

The IFC/COBie Report 2012

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Foreword

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Foreword

As it is now 18 months since the launch of the UK Government's Building Information Modelling (BIM) Strategy, the need to test some of the practicalities of BIM is ever pressing. 'How do we make BIM work?' is a popular discussion topic at conferences and across social media channels and, whilst the Government mandate for information in an open standard is clear, industry needs to break down the barriers to adoption. Studies such as this get into the detail of BIM and help to make it a success. It's time to roll up our sleeves and make BIM a reality.

Getting to grips with new technology is always a challenge, with BIM it is overcoming the cultural and process changes that it brings. The benefit of proactive group discussion was evident during this trial and the spirit of openness amongst competing commercial organizations was a strong indication that industry is working together to achieve the 2016 level 2 BIM objective. This requires a sound understanding of the practicalities of BIM and although those taking part in the trial had limited knowledge initially of the role of COBie in this, they reached a common view that it is the right choice. That said, it became clear during the trial that industry needs more support, more tools and project based evidence for BIM adoption to be achieved on a far broader scale.

Real world construction must get to grips with BIM. Despite being well defined the limited and in many cases non-existent practical knowledge of COBie amongst clients, designers, contractors and manufacturers is alarming. To get BIM working industry needs to experience it firsthand. So if you haven't tried COBie yet, give it a go – as this study shows it's the best way of getting to know it.

Open BIM technologies, such as buildingSMART International's Industry Foundation Classes (IFCs), have been developed over many years, since 1994 in fact, and exist with the sole aim of enabling interoperability between BIM applications. The suitability of IFC was scrutinized during this trial and the findings are most interesting. Firstly, IFC is a suitable mechanism for the creation of COBie data drops and secondly, yes there are tools already in the market place that generate COBie from IFC, but overall the support for COBie in BIM applications varies and must improve. There remains a lot to be done in this area but with the backing of the BIM Technologies Alliance and the OPEN BIM Network, there is a drive to create tools that support COBie (and beyond) which is most encouraging.

The rest of the world is in awe of the UK BIM strategy and the progress made so far. I hope that this report will encourage the construction industry to move forward with BIM. It's an opportunity we can't afford to miss.

Ian Chapman – Head of Specification,
NBS

For further reading, please see:

BIM for Specifications

[theNBS.com/topics/BIM/articles/
bimForSpecifications.asp](http://theNBS.com/topics/BIM/articles/bimForSpecifications.asp)

BIM for Service Engineers

[theNBS.com/topics/BIM/articles/
bimForBuildingServicesEngineers.asp](http://theNBS.com/topics/BIM/articles/bimForBuildingServicesEngineers.asp)

BIM and Roofing

[theNBS.com/topics/BIM/articles/
bimAndRoofing.asp](http://theNBS.com/topics/BIM/articles/bimAndRoofing.asp)

Context of the trial

In considering BIM as the process that gives all those involved access to the information they need, when they need it, efficient deployment requires three things to happen.

Ways need to be found to:

- Create model data in a consistent format
- Exchange that data in a common language
- Interrogate the data intelligently.

This year, whilst working with a number of Tier 1 contractors and their supply chains, we explored the most efficient ways to deploy BIM. Universal feedback indicated that, due to the large number of 'BIM tools' in regular use across the lifecycle of a building, a common language for data exchange is essential. Only then can all stakeholders select the technologies that best meet their particular needs.

In response to this, the OPEN BIM Network was founded earlier this year. It represents a rapidly growing membership who believes that using open communication protocols is the only logical way to proceed, if the benefits of BIM are to be realised.

With this fundamental principle established, leading industry names provided a mandate for a 'concept trial' to address a topical industry problem and whether IFCs can provide a solution to the problem – i.e. be used to visualise and validate COBie data in, and extract resulting data from, the Building Information Model. The ability to do this efficiently will both help the Government agenda and advance the increasing business demand for open protocols.

From the outset, the 'concept' nature of the trial has been stressed and all participants understood that even a positive outcome would be just a first step. But the journey has to begin somewhere and in addressing the three key requirements outlined above, this trial is a good place to start.

On behalf of the OPEN BIM Network, I would like to thank the contractors participating in this initial trial - BAM, Carillion, Mace, Laing O'Rourke, Skanska, Wilmott Dixon, Wates and VINCI Ltd; BIM Academy for providing parallel studies; plus several leading technology/design sources, for providing model data and technical support. Special thanks are given to NBS as the primary partner responsible for policing the trial and producing this report.

In terms of recent catalysts for change, this report may become a key contributor. I hope that it provides food for thought and informs strategy going forward.

David Jellings – Director OPEN BIM Network

For further information about the Open BIM Network, see:

openbimnetwork.com

Executive Summary

The Government is committed to Building Information Modelling (BIM) and the use of open-standard data so that the construction industry can deliver greater value and be more efficient. The open-standard data format required for level 2 BIM is defined in the Construction Operations Building information exchange (COBie) data schema. COBie allows information about buildings to be organised, documented and shared in a standardised way. It is particularly helpful to those who come to manage a building.

We wanted to test whether the buildingSMART IFC file format was capable of supporting the creation of COBie datasets and we did this by running a trial with a number of Tier 1 contractors.

The objectives of this trial were:

- To validate and check the suitability of an IFC file for the generation of a 'COBie data drop'
- To validate and check the generation of the corresponding COBie datasets from the IFC file
- To uncover any issues with the use of IFC for COBie in real business environments.

These objectives were met through a series of technical exercises and by holding a group discussion.

Overall, we found that the participants in the trial broadly shared the Government's belief that open file formats, specifically IFCs, could be used to generate COBie data drops. Further, COBie offers a way to standardise sharable information through the construction timeline – from design to use. The participants shared the belief that standardised, shareable construction information held in well-

structured models can, and perhaps must, be the future for the construction industry.

That said there are challenges ahead. The participants were keen to describe and explore a number of issues they currently faced, concerning standardisation, software capabilities and industry commitment. The group made recommendations in respect to how these issues could be resolved.

The most pressing needs the group identified were:

- The need for standards
- The need for guidance
- The need for enhanced IFC import export routines from BIM applications
- The need for agreed descriptions of who requires what data and when
- The need for an improved audit trail to allow greater confidence in collaboration.

The trial was initiated by the OPEN BIM Network after consultation with Government and industry representatives. A number of organisations supported NBS and the OPEN BIM Network during the trial and are thanked in the acknowledgements.

Introduction

We are at a turning point in the type and quality of information about buildings that we can create, share and collaboratively use. The Government is committed to BIM (Building Information Modelling) being a tool for delivering greater efficiency to the construction industry, efficiency that will, in turn, bring cost savings for all throughout the building lifecycle. But we are still at the start of this revolution, and there are still real questions about the technologies at our disposal. Not least among these questions is a debate about proprietary data formats versus open, interoperable standards.

This is where this trial comes in. Simply put, we wanted to investigate whether the existing open data standard, IFC (Industry Foundation Classes), is up to the job of generating a sufficiently robust and information rich Construction Operations Building information exchange (COBie) dataset.

NBS and the OPEN BIM Network have designed and overseen this trial but the participants have carried it out. These are BAM, Carillion, Laing O'Rourke, Mace, Skanska, VINCI Construction UK Ltd, Wates and Willmott Dixon Construction. BIM Academy also participated, playing the role of a Tier 1 contractor from an academic point of view.













Background

In the UK Government Construction Strategy, the Government has clearly laid down its requirements for the delivery of construction data and information.

This trial supports the Government's BIM strategy for development of BIM in the UK. The release of the Government's procurement strategy in late spring of 2011 has given an added impetus to this trial. We can summarise the main relevant points of the strategy as follows:

- A requirement to deploy COBie* as an asset management recording process. The report suggested BIM is the business process to do this.
- An indication that, in the future, as the market moves to level 3 BIM deployment, the Government will push for open interoperable standards (i.e. buildingSMART IFC, IFD, IDM).
- The market needs to be aware that the desired use of the open standards at level 3 BIM needs planning during the development and implementation of level 2 BIM.
- There is uncertainty around the status and capability of IFC as a communication protocol (possibly due to inconsistent technical and marketing messages from a wide range of sources).
- There is uncertainty about the ease of which COBie data may be generated from model sources and how this may be validated.

We should note that the Government deliberately does not specify the technologies that the industry should use to meet these requirements.

This trial investigates whether open standard file formats (as opposed to software specific ones) can deliver the

required information for level 2 BIM. Specifically, we look at whether IFC files can be successfully used to deliver COBie data.

Objectives of the trial

In the context of the above, the principal objectives of the trial are:

- To validate and check the suitability of an IFC file for generating a COBie dataset (or 'COBie data drop')
- To validate and check the validity of the COBie datasets that have been generated from the IFC file
- To uncover any issues with the use of IFC for COBie in real business environments.

Participants validated a number of defined tests of the IFC data exported from a BIM tool (such as the architectural tools of Autodesk, Graphisoft or Vectorworks) and then reported on the missing, incorrect or incomplete data. They then re-validated the updated IFC data file and used it to extract data in the form of a COBie report in a spread sheet (COBie data drops 1 and 2 were generated).

At the outset, our intention was that if we found that the trial demonstrated that the industry can successfully work with IFC for COBie, then we would use the results to promote wider adoption of IFC. If not, we intended to use the findings to describe current shortfalls and possible ways for improvement.

As the trial incorporated a group discussion, we also had the opportunity to highlight emerging themes that were not directly covered by the formal objectives. We discuss these later in this report.

We intended the trial to provide a focus for the industry around the suitability for

IFCs for providing the data required for COBie. The results given here will inform and influence CAD vendors, information specialists such as NBS, BIM bodies such as the OPEN BIM Network and buildingSMART, as well as the Government. We hope the trial will provide information that helps the industry develop better ways for processing construction information.

[*bimtaskgroup.org/cobie-uk-2012](http://bimtaskgroup.org/cobie-uk-2012)

Methodology

Outline

We wanted to carry out a trial that was able to uncover verifiable and repeatable technical issues around open construction information, rather than uncovering simply attitudes and beliefs. To do this we did not need a large sample, rather we needed a group of independent experts willing to use the same information as one another to see what models and documentation could be generated from it. Necessarily then, this trial is limited in scope, in that it involves relatively few participants from a subset of the construction industry – but that is not directly relevant to its validity.

We also wanted to supplement the technical findings with a broader discussion about process and about people’s attitudes towards building information. This was so that we could place the technical findings in the broader context of people’s professional experience. This helped us meet our research objective of uncovering any issues with the use of IFC for COBie in real business environments. The results of this discussion are described in the Findings from group discussion.

We approached Tier 1 contractors to carry out the tests. Happily, eight contractors agreed to join the trial group and supported the trial. As software tools were used during the trial, the BIM Technologies Alliance were kept informed of progress throughout.

Together the OPEN BIM Network and NBS agreed the scope and objectives of the trial and gave instruction on completion of the trial. These were in the form of a guide rather than a prescriptive list of instructions. This allowed for the kind of variance in working practice that we find in the real world.

NBS provided a building model, created in partnership with HOK, for the trial from a neutral, trusted, industry source. It didn’t favour one data format over another and is compatible with open standards. The model was created in native BIM formats and IFC 2x3. Within this model, NBS placed a number of control errors to test whether participants identified errors in the models.

The trial had four phases as shown in Figure 1 below:

In Phase 1 of the trial, the participants received and validated the IFC files and identified information shortfalls using their technologies of choice. The participants documented the technologies and processes used.

NBS provided a guide for this documentation before the trial started. The participants were invited, if they wished, to repeat the trial using different processes and/or technologies.

In Phase 2 the participants reported the outcome of the validation process to NBS. NBS arranged for the source data to be corrected and then re-issued the files to the participants.

In Phase 3 the participants re-validated the corrected IFC file and produced a documented comparison.

In Phase 4 the participants interrogated the corrected file and produced an output COBie spreadsheet directly from selected trial software(s). We asked participants to create a spreadsheet that conformed to the requirements of a COBie data drop. The spreadsheets were forwarded to NBS for assessment.

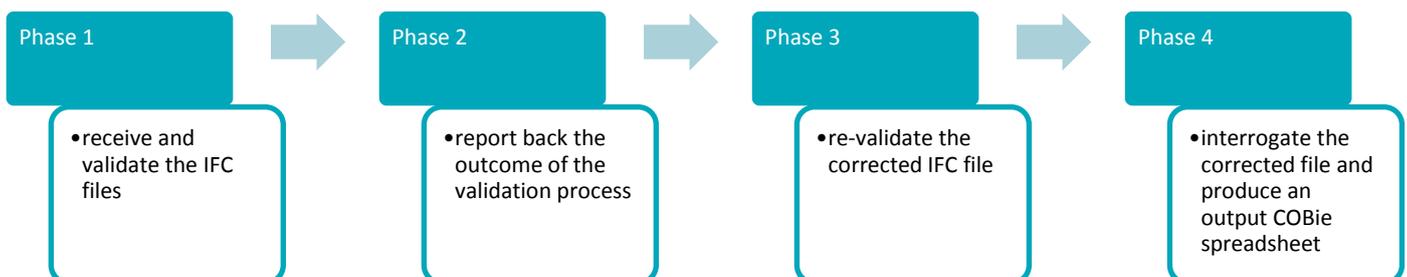


Figure 1 Phases of the trial

The design process

To mimic the design process on a real construction project we needed a high quality building information model. Earlier in the year, HOK London designed and modelled a restaurant building which looked into the quality of the National BIM Library objects. They created it using Autodesk Revit.

So that we could carry out the trial independently of any particular piece of software, the building was also modelled using Graphisoft and Vectorworks, to create it in both ArchiCAD and Vectorworks formats.

The building had one main floor and around twenty five rooms. The model was the source data for the test. It was sufficiently complex to allow thorough testing of both the IFC files and the corresponding COBie data set. You can see visuals of this design model in Figures 2 and 3.

We used the buildingSMART IFC export and import process so that the information in the model could go from one package into another and to make sure that the geometry data and building information was correct. In each of the building models we then inserted design-level objects with parametric functionality to give a true native model (again, with the support of Graphisoft and Vectorworks). We used National BIM Library objects where they were available to take advantage of the IFC and COBie parameters defined within them.

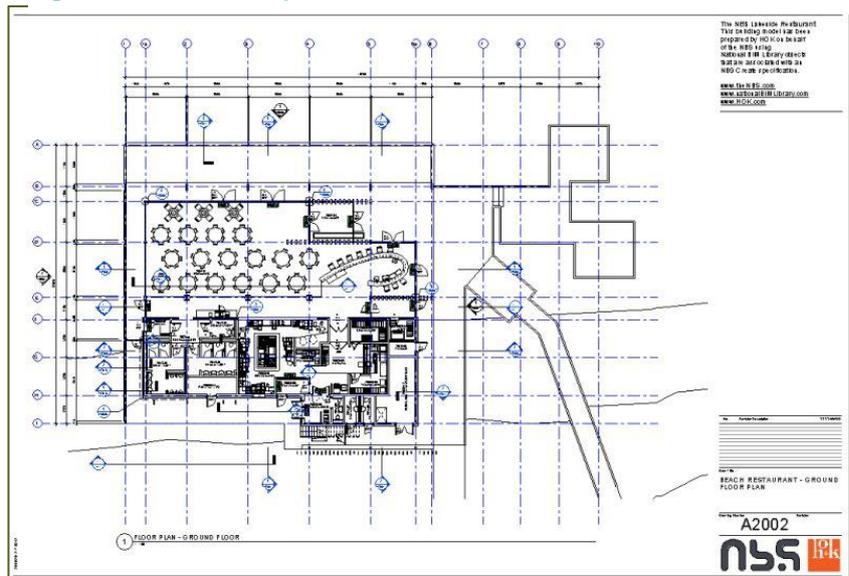
The trial was limited because we only used building fabric objects. In any future trial we would like to merge design models with structural, building services and landscape objects so they, too, could be tested. This must form part of any follow up trial.



Figure 2 Visualization of the model

We gave the trial group the IFCs generated from the various design models so that they could create the COBie dataset. We also provided the source design models in case these were also needed. We asked the trial group to report any clear problems they could see with the model that would impede construction.

Figure 3 Ground floor plan from the model



Examples of deliberate problems put in the model were access zones around doors and objects with no classification. An example of this is shown in Figure 4.

In the objectives we stated that we wanted “to validate and check the suitability of an IFC file for generating a COBie dataset (or ‘COBie data drop’)”.

There are, however, several ways to generate COBie data, for example:

- **Manually** – Clearly this is not a realistic option for an entire building. But for a manufacturer’s product range, the manufacturer could manually structure their product data sheets in COBie format using an everyday tool such as Microsoft Excel.
- **Directly from the native model** – At the very first BIM Technologies Alliance meeting the question was asked of all of the software vendors – “can you give those working on Government projects a ‘big COBie button’?” We were interested to see what progress had been made here.
- **Indirectly from the native model via IFC** – COBie is a subset of IFC. It should be possible to generate a COBie dataset automatically from an IFC model.

An additional software vendor, Solibri, volunteered their products for the trial too. The Solibri tool is not used for building design; it is for model checking.

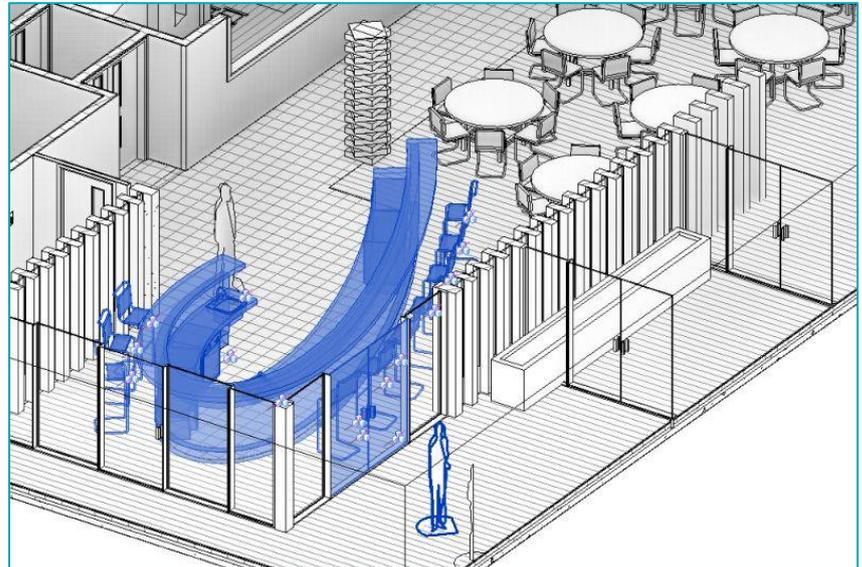


Figure 4 - Could issues such as access zones around doors and windows be highlighted?

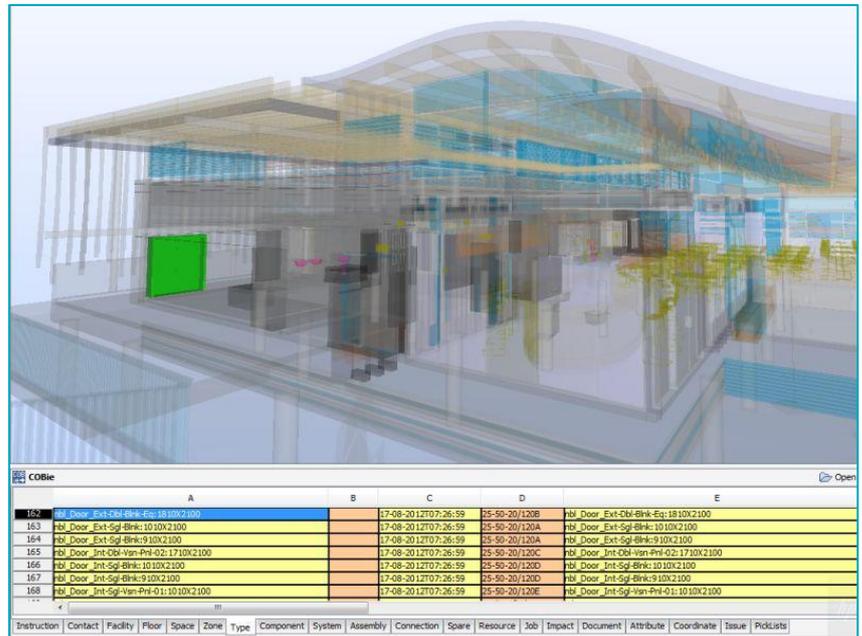


Figure 5 – A COBie dataset linked to the 3D model through IFC

Technical findings of the trial

Working with IFC

There are a number of software tools on the market that work with IFC data. Some of these are quite mature, though some are still in their infancy. Those who carried out the technical trial either used or mentioned the following tools:

- Tekla BIMsight
- Solibri Model Viewer/Checker
- Simplebim
- xBIM
- openBIM Server
- AEC3 BIMServices.

The group told us that it was possible to do a range of automatic checks when working with IFC or COBie data, ranging from the simple to the sophisticated. At the most simple, they used tools to compare the information held in two spreadsheets. At the most sophisticated, the group used tools to validate the rules applied within a 3D model.

Questions regarding COBie

Level of detail

The overwhelming technical challenge with COBie is the need for clarity on what data is required for the Attribute table. The required level of detail needs to be defined and, once defined, the BIM library authors and software vendors need to provide the functionality to produce it in an IFC model and a COBie spreadsheet export routine. If these things don't happen there is the risk of missing data, or, more likely, people will generate COBie files with an unworkably large number of rows of data. This risk is heightened by currently available processes for generating COBie being very manual.

Audit trail

Two of the fields in a COBie data are CreatedBy and CreatedOn as shown in Figure 6.

	A	B	C	D	E	F
1	Name	CreatedBy	CreatedOn	Category	FloorName	Description
2	20BOH.01		2012-09-28T00:30:40	45-20-45 - Kitchens	GROUND FLOOR	OPEN KITCHEN
3	20BOH.02		2012-09-28T00:30:40	65-10-51 - Lobbies	GROUND FLOOR	BOH CIRC.
4	20BOH.03		2012-09-28T00:30:40	45-20-45 - Kitchens	GROUND FLOOR	WASHING AREA
5	20BOH.04		2012-09-28T00:30:40	60-60-15 - Cooling Spaces	GROUND FLOOR	CHILLER ROOM
6	20BOH.05		2012-09-28T00:30:40	65-80-64 - Plant Rooms	GROUND FLOOR	BOH HOLDING SPACE
7	20BOH.06		2012-09-28T00:30:40	65-70-96 - Waste Storage Spa	GROUND FLOOR	WASTE ROOM
8	20BOH.07		2012-09-28T00:30:40	65-50-25 - Drying And Airing	GROUND FLOOR	JANITOR
9	20BOH.08		2012-09-28T00:30:40	45-20-45 - Kitchens	GROUND FLOOR	POT WASHING
10	20BOH.10		2012-09-28T00:30:40	45-20-46 - Larders	GROUND FLOOR	STORE
11	20BOH.12		2012-09-28T00:30:40	65-80-64 - Plant Rooms	GROUND FLOOR	PUBLIC HEALTH/ WATER
12	20BOH.14		2012-09-28T00:30:40	65-80-64 - Plant Rooms	GROUND FLOOR	PLANT/ BATTERY
13	20BOH.6		2012-09-28T00:30:40	65-80-64 - Plant Rooms	GROUND FLOOR	LV ROOM
14	20INT.01		2012-09-28T00:30:40	45-20-58 - Open-plan Dining	GROUND FLOOR	MAIN DINING
15	20INT.04		2012-09-28T00:30:40	65-10-51 - Lobbies	GROUND FLOOR	ENTRY LOBBY
16	20WC.01		2012-09-28T00:30:40	65-10-51 - Lobbies	GROUND FLOOR	RESTROOM LOBBY
17	20WC.02		2012-09-28T00:30:40	65-30-04 - Accessible Public Toilets	GROUND FLOOR	DISABLED TOILET
18	20WC.03		2012-09-28T00:30:40	65-30-53 - Mens Public Toilet	GROUND FLOOR	MALE TOILET
19	20WC.04		2012-09-28T00:30:40	65-30-99 - Womens Public Toilets	GROUND FLOOR	FEMALE TOILET
20	20WC.05		2012-09-28T00:30:40	65-30-66 - Private Toilets	GROUND FLOOR	STAFF TOILET

Figure 6 - Sample COBie output

It is good that that a level of quality assurance is provided by these fields that detail who created an object and when. However, during the trial it became clear that this information must be relevant to the object and not simply a stamp across the entire dataset (as it currently seems to be). What's more, simply having the CreatedBy and CreatedOn date/time stamp for each object on the COBie export will not be sufficient when you update and change a model and then go on to produce a further COBie export. To successfully achieve adequate quality control in such an instance, each object in a BIM must maintain a Globally Unique ID (GUID) which remains unchanged through subsequent IFC and COBie exports.

If this is right, as it seems to be, then we need a fuller audit history. BIM software must be capable of managing the persistence of GUIDs so that changes in different versions of models can be easily identified.

Object naming

The BS 8541 series of standards provides guidance on object naming. In summary, this covers uniqueness and rules on punctuation. When considering naming convention a balance must be achieved between being explicit in name and repeating information that is best stored in parameters. A solution where the object name is not derived from a single editable field, but is derived from a combination of parameters would be desirable.

Classification

The group felt that for COBie to work for clients across a set of facilities, a strong classification scheme is critical. It is good that there is a place for this in a number of tables (in the Category field) but there must be clear instruction to describe which classification should be used when. The group agreed that CPIC (Construction Project Information Committee) and Uniclass 2 was a good candidate for defining which classification system to use. However, the following points were noted:

- a) Uniclass 2 must be agreed and finalised.
- b) The benefits of a unified Uniclass, based around objects, must be communicated to the industry effectively.

Data storage

The group felt that the industry and Government need to continue to make it clear that that Microsoft Excel is a means to present COBie information. It is the simplest form and it allows all of the supply chain to engage in and work with structured data. The IFC schema can be used to define information at a richer semantic level than using a basic spreadsheet.

The benefits of COBie

Consistent and standard structure

The group saw the provision of a standard structured dataset as a major advantage of COBie. It provides consistency and uniformity. Once you have centrally held, consistent data and information, you can both track and manage it. From this, a standard, consistent and repeatable method of communicating building information among the design, construction and maintenance teams can be developed, reused and improved over time.

By using an open data standards format, the project team can share data across and along the project timeline in a bi-directional approach.

When teams use such open data standards, they can generate information from a number of different sources and authoring tools. In turn, this can be brought together into a federated model that allows comparisons and benchmarking across projects and companies.

The group found that COBie information gave the ability to interrogate information outside a 3D BIM environment.

A universally read format not only allows a number of neutral viewers to view the information but also makes sure its use is future proofed. While there is no guarantee that a particular file format will be supported in years to come, the IFC definition of the COBie dataset provides for an enduring format, independent of software vendors and versions. This also provides the client with compatible and interoperable data that they can reuse for the lifetime operation and maintenance of a building.

Ease of use and efficacy

The trial members saw the use of COBie as a real potential improvement in project documentation because it is an efficient mechanism to transfer and reuse data within the project team and beyond.

When correctly applied, datasets offer the potential to allow for quick analysis of various design and construction scenarios. Issues can be isolated and explored through analysis and calculation. The real ease with which information can be generated and shared is a great benefit and means the project team can collect information throughout the project lifecycle. This allows the industry to move away from the current

practice of generating information for operation and maintenance at the very end of the project; instead, it is generated as the project progresses.

COBie and the use of IFC provides a means for information to flow across into facilities management systems. All trial members saw this as being a greatly more efficient and cost effective practice. Currently information is inefficiently broken down and reassembled for use in FM software.

The trial members saw the COBie spreadsheet as a representation of data in a clear and readable format, providing a view of asset management data through the project time line. Although COBie only contains a part of the data contained within IFC they saw it as a more reader friendly format. What is more, it can be easily reused, for example in other databases within facility management and analysis software.

The challenges of working with COBie

Lack of knowledge

The trial members felt that there is only a limited knowledge of COBie data structure within the industry. There is very little publicly available robust data and few case studies.

The industry must do more to promote the examples that are available in the US and the UK. Example websites include:

wbdg.org/resources/cobie.php

bimtaskgroup.org/cobie-uk-2012

The trial members felt that for valuable collaboration to take place across the industry there has to be a widespread willingness and ability to adopt the COBie data format. This needs to be accompanied by a clear definition of what information should be shared for each COBie data drop.

At present the COBie data structure is well defined. That said, the scope of contents required to populate the COBie data drops is ambiguous. Input from designers and contractors using COBie varies greatly. Some guidance is presently available for each of the COBie data drops, however; there is still no formal definition of level of detail for each of these drops. All this is needed for real life projects.

There is also a lack of guidance on where the information to populate the COBie should be coming from, is it coming from the IFC schema or being manually added? For COBie to progress and be widely adopted the trial members saw a need for the development of consistent templates and Information Delivery Manuals for the FM Model View Definitions for different COBie Data Drops which can be customised for

sectors such as schools, hospitals and infrastructure.

If COBie is to realise its potential of adding significant value to the construction process, we need to be very clear on its use. Developing suitable elemental data structures, naming conventions and aligned cost break down formats for project information is a step on the way. Identifying what information is required at which stage and for which stakeholders is another.

There is a real opportunity for clients to include COBie data sets as part of the project brief. However, FM specialists will also need to define their needs so the data produced at an early stage can be used meaningfully later by them.

IFC export

The trial members raised concerns over the quality of IFC export from design authoring BIM platforms, with the level of exported data and geometry information varying from software to software. While some of this loss of information was directly through the export function capability of the design authoring BIM platform, it also came from other factors such as the competency of the design authoring teams and the different ways they model component objects.

While design authoring tools can create the COBie information, not all of this information is created at the design stage. Project teams will use other tools and systems to populate this information during the installation and commissioning stages. Contractors face the challenge of being able to add data to the COBie fields. In many instances they will rely on the original BIM authoring tools to add additional information. This is also true of the supply chain and sub contractors. The data produced by tools and systems used further down the chain has to have

the potential to be integrated into a federated model run by the Tier 1 contractors.

Too much data

If the design team export every object with every possible attribute from the designers models, there can be just too much data. The trial members saw large project models and their objects as generating very large data sets that can be overwhelming and sometimes unnecessary.

This needs the industry and the software vendors to agree the standards and conventions required, so aligning native software parameters to the corresponding COBie standard.

As data will be coming from a variety of sources the industry needs the ability to integrate, maintain and manage COBIE data.

Technology enhancements required

Data management

During a construction project, different disciplines and professions will produce different models. So the industry needs tools to merge models at the level of a COBie spreadsheet so that single spreadsheet can be handed over to the Client / FM team.

All stakeholders need to be able to add COBie data beyond the design stages, during the construction and commissioning stages. They also need to ability to check that the COBie structure is correct.

IFC model viewers and rule based model checkers that access common data can, in principle, facilitate real-time team working. Looking into the future and beyond level 2 BIM, a team working with an IFC server for the management and exchange of data (rather than just as a place to keep files) can each receive and supply data according to the permissions appropriate to their role and responsibility. To do this, teams need not only tools for partial import and export of IFC information (wrapped in an appropriate user interface) but also a clear delineation of roles and responsibilities within a team.

The trial members saw making the data 'interactive' through the use of viewing software as a great potential improvement. We're not there yet though. We need not just a simple spreadsheet but an interactive dataset. The ability to select elements within the model and then be served up with background specification, operation, and maintenance data relating to that object/product/element is what the team felt was needed.

Export

Participants of the trial felt that COBie export capabilities (from design software tools in particular) will need to be refined and developed right across the range of design, construction and FM software packages. This is so that shareable data can be verifiably provided to defined and agreed standards and naming conventions. They also saw the need for the Tier 1 contractors to be able to export and publish COBie data from any federated models they run.

There are clearly benefits in using a 'lowest common denominator' form of data exchange, such as a spreadsheet, to achieve this, though the group questioned its ability to manage large amounts of data.

Findings from group discussion

Having completed the proof of concept trail, we invited participants to a group discussion about the issues they faced.

We see group discussions as an effective way to develop a broader picture than the technical exercise alone would have given us. The group discussions helped us uncover beliefs and attitudes that we might not have anticipated beforehand.

The group discussion took place in London. Ten participants attended, from the Tier 1 contractors, as well as from NBS. The group can be thought of as being made up of representatives some of the most BIM-engaged companies in the UK. Despite coming from competing organisations, the members of the group were happy to work together in the hope that they can effect change.

As a group, we covered a number of related, overlapping topics, such as software used, the importance placed on IFC as an open standard, the role of the Government and changes we'd like to see. We went beyond the confines of the original research objectives. The main findings are captured below.

To give a flavour of the discussion, this section of the report is interspersed with verbatim comments from the group.

Emerging themes

From our discussions, a number of central themes emerged. These were as follows:

About COBie

COBie is the formal schema that helps organise information about new and existing facilities. The UK Government has, as part of their Construction Strategy UK 2012, clearly stated that the COBie schema will be the required format for



construction information in the UK. The group saw this as the right choice.

The group shared the view that the Government is not introducing a requirement for any additional information from the supply chain, instead it is asking for the existing information to be standardised in a well-structured format. This will only be possible through collaboration. The group were not aware of any commercial software that currently allows the automatic generation of rich COBie datasets. However, they were aware that a number of software vendors were working on this. There was a general feeling that the method of COBie file production was relatively unimportant – producing standardised, shareable information for the whole life of a building is the important thing.

“Data is disorganised at the moment. COBie forces us to be organised.”

Whilst the group saw that the Government will require the use of COBie, they would like to see clear evidence that the Government itself is using COBie and that it is finding it useful.

About using IFC and COBie

Unequivocally, the group believed that with improved tools they can use IFC as the primary data format to meet the Government's COBie data requirement. That said, the group felt further work needs to be done in the following areas:

- 1 buildingSMART must enforce IFC import/export routines in the commercial software. To do this they must ensure their IFC certification programme does effectively enforce the quality of the data flow.
- 2 The BIM Task Group must work with expert groups to deliver structured data templates for the UK market. The industry needs well defined model view definition for each COBie data drop. From this can come clear guidance on the “level of detail” required at each COBie data drop. This will give a shared understanding of what information is required from and by whom and at what stage.
- 3 The group felt that there are weaknesses in the IFC import /export processes in existing software products. These weaknesses make manual checking necessary and reduce confidence. An improvement from the software vendors is vital here.

“The differences were worrying.”

Manual checking shouldn't be needed. Confidence will improve with improvements to the processes. The software vendors need improve their open standard (IFC) import and export functionality.

4. Although the group believed that IFC can be used, they also believed that when generating COBie data, people will use whatever works and is available. The market requires

complete flexibility to choose what systems they use. Innovation should not be stifled by mandating a process to achieve the required data.

“The essence of BIM is linking lots of databases and data sources together.”

5. With level 2 BIM there will be multiple models. Data will need to link across them. The software vendors and data providers must collaborate to develop tools to ensure that this information can easily be coordinated within a project.
6. As an open standard, IFC can be backward and forward compatible and so allow future building, maintenance and retrofit. IFC can future proof building information.

“A model for use in delivery of the building”.

Without an open standard, future building maintenance or refurbishment will dangerously rely on there being current software to support old files in proprietary file formats.

“IFC is an enduring format.”

7. The future needs of Facilities Managers are required to inform the content of the COBie data drops. Facility management must be considered as early as the briefing process.

“Getting them to tell us what they want is hard.”



“It would be a huge leap forward getting an agreed format for the O&M manual and asset register.”

“End user (e.g. a school caretaker) doesn’t want or need a COBie spreadsheet.”

8. There is currently a lot of manual work that has to be done when creating the output in a tool such as MS Excel. If additional manual work is required, then the industry wants to ensure that the COBie output will be used and valued through the construction and maintenance process.

“The COBie spreadsheet is not as good as it could be but let’s work at improving it.”

About using Microsoft Excel

Microsoft Excel provides a view of the structured info of COBie data. Participants saw this as the “lowest common denominator” data format. The important point of COBie is that it is a hierarchal relational data schema – Microsoft Excel is simply one means of storing the data.

“Excel is fine for reporting but not good for authoring.”

The group believed that the COBie dataset in the form of a spreadsheet is

simply a view of the information within a complex model. They also believe that the IFC data-transfer schema could be used to enable communication between different software applications, for example between BIM and FM systems.

“A specification would have been nice, that was the bit that was missing.”

About guidance

The group felt that clear guidance about the content of COBie data drops needs to be provided to the UK construction industry. In particular, the industry needs guidance about naming conventions and the classification systems within COBie. The industry is looking for standardisation and guidance about naming and classification is a pre-requisite for it. This guidance should be developed through industry wide consultation.

Conclusion

When we set out on this trial, we wanted to do three things:

- To validate and check the suitability of an IFC file for the generation of a 'COBie data drop'
- To validate and check the generation of the corresponding COBie datasets from the IFC file
- To uncover any issues with the use of IFC for COBie in real business environments.

As we might have expected, the picture that arose turned out to be subtle and complex.

On the one hand, yes, IFC files can be a suitable format for the generation of 'COBie data drops'; yes, there are software tools on the market that allow automatic checking of the IFC file.

But it is the third test that turned out to be the most interesting; that of issues in the real business environment.

“It would have been easy for the trial to become a test of software rather than of COBie.”

We prefaced this report with a look at how BIM and open standards are integral to Government strategy for the construction sector. The participants (and, indeed, the organisers) of the trial believe that the Government is on the right track here. Well-managed construction data shared across disciplines and running through the building life cycle offers clear efficiencies and huge potential value to the client in both construction and maintenance. And it is important that the information is not held only in one piece of software or is

held in a format that could face eventual depreciation.

But it is a track that at the moment seems littered with obstacles. These obstacles are preventing wider adoption of open formats and reducing the potential value of their use. The issues we uncovered included:

- The need for standards
- The need for guidance
- The need for enhanced IFC import export routines
- The need for agreed descriptions of who requires what data and when
- Improved audit trail to allow greater confidence in collaboration

“We need tools to aid collaboration and bring people together, but the power of face to face is more important.”

The UK Government – supporting open standards.

In the section below Nick Nisbet, Advisor to UK Government BIM Task Group, describes some of the support now available when using open data. This will help in meeting the Government's BIM objectives. It may also ease some of the issues identified in the IFC/COBie Report 2012.

Nick Nisbet

Director - AEC3 UK. Advisor to UK Government BIM Task Group



“The BIM Task Group is charged with providing the information needed by industry to help meet the Government's purposes in receiving data, along with supporting the Governments pilot projects.

During the first half of 2012, the BIM Task Group delivered a suite of documents to support the adoption of COBie. Many of the questions and uncertainties being expressed have already been addressed directly by the

bimtaskgroup.org/cobie-data-drops

and the

bimtaskgroup.org/COBie-UK-2012

downloads. Between them, they illustrate and define the level of development expected and the use of classification. The requirements for classification are also embedded in the examples and blank templates as automatic drop-down lists.

The expected properties for Types are in the COBie templates

bimtaskgroup.org/cobie.

The COBie-UK-2012 document does provide guidance on naming of asset objects but strictly to the extent required by the COBie conventions: in summary, uniqueness and no 'special' punctuation. There is no need for any other restrictions as the role taken by naming conventions in the past are fulfilled by *Category* and other *Attributes* and associations. The recent publication of BS8541 part 1, 3 and 4 has also provided guidance on the delivery of template *Type* objects, library *Type* objects and manufacturers' *Products*.

There is already a couple of formal MVDs (Model View Definitions) which define the maximum information content of COBie drops up to *Tender* and up to *Handover*. The UK documentation already contains extensive text and illustrations of the clients' *Purposes* and the content of the *Drops*. We are now working on developing these and the templates already published, into tables of object *Types*, groups of *Attributes* and the expected delivery based on the new CIC stage-gates. These schedules will then represent the minimum requirement for each *Drop*.”

For further Information about the BIM Task Group and standards in construction, see

bimtaskgroup.org

theNBS.com/topics/BIM/articles/standardsInConstruction.asp

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