Environmental Product Declaration for asphalt mixtures from Stockholm mastic asphalt plant – Arlanda

According to EN 15804:2012+A2:2019/AC:2021, ISO 14025, ISO 14040 and ISO 14044

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EPD owner: NCC Industry Nordic AB

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The asphalt mixtures declared in the EPD are:

- BPM 93
- BPGJA 8
- BPGJA 8 VAX
- BPGJA 8 Skyddslager
- BPGJA 11
- BPGJA 11 An7
- BPGJA 16
- BINAPONT
- STALLMASSA
- SPÅR 4
- BCS 2-4
- ABT 11 160/220
- ABT 11 160/220 HAND
- AG 16 160/220
- AG 22 160/220

EPD INFORMATION	
Declared unit:	1000 kg product
PCR:	Product Category Rules PCR 2019:14 Construction products, version 1.11 of 2021-02-05
Programme:	The International EPD® System, www.environdec.com

1. General product information

The asphalt mixtures declared are manufactured at the Stockholm mastic asphalt plant in Arlanda, by NCC Industry, Division Asphalt in Sweden.

Asphalt plants manufacture asphalt mixtures for paving purposes. The asphalt mixtures that can be produced at the declared plant are hot mix asphalt (HMA) and polymer modified asphalt (PMB).

The main components in asphalt mixtures are mineral rock aggregates and bitumen. Other materials are added, and the content varies depending on the asphalt type. These include for instance wax and fibre and they normally constitute less than 0.5 weight-% of the product. The content declaration of the asphalt mixtures declared is shown in the section Content declaration including packaging, Table 4.

The temperature class for the asphalt mixtures are given in Table 1.

Table 1: Temperature class for the asphalt mixtures declared.

#	Asphalt mixture	Temperature class
1	BPM 93	PMB
2	BPGJA 8	PMB
3	BPGJA 8 VAX	PMB
4	BPGJA 8 Skyddslager	PMB
5	BPGJA 11	PMB
6	BPGJA 11 An7	PMB
7	BPGJA 16	PMB
8	BINAPONT	PMB
9	STALLMASSA	PMB
10	SPÅR 4	PMB
11	BCS 2-4	PMB
12	ABT 11 160/220	HMA
13	ABT 11 160/220 HAND	HMA
14	AG 16 160/220	HMA
15	AG 22 160/220	HMA

At the asphalt plant, the manufacture of a typical asphalt mixture is managed from the on-site control room where adjustments are made to individual raw materials. A schematic illustration of an asphalt plant is shown in Figure 1.

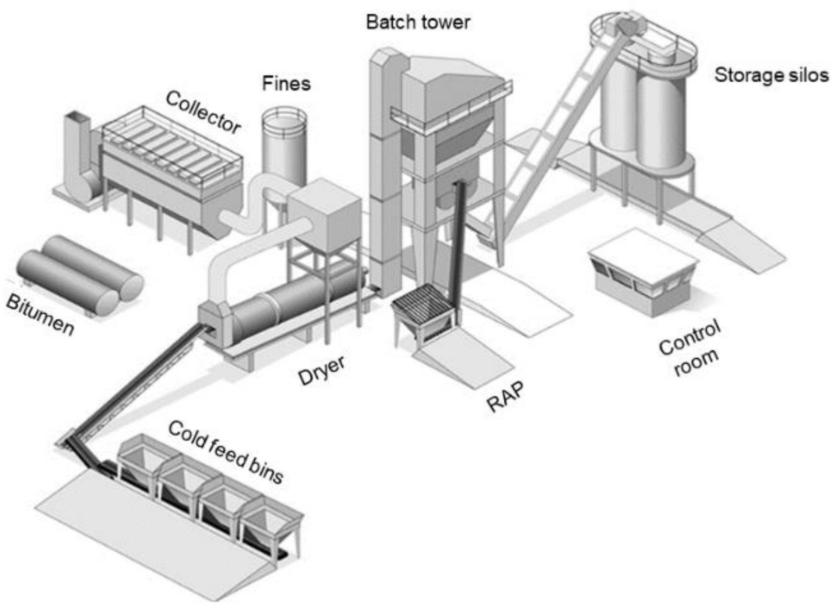

Figure 1: Schematic illustration of an asphalt plant.

Aggregates, which are obtained either from the quarry on-site or purchased from external suppliers, are stored in stockpiles of different fractions (e.g. 0/4, 4/8 and 8/11 etc). The aggregates in an individual stockpile are hauled to a cold feed bin of the asphalt plant before transported further, together with the other aggregate fractions of a given recipe, by a conveyor belt running below the bins. The mixed aggregates enter a rotating dryer drum, where the material is dried and heated to desired temperature. The heated material continues to an elevator and is further transported up to the batch tower.

The next step comprises screening using a hot screen were the heated aggregates are separated according to grain size and put into a weigh hopper. The material is mixed with bitumen, filler, fibres and other additives, such as adhesive agents (amines or cement), in the mixing chamber. When a homogeneous asphalt mixture is obtained it is transferred with a skip hoist to an insulated storage silo before being retrieved by a truck.

It is important to treat emissions (i.e. polyaromatic hydrocarbons, PAHs) generated in the dryer drum. Such emissions largely depend on production temperature, fuel type, amount and type of technique used for adding RAP. Depending on technique used, PAHs created at the drying drum or at the top of the batch tower are transported for filtering at the collector.

The products declared are classified as the United Nations Central Product Classification (UN CPC) code 15330. The products declared follow the technical standards SS-EN 13108-1, SS-EN 13108-5 and SS-EN 13108-6.

The geographical location of the mastic asphalt in Arlanda asphalt plant is shown in Figure 2.

Figure 2: Map and picture showing the geographical location of the declared plant.

2. Declared unit

The declared unit is 1 tonne (1000 kg) of asphalt mixture.

3. System boundary

The system boundaries cover aspects such as temporal and geographical. The setting of system boundaries follows two principles according to EN 15804: (1) The "modularity principle" and (2) the "polluter pays principle". This is a "cradle to gate with modules C1–C4 and module D" EPD and is based on an LCA model described in the background report and in the related annex (see reference list). The declared modules are A1-A3, C, D, see Figure 3. The product system under study is presented in Figure 4. Figure 4 is modified and originates from the PCR 2018:04 Asphalt Mixtures, version 1.03 of 2019-09-06. The figure has been slightly adjusted to be in line with EN 15804.

	Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundary
	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	Reuse, recovery, recycling potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	SE/ EU	SE/ EU	SE	-	-	-	-	-	-	-	-	-	SE	SE	SE	SE	SE
Specific data	>90%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	Not relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	Not relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-

Figure 3: Modules of the life cycle included in the EPD, reporting models declared, geography, share of specific data (in GWP-GHG indicator) and data variation.

Data that represent the current situation production process at the plant are used. All input data used in the LCA model (e.g. raw materials and production data) that NCC Industry has influence over are plant specific data for the production period December 2019 to November 2020. The geographical scope, i.e. location(s) of use and end-of-life performance, is Sweden.

The environmental impact from infrastructure, construction, production equipment, and tools that are not directly consumed in the production process are not accounted for in the Life Cycle Inventory (LCI). Personnel-related impacts, such as transportation to and from work, are neither accounted for in the LCI.

Declaration of the RSL is only possible if B1-B5 are included, i.e. RSL is not assessed.

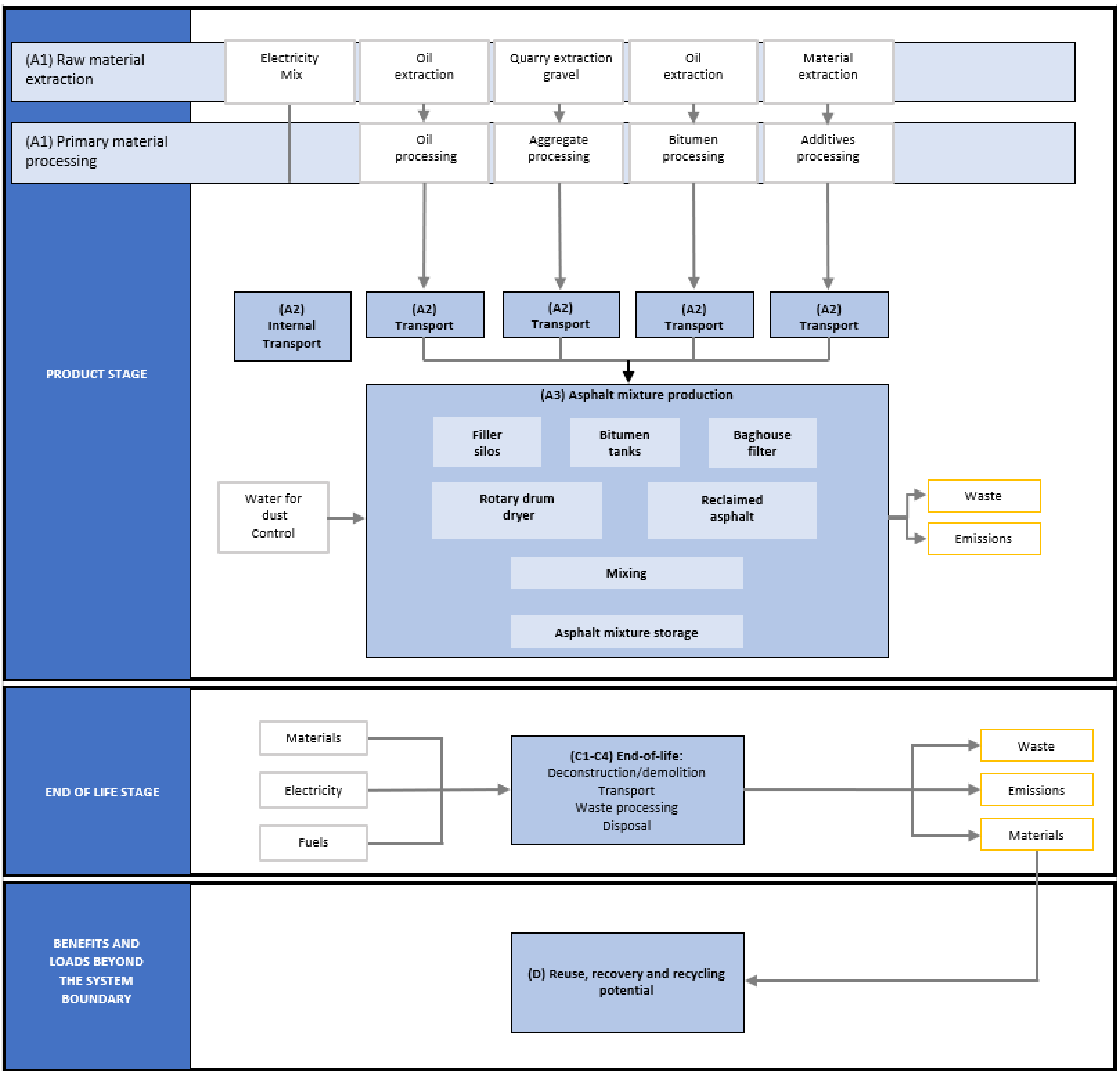

Figure 4: System boundaries for the studied product system.

4. Assumptions and approximations

PAHs emitted to air during production are approximately 40 mg per tonne asphalt produced. This is based on that bitumen heated to about 150°C emits PAHs less than 10 mg/kg*h heated (The German BITUMEN Forum 2016). The hot bitumen is contained in a closed system so no direct emission to air occurs at the asphalt plant, except when the asphalt is transported in contact with outside air. According to measurements and expertise judgments on-site, the time when the asphalt mixture is exposed to air is about five minutes. This time frame is a very conservative estimate. This means that the total direct PAH emissions to air during production are on average 40 mg/tonne asphalt produced.

5. Allocation

The asphalt manufacturing process does not produce any co-products.

During normal production in an asphalt plant, steady-state in terms of mass flow or temperatures rarely exists. Instead there are numerous transients with varying extensions and time delays. In addition, there are ad-hoc adjustments within a specific asphalt mixture because of e.g. weather and transport distance. Therefore, the heat required for specific asphalt mixtures cannot simply be inferred from statistical production data. Instead, allocation between mixtures are based on yearly sums of produced amounts of asphalts and used energy, which is subsequently allocated to mixtures according to a thermodynamic model of asphalt heating described in Ekblad and Lundström (2013). The allocation model is described in the background documentation to this EPD.

Concerning the manufacture of various mixtures, four temperature classes are defined with respect to their annual average production temperature as summarized in Table 2. The average temperature for each class is based on local experience and requirements in standards. Production temperatures can vary slightly between plants.

Table 2: Temperature classes and corresponding average production temperatures.

Temperature class	Annual average production temperature [°C]
Polymer modified (PMB)	180
Conventional hot mix asphalt (HMA)	165

6. Cut-offs

The cut-off criteria are 1% of the renewable and non-renewable primary energy usage and 1% of the total mass input of the manufacture process (according to the EN 15804 standard).

In the assessment, all available data from the production process are considered, i.e. all raw materials used, utilised ancillary materials, and energy consumption using the best available LCI GaBi datasets.

The following cut-offs have been made:

- The packaging for the input materials used in the production process are negligible.
- Lubricants used in the asphalt plant production are negligible.

7. Software and database

The LCA software GaBi Professional and its integrated database from Sphera has been used in the LCA modelling. See the list of references.

8. Electricity in manufacturing

If the electricity in module A3 accounts for more than 30% of the total energy in stage A1 to A3, the energy sources behind the electricity grid in module A3 shall be documented, including the LCA data of grams CO_2 eq./kWh. The information is given in Table 3.

Table 3: Electricity in manufacturing (A3).

Energy source	LCA data (g CO2 eq./kWh)
Hydropower	14.3

9. Data quality

The primary data collected by the manufacturer are based on the required materials and energy to manufacture the product. The data of the raw materials are collected per declared unit. All necessary life cycle inventories for the basic materials are available in the GaBi database or via EPDs. No generic selected datasets (secondary data) used are older than ten years. No specific data collected is older than five years and represent a period of about one year. The representativeness, completeness, reliability and consistency are judged as good.

10. About NCC

NCC is one of the leading construction and property development companies in the Nordic region, with sales of 5.4 billion Euro and approximately 14 500 employees in 2020. With the Nordic region as its home market, NCC is active throughout the value chain – developing commercial properties and constructing housing, offices, industrial facilities and public buildings, roads, civil engineering structures and other types of infrastructure. NCC also offers input materials used in construction and accounts for paving and road services.

NCC's vision is to renew our industry and provide superior sustainable solutions. NCC aims to be the leading society builder of sustainable environments and will proactively develop businesses in line with this.

NCC works to reduce both our own and our customers' environmental impact and continues to further refine our offerings with additional products and solutions for sustainability. In terms of the environment, this entails that NCC, at every step of the supply chain, is to offer resource and energy-efficient products and solutions to help our customers reduce their environmental impact and to operate more sustainably.

NCC's sustainability work is based on a holistic approach with all three dimensions of sustainability – social, environmental and economical. In NCC's new sustainability framework, our focus areas with regards to sustainability are defined; Climate and Energy, Materials & Waste, Social Inclusion, Health & Safety, Compliance and Portfolio Performance. Our sustainability strategy includes the aim of being both a leader and a pioneer in these areas.

NCC reports on its sustainability progress each year and the report has been included in NCC's Annual Report since 2010. NCC applies Global Reporting Initiative (GRI) Standards, the voluntary guidelines of the GRI for the reporting of sustainability information. In addition to GRI, NCC also reports the Group's emission of greenhouse gases to the CDP each year. NCC is a member in BSCI (Business Social Compliance Initiative), which is the broadest business-driven platform for the improvement of social compliance in the global supply chain and has been a member of the UN Global Compact since 2010. The UN Global Compact is a strategic policy initiative for businesses that are committed to aligning their operations and strategies with 10 defined and universally accepted principles in the areas of human rights, labour, environment and anti-corruption.

Also visit: https://www.ncc.group/sustainability

11. EPD owner

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CONTENT DECLARATION INCLUDING PACKAGING

The products do not contain any substances of very high concern (SVHC) according to REACH. Table 4 presents the content of all asphalt mixtures as ranges since it is at corporate secrecy and varies depending of the mixture. The mass of biogenic carbon in the products is less than 5%. The packaging material is negligible.

Table 4: Content declaration of the asphalt mixtures declared (ranges for declared products).

Product component	Weight, kg	Post-consumer material, weight-%	Renewable material weight-%
Aggregates 0/2	0 – 975	*	0
Aggregates 2/4	0 – 225	*	0
Aggregates 4/8	0 – 336	*	0
Aggregates 8/11	0 – 261	*	0
Aggregates 11/16	0 – 185	*	0
Quality aggregates 4/8	0 – 160	*	0
Quality aggregates 8/11	0 – 265	*	0
Crushed limestone	0 – 640	0	0
Bitumen, virgin	0 – 60	0	0
Polymer modified bitumen (PMB), virgin	0 – 300	0	0
Feldspar flour	0 – 217	0	0
Wax	<10	0	0
Baghouse fines	0 – 60	100**	0
Packaging material	**Weight, kg**	**Weight-% (versus the product)**	
Negligible for all product components	Negligible	Negligible	

*Data is not available, probably 0.
**Could be either pre- or post-consumer material.

The environmental performance results are presented for asphalt mixtures.

The results of the life cycle assessment based on the declared unit for asphalt mixtures are presented in Table 5 and 6 (core environmental indicators), Table 7 and 8 (resource use) and Table 9 and 10 (waste categories and output flows).

Table 5: Results of the LCA (modules A1-A3) – Core environmental indicators per declared unit of specific asphalt mixtures.

Core environmental indicators			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
			BPM 93	BPGJA 8	BPGJA 8 VAX	BPGJA 8 Skyddslager	BPGJA 11	BPGJA 11 An7	BPGJA 16	BINAPONT	STALLMASSA	SPÅR 4	BCS 2-4	ABT 11 160/220	ABT 11 160/220 HAND	AG 16 160/220	AG 22 160/220
Impact category		Unit	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3
Climate change	Total	kg CO_2 eq.	108	78	79	79	76	77	76	175	91	97	47	52	52	50	49
	Fossil* **	kg CO_2 eq.	108**	78**	79**	79**	76**	77**	76**	175**	91**	97**	47**	52*	52*	50*	49*
	Biogenic***	kg CO_2 eq.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Land use and land use change	kg CO_2 eq.	0.05	0.04	0.04	0.04	0.04	0.06	0.04	0.11	0.05	0.06	2.6E-03	0.01	0.01	0.01	0.01
	GWP-GHG	kg CO_2 eq.	108	78	79	79	76	77	76	175	91	97	47	52	52	50	49
Ozone depletion		kg CFC 11 eq.	1.9E-11	2.3E-11	2.3E-11	2.3E-11	2.3E-11	1.9E-11	2.4E-11	2.7E-13	2.3E-11	2.2E-11	3.3E-11	3.0E-11	3.0E-11	3.1E-11	3.1E-11
Acidification		mol H+ eq.	0.62	0.35	0.34	0.36	0.33	0.34	0.34	1.1	0.46	0.50	0.11	0.18	0.18	0.16	0.15
Eutrophication aquatic freshwater		kg P eq.	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.01	0.01	1.6E-03	1.1E-05	1.1E-05	1.0E-05	1.0E-05
Eutrophication aquatic marine		kg N eq.	0.13	0.08	0.08	0.08	0.08	0.08	0.08	0.24	0.10	0.11	0.03	0.05	0.05	0.04	0.04
Eutrophication terrestrial		mol N eq.	1.4	0.86	0.84	0.89	0.83	0.87	0.83	2.5	1.1	1.2	0.35	0.54	0.54	0.50	0.46
Photochemical ozone formation		kg NMVOC eq.	0.43	0.26	0.25	0.27	0.25	0.26	0.25	0.78	0.33	0.35	0.10	0.17	0.17	0.15	0.14
Depletion of abiotic resources - minerals and metals		kg Sb eq.	3.5E-06	3.4E-06	3.9E-06	3.4E-06	3.4E-06	3.5E-06	3.3E-06	5.9E-06	3.4E-06	3.3E-06	2.0E-06	2.0E-06	2.0E-06	2.0E-06	2.0E-06
Depletion of abiotic resources - fossil fuels		MJ, net calorific value	8030	4440	4320	4585	4206	4180	4246	15086	5936	6434	1262	3150	3194	2793	2525
Water use		m^3 world eq. deprived	56	30	28	31	28	28	28	107	41	44	7.0	4.6	4.6	4.2	3.9

* The default value in the Swedish Transport Administration´s tool Klimatkalkyl is 49 kg per tonne asphalt mixture (6.5% bitumen) for A1-A3 (Trafikverket, Klimatkalkyl version 7.0, 2021)
** There is no default value in Klimatkalkyl for this type of asphalt mixture (polymer modified bitumen based). It is however expected to give higher impacts than other asphalt mixtures.
*** This indicator is set to zero, due to inconsistencies in the dataset used delivered by Sphera. Though, net result over the life cycle is zero since carbon uptake and emission is zero during a life-cycle.

Table 6: Results of the LCA (modules C and D) – Core environmental indicators per declared unit of specific asphalt mixtures.

Core environmental indicators			1-15				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
			All asphalt mixtures				BPM 93	BPGJA 8	BPGJA 8 VAX	BPGJA 8 Skydds-lager	BPGJA 11	BPGJA 11 An7	BPGJA 16	BINA-PONT	STALL-MASSA	SPÅR 4	BCS 2-4	ABT 11 160/220	ABT 11 160/220 HAND	AG 16 160/220	AG 22 160/220
Impact category		Unit	C1 (S1/S2)	C2	C3	C4	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Climate change	Total	kg CO_2 eq.	2.1/0.6	3.0	NR	0	-33	-17	-16	-18	-16	-17	-17	-63	-24	-26	-4,1	-13	-13	-11	-10
	Fossil	kg CO_2 eq.	2.0/0.6	3.0	NR	0	-33	-18	-16	-18	-16	-17	-17	-63	-24	-26	-4,1	-13	-13	-11	-10
	Biogenic	kg CO_2 eq.	0/0	0	NR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Land use and land use change	kg CO_2 eq.	0.02/0.01	0.02	NR	0	0.01	0.01	0.01	0.01	0.01	2.3E-03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	GWP-GHG	kg CO_2 eq.	2.1/0.6	3.0	NR	0	-33	-17	-16	-18	-16	-17	-17	-63	-24	-26	-4	-13	-13	-11	-10
Ozone depletion		kg CFC 11 eq.	2.8E-16/8.0E-17	6.0E-16	NR	0	-2.7E-11	-3.1E-11	-3.1E-11	-3.1E-11	-3.1E-11	-1.6E-11	-3.1E-11	-2.2E-11	-3.0E-11	-2.8E-11	-3.3E-11	-3.0E-11	-3.0E-11	-3.1E-11	-3.0E-11
Acidification		mol H+ eq.	0.02/0.01	0.01	NR	0	-0.3	-0.17	-0.16	-0.18	-0.16	-0,17	-0.16	-0.64	-0.24	-0.26	-0.03	-0.13	-0.13	-0.11	-0.10
Eutrophication aquatic freshwater		kg P eq.	6.5E-06/1.9E-06	9.1E-06	NR	0	4.0E-06	4.1E-06	4.1E-06	4.1E-06	4.1E-06	2.1E-07	4.1E-06	4.1E-06	4.2E-06	4.0E-06	4.0E-06	3.9E-06	3.9E-06	3.9E-06	3.9E-06
Eutrophication aquatic marine		kg N eq.	0.01/3.5E-03	4.7E-03	NR	0	-0.07	-0.04	-0.04	-0.04	-0.04	-0,04	-0.04	-0.14	-0.05	-0.06	-0.01	-0.03	-0.03	-0.02	-0.02
Eutrophication terrestrial		mol N eq.	0.12/0.04	0.05	NR	0	-0.80	-0.42	-0.39	-0.44	-0.40	-0.43	-0.40	-1.5	-0.58	-0.63	-0.09	-0.31	-0.32	-0.27	-0.24
Photochemical ozone formation		kg NMVOC eq.	0.03/0.01	0.01	NR	0	-0.27	-0.14	-0.13	-0.15	-0.13	-0.14	-0,13	-0.53	-0.20	-0.21	-0.03	-0.10	-0.11	-0.09	-0.08
Depletion of abiotic resources - minerals and metals		kg Sb eq.	1.6E-07/4.8E-08	2.7E-07	NR	0	-1.2E-07	-1.5E-07	-1.5E-07	-1.5E-07	-1.5E-07	-1,5E-07	-1.5E-07	-7.1E-08	-1.4E-07	-1.3E-07	-1.7E-07	-1.5E-07	-1.5E-07	-1.6E-07	-1.6E-07
Depletion of abiotic resources - fossil fuels		MJ, net calorific value	28/8.4	41	NR	0	-6890	-3560	-3293	-3692	-3337	-3301	-3381	-13332	-4936	-5380	-672	-2626	-2670	-2271	-2004
Water use		m^3 world eq. deprived	0.11/0.01	0.03	NR	0	-7.6	-4.1	-4.0	-4.2	-3.8	-3.7	-3.9	-15	-5.5	-6.0	-1.0	-3.0	-3.1	-2.7	-2.4

Table 7: Results of the LCA (modules A1- A3) – Resource use per declared unit of specific asphalt mixtures.

Use of resources		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		BPM 93	BPGJA 8	BPGJA 8 VAX	BPGJA 8 Skyddslager	BPGJA 11	BPGJA 11 An7	BPGJA 16	BINAPONT	STALLMASSA	SPÅR 4	BCS 2-4	ABT 11 160/220	ABT 11 160/220 HAND	AG 16 160/220	AG 22 160/220
Parameter	Unit	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3
Use of renewable primary energy excl. renewable primary energy resources used as raw materials	MJ, net calorific value	168	168	171	167	169	167	166	204	167	164	146	145	145	145	145
Use of renewable primary energy as raw materials	MJ, net calorific value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total use of renewable primary energy	MJ, net calorific value	168	168	171	167	169	167	166	204	167	164	146	145	145	145	145
Use of non-renewable primary energy excl. non-renewable primary energy resources used as raw materials	MJ, net calorific value	1550	1100	1220	1113	1069	1086	1067	2539	1294	1374	634	653	655	634	620
Use of non-renewable primary energy as raw materials	MJ, net calorific value	6480	3350	3090	3471	3137	3095	3178	12547	4642	5060	627	2497	2540	2159	1905
Total use of non-renewable primary energy	MJ, net calorific value	8030	4440	4320	4585	4206	4181	4246	15086	5936	6434	1262	3150	3194	2793	2525
Use of secondary material	kg	40	10	10	0	10	20	10	60	0	40	10	42	52	37	53
Use of renewable secondary fuels	MJ, net calorific value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Use of non-renewable secondary fuels	MJ, net calorific value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Use of net fresh water	m^3	1.6	1.0	0.98	1.1	1.0	0.97	1.0	2.8	1.3	1.4	0.50	0.44	0.44	0.43	0.42

Table 8: Results of the LCA (modules C and D) – Resource use per declared unit of specific asphalt mixtures.

Use of resources		1-15				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		All asphalt mixtures				BPM 93	BPGJA 8	BPGJA 8 VAX	BPGJA 8 Skyddslager	BPGJA 11	BPGJA 11 An7	BPGJA 16	BINAPONT	STALL-MASSA	SPÅR 4	BCS 2-4	ABT 11 160/220	ABT 11 160/220 HAND	AG 16 160/220	AG 22 160/220
Parameter	Unit	C1 (S1/S2)	C2	C3	C4	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Use of renewable primary energy excl. renewable primary energy resources used as raw materials	MJ, net calorific value	1.6/0.47	2.3	NR	0	-12	-14	-14	-14	-14	-12	-14	-9.4	-13	-13	-15	-14	-13	-14	-14
Use of renewable primary energy as raw materials	MJ, net calorific value	0/0	0	NR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total use of renewable primary energy	MJ, net calorific value	1.6/0.47	2.3	NR	0	-12	-14	-14	-14	-14	-12	-14	-9.4	-13	-13	-15	-14	-13	-14	-14
Use of non-renewable primary energy excl. non-renewable primary energy resources used as raw materials	MJ, net calorific value	28/8.4	41	NR	0	-330	-173	-160	-179	-162	-169	-164	-633	-238	-258	-37	-129	-131	-112	-99
Use of non-renewable primary energy as raw materials	MJ, net calorific value	0/0	0	NR	0	-6560	-3390	-3130	-3513	-3175	-3132	-3217	-12699	-4699	-5122	-635	-2497	-2540	-2159	-1905
Total use of non-renewable primary energy	MJ, net calorific value	28/8.4	41	NR	0	-6890	-3560	-3290	-3692	-3337	-3301	-3381	-13332	-4936	-5380	-672	-2626	-2670	-2271	-2004
Use of secondary material	kg	0/0	0	NR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Use of renewable secondary fuels	MJ, net calorific value	0/0	0	NR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Use of non-renewable secondary fuels	MJ, net calorific value	0/0	0	NR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Use of net fresh water	m^3	2.2E-02/5.4E-04	2.7E-03	NR	0	-0.21	-0.13	-0.13	-0.13	-0.13	-0.12	-0.13	-0.36	-0.16	-0.17	-0.06	-0.11	-0.11	-0.10	-0.09

Table 9: Results of the LCA (modules A1- A3) – Waste categories and output flows per declared unit of specific asphalt mixtures.

Waste categories & output flows		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		BPM 93	BPGJA 8	BPGJA 8 VAX	BPGJA 8 Skyddslager	BPGJA 11	BPGJA 11 An7	BPGJA 16	BINAPONT	STALLMASSA	SPÅR 4	BCS 2-4	ABT 11 160/220	ABT 11 160/220 HAND	AG 16 160/220	AG 22 160/220
Parameter/Indicator	Unit	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3	A1-3
Hazardous waste disposed	kg	3.9E-03	4.7E-03	4.7E-03	4.8E-03	4.7E-03	1.7E-03	4.9E-03	4.8E-08	4.7E-03	4.6E-03	0.01	0.01	0.01	0.01	0.01
Non-hazardous waste disposed	kg	0.34	0.34	0.36	0.34	0.34	0.34	0.34	0.40	0.34	0.34	0.31	0.30	0.30	0.30	0.30
Radioactive waste disposed	kg	4.4E-03	4.2E-03	4.9E-03	4.1E-03	4.3E-03	4.3E-03	4.0E-03	0.01	4.0E-03	3.6E-03	1.3E-03	1.2E-03	1.2E-03	1.2E-03	1.24E-03
Components for re-use	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Materials for recycling	kg	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Materials for energy recovery	kg	0.08	0.09	0.09	0.09	0.09	0.08	0.09	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Exported energy	MJ per energy carrier	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 10: Results of the LCA (modules C and D) – Waste categories and output flows per declared unit of specific asphalt mixtures.

Waste categories & output flows		1-15				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		All asphalt mixtures				BPM 93	BPGJA 8	BPGJA 8 VAX	BPGJA 8 Skydds-lager	BPGJA 11	BPGJA 11 An7	BPGJA 16	BINAPONT	STALL-MASSA	SPÅR 4	BCS 2-4	ABT 11 160/220	ABT 11 160/220 HAND	AG 16 160/220	AG 22 160/220
Parameter/ Indicator	Unit	C1 (S1/S2)	C2	C3	C4	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Hazardous waste disposed	kg	1.4E-09/4.2E-10	2.2E-09	NR	0	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-4.5E-03	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Non-hazardous waste disposed	kg	9.9E-03/1.3E-03	6.4E-03	NR	0	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01	-0.01
Radioactive waste disposed	kg	3.5E-05/1.0E-05	7.4E-05	NR	0	-8.6E-05	-1.0E-04	-1.0E-04	-1.0E-04	-1.0E-04	-1.2E-04	-1.0E-04	-6.1E-05	-9.7E-05	-9.1E-05	-1.1E-04	-1.0E-04	-9.9E-05	-1.0E-04	-1.01E-04
Components for re-use	kg	0/0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Materials for recycling*	kg	0/0	0	**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Materials for energy recovery	kg	0/0	0	0	0	-0.01	-0.01	-0.01	-0.01	-0.01	-4.3E-03	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Exported energy	MJ per energy carrier	0/0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*100% of the all asphalt mixtures are assumed to be material recycled in the next life cycle. However, this figure presents the net flow going to module D.

** BPM 93: 960, BPGJA 8: 990, BPGJA 8 VAX: 990, BPGJA 8 Skyddslager: 1000, BPGJA 11: 990, BPGJA 11 An7: 980, BPGJA 16: 990, BINAPONT: 940, STALLMASSA: 1000, SPÅR 4: 960, BCS 2-4: 990, ABT 11 160/220: 958, ABT 11 160/220 HAND: 948, AG 16 160/220: 963, AG 22 160/220: 947.

Table 11: Additional environmental impact indicators are only declared in the Annex to the General background report.

Additional environmental impact indicators		
Impact category	Unit	Module A1-D
Particulate matter emissions	Disease incidence	Not declared in EPD, see Background Annex Report
Ionizing radiation, human health	kBq U235 eq.	Not declared in EPD, see Background Annex Report
Eco-toxicity (freshwater)	CTUe	Not declared in EPD, see Background Annex Report
Human toxicity, cancer effects	CTUh	Not declared in EPD, see Background Annex Report
Human toxicity, non-cancer effects	CTUh	Not declared in EPD, see Background Annex Report
Land use related impacts/Soil quality	dimensionless	Not declared in EPD, see Background Annex Report

Table 12: Classification of disclaimers to the declaration of core and additional environmental impact indicators.

ILCD classification	Indicator	Disclaimer
ILCD Type 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
	Potential incidence of disease due to PM emissions (PM)	None
ILCD Type 2	Acidification potential, Accumulated Exceedance (AP)	None
	Eutrophication potential, Fraction of nutrients reaching freshwater end compartment (EP-freshwater)	None
	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD Type 3	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2
	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2
Disclaimer 1 – This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.		
Disclaimer 2 – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.		

1. General information

Components in asphalt, such as aggregates and bitumen, are finite resources. Bitumen is a fossil resource. To extract aggregates or oil will affect the environment.

The production of asphalt mixtures requires equipment and vehicles running on fossil and renewable energy. The operations, including transports, cause mainly emissions and dust to air and disturbances such as noise.

Asphalt production is, depending on size, country and activities, regulated through specific legislation or site-specific decisions from authorities.

NCC's stationary plants in Denmark, Finland and Sweden are certified according to ISO 14001. The Business Management System in NCC Industry, including Norway, contains routines corresponding to this standard.

In the Nordic countries (Iceland excluded) approximately 1 tonne of asphalt mixtures per capita and year are produced and paved at our roads (EAPA, 2017). No asphalt is disposed during manufacture, application, maintenance or in the end-of life.

Since asphalt is a valuable resource, it is recycled into new asphalt mixtures. In NCC, Division Asphalt, 26% - as an average – of the produced asphalt mixtures originated from recycled asphalt pavements (RAP) during 2020.

Explanatory material is given in the background report to this EPD.

To read more about NCCs general sustainability work, please refer to our webpage:
https://www.ncc.group/sustainability

2. Release of dangerous substances to indoor air, soil and water during the use stage

According to EN 15804, the EPD does not need to give this information if the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonised test methods according to the provisions of the respective technical committees for European product standards are not available. This criterion is fulfilled for asphalt material.

3. Scenario information

For modules other than A1-A3, scenario-based information shall be declared for the products.

Module C

Scenario 1:

Pavement milling of asphalt is carried out in this scenario. It is further transported to the waste processing where it is crushed and sieved. It is assumed that all asphalt mixtures are recyclable, why no asphalt is sent for disposal. Crushing of RAP is accounted for in the next life cycle, to avoid double counting.

Scenario 2:

Asphalt excavation resulting in asphalt slabs is carried out in this scenario. It is further transported to the waste processing where it is crushed and sieved. It is assumed that all asphalt mixtures are recyclable, why no asphalt is sent for disposal. Crushing of RAP is accounted for in the next life cycle, to avoid double counting.

Table 13: Scenario-based information for end of life.

Scenario information	Unit (per declared unit)	Scenario 1 and 2
Collection process specified by type	kg collected separately	1000
	kg collected with mixed construction waste	0
Recovery system specified by type	kg for re-use	0
	kg for recycling	1000
	kg for energy recovery	0
Disposal specified by type	kg product or material for final disposal	0
Assumptions for scenario development, e.g. transportation	units as appropriate	Further scenario-based information is presented in the Annex of the Background Report

Module D

Information in module D aims at transparency of the environmental benefits or loads resulting from reusable products, recyclable materials and/or useful energy carriers leaving a product system e.g. as secondary materials or fuels.

Loads are assigned to module D for materials and fuels (that have left the system from any of the modules A4-C4) where further processing occur after the end-of-waste state is reached. This, in order to replace primary material or fuel input in another product system.

Benefits are assigned to module D for materials and fuels (that have left the system in any of the modules A4-C4) that can substitute primary material of fuels that do not need to be produced. A functional equivalence must be reached.

The substitution effect is only calculating the resulting net output flow. In this case, it is the weight of asphalt mixtures minus the amount of baghouse fines. The net output flow for the asphalt mixtures declared can be found in Table 14.

Table 14: Net output flow for module D per declared unit.

#	Asphalt mixture	Mass (kg)
1	BPM 93	960
2	BPGJA 8	990
3	BPGJA 8 VAX	990
4	BPGJA 8 Skyddslager	1000
5	BPGJA 11	990
6	BPGJA 11 An7	980
7	BPGJA 16	990
8	BINAPONT	940
9	SPÅR 4	960
10	BCS 2-4	990
11	ABT 11 160/220	958
12	ABT 11 160/220 HAND	948
13	AG 16 160/220	963
14	AG 22 160/220	947

Loads accounted for are crushing of the RAP (the same in both scenarios).

Benefits accounted for are aggregates and bitumen material which are replaced by RAP (the same in both scenarios).

The specific calculation procedure is described in the Annex of the Background Report.

This EPD is developed by NCC Industry Nordic AB. It is a result from an EPD certification process verified by Bureau Veritas. The EPD is valid for five years (after which it can be revised and reissued). NCC Industry Nordic AB is the declaration owner and has the liability and responsibility for the EPD.

EPDs of construction products may not be comparable if they do not comply with EN 15804. EPDs within the same product category but from different programmes may not be comparable.

The aim of this EPD is that it shall provide objective and reliable information on the environmental impact of the production of the declared product.

Table 15: Verification details.

CEN standard EN 15804 served as the core Product Category Rules (PCR)	
Product Category Rules (PCR):	PCR 2019:14 Construction products, version 1.11
PCR review was conducted by:	The Technical Committee of the International EPD® System. See www.environdec.com/TC for a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact.
Independent third-party verification of the declaration and data, according to ISO 14025:2006:	☒ EPD process certification (Internal) ☐ EPD verification (External)
Certification body:	Bureau Veritas
Accredited:	SWEDAC
Procedure for follow-up of data during EPD validity involves third party verifier:	☒ Yes ☐ No

Address of programme operator: EPD International AB, Box 210 60, SE-100 31 Stockholm, Sweden, E-mail: info@environdec.com

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DIFFERENCES VERSUS PREVIOUS VERSIONS

Table 16: Versions of this EPD.

Date of revision	Description of difference versus previous versions
2021-04-26	Original version
2022-02-18	Editorial changes