



EPD®



EPD® – Environmental Product Declaration

The International EPD System. EPD International AB

www.environdec.com

CONCRETE (B35 MF45) PRODUCED ON MossIA RAILWAY PROJECT



EN 15804+A1 and ISO 14025:2010 compliant

Registration number: S-P- 03442

Publication date: 2021-05-10

Valid until: 2026-05-10

Scope of the EPD: International

Verification date: 2021-05-09

Version of the EPD: 1st

An EPD should provide current information, and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com."

TABLE OF CONTENTS

1. INTRODUCTION.....	3
2. DESCRIPTION OF THE COMPANY	3
3. DESCRIPTION OF THE CONCRETE	4
4. FUNCTIONAL UNIT	4
5. SYSTEM BOUNDARIES AND DATA QUALITY	4
6. CONTENT DECLARATION	5
7. ENVIRONMENTAL PERFORMANCE	6
8. VERIFICATION AND CONTACT	8
9. REFERENCES.....	9

1. INTRODUCTION

This environmental product declaration (EPD®) describes, from a lifecycle perspective, the environmental impact of production of B35 MF45 concrete in MossIA railway project. The program operator of this EPD® is EPD International AB, Box 210 60, SE-100 31 Stockholm, Sweden (www.environdec.com)

The EPD® covers concrete production only. It includes the modules A1-A3 *Production stage* (extraction and processing of raw materials, transportation up of raw material to the factory gate, and manufacturing of the concrete). It is based on ISO standard 14025, this EPD® was drawn up in accordance with the Product Category Rules, UN PCR Construction products and construction services 2012:01, version 2.33 and PCR 2012:01-SUB-PCR-G Concrete and Concrete elements (EN 16757:2017).

The intended use of the EPD® is to communicate environmentally relevant information and LCA results to support the assessment of the sustainable use of resources and of the impact of construction works on the environment.

As this EPD® is based on data relating to MossIA railway project from 2021, the results might not be representative for the B35 MF45 concrete of other railway projects. EPD® of construction products may not be comparable if they do not comply with EN 15804+A1. Environmental Product Declarations within the same product category from different programs may not be comparable. In order to decide if the results can be representative for other railway project, the most important aspects that should be checked to be comparable with other concrete are:

- Composition
- Origin of materials

- Concrete functionality
- The geographical representativeness of data

The owner of this EPD is MossIA ANS joint venture located at Dronningens gate 16. 1530 Moss, Norway. The geographical scope of this EPD is Norway.

2. DESCRIPTION OF THE COMPANY

MossIA ANS is a joint venture between Implenla Norge AS and ACCIONA Construction S.A. Implenla and ACCIONA are international leaders in sustainable infrastructure who have combined their resources in a fully integrated partnership to complete the railway between Sandbukta in the north and Sæstad in the south.

MossIA ANS is organized as a responsible Norwegian company (ANS) and is located in Moss with a head project office in centrum and construction offices located at the following construction sites: Kransen, Carlberg, Verket and Larkollveien. As of today, MossIA has more than 220 employees represented by approximately 20 nationalities, and its workforce is comprised of approximately 30% female and 70% male employees.

Implenla is a contracting company specializing in complex infrastructure projects in Norway. Implenla Norway can demonstrate many years of experience and expertise in complex infrastructure projects across the country. The company offers services in road and groundwork, water and sewerage, concrete structures, bridges, tunnels and storage rooms, water and frost protection, mountain protection and environmental services.

ACCIONA is a leading provider of sustainable infrastructure solutions and renewable energy projects worldwide. The service offering encompasses the entire value chain, from design

and development to operation and maintenance. The company is present in over 40 countries and is committed to contributing to economic and social development in the communities in which it operates. ACCIONA is a leader in the transition to a low-carbon economy by working on quality and innovation process criteria, thus achieving efficient use of resources and environmental considerations in all its projects.

3. DESCRIPTION OF THE CONCRETE

This EPD® refers to concrete fabricated and used by MossIA ANS at the Bane NOR Intercity (SMS 2A) Railway Project. It is a double rail project through and under the municipality of Moss in Norway. It consists of 2 tunnels: under Moss (2.7 km), and from Moss station to Carlberg (2.3 km); Moss Station (800m); 2 significant culverts: Kransen and Carlberg; and 10 km demolition of the existing tracks. B35 MF45 is produced in two twins Batching Plants located in Granittveien 10 in Våler. It has high quality and durability that will withstand mechanical, climatic and local environmental conditions throughout the life of the construction. It will be used for structures subjected to frost resistance conditions according to the drawings provided by the engineering company. The concrete is assigned with B35 strength and MF45 durability class, which is related to the required maximum water-binder ratio and the frost resistance condition.

All concrete characteristics and tolerances follow the requirements set out in NS-EN 206 Standard. The strength of both was determined based on tests conforming to EN 12390-1 and made and cured in accordance with EN 12390-2 from samples taken in accordance with EN 12350-1; according to NS-EN 206.

The life expectancy of the tunnel as well as the studied concrete is at least 150 years taking into

account technical requirements specified on the MossIA project.

Regarding to production process, there are two twins independent batching plants to produce concrete for the project. There is also a shed to store the aggregates and protect them against the weather. For producing concrete, all raw materials are mixed on the concrete plant, taking into account dosages determined on laboratory tests. Product produced is trucked to the tunnel for the application

4. FUNCTIONAL UNIT

According to construction products PCR Construction products and construction services 2012:01, version 2.33 and PCR 2012:01-SUB-PCR-G Concrete and Concrete elements (EN 16757:2017), the Declared Unit provides a reference by means of which the material flows of the information module of a construction product are normalized to produce data, expressed on a common basis. The Declared Unit of this EPD is 1 m³ of concrete with a B35 strength class and 2.3 Ton/m³ of density.

5. SYSTEM BOUNDARIES AND DATA QUALITY

Life cycle stages and information modules are defined in the standard EN 15804+A1. This "Cradle-to gate" LCA analysis includes only upstream module (*A1-A3 Production stage*) as is shown in Figure 2. This EPD considers extraction and processing of raw materials, transportation up of raw material to the factory gate, and manufacturing of the concrete according to PCR Construction products and construction services 2012:01, version 2.33 and PCR 2012:01-SUB-PCR-G Concrete and Concrete elements (EN 16757:2017). The impact method CML 2001 (updated in January 2016) has been used. This model is an LCA methodology developed by the Center of Environmental

Science (CML) of Leiden University in the Netherlands.

Production Stage A1-A3			Construction Stage A4-A5		Use Stage B1-B7							End-of-Life Stage C1-C4				Benefits and loads beyond the D
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	
Raw material supply	Transport	Manufacturing	Transport	Construction	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Demolition	Transport	Waste processing	Disposal	Re-use recovery and recycling potential
X	X	X	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA

Figure 1. Stages of the LCA according to EN15804

At least 99% of the total materials and energy consumption, and 95% of the materials and energy consumption by stage have been included. The substances contained in the product that are listed in the “Candidate List of Substances of Very High Concern (SVHC) for authorization”¹ do not exceed 0,1% weight of the product. The verifier and the program operator do not make any claim nor have any responsibility of the legality of the product.

The electricity used comes from Norway national grid in 2020 is composed of 96.2% hydropower, 1.4% wind power, 1.8% natural gas, 0.3% waste, 0.2 hard coal and 0.1% others. [database 2019, GaBi software]. The contribution to global warming of the Norwegian gas is 0.031 kg CO₂ equiv./kWh.

The time coverage for data collection is one year. The geographical system boundary is Norway. All processes are valid for the production sites in Norway. An overview of system boundaries and included processes are given in Figure 2.

Where necessary an allocation based in mass has been applied. Both the polluter payer and modularity principles have been followed.

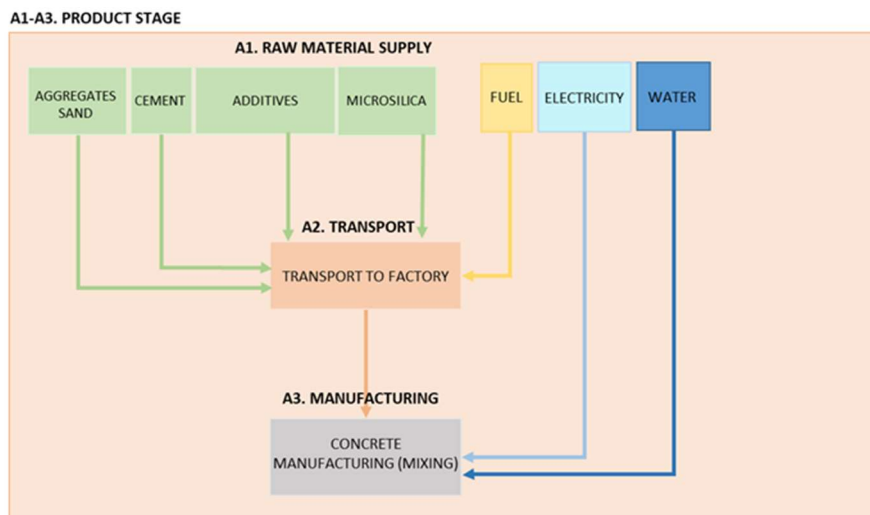


Figure 2. System boundaries of the production of the 1 m³ of concrete

6. CONTENT DECLARATION

Specific data regarding concrete production, origin and quantities of raw materials as well as energy requirements were collected from the

¹ <https://echa.europa.eu/web/guest/candidate-list-table>

work site. All available data were considered for the LCA assessment of the production stage (A1-A3) of the concrete. The material and energy flows are presented by all raw materials, and electric power consumption. Environmental information from EPDs listed below was taken into account in LCA analysis. For such indicators that are not included in the EPDs, environmental impacts were determined using Gabi Database.

- NEPD-2275-1028-NO.Norcem
Standardsement FA, Brevik - CEM II/B-M 42.5 R. EPD NORGE
- NEPD-1383-447-NO. Steelfibre (DE 35/0.55 DE 50/0.75 og DE 50/1.0). Mapei AS. EPD NORGE
- EPD-EFC-20150091-IAG1-EN.
Concrete admixtures, Plasticisers and Superplasticisers. EFCA
- EPD-EFC-20150086-IAG1-EN.
Concrete admixtures – Air entrainers. EFCA

The same applies to the transport A2 - from the factory of raw materials to the factory of concrete, located at Bane NOR Intercity (SMS 2A) -. All these data are owned and provided by MossIA ANS. All necessary background data relevant for modelling of the production process were taken from database within *Gabi ts 2020* (Gabi Software-System and Database). The

geographical representativeness of data reflects the region where the production is located, Norway in this case. Energy consumption was determined taking into account the real consumption of the plant for producing 1m³ of B35 MF45 concrete.

Life cycle inventory (LCI) includes the main raw materials used. The weight of raw materials is given in the table below:

Table 1. Required raw materials for production of 1 m³ of concrete

COMPONENTS	WEIGHT (%)
Cement	12-14
Silica dust	0,4-0,5
Sand	40-50
Aggregate	35-40
Additives	0,1-0,2
Water	6-8

Flows related to human activities such as employee transport are excluded. The construction of plants, production of machines and transportation systems are excluded since the related flows are supposed to be negligible compared to the production of the concrete when compared at these systems lifetime level.

7. ENVIRONMENTAL PERFORMANCE

The environmental performance section of the declaration is based on data provided by MossIA referring to 2020. Environmental potential was assessed according to EN 15804+A1 PCR Construction products and construction services 2012:01, version 2.33 and PCR 2012:01-SUB-PCR-G Concrete and Concrete elements (EN 16757:2017). The results are given per 1 m³ of concrete and include only production stage

module. The indicators presented in the table below were evaluated via *Gabi ts* software and taking into account, EPDs mentioned in content declaration part. Results of LCA analysis are presented in the following table. estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

Table 2: LCA results: Environmental Impacts for 1m³ of B35 MF45 concrete

PARAMETER	UNIT	B35 MF45			
Environmental Impact (CML 2001 - Jan. 2016)		A1	A2	A3	A1-A3
Abiotic Depletion (ADP elements)	kg Sb eq.	2,97E-05	1,55E-06	1,07E-06	3,24E-05
Abiotic Depletion (ADP fossil)	MJ	5,19E+02	8,18E+00	1,73E+02	7,01E+02
Acidification Potential (AP)	kg SO ₂ eq.	1,17E-01	7,63E-04	1,08E-02	1,29E-01
Eutrophication Potential (EP)	kg Phosphate eq.	2,81E-02	1,34E-04	2,25E-03	3,05E-02
Global Warming Potential (GWP 100 years)	kg CO ₂ eq.	2,01E+02	1,11E+00	1,28E+01	2,15E+02
Ozone Layer Depletion Potential (ODP, steady state)	kg CFC11 eq.	1,11E-06	1,08E-14	2,09E-15	1,11E-06
Photochem. Ozone Creation Potential (POCP)	kg Ethene eq.	5,95E-03	6,44E-05	-3,62E-04	5,65E-03
Resource use					
Use of renewable primary energy (PERE)	MJ	1,50E+01	1,58E+02	9,76E+00	1,83E+02
Use of primary renewable energy resources used as raw materials	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of renewable primary energy resources (PERT)	MJ	1,50E+01	1,58E+02	9,76E+00	1,83E+02
Use of non-renewable primary energy (PENRE)	ML	7,56E+01	1,17E+01	1,74E+02	2,61E+02
Use of primary non-renewable energy resources used as raw materials	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of non-renew. primary energy resources (PENRT)	MJ	7,56E+01	1,17E+01	1,74E+02	2,61E+02
Use of renewable secondary fuels (RSF)	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of non renewable secondary fuels (NRSF)	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Secondary materials	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water (FW)	m ³	1,12E-01	3,93E-01	1,13E-02	5,16E-01
Waste categories					
Hazardous waste disposed (HWD)	kg	1,10E-04	1,20E-08	8,09E-06	1,18E-04
Non-hazardous waste disposed (NHWD)	kg	9,78E+01	1,11E-01	2,66E-02	9,79E+01
Radioactive waste disposed (RWD)	kg	7,10E-03	1,47E-03	2,15E-04	8,79E-03

Table 3. Output flows categories of 1 m3 of B35 MF45SHO concrete

OUTPUT FLOWS	UNIT	A1-A3
Components for reuse	kg	0
Material for recycling	kg	0
materials for energy recovery	kg	0
Exported energy-electricity	kg	0
Exported energy-thermal	kg	0

As it can be seen in Table 2, the impact of the LCA of 1m³ of concrete is mainly dominated by stage A1 –Raw material supply-. This contributes with nearly 70-100% to the total environmental impacts. concrete included in this analysis was developed taking into account the compromise of MOSSIA project for reducing environmental

impacts in the concrete production. Since Global Warming Potential (GWP 100 years) point of view, it was possible to reduce CO₂ emissions not only using alternative materials but also applying all knowhow of the MOSSIA project for re-formulating a more sustainable concrete.

8. VERIFICATION AND CONTACT

Table 3: Verification information

ISO standard ISO 21930 and CEN standard EN15804 serves as the core Product Category Rules (PCR)
<p>Product Category Rules (PCR):</p> <p>PCR Construction products and construction services 2012:01, version 2.33</p> <p>PCR 2012:01-SUB-PCR-G Concrete and Concrete elements (EN 16757:2017)</p>
<p>PCR review was conducted by:</p> <p>The technical Committee of the International EPD® System. See www.environdenc.com for a list of members.</p> <p>Review chair: Massimo Marino. contact via info@environdenc.com</p>
<p>Independent third-party verification of the declaration and data, according to ISO 14025:2006</p> <p><input type="checkbox"/> EPD process certification <input checked="" type="checkbox"/> EPD verification</p>
<p>Third-party verifier:</p> <p>Marcel Gómez Ferrer</p> <p>Marcel Gómez Ferrer Consultoria Ambiental</p> <p>www.marcelgomez.com info@marcelgomez.com</p> <p>Barcelona SPAIN</p> <p>Approved by:</p> <p>The International EPD® System. Technical Committee, supported by the Secretariat</p>

Table 4: Contact information

<p><i>Contact in MossIA</i></p> <p><i>Martine Melgård</i></p> <p>martine.melgard@implenia.com</p> <p><i>Phone: +47 922 61 654</i></p> <p><i>Address: Dronningens gate 16. 1530 Moss</i></p> <p>www.mossia.net/en/</p>

9. REFERENCES

- EFCA. EPD-EFC-20150091-IAG1-EN. Concrete admixtures, Plasticisers and Superplasticisers.
- EFCA. EPD-EFC-20150086-IAG1-EN. Concrete admixtures – Air entrainers.
- EN 15804:2012+A1 Sustainability of construction works. Environmental product declaration. Core rules of the product category of construction products.
- EN 16757:2018 Sustainability of Construction Works - Environmental Product Declarations - Product Category Rules for Concrete and Concrete Elements
- ISO 14020:2000 Environmental labels and declarations. General principles.
- ISO 14025:2006 Environmental labels and declarations-Type III Environmental Declarations-Principles and procedures.
- ISO 14040:2006 Environmental management-Life Cycle Assessment-Principles and framework.
- ISO 14044:2006 Environmental management-Life Cycle Assessment-Requirements and guidelines.
- GaBi ts 2020. GaBi Software-System and Database for Life Cycle Engineering. Sphera.
- Norcem. NEPD-2275-1028-NO. Standardsement FA, Brevik - CEM II/B-M 42.5 R. EPD NORGE



- Mapei AS. NEPD-1383-447-NO. EPD NORGE Steelfibre (DE 35/0.55 DE 50/0.75 og DE 50/1.0).
- PCR 2012:01-SUB-PCR-G Concrete and Concrete elements (EN 16757:2017)
- PCR Construction products and construction services 2012:01, version 2.33