# Madaster IFC-import process explained

Technical description of the processing of IFC files within the Madaster platform

| Made for | Version | Date |
| --- | --- | --- |
| Madaster users | 0.2 | 7 July 2022 |

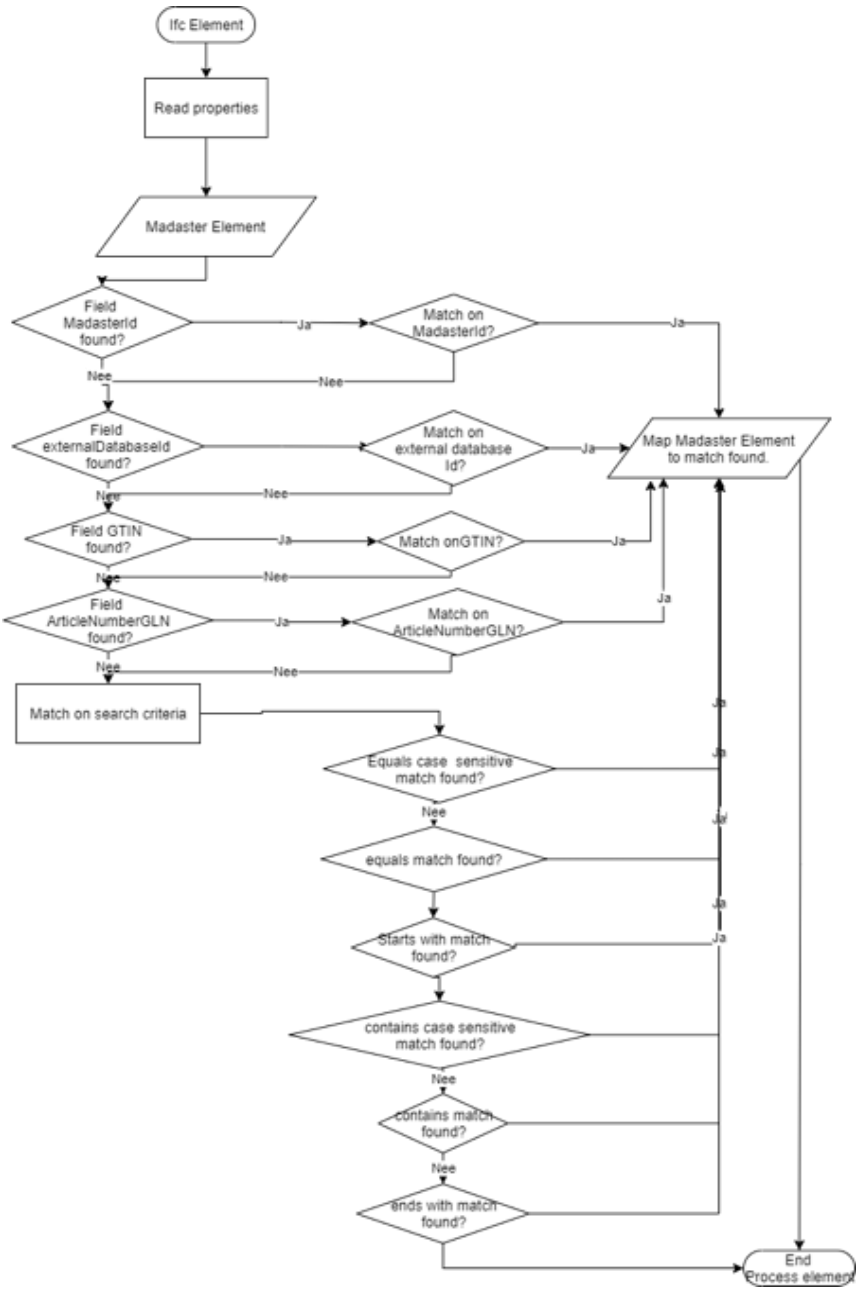
# Table of Contents

# 1 Introduction

This document explains the processing of IFC files within Madaster and as such provides insight how IFC files should be prepared for optimal use in the Madaster platform. In this guide, it is explained how the geometric properties, classification coding, construction phasing and material parameters are retrieved. In general, the IFC Import process in Madaster can be divided into two successive steps:

1. Reading/extracting the data fields from an IFC file.
2. Matching IFC elements by: (a.) Madaster Element or (b.) Search Criteria.

These steps are shown in detail in the flowchart below and explained on the following pages:



# 2 Reading/extracting the data fields from an IFC file.

## 2.1 Madaster Property set (Pset_Madaster)

If the property set with the name: Pset_Madaster is present on an IFC element and the properties below are entered within this data set, then these values of the properties are used within Madaster. Other properties are then ignored.

| Property Name | Property Type | Madaster Element | Description |
|---|---|---|---|
| MaterialOrProductId | IfcText | MadasterId | Unique identifier of a material or product within a Madaster database. |
| externaldatabaseId | IfcText | externaldatabaseId | Unique identifier of a material or product in an externalDatabase also connected to Madaster. |
| GTIN | IfcText | GTIN | |
| ArticleNumberGLN | IfcText | ArticleNumberGLN | The articleNumber\|GLN combination. |
| MaterialOrProductName | IfcText | MaterialName | When filled, madaster will use this material/product name to map to search criterias (Overrides the Material information explained before) |
| Volume | IfcVolumeMeasure | Volume | |
| Area | IfcAreaMeasure | Area | |
| Length | IfcLengthMeasure | Length | |
| Width | IfcLengthMeasure | Width | |
| Height | IfcLengthMeasure | Height | |
| Depth | IfcLengthMeasure | Depth | |
| Weight | IfcMassMeasure | | Not used yet |
| Classification | IfcText | Classification | Code of the used classification method. |
| Phase | IfcText | Phase | |
| DetachabilityConnectionType | IfcText | DetachabilityConnectionType | See list of possible values in Detachability section 1 |

| | | | |
|---|---|---|---|
| DetachabilityConnectionTypeDetail | IfcText | DetachabilityConnectionTypeDetail | See list of possible values in Detachability section 1 |
| DetachabilityAccessibility | IfcText | DetachabilityAccessibility | See list of possible values in Detachability section 2 |
| DetachabilityIntersection | IfcText | DetachabilityIntersection | See list of possible values in Detachability section 3 |
| DetachabilityProductEdge | IfcText | DetachabilityProductEdge | See list of possible values in Detachability section 4 |

## 2.2 Detachability (disassembly)

The 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 methodology for disassembly potential 2.0', which was developed and tested by a consortium of, among others, the Dutch Green Building Council, Netherlands Enterprise Agency and W/E Adviseurs on behalf of the Ministry of the Interior and the Transition Agenda Circular Building Economy.

1. Property DetachabilityConnectionType and **Detachability*ConnectionTypeDetail*** are used to indicate the type of connection

| **Detachability*ConnectionType*** | | **Detachability*ConnectionTypeDetail*** | |
|---|---|---|---|
| ***Possible values*** | ***Explanation*** | ***Possible values*** | ***Explanation*** |
| DryConnection | Dry Connection | Unknown | |
| DryConnection | Dry Connection | None | None |
| DryConnection | Dry Connection | Click | Click connection |
| DryConnection | Dry Connection | Velcro | Velcro connection |
| DryConnection | Dry Connection | Magnetic | Magnetic connection |
| AddedConnectionConnection | Connection with added elements | Unknown | |
| AddedConnectionConnection | Connection with added elements | BoltAndNut | Bolt and Nut connection |
| AddedConnectionConnection | Connection with added elements | Spring | Spring connection |
| AddedConnectionConnection | Connection with added elements | Corner | Corner joints |
| AddedConnectionConnection | Connection with added elements | Screw | Screw joints |
| DirectConnection | Direct integral connection | Unknown | |

| | | | |
|---|---|---|---|
| DirectConnection | Direct integral connection | Peg | Peg |
| DirectConnection | Direct integral connection | Nail | Nailing |
| SoftChemicalConnection | Soft chemical compound | Unknown | |
| SoftChemicalConnection | Soft chemical compound | Sealant | Sealant |
| SoftChemicalConnection | Soft chemical compound | Foam | Foam joint (PUR) |
| HardChemicalConnection | Hard chemical compound | Unknown | |
| HardChemicalConnection | Hard chemical compound | Glue | Adhesive bonding |
| HardChemicalConnection | Hard chemical compound | LandFill | Landfill connection |
| HardChemicalConnection | Hard chemical compound | Weld | Weld joint |
| HardChemicalConnection | Hard chemical compound | Concrete | Cementitious bond |
| HardChemicalConnection | Hard chemical compound | ChemicalAnchor | Chemische anchors |

2. Property ***DetachabilityAccessibility***

| ***Possible values*** | ***Explanation*** |
|---|---|
| Accessible | Freely accessible without additional actions |
| PartialNoDamage | Accessible with additional actions that do not cause damage |
| PartialWithRepairableDamage | Accessible with additional operations with fully repairable damage |
| PartialWithDamage | Accessible with additional operations with partially repairable damage |
| NotAccessible | Not accessible - irreparable damage to the product or surrounding products |

3. Property ***DetachabilityIntersection***.

| ***Possible values*** | ***Explanation*** |
|---|---|
| None | No intersections - modular zoning of products or elements from different layers |
| Incidental | Occasional intersections of products or elements from different |

| | |
|---|---|
| | layers |
| Complete | Full integration of products or elements from different layers |

4. Property ***DetachabilityProductEdge***

| *Possible values* | *Explanation* |
|---|---|
| Open | Open, geen belemmering voor het (tussentijds) uitnemen van producten of elementen |
| Overlapping | Overlapping, gedeeltelijke belemmering voor het (tussentijds) uitnemen van producten of elementen |
| Closed | Gesloten, volledige belemmering voor het (tussentijds) uitnemen van producten of elementen |

## 2.3 Default data fields for GTIN of Article number

The Madaster platform offers (subject to conditions) the option of automatically recognizing IFC installation elements and linking them to products in the 2BA database. An IFC file must contain specific element information for this, with which the Madaster system attempts to validate the product in the 2BA database based on the unique reference via:

**(1) GTIN:**

- GTIN code is available in the property 'ArticleNumber'.
- Property 'Manufacturer' does not need to be specified.

Or

(2) **Combination of Article number & GLN code:**

- Article number needs to be specified in property 'ArticleNumber'.
- GLN code needs to be specified in property in property 'Manufacturer'.

The tables below show the relevant data fields, depending on the IFC version used (IFC2x3 or IFC4).

IFCv2.3:

| Property set | Property Name | Madaster Element | Explanation |
|---|---|---|---|
| Pset_ManufacturerTypeInformation | ArticleNumber | ArticleNumberGLN | Field ArticleNumber GLN is specified as [ArticleNumber]\|[GLN] |
| | | GTIN | When ArticleNumber is 8, 13 or 14 characters long. |
| Pset_ManufacturerTypeInformation | Manufacturer | ArticleNumberGLN | GLN part of the field |
| Pset_ManufacturerTypeInformation | ModelReference | ArticleNumberGLN | When ArticleNumber is empty, this field is used as |

| | | | |
|---|---|---|---|
| | | | ArticleNumber is part of the Madaster ArticlNumberGLN element. |

IFCv4:

| Property set | Property Name | Madaster Element | Explanation |
|---|---|---|---|
| Pset_ManufacturerTypeInformation | GlobalTradeItemNumber | GTIN | Global Trade Item Number of the product. |
| Pset_ManufacturerTypeInformation | ArticleNumber | ArticleNumberGLN | Field ArticleNumber GLN is specified as [ArticleNumber]\|[GLN] |
| | | GTIN | When GlobalTradeItemNumber property is empty and ArticleNumber is 8, 13 or 14 characters long. |
| ManufacturerTypeInformation | Manufacturer | Manufacturer part of ArticleNumberGLN | |
| ManufacturerTypeInformation | ModelReference | When ArticleNumber data field is empty:<br>ArticleNumber part of ArticleNumberGLN | |

## 2.4 Classification

Note: The Madaster platform supports the local Dutch classification code (NL/SfB) and international OmniClass table 21 classification code.

First, all references of the element are searched for the type: IfcClassificationReference or IfcExternalReference. If no value is found in the IfcClassificationReference or IfcExternalReference, the system searches for the layer of the ifcElement and tries to match it to the classification.

- **NL/SFB** classification code

When a property of this type is found, the system tries to match the value of this property against the 2-digit and / or 4-digit NL/SfB coding list.

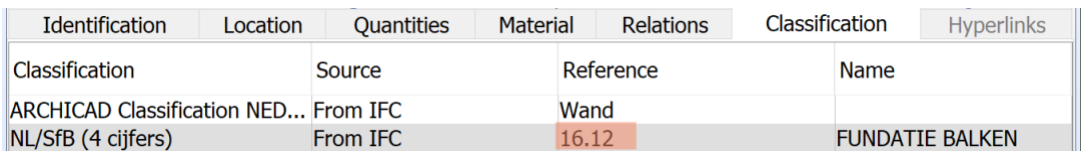



**Fig:** Example of 4-digit NL/SfB coding on element.

- **OmniClass table 21** classification code

When a property of this type is found, the system tries to match the value of this property against the 6 digit and / or 8 / 10-digit OmniClass table 21 coding list.

| Identification | Location | Quantities | Material | Profile | Relations | Classification | Hyperlinks | BaseQuantities | BaseQuantities_Ec |
|---|---|---|---|---|---|---|---|---|---|

| Classification | Source | Reference |
|---|---|---|
| Omniclass Classification | From IFC | 21-02 10 |

**Fig:** Fig: Example of a 6-digit OmniClass coding on an element

## 2.5 Geometrical properties

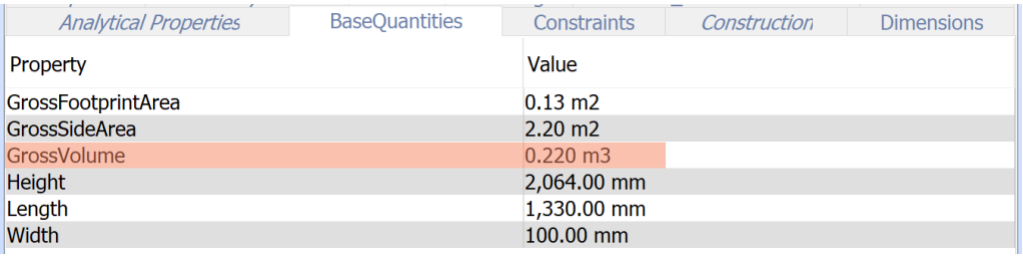
### 2.5.1 Volume

For each element, the area first tries to read the IfcQuantityVolume named “NetVolume” from the collection of type: IfcElementQuantity. If no value can be found for this, all property sets of the element will be searched for a property with the name: “NetVolume”.

If there are several properties sets of the type IfcElementQuantity or more properties with the name “NetVolume” then the first property is chosen. If no property with this naming convention can be found, the same process is repeated for properties with the following naming convention and in the following order until a value can be found:

- NetVolume
- Volume
- GrossVolume

Depending on the material composition, the volume is calculated in some scenarios by multiplying the material thickness by the material surface. For more information see section “Material”.



| *Analytical Properties* | BaseQuantities | Constraints | *Construction* | Dimensions |
|---|---|---|---|---|

| Property | Value |
|---|---|
| GrossFootprintArea | 0.13 m2 |
| GrossSideArea | 2.20 m2 |
| GrossVolume | 0.220 m3 |
| Height | 2,064.00 mm |
| Length | 1,330.00 mm |
| Width | 100.00 mm |

**Fig:** Example of volume property within BaseQuantities property set.

### 2.5.2 Surface area

For each element, the area first tries to read the IfcQuantityAreaproperty named “NetSideArea” from the collection of type: IfcElementQuantity. If no value can be found for this, all property sets of the element will be searched for a property with the name: “NetSideArea”.

If there are multiple property sets of the type IfcElementQuantity or more properties with the name “NetSideArea” then the first property is chosen. If no property with this naming convention can be

found, the same process is repeated for properties with the following naming convention and in the following order until a value can be found:

- NetSideArea
- GrossSideArea
- TotalSurfaceArea
- GrossSurfaceArea
- OuterSurfaceArea
- CrossSectionArea
- NetFootprintArea
- GrossFootprintArea
- GrossArea
- Area

### 2.5.3 Length

For each element, for the length, it first tries to read the IfcQuantityLength property named “Length” from the collection of type: IfcElementQuantity. If no value can be found for this, all property sets of the element will be searched for a property with the name: “Length”.

When there are multiple property sets of the type IfcElementQuantity or multiple properties with the name “Length”, the first property is chosen.

### 2.5.4 Width

For each element, for the length, it first tries to read the IfcQuantityLength property named “Width” from the collection of type: IfcElementQuantity. If no value can be found for this, all property sets of the element will be searched for a property with the name: “Width”.

When there are multiple property sets of the type IfcElementQuantity or multiple properties with the name “Width”, the first property is chosen.

### 2.5.5 Height

For each element, the length first tries to read the IfcQuantityLength property named “Height” from the collection of type: IfcElementQuantity. If no value can be found for this, all property sets of the element will be searched for a property with the name: “Height”.

If there are multiple property sets of the type IfcElementQuantity or multiple properties with the name “Height”, the first property is chosen.

### 2.5.6 Depth

For each element, for the length, it first tries to read the IfcQuantityLength property named “Depth” from the collection of type: IfcElementQuantity. If no value can be found for this, all property sets of the element will be searched for a property with the name: “Depth”.

If there are multiple property sets of the type IfcElementQuantity or multiple properties with the name “Depth”, the first property is chosen.

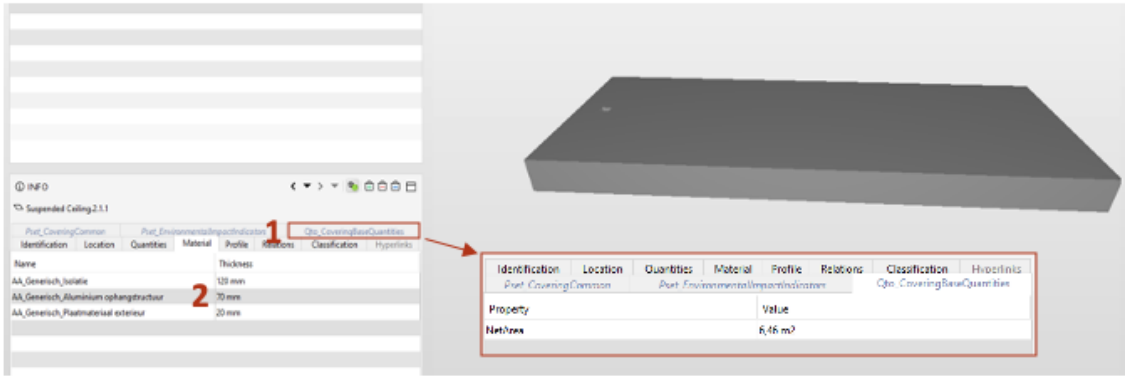
### 2.5.7 Weight

For each element, for the length, it first tries to read the IfcQuantityWeight property from the collection of type: IfcElementQuantity.

When there are multiple property sets of the type IfcElementQuantity or multiple properties of the type “IfcQuantityWeight”, the first property is chosen.

### 2.5.8 Geometrical properties nested elements

**IFC file:**

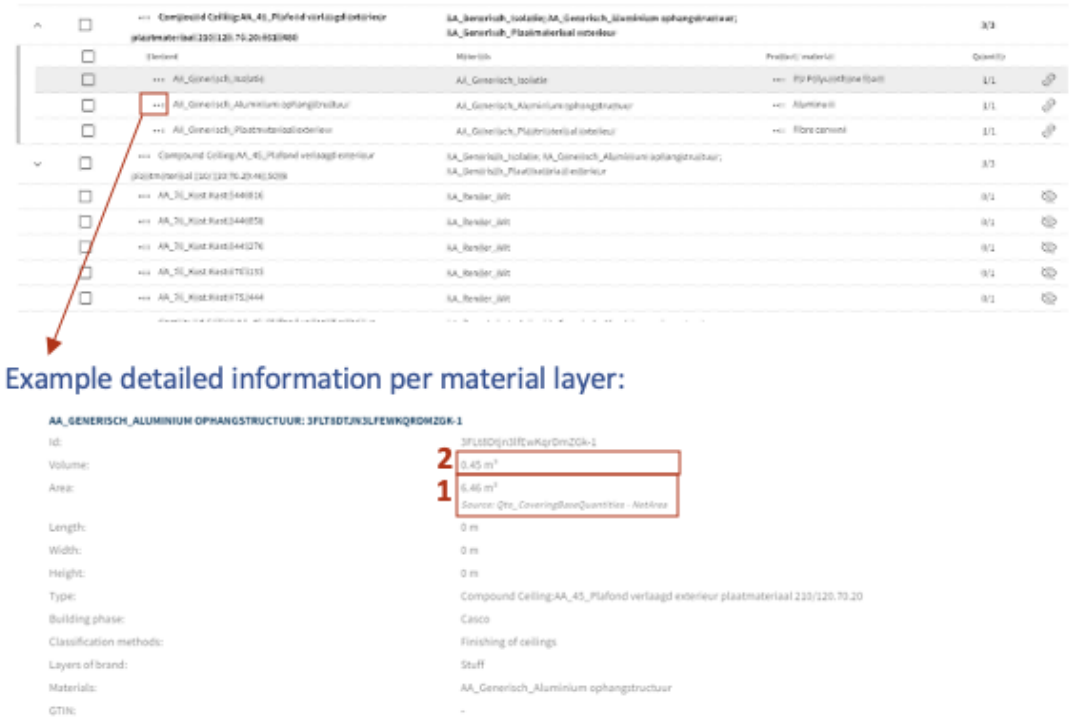



Grouped elements/nested families:

1. Define base quantity ($m^2$/$m^3$ of the entire element)
2. Define Thickness for each layer

The number of layers is not limited. You just need to make sure that each layer in your element has a defined thickness.

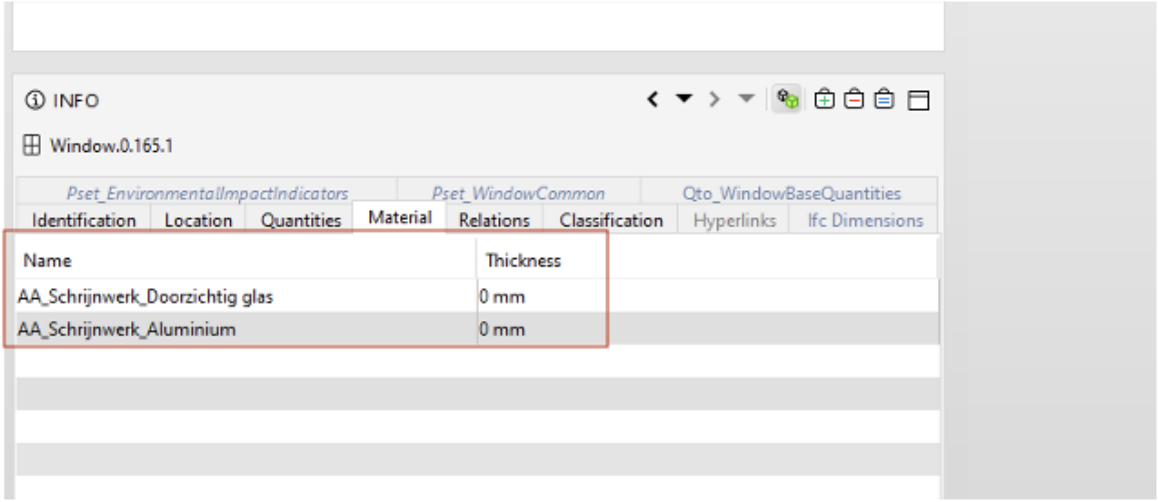
**Madaster Platform:**



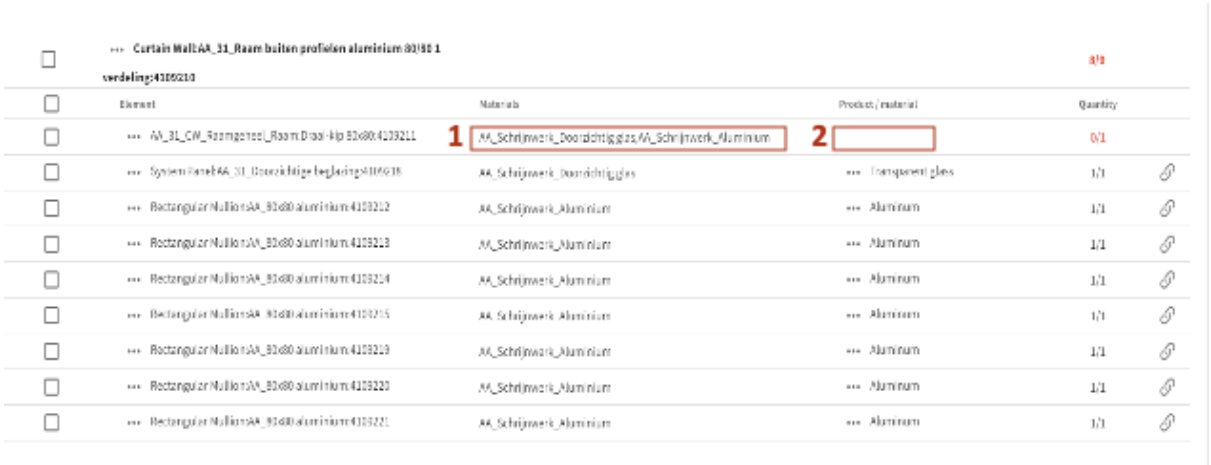

1. Area read out in Madaster as defined in the respective property set, e.g here Qto_BaseQuantities as given in the ifc file.
   -> For more information on what property sets are read out by Madaster please refer to “Madaster ifc import”
2. With the Thickness given in the ifc file, Madaster can derive the volume for the specific material layer, e.g. 6,46 x 0.07 = 0.45m$^3$

### *2.5.8.1 Problem if thickness is not defined*

**IFC file:**



**Madaster Platform:**




1. If thickness of a layer is not defined, they will appear in one element in Madaster.
2. Due to the double naming, e.g, here *glass* & *Aluminum*, Madaster is unable to identify a unique corresponding material, hence the field remains empty.

## 2.6 Material

For each element, the material is retrieved via the IfcMaterialSelect relationship. And depending on the characterization of the related material property, different scenarios are handled for the following characterizations:

### 2.6.1 IfcMaterialLayerSetUsage

If the material property is of type IfcMaterialLayerSetUsage then an attempt is made to get IIfcMaterialLayerSet. And here it is checked whether this list contains multiple elements and whether the thickness (Thickness) property has been entered. If this is the case and the value of the property Thickness is greater than 0 mm, the element is split into the number of materials that the layerset knows.

Identification | Location | Quantities | Material | Profile | Relations | Classification | Hyperlinks

| Name | Thickness |
|---|---|
| Steen - Baksteen | 100.00 mm |
| Lucht | 40.00 mm |
| Isolatie - Kunststof hard | 100.00 mm |
| Steen - Kalkzandsteen C | 100.00 mm |

**Fig:** Example of a material specification with layerSet

The volume of these materials is then calculated as follows:

Volume = Area * Thickness of layer.

If the property Thickness is 0 or not filled. Then multiple materials are specified on the element and the volume remains from the volume proportions as specified above. The **Name** field of the property is used for naming the material.

### 2.6.2 IfcMaterialLayerSet

If the material property is of type IfcMaterialLayerSet, then it is checked whether the list contains multiple layers. And whether the thickness (Thickness) property has been entered. If this is the case and the value of the property Thickness is greater than 0 mm, the element is split into the number of materials that the layerset knows.

The volume of these materials is then calculated as follows:

Volume = Area * Thickness of layer.

If the property Thickness is 0 or not filled. Then multiple materials are specified on the element and the volume remains from the volume proportions as specified above. The **Name** field of the property is used for naming the material.

### 2.6.3 IfcMaterialList

If the material property is of type IfcMaterialList, multiple materials are specified on the element and the volume remains from the volume proportions specified above. The **Name** field of the property is used for naming the material.

### 2.6.4 IfcMaterial

If the material property is of type “IfcMaterial” then the property is taken from the Name field of the property.

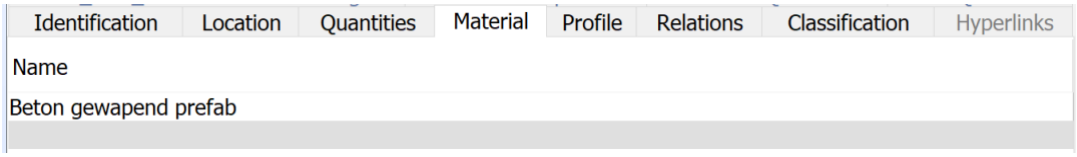
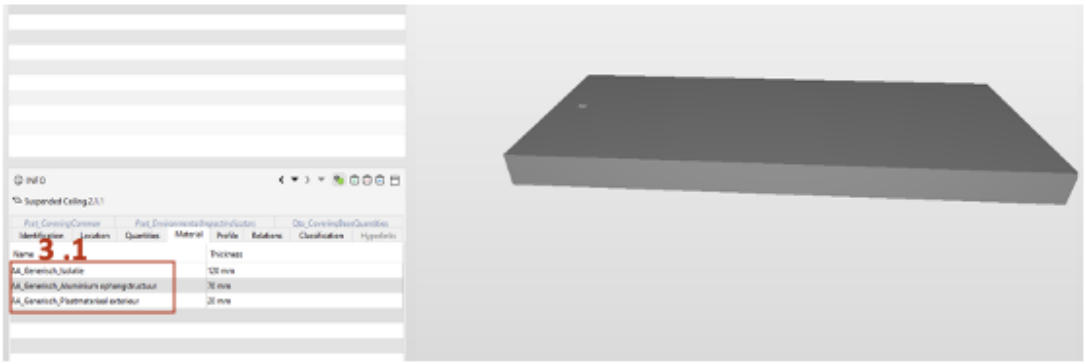



**Fig:** Example material specification without file set.

### 2.6.5 Material naming of nested elements

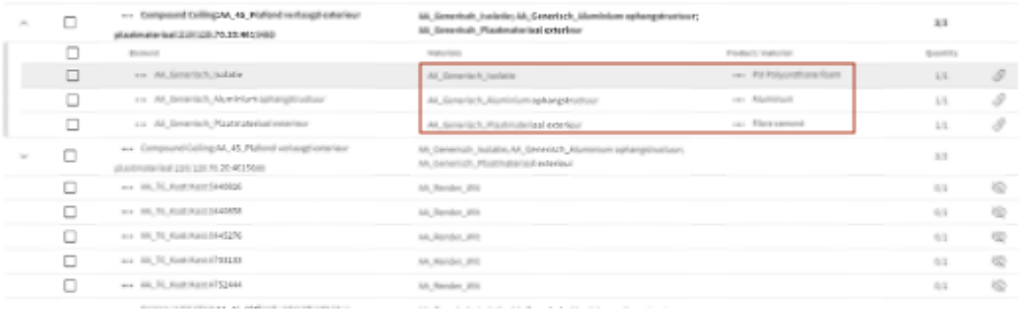
**IFC file:**




For all Elements:

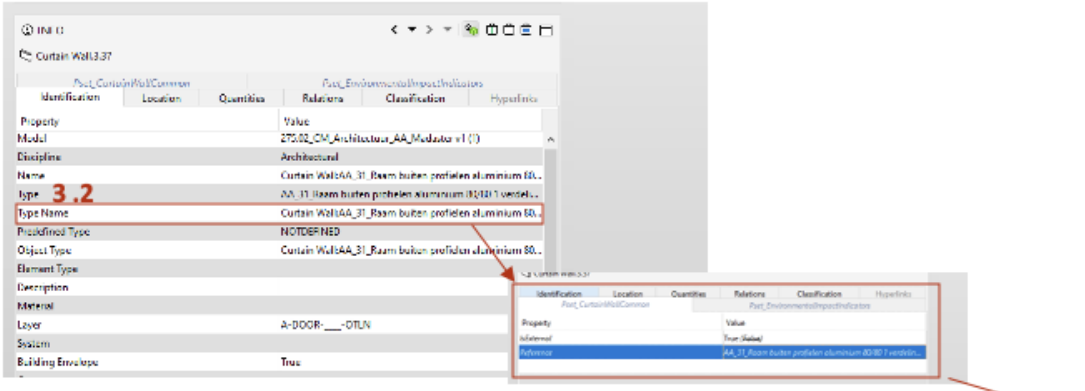
**3.1:** Give a clear Material Name in all Layers

**Madaster Platform:**



**3.1:** A clear material name is necessary for Madaster to match corresponding material information from the database.

**IFC file:**

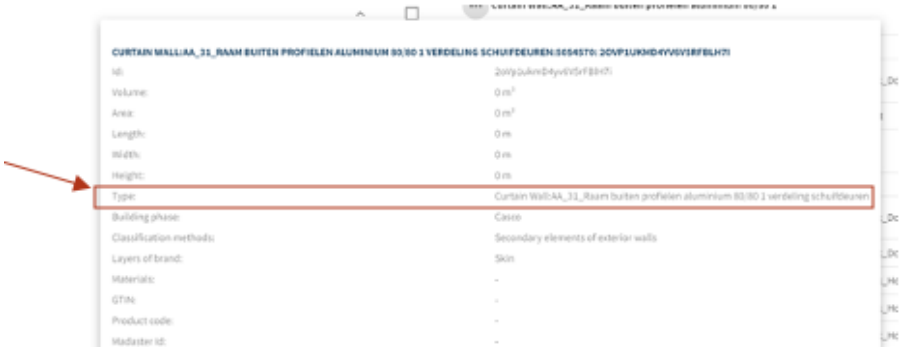



For all Elements:

**3.2:** Use the Name of the entire element, which is indicated as Type Name, and set up a corresponding "product" on Madaster yourself containing the material information of different layers.

**Madaster Platform:**


**3.2:** Set up your own product in your database containing the different material layers: Aluminium Frame, Glazing etc.
Setting the search criteria to be the same as the name of the element, Madaster is able to match the information.




## 2.7 Building phase

For each element, the build stage is taken from the property with one of the following naming conventions (this is case sensitive):

- Phase Created
- Renovation Status
- Phase

| AC_Pset_RenovationAndPhasing | ArchiCADProperties | ArchiCADQuantities | BaseQuantities |
|---|---|---|---|
| Property | Value | | |
| Renovation Status | Existing | | |

**Fig:** Example of phase in Archicad CAD-application

| Graphics | Identity Data | Other | Phasing | Pset_WallCommon | Structural |
|---|---|---|---|---|---|
| Property | | | Value | | |
| Phase Created | | | Nieuw | | |

**Fig:** Example of phase in Revit CAD-application

Then the values from these properties are matched as follows:

- Demolition
    - Demolition

    - To be demolished
    - Sloop
- New
    - Nieuw
    - New
- Casco
    - casco
    - existing
    - bestaand

The matching is performed on the entire sentence / word and is not case sensitive. If no matching has taken place with the above categories, the element will be mapped to Casco.

The construction phase current and final are calculated using the above phase according to the following calculation:

- Existing = Demolition + Casco
- Final = Casco + New

## 2.8 Building number (“split building” feature)

The 'split buildings' function offers the possibility in Madaster to draw up individual building files and passports based on a prepared IFC file with several buildings/homes. This makes it superfluous to prepare IFC models per object in IFC prior to being entered in Madaster, to subsequently prepare a building file (including materials passport) for this.

To make use of this function, a property set and name must be defined in the IFC file per element (is flexible) in which an individual construction number is recorded (e.g., A02).

It is also possible to assign several construction numbers (separated by a comma) to one IFC element. For example: A02, A03, A04, A05. Based on the number of construction numbers, the Madaster system will assign them proportionally in percentages. In the image below there is 1 IFC element, which is assigned to 4 construction number, because of which these construction numbers in Madaster are assigned "(25%)".

**FLOOR:NLRS_43_FL_CEMENTDEKVLOER_50_MIX:1705081: 2E5R42J4965PWD7TOMVQQC**

| | |
|---|---|
| Id: | 2e5r42J4965PWd7TOMvQqC |
| Volume: | 0,96 m³<br>*Bron: BaseQuantities - NetVolume* |
| Oppervlakte: | 19,12 m²<br>*Bron: BaseQuantities - GrossArea* |
| Lengte: | 0 m |
| Breedte: | 0,05 m<br>*Bron: BaseQuantities - Width* |
| Hoogte: | 0 m |
| Type: | Floor:NLRS_43_FL_cementdekvloer_50_MIX |
| Bouwfase: | Nieuwe materialen |
| Classificatiemethodes: | vloerafwerkingen; niet verhoogd, afwerklagen |
| Gebouwlagen: | Afbouw |
| Materialen: | NLRS_f2_zandcement dekvloer_mix |
| GTIN: | - |
| Artikelcode: | - |
| Madaster Id: | - |
| Gebouwnummer: | A02 (25%), A03 (25%), A04 (25%), A05 (25%) |

Note: it is not (yet) possible to read out a deviating percentage per construction number in Madaster (e.g., 1 IFC element with assignment to 2 construction numbers according to ratio: 70% vs. 30%).

## 2.9 Matching elements on search criteria

If the materials are specified per element, they will be automatically validated during data upload in Madaster against (linked with) materials and products that are known within the selected Madaster database(s). These can be found in the Madaster Navigation drawer (left vertical menu under 'Databases & suppliers'. If available, own/account specific databases can also be selected during this import process. Each material and/or product can be provided with search criteria per language:

**ABS POLYMERS**

MATERIAALINFORMATIE | ZOEKCRITERIA | DOSSIER | FINANCIEEL

CRITERIUM TOEVOEGEN

| Zoekcriterium | Matchingstype | Taal |
|---|---|---|
| ABS | Is gelijk aan | Alle talen |
| ABS Polimeri | Bevat | Alle talen |
| ABS polymeren | Bevat | Nederlands |
| ABS polymers | Bevat | Alle talen |
| ABS-Polymere | Bevat | Alle talen |
| polymères ABS | Bevat | Frans |

Rijen per pagina: 10 1-6 van 6

**Fig:** Example of search criteria in material/product in Madaster

When importing an IFC file, the materials of each element are matched against these search criteria(s). This involves checking whether the material of an element matches one of the search criteria at product / material level in the selected languages.

Search criteria on product / material level can be configured in several ways:

- Contains the search criterion
- Equals the search criterion
- Starts with the search criterion
- Ends with the search criterion

And runs sequentially as long as no match is found:

- 1- against the “Equals” criteria
- 2- against the “Equals” criteria (case sensitive)
- 3- Against the “Contains” criteria contained
- 4- Against the “Contains” criteria contained (case sensitive)
- 5- Against the “Starts with” criteria
- 6- Against the “Ends with” criteria

If multiple matches are found in step 2, 3 or 4, the longest match (largest number of matching characters) will be used.

When multiple materials are specified on an IFC element without a thickness (Thickness). Then these elements are skipped in terms of matching because it is then not possible to relate the element to 1 material and / or product.

If no products and / or materials are linked, they can be manually linked to the element via the enrichment screen in Madaster. Any new materials and / or products can also be created here.

# 3 Madaster Support

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

When logged in your Madaster environment, you can always consult the available online support documentation. Each page in the Madaster platform contains an "I" button on the right side (mid-screen). This always provides information about the relevant page and available functions.

This information and additional guides and reference works on the use and development of the Madaster platform can also be found directly at the following link.