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Material information required when transferring EPD / life cycle assessment data to ÖKOBAUDAT (Scope of application: life cycle assessment of buildings, eLCA)

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Preliminary remark:

The original of this document has been drawn up in German (Erforderliche Materialangaben bei der Datenübergabe von EPD-/Ökobilanzdaten an die ÖKOBAUDAT). The German version shall be the authentic one and prevail over the English one in all matters of interpretation and construction. The English version shall be deemed to be only a translation for information purposes.

Contents

1 Change documentation

Complete new revision

2 Relevance and scope

This document describes the requirements for material information in datasets in ÖKOBAUDAT. The aim of the specifications is to ensure the applicability of EPD datasets in tools for building life cycle assessment, in particular for the eLCA component editor (www.bauteileditor.de) developed by the federal government.

The LCA data in environmental product declarations are usually related to a declared unit. EN 15804 specifies the following unit types for this purpose:

- Piece (part), a combination of individual parts, e.g. 1 brick, 1 window
- Mass (kg), e.g. 1 kg of cement
- Length (m), e.g. 1 m pipe, 1 m beam
- Area (m^2), e.g. 1 m^2 of wall elements, 1 m^2 of roof elements
- Volume (m^3), e.g. 1 m^3 of timber, 1 m^3 of ready-mixed concrete

The use of other units must be justified. This includes, for example, the need to use the units commonly used in construction, planning, procurement and/or sales. In such a case, information must be provided on how this unit can be converted into one or more of the required unit types.

The declared unit is usually chosen either according to the specifications of product category rules or according to individual requirements. **There are currently no general rules on which unit type should be selected for which product category.**

For use in tools for the life cycle assessment of buildings, additional material information – usually the weight per declared unit – is required.

3 Overview of permissible and required material information

3.1 Permissible material properties

The following table shows the material specifications currently supported by the ILCD+EPD data format:

Table 1: Material specifications supported by the data format

Parameter	Unit
Gross density	kg/m^3
Bulk density	kg/m^3
Surface weight	kg/m^2
Layer thickness	m
Spreading rate	m^2
Linear weight *)	kg/m
Weight per piece	kg/piece
Conversion factor	kg/unit

*) 'Linear density' according to data format

All required material data was included in the ÖKOBAUDAT format with MatML (http://www.matml.org/).

Note: For the unit types piece, length and area, the dimensions must be specified in the EPD.

3.1.1 Excursus: Conversion Factor

The specification of the conversion factor into mass is mandatory according to EN 15804 for the development of e.g. transport and disposal scenarios. The conversion factor is therefore also required in ÖKOBAUDAT. If the indicator value for the declared unit is divided by the conversion factor, the result must be the indicator value for 1 kilogram of the product. The conversion factor must not contradict other values.

Remarks:

For declared units referring to 1 m³, 1 m², 1 m or piece, the conversion factor corresponds to the material data per declared unit (kg/DU).

The conversion factor to 1 kg is 1 for the declared unit 1 kg (see example in Figure 1).

Example for the conversion of an indicator value per declared unit to value per kg

Material specifications for a three-layer panel:

- Declared unit: 1 m^3 (volume)
- Gross density: 500 kg/m^3
- Conversion factor: 500 kg/m^3
- Indicator: Global warming potential - fossil (GWP-fossil)
- Indicator value for 1 m^3: 50 kg CO_2-eqv

Indicator value for 1 kg product = Indicator value for 1 m^3 product / conversion factor = 50 / 500 = 0.1 kg CO_2-eqv.

3.2 Required material information

Table 2 shows the required material information for the declared units weight, volume, area, length and piece.

In ÖKOBAUDAT, the material details are shown as follows:

Quantitative reference	
Reference flow(s)	Mauerziegel (575 kg/m³) - 1.0 * 1.0 m3 (Volume)
Material properties of the reference flow	◦ conversion factor to 1kg: 575.0 - ◦ gross density: 575.0 kg/m^3

Figure 1: Declared unit / reference flow (1 m^3) and material properties

The declared unit ('reference flow' according to the data format) in the example is 1 m³.
The gross density must also be specified.
The conversion factor to 1 kg is the same value as the gross density.

Table 2: Overview of required material information

Material type	Declared unit[1] (DU[2])	Conversion factor [kg/DU[2]]	Gross density [kg/m³]	Bulk density [kg/m³]	Layer thickness [m]	Surface weight [kg/m²]	Linear weight[3] [kg/m]	Weight per piece [kg/pc]	Spreading rate [m²]
Product	Weight [kg]	x	x						
Bulk	Weight [kg]	x		x					
Mixture	Weight [kg]	x	x[4]						where applicable
Product	Volume [m³]	x	x						
Bulk	Volume [m³]	x		x					
Mixture	Volume [m³]	x	x[4]						where applicable
Product	Area [m²]	x			x	x			
Product	Length [m]	x					x		
Product	Pieces [pc]	x						x	
All	Other units	x	x						

1) corresponds to ‘Reference flow’ in data format

2) DU ... declared unit

3) corresponds to ‘Linear density’ in data format

4) If the declared unit refers to 1 kg or 1 m³ of uncured mixture, the gross density for the uncured mixture must be stated.

4 Modelling in the eLCA component editor

4.1 Material information for products

4.1.1 Preliminary remarks

In the eLCA component editor, the life cycle assessment indicators per square meter of building material layer are calculated from:

Indicator value per square meter [unit/m²] =
Indicator value per kilogram [unit/kg] * Gross density [kg/m³] * Layer thickness [m]

LCA data with the declared unit of kilograms, which can be converted into kilograms per cubic meter using the gross density and layer thickness, are therefore ideal for the calculations in the component editor. All other life cycle assessment data must first be brought into this form. Special precautions must be taken in the case of fills and inhomogeneous building materials.

For construction products that only acquire their specific shape, surface or design, i.e. become a product, after processing on site, the material data must be provided in accordance with 4.2.

For construction elements that are installed in the building as prefabricated components (e.g. building services materials, windows and window components), other declared units or material specifications such as weight per piece or surface weight are useful.

4.1.2 Weight or volume as the declared unit

For datasets with the declared unit of one kilogram, a value for the mass / volume relation is required, since the layers' volume is required for the LCA calculations in eLCA. These material specifications are also required for datasets with a volume reference as declared unit (gross density, bulk density, etc.) in order to be able to convert to the reference value of one kilogram.

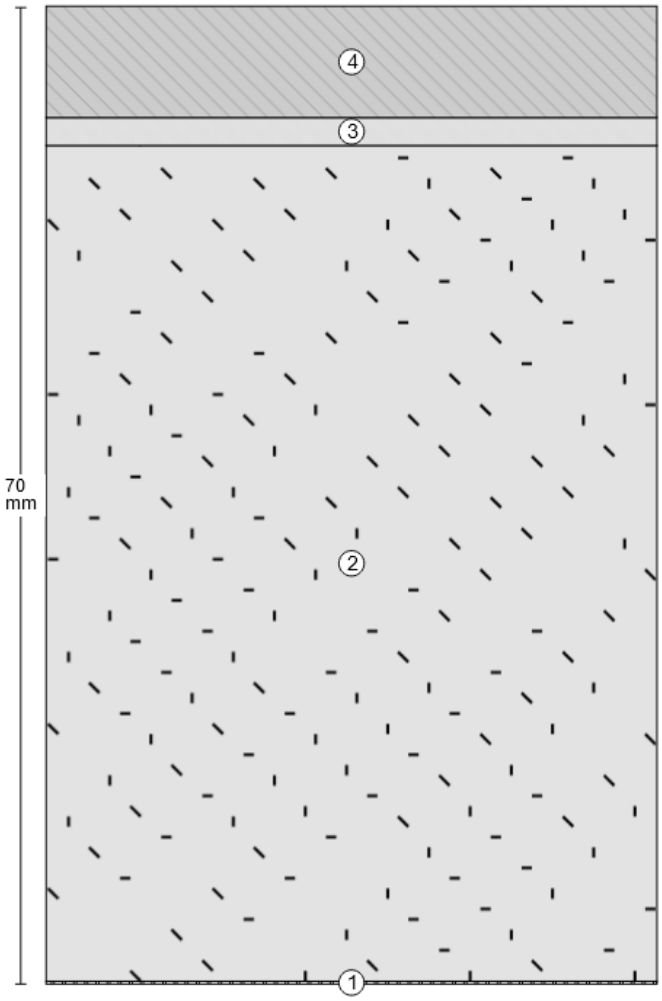
In the case of products with a homogeneous composition, the mass / volume relation corresponds to the gross density, in the case of bulk material to the bulk density. In the case of products with an inhomogeneous composition (mantle blocks, perforated panels, windows, building service engineering, etc.) another declared unit must be selected or a virtual gross density must be calculated.

Required material information for datasets with the declared unit of 1 kg

Declared unit:	1 kg (mass)
Required material information:	Gross density ρ or bulk density ρ_{Sch} respectively [kg/m³]

Graphical representation for datasets with the declared unit of 1 kg

The figure shows the graphic representation of a cement screed in eLCA in a floor construction with other materials. The material specifications for the cement screed were supplied in full (here: reference value 1 kg and gross density ρ = 2400.0 kg/m³).



Quantitative reference	
Reference flow(s)	Cement screed - 1.0 * 1.0 kg (Mass)
Material properties of the reference flow	gross density: 2400.0 kg/m^3

Figure 2: Graphic representation of a cement screed in eLCA (declared unit: 1 kg, material information: gross density)

A transfer of datasets in kilograms without specifying the gross density or the bulk density is prohibited.

Required material information for datasets with the declared unit of 1 m³

Declared unit:	1 m³ (volume)
Required material information:	Gross density ρ or bulk density ρ_{Sch} respectively [kg/m³]

Graphical representation for datasets with the declared unit of 1 m³

The figure below shows the graphic representation in eLCA for the material sand-lime brick, the material details of which are fully stored (here: reference value (declared unit) 1.0 m³ (volume) and gross density ρ = 2000.0 kg/m³).

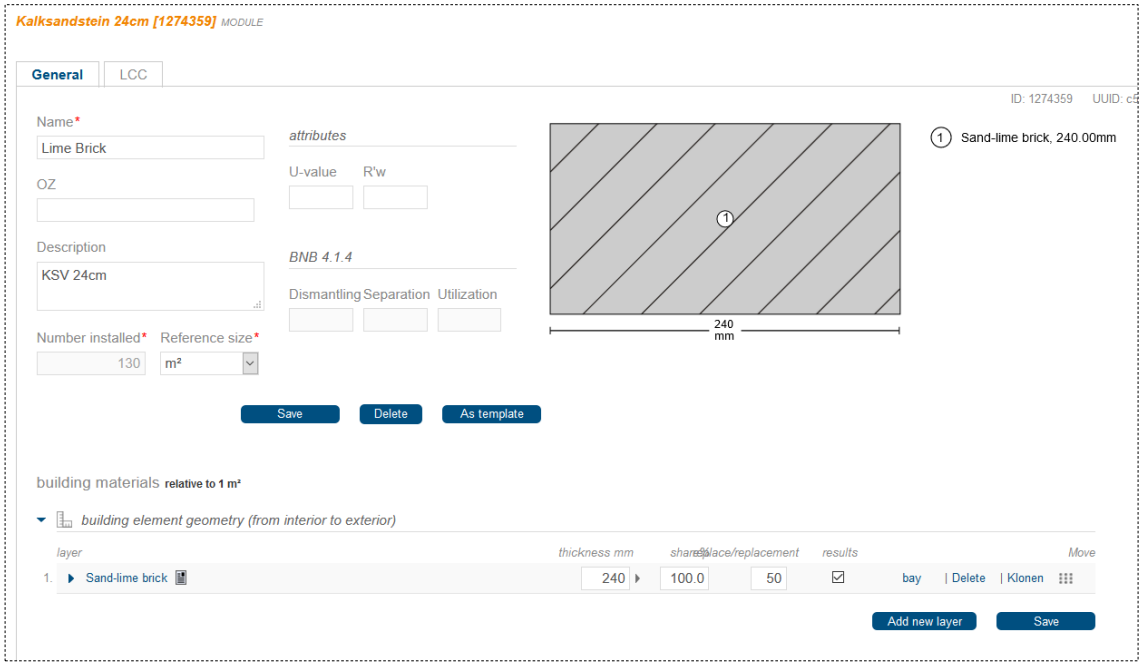


Figure 3: Graphic representation of sand-lime brick in eLCA, declared unit: 1 m³ (volume), material information: gross density

4.1.3 Area as the declared unit

If the results relate to one square meter [m²] (i.e. declared unit of 1 m²), calculations in eLCA are basically possible. However, for the graphical representation in eLCA, at least a volume reference via the additional specification of the material thickness *d* [m] is required.

Required material information for datasets with the declared unit of 1 m²

Declared unit:	1 m² (area)
Required material information:	Material thickness *d* [m] and surface weight [kg/m²]

Graphical representation for datasets with the declared unit of 1 m²

The graphical representation is the same as for volume as declared unit (Figure 3).

4.1.4 Length as the declared unit

Calculations in eLCA are possible for data in linear metres [m]; a graphic representation does not make sense and is therefore not provided for in eLCA.

Example: Cable

Required material information for datasets with the declared unit of 1 m

Declared unit:	1 m (length)
Required material information:	Linear weight [kg/m]

4.1.5 Pieces as the declared unit

For non-layer-based components or objects, the results can also be displayed in pieces [-]. A graphic representation is currently not provided.

Examples: Toilet seat, bathtub, washbasin, etc.

Required material information for datasets with the declared unit of 1 piece

Declared unit:	1 piece [-]
Required material information:	Weight per piece [kg/pc]

4.2 Material information for mixtures (materials processed on the construction site)

4.2.1 Preliminary remarks

Datasets that are affected by this rule are screed mortars, plaster mortars, industrial floors, bitumen waterproofing, etc.

ÖKOBAUDAT also contains datasets on construction chemicals (e.g. MC Construction Chemicals). These datasets are not taken into account in the building LCA with eLCA.
Furthermore, regulations for the specification of the amount of material required are pending, as this specification depends on the carrier material and the number of multiple coats.

In the case of mixtures, the dry bulk density (of the set product) usually differs from the gross density of the mixture. Example anhydrite screed:

- Raw density dry: 2000 kg/m^3
- Raw density wet: 2200 kg/m^3
- Bulk weight of dry material loose: 1600 kg/m^3

With the declared units ‘weight’ or ‘volume’ it is therefore important to know whether the declared unit relates to the mixture or to the set product.

4.2.2 Weight or volume of the mixture as the declared unit

In the case of construction products which only receive their specific shape, surface or design, i.e. become a product, after processing on site, the material information must be given as follows:

Required material information for weight or volume of the mixture as the declared unit

Declared unit:	1 kg (weight) or 1 m³ (volume)
Required material information:	Gross density of the mixture ρ [kg/m³]

4.2.3 Weight or volume of the finished product (cured / set mixture) as the declared unit

Required material information for weight or volume of the finished product (cured / set mixture) as the declared unit

If the declared unit relates to the finished product (e.g. 1 kg or 1 m^3 of hardened screed), the material information rules for products apply (see chapter 4.1).

4.3 Special cases

4.3.1 Linear scaling or handling of non-linearly scalable values

Basically, eLCA assumes linear scaling.

If different manufacturing processes are required for a building product depending on the gross density, different datasets are to be supplied accordingly, which cover a gross density range within which linear scaling can be performed.

Table 3: Datasets for different production processes / gross density ranges

Product: Stone		
Reference flow: 1 kg		
Production process	Gross density range	
Stone production 1	300 kg/m³ to 500 kg/m³	Dataset with linear scaling in the specified gross density range
Stone production 2	750 kg/m³ to 950 kg/m³	Dataset with linear scaling in the specified gross density range
Stone production 3	1,200 kg/m³ to 1,400 kg/m³	Dataset with linear scaling in the specified gross density range

4.3.2 Composite materials

Products made from individual components

In the case of products composed of individual components, the latter should preferably be mapped in individual datasets. The combined products can then be created from the individual datasets using tools (e.g. window assistant in eLCA).

Example: Window

The 'window assistant' in the eLCA building LCA tool can be used to compose the window product, which consists of several individual components. The individual components are entered via forms. The figure below shows the details for dimensions as well as for the various materials, such as frames, glazing, fittings and handles.

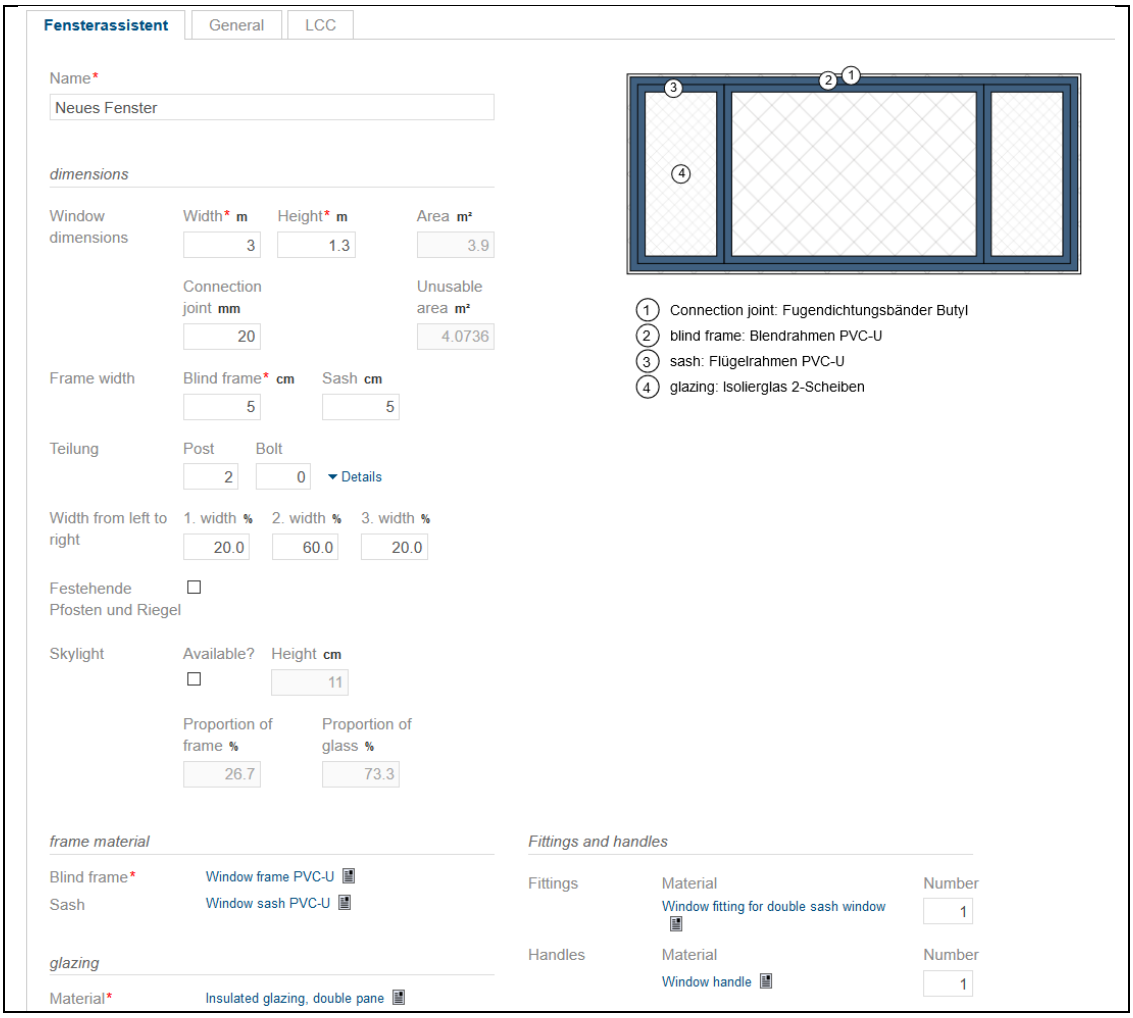


Figure 4: Window assistant (Example)

Composites or systems

For reasons of transparency, basically all individual building materials of the composite / system should be listed in the environmental product declaration. The corresponding results for the individual building materials are to be shown if possible.

Example thermal insulation system:
Here, datasets for the individual components are required so that the systems can be put together using building LCA tools (eLCA).
It is problematic if the datasets are summarized as a system and it is not transparent for the user which components may still have to be taken into account (e.g. thermal insulation system in which the thermal insulation material must be added).

Example composite:
Window pane (glass portion) and frame compound – for flexibility in calculation it is necessary to supply the individual components as a dataset so that different system variants (glass and frame in plastic or aluminium) can be created using the tool.

In ÖKOBAUDAT, the product category 10 Composites was introduced. The category is structured as shown in the figure below.

10 Composites
10.1 System components
10.1.03 Outer walls
10.1.04 Inner walls
10.1.05 Ceilings
10.1.06 Flooring
10.1.07 Reinforcement
10.1.09 Roof superstructures

Figure 5: ÖKOBAUDAT product category Composites

Note: The datasets available in the composites category currently do not meet the above-mentioned requirement for transparency of the results of the individual materials. The proportions of the individual components cannot be traced in the datasets. It is therefore unclear whether linear scaling is possible.