Project: VR19294A

October 29, 2020

The Mosaic Avenue Developments Ltd.
500 - 2609 Granville Street
Vancouver, BC V6H 3H3

E-mail: adrien.herberts@mosaichomes.com

Dear Adrien:

Re: 3015 & 3303 Murray Street, Port Moody, BC – Buildings 1 & 2
- Thermal Comfort Analysis for the City of Port Moody

1.0 BACKGROUND

It is our understanding that the proposed Murray project will consist three 5-6 storey buildings located at 3015, 3033 and 3093 Murray Street in Port Moody, BC. There are two legal lots. Lot 1 includes Phase 1 (Building 1) and Phase 2 (Building 2); Lot 2 includes Phase 3 (Building 3).

Building 1 includes 55 rental apartments and 2 commercial units. CRU1 is modelled as coffee shop while CRU2 is modelled as retail area. The Building 2 includes 80 rental apartments and 6 commercial units. CRU6 and CRU7 are treated as coffee shop/retail area. CRU3 and CRU4 are modelled as office. CRU5, CRU8 and CRU9 are simulated as retail area. The project will be designed and built to BC Energy Step Code. The City of Port Moody requires a thermal comfort study for the project. Therefore, ASHRAE 55-2004 "Thermal Environmental Conditions for Human Occupancy" has been followed for this study.

The purpose of this report is to confirm the thermal comfort compliance with the ASHRAE 55-2004 "Thermal Environmental Conditions for Human Occupancy". In order to determine the building's thermal comfort, two proposed thermal comfort models were developed using DesignBuilder and following the requirements of the ASHRAE 55-2004. The thermal comfort modelling inputs are listed in Appendix A and Appendix B.

The assemblies, nominal R-values and thermal performance of windows and doors are based on the architectural drawings dated on December 18, 2019 and August 1, 2020 and listed in Appendix A and Appendix B.

2.0 MODELLING METHODOLOGY

In order to mitigate noise impacts between sky train and residential uses in close proximity to each other, the windows will be modelled as closed during summer months. Therefore, outdoor air ventilated through windows is excluded from the thermal comfort analysis.

There is no mechanical cooling system inside each dwelling unit. Although according to ASHRAE 55-2004, "Mechanical ventilation with unconditioned air may be utilized", the mechanical assisted ventilation through kitchen rangehood has been excluded from the analysis in order to be conservative. In addition, as per ASHRAE 55-2004, all dwelling units analysed should be modelled as naturally conditioned spaces and 80% acceptability limits has been chosen for the analysis.

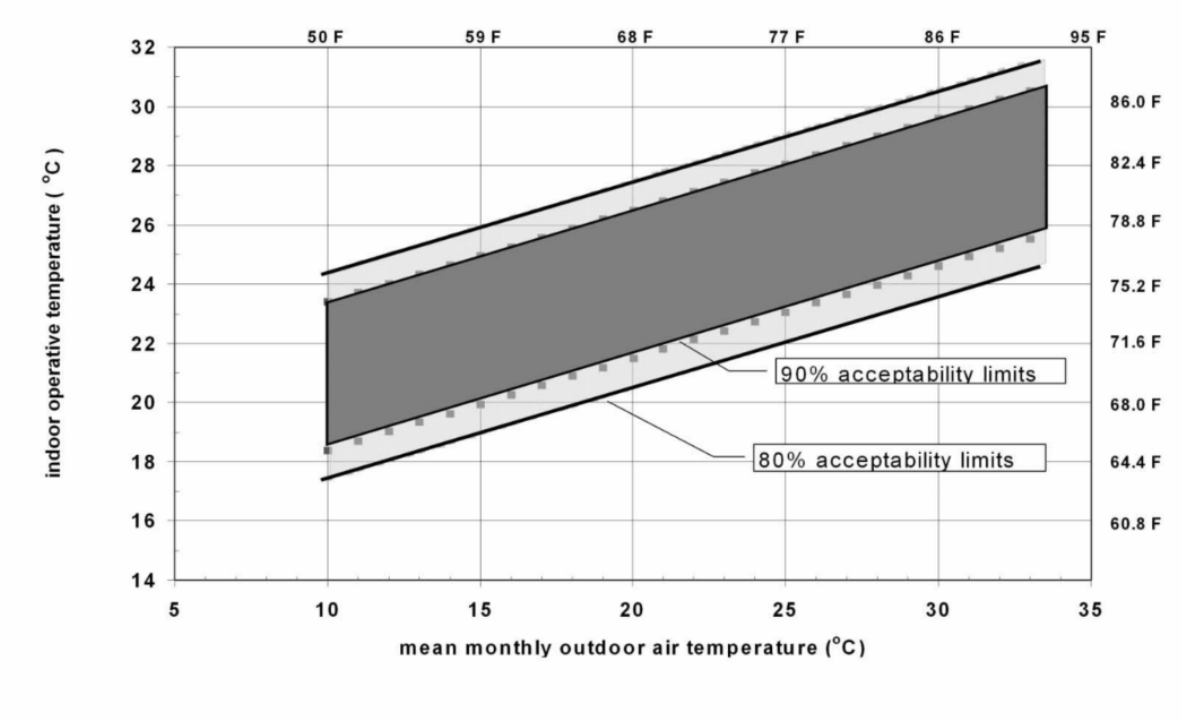

Figure 5.3 Acceptable operative temperature ranges for naturally conditioned spaces.

The dwelling units are provided with heating systems, which will be able to maintain the thermal comfort in the heating season so only the cooling season is required in the thermal comfort analysis. Because the mean monthly outdoor air temperature in the weather file used by the DesignBuilder is 18°C in Port Moody, the Figure 5.3 of ASHRAE 55 – 2004 shows 27°C (indoor operative temperature) will be the 80% acceptability limits for this project.

In this thermal comfort analysis, all dwelling units are included in the thermal comfort model. The following procedures have been implemented in the analysis:

- Identify the peak cooling load of the whole building: Hour 15:00 on July 15. In other words, it is the hottest hour in a typical year in this building. If the thermal comfort is met in all units at this hour, the thermal comfort can be considered met throughout the year.
- In the thermal comfort model, at hour 15:00 on July 15, windows are closed, HRV/ERVs are on because ASHRAE 55-2004 allows mechanical ventilation with unconditioned air. The unconditioned air or outdoor air can be induced into the indoor spaces through infiltration and other exhaust vents.
- The modelled operative temperatures of all thermal zones at peak cooling hour are checked whether 80% acceptability limits are met. If the operative temperatures in all dwelling units are lower than the limit target (27°C), the project is considered compliant in terms of thermal comfort.

3.0 MODELLING ANALYSIS SUMMARY

3.1 BUILDING 1

Table 1 outlines operative temperatures in all dwelling units of Building 1 at the peak cooling hour. It should be noted that the results use assumptions such as typical climactic data and software defaults to illustrate compliance over a typical year. In addition, the zone name does not represent the actual unit number as the zone name is automatically generated by the software. All input parameters are listed in the Appendix A.

Table 1: As-design Operative Temperature of Building 1 Dwelling Units/Thermal Zones at Peak Cooling Hour (Window SHGC = 0.23)

Zone Name	Operative Temperature (°C)	Zone Name	Operative Temperature (°C)	Zone Name	Operative Temperature (°C)
B1L2ZONE7	26.7	B1L2ZONE2	25.8	B1L6ZONE8	27.4
B1L2ZONE9	26.7	B1L4ZONE2	26.4	B1L6ZONE3	27.0
B1L3ZONE2	26.2	B1L3ZONE7	27.5	B1L6ZONE2	26.9
B1L3ZONE3	26.4	B1L5ZONE2	26.5	B1L4ZONE9	27.5
B1L3ZONE8	26.9	B1L4ZONE3	26.5	B1L5ZONE3	26.4
B1L3ZONE10	27.0	B1L4ZONE8	27.2	B1L4ZONE7	27.6
B1L3ZONE9	27.5	B1L4ZONE10	27.0	B1L5ZONE10	27.0
B1L2ZONE10	26.5	B1L6ZONE9	28.3	B1L5ZONE7	27.6
B1L2ZONE8	26.1	B1L6ZONE7	28.2	B1L5ZONE9	27.4
B1L2ZONE3	26.1	B1L6ZONE10	27.5	B1L5ZONE8	27.2

As shown in Table 1, there are 14 zones which can not comply with the thermal comfort requirement. In order to decrease the operative temperature in unmet zones, the SHGC of windows at Level 3, Level 4 and Level 5 was decreased to 0.17 from 0.23. The windows of Zone 9 and Zone 7 at Level 6 were replaced with windows SHGC=0.15. Figure 1 to Figure 4 shows the location of windows with different SHGCs. The operative temperatures of all Building 1 dwelling zones are listed in the following Table 2, which shows all dwelling zones in Building 1 can meet the thermal comfort target of 27°C.

Figure 1: Street Elevation (North Elevation)

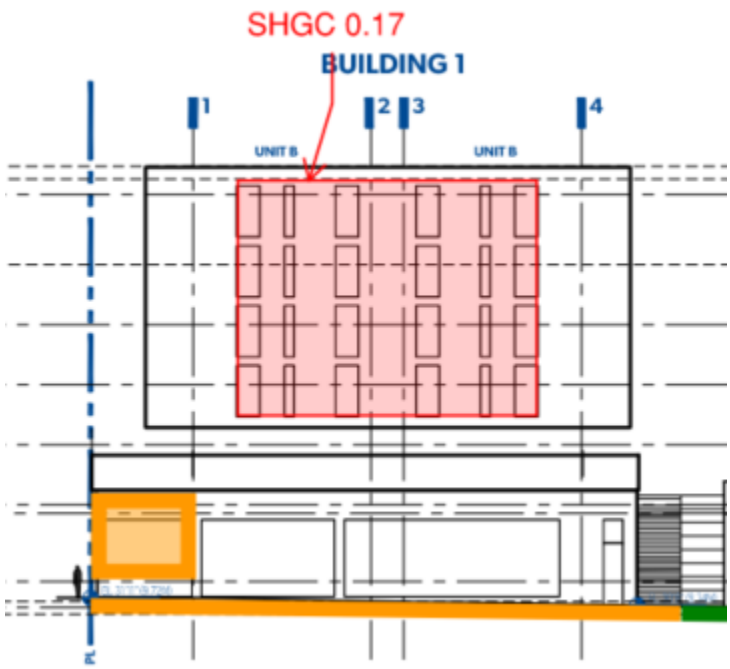

Figure 2: Rear Elevation (South Elevation)

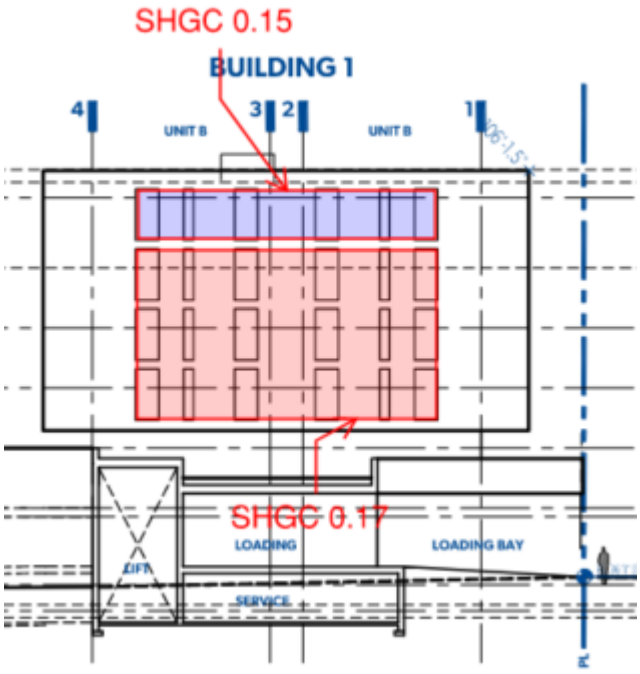

Figure 3: West Elevation

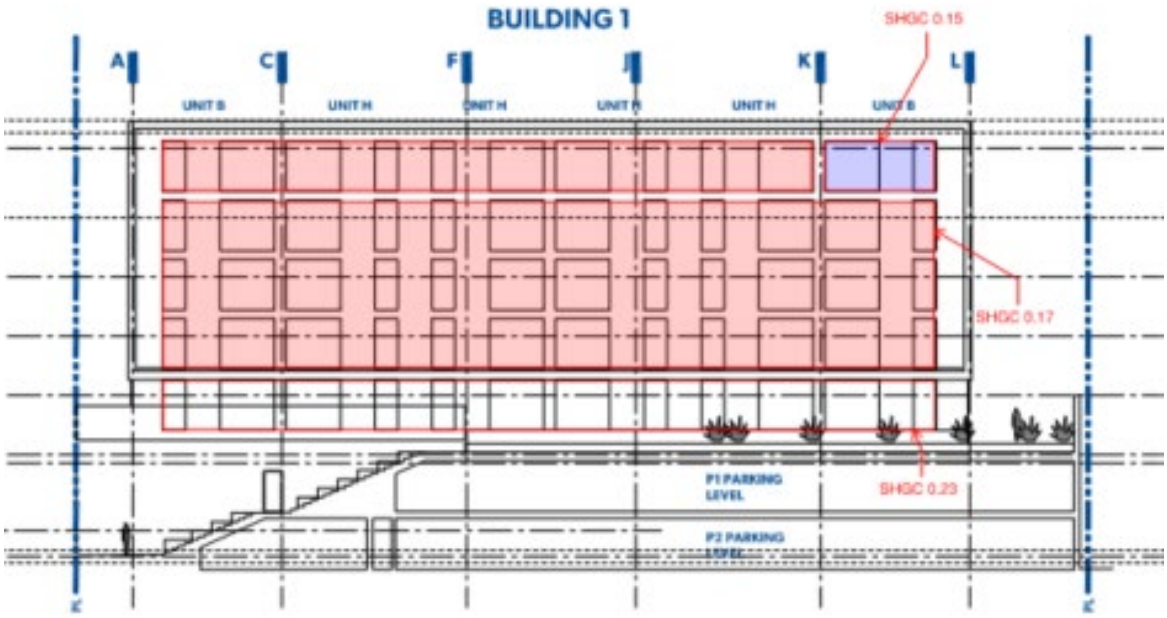

Figure 3: East Elevation

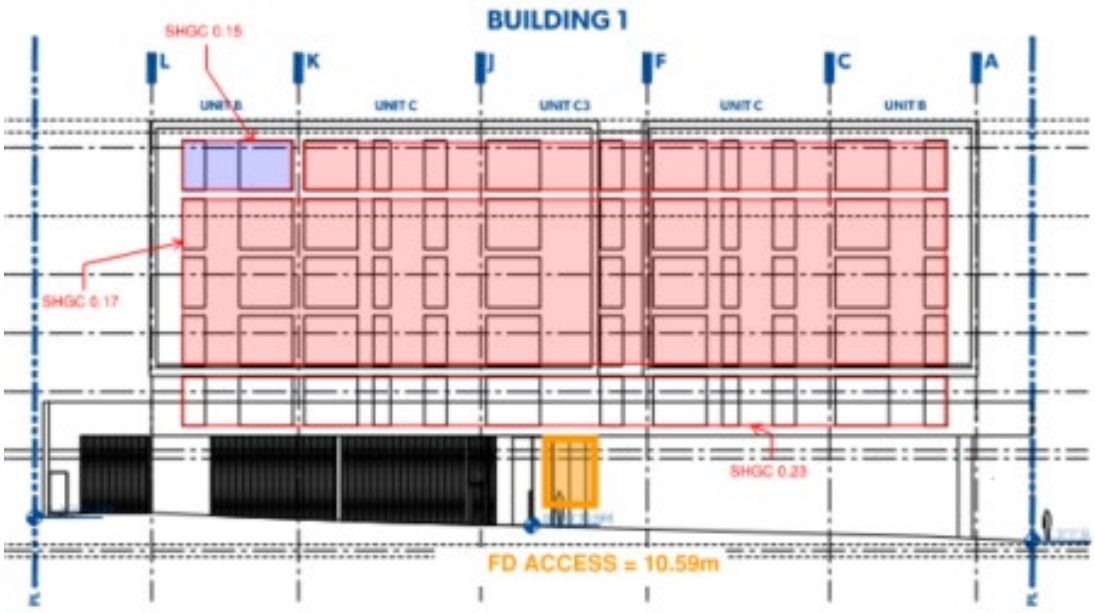

Table 2: Iteration 1 Operative Temperature of Building 1 Dwelling /Thermal Zones at Peak Cooling Hour (Window SHGCs = 0.23, 0.17, and 0.15)

Zone Name	Operative Temperature (°C)	Zone Name	Operative Temperature (°C)	Zone Name	Operative Temperature (°C)
B1L2ZONE7	26.45	B1L2ZONE2	25.63	B1L6ZONE8	26.79
B1L2ZONE9	26.51	B1L4ZONE2	25.76	B1L6ZONE3	26.28
B1L3ZONE2	25.65	B1L3ZONE7	26.59	B1L6ZONE2	26.21
B1L3ZONE3	25.76	B1L5ZONE2	25.80	B1L4ZONE9	26.55
B1L3ZONE8	26.40	B1L4ZONE3	25.75	B1L5ZONE3	25.68
B1L3ZONE10	26.33	B1L4ZONE8	26.54	B1L4ZONE7	26.64
B1L3ZONE9	26.56	B1L4ZONE10	26.32	B1L5ZONE10	26.23
B1L2ZONE10	26.30	B1L6ZONE9	26.99	B1L5ZONE7	26.57
B1L2ZONE8	25.89	B1L6ZONE7	26.92	B1L5ZONE9	26.42
B1L2ZONE3	25.94	B1L6ZONE10	26.77	B1L5ZONE8	26.51

3.2 BUILDING 2

Table 4 outlines operative temperatures in all dwelling units of Building 2 at the peak cooling hour. It should be noted that the results use assumptions such as typical climactic data and software defaults to illustrate compliance over a typical year. In addition, the zone name does not represent the actual unit number as the zone name is automatically generated by the software. All input parameters are listed in the Appendix B.

Table 3: As-design Operative Temperature of Building 2 Dwelling Units/Thermal Zones at Peak Cooling Hour (Window SHGC = 0.23)

Zone Name	Operative Temperature (°C)	Zone Name	Operative Temperature (°C)	Zone Name	Operative Temperature (°C)
B2L5ZONE9	26.9	B2L1ZONE2	25.7	B2L5ZONE3	27.3
B2L3ZONE3	26.0	B2L3ZONE1	26.0	B2L1ZONE17	24.8
B3L3ZONE8	26.1	B2L3ZONE9	26.1	B2L1ZONE7	25.3
B2L2ZONE4	25.4	B2L4ZONE4	26.0	B2L5ZONE4	26.9
B2L2ZONE5	25.5	B2L4ZONE5	26.1	B2L5ZONE5	27.0
B2L2ZONE9	26.0	B2L5ZONE1	27.4	B2L1ZONE12	25.0
B2L2ZONE3	25.7	B2L4ZONE9	26.1	B2L1ZONE9	25.8
B2L2ZONE8	26.1	B2L4ZONE3	26.2	B2L1ZONE6	25.8
B2L1ZONE5	25.8	B2L4ZONE8	26.1	B2L1ZONE11	25.4
B2L1ZONE4	25.8	B2L3ZONE4	25.6	B2L1ZONE3	25.3
B2L1ZONE1	25.7	B2L3ZONE5	25.7	B2L5ZONE8	26.8
B2L2ZONE1	25.6	B2L4ZONE1	26.1		

Table 3 shows 2 zones in Building 2 can not meet the thermal comfort requirement, and these 2 zones are located on Level 5. As a result, the window SHGC is changed for Level 5 from 0.23 to 0.17. Figure 5 and Figure 6 shows the locations of windows with SHGC = 0.17. The rest windows have SHGC = 0.23. Table 4 shows the analysis results and all zones satisfy the thermal comfort requirements.

Figure 5: Street Elevation (North Elevation)

Figure 6: Rear Elevation (South Elevation)

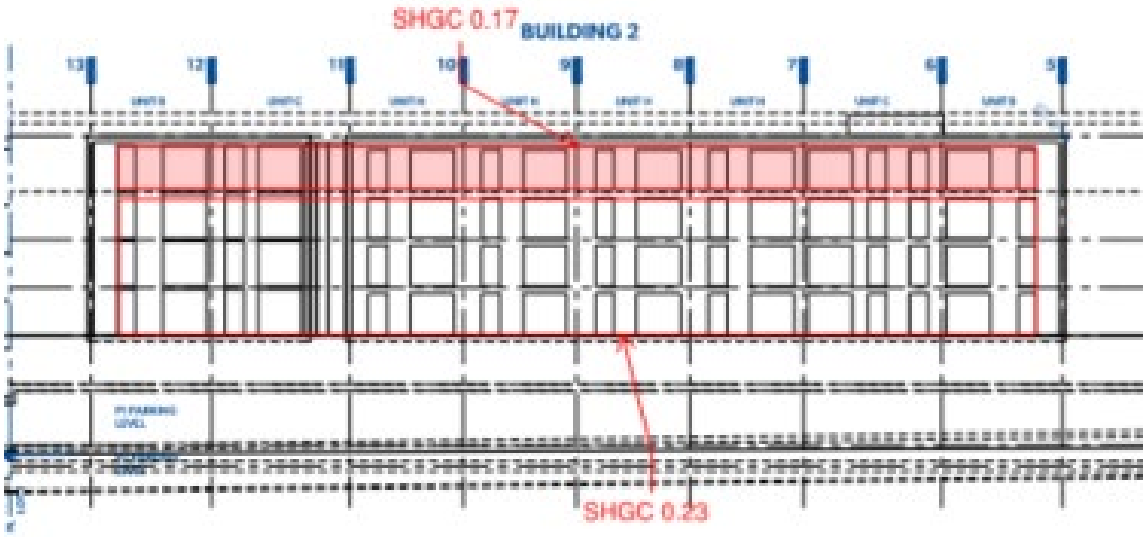

Table 4: Iteration 2 Operative Temperature of Building 2 Dwelling Units/Thermal Zones at Peak Cooling Hour (Window SHGCs = 0.23 and 0.17)

Zone Name	Operative Temperature (°C)	Zone Name	Operative Temperature (°C)	Zone Name	Operative Temperature (°C)
B2L5ZONE9	26.5	B2L1ZONE2	25.7	B2L5ZONE3	26.8
B2L3ZONE3	26.0	B2L3ZONE1	25.9	B2L1ZONE17	24.7
B3L3ZONE8	26.1	B2L3ZONE9	26.1	B2L1ZONE7	25.2
B2L2ZONE4	25.4	B2L4ZONE4	26.0	B2L5ZONE4	26.3
B2L2ZONE5	25.5	B2L4ZONE5	26.0	B2L5ZONE5	26.4
B2L2ZONE9	26.0	B2L5ZONE1	26.8	B2L1ZONE12	24.9
B2L2ZONE3	25.7	B2L4ZONE9	26.0	B2L1ZONE9	25.8
B2L2ZONE8	26.1	B2L4ZONE3	26.1	B2L1ZONE6	25.8
B2L1ZONE5	25.8	B2L4ZONE8	26.0	B2L1ZONE11	25.4
B2L1ZONE4	25.8	B2L3ZONE4	25.6	B2L1ZONE3	25.3
B2L1ZONE1	25.7	B2L3ZONE5	25.6	B2L5ZONE8	26.4
B2L2ZONE1	25.6	B2L4ZONE1	26.1		

4.0 CONCLUSION

Based on the thermal comfort model performed in the DesignBuilder, the proposed building satisfies the thermal comfort requirements of ASHRAE 55-2004.

5.0 CLOSURE

The inputs are confirmed by the project team as a true representation of the proposed building submitted for approval at this time.

This report was prepared by JRS for The Mosaic Avenue Developments Ltd. Any use that a third party makes of this report, or any reliance or decisions made based on it, are the sole responsibility of such third party.

If you should have any questions or wish to discuss this report in further detail, please contact the undersigned.

Sincerely,

JRS ENGINEERING
Per:

Reviewed By:

Glen Guo, CEA, M.Eng.
Energy Modeller

Jack Cui, MSc, P.Eng., LEED AP
Senior Energy Modelling Specialist | Division Manager

Enc. Appendix A – Thermal Comfort Parameters of Building 1

Appendix B – Thermal Comfort Parameters of Building 2

THERMAL COMFORT PARAMETERS OF BUILDING 1

Model Inputs	Proposed	Notes/Source/Date
General Building Information		
Project Location	Port Moody, BC	
Weather File	Per COV Energy Modelling Guidelines	
Total Number of Buildings	1	
Total Number of Units	44 Residential Units& 2 CRUs	
Modelled Floor Area (m^2)	5079	
Orientation of Plan North	East	
Energy Code	ASHRAE 55 - 2004	
Modeling Software/Version	Design Builder	
Modeller	GG/JCU	
Glazing Information (IP)		
Glazing assembly U-value (including frame) (IP)	U 0.36 (CRU) Aluminium framed) U 0.32 (Residential) Vinyl framed)	
Glazing solar heat gain coefficient (SHGC, including frame)	0.23	
WWR	43%	
Shading device	N/A	
Envelope Information (IP)		
Overall wall effective R-value (IP)	R-value 8	2×6 wood stud R22 cavity insulation
Overall roof effective R-value (IP)	R-value 28	2 layers rigid insulation
Opaque Doors effective R-value	R-value 5	Estimated by JRS
Infiltration	0.2 L/s/m2@ operating pressure 1.03 L/s/m2 @ 75 Pa	CoV Energy Modelling Guidelines
Kitchen Exhaust	200 CFM/unit	
Floor between parkade and suites	R-value 22	
Slab on grade	2' perimeter insulation	
Internal Loads		
Lighting power density	5 W/m2 (suites), 18.1 W/m2 (CRU) others per NECB	Mechanical to confirm
Lighting control	N/A	
Exterior lights	0.45 kW	Estimated by JRS

Miscellaneous Equipment	5 W/m2 (suites), 12.5 W/m2 (CRU), others per NECB	Mechanical to confirm
Process Load	N/A	CoV Energy Modelling Guidelines
Elevator	3 kW per elevator (1 elevator)	
Appliances	Included in Equipment Load (Residential)	
Low Flow Plumbing Fixture	Residential: 0.025 GPM/person, as per CoV Energy Modelling Guidelines; others per NECB	
Design Conditions		
Indoor design temperatures (heat/cool)	Per NECB	
Thermostat Temperature Schedule (heat/cool/setback)	Per NECB	
Operation Schedule (Zone group, Plant, Lighting)	Residential NECB G; Coffee NECB B; Retail NECB C	
Humidity Control	N/A	
HVAC System		
System description	Electrical baseboard for residential unit, gas fired MUA for corridor, gas fired furnace with DX cooling for CRUs, EFF heater for lobby and stairs	
Ventilation: System Level	MUA for Corridor	
Outdoor Air (supply)	MUA for corridors 25cfm/door; HRV for Suites 57cfm; HRVs for CRU 120cfm	Mechanical to confirm
System Fan Power (SA/RA/EA)	MUA 0.550 W/cfm ERV 0.856 W/cfm EFF 0.09 W/cfm	Assumed by JRS
Heat Recovery Ventilator efficiency	65% (Sensible Recovery Efficiency)	Mechanical to confirm
Heating Efficiency	Corridor MUA 80%, Baseboard 100%, CRU gas fired furnace 80%	Mechanical to confirm
Cooling Efficiency	CRU DX COP = 3	Mechanical to confirm
Ventilation: Zone and Room Level	HRV (suite)	
Local Exhaust Fan	32 W per bath @ 8 hr per day	Assumed by JRS
Parking ventilation fan power	3.02 kW	Assumed by JRS
Filters & Other system features	N/A	
Plant Information		
Domestic hot water heating type	Residential: Natural gas CRUs: Electric	
Domestic hot water heating efficiency	Natural gas:96% Electric: 100%	

Storage Tank Insulation	N/A	
Domestic hot Water Pumps	750 W (suites), 250 W(retail)	Assumed by JRS
Pump Control	Constant	

THERMAL COMFORT PARAMETERS OF BUILDING 2

Model Inputs	Proposed	Notes/Source/Date
General Building Information		
Project Location	Port Moody, BC	
Weather File	Per COV Energy Modelling Guidelines	
Total Number of Buildings	1	
Total Number of Units	80 Residential Units& 7 CRUs	
Modelled Floor Area (m^2)	7047	
Orientation of Plan North	North	
Energy Code	ASHRAE 55 - 2004	
Modeling Software/Version	Design Builder	
Modeller	GG/JCU	
Glazing Information (IP)		
Glazing assembly U-value (including frame) (IP)	U 0.36 (CRU) Aluminium framed U 0.32 (Residential) Vinyl framed	
Glazing solar heat gain coefficient (SHGC, including frame)	0.23	
WWR	48%	
Shading device	N/A	
Envelope Information (IP)		
Overall wall effective R-value (IP)	R-value 7.4	2×6 wood stud R22 cavity insulation
Overall roof effective R-value (IP)	R-value 28	2 layers rigid insulation
Opaque Doors effective R-value	R-value 5	Estimated by JRS
Infiltration	0.2 L/s/m2 @operating pressure 0.99 L/s/m2 @ 75 Pa	CoV Energy Modelling Guidelines
Kitchen Exhaust	200 CFM/unit	
Floor between parkade and suites	R-value 22	
Slab on grade	2' perimeter insulation	
Internal Loads		
Lighting power density	5 W/m2 (suites), 18.1 W/m2 (CRU) others per NECB	Mechanical to confirm
Lighting control	N/A	
Exterior lights	0.77 kW	Estimated by JRS
Miscellaneous Equipment	5 W/m2 (suites), 12.5 W/m2 (CRU), others per NECB	Mechanical to confirm

Process Load	N/A	CoV Energy Modelling Guidelines
Elevator	3 kW per elevator (2 elevators)	
Appliances	Included in Equipment Load (Residential)	
Low Flow Plumbing Fixture	Residential: 0.025 GPM/person, as per CoV Energy Modelling Guidelines; others per NECB	
Design Conditions		
Indoor design temperatures (heat/cool)	Per NECB	
Thermostat Temperature Schedule (heat/cool/setback)	Per NECB	
Operation Schedule (Zone group, Plant, Lighting)	Residential NECB G; Coffee NECB B; Retail NECB C; Office NECB A	
Humidity Control	N/A	
HVAC System		
System description	Electrical baseboard for residential unit, gas fired MUA for corridor, gas fired furnace with DX cooling for CRUs, EFF heater for lobby and stairs	
Ventilation: System Level	MUA for Corridor	
Outdoor Air (supply)	MUA for corridors 25cfm/door; HRV for Suites 57cfm; HRVs for CRU 120cfm	Mechanical to confirm
System Fan Power (SA/RA/EA)	MUA 0.550 W/cfm ERV 0.856 W/cfm EFF 0.09 W/cfm	Assumed by JRS
Heat Recovery Ventilator efficiency	65% (SRE)	Mechanical to confirm
Heating Efficiency	Corridor MUA 80%, Baseboard 100%, CRU gas fired furnace 80%	Mechanical to confirm
Cooling Efficiency	CRU heat pump Cooling COP = 3	Mechanical to confirm
Ventilation: Zone and Room Level	HRV (suite)	
Local Exhaust Fan	32 W per bath @ 8 hr per day	Assumed by JRS
Parking ventilation fan power	5.18 kW	
Filters & Other system features	N/A	
Plant Information		
Domestic hot water heating type	Residential: Natural gas CRUs: Electric	
Domestic hot water heating efficiency	Natural gas: 96% Electric:100%	
Storage Tank Insulation	N/A	
Domestic hot Water Pumps	750 W (suites), 250 W(retail)	Assumed by JRS

Pump Control	Constant	