BIMplementations That Stick: Harnessing Disruptive Technology Successfully

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Learning Objectives

- Discover the primary elements of a BIM implementation
- Understand the critical aspects of discovery and analysis
- Discover the concept of a “culture of continuous improvement”
- Learn how to realistically budget resources for a BIM implementation

Description

Regardless of an organization's size, implementing technologies such as Revit, Navisworks, and all of the other BIM (Building Information Modeling)-supporting products and tools requires more than just taking a class and investing in the software. It requires commitment, patience, a knowledgeable resource for ongoing assistance, buy-in and proactive support from upper management—and most importantly, a plan. This session will describe proven techniques for developing and executing a BIM implementation, and will provide case studies of implementations that the presenter has facilitated, for both members of the design community and facility owners and operators.

Speaker

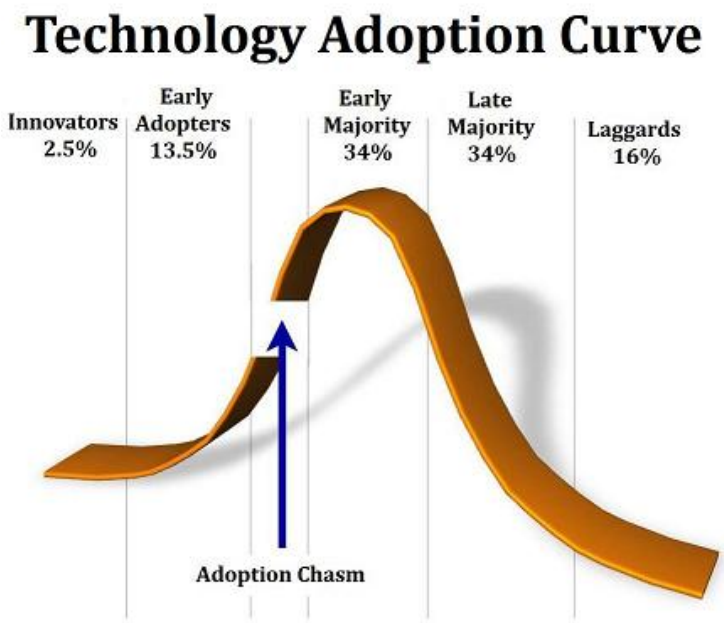
With a background as a registered architect, Matt Dillon has over 30 years of experience in Autodesk Architectural applications and is an Autodesk Certified Instructor at an Autodesk Authorized Training Center. In addition to assisting customers implement Building Information Modeling (BIM) and Revit Platform products, Dillon has also consulted with Autodesk, Inc., development staff in product design and usability for AutoCAD Architecture software. A published author, Dillon was one of the recipients of Autodesk's Distinguished Speaker Award in 2010, and he has been a highly rated instructor at Autodesk University since he first began presenting in 2000.

Introduction

Implementing a BIM workflow in your firm is significantly different than implementing a CAD workflow was 30-35 years ago. When firms began transitioning from manual drafting to CAD, new tools had to be learned, but the basic process of generating construction documents was still based on the same rules of drafting that had been in place for decades, if not longer. We simply traded our parallel bars, triangles, leroy sets and all of the other paraphernalia that allowed us to create our drawings for computers, plotters and software that allowed us to more efficiently draft. But we were still drafting.

BIM is disruptive. It's a disruptive process that in large part uses disruptive technology. The term "disruptive" may conjure up negative images, but in fact, it is frequently far from a negative thing. In fact, most leaps forward in history have been the result of disruptive technology. The printing press changed the way people communicated with the written word. The automobile has had a significant impact on the way we live. The "smart phones" that almost everyone carries around in their pockets are an excellent recent example of disruptive technology. Consider how it has changed the way you conduct your banking, make travel arrangements and stay in touch with family and friends via social media, email, etc. And… oh yes… it's a phone, too.

BIM, as disruptive technology, will necessitate a change in culture in any organization that wishes to successfully adopt and implement it. It will impact nearly every aspect of your business in one way or another and will impact the way your organization collaborates with others. In more and more cases, the deliverables themselves are changing as a direct result of what BIM offers to building owners and managers. To implement BIM, then, you need to take a different approach than what was done 30 years ago. Simply investing in new software and sending some people to a class, while certainly a part of the process, is not enough.



BIM, though disruptive, is no longer a new, untested concept. Many firms have adopted it successfully, and depending on the discipline you are in, you may find that if you have not yet implemented a BIM workflow, you might be falling behind your peers. The Technology Adoption Curve can be applied to virtually any new technology, and certainly holds true for BIM. Architects, Engineers and Contractors, for the most part are beyond the "Early Adopter" phase and some disciplines, notably Architects and some Engineering disciplines are at least in the "Late Majority" phase.

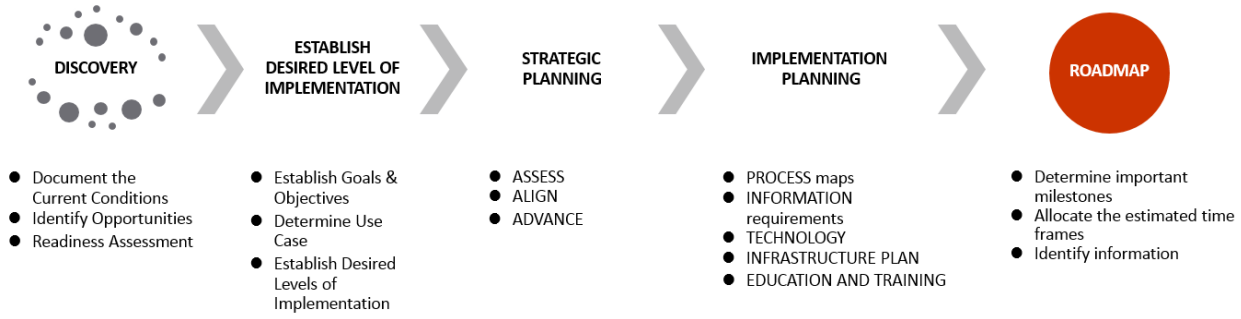
Common BIM Implementation Pitfalls and Best Practices

There are a variety of reasons for a BIM implementation to fail. Among the most common are:

- **Lack of Ownership and Buy-in from Leadership:** This is perhaps one of the most frequently encountered elements of a failed implementation. Leadership must not just tolerate or even support a BIM Implementation. Leadership must mandate and drive the BIM Implementation efforts. It is rare, if not impossible for a BIM Implementation to succeed from a "grass roots" effort that happens in spite of leadership opposition or concerns.
- **No Plan:** The old saying is true, "Fail to plan, plan to fail." A plan, or *Implementation Roadmap* is crucial to success – it needs to honestly and realistically acknowledge current strengths and weaknesses, and have reasonable, attainable and measurable goals. Attempting to implement BIM organically, with no real direction is a sure recipe for failure.
- **No Commitment:** It is inevitable that there will be bumps along the way, especially in the very beginning stages of an implementation. Without commitment, it is easy to drop back to older more "comfortable" technologies and processes. Again, it is important to remember that BIM technologies and processes are disruptive by nature, and require a "culture of continuous improvement", which is one that embraces change, rather than avoiding it. It should be expected that the first two or three projects of a BIM Implementation may not be profitable, and that should be factored in as a part of the overall investment required to realize a successful implementation.
- **Lack of understanding, "It's just a replacement for CAD."** It must be understood that BIM is not merely an upgrade of existing technology. It requires learning new tools, new methods and new thought processes.
- **No accountability:** All participants must be accountable and take ownership of their part of the BIM Implementation effort.
- **"Too Busy!"** Organizations frequently put off a BIM Implementation, waiting for "down time" so that their active, billable work will not be adversely affected. The problem with that is that "down time" either never comes, or during the "down time" period, management is hesitant to invest in the resources necessary to successfully implement BIM. There is never a perfect time to implement. The best time is almost always "Now".
- **Forced to adopt BIM (and then only use on limited projects):** Many firms are feeling forced to adopt BIM, either to respond to owner/client mandates or because of increased competition from organizations that have already implemented BIM. In many of these cases, the effort is limited, and BIM is only used when absolutely necessary, and at a very low level. Again, total commitment is a key component of a BIM implementation. Regardless of the motivation for making the move, it needs to be a committed, comprehensive effort, with the leadership coming from the top down.

The BIM Implementation Roadmap

BIM implementation plans, or roadmaps, will vary based on discipline, firm size, goals and budget, but there are elements that are common to nearly all of them. The development of a BIM Implementation Roadmap has its own process.



Discovery

> ***Note:*** *The tasks of Discovery, Analysis and Roadmap preparation are best done by an objective third party, free of any biases or pre-conceived notions.*

Before any planning can be done, data needs to be gathered to determine the current state of technology, current processes and workflows, bottlenecks, business and design goals, and challenges to project delivery. It is best for this to be done by an objective third party, through the use of in depth questioning of principals, managers and project team members, all of whom will have different perspectives on goals, challenges and bottlenecks.

Question	Answer
What aspects of your current design and/or drafting process do you intend to improve with new software? OR What are the main business problems that you expect a new software implementation to reduce or eliminate?	
Have you established specific goals to reuse engineering design data created by third party and/or internal software in your creation of C.D.?	
What are you planning to minimize documentation coordination errors between disciplines?	
Who is your largest customer?	
In what ways do you want to improve design presentations?	
In what ways can communication, coordination, and collaboration of design information be improved with consultants, owners and contractors?	
What would make the review, revision, and change tracking process easier for you?	
Who is your largest customer? In what ways can your design process improve customer satisfaction?	
How much work is "thrown away" or duplicated?	

Question	Answer	Action	Confirm
What are your company's primary business goals or objectives?			
What is the Principal/Owner's single, highest priority or goal for this year?			
What are the current barriers to achieving your goals?			
What changes need to be made to achieve your goals?			
What is the most important activity in your business?			
What are the top five factors that most hinder your ability to secure additional business?			
Have you established specific goals with respect to those factors?			
Who are your biggest competitors?			
What is your strategic advantage over your competitors?			
What advantages do your competitors have over you?			

Testing should be done to determine staff proficiencies with BIM technologies that are anticipated to be incorporated. There are a variety of ways this can be done, from self-evaluation surveys to formal testing. Web based utilities such as Surveymonkey are useful for conducting self-evaluations, and there are a variety of services available to conduct more formalized testing. Autodesk provides Certification Exams for certain products, such as Revit, AutoCAD and 3ds Max. 3rd parties such as Knowledgesmart provide for testing with reports that indicate knowledge and skill shortcomings for specific areas of software utilization.

At the same time, a survey of existing technology and infrastructure should be conducted to identify any upgrades or improvements that might be necessary. This can usually be

accomplished by asking IT staff to complete some basic questionnaires and surveys to gather information about client workstation hardware, software and operating systems, and network infrastructure.

Network diagram from IS?	
Primary Protocols	
Wide Area Network?	☐ YES ☐ NO
If you answered yes to the WAN, what is the speed of the network?	
Backup Method	
Backup Software	
Anti-Virus Software	
Additional Notes	

Do all CAD workstations meet minimum hardware requirements?

☐ YES ☐ NO If no, please list the client workstations below

The system requirements for Revit Structure 2008 workstations are listed below.

- Intel® Pentium® 4, 1.4 GHz, or equivalent AMD Athlon® processor
- Microsoft® Windows® XP SP1 or later (Professional, Home, Tablet PC Edition) or Windows® 2000 SP4, Microsoft® Windows Vista™ (Enterprise, Business, Premium, Ultimate Edition)
- 1 GB RAM
- 3 GB free disk space
- 1280x1024 monitor and display adapter capable of 24-bit color
- Internet connection for license registration
- Microsoft® Internet Explorer® 6.0 or later
- MS-Mouse compliant

System Recommendations:

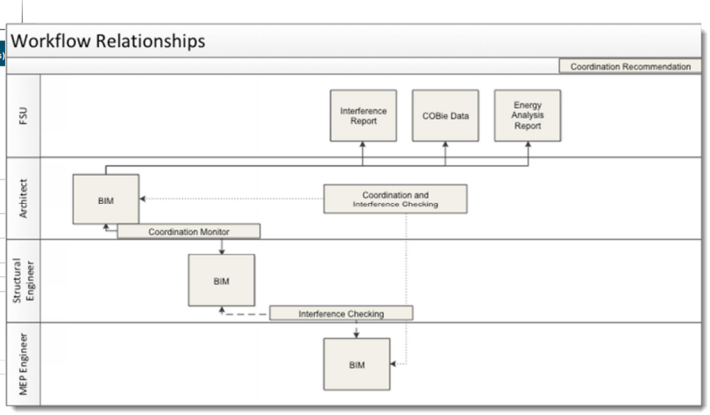
- Intel Core™ 2 Duo 2.40 GHz, or equivalent AMD Athlon processor
- Windows XP Professional (SP2 or later)
- 4 GB RAM
- 5 GB free disk space
- Dedicated video card with hardware support for OpenGL® spec 1.3 or later
- Two-button mouse with scroll wheel

Workstation Name	IP Address	Make/Model	CPU	RAM (MB)	HD Space (GB)	Video	O/S, Version	Location

In addition to interviews and questionnaires, it is frequently helpful to develop process maps of critical aspects of project delivery. During process mapping sessions, it is not uncommon for people to discover elements of their methods for delivering projects that they were not aware of before, and to reveal hidden bottlenecks that can be targeted as something to be addressed in a BIM implementation.

- Grow business by x percent in x amount of time

Business Challenges	Please use descriptive answers. (TAB to add more rows)
What are their issues that prevent them from achieving their goals? Examples: • No innovative tools to enter new fields of work or draw in new talent. • Current design tools too prone to rework and errors. • Disconnected workflows only allow coming up with first adequate design. • Lack of standardization and limitations on collaboration	
What type of projects are most commonly done today? How do they anticipate this changing in 2-3 years?	
How is the adoption and use of new technology accounted for on projects?	
Does the firm maintain an R&D group to evaluate new technologies and workflows?	
What types of projects do you not pursue and why?	
What is their tolerance for change?	
Where would they rate themselves within their segment with respect to: • Quality • Innovation • Reputation Or, how do they currently win business?	
What keeps you awake at night work-wise?	



During the Discovery process, short-term, mid-term and long-term BIM goals can be identified, through interviews with key staff members. It is important to keep the immediate goals to a limited set of realistic, attainable goals and not to “bite off more than can be chewed”. By focusing on immediate, reasonable goals first, there is a better chance of more quickly realized benefits, which in turn should spark interest in furthering the implementation once those immediate goals have been realized. Mid-term and long-term goals can be addressed in future evolutions of the BIM implementation.

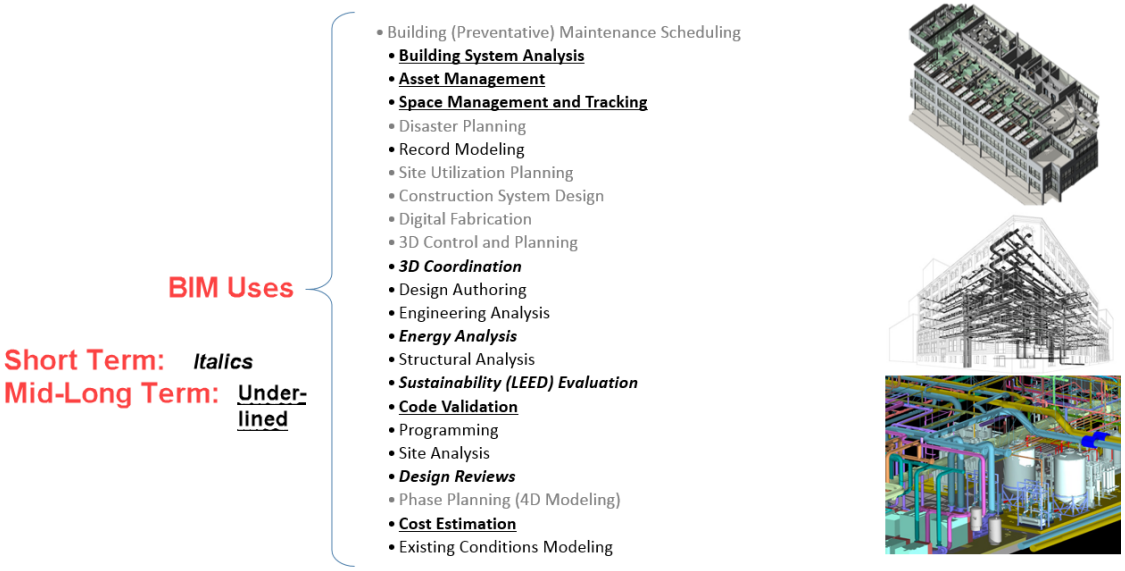
A more complete list of information to be gathered during the Discovery phase includes:

Data	Source	Method
Business Goals	Principal/Owner	Direct interview with open-ended questioning
Design Goals	Project Managers/Principals	Direct interview with open-ended questioning
End User Data (applications currently used, past training, etc.)	End users or managers	Questionnaire, Survey or Form
End User Proficiency with BIM Applications	Self-evaluations or testing	Survey, Proficiency or certification tests
Current Design/Project Delivery Workflow and Bottlenecks	Project managers and Project teams	Workflow process mapping session
File Management Standards and Protocols	CAD/BIM Manager	Questionnaire or form
Integrated Systems and Third-Party Applications	IT Dept. and CAD/BIM Manager	Form or direct questioning
File Server Information	IT Dept.	Form
Network Topology, Backup process, A/V Software	IT Dept.	Form
Client Workstations – CPU, Graphics Card, OS, etc.	IT Dept.	Form

Analysis and Planning

Once critical information about the current state of BIM implementation and the desired state has been gathered, it needs to be analyzed and assessed as the first step in developing the implementation road map

The very first thing that should be done is to finalize the BIM goals. These should have been determined to some extent during the Discovery.



While several possible benefits of BIM may have been identified before or during the Discovery process, the goals of the initial implementation should remain limited to a smaller number of attainable and reasonable goals, with others targeted for later evolutions of the implementation. It's tempting to attempt to accomplish too much with the first round, which can lead to overload, stagnation and ultimately failure. On the other hand, if the result of the implementation effort is the successful realization of a small set of immediate goals, then the initial adjustment (translation, "disruption") resulting from the adoption of BIM produces a positive outcome. The stage is then set for expansion of the implementation to realize more ambitious goals, most likely with far less effort than the first round of process changes.

Once the goals have been finalized, then analysis can begin. The primary tasks during this phase are:

- Identify existing strengths that can be leveraged.
- Identify weaknesses that must be addressed.
- Identify limitations in technology currently in place that need to be addressed to be able to fully realize the BIM goals. Is there additional technology, either software, hardware or cloud-based that needs to be acquired and implemented as a part of the larger BIM implementation?
- Identify bottlenecks in the current workflow that can be addressed with a BIM approach.
- Determine if any staffing changes need to be made. For example, there may be an increased need for more BIM support staff to assist the BIM manager, or there may not even be a BIM manager currently in place. If the size of the firm does not warrant a full or even part-time BIM Manager position, some provision must be made for the tasks that person would normally fulfill. Outsourcing may be necessary.

Specific elements from the Discovery that can assist with this analysis are:

- Surveys or test results on software proficiency.
- Information from IT on client workstations and network infrastructure.
- Information gathered from interviews with principals and project managers.
- Information from IT and the BIM/CAD Manager on current installed applications and their utilization.

Roadmap

Armed with the results of the Discovery and Analysis, the roadmap for the initial BIM implementation can be developed. This will include:

- Hardware and software upgrades, including network upgrades, if necessary
- Staff changes
- Third party applications, if any, that have been identified as necessary to meet the short term BIM goals.
- Curriculum for training, based on knowledge gaps and proficiency shortcomings that were identified, as well as any training required for third party applications that have been identified.

- BIM Execution Plan template, to assist in developing a BIM Execution Plan for delivery of projects – to include critical milestones, Level of Development requirements, meeting schedules, responsible parties for various aspects of the project, etc.

North East Independent School District

NEISD BIM Project Execution Plan Template

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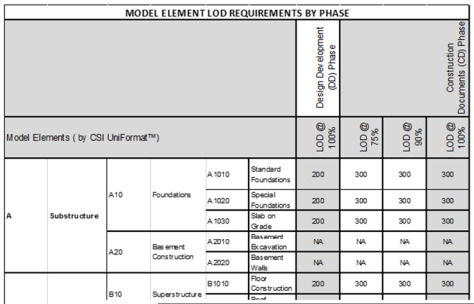
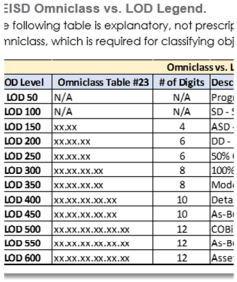
NEISD Model Element LOD Requirements by Phase.

The Project Team shall use the following Level of Development requirements for Model Elements for each given phase. Partial table shown below. Refer to the *NEISD LOD Requirements* document.



MODEL ELEMENT LOD REQUIREMENTS BY PHASE

Model Elements (by CSI UniFormat™)						Design Development LOD Phase	Construction Documents (CD) Phase		
						LOD @ 100%	LOD @ 75%	LOD @ 50%	LOD @ 100%
A	Substructure	A10	Foundations	A 1010	Standard Foundations	200	300	300	300
				A 1020	Special Foundations	200	300	300	300
				A 1030	Slab on Grade	200	300	300	300
		A20	Basement Construction	A 2010	Basement Excavation	NA	NA	NA	NA
				A 2020	Basement Walls	NA	NA	NA	NA
B	Shell	B10	Superstructure	B 1010	Floor Construction	200	300	300	300



EISD Omniclass vs. LOD Legend.

e following table is explanatory, not prescri
nniclass, which is required for classifying obj

OD Level	Omniclass Table #23	# of Digits	Desc
LOD 50	N/A	N/A	Progr
LOD 100	N/A	N/A	SD - S
LOD 150	xx.xx	4	ASD -
LOD 200	xx.xx.xx	6	DD -
LOD 250	xx.xx.xx	6	50%
LOD 300	xx.xx.xx.xx	8	100%
LOD 350	xx.xx.xx.xx	8	Mode
LOD 400	xx.xx.xx.xx.xx	10	Deta
LOD 450	xx.xx.xx.xx.xx	10	As-B
LOD 500	xx.xx.xx.xx.xx.xx	12	COBi
LOD 550	xx.xx.xx.xx.xx.xx	12	As-B
LOD 600	xx.xx.xx.xx.xx.xx	12	Asse

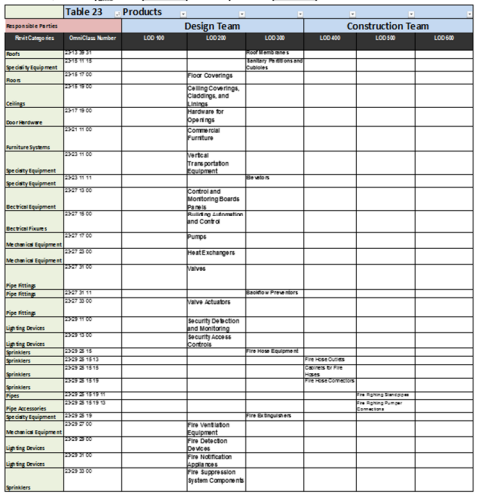


Table 23 Products

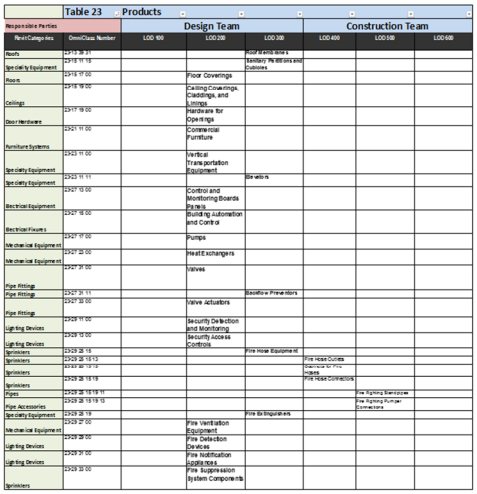
Responsible Parties		Design Team			Construction Team		
Revit Categories	OmniClass Number	LOD 100	LOD 200	LOD 300	LOD 400	LOD 500	LOD 600
Roofs	23-13 39 11			Roof Manufactures			
Specialty Equipment	23-15 11 13			Sanitary Facilities and Cubicles			
Rooms	23-15 17 00		Floor Coverings				
Ceilings	23-15 19 00		Ceiling Coverings, Claddings, and Linings				
Door Hardware	23-17 19 00		Hardware for Openings				
Furniture Systems	23-21 11 00		Commercial Furniture				
Specialty Equipment	23-23 11 00		Vertical Transportation Equipment				
Specialty Equipment	23-23 11 11			Elevators			
Electrical Equipment	23-27 13 00		Control and Monitoring Boards Panels				
Electrical Fixtures	23-27 16 00		Building Automation and Control				
Mechanical Equipment	23-27 17 00		Pumps				
Mechanical Equipment	23-27 23 00		Heat Exchangers				
Pipe Fittings	23-27 31 00		Valves				
Pipe Fittings	23-27 31 11			Backflow Preventors			
Pipe Fittings	23-27 32 00		Valve Actuators				
Lighting Devices	23-29 11 00		Security Detection and Monitoring				
Lighting Devices	23-29 13 00		Security Access Controls				
Sprinklers	23-29 26 13			Fire Hose Equipment			
Sprinklers	23-29 26 13 13				Fire Hose Outlets		
Sprinklers	23-29 26 13 19				Cabinets for Fire Hoses		
Sprinklers	23-29 26 13 19				Fire Hose Connections		
Pipes	23-29 26 13 19 11					Fire Fighting Standpipes	
Pipe Accessories	23-29 26 13 19 13					Fire Fighting Pumper Connections	
Specialty Equipment	23-29 26 19			Fire Extinguishers			
Mechanical Equipment	23-29 27 00		Fire Ventilation Equipment				
Lighting Devices	23-29 28 00		Fire Detection Devices				
Lighting Devices	23-29 31 00		Fire Notification Appliances				
Sprinklers	23-29 33 00		Fire Suppression System Components				

Section H: BIM and Facility Data Requirements

[This section should include the owners BIM requirements. Also refer to the attached NEISD BIM Component COBie Checklist_Omniclass Table 23 for a phase by phase description of COBie items and the responsibilities of each team member].

COBie is defined as "Construction Operations Building Information Exchange". COBie uses Omniclass classifications for asset tracking.

This checklist depicts OmniClass classifications by LOD by Revit Category. Refer to the *NEISD BIM Uses and Required Parameters* document for specific assets and associated data to be tracked.



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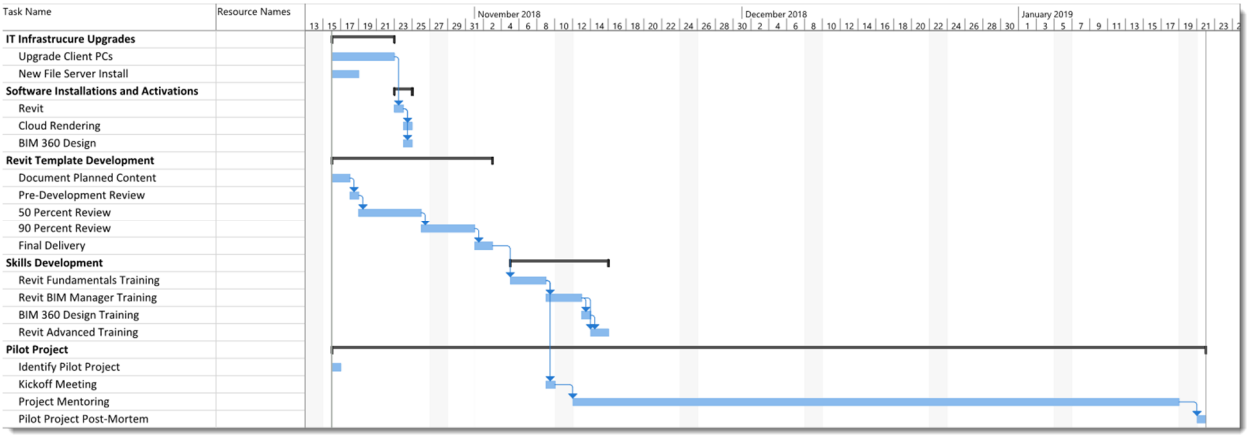
Lighting Devices	23-29 31 00		Fire Notification Appliances				
Sprinklers	23-29 33 00		Fire Suppression System Components				

Note: *while the BIM Execution Plan is not absolutely necessary for a successful BIM implementation, it should be considered, either for the initial implementation or future evolutions.*

- If a process in the overall project delivery workflow is going to be changed, flow charts and diagrams illustrating the new process should be included.
- Modifications to typical project team makeup and roles. For example, there will most likely be a need for a Model Manager, who will be involved with maintaining the BIM database and any custom content that needs to be developed for a given project. This typically not a BIM Manager, but instead is someone actively engaged in the project who will also interface with the BIM Manager.

- A schedule for implementation – a start date and an end date, along with critical milestones in between.



- Pilot project – this should a project that is large enough to involve a respectable sized team, but not so large or complex as to impose unnecessary complications on the project delivery.

Execution

As indicated earlier in this document, there are any number of reasons for a BIM implementation to fail. Fortunately, there at least as many ways to succeed:

- **Choose to adopt BIM:** Whatever your motivation for adopting BIM, you must choose to do it. It cannot be forced on you. You cannot be properly committed to something that is being forced on you from the outside. If you are feeling backed into a corner, step back, look at the situation objectively and determine if there are benefits for you in adopting BIM. If so, focus on the benefits, rather than the pressures that drove you to this point.
- **Top down approach, buy-in, leadership must drive:** The effort must begin with the organization's leadership, not just tolerance and support. Leadership must take an active role in mandating the effort and making sure the resources are provided to make it a success.
- **Excite staff, opportunities for all, market internally:** Foster a culture of excitement among the staff. This is a growth opportunity for everyone involved.
- **Partner with a trusted, experienced resource:** Find and partner with a resource that can assist you – someone who has experience and who can help you not only in the initial planning stages but with ongoing support as your implementation evolves.
- **Reward staff:** Provide rewards, incentives and goals for staff to encourage active and willing participation in the process
- **Provide support – external and internal:** Provide resources, internally and externally to support your staff as they develop new skills and adapt to new workflows and processes
- **Develop and follow a plan:** Have a plan and follow it. Make it attainable and reasonable. Don't bite off more than you can chew. Consider developing a plan for a phased implementation with short term, mid-term and long-term goals.
- **Make course corrections as needed and along the journey:** All plans will need adjustment along the way, so be prepared to make changes to address unforeseen developments and changes in technology and situations.
- **Don't bail - Get help:** There will be bumps in the road. It is important to power through them and resist the temptation to retreat to more traditional, "comfortable" technologies

and processes. These rough spots are your best opportunities for learning and development. Frequently when your staff is experiencing the most frustration, a milestone in your efforts is just around the corner, but you must persevere to realize it.

- **Be patient - It will take time:** Be patient with yourselves as well as your team members. New processes and workflows take time to master and to become comfortable with.

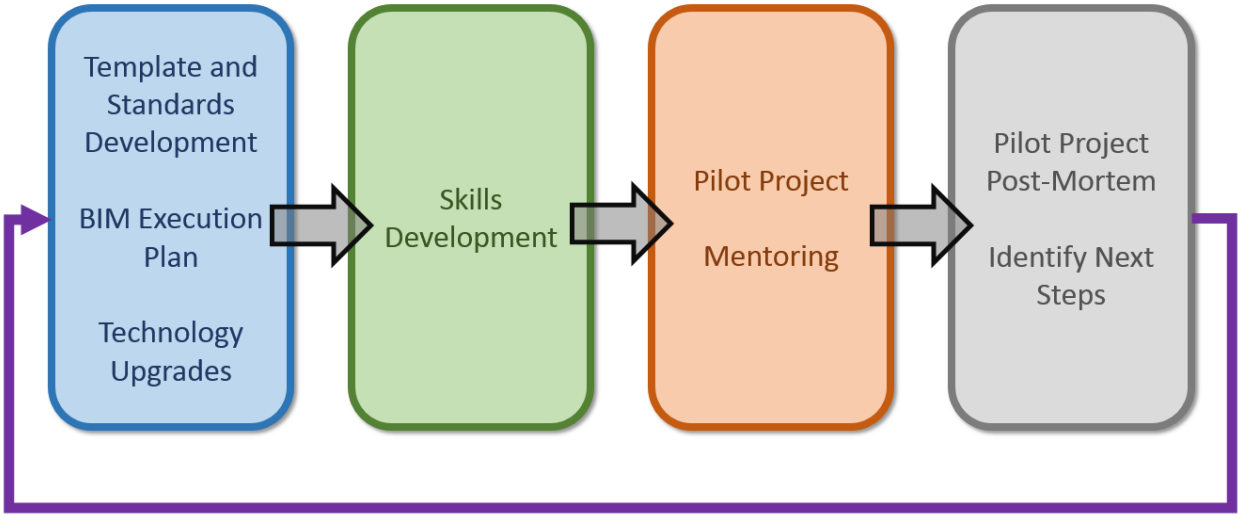
Evolving BIM – A Culture of Continuous Improvement

BIM is constantly evolving, therefore, your implementation is never complete. You should be constantly looking for ways to push the boundaries of your current BIM implementation to take advantage of new technologies and capabilities. You should adopt a "culture of continuous improvement", choosing to steadily evolve. Spending months or years in the same state of BIM evolution, will result in the inevitable realization that once again technology (and your competitors) have passed you by and that you have another long learning curve at the very least to get caught up.

If you make it a practice to be constantly looking for ways to improve and grow your BIM implementation you will find that it becomes easier and less disruptive. Consider holding a "post-mortem" after each project and ask at least three questions:

- What did we do well?
- Where do we need to improve?
- What can we implement on our next project to improve our process and possibly deliver additional services?

The result will be a continuous (but much more easily digested) cycle of *Implement->Execute ->Refine*:



Case Studies

The following case studies represent a variety of firms and organizations, each with a different "as-is" state at the beginning of the implementation, and each with a different approach, but all containing elements described in this document.

Small Architectural Firm – Lavin Architects

Lavin Architects is a small firm located in Amarillo, Texas that has educational facilities, university buildings, healthcare, financial and industrial design as the core of its work. At the time of their initial BIM implementation they had 5 people that were developing projects using AutoCAD, with nobody using Revit or with much if any exposure to BIM technologies in general.

Lavin Architects was not under any direct pressure to implement BIM (in this case, Revit), but one of their partners, David Nowell, was of the opinion that it was only a matter of time before owners in their market would start requiring a BIM deliverable on projects. Additionally, he was keenly aware of the internal benefits a successful Revit/BIM implementation would bring to the firm.

Realizing that they did not have either the expertise or the in-house resources to run an implementation, David turned to outside help for an initial, limited implementation, through their Autodesk reseller, who has a strong focus on providing consultative services as well as general training and support.

The initial goals were simple: Bring their staff up to speed on Revit and begin transitioning new projects over to Revit, to position themselves for the day when they would be required to provide BIM deliverables on their projects.

Implementation Approach

Because of their location – a fair distance from any source of BIM consulting, they decided to conduct the implementation remotely, utilizing screen sharing software for any video conferences and training that would be conducted, in order to eliminate travel costs and to simplify scheduling. It was also decided to conduct a minimal discovery, primarily concerned with determining the content that was to be included in their Revit template. Staff proficiencies were assumed to be at the novice level, so training would be conducted beginning with the fundamentals.

Once sample data (existing CAD files and PDF prints of current construction documents) were obtained, work began on developing a custom template. Once the template was finished and delivered, Revit Fundamentals training was conducted for the five people that were to use the software, with further training conducted for a smaller group on more advanced BIM Management topics. This was followed up with a pilot project during which project mentoring or "just in time training" was conducted on an as-needed basis. All training and mentoring was delivered remotely using GoToTraining technology.

Implementation Results

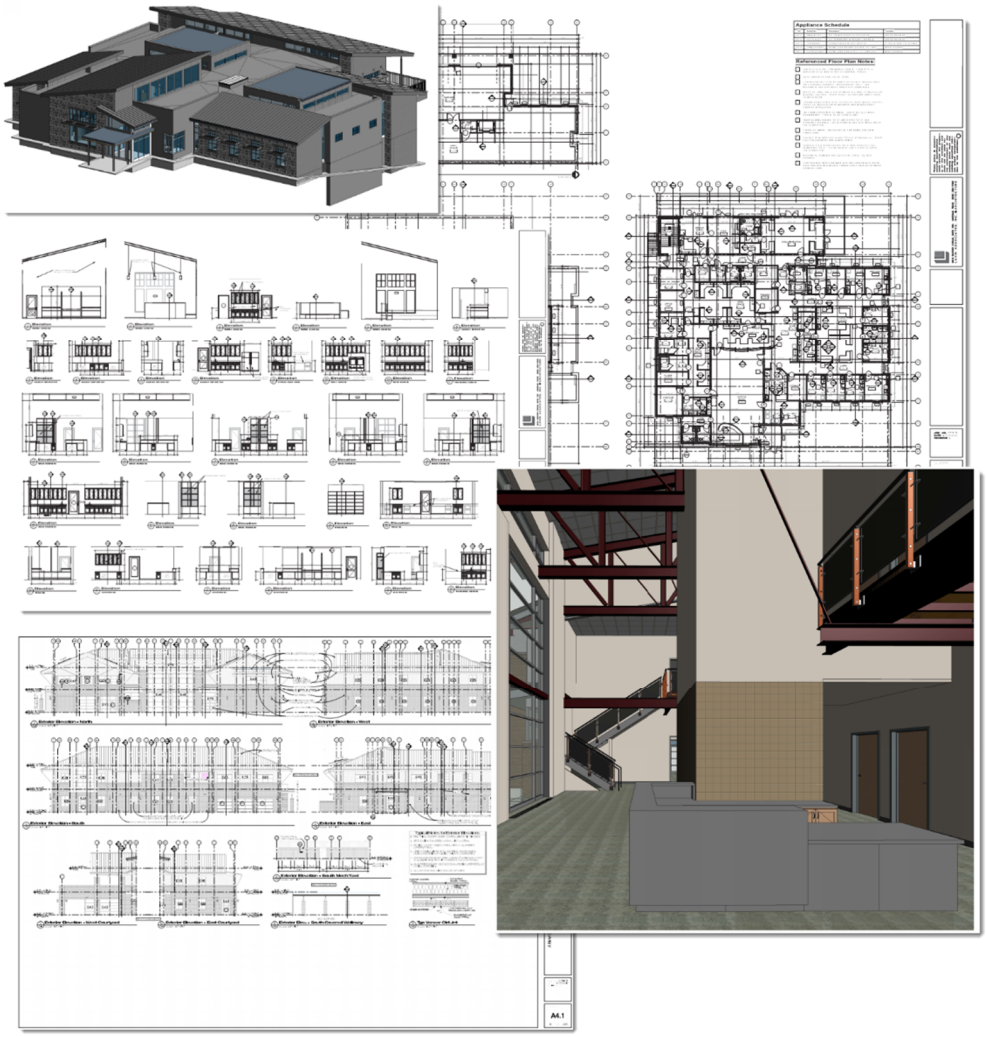
In a post-implementation interview, David Nowell shared that they have seven projects that have been completed through construction or that are currently in construction, with seven more projects in progress in Revit – all but one of which have already been through the bidding process.

Specific benefits that Lavin Architects has realized as a result of implementing BIM are:

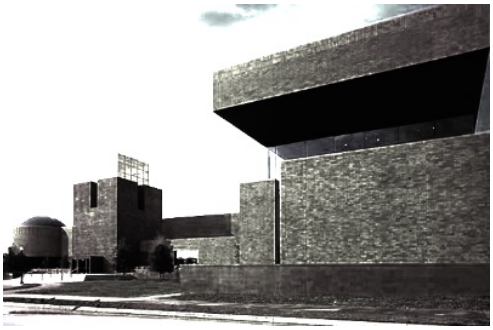
- Clash detection early on in the project has prevented real problems later on during the construction process (and saved money on costly change orders).
- There is better communication between the design and construction team and the owner.
- The BIM process encourages the 3-dimensional thought process.
- There is earlier meaningful visual feedback on projects.
- While there is still resistance among local engineering consultants that are reluctant to migrate to BIM, they are seeing more than enough benefits internally to justify the efforts and cost.

Future Plans

While Lavin Architects has not identified any major mid-term or long-term goals for their next evolution of BIM implementation, they feel that they are positioned to take advantage of more advanced technologies and do plan to improve their visualization capabilities with Revit, and have as a goal to have their entire team utilizing Revit 100 percent on any new projects moving forward.



Mid-size Architectural Firm – Rejuvenating an Existing Implementation



A mid-sized architectural firm in Fort Worth, TX, that provides a wide range of architectural services for civic, educational, community, commercial and industrial facilities had partially implemented Revit several years ago. They had a small core group of Revit users that were very competent and comfortable with the software and were already successfully delivering projects using Revit and BIM technology. Even though they had a group that had been using Revit successfully for some time they were faced with challenges moving forward:

- The person that developed their original template for Revit 2011 was no longer with the firm. None of the remaining Revit users were familiar enough with the content that had been customized in the template to be comfortable to make changes or update it for new releases of the software. The template had been upgraded with each release of the software, and the firm was currently using Revit 2016.
- Because the core group of Revit users were all actively engaged in billable work, nobody was able to take the lead in moving the BIM implementation forward. The feeling was that even though none of their current group of users had the time to perform BIM management tasks, their current staffing level did not justify a salaried BIM Manager position.
- Even though they had a group that was proving with every project the benefits and viability of the BIM process, the vast majority of their staff, which includes an interior design department, was hesitant to adopt Revit and was resistive to change, preferring to stay with the AutoCAD technology they were already comfortable with.

Their goal when they contacted their reseller for outside consulting assistance was to bring their entire office, including their interior design team, into the BIM process and update their existing template to the current version of Revit.

Implementation Approach

The discovery was conducted on site, and took place over a full day, consisting of meetings with novice and beginner-level users, intermediate-level users and the advanced-level users, and finally with the interior design department.

- The beginner-level users were generally receptive about going to Revit, but they were concerned about the learning curve, loss of productivity while learning, and wanted reassurance that there would be supporting resources beyond just a basic fundamentals class.
- After meeting with the intermediate level users there appeared to be no true consensus as to what the graphic standards should be from one project team to another. Many comments alluded to the fact that each Project Manager tended to have their own preferences, and as a result different project managers' projects had different graphic standards and appearances.
- The advanced users expressed a desire for training in more advanced topics such as Dynamo and the creation of custom families.
- The interior design department was more concerned that Revit may not be a tool that is well suited for the unique requirements of an interior design project.

In summary, each group had its own unique concerns and its own idea of what they would like to see as an outcome of the implementation. Further complicating matters was a relatively tight budget. In the end it was decided that the implementation effort should focus on three primary goals:

- Update the existing template to the current version of Revit. To do this it was decided to begin with a brand-new template, migrating key elements from the existing template forward and adding additional content to complete their standards.
- Bring the entire architectural department up to a level of competence with Revit that they would be able to ultimately deliver all their projects using Revit, leaving AutoCAD to be used only on legacy projects that were started before the implementation of Revit.
- Develop sufficient content to allow the interior design department to deliver their projects using Revit, and to bring them to an appropriate level of competence as well.

The template was then developed, and training was scheduled. Training took place on-site and was conducted over the course of a week in half-day sessions to minimize the impact on billable work. Morning sessions were conducted for the architectural department and afternoon sessions were reserved for the interior design department.

Following the initial fundamentals training, ongoing support was provided via project mentoring delivered remotely as-needed using GoToMeeting technology.

Implementation Results

In a post-implementation meeting with key members of the architectural and interior design group several months after the services were completed, feedback was overwhelmingly positive:

- Prior to the implementation, the majority of the staff were hesitant to learn Revit for the reasons already expressed. They are now embracing the technology and are more proficient than they would have thought.
- Some of the architectural department staff are still using AutoCAD, even though they attended the training, because their projects were already in progress in AutoCAD, however they are eager to begin working on new projects in Revit.
- The interiors department is now unanimously embracing Revit and successfully delivering projects with it.
- Users that were the most resistive and apprehensive prior to the implementation have now become the biggest champions of Revit and the implementation efforts.

Future Plans

The current state of this firm's BIM implementation can be considered a success, since their primary and most immediate goal of getting the entire office proficient on Revit and embracing BIM rather than avoiding it has been realized. However, there is much to be done to realize other goals that were expressed during the discovery meeting but that there was no budget for initially, in particular, training on more advanced topics such as Dynamo and custom families. Currently, there is no concrete plan to make that happen. The predominant limiting factor is that there is still no provision for a dedicated or outsourced BIM Manager to organize and drive further improvement.

Architectural Department of a Large A/E Consulting Firm

JEO Consulting Group is a large multi-disciplinary firm with offices in several cities in Nebraska, the largest being located in Omaha and Lincoln. In addition to a large group of Civil Engineers and Surveyors, they also have a small Structural Engineering department and an Architectural department that is located in both Omaha and Lincoln. Typical work consists of libraries, fire stations, community centers and other municipal projects.

In early 2016, Travis Klasna, JEO's Strategic Opportunity Manager, contacted the author of this document about implementing Revit and BIM into their Architectural department. There was a concern that they would not be able to compete on future projects due to a lack of BIM proficiency in the office. In fact, JEO had already lost one or two opportunities due to an inability to provide BIM deliverables. JEO had also begun finding it increasingly more difficult to hire creative talent from the pool of recent college graduates because they were still delivering projects utilizing 2D AutoCAD-based workflows little changed from the 1980's and 90's.

Implementation Approach

JEO's architectural department is relatively small; typically in the case of small groups an extensive on-site discovery is difficult to justify, however in this case because of the low level of BIM awareness, it was decided to invest in a 2-day on-site discovery visit as the first step in their implementation.

During the discovery a survey of existing hardware and network infrastructure showed that JEO's investment in technology in that area meant that there were no upgrades necessary to proceed with a BIM implementation. Additionally, JEO had in place a CAD Management team that was capable of assisting with the initial implementation tasks. Extensive training would need to be conducted to bring a largely BIM-ignorant staff up to a level of proficiency to successfully produce projects, however. Prior to that, a template with supporting content would need to be developed for Revit.

Also, during the discovery, short-term and long-term benefits were identified:

Short Term:

- Better coordinated Construction Documents
- Fewer change orders and RFI's due to clashes and interferences between objects
- The ability to attract more creative talent among graduate architects
- The ability to produce renderings in-house, eliminating the cost of outsourcing
- The ability to partner with or participate on joint-venture BIM projects with other consultants and architects who are currently using Revit and other BIM technologies

Long Term:

- Energy/Sustainability/Building Lifecycle cost analysis
- FM and CMMS data input into the building model as a deliverable for more sophisticated owners that may exist as BIM is more widely adopted in the region
- Lighting analysis, leveraging accurate photometric lighting components in Revit and 3ds Max
- Better coordinated federated models utilizing BIM 360 Glue and/or Navisworks Manage

Following the discovery, the template was developed, with periodic review sessions being conducted remotely utilizing GoToMeeting screen-sharing technology. Once the template was completed, Revit Fundamentals training was conducted on-site in JEO's Lincoln, Nebraska office. As work began on the initial pilot project, further intermediate-level training was conducted remotely using GoToTraining technology, scheduled in half-day sessions to minimize disruption to billable work, and a select group of users participated in more advanced BIM Manager training. Project mentoring was provided through the course of the pilot project to allow for "just in time" learning delivered in increments of as little as ¼ hour at a time to address things that occurred during the course of the project development that had not been covered in the formal training sessions.

Implementation Results

The BIM implementation at JEO is considered a success. Not only has their architectural staff become proficient in utilizing BIM technologies, their most resistive people have become BIM's biggest champions as a result of the training and mentoring they received during the implementation process. Jarred Meyer, a project coordinator at JEO and one of the people involved in the implementation said "The implementation services and training took a lot of the intimidation away." Since the initial pilot project was completed, all new projects (eight to ten so far) have been done in Revit.

They have also been able to realize many of their short-term BIM goals, in particular:

- They have hired a Revit-proficient project architect.
- Some of their consultants are now using Revit on the projects that JEO is delivering, utilizing the architectural model being generated by JEO.
- While they are still outsourcing some of their renderings, due simply to the fact that the resource that they use is very inexpensive, they have begun generating renderings internally as well, and are experimenting with visualization add-ons such as Enscape.

Future Plans

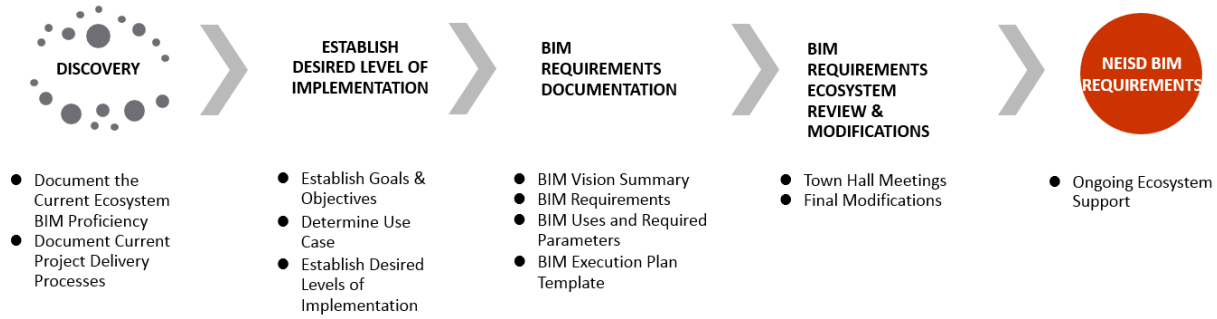
While the initial implementation has been successful, future plans are currently somewhat limited, due to staffing limitations. While the existing CAD management team was able to assist with the initial implementation, they do not have the resources to move the implementation forward. There has been some further development of the template however, and they are considering the utilization of BIM 360 Design for cloud collaboration in the near future.

Owner Implementation – BIM Standards Development – North East Independent School District

North East Independent School District is the 2nd largest public school district in San Antonio, TX, and the first to consider any sort of BIM mandate for their capital improvement projects. In the Spring of 2016, they were referred to the author's company by Autodesk, wanting to begin a first-round of BIM standards, with a limited budget and scope. Most of the architects, engineers and contractors in their ecosystem of consultants were already BIM-capable to varying degrees, and most of their larger projects were being conducted utilizing a CM at Risk delivery model, making BIM a good fit.

Implementation Approach

The BIM implementation process for an owner is significantly different than that of a design or construction firm, since the owner needs to be properly positioned to consume and utilize BIM data rather than generate the deliverables.



The NEISD BIM Requirements implementation began with an on-site discovery meeting in April of 2016 between the author, Jorge Cabello (Director of Construction Planning and Design for NEISD), the head of facilities management and representatives from some of the school district's consulting architectural firms.

Short term goals identified:

- Clash Detection Reports at Critical Phases of the Projects
- Fewer RFIs and Change Orders
- Clearly defined roles and responsibilities for project team members at major project milestones

A mid-term goal of model-based energy and sustainability analysis and a longer-term goal of the ability to track real time data for critical building systems were also identified. To properly position NEISD to realize the longer-term goal, critical data to be ultimately tracked was also identified. Jorge Cabello also expressed the desire to implement their BIM requirements and standards in "baby steps", so as to not unduly disrupt the consultant ecosystem. For this reason, it was decided not to place a BIM deliverable requirement on projects until the Design Development and Construction Documents phases of each project.

Finally, critical elements of documentation for the BIM Requirements were identified:

- **BIM Vision Summary** – a short document summarizing the findings of the Discovery – the justification and rationale for the BIM requirements.

- **BIM Requirements** – a comprehensive document that specifies critical milestones of a project, specific deliverables at each milestone and responsible parties. In addition, modeling best practices and Level of Development are specified, along with specifications for clash detection at each milestone of the project.
- **BIM Uses and Required Parameters** – a document listing all parameters to be stored in the Building Information Model (utilizing COBie conventions) and who the responsible party for establishing the parameters are. A Revit template with the parameters pre-built was to be provided as a resource for the consulting ecosystem.
- **BIM Execution Plan Template** – a document to be used on each project to explicitly name design and construction team members, coordination meeting schedules and formats, and Levels of Development for each category of BIM object at each critical milestone, using the BIM Requirements document as a guide.

Following the discovery meeting, work was begun on the BIM Requirements documents. During the development of the documents, three “town-hall” meetings were held with design consultants, contractors and construction managers that represented the NEISD consulting ecosystem. The purpose of these meetings was to inform them of progress and to obtain feedback and input, allowing for ownership of the process among the consultants. Once the BIM Requirements were complete and approved by NEISD, a final town hall meeting was held to present the finished documents and address any last-minute questions.

Implementation Results

In an interview with Josue Burguete, District Architect for NEISD, feedback was obtained as to the results of the initial round of BIM Requirements a little over 2 years post-implementation.

- Architects, Engineers and other design consultants are currently required to provide BIM deliverables under the umbrella of the NEISD BIM Requirements for any projects with a budget of $4 million (US) or more. Smaller projects may have a BIM mandate at the district’s discretion. Contractors are currently not being required to use BIM however many of them are already utilizing BIM technologies and processes internally utilizing the BIM deliverables from the design teams.
- There are currently fourteen projects underway at North East Independent School District with a BIM mandate, ranging in budget from $8.5 million to $35.5 million. These include new facilities as well as renovation projects and additions, with the first project scheduled for completion in March of 2019.
- NEISD has experienced significantly fewer delays in construction due to fewer RFIs and change orders, which they attribute directly to the implementation of a BIM mandate.
- The biggest challenge that they are seeing is that while the general contractors are, for the most part, BIM-capable, subcontractors are not. This will have an impact on their next evolution of the BIM mandate.

Future Plans

NEISD plans to begin its next phase of the BIM Requirements to coincide with the next bond election, which will probably occur in 2021. This will include:

- Possibly requiring BIM earlier in the process (schematic and conceptual design) to enable the utilization of energy analysis tools to provide early feedback as to building efficiency and lifecycle costs.

- Requirement for general contractors to provide BIM-enabled services (especially clash detection) according to the BIM requirements documentation. Again, this is largely being done already; it will be formalized during this phase.
- To move further toward the long-range plan of more automated building maintenance, additional COBie data will be required in the next round of BIM requirements documentation.

Summary

Embarking on a BIM implementation can appear to be a daunting task, and can be intimidating in the beginning. However, with a plan that contains the critical elements of a BIM implementation (realistic short term goals, upper management support and buy in, outside expert assistance, to name a few of the most critical elements) you can succeed. Once your initial implementation has been attained, you shouldn't get complacent and consider it "done". *Adopt a culture of continuous improvement*. The technology is constantly changing and improving, and with the changes comes more opportunities for additional services and better deliverables. Most importantly, if you don't continue to grow your BIM implementation after the initial effort, you will soon find yourself playing "catch-up" again, facing yet another major effort to get current and able to deliver on owner requirements and expectations.