

BES501330

Standardizing content used in MEP design across Revit and AutoCAD

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Learning Objectives

- Define CAD standards for use in both AutoCAD and Revit
- Create a library of standard symbols for use in both AutoCAD and Revit
- Set up templates to use standardized colors to represent MEP systems in both AutoCAD and Revit
- Configure bespoke settings for exporting dwg files of Revit drawings

Description

As BIM Lead for the MEP team in a multi-disciplinary design consultancy, trying to achieve a consistent look for our deliverables not only across several offices geographically, but also across multiple software platforms can be quite challenging. There is only so much content which can be included in a template without overwhelming it. This case study will follow our journey to find a way to standardize the symbols we use, colors, naming conventions, classifications and more.

The projects we work on vary from sizable new builds, which we would model in Revit, to "small works", where we may just be replacing a boiler in a plantroom, we originally designed some time ago, which will have been drawn up in AutoCAD. These smaller projects usually do not have a big enough budget to include modelling and then editing any existing services. Our aim is to provide drawings of the same look and quality across all our projects, regardless of the software package used.

Speaker(s)

I have been involved in the production and management of deliverables for Building Services design for over two decades. Over the last eight years I have developed my skills as a coordinator using tools such as Revit, Navisworks and other software packages. I now lead a team producing MEP models for projects across a diverse range of sectors including education, healthcare, retail, residential, and scientific research sectors. I recently qualified as a BSI BIM Project Information Professional.

Introduction

This case study is intended to inform anyone looking to create and maintain CAD standards whilst working in both Revit and AutoCAD. It is presented from the point of view of someone managing these standards for MEP Design consultants, but the lessons we learned may provide guidance for anyone with the same responsibilities, regardless of the discipline they work within.

The Challenge

In 2017, before we became part of the Tetra Tech family, I was invited to create a Revit template to be used by all our MEP design teams. It had come to the attention of our BIM Implementation Team that dissimilar templates were being used across our offices in various geographical locations, and not just in our department. Maintaining consistency has been an ongoing challenge, one that we have had to keep coming back to as changing circumstances have impacted on our workflows.

These challenges have included:

- Changes to where we work from and how we access our systems – we are no longer entirely office based.
- Modifications to operating systems – our previous method for delivering our CAD standards no longer worked when we upgraded to Windows 10.
- New software updates and applications providing new workflows – whilst ultimately timesaving, these can also take time to adopt.
- Becoming part of a larger organisation – we became part of Tetra Tech in 2019 and adopted its name and branding in January 2021.
- Company growth through acquisition and recruitment – bringing in expertise from other businesses has added to our excellent breadth and depth of experience. However, people bring their own ideas about how project deliverables should look, and unless your standards are clearly defined and available to use, they will apply what they are used to using.
- Varied BIM adoption - whilst most of our clients now expect us to use Revit, a number still use AutoCAD themselves, and expect us to return drawings to them in a format that they can keep up-to-date themselves in the future.

Define CAD standards for use in both AutoCAD and Revit

Define Scope

We began by thinking about the building blocks that we need to deliver our projects. I was provided with a core template, to be used by all disciplines, to use as a basis for our MEP template for both Revit and AutoCAD. These were updated when we rebranded and are central to keeping a consistent look across disciplines. Things to consider from a companywide point of view are:

- Titleblocks / drawing borders
- Fonts / Text styles
- Dimension styles
- Linetypes
- Logos and branding colors

Your organisation may well have branding guidelines documented already, and these should be taken into consideration when defining your CAD Standards. The way that all the above are named within the software should be consistent, so that it feels familiar to the user no matter which software package they are using. A companywide standard naming convention for AutoCAD blocks and Revit families is also advisable, particularly from a BIM perspective.

When reviewing what our MEP templates should cover in addition to the above, we considered:

- Drawing symbols
- System colors
- Standard details
- Sample Schematics
- Color fill legends / hatch colors and patterns
- Standard notes
- Standard legends

We also thought about how we would document and convey all the decisions made to the rest of our team, and how these resources would be shared, and produced a checklist of all these requirements.

Assessment

Once we had our list of requirements, we gathered all the resources that were already being used, assessed whether these resources were suitable for inclusion in our new standard templates, whether they could be updated or not, and then reviewed what was still required to fulfill our checklist. The first time we went through this process it was clear that the biggest area of concern was around the drawing symbols being used, and system colors. These were not applied consistently across software platforms or across offices. As reaching a consensus was proving difficult and time consuming, we decided to adopt an industry standard.

The Society of Digital Engineering (SDE), part of the Chartered Institution of Building Services Engineers (CIBSE), have create a standardized set of drawing symbols and system colors that can be applied across the building services sector. A link can be found at the end of this handout.

Assignment

It was initially thought that I would complete all this work myself, with the support of our technicians, but it became clear after a while that we all had so much project work to do that it was very difficult to find time to fit this standardization work in.

We eventually took the decision to outsource much of the work that was needed on our Revit template to MagiCAD, and I have managed any subsequent updates this required, including rebranding it as a Tetra Tech template. The benefits of getting the standard template in place outweighed the expense. Assignment of this type of work is very much a commercial decision.

What has worked well for us in recent years has been holding weekly meetings with the technicians and BIM Managers in our other offices via Microsoft Teams. We have a task list active on the Team page, where anyone can pick up a task if they have time to work on it. We have also used some of the tasks as training opportunities for new starters and apprentices.

Document

This team have also been working together to create a library of guidance documents to explain how our templates work, and specific processes and workflows which we use. Our goal is that this will eventually be embedded with several very short video demonstrations, following feedback from one of our apprentices that he would be more likely to watch training videos if they were short enough to be a TikTok. These will be hosted on a dedicated MEP page on the company's SharePoint site.

Our templates, AutoCAD blocks, Revit families, and other resources for use within the software are shared on a cloud-based server accessible by anyone in the organisation. We call this the Shared Content Library (SCL). Depending on the size and set up of your organisation, this is something you may wish to consider. Also think about any adjustments which could be made to your software deployment and discuss these with your IT team, that will aid the standardization process, such as setting the file path used by the software to look for blocks or families to wherever you set up your library.

Create a library of standard symbols for use in both AutoCAD and Revit

You will need to start with a set of defined symbols, whether you choose an industry standard, purchase a library, or come up with your own. Because we chose the CIBSE symbols we started with a set of symbols available in JPG and DXF format. This is accompanied by a document listing what each symbol represents and giving guidelines as to what size the symbol should be if printed full size.

AutoCAD

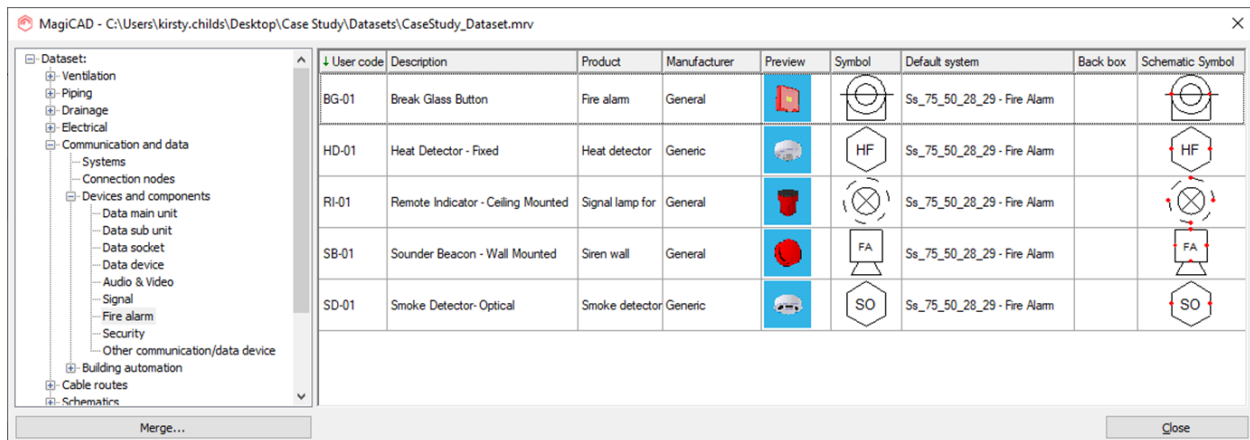
Knowing that CIBSE's intention is that these symbols should print the same size no matter what scale the drawing is, we set about turning these into annotative AutoCAD blocks. We started by setting up a drawing for each system which is used as a legend when setting up a new drawing. We then followed this process:

1. Open the relevant Legend drawing in AutoCAD.
2. Open DXF file for the block to be created.
3. Zoom extents (double click mouse wheel).
4. Save as an AutoCAD Drawing (DWG) to the SCL > 03 – AutoCAD > MEP > Blocks, aligning the file name with the Library Object Naming Convention.
5. Close this file.
6. Insert the file you have just saved into the Legend file as a block.
7. Place the block in alignment with the other blocks, with a 3mm gap top and bottom from the other symbols, in alphabetical order.
8. Select the block you have just placed, then right click and open it in the Block Editor.
9. In the properties of the block, change "Annotative" from "No" to "Yes".
10. Also in Properties, change "Allow Exploding" from "Yes" to "No".
11. Add the relevant description from the CIBSE Standard Symbols doc.
12. "Save Block As" and overwrite the block you previously saved.
13. Close the Block Editor.
14. Repeat the description as the Legend text. (Use single line text rather than multi-line text in this instance, as this will make spacing easier).
15. Save the Legend dwg.

Once a legend is copied into a drawing the blocks appear in a drop down on the Insert > Block panel on the ribbon. Alternatively, they can be dragged and dropped into a project from the SCL using the Design Center.

Revit

Unfortunately, this is not so simple a process in Revit, because the symbols we see are 2D objects embedded in 3D families. We thought about selecting a set of standard families to use and amending these so that they contained a parametric version of the symbols that would change size to suit the scale of the drawing it was used on in the same way that it does in AutoCAD, but we did not have the resources to do this. This was further complicated because in Revit we may have multiple families for the same item, depending on its specification and / or manufacturer. However, we found that the same plug-in we selected to help our engineers with their calculations would also allow us to use the same set of symbols when using its tools to create new families.









MagiCAD's dataset

This is managed using a dataset, where symbols can be assigned to 3D objects before they are inserted into a Revit project, at which point the family is created. Other data can be assigned using the dataset, including system and product classifications, and design data. The name that the family will have can also be defined in the dataset.

We do not include all these families in the Revit template, but instead have a standard dataset which can be copied when setting up a new project and then amended to include any project specific components, which will also be assigned with the same CIBSE symbols, which will change size with the scale of the drawing. They can also be assigned to represent the component in schematic views, which can be linked to the model itself.

Set up templates to use standardized colors to represent MEP systems in both AutoCAD and Revit

You will need to start with a set of defined system colors. Because we chose to follow the CIBSE standard to follow, this comes with a document which assigns an outline color and a fill color for each MEP system. This list is not exhaustive, but guidance is given for adding to the list when necessary.

Service	Outline	HSL	RGB	HEX	Fill	HSL	RGB	HEX
Pipework								
Domestic Hot Water Flow		340, 100%, 30%	153, 0, 51	#990033		340, 100%, 75%	255, 128, 170	#ff80aa
Domestic Hot Water Return		340, 100%, 45%	230, 0, 76	#e6004c		340, 100%, 75%	255, 128, 170	#ff80aa
Mains Cold Water		180, 100%, 30%	0, 153, 153	#009999		180, 100%, 75%	128, 255, 255	#80ffff

Extract from Society of Digital Engineering's "Standard Symbols – Systems"

AutoCAD

When we work in AutoCAD, we generally represent systems such as pipework as a single line, so to employ these colors, since we already used a different layer for each system, we merely changed the color of that layer to match the outline colors defined in the standard.

This was a departure from how we have worked previously, where we always stuck to the 255 colors indexed in AutoCAD, so we have also used layers to assign a lineweight, rather than relying on pen settings to do this, which in turn meant updating our plotstyles.

Revit

In Revit there are many ways to achieve the same result, and we needed to find a way which would work equally well when presenting a system as a single line drawing, which we use in earlier design stages, or a double line drawing with a color fill. We decided against using a system color fill because this did not work for single line drawings, and we wanted a single solution if possible.

We have used filters in view templates in the past to achieve the desired effect, but these were not as customizable when we started this journey as they are now, and there were so many filters in each view template that they started to become problematic. We now make use of a quirk in Revit that a system can have a different material to the pipes or ducts it is comprised of. The outline system color is applied using the VG overrides in the system's type properties, and the fill color comes from the system's material, whilst the material of the pipework families remains unchanged.

Configure bespoke settings for exporting dwg files of Revit drawings

Our final puzzle piece was getting a DWG export from Revit to look like one of our AutoCAD drawings. This is something that we often get asked to provide when handing our drawings over to a contractor who will be developing the project at the next design stage and cannot guarantee that everyone in their supply chain will be able to use Revit.

Previously we had used the default settings for these exports, and once we started to investigate this found that there some ways to make a big difference to these exports quite quickly, by changing the settings to use the colors as they appear in the view being exported.

Unfortunately, no matter what settings we used, our symbols became a group of lines when exported in this way, and the colors are by object rather than by layer. However, we are looking into a way of using layer modifiers to enhance layer naming for these exports, so that each system exports onto its own layer, just as we would work if the drawing started its life in AutoCAD, and this way could assign a color to these layers. However, it would have to be an index color rather than an RGB color.

This part of the process is something we are still perfecting and will link into a review of our layer naming, which for the UK market should now incorporate Uniclass classifications. We are regularly revisiting these standards, as software changes, BIM standards are updated and revised, and our clients' requirements change. Revisiting this process of defining our CAD Standards regularly also allows us to bring in research into software advances that may help us manage these and improve our workflows.

Additional Resources

Useful Websites

CIBSE's symbols and system colors

These are free for anyone to use. As it would not be possible to create a symbol for every product that exists within the building services sector, guides on how they made the symbols and the rules for creating new ones are included for some systems. The symbols are available in JPG and open-source DXF format. They can be downloaded from here:

[CIBSE Standard Drawing symbols | CIBSE](#)

MagiCAD MEP Software

MagiCAD are an Autodesk AEC Industry Partner. They have software solutions for both AutoCAD and Revit designed with MEP design and construction in mind. They are also the provider of Europe's largest BIM object library dedicated to MEP products:

[MagiCAD Group | Software solutions for the built environment](#)

AutoCAD CAD Standards Feature

Once you have spent time putting standards together, you will want to be able to check these are being used on your projects. This feature can be used to save your CAD standards, and to check drawings conform with that standard whilst you work or in batches of drawings:

[About CAD Standards | AutoCAD 2021 | Autodesk Knowledge Network](#)

Autodesk Model Checker for Revit

Similarly, this free tool can used to check your models based on a set of BIM requirements:

[Autodesk Model Checker for Revit](#)