



City of Langford

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Policy Name: Low-Carbon Concrete Policy

☐ New ☒ Amendment

DEPARTMENT: Planning

SP Governance/Corporate Policy and Planning/Policies and Procedures

POLICY NO: POL-0167-PLAN

1. Policy

This policy describes the City of Langford (the City) "Low-Carbon Concrete Strategy" which shall commence on June 1st, 2023. This applies to all ready-mix concrete supplied for municipal buildings and infrastructure as well as private construction projects over 50 m³ (and subject to rezoning). Reporting of concrete Global Warming Potential (GWP) values shall be verified by a third party, mix design specific, Type 3 Environmental Product Declaration (EPD). This policy applies to permanent works only that form the structure (including footings, walls, slabs, beams, columns, sidewalks, curbs, etc.)

The Low-Carbon Concrete Strategy includes two phases:

Phase A – GWP Limits Based on Industry Averages

Commencement Date: June 1st, 2023

Conclusion Date: To Be Determined (TBD)

- 1) The weighted Average Global Warming Potential (AGWP) for each project shall be less than or equal to the Baseline AGWP as determined by the following:

$$\text{Project AGWP} = \frac{\sum [GWP_i \times V_i]}{\sum V_i} = \frac{(GWP_{\text{Mix } 1} \times \text{Volume}_{\text{Mix } 1}) + (GWP_{\text{Mix } 2} \times \text{Volume}_{\text{Mix } 2}) + \dots}{\text{Total Concrete Volume of the Project}}$$

GWP_i = The global warming potential of mix design i [kgCO₂eq./m³]

V_i = The total volume of mix design i [m³]

$$\text{Baseline AGWP} = \frac{\sum [BGWP_i \times V_i]}{\sum V_i} = \frac{(BGWP_{\text{Mix } 1} \times \text{Volume}_{\text{Mix } 1}) + (BGWP_{\text{Mix } 2} \times \text{Volume}_{\text{Mix } 2}) + \dots}{\text{Total Concrete Volume of the Project}}$$

$BGWP_i$ = Baseline global warming potential of mix design i . That is, the AGWP of a baseline concrete mix as detailed in the *Concrete BC Member Industry Wide EPD for Ready Mix Concrete* dated July 27th 2022, and available here:

https://pcr-epd.s3.us-east-2.amazonaws.com/810.CRMCA_EP_D_BC.pdf

[kgCO₂eq./m³]

V_i = The volume of mix design i [m³]

- 2) Baseline mix designs shall be selected based on physical parameters of the concrete such as exposure classification, compressive strength, air entrainment, etc.

- 3) At the discretion of the City, and in consultation with industry, the maximum GWP threshold specified in (1) above shall be adjusted downward each year, in terms of percentage reduction, to meaningfully contribute to the City's overall carbon reduction goals.

a) Anticipated GWP reduction targets have been provided in **Schedule A**.

Phase B – GWP Limits Based on Structure Type

Commencement Date: TBD

Conclusion Date: TBD

The shortfall of Phase A is that the onus of AGWP reduction is placed solely on ready-mix suppliers. The philosophy of Phase B will engage other construction process members, including contractors and designers (Architects and Engineers) to contribute to the City's carbon reduction goals.

- 1) AGWP of concrete supplied on a project shall be calculated the same as in Phase A and shall be less than or equal to AGWP limits based on structure type.

$$Project\ AGWP = \frac{\sum [GWP_i \times V_i]}{\sum V_i} = \frac{(GWP_{Mix\ 1} \times Volume_{Mix\ 1}) + (GWP_{Mix\ 2} \times Volume_{Mix\ 2}) + \dots}{Total\ Concrete\ Volume\ of\ the\ Project}$$

GWP_i = The global warming potential of mix design i $[kgCO_2eq./m^3]$

V_i = The total volume of mix design i $[m^3]$

- 2) AGWP limits based on structure type are provided in **Schedule B**.
- 3) At the discretion of the City, and in consultation with industry, the maximum weighted average AGWP limits specified in Schedule B shall be adjusted downward each year to meaningfully contribute to the City's overall carbon reduction goals.
- 4) For projects with multiple structure types, AGWP reporting can be split between structure types for the volume of concrete associated with each portion of the overall structure. For example, an apartment building with underground parking may submit AGWP values for the volume of concrete associated with the parking structure separate from the volume of concrete associated with the apartment building.

2. Responsibilities

The City of Langford shall:

- 1) Share information with concrete suppliers so they are aware of the City's expectations in terms of product certification and emissions reductions in a timely manner.
- 2) Convene annually with industry representatives to review the AGWPs with the intent of progressively lowering the thresholds over time to meaningfully contribute to the City's overall carbon reduction goals.
- 3) Report to Council on implementation progress, financial implications, supplier compliance, complaints, supplier feedback, and other stakeholder input on an annual basis.
- 4) Ensure information resources relevant to project requirements, including the Embodied Carbon Project Reporting Template and this policy are incorporated as appendices in RFPs for design and construction services.

Concrete Suppliers shall:

- 1) Provide accurate, third party verified EPDs for concrete mixes.

- 2) Participate in discussions to determine future AGWP targets.
- 3) Endeavour to optimise concrete mix designs to achieve these GWP reduction goals by implementing efficiencies in the manufacturing process and adopting new lower GWP promoting materials and technologies.
- 4) Not substitute mix designs without submission of an updated EPD.
- 5) Communicate concrete mix design performance changes (rheology, set time, etc.) to users (contractors, finishers, etc.). Assist these users to better understand reduced carbon concrete characteristics as so methodologies and schedules may be altered accordingly.

Developers (permit applicants) shall:

- 1) Be aware of the AGWP limits on concrete mixes (Phase A) and projects (Phase B).
- 2) For Phase B, work with designers and contractors to meet the AGWP limits prescribed in Schedule B.
- 3) Submit to the City the required GWP information.

Design professionals (Architects, Engineers) shall:

- 1) Be aware of GWP contributions of concrete mix designs and work with developers (permit applicants) to optimize designs to reduce the carbon footprint of their project.
- 2) Assist developers (permit applicants) with reporting of 'GWP Estimates' and 'GWP Summary'.

3. Reporting

- 1) All EPDs must follow the accounting standards defined by the international standards ISO 14025 and ISO 21930.
- 2) Contractors for eligible projects that sub-contract services from concrete providers shall require sub-contract bids to adhere to the same rules and standards.
- 3) Two digital spreadsheets are available to assist permit applicants with reporting of GWP information, including:
 - a) 'Project Concrete GWP Estimate', and
 - b) 'Project Concrete GWP Summary'

The digital spreadsheets are effectively the same; the only difference is the 'Estimate' is completed at the start of the project and the 'Summary' is completed at project completion with actual concrete volumes. An example of a completed spreadsheet is provided in **Schedule C** for reference.

Phase A - GWP Limits Based on Industry Averages

- 4) For projects subject to this policy, the following reporting is required:
 - a) A 'Project Concrete GWP Estimate' indicating the following items prior to *Foundation Permit*:
 - i) Structure type,
 - ii) Proposed concrete mix codes (and properties),
 - iii) EPD's for each proposed mix,
 - iv) Estimated concrete volumes,
 - v) Overall estimated weighted AGWP for the project.
 - b) A 'Project Concrete GWP Summary' indicating the following items prior to *Occupancy Permit*:
 - i) Actual concrete mix designs,
 - ii) EPD's for each actual mix,
 - iii) Actual concrete volumes,
 - iv) Overall weighted AGWP for the project.

Phase B - GWP Limits Based on Structure Type

- 5) For projects subject to this policy, the following reporting is required:
- c) A 'Project Concrete GWP Estimate' indicating the following items prior to *Foundation Permit*:
 - i) Structure type,
 - ii) Proposed concrete mix codes (and properties),
 - iii) EPD's for each proposed mix,
 - iv) Estimated concrete volumes,
 - v) Overall estimated weighted AGWP for the project.
 - vi) Confirmation the AGWP is less than the limit listed in Schedule B.
 - d) A 'Project Concrete GWP Summary' indicating the following items prior to *Occupancy Permit*:
 - i) Actual concrete mix designs,
 - ii) EPD's for each actual mix,
 - iii) Actual concrete volumes,
 - iv) Overall weighted AGWP for the project.
 - vii) Confirmation the AGWP is less than the limit listed in Schedule B.

4. Exemptions

Special circumstances for a project may require that a mix (or mixes) be omitted from the AGWP calculation and submission. Therefore, permit applicants may submit requests for mix exemption from the requirements of Phase A or Phase B of this policy. At the discretion of the City, exemption may be provided if it can be demonstrated that no reasonable alternative exists. The following information must be submitted:

- 1) Structure type
- 2) Proposed concrete mix design(s)
- 3) Mix(es) proposed to be excluded (with EPDs)
- 4) Estimated concrete volume of the mix(es) to be excluded.
- 5) Estimated overall project concrete volume.
- 6) Estimated weighted AGWP with mix(es) included.
- 7) Estimated weighted AGWP with mix(es) excluded.
- 8) Written justification for why the mix or mixes cannot meet the policy requirement.

It is noted that exemption may only be provided for individual mix(es). An exemption to the weighted average GWP limits for a project will not be granted. Guidelines for the review and evaluation of exemption requests have been provided in **Schedule D**.

5. GHG Emission Reduction Policy Evaluation

The greenhouse gas emissions reduction of a project is equal to its carbon dioxide equivalent baseline emissions minus its carbon dioxide equivalent project emissions.

$$\%GWP\ Reduction = \frac{Baseline\ AGWP - Project\ AGWP}{Baseline\ AGWP} \times 100$$

6. Penalties

1. A permit will not be granted if the Estimated AGWP is above the Baseline AGWP for the project.
2. Upon completion of the project, if the AGWP as determined by the 'Project Concrete GWP Summary' exceeds the limit described in this policy, the permit applicant shall be fined for every kg of CO₂ in violation of this policy. The fine will be determined as:

$$\text{Fine (\$)} = [\text{Project AGWP} - \text{Baseline AGWP}] \times \text{Total Project Concrete Volume} \times \text{Penalty X}$$

$$\text{Penalty A} = \text{Per kilogram monetary fine for policy violation} \quad [\$/\text{kgCO}_2\text{eq.}]$$

3. Randomly selected projects will be audited by the City. If discrepancy is found in the reported values from the randomly selected projects (for example, with the concrete volumes or the reported EPD data) the fine for the culpable party will be determined as:

$$\text{Fine (\$)} = [\text{Project AGWP} - \text{Baseline AGWP}] \times \text{Total Project Concrete Volume} \times \text{Penalty Y}$$

$$\text{Penalty B} = \text{Audit discovered per kilogram monetary fine for policy violation} \quad [\$/\text{kgCO}_2\text{eq.}]$$

4. Values of 'Penalty A' and 'Penalty B' have been provided in **Schedule E**.

Adopted by Council
Meeting Date: March 6, 2023

CERTIFIED CORRECT



Administrator

Date: March 6, 2023

SCOTT GOODMANSON
MAYOR

Schedule A – Phase A, Anticipated Concrete AGWP Reduction Targets.

Table 1 – Phase A Anticipated GWP Reduction Targets

<u>Dates</u>	<u>GWP Target</u> <u>Compared to Baseline AGWP</u>
June 1, 2023 – June 1, 2024	0% below Baseline AGWP
June 1, 2024 – June 1, 2025	7%* below Baseline AGWP
June 1, 2025 – June 1, 2026	15%* below Baseline AGWP
2026, 2027, ...	TBD*

*AGWP adjustments will be reviewed on an annual basis and determined in consultation with industry.

Schedule B – Phase B, AGWP limits based on structure type.

Table 2 – Phase B Weighted Average GWP Limits

<u>Structure Type</u>		<u>AGWP Limit [kgCO₂eq./m³]</u>
<u>Residential</u>		
	Single-Family	TBD*
	Multi-Family	TBD*
	Apartment/ Condominiums	TBD*
<u>Commercial</u>		
	Warehouse	TBD*
	Service Station	TBD*
	Office Building	TBD*
	Recreational	TBD*
	Hotel	TBD*
	Restaurant	TBD*
<u>Institutional and Government</u>		
	Roadworks (Sidewalks, Curbs, etc.)	TBD*
	Laboratory	TBD*
	School	TBD*
	Hospital	TBD*
<u>Industrial</u>		
	Factory	TBD*
	Transportation	TBD*
	Parking Garage	TBD*

*AGWP adjustments will be reviewed on an annual basis and determined in consultation with industry.

City of Langford - Project Concrete AGWP Estimation

Rev. 0: January 12, 2023

Permit Applicant (Developer):	Developer XXX
Project Name (Address):	2345 Warehouse Street
Structure Type:	Warehouse

Directions:

- 1) Shall be completed at time of foundation permit application
- 2) List all concrete mixes used for the project
- 3) Environmental Product Declarations (EPD's) required for each concrete mix

Project Mix Design and GWP Emission Data									Industry (Concrete BC) Reference Data					
	Building Element or Structure (ex. walls, foundation, etc.)	Supplier Mix Design No.	Estimated Volume (m³)	Compressive Strength (MPa)	Air Entrainment	Exposure Classification	Mix Design GWP / m³ (kg CO₂eq./m³)	GWP Emissions Per Project Mix (kg CO₂eq.)	Concrete BC Reference Baseline Mix No.	Exposure Classification	Baseline Mix GWP (kg CO₂/m³)	GWP Emissions Per Baseline Mix (kg CO₂eq.)		
			[A]				[B]	[C] = [A x B]			[D]	[E] = [A x D]		
[1]	Footings	N252P	70	25	No	N	156	10,920	25 MPa No Air	N	219.70	15,379		
[2]	Grade Beams	F222p	35	25	Yes	F-2	160	5,600	25 MPa w/ Air	F-2	230.52	8,068		
[3]	Interior SOG	N302P	300	30	No	N	184	55,200	30 MPa No Air	N	258.92	77,676		
[4]	Exterior SOG	C221P	50	32	Yes	C-2	196	9,800	32 MPa w/ Air	C-2	285.31	14,266		
[5]	Pedestals	N352	15	35	No	N	195	2,925	35 MPa No Air	N	293.75	4,406		
[6]														
[7]														
[8]														
[9]														
[10]														
[11]														
[12]														
Total Concrete Volume:			470	[F]	Total Project GWP Emissions:			84,445	[G]	Total Baseline GWP Emissions:			119,795	[H]
			(m³)					(kg CO₂eq.)					(kg CO₂eq.)	

Estimated Project GWP Reduction = Total Baseline GWP Emissions - Total Project GWP Emissions = [H] - [G] = 35,350 (kg CO ₂ eq.)
Estimated % GWP Reduction = (Baseline GHG - Project GHG) / Baseline GHG x 100 = ([H] - [G]) / [H] x 100 = 29.51%
Estimated Project Weighted AGWP = Total Project GWP Emissions / Total Concrete Volume = [G] / [F] = 180 kg CO ₂ eq./m ³
Phase A - Baseline Weighted AGWP = Total Baseline GWP Emissions / Total Concrete Volume = [H] / [F] = 255 kg CO ₂ eq./m ³
Phase B - Weighted AGWP Limit: TBD kg CO ₂ eq./m ³

GWP - Global Warming Potential

AGWP - Weighted Average Global Warming Potential

Schedule D – Exemption Guidelines

For a mix to be considered for exemption, at least one of the following shall apply:

- 1) The design requires concrete performance outside the parameters of the baseline mixes and therefore a reference is not available for comparison.
 - Example: If the design requires the use of a 70 MPa concrete mix, this would be eligible for exemption as a baseline comparison is not available for 70 MPa concrete.
- 2) Unique and unsurmountable schedule restrictions require the use of a high early strength gain concrete mix.
 - In the exemption request, the applicant must supply detail of the circumstance surrounding the unique schedule restrictions.
- 3) The design requires the use of a specialized placement technique such as Self-Consolidating Concrete (SCC) or shotcrete.
 - The specialized placement technique shall be prescribed in the design by the professional of record to achieve project performance.
 - Specialized placement techniques employed by the contractor to contribute to ease of placement will not be considered applicable for exemption.
 - This criteria for exemption shall apply to Phase A, only.

Schedule E – Policy Violation Penalty Values

Penalty X:	0.25	<i>[\$/kgCO₂eq.]</i>
Penalty Y:	0.50	<i>[\$/kgCO₂eq.]</i>

Note: Penalty amounts are subject to change at the discretion of the City.