BIM: Contractual and Legal Perspectives

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Peter Barnes

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Preface

Building information modelling (BIM) is having an increasing impact on many areas of operation in the construction industry, both in the UK and further afield.

People are becoming more familiar with the BIM process and better understand that BIM is not something to be feared but is a technological development that should be welcomed by all in the construction and civil engineering industries. Of course, there is a learning curve, as there is with all new technologies, but rewards for becoming immersed in the BIM process are well worth the effort.

While the technological advances are leaping ahead, some of the more difficult legal, contractual and liability issues are lagging behind somewhat.

Presently, the majority of participants in the construction and civil engineering industries that are operating BIM use a standard form contract, with a BIM protocol document annexed to it. However, it is not always clear what the legal standing of the BIM protocol document is, nor where it comes in the hierarchy of contract documents. There is also often uncertainty about where the risks, including the design risk, lie and it is not always clear which party carries the liability of failure and/or is required to hold the insurance cover for that liability.

At this still relatively early stage of the development of BIM, this is not a major concern, but, as BIM takes more and more of a hold on the construction and civil engineering industries, it will become one of the major issues to be resolved and, if it is not resolved, this will almost certainly hamper the progress of and the adoption of BIM.

It must be remembered that, apart from the technological advances that BIM brings with it, a parallel and important side benefit of the use of BIM is the fact that the participants in the process (clients, consultants, designers, contractors and sub-contractors) will all need to collaborate with each other. Therefore, after all the many years of talking about how a collaborative behaviour pattern can be encouraged and applied, it may be a technological advance (i.e. BIM) that will turn out to be the long sought-after catalyst for true collaborative working in the construction and civil engineering industries.

Against the above background, and particularly the continually fast-developing BIM process, this book is intended to assist parties in recognising the contractual and legal obstacles that may occur in respect of the BIM process, and also in guiding them as to how those obstacles may be dealt with, so that the full benefits of BIM may be achieved.

It is hoped that the readers of this book will find it to be informative and easy to read and understand, and that it will develop an interest in them to investigate how the legal and contractual aspects surrounding BIM may be best dealt with.

Acknowledgments

I am most grateful to all those who have contributed to my knowledge about the subject matter of this book. Also, I am pleased to give my special thanks to my wife for the unstinting support and encouragement she has given to me while I have been writing this book.

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About the author

Peter Barnes MSc DipICArb FCIArb FCIOB MRICS MICE MCInstCES has been actively involved in the construction industry for over 45 years. He is a Chartered Arbitrator, a Registered Panel Adjudicator, an Accredited Mediator and a Chartered Conservationist. He started as a Quantity Surveyor and progressed through to being the Chief Quantity Surveyor for a London-based building contractor. In addition to this, he also became the General Manager of the construction arm of the same company. Since moving into consultancy work 25 years ago, he has been appointed to act as arbitrator, adjudicator, mediator and expert witness in respect of both construction and infrastructure claims and disputes. He provides seminars and training on a wide range of contract and commercial topics relating to the construction and infrastructure industries, and he gives training on JCT contracts and sub-contracts on behalf of the JCT. He is a member of the Adjudication Society, the King's College Construction Law Association, the Society of Construction Law, and is a Liveryman of the Worshipful Company of Arbitrators. He is the author (and/or co-author) of many published books, including *The JCT 05 Standard Building Sub-Contract; Subcontracting under the JCT 2005 Forms; Delay and Disruption Claims in Construction* (now in its third edition); *BIM in Principle and in Practice* (also now in its third edition); and *BIM for Project Managers*. He has also had many articles published in various construction industry/legal magazines.

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Chapter 1
Introduction

The acronym BIM stands for building information modelling or building information management.

BIM is a computerised digital form of construction and asset operation which brings together technology, process improvements, data collection and digital information. It applies to all sorts of construction, civil engineering and infrastructure assets, whether that relates to new build, renovation, refurbishment or maintenance projects.

At its most basic level, BIM is a process that is used to design, understand and demonstrate the key physical and functional characteristics of an asset on a ‘virtual’ computerised model basis, providing the opportunity to concurrently design and visualise the asset in three dimensions (3D).

At its more advanced levels, BIM is the use of a computer software model (i.e. a digital representation) to simulate the construction of and the operation of an asset throughout its entire lifecycle.

The resulting computer model makes it possible for views and data appropriate to suit various users’ needs to be extracted and analysed, generating information that can be used to make decisions which can improve both the process of delivering the asset as well as its use during its entire lifecycle, both as an entity in its own right and also (in some cases) as it is incorporated into its surrounding location and environment.

BIM is now widely adopted, both in the UK and internationally, and those that use it are aware of the many benefits that BIM brings with it, including, among other things, reducing the amount of inaccurate and conflicting information, saving time and money, saving natural resources and reducing the carbon footprint of a building.

Further, whereas documents such as drawings, schedules and specifications were previously written and stored in hard copy form, this information is now being mostly digitally generated and stored on computer servers and/or on cloud servers which can be remotely accessed.

As time moves on, and as technology improves and develops, BIM models will give more and more direct access to the stored construction documents through links to the appropriate server and, even now, the digital flow of information from inception through to demolition is becoming more and more common.

Technological improvements are occurring frequently, but the contractual and legal consequences of using BIM are (almost inevitably) lagging behind somewhat; the purpose of this book is to highlight the legal and contractual issues that need to be taken into consideration when operating under BIM, to illustrate the ways in which these issues are presently addressed and to consider how the issues may be further addressed in the future.

Several construction and infrastructure industry reports (including *Digital in Engineering and Construction* (Gerbert *et al*., 2016); *Rethinking Productivity across the Construction Industry* (Lara, 2015); *Modernising Construction* (UK NAO, 2001)) have identified present systemic problems in the construction and infrastructure processes emanating from the poor levels of collaboration; the matter of collaboration (a key component of the BIM process) is considered later within this book.

A major aspect of BIM is the potential full collaboration of the entire project team – the employer, the architect, the engineers, the consultants, the contractor and the specialist contractors – in developing the project design. This full collaboration (which has been sought for many years) not only allows for the increased speed of project delivery, enhanced economics for the project and true lean construction at all levels but also has the potential to change the relationships between the participants in the construction industry, from the more traditional contracts based on obligations and rights to the more modern partnering and collaboration associations based on a fair allocation and sharing of risks and liabilities.

Navigating the legal and contractual landscape in BIM is essential for the successful and ethically sound implementation of projects within the construction industry. Addressing legal issues related to data ownership and liability is a basic step that requires clarity and precision in defining responsibilities among the various parties involved in the process. Clearly, by establishing unambiguous protocols for the ownership of data and outlining liabilities associated with the accuracy of BIM-derived information, potential disputes can be mitigated, thereby fostering an environment of trust and collaboration.

Therefore, the updating of forms of contracts to accurately reflect BIM requirements and responsibilities is vitally important. Further, as BIM methodologies continue to evolve, contractual frameworks must be agile, adaptable and responsive to the changing demands. Clarifying and establishing roles and responsibilities within contracts not only removes ambiguity but also facilitates effective communication and coordination among the many participants.

Ensuring compliance with relevant industry standards and regulations is plainly a non-negotiable aspect of BIM projects. Adhering to established standards not only promotes consistency and reliability across projects but also safeguards against legal complications. By aligning contracts with industry standards, BIM participants contribute to an environment that not only adheres to best practices but also fosters innovation and ethical conduct within the construction and infrastructure industries.

Exciting times lie ahead, and we are still at the very early stages of that new journey, but to make sure that the journey proceeds unhindered we must ensure that the contractual and legal developments related to BIM keep up with the ever-increasing technological advances related to BIM.

This book deals with an overview of BIM (at Chapter 2); the BIM strategy (at Chapter 3); the BIM parties, teams and the information management process (at Chapter 4); the procurement phase, the planning phase, the production phase and the close-out phase of information management (at Chapter 5); the legal challenges raised by BIM (at Chapter 6); the contractual framework (at Chapter 7); collaboration and new contracts in respect of BIM (at Chapter 8); issues relating to design liability and insurance (at Chapter 9); information security matters (at Chapter 10); and dispute resolution involving BIM (at Chapter 11).

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Chapter 2
An overview of BIM

2.1. What is BIM?

BIM stands for building information modelling or building information management.

BIM is a digital process that relies on a comprehensive computerised virtual three-dimensional (3D) model of a built object (often referred to as a built asset) which is capable of reacting to changes in the 'virtual' world in the same way that the physical built asset would react when actually being constructed and/or when in operation. This virtual reaction is achieved by applying software applications to a computer model that are used to design, understand and demonstrate the key physical and functional characteristics of the built asset throughout its entire lifecycle (i.e. from its initial conception to its final demolition and/or disposal).

This computerised virtual 3D model also forms a shared knowledge resource of information about the built asset, providing data that can be collected, managed and used for a variety of reasons (again throughout the entire lifecycle of a built asset).

The BIM process creates data files of physical components and spaces to produce a sophisticated computerised model which contains the graphical representation of the built asset and, just as importantly, provides details of all associated information in the computerised model, including the built asset's geometry, spatial relationships, geographic information and various data attributes related to construction and operation, as data files that can be used and reused for other applications.

In many respects, BIM is closely linked to many other digital developments including smart devices, the Internet of Things, smart buildings and structures, smart cities and digital twins. These digital developments are briefly commented on below.

Smart devices are devices that are used to electronically monitor a wide range of parameters within a built asset, including things such as structural integrity, equipment performance, energy consumption, temperature, humidity and air quality. The data obtained from the various smart devices can be analysed in real time to identify and track patterns, trends and anomalies; this data can then be used to reduce energy costs and improve sustainability, among other things. These smart devices are often self-calibrating and, in those cases, in particular, the smart devices can detect or even resolve potential issues (including structural or performance-related) before they cause ongoing downtime, thereby helping to reduce maintenance costs and aiding with the improvement of productivity.

Linked to smart devices, the Internet of Things refers to a network of physical smart devices, vehicles, appliances and other physical objects that are embedded with sensors, software and network connectivity, allowing them to collect and share data. The Internet of Things is designed to enable different smart devices to communicate with each other and with other internet-enabled devices, thereby creating a network of interconnected devices that can exchange data and perform various tasks (often) autonomously. Through the linking and use of smart devices, the Internet of Things is advancing a new breed of smart buildings/smart built assets that are better aligned with the priorities of end-users and property managers. The Internet of Things facilitates operational systems that deliver more accurate and useful information for improving operations of the built asset, particularly in use.

Linked with the above concept of smart buildings/smart built assets are structures and built assets that utilise technology to monitor performance on a variety of metrics, such as comfort, efficiency and productivity, with the aim of optimising resource usage, efficiency and comfort for occupants and end-users. These buildings/built assets are equipped with a variety of modern and innovative technologies, from artificial intelligence (AI), virtual reality (which is a simulated experience that employs 3D near-eye displays and pose tracking to give the user the immersive feel of a virtual world) and augmented reality (which is technology that overlays video or images onto a display of the physical world to create an interaction between the end-user and the digital and the physical worlds).

The phrase ‘digital twin’ also relates to smart buildings/built assets. A digital twin is a virtual representation of an object or system designed to accurately reflect a physical counterpart (either one that has been constructed or one that has yet to be constructed). The digital twin spans the built asset’s lifecycle and is constantly updated in real time using data from embedded sensors. By leveraging simulation, machine learning and reasoning, digital twins help make informed decisions and improve the original physical entity and serve various purposes, such as simulation, integration, testing, monitoring and maintenance. Essentially, digital twins allow an end-user to study and optimise real-world objects or systems in a virtual environment; this pairing of the virtual and physical worlds allows analysis of data and monitoring of systems to head off problems before they even occur, thus preventing downtime and helping to develop new opportunities and plans for future possibilities by using simulations of prospective actual events.

A development of the above, which largely concentrates on one built asset/facility, is the linking of several or many built assets/facilities so that, for example, the energy usage across a range of built assets/facilities is optimised; therefore, rather than having a smart building/asset, this can be developed into smart communities (sometimes referred to as smart cities). For example, if smart technology was used for the control of heating and hot water services, so that the required temperature in a built asset/facility was kept at an optimum level, there would only need to be a saving of a few percentage points to make enormous financial and energy savings across an entire community area (a smart city). As a further development of this, the optimum temperature level (for example) may itself be produced in part from algorithms that try to learn the end-users’ behaviours and usage.

Of course, some of the above matters are being used in the present day, while others will come into use more and more in the coming years.

2.2. The levels of BIM and BIM maturity

Although becoming much less important in the current digital world and less often referred to and relied on, BIM was categorised in its earlier days by referring to BIM 'Levels' and BIM maturity. As the terms BIM Level and BIM maturity may still be referred to by others elsewhere and may be seen in other literature, a summary of those Levels and maturity is provided below.

Level 0 Level 0 of BIM relates to un-managed CAD in 2D, with paper or electronic data exchange, and simply uses 2D CAD files for design and production information. This is not really BIM as we now know it at all.

Level 1 Level 1 of BIM represents the first step towards genuine BIM and the use of 3D data to produce and present design. At this level of BIM, the designer is usually operating in isolation from other designers rather than working collaboratively with them. Designers at this level usually use managed CAD in 2D or 3D format. Normally, some standardised data structures and formats are used, and there may also be commercial data management provided by separate stand-alone finance and cost management software packages which are not integrated into the general BIM model.

Level 2 Level 2 of BIM is a managed 3D format held in separate BIM discipline software tools with data attached. This level of BIM introduces the first steps to utilising other digital add-ons, such as 4D software for construction time and sequencing data and/or 5D software for cost information.

Level 3 Level 3 of BIM (sometimes referred to as 'Open BIM') relates to a fully integrated and collaborative real-time project model. This level of BIM is capable of utilising 4D construction time and sequencing software, 5D cost information software, 6D facilities management information software and other software dimensions for other management information or functions.

It must be noted that despite the above, more often, at the present time, the concepts of BIM Levels and BIM maturity are incorporated into the overall concept of 'digital construction', which is a concept which recognises that too precise a definition and delineation of BIM Levels and maturity simply risks misunderstanding the BIM concept and may actually impede progress.

Of course, every project is different from another so the precise requirements in relation to the use of BIM for the various projects will also differ; therefore, it is now recognised more and more that rather than focusing on abstract terms such as BIM Levels and BIM maturity, it is more important to concentrate on BIM deliverables (i.e. what outputs are required from the BIM process) and to make sure that those BIM deliverables are clearly stated. For this to be effective, every party on a BIM project needs to know what it has to deliver and when, what it can expect the other parties to deliver and when, and the risks and obligations that surround this basic structure therefore need to be spelled out completely, clearly and unambiguously.

2.3. The benefits of BIM

The BIM process brings with it many benefits. These benefits relate not only to the design, engineering and construction phase of the process (sometimes referred to as the CapEX phase) but also, and perhaps even more so, to the operations phase of the built assets (sometimes referred to as the OpEx phase).

Some of the many benefits that are achieved through the use of BIM are set out below.

- The BIM process encourages collaboration of working and design between the various consultants and helps to streamline and coordinate communication and collaboration between teams by providing a centralised platform for sharing and updating project data in real time.
- The BIM process permits everyone involved in the process (including the client/end-user) to have a clear understanding of the concept design by providing the ability to visualise (e.g. by way of a virtual 3D model walkthrough) what is actually going to be built. This model walkthrough can also allow the built asset to be seen, virtually, at different times of day and from different angles. This possibility reduces the likelihood of misunderstandings at the very early design stages, reducing the prospect of disputes occurring at a later stage.
- Because of the collaboration noted above, the BIM process allows for a faster design and construction process.
- The BIM process allows for the full coordination of the various consultants' designs, thereby helping to prevent conflict between those designs.
- The BIM process provides the ability to identify physical collisions and clashes (e.g. identifying ductwork that would otherwise run into structural members) and as such can be rectified before construction starts on site, thus saving time and costs.
- The BIM process assists with better design and space planning which allows for the optimisation of the use of the built asset.
- The BIM process permits value engineering exercises to be carried out on all the works or on portions of the works, as applicable, projected on a virtual basis.
- By using the appropriate software, the BIM process can accurately and rapidly generate an array of essential estimating information, such as materials quantities and costs, size and area estimates, costs and productivity projections. This software approach can be carried out as changes to the scheme are made and/or variations are introduced, so that it is easy to see at a very early stage what the likely implications of the proposed changes will be, allowing a great saving on human resources.
- The BIM process allows for the modelling and remodelling of alternative layouts and options and for the comparison and selection of different construction techniques to see which options are most beneficial and cost effective.
- The BIM process helps to provide a very useful and successful marketing tool for all those involved in a project, particularly for consultants and contractors of a smaller size, as elements of the BIM process can help them compete in marketing terms with much larger organisations with much larger resources.
- The BIM process helps improve health and safety by predicting and foreseeing risks through advance visualisation of the construction process. Further, the use of 4D timelined models in design supports the principles relating to 'inherent safe design', 'safety by design' and the legislative duties on designers.
- The BIM process permits contractors to carry out a dry run of the proposed construction, making it simpler for them and their subcontractors to work out the safest