National BIM Standard - United States™ Version 2

5 PRACTICE DOCUMENT

Chapter 5.2 Minimum BIM – December 07, Revised May 2012

Introduction

The National Building Information Model Standard (NBIMS) is, by design, a standard of standards. Those who require specific information associated with the exchange of information at any time during a project's lifecycle may select those NIBMS standards that contain the information of interest. Formal or informal agreements between parties to provide standard information exchanges are used to implement these exchanges.

In this standard, the group of stakeholders in the BIM discussion is referred to as the Architect/Engineer/Constructor/Operator/ Owner/FM (AECOO/FM) community.

From the point of view of traditional vertical construction (e.g. office buildings), NBIMS Version 1 - Part 1 defines a minimum standard providing a baseline against which additional, developing information exchange requirements may be layered. For the purposes of defining a Minimum BIM, there are different use types and data complexity of a Minimum BIM, and different levels of technical capability and organizational maturity with BIM tools and processes. Use Types and Data Complexity can be viewed as:

- Conceptual
- Project
- Integrated Project Delivery
- Enterprise (Lifecycle) Integration

Many so called BIMs in existence do not meet the NBIMS definition of a BIM, since they are really only intelligent drawings, visualization tools, or production aides. The *NBIMS Version 1 - Part 1* defined minimum BIM and used a Capability Maturity Model to give the capital facilities industry a spectrum of tangible capabilities by which to determine the current maturity of a BIM. The Capability Maturity Model provided industry with higher levels on the spectrum as developmental goals.

The NBIMS vision is that stakeholders will use the CMM as a tool to plot their current location, while looking to more robust parts of the spectrum as goals for their future operations, and improve the performance of facilities over their full lifecycle by fostering a common, standard, and integrated

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lifecycle information model for the capital facilities industry. Readers should recognize that the issue of capability maturity models requires additional work as described in the 'Next Steps' section below.

To meet the future needs of a more streamlined AECOO/FM community and build on existing best business practices, a Capability Maturity Model (CMM) has been developed for users to evaluate their business practices along a continuum or spectrum of desired technical level functionality. The concept of a CMM may be familiar to software developers who create, test, field, and update their software[1], but the CMM included here is not currently targeted at software designers. The CMM as currently constituted is targeted at the AECO industry for immediate use and application on current processes or BIM projects.

Using the Capability Maturity Model to Define a Minimum BIM

It is important to note that the NBIMS Capability Maturity Model (CMM) described provides a range of opportunities for BIM; however, in this section we are looking at what constitutes the minimum BIM. Because of the information in this section, we are saying that if you are not taking into account this minimum BIM level, then you should not call what you are doing a building information model. Visualization or some level of improved document production may be one output from a BIM; however neither is in and of itself BIM. We, therefore, define the minimum BIM as having the following characteristics through the associated areas of maturity in the complete CMM:

- **Spatial Capability** - The facility need not yet be spatially located as this is a higher-level goal to be considered a minimum BIM.
- **Roles or Disciplines** - Minimum BIM includes the sharing of information between disciplines and documentation of the BIM's intended uses.
- **Data Richness** - The data must be of the level of detail to support the intended use of the BIM. The level of data for a concept BIM will be different from that of a design BIM or construction BIM.
- **Delivery Method** - BIM must be implemented in a way that allows discipline information to be shared.
- **Change Management or ITIL Maturity Assessment -**
- **Business Process -**
- **Information Accuracy** - The BIM must be used to compute space and volume and to identify what areas have been quantified.
- **Lifecycle Views** - A complete lifecycle does not need to be implemented at this point. NBIMS recommends the data should be maintained in interoperable formats that allow for future lifecycle use.

[1] For specific information, see http://www.sei.cmu.edu/cmm/ or read *Capability Maturity Model: Guidelines for Improving the Software Process*, Software Engineering Institute, Carnegie Mellon University, ISBN: 0-201-54664-7, 1995. Hardcover, 464 pages, 2006.

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- **Graphical Information** - Since all drawing output should at this point be National CAD Standard compliant, we are making this a requirement for a minimum BIM. This demonstrates that standards are being considered, when possible.
- **Timeliness and Response** - BIM is not yet expected as the trusted authoritative source for information about the facility for first responders.
- **Interoperability and Industry Foundation Class Support** - The BIM must be capable of creating IFC data; exporting IFC data; importing IFC data; and operating IFC, interoperable data.

Change Management, or Information Technology Infrastructure Library (ITIL), Maturity Assessment, Business Process, Graphical Information and Spatial Capability are other characteristics of Minimum Building Information Models that will be required as the industry matures and requirements develop

There are two versions of the BIM CMM included in NBIMS:

- Tabular CMM
- Interactive CMM

The first is called the tabular CMM because it is a static Microsoft Excel® workbook consisting of three worksheets with information that lists the information in a table that demonstrates the spectrum. The second is the interactive CMM which consists of a multi-tab Excel workbook that is based on the tabular version, but is different because it dynamically interacts with the user as information is entered into the user interface. It is envisioned that the CMM will be web-enabled and served off the NIBS-FIC website, but the Excel file is a low-tech, user friendly way to deliver the same functionality. Both of these two versions of the CMM will be explained here in order of their worksheet tabs in their respective workbooks in Microsoft® Excel.

NOTE: The Capability Maturity Model workbook may be downloaded here.

Tabular CMM

CMM Chart

As seen in the screen capture, Figure 5.2-1, the CMM is a matrix with an x-axis and a y-axis. On the x-axis, you see 11 areas of interest, in no particular order. On the y-axis, you see maturity levels from 1 to 10 with 1 being the least mature and 10 being the most mature. The body of the matrix puts into words varying levels of maturity describing the areas of interest in an organization or on an individual project.

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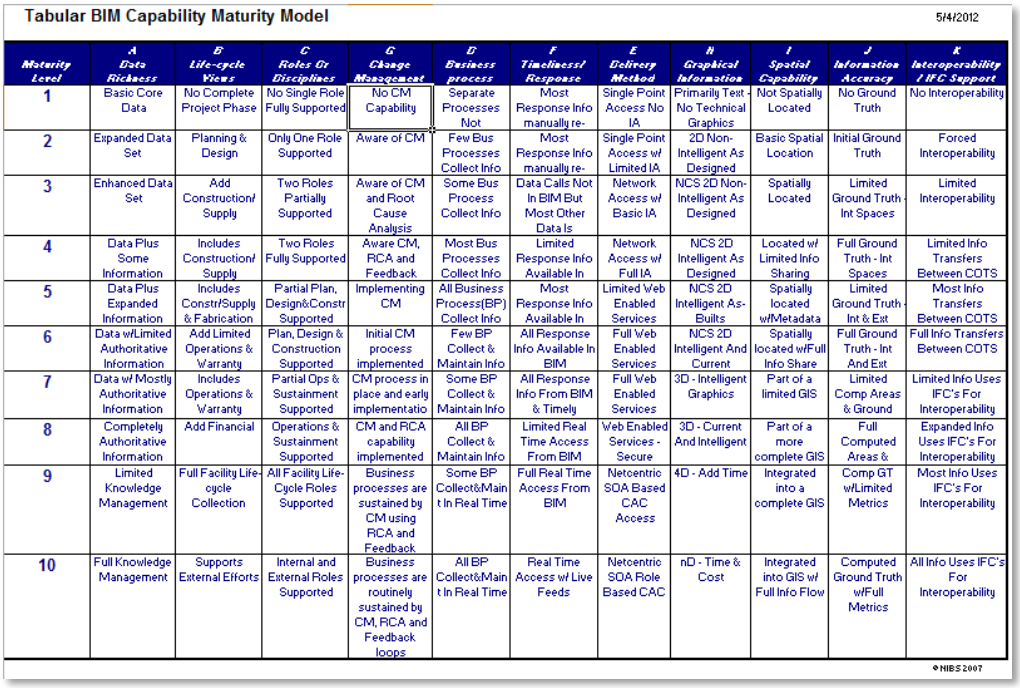

Tabular BIM Capability Maturity Model 5/4/2012

Maturity Level	A Data Richness	B Life-cycle Views	C Roles Or Disciplines	G Change Management	D Business process	F Timeliness/ Response	E Delivery Method	H Graphical Information	I Spatial Capability	J Information Accuracy	K Interoperability / IFC Support
1	Basic Core Data	No Complete Project Phase	No Single Role Fully Supported	No CM Capability	Separate Processes Not	Most Response Info manually re-	Single Point Access No IA	Primarily Text - No Technical Graphics	Not Spatially Located	No Ground Truth	No Interoperability
2	Expanded Data Set	Planning & Design	Only One Role Supported	Aware of CM	Few Bus Processes Collect Info	Most Response Info manually re-	Single Point Access w/ Limited IA	2D Non-Intelligent As Designed	Basic Spatial Location	Initial Ground Truth	Forced Interoperability
3	Enhanced Data Set	Add Construction/ Supply	Two Roles Partially Supported	Aware of CM and Root Cause Analysis	Some Bus Process Collect Info	Data Calls Not In BIM But Most Other Data Is	Network Access w/ Basic IA	NCS 2D Non-Intelligent As Designed	Spatially Located	Limited Ground Truth - Int Spaces	Limited Interoperability
4	Data Plus Some Information	Includes Construction/ Supply	Two Roles Fully Supported	Aware CM, RCA and Feedback	Most Bus Processes Collect Info	Limited Response Info Available In	Network Access w/ Full IA	NCS 2D Intelligent As Designed	Located w/ Limited Info Sharing	Full Ground Truth - Int Spaces	Limited Info Transfers Between COTS
5	Data Plus Expanded Information	Includes Constr/Supply & Fabrication	Partial Plan, Design&Constr Supported	Implementing CM	All Business Process(BP) Collect Info	Most Response Info Available In	Limited Web Enabled Services	NCS 2D Intelligent As-Builts	Spatially located w/Metadata	Limited Ground Truth - Int & Ext	Most Info Transfers Between COTS
6	Data w/Limited Authoritative Information	Add Limited Operations & Warranty	Plan, Design & Construction Supported	Initial CM process implemented	Few BP Collect & Maintain Info	All Response Info Available In BIM	Full Web Enabled Services	NCS 2D Intelligent And Current	Spatially located w/Full Info Share	Full Ground Truth - Int And Ext	Full Info Transfers Between COTS
7	Data w/ Mostly Authoritative Information	Includes Operations & Warranty	Partial Ops & Sustainment Supported	CM process in place and early implementatio	Some BP Collect & Maintain Info	All Response Info From BIM & Timely	Full Web Enabled Services	3D - Intelligent Graphics	Part of a limited GIS	Limited Comp Areas & Ground	Limited Info Uses IFC's For Interoperability
8	Completely Authoritative Information	Add Financial	Operations & Sustainment Supported	CM and RCA capability implemented	All BP Collect & Maintain Info	Limited Real Time Access From BIM	Web Enabled Services - Secure	3D - Current And Intelligent	Part of a more complete GIS	Full Computed Areas &	Expanded Info Uses IFC's For Interoperability
9	Limited Knowledge Management	Full Facility Life-cycle Collection	All Facility Life-Cycle Roles Supported	Business processes are sustained by CM using RCA and Feedback	Some BP Collect&Main t In Real Time	Full Real Time Access From BIM	Netcentric SOA Based CAC Access	4D - Add Time	Integrated into a complete GIS	Comp GT w/Limited Metrics	Most Info Uses IFC's For Interoperability
10	Full Knowledge Management	Supports External Efforts	Internal and External Roles Supported	Business processes are routinely sustained by CM, RCA and Feedback loops	All BP Collect&Main t In Real Time	Real Time Access w/ Live Feeds	Netcentric SOA Role Based CAC	nD - Time & Cost	Integrated into GIS w/ Full Info Flow	Computed Ground Truth w/Full Metrics	All Info Uses IFC's For Interoperability

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Figure 5.2-1 – CMM Chart, courtesy NIBS

Since the words are subjective and open to interpretation, it is possible that people will not always agree on all the possible divisions or descriptions of the varying levels of maturity, but they represent a simplified consensus-based approach. In 2007 the NBIMS Testing Team demonstrated this approach with its initial application of the CMM in the evaluation of the 2007 AIA Technology in Architecture Practice BIM award winners. Final score of the BIM was determined using a multiple step process, the first being an independent review of the BIM by each team member. Despite having no communication or feedback between team members during the first step in the evaluation, the team discovered minor differences in scores of 1-5% across reviewers. The minor differences in initial scores were discussed and a consensus reached on the final score. Furthermore, the minor variance in scores from independent reviewers validated the utility of the CMM as a scientific approach to evaluate the capabilities and maturity of a BIM[2].

The CMM provides an evaluation tool in which a large number of items are structured in a format that people can use as a launching point for classifying themselves on a somewhat standardized continuum. Finally, it is understood that these descriptions will be updated as the community progresses and greater levels of BIM adoption dictate.

[2] McCuen, Tammy, and Suermann, Major Patrick, P.E., *The Interactive Capability Maturity Model and 2007 AIA TAP BIM Award Winners,* Viewpoint #33, AECbytes, December 6, 2007. Retrieved from http://www.aecbytes.com/viewpoint/2007/issue_33.html

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Descriptions

As the screen capture, Figure 5.2-2, shows, the descriptions tab lists and describes all the areas of interest in weighted order in a tabular format. In the Description column, the text is primarily focused on the philosophy of the area of interest as well as setting the stage for what conditions are usually more preferable. For example, under the Information Technology Infrastructure Library ITIL Maturity Assessment, it alludes to best business practices or processes for storing and finding information.

Capability Maturity Model Category Descriptions

Weight	Title	Description
1.1	Data Richness	Identifies the completeness of the building Information Model from initially very few pieces of unrelated data to the point of it becoming valuable information and ultimately corporate knowledge about a facility
1.1	Life-cycle Views	Views refer to the phases of the project and identifying how many phases are to be covered by the BIM. One would start as individual stove pipes of information and then begin linking those together and taking advantage of information gathered by the authoritative source of the information. This category has high cost reduction, high value implications based on the elimination of duplicative data gathering. The goal would be to support functions outside the traditional facility management roles, such as first responders.
1.2	Roles Or Disciplines	Roles refer to the players involved in the business process and how the information flows. This is also critical to reducing the cost of data re-collection. Disciplines are often involved in more than one view as either a provider or consumer of information. Our goal is to involve both internal and external roles as both providers and consumers of the same information so that data does not have to be re-created and that the authoritative source is the true provider of the information.
1.2	Change Management	Change Management identifies a methodology used to change business processes that have been developed by an organization. If a business process is found to be flawed on in need of improvement, one institutes a "root cause analysis" of the problem and then adjusts the business process based on that analysis. Since this is related to the following item, business processes it should come after it.
1.3	Business process	The business process defines how business is accomplished. If the data and information is gathered as part of the business process then data gathering is a no cost requirement. If data is gathered as a separate process then the data will likely not be accurate. The goal is to have data both collected and maintained in a real time environment, so as physical changes are made they are reflected for others to access in their portion of the business process.
1.3	Timeliness/ Response	While some information is more static than other information it all changes and up to the minute accuracy may be critical in emergency situations. The closer to accurate real time information you can be the better quality the decisions that are made. Some of those decisions may be life saving in nature.
1.4	Delivery Method	Data delivery is also critical to success. If data is only available on one machine then sharing can not occur other than by email or hard copy. In a structured networked environment if information is centrally stored or accessible then some sharing will occur. If the model is a systems oriented architecture (SOA) in a web enabled environment the nentcentricity will occur and information will be available in a controlled environment to the appropriate players. Information assurance must be engineered into all phases.
1.5	Graphical Information	Often the starting point is a non-graphical environment. The advent of graphics helps paint a clearer picture for all involved. As standards are applied then information can begin to flow as the provider and receiver must have the same standards in place. As 3D images come into play more consumers of the information will have a common view and a higher level of understanding will occur. As time and cost are added then the interfaces can be expanded significantly.
1.6	Spatial Capability	Understanding where something is in space is significant to many information interfaces and the richness of the information. Energy calculations must know where the heat gains will come from, first responders need to know where water supplies and utility cutoffs are located in relation to the facility.
1.7	Information Accuracy	Having a way to ensure that information remains accurate is only possible through some mathematical ground truth capability. Having a mathematical product will also allow for better management by supporting difficult to game metrics. These numbers can be used for occupancy, information collection completeness and overall inventory calculations.
1.8	Interoperability/ IFC Support	Our ultimate goal is to ensure interoperability of information. Getting accurate information to the party requiring the information. There are many ways to achieve this, however the most effective is to use a standards based approach to ensure that information is a form that it can be shared and products are available that can read that standard for of information.

Figure 5.2-2 – Descriptions, courtesy of NIBS

Complying with this area of interest will first require ITIL awareness, followed by varying levels of excellence along the continuum of control, integration, or optimization. As was said earlier, this will need to be updated as times and terms dictate.

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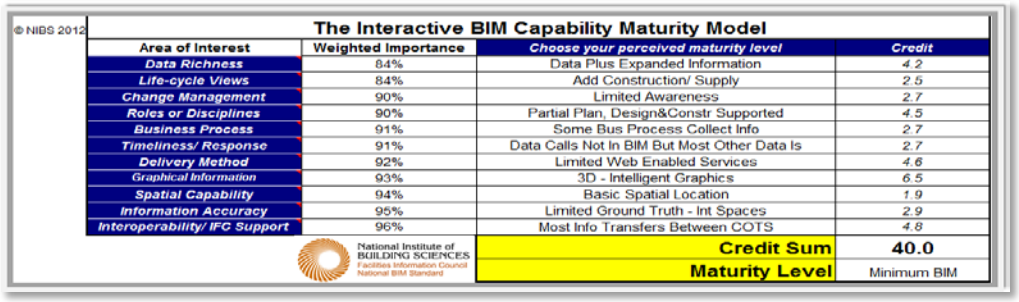
Interactive CMM (I-CMM)

As described above, the interactive CMM is based off the tabular CMM and, as such, it contains all the same information as the tabular CMM, but it centers on a graphical user interface that makes the static information come to life, in a way that may be more easy to digest and understand for some users. Just as the descriptions of the tabular CMM were listed according to their tab number and title in their workbook, so will the tabs of the interactive CMM be described here.

Interactive Maturity Model

The first, and primary, tab of interest (Figure 5.2-3) in the interactive maturity model workbook is the tab, "Interactive Maturity Model." This interface's mission is to turn the tabular chart, which is successful in showing all the information at once in a matrix format, into an interface that users can interact with to self-evaluate their own processes or BIMs. The areas of interest are listed in the first column, in increasing order of perceived importance. Hovering over each area of interest will elicit a comment with the full description of that area of interest.



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The Interactive BIM Capability Maturity Model

Area of Interest	Weighted Importance	Choose your perceived maturity level	Credit
Data Richness	84%	Data Plus Expanded Information	4.2
Life-cycle Views	84%	Add Construction/ Supply	2.5
Change Management	90%	Limited Awareness	2.7
Roles or Disciplines	90%	Partial Plan, Design&Constr Supported	4.5
Business Process	91%	Some Bus Process Collect Info	2.7
Timeliness/ Response	91%	Data Calls Not In BIM But Most Other Data Is	2.7
Delivery Method	92%	Limited Web Enabled Services	4.6
Graphical Information	93%	3D - Intelligent Graphics	6.5
Spatial Capability	94%	Basic Spatial Location	1.9
Information Accuracy	95%	Limited Ground Truth - Int Spaces	2.9
Interoperability/ IFC Support	96%	Most Info Transfers Between COTS	4.8
		Credit Sum	40.0
		Maturity Level	Minimum BIM

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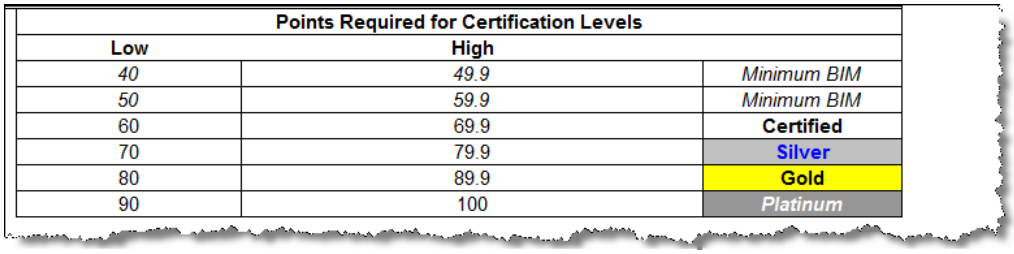
Figure 5.2-3 – Interactive Maturity Model, diagram courtesy of NIBS

The next column shows the relative percentage out of 100% that each area of interest garners, see Figure 5.2-4. After that, users will choose their own perceived maturity levels by employing the drop-down menus aligned with each area of interest. When clicking on this cell, the dropdown text reminds you of the definition of the area of interest, so that you may make an informed choice among ten levels of maturity. After choosing the correct level of maturity in the desired area of interest, the amount of credits automatically appears in the next column. Together, these credits are summed in the TOTAL box, which in turn determines the level of certification achieved.



Points Required for Certification Levels		
Low	High	
40	49.9	Minimum BIM
50	59.9	Minimum BIM
60	69.9	Certified
70	79.9	Silver
80	89.9	Gold
90	100	Platinum

Figure 5.2-4 – Highlighted, Date-Sensitive Minimum BIM levels, courtesy of NIBS

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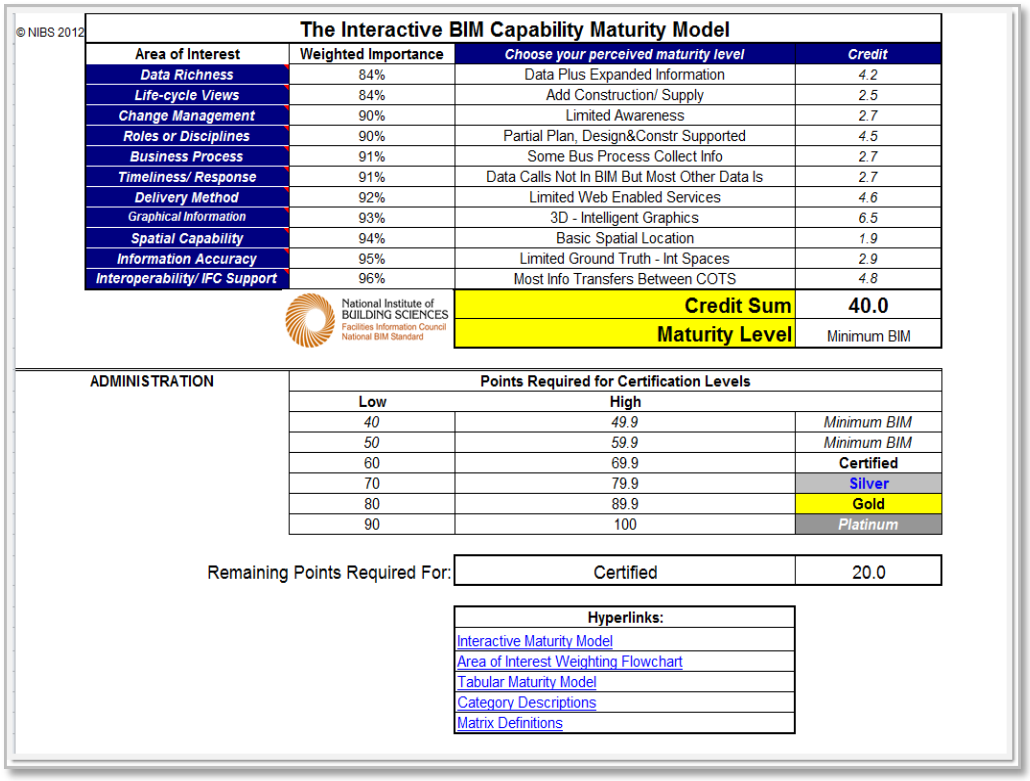
The varying levels of certification from simply 'Minimum BIM' to 'Platinum,' and they are listed below in the ADMINISTRATION section. Figure 5.2-4 displays the points required for a Minimum BIM in 2008 and is included for reference only as the minimum score required for a Minimum BIM changes on an annual basis. The minimum score required for a Minimum BIM is dependent on the date that the interface is used, which automatically is known as soon as the user opens the interface. In 2010, the minimum score was 50 points and in 2011, the minimum score required for the distinction of 'Minimum BIM' is 60 points. The annual increase in points required is included to allow for future education and BIM improvements industry-wide.

All Certified scores, see Figure 5.2-5, currently stay the same regardless of date. The certification scores are similar to most academic grades, with a maximum possible, weighted score of 100 points. Some added user-friendly features include the area that shows the remaining points required to reach the next level of certification, as well as hyperlinks to other tabs of functionality within the workbook.



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The Interactive BIM Capability Maturity Model

Area of Interest	Weighted Importance	Choose your perceived maturity level	Credit
Data Richness	84%	Data Plus Expanded Information	4.2
Life-cycle Views	84%	Add Construction/ Supply	2.5
Change Management	90%	Limited Awareness	2.7
Roles or Disciplines	90%	Partial Plan, Design&Constr Supported	4.5
Business Process	91%	Some Bus Process Collect Info	2.7
Timeliness/ Response	91%	Data Calls Not In BIM But Most Other Data Is	2.7
Delivery Method	92%	Limited Web Enabled Services	4.6
Graphical Information	93%	3D - Intelligent Graphics	6.5
Spatial Capability	94%	Basic Spatial Location	1.9
Information Accuracy	95%	Limited Ground Truth - Int Spaces	2.9
Interoperability/ IFC Support	96%	Most Info Transfers Between COTS	4.8
		Credit Sum	40.0
		Maturity Level	Minimum BIM

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ADMINISTRATION

Points Required for Certification Levels		
Low	High	
40	49.9	Minimum BIM
50	59.9	Minimum BIM
60	69.9	Certified
70	79.9	Silver
80	89.9	Gold
90	100	Platinum

Remaining Points Required For:		
	Certified	20.0

Hyperlinks:
Interactive Maturity Model
Area of Interest Weighting Flowchart
Tabular Maturity Model
Category Descriptions
Matrix Definitions

Figure 5.2-5 – Completed View (Certification Level = Minimum BIM), courtesy of NIBS

Area of Interest Chart

The Area of Interest Chart, see Figure 5.2-6, is tied to the credits column on the first tab of the application. Therefore, every time a perceived maturity level is selected, its credits are listed on the first

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tab but graphed on this tab. In this way, users can easily see where their operations are the most mature.

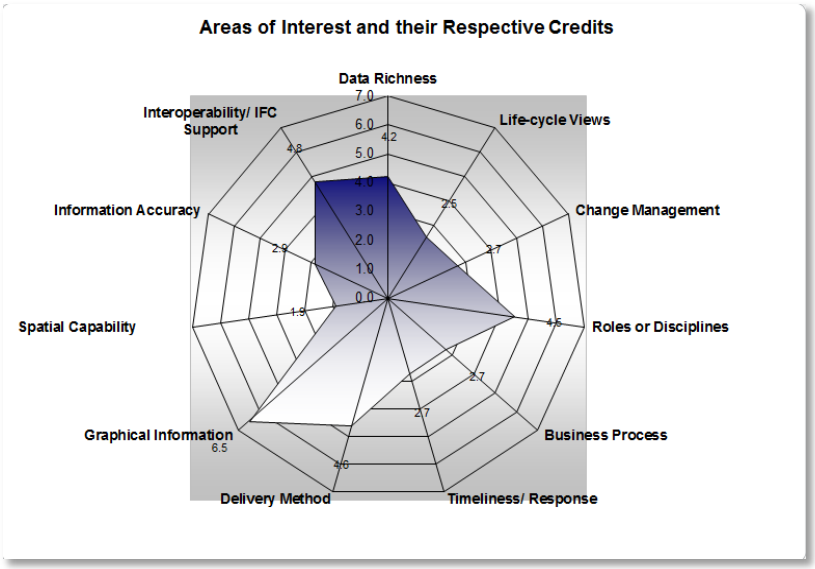

Figure 5.2-6 – Areas of Interest and their Respective Credit Chart, courtesy of NIBS

Area of Interest Weighting

The next tab, see Figure 5.2-7, the Area of Interest Weighting tab shows a hierarchical decision tree of the weighting of the different areas of interest. Were your organization to disagree with the existing weighting scheme, you could use this as a launching point for creating your own weighting scheme and edit the application to reflect your own preferences. However, as the community grows and best business practices are achieved, the hope is for a national consensus on the appropriate level of weighting for the 11 areas of interest.

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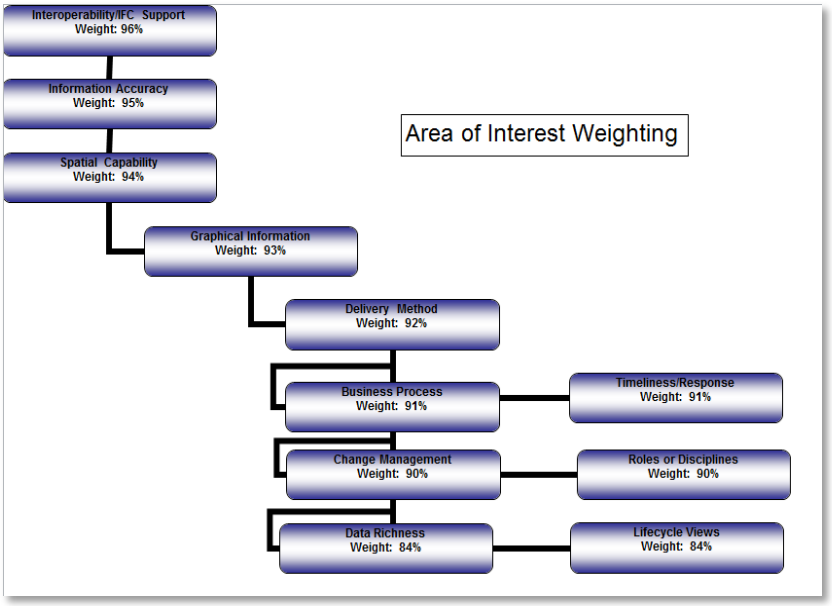

Figure 5.2-7 – Area of Interest Weighting Hierarchy, courtesy of NIBS

Tabular Maturity Model/Category Descriptions

The Tabular Maturity Model and Category Descriptions tabs are the same information as described above in the Tabular CMM portion of this section. The same information is also included in this application so that users may see their information in multiple ways to help them establish a metric for establishing and evaluating their own maturity level.

I-CMM Testing and Evaluation

As previously mentioned, to ensure that the I-CMM could be used to successfully convert subjective case-by-case ratings into an objective quantitative score, the NBIMS Testing Team undertook a test bed validation of the NBIMS I-CMM in the summer of 2007. With the approval of the American Institute of Architects, Technology in Architectural Practice (AIA-TAP) Community of Practice, the winning 2007 BIM Award submissions were evaluated using the I-CMM. Six NBIMS Testing Team Members evaluated the nine winning submissions. Because the test was focused on validating the I-CMM and not on the already proven superior quality of the BIM models themselves, special attention was focused on the ability of the individual evaluators to replicate similar scores without any influences from the other evaluators.

The results yielded no more than a 5% difference in the various scores of the evaluators on the same BIM, and normally resulted in a 1% (or only 1 point out of 100) difference when the evaluators used the I-CMM to analyze the different BIM submissions.
http://www.aecbytes.com/viewpoint/2007/issue_33.html

The team noted that the I-CMM is primarily focused on leveraging information management, rather than architectural, engineering, construction, or management metrics. Accordingly, the BIMs scored

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received a wide range of scores commensurate with their project requirements. Logically, the highest scoring BIM submission was a test bed BIM pushing the edge of current interoperability, while the lowest scoring BIM (which received a 'Minimum BIM' rating) was for a custom-designed residential home. Therefore, it is important to note that the I-CMM is very effective at measuring BIM information management, but it should not be used as a benchmark for any other metrics. In other words, just as owners' needs do not require that every building be built to LEED-Platinum standards, neither should any BIM be perceived as less successful if it does not achieve an I-CMM Platinum score.

Existing Implementations

Currently, the NBIMS Interactive Capability Maturity Model (I-CMM), AIA Model Progression Specification, and the Indiana University BIM Proficiency Matrix have been used within the AECOO/FM community as a Minimum BIM.

Since *NBIMS Version 1 - Part 1* was published, a number of alternative Maturity Models have been developed that may offer additional features or elements for a future Minimum BIM:

- COBIT, Control Objects for Information and related Technology - Information Systems Audit and Control Association (ISACA) and the IT Governance Institute (ITGI).
- CMMI, Capability Maturity Model Integration – Software Engineering Institute/ Carnegie Melon. CSCMM, Construction Supply Chain Maturity Model – Vaidyanathan & Howell (2007)
- I-CMM, Interactive Capability Maturity Model developed as part of the National BIM Standard (NBIMS).
- Indiana University BIM Proficiency Matrix.
- Knowledge Retention Maturity Levels – Arif, Egbu, Alom and Khalfan (2009)
- LESAT, Lean Enterprise Self-Assessment Tool – Lean Aerospace Initiative (LAI) at the Massachusetts Institute of Technology (MIT).
- P3M3, Portfolio, Programme and Project Management Maturity Model - Office of Government Commerce (UK).
- P-CMM®, People Capability Maturity Model v2 - Software Engineering Institute / Carnegie Melon.
- (PM), Project Management Process Maturity Model – Kwak & Ibbs (2002).
- SPICE, Standardised Process Improvement for Construction Enterprises - Research Centre for the Built and Human Environment, University of Salford - Hutchinson & Finnemore (1999)

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- Supply Chain Management Process Maturity Model and Business Process Orientation (BPO) maturity model – Lockamy III & McCormack (2004)

Conclusion

The purpose of the National BIM Standard Committee is to knit together the broadest and deepest constituency ever assembled to address the losses and limitations associated with errors and inefficiencies in the building supply chain. A BIM should access all pertinent graphic and non-graphic information about a facility as an integrated resource, but there are varying levels of maturity when pursuing this goal. The goals of the two Capability Maturity Models, both tabular and interactive, are to help users gauge their current maturity level, as well as plan for future maturity attainment goals through a commonly accepted, standardized approach. As industry evolves and more rapidly adopts greater levels of maturity, this model will change to accurately reflect best industry practices.

Next Steps

We are still in the early stage of BIM implementation in our industry. We are certainly seeking more than minimums in order to realize the true potential of BIM. One thing is certain: the BIM Capability Maturity Model is incomplete and much work remains to be done in order to mature it to be a fully integrated product. We see the following as the next steps in achieving improved capabilities.

1. Identify a baseline in the industry and create a system for actively measuring and maintaining the baseline as the industry progresses. What is the typical level of BIM in use?

2. Continue developing a vision for more mature BIMs and develop a roadmap for raising the level of BIM robustness. Identify deadlines for achieving higher level and more mature implementation over the next 20 or more years.

3. The following steps are required to take the CMM to the next level:

    - Research is required to evaluate the current level of capability of BIMs in use in the industry today and to ensure that the rankings proposed herein are valid. There is concern that we may have set the bar too high and that most current BIMs will not be certified.
    - The current Capability Maturity Model gives the AECOO/FM community a spectrum of tangible capabilities where they can determine their current maturity and use higher levels on the spectrum as developmental goals. Future work needs to be done to improve the Maturity Model as it needs to be bettered to mirror the burgeoning BIM community.
    - BIM data structures provided by authoring software should be capable of supporting a broad range of model views across the lifecycle to allow the model to gather more data as the building moves from concept to detailed design to construction to operations and

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maintenance. However, there remains much work to be done to define the information and capabilities required to accommodate this vision.

- It is the hope of the NBIMS Committee that a change management process such as the Information Technology Infrastructure Library (ITIL) program that provides a set of best practice approaches to information management would be required at some future point. Using these business processes will help ensure the convergence of everyone's efforts and will help information flow. If it does not, there will also be procedures to rectify the problems.
- The governing body will need to certify BIMs and testing processes in order to build a database of best practices and isolate areas of opportunity for improvements in the BIM community. It also needs to provide a means and motivation for users to create reliable information that is stored in open and interoperable formats.
- The Operate Workgroup has proposed that the organization actively consider the use of BIM Maturity Index (BMMI) concepts and the development of systems for certifying building information models and accrediting BIM individuals and organizations. CMM and BMMI are two factors of an organizations overall BIM Performance evaluation.

There are industry groups interested in providing web-enabled publication support of the interactive maturity model. This currently notional web-based interface should provide a means for both certifying BIM products (such as specific models) and accrediting individual professionals for demonstrating knowledge in the information and processes outlined in NBIMS. A diagram of the proposed, added functionality of this notional web interface looks like Figure 5.2-8.

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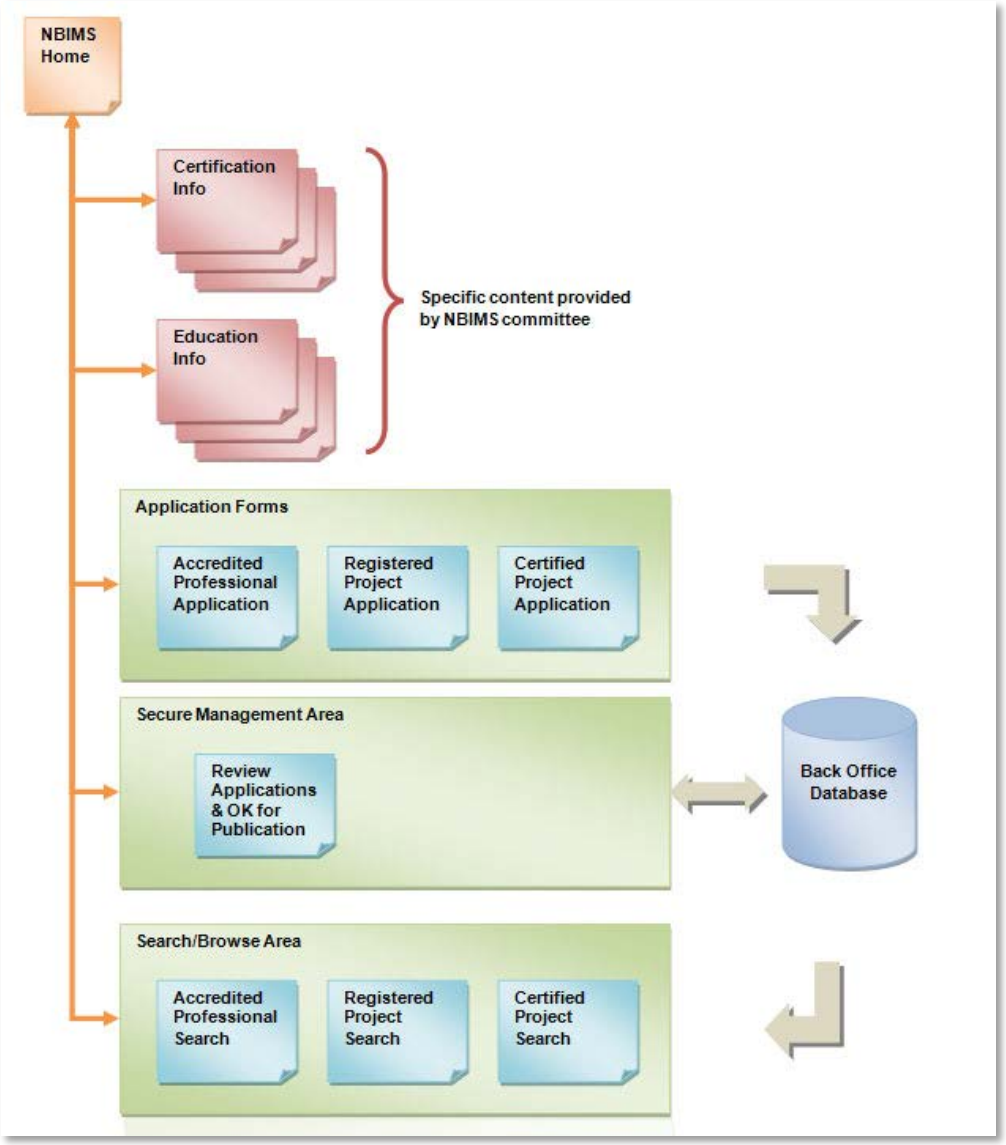

Figure 5.2-8 – Proposed Web-Based Application for Certifying BIMs and Accrediting BIM Professionals, graphic created and provided by Donald F. Sanborn, Unique Solutions

In this way, people would be motivated to learn the information in NBIMS because they could enjoy the recognition that accreditation would provide. The NBIMS Committee would benefit from having followers who could accurately relay correct information about proper BIM/IDM methodology. Furthermore, projects receiving certification would provide discriminators for forward-looking companies to demonstrate their ability to comply with proper NBIMS operations for the AECOO/FM community, which could help companies, win jobs or build respect in their fields. The corollary benefit would be that every certified BIM would go to a repository of information that could be mined for data

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regarding maturity or best business practices. This empirical data would provide trends that could easily be converted to lessons learned to leverage in recommending or shaping future business practices.

References

http://www.nationalcadstandard.org/

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