

BIM Vs CAD

The evolution of architectural
technology



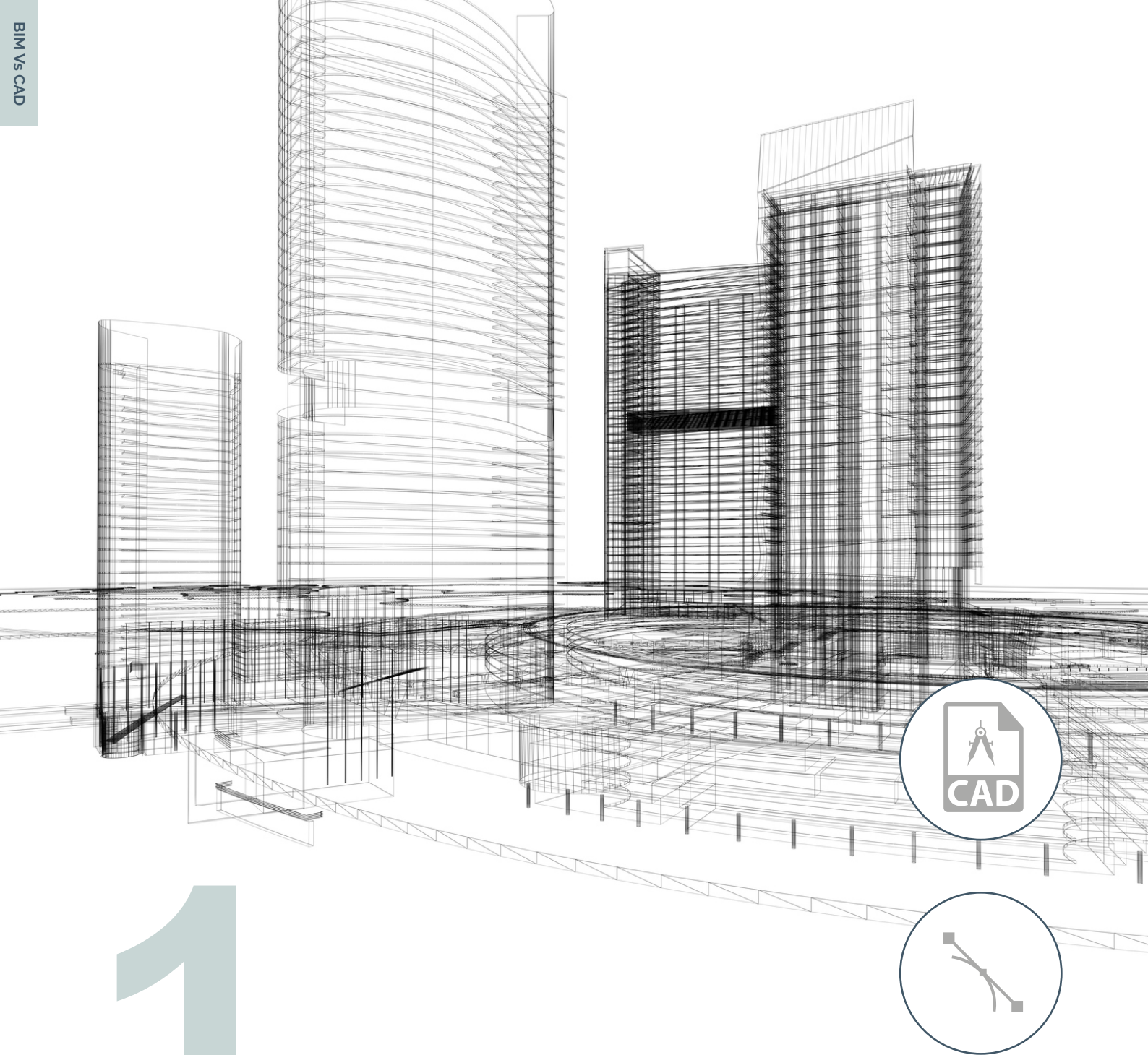
INTRODUCTION

The architectural industry is moving at a rapid pace as new technologies are continually evolving to provide a more precise, detailed view of building designs.

With Building Information Modelling (BIM) and Computer Aided Design (CAD) both offering a unique perspective into the look and feel of a building, which should you be using?

With the rise of Building Information Modelling (BIM), many questions have arisen regarding its adequacy and benefits within the industry, and whether it could even be superior to Computer Aided Design (CAD).

With architects leaving their drafting tables to gather dust, this whitepaper analyses real life examples of BIM and CAD, the history of these innovative techniques and industry opinions to provide the answers to your BIM vs CAD questions.



1

WHAT IS A CAD FILE?

A CAD file is the image file format used within Computer Aided Design. When an architect, engineer or other professional wants to create a precision drawing or technical illustration of a building/structure, they use a Computer Aided Design program to build either a **two-dimensional drawing or three-dimensional model**.

Within a chosen CAD program, it is possible to create, modify, analyse or optimise a design to meet specific requirements. Suppliers can create CAD files which enables architects to download and include the file within their designs.



2

HISTORY OF CAD

The foundations of Computer Aided Design can be traced back to 350 B.C. when Greek mathematician Euclid of Alexandria first proposed the idea of Euclidian Geometry, which most CAD software systems are based upon today.

Over 2,000 years later, MIT started to push the development of real time computing during World War II. By 1957, American Computer Scientist Patrick Hanratty, known as 'The Father of CAD', developed 'Program for Numerical Tooling Operations' (PRONTO), the first Computer Numerical Control system which later evolved into computer-aided manufacturing (CAM).

Throughout the 1960's there were numerous technological advancements which pushed the development of CAD.

In 1962, American Computer Scientists Ivan Sutherland, known as 'The Father of Computer Graphics', created 'Sketchpad', which featured a graphical user interface whereby the user could manipulate objects displayed on a cathode ray tube, which is regarded as the ancestor of CAD software.

350BC

1957

1962

2 HISTORY OF CAD



The creation of the first digitizer and production of interactive graphics manufacturing systems spurred on a number of companies to commercialise their CAD programs, such as SDRC, Applicon and M&S Computing.

Up until the 1970's, CAD was only operating in 2D, but when Computer Scientist Ken Versprille invented Non-Uniform Rational Basis Spline (NURBS), the basis for the 3D curve and surface modelling was born.

By the 1980's, UNIX workstations had emerged, allowing for commercial CAD systems such as CATIA to appear in the aerospace and automotive industries. In 1981, the first IBM PC created an opportunity for the large-scale adoption of CAD and the following year Autodesk was formed, who then released AutoCAD in 1983, which has grown to be the most distinguished CAD software in the industry.

AutoCAD was set to take over the market, but it was mainly used for 2D designs, so the introduction of Pro/ENGINEER and its 3D capabilities revolutionised the industry. It was only possible to run this program on UNIX workstations, however by the 1990's PCs were powerful enough to run 3D CAD programs.

In the modern day, CAD has seen huge improvements in functionality, modelling, management and analysis of the products and buildings it helps to create. While the features and user interface are constantly adapting, the basic principles of CAD remain faithful to the original versions and continue to improve the design process for architects across the world.

1970's

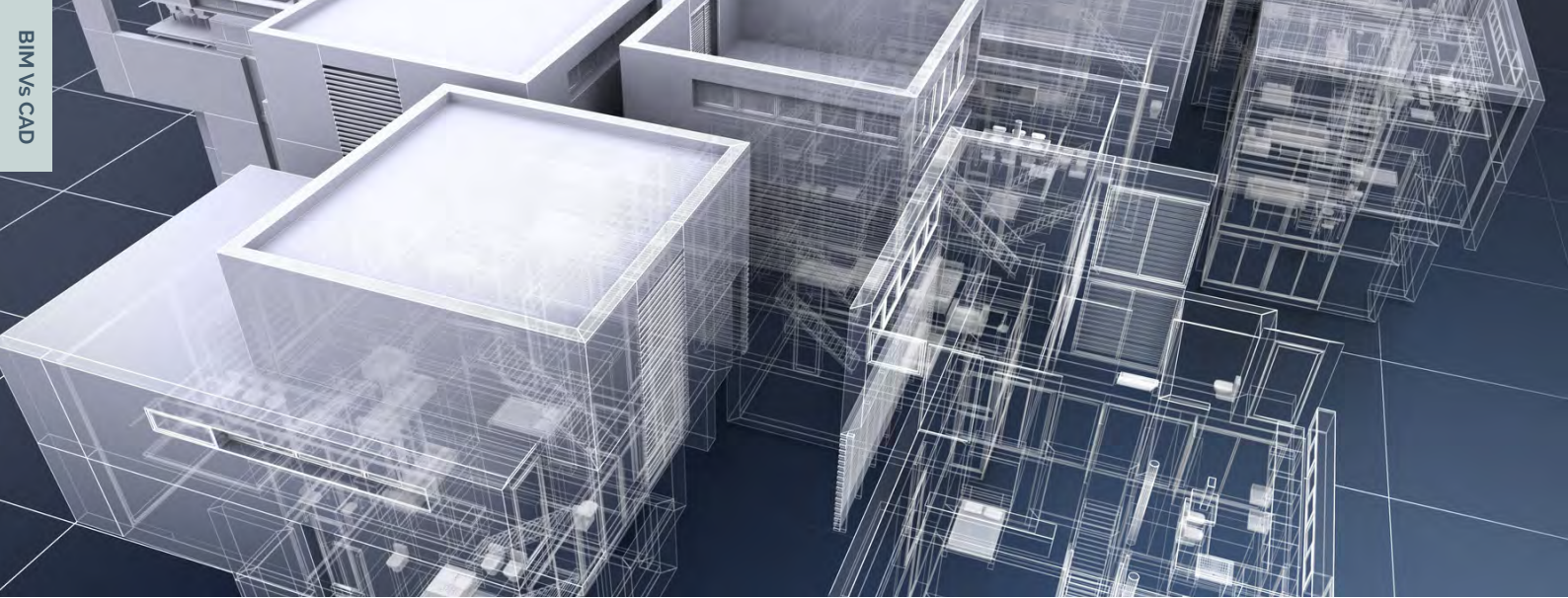
1980's

NOW

3

WHAT IS A BIM FILE?

BIM (Building Information Modelling) files come in various formats. Most are proprietary files, meaning they can only be opened within a certain software. The BIM file is similar to the CAD file as it contains the design visualisation of a certain element, however BIM files contain much more information about the functionality of that element. BIM software extends beyond the initial planning and design phase of the project and continues throughout the building life cycle. Processes such as cost management, construction management, project management and facility operation are all supported through the use of BIM.



4 HISTORY OF BIM

The history of Building Information Modelling and Computer Aided Design are closely linked; it is very difficult to ignore CAD when looking at how BIM began. Following the developments of CAD, in 1975 American Professor of Design and Computer Science, Charles Eastman, published a paper which described a prototype called Building Description System (BDS) which discussed the idea of parametric design and high quality computable 3D representations which utilised a single integrated database for visual and quantitative analysis. When BDS became a reality, BIM was born, and Charles Eastman is widely regarded as 'The Father of BIM'.

Whilst Eastman claimed that BDS solved the problem of decaying hardcopy drawings and the inability to have one object projected multiple times on varying scales, the program was not popular as it was limited to individual libraries and design choices, therefore in 1977 Eastman introduced Graphical Language for Interactive Design (GLIDE), which was, in essence, an advanced version of BDS, which aimed to monitor the accuracy of data, estimate costs and evaluate structural design. At this point, GLIDE was only useful in the design stage of a given project.

1975

1977

4 HISTORY OF BIM



In 1989, a program called Building Product Model (BPM) was developed which had a stronger focus on product information, including design and construction processes from planning of the project right through to completion. However, with BPM being so product focused, it lacked the necessary integration of design and construction management.

By 1995, Generic Building Modelling (GBM) had been introduced which succeeded in integrating information from current and future designs, making it useful throughout the product life cycle. This was the final iteration towards what we now know as BIM.

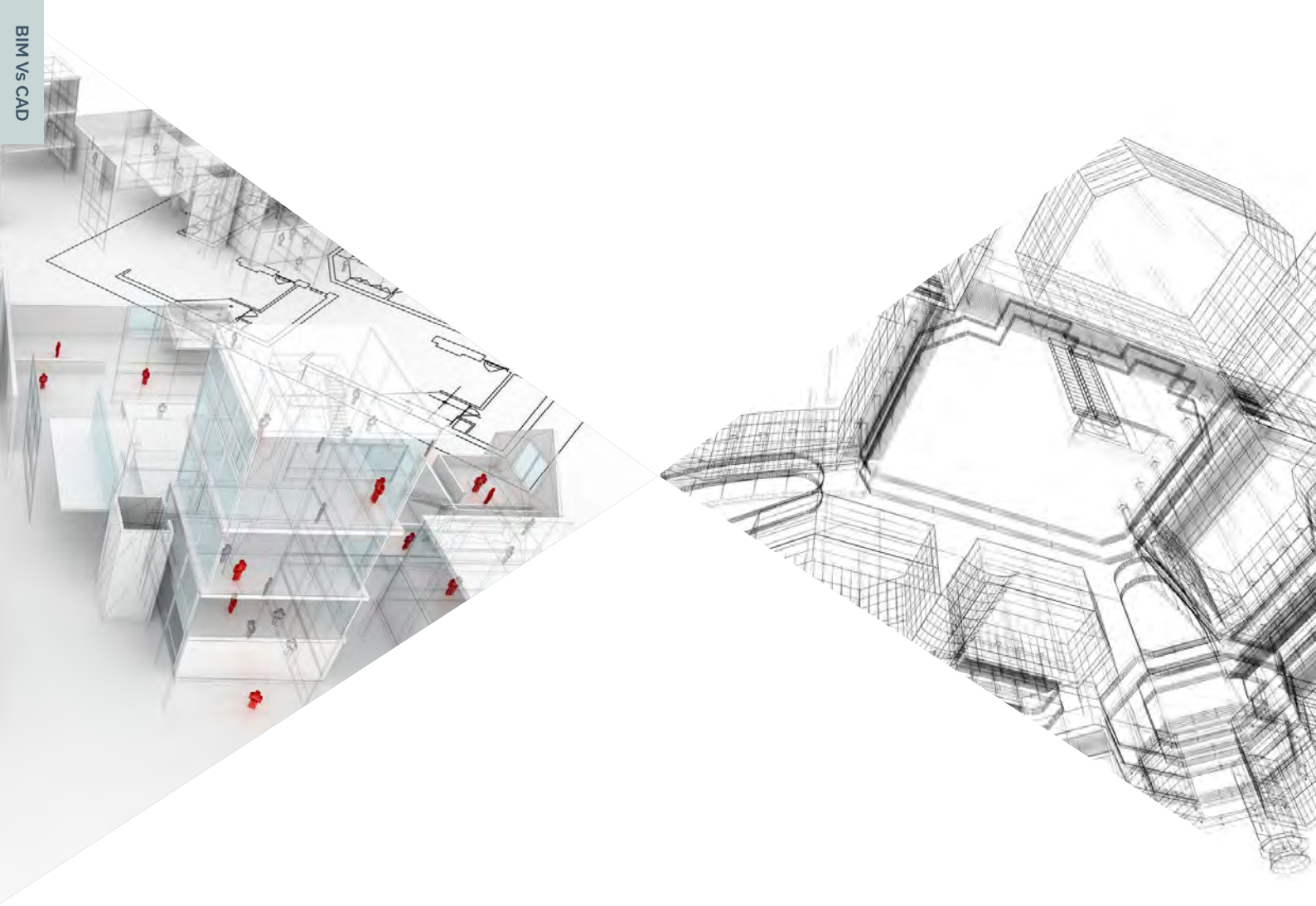
In the early 2000's, BIM - as we know it - was born. This new set of practices utilised modern technological developments to improve the flow of information, reduce errors and increase efficiency through collaborative construction and continues to be developed today.



1989

1995

2000's
- NOW



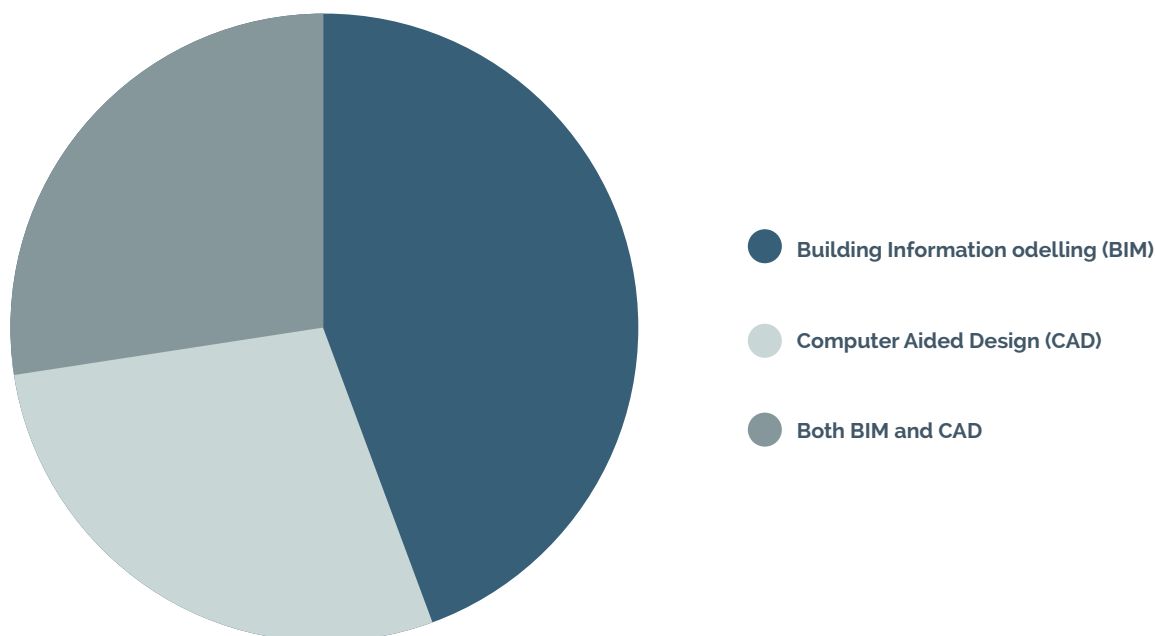
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BIM vs CAD ASKING THE EXPERTS

In the battle of BIM VS CAD, it's important to remember that these are two different practices, however they can be used either individually or in unison with each other to achieve the desired result. With this in mind, we conducted a survey to discover how the architectural industry perceives BIM and CAD, whether there is a preference for one more than the other and what the best BIM or CAD software available is. Respondents included Architects, Designers, Surveyors and Managing Directors within the architectural industry, making for some very interesting results.

5 BIM Vs CAD

Which of the following do you use when creating building designs?



Interestingly, while BIM was the dominant process used by architects at **42%**, we found that **26%** of architects are still using CAD and BIM in unison with each other, as well as **32%** exclusively using CAD. Despite CAD still being used so heavily within the industry, **47%** of respondents stated that they believe CAD will die out in the next 10 to 20 years and be completely replaced by BIM in the construction industry.

However, opinions were divided, with **37%** believing CAD and BIM will become increasingly similar to each other in the future. One survey respondent predicted that,

"CAD will die out in the future for larger projects. CAD will remain useful for producing quick details and simple 2D information".

So, perhaps CAD will not die out completely, but evolve into something which is almost indistinguishable from BIM.

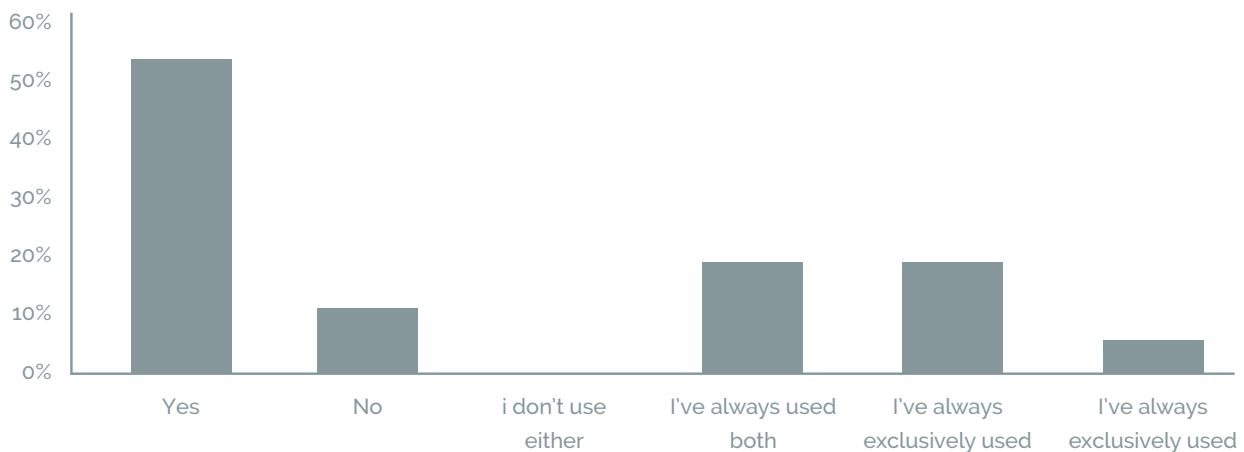
Another respondent shared these opinions, as they commented,

"CAD is better for smaller/quicker/simpler projects and in existing buildings whereas BIM is better for the larger or more complicated new ones. So, until BIM is streamlined it won't be used for small projects or projects involving existing buildings not already on a BIM Model format".

In order for BIM to become the dominant process within the architectural/construction industry, it needs to be able to cater to the smaller projects that CAD is currently so useful for.

5 BIM Vs CAD

Have you previously used CAD and made the switch to using BIM?



Supporting the prediction that CAD will be replaced by BIM, we saw that 53% of survey respondents had previously used CAD and made the switch over to using BIM. Part of this is due to pressure within the industry; as one respondent explained:

"BIM is being pushed by large contractors. It is not the cure all for the construction industry".

Another told us that all projects within their company were created using BIM as a company standard, which again highlights a strongly encouraged adoption of BIM practices and software.

Despite so many architects making the switch from CAD to BIM, there has been some criticism of BIM. One respondent said,

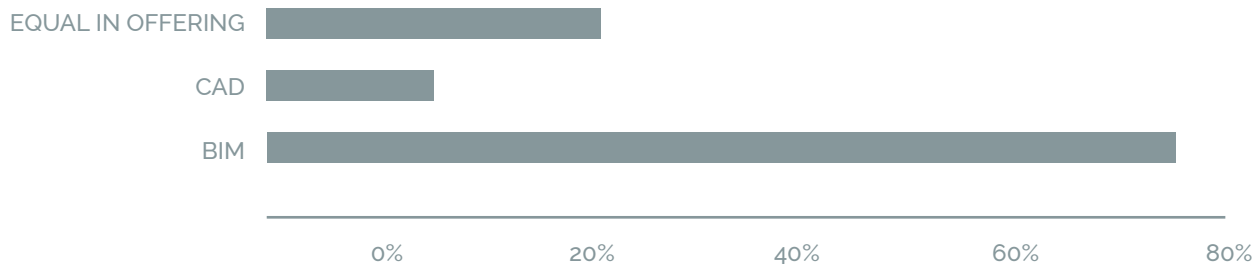
"BIM requires too much information from other professions too early on in the design process, which few clients appreciate." "BIM requires too much knowledge, which stifles pure artistic creativity, it is also better suited to series production than one off design as 'every building is a prototype'".

Another respondent agreed:

"A lot of BIM information is required for initial stages which can be more simply produced in simple design packages".

It seems that the initial setup of BIM is far more complicated than CAD, which is why CAD is viewed as the preferred method for smaller projects.

Which do you think offers the best visualisation of a building design?



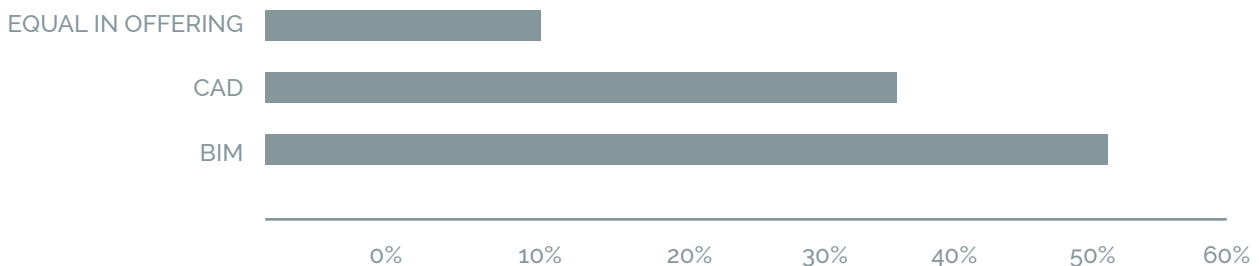
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In terms of industry opinions on BIM and CAD, we have seen a greater response in favour of BIM. When asked which practice offers the best visualisation of a building design, **74%** of respondents said they thought BIM provided the best visualisation, with only **5%** choosing CAD and **21%** saying they were equal in their offering.



5 BIM Vs CAD

Which do you think offers the fastest delivery?



When asked which practice offers the fastest delivery, **53%** said BIM, **37%** said CAD and **10%** thought they were equal in their offering. However, the speed of delivery depends entirely on what you are trying to produce, as one respondent states that "CAD is faster up front, BIM is poor for quick design".

Again, the reoccurring theme of CAD being better for smaller, quicker projects is being reinforced here, and while a small majority may feel that BIM offers a faster delivery, this is only relevant in terms of much larger scale projects as it provides a more centralised place for all the necessary information, allowing for a quicker, smoother process overall.

Some of our survey respondents felt that BIM and CAD each had a unique offering, taking the focus off having solely one practice and determining which is most appropriate for specific project. Ben Bennett of Luminous said,

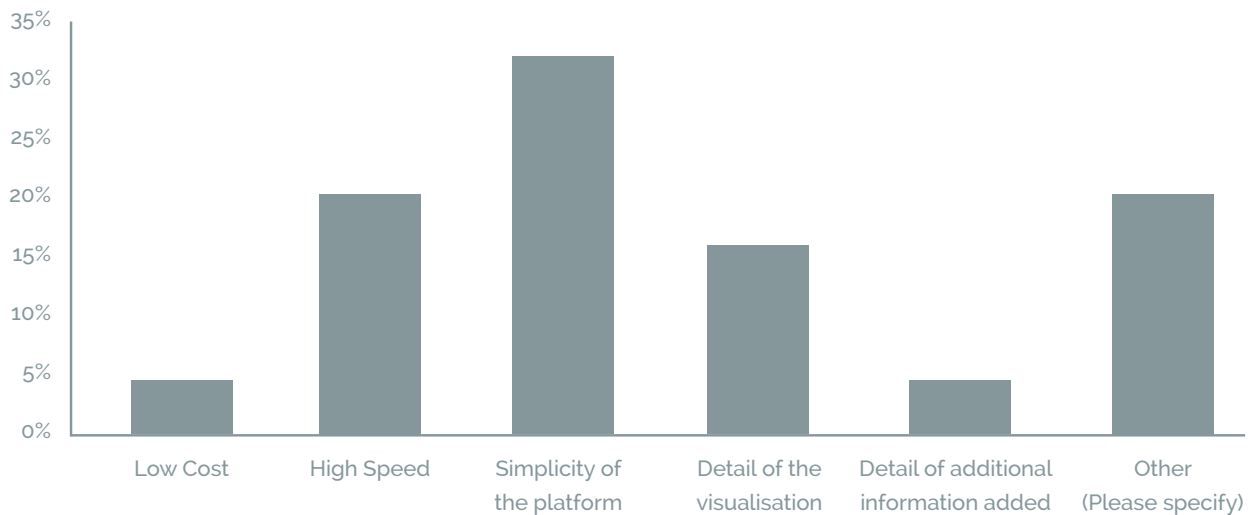
"They are two completely different concepts, it's like comparing photoshop and hand drawing. By switching to BIM and a database-driven design approach, the cost savings and efficiencies are huge. For small practices working on very basic projects then CAD is probably still a cheaper alternative, however as soon as you start introducing complexity and multiple users BIM is a much better solution".

Another respondent said,

"BIM and CAD products are simply tools and means of making marks in paper / screens so that things can be constructed. Neither is perfect and each are more suitable for some applications. Ideally the focus should be on how to get both to integrate more seamlessly, rather than championing one over the other".

5 BIM Vs CAD

Which of the following factors is most important to you when deciding which architectural design computer technology to use?



Another interesting insight into professional motivations for choosing to use a particular software is that 'Simplicity of the Platform' was the most popular factor architects considered during the decision-making process. **32%** of survey respondents stated that 'Simplicity of the Platform' was most important to them, with 'High Speed' being the second most popular with **21%** and 'Detail of the Visualisation' being third most popular with **16%**. Many respondents, however, stressed that a combination of all these elements was important, as one respondent said they looked for the

"Best value, which is a combination of more than one of the above elements".

Another respondent stated that a

"Mixture of speed, cost and ability to use on various sizes of projects" was important to them. They continued to say that for "Small projects CAD works better, (for) large projects BIM is best".

This reoccurring theme really highlights the idea that CAD is for use in smaller projects and BIM is best utilised in larger projects. A third respondent told us that "Ease of integration/coordination of other designers' work" was the most important factor.

Our survey also aimed to discover which BIM and which CAD software was considered to be the best available, and for both BIM and CAD, Autodesk products came out on top. In terms of BIM, **71%** of respondents found Autodesk Revit to be the best software. For CAD, **84%** found Autodesk AutoCAD to be the best software.

It seems that these products are the market leaders, however several respondents did admit that they had not tried other products and had used Autodesk for a long time. These could be considered to be the 'go-to' products for BIM and CAD; perhaps other options do not even get considered.

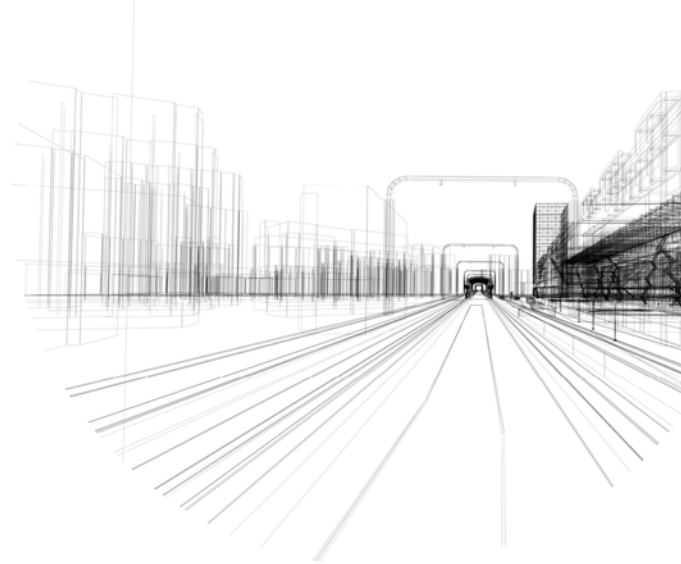


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KEY SURVEY FINDINGS SUMMARY

Below is a summary of the key findings from our survey, supported by the Architects, Designers, Surveyors and Managing Directors who participated in this survey:

- BIM is more widely used than CAD in the architectural industry, with **42%** of respondents using BIM, **32%** using CAD and **26%** using both.
- **47%** of respondents feel that BIM will completely replace CAD within the next ten to twenty years.
- CAD software performs better for smaller projects as it requires less information at the start of the project, while BIM software is ideally suited for larger projects which require much more detail.
- **53%** of respondents had switched from using CAD to BIM.
- BIM is being pushed within the industry by large contractors and company policies.
- **74%** of respondents feel BIM offers the best design visualisation.
- **53%** of respondents feel BIM offers the fastest delivery for large design projects.
- BIM's database driven design approach offers cost savings and increased efficiencies.
- 'Simplicity of the platform' was the most important factor influencing survey respondents' decision to choose a BIM or CAD software, however many expressed an opinion that a mixture of cost savings, high speed and ability was essential.
 - The most popular BIM software is Revit.
 - The most popular CAD software is AutoCAD.



7

THE FUTURE OF BIM AND CAD

Building Information Modelling and Computer Aided Design are set to continue innovating their offerings, and the future of both BIM and CAD looks promising. As both technological advancements and user demands dictate the direction each process will go in, we look at some of the big changes you can expect to see in the future.

CAD

Increased Personalisation – Current personalisation of CAD platforms is quite complex, with many different features and commands on offer, most of which are never even used, depending on the requirements of the project. However, with users demanding so many different functionalities, there is no 'one size fits all' option. CAD of the future will provide platforms which can be easily modified, with 'add-ons' being simple to discover and test. Third-party vertical applications will complement the base product seamlessly, allowing the user to modify their software to suit their specific needs.

Cloud Based Collaboration – While CAD software has done wonders for collaborative design processes, there is still some progress which needs to be made. There are often multiple stakeholders involved in the design process, so updates are often made asynchronously throughout the project. Cloud based collaboration is already a reality for some CAD software (such as Onshape), however it is likely that in the future it will become more of a standard feature, allowing multiple users to connect to different tools in a seamless way, working simultaneously on a single model and viewing historic changes instantly.



7 THE FUTURE OF BIM AND CAD



Automation – Automation is a trend which is taking over many industries, and the architectural industry is no different. Automation in CAD can assist with trivial tasks, such as creating assemblies multiple times. Predictive assemblies will be part of SOLIDWORKS CAD software soon. Automation will also help to simulate solutions to specific scenarios, automatically suggesting specific shapes, sizes and connections of all components, so the architect can think about the problems and the software can find the solutions.

BIM

Augmented Reality – The current animated virtual walkthroughs used in BIM software could well be replaced by augmented reality in the not too distant future. Augmented reality can make the construction process much easier, especially if tablets or headsets are available on site for construction workers to compare models to their blueprints on the go. This would eventually reduce the need to rely on 2D construction documents altogether.

Additive Manufacturing – 3D printing technology will be incorporated into BIM designs of the future. Prefabricated units will no longer be required as designs will be created using 3D printable concrete on site, allowing for enhanced customisation and flexibility.

One Dominant Software – In the future of BIM, ease of collaboration will be very important. As we discovered through our research, some companies are already pushing specific BIM software to create a seamless flow of work. One software package will dominate, making collaboration easier throughout the industry.



8

HOW BIM AND CAD INSPIRE ENTRANCE MATTING DESIGN

Offering architects and designers the opportunity to download BIM and CAD files is a necessity within the entrance matting industry. Without them, architects will not be able to visualise the design of the building, as the entrance matting completes the picture. The BIM and CAD files allow architects to make changes in design, colour, functionality, size and shape to guarantee they are choosing the right entrance matting solution for their project.

Ben Askew, Specification Consultant at INTRAsystems, is in contact with architects on a daily basis. He shares his thoughts on BIM VS CAD, based on his experiences with architects. Ben says,

"More projects are requiring BIM modelling, but this won't exactly replace CAD. If an architect is detailing a particular section of the project they will probably still use CAD".

So, while we are seeing an increase in the use of BIM, it certainly hasn't replaced the use of CAD when it comes to entrance matting.

In terms of the future of BIM and Cad, Ben says,

"BIM models will become essential on all projects – at the moment only a few projects are going the BIM route but generally the feeling is all projects will go that way in the next few years".

For INTRAsystems, providing both BIM and CAD files will continue to be a big part of the specification process, allowing architects the flexibility to use whichever process and software is best suited to their project.



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