

Environmental Product Declaration

A cradle-to-gate EPD according to ISO 14025 and ISO 21930



ASTM INTERNATIONAL



**Precast Concrete Products as Manufactured
by Emirates Precast Construction**



About Emirates Precast Construction

Emirates Precast (EPC) is a highly reputed precast company operating in the UAE, delivering quality concrete products for more than 40 years.



EPC produce a comprehensive range of products from simple pipes and manholes to complete building structures with sophisticated cladding panels. Our recently established glass reinforced concrete (GRC) division produces a comprehensive range of products, from cladding to highly ornate screening, which can be seen all over UAE. The business has an in-house design and draughting and concrete batching plants facility which is used for the vast majority of projects.



ASTM International Certified EPD

This is a business-to-business Type III environmental product declaration (EPD) for precast concrete products as manufactured by Emirates Precast Construction. This declaration has been prepared in accordance with ISO 14025 and ISO 21930, and the ASTM product category rules (PCR) and EPD program operator rules.

The intent of this document is to further the development of environmentally compatible and more sustainable construction products by providing comprehensive environmental information related to potential impacts of precast concrete products available in the UAE in accordance with international standards.

Program Operator	
 ASTM INTERNATIONAL	ASTM International Environmental Product Declarations 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 www.astm.org
Owner of the EPD	
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Precast Consultant	
	Grey Matters Consultancy P.O. Box: 283079 Dubai Investment Park Dubai - UAE www.greymatters.ws
EPD Information	
Product Names Structural precast, architectural precast, underground precast	Product Definition See Table I
Declared Unit 1 tonne precast concrete product	Declaration Number EPD- 086
Declaration Type A “cradle-to-gate” EPD - activity stages or information modules covered include production (modules A1 to A3). The declaration is intended for use in Business-to-Business (B-to-B) communication. This EPD of precast concrete products (UN CPC 3755) is applicable to those manufactured at the Emirates Precast Construction facility.	
Content of the Declaration The declaration follows Section 11, Content of the EPD, ASTM International, ASTM International, Product Category Rules for Preparing an Environmental Product Declaration For Precast Concrete.	



EPD Information

Declaration Comparability Limitation Statement

The following ISO statement indicates the EPD comparability limitations and intent to avoid any market distortions or misinterpretation of EPDs based on the ASTM's PCR, 2015:

- EPDs from different programs (using different PCR) may not be comparable.
- Declarations based on the ASTM PCR are not comparative assertions; that is, no claim of environmental superiority may be inferred or implied.

Applicable Countries

United Arab Emirates

Date of Issue

October 30 2018

Period of Validity

5 years

EPD Prepared by



Athena
Sustainable Materials
Institute

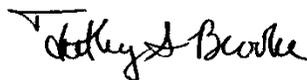
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This EPD was independently verified by ASTM in accordance with ISO 14025:

Internal

External

X



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EPD Project Report Information

EPD Project Report

A Cradle-to-Gate Life Cycle Assessment of Precast Concrete Products Manufactured by Emirates Precast Construction in the Emirate of Dubai, UAE, July 2018.

The report is available upon request at cert@astm.org.

EPD Project Prepared by



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This EPD and EPD project report were independently verified by in accordance with ISO 14025 and the reference PCR:

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PCR Information

Reference PCR

ASTM International, Product Category Rules for Preparing an Environmental Product Declaration For Precast Concrete (based on ISO 21930:2007, an alternative to EN 15804 standard)

Date of Issue

March 2015

PCR review was conducted by:

Nicholas Santero, PE International (Chairperson)
Christine Subasic, Consulting Architectural Engineer
Juan Tejada, ORCO Block Company

Contact information available upon request at cert@astm.org.

1. PRODUCT IDENTIFICATION

Precast concrete is a construction product produced by casting concrete in a reusable mold or "form" which is then cured in a controlled environment, transported to the construction site, and lifted into place. Precast concrete is used in building or civil engineering works and is primarily composed of cement, aggregates and reinforcement materials.

This EPD reports environmental information for the three precast concrete products types shown in Figure 1 below, produced by Emirates Precast Construction in Dubai, United Arab Emirates.



Structural precast products



Architectural precast



Underground precast

Figure 1: Emirates Precast Construction Products

Environmental information for products composed four different concrete mix designs are reported in this EPD — see Table 1 for a summary of the products covered.

Table 1: Summary of Products Applicable to this EPD

		Concrete Mix Design ¹			
		C40/20-1	C50/20	C60/20	C40/20-2
Applicable Products	▪ Manhole	▪ Retaining Wall	▪ Foundation	▪ Foundation	
	▪ Boundary Wall	▪ Boundary Wall	▪ Superstructures	▪ Manhole	
	▪ Substructures	▪ Pipe		▪ Boundary Wall	
	▪ Stairs	▪ Superstructures		▪ Substructures	
	▪ Wall Panels			▪ Stairs	
	▪ Cladding			▪ Wall Panels	
	▪ Barrier			▪ Cladding	
				▪ Barrier	

2. DECLARED UNIT

The declared unit is 1 tonne of precast concrete product.

3. MATERIAL CONTENT

Table 2 through Table 5 below present the material content by input material for the various precast concrete products, as provided by Emirates Precast Construction.

To provide LCA results applicable to any future construction project, the rebar quantities of the four concrete mixes designs were varied between 0² and 500 kg/m³, in 50 kg/m³ increments. It is intended that users of the EPD can reference the LCA results applicable to their design or interpolate between results.

¹ Concrete mix designations refer to the 28-day compressive strength of a concrete cube sample (in MPa) and maximum aggregate size (in mm), e.g. “C40/20” is 40 MPa strength concrete with 10mm maximum aggregate size.

² Note that 0 kg/m³ is not a realistic amount of rebar for these products and is intended only for interpolating results for designs that have between 0 and 50 kg/m³ rebar.



Table 2: Material Content for C40/20-1 Precast Products — kg per m³ product

Material	Rebar Quantity (kg/m ³)										
	0	50	100	150	200	250	300	350	400	450	500
Water	140	139	138	137	136	136	135	134	133	132	131
Portland Cement	250	248	247	245	244	242	240	239	237	236	234
Slag Cement (GGBFS)	150	149	148	147	146	145	144	143	142	141	140
Silica Fume	0	0	0	0	0	0	0	0	0	0	0
Crushed Coarse Aggregate, 20mm	765	760	755	750	746	741	736	731	726	721	716
Crushed Coarse Aggregate, 10mm	315	313	311	309	307	305	303	301	299	297	295
Crushed Fine Aggregate, 0-5mm	645	641	637	633	629	624	620	616	612	608	604
Natural Fine Aggregate, dune sand	235	234	232	231	229	228	226	225	223	222	220
Water Reducing Admixture (plasticizer)	6	6	6	6	6	6	6	6	6	6	6
Rebar	0	50	100	150	200	250	300	350	400	450	500
Steel Anchors	0	0	0	0	0	0	0	0	0	0	0
Total	2,506	2,540	2,574	2,608	2,642	2,676	2,710	2,744	2,778	2,812	2,846

Table 3: Material Content for C50/20 Precast Products — kg per m³ product

Material	Rebar Quantity (kg/m ³)										
	0	50	100	150	200	250	300	350	400	450	500
Water	140	139	138	137	136	136	135	134	133	132	131
Portland Cement	250	248	247	245	244	242	240	239	237	236	234
Slag Cement (GGBFS)	150	149	148	147	146	145	144	143	142	141	140
Silica Fume	0	0	0	0	0	0	0	0	0	0	0
Crushed Coarse Aggregate, 20mm	765	760	755	750	746	741	736	731	726	721	716
Crushed Coarse Aggregate, 10mm	315	313	311	309	307	305	303	301	299	297	295
Crushed Fine Aggregate, 0-5mm	645	641	637	633	629	624	620	616	612	608	604
Natural Fine Aggregate, dune sand	235	234	232	231	229	228	226	225	223	222	220
Water Reducing Admixture (plasticizer)	6	6	6	6	6	6	6	6	6	6	6
Rebar	0	50	100	150	200	250	300	350	400	450	500
Steel Anchors	0	0	0	0	0	0	0	0	0	0	0
Total	2,506	2,540	2,574	2,608	2,642	2,676	2,710	2,744	2,778	2,812	2,846



Table 4: Material Content for C60/20 Precast Products — kg per m³ product

Material	Rebar Quantity (kg/m ³)										
	0	50	100	150	200	250	300	350	400	450	500
Water	145	144	143	142	141	140	139	139	138	137	136
Portland Cement	276	274	272	271	269	267	265	264	262	260	258
Slag Cement (GGBFS)	140	139	138	137	136	136	135	134	133	132	131
Silica Fume	24	24	24	24	23	23	23	23	23	23	22
Crushed Coarse Aggregate, 20mm	765	760	755	750	746	741	736	731	726	721	716
Crushed Coarse Aggregate, 10mm	325	323	321	319	317	315	313	311	308	306	304
Crushed Fine Aggregate, 0-5mm	635	631	627	623	619	615	611	607	603	599	595
Natural Fine Aggregate, dune sand	191	190	189	187	186	185	184	182	181	180	179
Water Reducing Admixture (plasticizer)	8	8	8	8	8	8	8	8	8	8	7
Rebar	0	50	100	150	200	250	300	350	400	450	500
Steel Anchors	0	0	0	0	0	0	0	0	0	0	0
Total	2,509	2,543	2,577	2,611	2,645	2,679	2,713	2,747	2,781	2,815	2,849

Table 5: Material Content for C40/20-1 Precast Products — kg per m³ product

Material	Rebar Quantity (kg/m ³)										
	0	50	100	150	200	250	300	350	400	450	500
Water	133	132	131	130	130	129	128	127	126	125	125
Portland Cement	240	238	237	235	234	232	231	229	228	226	225
Slag Cement (GGBFS)	140	139	138	137	136	136	135	134	133	132	131
Silica Fume	0	0	0	0	0	0	0	0	0	0	0
Crushed Coarse Aggregate, 20mm	780	775	770	765	760	755	750	745	740	735	730
Crushed Coarse Aggregate, 10mm	320	318	316	314	312	310	308	306	304	302	300
Crushed Fine Aggregate, 0-5mm	665	661	657	652	648	644	640	635	631	627	623
Natural Fine Aggregate, dune sand	240	238	237	235	234	232	231	229	228	226	225
Water Reducing Admixture (plasticizer)	6	6	6	6	6	6	6	6	6	6	6
Rebar	0	50	100	150	200	250	300	350	400	450	500
Steel Anchors	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Total	2,526	2,560	2,593	2,627	2,661	2,695	2,729	2,763	2,797	2,831	2,865



4. SYSTEM BOUNDARY

As per the ASTM PCR, the system boundary is the product stage, which includes the following modules:

- A1 Raw material supply;
- A2 Transport (to the manufacturer); and
- A3 Manufacturing.

Figure 2 shows the production stage system boundary for precast concrete products.

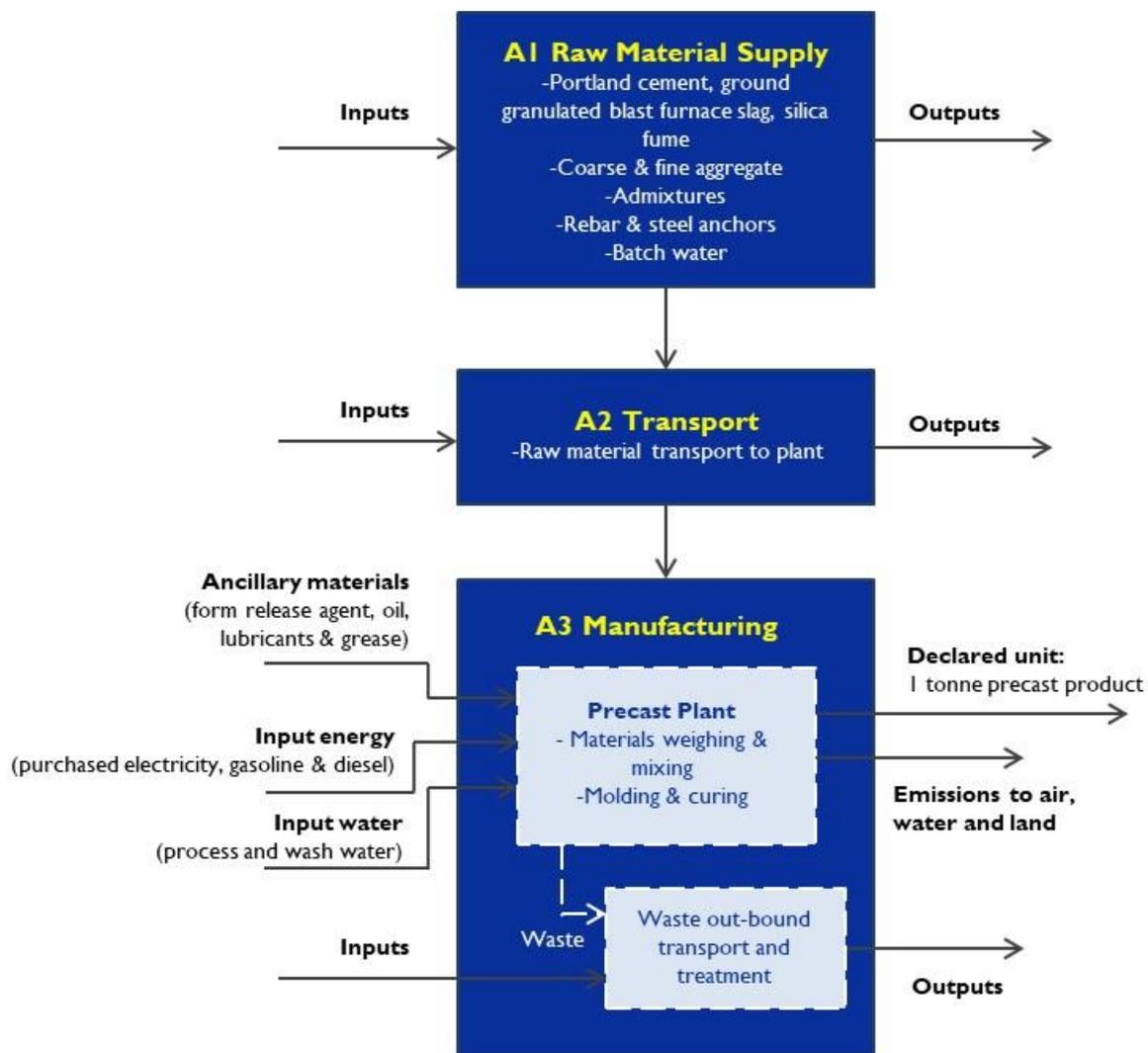


Figure 2: Product Stage (module A1 to A3) System Boundary

5. LIFE CYCLE ASSESSMENT

This section summarizes the results of the life cycle impact assessment (LCIA) based on the cradle-to-gate life cycle inventory inputs and outputs analysis. The results are calculated on the basis of 1 tonne precast concrete product. As per the ASTM PCR, Section 8, US EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI, version 2.1) impact categories are used for the mandatory category indicators to be included in this EPD. These are relative expressions only and do not predict category impact end-points, the exceeding of thresholds, safety margins or risks. Total primary and sub-set energy consumption was compiled using a cumulative energy demand model. Material resource consumption and generated waste reflect cumulative life cycle inventory flow information.

Table 6: Results (A1-A3): C40/20-1 Precast Products — per tonne product

Environmental Indicator	Unit	Rebar Quantity (kg/m ³)										
		0	50	100	150	200	250	300	350	400	450	500
Global warming potential (GWP)	kg CO ₂ eq.	168	211	253	294	335	374	412	449	485	521	555
Acidification potential	kg SO ₂ eq.	0.68	0.90	1.11	1.32	1.52	1.71	1.90	2.08	2.27	2.44	2.61
Eutrophication potential	kg N eq.	0.188	0.194	0.199	0.205	0.210	0.215	0.220	0.225	0.230	0.235	0.239
Smog creation potential	kg O ₃ eq.	9.19	9.20	9.21	9.22	9.23	9.24	9.25	9.26	9.26	9.27	9.28
Ozone depletion potential	kg CFC-11 eq.	4.84E-05	4.75E-05	4.67E-05	4.58E-05	4.50E-05	4.43E-05	4.35E-05	4.28E-05	4.21E-05	4.13E-05	4.07E-05
Nonrenewable energy resources	MJ (HHV)	1,962	2,570	3,161	3,737	4,298	4,845	5,378	5,898	6,405	6,900	7,383
Renewable energy resources	MJ (HHV)	22	43	63	82	101	120	138	156	173	190	206
Nonrenewable material resources	kg	1,072	1,074	1,076	1,079	1,081	1,083	1,085	1,087	1,089	1,091	1,092
Renewable material resources	kg	0.148	0.268	0.384	0.498	0.608	0.716	0.821	0.924	1.024	1.121	1.216
Net fresh water (inputs minus outputs)	L	915	965	1,012	1,059	1,105	1,149	1,192	1,234	1,276	1,316	1,355
Non-hazardous waste generated	kg	28.8	28.2	27.7	27.2	26.6	26.1	25.6	25.2	24.7	24.3	23.8
Hazardous waste generated	kg	0.11	1.14	2.14	3.12	4.07	5.00	5.90	6.78	7.64	8.48	9.30



Table 7: Results (A1-A3): C50/20 Precast Products — per tonne product

Environmental Indicator	Unit	Rebar Quantity (kg/m ³)										
		0	50	100	150	200	250	300	350	400	450	500
Global warming potential (GWP)	kg CO ₂ eq.	168	211	253	294	335	374	412	449	485	521	555
Acidification potential	kg SO ₂ eq.	0.68	0.90	1.11	1.32	1.52	1.71	1.90	2.08	2.27	2.44	2.61
Eutrophication potential	kg N eq.	0.188	0.194	0.199	0.205	0.210	0.215	0.220	0.225	0.230	0.235	0.239
Smog creation potential	kg O ₃ eq.	9.19	9.20	9.21	9.22	9.23	9.24	9.25	9.26	9.26	9.27	9.28
Ozone depletion potential	kg CFC-11 eq.	4.84E-05	4.75E-05	4.67E-05	4.58E-05	4.50E-05	4.43E-05	4.35E-05	4.28E-05	4.21E-05	4.13E-05	4.07E-05
Nonrenewable energy resources	MJ (HHV)	1,962	2,570	3,161	3,737	4,298	4,845	5,378	5,898	6,405	6,900	7,383
Renewable energy resources	MJ (HHV)	22	43	63	82	101	120	138	156	173	190	206
Nonrenewable material resources	kg	1,072	1,074	1,076	1,079	1,081	1,083	1,085	1,087	1,089	1,091	1,092
Renewable material resources	kg	0.148	0.268	0.384	0.498	0.608	0.716	0.821	0.924	1.024	1.121	1.216
Net fresh water (inputs minus outputs)	L	915	965	1,012	1,059	1,105	1,149	1,192	1,234	1,276	1,316	1,355
Non-hazardous waste generated	kg	28.8	28.2	27.7	27.2	26.6	26.1	25.6	25.2	24.7	24.3	23.8
Hazardous waste generated	kg	0.11	1.14	2.14	3.12	4.07	5.00	5.90	6.78	7.64	8.48	9.30

Table 8: Results (A1-A3): C60/20 Precast Products — per tonne product

Environmental Indicator	Unit	Rebar Quantity (kg/m ³)										
		0	50	100	150	200	250	300	350	400	450	500
Global warming potential (GWP)	kg CO ₂ eq.	178	221	263	304	344	383	421	458	494	529	563
Acidification potential	kg SO ₂ eq.	0.73	0.94	1.15	1.35	1.55	1.75	1.94	2.12	2.30	2.47	2.65
Eutrophication potential	kg N eq.	0.202	0.207	0.213	0.218	0.223	0.228	0.233	0.237	0.242	0.246	0.251
Smog creation potential	kg O ₃ eq.	9.87	9.87	9.87	9.86	9.86	9.86	9.85	9.85	9.85	9.85	9.84
Ozone depletion potential	kg CFC-11 eq.	4.86E-05	4.78E-05	4.69E-05	4.61E-05	4.53E-05	4.45E-05	4.38E-05	4.30E-05	4.23E-05	4.16E-05	4.09E-05
Nonrenewable energy resources	MJ (HHV)	2,059	2,664	3,253	3,827	4,386	4,930	5,461	5,979	6,484	6,977	7,458
Renewable energy resources	MJ (HHV)	23	43	63	83	102	121	139	156	174	190	207
Nonrenewable material resources	kg	1,064	1,067	1,069	1,071	1,074	1,076	1,078	1,080	1,082	1,084	1,086
Renewable material resources	kg	0.154	0.274	0.390	0.503	0.614	0.721	0.826	0.928	1.028	1.125	1.220
Net fresh water (inputs minus outputs)	L	995	1,042	1,089	1,134	1,178	1,221	1,263	1,303	1,343	1,382	1,420
Non-hazardous waste generated	kg	28.8	28.2	27.7	27.1	26.6	26.1	25.6	25.1	24.7	24.2	23.8
Hazardous waste generated	kg	0.11	1.14	2.14	3.11	4.06	4.99	5.89	6.77	7.63	8.47	9.29



Table 9: Results (A1-A3): C40/20-2 Precast Products — per tonne product

Environmental Indicator	Unit	Rebar Quantity (kg/m ³)										
		0	50	100	150	200	250	300	350	400	450	500
Global warming potential (GWP)	kg CO ₂ eq.	164	208	250	291	330	369	407	444	480	516	550
Acidification potential	kg SO ₂ eq.	0.67	0.88	1.09	1.30	1.49	1.69	1.88	2.06	2.24	2.42	2.59
Eutrophication potential	kg N eq.	0.184	0.190	0.195	0.201	0.206	0.211	0.216	0.221	0.226	0.231	0.235
Smog creation potential	kg O ₃ eq.	8.94	8.95	8.97	8.98	9.00	9.01	9.02	9.04	9.05	9.06	9.07
Ozone depletion potential	kg CFC-11 eq.	4.84E-05	4.75E-05	4.67E-05	4.59E-05	4.51E-05	4.43E-05	4.36E-05	4.28E-05	4.21E-05	4.14E-05	4.07E-05
Nonrenewable energy resources	MJ (HHV)	1,951	2,554	3,142	3,714	4,272	4,815	5,345	5,862	6,367	6,859	7,340
Renewable energy resources	MJ (HHV)	26	47	67	86	105	123	141	159	176	192	209
Nonrenewable material resources	kg	1,072	1,074	1,077	1,079	1,081	1,083	1,085	1,087	1,089	1,091	1,093
Renewable material resources	kg	0.156	0.274	0.390	0.502	0.612	0.719	0.823	0.925	1.024	1.121	1.216
Net fresh water (inputs minus outputs)	L	901	950	998	1,045	1,090	1,134	1,178	1,220	1,261	1,301	1,340
Non-hazardous waste generated	kg	28.6	28.0	27.5	27.0	26.5	26.0	25.5	25.0	24.5	24.1	23.7
Hazardous waste generated	kg	0.14	1.16	2.16	3.13	4.07	4.99	5.89	6.76	7.62	8.45	9.27

