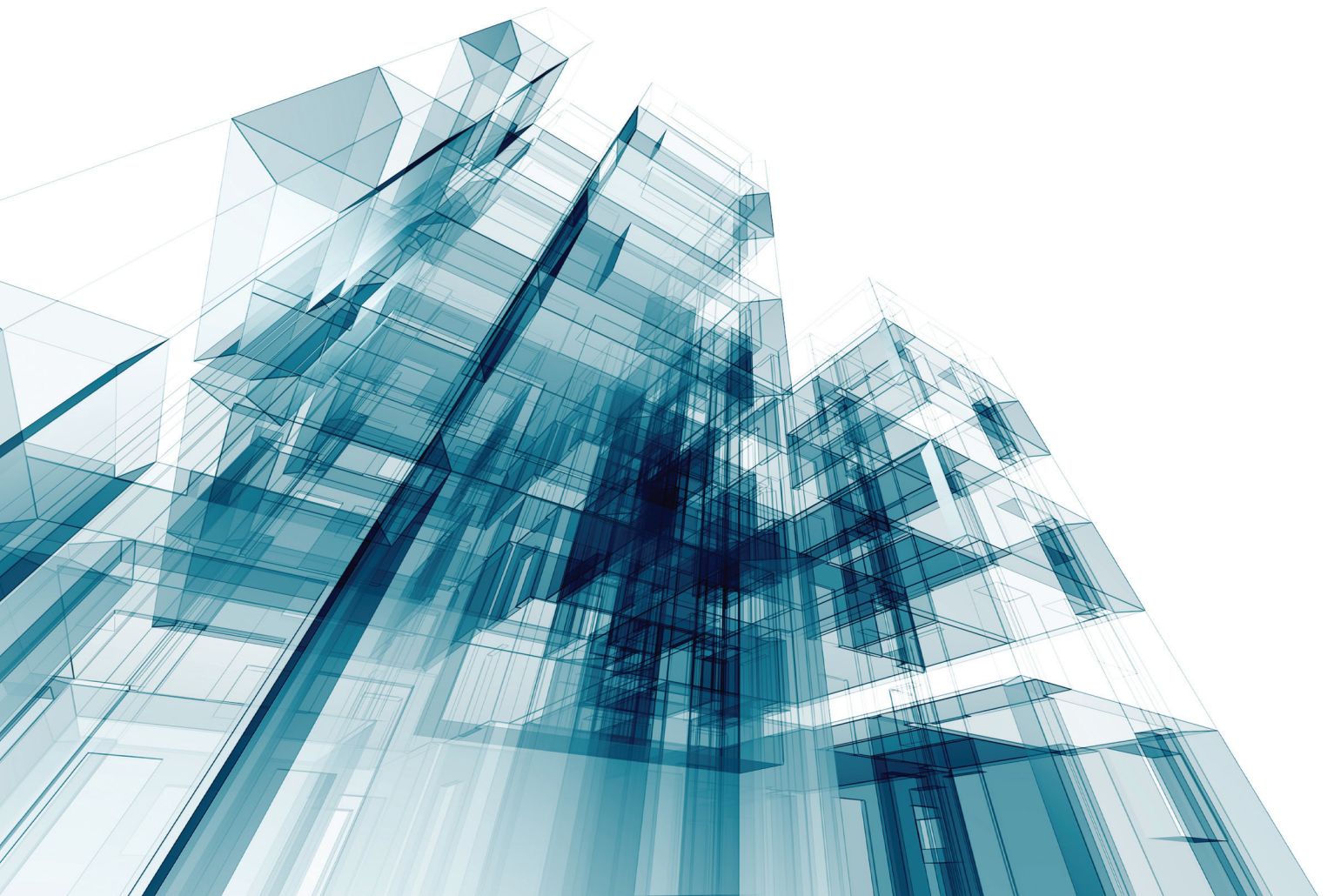




RICS professional guidance, global

BIM for cost managers: requirements from the BIM model

1st edition, August 2015



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RICS professional guidance

International standards

RICS is at the forefront of developing international standards, working in coalitions with organisations around the world, acting in the public interest to raise standards and increase transparency within markets. International Property Measurement Standards (IPMS – ipmsc.org), International Construction Measurement Standards (ICMS), International Ethics Standards (IES) and others will be published and will be mandatory for RICS members. This guidance note links directly to these standards and underpins them. RICS members are advised to make themselves aware of the international standards (see www.rics.org) and the overarching principles with which this guidance note complies. Members of RICS are uniquely placed in the market by being trained, qualified and regulated by working to international standards and complying with this guidance note.

RICS guidance notes

This is a guidance note. Where recommendations are made for specific professional tasks, these are intended to represent 'best practice', i.e. recommendations that in the opinion of RICS meet a high standard of professional competence.

Although members are not required to follow the recommendations contained in the guidance note, they should take into account the following points.

When an allegation of professional negligence is made against a surveyor, a court or tribunal may take account of the contents of any relevant guidance notes published by RICS in deciding whether or not the member acted with reasonable competence.

In the opinion of RICS, a member conforming to the practices recommended in this guidance note should have at least a partial defence to an allegation of negligence if they have followed those practices. However, members have the responsibility of deciding when it is inappropriate to follow the guidance.

It is for each member to decide on the appropriate procedure to follow in any professional task. However, where members do not comply with the practice recommended in this guidance note, they should do so only for good reason. In the event of a legal dispute, a court or tribunal may require them to explain why they decided not to adopt the recommended practice.

Also, if members have not followed this guidance, and their actions are questioned in an RICS disciplinary case, they will be asked to explain the actions they did take and this may be taken into account by the Panel.

In some cases there may be existing national standards which may take precedence over this guidance note. National standards can be defined as professional standards that are either prescribed in law or federal/local legislation, or developed in collaboration with other relevant bodies.

In addition, guidance notes are relevant to professional competence in that each member should be up to date and should have knowledge of guidance notes within a reasonable time of their coming into effect.

This guidance note is believed to reflect case law and legislation applicable at its date of publication. It is the member's responsibility to establish if any changes in case law or legislation after the publication date have an impact on the guidance or information in this document.

Document status defined

RICS produces a range of professional guidance and standards documents. These have been defined in the table below. This document is a guidance note.

| Type of document | Definition | Status |
|-------------------------------|---|---|
| Standard | | |
| International standard | An international high-level principle-based standard developed in collaboration with other relevant bodies. | Mandatory |
| Professional statement | | |
| RICS professional statement | A document that provides members with mandatory requirements or a rule that a member or firm is expected to adhere to. This term encompasses practice statements, Red Book professional standards, global valuation practice statements, regulatory rules, RICS Rules of Conduct and government codes of practice. | Mandatory |
| Guidance | | |
| RICS code of practice | Document approved by RICS, and endorsed by another professional body/stakeholder, that provides users with recommendations for accepted good practice as followed by conscientious practitioners. | Mandatory or recommended good practice (will be confirmed in the document itself). |
| RICS guidance note (GN) | Document that provides users with recommendations or approach for accepted good practice as followed by competent and conscientious practitioners. | Recommended best practice. Usual principles apply in cases of negligence if best practice is not followed. |
| RICS information paper (IP) | Practice-based document that provides users with the latest technical information, knowledge or common findings from regulatory reviews. | Information and/or recommended good practice. Usual principles apply in cases of negligence if technical information is known in the market. |

1 Introduction

1.1 Overview

This guidance note should be used as a source of reference for quantity surveyors (QS) or cost managers when BIM has been implemented in the life cycle of a project. It offers an awareness of BIM and provides readers with recommendations for good practice when producing measurement outputs.

Projects that utilise BIM involve the creation of and the sharing of coordinated data during the life of an asset, all to an agreed process and plan. This may include digital model(s), but is not solely limited to digital information.

This guidance note should be used to assist the QS/cost manager to understand how BIM will impact on their working practices and influence their service delivery.

1.2 Assumptions of BIM knowledge and working practices

This guidance note assumes a working knowledge of the following key documents and needs to be read in conjunction with these (information such as process maps and flow diagrams depicting the BIM process can be found within these documents and are not replicated here):

- BS 1192:2007
- PAS 1192-2:2013
- PAS 1192-3:2014
- COBie UK 2012 / BS 1192-4:2014
- PAS 1192-5:2015
- CIC BIM Protocol
- UK BIM Task Group Employer's Information Requirements guidance notes
- NBS BIM Toolkit (a unified classification system and Digital Plan of Work (DPoW))
- *International BIM implementation guide* (RICS guidance note, 1st edition, 2014) and
- *Overview of a 5D BIM project* (RICS information paper, 1st edition, 2014).

Plus, the following documents that, subject to when the QS/cost manager's role commences on a project, may be in existence for their project:

- BIM project plan/vision/strategy (informal document – no accepted standard)
- BIM Protocol
- Employer's Information Requirements (EIR) and
- BIM Execution Plan (BEP) (pre- or post-contract).

(These documents may be in commission, draft or final format).

This guidance note assumes that collaborative working practices will be adopted and there will be a BEP that all parties will adhere to. The BEP will be updated as the asset travels through its work stages and is a live document.

If there is an EIR document, it should make reference to the BIM Protocol.

1.3 Objectives and general principles

The main objectives of this guidance note are to:

- Assist the QS/cost manager in deriving benefits from delivering cost consultancy services in a BIM environment, by utilising model data rather than traditional manual measurement in the production of quantities.
- Inform the team in the needs of the QS/cost manager in performing their measurement role in a BIM environment. Regardless of an EIR regime or document, this guidance note will be useful on all projects involving inputs/outputs to a BIM model/project.

It is recommended that the QS/cost manager is consulted in the production of the BEP and this guidance note should assist in contributions to the BEP (pre- and post-contract). If a BEP is inadequate or non-existent, then the recommendations in this guidance note can still be used to inform the rest of the team. However, the absence of an adequate plan is likely to impact on the success of the ethos of BIM.

General principles informing this guidance note

The QS/cost manager will be expected to observe the tools, processes and standards that are agreed between the parties to share and re-use data.

This guidance note supports BIM working at level 2. However, as the required levels of data interoperability continue to vary between projects and sectors, it can be expected that working at level 2 BIM will differ between assets and continue to evolve.

This guidance note is about BIM as a multi-data model (sometimes referred to as a multi-dimensional model, 3D/4D/5D/6D), rather than a 3D-design model.

This guidance note does not align activities and outputs with a specific procurement route, but this will influence the flow of information and processes agreed between the parties.

If this guidance note is used outside of the UK, then verifications need to be undertaken to establish if similar national standards are already in place.

Topics outside the scope of this guidance note

- Contractual arrangements and any amendments thereto.
- Arrangements concerning intellectual property rights and professional indemnity (PI).
- Product names, software and hardware guidance or recommendations of particular systems.
- Any protocols required post-handover of the asset. (RICS are considering issuing protocols for post-handover of the asset at a later date.)
- Responsibilities of members of the design team (e.g. to deliver correct information, versions etc. to the QS/cost manager and which should all be described in the BEP). The CIC BIM Protocol can be used in this regard, which can be incorporated into contractual documents.

This guidance note is effective from publication in August 2015.

2 Working in a BIM environment

What is BIM?

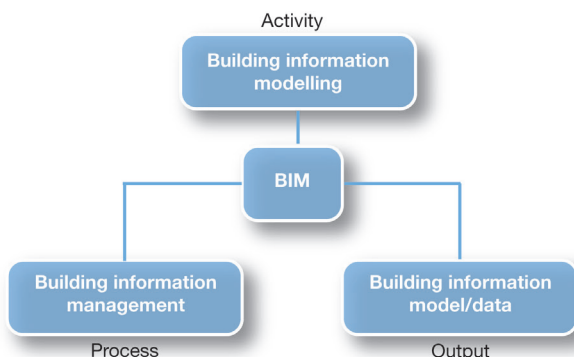
'BIM is essentially value creating collaboration through the entire life-cycle of an asset, underpinned by the creation, collation and exchange of shared three dimensional (3D) models and intelligent, structured data attached to them.'

(What is BIM? UK Building Information Modelling Task Group, 2013)

When packaged and deployed successfully, BIM embeds and links key asset data with a 3D building model. BIM promotes sharing of data and key building information in a structured manner for continual use and re-use.

The key element to BIM is the process. If all participants are set up correctly for the alignment of BIM implementation plans, protocols and processes, the project will be set for success.

The key elements to BIM are simplistically described in the figure below:



© This figure is based on an image by EC Harris.

2.1 Understanding the production and delivery of information

The QS/cost manager needs to understand how a model, its attributes and other data will be created and conveyed at different stages of the project life. This will enable the QS/cost manager to make suitable adjustments to quantities, rates and other ancillary costs and modifications, at each work stage as appropriate.

It is possible to link models to cost databases, and we expect this to evolve and develop in the future to provide a fully integrated BIM environment.

2.2 Team/data exchange formats

The different members of the design team may use different BIM authoring tools. Secondary tools may also be used for other purposes such as clash detection, data validation and 4D sequencing/programming (which can be used to review phasing – but this may be dependent on procurement route and contractor involvement). These should all be defined in the BIM Execution Plan (BEP).

The exchange formats need to be agreed between the parties and the QS/cost manager (as a recipient of data) needs to state what formats and versions they require (such as IFC, DWF, DWFx, DWG, PDF).

There are various BIM measurement software products available. The QS/cost manager needs to determine the tools and exchange formats that suit their particular service delivery and software platform, as well as consider any capability issues. Different software platforms will have different implications for the QS/cost manager.

IFC is an industry-wide open and neutral data exchange format that will interact with the majority of measurement software. However, a check with the design consultant's software provider is recommended, to understand how the measurement software tool will process the building elements and objects, as this may compromise the integrity of the electronic data being exchanged.

It is important that early liaison with the design team is undertaken and it is often beneficial to test exchange workflows early in the design process.

(Note that design information may be presented in viewing software products, which do not support measurement.)

2.3 Information provided to the QS/cost manager

At the early stages of the project the design may still be at the massing phase and in 2D, however, some designers may be issuing 3D data from concept stage. It may be that a 3D model may be received from one consultant and a 2D CAD from another. Non-graphical data such as specifications may also be provided (Microsoft Office Excel®, Microsoft Office Word®, PDF or other formats) and it is important these retain their association with their originating model. Levels of model detail and information at each stage will vary, depending on the nature of the project (some broad guidance is given in PAS 1192-2). The amount of graphical

information provided is the level of detail (LOD) and the non-graphical information (such as spatial, performance, standards, workmanship and certification) is the level of information (LOI) and these will develop alongside one another as the model progresses.

There will be information that may not be generated by the model and it is important that these are understood and agreement reached if the data is to be provided in alternative forms e.g. data sheets. It may be that some quantities required by the QS/cost manager will not be readily available and will have to be measured by another method.

The QS/cost manager needs to be aware that the LOD will increase as the design progresses and may vary between disciplines at each work stage, plus not all elements or objects within the same discipline will necessarily be at the same LOD at the same stage of the project lifecycle. Therefore, when measuring, the QS/cost manager needs to consider the output required versus the detail being provided by the models at each stage, as additional processing or supplementary quantification may be needed. For example, a wall modelled at concept stage may have the same overall dimensional data as one modelled at technical design stage (assuming no variations have occurred).

It is important to plan and communicate BIM deliverables to all parties and it should be agreed at what work stage data drops/information will be passed to the QS/cost manager as a model, and the definition of the information at each stage. These definitions and work stages need to be aligned with the project milestones and client output requirements and this information should form part of the model production and delivery table included in the BEP (refer to Appendix 1 of the CIC BIM Protocol for an example and a table template).

The QS/cost manager may be a recipient of definitions from the NBS BIM Toolkit. Each building component or element will have both a LOI and LOD allocated and both of these definitions will be provided to the consultant team.

The QS/cost manager may also come across the following:

- Level of development specification as defined by the AIA - This is different from the level of detail (which is how much detail is included in the model element) whereas the level of development is the degree to which the geometry of the element and attached information has been thought through and can be relied upon for the project data.

2.4 Data/drawings not complying with the BEP

Non-compliance with agreed protocols by the design team (as part of the information flow between the designers and the QS/cost manager during the design phase of the project) need to be highlighted to the QS/cost manager and then suitable adjustments can be made in the measurement or pricing.

The design team need to identify where contraventions of the protocol occur in the model, for example:

- where columns are drawn through slabs (but it was agreed that the slab should be continuous)
- where elements are modelled to a different level of detail than other elements of the same model but not agreed previously e.g. a particular section of a façade is detailed to a different LOD than the rest of the façade.

Communication of such items should be via the BIM manager who is the first point of contact for technical or process issues that arise regarding the BEP.

2.5 Capturing the requirements of the QS/cost manager

A map of a typical BIM measurement process for the QS/cost manager and the QS/cost manager's outputs at each work stage is included in appendix A. In the table, the DPoW is used for the project life stages and examples are given of the types of outputs that the QS/cost manager may be engaged in at each stage. A blank template is provided should the reader want to document the outputs for their project.

It is important that the QS/cost manager's requirements and working practices are captured in the BEP. This will inform the rest of the team and record items such as export requirements, software used etc. by the QS/cost manager. A blank template for the reader's use and an example are included in appendix B of this guidance note.

3 Background information on naming structures/conventions/data drops

There are various conventions and systems put in place to ensure interoperability between the parties to support the BIM process and the sharing of data, and knowledge of these will be required by the QS/cost manager as they will be a recipient of this data. RICS has been liaising with various professional bodies around the world to produce a set of international measurement standards.

3.1 Structured coding systems

Models, documents, project information and specifications need to be organised to ensure interoperability and allow the external processes such as cost planning to take place. Hence a system needs to be put in place to classify the BIM data. Available systems include Uniclass, NRM 1, 2 and 3, CESMM, SMM, BCIS, NBS BIM Toolkit, MasterFormat (US) and UniFormat (US).

Designers do not always design in a way that easily aligns to SMM, NRM or BCIS structure and tend to take the lead in proposing a structured data system. Therefore, the QS/cost manager needs to understand how the data has been organised in order to use it effectively. (Note that models are often structured using the classification that is built into the original authoring software.)

The QS/cost manager needs to check that the agreed system outputs and structure can align with the data required and subsequent documents that are to be produced by the QS/cost manager. In most instances, the QS/cost manager will be able to map the majority of classification systems across to NRM.

3.2 Naming conventions

Some form of naming convention will be agreed for files and layers and described in detail in the BEP. For example:

- Files - project/originator/volume/level/file type/discipline.
- Layers - field/discipline/classification/description.

These will become more accurate and detailed at each work stage, for example, by adding design and specification information. As with non-BIM projects, specification information may be limited at concept stage. For further information on naming conventions, there are definitions in BS1192-2007.

Note that projects may be divided into volumes to enable multiple users to work efficiently. These volumes are defined by coordinates and will be held as separate model files. Volume boundaries could be defined by use, grid lines or physical boundaries such as structural joints.

This subdivision strategy is usually set by the design team. On smaller projects this can be blocks of buildings, but on larger schemes such as towers this could be levels.

3.3 BIM object [digital building block] libraries

A BIM object should be a combination of information to define the product, geometry to give it physical characteristics and data relating to its function and visual appearance. They can be imported into a model by the designer and when objects all follow the same naming convention they can then be scheduled and compared.

BIM objects may be produced and shared by the team. These may be from a central 'client or project' library or from external sources. These object libraries are quite often used for portfolios of work. There are two main types of objects, components and layered. (Components have defined geometrical shape, e.g. doors. Layered objects do not have a fixed shape, e.g. carpets.)

The NBS has developed a BIM Object Standard for the creation of BIM objects to a clear set of guidelines, following a specific naming structure and can be used as a system to follow. Objects such as walls, floors, doors etc. are assessed against this standard, prior to inclusion in the NBS National BIM library.

3.4 Data [information] drops

Level 2 BIM requires that information is exchanged between parties at key milestones or data drops and these requirements should be clearly defined in the EIRs. Data drops need to be aligned to the gateway dates for a project and the cost deliverables required need to be agreed at each stage. Data drops typically include models, data structures (such as schedules e.g. COBie files) and reports.

On UK government projects COBie is the principal vehicle for collating and transferring the asset data/information. It is focused on collating asset data rather than geometric data. See *COBie Data Drops Structure, uses & examples* (www.bimtaskgroup.org/wp-content/uploads/2012/03/COBie-data-drops-29.03.12.pdf).

4 Internal practice procedures

Internal working practices and procedures need to be put in place when working in a BIM environment.

4.1 Planning the measurement process

The QS/cost manager should review and plan for which elements will have to be taken off manually or by measurement from the model. It is important that the QS/cost manager understands what data will be received and when and plan accordingly. Manual measurement should not alter the model in any way, and the QS/cost manager needs to ensure their measurements can be saved independently from the model. Quantities and costs are frequently required by clients for elements that do not appear on a model, especially at the earlier stages of a project. For example, these may be items that are yet to be modelled due to the level of design that the model components have been taken to, or items that as yet have unknown quantities as further investigations are required.

Some quantities may easily be generated by the design team for the QS/cost manager, if specifically requested from the software at exchange stage (e.g. room areas). (These measurements may not be compliant with *RICS property measurement*, 1st edition (2015) and a check will be necessary). However, there will be other quantities that the QS/cost manager may require that are not readily generated by a model, for example, the overall façade area and the total GIA.

If the total GIAs are not provided then these can be built up from the spaces/rooms. This will mean that consideration needs to be given to the thickness of walls between the spaces. Alternatively, slab areas may provide the overall GIA (see later note on columns through slabs). A similar process will have to apply to a façade overall area, this can be built up from the individual elements but adjustments may have to be given to jambs and other detailing.

4.2 Checks and balances

There is a greater need for carrying out sense checks and balances in a BIM environment. Measurement will be accelerated, but discretionary skills will be necessary. If the QS/cost manager is to rely on quantities from a BIM model, then they need to understand what they represent.

Essentially, BIM measurement falls into one of three categories:

- 1 Automated take off - Model quantities used, as generated.
- 2 Derived take off - Model quantities used, subject to manual adjustment.
- 3 Manual take off - Model quantities that cannot be used

or do not exist and therefore have to be replaced with manual measurement.

The QS/cost manager will be dealing with model quantities that do not conform to any recognised method of measurement as the model dimensional data (quantity properties) of the objects are generated in accordance with parameters set by the software vendor that do not conform to any recognised method of measurement to produce areas, volumes and lengths.

The QS/cost manager will also need to be aware of a possible risk of loss of data integrity, following transmission to non-native formats.

Even if the design team follow excellent modelling practice in accordance with the BEP and complete the design to the detail levels agreed, the QS/cost manager will still need to ratify the quantities. The QS/cost manager is still responsible for their use of the data extracted from the model.

The project BIM coordinator will run a clash detection process and issue clash reports as defined in the BEP, and the QS/cost manager will be a recipient of these reports.

Different work stages will deploy different tolerances to allow appropriate data clash reports to be produced (the tolerances reducing from design to as-builts – for example, from 200mm to 5mm for hard clashes). These tolerances are usually identified in a clash test matrix for the different stages and will be set to suit the project and type of clash. Clashes identified can include hard clashes, duplicate objects, design/modelling issues and missing objects. These reports can be used as part of the checks and balances procedures to look for items measured more than once and missing objects.

The QS/cost manager should put in place a series of their own independent internal sense checks and balances that will interrogate and support the outputs from the model. These will vary with the software platforms utilised by the design team and those by the QS/cost manager. Some examples of these include:

- Quantity checks:
 - Undertake gross internal area (GIA) measures from 2D sheets and manually compare these back to area totals for floor finishes, ceilings, slabs, etc. from the model
 - Do all elements join at the interfaces, e.g. columns stopping at the underside of slabs?
 - Have objects replaced elements that impact on quantity measures e.g. a complete lift core as an object?

- Scope gaps (missing items or elements) or duplications:
 - Are the quantities taken from multiple models or split models (creating scope gaps or overlaps)?
 - Does the clash detection report identify any missing/duplicated elements?
- Descriptions and associated quantities:
 - Are elements correctly named and hence quantified with the correct items?
- Level of detail:
 - Checks to ensure that the quantities extracted from the model align with the agreed quantum of work that is required.
 - An understanding of what additional items need to be allowed for, for example, where some of the scope is agreed to be contractor design but needs to be included by the QS/cost manager eg structural fittings and connections.
- Data missing, or altered, through transmission?
 - Review whether the file format being evaluated is derived from a proprietary file format i.e. dwf, dwf(x) etc. or an IFC file. Note: An IFC file is non-proprietary, so when an IFC file is received the QS/cost manager must ascertain which building elements have been mapped for export.
 - Information source. (for example, are the 2D drawings 'cuts' from the 3D model? If so, are they an unmodified views from the model, or has further information been added than shown on the model?).
- Visual checks:
 - the use of BIM doesn't eliminate the need to carry out the normal QS/cost manager checks.

Appendix A: BIM measurement

Visual guide to BIM measurement

| DPoW stage Definition | Stage 1 Brief | Stage 2 Concept | Stage 3 Definition | Stage 4 Design | Stage 5 Build and commission | Stage 6 Handover and closeout | Stage 7 Operation and end of life |
|---------------------------------|--|--|---|---|--|---|---|
| Models | Professional design team model | | Specialist design/construction model | | Construction record model | | |
| BIM execution plan | Pre-contract BEP | | | | Post-contract BEP | | Operation BEP |
| Measurement details | <ul style="list-style-type: none"> · RICS NRM 1 · GFA/ functional unit order of cost estimate · RICS NRM 3 · WLC | <ul style="list-style-type: none"> · RICS NRM 1 · Elemental cost plan · RICS NRM 3 · WLC | <ul style="list-style-type: none"> · RICS NRM 1 · Elemental cost plan/ approx. Q. · RICS NRM 3 · WLC | <ul style="list-style-type: none"> · RICS NRM 1 · Detailed cost plan/ approx. Q. · RICS NRM 2 trade/work · RICS NRM 3 · WLC | <ul style="list-style-type: none"> · RICS NRM 2 trade/work package/ contract BQ/ schedules | <ul style="list-style-type: none"> · RICS NRM 3 · WLC | <ul style="list-style-type: none"> · RICS NRM 3 · WLC |
| Cost-consultancy outputs | <ul style="list-style-type: none"> · Schedule/ verification of accommodation types · Schedule/ testing of any feasibility solution key quantities · Commercial COBie requirements and input to the overarching strategy | <ul style="list-style-type: none"> · Schedule/ verification of accommodation types · Model-linked costs for rapid iteration/ updates | <ul style="list-style-type: none"> · Schedule/ verification of accommodation types · Model-linked costs for rapid iteration/ updates · Life cycle costing quantity extraction/ costing | <ul style="list-style-type: none"> · Schedule/ verification of accommodation types · Model-linked costs for rapid iteration/ updates · Life cycle costing quantity extraction/ costing · As-designed vs as-tendered analysis (assuming model enabled procurement) | <ul style="list-style-type: none"> · Ongoing validation of area and quantum · Change control | <ul style="list-style-type: none"> · As-build life cycle costing | |

Blank template for BIM measurement

| DPOW stage | Stage 1 Brief | Stage 2 Concept | Stage 3 Definition | Stage 4 Design | Stage 5 Build and commission | Stage 6 Handover and closeout | Stage 7 Operation and end of life |
|---------------------------------|--------------------------------|--------------------|--------------------------------------|-------------------|------------------------------------|-------------------------------------|--|
| Definition | | | | | | | |
| Models | Professional design team model | | Specialist design/construction model | | Construction record model | | |
| BIM execution plan | Pre-contract BEP | | | | Post-contract BEP | | Operation BEP |
| Measurement details | | | | | | | |
| Cost-consultancy outputs | | | | | | | |

Appendix B: BIM project template and example

BIM project template for the QS/cost manager

This template is to be used to inform the BEP. Items to be completed where applicable.

| | |
|--------------------------|--|
| Project name | |
| Company name | |
| Project role | |
| Principal contact | |

| Export format requirements | From software | Preferred format | Any limitations |
|-----------------------------------|----------------------|-------------------------|------------------------|
| 3D files | | | |
| 2D files | | | |
| Schedules and spreadsheets | | | |
| Other | | | |

| Software used for take-off | | | |
|-----------------------------------|--|--|--|
| BIM models | | | |
| 2D drawings | | | |
| Other | | | |

| Software used for valuations/post-contract change | If different from above | | |
|--|-------------------------|--|--|
| BIM models | | | |
| 2D drawings | | | |
| Other | | | |

| Specific model requirements | At stage /gateway : |
|--|---------------------|
| Quantities [not readily provided in model] | |
| Data requirements of room objects | |
| Single discipline models | |
| Multi discipline models | |

| Other model/drawing requirements | |
|---|--|
| | |
| | |

| Units of measurement required | |
|--------------------------------------|--|
| | |

| Definitions to be used | |
|-------------------------------|--|
| Areas | |
| Volumes | |

| | |
|--|--|
| Information required from the team | |
| Object library | |
| Model validation checks and exercises undertaken | |
| Data/drawings not complying with the BEP | |

| | |
|--|--------------------|
| Work breakdown structure used for costing | At stage /gateway: |
| | |
| | |
| | |

BIM project example for the QS/cost manager

| | |
|--------------------------|---------------------------------------|
| Project name | |
| Company name | |
| Project role | <i>Quantity surveyor/cost manager</i> |
| Principal contact | |

| Export format requirements | From software | Preferred format | Any limitations |
|-----------------------------------|----------------------|-------------------------|---------------------------------|
| 3D files | <i>e.g. Revit</i> | <i>e.g. dwf</i> | <i>e.g. software version 14</i> |
| 2D files | | <i>e.g. dwg</i> | |
| Schedules and spreadsheets | <i>e.g. Excel</i> | | |
| Other | | <i>e.g. pdf</i> | |

| Software used for take-off | | | |
|-----------------------------------|-------------------------|--|--|
| BIM models | <i>e.g. BIM measure</i> | | |
| 2D drawings | <i>e.g. AutoCAD</i> | | |
| Other | | | |

| Software used for valuations/post-contract change | If different from above | | |
|--|--------------------------------|--|--|
| BIM models | <i>e.g. BIM measure</i> | | |
| 2D drawings | <i>e.g. AutoCAD</i> | | |
| Other | | | |

| Specific model requirements | At stage /gateway : |
|--|--|
| Quantities [not readily provided in model] | <i>e.g. GIAs, NIAs, room areas, façade areas, volumes from stage B</i> |
| Data requirements of room objects | <i>e.g. room function, intended occupancy at RIBA stage C</i> |
| Single discipline models | <i>Preferred at all stages up to stage E</i> |
| Multi discipline models | |

| Other model/drawing requirements | |
|---|--|
| | <i>e.g. Objects to be converted to sub components for external walls</i> |
| | <i>e.g. Rooms and areas in a separate layer</i> |

| | |
|--------------------------------------|--------------------------------|
| Units of measurement required | <i>e.g. metric or imperial</i> |
|--------------------------------------|--------------------------------|

| Definitions to be used | |
|-------------------------------|---|
| Areas | <i>e.g. RICS Code of measuring practice, NRM1, NRM2, NRM3</i> |
| Volumes | |

| Information required from the team | |
|--|---|
| Object library | e.g. NBS, client specific |
| Model validation checks and exercises undertaken | e.g. visual checks, model data checks, automated checks |
| Data/drawings not complying with the BEP | e.g. concrete columns drawn through concrete slabs |

| Work breakdown structure used for costing | At stage /gateway: |
|---|--|
| | RIBA Stage A RIBA Stage C £/ft ² order of cost SMM |

Appendix C: Definitions, acronyms and useful documents

- AIA – American Institute of Architects
- BCIS – Elemental standard form of cost analysis
- BEP – BIM Execution Plan. A plan setting out how all BIM tasks, processes and information will be carried out and integrated for all the stakeholders.
- BIM Level 2 – a managed 3D environment that shares data across various disciplines and captures operational data.
- BIM Protocol – the Protocol is a contractual document that identifies building information models that are required to be produced and sets out the specific obligations, liabilities and associated limitations on the use of the models.
- BS 1192:2007 – this is the British Standard that details how data should be structured and used.
- CESMM – *Civil Engineering Standard Method of Measurement*.
- CIC BIM Protocol – this document produced by the Construction Industry Council is compatible with all appointments/contracts and establishes the legal framework without creating new obligations.
- Classification – a standardised system of headings and subheadings to ensure that data can be indexed and structured to make it easily accessible.
- COBie (Construction Operation Building information exchange) – an information exchange standard for BIM projects to supply data to the building operator. Generally spreadsheet-based, it is developed progressively through the construction process.
- COBie (BS 1192-4:2014) *Collaborative production of information Part 4: Fulfilling employer's information exchange requirements using COBie - Code of practice* – publically available.
- NBS BIM Toolkit
 - Initiated by HM Government's BIM Task Group and funded by Innovate UK this document provides help to define, manage and validate responsibility for information development and delivery at each stage of the asset lifecycle, with an example model to assist practical understanding. Support has been provided by RICS and the tool should be available in mid-2015. This will be a free digital BIM Toolkit made up of:
 - a new unified classification system for the UK, based on the ISO 12006-2 framework
 - a set of level-of-definition guidance pages for BIM objects. The level of definition is split into two: level of detail and level of information and
 - a Digital Plan of Work (DPoW) tool defining who in a project team is doing what and when.
- EIRs (Employer's Information Requirements) – a document that allows clients to confirm what information they want from a model and to set out the uses of this.
- GIA (Gross Internal Area) – is the area of a building measured to the internal face of the perimeter walls at each floor level.
- IFC Files (Industry Foundation Classes) – open source information model for sharing data and to facilitate interoperability (not controlled by a software vendor).
- LOD (level of detail) – the level of resolution of graphical information required for a particular element at a particular stage of a project.
- LOI (level of model information) – is the description of the non-graphical content in models throughout the project.
- MasterFormat – a standard for organising specifications and other written information for commercial and institutional building projects in the US and Canada.
- Model – a digital representation of part of the physical and/or functional characteristics of a project, with true to scale spatial dimensions.
- Model production and delivery table – this table specifies the subject matter of each model, the person who is to produce and deliver each model at each stage and the level of detail for each model at each stage.
- NBS – Produces a range of construction information products. NBS is a trading name of RIBA Enterprises Ltd, which is wholly owned by the Royal Institute of British Architects (RIBA).
- NIA (Net Internal Area) – is the usable area within a building measured to the internal face of the perimeter walls at each floor level.
- NRM – RICS *New rules of measurement for building works*.
- NRM 1 – *Order of cost estimating and cost planning for building works. Elements, systems, subsystems and components*.

- NRM 2 – *Detailed rules for measurement and description of building works*. Trade-based classification system.
- NRM 3 – *Order of cost estimating and cost planning for building maintenance works*. Extension of NRM1.
- PAS 1192-2:2013 *Specification for information management for the capital/delivery phase of construction projects using building information modelling*.
- PAS 1192-3:2014 *Specification for information management for the operational phase of assets using building information modelling*.
- PAS 1192-5:2015 *Specification for security-minded building information modelling, digital built environments and smart asset management*.
- *RICS property measurement*, 1st edition (2015) – this professional statement updates the *RICS Code of measuring practice*, 6th edition, and incorporates *International Property Measurement Standards (IPMS)*.
- Uniclass – Classification system used in the UK, similar to a work package breakdown. This groups objects into numerical headers to allow things to be arranged or grouped according to a type or class. Can be applied throughout the asset life cycle.
- UniFormat – the elemental classification for building specifications, cost estimating and cost analysis produced by the US department of commerce.
- For AIA Level of Development:
 - www.bimforum.org/lod
- *How Can Building Information Modelling (BIM) Support the New Rules of Measurement (NRM1)*, RICS research, 2014:
 - www.rics.org/Global/BIM_NRM1_310114_dwl_aj.pdf
- *Journal of Information Technology in Construction* – ISSN 1874-4753 ITcon Vol.19 (2014) Wu et al, pg. 534 *A technical review of BIM based cost estimating in UK Quantity Surveying practice, standards and tools*
- NBS BIM Object Standard:
 - www.nationalbimlibrary.com/nbs-bim-object-standard

Useful websites

- BIM dictionary:
 - www.specifiedby.com/resources/bim-dictionary
- AEC (UK) BIM Protocol and supplementary documents:
 - www.aecuk.wordpress.com/documents/
- Building information modelling task group:
 - www.bimtaskgroup.org/
 - www.thenbs.com/topics/BIM/articles/bimInConstruction.asp
- Computer Integrated Construction (CIC) research program's BIM planning website:
 - <http://bim.psu.edu/>
- Construction Project Information Committee:
 - www.cpic.org.uk
 - www.rics.org/nrm
 - www.ice.org.uk
- Construction Industry Council:
 - www.cic.org.uk



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