Height		0.83
Direction Multiplier (M_d)	N	0.95
	NE	0.80
	E	0.80
	SE	0.80
	S	0.80
	SW	0.95
	W	1.00
	NW	0.95
	Any	1.00

AS1170.4 – Earthquake Loads

CRITERIA		
Subsoil Classification		C_e (TBC)
Importance Category		2
Annual Probability of Exceedance P		1/500
Probability Factor k_p		1.0
Hazard Factor Z		0.09
Structural Height (m) above NGL		3.95m
Earthquake Design Category (EDC)		I
Minimum Requirement for Analysis		Static Analysis

3.3. Materials and Design

3.3.1. Durability of Structure

AS4100 – Steel Structure – Corrosion Protection

CRITERIA	PART 1	PART 2	PART 3	Comments
Internal Steelwork	Class 1 blast clean	Zinc phosphate to 50µm prime	Topcoat as specified	
External Steelwork	Class 2.5 blast clean	Inorganic zinc silicate to 75µm prime (IZS1 system)	Topcoat as specified	Option 1
	Class 2.5 blast clean	Hot dip galvanised to AS4680	Optional topcoat as specified by Architect	Option 2

AS4100 –Timber Structure – Strength Grades, Treatments

CRITERIA	Comments
Internal Timber	Strength grade selected to suit structural performance but generally MGP, LVL or F as appropriate. Timber suitable for above ground internal use will be specified
External Timber – Protected by building fabric	Strength grade selected to suit structural performance but generally MGP, LVL or F as appropriate. Timber suitable for above ground internal use will be specified
External Timber – Exposed to the Elements	Strength grade selected to suit structural performance but generally MGP, LVL or F as appropriate. Timber suitable for above ground external use will be specified
Sub-Floor Framing	Strength grade selected to suit structural performance but generally MGP, LVL or F as appropriate. Timber suitable for above ground internal use will be specified
Stumps, posts, and the like	To the extent possible, timber will not be specified as below ground but if this is not avoidable, suitable species and/or treatment (LOSP in preference to CCA) will be specified as appropriate

3.3.2. Serviceability of Structure

AS1170.0, AS3600, AS4100 – Acceptable Structural Deflections

CRITERIA		LIMIT
Load Criteria		
Load Factor – Long Term – (roof)		0.0
Load Factor – Long Term – (floor)		0.0
Load Factor – Short Term – (roof)		0.7
Load Factor – Short Term – (floor)		0.7
Timber		
Load duration factor		3 (dead load only)
Steel		
Deflection – Eaves – Lateral		col ht/240
Deflection – Load – Dead Load only		span/500
Deflection – Load – Dead and Short-Term Live Load		span/300
Deflection – Load – Serviceability Wind Load (outward)		span/360
Deflection – Load – Serviceability Wind Load (inward)		span/300

3.3.3. Material Selection

AS3600 – Concrete Structures

CRITERIA		
Minimum Concrete Strength	Foundations	32 MPa
	Slabs – Ground Bearing	32 MPa
	Slabs – Internal	32 MPa
	Slabs – External	32 MPa
Surface Exposure Environment		Inland
Exposure Classification – External		B1
Exposure Classification – Internal		A2
Concrete Cover (minimum) – External		40 mm
Concrete Cover (minimum) – Internal		30 mm

AS4100 – Steel Structures

CRITERIA		
Steel Grade (Minimum Strength)	Open Sections	300 MPa
	Hollow Sections – SHS, RHS	450 MPa
	Hollow Sections – CHS	350 MPa
	Flat Plates	250 MPa
Bolts – Cast-in Hold Down	Grade	4.6
Bolts – Steel to Steel Connections	Grade	8.8
Bolts – Post-Fixed to Concrete		8.8
Bolts – Cast-in Ferrules		8.8

AS3700 – Masonry Structures

CRITERIA		
Blockwork – Non-core Filled	Compressive Strength	12 MPa
Blockwork – Core Filled, Reinforced	Compressive Strength	12 MPa
Masonry – Clay Brick	Compressive Strength	15 MPa
Mortar		M3

AS1720 – Timber Structures

CRITERIA		

Structural Timber	Strength Grade	As required by design
	Species	Australian grown, plantation pine as preference
	Surface Treatment	None preferred. If required, use LOSP as less hazardous to people and the environment

3.4. Geotechnical Conditions

The geotechnical parameters to be adopted for the project are summarised in the table below. Where a site-specific geotechnical report is not available, the adopted design will proceed on the basis of the expected parameters summarised below. These parameters will be updated where site specific information becomes available.

ITEM	DESCRIPTION	COMMENT
Consultant	TBC	
Report Number		
Date		
Site Classification (AS2870)	H2	Expected to be highly reactive due to shallow clays overlying basalt.
Type of Investigation		
Allowable Bearing Pressure – Ground Beams	100 kPa	Typically, suitable for stiff natural clays
Allowable Bearing Pressure – Pad Footings	150 kPa	Typically, suitable for stiff natural clays
Allowable Bearing Pressure – Slab Panels	30 kPa	Typically, suitable for stiff natural clays
Allowable Bearing Pressure – Stump Footings	15 kPa	Typically, suitable for stiff natural clays
Acceptable Founding Material	Stiff Natural Clay	Typical material overlying basalt in western districts
Minimum Embedment	100	Typically, suitable for stiff natural clays
Notable Ground Conditions	None	No site features expected to have adverse impact on the structure
Groundwater	None	Not expected that groundwater would occur within metres of the founding level of the existing structure

3.4.1. Conclusions

Site geotechnical conditions are expected to be consistent with the original building structural design. Review of existing structural drawings dating back to the original building construction shows ground level structure to be based on the principles of stiffened raft construction as per AS2870.

3.5. Applicable Standards

The Structural services will be undertaken in accordance with the following documents:

REFRENCE	TITLE
NCC 2022	National Construction Code of Australia 2022
AS 1170.0	Structural Design Actions Code – General Principles
AS 1170.1	Structural Design Actions Code – Permanent, imposed & Other Actions
AS 1170.2	Structural Design Actions Code - Wind Actions
AS 1170.4	Earthquake Code
AS 1684	Timber framing (including all relevant parts)
AS 1720.1	Timber Structures
AS 2312	Guide to Protection of Iron Steel
AS 3600	Concrete Structures Code
AS 3700	Masonry Structures Code
AS 4100	Steel Structures Code
AS 4678	Earth Retaining Structures

4. Civil Engineering – Basis of Design

The existing school site has subsurface drainage infrastructure that discharges to two distinct points in McLachlan St. The school site occupies the north-east third of the larger block bounded by McLachlan St, McPherson St, Roberts Ave, Urquhart St.

Internal drainage to the main building courtyards is graded west towards the carpark where it is joins stormwater pit and pipe in the carpark and discharges to infrastructure beyond the title boundary in McLachlan St.

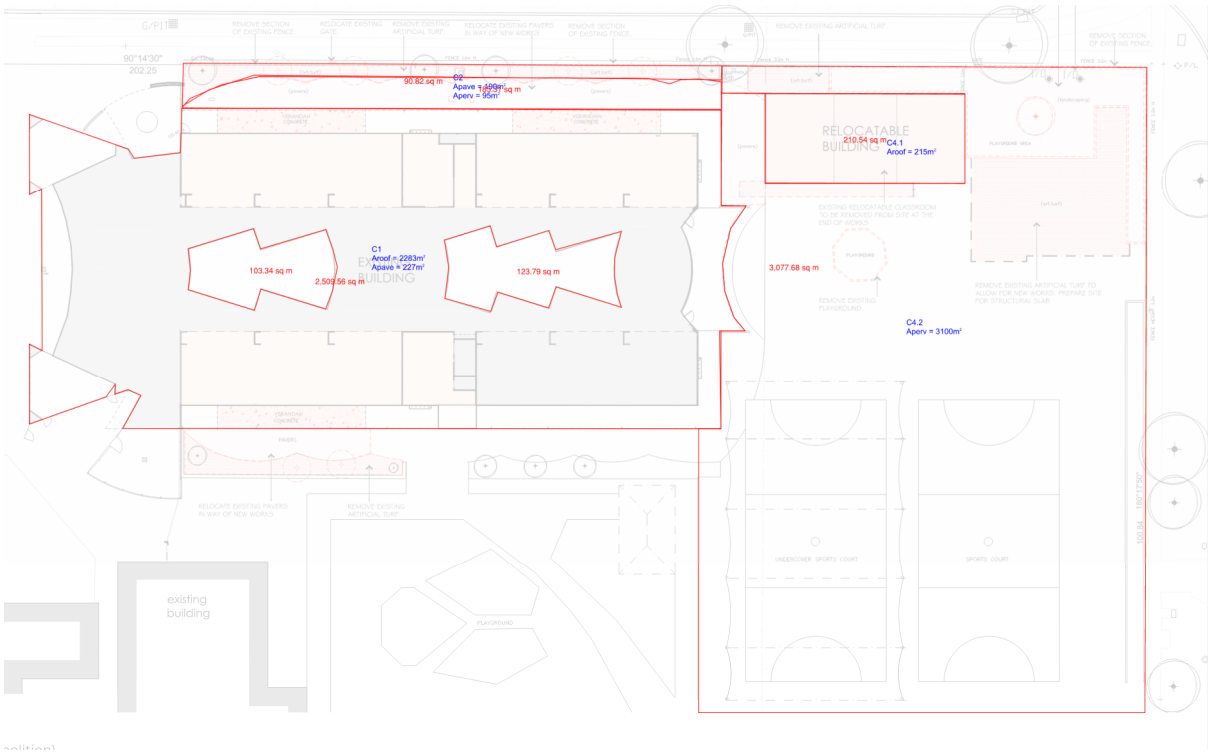
Roof drainage for the existing main building is picked up via downpipes and flows to existing in-ground infrastructure on the north and south sides of the building. These pipes then discharge north to McLachlan St where they meet the existing infrastructure beyond the title boundary.

The proposed new building works are intended to connect to existing in-ground infrastructure within the title boundaries and no modification to the existing outlets is required.

4.1. Catchment Analysis

4.1.1. Existing Catchment

The existing drainage catchment for the primary school site is as follows:



Catchment details are as follows:

CATCHMENT	A(roof) m²	A(impervious) m²	A(pervious) m²	A(total) m²
C1	2285	227	0	2512
C2	0	190	95	285
C4	215	3100	0	3315
TOTAL	2500	3517	95	6112

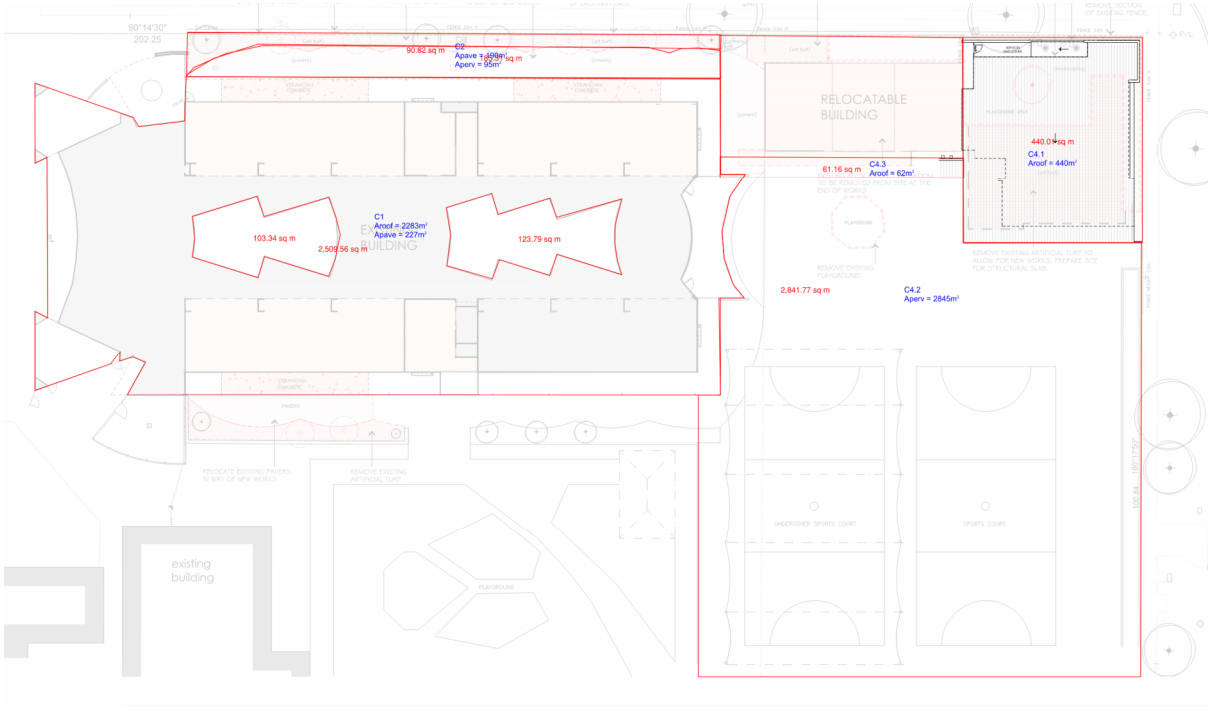
The corresponding drainage coefficients for each type of surface are as follows (and will be adopted for the new development works also):

- Roof drainage – C = 1.0
- Impervious (paved) surfaces – C = 0.9
- Pervious surfaces – C = 0.32

The effective drainage catchment area is therefore **A = 5700m²**

4.1.2. Proposed Catchment

The proposed drainage catchment for the primary school site is largely unchanged other than removal of the existing relocatable building and construction of the new building. Accordingly, the diagram and table below, only Catchment 4 details are altered:



Catchment details are as follows:

CATCHMENT	A(roof) m²	A(impervious) m²	A(pervious) m²	A(total) m²
C1	2285	227	0	2512
C2	0	190	95	285
C4	505	2845	0	3350
TOTAL	2790	3262	95	6147

The corresponding drainage coefficients for each type of surface are as follows (and will be adopted for the new development works also):

- Roof drainage – C = 1.0
- Impervious (paved) surfaces – C = 0.9
- Pervious surfaces – C = 0.32

The effective drainage catchment area is therefore **A = 5760m²**

Based on the proposed new development works the effective drainage catchment area, and corresponding outflows from site, increase by approximately 1.1% and so the effect of the new development works on the existing site conditions is negligible.

4.2. Authority Connection

As the existing authority drainage connections beyond the title boundary are suitable for the proposed new works, no further connection or modification of the authority connection is required and so no application is being made to the authority for an additional point of discharge.

4.3. Surface Finishes and Grading

External surfaces will be specified in conjunction with proposed finishes from the architectural and landscape (as applicable) documentation packages.

Finishes will be specified and detailed to suit existing conditions and proposed grading to the site.

Grading for areas of new works will aim to coordinate with the existing conditions, maintain a clear overland flow path, and achieve safe access requirements for pedestrians.

4.4. WSUD

Given the nature of the new building works, and the negligible impact on the existing site, it is not proposed that additional water sensitive urban design principles will be incorporated as part of the new building works.

The proposed new in-ground drainage and surface grading as part of this project will maintain, or improve, existing conditions.

5. Sketches

The proposed structural system described in this report is summarised in sketch form as per the attached sketches. These sketches represent a work in progress but are suitable for spatial planning and initial cost rate assessments by the Quantity Surveyor provided suitable provisions and contingencies are allowed for as is conventional for the relevant stage of the project.