AUTODESK UNIVERSITY 2013

Fabulous Fabrication: Spool, Estimate, and Burn Directly from Autodesk® Revit®, Autodesk® AutoCAD®, or PDF Documents

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FB2914 A lot has happened since Autodesk's acquisition 2 years ago of Micro Application Packages Limited. Learn what has happened to the products and see how they actually work. We expose the tremendous business value that sharing a common database between Autodesk® Fabrication CADmep™, Autodesk® Fabrication CAMduct™, and Autodesk® Fabrication ESTmep™ design, estimating, and CNC production software brings to your business. Create or change a service instantaneously and see the labor and material costs update along with them. See how content can be hooked to industry standard labor and material catalogs. If you are still spooling, estimating, or sending to the plasma table by hand, this class can change that forever.

Learning Objectives

At the end of this class, you will be able to:

- Create & use a single database file to transfer data between MEP design, fabrication, and estimation
- Convert Revit, AutoCAD, and PDF files into fabrication-level detail designs
- Describe the latest that the industry has to offer MEP to streamline MEP contractor workflows and significantly boost ROI
- Design and/or fabricate directly in and/or from either Revit or Inventor

About the Speaker

William is an MEP and Design to Fabrication SME (Subject Matter Expert) with Autodesk. He got his start as a plumbing designer with a consulting engineering firm in Seattle, WA, where he worked on a high-end, national department store chain account. During his nineteen years in the industry, he has gained experience power and lighting design, HVAC, architectural & energy design, CFD (computational fluid dynamics) and design to fabrication solutions across numerous disciplines. William has worked in several disciplines within the AEC industry, including O&M design work on a major pharmaceutical account for Johnson Controls, Inc., as well as plumbing and piping design coordination for a major mechanical contractor in Kansas City where he also currently resides with his wife Wendy and their five children.

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Class Goal

It's important to note this is an introductory course, and accordingly is why it's listed as a beginner level class. That said, we will *not* be covering intermediate or advanced level topics like tips & tricks on how to make what you're already doing even better. This course is intended to convey business value – the "why your company would want to make this your software solution for MEP fabrication," and do that by exposing you to the technology that's available, letting you see how it looks in action, and then give you the chance to ask all the questions you can.

Introduction

In 2006 my career took me to a large mechanical subcontracting firm in Kansas City, MO. There I became familiar with a pipe detailing product called CADPipe, and shortly thereafter the company migrated to Micro Application Package's (MAP) CAD-Mech. Autodesk has since combined that product with CAD-Duct and CAD-Elec into a single product and renamed Autodesk Fabrication CADmep. There are two other products however - ESTmep and CAMDuct, that together with CADmep* make up or round out the Autodesk® MEP Fabrication software hero product solutions. Used in concert, all three aid in extending Building Information Modeling (BIM) workflows from designers, to mechanical, electrical, and plumbing (MEP) subcontractors who can create metadata rich (attached estimating values, flat pattern development, spoolable) models that use manufacturer and/or detail (e.g. pressure class) specific content that can help generate better estimates, create more accurate building systems, and directly drive MEP fabrication.

*Note: Fabrication CADmep 2014 requires a licensed install base of AutoCAD 2014 software or an AutoCAD 2014 industry-specific software product to run on top of.

When I came to Autodesk, and before we had partnered with any fabrication solution provider, I advocated for Autodesk to look at partnering with MAP. I advocated for partnering with someone in the fabrication world at all, to fill a gap in Autodesk's portfolio (because think about it… where did designs go after leaving an MEP firm… out of Autodesk software and into another vendor's solution to be redrawn). But I advocated specifically for MAP for two key reasons – two details that made their (MAP's) offering distinct from anyone else's and in my opinion, ahead of anything else available. One was that (at the time FABmep, but now) CADmep and ESTmep were the only product that offered file conversion (mapping) from Revit, for all three disciplines (mech., elec. & plumbing). But the second, and more important reason was that all three products (at the time, over a dozen products) shared a common database. I will repeat that… All three products – CADmep, ESTmep and CAMDuct share a common database.

THIS IS HUGE!! From a business and workflow standpoint, the amount of rework this mitigates, makes this is game changing for most any company. Typically, historically as soon as you get done designing it, you have to figure out how to get the information to Estimating, into their software (without losing or altering data in the process), which equals rework, and then get any changes made there, back in to the drawing software (more rework), and then get all that out to be burned, spooled or otherwise fabricated, hoping that what's on the drawing is what's actually fabricated, and that ultimately it fits when installed on the jobsite. Change all that. Now you can translate the data back and forth seamlessly between the three solutions simply because the content format (IAM file) is common and therefor natively readable between the three programs. If you're interested, it's worthwhile viewing what other adopters of this software like Hill Mechanical Group, Southland Industries, Kemnor Sure Group and McCusker-Gill had to say after switching to this software and workflow. You can view their stories online to see what they felt benefitted them, and hear firsthand why they're not looking back.

There is a third way this software portfolio is distinct and uniquely powerful, and will positively impact your bottom line, and that is each piece of content has a unique ID code that you can associate material cost, shop fabrication labor rates and field labor rates to. And those numbers can be assigned from catalogs like Harrison, Ferguson, SMACNA, PHCC, etc. directly to that piece of content, so that as soon as a single element (valve, pipe, duct fitting, you name it) is placed, or a whole service of elements is laid out, the associated costing becomes immediately extant at that point.

So in this class we are going to demonstrate workflows in this product environment for all three disciplines, using both 3D (Revit) and 2D (pdf, dwg, jpg, etc.) to convert from. It's appropriate to point out here that there are two basic workflows for plan & spec. – one is 2D to 3D, and the other is 3D to 3D. In other words, you can start the detailing or estimating process using 2D design intent documentation like CAD files and pdfs, or 3D design models like AutoCAD MEP or Revit, but when you convert either, the point is you "land" at the same place – namely with a 3D, fabrication level detail file. I.e. if I handed you one file converted from a Revit model, and the other file (of the same design) converted from a pdf plan, it would be impossible to tell which came from where since both were mapped from the same library.

In the case of the design-build workflow, there's not as much to demonstrate there because as a design-build company, I can start designing at a fabrication level detail directly in CADmep so there's no converting needed. That said there are some related topics for discussion that we will be covering under NDA.

Note that the datasets we'll be using are included with the class materials for your use. If you download a 30 day free trial of any the fabrication software from the Autodesk Fabrication free trial page, when you launch the software and open the files, be sure to select imperial for any data translated from *Romulus Mech with Arch Linked 2014 (imperial).rvt*, and metric for *ADSK MEP Building Layout (metric).dwg*.

Demonstrated Workflows

2D to 3D Conversion/Mapping Workflows

Demonstrate 2D to 3D workflow – converting to fabrication level detail elements by drawing over duct design on a pdf using ESTmep. We're starting in ESTmep because many plan & spec shops need to develop a bid initially. So in ESTmep we can snap to key points on a vector pdf, sizing duct/pipe using Design Line. This develops a tender, base bid in ESTmep as you go. Transfer to CADmep via OPENJOB command, make some design changes required by an engineer or to accommodate any changes that have occurred since the initial bid. Then we'll send to CAMduct for production. Note that at this point you could also send back to ESTmep, using CAM / CREATECAM, for Estimating to re-evaluate costing. This evinces the value of having a common database behind the three platforms.

3D-3D Revit to CADmep conversion

Demonstrate 3D to 3D workflow – converting to fabrication level detail elements by directly exporting a RIF file from Revit MEP and using the PROCESSRUN command to import the same file into CADmep.

Review the import and mapping process, discussing Fitting Ignores, show flat pattern development, and then send to CAMduct for burning.

How to deal with crappy Revit models – export plan views from Revit, to 2D AutoCAD files and treat as underlays in CADmep/ESTmep. I.e. just go back to 2D to 2D workflow.

How to deal with owners who want a BIM model with fabrication level detail modeling. Save the Revit MEP file as a new file. Delete all the Revit elements that you would normally select foe RME to FAB export as Design Line elements, namely the transport elements (duct, pipe, conduit cable tray). Deleting that geometry does not destroy the system connectivity between supply and demand elements (or equipment) connected by those Design Line elements – they are still connected systems from an informational standpoint – that is the "I" in BIM is still intact.

With that geometry removed, go to CADmep and select all the same Design Line elements there and copy them to clipboard, and paste those back into the Revit file. You then have fabrication level detail objects in the Revit file while still maintaining the intelligence of a BIM model.

CAMDuct for Sheet Metal Nesting and Burning

CAMDuct is the software solution that writes to the plasma cutter, water jet, laser cutter, coil line or even insulation cutter. We'll walk through exporting the data from CADmep or ESTmep using the CAM or CREATECAM command to create the MAJ or ESJ file (utilizing the common database), importing it into CAMDuct to create a run of items (or a ticket) that are then nested in CAMDuct to maximize material usage and minimize waste, and finally are sent out to be cut as flat pattern developed panels from sheet metal stock.

CADmep to Convert from Revit to Spool Drawings

Continuing from the same file we converted over from Revit, we can take piping elements and continue the complete workflow process by converting them to spool drawings. We'll walk through the spool and batch spool commands and show CADmep takes care of the numbering and BOM automatically. You can also add dimensions there and choose if you want separate dwg outputs for each spool or if you want a single drawing with multiple tabs.

Modeling pipe in CADmep

Finally, we will show how CADmep makes it easy to layout piping using both the Designline functionality, as well as the Attacher for those tight spots.

Bonus Material… Piping & Round Column Fishmouth Templates (a.k.a. Nozzle Weld, Nipple Weld…) using Autodesk Inventor

Rapid Pattern Development in AIP & ACAD – A Reusable File

So I had a pipe fabricator ask me if one of our products – CADmep can unwrap pipe geometry to reveal pipe fishmouth (pipe end or lateral) openings (used for direct connection welded joints). While I am told it can, I was not aware of any designed method, so I thought about how I could accomplish that in Inventor, and do it in a repeatable way – that is so a user can use the same file over & over for infinite pipe size and joint angle & offset conditions. After two or three tries, I came up with a solution that works like a charm, even though Inventor wasn't intended for that use. I also learned from my structural compatriots that this same solution is useful not just for piping but also applies nicely to the end cuts on the round structural column braces commonly used for things like oil drilling platforms, water towers, etc. See fig 1.

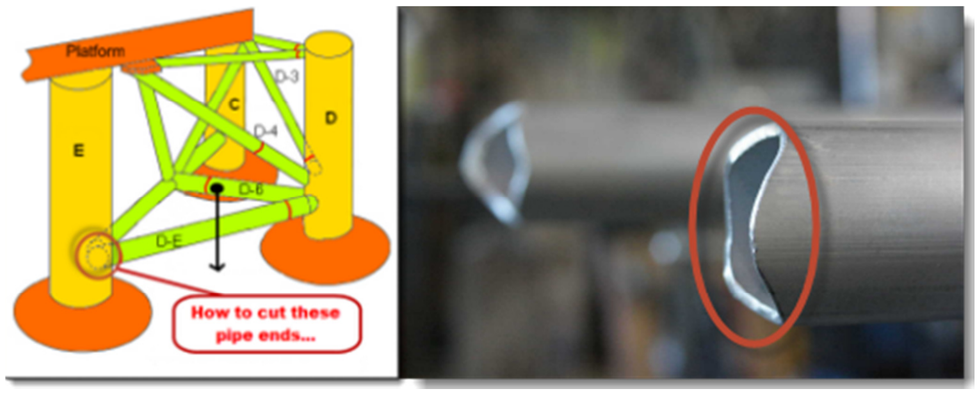
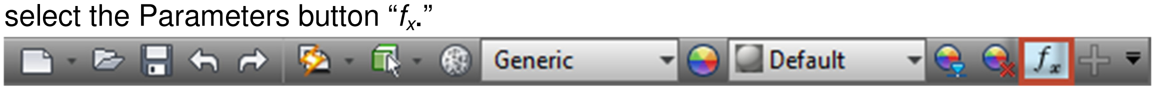


fig. 1

Open the *Pipe Fishmouth & Cope.iam* file in AIP. Note at the top of the Model Browser are the assembly relationships. The two we're going to control are the Pipe Centerline constraint and the Angle constraint. Further down the design tree are four other planes – Lateral & Main Pipes with TOP & BOP for each. Here's how they work.

- To control the angle between the two pipes, double click the Angle constraint, edit the dimension and the pipe angle will adjust accordingly.
- To control the offset between centerlines, double click the Pipe Centerline constraint and the value you enter will offset the centers by as much.
- Alternatively, if you want to align the tops or bottoms of the pipes, right click on the Centerlines Constraint and select Suppress. Now you can use the Constrain command on the Assembly tab to apply a flush constraint between the two TOP planes or the two BOP planes.
- To control the pipe sizes you need to adjust the Pipe Solids and not the Unfolds as both Unfold pipes are driven by its associated Solid pipes. So right click on Main_Pipe_Solid:1 or Lateral_Pipe_Solid:1 and select Edit. On the Quick Access toolbar select the Parameters button "f_x."



- Look for Main_Pipe_Solid_OD or Lateral_Pipe_Solid_OD and change the value to what you need. Note that the lateral pipe diameter can be equal or smaller than the main's, but not greater than the main's/ It will not cause the model to fail – it just won't make sense.

What makes this assembly work, and what Inventor was not intended for, is both pipe pieces are actually folded sheet metal parts that I used to represent pipes, adding a negligibly narrow rip to allow for unfolding.

The following steps are recorded on YouTube video I made: Create Piping Fishmouth Templates with Autodesk Inventor & AutoCAD. Before you start, if you want to turn off the workplanes, go to the View tab –> Visibility panel –> Object Visibility –> and uncheck User Workplanes, or just key in " alt+] "

Once you have the pipes adjusted to match your real world situation, it's time to cut the fishmouth opening either on the lateral end or on the side of the main. Let's start with cutting an opening into the side of the main (Main_Pipe_Unfold:1). To do this:

1) Select Main_Pipe_Unfold:1 (the part to be cut), right click and Edit.
2) Go to the 3D Model tab and on the Modify panel, select Copy Object command and pick the Lateral_Pipe_Solid:1 *actual geometry* (not the listing in the Model Browser). (If you have a hard time selecting the Lateral_Pipe_Solid:1 geometry, turn off the visibility for the Lateral_Pipe_Unfold:1 by right clicking on it in the Model Browser and unchecking Visibility.)
3) Once selected, in the Copy Object dialog box, check the settings to make sure Body is selected, Create New Composite is selected, and Associative is checked. Select OK. See fig. 2.
4) While still in the 3D Model tab, go over to the Surface panel and select the Sculpt tool and pick the Lateral_Pipe_Solid:1 *actual geometry* again (you're selecting the cutting object). The settings need to be Remove, and Out Side direction. Hit OK and select the Return command or Ctrl+Enter (to return to the assembly).
5) Now if you right click Main_Pipe_Unfold:1 and select Open, you'll see the fishmouth opening in the side.
6) Simply select the Go To Flat Pattern tool, right click on the unfolded part and select Export Face As and you can export the face as a dwg file that you can print/plot, wrap the plot paper around the actual pipe, trace over and you have the exact opening you need to cut out of the main pipe. Note that you can tell the grey side is the outside of the pipe as I assigned "Rusted" material to the inside of the pipe.

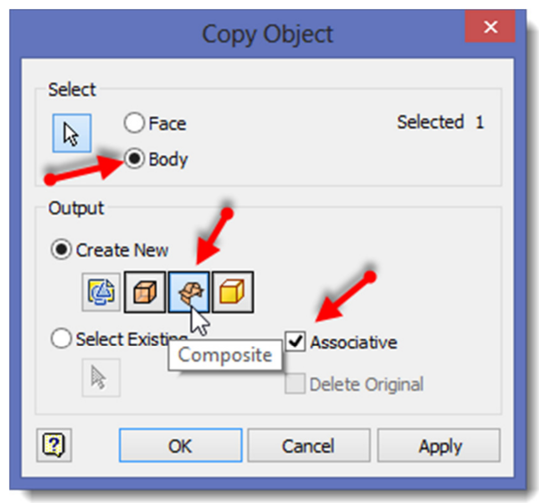


fig. 2

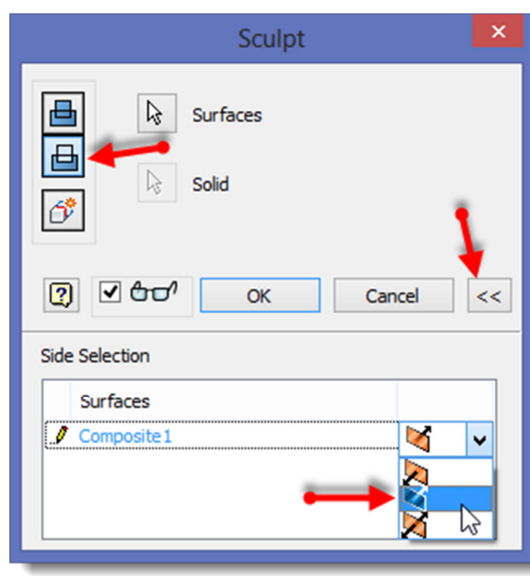
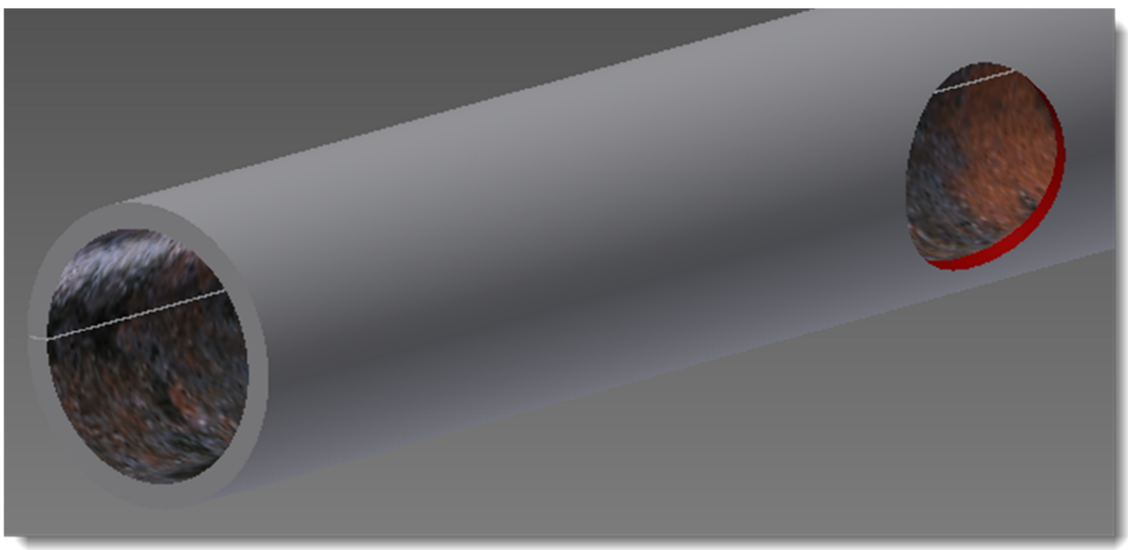


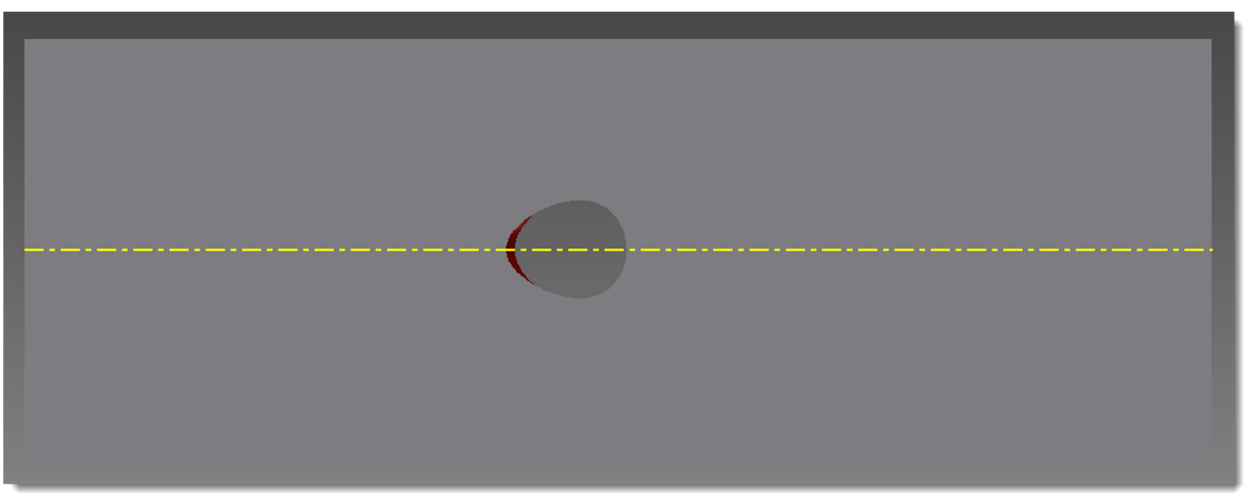
fig. 3

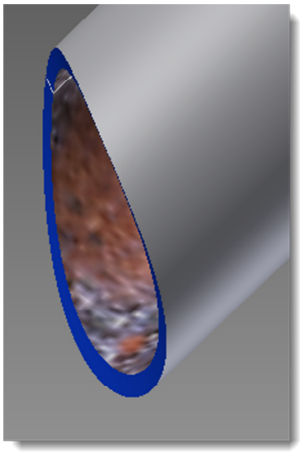
A file management consideration here would be to either save the file as a new name if you need to archive your cut, or save without closing and effectively restore the file to its original, uncut state. Remember that you have the dwg you can plot over and over again. Alternatively, if all you will ever use the file for is lateral openings, then save it as it is now. This last option allows you to leave the hole geometry you created for future lateral openings – just change the pipe diameters, angle and offset relationships as needed and the hole just updates.

7) If you want to cut the fishmouth on the end of the lateral (as structural fabricators would need for round column bracing), simply repeat steps 1-6 and just switch the objects you select. So for step 1. edit the Lateral_Pipe_Unfold:1; steps 2-3. copy the Main_Pipe_Solid:1; step 4. sculpt the Main_Pipe_Solid:1; and Return to the assembly file. Then just open the Lateral_Pipe_Unfold:1 and unfold it.

The following are example results you should get if done correctly. See AU 2013 class FB2938 *Design to Fabrication* for dataset.








- Q&A time -