

## Autodesk Revit for Project Managers

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**AB308-5** This class will cover the issues that project managers face with managing Revit projects in their office. We will cover simple navigation, commands, and implementation strategies that are required to effectively use Revit alongside project designers. We will also discuss the differences in workflow, as well as the change in process, and issues to watch out for while managing Revit projects and new Revit users.

### About the Speakers:

**Jim Balding** is a licensed architect with more than 20 years of experience integrating technology into the architectural field. He is currently employed with WATG in Irvine; CA. Jim earned his Bachelor of Environmental Design degree from the University of Colorado, Boulder. He has been a member of the Autodesk® Revit® Architecture Client Advisory board since its inaugural meeting and served as the Revit Product Chair for AUGI® for five years. He also served as the South Coast Revit Users Group (SCRUG) president for five years. Jim has spoken at several technology conferences and is one of the top-rated speakers at Autodesk University. He has developed a successful Autodesk Revit Architecture implementation strategy and is currently bringing the six offices of WATG up to speed in its use. Jim is currently serving as the Director of WimberlyLabs, the design technology R&D arm of WATG. [jbalding@watg.com](mailto:jbalding@watg.com)

**Scott D. Davis** Scott D. Davis is an AEC Technical Specialist with Autodesk, Inc., and specializes in Revit Architecture and building information modeling (BIM). Since joining Autodesk in March 2007, he has been active in promoting BIM around the country at events including the AIA Convention and Green Build International Conference and Expo. He has taught classes on BIM and Autodesk Revit at Autodesk University and at AUGI CAD Camps, and was the founder of the Revit Users Group Inland Empire. Prior to joining Autodesk, Scott was a Project Manager and the Technology Coordinator at WLC Architects, Inc, in Rancho Cucamonga, California. At WLC, Scott was responsible for bringing BIM to the firm, first discovering Revit in the spring of 2000. He was responsible for the firm-wide implementation of Revit for over 100 users across 3 offices. Scott's BIM portfolio includes the Child Development Center at Long Beach City College and the Silverado Ninth Grade Campus for Victor Valley Union High School District.

## Introduction

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As BIM and specifically Revit become more and more mainstream in the AEC industry the traditional roles are now becoming immersed into this new paradigm. One of those roles is the role of the Project Manager (PM). This class will review the traditional PM and how Revit both changes and enhances the PM role.

This session has grown out of training sessions from 2003/2004 that were conducted in the offices of WATG. It was initially all about "What is it" and a "How To" guide. As we contemplated this particular class we decided to take a fresh look at the topic resulting in a guide to what it means to be a PM in a BIM world. The following is the result of our research. Much of the document assumes that the readers are relatively new to the realm of BIM for the PM and we attempted to keep it as basic as possible. This document can be characterized as a generalization, "your results may vary"

## What does a Project Manager (PM) actually do?

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In order to define a Revit for PM's class one has to understand what a PM actually does. This can come from personal experience (both Jim and Scott have served in this role), interviews and large scale surveys/brainstorming. So, that is just what we did. We collaborated on our own experiences, interviewed several PM's from other firms and conducted brainstorm sessions with our local Revit User Group (SCRUG). Below are the tasks outlined from our findings with a blurb on how a new BIM process will "**MAY**" be affected.

### Manage

**Expectations: Client** - A PM must understand the BIM process and how it changes the deliverable, collaboration and effectively communicate that with the client to eliminate the "fear of the unknown".

**Expectations: Team** - The PM must manage the internal and extended design team. They must have a solid understanding of the workflow and expectation and be able to drive the team towards that common goal with new tools

**Expectations: Consultants** - Consultants, whether they are using Revit, 2D CAD or other platform have expectations in terms of getting information required to efficiently prepare their documents. The PM needs to understand and work with the team, the model and/or 2D drawings. The PM must allow time to provide the data as well as understand the short comings of working in this transitional period.

**Project Resourcing** - Revit projects are different; they are sourced differently; the PM needs to know the difference. This can vary from office to office. Early in an office implementation the teams are generally the same size as a traditional AutoCAD project. As the users progress in their BIM skills the team roles will change resulting in new, smaller teams. See Addendum A for a sample

**Project Scope** - As the BIM process matures we are finding that the line traditional phases are blurring between conceptual design, schematic design, design development and construction documents. This continues to blur as firms embrace Integrated Project Delivery (IPD) where the contractual relationships are blurring as well. In this transitional period, it is important for the PM to maintain focus on the deliverable, occasionally this means using traditional 2D drafting tools to meet deadlines when the entire design is not fully developed (The Horizontal Approach). See "What to Avoid" for the "Over Modeler"

**Project Budget** - Project budget becomes a bit tricky as a PM must understand that the BIM process tends to front load effort in contrast to a traditional delivery. A project "in trouble" during the concept or schematic phases may very well find itself very profitable in CD's. This is often the result of modeling a building using "real" building components lessening the documentation load traditionally performed in the latter stages of a project. As proposals and the BIM process is better understood throughout the industry this phenomenon will balance out.

**Project Schedule** - Managing the project schedule can be challenging to a PM new to the BIM process. Knowing that projects are often front loaded, that modeling a building "for real" takes time and that revisions are handled differently are key to a PM managing a project schedule. The PM will often see the ROI when certain types of revisions are handled much quicker in a proper BIM model. Understanding the project schedule change will take experience. The rule of thumb is three complete "typical" projects is when a full comfort level is established.

**Document Control** - Managing the drawings in Revit is different than CAD, and therefore the PM should be aware of the differences. Rather than controlling a multitude of individual DWG files that make up a set of documents, a Revit project is typically one RVT file per discipline and the documents all reside in the one file. As changes are made, the documents are automatically coordinated throughout the documentation set. This is important to a PM for several reasons. First, the time it takes for a project team to make changes is reduced. Rather than having to manually coordinate changes across many DWG files, the team simply needs to make the change in any view, and that change occurs across the entire project. Next, if there is an error anywhere in the drawings, then the error occurs throughout the documents. As a PM, this makes it easier to identify errors as they tend to be more visible when under review. Finally, as a PM recognizes an error in a Revit project, he or she only needs to mark-up the error in one location. As the team picks up those comments, the change affects the entire project. In a typical CAD process, the PM would need to identify the change throughout the documents and red-line it throughout the set. This is important because the time it takes for a PM to review a set of documents is reduced in Revit.

**Crisis** - As a PM manages crisis, BIM will alleviate some while exposing new. In the long run, a good Building Information Model (BIM) will far out perform the traditional 2D world's crisis.

## Administrative

**Review/write Proposals and Contracts** - This, above all, can be critical. A PM must fully understand what his/her team can deliver before contractually agreeing to anything. Often, a firm new to BIM will not change their proposals/contracts until their culture and process change has grown to maturity and is well established. Delivering plans, sections and elevations on paper with the associated dwg files as required.

**Code Analysis** - A PM that provides code analysis should be aware, if not using, Revit as a true database to assist with code analysis. There are numerous examples of this application; the most obvious is the use of areas and occupancy load factors to establish occupancy loads. Associate that with room color fills for a visual report.

**Marketing** - Understanding the BIM process will help a PM "Talk the Talk"

**Mentoring** - It is often said that younger staff "don't know how to put a building together". BIM provides an excellent opportunity for the passing of "constructability" knowledge from the senior to junior staff. The

reverse is also true as the senior often is drawn into the technology that they otherwise would not have been.

**Programming** - BIM does not directly affect the external efforts outside of potentially gathering data from completed models. The PM should know that programmatic information can be input into Revit to aide in the layout of spaces giving direct, immediate feedback to the project designer.

**Project Research** - Revit has capabilities that can help a PM research the project. Predicting a building's energy performance is once such capability. Using the model, a PM and the project team can try different options to optimize the design for energy efficiency. The PM can use the model to research how different manufacturer's products might affect the project. For instance, a PM could easily change all the windows from one manufacturer to another in a project, and get instant feedback on how the change affected the cost, aesthetic, and performance for the project.

**Review Drawings** - Gone are the days of checking each and every detail reference, section head and elevation tags\*. Revit handles that allowing the PM to be confident that they are cross referenced properly. It should be noted that the elevations and sections produced directly from Revit do not provide the traditional linework that one might be used to in a drafting environment. Linework tools and silhouette solutions are required, but often require more time than users like to spend. One solution used at WATG is to turn on the shadows to establish the depth rather than rely on lineweights. It does take some getting used to. \* Unless you see the "sim" or "typ" notation.

**Meetings: Clients** - A PM up to date on BIM will welcome the BIM into the meetings live or static (on paper) to be used as a communication tool as well as a resource for data - areas, materials, dimensions, etc. etc. etc.

**Meetings: Consultants** - More and more, consultant coordination meetings are live editing sessions. Efficiencies gained with users manipulating and sharing models in the same room or at the same time is proving to be very efficient. Of course the larger revisions and coordination issues will require more time to rectify.

**Meetings: Governmental Agencies** - While it is less likely that a live model will be used in a governmental type meeting, the use of 3D has great advantages in communicating and proving conformance. It is now becoming common place for agencies to require a BIM model as a submittal item.

## Production

**Design** - Better start the tutorials and contact your BIM Manager.

**Detailing** - A PM that traditionally produces details on a project should go through the training to produce details using Revit's detailing tools. As a rule of thumb 2 to 3 days of on the job training will provide enough knowledge to produce 95% of all details.

**Specifications** - The PM that traditionally produces the specifications on a project should go through the training to use a tool that takes advantage of the BIM database. E-SPECS is the leading specification tool for use in tandem with Revit. As a rule of thumb is that 2-3 days of on the job training will provide enough knowledge to produce the specifications.

**Project Coordination** - PM's often have to provide multi-discipline coordination, as well as the coordination of their own work. In a CAD workflow, this coordination was often done by overlaying CAD files in the computer or by laying printed sheets on a light table. This was almost entirely a manual process and prone to errors. In Revit, this type of coordination is done in the software, and tools are provided to help understand what changes have occurred. It's important for a PM to understand tools such as Coordination Review and Interference Check.

**Markups/Redlining** - Redlining or marking up continues to be a good tool for communicating clarifications and revisions. PM should consider "keeping it digital" with the use of any number of markup tools available. Autodesk Design Review allows for 2-way document communication and roundtrip coordination. Other products being used are Autodesk Sketchbook Pro (SBP) which adds pressure sensitivity in conjunction with a Wacom device and virtually unlimited pen selection. SBP is better used for the artistic markup rather than the straight forward redlines to communicate. Others are using Adobe Acrobat for PDF markup. It should be noted that this solution is not "round-tripable" and unless you already have Acrobat, is a more expensive solution.

## New Concepts and Processes

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The difference between moving from hand drafting to CAD was much less disruptive than the process change from CAD to BIM. Moving from hand drafting to CAD was essentially taking the same technique, and moving it from pencil/pen and paper to the computer. We were drafting on drawing boards, and then we were drafting with the help of a computer. Not much changed in the way we thought about the drawings. We adapted techniques from hand drafting and applied them to CAD, such as line weights in a drawing to make them "read" with more depth. CAD helped us automate some time consuming tasks in hand-drafting, such as the drafting of repetitive objects. In CAD, we just simply copied a group of lines or made blocks to easily repeat objects. While it was a change in process to move from hand drafting to CAD, it was less disruptive because it was *still drafting*.

With BIM and Revit, the process is much different. While the typical set of deliverables is, at this point, still a set of construction documents with BIM, we are no longer drafting lines, arcs and circles that represent the components of a building. Instead we are placing objects that are intelligent to create a virtual representation of the building. A door in the floor plan in CAD was represented by a rectangle and an arc, but the rectangle and arc were just lines. In Revit, we place a door object that is intelligent enough to know how to display properly in plan, section, elevation, schedule, and 3D. It's no longer just a collection of lines, but an object that can have any number of parameters that describe information about the object. In the case of the door, this could be the materials of the frame and door panel, the fire rating, the hardware, the size, and much more. When learning Revit, it's often been said that one should forget all they know about CAD. While this seems harsh at first, it will make the transition to BIM less disruptive. We can't simply adapt the new technology to fit the old process like we did when transitioning to CAD. The faster one stops trying to make Revit act like CAD, the faster one will be successful with Revit.

**From CAD to BIM:** Here we will look at some of the biggest differences between CAD and BIM to help one understand this transition.

**From Drawing to Modeling:** In CAD, we produced a number of drawings that existed as individual CAD files. (DWGs). These individual drawings were referenced together to produce the sheets that ultimately became the construction documents. There was no relationship between these CAD files. Each one

needed to be opened separately and all changes in each needed to be manually tracked and updated in any other drawing where they occurred. Only one person could edit a file at a time. In BIM we create a model of the building in one single file. All of the drawings exist in this one file as live representations of the model. All of the drawings update quickly as changes are made to the model. Multiple people can work on the single file at one time using Worksets, a collaboration tool in Revit.

**From Vectors to Database:** In CAD, we drafted vectors. These vectors as lines, arcs, and circles represented the building components. The vectors held little to no intelligence, other than knowing that they were lines. In BIM we are creating a database of information. The objects that represent the building components are intelligent in that they can be loaded with information and they understand what they represent. The database we create describes the objects in a graphic format (plans, sections, etc.) and also in a tabular format such as a door schedule. The database and all of its information is completely interrelated. A change to the database changes this information and affects the way it's displayed. Any view in Revit is simply a query of the database and the subsequent display of the information in a graphic or tabular way.

**From Drawings to Information:** In CAD, we produced drawings. These drawings provided information. In BIM, we can produce drawings, but they are the by-products of the information that we input.

**From Representations to Objects:** In CAD, lines are used to represent objects. Two lines 5" apart could be used to represent a wall, but they are just lines, just a representation. In Revit, we place objects. We place a wall, and the wall knows that it is 4 7/8" thick, and is composed of wood studs and gyp board and has 80 square feet of surface area. It's an object loaded with information.

**From 2D backgrounds to Model Sharing:** In CAD, we shared 2D background drawings with our consultants. The consultants would reference our drawings into their CAD files, and draft more lines over the top of our backgrounds to represent more objects. There was no relationship between our file and their file. In BIM, we share models, and as we read earlier, are ultimately sharing databases of information. Sharing models shares intelligence and the models can relate to each other. We can be notified by collaboration tools in Revit when the objects in the models has changed. If the architect moves a wall, the structural engineer can be notified of the change to the database.

**From File Management - Local to File Management - Central:** In CAD, all of the individual files were typically stored on a network location. Depending on the particular office standards, these files could have been spread across several folders as well. Managing these individual files took careful planning and consideration as many files were referenced (X-ref'd) together to create the documents. If a collection of drawings was to be sent to a consultant, one had to be sure all the related files and x-refs were also sent and that the correct paths to these files were used. In more recent versions of AutoCAD, tools were introduced to help manage all of the files. In BIM, one file is used and is stored on the network. One "central" file is used by everyone on the project. Since this one file is the database store for all the information, there is no management of hundreds of files to produce the project.

**From Drafting to Architecture:** In CAD, we drafted our plans. A PM or designer could produce a sketch on trace paper, hand it to a draftsman, and they could go reproduce the linework in CAD. This was a mindless task, and often times the draftsmen may not have knowledge about what they were drafting. In BIM, the team is producing a representation of the building so an understanding of how the components of the building go together is necessary. As the model is produced, you are in essence "constructing" the building. Rather than drafting, in Revit we are doing architecture: creating the building.

**From CAD Management to BIM Management:** In this next section, we will look at the new concepts and processes of Management.

**From 2D Collaboration to 3D Collaboration:** In the CAD days, we collaborated in 2D. We sent 2D drawings to consultants and received 2D drawings in return. From these 2D drawings we had to interpret 3D and make design decisions based on these interpretations, leading to many errors. In BIM, we can collaborate in 3D. We share 3D models that are databases rich with information. Further, when collaborating with 3D models, we can run interference detection to find clashes that in traditional 2D CAD may not be found until the project was under construction.

**From DWGs to Consultants to Models to Consultants:** In sending DWGs to consultants, we were supplying many files that the consultant then had to manage. In BIM, we send them one model with all of the information included.

**From Manual Coordination to Automatic Coordination:** In CAD, much of the coordination was done manually. A change on one floor plan would cause one to also manually make that change in any other drawing it occurred. If a sheet number changed, one would have to manually coordinate the change by a making sure the references to that sheet also were changed. In BIM, change management occurs automatically. A change somewhere in the database is a change everywhere.

**From CAD Standards to BIM Standards:** CAD Standards and BIM Standards are quite different. CAD Standards deal with the management of CAD. Things like layer standards and xref naming conventions could be found in a CAD Standards manual. Most CAD Standards manuals are thick documents with page after page of guidelines to follow to provide consistent documentation. In Revit, these "standards" are controlled by the use of a template file that provides the consistency. BIM Standards would provide guidelines for items such as family creation standards, for the creation of objects in Revit on a consistent basis,

**From Typical Deliverables to New Deliverables:** We have been delivering a "typical" set of documents for many years. This typical drawing set was born from the days of hand drafting, and included floor plans, sections, elevations, schedules, and details. Little to no 3D was used, with the exception of some axonometric drawings and an occasional perspective on the cover sheet. In BIM, we can rethink our set of deliverables. The ease in which one can make 3D section views, perspectives, and more changes the deliverables. Additionally, the drawing set itself is being transformed by BIM. Many have hypothesized that we will soon deliver an electronic model instead of a set of printed paper documents.

**From Printed Paper Output to Printed Model Output:** In CAD, we waste more paper than ever. The printer has made it easy to produce and reproduce paper documentation of 2D plans. With BIM, we can begin to show more information by printing in 3D. We can now describe a building or a part of a project in a physical 3D model by "printing" it using a Zcorp printer or other similar technology. We are also getting closer to digital fabrication of building components by having the BIM model drive manufacturing equipment such as CNC milling machines.

**From a CD loaded Process to a Front Loaded Process:** In CAD, we spend the bulk of our budgeted time in the CD phase. This can be as much as 50% or more of the project time. In BIM, we spend far less time creating CD's since they are a byproduct of the model, and more time in the early design phases. A PM must be aware of this shift in the process in order to budget and bill appropriately for these services.

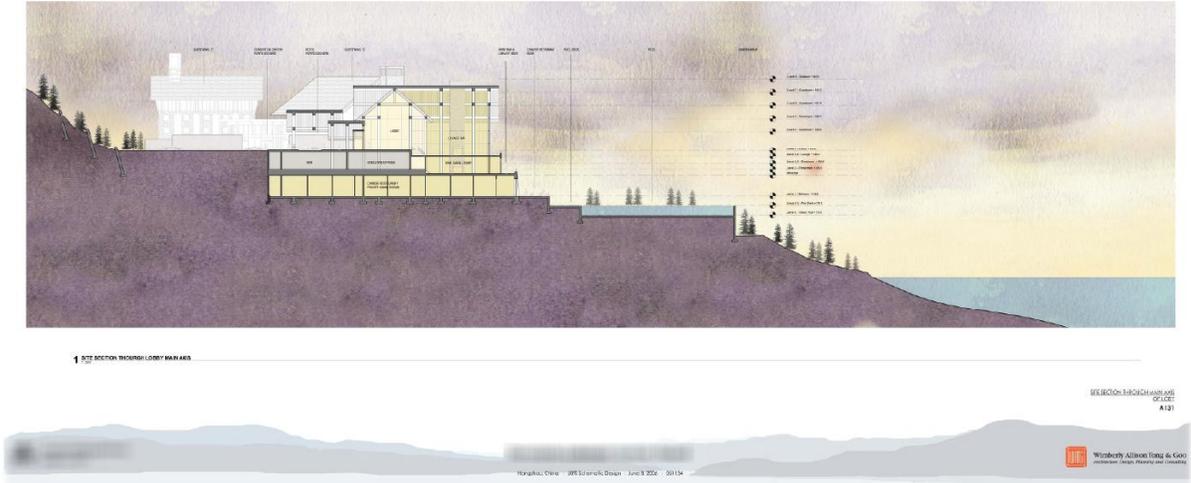
**From a Drawing-centric Team to an Information-centric Team:** In CAD, the team was focused on drawings. Some team members might work on plan drawings while others work on elevation drawings. In BIM, the team focuses on adding information to the database which in turn creates the drawings. It's this different approach that a PM needs to understand as a difference between CAD and BIM.

**From Traditional Phases to New Phases:** In CAD, we typically have phases which are defined by milestones in the project. Schematic design, design development, construction documents, etc., are the traditional phases of design. In BIM, the lines between these phases are being blurred or even erased. Construction documents are being created from the moment the project begins so the CD phase as we know it can be much shorter and not clearly definable by milestones. Schematic design and design development are becoming simply the "design" phase as there is less of a need to separate the design of a project into separate phases.

## The Horizontal Approach (HA)

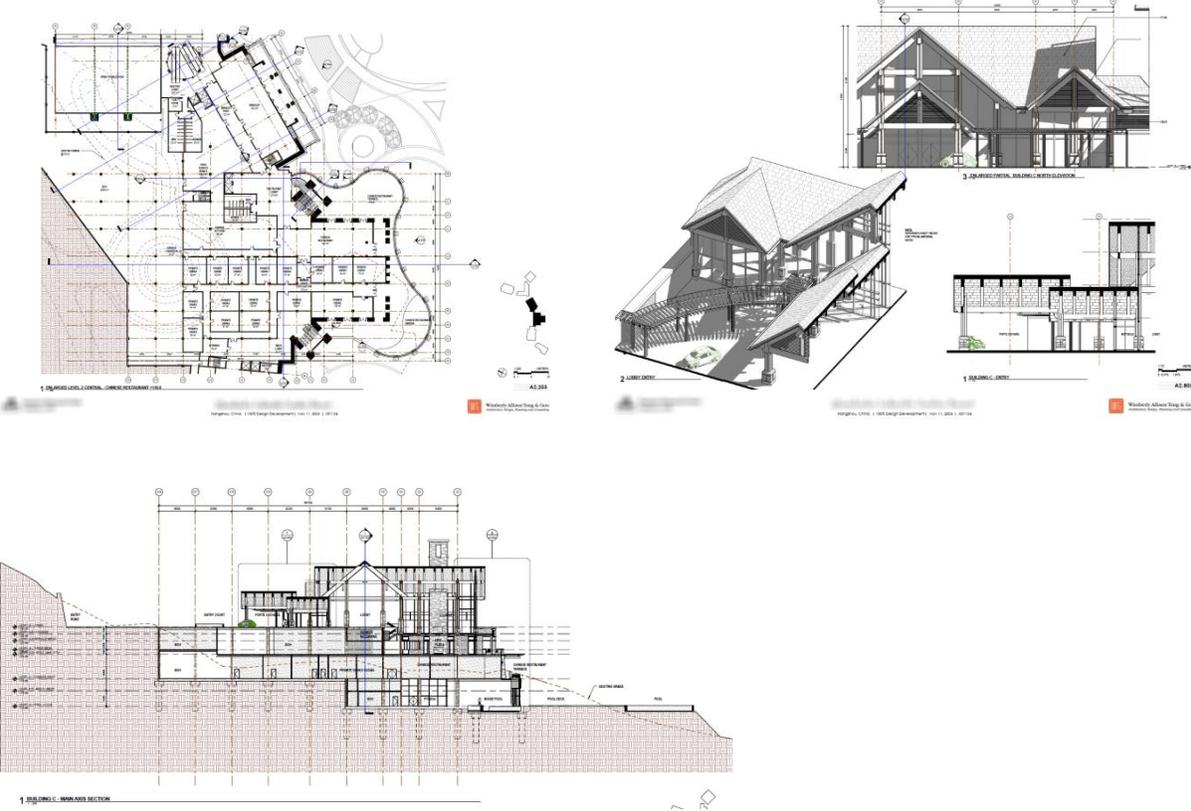
The "Horizontal Approach" (HA) is a technique that has evolved out of CAD implementation practices in the early 90's. It dictates that the horizontal views are produced with the "new technology" and the vertical views are produced in the traditional manner. In the 90's it was CAD for all plan views, enlarged plans, details and schedules, by contrast the sections, elevations, vertical details were produced by hand. Today, Revit is the new technology responsible for the plan views and CAD, hand drawings or even watercolors are used to produce the vertical elements. There is **ONE MAJOR DIFFERENCE** between then and now. The Horizontal Approach is only used during the early stages of a project and the expectation is that a full BIM will be the lone (or major) tool used for production by the time you are wrapping up the design development phase heading into CD's. This approach has many, many advantages; the two most notable are the fact that it lowers the learning curve for new users as there is less to learn early in the design process as well as detaching the plans from the elevations and allowing them to be "uncoordinated" early giving some design flexibility.





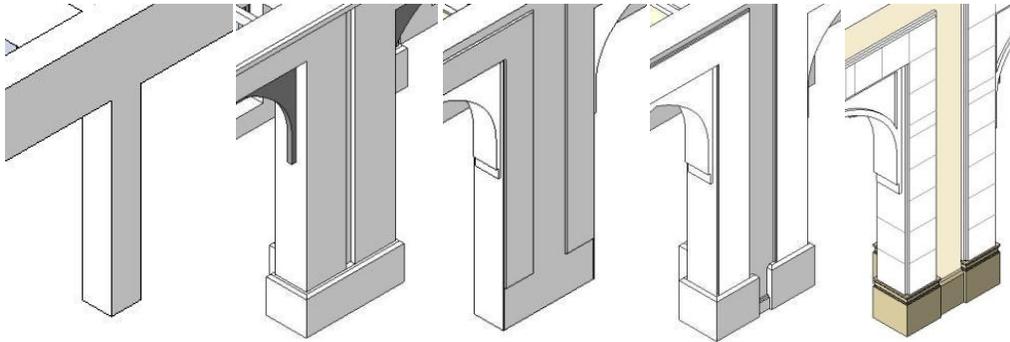
In the sheets above the floor plans are 100% Revit with an image of the site as a background. The elevations are the design watercolors imported into Revit utilizing the datum and graphics. The section was created with AutoCAD and Photoshop all based on an export from the Revit model.

The images below represent the same project at the end of the design development stage. Note that the model is fully detailed by this point.



## The Place Holder Approach (PHA)

The "Place-Holder Approach" is an approach that is designed to be used in conjunction with the "Horizontal Approach" though the schematic design phase into the design development phase. The concept is that detail level of the families you use on any one project mature over time as the design matures - going from massing to detail; large to small. When properly communicated, this lowers the expectations for fully detailed models early in the design process. If a family or set of families have been fully detailed early in the design phase and then it is determined that they are no longer necessary in the project you will have wasted the time spent detailing when a massing model would work for the time being. This also allows the model as a whole to mature systematically rather than have a few small areas fully detailed while others are bland and barren. The example below shows the evolution of a column in a colonnade, a small part of a much larger project. This evolution occurs over the six week period of schematic design.



**Figure 1: Week 1** - The column has been placed establishing a location and a rhythm or count in the colonnade. Early in the conceptual design process the size is not critical and the "architecture" on the exterior is even less important. Note that there was no change to the column during week 2 as the focus was on getting the plan right and exploring the exterior design by hand.

**Figure 2: Week 3** - With the rhythm has been established. Now is the time to establish the size and design the exterior finishes. The model is becoming more "elevation friendly" and proportions are settling in. Note the arch inset does not have an appropriate thickness at this point. This is key to the PHA as this family has been placed as a place holder and will evolve as time moves on.

**Figure 3: Week 4** - Note the inset has now gained an appropriate thickness and a notch has been added at the bottom and the surround has a step to it. The base was removed, to be replaced later.

**Figure 4: Week 5** - The base has been redesigned; the surround has an additional step.

**Figure 5: Week 6** - The final design of the column. The inset has a depression, the surround has model lines representing the stone pattern, the base has its final design and materials have been added for rendering purposes.

## Six Phases of a Revit User

The "Six Phases of a Revit User" was first published by Christopher Zoog on the ZoogDesign Forums in 2003. It is a lighthearted look at the emotions of a Revit user as they travel along the Revit learning

curve. While it is light hearted it is **VERY ACCURATE** and a PM should take note and understand that their team members will, indeed, go through each of these phases. When staffing a project it will be essential that the team is balanced with Zen Masters (or Enlightened) as well as those in Phase One. It should also be noted that once you reach one phase, it does not guarantee that you will not fall back to a lower phase at some point.

**Phase One - Initial Excitement!!!** - "Holy Crap! Look what I can do with this thing!"

**Phase Two** - First bump - "Hmmm...? Why won't it do what I want? That's not how I do it in (insert other cad software here)!"

**Phase Three** - Creamy Middle - "mmm... things are going more smoothly, now.....mmmm"

**Phase Four** - WTH stage - The family editor "eats you up and spits you out"!

**Phase Five - The Enlightenment** - Things really begin to click! You understand why things are happening in your model, and better yet how to control them and avoid problems. You have conquered the family editor.

**Phase Six - Zen of Revit** - You have mastered nearly all things Revit. You "know" what Revit "likes", and what it "dislikes" during model construction, a sixth sense, really. You spend your time exploring and tweaking advanced scheduling, OBDC, external parameters, AR3. You have a template to beat all templates, families for every situation.

Many people ask how long it takes to get to phase six. There is no real time frame as there are far too many variables to predict. The accepted time frame is that it takes about 3 "typical" projects to get to phase 5. So, if your typical project length is 2 months, then some where in the range of 6 months.

## 5 Emergent Categories of BIM Evolution

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Another study that PM's should be made aware of is the 5 Emergent Categories of BIM Evolution by John Taylor while at Stanford University. During the kickoff meeting these categories can be used to help asses the teams BIM goals. It should be noted that some disciplines can achieve different goals on the same project, i.e. a structural engineer may use analytical tools while the architect is looking to achieve coordination. The 5 categories that John refers to are:

1. **Visualization** - Sectional Perspectives, Renderings
2. **Production** - Schedules, Area Calculations, Annotation Coordination
3. **Coordination** - Interference Detection, 3D from Consultants
4. **Analysis** - Structural, Thermal, Egress
5. **Supply Chain Integration** - 4D Simulation, CNC Fabrication, FM, 'Intelligent' Site

The concept here is that a BIM can provide a great deal of data to many of the "players" in the construction and operation of a building. The PM should be aware of these benefits and how they affect scheduling, budgeting, team make up and the collaboration efforts required to provide the right model. Note that the further down this list you go the more data is required and the greater the accuracy.

## The Possibilities

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**More with less** - Using Revit, you will find that your project teams are smaller, and can accomplish more work in a shorter amount of time. That is with proper training and an implementation plan. Don't expect this on your first Revit pilot project, but as you and your team gain expertise, you will see these benefits.

**Specs** - There are spec writing applications out there, such as E-Specs, that link the database of the Revit Project, with the database of specifications. As the model changes, the spec can be automatically updated to reflect the model. Additionally, one can click an object in the Revit model and see the corresponding spec section(s) on the screen in the Revit window.

**IPD** - IPD, or Integrated Project Delivery, is a new project delivery method. It would replace the traditional Design-Bid-Build or Design-Build as well as other methods. Under an IPD project, the Owner, Architect, GC, and all the related consultants and subs form a LLC, with the single team-minded goal of designing and building the project to predefined goals. These goals can be time, budget, sustainability (LEED) and more. Because the team is part of a corporation, they all share responsibility and they cannot sue each other. For more info on IPD please see [www.autodesk.com/IPD](http://www.autodesk.com/IPD)

**Fabrication** - Digital Fabrication is the next level of BIM. Using the model to actually produce parts of the design.

**Pieces** - A part of the project is designed in Revit. The Revit model is then used to feed CNC machines as well as other fabrication devices to cut out and assemble the object.

**Modular - Prefabrication** - Whole building components are assembled from the digital models in a factory under controlled conditions, and then shipped to the site for final assembly. e.g. A hotel room is built in the factory, shipped to the site, and then "plugged" into its location in the building.

**Printed** - Using plastics-based or gypsum-based "printers", parts or whole models are printed in 3D to explore the design.

**Automation/robotics** - Robotics are used on site or in a factory to fabricate the parts of a building from the digital model. e.g. A robotic arm is used to lay down concrete grade beams for a project. The placement of the concrete is determined by the model.

**Immersion** - The use of digital 3D projectors or holograms to immerse the customer or design team in the project before it is built.

**Design** - During the design phase, the team can use immersion technologies to explore the design for aesthetics, clashes, program requirements, and more.

**Sell** - Immersion technologies used to sell an idea to a client. If the client can truly visualize the design, they may be more willing to hire the architect, or to buy into the design concepts the architect proposes.

**Experience** - Experience it before it's real. Using this technology, the entire team can experience the design and make decisions about it before construction begins. e.g. Jerry Jones, owner of the Dallas Cowboys, was able to "sit" in any seat in the Cowboys new stadium and visualize the experience from that seat using technology from video games adapted to architecture.

**Return the “Master Builder”** - Architect as the master builder is a concept that has been lost in time. BIM enables the architect and his team, which could contain the owner and builder under IPD, to control the design and construction of the project just as architects did many years ago. BIM allows the architect to create, predict, and deliver the project, thus returning the architect to the role of master builder.

**Design Computation** - Being able to predict how the building will behave is a value of BIM. With the model, we can run a series of analysis, or design computations, to understand how the building will perform. This could be for energy use, structural integrity, code compliance, and much more.

**Control** - Control on any project is key, and having control over cost and schedule are of utmost importance.

**Cost** - Leveraging the model to perform cost calculations is a benefit of BIM. Since we are building a virtual representation of the project, we can query that model using a tool such as Autodesk's Quantity Take Off (QTO) to extract the quantities of building materials in the project. Then QTO can be linked to a Timberline or other database to input the cost. Bottom line, using this technology allows the design team to see exactly where the cost of the building is at during the design phases.

**Schedule** - The term "4D" has been used with BIM for some time now. This "fourth dimension" is the dimension of time. We can use a BIM project, and tie it to a construction schedule, and then visually see the project build itself over time electronically. This method allows the team to uncover construction scheduling conflicts before construction of the real building begins.

**Operations and Maintenance** - Once the model has been created by the design team, and then more information such as as-built conditions have been put in the model by the construction team, the owner has a living database rich with all information about the project for his use in operations and maintenance of the building. The owner can continue to update the model and changes to the real building are made over time. The owner can also leverage the model to get warranty information, or to create a maintenance schedule for the building,

**Sustainability** - Buildings are the earth's biggest polluters, between the construction waste, the energy they consume, and the waste the occupants of the building generate. The key to reducing the pollution and creating sustainable buildings is to reduce waste.

**Reduce Waste** - The model can be used through design, construction, and maintenance and operations to analyze the project for sustainability. We can reduce construction waste by using the model to build projects more efficiently, We can use the model to predict energy usage, and reduce the amount needed by making smart design decisions from the model and the analytics. Then through the buildings life-cycle, we can continue to use the model to find additional ways to control waste and reduce pollution.

**Code Checking** - The possibilities here are great. Using the model to automatically review a project for code compliance would make our buildings safer worldwide. Additionally, electronic code checking would reduce the time needed to thoroughly review a project, and would help to make the process more consistent from project to project and from jurisdiction to jurisdiction.

## Watch Out

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What to watch out for when managing a Revit project

**The “overmodeler”** - In Revit, there is a saying that says "Just because you can model it doesn't mean you have to." Be careful to watch out for those that want to model everything down to the smallest details. Think about what needs to be shown in a view at a particular scale and only model to that level of detail. Detail items should only be shown as 2D detail items. Unnecessary modeling makes the models large and will slow the project down.

**Sloppy modeling** - There is a correct way to model in Revit, and a wrong way to model. Items should be drawn using the appropriate category. Do not use Massing in Revit to model items that are not massing. Do not try to "fake" things in Revit. You are building a virtual version of the building. Sloppy modeling leads to sloppy construction.

**Attempts to turn Revit into AutoCAD** - Revit is not AutoCAD. It's not based on AutoCAD, and functions very differently from AutoCAD. Do not attempt to compare the workflow in Revit to that of AutoCAD. For example, "In AutoCAD we would just do it like this." Statements like this will just undermine your efforts. The sooner you can understand this, the more successful you will be with Revit.

**Cutting corners “to get the Job out the door!”** - Do not cut corners! Once again, the process in Revit is different. It may take a little longer initially to get a piece of the model designed. But in the end, the process will be faster.

## Do's and Don'ts

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### First, the Don'ts:

The following list represents the do's and don'ts for a PM on any given project. These can vary greatly on the level of experience a PM has with Revit and his or her role as a "Technical" or "Managing" PM. We will leave it up to you which work for your situation.

**Over sell/promise the deliverables** - Know your BIM limitations! Don't promise energy analysis on your Revit pilot project if you don't know how to achieve results.

**Open the file** - This could go either way. If you are a Technical PM, then of course, open the file. If you are a Managing PM, and don't know how Revit works, you could really mess things up if you open the file.

**Open/delete/rename or move the CENTRAL file** - Central files are very important. Once they are created, it's important that they remain exactly as they were created.

**Force a dimension** - This isn't AutoCAD, and you can't force dimensions in Revit. If the dimension is wrong, the model is wrong. Fix the model!

**Erase it if you don't know what it is** - Lines in Revit views can represent any number of things, and often are live 3D objects. Deleting a line could be the edge of a wall that hosted doors and windows, with dimensions and notes. If you delete it, all that work in all the other views is gone!

**Leave a file open** - Leaving a file open means that others cannot access it, or in a workset environment, could mean that they can't access the objects you've checked out. Close the files when you are done.

**Over model** - Over modeling is unnecessary and will slow down the model and the entire process. Only model what you can see. At smaller scales, use detail components to describe the details!

**Expect it to be like CAD!!!** - This is not AutoCAD. There are no layers, and no command line. This is BIM, and it's different.

**Drag elements (press & drag)** - Dragging elements, or dragging across elements can move them. This will affect the entire model and all views. Turn off Press and Drag if you tend to click and drag the cursor around the screen.

**Upgrade the model** - There is no backwards compatibility in Revit. You cannot Save as a 2010 file down to a 2009 file. If the project team, including consultants, is using 2009, do not accidentally open the file in 2010 and save it. You will cause the entire team to not be able to work on the file.

**Move levels** - Levels define vertical space in Revit. Moving a level can move walls, doors, windows, ceilings, floors, roofs, and more. Levels are set early in a project, and usually do not need to be adjusted during a project. If they need adjusting, allow an experienced team member to do it.

**STC ;-)** - STC stands for Save to Central. If you STC, you just published any changes you made back to the Central file. If you are just "trying a few things" in Revit and make some changes, doing an STC will publish the changes to the central file, and in turn update everyone on the team.

**Get enamored by 3D** - Revit is great at 3D and at building models. Don't get too caught up in 3D so that you begin to over model, or expect your project teams to model too much. A really great model of a 3D toilet might look good for a perspective view, but placing hundreds of them in a model unnecessarily in the project will just slow things down.

**Expect to learn it over night** - Revit is a complex building modeling and documentation tool. It's very intuitive to learn, but it will take some time to master it!

**Explode anything!!!** - Just like in AutoCAD, exploding is BAD! Just don't do it!

## Now for the Do's!

**Relinquish upon STC** - Be sure to always relinquish control of objects when you save to central. This allows others on the team to access them while you are out.

**Have a kickoff strategy session** - You cannot plan enough. Be sure to kick off the project right. Use this meeting to set expectations and get the project heading in the right direction.

**Focus on the deliverables** - What do you need to get this project built? A well designed, well coordinated set of documents. Know what you need and focus on making it happen.

**Be open minded** - There will be times in a Revit project that things don't "work the way they did in CAD". Be open minded to change, and realize that CAD's don't have to be the same that they have for the last 25 years. Change is good!

**Expect training** - Proper training and ongoing training are the most important aspects of a Revit project and implementation.

**Detach from CENTRAL** - Detaching a file from the Central file allows a PM to make any changes without affecting the Central file. Detaching from Central allows you to safely "play" with the model without affecting the rest of the team's work.

**Have whole team on the same build** - Builds in Revit are "versions" in between the main releases. If the architect is on 2010 Service Pack 2, then make sure the MEP and Structural engineer are also on Service Pack 2.

**Use a "Sketch Project" to experiment** - a sketch project is a new separate project, where you can cut and paste portions of the main model. Here you can experiment with the design, and then copy and paste back into the main model if you like.

**Get consultants, GC and owner involved early and often** - This is very important. The earlier the entire team is on board, the more successful the project will be. It's easier to make design decisions early in the process, and if everyone is on board, decisions can be made together.

**Model for change and VE** - Swapping out objects in Revit for other objects is easy, as long as proper standards are followed.

**Keep the design team close** - As PM's, keep the team in close proximity to one another in the office. Revit facilitates communication, and changes can happen quickly that impact the entire team. Keeping them close together allows better communication faster.

**Set goals (by project)** - Goals in any process are important to measure success. Set the goals, reach for the goals, and then be sure to determine if you met the goals. If not, find out why not and learn from your mistakes!

**ROI** - Return on Investment, understand that you will see productivity gains with Revit. It won't happen immediately, but it will happen. Do set goals for ROI and then measure your ROI by looking at historical project data.

**Deliverables** - Goals for deliverables could include using the HA approach on a project, or a deliverable set that is "100% Revit".

**Sustainability** - "This Revit project will be LEED Platinum." Now go reach that goal!

**Use your reseller as a resource** - Resellers have teams of people for training and support. Many of them have industry experience. Use them for questions, support, advice, etc. They are there to help you!

**Understand constraints** - Revit creates relationships between objects, and users can add relationships and constraints. Understand what these constraints are and how they work. Know that you can over-constrain a model.

**Levels, grids, etc.** - Know what levels and grids do, and how objects get constrained to them

**Understand 7, 6, 5, 4...** - Understand the 7 Factors of Revit Implementation, the 6 phases of a Revit user, the 5 emergent categories of BIM and the 4 Keys to Success....

**Support the best hardware** - Revit needs power! Support Revit by feeding it processor and RAM. Don't expect a tool like this to run well on old, underpowered hardware.

## The Technical PM

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The following lists are areas of Revit that a Technical PM should be familiar with at a minimum.

Navigation

New interface

- Application Menu

- Ribbons (Tabs, Panels and Tools)

- Contextual Tab

- Quick Access Bar

- Info Center

Project Browser

Options Bar

View Control Bar

Status Bar

View Cube

Panning and zooming

## Thanks to

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## Sources

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During the course of our research we have used our own personal experience as PM's and BIM Managers at WLC and WATG.

In addition to that we have collaborated with:

The firms represented at the South Coast Revit Users Group (SCRUG)

AUGI Members

Project Managers and BIM Managers at:

- LPA
- SOM
- HOK
- Lee Sakahara
- WATG

Additional data came from:

- Digital Building Business Practice Evolution: Your Paradigm or Mine? - John E. Taylor, Stanford University
- Revit for PM's – AU 2005 – E. Philip Read
- Steve Stafford - AECAdvantage
- Online Sources:
  - Revit for Project Managers – MicroCAD (outline topics)
  - Revit Architecture for Project Managers – Master Academy (outline topics)
  - Autodesk Revit Architecture for BIM Managers – micorsol resources (outline topics)

## Wrapping Up

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As was noted early in the presentation, the difficulty presenting on a topic of this nature is that there are dozens upon dozens of ways to "crack this nut". Our intention was organize and outline the major topics when considering - "**Revit for Project Managers**"

# Revit - Management

## Large Project Organization

strategy  
planning  
architecture  
interiors

**WATG**

### Team Members

1. **Revit Implementation Manager** – The goal of this team member is to start the project on the right foot, gathering all necessary content required to get the design team running smoothly.
  - a. Required at kick off meetings per phase.
  - b. Assesses when and if BIM(Revit) Should be used on the project.
    - i. Recommends alternative work process depending on project,
      1. ie sketchup for concept work
  - c. Creates a work plan for the project based on scope definition in Contract.
  - d. Creates the Project Template / Project Files
    - i. Based on the location of project, scope of work and project requirements the template will include the following
      1. Anticipated Project Levels
      2. Initial Project Sheets per phase(maybe tasked to another team member)
      3. View Templates
      4. Annotation Families
      5. Dim styles
      6. Text styles
  - e. Creates Project Files
  - f. Asses training needs of project staff.

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## 2. **Building Systems Coordinator** –

- a. Responsible for all Wall Types, Floor Types, Roof Types and Ceiling types.
- b. This persons goal is to maintain consistency of core systems between all building models in a multi-building project.
- c. This person will decide on the System Type numbering system
  - i. This includes System notes
    1. R1 = Roof type 1
    2. W1 = Exterior Wall Type 1
    3. F1 = Floor type 1
    4. C1 = Equals Ceiling Type 1
    5. S1= Exterior Soffit Type
  - ii. System notes will be created from Wall schedules, Roof schedules Floor Schedules, etc.
- d. This person will also decide on the Interior Partition type numbering system.
  - i. Wall Schedule should be used to manage wall types in a project.
    1. Type Mark
    2. Wall Description
    3. Fire Rating
    4. Locations of use.
  - ii. Utilize a Wall Legend to graphically display the wall types for the team to refer to.

### 3. **Content Creation Coordinator-**

- a. Responsible for all Family Content to be used in the project(note this doesn't mean this person creates all content).
- b. This persons goal is to maintain consistency in Family usage throughout all buildings of the project.
- c. This person will decide Family Naming Conventions , based on watg standards
  - i. Component ID – Family Name (Suggested Below)
    1. HT – for Hotel
    2. CD – for Condo
    3. CS – Casino
    4. OV – For any family that will be used in more than one building (Content Coordinator may decide to use no prefix for common content)
    5. Note a separate folder in the project BIM Library for each style may help organize content.
  - ii. Names should be short but clearly identify the family type.
    1. OV-Sgl-CCM-1 = Single Clad Casement
    2. OV-Sgl-CCM-2x2 = Single Clad Casement 2x2 lite grid
      - a. OV-Clad Casement Sgl
    3. A Schedule for each component type on the project will help the coordinator manage the content and check for Non approved content in a project.
  - iii. Content should be transferred from Building Model to Building model carefully making sure no duplicates are created. Revit tends to rename content with a numeral after the name if content with the same name exists. The content coordinator is responsible for making sure there are no multiple families in the projects.
    1. Ie. Family – Circular Profile becomes Circular Profile and Circular Profile 2, then 3 ,etc.
    2. Annotation Families should be checked from time to time verifying the right view titles are used.
  - iv. The Content Coordinator is responsible for purging models – NO OTHER TEAM MEMBER SHOULD PURGE A MODEL. Team

members can delete content they loaded by mistake from the project browser.

- v. Content Coordinator is responsible for obtaining content from approved Outsourcing company.
  - 1. Content Coordinator should set the standards and parameters used for content.
  - 2. Content Coordinator will communicate content requirements from design team to outsourcing group.

#### **4. Model Documentation Coordinator**

- a. This persons main responsibility is to maintain consistency between models in regards to documentation styles.
  - i. View Templates
  - ii. Annotation Styles
  - iii. Line weights
  - iv. Object styles
  - v. Schedule Formatting.
  - vi. Sheet layouts