

# Environmental Product Declaration



## CalPortland Company

EPD for concrete produced at 9 CalPortland Washington Facilities



# Environmental Product Declaration

## NRMCA Certified Environmental Product Declaration

<b>Declared Product:</b>	Ready-mixed concrete produced by CalPortland Company	
<b>Date of Issue:</b>	Issued June 18, 2019	
<b>Period of Validity:</b>	5 Years	
<b>EPD Number</b>	NRMCAEPD: 20026	
<b>Declaration Owner:</b>	<b>CalPortland Company</b> 2025 East Financial Way, Glendora CA 91741 www.calportland.com	
<b>Program Operator:</b>	<b>National Ready Mix Concrete Association</b> 900 Spring St. Silver Spring, MD 20910 301-587-1400 www.nrmca.org/sustainability  Lionel Lemay	
<b>LCA and EPD Developer:</b>	<b>Athena Sustainable Materials Institute</b> 119 Ross Ave. #100 Ottawa, ON K1Y 0N6 613-729-9996 www.athenasmi.org  James Salazar	
<b>Product Category Rule:</b>	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 Version 1 (February 22, 2019) serves as the sub-category PCR	
	Sub-category PCR review was conducted by: Thomas P. Gloria, Ph. D. Industrial Ecology Consultants t.gloria@industrial-ecology.com	
<b>Independent LCA Reviewer and EPD Verifier:</b>	Independent verification of the declaration and data, according to ISO 21930:2017 and ISO 14025:2006 <input type="checkbox"/> internal <input checked="" type="checkbox"/> external Third party verifier: Cara Vought, LCACP, LEED AP ID+C Sustainable Solutions Corporation	

## Description of Company

CalPortland Company is a major diversified building materials and construction solutions provider to the Western United States and Canada. Since 1891, we have reliably provided quality innovative and efficient solutions to your greatest construction challenges with our expertise in cement production and distribution, ready mixed concrete, construction aggregates, asphalt, construction services and other building materials. Our products provide solutions everywhere; in buildings for shelter; roads and bridges that transport and link us; systems that provide electricity, water, gas and waste treatment; and other necessary infrastructure like hospitals, schools, railways and airports. We are creating solid foundations through the use of sustainable materials and renewable technologies.

CalPortland Company is the industry leader for energy conservation and environmental quality. Our commitment to continuously improve our environmental performance and provide positive contributions to our company and to society is a product of not just our words but also our actions. Sustainable development is defined as a society meeting the needs of the present without compromising the ability of future generations to meet their own needs. CalPortland is committed to solving tomorrow's challenges today through the advancement of sustainable materials and renewable technologies.

## Location of Facilities

**Bremerton Ready Mix Plant**  
8430 SW Barney White Road  
Bremerton, WA 98312

**Chehalis Ready Mix Plant**  
1419 Bishop Road  
Chehalis, WA 98532

**Dupont Ready Mix Plant**  
4301 Pioneer Way,  
DuPont, WA 98327

**Seattle (Duwamish) Ready Mix Plant**  
5975 East Marginal Way S.  
Seattle, WA 98134

**Kenmore Ready Mix Plant**  
6423 N.E. 175th St.  
Kenmore, WA 98028

**Poulsbo Ready Mix Plant**  
3251 NE Totten Road  
Poulsbo, WA 98370

**Snoqualmie Ready Mix Plant**  
5601 396th Drive S.E.,  
Snoqualmie, WA 98065

**Tumwater Ready Mix Plant**  
3190 29th Ave. SW  
Tumwater, WA 98512

**Tacoma Ready Mix Plant**  
3601 Taylor Way  
Tacoma, WA 98421



## Description of Product and Product System

Products covered by this EPD satisfy general purpose concrete as used in residential, commercial and public works applications in the United States. This EPD reports the impacts for 30 different ready-mixed concrete products produce at 9 different CalPortland facilities in accordance with the following:

- ACI 211: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
- ACI 318: Building Code Requirements for Structural Concrete
- ASTM C94: Standard Specification for Ready-Mixed Concrete
- CSI MasterFormat Division 03-30-00: Cast-in-Place Concrete
- UNSPSC Code 30111500: Ready Mix

This EPD is intended for use in Business to Business (B-to-B) communication. The scope of this EPD is cradle-to-gate and considers the following life cycle stages.

- **A1 - Raw Material Supply:** Includes all upstream processes related to extraction, handling, and processing of the raw materials and intermediate component products as well as fuels used in the production of concrete. Component products include cement, supplementary cementitious materials, aggregate (coarse and fine), water, admixtures and other materials or chemicals used in concrete mixtures.
- **A2 - Transportation:** Accounts for the transportation of all input materials and fuels from the supplier to the gate of the concrete plant.
- **A3 - Manufacturing (Core Processes):** Includes all core processes and the energy and water used to store, move, batch and mix the concrete and operate the concrete plant as well as the transportation and processing of wastes from these core processes.

## Methodology of Underlying LCA

### Declared Unit

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

- Compressive strength – Compressive strengths are represented in the various mix designs and include the number of days after pouring as a part of the reference value: e.g. 3,000 psi (20.7 MPa) @ 28 days; 4,000 psi (27.6 MPa) @ 56 days; 6,000 psi (31.0 MPa) and 90 days; etc.
- Water to cementitious materials ratio (w/cm)– Varies, but generally lower for higher strength non-air entrained mix designs (above 5,000psi (34.5 MPa)) in accordance with ACI 211.1 recommendations;
- SCM use– various mix designs call for portland cement displacement by incorporating fly ash (FA) and/or slag cement (SL);
- Admixtures use – Admixture use was specified for the different mixes that were modeled. These admixtures included an air-entraining admixture, water reducing and accelerating admixtures, and high range water reducer admixtures.

Product (mix design) components include: portland cement, slag cement, natural and crushed aggregates, admixtures and batch water.

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## Scope of LCA

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

- A1: Raw Material Supply (upstream processes): Extraction, handling and processing of the raw materials used in the production of concrete: cement, supplementary cementitious materials, aggregate (coarse and fine), water, admixtures and other materials or chemicals used in concrete mixtures.
- A2: Transportation: Transportation of these materials from the supplier to the 'gate' of the concrete producer.
- A3: Manufacturing (core processes): The energy used to store, batch, mix and distribute the concrete and operate the facility (concrete plant)

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); and
- Energy and water use related to company management and sales activities that may be located either within the factory site or at another location.

Building Life Cycle Information Modules (x: Included in LCA; mnd: Module Not Declared)																
Product stage			Construction Process stage		Use stage							End-of-life stage				
Raw Material supply	Transport	Manufacturing	Transport	Construction/Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	De-Construction/ Demolition	Transport	Waste processing	Disposal	
																A1
x	x	x	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd

Figure 1. Life cycle stage schematic – alpha-numeric designations as per NSF PCR

## 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 5% 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 used by Calportland 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 Appendix A.

## Allocation

The allocation of co-products or secondary flows cross the system boundary conforms with ISO 21930: 2017 Section 7.2.4. Specifically, the allocation criteria were applied as follows:

- Allocation was not applied any of the gate-to-gate production facilities. For facilities that manufacture additional products (i.e. aggregate), the LCI flows at the facility specific to the concrete production were reported.
- For secondary data sources, the NSF PCR default allocation selection (i.e. “Cut-off” or “Alloc Rec”) was applied.
- The product category rules for this EPD recognize fly ash, silica fume and slag as recovered materials and thus the environmental impacts allocated to these materials are limited to the treatment and transportation required to use as a concrete material input
- A portion (30%) of the reported fleet energy use for truck mixing plants was allocated to the mixing facility.

## Data Sources

This EPD is based on foreground LCI data collected from the participating company’s production facilities for the calendar year 2017. All upstream material, resource and energy carrier inputs have been sourced from various industry-average datasets and literature. Many of these data sets are defaulted to those specified for use in the NSF PCR 2019. Tables 1 to 3 describe each LCI data source and the data quality for each data source.

## EPD Calculation Tool

This EPD was produced with a software tool developed by the Athena Sustainable Materials Institute. Initial verification of the software system confirmed the tool calculates environmental impacts correctly utilizing Input-Output testing of calculations in conformance with the ISO/IEC/IEEE 29119 Software Testing Standard. An automated EPD generation system does not require verification of each and every EPD individually: only outliers are audited.

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**Table 1. A1 - Raw Material Supply**

Materials	LCI Data Source	Geography	Year	Data Quality Assessment
<b>USA Cement and Asian Cement</b> <i>ASTM C150, C595, C1157</i>	Portland Cement Association EPD USA Portland Cement <sup>1</sup>  (Modeled with complete LCI to support ISO 21930:2017)	USA	2016	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good</li> <li>• <b>Time:</b> very good</li> <li>• <b>Geography:</b> very good</li> <li>• <b>Completeness:</b> very good</li> <li>• <b>Reliability:</b> very good</li> </ul>
<b>Fly Ash</b> <i>ASTM C618</i>	None, no incoming burden, only inbound transport is considered	N/A	N/A	<ul style="list-style-type: none"> <li>• <b>N/A</b></li> <li>• <b>Recovered material</b></li> </ul>
<b>Silica Fume</b> <i>ASTM c1240</i>	None, no incoming burden, only inbound transport is considered	N/A	N/A	<ul style="list-style-type: none"> <li>• <b>N/A</b></li> <li>• <b>Recovered material</b></li> </ul>
<b>Slag Cement</b> <i>ASTM C989</i>	Slag Cement Association EPD of North America Slag Cement  (Modeled with complete LCI to support ISO 21930:2017)	North America	2015	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good</li> <li>• <b>Time:</b> very good</li> <li>• <b>Geography:</b> very good</li> <li>• <b>Completeness:</b> very good</li> <li>• <b>Reliability:</b> very good</li> </ul>
<b>Crushed Aggregates coarse and fine</b> <i>ASTM C33</i>	ecoinvent 3.4: "Gravel, crushed {RoW}  production   Cut-off, U"  Modified with region-specific electricity grid.	Global/ Regional	2001	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good</li> <li>• <b>Time:</b> poor</li> <li>• <b>Geography:</b> good</li> <li>• <b>Completeness:</b> very good</li> <li>• <b>Reliability:</b> very good</li> </ul>
<b>Natural Aggregates coarse and fine</b> <i>ASTM C330</i>	ecoinvent 3.4: "Gravel, round {RoW}  gravel and sand quarry operation   Cut-off, U"  Modified with region-specific electricity grid.	Global/ Regional	2001	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good</li> <li>• <b>Time:</b> poor</li> <li>• <b>Geography:</b> good</li> <li>• <b>Completeness:</b> very good</li> <li>• <b>Reliability:</b> very good</li> </ul>
<b>Manufactured Lightweight Aggregates</b>	ecoinvent 3.4: Expanded clay {RoW}  production   Cut-off, U  Modified with United States average electricity grid	Global/ USA	2000	<ul style="list-style-type: none"> <li>• <b>Technology:</b> good Representative per: <a href="http://www.epa.gov/ttnchie1/ap42/ch11/final/c11s20.pdf">http://www.epa.gov/ttnchie1/ap42/ch11/final/c11s20.pdf</a></li> <li>• <b>Time:</b> poor</li> <li>• <b>Geography:</b> good</li> <li>• <b>Completeness:</b> very good</li> <li>• <b>Reliability:</b> very good</li> </ul>

1: This EPD was calculated using industry average cement data. Cement LCA impacts can vary depending upon manufacturing process, efficiency and fuel source by as much as 50% for some environmental impact categories. Cement accounts for as much as 97% of the impacts of the concrete mixes included in this EPD and thus manufacturer specific cement impacts could result in variation of as much as 49%.

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**Table 1. A1 - Raw Material Supply**

Materials	LCI Data Source	Geography	Year	Data Quality Assessment
<b>Admixtures</b> <i>ASTM C494</i>	EFCA EPDs for Air Entrainers, Plasticisers and superplasticisers, Hardening Accelerators, Set Accelerators, Water Resisting Admixtures, and Retarders  Non-supported LCIA indicators estimated using TRACI equivalents	EU	2015	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good</li> <li>• <b>Time:</b> good</li> <li>• <b>Geography:</b> fair</li> <li>• <b>Completeness:</b> good</li> <li>• <b>Reliability:</b> very good</li> </ul>
<b>Batch and Wash Water</b> <i>ASTM C1602</i>	ecoinvent 3.4: Tap water {RoW}   market for   Cut-off, U  Modified with US average electricity grid	Global/ USA	2011	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good</li> <li>• <b>Time:</b> good</li> <li>• <b>Geography:</b> good</li> <li>• <b>Completeness:</b> very good</li> <li>• <b>Reliability:</b> very good</li> </ul>

**Table 2. A2 - Transportation**

Process	LCI Data Source	Geography	Year	Data Quality Assessment
<b>Ocean</b>	USLCI 2014: Transport, ocean freighter, average fuel mix /US U	USA	2007	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good</li> <li>• <b>Time:</b> fair</li> <li>• <b>Geography:</b> very good</li> <li>• <b>Completeness:</b> very good</li> <li>• <b>Reliability:</b> very good</li> </ul>
<b>Rail</b>	USLCI 2014: Transport, train, diesel powered /US U	USA	2007	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good</li> <li>• <b>Time:</b> fair</li> <li>• <b>Geography:</b> very good</li> <li>• <b>Completeness:</b> very good</li> <li>• <b>Reliability:</b> very good</li> </ul>
<b>Road</b>	USLCI 2014: Transport, combination truck, short-haul, diesel powered/tkm/RNA  Adjusted for Backhauls per NSF PCR 7.1.7.2	USA	2010	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good</li> <li>• <b>Time:</b> good</li> <li>• <b>Geography:</b> very good</li> <li>• <b>Completeness:</b> very good</li> <li>• <b>Reliability:</b> very good</li> </ul>

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**Table 3. A3 - Manufacturing**

Process	LCI Data Source	Geography	Year	Data Quality Assessment
<b>Electricity</b>	ecoinvent 3.4: Electricity, low voltage {WECC}  market for   Cut-off, U  Electricity grids based on 2014 NERC regions.	USA	2015	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good</li> <li>• <b>Time:</b> very good</li> <li>• <b>Geography:</b> very good</li> <li>• <b>Completeness:</b> very good</li> <li>• <b>Reliability:</b> very good</li> </ul>
<b>Diesel</b>	USLCI 2014: Diesel, combusted in industrial boiler /US U	USA	2007	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good</li> <li>• <b>Time:</b> fair</li> <li>• <b>Geography:</b> very good</li> <li>• <b>Completeness:</b> very good</li> <li>• <b>Reliability:</b> very good</li> </ul>
<b>Gasoline</b>	USLCI 2014: Gasoline, combusted in equipment /US U	USA	2007	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good</li> <li>• <b>Time:</b> fair</li> <li>• <b>Geography:</b> very good</li> <li>• <b>Completeness:</b> very good</li> <li>• <b>Reliability:</b> very good</li> </ul>
<b>Liquefied Propane Gas</b>	USLCI 2014: Liquefied petroleum gas, combusted in industrial boiler /US U	USA	2007	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good</li> <li>• <b>Time:</b> fair</li> <li>• <b>Geography:</b> very good</li> <li>• <b>Completeness:</b> very good</li> <li>• <b>Reliability:</b> very good</li> </ul>
<b>Hazardous Solid Waste,</b>	ecoinvent 3.4: Hazardous waste, for incineration {RoW}  treatment of hazardous waste, hazardous waste incineration   Alloc Rec, U  Modified with United States average electricity grid	Global	2011	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good</li> <li>• <b>Time:</b> good</li> <li>• <b>Geography:</b> good</li> <li>• <b>Completeness:</b> very good</li> <li>• <b>Reliability:</b> very good</li> </ul>
<b>Non-Hazardous Solid Waste,</b>	ecoinvent 3.4: Inert waste {RoW}  treatment of, sanitary landfill   Alloc Rec, U  Modified with United States average electricity grid	Global	2011	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good</li> <li>• <b>Time:</b> good</li> <li>• <b>Geography:</b> good</li> <li>• <b>Completeness:</b> very good</li> <li>• <b>Reliability:</b> very good</li> </ul>

## Life Cycle Assessment Results

This EPD supports 25 life cycle impact assessment indicators and inventory metrics as listed in Table 4. The US EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI), version 2.1, 2012 impact categories were used to calculate mandatory category indicators.

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. Additionally, 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. No regulated substances of very high concern were identified in the LCA.

<b>Table 4. Life Cycle Category Indicators and Inventory Metrics</b>		
<b>Core Mandatory Impact Indicator</b>		
Global warming potential	GWP	kg CO2e
Depletion potential of the stratospheric ozone layer	ODP	kg CFC11e
Acidification potential of soil and water sources	AP	kg SO2e
Eutrophication potential	EP	kg Ne
Formation potential of tropospheric ozone	SFP	kg O3e
Abiotic depletion potential (ADP <sub>fossil</sub> ) for fossil resources;	ADPf	MJ, NCV
Fossil fuel depletion	FFD	MJ Surplus
<b>Use of Primary Resources</b>		
Renewable primary energy carrier used as energy	RPRE	MJ, NCV
Renewable primary energy carrier used as material	RPRM	MJ, NCV
Non-renewable primary energy carrier used as energy	NRPRE	MJ, NCV
Renewable primary energy carrier used as material	NRPRM	MJ, NCV
<b>Secondary Material, Secondary Fuel and Recovered Energy</b>		
Secondary material	SM	kg
Renewable secondary fuel	RSF	MJ, NCV
Non-renewable secondary fuel	NRSF	MJ, NCV
Recovered energy	RE	MJ, NCV
<b>Mandatory Inventory Parameters</b>		
Consumption of freshwater resources;	FW	m3
Calcination and carbonation emissions	CCE	kg CO2e
<b>Indicators Describing Waste</b>		
Hazardous waste disposed	HWD	kg
Non-hazardous waste disposed	NHWD	kg
High-level radioactive waste, conditioned, to final repository	HLRW	m3
Intermediate- and low-level radioactive waste, conditioned,	ILLRW	m3
Components for re-use	CRU	kg
Materials for recycling	MR	kg
Materials for energy recovery	MER	kg
Recovered energy exported from the product system	EE	MJ, NCV

Tables 5 through 13 present the LCA results for the mixes produced at the different facilities. The results are presented first on the basis of a declared unit of 1 cubic yard (Tables 5a-13a) and on the basis of 1 cubic meter (Tables 5b-13b).

































































































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**Table 11a Continued: LCA Results for Ready Mix Concrete - CalPortland Snoqualmie  
Calculated Results A1-A3 per yd3**

Mix ID		63138	63169	63333	63335
	PSI @ 28				
<b>Strength</b>	days	4000	5000	5000	5000
GWP	kg CO2e	259.50	263.34	310.75	312.09
ODP	kg CFC11e	9.72E-06	1.00E-05	1.13E-05	1.13E-05
AP	kg SO2e	0.80	0.83	0.99	1.00
EP	kg Ne	0.35	0.35	0.41	0.41
SFP	kg O3e	15.02	15.47	18.25	18.33
ADP <sub>f</sub>	MJ, NCV	1616.68	1669.22	1930.88	1951.59
ADP <sub>e</sub>	kg Sbe	1.61E-04	1.62E-04	1.93E-04	1.93E-04
FFD	MJ Surplus	120.71	127.86	143.89	147.06
RPRE	MJ, NCV	87.85	90.00	103.77	104.59
RPRM	MJ, NCV	0.00	0.00	0.00	0.00
NRPRE	MJ, NCV	1706.84	1768.10	2050.09	2072.21
NRPRM	MJ, NCV	0.00	0.00	0.00	0.00
SM	kg	0.00	0.00	0.00	0.00
RSF	MJ, NCV	0.00	0.00	0.00	0.00
NRSF	MJ, NCV	0.00	0.00	0.00	0.00
RE	MJ, NCV	0.00	0.00	0.00	0.00
FW	m3	2.10E+00	2.11E+00	2.52E+00	2.53E+00
CCE	kg CO2e	116.87	116.87	140.25	140.25
HWD	kg	0.00	0.00	0.00	0.00
NHWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
HLRW	m3	5.35E-09	5.35E-09	5.35E-09	5.35E-09
LLRW	m3	9.70E-04	1.60E-03	1.56E-03	2.14E-03
CRU	kg	0.00	0.00	0.00	0.00
MR	kg	0.00	0.00	0.00	0.00
MER	kg	0.00	0.00	0.00	0.00
EE	MJ, NCV	0.00	0.00	0.00	0.00









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**Table 11b Continued: LCA Results for Ready Mix Concrete - CalPortland Snoqualmie  
Calculated Results A1-A3 per m3**

Mix ID		63138	63169	63333	63335
	PSI @ 28				
<b>Strength</b>	days	4000	5000	5000	5000
GWP	kg CO2e	339.42	344.44	406.45	408.20
ODP	kg CFC11e	1.27E-05	1.31E-05	1.48E-05	1.48E-05
AP	kg SO2e	1.05	1.08	1.30	1.30
EP	kg Ne	0.45	0.46	0.54	0.54
SFP	kg O3e	19.65	20.23	23.86	23.97
ADP <sub>f</sub>	MJ, NCV	2114.54	2183.26	2525.49	2552.59
ADP <sub>e</sub>	kg Sbe	2.10E-04	2.11E-04	2.52E-04	2.52E-04
FFD	MJ Surplus	157.88	167.23	188.20	192.35
RPRE	MJ, NCV	114.91	117.72	135.72	136.80
RPRM	MJ, NCV	0.00	0.00	0.00	0.00
NRPRE	MJ, NCV	2232.46	2312.59	2681.42	2710.35
NRPRM	MJ, NCV	0.00	0.00	0.00	0.00
SM	kg	0.00	0.00	0.00	0.00
RSF	MJ, NCV	0.00	0.00	0.00	0.00
NRSF	MJ, NCV	0.00	0.00	0.00	0.00
RE	MJ, NCV	0.00	0.00	0.00	0.00
FW	m3	2.75E+00	2.76E+00	3.30E+00	3.31E+00
CCE	kg CO2e	152.86	152.86	183.44	183.44
HWD	kg	0.00	0.00	0.00	0.00
NHWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
HLRW	m3	6.99E-09	6.99E-09	6.99E-09	6.99E-09
LLRW	m3	1.27E-03	2.09E-03	2.04E-03	2.79E-03
CRU	kg	0.00	0.00	0.00	0.00
MR	kg	0.00	0.00	0.00	0.00
MER	kg	0.00	0.00	0.00	0.00
EE	MJ, NCV	0.00	0.00	0.00	0.00

























## References

American Concrete Institute (ACI) 211: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

American Concrete Institute (ACI) 318: Building Code Requirements for Structural Concrete ASTM International (ASTM) C94: Standard Specification for Ready-Mixed Concrete

Athena Sustainable Materials Institute: A Cradle-to-Gate Life Cycle Assessment of Ready-Mixed Concrete Manufactured by CalPortland Company – Washington; Version 2.0. Prepared by the Athena Sustainable Materials Institute: April 2019.

Construction Specifications Institute (CSI) MasterFormat Division 03-30-00 Cast-in-Place Concrete

EN 15804:2012 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.

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