Environmental Product Declaration – EPD

ECO-ASFALT®

ENVIRONMENTAL PRODUCT DECLARATION IN ACCORDANCE WITH ISO 14025 AND EN 15804

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EPD®
THE INTERNATIONAL EPD® SYSTEM

PEAB
Peab Asfalt

Environmental Product Declaration

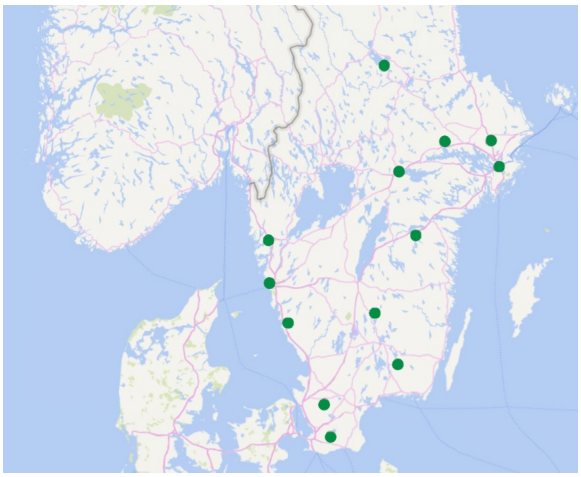
DESCRIPTION OF THE PRODUCT

The product ECO-Asfalt® was produced at thirteen of Peab Asfalt's stationary asphalt plants in Sweden in 2017, and total production of ECO-Asfalt® and ECO-Asfalt® Plus reached over 1.8 million tons. ECO-Asfalt® can completely replace conventional hot-mixed asphalt in all types of applications, such as high-speed roads, airfields, industrial plants, ports, streets and cycle paths.

The asphalt types covered in this EPD are AG, ABB, ABT and ABS, in all cases intended for the paving of roads. The intended use of the EPD is for business-to-business communication. As the variation in input between different production plants are small (t <10% in relation to all assessed impact categories), results are presented as averages for all thirteen plants.

ECO-Asfalt® is currently produced in the following stationary asphalt plants:

- Lekhyttan (Örebro)
- Dingtuna (Västerås)
- Västberga (Stockholm)
- Styvinge (Linköping)
- Kållered (Göteborg)
- Fröland (Uddevalla)
- Vålberg (Karlstad)
- Veberöd (Lund)
- Vidbo (Arlanda)
- Bjärsgård (Klippan)
- Rällsjön (Leksand)
- Linneryd (Linneryd)
- Sävsjö (Sävsjö)



Peab Asfalt intends to convert all of its remaining stationary asphalt plants in Sweden to producing ECO-Asfalt® by 2020.

PRODUCTION PROCEDURE

When making ECO-Asfalt®, bio-fuel is used for drying and heating the aggregate material, the process which requires the greatest amount of energy in the production process, see Figure 1. The asphalt plant receives unbound aggregate material in several fractions. These are dried, sieved and added to a pug mill in controlled proportions according to a recipe. The binder, bitumen, is stored in heated storage tanks and added to the aggregate material in the same way, together with an adhesive promoter, amine. When cellulose fibre is used (in ABS), it is added directly to the mixer. The pug mill drops the asphalt mix into isolated storage silos, according to mix type, after which trucks are loaded from the respective silo.

Reused asphalt (also illustrated in Figure 1) can be added to the mixture in a procedure similar to the drying of the aggregate material. This is further described in the section Additional environmental information.

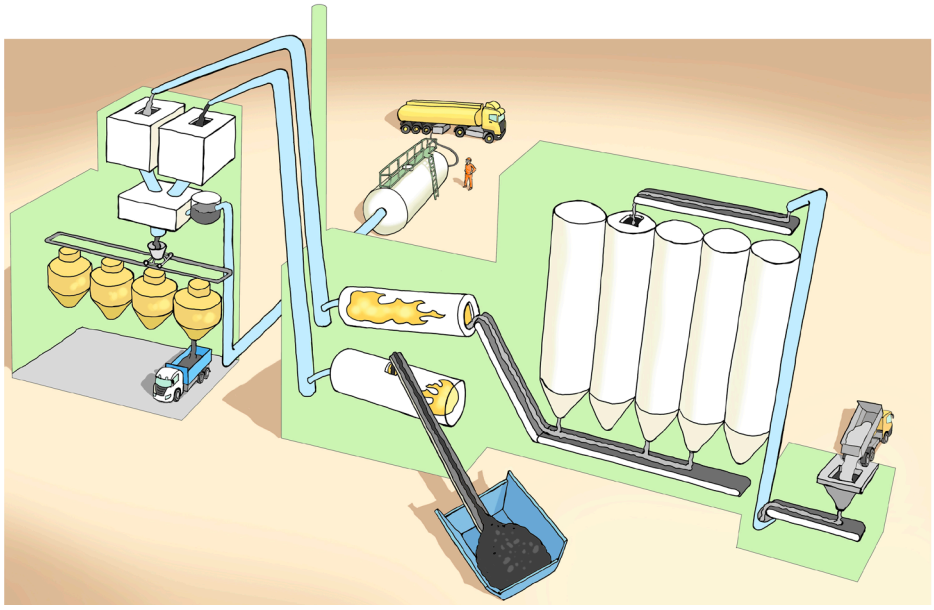


Figure 1 Illustration of the production procedure in an asphalt plant.

The composition of each type of asphalt produced in the plants included in the assessment is presented in Table 1, and details for each of the components are presented in Table 2.

Table 1 Composition declaration of the asphalt types declared. Data might not total 100% due to rounding.

Weight-%	AG 4,8%	ABB 5,2%	ABS 6,6%	AG 4,8% PMB	ABB 5,2% PMB	ABT 6,4% PMB	ABS 6,6% PMB	ABS 6,6% special stone	ABS 6,6% PMB special stone
Aggregate	95,20	94,80	93,36	95,20	94,80	93,60	93,36	28,00	98,00
Bitumen	4,80	5,20	6,60	-	-	-	-	6,60	-
Polymer bitumen (PMB)	-	-	-	4,80	5,20	6,40	6,60	-	6,60
Adhesion material	3,0E-04	3,0E-04	4,0E-04	4,0E-04	3,0E-04	4,0E-04	4,0E-04	4,0E-04	4,0E-04
Cellulose	-	-	0,035	-	-	-	0,035	0,035	0,035
Special stone	-	-	-	-	-	-	-	65,36	65,36

”E-” is written as a substitute for the number of zeros. For example 3,5 E-02 means 0,035.

Table 2 Details regarding the content of the asphalt type declared.

Component	Trade name	Substance name	CAS no	REACH no	Classification
Mineral rock aggregate	-	Granite, porphyry	-	-	-
Bitumen	Nynas 50/70, 70/100, 100/150, 160/220	-	8052-42-4	01-2119480172-44	Not classified
Adhesion material	Wetfix BE	Fatty acids, C18 unsaturated, reaction product with ammonia-ethanolamine reaction by-products	68910-93-0 272-756-1	01-2119492544-31-0000	H315 Skin irritation H318 Severe eye damages H400 Aquatic acute H410 Aquatic chronic
	Terra E	Ashes, Lime (CaO)	1305-78-8	01-2119475325-36-0030	H315 Skin irritation H318 Severe eye damages H335 May cause respiratory irritation
Cellulose	On-Way Arbocel ZG 8-1	Cellulose Calcium carbonate	9004-34-6 471-34-1	NA	NA
	Topcel	Cellulose Natural wax	9004-34-6 8002-53-7	NA	NA

Life cycle assessment – General information

DECLARED UNIT

The declared unit is 1 ton (1000 kg) of asphalt at production plant gate. The asphalt is manufactured according to relevant standards, mainly described in SS-EN standards and AMA Anläggning 13.

METHODOLOGY

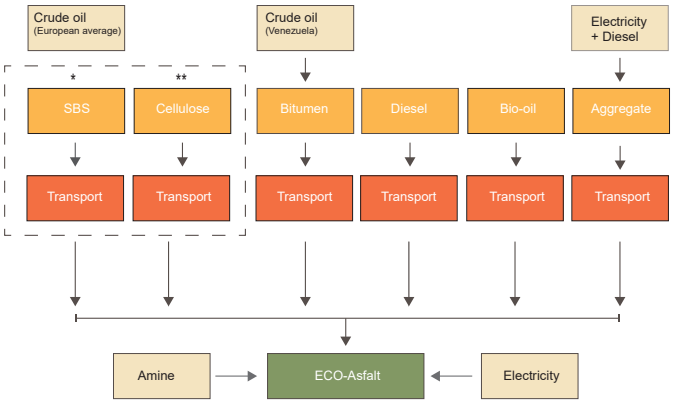
The environmental impact of Peab Asfalt's product ECO-Asfalt® was calculated according to the rules of the CEN standard EN 15804. The PCR Construction products and construction services 2012 v.2.2 (EPD International, 2012) is the basis for the calculation of the life cycle assessment (LCA) from cradle to gate, modelled in GaBi. The aim of the LCA was to serve as basis for the development of an EPD.

SYSTEM BOUNDARY AND ALLOCATION

The LCA covers the cradle-to gate stages, i.e. extraction and transports of raw materials (upstream modules A1-A2) and manufacturing to production plant gate (core module A3), see Figure 2 and Figure 3. The LCA covers all thirteen Swedish production plants where ECO-Asfalt® has been produced since January 2017.

Upstream	Core		Downstream													Other env. info
Production stage			Construction process		Use stage							End of life stage				Resource recovery stage
Raw material supply	Transport	Manufacturing	Transport	Manufacturing	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-constrction demoli-tion	Transport	Waste processing	Disposal	Future reuse, recycling or energy recovery potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Figure 2 The system boundaries of the LCA. Modules of the production life cycle included in the EPD. (X = declared module; MND = not declared module).



* SBS (styrene butadiene styrene) is included only in PMB. In PMB, bitumen is assumed to be based on European average crude oil.
** Cellulose - only in ABS (1 of 4 products presented in the EPD)

Figure 3 The declared modules are extraction and transports of raw materials (upstream modules A1-A2) and manufacturing to production plant gate (core module A3).

In the life cycle inventory (LCI), mass allocation is used for extraction and transport and economic allocation is used when byproduct with lower economic value occurs e.g. for the refinery stage (Eurobitumen, 2012). Bio-oil used for energy provision in the production of ECO-Asfalt® was modelled with an economic allocation for the allocation of environmental burdens between the main product (vegetable oils used in the food industry) and by-products (free fat-acids sold as fuel under the name “bio-oil”). The allocation is based on the allocation methods presented in the PCR used in the development of the present life cycle assessment (LCA).

In accordance with the PCR used, LCI-data for a minimum of 95% of total inflows (mass and energy) to the upstream and core module were included, and no data with an assumed potential importance in the included modules were omitted from the modelling. Motor and hydraulic oil used in machinery, as well as waste generated from the use of such products were not included in the LCA. Neither were production packaging of input materials nor handling of these packaging waste.

COMPARABILITY

EPD of construction products may not be comparable if they do not comply with EN 15804.

Life cycle inventory data

All foreground data are site specific and collected over 12 months in each of the thirteen production plants where ECO-Asfalt® is produced. Data includes storage of bitumen at the production site. Site specific data was also used for modelling of production and transport of aggregate. As no EPD is available for the bitumen produced by Nynas, representative LCI data for Venezuela bitumen from Eurobitume (2012) was used.

For electricity used in the production process (module A3), data for green electricity (hydro power) is applied, using data from EPD (Vattenfall Vattenkraft AB, 2015). Diesel was used as transport fuel, using generic data from the GaBi database.

Background data was collected from the GaBi database, and is geographically representative of the production site location and less than five years old. The overall data quality can be described as good.

Life cycle assessment – Results

The results of the life cycle assessment of 1 ton (1000 kg) of asphalt of various types are given in Table 3 to Table 6, presenting Potential environmental impact, Use of resources, Waste production and Output flows.

Potential environmental impact

Table 3 Results of the LCA, modules A1-A3 – Potential environmental impact for 1 ton (1000 kg) of specific asphalt types.

Impact category	Unit	AG 16	ABB 22	ABT 16	ABS 11	AG 16 PMB	ABB 22 PMB	ABT 16 PMB	ABS 11 PMB	ABS 11 special stone	ABS 11 PMB special stone
Global Warming Potential*	kg CO_2-Equiv.	26,2	27,5	31,6	34,3	32,6	34,4	40,1	43,0	34,8	43,5
Acidification Potential	kg SO_2-Equiv.	0,3	0,3	0,3	0,4	0,4	0,4	0,4	0,4	0,3	0,4
Eutrophication Potential	kg Phosphate-Equiv.	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
Ozone Layer Depletion	kg R11-Equiv.	1,9E-06	1,9E-06	2,1E-06	2,2E-06	1,9E-06	1,9E-06	2,1E-06	2,1E-06	2,4E-06	2,4E-06
Photochem, Ozone Creation Potential	kg Ethene-Equiv.	3,5E-02	3,6E-02	3,9E-02	4,0E-02	4,3E-02	4,5E-02	5,1E-02	5,2E-02	3,3E-02	4,4E-02
Abiotic Depletion (elements)	kg Sb-Equiv.	3,1E-05	3,1E-05	3,1E-05	3,1E-05	3,1E-05	3,1E-05	3,1E-05	3,1E-05	3,7E-05	3,7E-05
Abiotic Depletion (fossil)	MJ	2316	2499	3056	3163	2402	2593	3171	3282	3180	3330

”E-” is written as a substitute for the number of zeros. For example 3,5 E-02 means 0,035.
* The GWP indicator does not account for biogenic carbon stored in the final product.

Environmental impact across all categories varies less than 5% between the asphalt plants.

Use of resources

Table 4 Results of the LCA, modules A1-A3 – Use of resources for 1 ton (1000 kg) of specific asphalt types.

Impact category	Unit	AG 16	ABB 22	ABT 16	ABS 11	AG 16 PMB	ABB 22 PMB	ABT 16 PMB	ABS 11 PMB	ABS 11 special stone	ABS 11 PMB special stone
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	267	267	267	267	267	267	267	267	268	268
Use of renewable primary energy resources used as raw materials	MJ	0	0	1	36	0	0	1	36	36	36
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	267	267	267	303	267	267	267	303	304	304
Use of non-renewable primary energy excluding non- renewable primary energy resources used as raw materials	MJ	2161	2340	2882	2988	2253	2440	3005	3115	2988	3115
Use of non-renewable primary energy resources used as raw materials	MJ	162	167	182	185	160	165	180	182	230	227
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2323	2507	3064	3173	2413	2605	3185	3297	3218	3342
Use of secondary material	kg	0	0	0	0	0	0	0	0	0	0
Use of renewable secondary fuels	kg	0	0	0	0	0	0	0	0	0	0
Use of non-renewable secondary fuels	kg	0	0	0	0	0	0	0	0	0	0
Use of net fresh water	m^3	1,15	1,15	1,15	1,15	1,48	1,51	1,59	1,61	1,15	1,61

Waste production

Table 5 Results of the LCA, modules A1-A3 – Waste production for 1 ton (1000 kg) of specific asphalt types.

Results	Unit	AG 16	ABB 22	ABT 16	ABS 11	AG 16 PMB	ABB 22 PMB	ABT 16 PMB	ABS 11 PMB	ABS 11 special stone	ABS 11 PMB special stone
Hazardous waste disposed	kg	2,8E-06	2,8E-06	3,0E-06	3,1E-06	9,9E-05	1,1E-04	1,3E-04	1,3E-04	5,3E-06	1,4E-04
Non-hazardous waste disposed	kg	0,8	0,8	1,0	3,8	0,8	0,8	0,9	3,8	4,0	4,0
Radioactive waste disposed	kg	1,7E-04	1,8E-04	2,0E-04	8,6E-04	1,7E-04	1,8E-04	2,0E-04	8,6E-04	9,5E-04	9,5E-04

”E-” is written as a substitute for the number of zeros. For example 3,5 E-02 means 0,035.

Output flows

Table 6 Results of the LCA, modules A1-A3 – Output flows for 1 ton (1000 kg) of specific asphalt types.

Results	Unit	AG 16	ABB 22	ABT 16	ABS 11	AG 16 PMB	ABB 22 PMB	ABT 16 PMB	ABS 11 PMB	ABS 11 special stone	ABS 11 PMB special stone
Components for re-use	kg	0	0	0	0	0	0	0	0	0	0
Materials for recycling	kg	0	0	0	0	0	0	0	0	0	0
Materials for energy recovery	kg	0	0	0	0	9,3E-04	1,0E-03	1,2E-03	1,3E-03	0	1,3E-03
Exported energy	MJ	0	0	0	0	0	0	0	0	0	0

”E-” is written as a substitute for the number of zeros. For example 3,5 E-02 means 0,035.

Additional environmental information

Asphalt is 100% recyclable, offering the possibility to reduce environmental impact by reducing the need for new raw materials. Today, reused asphalt is included in the manufacture of new asphalt for several applications, with maintained technical performance. The recommended amount will however vary from case to case. The below example shows the potential environmental impact from including 10% reused asphalt.

Table 7 Result of Potential environmental impact including 10% reused material content, modules A1-A3.

Impact category	Unit	AG 16 10% RAP	ABB 22 10% RAP	ABT 16 10% RAP	ABS 11 10% RAP	AG 16 PMB 10% RAP	ABB 22 PMB 10% RAP	ABT 16 PMB 10% RAP	ABS 11 PMB 10% RAP	ABS 11 special stone 10% RAP	ABS 11 PMB special stone 10% RAP
Global Warming Potential (exluding biogenic CO_2)	kg CO_2-Equiv.	25,1	26,4	30,5	33,2	30,9	32,7	38,4	41,3	33,7	41,8
Acidification Potential	kg SO_2-Equiv.	0,3	0,3	0,3	0,3	0,3	0,4	0,4	0,4	0,3	0,4
Eutrophication Potential	kg Phosphate-Equiv.	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
Ozone Layer Depletion	kg R11-Equiv.	1,89E-06	1,96E-06	2,15E-06	2,19E-06	1,87E-06	1,93E-06	2,13E-06	2,16E-06	2,44E-06	2,41E-06
Photochem, Ozone Creation Potential	kg Ethene-Equiv.	0,03	0,03	0,04	0,04	0,04	0,04	0,05	0,05	0,03	0,04
Abiotic Depletion (elements)	kg Sb-Equiv.	3,06E-05	3,06E-05	3,07E-05	3,08E-05	3,06E-05	3,06E-05	3,06E-05	3,08E-05	2,68E-05	2,68E-05
Abiotic Depletion (fossil)	MJ	2120	2290	2860	2960	2190	2380	2960	3070	2980	3090

”E-” is written as a substitute for the number of zeros. For example 3,5 E-02 means 0,035.

RAP = Reclaimed asphalt pavement

When using the Swedish Transport Administration’s (Trafikverket) lifecycle calculation tool EKA, the results diverge from the results presented in this EPD. This is mainly due to two global warming potential values, GWP. The GWP value for bitumen used in EKA, from Eurobitume LCI 2012, is without regard to the actual crude bitumen oil source in Venezuela. The GWP value for bio-oil used in EKA considers the bio-oil to be carbon dioxide neutral with only a small contribution from extraction and transportation, in accordance with the sustainability criteria of the Swedish Renewables act (Hållbarhetslagen 2011) and as certified by the Swedish Energy Agency (Energimyndigheten). The results from EKA are presented in Table 8 and 9 with and without a 10% reused material content.

Table 8 Result of Potential environmental impact, according to Trafikverket´s tool EKA, modules A1-A3.

Impact category	Unit	AG 16	ABB 22	ABT 16	ABS 11	AG 16 PMB	ABB 22 PMB	ABT 16 PMB	ABS 11 PMB	ABS 11 special stone	ABS 11 PMB special stone
Global Warming Potential	kg CO_2-Equiv.	15,9	16,7	19,3	20,4	24,5	26,1	30,8	32,3	30,4	42,3

Table 9 Result of Potential environmental impact including 10% reused material content, according to Trafikverket´ s tool EKA, modules A1-A3.

Impact category	Unit	AG 16 10% RAP	ABB 22 10% RAP	ABT 16 10% RAP	ABS 11 10% RAP	AG 16 PMB 10% RAP	ABB 22 PMB 10% RAP	ABT 16 PMB 10% RAP	ABS 11 PMB 10% RAP	ABS 11 special stone 10% RAP	ABS 11 PMB special stone 10% RAP
Global Warming Potential	kg CO_2-Equiv.	14,4	15,2	17,8	18,9	22,3	23,8	28,6	30,1	28,8	40,0

RAP = Reclaimed asphalt pavement

Verification details

DECLARATION OWNER
Peab Asfalt AB

PROGRAMME OPERATOR
The International EPD® System

EPD International AB
Box 210 60
SE-100 31 Stockholm
Sweden
info@environdec.com
www.environdec.com

VERIFICATION
CEN standard EN 15804 served as the core PCR.

PCR:	PCR 2012:01 Construction products and Construction services. Version 2.2, 2017-05-30
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Massimo Marino. Contact via info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:	☐ EPD process certification (Internal) ☒ EPD verification (External)
Third party verifier:	Martin Erlandsson Tel: +46 8 587 940 00 Martin.Erlandsson@IVL.se Sweden
Accredited or approved by:	The International EPD® System

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COMISSIONER OF LCA STUDY

Peab Asfalt AB

LCA PRACTITIONER

Yannos Wikström, IVL

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2018-05-17

ADDITIONAL INFORMATION

Peab Asfalt is quality certified according to ISO 9001 and environmentally certified according to ISO 14001.

All of Peab Asfalt's asphalt plants deliver CE-marked asphalt as required by SS-EN ISO 13108-1-8 and SS-EN ISO 13108-20-21.

Environmental product declarations within the same product category from different programs may not be comparable.

This EPD version includes thirteen asphalt plants instead of eight.

The EPD also includes results of the product's GWP-value when using the lifecycle calculation tool EKA.

References

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About Peab Asfalt AB

Peab Asfalt AB, a subsidiary of Peab AB, is one of Sweden's leading asphalt companies and the only one with a nation-wide coverage, specializing in the production and deployment of hot, semi-hot, cold-mixed asphalt and sealcoating, The company has approximately 700 employees, operates all over in Sweden and has a subsidiary in Norway, Peab Asfalt Norge AS.

The success of Peab Asfalt is based on strong local presence where the company's business is characterized by good business ethics, skills and professionalism, Peab Asfalt's ambition is to take responsibility throughout the entire value chain for the environmental impact, The strive is to reduce climate impact, ensure a highly material effective operation and work actively to phase out environmental and health hazardous materials.

Peab Asfalt is striving to reduce the waste of old asphalt in coating work by reusing asphalt as much as possible in the manufacture of new asphalt, Through the reuse of asphalt directly in place, transportations to landfills are reduced, as well as the need for bitumen and rock materials.

Find out more at peabasfalt.se.

Peab Asfalt AB • Margretetorpsvägen 84 • 269 73 Förslöv • 0431-890 00