

BRIDGING THE AEC/FM TECHNOLOGY GAP

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Capturing useful, current and accurate data from design consultants and contractors to populate legacy FM technology systems has been an elusive goal for facility managers. Relevant lifecycle real estate, asset, and space data required for FM applications often has its genesis during the planning, design and construction phases of buildings. Owners employing FM technology obviously know what data is required to populate their systems and are in a position to contractually mandate such information from their design consultants. Yet, in an overwhelming number of cases, facility managers fail to contract effectively and they receive minimal useful electronic data from consultants. It appears, however, that this phenomenon is evolving in a positive direction! Numerous technical, social, financial, and even legal changes are taking place that will result in fundamental changes as to how buildings are designed, engineered and constructed and how data is exchanged between building consultants, constructors and owners. In this article, I have attempted to illustrate the drivers that are fundamentally changing how design consultants and contractors practice their trades and how these changes will benefit the facility manager in terms of their ability to capture useful graphic, asset and life-cycle data for their legacy FM technology systems.

Inhibitors and Opportunities

Why has it been so difficult for facility managers to acquire building data from their consultants? For one, the AEC industries typically have been extremely fragmented. Owners, realtors, architects, consulting engineers, general contractors and sub contractors, facility managers and outsource service providers all have individual and often competing roles in the creation and

maintenance of a facility under past and current professional and contractual relationships. However, this traditional fragmentation of industries is changing, not only because technically sophisticated facility managers are demanding faster delivery of better and more accurate information, but because of changes within the AEC industries themselves and their desire to offer value-added services to their clients.

The outsourcing of FM services is a rapidly growing and largely untapped market. The design and construction of buildings often represents less than 15% of the total life-cycle cost of that building. The performance of FM services is often not considered strategic and many organizations would therefore prefer to outsource one or more of their FM functions, with an associated cost savings and reduced personnel head-count. It has been estimated that the market for FM services has been growing at an average 15-25% annually since 1991 with about 25% of FM work currently being outsourced. The changes occurring in the AEC marketplace to tap into the FM service market will, for the most part, be financially driven. Technically savvy contractors and program managers, for example, are beginning to make a concerted effort to understand the needs of facilities management and want to tap into this FM services market – currently estimated to be about \$300 billion dollars annually.

Technology Changes in the AEC Industries

As in many other industries, availability of the Internet and associated technologies is beginning to bring about significant changes in the design and building industries that will facilitate the integration of AEC and FM information. Online collaboration and project management services are enabling traditionally fragmented industries to partner, often with the building owner, in a completely new way. Such collaboration often results in enhanced communications, fewer design conflicts, and fewer errors and omissions resulting in more efficient design and delivery of both construction documents and the actual construction of the building itself. Collaborative tools facilitate communication between relevant parties, illuminate design/construction conflicts, and facilitate targeted modifications.

The rapid growth of design-build firms has likewise been influenced by technology and the drive by FM clients for faster turnaround (design and delivery) of buildings and large renovation projects and their associated databases. Design-build firms offer better communication, a single entity for decision making, and the elimination of the bid process as significant advantages over the integration of discrete entities and technology systems.

Globalization, another factor enabled by Internet-based project management and collaboration, is contributing to greater efficiency and lowering professional service fees paid by facility managers. Many large AEC firms maintain project teams overseas and an increasing number of professional service firms, especially in China and India, are competing with the U.S. for AEC and FM services. It is not uncommon for design/construction documents to be passed from one geographic location to another which enable not only lowered costs but the documents to be worked on continuously for 24 hours a day because of differing time zones. Outsourcing production documents with groups linked by the Internet are already being used by hundreds of design/construction firms with the result of significantly lowering costs.

Data Required By Facility Managers

Facility management data required by an organization will vary according to a number of variables such as culture, existing legacy systems, FM functions performed in-house and out-tasked, costs, in-house capabilities and so forth. Technology related questions that need to be addressed before an owner negotiates with design consultants include the following:

- What are the specific graphic and non-graphic FM-related data that should be required from the design consultants and contractors?
- What is the availability, source and accessibility of facility information used during design, renovation, construction, maintenance and operations, asset management, security operations, and so forth?
- What are the current and planned future database needs vis-a-vis on-going facility management, renovation, remodeling and operations?

- What are the needs and requirements for Technical Support for FM information during future design and construction? and,
- Finally, what are the current requirements and methods of capturing facility information from design and construction processes to be migrated into the FM technology systems?

Once you have answered these questions, it is possible to:

- Define and prioritize what information might be important for asset inventory and operational purposes;
- Identify and inventory facility information available in construction drawings, specifications, construction logs, and construction submittals;
- Describe how that information should be incorporated into the legacy facility-related information systems, and;
- Develop a plan and process by which a follow-on phase of work might capture and load necessary information into relevant legacy systems.

Graphic Data

For CAFM-based space inventory, planning and management, it will usually be necessary to perform all or some of the following functions: create new space boundary lines, extract new and/or changed room IDs and update the CAFM database, re-link space boundaries and CAFM room records, label the drawings with your standard space classifications, and identify space owner and/or occupants. Ideally, it should be possible to generate three-dimensional models of a project (see discussion below) but most firms do not generate design/construction documents in 3D models now and their current CAD tools do not support this mode even if they chose to adopt it. The 3D CAD systems that offer FM applications have not yet been accepted by the FM industry. At some point CAFM systems will incorporate 3D databases but this is not the case presently.

There are also issues that need to be addressed associated with how best to capture design/construction changes in the field and how data should be maintained during construction –

between contractor and client and between contractor and sub-contractors who might have differing capabilities and software systems. Related to this is how best and when to transfer this data into the legacy systems of the owner.

Finally, the AEC industry has not yet comprehensively addressed FM needs to any extent, even though design and construction, as mentioned, account for less than 15% of the life cycle cost of a building. Data needs of architects, contractors and owners are different and, thus far, there has been little AEC knowledge, or financial incentive, on the part of the AEC industries to comprehend building owner operational data requirements.

Assets

For assets, it is desirable to identify important equipment either for capital asset inventory purposes and/or for maintenance purposes. Data collected should include extracted “as-is” equipment IDs and attributes from drawings and submittals to migrate into FM systems as well as life-cycle (e.g., replacement values of the asset at the end of its useful life), preventive maintenance information, service contract information and cost data. Life cycle data for assets and systems is particularly important for capital planning/budgeting purposes. To make this happen, contracting models that distribute risk/rewards and promote lifecycle information cooperation need to be developed. Additionally, to support Operations and Maintenance (O+M) functions, it is necessary to extract asset maintenance requirements from submittals and manufacturer’s manuals, edited to suit an organization’s specific practices, and migrate this data into the legacy FM systems in order to create, within the technology system, the preventive maintenance plan including both asset and location-based work.

Other Technology Issues

1. Electronic Documents

To enable the benefits of AEC-FM technology integration, design consultants must deliverer project specifications electronically and organized in a standard format. For example, project specifications, containing detailed requirements for various project elements, should be organized

according to MASTERSPEC Divisions and Sections. Additionally, construction contracts should contain clauses that require the contractor to deliver manufacturers' maintenance and operations (M&O) manuals and warranty information for new and rebuilt equipment electronically as well. In the Owner-Contractor agreement, the Contractor should be required to plan and submit materials supporting the commissioning of building systems (i.e., testing to assure performance meets design specifications) including electronic databases. Materials should include manufacturers' submittals, M&O requirements, ID tags attached to major equipment, schedules defining the item names and progress toward completing the [operational] commissioning of each item, plus any other data deemed significant for supporting the FM legacy systems.

2. Building Modeling

Ideally, the ultimate solution for AEC FM integration would be the development of a single 3D data model of a building's graphic/asset databases with manufacturers providing relevant asset data in a prescribed format. Such an integrated, coordinated building model would provide for the ability to check clearances, enable rapid communication between disciplines, enable changes to be made to all disciplines simultaneously and so forth. There are a number of entities trying to develop industry standards for building data that would enable such interoperability.

The most significant government entity involved in this effort is NIBS - the National Institute of Building Sciences (<http://www.nibs.org>) which owns the copyright for the CAD Standards Guide and has a Facility Maintenance and Operations Committee that is developing data standards to get equipment standards into Computerized Maintenance Management (CMMS) systems. Two-dimensional CAD standards are fairly complete at this point and 3D is under development by the International Alliance For Interoperability (<http://www.iai-na.org>). The IAI is under NIBS administratively and has incorporated NIBS' equipment standards into their guide specification. Vendors are currently evaluating these standards but no vendors support the standard yet.

To accomplish its mission, the IAI (i.e., the incorporation of a single Building Information Model or BIM) promotes Industry Foundation Classes (IFCs) for AEC data sharing over a project's life

cycle across disciplines and across discrete technical applications. The technology it employs for data can be interchangeable between software systems in a unified way and is based on the Extended Markup Language (XML), a flexible text format that enables the exchange of a wide variety of data on the Internet.

Again, the development of a building model holds enormous potential in saving time, reducing mis-communications and enabling Internet-based building/FM integration and interoperability, but it has not evolved to a point where it incorporates the needs of facility management. At present, I am not aware of anything available that provides interoperability in the FM world – and I do not expect that there will be for several years yet.

3. Data Commissioning

The final significant technology issue of AEC FM integration is associated with building commissioning as it relates to the electronic databases that are passed from the contractor to the owner. The area of commissioning seems to be in turmoil. What used to be a relatively simple function performed by architects is now being integrated more tightly with construction and owner issues. Increasingly, we are seeing both the general contractor and independent third party service groups wanting to get involved in this function and charging up to 2% of the construction cost for this service.

Yet many questions remain as to who should perform the commissioning of data and when it should be defined. It is beneficial to negotiate data commissioning contracts at the outset between the Owner/Architect and Owner/Contractor if the owner can pre-define data commissioning approaches and requirements. This is not always the case, however, and independently-contracted data commissioning is appropriate for projects where design and construction agreements have been executed without data commissioning requirements incorporated into the original Owner/Architect and Owner/Contractor contracts. In some cases, traditional Owner/Architect/Contractor agreements are being abandoned in favor of evolving shared-risk/reward contract models that enable a more coherent approach to lifecycle

information. For these types of agreements, a pre-defined integrated data commissioning approach would be a natural outcome of the process.

The tendency for sources of information to rapidly degrade, become disbursed or evaporate entirely following construction indicates that the owner should at least implement post-construction data commissioning – either as separate contracts timed to occur in the same time frame as building systems commissioning activities (e.g., independent) or as part of construction agreements themselves (e.g., integrated).

Conclusion

For better or for worse, we are clearly entering an age which will fundamentally change the relationships between facility managers and AEC professions – an age that will result in more integration, better data exchange, and communication between these groups throughout the lifecycle of buildings. The global search for efficiency and low prices will, as it has for other professions, squeeze domestic suppliers and service providers, result in offshore out-sourcing, and result in even lower wages for architects, engineers and contractors who continue to practice the status quo. Based to a large extent on Internet-based technology and led by large design consulting/contracting organizations seeking greater speed to market and the desire to offer new services to their clients, significant process changes will occur. Although integration and innovation is always disruptive at first, new opportunities will be created and increased productivity will eventually occur in the design, construction and operations of buildings.

About the Author

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