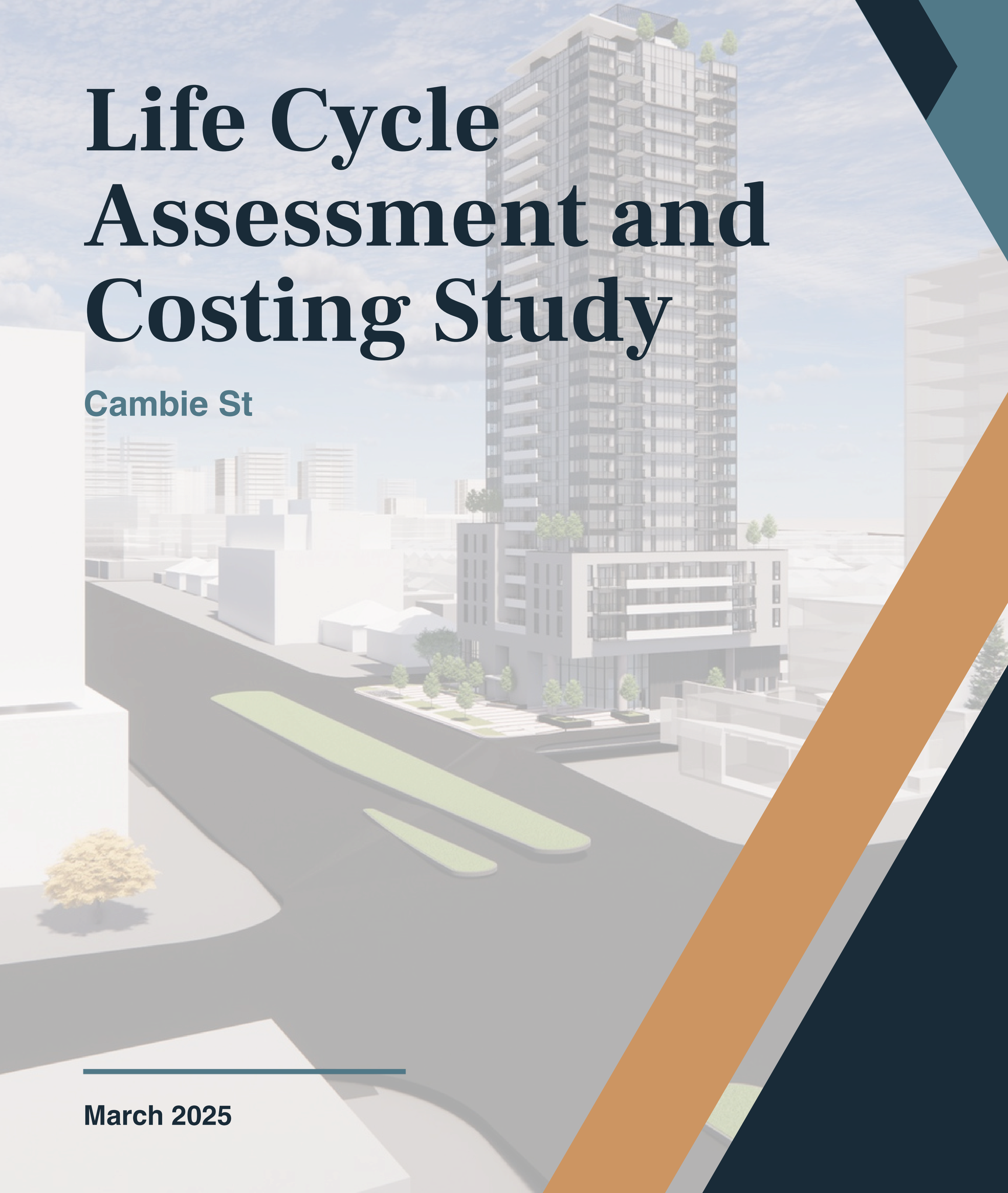


carbon wise
sustainable innovation

Life Cycle Assessment and Costing Study

Cambie St

March 2025

Project Overview

This case study was commissioned to assess the feasibility and cost implications of achieving a 10% reduction in embodied carbon for a high-rise residential building in Vancouver. The target aligns with the project target reduction of the City of Vancouver's embodied carbon policy, which allows projects to demonstrate compliance through either the Intensity or Baseline pathways.

This 26-storey residential building in Vancouver, currently at the rezoning stage, achieves a low embodied carbon intensity of 324 $kgCO_2e/m^2$. This reflects a 19% reduction in emissions, meeting the 10% target, with total embodied carbon estimated at 4,936 tCO_2e.

Building Type	Residential
Location	Vancouver
Gross Floor Area (without parkade in m²)	15,222
Building Height (m)	82
Number of floors above grade	26
Number of floors below grade	2
Design Stage	Schematic Design
Assessment Stage	Rezoning
Residential category	Market Rental Primary
Total Embodied Carbon (tCO_2e)	4,936
Embodied Carbon Intensity ($kgCO_2e/m^2$)	324
Meets the 10% Embodied Carbon target?	Yes
Reduction in Embodied Carbon	19%

Rendering Credit: Urban Solutions Architecture

Dual Pathway Success

Achieving 19% Reduction in Embodied Carbon - Intensity Path

This pathway sets a **fixed benchmark** for embodied carbon intensity. Under the project target reduction, the Intensity target would be 360kgCO_2e/m². This project achieves an Embodied Carbon Intensity of 324kgCO_2e/m², surpassing the target with a 19% reduction.

In the City of Vancouver's embodied carbon policy, the **Intensity path** sets a **fixed embodied carbon intensity limit** for new buildings against which all projects are measured.

Achieving 19% Reduction in Embodied Carbon - Baseline Path

By comparing the proposed design to a **functionally equivalent baseline** building, the project achieved a **19% reduction** in embodied carbon, exceeding the 10% reduction required under the project target reduction.

In contrast, the baseline path lets projects create a **similar reference version** of the building and then show a required **percentage reduction** in embodied carbon compared to that version.

Only one of the two paths is needed for compliance, but the example below shows how the project meets and exceeds the requirements for both.

By successfully meeting and exceeding the reduction targets under both the Intensity and Baseline pathways, this project highlights the flexibility of achieving embodied carbon reductions through either compliance path.

Embodied Carbon Reduction Strategies

Reducing embodied carbon starts with **smart design decisions** that minimize material use and prioritize low-impact choices. Strategies include **simplifying the building form**, which reduces the need for extra structure; **minimizing or eliminating transfer slabs**, which are often concrete-intensive; and **optimizing structural grids** to reduce oversized beams and columns.

For example, a compact, stacked layout can significantly cut down on concrete and steel use, which was the case from the beginning for this project. Early coordination between architects, structural engineers, and sustainability teams is critical to embed these strategies from the outset and ensure real carbon savings.

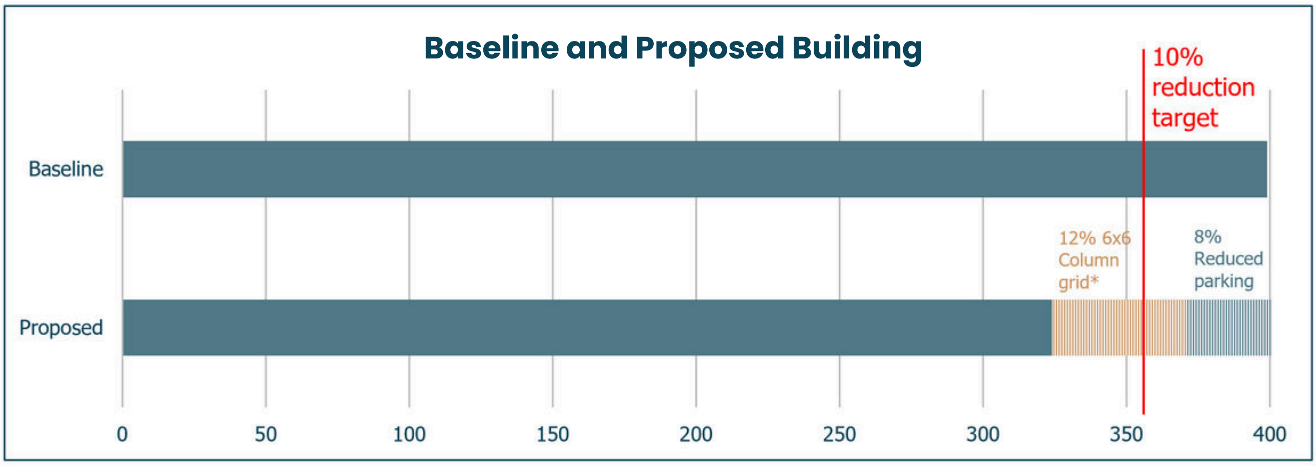
To achieve those reductions, the proposed building implemented **two key strategies**:

1. Reduced the underground parking from four (4) levels to two (2) levels, significantly cutting emissions associated with concrete.

2. Swapped the 8x8 structural grid for a 6x6, reducing slab area per floor and overall building height, which lowered the embodied carbon of the building envelope. **This strategy is based on the original design's assumption of four (4) parking levels.*

Embodied Carbon Reduction Strategies

The following graph compares the total Global Warming Potential (GWP) intensity of the baseline and proposed design, showcasing the cumulative impact of those 2 strategies. By combining targeted optimizations, the proposed building exceeded the reduction targets, demonstrating how smart design choices drive significant embodied carbon reductions.



*The 12% reduction attributed to the 6x6 column grid slightly overestimates carbon savings by approximately 3 $kgCO_2e/m^2$, as the model assumes all four (4) parking levels are built. However, the proposed design includes only two (2) parking levels, leading to a marginal discrepancy (0.76%) in the reported reduction.

Note: The second strategy (implementing a 6x6 structural grid) was analyzed based on the original design, which included four (4) parking levels. When both strategies were combined in the proposed design, some of the CO_2 reductions from the structural grid adjustment were offset by the reduction in total floors.

As a result, the combined savings were slightly lower than the sum of the individual measures. This outcome highlights how design choices interact and influence overall carbon performance. Despite this, the proposed building achieved a significant 19% reduction in embodied carbon, reinforcing the importance of a holistic approach to carbon-conscious design.

Cost Savings

These strategic design changes not only helped meet and exceed Vancouver's proposed embodied carbon targets but also contributed to significant cost savings, as shown below.

Strategy	% Reduction from baseline	GHG reduction (tCO_2e)	Costs Savings ($)*
Baseline	0%	6,072	0
6x6 column grid and reduced wall height	-12%	-722	-1,200,000
Reducing Parking to 2 levels	-8%	-481	-700,000
Proposed Total		4,936	
Proposed Reduction	-19%	-1,136	-1,800,000

**When both strategies were combined in the proposed design, overall cost savings were influenced by the reduction in total floors. As a result, the combined savings were slightly lower than the sum of individual measures. This analysis considers only material costs, emphasizing how design choices impact overall project expenses.*

Methodology

This study assessed life cycle stages from cradle to grave, focusing on the structure and envelope of the building. A 60-year lifespan was assumed, and the Bill of Materials (BoM) was developed through manual quantity takeoffs from the architectural and structural drawings. The analysis was conducted using Athena Impact Estimator, without any major deviations from default assumptions, following the City of Vancouver Embodied Carbon Guidelines.

It's important to highlight that detailed thermal performance, durability, and maintenance were not evaluated beyond the assumptions embedded within the software for the purposes of this study.

Cost savings were estimated by a professional quantity surveyor using locally sourced data, reflecting the most accurate material and pricing information available from suppliers at the time.