Introduction

Building Information Modeling (BIM) has improved the ways that structures are designed, built and maintained. BIM is defined as the process of generating and managing building data during a structure’s life cycle;\(^1\)\(^2\) it involves representing design through objects that carry the geometry, relations and attributes of the components that they represent. These objects can be vague or defined, generic or product-specific. Other options include representing an area in a form that is void-space oriented, like the shape of a room, or the use of solid shapes to represent known quantities.

As its use has expanded, so too has the complexity of BIM’s definition. BIM now encompasses much more than discrete technologies, databases or information: It also includes the process that uses these tools to facilitate the efficient delivery and maintenance of buildings. Taking a step further, recycling technology can now leverage BIM information to discern the salvage value of a structure.

As a suite of process tools, BIM creates a new level of transparency for project stakeholders. It enables waste reduction and improves profitability. It allows valuable project information to adhere to project objectives and creates a reporting mechanism for those who need project information. Benefits include a planning basis for planners, a go/no-go platform-assessment system for decision makers and a single collection point for all data that a project generates.

Problems Solved Using BIM

Properly applied, BIM can solve many of the problems inherent in construction or renovation projects.\(^3\)\(^4\) In this way, it offers the construction industry an opportunity to transcend challenges that have faced builders for decades. For example, when the Walt Disney Concert Hall was under construction in Los Angeles in 1997, the general contractor (GC), M.A. Mortensen, claimed that construction costs had exceeded the agreed-upon total by over $50 million. Subsequently, the project’s world-renowned architect, Frank O. Gehry, threatened to withdraw from the undertaking, and stakeholders faced extensive litigation. In a Harvard case study\(^5\) authored by Jack S. Nyman (now the Executive Director of The Steven L. Newman Real Estate Institute), it was found that major issues highlighted by the Disney Concert Hall case included:

- “Technology is only as good as the people who manage and use it.”
- “With a focus on (architectural) design, consequences upon the budget, team coordination and time delays (may occur).”

\(^1\) Robert S. Weygant, BIM Content Development, John Wiley & Sons, 2011.
\(^3\) LiDAR (Light Detection and Ranging) is often used to estimate costs for renovations. In the “LiDAR” section of this paper, the tool is discussed at length.
\(^4\) According to New York City Mayor Michael Bloomberg’s PlaNYC 2030 Initiative, approximately 85% of the structures that will comprise the city’s building stock in 2030 already exist today, making retrofits to older buildings vital to the plan’s success.
\(^5\) “The Walt Disney Concert Hall, Los Angeles, California. Managing Information Technology: From Design to Delivery of a Highly Complex Building,” by Jack S. Nyman (under the supervision of Professor S. N. Pollalis, Harvard University, Cambridge, MA, 2006.)
• “Process ownership is the feeling that each member of a team feels ownership.”
• “A lack of coordinated information in the design process can inhibit the effective transfer of information.”

How might the use of BIM have avoided some of these problems? Presumably, BIM can help the architectural, engineering, legal and construction fields to continuously improve their logistics, especially if the insight that BIM offers can be ingrained at both the project and organizational levels. For example, a wall and ceiling (W&C) contractor may arrive on site and assess the work area. The contractor may find that 30 to 50 modifications to plan are needed, per floor. Such changes may range from adjustments of ductwork and sprinkler lines to the alteration of elements as significant as structural beams. Working through these modifications on site could be very expensive and difficult: an architect might resist giving up any height; ductwork might be costly to relocate; and each change might lead to new challenges. By resolving such issues in the virtual world of BIM, however, these matters can be addressed much more efficiently, and costly field modifications can be all but eliminated. Changes can be worked out in collaborative sessions, often online, and over great distances. In the end, moving bytes will be much easier and less costly than engaging high-priced crews to move and cut actual building components.

Consider another all-too-common situation that might be avoided with the sophisticated use of BIM: the failed project syndrome. A bank might finance a given project based on market rates and construction costs at the time of application. As the project developed, cash out would typically become the basis for the project status. Once the project closed in on its final draw, another 20% might be required to finish, but the bank would often have no obligation to continue funding the project, leaving the project in peril. Such a situation could be avoided with BIM-based risk-control measures that plug into the project model, including completion targets that cross reference project indices. Under such circumstances, the bank, as well as project management, could monitor progress clearly and timely and avoid the kinds of overruns that might later result in financing crises. Similar sorts of progress visibility could also be available to bonding companies and underwriters; even risk assessments could be carried out in the BIM model.

Energy use, LEED compliance, facilities management, project personnel and numerous other goals could be managed effectively through an intelligent application of BIM. Yet, the BIM process still faces a good deal of skepticism. Developers still ask, “What is BIM going to cost me?” And architects, engineers, attorneys, contractors and manufacturers may reasonably have the same question. The answer, unfortunately, is not the same for every participant, nor is it necessarily the same for similarly situated competitors. BIM remains a slowly-developing phenomenon with great potential to improve project efficiency, profitability and building maintenance effectiveness. It also requires meaningful investments in equipment, software and education and, most importantly, a willingness to change established work patterns. We are approaching a point where the critical mass BIM-adopters will transform today’s skepticism about the costs of BIM into a new question: What is the cost of not using BIM?

Project Life Cycle

A project’s life cycle goes from the sketch on a lunch napkin, before the design phase, to the disposal of the end product in the landfill. Every step or micro-process in the lifecycle becomes water for the buckets of information collected along the way. Unlike the building itself, data and information can live forever, providing baseline information for new projects going forward. Legacy does have value.

In the defense industry, for example, a fighter aircraft may be designed, manufactured, built and deployed. After a few years, the manufacturer may discontinue the model, but crucial information about parts (such as their material properties, geometry, suppliers and thermal and structural loadings) must continue to be made available even after initial production stops. The same is true of building information. Unfortunately, the reference manuals that contain such information often run on archaic machines, with old software, meaning that their data cannot be easily retrieved. In addition, different aspects of building information may be stored in different places. The standardization of BIM could begin to address such accessibility problems, going forward, in the construction and maintenance industries. In order for this to happen, however, the formats of such information must be standardized. Increasingly, this will mean that, regardless of the original data platform, crucial information will always remain retrievable.

Uniform Standards versus Proprietary Software

A question that arises is whether proprietary BIM components can be used
Internally, while external outputs conform to industry standards. Clearly, an application can maintain its uniqueness within its own environment, while producing valuable data that would be useful to other aspects of a larger project. However, software companies have pecuniary interests that may inhibit standards adherence. By locking down exchange parameters, programs can be designed to ensure dependence on their platforms. The problem is that the lack of compatibility fostered by this approach will eventually stunt growth. There are now applications being introduced that bring more players into the BIM space.

Building Assemblies

A single YouTube video has amazed the construction world like no other. Development of a 30-story building in China was filmed from start to finish using time-lapse video. The project began from scratch and completed in just 15 days. Previously, similar achievements had also been recorded in China. What was hidden from view in these stories was the role of prebuilt assemblies in such projects. Today’s components are not like those in the prefab days of the 1970s, when houses were trucked down the Interstate in halves or quarters and pieced together on site. Today, walls, rooms, fixtures, appliances, furniture, deck panels and snap-together curtain walls are all combined on site, with final tie-ins and connections performed at that time. Management of such symphonic achievements is done using BIM and RFID (radio frequency identification) tracking tools to inventory, locate and check in the components. The buildings of tomorrow are being built today through the application of lean principles. This benefits the owner with real-time delivery, based on market conditions. Projections become less risky when the final product is delivered as close as possible to the timing of market demand.

By pre-fitting panels, rooms and wall sections within the virtual environment of BIM, the misalignments that once plagued the prefab housing industry have served as the inspiration for meticulous quality control at the highest level. The system of assembled components that can comprise our future buildings will be built in controlled environments and assembled in a low-risk construction environment. This is a large benefit to the highly accident prone world of construction.

The potential to facilitate due diligence during the design and construction phases is another advantage of BIM. For example, while the Letterman Digital Arts Center was in the design phase in San Francisco, George Lucas, the owner and well known film director, approved numerous drawings digitally while filming a new Star Wars film in Australia. Clearly, having project data available to stakeholders off-site allows those who are responsible for project management to determine whether processes are being carried out both carefully and correctly with fewer site visits and earlier opportunities to advise about modifications or best practices.

3D, 4D and Beyond

Like the physical world, the virtual world works within observable perspectives. Length, width and depth are described using Cartesian references to the X, Y and Z axes to generate three dimensions (3D). With new technologies, a fourth dimension (4D), the element of time, may be added. Many say that cost is represented by the fifth dimension (5D), but this is not quite descriptive enough; 5D actually describes the adjusted budget during the course of a project, compared to its actual cost or reporting figures. Finally, the sixth dimension (6D) is facilities management, which is discussed below.

4D software is focused on timing and sequence. With software such as Syncrho, 4D has brought about some of the most dynamic and descriptive models to date. A designer can now apply a planned schedule to a model and compare its benchmarks to the actual construction process, in split-screen mode. Traditionally, little time is spent maintaining, updating or even correcting information as a project progresses. The ability to catch errors has driven the BIM industry, since the invention of critical path method (CPM) and its subsequent applications. Simply put, 4D-oriented software facilitates the proper sequencing of labor crews, and fosters the improvement of best practices in the industry.

As mentioned above, 5D software is focused on the budgeted and actual costs of construction projects. It allows BIM to track project changes by the construction manager or subcontractors. Errors can be identified early, in order to pinpoint issues that may derail a project from its budgetary critical path. This can facilitate an expeditious resolution of problems and avoid costly detours. In another area with significant budget implications, BIM can also be used to identify design and constructability issues and can pinpoint where a job will go over-budget.

LiDAR

Recent developments in LiDAR technology may also complement BIM. LiDAR is an acronym for Light Detection and Ranging, a technology whose basic concept closely resembles radar. According to the British industry group, LiDAR UK, the technology measures distances between fixed light sources, sensors and target objects. LiDAR devices can be either land-based or aircraft-based; either way, they have proven to yield an exceptionally accurate survey of three-dimensional textures and objects.9

In the context of BIM, LiDAR’s greatest potential may lie in its ability to quickly scan and accurately depict existing structures. Since most of our buildings predate BIM, their basic elements are unlikely to be recorded anywhere in a BIM-compatible format. Traditionally, new CAD models would need to have been created for such buildings before any BIM components could be ascribed. LiDAR may prove useful as a labor-saving method for creating virtual starting points to serve as frameworks for these buildings. Those frameworks could then be amended with more manageable quantities of data regarding specific projects. For example, if LiDAR were used to image the dimensions and proportions of a large structure, then newly-added electrical or plumbing components could be represented within that model with relatively little labor. Under other circumstances, the process of constructing a CAD model for an entire structure might have made BIM modeling prohibitively labor-intensive.10

Facilities Management

Traditionally, Facilities Management (FM) has been a last priority for builders. An owner typically sees FM as a monthly line item on a spreadsheet. Often, an FM service is sourced just prior to commissioning, from a provider that has had little or no prior involvement with the project. Owner-supplied FM may or may not be less sophisticated than that which is contracted out. For example, One World Trade Center, a $3 billion project, reportedly has no formal FM plan in place, according to construction management personnel on the site. Typically, FM involvement in a project is minimal before commissioning, and by the time it becomes a factor, it is often too late to focus on items that would support efficient FM. This is true in spite of the fact that fewer than 20% of a building’s costs will be devoted to its construction. Examples of construction issues that may impact FM operations include:

- Access to crucial equipment is difficult.
- Storage space is inadequate.
- Complementary controls are not near one another.

With a comprehensive FM management package, such as Ecodomus, one can quickly access project information that once required hours of searching through records. If FM involvement occurs early in a project, and its interests are coupled with the best tools on the market, BIM can play an indispensable role in improving the FM process and maximizing a project’s lifetime value. Long-term archival and retrieval (LOTAR) systems may be used to streamline subsequent users’ access to technical data created during the construction phase and thereafter.11 BIM is central to this process, providing a platform with which to reference such data visually, throughout the life of a building.12 A BIM data repository allows subsequent users to analyze past decisions for evidence-based design.13 Knowledge management, which entails the supply, maintenance and delivery of graphical and topical information related to a project, is also a key component in the process.14

Design Intent

Coupled with contractual provisions that provide for shared input and responsibility, a BIM approach can help ensure that design intent is preserved in the construction phase, while value is also added. When specialty contractors are treated as valued process partners, buildings will be built much as they were designed, and at the best possible value. But design intent can only be secure if the final installers and the FM team can collaborate and add to the conversation. As in dynamics, where velocity is a vector comprised of speed and direction, in construction, value is a resultant of price and quality. Contractors often focus exclusively on price, but the value of a project is reflected in the combination of its price and the quality of the completed building.

9 http://www.lidar-uk.com/usage-of-lidar/
10 http://www.lidarnews.com/content/view/8226/
11 LOTAR provides value as a digital insurance policy. In the digital environment, what is produced today must remain accessible throughout the entire life of the building. Some developers do not include this as a concern since they often sell (“flip”) a building upon completion or sign a long term lease. At best, the developer will hire an FM company to maintain it. Government and institutional owners, as well as some BIM-smart corporate owners like Crate & Barrel, however, do understand that electronic retrieval of precise information at the right time is critical to efficiency and quality in the FM business. Without a smart LOTAR strategy, hardware and software platforms are more costly and difficult to maintain, with many different applications to monitor. When someone then attempts to extract information, the exercise is much like powering up a 1980s-era IBM XT computer with a 5-1/4” floppy drive to view an early version of an AutoCAD drawing. LOTAR highlights the need for future rich applications, and best practices adherence helps to further make the case.
Pursuant to these considerations, Integrated Project Delivery (IPD) is a contractual structure that has its roots in the AIA California model, and that differs substantially from the traditional top-down assignment of risk. In IPD, a general contractor (GC) and the various subcontractors agree to share in the spoils of a project. Such terms provide an incentive for all parties to proceed as efficiently and as value-consciously as possible. BIM-assisted coordination can be a key ingredient in the success of the IPD delivery mechanism.

In IPD, there are eight phases:

1. Conceptualization
2. Criteria Design
3. Detailed Design
4. Implementation Documents
5. Agency Review
6. Buyout
7. Construction
8. Closeout and Merge to Facilities Management

IPD has been adapted to accommodate the increasingly large role of technology. Accordingly, large files can now be shared, and version control can be managed. To assist in the design process, however, a contractor must be conversant in the BIM tools that are required for the project at hand. And subcontractors must be allowed to come in early, before design is complete, and to participate in the design process itself. Errors in this space will be costly on the job: competence is a core value for this level of collaboration. A related benefit of combining BIM with the inclusive framework of IPD is that traditionally-late participants can be brought on board much earlier in the development process. Walls and ceiling contractors, for example, were traditionally brought in on Fridays for jobs that would begin on Mondays. Now, such actors may be brought on board months earlier. Because of this, they are able to participate proactively in the actual project design.

The GSA and BIM

Indefinite delivery, indefinite quantity (IDIQ) contracts represent an agreement between parties for an undefined quantity of goods or services, at an agreed-upon price term, over a fixed period of time. Such contracts are used by the U.S. General Services Administration (GSA) — one of the world’s largest real estate management entities — when it cannot determine a precise quantity of supplies or services it will require during a given contract period.\(^15\)

The GSA has issued an IDIQ for developing its use of BIM. Given the size of the agency’s real estate portfolio, this represents a significant milestone for BIM. The GSA’s needs range from the identification of work space for federal agencies to the management of complex construction projects, and include everything in between. As the GSA becomes a de facto BIM shop, contracts and projects pertaining to federal buildings will be undertaken pursuant to the GSA’s BIM guidelines and open standards.

The GSA BIM Guide\(^16\) includes an overview of the “Central Facility Repository,” a strategic and graphical evaluation that takes into account the next two to five years. A very useful diagram, this resource shows that BIM files will be a central part of the Electronic Document Management System (EDMS). Other documents included in the EDMS are warranty documents, O&M manuals, digitized drawings, preventive maintenance schedules, 2D drawings and other, relevant project documents.

Notably, the federal government’s real property portfolio includes “almost 400,000 buildings,” equating to 3.35 billion square feet of building space, 79% of which is federally owned.\(^17\) Also of interest, the GSA has been recognized as “one of the leading owners at the forefront of BIM implementation.”\(^18\) In spite of this, there have been some questions about the accuracy of the recordkeeping in this context;\(^19\) data has been measured differently by each agency,\(^20\) making the accurate appraisal and valuation of this portfolio an ongoing challenge.\(^21\)

Downstream Subcontractors

Historically, the construction project sequence of events would be:

1. Design.
2. Bring in mechanical contractors.
3. Put out to bid to GCs with 70% drawings.
4. GCs put out to bid to their list of contractors.
5. The chosen GC gets the project and brings mechanical, steel and concrete contractors to work.
6. Piping and ductwork are coordinated through the iterative process of correction, checking, moving, checking and so on, until everyone’s work is coordinated.
7. The wall and ceiling (W&C) contractors begin work. They find that their work area has been impacted to such a degree that materials will have to come down and ceiling heights will have to be lowered.
8. Painters and other finishing contractors work on the project.

Historically, few W&C contractors objected to this process, because midstream changes were presumed to mean more revenues for their specialty. But such assumptions did not always prove true, as contractors

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15 See http://www.gsa.gov/portal/content/103926.
16 See www.gsa.gov/bim (Series 8).
20 Document GAO-12-645, June 2012, p. 17.
found themselves dealing with increasingly strict budgetary constraints from general contractors who understood these dynamics.

There are clearance requirements for safe and high-quality workmanship. Rather than having the CPM generate scheduled work flows, tolerance levels can be placed on walls that require an early execution of work. This could prevent mechanical contractors from crowding out other participants who require space in the same walls. By applying a simple space requirement on all walls, such work could then be color coded to show areas of concern. “Doing the floor” one time is a fool’s dream. The belief that planning to do a floor once would result in more efficiency was a multi-pass disaster that only looked good on paper.

By engaging the W&C contractor, as well as other downstream subcontractors, early in the process, the final component of clash detection is factored into the equation. Such work includes door jambs and king studs that require unfettered slab to slab access. They locate their work within the project parameters and become stakeholders in schedule development, ensuring that their plans work with all that the mechanical, electrical, plumbing and sprinkler contractors (MEPS) are doing.

At Risk Contracting

Risk is often overlooked as a component of building projects. Consider the position of financiers: they must rely on the accuracy of reports generated by their borrowers to follow the progress of investments. Similarly, a general contractor must trust that its drywall or concrete subcontractors will finish their respective work in a timely and quality fashion. Each at-risk actor bases its cost estimates on assumptions about the prices of materials, the competence of workers, and, ultimately, the competence of the entire team that must deliver a given project. Such actors also draw on a range of productivity estimates based on their previous experiences. Large contractors may hedge against fluctuations in the costs of materials. BIM can help every participant in a construction project to ensure against risk.

Of course, there are limits to the risk-mitigation potential of BIM. While some famous BIM projects claim 100% management of processes, this is rarely the case. As projects become complex, players inevitably move to undocumented activities. At some point, the bond to prescribed guidelines becomes weaker, and the players must resort to old-fashioned crisis management. Accordingly, BIM guidelines should be understood as starting positions. Additionally, BIM process adherence must be executed at all times throughout the project and managed by someone who has both clout and experience.

The transparency offered to contractors through BIM allows the users to see a development come together through the lens of the BIM model. By constantly updating the work that is in place, driven by multiple portals throughout the project team, suboptimal performance can be observed and acted upon as it happens. This will help to ensure that adverse curves are cut early, before significant impacts can harm the project. “Trust but verify” is the rule of the day. Transparency of the project to all stakeholders, both internal and external, will drive a more trustworthy project environment. BIM offers a tool that can be filtered for the perspective of the end user: the GC, the owner or the developer.

Energy Analysis and LEED Achievement

Leadership in Energy and Environmental Design (LEED) is an initiative that is driving much of the new thinking in architecture. Sustainability and the environment are the concerns that are factored into LEED projects.

40% of global energy used is consumed by buildings. Governments around the world incentivize green behavior through taxation on fossil fuels, grants for upgrading or greening and, in the US, by offering tax abatements for level of greenness or level of LEED achievement.

BIM is a natural tool for auditing and maintaining the green record for a project. It also serves as a valuable tool for calculating heat loss/gain and modeling building performance against regional conditions at various times of year. All in all, BIM is indispensable for modeling buildings built in light of today's ecological considerations. BIM will be there to meet the demands of managing the zero emission building.

The City of New York has begun to incorporate BIM components into its standard construction procedures. In fact, the development of BIM is now an important priority of the Department of Design and Construction (DDC) which is actively pursuing ways to advance the technical sophistication of development projects within its jurisdiction. At the time of this writing, however, the city's approach remains piecemeal; for instance, when procuring work from subcontractors, some city agencies may still rely on the use of CDs and may not yet have incorporated the processes or capabilities of BIM.

How Much Does BIM cost?

Return on Investment (ROI) analysis for information technology allows for an initial drop in productivity due to the implementation of new tools. However, with good investments, the end result should show increased productivity after the training period ends. Such increases should continue until the next upgrade, or in perpetuity. With some projects, it can be shown that the technology investment itself is the least

22 See http://www.nyc.gov/html/ddc/downloads/pdf/BIM_flyer_FINAL.pdf, for information about a conference on the topic that was held in September 2012.
critical cost element in the equation. In such cases, the decision to use best-of-breeds tools is often the right decision.

While a theoretical analysis is a necessary decision tool, hard evidence may be the spark for those considering the move to BIM. Crate & Barrel, for example, now requires BIM on every project; they have the experience of developing more than 160 stores nationwide to back that corporate policy.26 The Illinois-headquartered firm was an early adopter of BIM in 2002 and “never looked back.”27 Through the use of BIM, Crate & Barrel has been able to take advantage of IPD. The method allows greater exchange of information and ideas among team members by bringing them together earlier in the process when they can offer more benefit.

Since the adoption of BIM, the average material weight per project for Crate & Barrel has dropped from 220 Tons to 160 tons.28 Also, project duration has become a reliably predictable factor; before BIM, this was not possible. These are significant improvements. Prefabricated parts can now be installed before site measurements for the same parts were required in the past. Serial sequencing can now go to parallel, thus drastically collapsing durations.

Another ROI example is provided by the experience of Goshow Architects, a firm that has designed residence halls for both the City University and the State University of New York (CUNY and SUNY, respectively). In a recent example, two LEED-Gold projects each contained about 175,000 square feet of floor space and each was budgeted for about $52M. The main difference between the two was in how they were built: The SUNY hall was built with traditional processes, while the CUNY project was built using BIM methods, in conjunction with prefabricated wall and floor panels. The SUNY project took 30 months to complete, while the CUNY building was finished in 15 months. When time is money, BIM can make a difference.

### Other Possible Applications for the BIM Framework

It is interesting to consider how the framework that is presently being developed for BIM might be replicated to support the data management of other complex technical systems. For example, recent severe weather events have driven home the importance of having an accurate database of the minutest components that make up our power grids, communications networks and water works.

Time and money are lost when skilled technicians are required to spend precious time, in the aftermath of a major systems failure, investigating the components of the damaged networks, rather than immediately going about the necessary repairs. Other public networks, such as roads and sewers, could also benefit from the more efficient management that BIM-type databases foster by more thoroughly documenting their extensive components.

It is likely that many of the same issues presently being worked out via BIM could also improve logistics in other contexts. This includes the sharing of information by a complex cast of actors with different skill sets and priorities and the ability to determine workable strategies prior to the beginning of on-site, physical labor.

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25 Ibid.
28 Presentation by John Moebes, AIA, Director of Construction at Crate & Barrel, “Integrated Project Delivery at Crate & Barrel, April, 2010.
Going Forward

Surprisingly, it seems that some representatives of the design, architectural, legal and insurance sectors do not yet see benefits of using BIM in their own practices. Contrary to this, we believe that designers and architects could use BIM profitably, even without the collaboration with others. This could be true, for example, in the area of drawing production and updating. BIM enables better storage of all design data within a 3D model of a facility, while 2D plans and drawings can be generated automatically from this 3D model, with details. Therefore, designers can use BIM to integrate changes into the design easily, while drawings and details are updated automatically. Finally, using a BIM-based drawing-production process would ensure that a set of plans remained internally consistent. This approach would save time during drawing review and reduce the potential for liability problems arising from inconsistent drawing sets.

Researchers at Stanford University’s Center for Integrated Facility Engineering (CIFE) have observed that numerous design companies have applied the BIM-based, drawing production process beneficially on many projects. Similarly, we expect that lawyers would also be able to use the representation power of BIM in mitigation law suits and planning board presentations, while insurers could use BIM to better understand projects and reduce their financial risks.

Among its many merits, BIM saves time and prevents waste during the construction of a building. BIM also provides useful data throughout the life of a building, thereby reducing the facilities management costs for the asset. In time, the advantages of BIM are poised to be recognized and embraced by a greater number of professionals across numerous disciplines.

A Closer Look:
Component Assembly Systems, Inc.

Component Assembly Systems, Inc. is a leader in technology innovation for the construction industry. The firm won the Gold Vision Award from Constructech magazine for its risk management and project focused software methods to see the company’s position on any project and then favorably adjust the realities of the construction industry’s ever-changing variables.

Founded in 1964, Component Assembly Systems has offices in California, Connecticut, Maryland, Massachusetts, Nevada, New Jersey, New York, Pennsylvania and Washington, D.C. The company is among the nation’s leaders in drywall partitions, acoustical work, specialty ceilings, millwork installation and other carpentry and drywall-related services.

CAS has completed more than $6 billion worth of projects. These include:
- One World Trade Center (in process)
- The Barclays Center
- One Bryant Park
- Reuters America
- Chase Financial Services Building/Metrotech
- Museum of Natural History
- Carnegie Hall renovations
- Gramercy Park Hotel
- New School University Center (in process)
- Plaza Residences
- Columbia University Center for Disease Prevention
- Trump Taj Mahal
- Four Seasons Hotel, NY
- Yankee Stadium
- Bronx Criminal Court House.

30 From CIFE (Center for Integrated Facility Engineering at Stanford University)’s roundtable: Applications of BIM and Hardies for Widespread Adoption of BIM 2007.

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