NBS

DIGITAL CONSTRUCTION REPORT 2021

Incorporating the BIM report

Thank you to all 906 people who took the time to complete the survey and to the organisations shown below who supported us it by promoting it to their members and networks. We are extremely grateful.

Foreword

It might be argued that there is always change, that we are constantly evolving what we do and how we do it. That may be so, but there is a strong feeling that the built environment is currently going through a period of radical change, while dealing with critical challenges. In fact, this is more than just a feeling: in previous surveys, you have told us that the digitisation of the construction sector will transform the way that we work, and is already doing so. News headlines highlight on a daily basis the urgent requirement to address climate change and building safety; and recently, COVID has presented a new challenge: forcing us to rethink how we live and work.

Over the past decade, we have canvassed the views of the industry - with a particular focus on building information modelling (BIM) - and have seen how this has led to significant change in the ways that many people work, and the benefits that it has brought. This change is still happening: BIM is becoming more embedded for some, while for others, the jury is still out. The BIM adoption journey continues, but we felt that it was time to widen the scope of our survey to gain a broader understanding of digital transformation in 2021. So, earlier this year, we relaunched the BIM survey as the 'Digital Construction Survey', and 906 built environment professionals responded. We thank all those who took the time to share their views, and to all those individuals and organisations that supported the survey by promoting it on our behalf.

This report sets out the main findings from the survey, along with some of our thoughts about what this means for the industry. Alongside this downloadable report, we have published the findings as web pages, in a dedicated area on our website. You may want to revisit these pages as, from time to time, we anticipate adding further analysis and insight on the subject of digital construction. You can visit these pages here: thenbs.com/dcr2021

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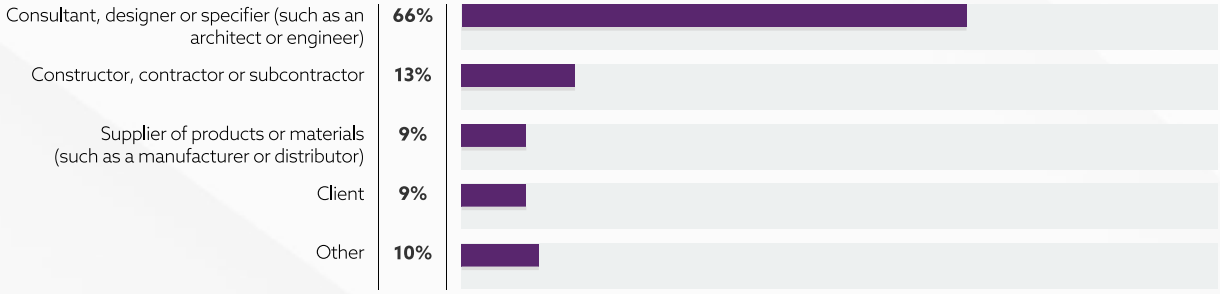
Introduction

We conducted the survey between April and August this year. 906 construction professionals took part. They represented the main project roles: client, constructor, consultant and supplier. Historically, the BIM survey was been completed primarily by consultants, such as architects and engineers. This remains the largest group, but a third of respondents to this year's survey were from other members of the project team. This allows us to compare views on digital construction by role.

Which of the following best describes your usual role on a project?



Our first BIM surveys comprised mainly UK respondents, but the survey is becoming increasingly international. In 2019 and 2020, those from outside the UK amounted to about a quarter of the BIM survey sample; in 2021, for this survey, that figure has grown to 36%. People based in Asia, mainland Europe, Africa, the Americas and Oceania have engaged with this research and shared their views. This gives us some insight into digital construction in different parts of the world.

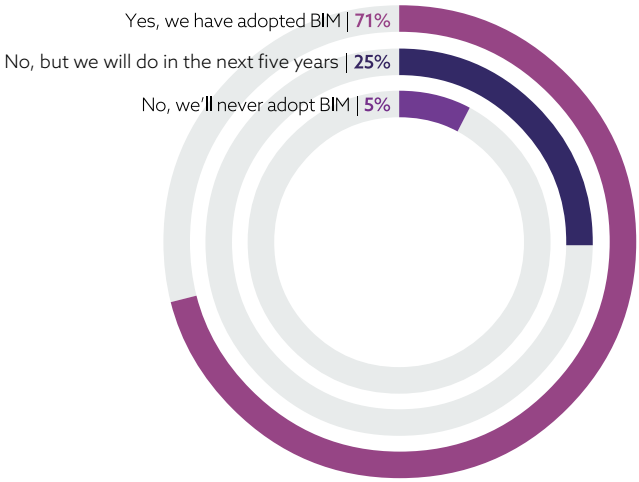
While this survey is different from the BIM survey that we carried out each year of the last decade, it still continues to ask some of the same questions that were in those previous surveys. So, we continue to track trends in BIM adoption, and the types of activity and tasks that people engage in as part of that way of working. We have also included questions that we posed in our Construction Technology survey of 2018, allowing us to track the use of technologies such as: cloud computing, immersive tech, off-site construction and digital twins.

However, this survey does introduce some new questions that we haven't asked before, covering: the impact of the Coronavirus pandemic; the effect digital construction is having on 'building better'; and views on the 'golden thread' of information.

BIM

A solid majority of construction professionals, 71%, say that they have adopted BIM. Another quarter have yet to do so, but plan to within the next five years. Only 5% have no intention of using BIM.

Within your organisation, have you adopted Building Information Modelling (BIM)?



'BIM is a wonderful tool in the right hands but not a substitute for design experience and appropriate, well-founded aesthetic judgement'.

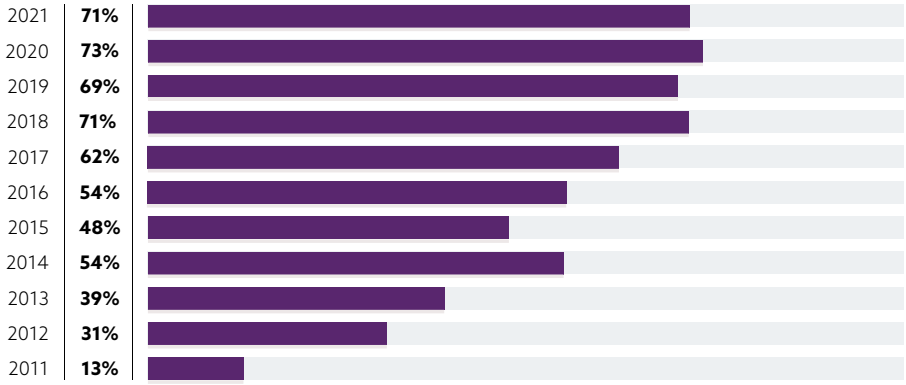
- Building services engineer, local authority, UK

'BIM has played, and is playing, a major role in our construction industry, and the intentions of the Latham and Egan reports are now bearing fruit'.

- Project manager, large building services engineers, UK

This proportion of people adopting BIM as a way of working has remained fairly steady for the past four years. It followed a period of quite rapid growth from very low levels of use, when we first started tracking BIM adoption in 2011. This slowing of adoption is typical of many new innovations or ways of working. We have also seen that most of those who have not yet adopted BIM do intend to. However, plans and reality often differ – with it often taking longer than intended to take the necessary steps. And we have seen in previous surveys that there are challenges: the need to invest in new software tools, to upskill staff, and to do so while working collaboratively with other members of the project team.

BIM adoption over time



Adoption among consultants is highest, at 75%, and higher again among architectural practices: 81%. Small organisations (with 15 staff or less) are less likely to have adopted BIM (55%), and 10% of these say that they never will.

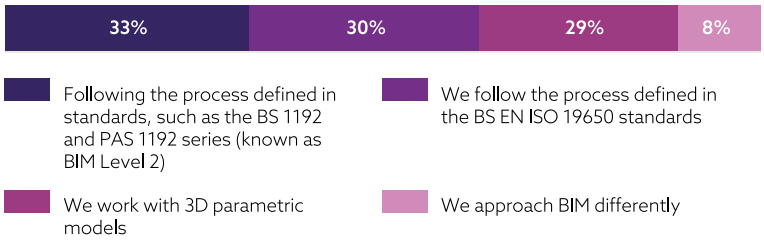
'Clients, contractors and manufacturers all appear to be on different points on the BIM journey. Until we are asked consistently for BIM data we will not fully adopt as default'.

- Architect, medium practice, UK

But what does it mean to adopt BIM?

For just under a third of respondents, it means working with 3D models. BIM is about more than this though – it is about better information management, following an agreed process or standard. Almost two thirds recognise this: 33% follow the BS / PAS 1192 series (BIM Level 2) and, almost a third, the new international series: ISO 19650. Those based in the UK are more likely to follow a series of standards: 41% follow the BS / PAS 1192 series and 33% follow the ISO 19650 series. This is, perhaps, unsurprising given that BS / PAS 1192 are British Standards and that the UK has been so heavily involved in developing the ISO 19650 suite.

Thinking about your organisation's overall approach to BIM, which of the following would you say best describes what you do?



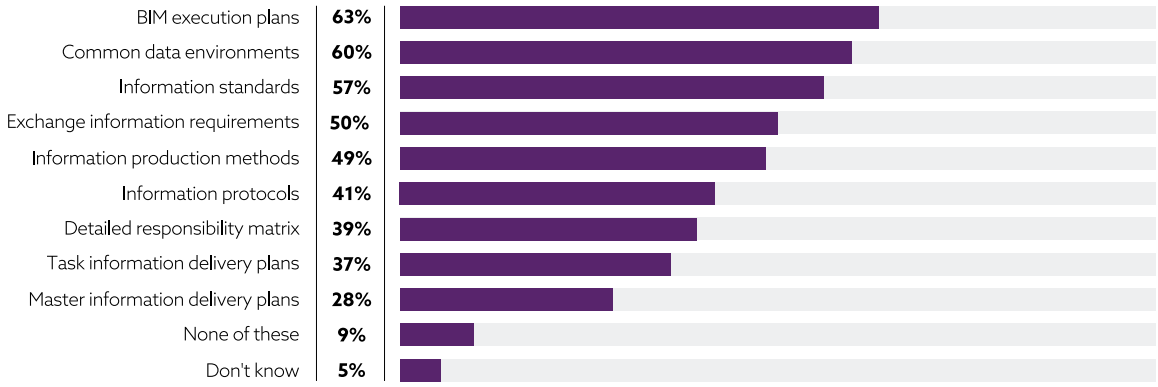
There are a number of tasks that should be carried out, or documents produced, to align with the BIM process as set out in the ISO 19650 series of standards. The number of respondents involved in these is almost unchanged when compared with 2020:

- Almost two thirds of professionals have been involved with BIM execution plans.
- 60% have collaborated using common data environments.
- At least half have experience with information standards and exchange information requirements.
- Only 39% mention a detailed responsibility matrix.

We might have expected these numbers to have risen. The fact that they have not changed much may be reflective of the general slowing in the adoption of BIM seen by the high-level figure above.

It is worth highlighting, though, that those based in the UK are more likely to have some involvement with most of these things: in particular, information production methods and procedures (51%), information protocols (47%), exchange information requirements (56%), detailed responsibility matrix (43%) and task information delivery plans (42%)

Thinking in more detail about BIM, in the last 12 months, which of the following things have you been involved with, in some way, on BIM projects you have worked on?

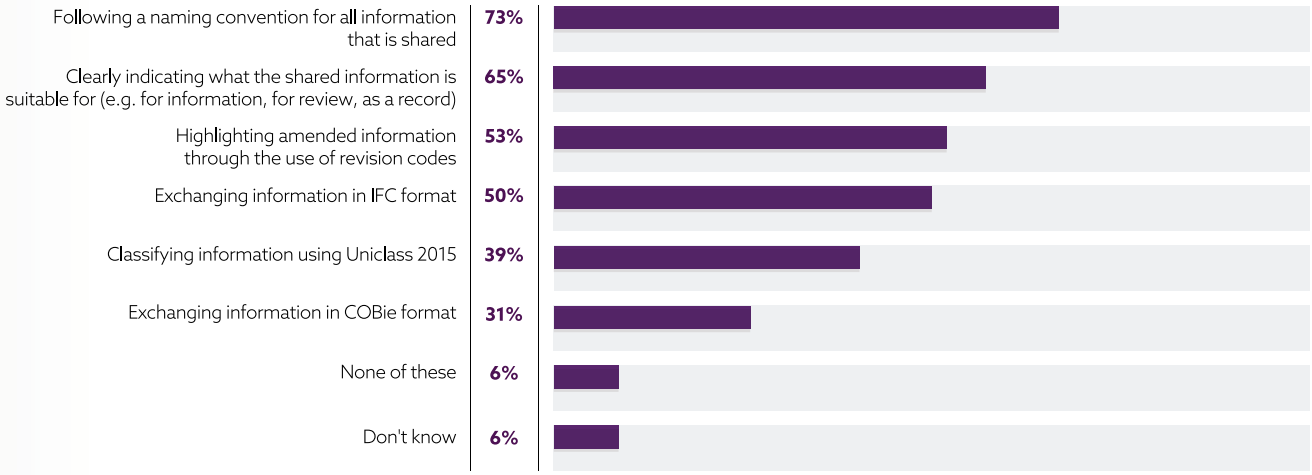


Almost three quarters say that their organisation follows a naming convention for all information that is shared. And nearly two thirds clearly indicate what the shared information is for. Again, these are higher among UK professionals.

Only half exchange information in IFC format [1] and 31% in COBie format [2], but this rises to 57% and 39% among those in the UK. 39% classify information using Uniclass 2015; 50% in the UK.

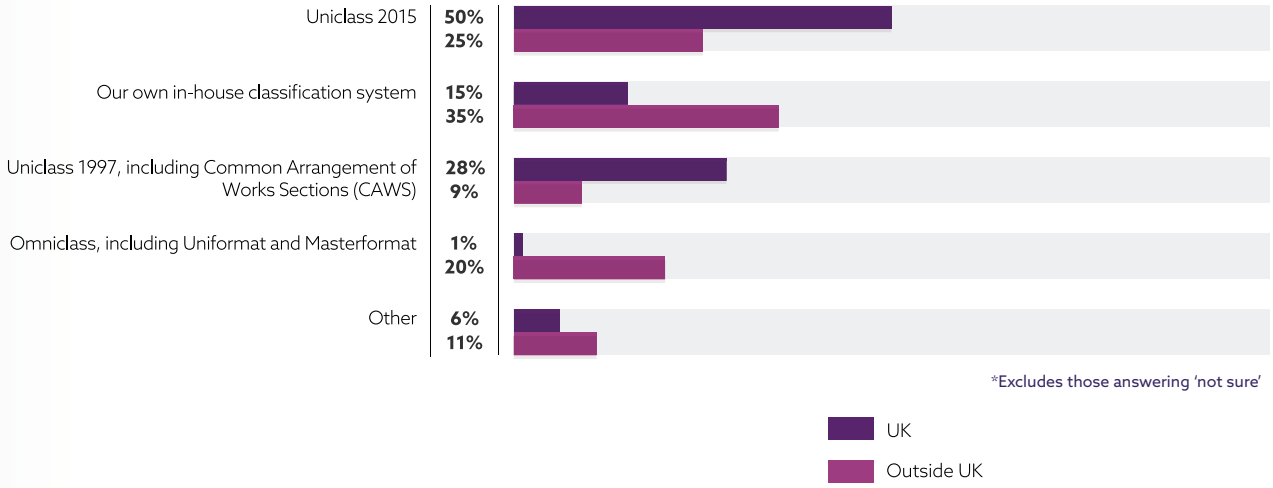
UK respondents are much more likely to highlight amended information through the use of revision codes (65%).

And, thinking about the projects where you have adopted BIM, which of the following approaches has your organisation adopted with respect to sharing information?



Uniclass 2015 is now the most commonly used classification among survey respondents: double the proportion using the Common Arrangement of Work Sections (CAWS). However, almost as many don't know what classification is most commonly used on their projects. Use of Uniclass 2015 and Common Arrangement are both higher in the UK, at 50% and 28%, respectively.

What type of classification is most commonly used on the projects that you work on?

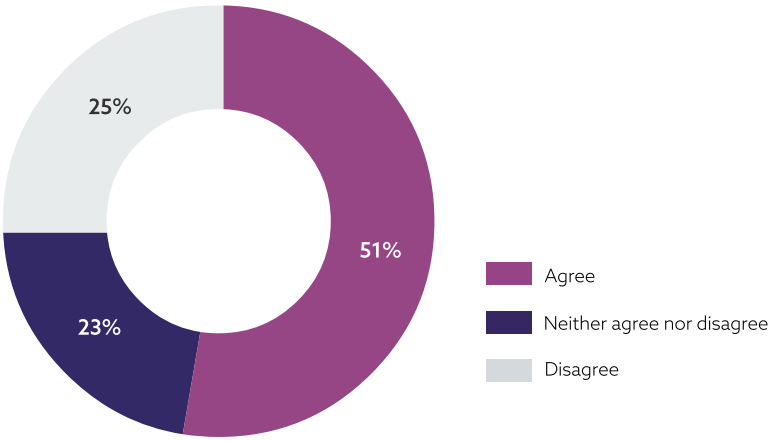


[1] Industry Foundation Classes

[2] Construction Operations Building information exchange

Just over half say that BIM is the norm for project information in their country. This is higher than in 2020 and 2019.

To what extent do you agree or disagree that BIM is the norm for project information in the country where you are based?

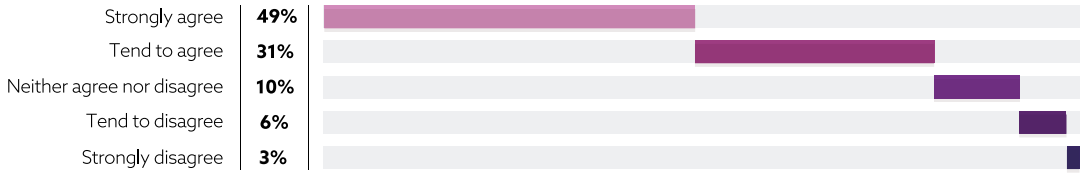


'Albeit the design side of the industry is gradually moving to more involved and defined BIM strategies, the translation to construction especially on site seems a long way off. Significant investment will be required by small subcontract businesses to accept and actively work from the digital twin etc. All the work creating the golden thread for Building Safety and maintenance and operation is useless without the installer working to the design intent in all cases'.

- Architectural technologist, small practice, UK

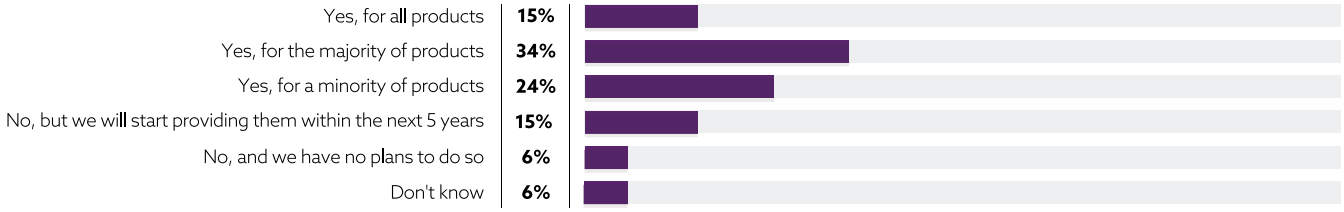
The vast majority of information users argee that they need manufacturers to provide them with BIM/digital objects: almost half strongly agree.

To what extent would you agree or disagree with the following statement: We need manufacturers to provide us with BIM / digital objects?
(Clients, contractors and consultants only)



Suppliers are responding, with 78% providing BIM or digital objects: almost half for the majority or all of their products.

Do you currently provide information about the materials, products or systems that you supply, in the form of BIM or digital objects?
(Suppliers only)



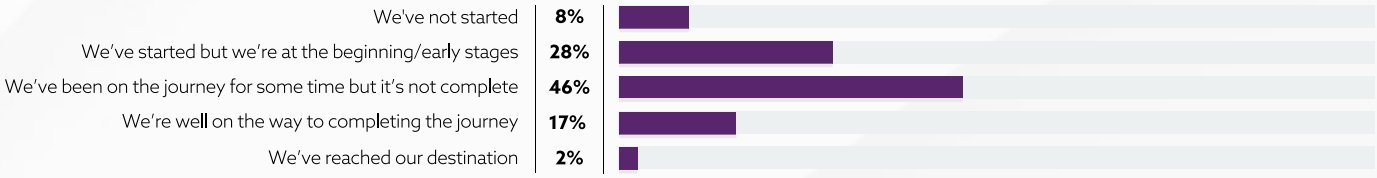
'Manufacturers' input in terms of product information as well as creating and supplying BIM objects is very crucial to digital transformation'.

Architectural Technician, medium-sized practice, UK technologist

Digital transformation and the adoption of new technologies

Most respondents have started on a digital transformation journey. Almost two thirds (64%) say that they've been on this journey for some time, that they are well on the way to completing it, or that they've reached their destination. This compares with 54% in 2018. More people in the UK have reached these stages of the journey (70%) – and more consultants (70%) compared with clients, constructors and suppliers.

If digital transformation was a journey, where is your organisation on that journey?

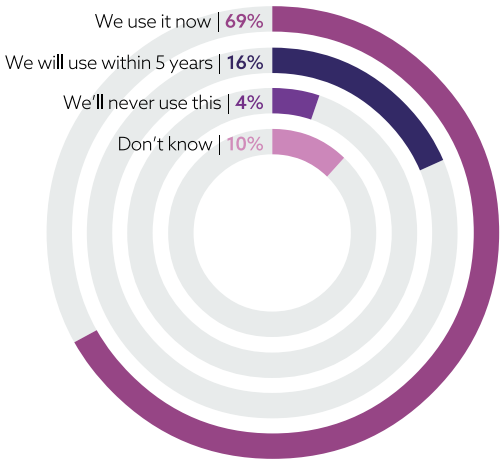


We asked built environment professionals whether they had used particular technologies. The high number stating 'not sure' or 'don't know' suggests that definitions of these terms are still not universally recognised, or that their use is not prevalent across their organisations.

In people's personal and working lives, there has been a huge growth in cloud computing in recent years. Over two thirds (69%) are using cloud computing, and the vast majority expect to do so within five years.

- In the UK, 76% are using cloud computing.
- Large organisations are more likely to use cloud computing (76%).
- This level of use is higher than in previous surveys.

Within your organisation, do you use cloud computing?



Microsoft Office 365 and common data environments, like Autodesk's Construction Cloud (previously BIM 360), Aconex, Asite and Viewpoint, are the most common examples of cloud computing: they are used by hundreds of respondents. Other applications include file transfer software and NBS Chorus.

'We are using Autodesk BIM Collaborate Pro to collaborate with external consultants, and to work on large projects from multiple geographic locations in our company. We also use NBS Chorus, BIMcollab, MS Office 365 and use clients' cloud-based document management systems such as SharePoint'.

- Architect/ BIM manager, medium-sized architectural practice, UK

'NBS Chorus for specification writing. There is a CDE on almost every project'.

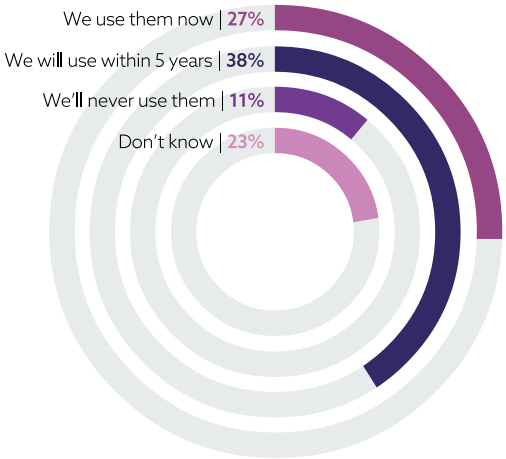
- BIM manager, large-sized architectural practice, Ireland

'Digital storage, digital transfer (365, Dropbox, Deltech, Asite, 4Projects)'.

- Design manager, large-sized subcontractor, UK

The use of immersive tech (such as virtual, augmented or mixed reality) hasn't really changed much over the past few years. The number using it has hovered around 30%, and was actually above this figure in 2018 and 2020, suggesting that the usage has dropped slightly this year. The figure is higher in large organisations (33%).

Within your organisation, do you use immersive technologies, like virtual, augmented or mixed reality?



The most common use is for client walkthroughs and presentations.

'VR, for doing "project walkthroughs" with clients and stakeholders. AR, to view systems or elements within a space, building without installation through BIM'.

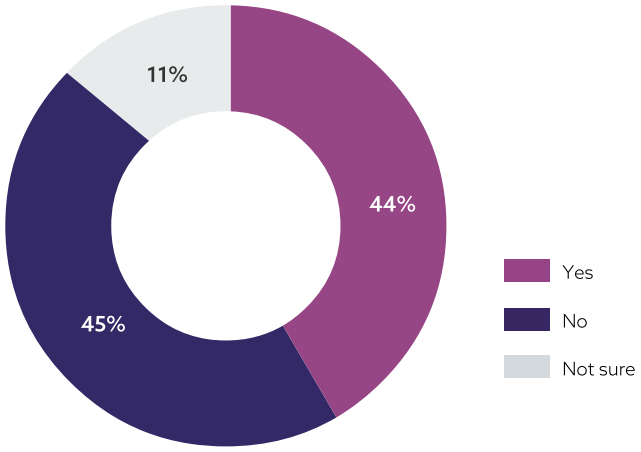
- Specification specialist, large-sized architectural practice, UK

'We use VR and AR for marketing, but also have use cases for on-site service and technical support. We also use VR to train robots at one of our manufacturing facilities'.

- BIM manager, large-sized manufacturer, UK

44% of survey respondents have been part of a project that involved an element of off-site construction. This is indicative of an increase from previous years.

In the past 12 months, have you been part of a project that involved an element of off-site construction or manufacture?



Constructors were most likely to have experienced off-site construction on their projects, as were medium-to-large organisations.

Respondents based in the UK were also more likely to have been involved in projects with elements constructed off-site: perhaps reflective of the UK Government's drive to promote it. The Coronavirus pandemic may also have been a factor, with fewer people able to work on site during lockdowns.

A wide range of elements was mentioned: particularly modular pods such as bathrooms, wall or floor panels, and MEP components.

'In my projects, bathroom pods and utility cupboards, sometimes plant rooms. We have used precast facade elements and masonry, and precast concrete elements for a car park construction. We have also built a hotel using off-site modular construction (similar to containers) which is then clad on site'.

- Architect, large-sized practice, UK

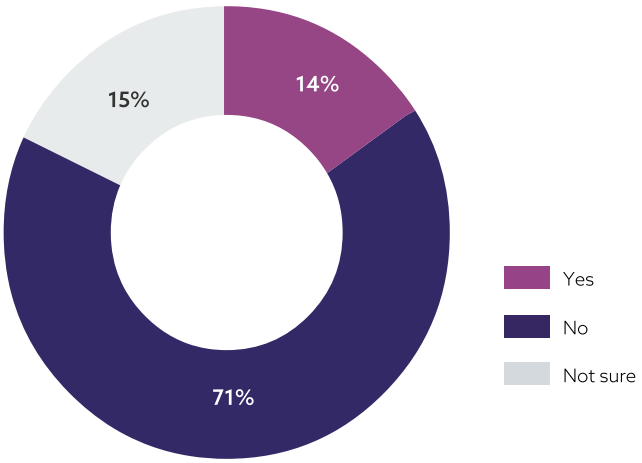
'We work with some companies which specialise in prefabricated housing, manufactured in factories and then brought on site and assembled. Sometimes it is the structure that is prefabricated, and sometimes whole walls or ceiling modules can be complete with piping, cables, etc. already installed'.

- Building services engineer, small-sized practice, UK

It's still quite early days for the use of digital twins, with 14% having been part of a project that used them. Use is highest among clients (18%) – perhaps unsurprisingly, as they can use the digital twins to understand how an asset is performing in use and apply that learning to ongoing maintenance or new buildings. Use was also higher outside the UK.

Looking at the explanations from survey respondents about how digital twins are used, it is evident that people have different interpretations of what constitutes a digital twin. We have seen this with BIM. This is an area where we expect to see further focus in the next few years.

In the past 12 months, have you been part of a project(s) that used a digital twin?



'Central design modelled for environmental optimisation, as well as in-use energy modelling to demonstrate capacity for net zero carbon in use, and for detailed operational modelling for movements and H&S'.

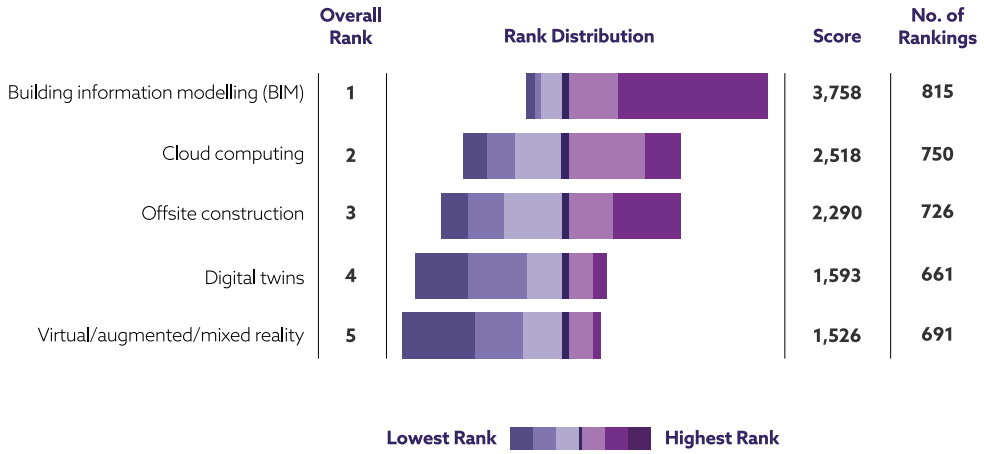
- Director, small-sized architectural practice, UK

'In-house development team creating digital twin using models & data from the construction handover combining with real time data from built asset'.

- BIM manager, large-sized developer, UK

When comparing the uptake of these different technologies and ways of working, we can see that cloud computing is most used, followed by BIM.

So, in the next five years, what will have the greatest potential to transform the built environment for the better? BIM is at the top, with off-site construction expected to be almost as significant as cloud computing. And despite their limited use just now, digital twins are expected to be at least as important as immersive technologies.

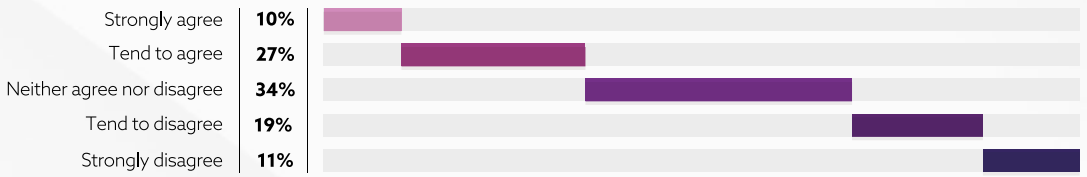


[3] Note the slight difference in some percentages, due to removing those who answered 'not sure' or 'don't know'.

Industry changes and challenges

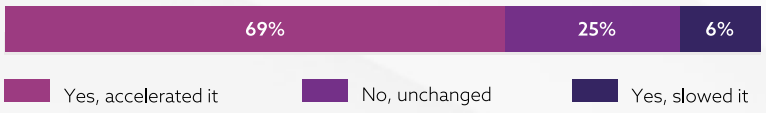
Just over a third (37%) believe that their country's government is leading the industry in terms of digital construction; however, only a few less disagree (30%), and a similar number are on the fence. Those in the UK are a little more positive, with only 24% disagreeing. Although subsamples are small, there are indications that respondents in some countries (like Northern Europe and Far-east Asia) are more positive still about their governments.

To what extent do you agree or disagree with the following statement: The Government in my country is leading the industry in terms of digital construction?



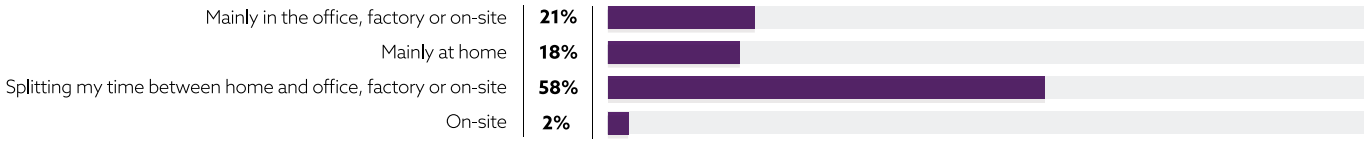
With the huge reliance on video conferencing over the past year, it is perhaps unsurprising that over two thirds (69%) of respondents said that the Coronavirus pandemic has accelerated their adoption of digital technologies. The large number of people using cloud-based software is likely to be due, in part, to the need to access files from locations outside of their normal place of work. Those working in small organisations were more likely to say that their adoption of digital tech was unchanged (38%).

Has the Coronavirus pandemic affected your adoption of digital technologies and ways of working?



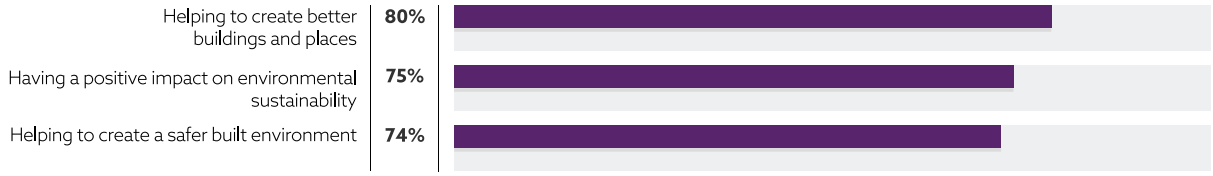
There are predictions about where we will be working from now on, with many saying that there will not be a return to how things were pre-pandemic. Organisations are already redeveloping their workspaces with this in mind. For the next five years, at least, it does look like many (58%) built environment professionals will split their time between home and their usual place of work: particularly in the UK (62%).

Thinking about where you work, during the next five years, where do you expect to be based?



There is strong agreement that the adoption of digital technologies and ways of working are: helping to create better buildings and places (80%); having a positive impact on environmental sustainability (75%); and helping to create a safer built environment (74%). Over a third strongly agree in all cases: 42% with respect to helping to create better buildings and places.

To what extent do you agree or disagree that the adoption of digital technologies and ways of working in the built environment are...?

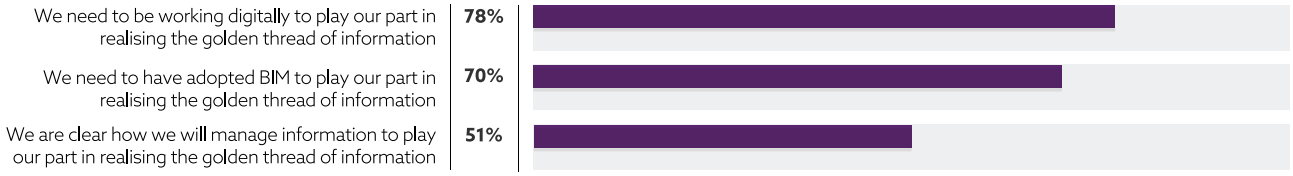


There are differences, with smaller organisations being less likely to agree that digital tech will help to enable these positive outcomes. And respondents in the UK are slightly less positive when their views are compared with those of the rest of the world as a whole.

The younger respondents are, the more likely they are to believe that digital technologies are having a positive effect on the built environment.

Most respondents believe that they will need to be working digitally to help realise the 'Golden Thread', and many agree that they need to adopt BIM. The larger the organisation, the more likely they are to agree with these sentiments. Just over half are clear on how they will manage information in order to play their part.

How strongly do you agree or disagree with the following statements relating to the golden thread of building information...?



Conclusions

There are always differing views about new technologies, and change of any kind. And it would be wise to evaluate the likely value of making a change before doing so, especially if that change or technology requires significant investment. The reason for the type of change that we're concerned with here – the use of digital technologies and better information management – is to help us create a better built environment: a safer one that is more environmentally sustainable. The results of this survey show that the majority of built environment professionals do agree that digital technologies are helping to achieve these things. With specific reference to safety, there is also strong agreement that professionals need to work digitally, and adopt BIM, in order to play their part in realising the golden thread of information. And when referring to BIM, around two thirds now think of this as being about better information management, rather than simply creating a 3D model. These findings indicate that the direction of travel is right, and that digital ways of working and better information management are helping us to create a better built environment.

To continue the travel metaphor, the majority (over 90%) recognise that they are on some kind of digital transformation journey. They may not normally use this terminology – and there may be debates about exactly what constitutes BIM, cloud computing and off-site construction – but these findings confirm that the industry is embracing digital, and that the majority believe that it is having a positive effect.

The potential for advances in technology to address fundamental challenges (in particular, the use of cloud computing and telecommunications infrastructure to enable remote working and collaboration) has been clearly demonstrated during the Coronavirus pandemic. It is therefore unsurprising that the use of cloud computing has increased, with a majority now using it. In addition, the ability to design and manufacture whole elements (or even whole buildings) in a factory setting and deliver them to site has reduced the number of people that need to be on site at one time, as well as bringing other advantages (such as efficiency and waste reduction). Some changes enforced by the pandemic may be here to stay, with well over half of professionals expecting to split their time between home and the office, factory or site.

If the industry broadly agrees with the principle that digital construction is good, the challenges are in the detail. What do people need to do, and how? As yet, there isn't clarity among all professionals in terms of what they need to do in order to play their part in creating the golden thread of information. And there continues to be a barrier (perceived or otherwise) to smaller organisations, who are less likely to see BIM (and, to some extent, digital construction generally) as positive or relevant to them. There are others who do see it as relevant but are grappling with the cost of investment in software and training. Because of these issues, BIM adoption has not permeated every part of the industry – although 81% of architectural practices say that they have adopted it.

Standards and guidance (from the likes of the UK BIM Alliance, BSI and the Centre for Digital Built Britain) are helping to address some of the challenges. This survey shows significant numbers of professionals (especially in the UK) carrying out the activities that align with these. The findings suggest that Uniclass 2015, recommended in the ISO 19650 series, is now the most-used classification system in the UK. Information users are asking for digital objects, and many suppliers are providing them. More people think that BIM is 'the norm' than in previous surveys and, looking ahead, they continue to see it as having the greatest potential to transform the built environment for the better.

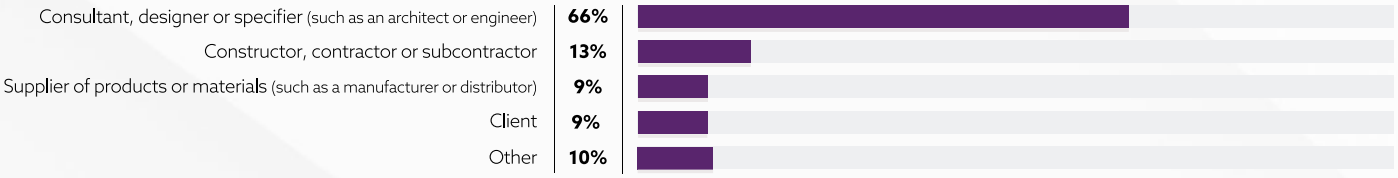
All of this does suggest that BIM and digital construction will continue to be adopted and further embedded, and that more organisations will make progress on their digital transformation journeys. If we believe that the principles of BIM and digital construction will benefit projects and organisations of all types and sizes, there still appears to be a challenge in taking that message to all parts of the industry so that those organisations see it as a positive change. And there is a need to better support smaller organisations who have decided that they want to make that change.

Respondent profile

We are pleased to report that 906 built environment professionals completed the survey. This sample size is in line with sample sizes that we consistently achieved for the BIM survey.

As with previous surveys, in terms of project role, consultants make up the largest group: 591 respondents, accounting for 66% of the sample. However, 119 (13%) are constructors or contractors, 82 (9%) suppliers, and 79 (9%) clients. Many of those classifying themselves as 'other' are in education: students, academics, lecturers or researchers. The remainder describe themselves terms of specific professional disciplines or job titles that include designers, BIM specialists, software vendors and marketing professionals.

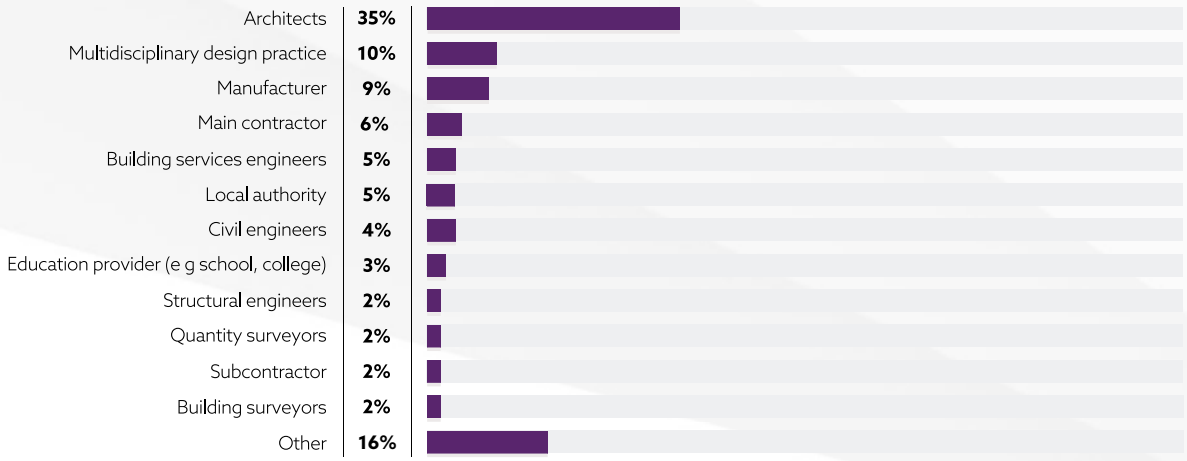
Which of the following best describes your usual role on a project?



A wide range of organisation types were represented, with architectural practices being the most common (35%), followed by: multidisciplinary design practices (10%), manufacturers (9%) and main contractors (6%). There were also engineering firms and surveyors, as well as local authorities and education providers.

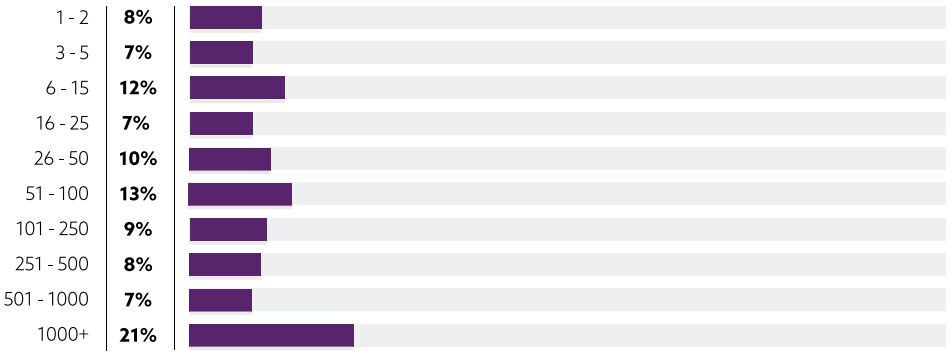
Other organisations included developers, facilities management companies, landscape architects, housing associations, distributors, health providers, builders' merchants, central government, project managers and software vendors.

What type of organisation do you work for?



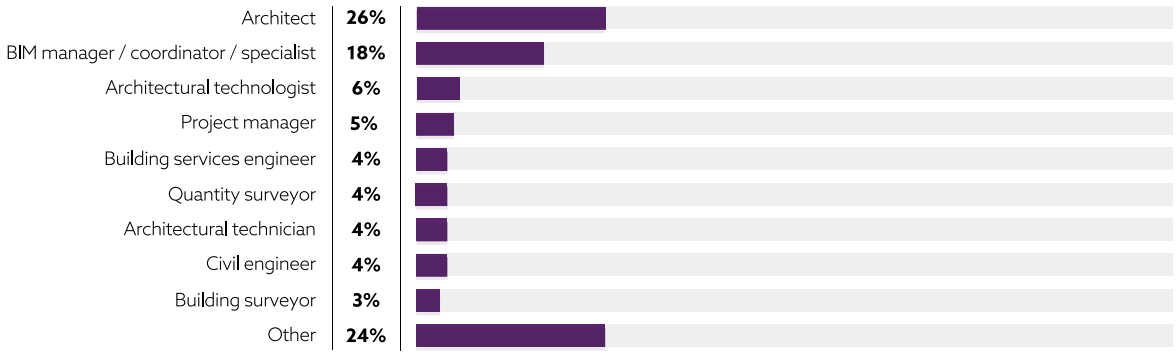
All organisation sizes were represented, with the most common being those with more than 1000 employees (21%).

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



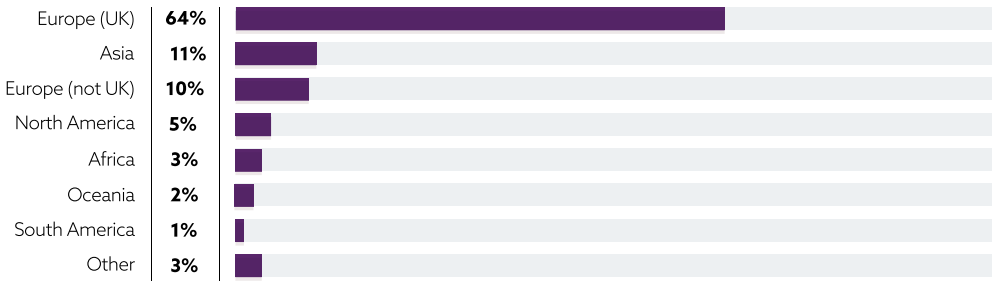
Those describing themselves as architects were the most common professional discipline (26%), followed by BIM specialists (18%). Several other design disciplines were represented – some of these will be working at supplier, contractor or client organisations, as well as for consultants. 5% were project managers. Others included technical product specialists, design managers, structural engineers, marketing specialists, landscape architects, asset managers, facilities managers, interior designers, sales professionals and those in education.

Which of the following best describes your current role / professional discipline?



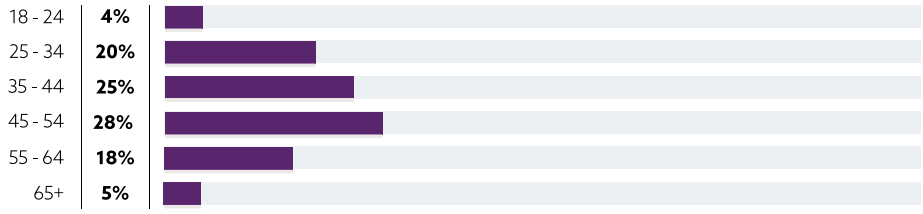
Almost two thirds (64%), or 574 respondents, were based in the UK, meaning that 36% were based in other countries. This is an increase in the proportion of international respondents and the highest that we have seen. 95 respondents (11%) were in Asia, 92 (10%) in Europe (outside the UK), and 48 (5%) in North America. Africa, Oceania and South America were also represented. Those selecting 'other' gave more general locations such as continents or multiple locations, or worked in one place but were based in another. There were also a small number based in locations not classified by the United Nations (the source of our list) as countries, such as Hong Kong, the Isle of Man and Taiwan.

Where are you personally based? (Grouped into continents)



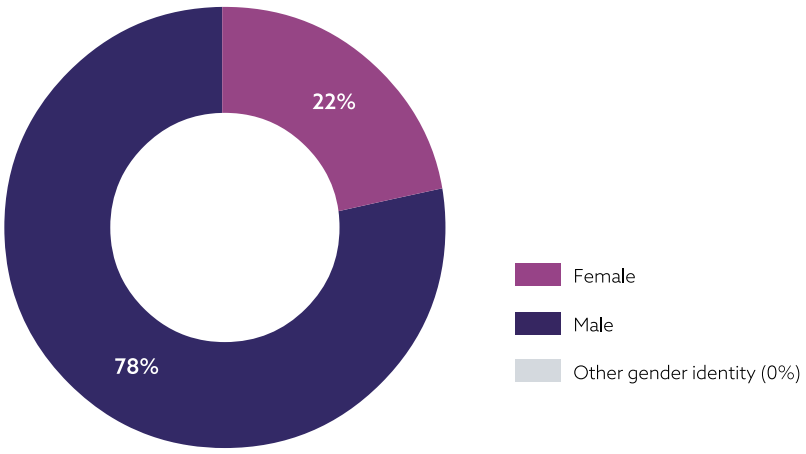
There were professionals of all (adult) age ranges, with a concentration between ages 35 and 54.

Please select your age band



In reflection of built environment professions, there were far more male respondents (659, or 78%) than those identifying themselves as another gender. 187 (22%) respondents described themselves as female.

How would you describe your gender?



Methodology

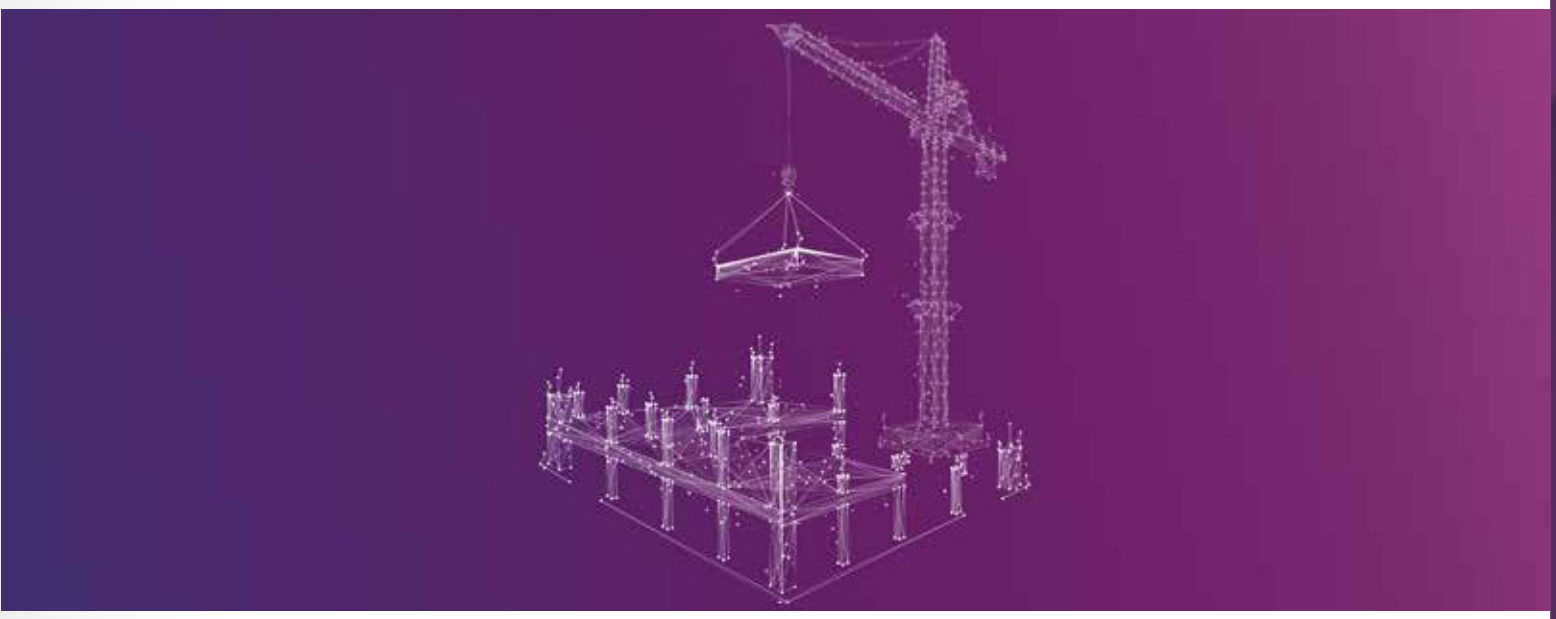
We carried out an online survey between April and August 2021. We publicised the survey by:

- Sending email invitations to professionals working in the built environment in the UK and beyond.
- Posting on social media.
- Sharing in the media.
- Working with over a dozen membership organisations and professional bodies, who very kindly promoted the survey to their networks. We thank these organisations for their support, which we were grateful to receive.

For every completed response that we received, we donated £1 to CRASH. The charity brings together construction expertise, products and donations to:

- Transform hostels, day centres, night shelters and move-on accommodation for homeless people in the UK.
- Create caring environments for children and adults who need end-of-life care in a hospice.

With so many people taking part in the survey, we are pleased to have been able to donate nearly £1000 to CRASH.



Analysis notes:

As part of our analysis, we have compared this year's findings with those from previous years and analysed results by respondent characteristics, such as: organisation size and type; project role; location; and age. Where this analysis revealed findings of note, we have included them in the report.

- The overall sample size is n=906. This, or a similar number, is the base size for most of the charts. For some, where the question was only asked to a subset of the sample, the base size will be lower. For example, some questions were asked only to those who had adopted BIM or were dependent on their project role, e.g. consultant as opposed to supplier.
- In some cases, percentages may not add up to 100%. This is due to rounding to whole numbers or where respondents could provide more than one answer.

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