



AutoCAD® Architecture 2008

Building Walls that Support

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(S5-4)

Course Summary:

AutoCAD Architecture walls can be very frustrating for new and experienced AutoCAD Architecture users alike. It seems that we keep getting those red circles when we try to do something special with a wall. This session will help you understand why the walls work the way they do, along with helping you do more with the wall than just drawing the wall. We'll cover wall clean-up to avoid the dreaded red circles. We'll even cover xref clean-up, and projecting walls and wall components. Learn how to get your walls working for you instead of fighting against you.

Instructor:

Paul has over 20 years of AEC industry experience specialising in CAD management, implementation and Autodesk training. As vice chairman of the AUGI-UK Chapter and a qualified architect, Paul has assisted Autodesk in the development of AutoCAD Architecture and chairs the technical forum for the ADT Community group. He has also been involved in various industry-led BIM initiatives and more recently Avanti. Paul is now an implementation specialist with UK based Cadpoint | AEC, an Autodesk Authorised Reseller and Training Centre. The company provides CAD consultancy services to clients ranging from small UK design companies to global architectural practices. Paul continues to present at major industry conferences throughout the world, providing industry professionals with guidance on improving efficiency, productivity and quality in the CAD arena.



Autodesk User Group International

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Building Walls that Support

Architectural Wall Styles in AutoCAD Architecture

AutoCAD Architecture walls are fundamental to the success of using AutoCAD Architecture and can make or break a project trying to use them. This session will have an in depth look at wall styles, their creation and use. The first part of this session will look at the importance of wall style creation and includes the dos and don't of creating wall styles, how to create UK specific walls and the various sub styles such as endcaps, plus what some of those buttons that no one seems to press actually do.

The second part of our session will look at using walls and will move from the basics of simply adding walls to complex construction drawing examples with interferences and modifiers.

The final section of the session will look at the support issues. How to get rid of those red circles, why don't my walls clean up and why do all my walls in Xrefs disappear.

Existing Content

To aid with content creation for AutoCAD Architecture there are a number of styles, tools and documents that should be reviewed. These include:

<i>Document</i>	<i>Location</i>
UK Walls Styles DWG	C:\Documents and Settings\All Users\Application Data\Autodesk\ACD-A 2008\enu\Styles\UK\Wall Styles - (Metric - UK).dwg
UK Content DWF	C:\Documents and Settings\All Users\Application Data\Autodesk\ACD-A 2008\enu\Styles\UK\ AutoCAD Architecture 2008 UK Content.dwf
UK Content Creation Guide	http://usa.autodesk.com/adsk/servlet/ps/dl/item?siteID=123112&id=9492064&linkID=9240658 acda2008content_w_appendix.pdf
UK Content Tools	(Subscription Site) ACD-A 2008 UK Content Tools (Build 3 7-9-2007).exe
UK Content Tools Guide	(Subscription Site) AutoCAD Architecture 2008 UK Content Tools.pdf

There are also a number of wall styles that can be downloaded from the Autodesk Web Site under the AutoCAD Architecture / Support / Styles sections. Although these are generally in imperial format the methodology used can be adapted to help you develop your own styles and techniques.

Building Wall Styles

Styles and Sub Styles

Walls are among the more complex of AutoCAD Architecture objects and are affected by a variety of styles and sub styles. When a wall style that references a specific sub style is imported into a drawing, all necessary sub styles are imported along with it. Typical sub styles that are associated with a wall style are:

- Materials Styles
- Wall Endcaps Styles,
- Opening Endcap Styles
- Classifications

When modifying a wall the affect of the above sub styles, specifically endcaps need to be considered. If the component widths are changed then the Endcap will probably need to be updated or disastrous results can appear at openings and the ends of walls. Similar to inserting blocks into a drawing, if a definition of a style or sub style already exists it will use the existing definition. When using Style manager to copy styles this will prompt whether you wish to update the styles or not. The advantage of using project navigator to manage styles with in a project can be of advantage for this reason.

Naming Conventions

To aid with wall identification it is best practice to provide as much information about the wall structure in the style name itself. This makes it easier to distinguish wall styles in a long list without having to refer to the wall style description.

The following is the recommended convention for naming wall styles:

<Classification> <Component name>-<Size in decimal units> <Component name>-<Size in decimal units>...

The first section of the name listed is the classification, such as Internal. This is omitted for generic wall styles that could be used for any classification. The components are then named from the External components inwards using the format of component name and then dimension with the last component listed the internal finish component.

Examples of Wall Style Names

Name = External Brick-102 Cavity-025 Insulation-50 Block-140 Plaster-13

Description = External 102mm Brick Cavity 75mm Cavity partially filled with 50mm Insulation Block 140mm. 13mm Plaster on internal face.

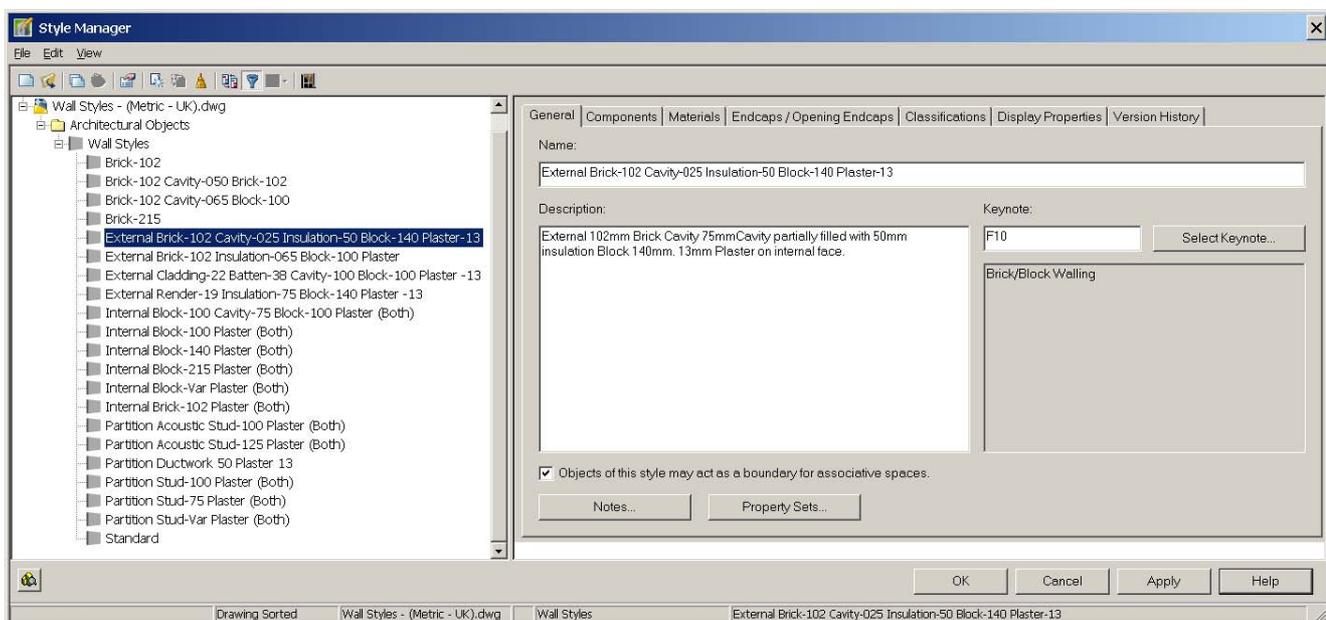
What is in a Wall Style

When creating walls styles there are a number of items that need to be considered. Consistency in all style creation is paramount in AutoCAD Architecture and specifically in wall styles. The wall style manager has a series of tabs. Each of these is important for different aspects of the style and time should be spent understanding what these are and what they do. We will therefore initially concentrate on the wall style manager and the various tabs.

The tabs consist of:

- General
- Component
- Material
- Endcaps and Opening Endcaps
- Classifications
- Display Properties
- Version History

The General Tab



The naming conventions for wall styles should be applied for the style name and description. Whilst most users realise the general tab holds the name and description for the wall style, there are also a number of other important pieces of data held on this tab. The Keynotes for the wall style based upon the CAWS classification (NBS) is available from the 'Select Keynote' button. Also the option to use the style, as a space boundary should be identified here. Style specific 'Property Sets' should be added using this button and the values defined for the specific wall style set. The ability to add specific notes can also be of use, as well as the ability to provide hyperlinks to specific documents that may provide information such as product literature.

The Components Tab

Walls styles consist of components. A Number of settings need to be defined for each component and these are fundamental to the success of the wall style. Each component is given an index. One use of the index is with endcaps, where each index defines which Polyline relates to which wall component. Indexes are also used in display configurations where style overrides are not used.

Component Name

Each component is generally given a name; the convention is to generally name the component as the construction object that they represent. The same naming convention for components should be used across all wall styles.

Component Priority

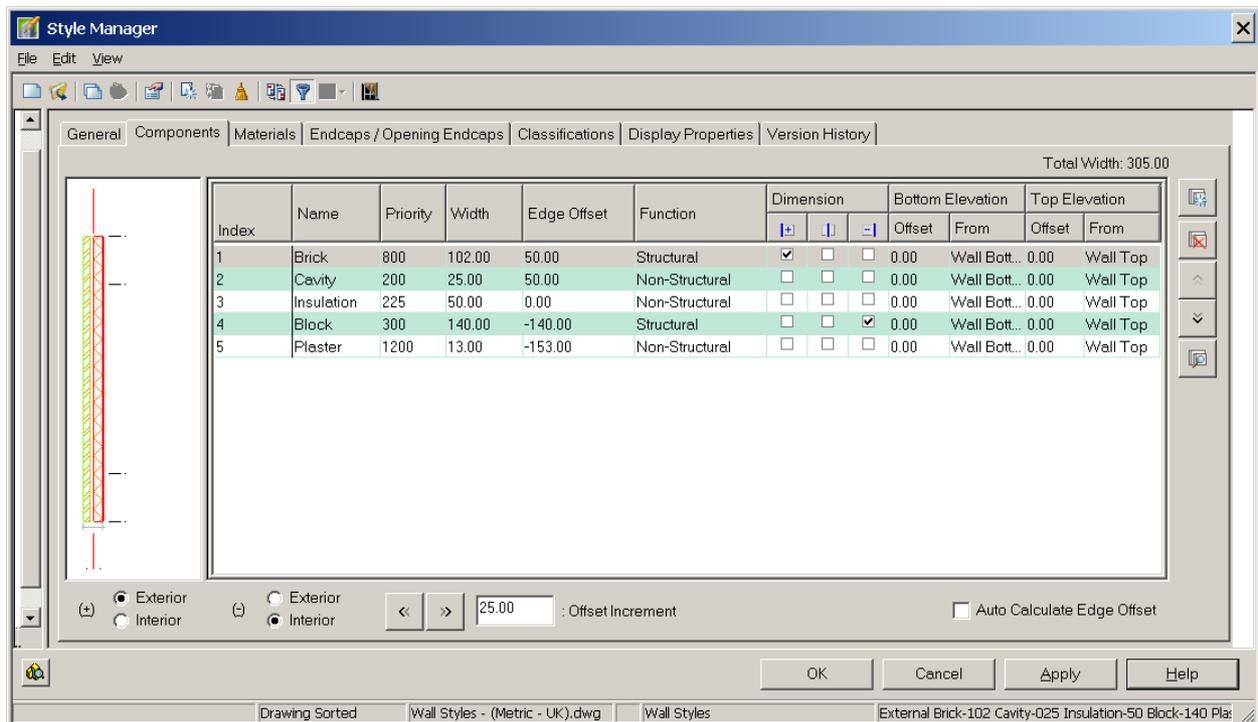
Each wall component must be given a priority to define the hierarchy of which components cut through each other. The lower priority cuts through the higher priority. Therefore items such as a cavity component that are required to cut through all materials are given a low priority. Finishes such as Plaster are therefore given a high priority number.

Typical UK Wall Component Priorities are

Component	Priority
Cavity	200
Insulation	225
Block (High Density)	290
Block (Thermal)	300
Brick	800
Stud	1000
Plaster	1200
Render / Timber Cladding	1350

Component Width

Each component can be either given a specific width or alternatively the Base Width can be used to create variable width walls. A variable width stud component with plaster each side would have a width of $BW - 25$. This would allow the overall width to be changed in the properties dialog with the wall consisting of 2 fixed dimension 12.5mm plaster components and a variable stud component. The use of negative wall dimensions is discouraged as these have a detrimental effect on AEC dimensions.



Edge Offset

The edge Offset is used to define the position of each component in relation to the baseline. It is standard practice for the base line of a wall to be positioned on the external face of the structural component. Wall components below the base line therefore have a minus offset whilst components above the baseline have a positive offset.

Component Function

The Function options provides the facility to choose whether a component is either Structural, non-structural or neither. This is specifically used within AEC Dimensions where the AEC dimension are set to dimension to either Structural or non-structural components.

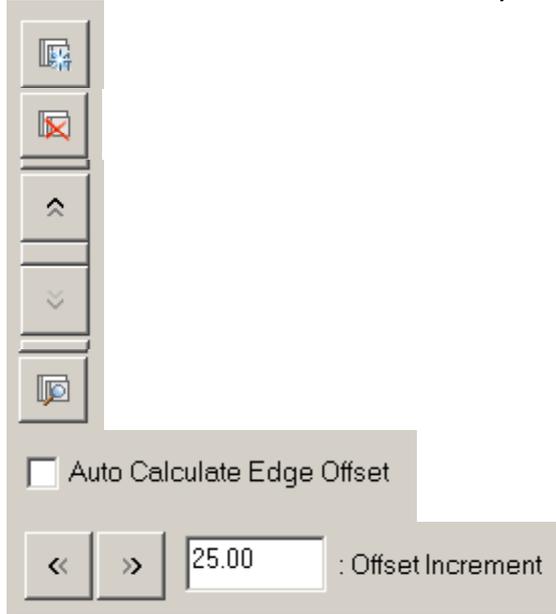
Component Dimension

This is another aspect of AEC Dimensions and allows for the specific side of components either positive or negative to be selected for use by the AEC dimension style. This is used in conjunction with the Exterior / Interior radio buttons in the bottom left hand corner

Component Bottom / Top Elevation

These options can be used to extend components either above or below the base height of a wall object. This could be used to show specific information such as footings at bottom level or parapet information at top level.

The Additional buttons on the components tab allow:



Add New Components to the wall style

Delete Components

Move Component Up the hierarchy

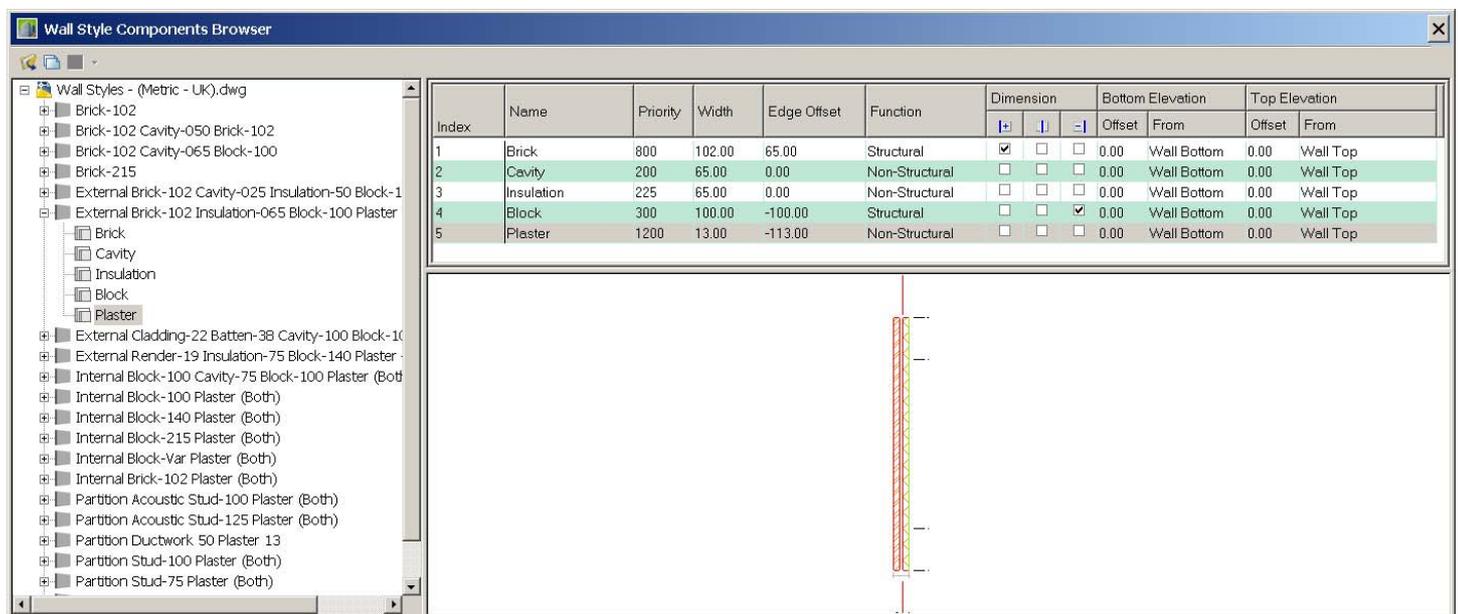
Move Component Down the hierarchy

Open the Wall Style Component Browser

Automatically calculate the edge offset for components upon creation.

The Offset Increment provides a means of changing the offset values for each component by adding or removing the specified offset.

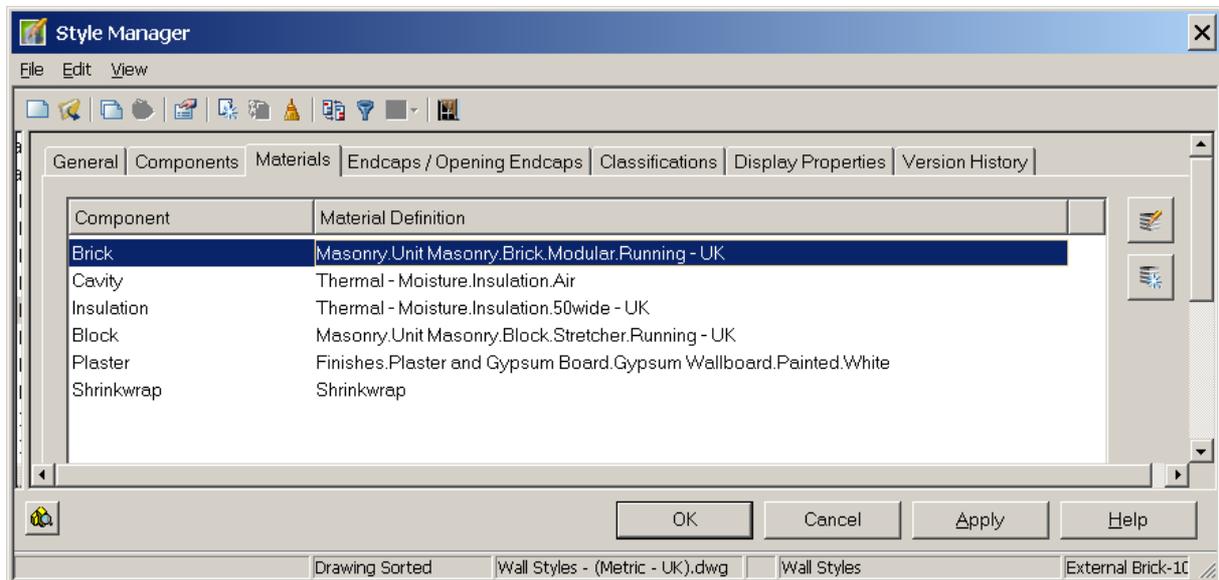
In order to allow the use of components between wall styles the wall Style Component Browser can be used to drag and drop wall style components into another wall style. Select the appropriate component and drag and drop into the wall style manager. This allows consistent naming and priority settings for each component.



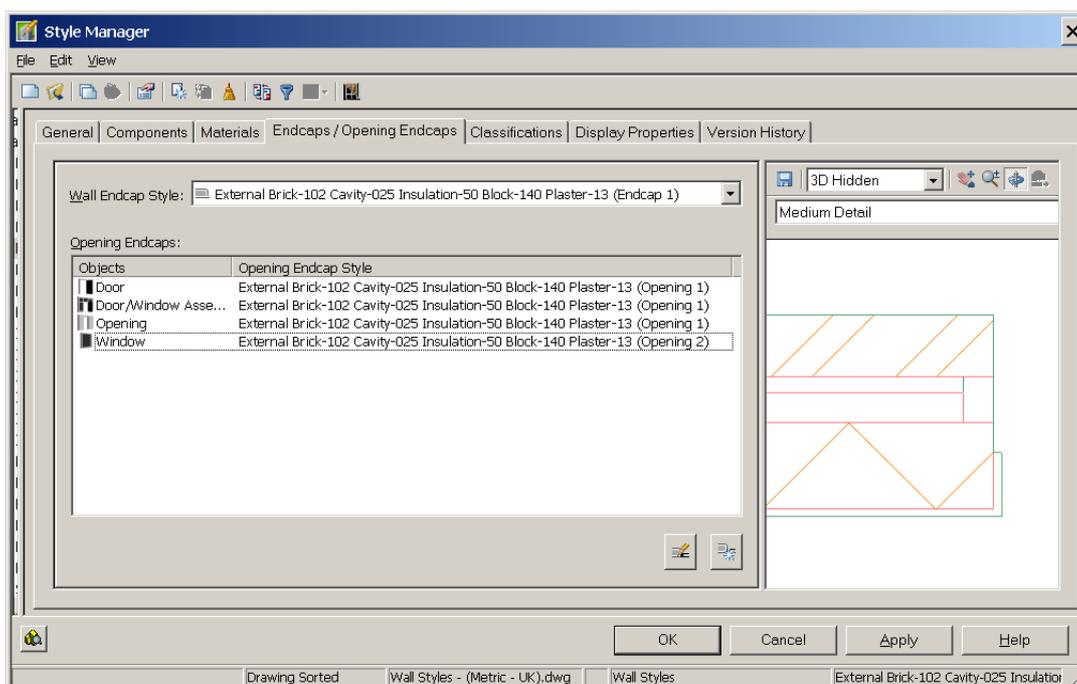
The Wall Component Browser

The Materials Tab

Material styles are a method of providing consistent display representations for objects of a specific type. The use of materials needs to be set in the display properties.



Within the UK wall styles specific UK Materials have been applied. These include specific UK hatch patterns, along with subtle changes in the surface hatch and realistic material displays. Custom materials can be added using the buttons provided or existing materials styles edited to meet requirements. Whilst there are examples of material styles such as 'Thermal – moisture insulation. 50 wide UK', for other widths additional materials will need to be created.



Endcaps / Opening Endcaps Tab

Endcaps are a method of defining what happens to each component either at the end of a wall or where an opening such as a door or window etc is used. Endcaps are created by the use of Polylines that should be drawn in an anti-clockwise direction. Endcaps relate to the specific width of the components within a wall style and are therefore generally style specific. Naming of endcaps to associate them with a wall style is therefore recommended. Within the UK content most wall styles have at least two endcaps. The second endcap generally returns the plaster for use with windows.

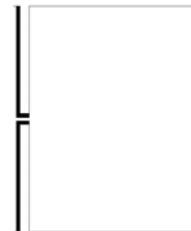
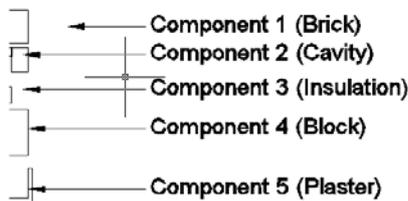
Opening Endcaps are a container for endcaps that define which endcaps are used for the left and right hand jambs, sill and head. The opening endcaps can then be assigned to a specific object such as a door or window etc.

Having drawn Polylines in an anticlockwise direction for each component the Polylines can be either manually or automatically assigned to each component to create the endcaps. The component widths need to be carefully followed.

Polylines cannot intersect each other or display issues will exist with the wall objects. Polylines with vertices separated by a small margin can give the impression of a cavity closer.

Note that Polylines with a width do not show.

External Brick-102 Cavity-025 Insulation-50
Block-140 Plaster-13 (Jamb 2)



Classifications Tab

Applying Classifications to objects provides a very powerful method of filtering specific objects as required. The ability to then schedule data by classification, use display themes based upon classifications and even control display configurations based upon Classifications can be very powerful.

By default there is a wall style classification that defines what type of wall the style actually represents.

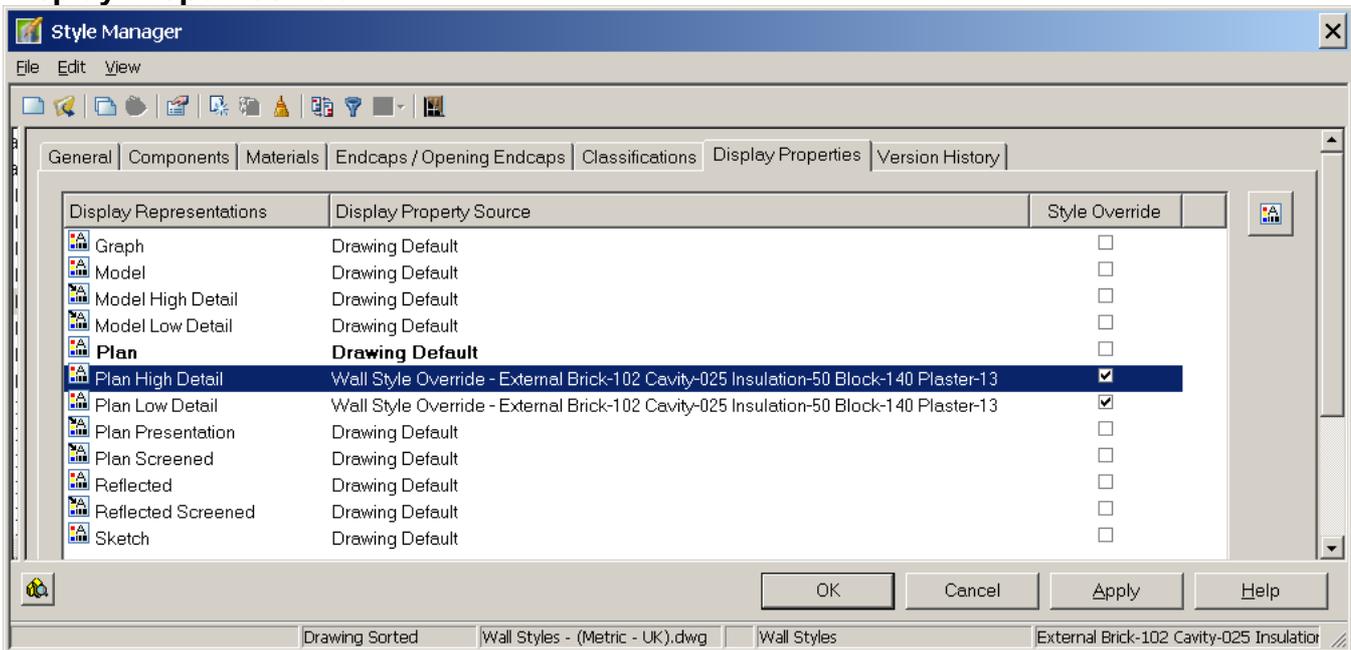
This can be adjusted to suite and additional classifications added.

Examples of the use of classifications will be demonstrated in the "Renovating AutoCAD Architecture" session.



UK Default Wall Classifications

Display Properties Tab

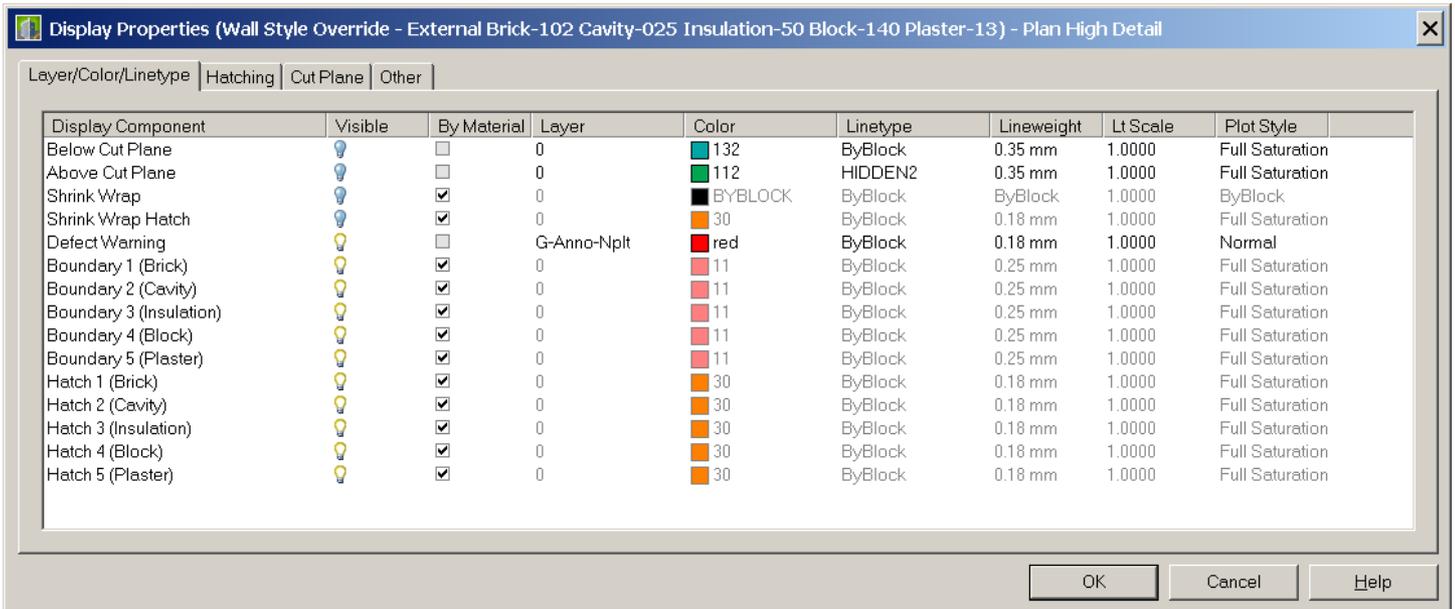


As with all styles the display properties defined for each object how the components would display and plot in a similar way that Layers work in traditional AutoCAD. To aid this property displays can be defined to work by material and then the majority of these settings are then set in the material display property.

This is best practice and materials should be used wherever possible. Each wall components is included in the Display property with a limit of only 20 components that can be managed. Materials then control additional components over the 20 limited.

NOTE

Prior to the introduction of material definitions in Architectural Desktop 2004, it was common and recommended practice to assign wall style components to nested layers and set their color, linetype, lineweight, and plot style settings to BYLAYER. While this is still technically valid in AutoCAD Architecture it is not recommended except for a very few exceptions (such as the Plan Screened display representation, which is frequently used to export plan displays to consultants using AutoCAD, who desire the items to be on a prescribed layer and to have colors appropriate for background drawings assigned.



When accessing the specific Property Display via the button there are a further four tabs available:

Layer / Color / Linetype

This allows the above specific settings to be set for each component but the 'By Material' should be used to force all components to display relating to their material display properties.

Hatching

This gives the opportunity to specify a specific hatch for each component. However, if the material option has been ticked then this tab is overridden by the material display property hatch.

Cut Plane

The options to 'Override Display Configuration Cut Plane' and set a specific cut plane height for this style is provided. Also the ability to 'Automatically Choose Above and Below Cut Plane' is provided with the default being this should be on.

Other

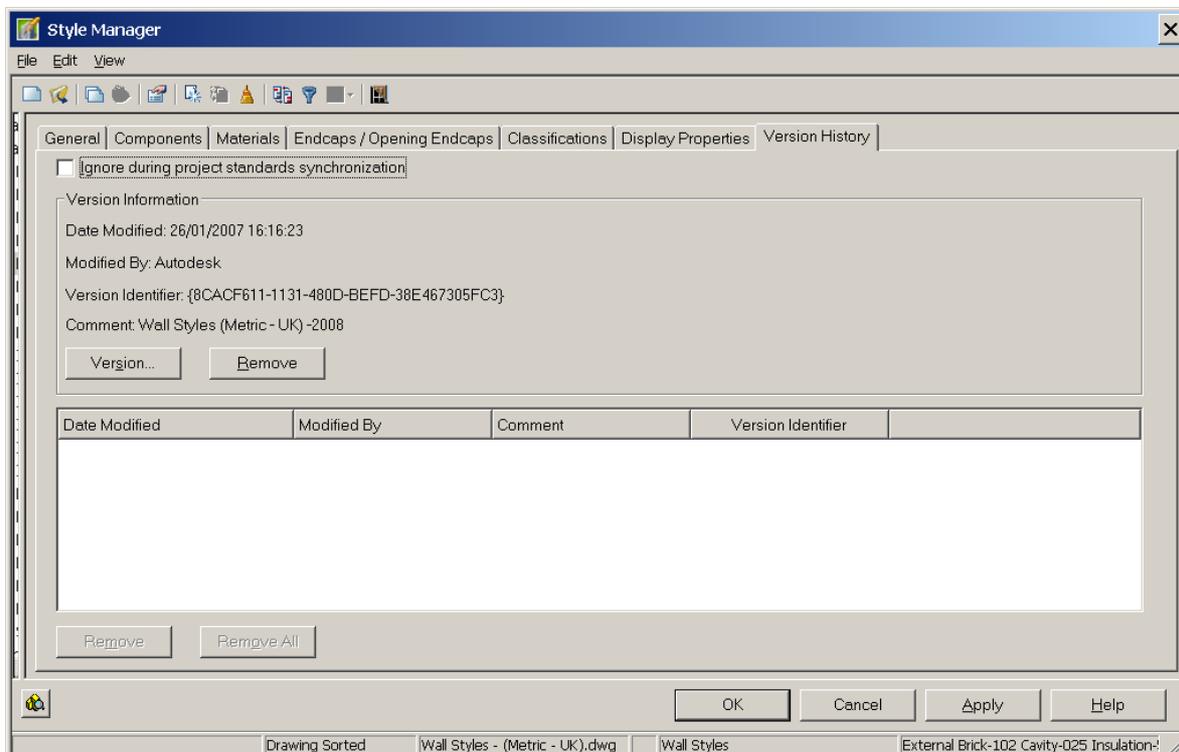
This provides a variety of settings as follows:

Display Inner Lines Above	Clear this option if you do not want to display the lines
Display Inner Lines Below	Clear this option if you do not want to display these lines
Hide Lines Below Openings Above Cut Plane	Clear this option if you want to display the lines.
Hide Lines Below Openings at Cut Plane	Clear this option if you want to display the lines.

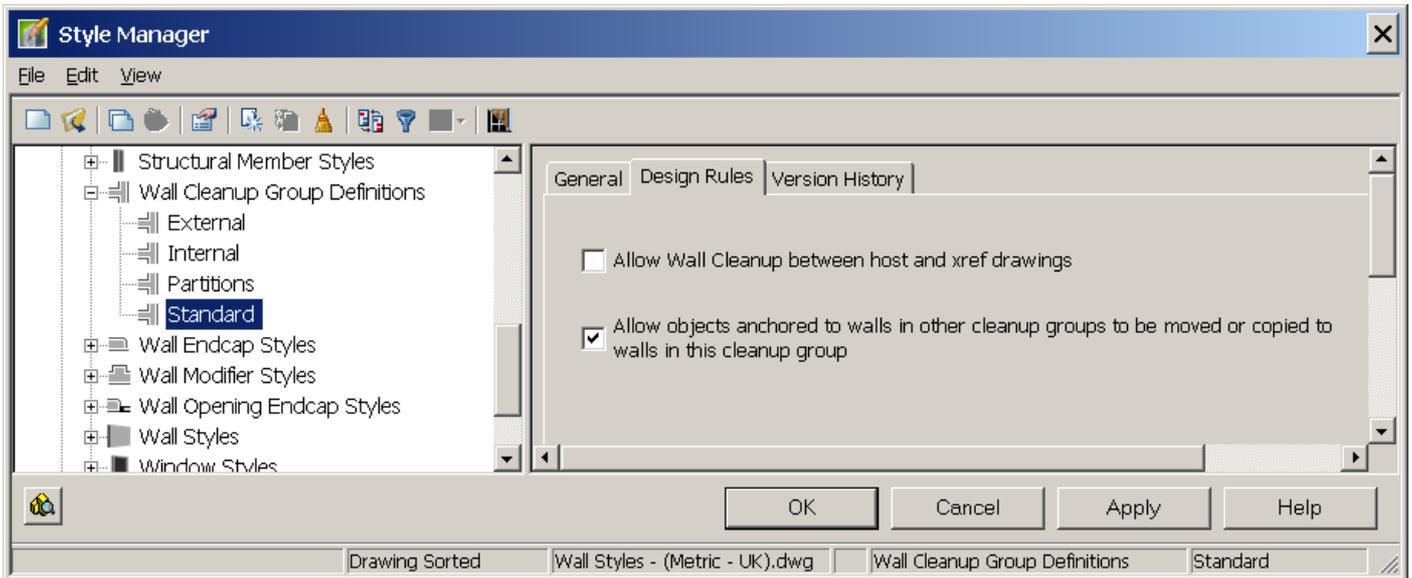
Display endcaps	Clear this option to display complex endcaps as a single line.
Cut Door Frames	Clear this option if you want door openings to cut the wall at the inside of the door frame.
Cut Window Frames	Clear this option if you want window openings to cut the wall at the inside of the window frame.
Component Draw Order by Priority.	Clear this option if you want to draw the components in the order that they were created.
Do True Cut	Clear this option if the wall does not have sweeps or body modifiers, or if they do not change along the height of the wall. If selected this will perform a slice of the actual 3-dimensional (3D) model at each cut plane to obtain more accurate views of walls with sweeps or body modifiers
Draw Mitre for Components	Select each component whose mitre lines you want to display.

Version History Tab

The version history is used with project navigator and is a method of documenting project changes to a style throughout the project lifecycle. When updating project styles the version history should be filled in and commented. Then when projects standards are synchronised the version history can be checked to ensure that the correct version is being used.



Wall Clean up Group Definitions



Wall Clean up Group definitions can be used to define whether walls clean up or not. Only walls in the same clean up group will clean up and this value is set in the wall properties dialog.

The Design Rules allow for walls to clean up across Xrefs or not as required.

Working with Walls

Walls can be created by either drawing directly with the wall objects or by applying a wall to line work. When adding walls objects the wall direction is important and walls should generally always be drawn in a clockwise direction.

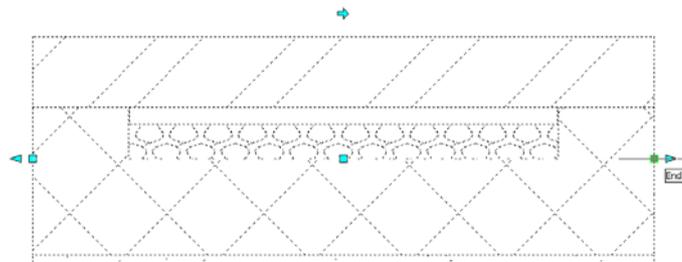
Wall Justification

The wall justification is also important in the design of the building. This can be defined as left, right, centre or baseline. When starting a project it is common to draw walls using generic styles before the actual construction is known. When the wall styles are updated at working drawing stage the walls size may change and either affect the internal area or external size of the building. It is therefore important to make the specific decisions regarding the justification of the walls at an early stage.

Wall Grips

Each wall has a series of grips. The appropriate end of the wall can be ascertained from the start and end grips and then any necessary overrides, such as endcaps or clean up radius can be applied from the properties palette.

The direction grip can be used to reverse the wall direction and use the control key if you want to maintain the baseline whilst changing the direction. Other wise the centre of the wall is used. The triangular grips are used to lengthen a wall whilst the end grips can also change the angle and orientation.



Walls without a fixed width also have additional grips for changing the width. In elevation or 3d view then additional grips relating to the base height and roofline are shown.

Wall Properties

As with most objects the properties dialog controls the properties of the selected object.

The Description, Layer and Styles can be set as per most objects.

Bound spaces provide an option to give an individual wall object the opportunity to not act as space boundaries if the wall style does or visa versa. This setting is usually set to 'By Style'.

Clean up automatically and the ability to specify cleanup groups can be useful. Specific clean up group definitions must be defined within the styles manager and only walls within that specific group will clean up. This definition also controls the clean up of walls through Xrefs

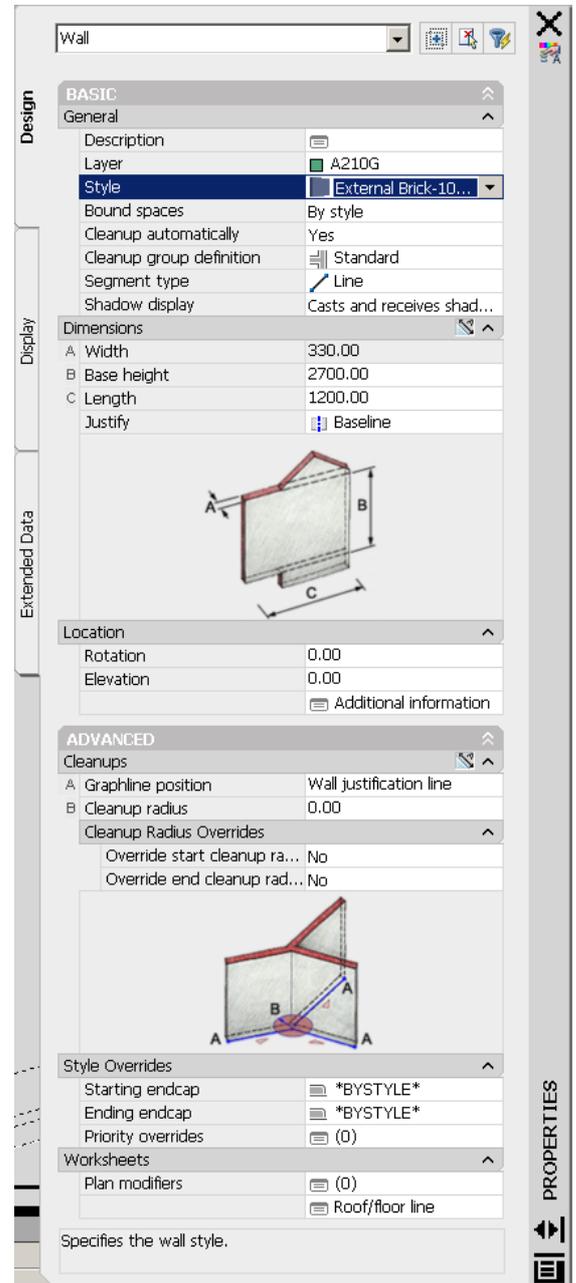
Dimension allow for the basic dimension settings to be modified.

The Location allows for the rotation and elevation settings to be checked and changed. Remember that walls must have the same elevation for them to clean up.

Under the Advanced options the clean up radius are probably the most important aspect of drawing with walls. Generally these should be set as small as possible with a zero value preferable. If required the ability to override a specific cleanup can be added. Alternatively by using the diagnostics view the clean ups can be edited as required.

Style overrides provide the ability to change specific endcaps at the start and end of a wall. Remember that if you want to change the endcaps of an opening then these overrides are on the opening properties not the wall.

Worksheets show the specific



Supported Modifiers for Walls

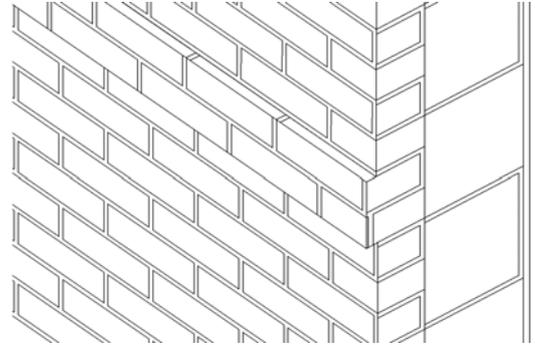
There are various methods of modifying walls to meet specific requirements. But how do these work and what are the advantages of each.

Sweeps

Sweeps are a method of applying an AEC profile to a specific component of a wall. In this situation a two-course brick sill has been added to the wall.

Once the Sweep has been created then the sweep can be applied to any wall object.

Mitring of components can also then be chosen to clean up junctions of walls.



Endcaps

The use of custom endcaps can provide specific modifiers to walls in positions such as bays or structural wrappings when used with wall merge conditions.

This endcap has been created for the wall merge option shown below and shows the path for each component from the two different wall styles that allow them to clean up seamlessly.

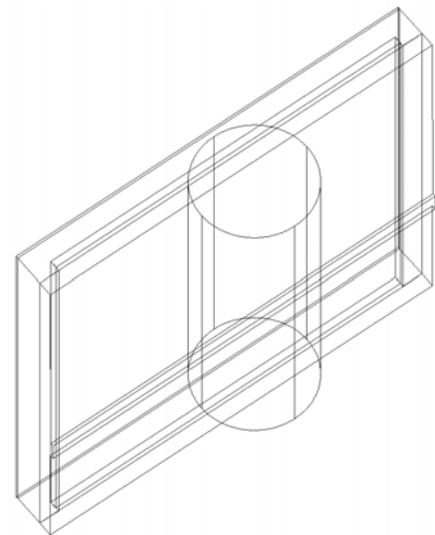


Body Modifiers

Use this procedure to create a body modifier and add it to a wall. You can apply the modifier to a single-component wall, or to a component in a multi-component wall.

You can create a 3-dimensional (3D) body modifier from a mass element, a mass group, or any other AEC object with mass. You can also create body modifiers from ACIS solids or blocks that form 3D bodies. You must place the object in the location you want in the drawing before defining the object as a body modifier.

The modifier can only be changed via the Edit in place option after creation.



Plan Modifiers

Use this procedure to change the path of components. Plan modifiers can be created as Polylines and then applied to a specific component.

Each individual plan modifier for each component needs to be created to obtain the result as shown. There are four plan modifiers for plaster, block, insulation and cavity.

Plan modifiers do actually changed the walls in the third dimension for the full height of the wall.

Roof / Floor Line

Roof and floor can be changed either to meet specific objects such as a roof or slab or alternatively project to Polylines.

The use of the isolate object in elevation view or edit in place can be particularly useful for creating custom roof lines as shown.

Interference Conditions

Interference conditions can be use to allow objects to automatically be cut by other objects.

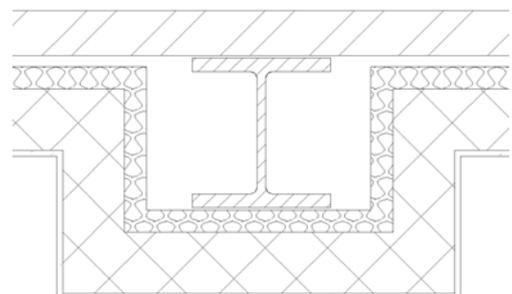
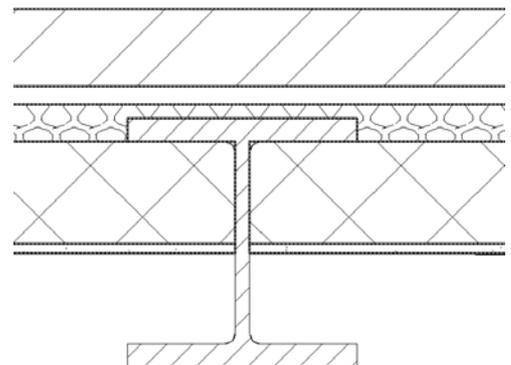
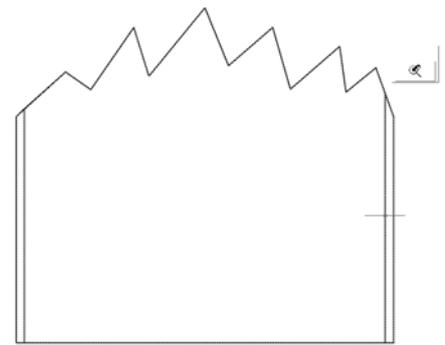
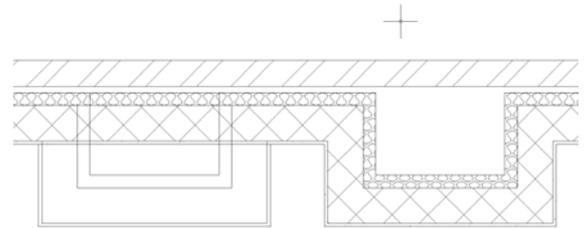
If the objects changes or moves then the interference will automatically update. In this case a UC has been applied as interference on the wall. Notice how the wall components automatically cut around the UC member. Xrefed objects can also act as interference conditions.

Merge Conditions

Merge conditions can be used to merge walls of different types and can be very powerful when using with specific endcaps.

This example shows two walls with merged together. Custom endcaps have been used to merge the components of the two walls but this has the advantage that the walls can be move and the length of the walls changed as required.

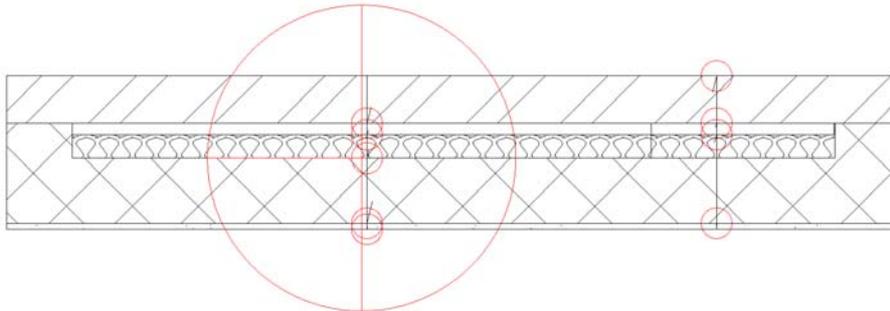
Before **After**



Supporting Walls

The 'Red Circles of Death'

Besides using the display reps to turn them off, how do we get rid of those 'Red Circles of Death' that signify that there are issues with our walls.



The reason for the defect marker issues with walls normally exist due to the following:

Duplicate wall

Where walls are placed on top of each other or small sections of duplicate walls exist then defect markers will appear. Window the area and check the number of walls in the properties and review the grips on screen.

Clean up Radius is too large

The Diagnostic display configuration is useful to highlight where wall baselines don't touch or cleanups are too large. The use of AutoCAD trim, extend, fillet and chamfer can help to resolve clean ups as well as the specific 'Apply 'L' Cleanup' and 'Apply 'T' Cleanup'. Try to keep the clean up radius to a minimum with zero preferable.

Overlapping walls with minor offsets.

Suitable differences in wall offset due to bad draftmanship where components attempt to clean up can create defect markers. Zoom into the components and check the wall alignments

Walls with different direction

Walls of the same style but different directions are unlikely to clean up

Complex endcaps intersecting with wall junctions

Often where a wall junction is too close to an opening then there is an issue with the endcap clashing with the wall junction. In this situation override the opening endcaps to standard and see if this resolves the problem. If so then a custom endcap etc may be required.

Too many walls attempting to clean up with each other.

At complex junctions check the clean up radius is set to zero. Then see if by changing a wall direction this will aid the clean ups, specifically with internal walls that can be reversed. Try pulling walls back from the junction to find which wall is creating the issue.

Testing Wall Styles

Walls with a slight difference in the components such as 12mm and 13mm plaster width can cause defect markers, as the two components cannot resolve themselves. Consistency in wall components is therefore important.

Another reason for the defect markers relates to self-intersecting Polylines in the Endcaps styles. A simple test for this is to create a curved wall with a few openings and apply a couple of interference conditions. These will normally highlight if there is an issue.

If you change the wall styles endcaps to standard and the issue is rectified then the issue is with the endcaps. A 'regen model' or 'objrelupdate' may be required.

Wall Cleanup issues

The other issue major issue relating to walls is there failure not to clean up. Again there are a general set of issues that should be reviewed. These are

Walls with different elevations

Walls with different elevations, no matter how small the difference will not clean up. Check the wall elevations and if necessary change the units to eight decimal places first.

Clean up radius not set

Walls will not clean up if the clean up radius does not intersect. So either the baselines need to touch or the clean radius set to the minimum to allow the walls to clean up.

Wall baselines not joining

If the walls baselines do not touch and the clean up radius does not intersect then the walls will not clean up. Use the diagnostic display configuration and the AutoCAD edit commands to resolve this.

Walls in different clean up groups

Walls in different cleanup groups will not clean up with one another by design. Check the Clean up group definition on the properties tag.

Cleanup overrides applied

If a Cleanup override has been applied to a specific end check that the cleanup radius is sufficient.

Best Practices for Wall Styles

- Walls are directional and should be considered as having an exterior and interior side. The exterior, or positive side of the wall is at the top of a wall running left to right. Wall components should be defined so that the index order is from exterior to interior. The component closest to the exterior side of the wall should have an index assignment of 1, while the most interior component should have the highest index assignment.
- When you specify the edge offset of a component, the value should always be to the most interior edge of the component.
- The width of components is always a positive value.
- Wall priorities should be standardized and based on the existing AutoCAD Architecture convention, which is documented in the AutoCAD Architecture User's Guide.
- Materials should be assigned to all wall components.
- Plan display of wall components should normally be set to observe the drawing default settings. Best practice is to assign materials to wall components and set their linework and hatch pattern parameters to By Material in the plan display settings.
- Model display of wall components should be set to the drawing defaults. This allows for material assignments to control the color and hatching of walls in non-orthogonal views.
- Wall styles should be classified. This allows for more flexible scheduling and tagging in the future, as well as more display control options.

In Summary

Be consistent in components and all sub styles creation when creating wall styles. Spend time testing your styles before putting them into production and try to test them to destruction.

Mastering endcaps is fundamental to wall style creation. Always create specific endcaps for each wall style. Make the endcaps as small as possible and don't try to be too clever.

Although you work at 1:1 remember the level of detail that needs to be issued. Even High detail is only really proposed for 1:50 level plans. By keeping things simple success will be more easily achieved.

I hope that you have enjoyed this session and that it has provided a useful insight into wall styles and their use. If you require any further information then please contact me at CADPoint on the email below.

Keep supporting those walls

Paul Oakley

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