We have been monitoring BIM adoption in the UK for almost a decade and during this period, the overall trends of BIM awareness and adoption have grown from little more than 10% in 2011 to around 70% in 2019. However, the latest survey shows some stagnation in adoption, possibly tied in with an increase in uncertainty in strategic leadership in the UK BIM rollout and in maintaining client requirements for BIM within central and local government.

As in previous years, the way that BIM is defined is a key factor. For some, BIM adoption will be claimed by those producing drawings and schedules using 3D modelling tools. For others, however, BIM is defined by the relevant standards that describe BIM as a process. Whilst this year’s survey was underway, the first of the new ISO 19650 series of standards were published, and the transition from the PAS 1192 series of standards had begun. These standards define BIM as a process, where exchange information requirements are developed and then delivered in an agreed collaborative process using a common data environment. If we consider adherence to these standards as full implementation of BIM, based on the number who say they use them, adoption in these terms may be closer to 40%.

Regardless of how BIM is defined, the main headline over the years has been the trend of increasing awareness and adoption across the UK industry, using standards and protocols as the platform for adoption. This national success will be bolstered with the new ISO 19650 series, creating a standardized digital process across the world based, in part, on the BS 1192 standards. This survey lists some of the main barriers to the adoption of BIM, such as training, the time required to get up to speed and a lack of standardized tools. NBS has sought to align the NBS content and software to the ISO method of working to allow our customers to more easily produce BIM deliverables within their project teams for their clients.

We also see some negative trends within the report, and trends that might suggest the emergence of a ‘two speed industry’ - the 'BIM engaged' and the 'BIM laggards'. For the advocates, 60% of those who have used BIM have seen improvements in efficiencies whilst 22% of those yet to use BIM have indicated they would rather not adopt it. In addition, the demand from clients, on both private and government projects, is mixed. The survey suggests that not all clients across the industry are seeing the benefits of BIM. We would expect this to increase as BIM, defined by ISO 19650, becomes more commonplace. Once teams have had a good experience of working collaboratively using digital processes then they will demonstrate the benefit to the client. The client will then, in turn, request that this process is followed on subsequent projects.

Another point to note is that there appears to be a drop in awareness of UK Government activities in this area. This is slightly surprising, considering that the Government’s initiatives are what led to the ISO standards that were launched at the end of 2018. Perhaps this drop in awareness of activities is to be expected as the BIM Task Group has been replaced by the Centre for Digital Built Britain (CDBB), and it will take time to rebuild this position in the market. With respect to CDBB, it is good to see that a number of really interesting projects are underway which combine government, industry and academia - so we’d expect awareness to rise again in next year’s survey.

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Overall, there can be no doubt that digital processes and technologies are changing the industry. Use of the cloud is enabling collaboration, giving the industry the opportunity to break down the silos and form a new approach to information development and distribution. In addition, the latest International Standards are giving us a once-in-a-generation opportunity to standardize processes across the global industry. This is an exciting time, and we must now take advantage of it to help create a step-change in productivity, transparency and quality within our industry.

At NBS, we have already played a significant role in the UK’s BIM journey and we will continue to do so as we move towards a global digital construction industry. We have supported the BSI committees that have developed BIM standards, as well as supporting the BIM Task Group’s original core initiatives, where we developed, published and now maintain the Uniclass 2015 classification system, defined in the UK as the system for classifying information on BIM projects in BS EN ISO 19650-2. This year, our journey to support the global BIM world takes a giant leap forward as we launch a global platform for BIM-related content. Our ground-breaking cloud specification tool, NBS Chorus, has connected specification clauses, technical guidance and manufacturer specifications for North America, the UK and Australia, dynamically linked to geometry objects and standards, technical and regulatory data. We have, and will continue to develop digital content and to enhance our software offerings to support global BIM processes.
As a company that mainly delivers private sector developments, we often find that our clients are still learning how to instruct digital processes appropriately, and so we have taken the lead and defined our own.

Our first steps towards rolling out this major process change across the business were to consolidate all of our digital platforms, make the building information models (BIMs) central to project delivery, and standardize all of our internal processes and procedures. This led to the development of “The Multiplex Minimum Digital Standard” (Figure 1).

In early 2018, Multiplex internally mandated the use of BIM and digital construction on all new projects, regardless of client requirements. We decided that this level of commitment was the only way to deliver our projects in the most efficient, safe and timely manner.

Vicki Holmes
Digital Manager, Multiplex
Delivering to this minimum standard places the model and its data firmly at the centre of every project, giving us a precise understanding of the design and construction process that could not be achieved using only traditional 2D information. This provides us with the tools to make more informed decisions faster, and allows us to test solutions in a virtual environment in a safe and cost-effective manner. This inevitably leads to a reduction in risk and waste associated with on-site problem solving and rework.

Our minimum data requirements are a major pillar of The Multiplex Minimum Digital Standard; they are aligned with existing industry standards such as Uniclass 2015. Every building component within the model carries a standard set of data for a precise understanding of design, which in turn leads to improved decision-making.

These four simple data requirements are:
- Project Name
- Project ID
- Supplier Code
- Uniclass 2015 Code

Our intention is simple: to know the ‘what’, ‘where’, and ‘by whom’ of every building component that we are responsible for.

The feedback from our supply chain so far has shown that our minimum data requirements are easy for consultants and subcontractors to understand and clearly communicated in our BIM Execution Plan - a short, practical document written in accessible language. Our digital deliverables are also tied into all subcontractor and consultant agreements, using our own amended version of the CIC BIM Protocol, and supplier capability to deliver the BIM requirements is assessed thoroughly during the procurement process using our capability assessment form. As part of each subcontractor’s tender response, we require sample files that demonstrate an understanding of the required level of geometry and information detail, as well as the technical skill to deliver those requirements for each relevant stage of the project. If a supplier lacks the in-house capability to deliver BIM as required, Multiplex has a list of capable preferred BIM consultants who will integrate with, and upskill, the supplier organization upon appointment.

Often, we do not receive clients' exchange information requirements (EIR). This means that it is essential for us to be clear in our own digital requirements, and for consultants and subcontractors on our projects to understand that BIM is a critical part of our standard process, and not a complicated or expensive add-on. When we are clear about our digital requirements from the beginning, our suppliers are better equipped to provide the correct deliverables, meaning that we can then spend less time chasing and checking, and more time using the data and information on our projects effectively.

By standardizing our minimum requirements, we have also been able to establish a stronger process for data management. This, in turn, has allowed us to develop more innovative solutions, such as automatic dashboarding for project performance analysis, and virtual mock-ups.

Our project teams can freely access information at all times because all models and drawings are available to site staff on their phones and tablets, which reduces the time taken to locate specific information required. It also improves productivity and reduces the risk of inaccurate information reaching the construction site, and as a result considerably reduces the waste that results from rework and inefficiencies.

Although we are still in the early stages of implementing these procedures, the way that we are trading systems, hardware and processes puts a very heavy focus on ease of use for our subcontractors. We are continuously collecting feedback from our suppliers to ensure that we are collaborating to find the best systems, rather than simply enforcing tools.

All of our projects have a dedicated Digital Manager to manage the models and data integrity, and to define and audit processes in the BIM Execution Plan. Our Digital Managers also support the project team, and all Multiplex staff (regardless of role) are now being trained in the use of Navisworks Freedom and Synchro Open Viewer, our nominated project model viewer platforms. This makes the model accessible to everyone and helps us move towards our goal of using 3D (rather than 2D) information as the default communication tool in meetings.

Each of the pillars outlined in our Multiplex Minimum Digital Standard contributes to an environment where design coordination is managed efficiently and issue resolution is pre-emptive. This progressive approach to design management allows us to explore the best possible construction methods virtually, including possibilities for off-site construction and better logistics management. Rather than the BIM process being integrated with design management and construction, it is the central focus of those functions as part of Multiplex best practice.

This has been a major change in our organizational process, and has obviously resulted in challenges. The review and consolidation of all of our processes and software platforms was no small feat, requiring a number of centralized full-time resources that could not be absorbed into project costs, as well as an initial investment in hardware, software and IT infrastructure before we saw any kind of return. Achieving this was only possible with the full support of our executive teams and senior management, who understood the longer-term benefits.

A change of this magnitude also had to be led by our own people on-site, and although a top-down approach was initially required, it was only by empowering our own employees with the right tools and harvesting an atmosphere of openness, collaboration and skills sharing that we began to see real change. This was led by our Digital Managers, who put in incredible time and effort building strong relationships with their teams. We learnt early on that people respond best to personal engagement, not to the technology.

Multiplex is focusing on the root of innovation, not technology for technology’s sake. We are creating strong digital and data-driven foundations that are simple and clear, and that will allow us to continue to build bigger and better. To date, this has only been achievable using standardization and industry classifications, and there is still a long way to go. Approximately 60% of our sites are now delivering in some degree to our Minimum Digital Standard, and there will certainly be new lessons to learn and challenges to overcome as we integrate this process into all new projects. So far, the outcomes have been incredibly positive, with clients, consultants and subcontractors alike communicating their appreciation for a set of standards that are simple, practical and fit for purpose.
Driving Economic Prosperity through BIM adoption

BIM adoption can improve lives by reducing poverty in the world’s fastest growing communities. That’s the view of the UK Foreign & Commonwealth Office (FCO), which has allocated part of the Cross-Government Prosperity Fund to the BIM delivery methodology via the Global Infrastructure Programme (GIP).

The fund aims to remove barriers to economic growth and promote sustainable development in partner countries. The fund’s focus is on Middle-Income Countries (MICs), where 59% of the world’s poor live and 60% of global growth will occur by 2030.

BIM supports the efficient design, delivery and maintenance of infrastructure and buildings. There is a strong link between infrastructure development and increased prosperity, which also includes the support of gender equality and inclusion.

Additionally, the fund seeks to improve trade links between partner countries and the rest of the world, including the UK.

Delivery Partner supporting CDBB

Mott MacDonald (MM), led by its Smart Infrastructure team, was appointed by the FCO as the ‘Delivery Partner’ for the BIM Pathfinder Programme in January 2019. The role of the Delivery Partner is to support and build upon the work undertaken by the Centre for Digital Built Britain (CDBB) international development programme.

The work is carried out in three phases. During Phases 1 and 2 of the programme, CDBB established relationships with the governments of the partner countries, including Colombia, Vietnam, Indonesia, Brazil, Mexico and Peru. This involved workshops and in-bound delegations to the UK to determine their appetite for a national BIM programme and assistance from the UK. These countries are at differing stages in their journeys. CDBB has initiated Phase 2 in most of the partner countries and is now being supported by MM. Phase 2 can be summarized as the ‘adapt and train’ stage. National BIM Strategy groups are formed by the countries and trained to adapt their current policies, standards and methods of working to shift towards collaboration and BIM. Training occurs at differing levels:

- National BIM Strategy groups are formed by the countries and trained to adapt their current policies, standards and methods of working to shift towards collaboration and BIM. Training occurs at differing levels:
- During Phase 2 the focus is on the national and organizational levels, enabling the decision-makers to understand BIM benefits and its application. Potential pilot projects to showcase the use of BIM will be reviewed and selected for implementation of Phase 3.
- The third and final phase sees the rollout of the use of BIM on the selected pilot project, and involves support in planning and delivery of the project. The aim of this pilot project is to become the country’s case study for BIM adoption, which they can build on. Learning from this pilot project will also be crucial to review and iterate current policy and standards as required.

The MM delivery support will be led from London, with team members located in Mott MacDonald offices in Singapore, Jakarta and Bogota. Atlas Industries will support in Vietnam. The programmed end date for Delivery Partner support is March 2021.

Phase 1: Engagement

Phase 2: Adapt and Train

Phase 3: Rollout
Themes arising during early engagement

MM engagement with stakeholders of partner countries commenced in February 2019, with workshops held in Jakarta, Bogota, Brasilia and Mexico City, and the visits to the UK by Vietnamese and Peruvian delegations undertaken thus far. Some trends are beginning to emerge in these discussions with stakeholders. These can be characterized as follows:

1. Focussing on BIM adoption in a Big Data world
2. Transitioning from 3D models to data-driven BIM
3. Facilitating client-led transformation

Partner countries are planning their approach to “Industry 4.0”, whilst having to maintain focus on the fundamentals of BIM. When the UK was getting to grips with BIM and the impending mandate, Digital Twins were not yet being discussed. To tackle this, Vietnam has established the goal of implementing BIM guidelines by 2021 and is developing a strategy for beyond 2021, which addresses wider digital transformation.

Other countries such as Brazil are embracing BIM under the umbrella of Industry 4.0. This is seen in Brazil’s BIM-BR Strategy, which aligns with Industry 4.0 and has streams for IoT and Big Data. Part of our role in the UK will be to help countries negotiate a route to obtaining structured and usable asset data, that data can be utilized sartetly by upmating technologies to facilitate Smart Infrastructure solutions.

Many of the countries have commenced with the 3D geometry modelling aspect of BIM; they need to transition to collaboration and the inclusion of data. The benefits of Common Data Environments (CDEs) are understood, but questions are arising regarding how to establish the right CDE for differing asset owners, and who is best placed to host. Cost is a major factor in CDE selection for clients or projects in MICs, along with ease of use and configuration.

A common query is how UK asset-owning organisations went about specifying BIM when their own company’s BIM knowledge was immature. We have seen in the UK that this is a gradual process, and lessons have been learned – particularly around having clarity over what BIM is in the contract. Well-defined client requirements are a major factor in successful BIM adoption, but a framework of standards and documents is needed to provide the clarity required. Training on awareness, process and interaction with models and the use of data is important for the clients, to enable BIM to be an integral part of the Design, Construction and Operation phases.

The shared goal amongst partner countries is to achieve better outcomes for the level of investment in infrastructure, and the determination of the people involved to make that happen has been clear to see during the early engagement process. Citizens of these countries face challenges ranging from having suitable learning spaces for children to mobility within cities and accessing adequate healthcare facilities. The shared goal amongst partner countries is to achieve better outcomes for the level of investment in infrastructure, and the determination of the people involved to make that happen has been clear to see during the early engagement process.

The UK is seen by many as global leaders in the digital transformation of the construction industry. This has been propelled by the UK Government’s BIM mandate for public projects, and the standardization of BIM under the British Standards and PAS 1192 suite providing a framework for delivery.

The publication of ISO 19650-1:2018 and ISO 19650-2:2018, and their strong alignment with the original BS 1192 and PAS 1192 documents, endorses the UK BIM process and creates a global platform for the specification and use of BIM. The ISO standards provide other countries with a vehicle to accelerate adoption of a tried and tested BIM standard.

Use of the ISO can reduce development effort in countries where standards are not yet in place, and help to ensure benefits for both the public and private sectors.

By sharing common definitions for BIM, it will become easier to collaborate and trade across the global infrastructure market.

This will be further enhanced by the release of future ISO 19650, Parts 3 and 5, which are now under development and will again be heavily based upon their PAS 1192 counterparts.

There is no doubt that MICs can learn a great deal from the UK’s BIM journey and use the lessons learned to fast-track their own development. This was seen in April 2019 when the National BIM Steering Committee of Vietnam visited London, Cambridge, Manchester and Newcastle over a two week period. A series of excellent and informative sessions was delivered by designers, contractors, asset owners, academics and legal practitioners. The array of knowledge and best practice on show was incredible, and proved to be an eye-opening experience for the delegation.
In social media, data is enhancing our ability to become connected, but its use can have a negative impact on our wellbeing, and when managed poorly it loses its value. Sound familiar?

We know that we can use data to learn more about who we are and how we behave, which can have major benefits, but this is also opening us up to ethical issues, and some organizations are using data for financial and political gains to influence opinions and behaviours. Is this the future that we want for our industry?

The way I see it, this could be mirrored in the production, application and use of data during the design, construction and operation of assets and critical infrastructure; however, we are lagging slightly behind in our industry. Our data is:

• Accelerating in growth
• Valuable if processed and managed
• A burden if it has no use
• A risk if it isn’t managed ethically and securely

Being behind the curve, we might just have a fighting chance of being mature enough (and disciplined enough) to deal with this level of information by the time we fully embrace AI – but only if we learn lessons from other leading industries. Worryingly, we are lagging behind in professional services and construction. Figures released by McKinsey show that we have some of the smallest levels of adoption, and are lacking in aspirations to invest and accelerate in the AI space.

One of the most important aspects of AI (specifically the Machines Learning element), is knowing when you have enough data to train a model. I think that’s becoming a reality.

We are generating more data than ever before, from social media and mobile data to image capture and the ever-growing menace of email. Did you know that more than 2.5 quintillion bytes of data are created every single day, and that the average office worker receives 120 emails in that time?
Drivers and enablers
So what’s been stopping us from getting to grips with AI?

One of the most important aspects of AI (specifically the ‘machine learning’ element) is knowing when you have enough data to train a model. I think that’s becoming a reality. Our industry isn’t quite where it needs to be yet, but we are certainly seeing an increase in centralised, accessible and structured information. All that it would take for us to start learning is a data amnesty. Key drivers which would enable this could be:

• The UK BIM Level 2 mandate and recent ISO
• The National Digital Twin (see ‘Data for the Public Good’ report)
• Intelligent construction specification and procurement
• The adoption of the IFC data model and file format specification
• Cloud processing
• Mainstream use of analytical and business intelligence tools
• Development of process around 3D computer vision

Major drivers for me are the mainstream expectation of BIM and the continuing adoption, following the UK BIM Level 2 mandate. Now that we are starting to see major programmes being handed over in this way, we can really start to test and develop AI tools on project data sets.

As an example of scale, we have been working with HM Revenue & Customs for the past few years to deliver their flagship programme. This is being delivered digitally with consistent requirements, which have been contractually implemented. In turn, analysis and reporting are also delivered digitally, including costing, performance and asset handover compliant with BIM Level 2 standards. The client has embraced the power of digital information in function, as well as its portfolio management!

HMRC is trying a 170 office portfolio, converting it into 13 regional hubs and five specialist sites, and relocating nearly 45,000 employees in the process – the data being generated is vast. At least ten new buildings are being constructed and fitted out, each the equivalent size of a corporate headquarters. This is really helping us (and the client) to understand the relationship between cost, quality and time through objective data-driven analysis. If we scale this up further and look at data blending for every government asset, it becomes obvious that there is a significant opportunity to analyse, optimize and learn from the big data warehouse – we would really have the processing power to do this effectively without AI. Longer term, what could unsupervised learning tell us about our industry on that scale?

The risk opportunity factor

Aside from much debated ethical issues, a big lesson we captured in a recent industry workshop was the automation equation. If we don’t rethink the fundamentals, including value and critical relations of our process, we could end up increasing productivity, resulting in ‘data sediment’ which builds up and calcifies over time. This is an immediate issue for machine learning (automated rubbish = more rubbish faster). It’s never been more important to be bold, and rethink our way of ‘doing what we have always done’.

The opportunity here might simply be to keep up with the rest of the world. AI will form part of our basic approach to most things in life in the coming years. If left behind, our industry won’t be able to compete, and will likely face total disruption from other sources. To paraphrase Sundar Pichai (Google’s CEO), ‘AI is the most important thing we are working on right now. It is likely to offer similar or greater impact to us than fire or electricity!’

As we develop AI tools on project data sets, this way, we can really start to test and guide efforts. Our Government is looking to put the UK at the forefront of the artificial intelligence and data revolution, and we have a part to play.

In response to this, we have started engaging our clients, peers, partners and suppliers to ask:

• Where should we invest?
• What are the most wasteful things we do?
• Do we have enough data and how do we get it?

Following some discussions with BEIS last year, we have developed a framework of tools which might assist, augment or automate us and our activities. We have hosted, and will continue to host, NOSE (Need Opportunity Solution Evidence) workshops to define our wish-list for disruption through AI. Emerging themes and methods are illustrated on the right.

So what?

As AI becomes mainstream in other industries and investment grows in our own, we have a responsibility to communicate and guide efforts. Our Government is looking to put the UK at the forefront of the artificial intelligence and data revolution, and we have a part to play.

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What next? My advice right now is simple:

1. Read the AI sector deal, the numbers alone are staggering
2. Follow the story and listen, don’t panic!
3. Work out where the low hanging fruit is for you, and just think about where to start
4. Invest in your digital initiatives NOW!
5. Look to other sectors or industries and recognize we can learn from them
6. Start talent mining and promote a growth mindset in your business or network to broaden capability
7. Have a plan for AI and make someone accountable
8. Come to terms with the idea of aiming for a moving target. In the coming years this will evolve rapidly
9. Get involved and have your say!

Our industry isn’t quite where it needs to be yet but we are certainly seeing an increase in centralised, accessible and structured information.
This is the ninth NBS report into the use of BIM, the associated knowledge of BIM and attitudes towards it. Over the last eight years, through our survey, we have observed the growth in awareness and use of BIM. Simultaneously, the construction industry (partly enabled by BIM) has begun to transform as it embraces digital ways of working.

So, is BIM now common practice in the industry? In the analysis of this year’s findings we consider the extent to which BIM usage in the UK has become embedded in design practice. We look at where BIM is yet to be adopted and what the impediments are to it being universally used and beneficial to the industry as a whole.

Each year, the survey that underpins this report is publicized by a number of professional bodies and institutes so that a range of industry perspectives is represented. We are extremely grateful to those organizations for collaborating with us to facilitate the participation of so many construction professionals in this research.

Almost a thousand (988) construction industry professionals completed this year’s survey: more than participated in last year’s survey. Engagement with BIM remains high and we thank all those taking the time to give their views.

Use of BIM
Almost all respondents know about BIM: only 2% said that they were not aware of it, and less than 1% weren’t sure. Of the 98% that were aware, just under three quarters (73%) said that their organization had adopted BIM for projects they’ve been involved with. This is slightly less than last year’s figure of 77% - the first time since 2015 that we have not seen an increase. If we factor in the respondents not aware of BIM, the figure drops to 69%. So, what does this mean? Why haven’t we seen a continuation of the growth in BIM use of the past few years?

Each year, the survey that underpins this report is publicized by a number of professional bodies and institutes so that a range of industry perspectives is represented.

Note: The way we calculated BIM adoption in 2018 was slightly different to this year. The figure for 2018 shown here is calculated the same way as this year’s figure and those prior to 2018.

And excluding those who didn’t know whether or not they had adopted BIM.
Well, if we look further into the data, we see that many organizations are continuing to embed BIM in their ways of working: 15% used BIM on all projects last year, and 26% on more than three quarters. This is comparable with the levels we saw in 2017 and 2018.

Looking ahead, the intent is to adopt BIM. Among both current BIM users and those yet to adopt it, most plan to use it within the next five years.

“The mandate has been a huge “pull” driver for the UK industry. To me it has created a buzz about turning digital. The number of events and publicity BIM is getting within the industry has helped carry the momentum.”

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

<table>
<thead>
<tr>
<th>Percentage Range</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
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<tbody>
<tr>
<td>Up to 25%</td>
<td>19%</td>
<td>19%</td>
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<tr>
<td></td>
<td>14%</td>
<td>12%</td>
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<tr>
<td>Up to 50%</td>
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<td>Up to 75%</td>
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Looking ahead, the intent is to adopt BIM. Among both current BIM users and those yet to adopt it, most plan to use it within the next five years.

How would you describe your organization’s current and future use of BIM?

<table>
<thead>
<tr>
<th>Description</th>
<th>Current Use</th>
<th>In One Year’s Time</th>
<th>In Three Years’ Time</th>
<th>In Five Years’ Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>We currently use BIM</td>
<td>69%</td>
<td></td>
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<tr>
<td>In one year’s time we will use BIM</td>
<td>91%</td>
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<td></td>
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<tr>
<td>In three years’ time we will use BIM</td>
<td>95%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In five years’ time we will use BIM</td>
<td>96%</td>
<td></td>
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BIM and design in the future

- Those who can effectively collaborate will be the most successful: 87%
- The demands of sustainability will mean we will have to radically change how we design buildings: 77%
- Creativity will become more important: 66%
- We will need to use BIM on all projects: 63%
- Buildings will be designed by algorithm, once we’ve described design requirements: 23%
- Traditional roles, like architect, will begin to disappear: 13%

Attitudes to BIM adoption

- For using BIM: 96% plan to use BIM within five years
- Against using BIM: 63% have adopted BIM successfully, 22% would rather not adopt BIM, 55% believe they’ll get left behind if they don’t

BIM remains the goal for many organizations, with only 7% of users saying that they regret adopting it and only 22% of non-users saying that they would rather not. Furthermore, almost two thirds (63%) of those who have adopted BIM feel that they have done so successfully, and (perhaps more importantly) 55% of those yet to adopt it think they’ll get left behind if they don’t.

Looking ahead, 63% anticipate that they’ll need to use BIM on all projects, and the vast majority (87%) believe that those who can collaborate effectively will be the most successful. This doesn’t mean that creativity will not remain important, nor that people envisage traditional roles, like architect, to disappear. Sustainability will also increasingly influence design.

These are all strong indicators that BIM is firmly embedded in the construction industry, and that it is only a matter of time before its use is almost universal. However, this doesn’t answer the question of why BIM adoption hasn’t risen again this year. We will start by looking at people’s experiences of BIM.
Almost three quarters (73%) believe that BIM results in operation and maintenance savings. Over two thirds (69%) need manufacturers to provide BIM objects, and a substantial majority of respondents disagree that BIM is just for larger organizations or only used in the design stages. This all suggests that construction professionals continue to believe in BIM, and that many of those not yet using it do plan to.

BIM experience
Let’s remind ourselves of why people use BIM. Both those using BIM and those yet to adopt it recognize that it increases coordination of construction documents. Those using BIM see that it brings cost efficiencies (60%) and increases speed of delivery (55%). Some non-users agree, although we can see here that it is first-hand experience which really brings home the benefits of using BIM.

Almost half of BIM users (48%) said that it has increased their profitability and that it makes it easier for them to work internationally. A substantial minority (interestingly more non-users than users) agree that BIM enables them to work in new sectors.

Both those using BIM and those yet to adopt it recognize that it increases coordination of construction documents.

How BIM affects and benefits working practices

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Agree user</th>
<th>Agree non-user</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adopting BIM has required/would require changes in our workflow, practices or procedures</td>
<td>91%</td>
<td>89%</td>
</tr>
<tr>
<td>Adopting BIM has increased/would increase coordination of construction documents</td>
<td>81%</td>
<td>81%</td>
</tr>
<tr>
<td>Clients will increasingly insist on us using BIM</td>
<td>61%</td>
<td>61%</td>
</tr>
<tr>
<td>Contractors will increasingly insist on us using BIM</td>
<td>61%</td>
<td>28%</td>
</tr>
<tr>
<td>Adopting BIM has brought/would bring cost efficiencies</td>
<td>60%</td>
<td>45%</td>
</tr>
<tr>
<td>Adopting BIM has increased/would increase speed of delivery</td>
<td>55%</td>
<td>48%</td>
</tr>
<tr>
<td>Adopting BIM has increased/would increase our profitability</td>
<td>48%</td>
<td>34%</td>
</tr>
<tr>
<td>Adopting BIM has made/would make it easier for us to work internationally</td>
<td>48%</td>
<td>43%</td>
</tr>
<tr>
<td>Adopting BIM has enabled/would enable us to work in new sectors and types of projects</td>
<td>44%</td>
<td>44%</td>
</tr>
<tr>
<td>Adopting BIM has made/would make traditional specifications redundant within our organization</td>
<td>25%</td>
<td>25%</td>
</tr>
</tbody>
</table>

Attitudes to BIM

<table>
<thead>
<tr>
<th>Attitude</th>
<th>Agree user</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using BIM results in operation and maintenance savings</td>
<td>73%</td>
<td>21%</td>
<td>7%</td>
</tr>
<tr>
<td>We need manufacturers to provide us with BIM objects</td>
<td>69%</td>
<td>19%</td>
<td>12%</td>
</tr>
<tr>
<td>Unless specifications are linked to the digital model, it’s not BIM</td>
<td>30%</td>
<td>25%</td>
<td>44%</td>
</tr>
<tr>
<td>Information models only work in the software they were made on</td>
<td>24%</td>
<td>21%</td>
<td>55%</td>
</tr>
<tr>
<td>BIM is just for larger organizations</td>
<td>20%</td>
<td>13%</td>
<td>67%</td>
</tr>
<tr>
<td>BIM is only used in the design stages</td>
<td>15%</td>
<td>12%</td>
<td>72%</td>
</tr>
</tbody>
</table>

This all suggests that construction professionals continue to believe in BIM, and that many of those not yet using it do plan to.
BIM necessitates significant change within an organization - almost all respondents agree that it requires changes to workflows, practices and procedures. It requires investment of knowledge in BIM standards and protocols, training in new software platforms, and financial investment to access these digital tools.

It can be challenging to find the resources to make these changes alongside day-to-day project delivery. Organizations need sufficient motivation to go through such a significant period of change, such as the promise of further work because clients require BIM.

Organizations are also more likely to take action to change if they know that guidance and support are readily available. Several themes emerging from the findings of this year’s BIM survey may indicate why BIM adoption has not kept pace this year.

**What are the main barriers to using BIM?**

- No client demand: 65%
- Lack of in house expertise: 63%
- Lack of training: 59%
- Cost: 51%
- No time to get up to speed: 48%
- The projects we work on are too small: 38%
- BIM is not relevant to the projects we work on: 36%
- No established contractual framework for working with BIM: 36%
- Lack of standardized tools and protocols: 33%
- Lack of collaboration: 33%
- Differences in expertise among collaborating parties in a project: 28%
- Operating System specific software: 18%
- Don’t see the benefit: 15%
- Liability concerns: 13%
- We are unsure of the Government’s commitment to BIM: 12%
- Other: 9%

These are:

- Different levels of BIM knowledge among clients.
- Particular challenges for certain sectors of the industry.
- Changes in the BIM support framework.
- Standardization and consolidation.

We explore these themes in the following sections.

**Clients and BIM**

The UK Government mandated the use of BIM Level 2 on all centrally funded government projects from April 2016 onwards. The run-up to this date saw a lot of publicity and discussion about BIM, and the sharing of knowledge and standards to help people understand what Level 2 meant. It was a catalyst for the industry to adopt BIM, and was very likely a key reason that we saw BIM use grow year-on-year from 2016 to 2018. Everyone who wanted to deliver central government projects knew that they had to achieve BIM at Level 2, and therefore made the decision to enact the required changes in their organizations.

Some organizations took the decision to fully embed BIM in their workflows and deliver it as standard for all types of project. As the profile of BIM grew, and design practices and large contractors demonstrated the benefits of BIM to all their clients, some of those outside the government sector began to include it in their project briefs.

Therefore clients, in particular the UK Government, have proven to be a key driver in the adoption of BIM. There are issues, however.

While the UK Government can take credit for setting the industry on the right path with BIM, respondents to this survey do not feel that it has been successful at maintaining the momentum with BIM since April 2016. Only 32% believe that it has not been successful. People are more positive in their assessment of the mandate itself, with almost half (48%) believing it to be successful. This is not a ringing endorsement of the BIM mandate’s success, but it is an improvement on last year, where only 41% felt that the mandate was successful. So, as time passes, the mandate continues to help embed BIM in practice.

The definitive industry update
The construction industry is taking too long to define Level 3 BIM.

Central government is not enforcing the Government’s 2016 BIM mandate.

I think the Government is on the right track with BIM.

I trust what I hear about BIM.

I’m still not clear on what I have to do to comply with the Government’s 2016 BIM mandate.

BIM is now the norm for project information.

The UK is the world leader in BIM.

By 2020 we will have a clear understanding of Level 3 BIM.

The construction industry is now delivering on the Government’s 2016 BIM mandate.

<table>
<thead>
<tr>
<th>UK Government, the Mandate and Level 3</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local government is not enforcing the Government’s 2016 BIM mandate</td>
<td>57%</td>
<td>36%</td>
<td>7%</td>
</tr>
<tr>
<td>The construction industry is taking too long to define Level 3 BIM</td>
<td>54%</td>
<td>32%</td>
<td>14%</td>
</tr>
<tr>
<td>Central government is not enforcing the Government’s 2016 BIM mandate</td>
<td>49%</td>
<td>40%</td>
<td>11%</td>
</tr>
<tr>
<td>I think the Government is on the right track with BIM</td>
<td>43%</td>
<td>33%</td>
<td>25%</td>
</tr>
<tr>
<td>I trust what I hear about BIM</td>
<td>41%</td>
<td>42%</td>
<td>17%</td>
</tr>
<tr>
<td>I’m still not clear on what I have to do to comply with the Government’s 2016 BIM mandate</td>
<td>38%</td>
<td>27%</td>
<td>34%</td>
</tr>
<tr>
<td>BIM is now the norm for project information</td>
<td>37%</td>
<td>22%</td>
<td>41%</td>
</tr>
<tr>
<td>The UK is the world leader in BIM</td>
<td>30%</td>
<td>49%</td>
<td>29%</td>
</tr>
<tr>
<td>By 2020 we will have a clear understanding of Level 3 BIM</td>
<td>27%</td>
<td>31%</td>
<td>42%</td>
</tr>
<tr>
<td>The construction industry is now delivering on the Government’s 2016 BIM mandate</td>
<td>22%</td>
<td>31%</td>
<td>47%</td>
</tr>
</tbody>
</table>

While it is seen to have been successful to some extent, only 23% believe that the industry is delivering on the mandate. But again, this is an incremental improvement on 2018, where only 19% felt so. Havi ng said that, there has been a slight drop in the proportion who believe that the Government is on the right track with BIM from 47% last year to 43% in 2019. 

"No sign that the mandate is being enforced, but then we adopted BIM tools and process before the 2017 construction strategy was written; we have a keen interest in improving construction processes and saw value in the use of BIM beforehand!"

Part of the problem is that many in the industry say that the Government is not enforcing the BIM mandate. 49% say so with respect to central government projects.

There is also the issue of knowing what to do to comply with the BIM mandate, and how to take BIM to the next level. BIM Level 3 is still to be defined, and over half (54%) say that it is taking too long to do so. There is little confidence that it will be defined soon, with only 27% thinking that it will be defined by 2020. In terms of compliance with the mandate, 39% remain unclear (slightly less than the 41% in 2018).

This lack of knowledge about BIM is particularly evident among clients. Given the mandate, it is perhaps surprising that almost half (46%) of survey respondents agree that those procuring assets for central government don’t understand the benefits of BIM, only 19% feel that they do understand the benefits. This lack of understanding is more acute among clients procuring buildings not covered by the mandate. 55% feel that local government procurement professionals don’t understand the benefits, and that almost a third (36%) of private clients don’t understand them.

We work on government projects and their project delivery staff do not understand BIM or what it is used for.’

‘The initial mandate was a good way to get BIM Level 2 recognised and projects being delivered in this way however it seems if a client or contractor choose they want to work without a BIM Level 2 structure they can still do this (this is applicable to many government procured projects).’

‘I know about BIM from numerous industry conferences I have attended, but that is the only place I’ve seen a drive towards it. Not from government, not from our clients who are the construction and architectural industries and local government. They are the people that should be pushing for it, if the government mandate had been effective.’

Clients and BIM

Private clients don’t understand the benefits of BIM

Those procuring buildings or other assets for local government don’t understand the benefits of BIM

Those procuring buildings or other assets for central government don’t understand the benefits of BIM

Our current contracts are not compatible with BIM

This does imply a loss of momentum. Has the Government lost focus? Well, it has continued to support the standardization of BIM through its involvement with the recently published information standard ISO 19650. More on that later.

There are other issues, too. Not everyone believes that contracts are compatible with BIM (33%); however, there have been recent changes, which are perhaps reflected in the 43% who do feel contracts are compatible.

There is also a need within client organizations for a joined-up approach to the procurement and management of buildings with the whole-life cost in mind. Traditionally, the facilities management teams have not always been involved at the early stages of projects. This can mean a lack of coordination between those responsible for capital expenditure and those focused on the operational costs of a building, and perhaps gaps in understanding of how BIM can benefit. There are signs that this is changing, but this kind of cultural change can be slow to take effect.

‘Clients still have the primary concern of the bottom line figure for capital expenditure... Until CAPEX and OPEX are combined and they are charged with managing the project beyond the procurement phase there will be no significant change’

BIM Level 3 is still to be defined, and over half (54%) say that it is taking too long to do so. There is little confidence that it will be defined soon, with only 27% thinking that it will be defined by 2020.
Particular challenges for certain sectors

Our survey shows that public sector and commercial projects are more likely to be carried out using BIM than projects in other sectors. 87% used BIM on educational projects in the last 12 months, 84% on mixed-use and 83% on offices. Only 63% used BIM on one-off housing and 77% on other private housing. This may partly reflect the influence of the BIM mandate on publicly funded projects, but may also relate to project and practice size. It's probable that the clients of small, one-off housing projects are less likely to be aware of and to request BIM. They may be one-off clients with limited knowledge of the construction industry.

When we look at this more closely, we see that respondents working on one-off new houses, extensions, conversions or alterations are less likely to agree that BIM is the norm for project information. It is perhaps partly for this reason that fewer small practices (rather than larger organisations) believe that in future they will need to use BIM on all projects, or that clients or contractors will insist that they use BIM. And among those yet to adopt BIM, fewer small practices are concerned that they will be left behind if they don’t adopt it. More small practices also tell us that they would rather not adopt BIM, and fewer recognize the benefits. Despite this, we did find examples of small practices using BIM for a variety of projects, including one-off residential.

While many small practices have adopted BIM, they are less likely to do so than larger firms. In 2019, 56% of practices with 15 employees or fewer had adopted BIM, compared with at least 80% of practices with more than 15 staff. Fewer also expected to use BIM, particularly within the next year, although the vast majority of small practices do intend to adopt BIM within five years.

This is partly explained by some projects which are perceived to be too small, as well as the cost of adopting BIM. We can see too that fewer respondents from small practices are confident in their knowledge and skills in BIM. 45%, compared with over 60% of those from larger practices.

“For small two and three man practices it costs too much to adopt completely new ways of working, especially if new CAD applications need to be bought and learned and if there is no demand and things aren’t broken, why bother?”

“There is a push and many companies are taking on Revit [but] there is still a lag in small companies... Some contractors are refusing to abide by BIM and 3D models instead requesting everything is exported to CAD.”

“The uptake of BIM is not straightforward for small to medium sized architectural practices. Any practice that does not have a full-time CAD / BIM manager will struggle to find the time required to implement new BIM software and working methods and practices within their organisation.”

While confidence is lower among smaller practices, the overall proportion of respondents who are confident in their BIM knowledge and skills has not increased since last year. 1% actually 1% lower. And there is a link between confidence and adoption, with those confident in their knowledge of BIM more likely to be using it. Those confident in their BIM knowledge are also more likely to see the benefits of BIM, even if they are not using it yet.

So why aren’t more people feeling confident in their knowledge of BIM?

Which of these project types have you used BIM on?

<table>
<thead>
<tr>
<th>Project Type</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>63%</td>
<td>63%</td>
<td>64%</td>
<td>65%</td>
<td>67%</td>
</tr>
<tr>
<td>Mixed use</td>
<td>72%</td>
<td>72%</td>
<td>73%</td>
<td>74%</td>
<td>76%</td>
</tr>
<tr>
<td>Offices</td>
<td>78%</td>
<td>78%</td>
<td>79%</td>
<td>80%</td>
<td>81%</td>
</tr>
<tr>
<td>Industrial</td>
<td>81%</td>
<td>81%</td>
<td>81%</td>
<td>82%</td>
<td>84%</td>
</tr>
<tr>
<td>Health</td>
<td>81%</td>
<td>81%</td>
<td>81%</td>
<td>82%</td>
<td>83%</td>
</tr>
<tr>
<td>Culture and entertainment</td>
<td>74%</td>
<td>74%</td>
<td>74%</td>
<td>75%</td>
<td>75%</td>
</tr>
<tr>
<td>Sport and leisure</td>
<td>72%</td>
<td>72%</td>
<td>73%</td>
<td>74%</td>
<td>75%</td>
</tr>
<tr>
<td>Other private housing</td>
<td>58%</td>
<td>58%</td>
<td>59%</td>
<td>59%</td>
<td>59%</td>
</tr>
<tr>
<td>Public housing including social housing</td>
<td>57%</td>
<td>57%</td>
<td>57%</td>
<td>58%</td>
<td>58%</td>
</tr>
<tr>
<td>Other private</td>
<td>56%</td>
<td>56%</td>
<td>57%</td>
<td>57%</td>
<td>57%</td>
</tr>
<tr>
<td>One-off new houses, extensions, conversions, or alterations</td>
<td>6%</td>
<td>6%</td>
<td>7%</td>
<td>8%</td>
<td>9%</td>
</tr>
</tbody>
</table>

Current and projected BIM usage by practice size

<table>
<thead>
<tr>
<th>Practice Size</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>We currently use BIM</td>
<td>65%</td>
<td>64%</td>
<td>63%</td>
<td>62%</td>
<td>61%</td>
</tr>
<tr>
<td>In one year’s time</td>
<td>82%</td>
<td>82%</td>
<td>82%</td>
<td>82%</td>
<td>82%</td>
</tr>
<tr>
<td>In three years’ time</td>
<td>95%</td>
<td>94%</td>
<td>94%</td>
<td>93%</td>
<td>92%</td>
</tr>
<tr>
<td>In five years’ time</td>
<td>99%</td>
<td>99%</td>
<td>99%</td>
<td>99%</td>
<td>99%</td>
</tr>
</tbody>
</table>

While confidence is lower among smaller practices, the overall proportion of respondents who are confident in their BIM knowledge and skills has not increased since last year.
Changes in the BIM support framework

As the UK prepared for the 2016 BIM mandate, there was a hubbub of noise about BIM – through the media, events and social media discussions. The PAS 1192 suite of documents was introduced, and various organizations were set up to promote and explain BIM Level 2. The Government’s BIM Task Group, initiated by Paul Morrell and Mark Bew, played a key role in raising the profile and setting the direction for BIM.

“I have not seen any direction from the government, nor any efforts at maintaining momentum, only from other organizations such as NBS, BuildingSMART and a couple of others. Online information about BIM is not in one centralised place and there is no enforcement of BIM on projects.”

There continues to be discussion and media activity about BIM, but increasingly the industry is also talking about other new technologies: immersive tech (e.g. virtual reality), the Internet of Things, artificial intelligence/machine learning and off-site construction.

In addition, some of the information sources on BIM have changed, and people are having to adjust. The Centre for Digital Built Britain (CDBB), based at the University of Cambridge, has taken on the BIM Task Group’s role of supporting delivery of the Government’s Digital Built Britain strategy.

It is a partnership between the Department of Business, Energy & Industrial Strategy and the University of Cambridge. It focuses on the digital transformation of the built environment through BIM.

Set up in 2017, the CDBB is still building awareness in the industry: 63% of respondents were aware of it, compared with 99% in 2016 who said that they were aware of the BIM Task Group. 23% would turn to the CDBB for information about BIM, compared with over half (56%) who said that they would turn to the BIM Task Group last year.

“I think the documentation for the 2016 mandate has been great and very useful, however I feel the support for implementation to companies at all levels was too little too late for the mandate date and it is only now we are seeing proper support.”

Although BIM has the potential to be a real game changer… the processes are overly complex such as the BEP, MIDP and CIC protocols. Without clients driving the need for BIM and lack of experience from 90% of construction industry… little or no training within the industry to increase skills.

Colleagues, other professionals and NBS continue to be key sources that professionals turn to for information about BIM. But there is a wide range of organizations and specialists that respondents turn to for information about BIM – all helping to build knowledge and skills across the industry.

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

- My colleagues 71%
- Other professionals I know outside my organization 64%
- BSJ (British Standards Institution) 54%
- A BIM consultant 45%
- A software vendor 44%
- The UK BIM Alliance 42%
- RIBA 40%
- BuildingSMART 38%
- BRE 34%
- A software reseller 29%
- Other professional institutes 25%
- Centre for Digital Built Britain 23%
- Other 17%

Likely 41%
Neither likely nor unlikely 21%
Not likely 19%
Unaware of source 29%

Source: National BIM Report 2019

The definitive industry update

The areas where more progress needs to be made remain the same: further integration of information from different team members and tools (federating a model that doesn’t rely on one piece of software: 34%), and use of the model throughout all stages of a project. Just under half (46%) used a model from project start to end and 29% passed it to those who will manage the asset.

As well as coordinating project information between people and project stages, good information management requires coordination of information formats. The ideal approach is to store each piece of information in one place that can be accessed by all, and that links with other relevant information. An example of this is the information held in specifications linking with the information held in models and drawings. The scope for error is reduced if models and specifications are coordinated. This, in turn, reduces the risk of design intent not being realized and the prospect of a dispute arising if models and specifications are contradictory.

The Government should still be applauded for setting the 2016 mandate however since then the loss of the BIM Task Group and the focus on Digital Built Britain has meant the industry has been able to take its foot off the accelerator rather than continue to drive forward with digital adoption.

“CDBB and UK BIM Alliance are continuing to move things forward.”

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

- Produce 3D digital models 75%
- Work collaboratively on design 78%
- Produce 2D digital drawings 74%
- Share models with design team members outside your organization 64%
- Share models inside your organization, across disciplines 57%
- Use a model from the very start to the very end of a project 56%
- Federate a model that didn’t rely on one piece of software 36%
- Pass on the model to those who are responsible for the continued management of the building or other asset 29%

Source: National BIM Report 2019

The definitive industry update

National BIM Report 2019

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

- For all Projects: 29%
- For the majority of projects: 30%
- For a minority of projects: 23%
- Never: 11%

As well as coordinating different types of document or information, true collaboration relies on the ability to work together regardless of the software vendor of choice. It’s important that one designer who chooses to work with Graphisoft ArchiCAD can collaborate with a practice using Autodesk Revit, for example. Or that parties who do not have access to modelling software can view data at the appropriate stages in a readily accessible format. Industry Foundation Classes (IFC) and Construction Operations Building Information Exchange (COBie) files are non-proprietary formats that allow data sharing, regardless of the proprietary software being used. The use of IFCs has increased: from 72% in 2018 to 77% this year. COBie continues to be used by a significant proportion of respondents: 41%. Despite the use of non-proprietary file formats, there were a number of comments from survey respondents about improving the compatibility between the different software platforms.

One use of COBie is to share non-geometric information about a building, usually in a spreadsheet format, with the client. It can then, ultimately, be shared with the FM teams who will operate the building. As we saw earlier, there are varying levels of understanding of BIM among clients, and we also saw that some project information (like the digital model) does not always reach FM professionals. Perhaps an increase in understanding and demand for BIM among clients will lead to more people exchanging COBie data.

Looking at these signs of BIM usage, we believe we’re seeing a period of consolidation – where more people understand what BIM really represents and they are continuing to adapt and embed it in their workflows. Something that will help people to do this is more standardization, but this is another area where there has been change which requires the industry to learn and adapt something new.

In this year’s survey, the indications are that people are increasingly coordinating specifications and models. There has been a 6% increase in those saying that they coordinate project specifications with drawings/models for all or the majority of projects: from 61% in 2018 to 67% this year. And only 11% now say that they never do this, compared with 15% last year. The NBS plug-ins for Revit and ArchiCAD make this coordination easier by highlighting where changes have been made in one or other of the documents, and provides some automation to update information in the corresponding document. This also reduces the scope for human error.

Do you use IFC on projects you’ve been involved with?

- Yes: 77%
- No: 23%

Don’t forget to download the definitive industry update...
Resources used to support BIM adoption

While BIM is a way of working and managing information (rather than simply the use of one tool or another), the adoption of BIM is facilitated by a range of tools and resources. Two of the tools that are key to adopting BIM are 3D modelling software and Common Data Environments (CDEs).

Autodesk continues to be the most commonly used software vendor for the production of models and drawings, with 70% using their tools. Their 3D modelling platform, Revit, is used by 46% of survey respondents, with the next most popular tool also being one that enables the production of digital models: Graphisoft’s ArchiCAD (15%). Other Autodesk software is also commonly used (with 14% using AutoCAD and 10% AutoCAD LT), but responses to this question indicate that practitioners are focusing on using modelling software that supports their adoption of BIM, rather than tools to produce 2D drawings. While many practitioners use Autodesk tools, we found that Graphisoft use is comparatively high among small organizations, rising to 24% among this group.

From our recent Construction Technology survey, we found that several CDEs are widely used, in particular: Viewpoint, Autodesk 360, Aaxis and Aconex. Viewpoint was the most popular, used by 41% of respondents. CDEs are becoming increasingly important. They enable the storage of data in one place, reducing the need for duplication, which helps to reduce error and conflicting information. Locating this data in the cloud promotes collaboration as it enables any of the project team to access it, from anywhere. This also improves transparency. All of this will hopefully reduce the likelihood of disputes, as well as making projects more efficient and profitable for all parties.

We saw earlier that three quarters of survey respondents produce 3D digital models. These models contain BIM objects: either generic or proprietary manufacturer objects. Over two thirds (66%) said that they need manufacturers to provide them with BIM objects. This year, 56% say that manufacturers do provide them (similar to last year’s 58%), although we might have expected this figure to increase. The most common way of getting BIM objects is for practitioners to create them within their organizations and then reuse them, or to create them specifically for a project. Over half (54%) do maintain them in a BIM object library in-house. Some do access manufacturer objects from a BIM library, with 45% using the NBS National BIM Library.

These figures do highlight some issues. They suggest that manufacturers generally need to provide more BIM objects to an industry quality standard. The most common means of getting BIM objects is still to create them. Creating BIM objects in-house can lead to problems. It is time-consuming, especially if it is done for each project. There can also be issues of inconsistency across a practice if more than one person is creating BIM objects and there isn’t a quality control process for managing and updating them. By using online sources of BIM objects, either direct from the manufacturer or through a central store (such as the NBS National BIM Library), users can be more confident that the information within the object is accurate and up-to-date.

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

<table>
<thead>
<tr>
<th>Tool</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autodesk</td>
<td>70%</td>
</tr>
<tr>
<td>Bentley</td>
<td>4%</td>
</tr>
<tr>
<td>Graphisoft</td>
<td>15%</td>
</tr>
<tr>
<td>Nemetscheck</td>
<td>6%</td>
</tr>
<tr>
<td>Trimble</td>
<td>1%</td>
</tr>
<tr>
<td>Other</td>
<td>4%</td>
</tr>
</tbody>
</table>

*Part of Nemetscheck group

Which Common Data Environments do you use?

<table>
<thead>
<tr>
<th>Environment</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viewpoint/Projects</td>
<td>23%</td>
</tr>
<tr>
<td>Autodesk 360 range</td>
<td>22%</td>
</tr>
<tr>
<td>Aaxis</td>
<td>18%</td>
</tr>
<tr>
<td>Aconex/Conject</td>
<td>17%</td>
</tr>
<tr>
<td>Bentley Projectwise</td>
<td>8%</td>
</tr>
<tr>
<td>Procore</td>
<td>5%</td>
</tr>
<tr>
<td>Clearbox BIMXtra</td>
<td>3%</td>
</tr>
<tr>
<td>Group BC</td>
<td>2%</td>
</tr>
<tr>
<td>Caanway LiveLink</td>
<td>1%</td>
</tr>
</tbody>
</table>

Common Data Environments chart taken from NBS Construction Technology Report 2019

Concluding thoughts – ‘Steady and constructive progress is being made’

When we first reported on BIM adoption eight years ago, 13% said that they used BIM. Now, almost 70% use it, and many more respondents plan to adopt it. This represents substantial progress, and the industry has come a long way.

However, throughout any journey, there are periods of momentum and also times when progress slows. There are challenges and there are times of consolidation. In 2019, the use of BIM has not continued to accelerate. After the catalyst of the UK Government’s BIM mandate, the noise around BIM appears to have quietened a little. But there have also been changes to the standard and the organizations set up to support BIM and digital transformation, which will help to consolidate its use in the future. It will take time for these changes to become embedded.

There are particular challenges for certain sectors – particular those working on smaller projects – and that needs to be recognized. The barriers to small organizations can also be significant. Clients, contractors and facilities management (FM) also need to understand how BIM can benefit their organizations during the construction and operational phases of a building’s life. However, this survey highlights the variation in understanding of the process and benefits that BIM can bring, and of what it means to adopt it. Perhaps the focus for BIM should now be on communicating the benefits to all parts of the industry, and building on the existing support framework to help all those organizations wishing to use BIM to realize its benefits.

‘I think it’s important that smaller practices can see the efficiencies in adopting BIM processes’.

‘The industry is changing, but the value of BIM still needs to be proven to clients’.

‘The next evolution is for BIM to be connected to Smart, dynamic data flows from occupied buildings to create a Digital Twin for optimizing performance and for guiding future design’.
How we did the research and who took part

We carried out an online survey that was live between December 2018 and the beginning of March 2019. 988 participants completed the survey, compared with 808 in 2018. All organization sizes were represented, from micro-practices of one or two people to large practices with over 500 staff. Responses came primarily from the design community, with 28% being architects, and engineers were also well represented. Over 20% were architectural technologists or BIM managers. However, other members of the project team also participated, including: contractors, project managers, cost consultants, manufacturers, facilities managers and clients. All project types were represented, with the top three being offices, education and one-off housing. Respondents came from all regions of the UK, and some were based outside the country.

In the last 12 months, which of the following project types have you been involved in?

- Offices: 46%
- Education: 38%
- One-off new house, extension, conversion or alteration: 37%
- Other private housing: 33%
- Retail: 32%
- Industrial: 32%
- Mixed use: 29%
- Sport and leisure: 24%
- Public housing including social housing: 22%
- Health: 22%
- Other public: 21%
- Culture and entertainment: 19%
- Other private: 19%
- Transport: 19%

Including yourself, approximately how many people are employed in your organization?

- 1 - 2: 12%
- 3 - 5: 7%
- 6 - 15: 15%
- 16 - 25: 10%
- 26 - 50: 11%
- 51 - 100: 10%
- 101 - 250: 8%
- 251 - 500: 6%
- 501+: 21%

Find out more at theNBS.com or book a demo on 0345 456 9594
BIM awareness and adoption

Before exploring BIM adoption, we wanted to understand whether people were aware of BIM and how this compares to the UK. Awareness of BIM in Ireland matches awareness in the UK; in both cases, it is nearly universal. All of the respondents to the Irish BIM Survey told us that they are aware of BIM; this is perhaps unsurprising, given the proximity between the two countries. As we have seen in the National BIM Survey this year, when you exclude those who are unaware of BIM, 73% have adopted BIM, but how does this compare to Ireland? In Ireland, 76% of respondents have adopted BIM, this is broadly similar to the UK’s adoption levels. However, when you look at the adoption of BIM by practice size and project type, the use of BIM does vary. Small practices (those employing 15 or fewer people) are significantly less likely to have adopted BIM. 54% are currently using it. We also see BIM being used more often on public sector projects such as health projects, and it is less likely to be used on one-off new houses, extensions, conversions, or alteration type projects. Ireland is at an earlier stage of its BIM journey, so we were keen to understand how embedded BIM is in the industry’s working practices. The picture matches the UK: 15% are using BIM on all projects, and a further 27% are using BIM on more than three quarters of their projects. The difference is in the level that those projects have reached. Fewer Irish respondents (63%) tell us that the highest level they have reached on a project is Level 2 BIM (compared to 71% in the UK).

BIM information and initiatives

Access to information and support is crucial to ensure BIM’s effective adoption, but where do Irish design professionals turn for information? Understandably, respondents’ colleagues are key sources of information, both within their organization and outside of it. For seven out of ten respondents, professional institutes or industry organizations are another important source of information. Most prominent among these are NBS, the Construction IT Alliance (Cita) and BuildingSMART: 81%, 79% and 68% respectively tell us that they are very or quite likely to turn to these organizations when looking for information about BIM.

To help the construction industry in Ireland achieve its digital transformation, the Irish Government introduced the BIM Adoption Strategy in late 2017, and also the NBC Roadmap 2018-2021, which sets out how the industry can progress this transformation between 2018 and 2021. At the time of the survey, both of these initiatives were only around a year old; in that time, three out of four respondents have become aware of them, but how successful do they think they are? 27% of respondents believe that the Irish Government’s BIM adoption Strategy has been very or quite successful, and 44% think that the NBC Roadmap 2018-2021 has been very or quite successful. This is a positive start to a roadmap and strategy despite the fact that the NBC Roadmap has not yet attracted any Government funding.

Barriers to and drivers of BIM

In both the UK and Ireland, design professionals are facing challenges to BIM adoption. In Ireland, the main barriers to BIM adoption are a lack of in-house expertise (74%), no client demand (67%) and a lack of training (67%). These challenges (in particular, the lack of expertise and related lack of training) are not unique to Ireland, but are more prevalent. The UK has, over time, started to overcome these challenges. Those in Ireland are also more likely to see the lack of an established contractual framework for working with BIM as a barrier, and a higher proportion of people questions the benefit of adopting BIM. There are clearly procedural challenges that Ireland needs to overcome for BIM to become fully embedded. But respondents, especially those who are already using BIM, recognize the advantages that BIM adoption brings: 83% of users believe that BIM increases the coordination of construction documents, and 64% that it brings cost efficiencies. Perhaps more importantly though, both current users and non-users believe that clients and (to a lesser extent) contractors will increasingly demand the use of BIM.

BIM progress in Ireland

The survey results are promising for Ireland. BIM awareness is universal, and adoption is matching that in the UK. It is clear that Ireland is at an earlier point of its BIM journey, as evidenced by fewer people achieving Level 2 BIM; however, the benefits of BIM adoption are widely recognized due to a number of successful projects that have applied Level 2 BIM processes. There is an expectation that both clients and contractors will increasingly insist on BIM, and therefore nine out of ten respondents expect to be using BIM within the next one to five years.

As we reflect on the ninth NBS National BIM survey, and the progress that the industry has made during that time, other countries around the world are also undertaking a journey of digital transformation. Many countries look at the UK construction industry and the Government’s BIM mandate with interest: they are keen to see the results of such a mandate, and are looking to learn from our experience of adopting BIM in the UK. Ireland is one of those countries undertaking their own digital transformation, and during 2019, NBS and Cita (Construction IT Alliance) undertook our first BIM survey, specifically for design professionals in Ireland. We had 116 responses to the survey from across all of the Irish regions. Those respondents were from a mixture of disciplines, including architects, architectural technologists, BIM managers, building services engineers and structural engineers, among others. Thank you to everyone who took part.

The survey included a number of the questions used in our UK survey, and has enabled us to compare key results across the UK and Ireland.

BIM Adoption 2019

<table>
<thead>
<tr>
<th>percentage</th>
<th>UK</th>
<th>Ireland</th>
</tr>
</thead>
<tbody>
<tr>
<td>yes</td>
<td>76%</td>
<td>72%</td>
</tr>
<tr>
<td>no</td>
<td>24%</td>
<td>28%</td>
</tr>
</tbody>
</table>

Percentage of respondents who agree with the following statements about adopting BIM

<table>
<thead>
<tr>
<th>percentage</th>
<th>UK user</th>
<th>Ireland user</th>
<th>UK non-user</th>
<th>Ireland non-user</th>
</tr>
</thead>
<tbody>
<tr>
<td>clients</td>
<td>61%</td>
<td>56%</td>
<td>51%</td>
<td>45%</td>
</tr>
<tr>
<td>contractors</td>
<td>61%</td>
<td>57%</td>
<td>56%</td>
<td>51%</td>
</tr>
</tbody>
</table>

Top 10 barriers to adoption in Ireland

<table>
<thead>
<tr>
<th>percentage</th>
<th>UK</th>
<th>Ireland</th>
</tr>
</thead>
<tbody>
<tr>
<td>lack of in house expertise</td>
<td>63%</td>
<td>67%</td>
</tr>
<tr>
<td>lack of client demand</td>
<td>65%</td>
<td>67%</td>
</tr>
<tr>
<td>lack of training</td>
<td>59%</td>
<td>65%</td>
</tr>
<tr>
<td>no time to get up to speed</td>
<td>48%</td>
<td>56%</td>
</tr>
<tr>
<td>no established contractual framework for working with BIM</td>
<td>36%</td>
<td>48%</td>
</tr>
<tr>
<td>cost</td>
<td>46%</td>
<td>48%</td>
</tr>
<tr>
<td>differences in expertise among collaborating parties in a project</td>
<td>28%</td>
<td>41%</td>
</tr>
<tr>
<td>lack of standardized tools and protocols</td>
<td>33%</td>
<td>41%</td>
</tr>
<tr>
<td>don’t see the benefit</td>
<td>15%</td>
<td>30%</td>
</tr>
<tr>
<td>lack of collaboration</td>
<td>33%</td>
<td>30%</td>
</tr>
</tbody>
</table>

National BIM Report 2019

The definitive industry update 2020
From BS 1192 to ISO 19650 and everything in-between

Paul Shillcock, co-author of PAS 1192-2, and author of ISO 19650-2 and the UK National Annex, talks to us about the journey to ISO 19650.

What is ISO 19650?
ISO 19650 is a series of International Standards. It defines the collaborative processes for the effective management of information throughout the delivery and operational phase of assets when building information modelling (BIM) is being used.

Based upon the UK 1192 series, the ISO 19650 series enables teams from around the world to minimize wasteful activities and increase predictability around cost and time, through a common approach to the management of information.

How ISO 19650 came about and its benefits to your organization
Following the UK Government’s BIM Level 2 initiative in 2011, a series of national standards and publicly available specifications was produced. These documents have become known as the UK 1192 series, and define BIM Level 2 in the UK.

Following their publication, international asset owners and clients (particularly in the Middle East and Australia) also recognized their benefit, and began to require the adoption of the management processes defined within the UK 1192 series on their projects.

As a result, many international organizations felt that being asked to work in accordance with UK standards to win work in those countries was unfair. As a result, the international community approached ISO and demanded that the UK 1192 series be elevated to an international level. It certainly wasn’t a case of the UK saying to the world, “We’re the best, so use our standards”. If anything, the elevation of UK 1192 series to an international series may give the UK construction industry a competitive advantage. This is because forming an international series of standards creates a level playing field for organizations and suppliers from around the world to compete, innovate and collaborate, regardless of where those companies are located.

From a global perspective, I believe this is a positive move. In fact, I strongly believe that the ISO 19650 series presents a real opportunity for the UK construction industry, and those organizations that have already aligned their business processes to the UK way of working, to capitalize on their investment and foresight.

The timing of the publication of ISO 19650 has also been important. We are increasingly seeing delivery teams consisting of organizations from different countries, with different cultures and differing ways of working, coming together on projects.

Therefore, the ISO has helped these teams to adopt a simplified and common approach to managing information.

There are also big benefits for large multinational organizations too. For many years, these organizations have struggled to accommodate the differing requirements from their customers, partners and suppliers.

The ISO 19650 series has helped these organizations to establish a unified approach across each of their regions and offices, creating immediate efficiencies and increasing the mobility of their internal resources.

We are increasingly seeing delivery teams consisting of organizations from different countries, with different cultures and differing ways of working, coming together on projects.
How to turn the UK 1192 series into an international series

I often get asked what the difference is between the UK 1192 series and the ISO 19650 series. The short answer is ‘Not a lot’. It’s 1192, but not as we know it. This is because to get an International Standard approved, you need to align with ISO’s editorial requirements and make certain compromises to gain a consensus across all the members of ISO.

With dozens of countries involved in the process, each with varying cultural and legal constraints, producing a common way of working at an international level isn’t a quick or easy task. When we started the process, I was told that it would take a minimum of five years to produce. I naively thought that this was bottles, and that I would have the second part done in a matter of months. But I was proved wrong, and the production of parts one and two of the ISO 19650 series took over four years.

Once published, the ISO 19650 series can be adopted as national standards by the member states of ISO. For the UK, this means that BS 1192 and PAS 1192-2 will be withdrawn and replaced by BS EN ISO 19650-1 and BS EN ISO 19650-2. This is because there cannot be two competing standards at a national level.

During this process, CEN (the European standards body) also confirmed that they would adopt the ISO 19650 series as European standards. This means that they will become the preferred method of procuring publicly funded projects across Europe.

Built on a solid foundation

The ISO 19650 series uses the UK 1192 series as its basis. The starting points were the collaborative production of information defined within BS 1192, and the management of information during the delivery and operational phase of assets defined within PAS 1192-2 and PAS 1192-3 respectively.

As lead authors, the first step for David Churche and I was to extract the text from the three base documents and remove all the UK-isms, such as the UK Government’s strategy, BIM Level 2 and UK-specific references, etc.

We then took the concepts and principles from all three documents to form the initial draft of ISO 19650-1. For BS 1192, this related to the concept of principles behind the collaborative production of information and the common data environment. PAS 1192-2 and PAS 1192-3, was the concepts and principles around the effective management of information. At this stage, it was important to include PAS 1192-3, so we could have the concepts and principles throughout the entire life of the asset.

Next, we focused on the activities and tasks within the information management process for the delivery phase of assets from both BS 1192 and PAS 1192-2. Combining the two documents made a lot of sense as they were very closely related. This became the initial draft of ISO 19650-2.

From that point, the international working group, convened by Anne Kemp, began the process of developing the documents. Our mission was to establish a common approach to the management of information when using BIM that could be adopted for anywhere in the world.

The next steps for ISO 19650

With ISO 19650-1 and ISO 19650-2 now published, the focus has moved on to the management of information during the operational phase of assets, and the adoption of a security-minded approach to the management of information relating to sensitive assets.

Using PAS 1192-3 and PAS 1192-5 as a baseline, the international working group is currently drafting ISO 19650-3 and ISO 19650-5. We hope that they will be published in early 2020, at which point PAS 1192-3 and PAS 1192-5 will be withdrawn.

How ISO 19650 works locally and internationally

During the process of developing ISO 19650-2, it became apparent that we were just not going to be able to get international consensus on some things, particularly when it came to standardized conventions and codification. We therefore came up with the idea of including region-specific requirements within a National Annex.

The idea is that ISO 19650-2 defines the requirements, and the National Annexes define the standards which must be used to meet the requirements in a particular region.

To give you an example: there’s a requirement within ISO 19650-2 for information to be classified. In the UK National Annex, it states that the classification system is to be Uniclass 2015, and we would expect the US National Annex to state that the classification system to be used is Uniclass. This enables the ISO 19650-2 requirement for classified information to be met, but in a way that allows flexibility for each region to use standards that are already in place.

The other big sticking point was naming conventions. ISO 19650-2 requires each information container to have a unique ID, but we’ve struggled to get everybody to adopt the convention defined within BS 1192, so getting an international consensus was close to impossible.

Whilst it overcame the barrier, it didn’t solve the problem.

The addition of a National Annex enabled the standards to be completed so that they meet the needs of different regions. But in doing so, I believe we failed as a working group to create a truly common approach. This is because organizations who work in different regions will still need to comply with local standards, which adds unnecessary overheads, such as continuously educating teams and maintaining multiple configurations in the common data environments, for example.

Helping the UK transition from BS 1192 to ISO 19650

Interestingly, when we started the development process, we expected some resistance from other countries – but what we didn’t expect was the amount of resistance we received from people in the UK. I think many people expected the ISO 19650 series to be the UK 1192 series in all but name, and they felt that it was somehow different to what they knew.

Our brief from the outset was to retain as much as we could from the original documents. Given the constraints under which we were working, I think Anne Kemp, David Churche and I did that very successfully.

I can assure everyone that all the key concepts and principles of the UK 1192 series remain. It certainly looks different, but I think it’s changed for the better, in terms of structure and clarity. I believe it’s now a much more complete and logical set of standards.

The ISO 19650 series also includes all the work that was done (but not published) to update the UK 1192 series based upon the lessons learnt in the UK over the past few years, and to align the requirements and terms within each of the documents. As such, it is recognized that there is a need to support people transitioning from the UK 1192 series, and to help them navigate their way around the new documents.

This led to the BSI commissioning David Churche, Anne Kemp and I to produce transitional guidance for those familiar with the UK 1192 series. This includes the mapping of terminology and key amendments, which will be published as PD 19650-0, alongside BS EN ISO 19650-2.

Guidance is key

I personally believe that the adoption of the UK 1192 series in the UK was hampered due to the lack of clear guidance. As a result, we ended up with a scattergun approach to guidance that was based upon different interpretations of the standards, which invariably included misinterpretations, contradictions or mistakes.

I was therefore delighted to hear that the three leading bodies in this space – the British Standards Institution (BSI), the UK BIM Alliance and the Centre for Digitally Built Britain (CDBB) – have agreed to collaborate to create a single guidance framework for the adoption and implementation of the ISO 19650 series.

This guidance framework is due to be available in the next few months, but it will be an ongoing process that will rely on everybody getting involved to share their experience with others. I would therefore encourage everybody to take part in supporting this initiative, which I’m sure will become a valuable resource for everybody, at all levels.

Further reading:
An introduction to Uniclass 2015
Working towards a unified approach to BIM in Europe
Platforms: Bridging the gap between construction and manufacturing.

To find out more about ISO 19650, you can contact:

paul.shilcock@opera.co.uk
www.opera.co.uk

The definitive industry update
As someone who started life writing and sending letters, it was hard to imagine that technology would ever come to play such a big role in our lives, not to mention the pace at which it would develop and change from day to day.

In the construction industry, technology has allowed processes to run more quickly, more accurately and far more efficiently. To not embrace technology is to risk being left behind!

However, there are many architects who still draw by hand. I sometimes show students of architecture and construction examples of hand-drawn plans, and they are truly surprised at the technical detail that has gone into those drawings. Some of them are literally works of art.

However, there are still many drawings that have not been created using the powerful technology of BIM. There are many hand-drawings that are quite simply beautiful and are the product of years of dedication, practice and talent, but in the digital age we now find ourselves in, this painstaking effort is quickly becoming a pastime.

Daylight is such a pivotal aspect of architecture and design, and many firmly believe that you cannot go wrong in life if you know about the principles of daylight/proportion/orientation and structure. Even positioning your new sofa or 50-inch television requires you to understand at least one of those principles. The Romans knew all about it, from the Pantheon in Rome to the smallest part of the building – allowing the largest amount of daylight to beam down on all those who visited it.

This brings us swiftly on to roof windows and how VELUX has embraced technology within the context of specification. We have created a variety of tools that allow not only architects but also the everyday homeowner the ability to visualize the impact that daylight can make in a space. The Daylight Visualiser tool, for example, is a simple conceptual digital tool that allows simple built-in daylight modelling and analysis.

VELUX has a dedicated department that works with BIM and other architectural digital tools. Operating in over 40 countries, we ensure that the differing needs of all are met, and that we understand the importance of sharing information, which surely is the purpose of BIM and technology in general. BIM is here to stay, and VELUX is more than ready to provide a range of information, from basic drawings to information for BIM objects or for the BIM library. Technology is swift and demanding; however, whatever is required, we make sure that it is readily accessible.

We have created a variety of tools that allow not only architects but also the everyday homeowner the ability to visualize the impact that daylight can make in a space.

As someone who started life writing and sending letters, it was hard to imagine that technology would ever come to play such a big role in our lives, not to mention the pace at which it would develop and change from day to day.
Not only does VELUX invest in digital daylight simulators, we’ve also very recently entered the smart-home market with our VELUX ACTIVE product. Technology in the construction industry isn’t just for the creation of tools, but also for new product innovation. We see the power of the Internet of Things and products that tap into our newfound need to have almost everything automated for our ease and comfort. The process of harnessing the power of digital technology and incorporating it into new products is only going to continue to grow, and it’s vital that the construction industry isn’t left behind in taking this step.

Of course, not everything is better in a digital format, and often face-to-face time with specifiers is vital, not only to impart new knowledge but to ensure that we continue to build human connections. VELUX offers both online and face-to-face CPDs on a variety of subjects, and I find that the latter sessions are great mutual learning opportunities where both parties can share wisdom and knowledge of their specialisms.

Not only does technology aid the industry with supplying a variety of specification tools and new product innovations, it also allows us to elevate our brand and product marketing so it’s accessible to a wider audience than it was before. We have interactive websites, product brochures, eShops and (our loyalty programme) VELUX Rewards, none of which would have been possible without embracing the new age of digital communication.

Digital advancement is fast-paced and ever-changing – what is new now will be old in a few months – and often it’s hard to keep up to date with it all. However, although I am no expert in the progressions of digital technology, I have come to conclude that it must be embraced in order to make headway, derive more knowledge and develop the construction industry more than ever before.

You can download Velux BIM objects here: nationalbimlibrary.com/velux-company-ltd and view their specifications in NBS Chorus.
Uniclass 2015: an international classification system

Uniclass 2015 is a definitive classification system for construction and associated industries. It provides a hierarchical suite of tables to identify and classify all ‘things’ – from a university campus or road network (at the macro level) to a floor tile or kerb unit (at the micro level).

Aimed at all phases of the ‘construction process’, Uniclass 2015 is designed to be applicable to the entire life cycle of individual buildings, complexes and infrastructure projects – from design and construction, to asset and facilities management and refurbishment, and/or eventual demolition.

As part of the UK Government’s drive to implement a more efficient way of procuring and delivering new construction projects to ensure a more manageable ‘estate’ and more controlled life cycle costs, Uniclass 2015 is one of the key tools developed to support the BIM Level 2 process.

Originally released in 1997 as ‘Uniclass’, this latest implementation of the system allows project information to be structured in accordance with a recognized standard. Uniclass 2015 is a heavily revised version of the original system which aligns more closely with modern construction industry practice, and is fully compatible with BIM - now and in the future.

But Uniclass 2015 is not just restricted to the UK. It potentially has worldwide applicability, and is attracting significant interest in other countries such as Australia and Canada, where various organizations are considering implementing Uniclass 2015 as their classification system of choice.

Uniclass 2015 categorizes high-level items (‘things’) into ‘Complexes’, ‘Entities’, ‘Spaces/locations’ and ‘Activities’. Each of these is a different class of information as set out in ISO 12006-2. The structure of the groups in these tables is shown in the diagram below.

Uniclass 2015 is a heavily revised version of the original system which aligns more closely with modern construction industry practice, and is fully compatible with BIM – now and in the future.
The relationship between these tables follows this hierarchy, with the ‘Activities’ relating to each table at an appropriate level.

In the latest update of the tables, we are publishing a ‘Form of information’ table and a ‘Roles’ table. These have been developed in consultation with the authors of the Annex to ISO 19650.

Publications from Digital Built Britain and Transport for New South Wales illustrate some of the ways that the classification tables can be implemented – see the examples to the right and over the page.

In Digital Built Britain’s publication ‘Delivery platforms for Government Assets’, examples of the use of the tables for a Healthcare example show how the hierarchy of tables enables the facility to be coded.

15 Preparatory  20 Structural  25 Wall and barrier  30 Roof, floor and paving  35 Stir and rangg  37 Text, sheet, vessel and tower  40 Signage, fittings, furnishings and equipment  45 Finishes and finishes

50 Water disposal  55 Piped supply  60 Heating, cooling and refrigeration  65 Ventilation and air conditioning  70 Electrical power and lighting  75 Communications, security, safety and protection  80 Transport  85 Process engineering  90 Soft facility management

The first diagram takes the ‘Complexes’, ‘Entities’, ‘Spaces/locations’ and ‘Activities’ tables and links them to the proposed project.

At the next level, the ‘Spaces/locations’ required for specific ‘Activities’ are linked to the ‘Elements/functions’ and ‘Systems’ tables.

Uniclass 2015 is not just restricted to the UK. It potentially has worldwide applicability, and is attracting significant interest in other countries such as Australia and Canada.

Uniclass classification - at Facility level

Uniclass classification - at Room level

Diagrams above: Reproduced with permission from Bryden Wood on behalf of the Centre for Digital Built Britain.
In Australia, we have been working with Transport for New South Wales and they have just published ‘TfNSW Application of Uniclass 2015’. They have set out their policy for adopting the classification, and have given examples of how they implement the use of the tables.

In this example, they illustrate how they expect the use of the classification to be applied throughout the stages. They have also set out how they will use the different tables for specific purposes.

We are constantly working to develop and improve the tables, and welcome feedback from all users of the classification.

Find out more about Uniclass 2015 and watch our webinars on classification, ISO 19650 and NBS Chorus:


Above: Classification relationships

<table>
<thead>
<tr>
<th>Systems (Ss)</th>
<th>Elements/ Functions (EF)</th>
<th>Products (Pn)</th>
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<tbody>
<tr>
<td>Systems (Ss)</td>
<td>Elements/ Functions (EF)</td>
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In the third illustration, the ‘Systems’ identified are ready to be linked to the components from the ‘Products’ table.

Diagram above: Reproduced with permission from Bryden Wood on behalf of the Centre for Digital Built Britain.

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Construction verification – a revolution in accuracy

The increasing frequency for as-built point cloud scans as part of the delivery of a project is a sign that clients are no longer willing to rely on design models unchecked and issued as record information.

However, the approach that contractors are taking is a reactive one which fails to make use or take the full benefit of the technology.

What is construction verification?

Verification during construction is not new. The positions of building components have always been checked by traditional surveying methods, whether that is using a total station or a tape measure. Software verification is different because it seeks to verify every component’s position using computing power, instead of the small subset that traditional methods can check. Like many technologies, this step change has been enabled by the wide adoption of other technologies. In this case, the increasingly common use of BIM and the low cost of mass data collection using laser scanning provide the reference model from the designer or fabricator and a point cloud snapshot of the current state of the build as scan data.

The core of the verification process involves comparing the registered laser scans against a model; the result provides visual and statistical feedback on the comparison. There are currently two types of verification process. These can be characterized as geometry-only or contextual verification.

The first compares geometry alone to the point cloud and reports on the statistics of the match. This can be applied to anything, including complex geometry. Reporting for these verifications is more difficult because the data is in a raw form and needs to be interpreted. The second usually makes a comparison of specific elements of a project: for example, the flatness of a floor. Reporting is more straightforward in contextual verifications, and is sometimes measured directly against a standard for that construction type that governs expectations for flatness or tolerance, for example.

So where are people going wrong?

The software itself is straightforward to use; it performs the verification once data has been collected then combined with the model. The problems arise because of poor briefing by clients and unplanned or reactive site work. Nearly every project I have been involved with has suffered from both of these issues.

We are at another point in the timeline of the industry where a group of factors have come together to disrupt and change the way that we work. Clients’ expectations for accurate as-built information, verification software and powerful computing, and a new generation of scanning total station hardware, have made the site-to-software pipeline rapid and largely automated.
Getting the specification right

At one end of the spectrum, briefs may be as ambiguous as simply specifying ‘verification’ and referring to the purpose of the activity as ensuring that the as-built model is accurate. At the other end, unrealistic expectations that either exceed construction tolerances or the capability of hardware or economic survey activities are common.

Consider this: performing a verification of 5 mm from a point cloud on data that is reliable to +/-15 mm is meaningless. While local scans can have better accuracy than this, positional verifications of less than 25 mm at whole-building scale deliver questionable results. For service installations, which often deviate from their design locations substantially, it is sensible to consider greater distances of 100 mm.

As with many new functions in digital construction, the question of what is specified should relate to the purpose of the exercise. Most client specifications expect verification to establish where design models need to be updated so that the as-built models are correct. In practice, the response to this can seem to come at the end of a project, which runs the risk of some components being covered up. Large elements such as wall layouts, steelwork, ducts, sheet metal cable trays and larger pipe runs are verifiable with software, but cage-type cable trays, flex ducts which differ from the model and smaller pipework are either not verifiable or impractical at any scale because of the density of the point cloud. In these situations, falling back to visual verification from the point cloud data is necessary as an alternative approach requires this. There are also a lot of materials (particularly in service installations) which laser scanning doesn’t capture well. Black glossy painted drainage and silvered ductwork are examples.

Late reactive verifications have another common problem: positioning the laser scan data to fit the model. Near to the end of a project, the control network that the building was set out from has often been removed or concealed. In this situation, the verification can only be performed by a ‘best fit’ approach to positioning the scan data. This is less reliable because it is a relative positioning, instead of an absolute positioning to the original setting out coordinate system. It is also more labour-intensive and therefore more costly.

Each of these issues can be overcome by planning the verification, and as with every workflow, the right time to plan is at the beginning of the project. Reactive verification at the end of a project is simply a cost item, whereas well planned verification can repurpose this requirement to the benefit of the smooth running of the construction programme.

Why verify during construction?

There are several additional advantages to performing a verification during construction. It can be used to establish if components are built out of position and will subsequently cause problems with follow-on packages. Early recognition of this sort of conflict allows time to decide whether a package needs to be re-positioned, or whether the follow-on package can accommodate the new position. It also gives a snapshot of what has been built at that point, and identifies components that are in the model but not yet built, which provides valuable support to the valuation process.

We are at another point in the timeline of the industry where a group of factors have come together to disrupt and change the way that we work. Clients’ expectations for accurate as-built information, verification software and powerful computing, and a new generation of scanning total station hardware, have made the site-to-software pipeline rapid and largely automated. A planned verification during construction is both more economic and more valuable, it provides trackable benefits to the project, and delivers the foundation for accurate as-built models.

*Below: Verification of wall positions against the as-built laser scan showing status of wall by colour. Green is found and in tolerance, yellow is found but out of tolerance and red is not found.*

*Below: This image shows an area of the as-built model where the services layout differ substantially from the design model. This will need to be updated.*

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