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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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Author: Stephan Rössig
(Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) within the Federal Office for Building and Regional Planning)

in cooperation with:
Hildegund Figl (IBO – Österreichisches Institut für Bauen und Ökologie GmbH)
ÖKOBAUDAT Users Advisory Group

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

The document at hand is intended to give instructions on geometrical and building physics information for building products (here: "Materials") and building elements (here: "Composite materials").

1 Material information

An overview of the required material information is given in Table A.1 (Appendix A).

All required material data was included in the ÖKOBAUDAT format with MatML (Appendix B).

The material information required for a building life cycle assessment (with eLCA) is stipulated below.

A Permissible material properties

The following material properties are currently supported in the ILCD + EPD data format:

Parameter	Unit	Description
Bulk density	kg/m^3	Mass in kilograms per volume in cubic meters
Surface weight	kg/m^2	Mass in kilograms per area in square meters
Gross density	kg/m^3	Mass in kilograms per volume in cubic meters
Layer thickness	m	Length in meters
Spreading rate	m^2	Area in square meters
Linear density	kg/m	Mass in kilograms per length in meters
Conversion factor	kg/unit	Mass in kilograms per declared unit

Excursus: Conversion Factors

The specification of the conversion factor into mass is mandatory according to EN 15804 for the development of e.g. transport and disposal scenarios and 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.

B Material information for products

Preliminary remark

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/m^2] =
Indicator value per kilogram [unit/kg] * Gross density [kg/m^3] * 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 fillers and inhomogeneous building materials.

Weight or volume as declared unit

Preliminary remark: 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 provided in accordance with *C Material information for mixtures, sub-item a)*.

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.

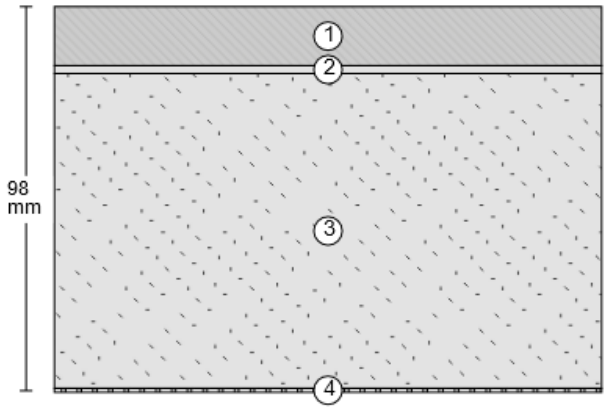
The following applies until the mandatory specification of the conversion factor to 1 kg has been implemented in ÖKOBAUDAT: These material specifications are also required for datasets with a volume reference as declared unit (gross density, bulk density, etc.) in order to be able to convert to the reference 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.

a) Required material information for datasets with the declared unit 1 kg

> Declared unit 1 kilogram **and gross density ρ or bulk density ρ_{Sch}**, respectively [kg + kg/m³]

Example: Concrete screed (kilograms and gross density)
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 = 1500.0 kg/m³).



1 Stoneware tiles glazed, 15.00mm
2 Tile adhesive, 2.00mm
3 Estrichmörtel-Zementestrich, 80.00mm
4 Damp insulation PE, 1.00mm

Estrichmörtel-Zementestrich … Concrete screed (data set not available in English language yet).

Quantitative reference	
Reference flow(s)	1 kg Estrichmörtel-Zementestrich - 1.0 * 1.0 kg (Mass)
Material properties of the reference flow	gross density: 1500.0 kg/m^3

Figure 1: Graphic representation of a cement screed in eLCA with material specifications mass and gross density

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

Explanatory statement: If incomplete datasets are transferred, additional parameters for the life cycle assessment (e.g. gross density) must be added (manually) for the graphic display and, if necessary, for the calculation in the eLCA. This is a possible source of error.

b) Required material information for datasets with the declared unit 1 m³

> Declared unit 1 m³ (volume) **<u>and</u> gross density ρ or bulk density ρ_{Sch}**, respectively [m³ + kg/m³]

Example: Sand-lime brick (Volume <u>and</u> gross density)
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).

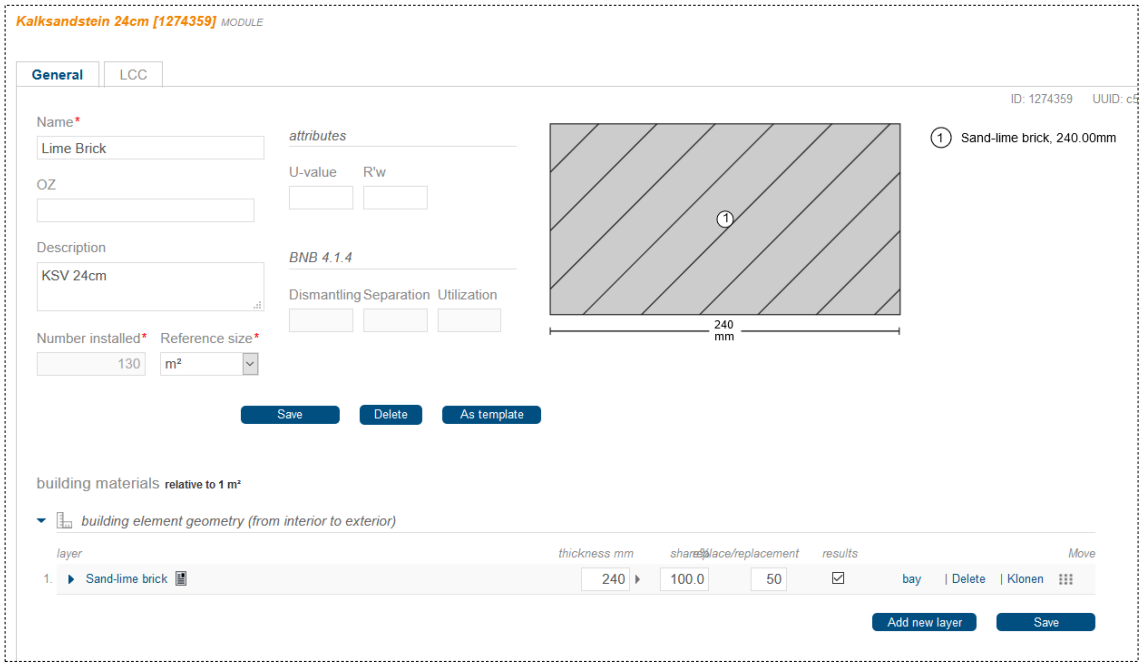


Figure 2: Graphic representation of sand-lime brick in eLCA, material specifications volume and gross density

Area as declared unit

If the results relate to one square meter [m²] (i.e. declared unit 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 [m² + d] is required. Furthermore, indication of the surface weight is possible, but not relevant for eLCA.

Required material information

> Declared unit 1 m² (area) **<u>and</u> material thickness *d*** [m² + m] or
> Declared unit 1 m² (area) **<u>and</u> gross density ρ <u>and</u> material thickness d** [m² + kg/m³ + m]

Length as 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.

Required material information (none)

Declared unit Length [m]

Example: Cable
For the material cable, the length was given in meters. This is the basis for calculations; no graphic is provided. In addition, the specification of the linear density in [kg / m] is recommended.

Figure 3: Indication of length of cable [m] in eLCA

Pieces as declared unit

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

Required material information (none)

Declared unit pieces [-]

The weight per piece can be specified, however this is not relevant for eLCA.

Examples:
Toilet seat, bathtub, washbasin, etc.

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

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, as only modules A1-A3 (product stage) are declared in the EPD datasets. There are currently no assignments to generic end-of-life datasets. Rules for end-of-life scenarios are pending.
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/m³*
- *Raw density wet: 2200 kg/m³*
- *Bulk weight of dry material loose: 1600 kg/m³*

With the declared unit "kilogram" it is therefore important to know whether the declared unit relates to the set product or to the mixture.

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:

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

> Declared unit 1 kilogram **and gross density of the mixture ρ** [kg + kg/m³] or
> Declared unit 1 cubic meter or 1 litre **and gross density of the mixture ρ** [m³ or l + kg/m³]

Example: (kilograms and gross density)

Quantitative reference	
Reference flow(s)	1 kg Estrichmörtel-Zementestrich - 1.0 * 1.0 kg (Mass)
Material properties of the reference flow	gross density: 1500.0 kg/m^3

Figure 4: declared unit / reference flow (1kg) and material properties
Estrichmörtel-Zementestrich … Concrete screed (data set not available in English language yet).

It would be desirable to also indicate the consumption (kilograms or liters) per m² area [kg + kg/m²] or [l + l/m²].

b) Required material information for weight, volume, area or pieces 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 m³ of hardened screed), the material information rules for products apply (see B).

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 (www.bauteileditor.de) 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.

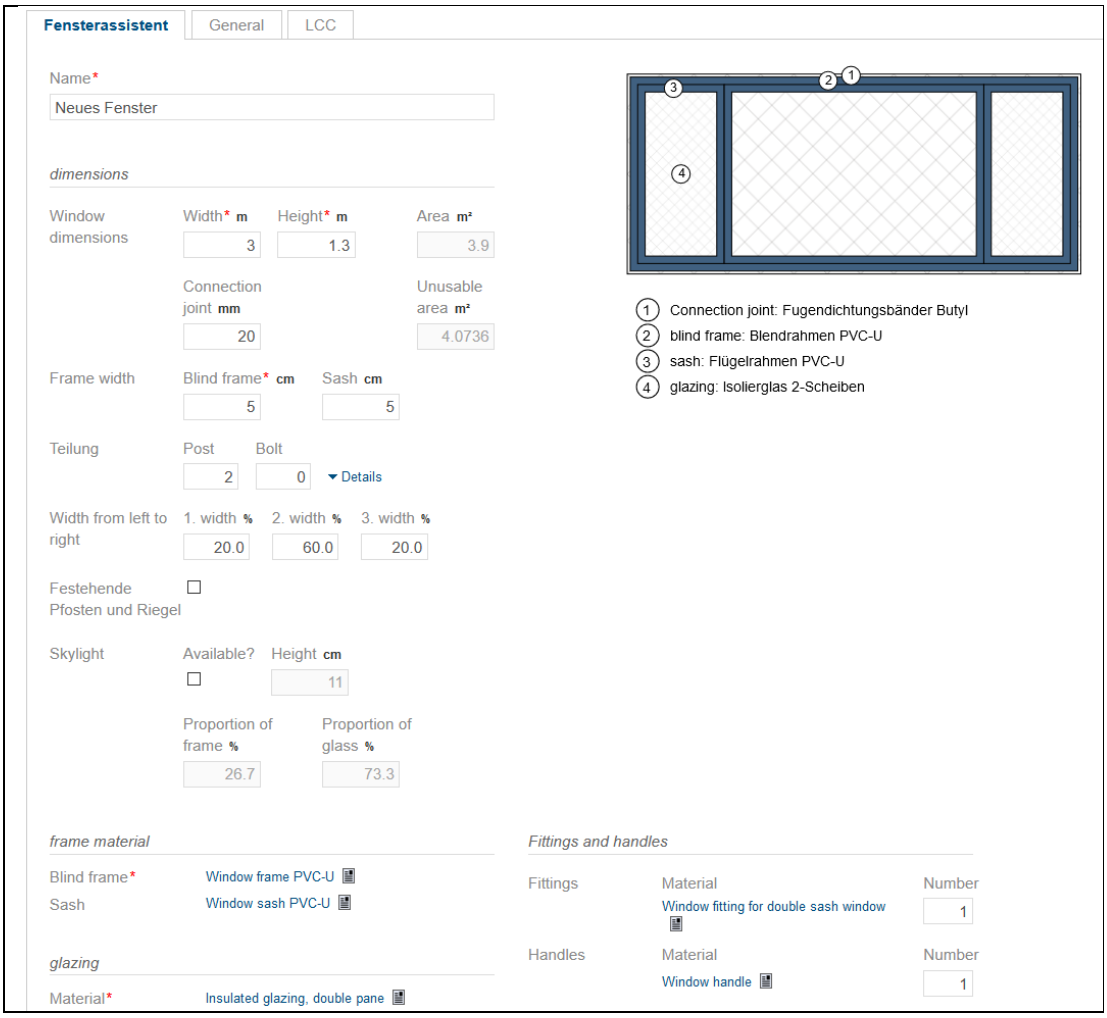


Figure 5: Window assistant (Example)

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.

Recommended material information:

List of the individual building materials

Example system: 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 aluminum) 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
10.1.04 Inner walls
Various room partition systems
10.01.05 Ceilings
Various raised floor systems

Figure 6: 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.

3 Scaling

Linear scaling or handling of non-linearly scalable values

Basically, eLCA assumes linear scaling.

a) Division into linearly scalable areas
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 1 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

b) Special cases

For special cases, such as windows, eLCA offers the option of taking non-linear scaling into account via the window assistant (see figure above).

Appendix A: Overview of material information

The figure below shows the required material information for the various reference values kilograms, area, length, pieces.

Table A.1 Overview of required / recommended material information

Material	**Reference flow*)**	**Material information required for reference flow**				
Product	Kilograms [kg]	Gross density [kg/m³]				
Product	Volume [m³]	Gross density [kg/m³]				
Product	Area [m²]		Material thickness [m]	*Where appropriate: Surface weight [kg/m²]*		
Product	Area [m²]	Gross density [kg/m³] for graph. representation	Material thickness [m]	*Where appropriate: Surface weight [kg/m²]*		
Product	Length [m]				*Where appropriate: Linear density [kg/m]*	
Product	Pieces [pieces]				*Where appropriate: Weight per piece [kg/piece]*	
Mixture	Kilograms [kg]	Gross density [kg/m³]				*Where appropriate: Amount required [kg/m²]*
Mixture	Quantity of mixture [l or m³]	Gross density [kg/m³]				*Where appropriate: Amount required [kg/m²]*

*) corresponds to "declared unit"

Appendix B: Physical Properties (MatML)

Physical product or material properties can be modelled by embedding MatML (http://www.matml.org/) markup as shown in the examples.

The following physical properties must be supported (property names like „grammage“ and „gross density“ are binding):

grammage (German: Flächengewicht) in kg/m2

```
<MatML_Doc>
<Material>
<BulkDetails>
<Name>(Material)</Name>
<PropertyData property="pr1">
<Data format="float">(Value)</Data>
</PropertyData>
</BulkDetails>
</Material>
<Metadata>
<PropertyDetails id="pr1">
<Name>grammage</Name>
<Units name="kg/m^2" description="kilograms per square metre">
<Unit>
<Name>kg</Name>
</Unit>
<Unit power="-2">
<Name>m</Name>
</Unit>
</Units>
</PropertyDetails>
</Metadata>
</MatML_Doc>
```

(Material) can be any text and *(Value)* the decimal value with a dot (.) as decimal separator (e.g. *42.1*).

gross density (German: Rohdichte) in kg/m3

```
<MatML_Doc>
<Material>
<BulkDetails>
<Name>(Material)</Name>
<PropertyData property="pr2">
<Data format="float">(Value)</Data>
</PropertyData>
</BulkDetails>
</Material>
<Metadata>
<PropertyDetails id="pr2">
<Name>gross density</Name>
<Units name="kg/m^3" description="kilograms per cubic metre">
<Unit>
<Name>kg</Name>
</Unit>
<Unit power="-3">
<Name>m</Name>
</Unit>
</Units>
</PropertyDetails>
</Metadata>
</MatML_Doc>
```