

## Environmental Impacts

### Declared Product:

Mix ID: G35C6

Description: 35MPa, 20mm, 5-8%, C-1  
 Compressive Strength: 35MPa at 56 days

**Declared Unit:** 1 m<sup>3</sup> of concrete

### Global Warming (kg CO<sub>2</sub>e) **215**

Ozone Depletion (kg CFC-11e) 9.91E-06

Acidification (kg SO<sub>2</sub>e) 0.971

Eutrophication (kg Ne) 0.175

Smog (kg O<sub>3</sub>e) 14.4

Non-Renewable Energy (MJ, NCV) 1292

Freshwater Use (m<sup>3</sup>) 3.59

**Product Constituents:** Natural Aggregate (CSA A23.1), Portland Limestone Cement (CSA A3001), Batch Water (CSA A23.1), Slag Cement (CSA A3001), Admixtures (ASTM C260/C260M, ASTM C494/C494M)

This Environmental Product Declaration (EPD) is intended for business-to-business (B2B) communication and reports the impacts for 1 m<sup>3</sup> of ready mixed concrete meeting the following specifications:

- CSA A23.1: Concrete materials and methods of concrete construction
- UNSPSC Code 30111505: Ready Mix Concrete
- CSI Division 03-30-00: Cast-in-Place Concrete

### Production Company:

Bedrock Redi-Mix

A Division of M & K Ready Mix Inc.

10 Nanaimo River Road

Nanaimo

BC, V9X 1S5

### Production Plant:

Nanaimo

10 Nanaimo River Road

Nanaimo

BC, V9X 1S5

## GENERAL INFORMATION

Declared Product	Ready mixed concrete produced by Bedrock Redi-Mix
Date of Issue and Validity Period	August 15, 2024; 5 years until August 15, 2029
EPD Holder	Bedrock Redi-Mix A Division of M & K Ready Mix Inc. 10 Nanaimo River Road Nanaimo, BC, V9X 1S5
Program Operator	ASTM International 100 Barr Harbour Drive West Conshohocken, PA 19428
LCA and EPD Developer	Amrize Canada Inc #300 115 Quarry Park Road SE Calgary, AB, T2C 5G9
Reference PCR	ISO 21930:2017 Sustainability in Building Construction – Environmental Declaration of Building Products serves as the core PCR. NSF International Product Category Rule (PCR) for Concrete v2.3 (February 2024) verified by Thomas P. Gloria, Ph.D., Industrial Ecology Consultants serves as the sub-category PCR.
Independent verification of the declaration	Thomas P. Gloria, Ph.D., Industrial Ecology Consultants according to ISO 14025:2006 and reference PCR <input type="checkbox"/> internal <input checked="" type="checkbox"/> external
Additional explanatory material	Manufacturer Representative: Faron Parlee (faron@bedrockredimix.ca) Software Tool: GCCA Industry EPD tool for Clinker, Cement, Aggregates, Concrete, and Precast products, North America v4.2
This EPD was calculated using manufacturer-specific cement data that represents 100% of the total cement used in this mix.	

## METHODOLOGICAL FRAMEWORK

### Declared Unit

The declared unit is 1 cubic meter of ready-mixed concrete product. Key product variables include:

- Compressive strength – Compressive strengths include the number of days after placement as part of the reference value. e.g. 20 MPa at 28 days, 30 MPa at 56 days, 40 MPa at 91 days etc.
- Water to cementitious materials ratio (w/cm) – Varies, but generally decreases as mix design strength increases in accordance with ACI 211.1 recommendations.
- Supplementary Cementitious Material (SCM) use – Some mix designs utilize fly ash, slag, or other SCMs.
- Admixture use – Admixtures are used in the production of ready-mixed concrete. These admixtures can include air entrainers, water reducers, super-plasticizers, accelerators, and retarders.
- No hazardous substances are present in the declared product.

### System Boundary

A summary of the life cycle stages included in the EPD is identified in Figure 1 below and is described as follows:

- A1 – Raw material supply (upstream processes) includes extraction, handling, and processing of the raw materials used in the production of concrete including cement, supplementary cementitious materials, coarse and fine aggregates, water, and admixtures.
- A2 – Transportation includes the transport of all materials from their point of extraction or manufacture to the concrete plant.
- A3 – Manufacturing includes the energy used to store, batch, and mix concrete. As this plant is a dry-batch (transit mix) plant, 30% of the delivery fleet vehicle use is included in this module.

A summary of activities excluded from the EPD is as follows:

- Production, manufacture, and construction of manufacturing capital goods and infrastructure.
- Production and manufacture of production equipment, delivery vehicles, and laboratory equipment.
- Personnel-related activities (travel, furniture, and office supplies)
- Energy and water use related to company management and sales activities.

















Building Life Cycle Information Modules (X: Included in LCA, MND: Module Not Declared)																
Production			Construction		Use							End-of-Life				
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Extraction and upstream processing	Transport to factory	Manufacturing	Transport to site	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction or demolition	Transport	Waste Processing	Disposal of waste	Optional information beyond system boundary
																
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Figure 1

**Cut-off Rules**

The cut-off criteria for all activity stage flows considered within the system boundary conform with ISO 21930:2017 Section 7.1.8. Specifically the cut-off criteria were applied as follows:

- All inputs and outputs for which data are available are included in the calculated effects and no collected core process data are excluded.
- A one percent cut-off is considered for renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process. The sum of the total neglected flows does not exceed five percent of all energy consumption and mass of inputs.
- All flows known to contribute a significant impact or to uncertainty (e.g. portland cement and admixtures) are included.
- The cut-off rules are not applied to hazardous and toxic material flows – all of which are included in the life cycle inventory.
- Proxy data was used for admixtures that did not align with any of the admixture categories published in the EFCA EPDs. In those cases, the Water Reducing Admixture data was selected as a conservative assumption as per the NSF PCR v2.3 Appendix A.

**Allocation**

The allocation of co-products or secondary flows cross the system boundary conforms with ISO21903:2017 Section 7.2.4. Specifically the allocation criteria were applied as follows:

- Allocation was not applied to any of the gate-to-gate production facilities.
- For secondary data sources, the NSF PCR v2.3 default allocation selection (i.e. “cut-off” or “Alloc Rec”) was applied.
- The NSF PCR v2.3 used for this EPD recognizes fly ash, slag, and silica fume as recovered materials and thus the environmental impacts allocated to these materials are limited to the treatment and transportation required for their use as a concrete material input.
- As this plant is a dry-batch (transit mix) plant, 30% of the reported delivery fleet energy use was allocated to the mixing facility.

## DATA SOURCES

This EPD is based on primary (foreground) LCI data collected from the participating company's production facility for the 2023 calendar year. This EPD was calculated using manufacturer-specific cement and SCM data that represents 100% of the total cementitious material used in the mix. The following table describes each LCI data source and includes the data quality assessment.

Material	LCI Data Source	Year	Geography	Data Quality Assessment
Portland Limestone Cement, CSA A3001 GUL	ASTM EPD 606 – Amrize Richmond Cement Plant	2022	CA-BC	Technology: very good, Time: very good, Geography: very good, Completeness: very good, Reliability: very good.
Slag Cement, CSA A3001 Slag	ASTM EPD 607 – Amrize Seattle Cement Plant	2022	US-WA	Technology: very good, Time: very good, Geography: very good, Completeness: very good, Reliability: very good.
Natural Aggregate, coarse and fine, CSA A23.1	ecoinvent 3.5: "Gravel, round, gravel and sand quarry operation {CH}   Cut-off, U" (2018)	2001	CH	Technology: very good, Time: poor, Geography: poor, Completeness: very good, Reliability: very good.
Crushed Aggregate, coarse and fine, CSA A23.1	ecoinvent 3.5: "Gravel, crushed, production {CH}   Cut-off, U" (2018)	2001	CH	Technology: very good, Time: poor, Geography: poor, Completeness: very good, Reliability: very good.
Admixtures, ASTM C260, ASTM C494	EFCA EPDs for Admixtures (2021)	2021	EU	Technology: very good, Time: very good, Geography: fair, Completeness: very good, Reliability: very good.
Water, CSA A23.1	ecoinvent 3.5: "Tap water {GLO}   market group for   Cut-off, U" (2018)	2011	World	Technology: very good, Time: fair, Geography: good, Completeness: very good, Reliability: very good.
Road Transport	USLCI 2014: Transport, combination truck, short-haul, diesel powered/tkm/RNA (2014)	2010	North America	Technology: very good, Time: fair, Geography: very good, Completeness: very good, Reliability: very good.
Rail Transport	USLCI 2014: Transport, train, diesel powered/US U (2014)	2007	North America	Technology: very good, Time: fair, Geography: very good, Completeness: very good, Reliability: very good.
Ocean Transport	USLCI 2014: Transport, ocean freighter, average fuel mix/US U (2014)	2007	North America	Technology: very good, Time: fair, Geography: very good, Completeness: very good, Reliability: very good.
Electricity	Canada Energy Regulator, Canada's Energy Future Data Appendices (2021)	2021	CA-BC	Technology: very good, Time: very good, Geography: very good, Completeness: very good, Reliability: very good.
Diesel	USLCI 2014: Diesel, combusted in industrial equipment/US U (2014)	2007	North America	Technology: very good, Time: fair, Geography: very good, Completeness: very good, Reliability: very good.
Gasoline	USLCI 2014: Gasoline, combusted in equipment/US U (2014)	2007	North America	Technology: very good, Time: fair, Geography: very good, Completeness: very good, Reliability: very good.
Liquefied Propane Gas	USLCI 2014: Liquefied petroleum gas, combusted in industrial boiler/US U (2014)	2007	North America	Technology: very good, Time: fair, Geography: very good, Completeness: very good, Reliability: very good.
Hazardous Solid Waste	ecoinvent 3.5: "Hazardous waste {GLO}   for incineration, market for   Alloc, Rec, U" (2018)	2011	World	Technology: very good, Time: fair, Geography: good, Completeness: very good, Reliability: very good.
Non-Hazardous Solid Waste	ecoinvent 3.5: "Inert waste {GLO}   market for   Alloc, Rec, U" (2018)	2011	World	Technology: very good, Time: fair, Geography: good, Completeness: very good, Reliability: very good.

# Environmental Product Declaration

## ENVIRONMENTAL INDICATORS DERIVED FROM LCA

**Facility:** Nanaimo

**Mix ID:** G35C6

**Description:** 35MPa, 20mm, 5-8%, C-1

**Compressive Strength:** 35MPa at 56 days

**Declared Unit:** 1 m<sup>3</sup> of ready mix concrete

Production stage (A1 to A3)	ABR	Units	per m <sup>3</sup>
<b>Core Mandatory Impact Indicators</b>			
Global Warming Potential	GWP 100	kg CO <sub>2</sub> e	215
Ozone depletion potential	ODP	kg CFC-11e	9.91E-06
Acidification potential	AP	kg SO <sub>2</sub> e	0.971
Eutrophication potential	EP	kg Ne	0.175
Photochemical smog creation potential	POCP	kg O <sub>3</sub> e	14.4
<b>Use of Primary Resources</b>			
Abiotic depletion potential for non-fossil mineral resources*	ADP <sub>e</sub>	kg Sbe	1.83E-04
Abiotic depletion potential for fossil resources	ADP <sub>f</sub>	MJ, NCV	1235
Renewable primary energy carrier used as energy*	RPR <sub>E</sub>	MJ, NCV	141
Renewable primary energy carrier used as material*	RPR <sub>M</sub>	MJ, NCV	0
Non-renewable primary energy carrier used as energy*	NRPR <sub>E</sub>	MJ, NCV	1292
Non-renewable primary energy carrier used as material*	NRPR <sub>M</sub>	MJ, NCV	0
Consumption of fresh water	FW	m <sup>3</sup>	3.59
<b>Secondary Material, Secondary Fuel and Recovered Energy</b>			
Secondary material*	SM	kg	117.2
Renewable secondary fuel*	RSF	MJ, NCV	143
Non-renewable secondary fuel*	NRSF	MJ, NCV	162
<b>Waste and Output Flows</b>			
Hazardous waste disposed*	HWD	kg	0.153
Non-hazardous waste disposed*	NHWD	kg	0.126
Radioactive waste disposed*	RWD	kg	ND
Components for re-use*	CRU	kg	0
Materials for recycling*	MFR	kg	0.274
Materials for energy recovery*	MER	kg	0
Exported Energy*	EE	MJ NCV	0
<b>Additional Inventory Parameters for Transparency</b>			
Emissions from calcination and removals from carbonation	CC	kg CO <sub>2</sub> e	111.5

\* Emerging LCA impact categories and inventory items are still under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting data in these categories.

ND – Not Declared. Not all LCA datasets for upstream materials include these impact categories and thus results may be incomplete. Use caution when interpreting data in these categories.

## REFERENCES

NSF International, February 2024, v2.3 – PCR for Concrete

ISO21930:2017 Sustainability in Building Construction – Environmental Declaration of Building Products

ISO14044:2006/AMD 1:2017/AMD 2:2020 Environmental Management – Life Cycle Assessment – Requirements and Guidelines

### DISCLAIMER AND LIMITATIONS

EPDs are comparable only if they comply with this document, use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works.

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