

TOWN OF CALEDON
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12100 Creditview Road

Embodied Carbon Assessment Report

12100 Creditview Road, Caledon, Ontario

Prepared for: 12100 Creditview Developments

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Limitations

This memo has been prepared by Pratus Group for 12100 Creditview Developments with the purpose of completing an embodied carbon assessment to satisfy the Town of Caledon Green Development Standards, Metric 3.4: Embodied Carbon, under the terms of our agreement. The material herein reflects Pratus Group's best judgement in light of the information available to it at the time of preparation. Any use that a third party makes regarding the information provided within this report including reliance on, or decisions to be made based on it, are the responsibility of such parties. Pratus Group accepts no responsibility for damages, if any, suffered by any party as a result of decisions made or actions taken based on this report.

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1. Introduction

1.1. Purpose of Assessment

Pratus Group Inc. was retained to perform an embodied carbon assessment for a new commercial development located in the Town of Caledon in Ontario. The purpose of the analysis conducted was to assess the bulk material embodied carbon emissions associated with the proposed project, in conformance with the guidance laid out in the Town of Caledon's Green Development Standard (GDS)

Metric 3.4: Embodied Carbon^a.

1.2. Embodied Carbon Overview

An embodied carbon assessment is a quantification of the greenhouse gas emissions associated with the entire life-cycle of a building, product, or material. Embodied carbon emissions include emissions arising from life-cycle stages including extraction, manufacturing, transportation, construction, maintenance, and end-of-life disposal.

The World Green Building Council estimates that the building sector is currently responsible for 39% of total global greenhouse gas emissions, with the manufacture and production of construction materials accounting for approximately 11% of annual global emissions.^b

1.3. Proposed Development

12100 Creditview is a proposed commercial retail development located at the northwest intersection of Creditview and Mayfield Roads in the Town of Caledon, Ontario. The site is 35.93 acres in size and is proposed to include three clusters of retail buildings consisting of a total building footprint of 28,046 m² and 1,631 at-grade parking spaces.

1.4. Caledon's GDS Metric 3.4 Requirements

Metric 3.4: Embodied Carbon is a mandatory requirement of the Town of Caledon's GDS. Per the GDS, this requirement is intended to enhance awareness and promote the reporting and benchmarking of greenhouse gas emissions associated with building materials. The metric establishes requirements for reporting on the expected embodied carbon emissions and mandates a 10% reduction in the embodied carbon emissions of concrete below the Concrete Ontario baseline values. **Table 1-1** outlines the specific requirements of this metric for institutional, commercial, and industrial developments.

^a Town of Caledon: <https://www.caledon.ca/en/town-services/resources/Energy-Environment/Caledon-GDS-Guidebook.pdf>

^b World Green Building Council: <https://worldgbc.org/advancing-net-zero/embodied-carbon/>

Table 1-1: GDS Requirements - Metric 3.4: Embodied Carbon

Building Type Applicability	Metric Requirement
Institutional, Commercial, and Industrial (ICI)	Report embodied carbon in these bulk materials based on the relevant Environmental Product Declaration (EPD): concrete, steel, masonry, wallboard, glass, thermal insulation, and wood. AND Include concrete mixes that are at least 10% below the Concrete Ontario baselines per mix type.

2. Embodied Carbon Assessment

2.1. Assessment Methodology

2.1.1. Material Quantity Estimation

The assessment is based on the Site Plan prepared by Turner Fleischer Architects Inc. dated September 20th, 2024, which was used to determine the preliminary building dimensions. As the project is currently at the schematic design stage, detailed construction specifications are yet to be finalized. Consequently, the building's architectural components—including elevations, cladding selection, and wall assemblies—were derived from the architectural elevations dated September 19th, 2024. Additional assumptions were made based on typical architectural drawings and details to complete the analysis.

As detailed structural drawings were not available, quantities of structural materials were estimated using the One Click LCA Carbon Designer tool. The project was assumed to primarily use structural steel framing, with reinforced concrete foundations for the construction of the proposed retail buildings. **Table 2-1** below outlines the building properties and parameters used for the assessment. The detailed building assemblies are presented in **Appendix A**.

Table 2-1: 12100 Caledon's Retail Buildings' Parameters

Parameter	Description
Project Location	12100 Creditview Road, Caledon, Ontario
Building Type	Retail
Gross Floor Area	Total development: 28,046 m ² - Retail A: 14,782 m ² - Retail B1: 1,336 m ² - Retail B2: 1,607 m ² - Retail B3: 1,142 m ² - Retail B4: 1,329 m ² - Retail B5: 409 m ² - Retail C1: 4,366 m ² - Retail C2: 1,579 m ² - Retail C3: 740 m ² - Retail C4: 756 m ²
Number of Floors	1
Internal Floor Height	~6.5 m
Building Service Life	60 years
Structural Framing	Steel columns and beams
Foundations	Footings
Floor Slab Construction	250 mm slab on grade
Exterior Walls and Cladding Retail A1 (80%*)	4" clay brick – 45% Aluminium metal panel - 21% Fiber cement cladding - 13%

Parameter	Description
Exterior Doors & Windows A1 (20%*)	Spandrel windows – 10%
	Glazing windows – 3%
	Spandrel doors – 3%
	Glazing doors – 1%
	Overhead Doors – 6%
Exterior Walls and Cladding Retail B1 to C4 (63%*)	4" clay brick – 29%
	Aluminium metal panel – 21%
	Fiber cement cladding – 13%
Exterior Doors & Windows Retail B1 to C4 (37%*)	Spandrel windows – 13%
	Glazing windows – 18%
	Spandrel doors – 3%
	Glazing doors – 2%
	Overhead Doors – 6%

*These values report the estimated percentage of wall area for each building

2.1.2. Global Warming Potential (GWP)

The GWP of each material was determined using Environmental Product Declarations (EPDs) published by the American Society for Testing and Materials (ASTM). The LCA assessor selected materials that best aligned with the intended project design as detailed by the project developer. **Table 4-2 of Appendix B** provides a summary of the material selection for the 12100 Creditview development, along with the corresponding EPDs and GWP values for each material. Upfront emissions (associated with Stages A1-A3) were calculated based on these documents and were recorded in the Town of Caledon's Embodied Carbon Reporting Tool, as required by the GDS.

2.2. Assessment Software

Material quantities for this assessment were generated using the One Click LCA Carbon Designer 3D (CD3D) tool. CD3D allows for the construction of localized baseline models based on average archetypical data and specific high-level building parameters. Specifically, quantities of concrete, steel reinforcement and framing, masonry, wallboard, insulation, and glazing were obtained from CD3D models.

2.3. Statement of Limitations

The embodied carbon assessment presented in this report is based on a preliminary site plan and a set of building elevations. The assessment of the development's carbon footprint is therefore preliminary and based on the assumptions outlined in **Table 2-1**. The modelled results additionally focus on the greenhouse gas emissions of bulk materials required to be reported per the GDS, which include concrete, steel, wallboard, glass, masonry, insulation, and wood. Additional materials, including most claddings, interior

finishes and furnishings, mechanical, electrical, and plumbing (MEP) equipment, and materials associated with site works are outside the scope of this assessment and therefore have not been included.

Material quantities for this assessment were generated using the One Click LCA Carbon Designer 3D (CD3D) tool, and as a result, structural quantities for concrete and steel are considered preliminary.

The building service life for this assessment was assumed to be 60 years, consistent with standard practice.

The scope of the analysis conducted was restricted to the proposed buildings on the site, and excludes all other construction materials consistent with the requirements of the GDS.

3. Results

To determine the embodied carbon impact for 12100 Creditview, Pratus Group completed Caledon's GDS Embodied Carbon Reporting Tool (see **Appendix C**). This tool captures the carbon intensity of each material listed in **Table 4-2**, along with the total estimated quantities to be used in the building and the resulting embodied carbon.

A breakdown of the estimated embodied carbon of major building material components for the 12100 Creditview development is included in **Figure 3-1**. It demonstrates the significant impact of structural materials, which are expected to account for an estimated 81% of the development's overall embodied carbon footprint. Steel components represent the single largest material GWP contributor, accounting for a total of ~41% of the development's overall embodied carbon. Ready-mix concrete is a close second, representing 40% of the development's total emissions.

Architectural assemblies also contribute notably to the overall embodied carbon, with masonry, wallboard, and glazing each accounting for 5% of the calculated footprint. Insulation constitutes the material with the lowest GWP, likely due to the specific manufacturer selection and the use of low-GWP manufacturing processes compared to industry standard, particularly for XPS.

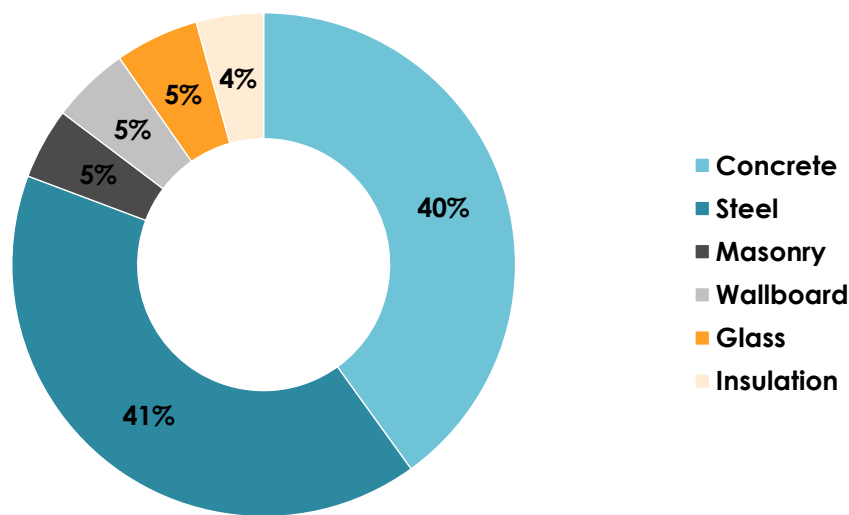


Figure 3-1: TRACI Life-cycle Impacts for Building 1 Modelled Scenario

3.1. Concrete Mixes

The Town of Caledon's GDS specifically requires the use of concrete mixes that achieve embodied carbon emissions performance 10% lower than Concrete Ontario's industry-wide baseline (or better). following section provides an in-depth analysis of embodied carbon reduction strategies for concrete, highlighting opportunities to lower its global warming potential (GWP). Additional information on strategies for reducing emissions from steel materials is reported in **Appendix D**.

Within the proposed 12100 Creditview development, concrete is expected to be utilized in building foundations (footings), as slab on grade, and in load-bearing walls and staircases.

The estimated concrete quantity for all retail buildings was calculated using the Carbon Designer module in One Click LCA, as shown in the **Table 3-1** below. Based on the building dimensions and properties, it was assumed that the concrete mix would have a strength of 32 MPa.

Table 3-1: Estimated Quantities of Concrete Materials Used by the 12100 Creditview Development

Building	Building Concrete Component (m ³)				12100 Creditview Total (m ³)
	Footings	Load Bearing	Ground Slab	Stairs	
Retail A	300.4	61.0	3,700.0	23.3	4084.7
Retail B1	27.0	20.4	334.0	23.3	404.7
Retail B2	32.7	20.3	401.8	23.3	478.0
Retail B3	23.2	18.2	285.5	23.3	350.2
Retail B4	27.0	20.4	332.3	23.3	403.0
Retail B5	8.3	10.2	102.3	23.3	144.1
Retail C1	88.7	30.5	1091.5	23.3	1234.0
Retail C2	32.1	20.0	394.8	23.3	470.1
Retail C3	15.0	14.1	185.0	23.3	237.4
Retail C4	15.4	14.0	189.0	23.3	241.6
Total	569.8	228.9	7,016.0	233.0	8,047.7

Table 3-2 below compares the Global Warming Potential (GWP) of the Concrete Ontario baseline mix with a recommended concrete mix that would meet the GDS requirements.

Table 3-2: Embodied Carbon Reduction

Concrete Scenario	Concrete Mix Description	EPD	ECI (kg CO ₂ e)	GWP Reduction (%)
Baseline	Ready-mix concrete, Ontario industry average, Baseline 32 MPa concrete with air entrainment, 0.45 w/cm (C-2) GU 10 SL (Concrete Ontario)	Ontario EPD	326.46	20%
Optimized	32Mpa - Heidelberg Mix EB3223306, Guelph Plant	Heidelberg EPD	260.07	

The building's concrete-specific baseline emissions are estimated to be 2,627 tCO₂e. By replacing the assumed Baseline concrete mix with an alternate mix such as Heidelberg's EB3223306 concrete mix, the concrete-specific emissions could be reduced by 20%, bringing the total down to 2,093 tCO₂e.

The concrete-mix presented in **Table 3-2** is one potential concrete mix that meets the carbon reduction requirements of the Town's GDS. It is, however, not the only solution. Viable strategies for reducing the GWP of concrete can include the use of SCMs such as fly ash, slag cement, or silica fume. These materials have a lower carbon impact than conventional Portland cement and can replace a quantity of this cement in the mix. Alternative cements, such as Portland limestone cement (GUL), which contains ground limestone and reduces the need for clinker, can also be incorporated to lower the embodied carbon footprint of concrete. This flexibility allows for a range of solutions that can meet the embodied carbon reduction goals, depending on local availability and project specifications.

Concrete mixes that incorporate general-use limestone (GUL) cement and/or Supplementary Cementitious Materials (SCMs) at a replacement rate of at least 35% would meet or exceed the prescribed reduction targets.

The property developer is encouraged to explore potential mix design options available to the project documented by EPDs from local concrete producers. All proposed concrete mix designs should be reviewed in collaboration with the project's structural engineer and contractor.

4. Conclusion

This assessment constitutes the requisite material reporting under Metric 3.4: Embodied Carbon of the Town of Caledon's GDS. However, to fully comply with the embodied carbon requirements, the project developer must commit to using concrete mix designs that achieve at least a 10% reduction in embodied carbon relative to the Concrete Ontario baselines.

The Heidelberg concrete mix proposed in **Section 3**, which includes a slag content ranging between 30% and 50%, presents one option to achieve the prescribed reduction, achieving a 20% reduction in Global Warming Potential (GWP) compared to the Ontario Baseline mix with a 10% slag content. Additional mixes from other concrete producers can also be used to demonstrate embodied carbon reductions, provided they contain increased SCM content, alternative cements, or other embodied carbon reduction measures. The feasibility of the concrete selection presented in this report should be further assessed with input from the broader consultant team as the project design progresses. This includes collaboration with the structural engineer and construction manager to explore the viability of the specified low-carbon concrete products that meet the GDS performance criteria.

For steel components, while there is no stated embodied carbon reduction required by the GDS, selecting products with high recycled content can further reduce the building's embodied carbon footprint. The materials recommended for the architectural assemblies were selected based on their capacity to achieve a lower GWP compared to industry standards. Use of these materials would further contribute to the overall reduction of 12100 Creditview's embodied carbon footprint.

Appendix A: Detailed Assembly Information

Table 4-1: Building Assemblies and Material Details

Building Component	Assemblies
Foundations	Footings:
	<ul style="list-style-type: none"> • Heidelberg 32 MPa concrete-mix EB3223306 • CRSI rebar, EAF manufacturing processes, 98% recycled content • 50mm XPS thermal insulation board, SOPRA-XPS • Waterproofing Membrane
Slab on Grade	250mm insulated cast in-situ concrete slab on grade assembly:
	<ul style="list-style-type: none"> • Heidelberg 32 MPa concrete-mix EB3223306 • CRSI rebar • 50mm SOPRA-XPS • Waterproofing Membrane
Cladding	Retail A1 Cladding (80% Wall Area):
	<ul style="list-style-type: none"> • 45% Clay-Brick, Brampton Brick • 21% Aluminium metal panel • 13% Fiber cement cladding
	Retail B1 to C4 Cladding (63% Wall Area):
	<ul style="list-style-type: none"> • 29% Clay-Brick, Brampton Brick • 21% Aluminium metal panel • 13% Fiber cement cladding
Walls	Load Bearing Walls:
	<ul style="list-style-type: none"> • Heidelberg 32 MPa concrete-mix EB3223306 • CRSI rebar, EAF manufacturing processes, 98% recycled content
	Wall Assembly:
Columns & Beams	<ul style="list-style-type: none"> • Polyiso Wall Insulation Boards, Carlisle • 16mm Durock glass-mat, USG • Steel Stud framing, Nucor • 16mm Sheetrock Firecode X gypsum wallboard, USG
	Steel Beams & Columns:
	<ul style="list-style-type: none"> • Steel Dynamics Inc., Structural steel profiles, 90% recycled content
Roof	Wind bracing & connecting parts:
	<ul style="list-style-type: none"> • Steel Dynamics Inc., Structural steel profiles, 90% recycled content
Roof	Roof Assembly:
	<ul style="list-style-type: none"> • Metal Deck, hot roll formed steel panels, MAC

Building Component	Assemblies
Windows & Doors	<ul style="list-style-type: none"> • TPO Single ply waterproofing roof membrane (Single Ply Roofing Industry) • Polyiso Roof Insulation Boards, Carlisle • Self-adhesive air/vapour barrier membrane • 13mm Securock Glass-mat Roof Board, USG
	Retail A1 Windows & Doors (20%):
	<ul style="list-style-type: none"> • 10% Spandrel Glazing, Viracon • 3% Vision glazing, Viracon • 1% Steel Frame Doors (AMBICO) + Laminated Glass Unit Doors (Multiver) • 6% Industry Standard Overhead Sectional Doors with PUR core
	Retail B1 to C4 Windows & Doors (37%):
	<ul style="list-style-type: none"> • 13% Spandrel Glazing, Viracon • 18% Vision glazing, Viracon • 5% Steel Frame Doors (AMBICO) + Laminated Glass Unit Doors (Multiver)
	Steel Interior and Exterior Stair
<ul style="list-style-type: none"> • Heidelberg 32 MPa concrete-mix EB3223306 • CRSI rebar • Aluminium handrails 	

Appendix B: Building Material Selection

Table 4-2: Building Material Selection from ASTM published EPDs

Material Description	Building Components	ASTM Published EPD	GWP (kgCO ₂ e/unit)
Concrete			
Concrete (32 MPa)	Footings, Stairs, SOG and Load bearing walls	Heidelberg EB3223306	260.07/m ³
Steel			
Reinforcement Steel	Concrete elements	CRSI Steel	0.854/kg
Steel Stud framing	Wall assembly	Nucor	1.24/kg
Steel Roofing	Roof Deck	MAC	12.1/m ²
Structural Steel	Beams, columns, wind bracing and connecting parts	Steel Dynamics Inc.	1.14/kg
Masonry			
Clay Brick	Building cladding	Brampton	559/m ³
Wallboard			
Glass-Mat (16mm)	Wall assembly	Durock USG	4.89/m ²
Gypsum Wallboard (16mm)	Wall assembly	Sheetrock Firecode X USG	3.92/m ²
Glass-mat Roof Board (13mm)	Roof assembly	Securock USG	6.57/m ²
Glass			
Spandrel Glazing	Windows	Spandrel Viracon	70.4/m ²
Vision Glazing	Windows	Viracon	69.5/m ²
Steel Frame Door	Doors	AMBICO	93.33/m ²
Laminated Glass Unit	Doors	Multiver	73.70/m ²
Thermal Insulation			
XPS Insulation Board	Footings and SOG	SOPRA-XPS	2.06/m ²
Polyiso Wall Insulation Boards	Wall Insulation	Carlisle	4.46/m ²
Polyiso Roof Insulation Boards	Roof Insulation	Carlisle	4.50/m ²
Wood	No wood building elements	N/A	N/A

Appendix C: Embodied Carbon Reporting Tool



Appendix D: Steel Materials

For the 12100 Creditview Road development, steel materials were modeled to contribute up to 41% of the project's total embodied carbon emissions, making the selection of steel products a significant factor in reducing the building's overall impact. The optimal strategy for minimizing the carbon impact of steel is to prioritize products that utilize high levels recycled content. Steel made with a high percentage of recycled content can reduce Global Warming Potential (GWP) by over 75% compared to virgin steel.

The project developer has received information from the prospective anchor tenant for the development regarding its standard sources for steel materials. **Table 4-3** and **Table 4-4** below outline the recycled content of steel products supplied by the two prospective sources — steel plants located in Annville, PA ('ANN') and Jackson, TN ('JAC')—which are the main steel providers for the Retail A building. The tables present the average post-consumer and pre-consumer recycled content, along with the total recycled content for each steel product type:

Table 4-3: Retail A Steel Provider - Annville, PA plant ('ANN')

ANN	Commodities	% Post Consumer Avg.	% Pre-Consumer / Post Industrial Avg.	% Total Recycled Content Avg.
Frames	web,bar	36.90%	31.00%	67.90%
Secondaries	Acrylic Galv, Bare HR	36.30%	31.00%	67.30%
Sheeting	Painted Galv/lume	6.20%	4.70%	10.60%
Sheeting	Galvalume	31.90%	35.00%	64.40%
Bracing	rod	81.10%	16.60%	97.70%
Other (mill)	wide flange, angle	72.10%	10.80%	82.90%
Truss	Chord	36.60%	31.60%	68.20%
	Tube	36.60%	31.60%	68.20%
	End seat	36.60%	31.60%	68.20%

Table 4-4: Retail A Steel Provider - Jackson TN plant ('JAC')

JAC	Commodities	% Post Consumer Avg.	% Pre-Consumer / Post Industrial Avg.	% Total Recycled Content Avg.
Frames	web,bar	n/a	n/a	n/a
Secondaries	Acrylic Galv	38.30%	37.20%	75.40%
Sheeting	Painted Galv/lume	4.10%	2.30%	6.30%
Sheeting	Galvalume	16.00%	16.30%	31.20%
Bracing	rod	81.10%	16.60%	97.70%



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