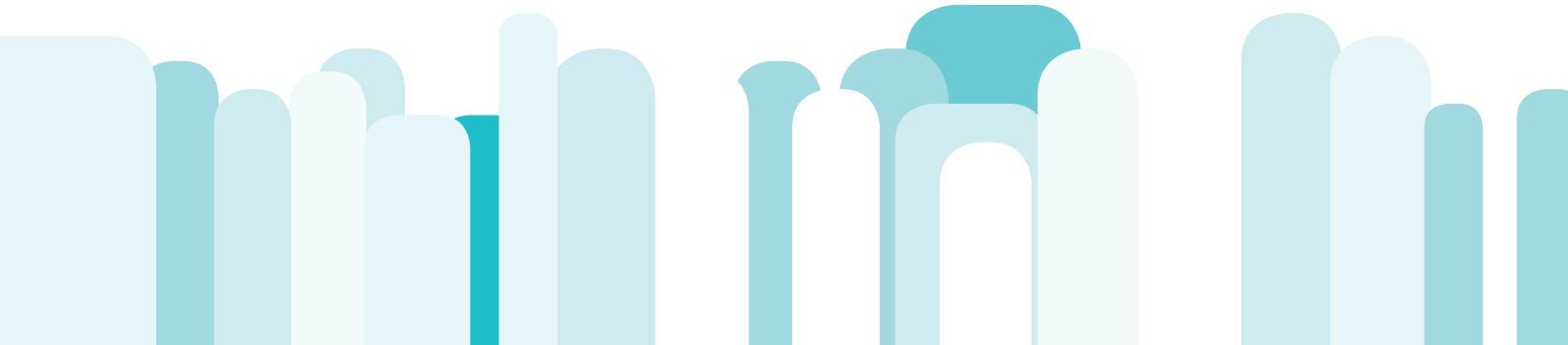


NBS National BIM Report 2015



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“It is through the success of BIM in centrally procured projects that we will see – and are seeing – real savings that make the return on investment in BIM evident to all sectors of the construction industry.”



We would like to thank the following organisations for supporting this report by circulating the survey to their members:



Introduction

Richard Waterhouse

CEO, NBS and RIBA Enterprises

This is our fifth annual BIM report and it has turned out to be one of the most intriguing yet.

The UK construction industry has emerged from its longest recession in living memory to a point where activity levels are placing increasing strain on resources. With industry forecasts predicting further significant growth for the coming years, additional pressure is likely and as a result, the need for delivering efficiencies in design and delivery stages are more needed than ever.

However, the availability of resource and expertise that can research, implement and educate the industry in new ways of working (including BIM) is limited. Despite the improvements noted below, further investment is needed to inform and enable the majority to understand and adopt the new methods of working.

In this report we see that BIM adoption is moving from being led by innovators and early adopters, towards being a more mature market, where the more mainstream are investigating and assessing the benefits of doing so. Time, levels of expertise and cost remain barriers to BIM adoption. There is still a lack of clarity in the industry, and many are sceptical of the claims made for BIM, by some.

However, those who have adopted BIM are willing to make its benefits clear. These include improved cost efficiencies, client outcomes, co-ordination, speed of delivery and better information retrieval. These are all benefits of BIM, seen by the majority of BIM users. With 92% telling us they will be using BIM within three years, we expect those benefits of BIM to be near universally felt.

Meanwhile, the Government's BIM target date of April 2016 is drawing near. The report examines the industry's assessment of the Government's decision to place BIM, as an enabler, at the heart of its strategy. The industry broadly supports the Government's approach, describing it as being on 'the right track'. It sees BIM as assisting the UK meeting at least two key targets – 33% reduction in the cost of construction and whole life costs, and a 50% reduction in the overall time, from inception to completion.

It is through the success of BIM in centrally procured projects that we will see – and are seeing – real savings that make the return on investment in BIM evident to all sectors of the construction industry.

In our first survey, I wrote of 'putting the 'I into BIM' – information at the heart of this technology. We have clearly moved on from the time when 3D CAD could be mistaken for BIM. At NBS we have been working to deliver increasingly sophisticated, and standardised, levels of information into the federated information model through the timeline. This began with our innovative specification product, NBS Create, and then developed through the creation and growth of the NBS National BIM Library. We were able to fully integrate these products together through plug-ins, allowing information to be co-ordinated between the specification model and the geometry model.

2015 sees the next stage in this trajectory of development. Part funded by Innovate UK, and produced in partnership with the industry, we have released the NBS BIM Toolkit. This free to use toolkit offers a digital Plan of Work tool, and a new unified classification system. It provides support to define, manage and validate responsibility for information development, as well as its delivery, at each and every stage of the construction life-cycle.

These are innovative times. The BIM journey continues – though the road isn't always straight. BIM is still developing, not least in the definition and standardisation of the higher levels, as well as in the development and adoption of COBie. Come 2016, we look forward to BIM, and the BIM mandate, proving their worth.

Completing BIM Level 2

Rob Manning
 Government Soft Landings
 Lead, BIM Task Group



Introduction

I was asked to write an article that addresses the activities of completing the Level 2 BIM documentation and tools. In attempting to do so, it seems appropriate to briefly surmise what the artefacts will be, their purpose and their publication dates, before moving to the last pieces of the jigsaw.

Level 2 BIM

Asset management and asset construction both require an information management system and process, supported by a number of tools to manage data. The data can then be used throughout many activities to realise and add value. The overall purpose is to meet the requirements of the stakeholders in the operation and construction of an asset.

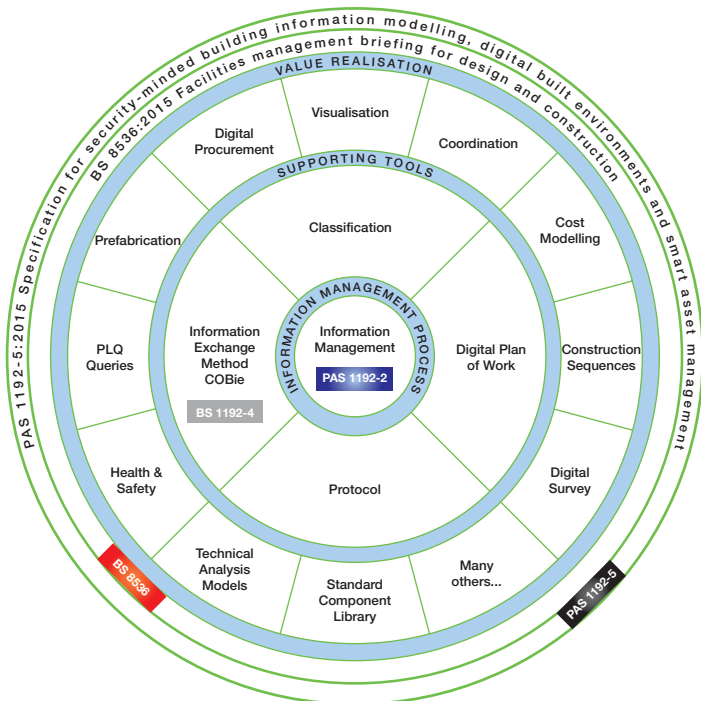
Security PAS 1192-5 (to be published summer 2015)

Enveloping all aspects of information exchange, a key requirement is to identify how to secure (for example) the intellectual property, the physical asset, the processes, the technology, the people and the information associated with the asset. PAS 1192-5 specifies a security-minded approach to be adopted at all times. The security-minded approach applies to all processes and tools used by the employer and the whole of their supply chain.

Defining required outcomes - BS 8536:2015 Facilities management briefing for design and construction (to be published summer 2015)

Construction projects emerge because there is a person or group of persons who wish to establish an asset that will enhance economic, social or environmental prosperity - hopefully in a balanced and sustainable way.

Asset Capital Delivery Phase



Asset Operation Phase

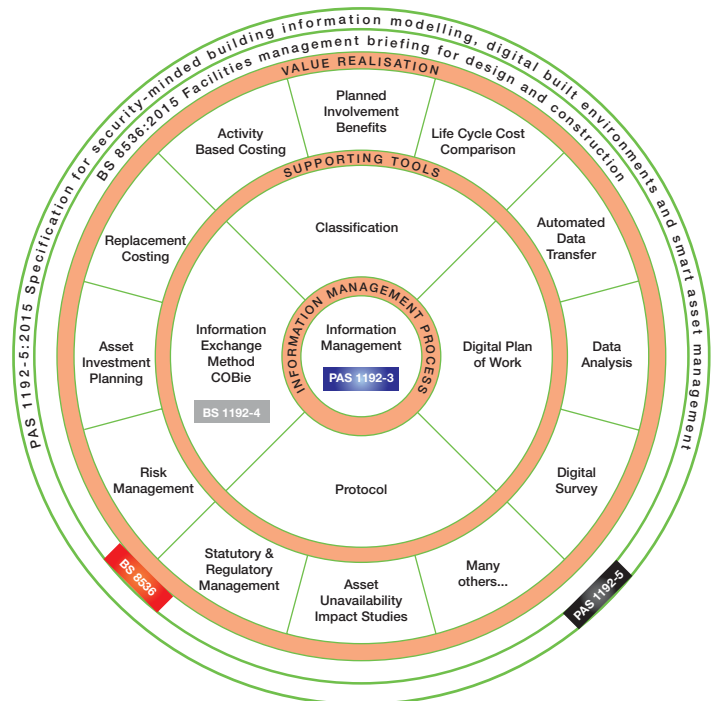


Figure 1 Some of the components of Level 2 BIM

Relevant survey statistics →

The proportion of practices reaching Level 2 has grown to 59%, up from 51%. This demonstrates an increase in the number ready to meet the Government's requirements.

For buildings infrastructure, guidance upon the definition of required social, environmental and economic outcomes and the process of achieving those required outcomes is addressed in BS 8536. The standard refers to the principle of Soft Landings published by BSRIA and UBT and to the approach advocated in Government Soft Landings.

It is hoped that a companion document will be produced for other infrastructure types.

Achieving the required outcomes of the stakeholders through the use of information management is a key purpose of Level 2 BIM.

Added value and leaving complexity in the supply chain

From the supply chain, many tools and activities are emerging that add value by using readily available data to enhance analysis, planning and visualisation. They are the exciting tools of the supply chain, dealing with complexity and adding real value. The core of Level 2 BIM is to provide accessible, up-to-date, accurate, verified information for use and re-use by such tools at the right time.

Information management process: PAS 1192-2:2013 and PAS 1192-3:2014

At the heart of information management are the processes and tools that enable the introduction of digital information management in a consistent way across the world of asset operation and construction.

PAS 1192: Part 2 and Part 3 define what are hoped to be commonly agreed and adopted work stages, reflecting the asset lifecycle across all market sectors - the diagram on the right.

The PAS 1192 series also introduces the requirement of the Common Data Environment in which data, documents and models are retained in a file and data store supported by the process of managing information by labelling it as 'work-in-progress', 'shared', 'published' and 'archived'.

PAS 1192 Part 3 addresses the importance of identifying the information that an organisation needs to run effectively and how that information is derived from multiple pieces of information about individual assets.

Some of that information has to come from any new asset construction projects, and hence there is a required strong link between those who operate assets and those who construct assets in order to define the specific Employer's Information Requirements.

Processes supported by tools

Processes are at the heart of information management, and there is a need to support those processes with other tools to support information exchange and enable alignment with existing contractual arrangements.

Information exchange - COBie - BS 1192-4:2014

COBie (Construction Operations Building information exchange) provides a common structure for the exchange of information about new and existing facilities, including both buildings and infrastructure.

This standard defines expectations for the exchange of information throughout the lifecycle of a facility. The use of COBie ensures that information can be prepared and used without the need for knowledge of the sending

“Asset management and asset construction both require an information management system and process, supported by a number of tools to manage data.”

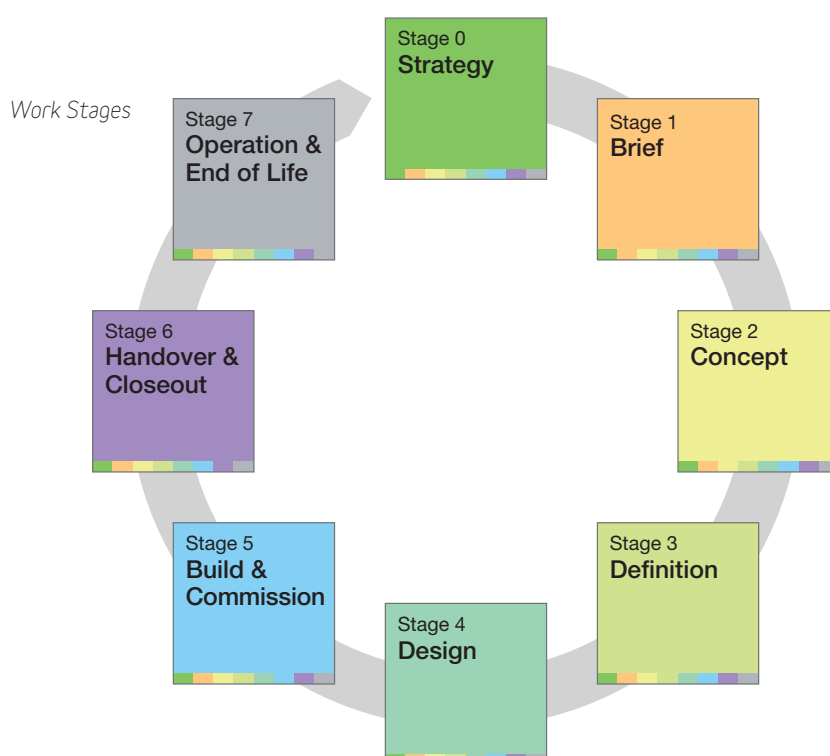
and receiving applications and databases. It ensures that the information exchange can be reviewed and verified for compliance, continuity and completeness.

Legal and contractual CIC Documents 2013

To enable the introduction of BIM to the construction industry, it was important to produce a supplementary legal document that is incorporated into professional services appointments and construction contracts by means of a simple amendment. The Protocol creates additional obligations and rights for the employer and the contracted party. The Protocol is based on the direct contractual relationship between the employer and the supplier. It does not create additional rights or liabilities between different suppliers.

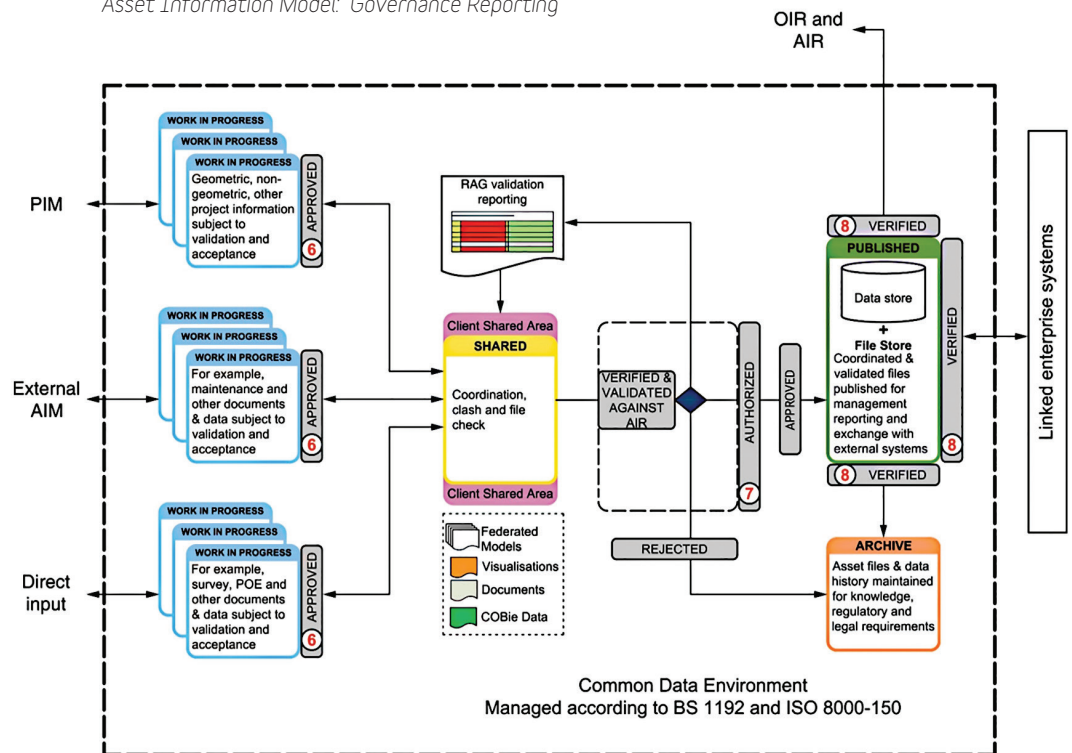
The role of Information Management is mandated in the BIM Protocol. The Employer is required to name a party to deliver Information Management Services.

Professional Indemnity Insurance Guidance has been prepared for the CIC following extensive consultation with the Insurance Industry.



“To enable introduction of BIM to the construction industry, it was important to produce a supplementary legal document that is incorporated into professional services appointments and construction contracts by means of a simple amendment.”

Asset Information Model: Governance Reporting



Standards aligned with the objectives of Level 2 BIM

It is important to recognise the limits of UK Government Level 2 BIM because the principles of information management invade so many activities. It is also important, however, to recognise the relationship of information management with the following documents:

- BS 11000: Part 1 2010 and Part 2 2011 Collaborative Business Relationships.
- PAS 91:2013 Construction pre-qualification questionnaires.
- BS 8541 series Library objects for architecture, engineering and construction.
- BS 7000-4:2013 Design Management Systems. Guide to managing design in construction.

Learning outcomes frameworks

In 2012, the UK BIM Task Group recommended the development of a learning framework that encouraged the industry's procurement and delivery of training and education courses to grow the capacity and capability of Level 2 BIM in the UK market.

A Learning Outcomes Framework with guidance notes for Level 2 BIM is to be published in spring 2015.

A detailed Learning Outcomes Framework for Government Soft Landings was made available in 2013 (BIM Task Group website).

What are the final pieces of the jigsaw?

It could be said that Level 2 BIM is really about enabling employers to better define their requirements and to enable the supply chain to better match the employer's expectations. To achieve that requires the 'hard' collaboration that comes from having a common language and knowing in detail what is required, when it is to be delivered and who is to deliver it.

A common language – a digital classification system

For the implementation of Level 2 BIM in the UK, a cross-sector, full lifecycle classification system is essential. The systems currently in place such as Uniclass 1.4, NRM and CESSM all cater for specific parts of the industry or are linked to specific proprietary methods of measure.

Any new system must support this existing legacy and be compliant with the emerging ISO standard 12006-2:2014 to enable us to share data with international markets.

The value of a unified classification system covering all disciplines, roles and sectors should include:

- Enabling the digital searching for like 'things' in models.
- Enabling the automated combination of models because all 'things' are consistently classified.
- Enabling the aggregation of like 'things' in models for the purposes of measurement, purchasing, maintenance etc.
- Enabling a common language for all people constructing and managing assets.
- Enabling the effective 'benchmarking' of measured values across similar assets.

“For the implementation of Level 2 BIM in the UK, a cross-sector, full lifecycle classification system is essential. The systems currently in place such as Uniclass 1.4, NRM and CESSM all cater for specific parts of the industry or are linked to specific proprietary methods of measure.”

Who does what, when and to which level of geometric (drawing) detail and information? – digital Plan of Work (dPoW)

A dPoW needs to enable an employer to define the deliverables required at each stage of the design, construction, maintenance and operation of built assets. The dPoW should be made available digitally to enable simple access to all stakeholders who will make use of the system and to give clear definition of what geometry, data and documentation they require to be delivered at each of the eight stages of a project.

The value of the digital Plan of Work covering all disciplines, roles and sectors includes:

- A framework for informed, consistent decision-making by all parties including the client, enabling each member of the team, at each work stage, to deliver agreed and consistent levels of geometry, data and documentation to construction clients. This information is essential to enable accurate, timely decisions to be made by the client.
- An enabler for collaboration, providing transparent definition of agreed deliverables from each contributing party at every single project work stage. This approach enables each party to understand their shared obligations to the project and also provides clear understanding of the materials they can expect to receive at the start of each work stage, thus enabling them to deliver appropriate documentation, non-graphical data and graphical data.
- The clear allocation of responsibility for deliverables in appointments and contracts, ensuring clarity over ‘who should deliver what to whom’ to be established at the start of a project and be appropriately monitored during the project.
- Validity testing. The BIM Strategy defined ten tests to gauge the success of the programme. One of these was that BIM-derived geometry, data and documentation should be verifiable. The dPoW enables the generation of a data deliverables template for each project, against which the validity of each delivery can be tested.
- Provision of clear guidance to system and product providers of the types and detail of information that should be delivered.

The digital Plan of Work and the Unified Classification System have the potential to enable the collaboration that has been sought for so long.



Mark Bew

Chairman at BIM Task Group

The Level 2 BIM package of documentation and tools will assist the UK construction and operation industry to operate more efficiently in terms of cost and time. It will enable more informed decisions to be made in terms of environmental, economic and social sustainability and it will put the UK in an excellent position in terms of exporting construction and operation services in the world economy.

It is important now that the Level 2 BIM approach is adopted across all sectors of the UK industry and by all contributors regardless of scale. It is hoped that the Level 2 BIM documentation and tools will enable that transition.

Implementation of Level 2 BIM needs to be the major focus of those on the digital information management journey.

An industry that is skilled in the digital management of information at BIM Level 2 will ultimately move readily into Level 3 BIM, which 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.



Terry Stocks

Ministry of Justice and Chair of the BIM Stewardship Group

The BIM Stewardship Group has representatives from the government departments that are actively involved in the procurement of operation and construction services from their supply chains. The objective of the Stewardship Group is to implement the Level 2 BIM approach across each department, to share and learn from emerging experience and to measure the impact of the programme.

In adopting the processes and tools of Level 2 BIM, the key focus has been to decide the organisation’s (operational) information requirements, to determine the asset information requirements that will provide answers and to incorporate those as appropriate into the Employer’s Information Requirements issued with any new construction procurement invitation.

Two major challenges for the Stewardship Group have been the need for a common language across different infrastructure types and the need to identify the documentation, the graphical data and the non-graphical data to be provided at each work stage by the supply chain.

The emergence of one commonly accepted digital classification system and of digital Plan of Work tools that will assist us to define required documentation and the Level of (geometric) Detail (LoD) and Level of Information (LoI) associated with deliverables, has the potential to really put Level 2 BIM on the road to practical implementation.

BIM Survey: Summary of findings

Adrian Malleson
Head of Research, Analysis
and Forecasting, NBS



Introduction

NBS first monitored the use and adoption of BIM in 2010. At the time, BIM was very much a minority process, which less than 15% of the design community engaged in. Fifty eight percent were aware of it, but that left a significant number who were unaware of BIM. We have moved on.

Discussion about BIM has proliferated, and awareness of it is now nearly universal. Many more people are using BIM than were in 2010. The industry, including NBS, is doing significant work in developing the tools, information and standards that we need to make BIM demonstrably deliver value to designers and clients alike.

The UK Government is committed to BIM. In its construction strategy document there is the clear statement that:

“Government will require fully collaborative 3D BIM (with all project and asset information, documentation and data being electronic) as a minimum by 2016.”

But time is short. 2016 is nearly upon us. As an industry, we have limited time to adopt BIM (in the sense the Government requires) for centrally-procured government projects.

This report looks at some of the issues that this raises, and how the market is responding. We explore BIM adoption and usage, attitudes towards BIM and its place in the construction timeline, as well as the industry's evaluation of the Government's approach. Because the survey has been running for a number of years now, and contains a number of unchanging questions, we can look at changes over time.

As in previous years, we are grateful to those of you who took the time to complete the survey - without the responses there could, of course, be no report. The free text comments can be especially enlightening and give clear illustrations of the real-world successes and frustrations with the BIM process. We have used these to illustrate specific points.

We are thankful too to the professional organisations that have publicised the survey among their membership. This assistance allows us to draw on the views of a range of design and construction professionals to give a more rounded view of BIM adoption in the UK.

Given how close 2016 is now, let us first look at the industry's assessment of the Government's approach to BIM.

The UK Government and BIM

We asked people what they thought about the UK Government and BIM. We wanted to understand whether people believed that the Government would mandate BIM and whether, broadly speaking, the Government was on the 'right track' here. We found that over four fifths (81%) of people believed that the Government would make people use BIM, in one way or another, for public sector work. More specifically, we found that 70% felt that the Government would mandate BIM in the way specified in the construction strategy document, namely 3D collaborative BIM.

We also see that a majority believe the Government is on the 'right track' with BIM. Part of the Government's approach is to establish the UK as a world leader in BIM, having identified BIM as a means of creating global opportunities for the UK construction sector. Those who responded to the survey were a little more circumspect. More disagree that the UK is a global leader than those who agree; most neither agree nor disagree.

For the UK Government there are four demanding targets for the construction sector, described in the 2025 Construction Strategy:

- 33% reduction in the initial cost of construction and the whole-life cost of built assets.
- 50% reduction in the overall time, from inception to completion, for new-build and refurbished assets.
- 50% reduction in greenhouse gas emissions in the built environment.
- 50% reduction in the trade gap between total exports and total imports for construction products and materials.

The requirement for BIM adoption is there because the Government sees it as integral to meeting these targets. We wanted to test whether people felt that it was true that BIM would help us to achieve them.

Of those who had an opinion (and not all did) there was, overall, a belief that BIM would help. This was strongest for 'reduction in building costs' (both capital and whole-life), with 63% feeling that BIM would help bring a reduction. A majority (54%) also felt that BIM would help to reduce the time it would take to move from the inception to the completion of buildings.

When it comes to a reduction in greenhouse gas emissions and a reduction in the trade gap of construction products, the feeling was less strong. Whilst in both cases very few feel that BIM will hinder efforts, there is a less strong feeling that BIM will help. Forty one percent think that BIM will help reduce carbon emissions, and 28% that it will reduce our construction product trade gap. But it's only a very small number (3% and 4%) who feel that BIM will hinder here.

Overall then, the assessment of the design community is that the Government is right to prioritise BIM, and they find the Government's commitment to BIM credible. Some want the Government to go further:

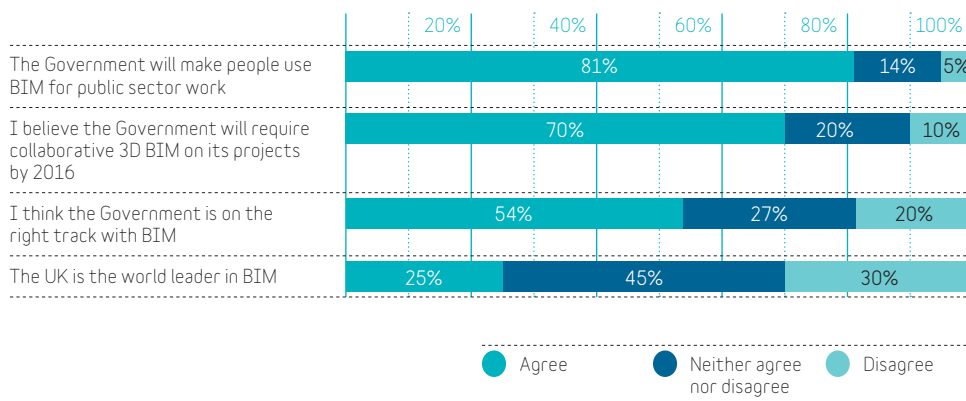
"Further extension of the Government's targets into areas such as social housing."

BIM is set to help reduce the whole-life cost of buildings for government-funded building, and reduce the time to completion. The hope is that success in government-funded projects will lead to wider adoption in the private sector:

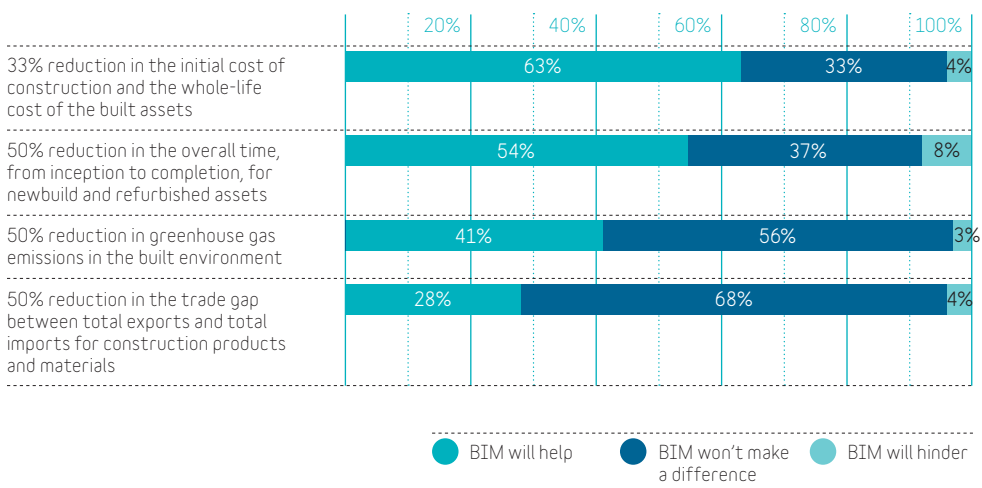
"The next natural step after 2016 is for BIM to trickle down to private enterprise."

"Discussion about BIM has proliferated, and awareness of it is now nearly universal. Many more people are using BIM than were in 2010."

From your understanding of BIM, how strongly do you agree or disagree with the following statements?



The Government's UK Construction Strategy for 2025 has set four targets. What role will BIM have in achieving them?



BIM usage and awareness

Current use

Until this year, the story of BIM usage and awareness has been straightforward. Year on year, the total usage and awareness has increased, as has the proportion of those using BIM.

This year the story has become more nuanced. Last year we saw a majority telling us they had adopted BIM on at least one project they had worked on in the preceding twelve months. This year we have seen no growth in BIM usage. Indeed, we see a very small drop (6%, from 54% to 48%).

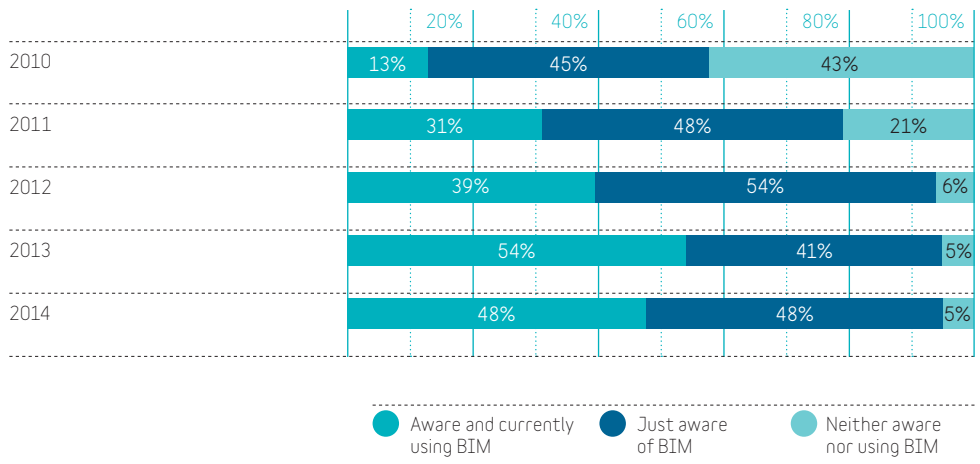
Thus at first sight these findings are puzzling. Have we reached BIM's peak? We would suggest not: it's more of a plateau before the 2016 deadline for BIM adoption.

A few things may be going on. Firstly, evidence from the market (see the RIBA Future Trends Survey and ONS construction output data) suggests that workloads are increasing, as we finally move firmly away from recession. As workloads increase, time to invest in new processes and software decreases.

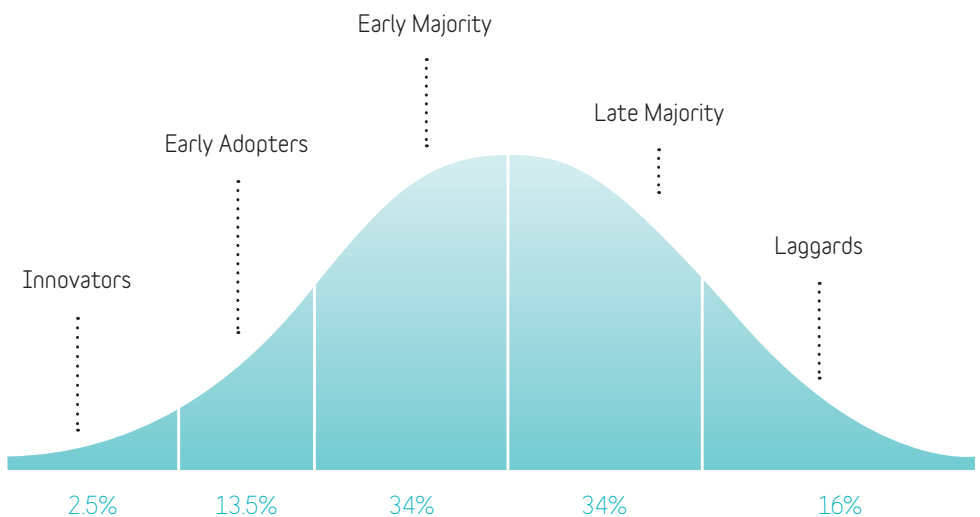
Secondly, we may understand this in terms of Everett Rogers' standard adoption curve. This follows a normal distribution curve where the 'Innovators', 'Early Adopters' and 'Early Majority' rapidly move to a new innovative technology to a point where its use is found within half of the population. Adoption then slows for a while as the 'Late Majority' join, followed by the 'Laggards'. Whilst not always finding these terms fitting, we suspect that we are at the midpoint of the adoption curve, and will see more rapid adoption in the coming years, as and when BIM demonstrates its real-world value.

Finally, detailed analysis of the data suggests that there has been a small, but statistically significant, shift in those who have taken part in the survey, particularly by the design software used. If we adjust the analysis to compensate for this, we do see an increase in BIM adoption.

BIM awareness and usage



Innovation Adoption Lifecycle



'Diffusion of Innovation' - Everett Rogers
<http://sphweb.bumc.bu.edu/otlt/MPH-Modules/SB/SB721-Models/SB721-Models4.html>

“We suspect that we are at the midpoint of the adoption curve, and will see more rapid adoption in the coming years, as and when BIM demonstrates its real-world value.”

Future use

“BIM is the future and should be embraced.”

We also asked those who are aware of BIM whether they will adopt it in the coming years. On this measure, we see a continued expectation that BIM will become the ‘de facto’ standard for the design process – and will do so within three years. Ninety two percent expect to be using BIM within three years, and 95% within five.

BIM maturity

BIM levels

We have seen that the Government requires Level 2 BIM by 2016. For this to happen, we need general awareness of the different ‘levels’ of BIM, and then for practices to reach the required level, Level 2. (These levels are described in the Richards and Bew model that you can access through the BIM Task Group).

Three quarters were aware of the different levels of BIM.

This is a very slight increase in the level of awareness we reported on last year, but it has only increased by a couple of percentage points. There is still work to do in terms of educating the market about these levels, and what they mean in practice.

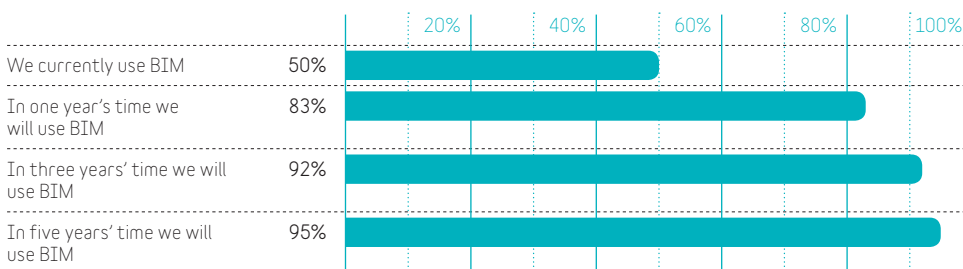
For those who had adopted BIM we asked what was the highest level of BIM they had achieved in the previous year.

We can see that the proportion of Level 0 projects has significantly dropped away, to just 1%. For over a third of BIM practitioners, Level 1 is the highest level they have reached.

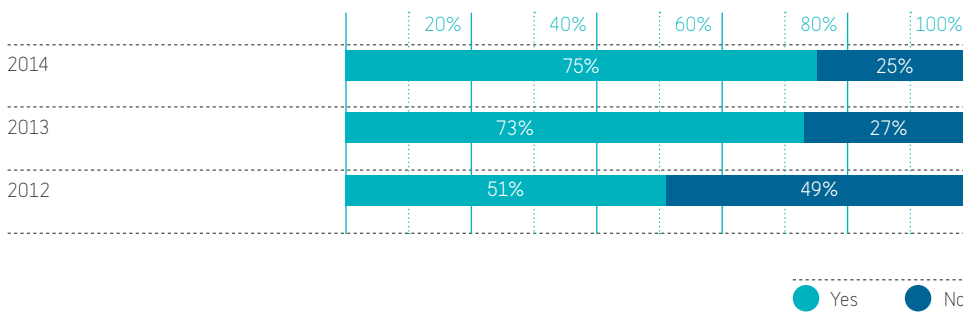
The proportion of practices reaching Level 2 has grown to 59%, up from 51%. This demonstrates an increase in the number ready to meet the Government’s requirements.

Level 3 remains a topic of occasionally intense discussion, with agreement that at best it is poorly defined. Many take the view that it’s impossible to achieve, given the current tools and standards that we currently have. Thus the very slight decline in those telling us that they have reached Level 3 is perhaps best understood as an increase in awareness that ‘Level 3’ is unclear, rather than a drop in BIM maturity *per se*.

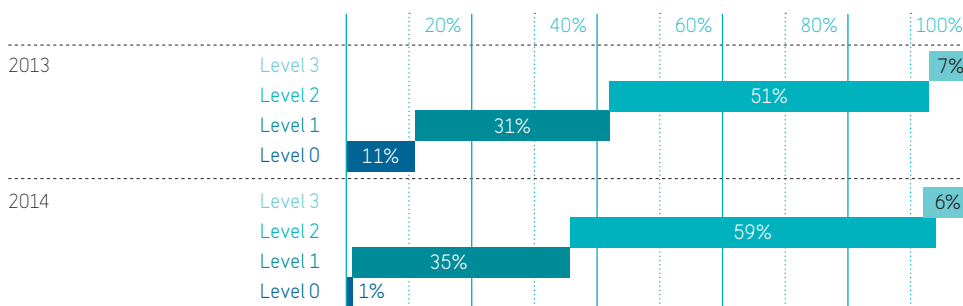
How would you describe your organisation’s future use of BIM?



The Government has described there being different levels of BIM. Are you aware of these different levels?



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



Use of standards

“All construction information should be based upon open standards.”

The adoption and use of shared standards is integral to BIM. They are the substrate for collaboration. Thus we wanted to understand which standards are being used, and by what proportion of the industry.

For BIM to be successful, models (and objects) must contain information that is verifiably of a shared, open standard. In the adoption of BS 1192:2007 and 34% using PAS 1192-2:2013, for example, we see a broad - but not universal - adoption and use of standardised processes for the ownership, review and sign-off of information.

We can also see that some of the newer standards (or descriptions of ways of working) have gained rapid traction.

The RIBA Plan of Work 2013, which organises the process of briefing, designing, constructing, operating and using buildings, is being used by 71% of respondents. The online toolbox, designed to support it, is being used by nearly a quarter. The NBS BIM object standard, released in September 2014, is now being used by 18%. This willingness to adopt and adapt to new standards is promising. The standards that describe (and prescribe) BIM are beginning to be adopted as they become available. However, greater adoption of them will be required in the future.

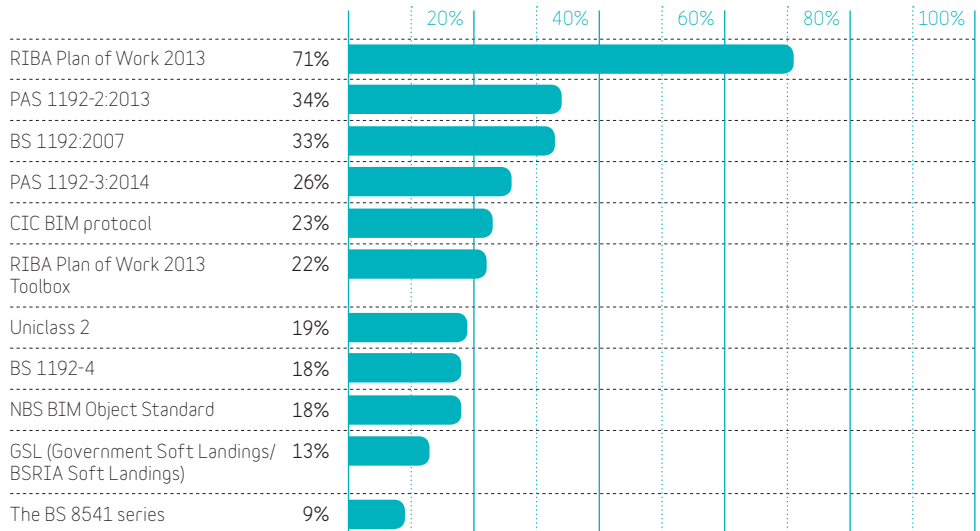
BIM practice

“BIM is not about software, but a more collaborative method of working.”

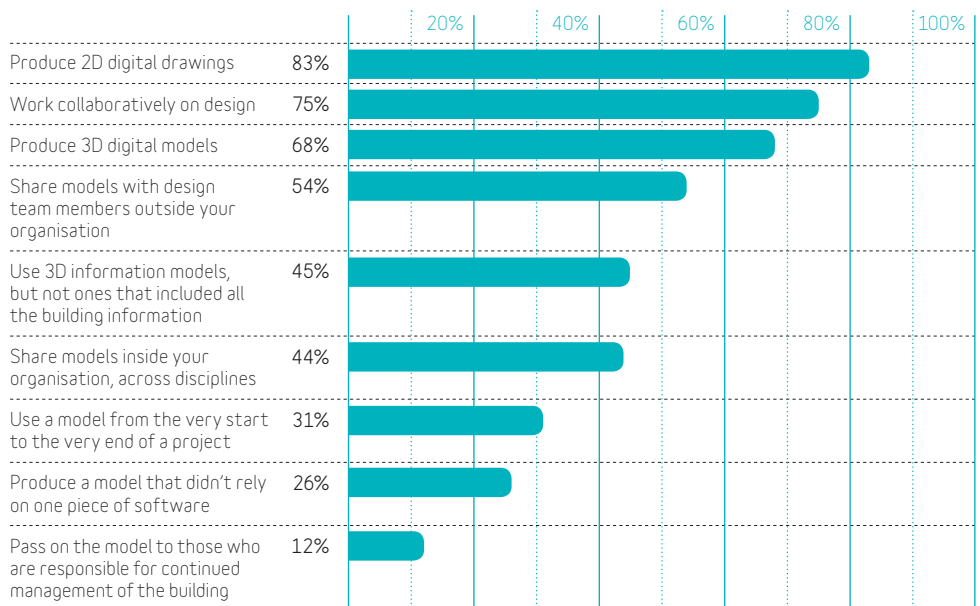
We also wanted to get a sense of what people were actually doing in the projects they had worked on, to see if BIM practice is embedded in the way people work, and whether traditional methods of working are still prevalent. We asked whether people had done the following in the previous year.

We found that 75% work collaboratively, and 68% produce 3D models. Fifty four percent share models outside of their organisations. These are criteria for Level 2 BIM. However, looking to further BIM maturity, less than a third use one model throughout the life of a project, or produce a format-independent model. Perhaps of most concern is that only 12% pass on the model to those responsible for the building. We will look at this again when we investigate COBie use.

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



Thinking about the projects you were involved in last year, did you ever?



IFC

“Given that BIM is about collaboration, there needs to be much more cross-platform interoperability between software, and robust compatibility with IFC.”

An effective BIM is one that allows for collaboration. This is increasingly important as we move up the levels of BIM. The format that allows models to be passed between disparate software formats is IFC (Industry Foundation Classes).

“I use IFC as a format for federating models from differing authoring software.”

“During the design process we hotlink IFC models from the structural engineer, M&E guys etc. into our model for reference and for coordinated design advantages.”

For BIM to be truly collaborative, both within and among organisations, we need to see an increasing adoption of IFCs. We are seeing steady, if unspectacular, growth here, with IFC adoption approaching 50% in 2014, up 4% from last year.

COBie

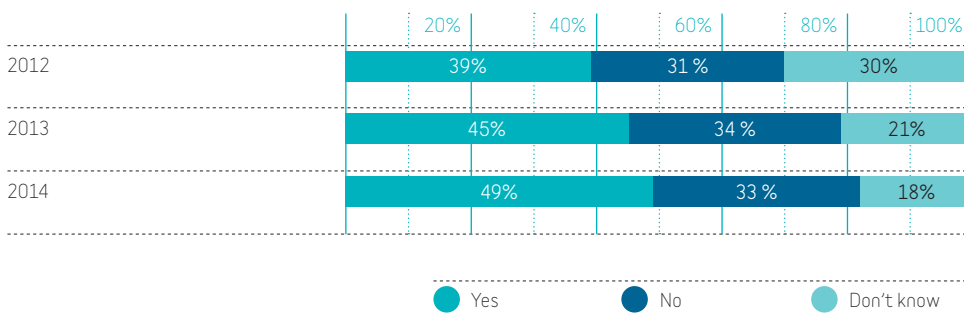
“People need to realise that the BIM is for everyone’s benefit - FM, letting agents, janitors.”

COBie, however, is much less widely used.

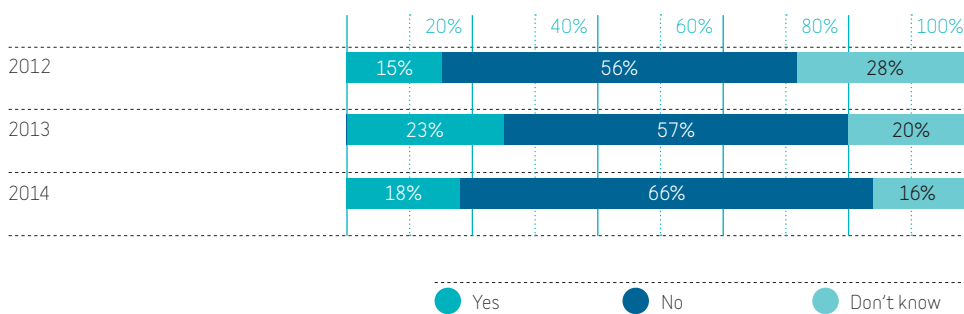
We see that fewer than one in five use COBie, a small drop from last year. If BIM is to deliver efficiencies throughout the life of a building, and not just in the design stages, we need to see a higher adoption rate. We have not explored whether this is due to difficulties with the format itself, or whether asset and facilities managers do not see a need for whole-life information models.

“I know a lot of effort (and money) has been put into COBie, but the whole Excel sheet concept contradicts the fundamental principle of a common data environment.”

Do you use IFC on your projects?



Do you use COBie on your projects?



“The adoption and use of shared standards is integral to BIM. They are the substrate for collaboration. Thus we wanted to understand which standards are being used, and by what proportion of the industry.”

Attitudes towards BIM

Over the years that the survey has been running, we have monitored people's attitudes toward BIM, whether they have adopted BIM or intend to. We have consistently found that most people are positive towards BIM - though there are pockets of scepticism.

The perception that BIM is the future of construction information remains, with nearly four fifths of people agreeing that it is. Small and medium practices are part of this future too, with only a quarter agreeing that BIM is 'just for larger organisations'.

There is still work for the industry to do in order to provide clarity for BIM, two thirds (67%) agreeing that 'the industry is not clear enough on what BIM is yet'. Aligned to this lack of clarity is a lack of trust. Only a quarter tell us that they 'trust what I hear about BIM', down a little from last year.

There is clarity in some areas though. BIM is not just software (you can't buy BIM in box), and it's not the same as a set of 3D CAD drawings.

There is a strong feeling that manufacturers need to provide their product information in a BIM-ready format, with more than three quarters (76%) agreeing that 'we need manufacturers to provide us with BIM objects'.

Finding out about BIM and BIM resources

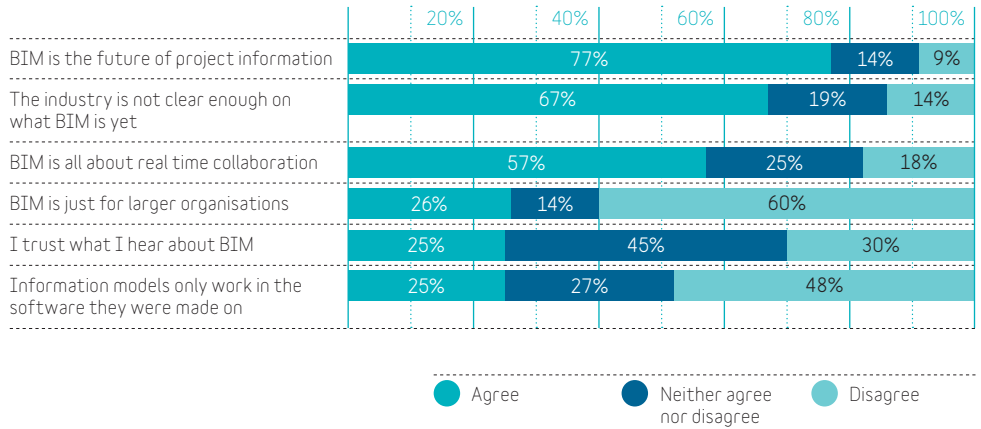
We continue to see that knowledge about BIM remains below the levels that people feel comfortable with.

"BIM is a great innovation and represents an exciting time for change in the construction industry, however more support is needed to help consultants across disciplines to adopt this."

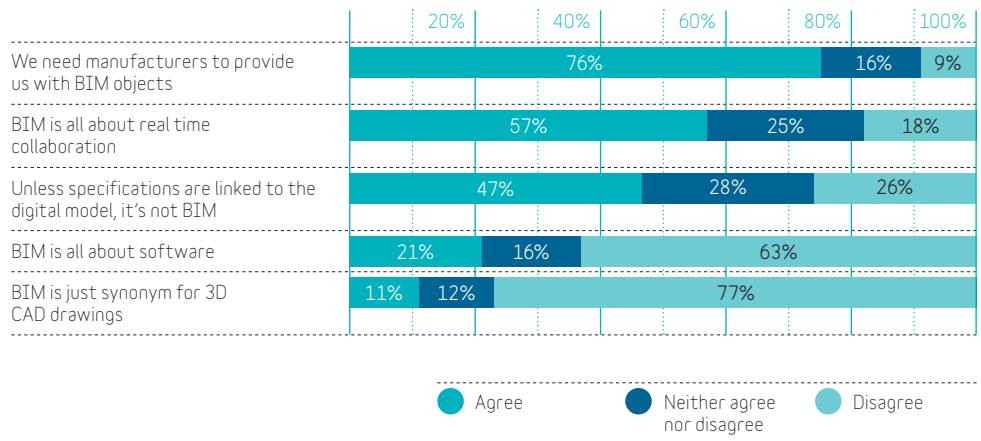
As in last year's report, around 45% of people describe themselves as confident in their knowledge and skills in BIM, but that leaves a majority who are either not confident, or who describe themselves as 'in-between'. There is still a need for BIM education among actual and potential users.

"[We need] education and training, with technical staff being the enablers within the companies (they will convince the management on the necessity of adopting BIM)."

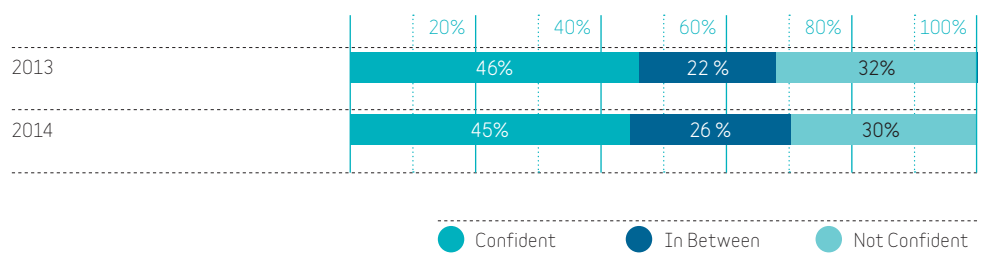
Attitudes towards BIM



How strongly do you agree or disagree with the following statements about BIM?



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



“The perception that BIM is the future of construction information remains, with nearly four fifths of people agreeing that it is. Small and medium practices are part of this future too, with only a quarter agreeing that BIM is ‘just for larger organisations’.”

So where do people turn to get information about BIM? Top of the list is personal contact. Nearly three quarters turn to other professionals, whether colleagues (71%) or those outside of their organisation (73%). Specialists such as BIM consultants (43%) or the BIM Task group (62%) have a prominent role, and we are pleased that two thirds tell us that they turn to NBS for information. Professional institutes feature strongly too, especially among the professions they are there to serve. CAD vendors (42%) and CAD resellers (32%) are also used, but to a lesser extent.

“I am concerned also that particular software manufacturers are seeming to be suggesting that you will only achieve BIM compliance if you use their product. That is not the case.”

An essential resource for well-developed models is the BIM objects that help make it up. At the moment, the design community is getting BIM objects from a range of sources. The most popular method is in-house creation and re-use (69%), followed by objects being created as needed for a project (63%). There are risks here, not only in the time taken to create objects, but also in the objects being non-standard, non-shareable outside of the practice, and when re-used, out-of-date. Each practice creating its own set of objects leads to a high level of duplication of work across the industry, reducing the efficiency gains that BIM can bring.

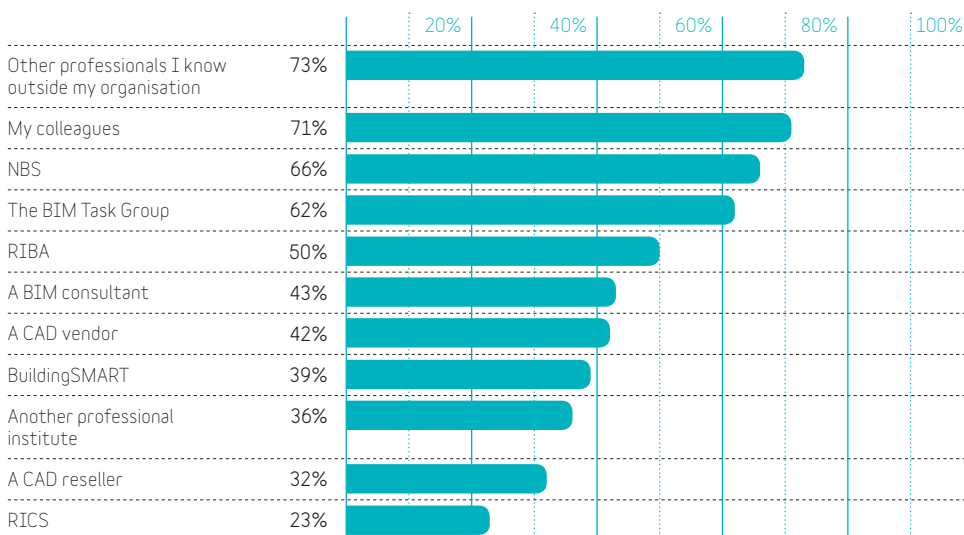
Manufacturers are a common source for objects, with 60% telling us that they source objects in this way. The design community is looking to manufacturers to help in the creation and implementation of BIM.

One way manufacturers can do this is through manufacturers’ objects being made available on a free-to-use, publicly-available online library. The NBS National BIM library is the most well-used library, with nearly half (46%) of BIM users turning to it.

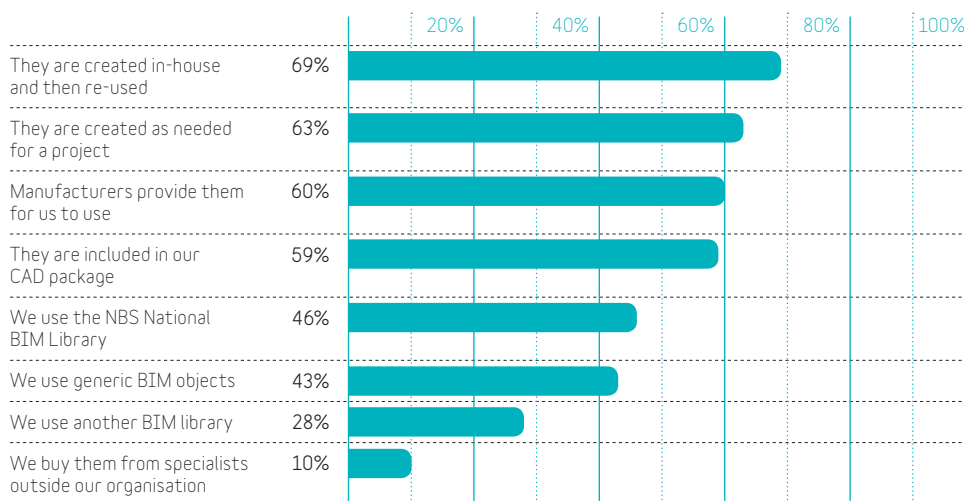
“Encourage suppliers to get their product range available via NBS library.”

Using open libraries reduces the risk of objects going out-of-date, and so becoming inaccurate. It increases the opportunity for inter-company collaboration through using a common object source.

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



Where do you get the BIM objects your organisation uses?



“An essential resource for well-developed models is the BIM objects that help make it up. At the moment, the design community is getting BIM objects from a range of sources.”

Software use

Since we started running the survey in 2010, Autodesk AutoCAD has consistently been the most used software package for building design in the UK. Last year Autodesk Revit took top spot, reflecting the increasing numbers producing fuller information models.

This year's survey results were a surprise.

Last year we noted that 'Graphisoft ArchiCAD and Nemetschek Vectorworks continue to have a loyal user base'. Analysis of the data suggests that this loyalty has translated into a significant increase of respondents to the BIM survey among Nemetschek Vectorworks customers, resulting in it being the most used piece of software among our respondents, with 29% using it. We suggest a little caution in taking this as a definitive description of the UK market.

BIM experience

Barriers to adoption

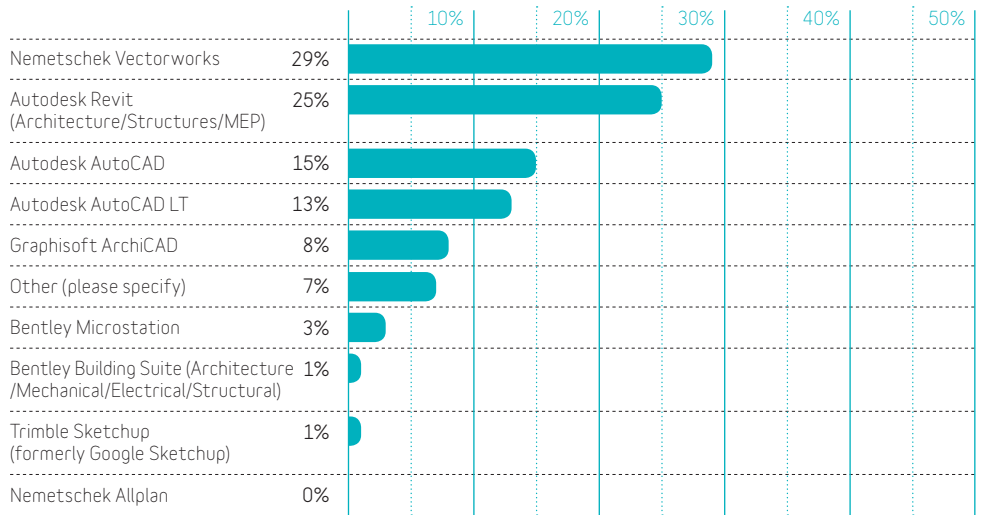
We asked those who were yet to adopt BIM what were the barriers to them doing so. The top two reasons link back to earlier discussions about a lack of confidence in BIM. Three quarters (74%) tell us that a lack of in-house expertise is a barrier, and two thirds (67%) tell us that a lack of training stands in the way. We know that the Government will require BIM - but not all clients will, or do. Lack of client demand is the third most cited barrier to BIM adoption.

Cost remains a barrier, but as the great recession recedes, another factor comes into play. As workloads increase, time becomes, literally, more valuable. Half of people who have yet to adopt BIM tell us that they don't have the time to 'get up to speed'.

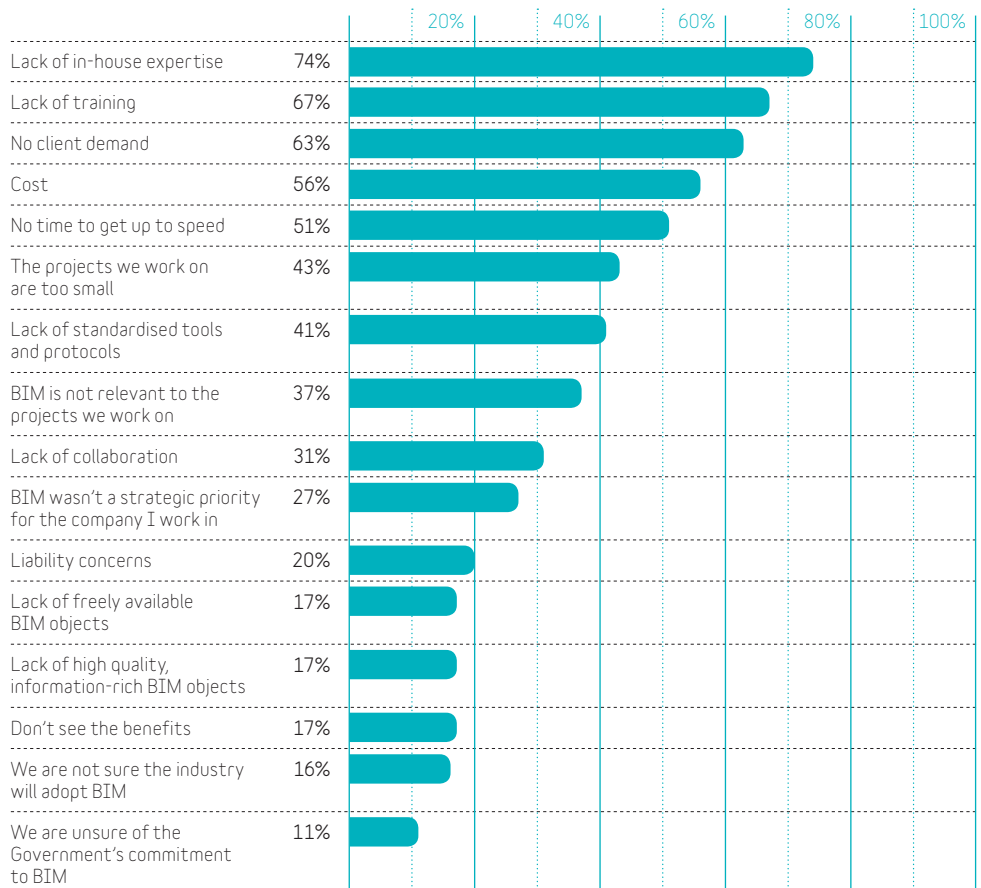
"It's a question of time available to adopt - in a small business it's difficult to schedule in."

On the other hand, those who are yet to adopt BIM do not see it as a passing fad. Only 16% tell us that they are not sure that the industry will adopt BIM, and only 11% are unsure of the Government's commitment to BIM.

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



What are the main barriers to using BIM?



Users and non-users

We again looked at the views of those who have adopted BIM, and compared them with those who were aware of BIM but were yet to adopt. This allows us to make comparisons between expectation and experience. Once again, we found that the experience is better than the expectation. Those who have adopted BIM are more likely to be positive about it than those who have yet to.

There is strong, shared agreement that ‘BIM requires changes in our workflow, practices and procedures’. Both those who have yet to adopt BIM and those who have done so see that adopting BIM is not an event, but a process that businesses go through. Business change is often difficult, and not always successful. But only 4% wish that they hadn’t adopted BIM, although 19% would rather not adopt BIM.

“All new builds should be being built using the BIM process NOW.”

“Architects have performed rather well for the past 200 years without BIM. Long may that continue.”

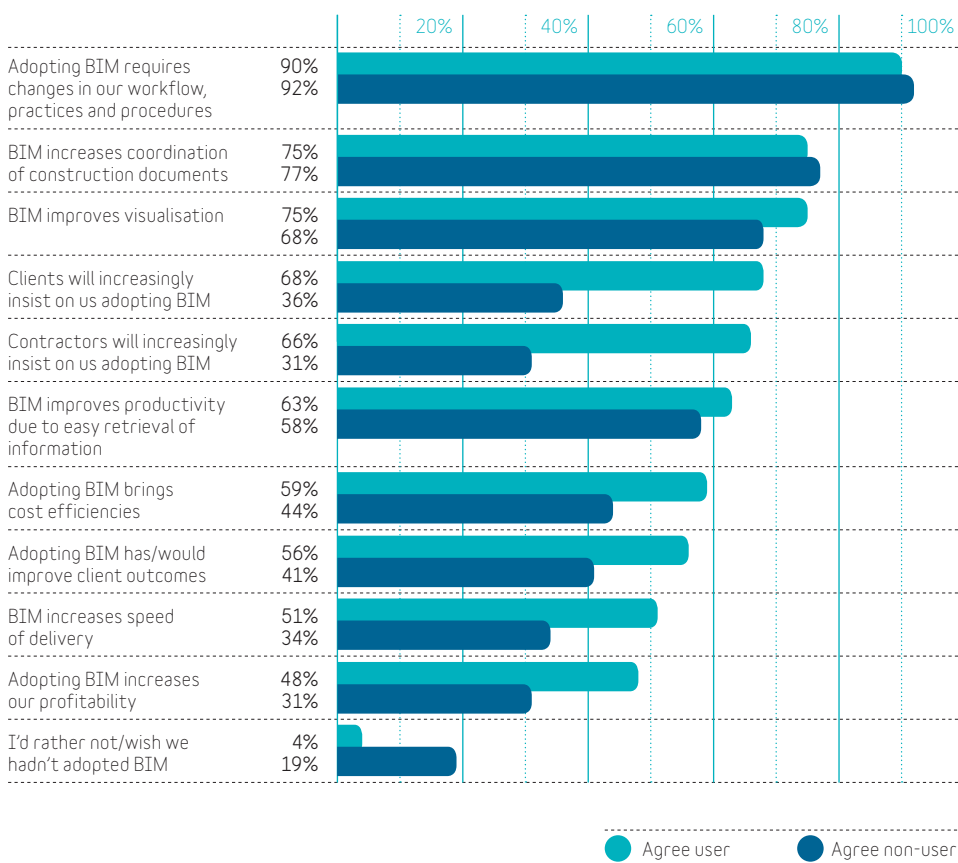
The benefits of BIM are clear to those who have adopted. Fifty nine percent see cost efficiencies, 56% an improvement in client outcomes, 51% an increase in the speed of delivery and 48% an increase in profitability. In every case, experience is better than anticipation.

According to those who have adopted BIM, there is a real and growing market for it: clients and contractors will increasingly insist on it.

This makes for a strong endorsement of BIM from the community of users: a more efficient and more profitable way of working that better meets the demands of a growing market.

“According to those who have adopted BIM, there is a real and growing market for it: clients and contractors will increasingly insist on it.”

Attitudes towards BIM: A comparison of those who use it and those who don’t



End note

This has been one of the more interesting sets of findings of our national BIM survey. Previously we have seen year-on-year growth in adoption, but this year, shortly before the Government mandate comes into force, we see a pause in BIM adoption. There remain a significant number of practices who do not see the advantages of BIM, and so choose not to adopt, or who are currently unable to adopt BIM because of time, cost or expertise. But the direction of travel remains clear – BIM will increasingly become the norm for the design and maintenance of buildings, and its widespread use is central to achieving the Government’s construction strategy.

There is more going on here than an adoption of a particular set of technologies, standards and working practices to support an improved

process for construction. Data collection, aggregation and interrogation, through collaborative working, is driving fundamental changes in how people work, across all sectors. It allows rapid learning, and increasingly sophisticated ways to form, test, and act upon evidence-based hypotheses. The construction industry is no exception to this. Younger generations are attuned to this, and perhaps it is they who will see BIM reach its full fruition.

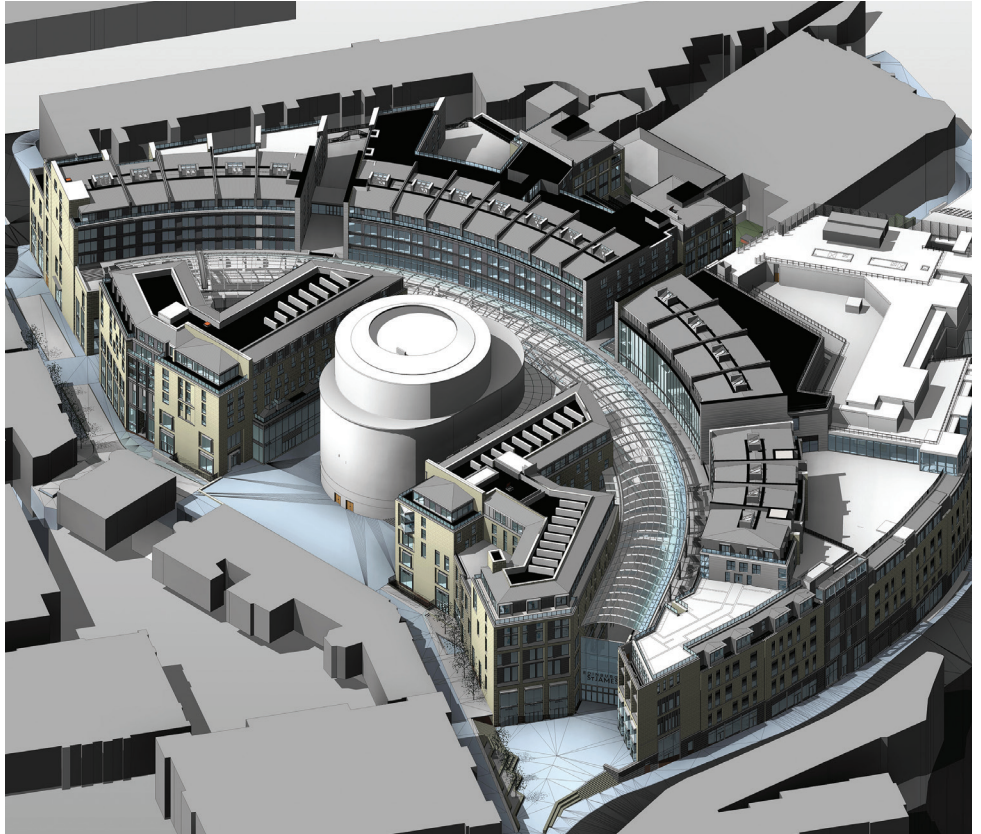
“BIM is only one part of the solution – all the industry needs is a fundamental change in the entire way it works... it will be the next generation that is able to benefit. The Minecraft generation who are collaborating across the globe in creating online imagined worlds. Minecraft is my tip for what Level 3 is going to look like!”

Levels of Detail

Alistair Kell
Director of Information
and Technology, BDP



BDP.



Project - Edinburgh St. James, Client - TIAA Henderson Real Estate, BDP Building Information Model

Managing the level of detail produced by a multi-disciplinary design team within a BIM project

BDP was established as an interdisciplinary design practice in 1961 with the principles of collaborative team working at its heart. BDP's founder, Sir George Grenfell-Baines, firmly believed in a holistic approach to project design and delivery, developing a series of procedures to support this philosophy. Grenfell-Baines also chaired the committee that developed the original RIBA Plan of Work in 1963; this document was heavily influenced by BDP's interdisciplinary approach. In understanding the current drive towards BIM adoption, in particular the developing standards within the UK, the overarching principles required to effectively manage the project design and delivery process have actually changed little. They are, however, now governed by technology and process to such a degree that without comprehensive management, the overall benefits BIM can enable will not be achieved.

Our approach recognises that the challenges of managing design development across disciplines do not vary dramatically between manual drafting, 2D CAD and BIM; the communication requirements of information remain constant. The application of standards supported by technology will, however, deliver more determined, efficient information with less inherent risk within it, providing improved building outcomes for our clients.

Following the Government's 'Level 2' BIM mandate, we recognise the primary change to established working practices as being the need for the project team overall to provide consistent digital information at an equivalent level across design stages; without this, the innovation that BIM can bring will simply not be realised. At BDP we therefore address standardisation across design disciplines and project workstages, ultimately leading to the normalising of outputs for all project participants. We have recognised that, with project teams progressing in a collaborative environment, there is a far

“The application of standards supported by technology will, however, deliver more determined, efficient information with less inherent risk within it, providing improved building outcomes for our clients.”

Relevant survey statistics →

We found that 75% of respondents work collaboratively, and 68% produce 3D models.

Fifty four percent share models outside of their organisations.

greater opportunity for BIM adoption on the project to succeed.

We manage the level of detail, or more importantly the progression of design development, through the RIBA Plan of Work 2013 (PoW). The PoW provides the structure and organisation for our project design and delivery methodologies. Through the standards developed following the UK Government BIM Mandate, applied across the PoW, greater uniformity across disciplines is being achieved.

Importantly, we see the PoW as a project-orientated rather than discipline-focussed document, and whilst this is not a project programme in itself, the workstages and necessary outputs define the intended level of detail to be delivered by each design discipline across workstages.

Whilst the principles of design development have not fundamentally changed to harness many of the benefits of BIM, there is far greater need for common, aligned geometric and information outputs. Without this coordination, quantification, energy analysis and many of the other BIM uses simply cannot be achieved. We utilise the BIM Execution Plan to ensure that all team members work to a uniform set of standards. This is developed on a project-specific basis, addressing appropriate Employer's Information Requirements.

The BIM Execution Plan (BEP) is developed for each project at inception. Our standard BEP template aligns to PAS 1192:2 and its creation,

application and regular review is both linked to the Technology Strategy outlined in the PoW and monitored through our internal QA Audit process. We develop the BEP in conjunction with all project participants, and once confirmed it is available to all internal team members and is shared with external project participants.

By utilising the RIBA PoW across all professions, we are better able to manage project deliverables, developing individual discipline models coordinated and guided by the BEP. Similarly we advocate the use of appointment documentation and supporting forms produced by the Construction Industry Council, BS 1192:2007 and the PAS 1192 suite of standards applied to the BDP Design Process to rigorously control project workflows.

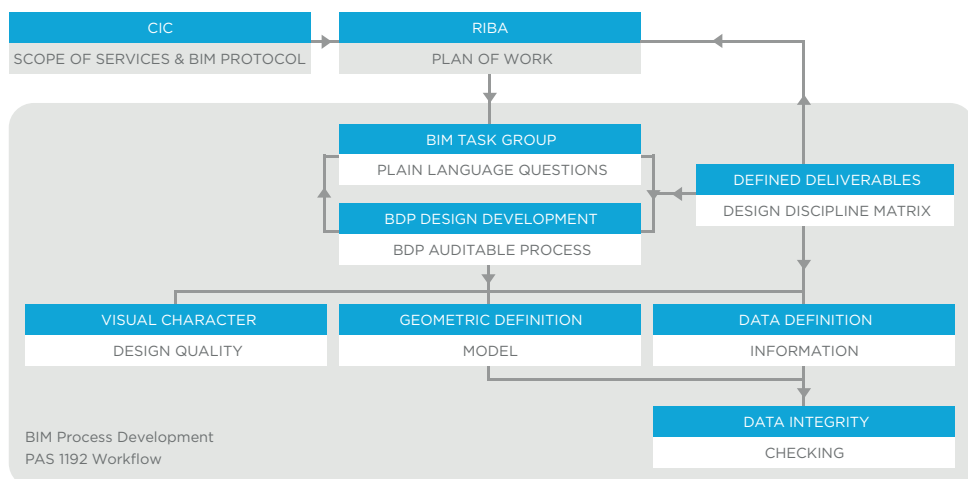
Through the application of PAS 1192:2 and BS 1192:2007, we establish the mechanisms for successful technical project delivery. However, the preparation of an interdisciplinary Design Responsibility Matrix (DRM) is a key tool to guide project development.

The DRM is the controlling document for workstage outputs, outlining the ownership of each building element and the level of detail that will be delivered at each workstage. We prefer to define these requirements early on in the design process when they can become contractual deliverables, prior to formal appointment documents being signed. Projects then progress with all parties having greater definition over what is to be delivered, when it is required and what the information can be used for.

With there being no published UK-specific standards that support the preparation of DRM to be prepared as part of a complete suite of aligned, UK-centric documents, we attempt to address this by aligning the RIBA work stages to the BSRIA BG6 Guide, American Institute of Architects E202 BIM Protocol Exhibit and the more recent Level of Development Specification 2013 prepared by the US BIMForum.

With the necessary protocols in place, we are then able to progress projects with the confidence that design development, project collaboration and workstage outputs can all be uniformly delivered.

The development of the BEP and associated documents and their application is managed on a project by project basis through our Project Technology Manager Group. These individuals are a dedicated resource, available within each office, with specialist skills and knowledge of BIM software, processes and standards. Working with project teams supports both BIM Coordinators and Design Team Leaders to produce deliverable documents. Once prepared, the Project Technology Managers then support the application of these documents, addressing training where necessary and increasingly providing QA/audit/data integrity checks as information is concluded. Their specialist knowledge assists with the upskilling of our technical teams, driving efficiency and allowing a greater focus on design creativity.



Interrelationship of Information

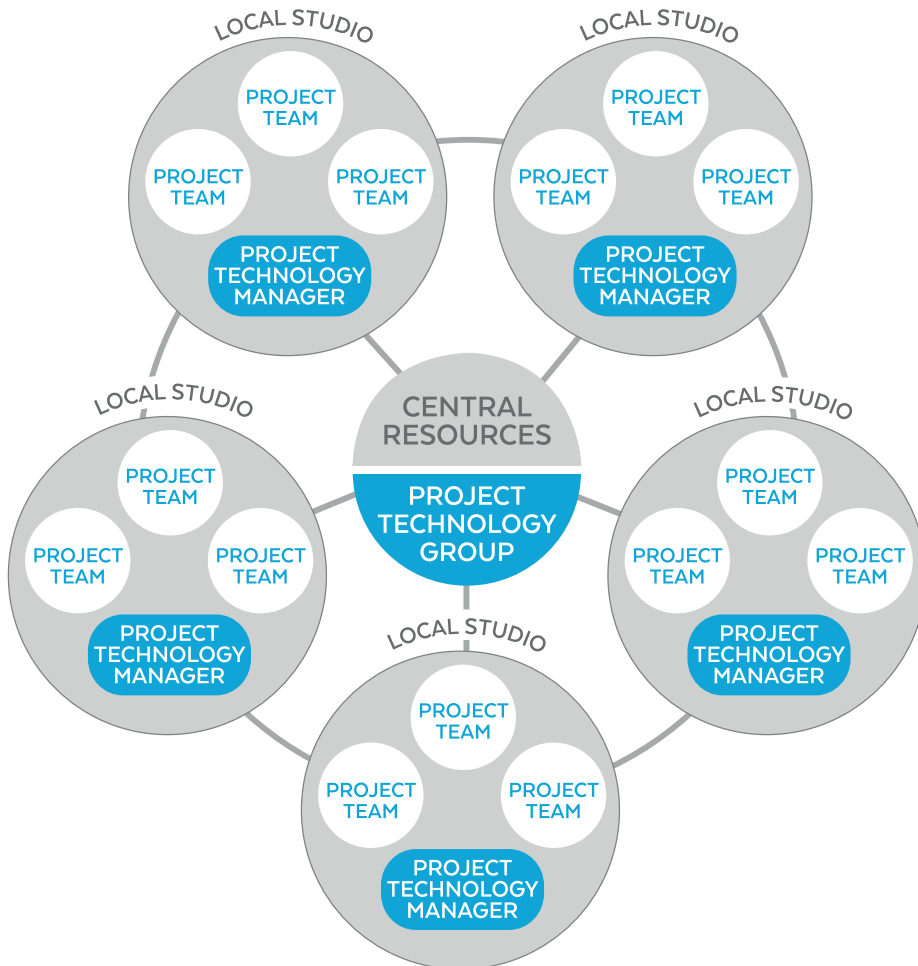
Moving forward, it is clear that the 'NBS Digital Toolkit' will provide a further level of understanding and ultimately commonality across the industry. With a set of aligned Level of Detail (LoD) and Level of Information (LoI) standards, revised classification system and the means of confirming compliance against a set of project-defined deliverables, the industry will be able to provide more coordinated, data-rich information, ultimately driving efficiencies in the design, construction and operation of buildings. Our hope is that by providing an industry baseline for information delivery, the conversation will move from the production of digital information back to the quality of the built form and end user experience.

To ensure we are informing this debate, BDP has been supporting NBS on the 'Digital Toolkit' project over the last 12 months, specifically developing the graphical definition (LoD) for some 400 objects across the RIBA workstages. These definitions cover architecture, landscape, MEP and structure, tackling typical building elements and providing guidance on graphical and geometric requirements. Each element is assessed across RIBA workstages and the suitable geometric definition prepared for the necessary workstage activities; coordination, analysis, procurement, etc. allow for a meaningful approach to model development and design coordination across disciplines.

By simply outlining what information is to be provided, who is to provide this and what it can be used for at various points throughout the design and construction phases of a project, greater efficiency can be brought to the project. In progressing this work, we have established an approach that acknowledges the development of information through each workstage and how this relates to the client brief. Our view is that the information available at the beginning of each workstage effectively defines the brief for that stage; the design activities are then progressed and the development of the briefing material is then encompassed in the workstage outputs, be they data drops, planning submission or end of stage reports, etc. The volume and detail of the information will vary appropriate to the workstage; however, this principle can be applied across all workstages and other key activities such as planning or procurement. Following this principle forward by confirming LoD and LoI requirements for each discipline against building elements, the workstage brief provides the checking mechanism to confirm compliance of the end of stage outputs against the confirmed brief provided at the stage commencement. Equally, once confirmed these outputs then provide a more comprehensive brief for the following workstage.

Ultimately, with the 'Digital Toolkit' now available, as it becomes established we expect to see both improvements to information development and efficiencies in overall project lifecycle. Clearly there are many challenges ahead, but significant progress has already been made and the target has now become clearer as the final components of the 'Level 2' specification have been finalised.

Support Structures



“Moving forward, it is clear that the 'Digital Toolkit' will provide a further level of understanding and ultimately commonality across the industry.”

“Ultimately, with the ‘NBS Digital Toolkit’ now available, as it becomes established we expect to see improvements to both information development and efficiencies in overall project lifecycle.”

LEVEL OF DETAIL PRINCIPLES

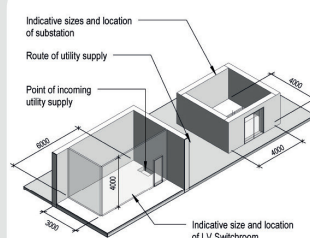
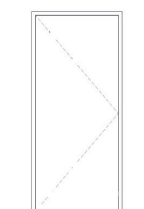
TYPICAL FOR STAGE

BUILDING FABRIC

BUILDING SERVICES

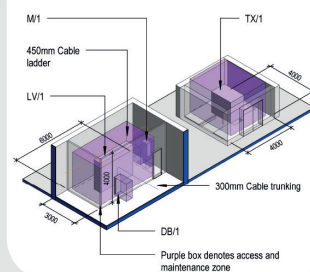
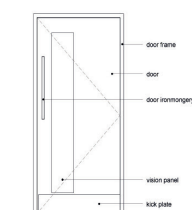
2. CONCEPT STAGE

To provide a visual indication of proposals at a Concept stage identifying key requirements such as: single or double leaf (doors), access and maintenance zones (Primary Plant) etc. Information to be suitable for zonal spatial coordination of primary systems/elements.



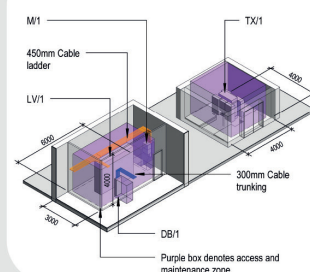
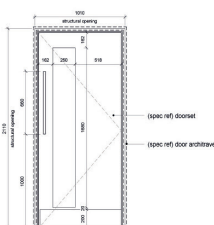
3. DEVELOPED DESIGN

To provide a visual representation of proposals at a Design Development stage and to allow general spatial coordination.



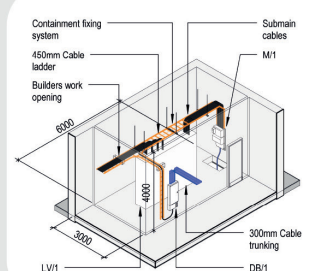
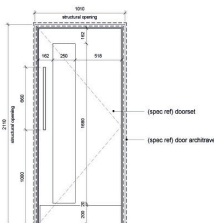
4. TECHNICAL DESIGN

To provide a visual representation of proposals at a Technical Design stage, supporting full spatial coordination.



5. CONSTRUCTION

To provide sufficient information for construction/installation of the appropriate products.





NBS BIM OBJECT STANDARD

NBS has revolutionised the way we visualise product information by producing a set of common data standards to which BIM objects are created.

These BIM objects will be of the right quality, consistent in terminology and format, accurate, harmonious and compatible with the industry-leading specification and design software tools.

Visit the NBS National BIM Library to view the Standard and supporting NBS guidance.

NBS is creating BIM objects you can trust.

nationalBIMlibrary.com

Levels of Information

Stefan Mordue
Architect and NBS Business
Solutions Consultant

Co-author of BIM for Construction
Health and Safety, and BIM for Dummies



nbs

Levels of Information

When you think of a model, perhaps the first thing that comes to mind is geometry. This is not surprising as models have been used for centuries to set out a designer's intentions – conveying shape, space and dimensions. The 'Great Model' of Sir Christopher Wren's St Paul's Cathedral did this in the 1670s and can still be seen today.

However, while the geometrical or graphical data can tell us the width of a brickwork leaf and the height of the walls, at a certain point during construction it is the written word that is needed to take us to a deeper level of information. It is within this textual environment that we describe the characteristics of the brickwork itself such as density, strength and source, and it is words that are used to describe the kind and type of mortar joint and wall ties.

In the context of BIM, we are actually looking at a rich information model which, aside from graphical data – such as geometry and shape – also includes non-graphical information such as performance requirements and associated documentation, presented in a specification or manual format. The written specification is not new and has been around for centuries. However, it is only now by combining these aspects of graphical and non-graphical information that we get the 'overall picture'.

Today, clients are not only procuring a physical asset: they are also procuring information, typically in a digital format. The amount and level of information increases as we progress through the project lifecycle. For example, at an early strategic briefing stage, when the client is assessing needs, there may just be a requirement for spaces and activities.

At concept stage this will be developed into the design intent of elements/systems to meet the Employer's Information Requirements (EIR). This is then further developed at design stage when considering the characteristics of each deliverable in terms of performance requirements; this could relate to security requirements of a plant room space, an external wall element or a doorset system. At technical design stage, or at least prior to construction, product selection can be determined by the specifier or delegated as 'contractor's choice' based upon generic product performance requirements.

The Government's 'Soft Landings' guidance recommends that a building's 'in operation' phase should be considered throughout the whole project lifecycle. By establishing required performance outcomes and operational budget at an early stage, these can then be compared to the actual performance outcomes. From a concept stage, the performance criteria – such as the structural performance of a partition system – can be considered. As the information develops, specific references to relevant standards and classes are stated, along with any testing methods that may be required. Certifications by accredited third party certification bodies are also considered as the information progresses, to ensure that the client's outcomes are met at the end of the project. At project handover, information specific to the installed object's operation and maintenance is incorporated into standard COBie properties, as well as documentation such as links to PDF manuals.

“The written specification is not new and has been around for centuries. However, it is only now by combining these aspects of graphical and non-graphical information that we get the 'overall picture'.”

Example: Partition system

Banding code	Description	Example
What is typical for concept stage?	A simple description outlining design intent.	<i>Partition system</i> To surround commercial kitchen area. Must have appropriate fire rating, structural strength suitable for holding kitchen units and acoustics to provide a comfortable environment for the adjacent restaurant.
What is typical as the design develops?	The specified overall performance of the deliverable.	<i>Partition system</i> <ul style="list-style-type: none"> • Structural performance: Medium duty to BS 5234-2. • Fire performance: 30 minutes to BS 476. • Acoustic performance: 50db.
What is typical in technical design?	The prescribed generic products that meet the desired overall performance requirements.	<i>Partition system</i> <ul style="list-style-type: none"> • Inner lining: Paper-lined plasterboard to BS-EN 520 Type A. 2 x 12.5 mm. • Insulation: Mineral wool, A1 Euroclass fire rating and 80% recycled content minimum. 50 mm thick. • Outer lining: Paper-lined plasterboard to BS-EN 520 Type A. 2 x 12.5 mm.
What is typical in the construction phase?	The prescribed manufacturer products that meet the generic product specification.	<i>Partition system</i> <ul style="list-style-type: none"> • Inner lining: British Gypsum WallBoard. 2 x 12.5 mm. • Insulation: Saint-Gobain Isover APR 1200. 50 mm thick. • Outer lining: British Gypsum WallBoard. 2 x 12.5 mm.
What is typical for operation and maintenance?	The key properties to be transferred into an asset database.	<i>Partition system</i> <ul style="list-style-type: none"> • Barcode: RFID Code. • Expected life: 25 years. • O&M Manual • Warranty start date: 2016-06-28T23:59:59.

“The Government’s ‘Soft Landings’ guidance recommends that a building’s ‘in operation’ phase should be considered throughout the whole project lifecycle.”



Project - The Old Post Office, Newcastle upon Tyne

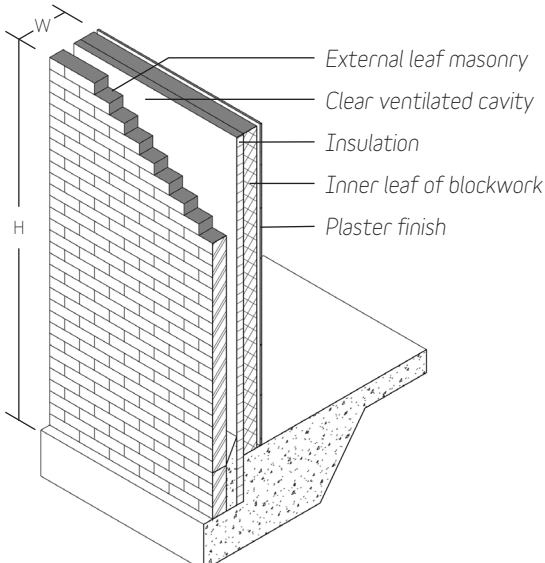
Relevant survey statistics →

For BIM to be successful, models (and objects) must contain information that is verifiably of a shared, open standard. In the adoption of BS 1192:2007 and 34% using PAS 1192-2:2013, for example, we see a broad - but not universal - adoption and use of standardised processes for the ownership, review and sign-off of information.

Example: Surveillance systems

Banding code	Description	Example
What is typical for concept stage?	A simple description outlining design intent.	Surveillance systems To have sufficient coverage of cycle storage and principal office entrance.
What is typical as the design develops?	The specified overall performance of the deliverable.	Surveillance systems <ul style="list-style-type: none"> • CCTV Zone: Property protection and surveillance, capable of identification. • Standards: In accordance with BS 8418. • Format: Digital. • Remote monitoring: Required. • Integration with other alarm and security systems: Access control system.
What is typical in technical design?	The prescribed generic products that meet the desired overall performance requirements.	Surveillance systems <ul style="list-style-type: none"> • Surveillance equipment: Bullet cameras. • Camera housing: External. • Data storage: Digital video recorder.
What is typical in the construction phase?	The prescribed manufacturer products that meet the generic product specification.	Surveillance systems <ul style="list-style-type: none"> • Surveillance equipment: Sony SNC-CH260 External Bullet Camera. • Camera Housing: UNI-ORBC6 outdoor housing. • Data storage: NSR-500 Network Surveillance Recorder.
What is typical for operation and maintenance?	The key properties to be transferred into an asset database.	Surveillance systems <ul style="list-style-type: none"> • Barcode: RFID Code. • Expected life: 25 years. • O&M Manual • Warranty start date: 2016-06-28T23:59:59.

Example: Typical masonry construction detail - some of the graphical and non-graphical considerations

Graphical information	Non-graphical information	
 <p>External leaf masonry</p> <p>Clear ventilated cavity</p> <p>Insulation</p> <p>Inner leaf of blockwork</p> <p>Plaster finish</p>	<p>Performance</p> <ul style="list-style-type: none"> • Accuracy tolerances (for structural performance) • Design submittals requirements (applicable where there is a contractor-designed component) • Working life • Fire performance • Structural performance - impact, M&E services, vehicular • Heat loss (U value) 	<p>Execution</p> <ul style="list-style-type: none"> • Workmanship during adverse weather • Cleanliness • Reference and sample panel requirements (to monitor workmanship, materials quality) • Specific product installation requirements (e.g. installing cavity wall insulation, installing lintels, block bonding new walls to existing, laying frogged bricks in mortar) <p>Product properties</p> <ul style="list-style-type: none"> • Thermal conductivity • Freeze/thaw resistance • Recycled content • Dimensional tolerances for masonry units • Compressive strength

Quality assured: the impact of the NBS BIM Object Standard

Ian Chapman
Director of National
BIM Library, NBS



“In February 2015, we released over 1,200 BIM object files spanning 17 manufacturers. The BIM survey results demonstrate that the demand for objects is high and in the future, manufacturers without BIM objects will be as lost as manufacturers without a website or pdf catalogue are today.”

It's hard to believe that 12 months have passed since I last wrote an article for the NBS National BIM Report, and even harder to believe that in just one year from now the UK will have arrived at its 2016 BIM mandate deadline. There is no doubt that awareness of BIM continues to grow, and both the client and supply sides of the construction industry are taking BIM seriously. Demand for BIM objects from designers has gone through the roof, and at the NBS National BIM Library we are releasing more objects than ever before. In February 2015, we released over 1,200 BIM object files spanning 17 manufacturers. The BIM survey results demonstrate that the demand for objects is high and in the future, manufacturers without BIM objects will be as lost as manufacturers without a website or pdf catalogue are today.

The help and leadership provided by the Government's BIM Task Group has, without doubt, been an extremely successful approach. Other countries are in awe of how far we've come in a relatively short time. The release of freely available, accessible-to-all standards has given the UK a big advantage over its overseas competitors. Standards are vital to all industries. They:

- Reduce time.
- Improve quality.
- Permit compatibility and integration.
- Improve value for money.
- Enable trade.

Their mere existence offers the purchaser a means of accepting or rejecting goods, on the basis of whether or not they comply with the standard.

How can you judge quality without a standard to make assessments against? This is a dilemma facing many when scouring the internet for BIM objects. There are more and more objects to choose from, but knowing which ones you can trust and which ones will have valuable information is not always obvious. Quality is essentially a measure of the extent to which an object fulfils its purpose. On this basis, it must therefore be possible to determine the quality of an object by comparing its inbuilt characteristics against a set of known requirements. If those characteristics meet all or most of the requirements, the object can be deemed 'high quality'; and when objects meet few of the requirements, then 'low quality'

is the label given. In essence, the quality of an object depends upon a set of requirements that aligns with a given purpose or need, together with the object's inherent characteristics, with quality being the measure of how well the characteristics comply with the requirements. NBS has set the standard for construction information for decades, and the need of the majority for both generic and manufacturers' BIM objects led to the creation of the NBS BIM Object Standard.

Published in 2014, the NBS BIM Object Standard defines clear requirements against which all BIM objects can be assessed. The first of its kind globally, the standard defines what constitutes a quality BIM object, and provides the foundations for a consistent approach that can be adopted by designers, manufacturers and all BIM content developers alike. It is a standard that sets out essential requirements for BIM objects for use with Level 2 BIM. Not only is it essential reading for designers and manufacturers, but clients and project managers procuring buildings and digital assets can easily reference this standard, giving assurance that objects purchased are useful. Developed in-house with feedback from industry and supported by all of the major BIM platforms, the standard has been extremely well received. With over 5,000 downloads of the NBS BIM Object Standard since launch, it has become more popular than we had imagined, and a day rarely goes by without someone letting us know that they're using it. The survey results show us the impact that the standard has had on industry to date, with 18% using it in their business within a matter of months of its launch.

Feedback has been overwhelmingly positive, and as a result (and very much in keeping with NBS's efforts to help digitise the construction industry), we've digitised the NBS BIM Object Standard so that it's now available in an entirely online form. It's accessible on any platform at any time. Better still, we've authored comprehensive guidance to accompany the standard, and the online version presents this guidance in context directly next to the clause information - in a very similar fashion to the comprehensive technical guidance included within NBS's trusted specification products.

Relevant survey statistics →

With over 5,000 downloads of the NBS BIM Object Standard since launch, it has become more popular than we had imagined, and a day rarely goes by without someone letting us know that they're using it. The survey results show us the impact that the standard has had on industry to date, with 18% using it in their business within a matter of months of its launch.

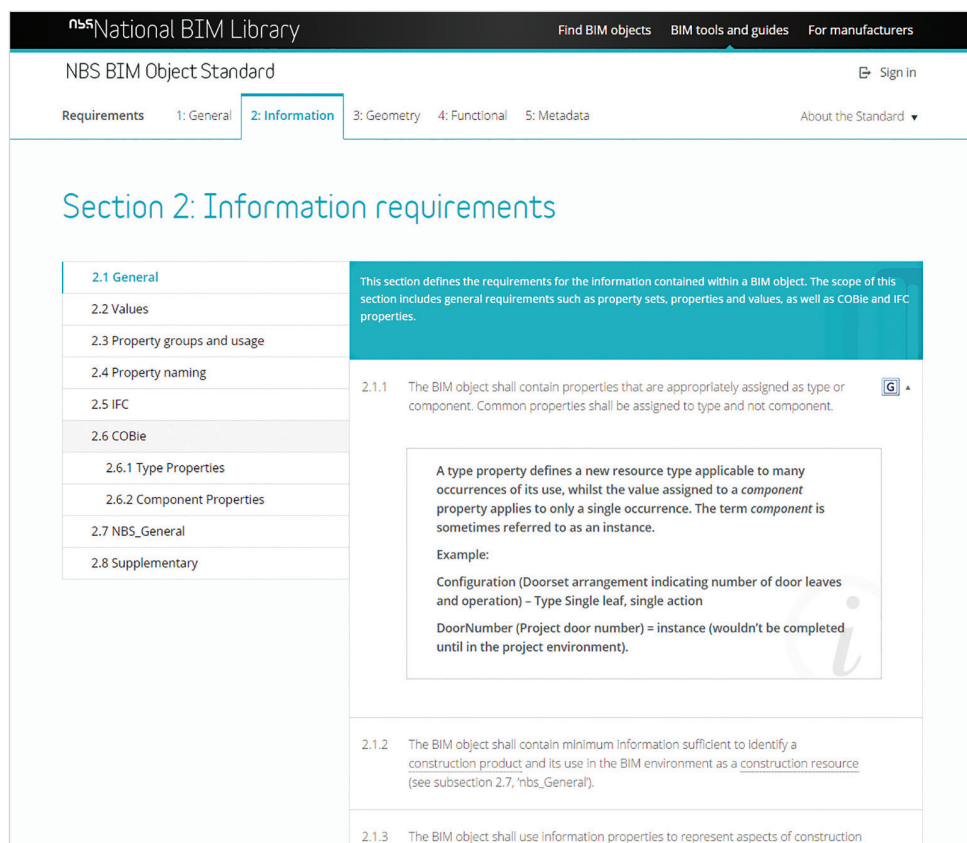


Image showing the online version of the NBS BIM Object Standard, together with comprehensive clause-by-clause guidance.

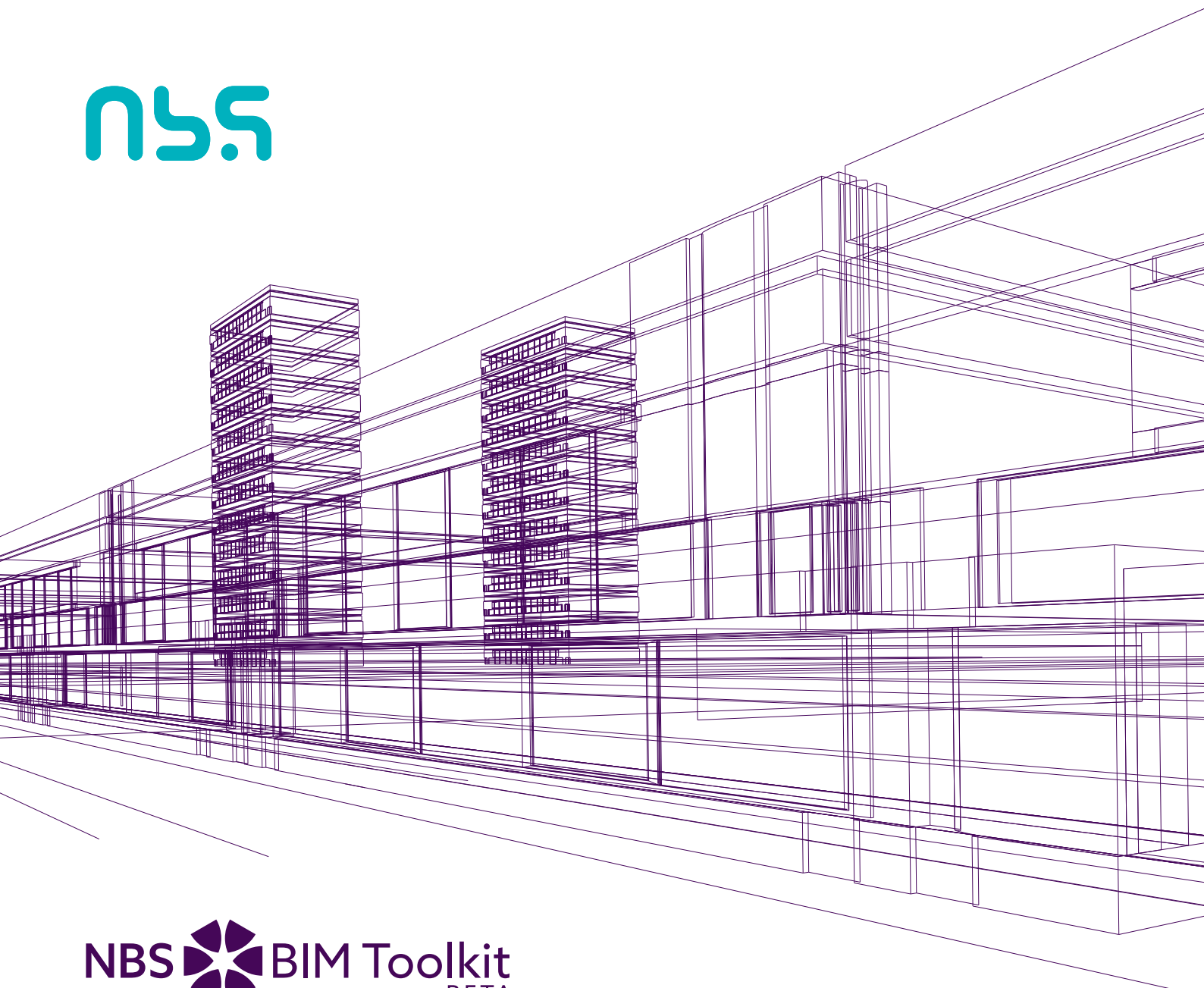
Use of a standard affords many advantages:

- **Assurance** – the assurance the standard brings to clients and project managers is significant. Clients need to improve their ability to procure data. Getting the right data about your built asset will yield benefits throughout the operational phase of the asset. By using and referencing the NBS BIM Object Standard, clients and project managers can be confident that the quality of BIM objects within their project models is suitable, and to a recognised standard.
- **Efficiency** – this survey shows that designers are creating objects themselves, as there are not enough manufacturers' objects in the marketplace. Operating in silos is not efficient for the UK construction economy. With the NBS BIM Object Standard, designers can create objects safe in the knowledge that they will be compatible with other objects to the same NBS standard. This will bring efficiency to the design process by enabling more meaningful information exchange, and ultimately lead to better designs and better buildings.

- **Quality** – manufacturers have a big job to do. They have the challenge of creating objects and making them available at the right time in the right place, and all by 2016. This standard gives manufacturers who want to create objects themselves a clear benchmark and a clear place to start. It provides knowledge and helps manufacturers focus on what matters. For any manufacturer, the NBS BIM Object Standard is an invaluable starting point, as well as a mark of quality.
- **Compatibility** – just as we saw with batteries, nuts and bolts, USB connectors and plug sockets, and will see in the not-too-distant future with mobile phone chargers, standardisation brings compatibility. BIM objects need to work with each other – adopting a common standard benefits everyone. Combining doors from multiple manufacturers within a single project becomes possible when they all have a consistent underlying data structure – creating door schedules at the click of a button is possible with BIM.

- **Price comparison websites have been around for years** – they exist and provide a valued service as a direct result of standardised information. By aggregating the results of many quotations into one place, comparison between the key features of the quotations is simple. BIM can offer far greater levels of data transparency and information comparison than ever before – and with this comes great insight and better buildings.

I'm very proud to be part of the construction industry's digital transformation, as are many others who I'm fortunate to work with. Based upon the UK's progress to date, we can all look forward to the continued opportunities that the BIM phenomenon brings.



NBS BIM Toolkit BETA

The NBS BIM Toolkit has been developed to guide you through the process needed to achieve Level 2 BIM.

This Toolkit offers a digital Plan of Work that provides step-by-step support to define, manage and verify responsibility for information development and delivery at each stage of the asset lifecycle. This is an essential tool to ensure you are ready for the Government mandated use of Level 2 BIM on all centrally-funded projects.

Supporting the Plan of Work is a new unified classification system and corresponding Level of Detail and Level of Information definitions. This enables project teams to clearly define who is delivering what and when.

The NBS BIM Toolkit is now in its public BETA phase which means you can start using it on your projects today.

theNBS.com/toolkit

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In partnership with



Cross-industry support for Level 2 BIM

“We at NBS have been one of many organisations that have contributed to what has been an incredible team effort to put together this package of standards and tools.”

Introduction by Dr Stephen Hamil

Director of Design and Innovation, NBS
Project Lead - The NBS BIM Toolkit

theNBS.com/BIMToolkit



In May 2011, the UK Government Construction Strategy stated that the Government, as a client, will require fully collaborative Level 2 BIM as a minimum by May 2016.

In a few months, this free-to-use Level 2 BIM package of standards and tools will be complete. This will provide the UK industry with a world-class toolset that will enable collaborative project teams to work to this Level 2 BIM process.

With a year to go until this government mandate, we asked a number of leading voices from some of the major UK construction institutions and organisations to give their thoughts on what benefits this will bring. These views are included here within this article.

We at NBS have been one of many organisations that have contributed to what has been an incredible team effort to put together this package of standards and tools. This includes being a part of the BSI B/555 working group that has overseen the development of the various standards. We have also worked under the guidance of the UK Government BIM Task Group to lead the development of the classification and digital Plan of Work aspect of Level 2 BIM (the NBS BIM Toolkit).

Specifically on the BIM Toolkit, we'd like to take this opportunity to thank the construction institutions that helped steer us through this project. We received support through monthly steering group meetings. We also received support through many focus group sessions where members of these construction institutions gave up their time. This is hugely appreciated.

Worldwide, there is an appetite to make the construction industry more efficient, and reduce environmental impact through digital technology and a more standardised process. It could be argued that at this point in time, the UK is taking a lead in this field. The completed Level 2 BIM package of standards and tools really shows that the UK can achieve something very special when working to a common strategy and vision.

“Worldwide, there is an appetite to make the construction industry more efficient, and reduce environmental impact through digital technology and a more standardised process.”

Adrian Malone

Group Head of Knowledge Management and Collaboration, Atkins
Association for Project Management

Level 2 BIM aims to define the process for the procurement, delivery and operation of built assets through digital modelling and the coordination of project delivery. BIM provides an opportunity for design and specification information to be shared and reused between disciplines and across the project and asset life cycles, which in turn can drive project efficiency and better client outcomes. Achieving these efficiencies in practice is not without its challenges, and requires both the adoption of processes and protocols associated with Level 2 BIM, and a collaborative approach throughout the whole supply chain. Project managers are playing a central role in planning and managing the application and in achieving the potential of BIM through projects, across programmes and within portfolios – of capital and operational works, installations and facilities – to achieve overall success, value and efficiency across the UK Construction sector. BIM is a comprehensive, volume opportunity and will shape the way in which we construct and operate the built environment now and for future generations.



ATKINS



Paddy Conaghan

Consultant - Hoare Lea
Chair - CIBSE BIM Group



The imminent introduction of Level 2 BIM presents a particular challenge in terms of bringing order to the management of data for building services systems. These are composed of strings of interdependent and often complex dynamic components, each requiring multiple data fields to describe their construction, performance and operation. These systems tend to comprise most of the maintainable and replaceable assets within a project, so the open and shareable nature of the online digital Plan of Work, clearly demonstrating the tasks to be carried out by each member of the design and delivery teams and enabling data sharing between them, is critical to its adoption in the MEP sector. Product traceability through classification, the organisation of data and the interoperability of the resulting model with simulation and CAFM tools are likely to be crucial to achieving the overarching ambition for the digital Plans of Work to facilitate the 2025 Construction Targets.

Inevitably, an industry already competitively wedded to Level 1 BIM has created the first movers in the new Level 2 world who have evolved bespoke data formats. Many variants of Level 2 building services BIM now coexist and threaten to confuse an already complex undertaking.

Thus CIBSE sees the BIM Toolkit as a timely means of bringing some orthodoxy and order to the process. Our early aim is for the Product Data Templates, evolved and road-tested initially by our BIM Group, and now increasingly taken up by other sectors, to be married with the BIM Toolkit, to stimulate its uptake by the MEP sector.



“BIM provides an opportunity for design and specification information to be shared and reused between disciplines and across the project and asset life cycles, which in turn can drive project efficiency and better client outcomes.”

Relevant survey statistics →

We see a continued expectation that BIM will become the 'de facto' standard for the design process - and will do so within three years. Ninety two percent expect to be using BIM within three years, and 95% within five.

Mike Packham

British Institute of Facilities Management

Facilities management has been a bit slower, perhaps, than the construction industry to recognise the benefits to be derived from Level 2 BIM, but we are now well and truly up to speed. All that well-structured information (and of course the underlying processes and procedures) present us with a tremendous opportunity to overcome many of the well-publicised difficulties that have dogged us in the past and which have arisen primarily as a by-product of the fragmented nature of the UK's built environment supply chain. Of course, the sheer volume of data now available presents us with a different sort of challenge, in terms of: what is necessary on 'day one', what is required for delivery of ongoing operational services, and what is needed when it comes round to time to refurbish. However, I think I speak for all facilities managers when I say that we would rather have too much information than too little.



BIFM
ADVANCING OUR PROFESSION

Rick Holland

Lead Technologist, Innovate UK

Innovate UK is the UK's innovation agency, which funded the research and development of the BIM toolkit.

Architectural, engineering and other construction services provide a huge boost to the UK economy - to the tune of over seven billion pounds of exports each year. By accelerating the take-up of BIM, which is now happening at pace, we're strengthening our base for exporting even more of these high-value services.

The new BIM Toolkit will help further. This framework enables UK practices and global practices to collaborate to a far greater degree. That will open doors for UK practices overseas, and it's already doing so. Looking ahead, the framework also provides a common platform for developing even more advanced innovations - to create a higher value built environment, efficiencies and job growth opportunities.



Innovate UK
Technology Strategy Board

Anne Kemp and Phil Jackson

Institution of Civil Engineers

One of our major goals, as the Institution of Civil Engineers (ICE), is to support and develop engineers in integrating their engineering skills with expertise in handling and using data, to add value and further understanding to their results. In short, recognising our duty in an ever increasingly digital world, to develop and support 'digitally-enabled engineers'.

The Government's Level 2 BIM Strategy has helped significantly in understanding the digital engineering world by placing emphasis on a 'requirements' driven process that consistently captures and uses data throughout the life cycle of assets, from strategic investment through concepts and design, to construction and operation. This has broadened the landscape and understanding of BIM from just parametric 3D modelling to one of asset intelligence, captured and used throughout an asset's life. This approach suits the world of infrastructure very well, where usually the asset is the business, e.g. railways and roads, rather than a platform for a business, such as office buildings. Much infrastructure spend is in maintaining, upgrading and modifying existing assets rather than building new. We are now beginning to understand that this needs to be supported not just by a single 3D (proprietary BIM) model but by a complete set of linked data that includes functional and design specification, project control information, and construction logistics which all lead to integrated and sustainable operational management.

In order to fulfil the full potential of BIM in this digital world we require a consistent approach to delivering BIM. The Level 2 Strategy with its base in data federation, Common Data Environment and underlying standards is proving to be a robust framework underpinning our exploration of BIM. It presents many challenges which, together with the rest of the industry, we are progressively working through. The work now being done to provide the digital Plan of Work that outlines phased deliverables and a good classification basis for all built environment components is an important and significant next step in delivering on Level 2 BIM, and providing the base for Level 3 and Digital Built Britain. ICE are pleased to be working to support its development both now and in the future as it continues to mature and fulfil its complete potential.



ice
Institution of Civil Engineers

Eddie Tuttle

Senior Public Affairs and Policy Manager
The Chartered Institute of Building (CIOB)

The Government's mandated use of Level 2 BIM on all centrally procured public sector projects is fast approaching. The NBS BIM Toolkit launch signals a real step change in the delivery of Level 2 BIM and highlights the importance of having clarity as to how digital data is defined, tested and effectively used alongside a consistent classification system and unified plan of work. This is the starting point for a digitally built Britain.

Data management and control are also real catalysts for coordination at an early stage in projects, providing an opportunity to finally address the issue of collaboration in the industry, which has been repeatedly identified as an obstacle in past reports. Digital Built Britain will of course help change the image and composition of the industry, ensuring that construction is a more attractive industry to work in for a diverse range of people. Getting the right spread of knowledge and ensuring we have the skilled workforce to take full advantage of the opportunities is key and CIOB will play its full role in delivering this.



James Fiske

Director of Delivery and Operations, RICS

Level 2 BIM carries with it a number of opportunities, one of which is a greater need for the industry to collaborate. As surveyors become more reliant on the information available in the model for their downstream activities, it is vital it contains information that is consistently coded and described. Information required by surveyors that is not represented by a physical object, such as a floor or an elemental area, also needs to form an integral part of the model in the future.

During the design stage, BIM should enable surveyors to spend less time on measurement, and more time adding value through better supply chain collaboration and a stronger focus on reducing whole life cost and environmental impacts. During the operational phase, surveyors can link condition surveys to the model, allowing for the more precise measurement of maintenance activities and better measurement of the building for valuation purposes.

Particularly in terms of the construction process, it is important to stress that BIM gives access to better quality information, which is needed for decision-making. Critically, this information must address capital and whole life cost issues, time, methodology and facilities management (FM) information, as well as design specifications. It is for this reason that Chartered Surveyors covering geomatics, construction and property management are working collaboratively with others, both nationally and internationally, and indeed must continue to do so in order to maximise the opportunities for Level 2 BIM and beyond.

All of this is vital if, as an industry, we are going to use BIM to help to deliver the savings identified in the Government's Construction 2025 Strategy.



“Two major challenges for the Stewardship Group have been the need for a common language across different infrastructure types and the need to identify the documentation, the graphical data and the non-graphical data to be provided at each work stage by the supply chain.”

Relevant survey statistics →

The proportion of practices reaching Level 2 has grown to 59%, up from 51%.

This demonstrates an increase in the number ready to meet the Government's requirements.

Sarah Fray

Director of Engineering and Technical Services, IStructE



*The Institution
of Structural
Engineers*

A substantially more integrated approach to the design, delivery and management of the built environment is the goal of Level 2 BIM. With this integration, buildings should be delivered more predictably and cost effectively and should be managed over their life more efficiently. Level 2 BIM provides the opportunity to engage the wider supply chain in the design and delivery of the end product. Linking the digital Plan of Work and Classification Level 2 BIM promotes and drives collaboration between design team members, constructors and the supply chain.

The data embedded within the BIM will be available to inform all the stakeholders in the design, construction, management and use of both buildings and infrastructure, resulting in improved outcomes for both clients and users. Designers, including structural engineers responding to the challenges of sustainability, resource depletion and climate change adaption/mitigation, will find the data available at Level 2 BIM a key asset in decision-making and measuring the effectiveness of the constructed assets. Level 2 BIM presents a step change to the way the industry commissions, delivers and uses the built environment.

Adrian Dobson

Director of Practice, RIBA



RIBA 

At the RIBA BIM Business Forum in autumn 2014, there were presentations from three architectural practices on their experiences of implementing BIM working methods. HOK, David Miller Architects and Croft Goode Architects each showed how BIM is transforming the way in which they manage the delivery of projects. It is clear that many architectural practices are now becoming deeply engaged with BIM at a practical level, and as BIM technologies become more affordable, this is no longer confined to the larger practices but applies to all sizes of practice. In fact it could be argued that in many ways small practices have the most to gain from these new approaches to handling and managing design and construction data; disruptive technologies do not always necessarily favour those with the deepest pockets or best established market presence.

The RIBA believes that it is essential that architects offer design leadership in the construction industry and that the adoption of BIM will be key to this. The changes introduced to the RIBA Plan of Work in 2013 were designed to ensure that this core industry framework was ready to support BIM Levels 2 and 3. The important work being undertaken by NBS in the development of the BIM Toolkit to facilitate greater clarity about the levels of definition of geometric detail and design information at each of the work stages is the next crucial step in piecing together the BIM jigsaw. As the findings of the NBS National BIM survey show, most informed people now believe that BIM is indeed the future model for the construction industry's information management.

“It is clear that many architectural practices are now becoming deeply engaged with BIM at a practical level, and as BIM technologies become more affordable, this is no longer confined to the larger practices but applies to all sizes of practice.”

Validating Employers' Information Requirements

Steve Lockley
Research Director
at BIM Academy
Professor of Building Modelling
at Northumbria University



In most data-centric industries, validation and/or verification of information exchanged between collaborating parties are key factors in their contractual relationships. As the construction industry continues its transition from a craft-based industry to one which exploits advanced manufacturing techniques with digital design and engineering methodologies, the issue of data validation and verification becomes more and more important.

Over the last 500 years or so the industry has always adapted to using the latest information management techniques to convey design intent. This ranges from sophisticated physical models such as Gaudi's model for Sagrada Familia (Figure 1), through CAD drawings to virtual reality models.



Figure 1 Tensile structural model, Sagrada Familia

However, over the last 40 years, the increased tendency to litigate for inadequate, late or incorrect information exchange between parties has driven professionals to regard information exchange as a liability and a part of their risk management procedures.

As the uptake of BIM begins to impact, leading-edge organisations have begun to understand

the benefits and problems that BIM technologies add to this information exchange arena. Many have realised that exchanging native models can dramatically increase productivity and efficiency. Others have realised that these models may contain information they are completely unaware of, and that could cause claims to be brought against them. Indeed some organisations go so far as to develop processes that automate the removal of most data from their models, just in case it may lead to litigation problems.

We have now reached a point where if we are to move forward with BIM and the efficiencies it can bring, we need to have mechanisms to formalise the data exchanges between parties - before they happen and to check that they are acceptable - when they happen. On the validation and verification spectrum there are many levels, ranging from the most simplistic that can be automatically checked by a computer, to the most complex that can only be performed with human expertise and judgment. Ironically, the industry has started to engage at the high end of this spectrum with validation activities such as clash detection, rather than address much simpler activities such as robust data sharing re-use. For successful clash detection several parties must each submit their BIM content in a form that can be federated consistently so that clashes can be identified. Common causes of failure in federation can often be traced back to the lack of clear data contracts defining what data is shared and how it can be re-used; these contracts include specifications of how to define items such as grids, co-ordinate systems, locations, object names and classifications. In an ad-hoc manner these issues are being addressed by the industry through the development of BIM execution plans and undoubtedly custom and practice will develop over time to standardise these activities.

“We have now reached a point where if we are to move forward with BIM and the efficiencies it can bring, we need to have mechanisms to formalise the data exchanges between parties.”

Relevant survey statistics →

We found that 75% work collaboratively, and 68% produce 3D models. Fifty four percent share models outside their organisation. These are criteria for Level 2 BIM. However, looking to further BIM maturity, less than a third use one model through the life of a project, or produce a format independent model.

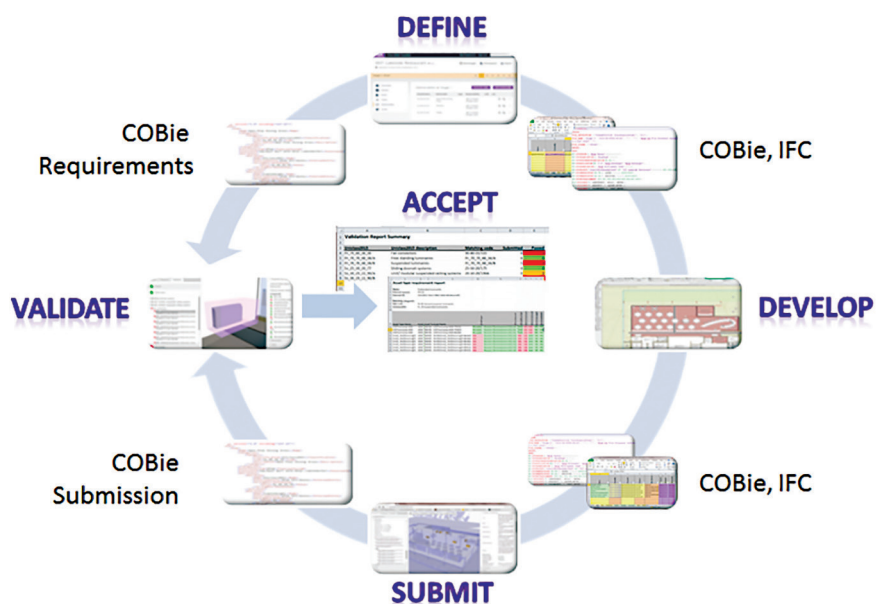


Figure 2 Verification workflow

In parallel with these technology changes we also have construction clients or employers becoming far more engaged with their supply chain. They have information they wish to communicate and requirements for information they wish to receive back from the industry. Essentially they wish to procure, or buy, information as well as buildings from the supply chain so that they can better manage their total expenditure on capital assets.

In this first release, the BIM Toolkit provides a mechanism to help employers specify 'what' information they want and to validate that this information has been supplied to them. This simple 'presence' form of validation is the keystone for future more sophisticated work, such as 'range checking' (the value within required bounds). It begins with the employer identifying the processes, assets and systems they are concerned about when they begin a procurement project. It may be a consultation process, a space demand, a facility such as an operating theatre or a prison cell, or an operational matter such as maintenance frequency. The BIM Toolkit provides a mechanism to easily capture these and formalise them in the COBie information structure. It also provides tools that check that the supplier's data submission contains the employer's required

information. The initial release does not check that the values of the data supplied meet the employer's requirements. A simple example would be an employer commissioning a building that contains a gas boiler and requiring to know the name of the boiler manufacturer and the model number. The validation in the BIM Toolkit would examine the BIM and identify that a boiler had been provided and that a manufacturer name and model had been given.

Figure 2 defines a typical workflow envisaged in the BIM Toolkit. An employer defines what they want to receive as structured data, the delivery team develop a proposal and submit a BIM in industry open standards such as IFC or COBie. The BIM Toolkit provides the tools to review the team's submission (Figure 3 overleaf) and identify where the client's information requirements have, or have not, been met. If there are errors or omissions the BIM Toolkit will identify these and allow the user to return to their BIM tool and correct them. This saves wasted time by avoiding the client receiving incorrect submissions.

To allow the BIM Toolkit review process to be carried out in all types of organisation, both a 'cloud' version and a standalone 'in-house' version are available.

"The BIM Toolkit provides a mechanism to help employers specify 'what' information they want and to validate that this information has been supplied to them."

"If there are errors or omissions the BIM Toolkit will identify these and allow the user to return to their BIM tool and correct them."

Once a submission is ready it is passed on to the validation tool which produces a simple spreadsheet report indicating the contents of the file and its compliance. Again this can be performed in-cloud or in-house.

A novel feature of the BIM Toolkit is the 'BIMogram' as shown in Figures 4. This is the ability to see an employer's requirements in 3D with all the required properties before the building has been given any geometric form, and this allows a quick thumbnail to be created giving an information signature for the requirements. The columns and different colours reflect different types of asset in the model.

All the software to perform validation and verification is free to use and built on the xBIM open source technology. It is envisaged that software vendors will utilise this codebase to integrate validation and submission into their commercial products.

For more details on the xBIM platform please visit www.OpenBIM.org or for the source code visit the xBIM Team at www.github.com/xBIMTeam

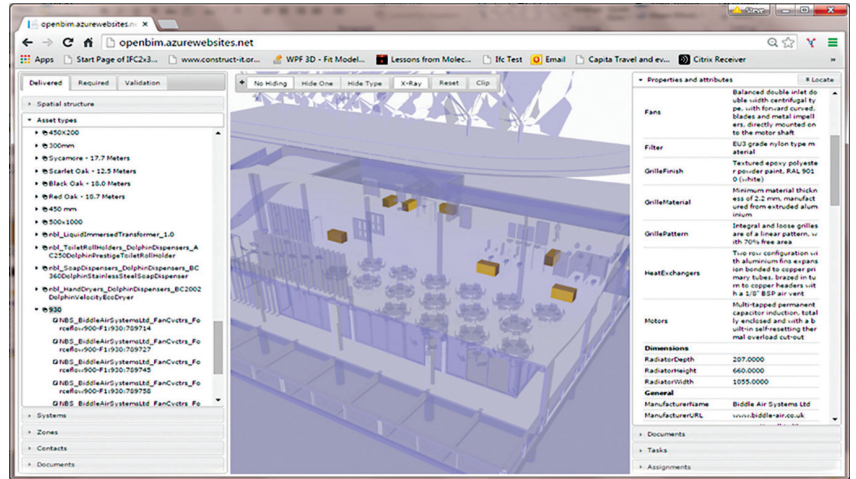
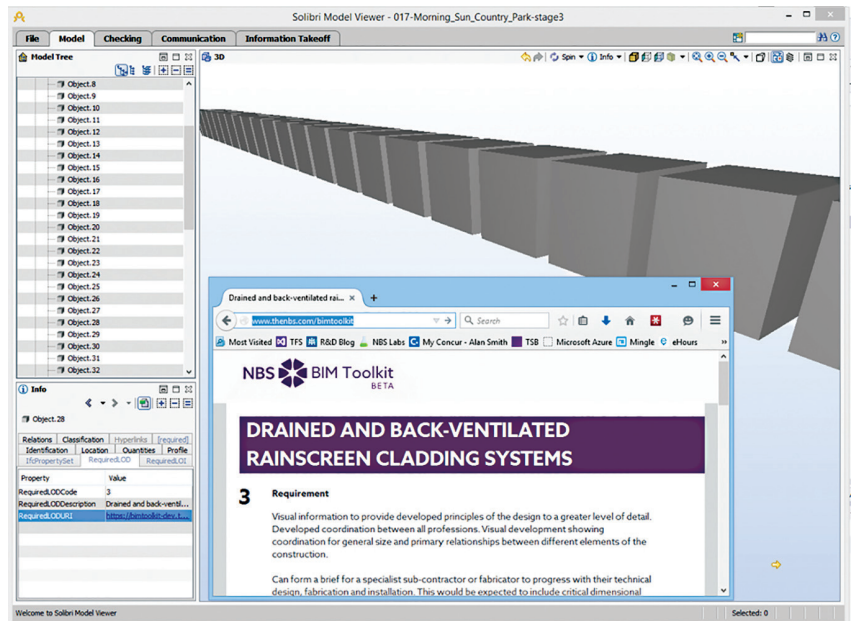


Figure 3 BIM Toolkit submission review tool



Figures 4 'BIMogram'

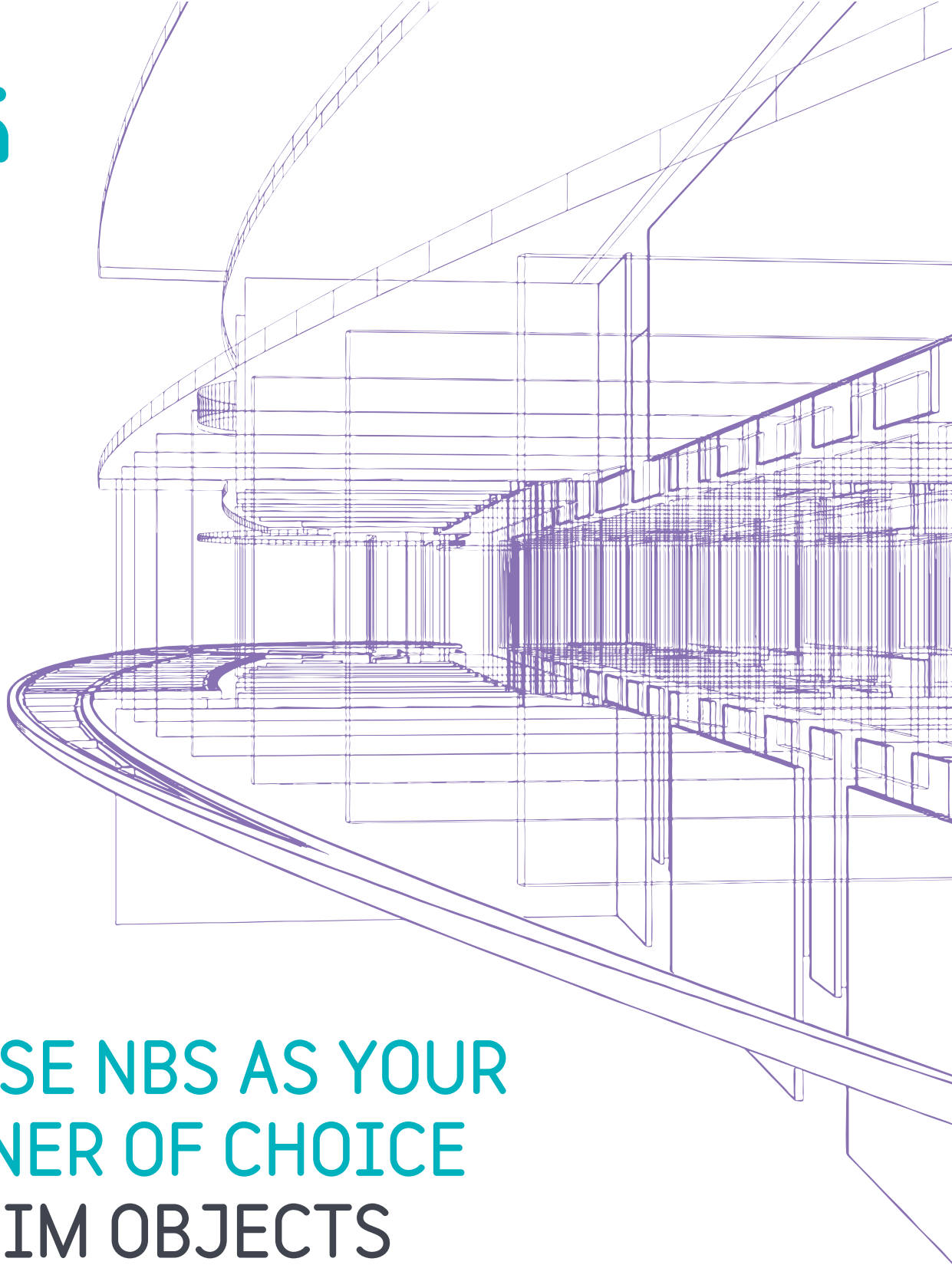
“All the software to perform validation and verification is free to use and built on the xBIM open source technology.”

Notes

A series of horizontal dotted lines for writing notes.

Notes

A series of horizontal dotted lines for taking notes.



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