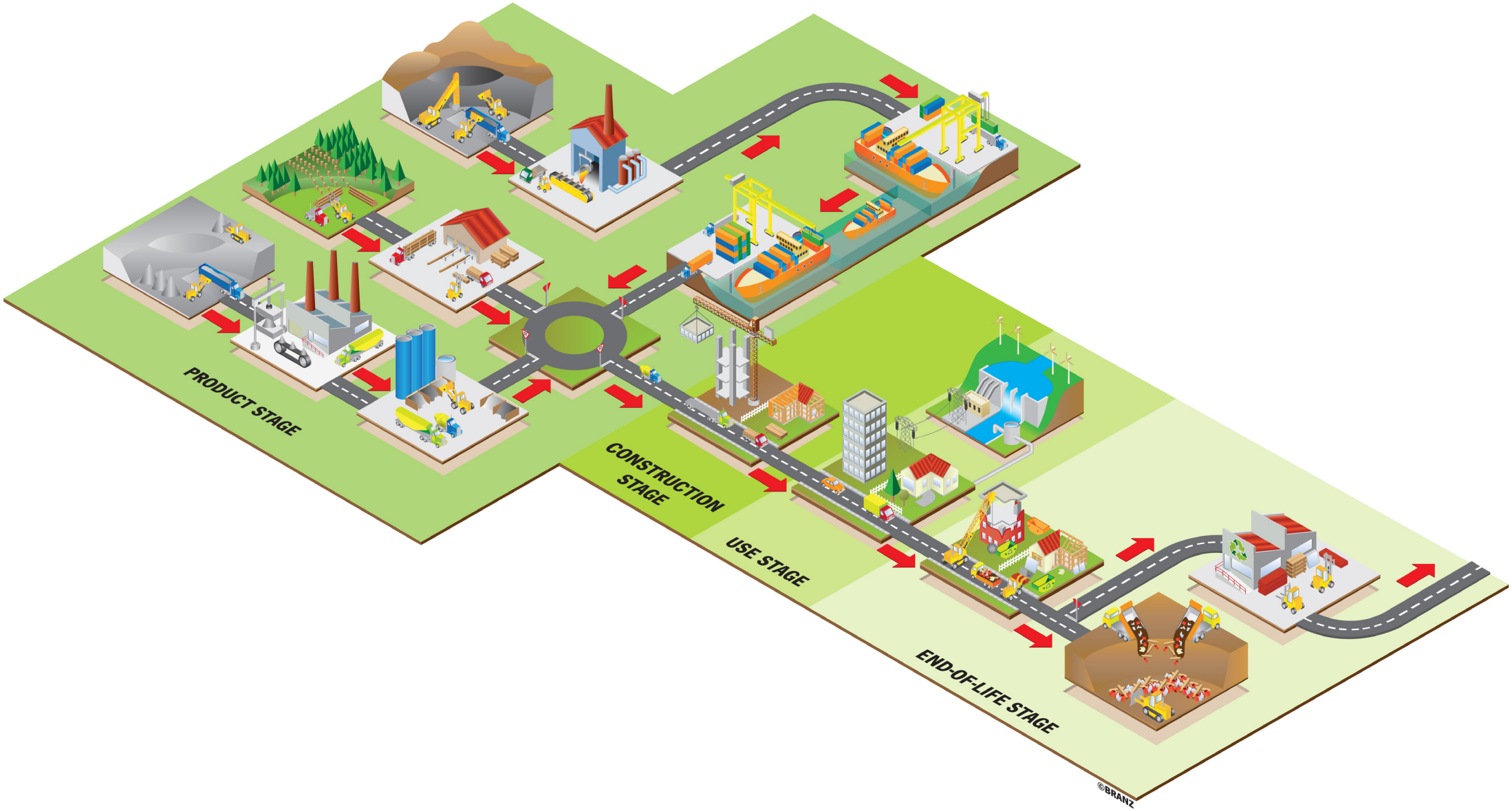


BRANZ

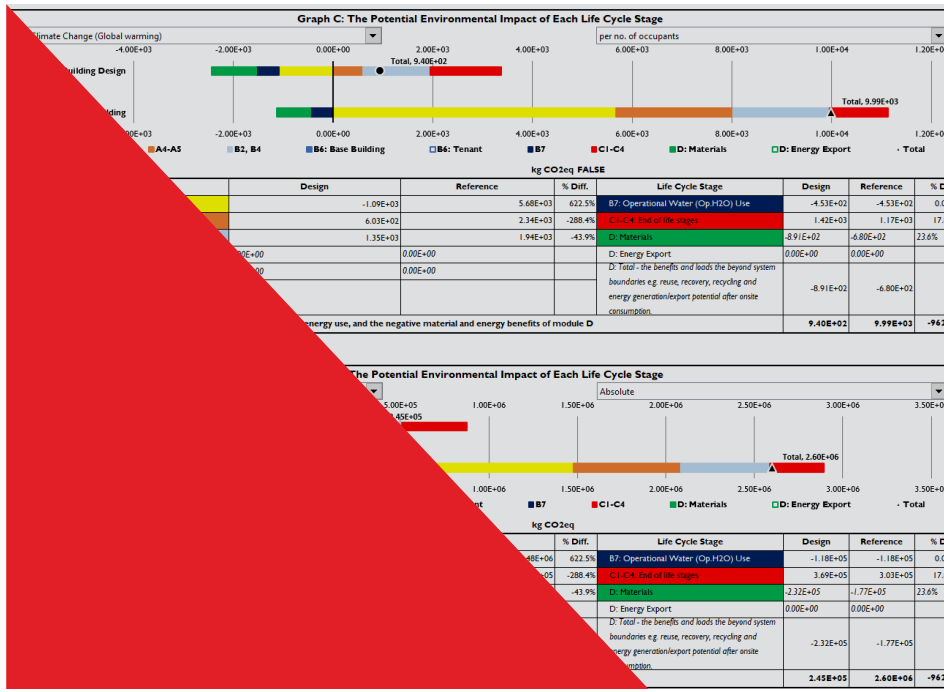
LCAQuick guide for ArchiCAD users

Using ArchiCAD to provide BIM data for LCAQuick calculations

V.1 2020

September

Contents



Thanks to James Service at Sills van Bohemen Architects

LCAQuick is a life cycle assessment tool that calculates the environmental impacts of a building throughout its life cycle. Materials used in the building contribute to these environmental impacts. LCAQuick can use the ArchiCAD building information model (BIM) to obtain material quantities needed for the calculation.

LOD for LCAQuick

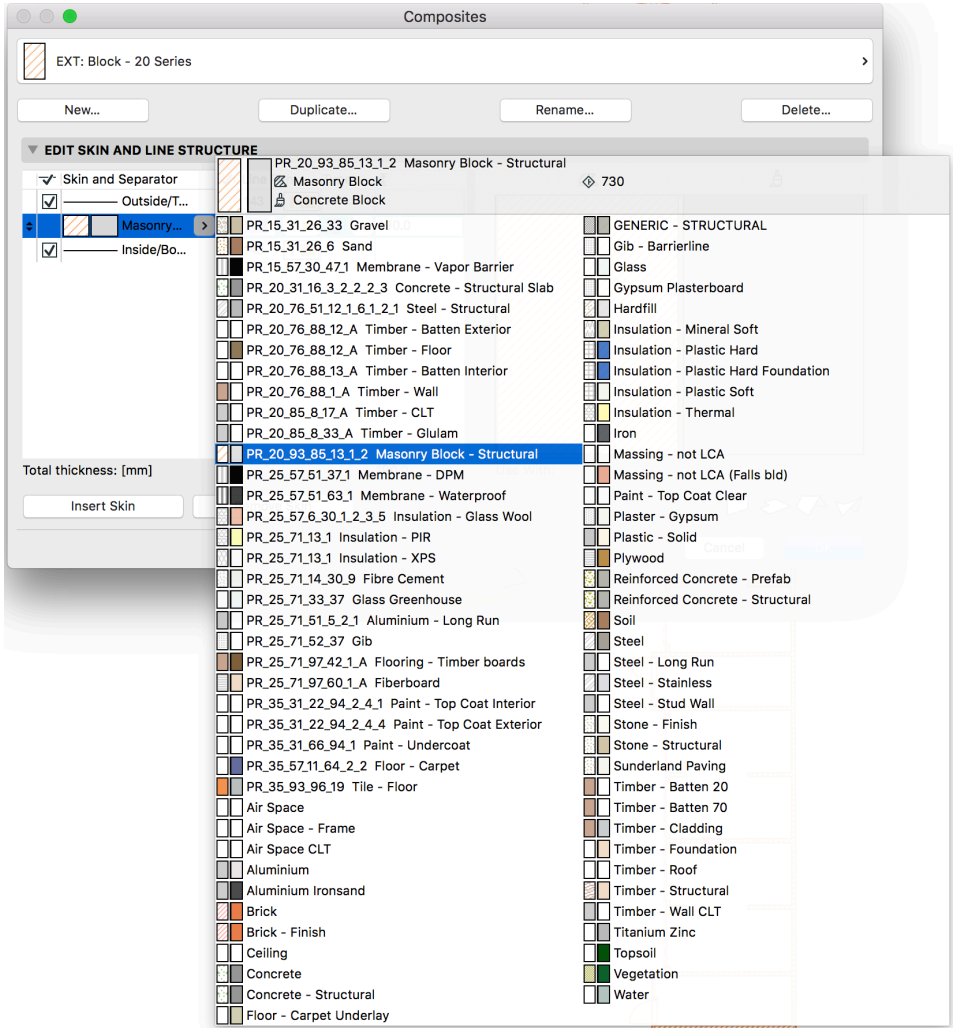
The level of development or LOD required from ArchiCAD for LCAQuick varies depending on the elements modelled between approximately LOD 200 and LOD 350.

https://www.biminnz.co.nz/s/NZ-BIM-Handbook-AppendixC-Levels-of-development-definitions-April-19.pdf

Some examples:

- LOD 200 would apply to a reinforced masonry wall with no coatings (LCAQuick includes the steel reinforcing).

  ArchiCAD element required > Wall > Structure > Basic or composite / Building material.



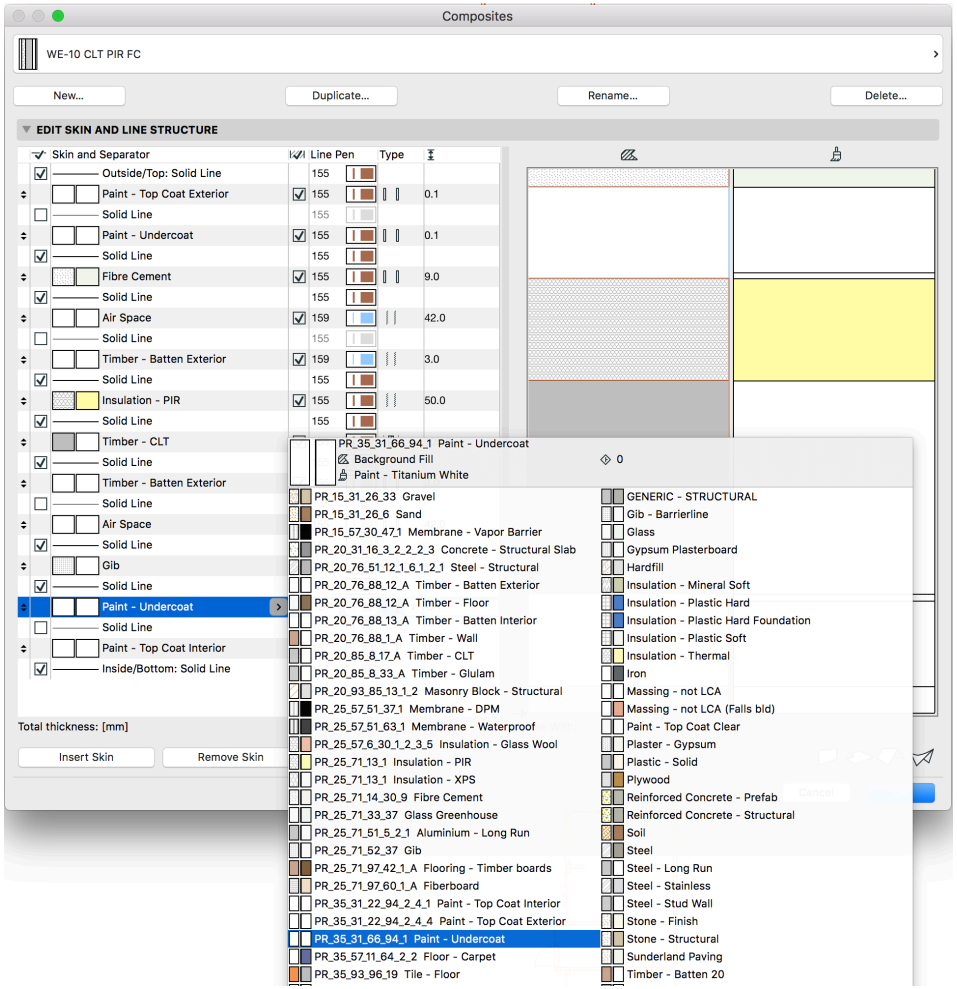
Masonry block composite

- LOD 350 would apply for a wall assembly – for example, fibre-cement cladding, cavity battens, insulation, CLT, strapping battens, plasterboard.

ArchiCAD element required > Wall > Structure > Composite or complex profile > Building material.

The method of calculating the constituent layers is similar to the calculations for thermal performance where each element in each layer needs to be accounted for.

Refer LCAQuick sheet *1b Unit Converters*.



FC wall assembly composite

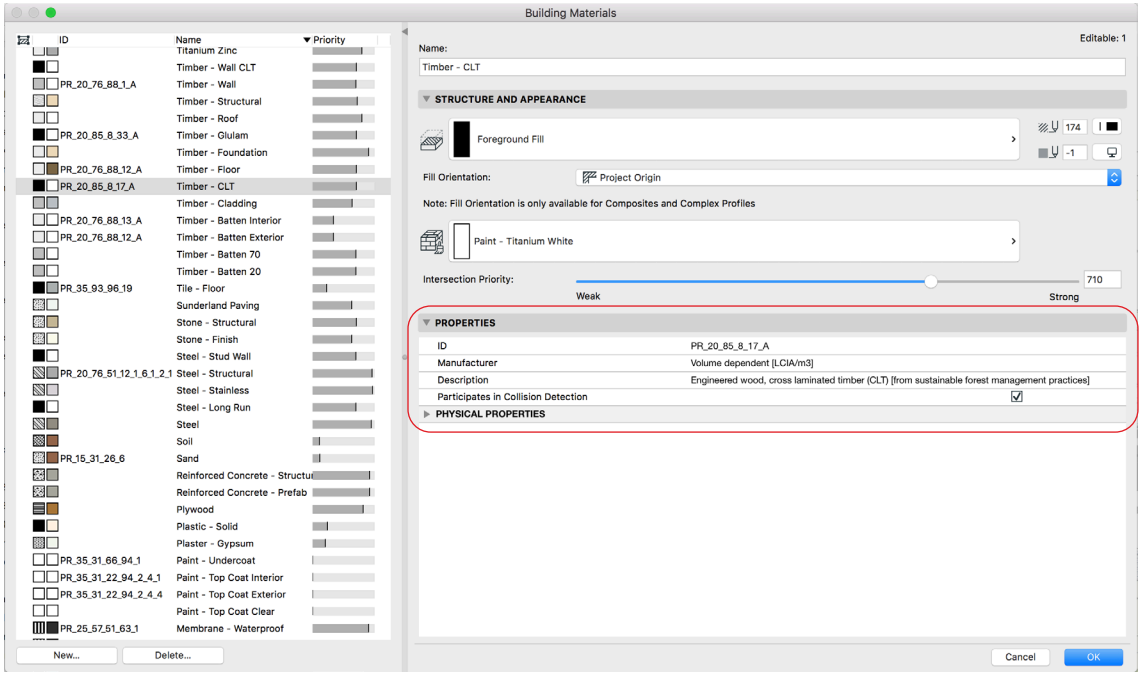
BIM in ArchiCAD for LCAQuick

LCAQuick uses codes to uniquely identify materials. These codes (and two other parameters) need to be added to the BIM elements' metadata.

Within ArchiCAD, there are a number of ways to assign the three required parameters for LCAQuick to the BIM. The approach taken in this document uses ArchiCAD's building materials attribute, which is described by Graphisoft as a:

> *"super attribute", a combination of multiple attributes having defined properties. Building Materials are defined globally, in the Building Materials dialog box, then applied to Construction Elements in their own Settings dialog boxes, or used as components of Composite Structures and Complex Profiles. Editing the Building Material attribute makes changes throughout the model.*

The benefit of this approach is that it is top-down. An ArchiCAD BIM at an early stage of developed design can, with just the addition of some classification attributes and some schedules, generate sufficient data for LCAQuick.



Building materials dialogue

The three parameters LCAQuick requires are:

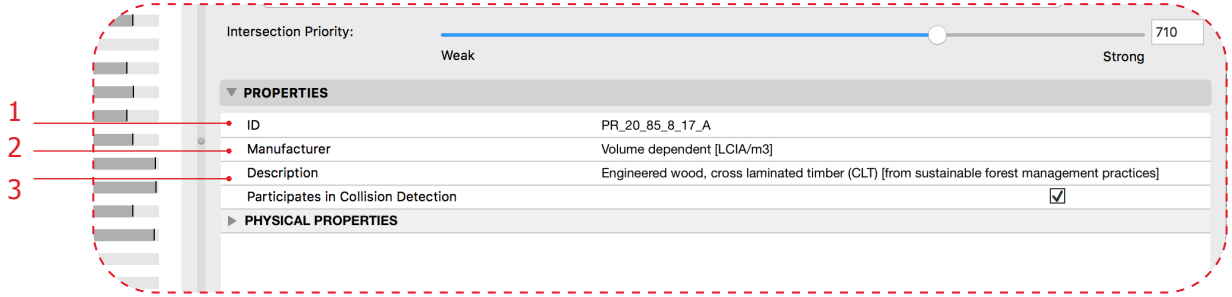
1. LCAQuick material code
2. LCAQuick material name/description
3. LCAQuick unit quantity requirement.

Building materials have only a few properties that are user editable. You need to use all of these to add the three parameters above. Copy and paste these properties from LCAQuick sheet *1a For Ref - Material Codes*. You will need to add these three parameters to each building material to be calculated in your project.

The third parameter (LCAQuick unit quantity requirement) has four options:

- Volume dependent [LCIA/m3].
- Area dependent [LCIA/m2].
- Area dependent, to derive volume [m3/m2].
- Number of items dependent [LCIA/item].

It is best to use ArchiCAD construction elements for those elements that are to be scheduled and calculated by LCAQuick. Try wherever possible to model using walls, columns, beams and slabs rather than objects for building elements. If the model includes complex geometries, use of complex profiles, shells and morphs is preferred.



Building materials dialogue

1	2	3
PR_20_93_85_13_1_2	Masonry wall, incl. concrete block 20 series (17.5MPa OPC), grouted 22MPa (OPC), inc. steel reinforcing	Volume dependent [LCIA/m3]
PR_20_85_8_17_A	Engineered wood, cross laminated` timber (CLT) [from sustainable forest management practices]	Volume dependent [LCIA/m3]
PR_25_57_51_63_1	Membrane, polyvinyl chloride (PVC)	Area dependent, to derive volume [m3/m2]

Examples of the three required LCAQuick parameters in a schedule

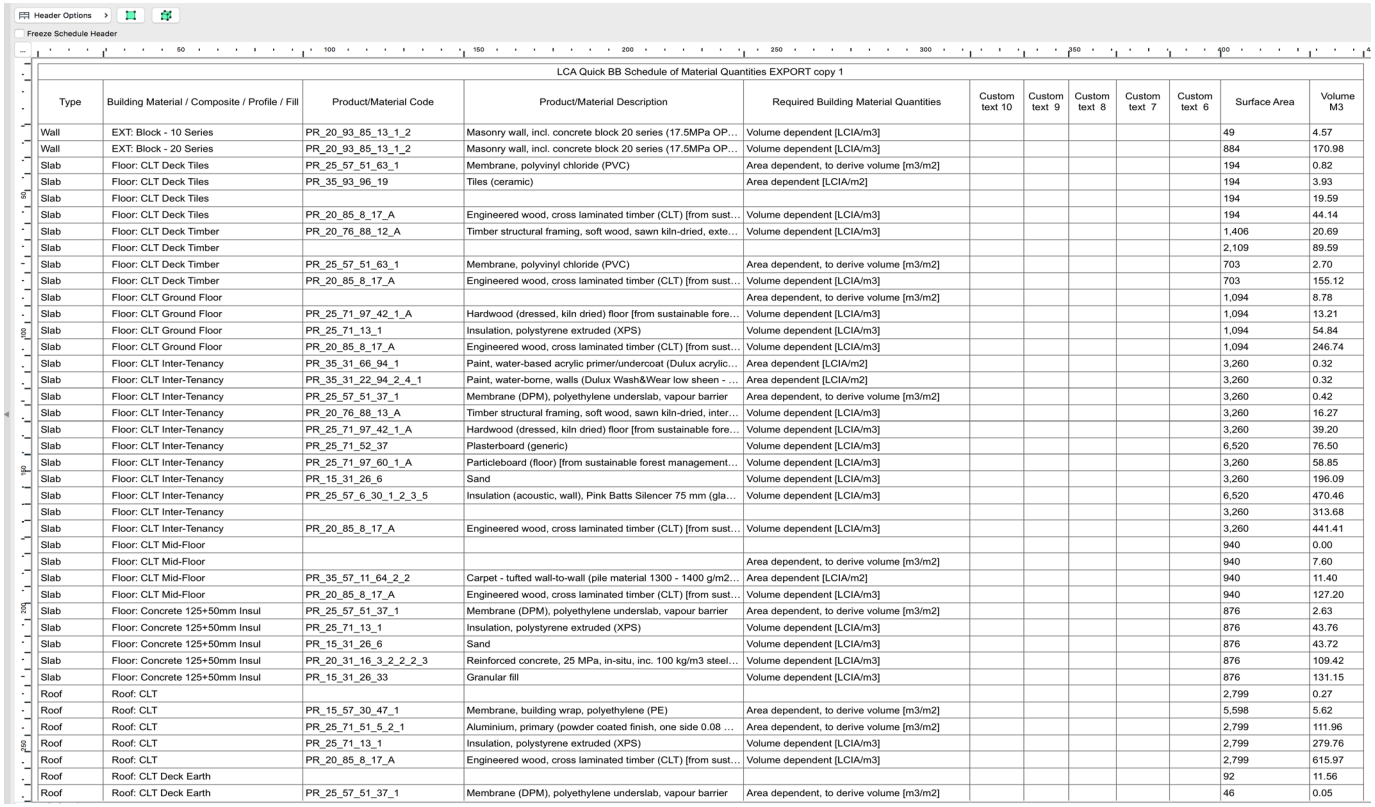
Schedules for LCAQuick

Interactive schedules in ArchiCAD allow for the display of quantities and other parameters. They also allow for the editing of model data within the schedules themselves. The interactive nature of schedules is invaluable when auditing and editing the model information.

Interactive schedules are used to format the data that is transferred into three LCAQuick input columns: *1c INPUT - Material Quant., 1c INPUT - Window Mat. Quant., 1c INPUT - Mat. Quant. WASHING*.

For LCAQuick, these two types of interactive schedules are useful:

- Components schedule
  This lists the components of elements – for example, the individual materials in a wall assembly composite. This is used to generate material schedules.



LCA Quick BB Schedule of Material Quantities EXPORT copy 1

Type	Building Material / Composite / Profile / Fill	Product/Material Code	Product/Material Description	Required Building Material Quantities	Custom text 10	Custom text 9	Custom text 8	Custom text 7	Custom text 6	Surface Area	Volume M3
Wall	EXT: Block - 10 Series	PR_20_93_85_13_1_2	Masonry wall, incl. concrete block 20 series (17.5MPa OP…	Volume dependent [LCIA/m3]						49	4.57
Wall	EXT: Block - 20 Series	PR_20_93_85_13_1_2	Masonry wall, incl. concrete block 20 series (17.5MPa OP…	Volume dependent [LCIA/m3]						884	170.98
Slab	Floor: CLT Deck Tiles	PR_25_57_51_63_1	Membrane, polyvinyl chloride (PVC)	Area dependent, to derive volume [m3/m2]						194	0.82
Slab	Floor: CLT Deck Tiles	PR_35_93_96_19	Tiles (ceramic)	Area dependent [LCIA/m2]						194	3.93
Slab	Floor: CLT Deck Tiles									194	19.59
Slab	Floor: CLT Deck Tiles	PR_20_85_8_17_A	Engineered wood, cross laminated timber (CLT) [from sust…	Volume dependent [LCIA/m3]						194	44.14
Slab	Floor: CLT Deck Timber	PR_20_76_88_12_A	Timber structural framing, soft wood, sawn kiln-dried, exte…	Volume dependent [LCIA/m3]						1,406	20.69
Slab	Floor: CLT Deck Timber									2,109	89.59
Slab	Floor: CLT Deck Timber	PR_25_57_51_63_1	Membrane, polyvinyl chloride (PVC)	Area dependent, to derive volume [m3/m2]						703	2.70
Slab	Floor: CLT Deck Timber	PR_20_85_8_17_A	Engineered wood, cross laminated timber (CLT) [from sust…	Volume dependent [LCIA/m3]						703	155.12
Slab	Floor: CLT Ground Floor			Area dependent, to derive volume [m3/m2]						1,094	8.78
Slab	Floor: CLT Ground Floor	PR_25_71_97_42_1_A	Hardwood (dressed, kiln dried) floor [from sustainable fore…	Volume dependent [LCIA/m3]						1,094	13.21
Slab	Floor: CLT Ground Floor	PR_25_71_13_1	Insulation, polystyrene extruded (XPS)	Volume dependent [LCIA/m3]						1,094	54.84
Slab	Floor: CLT Ground Floor	PR_20_85_8_17_A	Engineered wood, cross laminated timber (CLT) [from sust…	Volume dependent [LCIA/m3]						1,094	246.74
Slab	Floor: CLT Inter-Tenancy	PR_35_31_66_94_1	Paint, water-based acrylic primer/undercoat (Dulux acrylic…	Area dependent [LCIA/m2]						3,260	0.32
Slab	Floor: CLT Inter-Tenancy	PR_35_31_22_94_2_4_1	Paint, water-borne, walls (Dulux Wash&Wear low sheen - …	Area dependent [LCIA/m2]						3,260	0.32
Slab	Floor: CLT Inter-Tenancy	PR_25_57_51_37_1	Membrane (DPM), polyethylene underslab, vapour barrier	Area dependent, to derive volume [m3/m2]						3,260	0.42
Slab	Floor: CLT Inter-Tenancy	PR_20_76_88_13_A	Timber structural framing, soft wood, sawn kiln-dried, inter…	Volume dependent [LCIA/m3]						3,260	16.27
Slab	Floor: CLT Inter-Tenancy	PR_25_71_97_42_1_A	Hardwood (dressed, kiln dried) floor [from sustainable fore…	Volume dependent [LCIA/m3]						3,260	39.20
Slab	Floor: CLT Inter-Tenancy	PR_25_71_52_37	Plasterboard (generic)	Volume dependent [LCIA/m3]						6,520	76.50
Slab	Floor: CLT Inter-Tenancy	PR_25_71_97_60_1_A	Particleboard (floor) [from sustainable forest management…	Volume dependent [LCIA/m3]						3,260	58.85
Slab	Floor: CLT Inter-Tenancy	PR_15_31_26_6	Sand	Volume dependent [LCIA/m3]						3,260	196.09
Slab	Floor: CLT Inter-Tenancy	PR_25_57_6_30_1_2_3_5	Insulation (acoustic, wall), Pink Batts Silencer 75 mm (gla…	Volume dependent [LCIA/m3]						6,520	470.46
Slab	Floor: CLT Inter-Tenancy									3,260	313.68
Slab	Floor: CLT Inter-Tenancy	PR_20_85_8_17_A	Engineered wood, cross laminated timber (CLT) [from sust…	Volume dependent [LCIA/m3]						3,260	441.41
Slab	Floor: CLT Mid-Floor									940	0.00
Slab	Floor: CLT Mid-Floor			Area dependent, to derive volume [m3/m2]						940	7.60
Slab	Floor: CLT Mid-Floor	PR_35_57_11_64_2_2	Carpet - tufted wall-to-wall (pile material 1300 - 1400 g/m2…	Area dependent [LCIA/m2]						940	11.40
Slab	Floor: CLT Mid-Floor	PR_20_85_8_17_A	Engineered wood, cross laminated timber (CLT) [from sust…	Volume dependent [LCIA/m3]						940	127.20
Slab	Floor: Concrete 125+50mm Insul	PR_25_57_51_37_1	Membrane (DPM), polyethylene underslab, vapour barrier	Area dependent, to derive volume [m3/m2]						876	2.63
Slab	Floor: Concrete 125+50mm Insul	PR_25_71_13_1	Insulation, polystyrene extruded (XPS)	Volume dependent [LCIA/m3]						876	43.76
Slab	Floor: Concrete 125+50mm Insul	PR_15_31_26_6	Sand	Volume dependent [LCIA/m3]						876	43.72
Slab	Floor: Concrete 125+50mm Insul	PR_20_31_16_3_2_2_2_3	Reinforced concrete, 25 MPa, in-situ, inc. 100 kg/m3 steel…	Volume dependent [LCIA/m3]						876	109.42
Slab	Floor: Concrete 125+50mm Insul	PR_15_31_26_33	Granular fill	Volume dependent [LCIA/m3]						876	131.15
Roof	Roof: CLT									2,799	0.27
Roof	Roof: CLT	PR_15_57_30_47_1	Membrane, building wrap, polyethylene (PE)	Area dependent, to derive volume [m3/m2]						5,598	5.62
Roof	Roof: CLT	PR_25_71_51_5_2_1	Aluminium, primary (powder coated finish, one side 0.08 …	Area dependent, to derive volume [m3/m2]						2,799	111.96
Roof	Roof: CLT	PR_25_71_13_1	Insulation, polystyrene extruded (XPS)	Volume dependent [LCIA/m3]						2,799	279.76
Roof	Roof: CLT	PR_20_85_8_17_A	Engineered wood, cross laminated timber (CLT) [from sust…	Volume dependent [LCIA/m3]						2,799	615.97
Roof	Roof: CLT Deck Earth									92	11.56
Roof	Roof: CLT Deck Earth	PR_25_57_51_37_1	Membrane (DPM), polyethylene underslab, vapour barrier	Area dependent, to derive volume [m3/m2]						46	0.05

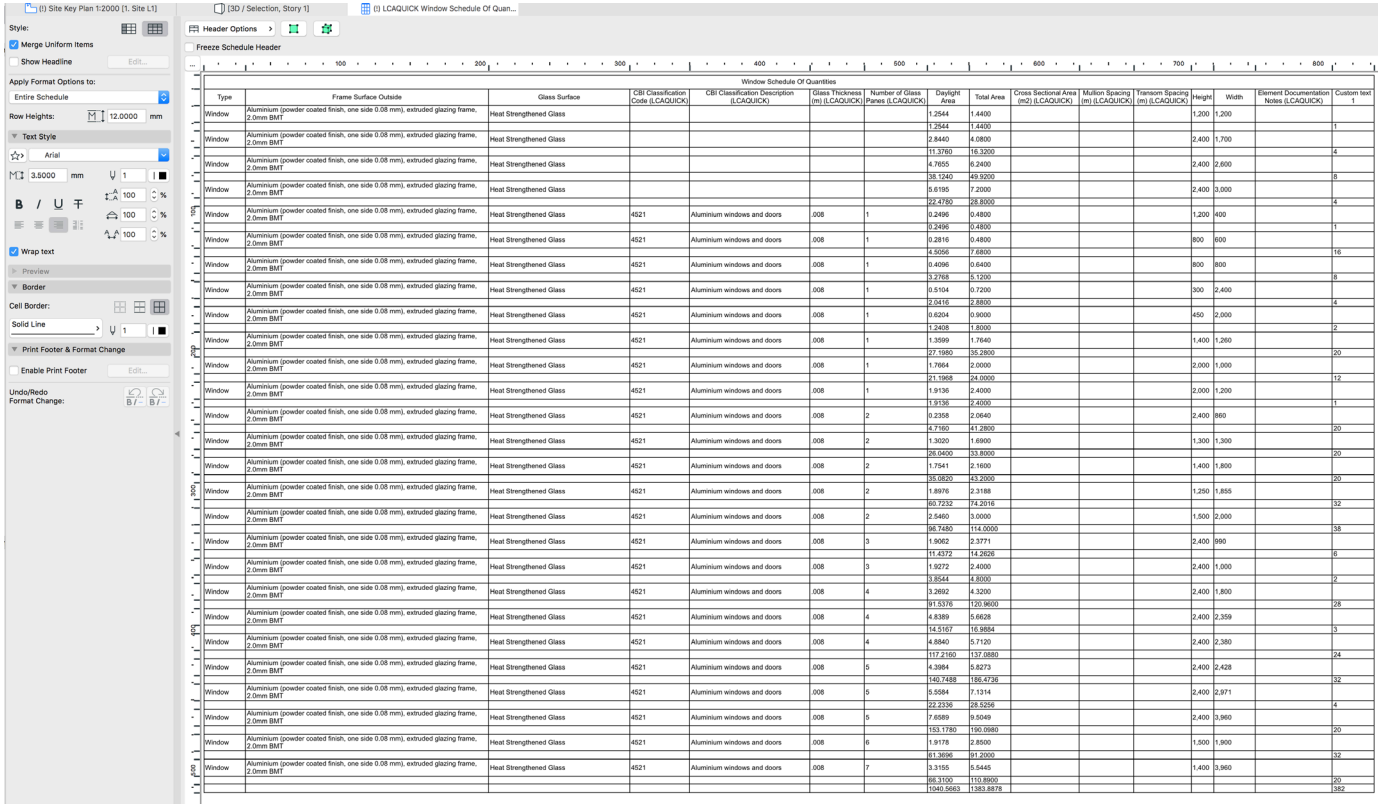
Components schedule – building materials

- Elements schedule

  This lists the characteristics of individual components – for example, the area of window frame for the window schedule or the areas of different zones.

If you are unfamiliar with creating schedules in ArchiCAD, the online help menu has extensive documentation on this topic.

https://helpcenter.graphisoft.com/user-guide-chapter/85111/



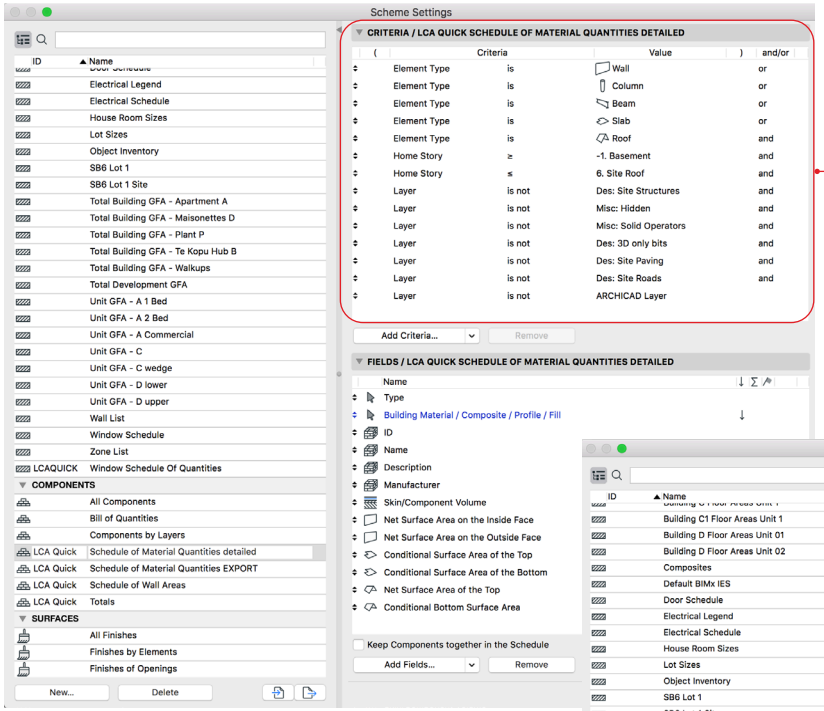
Elements schedule – windows

Building materials schedule

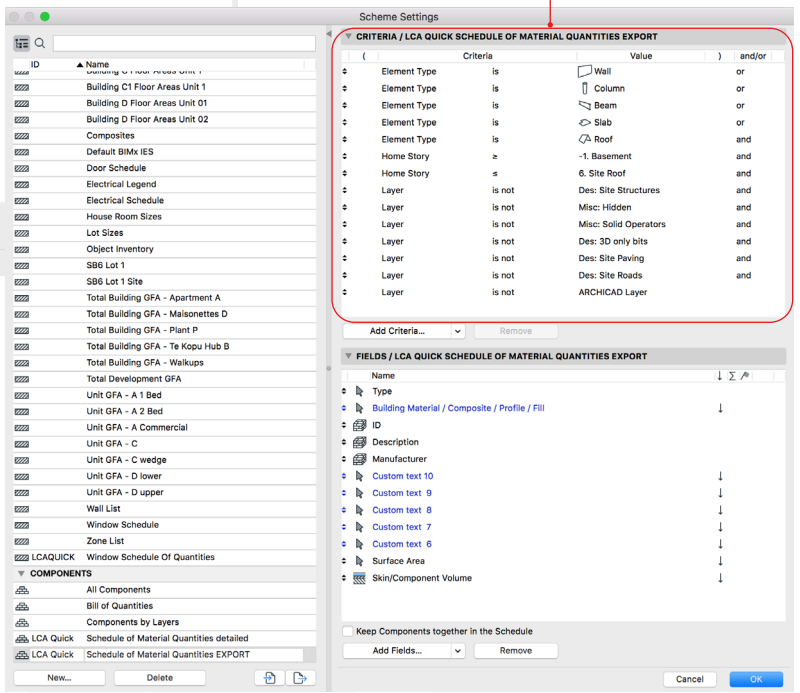
The building materials schedule contains the most information for use in LCAQuick and typically requires the most auditing to ensure that the information is correct.

It is suggested to create two schedules for this: one that is used for auditing the BIM (Detailed) and one that is used for exporting the data to LCAQuick (Export).

Criteria are used in schedules to ensure that only the required elements are scheduled. All criteria need to be customised based on your project and office BIM standards. You may not need all or any of the criteria illustrated here. It is best to start with no criteria or a very small set and add to these selectively to include only elements that are required.



Detailed building materials schedule settings

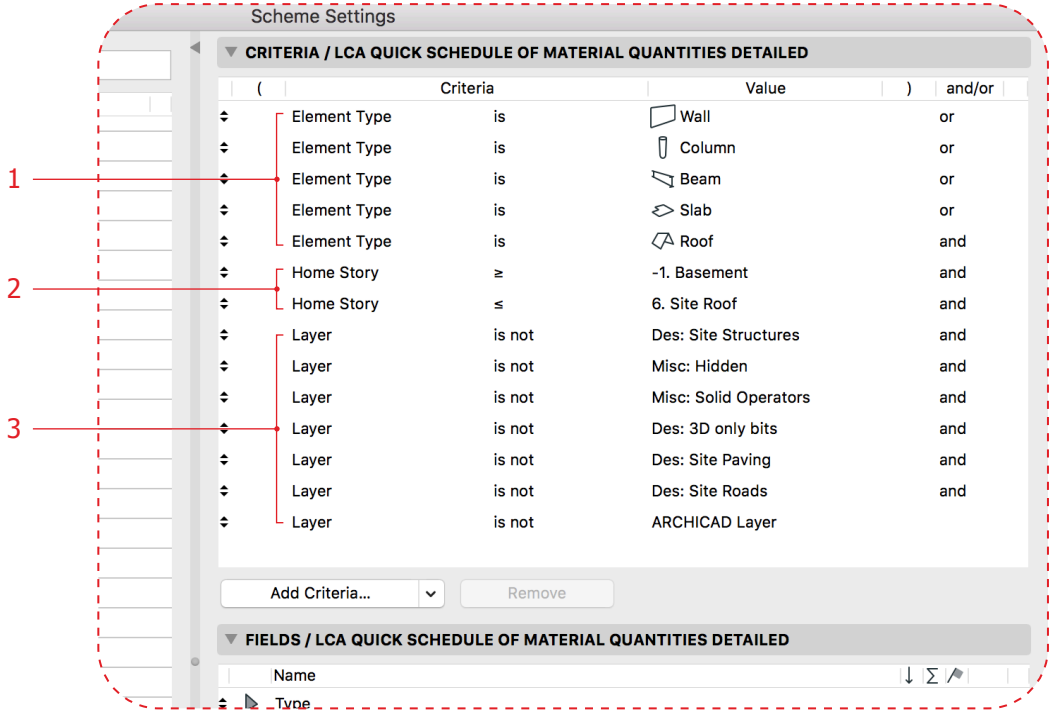


Export building materials schedule settings

The criteria

The criteria for the detailed and export schedules needs to be identical. Therefore it is best to create the detailed one first and duplicate this once everything is working correctly. In the example shown, three criteria types are employed.

1. Element type: This filters out objects and focuses on the elements used in the BIM required for LCAQuick.
2. Home storey: This filters out other elements located outside this storey range. Elements not required in the schedule may include template parts, working models, hot-linked modules or discarded options located on other storeys.
3. Layer: This filters out layers containing elements that are not part of LCAQuick calculations. It also filters out hidden and other non-building elements.

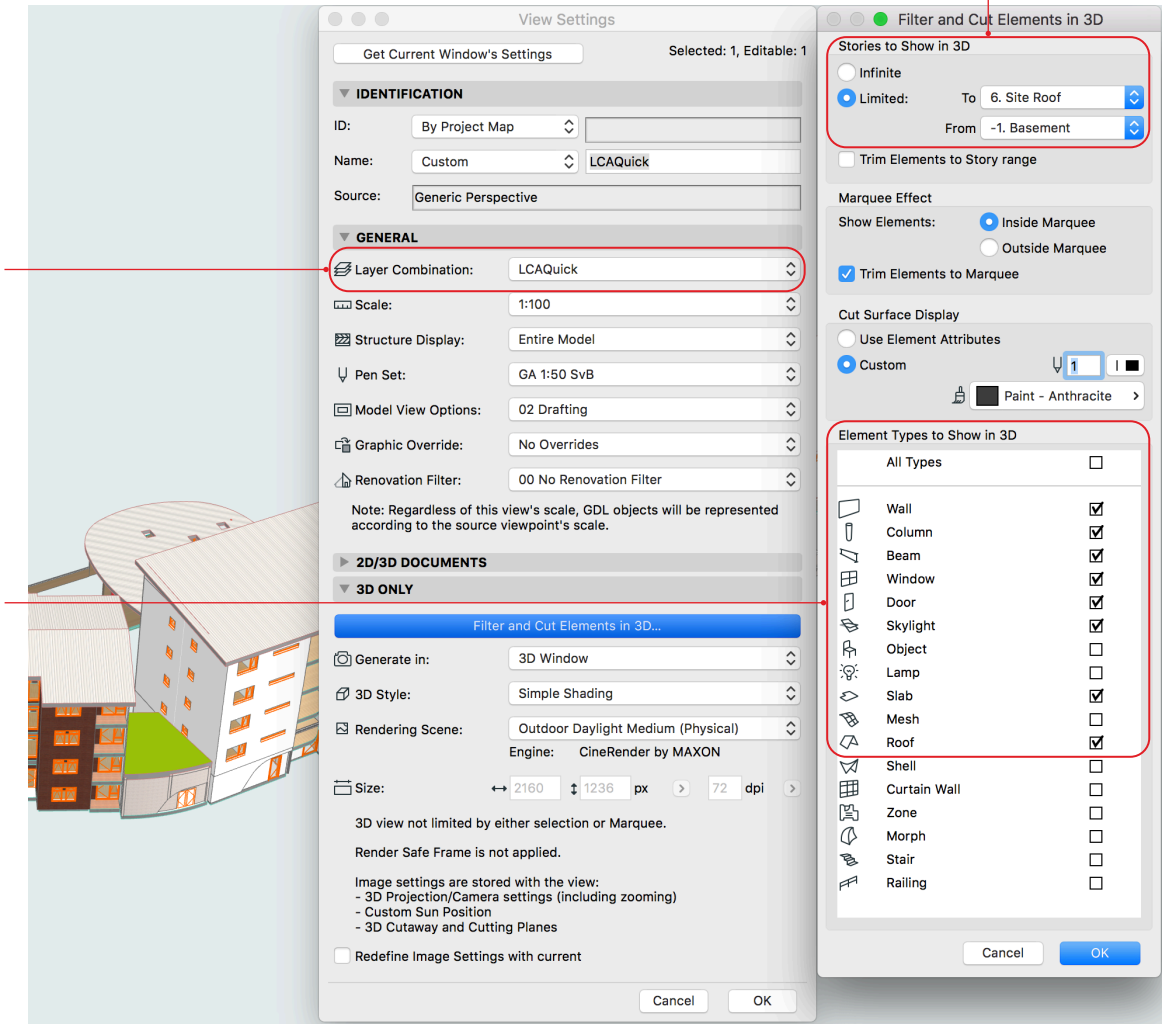


Detailed building materials schedule criteria

Views

It is worthwhile setting up a plan view and a 3D view in the view map using the same filtering criteria as in the schedule as this will help speed up the creation of the filters and the auditing of the model.

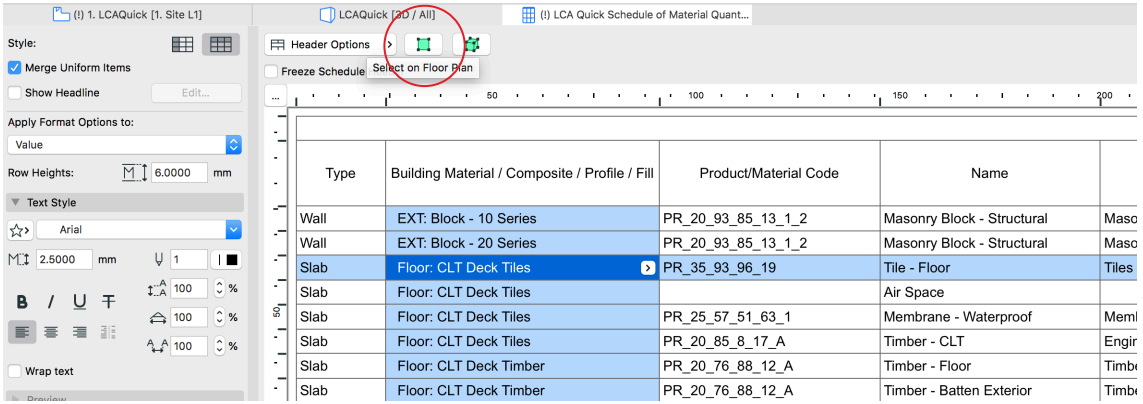
1. Element type
2. Home storey
3. Layer



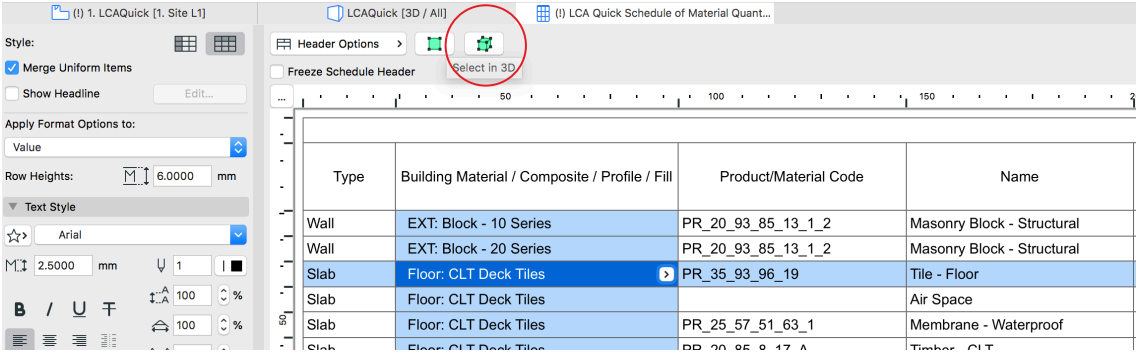
3D view filters

Data verification

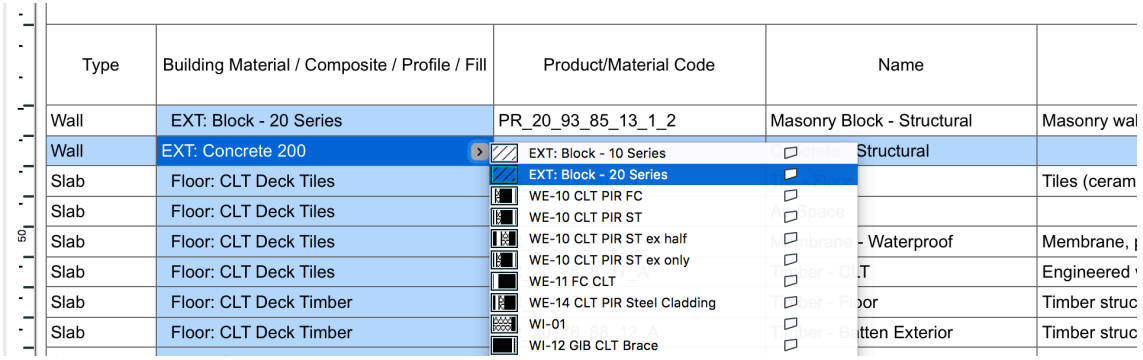
At the top of the interactive schedule are two buttons: Select on Floor Plan and Select in 3D. These allow you to quickly go to drawing windows and identify elements from the schedule. It is always best to visually check the correct materials have been used to model the elements.



Schedules select in plan



Schedules select in 3D

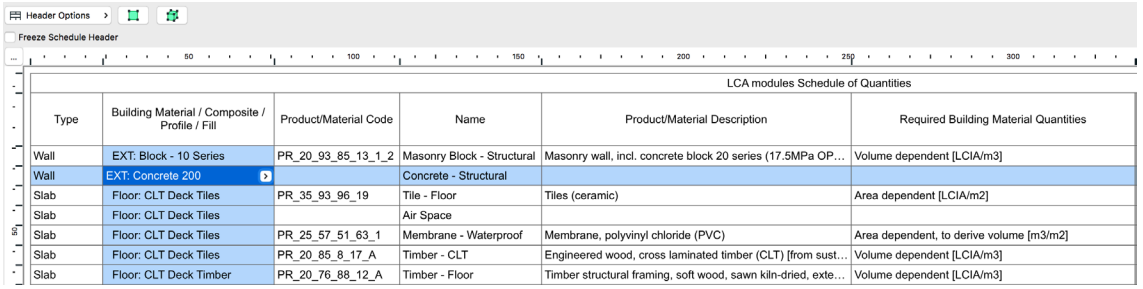


Interactive schedule editing

Editing data

Trust, but verify!

Once elements that require building material reassignment have been identified, the interactive functionality of the schedule makes it easy to edit the BIM to make corrections.

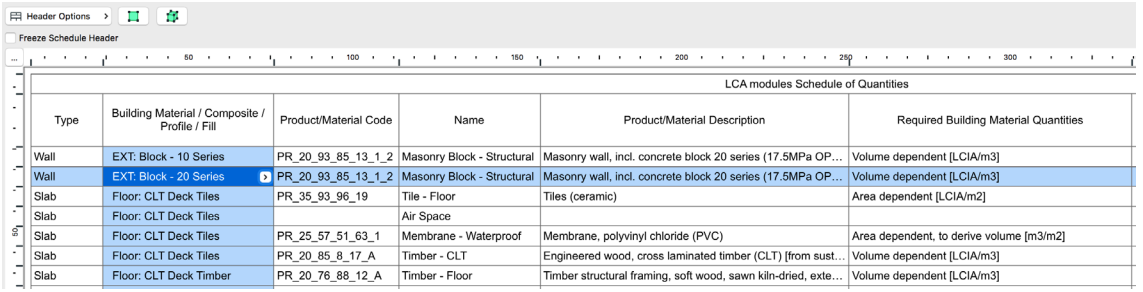


Header Options | Freeze Schedule Header

LCA modules Schedule of Quantities

Type	Building Material / Composite / Profile / Fill	Product/Material Code	Name	Product/Material Description	Required Building Material Quantities
Wall	EXT: Block - 10 Series	PR_20_93_85_13_1_2	Masonry Block - Structural	Masonry wall, incl. concrete block 20 series (17.5MPa OP…	Volume dependent [LCIA/m3]
Wall	EXT: Concrete 200		Concrete - Structural		
Slab	Floor: CLT Deck Tiles	PR_35_93_96_19	Tile - Floor	Tiles (ceramic)	Area dependent [LCIA/m2]
Slab	Floor: CLT Deck Tiles		Air Space		
Slab	Floor: CLT Deck Tiles	PR_25_57_51_63_1	Membrane - Waterproof	Membrane, polyvinyl chloride (PVC)	Area dependent, to derive volume [m3/m2]
Slab	Floor: CLT Deck Tiles	PR_20_85_8_17_A	Timber - CLT	Engineered wood, cross laminated timber (CLT) [from sust…	Volume dependent [LCIA/m3]
Slab	Floor: CLT Deck Timber	PR_20_76_88_12_A	Timber - Floor	Timber structural framing, soft wood, sawn kiln-dried, exte…	Volume dependent [LCIA/m3]

Editing in schedules before



Header Options | Freeze Schedule Header

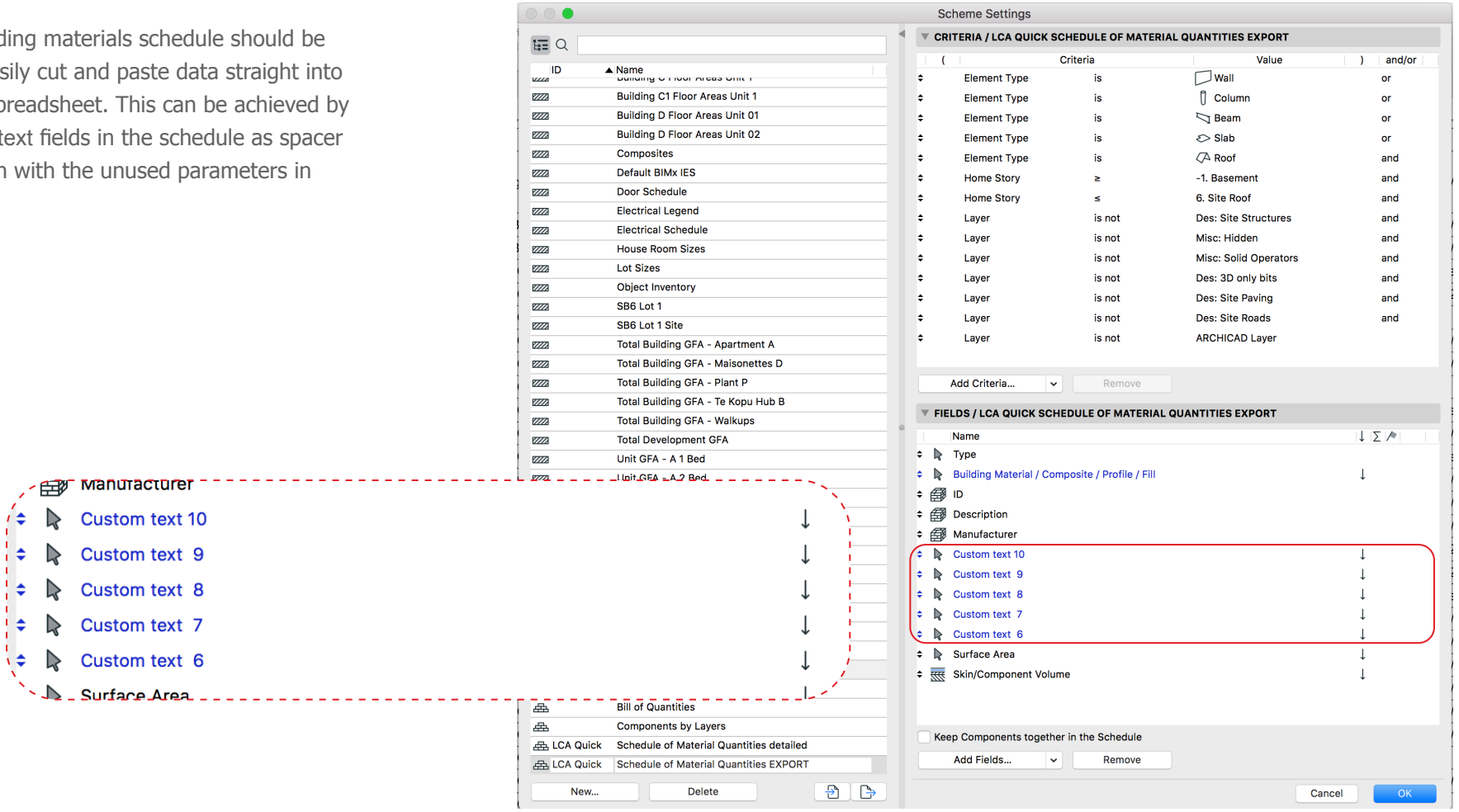
LCA modules Schedule of Quantities

Type	Building Material / Composite / Profile / Fill	Product/Material Code	Name	Product/Material Description	Required Building Material Quantities
Wall	EXT: Block - 10 Series	PR_20_93_85_13_1_2	Masonry Block - Structural	Masonry wall, incl. concrete block 20 series (17.5MPa OP…	Volume dependent [LCIA/m3]
Wall	EXT: Block - 20 Series	PR_20_93_85_13_1_2	Masonry Block - Structural	Masonry wall, incl. concrete block 20 series (17.5MPa OP…	Volume dependent [LCIA/m3]
Slab	Floor: CLT Deck Tiles	PR_35_93_96_19	Tile - Floor	Tiles (ceramic)	Area dependent [LCIA/m2]
Slab	Floor: CLT Deck Tiles		Air Space		
Slab	Floor: CLT Deck Tiles	PR_25_57_51_63_1	Membrane - Waterproof	Membrane, polyvinyl chloride (PVC)	Area dependent, to derive volume [m3/m2]
Slab	Floor: CLT Deck Tiles	PR_20_85_8_17_A	Timber - CLT	Engineered wood, cross laminated timber (CLT) [from sust…	Volume dependent [LCIA/m3]
Slab	Floor: CLT Deck Timber	PR_20_76_88_12_A	Timber - Floor	Timber structural framing, soft wood, sawn kiln-dried, exte…	Volume dependent [LCIA/m3]

Editing in schedules after

Exporting data

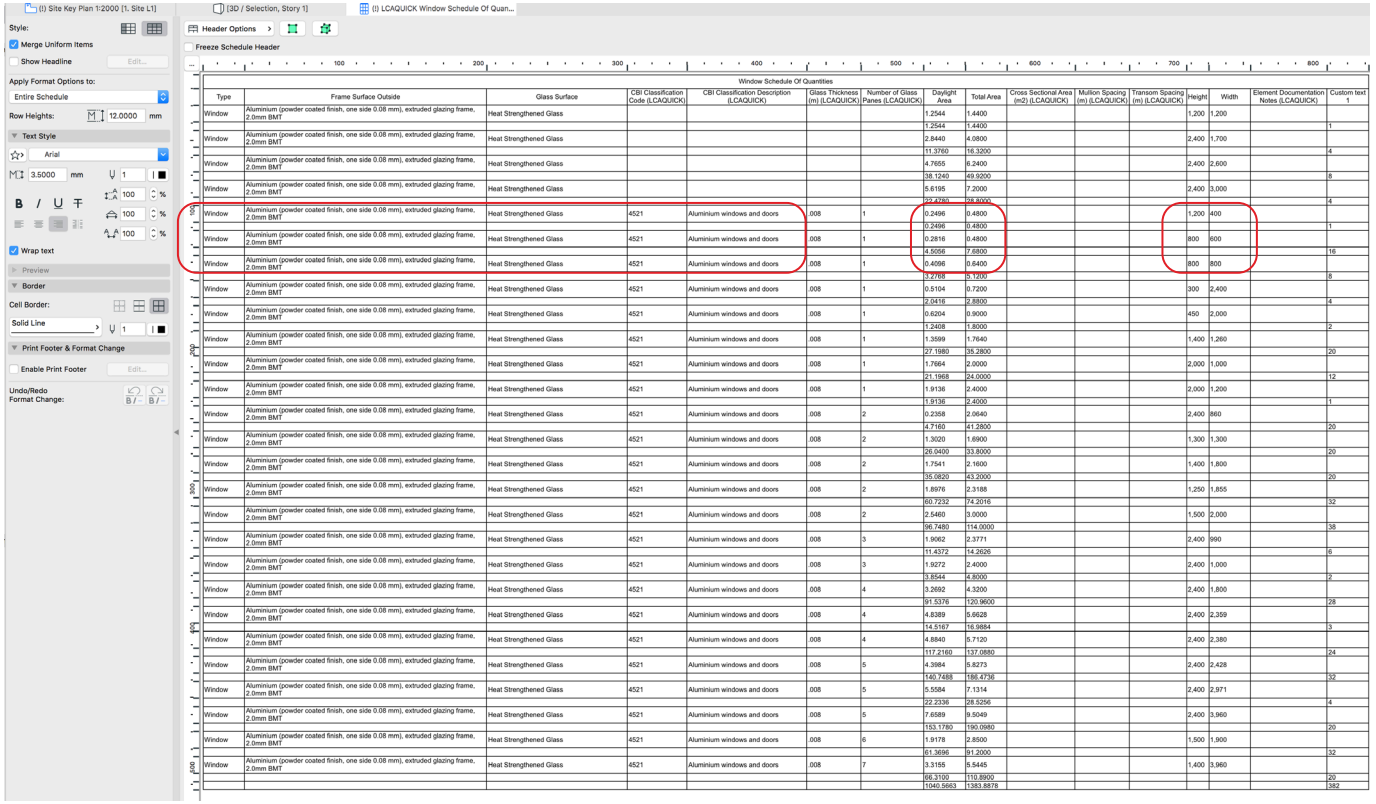
The export building materials schedule should be formatted to easily cut and paste data straight into the LCAQuick spreadsheet. This can be achieved by adding custom text fields in the schedule as spacer columns to align with the unused parameters in LCAQuick.



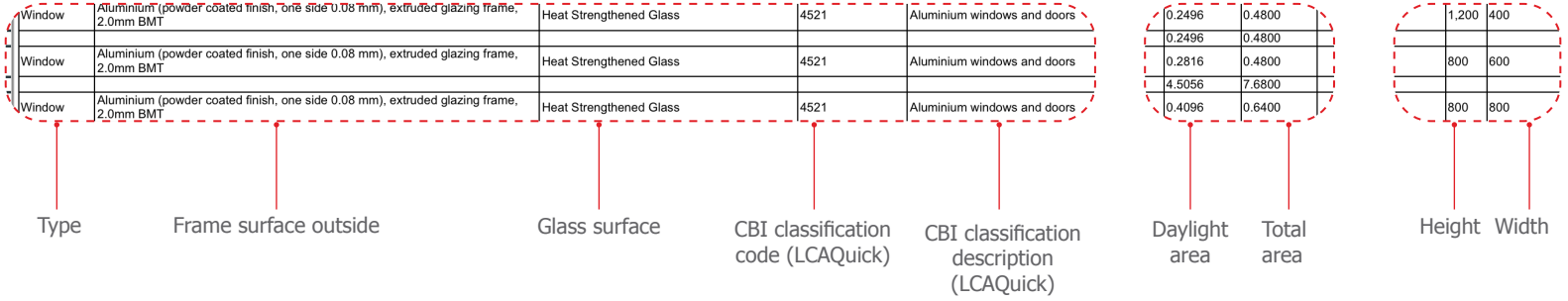
Export building materials schedule settings

Windows schedule

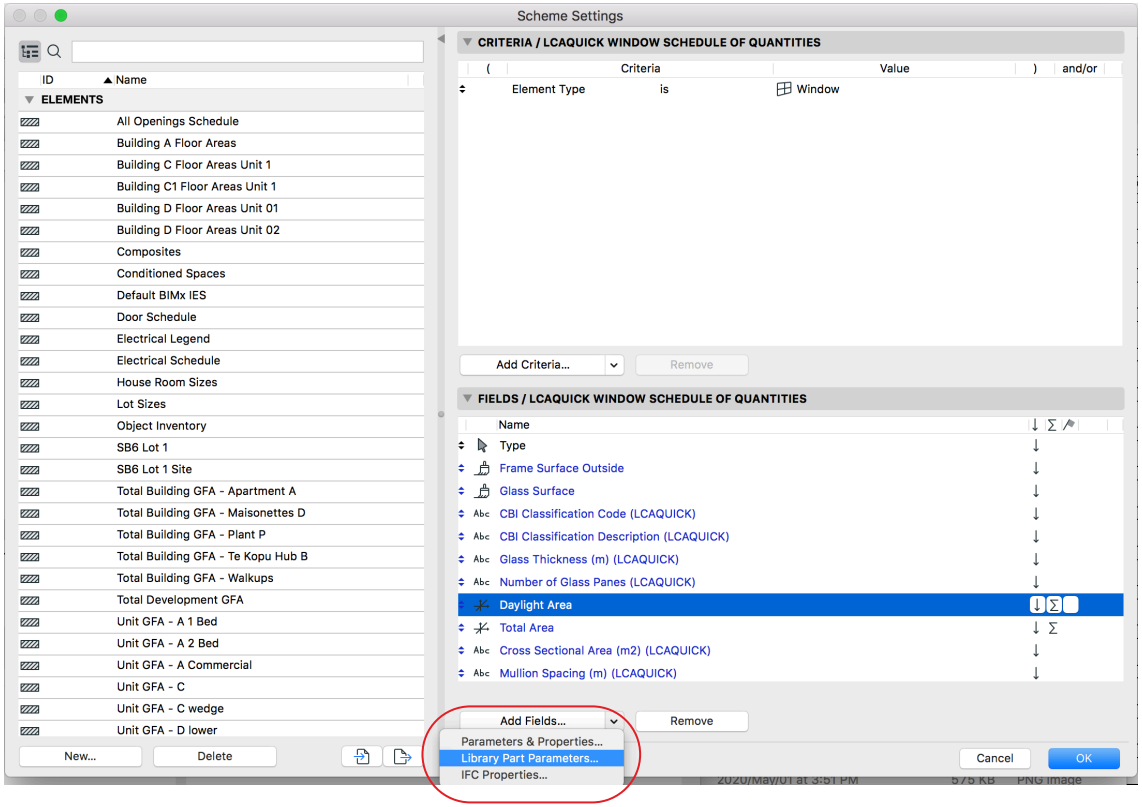
The windows schedule needs to calculate both the frame area and the glazing area. In the example shown, these parameters are daylight area and total area (i.e. subtract the glazing from the total area to get the frame area).



Windows schedule



Additional parameters are available for library parts such as doors and windows. In this example, the exterior joinery is modelled with Cadimage windows. These additional parameters are available from the **Add Fields...** drop-down menu.



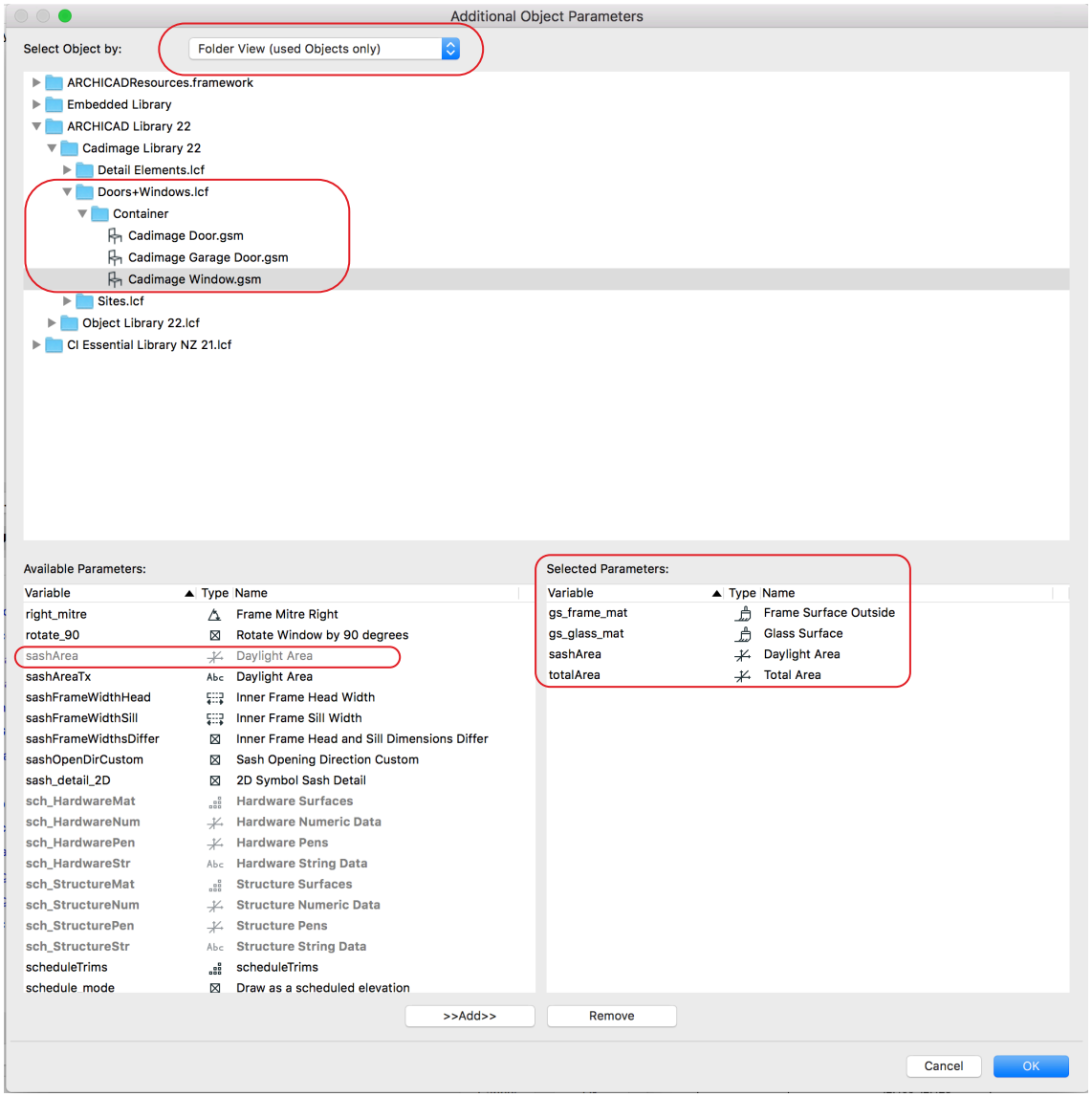
Windows schedule additional parameters

Browse to locate the required parameters. Use the drop-down menu at the top and select **Folder View (used Objects only)** as this will reduce the search dramatically.

Some further editing and calculation of the data in a spreadsheet application will be necessary before taking it into LCAQuick. This is because a window is not modelled in ArchiCAD exactly as it will be formed in construction. This is especially the case with aluminium windows with their complex extruded profiles. After the schedules are populated and exported to a spreadsheet, the window frame surface area will need to be multiplied by a multiplier to get the actual volume of aluminium used.

One way to calculate that multiplier is to take the cross-sectional area of the aluminium profile(s), multiply it by 4,000 mm (for the volume of a 4 m long section of aluminum) and divide it by the frame surface area from a 1 m x 1 m ArchiCAD window.

Alternatively, LCAQuick features a tool that can be used to build up schedules for windows and doors. It is located in the *INPUT - Window Door Builder* sheet.



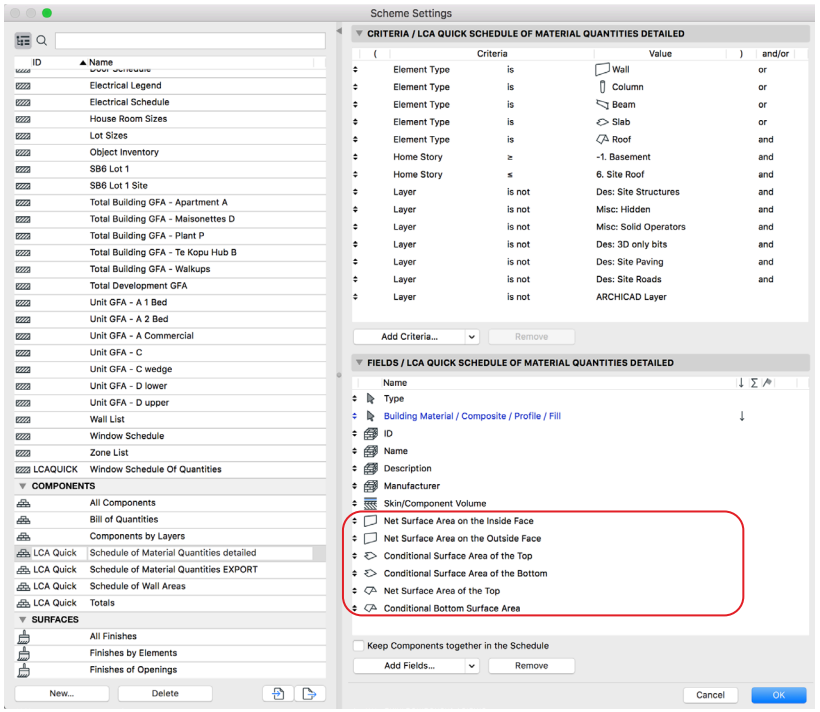
Windows schedule additional parameters

Washing schedule

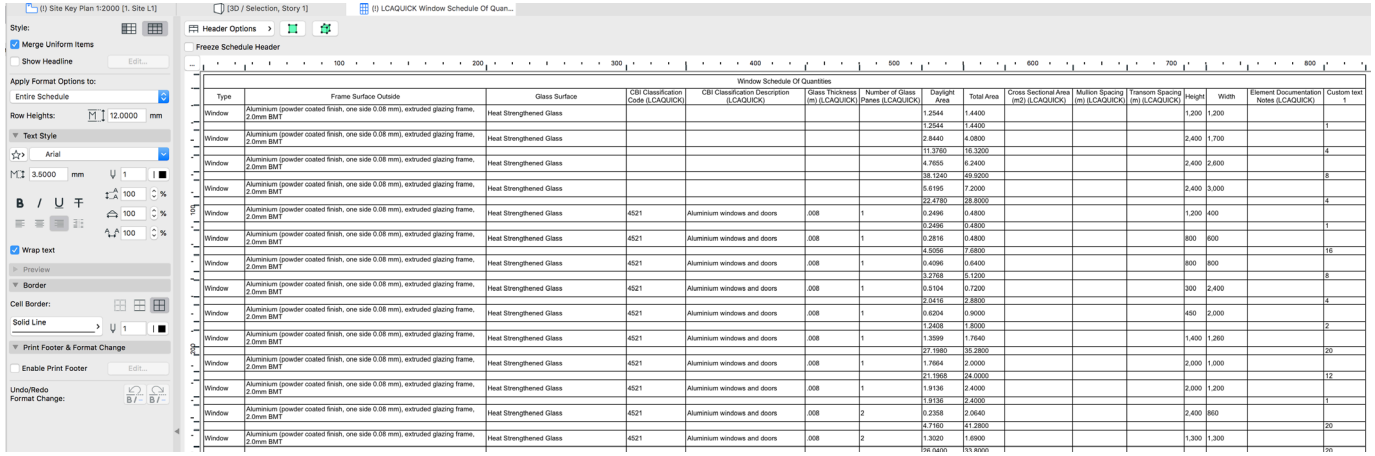
Both the materials schedule and windows schedule are used to generate area data for the washing schedule.

The external wall, roof and floor faces can be extracted from the building materials schedule.

The external surfaces for the window frames and glass are extracted from the windows schedule.



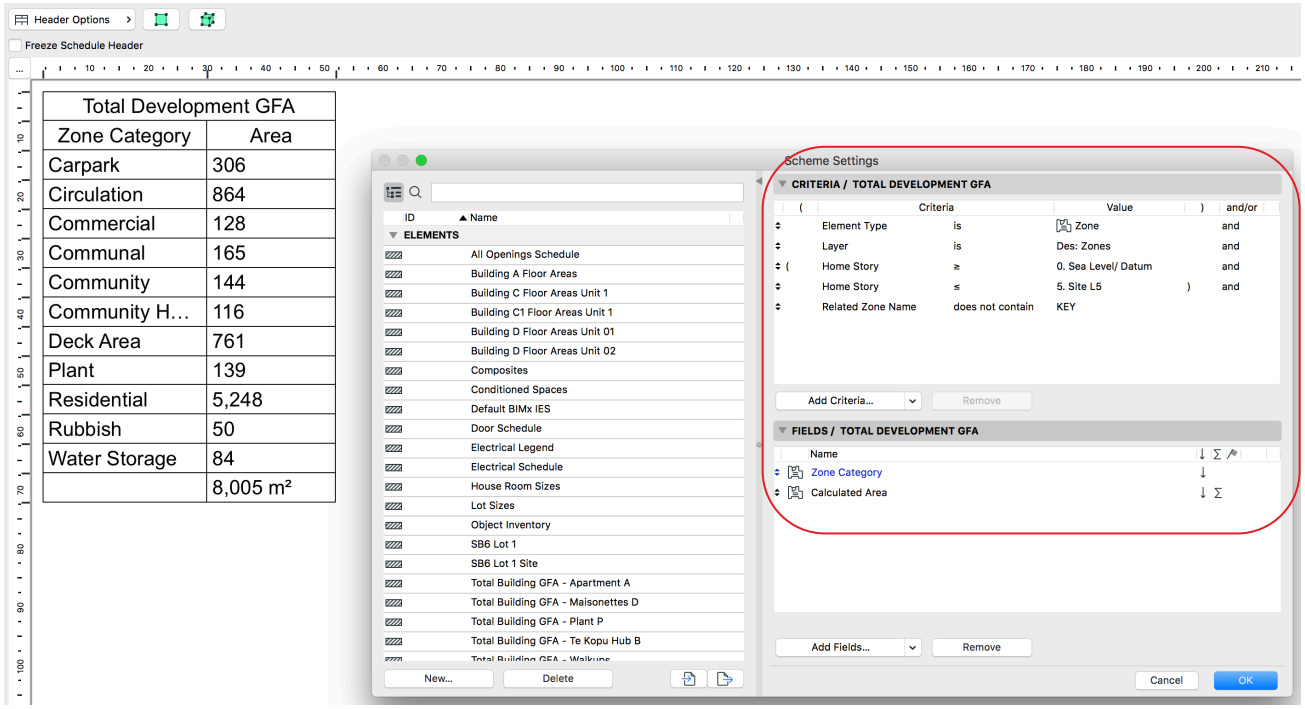
Detailed building materials schedule settings



Windows schedule

Area schedules

Area schedules derived from zones will also be required for LCAQuick. Use the different zone construction methods to create zones for the interior NLF and GFA calculations, then set up a zone area schedule as shown here.



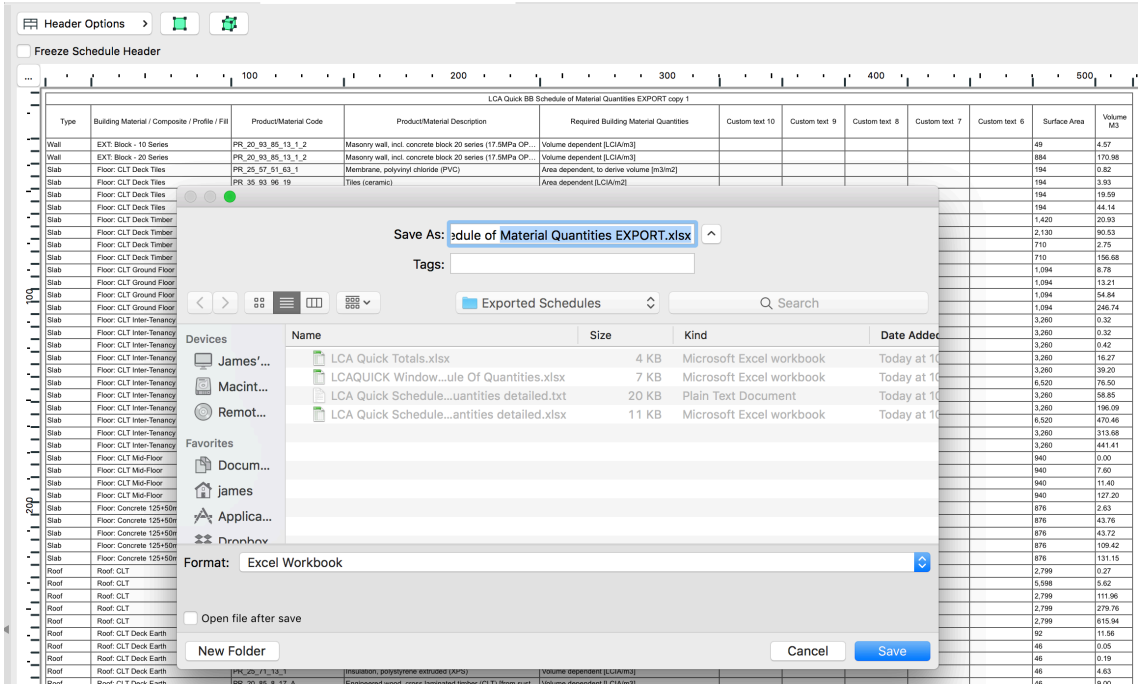
Zone area schedule

Export

Schedules are exported as Excel workbooks (.xlsx) (*File > Save as…*). They can also be exported as PDF and tabbed text as well as other formats.

It is best to export these to a folder and then make a copy to another folder for further calculations to avoid the files being overwritten when they are exported again.

The exporting of schedules can be automated using the publisher.



Export file