Madaster User Manual

General user guide of the Madaster Platform

Made for	Version	Date
Madaster Switzerland	3.3	11 March 2022

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1   Getting started.

1.1   What is Madaster?

Madaster is the brand name of the Madaster Foundation. The aim of the Madaster Foundation is to keep materials available in all economic cycles, by registering these materials and thus facilitating their availability at the highest possible level. The Madaster Foundation wants to realize this goal by offering a digital platform in which the built environment can be fully documented. Madaster is an independent Platform that is accessible to everyone: individuals, companies, governments, and the scientific community. Madaster is the "land register of materials".

In our closed system, the earth, raw materials are limited and scarce. To keep materials available indefinitely, they need to be documented/registered in use. With the help of a Materials Passport, materials retain their identity, so that they are not lost anonymously, as waste. Madaster thus acts as a library of materials in the built environment: it links the material identity to the location and records this in a Materials Passport.

1.2   What is a Materials Passport?

A Materials Passport is based on the entered materials and products of a building or building section, as created from one or more source files. In this Materials Passport, the quantities of the materials used are made transparent within the so-called 'building framework'. The materials in the various layers of the building are shown based on the eBKP-H classification coding applied in Switzerland, and these can be classified according to seven 'material families' or according to the eBKP-H categorization.

1.3   How does it work?

To register a new or existing building in Madaster, information (data) of this building is needed. The more extensive and complete this data is available (input), the more detailed and complete the report (output) is displayed in the Madaster Platform and specifically in the Materials Passport.

The Madaster Platform can process two types of source files:

1. IFC files (based on a 3D/BIM model).
2. a Madaster Excel template (if no 3D/BIM model of the building is available).

The various 3D CAD applications in which buildings are currently modelled digitally use their own file format but communicate with each other using the universal IFC file format. This IFC format can therefore be exported by all 3D CAD applications. For more information about the export possibilities of the 3D CAD application you are using, please contact your software supplier.

If a building is not modelled in 3D or certain elements are not worked out in the 3D model, an Excel template can be used in Madaster. The latest version of this template is always available in the Madaster Platform under: "Dossier" tab >> "Upload" button >> select classification method.

ADD FILE

File type *
Source file (BIM or Excel) ▾

Classification method *
eBKP ▾

Are you using Excel? Then use **this template.**

Select file(s) *

Picture 1: Download Madaster Excel template

Based on this secondary source of information, a building can still be registered in Madaster (without a 3D/BIM model), where the materials and products used in the building are recorded in a Materials Passport.
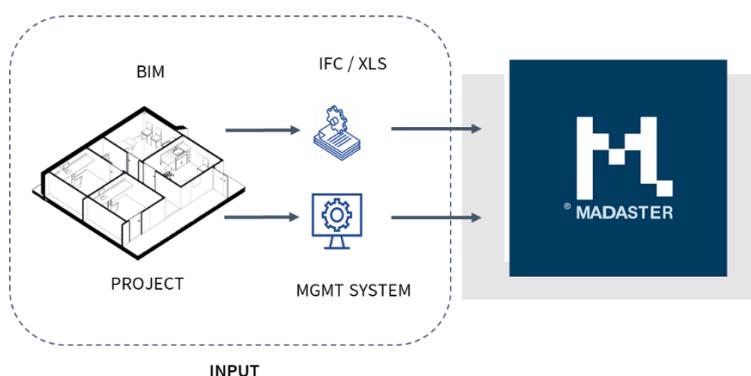
Picture 2: Madaster input data (various options)

Madaster then categorizes and summarizes the information contained in the source files, so that for a building or for each building section it is possible to see where and how much of which material is in the building. Madaster does not calculate quantities itself; all geometric information and quantities are imported directly from the IFC model.

The quality (completeness) of the source files is validated by Madaster and displayed in the system after the source file has been read. All calculations within Madaster take place within these frameworks. Missing or incomplete information in the source files leads directly to inaccuracies of the result compared to 100% accuracy.

1.4 What do you need?

A Materials Passport is created based on the available information (data) that the user uploads into so-called 'source files' in the Madaster Platform. These source files (in IFC and/or Excel file format) are automatically validated for completeness when imported into Madaster in terms of material description, classification code and geometric data.

Madaster focuses on the use of IFC files as source files as they can be exported in 3D CAD applications such as Autodesk Revit, Archicad, etc. This usually happens in the design phase of a building or during its renovation. If this type of source file is not available (e.g., for an existing building), the Materials Passport can be created in Madaster based on an Excel template.

More information about collecting and preparing the required building information (source data) is described in the Manual 'Madaster Action plan Materials Passport' (see Step 2).

1.5   Workflow Madaster Materials Passport

You can get started with the Madaster Platform using the manual 'Madaster Action plan Materials Passport'. This manual describes these necessary process steps in more detail and refers to other specific Madaster documentation or reference works for additional information.

* You can register your Madaster account via the Madaster website.

2   Workflow

2.1   Flexible Folder Structure

The Madaster platform works from "Accounts" - usually the owner of the property or the primary, leading party in a particular phase (e.g., the architect in the design phase, the contractor in the execution phase, or a designated building manager in the use phase).

You can set up your account structure in Madaster as you wish. Within your account, "Folders" can be created containing buildings or other folders (e.g., a region, department, or subsidiary). A folder contains the "Buildings", the existing real estate properties, or projects or those under development. This structure is flexible and allows you to configure your Madaster environment according to your needs.
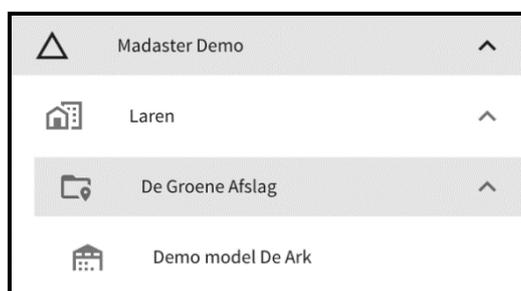
Picture 3: Madaster folder types (navigation)

"Users" can be assigned different roles in Madaster with specific management, write & read or read-only rights. These rights can be granted by an account manager to other users who have access to one or more folders, folders and/or buildings in the Madaster Platform.

2.2   Type of Folders

In the "Type Folders" tab, different types of folders can be created. Think of the above examples of regions, subsidiaries, or another definition of your (desired) organizational structure.

Picture 4: Define Madaster folder types

A few examples:

- A large construction company has several companies and subsidiaries. The projects for the different clients can now be organized per company/subsidiary.
- A nationally operating developer has divided his company into regions, with a department for "residential construction" and "non-residential construction" for each region. Various projects or area developments are underway in which the buildings are registered.
- An architectural firm wants to organize the projects per year and per sector (care, education, offices). Within the sectors there are projects with several buildings.

Each account is completely free to decide what the structure of leaflets will look like. By means of the different rights and roles of users, it is possible to determine per level who sees what and who can do what.

2.3   Users Rights

On account level, different users can be invited with different roles and permissions. Madaster has three types of users:

- Administrator: the account holder who is the owner of one or more portfolios and the buildings located within them; the owner can also delete them and has all the features of the role Manager and Reader.
- Manager: a person who is enabled by an owner to manage his portfolios and buildings. In addition, the Manager has all the features of a Reader.
- Reader: a person who can upload (source) files, use information, and generate Material passports.

AVAILABLE ROLES AND RIGHTS AT THE ACCOUNT LEVEL:

| Account level	Administrator	Manager & contributor to database	Manager	Reader
Creating and modifying folder types	Yes	No	No	No.
Creating folders	Yes	Yes	Yes	No
Creating database	Yes	No	No	No
Contributions to database created on account or shared with account with at least contribution rights	Yes	Yes	No	No

Picture 5: Available Madaster roles & rights (account level)

Folder level	Administrator	Manager & Contributer to database	Manager	Reader
Create folders and subfolders	Yes	No	No	No
View brochure and underlying buildings	Yes	Yes	Yes	Yes
Modify folder and underlying buildings	Yes	Yes	Yes	No
Delete folder and underlying buildings	Yes	No	No	No
Add building to a folder	Yes	Yes	Yes	No
Add and remove users	Yes	No	No	No
Add database (folder level)	Yes	No	No	No
Contribute to database created at folder level or shared with folder with at least contributions rights	Yes	Yes	No	No
Export Material Passport	Yes	Yes	Yes	No
Download Material Passport to PDF	Yes	Yes	Yes	No

Picture 6: Available Madaster roles & rights (folder level)

2.4 Features

At a company account level, the Madaster user can activate, use and evaluate new (example) functions ('features'). These functions will be further developed based on user feedback. Features can be activated directly by the user or are available by invitation and/or subject to conditions.


Picture 7 Madaster Features

2.4.1 Circularity Indicator Version 2

The 'CI V2' feature (to be activated directly by the user) offers the following additional insights:

- Adjusted circularity calculation, where elements without a classification code are no longer excluded.
- Input flow (primary vs. secondary material sources) and output flow (available for reuse and recycling) of materials in kilograms and percentages on building level and on building layer (see section 4.2. for details).
- Degree of detachability (% detachability index) of the building, including index quality score (see section 4.2 for details).
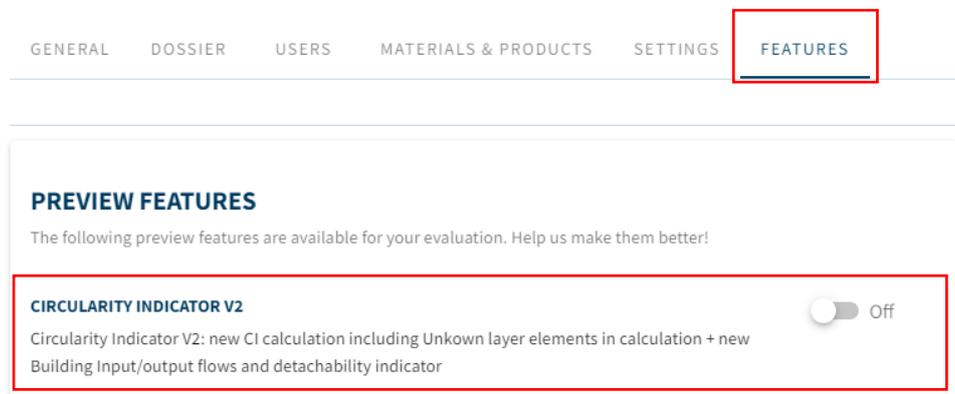
Picture 8 Madaster CI V2 Feature

2.4.2 Embodied Carbon Overview Feature

The 'Embodied Carbon Overview' feature can be activated directly by the user and offers the opportunity to gain insight into the CO2 value per square meter of the building. This value is shown on the "General" tab of the building
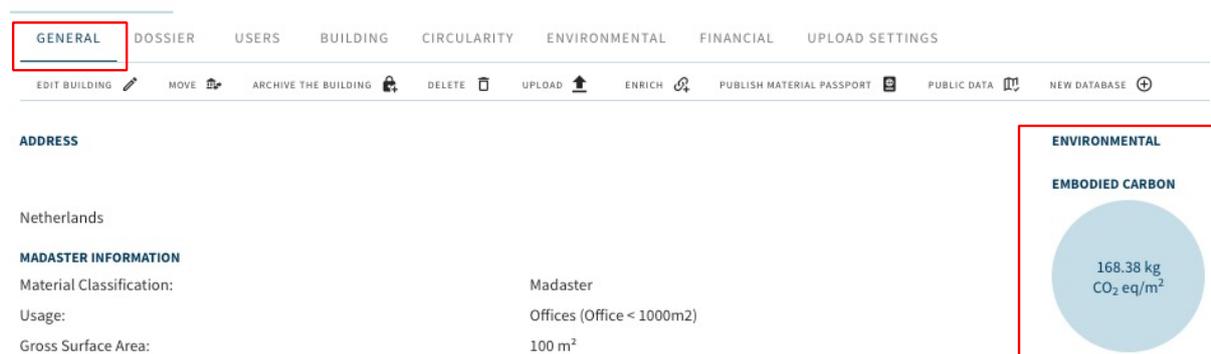
Picture 9: Madaster Embodied Carbon Overview feature.

Prerequisite: one or more elements in the source file (IFC/Excel) are linked to a product in Madaster that contains environmental impact expressed in "Global Warming Potential 100 years (kg CO2e)".

PRODUCT X

PRODUCT INFORMATION   CIRCULARITY   ENVIRONMENT   BILL OF MATERIALS   SEARCH CRITERIA   DOSSIER   FINANCIAL

EDIT ✏

Dataset owner:	-	Dataset type:	-
Reference year:	-	Dataset valid until year:	-
Compliance:	EN 15804	Environmental Cost Indicator:	€ 0

EN 15804:2012-04+A1 2013

IMPACT CATEGORY	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Global Warming Potential 100 years (kg CO2e)	1,398.1	31.7	120	1,640	14.9	-	-	-	-	-	-	3.08	159	0.853	-

Picture 10: Product's environmental impact (Global Warming Potential)

2.4.3   Split building feature

The 'Split buildings' preview function (available by invitation only) allows Madaster users to create individual building dossiers and passports based on an IFC file which entails several buildings/homes. This makes it more efficient to split up (IFC) models per real estate object prior to being uploaded into Madaster.

To use this function, an individual building number must be available for each IFC element in the IFC file. The property set and property name for this building number are flexible. This and other settings (see section 2.2 for details) can be specified in Madaster at company account level as "Presets for upload".

Picture 11: Madaster presets for upload

Picture 12: Set Madaster Upload Settings

When the data upload process in Madaster is completed, the user can manually link unlinked elements in the "Enrich" tab, adjust these elements and activate the relevant IFC files. Subsequently, via the button "Split the building" ("General" tab), the user can automatically create individual building.
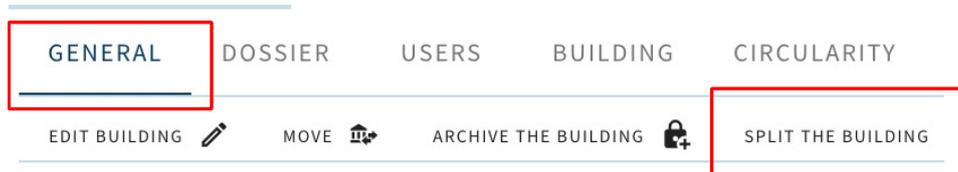
Picture 13: Split Building Functio

2.5   Types of Files

Within the Madaster Platform a distinction is made between two types of files, namely:

- **Source files:** the files with which the materials and products and the quantities of a building are delivered to be registered in Madaster. These include the IFC files and the Excel template of Madaster.
- **General files:** static files that contain information about the building and can be added to the building file in Madaster, but which cannot be used to serve as a source file.

2.6   Source Files

The Madaster Platform primarily uses IFC files (4 or 2x3) of the buildings to provide insight into the quantities of materials used. As an alternative, Madaster offers an Excel template. This template is made available on the Madaster Platform.

The elements in these two types of source files should, as far as possible, include:

- **Geometric properties** (so-called 'base quantities') of the CAD objects; information about the quantities in volume and weight.
- A **material description**, on the basis of which the Madaster system can provide insight into the materials used in the building.
- A **classification coding** (in Switzerland the eBKP-H code is common) on the basis of which the Madaster Platform can assign the elements to the building envelope in which the element is located (location).

Multiple source files can be uploaded in Madaster per building. For example, construction, installation, and architecture. A source file can be made active or inactive at any time (depending on user rights). If multiple source files are active, they will be added together in the different tabs of Madaster (e.g., "Building", "Financial" tab). The goal is to get 100% completeness before a source file is activated in the system.

Attention: duplications can occur! This can be displayed in specialized 3D-viewers, such as Solibri, BIMColllab Zoom, etc. The latter functionality is not available in the Madaster system.

2.7 IFC-Source File Manuals

- The manual "Madaster IFC guidelines" outlines the Madaster guidelines for setting up the BIM model and exporting the IFC file.
- The manual "Madaster BIM IFC import" describes in detail how to prepare an IFC file for processing within Madaster. It explains, among other things, how the geometric properties, classification coding, construction phase and material use is determined.
- The manual "Madaster BIM - IFC export" describes in more detail how to export an IFC file (from Archicad and Revit).

2.8 General Files

This includes files that provide information about the building or its design, e.g., digital drawings of the building in 2D CAD formats (e.g. .dwg, .dxf), PDFs, photographs, and scans of building drawings (in JPG, PNG, TIFF formats).

2.9 Data and information

Because the Information Delivery Manual (IDM) is already widely used in the Netherlands, we recommend using it. For more information see the BIMloket. Here you will also find very extensive manuals to comply with the ILS with your specific BIM software. In the IFC check section, you can also see whether your files comply with the IDM standards. This manual discusses what is specifically required for Madaster. This is less extensive than the full IDM standard and is mainly focused on materials and NL/Sfb coding.

2.10 Geometric Data

Madaster obtains all geometric data from the IFC files that are uploaded. This means that Madaster does not perform any calculations itself. Only the summation of the different quantities of the obtained information is used. Madaster uses six material group codes (Stone, Glass, Wood, Plastic, Organic, Metal) and a group into which the unknown materials end up.

STONE	GLASS	WOOD	PLASTIC	METAL	UNKNOWN
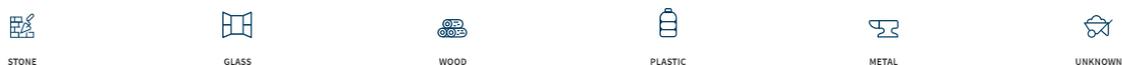
Picture 14: Material groups ("Building" tab)

Via the Materials & Products tab (in the left vertical navigation menu) you can view available materials and products from different data sources. If desired add your own materials and products to a database (on account, folder type or building level). By adding search criteria to your material/product the Madaster Platform can link these automatically to elements in the source file(s).

Picture 15: Material (example search criteria)

Madaster currently contains databases of materials and products linked to the material/product with the same designation as in your IFC file. These databases are continuously being expanded.

2.11 Standard Classification (eBKP-H)

In the construction sector, the eBKP-H code indicates the building layer in which a product or material is located. This coding is given to objects in the IFC file. This allows Madaster to categorize the materials. In this way it is made clear how many materials are located where in the building. Preferably use the eBKP-H code with 4 digits. Madaster then assigns these to the building envelope (e.g., Construction, Enclosure, etc.).

Picture 16: Classification (building layers)

In the respective building envelopes, you can also click on one of the materials mentioned in 2.9 Geometric data to see their quantities in detail.

In Picture 10 you can see the material family "Mineral" in the building layer "Structure":

Baukonstruktionen |Mineralisch

Materialien			
Beton	107 Stücke	697,55 m³	1,6 kt
Ziegel	35 Stücke	68,35 m³	99,11 t
Kalksandstein	74 Stücke	105,77 m³	200,97 t
Zement	3 Stücke	62,24 m³	124,48 t
Gipskarton	2 Stücke	1,11 m²	1,22 t
Steinwolle	6 Stücke	113,42 m³	6,47 t
Gips	4 Stücke	42,43 dm³	76,38 kg
Naturstein	5 Stücke	0,17 m³	443,87 kg

Picture 17 Mineral in Shearing Layer "Structure"

2.12 Building Process – Renovation Phases

Many building projects consist of the renovation of existing buildings. Part of an existing building is demolished; a shell remains and is built in and attached with new materials. This construction phase (Current-Demolition-Casco-New-Final) is supported by Madaster from the information that can be provided in a source file (IFC and/or Excel template).

Picture 18: Building process (renovation phases)

This tab will be displayed as the "Building phase" is marked as: "Existing", "Renovation" or "Demolition".

2.13 Databases

In Madaster it is possible to create and use multiple databases at different levels (e.g., project, portfolio and/or building level) within one's own account. A created database can be found in the navigation drawer on the left-hand side of the screen. The images below show several levels on which a new database can be created in the platform.
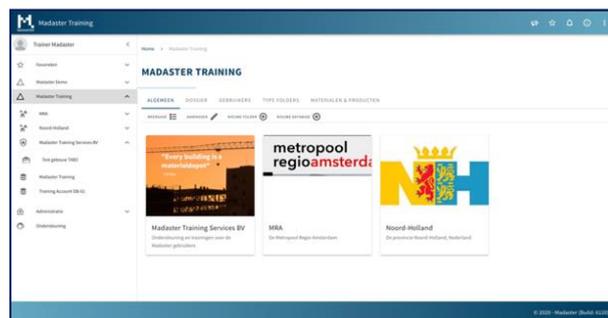
Picture 19: Database creation at account level
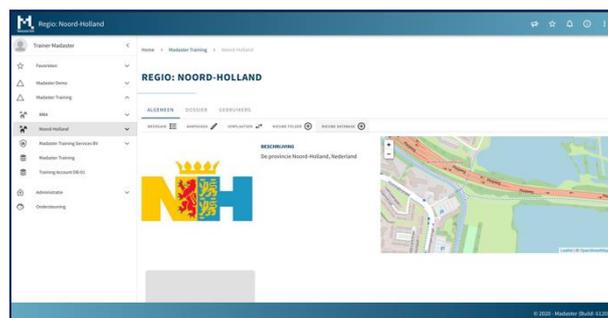
Picture 20: Database creation at folder level
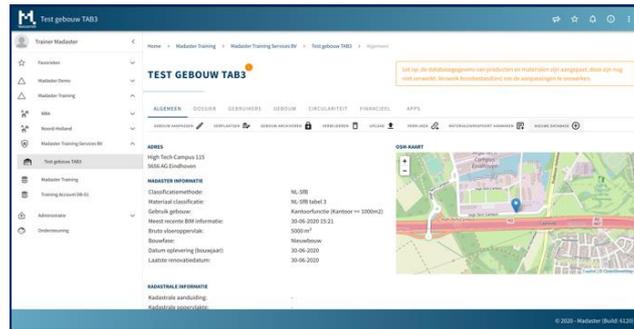
Picture 21: Database creation at building level

It is also possible to create multiple databases at a level (folder or building). These databases are always visible in the navigation drawer on account, (sub)folder or building level.
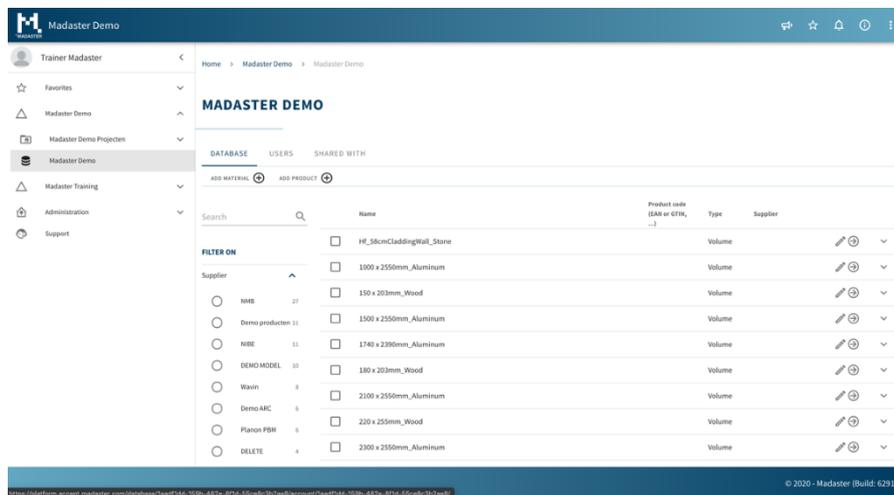
Picture 22: View/find created databases

2.14 Database Properties

A database has minimal properties: a name and the possibility to use this database as a standard selected database when uploading a source file. If a database is shared, several properties are added, which relate to the use of the (shared) database.

2.15 Database Users

Just as with accounts, folders and buildings, databases can also be used by several people or by another IT system using an API token. Users can now be invited and receive rights as administrator or contributor. The latter role can only create or modify materials and products in the platform.

2.16 Sharing Databases with other Accounts, Folders, Buildings

A database can be shared with multiple accounts, folders or buildings. This makes it possible, for example, for a company to set up your own database and then make these materials and products available to another user working under a different account.

2.17 Sharing a Database: Rights

When sharing a database, it is necessary to determine the rights with which these users on an account/folder/building level can use the materials and/or products.
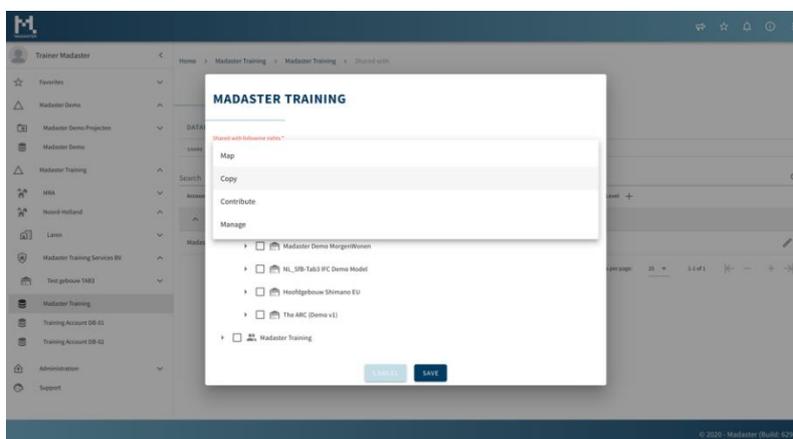
Picture 23: sharing databases (rights)

A database can be shared with four different rights, properties:

Map – elements can be linked to the materials and products in this database.

Copy – the materials and products from this database can be copied.

Contribute – new materials and products can be entered into this database by the users with whom this database is shared.

Manage – the database can be managed by the users with the rights, on the account/folder/building with which this database is shared.

2.18 Sharing a Database: Account, Folders, Buildings

A database can be shared with multiple accounts, folders or buildings. This makes it possible to create a central database that supports multiple folders and buildings or specific databases for certain types of buildings. After sharing a database, you get the choice to determine which accounts, folders, buildings have access to the shared database.
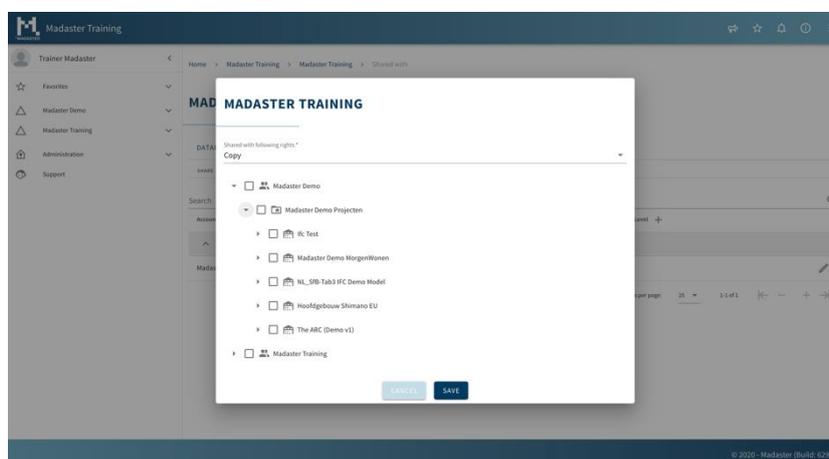
Picture 24: A database can be shared with other account(s), and/or one or more folders and/or buildings

2.19 Share and Use

The materials and products in a shared database are "synchronized": it is the same database, accessible from multiple accounts, folders and/or buildings. Changes and additions made by one user are also available to all other users of this database.

2.20 IFC Check (BIMCollab Zoom)

Before reading an IFC file into the Madaster system, you can perform a validation to determine whether the basic settings, such as materials and eBKP-H classification, are correct and complete. For this purpose, a Madaster smart view is available, which can be used with the free version of the "view" program BIMCollab Zoom. This public viewer and the Madaster smart view can be downloaded here.
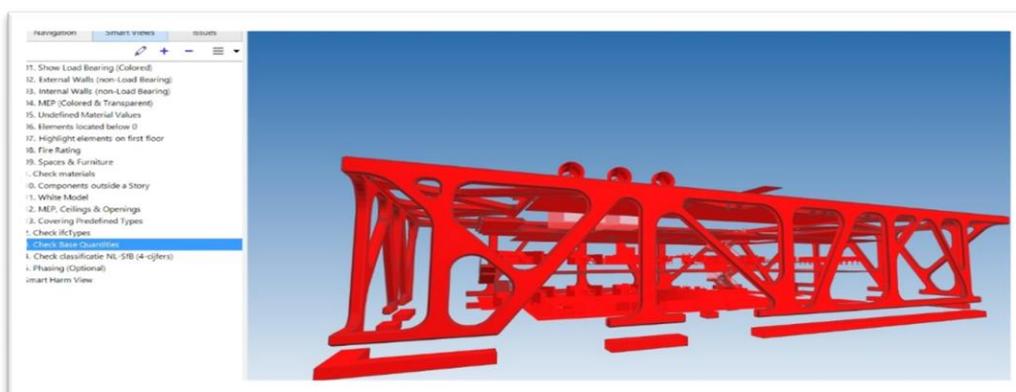
Picture 25: IFC checker (BIMCollab Zoom)

After loading your IFC model in BIMCollab Zoom, you can load the Madaster smart views under smart views. Now several pre-programmed views are loaded with which you can quickly scan elements that are missing a eBKP-H coding or do not yet have a material allocation. After this check and any adjustments in Archicad, Revit, etc. the IFC models can be uploaded into the Madaster Platform.

2.21 Upload Source Files & Enrichment Process

The Madaster platform can handle two types of source files: an IFC file (based on a 3D / BIM model) and a Madaster Excel template (if no 3D / BIM model is available). In the tab "Dossier", within the relevant building in the Madaster platform, one or more source files can be added (at the same time) consisting of, for example, construction, technical services and architecture. During the import process in Madaster, the source files are automatically checked for completeness:

- File type
- Classification method
- Geometric data

For more details about the upload process, please refer to Step 4 "Uploading the source data into Madaster" in the manual "Madaster Action Plan Materials Passport".

ADD FILE

File type *
Source file (BIM or Excel)

Classification method *

Select file(s) *

Select folder *
Source files

Picture 26: Upload files (Dossier tab)

In addition, based on the material description, the platform tries to link each element in the source file to a corresponding material or product registered in the available and selected databases.

When the material description of an element is recognised, the Madaster system automatically pairs the element. To make this automated "matching process" as effective as possible, a selection and prioritisation of the relevant data sources can be made in the Madaster platform before the source files are processed (prioritisation = vertical ranking). The selected sources are used during the automated matching process.

If no automatic pairing takes place, it is possible to pair the element manually in Madaster afterwards ("enrichment"). Alternatively, the source file can be modified and a new version of the IFC file can be uploaded and processed in Madaster (see chapter 2.21.2).

Make sure that the file is set to active after uploading (in the "Dossier" tab). This ensures that the source file contributes to the Building tab. After uploading, you will immediately see how complete the building's information is. If certain elements have not yet been provided with a material, this can still be added manually in the Enrichment tab.

Picture 27: Upload results source files (Dossier tab)

2.21.1 Upload settings

On different levels (account, folder type & building) within the Madaster platform, default upload preferences can be set and selected regarding classification method, language(s) for enrichment, selection of source files (incl. priority) and property settings for building numbers (for 'split building' feature).

Upload settings created at a higher level in the navigation tree (e.g., account, folder type, building) are made available by default at the lower levels as well, but this inheritance can also be broken at a lower level.
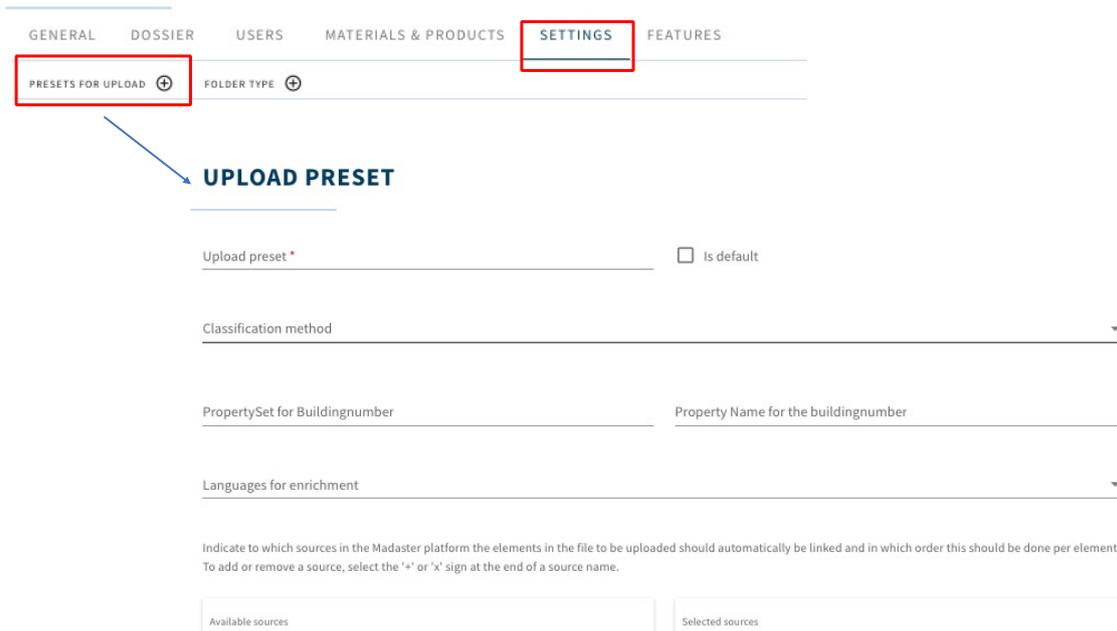
Picture 28: Define Madaster Upload Settings

The upload setting is then selected in the building's "Dossier" tab.
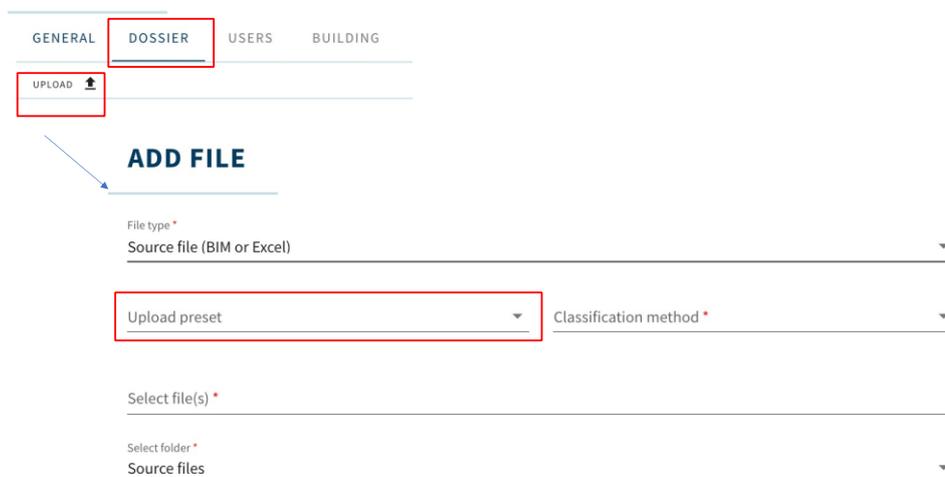
Picture 29: Select Madaster Upload Preset

2.21.2 Replace existing IFC File (keep linked elements)

It is also possible to replace an existing IFC file, of which elements have already been automatically or manually linked, with a new version of the IFC file while retaining the linked elements. Instead of the usual IFC upload procedure, this function starts via the upload icon (in Dossier tab) located behind the IFC file to be replaced.

Picture 30: Upload new version of source file (while retaining linked elements)

Subsequently, the regular upload process steps must be followed (as described at the beginning of this chapter). The system then processes the new IFC file and, if a unique element occurs again and was linked in the previous IFC file, will maintain this relationship. Ultimately, only <u>one</u> version of the same IFC file can be activated in the building dossier. By activating the most recent version, the system will automatically deactivate the former (replaced) version.

2.22 Enrichment Process

In the sub-step "Enrich" in Madaster, it can be checked which material or product is linked to an element from the source file. It is recommended to connect the products with the largest volume in each case. To do this, use the sort function. Then press "Enrich" to assign the correct material. Madaster it is only possible to manually create or change a link between element and material or product.

There is no way in Madaster to manually enrich elements whose eBKP-H code or geometric data is incomplete or missing. This data can only be added by uploading a modified source file (IFC or Excel) into Madaster.

If desired, use the search function or the predefined filters on the left side of this screen to select IFC elements. After selecting one or more elements, the user clicks on the "Link" button (paperclip icon). Then select the material/product from the available databases and subsequently click on the "Link" button. A maximum of 500 elements can be linked to a material/product in Madaster at the same time.

Picture 31: Link Elements (Enrich tab)

In addition to linking materials and products in Madaster, a user also has the option to adjust elements in the Madaster platform. This too takes place in the "Enrich" tab. After selecting one or more elements, the user clicks on the 'Edit' button (pen icon).

Picture 32: Adjust Elements (Enrich tab)

For more details about the enrich process, please refer to Step 5 "Check & enrich source data in Madaster" in the manual "Madaster Action Plan Materials Passport".

### 2.22.1 Adjust Classification per Element

Subsequently, it is possible to adjust the classification of one or more elements (material and product) at the same time (bulk). Select the desired classification from the defined list and "Save" the change.
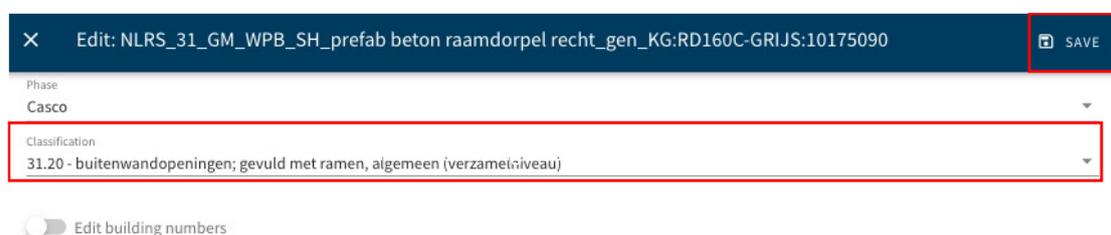
Picture 33: Adjust Classification of Element (Enrich tab)

2.22.2 Adjust Phase per Element

Subsequently, it's possible to adjust the phase (e.g., demolition, casco, new materials) of one or more elements (material and product) at the same time (bulk). Select the desired "Phase" from the defined list and "Save" the change.
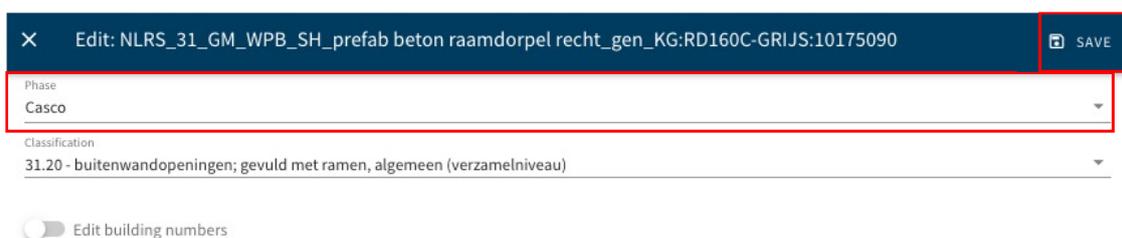
Picture 34: Adjust Phase of Element (Enrich tab)

2.22.3 Adjust Building Number per Element (Split Building Function)

Subsequently, it is possible to adjust the (%) allocation of one or more elements (materials and/or products) to a building number.

Picture 35: Adjust Building Number of Element (Enrich tab)

To do this, activate the function "Edit building numbers" and allocate the desired ratio (%) to the available building numbers.

2.22.4 Adjust Reuse (Feedstock Input & Output)

The degree of reuse in the construction phase (Feedstock input) and at the end-of-life phase (output) of one or more elements (product only) can be adjusted.

Picture 36: Adjust Reuse (Enrich tab)

To do this, fill in the fields "Feedstock input Reuse" (in %) and "Output available for reuse" (in %). Finally, click on the "Save" button to save the changes.

2.22.5 Adjust Detachability per Element

The detachability parameters of one or more elements (product only) can be adjusted. Clicking the "Save" button will save the adjusted parameters.
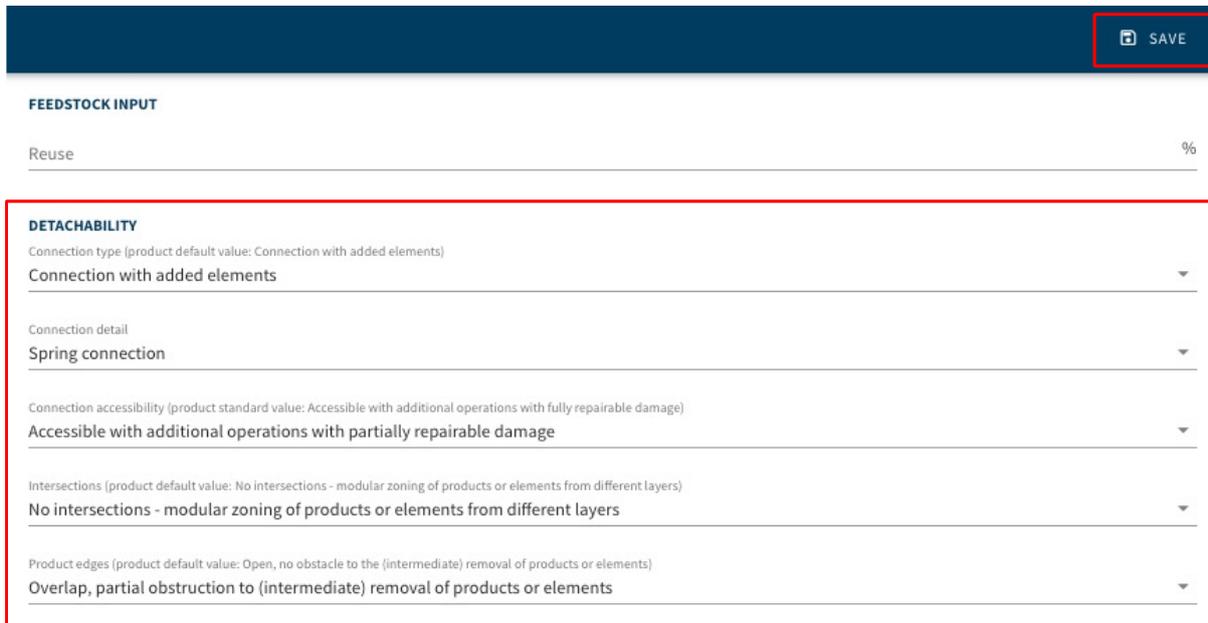
Picture 37: Adjust Detachability (Enrich tab)

2.22.6 Search function

The "Enrich" tab also contains a search function that enables the user to search for / find source file elements based on their material description (in column 'materials').

Picture 38: Search function (Enrich tab)

The following search characters can be used in a query string to improve the precision of a match:

- Wild card search character = *****
  - Search prefix = **alpha*** >> returns search results "<u>**alpha**</u>numeric" or "<u>**alpha**</u>betical".
  - Search suffix = ***numeric** >> returns search result "alpha<u>**numeric**</u>".
  - Search infix = **non*al** >> returns search results "<u>**non**</u>numeric<u>**al**</u>" and "<u>**non**</u>sensic<u>**al**</u>".

- Boolean operator's characters

Boolean operators can be embedded in a query string to improve the precision of a match. The full syntax supports text operators in addition to character operators. Always specify text Boolean operators (AND, OR, NOT) in all capitals.

AND: specifies terms that a match must contain.
  - Search = **wood AND stone** (with spaces)
  - Search = **wood+stone** (without spaces)
  - Search = **wood&stone** (without spaces)

For these search examples, the query will look for elements with a material description containing both "**wood**" and "**stone**".

OR: finds a match when either term is found.
  - Search = **wood OR stone** (with spaces)
  - Search = **wood|stone** (without spaces)

For these search examples, the query will return match on elements with a material description containing either "**wood**" or "**stone**" or both.

**NOT**: returns matches that exclude the term.
  - Search = **wood NOT birch** (with spaces)
  - Search = **wood!birch** (without spaces)

For these search examples, the query will return match on elements with a material description that have the "**wood**" term but not "**birch**".

2.23 3D-Model Viewer

After uploading your IFC source file, you can also view it in Madaster's 3D viewer. This allows you to see which IFC file contains which parts of the building.

After selecting one or more elements, those elements can be displayed in 3D, in the screen itself. Because of this, it is also possible to use the functionalities of the "candy bar" (the menu in light blue color at the bottom of this screen).
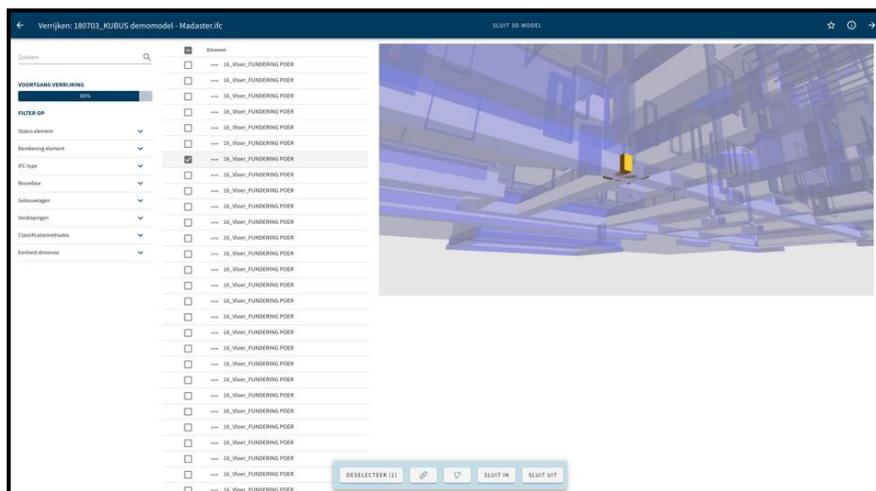
Picture 39: Selecting elements (Madaster 3D viewer)

After selecting one or more elements in the 3D window itself, where they will then be displayed, these elements are also selected in the list. This makes it also possible to use the functionalities of the "candy bar", after information about the respective element is displayed via the "three dots" (visible before the name of the document).
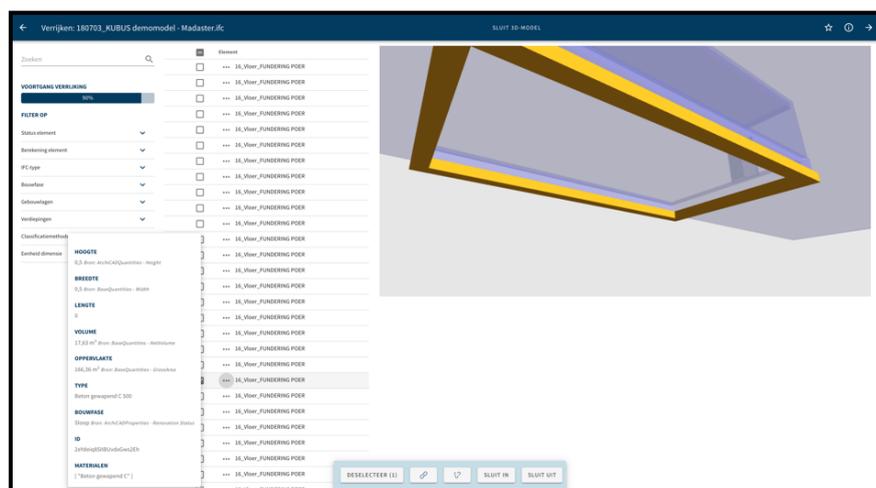
Picture 40: Selecting elements in viewer: possibility to connect/disconnect

3   Materials passport

3.1 A Materials Passport

A Building Materials Passport displays the building's information as shown in the 'building tab' on the Madaster Platform. The Material Passport consists of the selected source files that have been uploaded to the Madaster platform and from which the user has indicated that they wish to use the results with the building information.

3.1.1 (Owner) Label in Materials Passport

Administrator users can add and define a text label on a folder type (portfolio, region, etc.). The label is then shown on the front page and General page of the material passport (PDF & Excel file).
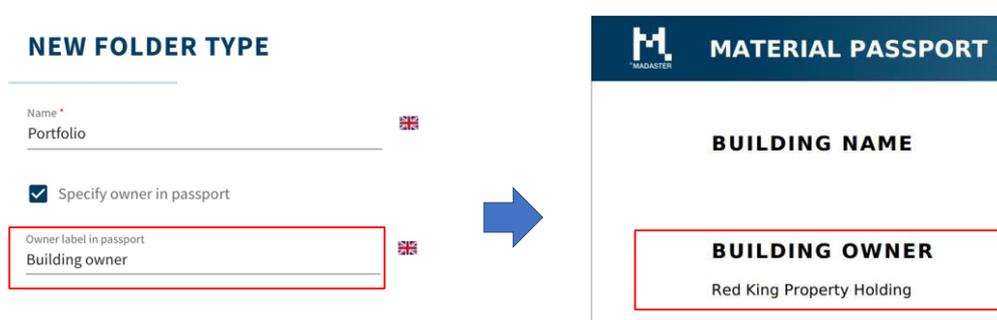
Picture 41: Result Owner Label

To define a text label by folder type, go to "Settings" at company account level. Then select the folder type (see section 2.1.1) and click on the "Edit" button (pen icon) behind the relevant folder type.
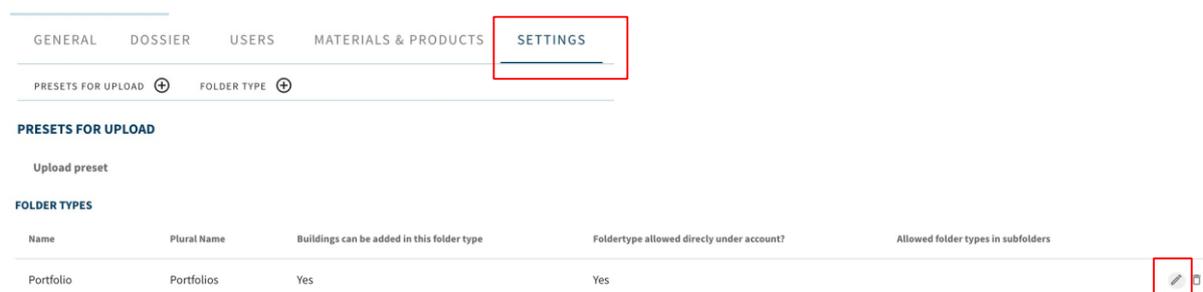
Picture 42: Adjust Folder Type (Owner Label)

Then select the option "Specify owner in Passport" and define the label, as it should be displayed in the material passport.

Picture 43: Define folder type (owner label)

This will generate a new section (a label) that can be filled in. When creating a new folder with this folder type, the new label can be specified (i.e. Building Owner – Red King Property Holding).

Picture 44: Insert owner label

All material passports created in this specific folder type will have this owner label on the front page and General page.

3.1.2   Generate a Materials Passport

Go to the tab "General" in the building. By clicking on the "Create Materials Passport" button, the user can create a Materials Passport based on the active source files. This Materials Passport will be created in a PDF and Excel format and saved directly in the 'Dossier' tab, under the 'Passports' folder. Each time a new Materials Passport is generated it will be added as a new file. The previous Materials Passports will remain available and accessible.

3.1.3 Download a Material Passport

Material Passports can be downloaded via the "Dossier" tab. All generated Material Passports can be downloaded under the category "General Document". Clicking on the download icon downloads the PDF file to the computer.

3.2 Archiving & Transferring Buildings

To preserve a fixed, certain state of a building or to transfer a building to another Madaster account, the "archive a building" functionality is available. This functionality is available on the "General" tab of a building. By archiving a building, the platform creates a collection of files of a building, with the active source files at its core. The archive is given a Version Name and a Version ID when it is created (entered by the user).

A distinction is made between four different archiving functions:
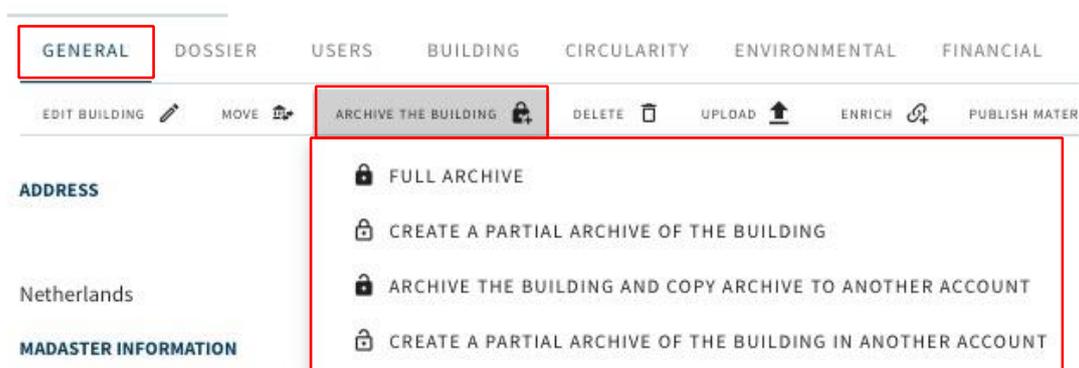
Picture 45: Archive & transfer building dossier

- **Full archive** – the entire archive is created and kept in the original account, including a database with all materials and products used (in the initial building). The fully archived building dossier can then be transferred to another Madaster account, where it can be edited again.

- **Partial archive** – Only items from non-globally available databases are included in the archive. Items from validated databases and globally available manufacturer databases are not copied to the building archive database.

To transfer an archived building file, click on the "Transfer building to other account" button (on the "General" tab) and then select the Madaster account of the recipient (client or end customer). Note: This receiving account must give prior permission for the transfer of the archive.

- **Full archive + transfer to another account** – the entire archive is created and transferred directly to another account <u>without being kept in the original account</u>. The transferred building can be edited under the new account and contains a database with all (in the initial building) applied materials and products.

- **Partial archive of building in another account** – the partial archive is created and transferred directly to another account <u>without being kept in the original account</u>. The transferred building can be edited under the new account and contains a database containing only the materials and products applied (in the initial building) from non-globally available databases.

General (static) documents made available from the "Dossier" tab are also added to the building archive. Finally, a new materials passport is generated. The archived building will be timestamped and, with the "Full archive" and "Partial archive" options, will also remain available as a separate archive in the navigation drawer on the left side of the screen.

For more details about the archiving process, please refer to Step 7 "Archive building" and to Step 8 "Transfer Building Archive" in the manual "Madaster Action Plan Materials Passport".
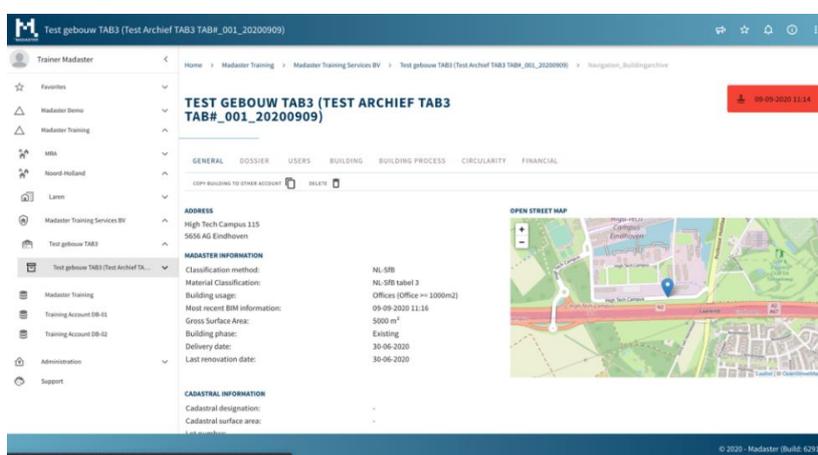
Picture 46: Archive building (General tab)

4   Circularity

4.1   Circularity Indicator

The value of the data stored in the Madaster Platform increases as the value of the products and materials in the building is better preserved. The Madaster Circularity Indicator (CI), based on the Ellen MacArthur Foundation's international open-source Material Circularity Indicator (MCI), has been developed to gain an idea of how buildings score in the field of circular construction. This Madaster CI gives an indication of the degree of circularity of the building. A fully circular building achieves a score of 100%.

The Circularity Indicator evaluates the building during three life phases:

(1) the materials used to construct the building (ratio of primary raw materials to materials used),

(2) the lifespan (in relation to the average lifespan), and

(3) how products and materials are processed at the end of life (ratio of reuse/recycling and waste to landfill or incineration).

More information and details, including the applied methodology, is described in the reference work "Madaster Circularity Indicator explained".

4.2   Circularity indication Version 2

By activating the "CI V2" preview feature (see section 2.4), Madaster offers its users additional insights on the buildings Circularity tab.

4.2.1   Adjusted Circularity calculation (V2)

In version 2 of Madaster's Circularity Indicator, elements in the imported source file (IFC/Excel) without classification code are no longer excluded (compared to V1). In other words, elements whose location (building layer) is unknown, are (via correction factor) included in the circularity calculation of the building.
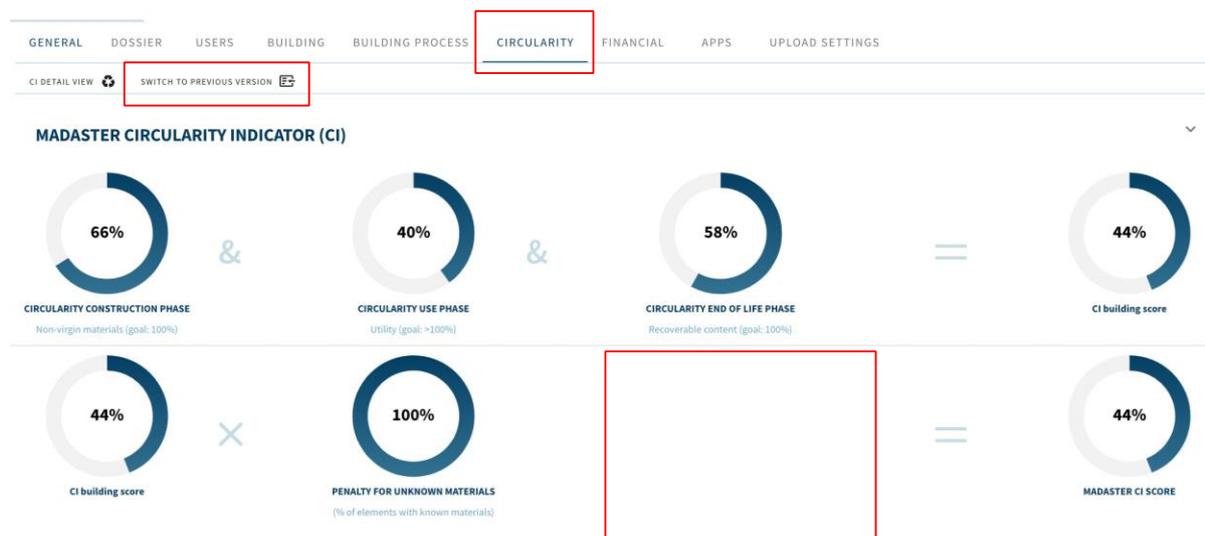
Picture 47: Adjusted CI calculation (Circularity tab)

By activating the "CI V2" function, the user has the possibility at any time to switch between the standard (V1) ("switch to previous version") and the adapted (V2) circularity evaluation of the building.

By clicking on a pie chart of the circularity indicators, the detail view becomes active, in which the details are displayed per building layer (e.g., Structure, Skin, etc.).

4.2.2   Feedstock Input & Output

By matching elements from a source file with materials/products in a Madaster dataset, the Madaster platform can provide insight into the "Feedstock Input" and "Output" flow of materials. The feedstock input flow indicates the amount (in tonnes) and ratio (in %) of primary (virgin) and secondary (reused/recycled) materials used in the building's construction phase. The output flow shows the amount (in tonnes) and ratio (in %) of materials released at the building's end of life stage, categorised according to materials available for reuse, recycling, landfill and incineration.
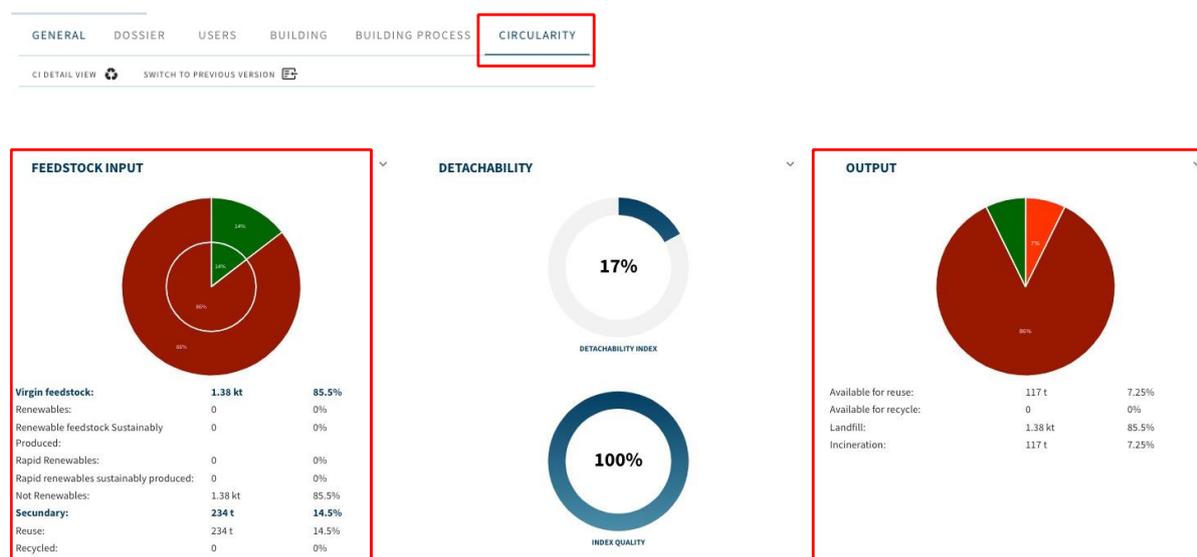
Picture 48: Feedstock Input & Output flow

By clicking the (feedstock input or output flow) pie chart on the building's Circularity tab, a more detailed view is displayed, in which these indicators are visible per building layer (e.g., Structure, Skin, etc.). Even more specs are displayed when the user expands the feedstock input and/or output rows in this view (via the menu on the right-hand side).
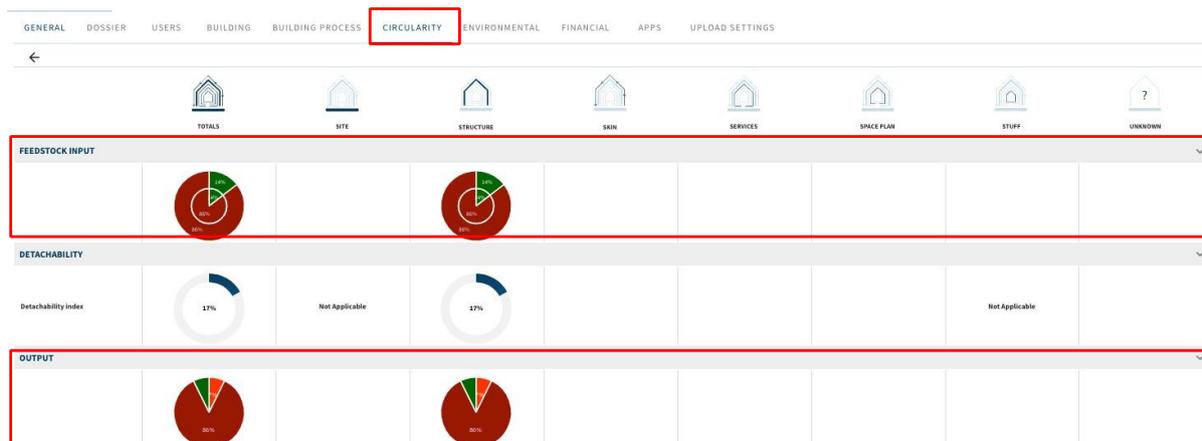
Picture 49: Feedstock input & Output flow (building layer level)

4.2.3 Detachability (index & quality score)

In addition to the building's circularity level, the degree of detachability on building and building layer level can be displayed. It shall indicate how detachable a building (layer) and the products contained are.

This detachability indication in Madaster is based on the revised (2.0) version of the uniform measurement method for detachability, as described in the report "Circular Buildings – a measurement method for detachability 2.0". This methodology has been developed and tested by a consortium of Alba Concepts, Dutch Green Building Council, etc. on behalf of the Dutch Ministry of the Interior and the Transition Agenda Circular Building Economy.

The following detachability factors are considered:

- **Connection type**: where dry connections are being preferred over connections with added elements and direct, integral connections taking precedence over soft and hard chemical ones.

- **Accessibility of the connection**: how easily you can (physically) reach the connecting elements and to what extent this causes damage to nearby objects.

- **Intersections:** indicates the extent to which products overlap or are integrated with each other. The higher the integration, the more actions required to disassemble an element at the end of its life.

- **Product edges inclusion**: assessment of how products are placed in a composition and whether it is open or closed. A 'locked up' product can only be dismantled in the reverse order of construction.

The building's detachability index (in %) is displayed on the Madaster "Circularity" tab when the "CI V2" feature is active (see section 2.4.1). This index is the sum of the number of individual elements within the building, which are linked to a product in Madaster, that (1) has the aforementioned four detachability factors filled in (or taken over from the IFC element).
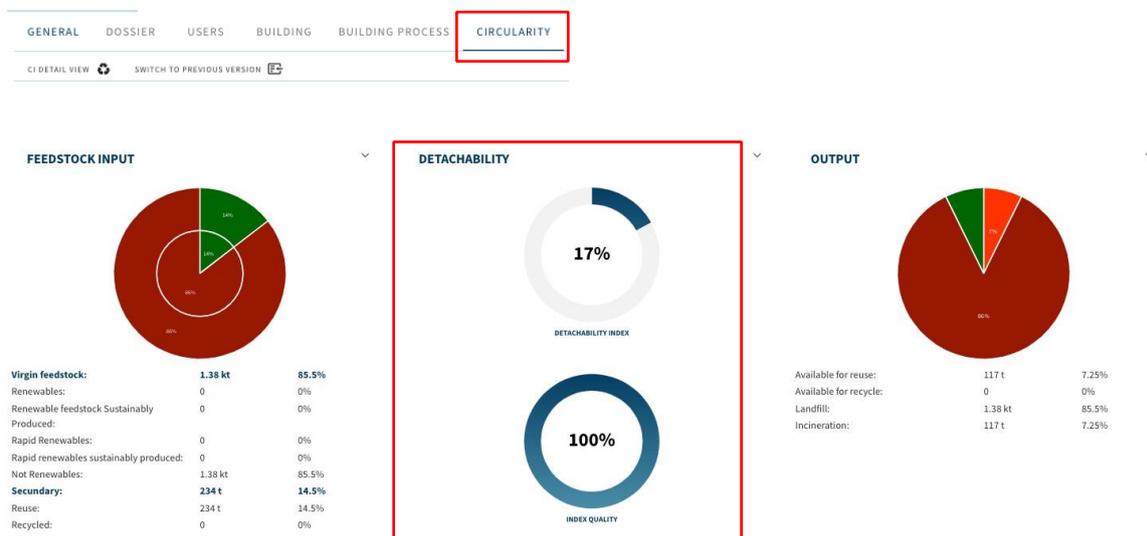
Picture 50: Detachability index (building level)

The "Index Quality" shows the ratio (in %) of the number of products for which a releasability index has been calculated compared to the total number of elements linked to a product on the Madaster platform.

By clicking on the detachability pie charts, a detail view per building layer is displayed (excluding Site and Stuff). Even more specs are displayed when the user expands the detachability row in this view (via the menu on the right-hand side).
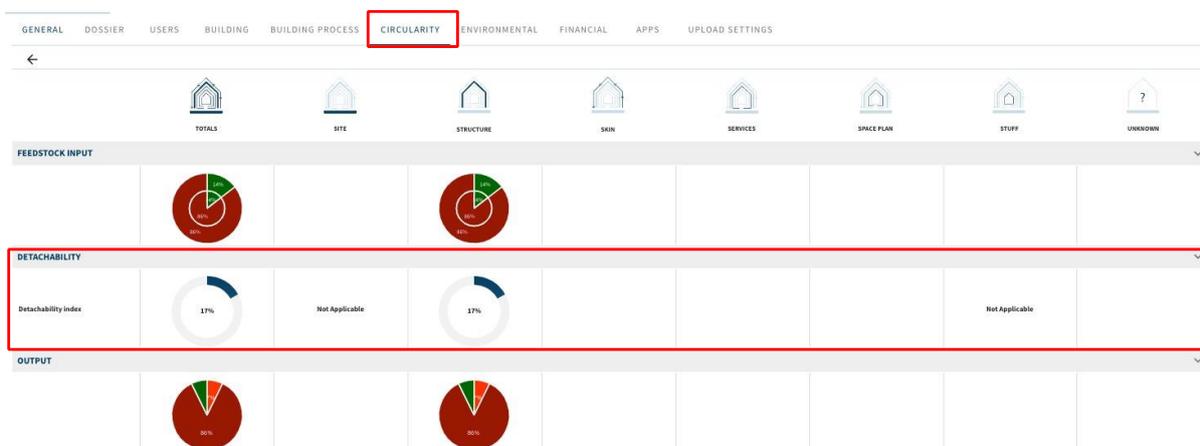
Picture 51: Detachability index (building layer level)

5   Financial

5.1   Financial Value and Residual Value

In addition to documenting the materials in a building, Madaster wants to link a financial value to the documented materials. The rationale behind this, is that if you really want to stimulate the circular economy, there must be a financial trigger attached to it. Therefore, the residual value of materials is calculated in the Financial tab. This data can be used to make circular propositions in the market and to determine more precisely what the final value is based on material value as an absolute minimum value. The more detachable and with sustainable materials are built, the higher the residual value. The financial module is therefore a driver for the circular economy and translates circularity into money.

The Financial module shows what the residual value of a building is at the end of the various lifetimes of products expressed in terms of material value. In addition, it shows the financial material value at this moment (current value) and the predicted development in the future.

In the 'building layers' level, the residual value of the various building layers is calculated back to today's capital value at the different final functional durations. This means that it is the residual value based on the expected functional life of the materials. This functional life is different for each building layer. If one assumes that a building remains completely intact during the use phase, the capital value of a building depends on the end of the building's useful life. This net present value calculation can be viewed via the Material Groups tab for the different years in the future. The current value of the materials within a building can be viewed via the Material Groups tab.

More information and details, including the applied methodology, is described in the reference work "Explanation Madaster Financial Model".

5.2   Financial Material

5.2.1   Calculation Method

The material value is preferably taken from commodity prices of common commodity exchanges. The historical price increase of materials is first corrected with the inflation of the respective year and the corresponding exchange rate if the raw material is in another currency. The data points of the commodity price development with this deduction are the basis for a linear trend line, which is determined on the basis of a regression analysis.

5.2.2   Correction Factors

Subsequently, the material values were corrected for deconstruction costs, processing costs, a correction for the size of the raw material flow and transport costs per kg. The demolition costs are indexed with the average BDB index of the last 18 years. The treatment and processing costs are material-dependent and were determined based on interviews and desk research. For the transport costs, a distance to the processor of 150 km per goods transport was assumed for all materials except mineral materials (20 km) and wood (40 km).

What influence do inflation, the BDB index (construction cost index) and the discount rate have on my calculation?

The influence on this can be tested well in the sensitivity analysis on the detail pages. Here, inflation, the BDB index and the discount rate can be adjusted. By default, the values for inflation and the BDB index are based on the average of the last 18 years. For the discount rate, the 10-year government interest rate (0.7 %) with risk (2 %) and profit (0.3 %) surcharges is taken.

5.3 Financial Building Layers

5.3.1 Calculation Method

The different building layers have a functional life, which is given by Madaster by default or set building-specific in the General tab. In the Building Layers tab, the value of the materials is determined at the end of their functional life (years). The materials are thus assigned to a specific service life. The value in t = end of life is calculated back to t = 0 in present value using the discount rate. The sum of the present values (NPV) of the different building layers is the summative present value.

Trend Line Determination

The trend line of the material value is used to determine the expected value this year. The material value is preferably taken from the commodity prices of the common commodity exchanges. The increase in the material price is first corrected for the inflation of the respective year and the corresponding exchange rate if the raw material is in another currency. The data points in the history of commodity prices with this deduction are the basis for a linear trend line, which is determined on the basis of a regression analysis.

5.3.2 Correction Factors

Subsequently, the material values were corrected for deconstruction costs, processing costs, a correction for the size of the raw material flow and transport costs per kg. The demolition costs are indexed with the average BDB index of the last 18 years. The treatment and processing costs are material-dependent and were determined on the basis of interviews and desk research. For the transport costs, a distance to the processor of 150 km per goods transport was assumed for all materials except mineral materials (20 km) and wood (40 km).

6   System Databases & Suppliers

Here you will find the databases of materials and products, which are platform-wide available for the Madaster users according to their country.
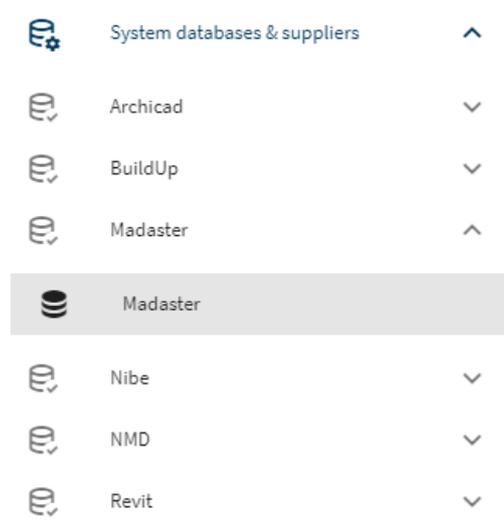
Picture 52: System databases & suppliers (left vertical navigation)

Picture 53 Madaster Material Database

7   Administration

The administration is the place where you find information on cross-regional topics.

7.1   Classification methods

A detailed overview of the classification structures (e.g., NL-SfB, eBKP-H and Omniclass) that are known for countries within Madaster. Per classification, a view of all codes and their mapping to the shearing layers of Brand is available.

7.2   Partner

As a building registration platform, Madaster is part of a whole ecosystem of companies. The companies Madaster has a partnership with can be found under this tab. They are categorised into "Solution, Data, Service Partners". Madaster Partner Apps are designed to add value to you within the Madaster platform. Madaster distinguishes three types of partners: solution partners, data partners and service partners. Each has its own knowledge, expertise and tools that you (as a Madaster user) can benefit from. Below you will find a further explanation of the different types of partners.

Solution Partner

Solution Partners offer software solutions that are integrated into the platform. The data available in the platform is used and linked directly.

Data Partner

Data Partners provide services to enrich the Madaster platform and increase the reliability of the data. Examples of data provided by Data Partners include financial, circular, and material data.

Service Partner

Service Partners provide their expertise on Madaster to a large group of clients. Examples include training, BIM modelling services, data certification or consultancy work.

8   Madaster Support

Madaster Service can be reached by phone during office hours (+31 85 060 1242).

In your Madaster environment, you can view the available support documentation online at any time. Each page in the Madaster platform contains an "i" button on the top right of the screen. This help-button will give you information about the page you are viewing and available features at any time.

This manual and other support and reference documents of the Madaster platform can also be found directly under the following link.