

Wall Behavior or ArchiCAD and Constructor

Summary

This document provides a summary of behaviors for the wall object in current ArchiCAD and Constructor, GraphiSoft.

The Appendix is quoted directly from the help file in Constructor. It provides detail information of a wall object including its constructions and behaviors.

Five tasks are to be investigated in this report, including:

- 1) Is a wall segment delimited to have a single floor plane?
- 2) Is a wall also delimited to a single roof plane?
- 3) Can a wall have non-horizontal changes in construction (through its cross-section)?
- 4) Does the wall object support internal framing layout?
- 5) Can a wall be a lofted surface, with a bottom curve and top (or intermediate curve) that is lofted between?

In fact, ArchiCAD and Constructor are tailored to different users. Building Objects (BO) in ArchiCAD are preliminary objects with less information for construction and detailing purposes. It is primarily to be used by Architects rather general contractors (GC).

- 1) Is a wall segment delimited to have a single floor plane?

No necessarily, building objects can be automatically trimmed by other objects in Constructor.

Objects such as wall, column and beam are automatically clipped by the intersect roof or slab. Most are unredoable to their original status except slab clipping, meaning slab is clipped without being able to convert back to its initiative status. Slope is another object then slab where slab is considered a single horizontal element, with or without openings. A step-like slab is a composite element by composing multiple segments as one grouped piece or alternatively, using a stair object to imitate a step-like slab. Wall, as a single piece, will be clipped automatically by a step or slope object if intersect.

- 2) Is a wall also delimited to a single roof plane?

Ceiling does not clip wall since wall, column and beam are mostly structural elements and ceiling is more likely internal features. Walls however can be automatically clipped by roof and slab objects.

3) Can a wall have non-horizontal changes in construction (through its cross-section)?

There are few constructors for special wall in ArciCAD, including:

- a) Moldings and Panelings- Adding molding (e.g. crown molding) to a generic wall section;
- b) Battered Wall - it is possible to construct a tapered wall in Constructor with layers of material; a battered wall differs to a lofting wall in terms of the constructing process. A battered wall is a special type of a lofting wall;
- c) Canted Wall ? Canted wall is a special wall where its horizontal section profiles change along the vertical extrusions. It is a type of a tapered beam.

As a summary, one can create a battered and canted wall from a top and bottom loop (i.e. edge). It serves as a special constructor of lofting. According to the application documentation, battered and canted walls are manipulated by the generic wall parametrically through a tilting angle, causing a limitation on lofting through two arbitrary curves (more test needed regard to this subject). Walls can be constructed in layers of materials, both explicitly or by external references, for instance library items

4) Does the wall object support internal framing layout?

Constructor does support wall framing and its representations, meaning its layout is directly displayable to users. It will automatically generate studs-layout based on given parameters. It also knows how to calculate and adjust studs connection where opening such as windows and doors are in place. The result is to be sent to so-called Lumber-Pack for quantity takeoff. It handles some special stud designs including: double studs, cripples, jack studs, etc.

A BIM tool may support automatic stud-layout and calculation, but may not be necessarily displayable to user. For example a wall with layers of material may not need to be displayed with explicit layers in its graphic representation, but it does not mean that the application does not support it. It is a graphical issue rather than a representation issue for an application.

5) Can a wall be a lofted surface, with a bottom curve and top (or intermediate curve) that is lofted between?

No it does not support such a wall constructor especially for complex curves.

Appendix

Wall behavior and possible constructors are listed in the following categories:

- 1) Walls – general description of creating a wall object;
- 2) Wall Accessories – describes how some detailing process can be applied to generic wall object, including modeling and temporized walls;
- 3) Drawing Walls – summarizes methods to create various wall types from 2D

Walls

The **Wall** is a fundamental element in the practice of architecture. When you create a Wall in *ArchiCAD*, you create the outline and hatching of a Wall in 2D and a solid Wall body in 3D. Walls can be straight, curved, trapezoidal and polygonal. Each Wall possesses a reference line and a direction. The reference lines allows the precise connection of Walls for clean intersections. It also establishes hotspots and edges for selecting, moving and transforming Walls.

Depending on the chosen Construction and Geometry Method, the wall body protrudes on either or both sides of the reference line. The **direction** of the wall is defined by the order in which you define the wall's endpoints.

The **reference line** is a heavy black line (including the arrow that shows the Wall's direction) that always appears when drawing the Wall on the **Floor Plan**, provided that the Options menu > Display Options > **Wall & Beam Intersections** feature is switched off.

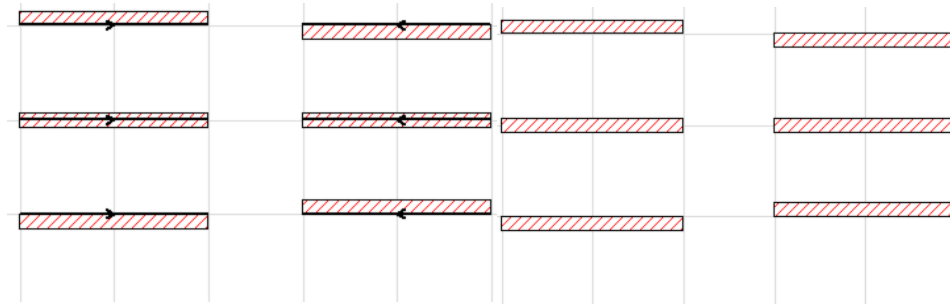
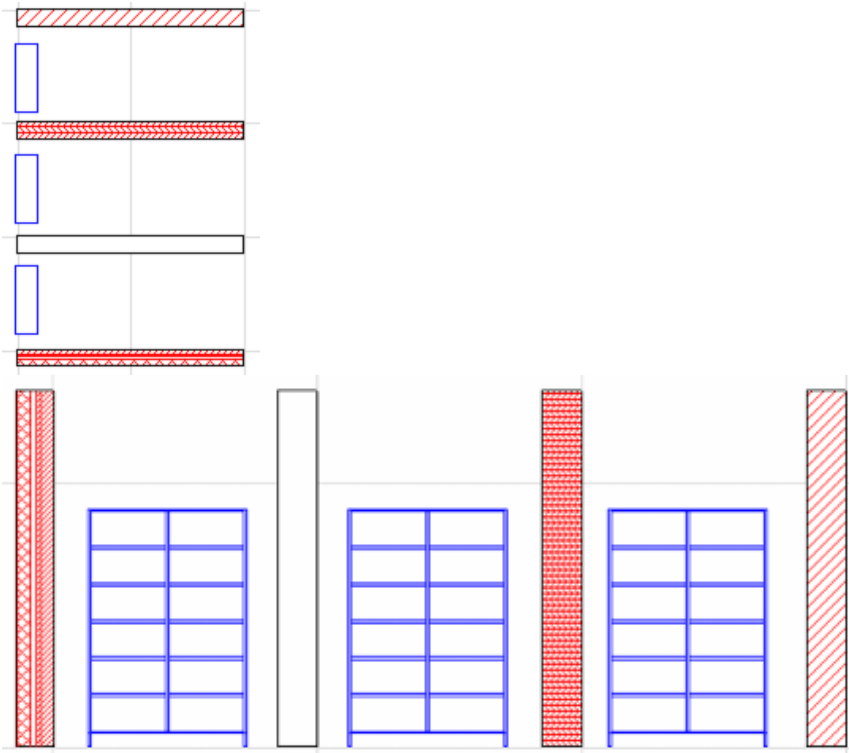


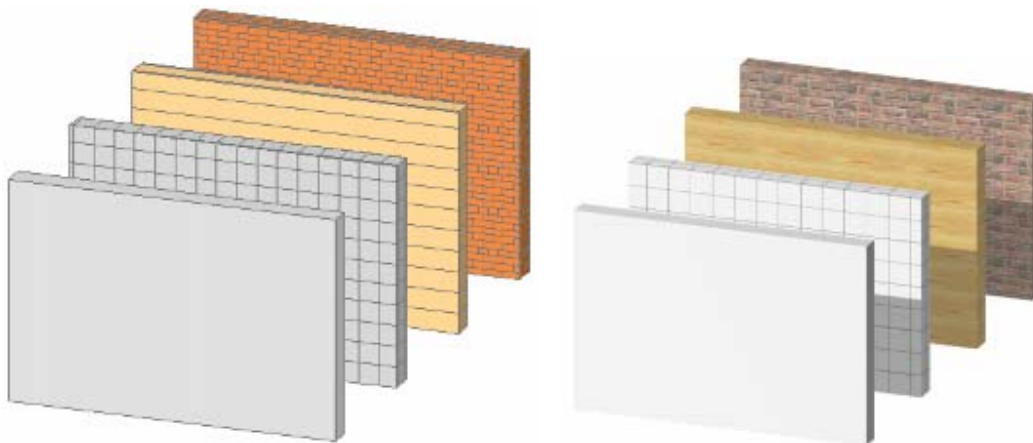
Table:

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The hatching inside the **Wall** body shows the Fill Pattern chosen to represent it on the **Floor Plan** and in **Sections**. Multiple hatches represent **Composite Structures**.



In **3D** views and **PhotoRendering**, the look of the wall's surfaces is provided by the **Materials** assigned to them.



Note that the display of the Wall depends on the current settings in Options > Display Options.



Wall & Beam Intersections can be set on and off.

It is possible to show only the reference lines of walls without the contour lines.

Fill patterns can be hidden (no fills), or displayed as solid, bitmaps or vectorial lines. In the case of composite walls, you can display only the separator lines, or only a solid fill with no lines.

Wall Accessories

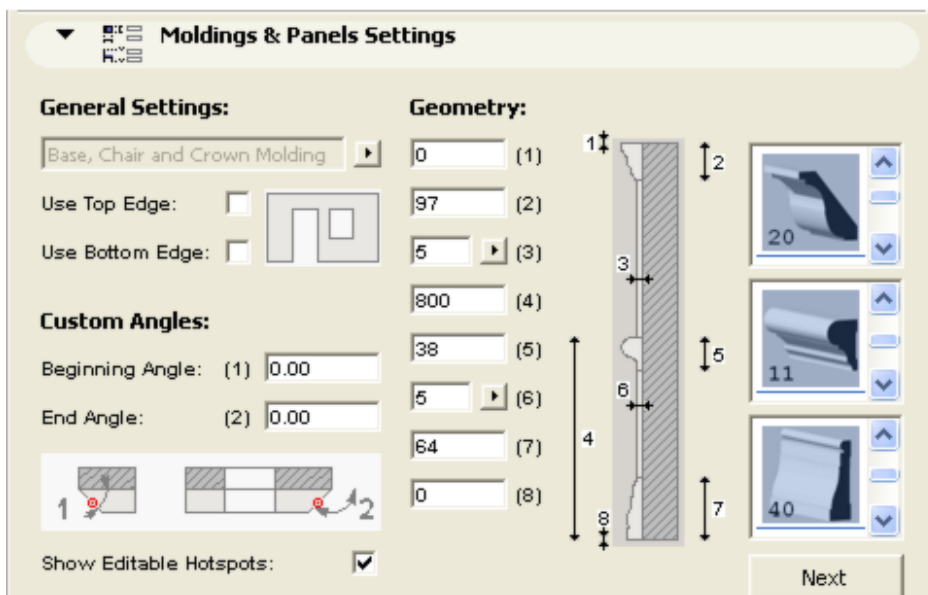
With the **Wall Accessories** command, you can place a variety of objects adding details to your walls.

The **Moldings and Panelings** object model interior details on walls consisting of up to three selectable molding profiles, and optional paneling (wainscot and wall panels) between these moldings.

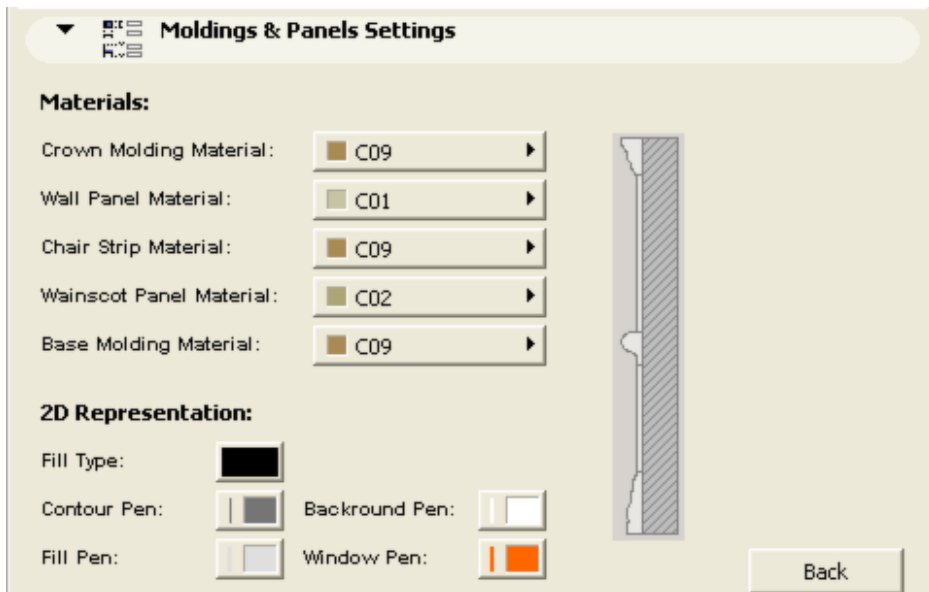
The object's custom parameters can be set in the **Choose Wall Accessory Object** dialog box, on either the Custom Settings or the **Parameters** panel. Parameters are grouped according to different criteria on the two panels.

The **Custom Settings** panel has two pages:

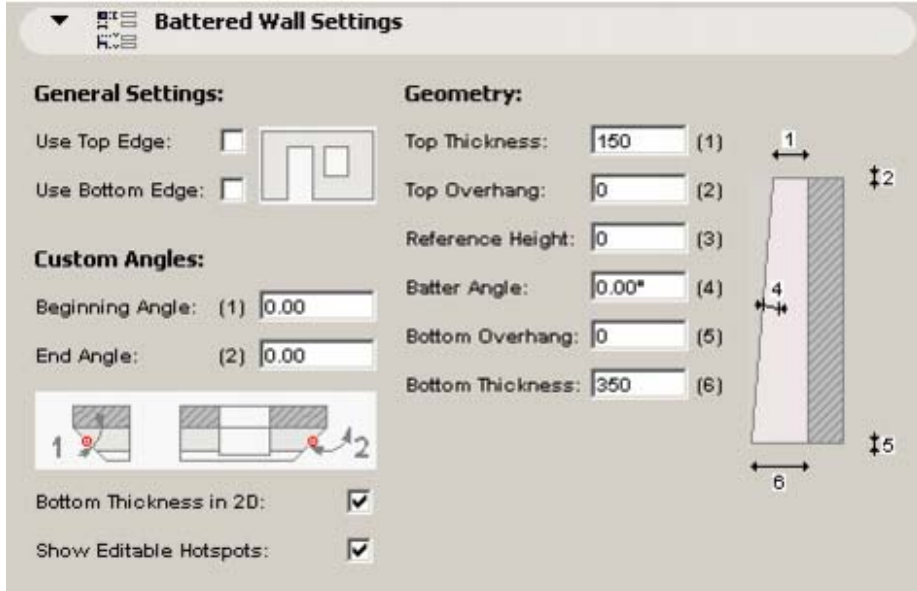
one for the General Settings, Geometry and Custom Angles

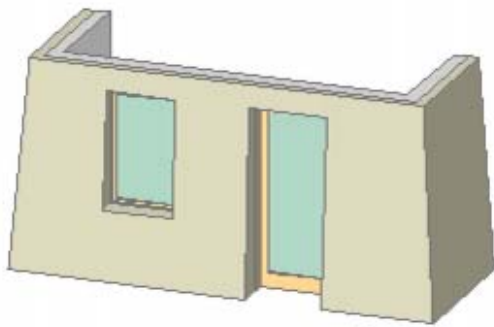


and one for the Materials and 2D Representation

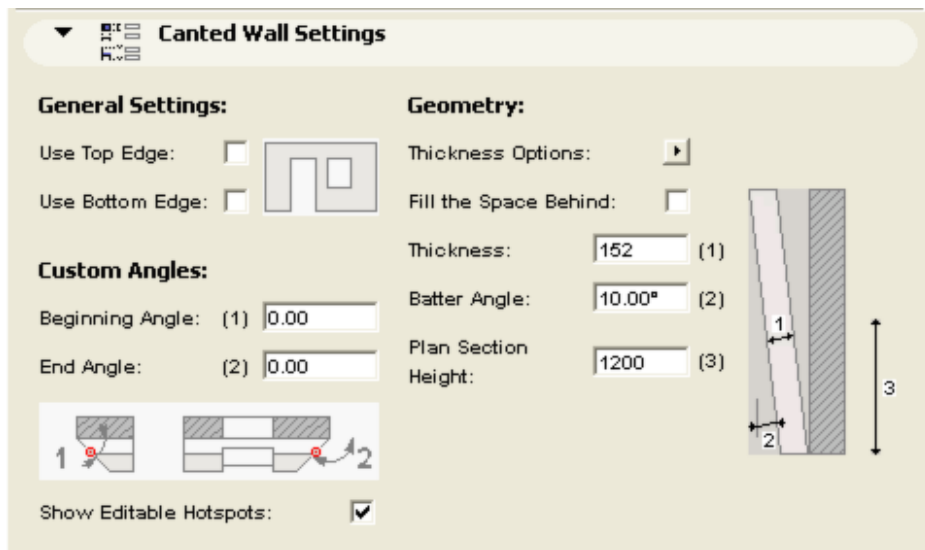


The **Battered Wall** object can model battered stone veneers and similar elements applied to a wall, and can have a different thickness at the bottom and the top. The object can extend beyond or end short of the bottom and the top of the wall by a specified distance.

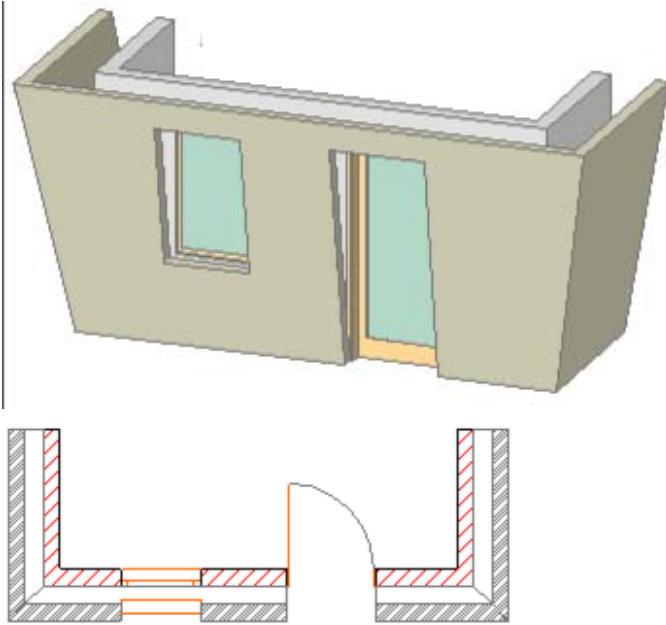




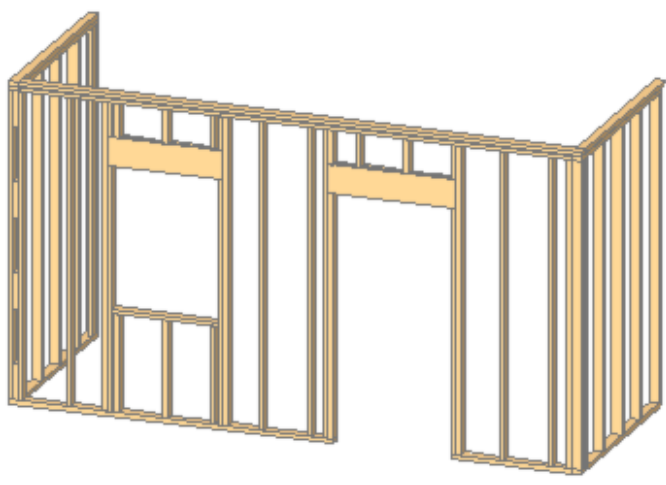
The **Canted Wall** object is an exact replication of the Wall it is derived from, except that it has a parametric tilting angle.

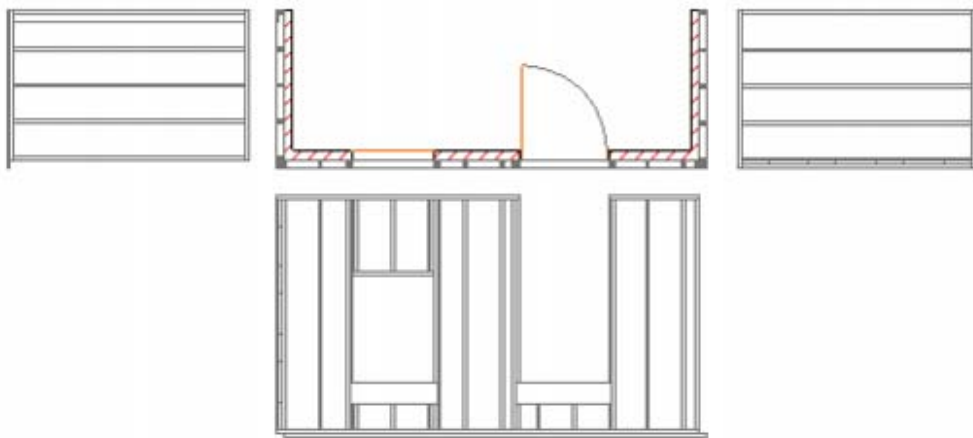


On the Floor Plan, the Canted Wall symbol shows the outside boundaries of the object, as well as the cross section at a given elevation (4 ft. by default).



The **Wall Framing** object can be used to represent stud framing within walls. It handles the properly added studs at right angle corners and incoming wall joints. At the windows and doors it adds double studs, cripples and jack studs as well as parametric headers. The top header plate is broken or extended to provide overlap at the joining walls.





The parameter list for 2D Representation includes an on/off checkbox for **Show Framing Elevation**. Switching this parameter On enables you to edit the 3D geometry on the Floor Plan.

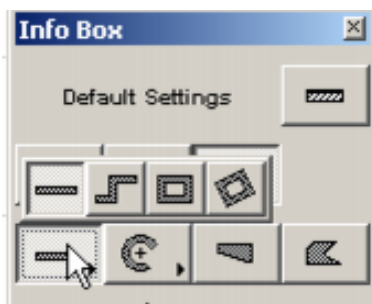
Restrictions: Openings for Doors and Windows will have horizontal edges perpendicular to the original wall plane. These objects have their property script set up to provide LUMBER PACK calculation where the individual pieces are listed with their nominal cross section sizes and their length is rounded up - if necessary - to the next inch. The list also gives an estimate on the overall board feet quantity.

Drawing Walls

When you are satisfied with the choices you made in the **Wall Settings** dialog box, you can start drawing Walls. New Walls can be created in either the Floor Plan or the 3D Window.

Wall Geometry

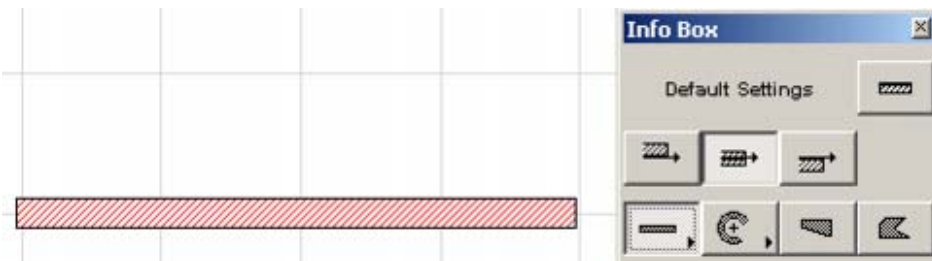
There are nine Geometry Methods available for drawing simple and special Wall configurations.



They can be activated by choosing the appropriate option in the **Info Box** before initiating the creation of the wall. You can also switch methods on the fly after you have already started drawing a Wall.

Drawing a Straight Wall Segment

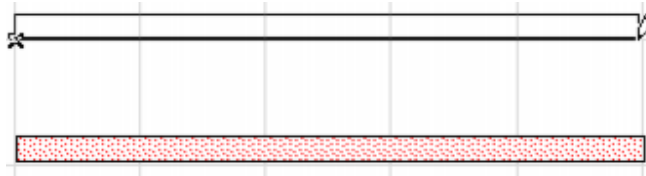
The *Single Wall* method produces one straight wall element at a time.



In the Floor Plan, you define the length of Wall segments by clicking at their endpoints.

Note: This CAD-like drawing method is the default method of drawing segments in ArchiCAD, but you can change it in Options > Preferences > Mouse Constraints & Methods.

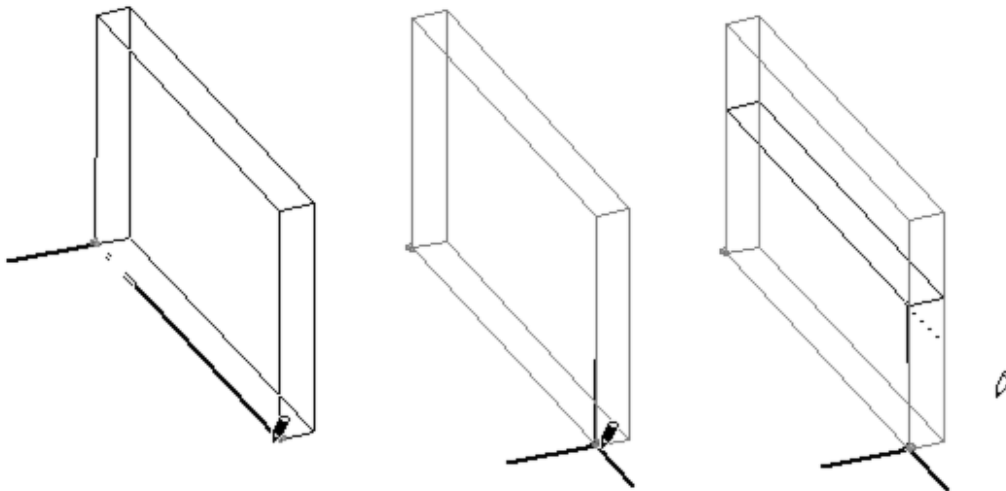
The moment you start drawing the **Wall**, a ghost contour appears and it follows the cursor until you click at the second endpoint.



In 3D view, walls are drawn the same way as in the Floor plan, by clicking at either end.

However, you can choose another method of drawing construction elements in 3D, which requires a third click to specify the Z-height value of the wall.

In Options > Preferences > Miscellaneous, mark the checkbox for "Specify Z-Coordinate when placing or editing element in 3D window".



To accept the original height of the Wall, double-click at the second endpoint.

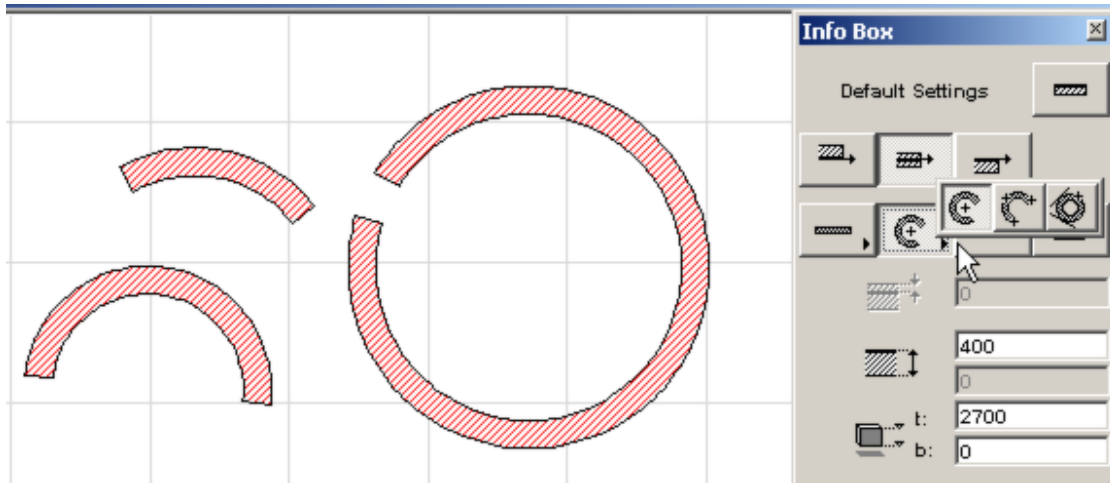
To override the height setting, move the Pencil cursor up or down along the vertical line projected from the second endpoint and click at the desired height.

Pressing Enter validates the height of the Wall at the current location of the cursor.

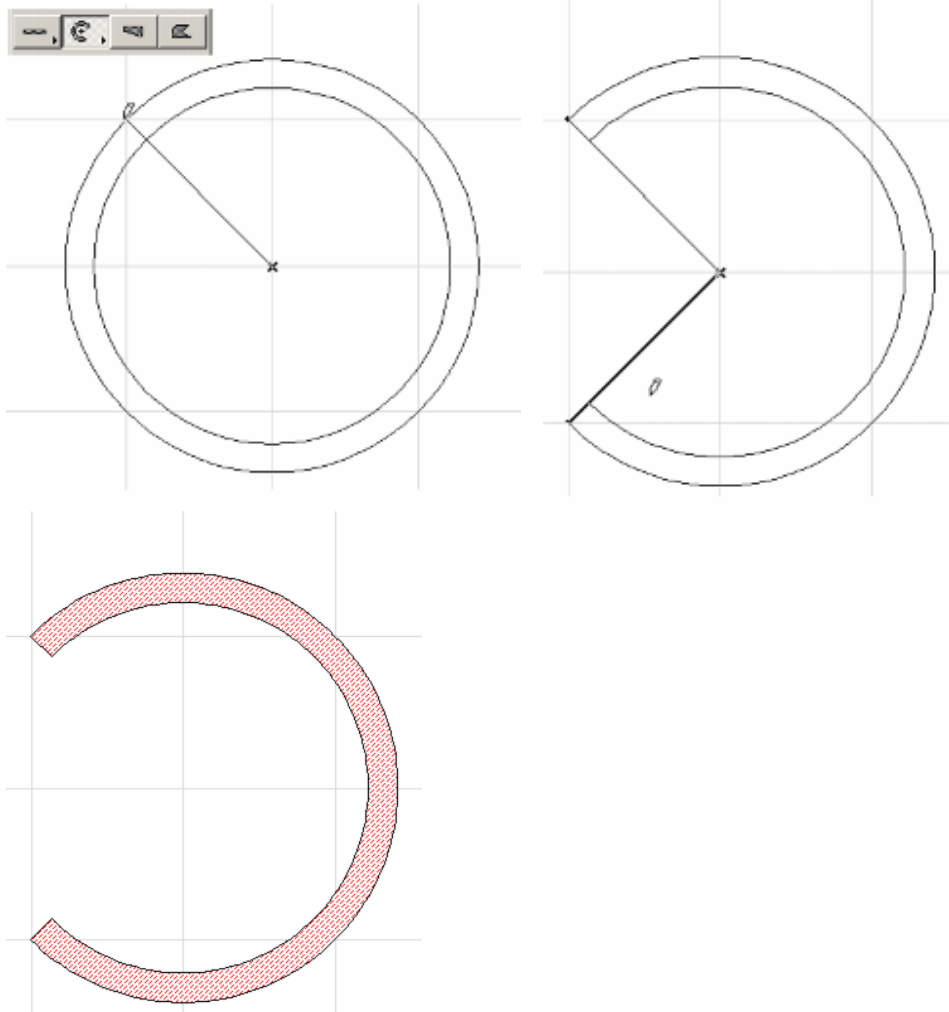
Note: This 3D working method was the standard drawing method in ArchiCAD 8.1 and earlier.

Drawing a Curved Wall

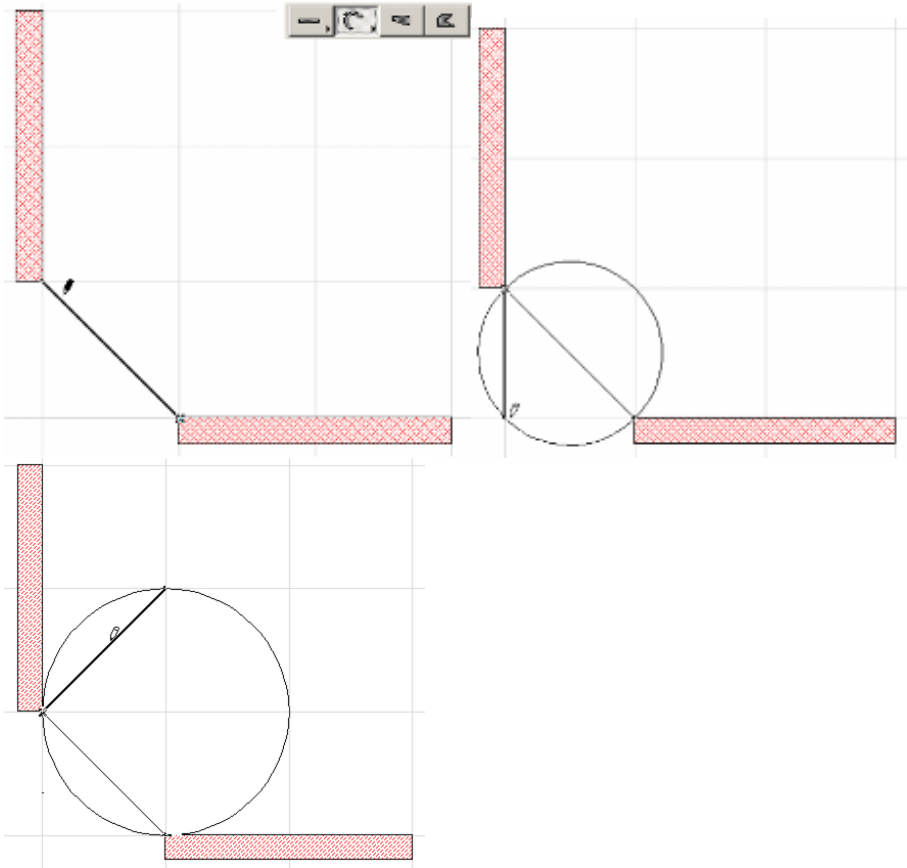
The Wall Geometry Methods available in the Info Box provide three different options for drawing Curved Walls in circular arc shapes. They differ in the basic points they define.



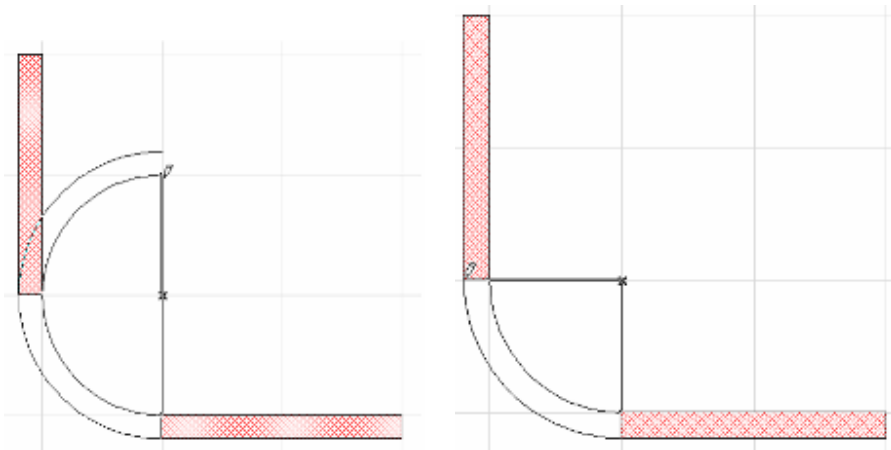
The first option defines the curved wall by the arc's or circle's **centerpoint** and **radius**. Your first click defines the centerpoint. A ghost contour of the circular wall follows your cursor until you click a second time to define the radius. After that, only a partial ghost curved segment is shown, until you click a third time to define the length of the arc wall's circumference. If you need a full circular wall, double-click when defining its radius. When all three points are defined, the ghost contour is replaced by the fully displayed wall contours and hatches.



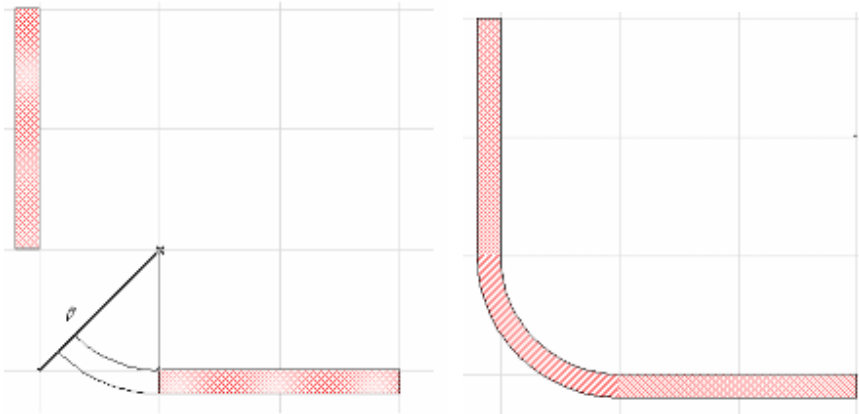
The second option defines the curved wall by three points on the arc's **circumference**. The first two clicks define two points that you will probably locate on points connecting other elements, grid intersections or special snap points. After that, a ghost circle follows the cursor until you click a third time to define the third point.



A fourth click is needed to define the length of the arc segment. Double-click the third point to define a full circular wall. Note that the second and the third points do not need to be actually part of the arc wall.



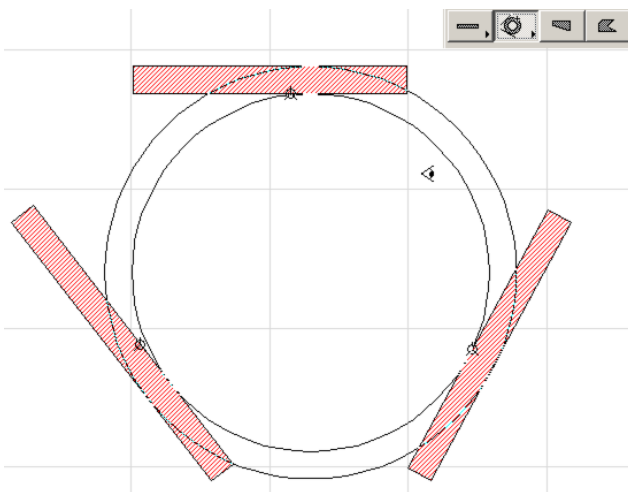
When the arc length is defined, the ghost arc is replaced by the fully displayed wall contours and hatches.



The third option only defines full circular shapes based on three **tangential edges** or points. In this process, you select three initial points: these can be a tangent edge (indicated by the Mercedes cursor), a node (indicated by the Checkmark cursor), or a free-floating point (indicated by the Crosshair cursor.) An endpoint cannot qualify as a tangent edge when using this method, so a maximum of two endpoints are allowed. If more than two are selected, the process will revert to the second method described above. Only linear tangency is allowed: all tangent points must be on the straight edges of Slabs, Lines, Walls, etc. If you click a radial edge with the Mercedes cursor, the resulting Circle will pass through that point rather than being a tangent to the curve. The next step depends on the geometric situation.

If there is only one solution, the circular Wall is automatically drawn.

If there are two or four solutions, the Eyeball cursor appears and the ghost contour of the Wall flips from one position to the other as you move the cursor around. Click when it is at the right place to complete the circular wall.



If there is no solution, (for example, if you define three parallel edges for tangency), no circle will be made.

Notes: Since Walls need to have two endpoints, the fully closed circular Wall that you draw will in fact consist of two half-circles.

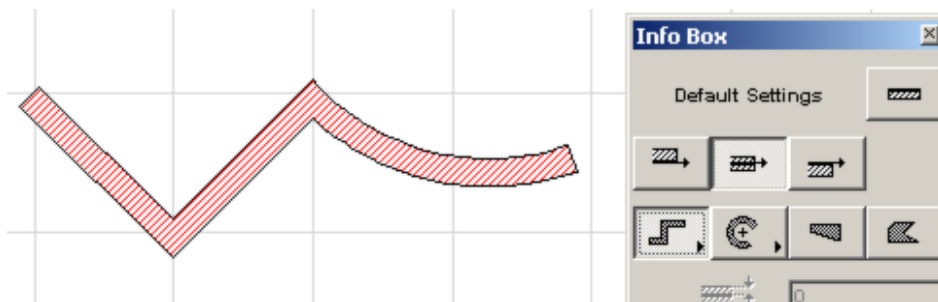
Walls in the forms of full ellipses, elliptic arcs or splines cannot be created directly, but you can trace the shapes of plain drawing elements with the Magic Wand.

For a detailed description, see ["Using the Magic Wand"](#).

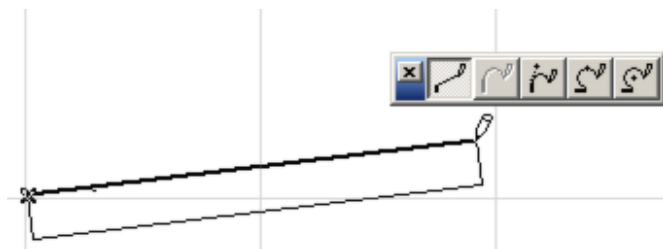
Drawing a Chain of Walls

The Chained Wall method produces a sequence of connected straight or curved wall elements with automatically coincident reference line endpoints that will share the same characteristics.

In the Info Box, choose the Geometry Method that represents a chain of Walls.

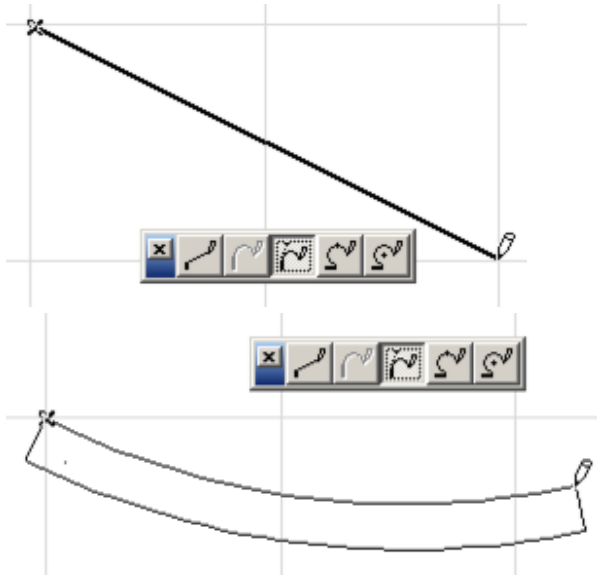


As soon as you start drawing the first Wall, a pet palette appears, offering you geometry options for drawing a straight or a curved segment.



The options are:

- A straight wall segment
- A curved segment tangential to the previous one (cannot be used for the first wall segment)
- A curved segment tangential to a line you define before actually drawing the segment
- A curved segment passing through two points
- A curved segment defined by its centerpoint, radius and length



Place the cursor on the option that suits you best and define the endpoint of the first segment using the methods described above for single Wall segments. This endpoint automatically becomes the starting point of the next Wall segment. When you want to finish drawing Wall chain segments, double-click the endpoint of the last segment.

Throughout the process, a ghost contour of the Wall segments is shown. The full Walls are only displayed when you are finished.

Clicking the **Cancel** button in the **Control Box** or hitting the Delete key at any time during drafting will abort the process, and no elements will be created.

Choosing the **Undo** command in the **Edit** menu will remove the entire new chain of Walls, not just the last segment.

Hitting the Backspace key allows you to undo the previous segment and continue the creation of the Wall chain.

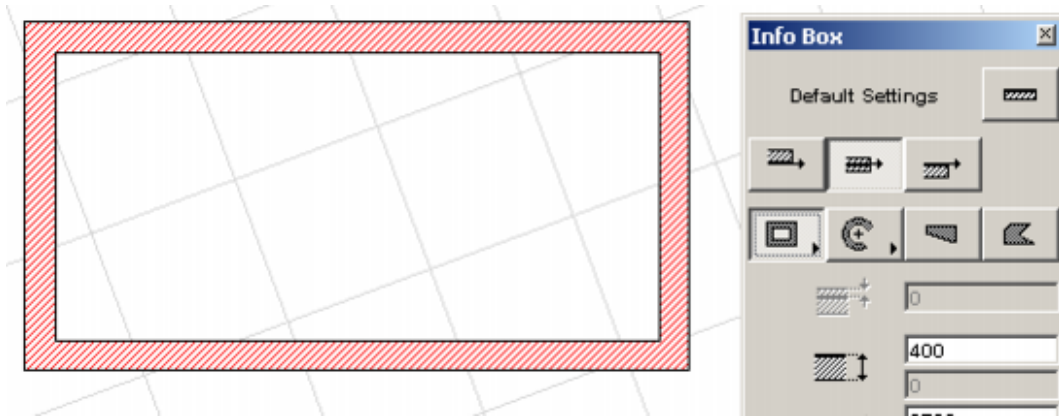
If you change the Wall's attributes in the **Info Box** during the creation process, all created Wall segments will have the modified attributes (reference line position, line type, fill color, material, etc.).

If necessary, you can switch methods on the fly with the pet palette.

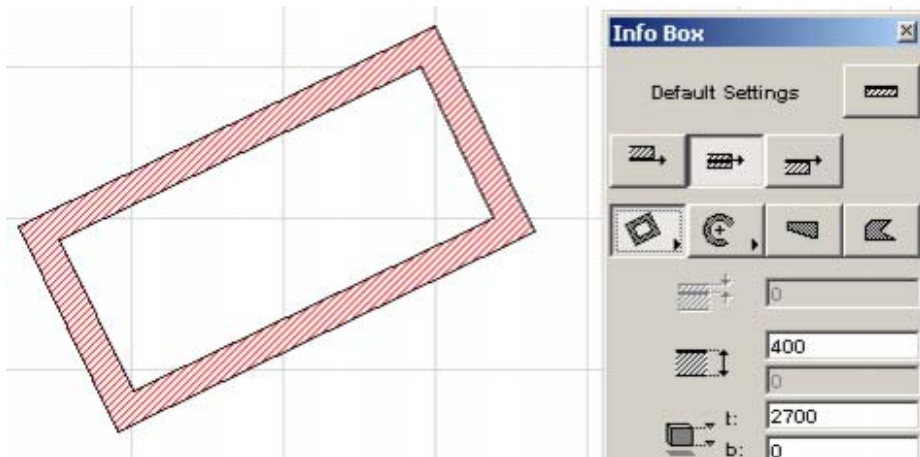
If the **Autogroup** function (**Tools** menu) is switched on, the chained Wall segments will be created as part of a group.

Drawing a Rectangle of Walls

The *Rectangle Wall* method produces four Wall elements with coincident nodes by defining the diagonal line of a rectangle. Its four sides are always aligned orthogonally with the Normal Grid and are not affected by the use of a Skewed Grid.



The *Rotated Rectangle Wall* method produces four wall elements as with the previous method, except that you first define a rotation vector for the rectangle's base reference line.

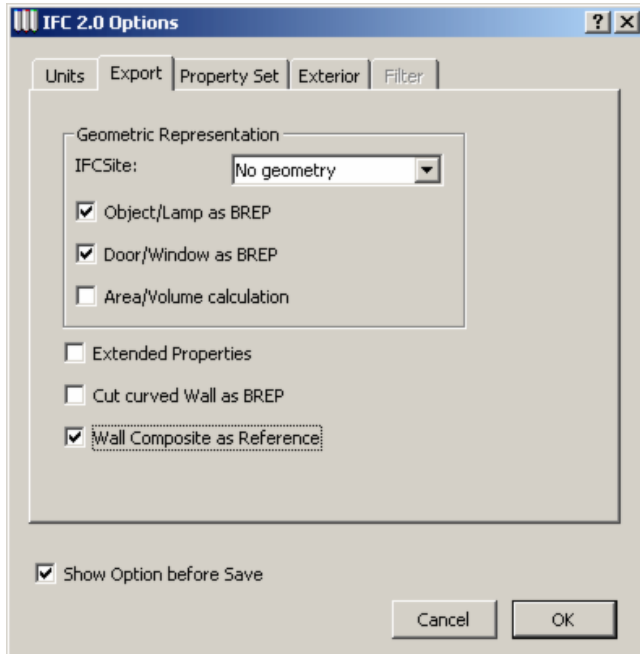


Drawing a Trapezoid Wall

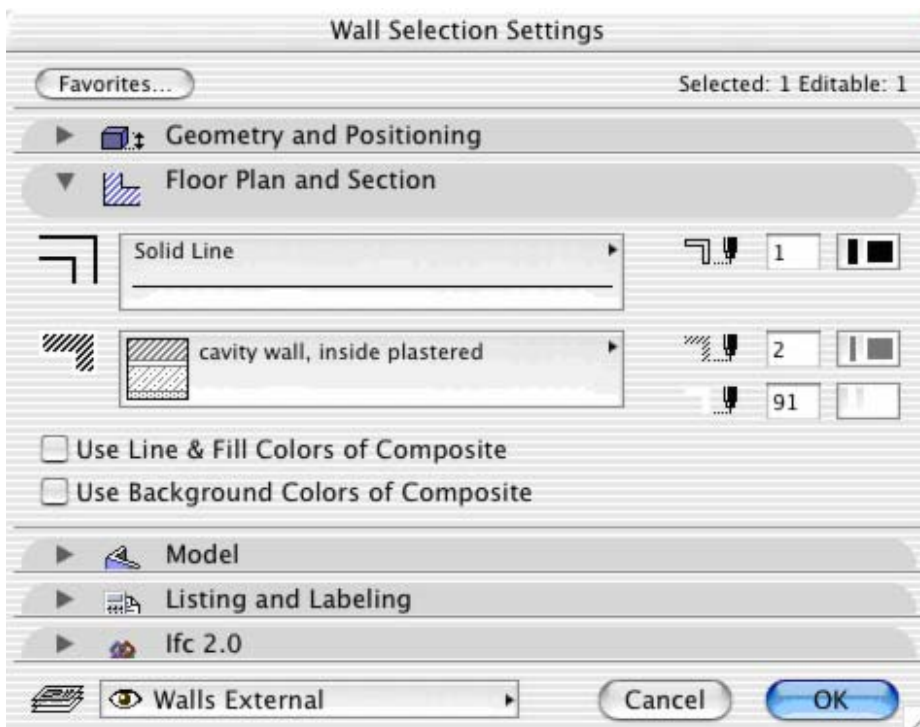
The *Trapezoid* or Non-Parallel method allows you to draw straight Walls whose thickness is not constant. You draw this type of Wall as a straight Wall, except that you will first enter the thickness of the Wall at its two endpoints.



Wall Composite as Reference



Some applications, such as costing, want to know the construction type of an element. The property that describes this is the Reference property defined in the standard property set PSET_WallCommon.



If you leave the option disabled, the value of the Reference property will be taken from the Wall element ArchiCAD ID field, i.e. "Wall-001". If the option is enabled, the value taken is the Wall element's composite name, e.g. "Cavity wall, inside plastered".

Note: Pre-configuring an office library and template file is a good method to ensure that information is consistent and easily accessible for projects.

Wall Intersections in 2D

Clean Wall intersections can only be created between walls that are correctly joined. The reference line is the focal point when you join walls, and the reference lines of the walls to be joined must fit precisely.

When drawing a new Wall or stretching an existing one by its endpoint, it is sufficient to click any edge or inside the hatching of the target Wall. The reference line of the new (or edited) Wall will be adjusted for proper connection. This construction aid is not effective with other editing operations.

When you are faced with a complex joining situation, it may help to switch off **Clean Wall & Beam Intersections** in the **Options** menu. (You can also switch Wall & Beam Intersections on or off in Options > Display Options.) With Wall Intersections **Off**, the reference lines will be clearly visible, helping you to construct your walls precisely.

To make alignment of connecting walls easier, the intelligent cursor snaps to all sides and corners of wall segments even if **Clean Wall & Beam Intersections** is turned off. In the



case of composite walls, the cursor snaps to each endpoint of the inner skin as well.

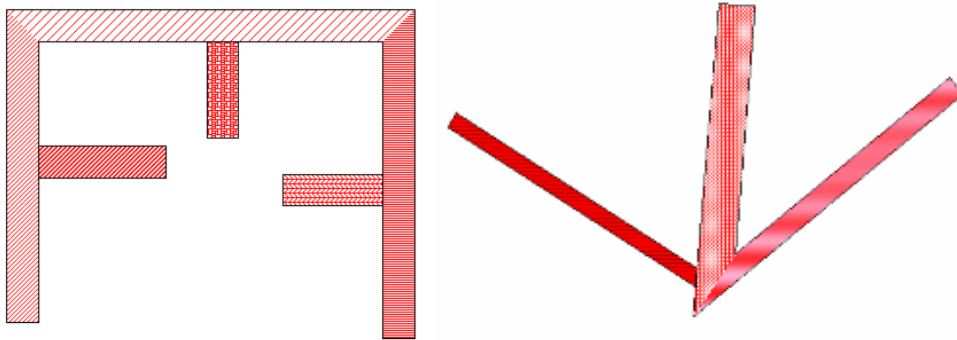
Automatic Clean Intersections at Wall Crossings

Two walls crossing each other in an X junction will automatically create a clean intersection. (This result is visible when the **Clean Wall & Beam Intersection** option is ON.)

When making an X wall junction, the wall you place second will cut the wall that is already on the plan; the intersection sequence is visible in the 2D window. You can modify this intersection sequence using the Display Order command from the Tools menu. The 2D Display Order affects the intersection sequence in both the 2D and 3D windows.

Note: Wall intersections are effective even if some of the intersecting elements are on currently hidden Layers.

Connection of Walls with Different Fill Patterns



If different walls are connected, in the case of L intersections, the wall patterns will be separated by the diagonal of the intersection. In the case of T intersections, the outline of the running wall will remain continuous.

If you need a more elaborate drawing detail at wall intersections, you can create a patch or a detail drawing. You can also retouch the drawing in PlotMaker before plotting or printing.

Priorities at Triple Wall Connections

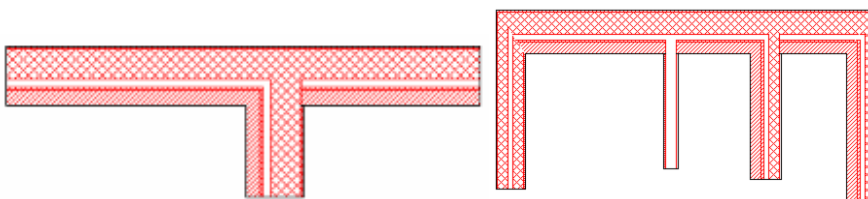
Triple wall connections are based on priorities, and generated in two steps. First, the two thickest walls are connected. Second, the third wall will be fitted to the above two. If all walls are of identical thickness, Composite Walls will be prioritized over homogeneous ones.

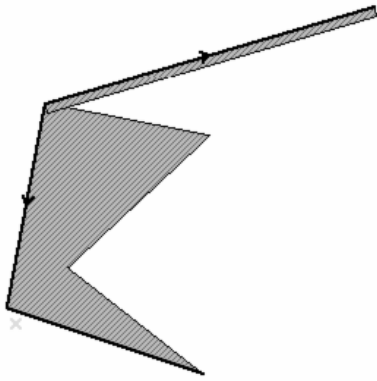
Intersections of Walls with a Vertical Displacement

If two walls are connected by their horizontal position but do not connect vertically or just touch each other, they will not intersect in either the Floor Plan or in 3D.

Smart Connection of Composite Walls

Connecting walls are automatically matched and the fill compositions are analyzed. The connection is set up accordingly.





Corner (L) joints of Composite Walls with wall skins of identical Fill Patterns are automatically cleaned even if the layers of identical Fill Patterns have a different thickness value.

The core skins of Composite Walls are never cut through by other skins.

PolyWall Corners

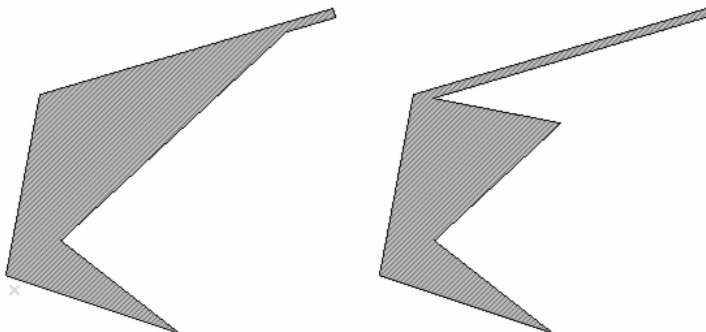
When connected to other, plain walls, wall polygons keep their original contour by default.

If you wish to override this setting, check the **PolyWall Corners Can Change** box in the **Geometry and Positioning** section of the **Wall Settings** dialog box (available when the PolyWall geometry method is active).

In the following example, a Single Wall is connected to a Wall Polygon.

The first illustration shows you the situation with **Clean Wall & Beam Intersections Off**.

Turning **Clean Wall & Beam Intersections On** (**Options** menu) will give a different results depending on whether **PolyWall Corners Can Change** is active.



Modifying Wall Geometry (Add-On)

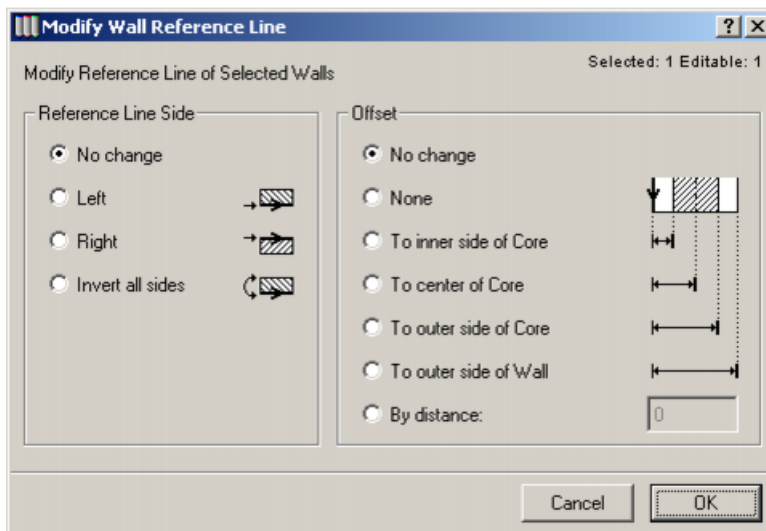
Note: This tool is not visible in the Standard profile interface. You can add it to the Edit menu (or any other menu) by customizing the menu scheme in Options > Work Environment > Command Layout Schemes > Menus; or by applying the Expert scheme in the Scheme Options dialog box (Command Layout Schemes).

With the commands of the **Modify Wall** hierarchical menu, you can modify the thickness, the Reference Line position and the direction of selected wall type elements.

With the **Modify Wall Structure** command, you can change the hatching of the selected Walls, and still keep the position of a desired part of the Wall. At the top of the dialog box, you can set the fill. If the chosen fill is not a composite, you can set its thickness, otherwise the thickness of the core layer is displayed.

Click the radio button at the bottom to choose which part of the wall should keep its position after the modification. (If possible, this will be done by adding an offset to the reference line. If not, the reference line will be moved.)

With the **Modify Wall Reference Line** command, you can move the reference line of the selected walls without changing the walls' position on the Floor Plan.



On the left side of the dialog box, you can change the reference line side of walls. On the right you can add an offset to the reference line to position it to the desired part of the wall.

With the **Invert Direction** command, you can change the direction of the reference line. (This is visible when the **Clean Wall & Beam Intersections** toggle command is **Off**.)

