THERMAL ENVIRONMENTAL

HYSIDE PROJECTS SUBTWO PTY LTD

21 Parramatta Road Homebush

BCA – SECTION J DTS COMPLIANCE REPORT

Report: S-R2019120500
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EXECUTIVE SUMMARY

Thermal Environmental has undertaken review of Section J requirements for the retail on ground of the proposed mixed use development at 21 Parramatta Road, Homebush. The energy efficiency provisions of the section J using the Deemed-to-Satisfy (DTS) method are analysed and presented within this report.

The proposed building fabric performance is detailed in Section 2.4.1 of this report. A summary of building fabric requirements are presented below.

Construction Reference	Location	Total Insulation Rating	Air Cavity (reflective and un-ventilated)
Roof / Ceiling Construction			
Flat Concrete roof - 200 mm thick	All retail Units on Ground Floor	R3.08	Varies and minimum 100 mm required.
External Wall Construction			
Concrete block work – 140 mm with reflective cavity and rigid insulation.	All External walls	R1.77	20 mm
Floor Construction			
Concrete Floor – 200 mm Concrete	Class 6 - soffit above carpark.	R1.70	-

The summary of compliant glazing system (glass and frame) for the proposed design using DTS method (Method 2) is summarised in detailed in Section 2.4.2 of this report. A summary of glazing requirements is as per below.

Building Level	Façade Aspect	Glazing System SHGC	U-value of Glazing System
Ground (Retail)	N	0.45	2.31
	E	0.45	2.30
	S	0.45	2.63
	W	0.45	4.66
Lobbies (Ground &Common area)	N	0.27	2.31
	S	0.27	2.61
	W	0.27	2.12

Reviews of the Section J provisions that are applicable to the development in the areas of building sealing, air conditioning and ventilation systems, artificial lighting and power, hot water supply and energy monitoring are presented, these needs to be further developed in conjunction with the services design.

1 INTRODUCTION

The proposed stage 2 development located at the corner of 5 Powell Street and 17-35 Parramatta Road, Homebush comprises the construction of a mixed use multi-unit residential building. The development consists of:

- 4 Levels of Basement;
- Ground floor retail and lobby
- Level 1 – 7 – serviced apartments;
- Level 8 – communal terrace, residential apartments; and
- Level 9 to 24 – Residential apartments.
- Roof level.

Under the Building Code of Australia (BCA 2019) the retail on ground is classified as:

- Retail on ground – Class 6.

The development has been assessed against the Deemed-to-Satisfy (DTS) requirements of the BCA 2019 Section J. The purpose of the report is to assess the design of the facility to establish minimum mandatory requirements and to comply with the BCA 2019 – Section J Energy Efficiency Provisions for building fabric and external glazing.

Other parts of the Section J such as J3, J5 to J8 to be reviewed by services engineers in the design, specification and equipment selection of mechanical, electrical, lifts and hydraulics services to comply with the DTS provision.

This review has not considered the alternative performance methods of demonstrating compliance. The alternative method requires detailed energy simulation of the building fabric and services to be undertaken using verification method (JV3). The verification method is only considered if it is not practical to achieve energy efficiency compliance using DTS provisions.

1.1 METHODOLOGY

The methodology employed in this report includes the following steps:

- Review BCA 2019 – Section J requirements.
- Review proposed building design and construction to assess compliance and identify and non-compliance issues.
- Provide appropriate recommendations for any non-compliance; and
- Review recommendations to determine the most appropriate solution for adoption and compliance.

1.2 DOCUMENTATION

The following documentation shown in Table 1, supplied by SJB was used in the preparation of this report:

Table 1: Documentation Supplied

Sheet No	Sheet Name	Rev
0001	Cover	2
0101	Site Location	3
0102	Site Plan and Analysis	4
0103	Survey Plan	2
0201	Basement 4	4
0202	Basement 3	4
0203	Basement 2	4
0204	Basement 1	4
0205	Ground	6
0206	Level 1 - Level 4	6
0207	Level 5 - Level 7	2
0208	Level 8	7
0209	Level 9 - Level 19	6
0210	Level 20 - Level 23	6
0211	Level 24 / Roof	4
0501	Elevation - South (Parramatta Road)	5
0502	Elevation - East (Arnotts Reserve)	5
0503	Elevation - North	5
0504	Elevation - West	5
0601	Section A	5
0602	Section B	5
1401	Apartment Types - Adaptable and Accessible Apartments	3
2901	Area Calculations - GFA	2
3101	Shadow Diagrams	3
3201	Analysis - Solar and Cross Flow	3
3301	3D Views	2
3401	External Material and Finishes	1
4001	Visualisation - View from Parramatta Road	2
4002	Visualisation - View from Arnotts Reserve	2

1.3 CLIMATE ZONE

The BCA splits regions of Australia up into eight different climate zones. Energy efficiency provision within the BCA Section J are dependent upon the climate zone a development falls within. The development is located within the Strathfield City Council and therefore falls within Climate Zone 5 according to Part A1 of the BCA 2019.

2 SECTION J ENERGY EFFICIENCY REVIEW

Section J of the BCA sets out a range of measures that requires buildings to be constructed to reduce greenhouse gas emissions. This requires improved building energy performance and ensures the installed services are operated in an efficient manner. Energy efficiency provisions are outlined for building construction and its services (heating, cooling, power, artificial lighting and hot water supply). In addition to this building's heating services, energy is to be obtained from a low greenhouse gas intensity source or an onsite renewable energy source or through another process as reclaimed energy

2.1 BCA SECTION J PERFORMANCE REQUIREMENTS

There are three performance requirements of Section J in the BCA as outlined below:

Performance Requirement – JP1

A building, including its services, must have, to the degree necessary, features that facilitate the efficient use of energy appropriate to:

- The function and use of the building and services; and
- The level of human comfort required for the building use; and
- Solar radiation being:
  - § utilised for heating;
  - § controlled to minimise energy for cooling;
- The energy source of the services; and
- The sealing of the building envelope against air leakage; and
- For a conditioned space, achieving an hourly regulated energy consumption, averaged over the annual hours of operation of not more than –
  - § for a Class 6 building, 80 kJ/m^{2}hr; and
  - § for a Class 5, 7b, 8 or 9a building other than a ward area, or a Class 9b school, 43 kJ/m^{2}hr; and
  - § for all other building classifications, other than a sole-occupancy unit of a Class 2 building or a Class 4 part of a building, 15 kJ/m^{2}hr.

There are two options to meet the performance requirement of Section J. The design and function of the building must comply with Deemed-to-Satisfy (DTS) provisions or pass Verification Method. The analysis of this report covers compliance with the Deemed-to-Satisfy provisions of Section J.

If the building design and function does not comply with the Deemed-to-Satisfy provisions, the building design and function must undergo Verification Methods (JV1, JV2 JV3) of the Section J. The Section J Verification Methods has processes outlined to determine the energy efficiency of a building through the use of a dynamic thermal simulation technique. In this case the verification method is outside the scope of this assessment.

2.2 DEEMED-TO-SATISFY (DTS) PROVISIONS

The DTS provisions within Section J of the BCA outline the following:

- Part J1 Building Fabric – Minimum thermal performance for constructions according to climate zone for roofs, ceilings, roof lights, walls – glazing as whole unit, and floors.
- Part J2 – deleted and combined with J1 – external walls
- Part J3 Building Sealing – Provisions to reduce the loss of conditioned air and restrict unwanted infiltration to a building.
- Part J4 Air Movement – No longer relevant. This section has been deleted from the BCA.
- Part J5 Air-Conditioning and Ventilation Systems – Requirements to ensure these services are used in an efficient manner.
- Part J6 Artificial Lighting and Power – Requirements for lighting and power to ensure energy is used efficiently within a building.
- Part J7 Heated water supply and swimming pool and spa pool plant – set the minimum requirements for heated water system for hot water supply, swimming pool, and spa.

- Part J8 Facilities for energy monitoring – to ensure that the building has the facilities to monitor its energy usage.

2.3 BUILDING CLASSIFICATION

The proposed retail on ground is classified as follows according to the Building Code of Australia:

- Class 6 – retail;

2.4 SECTION J APPLICABLE PARTS REVIEW

Table 2 outlines the Parts of Section J that are applicable to a Class 6 Building.

Table 2: Applicable Section J Parts

BCA Section J Parts	Class 6 Building and Class 2 Common Areas	Responsibility
Part J1 – Building Fabric	Applicable	Architect
Part J3 – Building Sealing	Applicable	Architect and Services Engineers
Part J4 – Air Movement	Not relevant	Not Applicable
Part J5 – Air Conditioning and Ventilation Systems	Applicable	Mechanical Services Engineers
Part J6 – Artificial Lighting and Power	Applicable	Electrical Services Engineers
Part J7 – Heated water supply and swimming pool and spa pool plant	Applicable	Hydraulic Services Engineers
Part J8 – Facilities for energy monitoring	Applicable	Architect and Services Engineers

Following section outlines the detail description of Section J requirements applicable to the proposed development.

2.4.1 Thermal Construction – General

- Where required, insulation must comply with AS/NZS 4859.1 and be installed so that it—
  - abuts or overlaps adjoining insulation other than at supporting members such as studs, noggings, joists furring channels and the like where the insulation must be against the member; and
  - forms a continuous barrier with ceilings, walls, bulkheads, floors or the like that inherently contribute to the thermal barrier; and
  - does not affect the safe or effective operation of a service or fitting
- where required, reflective insulation must be installed with—
  - the necessary airspace to achieve the required R-Value between a reflective side of the reflective insulation and a building lining or cladding; and
  - the reflective insulation closely fitted against any penetration, door or window opening; and
  - the reflective insulation adequately supported by framing members; and
  - each adjoining sheet of roll membrane being—
    - overlapped not less than 50 mm; or
    - taped together.
- Where required, bulk insulation must be installed so that—
  - it maintains its position and thickness, other than where it is compressed between cladding and supporting members, water pipes, electrical cabling or the like; and
  - in a ceiling, where there is no bulk insulation or reflective insulation in the wall beneath, it overlaps the wall by not less than 50 mm.
- Roof, ceiling, wall and floor materials, and associated surfaces are deemed to have the thermal properties listed in Specification J1.2.
- The required Total R-Value and Total System U-Value, including allowance for thermal bridging, must be—

- § calculated in accordance with AS/NZS 4859.2 for a roof or floor; or
- § determined in accordance with Specification J1.5a for wall-glazing construction; or
- § determined in accordance with Specification J1.6 or Section 3.5 of CIBSE Guide A for soil or sub-floor spaces.

2.4.2 Part J1 – Building Fabric

Part J1 of Section J outlines the requirements for Building Fabric covering Roof and Ceiling Construction, Walls- Glazing combined as a whole, Floors and Roof Lights (Sky Lights).

Based on the architectural information received, data tables have been compiled below showing the roof, ceiling, wall, floor construction make-ups of the development and the requirements for roof-lights if any used. Adjustments and/or inclusions to the construction make-ups where required in order to achieve the requirements have been outlined. Thermal properties of listed materials within data tables are assumed to be equivalent to those listed in *Specification J1.2 Material Properties* of Section J unless indicated otherwise. Insulation thicknesses quoted are nominal and taken from manufacturer's data for typical insulation products as assumed within the calculation tables.

Roof and Ceiling Construction

The conditioned spaces of the proposed development must achieve a minimum total thermal resistance (R-value) downwards heat flow direction (heat gain) of 3.7 m²K/W for a roof/ceiling generally. The minimum thermal resistance required and the absorptance values are as shown in Table 3.

The lighter coloured roof will have higher heat reflection or lower solar absorptance compared to darker roof. The light coloured roof or low solar absorptance will therefore require less minimum overall insulation compared to the medium and dark coloured roof.

The roof colour proposed for the development is a light coloured roof with upper surface solar absorptance value of not more than 0.45.

Table 3: Roof and Ceiling Minimum Total Thermal Resistance

Solar Absorptance	Absorptance Value	Climate Zone	Total Minimum R-Value
Upper surface solar absorptance.	≥0.45	5	3.7

The roof or ceiling insulation is required for the conditioned spaces separating a conditioned space from a non-conditioned or an exterior of the building.

Any space within the building that does not form the part of a conditioned space or envelope for Section J assessment, the roof/ceiling insulation requirements does not apply. However the roof/ceiling construction is recommended to have some form of insulation to maintain comfort conditions or provide more habitable space and reduce overall energy consumption. The detailed thermal comfort assessment associated with the level of insulation installed, is outside the scope of this report, and if thermal comfort assessment is required Thermal Environmental can provide a separate report.

The various roof types used within the development as a conditioned space envelope are shown in Table 4. The assessment and the insulation requirements for each of the roof types are detailed in this section.

Table 4: Roof Types Used within the Development

Roof/Ceiling	Roof Pitch	Construction Description	Area Serving
Concrete Slab	Flat (<5°)	Concrete Slab and plasterboard ceiling	Roof/Ceiling of Boarding House

Table 4 shows the detail thermal resistance calculation and the compliance requirements for the various roof constructions of the development as outlined within the architectural documentation.

The associated thermal data of the flat concrete roof construction is shown in Table 5, including the level of insulation required in order to comply with the section J requirements.

Table 5: External Roof/Ceiling Construction – Concrete Flat Roof

Construction Layer	Nominal Thickness (mm)	Thermal Conductivity W/m K	Thermal Resistance (m² K/W)
Outside Air Film (Still air assumed)	–	-	0.04
Concrete Slab	200	1.44	0.14
Air cavity (Non reflective and Unventilated)	Varies	-	0.22
Plasterboard Lining	10	0.17	0.06
Inside Air Film (still air assumed)	–		0.16
Total Thermal Resistance (R-Value) of the Construction			0.62
Deficit from Section J (DTS) Compliance Thermal Resistance(m^2 K/W)			3.08
Recommended Insulation Level			
Minimum Thermal Insulation Required	-	-	*3.08 (Product)*
New Total Thermal Resistance (R-Value)			*3.70*

It is seen the total construction thermal resistance adds up to R0.62 falling short of minimum section J requirements by 3.08. In order to meet section J requirements it is recommended that bulk insulation with minimum product rating of R0.08 be installed. With the minimum recommended insulation the roof/ceiling construction adds up to R3.70, which satisfies the minimum section J roof insulation requirements therefore complies with the requirements of the BCA.

More than 5% uninsulated ceiling space is not allowed. Interpolation of insulation values is allowed to determine the adjusted minimum R-value of the roof/ceiling insulation.

Roof Lights (Sky Lights)

There are no roof lights used within the facility, therefore the requirements of roof lights do not apply for the proposed development.

Wall and Glazing Construction

The total system U-Value of wall – glazing construction for a class 6 building must not be greater than U – 2.0 in climate zone 5. The total system U-value of wall –glazing construction must be calculated in accordance with Specification J1.5a.

The wall components of a wall-glazing construction must achieve a minimum Total R-Value of—

- where the wall is less than 80% of the area of the wall-glazing construction, R1.0; or
- where the wall is 80% or more of the area of the wall-glazing construction, the value specified in Table 6

Table 6: Roof Types Used within the Development

Climate Zone	Class 2 Common area, Class 5, 6, 7, 8 or 9B building or a Class 9A building other than a Ward Area
1	2.4
2	1.4
3	
4	
5	
6	
7	
8	

The wall construction of the development is shown within Table 7. The assessment and the insulation requirements for the wall types are detailed as below including the steel studs and noggings (15% - assumed) for thermal bridging calculation.

The total thermal resistance required for masonry concrete blockwork – 140 mm with reflective and ventilation air cavity with rigid XPS insulation, streel studs, purlins and plasterboard lining is as shown in Table 7.

Table 7: External Wall Construction Make-up and T-Value Calculation.

Total System R-value Calculator

	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5	Layer 6	Layer 7
Material	Concrete block - 140 mm dense or 190mm lightweight	Airspace - 20mm, inner surface 0.05 emittance	XPS - Extruded Polystyrene CO2 Blowing	Gypsum plasterboard			
Thickness (mm)	140	20	60	10			
Conductivity (W/mK)	0.850	n/a	0.034	0.170			
Framing Material			Steel				
Metal Frame, Web Thickness (mm)			5				
Metal Frame, Flange Width (mm)			50				
Framing Area %			15%				
Thermal Break Material			EPS				
Thermal Break Thickness (mm)			5				
Thermal Break Overlap Area %			1				
Resistance (W/m².K)	0.16	0.48	0.91	0.06			
Wall Construction	Wall1		External Surface Resistance (moving air, not more than 3m/s wind speed)				0.04
	Wall Construction Tip: Add wall construction name					Internal Surface Resistance (still air, on a wall)	0.12
						System R-Value (W/m².K)	1.77
						System U-Value (W/m².K)	0.57

The SHGC of the Glazing is determined using façade solar admittance for each aspect. The solar admittance of externally facing wall-glazing must not be greater than the values of Table J1.5b for Class 2 common area, a class 5, 6, 7, 8 or 9B building.

Based on the solar admittance values (Taken from Table J1.5b), amount of glazing on the façade and façade orientation for the proposed building, Table 8 summaries the Wall – Glazing U-Value and SHGC for each façade using method 2.

Table 8: Summary of Glazing Requirements

Building Level	Façade Aspect	Wall Area (m^2)	Glazing Area (m^2)	Glazing (%)	Total R-value of Wall	Method 2 Glazing SHGC	U-value of Glazing
Ground	N	12.46	57.32	82%	1.77 (Including thermal bridging and thermal breaks)	0.45	2.31
	E	11.45	54.96	83%		0.45	2.30
	S	45.26	51.48	47%		0.45	2.63
	W	29.98	53.82	35%		0.45	4.66
Lobbies (Ground &Common area)	N	5.46	25.08	82%		0.27	2.31
	S	21.48	50.12	70%		0.27	2.61
	W	2.19	26.18	92%		0.27	2.12

Floor Construction

In climate zone 5, the floor construction that is part of the envelope, that separates a conditioned space and a non-conditioned space without any in-slab heating or cooling system must achieve the total thermal resistance R-value for downward heat flow (heat loss) of 2.0m^{2}K/W as taken from Table J1.6 of Section J.

The suspended floor that is part of the envelope, that separates a conditioned space must achieve the total thermal resistance R-value as described above to satisfy the requirements of Section J.

Table 9: Floor Construction – Concrete Slab

Construction Layer	Nominal Thickness (mm)	Thermal Conductivity W/m K	Thermal Resistance (m² K/W)
Outside Air Film (7.0m/s wind assumed)	–	-	0.04
Solid Concrete (2400 kg/m^3)	200	1.44	0.14
Inside Air Film (still air assumed)	–	-	0.12
Total Thermal Resistance (R-Value) of the Construction			0.30
Deficit from Section J Compliance Thermal Resistance(m^2 K/W)			1.70
Recommended Insulation Level			
Product Insulation	-	-	*1. 70(Product)*
New Total Thermal Resistance (R-Value)			*2.0*

The floor construction as shown in Table 9 adds up to a total thermal resistance of 0.30m^{2}K/W falling short of the Section J requirement by 1.70 m^{2}K/W. In order to achieve the Section J DTS requirement. It is recommended that this construction contain thermal insulation with minimum rating of R1.70 to meet section J minimum floor insulation requirements.

2.4.3 Part J3 – Building Sealing

Part J3 of Section J outlines construction provisions to limit unconditioned air infiltrating into conditioned spaces and also limit conditioned air from escaping.

Chimneys and Flues

Clause J3.2 outlines the chimney or flue of an open solid-fuel burning appliance must be provided with a damper of flap that can be closed to seal the chimney or flue.

Roof Lights

Clause J3.3 outlines that a roof light must be sealed, or capable of being sealed where serving a conditioned space or a habitable room in climate zone 4, 5, 6, 7 or 8.

Windows and Doors

Clause 3.4 outlines windows and doors must be sealed when forming part of the envelope or in climate zones 4, 5, 6, 7 or 8. A seal to restrict air infiltration must be fitted to each edge of doors, openable windows or the like that separate conditioned spaces from non-conditioned spaces or external areas. The bottom edge of the door must be a draft protection device.
This provision is not required for windows complying with Australian Standard AS 2047, roller doors, and fire doors, roller shutter grilles, security doors or device installed out of hours service. The seal required may be a foam or rubber compressible strip, fibrous seal or the like.

The main entrance to the development must have an airlock, self-closing door, revolving door or the like, where the conditioned space has a floor area of more than 50 m^2 or where a café, restaurant, open shop front or the like has a 3 m deep unconditioned zone between the main entrance.

Exhaust Fans

Clause J3.5 outlines that any miscellaneous exhaust systems must be fitted with a sealing device such as a self-closing damper when serving a conditioned space or habitable room.

Construction of Ceiling, Walls and Floors

Clause J3.6 outlines for the conditioned areas that the roofs, walls floors and any openings such as for doors and windows must be constructed to minimise air leakage. The construction must enclose conditioned spaces by close fitting internal lining systems at the ceiling, wall and floor junctions or by sealing through caulking, skirting, architraves, cornices or the like. The requirements of this clause do not apply to openings, grilles and the like necessary for smoke hazard management.

Evaporative Coolers

Clause J3.7 outlines that if evaporative cooling is used, the system must be fitted with self-closing non-return dampers. This Clause is not applicable as there are no evaporative coolers being used for the proposed development.

It is recommended, Architect, services engineers along with the project's head contractor to document the building sealing requirements as to show how Part J3 of the BCA has been satisfied.

2.4.4 Part J5 – Air Conditioning and Ventilation Systems

Part J5 is the responsibility of Mechanical services design. Mechanical services engineer to document requirements of the section J part J5.

2.4.5 Part J6 – Artificial Lighting and Power

Part J6 is the responsibility of Electrical services design. Electrical services engineer to document requirements of the section J – part J6.

2.4.6 Part J7 – Heated water supply and swimming pool and spa pool plant

Part J7 is the responsibility of Hydraulic services design. Hydraulic services engineer to document requirements of the section J – part J7.

2.4.7 Part J8 – Facilities for Energy monitoring

Clause J8.3 of Part J8 requires facilities for energy monitoring for a building or sole occupancy unit with a floor area of more than 500 m^2 must have the facility to record the consumption of gas and electricity. A building with a floor area of more than 2,500 m^2 must have the facility to record individually the energy consumption of following:

- Air conditioning plant including, where appropriate, heating plant, cooling plant and air handling fans and
- Artificial lighting; and
- Appliance power; and
- Central hot water supply; and
- Internal transport devices including lifts, escalators and travelators where there is more than one serving the building; and
- Other ancillary plant.

The requiremets for metering is the responsibilty of the building services engineers.