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The Official Publication of Autodesk User Group International

July 2012

## Methods of Management

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- Beginning GIS: Asking the Right Questions
- iProperty, Used Properly
- When Systems Collide

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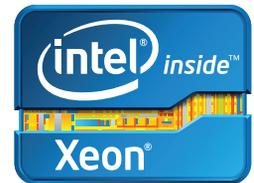


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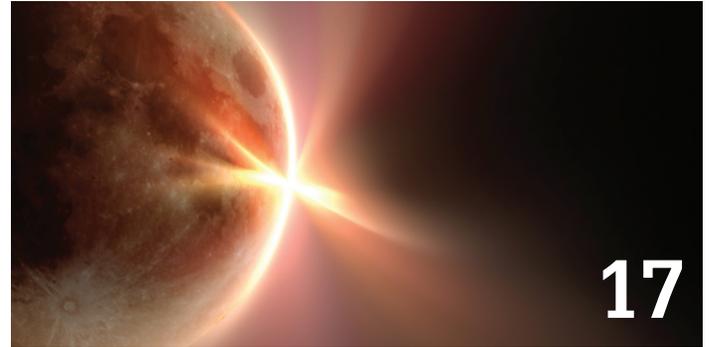
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Cover image courtesy of Castro Mello Architects. The project is of the new Estádio Nacional de Brasília, Brasília, Brazil. Read more about it: <http://goo.gl/3bXkC>

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# Editor's Note



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Dear Reader,



Welcome to the July 2012 issue of AUGIWorld! This month we are focusing on management, and how to apply that in your work. According to www.Wikipedia.Org, management is encapsulated in a brief paragraph:

Management is the act of getting people together to accomplish desired goals and objectives using available resources efficiently and effectively. Management comprises planning, organizing, staffing, leading or directing, and controlling an organization (a group of one or more people or entities) or effort for the purpose of accomplishing a goal. Resourcing encompasses the deployment and manipulation of human resources, financial resources, technological resources and natural resources.

Since organizations can be viewed as systems, management can also be defined as human action, including design, to facilitate the production of useful outcomes from a system. This view opens the opportunity to 'manage' oneself, a pre-requisite to attempting to manage others.

Wow. This isn't so simple now, is it? Management is a blend of just about everything we can possibly do. Fortunately, in dealing with software the parameters are much fewer and contained in a finite application. For example, AutoCAD® is a finite program—there are only so many hundred commands you can learn. These commands offer the opportunities to manage—be it layers, materials, and even objects.

Of course, you can manage beyond software as well, and we have an article or two on that approach. The key take away from all this is being keen on the topic whenever you can. Actively look for opportunities to manage, and do it. Even at the basic level it can improve your work process and increase your productivity. If nothing else, you can gain time by managing your daily life and have more time to visit AUGI.com!

On the cover we present an image many will recognize—it is used on the AutoCAD 2013 product packaging. The image is courtesy of Castro Mello Architects. The project is of the new Estádio Nacional de Brasília, Brasília, Brazil, a new soccer stadium for the World Cup. Read more about it: <http://goo.gl/3bXkC>

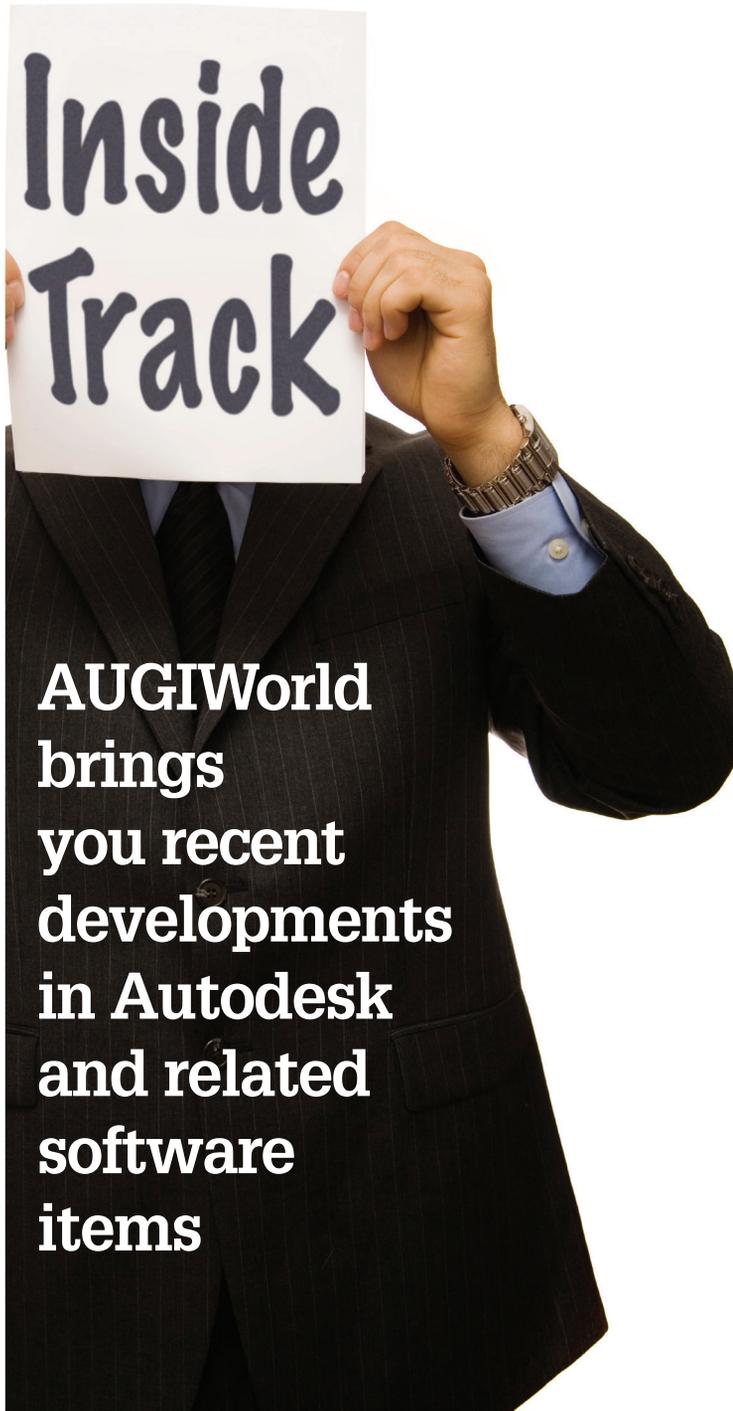
Until next time, happy reading!

*David Harrington*

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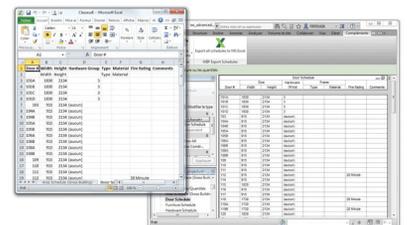
*Autodesk® BIM 360, the next generation of Building Information Modeling (BIM), is for anyone, anywhere, at any time. Building, infrastructure, design, construction professionals can access intelligent, model-based workflows through a broad range of cloud-based services within the Autodesk® 360 cloud-based platform that provide mobility, accessibility, and infinite computing power.*



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Until next issue!

If you'd have some news to share with us for future issues please let us know. Likewise if you are a user of a featured product or news item and would like to write a review, we want to know.

# Beginning GIS Asking the Right Questions



A few years ago, a local community approached my company requesting that we create a GIS system. We had the software and some of the know how, but with little experience, starting such a system

from scratch was quite a challenge. In the end, we not only created a system that worked, but we also learned invaluable lessons along the way. It starts by asking the right questions.

## 1. WHAT KIND OF SYSTEM DOES THE CLIENT NEED?

Does the client want an in-house system where the data will not be shared with outside sources? Is it to be on their website or downloaded as zip files or on an ftp site? What software will be used?

These are crucial questions, because knowing how to format the data at the end will save a lot of time.

Because I didn't ask the question about how they wanted the data formatted to the public, I went under the assumption they wanted it viewable online. Since they didn't have a large budget for developing a GIS website or using a hosting company, I created one on ESRI's ArcGIS online server.

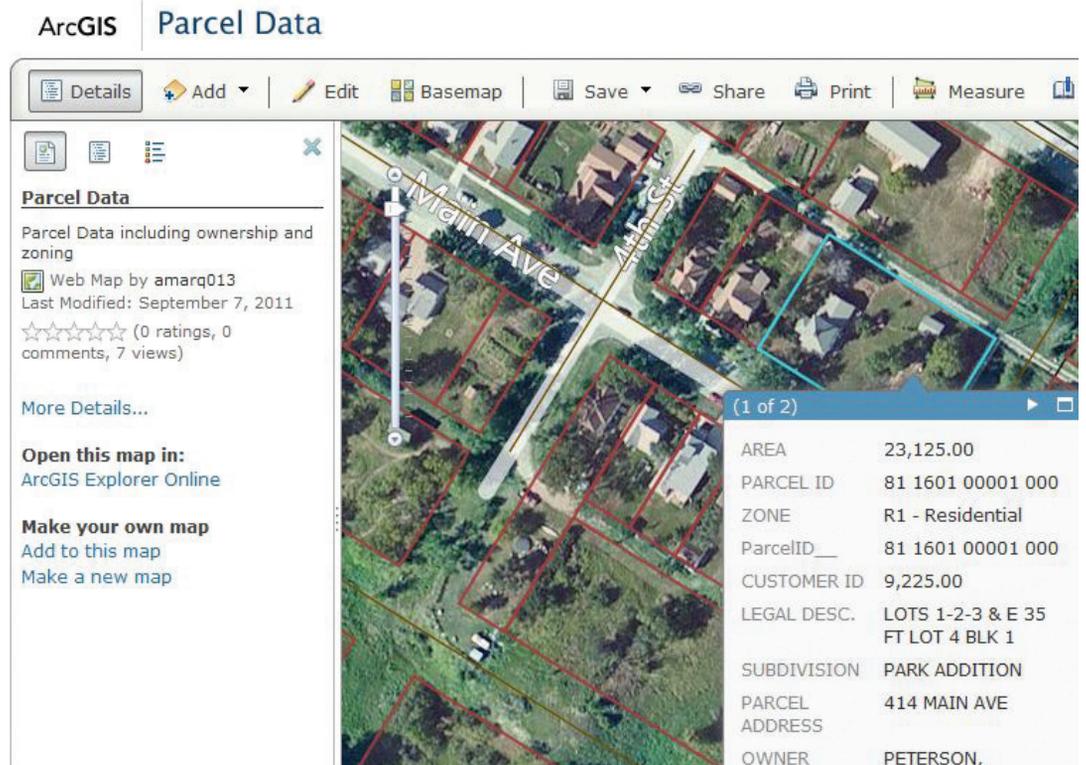
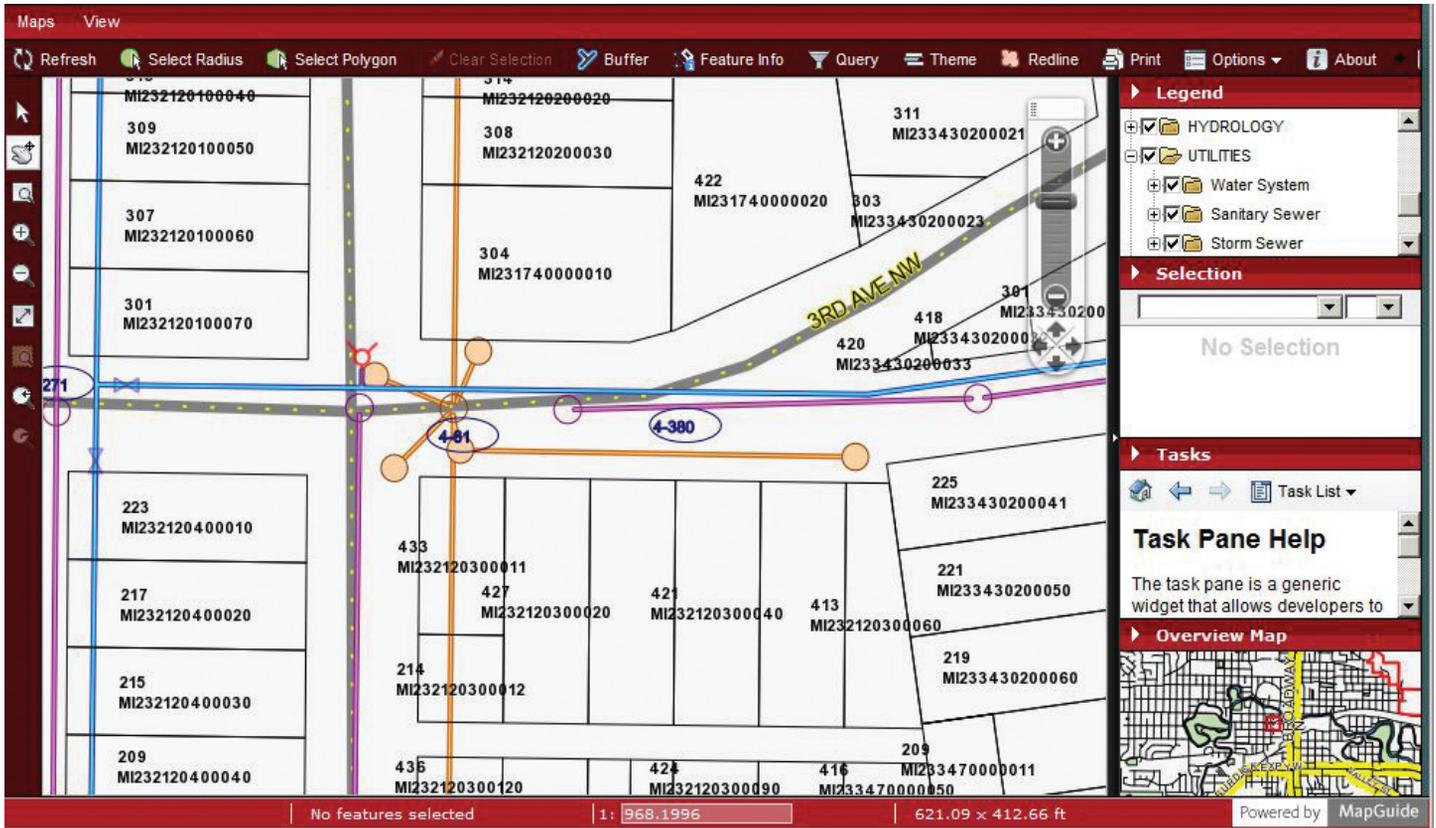


Figure 1: Online version using ArcGIS Online.



**Figure 2: Minot GIS**

After adding all the data and making it look really good, I presented it to our client and proceeded to show them how it worked. It was then they informed me they merely wanted the data available online to download as zip files.

Oh.

Easily 10 hours of my time wasted, but it was an important lesson I will not quickly forget.

This also begs the question: What if the client is uncertain how they want the data presented to the public (if at all)? This is where it helps to have examples of other systems to show.

We have several cities with excellent systems available to the public that I use almost daily. One is Minot, North Dakota. They have all infrastructure including water, sewer and storm as well as parcel data ([www.minotnd.org](http://www.minotnd.org)).

The City of Bismarck, by contrast, created a ftp site with all its data in both AutoCAD and ESRI shape files ([www.bismarck.org](http://www.bismarck.org)).

Name ^	Size	Type	Date modified
gsdata_		File folder	5/23/2012 5:26 AM
Bismarck Parcels		File folder	3/20/2012 5:37 AM
Hydrology4_12		File folder	4/13/2012 11:10 AM
LandBase4_12		File folder	4/13/2012 11:11 AM
MPO.gdb		File folder	3/26/2012 8:10 AM
Political4_12		File folder	4/13/2012 11:11 AM
Sanitary Sewer4_12		File folder	4/13/2012 11:11 AM
Storm Sewer4_12		File folder	4/13/2012 11:09 AM
Street Lights4_12		File folder	4/13/2012 11:09 AM
Traffic Signal Lights4_12		File folder	4/13/2012 11:09 AM
Transportation4_12		File folder	4/13/2012 11:09 AM
Water4_12		File folder	5/24/2012 7:23 AM
2011FloodMapBook_Disclaimer.pdf	34,992 KB	Adobe Acrobat Document	5/23/2011 7:00 PM
BismarckGIS.zip	28,773 KB	WinZip File	5/29/2012 9:36 AM
BurleighParcels.dbf	10,539 KB	DBF File	3/12/2012 5:37 AM
BurleighParcels.prj	1 KB	PRJ File	3/12/2012 5:37 AM
BurleighParcels.sbn	115 KB	SBN File	3/12/2012 5:37 AM
BurleighParcels.sbx	6 KB	SBX File	3/12/2012 5:37 AM
BurleighParcels.shp	6,189 KB	AutoCAD Shape Source	3/12/2012 5:37 AM
BurleighParcels.shp.xml	1 KB	Safari Document	3/12/2012 5:37 AM
BurleighParcels.shx	94 KB	AutoCAD Compiled Shape	3/12/2012 5:37 AM
Contours_2009_2ft.DWG.xml	1 KB	Safari Document	1/30/2011 6:00 PM

**Figure 3: City of Bismarck ftp site.**

By presenting such examples, the client can better understand what can be done and which way will work the best for them.

# AutoCAD Civil 3D 2013

## 2. WHAT'S INCLUDED IN THE DATA?

What data is the client looking for? Is it parcel data including areas, addresses, ownership with links to the Tax Assessor? Infrastructure including water, sewer, and storm sewer? How detailed do they want the data?

For instance, does the client want size, material, and installation date of all the water and sewer? Do they want the depths and sizes of all the sanitary and sewer manholes? Would they like to know the type of pavement of each street and the year streets were installed or improved?

Even if the client doesn't specify, asking the question is important, especially before compiling the data begins.

Do they also want links to not only other websites, but also pdf files of filed plats? Our client requested this, and it worked out great.

Which brings up the third most important question...

## 3. WHERE TO GET ALL THE DATA?

This is likely one of the most time-consuming parts of putting together all the data, aside from drawing in the features and adding all the data.

How much of it will need to be field surveyed? How much can be added from as-built drawings, or other resources such as the County Recorder, Tax Assessor, or City/County Engineer?

For the system we put together, the client was able to provide ownership data in an Excel file. For the rest, we had to send our surveyors out to tie in.

Another reason why knowing what information the client wants before any data is sought is so the surveyors know exactly what to tie in. If they tie in only the manholes without knowing they need to get the depths, they will have to be sent out twice. That can add a lot of cost that could have been avoided.

The same goes for any other research. If we are unaware the client wants the owners' home address along with the property address, it adds that much more time adding another column to the data table.

## COMMUNICATION ABOVE ALL

It's important to keep the client informed as to your progress, so give presentations fairly often on how the system is coming along.

That way they can see how the system works and make any suggestions additions and/or adjustments.

I guarantee there will be changes. As we progressed with the system for our client, at each presentation they came up with more data they wanted to add. If you know going in that this will happen, it will lessen your frustration.

Be sure the client knows you must be in constant communication with them, and that you are readily available if they have a question, concern, or addition. A GIS system is a huge undertaking, and keeping in constant contact will make the project go smoother from beginning to end.

## CONCLUSION

In the end, it's not just about the data, but about making sure the client is happy with the results. Knowing what questions to ask from the start will not only make your job easier, but will save the client—and your company—time and money. The client will also appreciate open lines of communication and your attention to detail. Doing so will increase their confidence that the end product will be what they want, need, and expect.

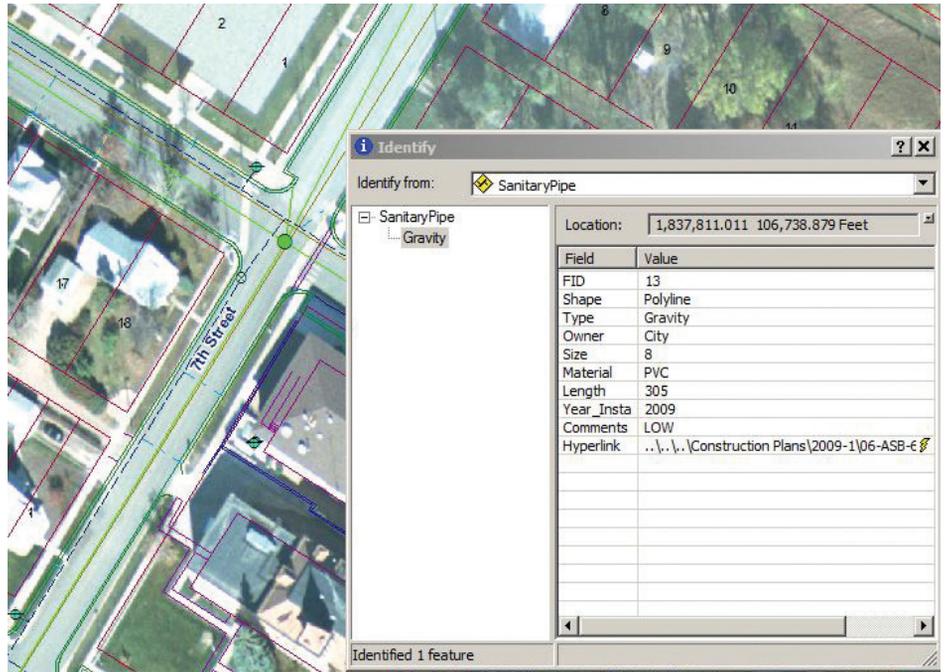


Figure 4: The End Result



*Andra Marquardt is a Professional Land Surveyor in the State of North Dakota, and has worked for Toman Engineering Company since 1997. She has used AutoCAD beginning with Version 9, and is works on projects using AutoCAD Civil 3D and MAP.*

# Employing the Right Hiring Practices



**C**ommon to every engineering, architecture, and design office across the world there is one sore spot. It isn't office locations, capital investments, or software migration strategies, though those can all be headaches. For the purposes of this article, we are talking about finding and bringing on new CAD drafting talent.

All of us crave success, both for our own careers and, by extension, for those who employ us. Bigger projects and longer backlogs of work equate to more stable employment, pay raises, advancement, and general "hoorahs" for everyone involved. However, there comes a time when we become the victims of our own success, when we determine that the current manpower is inadequate and we need to hire more people. And that is when a journey begins that can either well planned and executed or painful and prolonged.

Let's hope for the former rather than the latter.

## HIRING: HOW IT SHOULD BE

In a perfect world we would all be prepared for an opening that had to be filled. We would have two weeks, or more, advance notice from an outgoing employee or the foresight to see that more help was needed. In either case we would have ample time to put our ducks in a row and be ready to bring on someone new at just the right time.

The integration of this new soul into the office dynamic would be seamless. From the interview and testing process, we would know that the applicant's skills were exactly what we needed and that he or she would be a good fit with the existing CAD department. We would have already identified some areas of additional training that were required and a fully prepared workstation and desk would be ready for the new hire on day one.

That first day would also go well because our CAD manager, due to proper project planning, would be able to set aside a half or full day to introduce the new employee around, give them the "fifty cent" office tour, and get the person accustomed to the company CAD standards and network. No need to worry about HR paperwork—that was all taken care of before the first day of work!

Then it is off to the races. The new drafter is given enough work to get accustomed to the current project and to flex, but not overwhelm, his or her skills. Production moves on smoothly and no one can ever tell that one person has left and a new one has come in. It all works that well!

## HIRING: HOW IT REALLY IS

The scenario above shows how it would be in a perfect world. But we don't live in a perfect world; we live in the real world. And the real world can be unpredictable, unaccommodating, and even a little bit cruel.

In the real world people leave with little to no warning. If there is one legacy that the roaring 1980s decade has left us, it is that too many companies have little to no regard for their employees. This is more commonly known as "loyalty." Or at least it was when there *was* company loyalty. But now a great many, possibly a majority, of employees feel an utter lack of company loyalty. Some fear that they could be fired at any point, on any day. So they, in turn, have lost company loyalty as well.

If the 1980s showed us that companies can lack loyalty, then the late 1990s and early 2000s showed us that employees have little to no regard for the companies that employ them. Too often people leave a company with little care or thought for the reputation they leave behind. Consequently, the days of a guaranteed two-week notice are long gone. Sometimes people leave for the weekend and never come back. Now you have to hire someone. And fast!

# Management

Perhaps finding someone to fill a CAD opening wouldn't be so bad if you didn't have projects with deadlines. More likely, you have jobs that are behind schedule. But never fear, Human Resources is here. That's right; many companies have seen this problem and have people to help you. People who know nothing about CAD and probably less about your CAD department are going to review, sort, and vet your applicants. When did that become some sort of logic by which to operate a company? It's like asking your auto mechanic to pick your new doctor.

Still, you have to work with what you have. And that means that you are probably going to hire the first warm body that comes through the door and is even remotely suitable. Because time is short you'll need the person to begin as soon as possible which, incidentally, probably encourages him to leave his current position without giving notice. Then the new hire arrives for the first day of work with your company. Well, sort of.

The first half of that first day is spent filling out tax forms, non-disclosure agreements, W-4s, and other HR paperwork. Sounds like fun on a bun, doesn't it? After lunch you finally get to rip your new CAD drafter away from their human resources BFFs and sit the person in front of a CAD workstation. Too bad it's the old workstation that was previously in use so it has all of the old settings, customizations, and issues the last user had created. Isn't that a great place to begin? But we must soldier on and get to some training.

Or not. Since this new person is a CAD professional who was hired to meet the needs of the opening that was just vacated he must be ready for production. Assign a project and let's get to work! Never mind that the outgoing person probably had years of experience with this company's clients, projects, and standards. Management thinks "CAD is CAD," so what's the holdup?

It's a sad tale that plays out every single day in offices around the world. In fact, it's a tale that you have probably seen play out in your own office over and over. This is not how it should be, but it is how it is.

That whole story should leave you remembering how much fun it is not to have to hire new people. It probably even reminds you how little fun it is to be the one hired and rushed through the gears from the front door to production. So, how should this process work?

If we all had our druthers and some input, what would the hire process look like?

## HIRING: LET'S GET FANTASTIC

There is an old saying that opportunity will not come knocking at your door. Much along the same lines, good applicants will usually not beat a path to your office in search of work. It may happen from time to time, but not usually. No, in order to attract applicants you must advertise an opening. And in order to attract good applicants you have to advertise in the right spot.

Perhaps a classified ad in the newspaper may still be worthwhile, but it's a big maybe. Instead take time to advertise online and go where the CAD professionals are. Good talent congregates in pools, so find resources in those pools. Advertising openings on sites such as the AUGI Career Center, Design Engine, and forums are all excellent starts and are almost always free. Beyond that there is LinkedIn, Monster, Dice, and other professional-oriented sites to advertise openings (some for a fee). But don't stop there. Contact local user groups, resellers, and even industry blogs. One quick email to these often overlooked resources can yield dozens of great leads.

Attracting a generous number of applicants is essential to avoiding the need to hire "anyone with a pulse." In order to accomplish this, you must give your prospects time to respond. Hiring is not a "look until you stop" action, it is a set period of time in which you collect applications. Only after a predetermined and reasonable amount of time do you begin to weed through the stack of applicants.

It is a rare, but much desired, situation to have too many great applicants. If you play your cards right, that may be just what you end up with. Wouldn't it be much better to have to choose between several well-qualified candidates than to "settle" for one unqualified person?

After the chaff is separated from the wheat, it's time for the first interview. But before you sit down to make those calls, send emails to the applicants who did not make the cut. No one likes to be left wondering if they are in the running, so show them this courtesy. Then, off to the interviews!

Most often, first interviews are conducted over the phone. While this is entirely suitable, it is also sort of archaic. An interview by telegraph or messenger pigeon would also suffice, but this is the 21st century! Put down the phone and let the pigeon roost on it while you conduct your first interviews online. With services such as Skype, Google+, and dozens more, video conferences between two people are fast, free, and far more informative than a phone call.

The CAD profession is a technical one, so it is not unreasonable to expect your next hire to understand such common technologies as video chat. In addition to being the first "test" of technical know-how, video interviews let you see one another. Facial expressions and body language are so very important in determining whether this person is worth a second, in-person interview. You'll find that the difference between video and voice is even greater than the difference between an email and a phone call.

The second interview should be less about the interview and more about a CAD test. You do have a standard CAD test that you administer to applicants, don't you? Of course you do! That test, of course, represents a cross section of the type of work your office produces. For example, if you work for a civil firm using Civil 3D, that test would cover some common workflow topics.

Surfaces, alignments, cross sections, labeling, and volumes are the sorts of topics one would expect to see with a brief (very brief) exercise to determine whether or not your applicant understands and can perform these tasks. Of course, if your applicant comes to you with a current Autodesk Certification, then you can feel sure that person understands general workings and the basic concepts of the software in question with little additional vetting.

By this point you, as the CAD manager, should feel that this person is a viable candidate for your office. So, while you are reviewing the results of the “CAD test” why not have your staff sit down and meet with the potential new hire? Sure, you could call it a group interview, but really it is just a chance for your current staff to meet and chat with this person for a moment. This is an essential step in determining if the new addition will be a good fit with your current staff.

You can find the world’s most talented and capable CAD professional and feel great about it, but if no one in your office will work with that person then you are even worse off than you were with an empty desk! So be certain to take group dynamics into consideration when making those final determinations.

Let candidates know the date by which they can expect to hear from you and send them on their way. You should never buy the first car you test drive and you should never hire someone before you have interviewed all of your choices. After you say goodbye to a candidate, sit down and have a quick cup of coffee with your staff. A five-minute discussion will go a long way towards determining who is the right fit and also will keep your staff involved and feeling that their opinions matter.

After the hiring is done and the insurance paperwork is all filled out there is the training/normalizing period. Don’t expect your new CAD person to automatically know how things work at your company just because you gave him a cap with the company logo on it. Give the new hire a copy of the CAD standards and put the person in front of a freshly prepared workstation with a default installation of the software your firm uses. Let the person customize it, get things in order, and then slowly start blending them into production.

While they are getting settled, take a moment and send thank you emails to the few people you selected for second interviews. Explain that you have made your choice and appreciate their time. Why? Because it is the polite thing to do, and in this business a little kindness can go a long way.

## WHAT WE DIDN'T DO

Oh, if only the world were perfect. Wouldn’t it be wonderful to be able to conduct every hiring exercise just like this? But we have to do the best we can. Sometimes the steps listed above get combined. Sometimes they get moved around. But there was one decisive difference between the “reality” and the “dream” that is vital: the new CAD person was hired by a CAD person!

Somewhere along the line it became acceptable to have people in a department who hired people. That was their job and they did a good job of hiring people—a “good” job in the sense that they were “good” at the job of hiring people. That is very different than hiring good people.

It really is not fair to expect someone in HR to hire the perfect CAD professional for a CAD department when the person has no idea what CAD is. Without experience with the software, experience with the production environment, and (most of all) experience with the current CAD staff, how can they possibly be expected to hire THE best candidate? The best they can hope for is to find the first person who checks off the acceptable number of boxes on a list. That is a sad substitution for the finding THE right person with THE right experience who will fit in well with THE current staff.

All of those qualities are essential. For this reason it seems that CAD departments that work the best have at least some input into who is hired and who is not. The absolutely best departments with the best production histories have CAD professionals who are vetted and hired by CAD professionals.

It really is just that simple.

## IN CONCLUSION

The world and the workplace are not simple places where answers are easily found. Sometimes we have to make the best of the worst situations. Sometimes we are fortunate and have only to work to improve what is already a fairly workable situation. Either way the onus is on the CAD professional to strive to make those improvements a reality and make these answers more easily available.

The hiring process of CAD professionals affects all CAD professionals. So it is reasonable that it is we who understand the shortcomings of that process. It should also be reasonable, and apparent, that it is we who must take steps to improve this process. With the hiring process left completely to others, we cannot expect, and perhaps do not deserve, any change to better our situation.



Based in Houston, Texas, Curt Moreno is the CAD manager and is the owner and editor of the Kung Fu Drafter blog. He began using AutoCAD with Release 10 and has spent the past 20+ years working with various Autodesk products including AutoCAD, Civil 3D, Map 3D, and SketchBook Designer. Curt is also a freelance content creator, highly rated Autodesk University speaker, and training content developer. In his spare time he writes, games, and spends time with his dog and horses.

# iProperty, Used Properly

Every Autodesk Inventor® file has a set of properties called iProperties. We use iProperties to track and manage files, create reports, and update bills of material, parts lists, title blocks, and other information automatically. Some iProperties are automatically set, such as Part Number and Author.

During a transition from AutoCAD® to Inventor some users get lost in the proper utilization of iProperties in their design tracking. Common problems that arise tend to be incorrect information in parts lists and seemingly repetitive input of the same value in different areas of tracking. If not managed correctly, this can snowball into very poor reporting of critical information to the design process.

In this article we will take a look at the diagnosis, treatment, and preventive maintenance an organization can perform to ensure they are using iProperties effectively and making their data searches more productive.

## DIAGNOSIS

Let's say there are a few iProperties we need filled out in every drawing for our Title Blocks and Bills of Material. These can consist of standard iProperties as well as custom ones we create since Inventor may not ship with the terminology or content we require for our documentation.

If these values do not get filled out initially, we often spend time afterwards opening files and correcting them. In some cases, drafters and engineers may take the short cut and override these or simply add text on the drawing. This is a horrible practice because these overridden iProperty values persist only in the edited drawing, even though that component may be used in 50 other assemblies. We certainly do not want that attitude in our design group because items will no longer update the way we intend and expect them to. Making simple typographical errors or incorrectly cross referencing a file can lead to manufacturing mistakes and incorrect part orders.

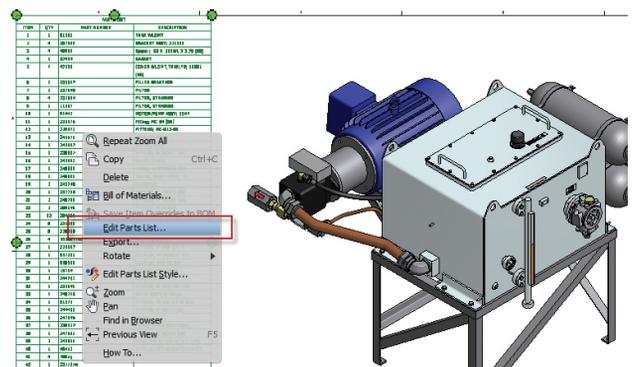
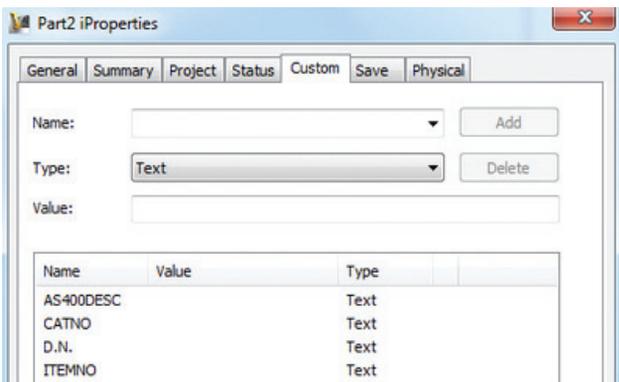


102650



102560

First let's see if your designs have problems right now. After we find out there is an issue, we can correct them for legacy designs and put in safeguards so it doesn't happen again. Open a completed assembly drawing containing one of your designs with a Parts List on it. Right-click on the parts list and choose Edit Parts List. Now look at what is going on in the Parts List Dialog.



ID	%	ITEM	QTY	PART NUMBER	DESCRIPTION
1		1	1	51361	TANK WLDMT
2		4	4	207905	BRACKET ASSY; 221399
3		4	4	46959	Spacer; .63 X .065WL X 3.75 (SS)
4		1	1	37454	GASKET
5		1	1	47290	COVER WLDHT, TANK* B; 100GL (SS)
6		1	1	235517	FILLER BREATHER
7		1	1	237648	FILTER
8		4	4	232894	FILTER, STRAINER
9		1	1	11587	FILTER, STRAINER
10		1	1	51442	MOTOR/PUMP ASSY; 50HP
11		1	1	230976	Fitting; MC-R4-(SS)

The blue text represents overridden properties. Now a little bit of blue text here is not a bad thing. If we need to specify overrides for a part in a special case, then this blue text is okay. If we require that these values be the same in every drawing where this part is referenced, then this is a VERY bad sign. To check the actual iProperty value for a cell, simply right-click on the cell and toggle the Static Value option. If it is blank, then the actual part or assembly file does not contain the information. If the cell returns a value that isn't correct, then the problem could be worse than we thought.

ID	%	ITEM	QTY	PART NUMBER	DESCRIPTION
1		1	1	51361	TANK WLDMT
2		4	4	207905	BRACKET ASSY; 221399
3		4	4	46959	Spacer; .63 X .065WL X 3.75 (SS)
4		1	1	37454	GASKET
5		1	1	47290	COVER WLDHT, TANK* B; 100GL (SS)
6		1	1	235517	FILLER BREATHER
7		1	1	237648	FILTER
8		4	4	232894	FILTER, STRAINER
9		1	1	11587	FILTER, STRAINER
10		1	1	51442	MOTOR/PUMP ASSY; 50HP
11		1	1	230976	Fitting; MC-R4-(SS)
12		1	1	229672	
13		1	1	245671	
14		1	1	245667	
15		1	1	238807	FITTING; EL-BC912-(SS)
16		1	1	243992	VALVE, CHECK
17		1	1	248809	Fitting; TE-C9C9G20-(SS)
18		1	1	248801	GAUGE, SIGHT LEVEL, 18"
19		2	2	245748	GASKET; A

Incorrect data can be more costly than adding an additional inch to an extrusion due to incorrect ordering, freight involved with shipping, and returning the items whether it be a purchased part or incorrect raw stock. We hope that our purchasing department sees these mishaps before that happens, but even if they catch it in time, there is still downtime involved with the mistake, and egg on your department's face.

With the blue override in place it also makes it harder to search for that value in any other design using either Design Assistant or Autodesk® Vault. Data that doesn't exist in the iProperties cannot be indexed and, therefore, is not searchable.

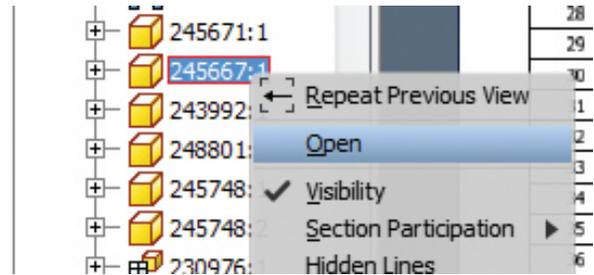
## TREATMENT

After identifying the overridden property and switching it back to the linked value by toggling off the Static Value, the best course of action is to return to the source file and correct the data in the original part or assembly.

There are actually a couple of different ways to get back to the source.

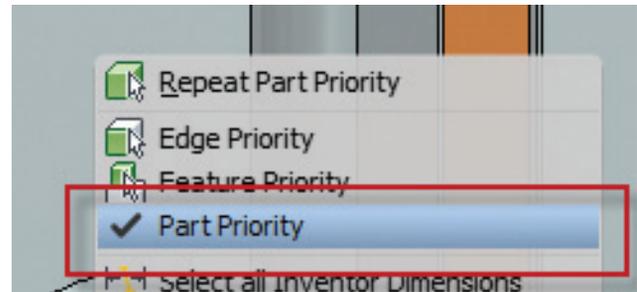
- Right-click on the modeling file in canvas.
- Right-click on the file in the browser.
- Use the Bill of Material.

The first two methods are a little tricky if you don't know your design intimately. In order to find the file in the drawing model browser, you have to know exactly where it is in the hierarchy of the design and will involve some digging through some expandable nodes.

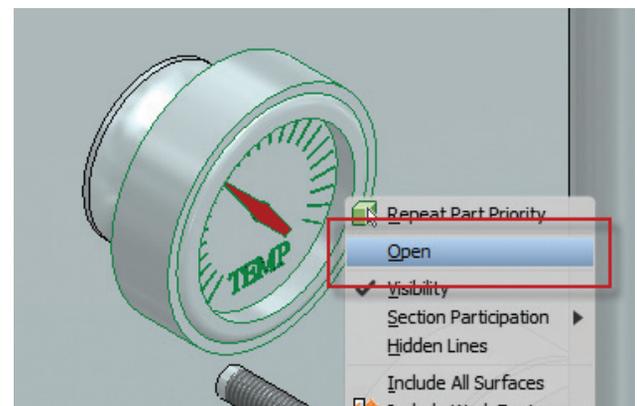


If you have knowledge of what the component looks like, then you can also open from the canvas by selecting it and picking Open.

*"But my cursor doesn't select parts in my drawing, just faces and edges."* Well, here is another free tip: hold Shift and right-click your mouse; this will cause your Selection Filter to pop up and allow you to change the priority of your drawing selection for your left click.



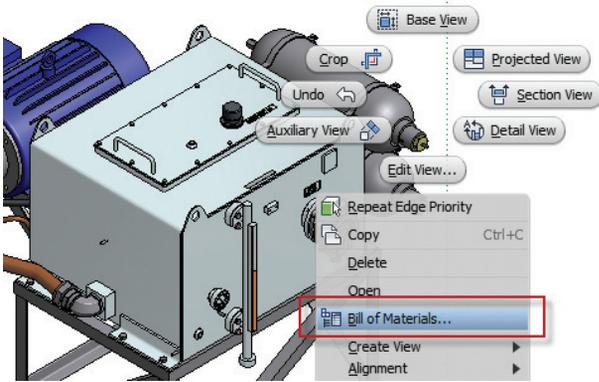
Perhaps the easiest way to fix these problems with the iProperty metadata is to force the update right from the drawing instead by using the Bill of Materials. This command is one of the most powerful for tracking data in a design and allows for quick changes across the file set without having to open every file or having to hunt down the correct file in a list or model tree. There are two ways to get to it in a drawing—right-click on the Parts List, or right-click on the Assembly or Presentation View in the drawing.



# Inventor 2013

Once inside the Bill of Materials, you can customize the columns, change the BOM structure, add new iProperties, modify material properties and, for our purpose, change any data that is linked from the modeling files.

And, just because I don't spend ALL day in my CAD package, I do forget to turn on the CAPS lock key. It is awesome that right-clicking on a cell contains the option to capitalize for me plus some other Excel-type functions such as Find, Replace, and Cell Fill.



A quick check on our Parts List will verify this is a linked value and not a static one and our last step to treat our metadata mishap is to save the drawing and approve the change to force the update and save the linked modeling file.

## PREVENTIVE MAINTENANCE

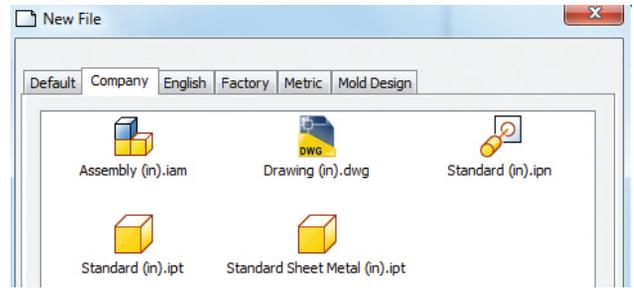
Now that we have identified our problem, treated it, and know the dangers involved with the incorrect fudging of data, how can we increase our productivity with the software and avoid missing data fields and taking the easy way out? There are actually a couple of options here: free or purchased add-ins.

So what is the best way to make sure your design team is filling out the data required for your tracking? Some methods could be as simple as education for the team or a process document that shows how the iProperties are utilized in your company and which ones are mission critical to fill out. However, even this management method doesn't remove human error. Is there an easier way to automate what gets filled out and something to watchdog our designs to ensure we are correctly getting the data we need?

Let's try some simple iLogic. There is some new stuff in 2012 that really opened up the ease of use for standardizing iProperties and creating easy user input screens.

First off, here are my source files that make this work. There is a decent starter drawing template as well as some free coding included. I just added them to my template directory so I have a new Tab in my New File screen.

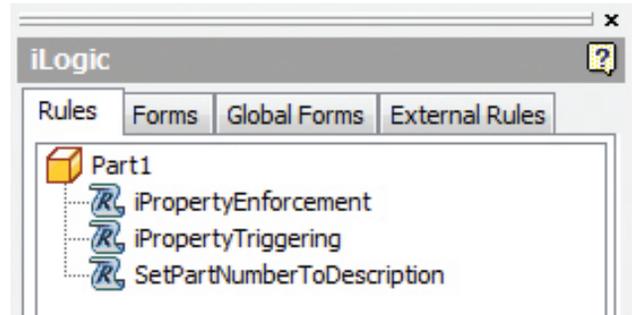
<http://blogs.rand.com/files/sample-templates.zip>



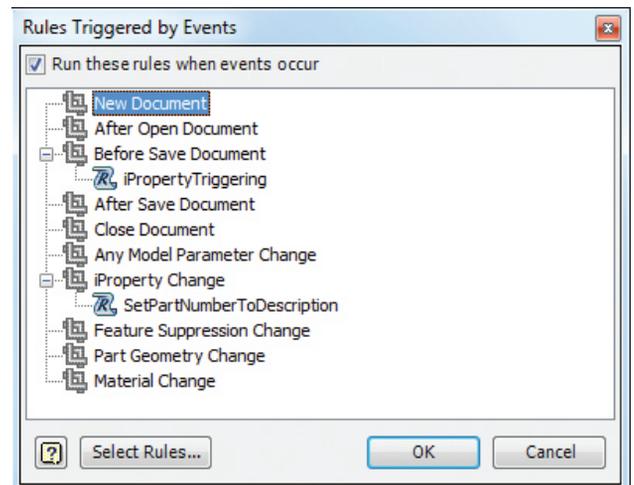
What we have in these templates is a few custom iProperties and settings that help us track our design (AS400DESC, Item Number, Category Number, and Drawing Number). In addition, there is a Rule that will take whatever we put into Description to automatically populate the Part Number, instead of the default Inventor method of making the Part Number equal to the File Name.

**Disclaimer:** This might not be your way of tracking or incorporate the same properties you use, but you can adjust based on your company's needs.

Let's start by looking at the existing rules in the Part file. Go to the Manage tab and select the Rule browser. There are only a few (but very potent) rules here.



Let's look at how these rules fire. Click the Event Triggers command to examine. Here I used *Before Save Document* because it works better with Vault during the Check in and out protocols. I also have *iProperty Change* firing another rule to make my Part Number equal to the Description so when Description is changed the Part Number follows suit.



So when does the iPropertyEnforcement fire? To find out, examine the iPropertyTriggering rule by right-clicking on it and selecting Edit Rule.

```

If iProperties.Value("Custom", "AS400DESC")="" Then
iLogicVb.RunRule("iPropertyEnforcement")
End If

If iProperties.Value("Project", "Description")="" Then
iLogicVb.RunRule("iPropertyEnforcement")
End If

If iProperties.Value("Custom", "CATNO")="" Then
iLogicVb.RunRule("iPropertyEnforcement")
End If

If iProperties.Value("Custom", "ITEMNO")="" Then
iLogicVb.RunRule("iPropertyEnforcement")
End If

If iProperties.Value("Custom", "D.N.")="" Then
iLogicVb.RunRule("iPropertyEnforcement")
End If
    
```

In this rule if any of the values are empty (signified by the empty quotation marks) then the iPropertyEnforcement rule will automatically fire upon trying to save and leave the file. So what's in the iPropertyEnforcement rule? What has five fields and keeps us tracking our data?

This guy...

### iLogicForm.Show("iProperties")

This form is created with the new iLogic Form creator that was added to Inventor 2012. To examine this sample form go to the Form tab in the iLogic Rule Browser, right-click on iProperties, and select Edit. These forms can be created and stored locally in a file or stored externally as Global Forms.

If you are using Inventor 2011, this form creation isn't impossible—it's just harder to set up and very time consuming if you don't already know how to create a VB form outside of Inventor. You could also use the InputListBox in iLogic, but you would need one for each of these fields.

To examine the iProperty tracking further we head on to the Drawing sample I have provided. In that drawing file there are a couple different rules. Here we only have one particular rule: *iPropertyCopying*. The idea here is to get the values from the original modeling file to be copied directly over to drawing environment not only for Title Block mapping, but also for indexed Vault searches. Normally, during a Vault search it would only return the modeling file, but with this copying it will return both the modeling file and the drawing file since the iProperties are synced.

The single rule here will fire upon Drawing View Changes and Before Save Document and contains logic to not fire if values are already copied correctly or if no view exists.

```

' exit rule if no part or assembly is in the drawing yet
If (ThisDrawing.ModelDocument Is Nothing) Then Return

'get the filename of the doc the drawing points to
modelName = IO.Path.GetFileName(ThisDrawing.ModelDocument.FullFileName)

iProperties.Value("Custom", "I.N.") = iProperties.Value(modelName, "Custom", "ITEMNO")
iProperties.Value("Custom", "D.N.") = iProperties.Value(modelName, "Custom", "D.N.")
iProperties.Value("Custom", "CATNO") = iProperties.Value(modelName, "Custom", "CATNO")
iProperties.Value("Project", "Description") = iProperties.Value(modelName, "Project", "Description")

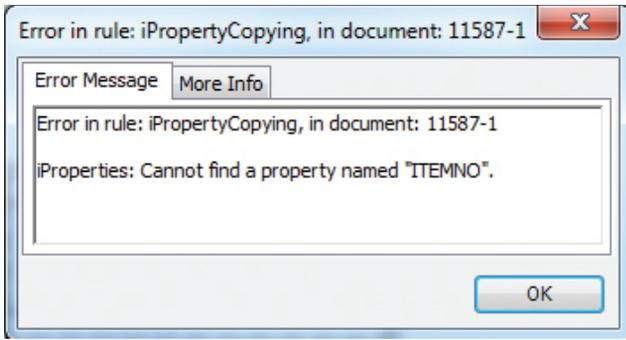
If iProperties.Value("Custom", "D.N.")="" Or iProperties.Value("Project", "Description")=""
Or iProperties.Value("Custom", "CATNO")="" Or iProperties.Value("Custom", "I.N.") = ""
Then
i = MessageBox.Show("One or more of the iProperties for Description, Item Number, Category Number, or
End If
    
```

If the file that has been placed in the drawing is missing any of the required information, a prompt will open stating that the user must return to the original file to make changes to the iProperties so they will copy over correctly for Title Blocks as well as Parts Lists.

This iLogic rule for duplication of the iProperty data to the drawings from the model also ensures that when you search in Vault for the metadata, it will return the modeling file as well as the drawing and that they always stay in sync.

If you receive an error when this rule runs, then you will see a potential downside to this usage. What if the source file didn't come from our team and therefore did not contain any of the custom tracking parameters? Or perhaps it is an older migrated file before we figured out what we wanted to track.

# Inventor 2013



Well, you have three choices. Add the values to the source file, suppress the rule so it doesn't annoy the user, or process your rules to your old files (there is some free code out there to do that). I prefer the first choice and the Design Assistant is an easy way to Copy Model iProperties from a single source file to a series or entire folder of files so they can be tracked correctly. You can also use Vault to force a parameter to exist when it doesn't already.

## OTHER IDEAS FOR FORMS

With the aforementioned example we worked through, it assumes we use data tracking from the model to populate title block and drawing properties. But what if we do all or a majority of iProperty usage through the drawing and not the modeling files? What about values that we fill into title blocks?

There are two ways of filling out title block fields, iProperty and Prompted Entries. What's the difference between these? From an AutoCAD perspective:

1. Inventor iProperties are equivalent to AutoCAD Drawing Properties (DWGPROPS)
2. Inventor Prompted Entries are equivalent to AutoCAD Block Attributes (ATTDEF)

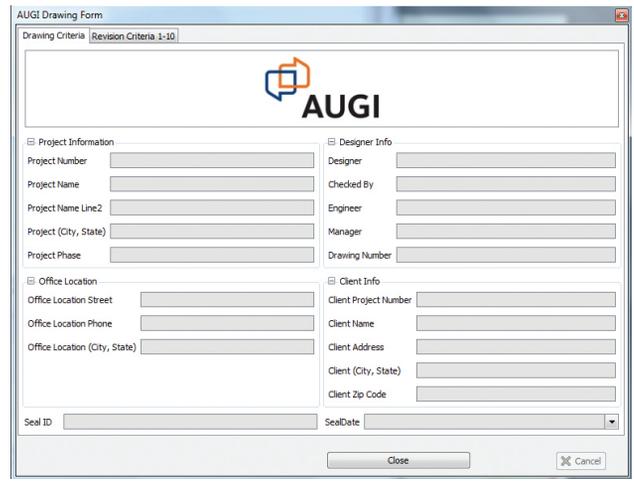
Based on this precursory knowledge that a lot of transitioning users have about AutoCAD, they almost immediately start creating Prompted Entries for the Title Block since it is a similar method to how things are done by the majority of AutoCAD users.

It seems to be a well-kept secret in AutoCAD that DWGPROPS and the use of FIELDS are the best way to populate a Title Block in AutoCAD. When companies find out about this method of Title Block population, it is usually too late as they might already have created a large number of legacy drawings using attributed blocks. This usually becomes apparent when companies start looking at data management solutions. Some of these programs have a very hard time working with attributed blocks. Autodesk Vault is perhaps the most skilled at this, but others are not that well integrated.

When data management systems index metadata of files they can inherently read the properties of a file, whether it is MS Word, Adobe, Inventor, or AutoCAD. This makes searching for any data in the data management system very easy and greatly speeds up the design process by circumventing the opening of a large amount of files to find the correct one.

In order to have this functionality you must use iProperties in your template. Prompted Entries will not be searchable. Moreover, they can control the same information across multiple layout sheets, so if the information is the same in seven layouts, then the user does not have to change the attributed Title Block seven times; rather it is changed only once in the DWGPROPS. This will work the same way in Inventor across multiple sheets in a drawing, compared to inputting the same information in prompted entries over and over again.

Now if this is our method of input, why don't we just go all in and make an all-inclusive form for inputting our values that will fill out our iProperties?



Armed with this knowledge about iProperties and some of the tips and tools presented here, we can make our designs easier to locate and more accurate in tracking of important data for reporting and procurement of materials.



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*Mark has extensive experience and a comprehensive understanding of the technical, practical business, and human dimensions of implementation. When not providing training, support and implementation, he writes the IMAGINiT Manufacturing Blog and takes an active role in the manufacturing community. Mark is an ATC certified instructor, and is PSE and ATC certified in AutoCAD®, AutoCAD® Mechanical, AutoCAD® Electrical, Autodesk® Data Management, and Autodesk® Inventor®.*



# Managing in the BIM Age

## MANAGING THE BUILDING INFORMATION MODEL

**W**e all make sure we have a project manager on every project that comes into our offices, but who is managing the model? Do the individuals that run our firms understand the importance of the role of BIM manager on every project? Is there time allotted in the project plan for the model management? Different projects will require a different level of BIM management depending on the size, complexity, and type of project. A large complex project may need a person specifically in the role of Project BIM Manager. Smaller projects may have the Project Architect or a Draftsperson that is already on the project performing the responsibilities of this role along with their other responsibilities on the project. These responsibilities may even be split among multiple team members. Many times this responsibility will even fall to the office BIM manager.

July 2012

## THE I IN BIM

There are a number of things that a project BIM manager will be doing throughout every phase of the project. They will look through the model to confirm that the information portion of BIM that the model should contain is there. The “I” portion is the main differentiator between BIM and just drawing. The information enriched model is what is changing our entire industry. We have to make sure that all of our model content includes the proper information. Some of the information that could be contained, and confirmed, in the model is information being used for scheduling, facilities management, cost estimating, and specifications just to name a few. These types of information are dependent on what was discussed at the beginning of the project. This could be an internal discussion—what do you as a team want to get out of the model? Or this could be a discussion with the client—what do they want to do with the model once they receive it?

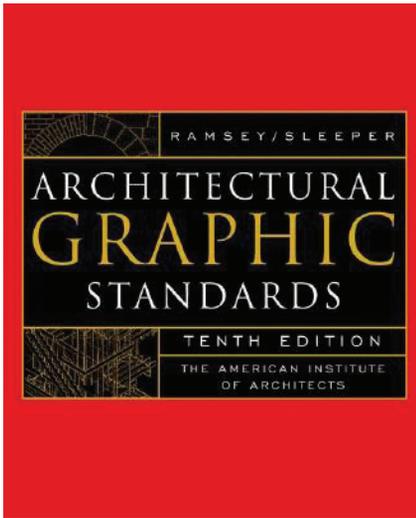
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# Revit Architecture 2013

## GUIDELINES AND PROTOCOLS

Another thing that the project BIM manager will be doing during the project is confirming that the model is following the office guidelines and protocols. Following these guidelines is a must for an office to function as a singular unit. When the project is nearing the end, additional staff may be required to help the team meet a deadline. Having followed office guidelines throughout the entire project will make it that these additional team members can be added seamlessly. These team members will not require a long transition period to become acquainted with the model because they have seen this organization and typical content before. This way they can start out being a productive team member right away.



**Figure 1:** Cover image of Ramsey / Sleeper Architectural Graphic Standards book.

Some things that are required to be in the office guidelines may be view templates, file naming conventions, sheet naming conventions, project browser layout, titleblocks, color schemes, dimension styles, and text styles along with any number of additional possibilities. If these things are automated and well documented, users will be able to concentrate on the design and the content to tell the story of the building, not to tell the story of the drawings.

The model will also be reviewed to confirm that things are being modeled in 3D and not drafted in 2D and that the level of detail that is spelled out in the contract is being adhered to. Too often the team does not know what the contract states or understand the importance of modeling to a certain level of detail. Contractual issues should be understood by all since obviously there could be legal ramifications to not understanding this. Things like this tend to come down to communication. Making sure things regarding and affecting the model are being communicated through the team will also be the responsibility of the BIM project manager. This includes keeping management informed about the modeling effort and how the team is doing with it. This person also needs to have the authority to approach team members and discuss if they are not following the office protocols.



## PLOTTING

Another thing for a project BIM manager to look at is how things are reading—are the drawings going to look correct when it comes time to print the set. Unfortunately, at this time a majority of projects are still being plotted so we have to take this into account. When you start plotting, there are going to be things that slow the process. We have to have things set up to avoid the simple printing woes as much as possible. Are there view templates set up for the team to start from? Is the team utilizing the view templates that are in place? These things need to be monitored during the project. If overrides are being done in a majority of the views then this should tell you that the view template needs to be adjusted to accommodate these issues. This problem should also be reiterated back to the office BIM manager so that it can be adjusted in the office template. Again, communication is an important factor. With each project you should learn new things that inform and further the development of your office template and guidelines.

## MODEL CLEANUP

Model cleaning is another aspect that someone will need to manage. Are the user and central files being remade on a regular basis? Is the model being purged? Are miscellaneous views being deleted? As the team grows, the amount of material in the model can become unwieldy and this can make the team less productive. Searching through a long list of views or content can take up valuable time. It can also cause problems with your model, which can make it crash and result in lost information, not to mention the time it can take to remake or recover the model.

## MODEL TRANSFER

The BIM project manager should also handle the transfer of the model between consultants and other disciplines. Having one person consistently performing this task will confirm that the same steps are taken, consistency in this is just as important as the consistency in the modeling itself.

The reviews and cleaning of the model will need to be done on a regular basis. On smaller projects this may be done on a weekly basis, or it may be satisfactory to do it less frequent. On larger projects this may need to be done continually. Discussion at the start of the project with the team, including the office BIM manager, will determine the ideal schedule for these tasks for a specific project.

Many of the things listed throughout this article may sound like they are quick and easy tasks, and individually many of them are, but the time for each task will add up. Make sure you allow for this time in the project plan. Many of these tasks can easily fall through the cracks; this will cause problems later and your model will give you problems or it may not contain the needed information.

As an architect on a variety of projects, I have experienced models being managed or mismanaged as the case may be. I have experienced and understand that these tasks are an important part of achieving a successful BIM project; time must be allotted for all of these tasks. And someone must be held responsible for following through with these tasks. That is the only way to ensure that they are done.



Jennifer Storey is a Registered Architect in Ohio. She is currently employed at Leo A Daly as a senior Healthcare Architect. Previously she was an Associate at Bostwick Design Partnership in Cleveland Ohio where she performed the role of Project Architect and BIM Manager.

As a way to further her Revit development Jennifer, along with three people from other Cleveland area firms, formed the Northeast Ohio Revit User Group and became the first official President in 2010. She was also a presenter at the Inaugural North American Revit Technology Conference in 2011. She is a Revit Certified Professional and member of both the National Institute of Building Sciences and the National BIM Standard Project Committee.

Jennifer was an active member of the Cleveland AIA board in 2009 and 2010 where she developed a series of study seminars for the Architect Registration Examination to help eligible professionals become registered architects.



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# Organize with Sheet Set Manager

 Sheet Sets are an excellent CAD management tool in AutoCAD® Architecture 2013. A sheet set is an organized collection of sheets from several drawing files. A sheet is basically a selected layout from a drawing file. Sets of drawings, the primary deliverable for most design groups, communicate the overall design intent of a project and provide the documentation and specifications for the project.

Managing sets of drawings manually can be complicated and time consuming. With the Sheet Set Manager, you can manage drawings as sheet sets. A sheet set is an organized and named collection of sheets from several drawing files. You can import a layout from any drawing into a sheet set as a numbered sheet.

A sheet set can be created with the Create a Sheet Set wizard. With this wizard, you can either create a sheet set from scratch based on existing drawings or use an example sheet set as a template. Layouts from specified drawing files are imported into the sheet set. The associations and information that define a sheet set are stored in a sheet set data (DST) file. When you create a new sheet set using the Create Sheet Set wizard, a new folder is created as the default sheet set storage location. This new folder, which is named AutoCAD Sheet Sets, is located in the My Documents folder.

It is important to note that the DST file should be stored in a network location that is accessible to all sheet set users on the network and mapped using the same logical drive. It is strongly recommended that you store the DST and the sheet drawings in the same folder. If an entire sheet set needs to be moved, or if a server or folder name changes, the DST file will still be able to locate the sheets using relative path information

## OVERVIEW

Before you begin creating a sheet set, several steps should be completed. First, drawing files need to be consolidated. Move the drawing files to be used in the sheet set into a small number of folders in order to simplify sheet set administration.

Second, eliminate multiple layout tabs. Each drawing you plan to use in the sheet set should have only one layout to be used as a sheet in the sheet set. This is important for access to sheets by multiple users, as only one sheet in each drawing can be open at a time.

Third, create a sheet creation template. Create a drawing template (DWT) file to be used by the sheet set for creating new sheets. You specify this template file in the Sheet Set Properties dialog box or the Subset Properties dialog box.

Fourth, create a page setup overrides file. Create a DWT file to store page setups for plotting and publishing. This file can be used to apply a single page setup to all sheets in a sheet set, overriding the individual page setups stored in each drawing. Although it is possible to use several layouts from the same drawing file as separate sheets in a sheet set, it is not recommended because it makes concurrent access to each layout by multiple users impossible. This practice can also reduce your management options and can complicate the organization of your sheet sets.

In the Create Sheet Set wizard, when you choose to create a sheet set from an example (see Figure 1), the example sheet set provides the organizational structure and default settings for the new sheet set. You can also specify that folders are created corresponding to the subset storage paths of the sheet set. After you create an empty sheet set with this option, you can import layouts or create sheets individually.

In the Create Sheet Set wizard, when you choose to create a sheet set from existing drawing files (Figure 1), you specify one or more folders that contain drawing files. With this option, you can specify that the subset organization for the sheet set duplicates the folder structure of the drawing files. The layouts from these drawings can be imported into the sheet set automatically. You can easily add more folders containing drawings by clicking the Browse button for each additional folder.

## CREATE A NEW SHEET IN A SHEET SET

As an alternative to importing existing layouts, you can create a new sheet. When you place views in this sheet, the drawing files associated with the views are attached as xrefs to the sheet drawing. To create a new sheet in a sheet set, begin by clicking the View tab on the Palettes panel and select Sheet Set Manager. In the Sheet Set Manager, Sheet List tab, right-click on the sheet set node and then click New Sheet. You can now select a drawing template and layout and then select OK.

## CREATE A NEW SUBSET

Sheet subsets are often associated with a discipline such as architectural, electrical, and so on. For example, in architecture, you might use a subset named Structural, and in electrical, you might use a subset called Lighting. In some cases, you might also find it useful to create subsets associated with a review or completion status. Subsets can be nested into other subsets as needed. After you create or import sheets or subsets, you can reorder them by dragging them in the tree view.

To create a new subset, begin by clicking the View tab on the Palettes panel and select Sheet Set Manager. In the Sheet Set Manager, Sheet List tab, right-click the sheet set node or an existing subset, and click New Subset. In the Subset Properties dialog box under Subset Name, enter the name of the new subset and click OK (see Figure 3). You can drag the new subset anywhere on the sheet list, even under other subsets. If you want to create a subset under an existing subset, you can right-click the existing subset. On the shortcut menu, click New Subset.

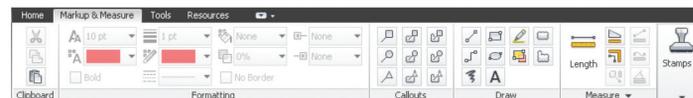


Figure 3: Create a new subset.

## RE-ASSOCIATE A SHEET IN A SHEET SET

If you move a sheet to a different folder, you should re-associate the sheet to the sheet set with the Sheet Properties dialog box to correct the path. For any relocated sheet drawing, the paths for Expected Layout and Found Layout are displayed in the Sheet Properties dialog box.

To re-associate the sheet, click the path in Expected Layout and then click to navigate to the new location of the sheet. You can quickly confirm whether a sheet is in the expected folder by looking at Details at the bottom of the Sheet List tab. If the selected sheet is not in the expected location, path information for both Expected Location and Found Location is displayed in Details.

To re-associate a sheet in a sheet set, begin by clicking the View tab on the Palettes panel and select the Sheet Set Manager. In the Sheet Set Manager, open a sheet set. Now on the Sheet List tab, open the sheet that you want to re-associate. Next, in the Sheet

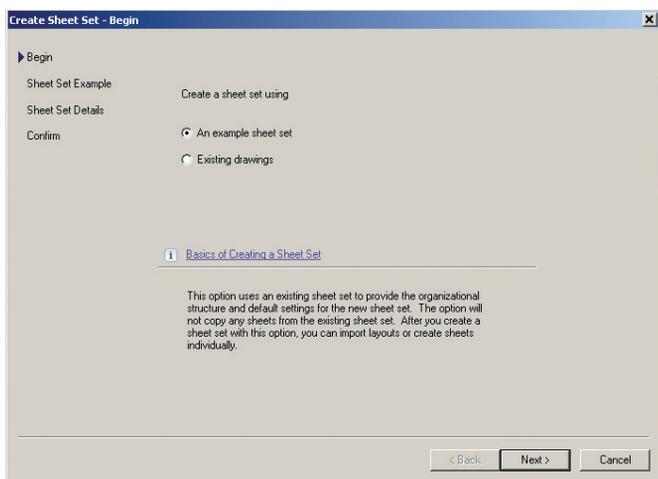


Figure 1: Create a new sheet set.

## IMPORT A LAYOUT INTO A SHEET SET

After you create a sheet set, you can import one or more layouts from existing drawings. You can initialize a layout by clicking on its tab to activate the previously unused layout. A layout does not contain any plot settings before initialization. Once initialized, layouts can be drawn upon, published, and added to sheet sets as sheets after the drawing has been saved. This is a fast method for creating multiple sheets from layouts in several drawings. In the current drawing, you can drag a layout tab directly onto the Sheets area of the Sheet List tab in the Sheet Set Manager.

To import a layout into a sheet set, begin by clicking the View tab on the Palettes panel and select Sheet Set Manager. In the Sheet Set Manager, Sheet List tab, right-click the sheet set node, a subset node, or a sheet node and then click Import Layout as Sheet (see Figure 2). In the Import Layouts as Sheets dialog box, click Browse for Drawings and then navigate to the drawing you want to use. If you wish to select several drawings, use SHIFT or CTRL when you click on the drawing files. Next, click the check boxes of the layouts to be imported as sheets in the current sheet set and click Import Checked.

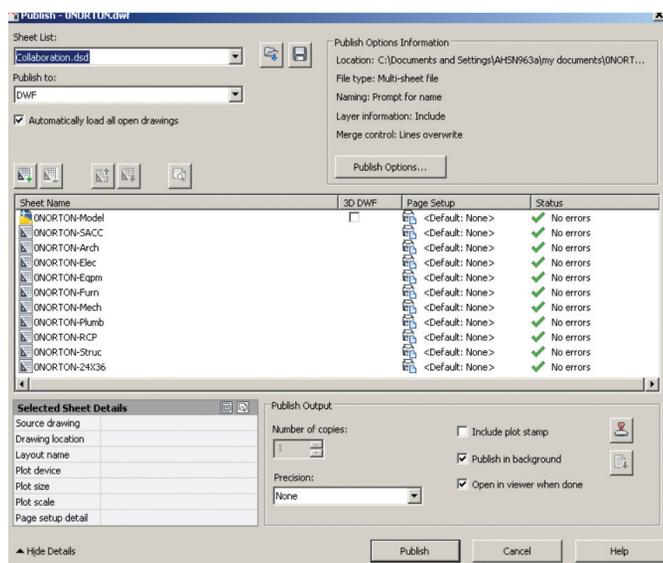


Figure 2: Import a layout into a sheet set.

# AutoCAD Architecture 2013

Set Manager, right-click the sheet you wish to remove and then click Remove Sheet. Save the drawing. In the Sheet Set Manager, right-click the Sheet Set and click Import Layout as Sheet. In the Import Layout as Sheet dialog box, click Browse for Drawings and navigate to the drawing you wish to use. Click the check box of the layout to be re-associated as a sheet in the current sheet set and click Import Checked (see Figure 4).



Figure 4: Re-associate a sheet in a sheet set.

## ADD A VIEW TO A SHEET

From the Model Views tab, you can easily add a view to a sheet by placing a named model space view or the entire drawing onto the current sheet. After creating a named model space view, you must save the drawing to add the view to the Model Views tab. Click Refresh on the Model Views tab to update the Sheet Set Manager tree view.

To add a view to a sheet, begin by clicking the View tab on the Palettes panel and select Sheet Set Manager. In the Sheet Set Manager, open a sheet set. On the Sheet List tab, you can either double-click on a sheet to open it, or create a new sheet and open it. On the Model Views tab, click the plus sign next to a folder to list the drawings in the folder.

From the list of drawing files, do one of the following:

- To add a model space view to a sheet, click the plus sign next to a drawing file to list its named model space views and then right-click a model space view.
- To add an entire drawing as a view in a sheet, right-click a drawing file.

Click Place on Sheet. An alternative method is to drag a model space view or a drawing from the Model Views tab to a sheet.

Now, right-click on the sheet and then click the scale you wish to use for the sheet view. Specify the insertion point for the sheet view. The specified view is now added to the sheet. If a view label block is defined in the sheet set properties, a view label that displays view-specific information is automatically placed on the sheet.

## ADD A SHEET LIST TABLE

The first sheet in a sheet set will usually be a title sheet that includes a description of the sheet set and a table that lists all the sheets in the sheet set. You can create this table, called a sheet list table, on an open sheet. The table automatically includes all the sheets in the sheet set. Once a sheet list table is created, you also have options to edit, update, or delete the cell content of the table.

To add a sheet list table, begin by clicking the View tab of the Palettes panel and select Sheet Set Manager. In the Sheet Set Manager, open a sheet set. Right-click a sheet set name, subset, or multiple sheet set names and subsets and then click Insert Sheet List Table. In the Insert Sheet List Table dialog box, set the Table Style in the Table Style Settings group. Next, on the Table Data tab, specify Title Text for the table and add, remove, or change the order of the column entries. On the Subsets and Sheets tab, select the subsets and sheets to be included in the sheet list table. Please note that if you add a sheet to a subset later on, you will automatically be prompted to update the sheet list table. Click OK.

## PUBLISH A SHEET SET

From the Sheet Set Manager, you can easily publish an entire sheet set, a subset of a sheet set, or a single sheet. It is quicker to publish a sheet set in the Sheet Set Manager rather than using the Publish dialog box. When you publish from the Sheet Set Manager, you can publish an electronic sheet set by publishing to a DWF, DWFx or PDF file, or you can publish a paper set by publishing to the plotter named in the page setup that is associated with each drawing sheet. You can also publish your sheets using a page setup that is saved in the page setup overrides DWT file associated with the sheet set. This page setup overrides the current page setup settings for the individual publish job.

When you open the Publish dialog box from the Sheet Set Manager, the dialog box automatically lists the sheets you selected in the sheet set. You can then modify the sheet set for publishing. You can specify that sheets are sent to the plotter in reverse order. This option is available from the Publish dialog box and from the Sheet Set Manager.



Figure 5: Publish a sheet set.

## TO CONCLUDE

The Sheet Set Manager in AutoCAD Architecture is a powerful tool for CAD management. Keeping uniformity throughout all drawings for all users can be a big challenge, but the Sheet Set Manager is just the tool to keep everything in line!



Melinda Heavrin is a CAD Coordinator & Facility Planner for Norton Healthcare in Louisville, Kentucky. She has been using AutoCAD Architecture since release 2000. Melinda can be reached for comments and questions at [melinda.heavrin@nortonhealthcare.org](mailto:melinda.heavrin@nortonhealthcare.org)



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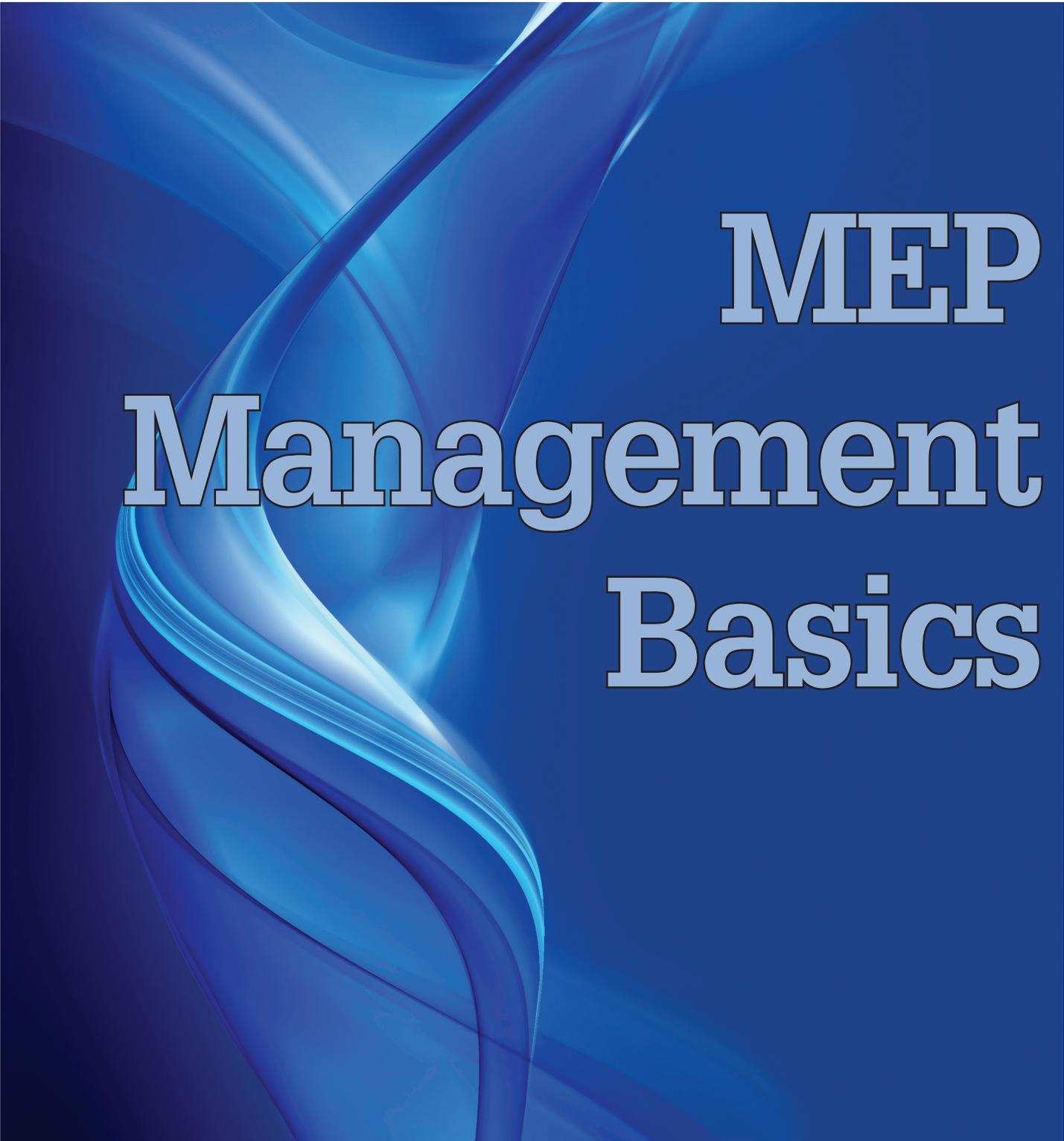


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# MEP Management Basics



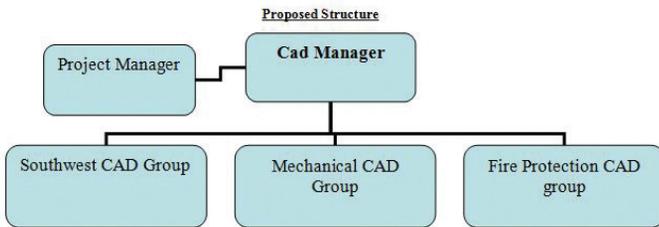
**M**anaging an AutoCAD® MEP department within a large national corporation and a small company can be quite similar. Managing is about getting things done effectively and then

improving how they are done. There are several items that, if structured properly, can make a CAD department perform quite efficiently.

You may ask yourself how this is possible if no two jobs are alike. Job 1 is different from job 2; there are difficult clients versus easy-going ones; the lead designer is a different engineer or architect on every project, and it's either new work or a redesign.

It is easy if you start at the root and make sure your company's document structure and management are in order. A few important objectives to follow are: software, equipment, document management, type of work, team members' levels of expertise, and communication between members.

Regardless of company size, it is good to have a CAD manager because this allows a specific company format to be set in place and helps ensure it is followed. This also assigns one person through whom jobs and drawings will be channeled. All work should be delegated and approved by a CAD manager once the job-specific project manager gives the thumbs up to proceed. The CAD manager should filter all final drawings through the job site's superintendent, or whomever the job specific manager appoints, once the drawings/sketches are completed. A typical hierarchy should look as follows (depending on the size of the company).



Following a specific hierarchy will help keep track of issues and hold a user or group responsible for solving them.

When building an AutoCAD MEP group/team it is important to have a variety of levels. Larger companies with multiple trades will need multiple people with specific skill sets. Also it is very important that the MEP CAD manager be knowledgeable about all the trades so decisions can be made in a timely manner.

Beginner CAD employees are good for doing the tedious work such as notes and dimensions that a top dollar employee shouldn't be paid to do. All the CAD division employees must report back to the CAD manager; the manager will schedule their time for projects and assign what has to be done by each employee. Weekly meetings with the CAD team will help the manager stay on top of progress and allow questions to be brought forward for group discussion and resolution.

Every corporation should have a standard platform of software and a computer that is capable of handling the specified requirements for that software. A CAD manager should communicate with the company's IT department and agree on a standard CAD workstation.

This station may vary depending on the expertise level of the CAD employee being hired; for example: will it be a BIM coordinator or a simple detailer? Obviously someone that will be involved in 3D or BIM will be dealing with multiple MEP trades and need a more 'beefed up' computer that can open large-scale 3D models, as well as append several large drawings into them while running through clash detection.

The simple CAD detailer would only need a basic machine capable of running AutoCAD and other miscellaneous programs. Three important items when building any AutoCAD machine are processor, RAM, and graphics processor. These three items should be above and beyond any other computers in the office. Multiple monitors should also be a standard for CAD users; this allows users to have multiple items open on multiple screens.

## View basic information about your computer

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Windows 7 Professional

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### System

Manufacturer:	Dell
Model:	Precision M4500
Rating:	<b>5.9</b> Windows Experience Index
Processor:	Intel(R) Core(TM) i7 CPU M 620 @ 2.67GHz 2.67 GHz
Installed memory (RAM):	4.00 GB
System type:	64-bit Operating System
Pen and Touch:	No Pen or Touch Input is available for this Display

Document management is a very important part in managing and organizing an AutoCAD MEP department of any scale. Spending too much time searching for files on a disorganized server is unnecessary and a complete waste of time management. An AutoCAD document management solution is easy to put together and can be customized to suit your business.

First you must have a specific spot on a server to place AutoCAD or drawing files for all jobs. This location will be known by all employees in case access is needed. Keep in mind the security of the files beyond a navigational structure must be addressed. If you are responsible for your office AutoCAD folder, it is up to you to ensure that the appropriate staff has access only to the projects that concern them. Files can be protected from deletion by setting directory and sub-directory permissions accordingly. Of course, certain individuals may need access and this would need to be addressed as you organize the network security settings for each employee. Keep in mind that some upper management may need to view certain drawings and may not have access to AutoCAD. They may benefit from a PDF file or DWG file viewer. For every job, it should be required that a PDF be made of each sketch or drawing, allowing anyone ease of viewing. The PDF folder should have open access to all personal with the exception of file deletion.

Once a location of the AutoCAD folder is in place on the server, organizing a specific folder should contain, but not be limited, to the following.

# AutoCAD MEP 2013

>Job Name/Number

>As-Builts

>Submitted Drawings

>PDFs

- Details\_Sketches

>Working Drawings

- CAD Files from GC\_Engineer
- Coordinated Drawings
  - Upload Files
  - 3D Models
  - Other Trades DWGs
- Xrefs

Within these folders a file naming convention should be set in place as well. The naming should be broken up into about five parts: job number, discipline, floor number, area designation, and date. This will ensure you are in the correct MEP trade and most recent file. Many companies have multiple trade divisions these days, so additional information might need to be added if this is the case. For example, a division number or name after the job number would be a proper placement for this. Here is an example of a completed job file name: 12001\_ELEC\_01\_B\_6,1,12.dwg. This would let a user know that it is a drawing from Job#12001, and it is the First Floor Area B Electrical Drawing.

Within each drawing a layer management standard should be used. This way, anyone who opens the drawing knows which layers/lines were created within your company. It is beneficial to change all other layers other than your company's to a color not used by your company standards; typically a light grey (color 8) is used allowing the background and other trades to be seen subtly while all your work appears bold and is easy to reference. Each MEP trade within the company should be assigned a layer/color set as well. A generic layer chart is as follows but not limited to:

- Company\_Electrical Text (Color 7)
- Company\_Equipment (Color 8)
- Company\_Dimensions (Color 8)
- Company\_Telecom (Color 3)
- Company\_Cable Tray (Color 3)
- Company\_Clearances (Color 1) No Plot
- Company\_Emergency (Color 1)
- Company\_HVAC (Color 5)
- Company\_HVAC Text (Color 7)
- Company\_Fire (Color 1)
- Company\_HWS (Color 6)

---

## NOW THAT YOU HAVE A BASIC IDEA OF WHAT NEEDS TO BE DONE IN A MANAGEMENT ROLE, SIT DOWN AND PLAN YOUR STRATEGY.

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Company\_HWR (Color 4) Improved communication can be handled by implementing a wide variety of tools. Instant messaging such as Skype can help manage communication between users. Often designers have questions or comments regarding the project, so being able to get immediately answers from co-workers will result in a quick turnaround. Web conferencing systems, such as WebEx, also can help with weekly conference calls and can assure that everybody views design data at the same time. When dealing with a company that has multiple MEP divisions, communication is going to be the most critical part in assuring a successful job. It is also wise to make sure all employees have an updated contact list for all CAD personnel.

Now that you have a basic idea of what needs to be done in a management role, sit down and plan your strategy. You will need to coordinate with upper management before implementing your plan. Start by writing down your current structure and alter it to what you feel best suits the company. Once you have identified the ideal AutoCAD management structure for your office, present a final draft to upper management. Your draft should include a list of benefits the new structure will obtain. Once approved, be sure management sends out an office memo outlining and enforcing the AutoCAD document structure and rules.



*Greg Firman lives in the Metro Detroit area and works as "CAD Manager" for Conti Corporation in Sterling Heights, MI. He has traveled all over the country for his company working on several large 3D projects. His main background is in electrical and is self-taught in AutoCAD, AutoCAD MEP, Navisworks Manage, and limited Revit. He loves being out doors, hunting, and traveling. Being from Detroit, he is also a big Auto-enthusiast. His future plans are to grow with his company nationwide, and to expand his knowledge with Autodesk's upcoming products and updates.*



# Six Steps to a Sturdy Foundation

It's not uncommon to hear the outburst, "I need more RAM!" Truthfully, more than RAM should be considered, even though RAM seems to be the culprit when waiting for a Revit screen to refresh after a command or Save to Central. It's no secret that Revit has hardware requirements, but often overlooked are things such as project setup, worksets, efficient family content, worksharing monitor, and so on. These are all part of the process of managing a Revit MEP project.

It is true that developing and maintaining an efficient Revit MEP model can be a daunting task, but investing time up front can alleviate most of the pain encountered. One of the major keys to having a successful Revit MEP project is to understand the setup and structure of a project. Just like a building, projects must have a sturdy foundation. To have an efficient and consistent model with good performance from beginning to end, the initial steps are crucial to start it off properly.

## STEP ONE: APPOINT A MODEL MANAGER FOR THE PROJECT

Regardless of your firm's size, it is important to designate one or two individuals responsible for setting up and maintaining an MEP model. Their role should include, but not be limited to, setting up the model, setting up worksets, compacting and auditing models, reviewing warnings, purging linked models (if they are static), and

updating linked files. A model manager is the go-to person when one hour from printing a change is about to occur within a linked architectural model. The model manager knows the setup and structure of the MEP model and can make the necessary changes to get the project out in time. Now that a team has been developed, the process of setting up the MEP Model can begin.

## STEP TWO: DETERMINE THE PROJECT OR BUILDING TYPE

Be aware that projects such as health care facilities can require more computer resources and management because of the number of MEP systems that are modeled within this type of facility. Compare this to a multi-story office building or industrial building that may have similar square footage but not as many MEP systems. It is often too difficult to relate a Revit files size to a building's square footage for the above reasons. As a company, be sure to monitor file sizes and develop a standard for splitting up models and worksets.

## STEP THREE: ENABLE WORKSETS

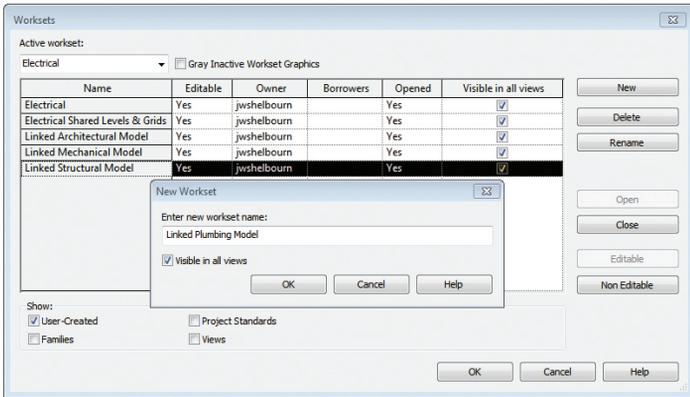
Whether you are working in the same model or within separate discipline models, enabling worksets can be very beneficial to the project. Worksets can be thought of as another level of visibility management in which we can select any combination of elements

# Revit MEP 2013

and group them into a workset and have control over whether or not Revit will display them. Worksets also give the ability to maintain the long-term performance of a project while easing control when coordinating levels and grids between architectural and structural disciplines. More detail on this later.

To enable worksets, navigate to the Collaborate tab and select Worksets. The Worksharing dialog box will appear. At this point Revit offers two different worksets—one for shared levels and grids and the other for the remaining elements within the project. Worksets can be renamed at this point, but it is not absolutely necessary to do so. Select OK. Be patient—it will take a minute for Revit to rewrite the project data base to enable worksharing and for the worksharing dialog box to appear.

Once the worksets dialog box appears worksets can be created. In this case, a workset for each discipline—one for each of the linked models—and a workset for shared levels and grids is created from each linked model from the Architectural and Structural projects.



## STEP FOUR: LEVERAGE WORKSETS

After the necessary worksets have been created, select OK and save the project as a central file. In the Save As dialog, select Options and then select Specify under the Open Workset Default. This will bring up the worksets screen prior to opening your Revit file, which will give you the ability to choose the worksets when opening the project. This can potentially decrease the amount of time Revit takes to load a project. After saving the project as a central file, be sure to go back into the worksets dialog box and select “No” under the “Editable” column to make the workset non editable.

## STEP FOUR: USE ELEMENT BORROWING

It is good practice to use element borrowing instead of making the entire worksets editable. There are situations where a user might want to make a workset editable and, therefore, takes ownership of all objects that belong to that workset. The trouble is that no one will have access to any elements within that workset until that workset returns to a borrowed workset. Using element

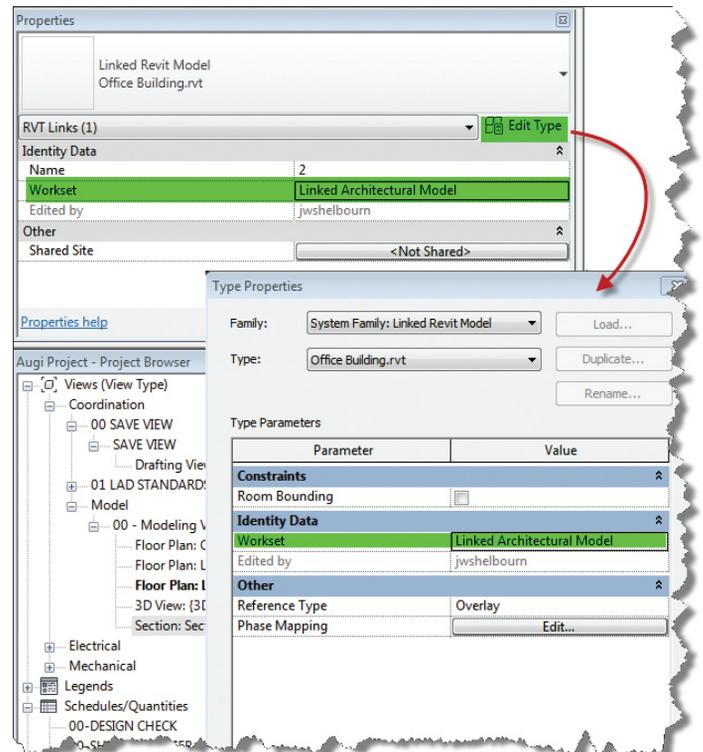
borrowing is as easy as not checking out any worksets. With no workset checked out, any accessed elements are borrowed from the workset, leaving the rest available to other users. It is important for users to set the appropriate workset when introducing new elements to the project and to Sync to Central often to release the borrowed elements.

## STEP FIVE: MANAGE WORKSETS

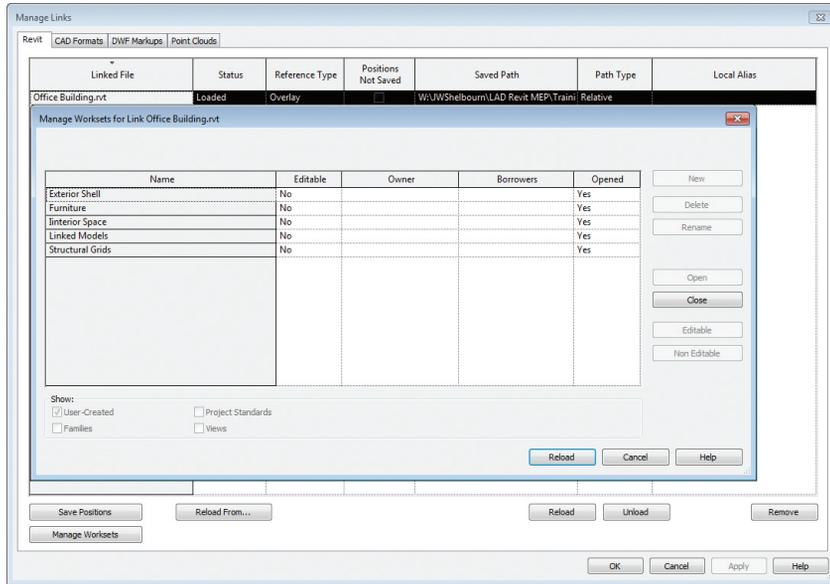
Worksets are meant to be flexible. They can be added, deleted, or renamed at any time during the project. Within the worksets dialog box, users can choose whether or not the workset is “Visible in all views.” In most cases worksets should be visible in all views. An example of why you would deselect “Visible in all views” might be an existing DWG file that is being used for a demolition plan and should only be visible within that view. In that case, deselect “Visible in all views” and from Visibility/Graphics Overrides within the Demolition view, turn that workset visibility on. It is good practice to use this technique when importing a file that is only visible in a few views. There is a potential increase in performance because Revit is not refreshing that DWG file in every view.

## STEP SIX: ASSOCIATE WORKSETS WITH LINKED FILES

After linking in the appropriate Revit files, make sure to select the linked file in plan view and choose the appropriate workset within the instance properties and type properties. Below see the link is now associated to the “Linked Architectural Model” workset within the MEP model.



This gives the ability to control the visibility without actually unloading the linked file. On the Manage tab, select the Manage Links tool to control the linked file worksets. In this example the user can choose to close or leave open the Exterior Shell, Furniture, Interior Space, Linked Models, or Structural Grids within the “Office Building.rvt model.”



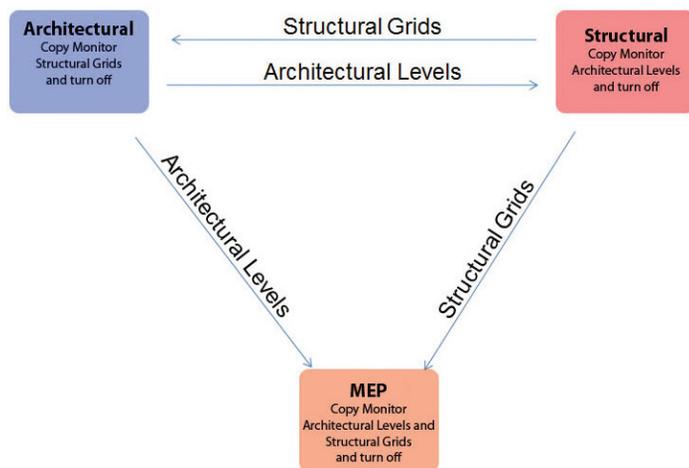
eral will enhance the performance and flexibility of the model. Multiple worksets can get confusing, however, so carefully consider how they should be used project by project.

## CONSIDERATIONS

When determining how to use worksets, consider the makeup of the team. If there are multiple engineering teams working on a project, worksets by team may best accommodate the project requirements. This allows individual teams' worksets to be loaded or not loaded, which will lead to increased computer resources and eliminate teams from working on top of each other. This requires a comprehensive coordination plan.

Splitting worksets by discipline can benefit offices that work within the same model. In addition, separating the engineering systems can be useful. Electrical engineers can control the display of HVAC and plumbing separately or the display of mechanical equipment requiring electrical hookup separate from mechanical equipment that does not. This will speed up and increase performance within the model.

The ability to control the linked files worksets can be very beneficial for not only performance, but also for visibility graphics control. For instance, using worksets will allow the control of levels and grids between structural and architectural models. In a common workflow, the architectural model gets grids from the structural model. Conversely, the structural model gets levels from the architectural model. MEP gets levels from the architectural model and grids from the structural model.



The ability to control the levels and grids between the architectural and structural models is beneficial when managing grids and levels between multiple links.

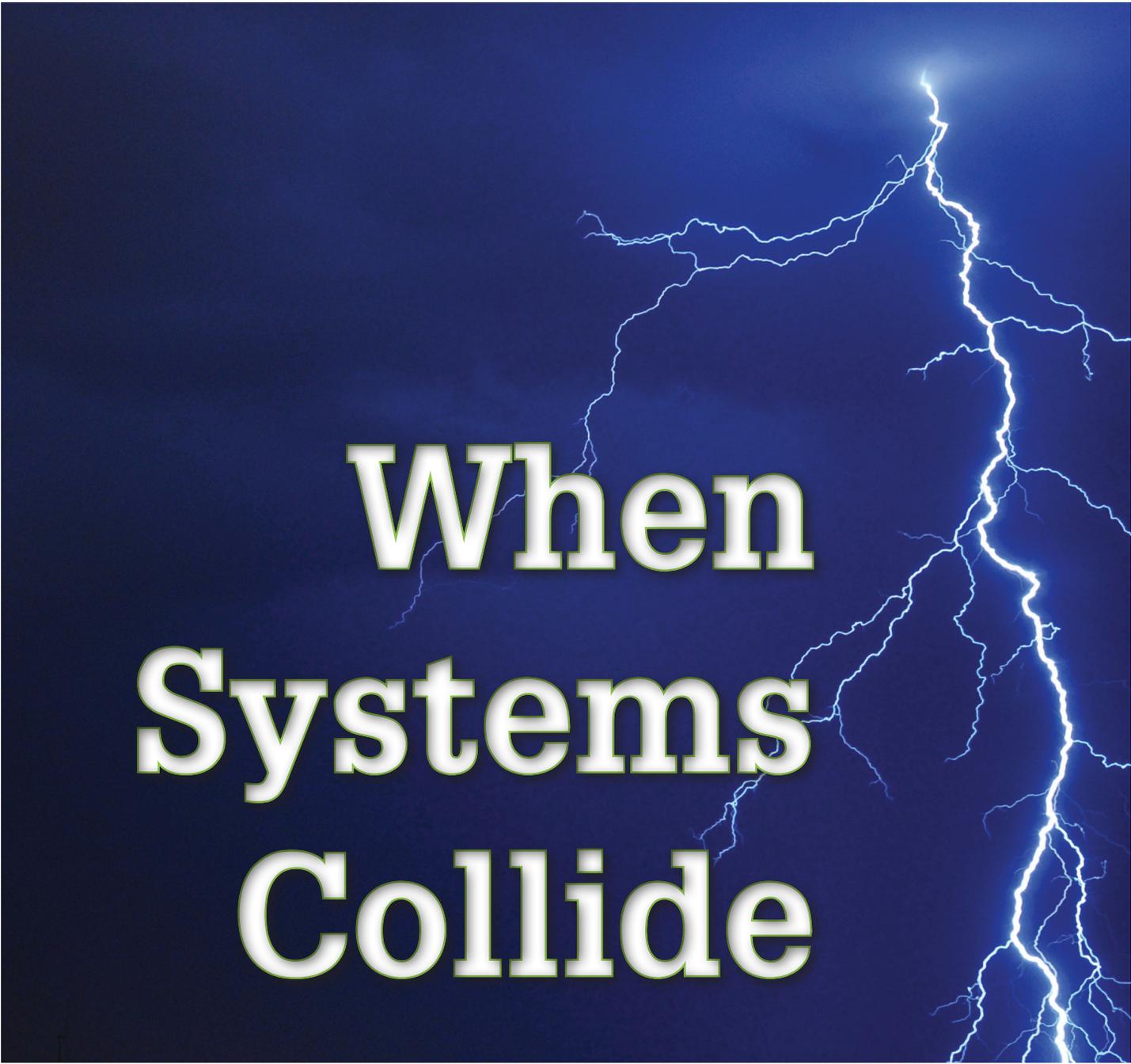
There are a number of ways to use worksets. Technically, one workset would be enough for Revit to function, but using sev-

Projects that contain multiple areas, levels, or a campus of buildings are all great candidates for worksets. Separating the building areas, levels, or buildings will optimize work on larger projects and multiple systems within the same MEP Model.

As projects evolve from schematic design to construction documents the files size can grow over three times. These are just a few ways to manage a Revit MEP project to maximize speed and build predictability. The options for individual firms are complex and endless, but making the effort to coordinate and agree on the best procedures and practices will allow firms to be more consistent and productive. This will not only affect the project over time, but it spans projects, teams, and geography. Maybe some more RAM would be nice, but addressing options to increase productivity efficiency and managing a project better is far more beneficial than simply adding RAM to PCs.



*John Shelbourn is currently the BIM MEP Manager for Leo A Daly. John has been working with Revit MEP since 2008 and has previous experience with many different types of Autodesk software including; AutoCAD, Autodesk Building Systems, 3ds Max, and Navisworks. He has been the guest speaker at the Revit User Group of Nebraska. Being an early advocate of Revit MEP, he continues to support the process behind Building Information Modeling.*



# When Systems Collide

**I**f you're like me (and let's face it, if you're reading this article the day it came out then you ARE like me), you've been looking ways to best approach the problem of MEP clash coordination. I've seen multiple walkthroughs and guidelines, but most of them don't really apply to what I am typically tasked to do. Frankly, I don't have the time to do it the way they say to do it.

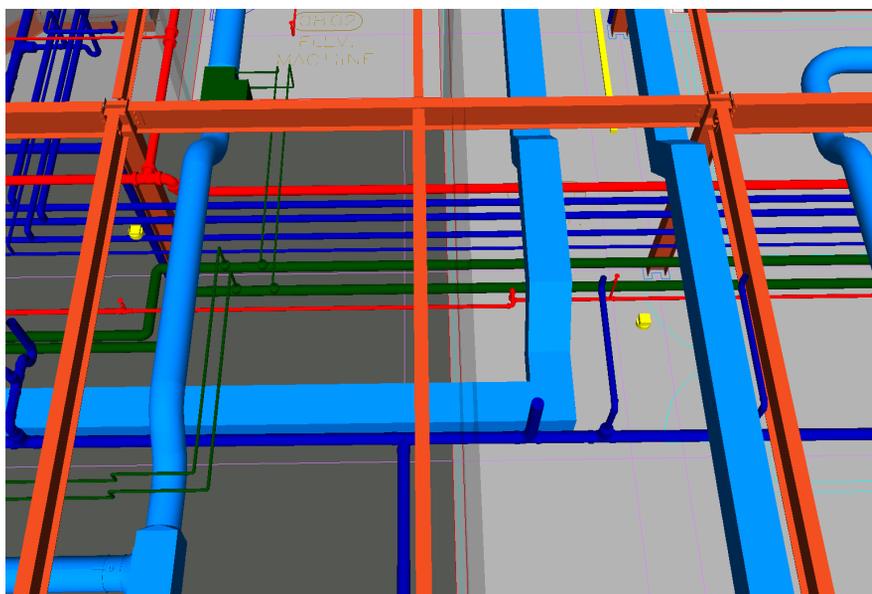
## IN A PERFECT WORLD

The articles I've read begin innocently enough. First you combine files, then you create Clash Sets, then you flag the clashes by responsible party, then your subcontractors address them. See you

next week.

But when I add the difficulty of low floor to floor heights, increasingly complex systems, high ceilings, and a short schedule, I end up with THOUSANDS of clashes per week! There has to be a better way. This article attempts to address these issues with approaches to make best use of your short amount of time—without flagging 15,000 clashes per week.

The fact is, with six full-time detailers providing me with new models on a (at least) weekly basis, I can expect this amount of clashes at the beginning of a project for several weeks. For me to



**Figure 1: An overhead example of a simple coordination.**

If Figure 1 represents what one of your project typically looks like, this article may not be of the most benefit to you. For everyone else, read on!

## REALITY SETS IN

When you first start a project, you might take the model you got from your architect, or perhaps a model that you created yourself, export out an .nwc file (the Navisworks Cache File) from Revit, and append that .nwc into Navisworks. From there, you can append relevant .dwg files that contain additional information, and then it's time to share.

You will use a file sharing service such as a dedicated FTP account that your IT department may have set up, or perhaps you use BOX.NET, Dropbox, or a similar service. You can share your base files with your team, and decide on a 0, 0 location so that everyone is coordinating in the same space.

Next, you need to append their files into your base .nwf (this is the Navisworks file format for combination files) and verify that all of your files are lining up.

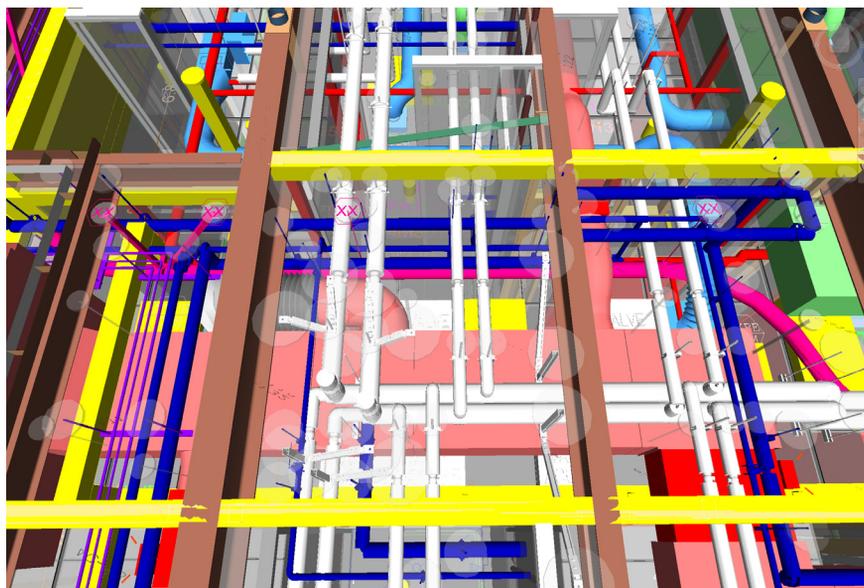
Next, you need to set up Clash Sets. But what is the right approach? Do you work in a hierarchal setup, where your first clash set is *Fire vs. Everyone*, then *Drainage vs. Everyone except Fire*, then *HVAC vs. Everyone except Fire and Drainage*, and so on? If you work this way, you may find that some of your Clash Sets come back with thousands of clashes that have to be sorted through.

It is for this reason that I work in a true "trade vs. trade" clash environment, regardless of responsible subcontractor. This gives me upwards of 30 clash sets per project area.

## STEP BACK

This is the time in a project when I am tempted to tear out my hair. With all of these clashes, there is really no way to address each one, but in reality, there is no reason to do so anyway.

Your job at this point isn't to point out each individual clash, your job is to identify pinch points, or areas that don't look like the designed items are going to fit. Leverage your subcontractors' experience and knowledge of their own systems to find out what they can and can't do reasonably. Discuss major ductwork crossings, and find out what can be done to resolve these issues. Find the general direction the team wants to go by working together. Remember, nobody wants to model their entire system, only to find that somebody else put all of their items at that same location as well.



**Figure 2: An overhead example of a complex coordination.**

Once you have determined the basic direction for the team, you can start your coordination by stepping back and flagging the specific areas of conflict. Then you can try and decide on the approach that you are going to utilize to resolve these issues.

Often you will run into an area that has lots of repetitive clashes. For example, arrayed conduits or pipes that run through ductwork, where hundreds of clashes are found. In reality there is only one issue. To address it, I suggest leveraging the view settings in the Clash Detective. First, use a selection window to select the offending objects. (To minimize the items you have to select I would pick the ductwork in the example above.) Then use the Filter by Selection option in the Display Settings, then New Group the clashes, and assign the party. Name it something like HVEL 01. Using this technique throughout a project can reduce a Clash Set from having several thousand to a much more manageable several dozen or

# Navisworks Manage 2013

so. Use the Report functionality to publish Group Headers Only to HTML to reduce the apparent amount of clashing in the project. By exporting the report using the Group Headers Only option, you will only see the settings contained in the top level Group of each clash.

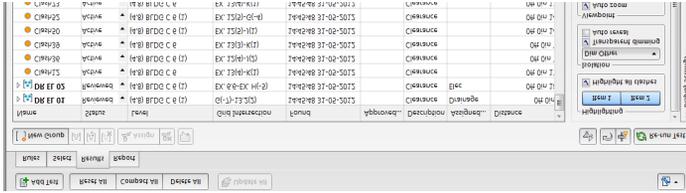


Figure 3: Combine clashes into Groups.

## TEMPLATE FILE

By using a Template file with which you start each project, you can avoid the tedious task of setting up Clash Tests at the beginning of each project. These tests should include individual clashes, or “Trade vs. Trade.” By analyzing the project in this granular approach, you minimize the volume of clashes to be found by any one Clash Set.

Not only should you build your Clash Tests to clash Trade vs. Trade, but you should also include several extra tests of All Trades against things such as Structural Steel, King Studs, Top Track Clearances, and Ceiling Grid. This will verify your subcontractors are installing as per the construction documents, along with the added benefit of notifying you of any discrepancies between the Consultant Drawings versus the Architectural Drawings. (A-100s versus M-100s versus E-100s, etc.)

If the Clash Tests in your Template file are built by utilizing the Sets Tab of the Selection Tree, you can automatically have all of your tests populated just by verifying that your subs use the specific rules that you will build to create your Search Sets.

## SEARCH SETS

In my process I have found that by enforcing a strict naming convention on our subcontractors, we are able to streamline many of the processes we utilize in Navisworks. For example: we make our electrical subcontractor name the file something that contains “EL” in it, and it doesn’t even matter the file format used. You can then use the “Find Items” tool, look for the specific “EL” term in the name of the file, Find All, then save this as a Search Set. Now you can always have a Search Set for each trade, even as they update their files each week. (You can even export these Search Sets to apply to other projects.)

Create an individual Search Set for specific items such as Diffusers, Recessed Lights, Ceiling Grids, King Studs, Structural Steel, and any objects that could set you up for smoother results down the road as well.

Name	Status	Clashes	New	A...	Approved	Resolved
DR DW	Done	0	0	0	0	0
DR EL	Done	1	0	0	0	1
DR FR	Done	0	0	0	0	0
DR HP	Done	0	0	0	0	0
DR HV	Done	1	0	0	0	1
DR MG	Done	0	0	0	0	0
DR PT	Done	0	0	0	0	0
DW EL	Done	0	0	0	0	0
DW FR	Done	1	0	0	0	1
DW HP	Done	0	0	0	0	0
DW HV	Done	0	0	0	0	0
DW MG	Done	0	0	0	0	0
DW PT	Done	0	0	0	0	0
EL FR	Done	0	0	0	0	0
EL HP	Done	0	0	0	0	0

Figure 4: How to structure clash sets using search sets in a template file.

For example: when clashing your “HV” Search Set vs. your “EL” Search Set, you can create a Rule to ignore items in Search Sets “Diffusers” or “Recessed Lights” using the Custom Rules function. This will pull out items that are supposed to be 1” or less apart from each other (the registers and the lights in the ceiling grid) and allow you to concentrate on the items that are actually an issue.

To address the possibility of lights and diffusers actually being in conflict, create a Clash Set between only the Search Sets “Diffuser” and “Lights” using a Hard Clash with a 2” Tolerance. Using this same technique you can clash the locating of these items in the ceiling grid with a “Ceiling Grid” Search Set versus both the “Lights” and “Diffusers” Search Sets.

## NEW FUNCTIONALITY

Navisworks Manage has brought some new functionality in its 2013 release. Among these are the ability to natively import Revit files, the ability to display grids and levels from Revit, and a totally redesigned Clash Detective tool.

Although I have not implemented the native import of Revit files into Navisworks in a real project yet, I have sampled it, and it looks like it may be the way I approach coordination in the future. One benefit is the way the Selection Tree separates items by object type as opposed to by hosted level. This is perhaps a personal preference, but I find it easier to navigate the model through the object type format. One drawback, however,

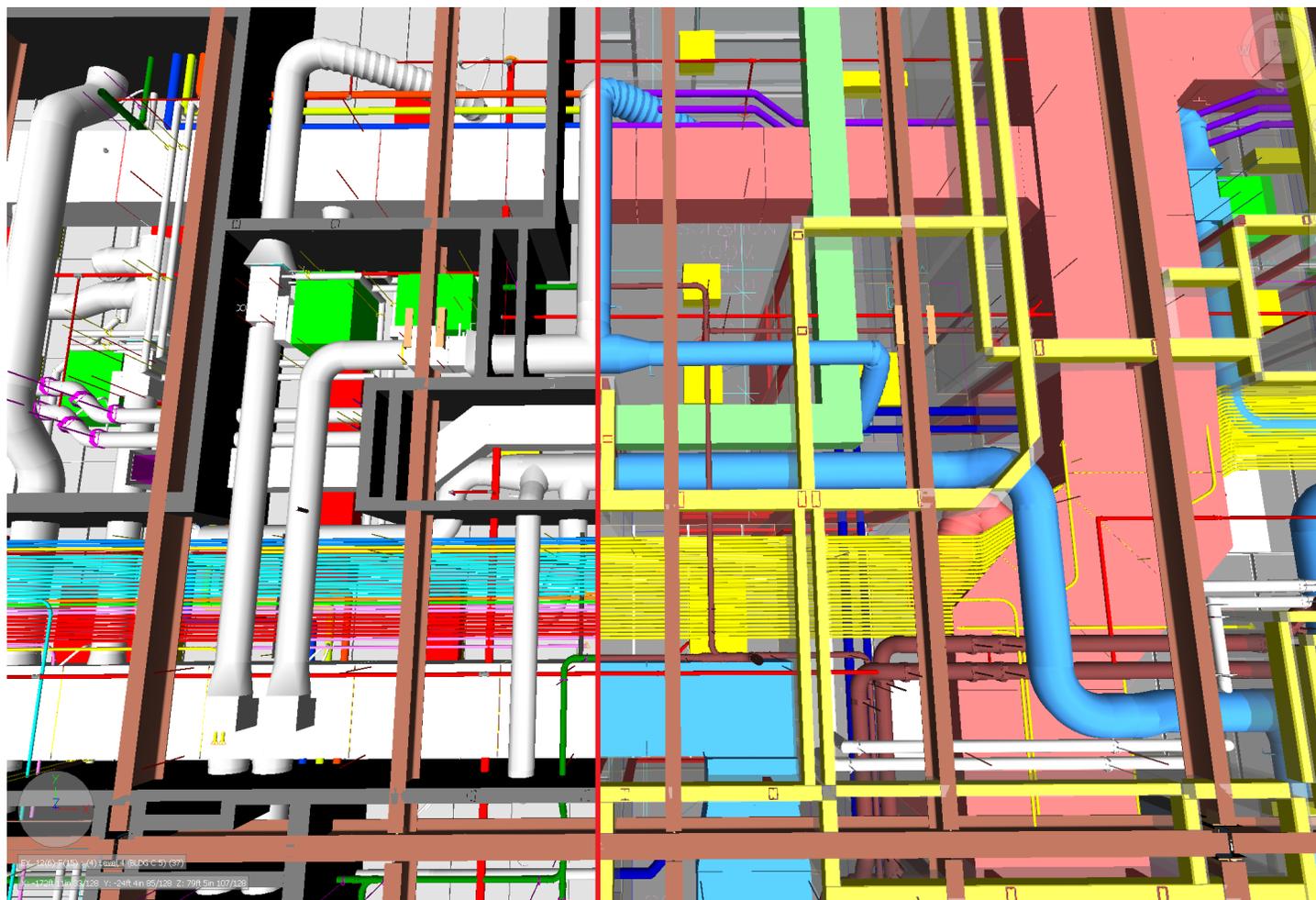


Figure 5: Appearance Profiler—before (left) and after (right) comparison.

is that it does seem to take quite a while to import the Revit file, so the complexity of the project may keep this from being an option for you.

The grids and levels display functionality is a great way to orient yourself throughout the project, and is also available as a column header in the Clash Detective, making it easier to locate clashes throughout the project.

A previous *AUGIWorld* article covered the basics when it comes to the new Clash Detective, so I won't go over it in detail, but I will say that being able to hide both the display settings and the items clashed, gives you more room to understand the items that are clashing, making clash detection that much easier.

## APPEARANCE PROFILER

If you haven't taken the time to embrace the Appearance Profiler tool, this is something I recommend as an easy way to simplify communication between trades. When you look at a file that comes in natively from your subs, it may be hard to tell if that round pipe is an electrical conduit, or a domestic water line, or a med gas line. The colors that have been pre-

defined by your subs just aren't that easy to lock into your brain. (I'm sure it makes sense to them.)

So take some time to build an Appearance Profiler file (as a .dat). Use the Search Sets by Trade that you have built previously to assign a new appearance to each system. Use what makes sense to you. You could choose brown for waste/vent, blue for domestic water, red for fire protection, etc. I even go one step further and separate out my mechanical systems to supply, return, and exhaust. (Most third-party detailing software provides a field in the properties of the object to determine to which system they belong.)

I'm sure you can imagine the communication that can be streamlined by using this approach. Now every time I open a file, I can confidently say whose items are where.

Using the Appearance Profiler has the added benefit of showing you exactly what items have been added since your last meeting. As new items are added to each appended file, they will come in as their original color; you will then be able to identify these items giving you a heads up on what has changed. (Of course you will then want to rerun your profiler.)

# Navisworks Manage 2013

## SAVE OFTEN

One of the most worrisome things I've experienced while using Navisworks Manage 2013 is its tendency to crash. I've run into multiple tasks where, if you use them, you're in for an error report.

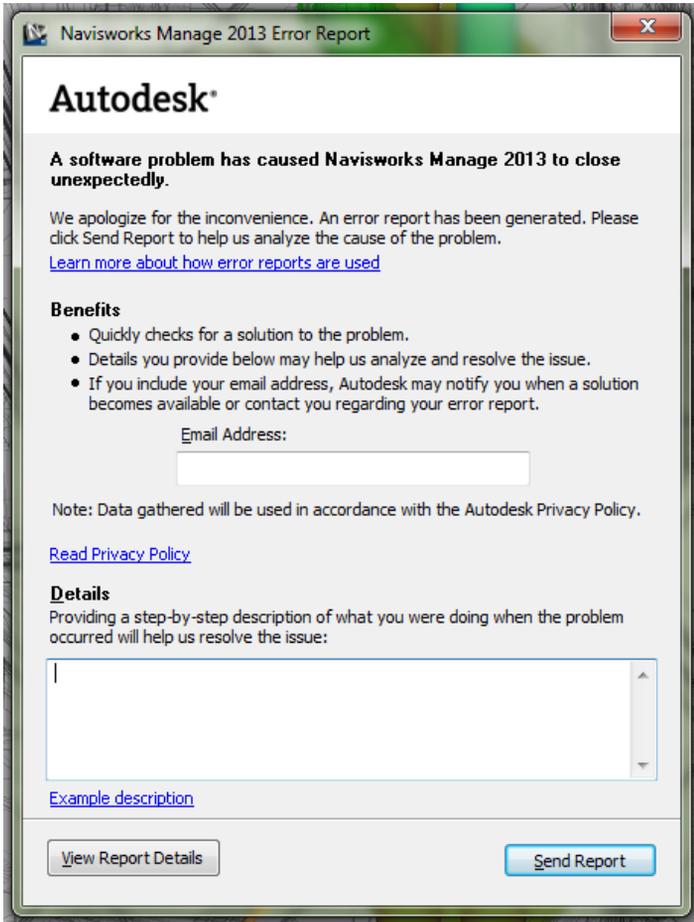


Figure 6: Not a graphic you want to see often.

The first, and most problematic for me, is the Refresh command. Simply hitting the Refresh command crashes Navisworks (for me) about 60 percent of the time. I now prepare for this, and save immediately before doing such a refresh. (Sometimes I just close the file and reopen it.)

The next major issue (bug) comes when grouping clashes into clash folders in the Clash Detective tool (or dragging additional clashes into existing clash groups). Utilizing this workflow can cause Navisworks to crash on a consistent basis as well. Using the process that I described before, you can see how this would be especially problematic as that is how I approach large Clash Sets.

The only work around I have found for this one is to be deliberate when combining clashes. I've found that if I'm trying to work too quickly, that is when the crash will happen. So I slow down, wait for my 3D view to settle down, and then drag the selected clashes into a group folder, (or create a new one).

Both of these issues have me doing something I haven't done since AutoCAD 2006—saving often, ramping down my Autosave timings, and being ready for work to be lost. Hopefully this is something that gets addressed sooner rather than later by Autodesk.

## EMBRACE THE DESIGNERS

As your coordination process continues, one potential bottleneck you may run into is the hesitance of your subs to make revisions without the appropriate RFI process being employed. This keeps them protected from rework, and progressing too far down a proposed solution that may ultimately be the wrong one.

One way you can help them move quicker is to reach out to the design team early and get them to buy into your process. I will typically get introduced to them through my project manager, and ask if they are willing to meet with me on a weekly basis, for about an hour at a time. They are usually excited to see such planning to streamline the process.

During your weekly coordination meetings with your subcontractors, take notes of items you want to bring up to the design teams; the architect, and consulting engineers. These items could be the sizing or routing of ductwork, the option of lowering the ceiling in specific areas, missing dimensions, missing piping sizing, and others.

If you can bring these items to the table quickly, I prefer the meeting with the designer team to be the day after the MEP coordination meeting; you can get answers immediately about how to proceed. Of course you will need to have your subs follow through with the appropriate RFI process to tie up the paperwork side of things.

## COMMUNICATE

At the end of the day, your job is most impacted by your ability to communicate effectively. It's your job to resolve issues early, without feelings being hurt, and in a mutually beneficial manner for all parties involved. If you can't do this, you're in for a long coordination process. Remember that everyone is on the same team. We all want to finish the project on time, under budget.



Josh Taylor is a Project Manager of Virtual Construction for one of the largest General Contractors in the Mountain West. Josh has seven years of BIM-related experience in both the Architectural and Construction fields, has worked with AutoCAD since 2002, Revit since 2007, and Navisworks Manage since 2010. Josh can be reached for question or comment at [jostaylortwo@gmail.com](mailto:jostaylortwo@gmail.com).



# Tips for Revit Project Management

## GOING SOLO?



If someone will be working with you to help manage the project, be thankful—particularly if you are new to Autodesk® Revit®.

I enjoy learning and sharing with others, but I was alone for my first few projects. Afterward, I was able to see that the mistakes and problems that occurred were ones I often created myself. Recognizing your own mistakes can sometimes be tough when you are working with others. Let's face it—Revit does some funny things sometimes, but they are usually our own fault.

Hopefully your first project will not be huge with many people working together, but most of us don't have that choice. I've witnessed a big team of about 10-15 people learning together for the first time on a large multi-building, multi-phased project going through an IPD phased review process through OSHPD. I can say it seemed to work out. Of course they had some experts to help them (including Titan AEC: [www.titanaec.com](http://www.titanaec.com)) so I was a little jealous, but I learned to use it as a resource as well.

## TIME TO LEARN MORE ABOUT WORKSETS

In my opinion, every project should have at least two people in charge. If one leaves for vacation, quits, dies, or is fired, the project still moves forward. It can be tough to work on a project that was started by someone else if you don't have a good handoff.

By using the two-person approach you have a better chance of the team members helping each other and sharing ideas of how they plan to model and manage portions of the sometimes complicated structure. Some experts can create elaborate families that need further explanation or documentation, especially if you're still learning.

Phil Russo authored a good article in the *AUGIWorld* August 2011 issue regarding worksharing/worksets, and here are a few more options to consider. When creating the central file, within the "Save As" dialog box, to the bottom right is an options button. Within that dialog box you'll notice within worksharing "Open workset default." It may be good to use "specify" here so that when opening the model, team members will have to specify which workset they're starting off with. It also allows you to turn off worksets that are not needed at first.

# Revit Structure 2013

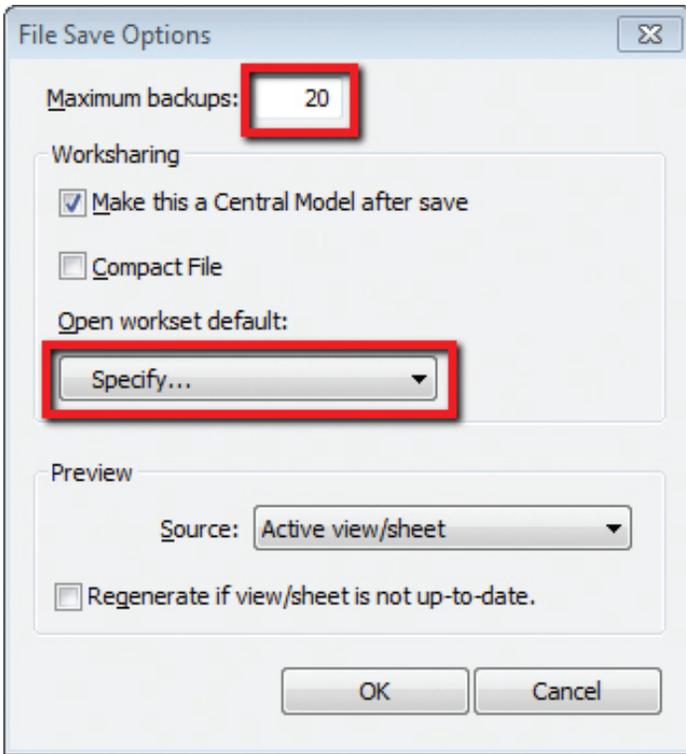


Figure 1: File save options, specifying default/current workset during open, maximum backup location.

More backup files should be used as more people work on the project, enabling you to roll back to an earlier state. The magic number of backup files should be about 2x or 3x the number of teammates working on the project.

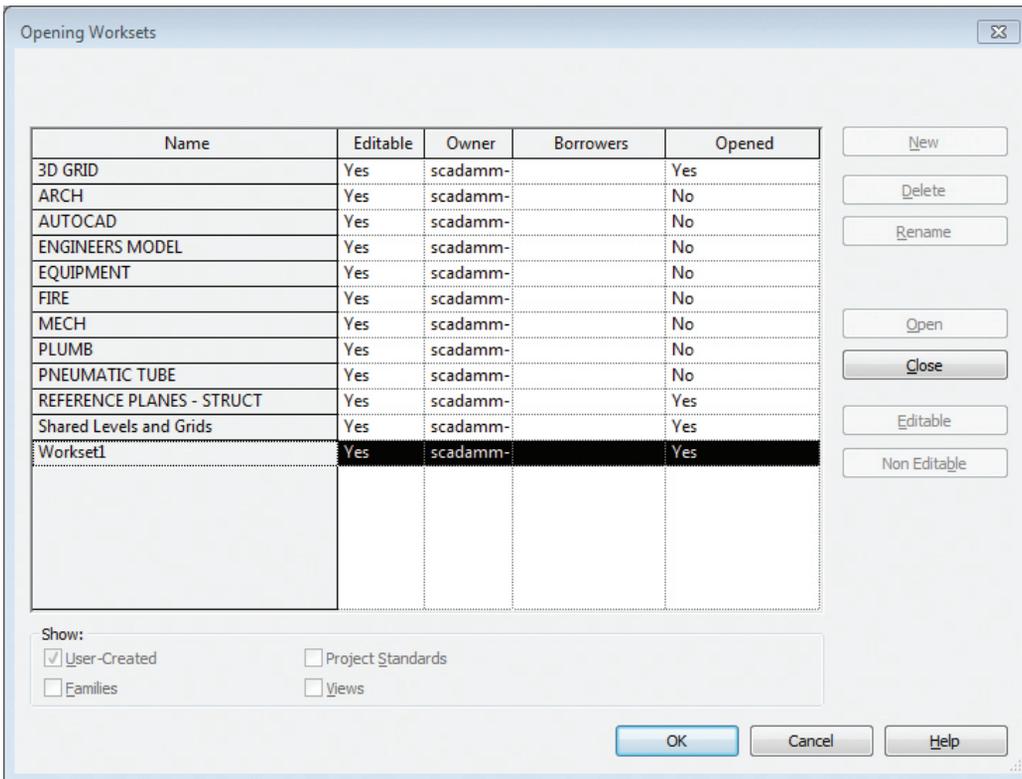


Figure 2: Opening worksets from the beginning, CTRL to choose multiple worksets you want closed. To select current workset: left-click Workset1 and choose OK.

I no longer stress out too much about what worksets to create. I typically use only one (Workset1), since “element borrowing” does the trick. Some worksets I like to utilize would be one workset for every link you have in your model, Revit and DWG. This allows individual Revit users in the same model to turn off workset versus unloading the Revit link. A workset for your Reference Planes will allow other disciplines linking in your model to unload that workset if it starts to get busy.

What was that? You have a chunk of modeled elements weighing your file down? Try Revit’s version of WBLOCK; turn the heavy models into a group, turn the group into a workset, unload it or remove it, and presto!

“Worksharing Monitor” is also available, which is free if your office is on Autodesk subscription. You may be able to find it now in your Autodesk program files if it was installed during the Revit installation. This feature provides the following information.

- When everyone is in the file, it shows each user and how long it has been since each team member has saved to central.
- It shows you when others are “Saving to Central,” as only one person can save to central at a time.
- It reflects how old or out of date your file is.
- It shows how many saves others have done since your last save.

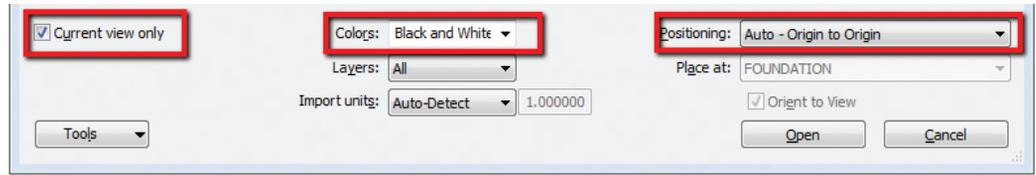
Also, when synchronizing with central, I typically check every checkbox in the dialog. One thing to remember is after initiating worksets, nobody should open and/or work in the central file. Something else to watch for: after saving to central your current workset is changed to whatever was current during the previous Save to Central.

## REASONS TO OPEN CENTRAL

You’ll need to access central if you to do an audit (which you should do when you update to the next version of the software). Some companies audit once a week or once a month—it depends how big the file is. Also for archiving or sharing the model, be sure to “Detach from Central.” There is a new eTransmit for Revit we should all look into, available on Autodesk Labs. <http://labs.autodesk.com/>

## OVERWRITE EXISTING

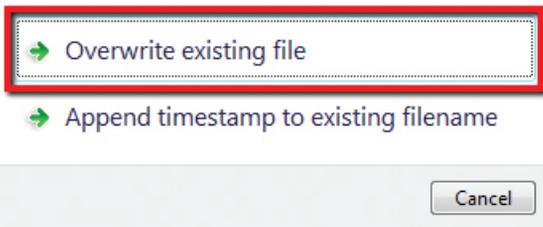
After opening Revit, I do not choose to open the project using the copied file located on my hard drive (shown in the display history). Instead, I browse to the central file on the network and left click the central file once. Notice the bottom of the dialog box under “Worksharing” the two buttons “Detach from Central” and “Create New Local.” Create New Local gives you a fresh copy of everyone’s work from the day before (or before lunch). You should completely delete this file (and the folder it creates) from your local drive maybe once a week or once a month; again, it depends on the size of the file. You do not want old items you changed or deleted sneaking back into your model.



**Figure 4:** Current View only brings lines in as detail lines; unchecked they come in as model lines (visible in 3D views). Black and white can still be changed to halftone or your color of choice for coordination, Origin to Origin (the new o,o).



You are trying to create a new local file C:\Users\scadamm\Documents\Revit Local Files\Project1\_scadamm-PC6497.rvt but a file with this name already exists. What do you want to do?



**Figure 3:** Get a fresh start with the latest and greatest updates in the model.

## THE NEW “READ ONLY”

This paragraph is dedicated to those who “should” be getting into the model, but are scared to mess things up. “Detach from Central” is equal to opening up the file in “read only” format (good for non-users and new users to check out).

This is also useful for teams wanting to bring the model into the field for reference and have no intention of reconnecting back to the central file. I suggest sharing the “Detach from Central” concept with people who wish to learn Revit or people you would like to review your model for accuracy such as QA/QC. It is easy (to be a BIM joker) to create your own 3D view, print, cut details, and figure out dimensions.

## WHERE IS MY 0,0? (UCS & INSERTION POINT)

It’s now called “Origin to Origin.” In earlier versions it was a little tough to find that crazy 0,0... but it was and is possible. With the new versions it’s a little easier as it has its own nifty little symbols. If you go to a plan view and “reveal hidden elements” you’ll notice a circle and triangle over each other, “project base point” and “survey point.” If the architect or sub-contractor is using AutoCAD, you can typically use Origin to Origin.

Learning about Revit “Coordinates” can help you understand how to acquire, publish, and so on. I’ve learned the hard way that it is an important step to coordinate early in the project. It is especially important when the architect is using Revit or you want to do some Google Earth or civil alignment. You may also want to consider the shared coordinates tool available on Autodesk labs which is great for coordinating Revit, Civil 3D, and Navisworks: <http://labs.autodesk.com/>

## COMMUNICATE WITH THE PROJECT TEAM

I suggest trying to meet the other modelers. As Jeremiah Bowles wrote in *AUGIWorld*, November 2011, “you need to figure out your modeling accountability, who models what, when, where and why.”

(Also see Vico MPS 3.0) <http://goo.gl/Soor6>

To formulate a plan of attack, find out what software versions the other project team is using and if and when they plan to upgrade.

## WATCHING THE 3D VIEW WHILE MODELING

I create a level and floor plan 10 feet above all other levels and call it “OVERALL,” setting the bottom of my view range about 10 feet below the lowest modeled item. This allows me to see everything in plan similar to a 3D view, but with grids and the ability to write notes to myself. Assure that levels and grids are consistent by creating a perpendicular elevation for each set of grids at every angle. Within the elevation views, you can use a level or reference plane to snap grid endpoints in elevation throughout the project.

If you need to work with a model that was created by someone else or even generated outside of Revit, it is important to verify accuracy before commencing work. After linking or importing, make sure you can flex your model.

I’ve typically adjusted the columns to represent actual splice locations. Afterwards, verify that the beam endpoints are moving with and about the exact center of the column. This can be accomplished by setting your view to a medium or fine level of detail and zooming in, checking one by one.

# Revit Structure 2013

One of the last things to fix would be adjusting the beams in a bay to be equal to the spacing specified by the engineer. If you don't want to use beam systems, I've also used dimension strings to lock or equally space beams between the grids. You can delete the dimension you create and the beams will stay locked or equally spaced. (You'll receive an error, shown in Figure 5. Choose OK and the beams will follow your orders.) Notice when you select one of the beams, a light blue dashed line will appear if you hover around the item, sometime extending off your screen if you locked to grids and they're too long. This light blue dashed/invisible dimension string can be deleted if you would like to re-space that bay anytime.

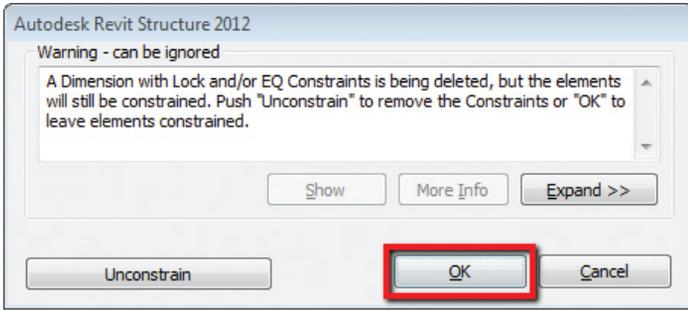


Figure 5: By choosing OK you do not populate the warnings.

There are many other analytical items to take into consideration that you can learn online—even if your engineers are not utilizing or helping you with this process. If they do plan to do some round-tripping it may be good to keep that model separate as its own link. This allows you to move forward with preparing the documents to assure that you can meet your deadline.

## A LITTLE UNDERGROUND HELP

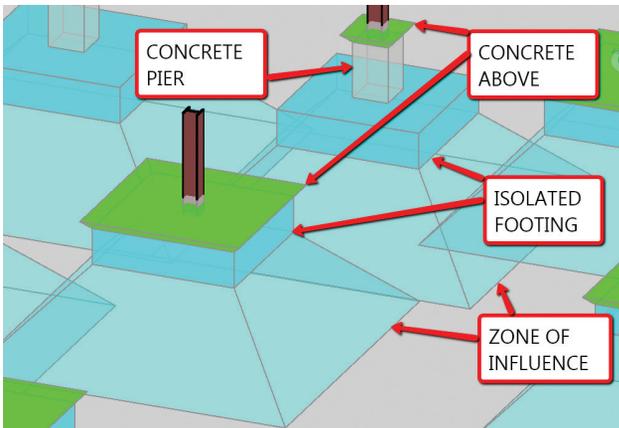


Figure 6: Isolated footing with concrete above, concrete piers, and zones of influence.

In AUGIWorld February 2011, Gabe Cottam reminds us that as a model author, try to keep in mind your project team members downstream who will be receiving your model. This is great advice.

Modeling the concrete above an isolated footing helps create a closer estimate of concrete (and the architects appreciate it if they're utilizing your model inside their own). Modeling the zone of influence to the correct angle of repose below the footing can help assist with underground coordination (see Figure 6).

The first time I used this technique on a project, I used Component / Model in Place / Structural Foundations / solid blend, and matched project concrete material above and utilized semi-transparent material below. I made these a group so in plan I could hide it in one shot.

I've also dabbled with using voids to cut out sand and gravel from my slab layers. This can be hard to maintain depending on the deadline and design changes. This can produce satisfying results when joined to adjacent concrete (unless you need a cold joint). I ended up taking out the sand and gravel from my slab layers, but I may end up adding that stuff back in now that we don't need voids to create voids in geometry.

I was able to copy concrete and zones of influence from one same size footing to another, making it fairly quick. Building this into a family can make it even quicker. Thanks, Tomas!

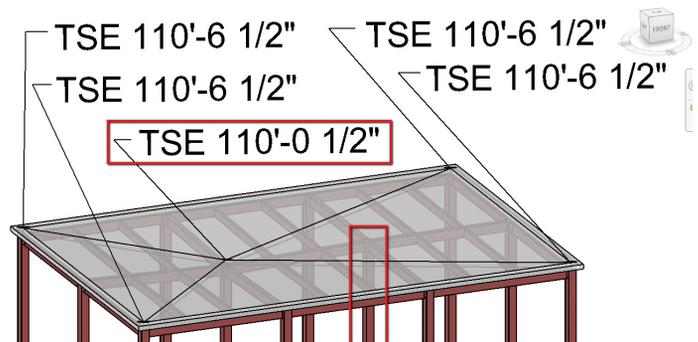
## OVERLAYING TWO PLANS

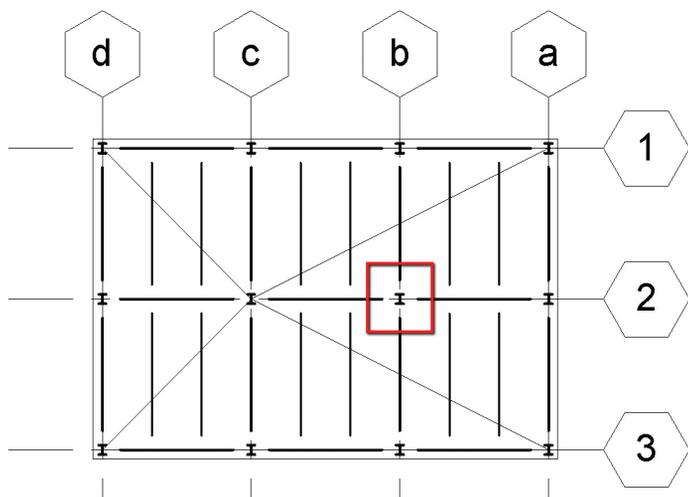
The idea here is when you place two plans on top of each other on a sheet, they snap into place. Try it, it's fun! I know I should be doing this another way, but I have a problem understanding why a thin half-tone line would be plotted on top of a thick black line. In AutoCAD we had a .PC3 file option for graphics that we could set the "merge control" to "lines overwrite."

So what you do is create a plan isolating the architect's model through Visibility Graphics, set the view range to reflect what you want to view—walls above, walls below, both with one or the other as thin dashed lines, half-tone, and so on.

Now if you place that plan view on a sheet with a structural plan, notice the snapping into place that occurs. Great, except some items may overpower your structural plan. To resolve this display issue, delete your plan from the sheet, then place the structural plan you deleted on top of the architect's plan and, voilà, the structural stuff is on top, nice and thick! I've used this technique when creating mechanical screen framing plans to show framing below half-tone (for clarity and post location coordination), mechanical screen framing. Again, solid and thick.

## FIGURING OUT COLUMN HEIGHT ON A WARPED STEEL ROOF





Figures 7 and 8: How high is this column?

Now this process gave me interesting results. Let's say the roof has been defined with a high and low point at the column/grid intersections. But you have this straggler column between the high and low points and you'd like to figure out the top of that column.

I proceed to warp the slab and framing to satisfy the high and low points and now I need to attach the column to the bottom of the slab. (Note: I like to keep my flat slabs and warped slab separate as the architect can tab/select into your model, copying your slab into theirs, moving it up the thickness of insulation, now following the contours of your warped slab that actually sits on beams and doesn't float above or merge into each other.) They can convert your separate flat slabs for built-up insulation using a similar type that has the "variable" options checked, allowing them to "raise the roof."

Next you select the straggler column and "attach top" to slab above. Be sure to choose the correct options (see Figure 9).

Your slope lines should look similar to the architect's slope line on their roof, although the steel doesn't actually slope like that—they're representing insulation. To help everyone's building sections look closer to reality, you need to select the warping slab and start to "pick supports." If the slab is too big you'll need to break it up somehow. I do this for every chunk of slab that either slopes up or down. Too many triangles, faces, and slab edges will start to muddy your plan.

In your Visibility Graphics, go to Floors or Roofs and turn off "interior edges." BAM! For separated slabs transitioning from flat to warped, get rid of edges by using the join tool. (Note: for projects scheduling volume of concrete, overlapping concrete should be joined. If not, the schedule will be inaccurate.)

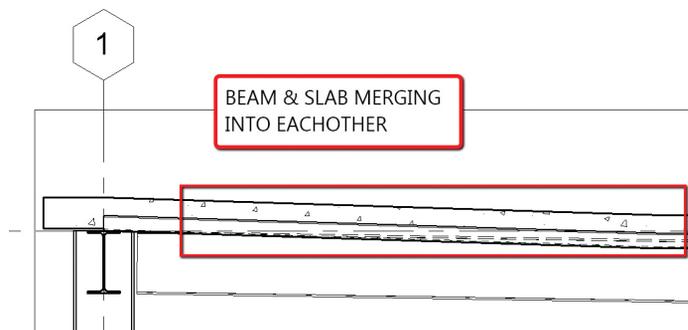


Figure 10: Not good

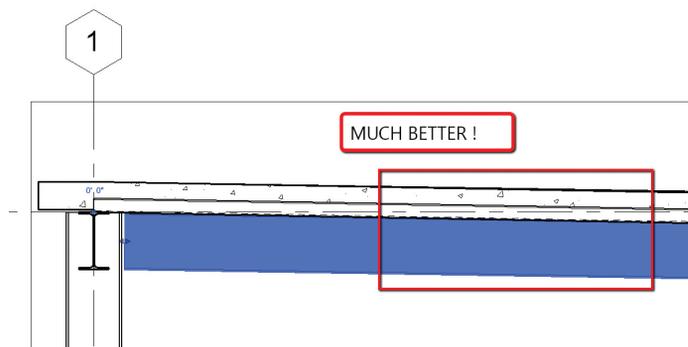


Figure 11: Not bad



Adam Muñoz started with hand drafting in his freshman year at Roseville High School in 1992 and was introduced to AutoCAD a year later. He has a degree in Electro-Mechanical design and has also assisted as a drafter in Architectural, Mechanical, Electrical and Plumbing. Adams passion for 3D Modeling and Animation as well as Structural Drafting and Design has helped him embrace Revit Structure since Release 2 in 2005. He currently works as a Structural Drafter in the Roseville office for Hammel, Green & Abrahamson, an integrated architectural, engineering and planning firm. He can be reached at [amunoz@hga.com](mailto:amunoz@hga.com)



Figure 9: Options "Do Not Cut" and "Intersect Column Middle Line." Crazy things happen if you don't (such as columns half disappearing).



# Real Quality Assurance

I grew up in two very different worlds: Europe, where we had huge amounts of resources but seemed to accomplish very little, and Africa, where the reverse was true—we had very few resources and accomplished the seemingly impossible. I began my career in engineering and construction in Africa, where we practiced Quality Assurance religiously, systemically, and systematically. We didn't name it as such—we just knew that because we couldn't afford to correct mistakes, we had to do things right the first time, every time. Sadly, when I came to the U.S. I found that in America we are emulating what I saw in Europe.

There are many reasons this is so. First, QA, properly practiced, is neither simple nor formulaic: it requires long-term commitment, long-range planning, and the patience to tolerate delayed gratification—none of which are typical characteristics of American companies. Second, too few companies recognize consequences from failure to practice real QA. Finally, and insidiously, easy access to capital resources encourages the correction of mistakes through expensive re-work.

Insurance, regulatory, and the economic challenges bring a renewed interest in the benefits of real QA because real QA serves as a risk management methodology, a business strategy, and a profit driver. A real QA program can be viewed, metaphorically, as the seat belt that no company should operate without.



## REAL QA IS A RISK MANAGEMENT METHODOLOGY

Real QA serves as a risk management methodology by reducing the probability of liability events and the cost of insuring against such events. In the past five years, the insurance environment has undergone tremendous change (see the sidebar *Risk Management, Before and After 2008*).

The better insurers understand the positive influence of QA programs on company-wide operations, the lower the potential risk, the lower the cost to offset that risk, and ultimately, the lower the insurance premium. Companies with comprehensive and effective QA programs produce better products and avoid more catastrophic events. Premiums rise for companies that fail to practice what their dusty QA manuals teach—if they're eligible for coverage at all.

### SOX AND OTHER REGULATORY RISK

The risk of violating regulations and paying ensuing fines or penalties is virtually uninsurable. Somewhere, on every insurance application form, a company officer or designee must attest that the company adheres to regulations governing its industry. While different industries operate under different production-related regulations, all companies must abide by financial regulations. The Sarbanes–Oxley Act of 2002 (SOx) produced a slew of new financial regulations for public companies.

Ten years later, the implications of SOx are just beginning to be fully understood. In particular, the impact of the requirement—that management and the external auditor report annually on the adequacy of the company's internal control over financial reporting (§ 404)—continues to be debated.

While regulators and legislators do not always name QA as an outright requirement, QA programs—where they exist—play a significant role in demonstrating to regulators and auditors that a company adheres to regulations or accepted best practices. Indeed, in many industries, a license to operate depends on attestation that a QA program is in place.

### REAL QA IS A BUSINESS STRATEGY

The underlying operating principle of virtually all quality assurance systems is an iterative, four-step quality assurance cycle of continuous improvement—Plan–Do–Check–Act, then start over again at Plan. It's simple, and it works—but only if QA is applied systemically and systematically. You cannot isolate one function of a company or a process, apply QA only there, and expect success. Nor can you mount a time-limited QA blitz and expect persistent results. QA is an iterative system that embraces the entire operations of a company.

### REAL QUALITY ASSURANCE IS ...

Real Quality Assurance is a systematic methodology for doing things right. In many ways, it is a state of mind. It is all encompassing in that a promise of quality must be a reflection of the total operations of the company as a whole. We have all heard it said in jest that “the operation was a success, but the patient died.” If QA is implemented piecemeal, with some departments adhering to a specific quality-control protocol and others to a different one or even to none, it might be said that one aspect of the total effort was executed with excellent quality—but the customer was not satisfied with the product.

### QA IS A PROGRAM, NOT A MANUAL

For a long time, quality certification programs relied on documentation to demonstrate a company was applying QA in its operations. Unfortunately, this fueled a focus on documentation to the detriment of action. Many QA programs that exist today are really manuals of policies, procedures, and checklists. Often, the entire manual simply sits on a shelf and is dusted off when the auditor comes.

In other cases, individual policies or procedures are faithfully carried out in isolation by individual departments. These may be the departments that have regulatory or contractual compliance requirements. These departments may individually be practicing quality control, but the company does not have a quality assurance program!

We see proof of this when we are called in to do root cause analysis on a catastrophic project failure. We ask: “What was the primary controlling QA program that you were using during this failed project?” The most frequent answer is some sort of specific QC protocol—a good indicator that there really was no company-wide QA program in place. But then, companies that adhere to a real QA program as described in this article rarely have to analyze failed programs.

### QUALITY ASSURANCE IS NOT QUALITY CONTROL

Quality assurance is a radically different approach from enforced quality control. At a psychological level, QC attempts to enforce seemingly arbitrary rules for human behavior—which we know is not often a successful approach. QA, on the other hand, promotes organizational structures that encourage employees to act in certain ways.

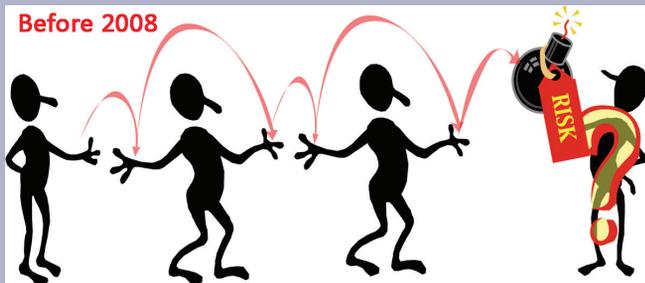
QA	versus	QC
methodology	drives	paperwork
people	not	statistics
continuous cycle	produces	individual outputs
	≠	

Quality assurance strives to deliver customer and employee satisfaction; quality control, too often, seeks compliance with external mandates (such as regulatory compliance requirements) or generic checklists. An internal culture of collaboration drives QA while outside forces dictate QC. Real QA programs focus on people and their actions; statistics and reporting represent byproducts that serve as useful tools, but not the true measure of success.

### RISK MANAGEMENT, BEFORE AND AFTER 2008

Businesses manage risk by identifying and assessing potential risks, then prioritizing the allocation of resources to minimize, monitor, control, or insure against them. Until about 2008, the core of a risk-management plan could often simply be described as “quantify the risk and insure to that amount.” With easily obtainable insurance as a safety net, few perceived a need to qualify risks and adjust internal procedures to actually reduce the probability of an event.

Companies qualify for insurance based on a risk analysis profile. Up to 2008, a declaration that QA was in place could influence the profile and enable the company to obtain General Liability, Product Liability, and Errors and Omissions insurance coverage—without which it could not operate—at very affordable rates. Neither businesses nor insurers performed real risk assessment.



Insurance companies aggregate their risks and offset them by bundling them up and reinsuring them. In essence, prior to 2008 risk management was accomplished by handing off risk: businesses passed it to insurers and insurers passed it to reinsurers. As with every good game of “pass the hand grenade,” eventually there was a loser. In 2008, claims escalated to stratospheric proportions, and top reinsurers started to reject claims on the basis that many of the risk-analysis profiles on which risk assessments and coverage had been based had never been verified, thus invalidating coverage.



Post-2008, insurers have increased the level of scrutiny and due diligence investigation of the declarations on which the risk profile is based. True risk-management profiles are being drawn that are a total reflection of the risk potential of the company as a whole. As insurers are now insisting, risk assessment must be based not on paper declarations, but on the actual operations of the company.

Finally, real QA is a continuous, iterative, and active process. A true QA program is never “completed,” but instead manifests continuous improvement; it is not about inspecting individual outputs. We represent the Plan–Do–Check–Act cycle as a spiral, because real QA is a repetitive process that is always looking for further improvement by a continuous re-examination of the complete activity. Tremendous problems are caused by QC systems that take the opposite viewpoint and mandate that what is happening in the real world is irrelevant and the written record is all that counts.

### CONSISTENCY AS A MEASURE OF QUALITY

Consistency of practices is one of the most important indicators that a company is practicing real QA. This is a fundamental yet simple principle. Real QA is both systemic and systematic. Evidence that real QA is being practiced will be pervasive throughout an organization. Any manager or administrator can check this by simply looking at any practice or problem and checking four aspects of any activity. When we do a process audit, the first thing we do for any process is ask these four questions.

1. You say you are running a Quality Assurance program: describe it to us.
2. Show us the **written** documentation that supports your statement.
3. Show us your MIS/IT system and allow us to verify that, at all stages, the programmed workflow, activity logs, and web records support your original statement
4. Allow us to visually observe as you **do** the work you have described.

We call this the Say–Write–IT–Do cycle (see the sidebar on Say–Write–IT–Do). Very simply, if the answers to all four questions are consistent among themselves, it gets a green light; if not, it gets a red or amber light.

You can perform this check on any activity. It’s a very simple check that takes little time and anyone can ask the questions (it doesn’t have to be an expert in the field). Companies that practice real QA will have lots of green lights, whereas companies that don’t will have lots of red lights. Paradoxically, this simple test is, at the same time, much easier to perform, far more detailed, and generally more actionable than an ISO floor audit.

### REAL QA IS A PROFIT DRIVER

QA may be my personal religion, but the practical reason that companies with real QA programs practice it is because, when practiced correctly, quality assurance improves the bottom line. When systems of production and service are being continuously improved, both quality and productivity improve. When people and organizations focus primarily on quality, quality tends to increase and costs fall over time. This has been represented formulaically as:

Quality =	Results of work efforts Total Costs
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Of course, the right side of the equation is also one definition of profit. The positive impact of real QA can be measured against the corporate bottom line, and the formula is still relevant today in all industries.

### INTEGRATING REAL QA

Let's recap:

- QA is a state of mind
- QA is a system that embraces the entire operations of a company
- QA is a business strategy
- QA is a risk-management methodology
- QA is a profit driver.

With the technologies available today, QA can easily be integrated into the information systems of any company. A simple dashboard like the one illustrated in the sidebar can become a continuous monitoring system that not only alerts management when a process is veering off track, but also reassures funding sources and ensures that a company is actively practicing QA, and that its QA system is in good health.

Ultimately, however, it's the first bullet that counts. When QA is integrated into the culture of a company, waste is radically reduced and profits increase. It's that simple.

*This article is adapted from "Real Quality Assurance: An Article for Executive Managers and Administrators," a white paper from IDEAS that can be found at <http://www.ideapete.com/pdfs/RealQAforExecs.pdf>. Pete Baston's presentation on this topic is proving to be one of the most sought-after presentations in boardrooms everywhere, and the nearly universal response is "So that's what QA does to our bottom line! Why didn't anyone explain it like this before?" Major re-insurance companies are also watching the development of IDEAS' XML templates for web-based consistency reporting with interest.*



Peter Baston is the CEO of IDEAS, a business technology integration company. IDEAS uses intelligent quality metrics to perform due diligence and risk analysis of large projects in many different industries worldwide. An expert in the configuration of integrated parametric technologies for project, operational, and fiscal management, Pete has a passion for doing it right in the real world and a reputation for accomplishing the seemingly impossible.

### SAY-WRITE-IT-DO

Previously, we described a simple four-step process analysis that we use during process audits. We called it the Say-Write-IT-Do cycle. Performing this kind of analysis is a quick and easy way to tell if a company is adhering to best practices of any kind, or practicing QA. To analyze processes in this way, you do not have to know the jargon, understand highly technical issues, or have had extensive training at the highest level of any specific QA or QC program.

We use a simple web-based system to collect the results of individual process analyses, which can be logged on a mobile device. When a log entry is created, the entry envelope automatically associates each record with a location and a time. Coupled with a model of the workflow, the system uses an algorithm to calculate the overall process health based on the Say-Write-IT-Do scores.



Company A	Process	1	2	3	4	5	6	7	8
	Say	39° 5'02.18" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N
Write	16 May 2011 13:27:21								
IT	39° 5'02.18" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N
Do	16 May 2011 13:27:21								

Company B	Process	1	2	3	4	5	6	7	8
	Say	39° 5'02.18" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N
Write	16 May 2011 13:27:21								
IT	39° 5'02.18" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N	105° 5'08.49" N
Do	16 May 2011 13:27:21								

The results of the analysis of individual processes are aggregated at any desired level (department, division, etc.) Above is a comparison of the display of results from two different companies. You can see at a glance which company is on relatively sound footing and which one is in trouble. Would it surprise you to know that Company B entered bankruptcy shortly after this snapshot was taken?



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