

National BIM Report 2017



Introduction	03
Richard Waterhouse CEO, NBS	
Digital Built Britain – building the future	04
Mark Bew MBE Chair of the HM Government – Digital Built Britain	
Standards supporting UK innovation	06
Kieran Parkinson Market Development Manager, BSI	
BIM survey: summary of findings	10
Adrian Malleson Head of Research, Analysis and Forecasting, NBS	
Working toward a unified approach to BIM in Europe	28
Dr Ilka May CEO, LocLab Consulting GmbH	
Adam Matthews MBA International Director for the UK Government's BIM Task Group and Chair of the EU BIM Task Group	
Richard Lane CLO, KnowledgePoint and Programme Manager, EU BIM Task Group	
Scotland's journey to the digitisation of construction	32
Paul Dodd Associate Director, Scottish Futures Trust	
BIM on a live project	36
Dr Stephen Hamil Director of Research and Innovation, NBS	

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We would like to thank the following organisations for supporting this report:



Introduction



Richard Waterhouse
CEO, NBS

This is the first NBS National BIM Report since the introduction of the UK Government's BIM mandate. It is significant, therefore, that BIM adoption has reached a high point this year. The UK BIM mandate has added an impetus to BIM adoption in the UK. BIM Level 2 looks to be well established; the normal way for most practices to carry out design work. Over 60% now use BIM, and 95% expect to within three years. To change a relatively static industry like construction in such a short period is nothing short of astonishing and is best in class at a global level.

The design community is broadly supportive of the UK Government mandate. Most feel the Government is on the right track with BIM, and that it supports at least two of the four core strategic aims of the Government for construction, namely;

- BIM will help bring a reduction in the initial and whole life costs of built assets.
- BIM will help bring time efficiencies, reducing time from inception to completion.

This fits with the benefits of BIM to those routinely using it; better collaboration and information co-ordination that bring cost efficiencies. These cost efficiencies are already apparent to the design team; the next challenge is to educate more clients about them. The report shows there is still work to do here, but the work is well underway.

Part of this work is demonstrating that BIM is (of course!) not just for the public sector. Each year the UK Government publishes details of the construction cost reductions it has made. Seeing these savings makes it clear why the UK Government has backed BIM, and why other countries are looking to the UK to inform their BIM journey. As the UK public sector shows the real benefits BIM brings, the private sector is also showing itself quick to implement, as are other countries.

It is not all good news and the report shows there is still work to do. Whilst confidence in BIM skills is improving among the design team, it could be better. Many still need information, CPD and training. Fortunately, there are many resources to help here. Whilst some clients lead the way on BIM, many others need further support and careful explanation of the process and its benefits. The UK has a comprehensive suite of BIM standards and protocols, yet they remain underused and are sometimes seen as too complex. Additionally, BIM adoption is lower among smaller practices, although even here, it is getting close to a majority. This work is underway and year on year, on all these issues, the picture is improving.

What next for BIM in the UK? We can expect adoption and use to increase steadily over the coming years.

This is not just existing designers adopting new, better, ways of working. Those who have grown up online will expect to design within a collaborative digital working environment. The young digital natives will mould the working practices of the digital visitors.

The move to BIM Level 2 is just a step on the way, though. As the UK BIM mandate becomes embedded, thoughts are naturally turning to what next. The report hints at some future technologies that will be significant: robotics, 3D printing, future cities and machine learning, for example.

These form a part of a general trend. Information is getting physical, and the physical is getting information. We are moving from gathering information to improve the design stages, to information being continuously added to and evaluated by buildings, as they are used.

The easier design iterations that BIM Level 2 has brought us will lead to iterative building production, as in use data refines buildings design. Value will be held less in the built asset itself, and increasingly in the information about that asset.

Through social media and web use, we are starting to get used to 'collaborative consumerism'. As we come to give more and more information about ourselves in the future through our use of tomorrow's buildings and cities, will we see 'collaborative living'?

That's for the future, a future that is now assured to come through BIM. We've come a long way since our first BIM report and our journey continues. We can look forward to future developments, with the UK at the forefront of design innovation.

Digital Built Britain – building the future



Mark Bew MBE
Chair of the
HM Government –
Digital Built Britain

The volume of information generated in today's digital world will not have escaped anyone. It is safe to say that we have now firmly entered the 'big data' age, where large pools of data and information are captured, communicated, aggregated, stored and analysed as part of sectors such as retailing, publishing, travel and financial services.

With the construction industry being one of the last major sectors to commence its digital journey, the successful delivery of the UK Government Construction Strategy (GCS) Level 2 BIM programme now sees the UK take on a global leadership role and represents an internationally unparalleled achievement on the journey towards the digitisation of our built environment.

Building on the success of the Level 2 BIM programme, Digital Built Britain was launched last year and will enable the interconnected digital design of different elements in a built environment, and will extend BIM into the operation of assets over their lifetimes – where the lion's share of cost arises. It will support the accelerated delivery of smart cities, services and grids. Owners and operators will be able to better manage assets and services as they track their real-time efficiency, maximising utilisation and minimising energy use.

Digital Built Britain will enable the digitisation of our built environment and will help meet the Government Industrial Strategy (2025) targets of 33% lower costs, 50% faster delivery, 50% lower emissions and 50% improvements in exports. As the results of the survey confirm, BIM and data will continue to play a large part in sector transformation and the achievement of these goals.

Level 2 BIM journey

The Level 2 BIM journey began in 2011 and continued until the Government's mandate was reached in April 2016. All central government departments are fundamentally procuring Level 2 BIM data. I am often asked 'How are the departments getting on?' and this survey begs a similar response. My response must be that they are all on a journey like the rest of the sector. Some have travelled further than others, but all are significantly better than they were four years ago. Construction is the largest industrial sector in the UK: we employ over two and a half million people and they all move at different speeds. However, one thing is for sure: they have all moved, and so has the rest of the world, with nearly half of the world's rail and metros now being delivered using Level 2-based standards, including those in Kuala Lumpur and New York.

Now we have passed the 2016 milestone, the work starts. We need to move Level 2 BIM to 'business as usual'. This is where industry needs to lead the transition to BIM Level 2 and spread it across the market, not just centrally-procured public sector projects but local authorities and the private sector. To do this we are working with several parties, including the UK BIM Alliance. The Alliance was launched in October 2016 and is a cross-industry alliance formed to lead BIM Level 2 and the digital transformation of the construction sector. Its focus will be the implementation of BIM Level 2 across the wider industry over the next four years until 2020, which will establish the essential foundations for BIM Level 3 and digital transformation as we move towards 2025.



UKAS BIM certification scheme

Announced in September 2016, the United Kingdom Accreditation Service (UKAS) is considering extending its accreditation activity into a new area: that of accredited Building Information Modelling (BIM) certification, and in doing so will help support the Construction Strategy published by the UK Government in May 2011. It is evident that there are a number of certification schemes (e.g. 'process' certification, 'person' certification) for BIM Level 2 available to the market now; however, UKAS wishes to promote a common approach to accredited BIM Level 2 certification and service levels.

Digital Built Britain

The continuing success of the Level 2 programme, underlined by the results of this survey, has provided the platform to move to the next stage. The move to Level 3 and the commencement of the Digital Built Britain programme heralds a new generation of SMART Infrastructure and Construction.

The UK has made a significant step in creating a world-class position in delivering capability, standards and capacity in the sector to reduce cost and increase value. The coming together of the BIM and Smart City programme into Digital Built Britain will continue this commitment to providing jobs, homes, services and growth to the UK economy.

The Digital Built Britain programme comprises the following work areas:

- Level 2 legacy activity, to continue to drive Level 2 uptake and realise further savings.
- Level 2 (Convergence) is the programme of activity that will provide the first end-to-end asset life cycle data management process. The fusing of BIM, Sensors and City Services in a single set of Level 2 standards will provide a key first step for both construction and city services providers to work much closer in the delivery of assets and services.
- Level 3 is a programme which is a fully developed version of Level 2 (c) and will provide the basis for a fully functioning secure digital economy for the built environment.
- The final work stream is a research stream investigating trends and developments just over the horizon which will have significant impacts on the sector.

The results of the NBS survey once again show a welcome trend of development: proof, if it were needed, that the UK continues to be an innovative developer and adopter of technology. In light of the demand which will be made of us all in the new trading future outside of the EU, this should give us encouragement and push us on to even better things.

For more information

visit www.digital-built-britain.com

The UK has made a significant step in creating a world-class position in delivering capability, standards and capacity in the sector to reduce cost and increase value.



Standards supporting UK innovation



Kieran Parkinson
Market Development
Manager, BSI



In today's global construction industry, the drive for faster, more efficient delivery of infrastructure or building projects has never been more challenging. Efforts to improve efficiency are difficult in a market that is often defined by low margins, aggressive procurement, skills shortages, uncertain work pipelines and complex supply chains.

In a global economy of rapidly evolving markets and technologies, rules and frameworks are often needed to help organisations adapt and innovate successfully. Standards can help establish those rules and frameworks, and BIM standardisation is an example of this.

Digitising the process of the design, build and operation of built assets wasn't a new concept, but the financial, technical and behavioural implications were difficult to overcome. However, in the last decade significant advancements in technology have brought the concept much closer to reality. In 2011, the UK Government Construction Strategy announced that Building Information Modelling (BIM) would be a requirement for all centrally procured government projects from

2016. This wasn't a legal requirement, but a condition of contract to work with the largest client in the market. The focus on BIM was further refined in the Construction 2025 Strategy, setting out a requirement for BIM Level 2 (as defined by the BIM Maturity Model) on government projects, irrespective of project size.

BSI started developing BIM standards in 2007, working with industry bodies, researchers, UK Government and business organisations to develop the overarching principles, rules and guidance necessary to implement BIM. In 2016, BSI (in partnership with government) developed a website providing the standards, tools and guidance necessary for implementing BIM Level 2. All are available to download at www.BIM-Level2.org

The BSI BIM standards have helped remove much of the risk and uncertainty associated with sharing information in a virtual construction environment. The security, interoperability and shared language established by the standards have helped to create market conditions that have attracted investment and driven innovation.



Internationalising UK standards

As the UK National Standards Body, BSI manages over 1,200 committees, comprising over 11,000 committee members. With the help of these committees, BSI is responsible for maintaining over 39,000 standards, most of them originating from Europe (CEN/CENELEC) and internationally (ISO/IEC), and covering most UK industry sectors. BSI can and has used this breadth of sector coverage and global reach through ISO and CEN to take UK best practice globally, thereby positioning the UK industry as thought leaders. Again, BIM is an example of this.

BSI, in collaboration with global partners in international technical committee ISO/TC 59/SC13, put forward PAS 1192-2 to be used as the basis for two international BIM standards:

- ISO 19650-1 Organisation of information about construction works - Information management using building information modelling - Part 1: Concepts and principles.
- ISO 19650-2 Organisation of information about construction works - Information management using building information modelling - Part 2: Delivery phase of assets.

These projects were out for public consultation until 16th April, and are expected to be published in early 2018. Comments on these (or any other standards) can be made via BSI's free-to-use standards development portal (see references overleaf).

In Europe, BSI is working with partners in CEN/TC 442 to adopt ISO standards as European (EN) standards, and where appropriate develop regional European standards that complement the ISO work programme.

Further information about ongoing standards development projects can be found on BSI's standard development portal (see references overleaf).

The BSI BIM standards have helped remove much of the risk and uncertainty associated with sharing information in a virtual construction environment.



The future of BIM standardisation

The implementation of BIM Level 2 in the UK is far from complete, and to help embed BIM Level 2 best practice there are currently four UK BIM standards projects underway:

- two projects aligning existing standards (PAS 1192-2 and PAS 1192-3);
- two new standards (PAS 1192-6 and PAS 1192-7).

The projects aligning PAS 1192-2 and PAS 1192-3 are intended to be small in scope, focusing on aspects such as terminology, and are expected to be published in the summer of 2017.

The new standards project for PAS 1192-6 'Specification for collaborative sharing and use of structured hazard and risk information for Health and Safety' has just completed public consultation and is expected to be published in Summer 2017, and will be available on www.BIM-level2.org

The other new standard project PAS 1192-7 'Specification for defining and sharing structured digital construction product information' will be based on the Product Data Definition document currently available at www.BIM-level2.org (under Guidance).

References:

ISO/TC 59/SC 13 Technical Committee website: <https://www.iso.org/committee/49180.html>

BSI Standards Development portal: <https://standardsdevelopment.bsigroup.com/>

Comments on ISO 19650-1 and -2: <https://standardsdevelopment.bsigroup.com/committees/50248634>

Digital Built Britain: <http://digital-built-britain.com/>

Smart cities: <https://www.bsigroup.com/en-GB/smart-cities/>

Internet of Things: <http://www.hypercat.io/>

CEN/TC 442 Technical Committee website: <https://standards.cen.eu>

PAS 1192-7 is intended to be a technical specification providing a consistent methodology for the definition, creation, management and sharing of product information through the life cycle of an asset, based on the purpose of that information, and who the information is to be used by.

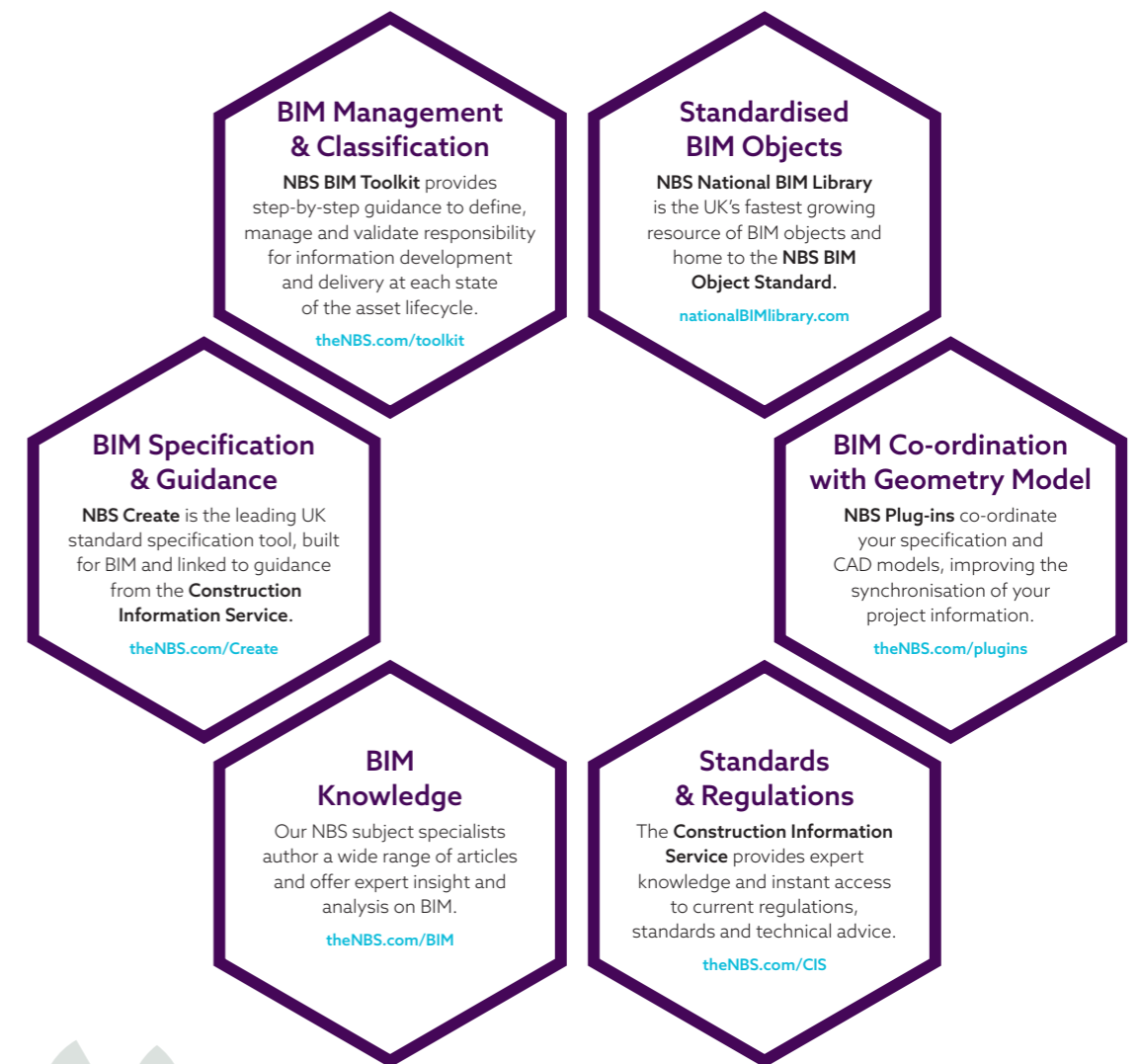
Looking towards BIM Level 3, the vision described in Digital Built Britain is a completely integrated approach to the management of asset- and project-related data, where information will be seamlessly available to those who need it in a format that allows different stakeholders to reuse it for different purposes. BIM Level 3 will start to make links with other digital innovations and concepts such as building management systems, smart cities and the Internet of Things (IoT); see references.

BSI will continue to work with government and industry to coordinate the development of appropriate standards, in the first instance linking together our existing standards work programmes on smart cities and IoT.



NBS BIM tools and content support your BIM workflow – individually effective and powerfully connected

You can use our BIM tools individually. But use them collectively and harness their full power and potential to deliver informed decisions, more efficient processes and reduced risk across your Level 2 BIM projects.



Find out more about our suite of tools to support you throughout the BIM workflow at theNBS.com/BIMworkflow

BIM survey: summary of findings



Adrian Malleson
Head of Research,
Analysis and
Forecasting, NBS

Welcome to our seventh annual NBS National BIM Report. In the twelve months since our last report, we have seen the introduction of the UK BIM mandate. Collaborative working practice and BIM Level 2 data delivery is now a contractual requirement for work on central government-funded projects.

The NBS National BIM Survey gives a snapshot of the change the design community is both creating and going through. In this report, we examine some of the key themes the survey brings to light, and we point to some of the future changes to come. This year, we also spend a little time looking at the community's assessment of the approach the Government has taken to inject BIM into UK design practice.

As ever, our sincere thanks to the more than 1,000 people who took part in the research. By taking part, you have helped ensure that the UK has a reliable resource with which to assess BIM in the UK.

Those who responded to the survey came from a range of professions and practice types, and from all the nations and regions of the UK.

In this report, we examine some of the key themes the survey brings to light, and we point to some of the future changes to come.



The UK Government and BIM

"The Government stated that all public funded projects needed to be BIM; this has played a big part in getting the majority of the sector to take note. I have to admit that a government can sometimes do good".

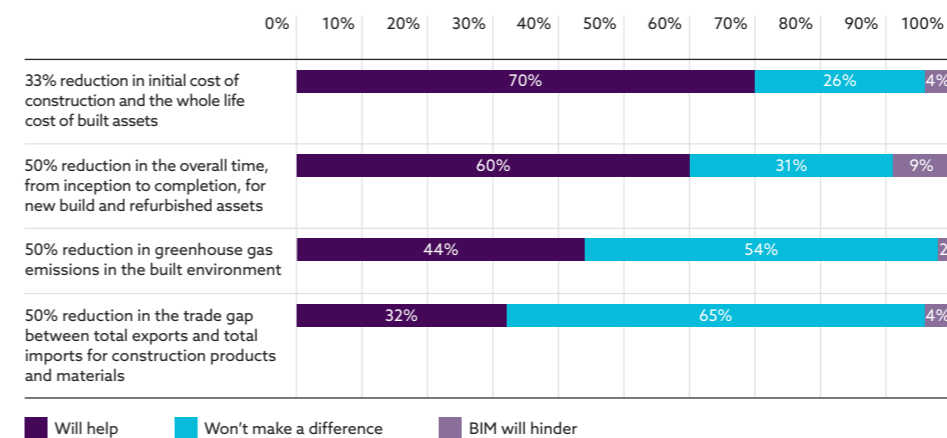
The Government's construction strategy

The UK's BIM mandate is strategic; it derives from the Government's construction strategy. Within the strategy are four ambitious targets. The role of BIM, in part, is to support our reaching them. The targets are for lower cost, more rapid delivery, fewer greenhouse emissions, and a better trade balance for construction products. The graph below shows the design community's assessment of BIM's ability to help meet those targets.

Very few think that BIM will stand in the way of our meeting these targets. Seventy percent see that BIM will help bring cost reduction in the design build and maintain life cycle. Sixty percent see that BIM will help bring time efficiencies, reducing time from inception to completion. Less pronounced is BIM's ability to reduce greenhouse gas emissions (44% agree that it will help), or improve the trade gap in construction products (32% agree).

Sixty percent see that BIM will help bring time efficiencies, reducing time from inception to completion.

Please tell us the role you think BIM will have in our achieving the following...



The vision of the UK being the world leader in BIM has yet to be realised, according to the design community.

The Government's role in BIM strategy

Given the introduction of the BIM mandate, we took the opportunity to ask for a broader assessment of the Government's role in BIM strategy and implementation.

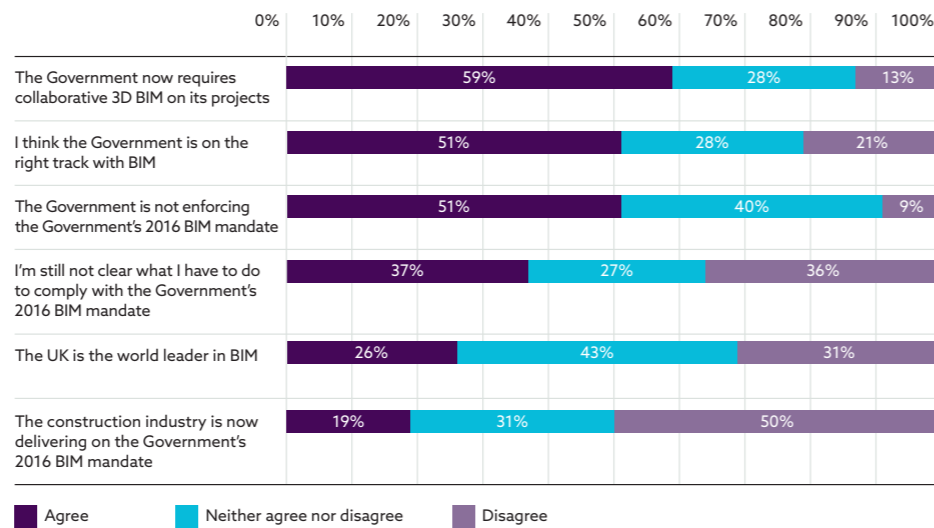
'The industry has mobilised to meet this mandate.'

A majority (51%) think that the Government is on the right track with BIM. Fifty-nine percent agree that the Government requires collaborative 3D BIM on its projects.

However, not everything is positive. A majority think that the Government is failing to enforce the BIM mandate.

'A lot of government agencies and bodies have used loopholes in contract form to get out of mandated BIM requirements.'

Agreement with statements



Legend: Agree (dark purple), Neither agree nor disagree (cyan), Disagree (grey)

World leadership

'This whole sector approach to BIM will see the UK as the world leader in a new digitally built era, offering new ways of working, as well as massive growth potential both at home and abroad.'

Francis Maude, Government Construction Summit

The vision of the UK being the world leader in BIM has yet to be realised, according to the design community. Only 19% agree that we are the world leader. Perhaps the Government set the bar a little high? The UK is certainly one of a handful of countries that is leading BIM development and implementation. Other countries are looking to the UK to learn what we are planning, doing, and have done, to inform their own BIM strategy. So if not the leader, the UK is certainly a leader.



BIM usage and awareness

"I believe at least 50% of the construction industry has embraced it - that's quite a good result!"

Current use

BIM awareness is near-universal. BIM adoption is up. Those who have not adopted BIM intend to. The UK is well placed to have BIM as the most common project design environment within the next five years.

Awareness is near-universal, with 97% telling us they are aware of BIM (we solicit and receive responses from a wide range of design practices, not just the BIM community).

Sixty-two percent of practices now use BIM on some of their projects, up from 54% last year: an 8%

year-on-year increase. Over the six years we have been running the report, BIM adoption has increased over 8% each year, on average. However, it was in the early years that the rate of growth was most rapid. That rate slowed somewhat between 2014 and 2016: a normal adoption curve in action.

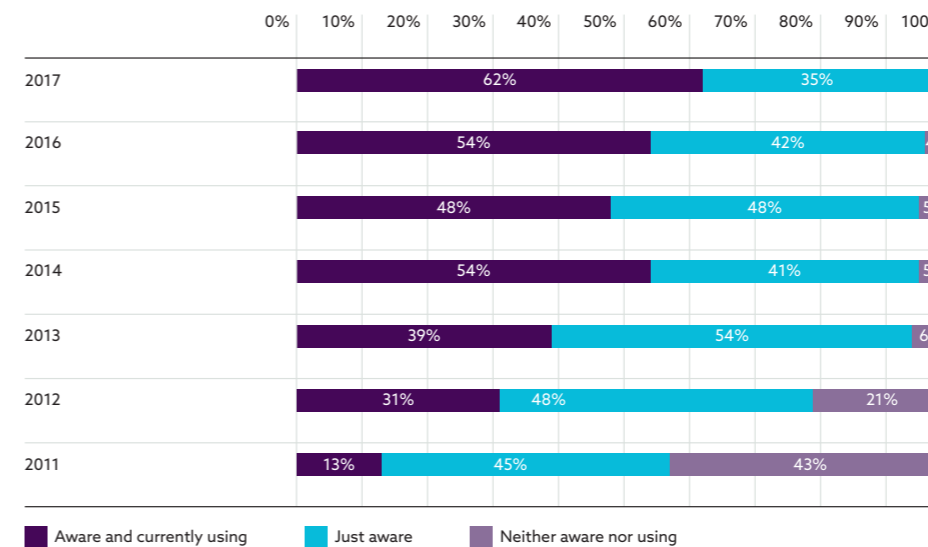
The twelve months preceding this report have seen the most rapid BIM growth since 2014, suggesting that the UK Government's BIM mandate is having the intended effect.

BIM usage and awareness



Legend: Aware and currently using BIM (dark purple), Just aware of BIM (cyan), Neither aware nor using (grey)

BIM adoption over time



Legend: Aware and currently using (dark purple), Just aware (cyan), Neither aware nor using (grey)

One third who are using BIM do so on a minority of projects, and two thirds use BIM on a majority.

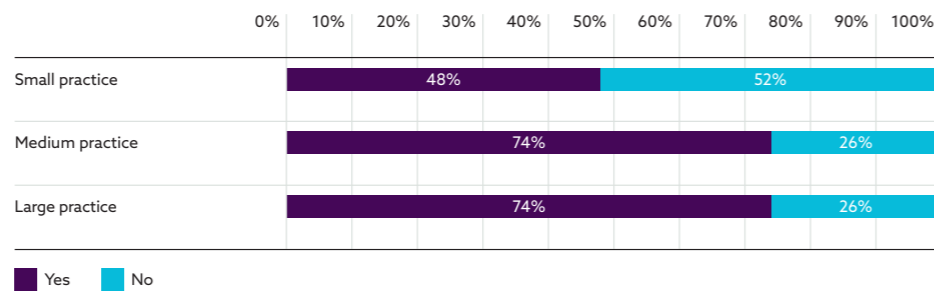
Adoption and practice size

We sometimes hear that BIM is 'only for large practices'. This is aligned to the view that BIM is useful for larger, more complex projects but not for less complex ones like domestic work (though many smaller practices create highly complex designs).

When looking at BIM adoption by practice size, we found that small practices (with 15 or fewer staff) were less likely to have adopted BIM than larger ones, though 48% had. For medium (16 to 50 staff) and larger practices (50+ staff), almost three quarters had adopted BIM.

So, clearly, BIM is not just for larger practices – but small practices are less likely to have adopted BIM.

Within your organisation, have you adopted BIM for projects you've been involved with?



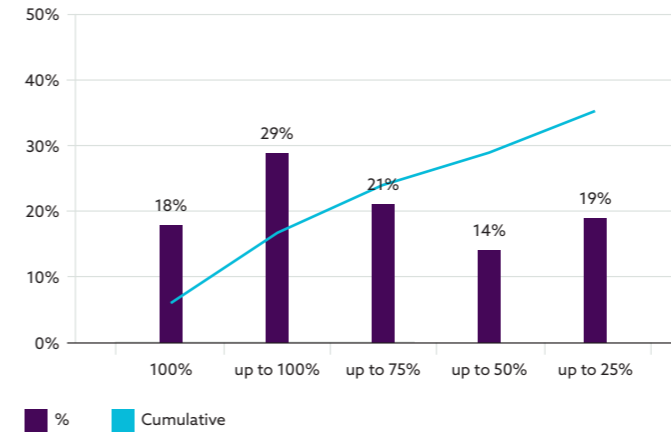
Frequency of BIM use

Of course, adopting BIM does not necessarily mean using it for every project. For the first time, we explored the percentage of projects that were designed using BIM. We asked those who had adopted BIM 'Approximately what percentage of projects have you used BIM for in the last 12 months?'

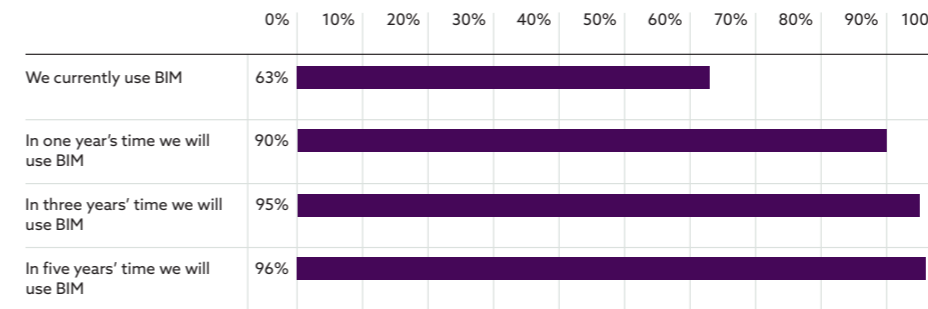
The graph to the right shows the response to this. It shows us that 18%, nearly one in five, use BIM on every project they work on, and 29% use BIM not on every project, but on more than 75% of their projects. To describe the findings another way, one third who are using BIM do so on a minority of projects, and two thirds use BIM on a majority. Once BIM is adopted, it is usually the design methodology of choice.



Approximately what percentage of projects have you used BIM for in the last 12 months?



How would you describe your organisation's future use of BIM?



Future use

We ask those who are aware of BIM about their intended BIM use, and whether they will adopt BIM in the coming years. We find that the intention among the design community is for near-universal BIM adoption, and soon.

There are a couple of things to note here. If people's intentions are realised, 90% will be using BIM by next year, and within three years almost all practices (95%) will. Intentions are not always realised though, and over the last few years we have seen an emerging pattern of actual BIM adoption falling short of what is anticipated.

So where does this leave us? The first thing to note is that the possibility of BIM adoption is not being dismissed. People intend to adopt BIM but, for whatever reason, are not at present (and we will look at this later). Secondly, as we have seen, BIM adoption is steadily rising. If it's taken six years for 60% to adopt BIM, then reaching 95% in another five years begins to look realistic (more realistic, perhaps, than 90% by next year). We will see.

We find that the intention among the design community is for near-universal BIM adoption, and soon.

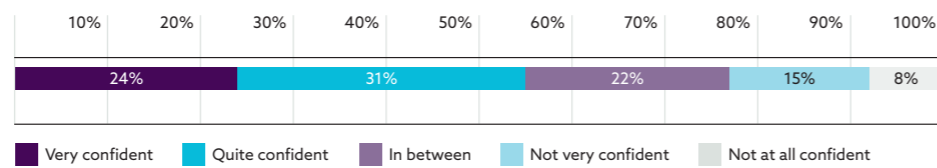
BIM maturity

In order for BIM to be implemented effectively, at both a national and practice level, it is essential that designers have the skills they need to work effectively with BIM. Year on year, we have been monitoring confidence levels of people's knowledge and skills in BIM. Looking at the graph on the right, we can see that, for the first time, a majority describe themselves as confident in BIM. Fifty-five percent are confident and 23% are not.

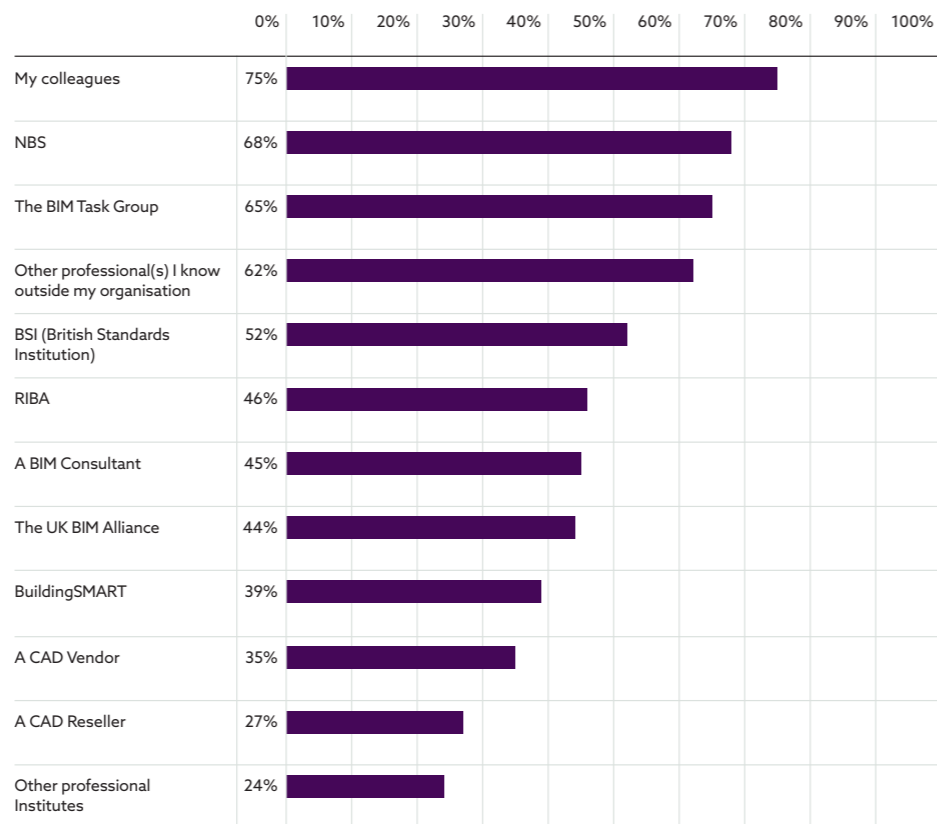
Back in 2012, only 35% described themselves as confident in BIM, and 40% were not confident. It is taking time, but gradually the skills and expertise needed to make a success of BIM are becoming more widespread.

Where are these increasing levels of skills coming from? Fittingly, as a collaborative process, people learn skills in BIM through other professionals. Three quarters turn to colleagues within their organisation for information about BIM and 62% turn to other professionals outside their organisation. The information that professional bodies and expert organisations make available (often at no cost) is important too. NBS, the BIM Task Group, BSI and the RIBA, among others, are significant here. As we have seen before, people turn less often to CAD vendors and re-sellers.

How confident are you in your knowledge and skills in BIM?



How likely are you to turn to the following sources of information about BIM?



BIM levels

BIM adoption is progressive, and often described as a 'journey'. The milestones on that journey are the BIM Levels. Not all Levels are clearly described yet: BIM Level 3 and beyond are works in progress. But by describing different BIM Levels, and mandating Level 2, the Government mapped out a clear direction of travel for the industry.

In 2012, not everyone had seen that map. Only 51% were aware of the different Levels of BIM. Since then, awareness has grown significantly: 85% are now aware of the different BIM Levels.

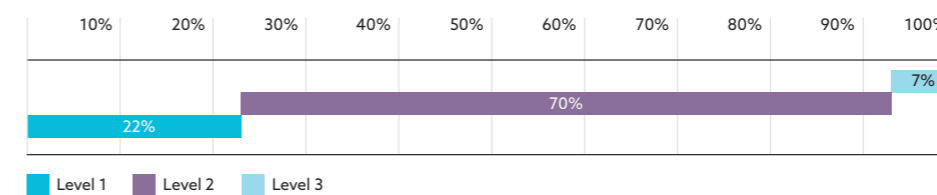
We asked which Levels of BIM people saw themselves as having reached. Twenty-two percent told us that they had reached Level 1; Level 1 is where designers typically create 3D models, and share information through a common data environment. Seventy per cent told us that they had reached Level 2; this is the mandated level in which 3D models are created and collaborated on through, for example, a federated BIM model.

'The government will develop the next digital standard for the construction sector - Building Information Modelling 3 - to save owners of built assets billions of pounds a year in unnecessary costs, and maintain the UK's global leadership in digital construction.'
Budget 2016 Policy Paper.

Seven percent tell us that they are at BIM Level 3; so full collaboration between all disciplines by means of using a single, shared project model. It is fair to say that the full definition of what constitutes BIM Level 3 has yet to be worked out and standardised. Those describing themselves as being at Level 3 are perhaps best seen as those pushing collaborative BIM to its fullest current potential.

In any case, more than three quarters of organisations who have adopted BIM are at or beyond the Level required by the BIM mandate.

What level would you say is the highest level of BIM your organisation has reached on a project?



Those describing themselves as being at Level 3 are perhaps best seen as those pushing collaborative BIM to its fullest current potential.

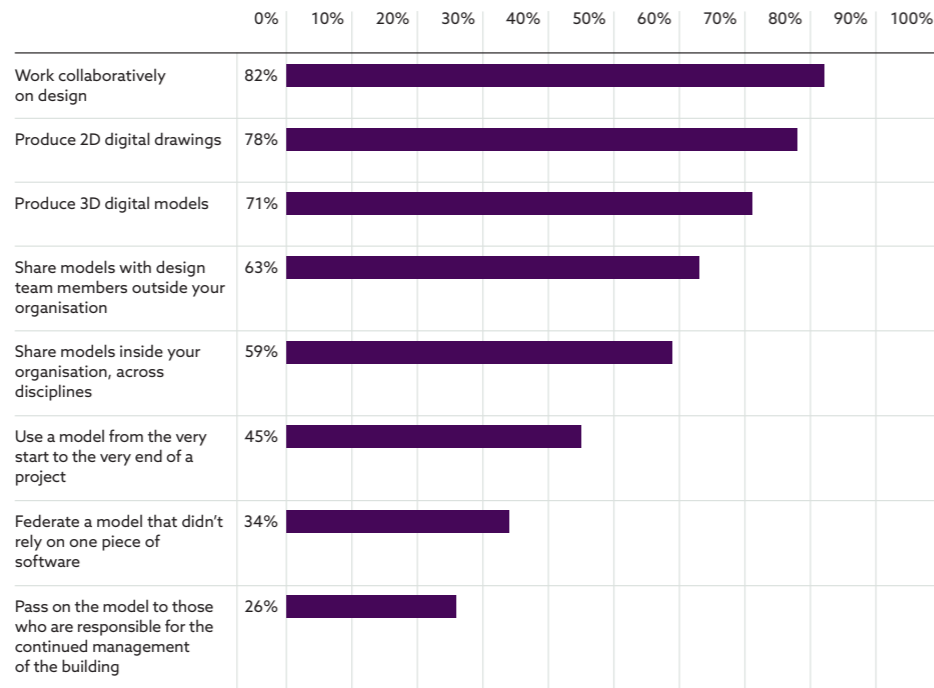


The self-descriptions of the levels attained are mirrored in working practice: working collaboratively on design is standard practice. 3D models are routine, produced by 71% of respondents. Sharing models is common within and outside organisations, with 59% and 63% doing so respectively. Within the design stages, we can see that the BIM practice of collaboration and model sharing is now commonplace.

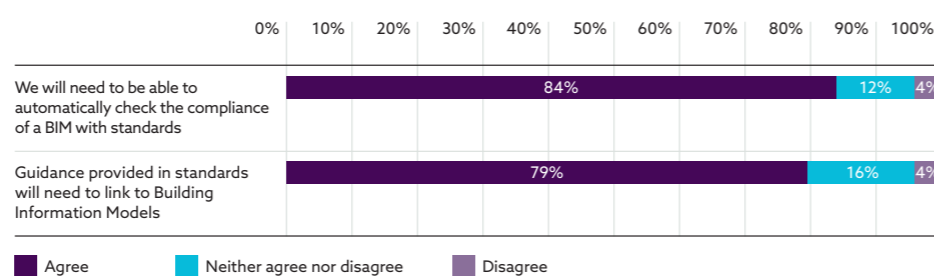
We can also see the challenge of future work to be done. Much of the potential value of BIM lies in its application to later stages, to testing the practical efficacy of a design. By using a BIM to gather and evaluate the performance of a design through construction and use, later designs can be refined and improved in light of the information gathered.

This data-driven, real-world testing and refinement cycle is commonplace in other industries, but we see it less in construction. Only 45% use a model from the start to the end of a project, and only 26% pass on a model for building management. The value of the information embodied in BIM is yet to be fully realised.

Thinking about the projects you were involved in over the last 12 months, did you ever....



Do you agree or disagree with the following statements?



Much of the potential value of BIM lies in its application to later stages, to testing the practical efficacy of a design.

Use of standards

BIM is collaborative. Standards describe the shared process, structures and definitions that allow collaboration. For collaboration to be successful, collaborating parties need to adhere to agreed standards.

The graph below shows the standards and publications that people are using to inform their BIM processes. It is striking that whilst a majority have adopted BIM, no one standard is used by a majority.

BS 1192:2007+A2:2016, which describes the collaborative production of architectural, engineering and construction information, is the most commonly used (by 39%). PAS 1192-2, which specifies requirements for BIM Level 2, is the next most commonly used (38%). Over a third of organisations use the unified work stages, such as the RIBA Plan of Work.

It looks like there is work to do to bring about wider adoption and use of these standards and publications. That work is already underway: the RIBA Plan of Work, with an accompanying toolbox, is freely available at ribaplanofwork.com. The core standards are freely available at bim-level2.org/standards

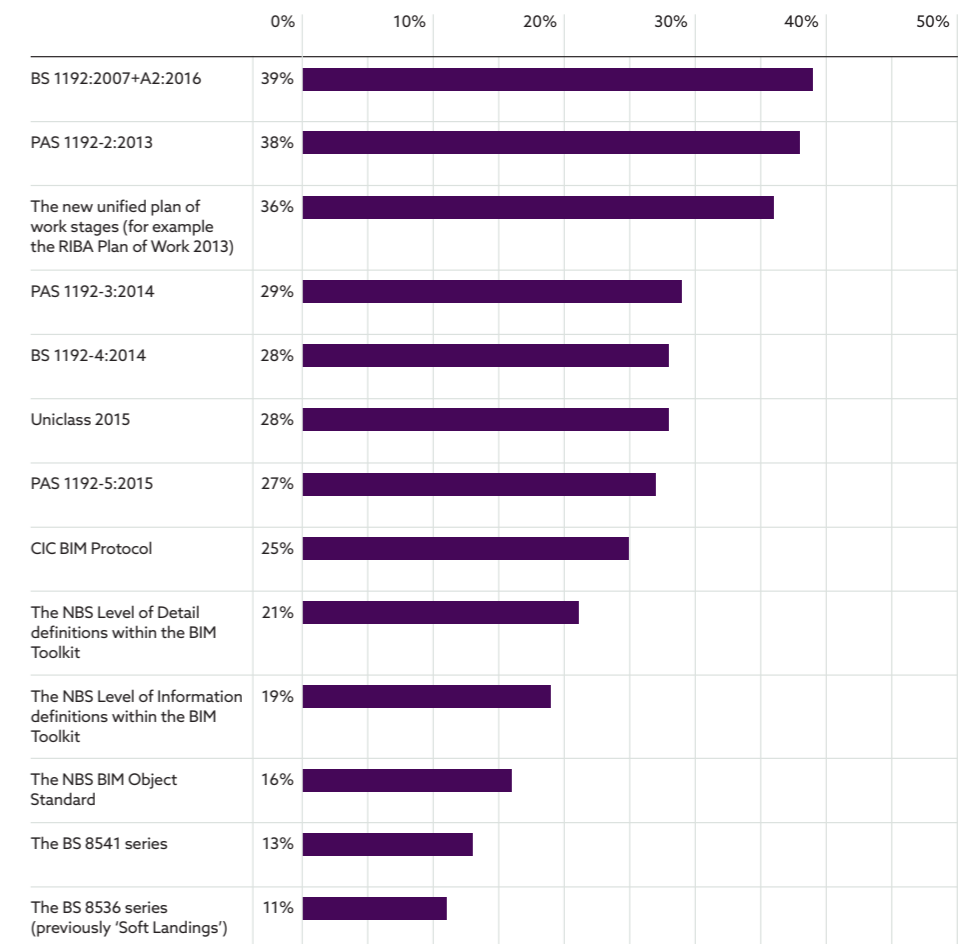
Then again, there is some resistance to the growing list of BIM standards 'We just need to cool it on all the standards'.

There are standards about BIM, and there are standards about buildings and the products that make them up. For the latter, these standards are an integral part of construction information. They are a part of the 'I' in BIM, just like geometric information, specifications or product information.

Like other design and construction information, information about, and from, standards will need to be embedded within a BIM.

Eighty-four percent see automatic compliance checking as a future need, and 79% see the need for a link between standards and BIMs.

Which of the following standards/publications does your organisation use?



The design community needs manufacturers to provide BIM objects. It also needs well-structured generic objects. The NBS National BIM Library provides both of these.

BIM resources

Whilst at its core BIM is a structure within which people can work collaboratively, that structure has many component parts. Among them are: BIM objects, modelling software, standard workflows, contractual arrangements, specifications, and the regulatory and standards environment. We explored these themes a little.

For BIM objects, the message is clear: the design community needs manufacturers to provide BIM objects. It also needs well-structured generic objects. The NBS National BIM Library provides both of these.

Standards need to be placed within the BIM environment, ideally accessible via BIM software tools.

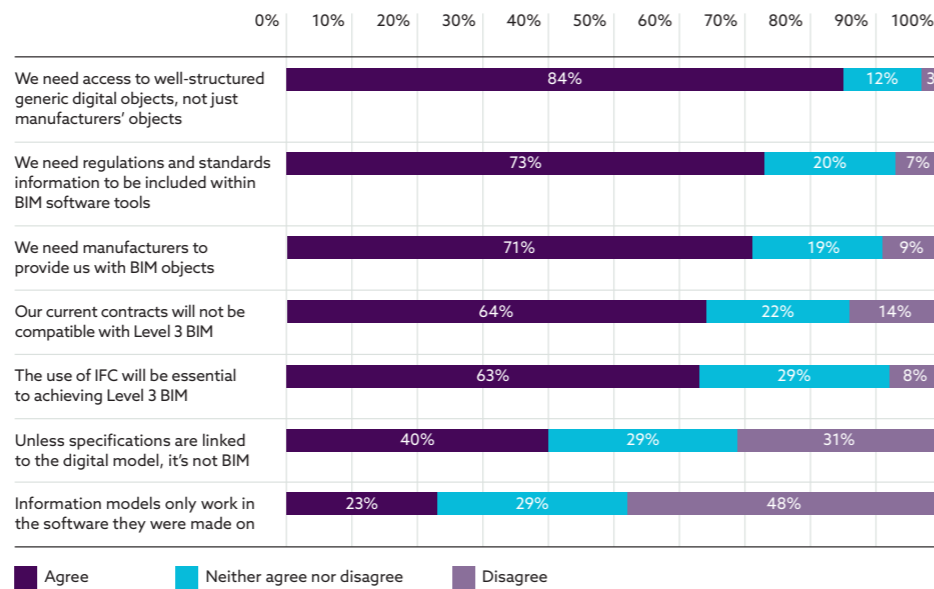
Specifications contain a level of design information not held in a CAD package, so will increasingly be linked dynamically to the BIM.

Contracts need to increasingly reflect the collaborative BIM reality, particularly as we move to Level 3.

'Contracts need to be (re)written with BIM in mind. Design and Build procurement especially works against BIM workflows.'

Similarly, as we to move to Level 3, frictionless movement of BIMs between software packages is essential, and IFCs are the way to do this. Currently 71% use IFC on their projects, a level of adoption that provides a firm base for greater future use and functionality.

Agreement with statements



COBie

Whilst a majority now use the IFC file format, fewer (42%) use COBie (Construction Operations Building information exchange). Like IFC, COBie is a non-proprietary data format. It is there to help deliver the asset information held within a BIM, so that a building can be better managed through its life. A majority of those who do generate COBie output find it useful for delivering information about the management of the facility. So why aren't more people generating COBie output?

'We haven't yet had a client request for this information.'

We asked, and the most common response by far was lack of client demand. Many clients don't know what a COBie output is, and wouldn't know what to do with it if they got it. This may evolve as BIM is pushed beyond the design stages.

That said, a number of respondents raised the issue of COBie generation requiring time and expertise from those creating the BIM. This needs to be paid for.

'Additional time and resource required to compile COBie makes it un-feasible unless specifically requested and included within the agreed fee.'

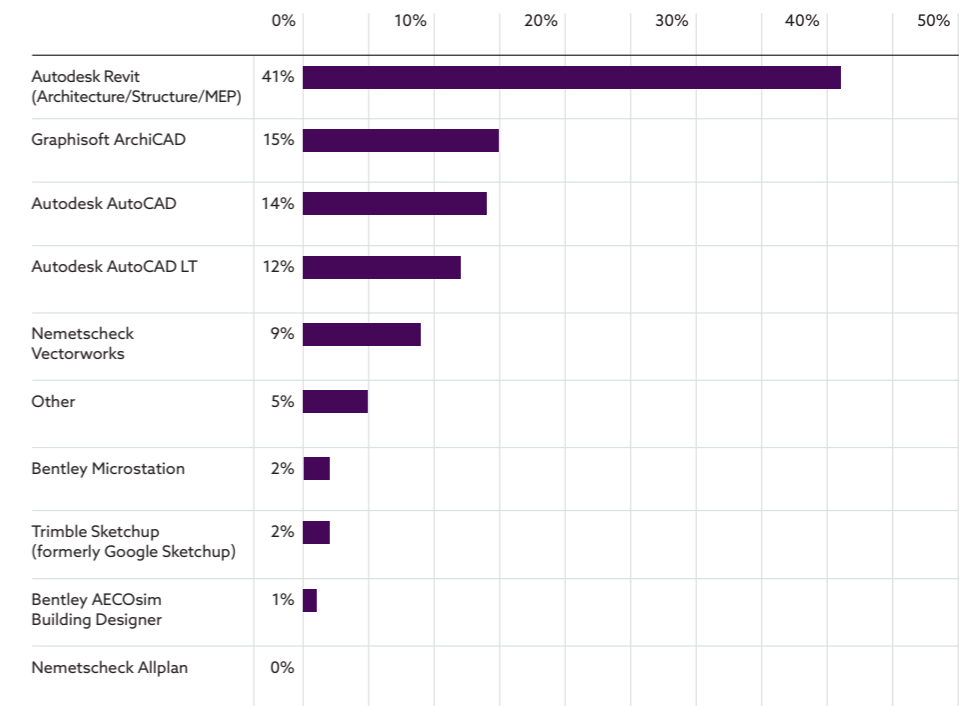
Do you generate COBie output for projects you've been involved with?



How useful did you find COBie for delivering information about the management of the facility?



When producing drawings or models, which of the following tools do you mainly use?



Thirty-five percent now manage their specification references digitally using a free plug-in from NBS.

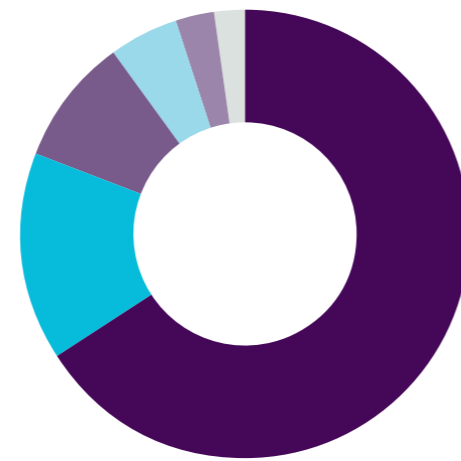
Software Use

As part of our BIM Survey, we have consistently asked which software tools people use. In 2014, we saw Autodesk Revit overtake Autodesk AutoCAD, as designers increasingly created information-rich models, rather than simply geometric representations. Now 41% of those who took part in the survey use Autodesk Revit, well above AutoCAD.

Autodesk dominates the UK market, with 66% using an Autodesk product. Revit is not the only option though: other vendors such as Graphisoft, Nemetschek and Bentley have a significant user base.

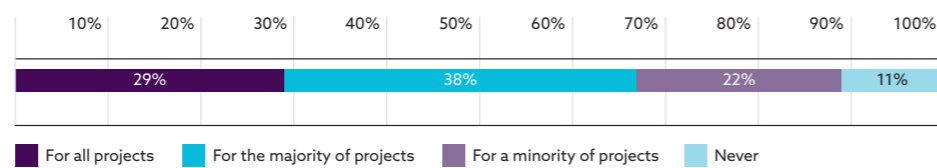
Whilst modelling tools become increasingly sophisticated, sound design will continue to rely on well-written specifications. Increasingly, these need to co-ordinate with the drawings and models to ensure consistency of design information. More than two thirds of respondents are co-ordinating specifications and models/drawings on the majority, or all, of projects. A majority still manually add specification references when modelling. However, 35% now manage their specification references digitally using a free plug-in from NBS.

When producing drawings or models, which of the following tools do you mainly use?



Autodesk	66%
Graphisoft	15%
Nemetschek	9%
Other	5%
Bentley	3%
Trimble	2%

Within the projects you are involved in, do you coordinate project specifications with drawings/models...



BIM objects

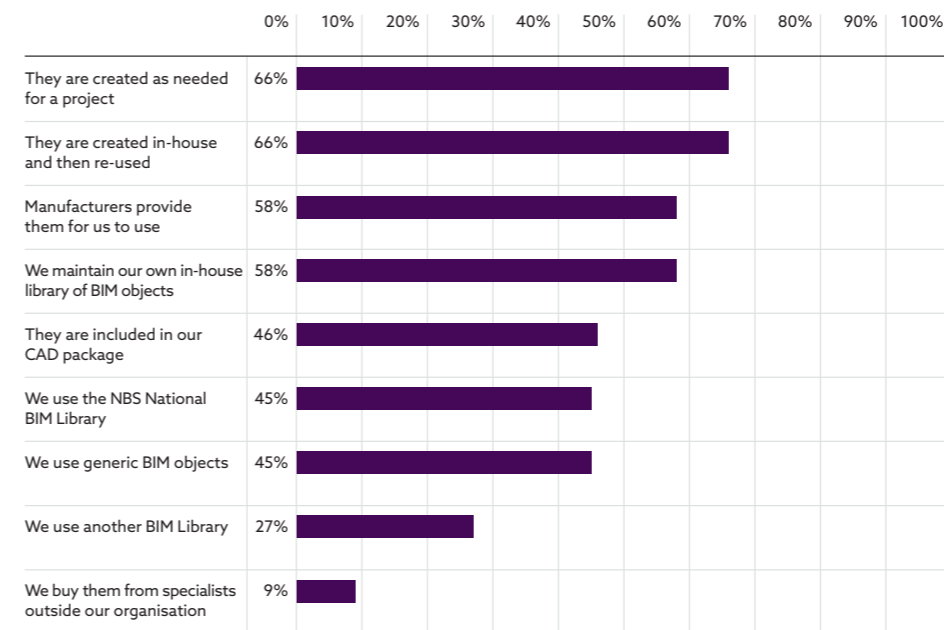
As more practices and projects are created using BIM, so the need grows for an ever broader range of objects with which to populate the models. Indeed, as models come to contain greater detail, the need for standardised, information-rich BIM objects increases.

The most popular ways of getting BIM objects is to create them as needed (66%), and to create them in-house, and then re-use them (66%). Other popular sources are objects provided by manufacturers, and maintaining an in-house library of BIM objects (presumably from multiple sources).

Any sourcing of objects that relies on re-use brings with it a degree of risk. Out-of-date information in a design threatens its realisation. Thorough checking of the information within objects to make sure that it is still accurate mitigates this risk. Even better is taking objects from an up-to-date, central, free-to-use library of information-rich BIM objects. Forty-five percent use such a library: the NBS National BIM Library. This is more than all other libraries combined.

Out-of-date information in a design threatens its realisation.

Where do you get the BIM objects your organisation uses?



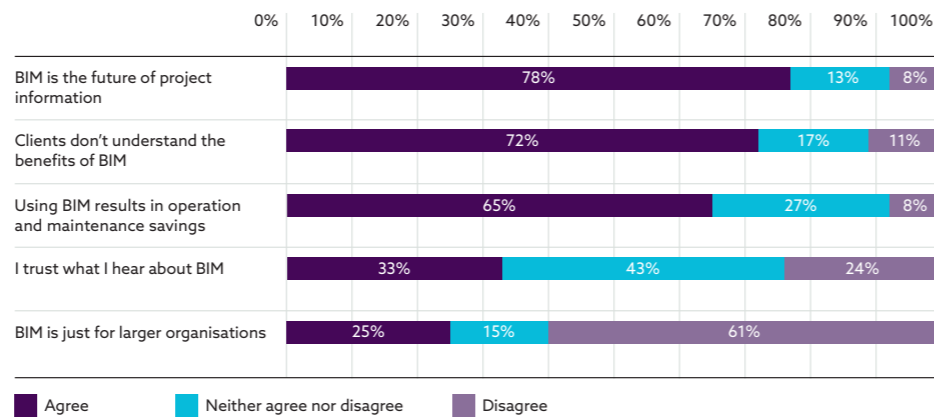
BIM has the capacity to bring real benefit beyond the design stages.

BIM experience

The future of the design process is BIM. Seventy-eight percent see it as the future of project information. In the years we have monitored its adoption, we have seen BIM become the norm for design practice.

The chart below outlines the next challenge. BIM has the capacity to bring real benefit beyond the design stages; 65% see that using BIM results in operational and maintenance savings, but 72% of clients don't understand the benefits of BIM.

Agreement with statements

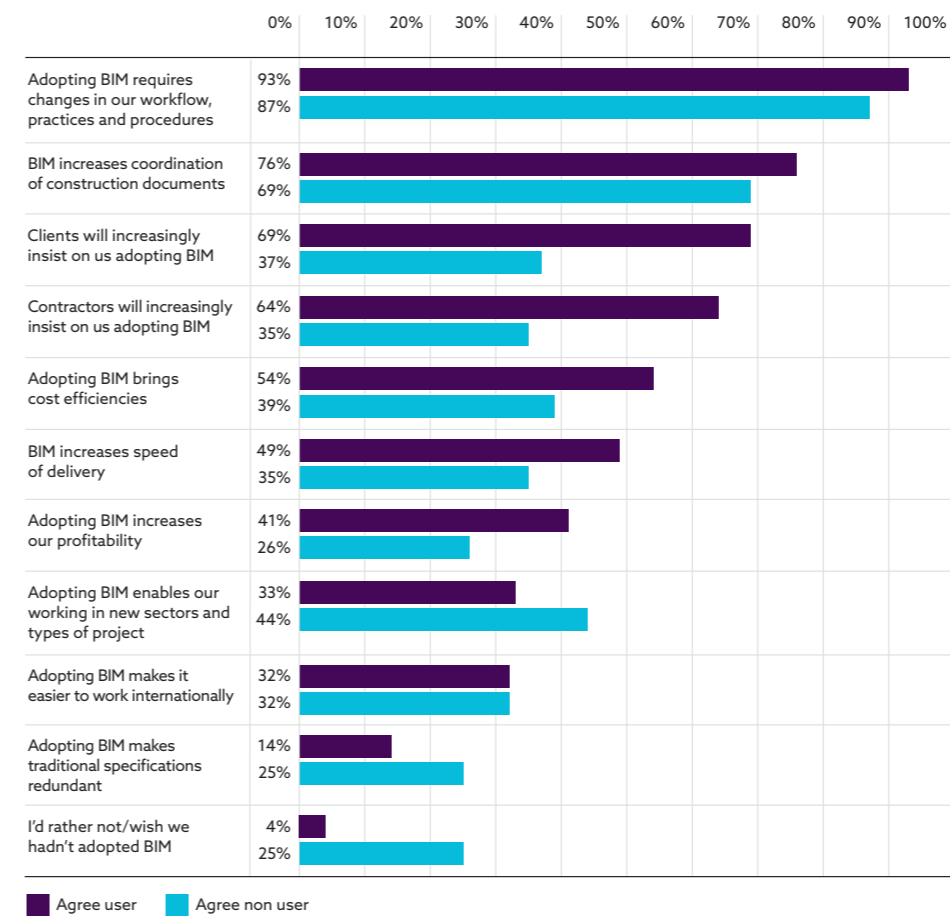


We can understand why so few regret adopting BIM when a majority see that BIM brings cost efficiencies, and that clients and contractors will increasingly insist on it.

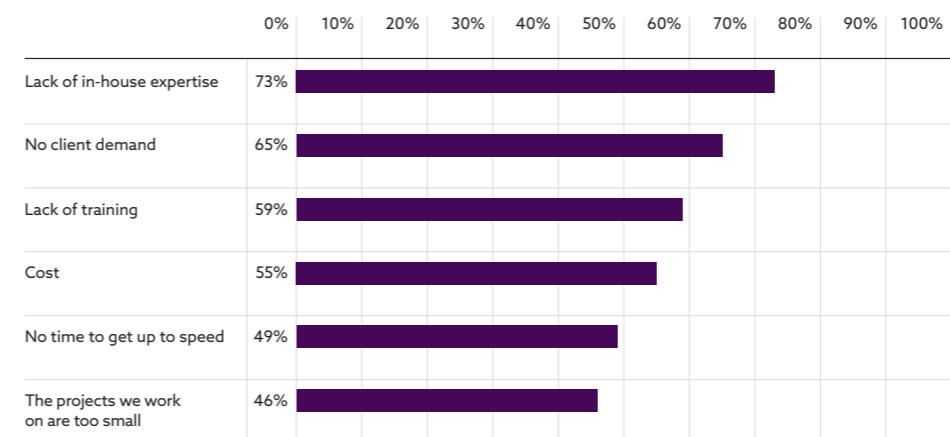
For the benefits of BIM to be more widely felt, there is a need for greater client education. Central Government is leading the way here, not least by outlining the cost savings that BIM has brought. These efficiencies need to become apparent, and to be demonstrated, to a wider range of clients. The move to BIM Level 3, in whatever form that ultimately takes, must help here.



Do you agree or disagree with the following statements?



What are the main barriers to using BIM?



As in previous years, we looked at the views of those who have adopted BIM and compared them with those who have yet to start using it. This allows us to compare expectation with experience: experience is better than the expectation.

Adopting BIM is not easy. Over 90% of BIM users agree that it has required changes in their workflow, practices and procedures, yet only 4% wished that they hadn't adopted BIM (compared to a quarter of non-users who would 'rather not'). We can understand why so few regret adopting BIM when a majority see that BIM brings cost efficiencies, and that clients and contractors will increasingly insist on it.

We asked those who have yet to adopt BIM what the barriers to adoption are. These barriers fall into two types: internal, such as a lack of training, expertise, time or available funds to meet the cost of investment; and external, specifically a lack of client demand and projects being too small to require BIM.

Not using BIM may be sustainable in the short-term by restricting design work to those clients, contractors and projects where BIM is either not required or not appropriate. But that work may increasingly become a niche area.

End note

BIM adoption in the UK is growing in both extent (more people are using BIM) and in depth (people are moving up the BIM Levels). The introduction of the Government's BIM mandate has gone hand in hand with this. The BIM mandate has broadly been a success. There are areas for attention though, particularly in the education of clients and the enforcement of the mandate. In the longer term, there is a need for BIM to more fully move out of the design stages and into the maintenance of buildings.

Perhaps the significant changes of these last twelve months have been as important as the introduction of the BIM mandate.

In politics and economics, we are seeing era-defining change, through Brexit and the uncertainty that it brings across the design and construction sector.

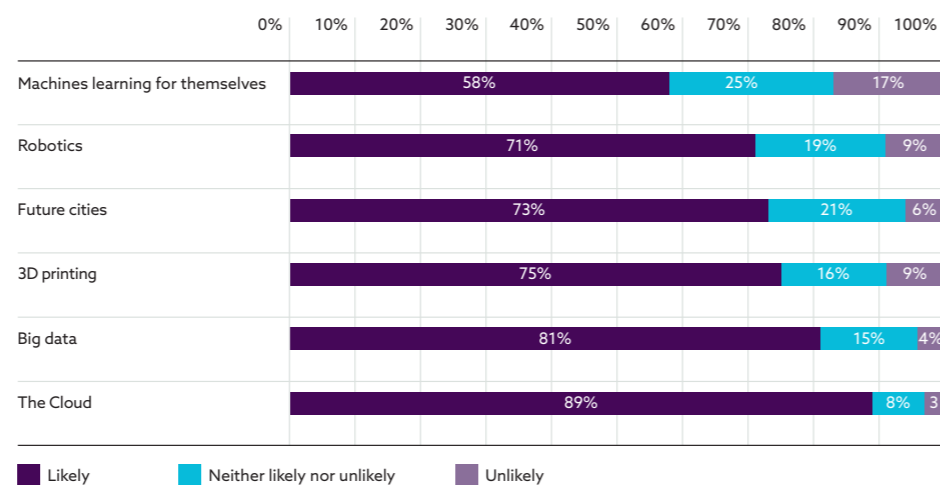
In technology, we see the rapid, at times astonishing, growth and development of data capture, exchange, aggregation and interrogation. Distinctions between consumers and producers of data are blurring rapidly. This is bringing new ways of working, and of working together.

Information is also changing how products are produced, whether they are apps, cars or jet engines. Real-time data capture and performance evaluation allows continuous design evolution. The value of a product is decreasingly held within the product itself, and increasingly in the data held about it. Unlike physical products, data can be reproduced and distributed at virtually no cost. This allows rapid collaborative improvements in design through the as-needed formation of disparate teams.

In such times of rapid change, new ways of working often flourish, and go on to displace old methods of production. We are seeing this with BIM, but BIM is likely just to be the start. The graph below suggests some of the developments that the design community anticipates next.

It is likely that these things will work together in ways that we don't foresee, but it's a safe bet that information-rich companies will flourish best.

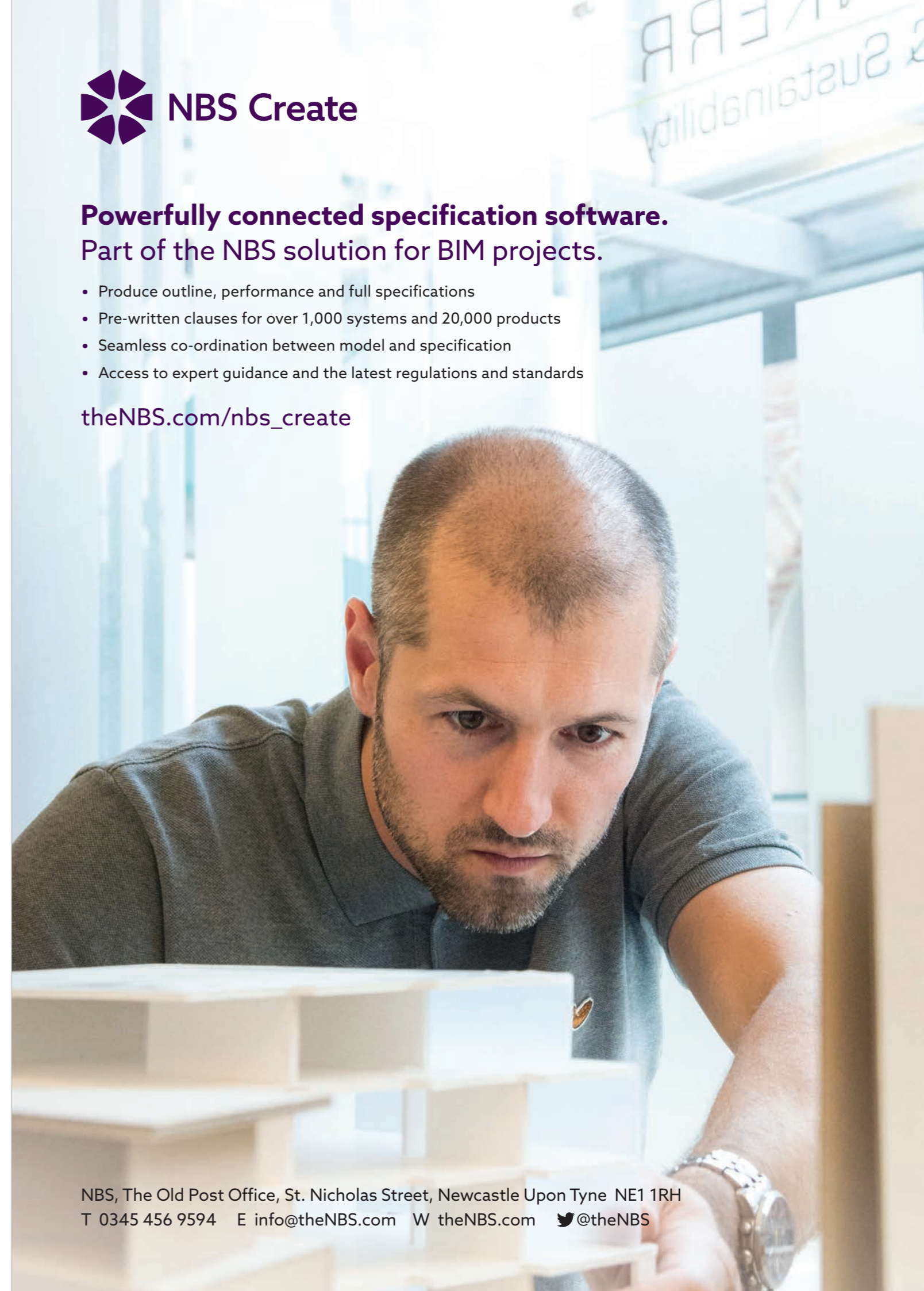
In terms of the future of the construction industry, how likely are the following technologies to have a significant influence?



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Working toward a unified approach to BIM in Europe



Dr Ilka May
CEO, LocLab Consulting GmbH

How is the EU BIM Task Group getting on?

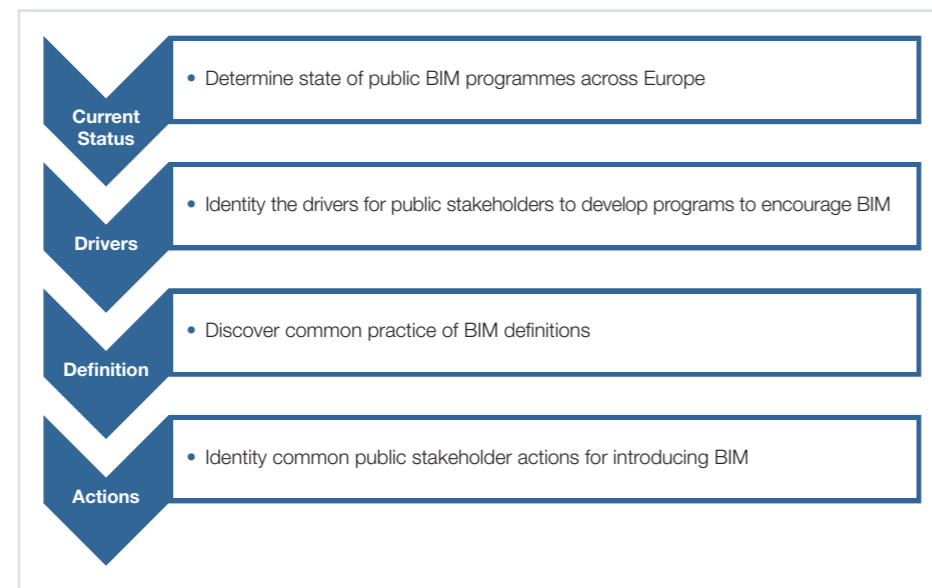
A year ago, Adam Matthews, Chair of the EU BIM Task Group, reported here that Europe's public procurers, policymakers and public estate owners are beginning to recognise the positive and transformative effect that digitalisation brings to both public works and the construction sector. European nations are introducing national programmes to encourage Building Information Modelling (BIM) with the common aim of improving value for public money, quality of the public estate and the sustainable competitiveness of markets. To address this opportunity in a common approach for Europe, the EU BIM Task Group was formed in 2016.

This task group includes a mix of public sector representatives and nominated industry advisers from 22 European nations, comprising public estate owners, infrastructure operators, policy officers and procurers. The European Commission awarded the EU BIM Task Group funding for a two-year programme (2016-2017) to deliver 'a common European network aimed at aligning the use of Building Information Modelling in public works'. This framework will be produced as a handbook describing common practice and definitions to support Europe's public sector stakeholders who are considering a harmonised introduction of BIM.

Why and how are the European Nations approaching BIM?

As their first activity after its official launch in February 2016, the task group carried out a survey amongst its member states. The purpose of the survey was to establish a better understanding of the current status

and practices of the member states regarding BIM implementation programs. This survey was a step towards the development of the handbook. It was designed to collect information in these four areas:



Questions concerning the member states' current or planned activities have revealed that an increasing number of European governments and public sector organisations have introduced programmes to encourage the wider adoption of BIM at a national, regional or public estate level. The number of national public sector-led BIM programmes has increased significantly since 2011 to approximately 11 active programmes.

The benefits the member states expect from a wider adoption of BIM on public sector projects and by private industry include:

- Fewer errors;
- Less waste;
- Greater certainty of delivery timescales;
- Improved coordination and collaboration within the supply chain and with the client;
- Better outcomes for the public client, and users and operators of the facility or infrastructure asset.

The survey identifies that these benefits for the public sector can be categorised as:

- Economic **cost benefits** in the capital phase or whole life of the asset;
- **Value benefits** such as environmental or social, i.e. growths, sustainability, protection of small and medium enterprises etc.

Understanding the drivers and expectations of the member states forms an essential foundation for a harmonised European framework, addressing the risk of divergence across different European markets. Divergence in definitions and practices for BIM would likely create new barriers for working in different markets and add cost of compliance to the construction sector.

The handbook, which aims to provide guidance and support to the member states, provides two central frameworks for the common introduction of BIM to Europe's public estate and public works:

- A strategic framework for public sector-led BIM programmes;
- A common performance definition of BIM.

These two frameworks complement each other to provide public stakeholders with a holistic methodology for the introduction of BIM as a national, regional or public estate initiative, and an implementation level definition of BIM to provide consistency at the project level.

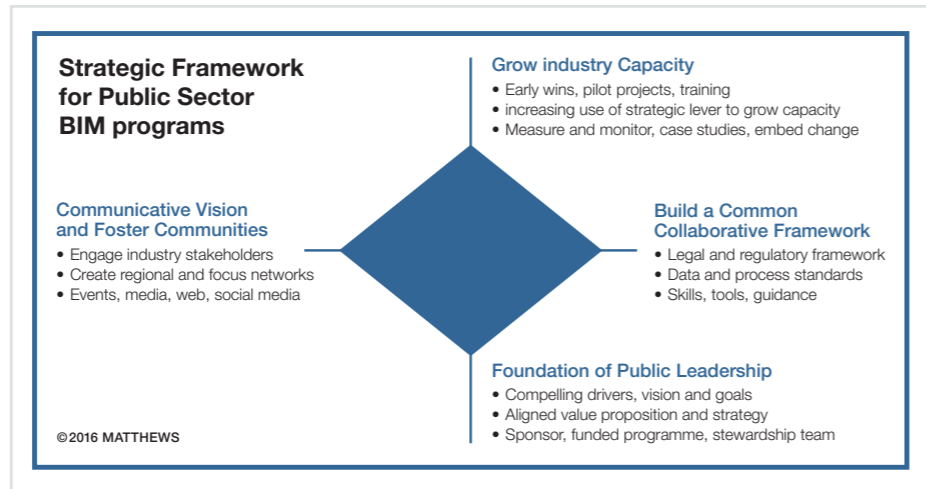


Adam Matthews MBA
International
Director for the UK Government's BIM Task Group and
Chair of the EU BIM Task Group





Richard Lane
CLO, KnowledgePoint and Programme Manager, EU BIM Task Group



A common strategic framework for BIM implementation

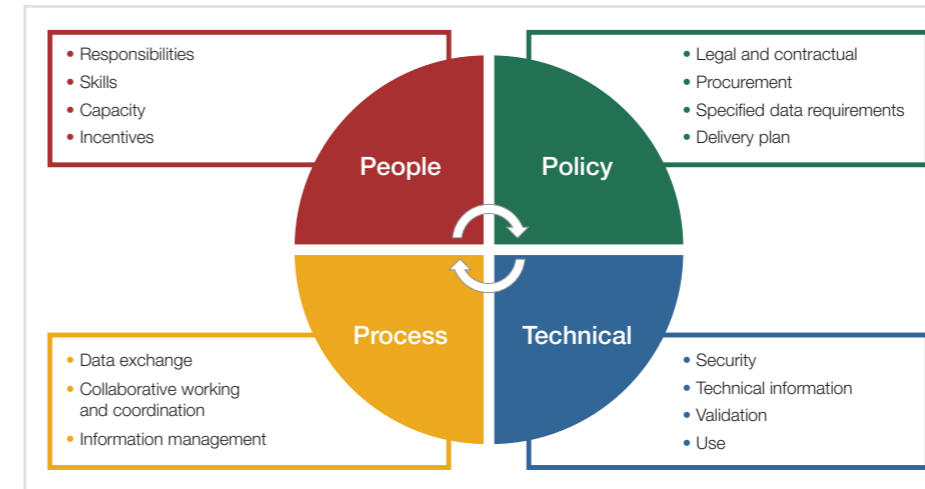
BIM programmes are change management initiatives that require goals, resources, people, developments, momentum, successes and time. In order to coordinate and align these various elements in order to deliver robust BIM programmes, a strategic framework is required. Based on the analysis of a range of public sector-led BIM programmes, the handbook describes a common strategic framework to provide a common approach for the introduction of BIM by Europe's public sector.

The framework identifies four strategic areas of action that are important when developing robust and effective BIM initiatives:

1. Establishing public leadership;
2. Communicating vision and foster communities;
3. Developing a collaborative framework;
4. Growing client and industry capability and capacity.

Each of these four high level areas contains specific actions for the public stakeholder to consider. The framework provides a route map for those stakeholders starting the journey and offers a cross-check to those who have already begun.

This framework recommends that public sector-led programmes are most effective and robust when these four strategic areas are well-defined and equally developed. The handbook contains detailed descriptions of the recommended actions for a successful implementation.



A common performance definition of BIM

When BIM is introduced or specified at a project, organisational or national level, there is often a lack of clarity and common understanding of what BIM actually is. Despite more or less common definitions, we often observe that BIM means many things to different people. There is no single international standard or definition of the activities that should be procured and performed on a project for it to be considered 'a BIM project'. BIM is inconsistently understood as software, a 3D model or a system. This inconsistency causes confusion and divergence for public procurers and private sector suppliers, leading to barriers for successful implementation. Over-production and processing of data and information is a frequently observed result of the technical capability with a lacking ability to identify, specify and procure only the required amount and quality of information at a given point in time.

Experience from the EU BIM Task Group recommends that a clear and specific definition of minimum activities and characteristics, combined with the phased implementation of the strategic framework in a realistic timeframe, seems to be the most promising approach for a successful transformation of the construction sector.

The characteristics cover four core definition areas, as shown above.

The minimum characteristics described in the handbook will enable the change from a strategic level to the operational use of the BIM methodology at a project level. The common EU BIM performance level provides a signpost to existing and developing standards. It will be most effective when the four definition areas are well defined and equally developed.

The handbook will be published in summer 2017. The European Commission has already confirmed further support for a harmonised and aligned European approach to digitisation in the construction sector.

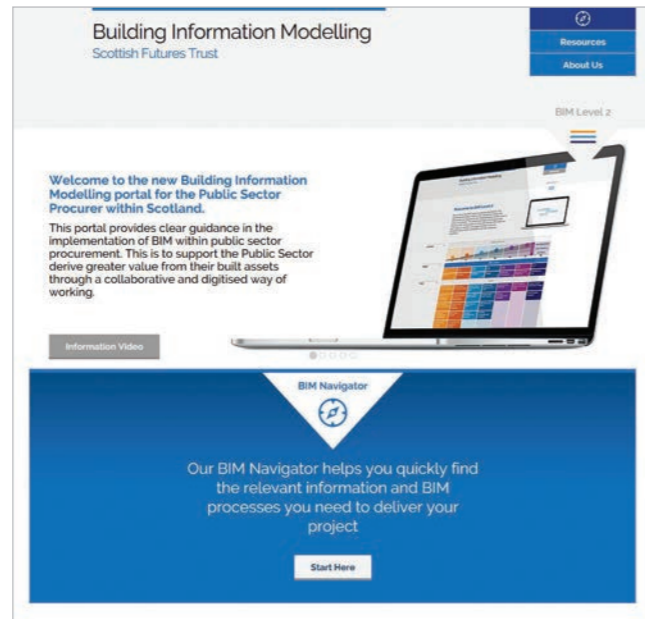
Conclusion

The European Commission has announced its continued support for the Task Group and its aim for a harmonised and aligned European approach to digitisation of the construction sector. Industry engagement with the handbook has already begun, with events and briefings at European and national levels – and provides useful input and support for its aim.

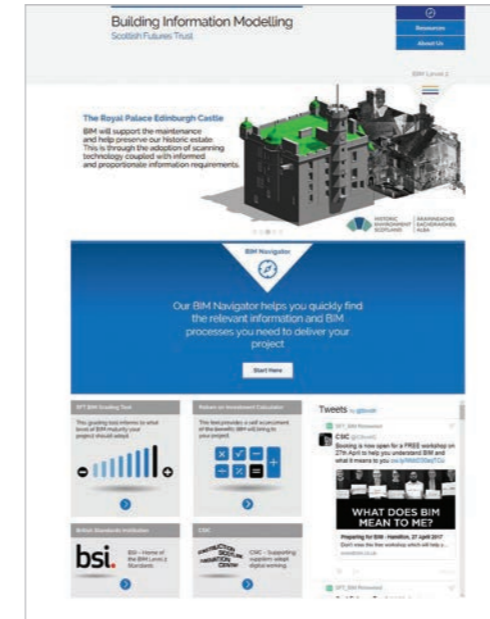
Scotland's journey to the digitisation of construction



Paul Dodd
Associate Director,
Scottish Futures
Trust



The innovative BIM guidance website will support public sector procurers who adopt BIM on new construction projects.



As Scotland's construction sector continues to move towards digitisation, the management of digital data and information within the public estate is seen as a key mechanism to drive efficiencies during the construction and operational stages.

The Scottish Government recognised this, and accepted the recommendations of the Review of Scottish Public Sector Procurement in Construction which stated that *'Building Information Modelling (BIM) should be introduced in central government with a view to encouraging adoption across the public sector. The objective should be that, where appropriate, projects across the public sector adopt BIM Level 2 by April 2017.'*

In response to the Review's recommendations, the Scottish Futures Trust (SFT) established the BIM Delivery Group for Scotland in August 2015, and a Scottish BIM Implementation Plan was published in October 2015. Since then, SFT has been working in partnership with public sector bodies, academia and industry to deliver the challenging April 2017 BIM objective.

The Scottish BIM Implementation Plan set out a roadmap to deliver the Scottish Government's objective and focused on several enabling actions, including guidance creation, pathfinder projects and training for the public sector, which have all been delivered.

In forming the BIM Delivery Group for Scotland, SFT appointed David Philp, Global BIM Consultancy Director for AECOM, as chair. Paul Dodd, Associate Director from SFT, noted that: *'David's experience, expertise and support has been of great value to the BIM programme within Scotland.'*

Ahead of April 2017, the Scottish Government reconfirmed their commitment to BIM by embedding it within procurement policy through a policy note issued in March 2017. In addition, the BIM Delivery Group for Scotland launched their new innovative BIM Guidance website. The website will support public sector procurers who adopt BIM on new construction projects.

The new guidance website seeks to answer three questions for the procurer: When should BIM be adopted, and to what level? Why should BIM be implemented through a likely-return-on-investment tool? And thirdly, how do I implement BIM on projects?

When should I adopt BIM as a client? In Scotland, as of April 2017, the new Scottish government policy will require relevant public sector procurers to assess each new project for BIM via a new 'BIM Grading Tool'. The online tool seeks project-specific information and states which BIM Level the project should adopt.

Why should I adopt BIM? The BIM programme for Scotland has developed a unique return-on-investment tool that assesses the cost and qualitative benefits of adopting BIM Level 2. This is a new online tool that allows public sector bodies to provide project-specific data and assess the likely benefits. The tool generates a summary dashboard to support business cases and investment. This will assist in clarifying why BIM should be adopted by identifying the marginal gains on a cost and qualitative basis.

Finally, **how** should I adopt BIM as a client? The new BIM Guidance Portal for Scotland provides a new BIM Navigator that quickly directs users to organisation-specific guidance to support their BIM adoption. Key to the guidance is to support public sector clients in developing considered and well-defined information requirements to set the conditions for success. The BIM Guidance Portal includes templates, guidance and best practice all aligned to the British Standards and for BIM Levels 1 and 2.

The approach is one of proportionality. There is an awareness that procurers, as well as industry, need to get the basics right and develop a robust information management platform to allow the industry to progress on its digital journey. Therefore, it may be better to implement BIM Level 1 in lieu of BIM Level 2 to meet the needs of the project and embed better data management and sharing.

All these new tools and guidance are contained within the new BIM Guidance Portal that is available to all: <https://bimportal.scottishfuturestrust.org.uk>

In delivering its objectives, the BIM Delivery Group for Scotland has focused on collaborative working and created key working groups to support Scotland's BIM journey. A BIM supplier group was formed in partnership with Construction Scotland Innovation Centre to align the approach of the public sector to the needs and capacity of industry. A new parallel BIM programme for industry has been developed in partnership between the Construction Scotland Innovation Centre, BIM Regions and the SFT BIM Supplier Group. This will encompass raising of awareness, training and seminars for industry over the next three years.

The BIM Delivery Group also recognised how digital working can support the skills shortage within the construction sector. A BIM academia working group was created to consider the approach to skills, training and using digital working to attract new entrants to the construction industry. Furthermore, the BIM Delivery Group delivered training workshops across Scotland attended by 350 public sector delegates. Finally, a BIM Buyers group has been created, to bring public sector bodies together to share the development of guidance and lessons in how BIM is implemented within public sector organisations.

Scotland's BIM programme has attracted interest both nationally and internationally. This has enabled collaborative working with other national BIM programmes, including Germany, Ireland, Singapore and New Zealand.

'The Scottish Government's BIM programme has delivered innovative tools to ensure that an appropriate journey towards digitisation for the Scottish public sector can be determined and built upon. From my global perspective the Scottish BIM programme is attracting a lot of positive interest and is a true partnership between government and industry seeking new ways to better our construction industry', said David Philp.

The construction sector has seen gradual adoption of digital working, and there are many recent examples of infrastructure projects within Scotland where greater digital working has been adopted. The new BIM requirements will be a further step in Scotland's journey towards digital working within the built environment.

'The BIM programme for Scotland set ambitious and bold objectives which will be delivered this year. Through embedding BIM requirements within Scottish Government policy, the new innovative guidance portal and collaborative working across industry, Scotland is well placed to adopt digital working to support better outcomes within the built environment', said Paul Dodd.

From April 2017, the BIM Delivery Group for Scotland will continue to engage and collaborate with the public sector and industry. The BIM Guidance Portal will offer a platform to share best practice and engage with industry as BIM is implemented beyond April 2017.

The launch of the Scottish Government's BIM policy in April 2017 has marked a significant milestone for Scotland's own BIM journey. With billions of pounds spent by Scotland's public sector on vital infrastructure each year, the implementation of BIM will support improved project delivery and maintenance, and lead to improved efficiencies and savings for the public sector.

The BIM Delivery Group for Scotland will seek to continue this digital journey as we have to date: through an approach of proportionality, collaboration and ambition.

The implementation of BIM will support improved project delivery and maintenance, and lead to improved efficiencies and savings for the public sector.



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Our integrated suite of BIM tools and content support you through the BIM workflow, enabling you to make the right decisions and deliver outstanding projects in an informed, collaborative and efficient way.

Stage 00 Strategy to Stage 01 Brief

Use the free **NBS BIM Toolkit** to ease collaboration on your Level 2 BIM project, by defining who is doing what and when to ensure the client's requirements are met.

Stage 02 Concept

Develop your concept design using BIM objects from **NBS National BIM Library** – the UK's fastest-growing BIM library and the only source of objects guaranteed to meet the **NBS BIM Object Standard**.

Stage 03 Definition to Stage 04 Design

Use **NBS Create** to specify the performance of systems and then develop your full specification, including easy access to the latest regulations and standards in the **Construction Information Service**.

Stage 04 Design

Synchronise your CAD model and specification with the **NBS Plug-in for Autodesk Revit**.

Stage 05 Build and Commission to Stage 06 Handover and Closeout

Where product decisions are left to the contractor, they have the latest manufacturer content at their fingertips using BIM objects that are linked to **NBS Plus** specifications

Stage 06 Handover and Closeout to Stage 07 Operation and End of Life

Hand the model over to those maintaining the built asset who will benefit from the populated facilities management properties contained within the standardised NBS BIM objects

theNBS.com/BIMworkflow

BIM on a live project



Dr Stephen Hamil
Director of Research and Innovation, NBS

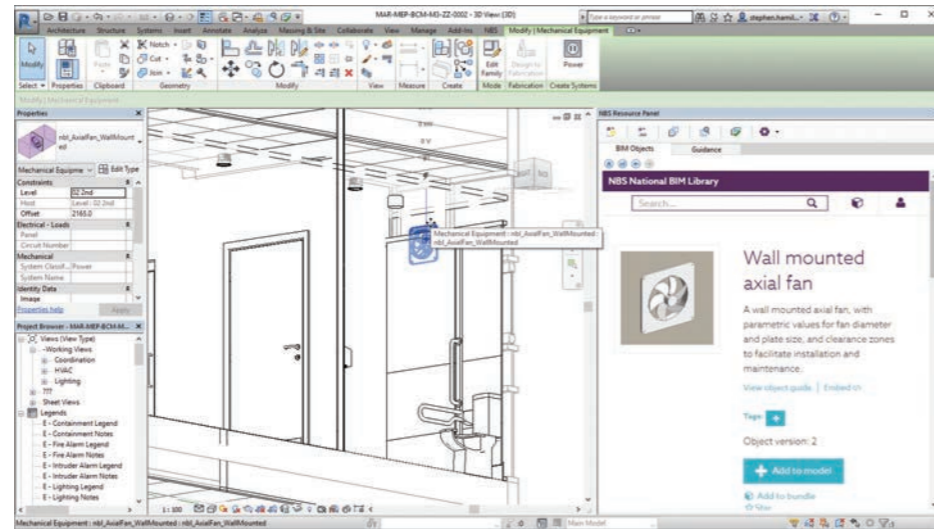


Figure 1.1 – Use of generic BIM objects within the design

This case study looks at how Manchester City Council's supply chain is utilising BIM on their schools' programme. It looks at one of these schools, the St Margaret's refurbishment project, through the design and specification phases.

The project team included: ISG (main contractor), Lovelock Mitchell (architect), BCM (engineering services) and Scott Hughes (structural engineering).

1. Designing with objects

Following the agreement of responsibilities and deliverables in the plan of work, the team began work on the design and specification process. With respect to the design, all members of the team modelled the project in 3D. Both generic and manufacturer objects from the NBS National BIM Library were used on the project. Examples of where generic objects were used included engineering services components where the overall system was being specified by performance. For example, for the ventilation system, the overall system performance was tightly specified – but just the type of product that should serve these systems was specified. As the product selection was left to the Contractor, generic

objects such as the wall-mounted axial fan were used for the ventilation system, as shown in Figure 1.1.

Where manufacturers were selected by the design team, manufacturer objects were used. Examples of this include ceilings, door sets, cubicles and floor coverings. Figure 1.2 shows an example of a manufacturer BIM object that formed part of the ceiling system in the architectural design.

Having standardised BIM objects in terms of naming convention, classification and the property sets within the objects were considered essential to the project team and the client. These rules were agreed in the BIM Execution Plan when the project team was first assembled.

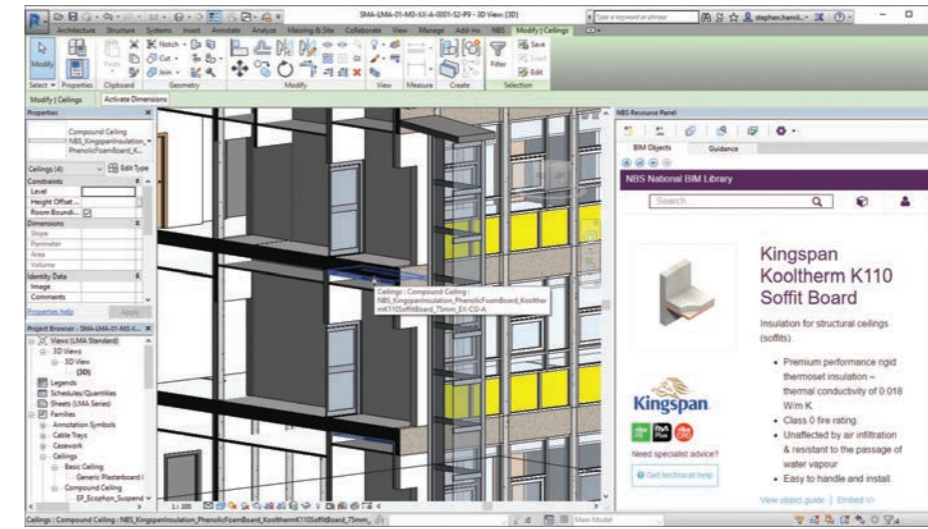


Figure 1.2 – Use of manufacturer BIM objects within the design

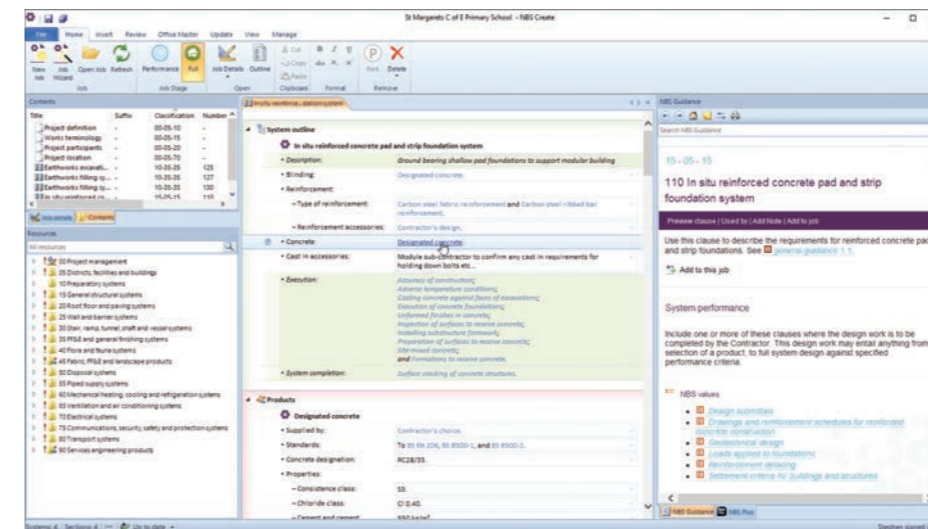


Figure 2.1 – A full specification for a concrete foundation system

2. Well-structured specifications

All of the main disciplines used NBS Create for their project specifications. Having a consistent specification structure and format across all of the disciplines created consistency for the team, and also for the Contractor who then uses these specifications.

The specifications were a mixture of performance and full specifications. For the architecture, an example of a performance specification was the cycle shelter, where the Contractor had the responsibility of submitting suitable proposals based on a durability requirement of 20 years and appropriate inclusive design considerations. An example of a full specification was the modular ceiling system, where each product specified was from a specific manufacturer's product range. These products were added to the specification using the NBS Plus functionality where the latest manufacturer information can be inserted into the specification from the cloud.

A final method of specification used on the project is illustrated in Figure 2.1. In this example, the concrete foundation system was fully specified, but the manufacturer selection for the individual products was left to the Contractor, provided that these selections met the criteria specified.

Having standardised BIM objects in terms of naming convention, classification and the property sets within the objects were considered essential to the project team and the client.



3. Coordinating model with specification

As expected on BIM projects, the design models were coordinated at regular intervals to avoid clashes between the architecture and the engineering. In addition to this, the models and the specifications were also coordinated.

Figure 3.1 shows the free NBS Plug-in being used to link the model and specification. In this example, the floor covering to the school gym is selected in the design, and the specification for this item is being viewed in the context of the model.

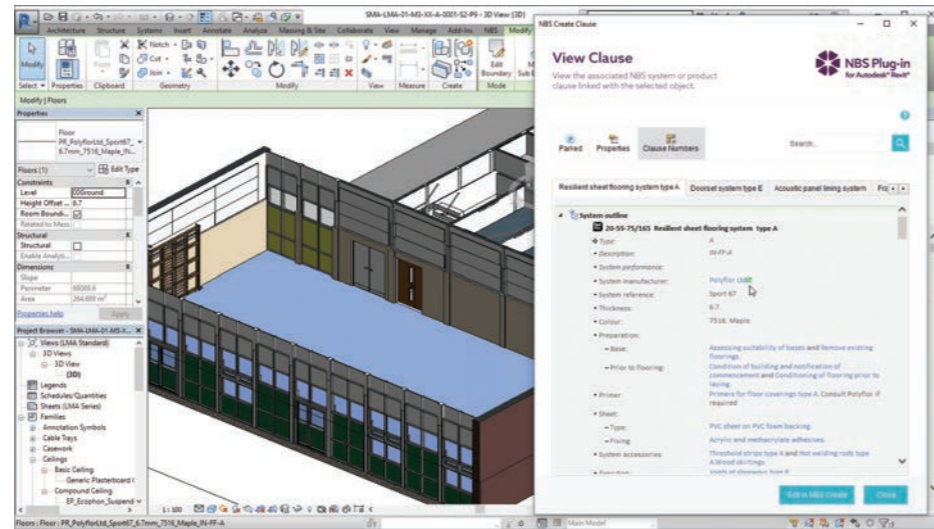


Figure 3.1 - Linked design and specification in the architectural model

4. Published output

Within the BIM Level 2 process, PDF is still the contractual output format. Each of the specifications was published to PDF format and presented with the brand of the organisation who had responsibility for each specification.

Figure 4.1 shows the three specifications for architecture, engineering services and structural engineer in PDF format.

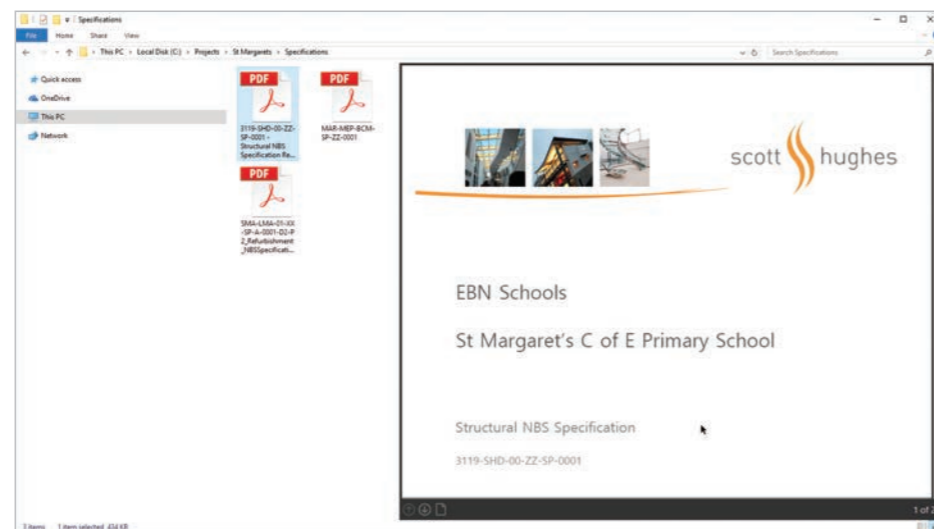


Figure 4.1 shows the three specifications for architecture, engineering services and structural engineer in PDF format.

By utilising NBS we can have a standardised approach on our BIM projects. Objects within the model are consistently structured.

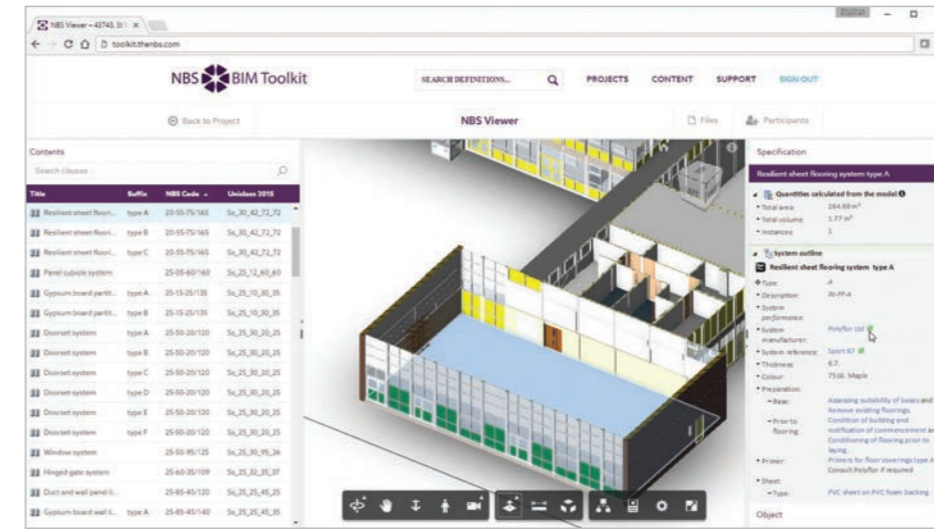


Figure 5.1 - Viewing the specification and the model through the web browser

5. Future developments

Going forward, it will not just be the design team that benefit from the coordination between model and specification. Emerging technologies such as the cloud and modern web browsers allow complex information to be visualised without installing any software.

Within the NBS BIM Toolkit, this capability is now being tested. Within each project, users may upload their models and specifications to allow other members of the project team (such as the client, the cost consultant or the Contractor) to query and understand this information in ways not possible through traditional paper methods of working.

Key benefits of the NBS BIM ecosystem

Having project teams utilise the NBS BIM ecosystem has benefits for the designers, but it also has benefits for the client and wider project team.

Alistair Burns, Design Manager with the Capital Programmes and Property Team for the Council commented: 'As a client running a number of construction projects it is essential that our various supply chain partners have a consistent process for developing information through each project. With this current secondary school programme we've been able to look at the BIM Level 2 process and implement an approach that we are very happy with'.

Jane Shaw, Design Manager for ISG, commented: 'As a contractor we need consistent information from each member of the team. By utilising NBS we can have a standardised approach on our BIM projects. Objects within the model are consistently structured. The specifications from each discipline have the same structure and it is clear where design responsibility lies and where as a contractor choices and proposals are required'.

Key benefits included:

- A standardised approach to objects within the design models.
- Better coordination between the drawings generated from the models and the specification.
- A consistent set of specification documentation from each discipline for the Contractor to take advantage of.

Find out more about NBS for BIM Projects at: www.theNBS.com/bimworkflow

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