V by Crown

Section J, JV3 Assessment

19th July 2014
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WSP | Built Ecology

Quality Management

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1. INTRODUCTION

Introduction

WSP Built Ecology has carried out an analysis for the non-residential spaces of the V by Crown development located in Parramatta.

Verification Method JV3 requires a comparison between a reference building (constructed according to Specification JV and the DTS Provisions detailed in Section J of Volume One of the NCC Series 2014) and the proposed building design.

The following simulations have been carried out:

- Reference Building + Reference Services—modelling of the building with the building envelope and services meeting the DTS Provisions
- Proposed Building + Reference Services—modelling of the building with the building envelope meeting the design intent and the services meeting the DTS Provisions

This report presents the methodology used for the JV3 modelling and the results of the simulations undertaken.

Expert

Alan Davis has a Bachelor of Science in Mechanical Engineering and a Masters of Science in Sustainable Energy Engineering. He is an Associate Director and Sydney Team Leader of WSP Built Ecology. Alan has ten years of experience in energy modelling and building code compliance reporting. He is also a Chartered Institution of Building Services Engineers (CIBSE) Low Carbon Consultant and Low Carbon Energy Assessor, and a Green Star and Infrastructure Sustainability Accredited Professional.

Performance Requirements

Volume One of the NCC Series 2014 Clause A0.10 Requirements

The relevant DTS Provisions considered in the Reference Building + Reference Services and the Proposed Building + Reference Services are as follows:

- Section J Part J0 Energy Efficiency
- Section J Part J1 Building Fabric
- Section J Part J2 Glazing
- Section J Part J3 Building Sealing
- Section J Part J5 Air Conditioning and Ventilation System
- Section J Part J6 Artificial Lighting and Power

There are no performance requirements from other Sections or Parts of Volume One of the NCC Series 2014 that are relevant to any aspects of the Reference Building + Reference Services and the Proposed Building + Reference Services or that are affected by the application of the DTS Provisions that are the subject of the Reference Building + Reference Services and the Proposed Building + Reference Services.

Table 1 summarises the entities who are generally responsible for demonstrating compliance with the Parts of Section J through self-certification.

Volume One of the NCC Series 2014 JP1 Requirements

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 its services
- The internal environment
- The geographic location of the building
- The effects of nearby permanent features such as topography, structures and buildings
- Solar radiation being utilised for heating and controlled to minimise energy for cooling
- The sealing of the building envelope against air leakage
- The utilisation of air movement to assist heating and cooling
- The energy source of the services

Table 1: Application of Parts

Design Team	Section J Parts							
	1	2	3	4	5	6	7	8
AJ+C	✓	✓	✓	N/A				✓
Services Consultant(s)			✓	N/A	✓	✓	✓	✓

1. INTRODUCTION

Assessment Method Used

Clause A0.9 of Volume One of the NCC Series 2014 stipulates that the following assessment methods, or any combination of them, can be used to determine that a building solution complies with the performance requirements:

- Evidence to support that the use of a material, form of construction or design meets a Performance Requirement or a Deemed-to-Satisfy provision as described in A2.2
- Verification Methods such as the Verification Methods in the BCA; or such other Verification Methods as the appropriate authority accepts for determining compliance with the Performance Requirements
- Comparison with the DTS Provisions
- Expert judgement

The non-residential spaces of the V by Crown development seeks to demonstrate compliance with JP1 by using:

1. Verification Method JV3; determining that the annual energy consumption of the Proposed Building + Reference Services is not more than the annual energy consumption of the Reference Building + Reference Services

AND

2. Expert judgement

Building Classification

Under Part A3.2 of Volume One of the NCC, the non-residential spaces of the V by Crown development are categorised as Class 5 (office building) or Class 6 (shop).

The site falls within Climate Zone 6.

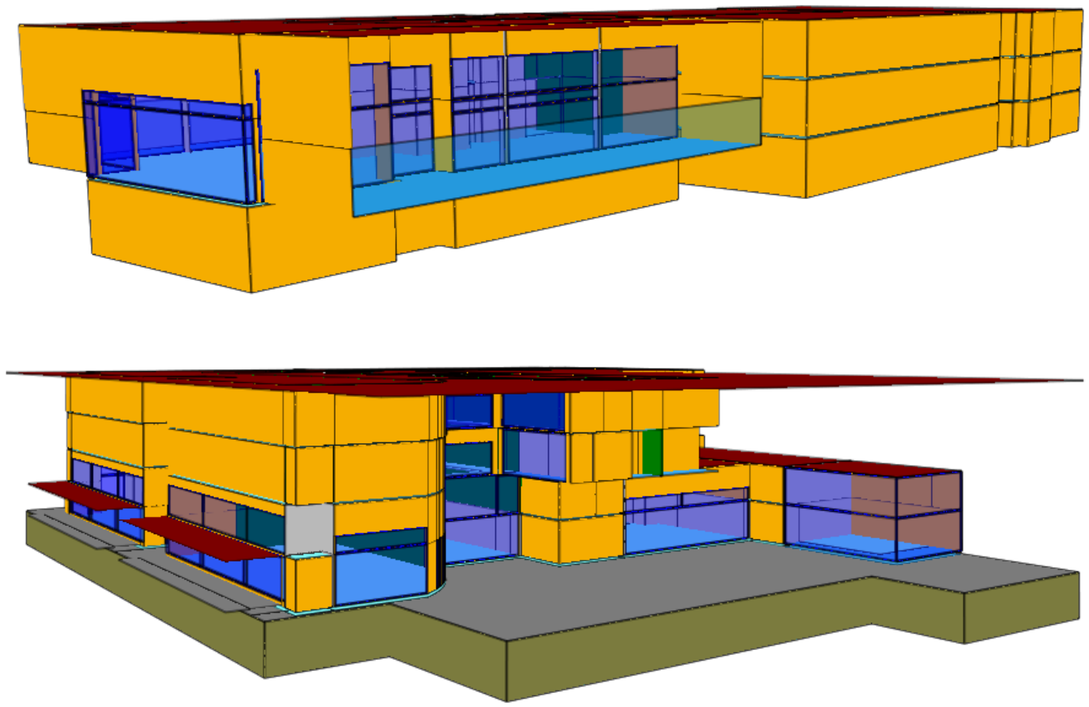

Figure 1: Thermal model of the non-residential spaces of the V by Crown development on Ground Floor, Mezzanine and Level 1 [bottom] and on Level 26 and Level 27 [top]

2. METHODOLOGY

This section describes the methodology used for obtaining the information required to undertake the JV3 analysis.

Software

The computer package used for the thermal simulation was Tas version 9.3.1, by Environmental Design Solutions Limited. It is an EN ISO 13791 validated dynamic simulation modelling (DSM) software tool and is approved under the *ABCB Protocol for Building Energy Analysis Software*, *Version 2006.1*.

Figure 1 on page 5 illustrates the thermal model developed as part of the JV3 analysis undertaken.

Equipment Loads

Simulations of the Reference Building + Reference Services and Proposed Building + Reference Services use consistent equipment loads, as per Volume One of the NCC Series 2014, including:

- Specification JV Table 2b for the appliances and equipment schedule
- Specification JV Table 2h for equipment loads

Mechanical Services

Simulations of the Reference Building + Reference Services andProposed Building + Reference Services use consistent air conditioning parameters, as per Volume One of the NCC Series 2014, including:

- Specification JV Table 2b and Table 2c for the air conditioning operational schedule
- Clause JV3 (d), sub clause (i) (D) for the air conditioning temperature range
- Maximum fan motor power, as per Table J5.2

Occupancy Loads

Simulations of the Reference Building + Reference Services, Proposed Building + Reference Services and Proposed Building + Proposed Services use consistent occupancy loads, as per Volume One of the NCC Series 2014, including:

- Specification JV Table 2b and Table 2c for the occupancy schedule
- Specification JV, clause 2(b)(iii)(A) for sensible and latent occupancy heat gain
- Table D1.13 for occupant density

Lighting Loads

Simulations of the Reference Building + Reference Services and Proposed Building + Reference Services use consistent lighting loads, as per Volume One of the NCC Series 2014, including:

- Specification JV Table 2b and Table 2c for artificial lighting schedule
- Table J6.2a for maximum illumination power density

Architectural Design

- Architectural drawings issued by AJ+C on 30/05/2014

3. PERFORMANCE PARAMETERS—Building Fabric for Non-Residential Spaces

Building Fabric Performance Parameters

Simulations incorporate building fabric elements with thermal performances as per Table 2. Table 1 of *V by Crown, Section J Part J1 and Part J2 DTS Analysis Report,* Issue 01, prepared by WSP Built Ecology and issued on 28/02/2014, should be read in conjunction with Table 2 below. Only the thermal performance those building fabric elements that have changed since issue of the DTS report are detailed.

Table 2: Building fabric performance parameters

Building Envelope Element	Reference Building	Proposed Building
Suspended floor	**R 2.0 m^2.K/W** Suspended floor without an in-slab heating or cooling system; the non-conditioned space is enclosed and mechanically ventilated by more than 1.5 air changes per hour	**R 0.4 m^2.K/W** 150mm concrete

3. PERFORMANCE PARAMETERS—Building Fabric for Non-Residential Spaces

Proposed Building Insulation Application

Proposed building simulations incorporate building fabric insulation application as per Figure 2 and Figure 3 for the Ground Floor, Mezzanine and Level 1.

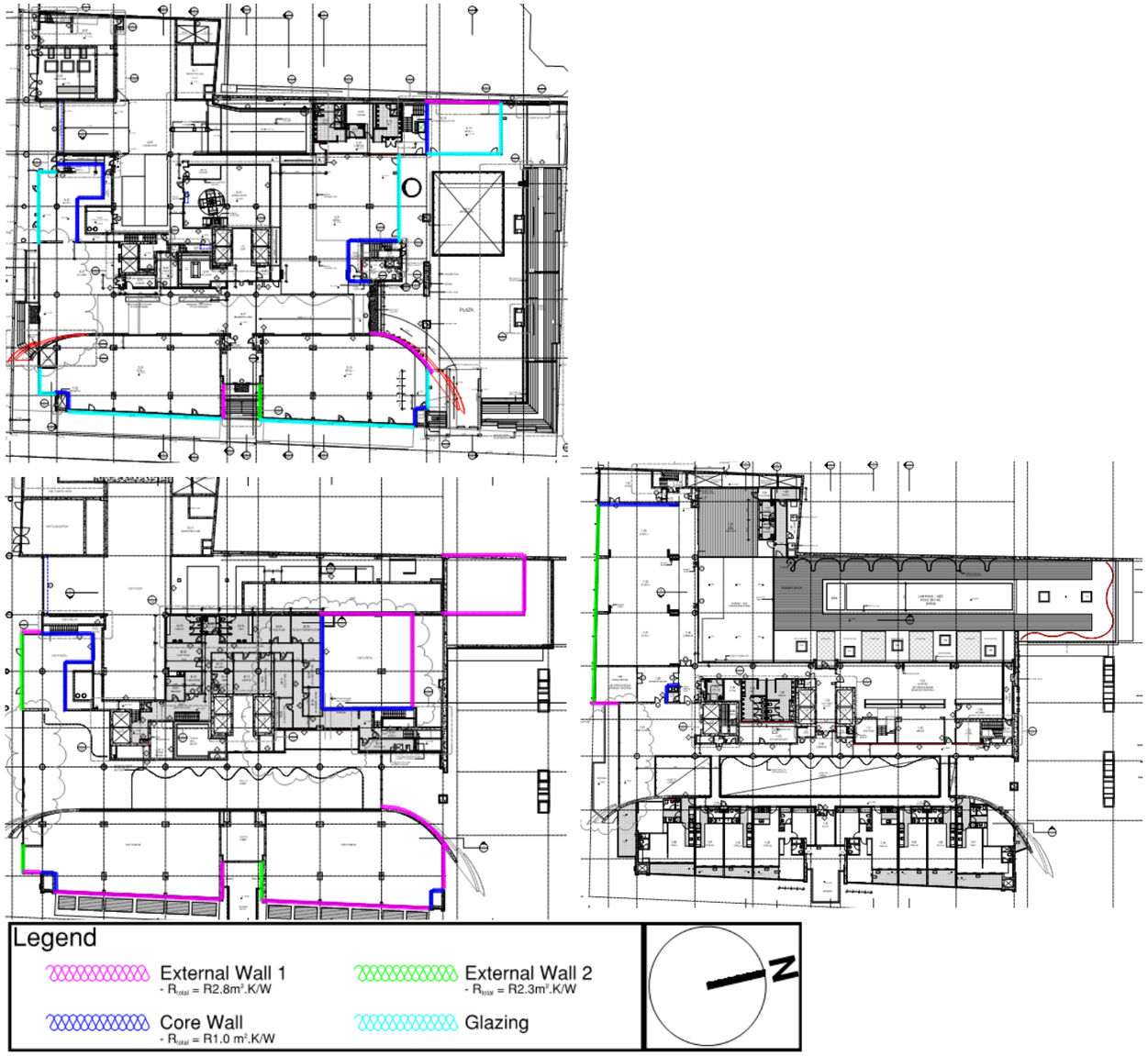

Figure 2: Ground Floor [top left], Mezzanine [bottom left] and Level 1 [right] wall insulation

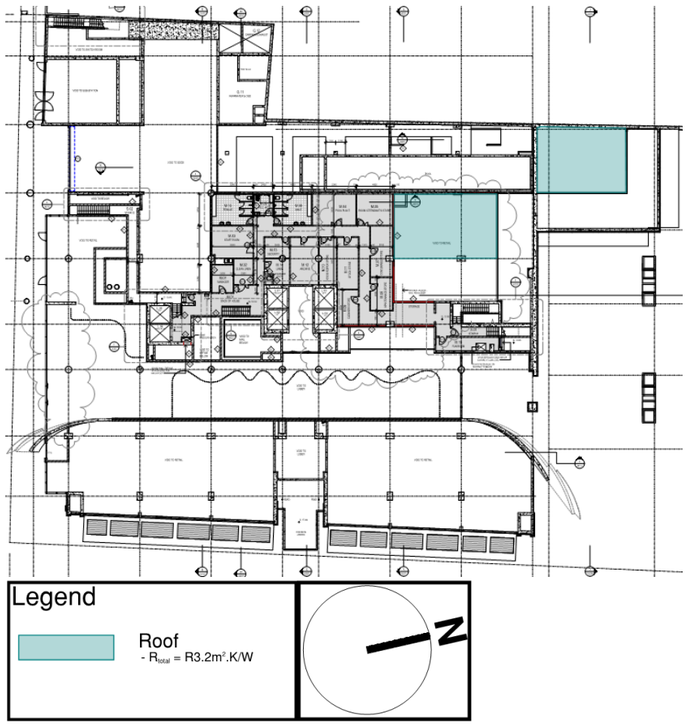

Figure 3: Mezzanine roof insulation

3. PERFORMANCE PARAMETERS—Building Fabric for Non-Residential Spaces

Proposed Building Insulation Application

Proposed building simulations incorporate building fabric insulation application as per Figure 4 and Figure 5 for Level 26 and Level 27.

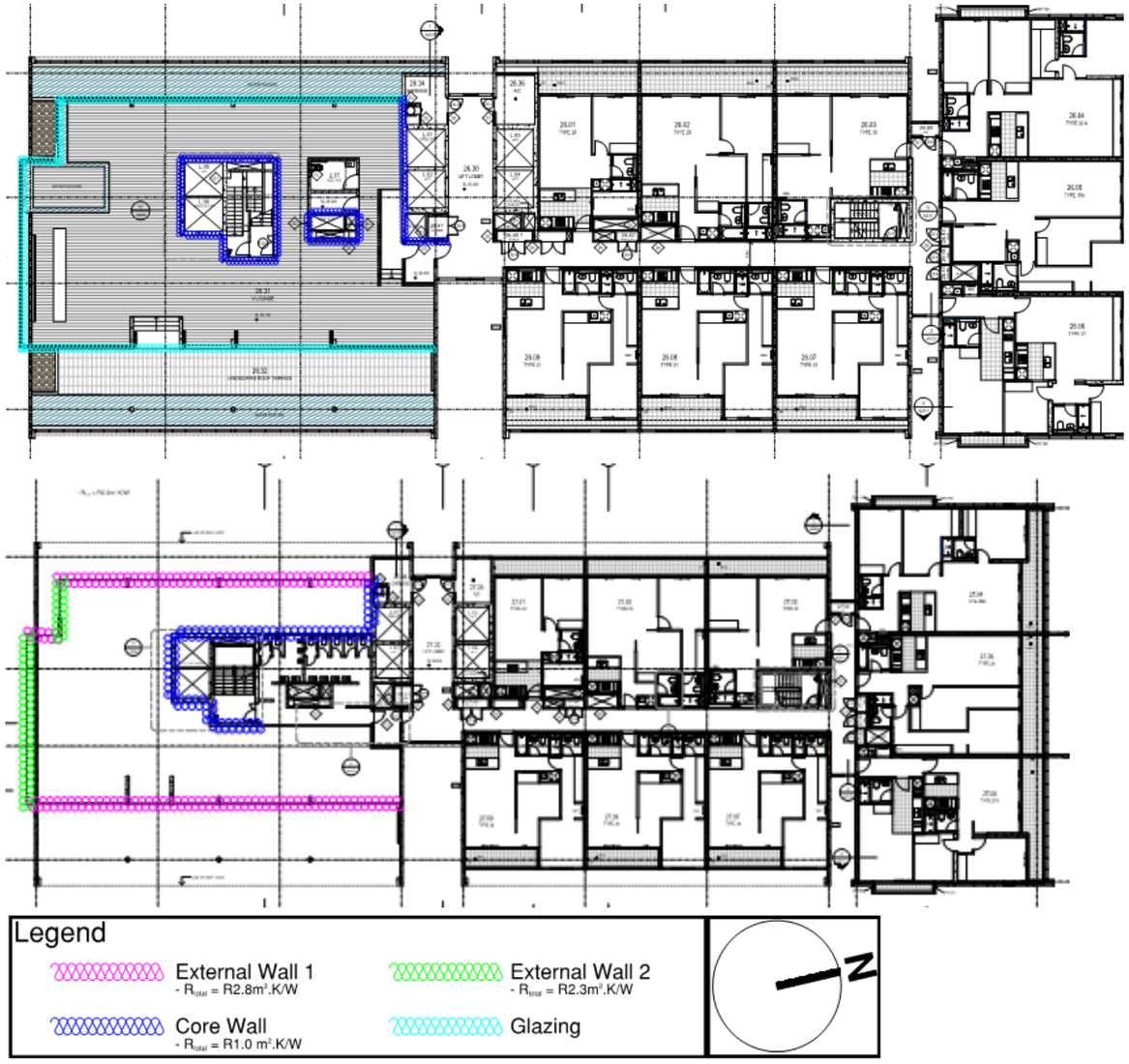

Figure 4: Level 26 [top] and Level 27 [bottom] wall insulation

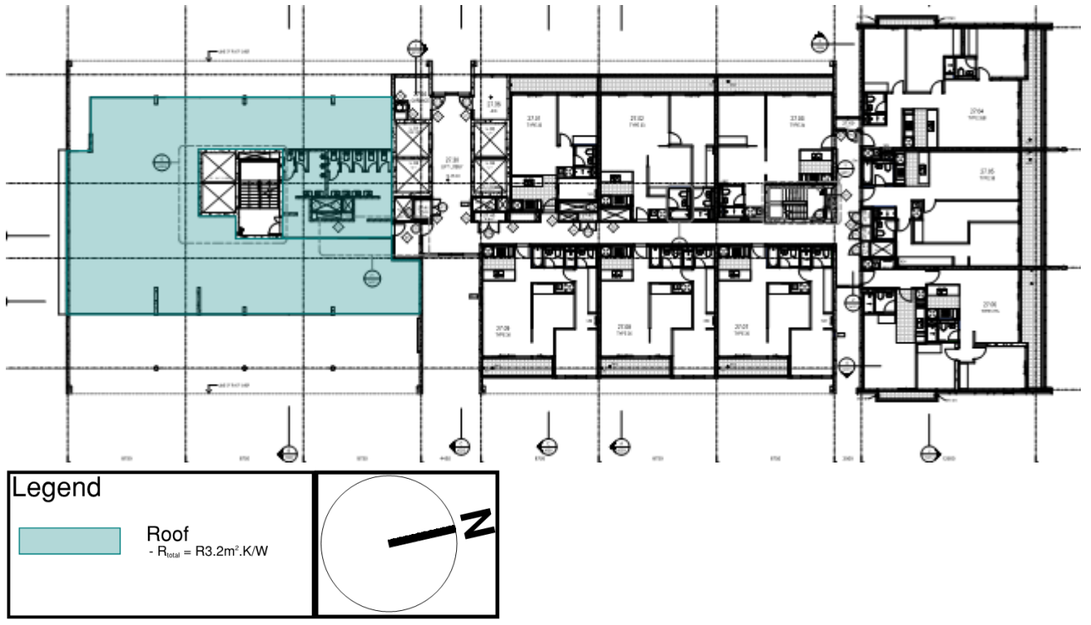

Figure 5: Level 27 roof insulation

3. PERFORMANCE PARAMETERS—Glazing for Non-Residential Spaces

Glazing Performance Parameters

Simulations incorporate building fabric elements with thermal performances as per Table 3 - 5.

Table 3: Glazing performance parameters—Ground Floor & Mezzanine Retail

Building Envelope Element		Reference Building	Proposed Building
Glazing	**Internal**	**U 2.8** W/m^2.K **SHGC 0.63** (whole of window) Benchmark product: 6mm Viridian VFloat Clear / 12mm Air Gap / 6mm Viridian VFloat Aluminium frame with thermal break	**U 3.6** W/m^2.K **SHGC 0.51** (mid-pane) Benchmark product: Viridian ComfortPlus Neutral 59 6.38mm Aluminium frame
	East	**U 3.5** W/m^2.K **SHGC 0.24** (whole of window) Benchmark product: 4mm Viridian EnergyTech / 12mm Air Gap / 4mm Viridian VFloat SuperGrey Aluminium frame	
	South	**U 3.5** W/m^2.K **SHGC 0.63** (whole of window) Benchmark product: 6mm Viridian VFloat Clear / 12mm Air Gap / 6mm Viridian VFloat Aluminium frame	

3. PERFORMANCE PARAMETERS—Glazing for Non-Residential Spaces

Table 4: Glazing performance parameters—Level 1

Building Envelope Element		Reference Building	Proposed Building
Glazing	**South**	**U 4.62** W/m^2.K **SHGC 0.50** (whole of window) Benchmark product: 6.38mm Viridian ComfortPlus Neutral 59 Aluminium frame	**U 3.6** W/m^2.K **SHGC 0.51** (mid-pane) Benchmark product: 6.38mm Viridian ComfortPlus Neutral 59 Aluminium frame

Table 5: Glazing performance parameters—Level 26 & Level 27

Building Envelope Element		Reference Building	Proposed Building
Glazing	**East**	**U 1.0** W/m^2.K **SHGC 0.15** (whole of window) No benchmark product identified due to thermal performance characteristics; thermal performance characteristics denote a triple glazed, argon filled system Aluminium frame	**Glazing:** **U 1.64** W/m^2.K **SHGC 0.28** (mid-pane) Benchmark product: 6mm China Southern Glass Clear Float / 12mm Air Gap / 6mm China Southern Glass Triple Silver Low E on Clear Float Aluminium frame **Bi-fold Doors:** **U 3.6** W/m^2.K **SHGC 0.51** (mid-pane) Benchmark product: 6.38mm Viridian ComfortPlus Neutral 59 Aluminium frame
	South	**U 2.66** W/m^2.K **SHGC 0.66** (whole of window) Benchmark product: 4mm Viridian VFloat Clear / 10mm Air Gap / 4mm Viridian VFloat Clear Aluminium frame	**U 1.64** W/m^2.K **SHGC 0.28** (mid-pane) Benchmark product: 6mm China Southern Glass Clear Float / 12mm Air Gap / 6mm China Southern Glass Triple Silver Low E on Clear Float Aluminium frame
	West	**U 1.0** W/m^2.K **SHGC 0.10** (whole of window) No benchmark product identified due to thermal performance characteristics; thermal performance characteristics denote a triple glazed, argon filled system Aluminium frame	

4. RESULTS

Table 6 and Figure 6 demonstrate the predicted annual energy consumption for the simulations performed.

These show that the annual energy consumption of the Proposed Building + Reference Services is 0.44% below that of the Reference Building + Reference Services.

Based on the modelling performed and using expert judgement, the building envelope solution is deemed to comply with the performance requirements.

Table 6: Simulation results for the non-residential spaces of the V by Crown development

Building	Annual Energy Consumption					
	Equipment	Heating	Cooling	Fans	Lighting	TOTAL
Reference Building + Reference Services	26.52	15.19	55.72	42.08	141.12	280.64
Proposed Building + Reference Services	26.52	18.12	50.17	43.47	141.12	279.40
Proposed Building + Proposed Services	26.52	13.22	39.52	43.47	141.12	263.90

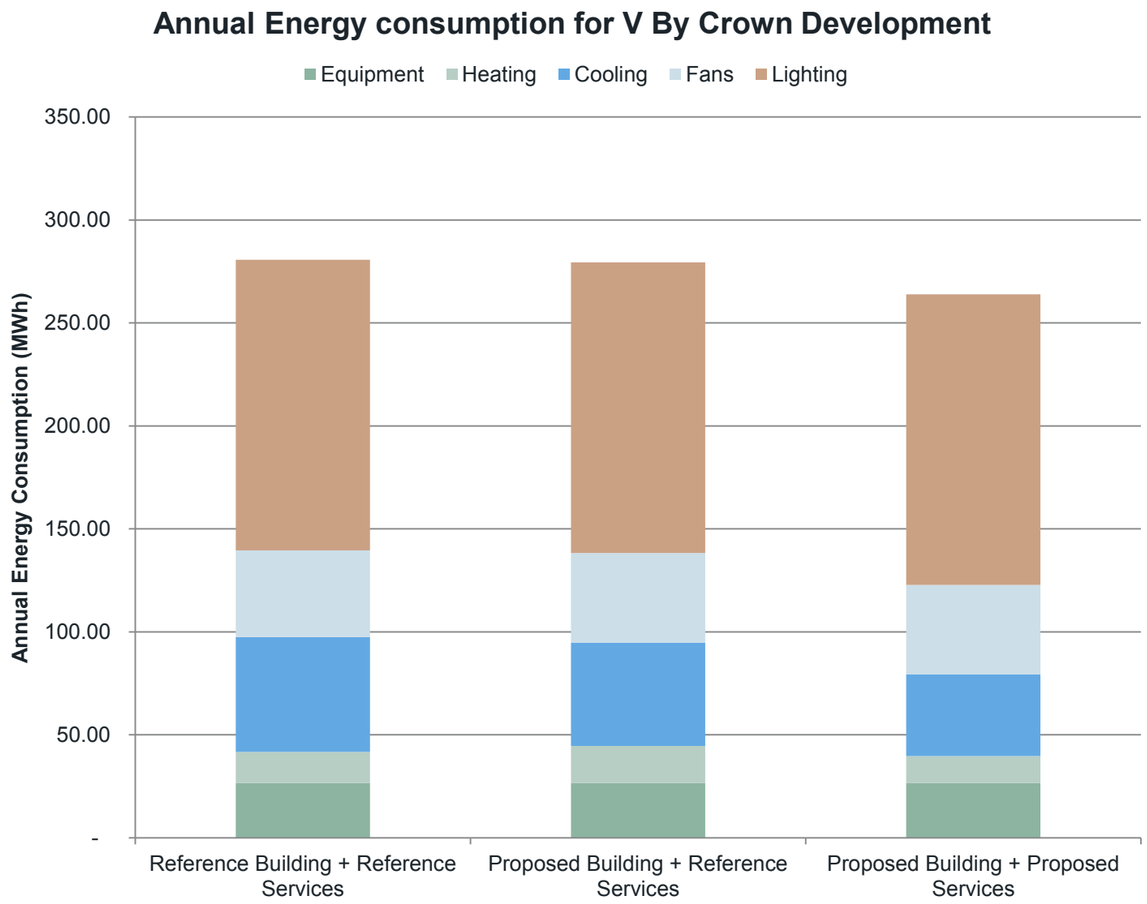

Figure 6: Simulation results for the non-residential spaces of the V by Crown development

Appendix A | Glazing Calculator Inputs

NCC VOLUME ONE GLAZING CALCULATOR (first issued with NCC 2014)

HELP

Building name/description: ADVD090660E Retail Spaces and Interpretation Centre_GF

Application: shop display

Climate zone: 6

Storey: 1

Facade areas

	N	NE	E	SE	S	SW	W	NW	internal
Option A			160m²		48.3m²				163m²
Option B									n/a
Glazing area (A)			*145m²*		*46.2m²*				*141m²*

Number of rows preferred in table below: 25 *(as currently displayed)*

GLAZING ELEMENTS, ORIENTATION SECTOR, SIZE and PERFORMANCE CHARACTERISTICS									SHADING		CALCULATED OUTCOMES OK (if inputs are valid)					
Glazing element		Facing sector		Size			Performance		P&H or device		Shading		Multipliers		Size	Outcomes
ID	Description (optional)	Option A facades	Option B facades	Height (m)	Width (m)	Area (m²)	Total System U-Value (AFRC)	Total System SHGC (AFRC)	P (m)	H (m)	P/H	G (m)	Heating (S_W)	Cooling (S_C)	Area used (m²)	Element share of % of allowance used
1	W.53 north G.13 & G.18 (	internal		3.25	7.48		2.8	0.63			2.00	0.00	0.55	0.55	24.31	17% of 99%
2	W.53 east G.13 & G.18	internal		3.25	11.43		2.8	0.63			2.00	0.00	0.55	0.55	37.15	26% of 99%
3	W.51 north G.21	internal		3.25	13.11		2.8	0.63			2.00	0.00	0.55	0.55	42.61	30% of 99%
4	W.26 x 7 NW G.19	internal		2.40	4.20		2.8	0.63			2.00	0.00	0.55	0.55	10.08	7% of 99%
5	W.32 north G.19	internal		3.25	5.80		2.8	0.63			2.00	0.00	0.55	0.55	18.85	13% of 99%
6	W.43 west G.22	internal		3.25	2.57		2.8	0.63			2.00	0.00	0.55	0.55	8.35	6% of 99%
7	W.38 east G.20 (Viridian	E		2.75	6.68		3.5	0.24	3.230	2.870	1.13	0.12	0.55	0.53	18.37	11% of 96%
8	W.37 east G.20	E		2.85	8.41		3.5	0.24	3.230	2.870	1.13	0.02	0.27	0.41	23.97	14% of 96%
9	W.36 east G.20 (shaded	E		2.85	4.28		3.5	0.24	3.230	2.850	1.13	0.00	0.27	0.41	12.20	7% of 96%
10	W.36 east G.20 (unshade	E		2.85	3.23		3.5	0.24	3.230	2.850	1.13	0.00	0.27	0.41	9.21	6% of 96%
11	W.33 east G.19 (shaded	E		3.23	3.36		3.5	0.24				0.00	1.00	1.00	10.85	10% of 96%
12	W.33 east G.19 (unshade	E		3.23	3.32		3.5	0.24	3.320	3.230	1.03	0.00	0.33	0.43	10.72	6% of 96%
13	W.34 east G.19	E		3.23	8.41		3.5	0.24				0.00	1.00	1.00	27.16	24% of 96%
14	W.35 east G.19 (shaded	E		3.23	4.19		3.5	0.24	3.320	3.230	1.03	0.00	0.33	0.43	13.53	8% of 96%
15	W.35 east G.19 (unshade	E		3.23	3.32		3.5	0.24	3.320	3.230	1.03	0.00	0.33	0.43	10.72	6% of 96%
16	W.39 east G.20	E		3.25	2.40		3.5	0.24				0.00	1.00	1.00	7.80	7% of 96%
17	W.40 south G.20 (Viridia	S		3.25	3.71		3.5	0.63				0.00	1.00	1.00	12.06	26% of 93%
18	W.44 south G.22 (shade	S		3.25	7.14		3.5	0.63	3.370	6.350	0.00	3.10	1.00	1.00	23.21	50% of 93%
19	W.44 south G.22 (shade	S		3.25	3.37		3.5	0.63				0.00	1.00	1.00	10.95	24% of 93%
20																
21																
22																
23																
24																
25																

IMPORTANT NOTICE AND DISCLAIMER IN RESPECT OF THE GLAZING CALCULATOR

if inputs are valid

The Glazing Calculator has been developed by the ABCB to assist in developing a better understanding of glazing energy efficiency parameters.
While the ABCB believes that the Glazing Calculator, if used correctly, will produce accurate results, it is provided "as is" and without any representation or warranty of any kind, including that it is fit for any purpose or of merchantable quality, or functions as intended or at all.
Your use of the Glazing Calculator is entirely at your own risk and the ABCB accepts no liability of any kind.

NCC VOLUME ONE GLAZING CALCULATOR (first issued with NCC 2014)

HELP

Building name/description: ADVD090660E Retail Spaces and Interpretation Centre_Mezz

Application: shop display

Climate zone: 6

Storey: 1

Facade areas

	N	NE	E	SE	S	SW	W	NW	internal
Option A			7.94m²		46m²				129m²
Option B									n/a
Glazing area (A)			*5.64m²*		*29m²*				*52m²*

Number of rows preferred in table below: 25 *(as currently displayed)*

GLAZING ELEMENTS, ORIENTATION SECTOR, SIZE and PERFORMANCE CHARACTERISTICS									SHADING		CALCULATED OUTCOMES OK (if inputs are valid)					
Glazing element		Facing sector		Size			Performance		P&H or device		Shading		Multipliers		Size	Outcomes
ID	Description (optional)	Option A facades	Option B facades	Height (m)	Width (m)	Area (m²)	Total System U-Value (AFRC)	Total System SHGC (AFRC)	P (m)	H (m)	P/H	G (m)	Heating (S_W)	Cooling (S_C)	Area used (m²)	Element share of % of allowance used
1	W.53 north G.13 & G.18 (	internal		1.25	7.48		2.8	0.63			2.00	0.00	0.55	0.55	9.35	18% of 46%
2	W.53 east G.13 & G.18	internal		1.25	11.43		2.8	0.63			2.00	0.00	0.55	0.55	14.29	28% of 46%
3	W.51 north G.21	internal		1.25	13.11		2.8	0.63			2.00	0.00	0.55	0.55	16.39	32% of 46%
4	W.32 north G.19	internal		1.20	5.80		2.8	0.63			2.00	0.00	0.55	0.55	6.96	13% of 46%
5	W.43 west G.22	internal		1.93	2.57		2.8	0.63			2.00	0.00	0.55	0.55	4.96	10% of 46%
6	W.39 east G.20 (Viridian	E		2.35	2.40		3.5	0.24				0.00	1.00	1.00	5.64	100% of 96%
7	W.40 south G.20 (Viridia	S		2.35	3.71		3.5	0.63				0.00	1.00	1.00	8.72	30% of 62%
8	W.44 south G.22 (shade	S		1.93	7.14		3.5	0.63	3.370	6.350	0.00	4.42	1.00	1.00	13.78	48% of 62%
9	W.44 south G.22 (shade	S		1.93	3.37		3.5	0.63				0.00	1.00	1.00	6.50	22% of 62%
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Appendix E | Glazing Calculator Inputs

NCC VOLUME ONE GLAZING CALCULATOR (first issued with NCC 2014)

HELP

Building name/description: ADVD090660E Meeting Room & Studios Level 1

Application: other

Climate zone: 6

Storey: 2

Facade areas

	N	NE	E	SE	S	SW	W	NW	internal
Option A					215m²				
Option B									n/a

Glazing area (A) *25m²*

Number of rows preferred in table below: 10 *(as currently displayed)*

GLAZING ELEMENTS, ORIENTATION SECTOR, SIZE and PERFORMANCE CHARACTERISTICS								SHADING		CALCULATED OUTCOMES OK (if inputs are valid)					
Glazing element		Facing sector		Size			Performance			P&H or device		Shading		Multipliers		Size	Outcomes
ID	Description (optional)	Option A facades	Option B facades	Height (m)	Width (m)	Area (m²)	Total System U-Value (AFRC)	Total System SHGC (AFRC)		P (m)	H (m)	P/H	G (m)	Heating (S_H)	Cooling (S_C)	Area used (m²)	Element share of % of allowance used
1	Glazing on studios & m	S		1.70	14.72		4.6	0.50					0.00	1.00	1.00	25.02	100% of 45%
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

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if inputs are valid ✓

NCC VOLUME ONE GLAZING CALCULATOR (first issued with NCC 2014)

HELP

Building name/description: ADVD090660E Bar Level 26

Application: other

Climate zone: 6

Storey: 27

Facade areas

	N	NE	E	SE	S	SW	W	NW	internal
Option A			87.3m²		52.7m²		80.9m²		
Option B									n/a

Glazing area (A) ..... *82.1m²* ..... *47.5m²* *77.1m²*

Number of rows preferred in table below: 10 *(as currently displayed)*

GLAZING ELEMENTS, ORIENTATION SECTOR, SIZE and PERFORMANCE CHARACTERISTICS									SHADING		CALCULATED OUTCOMES OK (if inputs are valid)						
Glazing element		Facing sector		Size			Performance		P&H or device		Shading		Multipliers			Size	Outcomes
ID	Description (optional)	Option A facades	Option B facades	Height (m)	Width (m)	Area (m²)	Total System U-Value (AFRC)	Total System SHGC (AFRC)	P (m)	H (m)	P/H	G (m)	Heating (S_H)	Cooling (S_C)	Area used (m²)	Element share of % of allowance used
1	Western glazing (shade	W		3.25	23.29		1.0	0.10	device		2.00	0.00	0.05	0.31	75.69	98% of 90%
2	Western glazing (unsha	W		3.25	0.43		1.0	0.10				0.00	1.00	1.00	1.40	2% of 90%
3	Southern glazing (shade	S		3.25	2.72		2.6	0.66	*1.800*	6.500	*0.00*	*3.25*	*1.00*	*1.00*	8.84	19% of 52%
4	Southern glazing (unsha	S		3.25	11.91		2.6	0.66				0.00	1.00	1.00	38.71	81% of 52%
5	Eastern bifold doors (sh	E		3.25	12.52		1.0	0.15	device		2.00	0.00	0.01	0.29	40.69	50% of 73%
6	Eastern glazing (shaded	E		3.25	8.73		1.0	0.15	device		2.00	0.00	0.01	0.29	28.37	35% of 73%
7	Eastern glazing (unshad	E		3.25	4.00		1.0	0.15	device		2.00	0.00	0.01	0.29	13.00	16% of 73%
8																
9																
10																

IMPORTANT NOTICE AND DISCLAIMER IN RESPECT OF THE GLAZING CALCULATOR

The Glazing Calculator has been developed by the ABCB to assist in developing a better understanding of glazing energy efficiency parameters.
While the ABCB believes that the Glazing Calculator, if used correctly, will produce accurate results, it is provided "as is" and without any representation or warranty of any kind, including that it is fit for any purpose or of merchantable quality, or functions as intended or at all.
Your use of the Glazing Calculator is entirely at your own risk and the ABCB accepts no liability of any kind.

if inputs are valid ✓

NCC VOLUME ONE GLAZING CALCULATOR (first issued with NCC 2014)

HELP

Building name/description: ADVD090660E Bar Level 27

Application: other

Climate zone: 6

Storey: 28

Facade areas

	N	NE	E	SE	S	SW	W	NW	internal
Option A			87.3m²		52.7m²		80.9m²		
Option B									n/a

Glazing area (A) ..... *44.8m²* ..... *8.19m²* *29.6m²*

Number of rows preferred in table below: 10 *(as currently displayed)*

GLAZING ELEMENTS, ORIENTATION SECTOR, SIZE and PERFORMANCE CHARACTERISTICS									SHADING		CALCULATED OUTCOMES OK (if inputs are valid)						
Glazing element		Facing sector		Size			Performance		P&H or device		Shading		Multipliers			Size	Outcomes
ID	Description (optional)	Option A facades	Option B facades	Height (m)	Width (m)	Area (m²)	Total System U-Value (AFRC)	Total System SHGC (AFRC)	P (m)	H (m)	P/H	G (m)	Heating (S_H)	Cooling (S_C)	Area used (m²)	Element share of % of allowance used
1	Western glazing (shade	W		1.25	17.49		1.0	0.10	device		2.00	0.00	0.05	0.31	21.86	74% of 35%
2	Western glazing (shade	W		1.81	4.30		1.0	0.10	device		2.00	0.00	0.05	0.31	7.78	26% of 35%
3	Southern glazing (shade	S		0.56	2.72		3.0	0.66	*1.800*	6.500	*0.00*	*5.94*	*1.00*	*1.00*	1.52	19% of 17%
4	Southern glazing (unsha	S		0.56	11.91		3.0	0.66				0.00	1.00	1.00	6.67	81% of 17%
5	Eastern bifold doors (sh	E		1.81	9.54		2.0	0.15	device		2.00	0.00	0.01	0.29	17.27	39% of 53%
6	Eastern glazing (shaded	E		1.81	12.73		2.0	0.15	device		2.00	0.00	0.01	0.29	23.04	51% of 53%
7	Eastern bifold doors (sh	E		1.51	2.98		2.0	0.15	device		2.00	0.00	0.01	0.29	4.50	10% of 53%
8																
9																
10																

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if inputs are valid ✓

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