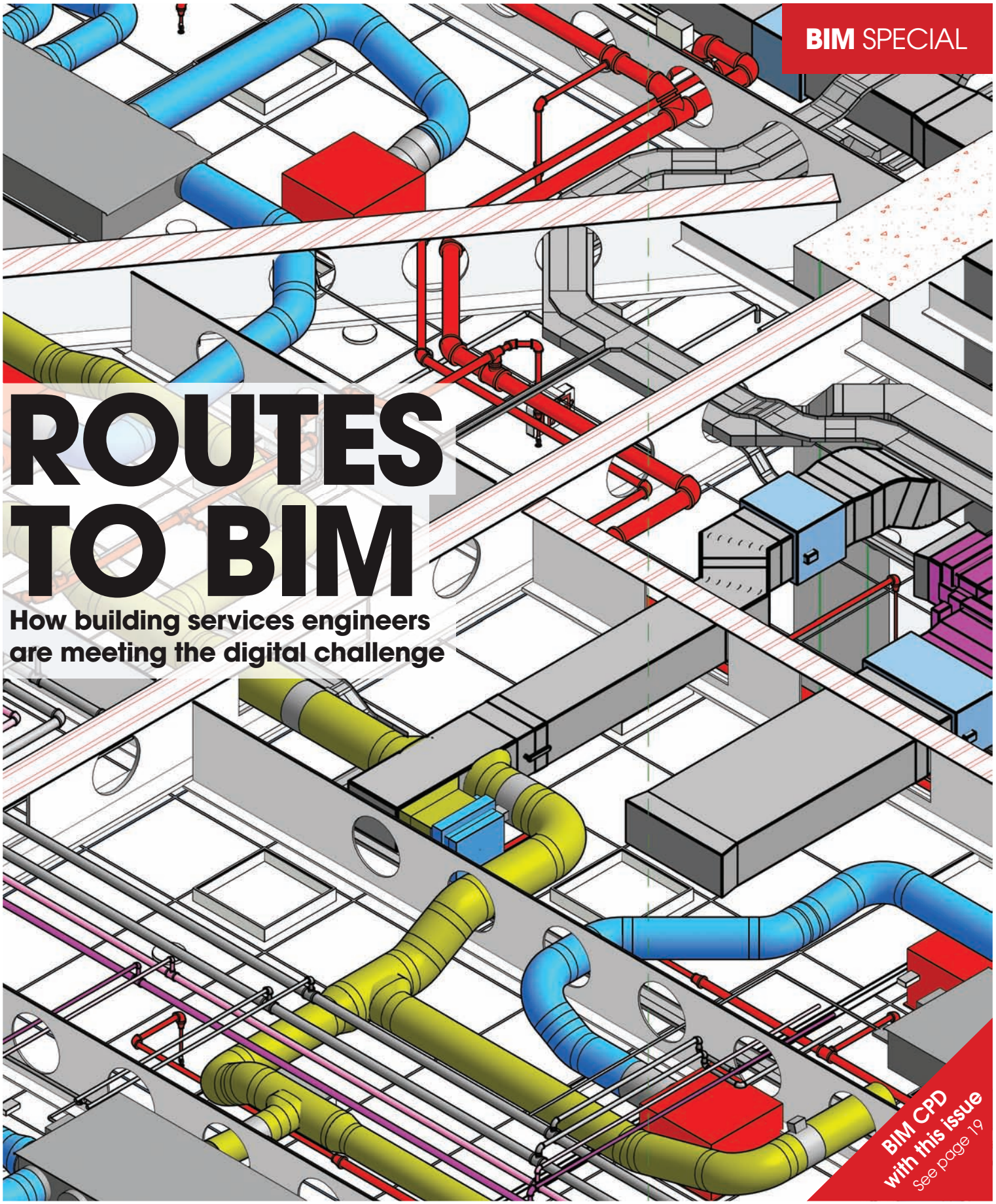
CIBSE JOURNAL

The official magazine of the Chartered Institution of Building Services Engineers

SPONSORED BY ANDREWS WATER HEATERS

June 2016
www.cibsejournal.com



BIM SPECIAL

ROUTES TO BIM

How building services engineers are meeting the digital challenge

BIM CPD with this issue
see page 19

When you need hot water, and you need it fast. It has to be Andrews. Proven in the most demanding environments, from rugby clubs and military barracks, to hotels, hospitals and university campuses. Our industry-leading products are designed to work, and keep on working. First time. Every time.

Sales: **0345 070 1055** Web: **andrewswaterheaters.co.uk**

Andrews. Built to perform.

ANDREWS
WATER HEATERS

CIBSE JOURNAL

Supplement

www.cibsejournal.com

Editorial
Editor: Alex Smith
Tel: 01223 378034
Email: asmith@cibsejournal.com
Deputy editor: Liza Young
Tel: 01223 378048
Email: lyoung@cibsejournal.com
Designer: James Baldwin
Technical editor: Tim Dwyer

Advertisement sales
Sales manager: Jim Folley
Tel: 020 7324 2786, jim.folley@redactive.co.uk
Sales executive: Darren Hale
Tel: 020 7880 6206
darren.hale@redactive.co.uk
Sales executive: Patrick Lynn
Tel: 020 7880 7614
patrick.lynn@redactive.co.uk
Senior sales executive: Paul Wade
Tel: 020 7880 6212
paul.wade@redactive.co.uk
Advertising production: Jane Easterman
Tel: 020 7880 6248
jane.easterman@redactive.co.uk

For CIBSE
Journal production manager: Nicola Hurley
Tel: 020 8772 3697, nhurley@cibse.org

CIBSE Journal is written and produced by CPL (Cambridge Publishers Ltd) Tel: +44 (0) 1223 378000. www.cpl.co.uk
1 Cambridge Technopark, Newmarket Road, Cambridge, CB5 8PB.

Editorial copy deadline: First day of the month preceding the publication month

Printed by: Warners Midlands PLC

CIBSE, 222 Balham High Road, London SW12 9BS
Tel: +44 (0) 20 8675 5211. www.cibse.org
 ISSN 1759-846X

Subscription enquiries

If you are not a CIBSE member but would like to receive *CIBSE Journal*, subscribe now! Costs are £80 (UK) and £100 (international). For subscription enquiries, and any change of address information, please contact Nicola Hurley at nhurley@cibse.org or telephone +44 (0)20 8772 3697. Individual copies are also available at a cost of £7 per copy plus postage.

The 2016 US annual subscription price is £100. Airfreight and mailing in the US by Air Business, C/O Worldnet Shipping NY Inc, C/O Air Business Ltd / 155-11 146th Street, Jamaica, New York, NY11434. Periodical postage pending at Jamaica NY 11431. US Postmaster: Send address changes to *CIBSE Journal*, C/O Air Business Ltd / 155-11 146th Street, Jamaica, New York, NY11434.

Cover image: Hilson Moran

ABC audited circulation: 18,625 January to December 2015

The next chapter

The deadline for using Level 2 BIM on centrally procured projects was reached on 4 April, and the latest NBS figures suggest that large numbers of practioners are now getting up to speed with BIM (page 4).

We have two case studies that demonstrate how BIM is helping project teams coordinate design, installation and maintenance on site, and it's encouraging to see both projects tagging assets and linking back to operating and maintenance manuals.

But client involvement with BIM is the expection rather than the rule, according to Rolton associate director Matt Colebrook. While BIM appears to be forcing contractors and designers to work together at an earlier stage of design, Colebrook says clients generally lack awareness of BIM. In his experience, the 'handover element is being ignored'. This is borne out by the NBS survey that found only 16% of construction professionals have passed the model over to a FM team.

Another group not engaged in BIM, says Cundall's Chloe Agg, is sub-contractors who are not yet equipped with the hardware, so cannot see coordinated drawings from the model.

The next stage on the journey is optimising model data in the operation of buildings. David Philp, former head of government BIM Implementation, says there is huge value in being able to manage and analyse the data, and is now looking to maximise its use in his new role as director of BIM at Aecom.

Alex Smith, editor
asmith@cibsejournal.com

CONTENTS

04 ENTERING THE DIGITAL AGE
A new era of tech-savvy engineering dawns

06 BREAKING BIM
Removing the stigma around BIM

07 LAW AND ORDER
Legal and contractual considerations for BIM

10 INHERENT BENEFITS
BIM's central role in design of the award-winning Rosalind Franklin laboratory

14 MONUMENTAL FEAT
Using Level 2 on London's new Monument Building

19 CPD
Moving product information into BIM

Tailor data to get the most out of BIM

After much anticipation, discussion and debate, BIM at Level 2 now needs to be implemented on all centrally procured, public-funded construction projects.

Undoubtedly, the impact will be seen, first and foremost, in the design and construction of public sector buildings, where it is hoped that the promised benefits of better collaboration, closer working relationships and improved design, creativity, innovation and visualisation will be realised.

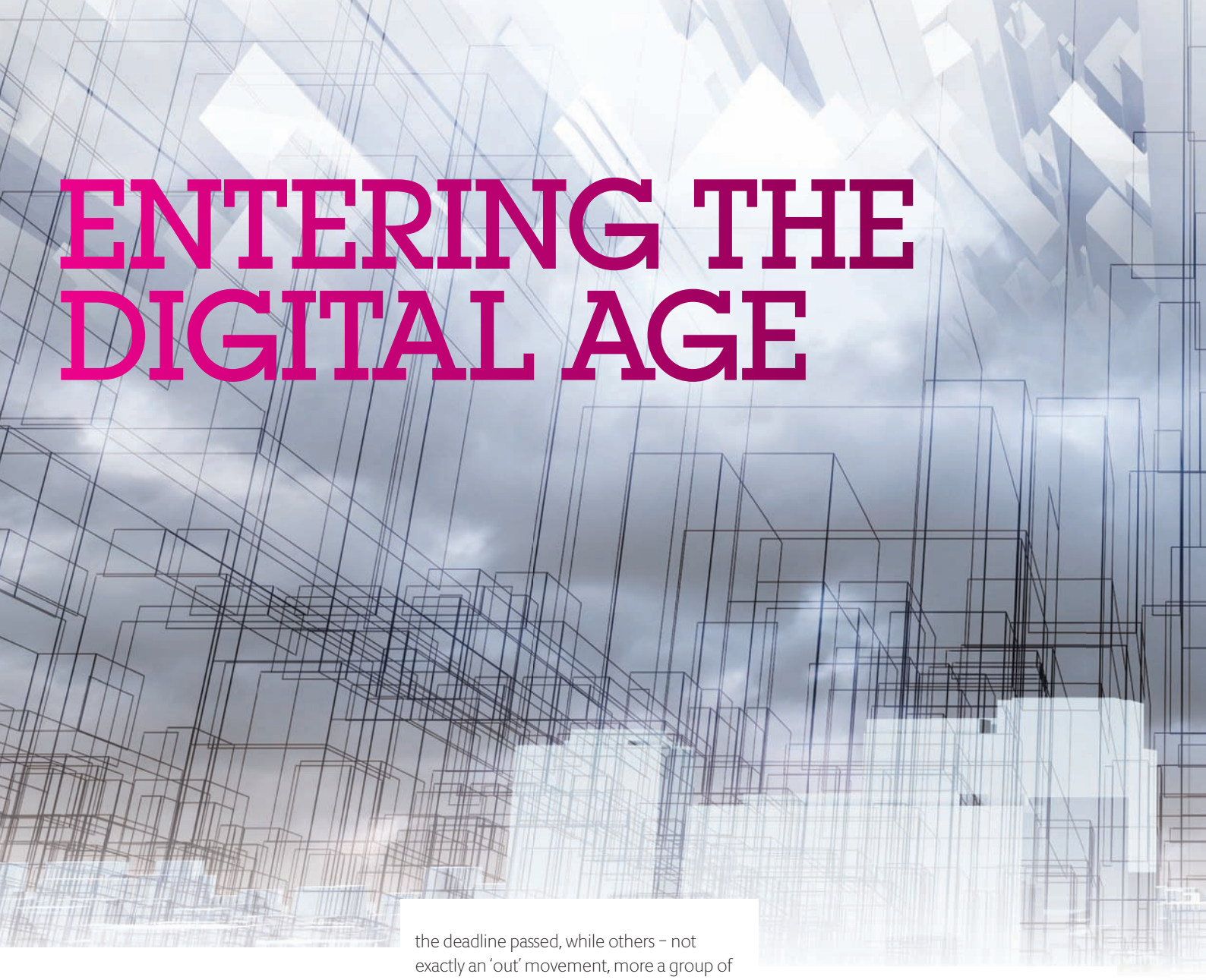
However, the benefits of BIM are more far-reaching than that. The concept may have come about from a need to improve the design and construction process, but there are advantages for the facilities management (FM) sector too. We must not forget that, once a building is handed over, the building manager can use BIM for many purposes, such as planning maintenance and repair programmes – improving efficiency and achieving cost and carbon savings.

For this to become a reality, however, the data must be tailored, with building designers and FMs needing quite different sets of information.

Facilities management should be considered at the very start of projects, so the information required can be identified – but it needs to be included at the right stage, and in the right format.

If an FM manager is presented with a model that contains lots of information they don't need – and very little of what they do – this will inevitably lead to them continuing to use traditional methods of managing a building, rather than embracing the new world of BIM.

Chris Meir,
Sales director,
Andrews Water Heaters



ENTERING THE DIGITAL AGE

Do recent advances in building information modelling (BIM) herald the dawn of a generation of technology-savvy engineers? **Ewen Rose** logs on

Amid the growing clamour and controversy surrounding the UK's EU referendum on 23 June, another key date has slipped past quietly - the 4 April deadline for the introduction of Level 2 BIM on public sector projects. The electorate is already showing signs of 'Brexit' fatigue – and the building services industry was clearly punch drunk after five years of debate, thousands of seminars, and millions of words about the battle to implement what is, fundamentally, a fairly modest step forward for information exchange on engineering projects.

A new mood of optimism abounds among the 'in' campaigners for BIM since the deadline passed, while others – not exactly an 'out' movement, more a group of informed sceptics – are keen to inject a note of caution. There is also concern that some major contractors are developing their own interpretations of BIM, thereby threatening to create a new form of technological anarchy.

But providers of BIM related services definitely have a spring in their step. 'It seems we are on the gradual slope of enlightenment towards productivity,' says BIM Academy managing director, Peter Barker, who gives credit to the government for creating momentum. The Academy has seen in other parts of the world how a 'lack of direction or "laissez-faire" policy... frequently leads to unstructured practice, inconclusive debate and unfulfilled potential and inertia'. So if the UK's BIM mandate wasn't exactly a 'Big Bang', it was a gentle shove – so how is the 'pull' going across the sector?

Adoption

According to the 2016 NBS National BIM Survey, optimism about the modelling tool is high and adoption rates are rising, albeit slowly – up to 54% from 48% last year. Of those respondents who were aware of BIM, 86% expect to be using it by this time next year and 97% within five years. Yet 41% said they were 'not clear' about what was required of them to meet the government's mandate, and 28% said they lacked the necessary skills and knowledge to do so. And the recent ECA/CIBSE survey suggested that adoption within the MEP sector is lower still.

The government's vision is for BIM to deliver major operational benefits to end users and improve collaboration – but the NBS survey showed that only 37% of construction professionals have used BIM models from design to completion, and just 16% have passed a model over to a facilities management (FM) team. Adrian Malleson, head of research, analysis and forecasting at NBS, admits there could be a sizeable gap between 'intention' to implement and what actually happens. 'Adopting BIM is not trivial,' he says. 'You can't buy BIM in a box. More than 90% [of respondents] said that "adopting BIM requires changes in our workflow, practices and procedures".'

It requires considerable investment of time

and money, and this is creating a two-speed BIM highway with many small and medium-size enterprises (SMEs) stuck in the slow lane – or even on the hard shoulder – while the larger players power away. This is confirmed by Matt Colebrook, associate director of Rolton engineering group, who says small firms are struggling to put in place the investment, in terms of time, expertise and equipment. His company was grateful for a grant from the Northamptonshire Enterprise Partnership, which has helped it invest in the necessary building blocks for BIM.

'We were ready for the deadline because we had a plan,' Colebrook says. 'However, we had to invest considerably in training, as well as 3D modelling software and upgrading our hardware. The grant was extremely helpful – small firms don't have the resources of the bigger players, but we needed to make the investment to stay competitive. The industry has a long way to go with Level 2 before we can even think about further developments. BIM has not been implemented across the board yet, and is still something of a "buzzword" rather than a reality.'

Colebrook also believes clients have to become more engaged. 'The handover element is being ignored – yet we are all adopting this for the benefit of clients. The post-occupancy side needs to be planned properly, so clients can see the real benefits. We need to get better at explaining it.'

However, he does think the culture around project teams is changing thanks to the emergence of BIM. 'The coordination between design elements is the main selling point, as we all still spend far too much time trying to fix things on site. The great thing is that we are having conversations in contractors' offices about clash detection that simply wouldn't have happened before.'

Wider strategy

Level 2 is just a foundation and, although it is not fully in place, BIM is a central plank of the government's Digital Built Britain programme, which has a £15m development budget and is key to its Construction Strategy for 2016-20. The need to see BIM as part of this wider digital strategy is crucial, according to David Philp, director of BIM at Aecom. 'The government deadline was never going to be a Big Bang, but it has provided momentum that we can build on,' he says.

The deadline has opened up avenues into the FM sector and has stimulated innovation in the supply chain, Philp adds. Clients are also getting better at prescribing the data they want to improve lifetime operation of their built assets. 'A big benefit has been the ability to demonstrate and visually prototype innovative ideas,' he says. 'Few clients really want cutting-edge stuff on their projects because of the risk, but being able to visualise it makes them more likely to accept it.'

> The government deadline was never going to be a Big Bang, but it has provided momentum that we can build on
> *– David Philp, Aecom*

Level 2 is a long way from the big vision of a truly digital, interoperability model for construction and building services engineering – the industry 'model 4.0' championed by true believers such as Philp – but being able to better organise and provide embedded data is the bedrock on which that future will be built.

'You can't get to there if you don't get the foundation right,' Philp says. 'We are getting better at putting the labels on the suitcase and arranging our information more effectively. There is huge value in being able to manage and analyse the data.' The technical standards are now in place - the task is to get everyone to follow them.

If the true interoperability of more advanced BIM levels is some way off, the role of data management is already taking hold. CIBSE President, John Field, believes we need

to keep a close eye on what this means for the engineering workforce. 'We must not become slaves to technology,' he says.

'The accountancy profession recently stated that more and more of its base-load work is being taken over by computers, with dramatic consequences for its recruitment – the same could happen to us. The concern for us is that, eventually, the "grunt" design work of engineers will be completely computerised and we will move to a plug-and-play approach – we need to watch this.'

Philp sees engineers skilled in data analysis taking a leading role. 'These will be the rock stars of the future, and could be recruited from a computer science background – we are working with academia to get this right.'

Seismic change

A number of virtual reality tools in the pipeline will allow engineers to create high-quality visualisations of their ideas within BIM models and share these across the cloud. To anticipate this potentially seismic technological change, Field believes CIBSE should extend its membership to professionals from a wider community around the built environment, including those in the data and environmental management sectors.

His predecessor as CIBSE President, Nick Mead, also foresees a time – perhaps a decade hence – when 25% of the current labour force is replaced by IT. 'When we adopt BIM more fully then you could see many of the support jobs – such as estimating and quantity surveying – being replaced. The danger is that you end up with lots of busy fools, as engineers are left to do everything.'

Both presidents believe CIBSE has a key role to play in managing the transition and in providing the standardisation and commonality needed to ensure everyone is working with the same BIM platforms.

'We shouldn't fight digitisation – it is the right way to go and the rest of the world is moving this way, so we must keep up,' Field told a recent meeting of the CIBSE Patrons. 'We just have to be aware of the dangers, as well as the benefits, and make sure we manage the change.'

However, Mead worries about the possibility of a disconnect between the 'real' world and 'virtual' engineers who may not fully appreciate the practical nature of the things they design on a computer.

'They need to have good critical thinking skills to challenge designs,' says Mead. 'I grew up with Meccano; today's engineers grew up with PlayStation – we are in danger of entering an era of "the computer says..."'.

BREAKING BIM

If the advent of Level 2 BIM has left you scratching your head and wondering what digital technology has to offer building services, **Ben Roberts** explains

Baffled by the mysterious and ever-changing dark cloud of BIM? This new, regular column will bring you the most prescient BIM insights in the mechanical, electrical and plumbing (MEP) industry, share what is being discussed among the institutions, clarify what MEP professionals need to know – and what you don't need to be worrying about right now. Some updates will be informative; others will just provoke debate.

The aim is to demystify BIM and remove the stigmas that are preventing a move towards better ways of working digitally.

> Level 2 BIM has been a catalyst for some long overdue navel gazing

This month, RIBA Plan of Work stage 4 has been under the spotlight. Does anyone want to receive a not-fully-coordinated-detailed-design 'stage 4a', or should designers be delivering more coordinated models as standard? Should this attract a higher fee for designers, as the contractor no longer has responsibility for coordination? BSRIA's *BG6 Design Framework for Building Services* is widely respected and adhered to by MEP professionals, but does it reflect the needs of clients in the modern world?

Certainly the interface between designer and installer needs to be fine-tuned to ensure smoother handover of models at this stage; the current thinking is that early contractor involvement is very helpful on BIM projects. This means the installation requirements can be considered during the detailed design stage, rather than having to remodel everything afterwards. Plenty of food for thought on this one.

Level 2 BIM anyone? For those who don't know, this is the UK government's mandated method for delivering public sector projects as defined by 'the 10 Commandments' (that's not the official phrase, I made it up – but there are 10 aspects that define Level 2); in a nutshell, these include standard processes, team structures, classification, soft landings, data sharing methods, and advice on data ownership.

After a grandiose five-year buildup, 4 April came and went without the seismic shock many predicted. But Level 2 BIM has certainly been a catalyst for getting the industry to engage in some long overdue navel gazing. Here's a quick rundown of some of the things BIM will have made you think about recently: collaboration, sharing information, more efficient processes, digital technologies, the power of data, upfront coordination, security, client requirements, better post-occupancy analysis, and data visualisation or infographics. BIM covers all these things, and gives us a kick into the 21st century – exciting times!

BEN ROBERTS is the BIM delivery manager at Hoare Lea and a member of the CIBSE BIM steering group

LAW AND ORDER

All centrally funded public sector work must now be done using BIM, so the modelling process must become a common language for the whole industry. **Phil King**, of Hilson Moran, discusses the legal and contractual considerations associated with BIM

Building information modelling (BIM) is now extensively used in the design, construction and operation of buildings. It has been adopted across many building types by both the public and private sectors, driving improvements in team collaboration, accuracy and efficiency within the industry.

Technology and systems are being enhanced and fine-tuned all the time – but one thing that has lagged behind is how to deal with the legal and contractual matters associated with BIM. There are several issues to be dealt with, including: definitions and ownership of the model; fees; professional indemnity (PI) insurance levels; Construction (Design and Management) Regulations; consultant appointments; and building contract. The CIBSE BIM Steering Group has created a resource that aims to highlight these different areas and give advice on how to deal with them in a range of scenarios. The full report is available at **BIMtalk.co.uk**, but here we outline some of the issues the industry needs to address.

Legal and contractual concerns vary significantly depending on the client brief and the procurement process, as well as the scope of work carried out by the contractor and consultant. That said, there are common scenarios:

- Early engagement with a prime contractor
- Novated to main contractor on a design-and-build project
- Traditional procurement to tender at RIBA Stage 4. Contractor to complete the design.

One common issue is the traditional procurement route, where the consultant produces a Level 2 BIM to RIBA Stage 4 and then converts it to 2D drawings and specifications for tender purposes, based on notional plant and equipment manufacturers. The successful contractor and subcontractors then produce their own Level 2 BIM, based on the actual plant and equipment procured.

> Definitions of 3D, Revit and BIM 1, 2, 3 must be the same for all options – and industry wide

Some may say this is wasteful and that the client is paying twice for the model. On the other hand, the client gets the best of both worlds: the consultant defines clear systems, specification, parameters, space planning, routing and distribution to achieve competitive and meaningful tenders, while the contractor brings his commercial and 'buildability' skills.

An alternative route, such as quick engagement with a prime contractor, may lead to early meetings with the designers, the subcontractors and supply chain, resulting in the BIM model only being created once. In this case, the client would still want to see competitive tendering.

Above all else, though, the definitions of 3D, Revit, and BIM 1, 2 and 3 have to be the same for all options – and industry wide. Failure to ensure this leads to confusion and differing expectations, and complicates contractual obligations.

Fees, appointment documents and building contracts must also be back-to-back, well-defined and thorough, and lead to clear agreement of responsibilities by all parties. The more aligned the team is, the less risk there is with the project. A detailed BIM execution plan should be created by the whole team at the earliest possible stage, defining the project intent and how the work will be implemented. This will clarify who has responsibility for the model. The client ultimately owns it because they are paying for it.

Fees

Fees should increase in proportion to the scope and extent of the works required. The decision about whether the consultant or the contractor creates the Level 2 BIM model must be appropriate for the procurement route and agreed at the outset. If responsibility is split, this should be defined in the request for proposal (RFP), fee proposal, appointment documents and building contract, and reflected in the BIM execution plan.

Where roles are separate, the consultant's appointment should be defined at the RFP, fee proposal, BIM execution plan and contract document stages, so the contractor understands the consultant's responsibilities. PI insurers should then be notified about any additional services being provided.

Building managers and building services maintainers should be given enough relevant information for the ongoing management of the asset, allowing for the adaptation or extension of systems.

As an industry, we need to be BIM-ready. Avoidance is not an option, especially as all centrally funded government work must now use it. If contractual issues can be addressed and more clarity created, we're confident the industry and its clients will reap the rewards of BIM.

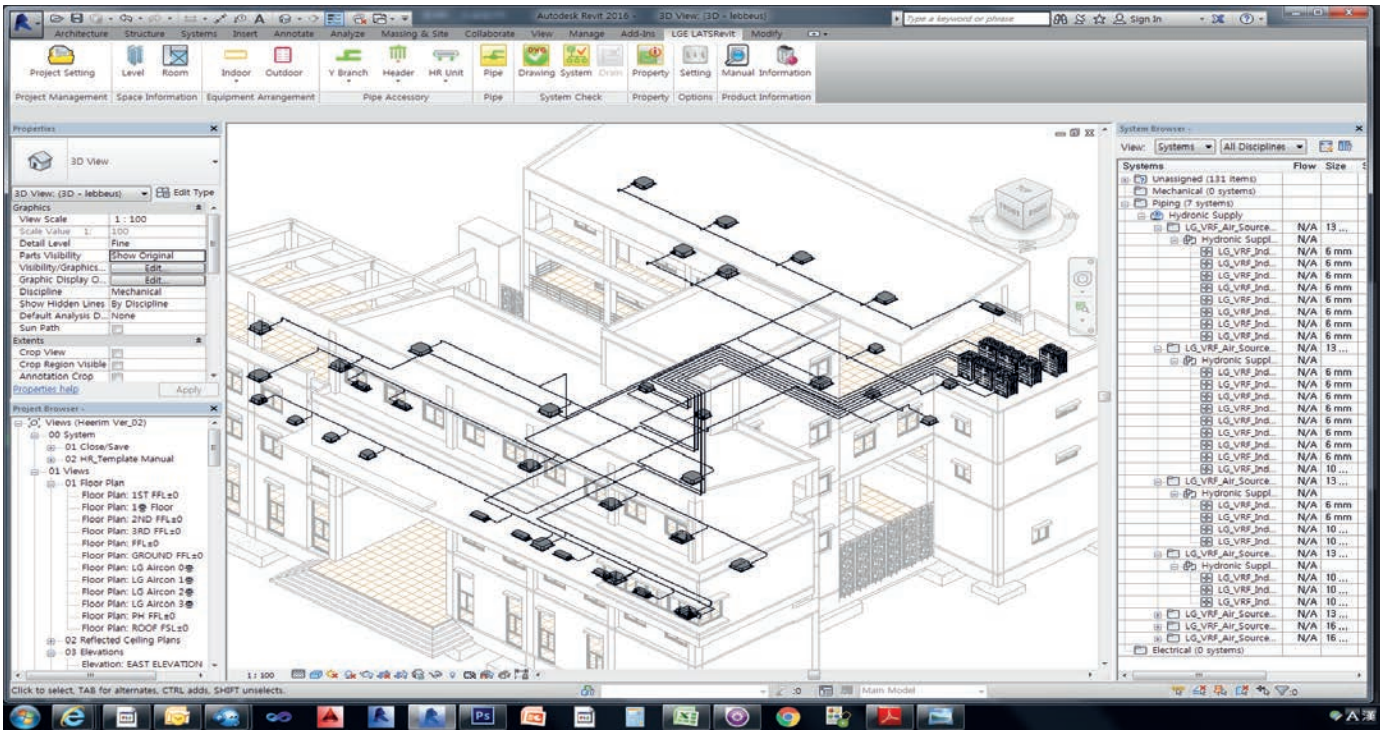
SCOPE OF THE REPORT

See BIMtalk.co.uk for advice on:

- **Definitions**
- **Fees**
- **PI insurance**
- **Split responsibility**
- **Consultant appointments**
- **Building contract**
- **Model ownership**
- **Procurement**
- **FM and CAFM**
- **Industry engagement**
- **Readiness**
- **Process/workflow**
- **CDM**
- **Pre-qualification questions**
- **BIM execution plan**
- **Risk**
- **Security**

PHIL KING FCIBSE is design director at Hilson Moran

TO THE SIXTH DIM



Overview of LATS REVIT menu

Working with BIM is like enjoying an engineering virtual reality. Your air conditioning design experience is enhanced to a new level with LATS REVIT says **Monica Marza**, Technical manager at LG

LG Electronics Air Solution Business Unit has introduced its first BIM simulation tool for direct expansion systems at MCE 2016 (Mostra Convegno Expocomfort was the biggest fair of 2016 for air conditioning in Europe). The application, called LATS REVIT is a plug-in for REVIT and it enables accurate design of LG Direct Expansion Systems in BIM environment. This application has been specifically developed to cater for consulting engineering companies in the field of HVAC that want to increase the effectiveness and accuracy of direct expansion systems in their projects.

The top three economic players (Germany, France, and the UK) in Europe are in the process of launching BIM strategies. The UK has mandated BIM for national government procurement in 2016. France will mandate BIM for public procurement in 2017. The details of what is going to be included in that mandate are still being worked out. It also appears that Germany will implement a BIM strategy in a similar timeframe around 2020. Nordic countries including Norway (2007), Finland (2007), and Denmark (2007) and the Netherlands (2012) have already implemented BIM strategies for public procurement. With a 30 % frequency of requests for BIM content in Europe from various actors, LG was committed for further investments thus exploring its capabilities of integrating a LG plug-in to REVIT.

As Michael P Totten was stating, given the benefits of BIM on the overall lifetime of a building such as: "20% reduction in build costs, 33% reduction in costs over the lifetime of the building, 47%~65% reduction in conflicts and rework during construction, 44%~59% increase in the overall project quality, 35%~43% reduction in risk, better predictability of outcomes, 34%~40% better performing completed infrastructure, 32%~38% improvement in review and approval cycles", one cannot look careless at the impact BIM is having. Therefore, LG has considered not only carefully conceived objects / families to be integrated in BIM, but also features and functions to participate in the overall conception of air conditioning systems in buildings.

When design engineers conceive an air conditioning system for a building, they must consider numerous factors – LATS REVIT can help reduce design time, by accounting for these constraints. Working within a 3D application scope with numerous information related to each equipment, LATS REVIT can perform simulations in real time conditions for variable refrigerant flow systems considering many of the direct expansion systems constraints such

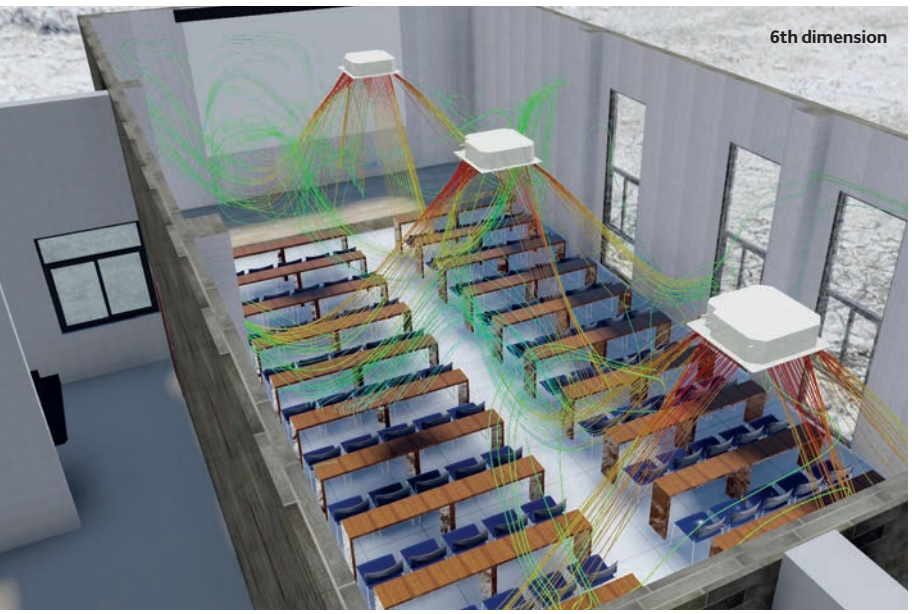
ENSION WITH LG

as: temperature, necessary loads, piping lengths, combination ratios, efficiency, recovery conditions etc.

LATS REVIT is not only a time saving tool for engineering companies that design HVAC building systems, but also a facilitator of objects that otherwise would have to be conceived from scratch such as the copper pipes. Checking and modifying LG VRF systems in BIM is now faster and more accurate than it has ever been before. At one click, system simulation will start checking the configuration for load ratios, temperature conditions, combination ratios, and piping lengths. Upon completion of the simulation, you can be assured the correct equipment has been selected for the job.

The reduced amount of time needed in tri-dimensional design means several variations can be considered in a short time frame. Once the tri-dimensional design is completed an equipment list is ensued, this can be the setup for a schedule. For the engineers, the schedule is interpreted as a planning that adds to the development of the construction hence the tri-dimensional design gains a fourth dimension, that of time. The timeline of the project/building/construction, this fourth dimension, has all the more significance as it carefully attends to all participants' need of knowing their own intervention moment thus allowing considerable savings. Based upon the four dimensions of our LG project, one can easily start preparing a cost analysis. Following each step of the constructions' schedule/planning, the financial assessment seems an imminent setup for the proper exploitation of BIM. Based on the equipment list, the tri-dimensional design completed with numerous product information, the financial status of the project leads to the fifth dimension of our LG project.

Rendering of the air conditioned room



6th dimension

Each LG family has been cautiously created for LATS REVIT so that at any given moment other plug-ins lucrative on REVIT could be able to deliver various benefits such as fluid dynamics or energy assessments, hence our LG project gains its sixth dimension.

LATS REVIT is an innovative BIM tool that accompanies constructors all along the way in their pursuit of efficiently building and it shows LG's commitment to further investments in total building system solutions. LATS REVIT is distributed freely by LG Electronics in Europe to support BIM users in their initiative to design air conditioning systems.

For further information please visit our website at www.lgeaircon.com

LG Life's Good

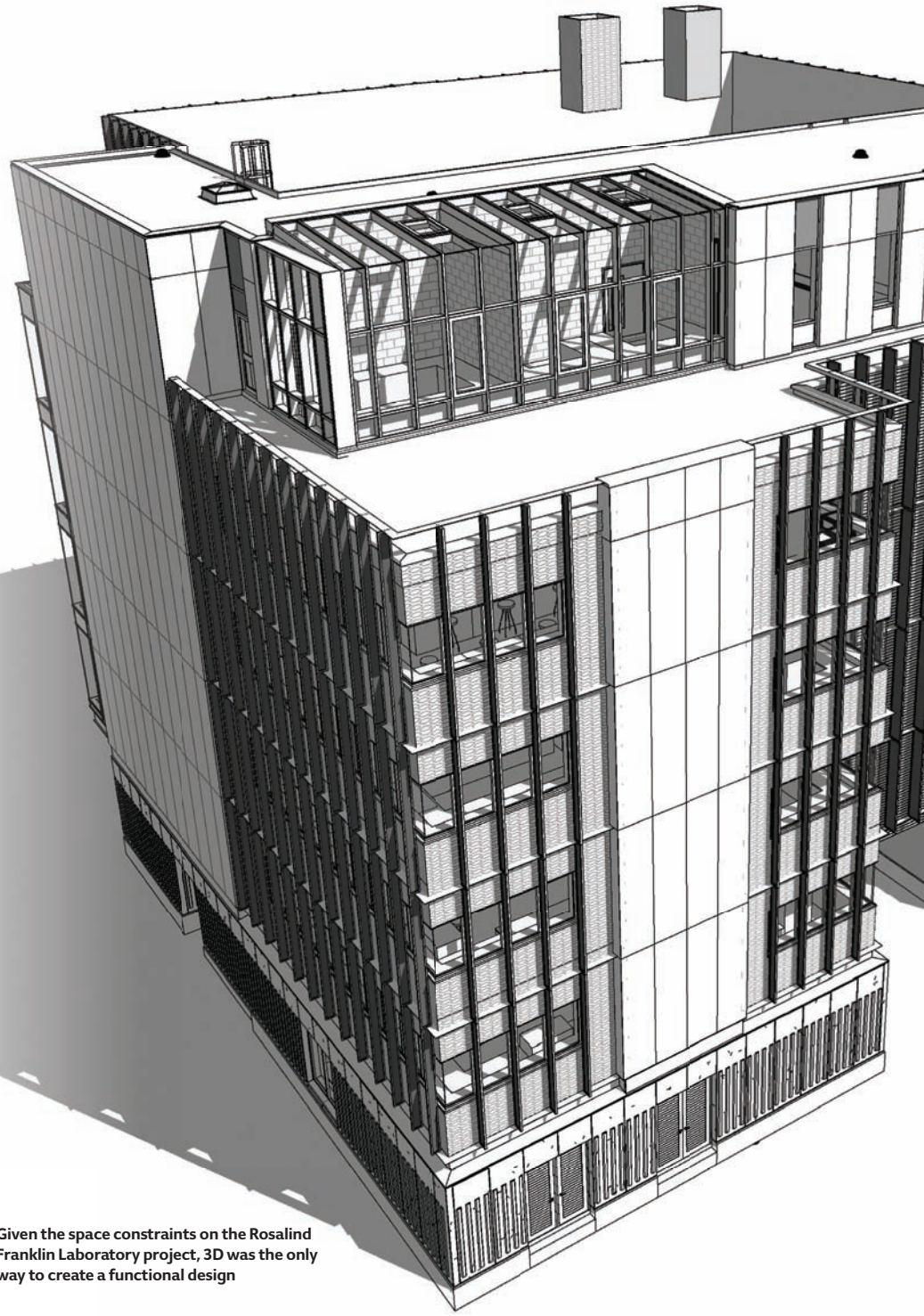
Building information modelling (BIM) is a much-debated topic in our industry. There is a full spectrum of opinions, from those who passionately endorse it to those who see it as a vast expense and question its value. Whatever your views, however, BIM is now part of our everyday lives, because – since April – all central governmnet procured construction projects greater than £5m must be delivered using BIM.

And with the cost of licenses, adequate computers and training running into tens of thousands of pounds per year, it is vital that we start finding, and recognising, the value in these tools. We need to transform a large business expense into a real asset.

Consultants are not the only ones debating the topic, however, as BIM balances its costs with big benefits for facilities managers when the models are made with maintenance in mind. Universities are also supporters of BIM, and use the post-construction models not just for facilities management (FM), but also as teaching materials. The University of Wolverhampton, for example, is using the model to teach BIM to built environment students.

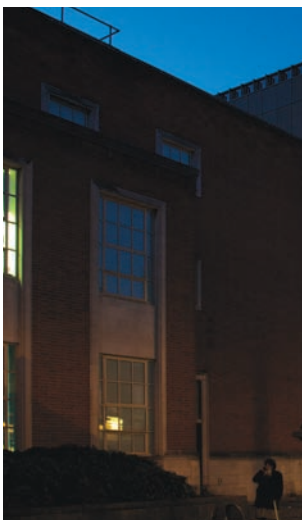
As with the vast majority of our projects, Cundall employed widely-used BIM software, Revit, to design the University of Wolverhampton's new laboratory facility, the Rosalind Franklin Building. The company was appointed to carry out the M&E design to stage F2 in Revit.

It is now relatively commonplace to use BIM to check arrangement philosophies and sections, and to coordinate bottlenecks and confined spaces, such as plantrooms. However, it is still relatively rare for all disciplines to carry out a full installation

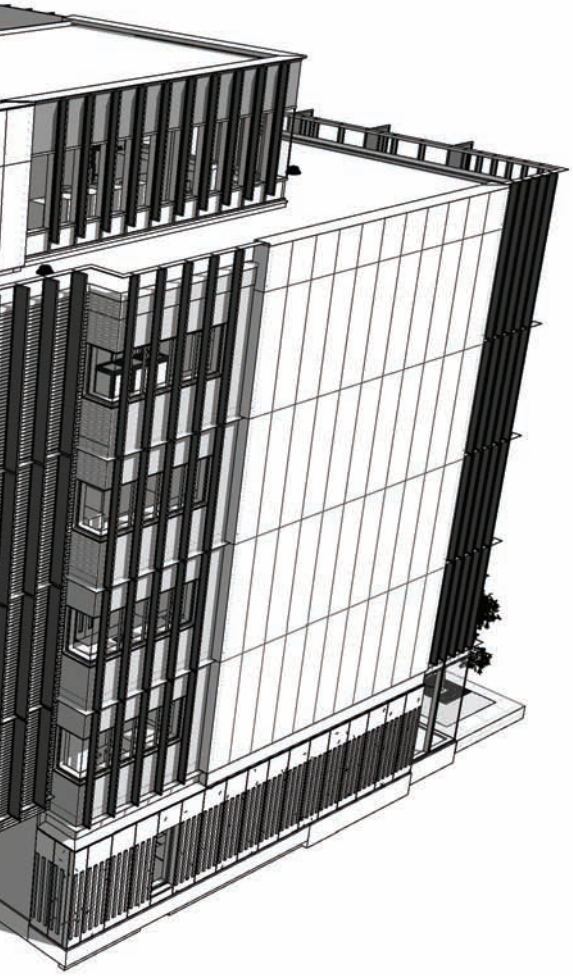


Given the space constraints on the Rosalind Franklin Laboratory project, 3D was the only way to create a functional design

INHERENT BENEFITS



An existing building formed the basis of the new Rosalind Franklin Laboratory, which meant there was limited space to design and install the extensive services. Cundall's **Chloe Agg** explains how BIM was used to coordinate the complex design, as well as tag assets and feed information into the O&M manuals



design using BIM, so this project was a challenge for everyone involved.

The project comprised a complete strip-out – right back to the steel and concrete structure of the existing building in Wolverhampton city centre – the construction of a full-height, wraparound extension on three sides, and a complete fit out of all services, plant, equipment and finishes. Each of the six floors contains at least two teaching or research labs, plus support labs, amenities, and meeting and write-up spaces. The majority of the teaching labs are designed to accommodate 60 students, as well as medical gases, Bunsen burners and anything from two to 11 fume cupboards per lab, so the building is very heavily serviced.

That amount of pipe and ductwork would have been complex enough to install on a new construction project, but on an existing building – where floor-to-soffit heights, steel depths and bracing positions are all fixed – it was a real challenge.

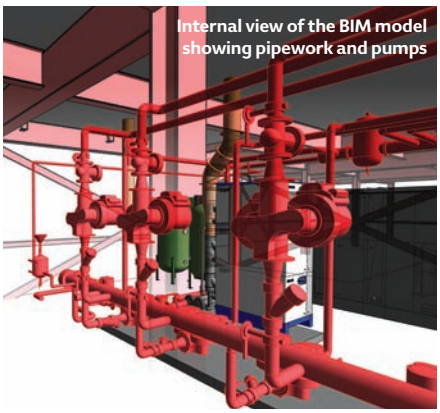
With such space constraints, and the service requirements for the laboratory equipment and its use, it would have been impossible to take the traditional route of doing a couple of sections and allocating zones for each service to run in. It was only possible to create a functional design by solving the space constraints in 3D. Furthermore, the problem could not be overcome by one discipline alone.

BIM is often thought of purely for its 3D modelling, but the collaboration the model facilitates came to the fore on the Rosalind Franklin Building, allowing us – as the M&E consultant – to sit down with the architects, structural engineers, client and installers.

This shared virtual environment enabled Cundall to develop solutions that required compromise, change or understanding from every party. It was this collaborative approach and the use of BIM that helped the project win BIM Project of the Year in the West Midlands Constructing Excellence Awards.

The advantages of BIM don't stop there – the 'information' aspect of building information modelling had a big role to play in the project.

With construction complete, Cundall updated the Revit file with any on-site

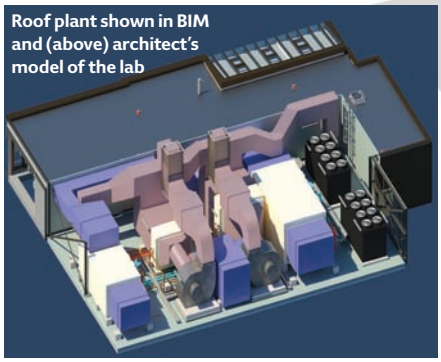


Internal view of the BIM model showing pipework and pumps

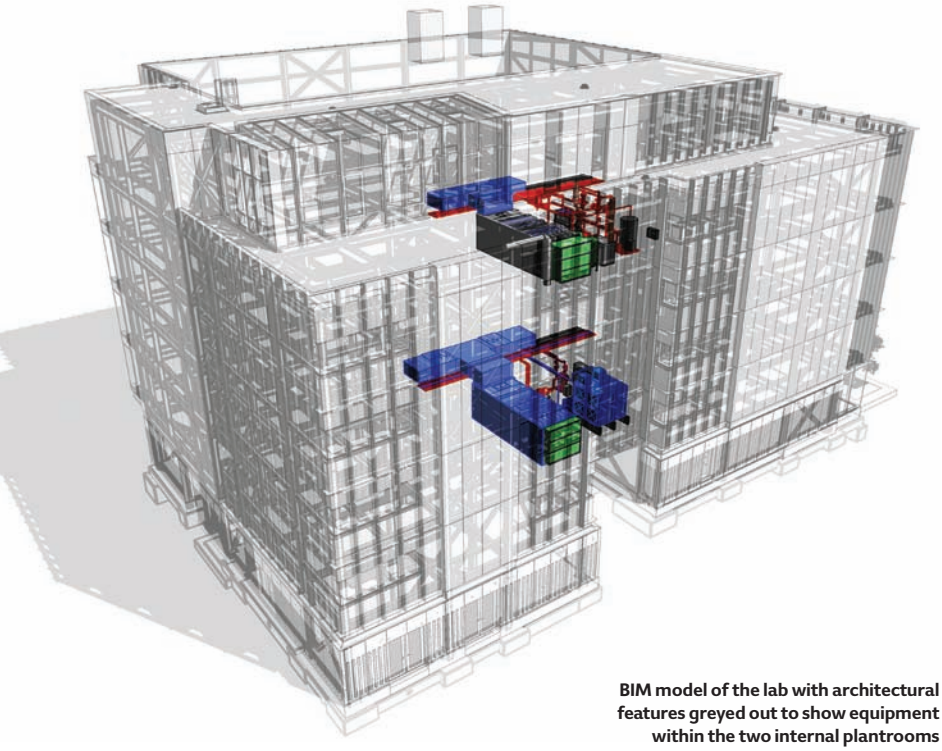
> The shared virtual environment enabled Cundall to develop solutions that required compromise, change or understanding from every party

The Rosalind Franklin Building in Wolverhampton city centre

Each of the building's six floors has at least two teaching labs



Roof plant shown in BIM and (above) architect's model of the lab



BIM model of the lab with architectural features greyed out to show equipment within the two internal plantrooms

changes to develop the as-built model. We also asset-tagged every item and set up links back to the relevant section of the operating and maintenance (O&M) manual to give the FM team a live model that would assist with their maintenance.

Collaborative use of BIM facilitated a well-coordinated design in a very constrained space, with solutions that had buy-in from all parties and left the client with a means of carrying out well-informed maintenance. However, there is still much more we, as an industry, could do with BIM.

There were still installation issues on site, even with the 3D coordination, because site-based subcontractors are not yet equipped with the hardware – or training – to make use of the model. As a result, they interpret 2D drawings differently than had been intended. This was particularly prevalent where individual trades only had sight of the drawings for their own discipline, and didn't see the coordinated drawing to understand how critical it was for them to set out within a very small margin for error.

There were also installation issues when information was incorrect or missing in the model. These situations arose largely where items – such as the fire protection on the steels – were not the specific responsibility of anyone within the design team. Similarly, it was not within anyone's scope to do a laser survey, but had one been carried out it would have ensured the base model was as accurate as possible. These examples highlight the importance of having a clearly defined scope for all parties and ensuring that no aspects of the build 'fall between the gaps'.

Where we are using BIM for existing buildings, we should consider investing in laser scans and other detailed surveys because the accuracy of the base model plays a significant role in the success of the project. Additionally, very little use is being made of the design and calculation capabilities of software packages that employ BIM. It is possible, for example, to do pipe and duct system pressure-drop and duct-sizing calculations, and even basic routing. However, in typical construction industry style, there is little take-up of this because people don't trust the outcome.

We haven't compared the results from conventional methods and from BIM to verify the outcomes of the latter. This would mean doing a batch of calculations twice and the cost of this rapidly eats into already tight profit margins. As an industry, our margins are too small and we are too risk averse to be willing to try new things or run these checks to verify new software, especially when they are at our own cost.

Given the successes from other aspects of BIM, perhaps this is an area we need to invest more time in because it will be a part of our future as much as collaboration is part of our every day.

CHLOE AGG is a senior engineer at Cundall

> Very little use is being made of the design and calculation capabilities of software that employs BIM… people don't trust the outcome

THE LEVEL OF DETAIL IS THE KEY TO **BIM**

Chris Meir, sales director at Andrews Water Heaters, explains why the company has varied the level of detail (LOD) in its recently launched BIM models.

The water heating industry has been talking about BIM for what seems like a very long time. It certainly became a hot topic very quickly, with the completion of BIM models almost turning into a race between manufacturers. BIM at Level 2 has needed to be implemented on all centrally procured public sector projects since April 2016, and with the clock ticking, many businesses rushed to get their models created.

But the problem was that, in the beginning, there were no industry standards to follow, and no guidelines for file creation, so each manufacturer was doing its own thing, and there was no uniformity.

This quickly became problematic at the early stages of building design, as a lack of interoperability meant that once a BIM file for a water heater was added to a design it was difficult to change it for another product at a later date – and of course during the specification process things often need to be altered. Meanwhile, some manufacturers didn't know how to create BIM files, and so didn't take any action, meaning their products couldn't be included on projects where BIM models were already being requested.

This led CIBSE to step in and create a Product Design Template (PDT) for each product group, which has been a very useful outcome. However, it was not only the lack of uniformity in file templates that was causing problems; the level of detail (LOD) provided by manufacturers has also resulted in some usability issues.

Andrews Water Heaters has developed files with minimum detail for the first stages of projects – LOD 300 – and more detailed files – LOD 500 – for the latter stages.

BIM files with varying levels of detail have been created by different manufacturers – some are very basic, with just the bare minimum amount of detail, whereas others are very comprehensive, and include vast amounts of information on things like energy savings and service and maintenance schedules.

Market research carried out by Andrews Water Heaters has revealed that the more comprehensive files have started to cause some major issues, as the larger the file, the slower it is to upload and manoeuvre. And, in the early stages of a building's design, products need to be moved around (which is one of the key benefits of BIM). The water heating system is of course only one part of a building – so if a specifier or designer is uploading very detailed files for every product and piece of equipment, the overall building model becomes very difficult to work with.

In reality, specifiers want very basic drawings while the design is still being finalised, but much more detail when the building is handed over to the owner or operator. The building manager will want specific information on things like service intervals and when parts need to be replaced to be included within the overall BIM model, but in the beginning, before the scheme is built, simplicity is key.

This insight has led Andrews Water Heaters to develop files with minimum detail for the first stages of projects – LOD 300 – and more detailed files – LOD 500 – for the latter stages. It is believed that Andrews Water Heaters is the only water heater manufacturer to meet market requirements by producing two variants of the same model.

Both versions of our BIM files have been developed in line with the CIBSE PDT standards. We have launched our storage water heater files in conjunction with CIBSE releasing the PDTs for this product group, which are available at www.andrewswaterheaters.co.uk. The CIBSE PDTs for circulating and instantaneous water heaters are still in consultation; once these PDTs are released further BIM files from Andrews Water Heaters – in LOD 300 and LOD 500 versions – will follow.

Andrews Water Heaters has the widest range of products in the UK commercial water heater sector, and offers energy efficient water heating solutions for commercial, industrial and large residential properties.

● For more information, visit **www.andrewswaterheaters.co.uk.**

ANDREWS
WATER HEATERS

As the built industry moves towards digital delivery, **Liza Young** finds out how Skanska used BIM Level 2 in the design and construction of The Monument Building in London

MONUMENTAL

Building information modelling (BIM) is not – as some may believe – about creating a 3D model for its own sake; nor is it an add-on process. BIM is fundamental to the way a project is set up and run.

Adhering to this philosophy has resulted in Skanska making impressive progress in its use of BIM, and is the reason why its project – The Monument Building, in London – is of particular note. As the developer, customer and owner, Skanska has been able to push the boundaries of BIM, using Level 2 throughout the design and construction process, and moving towards creating a single collaborative, online model, which includes construction sequencing (4D BIM) and cost (5D BIM).

Project manager, Tim Walsh, and BIM coordinator, Ainara Thompson, say the building was kept on a tight construction schedule, not least because all of the project partners engaged with BIM. They reveal the challenges and opportunities of the process, and why BIM is a fundamental part of any Skanska project.

Level 2 BIM

Effectively using the limited space of The Monument Building's basement – where 90% of the building services plant is housed – was a major test for the team.

'We didn't dig down, so it was fairly congested down there, with huge areas of ductwork – so coordination has been interesting,' says Walsh, who acknowledges that BIM played a key role in both clash detection and programming works. 'With this being a Skanska development, we wanted to push BIM further than most of our traditional customers would ask for,' he adds. 'It was a big challenge in the beginning because the architects and design team were unsure about where we wanted to go with the BIM deliverables.'

Walsh says the most problematic aspect of the process was integrating the mechanical, electrical and plumbing (MEP) services elements with the design model for the Level 2 federated model.

Unlike architects and consultants, who model in Revit, Skanska create theirs in MEP CAD-Duct – or CADmep – a manufacturing tool that sends information directly to the ductwork fabrications unit, where parts can be cut straight from the model.

'We have had to do a lot of work taking the design model and turning it into a working, operational one,' says Walsh. This was done with the help of a full-time BIM coordinator, Ainara, who has owned all the models and managed coordination between them.

'The design team's models were very easy to combine because they were all using very similar software. But when it came to the construction issue model, we had to take

PROJECT TEAM

- **Customer:** Skanska Project Developments Limited (SPDL)
- **Architect:** Make Architects
- **Building services engineer:** Arup
- **Structural engineer:** Arup
- **Fire engineer:** Arup

FEAT

out the Revit M&E design model and input our own version, which was in CADmep. That allowed us to manufacture and prefabricate directly from the model, which we would not necessarily have been able to do if we had continued on a federated model.'

Autodesk Fabrication CADmep uses databases of parametric and manufacturer-specific components and fittings for detailing. Typically, these components have been restricted to Fabrication products.

Walsh says there is now software – such as CADmep 2016 – that allows users to share models created with these components more seamlessly with Revit. 'We were too early in the design phase for that,' he explains. 'But we will certainly use it for the next job, where we will take on all the design information and transfer it into a working model, rather than scrapping any of it.'

Programming and costing

Skanska used the model for quantity takeoffs of some build items, including blockwork. This is the first step in the process of 4D BIM.

The quantity takeoff algorithm looks at each piece of geometry within the 3D BIM and calculates its properties – such as surface area and volume. This drives more precise model-based schedules for deliveries and installation, and 5D cost estimates, because the quantities are properly defined.

The 'smart' materials that made up The Monument Building model could be interrogated to find out the geometry and property of each component. 'You can then get the model to do a takeoff of all the area of that material in the building. It strips away everything else and just gives you the required data, which you can import into a spreadsheet, giving you the total quantities of – for example – blockwork or ceilings,' says Walsh.

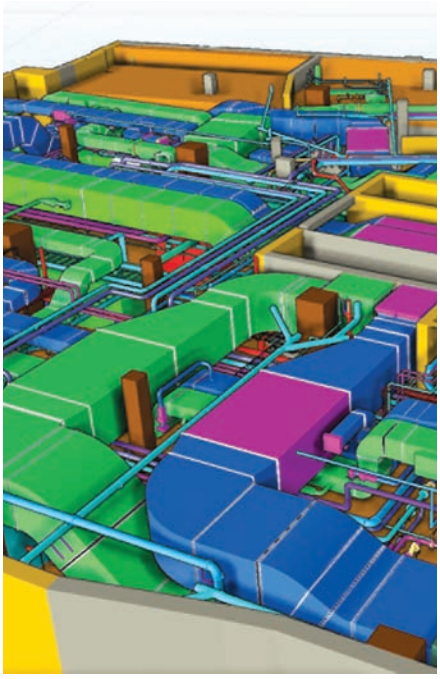
This blockwork data was then checked against the sub-contractors' prices, says Walsh. 'So we were able to have a conversation with them about areas where they had looked at things differently to us.'

Ultimately, as the design moves through iterations and the level of detail increases in the model, the estimate hones in on the final number. This type of analysis is much more intuitive than simply counting windows, doors, floors, ceilings, and walls; you can quickly see which elements have been costed and those that still need attention. It also allows owners to see how areas of the building are contributing to the total cost of the project.

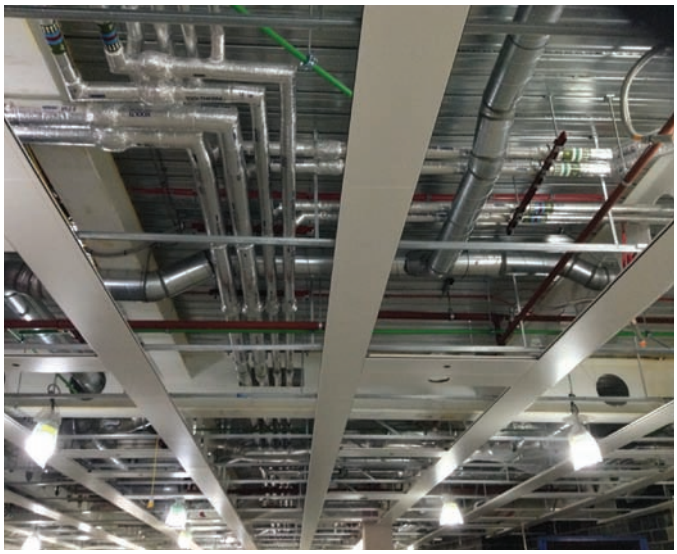
To achieve 4D planning, Skanska linked the programming software with the 3D model, breaking it down into certain tasks. 'Being able to schedule works according to the model really helped in the basement,' says Walsh.

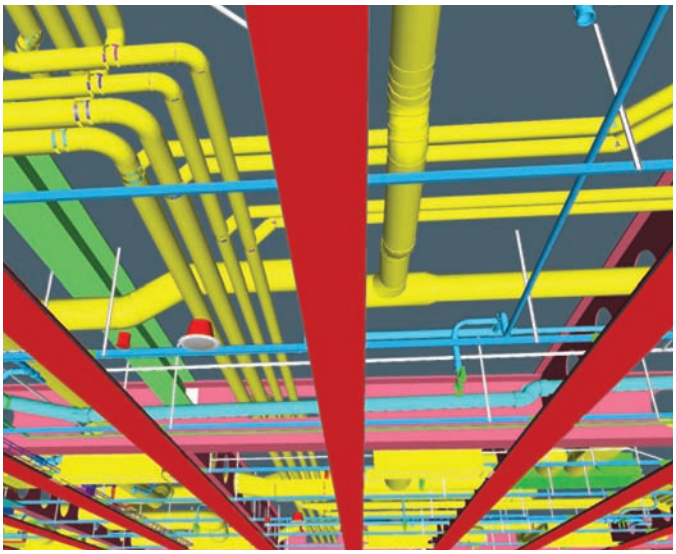
'We cut through layers of the model, took off certain services and gave the model to the guys on site and said: "This is your week's worth of work – this is what you can and can't install – because if you install from the second section, you'll prevent someone else from installing."'

> We're trying to get BIM and digital technology engraved into everything, and not to be a stand-alone entity – *Ainara Thompson*



A 4D model of services in the restricted basement





Heating, ventilation, air conditioning and power installation, designed through BIM

Thompson adds: 'The good thing about this technology is that you can update the program on one side and the model on the other. But you don't have to start again because, as long as you keep the data links, it's an automated process.

'So, if you move a door, the program recognises that it has moved and retains the link to the activity.'

The 'link' is the association between a 3D CAD object and its location in a construction project – giving Skanska the ability graphically to review its programme.

For the next project, Thompson says she would add the app for the program, so the planner can go around and capture progress on site using an iPad.

Knowing where to invest your money and where not to is a lesson learned, says Walsh. 'BIM is an endless amount of information and you can quite easily lose money trying to chase a solution to a problem that could be solved with experience and a bit of personal knowledge. For example, we could have modelled every plasterboard stud, but decided that this entailed a lot of upfront design work for an installation that was relatively flexible.'

Towards 6D BIM

Knowing who the potential facilities management (FM) companies are going to be is a key issue, says Thompson. 'It's important to get customers and facilities management teams engaged earlier, so they can set the requirements for all the asset tagging and an agreed list that covers the naming conventions.'

For The Monument Building, a facilities management company was not specified, so Skanska's in-house facilities services team offered support, using its own referencing structure, including naming, organising and scheduling assets.

Walsh says: 'If another facilities company were to come in, then our digital operating and maintenance information could be handed over to them. However, they may wish to use their own classification system.'

As well as the soft landings agreement – which includes a settlement period and regular visits by Skanska to ensure the building is operating as intended – Thompson is working with digital operation and maintenance (O&M) manual writers, Edocuments, to create a digital cloud-based guide for future FMs.

The digital O&M is connected to the combined 3D CAD model that enables FMs to access or update asset maintenance requirements or defects.

Walsh says Skanska has also been barcoding assets, which allows FMs to scan them in the plantroom and instantly browse relevant regimes in the searchable O&M manual. In the office, they would be able to open the 3D model, click on the item, and bring up the manual and asset register.

Thompson says: 'I think that's something quite groundbreaking. Even the O&M manual company is experimenting with us, so we're going on the journey together.'

The operation and maintenance manual is live, so any redundant information or defect – a leak, for example – as well as future fit outs can be instantly updated with an iPad, adds Thompson.

Skanska has a full training programme for the O&M manual, and is looking at the potential for using video.

'If there's a specific maintenance requirement for a piece of kit and the user needs specialist training, often the person you train isn't the one who will be doing it in six months' time,' Walsh says. 'So we are looking at creating training videos embedded in the O&M manual.'

The Monument Building

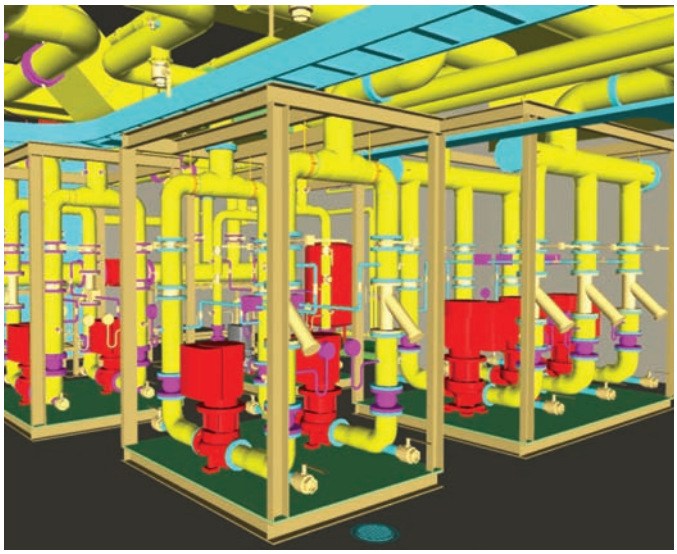
Located next to the Monument to the Great Fire of London, the building has 88,000ft² of office space and 4,000ft² of retail space on the ground floor.

Designed by Make Architects, the office space is split over 10 floors, with terraces at levels 4, 5, 7 and 9.

The building is constructed to achieve a Breeam 'Excellent' rating, and features a green roof, a 54m² photovoltaic panel array – producing 8,547KWh of electricity per year – LED lighting throughout, an intelligent lighting control system and a twisted steel-fin façade to reduce heat gains and 'mask the new from the old'.

It also incorporates a fire-protection system that is unique to a building of that size. The strategy works on positive and negative pressures, with positive pressures in the single-core fire lobby and negative pressures on the floorplates. Walsh says: 'It's a reverse system that keeps smoke out of the core, rather than pulling it into the core and out of the building.'

The building has a traditional four-pipe fan coil system on the floor, and air-cooled chillers and gas-fired boilers.



Planning the pump sets installation schedule in BIM avoided trade clashes and minimised access challenges

Walsh adds: 'We're seeing the benefits of BIM and so is the customer, so they can sell it to their potential tenants. They've got the information installed in the model, so it's not a case of getting everything remodelled – just a case of updating their changes.

'It's taking a life-cycle approach to the building, rather than just building it and walking away.'

Collaboration

Skanska used cloud-based construction field management software Autodesk BIM 360 Field to manage defects, and this helped the whole project team to collaborate more effectively. Walsh says: 'It allows us to open up the model and drop a pin in it, to show where the defect is, attach a photograph or description, and name the subcontractor that will rectify the defect.'

That defect automatically gets sent to the company to resolve, after which they are able to go out with their iPads and change its status, says Walsh. On that system, all contractors and subcontractors have access to the 3D models. 'In theory, they should never be working to superseded models because the latest version is on their iPad.'

Thompson adds: 'We're trying to get BIM and digital technology engraved into everything, and not to be a stand-alone entity. Some people think BIM is a separate thing, but it's embedded in the business and in different roles.'

Collaboration as a result of BIM has taken a real step forward, says Walsh, not just for Skanska, but for construction as a whole – from the customer down to the contractor. 'We're seeing a willingness from contractors to get involved in BIM. We've been talking about technology in construction for a long time and it's only over the past four or five years that we have actually started to see what everyone is talking about – the automation of things – and BIM is driving that forward, in no small part by the government directive [for the industry to achieve Level 2 BIM on centrally procured projects by 2016].

'It's paying dividends because people have had to take note and improve. It's easy to talk about these things, but putting them into practice is another matter. Skanska has put its hand in the air and said: "This is our project, we said we can do it, so we'll put our money where our mouth is." The industry and the government have set the bar, and we're just above it as we try to upskill the sector.'

Ultimately, it is BIM's job to facilitate collaboration between the owner, architect, engineer, contractor and subcontractors. By providing a data-rich picture of the project, stakeholders can work together towards the common goal: a high-quality project delivered on time and on budget. Skanska, it appears, is leading the way.

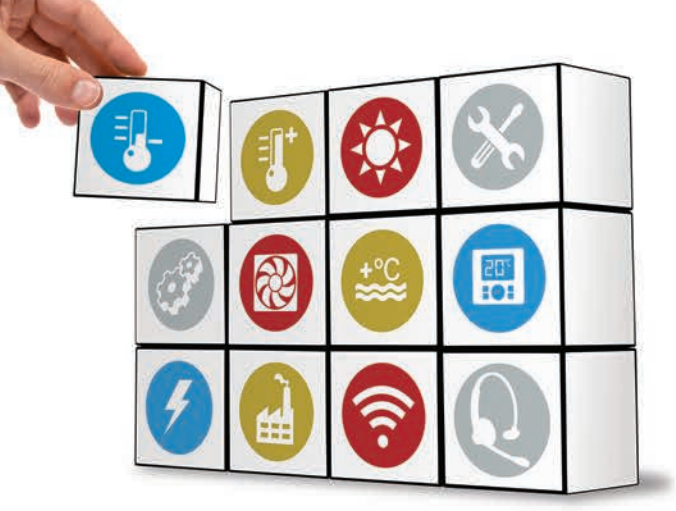
> You can quite easily lose money trying to chase a solution to a problem that could be solved with experience and a bit of knowledge

BIM levels

There are four different levels of BIM maturity (see page 21). The higher levels are:

BIM Level 2 – the creation of a managed 3D environment with data attached, but created in separate, distinct discipline models that may originate with the customer, the building services engineer or the architect. A federated model is an assembly of these to create a single model consisting of linked – but distinct – component models. This level of BIM may use 4D construction sequencing and/or 5D cost information.

Level 3 involves the creation of a single, online project model, worked on – and available to – all parties. Interoperability and collaboration is still a barrier to this, and the resulting copyright and liability issues may be more difficult to resolve.



Build the complete solution.

Heating, hot water and now air-conditioning from Bosch.

NEW

In order to maintain our commitment to meeting your needs, Bosch has added air-conditioning to its commercial and industrial heating and hot water solutions.

Our ALL-NEW Bosch Climate 5000 VRF range includes:

- SDCI Series - All Inverter Heat Pump
- MDCI Series - Mini VRF Heat Pump
- RDCI Series - All DC Inverter Heat Recovery

For more information, please visit **bosch-industrial.co.uk/VRF**

Bosch Commercial and Industrial UK

BOSCH
Invented for life

Professional development

The *CIBSE Journal* CPD Programme

Members of the Chartered Institution of Building Services Engineers (CIBSE) and other professional bodies are required to maintain their professional competence throughout their careers.

Continuing professional development (CPD) means the systematic maintenance, improvement and broadening of your knowledge and skills, and is therefore a long-term commitment to enhancing your competence. CPD is a requirement of CIBSE and the Register of the Engineering Council (UK).

CIBSE Journal is pleased to offer this module in its CPD programme. The programme is free and can be used by any reader. This module will help you to meet CIBSE's requirement for CPD. Equally, it will assist members of other institutions, who should record CPD activities in accordance with their institution's guidance.

Simply study the module and complete the questionnaire on the final page, following the instructions for its submission. Modules will be available online at **www.cibsejournal.com/cpd** while the information they contain remains current.

You can also complete the questionnaire online, and receive your results by return email.

Moving product information into BIM

This module considers how to use product data templates and sheets to input information for building information modelling (BIM)

BIM can be a truly enabling concept that is able to drive a more sustainable and effective building life-cycle, starting at any point – from planning, design and construction through to operation, refurbishment, demolition and reuse. There has been a deluge of initiatives and documents attempting to formalise the way in which the information is stored, and how it flows – and is made available – throughout a building's life. Underlying the standardisation of process is the core requirement for the basic product information that drives the BIM – without appropriate, maintained, good-quality data, the BIM is vacuous.

Manufacturers already exchange information with their customers regularly, for all manner of products, in the form of manuals and data sheets. However, as well as there being no standardised presentation format, the information is often in a form that is not easily readable by the computer software that is able to contribute to the building information model. This CPD will consider the fundamental need of the production and delivery of that information to the BIM, through the application of product data templates and sheets.

BIM – variously known as 'building information model/modelling' or 'building information management', but always including the word 'information' – provides a single source of data for, and from, all project members. Typically, current practice is for each discipline to hold its own 'model' and regularly issue the model – or information from it – to a central location, where all the information is collated. In reality, for many projects, this is still undertaken with 'marked up' drawings as the means of communication, with either little or no digital data exchange. The basis of the maturity Level 2 BIM (see panel), as defined by the UK Government Construction Strategy, is where output from separately operated modelling systems – for example, architectural, structural, services – sometimes known as 'lonely BIM', is combined with the provision of a single common data environment to store and share information.

Figure 1: CIBSE holds the master PDTs for building services BIM assets, such as would be used as a basis of a PDS for these commercial boilers

The stored data gives a digital representation of the building and its systems. This can then feed contextualised interfaces for the building team, the client and end users. For the building services engineer, for example, it may provide data that drives thermal models, system simulations and sizing tools. Software can create virtual 3D models, drawing on the BIM data sets to coordinate building components with mechanical and electrical systems, and supply the data to drive fabrication tools.

By accessing the common data set provided by the BIM, an object can be selected – whether it is a building services item, such as a boiler, or a constructional item, such as a floor – and its 'properties' can be interrogated. This might, for example, provide performance data or purchasing information during the construction stage, or automated procurement when replacement

items are needed throughout the building's life. When collections of objects are joined to create a system, all of the objects in the system can inherit and share attributes. So, potentially, this can automatically produce a planned maintenance scheme for a whole heating system, built on the collection of its components' needs.

Embedded financial and operational parameters can be accessed to determine total operational costs that may be projected from year to year throughout the project's life-cycle.

It is the 'richness' of the data that will determine the potential effectiveness of the BIM tools. The information does not necessarily have to be any different from that provided in traditional schedules or specifications. BIM does not change what information is provided, but it does enable different ways of accessing, storing, sharing, linking, manipulating and delivering it.

COBie

An integral part of the UK's maturity Level 2 BIM deliverables is the production of information in the construction operations building information exchange (COBie) format, as submissions – or 'data drops' – at key stages in the development of projects to the client. This will enable checks on progress and compliance, as well as at the handover to the building operator as an element of the as-constructed Asset Information Model. This model will include necessary information to enable those managing and maintaining the building to do so more efficiently.

The UK government has set COBie as the chosen format for the transfer of non-graphical data from the BIM model. COBie consolidates information – including the catalogue and operating manual information provided by the manufacturer of the equipment – into a single digital format. It was originally conceived in the US to capture assets within a project, especially those that will require maintenance in the operation phase, so it can help 'the project team organise electronic submittals approved during design and construction, and deliver a consolidated electronic operation and maintenance (O&M) manual with little or no additional effort'.[1]

But COBie is not intended to be read by the end user. It is in a suitable format (a spreadsheet that includes multiple tabbed sheets) that can, if needed, be referred to – or amended – by humans, but it is specifically for exchanging data between systems, which can then provide contextualised output to the end user.

COBie output can comprise large spreadsheets – of many tens of thousands of rows – that may be difficult, practically, for some systems to handle, so it is not considered by some as the ideal vehicle for this information.

The benefit of quality asset information goes beyond the demands of COBie, and should be seen as fundamental to the creation – and maintenance – of a truly useful building information model. The UK government mandate for COBie has acted as a stimulus to develop practically useful ways to deliver product information readily into the BIM.

Information needed for the COBie output is added at various stages of the project, from concept through to commissioning. Specific information is required for items (or 'assets'). In COBie language, a 'type' is a specific asset type – such as a boiler or pump that might be used several times in a project as a 'component'. The COBie output for a particular asset is likely to contain numerous elements ('fields') of data. For many COBie assets, it is likely that only a few of the many data fields that make up the COBie output are unique for each specific asset in a building (such as a pump or boiler) – the remainder will be information that is common to a range of the particular asset.

Information required by COBie does not reflect the whole rich data set that might have been needed – or even developed – throughout the design and construction process, but is limited to data particularly needed by the end-user client and the facilities management operator.

The complete data set defining a particular product comprises two types of input – 'general product data' and 'project specific data'. General product data includes, for example, who made it, what it's built from, its size and weight, applicable standards, sustainability information, and maintenance procedures. All of this is intrinsic to a product, irrespective of its specific application.

Project specific data defines the product's actual application – for example, its operating conditions, performance and related electrical control data. This can all be delivered from the design process. This would be held by the building information model, so can be fed directly into the product data set – becoming increasingly refined as the project evolves.

Elements of both general product data and project specific data will feed into the COBie output.

Product data template

General product data may be drawn from the disparate manufacturers' catalogues and data sheets, transcribed into a digital format. This can be both time-consuming and prone to error. To enable a far more effective – and simple – input of product data, a cross-industry group, coordinated by CIBSE, has developed the product data template (PDT). This provides an accessible way for product manufacturers to supply information in a simple common format that can then be automatically read into the

The Chartered Institution of Building Services Engineers
Product Data Template

Boiler with Integrated Burner - Gas/Oil

Template Category	**Boiler with Integrated Burner - Gas or Oil**			
Template Version	v3			
Category Description	Gas & Oil Fired Boiler used for space heating and indirect hot water generation with integrated burner			**Product type, function, classification, reference and other general information**
Classification System				
Classification	Value			
Suitability for Use	Approved			
Template Custodian	CIBSE			
Information Category	Parameter Name	Value	Units	Notes
Manufacturer Data				
Specifications	Manufacturer	Bosch Thermotec		
Specifications	Manufacturer Website	www.bosch-indust		
Specifications	Product Range	GB402		**Manufacturer contact and website info, specification and construction process information**
Specifications	Product Model Number	60kW		
Specifications	CE Approval	CE0085BU0332		
Specifications	Product Literature	http://www.bosch-i		
Specifications	Additional Technical Details	http://www.bosch-industrial.co.uk/GB402	URL	URL to technical details, e.g. system flow rates, pressure droo curves
Sustainability				
Sustainable Material BREEAM etc	Embodied Carbon		kgCO2e	*Awaiting industry standard*
Sustainable Material BREEAM etc	Life Cycle Analysis		Number	*Awaiting industry standard*
Sustainable Material BREEAM etc	Location of Manufacturer		GridRef	*Awaiting industry standar*
Sustainable Material BREEAM etc	Green Guide for Specification		Enumeration	A – E (Awaiting industry s
Sustainable Material BREEAM etc	Environmental Product Declaration		Text	3rd Party Verification (As
Sustainable Material BREEAM etc	Responsible Sourcing of Materials		Enumeration	Endorsing body (Awaiting
Sustainable Material ETL	Energy Technology List	https://etl.decc.gov.uk/english/toxlive/ETL_PUBLIC_P	URL	Hyperlink to ETL webpag
Sustainable Material LEED v.4	Responsible Extraction of Materials		Text	*Awaiting industry standar*
Sustainable Material LEED v.4	Material Ingredient Reporting		Text	*Awaiting industry standard*
Sustainable Product Directive Ecodesign	ErP Energy Label	0	Text	State ErP efficiency class. If Not Applicable Mark '0'
Operations & Maintenance				
Facilities/Asset Management	O&M Manual	http://www.bosch-industrial.co.uk/GB402	URL	Hyperlink to Manufacturer O&M Data
Facilities/Asset Management	Daily	0	Text	Maintenance tasks or SFG20 codes. If Not Applicable Mark '0'
Facilities/Asset Management	Weekly	Water pressure check	Text	Maintenance tasks or SFG20 codes. If Not Applicable Mark '0'
Facilities/Asset Management	Monthly	0	Text	Maintenance tasks or SFG20 codes. If Not Applicable Mark '0'
Facilities/Asset Management	Quarterly	0	Text	Maintenance tasks or SFG20 codes. If Not Applicable Mark '0'
Facilities/Asset Management	6 Monthly	0	Text	Maintenance tasks or SFG20 codes. If Not Applicable Mark '0'
Facilities/Asset Management	Annually	Annual maintenance	Text	Maintenance tasks or SFG20 codes. If Not Applicable Mark '0'
Facilities/Asset Management	Bespoke / Insolance	0	Text	Maintenance
Facilities/Asset Management	Maintenance Required 0-300hrs	0	Text	Maintenance
Facilities/Asset Management	Maintenance Required 301-600hrs	0	Text	Maintenance
Facilities/Asset Management	Maintenance Required 601-1000hrs	0	Text	Maintenance tasks required during this time frame. If Not Applicable Mark '0'
Facilities/Asset Management	Maintenance Required 1001-2000hrs	0	Text	Maintenance tasks required during this time frame. If Not Applicable Mark '0'
Facilities/Asset Management	Maintenance Required 2001-4000hrs	0	Text	Maintenance tasks required during this time frame. If Not Applicable Mark '0'
Facilities/Asset Management	Maintenance Required 4001-8000hrs	0	Text	Maintenance tasks required during this time frame. If Not Applicable Mark '0'
Facilities/Asset Management	Maintenance Required 8001-12000hrs	0	Text	Maintenance tasks required during this time frame. If Not Applicable Mark '0'
Facilities/Asset Management	Expected Life	15 - 20	Years	**Maintenance information**
Facilities/Asset Management	Warranty ID	Customer registration	Text	

Figure 2: Anatomy of a completed PDT– a product data sheet (PDS)

building information model. The PDT provides a set of understandable questions in a spreadsheet format that, when answered, describe the operational characteristics of a product – typically, one set of answers for each product range.

The questions encompass all the needs of the COBie data set, but the repetitive fields of COBie have been removed, and extended information has been added where it would provide improved utility for the BIM.

The PDT comprises five columns – instead of the 13 used by COBie – in the form of a technical schedule, as shown in Figure 2, that, in the BIM world, is known as the product data set. This is a pro-forma that looks like the widely used technical schedule from a contractor or consultant.

In the five columns of a PDT – information category, allowable parameters, the answers that define the product, the units that should be used, and guidance notes – only the third needs to be filled in by the product manufacturer; the others are pre-completed and fixed.

The rows of a PDT are both 'human readable' and logical, as shown in the outline in Figure 2. The first few rows include product type, function, classification, reference and other general information. The contact information lists the manufacturer's details, including a link to its website.

The remainder of the orange block contains information used directly in the specification and construction process, such as dimensions and weights, performance data and relevant electrical data.

The yellow section contains information on product sustainability, while the purple one includes maintenance procedures.

The PDTs are devised to fast-track the flow of general product information into the building information model. In a single spreadsheet, they provide standard formats for presenting general product data digitally – and comprehensively – to deliver the information needed by everyone involved in selecting, buying, installing, and operating the product.

PDTs have been – and continue to be – developed through the input of various trade bodies, institutions and practitioners, via an approval process in which they are fully reviewed before they are released. The standard PDTs are held by the responsible institution – for example, CIBSE holds the master PDTs for building services products (or 'assets') and the Landscape Institute maintains the standard library of PDTs associated with landscaping.

Figure 3: Installed commercial boilers

UK BIM maturity levels

(Note that these are different from levels of detail, levels of information and levels of development – see **bimtalk.co.uk/glossary** for an explanation)

Level 0 – use of 2D CAD drafting, with paper-based or electronic print information and data exchange.

Level 1 – use of a mixture of 2D or 3D CAD, backed by a common data environment for electronic sharing of drawings and data, with a standardised data structure and format managed to BS 1192:2007.

Level 2 – collaborative working across disciplines, with all parties using 3D BIM models, integrated but not necessarily shared. Design information is shared through a common file format such as Industry Foundation Class (IFC) or COBie. Commercial data is managed by enterprise resource planning software and integrated with the federated BIM model.

Level 3 – fully collaborative working across all disciplines, using a single, shared project model held centrally and accessible to all to modify and share data.

The PDTs are downloadable, at no cost, for anyone to use. The particular target users are manufacturers and suppliers looking to present catalogue information in a BIM-usable format.

Once the PDT has its data fields completed by the manufacturer or supplier of a particular product range, it becomes a 'product data sheet' (PDS). So, for example, the characteristics of the range of boilers, as shown in Figures 1 and 3, would be reflected in the PDS. The manufacturer would make the PDS available on its website for anyone to read into their BIM. This sheet is the manufacturer's property to publish and use to promote its product. The manufacturer or supplier does not need any expertise in BIM, and the resulting spreadsheet can be imported simply, to any BIM platform. It provides all the general information normally required and, failing that, it offers a web link to download further data from the manufacturer or supplier to provide more information about the product's key features.

The development of the PDT enables data-rich assets to be introduced into BIM in a simple format, and the resulting PDSs are now being produced by several manufacturers. There is no doubt that, as BIM develops, PDTs will evolve. However, PDTs already provide an essential component in the successful application of BIM, as they solve a real practical need – they are an open format, freely available and not tied to particular software.

Further reading:

BIMTalk.co.uk provides a glossary of BIM terminology, as well as basic explanations and links to many of web-based resources. Key standards are identified at **BIMTalk.co.uk/standards**

The current PDTs can be viewed on the CIBSE website via the link at **www.cibse.org/pdts** and an example of a completed PDS for a boiler is available at **www.bosch-industrial.co.uk/pds**

References:

1 **www.wbdg.org/resources/cobie.php** – accessed 2 May 2016.

Turn over page to complete module

Module 96
June 2016

BOSCH
Invented for life

1. What term is always included when expanding the various BIM acronyms?

- ☐ A Information
- ☐ B Inclusive
- ☐ C Intelligent
- ☐ D Integrated
- ☐ E Interoperable

2. Currently, Level 2 BIM is required in relevant UK government projects. What does this refer to?

- ☐ A Level of detail
- ☐ B Level of development
- ☐ C Level of definition
- ☐ D Level of integration
- ☐ E Level of maturity

3. Which one of these is most likely to be a case for BIM as generally discussed in the article?

- ☐ A BIM is excellent at producing 3D visualisations
- ☐ B BIM is principally about the management of information
- ☐ C BIM is driven by information that did not exist before BIM
- ☐ D BIM is an output of COBie
- ☐ E BIM can only be initiated at the design stage of a project

4. In the outline of the PDT, which of these is likely to be detailed in the yellow section?

- ☐ A Construction process information
- ☐ B Maintenance information
- ☐ C Manufacturer contact information
- ☐ D Product sustainability information
- ☐ E Product type

5. Which one of these is most unlikely for a PDT?

- ☐ A It can be readily edited by a human being
- ☐ B It has only five columns of data
- ☐ C It is free to access and use
- ☐ D The PDT is a pro-forma that is used as the basis of a PDS
- ☐ E When completed, it is used to deliver only COBie information

Name (please print) .....

Job title .....

Organisation .....

Address .....

.....

.....

Postcode .....

Email .....

Are you a member of:

☐ CIBSE

If so, please state your membership number

(if available) .....

☐ Other institution

(please state) .....

To help us develop future CPD modules, please indicate your primary job activity:

- ☐ Building services engineer
- ☐ Mechanical engineer
- ☐ Electrical engineer
- ☐ Commissioning engineer
- ☐ Energy manager
- ☐ Facilities manager
- ☐ Other (please give details) .....

If you do NOT want to receive information about Bosch, the sponsor of this CPD module, please tick here: ☐

By entering your details above, you agree that CIBSE may contact you from time to time with information about CPD and other training or professional development programmes, and about membership of CIBSE if you are not currently a member.

Please go to **www.cibsejournal.com/cpd** to complete this questionnaire online. You will receive notification by email of successful completion, which can then be used to validate your CPD records in accordance with your institution's guidance.

Alternatively, you can fill in this page and post it to:
N Hurley, CIBSE, 222 Balham High Road, London, SW12 9BS

CIBSE BUILDING PERFORMANCE AWARDS 2017

In association with CIBSE JOURNAL

Recognising the people, products and projects that demonstrate engineering excellence in the built environment

CELEBRATING 10 YEARS OF SUCCESS

PROJECT OF THE YEAR 2016

"I am so excited about winning this award. It's made my career. I would encourage everybody to submit their best work so as a profession we can learn from each other"

Kevin Hydes, CEO, Integral Group, 2016 winner of Project of the Year – International

CALL FOR ENTRIES

2017 CATEGORIES FOR ENTRY:

- Building Performance Consultancy (◂ 100 employees)
- Building Performance Consultancy (101 – 1000 employees)
- Building Performance Consultancy (▸ 1000 employees)
- Building Performance Training Programme
- Collaborative Working Partnership
- Energy Management Initiative
- Facilities Management Team
- Lighting for Building Performance
- Product Innovation NEW FOR 2017
  - Energy Saving Product
  - Energy Efficient Product
- Project of the Year – Commercial/ Industrial
- Project of the Year – Leisure
- Project of the Year – Public Use
- Project of the Year – Residential
- Project of the Year – Retail
- Project of the Year – International
- Building Performance Champion*

*Not available for entry. The Building Performance Champion is chosen by the judges from the category winners, and in their opinion, has made the most outstanding contribution and commitment to achieving improved building performance.

ENTRY DEADLINE: THURSDAY 15 SEPTEMBER 2016

FIND OUT MORE AT: www.cibse.org/bpa

@CIBSEAwards
#BPA2017

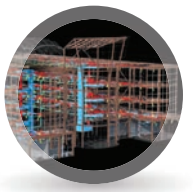
FREE TO ENTER

Sponsorship enquiries please contact jim.folley@redactive.co.uk or 020 7324 2786

cadline | AUTODESK. Platinum Partner | EDSL Tas | Tas Engineering | cymap

BIM Compliant Building Services Design...

- Meet Criterion 3 and Part L regulations
- Issue EPC certificates
- Government accredited software
- Import Revit model, improving workflow
- Export M&E Schemes to Revit MEP for auto 3D generation
- Fully gbXML BIM compliant
- Automatic clean up of CAD models
- Check for compliance from concept design stage
- Merge architectural changes to analysis model quickly through the design cycle
- Access to manufacturers or your own databases to help drive analysis and results
- Reduce project and design costs
- Co-ordinated Mechanical, Electrical & lighting schemes



Revit Architecture Model

BIM

TAS Dynamic Simulation

CYMAP - M&E Building Services Design

BIM

Revit MEP Model

Call today to arrange a demonstration on **01924 442333**

or visit our website to register for a webinar **www.cadline.co.uk/events**

scan this code to watch our workflow video

Autodesk Building & Infrastructure User Conference 2016

Powered by cadline

WHY ATTEND?

- BIM Leadership breakfast meeting – what are your Level 2 deliverables?
- LIVE Technical presentation of a compliant Building and Infrastructure BIM level 2 project using Autodesk 2017 tools
- Receive half a day of free product training with 3 x Technical Masterclasses
- Full supporting technical documentation provided
- Autodesk product tips and tricks
- Great networking opportunities
- Hands on Solutions Technology center

DATES & VENUES:

Sheraton Grand Hotel, Edinburgh – 23rd June 2016
Etc.venues, St Pauls – 29th June 2016
Radisson Blu, Manchester – 5th July 2016

FIND OUT MORE & REGISTER NOW: **www.cadline.co.uk/UserConference2016**