

# CONSTRUCTION MANAGER'S BIM HANDBOOK

**John Eynon**



WILEY Blackwell

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# Dedication

Firstly to the Tribe of Eynon – my wife Anne Marie, and my children Natalie, Michael and Robert. I'm not sure they ever quite understand what I do, or why, but they support me anyway – thank you!

Secondly, this Handbook is dedicated to all those like me, who believe that our industry can be and should be so much better – more professional, respected, diverse, innovative, technologically advanced, valued and ...fun!

It can really happen! .... Keep the faith!

Cheers! :o)

JOHN EYNON

# #BIMCreed

Our god is in the Cloud

We have legions of Servers

We have our own Language ... IFC, LOD, 1192, B555, BEP, MIDP, TIDP *et al.*

Our Icon is the Wedge, forever may it be hallowed, branded on our palms

Our Holy Writ is the 1192s and The Protocol

We have our Apostles ... Mark, David and Mervyn – forever may they be venerated

Our Acolytes, Evangelists and helpers are everywhere ... they are the #BIMcrews,  
the #BIM4s, the #BIMCommunities and #TheB1M

Collaboration is our Shield of righteousness

Interoperability is our Staff of comfort, may our BIM always be Open

COBie/IFC is our Watchword ... respect to the Nick and the Smart Builders

WE are passionate, fervent

WE are enthusiastic

WE are committed to the #BIMcause

WE are the Makers ... we are the Coders and Digital Engineers, the growing point of  
the revolution

WE conceive, create, design, make, construct and operate

WE *will* transform our industry for a better day for all –

Respected, efficient, lean and profitable, technically innovative, oozing quality and  
creating an outstanding environment

And having fun :o) LOL!

UKPLC will be the leading global digital information economy, and #AECOBIM will be  
at its heart

Go forth in the Name of the #BIM and multiply!

# Foreword

Building Information Modelling and related technologies are set to transform our industry beyond recognition.

Within a generation we will have a digitally enabled industry sharing data and information via the Cloud across all stages of the asset lifecycle – seamlessly, efficiently, consistently, reliably and creating value for all stakeholders in the process, but most of all for asset owners and operators – our customers.

You may feel this is a far cry from the current state of affairs in our industry, but nevertheless this is where we are headed. Many are already on this journey, and more begin every day. A few years ago, in 2011, the UK Government embarked on a bold programme – to move our industry towards delivering digital management of assets in the public sector.

The target was set of reaching BIM Level 2 (UK) by 2016. For the leading UK Government departments this has been met, but we know the reality at local authority level and in the private sector is very different. Upskilling SMEs is a particular challenge. Our industry has a notoriously long tail and it will take several years before we can confidently say that we have reached Level 2 across the board.

However, Level 2 is but a staging post on the journey to Level 3 and beyond. The recently published Level 3 strategy document – Digital Built Britain – signposts us to the Internet of Things and the Internet of Everything, Smart Cities, Big Data and a world where everything joins up, including the built environment.

Moreover, this approach positions our industry as a leading player in the Digital Information Economy – UKPLC. The UK approach in developing the strategy, processes and standards to enable this vision to be achieved has already won international recognition – and considerable envy!

CIOB people are leading members of the industry holding responsible roles across the whole asset lifecycle. This guide for Level 2 brings together comment, guidance and advice from some of the leaders in UK BIM. Included is basic guidance about what Level 2 means, but also some thoughts on the future.

We are on the brink of the most profound and far-reaching transformation of our industry since the First Industrial Revolution. This *Handbook* is intended to help you begin that journey, and I commend it to you.

**James Wates CBE, FCIQB, FRICS, FICE, FCGI, FRSA**

James joined Wates Construction in 1983 and the Wates Construction Board as Marketing Director in 1994. He was appointed to the Wates Group Board in 1997 and became Chairman in 2013. He is Chairman of the Nominations Committee and until April 2013 was a member of the Remuneration Committee.

Outside the Group James is involved with several industry bodies. He is Chairman of CITB, Chairman of UKCG, Chairman of the BRE Trust, Past President of CIOB, a Member of CBI and a Non-Executive Board Director of Argent Services LLP.

James is also Chairman of the Prince's Trust Built Environment Leadership Group, Vice Chairman of the Queen Elizabeth's Foundation for Disabled People, a Governor of the Emanuel School and a Governor of the University of Westminster and a patron of the Wates Family Enterprise Trust. In January 2012 James was awarded the CBE for services to Construction and the charitable sector.

# Introduction

‘ ... Building Information Modelling ... ’

A phrase that creates fear, generates confusion and misconception, and is polarising our industry into those that do, those that don't, perhaps those that really don't care, and maybe those that would rather it just all went away!

For many thinking about starting their BIM journey, the difficulty is knowing where to start, achieving a basic understanding and then working out how to move forward.

The aim of *The Construction Managers BIM Handbook* is to provide some basic guidance, to cut through the misconceptions and provide CIOB members and the wider industry with a platform to progress.

This is deliberately intended to be concise, topical and a little basic.

With the help of some distinguished contributors, we will shed some light on the different aspects of BIM, unpack UK BIM Level 2 and explore what it means. This isn't necessarily for the 'experts', as I believe those that are trying to just understand 'which way is up' will far outnumber the early adopters and leading protagonists for several years yet. Our challenge is to transform an entire industry, dragging it by its bootstraps into the twenty-first century and beyond.

Let's be direct. I believe there is a tendency to over complicate this. To be bamboozled by the technology, excluded by the language and terminology, and blinded by the smoke and mirrors of media and PR. Perhaps some people would prefer you to continue believing that! There is money to be made in promoting the myths of complication. At its core, BIM is very simple – working together, collaborating seamlessly, efficiently, exchanging and using digital information all around the asset lifecycle.

Of course, like any change and working processes, there are rules and guidelines that need to be followed. Naturally, much of our thinking in this *Handbook* will be around process and technology, but we will also consider people. Fundamentally, BIM is about collaboration and sharing information around the asset lifecycle supported by a conducive culture and environment. Successful teamwork is achieved by *people* working successfully together. The technology as yet does not do everything for us! This soft underbelly of our industry is rarely consciously considered, yet we bump into this every day, whether we know it or not. The technology



and the processes/standards are perhaps the easy part of the equation, which looking from the outside some may find hard to believe.

We will look at the key BIM Level 2 documents and processes, and some of the technologies involved. We will also consider some broader contextual issues, such as education, the impact of the digital tsunami and the future of our industry.

The recent publication of the Digital Built Britain – Level 3 BIM Strategic Plan, 2015, points to the way forward way beyond 2016 – connecting and joining up sectors and industries on a global scale, in digital environments and communication. Whatever you call it, the Cloud, Common Data Environments, BIM, Smart Cities, Digital Built Britain, this is transforming the way we live, work and play – how things are and will be – the community of our existence.

The tidal wave of digital living will continue to impact across our industry for many years to come, in time affecting professions, institutions and academia. Other industries have made this transition over the last few decades; the built environment industry is perhaps the last major bastion of analogue thinking and working. But this is changing – rapidly! While the industry changes around us, Project, Design, Construction, Operations, Facilities and Information Management are all roles that will change and morph in the BIM environment, affecting businesses, organisations and our careers.

We have reached the 2016 UK target for Level 2 adoption. Key government departments have BIM embedded in their processes. For the rest of our industry, the picture is much more mixed with some beacons of excellence that still represent the minority experience.

If we keep on doing the same old things then we will always get the same results. In the past we have tried to improve existing methods a bit more each time, and while we might have leveraged small improvements, these aren't on a scale to make any real difference. Surely deep down we know that our industry can be better, *should* be better, in all kinds of ways. Our industry is under fire and pressure from many quarters and there is an urgent need for change, improvement, more respect and better quality. BIM is not the golden or silver bullet, but it is a catalyst that will help us leverage improvements and benefits.

We have a long way to go in establishing BIM Level 2 as business as usual, particularly among the various tiers of the supply chain and SMEs. I believe that the CIOB has a significant role to play in leading the change to a digitally based industry operating at UK BIM Level 2 and beyond. This *Handbook* is offered as a contribution to that journey.

## PS: Note to the reader

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How you read this book is entirely up to you (of course!). However, while you could read it cover to cover if you wish, that isn't the way it's been written. Each section can stand alone to a lesser or greater extent, so you can dip in to it as and when, depending on what topic is hot for you at the time.

The *Handbook* is intended as a jumping off point for your own #BIMjourney and learning. We've provided some thoughts, comments, basic explanations and further resources.

There is no short cut here.

We will all have to become technicians and technologists in some measure, not only understanding the details of our own discipline but also how, in the BIM world, it works for us. With that comes the territory – we need to understand the regulation, standards, process and technology appropriate to what we're doing and our own role/activity. So in a way it's back to school for us all – unless you're Gen Z in which case you know most of it anyway!

Also remember we've included some information that you can find on the Internet anyway, but we've reproduced it here in the *Handbook*, to save time and collect useful information together for reference.

Good luck and best wishes – J.

# Acknowledgements

Where to start?

First, the guys at the CIOB – Saleem Akram, Eddie Tuttle and the team – whom I've always found fantastically supportive and encouraging. If I've achieved anything over the last few years, then in some way most of it is due to you!

Second, the publishing team at Wiley Blackwell led by Paul Sayer. Bringing any publication to birth is a process fraught with angst and this one has been no exception – so thanks!

To my wife Anne Marie who has put up with me working on this at all sorts of odd times with longstanding patience.

And finally, in my own #BIM journey over the last few years, I've been very fortunate to rub shoulders with people who are leaders in their field. In the spirit of BIM, this book is a true collaboration and, as the list below shows, it is down to some pretty amazing, distinctive and inspiring contributions, from leaders in their respective fields – thank you! You have made this happen.

The guest contributors are:

James Wates	Foreword
Phil Jackson	Infrastructure
Anne Kemp	Collaboration
Saima Butt	People
Stephanie Kozandiak	B555 Roadmap, with permission from BSI
Stephen Hamil	Digital Toolkit
Sarah Rock	Legal
Kath Fontana	Facilities Management
Steve Race	Digital Security
Mark Bew	Beyond Level 2
Richard Threlfall	The next construction revolution
Stephen Emmitt	Design Management
Fred Mills	Social Media
Alison Watson	Education
Rob Jackson	Dictionary/Acronyms

And finally thanks to the guys at Autodesk, Bentley, Codebook, Graphisoft, Vectorworks, Synchro, and Tekla.

# Glossary

BIM has its own language, full of terms, acronyms and at the outset a puzzling plethora of terminology which in itself is an enormous barrier to getting involved.

Rob Jackson and the team at Bond Bryan Architects have produced *The BIM Dictionary* and *BIM Acronyms* that are reproduced in full with their permission in Appendices A and B.

The beauty of these documents is that they are in plain English and are based on UK standards and terminology.

This is a tremendous piece of work by Rob and his team, and in the true spirit of collaboration has been freely contributed to the industry.

At the time of going to press these are the latest versions, but they are being continually revised and you can access current versions here:

<http://bimblog.bondbryan.com/document/>

And there is an online version published here by Darren Lester at SpecifiedBy:

<https://www.specifiedby.com/resources/bim-dictionary>

My thanks to Rob and Darren who have saved me a huge amount of work!

Very well done guys!

# Notes on Contributors

Any project is a team effort. This *Handbook* is no exception and I'm delighted, fortunate and grateful, to have been able to enlist the help of the following contributors, who are leaders in their field in their own right.

*BIM = Collaboration!*

Thanks to you all for your specialist contributions that have filled in the context for UK BIM Level 2 and the way forward.

## **Mark Bew MBE**

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Mark is the Managing Director of Engineering Construction Strategies and Chairman of the UK Government BIM Task Group and BuildingSMART (UK). He is tasked with the delivery of Building Information Modelling and Soft Landings into the UK Public Sector by 2016. The programme was awarded the International Fiatch award for outstanding leadership and innovation of a programme recognised as world leading.

Mark is a Chartered Engineer with strong technical and commercial skills and a BSc in Computer Science. He is currently researching the use of BIM to improve the social outcomes of the built environment for a PhD.

Mark was previously Business Systems Director at both Scott Wilson Group and Costain Group plc, and has held positions with John Laing, Kvaerner Construction and GEC Avionics. He was awarded the MBE for services to construction in January 2012.

## **Saima Butt**

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Change Advantage was founded in 2001 by Co-Directors Aamir Ahmed and Saima Butt, driven by their belief in the limitless potential of individuals, teams and organisations. Drawing on years of valued practical experience in leading and developing teams in industry, and applying their unique mix of intuition, energy and humour, they aim to bring out the best in every person they work with.

Saima's corporate experience in the pharmaceutical industry was followed by an MBA at the OU. She coaches and mentors senior executives and holds a Master Certified Coach (MCC) credential with the International Coach Federation (ICF), an elite band of coaches internationally. Her work also takes her around the world as an ICF accredited Coach Trainer and Certified Mentor Coach, teaching professionals how to become successful coaches in their own right.

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## **Stephen Emmitt BA (Hons), Dip. Arch., MA (Prof. Ed.), PhD, Architect**

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Stephen is an architect and Professor of Architectural Practice at the University of Bath, Department of Architecture and Civil Engineering. He is Director of the Department's Centre for Advanced Studies in Architecture (CASA) and Editor-in-Chief of the *International Journal of Architectural Engineering and Design Management* (AEDM). He is the author of numerous books and articles on design management and architectural technology. Prior to entering education, Stephen worked as a design manager, and that experience continues to underpin his interest in the challenges of collaborative working in temporary project teams.

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## **John Eynon**

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John is a journeyman architect and design manager, having spent over 35 years in the AEC industry.

Over that time he has worked in the public and private sectors, and for 15 years in total worked with Carillion and Wates in Design Management and Work Winning.

He works with Class of Your Own and Surrey SATRO, and has lectured at various universities including Bath, Loughborough, Reading and Northumbria. He is now a PhD research student at Leeds Beckett University, looking at the impact of BIM and also team collaboration.

During the last five years he has become increasingly involved in the UK BIM agenda. He chairs the South East Regional BIM Hub, is involved with BIM4SME, represents the CIOB on BSI B555 and other industry groups, and works with the CIOB on BIM and regional presentations/workshops. He is a BRE Academy BIM Accredited Professional.

He is author of *The Design Manager's Handbook*, published by Wiley Blackwell in 2013.

Through his own consultancy, Open Water, he provides services related to BIM, Design Management and Work Winning.

He lives on the south coast with his wife Anne Marie and children, including various dogs and cats and a fire bellied newt.

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## **Kath Fontana BA (Hons), Cert IOD, FRICS**

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Kath is a Chartered Facilities Management Surveyor with 25 years' experience of delivering Facilities and Asset Management solutions working for blue chip companies such as Serco, Aspire Defence Services, Interserve and most recently BAM FM Ltd, a wholly owned subsidiary of BAM Construct UK. She has extensive experience of managing complex programmes and service delivery at senior level across a range of sectors and within various contracting arrangements, including PFI.

Kath has particular experience in managing the interface between construction and FM and as a result she is passionate about innovation, integration and the whole life

management of buildings. Most recently, she has been instrumental in developing BAM's integrated construction/FM strategy.

She is active in the development of professional standards, being Chair of the RICS Professional Group for Facilities Management, Vice Chair of the Government's BIM4FM Group and a member of the BSI Advisory and Technical Committees for FM. Kath is a mentor on the FLUID Diversity Programme and a regular speaker at industry events. She was a finalist in the 2014 Women in the City Awards.

## **Adrien Guillemet**

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Adrien Guillemet is the 5D (BIM) Information Manager at Henry Riley LLP. He joined the company in 2014 as the KTP Associate attached to the University of Reading, where his main research focus is 5D BIM Quantity Surveying. He was born in France, where he holds an MSc in Mechanical Engineering, and then moved to Canada, where he studied Civil Engineering with a special interest in BIM and computer vision. Now at Henry Riley in Croydon, he is responsible for BIM development and projects within the company.

## **Stephen Hamil**

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Dr Stephen Hamil is Director of Design and Innovation at NBS. Stephen first started working on NBS products in 1999 and has played a big part in the developments of products such as NBS Building, NBS Create and the National BIM Library. He is the project lead for the BIM Toolkit project, which will complete the Level 2 BIM suite of tools for the UK Government's BIM Task Group. Prior to joining NBS, Stephen studied at Durham University. His first degree was in Structural Engineering followed by a PhD in the digital modelling of building structures.

## **Phil Jackson BSc CEng FICE FRSA**

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Phil is a Fellow of the Institution of Civil Engineers with many years of practical experience in design and construction. He is an acknowledged leader in the deployment of Information Technology in Infrastructure Design, Construction and Operational Management. His background and experience has encompassed most aspects of the construction industry, from buildings, through infrastructure, to asset management.

He is passionate about the use of data as an asset and seeing it used throughout the lifecycle of the built environment. And he feels strongly that BIM has too long been seen as a 3D modelling solution and not the information management tool it really is. He is therefore actively involved in helping asset owners, designers, builders and operators develop strategies that capture manage and leverage this information.

Over his career, Phil has been involved in some of the world's most prestigious projects, including the UK Channel Tunnel, Hong Kong's Airport, Heathrow Terminal 5, Dubai Festival City, Masdar City in Abu Dhabi and London Crossrail.

He is a member of the London Crossrail BIM Advisory Panel and has worked with the UK BIM Task Group as a team member developing strategy and supporting the delivery of BIM to Government departments majoring on BIM for Infrastructure for the Highways Agency and the Environment Agency. Most recently, he has joined the Atkins team assisting the UK High Speed 2 Rail project in implementing information management solutions to the project.

Phil runs his own independent consulting company and is Royal Academy Visiting Teaching Fellow for BIM at the University of Surrey. He also chaired the Institution of Civil Engineers Information Systems Panel for a number of years, is a board member of Building Smart UK, and serves on a number of standards steering groups related to BIM.

## **Rob Jackson**

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Rob is a qualified architect and has delivered projects in the education and advanced manufacturing sectors.

His significant project experience and passion for technology resulted in his selection for a number of special projects, including the development of the quality systems and office intranet facility. This work then led to his current role of BIM Manager.

He speaks at both national and international events as a passionate advocate of an open BIM approach, exploring the sharing of data between different software packages via the 'IFC' open format and promoting industry wide standards that enable full collaboration between different parties.

He chairs the sub-committee for the AEC (UK) BIM Protocols for GRAPHISOFT ArchiCAD, is a member of the buildingSMART UK's Technical Group, an ambassador for thinkBIM at Leeds Beckett University, tweets and also writes Bond Bryan Architect's BIM Blog.

## **Anne Kemp**

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Dr Anne Kemp is an Atkins Fellow and Director at Atkins, responsible for BIM Strategy and Implementation across the UK. She has been working in the industry for 25 years, delivering information to where it is needed for informed and intelligent decision-making. At the start of 2015, she became Vice Chair of BuildingSmart UK, having completed two years as Chair for AGI, where she remains as an active member of Council. She is Chair of ICE's BIM Action Group, and BIM4Infrastructure UK. She has been part of the UK Government BIM Task Group helping the departments to implement BIM, in particular the Highways Agency and Environment Agency, and recently graduated as a prizewinner for her MSc in Coaching and Behavioural Change at Henley Business School, focused on enabling sustained collaborative working.



## **Fred Mills**

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Fred Mills is Founder of The B1M ('BIM one million'); a free BIM video resource that is inspiring one million people to help mobilise widespread BIM adoption. Fred has grown The B1M into an award-winning social enterprise business that now reaches people across six continents. He lives in Surrey with his family.

## **Steve Race**

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Steve Race is currently a Lecturer at Middlesex University assisting in the delivery of the MSc Building Information Modelling Management Course. He recently represented the Royal Institute of British Architects as a co-contributor to a new and first Code of Practice for Cyber Resilience in the Built Environment, carried out under the auspices of the Institute of Engineering and Technology.

Between 2003 and 2006 he was one of two lead consultants on the Government funded programme Avanti, whose brief was to facilitate project teams in the implementation of BIM.

Between 2006 and 2011 he taught Management Practice and Law at Degree and Diploma levels at Oxford Brookes University and was also the Programme leader for the Part 3 examination, which is the final stage of architectural qualification before entry to the architects' legal register.

During 2012 and 2013, he was the BIM Hub Ambassador and a member of the BIM Task Group, Core Management Team, both concerned with delivering the Government's message on BIM.

For 40 years he has been involved in a wide variety of national and international, ground-breaking projects in cooperative working supported by IT, currently called BIM.

## **Sarah Rock**

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Sarah Rock is a member of the Construction and Projects team at RPC. She acts for clients in the resolution of construction-related disputes as well as advising clients through the various stages of construction transactions and has experience of drafting and negotiating core and ancillary construction documents.

Sarah advises on the legal aspects of BIM and has spoken at various conferences on the subject. Sarah tweets regularly about BIM as well as writing BIM related blogs and articles. She is a named contributor to the Chartered Institute of Building's Complex Projects Contract having assisted with the drafting of the BIM clauses.

Prior to entering the law, Sarah worked in the construction industry as an electrical contractor and also ran her own CAD engineering business.

## **Richard Threlfall**

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Richard is UK Head of Infrastructure, Building and Construction at KPMG and has over 20 years experience in the financing and structuring of infrastructure projects.