



Guidance Document

for

preparing Product Category Rules (PCR)
and Environmental Product Declarations
(EPD) for Asphalt Mixtures

by the European Asphalt Pavement
Association
(EAPA)

2nd November 2016

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1. Introduction

Environmental Product Declarations (EPDs) have been developed as an approach to “providing quantified environmental data using predetermined parameters and, where relevant, additional environmental information” for products over their life cycle. Increasing demand from road owners, operators and users for sustainability and environmental accountability as included in the Construction Products Regulations has raised the need for producers to make EPDs available.

In order that EPDs for the same product or products may be compared or declared by different producers, they must be prepared on the same technical basis. Product Category Rules (PCR) enable EPDs to be prepared with a common methodology.

This Document seeks to provide guidance on preparing PCRs, and individual or generic EPDs for asphalt mixtures for the European market.

Further Explanation – Comparison of EPDs

Producers and users of EPDs need to be aware that as each product sector develops its own EPDs, under their own PCR, then it is generally not possible to compare the outputs of different products or product types e.g. EPDs for asphalt concrete and surface dressing can't be directly compared. Comparison between EPDs can only be realised between mixes that are used in the same application and provide the same performance.

This guidance document represents the current knowledge at the time of publication.

2. General information

These guidelines for product category rules (PCR) are intended for European companies (including companies located beyond the EU29) to prepare Environmental Product Declarations (EPDs) for asphalt mixtures. The guidelines were prepared by members of the “EAPA Task Group CFD” (see Appendix A).

The document references the requirements of the following standards

1. European Committee for Standardization, (EN). 15804:2012 “Sustainability of Construction Works – Environmental Product Declarations – Core rules for the product category of construction products.”
2. International Organization for Standardization (ISO) 14025:2006 “Environmental Labels and Declarations — Type III Environmental Declarations — Principles and Procedures.”



3. ISO 14040:2006 “Environmental Management – Life Cycle Assessment - Principles and Framework.”
4. ISO 14044:2006 “Environmental Management – Life Cycle Assessment –Requirements and Guidelines.”

This document is based upon information gathered from relevant documentation from Norway, France, UK, USA e.g. “Product Category Rules for preparing an environmental declaration for product group asphalt and crushed stone” by The Norwegian EPD Foundation published in 2010.

Any EPDs derived from the PCR based on this guidance document will still need to be third party validated. Validation is normally for a period of five years.

3. PCR Purpose

The PCR based on this guidance is developed to accommodate the use and implementation of Type III Environmental Product Declarations that will provide the basis for comparing cradle-to-gate environmental impacts for the production of asphalt mixtures in Europe. Producers or organisations who develop an EPD in accordance with this PCR guidance document maintain sole ownership and have sole responsibility and liability for their EPDs. EPDs compliant with this programme may be used as a data input for pavement life cycle assessments to compare the environmental impacts of different asphalt pavement alternatives only.

Further Explanation — Life Cycle Inventory Data

To minimize variances resulting from differences in choice of secondary data sources, all life cycle inventory data is described in this PCR guidance. Therefore, EPDs compliant with this document reflect only differences in primary data such as plant energy use, material use, and plant emissions. This provides an effective approach to compare the environmental impacts of the processes used in the production of asphalt mixtures.

4. Definitions

General definitions are given in the referenced standards.

1. Asphalt mixture - a homogenous mixture typically of coarse and fine aggregates, filler aggregate, bituminous binder, and additives which is used in the construction of a pavement. They are plant produced materials in accordance with EN 13108 series



European standard. The mixture may contain Reclaimed Asphalt **or** chemical additives or organic additives or pigment or fiber or combination of these to replace partially or completely some components.

2. Aggregate — granular material used in construction. Aggregate maybe natural, manufactured or recycled (see EN 13043).
3. Bituminous binder – a liquid residue obtained from the distillation of suitable crude oils or derived from naturally occurring deposits. Shall be a paving grade bitumen, a polymer modified bitumen, a hard-paving grade bitumen, a multigrade bitumen or a blend of one of them with natural asphalt. The paving grade bitumen shall be conforming to EN 12591, the modified bitumen to EN 14023, the hard-paving grade bitumen to EN 13924-1 and the multigrade bitumen to EN 13924-2.
4. Site-won Asphalt: the material to be recycled, in the form of milled asphalt road layers or as slabs ripped up from asphalt pavements, or being asphalt from reject, surplus or failing production.
5. Reclaimed Asphalt (RA) - a processed site won asphalt, suitable and **ready** to be used as constituent material for asphalt, after being tested, assessed and classified (EN 13108-8)
6. Mixture additives - used to enhance the laying characteristics, performance or appearance of the mixture
7. Primary data - any data item directly observed and collected
8. Secondary data - data inventories from other sources that have not been directly observed.

5. Acronyms

ADP: Abiotic Depletion Potential

EAPA: European Asphalt Pavement Association

EPD: Environmental product declaration

LCA: Life cycle assessment

LCI: Life cycle inventory

PCR: Product category rules

RA: Reclaimed Asphalt

RSL: Reference Service Life



6. Product Scope

This PCR guidance document is for Asphalt Mixture. The approach taken for this PCR may be considered applicable and adaptable for other bitumen based products.

This guideline provides PCRs that can be applied for a particular asphalt mixture, from a specific asphalt plant with a specific production temperature. Hence, the design of the asphalt mixture is necessary to produce the specific EPD.

Further Explanation — Asphalt Production Temperature

Reducing production temperatures can reduce energy requirements and thus lower the environmental impact of asphalt production. Different plants achieve temperature reductions in different ways; however, the use of RA and/or polymer-modified bitumen can place a limit on how low temperatures can be reduced. This creates significant variability in the actual temperatures at which asphalt mixtures are produced. Therefore, no differentiation is made between asphalt mixtures produced at different target temperatures as the plant production temperature will be declared in the EPD.

7. Declared Unit

One metric tonne of asphalt mixture.

8. System Boundaries

This PCR and EPD guidance accounts for processes that are within the bounds of phases A1: Raw Material Supply, A2: Transport and A3: Manufacturing of the product stage (see Figure 1). The system boundaries of this PCR and EPD guidance document are established in Figure 2.

The scope of the underlying life cycle assessment of the asphalt mixture is strictly, Cradle-to-Gate, with the gate being defined as the point at which the asphalt mixture is transferred from the silo at an asphalt plant to the truck for transport to consumer.

All inputs and outputs to the unit processes identified must be included in the calculation.

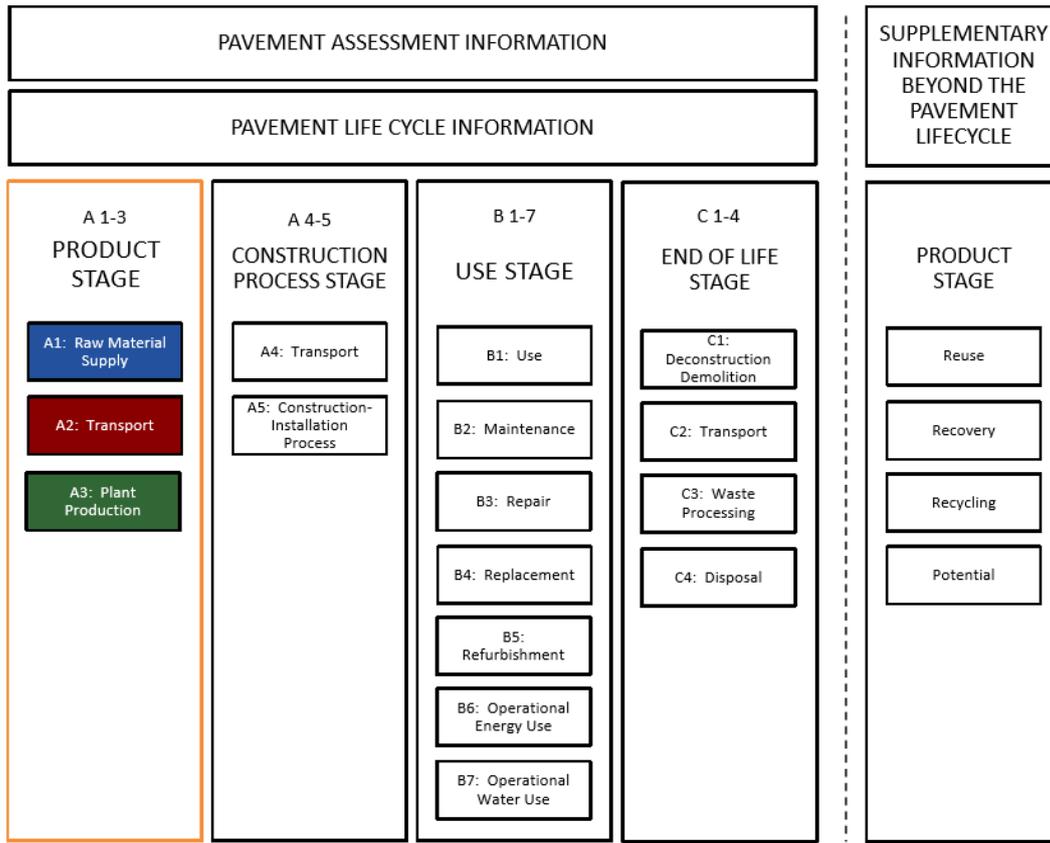


Figure 1: Diagram of designations of modular information used for life cycle assessments for pavements. The boundaries for this PCR and EPD guidance are in the left box outlined in orange, covering the product stage with phase A1 to A3

Processes in phase A1: Raw Material Supply

Data for all these processes will be based on secondary data, supplier data sources and/or existing national LCI data. Transportation distances that are part of upstream processes, involving transport of a raw material through the supply chain before it arrives to the plant, are considered part of the secondary data. The following impacts are included:

1. Impacts of all co-products of crude oil refining including extraction, transport, refining, and storage. The co-products of interest to this PCR guidance include gasoline, diesel, residual fuel oil, polymers, bitumen additives and bituminous binder. The Eurobitume LCI Methodology is used to allocate the relative impacts of the crude oil refining process across the different co- products.
2. Impacts associated with the extraction and production of burner fuels.
3. Impacts associated with the mining, extraction and production of aggregate.
4. Impacts associated with the use of asphalt additives (including water for foaming).
5. Impacts associated with the processing of site won asphalt to become RA.



Transportation of site won asphalt to the processing plant, is considered to be zero because it belongs to N-1 jobsite. This method is named "Stock method".

6. Impacts associated with the production of electricity and transmission to asphalt plant.

Processes in phase A2: Transport to Asphalt Mixing Plant

Transportation distances of raw materials to the plant are considered to be primary data.

1. Transportation of bituminous binders to the asphalt mixing plant.
2. Transportation of the burner fuels to the asphalt mixing plant.
3. Transportation of aggregate to the asphalt mixing plant.
4. Transportation of asphalt additives to the asphalt plant.
5. Transportation of RA from processing unit to asphalt plant.

Transportation of site won asphalt to the processing plant, is considered to be zero because it belongs to N-1 jobsite. This method is named "Stock method".

Processes in phase A3: Manufacturing

All data collected for this part of the system will be directly based on plant operations and will be considered primary data.

1. Energy (fuel and electricity) used at the plant for the mix production process including:
 - a. Vehicles used in moving aggregate and other related mobile equipment used on site for the production of asphalt mixtures.
 - b. Burner used for drying and heating of aggregates and RA
 - c. Heating of bituminous binder in storage tanks
 - d. Movement of materials (belts and conveyors) through the plant and mixing process
 - e. Asphalt mixture storage in silos.
 - f. Asphalt Additive addition completed at the plant
2. Total amount of water used on the plant for dust control, etc.
3. Total amount of bituminous binder, aggregates, reclaimed asphalt and additives used.
4. Output/Emissions from plant
 - a. Total plant emissions from stack according to ISO 14025.
 - b. Waste associated with plant and equipment maintenance activities (e.g. loader tires, lubricants, dust filter) may be included, even if they meet the cut-off criteria.

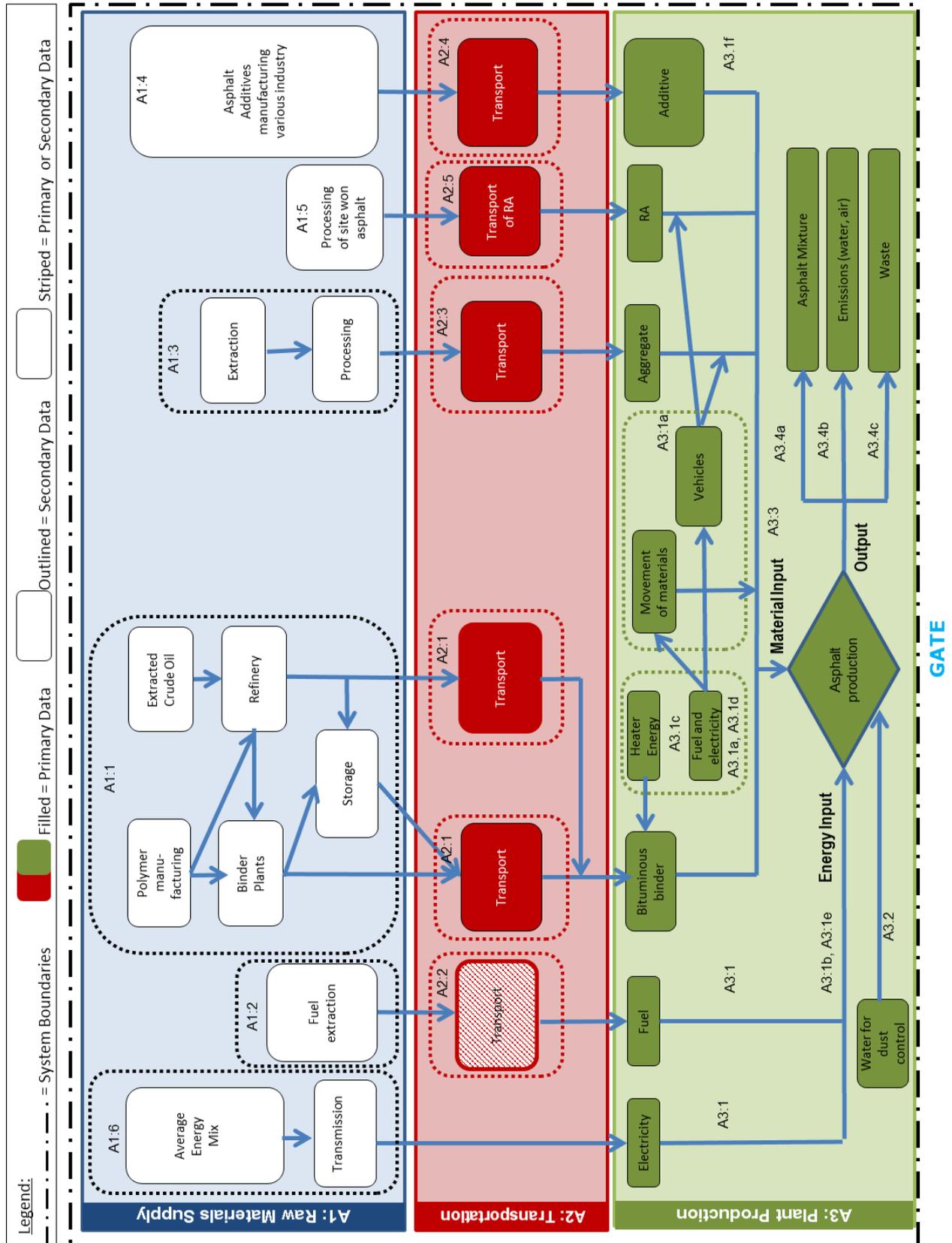


Figure 2: Diagram of the system boundaries, processes, and data types



9. Cut off Criteria

In order to simplify inventory activities, Standard EN 15804 allows a cut-off threshold of 99% of the mass of the input flows, provided that substances that are very toxic, toxic, harmful or hazardous to the environment and are intentionally introduced into the manufacturing of the assessed products should be taken into consideration.

1. In case of insufficient input data or data gaps for a unit process, the cutoff criteria shall be 1% of the total (renewable and non-renewable) primary energy usage and 1% of the total mass input of that unit process. The total sum of neglected input flows shall not exceed 5% of energy usage and mass. This applies particularly to material and energy flows known to have the potential to cause significant emissions into air and water or soil during the life cycle of the product; it also applies to processes that are known to be resource intensive.
2. Materials that are less than 1% of the total mass input but are considered environmentally relevant include additives and polymers such as those listed below. There are data gaps in their publicly available life cycle inventories and these materials should be included when publicly available data exists. This may include, but not limited to, the following:
 - a. Polymers in binder, broken down into two classes of chemicals: elastomers or rubbers, such as styrene-butadiene-styrene (SBS), and plastomers
 - b. Liquid antistrips, recycling agents, and warm-mix chemical additives
 - c. Fibres

All inputs and outputs to a (unit) process shall be included in the calculation, for which data are available. Data gaps may be filled by conservative assumptions with average or generic data. Any assumptions for such choices shall be documented.

10. Excluded from System Boundary

Upstream impacts of extraction, production, and manufacturing of any material that is not consumed in the production of the asphalt mixture is considered to be part of the plant infrastructure and therefore may be excluded from the system boundary.

These include:



- a) The asphalt mixture production equipment and machinery and its upkeep and maintenance, including dust filters, loader tyres, lubricants and any other substance used to facilitate the smooth functioning of the plant;
- b) Machinery for the recycling of site won asphalt
- c) Solar panels or any other alternative energy apparatus that is used to substitute traditional energy sources at the plant;
- d) General management, office, and headquarter operations; and
- e) Personnel at the plant or their commuting to and from the plant.

Note: Some member states may choose to include the mass of loaders and the mass of the plant.

11. Data Quality

Data sources should be publicly available and freely accessible to ensure transparency. Use of transparent data source will ensure comparability among EPDs developed using this PCR guidance document by limiting any variability due to differences in the upstream data within the system boundaries.

- 1. Age — Data should be no more than 5 years old, unless verified that it is unchanged.
- 2. Representativeness — Data should represent the technology in use.
- 3. Geography — Data should represent the proper geographical region.
- 4. Local data when available, and then regional or national data should be used.
- 5. Alternative data sources modified with the local energy mix may be used.
- 6. Precision — Data must be reported to no more than two significant figures.
- 7. Units —metric units have to be used.
- 8. Completeness — Must include all data within the defined system boundaries as noted in this PCR guidance document.
- 9. Uncertainty — Shall evaluate any assumptions and primary data through sensitivity analysis as noted in this PCR guidance document.



12. Life Cycle Inventory Analysis

Primary Data

Primary data should be collected in accordance with the following requirements:

1. Time Period: All data reported must be reflective of plant production over a period of 12 consecutive months, within the last 5 years.
2. Documents on File: Primary data reported should be based on utility and energy bills, production records, and other similar documents, all of which should be on file and easily accessible.
3. Accuracy Check: Sensitivity analysis of energy consumption per ton should be used to assess the accuracy of the primary data collected.
4. Data Gaps: Efforts should be made to ensure gaps in primary data collection are identified.

The following primary data should be reported

- a) Total asphalt produced at the plant, reported in metric tons.
- b) Total electricity
 - Line power use in kWh, based on the energy production mix for the region in which the plant is located.
 - Renewable energy generated on site in kWh
 - Generator energy fuel in liters
- c) Plant burner energy in MJ
- d) Storage tank heater energy in MJ
- e) Vehicles fuel in MJ
- f) Aggregate, bituminous binder, reclaimed asphalt and additives used in production in metric tons by mass
- g) Transport distances to plant for asphalt binder and aggregate expressed in metric tonne-kilometers.
- h) Water used in liters.
- i) Stack emissions from plant in kg

For the parameters that may be difficult to estimate or collect primary data for, the following estimates have been generated:

- Default energy requirements for processing of site won asphalt is about 47MJ/t in France (UNPG LCI 2011)



Secondary Data

If an EPD exists for a purchased sub-product, the EPD should be used as data source/input to the LCA

Secondary data shall be prioritized as follows,

1. Product-specific EPDs.
2. Industry-average EPDs.
3. Freely available public datasets. Data sources that are publicly available and freely accessible to ensure transparency can be used for the following upstream processes. Use of the prescribed data source will ensure comparability between EPDs developed using this PCR guidance.

The producer of the EPD shall apply data that is current and verified against national requirements.

The following life cycle inventory data are recommended:

1. Impacts of all co-products of crude oil refining including extraction, refining, transport and storage. The co-products of interest to this PCR guidance document include gasoline, diesel, residual fuel oil and bituminous binders. The Eurobitume study “Life Cycle Inventory of Bitumen” is used to allocate relative impacts of the crude oil refining process across the different co-products.
2. Impacts associated with the mining, extraction and production of aggregate: “Model Environmental Product Declaration for Aggregates” of UEPG.
3. Impacts associated with the transportation of raw material and fuels to plant based on primary transport distance data are typically determined at a national level.

13. Allocation

This section considers how environmental impacts of upstream products, including recycled products and products that originate in processes with multiple co-products, are allocated to the asphalt mixture.

1. Principle

Allocation must follow ISO 14044, which states:

- a) Allocation should be avoided, wherever possible.

- b) If allocation cannot be avoided, inputs and outputs of the system should be partitioned based on physical relationships before other alternative relationships, such as economic, are used.

2. Bituminous Binder

The allocation rules used in the Eurobitume study “Life Cycle Inventory of Bitumen” for the various stages of bituminous binder production should be applied:

Extraction and transport: allocation by mass,

Refining: economic allocation.

3. Recycled materials

- a) The upstream impacts associated with recycled/reclaimed materials previous life cycles, including production/manufacturing, transport and use are excluded from the system boundary, i.e. it arrives with zero allocation at the point of production / utilization for the production of new asphalt mixture.
- b) Impacts associated with the processes involved in preparing the recycled materials for use in the asphalt mixture are considered part of the system boundary. e.g. crushing, screening of site won asphalt to become RA at the plant site. If the processing is outside the asphalt mixing plant, transport has to be considered.

4. Asphalt Additives

When necessary, a mass based allocation should be applied.

14. Life Cycle Impact Assessment

EN 15804 states, that the impact assessment is carried out for the following impact categories, using characterisation factors applied in the European Reference Life Cycle Database (ELCD) provided by the European Commission - DG Joint Research Centre - Institute for Environment and Sustainability and shall follow the respective updates of the ELCD:

- global warming;
- ozone depletion;
- acidification of land and water;
- eutrophication;
- photochemical ozone creation;
- depletion of abiotic resources (elements);
- depletion of abiotic resources (fossil).

The characterisation factor for ADP (elements and fossil) shall be taken from CML (Institute of Environmental Sciences Faculty of Science University of Leiden, Netherlands). The characterisation factors for ADP-fossil fuels are the net calorific values at the point of extraction of the fossil fuels.

Further Explanation – Feedstock Energy

The bituminous binder has feedstock energy. Since it is unlikely the feedstock energy will be released as the asphalt mixture will not be used as a source of fuel beyond the life of the pavement, feedstock energy will be reported separately according to EN 15804, Table 4 “Use of non-renewable primary energy resources used as raw materials”. The use of the bituminous binder in the mixture helps avoid the impacts of further refining it, therefore it should not be counted negatively on the environmental impact of the asphalt mixture.

15. Content of the EPD

EN 15804 states which items of information are required to be declared in an EPD, see appendix B.

16. References

1. ISO 14025: 2006 Environmental labels and declarations –Type III environmental declarations – Principles and procedures
2. ISO 14044: 2006 Environmental management - life cycle assessment - requirements and guidelines
3. ISO 14001: 2004 Environmental management – Specification of the requirements of an environmental management system (EMS)
4. EN 15804: 2010 Sustainability of construction works – Environmental Product Declarations – core rules for the product category of construction products.
5. ISO 21930: 2007 Sustainability in building construction - Environmental declaration of building products
6. EN 12591: 2009 Bitumen and bituminous binders - Specifications for paving grade bitumens.
7. EN 14023: 2010 Bitumen and bituminous binders. Framework specification for polymer modified bitumens.
8. EN 13108: Bituminous mixtures – Materials specifications



9. EN 13924: 2016 Bitumen and bituminous binders - Specifications framework for special paving grade bitumen. Hard paving grade and multigrade bitumens.
10. "Life Cycle Inventory of Bitumen" , Eurobitume, 2011
11. "Module d'informations environnementales de la production de granulats recycle", Union National des Producteurs de Granulats (UNPG), 2011
12. "Product Category Rules for preparing an environmental declaration for product group asphalt and crushed stone", The Norwegian EPD Foundation, published 2010

**APPENDIX A:****PCR Development Working Group / EAPA Task Group
Carbon Footprint Document (TG CFD)**

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Iain Simpson	Mineral Products Association, UK
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APPENDIX B:

Content of the EPD according to EN 15804

1. Declaration of general information

The following items of general information are required and shall be declared in an EPD.

- a) the name and address of the asphalt mix producer;
- b) the description of the product's application and the declared unit to which the data relates;
- c) product identification by name (including any product code) and if applicable a simple visual graphic of the product;
- d) a description of the main product components and or materials;
- e) name of the EPD programme used and the EPD programme operator's name and address and, if relevant logo and website;
- f) the date the declaration was issued and the 5 year period of validity; and information on which life cycle stages are included and the system boundaries;
- h) a statement that EPD of construction products may not be comparable if they do not comply with this standard;
- i) in the case where an EPD is declared as an average environmental performance for a number of products a statement to that effect shall be included in the declaration together with a description of the range/ variability of the LCIA results if significant;
- j) the site(s), manufacturer or group of manufacturers or those representing them for whom the EPD is representative;
- k) the declaration of material content of the product shall list as a minimum substances contained in the product that are listed in the "Candidate List of Substances of Very High Concern for authorisation" when their content exceeds the limits for registration with the European Chemicals Agency (EChA);
- l) information on where explanatory material may be obtained.

In addition to the above-mentioned general information, Table 1 shall be completed and reproduced in the EPD.

CEN standard FprEN 15804 serves as the core PCR ^a
Independent verification of the declaration, according to EN ISO 14025:2010 <input type="checkbox"/> internal <input type="checkbox"/> external
(Where appropriate ^b) Third party verifier: <Name of the third party verifier>
^a Product category rules ^b Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4).

Table 1: Demonstration of verification

2. Declaration of environmental parameters derived from LCA

General

To illustrate the product system studied, the EPD shall contain a simple flow diagram of the processes included in the LCA. They shall be sub-divided at least into the life cycle stages of the product stage (see Figure 1). The EPD shall specify that it describes “Cradle to Gate”. For a “Cradle to Gate” EPD a declaration of the RSL is not possible. The RSL shall be declared as: “not specified”. Normally in this type of EPD module D is not declared;

Parameters describing environmental impacts

The following information on environmental impacts is expressed with the impact category parameters of LCIA using characterisation factors. These parameters are required and shall be included in the EPD as follows:



Impact Category	Parameter	Unit (expressed per functional unit or per declared unit)
Global Warming	Global warming potential, GWP;	kg CO ₂ equiv
Ozone Depletion	Depletion potential of the stratospheric ozone layer, ODP;	kg CFC 11 equiv
Acidification for soil and water	Acidification potential of soil and water, AP;	kg SO ₂ equiv
Eutrophication	Eutrophication potential, EP;	kg (PO ₄) ³⁻ equiv
Photochemical ozone creation	Formation potential of tropospheric ozone,, POCP;	kg Ethene equiv
Depletion of abiotic resources-elements	Abiotic depletion potential (ADP-elements) for non fossil resources ^a	kg Sb equiv
Depletion of abiotic resources-fossil fuels	Abiotic depletion potential (ADP-fossil fuels) for fossil resources ^a	MJ, net calorific value
^a The abiotic depletion potential is calculated and declared in two different indicators: <ul style="list-style-type: none"> • ADP-elements: include all non renewable, abiotic material resources (i.e. excepting fossil resources); • ADP -fossil fuels include all fossil resources. 		

Table 2: Parameters describing environmental impacts

Parameters describing resource use

The following environmental parameters apply data based on the LCI. They describe the use of renewable and non-renewable material resources, renewable and non-renewable primary energy and water. They are required and shall be included in the EPD as follows:

Parameter	Unit(expressed per functional unit or per declared unit)
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value
Use of renewable primary energy resources used as raw materials	MJ, net calorific value
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value
Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials	MJ, net calorific value
Use of non renewable primary energy resources used as raw materials	MJ, net calorific value
Total use of non renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value
Use of secondary material	kg
Use of renewable secondary fuels	MJ, net calorific value
Use of non renewable secondary fuels	MJ, net calorific value
Net use of fresh water	m ³

Table 3: Parameters describing resource use

Other environmental information describing different waste categories and output flows

The parameters describing waste categories and other material flows are output flows derived from LCI. They are required and shall be included in the EPD as follows:

Parameter	Unit(expressed per functional unit or per declared unit)
Hazardous waste disposed	kg
Non hazardous waste disposed	kg
Radioactive waste disposed	kg

Table 4: Other environmental information describing waste categories



Parameter	Unit (expressed per functional unit or per declared unit)
Components for re-use	kg
Materials for recycling	kg
Materials for energy recovery	kg
Exported energy	MJ per energy carrier

Table 5: Other environmental information describing output flows