

ARCHICAD EXPRESSION-DEFINED PROPERTIES

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Questions / Main Ideas

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LEARNING OBJECTIVES

- Explore methods to leverage the “I” in BIM to meet project specific data requirements for internal use or collaboration.
- Understand the benefits of using Expression-Defined Properties for model accuracy, scheduling, and documentation.
- Create custom Expression-Defined properties from scratch.
- Evaluate Expression-Defined properties and fix formula errors.
- Apply Expression-Defined Properties in Documentation, Area Calculation, Model Standardization, Design Compliance / Quality Assurance, and Quantification.

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AGENDA

PART 1

- › Data, Classifications, and Properties
 - + Data Management and Archicad
 - + Classifications and Properties

PART 2

- › Expression-Defined Properties
 - + Creating a New Expression-Defined Property
 - + Data Types
 - + Expression Editor
 - + Evaluating Expression-Defined Properties
 - + Fixing Errors in Expressions

PART 3

- › Practical Examples
 - + Documentation
 - + Area Calculation
 - + Model Standardization
 - + Compliance / Quality Assurance
 - + Quantification



Questions / Main Ideas

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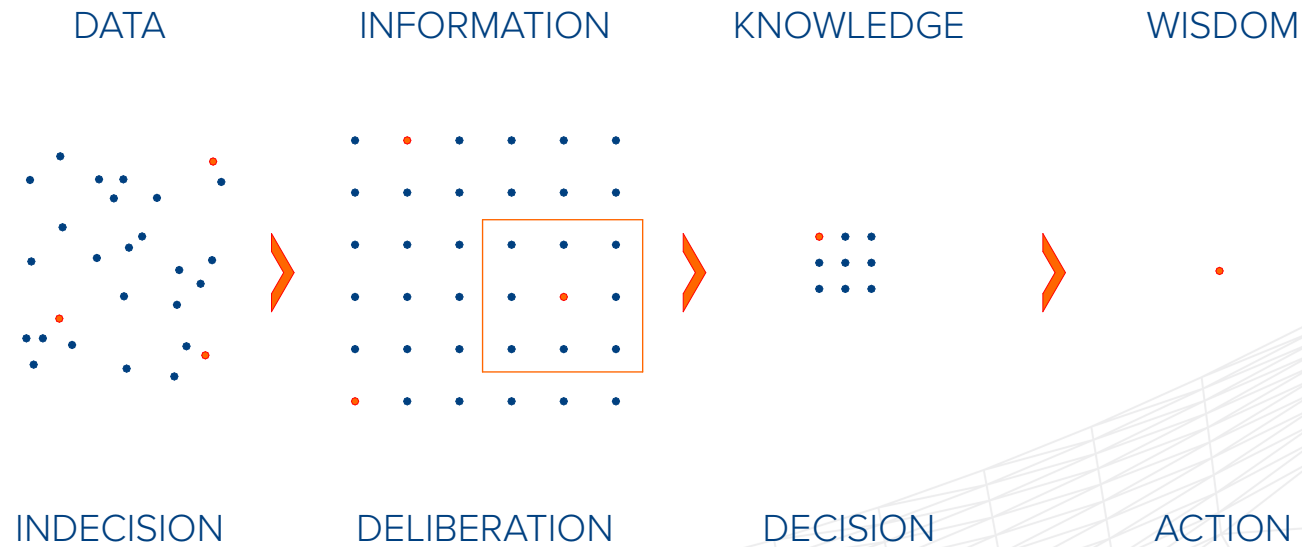


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FROM DATA TO ACTION



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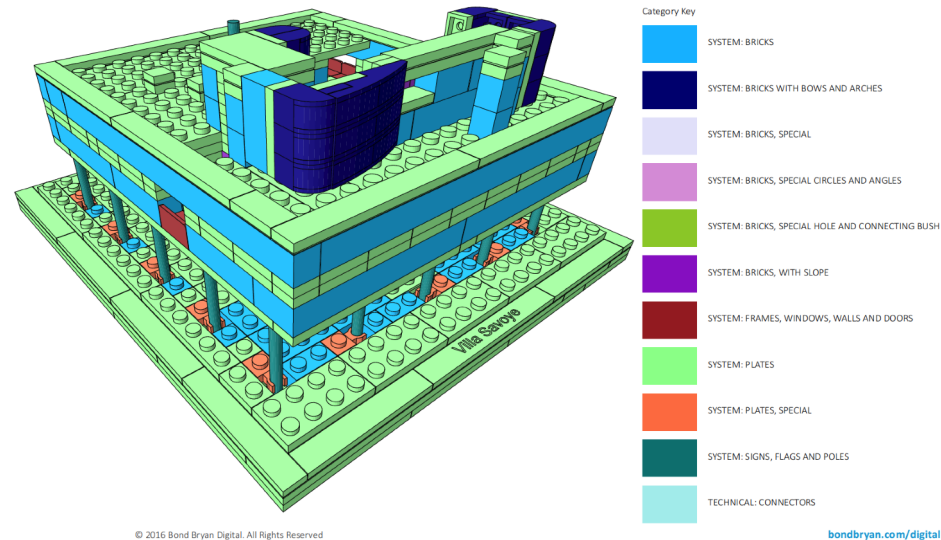
BUILDING INFORMATION MODELING+MANAGING

Questions / Main Ideas

True BIM Model

- > Properties
- > Structural Data by Elements
- > Schedules
- > Non-graphical Information
- > Calculations

Graphic Override - Category



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<https://bimblog.bondbryan.co.uk/lego-architecture-meets-bim-part-07-data-display-on-drawings/>

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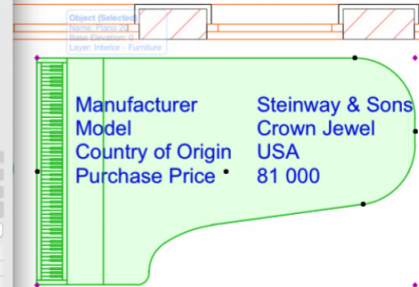
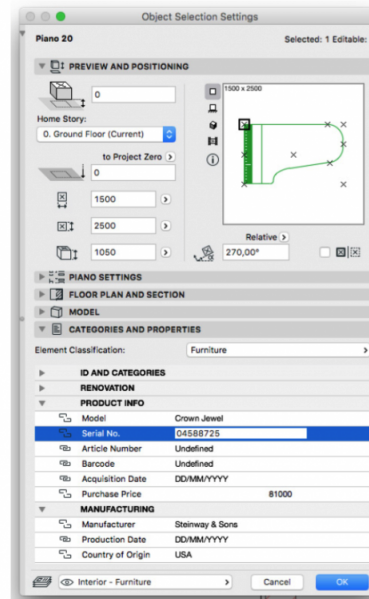


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BENEFITS

- > Minimize risk - BIM
- > Interactive Schedules
- > Efficient workflows
- > Automatic update of lists
- > Transparent queries
- > QA / QC
- > Instant visual feedback



<https://www.applecoredesigns.co.uk/coreblog/archicad-20-information-management>

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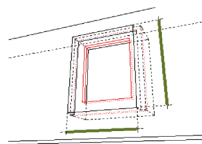
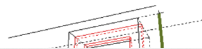
DATA TYPES

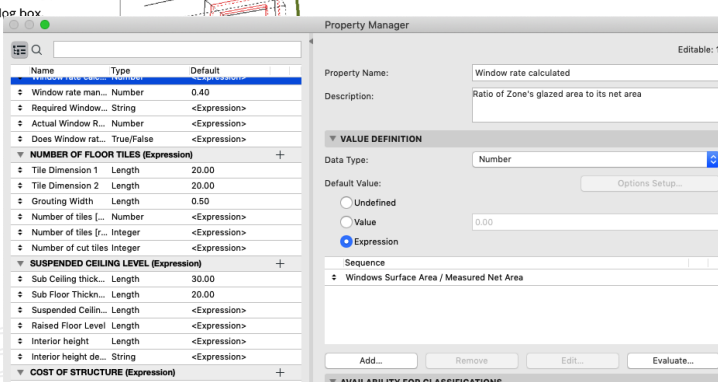
3D Model Data

- > Length
- > Surface Area
- > Volume
- > Element count

Property Based Data

- > Elements which can't be modeled
- > Fire Rating, Density, etc.
- > Calculations (Expression-Defined Properties)

Reveal Dimensions	Width and Height of the window.	The Height and Width parameters defined for Reveal Dimensions, in the opening's Settings dialog box (Custom Settings, Nominal Sizes and Tolerance page)	
Sill/Header Value	Distance from the header (or from the sill) to the Wall Base (or to the current Story), as defined by the user.	Sill or header value as defined in Preview and Positioning panel of the Settings Dialog box	



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AVAILABLE GUIDES

EXAMPLES

SCAN FOR COMPLETE LIST



Wall Listing Parameters

Parameter	Short Description	Long Description	
Air Skin Thickness	Thickness of Wall skin whose structure is defined as "Air skin"	Air Skin is defined at Options > Project Preferences > Calculation Units & Rules.	
Analytic Surface Area of Openings on the Inside Face	Surface Area of all Wall Openings (windows, doors, empty Openings) on the Wall's Inside Face.	Surface calculation is based on hole that results from cutting the GDL Openings out of the Wall.	
Analytic Surface Area of Openings on the Outside Face	Surface Area of all Wall Openings (windows, doors, empty Openings) on the Wall's Outside Face.	Surface calculation is based on hole that results from cutting the GDL Openings out of the Wall.	
Analytic Volume of the Openings	Volume of all Wall Openings (windows, doors, empty Openings).	Volume calculation based on hole that results from cutting the GDL Openings out of the Wall. Does not take SEO's into account.	
Combined Width of Doors	Sum of the nominal widths (as defined in Door Settings) of all doors placed in the Wall.		

Zone Listing Parameters

Parameter	Short Description	Long Description	
Area Reduction	The Calculated Area	In Zone Settings - Area Calculation Panel: check "Reduce by" and enter a percentage. The result is the Calculated Area. (For example: If "Reduce by" is 20 percent, the "Area Reduction" is 80 percent.)	
Calculated Area	The Zone's area after the Reduced Area is further reduced by the percentage value set in the Area Calculation panel of Zone Settings.	In Zone Settings - Area Calculation Panel: check "Reduce by" and enter a percentage to subtract that from the Reduced Zone area. The result is the Calculated Area.	
Doors Surface Area	Total surface area of all Doors in the Zone.	A Door is in the zone if any part of its 2D polygon is inside of, or coincides with the edge of, the Zone's 2D polygon.	
Doors Width	Total width of all Doors in the Zone.	A Door is in the zone if any part of its 2D polygon is inside of, or coincides with the edge of, the Zone's 2D polygon.	
Extracted Column Area	Column area subtracted from Measured Zone area.	Relevant if the zone polygon contains Columns. If Relation to Zones = "Reserve Zone Area Only" AND the Column's area exceeds the minimum defined in Zones Preferences, then the Zone is reduced by the percentage set in Zones Preferences.	
Extracted Fill Area	Fill area subtracted from the Measured Zone area.	Relevant if the zone polygon contains Fills. If Subtract from Zones is enabled for the Fill (see Fill Settings - General Settings), then the Zone area is reduced by the defined percentage.	
Extracted Low Area	Low ceiling area subtracted from Measured Zone area.	If the Zone is limited by a Roof or Shell: The zone area is reduced by the "Area reduction under Low Ceiling" as defined in Zones Preferences. Relevant if the zone volume contains	

Column Listing Parameters

Parameter	Short Description	Long Description	
Column Cross Section	Rectangular, Circular or Profiled.	Defined in Column Settings	
Core Height / Diameter	For a rectangular or profiled Column: One of the dimensions of the Column in cross-section. (The other dimension is "Core Width".) Does not include veneer. (To include veneer, use the General "Veneer" parameter.)	For a circular Column: the diameter of the Column.	
Core Width	For a rectangular or profiled Column: One of the two dimensions of the Column in cross-section. (The other dimension is "Core Height / Diameter".) Does not include Veneer. (To include veneer, use the General "Veneer" parameter.)	For a circular Column: the diameter of the Column.	
End Surface	Surface assigned to Column Ends.	Defined in Column Settings (via Building Material, or Override in Model Panel)	
Extrusion Surface	Surface assigned to Column Extrusion.	Defined in Column Settings (via Building Material, or Override in Model Panel)	

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MINIMUM DATA REQUIRED

- > **Classification**
- > **ID** (Office Standards)
- > **Structural Function**
- > **Position**
- > **Renovation Status**
- > Key **Properties** (Office Standards)
- > **Layer**

The screenshot shows the 'STRUCTURAL ANALYTICAL PARAMETERS' dialog box for a 'Wall' element. The 'CLASSIFICATION AND PROPERTIES' section is expanded, showing the following data:

CLASSIFICATIONS	
<input checked="" type="checkbox"/>	ARCHICAD Classification - v... Wall

ID AND CATEGORIES	
ID	FND-142
Structural Function	Load-Bearing Element
Position	Exterior

RENOVATION	
Renovation Status	Existing
Show On Renovation Filter	All Relevant Filters

WALL PROPERTIES	
Wall Type	<Undefined>
NOTES	

IFC PROPERTIES	
IFC Type	IfcBuildingElementProxy

At the bottom, the layer is set to '4 - Structure.Wall'. The 'Cancel' and 'OK' buttons are visible.

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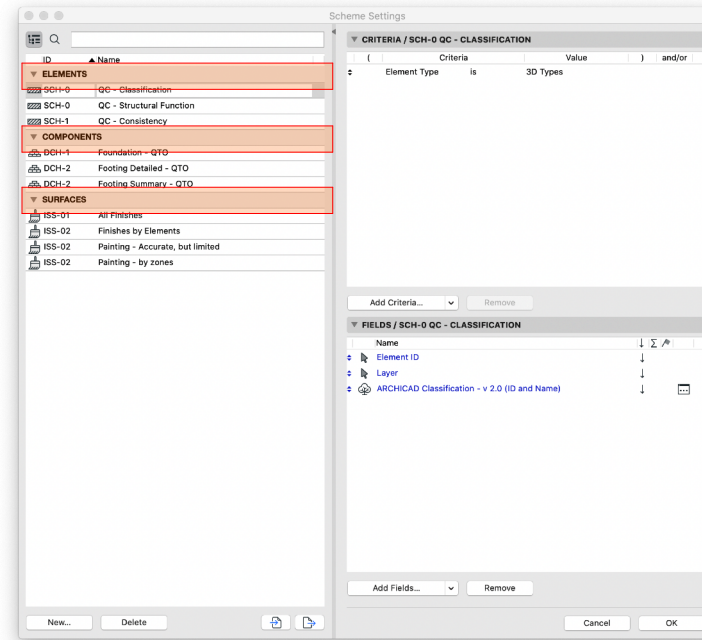
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INTERACTIVE SCHEDULES

- > **Element Lists:** characteristics of basic construction elements.
- > **Component Lists:** list information about each component of composite, profile or basic elements: walls, slabs, roofs, morphs, meshes, and/or multi-component profile elements).
- > **Surface Lists:** list elements by their exposed surfaces.



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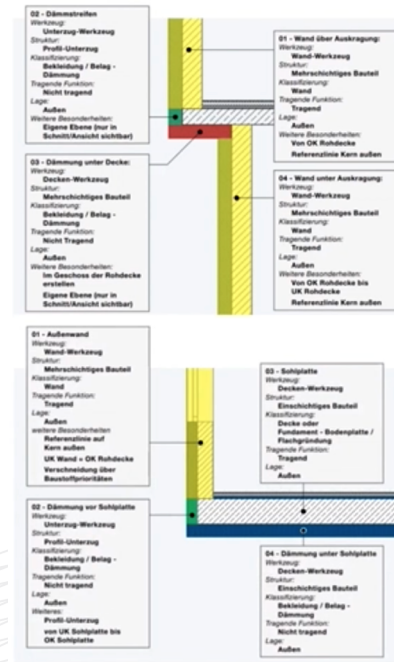
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BEST PRACTICES

- > **Accurate modeling** according to LOD
- > Proper **identification** of elements (Classification, Naming, ID)
- > **Priority Based Connections** (PBC) and **Intersections**
- > **Hidden Structures** / need to be modeled?
- > Follow **modeling guidelines** / defined in BIM Manual
- > Follow **naming standards** / defined in BIM Manual
- > **Avoid duplicates**
- > **Avoid over-detailed** models / slower project files
- > **Avoid irrelevant data** / creates confusion



(IMAGE INTENTIONALLY BLURRED)

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ELEMENT INTERSECTIONS

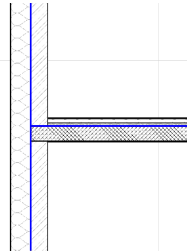
Questions / Main Ideas

AUTOMATIC INTERSECTIONS

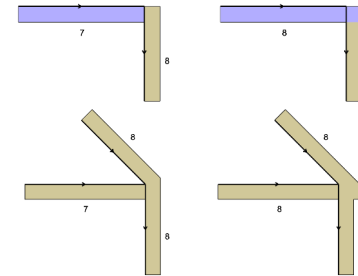
	Wall	Beam	Column	Slab	Roof	Shell	Morph
Wall	Collision and Ref. Line	Collision	Collision or Wrapping	Collision	Connect	Connect	Connect
Beam		Collision or Ref. Line	Collision	Collision	Connect	Connect	Connect
Column			SEO	Collision	Connect	Connect	Connect
Slab				SEO	Connect	Connect	Connect
Roof					Connect	Connect	Connect
Shell						Connect	Connect
Morph							Connect

Priority Support	Intersection display in 3D Model
Building Material Priority (Automatic)	Skin-level
Building Material Priority (Requires Merge/Trim)	Skin-level
No Priority Support; Element Cut Only	Element-level only

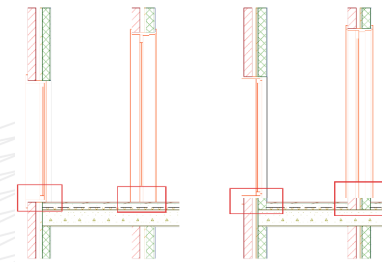
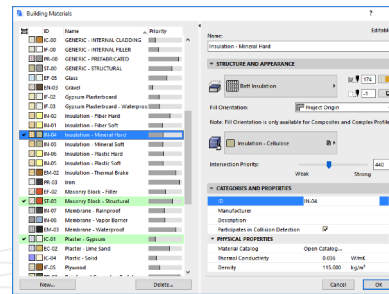
REFERENCE LINE



JUNCTION ORDER



BUILDING MATERIAL PRIORITY



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SCAN FOR
ELEMENT INTERSECTION PRINCIPLES

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LAYER INTERSECTION GROUP

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LAYERS		
	Layer name	Extension
1	ARCHICAD Layer	
0	3 ----- 2D/3D ----- SITE-----	3
1	3 - Site	HOTSPOTS
1	3 - Site	Pavement
1	3 - Site	Site Original - Main part
0	4 ----- 3D ----- DD - CONSTRUCTION ELEMENTS-----	4
1	4 - Covering	Roof
1	4 - Structure	Beam
1	4 - Structure	Column
1	4 - Structure	Footing
1	4 - Structure	Foundation
1	4 - Structure	Roof
1	4 - Structure	Slab
1	4 - Structure	Stair
1	4 - Structure	Wall
1	4 - Structure	Wall Partition
0	5 ----- 3D ----- DD - INTERIOR -----	5
1	5 - Interior	Zones
0	99 ----- 3D ----- OPERATORS-----	99
999	99 - Operator	SEO

Number indicates
Intersection Groups.

If layer set to "0", elements on layer
will NOT intersect with:

+ any other elements on

other layers

+ each other

NOTE: Hidden layers are
considered in schedules.

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CLASSIFICATION+PROPERTIES

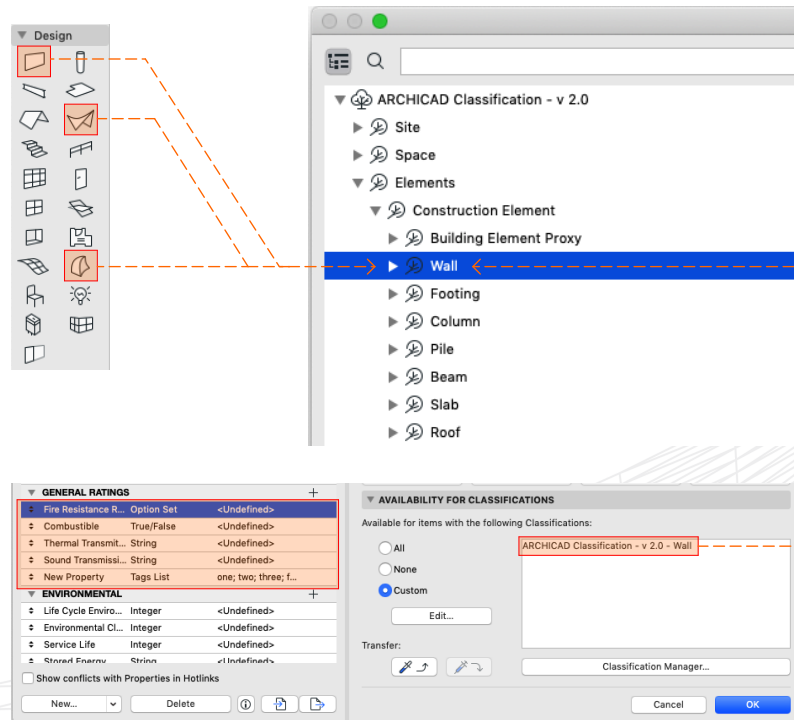
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CLASSIFICATION

Element Identity.

PROPERTY

Properties are optional, user-defined data assigned to an element or Building Material to provide additional, searchable information.
e.g. fire resistance rating, model, etc.



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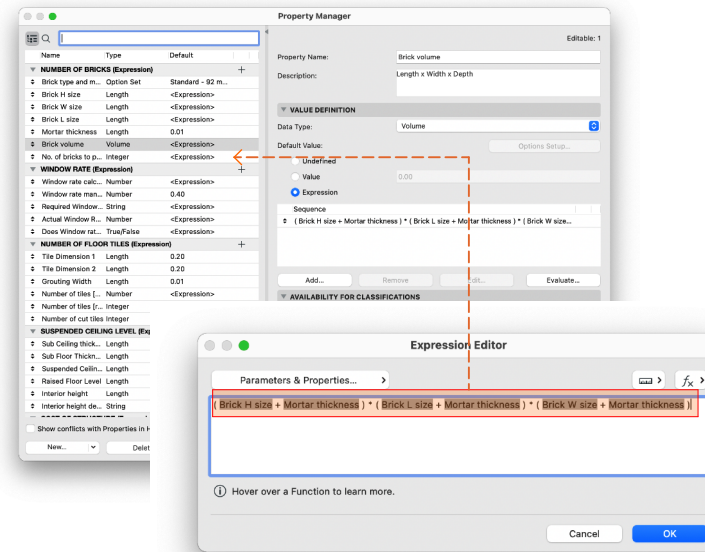
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EXPRESSION-DEFINED PROPERTY

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Define any calculation rule as an element property value and **update the value automatically**, without time-consuming and error-prone manual data entry



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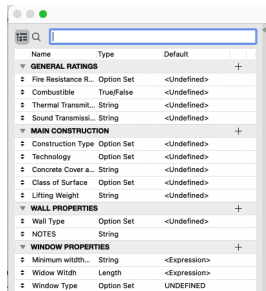


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


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EDP'S BUILDING BLOCKS

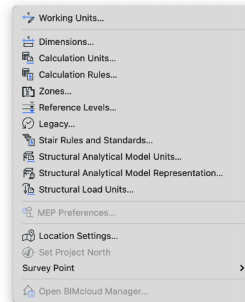
Properties



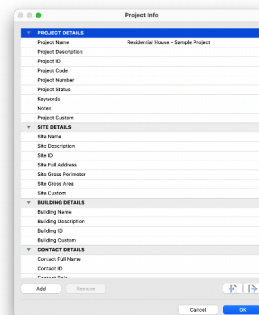
Parameters

Gross Surface Area of the wall on the Inside Face	Gross Surface Area of the Wall - including the surfaces of any openings - on the inside face.	Reduced by trim. SEOs are ignored.	
Gross Surface Area of the wall on the Outside Face	Gross Surface Area of the Wall - including the surfaces of any openings - on the outside face.	Reduced by trim. SEOs are ignored.	
Inside Face Surface	Name of the surface assigned to the wall's inside face.		
Length of Reference Line	Length of the Wall's Reference Line.		

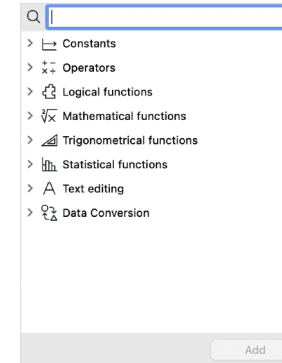
Global Settings



Project Info



OPERATORS



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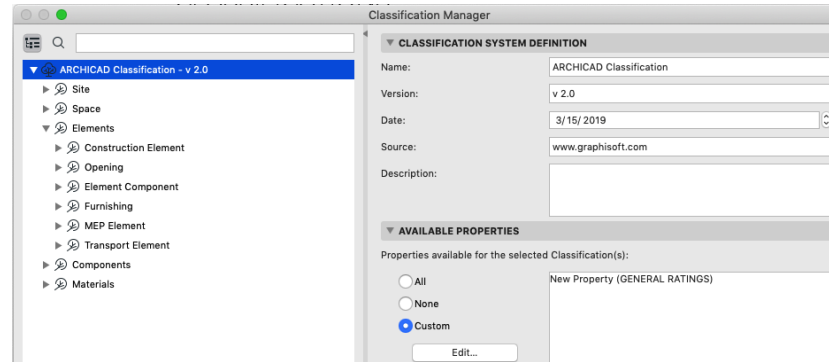
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CLASSIFICATION USES

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Classifications are used:

- > To **organize** project elements/materials and their related data
- > To **define available properties** to an Element or Building Material
- > To provide mandatory **deliverables** based on Classification Standards
- > To ensure accurate data exchange with other applications, e.g. **IFC**
- > To **Find & Select** elements or materials by Classification: e.g. walls, including walls made with other tools like morph.
- > To apply **Graphic Override Rules**.

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CLASSIFICATION USES

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BEST PRACTICES

- > Ensure the **correct classification** is assigned to **every tool's default settings**.
- > If a tool is used to model more than one type of element, **save Favorites for each different type** with the correct classification assigned to them.

Tool examples:

- > **Slab** / model slabs (structural), finished floors, ceilings, soffits, etc.
- > **Wall** / model walls, wall finishes, cladding elements, etc.
- > **Column** / model columns (structural), raised access floor pedestals, etc.
- > **Roof** / model roofs (structural), roof finishes, ramps, etc.
- > **Beam** / model beams (structural), shading systems, etc.

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PROPERTY TYPES

String: Any text or non-unit number
(Manufacturer, Brand)

Number: Any non-unit number expressed in decimals
(Purchase Price, Ratio)

Integer: A whole number
(Occupancy, Number of bricks)

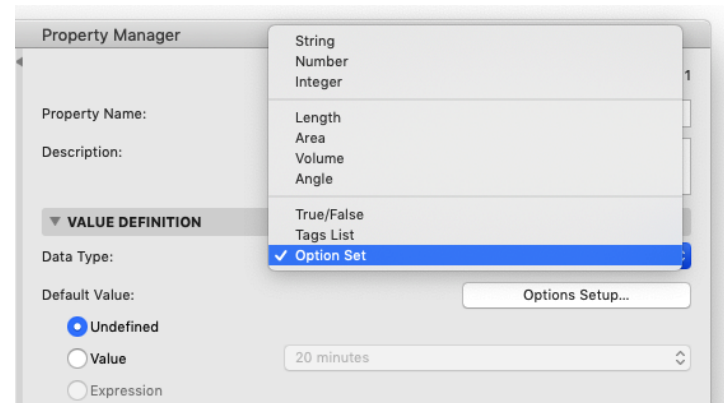
Unit values:

Area

Length

Angle

Volume



True/False

Tags List: Can be a tag or series of tags (e.g. Building A, Floor 2, Common Use, Kitchenette)
–This data type **cannot be used for an Expression-based property.**

Option Set: Provides a fixed set of options (e.g. for the “Fire Resistance Rating” property)
–This data type **cannot be used for an Expression-based property.** However, Option Set-type properties (without Multi-Choice) can be used within an Expression.

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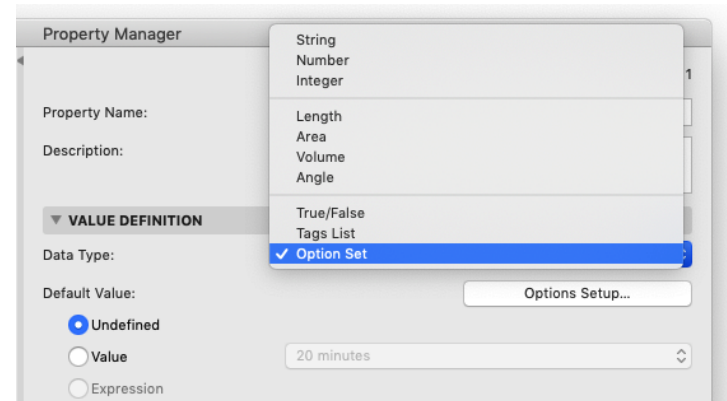
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PROPERTY USES

With Element Properties, you can:

- > Load **meta-data** into the project carried by the building elements
- > **List / manage** with the Interactive Schedule
- > **Display information** in Labels, Zone Stamps, Door/Window Markers
- > **Override elements** by property values, using Graphic Overrides
- > **Import and export** among software packages
- > **Export data structure to spreadsheet**, then import property data from spreadsheets into Archicad elements



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