

SUSTAINABLE DESIGN STRATEGY

Rezoning Application: 485 West 35th Ave Proposed Mixed-Use Development

Prepared for:

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OVERVIEW

As a part of the Rezoning Application package, the following Sustainable Design Strategy has been developed to provide confirmation the project design submitted is on target to meet the requirements as dictated by the Green Buildings Policy for Rezonings 2016, option B. Low Emissions Green Building, effective May 1, 2017.

The following narrative includes preliminary strategies explored by the design team, with the aim to achieve the various requirements of the Low Emissions Green Building pathway, along with all required supporting evidence at this stage, as listed:

- Item B.2: Brief summary of strategies and measures to achieve performance limits for energy use, heat loss, and greenhouse gas emissions, including;
 - Preliminary Zero Emissions Building Plan (ZEBP) Energy Checklist, completed by the project energy modeller, showing that the project meets the performance limits for energy use (TEUI), heat loss (TEDI), and greenhouse gas emissions (GHGI), together with key inputs;
 - 2-4 page summary of detailed energy model inputs for detailed and/or 3rd party review.
- Item B.6.2: Preliminary embodied emissions calculations, and a description of specific measures that will be explored during design to reduce embodied emissions;
- Item B.10: The site IRMP, describing the chosen strategies and green and grey infrastructure measures included in the landscape and building design. The IRMP describes;
 - How these measures contribute to the city-wide IRMP targets for water volume reduction and quality treatment, and
 - Include preliminary site and volume calculations to compare site performance to the City-wide targets;
 - Landscape/Architectural Site Plans highlighting the green and grey infrastructure measures described in the site IRMP as also provided.
- A commitment by the owner to meet the requirements of the Green Buildings Policy for Rezonings with documentation to be submitted at a later project phase, including:
 - B.3: design, build, and test to meet an airtightness target of 2.0 L/s/m² @ 75 Pa;
 - B.4: complete an enhanced commissioning process;
 - B.5: design and build to include building metering and sub-metering of energy, and to enter into agreement on energy reporting, including assistance for building future owners;
 - B.6.1: complete refrigerant emissions calculations;
 - B.7: design and build a direct ventilation system;
 - B.8: design and build with low-emitting materials;
 - B.9: test indoor air quality prior to occupancy;
 - B.11: design and build a resilient potable water access point.

B.1: LEED GOLD - BUILDING DESIGN + CONSTRUCTION

As the project is over 50% residential, LEED registration, design and certification is not required.

B.2: PERFORMANCE LIMITS

At this stage, the project is still in concept design where the building shape/massing and suite layout are subject to City approval and other changes. Additionally, the mechanical, electrical and envelope design are not fully defined, but instead, under exploration.

A preliminary energy model has been conducted to identify building design parameters required to be in compliance with the performance limits for Residential Low-Rise buildings (connected to a city-recognized low carbon energy system). Whole-Building Performance modeled for 485 West 35th Ave include: TEUI 90.7 kWh/m²; TEDI 13.4 kWh/m²; GHGI 1.0 kgCO₂/m². The design team and project owner confirm the project will be designed in compliance with these limits.

The Zero Emissions Building Plan Energy Checklist, along with a summary of the detailed model inputs have been included to confirm compliance – please see *Sustainability Appendix 1.1 - Zero Emissions Building Plan Energy Checklist & detailed model inputs*.

B.3: AIRTIGHTNESS TESTING

Whole-building and suite airtightness testing and reporting is required for this residential building. The project owner has committed to meet this requirement – please see *Sustainability Appendix 1.2 - Letter of Commitment*.

B.4: ENHANCED COMMISSIONING

An enhanced commissioning process is required for all building energy systems. The project owner has committed to meet this requirement – please see *Sustainability Appendix 1.2 - Letter of Commitment*.

B.5: ENERGY SYSTEM SUB-METERING + REPORTING

Separate master metering for each energy utility, along with sub-metering of all major energy end-uses and major space uses is required. The building owner must enter an agreement with the City of Vancouver to share utility data for minimum three (3) years and provide assistance for building future owners. The project owner has committed to meet this requirement – please see *Sustainability Appendix 1.2 - Letter of Commitment*.

B.6: REFRIGERANT EMISSIONS + EMBODIED EMISSIONS

Preliminary embodied emissions calculations for all major building materials have been conducted based on the building’s rezoning concept design. Various floor, wall and roof areas have been confirmed through the preliminary energy model. As current designs do not include detailed structural information, various comparable mixed-use developments in Vancouver were referenced. From these reference buildings, applicable details related to column quantity, span, load and typical wall assemblies have been applied to the various floor, wall, and roof lengths and areas for this building. As more detailed information is available specific to this project, the life cycle assessment model will be refined and updated.

The total building height is 20.4 m and the building includes one level of parkade. Other major concept design assumptions include:

Concept Design Assumptions	Parkade	Above Grade
Floor Area	683.0 m2	1939.4 m2
Building Footprint	683.0 m2	397.8 m2
Columns & Beams	Type: Concrete Height (m): 3.53	Type: Concrete Height (m): 3.04
Foundations	Concrete Slab, Concrete Footings	

Concept Design Assumptions	Parkade	Above Grade
Interior Walls	Elevator/Stairwell Cores: Cast in place concrete	Elevator/Stairwell Cores: Cast in place concrete Interior Hallways: Steel Stud, Gypsum Fire Rated Type X, Mineral Wool Batt
Exterior Walls	118.5 m2 total wall area Cast in place 35 MPa Concrete, Drainage mat, Polyethylene Filter Fabric, PVC Membrane	914.4 m2 total wall area Steel Stud, Metal Cladding, Mineral Wool Batt and Polyethylene
Floors	683.0 m2 total floor area Concrete 35 MPa, Polyethylene	1939.4 m2 total floor area Concrete 30 MPa
Roof		451.5 m2 Concrete 30 MPa, Drainage Mat, Polystyrene board, EPDM Membrane
Glazing		607.3 m2 total glazing area Aluminum Frame Triple Pane, Triple Glazed Hard Coated Argon

The Athena Impact Estimator for Buildings software was utilized, which is in compliance with EN 15978. A 60 year building life expectancy was modeled. The following outputs represent the overall embodied emissions associated with these assumed structural and enclosure components:

Embodied Emissions at Concept Design		
	Unit	Total
Global Warming Potential	kg CO2 eq	7.84 E+05
Global Warming Potential Intensity	kgCO2eq/m ²	379.7
Global Warning Potential Annualized Intensity (60 year building life expectancy)	kgCO2eq/m ² /year	6.32

It has been determined based on the Concept Design of 485 West 35th Ave, the total lifecycle embodied emissions Global Warming Potential *intensity* is 379.7 kgCO2eq/m² and *annualized intensity* is 6.32 kgCO2eq/m²/year, considering a 60 year building life.

During design development, the same exercise will be conducted should the building heating and cooling system selections have a capacity of equipment containing refrigerants 35 kW or greater. Once mechanical systems have been selected, emissions from refrigerants will be calculated using the following formula: $\text{kgCO}_2\text{e}/\text{m}^2 = [\text{GWPr} \cdot \text{Rc} \cdot (0.02 \cdot \text{L} + 0.1 +)] / (\text{L} \cdot \text{A})$. Outputs representing the overall refrigerant emissions associated with the building's mechanical components will be provided to the City of Vancouver.

Upon Building Permit Application, the project team will provide embodied emissions calculations representing the building permit stage design and a description of what measures, if any, were taken to reduce embodied emissions.

B.7: VERIFIED DIRECT VENTILATION

The building's ventilation system will provide outdoor air directly to all available spaces, in the quantities defined by code. The project owner has committed to meet this requirement – please see *Sustainability Appendix 1.2 - Letter of Commitment*.

B.8: LOW EMITTING MATERIALS

All interior finishes will be selected to minimize volatile organic compounds and added urea formaldehyde to improve the indoor environmental quality. The project owner has committed to meet this requirement – please see *Sustainability Appendix 1.2 - Letter of Commitment*.

B.9: INDOOR AIR QUALITY TESTING

Prior to occupancy, testing for formaldehyde, particulates, ozone, total volatile organic compounds and carbon monoxide will be conducted. The results will be compared to City targets and will be reported for occupancy permit. The project owner has committed to meet this requirement – please see *Sustainability Appendix 1.2 - Letter of Commitment*.

B.10: INTEGRATED RAINWATER MANAGEMENT + GREEN INFRASTRUCTURE

In consultation with the City of Vancouver’s Best Management Practice Toolkit, the project site Integrated Rainwater Management Plan includes green and grey infrastructure measures considered appropriate for the building type, design, project location and surrounding area. Landscape/Architectural Site Plans highlighting the green and grey infrastructure measures described in the site IRMP has been included with this Rezoning Application Package – please see *Sustainability Appendix 1.3 - Integrated Rainwater Management Plan & Site Plan*.

B.11: RESILIENT DRINKING WATER ACCESS

The building’s design will provide access to potable water which utilizes City operated system pressure (not electrically aided). Points of water access will be provided for every 75 occupants; according to current project data, this would equate to one (1) point of resilient water access.

FTEs			
<u>Space Type</u>	<u>Room Type</u>	<u>Quantity</u>	<u>Occupant Count</u>
Residential	Studio	0	0
	1 Bedroom	7	14
	2 Bedroom	4	12
	3 Bedroom	5	20
	Total	16	
<u>Total Residential Occupants</u>			46
<u>Total Commercial Occupants</u>			0
Total Building Occupants			46
Potable Water Access Points			0.61

The project owner has committed to meet this requirement – please see *Sustainability Appendix 1.2 - Letter of Commitment*.

SUMMARY

The above noted strategies support a holistic approach to addressing the requirements of the City of Vancouver’s Green Buildings Policy for Rezoning. Implementing these strategies through design and construction will produce a sustainable and resilient building capable of delivering optimum building performance, while also improving indoor environmental quality for occupants.

485 West 35th Avenue

City of Vancouver Rezoning Energy Modeling Input Summary Table

Proposed Design Model Characteristics																					
General																					
Location	Vancouver, BC																				
Simulation Weather File	Vancouver (CWEC)																				
Climate Zone	ASHRAE Climate Zone 5C																				
Modeling Software	eQUEST 3.64																				
Building Area	20,877 ft ² as per architectural drawing F.S.R area																				
Envelope surface area to floor area ratio	76%																				
Hours of Operation	Based on <i>ENERGY MODELLING GUIDELINES section 2.1 Schedules</i>																				
Envelope Performance																					
Overall Roof U-value (BTU/h-ft ² -°F)	U-0.025 (R-40)																				
Overall Wall U-value (BTU/h-ft ² -°F)	U-0.067 (R-15) (includes all thermal bridges per CoV's <i>ENERGY MODELLING GUIDELINES</i>)																				
Percentage Glazing	40%																				
Overall Glass U-value including frame (BTU/h-ft ² -°F), and Solar Heat Gain Coefficient (SHGC)	Windows: U-0.14 (Passive House) SHGC-0.40																				
Infiltration	Based on <i>ENERGY MODELLING GUIDELINES section 2.4 Infiltration</i>																				
Internal Loads																					
Occupancy	Residential: People = no. bedrooms + 1 (based on ASHRAE 62-2001 Table 2)																				
Lighting Power Density (LPD) (W/ft ²)	<table border="1"> <thead> <tr> <th>Space by Space Method</th> <th>Proposed Lighting Power Density [W/ft²]</th> </tr> </thead> <tbody> <tr> <td>Corridor/Transition</td> <td>0.800</td> </tr> <tr> <td>Electrical/Mechanical</td> <td>1.245</td> </tr> <tr> <td>Lobby</td> <td>0.901</td> </tr> <tr> <td>Lobby for Elevators</td> <td>0.641</td> </tr> <tr> <td>Lounge/recreation</td> <td>0.873</td> </tr> <tr> <td>Parking Garage</td> <td>0.130</td> </tr> <tr> <td>Stairway</td> <td>0.500</td> </tr> <tr> <td>Storage</td> <td>0.632</td> </tr> <tr> <td>Residential Suite</td> <td>0.464</td> </tr> </tbody> </table>	Space by Space Method	Proposed Lighting Power Density [W/ft ²]	Corridor/Transition	0.800	Electrical/Mechanical	1.245	Lobby	0.901	Lobby for Elevators	0.641	Lounge/recreation	0.873	Parking Garage	0.130	Stairway	0.500	Storage	0.632	Residential Suite	0.464
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	Stairway	0.500																			
Storage	0.632																				
Residential Suite	0.464																				
Exterior lighting	0.5 kW (preliminary exterior lighting allowance)																				
Plug-Loads	Residential: 0.464 W/ft ² (as per Based on <i>ENERGY MODELLING GUIDELINES section 2.2.1 Residential Suites</i>)																				
Process Loads (Electric)	Miscellaneous: 1 kW (preliminary process load allowance) Elevators: 3 kW																				
Domestic Hot Water Consumption	Residential: 0.025 gpm/person with 30% reduction (low flow fixture) (Based on <i>ENERGY MODELLING GUIDELINES section 2.2.1 Residential Suites</i>)																				
Mechanical Systems																					

	Proposed Design Model Characteristics
Indoor Design Temperature for Conditioned Areas	Based on <i>ENERGY MODELLING GUIDELINES section 2.1 Schedules</i>
System Description and Efficiency	<p>Dwelling Units: Air source VRF fan coil units with ventilation by Zehnder 160 ERV-PH certified</p> <ul style="list-style-type: none"> • Fan coil unit: ≈ 0.20 W/cfm • ERV fan power: 40 W • Bathroom fan power: 13 W • Ventilation fans on continuously • Bathroom fans on 2 hr/day <p>Corridor: Ventilation by electric ventilator (no heat recovery)</p> <ul style="list-style-type: none"> • Ventilator fan power: 0.20 W/cfm • Ventilation fans on continuously
Minimum Ventilation Rates	<p>Living areas: 0.35 air changes per hour but not less than 15 cfm per person</p> <p>Corridor ventilation: 10 cfm per door (kept at 60°F)</p> <p>(Outdoor air is calculated as per ASHRAE 62-2001)</p>
Heat Recovery	Zehnder 160: 89% sensible effectiveness (PH certified)
Central Plant	
Heating Type and Efficiency	<p>Air source VRF condensing unit</p> <ul style="list-style-type: none"> • Efficiency: 2.5 seasonal COP (heating)
Cooling Type and Efficiency	<p>Air source VRF condensing unit</p> <ul style="list-style-type: none"> • Efficiency: 4.0 seasonal COP (cooling)
Domestic Water Heater and Efficiency	<p>Hybrid heat pump electric resistance DHW tanks</p> <ul style="list-style-type: none"> • Seasonal efficiency: 1.64 COP



Zero Emissions Building Plan Energy Checklist

Please complete all fields that apply to the project, using information that represents the current stage of design. For fields that do not apply or for which there is no information yet, please enter "N/A".

Project Information (enter all that apply)							
Project Address	485 West 35th Avenue, Vancouver, B.C.						
Secondary Address							
Project Working Title	485 West 35th Avenue						
POSSE File Name (City use only)							
Gross Floor Area indicated on Arch. Drawings (m ²)	1,940						
Parkade Area (m ²)	683						
Building Information and Performance Limits							
For building types with Performance Limits, enter this information in this section							
Building Type(s)	Modelled Floor Area (m ²)	City-Recognized Low Carbon Energy System?	TEUI	TEDI	GHGI		
Residential Low-Rise (RZ, < 7 storeys)	1,940	No	100	15	5		
			0	0	0		
			0	0	0		
For other building types, create a baseline energy model to establish a TEUI limit, and enter this information in this section							
Building Type	Modelled Floor Area (m ²)				TEUI	TEDI	GHGI
Enter Other Building Type	Baseline Model Performance	Energy (kWh)	Em. Factor	Emissions (kgCO ₂ e)			
	Total Annual Electricity Use		0.011	-	Baseline: 0	N/A	0
	Total Annual Natural Gas Use		0.185	-	Target: 0	N/A	0
	Total Annual District Energy Use		0.070	-			
Total							
Total Modelled Floor Area (m ²)					TEUI	TEDI	GHGI
1,940					100.0	15.0	5.0
Modelled Floor Area within 5% of Gross Floor Area?							
Yes							
Modelled Building Performance							
	Energy (kWh)	Fuel Type	Em. Factor	Emissions (kgCO ₂ e)	TEUI	GHGI	
Interior Lighting	41,016	Electricity	0.011	451.176	21.1	0.2	
Exterior Lighting	1,862	Electricity	0.011	20.482	1.0	0.0	
Heating	12,800	Electricity	0.011	140.8	6.6	0.1	
Cooling	25,281	Electricity	0.011	278.091	13.0	0.1	
Pumps	-	Electricity	0.011	0		0.0	
Fans	38,556	Electricity	0.011	424.116	19.9	0.2	
Domestic Hot Water	19,425	Electricity	0.011	213.675	10.0	0.1	
Plug Loads	34,457	Electricity	0.011	379.027	17.8	0.2	
Elevator	6,461	Electricity	0.011	71.071	3.3	0.0	
Enter other end use here							
Enter other end use here							
Total Annual Electricity Use	179,858		0.011	1,978			
Total Annual Natural Gas Use	-		0.185	-			
Total Annual District Energy Use	-		0.070	-			
Total	179,858			1,978			
Total Electricity Generated On-Site (kWh)		% of Use	0.0%				
Total Purchased Renewable Electricity (kWh)		% of Use	0.0%				
Total Purchased Renewable Natural Gas (kWh)		% of Use	0.0%				
Note: purchases renewables used to demonstrate compliance must be secured to satisfaction of AHJ							
Adjusted Electricity Emissions Factor (kgCO ₂ e/kWh)	0.011						
Adjusted Natural Gas Emissions Factor (kgCO ₂ e/kWh)	0.185						
Total Annual Heat Demand - for TEDI (kWh)	29,924	15.4 kWh/m ²					
Total Annual Cooling Demand - for info only (kWh)	104,079	53.6 kWh/m ²					
Note: report for portion of building with TEDI targets only							
Modelled Whole-Building Performance					TEUI	TEDI	GHGI
					92.7	15.4	1.0
Corridor Pressurization Adjustment							
Number of Suite Doors Pressurized	16						
Airflow for Pressurization per Door (L/s/door)	4,719474439						
Area of Corridors Pressurized (m ²)	128.7174721						
Make-Up Air Fuel Type	Electricity						
Make-Up Air Emissions Factor	0.011	Adjustments for Corridor Pressurization			TEUI	TEDI	GHGI
					2.0	2.0	0.0
Suite-level Metering for Space Heating	Yes		Adjustments for Suite Submetering of Heating				
			-				
Note: select yes if the energy used for heating is metered at the suite level							
Adjusted Whole-Building Performance for Compliance					90.7	13.4	1.0

Modelled Inputs

Modelled Above-Ground Wall Area (m ²)	1,522	Vertical facade-to-Floor Area Ratio (VFAR)	0.78
Window-to-Wall Area Ratio (WWR)	40%	Window-to-Floor Area Ratio	0.31
Average Infiltration Rate (L/s/m ² _{acc})	0.0179		
Wall Effective R-Value - incl. thermal bridging (m ² K/W)	2.7	15.15 (ft ² hr ² F/Btu)	Average Floor Edge Psi-Value (W/m ² K) N/A
Roof Effective R-Value - incl. thermal bridging (m ² K/W)	7.0	39.76 (ft ² hr ² F/Btu)	Avg. Window Transition Psi-Value (W/m ² K) N/A
Average Window Effective U-Value (W/m ² K)	0.8	0.15 (Btu/ft ² hr ² F)	Window Solar Heat Gain Coefficient N/A
Average Suite Occupant Density (m ² /pers)	15.17		Average Lighting W/m ² 5 (suite)
Average Suite Ventilation Rate (L/s/m ²)	29.34923167		DHW Low-Flow Savings 30%
Average HRV Effectiveness	89%		DHW Drain Heat Recovery Effectiveness 0%
Heating System Type (fuel, plant, distribution, etc.)	Air source VRF condensing units: COP 2.5 heating (seasonal)		
Cooling System Type (fuel, plant, distribution, etc.)	Air source VRF condensing units: COP 4.0 cooling (seasonal)		
DHW System Type (fuel, plant, distribution, etc.)	Hybrid heat pump electric resistance DHW tanks		

Modeller Information

Modeller Name	Lam Pang	
	<input checked="" type="checkbox"/> <i>These results have been created using the COV Energy Modelling Guidelines version:</i>	1
Company	Integral Group	
Phone Number	604-687-1800	
Email	lpang@integralgroup.com	

1143209 B.C. LTD

June 22, 2018

Planning, Urban Design + Sustainability Department
City of Vancouver
453 West 12th Avenue
Vancouver, BC V5Y 1V4

Email: planning@vancouver.ca

**Re: 485 West 35th Rezoning Application
Commitment to meet the requirements of the Green Buildings Policy for Rezonings**

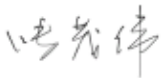
As a part of the Rezoning Application package for 485 West 35th, 1143209 B.C. LTD hereby commits to meet the requirements of the Green Buildings Policy for Rezonings, and commits to providing the required documentation at time of Development Permit Application, Building Permit Application and Occupancy Permit Application. At this concept stage of design, in addition to the measures identified previously in the Sustainable Design Strategy section of the Rezoning Application package, 1143209 B.C. LTD commit to the following requirements:

- B.3: Airtightness Testing: design, build, and test to meet an airtightness target of 2.0 L/s/m² @ 75 Pa;
- B.4: Enhanced Commissioning: complete an enhanced commissioning process;
- B.5: Energy System Sub-Metering and Reporting: design and build to include building metering and sub-metering of energy, and to enter into agreement on energy reporting, including assistance for building future owners;
- B.6.1: Refrigerant Emissions and Embodied Emissions: complete refrigerant emissions calculations;
- B.7: Verified Direct Ventilation: design and build a direct ventilation system;
- B.8: Low-Emitting Materials: design and build with low-emitting materials;
- B.9: Indoor Air Quality Testing: test indoor air quality prior to occupancy;
- B.11: Resilient Drinking Water Access: design and build a resilient potable water access point.

The design team and future operations team will coordinate to incorporate the measures required to meet all requirements of the Green Buildings Policy for Rezonings.

Yours truly,

1143209 B.C. LTD



Maowei Zhang
CEO

2018-06-22

SUSTAINABILITY APPENDIX 1.3 - Integrated Rainwater Management Plan & Site Plan