APPLICATION GUIDE

BIM

LUXEMBOURG

CRTI·B
CENTRE DE RESSOURCES DES TECHNOLOGIES ET DE L'INNOVATION POUR LE BÂTIMENT

digital building.lu

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Foreword

The era of digitalisation is in full swing and inroads have now been made into all sectors of business – including the construction sector. This evolution poses a serious challenge which the construction industry is ready to address; and there is a real opportunity here for our sector to make greater progress in integrating digital technology into the way we operate.

Whenever "digitalisation" and "construction" are mentioned, a key issue is unavoidable: "Building Information Modelling", commonly known as "BIM" which is going to revolutionise our profession, our work habits and how we design projects in a way similar to or even more far-reaching than the introduction of "computer-aided design" in the early 1980s.

The BIM process is about creating added value at the various stages in a building project and optimising its processes. By using BIM, we can succeed in improving the quality of the built asset, while at the same time increasing the effectiveness of construction industry actors and productivity across the whole sector. Furthermore, by using BIM we can achieve the objectives of the Third Industrial Revolution in the medium and long term, in particular by moving towards the construction of buildings that meet the requirements of a circular economy. This is the reason why the Rifkin Study, published at the end of 2016, identified BIM as being one of the main pillars of future developments in the construction industry.

So the transition towards the "Lëtzebuerg Digital" era presents us with great opportunities which should be eagerly grasped. I firmly believe that proper collaboration between all actors will be a key strength and be of huge benefit not only to the development of the construction sector but also to our country. However, we must not lose sight of the fact that this sort of technological evolution can only succeed if all the parties involved are included, and not just the building owners and the project management team, but construction companies too, and in particular small and medium-sized companies.

So this is why in 2015 the CRTI-B (*Centre des ressources des technologies et de l'innovation pour le bâtiment* – Resource Centre for Technologies and Innovation in Construction) set up a working group that brought together everyone involved in the construction industry in Luxembourg. The purpose of their collaboration was to draw up a reference document for BIM collaboration in Luxembourg. This "BIM Application Guide", which has been written for the Luxembourg construction sector, represents the first stage of the support being provided to implement BIM and to help companies make the digital transition.

Finally, I'd like to take this opportunity to thank all the partners, institutions and federations, as well as everyone else who has been involved in this project, for their contributions, their valuable work and efforts which have resulted in the "BIM in Luxembourg" project being a piece of genuinely collaborative work between everyone working in the sector, which is totally in line with our CRTI-B mindset! This Guide is therefore proof that collaborative work – sharing and exchanging expertise – will move us forward in the best way possible, focussed on high quality, and will ultimately ensure that our whole industry keeps evolving.

Thierry Hirtz
CRTI-B Chairman

Contents

1 Introduction

1.1 Purpose of this Guide

This Luxembourg BIM Application Guide has been devised to provide a shared frame of reference for everyone involved in the construction industry. When it comes to understanding what BIM is and the changes it will bring about in projects, it is absolutely essential that everyone talks the same language and operates on an equal footing.

The guide is divided into four main sections:

- "Introduction" – this first section explains the purpose of the guide and the background to its creation.
- The second section "BIM: What You Need to Know" sets out important theoretical principles which need to be grasped to ensure a sound understanding of BIM.
- The third section is about "Setting Up a BIM Project" and describes the steps that have to be followed and the standard document templates which can be used (appendices).
- The fourth section provides a "Conclusion" to this work and looks forward to future developments.

This document therefore offers a comprehensive approach which starts off describing important concepts that need to be grasped (please refer to Chapter 2) and then the steps to be followed in order to successfully complete a BIM project (please refer to Chapter 3). There are also appendices which provide either sources of additional information or "ready-to-use" document templates.

It is important to note that this body of work is not prescriptive and remains a work that aims to "guide without compulsion". Moreover, as far as commercially available software solutions are concerned, the guide remains completely neutral.

1.2 Background to the Guide and Updating

The "Luxembourg BIM Application Guide" and its appendices are the result of a project which has brought together different representatives from the building sector who formed a working group led by the CRTI-B. Its content is drawn from reference works and standards in the field, as well as from the experience of the working group's various members.

The guide is based on a document drawn up by the OAI (Ordre des architectes et des ingénieurs-conseils – Luxembourg Order of Architects and Consulting Engineers), which was written to help its members prepare to address the challenge presented by BIM. In this context, the OAI was able to define for a BIM project the collaborative framework within the project management team and the interactions with the owner. Since BIM is such a vast subject and one that impacts upon everyone involved in the sector, the OAI handed over its studies to the CRTI-B so that a cross-sector working group could complete it by getting all the industry's actors in Luxembourg to work on it together.

Remaining in tune with this same philosophy of giving representation to the greatest number, the work on this guide is bound to continually evolve with time so that it takes into account advances made in the field, but most importantly includes feedback from the sector.

2 BIM: Wat You Need to Know

2.1 BIM Definitions and Principles

BIM or Building Information Modelling aims to simplify the design, execution and operation of a building or renovation project. BIM is a “modelling technology and associated set of processes to produce, communicate and analyze building models” (Eastman, 2011).

ISO 29481-1:2016 defines it as follows: “use of a shared digital representation of a built object to facilitate design, construction and operation processes to form a reliable basis for decisions”.

Specifically this means that by modelling and visualising a building in 3D in the form of a catalogue of objects positioned in space and described by their properties, a digital modal is created which supports:

- the generation of scale drawings (plans, cross sections, facades) and views without any “re-drawing”
- the automatic production of various measurements and the generation of bills of quantities
- the bringing together of different models (e.g. the combining of architecture and engineering models) to check that they match.

Adding different kinds of information, and in successive layers, is generally akin to adding new “dimensions” to the 3D model:

- 4D (addition of time-related information) to assist with planning
- 5D (addition of prices) to manage information about bills of quantities and associated costs
- 6D (addition of project lifecycle maintenance information) to manage facilities and assets
- etc.[1]

Using a digital model does not rule out the production and exchange of other documents. ISO/DIS 19650-1 speaks more generically of an information model which refers to “geometric models, structured data and documentation”, i.e. reports, specifications, data or information about systems or components, geometric data or information, etc.

It is important to remember that models are manipulated through appropriate collaborative processes and around a “common data environment”, which themselves depend on the project’s context:

- Organisation (the teams involved, roles and skills): please refer to 2.2
- Technologies (the tools used, skills available): please refer to 2.3
- Requirements (architectural design, structural calculations, simulations, etc.): please refer to 2.4

The models created during a project will change from one project phase to the next. It is said that they gain in “level of detail”: please refer to 2.5.

[1] With regard to defining 4D and 5D, a consensus is emerging around the different approaches. Beyond this there is no universal benchmark: information is added as and when needed, thereby multiplying the “xD” being manipulated (one dimension = 1 piece of added information (or one set of information)).

If a building's life cycle is considered in its entirety, BIM can then be divided into two information models:

- The Project Information Model (PIM), into which information is fed by all the actors involved in the building's execution (up until its delivery)
- The Asset Information Model (AIM), into which information is fed by the actors involved in the building's operation.

BIM Maturity Levels

In Luxembourg, as in neighbouring countries, the aim is to achieve Level 2 BIM (please refer to the diagram below). This entails defining the processes during which each actor involved in the project creates its own model using software with which it is familiar and then sharing this model via appropriate tools. There has to be interoperability between the various software applications for this to happen.

Level 3 BIM, i.e. the single model principle, is difficult to implement (both organisationally and technically) and is not a short-term goal.

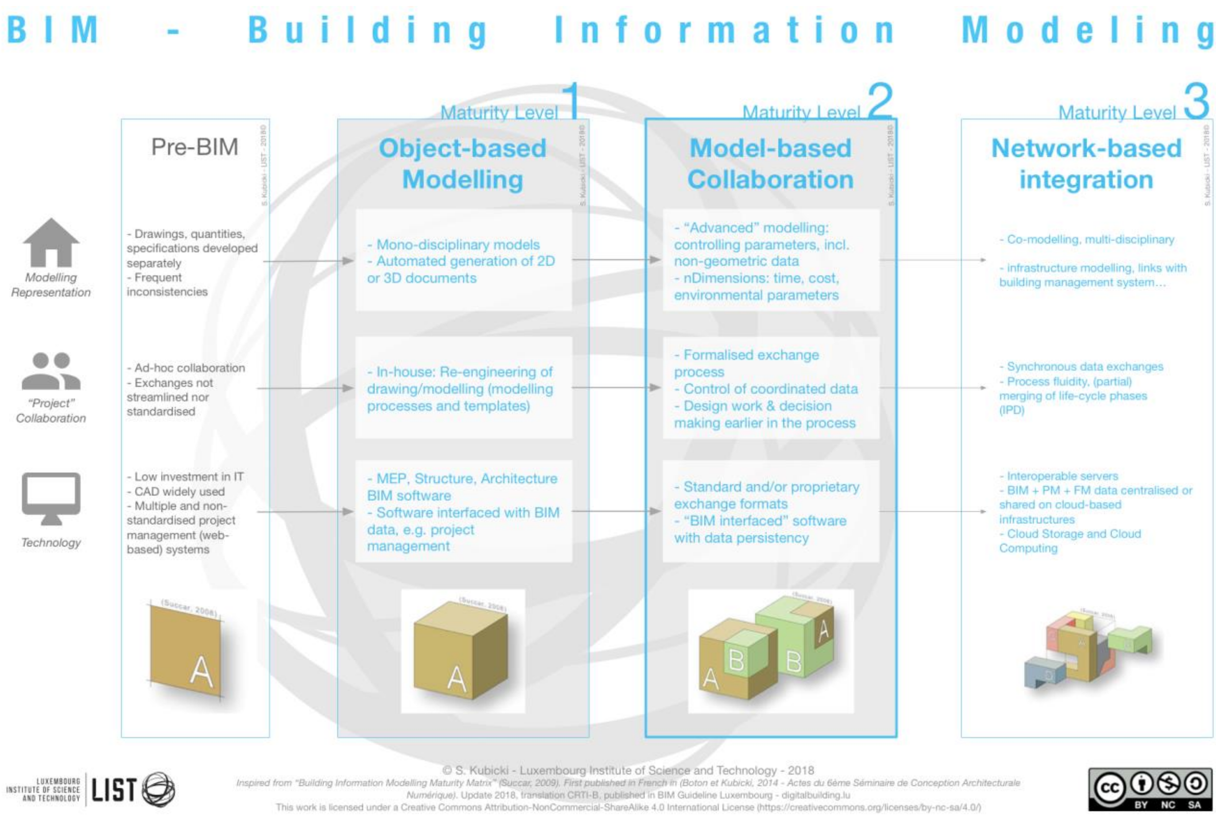

Figure 1. BIM Maturity Levels (Kubicki 2015)

Little BIM / Big BIM – Closed BIM / Open BIM

Little BIM describes all the technologies and processes that are set up so that work can take place using the digital model, the aim being that very specific tasks are carried out and in isolation. Little BIM is therefore the working environment adopted within each organisation and where organisations develop their own expertise. The work is organised so that people work together following established practice which is adhered to on a daily basis.

Big BIM describes all the technologies and processes in place to enable collaboration using the digital model in a multidisciplinary environment, typically throughout a project's life cycle. Here the challenge is to be able to integrate the "Little BIMs" of all the organisations involved so that they function and are linked to the objectives, thereby ensuring that all the organisations can collaborate with one another. Big BIM is therefore something which varies and which has to be redefined for each project.

Closed BIM is provided by using software applications from the same manufacturer. This means that they have proprietary functionalities and exchange formats which ensure (almost) total compatibility between each other. In certain cases, it could result to be preferable to use a closed BIM environment to avoid interoperability problems.

Open BIM operates when software applications from different manufacturers are used so that data exchange is provided via compatible exchange formats and appropriate import/export functionalities. IFC is the universal standardised format for Open BIM exchange.

As is shown in the diagram below, it is possible to combine the concepts of Little BIM and Big BIM, as well as Closed BIM and Open BIM, and create four different work environments.

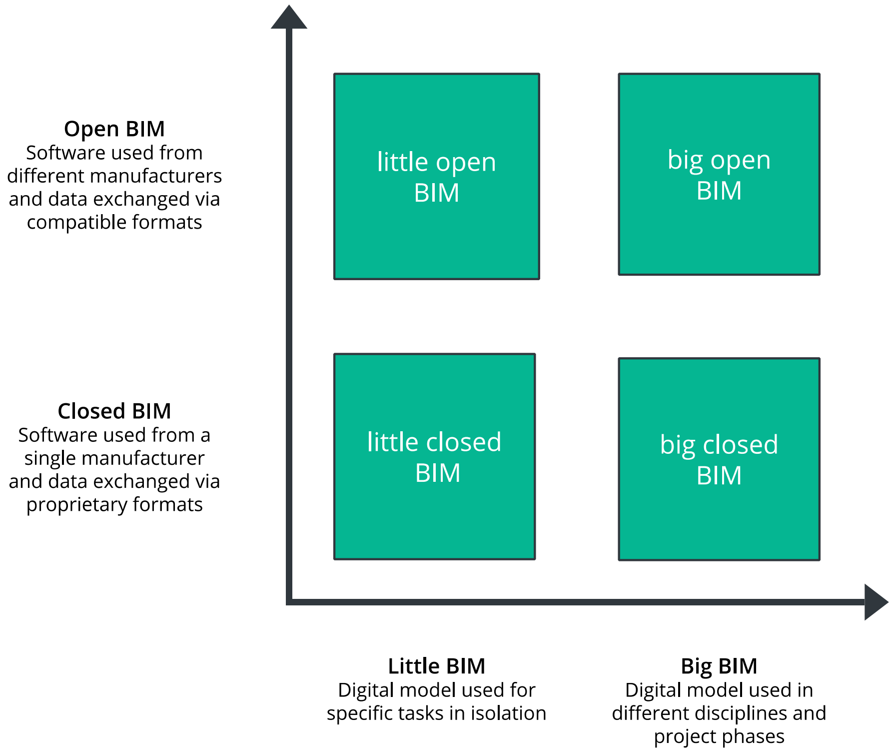

Figure 2. BIM Environment Matrix, combining Little BIM / Big BIM, Closed BIM / Open BIM

2.2 BIM Roles

Standard Organisation Chart

For BIM to be efficient, mastery is required of the tools AND the methods which are specific to BIM. In a broad sense, "BIM Management" of a project entails establishing "new roles" which add to/become incorporated into the organisation, whether this is on the side of the building owner's team or the project management team and companies.

On the owner's side:

- The **Information Manager**: this person formalises the owner's requirements and then checks that the information provided complies with these requirements (please refer to 3.1). The Information Manager has to therefore understand what the owner needs and be capable of implementing the requisite technical configurations (e.g. setting the parameters for the collaborative platform, checking models, etc.).

On the side of the design / construction teams:

- The **BIM Modeller**: this is the role that has "evolved" out of that of project designer[2] and a Modeller must be fully trained in using 3D design software tools such as Revit, Archicad, Allplan, etc. The BIM Modeller is responsible for producing a geometrically accurate model, but also the correct information according to what is needed. So this is first and foremost a "technical" profile: the Modeller must have received appropriate training (BIM modelling and collaborative platform software).
- The **BIM Coordinator**: is responsible for supervising the BIM Modellers in their organisation, checking the accuracy of (their organisation's) models, and taking care of their organisation's exchanges with the other organisations. Therefore within its area of activity, this role combines technical and managerial skills. Competent mastery of modelling tools is required, as well as the ability to verify models and sharing/collaboration processes.
    - In the project management team, coordinators have to produce the design team's coordinated deliverables. A person may be selected from among the BIM coordinators to act as the design team's "representative" with the project's BIM Manager (please refer to the definition below) and to be the team's main point of contact.
    - Certain construction teams will also have digital information that needs to be added to the project. They shall be subject to the same rules as the project management team and will have to report to the BIM Manager for their work on the digital model.
- The **BIM Manager**: draws up the project's "BIM Execution Plan" which governs the project while complying with the owner's requirements. On receiving the deliverables from the various BIM coordinators, it is the Manager who checks that they comply with the plan. The BIM Manager's role is different from that of project manager: this is not a decision-making role but rather one that involves audit and advice. The BIM Manager's sphere of influence is limited to ensuring the integrity of the BIM models, it is the people in charge of the project (SCMC synthesis, project manager, etc.) who analyse and use the models. However, BIM Managers **must** have experience of building projects as a whole so that they understand how the different phases

[2] What is being described here is "developing a project" which may be undertaken equally well by an architect, an engineer or a draughtsman.

work and fit together. From a technical point of view, the BIM Manager has the skills to analyse digital models using dedicated software. The BIM Manager may also have to provide support as a supervisor working, for example, with the various BIM coordinators to ensure that the BEP is being followed correctly (parametering, etc.)

- **NB: since the BIM Manager's duties are wide-ranging, entrusting them to a "BIM Management Team" rather than to a single individual is not out of the question.**

Please note: when roles are described not all systems of reference adopt the same vocabulary. Therefore the terms used here are a syntactical choice that seems consistent and follows most systems of reference.

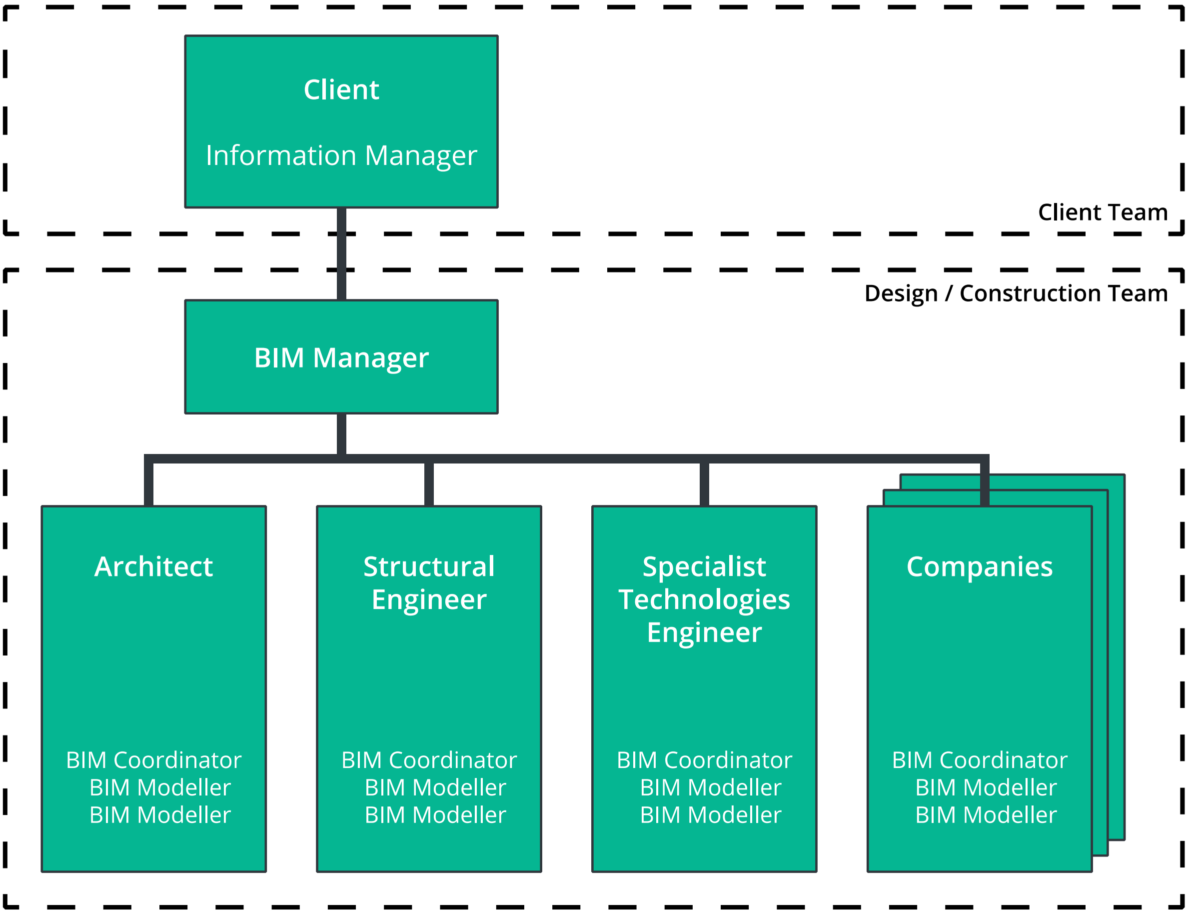

Figure 3. Standard Organisational Chart

Allocating Roles

BIM-related roles are allocated to fit with the project's context and the skills required. The flow chart above is in no way representative of any particular contractual framework (separate contracts, consortium, "design & build", etc.). Accordingly, depending on the context, the duties relating to these different roles may be allocated differently. For example, the BIM Manager role may be taken on partly or wholly by one of the design teams. It may also be "outsourced" and performed by an independent agency. The same is true for the role of Information Manager on the side of the owner's team.

	BIM Modeller	BIM Coordinator	BIM Manager	Information Manager
Framing the owner's requirements (Project BIM Brief - PBB)			Analyses requirements in the PBB to write the BEP	Writes up the requirements in the PBB
Setting up the project (BIM Execution Plan - BEP)	Monitors the BEP	Contributes certain inputs needed to write up the BEP. Monitors the BEP.	Writes up the BEP	Checks and validates the BEP
Modelling tool skills	Depends on the tools used in the workplace	Depends on the tools used in the workplace. Can handle IFC exchanges.	Diverse technical baggage – can give support wherever it is needed.	Depends on the owner's tools.
Exchange tool skills	Uses tools at his organisation's level	Uses tools at his organisation's level	Uses and manages/ configures tools	Uses and manages/ configures tools
Supervision tool skills	May use them to check models	Uses and manages/ configures tools (internal rule checking)	Uses and manages/ configures tools (project rule checking)	Uses and manages/ configures tools (rule checking specific to the owner's requirements)

2.3 BIM Software and Formats

Modelling and Data Processing Software

To create a digital model, modelling software has to be used which not only can produce 3D drawings but which most importantly can identify and characterise the objects created with different information. There are several software packages available: they offer equivalent functionalities even if on certain points each one may differ from its competitors. IFC format is an exchange format that aims to be universal so that it is possible to exchange and work on models, regardless of which modelling tool is used.

In addition to these modelling software packages, there are other tools with which BIM data can be manipulated, whether for checks, calculations, reporting, etc.

Using BIM does not rule out using 2D design, especially when creating complex details (e.g. details of watertight seals, special pieces that need to be boxed in, complicated corners in a reinforcement, etc.). However, please take care as to how this is done: the desired details can be created by exporting a 2D view and editing it with drawing software, but these details will then no longer be associated with the model. Consequently any alteration to one will no longer make any changes to the other. To maintain the link, the details will have to be created in the actual modelling software, by overlaying them onto the model.

IFC ("Industry Foundation Classes"): "Open BIM" exchange format

The IFC format is an exchange format that has been created to ensure interoperability between software packages, making it possible to universally describe the "elements" which make up a building throughout its life cycle (design, construction, operation) and according to different viewpoints (architecture, structure, thermal, estimations, etc.). IFCs are included in a file whose format is pre-defined according to ISO 10303-21 (STEP – Standard for Exchange of Product Data).

"Elements" are the spaces and groups of spaces which form the building's structure (room, area, floor, site, etc.) and the objects which define it and of which it is composed (architectural structures, technical facilities, furnishings, etc.). Accordingly, for each element the IFC properties indicate its shape (or representation), any information characterising the element and its relationship to other elements.

Since 2013, IFC format has been standardized as ISO 16739:2013 ("Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries")

(http://www.iso.org/iso/catalogue_detail.htm?csnumber=51622)

Useful Links

http://bimstandards.fr/

http://www.buildingsmart-tech.org/ifc/IFC2x3/TC1/html/index.htm

http://www.buildingsmart-tech.org/ifc/IFC4/final/html/index.htm

BCF (BIM Collaboration Format): the Communication Format around Models

BCF is a format for communicating messages that describe problems encountered on the digital model. It is used to transfer comments about an object in a model between the different parties involved in a project. Using the BCF format, viewpoints, selected objects, snapshots and comments can be retrieved directly from any modelling software programme and amended directly in order to deal with the problem highlighted.

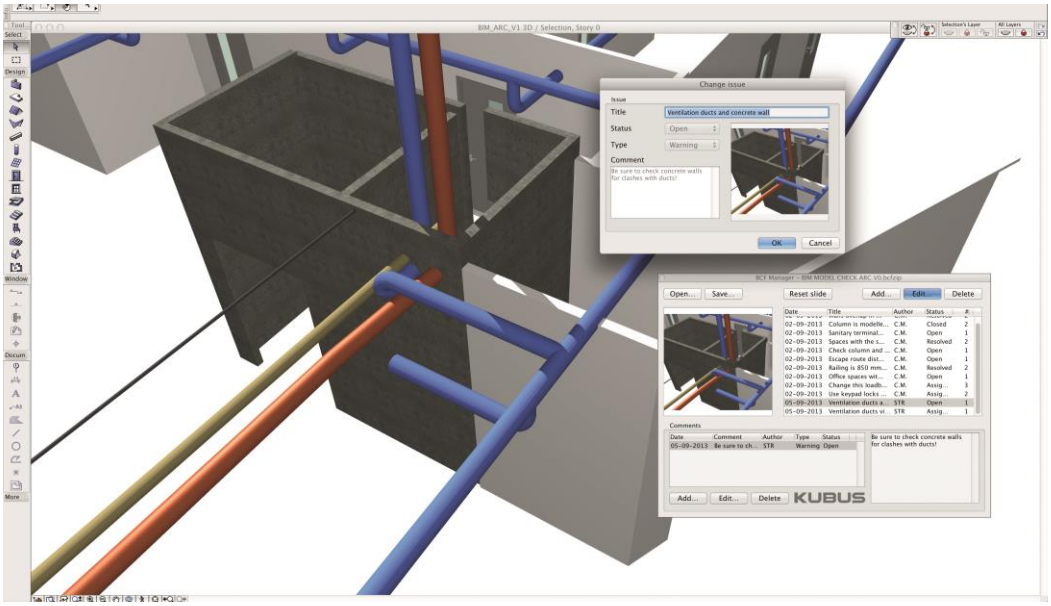

Figure 4. Illustration of a BCF communication (Solibri Kubus)

Collaborative Platforms (Common Data Environment)

So that people can work together on the models and exchange documents, an appropriate methodology for collaboration has to be set up based around a common data environment (CDE) – a central reference system where the information about building projects is stored and interlinked. CDE content is not limited to the deliverables created in a "BIM environment": it also includes documentation, the geometric model and non-geometric elements.

Collaborative platforms already in use in the construction industry for exchanging documents and managing workflows can be adapted to share models and visualise the information they contain. It is crucial that exchanges are centralised so that information is correctly passed between the project teams AND the owner. Centralisation also enables the BIM Manager to have a general overview of the project work going on which makes their job easier.

A CDE has to be organised into different work spaces which enable the various files to be moved from one status to another and which allow the right people access as and when necessary. Typically, a CDE that shares modelling is structured as follows:

- Ongoing work: for information being currently produced and unverified data (one space per team)
- Shared: for information shared between several design/construction teams who will use it to coordinate their work (e.g. coordination of models and clash detection) and as a starting point on which to base subsequent work (e.g. sharing the architecture model as a basis for the

structure model). In this area, the BIM Manager is able to examine and validate the information's compliance with the project BEP.

  - The owner cannot see this space. Should it be necessary to send the owner any work documents which have not been finalised, it is then recommended that a second shared space is used ("shared with the owner"). Otherwise the "published" space can be used.

- Published: the information validated by the BIM Manager is accessible to all the other stakeholders. It is used to generate the project's deliverables (e.g. models, plans and other submission documents).
- Archiving: Once data is no longer being used it is archived, but remains available.

When models are being shared, it is important to be able to control their size. Problems may arise when working on files that are too large. If need be, the "Architecture", "Technical" and "Structure" models can be divided:

- According to the elements which have to be modelled or by batch (e.g. by placing furnishings into a separate model)
- According to the project's actual structure (e.g. in the case of a project comprised of several buildings: one model per building)

Another essential feature of CDE is its capacity to manage the different versions of a file and to track them (it is possible to monitor their sharing, downloading and updating, etc.).

2.4 BIM Uses

BIM is not intended to be used to do everything. It is vital to work out which BIM uses will be appropriate during the project and these should be linked to the project' specific features, whether with regard to objectives or skills. In other words, it is necessary to define which BIM uses are going to be implemented (please also refer to Penn State CIC's document "The uses of BIM":

http://bim.psu.edu/Uses/the_uses_of_BIM.pdf as well as to chapter 3.4 of Mediaconstruct's
"Guide méthodologique de rédaction d'une convention BIM"
(in French): http://www.mediaconstruct.fr/travaux/guide-de-convention-bim).

This choice of uses therefore takes place at the start of a project, and these uses will then determine which work processes are put in place (please refer to chapter 2). This must therefore be clearly defined and there must be consensus among all the project's stakeholders. The skills and tools must be available to enable the selected uses to be implemented.

We are able to list 21 standard uses:

1	**Programming** A BIM use that links the programme for an operation with future digital models. This makes it possible to incorporate the owner’s requirements and makes it easier for the project management team to take these into account and carry out compliance checks.
2	**Analysis and Modelling of Existing Conditions (Site + Structure)** This use involves carrying out an accurate digital survey of the various existing buildings and site to create a reliable model of them which will then serve as a starting point for the new project.
3	**Architectural Design** This use involves creating an “architecture” model to define the designed spaces. This model will keep changing throughout the project and will serve as a basis for the engineers’ work when undertaking technical and structural studies.
4	**Construction System Design** This use involves creating a “structure” model to define the construction systems. The model will keep changing throughout the project, according to which choices are made and how the architecture model develops.
5	**Technical System Design** This use involves creating a “specialist technical” model to define the technical systems. The model will keep changing throughout the project according to which choices are made and how the architecture model develops.
6	**Project Review, 3D Coordination (“Clash Detection”)** This use involves overlaying the models to get an overview of the project as a whole and then taking it forward in view of any coordination problems which become apparent from the overlay. This use covers the detection of collisions (clashes) between models.
7	**Production of Deliverables (Geometrics, Views, Bills of Quantities, etc.)** The digital model is used as a basis for producing standard outputs for a project: plans of every sort, sections, elevations, perspectives, bills of quantities, etc. Tender documentation may also be extracted from the digital models.
8	**Cost Estimation** This use involves estimating the project costs by linking the quantities extracted from the digital model to a financial basis to simulate what the project will cost (this requires modelling that is suitable for extracting the required quantities).
9	**Performance Assessments / Comfort Simulations** **(Thermal, Luminosity, Acoustic, etc.)** This use involves simulating from the model the building’s future performance with regard to heat transfer, luminosity and acoustics. The goal is to check that there is compliance with the requirements and if necessary to be able to amend the design.
10	**Performance Assessments / Stability Simulations** This use involves simulating from the model the building’s future performance with regard to load transfers and load-bearing capacity. The goal is to check that there is compliance with the requirements and if necessary to be able to amend the design.
11	**Assessments / Simulations of the Building’s Environmental Impact** This use involves assessing the building’s environmental impact using the model and looking at the materials used, simulated energy consumption and also recycling opportunities during demolition. It is also possible, for example, to identify potentially harmful products.

12	**Checking Standards and Compliance with Requirements or Constraints** This use involves checking on the model the project's compliance with predetermined and regulatory standards (e.g. accessibility for the disabled). This verification is carried out by establishing automated rule checking rules.
13	**Simulation of the Construction and/or Demolition Sequencing: 4D Planning** This use involves virtually simulating the sequencing of the project by associating the model to a Gantt type chart. This chart may be predetermined succinctly in the design phase and then become increasingly accurate during the construction phase. Used in conjunction with the "cost estimation" use, the site's financial progress can be managed.
14	**Simulation of the Site Set Up and/or Demolition** This use involves virtually simulating the site set up (temporary buildings, waste storage, etc.) and the logistics required (supplies, orders, stocks, etc.) in order to make optimum use of the spaces available, the resources used and the time available to set up the site.
15	**Prefabrication** This use involves accurately modelling certain elements by defining their dimensions and the cutting required for prefabrication and then their positioning on the site. This "prefabrication" use is similar to uses 13 and 14 for construction simulation, but a greater level of detail is required for any elements that are to be prefabricated.
16	**Consolidation of Digital Models and Documents, Final Digital Model** This use involves updating the final model (geometry + information) and associated documentation so that they can be given to the owner as an "as-built" dossier.
17	**Provisional Maintenance Schedule (Definition of Maintenance Task Schedules)** This use involves developing a maintenance schedule for the building's different elements throughout its life cycle by drawing upon the information contained in the operation model.
18	**Analysis of the Building's Actual Performance** This use involves adding to the operation model actual values measured inside the building (consumption, temperatures, luminosity, air flow rates, etc.). These values can be compared to those estimated during the design phase based on simulations (cf. uses 9 to 11).
19	**Building and Facilities Management (CMMS)** This use involves linking a CMMS system to an operation model to draw upon the information it contains to schedule and manage maintenance tasks, both preventive and corrective. A bilateral link makes it possible to update the model based on the information gathered while maintenance is being carried out.
20	**Managing Spaces and Space Allocation (Occupation, Removals, etc.)** This use involves linking a space management system to an operation model to draw upon the information it contains to plan and manage how the building will be occupied, the removals, furnishings, etc. A bilateral link makes it possible to update the model based on information gathered once these changes have been made.
21	**Providing the Project with a Media Profile (Images, Videos, Virtual Visits, etc.)** This use involves using the model to present the project through images and videos as a way of explaining its architectural and technical concepts. Using advanced technical features, it could be possible to organise virtual visits.

2.5 Levels of Detail of the BIM Model

The concept upon which Level of Development (LOD) is based has changed greatly over time and because of the ways in which it has been interpreted, in particular with the appearance of different national guides, including our “Luxembourg BIM Application Guide”. Consequently, what is meant today by “Level of…” can vary, as there are several different definitions – especially as there is now starting to be talk about a general concept of “LoX” (to find out more about this, please refer to Marzia Bolpagni’s article: “The many faces of ‘LOD’”[3]).

According to ISO/DIS 19650-1, Level of Development should be defined as a “level of information requirement”, i.e. the quality of each piece of information to be provided in terms of granularity so that it serves the purpose for which this information is required, and not more. So there are a certain number of measurement parameters, which may be complementary but independent, but which make it possible to establish the granularity and the level of information requirement which need to be defined.

The level suggested in this guide for the Luxembourg national level follows this approach. It is called “GID level” and is arrived at by adding three levels of granularity with respect to Geometry (100/200/300/400/500), Information (10/20/30/40/50) and Documentation (1/2/3/4/5).

The addition of this level of documentation on top of the usual “Geometry & Information”[4] level is a specific feature which takes account both of the sector’s current expertise and the limitations of the software available: since not everyone has the same options for producing BIM, an alternative to modelling has to be found with which it is possible to deliver “less detailed” models, but ones which can be supplemented by accompanying documents (2D details, photos, catalogue references, technical data sheets, etc.) according to what is needed[5].

Accordingly the GID concept takes into consideration all the data required and shared throughout a project: “geometric models, structured data and documentation” (please refer to 2.1).

Furthermore, it is helpful that it is divided into three distinct sections as this offers greater flexibility to adjust it based on the projects. So, for example, if it is agreed in the final draft (APD) phase that the common GID level is 222, on an ad-hoc basis the geometry level G may be varied from 200 to 300, which would produce a total GID of 322.

The table below sets out what these levels and their values equate to. The GID forms (appended to this document) will enable you to understand exactly what these levels equate to for each object that has to be modelled. The associated project phases at each level are reference phases: this association is not in any way restrictive and may vary according to what is needed.

[3] http://www.bimthinkspace.com/2016/07/the-many-faces-of-lod.html
[4] You will often come across both these concepts, termed as LOG: “Level of Geometry” and “LOI: Level of Information”.
[5] Documents which need to be added should be made available on the project’s collaborative platform. A document is not necessarily linked to one of the model’s objects in particular; however, it is important for each document to be correctly named and filed, so that the information it contains can be easily found.

	Intentions / Pre-design (Programming, Preliminary Draft)	Design (Final Draft, Approvals)	Submission (Project, Tender)	Execution (Site, As- Built)	Operation (Facility Management, Demolition)
G (Geometry)	**100**	**200**	**300**	**400**	**500**
	Level 100 is used to obtain a "basic – as designed" model in order to get the initial design choices validated. The object is represented in outline form to convey what the design intends and to show its dimensions and positioning.	Level 200 is used to obtain a "detailed – as designed" model to get the project validated as a whole. The object's representation makes it possible to visualise its dimensions, positioning and main characteristics on a 2D geometric drawing and on a 3D view.	Level 300 is used to obtain an "as prescribed" model in order to submit the project for tender. The object's representation makes it possible to visualise its appearance in space and some of its specific technical features.	Level 400 is used to obtain an "as to be built" model, in particular whenever there is to be prefabrication of elements or details of construction elements. The object is represented by a real view which includes its constituent elements.	Level 500 is used to obtain an "as operated" model which includes any modifications to the building during its operation and which may add a graphical layer that is useful for maintenance.
I (Information)	**10**	**20**	**30**	**40**	**50**
	Levels 10 and 20 provide information which is useful for drawing up various technical studies during the design phase (10 = basic, 20 = detailed). The object has at least a name, a type and an identifier. Even if it is not modelled (G0), at least its main dimensions are entered. Additional information must meet requirements for both simulation and generation of the different outputs during the design process.		With level 30 it is possible to submit a tender and thereby send the tenderers all the requisite information for suggesting appropriate products and building work. The object has enough necessary technical information for choosing a product, depending on its nature.	Level 40 provides real information about the products and building work implemented. The object has all the technical information required for implementing the building, depending on its nature.	Level 50 provides all the information relating to maintenance, including reporting of measures taken in situ, whenever necessary. The object has useful information for operating the building namely relative prices, installation, maintenance and warranty dates and so on.
D (Documentation)	**1**	**2**	**3**	**4**	**5**
	Levels 1 to 5 reflect how the project's body of documents gradually takes shape, from the initial outline diagrams to the execution details and technical data sheets.				
	Any document showing an intention, a requirement or a constraint.	The object is associated with a product which can be identified by a photo, a representative diagram or even a catalogue reference.	The object is associated with a detailed technical document which provides precise information about the object but without it being associated with a product.	The object is associated with one or more technical data sheets as well as with the details and procedures for implementing the actual product. This implementation may also be managed by photos and reports.	The information quoted above is supplemented by any document linked to the object and its installation and which may be useful for managing the building (installation photos, purchase orders, invoices, installation notes, service manuals, etc.).

Please note: level 0 may be used to show that nothing is expected for one or two of the three parameters (e.g. 300 = a detailed 3D drawing without any added information or documentation, 055 = one COBie)

3 Setting up a BIM project

This chapter describes the methodology for setting up and monitoring a BIM project, by drawing inspiration from similar approaches and reference standards in the field (please refer to Chapter 5 “References”).

This methodology is complemented by the “template”-type supporting documents found in the Appendices, which can be used as a basis to formalise the various steps in the process.

3.1 Formalising the Owner’s Requirements: the Project BIM Brief (PBB)

The Project BIM Brief (PBB[6]) describes the owner’s expectations with regard to the organisation of the BIM project. A PBB template is available in the appendices to this document.

The methodology for creating a PBB can be divided into several themes:

Why?

- Description of the BIM objectives
- Description of **recommended / required** BIM uses

Who? What? When?

- Definition of the predetermined organisational context on the side of the owner’s team (with a detailed description of each individual’s role and skill set)
- Definition of the information requirements based on the milestones (PIR / AIR / MIDP)
- Table summarising the **recommended** GID levels per object and per phase (EIR)
- Any other particular requirements per phase

How?

- Definition of the technical context and **recommended** methods of exchange (software and exchange formats, naming conventions, modelling requirements, etc.)
- Definition of the resources available
- Any other specific requirements

Defining General Objectives and Recommended BIM Uses

The owner’s team defines its general goals with regard to BIM and how BIM fits with its own organisation (management strategy, budget, regulations, policies, etc.). For example, the goal might be to use BIM only for operating the building, without any involvement with how the construction and design phases for its building will be managed.

The “BIM uses” which it recommends for its project are worked out from this general strategy (please refer to 2.4).

Defining Information Requirements and Delivery Milestones

Based on which uses the owner’s team recommends, it can work out its information requirements from these, i.e. the expected deliverables:

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[6] A concept which can also be found under the terms “Employer’s Information Requirements” or “BIM Specifications”

- **during the execution phase** to manage its project and take decisions (models, plans and other graphical deliverables for architectural evaluation of the project; analysis reports to evaluate the building's performances; schedule tracking reports; budget monitoring reports, etc.). **Project Information Requirements** (PIR) are then referred to.
- **during the operation** of its building in order to manage it. These requirements start to be defined at the beginning of the project because some of the information will need to be provided while the project is happening (e.g. nomenclatures for the spaces, description of the spaces, equipment technical data, information about warranties, maintenance task lists, etc.). Asset Information Requirements (AIR) are then referred to.

A set of information requirements needs then to be developed **for each decision point** during the project, for example, at the end of each phase (preliminary draft, final draft etc.) and based on other intermediary milestones. This means that accurate phasing for the project must be defined. Based on these decision points, **the owner's team defines the delivery milestones for the required project information: The Master Information Delivery Plan (MIDP)**. These delivery milestones take into account periods for analysis which the owner will need to have in between the information being provided and the decision being taken.

Using the PIR and AIR and working with the MIDP, the owner's team is in a position to determine the correct level of information requirement (please refer to 2.5) at each milestone and who shall be responsible for it. This step is called Exchange Information Requirements (EIR)[7].

In addition to the PBB template, we are also providing "GUIDE BIM LUX _ Annexe – EIR & Fiches GID" – a document which helps define EIRs. This file contains an initial table where it is possible to select the GID level per type of modelled object (e.g. walls, doors, windows, slabs, etc.)[8] and per phase (or milestone), while at the same time specifying who shall have responsibility for it.

Uniformat Level					Omniclass Level								MILESTONE 1			MILESTONE 2		
													GID Reference			GID Reference		
													Delivery Date			Delivery Date		
1	2	3	4	5	T	1	2	3	4	5	English terms	French terms	GID	Person responsible	Comments	GID	Person responsible	Comments
-					13-						SPACE	ESPACE						
A					21-	01	00	00	00	00	SUBSTRUCTURE	Sous-structure						
A	10				21-	01	10	00	00	00	Foundations	Fondations						
A	10	10			21-	01	10	10	00	00	Standard Foundations	Fondations standards						
A	10	20			21-	01	10	20	00	00	Special Foundations	Fondations spéciales						
A	20				21-	01	20	00	00	00	Subgrade Enclosures	Enceinte en sous-sol						
A	20	10			21-	01	20	10	00	00	Walls for Subgrade Enclosures	Murs d'enceinte en sous-sol						
A	40				21-	01	40	00	00	00	Slabs-on-Grade	Dalle inférieure						
A	40	10			21-	01	40	10	00	00	Standard Slabs-on-Grade	Dalle inférieure standard (dallage)						
A	40	20			21-	01	40	20	00	00	Structural Slabs-on-Grade	Dalle inférieure structurelle (radier)						
A	40	30			21-	01	40	30	00	00	Slab Trenches							
A	40	40			21-	01	40	40	00	00	Pits and Bases							
A	40	90			21-	01	40	90	00	00	SlabOn-Grade Supplementary Components	Composants supplémentaires						

Figure 5. Extract from the EIR selection table, please refer to the appendix "EIR and GID Forms"

[7] The acronyms PIR, AIR, MIDP and EIR and their respective definitions are laid down in ISO/DIS 19650-1

[8] The classification chosen for objects to be modelled is Uniformat (http://www.csinet.org/Home-Page-Category/formats/uniformat). This classification is a method for organising building information based on functional elements or sections of an installation characterised by their functions, regardless of the materials or methods used to achieve them. Uniformat is used as a way of organising elements before their GID level gets defined. Nevertheless, there is no obligation to use this classification when modelling models, and it may vary depending on the project.

The following tables contain "GID forms": they provide details of the correct levels of geometric information[9], non-geometric information and documentation for the different types of objects and they do this for the different phases in the project.

The content of these GID forms is an ideal to be achieved, a level deemed "satisfactory" at "common" milestones.Project phases associated at each level are reference phases: this association is by no means restrictive and may vary depending on what is needed. Given the wide variety of projects, it is obvious that cases are bound to vary: consequently the GID levels shown are neither an absolute minimum to be achieved nor a maximum limit.

GID A1010 Form: Standard Foundations

Uniformat Classification:

A				Sub-structure
A	10			Foundations
A	10	10		Standard Foundation
A	10	10	.10	Foundation walls
A	10	10	.30	Foundation columns
A	10	10	.90	Standard Foundation Supplementary Components

Associated IFC Objects:

Walls:	IfcWall
Columns:	IfcColumn
Footing, pad, strip	IfcFooting (Pad_Footing / Strip_Footing)
Other:	
Reinforcing bars	IfcReinforcingBar
Voiding features	IfcVoidingFeature
Plate	ifcPlate
etc.	...

Figure 6. Extract 1 from a GID form; please refer to the "EIR and GID Forms"

LEVEL OF INFORMATION							
Element to be updated	Detail	GID X1X	GID X2X	GID X3X	GID X4X	GID X5X	Associated IFC (4) Parameters
Reinforcement	Estimated reinforcement rate (kg /m3)			X	X	X	Pset_ConcreteElementGeneral: ReinforcementVolumeRatio
Material	Name of the material for each element or constituent layer (according to the convention selected)		X	X	X	X	IfcMaterialLayer/IfcMaterial IfcMaterialProfile/IfcMaterial
Load bearing element	Identify if the element is load-bearing (yes/no)	X	X	X	X	X	IfcSlab/Pset_SlabCommon: LoadBearing(=TRUE) IfcColumn/Pset_ColumnCommon: LoadBearing(=TRUE) IfcBeam/Pset_BeamCommon: LoadBearing(=TRUE)
Thermal transmittance	U of the slab		X	X	X	X	IfcSlab/Pset_SlabCommon: ThermalTransmittance

Figure 7. Extract 2 from a GID form, please refer to the "EIR and GID Forms"

Defining the Reference Information Provided by the Owner

The owner's team compiles the reference information which will be made available to the design / construction teams and with which these teams must comply:

- Information regarding the project's context (site and surrounding area, existing framework, standards in force, etc.)
- The resources to be used: such as document templates, model structures, BIM object libraries, graphical guidelines, guides, etc.

[9] In order to make exchanges easier, each element described is associated with the corresponding IFC object and its available IFC properties.

Defining the Common Data Environment (CDE)

The owner's team is in charge of establishing a common data environment which shall be used throughout the project to support collaborative production of information. This CDE abides by the key principles described in the previous chapter (managing nomenclatures, managing versions, managing status, security, etc.).

Defining Specific Rules Covering the Production and Exchange of Information

The owner must formalise specific rules for each party's obligations with regard to the production and exchange of information: CDE use, shared resources use, intellectual property rights and data reuse after the project, etc.

Comments

1/ Owners may experience repetition in projects which may help to produce a generic set of requirements which may be re-used across all their projects whenever a new PBB has to be drawn up.

2/ The owner's team has to find a balance when it comes to specifying these requirements: they will need to be specific enough to provide the project with a framework, while not being too restrictive to impede the design / construction teams' work in the future.

3/ Part of the PBB (such as defining the CDE) might not be stipulated by the owner and may be left as something for which future contractors will be responsible (by contractual obligation). This will all depend on the extent to which the owner is involved in the project's BIM process.

3.2 Formalising the Project Team's Proposal: the "BIM Execution Plan" (BEP)

A BIM Execution Plan (BEP)[10] describes the way in which collaboration will be organised during a BIM project to comply with the owner's requirements (please refer to 3.1), while nevertheless taking account of the specific features of the project's organisational and technological context. In other words, **it is an updated and completed version of the PBB based on the response to the owner's requirements**. The BEP then becomes contractually binding and the reference document to which anyone can turn at any time to understand:

- What is expected of them
- What they can expect of others

A BEP template is provided in the appendices: "Modèle de BEP" (Model BEP)

It is the responsibility of the person who has the role of **BIM Manager** in the project (please refer to 2.2) to create, manage and send out this document. It must be kept updated and reflect how the project is advancing from one stage to the next and there must be consensus around it.

Please note: if the tender requires it, an initial version of the BEP must be created for the BIM Manager's role before the contract is agreed. Under such circumstances, this is referred to as a pre-contract BEP. The

[10] Other different names are used for this type of document, including in particular "BIM Management Plan", "BIM Protocol" as well as "BIM Agreement"

proposal produced by the BIM Manager who takes on this role shall then be completed and become the (post-contract) project BEP.

The methodology for compiling a BEP therefore follows the same thematic issues as the PBB, while at the same time completing it with the directives which will be **actually implemented** during the project:

Why?

- Project description
- Description of **the BIM end uses** to be implemented

Who? What? When?

- Definition of the **entire organisational context** (with a detailed description of everyone's role and skill set)
- **Summary schedule for the different milestones and expected deliverables**, which includes intermediary deliverables (TIDP)
- **Workflow** and exchanges depending on the uses and milestones
- **Table summarising the final GID levels** per object and per milestone / phase (EIR)

How?

- Definition of the technical context and **methods for final exchanges** (software packages and exchange formats, naming conventions, modelling requirements, etc.)
- Other specificities to be taken into consideration (e.g. arrangements for checking models, geo-referencing, size of the models, etc.)

These three steps shall be monitored jointly and iteratively until the end of the project. There must be consensus about all the decisions taken.

Reminder of Objectives and Defining BIM End Uses

General information about the project is taken directly from the reference information provided by the owner's team.

It is then necessary to specify which uses are to be implemented. Here again, the final uses will be determined according to the owner's requirements (recommended uses). For each use, it is recommended that a **workflow** is defined which describes the precise order in which the tasks will be carried out, by whom and where the different milestones will be placed (verification, delivery, etc.).

Defining the Organisational Context

Any institution involved in the project must be known and identified. Apart from general information (name, contact details, role, etc.), the software being used must also be described. For each institution identified, the actors (or groups of actors) need to be identified by their roles (including "BIM Manager", "BIM Coordinator" and "BIM Modeller"), their responsibilities and their skills.

Please note: for a pre-contract BEP, the teams described are the teams which submit known tenders. Thereafter, it will be necessary to take stock of the situation once the companies and individuals have been *hired contractually. Their skills will need to have been assessed and checked before they are hired. However, should any gaps be picked up during the project, measures must be taken (external support, training, etc.).*

Defining Information Exchanges to Meet the Owner's Requirements

The final scheduling for deliverables and information exchanges suggested by the design/construction teams must take the owner's exchange information requirements (EIR) into consideration. Nevertheless, these may be different and there must be consensus about them among all the stakeholders. **They will in fact be dependent on each party's capacities (as regards skills and software) to provide this information and they should not hold up the project.**

In practical terms, this means it is necessary to **"update":**

- The Master Information Delivery Plan, the general schedule for deliverables, to produce a detailed schedule: the Task Information Delivery Plan (TIDP)[11]
- **The owner's EIRs** with details of the GID levels which will be actually implemented at the various milestones and the correct people to manage this (cf. the "EIR & Fiches GID" appendix (EIR & GID Forms))

Defining the Means Used (Technical and Other) to Meet the Owner's Requirement

- The BIM Manager specifies all the **information delivery arrangements, always complying with the owner's requirements**, such as:
- The convention to be used for naming project files
- The formats in which files will be exchanged among the parties involved in the project
- General rules for modelling (maximum size, cutting and cross section options for models, classification, project geo-referencing, measurement units, etc.)
- The checks which will be put in place
- How the CDE will be used

Comments

1/ Compliance with the final BEP (post-contract) must be **contractually binding**. Therefore there has to be **consensus among all the stakeholders** so that they will then not be free at any time to "stop" through lack of skills or financial resources (software licences, training, etc.).

2/ **Whenever a change is made, the BEP must be updated** as regards the elements it contains. It is made available to **everyone working on the project** via the project's CDE.

[11] The acronym "TIDP" and its definition, just like "MIDP", are laid down by ISO/DIS 19650-1.

3.3 Project Monitoring

The project's "BIM Manager" is responsible for ensuring compliance with the BEP. It is advisable that regular coordination meetings are held (regardless of whether they are specifically devoted to BIM or not) and that a monitoring document is used which allows the project to be supervised according to the actions which need to be taken between each milestone and for each company involved.

We have provided a monitoring document template in the appendices: "Fiche de suivi BIM" (BIM Monitoring Form)

There are different kinds of actions that need to be identified, such as:

- **Management**: in order to sort out an organisational or administrative problem
- **Reminder about a deliverable that needs to be sent out**: based on the deliverables schedule stipulated in the BEP.
- **Information that needs to be completed/provided**: this may be geometric information, non-geometric information or external documentation
- Etc.

Depending on the assessments carried out, it is recommended that additional reports are attached to these monitoring forms:

- So that any non-compliance identified can be described in more explicit detail
- So that if a problem is blocking progress, a formalised solution (technical or organisational) can be put forward to be used directly but which will also provide a lasting solution should similar cases arise in the future.

At the end of a phase (or an intermediary milestone), a final assessment is made based on the models and deliverables so that the BIM Manager can attest compliance with the BEP and validate the project moving to the next phase. The monitoring document is then signed off and a new one is created.

3.4 Workflows (Summary Diagram)

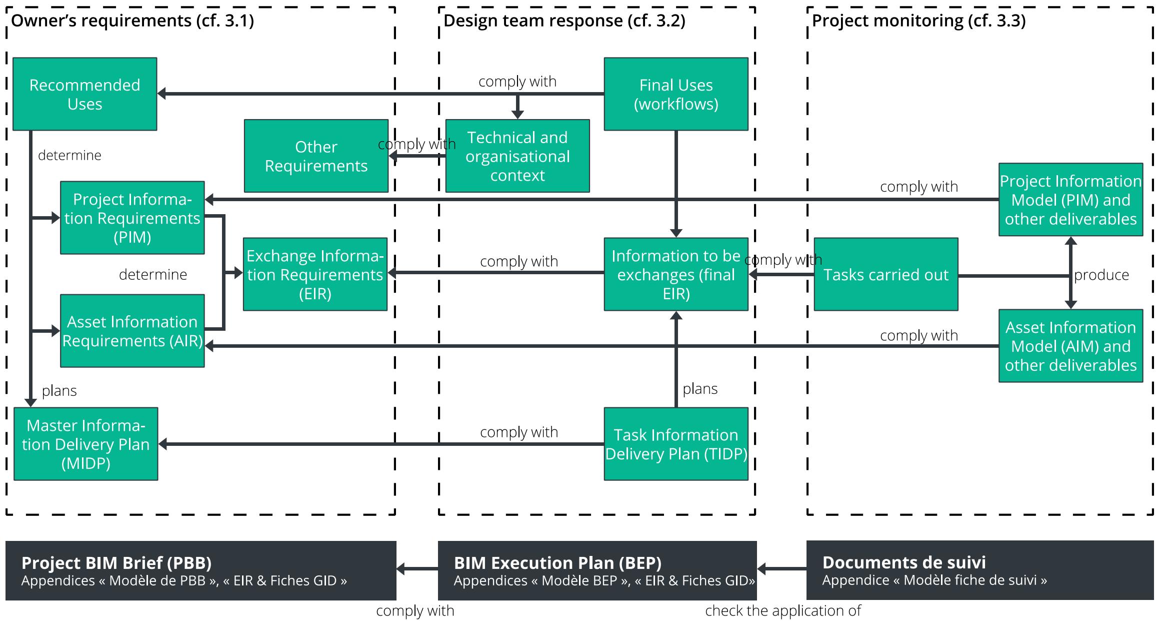

Figure 8. Process Workflow

4 Conclusion

The different aspects of BIM presented to you in this guide provide a reference framework which you can use to run a BIM project.

As mentioned in the introduction, this reference framework is not prescriptive. It is each individual's responsibility to take ownership of it, to experience it and to make it fit with their own needs. Each actor in the sector is encouraged to go down the BIM route and, by giving their feedback, support the development of the "BIM Skills Centre" which the CRTI-B has set up.

To go beyond this, a final appendix entitled "Bonne pratiques collaboratives BIM" (BIM Good Collaborative Practice) sets out the sequencing of the project phases (from programming to operation) and how they are generally run when BIM is used. This appendix will provide a better understanding and further details of how the owner's team, the project management team and the companies involved should collaborate while following BIM methodology.

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ISO/DIS 19650-2 [DRAFT]. “Organization of information about construction works — Information management using building information modelling — Part 2: Delivery phase of assets”

Other useful links

https://bimdictionary.com/

http://bimstandards.fr/

http://objectif-bim.com/

http://www.buildingsmart-tech.org/ifc/IFC2x3/TC1/html/index.htm

http://www.buildingsmart-tech.org/ifc/IFC4/final/html/index.htm

6 Glossary

In addition to the glossary below, please also refer to the bimdictionary.com website which lists terms and definitions from different directives and standards.

AIM *(Asset Information Model)*

An asset information model refers to "the geometric models, structured data and documentation" exchanged during the building's operation.

AIR *(Asset Information Requirements)*

Asset Information Requirements are the deliverables which the owner has requested for when its building is being operated so that the building can be managed (e.g. nomenclatures for the spaces, description of the spaces, equipment technical data, information about warranties, maintenance task schedules, etc.).

BCF *(BIM Collaboration Format)*

BCF is a format used to communicate messages describing the problems found on the digital model. It enables the various parties involved in a project to exchange comments about an issue.

BEP *(BIM Execution Plan)*

The BIM Execution Plan (BEP) is an updated, supplemented version of the PBB, based on the response given by the project management team. It is then contractually binding and becomes the guiding document to which anyone can turn at any time to understand what is expected of them and what they can expect of others. Therefore the methodology for composing a BEP follows the same themes as the PBB while at the same time completing it with those directives which will be actually implemented during the project:

- Description of the project and the BIM's end uses which are to be implemented
- Definition of the entire organisational context (with a detailed description of everyone's role and skill set)
- A summary schedule for the different milestones and expected deliverables, which includes intermediary deliverables (TIDP)
- Workflow and exchanges depending on the uses and milestones
- Table summarising the final GID levels per object and per milestone / phase (EIR)
- Definition of the technical context and methods for final exchanges (software packages and exchange formats, naming convention, modelling requirements, etc.)
- Other specificities to be taken into consideration (e.g. arrangements for checking models, geo-referencing, size of the models, etc.)

CMMS *(Computer Managed Maintenance System)*

A CMMS is used to assist with services to maintain a building such as managing equipment (inventory, location, technical information), managing maintenance jobs (corrective or preventive), managing the security of the facilities for maintenance work, managing purchases and stock, managing employees and their work schedules. Some of the information required for these services (for example information about equipment and its location) may be extracted from a digital model.

Digital Model

Models are geometric digital files, produced and supplied with data for the design, execution and management of the building. Models make it possible to visualise, carry out checks and simulations (thermal, acoustic, etc.) and also extract informed quantities and deliverables.

EIR *(Exchange Information Requirements*

Exchange Information Requirements define the correct “level of information requirement” at each milestone and who shall be responsible for it.

IFC *(Industrial Foundation Class)*

IFC format is an exchange format created to ensure interoperability between software packages making it possible to universally describe the “elements” which make up a building throughout its lifecycle (design, construction, operation) and according to different viewpoints (architecture, structure, thermal analysis, estimating, etc.). IFCs are included in a file whose format is pre-defined according to (STEP) ISO 10303-21, the international standard.

LOD/LOI – “*Level of…”*

The acronym “LOD” was used for the first time in 2004. At the time it stood for “Level of Detail” and determined the progressive reliability of information over a period of time.

In 2008, the American Institute of Architects (AIA) created the “BIM Protocol” which went on to become the benchmark document across the world and which introduced five “LOD” levels (100 to 500), with the same acronym, but used here to describe a different definition: Level of Development.

Each country has made this concept its own and created its own specifications. Among the most well-known and accepted, the Anglo-Saxon approach (formalised in PAS1192-2, published in 2013) mentions a Level of Definition whose value ranges from 1 to 7 and which is divided into two sub-levels: Level of Detail (LOD) for graphical content and Level of Information (LOI) for non-graphical content.

ISO standards are currently being drawn up to standardise these approaches. In particular, they introduce the more generic concept of Level of Information Requirement (please refer to the definition below in this glossary).

Level of Information Requirement

The level of information requirement defines the quality of each piece of information to be provided in terms of granularity so that it serves the purpose for which this information is required, and not more. So there are a certain number of measurement parameters, which may be complementary but independent, but which means it is possible to establish the granularity and the level of information requirement which need to be defined.

MIDP *(Master Information Delivery Plan)*

A general plan which lists when the various sets of information (deliverables) which the owner expects will be delivered at different phases during the project.

TIDP *(Task Information Delivery Plan)*

A detailed schedule listing delivery of the different sets of information (deliverables) between the project team members and specific delivery milestones (a breakdown of the MIDP).

« nD » ou « xD »

Adding different types of information, and in successive layers, to a 3D model is generally akin to adding new “dimensions”:

- 4D (adding time-related information) to assist with planning
- 5D to manage quantitative information and associated costs (addition of prices)
- 6D project lifecycle maintenance information to manage assets (addition of maintenance schedules)
- Etc.

As to how to define 4D and 5D, a consensus is emerging regarding the different approaches. However, beyond this there is no universal reference: information is added as and when needed, thereby multiplying the “xD” being manipulated (one dimension corresponding to one piece of added information (or one set of information)).

PBB *(Project BIM Brief)*

The Project BIM Brief describes the owner’s expectations with regard to how the BIM project is to be organised and deals with the following thematic issues:

- Description of BIM goals and the recommended / required ways BIM will be used
- Definition of the predetermined organisational context on the side of the owner’s team (with a detailed description of each individual’s role and skill set)
- Definition of the information requirements based on the milestones (PIR / AIR / MIDP)
- Table summarising the recommended GID levels per object and per phase (EIR)
- Definition of the technical context and recommended methods of exchange (software and exchange formats, naming conventions, modelling requirements, etc.)
- Definition of available resources
- Any other particular requirements

PIM *(Project Information Model)*

Project information model is the term used for the geometric models, structured data and documentation exchanged during the course of the project.

PIR *(Project Information Requirements)*

Project Information Requirements are the deliverables which the owner requests during the construction phase to manage the project and take decisions (models, plans and other graphical deliverables for architectural evaluation of the project; analysis reports to evaluate the building's performances; schedule tracking reports ; budget monitoring reports, etc.).

Workflow

A workflow is a series of production jobs punctuated by information exchanges (including deliverables) and validation steps. Formalising a process means it is possible to structure the jobs for all the various actors and to assess whether the process is running smoothly.

7 Appendices

Guide d'accompagnement BIM Luxembourg – EIR & Fiches GID

(Luxembourg BIM Companion Guide – EIR & GID Forms)

Guide d'accompagnement BIM Luxembourg – Modèle de PBB

(Luxembourg BIM Companion Guide – PBB Template)

Guide d'accompagnement BIM Luxembourg – Modèle de BEP

(Luxembourg BIM Companion Guide – BEP Template)

Guide d'accompagnement BIM Luxembourg – Modèle de Fiche de suivi

(Luxembourg BIM Companion Guide – BIM Monitoring Form Template)

Guide d'accompagnement BIM Luxembourg – Bonnes pratiques collaboratives BIM

(Luxembourg BIM Companion Guide – BIM Good Collaborative Practice)

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