

**ACEI Building Information Modelling (BIM)
Advice Note
for
Building Services Consulting Engineers**

January 2023

1 Introduction

This advice note is intended to give guidance to ACEI members and to create an industry benchmark in defining a standardised scope of service (appointment) and how we deliver BIM projects in the BIM environment. It aims to highlight the areas where we can achieve increased efficiency and identify the primary areas of risk for Building Services / MEP consultants working in BIM including:

- Level of Information Need
- Costing
- Coordination and
- Levels of clash resolution in the design model.

This advice note also intends to clarify what can reasonably be expected from consulting design engineers. It also links these expectations to the standards set out in BSRIA BG6/2018: “A Design Framework for Building Services” while conforming to I.S. EN ISO 19650 requirements which deals specifically with the process for structuring electronic or digital building information using BIM.

The key early-stage documents setting out the BIM deliverables required are the EIR (Exchange Information Requirements) and the BEP (BIM Execution Plan). These documents are required to plan efficient workflows, and to ensure that all parties understand their responsibilities and that the best project outcomes are achieved. The EIR is written by / on behalf of the client and defines the project BIM scope of works. It should include details on what the models will be used for, and any standards or classifications required. The Pre-Appointment BEP should be written in response to the EIR during the bidding process and it should indicate the proposed delivery team approach.

A high-level Responsibility Matrix should also be included in the bid documents indicating the elements which will be modelled and the Level of Information Need (typically a combination of Level of Detail and Level of Information) at each stage of the project. The Responsibility Matrix should also note elements which will not be modelled. The Pre-Appointment BEP should be updated following award of contract to form the Post Appointment BEP and should be agreed by all members of the design team and under current practice is managed by the Project Lead and should include specific details of how the requirements of the EIR will be achieved. The same process should take place prior to appointment of the contractor(s) for construction stage.

The contractor(s) should refer to the design stage Post-Appointment BEP, the EIR and all other relevant BIM documentation when establishing their construction stage Pre-Appointment BEP. It is important to note that the EIR is an appointment-level document. Each entity that enters into an appointment which specifies BIM should be in receipt of an EIR at tender stage. A clear

understanding of the Appointing Party's Information Requirements is required in order to facilitate the delivery of a quality project using BIM. If BIM is specified by the Appointing Party and an EIR is not provided, one should be requested. In the absence of comprehensive Information Requirements, designers should include details of the basis of their fee and service proposal, and any associated assumptions in their tender response.

2 Typical Level of Information Need

The typical Level of Information Need table overleaf is based on the requirements set out in BSRIA BG6 2018. As we are generally working to UK Standards it is more suitable to use the British NBS LOD (Level of Detail) and LOI (Level of Information) definitions, rather than the American AIA BIM Forum versions. The table assumes building services engineers taking the model to BSRIA BG6 Stage 4a (feasible-generic design model) described as:

A model showing detailed building services designs, with locations and sizes of all items of plant, pipes, ducts and cable containment using generic objects in positions that are feasible for building services contractor and trade contractor pricing and for installation without major rerouting. This is analogous to the level of detail in Technical Design drawings using generic objects.

"Generic objects" are distinct from supplier specific objects. (e.g., company specific / "out of the box" elements). As structured data is a very important factor in efficient BIM processes and workflows, all modelled elements should follow a classification / naming convention agreed in the Post-Appointment BEP.

RIBA Stage	RIAI / ME2000 Stage	BSRIA BG6 2018 Stage	Irish Government Contract Stage	LoIN		Responsibility	Coordination	Clash Resolution	Use of Model for BOQ
				LOD (NBS)	LOI (NBS)				
2 (Concept Design)	2 (Outline Proposal)	2 (Concept Design Model)	Stage 1 (Preliminary)	LOD 2	LOI 2	Design Team	Not coordinated	No clash resolution	N/A
3 (Spatial Coordination)	3 (Scheme Design)	3 (Developed Design Model)	Stage 2A (Developed Sketch Design) Stage 2B (Detailed Design)	LOD 3	LOI 3	Design Team	Partially coordinated	Basic clash resolution (model is not clash free)	N/A
4 (Technical Design)	4&5 (Detailed Design & Production Information)	4.a (Technical Design Model - Feasible Generic Design)	Stage 2C (Tender)	LOD 3	LOI 3	Design Team	Coordinated for feasible design	Primary clash resolution (see section (model is not clash free))	Can be used as a guide for bulk quantities with caution
<p align="center">Point at which MEP model ownership transfers to the Contractor</p> <p align="center">Note: The Designer completes stage 4a as defined in BSRIA BG6 2018 at RIBA Stage 4 and the Contractors then develop stage 4b/c as defined in BSRIA BG6 2018 prior to commencing RIBA Stage 5 (Construction stage LOD and LOI should be detailed in the Contractor's Responsibility Matrix. The design stage Responsibility Matrix should leave Stages outside of the design team's scope blank to maintain clarity)</p>									
5 (Manufacturing and Construction)	Construction	4.b (Technical Design Model - Coordinated Generic Design)	Stage 3 (Implementation)	As per EIR	As per EIR	Contractor	Primary services fully coordinated	Primary services are clash free	Can be used as a guide for bulk quantities with caution
5 (Manufacturing and Construction)	Construction	4.c (Technical Design Model - Coordinated Specific Design)	Stage 3 (Implementation)	As per EIR	As per EIR	Contractor	Primary services fully coordinated	Primary services are clash free	Can be used as a guide for bulk quantities with caution
5 (Manufacturing and Construction)	Construction	5a (Installation Model) 5b (As Built Model)	Stage 3 (Implementation)	As per EIR	As per EIR	Contractor	Fully coordinated	Clash free	Should be possible to quantify all services
6/7 (Handover / Use)	Construction	6/7 (As Built Model)	Stage 4 (Review)	As per EIR	As per EIR	Contractor	Fully coordinated	Clash free	Should be possible to quantify all services

3 Costing and Quantity Take-Offs

2D drawings taken from the model at the end of design stage (BSRIA BG6 Stage 4a) should be suitable for costing by contractors. If design models are to be used for this purpose (not recommended) they should be used with caution and in conjunction with a detailed Responsibility Matrix, paying particular attention to the elements which are not included in the 3D model. It should also be noted that the quantities of scheduled elements in a Revit model will not seamlessly tie in with the Agreed Rules of Measurement 4.

Typical model elements which may not be included in the 3D model are noted below:

- Elements associated with specialist / client design packages (sprinkler, gaseous / foam fire suppression / modular wiring, AV systems, DX refrigeration systems, cold rooms, etc.)
- Typical detail elements e.g. valving arrangements at mechanical equipment / sanitary ware, AAVs / drain points / etc. are not included as 3D elements in the design model but are included on 2D detail sheets / schematics. (Space allowance should however be provided in the model)
- Access hatches
- All services supports, steelwork, plinths, bearers, access gantries and walkways / stepovers, anchors, guides, expansion bellows and loops, anti-vibration mounts, etc.
- Final foul, condensate and soil vent connections to sanitary appliances including traps, WC connectors, adaptors, vent pipe roof cowls, etc.
- Electrical Cabling and conduits under 50mm
- Modular wiring / Lighting termination (Klik) boxes
- BMS field devices sensors, VSDs, trace heating, leak detection tape, control valves, etc.
- Air intake / exhaust louvres
- Below ground water / waste pipework (typically civil engineering scope)
- Lightning protection systems
- Builder's works opening design, modelling and detailing
- Rainwater pipework
- Room data sheets (elevations with set out by architect).

4 Model Coordination and Design Clashes

The technical design stage (RIBA Stage 4) of a project has been divided into three general phases in BSRIA BG6 for the purpose of defining and assigning design activities and outputs. As consulting design engineers, we complete 'feasible generic design' as per BSRIA BG6 Stage 4a. We do not complete to BSRIA BG6 Stage 4b/c Stage 'Coordinated generic / specific design' - which includes the production of coordinated working drawings. This is 'coordination' as opposed to 'design' and is completed by the contractor. This point needs to be clearly communicated in the design stage Post-Appointment BEP to reduce risk.

The design model will not be completely clash free - but will be clash resolvable and coordinated to a point where it has been demonstrated that the services installations can be accommodated

within the allocated plant rooms, service routes and risers and that the contractor will be able to develop the construction / coordination model. A typical example of this is where a cable tray or pipe intersects another service at the same offset, and where there is sufficient clear service zone above, below or adjacent to the clash. Such clashes can be deemed resolvable and may remain in the model at Stage 4 (BSRIA BG6 4a), to be resolved in the Contractor's coordination / working model. It is important to note that the model issued for contract stage (Stage 4a following Tender action) is design intent only and is not suitable for construction; the contractor has responsibility for final working coordination and any specialist design elements which should be developed in their construction model(s).

Main plant equipment and primary distribution services clashing with structural or building fabric elements should be coordinated to avoid major re-routing and to facilitate the design of primary service openings in the structure (Refer BG6 2018 Fig. 5).

It is recommended that a minimum of 20mm tolerance is used for clash detection purposes during design stage.

5 Summary

- EIR and BEP (including a well detailed Responsibility Matrix) are key documents. A clear understanding of what the client is expecting is needed in order to facilitate the delivery of a quality BIM project. It is important to read and fully understand the requirements set out in these documents
- Where the Works specify BIM and / or digital deliverables, information shall be provided by the Client in line with the requirements of ISO 19650, including Exchange Information Requirements (EIR) and an Information Protocol. If BIM is introduced after the Consultant's Appointment, it should be paid for as an Additional Service. The Consultant's bid should clearly state any assumptions made and any elements excluded from the fee proposal. Establish project standards, methods and procedures between the whole design team at an early (project concept) stage
- BSRIA BG6 2018 should be used as the reference point for project teams
- Design models being used for costing at BSRIA stage 4a should be used with caution, and only in conjunction with a detailed Responsibility Matrix
- Unless specified otherwise LoD / LoI 3 is standard for M&E at stage 4a. (LoD / LoI definitions as per NBS toolkit)
- The design model will not be completely clash free but will be clash resolvable to enable the Contractor to develop the construction / coordination model
- In the absence of an EIR, consultants should detail the basis of their fee and service proposal, and associated assumptions. Risk may be increased by either remaining silent, including incomplete protocols / appendices, or inconsistencies in comparison to the agreed BIM approach at project level
- Many opportunities are possible if information is well structured within the BIM environment (critical for data harvesting and automation). This should be discussed and agreed with the client and project team prior to BIM commencement

- Early-stage planning and clash prevention strategies ensure a more efficient coordination workflow
- Project clash detection workshops should be run by the project lead at regular intervals and include a report of issues to be resolved for models to comply with requirements of the BEP
- NBS toolkit is a valuable resource for defining information development and delivery at each stage of the asset lifecycle: <https://toolkit.thenbs.com/>
- Establishing and maintaining a Common Data Environment ensures that the whole project team collaborates using the “single source of truth” for all project data. It is important that consultants maintain their own separate back-up/record of all data uploaded to the CDE (*reference* Trant v Mott MacDonald case)
- The CDE should be hosted by the Project Lead at design stage and by the Principal Contractor during construction stage
- Quality BIM models will only be achieved if all design team members commit to BIM
- All design team members should use a common software platform and version agreed in the BEP. Where this is not possible for all disciplines, models should also be shared in *.ifc format
- The UK BIM Framework Information Protocol includes an exclusion of liability for data corruption after the information model has been shared, published or otherwise issued through the CDE Solution and Workflow by the issuing party
- A specific construction stage BEP should be included in tender. Design team BEP should be kept separate from contracting team requirements
- IES is the only SEAI validated software at present. Check the EIR for thermal modelling requirements in the model
- Post model handover change procedure to be agreed in BEP. (The most efficient workflow would avoid keeping a live design team model through construction)
- Day to day design development updates communicated via CAD or pdf markups are acceptable, however if there is a more fundamental material change in project brief then a more suitable structured approach for the delivery of design information should be agreed between the contractor and the design team
- Coding / Automation requirements should be discussed with design team in advance of model set up
- Sufficient time should be allowed for BIM in your programme
- The term “clash resolvable” should be used instead of “clash resolved” when describing the model coordination at stage 4a
- The Consultant will initiate COBie within M&E models to a reasonable level; contractor is responsible for populating parameter values in excel sheet based on the final equipment selection. (Exact requirements to be included in EIR and Post Appointment BEP)
- Under public contract forms, the model does not typically form part of the contract and is issued for information-only to contractors. The BOQ is the primary pricing document.