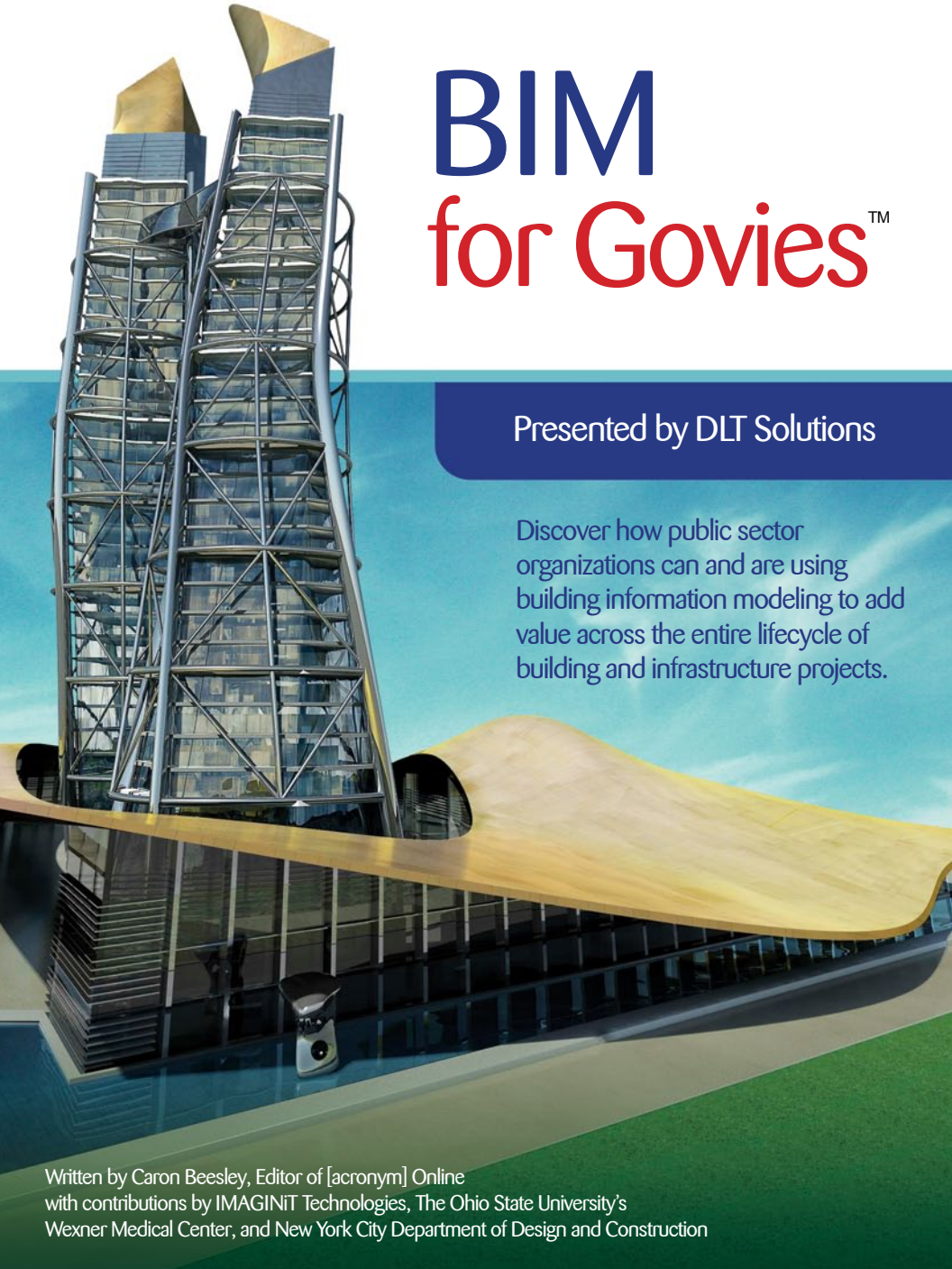
Knowledge. Advice. Clarity.



BIM for Govies™

Presented by DLT Solutions

Discover how public sector organizations can and are using building information modeling to add value across the entire lifecycle of building and infrastructure projects.

Written by Caron Beesley, Editor of [acronym] Online
with contributions by IMAGINiT Technologies, The Ohio State University's Wexner Medical Center, and New York City Department of Design and Construction

About this Guide

Building Information Modeling (BIM) is changing the way both the public and private sector work together to design, communicate, solve problems, and build better projects faster and at less cost.

With tight budgets and fast-changing policies – such as sustainability and green building mandates – BIM lets agencies quickly evaluate and better predict design alternatives early in the design process. At this point, changes are less expensive to make saving time and money, minimizing on-site waste, and improving the on-time delivery and value of government projects.

In fact, the adoption of BIM by many government agencies, most notably the General Service Administration (GSA), U.S Air Force and the U.S. Coast Guard has much to do with the proliferation of BIM by private sector firms eager to secure future contracts for public sector architectural, engineering and construction (AEC) projects.

State and local governments are also embracing BIM. The states of Wisconsin, Texas, and the City of New York have all adopted BIM deliverable standards for buildings, while others are looking to utilize BIM for road and highway design and other civil engineering projects.

But how can your agency benefit from BIM? What projects can BIM make a difference to? What's involved in implementation and how can you ensure your agency's adoption of BIM is a success?

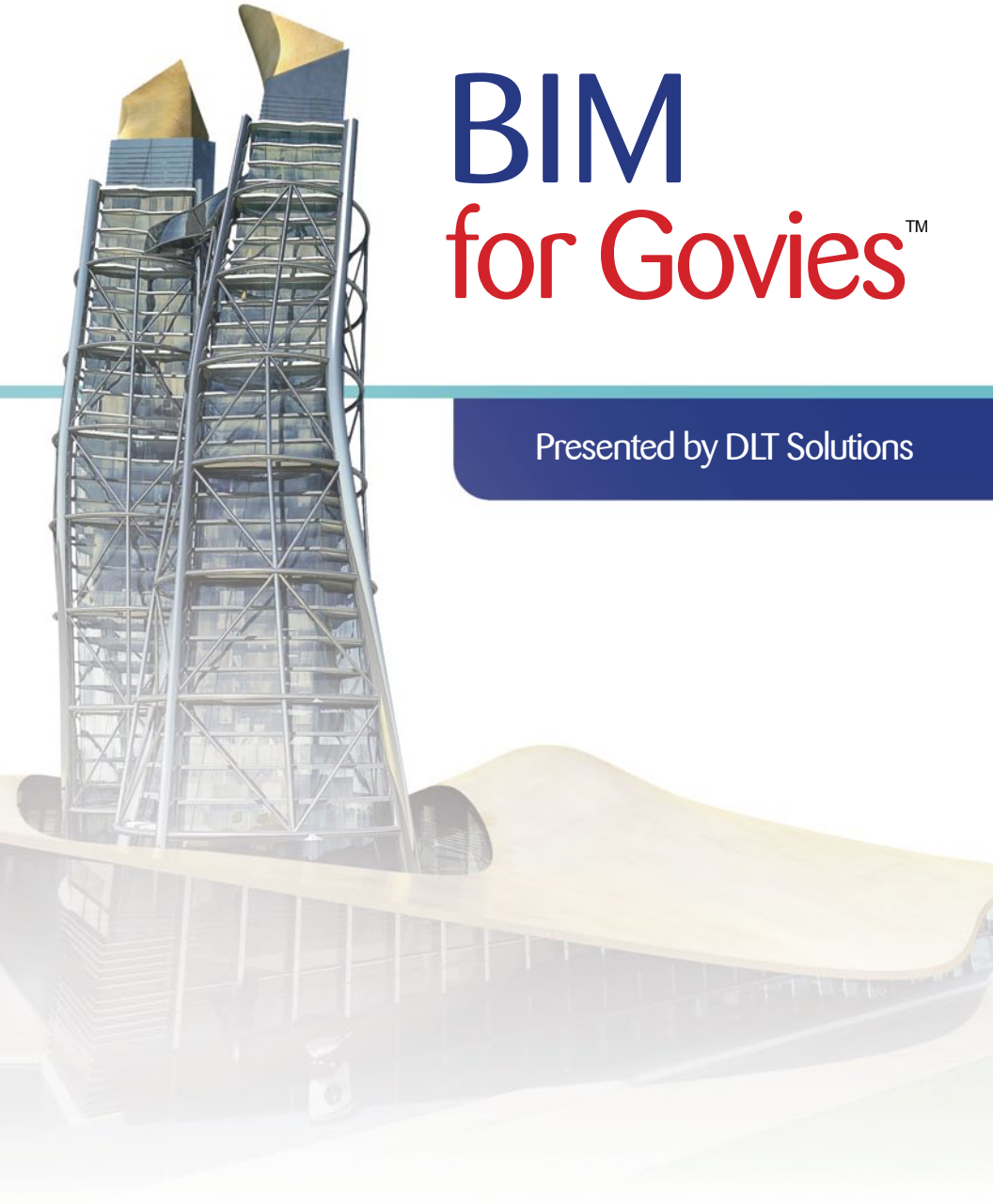
Over the following chapters, we'll answer these questions and many more. Read on to:

- **Understand** the basics of BIM
- **Witness** real-life examples of how the public sector is using BIM for building and infrastructure projects
- **Discover** more about BIM technologies and standards
- **Get tips** for assembling the right BIM team
- **Learn** the do's and don'ts for a realistic BIM implementation

About the Insights Shared in this Guide

The insights and real-life best practices shared in this guide are all drawn from contributed blogs previously published on [acronym] Online (www.acronymonline.org). DLT Solutions is a sponsor of [acronym] Online and its sister publication, [acronym] Magazine. [acronym] is the only complete source of news and information about CAD and related digital design technologies dedicated to the public sector.

Knowledge. Advice. Clarity.



BIM for Govies™

Presented by DLT Solutions

Copyright

BIM for Govies™

Published by
DLT Solutions, LLC
13861 Sunrise Valley Drive, Ste 400
Herndon, VA 20171
www.dlt.com

For general information about products and services, please contact DLT Solutions at 800-262-4DLT (4358) or at sales@dlt.com.

Table Of Contents

Chapter 1
An Overview of BIM and its Uses

Learn about:
— BIM Explained
— How BIM Supports the Entire Project Lifecycle
— How BIM Enables Better Coordination and Collaboration

Before we begin let's clarify what BIM is and how it can be used across the lifecycle of building and public infrastructure projects.

First and foremost, it's important to understand that BIM is not a specific product or technology, instead it's a collection of software applications designed to facilitate coordination and project collaboration. In addition, BIM is also a process for developing design and construction documentation by virtually construction a building, bridge or other form of infrastructure – before anything is built.

Unlike CAD, which uses software tools to generate digital 2D or 3D drawings, BIM facilitates a new way of working: creating designs with intelligent objects or building information models. Regardless of how many times the design changes—or who changes it—the data remains consistent, coordinated, and more accurate across all stakeholders. Cross-functional project teams use these model-based designs as the basis for new, more efficient collaborative workflows that give all stakeholders a clearer vision of the project and increase their ability to make more informed decisions faster – from the earliest conceptual stages, through design and construction, the operational life of the structure, retrofits and even demolition.

BIM at Work in the Public Sector

The New York Department of Design and Construction (NY DDC) uses BIM to champion design and construction excellence across its $6 billion portfolio.

Since adopting BIM, NY DDC and the municipal agencies it supports have reaped the following benefits:

- Greater transparency and consistent workflows throughout the design/ construction process
- A reduction in errors, reduced change orders, and increased productivity
- Ease of collaboration with contractors
- Cost savings

Read more on page 6

BIM Scales across Teams and Project Lifecycles

When a BIM is implemented, nearly every piece of information that an owner needs about a facility or structure throughout its life can be made available electronically. This is one of the fundamental reasons for the growing adoption of BIM – its inherent scalability across the lifecycle of a project – not just in terms of the projects magnitude and complexity that it can handle – but in terms of its breadth, depth and application on almost any project.

This scalability is made possible because BIM builds upon the 2D drawings used in traditional AEC design to include 3D design visualization and more. In fact, a BIM model is a multidimensional model on which users can tag and attribute visual and non-visual project and building-related information as a collection of attributes. BIM models can start out as simple 3D design elements, as the project evolves and more information is added to each model element about how a building or a bridge looks and functions – and the model scales with it. The underlying information is captured in a shared BIM database which creates a virtual model of the building at every stage of its life. This reduces information loss that often occurs when a new team takes ownership of a project, and provides more extensive information to owners of complex structures.

BIM Eases Coordination and Collaboration

As a project progresses and the model scales, the virtual information in the building information model (BIM) can be shared seamlessly between the core design team and project stakeholders including contractors, sub-contractors, program/project managers and even non-technical stakeholders in the form of highly polished project visuals, animations and presentations. Each of these stakeholders can add discipline-specific data to the shared model. And, because BIM design tools define objects parametrically – any changes to a single object by a team member will automatically change all related objects, saving costly and time-consuming design changes.

Quantities and shared properties of materials can also be extracted easily from the BIM model. Scopes of work can be isolated and defined. Systems, assemblies and sequences can be shown in a relative scale with the entire facility or group of facilities. BIM also prevents errors by enabling conflict or 'clash detection' by visually highlighting where parts of the building (for example, structural frame and building services pipes or ducts) may wrongly intersect.

BIM also ensures that information isn't lost when a project is handed from the design team, to construction and to the building or infrastructure operator. The new owner of the BIM can easily add and reference back to all the information stored in the model. For example, if a leaks is found the BIM or facility manager can reference the original BIM model to determine where water valves are located near the location of the leak. Not only that, the model will also contain information about the valve size, manufacturer, and so on, so that it can be easily fixed or replaced.

Existing conditions modeling Used to create a 3D model for retrofitting or new construction purposes	**Site analysis** Using BIM and GIS to determine optimum site location for future projects
Programming Using spatial tools to assess design performance in regards to spatial requirements	**Engineering analysis** Intelligent modeling software uses the BIM model to determine most effective engineering method
Design authoring 3D software is used to develop a BIM model based on criteria that is important to the development of the building's design	**Sustainability (LEED) evaluation** Evaluate a project based on sustainability criteria across all phases of the design/build and operations phase
Design review A 3D model is used to prototype the design layout, sightlines, security, colors, textures, and more. Design alternatives can be assessed and problems solved early in the process	**Code validation** Code validation software is used to check the model parameters against specific project codes
Clash detection Helps determine field conflicts by comparing 3D models of building systems and eliminate major system conflicts prior to installation	**Cost estimation** BIM is used to generate an accurate quantity take-off and cost estimate early in the design process
Construction system design Design and analyze the construction of a complex building system in 3D	**Phase planning** BIM is used to plan the phased occupancy in a renovation, retrofit, addition, or to show the construction sequence and space requirements on a building site
Digital fabrication A process that utilizes machine technology to prefabricate objects directly from a BIM model	**Record modeling** Depict an accurate representation of the physical conditions, environment, and assets of a facility in relation to architectural and MEP elements
Asset management Using an organized management system, building and facility managers can better maintain and operate a facility and its assets within budget. The data in a BIM model is used to determine the cost implications of changing or upgrading building assets, segregates costs, and maintain a detailed database of the value of your agency's assets	

Figure 1: How BIM adds Value across the Lifecycle of a Construction Project (Source: New York City Department of Design and Construction BIM Guidelines)

BIM and Sustainable Design

The U.S. federal government has played a leading role in the propagation of green building practices for a number of years, and in recent months state and local agencies are also increasingly mandating the use of the U.S. Green Building Council's LEED (Leadership in Energy and Environmental Design) standards for new building projects. But what role does BIM play in greener buildings? Green building teams are discovering that BIM tools can help them achieve more sustainable outcomes. BIM technologies provide immediate insight in how design decisions impact building performance, while BIM processes encourage an integrated design approach – a critical strategy for making projects greener. Also green design and construction rely on improving building performance. Many of the tools included in BIM software enable energy modeling and day lighting studies, and provide valuable information on how design changes impact building performance than traditional design software could. BIM models can also give more information to product manufacturers, which can eliminate waste.

Using BIM, extended design teams can visualize design changes and simulate how various scenarios will affect building performance. With this direct feedback, designers can analyze alternatives that will improve energy efficiency, optimize for natural light and ventilation, evaluate viability and placement of solar panels, and more. For existing buildings, agencies can use BIM to perform a building analysis through the creation of 3D models. Visualization and analysis tools can then help agencies understand how existing buildings are using energy and come up with strategies to improve energy performance of the existing portfolio.

The following chapters will address how the public sector is using BIM today and its plans for tomorrow. We'll also take a look at how BIM technologies are evolving. Plus we'll offer advice from industry experts on how you can ensure senior management is on-board with BIM and tips for a seamless implementation.

Chapter 2
BIM for Design, Build and Retrofits Projects – Three Powerful Case Studies

Learn about:
— How BIM Helps Ensure Mission Success
— BIM-Enabled Efficiencies
— BIM-Powered Decision Making
— New Build, Retrofit, or Demolition? BIM can Help

As you learned in Chapter 1, BIM can transform the way the government manages the entire lifecycle of government design, construction and building operation projects – helping to improve the way work gets done by providing more insight and predictability.

In this chapter we'll discuss three examples of BIM at work in the public sector:

Case Study 1: The New York Department of Design and Construction– An early adopter of BIM, NY DDC is an award-winning example of a progressive state and local agency that has leveraged BIM tools and processes to manage some of the biggest construction projects in the world.

Case Study 2: The Ohio State University Wexner Medical Center – Another award-winning BIM implementation from one of our nation's largest medical centers who moved from AutoCAD to six million square feet of BIM in order to deliver more value out of building floor plans and space data to internal customers.

Case Study 3: A Public sector agency faced with a costly decision of whether to retrofit two existing buildings into one or demolish both and build a new structure.

Each organization has leveraged the fundamentals of BIM in uniquely different ways to transform the business of design/build and operations management of a combined design portfolio that runs to billions of dollars.

Here's how they did it:

Case Study 1: BIM Helps NY DDC Tackle the Big Apple's Biggest Design and Construction Management Challenges

The Public Buildings Division of The New York Department of Design and Construction (NY DDC) manages the design and construction of buildings for more than 20 client agencies. These buildings include libraries, museums, police precincts, firehouses, emergency medical stations, day care centers, and more.

NY DDC is an early pioneer of BIM in local government, in fact Deputy Commissioner, David Resnick mandated the use of BIM tools such as Autodesk® Revit® Architecture in the development and management of two key DDC projects: The design and construction of a consolidated LEED Silver-targeted training facility for the New York City Police Department (architect: Perkins + Will) and the new Public Safety Answering Center, established to augment and provide redundancy to current 911 services in the wake of the 9/11 attacks (architect: Skidmore, Owings and Merrill).

Both projects were a triumph of technology and innovation, providing DDC and its client agencies with greater transparency throughout the design/construction process, minimized errors, increased productivity, and, ultimately, cost savings.

Figure 2: A photorealistic BIM visualization of the New York Police Academy, Queens, NY. This consolidated training facility is a collaboration of New York City Department of Design and Construction and architects Will + Perkins and is currently LEED Silver targeted. The 730,000 foot interior and 200,000 foot exterior facility is one of the largest public campuses in the world and is scheduled for completion in 2013.

Building a Targeted Pool of BIM Expertise

Standardizing on BIM is not without its challenges, and as DDC looked to expand the use of BIM across its projects it needed to ensure the integration of its existing group of design consultants and contractor, all of whom had differing levels of BIM expertise.

"Engaging our current design consultants and contractors and ensuring them of our commitment to their design excellence was a major priority for us. Because we consider BIM as technology and process that is superior to traditional non-BIM methods, it was critical that we provided our consultants with the means and processes to support us," explained Safiy Abdur-Rahman, BIM Manager, NY DDC in an interview with DLT Solutions.

The Role of the BIM Manager

BIM models span the whole planning-to-occupation time-span and are managed by a BIM Manager, who develops and tracks the model against performance objectives across multiple-disciplines that drive analysis, schedules, take-off and logistics.

In order to ensure that only the best qualified firms were hired for their public projects, the DDC modified the design procurement process by eliminating fee competition and emphasizing qualifications and expertise in selecting design consultants. The result? A pool of 28 firms selected according to a quality-based selection model who met DDC's design excellence criteria and commitment to BIM. These firms were now able bid more competitively on DDC projects, without being under-cut by lower-priced, less skilled firms. It also ensured the DDC had access to a group of select firms with the appropriate skill set and experience for the design services required.

Ensuring Uniformity in the Use of BIM with Consistent Standards and Guidelines

With the procurement process refined, NY DDC next needed to ensure the consistent application of design standards so that it could expand its use of BIM with the help of these external contractors.

Ensuring Uniformity in the Use of BIM with Consistent Standards and Guidelines (Continued)

"The information in BIM and the digitization of building data will improve and enhance buildings from design concept to operations and on to repurposing or demolition. The standardization of this data is important to our agency our clients, and the city of New York, as we begin to share more and more information across multiple agencies on multiple platforms and with our millions of citizens," explained, Safiy Abdur-Rahman.

"As the general contractors and trades begin to submit models for coordination along with their traditional shop drawings we anticipate an elimination of change orders due to scope, conflict in the field, and lack of coordination, all helping us to deliver projects on-time and on-budget. The DDC's decision to require BIM on its projects make's all this possible."

Safiy Abdur-Rahman,
NY DDC BIM Manager

Working with each firm, together with local BIM specialists, MicroDesk, NY DDC set about developing BIM guidelines to provide precisely developed specifications for use by architects, engineers and construction managers to assist them in preparation of contract documentation and standardized building information models. The DDC also provided guidelines for the consistent development and use of BIM across multiple building types and for a wide range of municipal agencies or organizations that may have been interested in utilizing BIM for projects in New York City but did not have their own standards in place. This would ensure uniformity in the use of BIM for all New York City Public Buildings projects.

DDC's BIM Guidelines also enable the consistent use of BIM throughout the project workflow making it easy for teams to assess and visualize higher quality building designs, and collaborate more effectively than would otherwise be possible with traditional and cumbersome paper-based blueprints.

NY DDC's BIM guidelines are now a go-to resource for any-one doing work with the City of New York. Because they are agency- and design platform-agnostic they form a useful resource for anyone looking to implement BIM in the city. As BIM toolsets and uses continue to evolve, the DDC BIM Guidelines will continue to be reviewed and updated to reflect advances in industry technology, methodology and trends, as deemed appropriate for municipal agency work in New York City.

The Future – Extending the Power of BIM Across the Bidding Cycle, in the Field, and more!

NYC DDC's commitment to design excellence means that each strategy leads to another, and all serve to inform the next. Working closely with its extended team as well as with industry specialists including Autodesk, DLT Solutions and Microdesk, NY DDC continues to leverage technology to deliver on its design excellence goals.

Using tools such as Autodesk® Building Design Suite Ultimate (which includes a comprehensive set of tools, such as Autodesk® Navisworks), the DDC is planning on taking advantage of BIM workflows to further achieve its goals.

Several pilot projects are currently underway to upgrade to a digital review process, which will eliminate complex paper-based processes. Thanks to the power of digital design review tools, such as Autodesk Design Review, Navisworks, and Solibri, the DDC will be able to seamlessly share and review 3D models and multi-format data with all stakeholders resulting in improved collaboration, conflict resolution, and planning – all before construction or renovation begins

Changing the Face of the City for Years to Come

To an outsider the construction of civic facilities appears straightforward, but to those involved construction projects don't happen in silos. It's a collaborative process that requires planning, coordination, and the application of lessons learned.

"Through our strategic programs and the use of digital design tools, NYC DDC has been able to enhance its workforce and this has led to gains in efficiency and more effective use of public funds," said David Resnick, Deputy Commissioner, NY DDC.

"While we deliver on our promise of design and construction excellence, digital design tools help us reduce construction-related disruptions and enhance our ability to study and provide solutions to complex issues affecting communities and neighborhoods."

For its design innovation and excellence in BIM, the NY DDC was a runner-up in the [acronym] Magazine 2011 Public Sector CAD Awards. Read more about NY DDC's achievements with BIM at:
www.dlt.com/bim4govies/NYC

Case Study 2: The Ohio State University Wexner Medical Center – Moving from AutoCAD Floor Plans to Six Million Sq. Feet of BIM

While the New York Department of Design and Construction demonstrates the power of BIM across all facets of government design and construction programs, the Wexner Medical Center at Ohio State University takes BIM beyond the design and construction phase and leverages it to optimize building operation and facilities management.

> *"In short, AutoCAD amounted to lines on a piece of paper for us, and our internal customers desired more value out of our space data."*
>
> **Joe Porostosky, Senior Manager of Facilities Information and Technology, Ohio State University**

Over the past four years, the Wexner Medical Center, has planned and executed a project to convert six million square feet of space from 2D drawings to intelligent 3D building information. Recognizing the limitations of traditional AutoCAD® documentation for representing building floor plans, in July 2008 the university's Facilities Information and Technology Services began investigating how it could provide its internal customers, including patients and visitors, with a more realistic representation of space and improved way-finding tools while improving the medical center's space planning methods.

Idea Development – Moving from Lines on a Piece of Paper

Joe Porostosky, Senior Manager of Facilities Information and Technology at the Medical Center spent six months informally reviewing their options. But it wasn't until 2010, after Joe was introduced to Brian Skripac AIA, LEED AP BD+C that Porostosky and his team made the decision to switch to BIM (at the time, Skripac was the Director of BIM at DesignGroup, a Columbus, Ohio-based architecture firm with a reputation for BIM leadership).

"The dramatic improvement to the visual presentation of facility plans, along with the ability to do energy modeling, and the general move to BIM by the architecture industry were the driving forces behind this decision," explained Porostosky in the first of his contributed blogs to [acronym] Online that showcase the project. "In addition, a 1.1 million square foot Medical Center expansion project was being designed in Revit and coordinated in Autodesk Navisworks, and we wanted to be ready for the BIM deliverables at the end of that project. One of our outstanding students, Michael Lindawan, was tasked with using the summer to investigate several conversion methods. At the end of the summer, he presented his research along with some metrics of how much time, per square foot, the conversion from 2D to 3D would take."

Planning the Conversion to BIM

Building on these foundations, during the autumn of 2010 Porostosky's team developed a detailed BIM Proposal and Implementation Plan to fully understand the timeline and resource requirements for a complete conversion to BIM. As Porostosky explains: *"This document was to serve as our way to formally scope the project and to promote this forward thinking initiative to senior leadership gaining the necessary labor and financial resources."*

The Beneficial Outcomes of Implementing BIM at Ohio State's Wexner Medical Center

With its BIM implementation underway, in 2011 the facilities team at the Wexner Medical Center was already reaping the benefits. Perhaps the single biggest benefit gained from the transition is what Joe Porostosky's team calls "BIM-Powered Decision Making" which helps the Center's staff, faculty, and to a lesser extent patients and visitors, make better decisions faster.

The Beneficial Outcomes of Implementing BIM at Ohio State's Wexner Medical Center (Continued)

Here are just a few examples of BIM at work at the Medical Center:

Renovation Decision Making – One of the immediate benefits that BIM brought to the Medical Center was the ability for the facilities team to visualize different renovation options for a given space. *"Previous to BIM, customers would be provided several 2D floor plans of a space and asked to decide which one they liked best. While those of us who work in this industry every day might be able to visualize a space from a 2D floor plan (Figure 3), most of our customers cannot," explained Porostosky. "They would make their best guess, but would frequently not be completely satisfied once they saw the completed space. During our BIM Implementation, in the summer of 2011, we had a new senior leader join the Medical Center. Before arriving, she was sent several 3D renderings of potential office layouts. With these images available she was able to easily understand the space and formulate a decision on which option best met her needs."* (Figure 4)

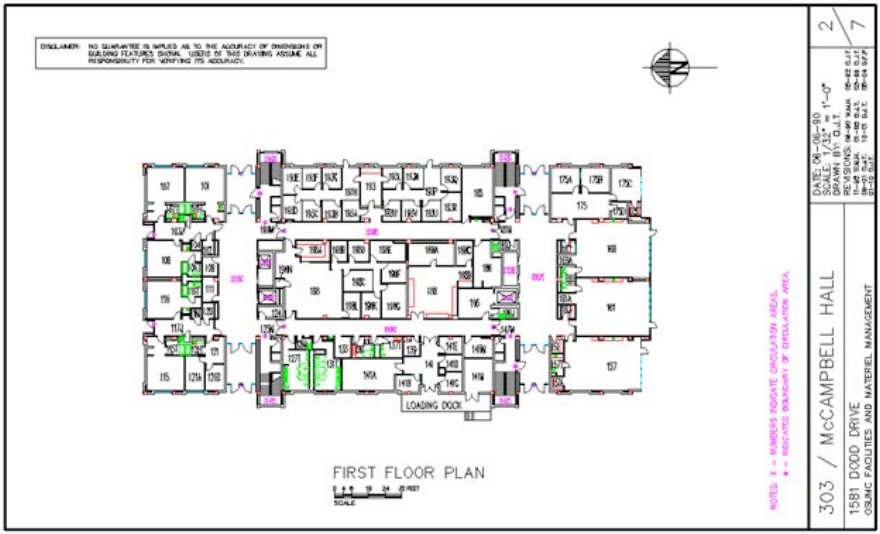


Figure 3: 2D Floor Plan

Figure 4: 3D rendering of potential office layouts

Funding Decision Making – BIM has also enabled the Medical Center to mock up spaces in great detail to inform the decision making process for future project funding. As Porostosky explains: "Recently, the Medical Center was working to determine if we should invest in renovating the Emergency Department with all new finishes. Since we already had a model of this building, we were able to quickly add the actual finishes to the space producing a visualization that was as close to accurate as possible. Instead of using a traditional finish board and asking the decision makers to interpret what the space might look like, they were able to see renderings and a video walkthrough of how the space will appear, complete with accurate finishes and furniture." (Figure 5)

Figure 5: Rendering and video walkthrough of Emergency Department

Donor Recognition Decisions – Space visualization capabilities made possible with BIM also provides the Medical Center with the ability to provide prospective donors with a visual of how a space might look and how they will be recognized for their contribution. For example: "… the Medical Center wanted to improve the exterior recognition for a major donor," said Porostosky. "Utilizing our new developed models, it took little time to develop several signage options that the University Architect and the Department of Development could consider. This allowed them to quickly make a decision about which signage looked best and provided the best visibility to visitors. The installed product matches almost identically to the rendering, further reinforcing the value of BIM in decision making." (Figure 6)

Customer Decisions – While Columbus has a number of high quality health systems that compete with one another, the Wexner Medical Center's ability to develop renderings of renovation, new buildings, or new spaces is aiding its marketing efforts to the community and proving to be yet another way to advertise its services and differentiate its care.

Figure 6: 3D rendering allows for review of various signage options for building exterior

Improved Accuracy – The effort to develop models for Medical Center buildings has also improved the accuracy of its building floor plans due to research conducted into the original building documentation and field verifications. In addition, the Center's building models include data that its traditional 2D AutoCAD plans do not, such as exteriors, roofs, window placement, ceilings, and heights contributing to the improved the accuracy and value of the models.

Future Expected Benefits

Even as the BIM implementation was nearing its completion, Joe Porostosky and Brian Skripac already had a clear vision of additional benefits that the BIM adoption would afford the Medical Center, including:

Enhanced Planning Support – Utilizing the newly created models, the Center's Facility Planners had access to a more robust and communicative method of planning future space needs. For example, the team anticipates being able to more easily demonstrate vertical and horizontal adjacencies, and compare how space is currently being used to how it will be utilized in the future. This not only aids in understanding the implications of their plans, but helps communicate those plans to decision makers and customers throughout the Medical Center.

Improved Patient and Visitor Way-Finding – With such a large campus, way-finding can be confusing to a new patient or visitor, but using BIM models the team will be able to create wall mounted maps with a 3D look and feel will certainly improve this effort. One possibility that the facility team is looking into, explains Porostosky "is to create video walkthroughs using the BIMs that take a patient or visitor from a parking garage to their location, thus familiarizing them with space within the Medical Center and helping them visualize their personalized path to their destination prior to their arrival, helping to improve their overall experience."

Energy Analysis – "With sustainability being a clear goal of every new building and major renovation at Ohio State…. we're always looking for ways to reduce the energy consumption in existing buildings and see BIM as a way for us to quickly extract the needed data for this analysis. Leveraging technologies such as Autodesk Green Building Studio and eQUEST will allow us to analyze different sustainability projects to determine which will provide the greatest return on investment, "said Porostosky.

Recruitment Tool – Who'd have thought that BIM could help staff recruitment efforts? But at the Wexner Medical Center, providing renderings of proposed lab or offices spaces can also support the recruitment of new faculty staff and researchers

Improved Asset Management – *"Following new construction or major renovations, there is typically significant work to get all the systems of the building into our preventative maintenance system," said Porostosky. "If a BIM model was provided at the close out of a project, this could potentially speed up that process and increase the accuracy, while also providing the basis for improved asset tracking by connecting to asset management systems."*

Capacity Planning and Detour Effects – *"We are also currently looking into additional technologies that would allow us to analyze our BIMs for people and vehicle capacity analysis, to better understand the effects of a hallway being closed or a street being limited to one lane during a construction process." Continues Porostosky: "This would allow us to better understand, ahead of time, how severe the effects of a closure are going to be, and better prepare for the negative effects of those detours."*

Adding Additional Data to Models – As more internal clients see the value that BIM can provide, the facilities team is being asked for additional data to be added to the already robust BIM models. Major building components such as fume hoods, accurate casework, signage, and more will be added to the models in later phases. The team has also purchased a 3D laser scanner to aid in data collection and improve the quality of new model documentation – as compared to existing, often inaccurate, AutoCAD drawings – and has already scanned a space with historical significance to the University that was undergoing a complete renovation. Future plans also include using the scanner to rapidly model mechanical spaces in Revit and support the collection of highly accurate "behind-the-wall" conditions.

Read more about the Wexner Medical Center's implementation of BIM in a series of guest blogs from Joe Porostosky and Brian Skripac on [acronym] Online: **www.acronymonline.org/tag/osuwmc**.

Figure 7: Point cloud data incorporated into Revit to improve the accuracy of the building model

Case Study 3: Teardown or Retrofit: A BIM Evaluation Gives the Answer

As you can see, numerous government agencies and public sector organizations are moving ahead by incorporating BIM process into their workflow, but some are still yet to be convinced of the benefits than an intelligent model can provide. Case in point, in 2011, IMAGINiT Technologies, a provider of enterprise solutions to the engineering community, assisted a public sector client faced with a unique challenge – they had to decide whether to retrofit two existing structures into one or demolish both and build a new structure. Using the BIM process, IMAGINiT was able to help them identify substantial cost and time savings by changing the direction of the project from demolition and rebuild, to a retrofit.

Bryan Cowles, Applications Specialist & BSD Technical Team Manager, at IMAGINiT Technologies explains:

"This particular government agency was investigating the feasibility of retrofitting two side-by-side existing structures in order to combine them into one larger building. However, due to the large footprint of the existing buildings, the engineers were skeptical and thought they would need to demolish both and start from scratch – an expensive proposition. From an examination of the 2D drawings, the neighboring structures had been constructed independently without any uniformity and very little similarity in design. Each had contrasting angles to the other and it didn't appear possible to incorporate the two into one. It was decided to use the BIM process to obtain an accurate account of the materials used in the existing properties and to see how the two might be combined. This procedure would help to determine what existing materials could be reused and what new materials would be required. It would also assist in determining the consequences a demolition would have on the property's adjacent surroundings, the grounds and underground infrastructure."

Building the Model

The team started by importing the existing original 2D drawings of the two buildings into Autodesk Revit and then generating a 3D image to accurately recreate the current conditions. Using Revit, the team visualized the existing structures and a timeline was created for the various demolition/retrofit scenarios.

Models using three different products (Revit Architecture, AutoCAD® MEP and Autodesk® Revit® Structure) were integrated to conduct inference tests on each of the retrofit and rebuild scenarios. By generating these details in the model stage, issues could be dealt with quickly and easily and the new construction design was confirmed to work.

Explains Bryan Cowles: *"This comprehensive evaluation clearly demonstrated that the new structure could be built using the existing structures and changed the focus from a demolition and new construction to a more economical renovation. A plan was developed which left a substantial part of the existing structures intact and would allow for small areas to be carefully demolished. From these two existing structures, the new building would emerge. Overall, we estimated they could reuse at least 50 per cent of the existing structures which led to an enormous cost savings by eliminating a major demolition and requiring fewer new materials and a shorter construction timeline. The environmental impact was also drastically reduced because of the reuse of materials and the reduced impact on the surrounding environment."*

Without BIM, this type of in depth evaluation would have taken up to five times longer. *"Furthermore, because of the client's initial skepticism that a renovation would actually work, this upfront work may not even have been undertaken. Now that the BIM process can quickly take the guesswork out of the equation, more options to create better construction solutions are being explored. In fact, the effectiveness of this evaluation has led this government agency to institute a policy that a 3D BIM model is required for all future projects. It's now an essential step in their project workflow,"* concludes Brian Cowles.

The three case studies highlighted in this chapter touch the surface of how real-life BIM implementations can transform the business of government and public service – helping organizations achieve transparency in operations, realize efficiencies, and design, build and manage buildings smarter.

But BIM has benefits beyond buildings. In chapter 3 we'll discuss how BIM is bringing similar benefits to transportation and infrastructure design projects.

Chapter 3
It's not Just Buildings!

Learn about:
— BIM and Advances in Road and Highway Design
— How State Departments of Transportation are Using BIM
— Accelerated Approvals and Permits for Infrastructure Design Projects
— Using BIM to Identify Conflicts and Minimize Change Orders
— How BIM can Enhance Budget Management Across Project Lifecycles

Despite its name, the many benefits of building information modeling are no longer restricted to the architecture and building industry. BIM is quickly establishing a foothold with civil engineers, public sector transportation, and infrastructure officials as a tool to deliver design projects faster and smarter thanks to technology like AutoCAD® Civil 3D® and Autodesk® Infrastructure Design Suite (a comprehensive software solution for planning, designing, building, and managing civil and utility infrastructure – also known as the ultimate "BIM for Infrastructure" solution).

"While it has its roots in architecture, the principles of BIM apply to everything that is built, including roads and highways," writes Adam Strafaci, Industry Marketing Manager, for Autodesk's Infrastructure Division in a 2008 white paper published by CE News: *"What does BIM mean for civil engineers?".*

"To understand how BIM applies to civil engineering, and to road and highway design projects specifically, it is helpful to first take a look at the legacy 2D drafting-centric design process. This process, which can best be described as "siloed," starts with preliminary design, moves to detailed design, and then on to construction documentation. Each step is com¬pleted before the next one begins, and collaboration is very limited. This process works well until the inevitable design change needs to be made, at which point time-consuming and error-prone manual drafting updates are required. As such, this process has inherent practical limitations," explains Strafaci.

"Contrast this legacy approach with one that is becoming a standard across the AEC industry — BIM. Implement¬ing a BIM process for road and highway design starts with creation of coordinated, reliable design information about the project. This results in an intelligent 3D model of the road¬way in which elements of the design are related to each other dynamically — not just points, surfaces, and alignments, but a rich set of information and the attributes associated with it," Strafaci continues.

In summary:

- BIM facilitates the evaluation of design alternatives
- The information model can be used to conduct simulation and analysis to optimize the design for objectives such as constructability, sustainability, and road safety
- With a BIM process, design deliverables can be created directly from the information model. These include not only 2D construction documentation, but also the model itself and the rich information it contains. This can be leveraged for quantity take off, construction sequencing, as-built compari-sons, and operations and maintenance

How State Departments of Transportation are using BIM

By embracing BIM technologies and processes, state government agencies, municipalities, and federal governments are planning, designing, building, and managing transportation infrastructure projects smarter, faster, and more affordably.

"Some of the largest states and construction firms in the United States have begun to adopt 3D modeling software such as AutoCAD Civil 3D software for engineering design…(and) have begun to explore some of the opportunities for greater efficiency, improved designs and better cost management that the use of 3D models provide," explains Joe Hedrick, LS, EIT, manager of **IMAGINiT Technologies'** Infrastructure Solutions team in his [acronym] Online guest blog ***"What's Trending in Transportation Design"*** (published in August 2012).

Hedrick goes on to explain some of the ways modeling software has transformed large transportation project design and development. Here are excerpts from his blog:

What's Trending in Transportation Project Design

IMAGINiT's Joe Hedrick explains some of the ways modeling software has transformed large transportation project design and development..

Project Visualization

> *"In Autodesk Civil 3D, there is literally a drive-through function that allows engineers to easily develop movies of how drivers might experience a proposed design. This is revolutionary in transportation project communication… (and) invaluable when presenting plans to the many constituents involved in approving and building a transportation project."*
>
> **Joe Hedrick, LS, EIT, Infrastructure Solutions Manager, IMAGINiT**

With large transportation projects, public meetings and consultations often spur design changes, however, most people don't know how to read traditional 2D drawings, so a 3D drive through or fly-by of the project immediately communicates the engineer's design intent. By showing people a photo-realistic rendering of what the project might look like from different perspectives, consultations with the public, with contractors and other government agencies can be more productive and efficient. In Autodesk Civil 3D, there is literally a drive-through function that allows engineers to easily develop movies of how drivers might experience a proposed design. This is revolutionary in transportation project communication. Before 3D modeling, it was prohibitively expensive to develop drive-throughs and designers rarely created them – but with the advent of 3D many are finding that these illustrations are invaluable when presenting plans to the many constituents involved in approving and building a transportation project. For example, engineers are beginning to use the model to explore safety aspects of the project in a visually accurate manner. They can look at passing and stopping site distances, as well as spot blind corners or intersections and then make design tweaks to improve road safety.

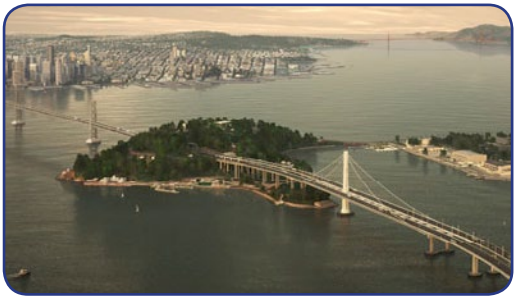


Figure 8: 3D Visualization of San Francisco – Oakland Bay Bridge, by Randy Burton of Parson Brinckerhoff (courtesy of IMAGINiT Technologies)

Accelerating Approvals

There are a myriad of approvals and permits required when building large roadway infrastructure projects. These include federal, state, and county level environmental agencies, water management regulatory bodies, as well as the actual counties and cities impacted by the projects. Each of these regulatory bodies requires specific information and associated drawings for permit and approval reviews.

Prior to information modeling, these drawings would be produced on a one-off basis, and considering that designs often change in large civil projects, would require frequent updating. Now, using a 3D model the project team can simply call up the view required in the model and obtain the necessary information far more quickly and easily. Approvals and permitting information and drawings are simply subsets of the information already included in the model. For example, for water management approvals, engineers need to detail the pre-construction flow conditions and the post-construction flow conditions to design drainage management systems. This is a very dynamic area of investigation and can be time intensive – especially when the design changes. However, because the information in the model provides accurate guidelines, engineers can perform water flow calculations more quickly than ever before. And, when the model changes, so too will the corresponding drainage analysis.

Figure 9: Fort Worth – Clearfork Main Street Bridge, by Claudio Branch, Freese and Nichols (courtesy of IMAGINiT Technologies)

Managing Costs

Billions of dollars spent on public infrastructure projects can be better managed if the project constituents use design engineering modeling throughout the project's lifecycle. At the early design stage, engineers can present more than one design option in order to receive agreement from the various stakeholders. As the design work proceeds and changes are made in response to environmental or social requirements, engineers can now use the model to readily calculate the cost of alterations without significant manual work.

Prior to and during construction, the project team can view the construction sequence virtually in order to create a schedule that optimizes both human and machine assets, as well as reduce conflicts and potential safety issues. After construction, the model can populate asset management systems. This allows road maintenance crews and owners to schedule and maintain the new asset to extend its life and ensure safety.

Virtual Construction

Whether adding another lane, creating a new intersection or otherwise altering an existing roadway, keeping the project on schedule and on budget is of paramount importance. Using a model and placing it into a tool such as Autodesk® Navisworks®, allows the construction team to schedule and build the entire project virtually to help identify conflicts ahead of time and minimize the number of change orders. This type of analysis also aids in public safety as traffic management plans can be created and communicated well ahead of time.

Figure 10: I-95 / I-695 Interchange, by Glen Lloyd of Parsons Brinckerhoff (courtesy of IMAGINiT Technologies)

These are just some of the many changes to the way transportation projects are being conceived of, designed and constructed in the post-modeling world. As more engineers and transportation departments adopt 3D modeling, more innovation will occur.

About Joe Hedrick, LS, EIT

As a manager for IMAGINiT's Infrastructure Solutions team, Joe oversees the civil and survey application engineers in the eastern half of the United States and provides Autodesk civil engineering and survey implementation consulting services. **www.imaginit.com**

Chapter 4
BIM Implementation – Ensuring Success During this Critical Phase

Learn about:
— How to Prepare your Agency for a Move to BIM
— The Importance of Stakeholder Buy-In and Pre-Implementation Planning
— A BIM Implementation Case Study

Public sector agencies adopt new software on a regular basis, often there is a learning curve and some training expense, before benefits start to be realized.

Implementing BIM is different. BIM implementation is not really about software adoption, it's about organizational change with people and processes playing a far bigger role than the technology itself. As we explained in chapter 3, the benefits of BIM are numerous, but it takes more than a license purchase to make it a success. Adoption is often regarded as a wilderness; it's an inconvenient that many architectural, engineering and construction consultants will testify to.

BIM adoption can go wrong in many ways, even in instances where it's mandated, on the job site it can be disregarded, often by stakeholders who aren't prepared or ready for the process and organizational change that BIM represents. Once adopted, the speed of change is often too great and teams quickly get bogged down, even with the help of training. Other organizations deploy BIM successfully, but aren't able to sustain it. Faced with such calamities, many of these organizations simply outsource BIM to help them meet their objectives, which essentially makes BIM another cost, instead of a cost-savings tool and renders the collaborative benefits of BIM worthless.

Implementing a Successful and Sustainable BIM Deployment

In chapter 2, we discussed the benefits that Ohio State University's Wexner Medical Center has realized from its implementation of BIM. However, much of this was achieved as a direct result of the planned approach to understanding the technology and, more importantly, how it would be integrated and redefine the organization's existing team and processes. The cornerstone of the Medical Center's successful BIM implementation was partnership and collaboration between Joe Porostosky and his facilities management team, and Brian Skripac, formerly the Director of Building Information Modeling at DesignGroup, Columbus, Ohio.

Utilizing what they define as the "Big Bang Approach" the team conducted significant pre-implementation planning to ensure the Medical Center leadership was fully bought into the project and the that the right team, standards and processes were in place before a single model was developed

Here's how this approach unfolded:

1. Using Project Definition to Ensure Stakeholder Buy-In

Building on initial research conducted by university architectural student, Michael Lindawan, into the scale of the task at hand, Porostosky's team in collaboration with DesignGroup's Brian Skripac developed a detailed BIM proposal and implementation plan to fully understand the timeline and resource requirements for a complete conversion to BIM and gain buy-in from senior leadership.

A key factor in securing buy-in was to clearly define the outcomes for the Medical Center: "Understanding how they were going to use the model geometry was important, but equally important was knowing what additional data was needed in the models to optimize their use and meet the wide range of uses and expectations for the team at the Medical Center," wrote Brian Skripac in his blog describing the implementation on [acronym] Online.

"In addition, we had lengthy conversations about how the internal team at the Medical Center would be structured. Who was going to take on the task of modeling the more than six million square feet of buildings? Would it be the Medical Center, DesignGroup, or both? Who would provide the needed internal technical leadership for this project and the larger ongoing BIM initiatives, and how could that person quickly get up to speed with the technology so they could provide the needed owner's perspective to the on-going project development?"
Implementing BIM takes teamwork, something that Skripac was keen to drive home during these conversations.

"A key driver behind this discussion was to make sure we were reinforcing the larger educational mission of the Medical Center, and taking a 'teach a man to fish' approach to the project. With this in mind we concluded that the best way to accomplish this project was to further educate the Medical Center team on the applications of BIM rather than doing the work and passing off a completed model for their use," said Skripac.

The outcome? Porostosky and Skripac made the decision to utilize the valuable resources on their doorstep and brought on a team of architectural and engineering students from The Ohio State University to learn how to develop these models, while providing a valuable real world, educational experience.

2. Defining Project Phases

A critical factor in securing buy-in from the leadership to get the green light to move forward with BIM, was the development of a multi-phased plan for the overall BIM implementation project. Using shared experiences and a desired outcomes, the team was able to define a clear scope of work, schedule and a well-planned multi-phased approach to the overall BIM implementation project (below):

"The initial project preparation of Phase 0 proved to be critical to the success of the project, as significant and long lasting decisions were made that would have been difficult and painful to change once our implementation began."

Joe Porostosky,
Senior Manager
of Facilities Information
and Technology Services,
The Ohio State University

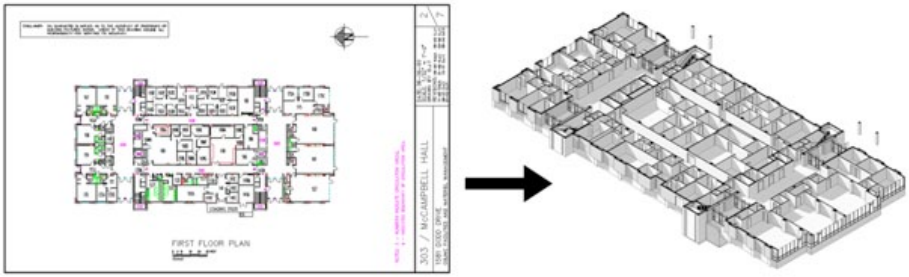
The Multi-Phased Approach to Implementing BIM at The Ohio State University's Wexner Medical Center	
Phase 0	• Standards & Template Development • Process Map and Workflow Integration • Best Practices & Consulting
Phase 1	• Implementation – "Big Bang Approach" • 54 Buildings – 6,012,540 square feet • Includes basic building information: exterior, walls, windows, doors, columns, etc. • Student and User Training
Phase 2	• Planned future detail to models

3. Focusing on BIM Standards and Process Development

In November, 2010 the project received the green light and in early 2011, Skripac and Porostosky's team began Phase 0 of the BIM implementation plan, which included four primary objectives:

A. Creation of the BIM Implementation Team – Defining who did what was a critical first step, the team eventually included a Project Consultant (Brian Skripac), a Project Champion (Joe Porostosky), a Technical and Process Lead, a BIM Coordinator and two Project Support resources.

B. Development of BIM Standards and Revit Templates – "Over the next couple of months, creating standards and templates was not just about rebuilding our AutoCAD content in Revit (Autodesk's BIM software), but reinventing those systems and process to create a new and better way of doing things," blogged Porostosky. "There were also extensive conversations about what the appropriate level of detail for the models would be (for both now and in the future) to accomplish the outcomes we had defined for this project."



C. Development of a process and workflow for model development *– "Knowing there is no easy way to move from AutoCAD to Revit, our collaboration with Brian allowed the team to clearly understand how the conversion process would occur,"* wrote Porostosky. The team used AutoCAD floor plans as an underlay in Revit so that they could model on top of it. However, while this provided the floor plan information a significant amount of data was needed to build a full 3D model that did not exist in the AutoCAD files, such as floors, ceilings, roofs, exteriors, and window, door and wall heights.

D. Preparing for Phase 1 ("Big Bang Conversion") kick off – "With this in mind, the last step in Phase 0 was to collect as much existing building information as possible to ensure the students could hit the ground running when they started in June of 2011," wrote Porostosky. For each of the 53 buildings intended to be modeled, the team needed to:

- Conduct a field verification to determine accuracy of the existing AutoCAD floor plans
- Collect supporting drawings such as: as-built plans, wall sections, building sections, elevations, etc.
- Photo document the building exterior and any of its unique features

"The initial project preparation of Phase 0 proved to be critical to the success of the project, as significant and long lasting decisions were made that would have been difficult and painful to change once our implementation began. In addition, the Phase 0 work that was conducted significantly accelerated the students' work in creating the building information models," said Porostosky.

4. The "Big Bang" Implementation Approach

In June of 2011, the implementation process started with two undergraduate and two graduate architecture students along with one undergraduate civil engineering student, all from Ohio State University. While their first week included on-site orientation, team building and a project overview, the students quickly became acclimated with the technology they would become expert at during a focused three day training session on Revit Architecture led by Brian Skripac.

Explained Porostosky: *"The training focused on the execution of the newly defined process map and workflow integrations to translate information from 2D to 3D. The students were not only taught how to use Revit Architecture but it was presented in a way that would mimic their everyday use of the software as they began to model the existing facilities. As the training concluded, the students were immediately assigned a building and began the process of developing their first model."*

Once the first set of models was completed each building was carefully audited by Brian Skripac who documented their adherence to the BIM standard. A review session was then held with the team as a whole, this allowed the students and full time staff to learn how to create the most accurate and useable models as they continued their work.

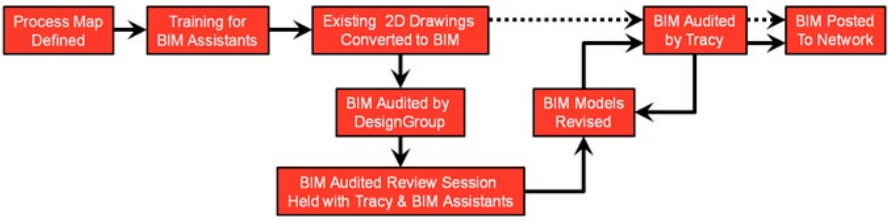


Figure 11: BIM Implementation Workflow at The Ohio State University's Wexner Medical Center

"Lastly, we further developed the Revit files to make information more readily available to the masses who would not be using Revit every day. Additional prototypical and printable view, schedules and sheets were built in requiring more time to update all our models with these changes," said Porostosky. "We also required the students to produce several renderings of their buildings to maintain on our online gallery of images, which can be found here."

5. End User Training

"Transitioning to BIM is not primarily a technical challenge, it is culture change," Porostosky emphasized. To aid in the adoption of BIM across the Medical Center, DesignGroup was also tasked with developing and conducting a series of training sessions customized to the specific needs of its varying end user groups, including the following:

- Engineering and Operations: A three day session covering how to navigate/interact with a Revit model and how to extract information from the model.
- Interior Designers and Space Planners: A four day session covering everything from scheduling to views to moving walls and placing families, along with how to create renderings and walkthroughs.
- Construction Managers: A half-day session on navigating DWF versions of the Revit model in Autodesk Design Review.
- Energy Engineering: A two day session on how to translate the existing Revit models as gbXML files for their use in tools like Autodesk Green Building Studio and eQUEST.

The Importance of Consistent BIM Standards

As the Wexner Medical Center BIM implementation reveals, adherence to process and the definition and use of consistent BIM standards is critical to any BIM adoption and ensures uniformity in the use of BIM across multiple stakeholders and end users. We'll learn more about this in the next chapter.

Chapter 5
The Importance of BIM Standards

Learn about:
— Why BIM standards Matter
— How BIM standards Impact Project Productivity
— What Public Sector BIM Standards Look Like
— Resources to Help Agencies Build their Own Standards

BIM standards, much like traditional CAD standards, are utilized when creating and sharing the model. BIM standards ensure continuity for the project and provide the project owner with the format they desire; they can also have a big impact on productivity and ensure the overall BIM implementation is sustainable. Consistent BIM standards are particularly critical to government agencies and departments who manage multiple projects across multiple stakeholders, contractors, and end users

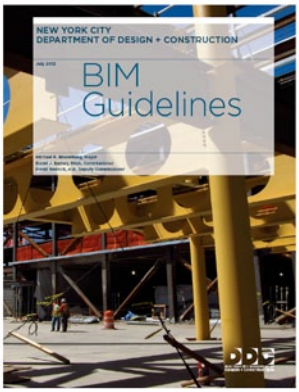
However, as with CAD standards, some project coordinators or owners aren't diligent about establishing and enforcing those standards or end up referring to their own standards, creating complications downstream.

For any investment in BIM to be sustainable, the consistent development and use of BIM across multiple building types and across a wide range of government projects and agencies is essential. Without a national uniform standard, more and more agencies are establishing BIM standards or guidelines of their own.

For example, the New York Department of Design and Construction (NY DDC), a leader in the public sector adoption of BIM for infrastructure and building projects recently developed its own comprehensive BIM Guidelines to address the challenges of sharing more information across multiple agencies on multiple platforms and with its millions of citizens.

BIM Standards and Guidelines – At Work for NY DDC

Prior to standardizing on BIM, NY DDC was faced with a variety of limiting issues including a bidding process that failed to deliver the necessary expertise needed for specialized projects; cumbersome project management processes; quality control issues; a lack a lack of uniform design standards for BIM projects, and more.



By implementing BIM and consistent standards for its use across the agency and by the contractors who support the agency, NY DDC has put in place BIM methodologies and processes that make it easier for teams to assess and visualize higher quality building designs, and collaborate more effectively than would otherwise be possible with traditional and cumbersome paper-based blueprints.

Based on its own experiences adopting and implementing BIM, NY DDC's BIM Guidelines contain precisely developed specifications for use by architects and engineers and construction managers to assist them in preparation of contract documentation and standardized building information models, including:

- The BIM software acceptable for DDC projects
- Choice of project delivery model
- Client agency design standards
- The types of models and any analysis files expected at each submission
- The naming conventions and standards required to be used when developing a project using BIM technology
- Roles and responsibilities of team members
- A BIM execution plan (required within 30 days of project award). This plan is designed to provide a framework that enables all parties involved to use and take advantage of BIM technology, along with best practices and procedure aligned with the DDC BIM Guidelines. To ensure that the project is complete and on time and with minimum design and coordination problems.

BIM Standards and Guidelines – At Work for NY DDC (Continued)

NY DDC's BIM Guidelines considers the end-use of the model for multiple client agencies, allowing qualified and authorized client agency representatives to review the ways in which the BIM may facilitate their ongoing building operation and maintenance protocols, and tailor their agency requirements and standards to leverage the enhanced capabilities provided by BIM for building operations and management.

The BIM guide also enables the consistent use of BIM throughout the project workflow making it easy for teams to assess and visualize higher quality building designs, and collaborate more effectively than would otherwise be possible with traditional and cumbersome paper-based blueprints.

Through the use of BIM tools such as Revit and clear BIM guidelines, the DDC and its partners have accomplished a more coordinated set of documents with each required submission.

Speaking with DLT Solutions, NY DDC's, BIM Manager, Safiy Abdur-Rahman highlighted the benefits of BIM beyond the planning and design phase, made possible thanks to consistent guidelines:

"The benefits were even greater when transitioning into the construction phase with the transfer of BIM models from the design team to the construction manager for assistance in the virtual design and construction process. The construction manager's use of BIM for scheduling, logistics, and coordination already have proven paramount," said Abdur-Rahman.

NY DDC's BIM guidelines are now a go-to resource for any-one doing work with the City of New York. Because they are agency- and design platform-agnostic they form a useful resource for anyone looking to implement BIM in the city. As BIM toolsets and uses continue to evolve, the DDC BIM Guidelines will continue to be reviewed and updated to reflect advances in industry technology, methodology and trends, as deemed appropriate for municipal agency work in New York City. Learn more about NY DDC's BIM implementation and how it has helped the agency achieve its mission of championing design and construction excellence in this informative case study.

Build your own Standards

There are a number of very good project implementation guides and standards available, in addition to NY DDC's BIM Guidelines, developed by trusted organizations such as NIST, Penn State and the U.S. Air Force. So there should be no real need to develop your standards from scratch, unless none of the published works are appropriate for your organization. Adapting an existing standard is much less effort, and enables agencies to draw on a wider experience base than their own.

Download and read NY DDC's BIM Guidelines. Many other states have also developed BIM standards and guidelines including Wisconsin, Ohio, and Texas.

Chapter 6
Your BIM Toolkit

Learn about:
— BIM Software
— Supporting BIM – Other Technology Considerations
— BIM in the Cloud
— The Role of Existing CAD Software

We've already discussed the role that a well thought-out BIM implementation plans in a successful adoption, but what about the technologies that enable, augment and extend BIM across the lifecycle of AEC projects? What should your BIM toolkit comprise?

Your BIM Toolkit

Yes, you'll need to make an investment in BIM software – Autodesk Revit products, Autodesk Building Design Suite, and Autodesk Infrastructure Design Suite, are just a few examples of best-in-breed solutions available in the marketplace. But to support BIM, government organizations will also need to look at their entire IT infrastructure. Agencies will typically require hardware and networking upgrades: more powerful CPUs, more memory, WAN devices, and even bigger monitors. Making the commitment to using top of the line hardware, connectivity, and communication devices is essential, since the technology often used for traditional CAD may be insufficient for BIM.

What about other technology? To take full advantage of the power of BIM, you may need technology for collaboration, analysis, visualization, design review, data management, and so on. For example, enhanced collaboration may require additional investment in the mobile tablets for field users and video conferencing technology. The increase in the sheer amount of information being shared may require a data management solution. In some cases, additional computing power might be required, although today much of the heavy lifting can be done in the cloud. Cloud-based BIM technologies, such as Autodesk® BIM 360™ for example, design team members are able to work together in real time in a single project environment. In fact, cloud computing represents a whole new frontier for BIM, giving users access to a wide range of services while ensuring that their information and services are current.

With Autodesk BIM 360, users can get "anywhere, anytime" access to their design models through a variety of services offered on Autodesk's cloud-based platform. This allows users to free up their desktops by moving computing-intensive designs and processes, such as clash detection and energy analysis to the cloud.

Mobile technologies are also starting to play a significant role in BIM roll-outs as new technology enables construction personnel to access BIM models in the cloud. This addresses one of the biggest problems in any construction project – technology is not being applied in the field. With new BIM technologies such as Autodesk® BIM 360™ Field software enables construction and infrastructure industry professionals to combine mobile technologies and BIM at the point of construction – filling a much needed void. Automation of field processes such as quality, safety, and commissioning checklists; distribution of plans and drawings; and mobile model access helps to provide measurable time and cost savings for architecture, engineering, civil infrastructure and construction projects.

Users can do all this while giving team members, contractors, and other stakeholders access to the same models for improved collaboration. All of these investments can be important to realizing the full value of BIM

What about Existing Software?

In some cases, an agency's investment in existing software can still pay off – it is just used differently. CAD software can still be used for detailing and documentation at the end of a project. Visualization software can still be used for advanced design visualizations, but will be better integrated into your workflow, using the BIM-based design models as the starting point instead of creating the model from scratch using the visualization software. Software tools such as Autodesk Building Design Suite and Autodesk Infrastructure Design Suite actually combine BIM (Revit and Civil 3D) with familiar CAD and civil engineering tools – helping users make the transition to BIM within familiar interfaces.

Finally, there is training. On this point, there is total agreement: on the job, off the job, in-house, out of house, over the shoulder, formal classes, luncheon roundtables, project-based, web-based—it is all good. Agencies and contractors need to train well, train often, and train continuously.

Chapter 7
Final Thoughts – Do's and Don'ts for a Realistic BIM Implementation

The transformative power of BIM is worth the effort helping federal, state and local agencies increase efficiency, productivity, and quality. Equally as important, according to a 2009 SmartMarket Report, is that the vast majority of users report seeing positive returns on their investment in BIM.

As we've seen, adapting to the advantages BIM offers requires investment in staff, processes, and technology. It also requires a flexible and positive approach which, many agree and the case studies in this book prove, is essential to ensuring agencies and other organizations can quickly realize the productivity and quality gains possible with BIM.

If you're agency is ready to adopt BIM technologies and processes here are nine do's and don'ts to ensure the implementation is realistic and successful:

9 Do's and Don'ts for a Realistic BIM Implementation *(Source: Robert Green, Cadalyst Magazine and Brendan McFarlane, bim4all)*	
1. Choose a BIM Test Project	**Do:** Take a typical design task that your team members understand and evaluate how it works using BIM methods. Tell management that by focusing your early BIM efforts on manageable projects you'll shorten training times and pave the way to doing BIM projects faster than you ever would by floundering around with a trial-and-error methodology. **Don't:** Try to design the next Taj Mahal on your first BIM project.
2. Select your Test Project Staff (or Project Champions)	**Do:** Choose your test process staff in a way that gives you the best chance for success. Push hard for the right BIM staffing. Tell senior management what you need to make BIM go well! Build backup documentation by writing down your recommendations, then do your best to make your managers listen. **Don't:** Waste your time trying to convince the "BIM will never work" crowd to join your first BIM project — deal with them later.

9 Do's and Don'ts for a Realistic BIM Implementation *(Source: Robert Green, Cadalyst Magazine and Brendan McFarlane, bim4all)*	
3. Choose the Right Tools	**Do:** Ideally, choose best-of-breed BIM software. Make sure structural and architectural software works together efficiently and that model data can be exchanged without loss of fidelity. **Don't:** Don't immediately jump for a single vendor solution without exploring all the alternatives, as you could be missing out on productivity and quality gains which will pay off handsomely over time
4. Concentrate on Process First	**Do:** Consider the impact that BIM will have on your processes. BIM changes how projects are planned, developed, and how you communicate and collaborate with others. **Don't:** Assume that BIM won't change the way you do things and that it's all about learning the technology.
5. Identify IT Issues	**Do:** View your test project as an IT readiness test for BIM. CAD managers should be prepared to go to their management teams and IT departments with a hardware specification and cost estimate for BIM machines in hand. **Don't:** Move forward with more BIM implementations if your testing reveals substantial IT problems.
6. Line Up Reseller Resources and other Sources of Support	**Do:** Honestly assess your ability to provide the support that will be required, and bring in extra help if you need it! Line up reseller or consultant assistance before you need it. **Don't:** Allow your BIM test project to flounder because you're too proud to ask for help.
7. Use Test Project Staff to Evaluate Training Classes	**Do:** Run several smaller classes so users are trained just in time for their first BIM project. The goal is to have each employee begin practical software usage immediately after he or she completes training. **Don't:** Resist the urge to train everybody who at one time, then expect them to jump into BIM months later
8. Work with Project Staff to Build Standards and Practices	**Do:** Analyze all the processes you will be using in delivering BIM, and document them thoroughly with supporting diagrams and reports. Once standards are set, put in place procedures to ensure that they are followed, develop quality assurance and control systems which make it easy for everyone to follow the correct methods. **Don't:** Assume standards will flow from nowhere.
9. Set Achievable Goals	**Do:** Set realistic achievable targets, you'll need to juggle many balls. Then delegate responsibilities to your project team so you can focus on bringing all the pieces together. **Don't:** Assume you can manage it all in a random, given timeline.

Useful References

DLT Solutions – BIM Resources for Government
www.dlt.com/BIM

[acronym] Online
www.acronymonline.org

Autodesk BIM Resources
www.autodesk.com/BIM

AIA Technology in Architectural Practice (AIA TAP)
www.network.aia.org/technologyinarchitecturalpractice/

U.S. General Services Administration
www.gsa.gov/BIM

DLT SOLUTIONS

Learn more, visit
www.dlt.com or email us at autodesk-solutions@dlt.com

The insights and real-life best practices shared in this guide are all drawn from contributed blogs previously published on [acronym] Online (www.acronymonline.org). DLT Solutions is a sponsor of [acronym] Online and its sister publication, [acronym] Magazine. [acronym] is the only complete source of news and information about CAD and related digital design technologies dedicated to the public sector.

Notes:

[acronym]

Commune. Share. Explore.

Caron Beesley

Editor of [acronym] Online

Caron is the Editor in Chief of [acronym] Online and its sister publication, [acronym] Magazine. With more than 15 years' experience in the publishing and marketing industries, Caron specializes in the public sector and related digital design disciplines.

Caron has led the editorial team since [acronym] was launched in 2006 and has written several guides designed to help the public sector leverage information technology and digital design solutions to improve government operations and the delivery of public services. Caron is also the point of contact for contributed articles and guest bloggers. Contact Caron at **editor@acronymonline.org** or via Twitter **@caronbeesley**.

BIM for Govies™ addresses many questions that government agencies have about BIM technologies and processes. It explains the basics of BIM, its uses, benefits and includes real life examples of successful public sector BIM implementations which your agency can draw on as you transition to BIM.

DLT SOLUTIONS

13861 Sunrise Valley Drive, Suite 400 • Herndon, VA 20171
800.262.4DLT (4358) • autodesk-solutions@dlt.com