

# Environmental Product Declaration



## Maschmeyer Concrete Company of Florida Inc.

EPD for concrete produced at three Orlando facilities



# Environmental Product Declaration

## NRMCA Certified Environmental Product Declaration

This environmental product declaration was conducted in accordance with ISO 14025:2006  
 Internal Verification      External Verification

<b>Declared Product:</b>	This Environmental Product Declaration (EPD) covers concrete mixes produced by Maschmeyer Concrete Company of Florida Inc.	
<b>Declaration Owner:</b>	<b>Maschmeyer Concrete Company of Florida Inc.</b> Maschmeyer Concrete Company of Florida Inc. 1142 Water Tower Road; Lake Park, 33403 www.maschmeyer.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>	The Carbon Leadership Forum PCR: Product Category Rules (PCR) for ISO 14025 Type III Environmental Product Declarations (EPDs) for Concrete Version 1.1 dated December 4, 2013, Serves as the PCR for this EPD. The EPD has been prepared in accordance with the guidance provided in clarification #1, #2 & #3 per section 4.6 of the Version 1.1 PCR (6/1/2015) www.carbonleadershipforum.org.	
	PCR review was conducted by: Nicholas Santero, PE International; Holly Lahd, EL Analytics and Medgar Marceau, Morrison Hershfield; December 4, 2013	
	Independent verification of the declaration, according to ISO 14025: 2006 <input type="checkbox"/> Internal <input checked="" type="checkbox"/> External	
<b>Independent LCA Reviewer and EPD Verifier:</b>	<b>Climate Earth</b> The David Brower Center 2150 Allston Way, #280 Berkeley, CA, 94704-1381 www.climateearth.com  Laurel McEwen	
<b>Date of Issue:</b>	Issued August 1, 2018	
<b>Period of Validity:</b>	5 Years (expires August 1, 2023)	
<b>EPD Number</b>	NRMCAEPD:10021	



## Description of Company

Celebrating over 31 years in Florida, Maschmeyer Concrete has become one of the leading privately-held, family-operated ready mix concrete, block and building materials suppliers in the state. We have built our business by building strong customer relationships through the relentless pursuit of our mission. We have developed a "best in class team", led by managers with an average of 22 years of industry and professional experience. From our humble beginnings, Maschmeyer Concrete has grown to fifteen locations servicing customers throughout Southeast, Central and the Space Coast of Florida - with a fleet of over 200 delivery vehicles providing concrete, block and building materials.

Maschmeyer Concrete's workforce has made a commitment to safety and environmental excellence. A group consisting of team member volunteers, known as the Environmental and Safety Committee, support the efforts through the use of education, training and recognition programs. The task group proactively addresses and solves issues that affect the occupational safety and the health needs of our team members, customers and the community. Through the use of environmental benchmarking and following the industry's movement towards sustainability, our team has developed sound, consistent environmental management methods that are known to protect the environment. We all benefit from the savings of an effective loss control, pollution control and waste reduction program.

## Location of Facilities

St. Cloud Plant  
2070 Hickory Tree Road  
St. Cloud, FL 34772

Orlando Taft Plant  
10550 Rocket Ct.  
Orlando, FL 32824

Orlando Silver Star Plant  
2311 Dinneen Ave  
Orlando, FL 32884



## Description of Product

Products covered by this EPD satisfy general purpose concrete as used in residential, commercial and public works applications in the US and Canada. This EPD reports the impacts for 30 different ready-mixed concrete products produce at three different Maschmeyer 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 meter 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 and their corresponding product standards include:

- Portland cement: ASTM C150
- Slag cement: ASTM C989
- Fly ash: ASTM C618
- Natural and Crushed Aggregates: ASTM C33
- Admixtures: ASTM C494
- Batch water: ASTM C1602



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## Scope of LCA

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

1. 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.
2. Transportation: Transportation of these materials from the supplier to the 'gate' of the concrete producer.
3. Manufacturing (core processes): The energy used to store, batch, mix and distribute the concrete and operate the facility (concrete plant)
4. Water use in mixing and distributing concrete.

A summary of life cycle stages excluded from the EPD is as follows:

1. Production, manufacture and construction of buildings capital goods and infrastructure
2. Production and manufacture of concrete production equipment, concrete delivery vehicles, earthmoving equipment, and laboratory equipment
3. Personnel---related activities (travel, furniture, office supplies).
4. Energy use related to company management and sales activities.

Building Life Cycle Information Modules																
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	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	

Figure 1. Life cycle stage schematic – alpha-numeric designations as per CLF PCR 2013(adapted from CEN 15978:2011)



## Cut-off Rules

The cut-off criteria for all activity stage flows considered within the system boundary conform with ISO14044:2006 and section 3.3 of the CLF PCR 2013. 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.

## Allocation

The applied allocation procedures conform with ISO 14044:2006 clause 4.3.4.

## Limitations

The limitations of this EPD include:

- This EPD does not report all of the environmental impacts due to manufacturing of the product, but rather reports the environmental impacts for those categories with established LCA-based methods to track and report. Unreported environmental impacts include (but are not limited to) factors attributable to human health, land use change, and habitat destruction.
- In order to assess the local impacts of product manufacturing, additional analysis is required.
- This EPD reports the results of an LCA or the 'cradle-to-gate' analysis. Thus, declarations themselves are not comparative assertions, defined as an environmental claim regarding the superiority or equivalence of one product versus a competing product that performs the same function. An EPD does not make any statements that the product covered by the EPD is better or worse than any other product.
- The EPD participants may participate in other sustainability or environmental best practice programs. However, no such additional environmental claim or declaration is conveyed in this EPD.
- EPDs of concrete mixtures may not be comparable if they do not comply with this standard and data from this EPD. The data cannot be used to compare between concrete mixes, construction products or concrete mixtures used in different concrete products unless the data is integrated into a comprehensive LCA. For example, precast concrete, concrete masonry units and site cast concrete all have different manufacturing processes whose impacts are attributed to different LCA stages. This precludes direct comparison between mixtures used in these different products unless all lifecycle phases are included.
- Life cycle impact assessment (LCIA) results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.
- This EPD was created using industry average data for upstream materials. Variation can result from differences in supplier locations, manufacturing processes, manufacturing efficiency and fuel type used.



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## Data Sources and Data Quality Assessment

This EPD is based on foreground LCI data collected from the participating company's production facilities for the calendar year 2016. 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 CLF PCR 2013. Tables 1 to 3 describe each LCI data source and the data quality for each data source.

Table 1. A1 - Raw Material Supply				
Materials	LCI Data Source	Geography	Year	Data Quality Assessment
<b>Cement (lbs)</b> <i>ASTM C150</i>	Portland Cement Association EPD USA Portland Cement, 2016	USA	2014	<ul style="list-style-type: none"> <li>• <b>Technology:</b> good Process models USA industry average portland cement production</li> <li>• <b>Time:</b> good Data is within 3 years</li> <li>• <b>Geography:</b> very good</li> <li>• <b>Completeness:</b> good</li> <li>• <b>Reliability:</b> very good, third-party verified EPD</li> </ul>
<b>Fly Ash (lbs)</b> <i>ASTM C618</i>	None, no incoming burden, only inbound transport was 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 (lbs)</b> <i>ASTM c1240</i>	None, no incoming burden, only inbound transport was 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 (lbs)</b> <i>ASTM C989</i>	Slag Cement Association N. America EPD Slag Cement, 2015	N. America	2013-2014	<ul style="list-style-type: none"> <li>• <b>Technology:</b> good Process models ground granulated blast furnace slag</li> <li>• <b>Time:</b> good Data is within 3 years</li> <li>• <b>Geography:</b> very good</li> <li>• <b>Completeness:</b> good</li> <li>• <b>Reliability:</b> very good, third-party verified EPD</li> </ul>
<b>Crushed Aggregates (lbs)</b> <i>coarse and fine</i> <i>ASTM C33</i>	ecoinvent process: "Gravel, crushed, at mine" ecoinvent 2.02  CLF PCR Default	EU	2004	<ul style="list-style-type: none"> <li>• <b>Technology:</b> good Processes represent aggregate, with and without crushing. Dust emissions are estimated from limestone mining.</li> <li>• <b>Time:</b> fair Data is twelve years old but technology remains consistent across the industry</li> <li>• <b>Geography:</b> fair Processes model Swiss production (no US process in USLCI database).</li> <li>• <b>Completeness:</b> very good</li> <li>• <b>Reliability:</b> very good Data is verified by ecoinvent.</li> </ul>
<b>Natural Aggregates (lbs)</b> <i>coarse and fine</i> <i>ASTM C33</i>	ecoinvent process: "Gravel, round, at mine", ecoinvent 2.02  CLF PCR Default	EU	2004	



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

Materials	LCI Data Source	Geography	Year	Data Quality Assessment
<b>Manufactured Lightweight Aggregates (lbs)</b>	ecoinvent, Expanded clay {USA}  production   Alloc Def, U	USA	2013	<ul style="list-style-type: none"> <li>• <b>Technology:</b> good Process represents production of manufactured lightweight aggregate used in the production of lightweight concrete. Based on the following generic process description, <a href="http://www.epa.gov/ttnchie1/ap42/ch11/final/c11s20.pdf">http://www.epa.gov/ttnchie1/ap42/ch11/final/c11s20.pdf</a>, Most lightweight aggregate is produced from materials such as clay, shale, or slate.</li> <li>• <b>Time:</b> good Data is within 3 years.</li> <li>• <b>Geography:</b> good Processes model US production.</li> <li>• <b>Completeness:</b> very good</li> <li>• <b>Reliability:</b> very good Data is verified by ecoinvent.</li> </ul>
<b>Admixtures (oz)</b> Accelerator Air Entrainment Retarding Waterproofing Plasticizer Superplasticizer <b>ASTM C494</b>	EFCA EcoProfiles (300, 301, 302, 303, 324 and 325)  CLF PCR Default	EU	2005 - 2006	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good Processes represents admixture production for use in concrete</li> <li>• <b>Time:</b> fair Data is within eleven years</li> <li>• <b>Geography:</b> fair</li> <li>• <b>Completeness:</b> good Data from a federation of European admixture producers</li> <li>• <b>Reliability:</b> good Profiles have undergone an independent review process. Compliance with ISO standards (unknown)</li> </ul>
<b>Concrete Batch and Wash Water (gallons)</b> <b>ASTM C1602</b>	ecoinvent process: Tap water, at user RER U (modified with FRCC electricity grid)	Global/Florida	2013 & 2015	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good Data represents fresh batch water, recycled wash water used as batch water and wash water inputs</li> <li>• <b>Time:</b> very good Data is within three years</li> <li>• <b>Geography:</b> very good</li> <li>• <b>Completeness:</b> very good Primary data from core processes survey</li> <li>• <b>Reliability:</b> very good Data based on specified use</li> </ul>
<b>Crushed Returned Concrete (lbs)</b>	Primary (Pre-consumer, burden of crushing is reported and included in module A3)	USA	2013 & 2015	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good Primary data collected via industry survey</li> <li>• <b>Time:</b> very good Data is within three years</li> <li>• <b>Geography:</b> very good</li> <li>• <b>Completeness:</b> very good Primary data from core processes survey</li> <li>• <b>Reliability:</b> very good Data based on specified use</li> </ul>





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

Materials	LCI Data Source	Geography	Year	Data Quality Assessment
<b>Crushed Demolition Concrete (lbs)</b>	LCI Slag Cement Manufacturing (crushing data used as proxy)	USA	2003	<ul style="list-style-type: none"> <li>• <b>Technology:</b> good Process models crushing of blast furnace slag.</li> <li>• <b>Time:</b> fair Data is within thirteen years.</li> <li>• <b>Geography:</b> very good</li> <li>• <b>Completeness:</b> fair</li> <li>• <b>Reliability:</b> fair</li> </ul>

**Table 2. A2 - Transportation**

Process	LCI Data Source	Geography	Year	Data Quality Assessment
<b>Rail, ocean freighter and barge* (lbs*miles)</b>	USLCI - rail transport, diesel powered; ocean freighter, average fuel mix; barge, average fuel mix	USA	2008	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good Processes represents U.S average transportation profiles</li> <li>• <b>Time:</b> fair Data is within ten years</li> <li>• <b>Geography:</b> good</li> <li>• <b>Completeness:</b> good (all data place holders filled) Data is representative of US conditions</li> <li>• <b>Reliability:</b> good</li> <li>• Data is from USLCI database</li> </ul>
<b>Road (lbs*miles)</b>	USLCI 2014 – single unit truck transport, diesel powered, short haul US avg.;	USA	2014	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good Processes represents U.S average transportation profiles</li> <li>• <b>Time:</b> very good Data is within two years</li> <li>• <b>Geography:</b> good</li> <li>• <b>Completeness:</b> good (all data place holders filled) Data is representative of US conditions</li> <li>• <b>Reliability:</b> good</li> <li>• Data is from USLCI database</li> </ul>



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**Table 3. A3 - Manufacturing**

Process	LCI Data Source	Geography	Year	Data Quality Assessment
<b>Electricity (kWh)</b>	Florida purchased electricity grid mix- Electricity, medium voltage, FRCC at grid, US (ecoinvent v3.01)	US	2008/2013	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good Process represents production of electricity in the appropriate NERC region. <b>Time:</b> fair/good Electricity production data is within ten years. NERC regional production breakdown from 2013.</li> <li>• <b>Geography:</b> very good</li> <li>• <b>Completeness:</b> good Data is representative of US production</li> <li>• <b>Reliability:</b> good ecoinvent has verified the data</li> </ul>
<b>Natural Gas (cu.ft.)</b>	USLCI, Natural gas, combusted in industrial boiler/US	US	2008	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good Process represents combustion of natural gas in an industrial boiler.</li> <li>• <b>Time:</b> fair Data is within ten years</li> <li>• <b>Geography:</b> fair</li> <li>• <b>Completeness:</b> good Data is representative of US conditions</li> <li>• <b>Reliability:</b> good Data is from USLCI database</li> </ul>
<b>Fuel Oil (other than diesel), (gallon)</b>	US LCI: Residual fuel oil, combusted in industrial boiler/US	US	2008	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good Process represents combustion of RFO in an industrial boiler.</li> <li>• <b>Time:</b> fair Data is within ten years</li> <li>• <b>Geography:</b> fair</li> <li>• <b>Completeness:</b> good Data is representative of US conditions</li> <li>• <b>Reliability:</b> good Data is from USLCI database</li> </ul>
<b>Diesel (gallon)</b>	US LCI: Diesel, combusted in industrial equipment/US	US	2008	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good Process represents combustion of diesel in industrial equipment.</li> <li>• <b>Time:</b> fair Data is within ten years</li> <li>• <b>Geography:</b> fair</li> <li>• <b>Completeness:</b> good Data is representative of US conditions</li> <li>• <b>Reliability:</b> good Data is from USLCI database</li> </ul>
<b>Gasoline (gallon)</b>	US LCI: Gasoline, combusted in equipment/US	US	2008	<ul style="list-style-type: none"> <li>• <b>Technology:</b> very good Process represents combustion of gasoline in equipment.</li> <li>• <b>Time:</b> fair Data is within ten years</li> <li>• <b>Geography:</b> fair</li> <li>• <b>Completeness:</b> good Data is representative of US conditions</li> <li>• <b>Reliability:</b> good Data is from USLCI database</li> </ul>



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**Table 3. A3 - Manufacturing**

Process	LCI Data Source	Geography	Year	Data Quality Assessment
<b>Hazardous Solid Waste, (lbs)</b>	ecoinvent 3.1, 2014 -Hazardous waste, for incineration {US}  treatment of hazardous waste, hazardous waste incineration   Alloc Def, U	EU	2008	<ul style="list-style-type: none"> <li>• <b>Technology:</b> good</li> <li>• <b>Time:</b> fair Data is within ten years.</li> <li>• <b>Geography:</b> fair Processes model Swiss production (no US process in USLCI database).</li> <li>• <b>Completeness:</b> very good</li> <li>• <b>Reliability:</b> very good Data is verified by Ecoinvent.</li> </ul>
<b>Non-Hazardous Solid Waste, (lbs)</b>	ecoinvent 3.1, 2014 -Waste concrete {US}  treatment of, inert material landfill   Alloc Def, U	EU	2008	<ul style="list-style-type: none"> <li>• <b>Technology:</b> good</li> <li>• <b>Time:</b> fair Data is within ten years.</li> <li>• <b>Geography:</b> fair Processes model Swiss production (no US process in USLCI database).</li> <li>• <b>Completeness:</b> very good</li> <li>• <b>Reliability:</b> very good Data is verified by Ecoinvent.</li> </ul>

## Data Quality

Data quality requirements, as specified in the CLF PCR: 2013, sections 3.5 and 3.6, are applied and reported in Tables 1 to 3. This section also describes the achieved data quality relative to the ISO 14044:2006 requirements. This LCA and resulting EPD was created using industry average data for upstream materials. Data variation can result from differences in supplier locations, manufacturing processes, manufacturing efficiency and fuel types used. Data quality is judged on the basis of its representativeness (technological, temporal, and geographical), completeness (e.g., unreported emissions), consistency and reliability.

All LCI data (Tables 1 to 3) are assessed on the basis of the five data quality indicators listed below. Each indicator is interpreted with respect to its context and key determining data parameters are discussed to provide clarity as to how the overall quality of each indicator is assessed and stated.

### Technical representativeness: Overall quality - Good to very good

The degree to which the data reflects the actual technology(ies) used. Core manufacturing process technology is derived from the manufacturing facilities. These data are deemed to be reflective of typical or average technologies used by Maschmeyer in the production of ready-mixed concrete. Some background material and process data are European but deemed to be similar to technologies used in the US and are often cited as preferred “default data” in the governing CLF PCR.

### Temporal representativeness: Overall quality - Fair to very good

The degree to which the data reflects the actual time (e.g. year) or age of the activity. Core manufacturing process data is very recent (2016). All other LCI data sources are less than 10 years old.

### Geographical representativeness: Overall quality - Fair to very good

The degree to which the data reflects the actual geographic location of the activity (e.g. country or site). Geographical coverage of core manufacturing processes is specific to Florida. All background energy profiles reflect US conditions and the electricity grid that was specified for the Maschmeyer facilities was the FRCC NERC region. Some material (aggregates and admixtures) and process data are based on European sources. These data have been previously verified or listed in the governing PCR for default use.



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## **Completeness: Overall quality - Good to very good**

The degree to which the data are statistically representative of the relevant activity. Completeness includes the percentage of locations for which data is available and used out of the total number that relate to a specific activity. Core manufacturing processes are very complete and were derived from data gathered at the participating facility. These data reflect annual operations inclusive of seasonal and other normal annual fluctuations in operations. All relevant, specific processes, including inputs (raw materials, energy and ancillary materials) and outputs (emissions and production volume) were considered and modeled to represent the specified and declared RMC products. The relevant background materials and processes were taken from the US LCI Database (adjusted for known data placeholders); US system boundary adjusted ecoinvent v 2.2 and v3.0 LCI databases and modeled in SimaPro software v.8.0.1, 2014. Efforts were made to ensure that all data used was as complete as reasonably possible.

## **Reliability: Overall quality - Fair to very good**

The degree to which the sources, data collection methods and verification procedures used to obtain the data are dependable. For core manufacturing processes the reliability of the information and data is deemed to be very good as these were derived from specific data of the RMC production facilities. Similarly, the LCI data for portland cement, at plant, reflects an update to the older PCR default database whereby missing upstream impacts associated with fuel and energy production have been filled. All missing process data (dummies) associated with the US LCI data have been consistently filled. All other LCI data have been incorporated in accordance with the default PCR requirements or derived from ecoinvent databases, which have been verified by ecoinvent.

Furthermore, the data quality is evaluated on the basis the precision, consistency and reproducibility.

**Precision:** Maschmeyer, through measurement and calculation, collected primary data on their annual production of RMC products. For accuracy the LCA team validated these gate-to-gate input and output data.

**Consistency:** To ensure consistency, the LCI modeling of the production weighted input and output LCI data for the declared products used the same modeling structure across the respective product systems, which consisted of input raw and ancillary material, energy flows, water resource inputs, product and co-products outputs, returned and recovered concrete materials, emissions to air, water and soil, and waste recycling and treatment. The same background LCI were used across all RMC product systems LCI modeling. Crosschecks concerning the plausibility of mass and energy flows were continuously conducted. The LCA team conducted mass and energy balances for the RMC plant to maintain a high level of consistency.

**Reproducibility:** Internal reproducibility is possible since the data are stored in an available calculator (Maschmeyer Concrete EPD Calculator, 2018). A considerable level of transparency is provided throughout the report as the specifications and material quantity make-up for the declared RMC products are presented and key primary and secondary LCI data sources are summarized in Tables 1, 2, and 3. The provision of more detailed data to allow full external reproducibility was not possible due to reasons of confidentiality.



## Life Cycle Assessment Results

### Environmental Indicators and Inventory Metrics

This EPD supports 15 life cycle impact assessment indicators and inventory metrics as listed in Table 4. As specified in the CLF PCR 2013, Section 8., 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.

<b>Table 4. Life Cycle Category Indicators and Inventory Metrics</b>			
<b>#</b>	<b>LCIA Indicators</b>	<b>Abbreviations</b>	<b>Units</b>
1	Global Warming Potential (climate change)	<b>GWP</b>	kg CO2-eq
2	Ozone Depletion Potential	<b>ODP</b>	kg CFC-11-eq
3	Acidification Potential	<b>AP</b>	kg SO2-eq
4	Eutrophication Potential	<b>EP</b>	kg N-eq
5	Photochemical Ozone Creation/Smog Potential	<b>POCP</b>	kg O3-eq
<b>Inventory Metrics</b>			
6	Total primary energy consumption	<b>PEC</b>	MJ (HHV)
7	Depletion of non-renewable energy resources	<b>NRE</b>	MJ (HHV)
8	Use of renewable primary energy	<b>RE</b>	MJ (HHV)
9	Depletion of non-renewable material resources	<b>NRM</b>	kg
10	Use of renewable material resources	<b>RM</b>	kg
11	Concrete batching water consumption	<b>CBW</b>	m3
12	Concrete washing water consumption	<b>CWW</b>	m3
13	Total water consumption	<b>TW</b>	m3
14	Hazardous waste	<b>HW</b>	kg
15	Non-hazardous waste	<b>NHW</b>	kg

The CLF PCR 2013 also requires the reporting of carbon emissions from biofuel combustion. No biofuels are combusted in the life cycle of any of the products declared in this EPD and thus this metric was excluded from the results.

Tables 5 through 7 present the LCA results for the mixes produced at the different facilities. The results are presented first on the basis of 1 cubic yard (Tables 5a-7a) and on the basis of the declared unit, 1 cubic meter (Tables 5b-7b).



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**Table 5a: Calculated Results A1-A3 per yd3 - Impact Assessment for ready mix concrete produced at Maschmeyer's St. Cloud Plant**

Indicator/LCI Metric	Strength		GWP	ODP	AP	EP	POCP	PEC	NRE	RE	NRM	RM	CBW	CWW	TW	HW	NHW
Mix Name	PSI	# Days	kg CO2	kg CFC-11	kg SO2	kg N	kg O3	MJ	MJ	MJ	kg	kg	m3	m3	m3	kg	kg
40090451	4000	28	177.21	6.00E-06	0.88	0.22	17.27	1447.35	1418.84	28.51	1612.56	1.47	0.11	0.08	0.20	0.05	1.14
G40890451	4000	28	185.81	6.32E-06	0.91	0.23	17.70	1509.82	1479.84	29.98	1614.17	1.55	0.12	0.08	0.20	0.05	1.21
50090451	5000	28	183.50	6.23E-06	0.90	0.23	17.71	1496.19	1466.58	29.61	1611.39	1.53	0.12	0.08	0.20	0.05	1.19
G60010401	6000	28	343.65	8.37E-06	1.09	0.40	23.25	2198.83	2158.02	40.81	1844.85	2.47	0.12	0.08	0.20	0.02	2.69
G60050401	6000	28	289.44	7.03E-06	0.95	0.34	20.69	1895.25	1860.90	34.34	1771.84	2.09	0.11	0.08	0.20	0.01	2.23
G60090401	6000	28	194.88	6.62E-06	0.95	0.25	18.48	1581.69	1550.24	31.45	1618.26	1.62	0.11	0.08	0.20	0.05	1.27
10250321	10000	28	412.39	1.00E-05	1.26	0.48	26.71	2583.56	2534.71	48.85	1738.32	2.95	0.14	0.08	0.23	0.02	3.27
10250328	10000	28	412.07	1.00E-05	1.25	0.48	26.58	2580.13	2531.36	48.77	1710.87	2.95	0.14	0.08	0.23	0.02	3.27
10290351	10000	28	271.16	9.32E-06	1.25	0.34	23.39	2109.06	2064.86	44.20	1549.47	2.25	0.14	0.08	0.23	0.07	1.84
05-FF-191	100	28	46.56	1.14E-06	0.20	0.05	4.94	362.80	357.60	5.20	969.34	0.33	0.23	0.08	0.31	0.00	0.31
30030000	3000	28	132.49	4.02E-06	0.63	0.17	13.59	1058.44	1039.15	19.29	1603.34	1.06	0.12	0.08	0.20	0.02	0.86
40050450	4000	28	244.01	5.96E-06	0.82	0.29	18.25	1608.13	1579.00	29.13	1713.69	1.77	0.12	0.08	0.20	0.01	1.86
40050450P	4000	28	244.09	5.96E-06	0.82	0.29	18.26	1609.45	1580.30	29.15	1738.30	1.77	0.12	0.08	0.20	0.01	1.86
40050451	4000	28	243.70	5.93E-06	0.83	0.29	18.31	1626.85	1597.88	28.98	1740.15	1.76	0.12	0.08	0.20	0.01	1.85
40050451P	4000	28	243.70	5.93E-06	0.83	0.29	18.31	1626.85	1597.88	28.98	1740.15	1.76	0.12	0.08	0.20	0.01	1.85
40550451	4000	28	278.35	6.78E-06	0.89	0.33	19.10	1792.72	1759.79	32.94	1698.72	2.00	0.14	0.08	0.22	0.01	2.17
40550451P	4000	28	278.52	6.78E-06	0.89	0.33	19.16	1795.15	1762.19	32.96	1698.25	2.00	0.14	0.08	0.22	0.01	2.17
4009T450	4000	28	239.40	6.72E-06	0.92	0.29	19.20	1685.53	1653.09	32.44	1728.97	1.84	0.12	0.08	0.20	0.03	1.75
4009T450P	4000	28	239.40	6.72E-06	0.92	0.29	19.20	1685.53	1653.09	32.44	1728.97	1.84	0.12	0.08	0.20	0.03	1.75
4009T451	4000	28	235.37	6.58E-06	0.92	0.28	19.03	1678.83	1647.10	31.73	1735.26	1.80	0.11	0.08	0.20	0.03	1.71
4009T451P	4000	28	237.03	6.63E-06	0.92	0.29	19.14	1691.14	1659.16	31.97	1734.85	1.81	0.11	0.08	0.20	0.03	1.72
4059T451	4000	28	277.40	7.77E-06	1.02	0.33	20.53	1919.49	1882.19	37.29	1690.99	2.11	0.14	0.08	0.22	0.04	2.07
4059T451P	4000	28	277.47	7.78E-06	1.02	0.33	20.54	1920.60	1883.28	37.33	1690.52	2.11	0.14	0.08	0.22	0.04	2.07
10G50321	10000	28	403.62	9.81E-06	1.24	0.47	26.49	2542.36	2494.48	47.88	1836.61	2.90	0.13	0.08	0.21	0.02	3.19
10G90351	10000	28	260.95	8.97E-06	1.21	0.33	22.91	2042.61	2000.06	42.54	1657.12	2.17	0.12	0.08	0.21	0.07	1.76
3065C476	3000	28	264.69	6.46E-06	0.81	0.31	17.47	1671.50	1640.23	31.27	1587.83	1.90	0.16	0.08	0.24	0.01	2.09
30050000	3000	28	202.54	4.96E-06	0.72	0.24	16.16	1369.31	1345.04	24.26	1706.09	1.48	0.12	0.08	0.20	0.01	1.51
30090000	4000	28	138.22	4.68E-06	0.72	0.18	14.69	1156.75	1134.47	22.28	1601.41	1.16	0.12	0.08	0.20	0.03	0.86
40030000	4000	28	146.00	4.44E-06	0.68	0.18	14.49	1150.42	1129.11	21.31	1605.38	1.17	0.12	0.08	0.20	0.03	0.96
40090000	4000	28	149.19	5.06E-06	0.76	0.19	15.39	1233.93	1209.83	24.10	1609.70	1.25	0.12	0.08	0.20	0.04	0.94



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**Table 5b: Calculated Results A1-A3 per m3 - Impact Assessment for ready mix concrete produced at Maschmeyer's St. Cloud Plant**

Indicator/LCI Metric	Strength		GWP	ODP	AP	EP	POCP	PEC	NRE	RE	NRM	RM	CBW	CWW	TW	HW	NHW
Mix Name	PSI	# Days	kg CO2	kg CFC-11	kg SO2	kg N	kg O3	MJ	MJ	MJ	kg	kg	m3	m3	m3	kg	kg
40090451	4000	28	231.78	7.85E-06	1.15	0.29	22.58	1893.06	1855.77	37.29	2109.15	1.93	0.15	0.11	0.26	0.06	1.49
G40890451	4000	28	243.03	8.27E-06	1.19	0.31	23.15	1974.77	1935.56	39.21	2111.25	2.02	0.16	0.11	0.27	0.06	1.58
50090451	5000	28	240.01	8.15E-06	1.18	0.30	23.17	1956.94	1918.21	38.73	2107.61	2.00	0.15	0.11	0.26	0.06	1.56
G60010401	6000	28	449.47	1.09E-05	1.42	0.53	30.42	2875.96	2822.58	53.38	2412.97	3.24	0.16	0.11	0.27	0.02	3.52
G60050401	6000	28	378.58	9.20E-06	1.25	0.44	27.06	2478.89	2433.97	44.92	2317.48	2.73	0.15	0.11	0.26	0.02	2.92
G60090401	6000	28	254.89	8.66E-06	1.24	0.32	24.17	2068.77	2027.63	41.13	2116.60	2.12	0.15	0.11	0.26	0.07	1.66
10250321	10000	28	539.39	1.31E-05	1.64	0.63	34.94	3379.16	3315.27	63.89	2273.64	3.86	0.19	0.11	0.30	0.03	4.28
10250328	10000	28	538.97	1.31E-05	1.64	0.63	34.77	3374.68	3310.90	63.78	2237.74	3.86	0.19	0.11	0.30	0.03	4.28
10290351	10000	28	354.67	1.22E-05	1.63	0.44	30.60	2758.54	2700.73	57.81	2026.63	2.95	0.19	0.11	0.30	0.10	2.41
05-FF-191	100	28	60.90	1.49E-06	0.27	0.07	6.46	474.52	467.72	6.80	1267.85	0.44	0.30	0.11	0.41	0.00	0.40
30030000	3000	28	173.29	5.25E-06	0.83	0.22	17.77	1384.38	1359.16	25.23	2097.09	1.39	0.16	0.11	0.27	0.03	1.13
40050450	4000	28	319.15	7.79E-06	1.08	0.38	23.86	2103.35	2065.26	38.10	2241.42	2.32	0.15	0.11	0.26	0.02	2.43
40050450P	4000	28	319.26	7.80E-06	1.08	0.38	23.88	2105.08	2066.96	38.12	2273.61	2.32	0.15	0.11	0.26	0.02	2.43
40050451	4000	28	318.75	7.76E-06	1.09	0.38	23.95	2127.84	2089.94	37.90	2276.02	2.31	0.15	0.11	0.26	0.02	2.42
40050451P	4000	28	318.75	7.76E-06	1.09	0.38	23.95	2127.84	2089.94	37.90	2276.02	2.31	0.15	0.11	0.26	0.02	2.42
40550451	4000	28	364.07	8.86E-06	1.16	0.43	24.98	2344.79	2301.71	43.08	2221.84	2.62	0.18	0.11	0.29	0.02	2.84
40550451P	4000	28	364.29	8.87E-06	1.16	0.43	25.06	2347.97	2304.85	43.11	2221.23	2.62	0.18	0.11	0.29	0.02	2.84
4009T450	4000	28	313.12	8.80E-06	1.21	0.38	25.11	2204.58	2162.15	42.43	2261.41	2.40	0.15	0.11	0.26	0.04	2.29
4009T450P	4000	28	313.12	8.80E-06	1.21	0.38	25.11	2204.58	2162.15	42.43	2261.41	2.40	0.15	0.11	0.26	0.04	2.29
4009T451	4000	28	307.85	8.61E-06	1.20	0.37	24.90	2195.83	2154.33	41.51	2269.64	2.35	0.15	0.11	0.26	0.04	2.23
4009T451P	4000	28	310.02	8.68E-06	1.21	0.38	25.03	2211.92	2170.10	41.82	2269.09	2.37	0.15	0.11	0.26	0.04	2.25
4059T451	4000	28	362.83	1.02E-05	1.33	0.43	26.85	2510.59	2461.82	48.78	2211.72	2.76	0.18	0.11	0.29	0.05	2.70
4059T451P	4000	28	362.92	1.02E-05	1.33	0.43	26.86	2512.05	2463.23	48.82	2211.11	2.76	0.18	0.11	0.29	0.05	2.70
10G50321	10000	28	527.92	1.28E-05	1.62	0.62	34.65	3325.29	3262.66	62.63	2402.19	3.79	0.17	0.11	0.28	0.03	4.17
10G90351	10000	28	341.30	1.17E-05	1.58	0.43	29.96	2671.63	2615.98	55.64	2167.43	2.84	0.16	0.11	0.27	0.09	2.31
3065C476	3000	28	346.20	8.45E-06	1.06	0.40	22.85	2186.24	2145.34	40.90	2076.80	2.49	0.21	0.11	0.32	0.02	2.73
30050000	3000	28	264.91	6.49E-06	0.94	0.32	21.14	1790.99	1759.25	31.74	2231.48	1.94	0.16	0.11	0.27	0.01	1.98
30090000	4000	28	180.78	6.12E-06	0.94	0.23	19.22	1512.97	1483.83	29.14	2094.56	1.52	0.16	0.11	0.27	0.04	1.13
40030000	4000	28	190.96	5.80E-06	0.89	0.24	18.96	1504.70	1476.82	27.87	2099.76	1.53	0.16	0.11	0.27	0.03	1.26
40090000	4000	28	195.13	6.62E-06	0.99	0.25	20.12	1613.92	1582.39	31.53	2105.41	1.64	0.16	0.11	0.27	0.05	1.23



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**Table 6a: Calculated Results A1-A3 per yd3 - Impact Assessment for ready mix concrete produced at Maschmeyer's Orlando Taft Plant**

Indicator/LCI Metric	Strength		GWP	ODP	AP	EP	POCP	PEC	NRE	RE	NRM	RM	CBW	CWW	TW	HW	NHW
Mix Name	PSI	# Days	kg CO2	kg CFC-11	kg SO2	kg N	kg O3	MJ	MJ	MJ	kg	kg	m3	m3	m3	kg	kg
40090451	4000	28	176.99	6.01E-06	0.88	0.22	17.41	1444.87	1416.36	28.51	1612.56	1.47	0.11	0.08	0.20	0.05	1.14
G40890451	4000	28	185.51	6.33E-06	0.91	0.24	17.82	1506.23	1476.25	29.98	1614.17	1.55	0.12	0.08	0.20	0.05	1.21
50090451	5000	28	183.25	6.24E-06	0.91	0.23	17.85	1493.20	1463.59	29.61	1611.39	1.53	0.12	0.08	0.20	0.05	1.19
G60010401	6000	28	342.26	8.37E-06	1.08	0.40	23.19	2180.30	2139.48	40.81	1844.85	2.48	0.12	0.08	0.20	0.02	2.69
G60050401	6000	28	288.38	7.04E-06	0.95	0.34	20.69	1881.17	1846.83	34.35	1771.84	2.09	0.11	0.08	0.20	0.01	2.23
G60090401	6000	28	194.56	6.63E-06	0.96	0.25	18.60	1577.82	1546.37	31.45	1618.26	1.62	0.11	0.08	0.20	0.05	1.27
10250321	10000	28	410.53	1.00E-05	1.25	0.48	26.56	2558.41	2509.56	48.85	1738.32	2.96	0.14	0.08	0.23	0.02	3.27
10250328	10000	28	410.19	1.00E-05	1.25	0.48	26.42	2554.72	2505.96	48.77	1710.87	2.95	0.14	0.08	0.23	0.02	3.27
10290351	10000	28	270.41	9.33E-06	1.25	0.34	23.43	2099.21	2055.01	44.20	1549.47	2.25	0.14	0.08	0.23	0.07	1.84
05-FF-191	100	28	46.48	1.14E-06	0.20	0.05	4.90	362.13	356.93	5.20	969.35	0.34	0.23	0.08	0.31	0.00	0.31
30030000	3000	28	132.45	4.02E-06	0.64	0.17	13.76	1058.40	1039.12	19.29	1603.35	1.06	0.12	0.08	0.20	0.02	0.86
40050450	4000	28	243.23	5.96E-06	0.82	0.29	18.29	1597.91	1568.79	29.13	1713.69	1.77	0.12	0.08	0.20	0.01	1.86
40050450P	4000	28	243.31	5.97E-06	0.82	0.29	18.30	1599.23	1570.08	29.15	1738.30	1.77	0.12	0.08	0.20	0.01	1.86
40050451	4000	28	242.93	5.94E-06	0.83	0.29	18.36	1616.69	1587.72	28.98	1740.15	1.76	0.12	0.08	0.20	0.01	1.85
40050451P	4000	28	242.93	5.94E-06	0.83	0.29	18.36	1616.69	1587.72	28.98	1740.15	1.76	0.12	0.08	0.20	0.01	1.85
40550451	4000	28	277.19	6.78E-06	0.88	0.33	19.01	1777.17	1744.23	32.94	1698.72	2.00	0.14	0.08	0.22	0.01	2.17
40550451P	4000	28	277.36	6.79E-06	0.89	0.33	19.08	1779.71	1746.75	32.96	1698.25	2.01	0.14	0.08	0.22	0.01	2.17
4009T450	4000	28	238.74	6.73E-06	0.92	0.29	19.26	1676.95	1644.50	32.44	1728.97	1.84	0.12	0.08	0.20	0.03	1.75
4009T450P	4000	28	238.74	6.73E-06	0.92	0.29	19.26	1676.95	1644.50	32.44	1728.97	1.84	0.12	0.08	0.20	0.03	1.75
4009T451	4000	28	234.73	6.59E-06	0.92	0.29	19.10	1670.57	1638.83	31.74	1735.27	1.80	0.11	0.08	0.20	0.03	1.71
4009T451P	4000	28	236.38	6.64E-06	0.93	0.29	19.21	1682.74	1650.76	31.98	1734.85	1.81	0.11	0.08	0.20	0.03	1.72
4059T451	4000	28	276.36	7.78E-06	1.02	0.33	20.47	1905.59	1868.29	37.29	1690.99	2.11	0.14	0.08	0.22	0.04	2.07
4059T451P	4000	28	276.42	7.78E-06	1.02	0.33	20.48	1906.70	1869.38	37.33	1690.52	2.11	0.14	0.08	0.22	0.04	2.07
10G50321	10000	28	401.85	9.81E-06	1.24	0.47	26.37	2518.47	2470.59	47.88	1836.61	2.90	0.13	0.08	0.21	0.02	3.19
10G90351	10000	28	260.28	8.97E-06	1.21	0.33	22.98	2033.99	1991.45	42.54	1657.12	2.17	0.12	0.08	0.21	0.07	1.76
3065C476	3000	28	263.46	6.47E-06	0.81	0.31	17.32	1655.03	1623.76	31.27	1587.83	1.91	0.16	0.08	0.24	0.01	2.09
30050000	3000	28	202.03	4.97E-06	0.72	0.24	16.25	1362.80	1338.54	24.27	1706.09	1.48	0.12	0.08	0.20	0.01	1.51
30090000	4000	28	138.23	4.68E-06	0.72	0.18	14.88	1157.28	1135.00	22.28	1601.41	1.16	0.12	0.08	0.20	0.03	0.86
40030000	4000	28	145.90	4.44E-06	0.69	0.18	14.66	1149.49	1128.17	21.31	1605.38	1.17	0.12	0.08	0.20	0.03	0.96
40090000	4000	28	149.13	5.07E-06	0.77	0.19	15.56	1233.55	1209.45	24.10	1609.70	1.26	0.12	0.08	0.20	0.04	0.94





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**Table 6b: Calculated Results A1-A3 per m3 - Impact Assessment for ready mix concrete produced at Maschmeyer's Orlando Taft Plant**

Indicator/LCI Metric	Strength		GWP	ODP	AP	EP	POCP	PEC	NRE	RE	NRM	RM	CBW	CWW	TW	HW	NHW
Mix Name	PSI	# Days	kg CO2	kg CFC-11	kg SO2	kg N	kg O3	MJ	MJ	MJ	kg	kg	m3	m3	m3	kg	kg
40090451	4000	28	231.50	7.85E-06	1.15	0.29	22.77	1889.81	1852.52	37.29	2109.15	1.93	0.15	0.11	0.26	0.06	1.49
G40890451	4000	28	242.64	8.27E-06	1.19	0.31	23.31	1970.08	1930.86	39.22	2111.25	2.02	0.16	0.11	0.27	0.06	1.58
50090451	5000	28	239.68	8.16E-06	1.19	0.30	23.35	1953.04	1914.31	38.73	2107.61	2.00	0.15	0.11	0.26	0.06	1.56
G60010401	6000	28	447.66	1.10E-05	1.42	0.53	30.33	2851.72	2798.34	53.38	2412.97	3.24	0.16	0.11	0.27	0.02	3.52
G60050401	6000	28	377.19	9.21E-06	1.25	0.44	27.06	2460.48	2415.56	44.92	2317.48	2.73	0.15	0.11	0.26	0.02	2.92
G60090401	6000	28	254.48	8.67E-06	1.25	0.32	24.33	2063.72	2022.58	41.14	2116.60	2.12	0.15	0.11	0.26	0.07	1.66
10250321	10000	28	536.95	1.31E-05	1.63	0.63	34.74	3346.27	3282.38	63.89	2273.64	3.87	0.19	0.11	0.30	0.03	4.28
10250328	10000	28	536.51	1.31E-05	1.63	0.63	34.56	3341.45	3277.66	63.79	2237.74	3.86	0.19	0.11	0.30	0.03	4.28
10290351	10000	28	353.69	1.22E-05	1.63	0.44	30.65	2745.67	2687.85	57.82	2026.63	2.95	0.19	0.11	0.30	0.10	2.41
05-FF-191	100	28	60.80	1.49E-06	0.27	0.07	6.41	473.65	466.84	6.81	1267.86	0.44	0.30	0.11	0.41	0.00	0.40
30030000	3000	28	173.24	5.26E-06	0.84	0.22	18.00	1384.34	1359.11	25.23	2097.10	1.39	0.16	0.11	0.27	0.03	1.13
40050450	4000	28	318.13	7.80E-06	1.08	0.38	23.92	2089.99	2051.89	38.10	2241.42	2.32	0.15	0.11	0.26	0.02	2.43
40050450P	4000	28	318.24	7.81E-06	1.08	0.38	23.94	2091.72	2053.59	38.13	2273.61	2.32	0.15	0.11	0.26	0.02	2.43
40050451	4000	28	317.74	7.77E-06	1.09	0.38	24.01	2114.56	2076.65	37.90	2276.02	2.31	0.15	0.11	0.26	0.02	2.42
40050451P	4000	28	317.74	7.77E-06	1.09	0.38	24.01	2114.56	2076.65	37.90	2276.02	2.31	0.15	0.11	0.26	0.02	2.42
40550451	4000	28	362.54	8.87E-06	1.15	0.43	24.87	2324.44	2281.36	43.08	2221.85	2.62	0.18	0.11	0.29	0.02	2.84
40550451P	4000	28	362.77	8.88E-06	1.16	0.43	24.96	2327.77	2284.66	43.12	2221.23	2.62	0.18	0.11	0.29	0.02	2.84
4009T450	4000	28	312.26	8.80E-06	1.21	0.38	25.20	2193.36	2150.93	42.43	2261.41	2.41	0.15	0.11	0.26	0.04	2.29
4009T450P	4000	28	312.26	8.80E-06	1.21	0.38	25.20	2193.36	2150.93	42.43	2261.41	2.41	0.15	0.11	0.26	0.04	2.29
4009T451	4000	28	307.02	8.62E-06	1.20	0.37	24.99	2185.02	2143.51	41.51	2269.64	2.36	0.15	0.11	0.26	0.04	2.23
4009T451P	4000	28	309.18	8.68E-06	1.21	0.38	25.12	2200.94	2159.12	41.82	2269.09	2.37	0.15	0.11	0.26	0.04	2.25
4059T451	4000	28	361.46	1.02E-05	1.33	0.43	26.77	2492.41	2443.63	48.78	2211.73	2.76	0.18	0.11	0.29	0.05	2.70
4059T451P	4000	28	361.55	1.02E-05	1.33	0.43	26.78	2493.87	2445.05	48.82	2211.11	2.76	0.18	0.11	0.29	0.05	2.70
10G50321	10000	28	525.60	1.28E-05	1.62	0.62	34.49	3294.04	3231.41	62.63	2402.19	3.79	0.17	0.11	0.28	0.03	4.17
10G90351	10000	28	340.44	1.17E-05	1.59	0.43	30.05	2660.36	2604.71	55.65	2167.43	2.84	0.16	0.11	0.27	0.09	2.31
3065C476	3000	28	344.59	8.46E-06	1.06	0.40	22.65	2164.70	2123.80	40.90	2076.80	2.49	0.21	0.11	0.32	0.02	2.73
30050000	3000	28	264.25	6.49E-06	0.94	0.32	21.26	1782.48	1750.74	31.74	2231.49	1.94	0.16	0.11	0.27	0.01	1.98
30090000	4000	28	180.79	6.12E-06	0.95	0.23	19.46	1513.67	1484.53	29.14	2094.56	1.52	0.16	0.11	0.27	0.04	1.13
40030000	4000	28	190.83	5.81E-06	0.90	0.24	19.17	1503.47	1475.59	27.88	2099.76	1.53	0.16	0.11	0.27	0.03	1.26
40090000	4000	28	195.05	6.63E-06	1.00	0.25	20.35	1613.43	1581.90	31.53	2105.41	1.64	0.16	0.11	0.27	0.05	1.23



# Environmental Product Declaration

**Table 7a: Calculated Results A1-A3 per yd3- Impact Assessment for ready mix concrete produced at Maschmeyer's Orlando Silver Star Plant**

Indicator/LCI Metric	Strength		GWP	ODP	AP	EP	POCP	PEC	NRE	RE	NRM	RM	CBW	CWW	TW	HW	NHW
Mix Name	PSI	# Days	kg CO2	kg CFC-11	kg SO2	kg N	kg O3	MJ	MJ	MJ	kg	kg	m3	m3	m3	kg	kg
40090451	4000	28	177.22	6.00E-06	0.89	0.22	17.66	1447.60	1419.09	28.51	1612.56	1.47	0.11	0.08	0.20	0.05	1.14
G40890451	4000	28	185.70	6.32E-06	0.92	0.24	18.06	1508.48	1478.50	29.98	1614.17	1.55	0.12	0.08	0.20	0.05	1.21
50090451	5000	28	183.47	6.23E-06	0.92	0.23	18.10	1495.87	1466.26	29.61	1611.39	1.53	0.12	0.08	0.20	0.05	1.19
G60010401	6000	28	342.32	8.37E-06	1.09	0.40	23.41	2180.68	2139.87	40.81	1844.85	2.47	0.12	0.08	0.20	0.02	2.69
G60050401	6000	28	288.47	7.04E-06	0.96	0.34	20.92	1881.99	1847.65	34.34	1771.84	2.09	0.11	0.08	0.20	0.01	2.23
G60090401	6000	28	194.77	6.62E-06	0.96	0.25	18.86	1580.34	1548.89	31.45	1618.26	1.62	0.11	0.08	0.20	0.05	1.27
10250321	10000	28	410.47	1.00E-05	1.25	0.48	26.76	2557.36	2508.51	48.85	1738.32	2.95	0.14	0.08	0.23	0.02	3.27
10250328	10000	28	410.12	1.00E-05	1.25	0.48	26.61	2553.43	2504.66	48.77	1710.87	2.95	0.14	0.08	0.23	0.02	3.27
10290351	10000	28	270.55	9.32E-06	1.25	0.34	23.67	2100.79	2056.58	44.20	1549.47	2.25	0.14	0.08	0.23	0.07	1.84
05-FF-191	100	28	46.32	1.14E-06	0.20	0.05	4.89	359.48	354.28	5.20	969.34	0.33	0.23	0.08	0.31	0.00	0.31
30030000	3000	28	132.68	4.02E-06	0.65	0.17	14.01	1061.14	1041.86	19.29	1603.34	1.06	0.12	0.08	0.20	0.02	0.86
40050450	4000	28	243.35	5.96E-06	0.83	0.29	18.53	1599.32	1570.19	29.13	1713.69	1.77	0.12	0.08	0.20	0.01	1.86
40050450P	4000	28	243.44	5.96E-06	0.83	0.29	18.54	1600.64	1571.49	29.15	1738.30	1.77	0.12	0.08	0.20	0.01	1.86
40050451	4000	28	243.06	5.93E-06	0.84	0.29	18.60	1618.06	1589.09	28.98	1740.15	1.76	0.12	0.08	0.20	0.01	1.85
40050451P	4000	28	243.06	5.93E-06	0.84	0.29	18.60	1618.06	1589.09	28.98	1740.15	1.76	0.12	0.08	0.20	0.01	1.85
40550451	4000	28	277.13	6.78E-06	0.89	0.33	19.16	1776.01	1743.07	32.94	1698.72	2.00	0.14	0.08	0.22	0.01	2.17
40550451P	4000	28	277.31	6.78E-06	0.89	0.33	19.23	1778.67	1745.70	32.96	1698.25	2.00	0.14	0.08	0.22	0.01	2.17
4009T450	4000	28	238.91	6.73E-06	0.93	0.29	19.51	1678.92	1646.48	32.44	1728.97	1.84	0.12	0.08	0.20	0.03	1.75
4009T450P	4000	28	238.91	6.73E-06	0.93	0.29	19.51	1678.92	1646.48	32.44	1728.97	1.84	0.12	0.08	0.20	0.03	1.75
4009T451	4000	28	234.90	6.58E-06	0.93	0.29	19.35	1672.52	1640.79	31.73	1735.26	1.80	0.11	0.08	0.20	0.03	1.71
4009T451P	4000	28	236.55	6.63E-06	0.93	0.29	19.45	1684.67	1652.70	31.97	1734.85	1.81	0.11	0.08	0.20	0.03	1.72
4059T451	4000	28	276.35	7.77E-06	1.02	0.33	20.62	1905.13	1867.84	37.29	1690.99	2.11	0.14	0.08	0.22	0.04	2.07
4059T451P	4000	28	276.42	7.78E-06	1.02	0.33	20.64	1906.25	1868.92	37.33	1690.52	2.11	0.14	0.08	0.22	0.04	2.07
10G50321	10000	28	401.84	9.81E-06	1.24	0.47	26.59	2517.95	2470.07	47.88	1836.61	2.90	0.13	0.08	0.21	0.02	3.19
10G90351	10000	28	260.46	8.97E-06	1.22	0.33	23.23	2036.06	1993.52	42.54	1657.12	2.17	0.12	0.08	0.21	0.07	1.76
3065C476	3000	28	263.28	6.46E-06	0.81	0.31	17.39	1652.26	1620.99	31.27	1587.83	1.90	0.16	0.08	0.24	0.01	2.09
30050000	3000	28	202.20	4.96E-06	0.73	0.24	16.50	1364.83	1340.57	24.26	1706.09	1.48	0.12	0.08	0.20	0.01	1.51
30090000	4000	28	138.49	4.68E-06	0.73	0.18	15.14	1160.55	1138.27	22.28	1601.41	1.16	0.12	0.08	0.20	0.03	0.86
40030000	4000	28	146.12	4.44E-06	0.70	0.18	14.91	1152.22	1130.91	21.31	1605.38	1.17	0.12	0.08	0.20	0.03	0.96
40090000	4000	28	149.38	5.06E-06	0.77	0.19	15.82	1236.63	1212.53	24.10	1609.70	1.25	0.12	0.08	0.20	0.04	0.94



# Environmental Product Declaration

**Table 7b: Calculated Results A1-A3 per m3- Impact Assessment for ready mix concrete produced at Maschmeyer's Orlando Silver Star Plant**

Indicator/LCI Metric	Strength		GWP	ODP	AP	EP	POCP	PEC	NRE	RE	NRM	RM	CBW	CWW	TW	HW	NHW
Mix Name	PSI	# Days	kg CO2	kg CFC-11	kg SO2	kg N	kg O3	MJ	MJ	MJ	kg	kg	m3	m3	m3	kg	kg
40090451	4000	28	231.79	7.85E-06	1.16	0.29	23.10	1893.39	1856.10	37.29	2109.15	1.93	0.15	0.11	0.26	0.06	1.49
G40890451	4000	28	242.89	8.27E-06	1.20	0.31	23.62	1973.02	1933.80	39.21	2111.25	2.02	0.16	0.11	0.27	0.06	1.58
50090451	5000	28	239.97	8.15E-06	1.20	0.30	23.68	1956.52	1917.79	38.73	2107.61	2.00	0.15	0.11	0.26	0.06	1.56
G60010401	6000	28	447.73	1.09E-05	1.42	0.53	30.61	2852.22	2798.84	53.38	2412.97	3.24	0.16	0.11	0.27	0.02	3.52
G60050401	6000	28	377.30	9.20E-06	1.25	0.45	27.36	2461.55	2416.63	44.92	2317.48	2.73	0.15	0.11	0.26	0.02	2.92
G60090401	6000	28	254.75	8.67E-06	1.26	0.32	24.66	2067.01	2025.87	41.13	2116.60	2.12	0.15	0.11	0.26	0.07	1.66
10250321	10000	28	536.88	1.31E-05	1.64	0.63	35.00	3344.90	3281.01	63.89	2273.64	3.86	0.19	0.11	0.30	0.03	4.28
10250328	10000	28	536.41	1.31E-05	1.63	0.63	34.80	3339.75	3275.97	63.78	2237.74	3.86	0.19	0.11	0.30	0.03	4.28
10290351	10000	28	353.87	1.22E-05	1.64	0.45	30.96	2747.72	2689.91	57.81	2026.63	2.95	0.19	0.11	0.30	0.10	2.41
05-FF-191	100	28	60.58	1.49E-06	0.27	0.07	6.40	470.19	463.38	6.80	1267.85	0.44	0.30	0.11	0.41	0.00	0.40
30030000	3000	28	173.54	5.25E-06	0.84	0.22	18.32	1387.92	1362.69	25.23	2097.09	1.39	0.16	0.11	0.27	0.03	1.13
40050450	4000	28	318.30	7.79E-06	1.09	0.38	24.23	2091.82	2053.73	38.10	2241.42	2.32	0.15	0.11	0.26	0.02	2.43
40050450P	4000	28	318.41	7.80E-06	1.09	0.38	24.25	2093.55	2055.43	38.12	2273.61	2.32	0.15	0.11	0.26	0.02	2.43
40050451	4000	28	317.90	7.76E-06	1.10	0.38	24.32	2116.35	2078.45	37.90	2276.02	2.31	0.15	0.11	0.26	0.02	2.42
40050451P	4000	28	317.90	7.76E-06	1.10	0.38	24.32	2116.35	2078.45	37.90	2276.02	2.31	0.15	0.11	0.26	0.02	2.42
40550451	4000	28	362.47	8.87E-06	1.16	0.43	25.06	2322.93	2279.85	43.08	2221.84	2.62	0.18	0.11	0.29	0.02	2.84
40550451P	4000	28	362.71	8.87E-06	1.16	0.43	25.15	2326.41	2283.29	43.11	2221.23	2.62	0.18	0.11	0.29	0.02	2.84
4009T450	4000	28	312.48	8.80E-06	1.22	0.38	25.52	2195.94	2153.51	42.43	2261.41	2.40	0.15	0.11	0.26	0.04	2.29
4009T450P	4000	28	312.48	8.80E-06	1.22	0.38	25.52	2195.94	2153.51	42.43	2261.41	2.40	0.15	0.11	0.26	0.04	2.29
4009T451	4000	28	307.24	8.61E-06	1.21	0.37	25.31	2187.58	2146.07	41.51	2269.64	2.35	0.15	0.11	0.26	0.04	2.23
4009T451P	4000	28	309.40	8.68E-06	1.22	0.38	25.44	2203.47	2161.65	41.82	2269.09	2.37	0.15	0.11	0.26	0.04	2.25
4059T451	4000	28	361.45	1.02E-05	1.33	0.43	26.98	2491.82	2443.04	48.78	2211.72	2.76	0.18	0.11	0.29	0.05	2.70
4059T451P	4000	28	361.54	1.02E-05	1.34	0.43	26.99	2493.28	2444.46	48.82	2211.11	2.76	0.18	0.11	0.29	0.05	2.70
10G50321	10000	28	525.58	1.28E-05	1.62	0.62	34.78	3293.36	3230.73	62.63	2402.19	3.79	0.17	0.11	0.28	0.03	4.17
10G90351	10000	28	340.67	1.17E-05	1.60	0.43	30.38	2663.07	2607.43	55.64	2167.43	2.84	0.16	0.11	0.27	0.09	2.31
3065C476	3000	28	344.36	8.45E-06	1.06	0.40	22.75	2161.07	2120.17	40.90	2076.80	2.49	0.21	0.11	0.32	0.02	2.73
30050000	3000	28	264.47	6.49E-06	0.95	0.32	21.58	1785.13	1753.39	31.74	2231.49	1.94	0.16	0.11	0.27	0.01	1.98
30090000	4000	28	181.14	6.12E-06	0.96	0.23	19.80	1517.94	1488.80	29.14	2094.56	1.52	0.16	0.11	0.27	0.04	1.13
40030000	4000	28	191.12	5.80E-06	0.91	0.24	19.50	1507.05	1479.17	27.88	2099.76	1.53	0.16	0.11	0.27	0.03	1.26
40090000	4000	28	195.38	6.62E-06	1.01	0.25	20.69	1617.46	1585.93	31.53	2105.41	1.64	0.16	0.11	0.27	0.05	1.23



## 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 Maschmeyer Concrete Company of Florida Inc.; Version 1.0. Prepared by the Athena Sustainable Materials Institute: June 2018.

Carbon Leadership Forum (December 4, 2013). Product Category Rules (PCR) for ISO 14025 Type III Environmental Product Declarations (EPDs) of Concrete v1.1.

Carbon Leadership Forum Clarification #1 (April 10, 2014), Clarification #2 (July 17, 2014) and Clarification #3 (June 1, 2015) to: PCR for ISO 14025 Type III Environmental Product Declarations (EPDs) of Concrete v1.1.

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.

European Federation of Concrete Admixture Associations (2006). EFCA Environmental Declarations for Admixtures. <http://www.efca.info/publications.html>

ISO 21930: 2007 Building construction – Sustainability in building construction – Environmental declaration of building products.

ISO 14025: 2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.

ISO 14044: 2006 Environmental management - Life cycle assessment - Requirements and guidelines.

ISO 14040: 2006 Environmental management - Life cycle assessment - Principles and framework.

National Ready Mixed Concrete Association 2013. Program Operator Instructions for Environmental Product Declarations v1.2.

National Renewable Energy Laboratory 2014. U.S. Life Cycle Inventory Database. <https://www.lcacommons.gov/nrel/search>.

