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The application of COBie to Increase the Functionality of Existing Facilities Management Software

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Abstract

Building Information Modelling (BIM) can provide a focus on collaboration between the designers, constructors and facility management (FM) personnel leading to major efficiencies in the operational and maintenance phase of a building. The information within a model can be extracted at various stages throughout the project life cycle using the Construction-Operation Building Information Exchange (COBie) schema that provides an open framework for the exchange and delivery of construction handover information. However, it is then up to the FM software companies to take the information and display it in a user friendly way. The authors have set about enhancing an established FM software package, which more efficiently transfers the equivalent of multiple documents. This gives the user a front end view of all of the information that has been captured over the construction period, resulting in the FM having all of the information available at their fingertips in a visualized database, which greatly assist the operational maintenance of built assets.

Keywords

Building Information Modelling, COBie, Facilities Management.

Introduction

Today, most contracts require the handover of paper documents containing equipment lists, product data sheets, warranties, spare part lists, preventive maintenance schedules, and other information. This information is essential to support the operations, maintenance, and the management of the facilities assets by the owner and/or property manager (East, 2012). Operating and maintaining high performance buildings requires a sophisticated organization with careful preparation and planning, requiring a well-managed project delivery system that can cater with complex business processes and an expert operation and maintenance (O&M) team (Ruiz, 2010).

The challenge for the future is to optimize FM and to find solutions for supportive tools to help FMs operate and maintain their buildings more efficiently by including user behavior in the building process (Sabol, 2008). The same author further explains that FMs are continually faced with the challenge of improving and standardising the quality of the information they have at their disposal, both to meet day to day operational needs and to provide senior management with reliable data for organisational management and planning. In order for the FM process to advance and

meet day to day operational needs it is essentially that a more efficient method of generating and managing building data during the life cycle of the building is explored. This process is now more possible with the increased sophistication of BIM tools, which has the ability to offer a new level of functionality for the management of buildings and the physical assets within them. BIM tools have matured to provide a unified digital repository of all building components, and as a full 3D model it is capable of displaying views with a clarity that typically eludes users not schooled in interpreting standard 2D building drawings (Sabol, 2008).

The BIM model retains information such that is invaluable in the operational and maintenance phase of a building, as today most contracts require the handover of paper documents containing equipment lists, product data sheets, warranties, spare part lists, preventive maintenance schedules, and other information which the BIM model contains routinely as rich data. This information can be then extracted from the model using the COBie schema, which provides an open framework for the exchange and delivery of construction handover information. The purpose of this paper is to outline how an established FM software product can be enhanced by integrating BIM and COBie data, thereby displaying the information in a more user friendly way for FMs.

Methodology

The methodology involved action research combining theory and practice through change and reflection in an immediate problematic situation, within a mutually acceptable ethical framework. Action research is an iterative process involving researchers and practitioners acting together on a particular cycle of activities, including problem diagnosis, action intervention, and reflective learning (Avison et al., 1999). At the time of completing this paper the software was under review and validation and may undergo further improvements as a result of feedback from users in the field of FM.

Types of Building Information

For large construction projects, an extensive amount of information must be included in the handover file. The building documentation is usually compiled by the main contractor on the project. The Project Supervisor Design Process (PSDP) is the person who has to handover the safety file. The main contractor usually includes this in their handover file. The clients' requirements will depend on the level of detail that must be incorporated in the file. The clients, who have a hands-on approach and are involved in the project, will normally require a more detailed file at the end of the project. The type of information that is ordinarily associated with project information is as follows:

- Design Team Documentation;
- Building Structure;
- Fabrics & Finishes and
- Mechanical & Electrical Services:

The quantity of information that is required in the O&M file can be quite extensive. With this large amount of information it is easy to omit or misplace documentation. It is difficult to get every discipline to include all information associated with their system. For this reason, the main contactors and PSDP are outsourcing the compilation of these files to specialist contractors. These specialists have developed

software to use to compile the files. A problem that these specialist contractors face is to ensure that all of the information is contained within the file. The reason for this is that the specialist contractor compiling the files are not involved in the actual design or construction of the project, and, are usually brought onto the project near the end. This means that they are reliant on the subcontractors and designers to provide all of the required information.

There is a growing interest in how BIM can be leveraged to streamline the operations and maintenance of existing buildings. This includes questions about how BIM tools, created for the design, planning and construction phases of a project, can be used for data exchange with owner organisations and for O&M activities. (Anderson et al, 2012). Langdon (2012) outlines a number of benefits in the FM field when a BIM model is in use at the design and construction phases of a project. These include the

- creation of an FM database directly from the project (as built) model;
- ability to perform FM costing and procurement from the model; and
- ability to update the model with real-time information on actual performance through the life of the building.

In regards to FM and BIM probably one of the most exciting developments to come from combining both processes is the COBie schema. The COBie approach envisions capturing information incrementally throughout the planning, design and construction processes and providing a framework for robust information organisation for FM (Sabol, 2008).

Construction-Operations Building Information Exchange (COBie)

COBie can be used to capture and record project handover data. The COBie format facilitates the delivery of building information during planning, design, construction, and commissioning for delivery to facility owners and operators (buildingSMART Alliance). This standard allows retrieving process specific IFC-based facility data but uses spreadsheets to view and store this data (Taneja et al, 2010). The COBie schema provides an open framework for the exchange and delivery of construction handover information (East, 2007). COBie as explained by Mills (2010) was a prototype model proposed for US government facilities and is IFC friendly but functions within desktop software applications e.g. spreadsheets, digital images, and PDF's. COBie identifies the contents deliverables for information exchanges during design, construction, commissioning, and closeout and archives them in a spreadsheet. The COBie approach as outlined by East (2012) is to enter the data as it is created during design, construction, and commissioning as detailed in see Figure 1.

Designers can provide floor, space, and equipment layouts, whilst contractors can provide make, model, and serial numbers of installed equipment. Much of the data provided by contractors comes directly from product manufacturers who can also participate in COBie data population. The three main stages that the COBie information falls into are as follows:

- **Design:** During the design stage the room areas, sizes, layouts and construction details are decided. All of the information associated with these aspects should be inputted into the model. At the end of this stage a spreadsheet can be produced with all of the rooms and areas in the building with associated room names, tags, etc.

- **Construction:** The designed model is taken by the construction team where makes, models, serial numbers, contact details and O&M information is linked into the COBie spreadsheets. They simply have to link the information to the equipment which has already been selected by the designers. By linking all of the manufacturers' technical data, O&M / User guides on equipment, the contractor is basically compiling their operation and maintenance manual as they go, rather than the process just being rushed at the end of the project.
- **Commissioning:** The commissioning stage is when all the as-installed or as-built information is entered. Commissioning and testing records are inserted into the spreadsheets. The final as-built drawings are also produced and attached to the spreadsheet.

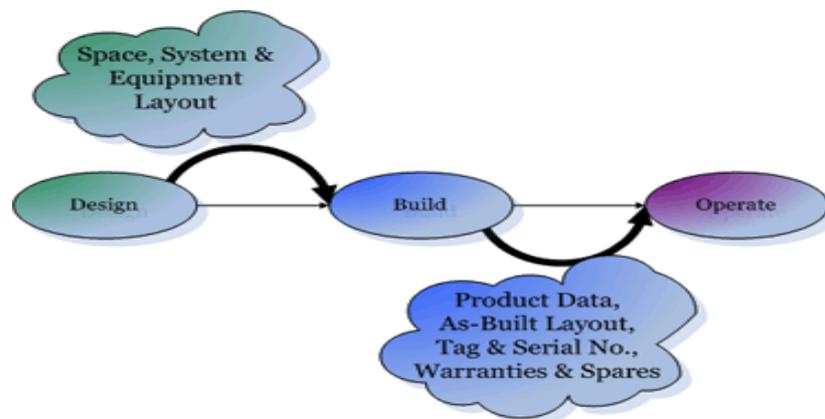


Figure 1 – COBie Layout

However, if BIM and COBie are adopted, we need to not only streamline the flow of information between programmes, we need to address the interface for facility services crews, so they too can leverage these new datasets. Time spent training with new technologies and grappling with complicated interfaces means less time on the physical systems that need their attention. (Anderson et al. 2012). The authors add that as more digital information is amassed; including information from COBie and BIMs, organisational cultures and practices need to be developed around these new datasets.

Case Study Software: InControl DFM Software

Moore DFM has been compiling documentation since its formation in 2004. It has developed its own software for compiling digital building files. A problem that the company faces is to ensure that all of the information is contained within the file. The reason for this is that the specialist contractor compiling the files are not involved in the actual design or construction of the project, and are reliant on the subcontractors and designers to provide all of the required information.

InControl DFM has been developed by InControl Ltd trading as Computech Ltd. It is a FM software application that can be used for various types of project handover documentation. It can be used for mechanical and electrical services O&Ms, building files and safety files. DFM is an interactive file that is used as an interface for all of the documentation on a project. It has been used as the digital building file for some

of the biggest projects in Ireland. The following are some of the projects on which it has been used:

- Convention Centre, Dublin
- Grand Canal Theatre and Office Development
- Spencer Dock Block C, R, STUV
- The Point Village Development
- St Vincent's New Private Hospital
- Blackrock Clinic



Figure 2 - Layout of DFM Software

Figure 2 above shows the O&M section of the DFM software. On the left-hand side (marked 1 above) is the system tree. This is where all of the project systems are set up. Information is linked here during construction of the file. In the middle of the figure (marked 2) are all of the tabs over which the information is spilt. During the construction of the file the information will be broken down into these tabs. On the right hand side of the figure (marked 3) are all of the base tables. This is where all the information is based. By clicking on the drawings link, the drawings for the entire project will appear. This is different to the system tree where clicking on a system will show only the documentation linked to that system.

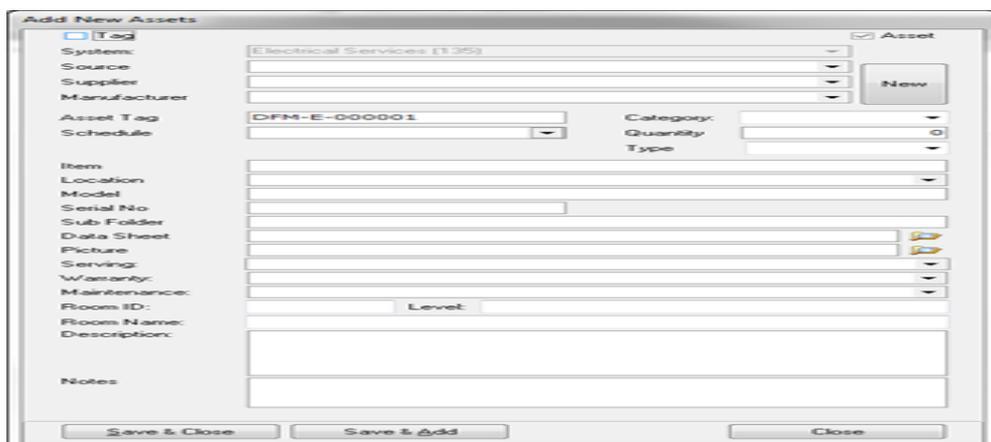


Figure 3 - DFM Asset Tab move text to make larger in size for clarity

The asset register is one of the main functions of the DFM software. Each asset is inserted into the system with information attached. This is to ensure that the end user

COBie vs. InControl DFM.

The commercial software that has been used to create digital building files is called InControl DFM. The authors have examined all of the fields that are manually compiled and compared them to the information available in the COBie spreadsheet. A list of common fields was compiled and a map of data transfer was drawn out. This showed what information would flow between the COBie data and the FM software. Considering there was a lot more information in COBie compared to InControl DFM, not all of the data contained in COBie is directly relevant to the facilities side. Fields that are commonly used in FM software are shown in Table 2.

DFM – Asset Register Fields	
System	Asset Model
Source	Warranty Period
Supplier	Maintenance Period
Manufacturer	Room ID
Asset Tag	Level/Floor
Category	Room Name
Quantity	Description
Type	Serial Number
Asset Name	Link to Data Sheet / Information
Asset Location	Area Serving

Table 2 - DFM Asset Fields

After reviewing COBie, it was evident that all of the information that would normally go into a digital building file is contained within the spreadsheet. By importing this information into the InControl DFM it would create a full asset register of all the main plant items on the project. All of the operation, maintenance and technical data on the assets are stored in the Documents Tab in the COBie spreadsheet.

Importing COBie information into DFM Software

At first it was expected that it would be very easy to link information from the COBie spreadsheet into the DFM software. The problem in transferring the information across from one to the other is the “language used”. When looking across all the tabs in the COBie spreadsheet, the same “Name” or “Ref” is not always used. A variant of the original name is often used. While it is clear to the human eye that the information is linked, a computer is unable to recognise this. The software has parameters, filters and searches developed into its code to link information together. In order for the software to work it requires a field in all tabs to link the information together. An element code or reference for each main piece of plant, asset or equipment is required. This should not be site or project specific but common for every site and every project. In simple terms it should be a universal element numbering system.

As with most FM software, InControl DFM is based around an assets section. The assets section contains a lot of information about the element. If there are ten thousand files in FM software and only one thousand assets, the majority of those files will be associated directly with the asset. For instance, if you take a pump as an asset, it will have a lot of technical information associated with it and will not have just one document. You will have pump curves, operation data, maintenance data, spare parts lists, safety data, wiring diagrams, testing and commissioning data, etc. That means that one asset can have numerous files. Therefore, we will need to be able to link numerous documents to a single asset.

The actual process that the software follows to import the information from the COBie spreadsheet to the DFM software is very straight forward.

1. The link software extracts each worksheet from the COBie excel file and creates a single CSV file for each.
2. Then, using map files and the individual CSV files, it imports the information from COBie into the DFM database.
3. Using SQL commands, it creates a link table between the systems and database.

The software uses map files to extract the information from the COBie spreadsheet. The authors have created tables in Microsoft Word mapping out how the information should be interchanged between the spreadsheet and the DFM software. Within the DFM software there are nine different categories that information can be linked into. This resulted in the creation of nine map files for importing the information from COBie. All the documents and elements listed in the COBie spreadsheet were imported into the DFM system. The three assets were imported with all their fields of information filled in automatically. The process is not just developed for use with the DFM software but can be taken and used to import COBie information into any FM software. The figure below shows all the fields that were automatically populated using the import software.

The screenshot shows a software window titled 'Assets' with a 'Tag' checkbox (unchecked) and an 'Asset' checkbox (checked). The form contains the following populated fields:

- System: Mirrors and Noticeboards (45-35-55) (140)
- Source: nn@aec3.com
- Supplier: Wallagte Ltd
- Manufacturer: Wallagte Ltd
- Asset Tag: DFM-E-000001
- Schedule: [dropdown]
- Category: 45-35-
- Quantity: 1
- Type: Moveable
- Item: Mirror
- Location: Level 0
- Model: n/a
- Serial No: n/a
- Sub Folder: Mirrors and Noticeboards (45-35-55) (140)\
- Data Sheet: acrylic_mirror_technical_data_sheet.pdf
- Picture: [empty field]
- Serving: n/a
- Warranty: 12 Months
- Maintenance: Yearly
- Room ID: L0-01A
- Level: 0
- Room Name: Cell 1
- Description: Mirror
- Notes: [empty text area]

Buttons at the bottom include 'Save & Close', 'Save & Add', and 'Close'.

Figure 5 – Populated DFM Asset Table move text to make larger in size for clarity

Conclusions

With the slowdown of the world economy, all companies are trying to get ahead of their competitor. This means that most companies are trying to find niches in the

market or provide extra functionality compared to rival companies. If properly implemented, COBie can increase the functionality of an existing FM program. COBie contains within a spreadsheet all the information collected from construction that is handed over to the facilities department. This information can be accessed by clicking on the color coded tab within the spreadsheet. The authors have demonstrated how software companies can take all of these extra fields of information from COBie and provide it in their software. The software demonstrated this through the use of map files to extract the information from the COBie spread sheet. This gives the user a front end view of all of the information that has been captured over the construction period and ultimately means that from day one the FMs have all of the information available at their fingertips in a friendly and visualized database. This process was not just developed for use with the practiced software detailed within the research but can be taken and used to import COBie information into any FM software.

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